

# OTTO®

CATALOG 115

## FULL LINE PRODUCT CATALOG

PUSHBUTTON

GRIP

JOYSTICK

TOGGLE

SWITCH

HALL EFFECT

CANBUS

ENGINEERING

CUSTOM

ROCKER

INDUSTRIAL

TRIGGER

# CONTROLS SOLUTIONS

TESTING

CANBUS

TROMECH

TRANSDUCER



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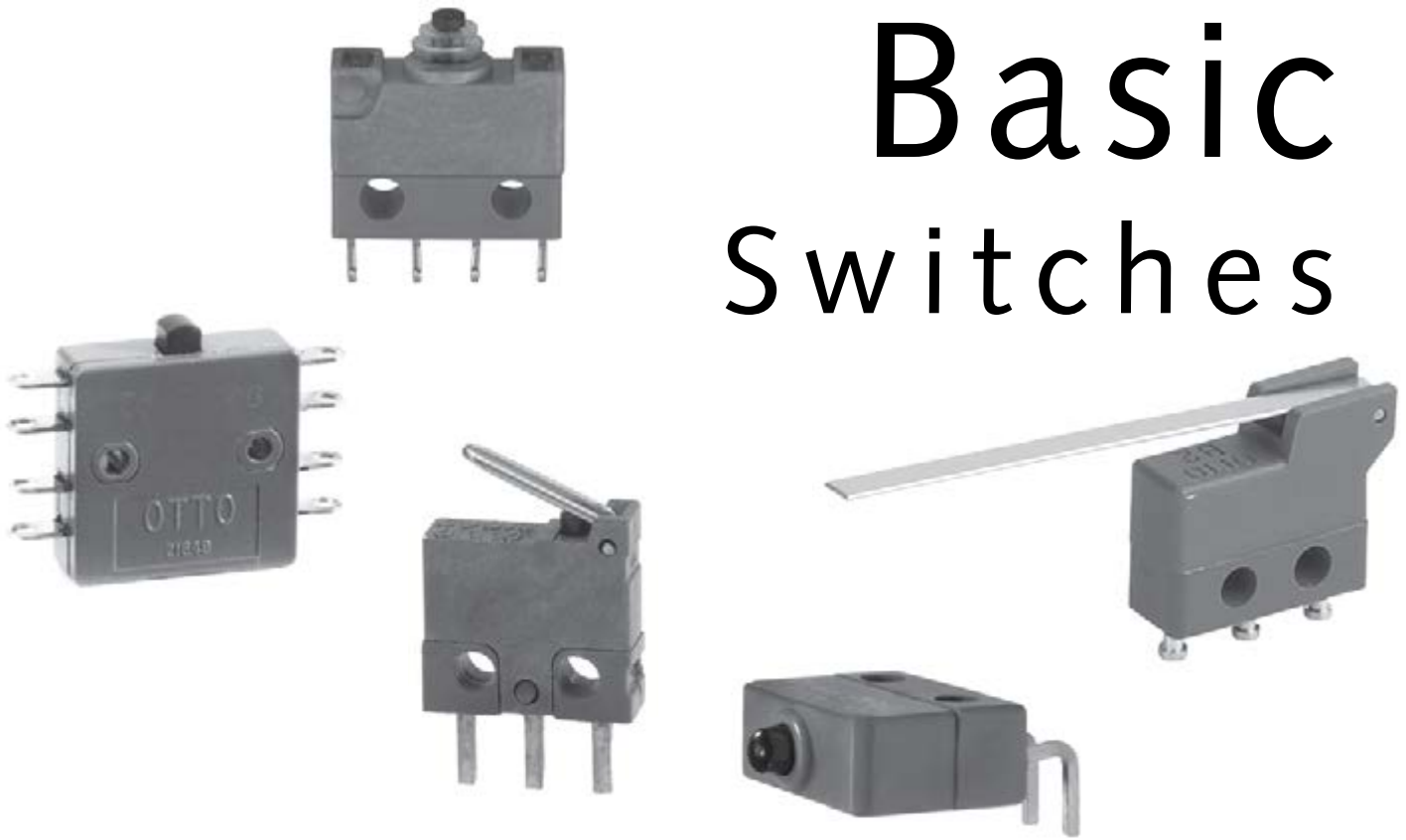
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# Basic Switches



SERIES	FEATURE	MAX RATING (Resistive)	MECHANICAL LIFE	APPROVALS	CIRCUITRY
B1	Ultra Small Subminiature	2A @ 28VDC or 10mA @ 5VDC (logic level)	100,000	N/A	SPST, SPDT
B1-5	Ultra Small Subminiature with Integral Levers	2A @ 28VDC or 10mA @ 5VDC (logic level)	1,000,000	N/A	SPST, SPDT
B2	Subminiature	7A @ 28VDC or 1A @ 28VDC (low level)	50,000-250,000 (varies by part number)	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST, SPDT
B2-5	Subminiature with Integral Levers	7A @ 28VDC or 1A @ 28VDC (low level)	100,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST, SPDT
B2D	Subminiature with Reduced Dead Break	2A @ 28VDC or 10mA @ 5VDC (logic level)	50,000	N/A	SPDT, SPST
B3	Double Break Subminiature	8A @ 28VDC or 10mA @ 30mV (low level)	1,000,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST-DB, SPDT-DB
B3S	Sealed Double Break Subminiature	8A @ 28VDC or 10mA @ 5VDC (logic level)	1,000,000	N/A	SPST-DB, SPDT-DB
B5	Double Break Miniature	10A @ 28VDC or 10mA @ 30mV (low level)	1,000,000	UL (E61705), DSCC (QPL8805)	SPST-DB, SPDT-DB
B5-7	Double Break Miniature, Two Pole	10A @ 28VDC or 10mA @ 30mV (low level)	100,000	UL (E61705), DSCC (QPL8805)	DPDT-DB

# ULTRA SMALL SUBMINIATURE BASICS

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, ULTRA SMALL SUBMINIATURE

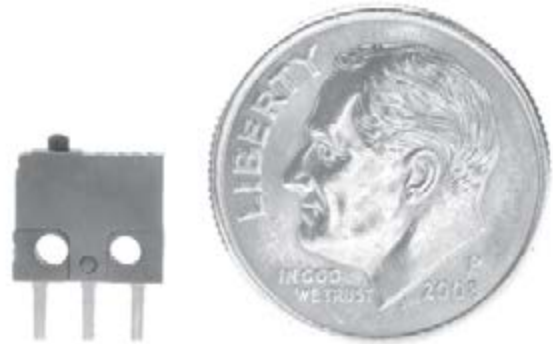
The B1 series basic switches are ultra-subminiature in size, designed to reliably switch logic level signals as well as up to 2 amps switching capacity for a minimum of 25,000 cycles. Mechanical life expectancy is in excess of one million cycles.

The molded housing is rugged and structurally stable. The terminals are molded-in and sealed against solder flux entering the switch. The terminals are available in a choice of double turret solder style and 0.020" x 0.025" PC pins.

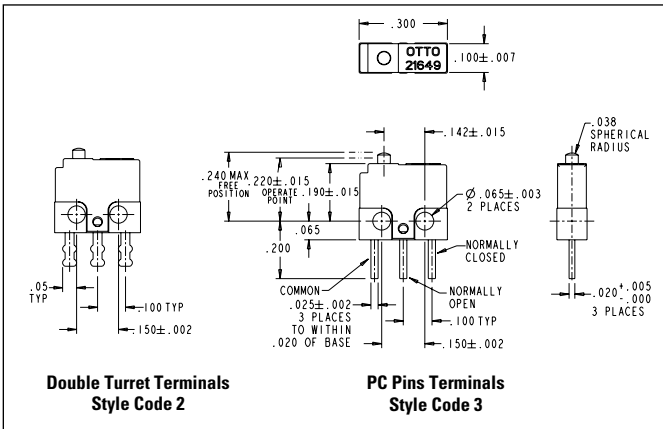
The B1 series is also available with integral lever actuators as B1-5 series.

## Features:

- **Ultra-compact: only 0.300" w x 0.255" h x 0.100" thick**
- **1 million cycle life, B1-5 Series**
- **Logic level switching capability**
- **Designed in accordance with MIL-PRF-8805/94**
- **Available in Commercial & Military grades**
- **Choice of solder or PC molded-in terminals**
- **Precision operating points**
- **RoHS compliant**



Actual Size



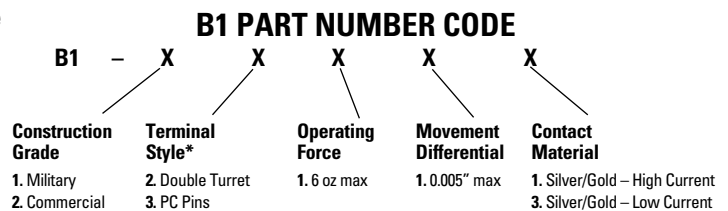
Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>		
<b>Load</b>	<b>Sea Level @ 28VDC or 115VAC, 60Hz</b>	<b>50,000 feet @ 28VDC</b>
Resistive	2A	2A
Inductive*	0.5A	0.2A
DWV	1000Vrms	400Vrms
Logic Level	10mA @ 5VDC	10mA @ 5VDC
*L/R = 0.026		
<b>Electrical Life:</b>	25,000 cycles	
<b>Mechanical Life:</b>	B1 Series is 100,000 cycles (B1-5 Series is 1,000,000 cycles)	
<b>Seal:</b>	Unsealed	
<b>Operating Temp Range:</b>	-55°C to +125°C	
<b>Operating Force:</b>	6 oz max	
<b>Release Force:</b>	0.7 oz min	
<b>Operate Point:</b>	0.220 +/- 0.015 inches from mounting holes	
<b>Overtravel:</b>	0.003 inches min	
<b>Movement Differential:</b>	0.002 inches nominal, 0.005 inches max	
<b>Pretravel:</b>	0.015 inches max	
<b>MATERIALS:</b>		
<b>Case:</b>	Thermoset, blue	
<b>Cover:</b>	Thermoplastic, blue	
<b>Button:</b>	Thermoplastic, black	
<b>Terminals:</b>	Silver with gold	
<b>Contacts:</b>	Stationary: Silver with gold Moveable: Silver with gold	
<b>Terminal Hardware:</b>	None provided	
<b>Mounting Hardware:</b>	None provided	

## ORDERING INFORMATION:

### B1 Basic

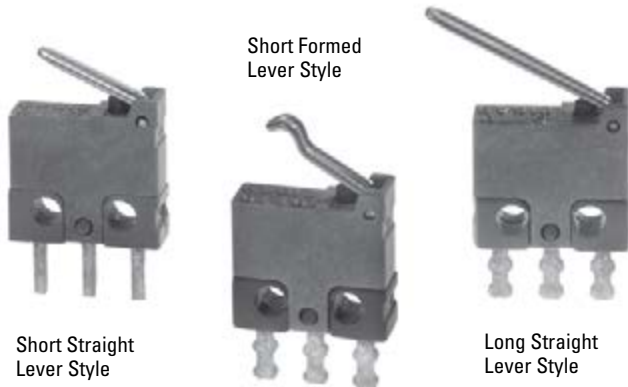
Select the OTTO B1 basic switch to match your specific circuit and mechanical requirements. To order, specify your requirement using the OTTO Part Number Code shown below.

**Example:** B1-12111 specifies Military grade construction, double turret terminals, 6 oz max operating force and silver/gold high current contacts.



\* Wire leads available, contact factory.

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, ULTRA SMALL SUBMINIATURE WITH INTEGRAL LEVERS



### B1-5 Integral Lever Basic Switches

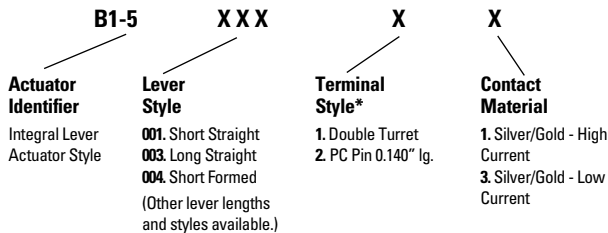
B1-5 series basic switches feature integral actuating levers. The lever is built-in so that the switch and actuator are one assembly.

Making the lever actuator an integral part of the basic switch case makes sense and saves money, too. Better precision, no parts to assemble and more variety add up to a cost saving proposition.

Lever Style	STANDARD OPERATIONAL CHARACTERISTICS						
	Catalog Number	Operating Force (max ounces)	Release Force (min ounces)	Pretravel (max inches)	Overtravel (min inches)	Movement Differential (max inches)	Operating Point (inches)
Short Straight Lever	B1-500111	1.8	0.11	0.054	0.015	0.016	0.250 +/- 0.025
Long Straight Lever	B1-500311	1.0	0.09	0.185	0.023	0.032	0.293 +/- 0.070
Short Formed Lever	B1-500411	2.0	0.15	0.030	0.015	0.020	0.293 +/- 0.025

(Other lever lengths and styles available.)

### B1-5 PART NUMBER CODE



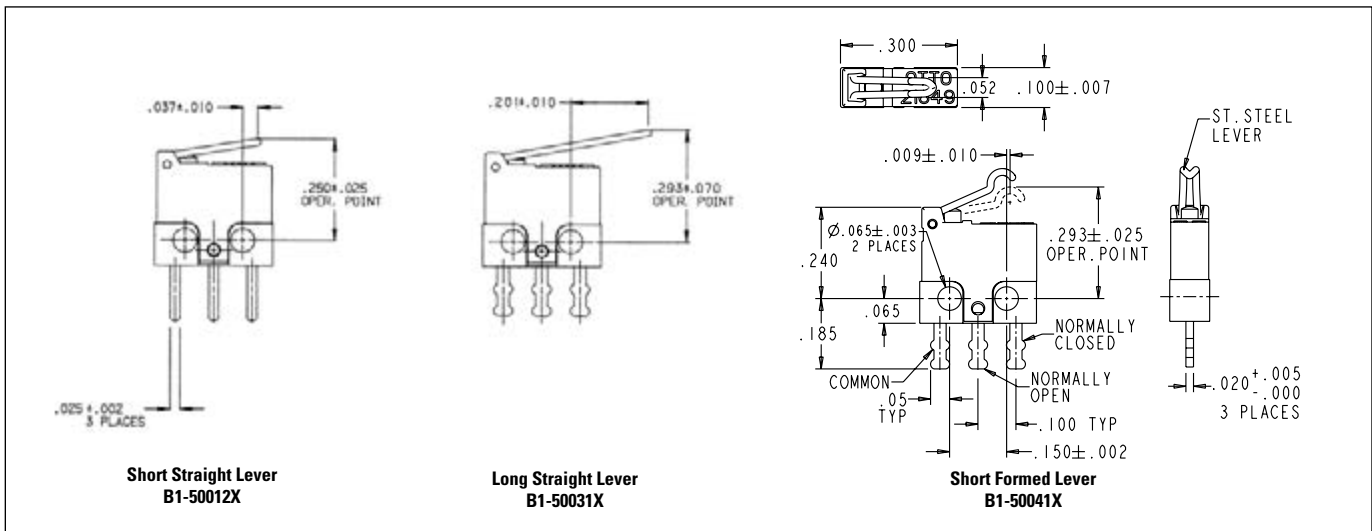
\* Wire leads available, contact factory.

### ORDERING INFORMATION:

#### B1-5 Series, Basic Switch with Integral Lever Actuator

Select the OTTO B1-5 basic switch to match your specific circuit and mechanical requirements. To order, specify your requirement using the OTTO Part Number Code shown at left.

**Example:** B1-500111 specifies short straight integral lever, double turret terminals and silver/gold high current contacts.





# SUBMINIATURE BASIC SWITCHES

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS

Available in two widths, the B2 series can be specified to fit your application exactly.

In addition to being available with integral actuating levers as in the B2-5 series, the B2 series is also available with the A1 series auxiliary lever actuators as shown in the B3 section.

While the B2 series conforms to and is qualified to various military specifications, the same switch can be specified for commercial use at a cost savings.

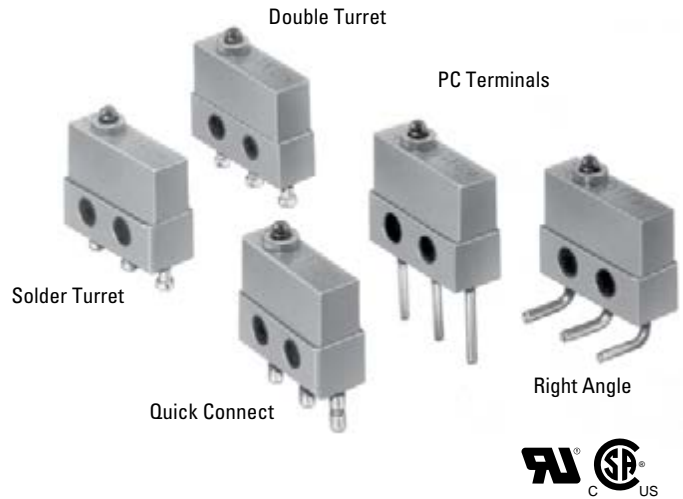
A choice of turret, quick connect and three lengths of printed circuit board style terminals are available for both the 0.156" and 0.200" wide models.

Whether it be military or commercial applications, OTTO can provide features you select for your application. You can specify the features you require without paying for ones you don't need.

The OTTO B2 subminiature switches conform to and are qualified under MIL-PRF-8805/4, MIL-PRF-8805/106 (high temp -55°C to +205°C) and MIL-PRF-8805/109. Basic switches are designed for miniature spaces where cam or other limit actuators are used on the button. In addition, a full range of toggle, pushbutton and lever actuators are available.

## Features:

- Choice of 0.156" & 0.200" wide models
- Up to 7 amps switching
- Sensitive movement differentials
- Low operating forces
- Choice of 8 terminal styles or wire leads
- Long operating life
- Qualified under MIL-PRF-8805/4, MIL-PRF-8805/106 & MIL-PRF-8805/109
- UL recognized & CSA certified
- RoHS compliant



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>		
<b>High Level Switch Ratings</b>		
Load	Rating – Sea Level	Rating – 50,000 feet
<b>115VAC, 60Hz silver contacts with gold plate</b>		
Resistive	7A	N/A
Inductive	7A	N/A
Lamp	2A	N/A
<b>28VDC, silver contacts with gold plate</b>		
Resistive	7A	4A
Inductive	4A	2.5A
Lamp	2.5A	2.5A
<b>Low Level Switch Ratings</b>		
<b>28VDC, gold plate contacts</b>		
Resistive	1A	1A
Inductive	0.5A	0.5A
Lamp	N/A	N/A
<b>DWV:</b>	1000Vrms	400Vrms
<b>Electrical Life:</b>	25,000 to 100,000 cycles (dependent on part number)	
<b>Mechanical Life:</b>	50,000 to 250,000 cycles (dependent on part number)	
<b>Seal:</b>	Unsealed	
<b>Operating Temp Range:</b>	-55°C to +85°C, high temp rating -55°C to +205°C	
<b>Operating Force:</b>	5 oz or 6 oz	
<b>Release Force:</b>	1 oz min	
<b>Operate Point:</b>	0.320 +/- 0.015 inches from mounting holes	
<b>Overtravel:</b>	0.004 inches min	
<b>Movement Differential:</b>	0.006 inches max	
<b>Pretravel:</b>	0.020 inches max	
<b>MATERIALS:</b>		
<b>Case:</b>	Thermoset, blue	
<b>Cover:</b>	Thermoplastic, blue	
<b>Button:</b>	Thermoplastic, black	
<b>Terminals:</b>	Brass, gold over nickel	
<b>Contacts:</b>	Stationary: Silver with gold Moveable: Silver or gold	
<b>Terminal Hardware:</b>	None provided	
<b>Optional Wires:</b>	24 AWG blue, red, yellow	
<b>Mounting Hardware:</b>	None provided	

### Auxiliary Lever Actuators for B2

Catalog Number	Number of Poles
A1-115-01	1
A2-109	2

Supplied with two 2-56 panhead screws, hex nuts and lockwashers.

**A1-115-01 Shown**

For additional options, contact factory.

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS

**MILITARY APPROVALS**

(MIL-PRF-8805/4, MIL-PRF-8805/106 & MIL-PRF-8805/109)

Certain OTTO B2 models have been qualified to the military specification for these parts. The following is the latest listing.

MILITARY NO.	OTTO P/N
M8805/106-01	B2-200031
M8805/106-02	B2-200032
M8805/109-01	B2-111351
M8805/109-02	B2-112351
M8805/109-03	B2-111353
M8805/109-04	B2-112353
MS24547-1 (M8805/4)	B2-211351
MS24547-2 (M8805/4)	B2-211353
MS24547-4 (M8805/4)	B2-212351
MS24547-5 (M8805/4)	B2-212353
MS24547-6 (M8805/4)	B2-200029
MS24547-7 (M8805/4)	B2-200030

**TERMINAL STYLE 1**  
SINGLE SOLDER TURRET

**TERMINAL STYLE 2**  
DOUBLE SOLDER TURRET

**TERMINAL STYLE 3**  
QUICK CONNECT  
MATES WITH AMP .058" RECEPTACLES

**TERMINAL STYLE 4**  
PRINTED CIRCUIT PIN 0.150" LONG

**TERMINAL STYLE 5**  
PRINTED CIRCUIT PIN 0.270" LONG

**TERMINAL STYLE 6**  
PRINTED CIRCUIT PIN 0.090" LONG

**TERMINAL STYLE 7**  
RIGHT ANGLE PRINTED CIRCUIT PIN

**TERMINAL STYLE 9**  
RIGHT ANGLE, OPPOSITE OF 7

SWITCH WIDTH DIM. "A"

.156	.110
.200	.085

SWITCH WIDTH DIM. "A"

.156	.110
.200	.085

WIRE LENGTH CODE

WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00±.38	06.09±.38
B	12.00±.50	12.09±.50
C	18.00±.50	18.09±.50
D	24.00±.50	24.09±.50
E	30.00±.75	30.09±.75

NC 24 AWG BLUE  
NO 24 AWG RED  
C 24 AWG YELLOW

**ORDERING INFORMATION:**

Select the OTTO B2 basic switch to match your specific circuit and mechanical requirements. To order, specify your requirement using the OTTO Part Number Code shown to the right.

**Example:** B2-112351 specifies Military grade construction on a 0.156" wide base, double turret terminals, 5 oz operating force, 0.005" movement differential and silver/gold high current contacts.

**B2 PART NUMBER CODE**

Bold Code numbers signify standard features with best availability.

**B2** - **X** **X** **X** **X** **X** **X**

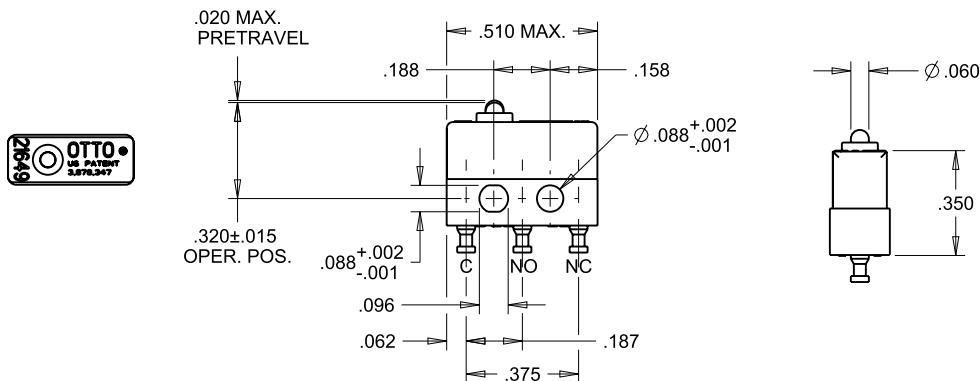
<b>Model (Width/Constr.)</b>	<b>Actuator Style</b>	<b>Terminal Style</b>	<b>Operating Force</b>	<b>Movement Differential</b>	<b>Contact Material</b>
1. 0.156" (MIL Grade)	1. Button	1. Single Turret	3. 5 oz max	2. 0.002"	1. Silver/Gold - High Current
2. 0.200" (MIL Grade)		2. Double Turret	4. 6 oz max	3. 0.003"	3. Silver/Gold - Low Current
3. 0.156" (Com'l Grade)		3. O.C. Tab ①		4. 0.004"	
4. 0.200" (Com'l Grade)		4. PC Pin 0.150" lg.		5. 0.005"	
		5. PC Pin 0.270" lg.		6. 0.006"	
		6. PC Pin 0.090" lg.			
		7. Right Angle PC			
		9. Right Angle, Opposite of 7			
		A. With 24 AWG Wires 06.0" lg.			
		B. With 24 AWG Wires 12.0" lg.			
		C. With 24 AWG Wires 18.0" lg.			
		D. With 24 AWG Wires 24.0" lg.			
		E. With 24 AWG Wires 30.0" lg.			

① Mates with AMP 0.058" receptacles.

# SUBMINIATURE BASIC SWITCHES

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS

## BASIC SWITCH (APPLIES TO ALL SWITCHES ON THIS PAGE)

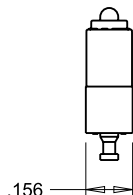
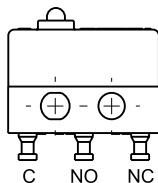


MODEL (WIDTH/CONSTRUCTION) 1  
0.156" (MILITARY GRADE)

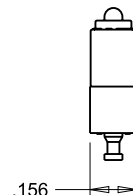
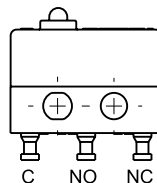


MILITARY NO.      OTTO P/N

M8805/109-01	B2-111351
M8805/109-02	B2-112351
M8805/109-03	B2-111353
M8805/109-04	B2-112353



MODEL (WIDTH/CONSTRUCTION) 3  
0.156" (COMMERCIAL GRADE)

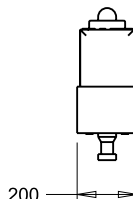
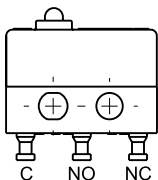


MODEL (WIDTH/CONSTRUCTION) 2  
0.200" (MILITARY GRADE)

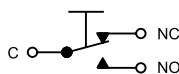
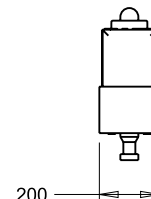
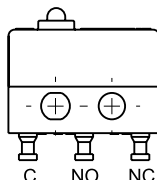


MILITARY NO.      OTTO P/N

MS24547-1 (M8805/4)	B2-211351
MS24547-4 (M8805/4)	B2-212351
MS24547-2 (M8805/4)	B2-211353
MS24547-5 (M8805/4)	B2-212353

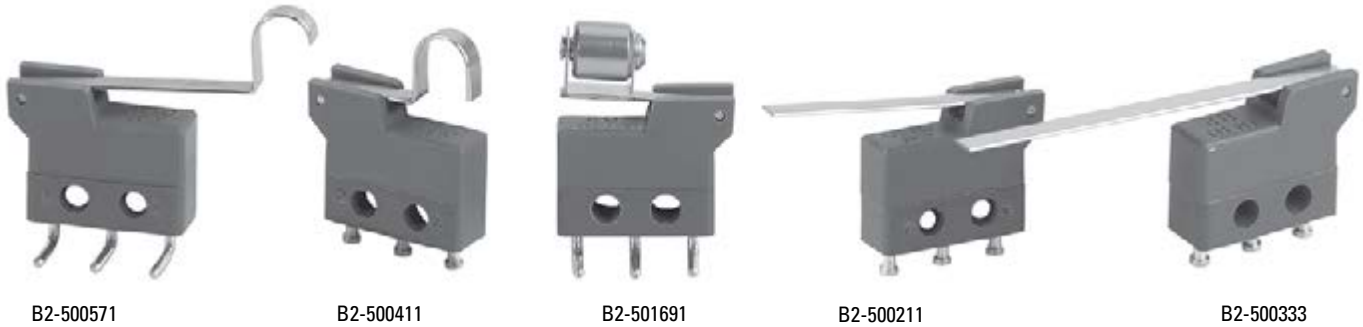


MODEL (WIDTH/CONSTRUCTION) 4  
0.200" (COMMERCIAL GRADE)



SPDT-FORM C  
SCHEMATIC

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS, INTEGRAL LEVERS



Shown are examples of available lever styles.

### B2-5 Integral Lever Basic Switches

B2-5 series basic switches feature integral actuating levers. The lever is built-in so that the switch and actuator are one assembly.

Making the lever actuator an integral part of the basic switch case makes sense and saves money, too. Better precision, no auxiliary parts for you to assemble, and more variety add up to a cost saving proposition.

Lever Style	Catalog Number	STANDARD OPERATIONAL CHARACTERISTICS					
		Operating Force (max ounces)	Release Force (min ounces)	Pretravel (max inches)	Overtravel (min inches)	Move't Differ'l (max inches)	Operating Point (inches)
Short Lever	B2-500111	1.76	0.32	0.065	0.014	0.020	0.330 +/- 0.045
Medium Lever	B2-500211	1.10	0.18	0.115	0.025	0.035	0.330 +/- 0.045
Long Lever	B2-500311	0.71	0.11	0.185	0.046	0.060	0.330 +/- 0.045
Short Formed "U" Lever	B2-500411	2.10	0.39	0.050	0.010	0.015	0.553 +/- 0.035
Long Formed "U" Lever	B2-500511	1.10	0.18	0.105	0.022	0.035	0.572 +/- 0.070
Lever Style with Hole	B2-500611	1.10	0.18	0.115	0.025	0.035	0.330 +/- 0.045
Short "V" Lever	B2-501211	3.00	0.57	0.042	0.010	0.010	0.419 +/- 0.030
Roller Sleeve Sideways	B2-501611	2.29	0.43	0.065	0.008	0.020	0.560 +/- 0.045
Short "L" Lever	B2-501711	3.00	0.57	0.036	0.008	0.009	0.411 +/- 0.028
Short Flat "V" Lever	B2-501811	2.20	0.40	0.049	0.010	0.015	0.421 +/- 0.037
Roller Lever in Line	B2-501911	2.29	0.43	0.070	0.008	0.020	0.559 +/- 0.050
Long Roller Lever in Line	B2-502011	1.00	0.17	0.125	0.020	0.040	0.552 +/- 0.100

### B2-5 PART NUMBER CODE

**B2-5    X X X**

**Lever Style**

- 001. Short Straight
- 002. Medium Straight
- 003. Long Straight
- 004. Short Formed "U"
- 005. Long Formed "U"
- 006. With Hole
- 012. Short "V"
- 016. Roller Sleeve Sideways
- 017. Short "L"
- 018. Short Flat "V"
- 019. Roller Lever in Line
- 020. Long Roller Lever in Line

**X**

**Terminal Style or Wire Length**

- 1. Single Solder Turret
- 2. Double Solder Turret
- 3. Quick Connect\*
- 4. PC Pin 0.150" lg.
- 5. PC Pin 0.270" lg.
- 6. PC Pin 0.090" lg.
- 7. Right Angle PC Pin
- 9. Right Angle\*\*
- A. With Wires 06.0" lg.
- B. With Wires 12.0" lg.
- C. With Wires 18.0" lg.
- D. With Wires 24.0" lg.
- E. With Wires 30.0" lg.

**X**

**Contact Material**

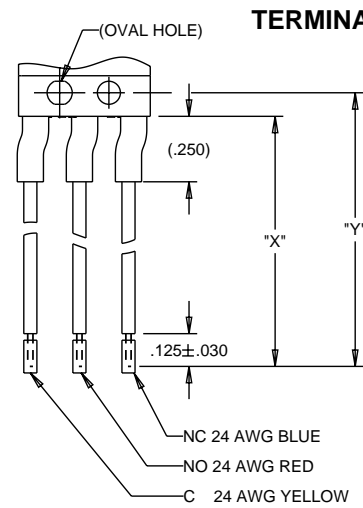
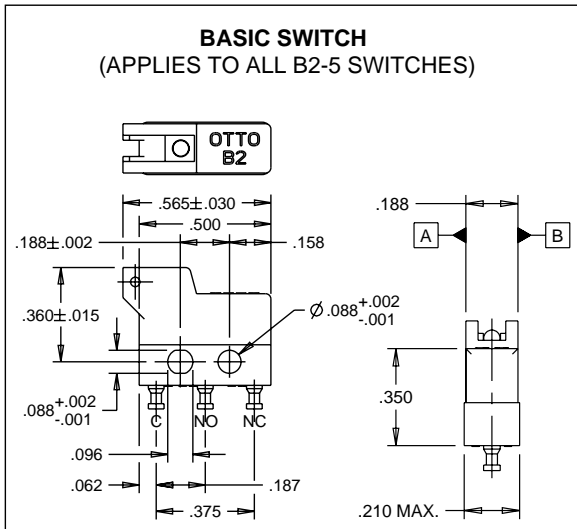
- 1. Silver/Gold - High Current
- 3. Silver/Gold - Low Current

\* Mates with AMP .058" receptacles  
\*\* Opposite of 7

# B2 BASICS WITH INTEGRAL LEVERS

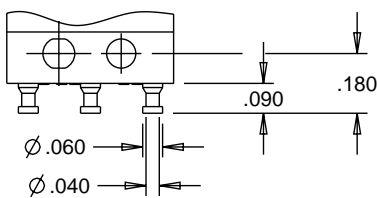
**B2-5**  
BASIC SWITCHES

SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS, INTEGRAL LEVERS

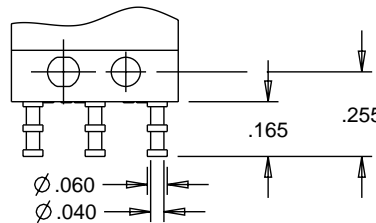


WIRE LENGTH FOR A, B, C, D & E

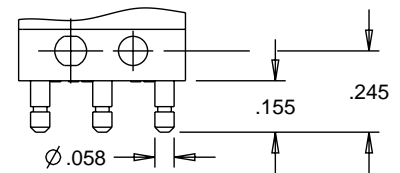
WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00±.38	06.09±.38
B	12.00±.50	12.09±.50
C	18.00±.50	18.09±.50
D	24.00±.50	24.09±.50
E	30.00±.75	30.09±.75



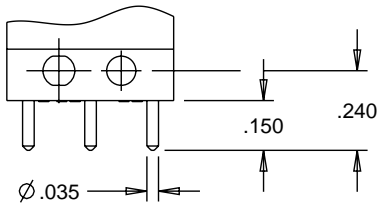
**TERMINAL STYLE 1**  
SINGLE SOLDER TURRET



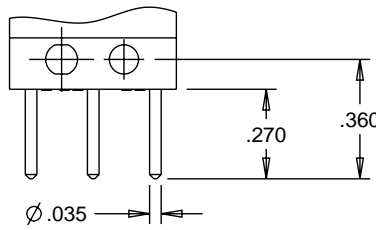
**TERMINAL STYLE 2**  
DOUBLE SOLDER TURRET



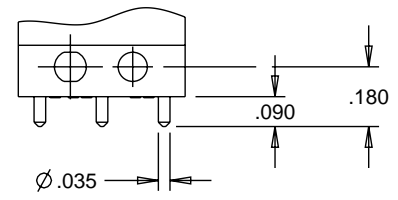
**TERMINAL STYLE 3**  
QUICK CONNECT  
MATES WITH AMP .058 INCH RECEPTACLES



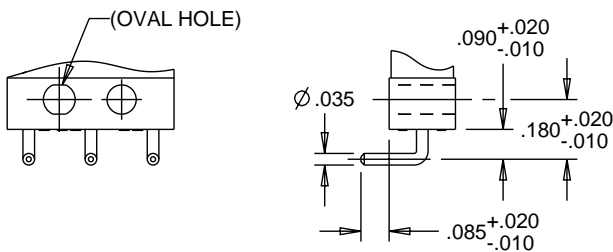
**TERMINAL STYLE 4**  
PRINTED CIRCUIT PIN 0.150" LONG



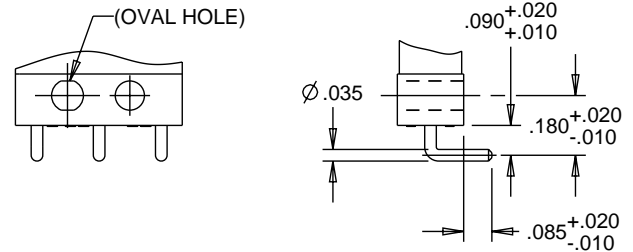
**TERMINAL STYLE 5**  
PRINTED CIRCUIT PIN 0.270" LONG



**TERMINAL STYLE 6**  
PRINTED CIRCUIT PIN 0.090" LONG



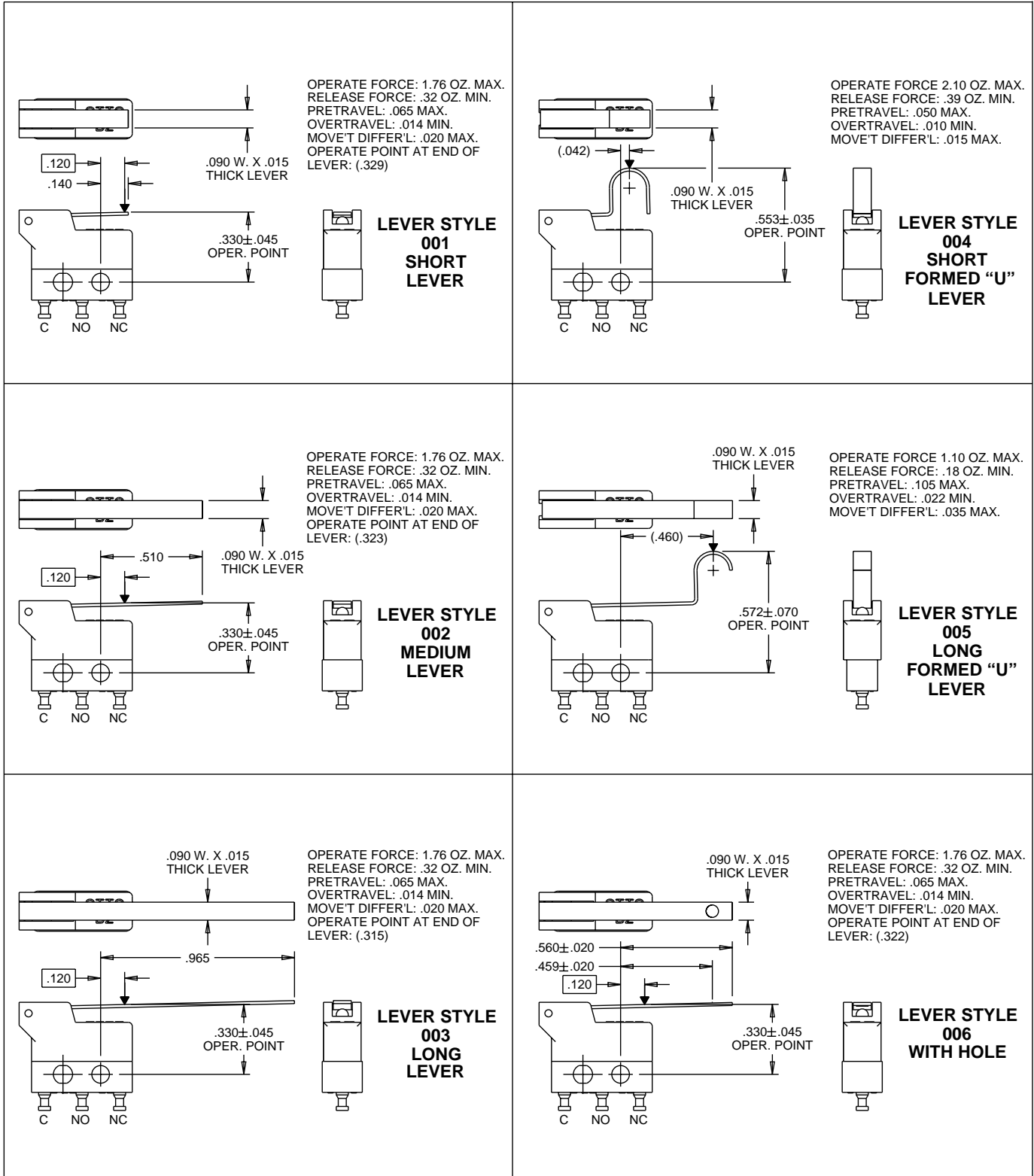
**TERMINAL STYLE 7**  
RIGHT ANGLE PRINTED CIRCUIT PIN



**TERMINAL STYLE 9**  
RIGHT ANGLE, OPPOSITE OF 7

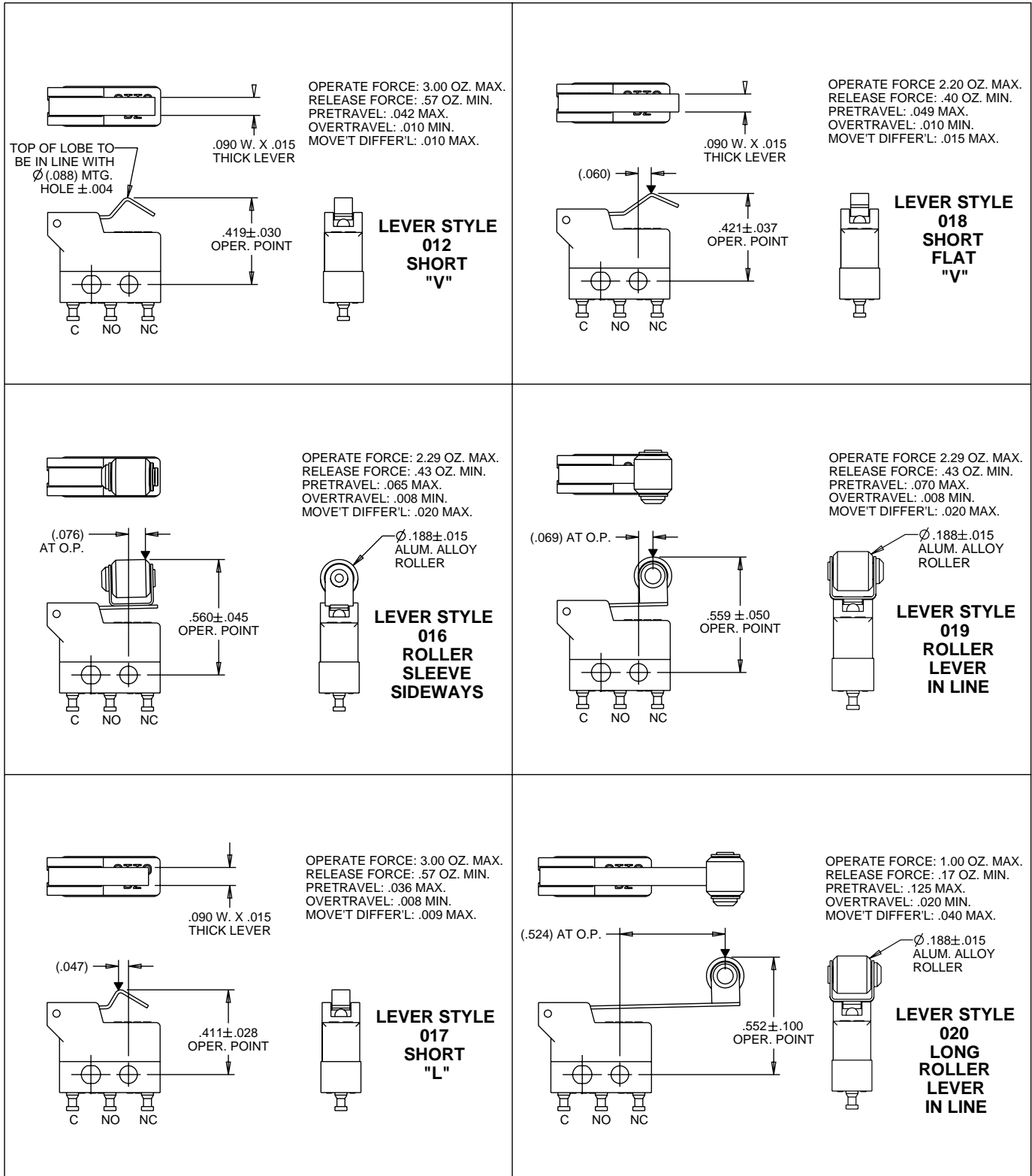
SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS, INTEGRAL LEVERS

## B2-5 LEVER STYLES



SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS, INTEGRAL LEVERS

### B2-5 LEVER STYLES



REDUCED DEAD BREAK, SNAP-ACTION, SINGLE BREAK, SUBMINIATURE, TWO WIDTHS

The B2D is a single break, snap action, subminiature basic switch with reduced dead break. It is designed for pressure transducers, level sensors and other applications where the difference between the breaking of the first circuit and the making of the second circuit needs to be as close as possible to zero.

As multi-circuit switches change from one circuit to another, there is always a small amount of time or distance where the actuator is depressed and the switch is not connected to either circuit. Dead break is the distance of actuator travel to cause the switch to transfer from one circuit to the other. OTTO's B2D closes that gap quicker than a traditional basic switch. It will outperform most switches when the actuator is being depressed very slowly, or when it is important for the application to minimize the time the switch is not connected to either circuit.

There are 13 terminal styles which include single turret solder style, double turret solder style, Quick Connect, PC pins and wires.

The B2D shares the same dimensions as OTTO's B2 basic switch, is a drop-in replacement and is available with or without lever actuators.

Able to withstand high vibration, OTTO's B2D is ideal for pressure sensing and level sensing in aerospace, off-road and marine applications.

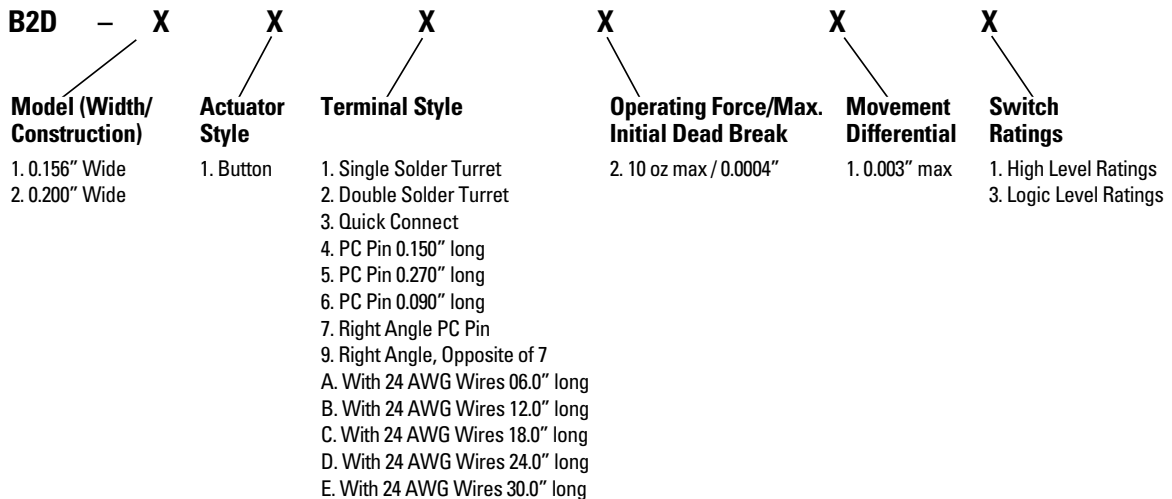
## Features:

- Choice of 0.156" and 0.200" wide models
- Logic level switching capability
- Choice of 13 standard terminal styles or wire leads
- Lever actuators available
- RoHS compliant



B2D Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>		
Load	Sea Level @ 28VDC or 115VAC, 60Hz	50,000 feet @ 28VDC
Resistive	2A	1A
Inductive	1A	0.5A
DWV	1000Vrms	400Vrms
Logic Level	10mA at 5VDC	10mA at 5VDC
<b>Electrical Life:</b>	50,000 cycles	
<b>Mechanical Life:</b>	50,000 cycles	
<b>Seal:</b>	Unsealed	
<b>Operating Temp Range:</b>	-55°C to +85°C	
<b>Operating Force:</b>	10 oz max	
<b>Release Force:</b>	1.0 oz min	
<b>Operate Point:</b>	0.320 +/- 0.015 inches from mounting holes	
<b>Overtravel:</b>	0.004 inches min	
<b>Movement Differential:</b>	0.003 inches max	
<b>Pretravel:</b>	0.020 inches max	
<b>Initial Dead Break:</b>	0.0004 inches max	
<b>MATERIALS:</b>		
<b>Cover:</b>	Thermoplastic, blue	
<b>Button:</b>	Thermoplastic, black	
<b>Terminal Hardware:</b>	None provided	
<b>Mounting Hardware:</b>	None provided	

## B2D PART NUMBER CODE



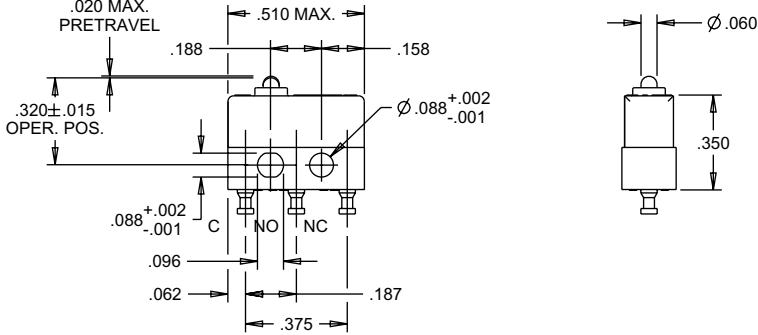


# B2 BASICS WITH REDUCED DEAD BREAK

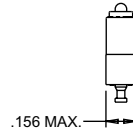
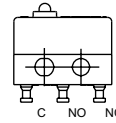
**B2D**  
BASIC SWITCHES

REDUCED DEAD BREAK, SINGLE BREAK, SNAP-ACTION, SUBMINIATURE, TWO WIDTHS

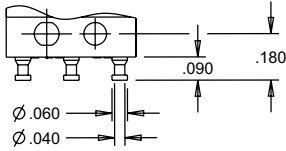
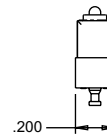
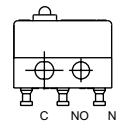
## BASIC SWITCH (APPLIES TO ALL SWITCHES IN THIS DRAWING)



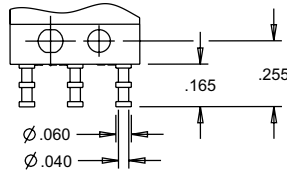
### MODEL (WIDTH/CONSTRUCTION) 1 0.156" WIDE



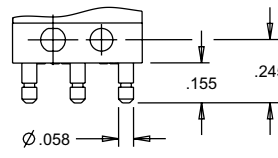
### MODEL (WIDTH/CONSTRUCTION) 2 0.200" WIDE



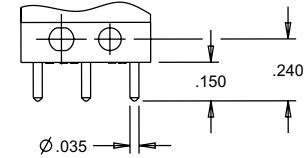
**TERMINAL STYLE 1  
SINGLE SOLDER TURRET**



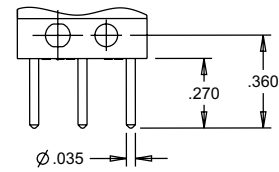
**TERMINAL STYLE 2  
DOUBLE SOLDER TURRET**



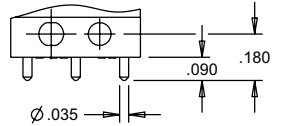
**TERMINAL STYLE 3  
QUICK CONNECT  
MATES WITH AMP .058" RECEPTACLES**



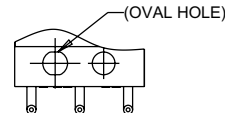
**TERMINAL STYLE 4  
PRINTED CIRCUIT PIN 0.150" LONG**



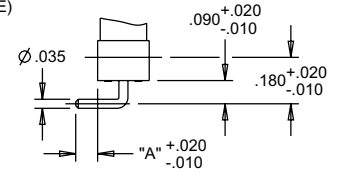
**TERMINAL STYLE 5  
PRINTED CIRCUIT PIN 0.270" LONG**



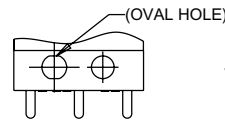
**TERMINAL STYLE 6  
PRINTED CIRCUIT PIN 0.090" LONG**



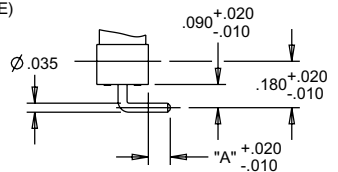
SWITCH WIDTH	DIM. "A"
.156	.110
.200	.085



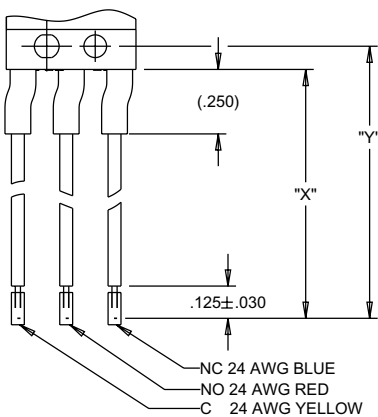
**TERMINAL STYLE 7  
RIGHT ANGLE PRINTED CIRCUIT PIN**



SWITCH WIDTH	DIM. "A"
.156	.110
.200	.085



**TERMINAL STYLE 9  
RIGHT ANGLE, OPPOSITE OF 7**



**WIRE TERMINAL STYLES**

### WIRE LENGTH FOR A, B, C, D and E

WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00±.38	06.09±.38
B	12.00±.50	12.09±.50
C	18.00±.50	18.09±.50
D	24.00±.50	24.09±.50
E	30.00±.75	30.09±.75

DOUBLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE

### MIL-PRF-8805/76 (0.200 inches wide)

OTTO's B3-2XXXX series is a subminiature switch that is qualified to MIL-PRF-8805/76. Designed to switch at least one million mechanical cycles, the B3 surpasses the requirements of the military in these categories: contact resistance less than 25mΩ, contact bounce and overall cycle life. For MIL-PRF-8805/76 requirements, B3-22141 has standard silver with gold contacts, SPDT double break two circuit (Form Z), solder terminals in thermoset case material. Gold plated contacts are available for non-military applications. UL recognized and CSA certified models available.

### MIL-PRF-8805/101 (0.156 inches wide)

For your really difficult projects, try OTTO'S B3 series. They are qualified to the OTTO inspired MIL-PRF-8805/101 specification. Only 0.156" thick, think of all those extra 0.044" you can use in those tight ganged jobs. With the B3 series, you can get an extra pole in where only four MIL-PRF-8805/76's fit, with room to spare. Examine the characteristics. With the MIL-PRF-8805/101, the only thing you give up is the extra space the MIL-PRF-8805/76 takes. Cycle life, very low contact resistance, minimal contact bounce... everything is exactly as provided by the MIL-PRF-8805/76 specification.

For MIL-PRF-8805/101 requirements, B3-11141 (PC pin) and B3-12141 (turret) have silver with gold contacts and SPDT double break (Form Z) contact. For commercial applications, a variety of contact forms, special forces and gold plate contacts are available. Most versions are also UL recognized and CSA certified.

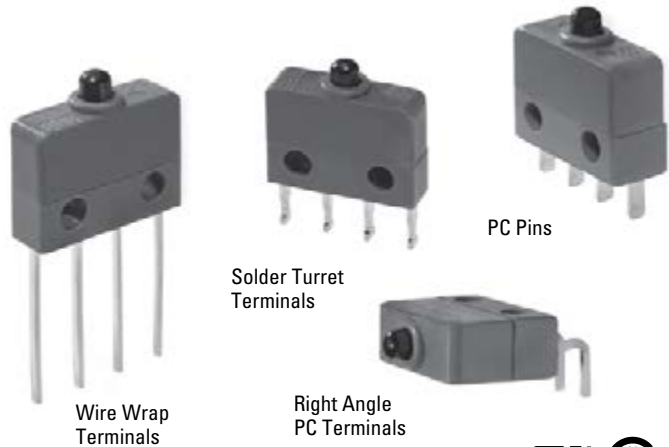
Great circuit versatility is available with either switch style. You have your choice of normally open (Form X) or closed (Form Y), 3 terminal (Form C) and 4 terminal (Form Z) SPDT double break.

### Features:

- Low level switching capability
- Less than 25mΩ initial contact resistance
- Up to 8 amps switching capability
- Button accepts actuation directly from a cam
- Choice of 0.156" & 0.200" wide models
- Choice of 6 standard terminal styles or wire leads
- Available in Commercial & Military grades
- Qualified to MIL-PRF-8805/76 & MIL-PRF-8805/101
- UL recognized & CSA certified
- RoHS compliant

### APPLICATIONS

OTTO subminiature switches are designed to meet all applications requiring MIL-PRF-8805/76 or MIL-PRF-8805/101 switches. Basic switches are designed for miniature spaces where cam or other limit actuators are used. In addition, toggle, pushbutton and lever actuators are available.

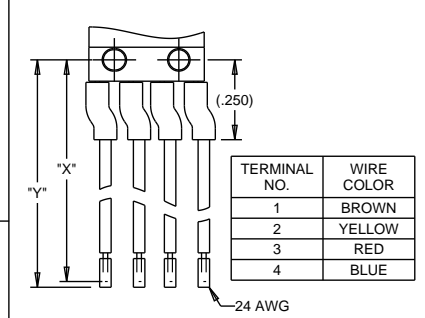
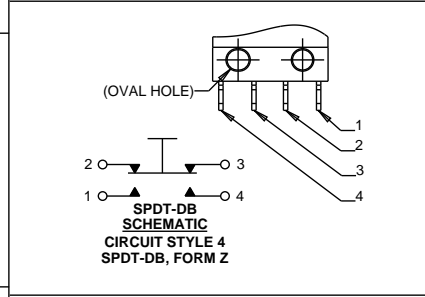
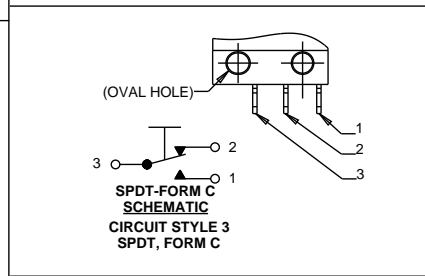
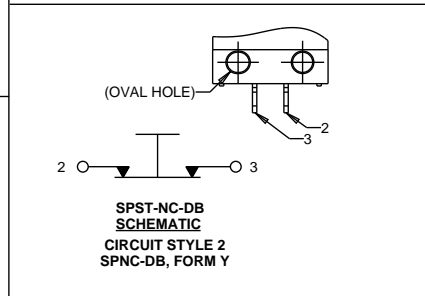
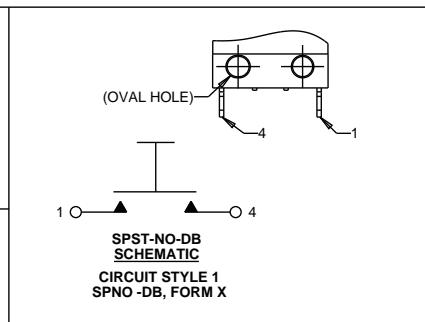
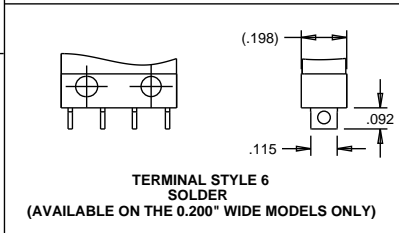
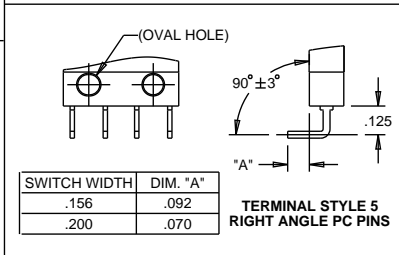
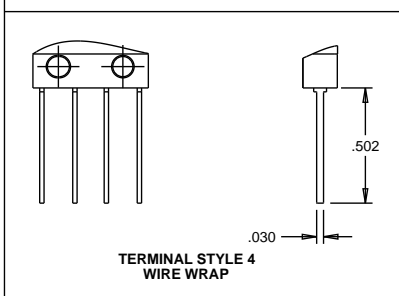
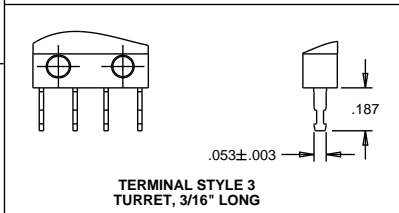
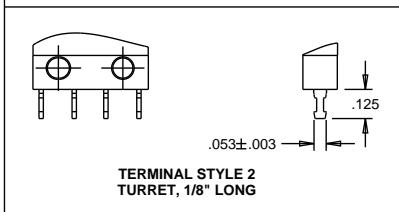
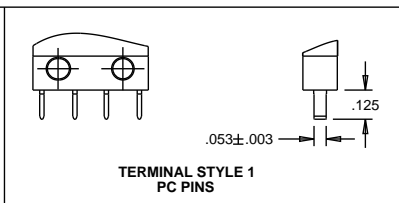
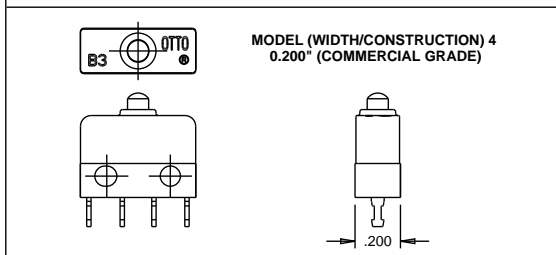
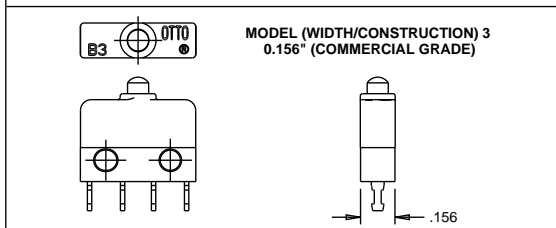
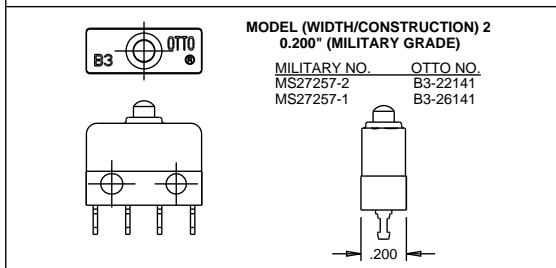
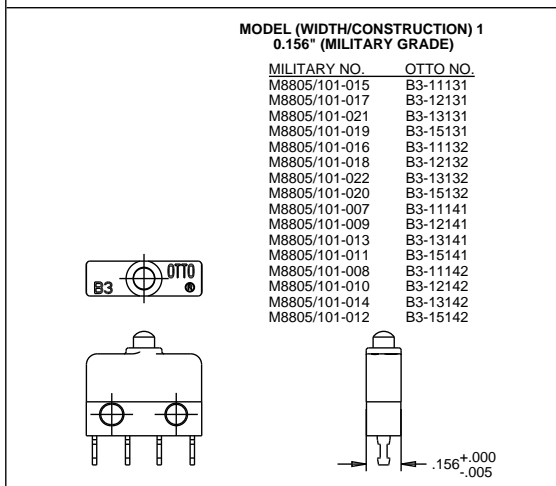
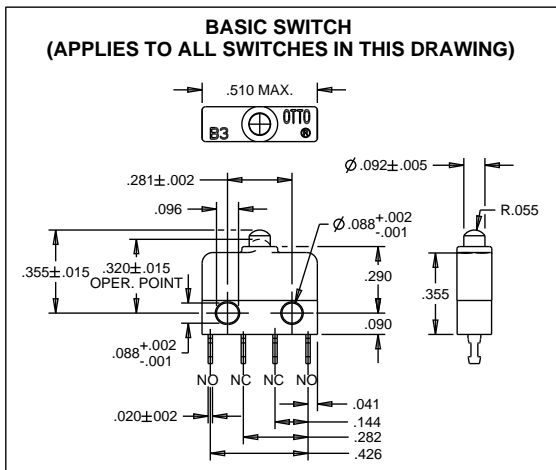


Standard Characteristics/Ratings:				
ELECTRICAL RATINGS:				
Circuitry	Load	Sea Level @ 28VDC	70,000 feet @ 28VDC	Sea Level @ 115VAC, 60/400Hz*
SPST-NO or NC	Resistive	8A	8A	8A
Form Z		5A	5A	5A
Form C		5A	5A	5A
Gold Contacts		5A	5A	N/A
SPST-NO or NC	Inductive**	5A	3A	5A
Form Z		3A	2A	3A
Form C		2.5A	1.5A	2.5A
Gold Contacts		3A	2A	3A
*Applies to commercial grade switches				
**L/R = 0.026				
Lamp		1A	N/A	1A
Motor		5A	N/A	
DWV		1000Vrms	400Vrms	
Low Level:	Gold contacts 10mA @ 30mV			
Electrical Life:	50,000 cycles at full load			
Mechanical Life:	1,000,000 cycles			
Seal:	Unsealed			
Operating Temp Range:	-65°C to +125°C			
Operating Force:	5 oz +/- 2 oz typical, 6 oz max, or 5 oz min options			
Release Force:	1.5 oz min			
Operate Point:	0.320 +/- 0.015 inches from mounting holes			
Overtravel:	0.004 inches min			
Movement Differential:	0.018 +/- 0.008 inches			
MATERIALS:				
Case:	Thermoset, blue			
Cover:	Thermoplastic, blue			
Button:	Thermoplastic, black			
Terminals:	Brass with gold			
Contacts:	Stationary: Silver with gold plate Moveable: Silver with gold plate			
Terminal Hardware:	None provided, optional wires			
Mounting Hardware:	None provided			

# SUBMINIATURE BASIC SWITCHES

DOUBLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE

BASIC SWITCHES



WIRE LENGTH FOR A, B, C, & D

WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00±.38	06.09±.38
B	12.00±.50	12.09±.50
C	18.00±.50	18.09±.50
D	24.00±.50	24.09±.50
E	30.00±.75	30.09±.75

DOUBLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE

**CONTACT CONFIGURATIONS:**

MIL-PRF-8805/76 and MIL-PRF-8805/101 specify single pole, double throw, double break (Form Z) contact configuration. Available and included in the military specifications are SPNO and SPNC double break, (Form X and Y). The MIL-PRF-8805/101 also specifies SPDT Form C.

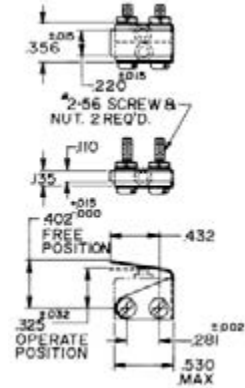
**MILITARY APPROVALS**

(MIL-PRF-8805/76 & MIL-PRF-8805/101)

Certain OTTO B3 models have been qualified to the military specification for these parts. The following is a partial listing. Consult the Cross Reference that appears at the back of this catalog for the latest, complete listings.

MILITARY NO.	OTTO P/N	MILITARY NO.	OTTO P/N
MS27257-1	B3-26141	M8805/101-011	B3-15141
MS27257-2	B3-22141	M8805/101-012	B3-15142
M8805/101-001	B3-10064	M8805/101-013	B3-13141
M8805/101-002	B3-10065	M8805/101-014	B3-13142
M8805/101-003	B3-10066	M8805/101-015	B3-11131
M8805/101-004	B3-10067	M8805/101-016	B3-11132
M8805/101-005	B3-10063	M8805/101-017	B3-12131
M8805/101-006	B3-10072	M8805/101-018	B3-12132
M8805/101-007	B3-11141	M8805/101-019	B3-15131
M8805/101-008	B3-11142	M8805/101-020	B3-15132
M8805/101-009	B3-12141	M8805/101-021	B3-13131
M8805/101-010	B3-12142	M8805/101-022	B3-13132

**Auxiliary Lever Actuators for B3**



Catalog Number	Number of Poles
A1-101-02	1
A3-102	2

Supplied with two 2-56 panhead screws, hex nuts and lockwashers.

For additional options, contact factory.

**ORDERING INFORMATION:**

**B3 Basic**

Select the OTTO B3 basic switch to match your specific circuit and mechanical requirements. To order, specify your requirement using the OTTO Part Number Code shown below.

**Example:** B3-12141 is 0.156" wide, has 1/8" long turret terminals, 5 oz operating force, SPDT double break and silver/gold contacts (MIL-PRF-8805/101).

**B3 PART NUMBER CODE**

**Bold Code** items signify conformance to MIL-PRF-8805 specifications.

**B3** - **X**

**Model**

- 1. 0.156" (MIL Grade)
- 2. 0.200" (MIL Grade)
- 3. 0.156" (Com'l Grade)
- 4. 0.200" (Com'l Grade)

**X**

**Terminal Style or Wire Length**

- 1. PC Pins
- 2. Turret, 1/8" lg.
- 3. Turret, 3/16" lg.
- 4. Wire Wrap
- 5. Right Angle PC Pins
- 6. Solder ①
  - A. With Wires 06.0" lg.
  - B. With Wires 12.0" lg.
  - C. With Wires 18.0" lg.
  - D. With Wires 24.0" lg.
  - E. With Wires 30.0" lg.

**X**

**Operating Force**

- 1. 5<sup>+3</sup>/<sub>-2</sub> oz
- 2. 5 oz min
- 3. 6 oz max

**X**

**Circuitry**

- 1. SPNO-DB, Form X
- 2. SPNC-DB, Form Y
- 3. SPDT, Form C
- 4. SPDT-DB, Form Z

**X**

**Contact Material**

- 1. Silver/Gold – High Current
- 2. Silver/Gold – Low Current

① Available on 0.200" wide models only.

# SEALED SUBMINIATURE BASIC SWITCHES

**B3S**  
SEALED BASIC SWITCHES

SEALED, DOUBLE BREAK, SNAP-ACTION, SUBMINIATURE

OTTO's sealed, double break B3S basic switch is designed for demanding applications that require a reliable seal. Sealed to IP68S, the B3S basic switch has a high cycle life - tested to 1 million cycles at logic level. The switch is also capable of handling up to an 8 amp resistive load.

Great double break circuit versatility is available with your choice of normally open (Form X), normally closed (Form Y), 3 terminal SPDT (Form C) or 4 terminal SPDT (Form Z).

The B3S is designed for use in places where space is limited, with or without lever actuators. In addition, the switch can be used as part of pushbutton, trigger and toggle switches that require sealing for demanding applications. Multiple terminal styles and wire lead options are available.



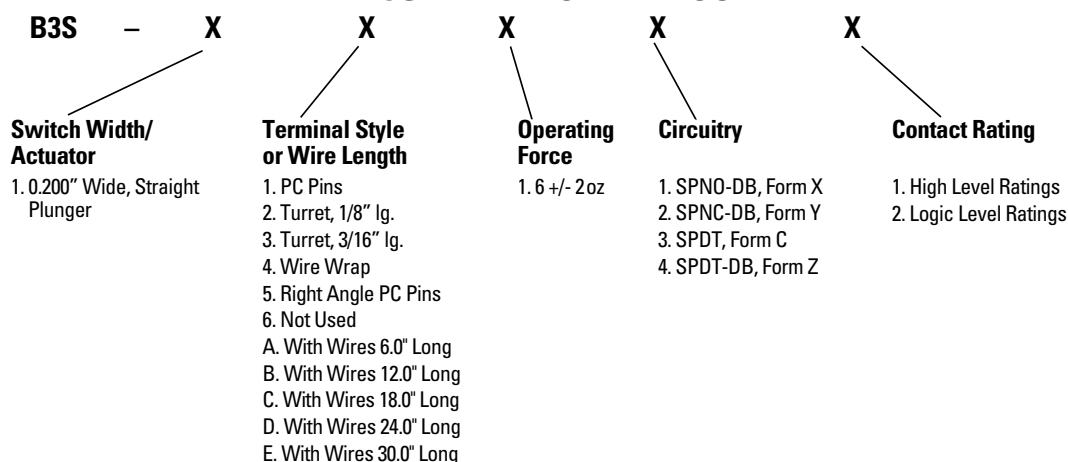
## Features:

- Sealed to IP68S
- Double break circuit
- Logic level switching option tested to 1 million electrical cycles
- 0.200" switch width
- Choice of 10 standard terminal styles or wire leads
- Lever actuators are also available
- RoHS compliant

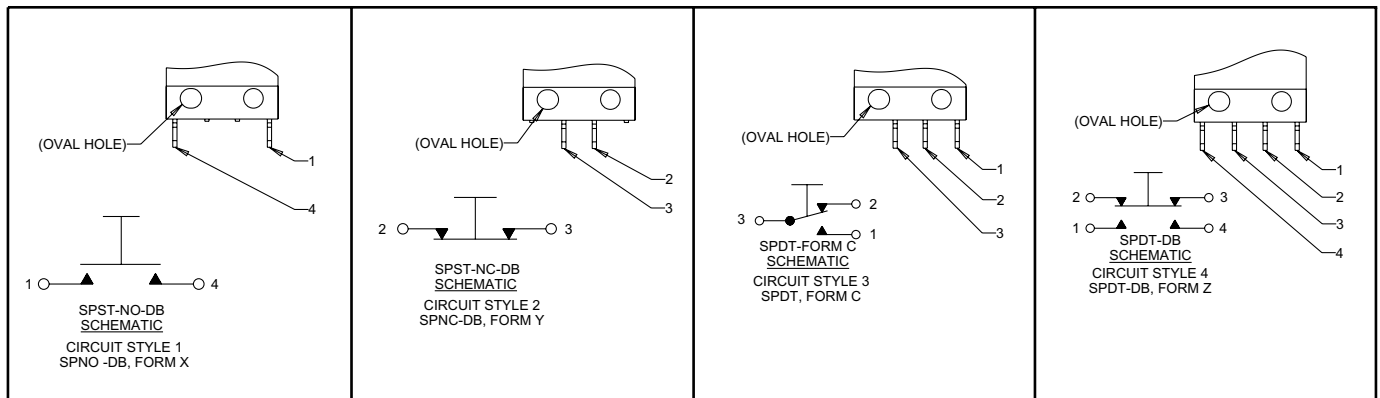
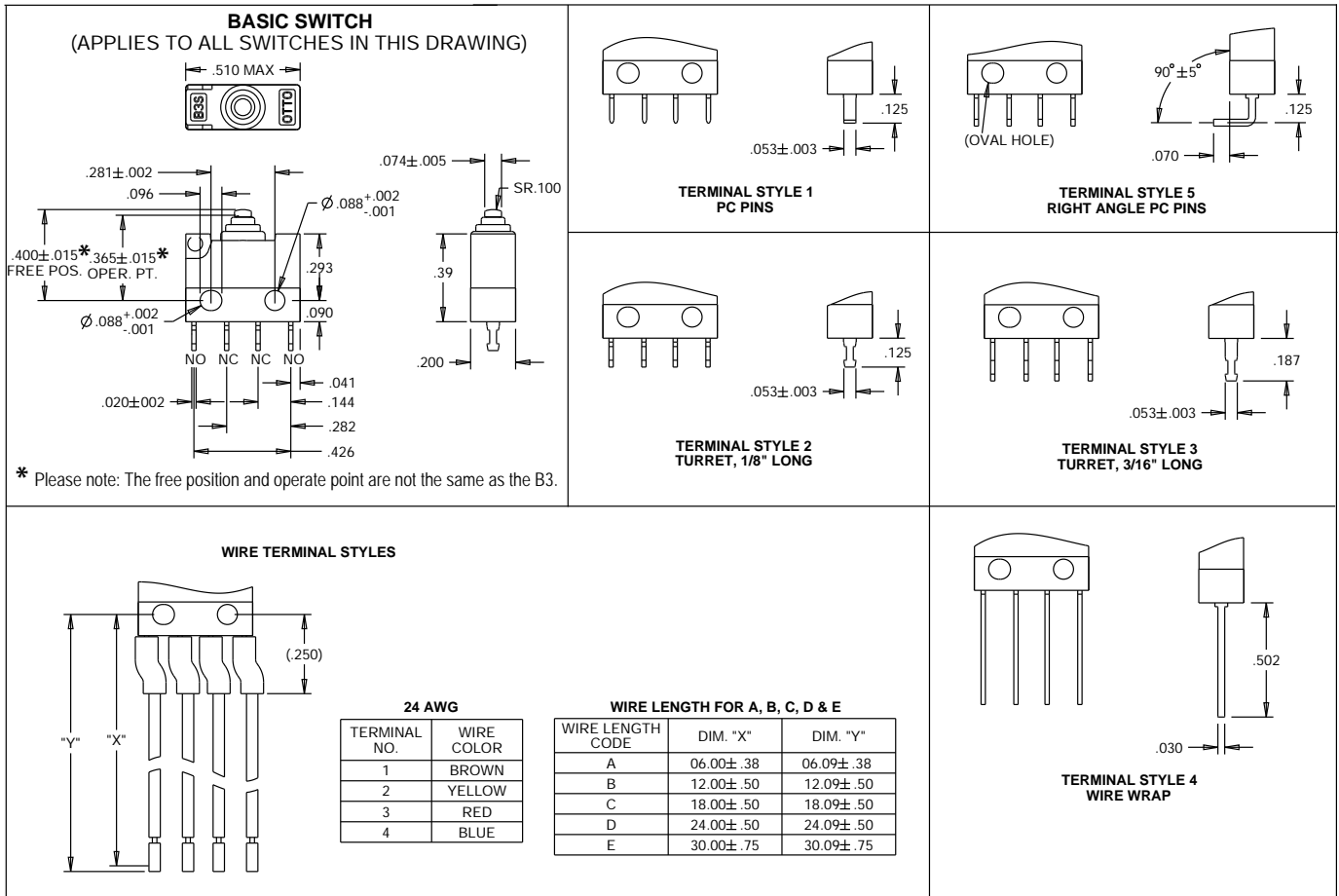
### B3S Standard Characteristics/Ratings:

ELECTRICAL RATINGS: Sea Level @ 28VDC			
Rating	Load	Current	Life Cycles
High Level N.C. or N.O. Form C	Resistive	8A	50,000
High Level N.C. or N.O. Form Z	Resistive	8A	50,000
High Level SPDT Form C	Resistive	5A	50,000
High Level SPDT Form Z	Resistive	5A	50,000
Logic Level @ 5VDC	Resistive	10mA	1,000,000
DWV	1000Vrms		
<b>Mechanical Life:</b>	1,000,000 cycles		
<b>Seal:</b>	IP68S		
<b>Operating Temp Range:</b>	-40°C to +85°C		
<b>Operating Force:</b>	6 ± 2 oz.		
<b>Overtravel:</b>	.004 min.		
<b>Release Force:</b>	1 oz. min.		
<b>Movement Differential:</b>	.018 +/- .008		
<b>MATERIALS:</b>			
<b>Cover:</b>	Blue Thermoplastic		
<b>Case:</b>	Blue Thermoset		
<b>Boot:</b>	Silicone Rubber		

## B3S PART NUMBER CODE



SEALED, DOUBLE BREAK, SNAP-ACTION, SUBMINIATURE



# MINIATURE BASIC SWITCHES

DOUBLE BREAK, SNAP-ACTION COMMERCIAL & MILITARY GRADES, MINIATURE

B5 series basic switches are miniature in size and feature up to 10 amps switching capability of 100,000 cycles. Mechanical life is one million cycles.

The molded housing is rugged and structurally stable. The terminals are sealed against solder flux entering the switch and are bright acid tin plated for excellent solderability.



Solder Terminal Style



## Features:

- Up to 10 amps switching capability
- High contact pressure
- Precision operating points
- Button accepts actuation directly from cam
- Constructed in accordance with MIL-PRF-8805/7
- Available in Commercial & Military grades
- Choice of four standard terminal styles or wire leads
- UL recognized
- B5-21141 qualified to MS27217-1
- RoHS compliant

### Standard Characteristics/Ratings:

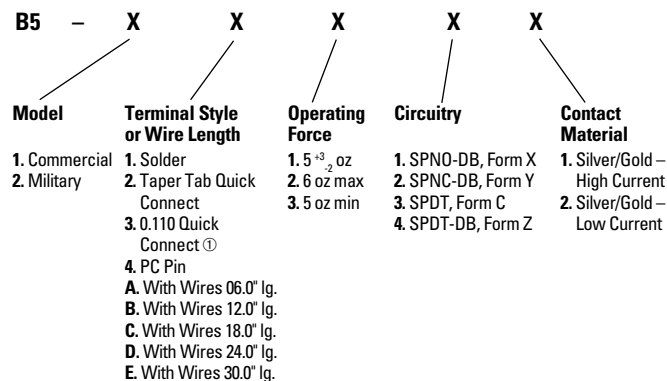
#### ELECTRICAL RATINGS:

Circuitry	Load	Sea Level @ 28VDC	70,000 feet @ 28VDC	Sea Level @ 115VAC, 60Hz
SPNO-DB & SPNC-DB	Resistive	10A	10A	10.1A
	Inductive*	7.5A	3.5A	5A
	Lamp	1A	N/A	3A
SPDT-DB	Resistive	10A	10A	10.1A
2 Circuit	Inductive*	5A	2A	5A
	Lamp	3A	N/A	1.5A
SPDT	Resistive	10A	10A	10.1A
	Inductive*	3A	1.5A	N/A
	Lamp	3A	N/A	N/A

\*L/R = 0.026

<b>DWV</b>	1000Vrms	400Vrms
<b>Electrical Life:</b>	100,000 cycles	
<b>Mechanical Life:</b>	1,000,000 cycles	
<b>Seal:</b>	Unsealed	
<b>Operating Temp Range:</b>	-65°C to +125°C	
<b>Operating Force:</b>	5 oz, +3/-2 oz or 6 oz max or 3 oz min	
<b>Release Force:</b>	2 oz min	
<b>Operate Point:</b>	0.406 +/- 0.010 inches from mounting holes	
<b>Overtravel:</b>	0.012 inches min	
<b>Movement Differential:</b>	0.020 +/- 0.005 inches	
<b>Pretravel:</b>	0.050 inches max	
<b>MATERIALS:</b>		
<b>Case:</b>	Thermoset, blue	
<b>Cover:</b>	Thermoset, blue	
<b>Button:</b>	Thermoplastic, black	
<b>Terminals:</b>	Brass with bright acid tin plating	
<b>Contacts:</b>	Stationary: Silver with gold Moveable: Silver with gold	
<b>Terminal Hardware:</b>	None provided, optional wires	
<b>Mounting Hardware:</b>	None provided	

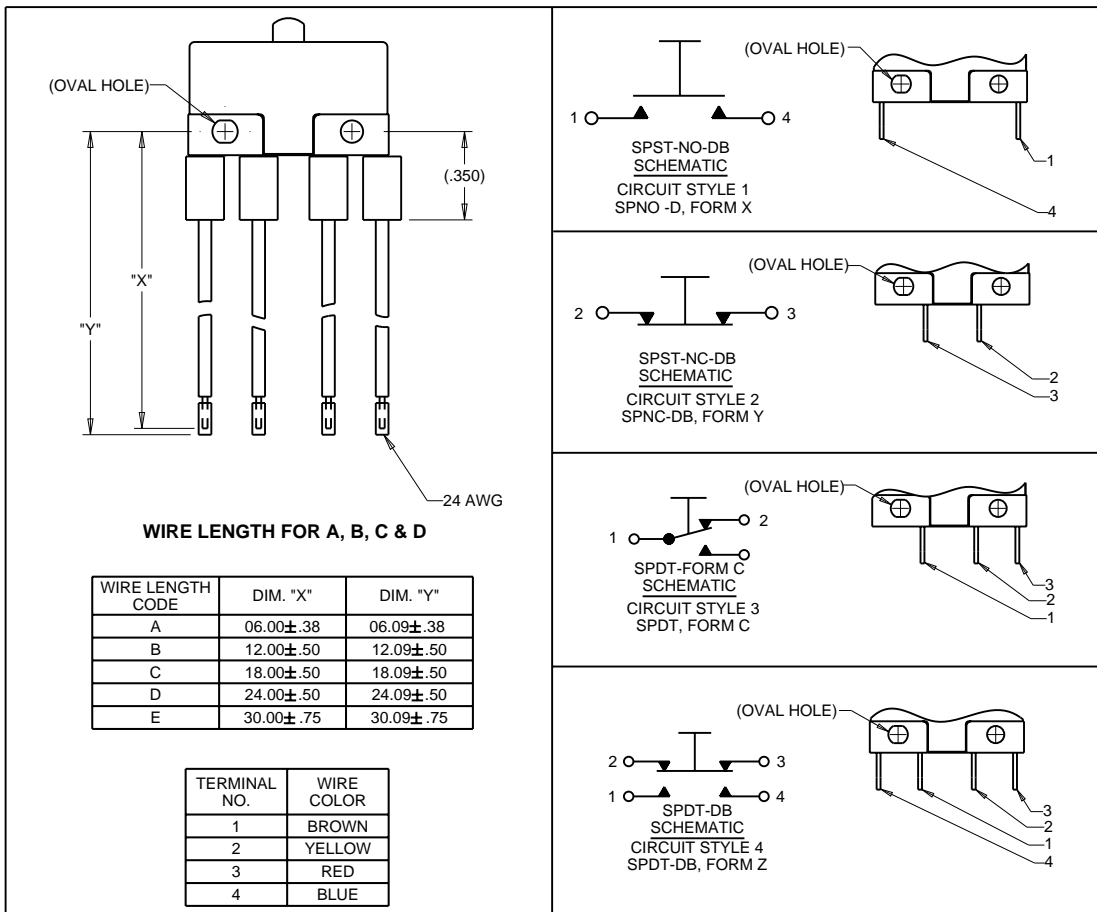
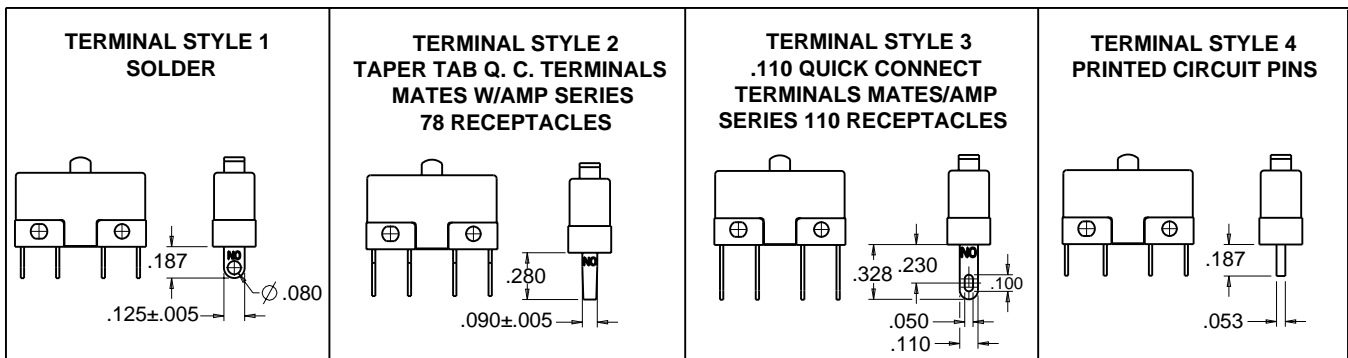
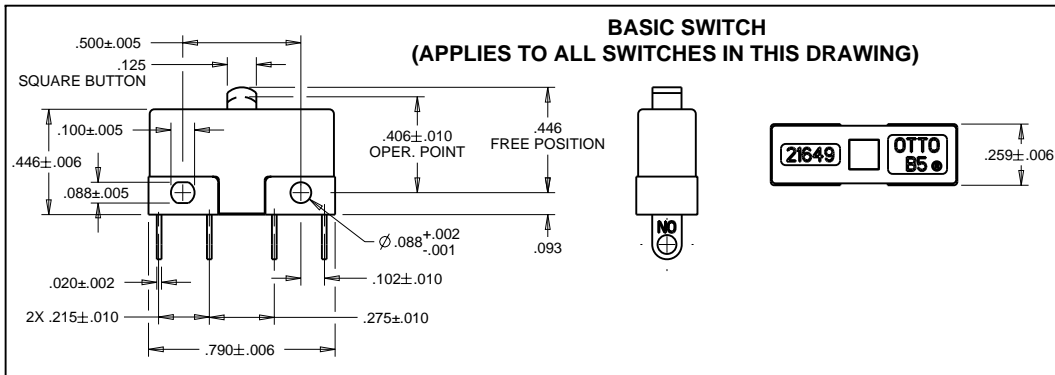
### B5 PART NUMBER CODE



① Mates with AMP Series 110 receptacles.

# MINIATURE BASIC SWITCHES

DOUBLE BREAK, SNAP-ACTION COMMERCIAL & MILITARY GRADES, MINIATURE





# MINIATURE BASIC SWITCHES

DOUBLE BREAK, SNAP-ACTION, MINIATURE, FRONT OR END TERMINALS



End Terminal Style



Front Terminal Style

Two switches in one case! The B5-7 series basic switches are miniature in size but feature up to 10 amps switching capability of 100,000 cycles.

The molded housing is rugged and structurally stable. The terminals are sealed against solder flux entering the switch and are bright acid tin plate brass for excellent solderability. B5-71 has end terminals; B5-72 has front terminals.

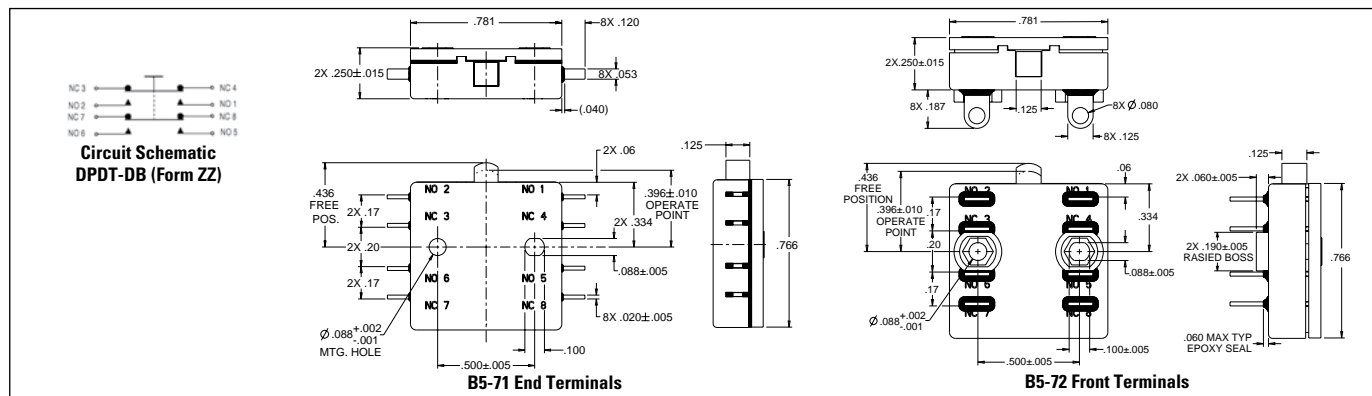
## Features:

- Double pole, 4-circuit
- Up to 10 amps switching capability
- Simultaneity of both poles to within 0.004"
- Button accepts actuation directly from cam
- Choice of end or front terminals
- RoHS compliant

Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS: See chart below</b>	
<b>Electrical Life:</b>	50,000 cycles
<b>Mechanical Life:</b>	100,000 cycles
<b>Seal:</b>	Unsealed
<b>Operating Temp Range:</b>	-65°C to +125°C
<b>Operating Force:</b>	12 +/- 4 oz
<b>Release Force:</b>	5 oz min
<b>Operate Point:</b>	0.396 +/- 0.010 inches from mounting holes
<b>Overtravel:</b>	0.012 inches min
<b>Simultaneity:</b>	Within 0.004 inches
<b>Movement Differential:</b>	0.020 +/- 0.010 inches
<b>Pretravel:</b>	0.050 inches max
<b>MATERIALS:</b>	
<b>Case:</b>	Thermoset, blue
<b>Cover:</b>	Thermoset, blue
<b>Button:</b>	Thermoplastic, black
<b>Terminals:</b>	End or front solder type brass with bright acid tin plating
<b>Contacts:</b>	Silver with gold
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	None provided

Catalog Number	Type of Load	Sea Level @ 28VDC DPST	Sea Level @ 28VDC 4 Circuit	Sea Level @ 115VAC, 60Hz DPST	Sea Level @ 115VAC, 60Hz 4 Circuit	70,000 feet @ 28VDC DPST	70,000 feet @ 28VDC 4 Circuit	Contact Plating Over Silver
B5-71001 & B5-72001	Resistive	10A	10A	7.5A	5A	10A	10A	Gold
B5-71001	Inductive*	7.5A	5A	5A	5A	3.5A	2A	Gold
B5-72001	Inductive	5A	2A	5A	5A	3.5A	2A	Gold
B5-71001 & B5-72001	Lamp	2A	2A	N/A	N/A	N/A	N/A	Gold
B5-71004 & B5-72004	Resistive	5A	5A	N/A	N/A	5A	5A	Gold
B5-71004 & B5-72004	Inductive*	3A	3A	N/A	N/A	3A	3A	Gold
B5-71002 Logic Level	Resistive	1A	1A	N/A	N/A	1A	1A	Gold
B5-72002 Logic Level	Inductive*	0.5A	0.5A	N/A	N/A	0.5A	0.5A	Gold
Dielectric Withstand:		1000Vrms	1000Vrms	1000Vrms	1000Vrms	400Vrms	400Vrms	

\*L/R = 0.026



# G2 and G3 Grips



## MILITARY GROUND SUPPORT & FLIGHT CONTROL GRIPS

For over 50 years, OTTO has built a reputation for innovative engineering capabilities and adherence to the highest quality standards. Our switches and controls perform every day in some of the toughest applications in the world, from Military Ground Support Grips, Throttle Quadrant and Control Grips for fixed-wing aircraft, to Helicopter Cyclic and Collective Grips. OTTO houses a complete MIL-I-45208, as well as ISO 17025 (A2LA), onsite test lab facility with environmental, mechanical, electrical and audio test capabilities. Registration to ISO 9001:2015, AS9100D and FAA Part 145 Repair Station. Our experience and know-how in the design and manufacturing of precision switches and grips have made us a supplier to all flight control manufacturers. With an emphasis on sealed-switch technology and custom electromechanical switch design and development, OTTO has a solution to meet the most demanding applications.

### Military Ground Support Grips

- Custom machined heads available to fit standard handles
- Backlighting options
- Custom head can be outfitted with a variety of OTTO switches

### Military Flight Control Grips

- B8 & Cobra style grips are made in accordance with MIL-DTL-25561
- Most ergonomic version on the market
- Non-reflecting, non-hygroscopic, rugged injection molded grip
- Choice of termination styles—from integral connectors to wire harnesses
- Threaded disconnect or tube mounting
- Can be populated with MIL qualified switches, standard or custom configurations

### Throttle Control Grips

- Control for fixed-wing aircraft
- Custom toggle & rocker switches can be used to meet high cycle requirements



Collective Grips



Military Ground Support Grips



Cyclic Grips



Cobra Style Grips



B8 Style Grips



Throttle Grips

## HELICOPTER CYCLIC & COLLECTIVE GRIPS



Exploded View

### Helicopter Cyclic & Collective Grips

- Grips have thin-wall, investment cast aluminum construction for high strength & low weight
- Modular construction
- Custom heads & switch mounting plates can be fabricated to fit standard handles
- Available with switch access panel for easy repair & maintenance
- A variety of button colors & style options available
- Transducer & electromechanical trim switch options



Collective Grip with  
Thumbwheel Switch  
and NVG Compatible  
Backlighting



Helicopter  
Cyclic Grips



Cyclic Grip with  
Custom Switch  
Guards

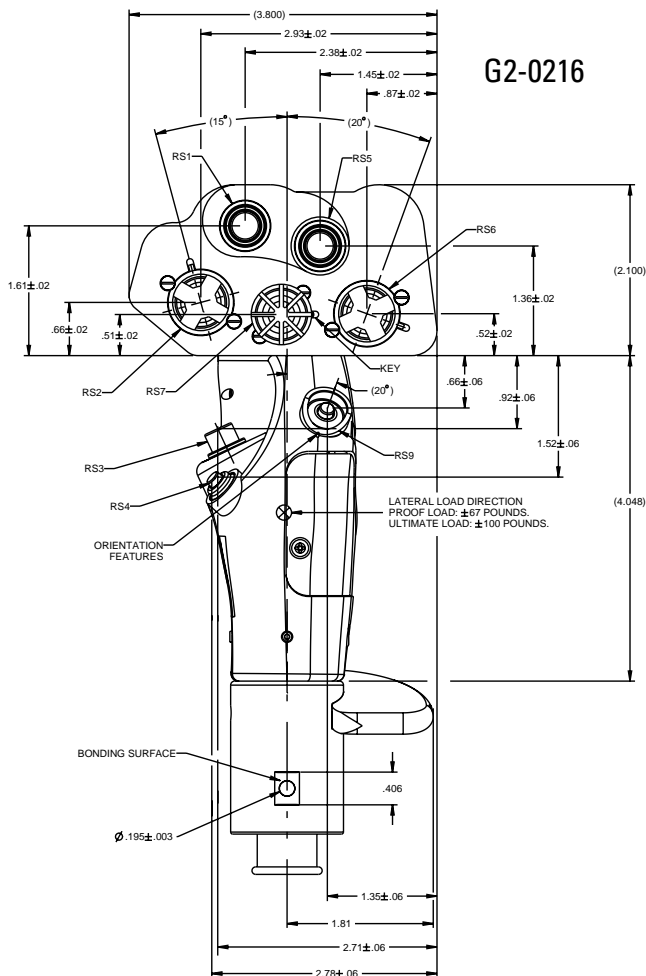


Systems Grip

## RUGGED DESIGN

For over 50 years, OTTO has built a reputation for innovative engineering capabilities and adherence to the highest quality standards. Our switches and controls perform every day in some of the toughest applications in the world, from Military Ground Support Grips, Throttle Quadrant and Control Grips for fixed-wing aircraft, to Helicopter Cyclic and Collective Grips. OTTO houses a complete MIL-I-45208, as well as ISO 17025 (A2LA), onsite test lab facility with environmental, mechanical, electrical and audio test capabilities. Registration to ISO 9001:2015, AS9100D and FAA Part 145 Repair Station.

Using OTTO's extensive experience in designing and manufacturing flight grips combined with OTTO's high quality, high performance switches, OTTO has created standard flight grips for use in a variety of flight control applications. The G2-0216, G2-0217 and G2-0218 grips are cast aluminum for strength and include a multitude of switches to control a myriad of functions. Standard cable length is 8' min. The grips are designed to be dropped in to almost any flight control application.

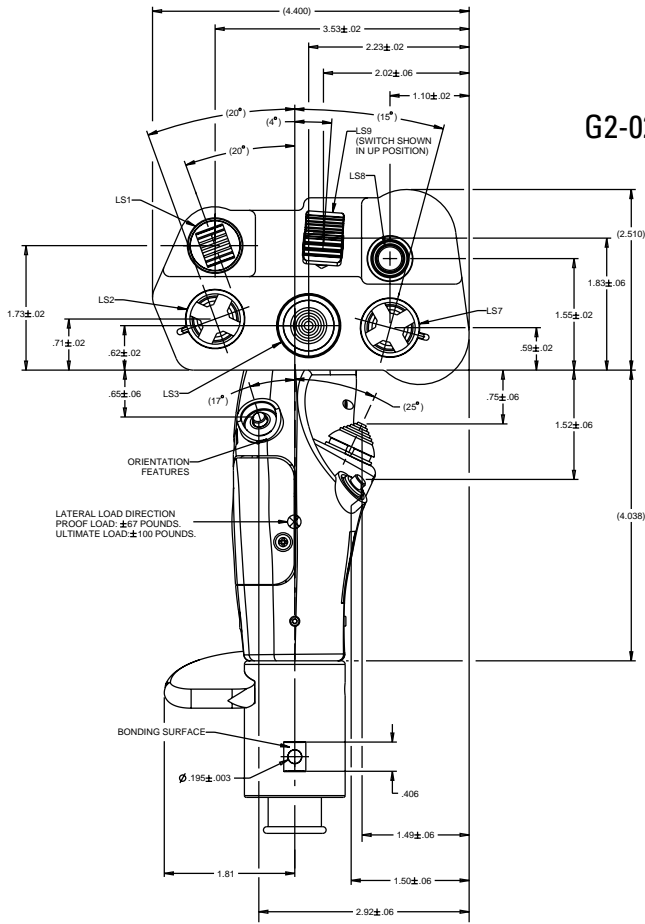


### Features:

- **Flight control grips now offered as a standard part - Ready to use right out of the box**
- **Available in three versions - left hand with hand rest, right hand with hand rest and right hand with no hand rest**
- **Grips have thin-wall, investment cast aluminum construction for high strength & low weight**
- **Modular construction**
- **Incorporates switch access panel for easy repair & maintenance**

Our experience and know how in the design and manufacturing of precision switches and grips have made us a supplier to all major flight control manufacturers. With an emphasis on sealed-switch technology and custom electromechanical switch design and development, OTTO has a solution to meet the most demanding applications.

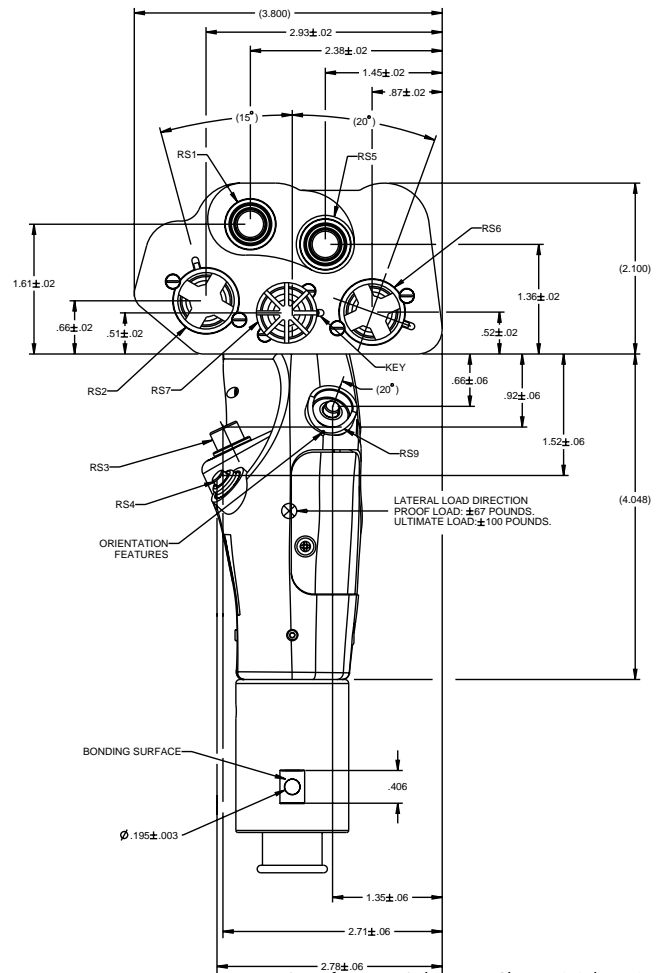
RUGGED DESIGN



G2-0217



G2-0218



Specifications Subject To Change Without Notice

## RUGGED DESIGN

Cast from aluminum alloy, the G2 Commander Grip is a rugged industrial control grip suitable for demanding applications. The standard G2 Commander Grip offers nine different faceplate configurations that include pushbutton, toggle, transducer, split trim and Hall effect switches. Thousands of custom faceplate configurations are possible. The grip has 10 possible switch location options.

The G2 Commander Grip is suitable for use in military, aerospace and industrial applications, and is the ideal solution where durability and dependability are required.

### Features:

- **Standard design eliminates the need for tooling charges**
- **Available as a fixed grip or can be mounted on an OTTO Hall effect joystick**
- **Various mounting & termination options available**
- **Nine standard faceplate configurations that collectively include OTTO's T3, T4 and T5 toggle switches, P4, P7 and P9 pushbutton switches, K1 rocker switches, SPT split trim switches, J2 transducer switches, FG flip guards, and HTWM, HTL and HTLT Hall effect controls.**
- **Thousands of custom faceplate configurations possible that can accommodate virtually all OTTO pushbutton, rocker, toggle, trim, transducer and thumbwheel switches**
- **Operator presence and trigger options**
- **USB output option**
- **Tested to withstand a 265 lb. load**
- **Grip sealed to IP68S (subject to change based on switch choice)**



Commander Grip with Brow Shown

#### Standard Physical Characteristics:

MATERIALS:	
Handle:	Aluminum, investment cast, A356-T6
Faceplate:	Aluminum, wrought, 6061-T6
Wires (Flying Leads):	22 AWG per M22759/11-22
Wires (USB Cable)	USB 2.0 type A connector

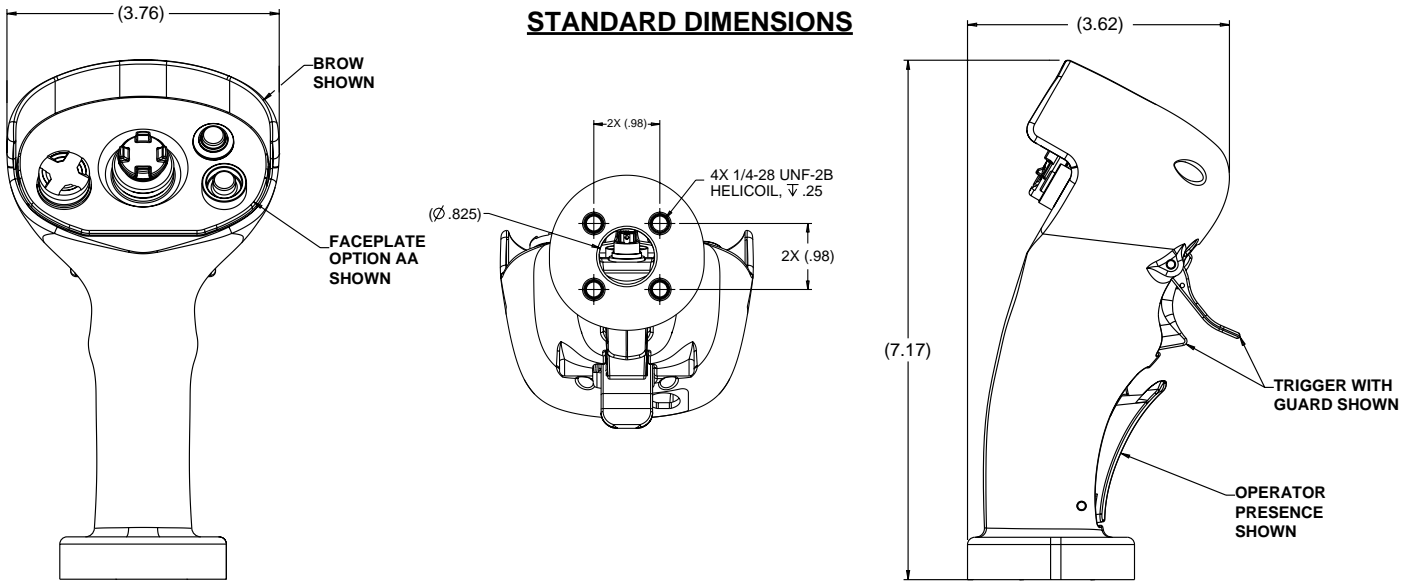
### G2 COMMANDER GRIP PART NUMBER CODE

G2	-	X	X	XX	X	X	X	X	X	X	X
Trigger With Guard	Operator Presence	Faceplate Option*	Grip Head Brow	Grip Head Switches Back	Grip Head Switches Top	Grip Head Switches Side*	Handle Switches	Cable Output	Paint		
1. None 2. Yes	1. None 2. Yes	AA AB AC AD AE AF AG AH AJ	1. None 2. Yes	1. None 2. One P7 Back Left 3. One P7 Back Right 4. Two P7's - Back Left & Right	1. None 2. One P7 Top Left 3. One P7 Top Right 4. Two P7's - Top Left & Right	1. None 2. One P7 Side Left 3. One P7 Side Right 4. Two P7's - Side Left & Right	1. None 2. One P7 Side Left 3. One P7 Side Right	1. Flying Leads 3' 2. USB Cable 5'**	1. Polyurethane Per MIL-DTL-53039, Color Black #37038 Per FED-STD-595 2. Powder Coat, Color Black #37038 Per FED-STD-595		

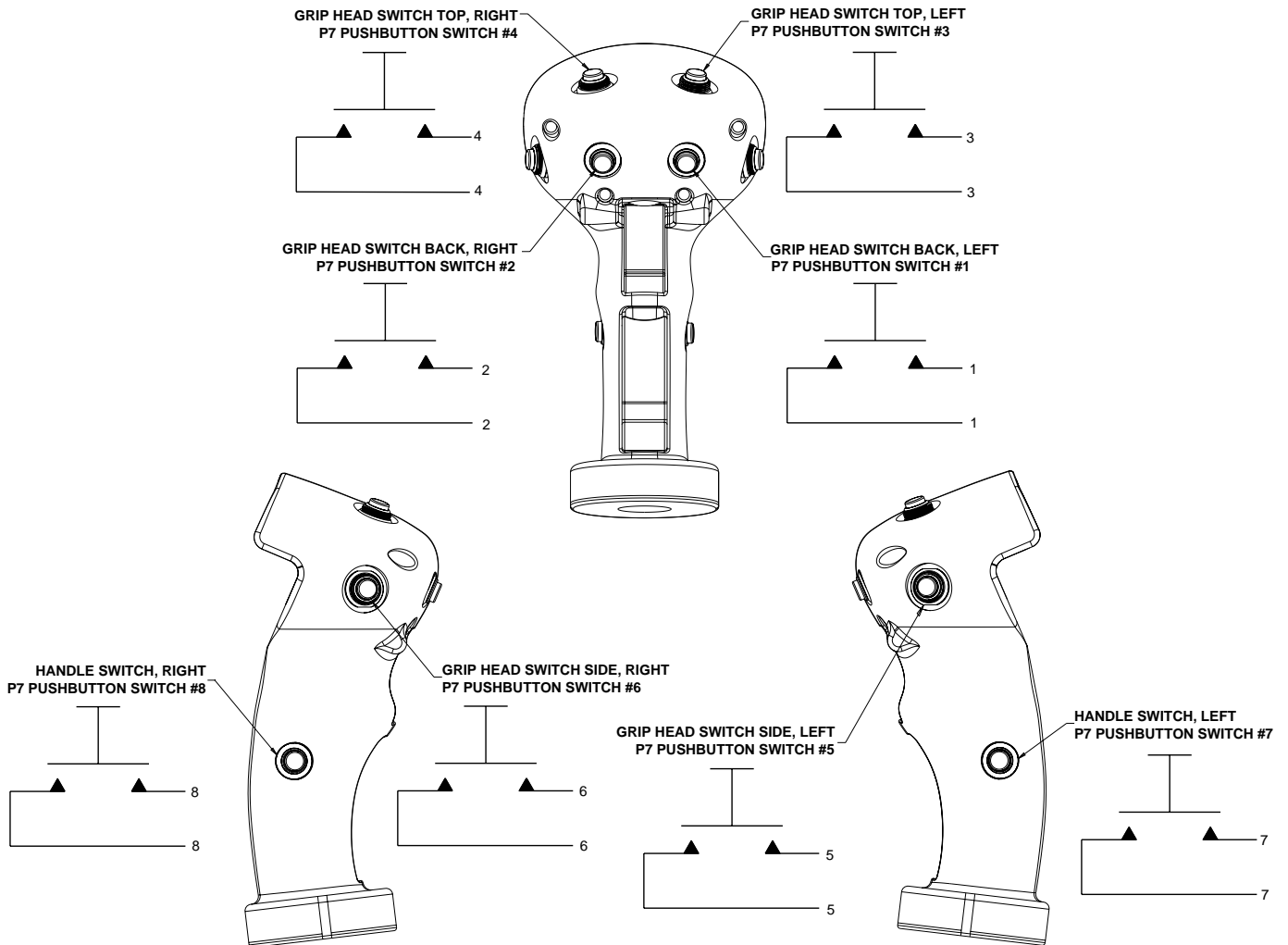
\* See Faceplate Configurations on Pages 33-34.  
Faceplate options AB, AD and AH not available with grip head switches side, option 2 & 4.  
Faceplate options AE and AF not available with grip head switches side, option 3 & 4.  
\*\*Faceplate options AC and AF not available with USB Cable Output option.

**RUGGED DESIGN**

**STANDARD DIMENSIONS**



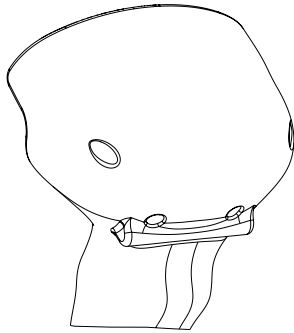
**GRIP HEAD AND HANDLE SWITCH OPTIONS**



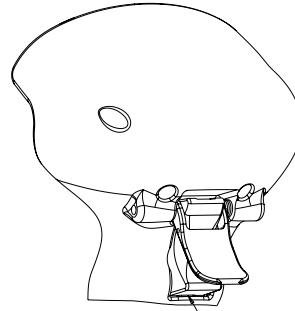


## TRIGGER, BROW AND OPERATOR PRESENCE OPTIONS

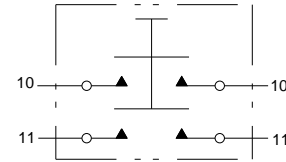
### TRIGGER OPTIONS



NO TRIGGER

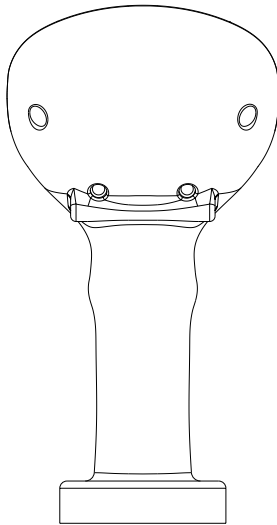


P4 PUSHBUTTON SWITCH

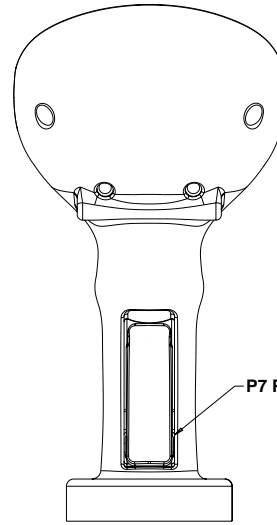


TRIGGER WITH GUARD

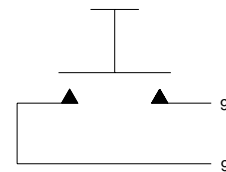
### OPERATOR PRESENCE OPTIONS



NO OPERATOR PRESENCE

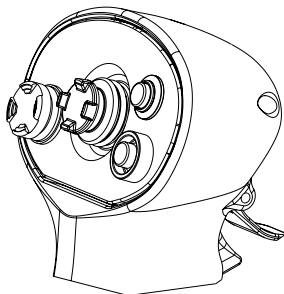


P7 PUSHBUTTON SWITCH #9

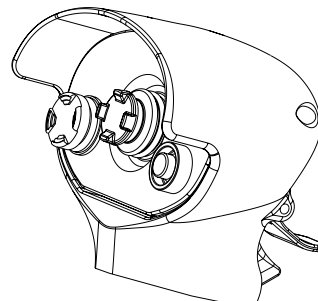


OPERATOR PRESENCE

### BROW OPTIONS



NO BROW

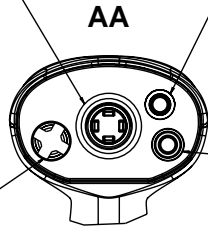
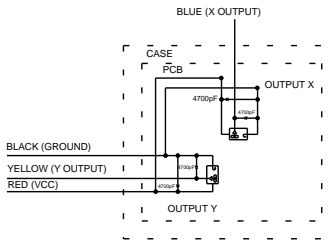


WITH BROW

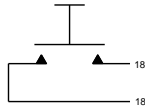
STANDARD CONFIGURABLE FACEPLATE OPTIONS

## FACEPLATE OPTIONS

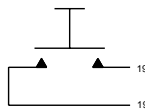
### HTL4 HALL EFFECT SWITCH



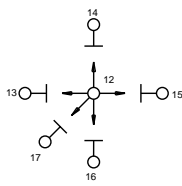
### P7 PUSHBUTTON SWITCH



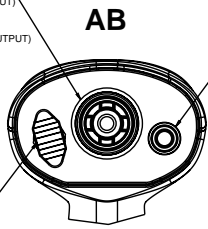
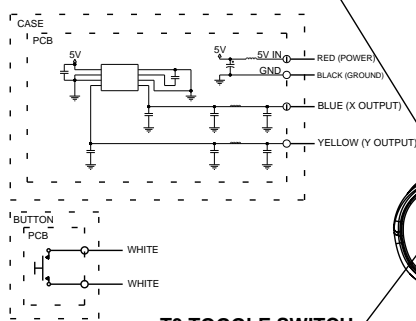
### P7 PUSHBUTTON SWITCH



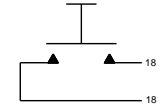
### T5 TOGGLE SWITCH



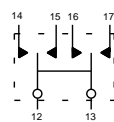
### HTL4 HALL EFFECT SWITCH



### P7 PUSHBUTTON SWITCH

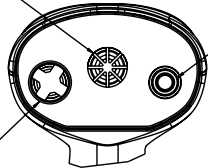
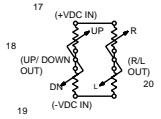


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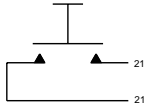


### AC

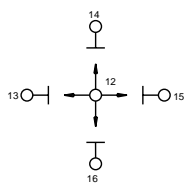
### J2 TRANSDUCER SWITCH



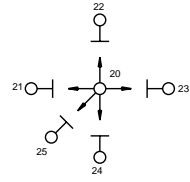
### P7 PUSHBUTTON SWITCH



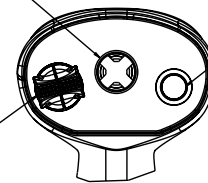
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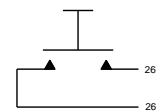
### T5 TOGGLE SWITCH



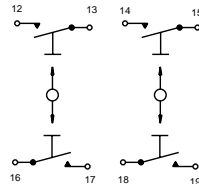
### AD



### P7 PUSHBUTTON SWITCH

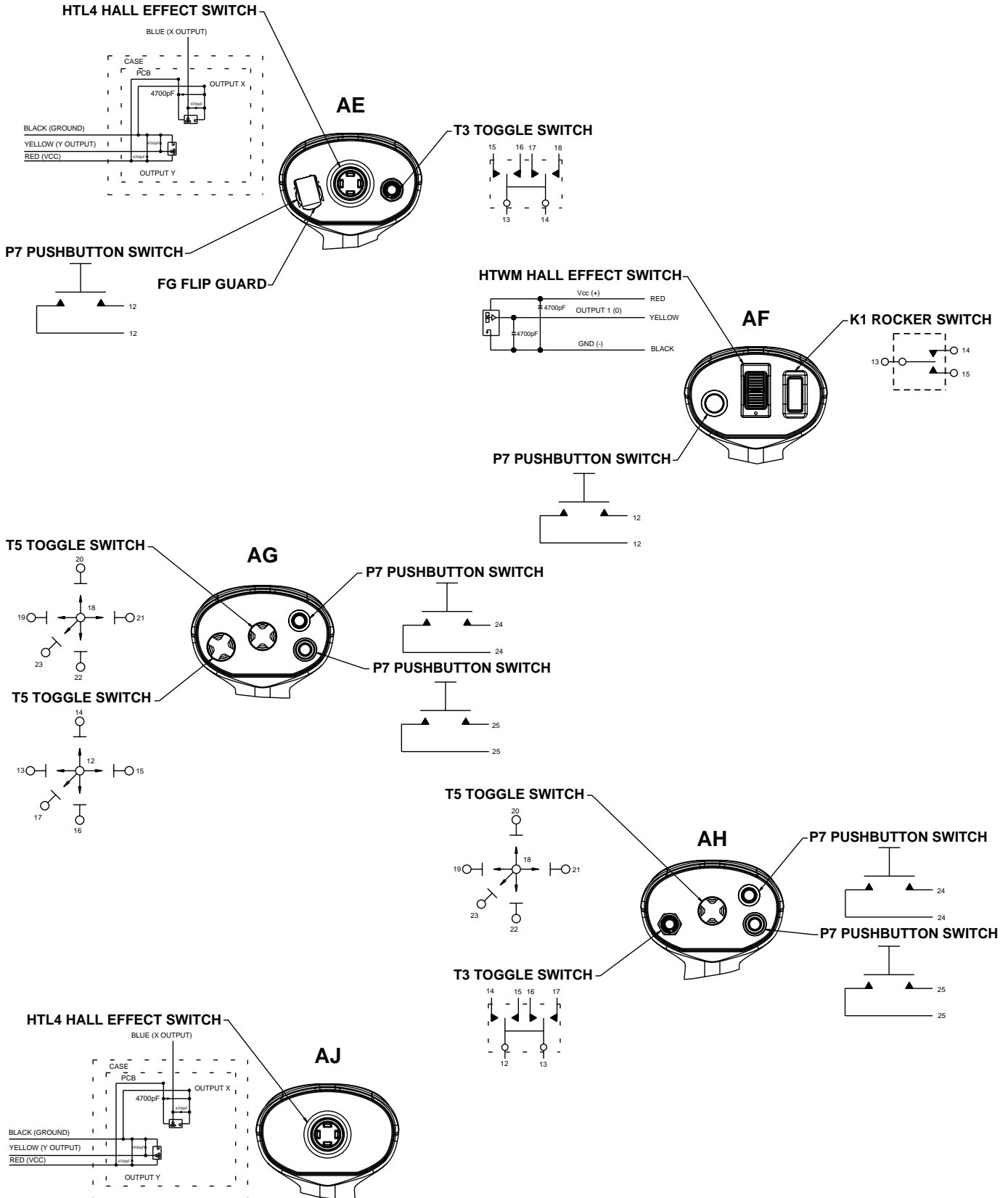


### SPT SPLIT TRIM SWITCH



## STANDARD CONFIGURABLE FACEPLATE OPTIONS

### FACEPLATE OPTIONS



## HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

The G3 Universal Grips can be customized for top-of-the-line machines requiring high switch content, or to provide only basic control functions on lower tier units. The grips are designed to be panel mounted as a fixed control grip or mounted on an OTTO JH, JHL or JHM joystick.

The OTTO G3 Universal Grips have a modular design and were developed for use with OTTO's standard pushbuttons, rockers, toggles, Hall effect switches and the JH, JHL and JHM series Hall effect joysticks. The G3 Grips are easily customized with multiple switch configurations, quickly and without tooling charges.

### Features:

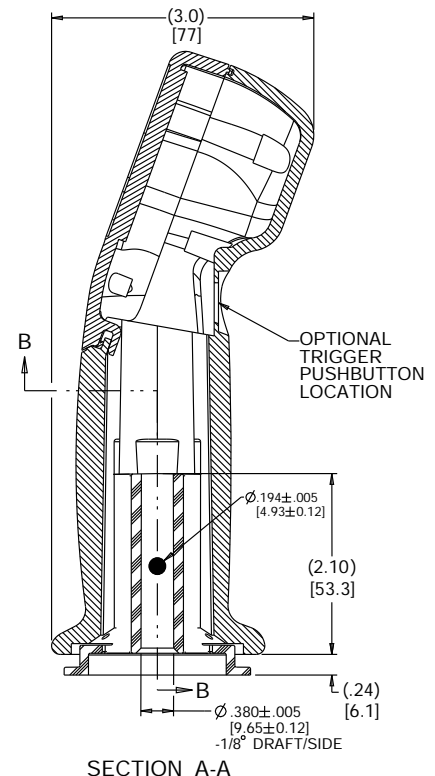
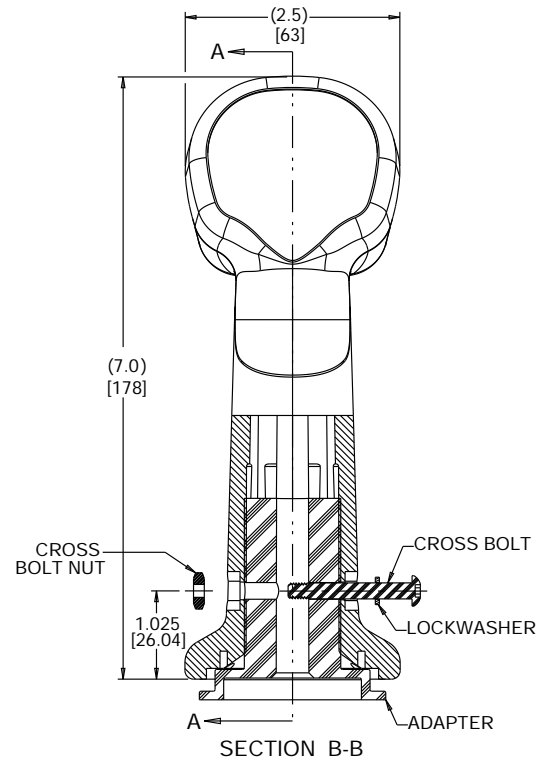
- **Compatible with the OTTO JH , JHL and JHM series Hall effect Joysticks**
- **Variety of sizes/shapes available**
- **Accommodates a full line of pushbutton, rocker, toggle, HP Hall effect & HPL proportional output series of switches**
- **Various mounting & termination options available**
- **Includes mounting adapter with boot ring (where applicable)**
- **Modular faceplate design reduces the need for tooling charges**



## G3-A UNIVERSAL GRIP

Standard Characteristics/Ratings:				
<b>ELECTRICAL RATINGS:</b>				
<b>K1 Switches</b>				
Electrical Rating @ 28 VDC	16 AMP Resistive Load; 7 AMP Inductive Load			
Electrical Life	25,000 Cycles at Full Load			
<b>P9 Switches</b>				
Electrical Rating @ 28 VDC	5 AMP Resistive Load; 3 AMP Inductive Load			
Electrical Life	25,000 Cycles at Full Load			
<b>MECHANICAL RATINGS</b>				
<b>K1 Switches</b>				
Mechanical Life	100,000 Cycles			
<b>P9 Switches</b>				
Mechanical Life	1,250,000 Cycles			
<b>ENVIRONMENTAL:</b>				
<b>Operating Temperature:</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
	° C	-40*	20	85
<b>K1 Switches</b>				
Switch Seal Integrity	Watertight per IP68S (1 meter) and IP69K			
<b>P9 Switches</b>				
Switch Seal Integrity	Watertight per IP68S (1 meter) and IP69K			
<b>Grip</b>				
Seal Integrity	Unsealed			
<b>MATERIALS:</b>				
<b>Handle</b>	Thermoplastic, Glass Reinforced, Black			
<b>Faceplate</b>	Thermoplastic, Glass Reinforced, Black			
<b>Mounting Hardware</b>	#10 Crossbolt with Nut and Lockwasher			
<b>Wires</b>	22 AWG, UL Style 1569, (20" Long)			

\* Minimum operating temperature is -30°C when a K1 Switch is installed.



Note: All dimensions are for reference only.

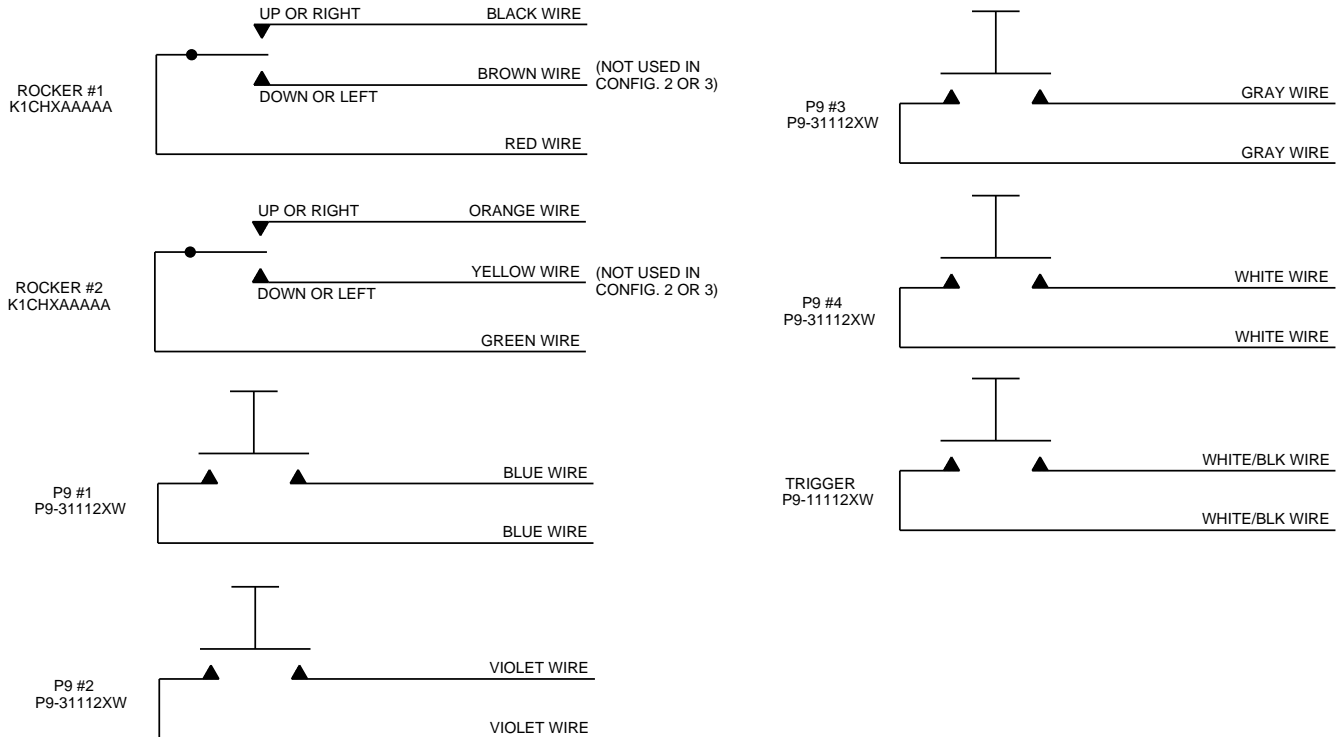
HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

## G3-A UNIVERSAL GRIP PART NUMBER CODE

	G3-A	X	XX	X	X	X	X	X	X
	Configuration	Switches	Trigger Pushbutton in Handle	K1 Rocker #1 Style - Black *	K1 Rocker #2 Style - Black *	P9 Button #1 Color	P9 Button #2 Color	P9 Button #3 Color	P9 Button #4 Color
1. Grip With Adapter	See Configuration Sheet on next page	1. None	1. None	1. None	1. None	1. Red	1. Red	1. Red	1. Red
2. Grip Without Adapter	See Configuration Sheet on next page	2. Black	2. Black	2. On-Off	2. On-Off	2. Black	2. Black	2. Black	2. Black
		3. Red	3. Red	3. (On)-Off	3. (On)-Off	3. Orange	3. Orange	3. Orange	3. Orange
				4. On-Off-On	4. On-Off-On	4. Yellow	4. Yellow	4. Yellow	4. Yellow
				5. (On)-Off-(On)	5. (On)-Off-(On)	5. Green	5. Green	5. Green	5. Green
						6. Blue	6. Blue	6. Blue	6. Blue
						7. Violet	7. Violet	7. Violet	7. Violet
						8. Gray	8. Gray	8. Gray	8. Gray
						9. White	9. White	9. White	9. White
						N. None	N. None	N. None	N. None

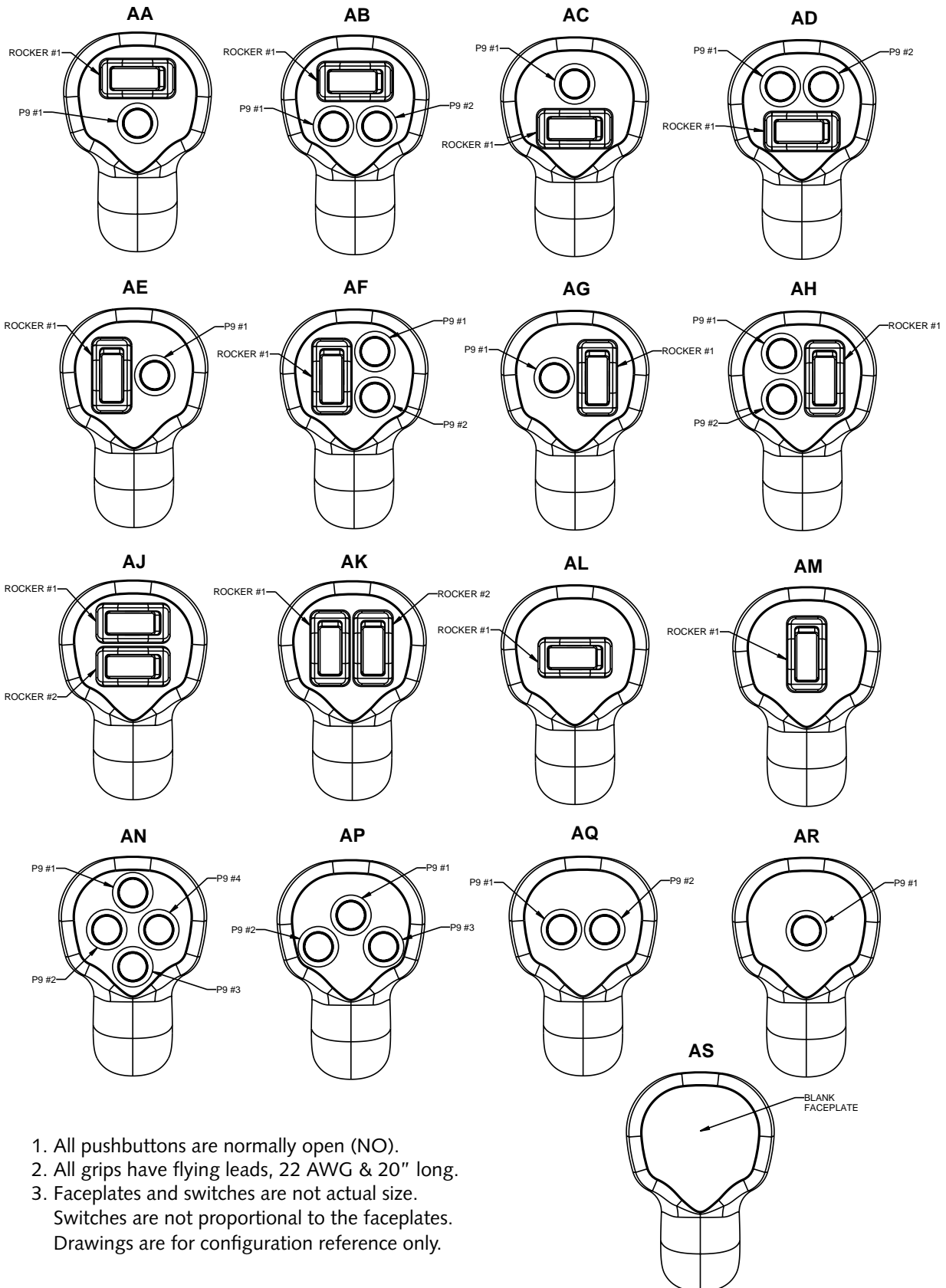
\* ( ) denotes momentary. On position or momentary position is up or to the right. Contact factory for rocker legends and additional color options.

## G3-A UNIVERSAL GRIP SCHEMATICS



HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-A UNIVERSAL GRIP SWITCH CONFIGURATIONS



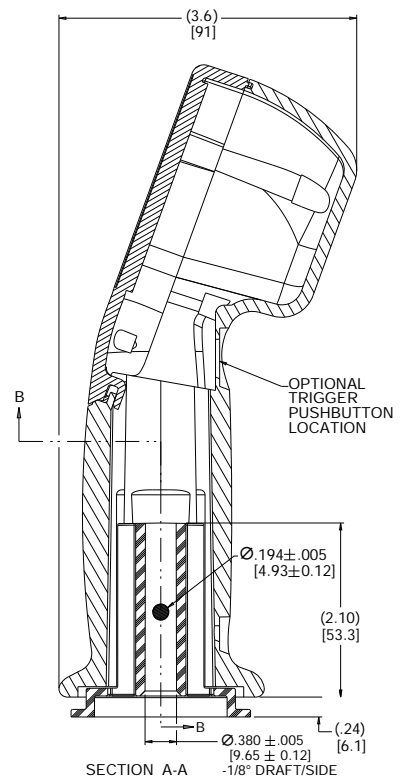
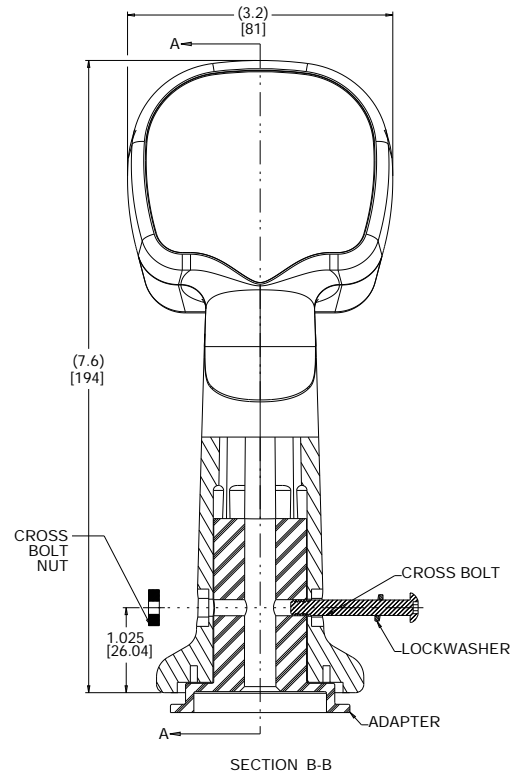
1. All pushbuttons are normally open (NO).
2. All grips have flying leads, 22 AWG & 20" long.
3. Faceplates and switches are not actual size.  
Switches are not proportional to the faceplates.  
Drawings are for configuration reference only.

HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-B UNIVERSAL GRIP

Standard Characteristics/Ratings:					
<b>ELECTRICAL RATINGS:</b>	<b>Full Load</b>	<b>Logic Level</b>			
<b>K1 Switches</b>	@ 28VDC	@5VDC			
Electrical Rating @ 28 VDC	16 AMP Resistive Load 10 AMP Inductive Load	10mA Resistive Load			
Electrical Life	25,000 Cycles	100,000 Cycles			
<b>P9 Switches</b>	@ 28VDC	@5VDC			
Electrical Rating	5 AMP Resistive Load 3 AMP Inductive Load	10mA Resistive Load			
Electrical Life	25,000 Cycles	1,250,000 Cycles			
<b>Thumbwheels</b>					
Rated at $V_{cc}=5V@20^{\circ}C$ ; Load = 1ma (4-7K)					
	<b>Units</b>	<b>M</b>	<b>In</b>	<b>Typ</b>	<b>Max</b>
Supply Voltage	VDC		4.50	5.00	5.50
Output Voltage – Return to Center Tolerance at Center	VDC @ 5V Vcc		-.10	N/A	+.10
Output Voltage – Return to End Tolerance at Rest	VDC @ 5V Vcc		-.25	N/A	+.25
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc		-.25	N/A	+.25
Supply Current B=0, Vcc=5V, Io=0	mA		N/A	N/A	10
<b>MECHANICAL RATINGS</b>					
<b>K1 Switches</b>					
Mechanical Life	100,000 Cycles				
<b>P9 Switches</b>					
Mechanical Life	1,250,000 Cycles				
<b>Thumbwheels</b>					
Mechanical Life (Full Forward to Full Back)	3,000,000 Cycles (Return to Center) 1,000,000 Cycles (Return to End) 250,000 Cycles (Friction)				
	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
Operating Force (25°C at the Top of Roller)	OZ	8	12	16	
Initial Operating Force - Friction (25°C at the Top of Roller)	OZ	2	4	6	
Max Allowable Radial Load	LBS	N/A	N/A	30.0	
Travel	± 40 Degrees				
<b>ENVIRONMENTAL:</b>					
<b>Operating Temperature:</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
	° C	-40*	20	85	
<b>K1 Switches</b>					
Switch Seal Integrity	Watertight per IP68S (1 meter) and IP69K				
<b>P9 Switches</b>					
Switch Seal Integrity	Watertight per IP68S (1 meter) and IP69K				
<b>Thumbwheels</b>					
Electronics Seal Integrity	Watertight per IP68S (1 meter)				
Mechanical Seal Integrity	Unsealed				
<b>Grip</b>					
Seal Integrity	Unsealed				
<b>MATERIALS:</b>					
<b>Handle</b>	Thermoplastic, Glass Reinforced, Black				
<b>Faceplate</b>	Thermoplastic, Glass Reinforced, Black				
<b>Mounting Hardware</b>	#10 Crossbolt with Nut and Lockwasher				
<b>Wires</b>	22 AWG, UL Style 1569, (20" Long)				

\* Minimum operating temperature is -30°C when a K1 Switch is installed.



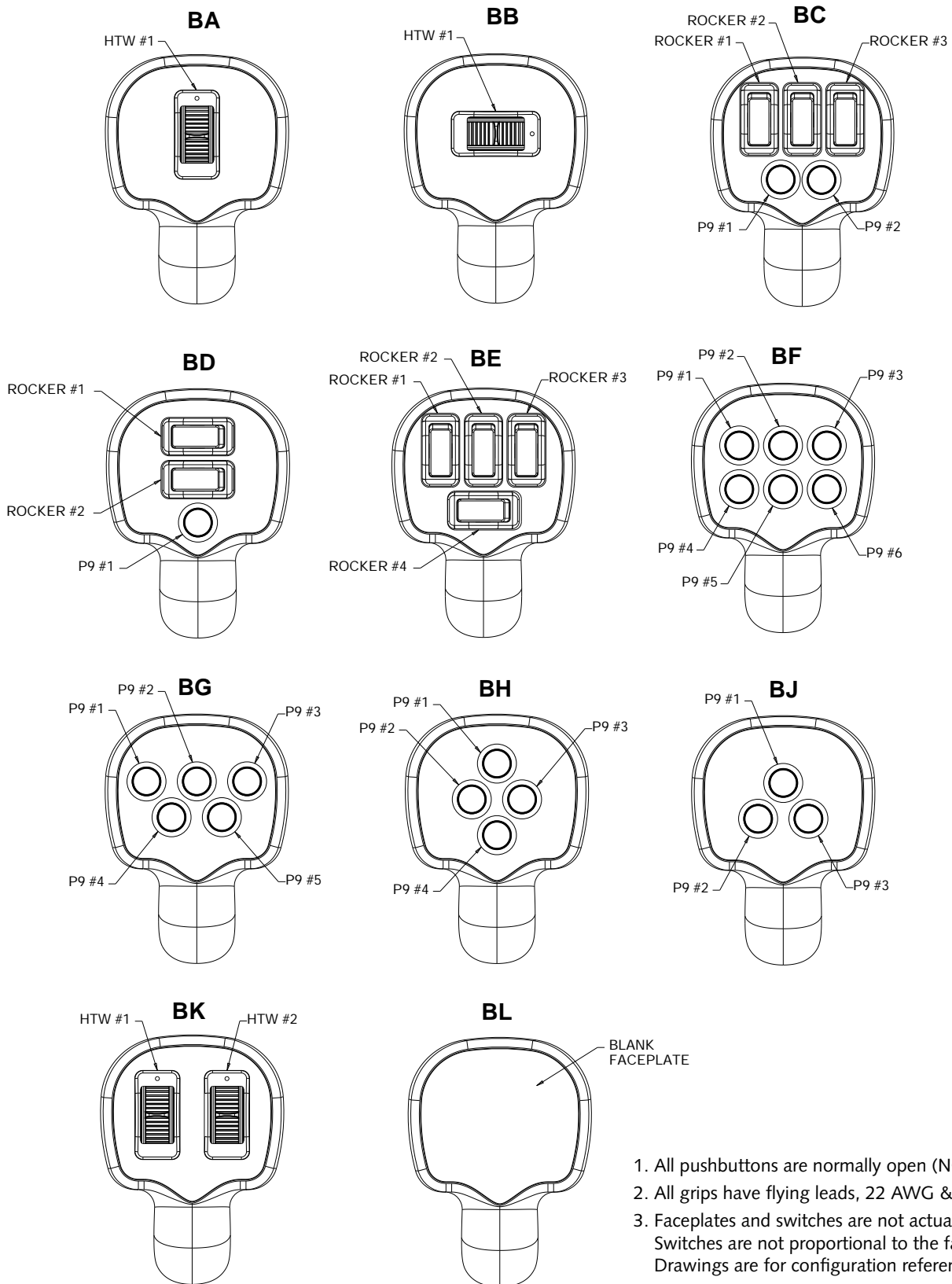
Note: All dimensions are for reference only.

Specifications Subject To Change Without Notice



STANDARD FACEPLATES

## G3-B UNIVERSAL GRIP SWITCH CONFIGURATIONS



1. All pushbuttons are normally open (NO).
2. All grips have flying leads, 22 AWG & 20" long.
3. Faceplates and switches are not actual size. Switches are not proportional to the faceplates. Drawings are for configuration reference only.

HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

## G3-B UNIVERSAL GRIP PART NUMBER CODE

	<b>G3-B</b>	<b>X</b>	<b>XX</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>Part Number Code Continued Below</b>
	<b>Configuration</b>	<b>Switches</b>	<b>Trigger Pushbutton in Handle</b>	<b>K1 Rocker #1 Style - Black *</b>	<b>K1 Rocker #2 Style - Black *</b>	<b>K1 Rocker #3 Style - Black *</b>	<b>K1 Rocker #4 Style - Black *</b>		
	1. Grip With Adapter	See Configuration Sheet on next page	1. None 2. Black	1. None 2. On-Off 3. (On)-Off 4. On-Off-On 5. (On)-Off-(On)	1. None 2. On-Off 3. (On)-Off 4. On-Off-On 5. (On)-Off-(On)	1. None 2. On-Off 3. (On)-Off 4. On-Off-On 5. (On)-Off-(On)	1. None 2. On-Off 3. (On)-Off 4. On-Off-On 5. (On)-Off-(On)		
	2. Grip Without Adapter		3. Red						

\* ( ) denotes momentary. On position or momentary position is up or to the right. Contact factory for rocker legends and additional color options.

## G3-B PART NUMBER CODE CONTINUED

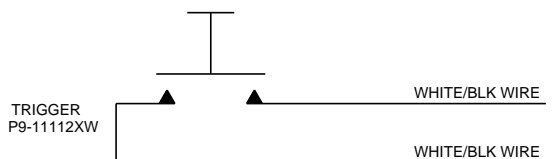
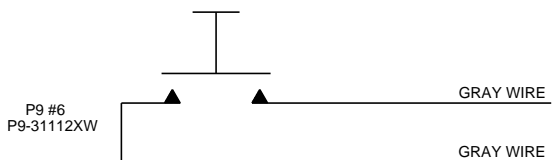
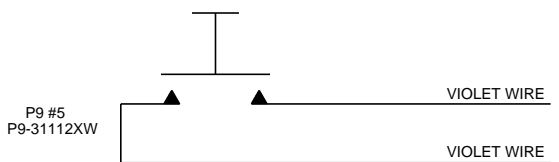
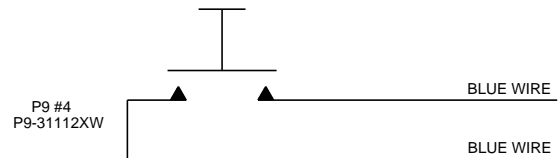
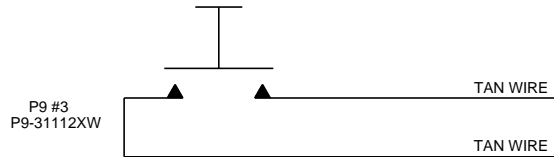
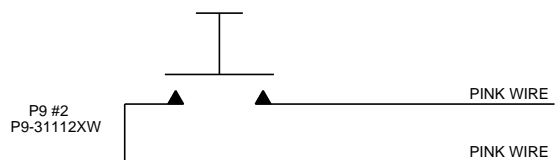
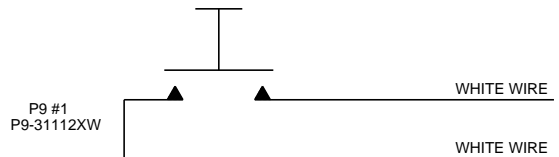
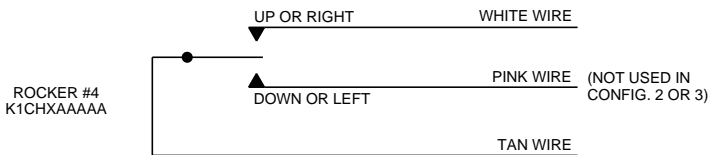
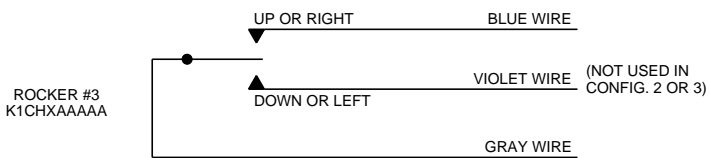
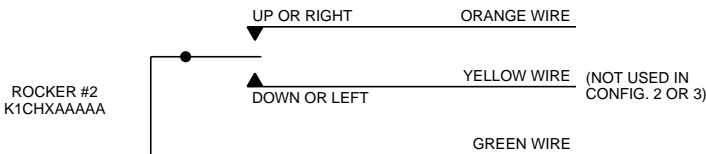
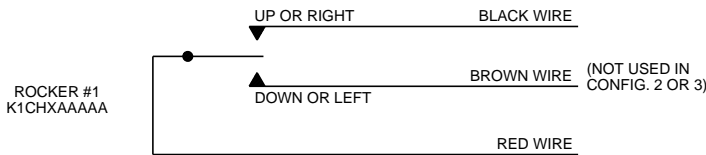
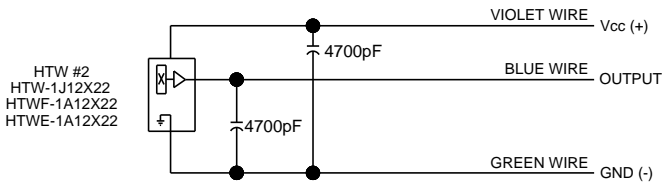
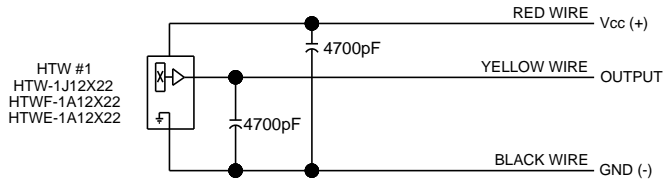
<b>Cont.</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>HTW #1**</b>	<b>HTW #2**</b>	<b>P9 Button #1 Color</b>	<b>P9 Button #2 Color</b>	<b>P9 Button #3 Color</b>	<b>P9 Button #4 Color</b>	<b>P9 Button #5 Color</b>	<b>P9 Button #6 Color</b>	
1. None	1. None	1. Red	1. Red	1. Red	1. Red	1. Red	1. Red	
2. Return to Center <sup>1</sup>	2. Return to Center <sup>1</sup>	2. Black	2. Black	2. Black	2. Black	2. Black	2. Black	
3. Friction <sup>2</sup>	3. Friction <sup>2</sup>	3. Orange	3. Orange	3. Orange	3. Orange	3. Orange	3. Orange	
4. Return to End <sup>3</sup>	4. Return to End <sup>3</sup>	4. Yellow	4. Yellow	4. Yellow	4. Yellow	4. Yellow	4. Yellow	
		5. Green	5. Green	5. Green	5. Green	5. Green	5. Green	
		6. Blue	6. Blue	6. Blue	6. Blue	6. Blue	6. Blue	
		7. Violet	7. Violet	7. Violet	7. Violet	7. Violet	7. Violet	
		8. Gray	8. Gray	8. Gray	8. Gray	8. Gray	8. Gray	
		9. White	9. White	9. Whit	9. White	9. White	9. White	
		N. None	N. None	N. None	N. None	N. None	N. None	

1 = HTW-1J12X22\*\*\*  
2 = HTWF-1A12X22\*\*\*  
3 = HTWE-1A12X22\*\*\*

\*\* Positive travel is up or to the right. Contact factory for additional options.  
\*\*\*Contact factory for additional options.

HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

## G3-B UNIVERSAL GRIP SCHEMATICS



## G3-C UNIVERSAL GRIP

Z-axis rotation, trigger switches, grip touch switch, side keypads, and faceplate keypads are the exciting features of OTTO's ergonomically designed and customizable G3-C Universal Grip. Its high switch content capability increases the level of functionality, benefiting anyone who requires versatility in a grip.

The grip touch switch uses a sensor to detect the presence of the operator's hand on the grip. The new trigger switch selections for the back of the grip include single trigger, dual momentary trigger and dual maintained trigger. Keypads are available on both the faceplate, with up to 8 switches, and on either side of the grip as a side keypad, with up to 10 switches on each side (G3-CK). Backlighting is also an option. The z-axis feature allows for a +/- 25° horizontal rotation of the grip.\*

With numerous faceplate selections, the G3-C can be customized from applications requiring basic control functions to those requiring high switch content. The G3-C can be panel mounted as a fixed control grip or it can be mounted on an OTTO JH, JHL and JHM joystick with or without z-axis.

The G3-C is designed for use with OTTO's pushbuttons, rockers, toggles and Hall effect switches, and can handle many types of high-performance industrial vehicle and machinery applications.

### Features:

- Z-axis option with +/- 25° rotation\*
- The grip can be used with either the left or right hand
- Numerous standard faceplate designs incorporating up to 8 control switches (G3-C) or an 8-button keypad (G3-CK)
- 10-button side keypad option (G3-CK)
- Grip touch switch option
- Switch selections for the back of the grip handle include pushbutton, thumbwheel or trigger switches
- Various mounting & termination styles available
- Includes mounting adapter with boot ring

### Benefits:

- Modular design provides high level of customization and reduces the need for tooling charges
- Compatible with the OTTO JH, JHL and JHM series Hall effect Joysticks
- Accommodates a full line of OTTO pushbutton, rocker, toggle, and Hall effect switches

\* Z-axis available with grip mounted on an OTTO Joystick



G3-C with CC Faceplate



G3-CK with 8-Button Faceplate Keypad



G3-CK with Backlighting 8-Button Faceplate and a 10-Button Side Keypad



G3-C with Custom Faceplate Configuration



G3-C with Dual Direction Trigger on Back



G3-C with Pushbutton on Side and Back

HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-C & G3-CK UNIVERSAL GRIPS

Standard Characteristics/Ratings:					
<b>ELECTRICAL RATINGS:</b>					
<b>K1 Switches</b>					
Electrical Rating @ 28 VDC	16 AMP Resistive Load; 7 AMP Inductive Load				
Electrical Life	25,000 Cycles at Full Load				
<b>Keypads</b>					
Circuit Configuration	SPST N.O.				
Voltage	1-32 VDC				
Current	10-100mA Resistive				
<b>P9 Switches, Single and Dual Trigger</b>					
Electrical Rating @ 28 VDC	5 AMP Resistive Load; 3 AMP Inductive Load		10mA Resistive Load @ 5VDC		
Electrical Life	25,000 Cycles at Full Load		1,250,000 Cycles		
<b>HTWM Switches</b>					
Rated at Vcc = 5V @ 25°C; Load = 1ma (4-7KΩ)					
	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
Supply Voltage	VDC	4.50	5.00	5.50	
Output Voltage - Return to Center Tolerance at Center	VDC @ 5V Vcc	-0.15	N/A	+0.15	
Output Voltage - Return to End Tolerance at Rest	VDC @ 5V Vcc	-0.25	N/A	+0.25	
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-0.25	N/A	+0.25	
Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10	
<b>HTWS Switches</b>					
Rated at Vcc = 5V @ 25°C; Load = 1ma (4-7KΩ)					
	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
Supply Voltage	VDC	4.50	5.00	5.50	
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-0.25	N/A	+0.25	
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-0.25	N/A	+0.25	
Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	20	
<b>HRTL4 Switches</b>					
Rated at Vcc = 5V @ 25°C; Load = 1ma (4-7KΩ)					
	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
Supply Voltage	VDC	4.50	5.00	5.50	
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-0.25	N/A	+0.25	
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-0.25	N/A	+0.25	
Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	10	12	
<b>TC-5 Switches</b>					
Electrical Rating @ 1-32 VDC	10-100mA				
Electrical Life	3,000,000 Cycles				
<b>Grip Touch Switch</b>					
Rated at Vcc = 5V @ 25°C; Load = 1ma (4-7KΩ)					
	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
Supply Voltage	VDC	3.15	NA	5.50	
Output (Active Low)	VDC	N/A	N/A	0.60	
Output Current (Sink)	mA	N/A	N/A	10	

Standard Characteristics/Ratings (continued):					
<b>MECHANICAL RATINGS</b>					
<b>K1 Switches</b>					
Mechanical Life	100,000 Cycles				
<b>Keypads</b>					
Mechanical Life	3,000,000 Cycles				
<b>P9 Switches, Single and Dual Trigger</b>					
Mechanical Life	1,250,000 Cycles				
<b>HTWM Switches</b>					
Mechanical Life (Full Forward to Full Back)	3,000,000 Cycles (Return to Center)				
	1,000,000 Cycles (Return to End)				
<b>HTWS Switches</b>					
Mechanical Life (Full Forward to Full Back)	3,000,000 Cycles				
<b>HRTL4 Switches</b>					
Mechanical Life	3,000,000 Cycles				
<b>TC-5 Switches</b>					
Mechanical Life	3,000,000 Cycles				
<b>ENVIRONMENTAL:</b>					
<b>Operating Temperature:</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	
	°C	-40*	20	85	
<b>K1 Switches</b>					
Switch Seal Integrity	Watertight per IP68S and IP69K				
<b>Keypads</b>					
Switch Seal Integrity	Watertight per IP68S and IP69K				
<b>P9 Switches, Single and Dual Trigger</b>					
Switch Seal Integrity	Watertight per IP68S and IP69K				
<b>HTWM Switches</b>					
Electronics Seal Integrity	Watertight per IP68S and IP69K				
<b>HTWS Switches</b>					
Electronics Seal Integrity	Watertight per IP68S and IP69K				
<b>HRTL4 Switches</b>					
Electronics Seal Integrity	Watertight per IP68S and IP69K				
<b>TC-5 Switches</b>					
Electronics Seal Integrity	Watertight per IP68S and IP69K				
<b>Grip</b>					
Seal Integrity	Unsealed				
<b>MATERIALS:</b>					
<b>Handle</b>	Thermoplastic, Glass Reinforced, Black				
<b>Faceplate</b>	Thermoplastic, Glass Reinforced, Black				
<b>Keypads</b>	Silicone Rubber, Black				
<b>Keypads, Lighted</b>	Silicone Rubber, Black with White Graphic				
<b>Wires</b>	22 AWG				
<b>Side Keypad Wires</b>	24 AWG				
<b>Wire Length</b>	40 +/- 3 inches				

\* The min. temperature is -30°C when using a K1 switch.

**WARNING; Do not use the grip touch switch as a safety or emergency stop device or in any application where failure of the product could result in personal injury. Failure to comply with these instructions could result in death or serious injury. OTTO Engineering Inc. makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does OTTO Engineering Inc. assume any liability whatsoever arising out of the application or use of any product. The product sold hereunder by OTTO has been subject to limited testing and should not be used in conjunction with detection of the presence of an operator on or with any equipment that is in any way safety related. OTTO does not accept any liability for incidental, consequential damages, personal injury or loss of life for any claims against the use of this product.**

HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-C UNIVERSAL GRIP PART NUMBER CODE

<b>G3-C</b>	<b>X</b>	<b>XX</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>Part Number Code Continues Below</b>
<b>Configuration</b>	<b>Faceplate</b>	<b>Trigger in Handle</b>	<b>PB in Grip Head - Black</b>	<b>K1 Rocker #1 Style - Black **</b>	<b>K1 Rocker #2 Style - Black **</b>		
<ol style="list-style-type: none"> <li>1. Grip With Adapter</li> <li>2. Grip Without Adapter</li> <li>3. Grip with Adapter, with Grip Touch Switch</li> <li>4. Grip without Adapter, with Grip Touch Switch</li> </ol>	See Configuration Sheet	<ol style="list-style-type: none"> <li>1. None</li> <li>2. One Pushbutton, Black</li> <li>3. Two Pushbuttons, Black</li> <li>4. HTWS*</li> <li>5. Single Direction Momentary</li> <li>6. Dual Direction Momentary</li> <li>7. Dual Direction Maintained</li> </ol>	<ol style="list-style-type: none"> <li>1. None</li> <li>2. Left</li> <li>3. Right</li> <li>4. Left &amp; Right</li> </ol>	<ol style="list-style-type: none"> <li>1. None</li> <li>2. ON-OFF</li> <li>3. (ON)-OFF</li> <li>4. ON-OFF-ON</li> <li>5. (ON)-OFF-(ON)</li> </ol>	<ol style="list-style-type: none"> <li>1. None</li> <li>2. ON-OFF</li> <li>3. (ON)-OFF</li> <li>4. ON-OFF-ON</li> <li>5. (ON)-OFF-(ON)</li> </ol>		

\* HTWS-1A12X22

\*\* ( ) denotes momentary action. On position or momentary position is up or to the right. Contact factory for rocker legends and additional color options.

## G3-C PART NUMBER CODE CONTINUED

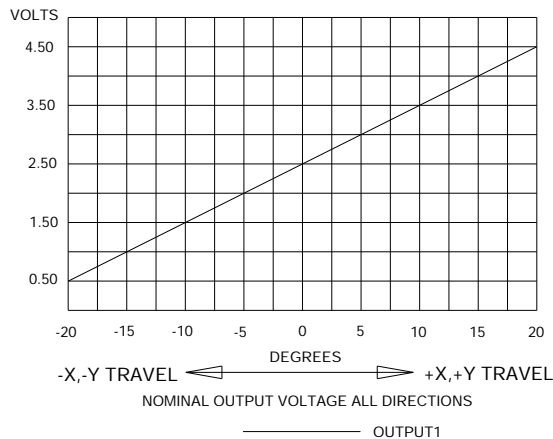
<b>HTWM #1***</b>	<b>HTWM #2***</b>	<b>P9 Button #1 Color</b>	<b>P9 Button #2 Color</b>	<b>P9 Button #3 Color</b>	<b>P9 Button #4 Color</b>	<b>P9 Button #5 Color</b>	<b>P9 Button #6 Color</b>	<b>P9 Button #7 Color</b>	<b>P9 Button #8 Color</b>
<ol style="list-style-type: none"> <li>1. None</li> <li>2. Return to Center<sup>1</sup></li> <li>3. Return to End<sup>2</sup></li> </ol>	<ol style="list-style-type: none"> <li>1. None</li> <li>2. Return to Center<sup>1</sup></li> <li>3. Return to End<sup>2</sup></li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>	<ol style="list-style-type: none"> <li>1. Red</li> <li>2. Black</li> <li>3. Orange</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Blue</li> <li>7. Violet</li> <li>8. Gray</li> <li>9. White</li> <li>N. None</li> </ol>

<sup>1</sup> = HTWM-1J12X22\*\*\*\*  
<sup>2</sup> = HTWME-1A12X22\*\*\*\*

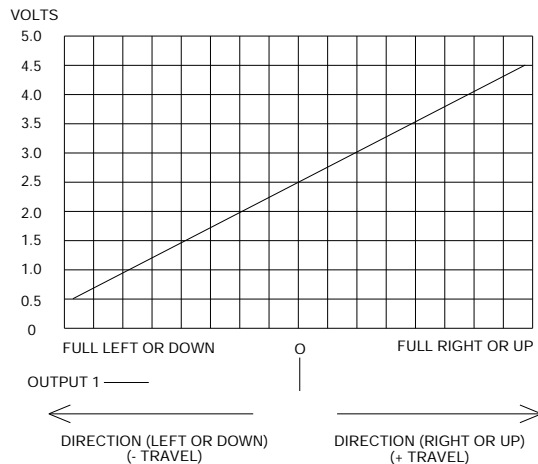
\*\*\* Positive travel is up or to the right. Contact factory for additional options.  
\*\*\*\* Contact factory for additional options.

## G3-C UNIVERSAL GRIP OUTPUT

HTLT4 OUTPUT

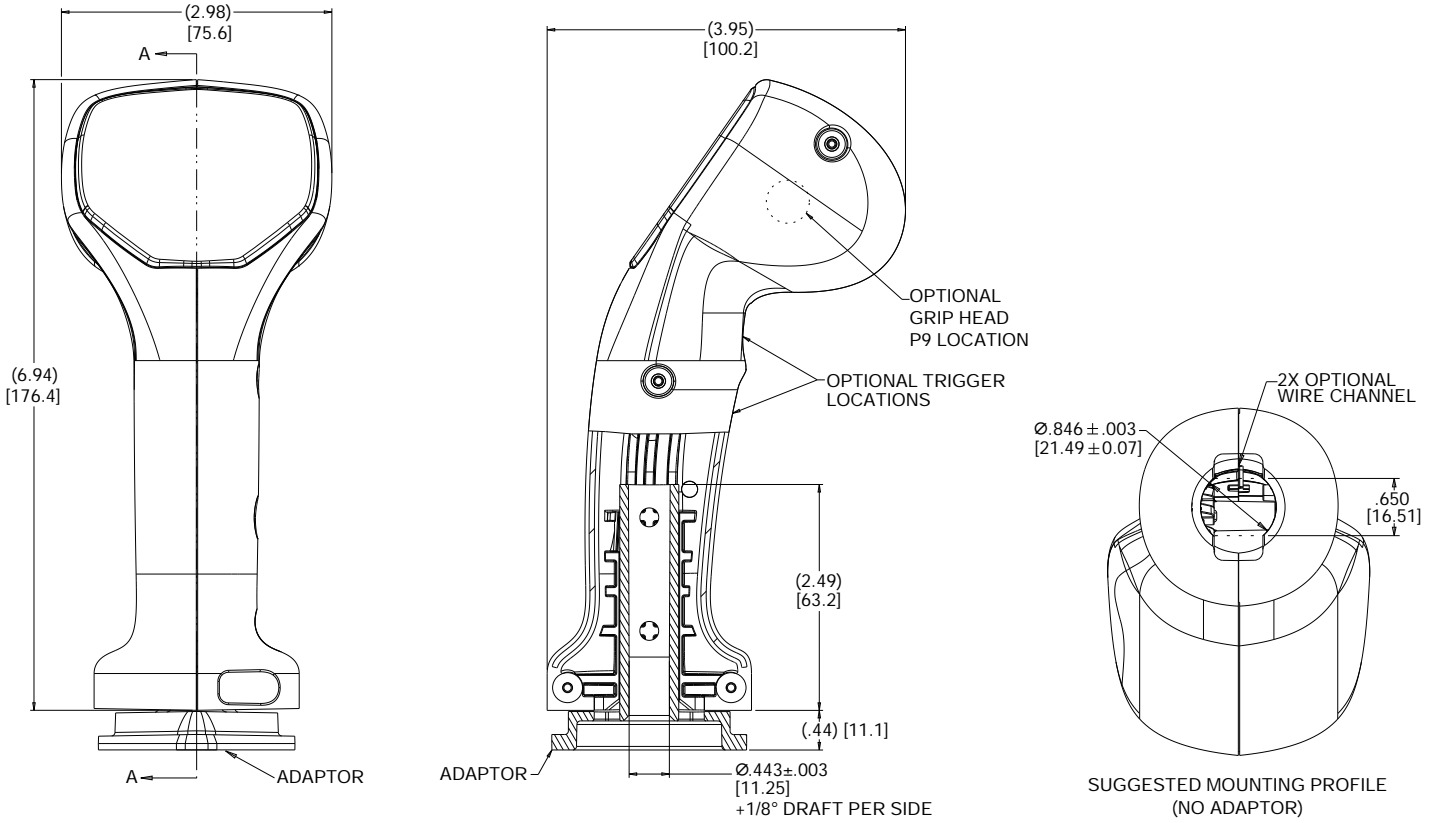


HTWM & HTWS OUTPUT

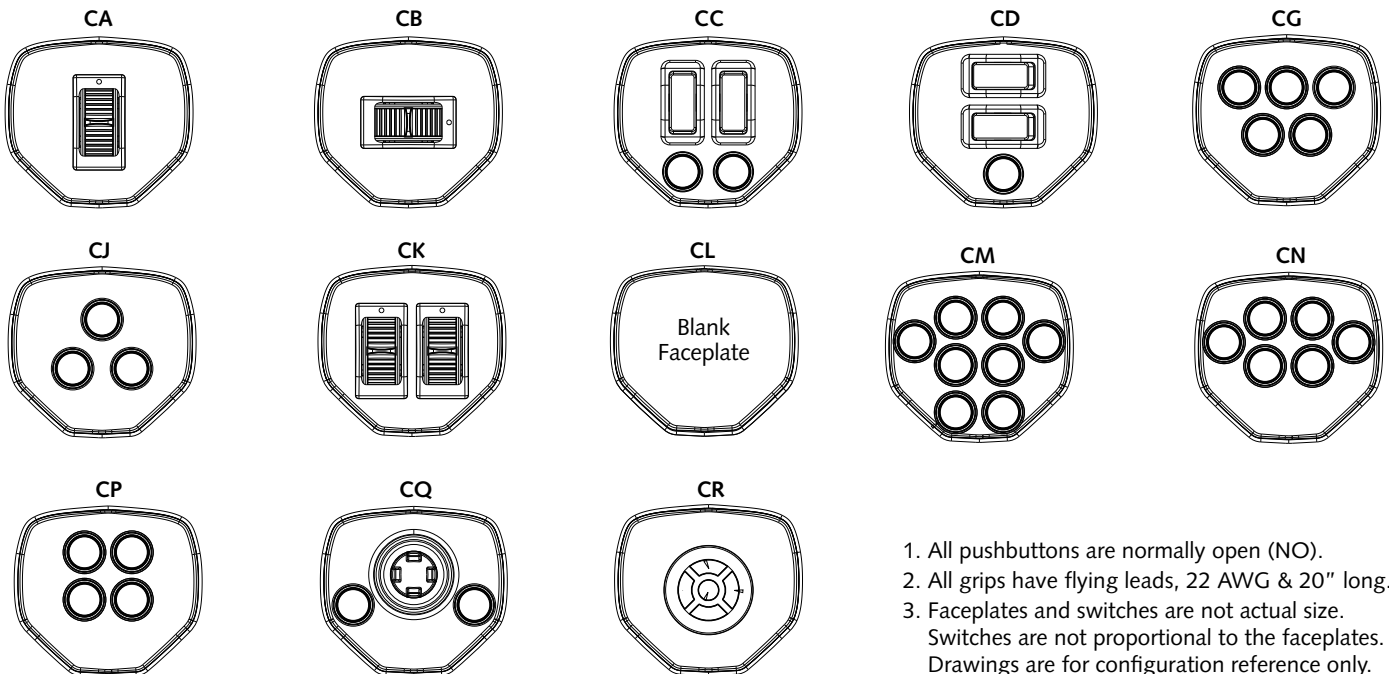


HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-C UNIVERSAL GRIP DRAWINGS



## G3-C UNIVERSAL GRIP FACEPLATES

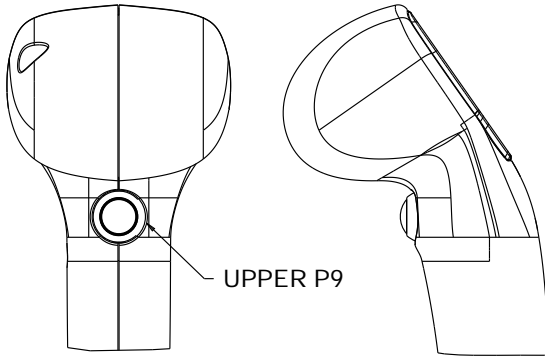


1. All pushbuttons are normally open (NO).
2. All grips have flying leads, 22 AWG & 20" long.
3. Faceplates and switches are not actual size. Switches are not proportional to the faceplates. Drawings are for configuration reference only.

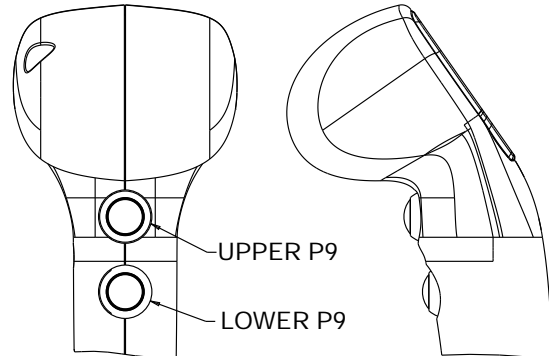
HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-C UNIVERSAL TRIGGER CONFIGURATIONS

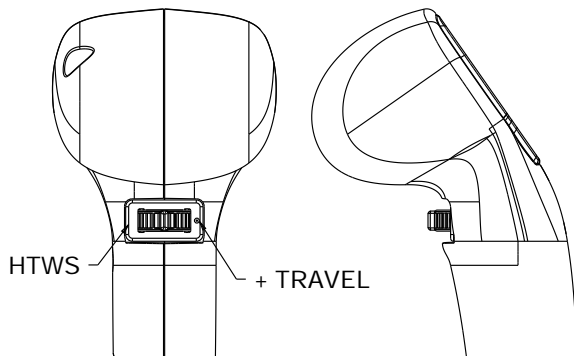
CONFIGURATION #2



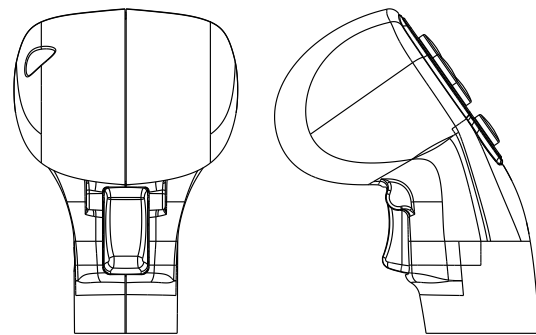
CONFIGURATION #3



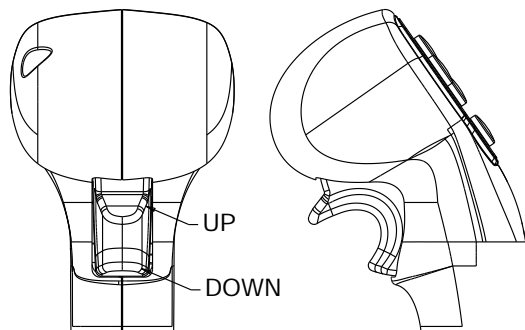
CONFIGURATION #4



CONFIGURATION #5



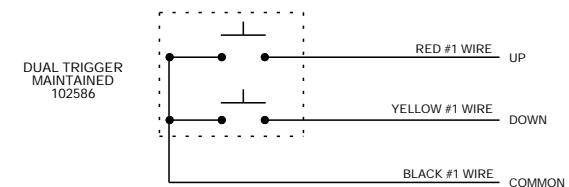
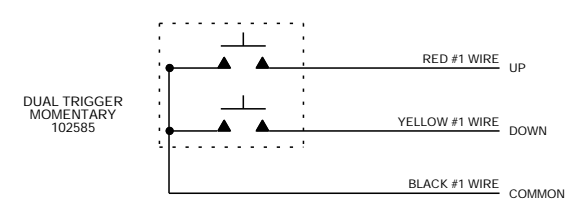
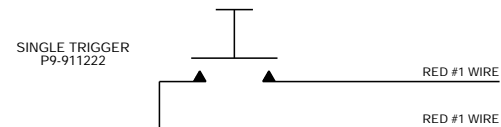
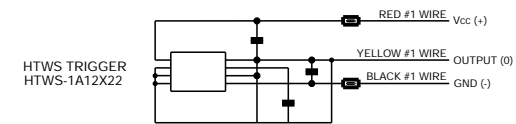
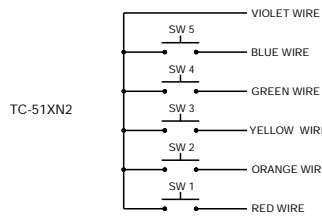
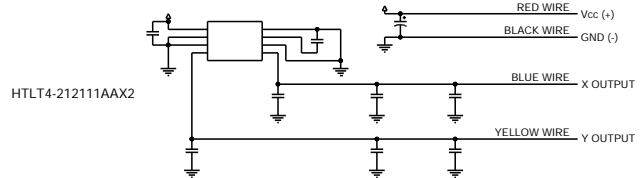
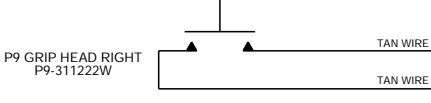
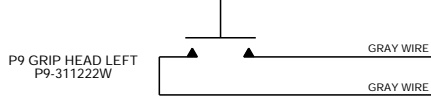
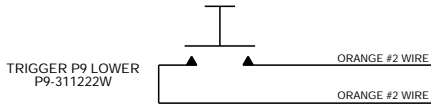
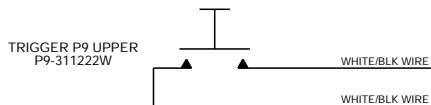
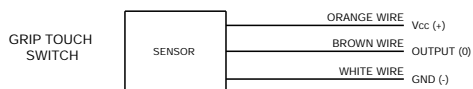
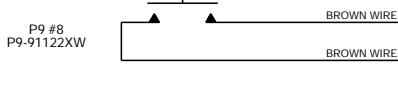
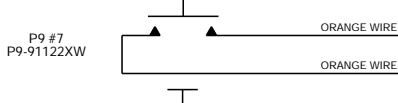
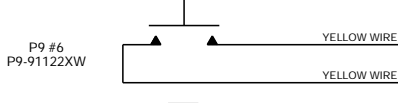
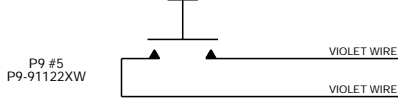
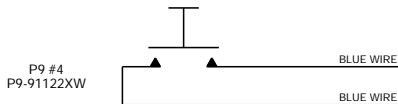
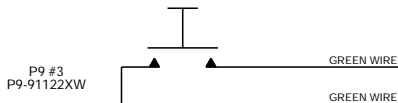
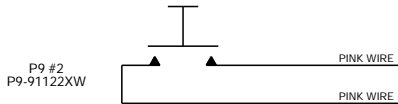
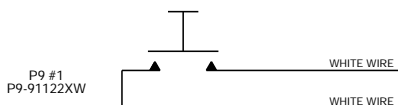
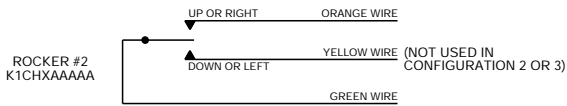
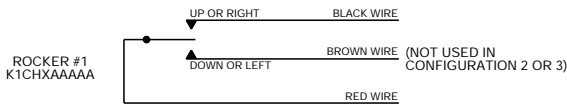
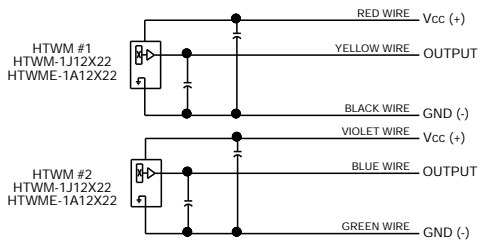
CONFIGURATION #6, 7





HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-C UNIVERSAL GRIP SCHEMATICS



HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

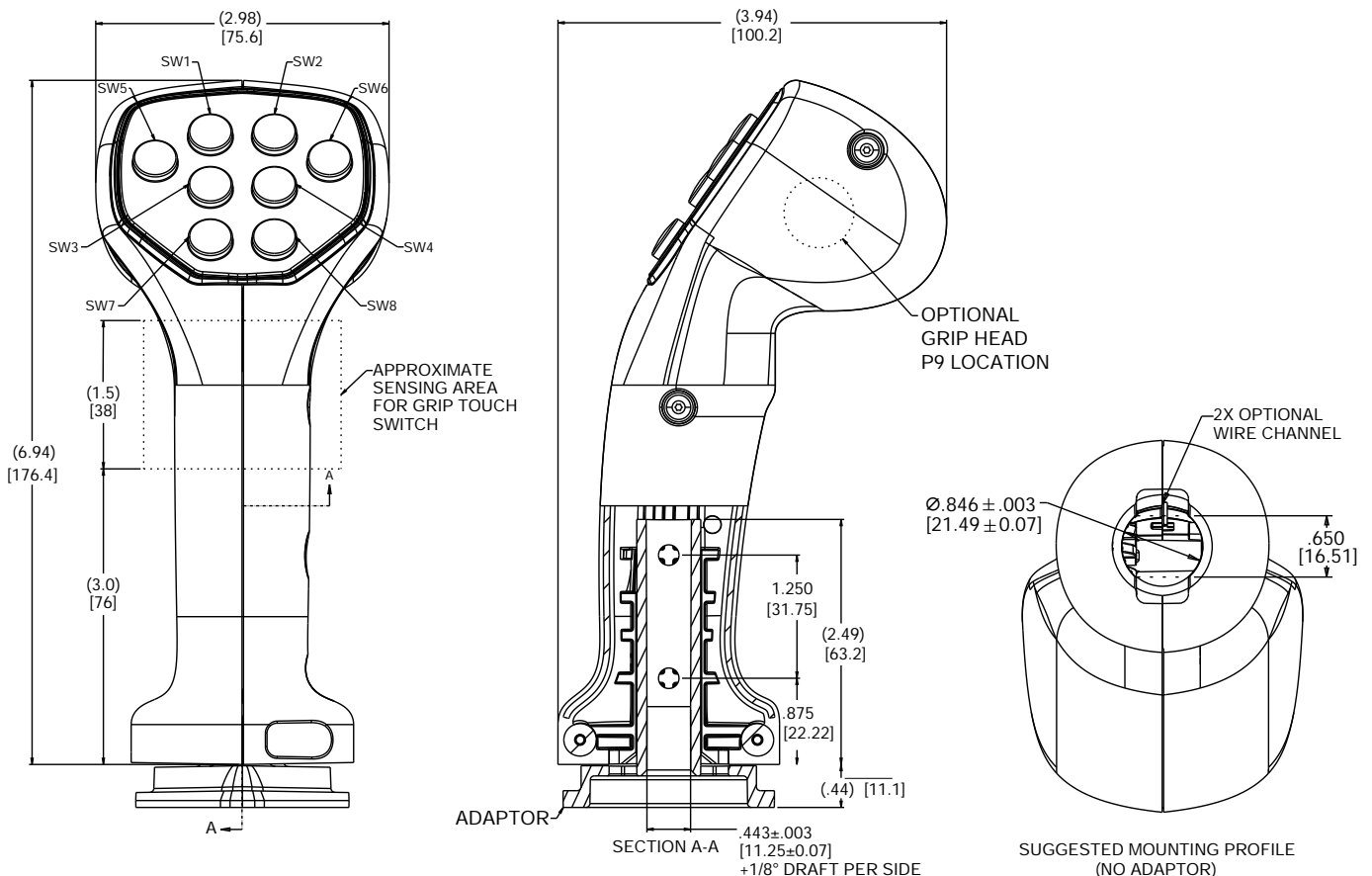
## G3-CK UNIVERSAL GRIP PART NUMBER CODE

G3-CK	X	X	X	X	X	X	X
Adapter	Faceplate Keypad Configuration	Side Keypad Configuration	Back Lighting*	Trigger Option	P9 In Head (Black)	Grip Touch Switch**	
1. No Adapter	4. 4 Buttons	1. None	N. None	1. None	1. None	1. None	
2. With Adapter	6. 6 Buttons	L. Left Hand	L. Lighted Faceplate Keypad & Side Keypad	2. One Pushbutton – Black	2. Left Hand	2. Handle	
3. Grip without Adapter, with Grip Touch Switch	8. 8 Buttons	R. Right Hand	F. Lighted Faceplate Keypad Only	3. One Pushbutton – Red	3. Right Hand		
4. Grip with Adapter, with Grip Touch Switch			S. Lighted Side Keypad Only	4. Single	4. Both		
				5. Dual Momentary			
				6. Dual Maintained			
				7. Two Pushbuttons – Black			
				8. Two Pushbuttons – Red			
				9. HTWS			

\* Back lighting applies to both the Faceplate Keypad and Side Keypad

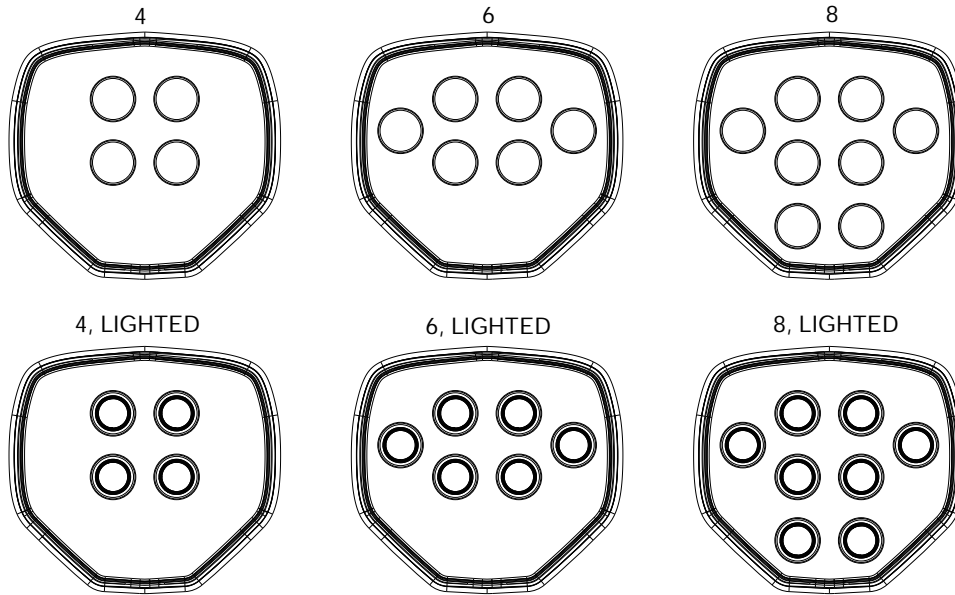
\*\* Operator Presence is not available with Trigger Option 5 or 6.

## G3-CK UNIVERSAL GRIP DRAWINGS

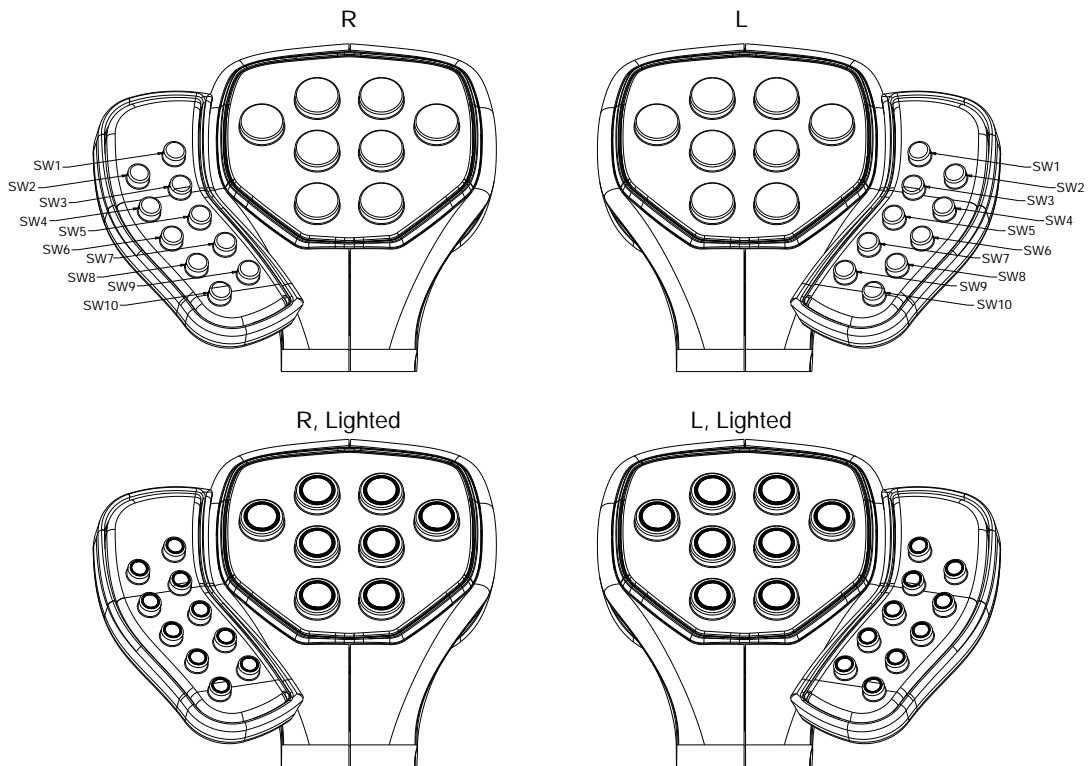


HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-CK UNIVERSAL KEYPAD CONFIGURATIONS



### CENTER KEYPAD CONFIGURATIONS

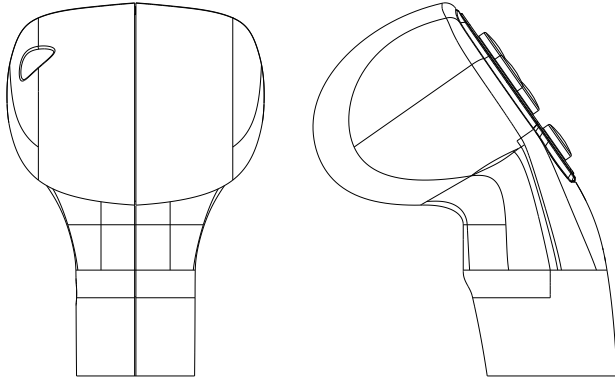


### SIDE KEYPAD CONFIGURATIONS

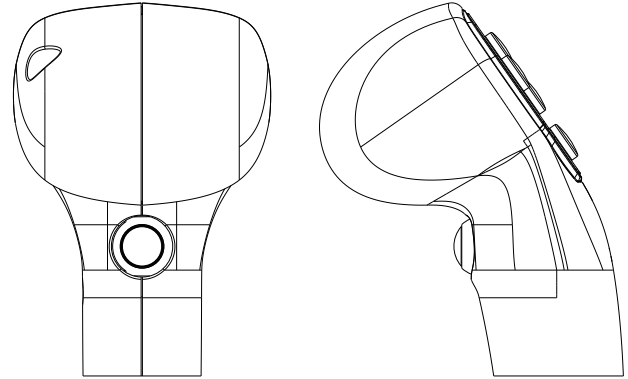
HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-CK UNIVERSAL TRIGGER CONFIGURATIONS

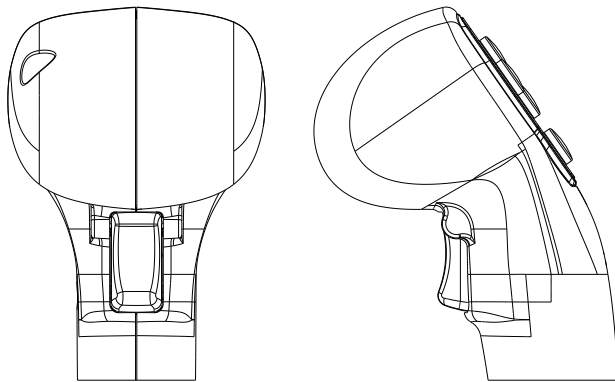
CONFIGURATION #1



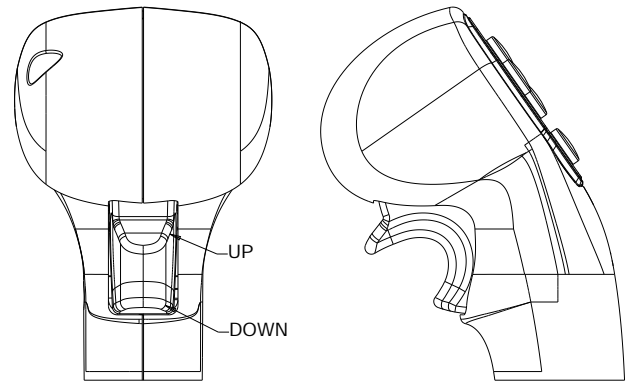
CONFIGURATION #2, 3



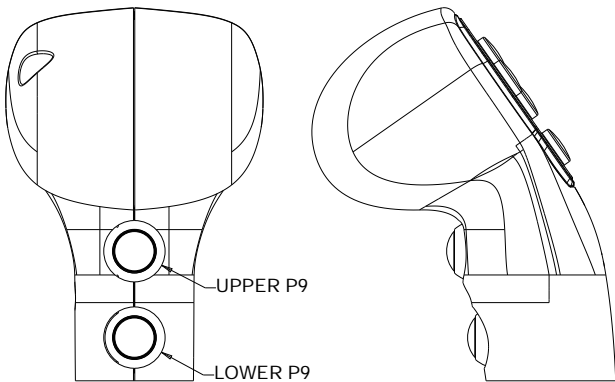
CONFIGURATION #4



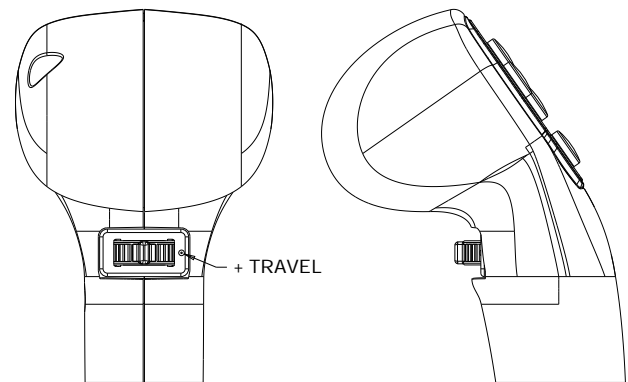
CONFIGURATION #5, 6



CONFIGURATION #7, 8

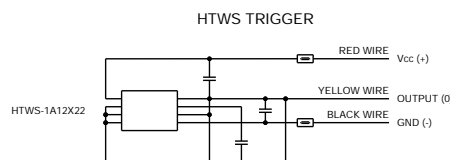
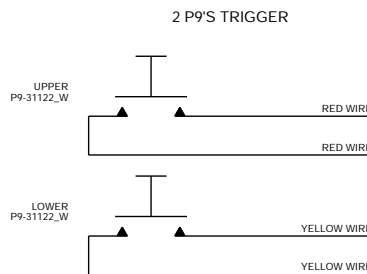
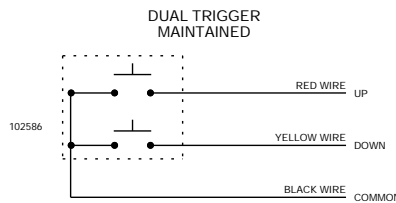
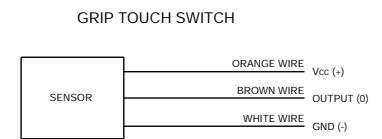
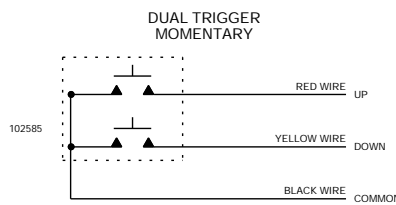
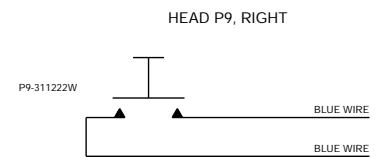
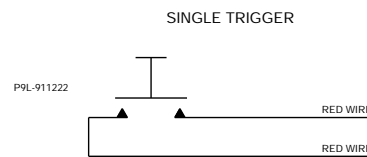
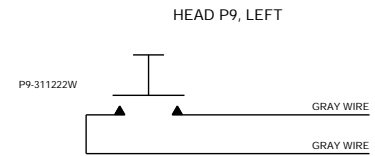
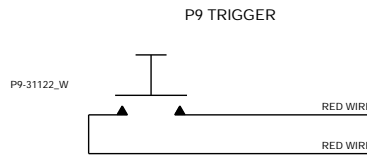
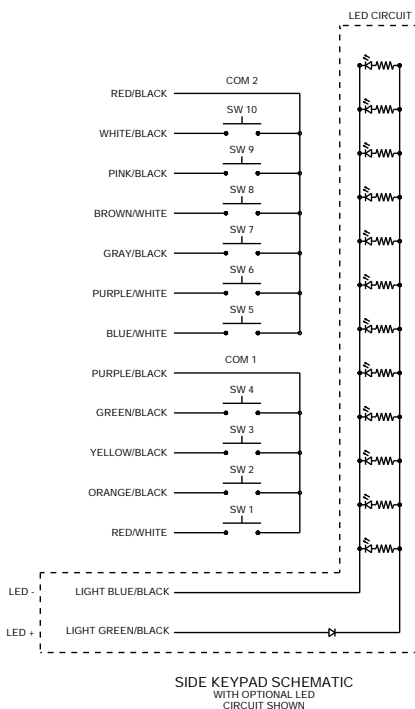
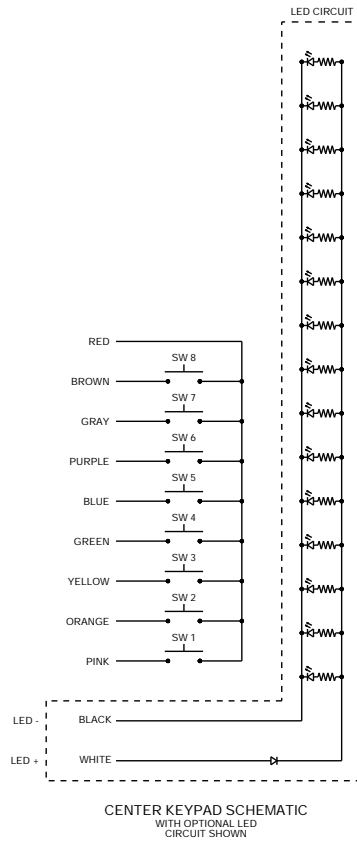


CONFIGURATION #9



HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-CK UNIVERSAL SCHEMATICS



## G3-D CONTROL GRIP

The rugged, ergonomically designed G3-D Control Grip can be configured with a rocker switch or a pushbutton at the top of the grip handle, and an operator presence lever switch to help prevent inadvertent actuation. Top mount and bottom mount are both available as standard offerings.

The G3-D grip can be assembled with OTTO's JHM joystick, providing a variety of gating options including single axis, dual axis, friction held and omni-directional. Output choices include analog, PWM, USB, CANopen and CANbus.

The G3-D Control Grip works well in industrial, agricultural, mining, utility and construction applications such as aerial work platforms, scissor lifts, bucket trucks, telehandlers, trenchers and track trucks.



Top Mount G3-D with Rocker Switch and Operator Presence

### Features:

- Operator Presence Option
- Rocker or pushbutton switch options for the top of the handle
- Switches sealed to IP68S
- Top mount or bottom mount
- Can be assembled with an OTTO JHM joystick
- RoHS compliant



G3-D with Rocker Switch, Operator Presence and Top Mount JHM Joystick



G3-D with Pushbutton and Bottom Mount JHM Joystick

Standard Characteristics/Ratings:				
<b>ELECTRICAL RATINGS:</b>				
<b>P9 Switches</b>				
Electrical Rating @ 28 VDC	50mA Resistive Load			
Electrical Life	1,000,000 Cycles			
<b>MECHANICAL RATINGS</b>				
<b>P9 Switches</b>				
Mechanical Life	1,250,000 Cycles			
<b>ENVIRONMENTAL:</b>				
<b>Operating Temperature:</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
	° C	-40	20	85
<b>P9 Switches</b>				
Enclosure Design	ISO 20653, IP68S - Dusttight, Continuous Immersion, 1 Meter For 31 Minutes, Static During Test(s)			
<b>Grip</b>				
Enclosure Design	ISO 20653, IP65 - Dusttight, Water Jets, Static During Test(s)			
<b>MATERIALS:</b>				
<b>Grip Halves, Faceplate</b>	Thermoplastic, Glass Reinforced, Black			
<b>Lever, Rocker</b>	Thermoplastic, Unfilled, Black			
<b>Boot</b>	Elastomer, 40 Durometer, Black			

### G3-D PART NUMBER CODE

G3-D X

**Mounting**

1. Top Mount
2. Bottom Mount

XX

**Configuration**

11. Rocker (ON)-OFF-(ON) and Operator Presence
22. Rocker (ON)-OFF-(ON) and No Operator Presence
33. One Pushbutton and Operator Presence
44. One Pushbutton and No Operator Presence
55. No Pushbutton, No Rocker and Operator Presence
66. No Pushbutton, No Rocker and No Operator Presence

X

**OP & PB Configuration**

1. None\*
2. Normally Open (NO)
3. 2 Circuit (NO/NC)\*\*
4. 2 Circuit (NO/NC)\*\*\*

X

**Termination**

- N. No Wires\*\*\*\*
1. 20" Flying Leads 22 AWG

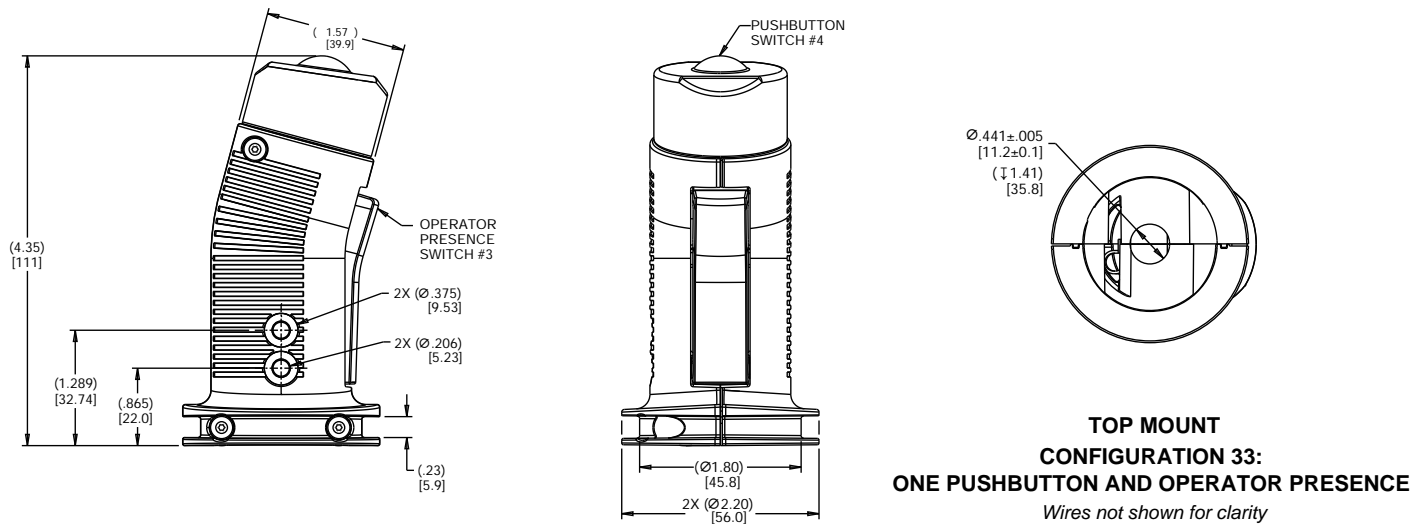
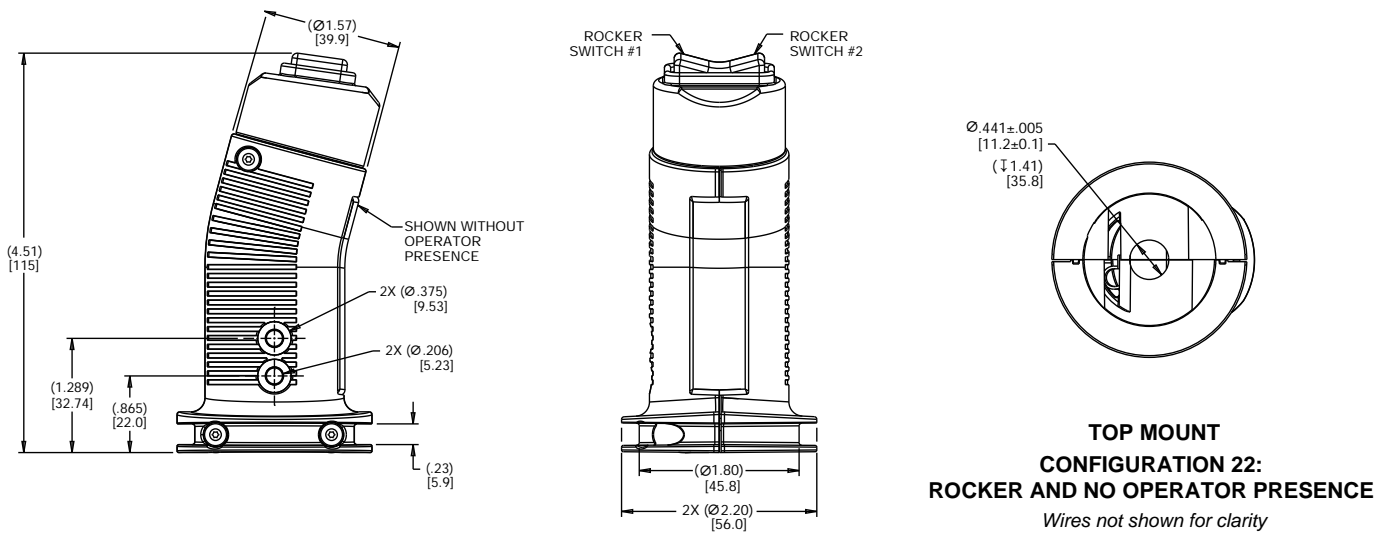
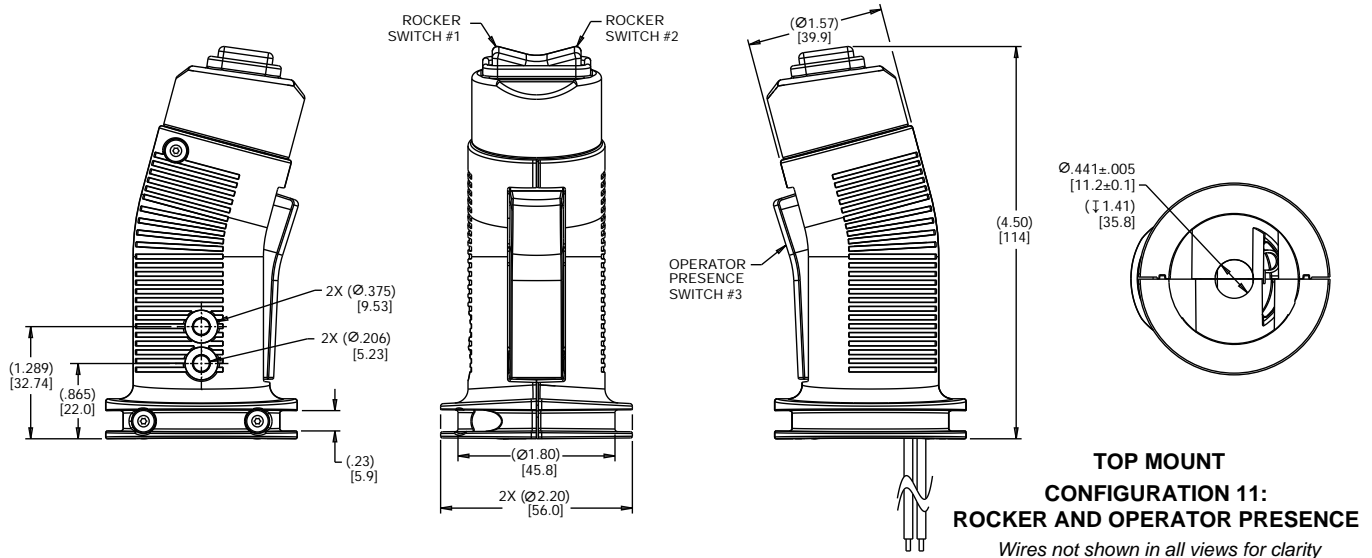
\* can only be used with configurations 22 and 66

\*\* for options 11 (Operator Presence), 44, 55

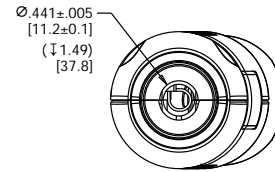
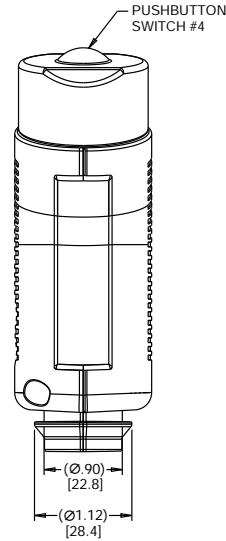
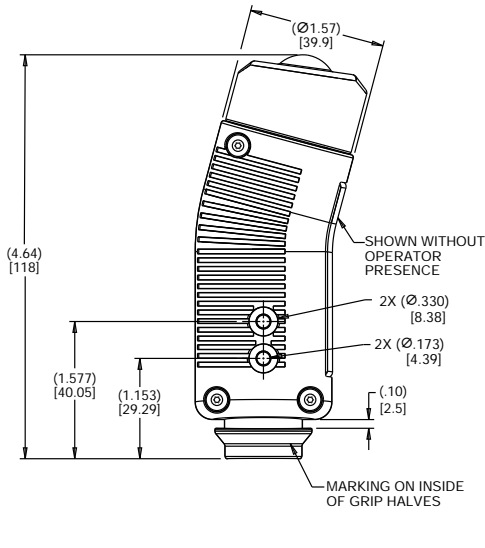
\*\*\* for option 33

\*\*\*\* can only be used with configuration 66

## HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

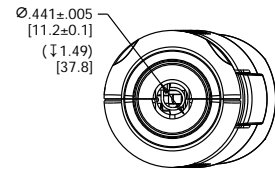
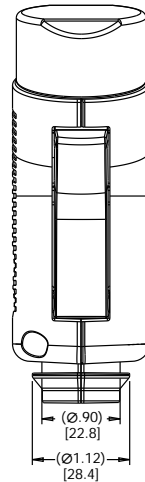
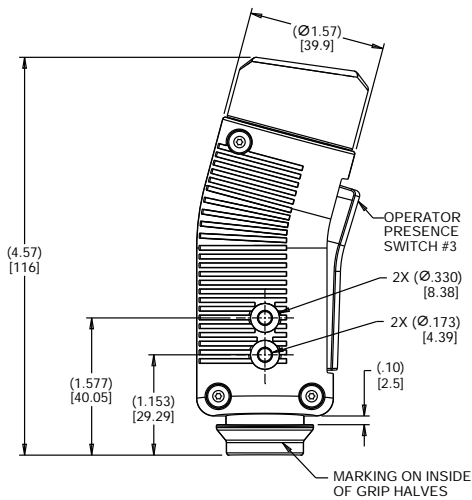


## HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS



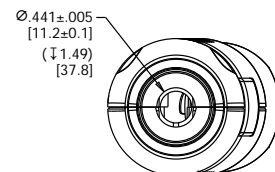
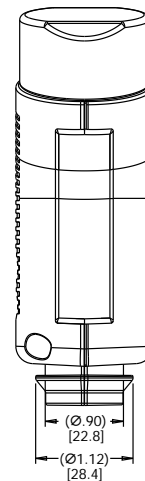
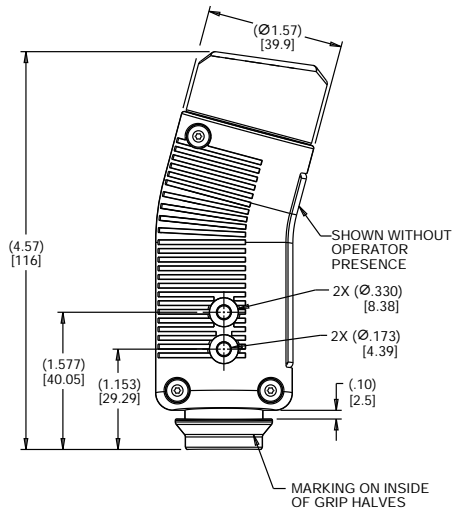
**BOTTOM MOUNT  
CONFIGURATION 44:  
ONE PUSHBUTTON AND  
NO OPERATOR PRESENCE**

*Wires not shown for clarity*



**BOTTOM MOUNT  
CONFIGURATION 55:  
NO PUSHBUTTON, NO ROCKER  
AND OPERATOR PRESENCE**

*Wires not shown for clarity*



**BOTTOM MOUNT  
CONFIGURATION 66:  
NO PUSHBUTTON, NO ROCKER  
AND NO OPERATOR PRESENCE**

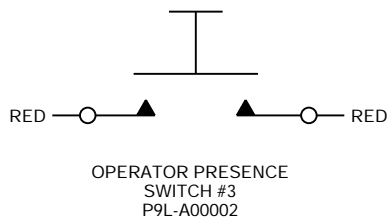
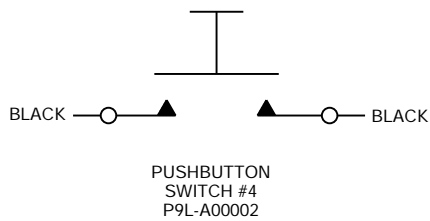
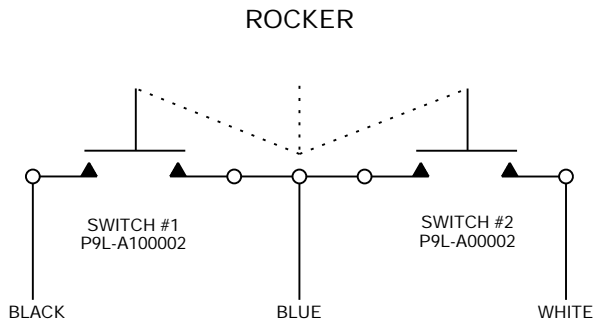
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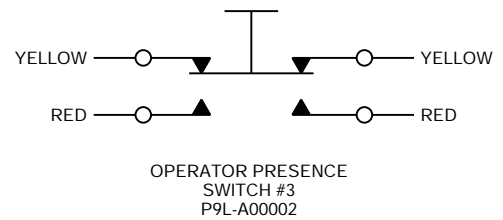
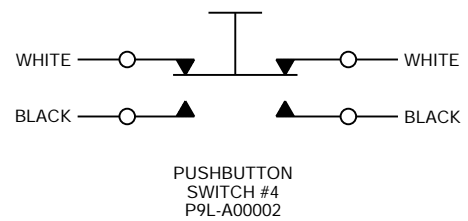
HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-D CONTROL GRIP SCHEMATICS

### NORMALLY OPEN (NO) CIRCUITS



### NORMALLY OPEN/NORMALLY CLOSED (NO/NC) CIRCUITS



## G3-E CONTROL GRIP



OTTO's multi-function, compact G3-E Control Grip is equipped with a proportional Hall effect rocker and either 5 or 7 momentary pushbuttons on the handle. Available in both left-handed and right-handed versions, the two often work together within the same control seat. The grip's switches provide sealing protection to IP68S, a variety of output options and a high cycle life.

The G3-E is a standalone, catalog codable grip or it can be mounted on a joystick with a wide selection of gating options. Mounting the G3-E on an OTTO bottom mount JHM joystick is a standard offering available as a JHM-61xxxxx or JHM-62xxxxx with the 5-button handle and as a JHM-63xxxxx or JHM-64xxxxx with the 7-button handle (see JHM page).

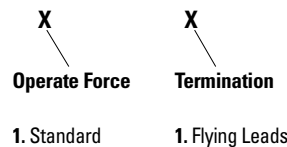
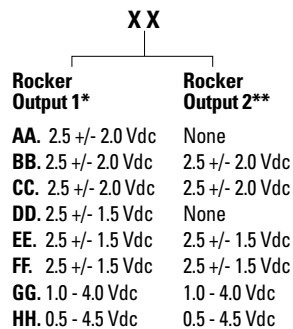
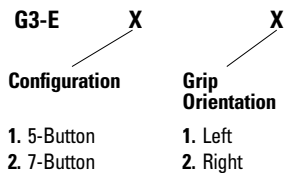
The G3-E Control Grip is great for forestry applications, and also works well in construction, off-road and other demanding applications where reliability is paramount.

### Features:

- Available in left-handed and right-handed versions
- Switches sealed to IP68S
- High cycle life
- Variety of output options
- RoHS compliant

Standard Characteristics/Ratings:				
<b>ELECTRICAL RATINGS:</b>				
<b>U2 Hall Effect Rocker</b>				
Rated @ Vcc = 5V @ 25°C Load = 1ma (4-7Ω)	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Supply Voltage	VDC	4.50	5.00	5.50
Output Voltage +Z, -Z 0° Deflection	VDC @5V Vcc	-0.25	N/A	0.25
Output at Full Travel +Z Direction	VDC @5V Vcc	-0.25	N/A	0.25
Output at Full Travel -Z Direction	VDC @5V Vcc	-0.25	N/A	0.25
Supply Current B=0, Vcc=5V, Io=0	mA	N/A	N/A	10
Output Source Current Limit B=X*, Vo=0	mA	-1.2	N/A	1.2
<b>Pushbuttons</b>				
Electrical Rating @ 12 VDC	.050 AMP Resistive Load			
Circuit	SPST-NO			
<b>MECHANICAL RATINGS</b>				
<b>U2 Hall Effect Rocker</b>				
Mechanical Life	2,500,000 Cycles			
Full Forward to Full Back	2,500,000 Cycles			
Operating Force at 25° C	OZ	3.5	6.5	9.5
Maximum Allowable Radial Load	Lbs	N/A	N/A	30
Full Travel Angle (From Center)	Degree	15	17	19
Minimum Return Force	OZ	2.0	N/A	N/A
<b>Pushbuttons</b>				
Mechanical Life	3,000,000 Cycles			
Operating Force at 25° C	OZ	4	8	12
	N	1.1	2.2	2.3
<b>ENVIRONMENTAL:</b>				
<b>Operating Temperature:</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
	°C	-40	20	85
<b>U2 Hall Effect Rocker</b>				
Electronics Enclosure Design	IP68S			
<b>Pushbuttons</b>				
Electronics Enclosure Design	IP68S			
<b>MATERIALS:</b>				
<b>Wires</b>	26 AWG, MIL-W-22759/33, Color Per Schematic			

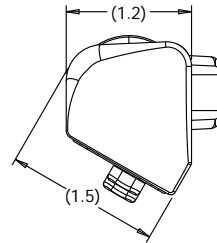
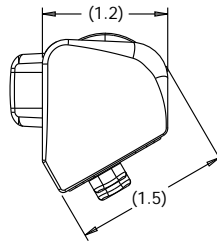
### G3-E PART NUMBER CODE



\* Outputs are from the center position to the full travel position in each direction. Options "AA" "BB" "CC" "DD" "EE" "FF" provide increasing voltage in direction 1 and decreasing voltage in direction 2 from a single output. Option "GG" and "HH" provide increasing voltages in both directions from two separate outputs.  
\*\*Option "BB" and "EE" provide redundant output 2 which duplicates output 1. Option "CC" and "FF" provide redundant output 2 which is inverse of output 1.

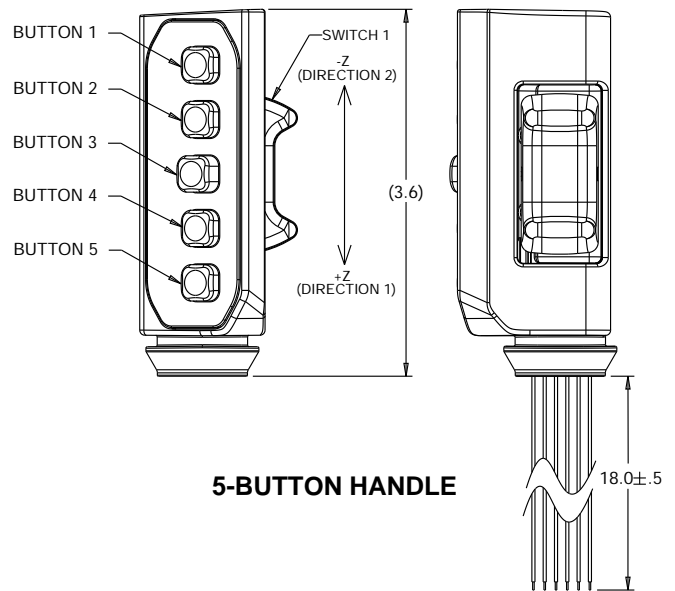
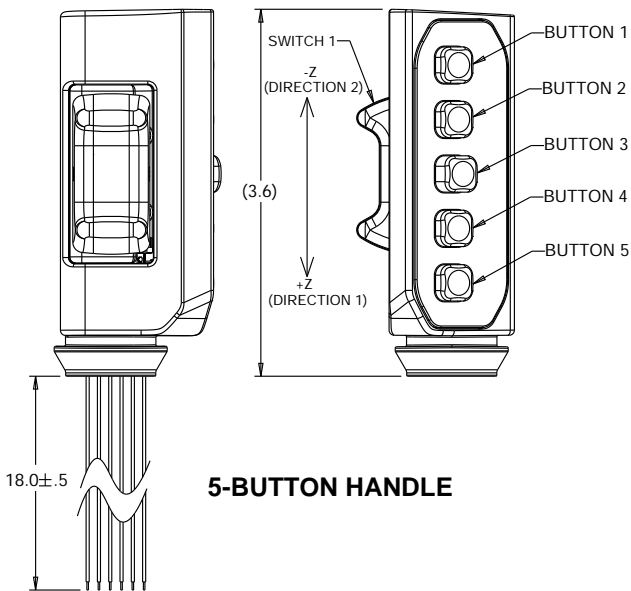
HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-E CONTROL GRIP



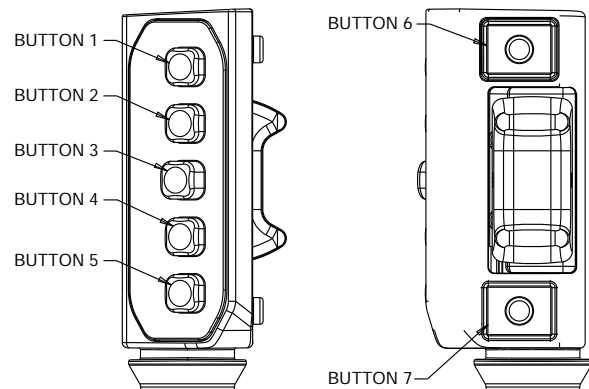
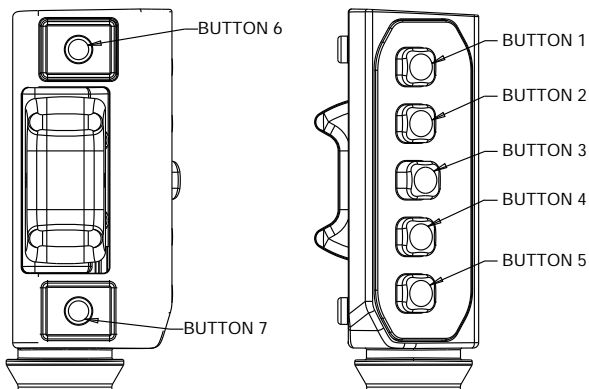
### GRIP ORIENTATION LEFT

### GRIP ORIENTATION RIGHT



**5-BUTTON HANDLE**

**5-BUTTON HANDLE**

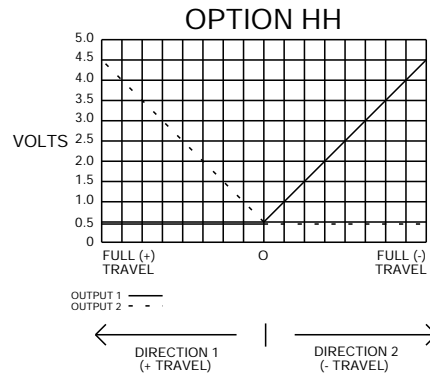
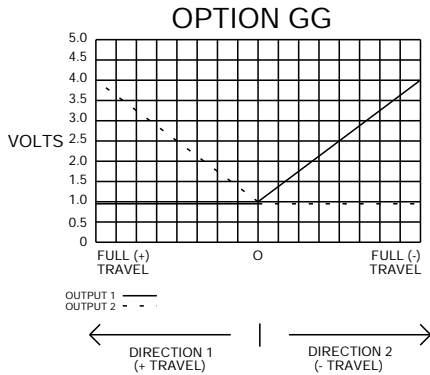
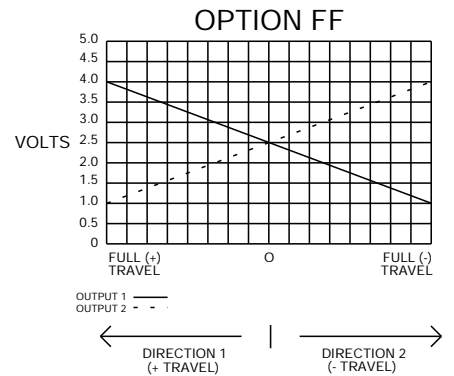
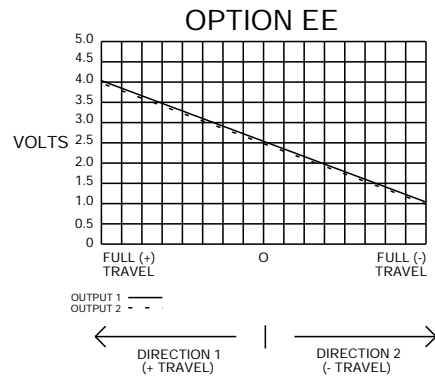
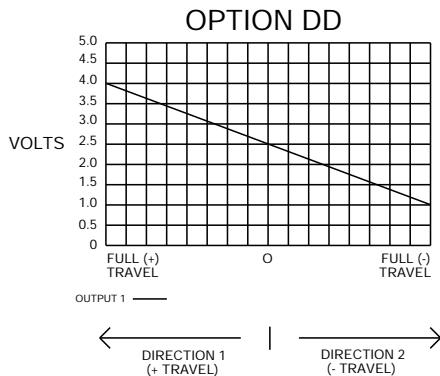
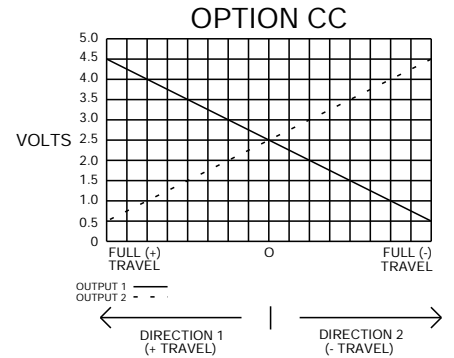
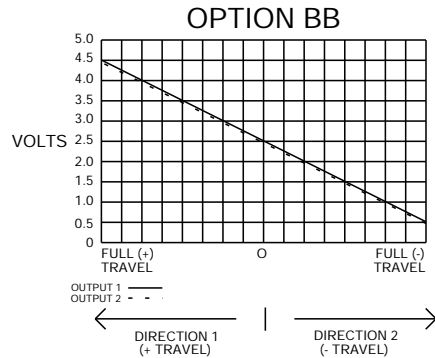
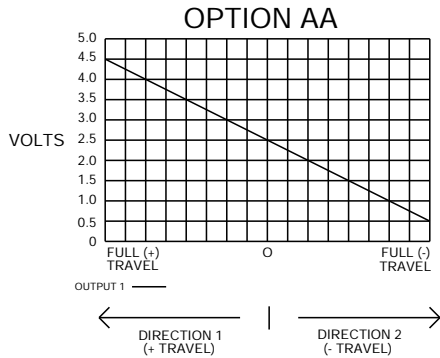


**7-BUTTON HANDLE**  
(Switch and wire info same as 5-Button)

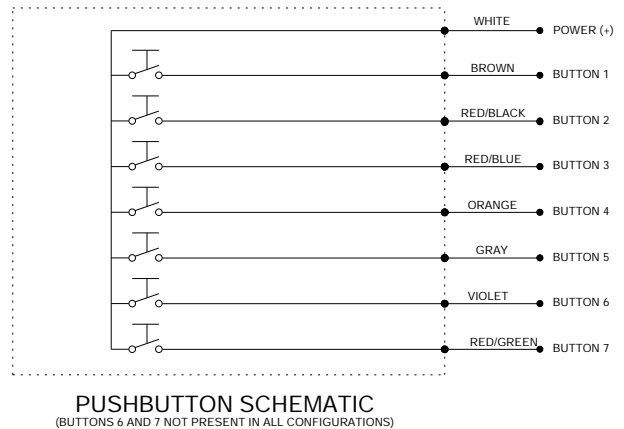
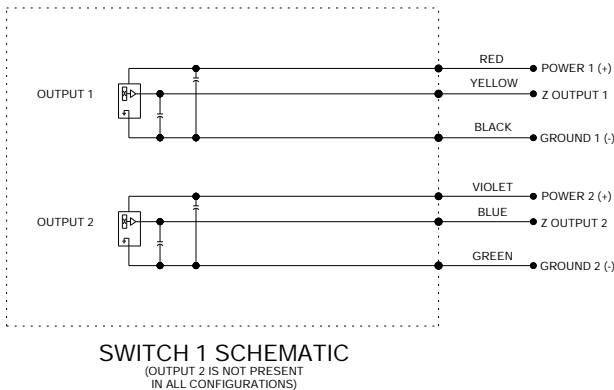
**7-BUTTON HANDLE**  
(Switch and wire info same as 5-Button)

HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

## G3-E CONTROL GRIP OUTPUT



## G3-E CONTROL GRIP SCHEMATICS



TWO-HANDED GAME STYLE GRIP, ERGONOMIC DESIGN

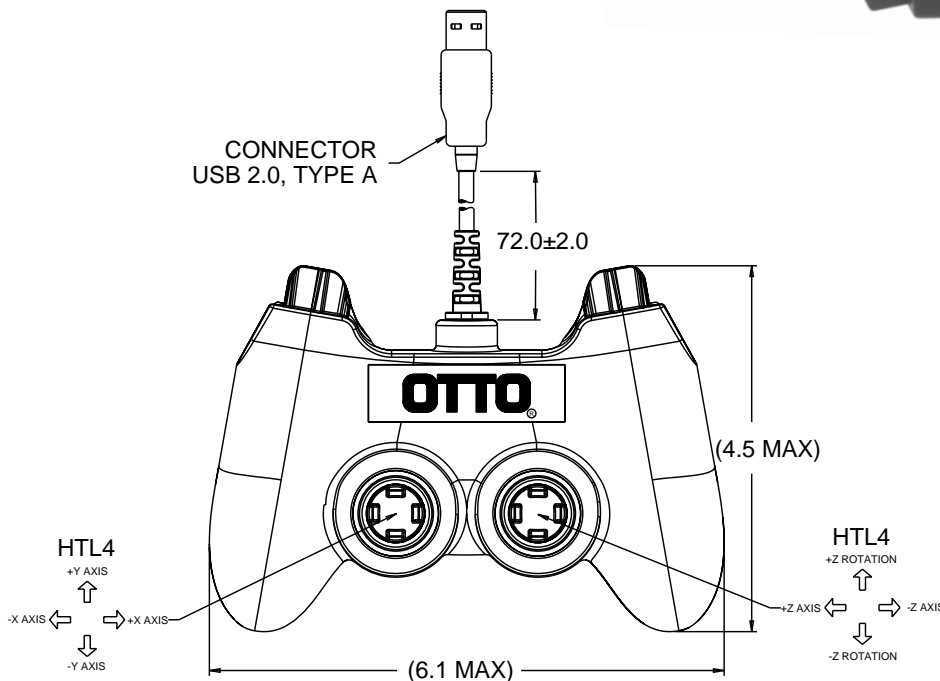
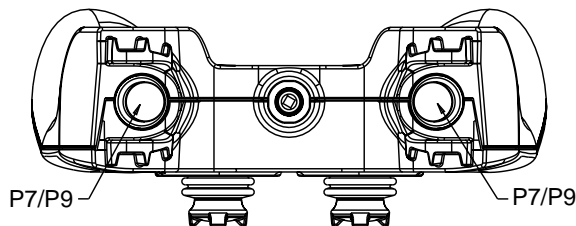
The G3 Dual Grip remote is a durable, lightweight, two-handed game style grip. Its ergonomic design allows for comfortable extended use and its molded body eliminates the need for tooling charges. The G3 dual grip remote accommodates OTTO's standard HTL and P7/P9 series switches, with your choice of button styles and colors. Ideal for controlling unmanned vehicles, unattended ground sensors and other remote controlled applications.

**Features:**

- **Standard USB interface**
- **Readily available options include HTL series and P7/P9 switches**
- **Lightweight, ergonomic design for comfortable use**
- **Excellent proportional control**
- **Switches sealed to IP68S**
- **Switches have excellent EMI/RFI immunity**
- **RoHS compliant**



Standard Configuration Shown (G3-0360)



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HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

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OTTO serves agriculture, off-highway, material handling and specialized industrial equipment markets. If your application cannot be met with one of our standard grips, OTTO can help design and build a truly custom made solution, utilizing state-of-the-art 3D solid modeling work stations. Our grips can be manufactured with an almost unlimited variety of switches, custom termination and custom mounting options. OTTO is a vertically integrated facility offering SLS and SLA compatible outputs for in-house rapid 3D prototyping using FDM (fused deposition model); in-house precision machining; progressive die stamping; injection, insert and compression molding; and cable over-molding assembly capabilities. All OTTO products are manufactured under an ISO 9001:2015 approved quality system, ensuring the greatest value and the highest performance for our customers.

## Heavy Equipment & Material Handling Grips

- Rugged injection molded grip can be outfitted with a variety of OTTO switches
- Ergonomic design for extended use
- Custom designs
- Left or right hand orientation available
- Comfortable Soft Touch Grip available

## Tractor Grips

- Rugged thermoplastic
- Can be outfitted with a variety of OTTO switches

## Agricultural Grips

- Powder-coat, cast aluminum grip & steel mounting bracket
- Can be outfitted with a variety of OTTO switches



The ergonomically designed Contour Grip reduces muscle strain allowing for extended use with minimal fatigue and is available in both left-handed and right-handed versions.



G3 Soft Touch Grips



Palm Grips

# Hall Effect Switches

SERIES	DESCRIPTION	ELECTRONICS SEAL	CYCLE LIFE	OUTPUT OPTIONS	REDUNDANT OUTPUT OPTION
HFNR	Forward/Neutral/Reverse Rocker	IP68S	3M	Analog	Yes
HJFC	Foot Pedal	IP68S	9M	Analog/CAN/J1939	Yes
HJLG3	Joystick with Grip Options	IP68S or Unsealed	Up to 6M (without detent)	Analog/CAN/J1939	Yes
HJMG3	Medium Joystick with Grip Options	IP68S or Unsealed	5M (without friction)	Analog/CAN/J1939/USB/PWM	Yes
HP7	Pushbutton	IP64 or IP68S	10M (without detent)	Analog	No
HP7C	Lower Cost Pushbutton Version	IP68S	10M (without detent)	Analog	No
HPL	Linear Output Pushbutton	IP65 or IP68S	1M	Analog	No
HPW	Single Axis Paddle	IP68S	5M (without detent)	Analog	Yes
HTL2	Single Axis Finger Joystick	IP68S	1M	Analog	Yes
HTL4	Dual Axis & 360° Finger Joystick	IP68S	1M	Analog	Yes
HTLT2	Single Axis Finger Joystick	IP68S	3M	Analog/PWM/SPI	Yes
HTLT4	Dual Axis & 360° Finger Joystick	IP68S	3M	Analog/PWM/SPI	Yes
HTW	Thumbwheel (Return-to-Center)	IP68S	3M	Analog	Yes
HTWE	Thumbwheel (Return-to-End)	IP68S	1M	Analog	Yes
HTWF	Thumbwheel (Friction Hold)	IP68S	250K	Analog	Yes
HTWM	Mini Thumbwheel (Return-to-Center)	IP68S	3M	Analog	Yes
HTWME	Mini Thumbwheel (Return-to-End)	IP68S	1M	Analog	Yes
HTWS	Subminiature Thumbwheel (Return-to-Center)	IP68S	3M	Analog	Yes
JH	Rugged Joystick	IP68S	5M to 15M	Analog/CAN/J1939/USB/Ethernet	Yes
JHL	Cost-Effective Robust Joystick	IP68S	1M to 6M	Analog/CAN/J1939	Yes
JHM	Medium Joystick	IP68S	2.5M to 10M	Analog/CAN/J1939/USB/PWM/Serial	Yes
JHS-F	Single Axis Joystick (Friction Hold)	IP68S	500K	Analog	No
JHS-RC	Single Axis Joystick (Return-to-Center)	IP68S	4M	Analog	No
JHT	Miniature Joystick	IP68S	5M	Analog	Yes
JHT-Z	Miniature Joystick with Z-Axis	IP68S	5M	Analog	Yes

## 3-POSITION ANALOG OUTPUT SNAP-IN ROCKER WITH BACKLIGHTING



The HFNR is compact, robust and reliable, ideal for grip or panel mount applications. This 3-position switch provides operator comfort by reducing the movement required to change direction or switch gears. Backlighting provides enhanced visibility; making them easy to see in poor lighting or nighttime operation. The electronics are sealed to IP68S, the switch has excellent EMI/RFI immunity, and a mechanical life of three million cycles.

### Features:

- **3 million cycle life, full forward to full backward**
- **Hall effect contactless sensing technology**
- **Choice of bezel and button colors**
- **2V to 24V LED backlighting options**
- **Electronics sealed to IP68S**
- **Outstanding EMI/RFI immunity**
- **Snap-in panel mounting—accepts multiple panel thicknesses**
- **RoHS compliant**

### Standard Characteristics/Ratings:

#### MECHANICAL:

**Mechanical Life:** 3,000,000 full forward to full back

Angle of Throw Between Adjacent Positions: 10 degrees typical

**Max Allowable Radial Load:** 30.0 lbs.

#### ELECTRICAL RATINGS:

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage, Tolerance at Center	VDC @ 5V Vcc	-0.35	N/A	+0.35
Output Voltage, Tolerance at Full Travel	VDC @ 5V Vcc	-0.35	N/A	+0.35
Supply Current Per Sensor	mA	N/A	N/A	10

#### ELECTRONICS:

**Seal:** Electronics sealed to IP68S

#### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

**Vibration:** Per MIL-810F minimum integrity

**EMI:** Withstand per SAE J1113 (contact factory for details)

**RFI:** Withstand per SAE J1113 (contact factory for details)

#### MATERIALS:

**Button:** Thermoplastic

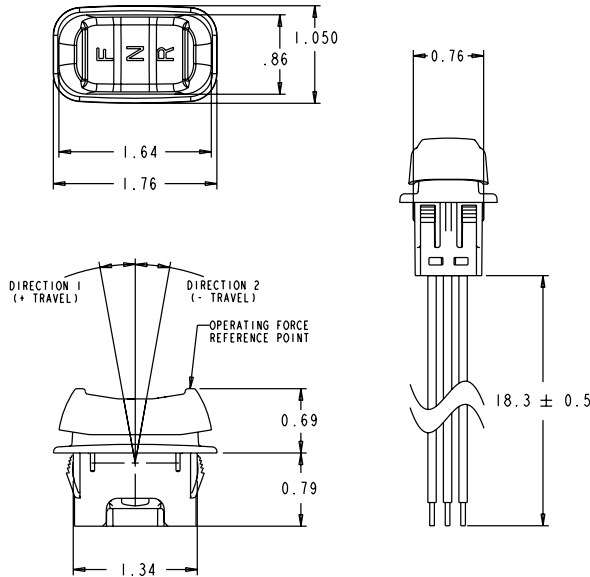
**Bezel:** Thermoplastic

**Mounting Hardware:** None provided



# HALL EFFECT FORWARD/NEUTRAL/REVERSE ROCKER

## 3-POSITION ANALOG OUTPUT SNAP-IN ROCKER WITH BACKLIGHTING

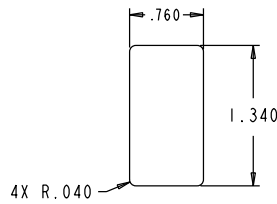


### MOUNTING :

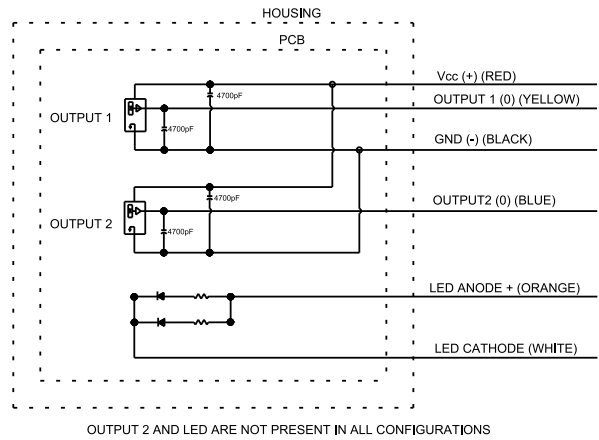
RECOMMENDED PANEL THICKNESS: 0.112 OPTIMUM THICKNESS  
(0.040 MIN. - 0.205 MAX.)

RECOMMENDED PANEL OPENING: 0.760 X 1.340 OPTIMUM  
(0.760/7.770 X 1.335/1.345)

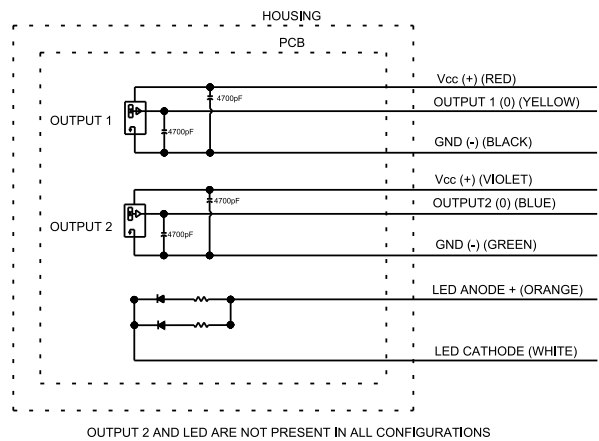
RECOMMENDED PANEL RADIUS: 0.040 OPTIMUM  
(0.070 MAX.)



### WIRING OPTION 1 COMMON POWER AND GROUND



### WIRING OPTION 2 SEPARATE POWER AND GROUND



## HFNR PART NUMBER CODE

Light Source ①	Output 1 ②	Output 2	Wiring Option	Operating Force Direction 1 & 2 to Center/ Center to Direction 1 & 2	Button Style	Termination	Bezel Color ③	Button Color ③	FNRL Legend
A. NONE	A. 4.5/2.5/0.5VDC	NONE ④	1. Common Power and Ground ④	1. 2.6/3.6 lbs.	1. Rocker	A. 20 AWG Wires 18.3" Long, Stripped and Tinned Ends	1. Red 2. Black 4. Yellow 6. Blue 8. Gray	1. Red 2. Black ① 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	A. NONE B. FNR/White ①
B. 2V Green LED	B. 4.5/2.5/0.5VDC	4.5/2.5/0.5VDC	2. Separate Power and Ground						
C. 2V Amber LED	C. 4.5/2.5/0.5VDC	0.5/2.5/4.5VDC							
D. 5V Green LED	D. 4.0/2.5/1.0VDC	NONE ④							
E. 5V Amber LED	E. 4.0/2.5/1.0VDC	4.0/2.5/1.0VDC							
F. 12V Green LED	F. 4.0/2.5/1.0VDC	1.0/2.5/4.0VDC							
G. 12V Amber LED	G. 1.0/2.5/4.0VDC	4.0/2.5/1.0VDC							
H. 24V Green LED	H. 1.0/1.0/4.0VDC	4.0/1.0/1.0VDC							
J. 24V Amber LED									

① Only button color black is available on backlit version; only legend color translucent white is available on backlit version.

② Outputs are when switch is in detented position.

③ Minimum lot charges may apply for certain color options.

④ For single output switches, wiring option 1 should be selected.

9 MILLION LIFE CYCLE

The HJFC Hall Effect Foot Pedal is built to perform under the worst possible conditions. The unique design places Hall effect sensors and electronics behind a solid plastic diaphragm that separates the top and bottom halves of the front pedal, sealing the electronics in an IP68S rated enclosure. The bottom half of the pedal utilizes the same proven contactless analog output Hall effect technology used in OTTO joysticks and is available in J1939 and CANopen® formats. The CAN interface provides three analog input channels, 12 digital input channels and two digital output channels. It will withstand operating temperature extremes of -40°C to +85°C, is sealed to IP68S immersion requirements and passes EMI/RFI immunity testing to 100V/M.

The HJFC Hall Effect Foot Pedal provides a life of nine million cycles. The pedal's pivot point itself is also sealed against large debris. Customer specified features such as pretravel (dead band) and overtravel, along with a minimum and maximum output, are programmable. The sensor programming is completed in automated fixtures during assembly ensuring tight output tolerances. The HJFC Hall Effect Foot Pedal offers more performance features and a higher cycle and seal rating than any other foot pedal on the market.

## Features:

- Outstanding EMI/RFI immunity
- Heavy gauge, corrosion-resistant metal
- Proven contactless analog output Hall effect technology
- J1939, CANopen® formats available
- Life expectancy of 9 million cycles
- Hall sensors & electronics are sealed against the elements, behind a solid plastic diaphragm that separates the top & bottom halves of the foot pedal
- Electronics are sealed to IP68S
- Pedal pivot point sealed against large debris
- Programmable pretravel (dead band) & overtravel along with minimum & maximum output
- Sensor programming is completed in automated fixtures during assembly ensuring tight output tolerances
- Reverse polarity protection available
- RoHS compliant



Bidirectional  
(Dual Direction)  
Foot Pedal

Standard Characteristics/Ratings:				
<b>MECHANICAL:</b>				
<b>Mechanical Life:</b>	9,000,000 cycles			
<b>Vibration:</b>	10g, 24Hz to 2KHz swept sinusoidal			
<b>TRAVEL ANGLE:</b>				
<b>Degrees:</b>	13° nominal dual direction, 15° nominal single direction			
<b>Operating Force (lbs.):</b>	14.0 lbs. typical -40°C to +85°C at load reference point			
<b>Electrical Life:</b>	9,000,000 cycles			
<b>ELECTRICAL RATINGS:</b>				
Electrical	Units	Min	Typ	Max
Supply Current Per Sensor	mA	N/A	N/A	10
Output Resistance (I <sub>o</sub> ≤ -2mA)	Ω	N/A	100	N/A
Analog Supply Voltage (Option 1)	VDC	4.5	5	5.5
Analog Supply Voltage (Option 2)	VDC	8	12	18
Analog Output Voltage Tolerance at Center (see graph for output values)	VDC @ 5Vcc	-0.15	N/A	+0.15
Analog Output Voltage Tolerance at Full Travel (see graph for output values)	VDC @ 5Vcc	-0.15	N/A	+0.15
Limit Switch Supply Voltage (if applicable)	Volts	5	N/A	30
Limit Switch Actuation (if applicable)	Degrees	1°	2°	3°
Analog Output Pretravel	Degrees	1°	2°	3°
Analog Output Overtravel	Degrees	1°	2°	3°
<i>Note: Limit switch outputs will source limit switch supply voltage when actuated.</i>				
<b>ELECTRONICS:</b>				
<b>Seal:</b>	Electronics IP68S			
<b>RFI:</b>	Withstand per SAE J1113			
<b>EMI:</b>	Withstand per SAE J1113			
<b>ENVIRONMENTAL:</b>				
<b>Operating Temp Range:</b>	-40°C to +85°C			
<b>Humidity:</b>	96% RH, 70°C, 96 hours			
<b>Drop:</b>	1 Ft. Max. to Concrete			
<b>Vibration:</b>	10g, 24Hz - 2KHz; Swept Sinusoidal			
<b>Sand/Dust:</b>	Withstand per SAE J1455			
<b>MATERIALS:</b>				
<b>Foot Pedal Plate:</b>	Zinc and high corrosion trivalent chromate			
<b>Housing:</b>	PPE/PA			
<b>Cable:</b>	22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket			
<b>Mounting Hardware:</b>	None provided			

# HALL EFFECT FOOT PEDAL

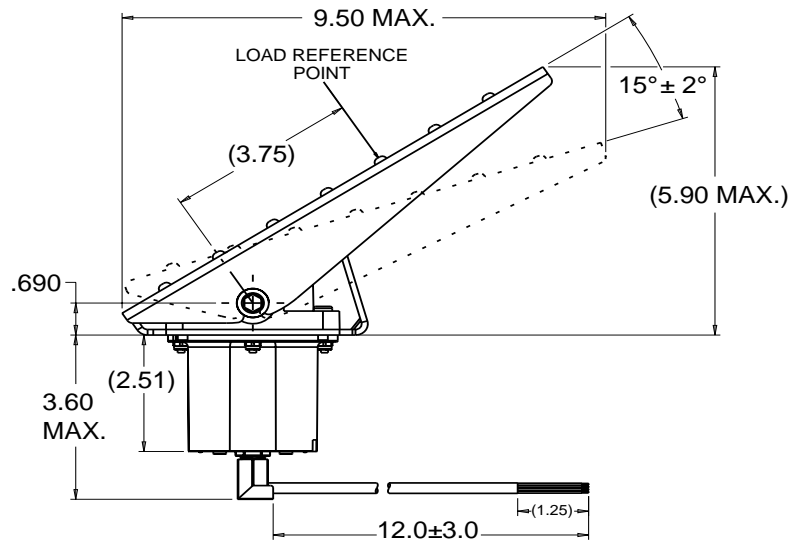
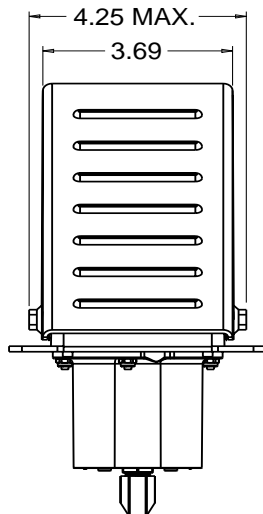
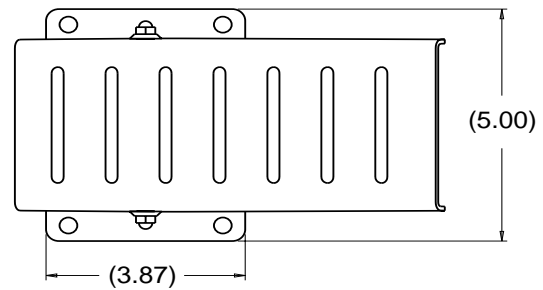
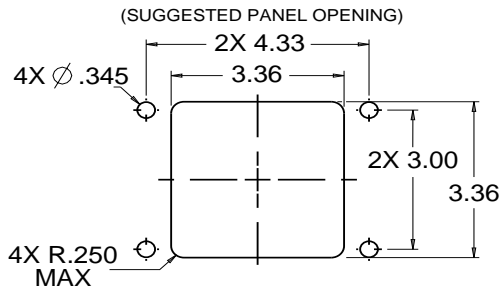
## SINGLE DIRECTION & DUAL DIRECTION

### HJFC PART NUMBER CODE

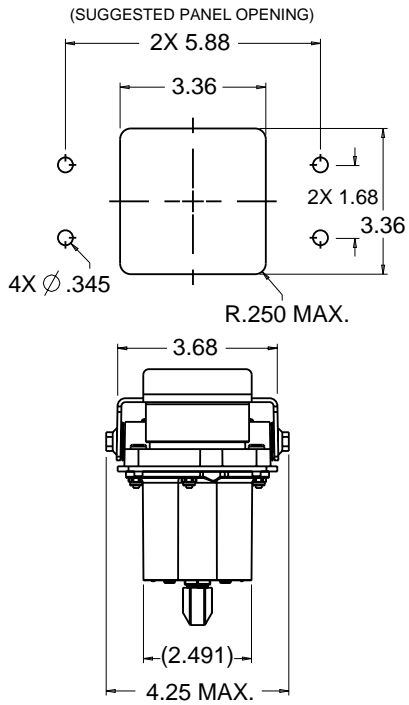
HJFC - X X X X X X X X						
Direction	Travel	Output*	Sealing	Power	Termination	Pedal
1. Single	1. 15 Degrees	1. Single Direction Analog Output: (Rest/Full) 0.5/4.5VDC	1. Fully Sealed	1. Regulated 5VDC Clean Supply, No Reverse Polarity Protection	1. 0.225" Dia., 12" Cable, Unterminated	1. Narrow Mounting**
2. Dual	2. 13 Degrees	2. Dual Direction Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC	2. Unsealed	2. 12VDC Power Supply with Reverse Polarity Protection		2. Wide Mounting
	Dual Direction	3. Dual Direction Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC & Dual Direction Position Indication		3. 24VDC Power Supply with Reverse Polarity Protection		
		4. Dual Direction Dual Analog Output 1: (CTR/FWD) 0.5/4.5VDC Output 2: (REV/CTR) 4.5/0.5VDC				
		5. Single Direction Analog Output: (Rest/Full) 0.5/4.5VDC & Single Direction Position Indication				
		6. Single Direction Dual Analog Output 1: (Rest/Full) 0.5/4.5VDC Output 2: (Rest/Full) 4.5/0.5VDC				
		7. Dual Direction Dual Analog Output 1: (REV/CTR/FWD) 0.5/2.5/4.5VDC Output 2: (REV/CTR/FWD) 0.5/2.5/4.5VDC				
		8. Dual Direction Dual Analog Output 1: (REV/CTR/FWD) 0.5/2.5/4.5 Output 2: (REV/CTR/FWD) 4.5/2.5/0.5				

\* Additional configurations are available. Contact factory.  
\*\* Single direction not available in narrow mounting.

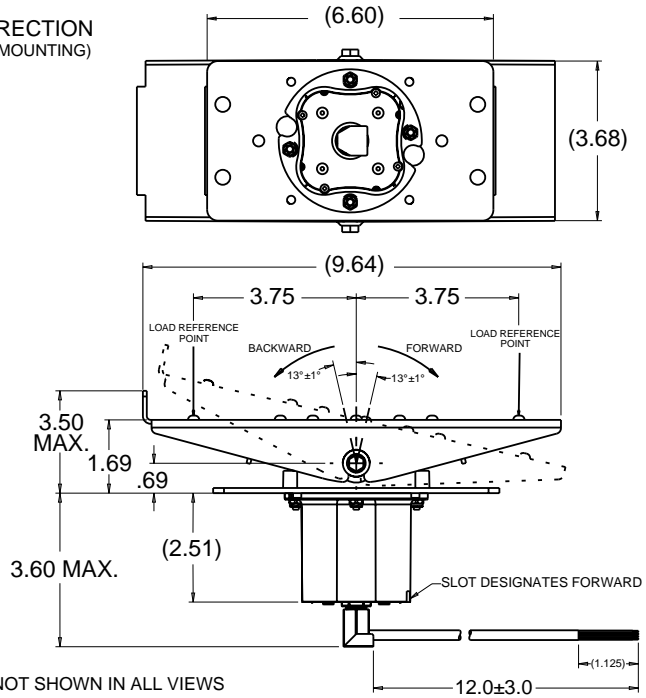
### SINGLE DIRECTION WIDE MOUNTING



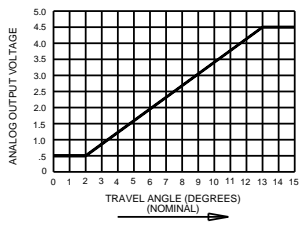
## SINGLE DIRECTION & DUAL DIRECTION



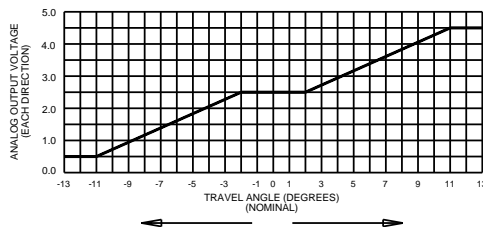
DUAL DIRECTION  
(NARROW MOUNTING)



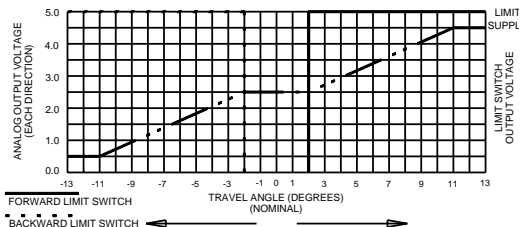
## OUTPUT OPTIONS



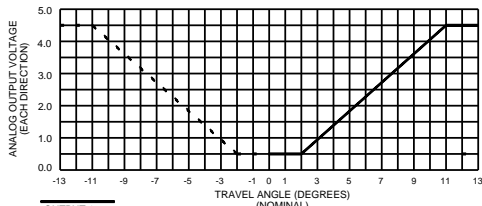
OPTION 1



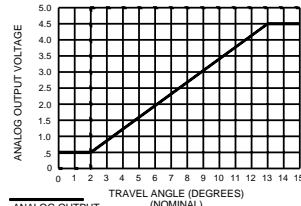
OPTION 2



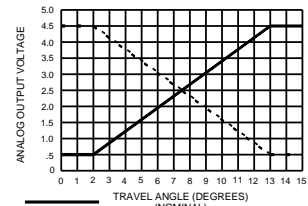
OPTION 3



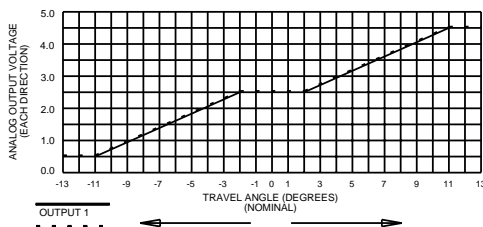
OPTION 4



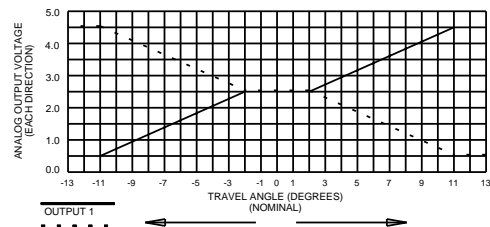
OPTION 5



OPTION 6



OPTION 7



OPTION 8

# HALL EFFECT PUSHBUTTON SWITCHES

**HP7**  
HALL EFFECT  
PUSHBUTTONS

10 MILLION CYCLES, CONTACTLESS HALL EFFECT TECHNOLOGY

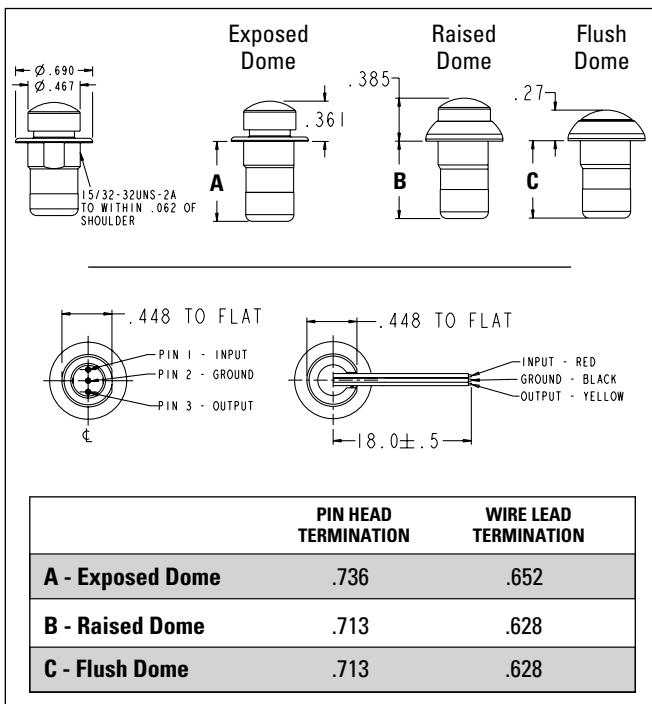
Designated the HP7 series, these momentary pushbutton switches utilize Hall effect sensor technology for long life contactless switching, with 10 million cycles. Available in dusttight and moistureproof sealed configurations, these switches can also be watertight sealed to IP68S. The stylish dome-shaped pushbuttons are available in nine colors and a mechanical detent option is available for tactile feedback.

Case and bezel are precision-machined aluminum alloy, available with either a black or clear coat anodized finish. Three case and button styles are offered in raised dome, flush dome and exposed dome styles. PC pins or wire leads are standard, with value-added connectors available.

This rugged switch is designed to withstand harsh environments while being subjected to high rates of actuation. Applications that require repeated "jogging" and other continuous operations are prime applications for the HP7 Hall effect switch. Examples can be found in material handling equipment such as loaders, lift trucks, bucket and shovel, and other applications where positioning of the load is critical.

## Features:

- 10 million cycles
- Hall effect technology for long life
- Electronics sealed to IP64 or watertight to IP68S
- Stylish dome-shaped buttons in 9 colors
- Momentary action
- Choice of termination styles
- Mechanical detent available for tactile feedback
- RoHS compliant



Standard Characteristics/Ratings:			
<b>MECHANICAL:</b>			
<b>Mechanical Life:</b>	10,000,000 cycles without detent		
<b>Button Travel:</b>	0.080 inches max		
<b>Overtravel:</b>	0.010 inches min		
<b>Operating Force:</b>	Without detent: 16 oz +/- 8 oz With detent: 28 oz +/- 8 oz		
<b>Operating Point:</b>	0.040 inches +/- 0.010		
<b>Electrical Life:</b>	10,000,000 cycles		
<b>ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)</b>			
<b>Electrical</b>	<b>Units</b>	<b>Min</b>	<b>Max</b>
Supply Voltage	VDC	3.0	24
Reverse Output Voltage	VDC	N/A	0.5
Supply Current	mA	N/A	9
Continuous Output Current	mA	N/A	18
Reverse Battery Protection	VDC	N/A	-15
<b>ELECTRONICS:</b>			
<b>Seal:</b>	IP64 or IP68S		
<b>ENVIRONMENTAL:</b>			
<b>Operating Temp Range:</b>	-40°C to +85°C		
<b>Storage Temp Range:</b>	-60°C to +105°C		
<b>MATERIALS:</b>			
<b>Button:</b>	Thermoplastic		
<b>Case:</b>	Aluminum alloy		
<b>Mounting Hardware:</b>	Hex nut & lockwasher		

### HP7 PART NUMBER CODE

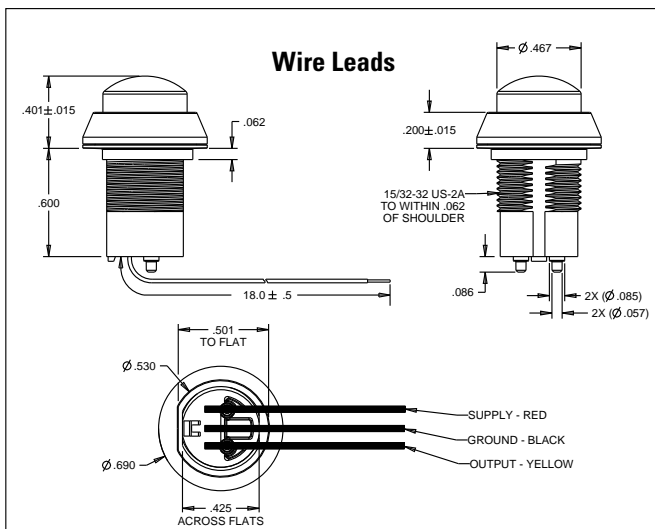
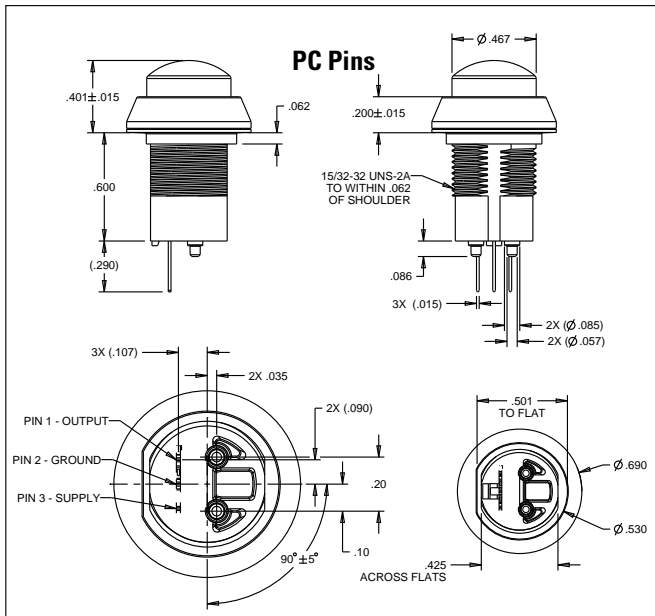
Dome Style	Action	Terminal Style	Seal Level	Case Color	Button Color
DE. Exposed Dome	1. Normally High Momentary	3. 3 Pin Header	2. Dusttight	1. Clear	1. Red
DF. Flush Dome	2. Normally High Momentary with Detent	5. 18" Potted 26 AWG Wire Leads	3. Watertight	2. Black	2. Black
DR. Raised Dome	3. Normally Low Momentary				3. Orange
	4. Normally Low Momentary with Detent				4. Yellow
					5. Green
					6. Blue
					7. Purple
					8. Gray
					9. White

10 MILLION CYCLES, CONTACTLESS HALL EFFECT TECHNOLOGY

The HP7C Hall effect momentary action pushbutton series shares similar characteristics to the HP7 series but is a lower cost version made with a thermoplastic case and a nylon button. With a 10 million cycle life, the HP7C works well in industrial joystick controls, remote controls and other applications requiring high reliability and high rates of actuation. PC pins or wire leads are standard with value-added connectors available to specification.

## Features:

- 10 million cycles
- Hall effect technology for long life
- Stylish dome-shaped buttons in 9 colors
- Momentary action
- PC pin or wire lead termination styles
- RoHS compliant



Standard Characteristics/Ratings:			
<b>MECHANICAL:</b>			
Mechanical Life:	10,000,000 cycles		
Button Travel:	0.080 inches max		
Overtravel:	0.010 inches min		
Operating Force:	12 oz +/- 4 oz		
Operating Point:	0.040 inches +/- 0.012		
Electrical Life:	10,000,000 cycles		
<b>ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)</b>			
Electrical	Units	Min	Max
Supply Voltage	VDC	4.5	24.0
Reverse Output Voltage	VDC	N/A	0.5
Supply Current (B=0, Vcc=5V, Io=0)	mA	2.3	4.2
Continuous Output Current	mA	N/A	20.0
Reverse Battery Protection	VDC		-15.0
<b>ENVIRONMENTAL:</b>			
Operating Temp Range:	-40°C to +85°C		
Storage Temp Range:	-40°C to +105°C		
Electronic Enclosure Design:	IP68S		
<b>MATERIALS:</b>			
Button:	Nylon		
Case & Bezel:	Thermoplastic		
Mounting Hardware:	Hex nut & lockwasher		

## HP7C PART NUMBER CODE

HP7C	-	X	X	X	1	X	X
<b>Button Style</b>		<b>Circuit Style</b>	<b>Terminal Style</b>	<b>Seal Level</b>	<b>Bezel Color</b>	<b>Button Color</b>	
DR. Raised Dome Matte Finish		1. Normally High Momentary 3. Normally Low Momentary	3.3 Pin Header 5. 18" Potted 26 AWG Wire Leads		1. Red 2. Black	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Purple 8. Gray 9. White	

# HALL EFFECT LINEAR OUTPUT PUSHBUTTONS

**HPL**  
LINEAR OUTPUT  
PUSHBUTTONS

1 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

The HPL Hall Effect Linear Output Pushbutton Switch utilizes Hall effect technology to provide the user an output proportional to the travel of the button. The HPL delivers up to 1 million cycles. This rugged switch is ideal for applications where a simple on/off control is insufficient and a linear output is desired. Using the HPL, an operator can control the motion of a device as well as the speed of the movement. The HPL switch is an ideal control device for valves and variable speed drives, and can be used in industrial control, heavy equipment and material handling applications.

The HPL is offered as a stand-alone switch and in a dual HPL rocker assembly. As with all OTTO switches, a wide variety of case and button styles and colors are offered, along with various termination styles and two levels of sealing. OTTO can provide custom configurations as well as provide the HPL switches installed in a control grip.

## Features:

- Programmable outputs of 0.5 to 4.5 volts
- 1 million cycles
- Hall effect for reliable contactless switching
- Watertight per IP68S available
- Front or behind panel mounting
- Wire or pinned termination options
- Rocker version available
- RoHS compliant



HPL-4  
15/32" – 32 Thread  
Rear Mount



HPL-R  
Hall Effect Rocker



HPL-3  
5/8" Front Mount

## HPL PART NUMBER CODE

HPL	-	X	X	X	X	X	X	X
<b>Case Style</b>		<b>Output</b>	<b>Terminal Style</b>	<b>Seal Level</b>	<b>Case Color</b>	<b>Button Color</b>	<b>Button Style*</b>	
1. Press Fit		1. 1.0 - 4.0VDC	1. 3 Straight Pins, 0.100" Centers	1. IP65 Splashproof	1. Clear Anodized	1. Red	1. 0.375" OD (Case Styles 1, 3, 4 & 6)	
3. Front Mount 5/8" Thread		2. 4.0 - 1.0VDC	2. 18" Potted 22 AWG Wire Leads	2. IP68S Watertight	2. Black Anodized	2. Black	2. 0.500" OD Domed (Case Styles 1, 3 & 6)	
4. Rear Mount 15/32" Thread		3. 0.5 - 4.5VDC				3. Orange		
6. Rear Mount 5/8" Thread		4. 4.5 - 0.5VDC				4. Yellow		
R. Rocker Assembly						5. Green		
						6. Blue		
						7. Purple		
						8. Gray		
						9. White		

\* For availability of larger button diameters, contact factory.

1 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

**Standard Characteristics/Ratings:**

**MECHANICAL:**

<b>Mechanical Life:</b>	1,000,000 cycles full stroke per button
<b>Button Travel:</b>	0.135 inches min to 0.160 inches max
<b>Full Travel Force:</b>	0.15 inches, 3.0 lbs. typical to 3.8 lbs. max @ 25°C
<b>Reset Force:</b>	5 oz min @ 25°C
<b>Electrical Life:</b>	1,000,000 cycles

**ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)**

Electrical	Units	1 - 4 Volts			4 - 1 Volts			0.5 - 4.5 Volts			4.5 - 0.5 Volts		
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5
Output Voltage (Button Up)	VDC @ 5V Vcc	0.85	1	1.15	3.85	4	4.15	0.35	0.5	0.65	4.35	4.5	4.85
Output Voltage (Button Down)	VDC @ 5V Vcc	3.85	4	4.15	0.85	1	1.15	4.35	4.5	4.65	0.35	0.5	0.65
Supply Current	mA	N/A	8	10	N/A	8	10	N/A	8	10	N/A	8	10
Continuous Output Current	mA	-1	N/A	1	-1	N/A	1	-1	N/A	1	-1	N/A	1
Output Resistance (Io ≤ -2mA)	Ω	N/A	1	10	N/A	1	10	N/A	1	10	N/A	1	10

**ELECTRONICS:**

**Seal Integrity:** IP65 or IP68S

**ENVIRONMENTAL:**

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

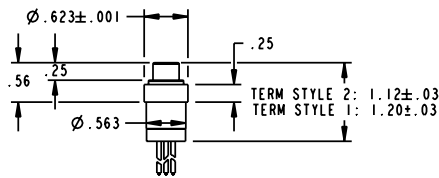
**MATERIALS:**

**Housing:** Anodized Aluminum alloy

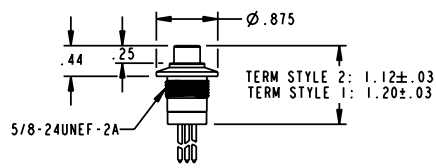
**Button Cap:** Thermoplastic

**Mounting Hardware:** Lockwasher, hex nut, washer when applicable

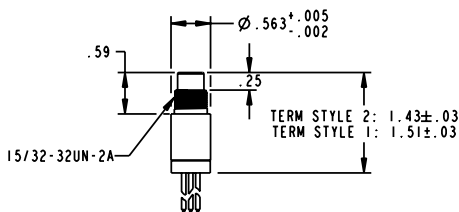
**.375" O.D. Button Style**



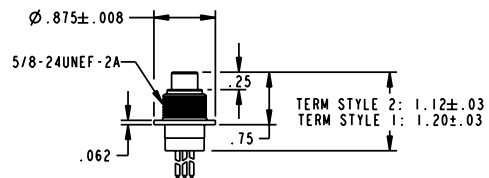
HPL - 1XXXXXI  
PRESS FIT



HPL - 3XXXXXI  
5/8" THREAD  
FRONT MOUNT



HPL - 4XXXXXI  
15/32" THREAD  
REAR MOUNT



HPL - 6XXXXXI  
5/8" THREAD  
REAR MOUNT

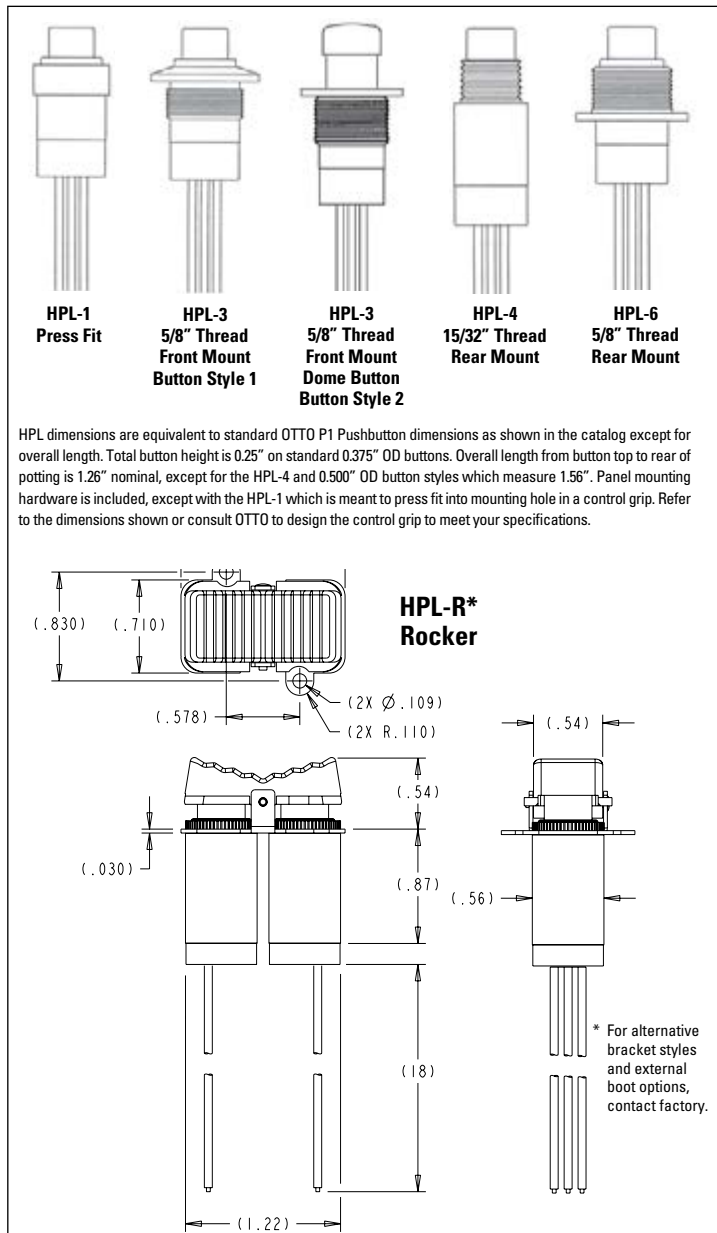


# HALL EFFECT LINEAR OUTPUT PUSHBUTTONS

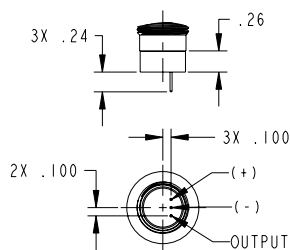
**HPL**  
LINEAR OUTPUT  
PUSHBUTTONS

1 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

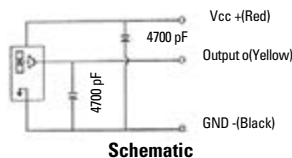
## Case Styles



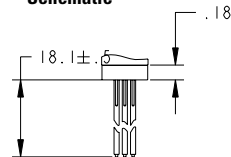
## Terminal Styles



**TERMINAL STYLE 1**  
3 STRAIGHT PINS  
.100 CENTERS

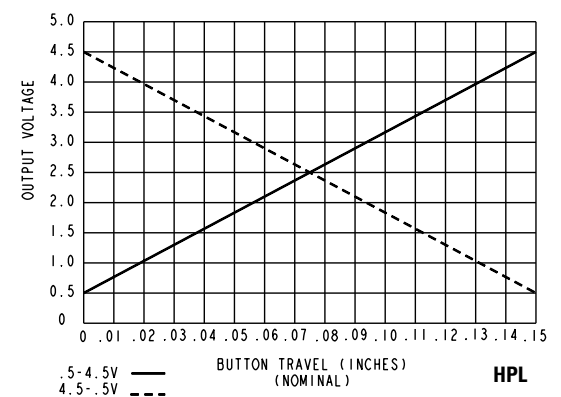
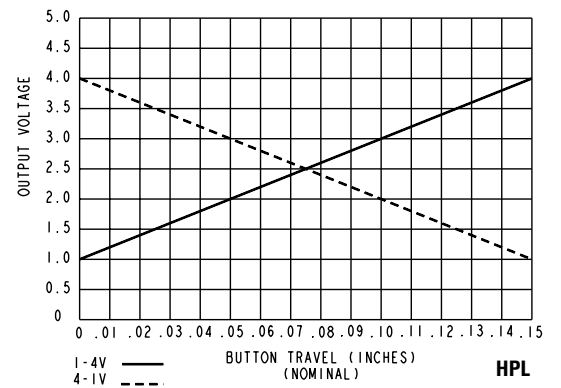
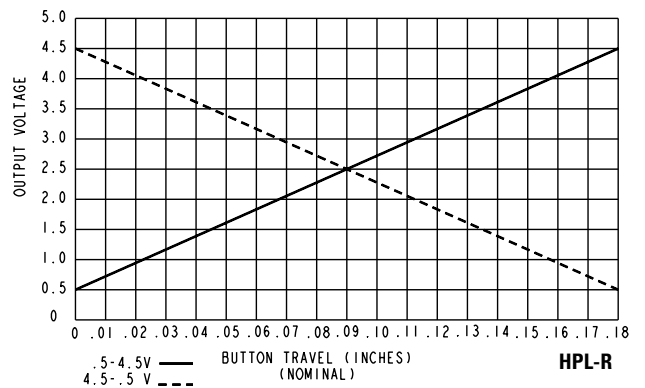
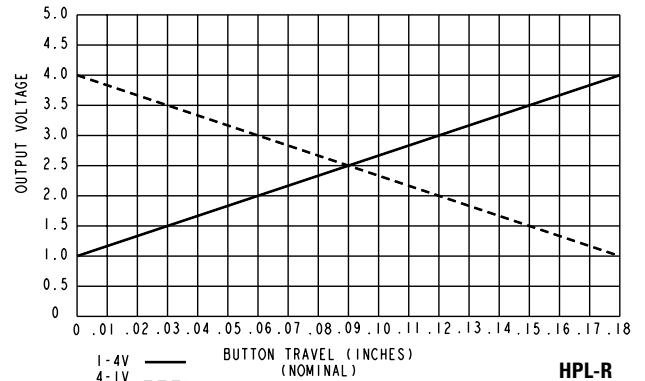


**Schematic**



**TERMINAL STYLE 2**  
18" POTTED  
22 AWG, UL 1569  
WIRE LEADS

## Linear Output Graphs (Vcc = 5V @ 20°C)



# HALL EFFECT SINGLE AXIS PADDLE

UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS



HPW-1  
Lever Style #1  
(Paddle)



HPW-2  
Lever Style #2  
(Standard Lever)



HPW-3  
Lever Style #3  
(Ergonomic Lever)

The HPW series, available with 14 output options, offers a self-centering single axis actuator that provides linear change in voltage output in either direction from center. Options include increasing or decreasing voltage output in either direction (from center position to the full travel position) with single or dual outputs in either direction. The HPW series without detent provides a five million cycle, full forward to full back life, and with detent (available with HPW-3) provides a two million cycle full forward to full back life. Electronics are sealed to IP68S, while offering outstanding EMI/RFI immunity.

## Features:

- Designed for grip, armrest & panel mounting
- Proven contactless analog output Hall effect technology
- 14 output options available
- Self-centering, single axis actuator
- Up to 5,000,000 mechanical life
- Electronics sealed to IP68S
- RoHS compliant
- Optional soft touch coating available

Standard Characteristics/Ratings:				
<b>MECHANICAL:</b>				
<b>Mechanical Life with Detent:</b>	Up to 2,000,000 cycles full forward to full back			
<b>Mechanical Life without Detent:</b>	Up to 5,000,000 cycles full forward to full back			
<b>Travel:</b>	Full travel angle each direction from center to 25° typical			
<b>Operating Force:</b>	HPW-1 is 4 oz typical @ 25° HPW-2 and HPW-3 are 3 oz typical @ 25°			
<b>Max Allowable Radial Load:</b>	30.0 lbs.			
<b>ELECTRICAL RATINGS: Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)</b>				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center (A, B, C, D, E, F, G & H)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Center (J, K, L, M, N & P)	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance at Full Travel (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Options A & D (B = 0, Vcc = 5V, Iout = 0)	mA	N/A	8	10
Supply Current All Other Options (B = 0, Vcc = 5V, Iout = 0)	mA	N/A	16	20
<b>ENVIRONMENTAL:</b>				
<b>Operating Temp Range:</b>	-40°C to +85°C			
<b>Electronic Enclosure:</b>	IP68S			
<b>Mechanical Enclosure:</b>	Unsealed			
<b>RFI/EMI:</b>	Withstand per SAE J1113			

## HPW PART NUMBER CODE

Button Style	Output 1*	Output 2**	Operating Force	Termination	Bezel Color	Button Color	Detent
1. Lever Style #1 (Paddle)	A. 2.5 +/- 2.0VDC	NONE	1.4 oz (HPW-1)	A. 22 AWG 18.3" Long, Stripped Ends	1. Red	1. Red	N. None
2. Lever Style #2 (Standard Lever)	B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	3 oz (HPW-2 and HPW-3)	B. 0.025" SQ. Pins, Phosphor Bronze Alloy, Tin Plated	2. Black	2. Black	A. ±18°
3. Lever Style #3 (Ergonomic Lever)	C. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2.5 oz (HPW-2 and HPW-3)		3. Orange	3. Orange	
	D. 2.5 +/- 1.5VDC	NONE			4. Yellow	4. Yellow	
	E. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			5. Green	5. Green	
	F. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			6. Blue	6. Blue	
	G. 1.0 - 4.0VDC	1.0 - 4.0VDC			7. Violet	7. Violet	
	H. 0.5 - 4.5VDC	0.5 - 4.5VDC			8. Gray	8. Gray	
	J. 2.5 +/- 2.0VDC	NONE***			9. White	9. White	
	K. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC***					
	L. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC***					
	M. 2.5 +/- 1.5VDC	NONE***					
	N. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC***					
	P. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC***					

**STOP HERE for HPW-1 and HPW-2 switches.**

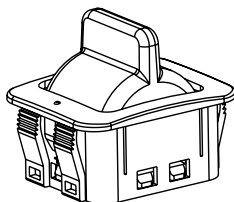
\* Outputs are from the center position to the full travel position in each direction. Options A-F provide increasing voltage in Direction 1 and decreasing voltage in Direction 2 from a single output. Options G and H provide increasing voltages in both directions from two separate outputs.

\*\* Options B and E provide redundant output 2 which duplicates output 1. Options C and F provide redundant output 2 which is inverse of output 1.

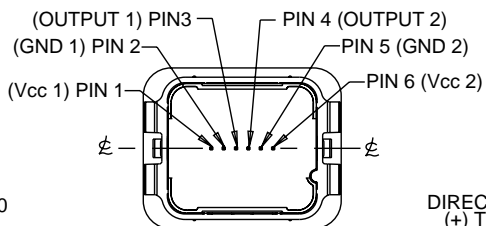
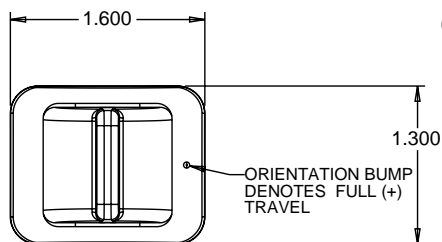
\*\*\* Options J, K, L, M, N and P are identical to Options A, B, C, D, E and F respectively, except with a tighter center tolerance.

# HALL EFFECT SINGLE AXIS PADDLE

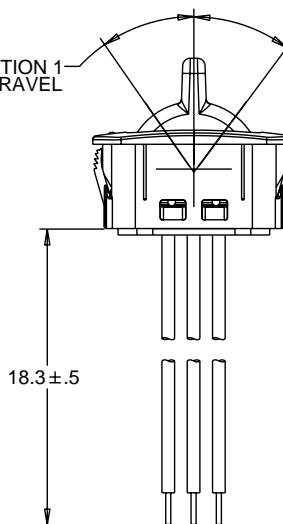
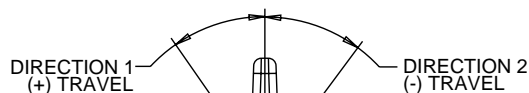
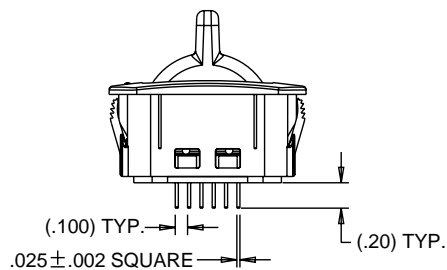
UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS



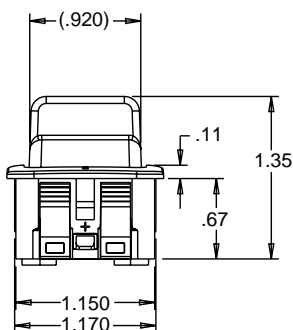
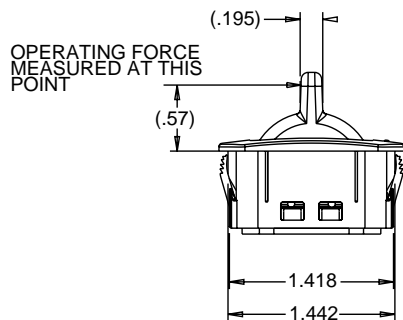
**LEVER STYLE #1  
(Paddle)**



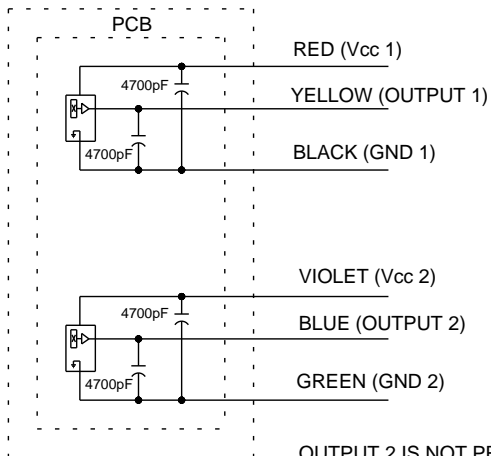
PINNED TERMINATION  
NOT ALL PINS ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS



WIRED TERMINATION  
NOT ALL WIRES ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS



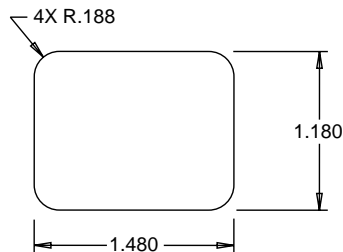
**ROCKER SWITCH**



OUTPUT 2 IS NOT PRESENT  
IN ALL CONFIGURATIONS

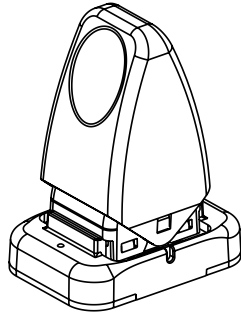
RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS  
(0.065 MIN. - 0.175 MAX.)

RECOMMENDED PANEL OPENING: 1.180 X 1.480 OPTIMUM  
(1.175/1.185 X 1.475/1.485)

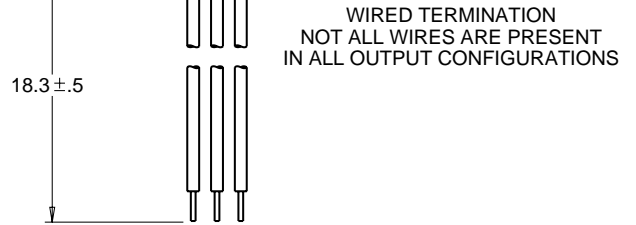
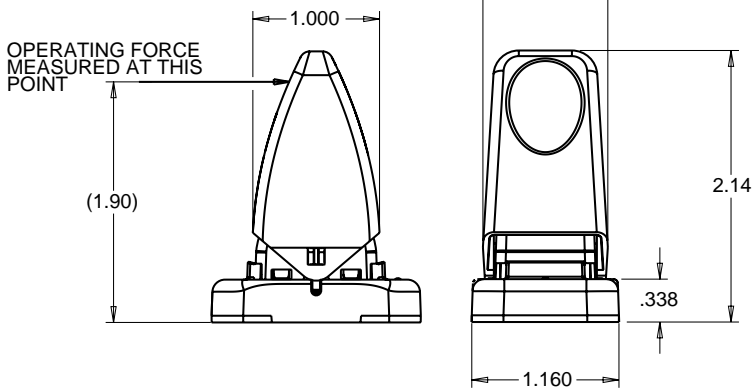
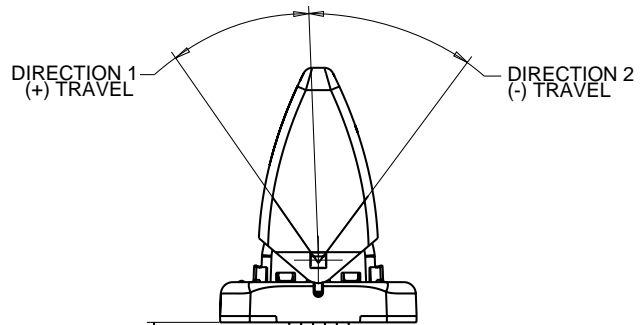
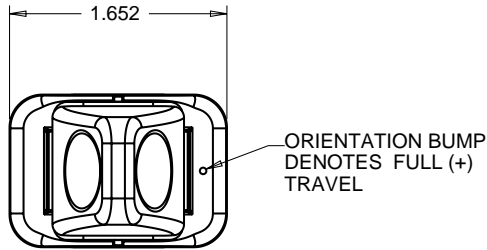
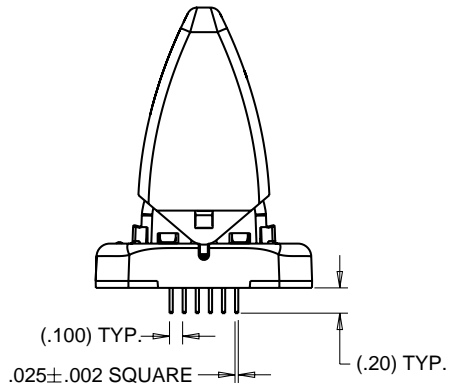


# HALL EFFECT SINGLE AXIS PADDLE

UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS

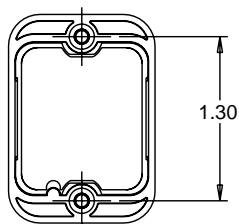
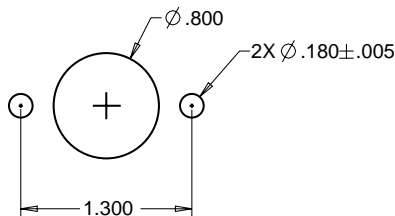
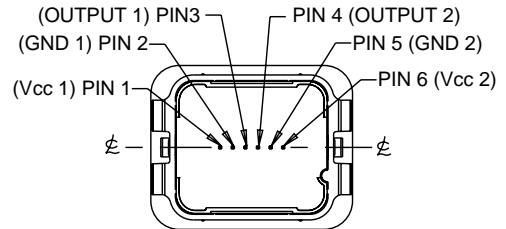


**LEVER STYLE #2**  
**(Standard Lever)**



RECOMMENDED PANEL THICKNESS: 0.130 OPTIMUM THICKNESS  
(0.125 MIN. - 0.135 MAX.)

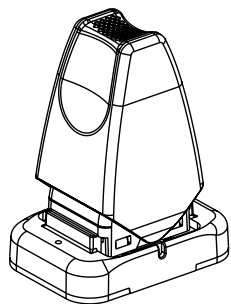
RECOMMENDED PANEL OPENING:  $\varnothing$  0.800 OPTIMUM  
(0.750 MIN. - 0.850 MAX)



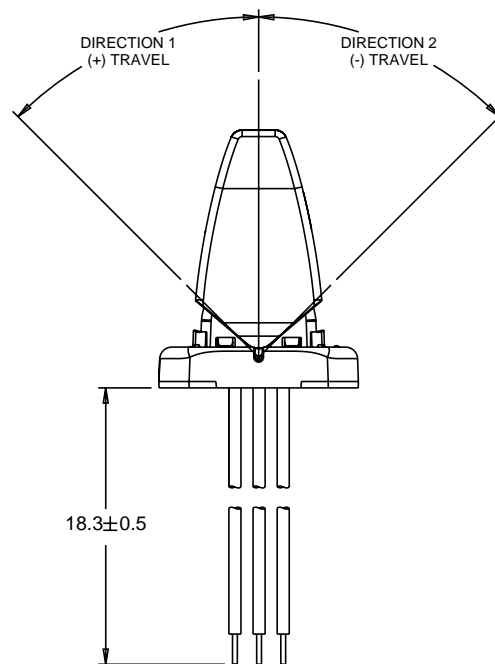
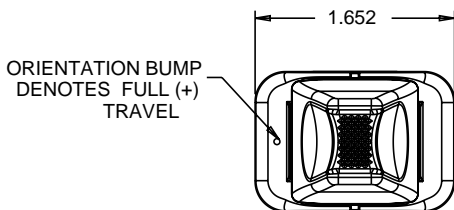
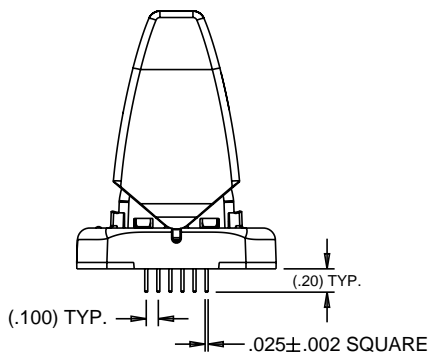
PINNED TERMINATION  
NOT ALL PINS ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS

# HALL EFFECT SINGLE AXIS PADDLE

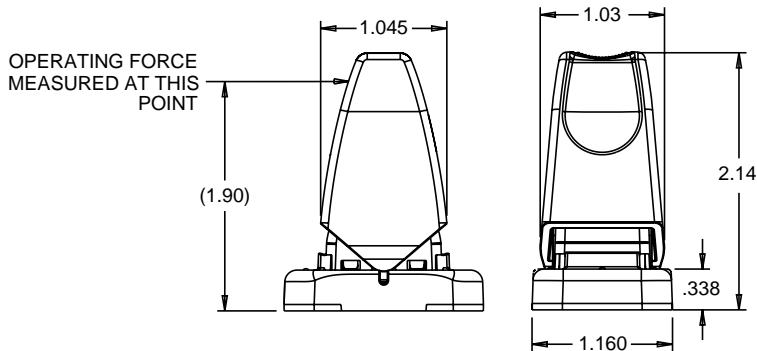
UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS



**LEVER STYLE #3**  
**(Ergonomic Lever)**



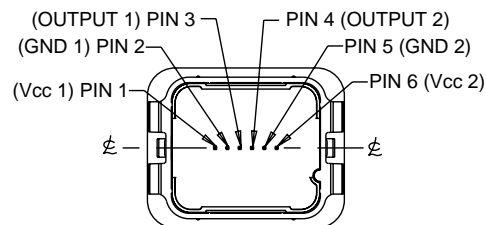
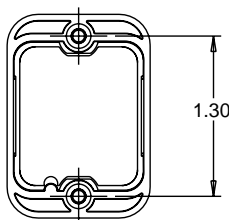
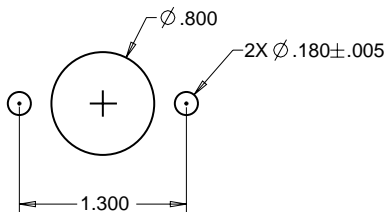
WIRED TERMINATION  
NOT ALL WIRES ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS



OPERATING FORCE  
MEASURED AT THIS  
POINT

RECOMMENDED PANEL THICKNESS: 0.130 OPTIMUM THICKNESS  
(0.125 MIN. - 0.135 MAX.)

RECOMMENDED PANEL OPENING:  $\varnothing$  0.800 OPTIMUM  
(0.750 MIN. - 0.850 MAX.)

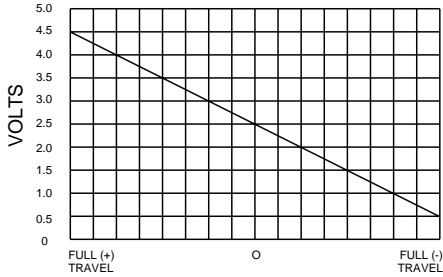


PINNED TERMINATION  
NOT ALL PINS ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS

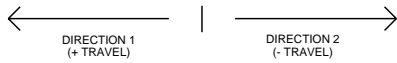
# HALL EFFECT SINGLE AXIS PADDLE

UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS

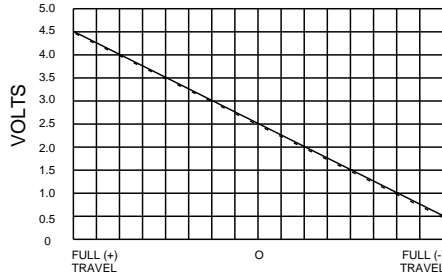
**OPTION A & J**



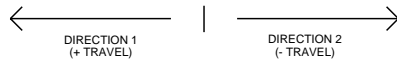
OUTPUT 1 ———



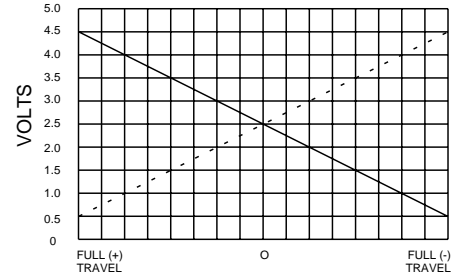
**OPTION B & K**



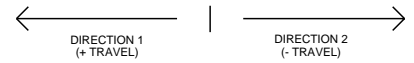
OUTPUT 1 ———  
OUTPUT 2 - - -



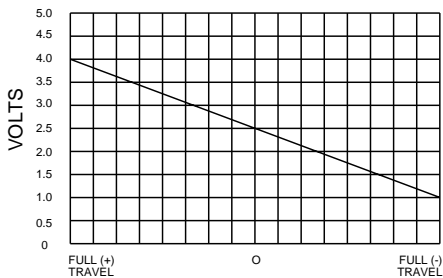
**OPTION C & L**



OUTPUT 1 ———  
OUTPUT 2 - - -



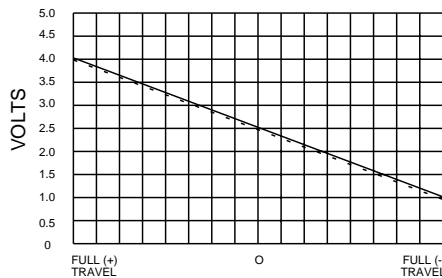
**OPTION D & M**



OUTPUT 1 ———



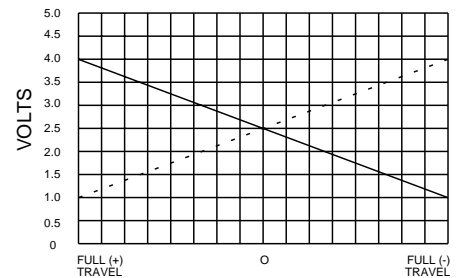
**OPTION E & N**



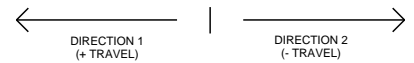
OUTPUT 1 ———  
OUTPUT 2 - - -



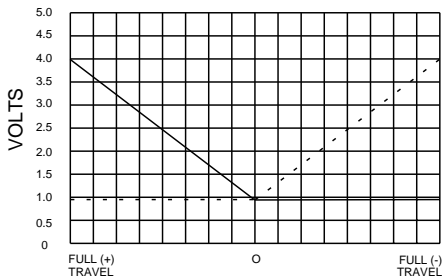
**OPTION F & P**



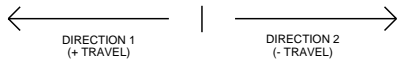
OUTPUT 1 ———  
OUTPUT 2 - - -



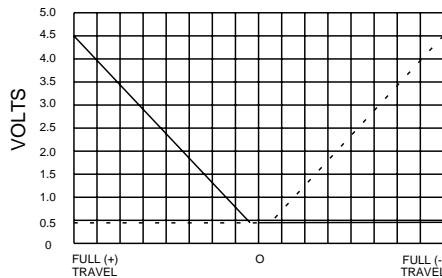
**OPTION G**



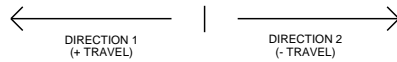
OUTPUT 1 ———  
OUTPUT 2 - - -



**OPTION H**



OUTPUT 1 ———  
OUTPUT 2 - - -



# LINEAR HALL EFFECT FINGER JOYSTICK

**HTL**  
HALL EFFECT  
JOYSTICK

## 2 & 4-WAY LINEAR HALL EFFECT FINGER JOYSTICK



HTL4 with External  
Castle Boot Style  
Button



HTL2 with Tall  
Concave Stadium  
Boot Style Button

The HTL series provides all of the performance of a full size, dual axis joystick in a miniature package that can be mounted in control handles, armrests and panels. The Hall effect sensors are immune to electromagnetic and radio frequency interference up to 100V/M. Programmable sensors with built-in temperature compensation ensure consistent and repeatable operation. The HTL series has excellent tactile feel for improved operator control and is available with either dusttight or IP68S watertight seal. A wide variety of output configurations are available to satisfy different applications.

### Features:

- Designed for grip, armrest & panel mounting
- Proven contactless analog output Hall effect technology
- Redundant outputs available
- 1 million cycles
- Electronics watertight to IP68S
- Outstanding EMI/RFI immunity
- Variety of button styles
- Tighter center tolerance options
- RoHS compliant
- PWM output option

### Standard Characteristics/Ratings:

#### MECHANICAL:

**Mechanical Life:** 1,000,000 all directions

**Travel Angle:** 23° min to 27° max, 25° typical

**Operating Force with Boot:** 16 oz typical to 20 oz max (at top of button) @ 20°C

**Max Allowable Vertical & Radial Force on Button:** 25.0 lbs.

**Max Allowable Torque on Button about Shaft Axis:** 5.5 lbs.

#### ELECTRICAL RATINGS:

**HTL2: Rated at Vcc = 5V @ 20°C Load = 1mA (4.7KΩ)**

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.50	5.00	5.50
Output Voltage Tolerance at Center AA, BB, CC, DD, EE, FF, GG & HH	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Center AT, BT, CT, DT, ET and FT	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance at Full Travel (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current per Sensor B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10.00
Output Source Current Limit B=X*, Vo=0	mA	-1.00	N/A	1.00

**HTL4: Rated at Vcc = 5V @ 20°C Load = 1mA (4.7KΩ)**

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.50	5.00	5.5
Output Voltage Tolerance at Center AA, BB, CC, DD, EE, FF, GG & HH	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Center AT, BT, CT, DT, ET and FT	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance at Full Travel (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current per Sensor B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10.00
Output Source Current Limit B=X*, Vo=0	mA	-1.00	N/A	1.00

#### ELECTRONICS

**Seal Integrity:** Electronics IP68S

#### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Storage Temp Range:** -40°C to +85°C

**RFI:** Withstand per SAE J1113

**EMI:** Withstand per SAE J1113

#### MATERIALS:

**Boot:** Elastomer

**Button:** Thermoplastic, black

**Case:** Thermoplastic, black

**Flange:** Thermoplastic, black

**Wires:** 22 or 24 AWG

**Mounting Hardware:** Panel fastener assembly

## 2 & 4-WAY LINEAR HALL EFFECT TOGGLE

### HTL2 PART NUMBER CODE

HTL2	-	X	X	X	X	X	XX	X	X
Button Style	Case Style	Seal	Travel	Detent	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color
1. Castle	1. 0.970" SQ.	1. Dusttight	1. 25°	1. None	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads	2. Black
2. External Castle Boot		2. Watertight Panel Seal*		2. Detent at 50% travel (not available with button style 7)		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	22 AWG, UL 1569	
3. Short Double Stadium						CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. Pins	
4. Tall Concave Stadium						DD. 2.5 +/- 1.5VDC	NONE	3. Wire Leads	
5. External Bat Handle Boot						EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	24 AWG, SAE AS22759	
6. External Smooth Boot						FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
7. Long Concave Y Axis Button						GG. 0.5 - 4.5VDC	0.5 - 4.5VDC		
8. Low Profile Button						HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		
						AT. 2.5 +/- 2.0VDC	NONE**		
						BT. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC**		
						CT. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC**		
						DT. 2.5 +/- 1.5VDC	NONE**		
						ET. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC**		
						FT. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC**		

### HTL4 PART NUMBER CODE

HTL4	-	X	X	X	X	X	XX	X	X
Button Style	Case Style	Seal	Travel	Gating***	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color
1. Castle	1. 0.970" SQ.	1. Dusttight	1. 25°	1. Omnidirectional; Square; On-Axis and Off-Axis Guided Feel	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads	2. Black
2. External Castle Boot		2. Watertight Panel Seal*		2. Gated; Two Axis Return to Center		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	22 AWG, UL 1569	
3. Short Double Stadium				3. Omnidirectional; Round; Smooth Feel		CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. Pins	
4. Tall Concave Stadium				4. Omnidirectional; Round; On-Axis Guided Feel		DD. 2.5 +/- 1.5VDC	NONE	3. Wire Leads	
5. External Bat Handle Boot				5. Omnidirectional; Square; On-Axis and Off-Axis Guided Feel with Detent at 50% Travel		EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	24 AWG, SAE AS22759	
6. External Smooth Boot				6. Omnidirectional; Round; Smooth Feel with Detent at 50% Travel		FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	4. Wire Leads	
				7. Omnidirectional; Round; On-Axis Guided Feel with Detent at 50% Travel		GG. 0.5 - 4.5VDC	0.5 - 4.5VDC	22 AWG, UL 1569	
						HH. 1.0 - 4.0VDC	1.0 - 4.0VDC	shared powers and grounds (see schematic)	
						AT. 2.5 +/- 2.0VDC	NONE**	5. Wire Leads	
						BT. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC**	24 AWG, SAE AS22759	
						CT. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC**	shared powers and grounds (see schematic)	
						DT. 2.5 +/- 1.5VDC	NONE**		
						ET. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC**		
						FT. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC**		

\* Watertight panel seal option available with button styles 2, 5, 6 and 8.

\*\* Options AT, BT, CT, DT, ET and FT are identical to options AA, BB, CC, DD, EE and FF respectively except with a tighter center tolerance.

\*\*\*Gating options 5, 6 and 7 not available with button style 7.

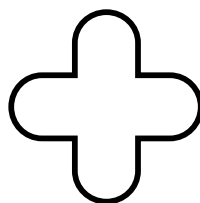
① Outputs are from the center to the full travel position in each direction. Options "AA," "BB," "CC," "DD," "EE," and "FF" provide increased voltage in +Y; and decreasing voltage in -Y direction from one output per axis with the HTL2 and increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis with the HTL4. Options "GG" and "HH" provide increasing voltages in all directions (+Y, -Y with the HTL2 and +X, +Y, -X, -Y with the HTL4) from 2 outputs per axis.

② Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

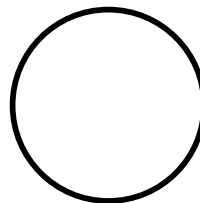
### Gating Icons



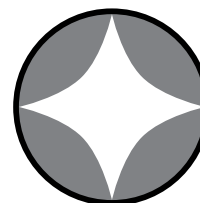
Omnidirectional Square On-Axis and Off-Axis Guided Feel\*\*\*\*



Gated Two Axis Return to Center



Omnidirectional Round Smooth Feel



Omnidirectional Round On-Axis Guided Feel\*\*\*\*



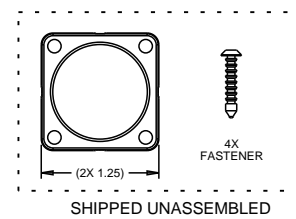
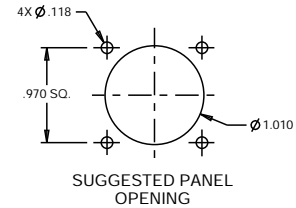
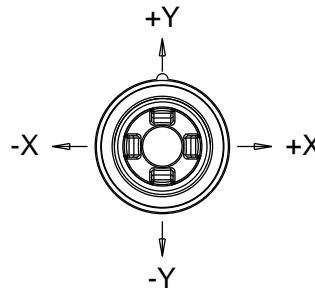
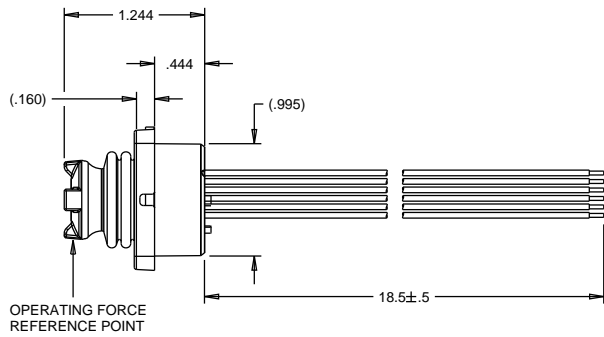
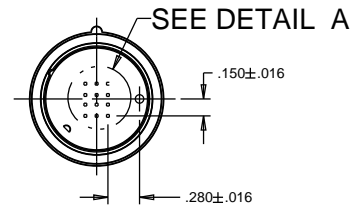
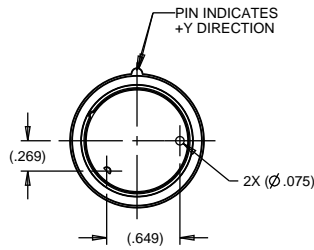
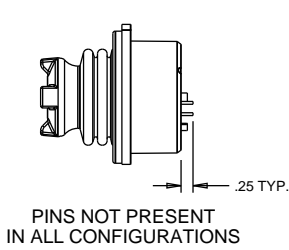
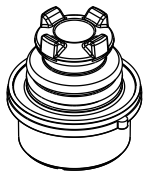
Single Axis (HTL2 version)

\*\*\*\*Feel defined by shading.

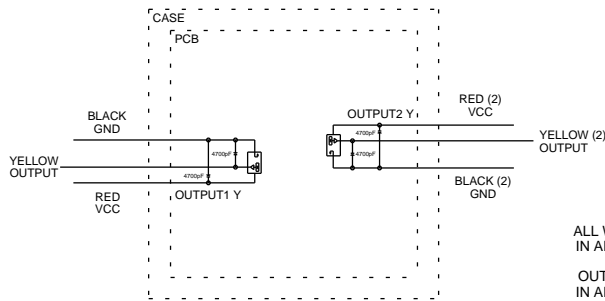


# LINEAR HALL EFFECT FINGER JOYSTICK

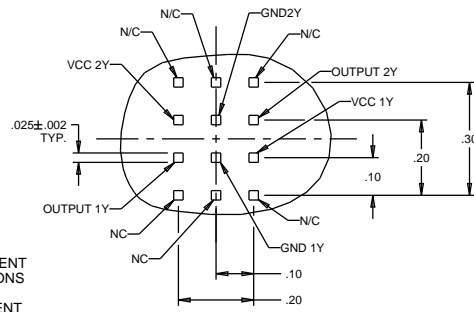
## 2 & 4-WAY LINEAR HALL EFFECT TOGGLE



### HTL2 FOOTPRINT



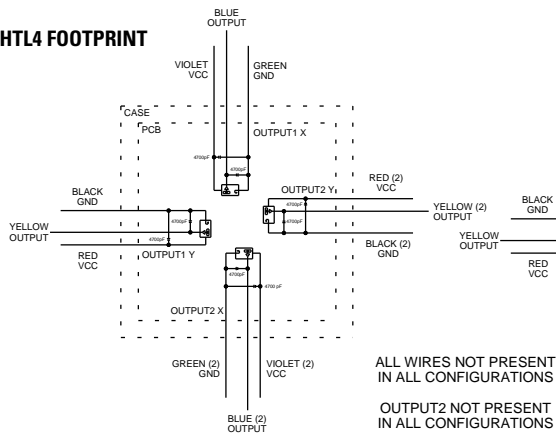
ALL WIRES NOT PRESENT  
IN ALL CONFIGURATIONS  
OUTPUT2 NOT PRESENT  
IN ALL CONFIGURATIONS



DETAIL A

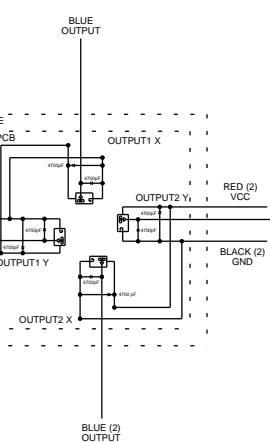
ALL PINS NOT PRESENT IN ALL CONFIGURATIONS

### HTL4 FOOTPRINT

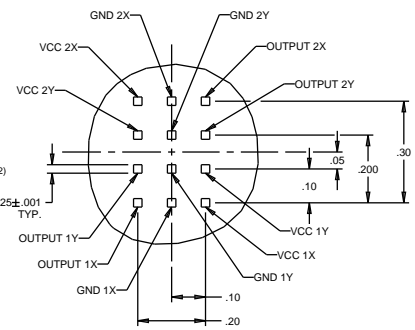


ALL WIRES NOT PRESENT  
IN ALL CONFIGURATIONS  
OUTPUT2 NOT PRESENT  
IN ALL CONFIGURATIONS

TERMINATION STYLE 1, 2, AND 3



TERMINATION STYLE 4 AND 5



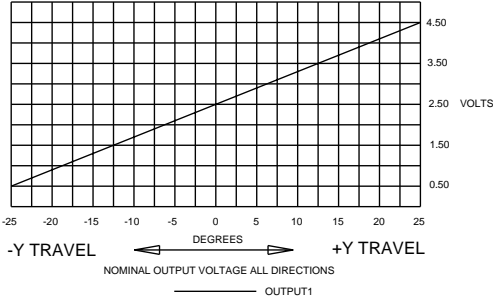
DETAIL A

ALL PINS NOT PRESENT IN ALL CONFIGURATIONS

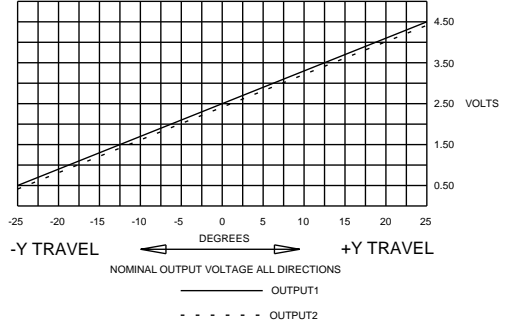
## 2 & 4-WAY LINEAR HALL EFFECT TOGGLE

### HTL2 OUTPUTS

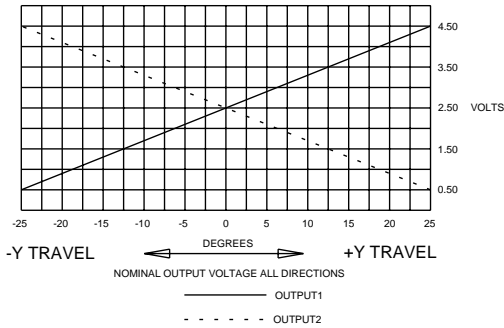
**OPTION AA & AT**



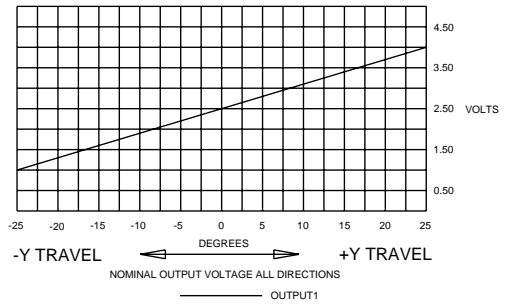
**OPTION BB & BT**



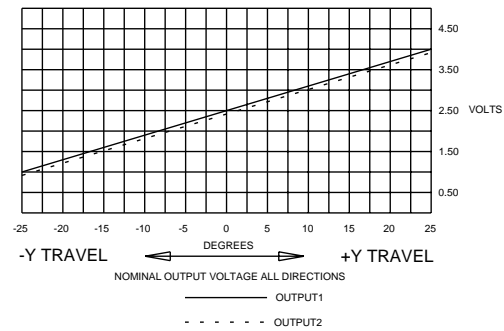
**OPTION CC & CT**



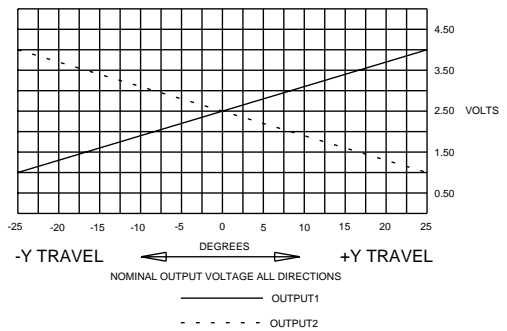
**OPTION DD & DT**



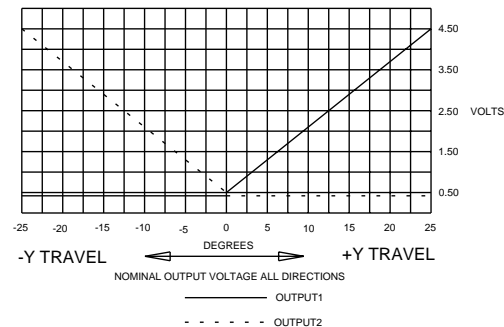
**OPTION EE & ET**



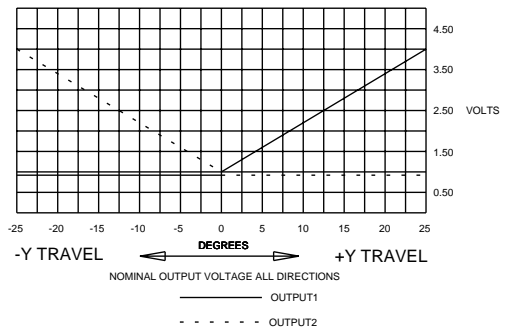
**OPTION FF & FT**



**OPTION GG**



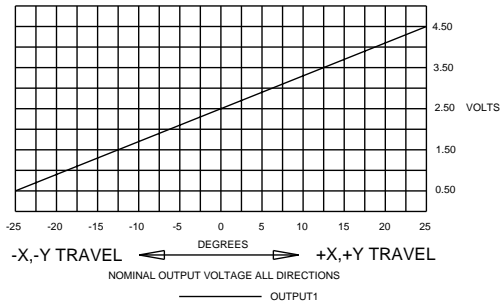
**OPTION HH**



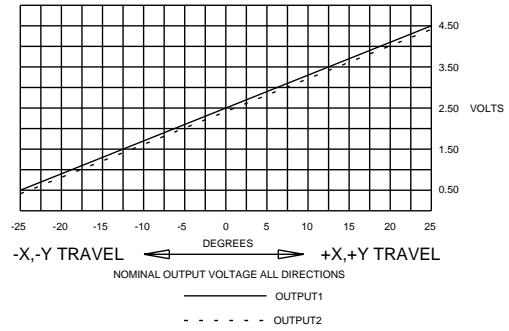
## 2 & 4-WAY LINEAR HALL EFFECT TOGGLE

### HTL4 OUTPUTS

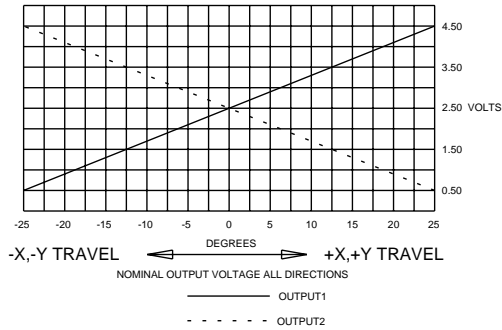
OPTION AA & AT



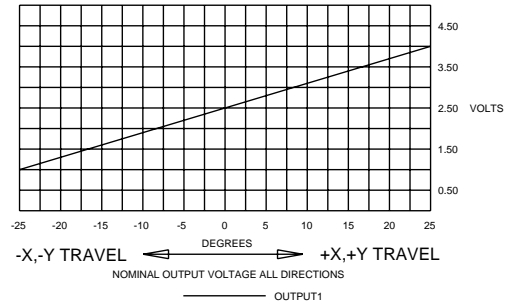
OPTION BB & BT



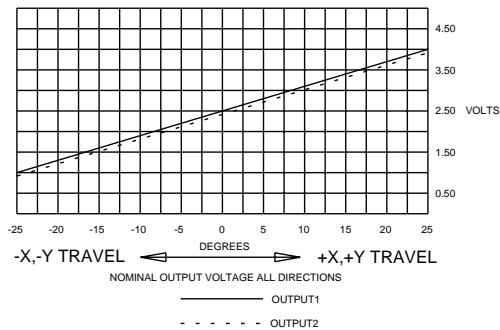
OPTION CC & CT



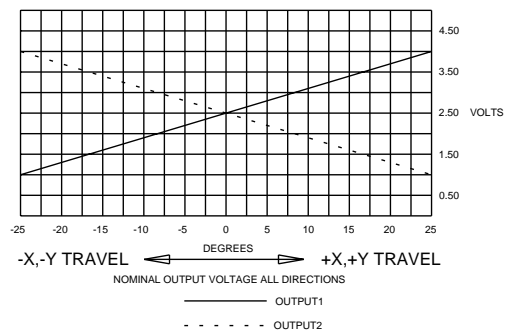
OPTION DD & DT



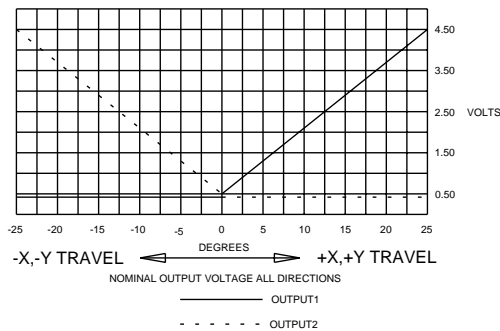
OPTION EE & ET



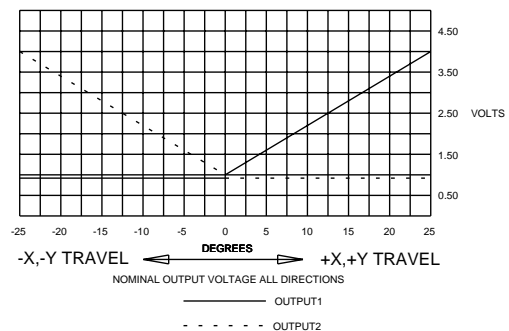
OPTION FF & FT



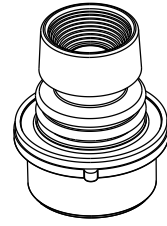
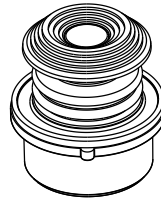
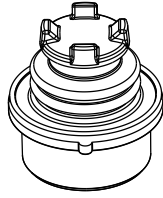
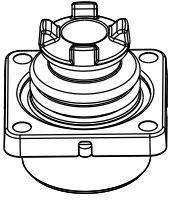
OPTION GG



OPTION HH



## BUTTON CONFIGURATIONS

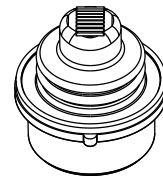
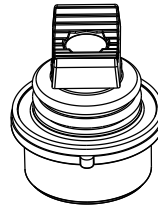
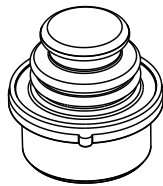
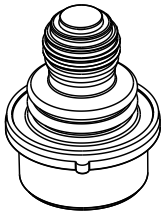


**BUTTON STYLE 1**  
(CASTLE)

**BUTTON STYLE 2**  
(EXTERNAL CASTLE BOOT)

**BUTTON STYLE 3**  
(SHORT DOUBLE STADIUM)

**BUTTON STYLE 4**  
(TALL CONCAVE STADIUM)



**BUTTON STYLE 5**  
(EXTERNAL BAT  
HANDLE BOOT)

**BUTTON STYLE 6**  
(EXTERNAL SMOOTH BOOT)

**BUTTON STYLE 7**  
(LONG CONCAVE Y AXIS BUTTON)  
(AVAILABLE FOR HTL2 ONLY)

**BUTTON STYLE 8**  
(LOW PROFILE BUTTON)  
(AVAILABLE FOR HTL2 ONLY)

# FINGER JOYSTICK WITH PUSHBUTTON OPTION

**HTLT**  
HALL EFFECT  
FINGER JOYSTICK

3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION



HTLT4 with  
Center Pushbutton

OTTO's HTLT Series miniature Hall effect joystick is a proportional linear output finger joystick with a pushbutton option. With a lower base price than the HTL, the HTLT features 8 different button styles, multiple output configurations and 3 mounting options including top mount with threaded housing.

Gating options include omnidirectional square on axis guided feel, gated single axis return to center, gated dual axis return to center and omnidirectional round smooth feel. The HTLT offers excellent tactile feedback and is available with a mechanical seal of either dusttight or watertight per IP68S. All electronics are sealed to IP68S.

Featuring contactless Hall effect technology, the HTLT is designed to withstand harsh environments and works well in the industrial, medical, unmanned vehicle and off-highway industries for applications such as remote controls, armrest integration, control panels and belly boxes.

## Features:

- One/two axis gated or 360°
- Pushbutton option
- Electronics sealed to IP68S
- Dusttight or Watertight per IP68S option
- 3.3V SPI output option
- Single or redundant analog output options
- PWM output option
- 3 million cycle mechanical life
- Tested for harsh environments
- Great for industrial, medical, unmanned vehicle and off-highway industries

## Standard Characteristics/Ratings:

### ELECTRICAL RATINGS:

Analog Joystick: Rated at Vcc = 5V @ 20°C Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.50	5.00	5.50
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-25	N/A	+25
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-25	N/A	+25
Supply Current Outputs "AA" & "DD" B=0, Vcc=5V, Io=0	mA	N/A	10.00	12.00
Supply Current Outputs "BB", "CC", "EE", "FF", "GG" & "HH" B=0, Vcc=5V, Io=0	mA	N/A	20.00	24.00

### SPI Joystick

Electrical	Units	Min	Typ	Max
Supply Voltage - Output JJ	VDC	3.15	3.3	3.45
Supply Voltage - Output KK	VDC	4.50	5.00	5.50

Pushbutton Circuit: Normally Open Tact Switch

### MECHANICAL RATINGS

Joystick: Mechanical Life All Directions 3,000,000 Cycles  
Joystick: Mechanical Life All Directions (Friction Held) 1,000,000 Cycles

Mechanical	Units	Min	Typ	Max
Travel Angle	Degrees	19.0	20.0	21.0
Over Travel Angle	Degrees	0.5	1.0	1.5
Operating Force (w/ Boot) at 0.8" from Flange, @ 20° C*	OZ	5.0	8.0	16.0
Max Allowable Vertical Force on Button	LBS	N/A	N/A	25.0
Max Allowable Radial Force on Top of Knob*	LBS	N/A	N/A	25.0
Max Allowable Torque on Button About Shaft Axis*	IN-LBS	N/A	N/A	5.5

\* Button style "A" has a max allowable radial force of 10 lbs and max allowable torque of 3 in-lbs

### Pushbutton:

Mechanical Life	3,000,000 Cycles
Button Style 8 Operating Force @ 20° C	OZ 6.0 8.0 10.0
Button Style 9 Operating Force @ 20° C	OZ 8.0 14.0 16.0

### ENVIRONMENTAL:

Operating Temperature: ° C -40 20 85

### Joystick:

Mechanical Seal ISO 20653, Dusttight or watertight per IP68S (Button styles 2,5,6,8 and 9)

Drop 1 meter max to concrete

EMI/RFI Withstand Per SAE J1113, Contact Factory for Details

### Pushbutton:

Mechanical Seal ISO 20653, Watertight per IP68S Panel Seal (Button styles 8 and 9)

### ELECTRONICS

Seal Integrity: Electronics IP68S

### MATERIALS:

Housing:	Thermoplastic
Button:	Thermoplastic
Flange:	Thermoplastic, black
Bellows:	Silicone, black
Pushbutton Wires:	24 AWG
Mounting Hardware:	1-27 Hex nut (.09 Thick) included (with threaded base) Recommended max torque = 7 IN-LBS. or 4x #4-40 x .38 screws with square mounting flange

3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

## HTLT2 PART NUMBER CODE

HTLT2 - X	X	X	X	X	X	XX	X	X	
Button Style	Case Style	Seal*	Travel	Gating	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color
1. Castle	1. 1-27 Thread	1. Dusttight	1. 20°	1. Single Axis Return to Center	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads 22 AWG UL 1569***	2. Black
2. External Castle Boot	2. 1" Smooth	2. Watertight Panel Seal**		2. Single Axis - Friction Held		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. Wire Leads 24 AWG SAE AS22759***	
3. Short Double Stadium						CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		
4. Tall Concave Stadium						DD. 2.5 +/- 1.5VDC	NONE		
5. External Bat Handle Boot						EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
6. External Smooth Boot						FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
8. External Castle Boot with Pushbutton						GG. 0.5 - 4.5VDC	0.5 - 4.5VDC		
9. External Castle Boot with High Force Pushbutton						HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		
						JJ. SPI, 3.3V Supply	NONE		
						KK. SPI, 5V Supply	NONE		

\* Electronics sealed to IP68S.

\*\* Watertight panel sealed option available with button styles 2, 5, 6, 8 and 9.

\*\*\* Pushbutton wire leads are 24 AWG, SAE AS22759.

① Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE" and "FF" provide increased voltage in +Y and decreasing voltage in -Y. Direction from one output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+Y -Y) from 2 outputs per axis

② Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

## HTLT4 PART NUMBER CODE

HTLT4 - X	X	X	X	X	X	XX	X	X	
Button Style	Case Style	Seal*	Travel	Gating	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color
1. Castle	1. 1-27 thread	1. Dusttight	1. 20°	1. Omnidirectional; Square; on Axis Guided Feel	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads 22 AWG UL 1569***	2. Black
2. External Castle Boot	2. 1" smooth	2. Watertight Panel Seal**		2. Gated; Two Axis - Return to Center		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. Wire Leads 24 AWG SAE AS22759***	
3. Short Double Stadium				3. Omnidirectional; Square; Smooth Feel		CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		
4. Tall Concave Stadium				4. Gated; Two Axis - Friction Held		DD. 2.5 +/- 1.5VDC	NONE		
5. External Bat Handle Boot						EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
6. External Smooth Boot						FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
8. External Castle Boot with Pushbutton						GG. 0.5 - 4.5VDC	0.5 - 4.5VDC		
9. External Castle Boot with High Force Pushbutton						HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		
A. Tall Metal Bat Handle****						JJ. SPI, 3.3V Supply	NONE		
						KK. SPI, 5V Supply	NONE		

\* Electronics sealed to IP68S.

\*\* Watertight panel sealed option available with button styles 2, 5, 6, 8 and 9.

\*\*\* Pushbutton wire leads are 24 AWG, SAE AS22759.

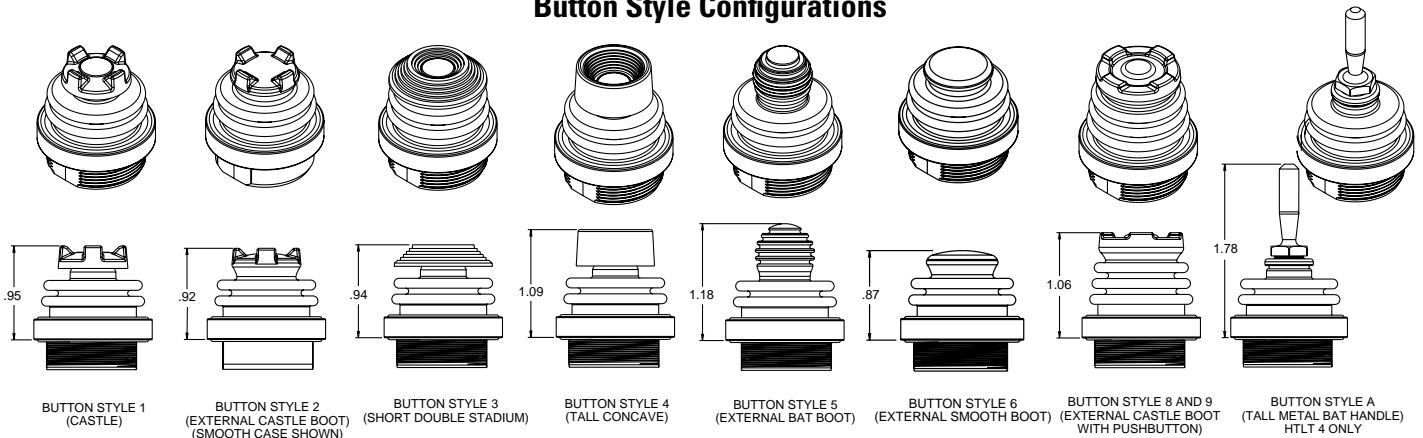
\*\*\*\* Button style "A" has a max. allowable radial force of 10 lbs and max allowable torque of 3 in-lbs.

① Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE" and "FF" provide increased voltage in +X, +Y and decreasing voltage in -X, -Y. Direction from one output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+X, +Y, -X, -Y) from 2 outputs per axis.

② Options "BB" and "EE" provide redundant output 2 which duplicates output 1.

Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

## Button Style Configurations

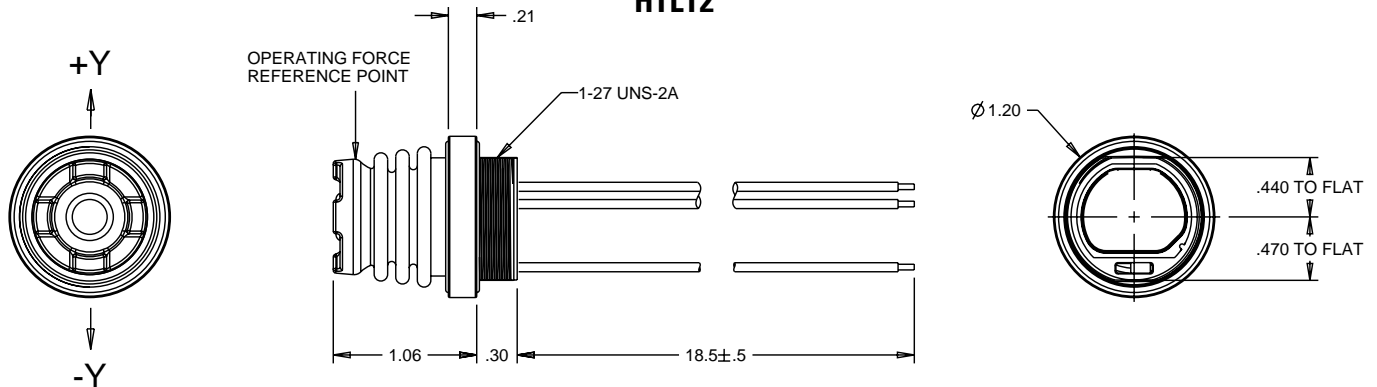


# FINGER JOYSTICK WITH PUSHBUTTON OPTION

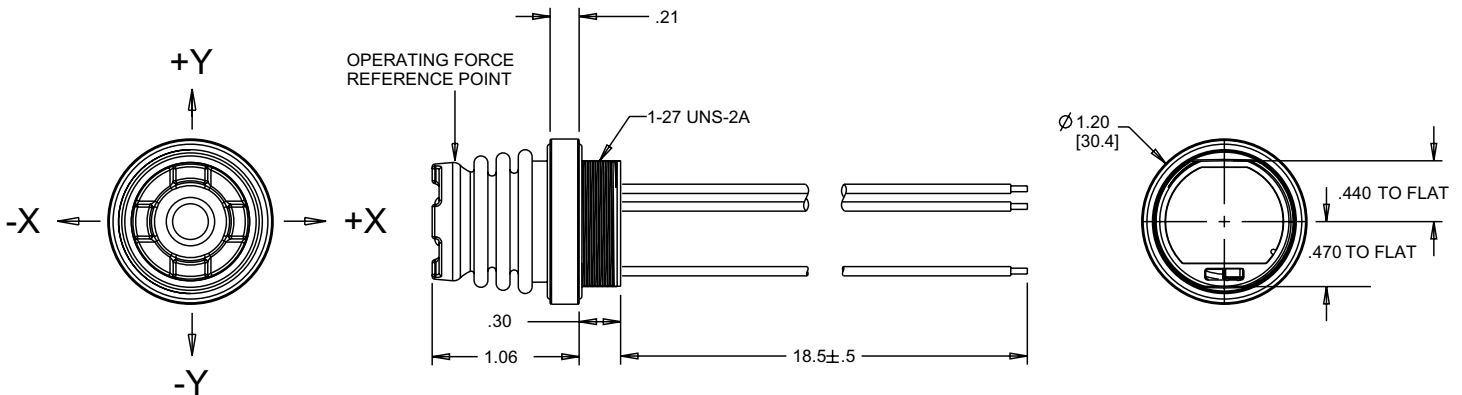
**HTLT**  
HALL EFFECT  
FINGER JOYSTICK

3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

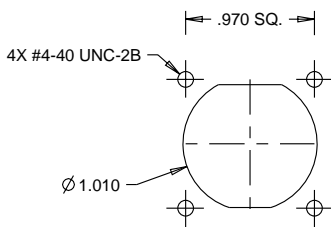
## HTLT2



## HTLT4



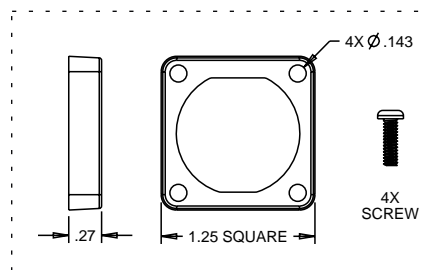
## HTLT2 and HTLT4 Panel Footprint



SUGGESTED PANEL OPENING  
WHEN USING FLANGE AND SCREWS.

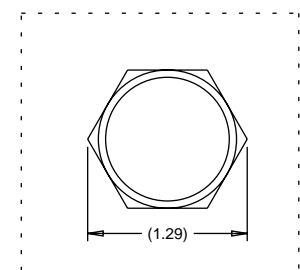
MAX. PANEL THICKNESS OF 0.125  
FOR BOTTOM MOUNT

MIN. PANEL THICKNESS OF .100  
FOR TOP MOUNT

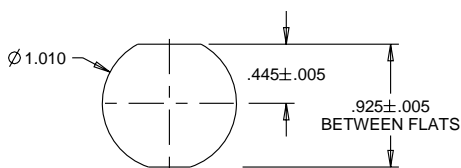


1" SMOOTH CASE STYLE HARDWARE  
SHIPPED UNASSEMBLED

OR



1-27 THREAD CASE STYLE HARDWARE  
SHIPPED UNASSEMBLED



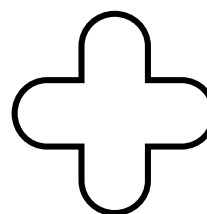
SUGGESTED PANEL OPENING  
WHEN USING 1-27 NUT.

MAX. PANEL THICKNESS OF 0.125

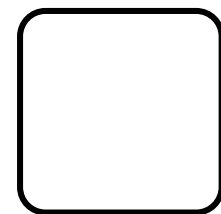
## HTLT4 Gating Icons



Omnidirectional;  
Square On-Axis  
Guided Feel  
(defined by shading)



Gated;  
Two Axis  
Return to Center

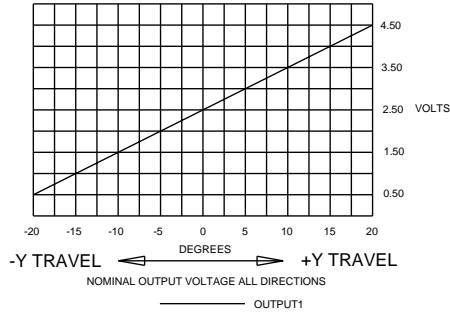


Omnidirectional;  
Square;  
Smooth Feel

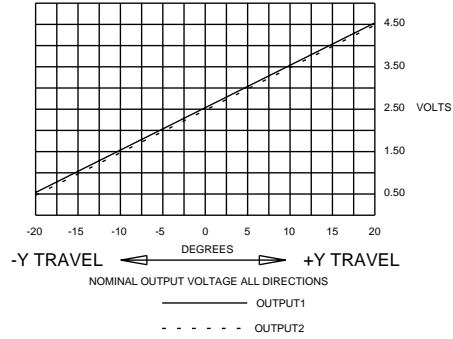
3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

## HTLT2

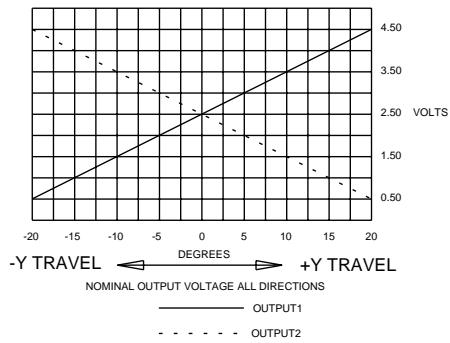
**OPTION AA**



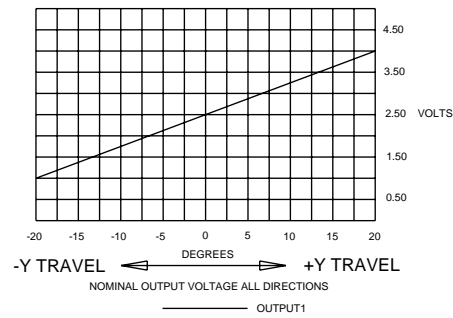
**OPTION BB**



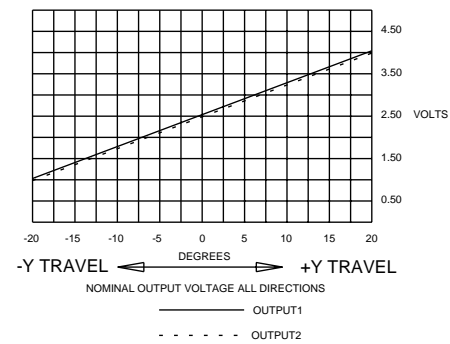
**OPTION CC**



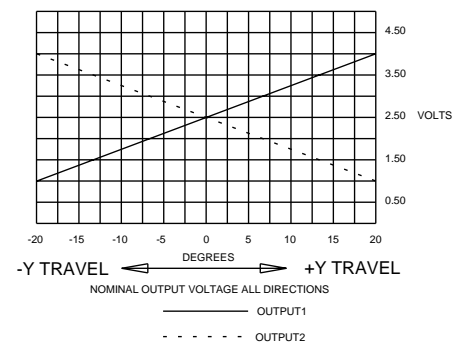
**OPTION DD**



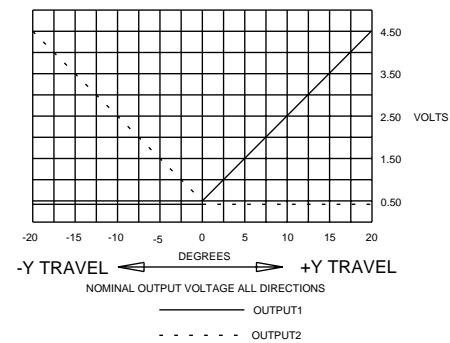
**OPTION EE**



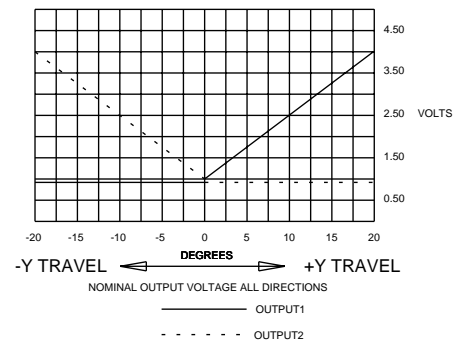
**OPTION FF**



**OPTION GG**



**OPTION HH**



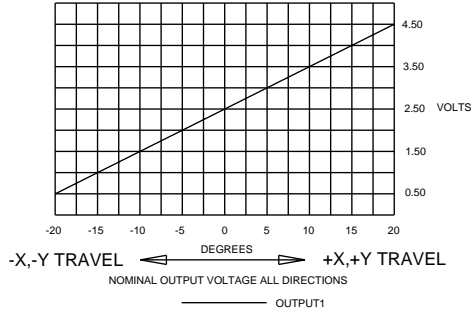


# FINGER JOYSTICK WITH PUSHBUTTON OPTION

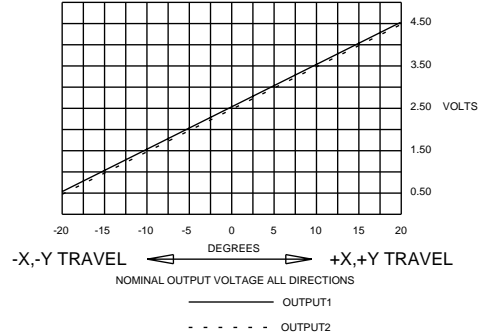
3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

## HTLT4

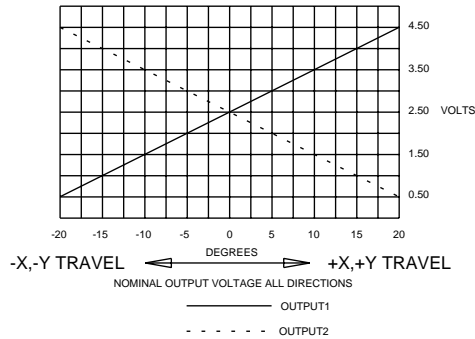
### OPTION AA



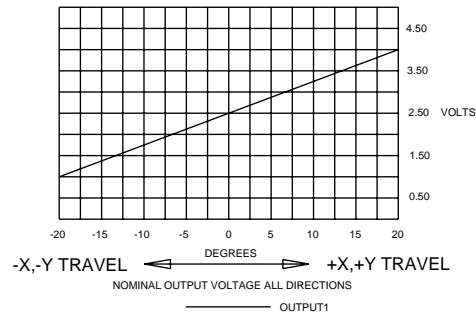
### OPTION BB



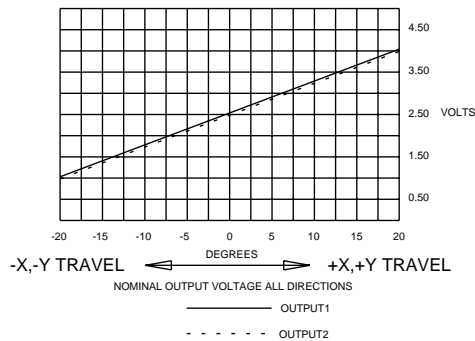
### OPTION CC



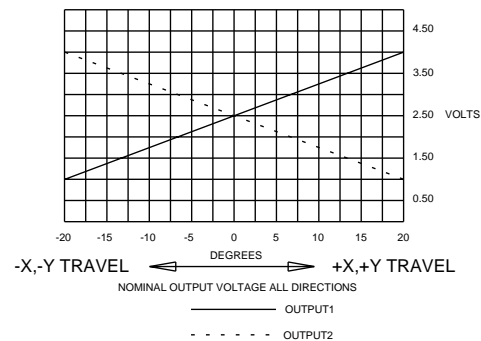
### OPTION DD



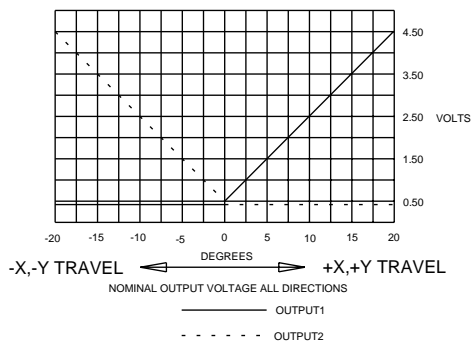
### OPTION EE



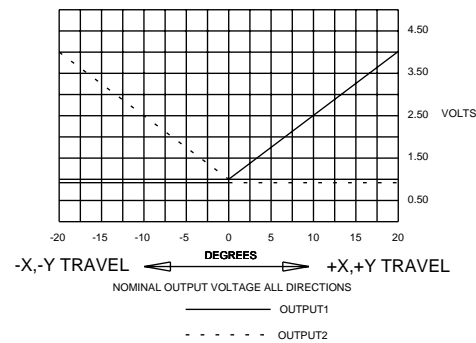
### OPTION FF



### OPTION GG



### OPTION HH



3 MILLION CYCLE ROTATIONAL LIFE



Knurled Wheel  
(with Wires)



PaddleWheel  
(with Pins)

The HTW Hall Effect Proportional Output Thumbwheel is a spring return-to-center, single axis thumbwheel with an actuator that provides linear change in voltage output in either direction from the center. Available with eight output options, including increasing and decreasing voltage output from the center position to the full travel position and single or dual (redundant) outputs. The HTW snaps into a 1.47" x 0.710" panel opening with rocker switch style mounting. A durable switch providing three million cycle rotational life, sealed to IP68S and excellent EMI/RFI immunity.

## Features:

- 14 output options
- Spring return-to-center single axis actuator
- Snaps into 1.47" x 0.710" panel opening
- Rocker switch style mounting
- 3 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- Detent options available
- Tighter center tolerance options
- RoHS compliant

### Standard Characteristics/Ratings:

#### MECHANICAL:

**Mechanical Life:** 3,000,000 full forward to full back

**Mechanical Detent Cycle Life Per Detent:** 100,000 (detent @ +/- 21°, full travel is +/- 30° max)

**Max Allowable Radial Load:** 30.0 lbs.

**ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)**

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.50	5	5.50
Output Voltage Tolerance at Center (A, B, C, D, E, F, G and H)	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance at Center (J, K, L, M, N and P)	VDC @ 5V Vcc	-0.10	N/A	+0.10
Output Voltage Tolerance at Center (for detent version A only)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Options A & D B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
Supply Current For all Other Options B=0, Vcc=5V, Iout=0	mA	N/A	N/A	20

**Reverse Voltage Protection:** -5VDC max

#### ELECTRONICS:

**Seal Integrity:** Electronics IP68S

#### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

**Vibration:** Per MIL-810F minimum integrity

**EMI:** Withstand per SAE J1113

**RFI:** Withstand per SAE J1113

#### MATERIALS:

**Button:** Thermoplastic

**Bezel:** Thermoplastic

**Snap Arms:** Stainless steel

**Wires:** 18 AWG

# PROPORTIONAL OUTPUT THUMBWHEEL

3 MILLION CYCLE ROTATIONAL LIFE

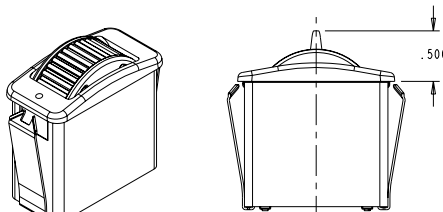
## HTW PART NUMBER CODE

HTW	-	X	X	X	X	X	X	X
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	Detent (if required)*
1. +/- 40°	A. 2.5 +/- 2.0VDC	NONE	1. 5.0 oz.	1. Knurled Wheel 2. Paddle Wheel	A. 18 AWG Wires 18.3" Long, Stripped Ends B. 0.025" SQ. Pins	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	A. Spring return center +/- 21°. 12 oz detent at end of travel, both directions**
2. +/- 30°	B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC						
	C. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC						
	D. 2.5 +/- 1.5VDC	NONE						
	E. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC						
	F. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC						
	G. 1.0 - 4.0VDC	1.0 - 4.0VDC						
	H. 0.5 - 4.5VDC	0.5 - 4.5VDC						
	J. 2.5 +/- 2.0VDC	NONE***						
	K. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC***						
	L. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC***						
	M. 2.5 +/- 1.5VDC	NONE***						
	N. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC***						
	P. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC***						

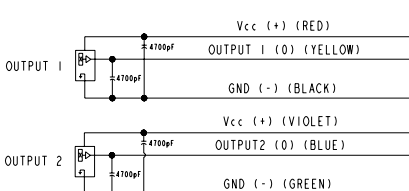
\* Detented switch full travel is ±30° max. Detented switches reach full output before engaging detents.

\*\* Only available with Travel option 2.

\*\*\* Options J, K, L, M, N and P are identical to options A, B, C, D, E and F respectively, except with a tighter center tolerance.



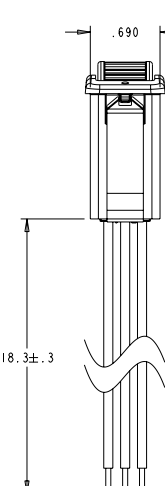
PADDLE WHEEL  
BUTTON STYLE



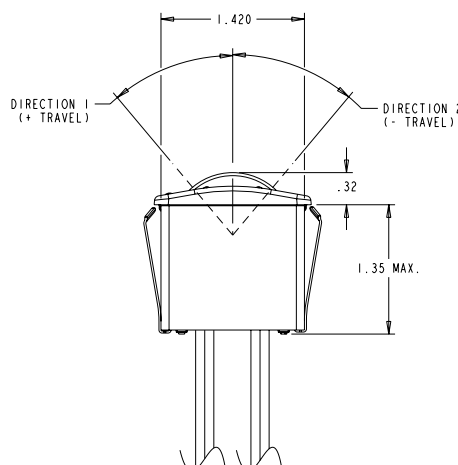
OUTPUT 1: Vcc (+) (RED), OUTPUT 1 (O) (YELLOW), GND (-) (BLACK)

OUTPUT 2: Vcc (+) (VIOLET), OUTPUT 2 (O) (BLUE), GND (-) (GREEN)

OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS



18.3 ± .3



1.420

DIRECTION 1 (+ TRAVEL)

DIRECTION 2 (- TRAVEL)

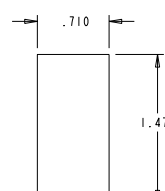
.32

1.35 MAX.

**MOUNTING:**

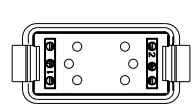
RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS (0.050 MIN. - 0.120 MAX.)

RECOMMENDED PANEL OPENING: 0.710 X 1.072 OPTIMUM (0.710/0.720 - 1.460/1.480)

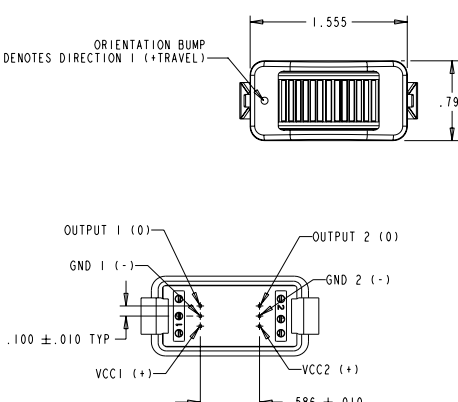


.710

1.470



NOT ALL WIRES ARE PRESENT IN ALL OUTPUT CONFIGURATIONS



ORIENTATION BUMP DENOTES DIRECTION 1 (+TRAVEL)

1.555

.790

OUTPUT 1 (O)

GND 1 (-)

OUTPUT 2 (O)

GND 2 (-)

.100 ± .010 TYP

VCC1 (+)

VCC2 (+)

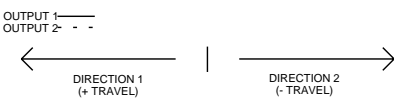
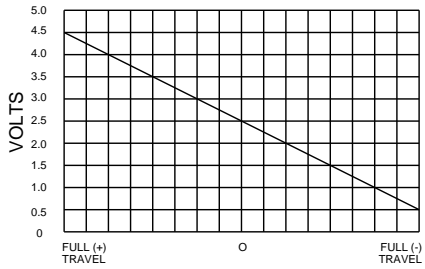
.586 ± .010

**PINNED TERMINATION**

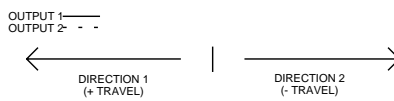
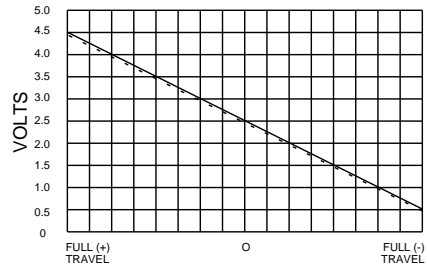
NOT ALL PINS ARE PRESENT IN ALL OUTPUT CONFIGURATIONS

3 MILLION CYCLE ROTATIONAL LIFE

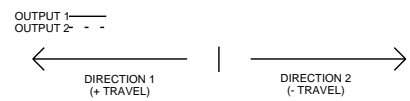
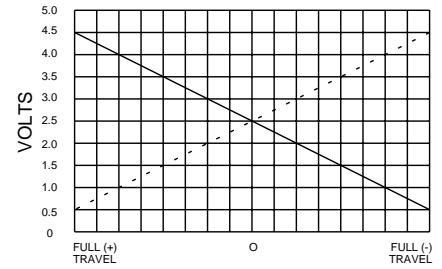
**OPTION A & J**



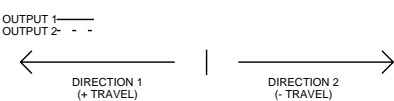
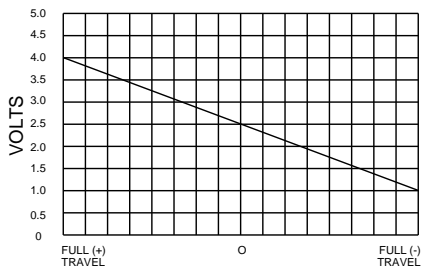
**OPTION B & K**



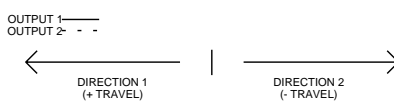
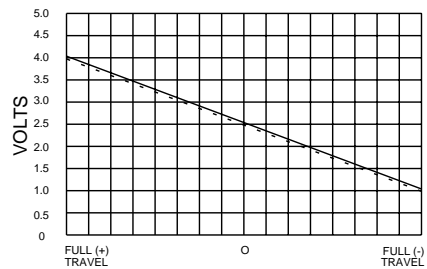
**OPTION C & L**



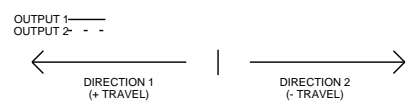
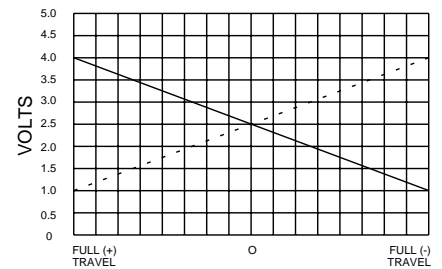
**OPTION D & M**



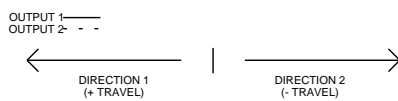
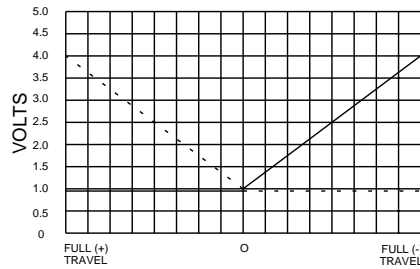
**OPTION E & N**



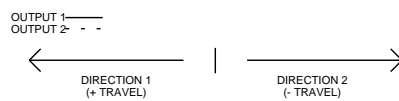
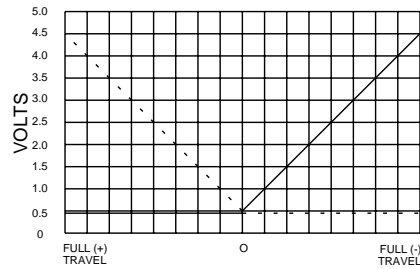
**OPTION F & P**



**OPTION G**



**OPTION H**



## PROPORTIONAL OUTPUT THUMBWHEEL



Knurled Wheel



Paddle Wheel

OTTO's HTWE control is a spring return-to-end, single axis, proportional output thumbwheel. Utilizing non-contact Hall effect technology, the HTWE delivers one million actuations. Electronics are sealed to IP68S. The HTWE is available as an individual control ideal for panel mountings, or may be incorporated into one of OTTO's joysticks.

### Features:

- Spring return-to-end single axis actuator
- Knurled & Paddle style actuators
- Wire or pinned termination options
- Variety of button & bezel colors
- 8 output options
- Rocker switch style mounting
- Snaps into 1.47" x 0.710" panel opening
- 1 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS compliant

### Standard Characteristics/Ratings:

#### MECHANICAL:

**Mechanical Life:** 1,000,000 full forward to full back

**Max Allowable Radial Load:** 30.0 lbs.

#### ELECTRICAL RATINGS: Rated 5V @ 25°C Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5.0	5.5
Output at Rest	VDC @ 5V Vcc	-.25	N/A	+.25
Output at Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current Per Sensor	mA	N/A	N/A	10

#### ELECTRONICS:

**Seal Integrity:** Electronics IP68S

#### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

**Vibration:** Per MIL-810F minimum integrity

**EMI:** Withstand per SAE J1113

**RFI:** Withstand per SAE J1113

#### MATERIALS:

**Button:** Thermoplastic

**Bezel:** Thermoplastic

**Snap Arms:** Stainless steel

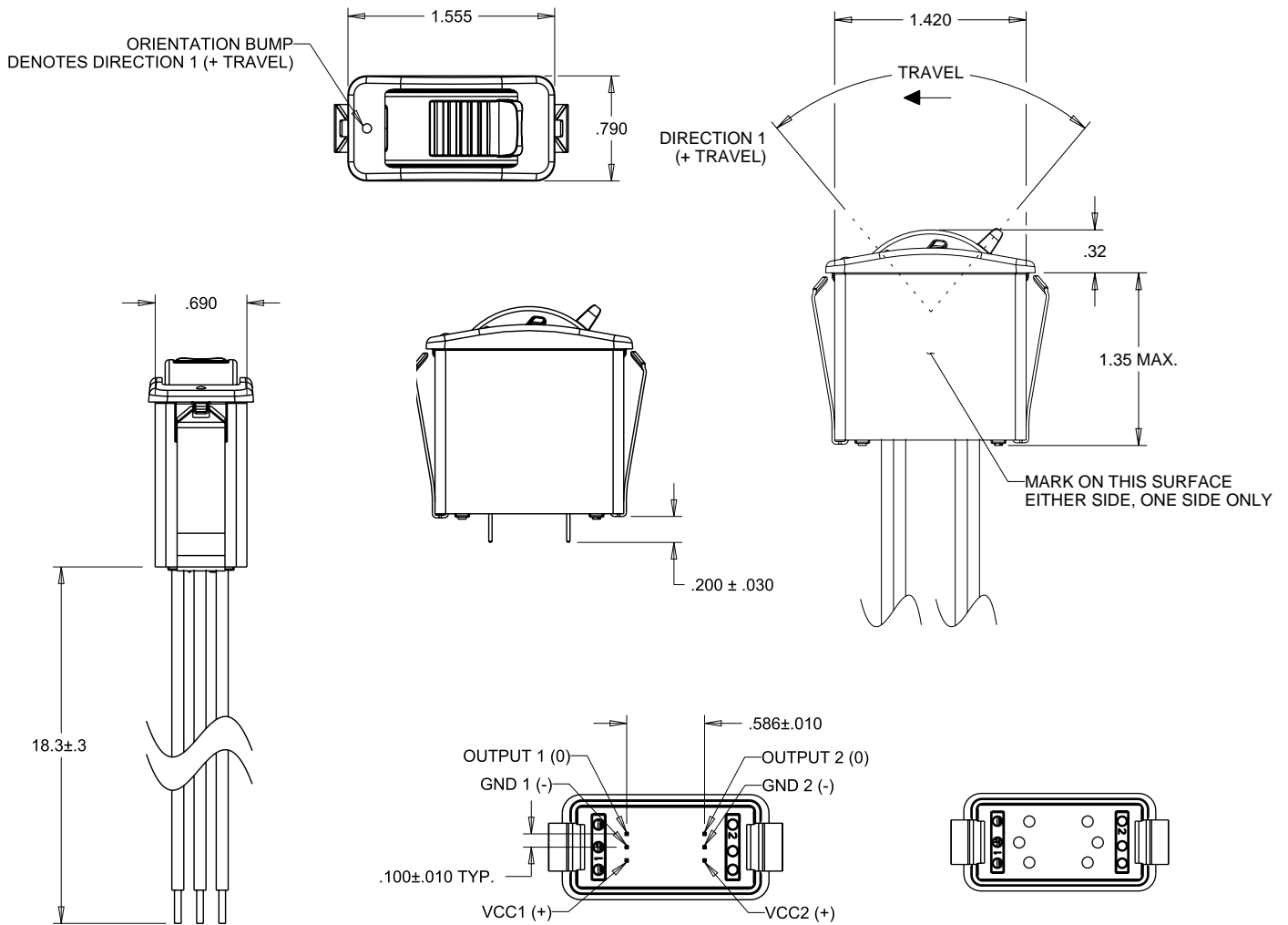
**Wires:** 18 AWG

### HTWE RETURN TO END STANDARD THUMBWHEEL

HTWE	-	X	X*	X	X	X	X	X
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	
1. 80°	A. 0.5 - 4.5VDC	NONE	1. 10 oz typ	1. Knurled Wheel	A. 18 AWG Wires, 18.3" Long, Stripped Ends	1. Red	1. Red	
2. 60°	B. 0.5 - 4.5VDC	0.5 - 4.5VDC		2. Paddle Wheel	B. 0.025" SQ. Pins	2. Black	2. Black	
	C. 0.5 - 4.5VDC	4.5 - 0.5VDC				3. Orange	3. Orange	
	D. 1.0 - 4.0VDC	NONE				4. Yellow	4. Yellow	
	E. 1.0 - 4.0VDC	1.0 - 4.0VDC				5. Green	5. Green	
	F. 1.0 - 4.0VDC	4.0 - 1.0VDC				6. Blue	6. Blue	
						7. Violet	7. Violet	
						8. Gray	8. Gray	
						9. White	9. White	

\* Output options B and E provide redundant output 2 which duplicates output 1. Output options C and F provide redundant output 2 which is inverse output 1.

PROPORTIONAL OUTPUT THUMBWHEEL

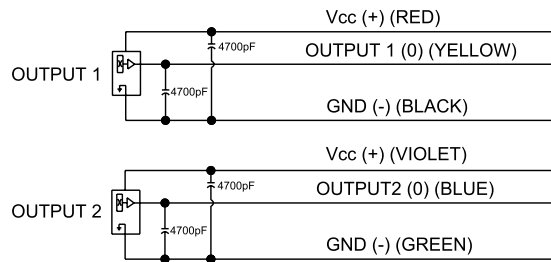
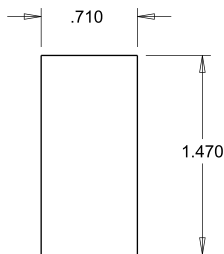


**PINNED  
TERMINATION**  
NOT ALL PINS ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS

**MOUNTING:**

RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS  
(0.050 MIN. - 0.120 MAX.)

RECOMMENDED PANEL OPENING: 0.710 X 1.470 OPTIMUM  
(0.710/0.720 - 1.460/1.480)

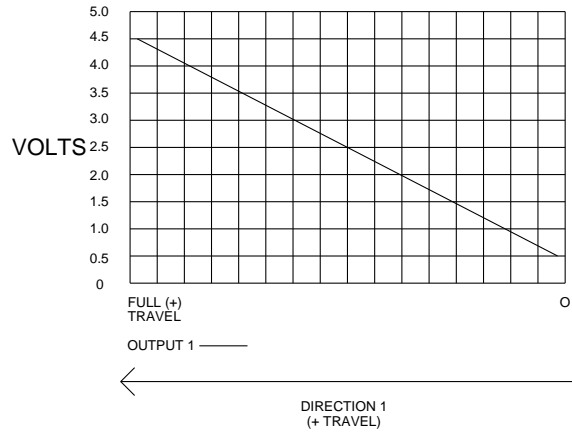


OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

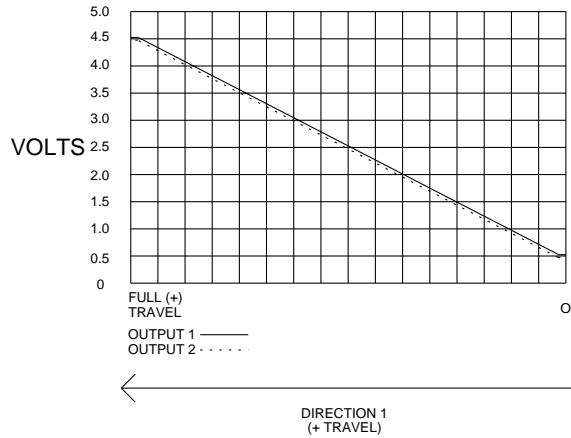
# RETURN TO END STANDARD THUMBWHEEL

## PROPORTIONAL OUTPUT THUMBWHEEL

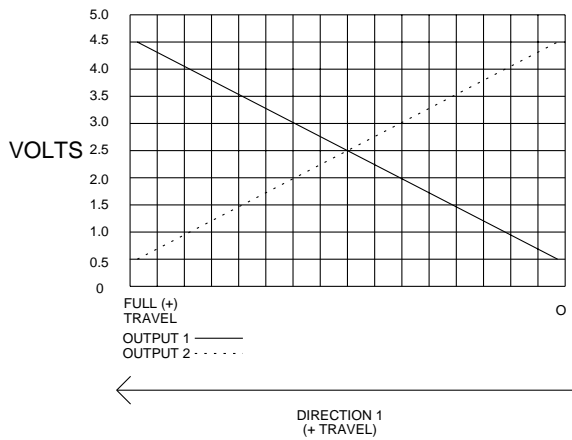
**OPTION A**



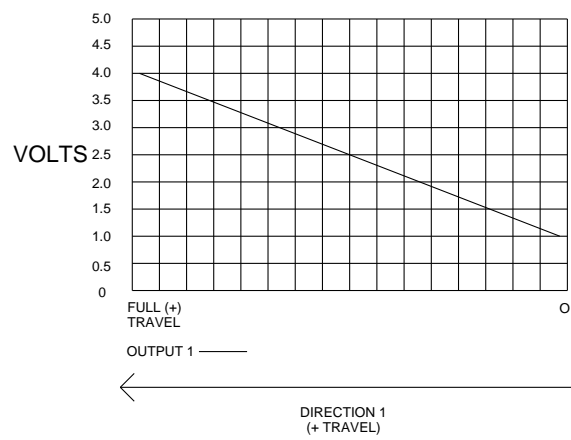
**OPTION B**



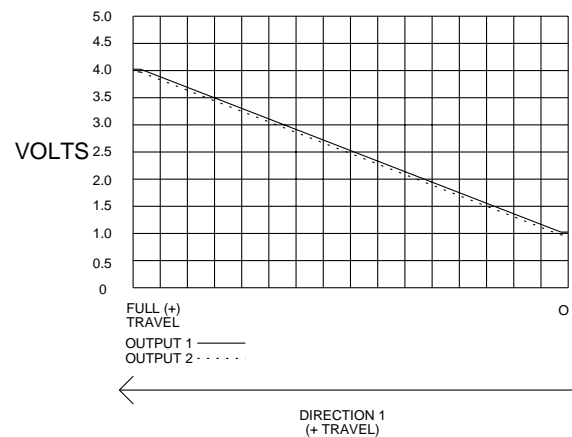
**OPTION C**



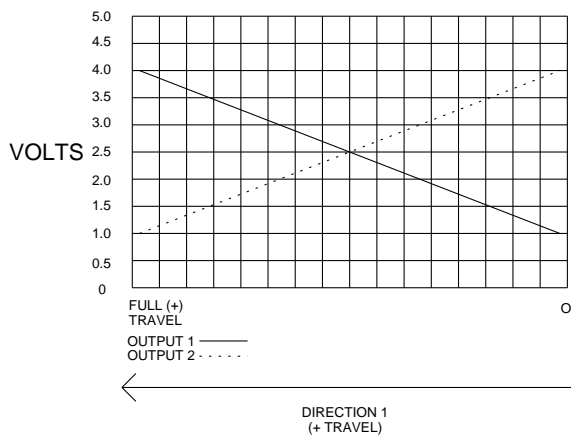
**OPTION D**



**OPTION E**



**OPTION F**



## FRICION HOLD ACTUATION STYLE THUMBWHEEL



The HTWF Friction Hold Thumbwheel offers a maintained position, single axis thumbwheel actuator that provides a linear change in voltage output in either direction from center. Options include increasing or decreasing voltage output from the center position to the full travel position, and single or dual (redundant) outputs per axis. The HTWF Thumbwheel has a rocker style snap-in mounting feature to accommodate a 1.47" x 0.710" panel opening. The HTWF provides 250,000 cycle life, full forward/full backward, electronics are sealed to IP68S, and offers excellent EMI/RFI immunity and a flow through design. Ideal for heavy equipment, industrial machines or remote control applications.

### Features:

- 250,000 cycle life, full forward/full backward with center detent
- Maintained control positioning, no return to center
- Hall effect contactless sensing technology
- Number of output options
- Choice of bezel & button colors
- Snaps into 1.47" x 0.710" panel opening
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS compliant

Standard Characteristics/Ratings:				
<b>MECHANICAL:</b>				
<b>Mechanical Life:</b> 250,000 full forward to full back with center detent				
<b>Initial Operating Force at Top of Roller:</b> 2 oz min to 6 oz max @ 25°C				
<b>Max Allowable Radial Load:</b> 30.0 lbs.				
<b>ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)</b>				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center (see graph for output values)	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance Full Travel (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10
<b>ELECTRONICS:</b>				
<b>Seal Integrity:</b> Electronics watertight per IP68S, 1 meter				
<b>ENVIRONMENTAL:</b>				
<b>Operating Temp Range:</b> -40°C to +85°C				
<b>Humidity:</b> 96% RH, 70°C, 96 hours				
<b>Vibration:</b> Per MIL-810F minimum integrity				
<b>EMI:</b> Withstand per SAE J1113				
<b>RFI:</b> Withstand per SAE J1113				
<b>MATERIALS:</b>				
<b>Button:</b> Thermoplastic				
<b>Bezel:</b> Thermoplastic				
<b>Snap Arms:</b> Stainless steel				
<b>Wires:</b> 18 AWG				

### HTWF PART NUMBER CODE

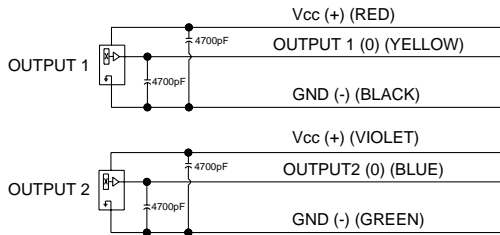
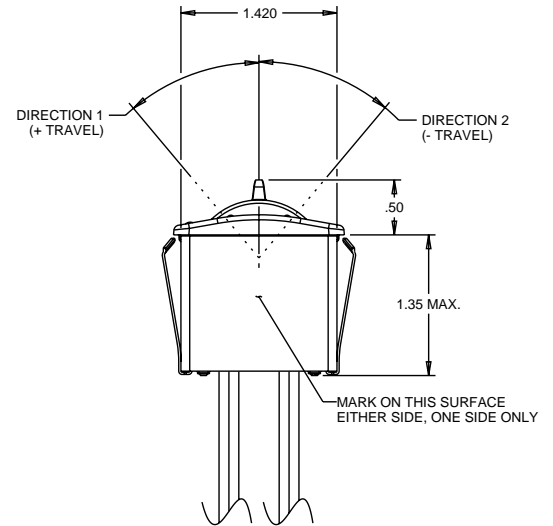
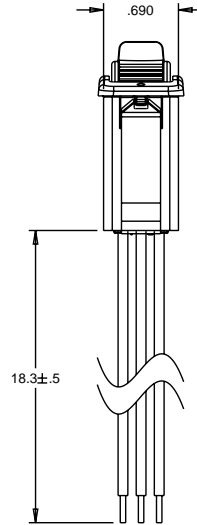
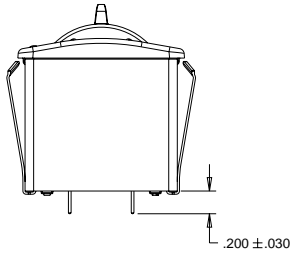
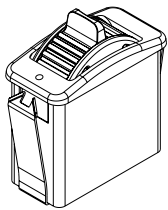
HTWF	-	X		X	X	X	X	X	X
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	Detent (if required)	
1. +/- 30°	A. 2.5 +/- 2.0VDC B. 2.5 +/- 2.0VDC C. 2.5 +/- 2.0VDC D. 2.5 +/- 1.5VDC E. 2.5 +/- 1.5VDC F. 2.5 +/- 1.5VDC G. 1.0 - 4.0VDC H. 0.5 - 4.5VDC	NONE 2.5 +/- 2.0VDC 2.5 +/- 2.0VDC NONE 2.5 +/- 1.5VDC 2.5 +/- 1.5VDC 1.0 - 4.0VDC 0.5 - 4.5VDC	1. 4.0 oz.	1. Knurled Wheel 2. Paddle Wheel	A. 18 AWG Wires, 18.3" Long, Stripped Ends B. 0.025" SQ. Pins	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	A. Detent 2 oz increase out of center in both directions*	* Output options A-F do not have a tolerance on the center outputs unless a center detent is selected. Output options G and H are only available with center detent.



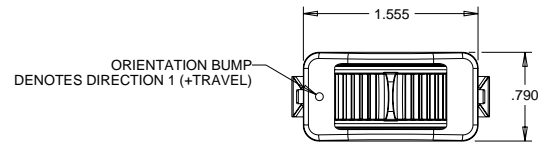
# PROPORTIONAL OUTPUT THUMBWHEEL

## FRICION HOLD ACTUATION STYLE THUMBWHEEL

### HTWF - Paddle Wheel Style Thumbwheel Shown



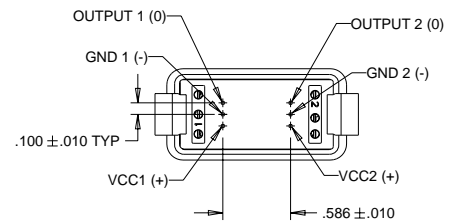
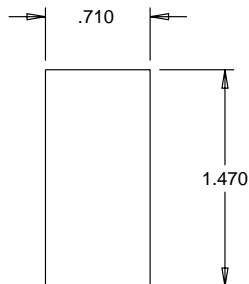
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS



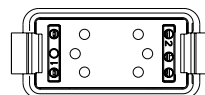
### MOUNTING:

RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS  
(0.050 MIN. - 0.120 MAX.)

RECOMMENDED PANEL OPENING: 0.710 X 1.470 OPTIMUM  
(0.710/0.720 -1.460/1.480)



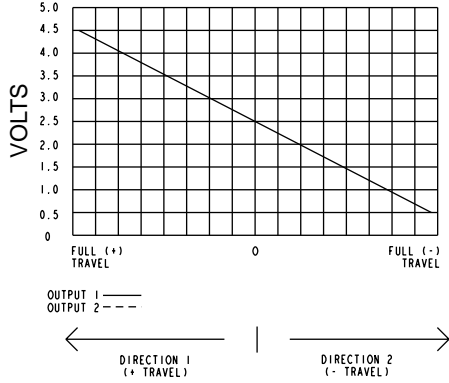
**PINNED  
TERMINATION**  
NOT ALL PINS ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS



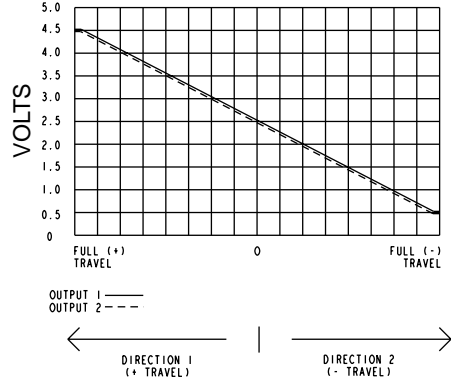
NOT ALL WIRES ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS

FRICION HOLD ACTUATION STYLE THUMBWHEEL

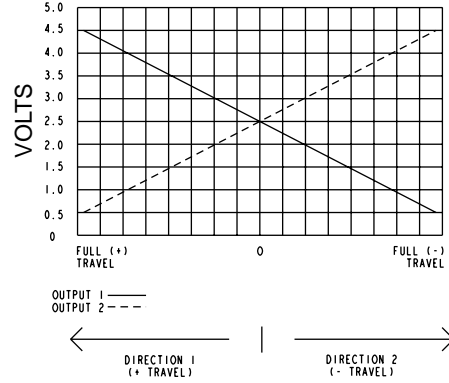
**OPTION A**



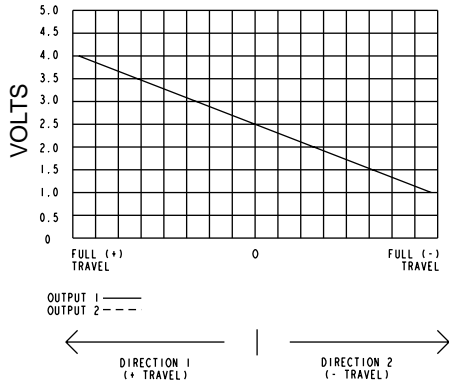
**OPTION B**



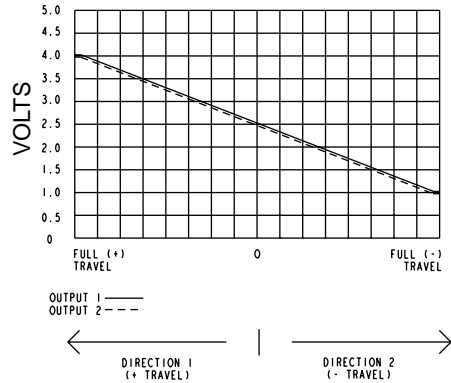
**OPTION C**



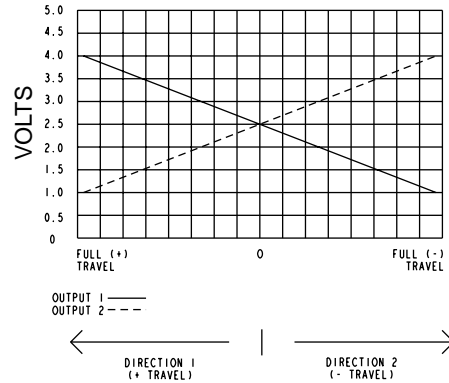
**OPTION D**



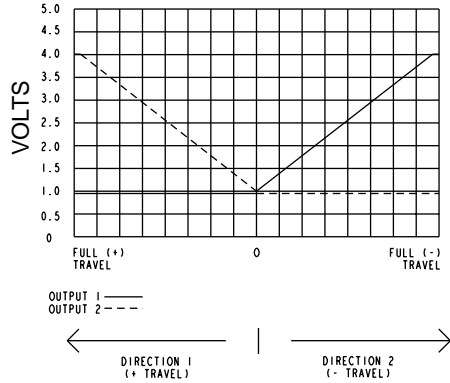
**OPTION E**



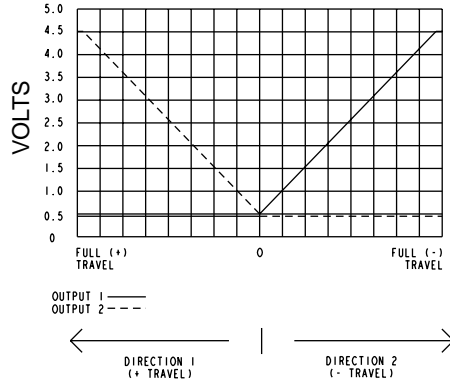
**OPTION F**



**OPTION G**



**OPTION H**



# MINI PROPORTIONAL OUTPUT THUMBWHEEL

**HTWM**  
MINIATURE  
THUMBWHEEL

SHORTER BEHIND PANEL DEPTH



Knurled Wheel



Paddle Wheel

The HTWM offers the same performance as the standard HTW Proportional Thumbwheel but with a much shorter behind panel depth, ideal for use in grip, armrest and panel applications. Available with eight output options, the HTWM offers a spring return-to-center, single axis thumbwheel actuator that provides linear change in voltage output in either direction from center. Options include increasing or decreasing voltage output from the center position to the full travel position, and single or dual (redundant) outputs per axis. The HTWM offers snap-in style mounting and a three million cycle rotational life. The HTWM electronics are sealed to IP68S and have excellent EMI/RFI immunity.

## Features:

- Shorter behind panel depth: 0.96" max.
- 8 output options
- Spring return-to-center single axis actuator
- Rocker switch style mounting
- 3 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- Tighter center tolerance options
- RoHS compliant

### Standard Characteristics/Ratings:

#### MECHANICAL:

**Mechanical Life:** 3,000,000 full forward to full back

**Max Allowable Radial Load:** 30.0 lbs.

**ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)**

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.50	5.00	5.50
Output Voltage Tolerance at Center (A, B, C, D, E, F and G)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Center (J, K, L, M, N and P)	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10

#### ELECTRONICS:

**Seal Integrity:** Electronics IP68S

#### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

**Vibration:** Per MIL-810F minimum integrity

**EMI:** Withstand per SAE J1113

**RFI:** Withstand per SAE J1113

#### MATERIALS:

**Button:** Thermoplastic

**Bezel:** Thermoplastic

**Wires:** 18 AWG

HALL EFFECT CONTROLS

SHORTER BEHIND PANEL DEPTH

## HTWM PART NUMBER CODE

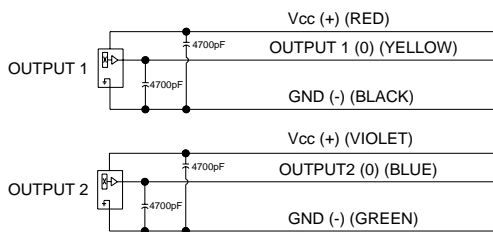
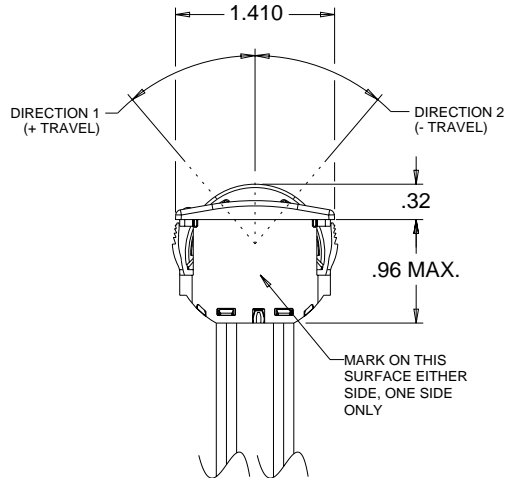
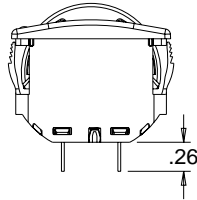
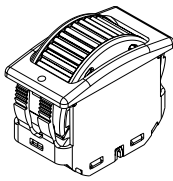
HTWM	-	X	X	X	X	X	X	X
<b>Travel</b>								
1. +/- 40°								
<b>Output 1*</b>								
A. 2.5 +/- 2.0VDC								
B. 2.5 +/- 2.0VDC								
C. 2.5 +/- 2.0VDC								
D. 2.5 +/- 1.5VDC								
E. 2.5 +/- 1.5VDC								
F. 2.5 +/- 1.5VDC								
G. 1.0 - 4.0VDC								
H. 0.5 - 4.5VDC								
J. 2.5 +/- 2.0VDC								
K. 2.5 +/- 2.0VDC								
L. 2.5 +/- 2.0VDC								
M. 2.5 +/- 1.5VDC								
N. 2.5 +/- 1.5VDC								
P. 2.5 +/- 1.5VDC								
<b>Output 2**</b>								
NONE								
2.5 +/- 2.0VDC								
2.5 +/- 2.0VDC								
NONE								
2.5 +/- 1.5VDC								
2.5 +/- 1.5VDC								
2.5 +/- 1.5VDC								
1.0 - 4.0VDC								
0.5 - 4.5VDC								
NONE***								
2.5 +/- 2.0VDC***								
2.5 +/- 2.0VDC***								
NONE***								
2.5 +/- 1.5VDC***								
2.5 +/- 1.5VDC***								
<b>Operating Force</b>								
1. 5.0 oz.								
<b>Button Style</b>								
1. Knurled Wheel								
2. Paddle Wheel								
<b>Termination</b>								
A. 18 AWG Wires, 18.3" Long, Stripped Ends								
B. 0.025" SQ. Pins								
<b>Bezel Color</b>								
1. Red								
2. Black								
3. Orange								
4. Yellow								
5. Green								
6. Blue								
7. Violet								
8. Gray								
9. White								
<b>Button Color</b>								
1. Red								
2. Black								
3. Orange								
4. Yellow								
5. Green								
6. Blue								
7. Violet								
8. Gray								
9. White								

\* Outputs are from the center position to the full travel position in each direction. Options A-F provide increasing voltage in Direction 1 and decreasing voltage in Direction 2 from a single output. Options G and H provide increasing voltages in both directions from two separate outputs.

\*\* Options B and E provide redundant output 2 which duplicates output 1. Options C and F provide redundant output 2 which is inverse of output 1.

\*\*\* Options J, K, L, M, N and P are identical to options A, B, C, D, E and F respectively, except with a tighter center tolerance.

### HTWM Knurled Wheel Style Thumbwheel Shown



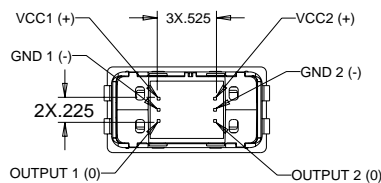
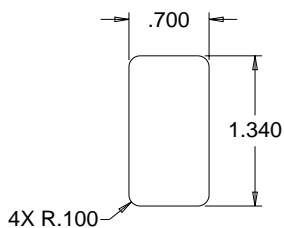
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

### MOUNTING:

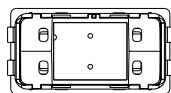
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS (0.040 MIN. - 0.200 MAX.)

RECOMMENDED PANEL OPENING: 0.700 X 1.340 OPTIMUM (0.695/0.705 X 1.335/1.345)

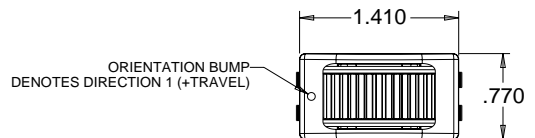
RECOMMENDED PANEL RADII: 0.100 OPTIMUM (0.090 - 0.110 MAX.)



**PINNED TERMINATION**  
NOT ALL PINS ARE PRESENT IN ALL OUTPUT CONFIGURATIONS



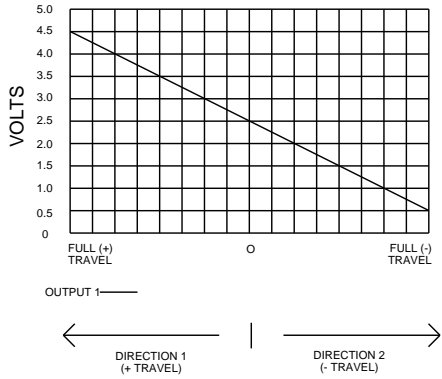
NOT ALL WIRES ARE PRESENT IN ALL OUTPUT CONFIGURATIONS



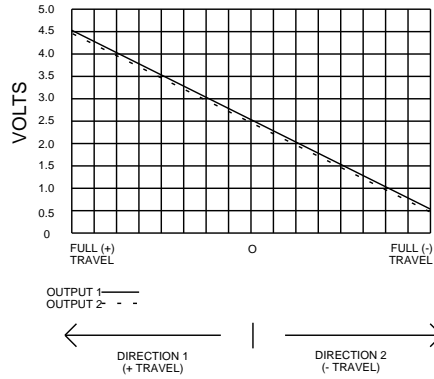
# MINI PROPORTIONAL OUTPUT THUMBWHEEL

SHORTER BEHIND PANEL DEPTH

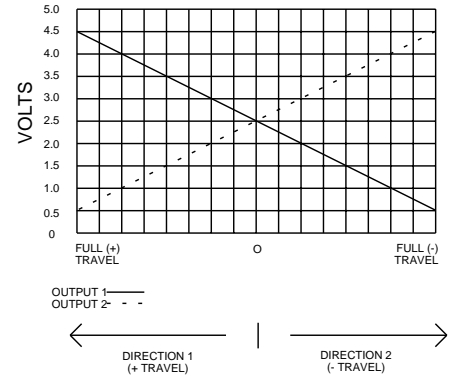
**OPTION A & J**



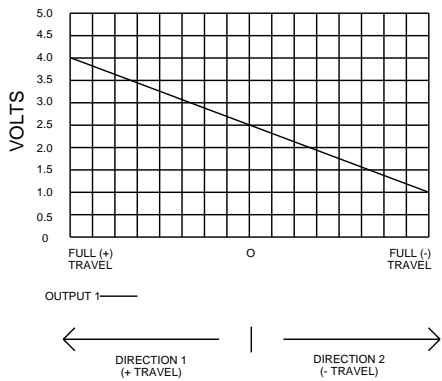
**OPTION B & K**



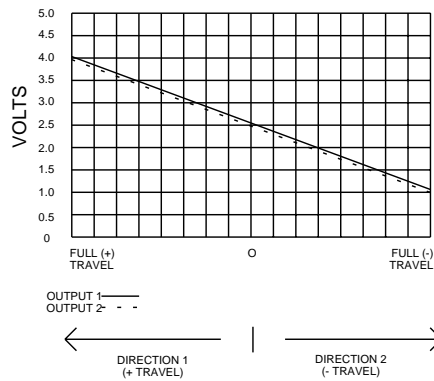
**OPTION C & L**



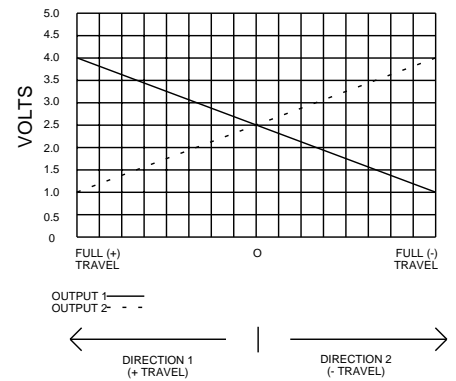
**OPTION D & M**



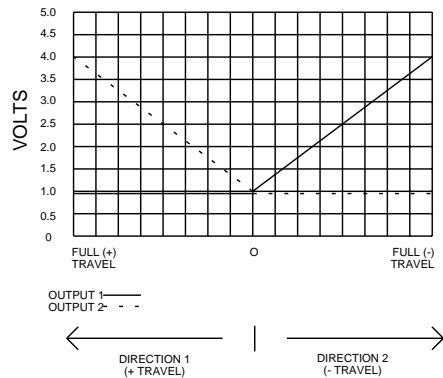
**OPTION E & N**



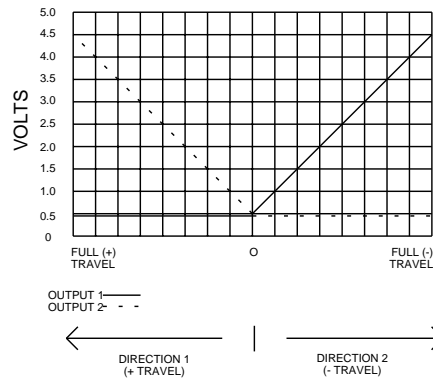
**OPTION F & P**



**OPTION G**



**OPTION H**



PROPORTIONAL OUTPUT HALL EFFECT MINI THUMBWHEEL



Knurled Wheel



Paddle Wheel

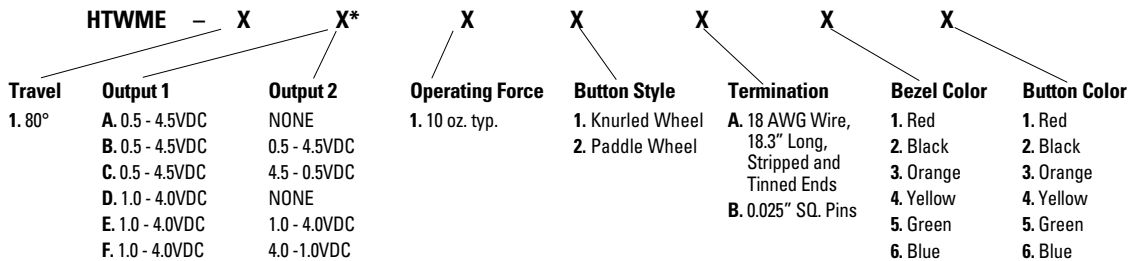
The HTWME offers the same performance as the standard HTWE single axis, proportional output thumbwheel, but has a much shorter behind panel depth. With a panel depth of 0.96" max., the HTWME is ideal for panel or armrest mountings, or can be incorporated into one of OTTO's joysticks. The HTWME provides snap-in style mounting, and also utilizes non-contact Hall effect technology, which accounts for a one million cycle life. It also has excellent EMI/RFI immunity. Configuration options include a choice of six linear voltage outputs.

### Features:

- Return-to-end single axis actuator
- Shorter behind panel depth: 0.96"
- Knurled & Paddle style actuators
- Wire or pinned termination options
- Variety of button & bezel colors
- 6 output options
- Easy snap-in mounting
- 1 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS compliant

Standard Characteristics/Ratings:				
<b>MECHANICAL:</b>				
<b>Mechanical Life:</b> 1,000,000 full forward to full back				
<b>Max Allowable Radial Load:</b> 30.0 lbs.				
<b>ELECTRICAL RATINGS: Rated at 5V @ 25°C Load = 1mA (4.7KΩ)</b>				
<b>Electrical</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Supply Voltage	VDC	4.5	5.0	5.5
Output at Rest	VDC @ 5V Vcc	-.25	N/A	+.25
Output at Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current Per Sensor	mA	N/A	N/A	10
<b>ELECTRONICS:</b>				
<b>Seal Integrity:</b>	Electronics IP68S			
<b>ENVIRONMENTAL:</b>				
<b>Operating Temp Range:</b> -40°C to +85°C				
<b>Humidity:</b>	96% RH, 70°C, 96 hours			
<b>Vibration:</b>	Per MIL-810F minimum integrity			
<b>EMI:</b>	Withstand per SAE J1113			
<b>RFI:</b>	Withstand per SAE J1113			
<b>MATERIALS:</b>				
<b>Button:</b>	Thermoplastic			
<b>Bezel:</b>	Thermoplastic			
<b>Snap Arms:</b>	Thermoplastic			
<b>Wires:</b>	18 AWG			

### HTWME RETURN TO END MINIATURE THUMBWHEEL PART NUMBER CODE

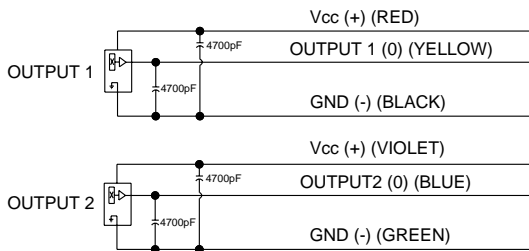
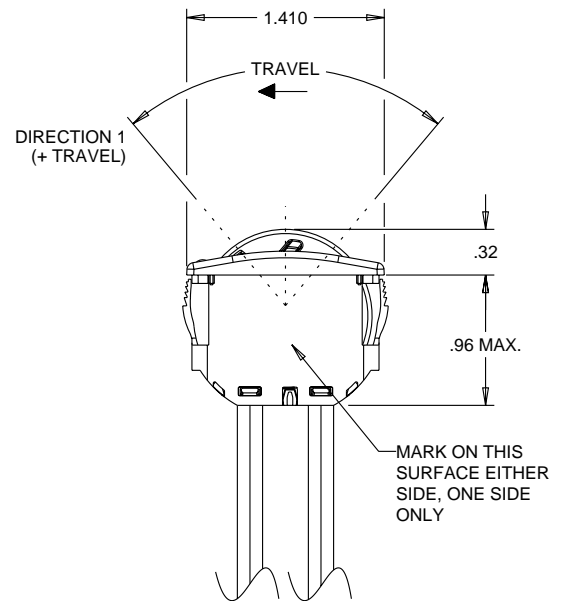
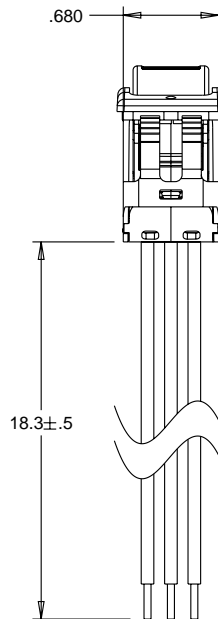
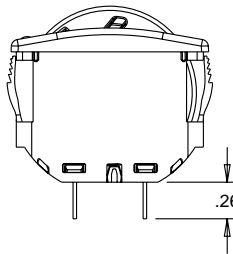
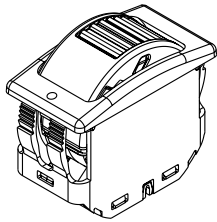


\* Output options B and E provide redundant output 2 which duplicates output 1. Output options C and F provide redundant output 2 which is inverse output 1.

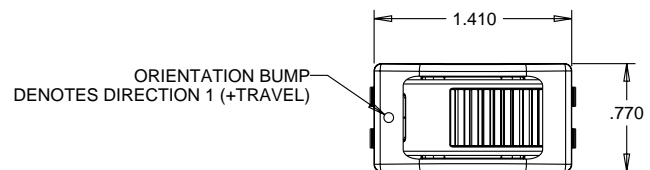
# RETURN TO END MINI THUMBWHEEL

SHORTER BEHIND PANEL DEPTH

## HTWM Knurled Wheel Style Thumbwheel Shown



OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

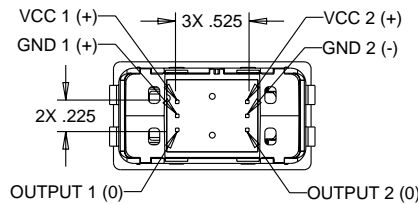
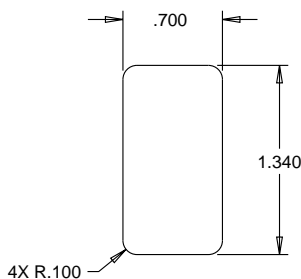


### MOUNTING:

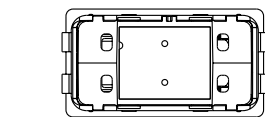
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS  
(0.040 MIN. - 0.200 MAX.)

RECOMMENDED PANEL OPENING: 0.700 X 1.340 OPTIMUM  
(0.695/0.705 X 1.335/1.345)

RECOMMENDED PANEL RADII: 0.100 OPTIMUM  
(0.090 - 0.110 MAX.)



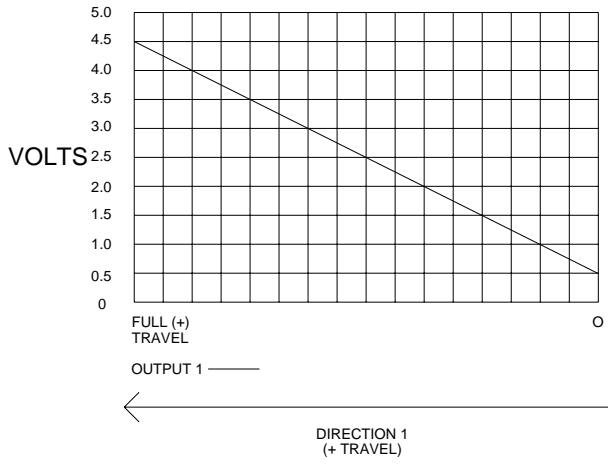
**PINNED  
TERMINATION**  
NOT ALL PINS ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS



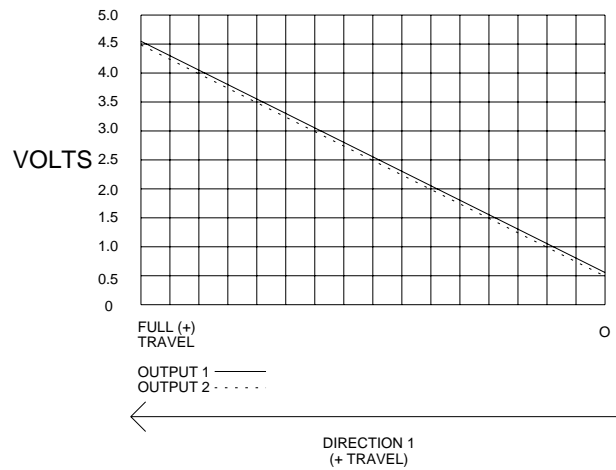
NOT ALL WIRES ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS

SHORTER BEHIND PANEL DEPTH

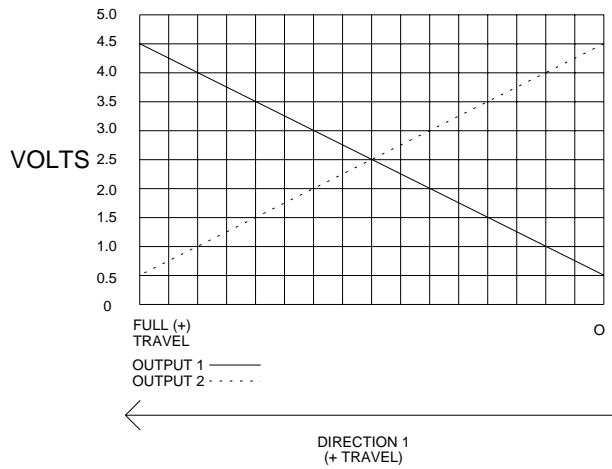
**OPTION A**



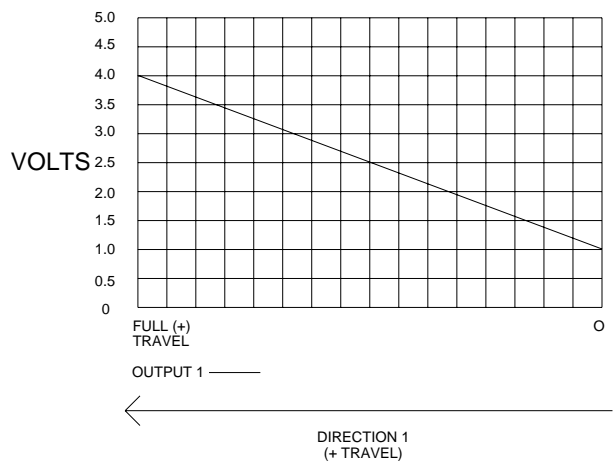
**OPTION B**



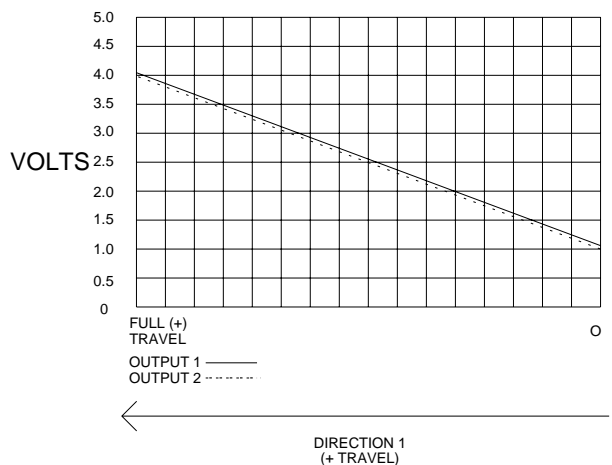
**OPTION C**



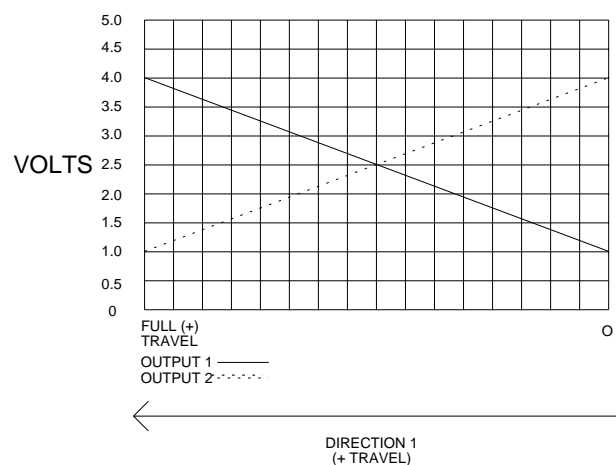
**OPTION D**



**OPTION E**



**OPTION F**





# PROPORTIONAL OUTPUT THUMBWHEEL

**HTWS**  
SUBMINIATURE  
THUMBWHEEL

## SUBMINIATURE PROPORTIONAL OUTPUT THUMBWHEEL WITH OPTIONAL SEAT BOOT

The HTWS Hall Effect Proportional Output Thumbwheel is a smaller version of OTTO's HTW and HTWM. It is a spring return-to-center, single axis thumbwheel that provides a linear change in voltage output corresponding to actuator movement in either direction from center. Its smaller size makes it a perfect choice for use in grips or panels where space is limited. The HTWS is available with eight output options, including increasing and decreasing voltage output from the center position to the full travel position and single or dual (redundant) outputs.

The HTWS snaps into a 0.895" x 0.420" panel opening. Electronics are sealed to IP68S, and the optional sealing boot is offered for above panel mechanical protection against dust, sand, and water ingress. The HTWS offers a three million cycle rotational life, operate force options and excellent EMI /RFI immunity. It is available with flying wire leads or pin connection.

### Features:

- 8 output options
- Spring return-to-center single axis actuator
- Installs into 0.895" x 0.420" panel opening
- Integrated snap-in retaining feature
- Sealing boot option
- 3 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- Flow through design
- RoHS compliant



Standard Characteristics/Ratings:				
<b>ELECTRICAL RATINGS: Rated at 5V @ 25°C Load = 1mA (4.7KΩ)</b>				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage	VDC	-25	N/A	+25
Tolerance at Center	@ 5V Vcc			
Output Voltage	VDC	-25	N/A	+25
Tolerance Full Travel	@ 5V Vcc			
Supply Current Per Sensor	mA	N/A	N/A	20
B=0, Vcc=5V, Iout=0				
<b>MECHANICAL:</b>				
<b>Mechanical Life:</b>	3,000,000 full forward to full back (button styles 1, 2) 1,000,000 full forward to full back (button style 3)			
<b>Max Allowable Radial Load:</b>	15.0 lbs. (button styles 1, 2); 10.0 lbs (button style 3)			
<b>ENVIRONMENTAL:</b>				
<b>Operating Temp Range:</b>	-40°C to +85°C			
<b>Humidity:</b>	96% RH, 70°C, 96 hours			
<b>Vibration:</b>	Per MIL-810F minimum integrity			
<b>Electronics Enclosure:</b>	IP58S (button styles 1, 2) IP68S (button style 3)			
<b>Mechanical Enclosure:</b>	Unsealed (button styles 1, 2)			
<b>Mechanical Enclosure:</b>	IP68S (button style 3) (above panel)			
<b>Mechanical Enclosure:</b>	Unsealed (button style 3) (below panel)			
<b>RFI:</b>	ISO 11452-2 & ISO 11452-4 (Single Output) SAE J1113-21 & SAE J1113-22 (Dual Output)			
<b>EMI:</b>	ISO 11452-8 (Single Output) SAE J1113-22 (Dual Output)			
<b>ESD (Powered &amp; Un-Powered):</b>	ISO 10605 (Single Output) SAE J1113-13 (Dual Output)			
<b>MATERIALS:</b>				
<b>Button Top:</b>	Thermoplastic			
<b>Bezel:</b>	Thermoplastic			
<b>Boot:</b>	Silicone Rubber, Black			

### HTWS PROPORTIONAL THUMBWHEEL PART NUMBER CODE

HTWS	-	X	X**	X	X	X	X****	X*****
Travel	Output 1	Output 2	Operate Force	Button Style	Termination	Bezel Color	Button Color	
1. +/-30°	A. 2.5 +/- 2.0VDC	NONE	1. 5 oz. typ.	1. Knurled Wheel*	A. Wire Leads, 22	1. Red	1. Red	
2. +/-45°*	B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. 8.5 oz. typ.	2. Paddle Wheel	AWG UL 1569	2. Black	2. Black	
	C. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	3. 12 oz. typ.	3. Paddle Wheel with Seal Boot***	(Single Output Only)		3. Orange	
	D. 2.5 +/- 1.5VDC	NONE			B. Wire Leads, 22		4. Yellow	
	E. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			AWG UL 1569,		5. Green	
	F. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			(Dual Output Only)		6. Blue	
	G. 1.0 - 4.0VDC	1.0 - 4.0VDC					7. Violet	
	H. 0.5 - 4.5VDC	0.5 - 4.5VDC					8. Gray	
							9. White	

\* Not available with Operate Force selection "3"

\*\* Outputs are from the center position to the full travel position in each direction. Options "A" "B" "C" "D" "E" "F" provide increasing voltage in direction 1 and decreasing voltage in direction 2 from a single output. Option "G" and "H" provide increasing voltages in both directions from two separate outputs. Option "B" and "E" provide redundant output 2 which duplicates output 1. Option "C" and "F" provide redundant output 2 which is inverse of output 1.

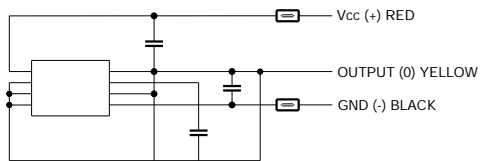
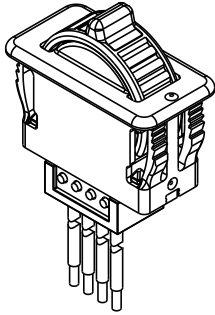
\*\*\* Available with Operate Force selection "3" only

\*\*\*\* Contact Factory for additional bezel color choices.

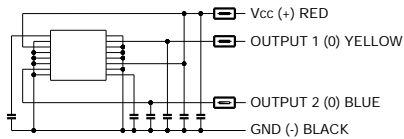
\*\*\*\*\* Minimums may apply to colors other than red and black.

SUBMINIATURE PROPORTIONAL OUTPUT THUMBWHEEL WITH OPTIONAL SEAT BOOT

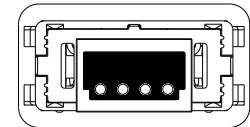
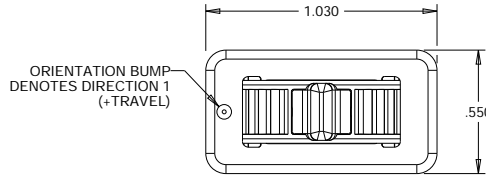
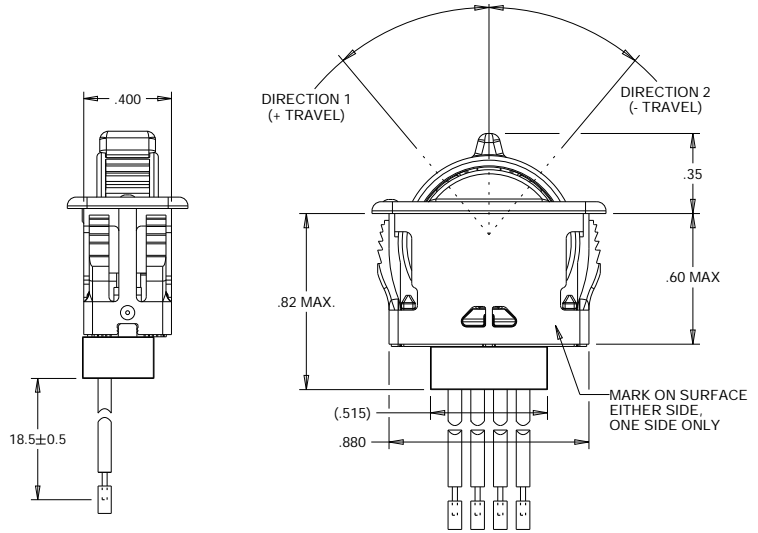
## HTWS Paddle Wheel Style Shown



SINGLE OUTPUT SCHEMATIC

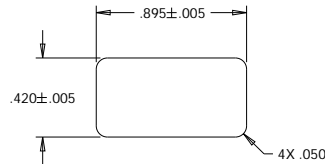


DUAL OUTPUT  
COMMON POWER & GROUND  
SCHEMATIC

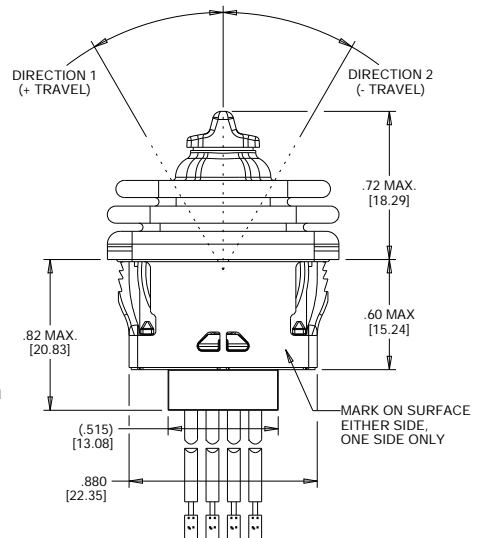
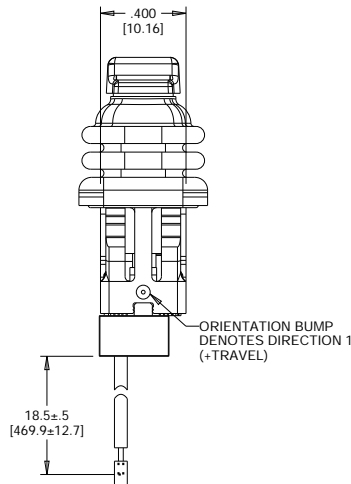
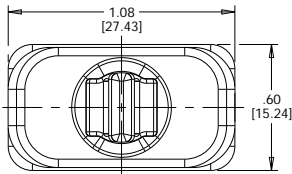
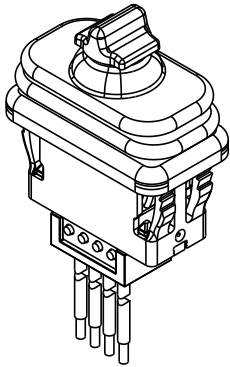


NOT ALL WIRES ARE PRESENT  
IN ALL OUTPUT CONFIGURATIONS

MOUNTING:  
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS



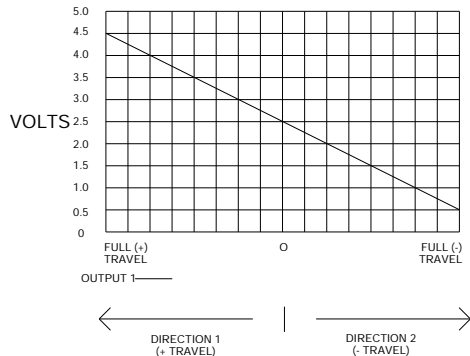
## HTWS Paddle Wheel with Boot Style Shown



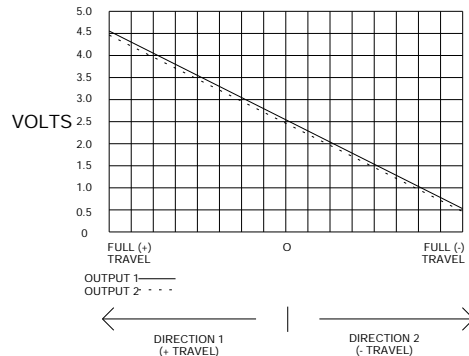
# PROPORTIONAL OUTPUT THUMBWHEEL

## SUBMINIATURE PROPORTIONAL OUTPUT THUMBWHEEL WITH OPTIONAL SEAT BOOT

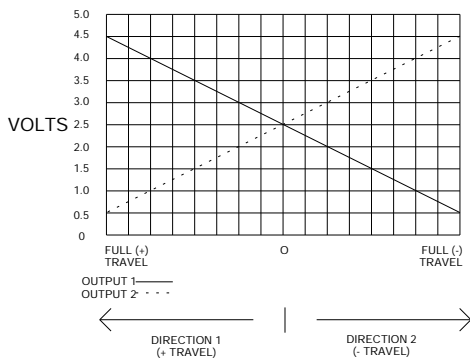
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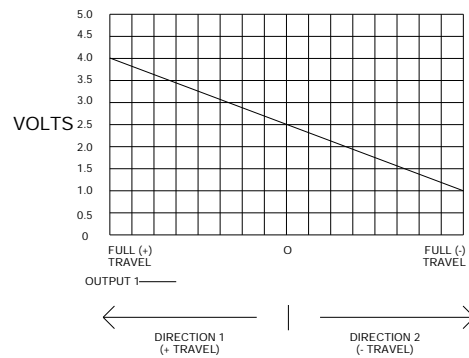
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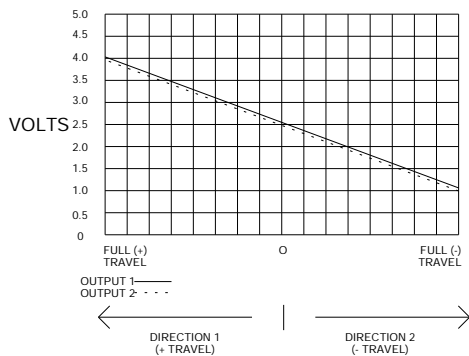
**OPTION C**



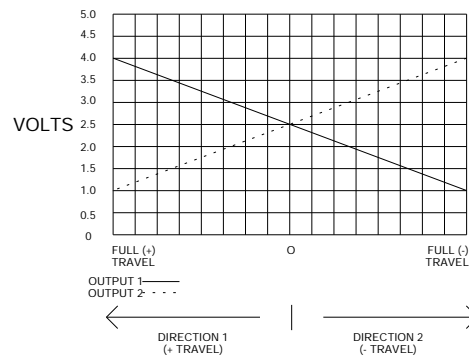
**OPTION D**



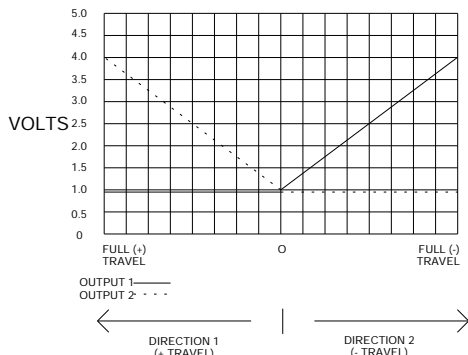
**OPTION E**



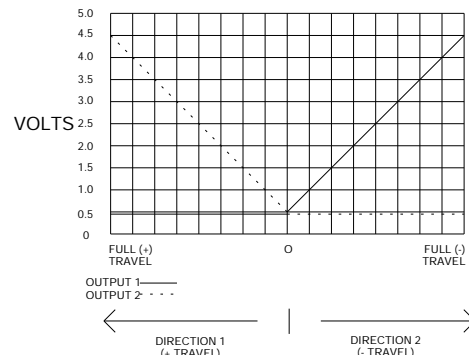
**OPTION F**



**OPTION G**



**OPTION H**



The JH Series Joystick is designed around the rugged mechanism of a traditional 4-way hydraulic joystick, but it utilizes contactless Hall effect technology for increased life and more dependable performance in the field. This combination provides performance and features never before available in an electronic joystick. The JH series uses OTTO's field-proven dual magnet configuration found in OTTO's HPL Linear Output Hall Effect switches. The Hall effect sensors are fully protected against electromagnetic and radio frequency interference (EMI and RFI) up to 100V/M. Programmable sensors with built-in magnetic temperature compensation logic ensure consistent and repeatable operation. The JH series is designed for maximum flexibility in features and in tactile feel. A wide variety of input and output configurations are available to satisfy different applications. The modular electronic package can be configured for both standard and custom I/O requirements including CANbus and other output options available.

### Features:

- **Adapts to a wide variety of shaft styles**
- **15 million cycle life in all directions**
- **300 lbs. static load strength at grip reference point (grp)**
- **Electronics sealed to IP68S**
- **Excellent EMI/RFI immunity**
- **Factory programmable pretravel & overtravel**
- **Analog, CANbus, USB & other custom output options available**
- **Redundant outputs available**
- **Fail safe & neutral indicator available**
- **Single and dual axis available**
- **Z axis available with universal grip only**
- **Programmable sensors**
- **5V standard regulator available to accommodate a 9-32VDC power supply input**
- **Various output configurations**
- **Available with a variety of grip & switch options**
- **RoHS compliant**



JH Joystick Shown with OTTO Medium Universal Grip, K1 Rockers and P3 Pushbutton Switches

## HALL EFFECT TECHNOLOGY JOYSTICK

### Standard Characteristics/Ratings:

#### GENERAL:

**Sensor Type:** Hall effect analog, 1 or 2 outputs per axis

**Design:** Dual magnet

#### ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)

Electrical		Units	Min	Typ	Max
Output Voltage 0° to 2° Tolerance at Center	Deflection @ 5V Vcc	VDC	-0.15	N/A	+0.15
Output Voltage 19° to 20° Tolerance at Full Load	Deflection @ 5V Vcc	VDC	-0.15	N/A	+0.15
Supply Current Per Sensor		mA	N/A	N/A	10
Output Source Current Limit		mA	-1	N/A	1

#### MECHANICAL:

**Mechanical Life:** 5,000,000 min. up to 15,000,000 in all directions depending on configuration

**Travel Angle:** 20° typical

**Operating Force:** With bellows, 20°C to 85°C at grip, 1 lbs. min to 7 lbs. max  
With bellows, -40°C at grip, 13.0 lbs. min to 18.0 lbs. max depending on selected spring

#### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

**Vibration:** 10g, 24Hz to 2KHz swept sinusoidal

**Electronics:** Sealed to IP68S

**EMI/RFI:** Withstand per SAE J1113 (typical), contact factory for details

**Sand/Dust:** Without bellows, withstand per SAE J1455

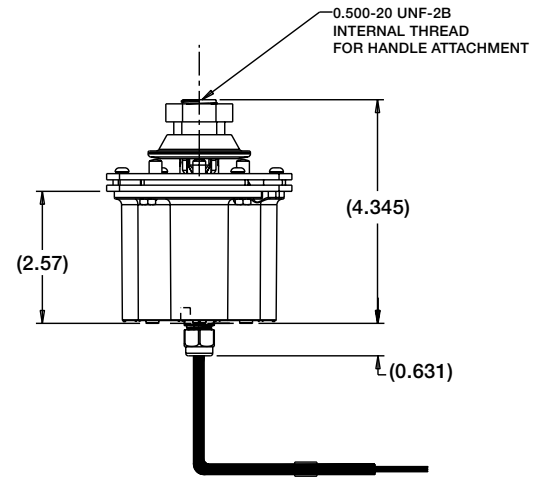
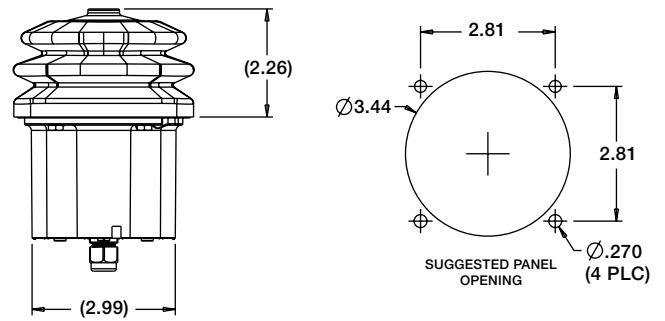
#### MATERIALS:

**Housing:** Polyester

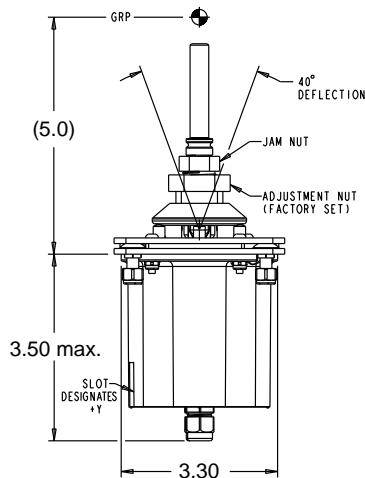
**Bellows:** EPDM, black

**Cable:** 22 AWG (19 strands of 34 AWG TSC)

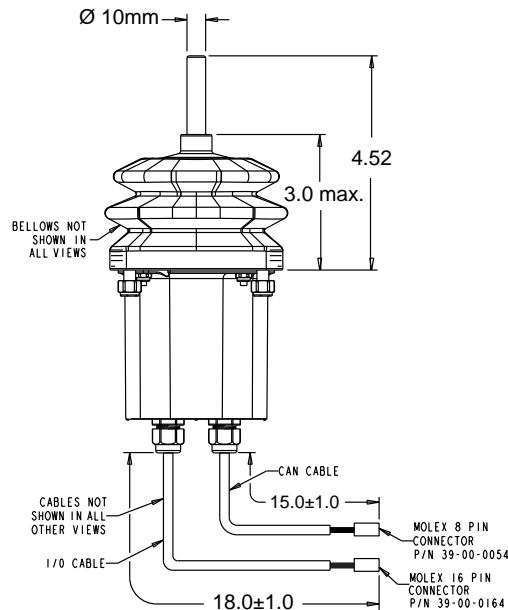
**Mounting Hardware:** 1/4-20 x 3/4 carriage bolts, self-locking nuts



Analog Hall Joystick



CANbus Technology Joystick  
(22 or 24 AWG)



HIGH PERFORMANCE, COST-EFFECTIVE, SEALED



Offering high performance in a cost-effective, sealed Hall effect joystick, the JHL series boasts a cycle life of up to 6 million cycles and can handle up to 250 lbs. static load strength. Electronics are sealed to IP68S and it offers excellent immunity to RFI and EMI per SAE J1113.

The standard JHL is a top mount joystick. Available as a joystick only or with a ball handle, it has multiple gating options and various output configurations including single analog output, dual analog output, CANopen, CANbus J1939, and redundant sensors.

The JHL can also be paired with an OTTO G3 series universal grip or a G3-D control grip for a more complete solution. See the HJLG3 series.

## Features:

- **Contactless analog output Hall effect technology**
- **Electronics sealed to IP68S**
- **Up to 250 lbs. static load strength at grip reference point (GRP)**
- **Top mount is standard**
- **Excellent EMI/RFI immunity**
- **Up to 6 million cycle mechanical life (1 million cycle life with detent)**
- **Multiple output configurations available**
- **Available with grips in the HJLG3 series**

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS

Joystick	Units	Min	Typ	Max
Rated at 5V @ 20°C, Load = 1ma (4.7kΩ)				
Supply Voltage, Vcc	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center (See Appropriate Graph)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel (See Appropriate Graph)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output at Full Travel +X, +Y Direction	VDC @ 5V Vcc	4.25	4.50	4.75
Supply Current Per Die B=0, Vcc=5V, Iout=0	mA	N/A	10	12
Output Impedence	kΩ	N/A	1.00	N/A

#### Joystick CANopen

Supply Voltage	VDC	9	N/A	32
Node Identifier (configurable)	Dec.		10	
Baud Rate (configurable)	B/S		125K	

#### Joystick J1939

Supply Voltage	VDC	9	N/A	32
Source Address (configurable)	Dec.		51	
Baud Rate	B/S		250K	

#### MECHANICAL

Joystick	Units	Min	Typ	Max
<b>Mechanical Life</b>		6,000,000 Cycles (1,000,000 cycles, with detent)		
<b>Mech. (Operating Force w/Bellows)</b>				
Travel Angle	Degrees	18	20	22
Low Force @ GRP, Ret. to Ctr.	Lbs.	0.25	0.5	1.0
Low Force @ GRP, Ret. to Ctr., Detent	Lbs.	0.5	1.0	1.5
Medium Force @ GRP, Ret. to Ctr.	Lbs.	0.75	1.0	1.5
Medium Force @ GRP, Ret. to Ctr., Detent	Lbs.	2.0	2.5	3.0
High Force @ GRP, Ret. to Ctr.	Lbs.	1.5	2.0	2.5
High Force @ GRP, Ret. to Ctr., Detent	Lbs.	2.0	4.0	6.0
Maximum Allowable Load @ GRP	Lbs.		250 Lbs	

#### ENVIRONMENTAL

Joystick	Units	Min	Typ	Max
Operating Temperature	°C	-30	20	85
Humidity		96% RH, 70°C, 96 HRS.		
Vibration		10g, 24Hz - 2Khz, Swept Sinusoidal		
Electrical Enclosure Design		IP68S		
EMI/RFI Withstand		Per SAE J1113, Contact Factory for Details		

#### MATERIAL

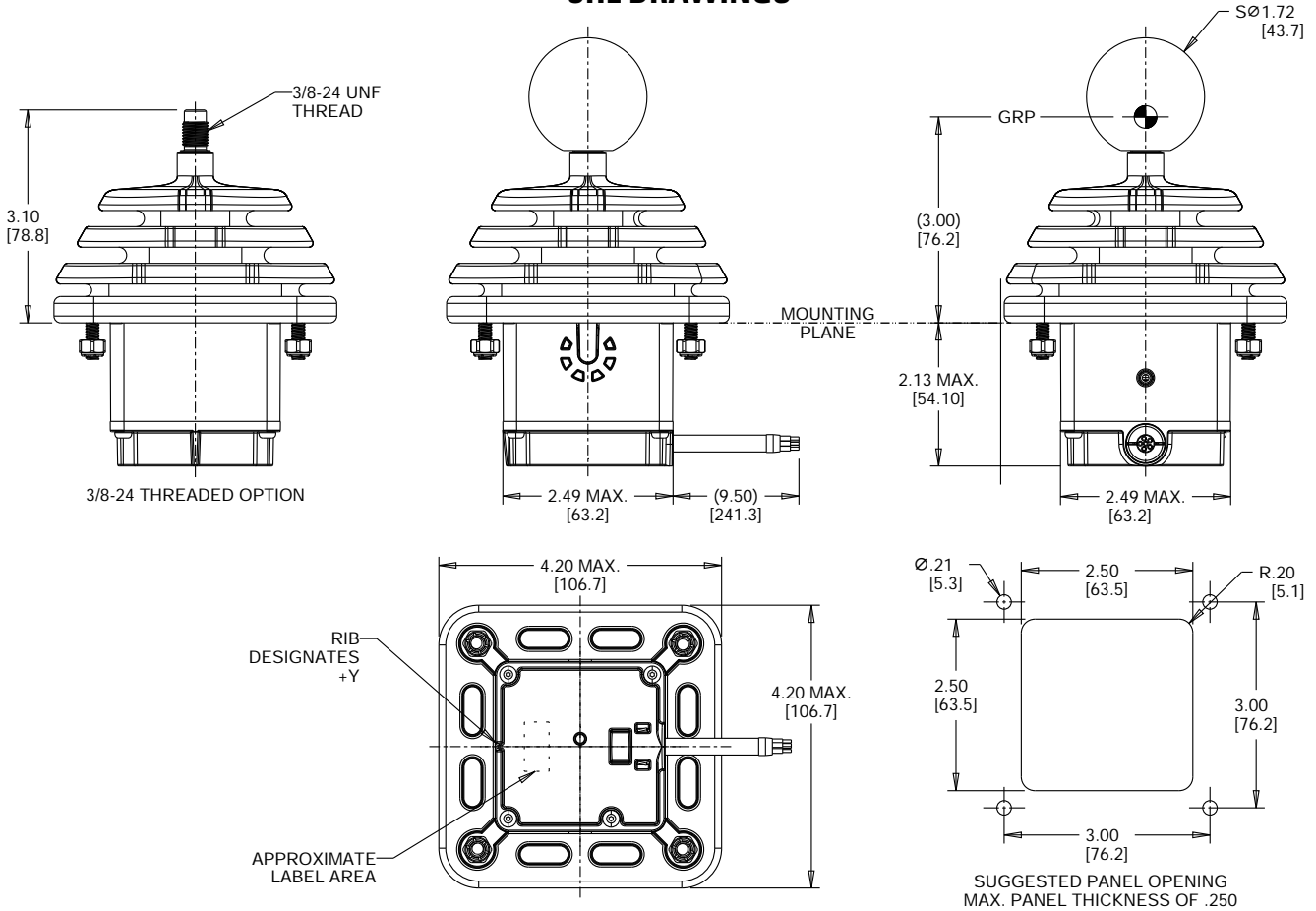
Joystick	
Plunger	Thermoplastic
Housing	Thermoplastic, Black
Bellows	Silicone, Black
Ball Knob	Thermoset, Black
Cable	Output Option AA, DD, JJ & KK: 22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane Blend Outer Jacket Output Option BB, CC, EE, FF, GG & HH: 22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane Blend Outer Jacket
Mounting Hardware	#10-24 x 3/4 Carriage Bolts Self Locking Nuts

# LARGE HALL EFFECT JOYSTICK

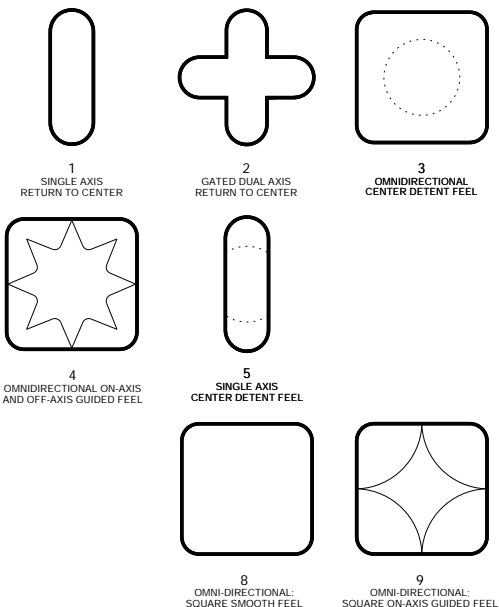
**JHL**  
HALL EFFECT  
JOYSTICK

HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

## JHL DRAWINGS



## JHL GATING ICONS



## JHL PART NUMBER CODE

JHL - X

### Actuator Options

- 3/8-24 Threaded
- 1.72 Ball Knob

### Gating Options

- Gated Single Y-Axis: Return to Center
- Gated; Dual Axis - Return to Center
- Omni-directional; Center Detent Feel
- Omni-directional: On-Axis and Off-Axis Guided Feel
- Gated Single Y-Axis: Center Detent Feel
- Omni-directional: Square Smooth Feel
- Omni-directional: Square On-axis Guided Feel

### Joystick Output 1\*

- AA. 2.5 +/- 2.0VDC  
BB. 2.5 +/- 2.0VDC  
CC. 2.5 +/- 2.0VDC  
DD. 2.5 +/- 1.5VDC  
EE. 2.5 +/- 1.5VDC  
FF. 2.5 +/- 1.5VDC  
GG. 0.5 - 4.5VDC  
HH. 1.0 - 4.0VDC  
JJ. CANbus J1939  
KK. CANopen

### Joystick Output 2\*\*

- NONE  
2.5 +/- 2.0VDC  
2.5 +/- 2.0VDC  
NONE  
2.5 +/- 1.5VDC  
2.5 +/- 1.5VDC  
0.5 - 4.5VDC  
1.0 - 4.0VDC  
NONE  
NONE

### Force

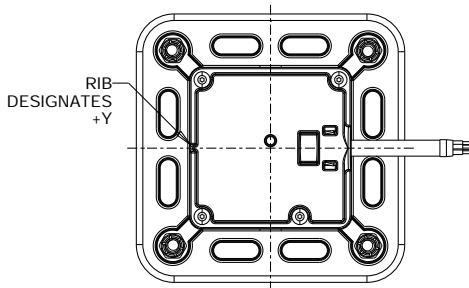
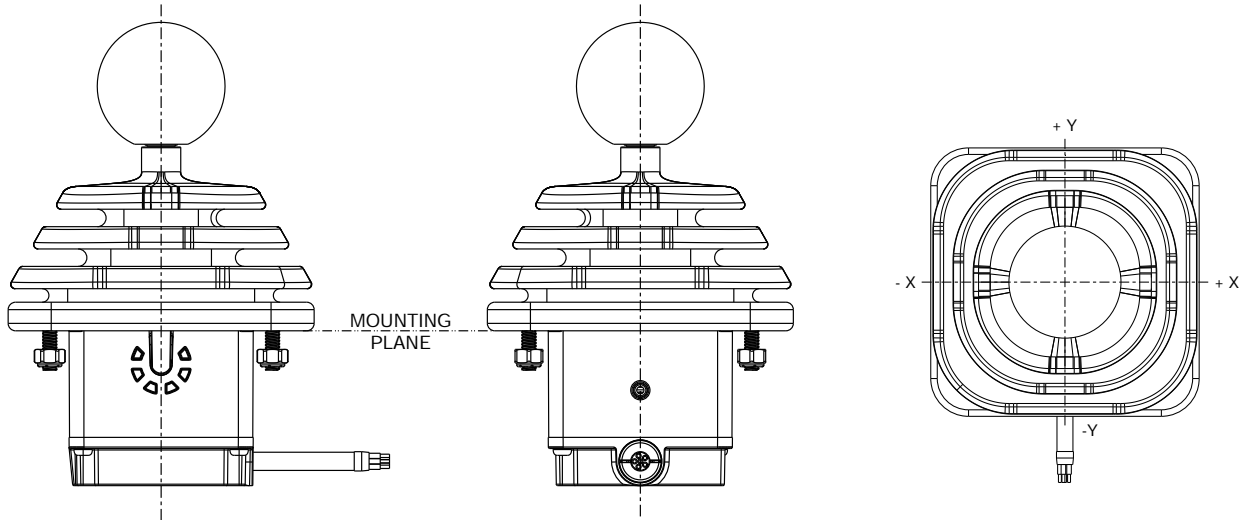
- Low
- Medium
- High

\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y direction from 1 output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) from 2 outputs per axis.

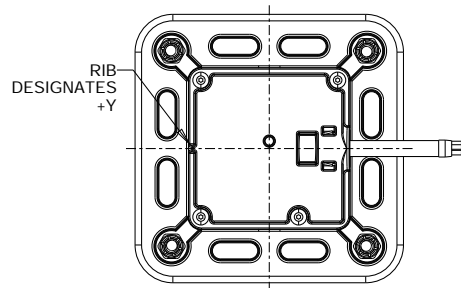
\*\*Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

## JHL OUTPUT DRAWINGS



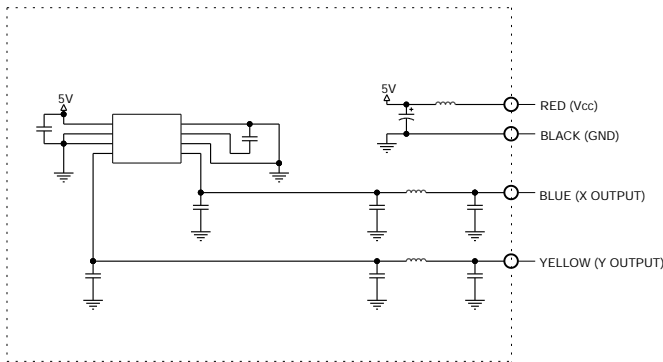
OUTPUTS AA-HH SHOWN



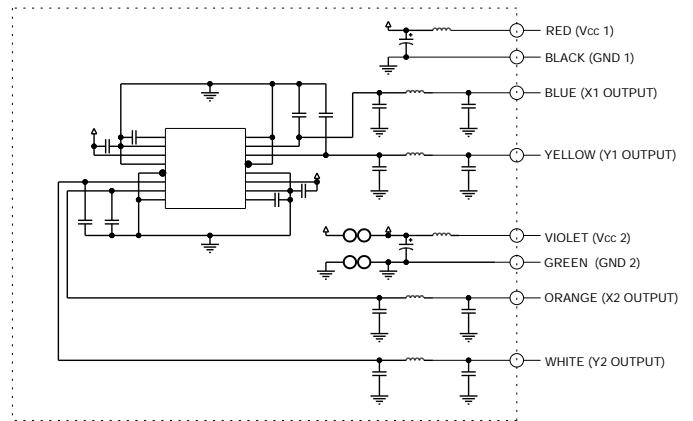
OUTPUTS JJ AND KK SHOWN

FUNCTION	COLOR
CAN HIGH	YELLOW
+SUPPLY	RED
-SUPPLY	BLACK
CAN LOW	GREEN

## JHL SCHEMATICS



JOYSTICK SCHEMATIC  
(AA AND DD OUTPUTS)



JOYSTICK SCHEMATIC  
(BB, CC, EE, FF, GG, & HH OUTPUTS)

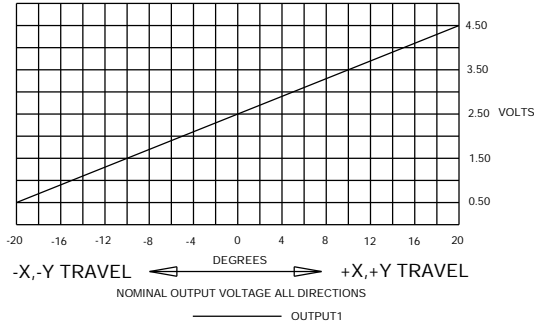


# LARGE HALL EFFECT JOYSTICK

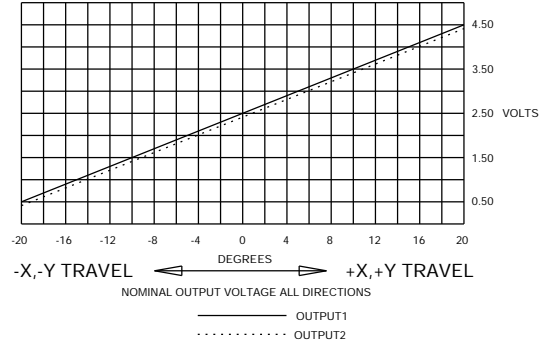
HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

## JHL OUTPUTS

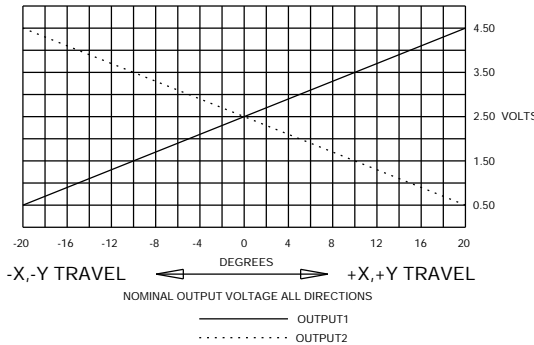
OPTION AA



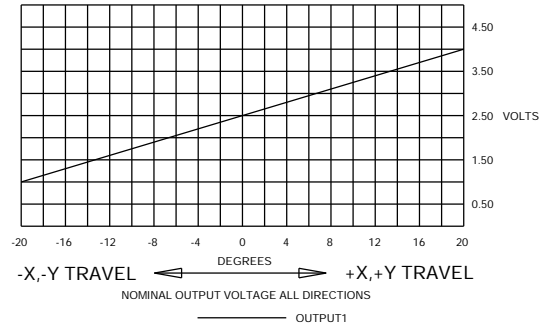
OPTION BB



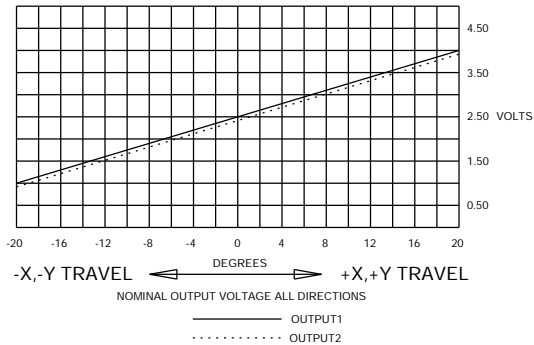
OPTION CC



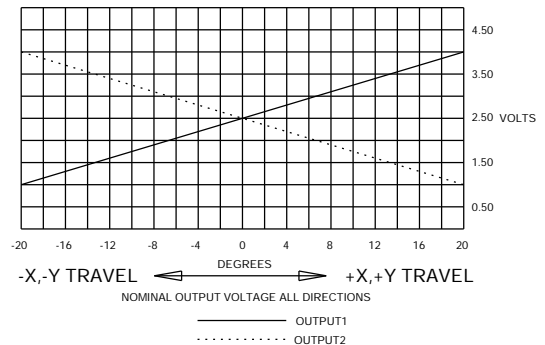
OPTION DD



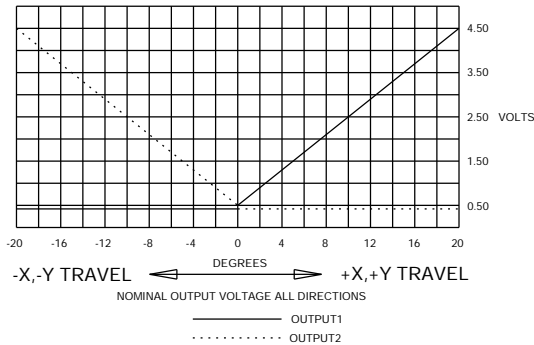
OPTION EE



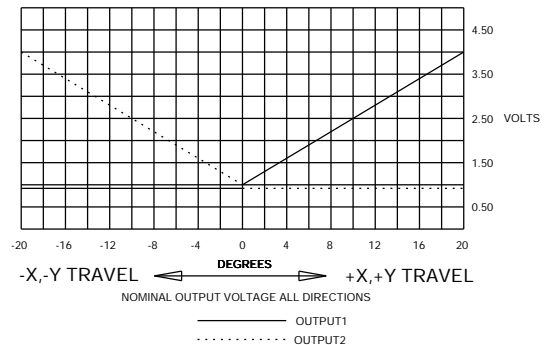
OPTION FF



OPTION GG



OPTION HH



## HALL EFFECT JOYSTICK WITH GRIP



The HJLG3 medium Hall effect joystick with grip allows you to easily create a standard, catalog codable solution that handles loads up to 250 lbs., has a compact behind-panel size, and a long life. Choose from a variety of grips, faceplates, outputs and gating options that match your application.

Grip choices include G3-A, G3-B, G3-C, and G3-CK Universal Grips as well as the G3-D Control Grip that altogether include nearly 50 standard faceplate design options to choose from.

Analog and digital outputs, CANopen, CANbus J1939, PWM, USB, and redundant sensor output selections are available. Gating options are single axis, single axis with center detent, dual axis, and various omnidirectional selections that include square smooth feel, on-axis and off-axis guided feel, square on-axis guided feel and center detent.

The HJLG3 serves agriculture, construction, off-highway, material handling and industrial equipment markets.

### Features:

- **Compact design made for armrest and panel mounting**
- **Contactless Hall effect technology**
- **Mechanical life up to 6 million cycles**
- **Handles loads up to 250 lbs.**
- **Multiple output options, both analog and digital**
- **Electronics sealed to IP68S**
- **Redundant sensors available**
- **Variety of gating options**
- **Modular design**
- **Left or right handed**
- **RoHS compliant**

# JOYSTICK WITH GRIP OPTIONS

**HJLG3**  
MEDIUM  
JOYSTICK  
WITH GRIP

## HALL EFFECT JOYSTICK WITH GRIP

Standard Characteristics/Ratings:				
<b>ELECTRICAL:</b>				
<b>Joystick</b>				
Rated at Vcc = 5V @ 20°C Load = 1 ma (4.7 KΩ)	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-.25	N/A	+.25
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Output at Full Travel +X, +Y Direction	VDC @ 5V Vcc	4.25	4.50	4.75
Supply Current Per Die B=0, Vcc=5V, Iout=0	mA	N/A	10	12
Output Impedance	kΩ	N/A	1.0	N/A
<b>Joystick CAN Open</b>				
Supply Voltage	VDC	9	N/A	32
Node Identifier	Dec.		10	
Baud Rate	B/S		125K	
<b>Joystick J1939</b>				
Supply Voltage	VDC	9	N/A	32
Source Address	Dec.		51	
Baud Rate	B/S		250K	
<b>Grip Touch Switch*</b>				
Supply Voltage	VDC	3.15	NA	5.5
Output Active (Low)	VDC	NA	NA	0.60
Output Current Sink	mA	N/A	NA	10
<b>Operator Presence</b>				
Electrical Rating	10mA Resistive Load @ 5VDC			
Logic Level Electrical Life	1,250,000 Cycles			
<b>Keypads</b>				
Circuit Configuration	SPST N.O.			
Voltage	1-32 VDC			
Current	10-100 mA Resistive			
<b>P9 Switches</b>				
Electrical Rating	10mA Resistive Load @ 5VDC			
Logic Level Electrical Life	1,250,000 Cycles			
<b>K1 Switches</b>				
Electrical Rating	10mA Resistive Load @ 5VDC			
Electrical Life	100,000 Cycles			
<b>HTW Switches</b>				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage	VDC	-.15	NA	+.15
Tolerance at Center	@ 5V Vcc			
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-.25	N/A	-.25
Supply Current per Die B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
<b>HTWM Switches</b>				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage	VDC	-.25	NA	+.25
Tolerance at Center	@ 5V Vcc			
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-.25	N/A	-.25
Supply Current per Die B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
<b>HTWS Switches</b>				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage	VDC	-.25	NA	+.25
Tolerance at Center	@ 5V Vcc			
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current per Die B=0, Vcc=5V, Iout=0	mA	N/A	N/A	20

Standard Characteristics/Ratings (continued):				
<b>HJLT4 Switches</b>				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage	VDC	-.25	NA	+.25
Tolerance at Center	@ 5V Vcc			
Output Voltage Tolerance at Full Travel	VDC @ 5V Vcc	-.25	N/A	-.25
Supply Current per Die B=0, Vcc=5V, Iout=0	mA	N/A	10	12
<b>TC-5 Switches</b>				
Electrical Rating @ 1-32 VDC	10-100mA			
Electrical Life	3,000,000 Cycles			
<b>MECHANICAL:</b>				
<b>Joystick</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Mechanical Life, Return to Center	6,000,000 cycles; 1,000,000 cycles (Detent)			
Travel Angle	Degrees	18	20	22
Op. Force (w/Bellows) Low Force @ GRP, Ret. to Ctr.	Lbs.	.25	.50	1.0
Op. Force (w/Bellows) Low Force @ GRP, Ret. to Ctr., Detent	Lbs.	.50	1.0	1.5
Op. Force (w/Bellows) Medium Force @ GRP, Ret. to Ctr.	Lbs.	.75	1.0	1.5
Op. Force (w/Bellows) Medium Force @ GRP, Ret. to Ctr., Detent	Lbs.	2.0	2.5	3.0
Op. Force (w/Bellows) High Force @ GRP, Ret. to Ctr.	Lbs.	1.5	2.0	2.5
Op. Force (w/Bellows) High Force @ GRP, Ret. to Ctr., Detent	Lbs.	2.0	4.0	6.0
Maximum Allowable Load @ 5" GRP	Lbs.		250 Lbs.	
<b>Keypads</b>				
Mechanical Life	3,000,000 Cycles			
<b>P9 Switches</b>				
Mechanical Life	1,250,000 Cycles			
<b>K1 Switches</b>				
Mechanical Life	100,000 Cycles			
<b>HTW Switches</b>				
Mechanical Life, Full Forward to Full Back, Ret. to Ctr.	3,000,000 Cycles			
Mechanical Life, Full Forward to Full Back, Friction	250,000 Cycles			
Mechanical Life, Full Forward to Full Back, Ret. to End	1,000,000 Cycles			
<b>HTWM Switches</b>				
Mechanical Life, Full Forward to Full Back, Ret. to Ctr.	3,000,000 Cycles			
Mechanical Life, Full Forward to Full Back, Ret. to End	1,000,000 Cycles			
Operating Force 25°C at Top of Roller	Oz.	2.0	5.0	8.0
Maximum Allowable Radial Load	Lbs.	N/A	N/A	30.0
<b>HTWS Switches</b>				
Mechanical Life, Full Forward to Full Back	3,000,000 Cycles			
Operating Force 25°C at Top of Roller	Oz.	2.0	5.0	8.0
Maximum Allowable Radial Load	Lbs.	N/A	N/A	15.0

HALL EFFECT CONTROLS

## HALL EFFECT JOYSTICK WITH GRIP

Standard Characteristics/Ratings (continued):				
<b>HJLT4 Switches</b>				
Mechanical Life,	3,000,000 Cycles			
Operating Force (w/Boot) Top of Roller @ 20°C	Oz.	5.0	8.0	16.0
Maximum Allowable Vertical Force on Button	Lbs.	N/A	N/A	25.0
Maximum Allowable Radial Force on Top of Knob	Lbs.	N/A	N/A	25.0
Maximum Allowable Torque on Button about Shaft Axis	In-Lbs	N/A	N/A	5.0
<b>TC-5 Switches</b>				
Mechanical Life	3,000,000 Cycles			
Operating Force	Oz.	8.0	16.0	24.0
<b>ENVIRONMENTAL:</b>				
<b>Joystick</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Humidity	96% RH, 70°C, 96 Hrs.			
Vibration	10g, 24 Hz – 2KHz Swept Sinusoidal			
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
EMI/RFI Withstand	Per SAE J1113 (Contact factory for details)			
<b>Keypads</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Faceplate Keypad Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>P9 Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>K1 Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-30	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>HTW Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>HTWM Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>HTWS Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP5K8S – Dust-protected, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>HJLT Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>TC-5 Switches</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
<b>Grip</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Temperature	°C	-40	20	85
Electrical Enclosure Design	Unsealed			

Standard Characteristics/Ratings (continued):	
<b>MATERIAL:</b>	
<b>Joystick</b>	
Plunger	Thermoplastic
Housing	Thermoplastic, Black
Bellows	Silicone, Black
Cable	Output Option AA, DD, JJ & KK: 22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane Blend Outer Jacket  Output Option BB, CC, EE, FF, GG & HH: 22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane Blend Outer Jacket
Mounting Hardware	#10–24 x 3/4 Carriage Bolts Self Locking Nuts
<b>Keypads</b>	
Keypads	Silicone Rubber, Black
Keypads, Lighted	Silicone Rubber, Black with White Graphic
<b>P9 Switches</b>	
Button	Thermoplastic
Housing	Thermoplastic
<b>K1 Switches</b>	
Button	Thermoplastic
Housing	Thermoplastic
<b>HTW Switches</b>	
Button Top	Thermoplastic
Housing	Thermoplastic
<b>HTWM Switches</b>	
Button Top	Thermoplastic
Housing	Thermoplastic
<b>HTWS Switches</b>	
Button Top	Thermoplastic
Housing	Thermoplastic
<b>HJLT4 Switches</b>	
Housing and Flange	Thermoplastic
Bellows	Silicone, Black
<b>TC-5 Switches</b>	
Housing	PBT
Keypad	Silicone Rubber
<b>Grip</b>	
Handle	Thermoplastic, Glass Reinforced, Black
Faceplate	Thermoplastic, Glass Reinforced, Black
Wires	22 AWG, UL Style 1569 (8.5 in. long from bottom of joystick)
Side Keypad Wires	24 AWG, (26/.10TA) Insulation Diameter: .037 Insulation Type: PVC (40 in. from bottom of joystick)

**\*WARNING ON PERSONAL INJURY AND ANY USE AS SAFETY RELATED:**

Do not use these products as safety or emergency stop devices or in any application where failure of the product could result in personal injury. Failure to comply with these instructions could result in death or serious injury. OTTO Engineering Inc. makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does OTTO Engineering Inc. assume any liability whatsoever arising out of the application or use of any product. The product sold hereunder by OTTO has been subject to limited testing and should not be used in conjunction with detection of the presence of an operator on or with any equipment that is in any way safety related. OTTO does not accept any liability for incidental, consequential damages, personal injury or loss of life for any claims against the use of this product.

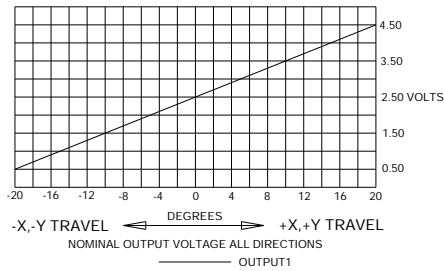
# JOYSTICK WITH GRIP OPTIONS

**HJLG3**  
MEDIUM  
JOYSTICK  
WITH GRIP

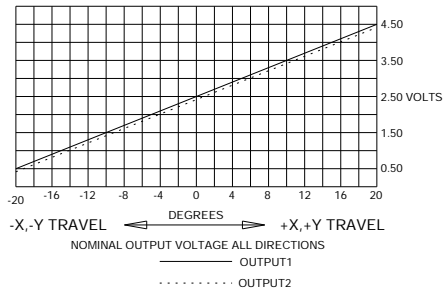
## HALL EFFECT JOYSTICK WITH GRIP

### HJLG3 OUTPUT CONFIGURATIONS

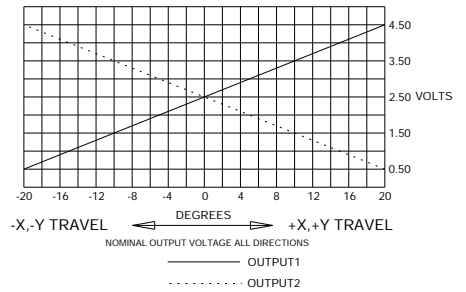
OPTION AA



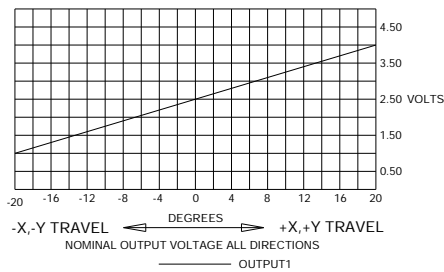
OPTION BB



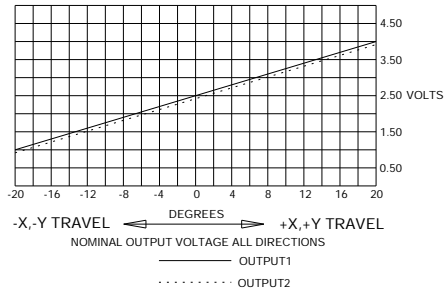
OPTION CC



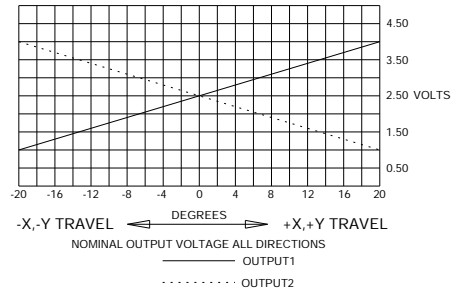
OPTION DD



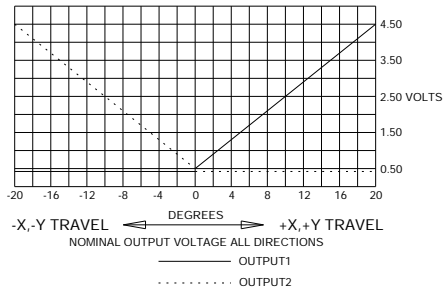
OPTION EE



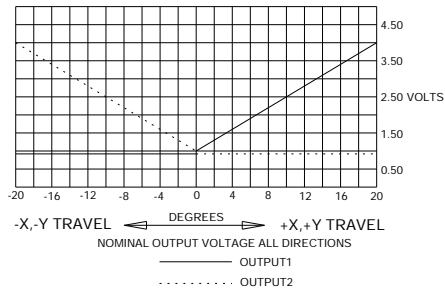
OPTION FF



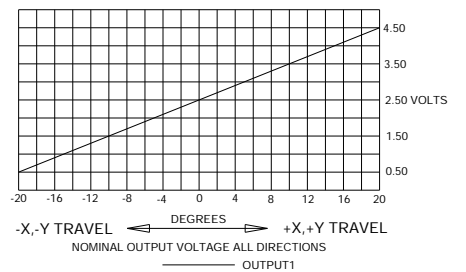
OPTION GG



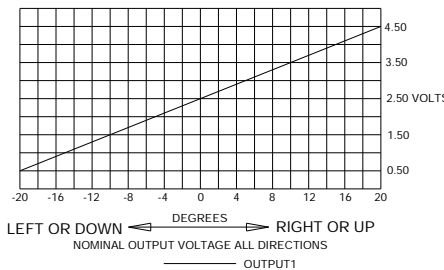
OPTION HH



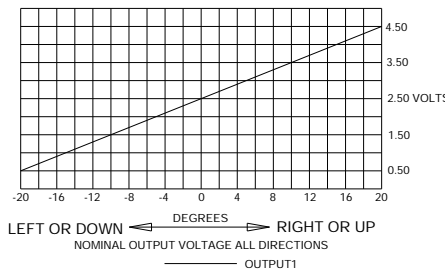
HTLT4 OUTPUT



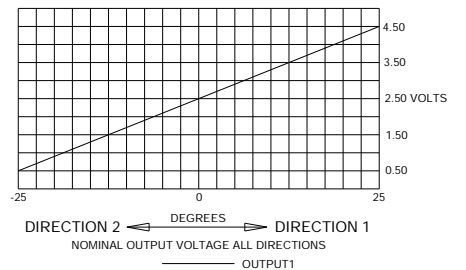
HTWM OUTPUT



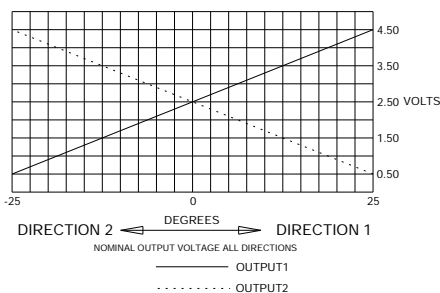
HTWS OUTPUT



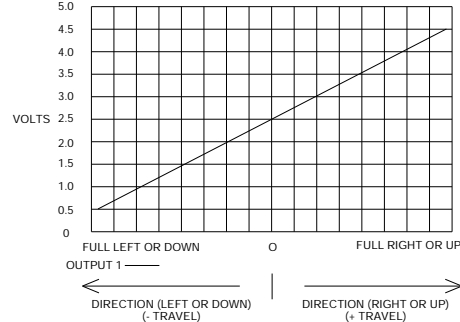
Z-AXIS SINGLE OUTPUT



Z-AXIS DUAL OUTPUT

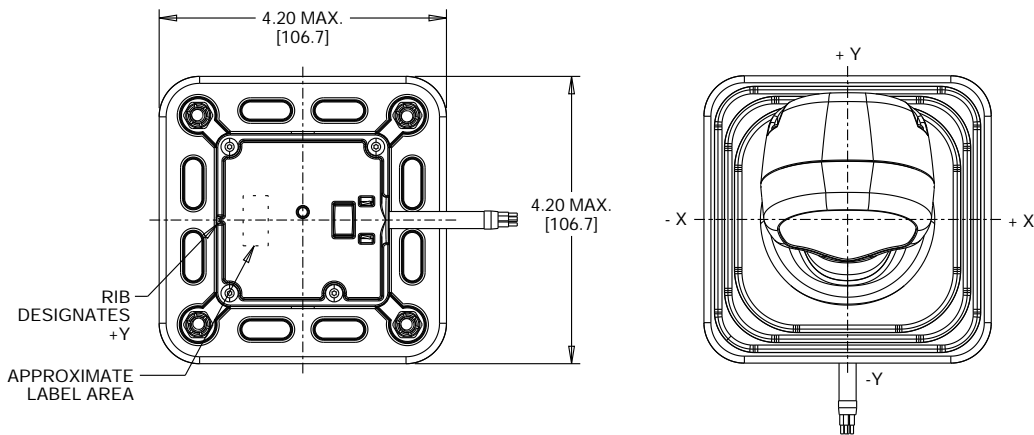
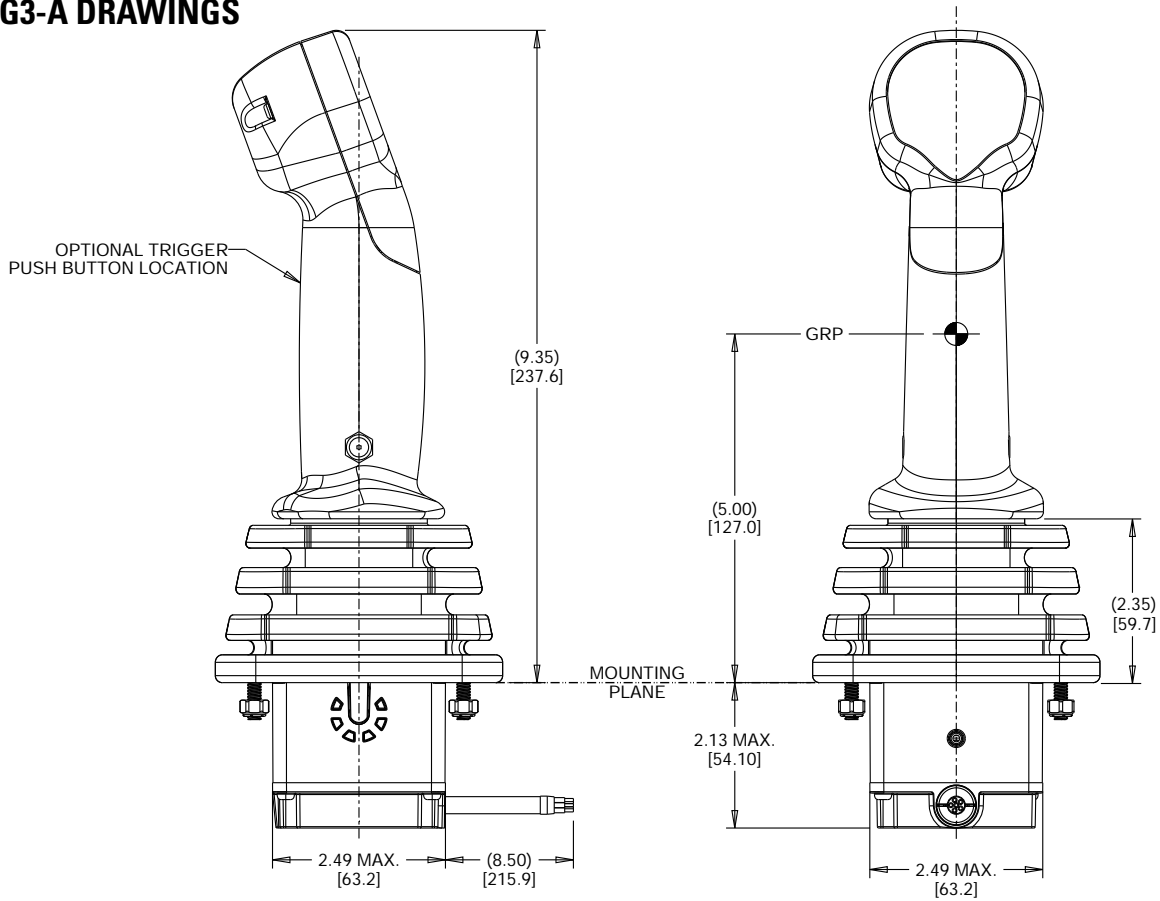


THUMBWHEEL OUTPUT

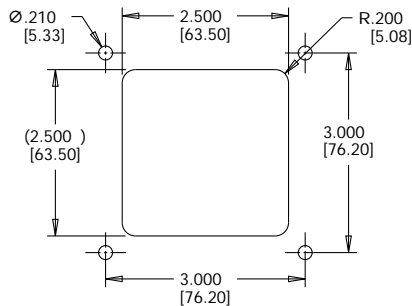


## HALL EFFECT JOYSTICK WITH G3-A UNIVERSAL GRIP

### HJLG3-A DRAWINGS



### HJLG3 SUGGESTED PANEL OPENING



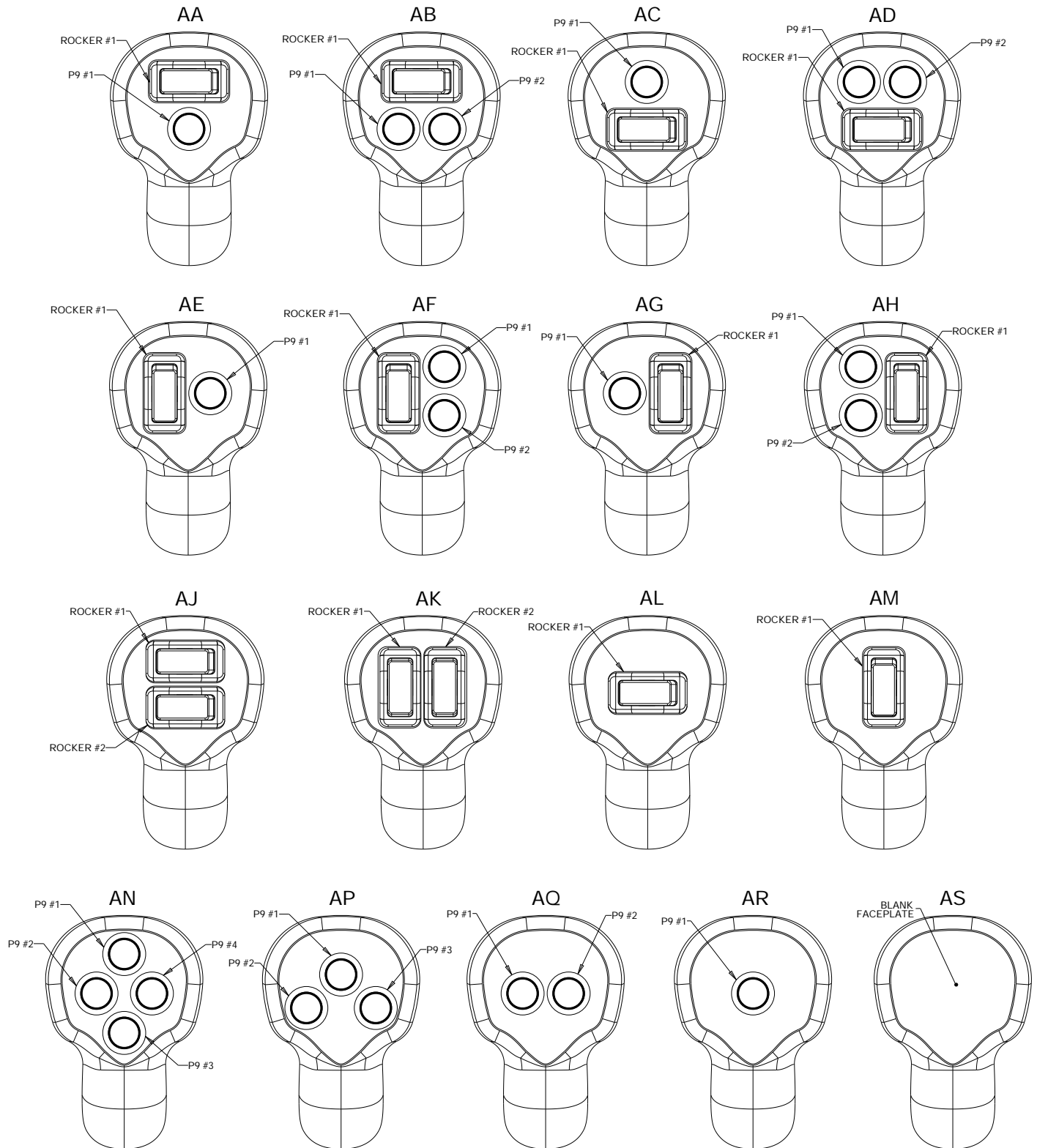
SUGGESTED PANEL OPENING  
MAX. PANEL THICKNESS OF .250

# JOYSTICK WITH GRIP OPTIONS

**HJLG3-A**  
MEDIUM  
JOYSTICK  
WITH GRIP

HALL EFFECT JOYSTICK WITH G3-A UNIVERSAL GRIP

## HJLG3-A FACEPLATES



## HALL EFFECT JOYSTICK WITH G3-A UNIVERSAL GRIP

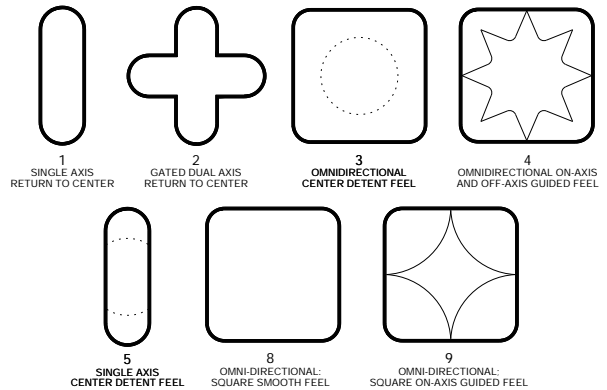
### HJLG3-A PART NUMBER CODE

HJLG3-A	X	XX	X	X	XX	X	X	Continued Below
Gating	Joystick Output 1*	Joystick Output 2**	Operate Force	Trigger Pushbutton	Faceplate	K1 Rocker #1 Style - Black***	K1 Rocker #2 Style - Black***	
1. Gated Single Y-Axis; Return to Center	AA. 2.5 +/- 2.0VDC	NONE	2. Medium	1. None	AA	1. None	1. None	
2. Gated Dual Axis; Return to Center	BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	3. High	2. P9 - Black	AB	2. On-Off	2. On-Off	
3. Omni-directional; Center Detent Feel	CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		3. P9 - Red	AC	3. (On)-Off	3. (On)-Off	
4. Omni-directional; On-Axis and Off-Axis Guided Feel	DD. 2.5 +/- 1.5VDC	NONE			AD	4. On-Off-On	4. On-Off-On	
5. Gated Single Y-Axis; Center Detent Feel	EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			AE	5. (On)-Off-(On)	5. (On)-Off-(On)	
8. Omni-directional; Square Smooth Feel	FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			AF			
9. Omni-directional; Square On-Axis Guided Feel	GG. 0.5 - 4.5VDC	0.5 - 4.5VDC			AG			
	HH. 1.0 - 4.0VDC	1.0 - 4.0VDC			AH			
	JJ. CANbus J1939	NONE			AJ			
	KK. CANopen	NONE			AK			
					AL			
					AM			
					AN			
					AP			
					AQ			
					AR			
					AS			

### HJLG3-A PART NUMBER CODE CONTINUED

Cont.	X	X	X	X
	P9 #1 Button Color	P9 #2 Button Color	P9 #3 Button Color	P9 #4 Button Color
	1. Red	1. Red	1. Red	1. Red
	2. Black	2. Black	2. Black	2. Black
	3. Orange	3. Orange	3. Orange	3. Orange
	4. Yellow	4. Yellow	4. Yellow	4. Yellow
	5. Green	5. Green	5. Green	5. Green
	6. Blue	6. Blue	6. Blue	6. Blue
	7. Violet	7. Violet	7. Violet	7. Violet
	8. Gray	8. Gray	8. Gray	8. Gray
	9. White	9. White	9. White	9. White
	N. None	N. None	N. None	N. None

### HJLG3 GATING ICONS



\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y direction from 1 output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) from 2 outputs per axis.

\*\*Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

\*\*\* K1 Rocker Switches: on position or momentary position is up or to the right and ( ) denotes momentary action. Contact factory for rocker legends and additional color options.



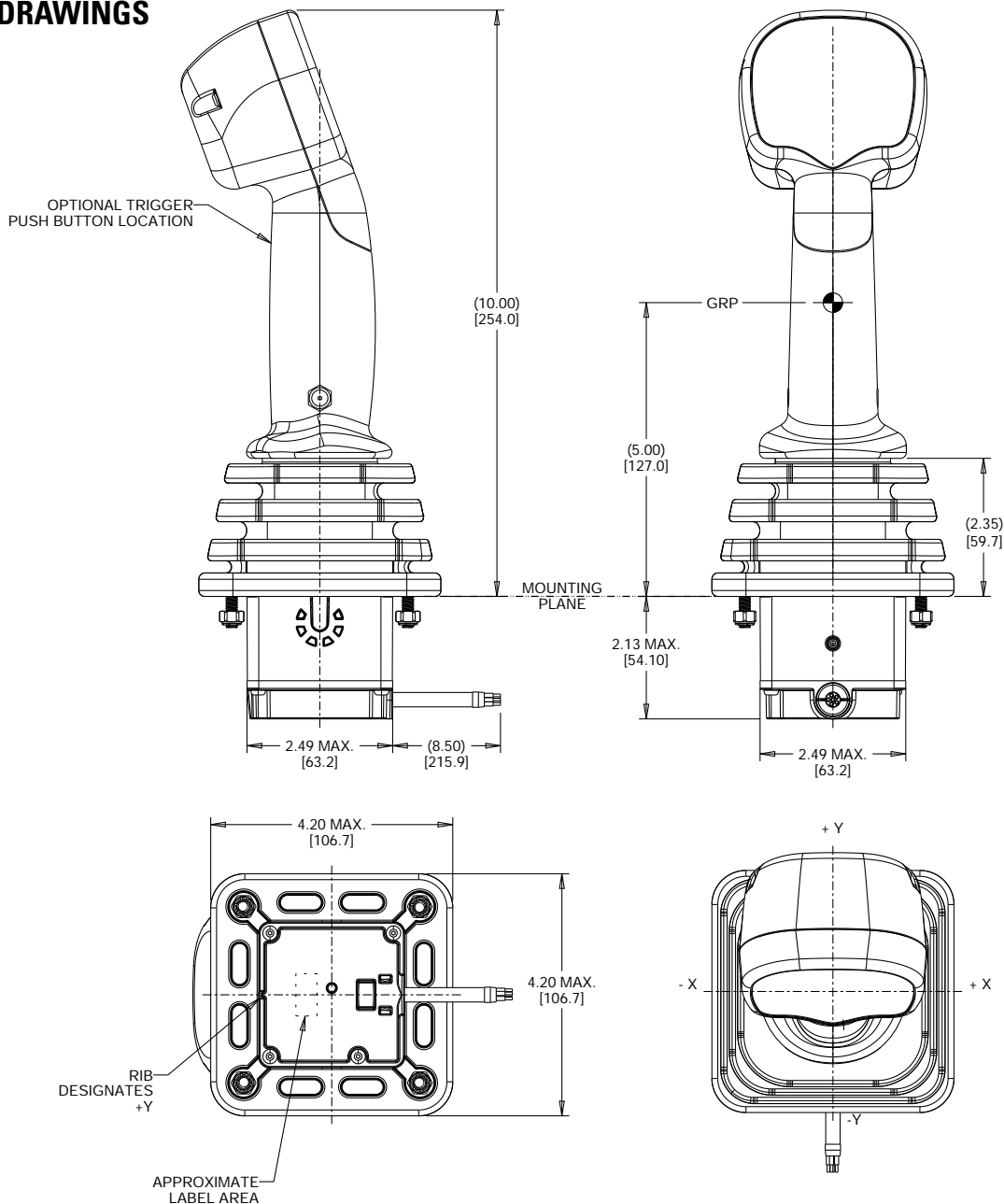
# JOYSTICK WITH GRIP OPTIONS

HJLG3-B

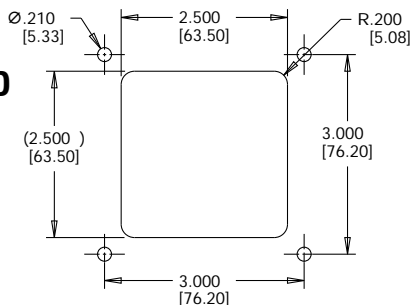
MEDIUM  
JOYSTICK  
WITH GRIP

## HALL EFFECT JOYSTICK WITH G3-B UNIVERSAL GRIP

### HJLG3-B DRAWINGS

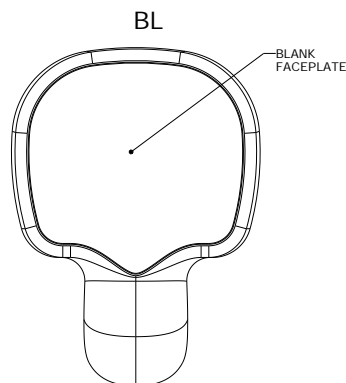
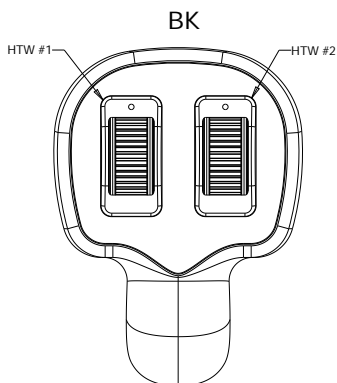
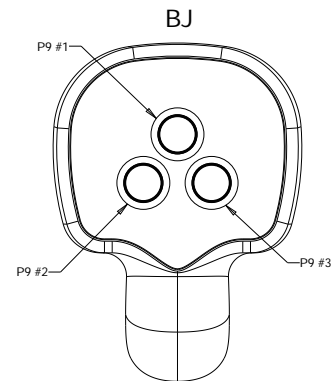
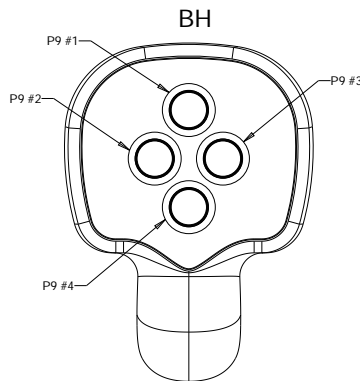
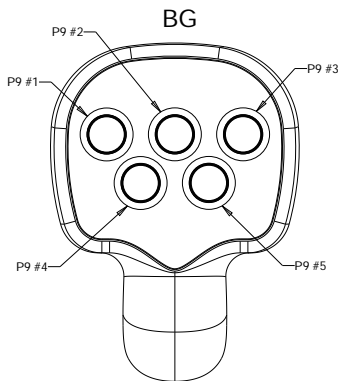
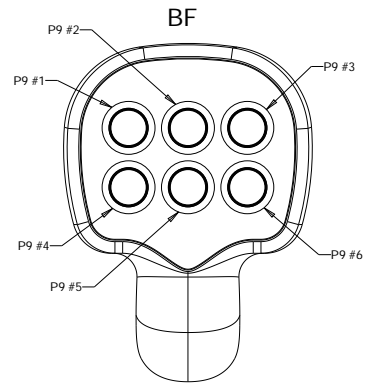
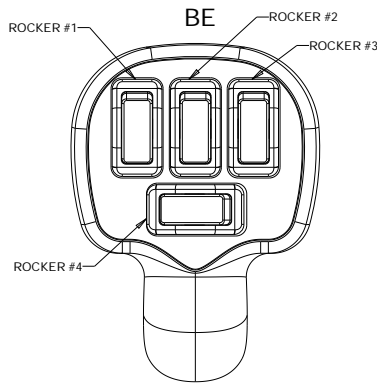
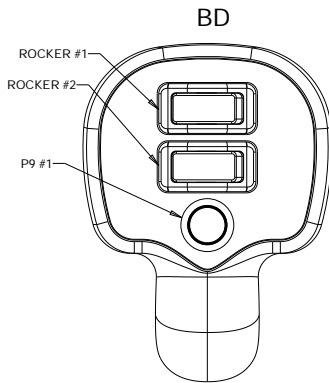
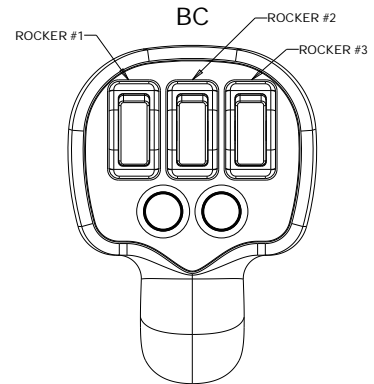
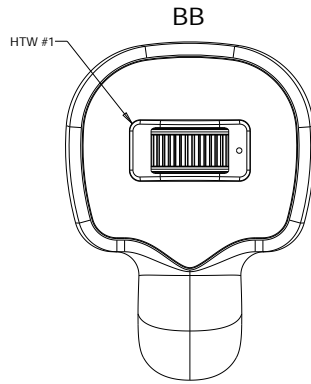
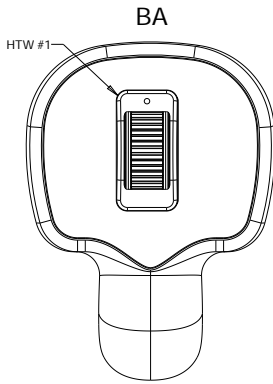


### HJLG3 SUGGESTED PANEL OPENING



SUGGESTED PANEL OPENING  
MAX. PANEL THICKNESS OF .250

## HJLG3-B FACEPLATES



# JOYSTICK WITH GRIP OPTIONS

**HJLG3-B**  
MEDIUM  
JOYSTICK  
WITH GRIP

## HALL EFFECT JOYSTICK WITH G3-B UNIVERSAL GRIP

### HJLG3-B PART NUMBER CODE

HJLG3-B	X	XX	X	X	XX	X	X	X	X	X	Continued Below
Gating	Joystick Output 1*	Joystick Output 2**	Force	Trigger Pushbutton	Faceplate	K1 Rocker #1 Style - Black***	K1 Rocker #2 Style - Black***	K1 Rocker #3 Style - Black***	K1 Rocker #4 Style - Black***		
1. Gated Single Y-Axis; Return to Center	AA. 2.5 +/- 2.0VDC	NONE	2. Medium	1. None	BA	1. None	1. None	1. None	1. None		
	BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	3. High	2. P9 - Black	BB	2. On-Off	2. On-Off	2. On-Off	2. On-Off		
2. Gated Dual Axis; Return to Center	CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		3. P9 - Red	BC	3. (On)-Off	3. (On)-Off	3. (On)-Off	3. (On)-Off		
	DD. 2.5 +/- 1.5VDC	NONE			BD	4. On-Off-On	4. On-Off-On	4. On-Off-On	4. On-Off-On		
3. Omni-directional; Center Detent Feel	EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			BE	5. (On)-Off-(On)	5. (On)-Off-(On)	5. (On)-Off-(On)	5. (On)-Off-(On)		
	FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			BF						
4. Omni-directional; On-Axis and Off-Axis Guided Feel	GG. 0.5 - 4.5VDC	0.5 - 4.5VDC			BG						
	HH. 1.0 - 4.0VDC	1.0 - 4.0VDC			BH						
5. Gated Single Y-Axis; Center Detent Feel	JJ. CANbus J1939	NONE			BJ						
	KK. CANopen	NONE			BK						
8. Omni-directional; Square Smooth Feel					BL						
9. Omni-directional; Square On-Axis Guided Feel											

### HJLG3-B PART NUMBER CODE CONTINUED

Cont.	X	X	X	X	X	X	X	X
HTW #1 Roller - Black****	HTW #2 Roller - Black****	P9 #1 Button Color	P9 #2 Button Color	P9 #3 Button Color	P9 #4 Button Color	P9 #5 Button Color	P9 #6 Button Color	
1. None	1. None	1. Red	1. Red	1. Red	1. Red	1. Red	1. Red	
2. Return to Center <sup>①</sup>	2. Return to Center	2. Black	2. Black	2. Black	2. Black	2. Black	2. Black	
3. Friction <sup>②</sup>	3. Friction	3. Orange	3. Orange	3. Orange	3. Orange	3. Orange	3. Orange	
4. Return to End <sup>③</sup>	4. Return to End	4. Yellow	4. Yellow	4. Yellow	4. Yellow	4. Yellow	4. Yellow	
		5. Green	5. Green	5. Green	5. Green	5. Green	5. Green	
		6. Blue	6. Blue	6. Blue	6. Blue	6. Blue	6. Blue	
		7. Violet	7. Violet	7. Violet	7. Violet	7. Violet	7. Violet	
		8. Gray	8. Gray	8. Gray	8. Gray	8. Gray	8. Gray	
		9. White	9. White	9. White	9. White	9. White	9. White	
		N. None	N. None	N. None	N. None	N. None	N. None	

- ① = HTW-1J12X22
- ② = HTWF-1A12X22
- ③ = HTWE-1A12X22

Contact factory for additional options.

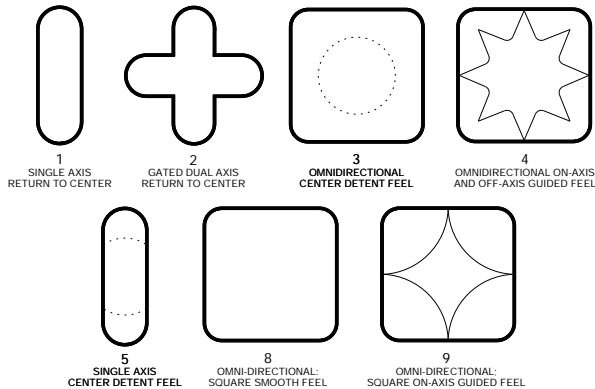
\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y from 1 output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) from 2 outputs per axis.

\*\*Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

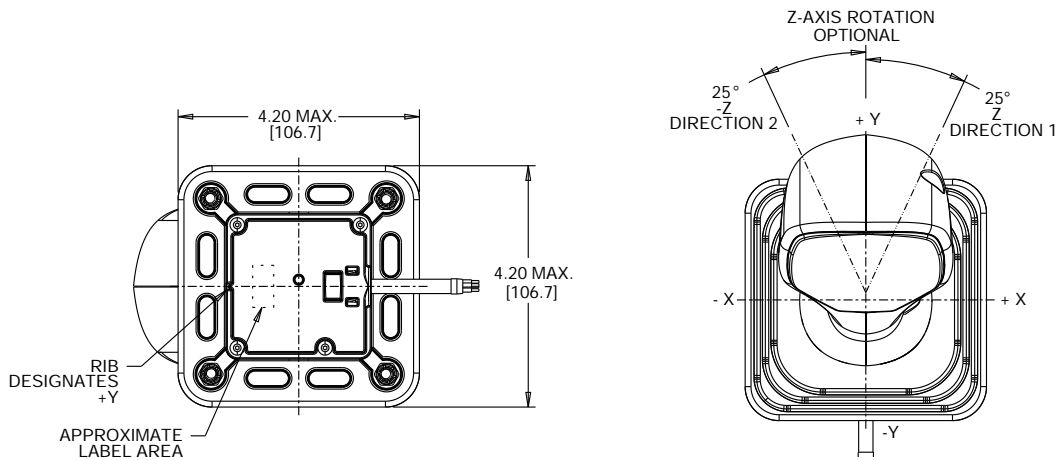
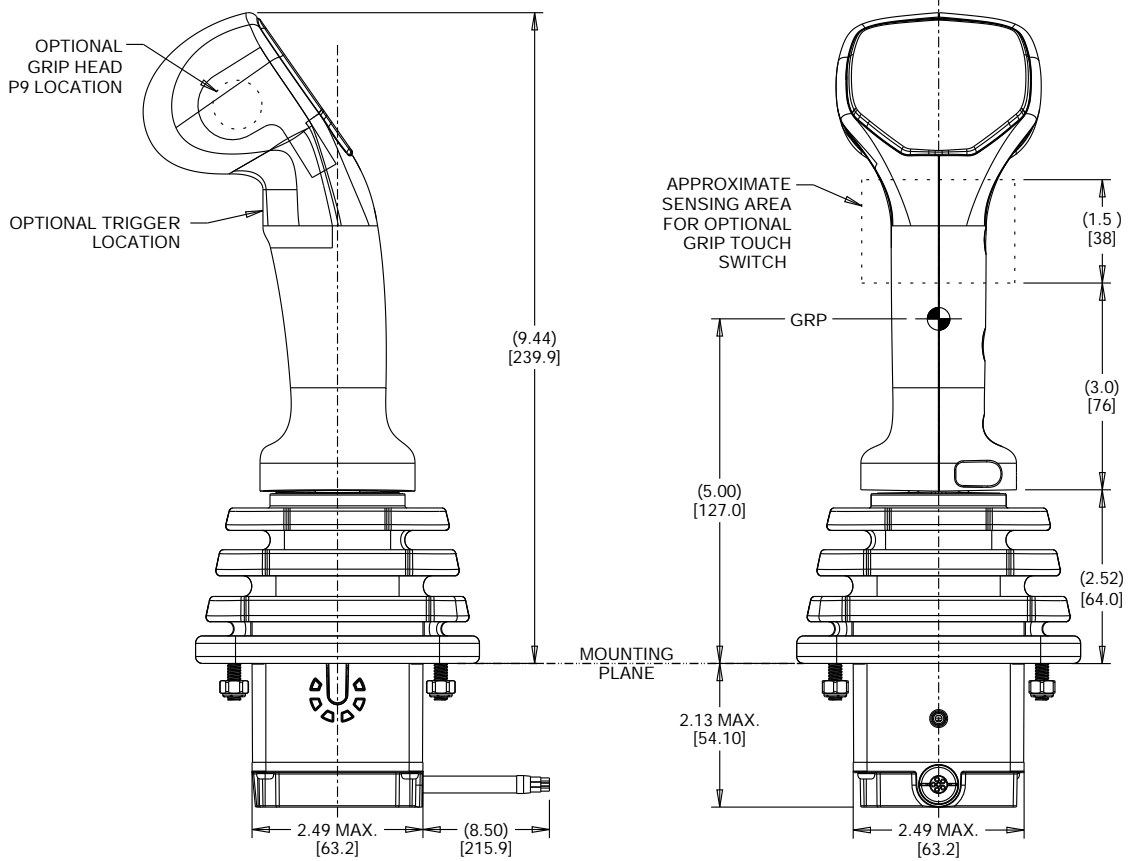
\*\*\* K1 Rocker Switches: on position or momentary position is up or to the right and ( ) denotes momentary action. Contact factory for rocker legends and additional color options.

\*\*\*\* HTW Roller Switches: positive travel is up or to the right. Contact factory for additional options.

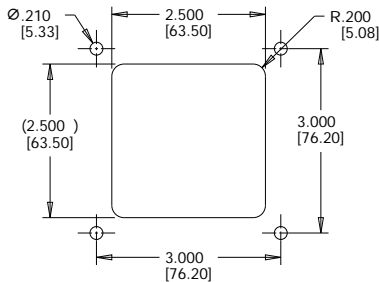
### HJLG3 GATING ICONS



## HJLG3-C DRAWINGS



### HJLG3 SUGGESTED PANEL OPENING

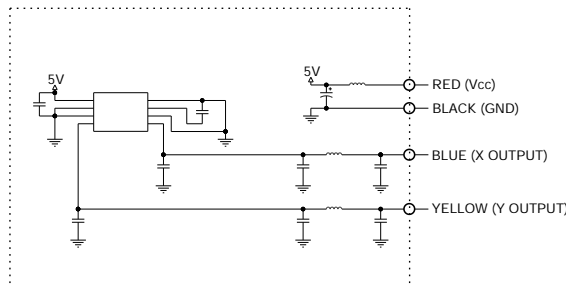
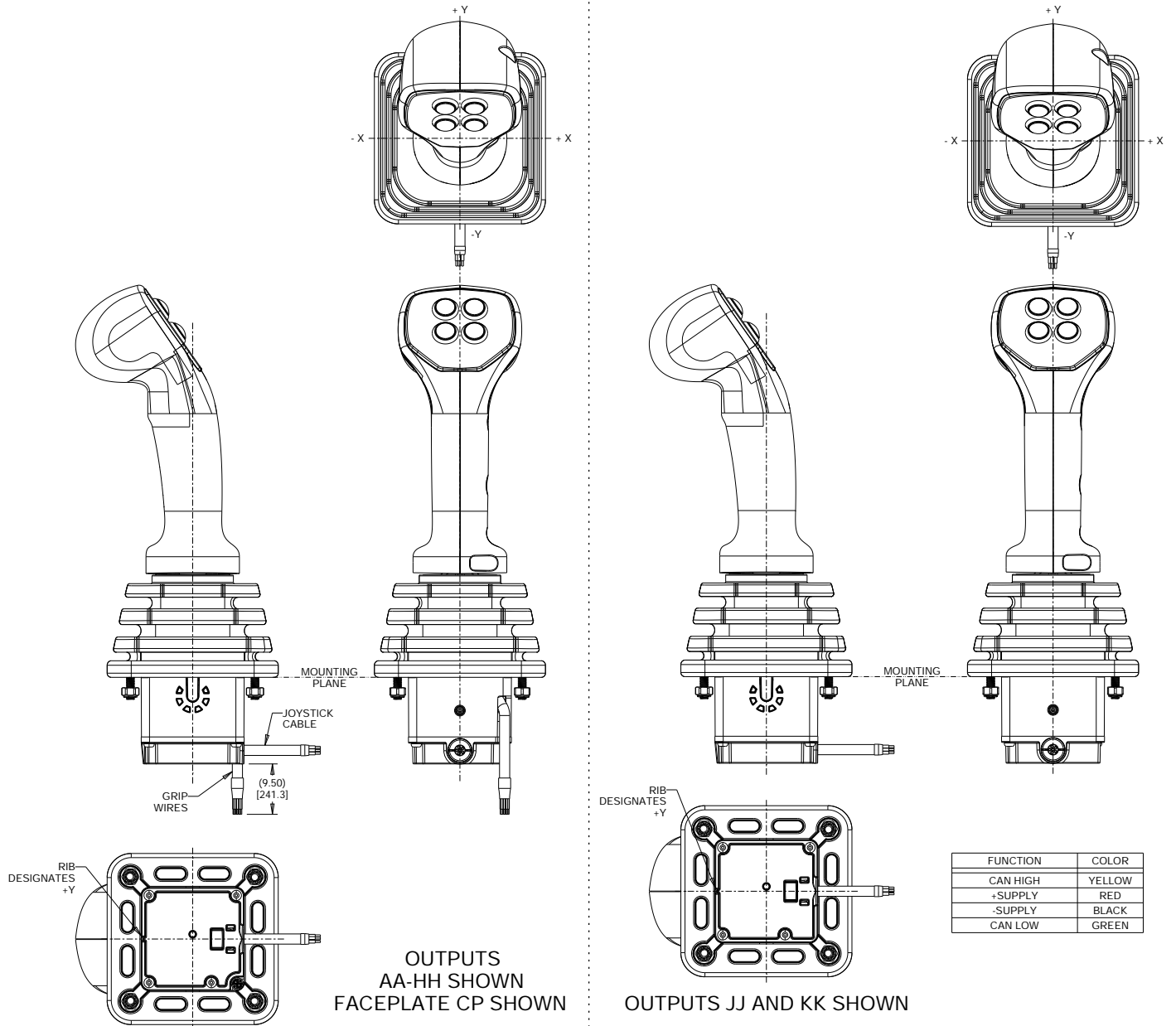


SUGGESTED PANEL OPENING  
MAX. PANEL THICKNESS OF .250

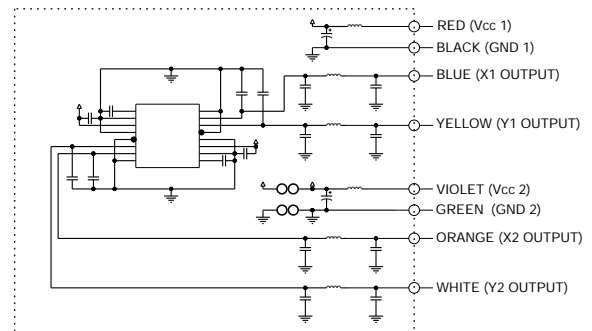
# JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

## HJLG3-C OUTPUTS AND JOYSTICK SCHEMATICS



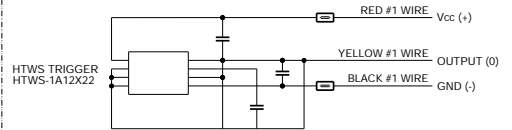
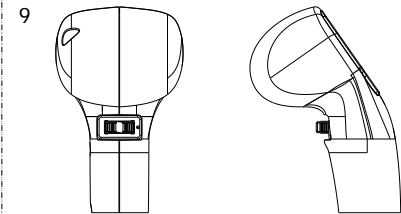
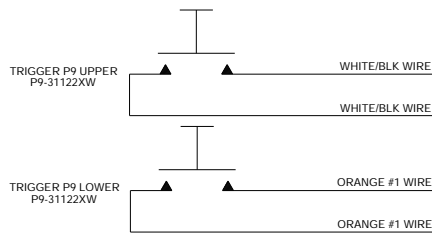
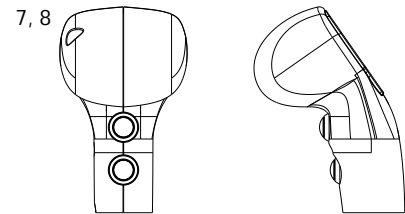
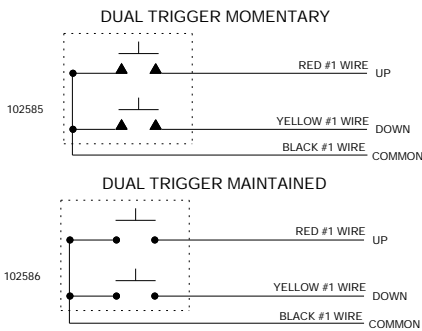
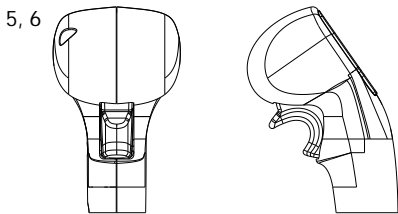
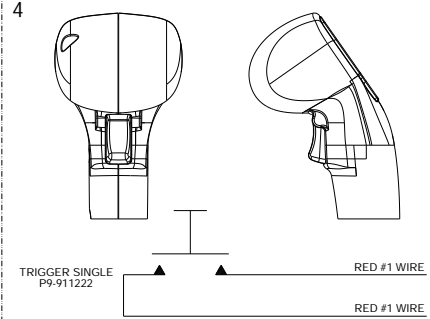
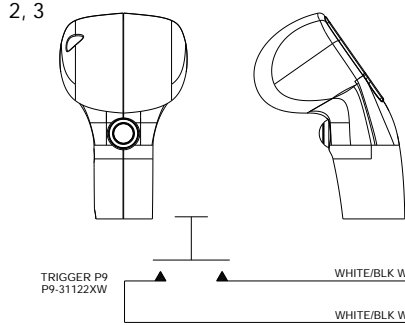
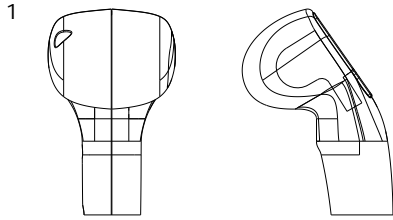
JOYSTICK SCHEMATIC  
(AA AND DD OUTPUTS)



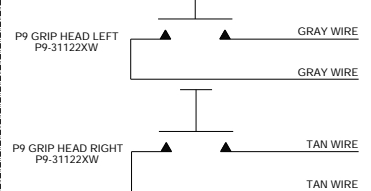
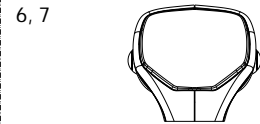
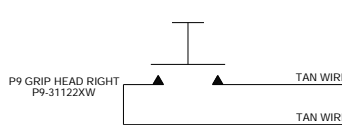
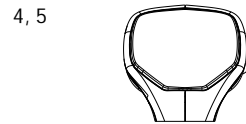
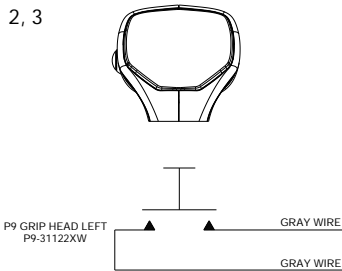
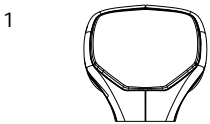
JOYSTICK SCHEMATIC  
(BB, CC, EE, FF, GG, & HH OUTPUTS)

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

## HJLG3-C TRIGGER OPTIONS



## HJLG3-C HEAD PUSHBUTTON OPTIONS

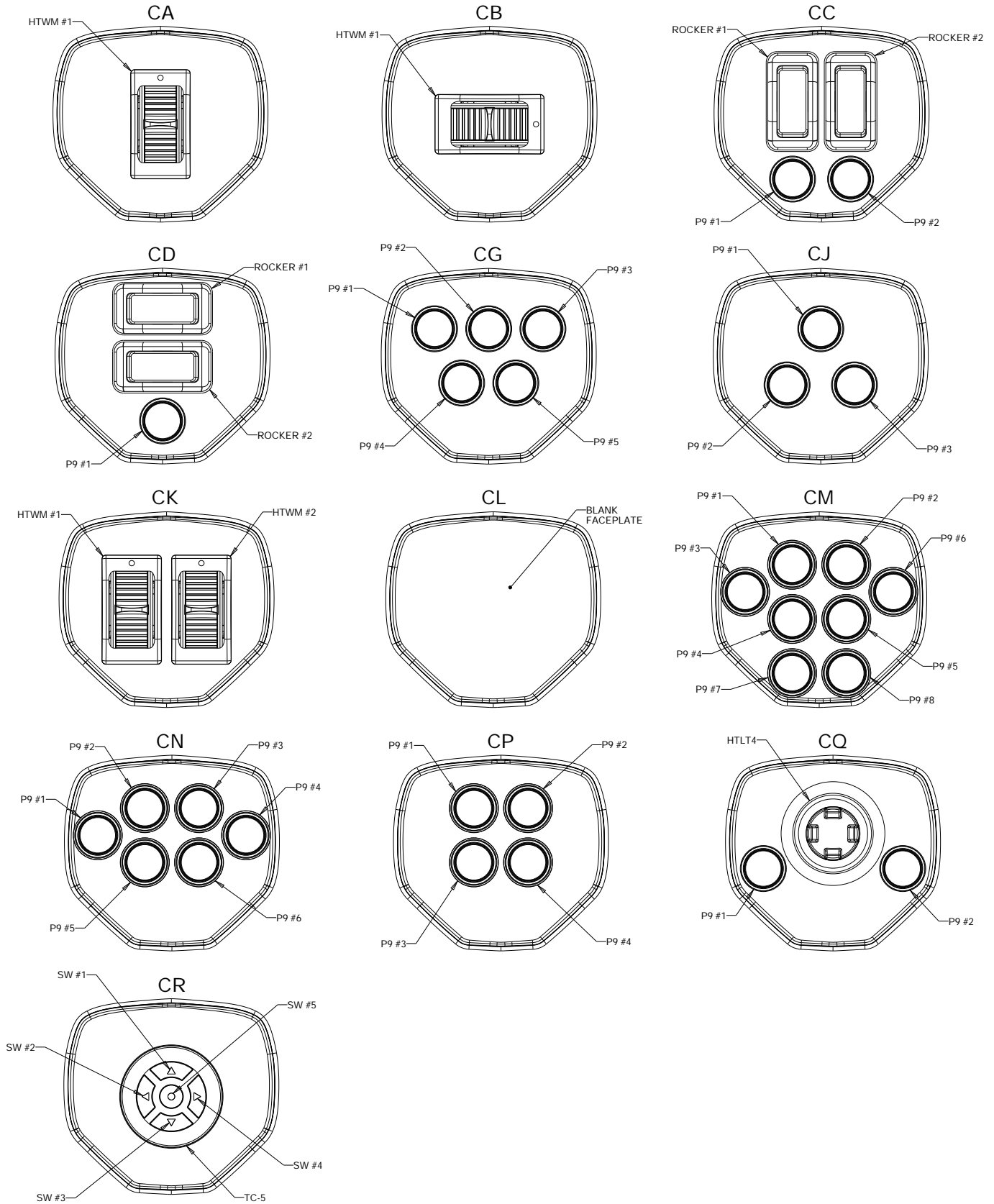


# JOYSTICK WITH GRIP OPTIONS

**HJLG3-C**  
MEDIUM  
JOYSTICK  
WITH GRIP

## HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

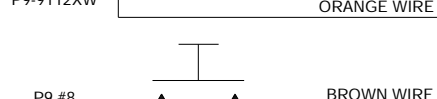
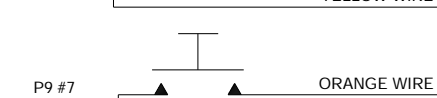
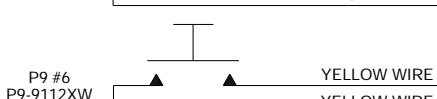
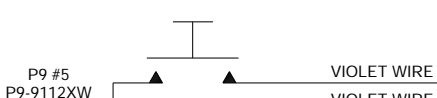
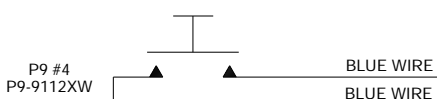
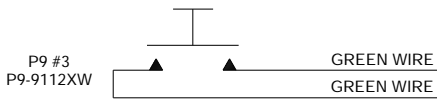
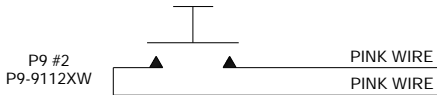
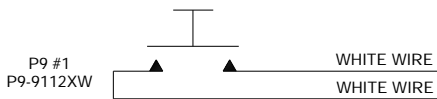
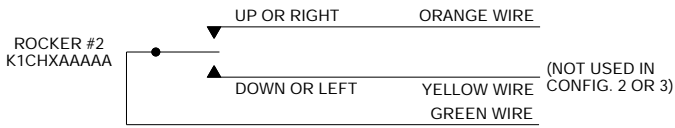
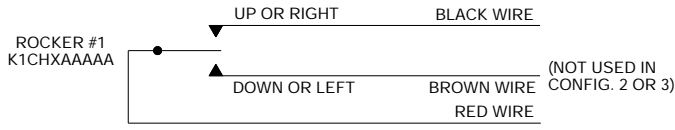
### HJLG3-C FACEPLATES



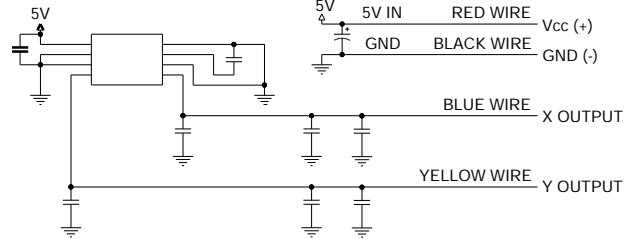
HALL EFFECT CONTROLS

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

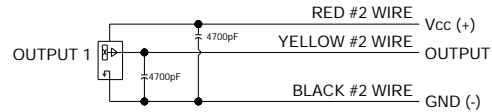
## HJLG3-C FACEPLATE SCHEMATICS



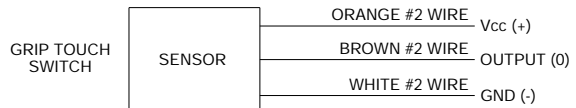
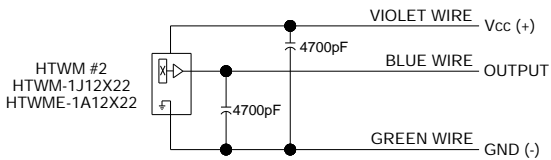
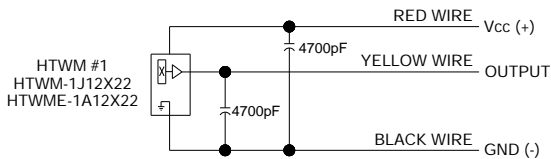
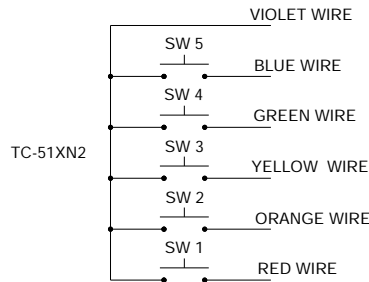
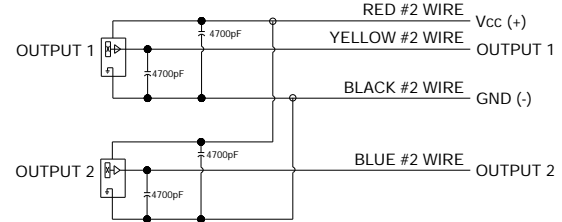
HTLT4-212111AAX2



Z-AXIS SINGLE OUTPUT



Z-AXIS DUAL OUTPUT





# JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

## HJLG3-C PART NUMBER CODE

HJLG3-C	X	X	XX	X	X	X	XX	Continued Below
Z-Axis/Grip Touch Switch	Gating	Joystick Output 1**	Joystick Output 2***	Operate Force	Trigger in Handle	Grip Head Pushbutton	Faceplate	
1. No Z-Axis with No Grip Touch	1. Gated Single Y-Axis; Return to Center	AA. 2.5 +/- 2.0VDC	NONE	2. Medium	1. None	1. None	CA	
2. No Z-Axis with Grip Touch* ① ②	2. Gated Dual Axis; Return to Center	BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	3. High	2. P9 - Black	2. Left (Black)	CB	
3. Z-Axis (Single Output) with No Grip Touch	3. Omni-directional; Center Detent Feel	CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		3. P9 - Red	3. Left (Red)	CC	
4. Z-Axis (Dual Output) with No Grip Touch	4. Omni-directional; On-Axis and Off-Axis Guided Feel	DD. 2.5 +/- 1.5VDC	NONE		4. Single	4. Right (Black)	CD	
5. Z-Axis (Single Output) with Grip Touch* ① ②	5. Gated Single Y-Axis; Center Detent Feel	EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		5. Dual Momentary*	5. Right (Red)	CG	
6. Z-Axis (Dual Output) with Grip Touch* ① ②	8. Omni-directional; Square Smooth Feel	FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		6. Dual Maintained*	6. Left and Right (Black)	CJ	
	9. Omni-directional; Square On-Axis Guided Feel	GG. 0.5 - 4.5VDC	0.5 - 4.5VDC		7. 2 P9s - Black	7. Left and Right (Red)	CK	
		HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		8. 2 P9s - Red		CL	
		JJ. CANbus J1939	NONE		9. HTWS - Black③		CM	
		KK. CANopen	NONE				CN	
							CP	
							CQ	
							CR	

## HJLG3-C PART NUMBER CODE CONTINUED

Cont.	X	X	X	X	X
	K1 Rocker #1 Style - Black④	K1 Rocker #2 Style - Black④	HTWM #1 Roller - Black⑤	HTWM #2 Roller - Black⑤	P9 Faceplate Button Color
	1. None	1. None	1. None	1. None	1. Red
	2. On-Off	2. On-Off	2. Return to Center <sup>1</sup>	2. Return to Center	2. Black
	3. (On)-Off	3. (On)-Off	3. Return to End <sup>2</sup>	3. Return to End	3. Orange
	4. On-Off-On	4. On-Off-On			4. Yellow
	5. (On)-Off-(On)	5. (On)-Off-(On)	1= HTWM-1J12X22		5. Green
			2= HTWME-1A12X22		6. Blue
					7. Violet
					8. Gray
					9. White
					N. None

\*Grip Touch is not available with trigger option 5 or 6.

\*\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y direction from 1 output per axis.

Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) from 2 outputs per axis.

\*\*\*Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

① Warning On Personal Injury And Any Use As Safety Related: Do not use these products as safety or emergency stop devices or in any application where failure of the product could result in personal injury. Failure to comply with these instructions could result in death or serious injury. OTTO Engineering Inc. makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does OTTO Engineering Inc. assume any liability whatsoever arising out of the application or use of any product. The product sold hereunder by OTTO has been subject to limited testing and should not be used in conjunction with detection of the presence of an operator on or with any equipment that is in any way safety related. OTTO does not accept any liability for incidental, consequential damages, personal injury or loss of life for any claims against the use of this product.

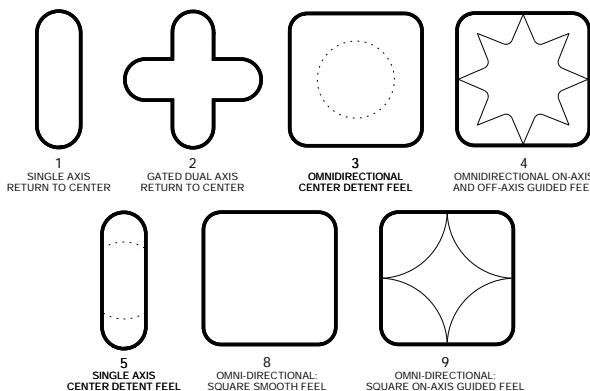
② User Caution: To guarantee the intended operating characteristics of the capacitive switches, the zone around the switch must be free from materials which can affect switch performance. Those materials include but are not limited to water, cleaning solutions, and other conductive materials. Failure to maintain this contaminant free zone may result in unintended actuation of the capacitive switch.

③ HTWS Trigger Switches: positive travel is to the right. Contact factory for additional options.

④ K1 Rocker Switches: on position or momentary position is up or to the right and ( ) denotes momentary action. Contact factory for rocker legends and additional color options.

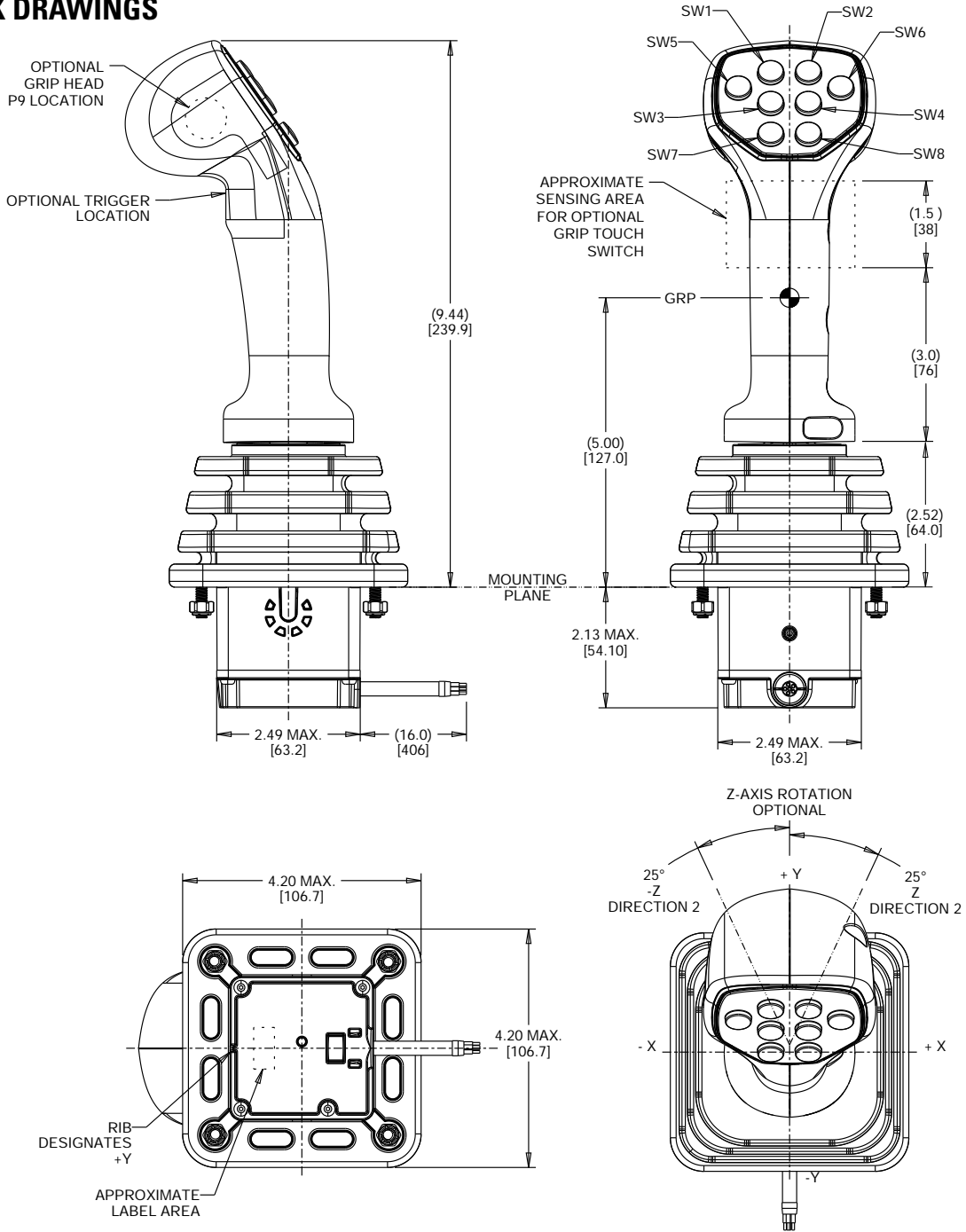
⑤ HTWM Roller Switches: positive travel is up or to the right. Contact factory for additional options.

## HJLG3 GATING ICONS

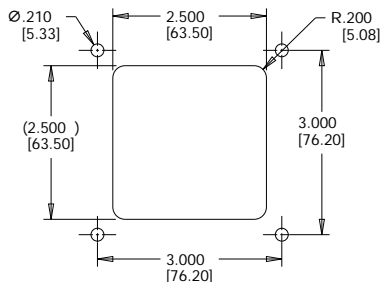


HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

## HJLG3-CK DRAWINGS



## HJLG3 SUGGESTED PANEL OPENING



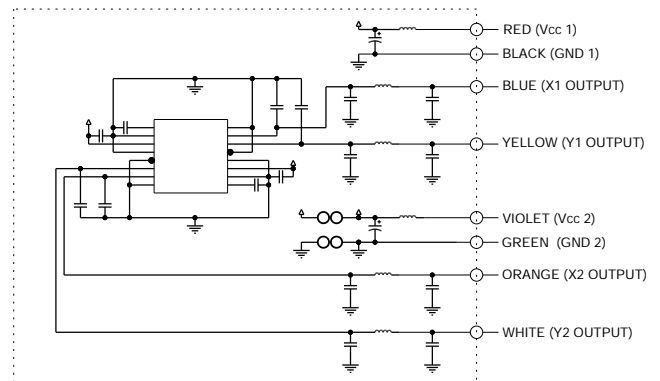
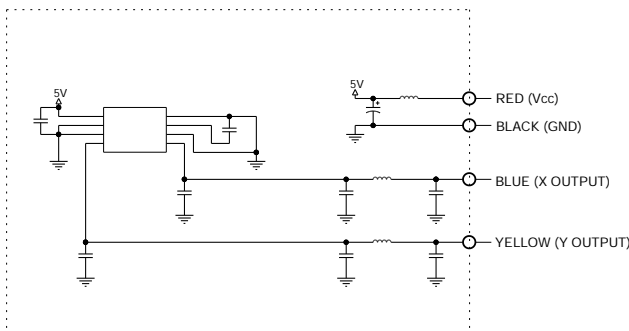
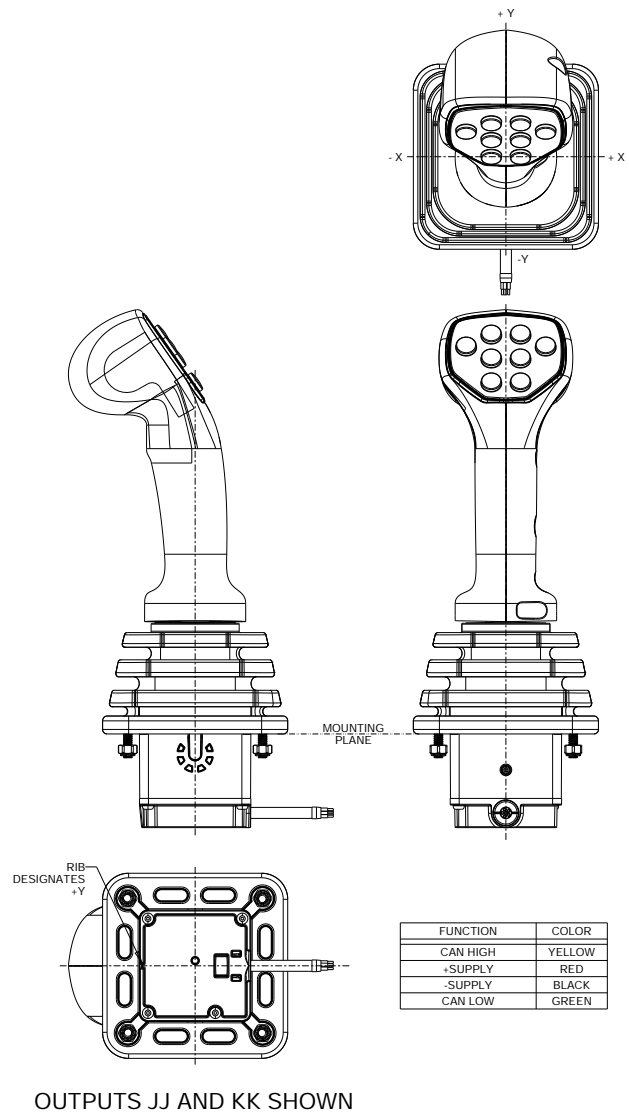
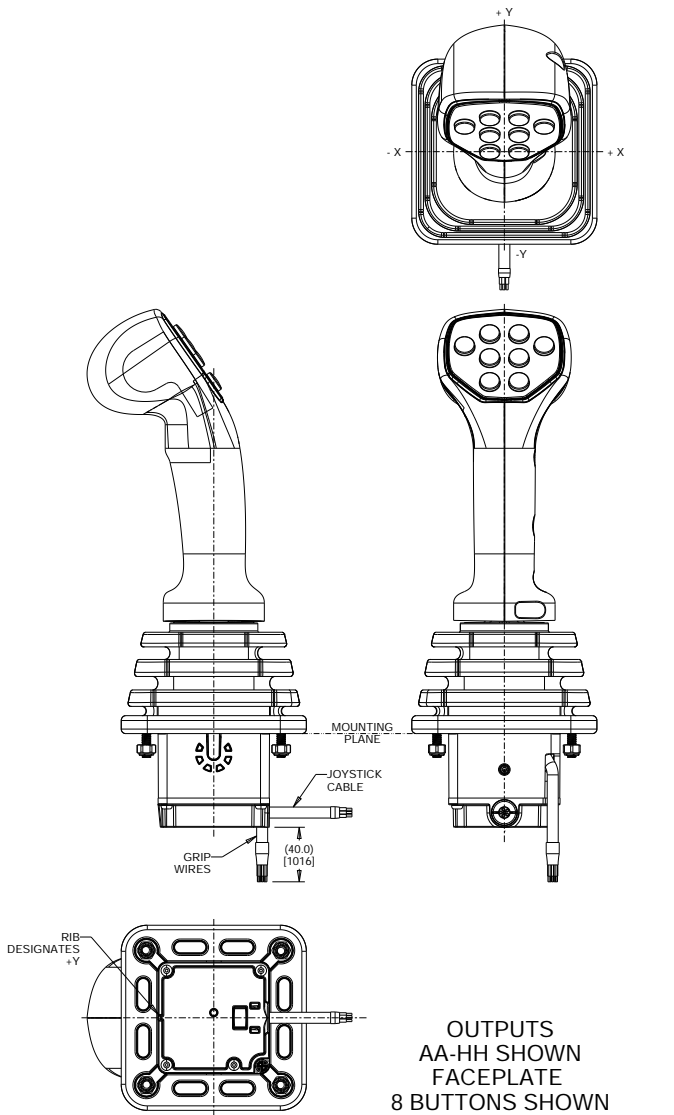
SUGGESTED PANEL OPENING  
MAX. PANEL THICKNESS OF .250

# JOYSTICK WITH GRIP OPTIONS

**HJLG3-CK**  
MEDIUM  
JOYSTICK  
WITH GRIP

HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

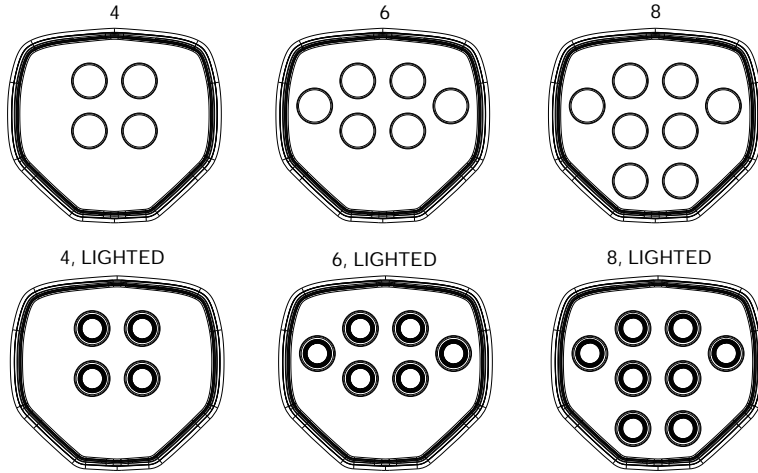
## HJLG3-CK OUTPUTS AND JOYSTICK SCHEMATICS



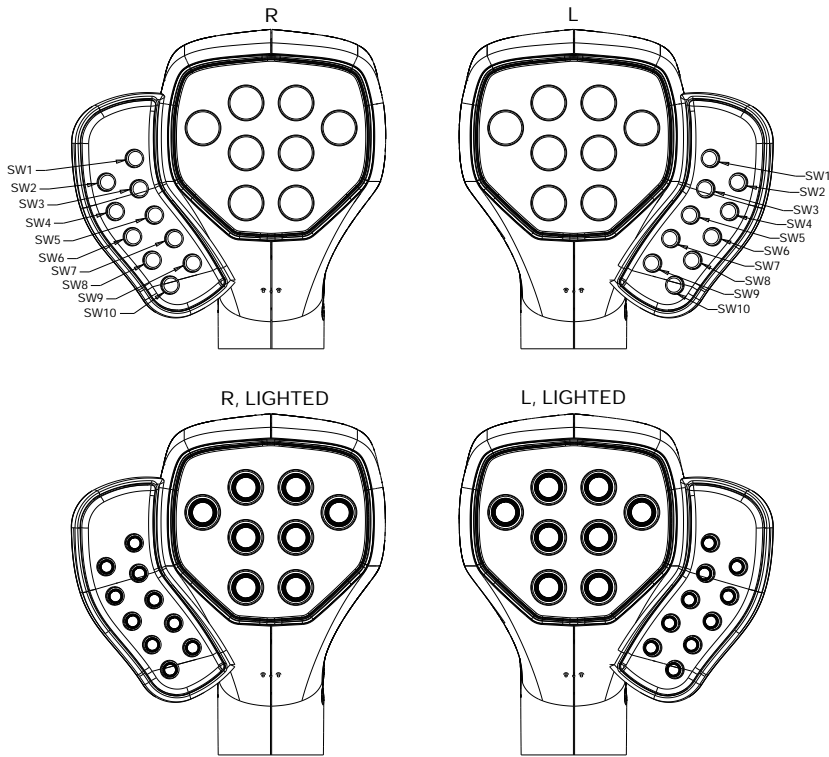
HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

## HJLG3-CK KEYPAD CONFIGURATIONS AND SCHEMATICS

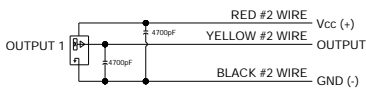
### CENTER KEYPAD CONFIGURATIONS



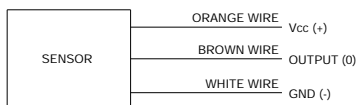
### SIDE KEYPAD CONFIGURATIONS



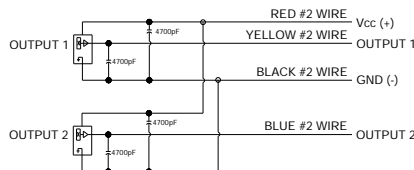
Z-AXIS SINGLE OUTPUT



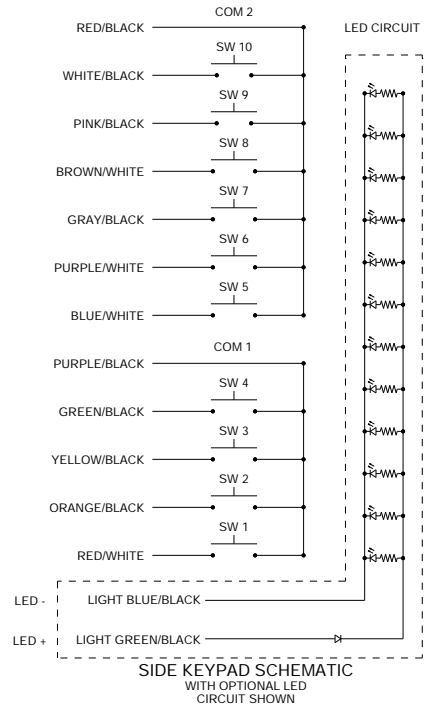
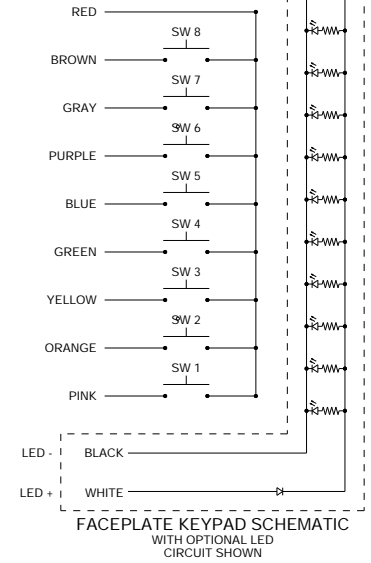
GRIP TOUCH SWITCH



Z-AXIS DUAL OUTPUT



### SCHEMATICS

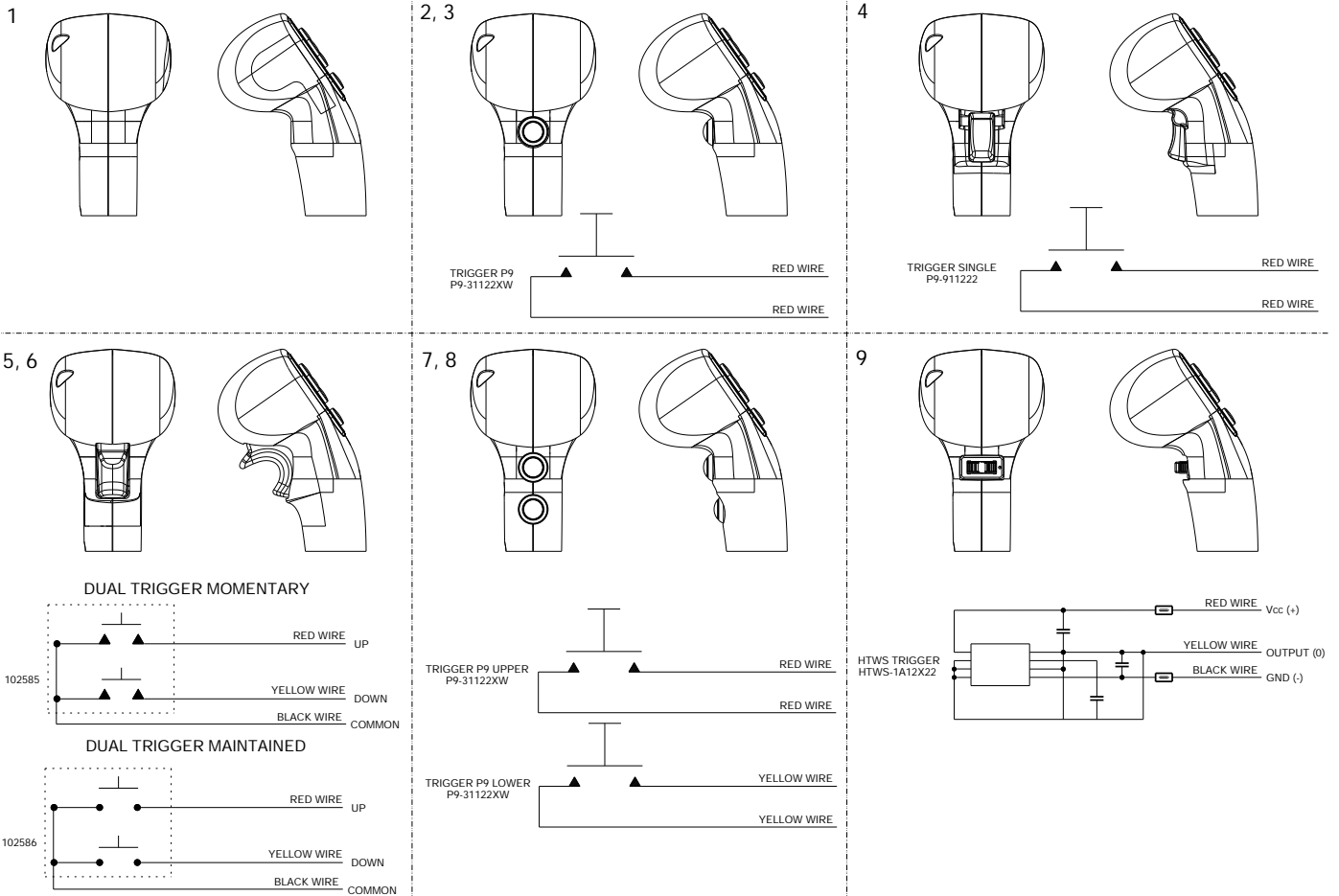


# JOYSTICK WITH GRIP OPTIONS

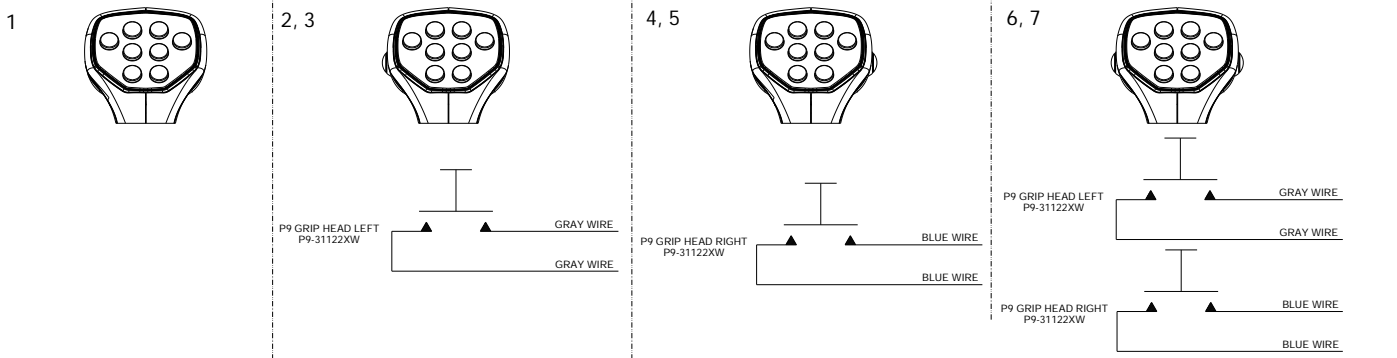
**HJLG3-CK**  
MEDIUM  
JOYSTICK  
WITH GRIP

## HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

### HJLG3-CK TRIGGER OPTIONS



### HJLG3-CK HEAD PUSHBUTTON OPTIONS



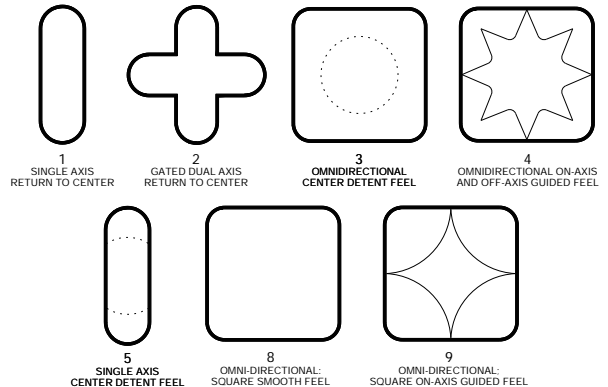
## HJLG3-CK PART NUMBER CODE

<p><b>HJLG3-CK</b> - <b>X</b></p> <p><b>Z-Axis/Grip Touch Switch*</b></p> <ol style="list-style-type: none"> <li>No Z-Axis with No Grip Touch Switch</li> <li>No Z-Axis with Grip Touch Switch** ① ②</li> <li>Z-Axis (Single Output) with No Grip Touch Switch</li> <li>Z-Axis (Dual Output) with No Grip Touch Switch</li> <li>Z-Axis (Single Output) with Grip Touch Switch** ① ②</li> <li>Z-Axis (Dual Output) with Grip Touch Switch** ① ②</li> </ol>	<p><b>X</b></p> <p><b>Gating</b></p> <ol style="list-style-type: none"> <li>Gated Single Y-Axis; Return to Center</li> <li>Gated Dual Axis; Return to Center</li> <li>Omni-directional; Center Detent Feel</li> <li>Omni-directional; On-Axis and Off-Axis Guided Feel</li> <li>Gated Single Y-Axis; Center Detent Feel</li> <li>Omni-directional; Square Smooth Feel</li> <li>Omni-directional; Square On-Axis Guided Feel</li> </ol>	<p><b>XX</b></p> <table border="0"> <tr> <td style="vertical-align: top;"> <p><b>Joystick Output 1***</b></p> <p><b>AA.</b> 2.5 +/- 2.0VDC</p> <p><b>BB.</b> 2.5 +/- 2.0VDC</p> <p><b>CC.</b> 2.5 +/- 2.0VDC</p> <p><b>DD.</b> 2.5 +/- 1.5VDC</p> <p><b>EE.</b> 2.5 +/- 1.5VDC</p> <p><b>FF.</b> 2.5 +/- 1.5VDC</p> <p><b>GG.</b> 0.5 - 4.5VDC</p> <p><b>HH.</b> 1.0 - 4.0VDC</p> <p><b>JJ.</b> CANbus J1939</p> <p><b>KK.</b> CANopen</p> </td> <td style="vertical-align: top;"> <p><b>Joystick Output 2****</b></p> <p>NONE</p> <p>2.5 +/- 2.0VDC</p> <p>2.5 +/- 2.0VDC</p> <p>NONE</p> <p>2.5 +/- 1.5VDC</p> <p>2.5 +/- 1.5VDC</p> <p>0.5 - 4.5VDC</p> <p>1.0 - 4.0VDC</p> <p>NONE</p> <p>NONE</p> </td> </tr> </table>	<p><b>Joystick Output 1***</b></p> <p><b>AA.</b> 2.5 +/- 2.0VDC</p> <p><b>BB.</b> 2.5 +/- 2.0VDC</p> <p><b>CC.</b> 2.5 +/- 2.0VDC</p> <p><b>DD.</b> 2.5 +/- 1.5VDC</p> <p><b>EE.</b> 2.5 +/- 1.5VDC</p> <p><b>FF.</b> 2.5 +/- 1.5VDC</p> <p><b>GG.</b> 0.5 - 4.5VDC</p> <p><b>HH.</b> 1.0 - 4.0VDC</p> <p><b>JJ.</b> CANbus J1939</p> <p><b>KK.</b> CANopen</p>	<p><b>Joystick Output 2****</b></p> <p>NONE</p> <p>2.5 +/- 2.0VDC</p> <p>2.5 +/- 2.0VDC</p> <p>NONE</p> <p>2.5 +/- 1.5VDC</p> <p>2.5 +/- 1.5VDC</p> <p>0.5 - 4.5VDC</p> <p>1.0 - 4.0VDC</p> <p>NONE</p> <p>NONE</p>	<p><b>X</b></p> <p><b>Operate Force</b></p> <ol style="list-style-type: none"> <li>Medium</li> <li>High</li> </ol>	<p><b>X</b></p> <p><b>Trigger in Handle*</b></p> <ol style="list-style-type: none"> <li>None</li> <li>P9 - Black</li> <li>P9 - Red</li> <li>Single</li> <li>Dual Momentary</li> <li>Dual Maintained</li> <li>2 P9s - Black</li> <li>2 P9s - Red</li> <li>HTWS - Black③</li> </ol>	<p><b>X</b> Continued Below</p> <p><b>Grip Head Pushbutton*</b></p> <ol style="list-style-type: none"> <li>None</li> <li>Left (Black)</li> <li>Right (Black)</li> <li>Left and Right (Black)</li> <li>Left (Red)</li> <li>Right (Red)</li> <li>Left and Right (Red)</li> </ol>
<p><b>Joystick Output 1***</b></p> <p><b>AA.</b> 2.5 +/- 2.0VDC</p> <p><b>BB.</b> 2.5 +/- 2.0VDC</p> <p><b>CC.</b> 2.5 +/- 2.0VDC</p> <p><b>DD.</b> 2.5 +/- 1.5VDC</p> <p><b>EE.</b> 2.5 +/- 1.5VDC</p> <p><b>FF.</b> 2.5 +/- 1.5VDC</p> <p><b>GG.</b> 0.5 - 4.5VDC</p> <p><b>HH.</b> 1.0 - 4.0VDC</p> <p><b>JJ.</b> CANbus J1939</p> <p><b>KK.</b> CANopen</p>	<p><b>Joystick Output 2****</b></p> <p>NONE</p> <p>2.5 +/- 2.0VDC</p> <p>2.5 +/- 2.0VDC</p> <p>NONE</p> <p>2.5 +/- 1.5VDC</p> <p>2.5 +/- 1.5VDC</p> <p>0.5 - 4.5VDC</p> <p>1.0 - 4.0VDC</p> <p>NONE</p> <p>NONE</p>						

## HJLG3-CK PART NUMBER CODE CONTINUED

<p>Cont. <b>X</b></p> <p><b>Faceplate Keypad Configuration</b></p> <ol style="list-style-type: none"> <li>4 Buttons</li> <li>6 Buttons</li> <li>8 Buttons</li> </ol>	<p><b>X</b></p> <p><b>Side Keypad Configuration</b></p> <ol style="list-style-type: none"> <li>None</li> <li>L. Left Hand</li> <li>R. Right Hand</li> </ol>	<p><b>X</b></p> <p><b>Back Lighting ④</b></p> <ol style="list-style-type: none"> <li>None</li> <li>L. Lighted Faceplate Keypad &amp; Side Keypad</li> <li>F. Lighted Faceplate Keypad Only</li> <li>S. Lighted Side Keypad Only</li> </ol>
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## HJLG3 GATING ICONS



\*Wires from Z-Axis, Trigger, Head Position and Grip Touch Switch will be bundled in a shrink tube.

\*\*Grip Touch Switch is not available with trigger option 5 or 6.

\*\*\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y direction from 1 output per axis.

Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) from 2 outputs per axis.

\*\*\*\*Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

① Warning On Personal Injury And Any Use As Safety Related: Do not use these products as safety or emergency stop devices or in any application where failure of the product could result in personal injury. Failure to comply with these instructions could result in death or serious injury. OTTO Engineering Inc. makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does OTTO Engineering Inc. assume any liability whatsoever arising out of the application or use of any product. The product sold hereunder by OTTO has been subject to limited testing and should not be used in conjunction with detection of the presence of an operator on or with any equipment that is in any way safety related. OTTO does not accept any liability for incidental, consequential damages, personal injury or loss of life for any claims against the use of this product.

② User Caution: To guarantee the intended operating characteristics of the capacitive switches, the zone around the switch must be free from materials which can affect switch performance. Those materials include but are not limited to water, cleaning solutions, and other conductive materials. Failure to maintain this contaminant free zone may result in unintended actuation of the capacitive switch.

③ HTWS Trigger Switches: positive travel is to the right. Contact factory for additional options.

④ White LED's

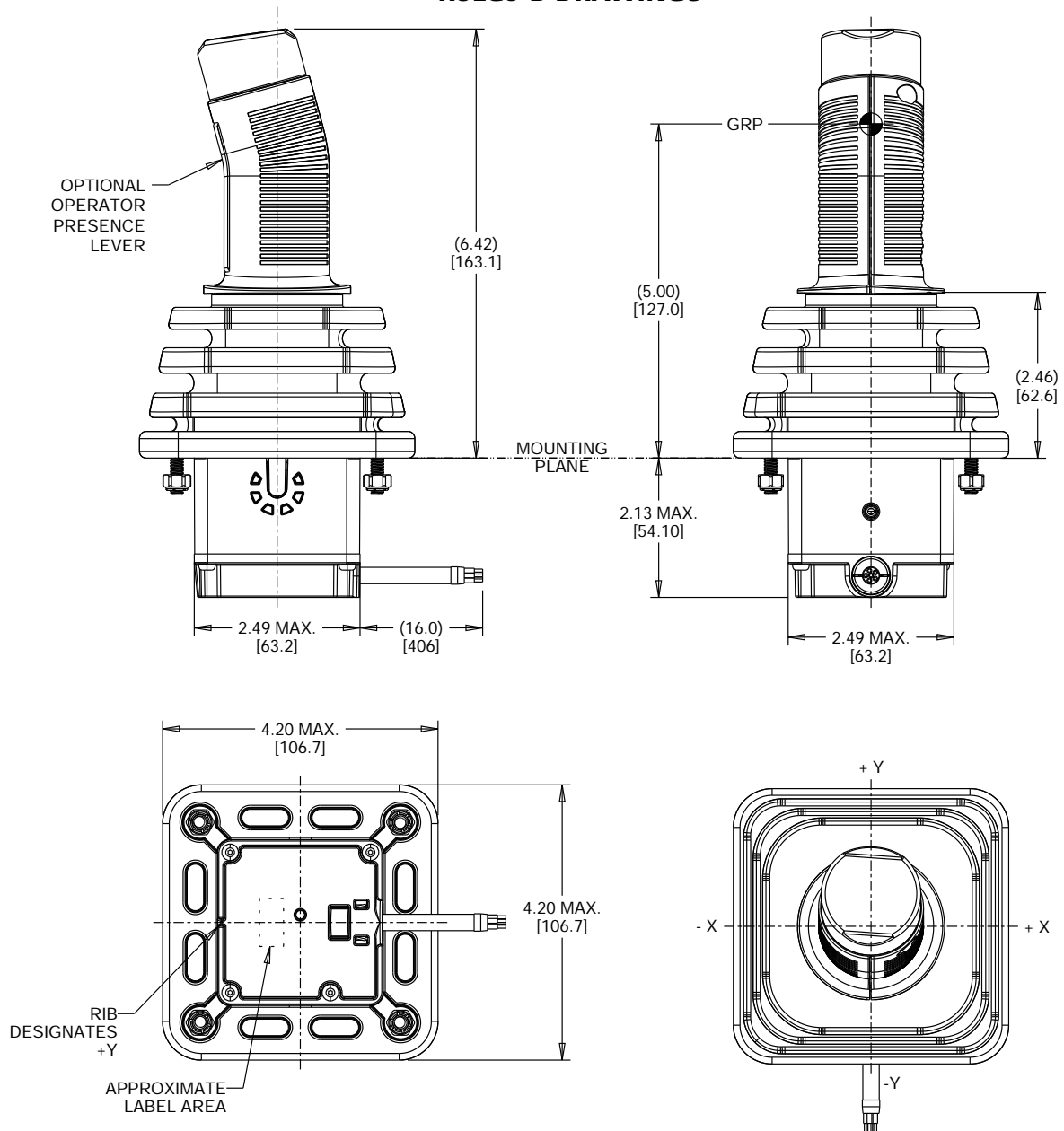
# JOYSTICK WITH GRIP OPTIONS

## HJLG3-D

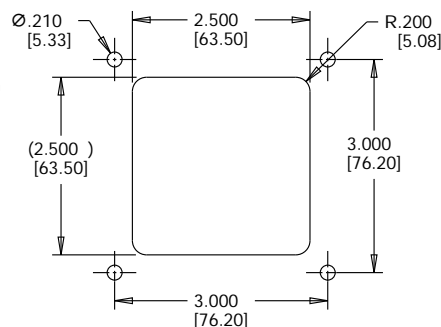
MEDIUM  
JOYSTICK  
WITH GRIP

HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

### HJLG3-D DRAWINGS



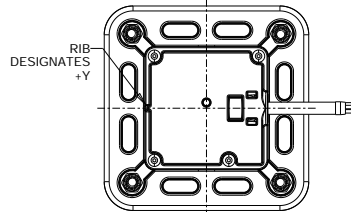
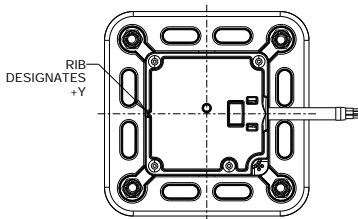
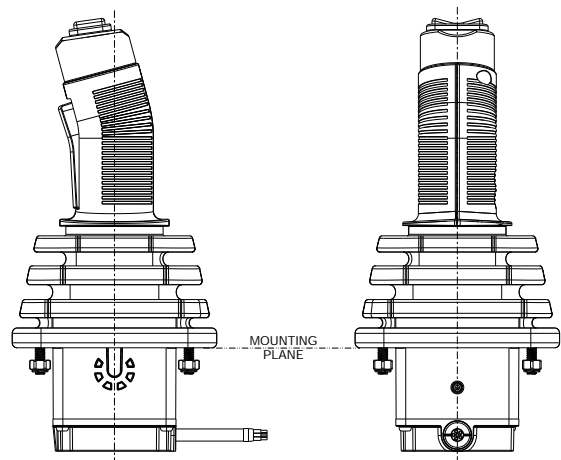
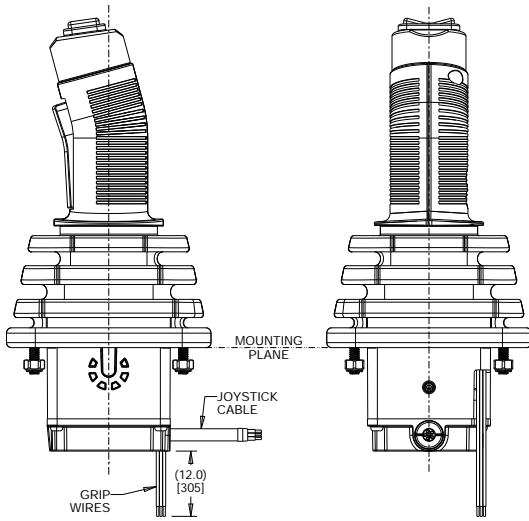
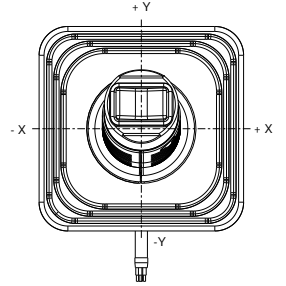
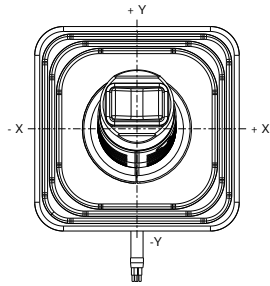
### HJLG3 SUGGESTED PANEL OPENING



SUGGESTED PANEL OPENING  
MAX. PANEL THICKNESS OF .250

HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

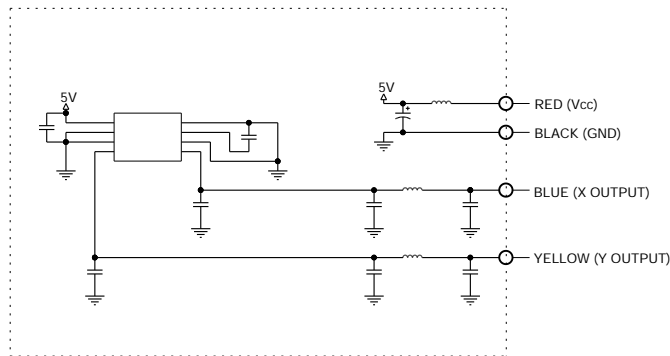
## HJLG3-D OUTPUTS AND JOYSTICK SCHEMATICS



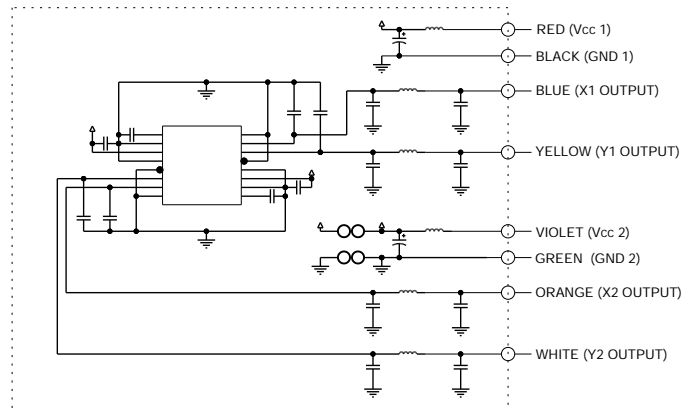
FUNCTION	COLOR
CAN HIGH	YELLOW
+SUPPLY	RED
-SUPPLY	BLACK
CAN LOW	GREEN

OUTPUTS  
AA-HH SHOWN

OUTPUTS JJ AND KK SHOWN



JOYSTICK SCHEMATIC  
(AA AND DD OUTPUTS)



JOYSTICK SCHEMATIC  
(BB, CC, EE, FF, GG, & HH OUTPUTS)



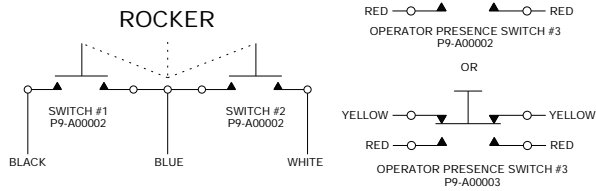
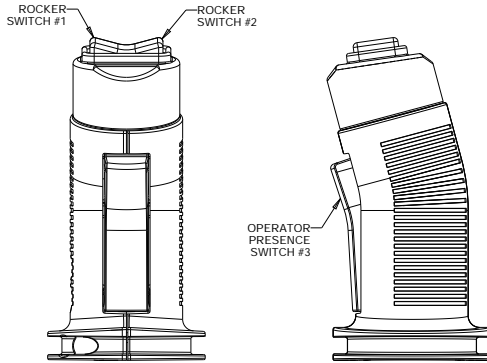
# JOYSTICK WITH GRIP OPTIONS

**HJLG3-D**  
MEDIUM  
JOYSTICK  
WITH GRIP

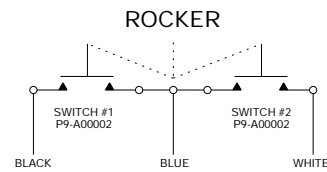
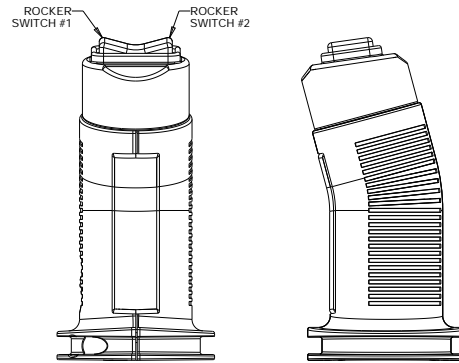
## HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

### HJLG3-D FACEPLATE OPTIONS

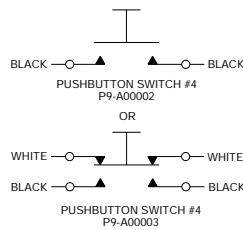
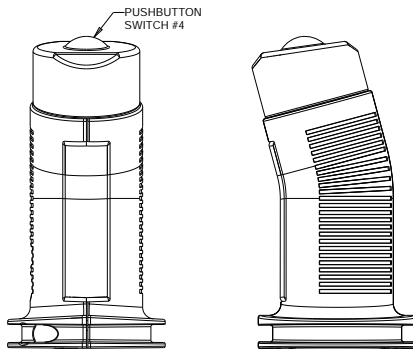
#### ROCKER AND OPERATOR PRESENCE



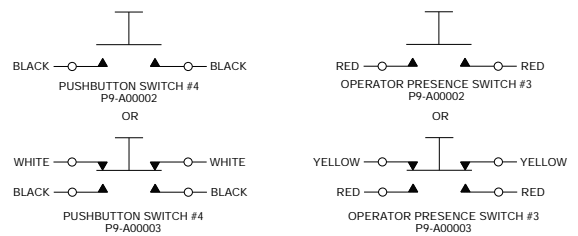
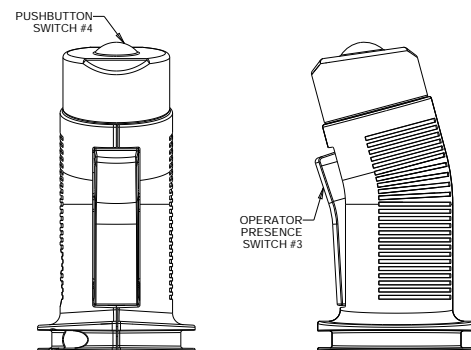
#### ROCKER



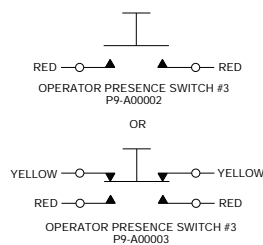
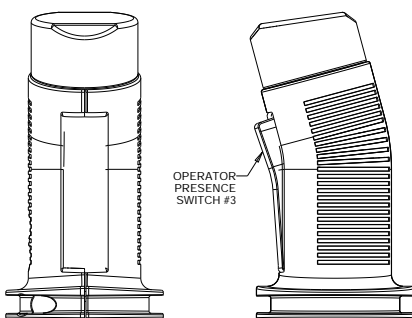
#### ONE PUSHBUTTON



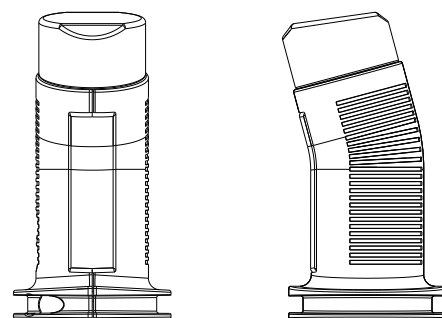
#### ONE PUSHBUTTON AND OPERATOR PRESENCE



#### NO PUSHBUTTON AND OPERATOR PRESENCE



#### BLANK



## HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

### HJLG3-D PART NUMBER CODE

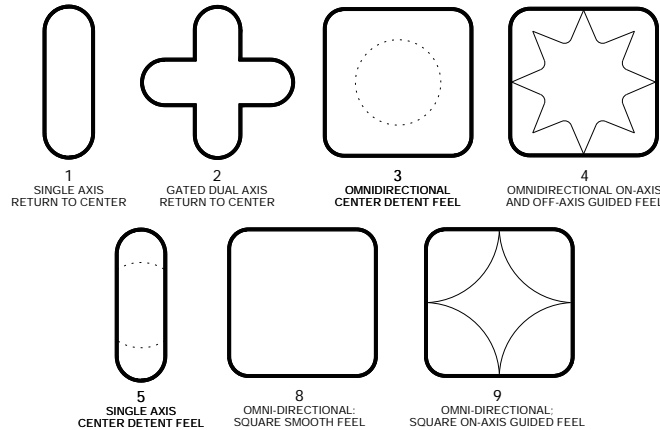
HJLG3-D	XX	X	XX	X	
Gating	Joystick Output 1*	Joystick Output 2**	Operate Force	Faceplate Options	
<b>1.</b> Gated Single Y-Axis; Return to Center <b>2.</b> Gated Dual Axis; Return to Center <b>3.</b> Omni-directional; Center Detent Feel <b>4.</b> Omni-directional; On-Axis and Off-Axis Guided Feel <b>5.</b> Gated Single Y-Axis; Center Detent Feel <b>8.</b> Omni-directional; Square Smooth Feel <b>9.</b> Omni-directional; Square On-Axis Guided Feel	<b>AA.</b> 2.5 +/- 2.0VDC <b>BB.</b> 2.5 +/- 2.0VDC <b>CC.</b> 2.5 +/- 2.0VDC <b>DD.</b> 2.5 +/- 1.5VDC <b>EE.</b> 2.5 +/- 1.5VDC <b>FF.</b> 2.5 +/- 1.5VDC <b>GG.</b> 0.5 - 4.5VDC <b>HH.</b> 1.0 - 4.0VDC <b>JJ.</b> CANbus J1939 <b>KK.</b> CANopen	NONE 2.5 +/- 2.0VDC 2.5 +/- 2.0VDC NONE 2.5 +/- 1.5VDC 2.5 +/- 1.5VDC 0.5 - 4.5VDC 1.0 - 4.0VDC NONE NONE	<b>1.</b> Low <b>2.</b> Medium <b>3.</b> High	<b>11.</b> Rocker (On)-Off-(On) and Operator Presence <b>22.</b> Rocker (On)-Off-(On) and No Operator Presence <b>33.</b> One Pushbutton and Operator Presence <b>44.</b> One Pushbutton and No Operator Presence <b>55.</b> No Pushbutton, No Rocker and Operator Presence <b>66.</b> No Pushbutton, No Rocker and No Operator Presence	<b>OP &amp; PB Configuration</b> <b>1.</b> None <sup>①</sup> <b>2.</b> Normally Open (NO) <b>3.</b> 2 Circuit (NO/NC) <sup>②</sup> <b>4.</b> 2 Circuit (NO/NC) <sup>③</sup>  <sup>①</sup> Can only be used with configurations 22 and 66. <sup>②</sup> For options 11 (Operator Presence), 44, 55. <sup>③</sup> For option 33.

\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y direction from 1 output per axis.

Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) from 2 outputs per axis.

\*\*Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

### HJLG3 GATING ICONS



# MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS



Handle Style 32 with  
2 Pushbuttons



Handle Style 61  
with Rocker and  
5 Switches

The JHM series Medium Hall Effect Joystick is a full function operator control that will fit in an armrest, on a panel, or any other location where a shallow behind panel depth joystick is needed. It utilizes Hall effect technology for long life and reliability. Electronics are sealed up to IP68S with an operational life of ten million cycles in all directions.

The standard JHM offers 19 handle styles, 18 output configuration choices and 9 gating options.

Output options include CANopen, J1939, PWM, USB, analog and digital control outputs, and redundant sensors. The JHM offers a variety of switches and handle styles such as a ball handle, a lockout handle, a G3-D grip and handles with pushbuttons, rockers and 5-button keypads.

Gating options include single axis, dual axis, friction y-axis, and various omnidirectional selections that include omnidirectional round smooth feel, omnidirectional on-axis and off-axis guided feel and omnidirectional square on-axis guided feel.

## Features:

- **Designed for armrest & panel mounting**
- **Shorter behind panel depth**
- **Contactless analog output Hall effect technology**
- **Electronics sealed up to IP68S**
- **Up to 10 million operational cycles in all directions**
- **Available with a variety of grip & switch options**
- **Redundant sensors available**
- **Various output configurations**
  - CANopen
  - J1939
  - USB
  - PWM
  - Serial
  - Analog
- **Variety of gating options**
- **RoHS compliant**

### Standard Characteristics/Ratings:

**Sensor Type:** Hall effect analog, factory programmed with temperature compensation, ground and supply line break detection, and over voltage and reverse voltage protection options.

**Design:** Contactless sensing using dual bar permanent magnet

#### ELECTRICAL RATINGS: Joystick Rated at 5V @ 20°C, Load = 1ma (4.7kΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage, Vcc	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center AA, BB, CC, DD, EE, FF, GG & HH	5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Center AT, BT, CT, DT, ET & FT	5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance Full Travel	5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10.00
Output Source Current Limit	mA	-1.00	N/A	1.00

#### ELECTRICAL RATINGS: U2 Rated at Vcc = 5V @ 25°C, Load = 1ma (4.7kΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage, Vcc	VDC	4.5	5.0	5.5
Output Voltage +, - 0° Deflection	5V Vcc	2.25	2.50	2.75
Output at Full Travel Direction -Z	5V Vcc	0.45	0.50	0.75
Output at Full Travel Direction +Z	5V Vcc	4.25	4.50	4.55
Supply Current B-0, Vcc=5V, I <sub>o</sub> =0	mA	N/A	N/A	10.00

#### ELECTRICAL RATINGS: P9 Switches Rated at 10mA Resistive Load at 5VDC

**Electrical Life:** 1,000,000 cycles

#### MECHANICAL (JOYSTICK):

**Mechanical Life:** 5 Million Cycles, High Force  
10 Million Cycles, Low Force  
2.5 Million Cycles, Outputs JJ, KK,MM, Rear Mount  
250,000 Cycles, Friction Held, High Force  
Boot Life up to 1 Million Cycles

Mechanical (Operating Force w/Boot) Travel Angle	Units	Min	Typ	Max
	Degrees	18°	20°	22°
High Force @ 2" GRP (Return to Center)	Lbs.	0.5	1.25	2.0
Low Force @ 2" GRP (Return to Center)	Lbs.	0.5	1.0	1.5
High Force @ 3" GRP (Return to Center)	Lbs.	0.5	1.0	1.5
Low Force @ 3" GRP (Return to Center)	Lbs.	0.4	0.7	1.0
High Force @ 4" GRP (Return to Center) Handle Styles 51, 52, 53	Lbs.	1.2	2.5	3.8
Low Force @ 4" GRP (Return to Center) Handle Styles 51, 52, 53	Lbs.	0.4	0.8	1.2
High Force (w/Boot) Y Direction @ 2" GRP (Friction)	Lbs.	1.5	4.5	7.5
High Force (w/Boot) Friction @ 3" GRP, Y Direction	Lbs.	1.0	3.5	6.0
High Force (w/Boot) Friction @ 4" GRP (Handle Styles 51, 52, 53), Y Direction	Lbs.	0.8	2.4	4.0

#### MECHANICAL (U2 SWITCH): 2,500,000 Cycle Mechanical Life

Mechanical Operating Force	Units	Min	Typ	Max
	Oz.	3.5	6.5	9.5

#### MECHANICAL (P9 SWITCH): 1,250,000 Cycle Mechanical Life

Mechanical Operating Force	Units	Min	Typ	Max
	Oz.	8	12	16

#### MECHANICAL (KEYPAD PUSHBUTTONS): 3,000,000 Cycle Mechanical Life

Mechanical Operating Force	Units	Min	Typ	Max
	Oz.	2	8	10

#### ENVIRONMENTAL

<b>Electronics (Handles 11, 12, 21, 35, 41, 53, 71, 72)</b>	IP68S
<b>Seal</b>	Handle styles 34 and 35 panel sealed to IP68S
<b>RFI / EMI</b>	Withstand per SAE J1113

HALL EFFECT TECHNOLOGY JOYSTICK

## JHM PART NUMBER CODE

<p><b>JHM - XX</b></p> <p><b>Handle Style*</b></p> <ul style="list-style-type: none"> <li>11. No Handle ①</li> <li>12. Standard - Blank ①</li> <li>21. With Hall effect Rocker</li> <li>31. With Pushbutton-Top Handle, Half Boot</li> <li>32. With 2 Pushbuttons - Handle</li> <li>33. With 3 Pushbuttons</li> <li>34. With Pushbutton - Top Handle, Full Boot ②</li> <li>35. No Pushbutton - Top Handle, Full Boot ①②</li> <li>41. Lockout ①</li> <li>51. G3-D, Rocker and Operator Presence ②</li> <li>52. G3-D, Rocker ③</li> <li>53. G3-D, Blank ①③</li> <li>54. G3-D, Operator Presence</li> <li>61. 5-Button Keypad &amp; Hall Rocker Right ③⑤</li> <li>62. 5-Button Keypad &amp; Hall Rocker Left ③⑤</li> <li>63. 7-Button Keypad &amp; Hall Rocker Right ⑤</li> <li>64. 7-Button Keypad &amp; Hall Rocker Left ⑤</li> <li>71. Ball Handle, Large, Thermoset ①</li> <li>72. Ball Handle, Small, Rubber ①</li> </ul>	<p><b>X</b></p> <p><b>Gating</b></p> <ul style="list-style-type: none"> <li>1. Gated; Single axis – Return to Center</li> <li>2. Gated; Dual axis – Return to Center</li> <li>3. Omni-directional; Round Smooth Feel</li> <li>4. Omni-directional; On-Axis and Off-Axis Guided Feel</li> <li>5. Omni-directional; Round On-Axis Guided Feel</li> <li>6. Friction - Single axis ①④</li> <li>7. Friction Y-axis; Return to Center X-axis ①④</li> <li>8. Omni-directional; Square Smooth Feel</li> <li>9. Omni-directional; Square On-axis Guided Feel</li> </ul>	<p><b>X</b></p> <p><b>Force</b></p> <ul style="list-style-type: none"> <li>1. Low ④</li> <li>2. High</li> </ul>	<p><b>XX</b></p> <table border="0"> <tr> <td style="vertical-align: top;"> <p><b>Output 1**</b></p> <ul style="list-style-type: none"> <li>AA. 2.5 +/- 2.0VDC</li> <li>BB. 2.5 +/- 2.0VDC</li> <li>CC. 2.5 +/- 2.0VDC</li> <li>DD. 2.5 +/- 1.5VDC</li> <li>EE. 2.5 +/- 1.5VDC</li> <li>FF. 2.5 +/- 1.5VDC</li> <li>GG. 0.5 - 4.5VDC</li> <li>HH. 1.0 - 4.0VDC</li> <li>AT. 2.5 +/- 2.0VDC</li> <li>BT. 2.5 +/- 2.0VDC</li> <li>CT. 2.5 +/- 2.0VDC</li> <li>DT. 2.5 +/- 1.5VDC</li> <li>ET. 2.5 +/- 1.5VDC</li> <li>FT. 2.5 +/- 1.5VDC</li> <li>JJ. CANbus J1939</li> <li>KK. CANopen</li> <li>LL. PWM</li> <li>MM. USB</li> </ul> </td> <td style="vertical-align: top; padding-left: 20px;"> <p><b>Output 2</b></p> <ul style="list-style-type: none"> <li>NONE</li> <li>2.5 +/- 2.0VDC</li> <li>2.5 +/- 2.0VDC</li> <li>NONE</li> <li>2.5 +/- 1.5VDC</li> <li>2.5 +/- 1.5VDC</li> <li>0.5 - 4.5VDC</li> <li>1.0 - 4.0VDC</li> <li>NONE</li> <li>2.5 +/- 2.0VDC</li> <li>2.5 +/- 2.0VDC</li> <li>NONE</li> <li>2.5 +/- 1.5VDC</li> <li>2.5 +/- 1.5VDC</li> <li>NONE<sup>⑤</sup></li> <li>NONE<sup>⑤</sup></li> <li>NONE</li> <li>NONE<sup>⑤</sup></li> </ul> </td> </tr> </table>	<p><b>Output 1**</b></p> <ul style="list-style-type: none"> <li>AA. 2.5 +/- 2.0VDC</li> <li>BB. 2.5 +/- 2.0VDC</li> <li>CC. 2.5 +/- 2.0VDC</li> <li>DD. 2.5 +/- 1.5VDC</li> <li>EE. 2.5 +/- 1.5VDC</li> <li>FF. 2.5 +/- 1.5VDC</li> <li>GG. 0.5 - 4.5VDC</li> <li>HH. 1.0 - 4.0VDC</li> <li>AT. 2.5 +/- 2.0VDC</li> <li>BT. 2.5 +/- 2.0VDC</li> <li>CT. 2.5 +/- 2.0VDC</li> <li>DT. 2.5 +/- 1.5VDC</li> <li>ET. 2.5 +/- 1.5VDC</li> <li>FT. 2.5 +/- 1.5VDC</li> <li>JJ. CANbus J1939</li> <li>KK. CANopen</li> <li>LL. PWM</li> <li>MM. USB</li> </ul>	<p><b>Output 2</b></p> <ul style="list-style-type: none"> <li>NONE</li> <li>2.5 +/- 2.0VDC</li> <li>2.5 +/- 2.0VDC</li> <li>NONE</li> <li>2.5 +/- 1.5VDC</li> <li>2.5 +/- 1.5VDC</li> <li>0.5 - 4.5VDC</li> <li>1.0 - 4.0VDC</li> <li>NONE</li> <li>2.5 +/- 2.0VDC</li> <li>2.5 +/- 2.0VDC</li> <li>NONE</li> <li>2.5 +/- 1.5VDC</li> <li>2.5 +/- 1.5VDC</li> <li>NONE<sup>⑤</sup></li> <li>NONE<sup>⑤</sup></li> <li>NONE</li> <li>NONE<sup>⑤</sup></li> </ul>	<p><b>X</b></p> <p><b>Termination***</b></p> <ul style="list-style-type: none"> <li>1. Wire Leads 24 AWG SAE AS22759 ③</li> <li>2. Cable, 22AWG (19/34), PVC/Polyurethane Outer Jacket</li> <li>3. USB 2.0 HID Joystick USB Mini B</li> </ul>
<p><b>Output 1**</b></p> <ul style="list-style-type: none"> <li>AA. 2.5 +/- 2.0VDC</li> <li>BB. 2.5 +/- 2.0VDC</li> <li>CC. 2.5 +/- 2.0VDC</li> <li>DD. 2.5 +/- 1.5VDC</li> <li>EE. 2.5 +/- 1.5VDC</li> <li>FF. 2.5 +/- 1.5VDC</li> <li>GG. 0.5 - 4.5VDC</li> <li>HH. 1.0 - 4.0VDC</li> <li>AT. 2.5 +/- 2.0VDC</li> <li>BT. 2.5 +/- 2.0VDC</li> <li>CT. 2.5 +/- 2.0VDC</li> <li>DT. 2.5 +/- 1.5VDC</li> <li>ET. 2.5 +/- 1.5VDC</li> <li>FT. 2.5 +/- 1.5VDC</li> <li>JJ. CANbus J1939</li> <li>KK. CANopen</li> <li>LL. PWM</li> <li>MM. USB</li> </ul>	<p><b>Output 2</b></p> <ul style="list-style-type: none"> <li>NONE</li> <li>2.5 +/- 2.0VDC</li> <li>2.5 +/- 2.0VDC</li> <li>NONE</li> <li>2.5 +/- 1.5VDC</li> <li>2.5 +/- 1.5VDC</li> <li>0.5 - 4.5VDC</li> <li>1.0 - 4.0VDC</li> <li>NONE</li> <li>2.5 +/- 2.0VDC</li> <li>2.5 +/- 2.0VDC</li> <li>NONE</li> <li>2.5 +/- 1.5VDC</li> <li>2.5 +/- 1.5VDC</li> <li>NONE<sup>⑤</sup></li> <li>NONE<sup>⑤</sup></li> <li>NONE</li> <li>NONE<sup>⑤</sup></li> </ul>					

\* Wire loop not in handle style 11, 12, 35, 41, 53 and 71.

\*\*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF", "AT", "BT", "CT", "DT", "ET" and "FT" provide increased voltage in +x, +y; and decreasing voltage in -x, -y for output 1. Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) for output 1 and output 2.

Options "BB", "EE", "BT", "ET" provide redundant output 2 which duplicates output 1.

Options "CC", "FF", "CT", "FT" provide redundant output 2 which is inverse of output 1.

Options "AT", "BT", "CT", "DT", "ET" and "FT" are identical to options "AA", "BB", "CC", "DD", "EE", and "FF" respectively except with a tighter center tolerance.

\*\*\*Outputs "AA" through "FT" and "LL" utilize termination 1, outputs "JJ" and "KK" utilize termination 2, and output "MM" utilizes termination 3.

① Friction hold only available with handle styles 11, 12, 35, 41, 53, 71 and 72.

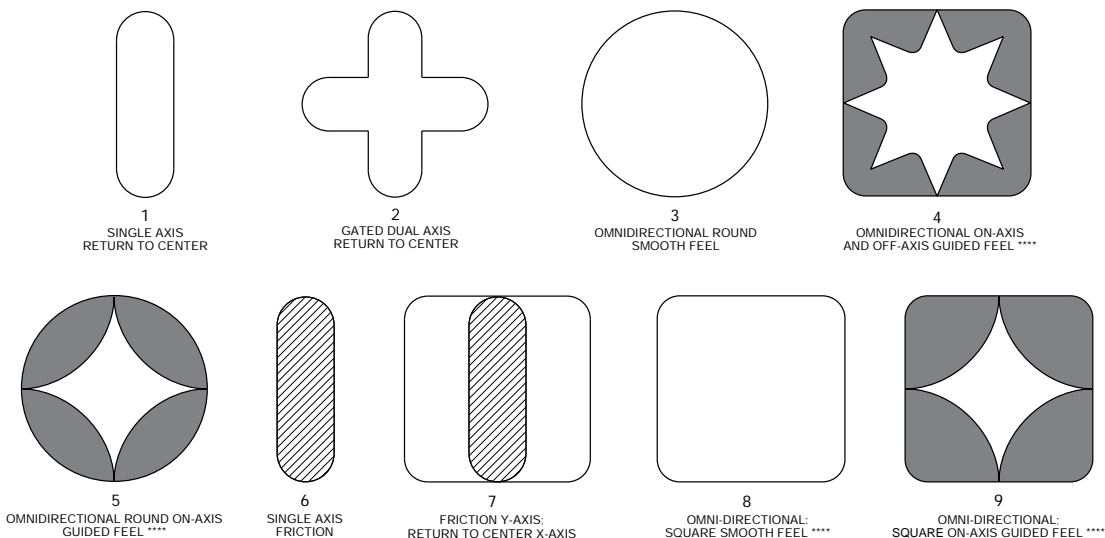
② Watertight panel seal applies to handle style 34 and 35.

③ Handle styles 61, 62 have the following wires for the 5-button switch array: 26 AWG, MIL-W-22759/33. Handle styles 52, 53 have the following wires for the handle wires: 22 AWG, UL1569.

④ Low force not available with gating options 6 and 7.

⑤ Outputs "JJ", "KK" and "MM" not available with handle styles 61, 62, 63 and 64.

### JHM GATING ICONS

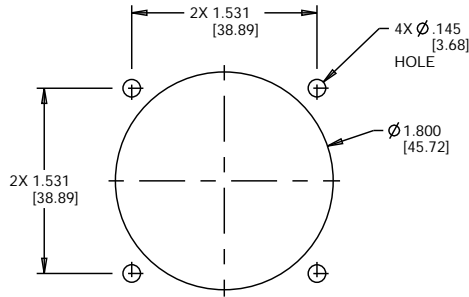


\*\*\*\* FEEL DEFINED BY SHADING

# MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

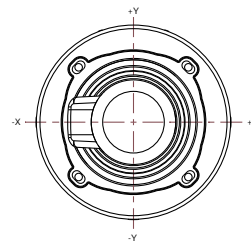
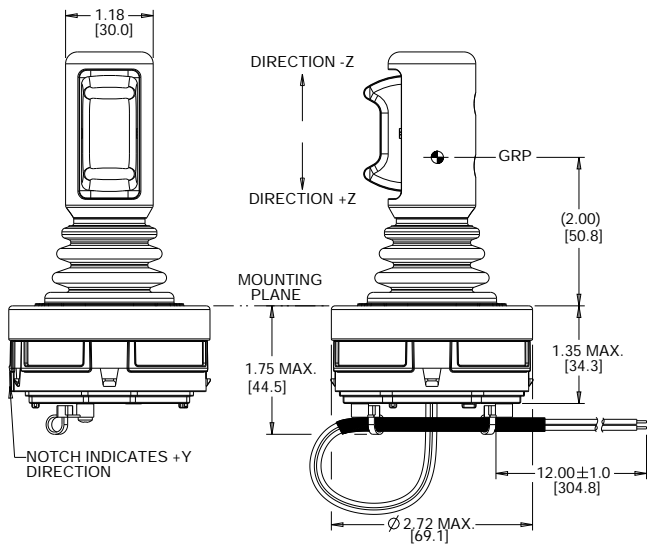
## JHM Suggested Panel Opening



SUGGESTED PANEL OPENING  
REAR MOUNT  
(ALL HANDLE STYLES EXCEPT HANDLE 51)  
PANEL THICKNESS .06

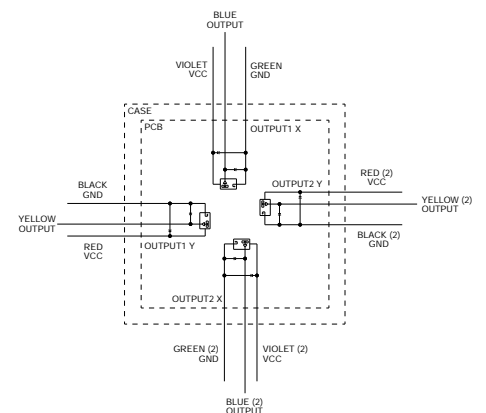
## Mounting Hardware Information

MOUNTING HARDWARE INFORMATION	
MATERIAL:	
MOUNTING HARDWARE (EXCEPT HANDLE STYLE 51)	4X M3X0.5X14MM



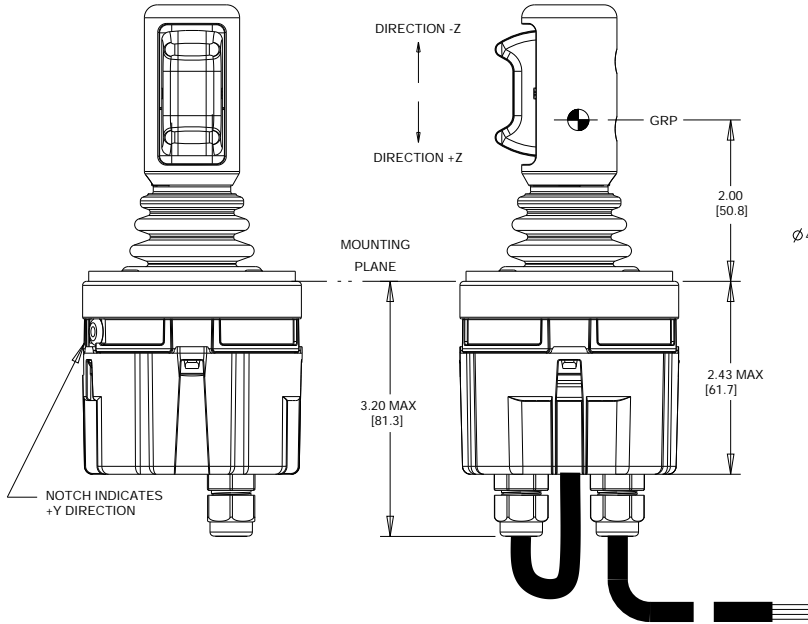
## JHM Outputs AA-FT and LL (Output Graph at end of JHM section)

PWM PRODUCT SPECIFICATIONS				
ELECTRICAL:				
PWM INTERFACE				
SUPPLY VOLTAGE, Vcc	VDC	4.5	N/A	18.0
OUTPUT FREQUENCY	Hz	460	500	540
AMPLITUDE LOW	A	0.0	N/A	.020
AMPLITUDE HIGH PULLUP REQUIRED	VDC	3.0	N/A	12.0
PWM OUTPUT @ +X AND +Y FULL TRAVEL	%	80.0	90.0	92.0
PWM OUTPUT @ ZERO TRAVEL	%	42.0	50.0	58.0
PWM OUTPUT @ -X AND -Y FULL TRAVEL	%	8.0	10.0	20.0



## HALL EFFECT TECHNOLOGY JOYSTICK

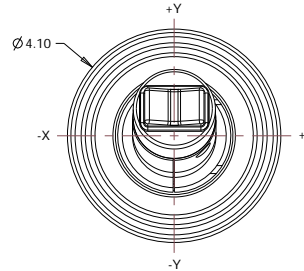
### Rear Mount Style



### JHM Outputs JJ and KK

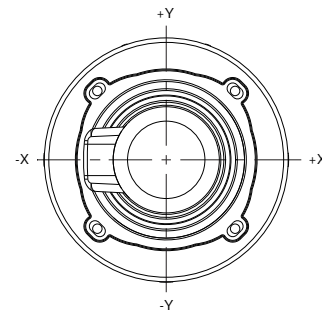
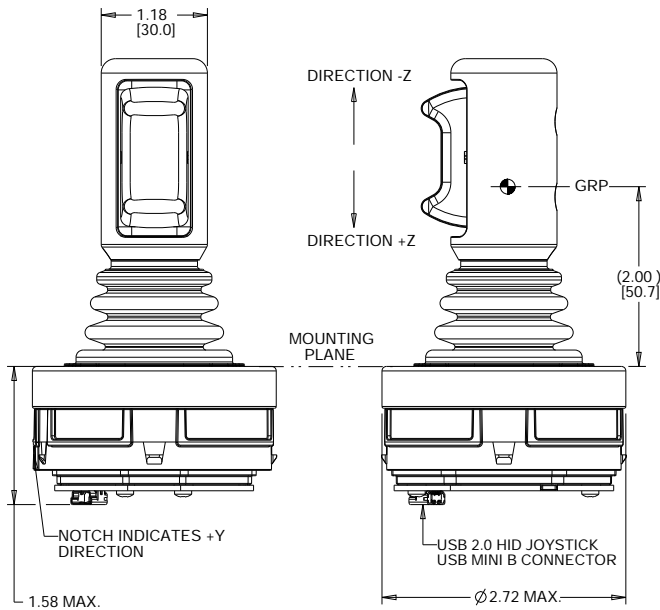
FUNCTION	COLOR
CAN HIGH	YELLOW
-SUPPLY	BLACK
+SUPPLY	RED
CAN LOW	GREEN
SHIELD	DRAIN

PRODUCT SPECIFICATIONS				
ELECTRICAL:				
JOYSTICK CAN OPEN				
	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	9	N/A	32
NODE IDENTIFIER		10 DECIMAL		
BAUD RATE		125K bits/s		
TRANSMISSION REPETITION RATE		100 ms		
JOYSTICK J1939				
	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	9	N/A	32
SOURCE ADDRESS		51 DECIMAL		
BAUD RATE		250K bits/s		
TRANSMISSION REPETITION RATE		100 ms		



### JHM Output MM

PRODUCT SPECIFICATIONS	
ELECTRICAL:	
JOYSTICK POWERED BY STANDARD USB INTERFACE	

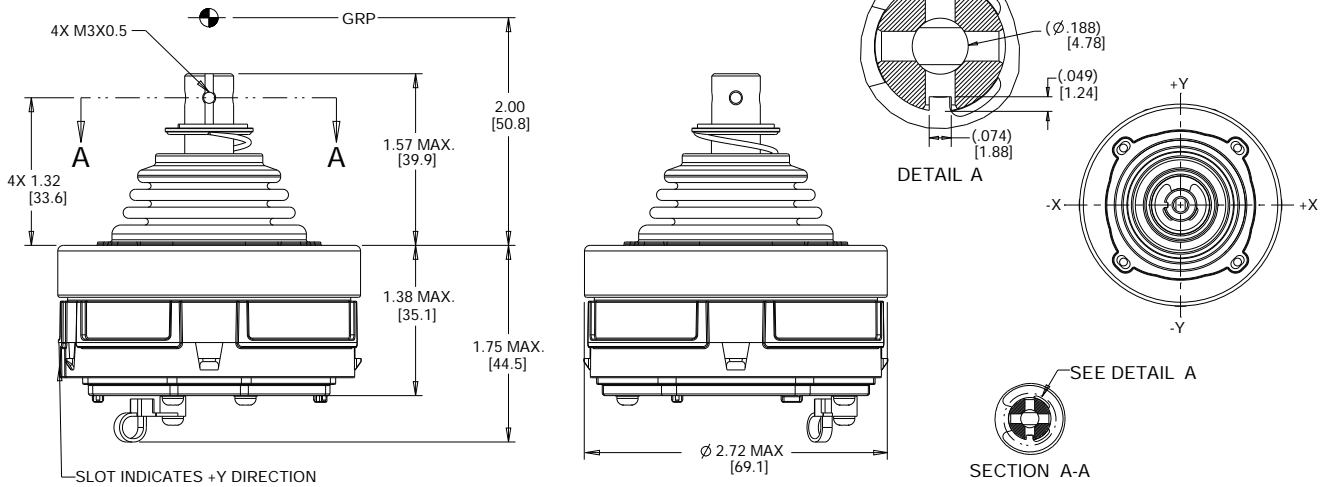


Wires and Strain Relief not shown in all views for clarity.

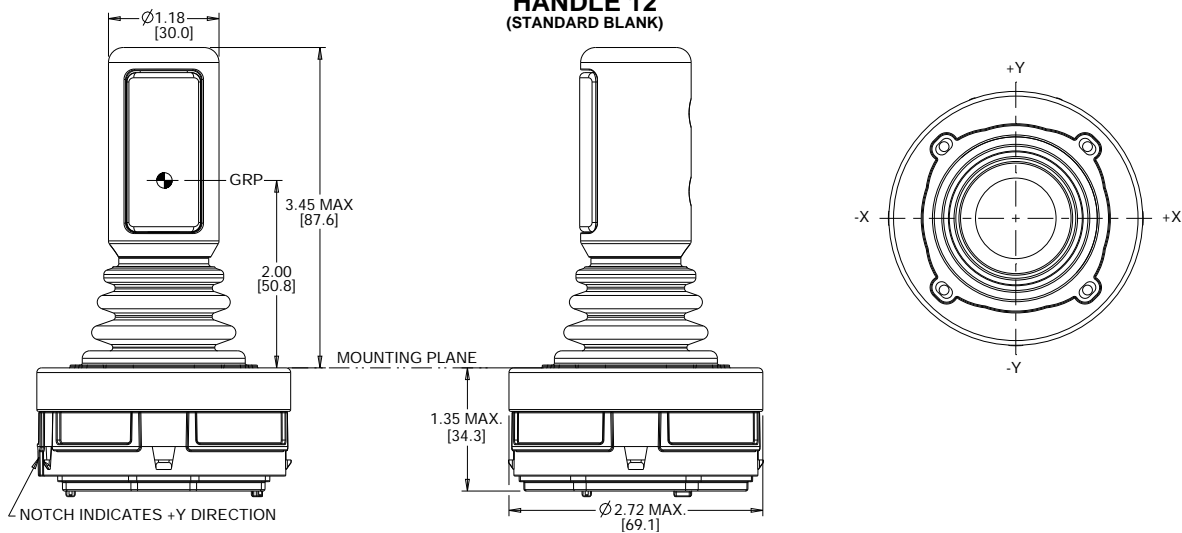
# MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

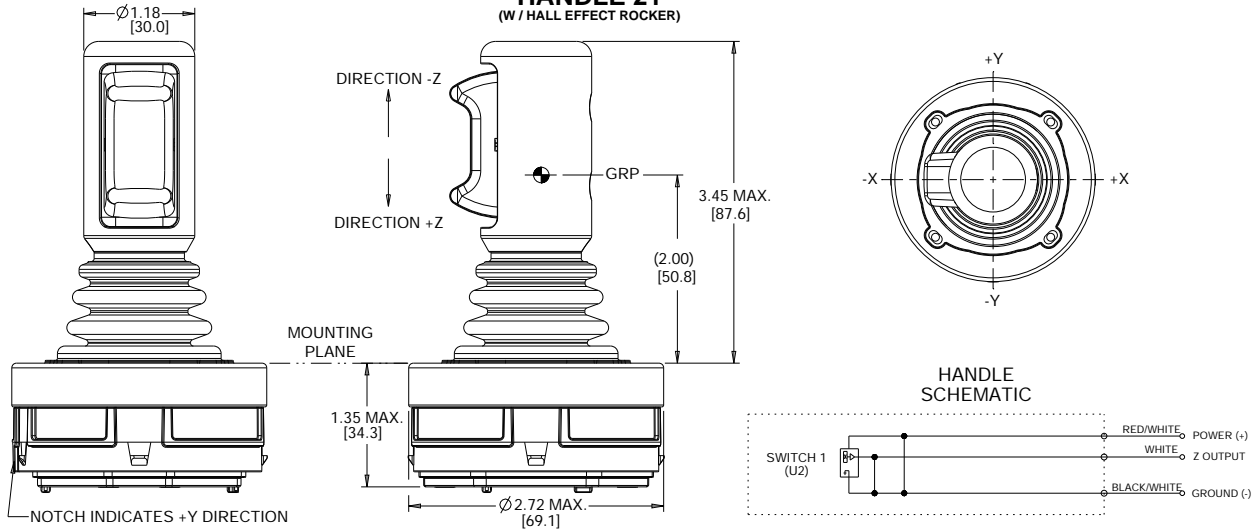
## HANDLE 11 (No Handle)



## HANDLE 12 (STANDARD BLANK)



## HANDLE 21 (W / HALL EFFECT ROCKER)

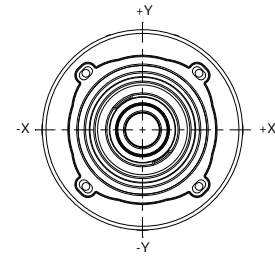
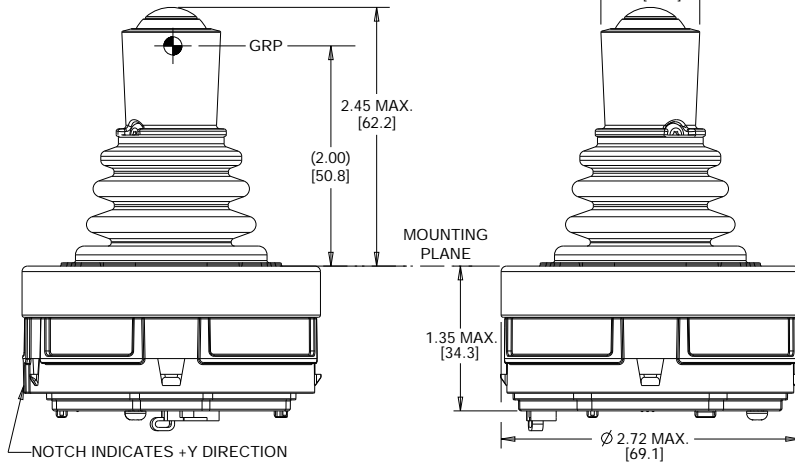


Wires and Strain Relief not shown in all views for clarity.

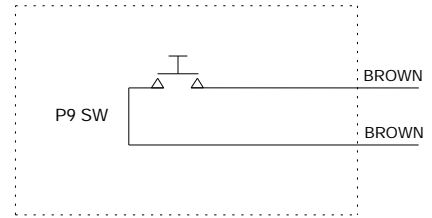
## HALL EFFECT TECHNOLOGY JOYSTICK

### HANDLE 31

(W / PUSHBUTTON, TOP HANDLE, HALF BOOT)

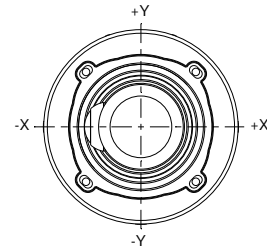
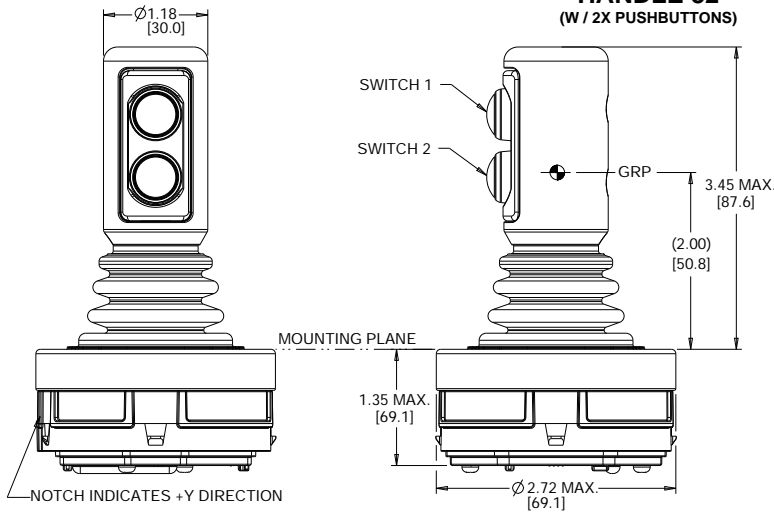


HANDLE SCHEMATIC

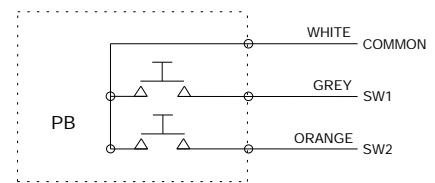


### HANDLE 32

(W / 2X PUSHBUTTONS)

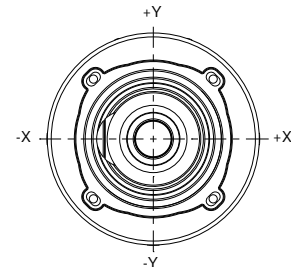
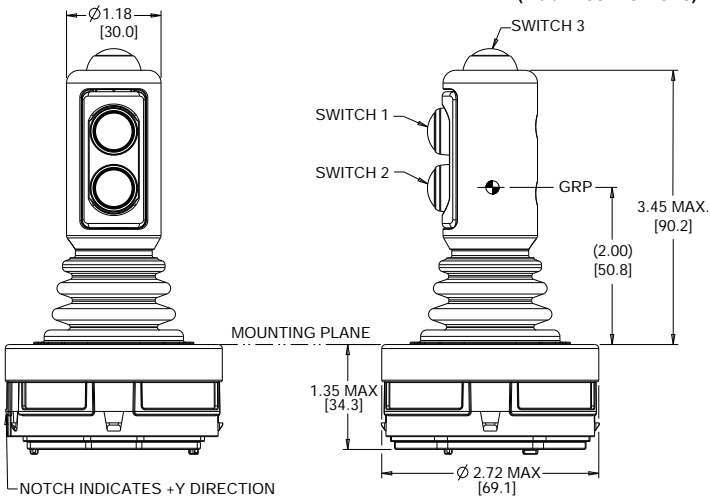


HANDLE SCHEMATIC

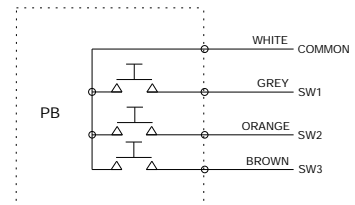


### HANDLE 33

(W / 3X PUSHBUTTONS)



HANDLE SCHEMATIC



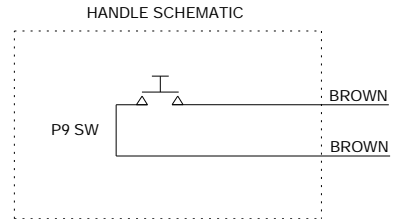
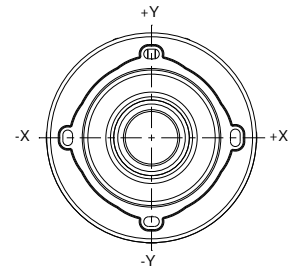
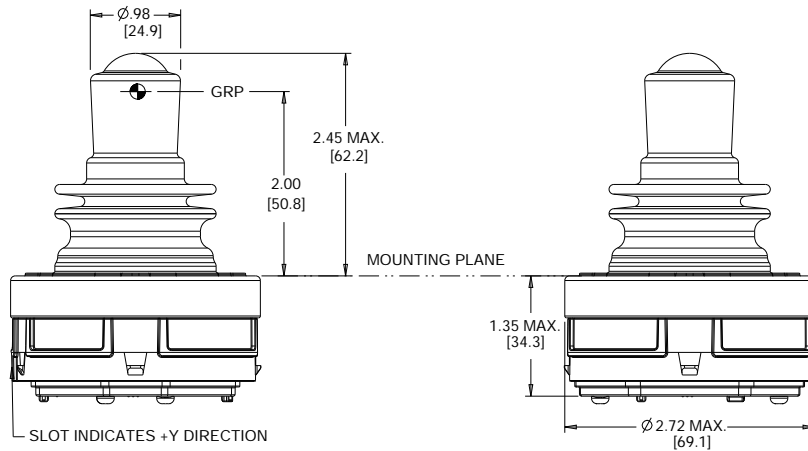
**Wires and Strain Relief not shown in all views for clarity.**



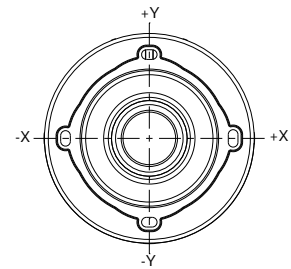
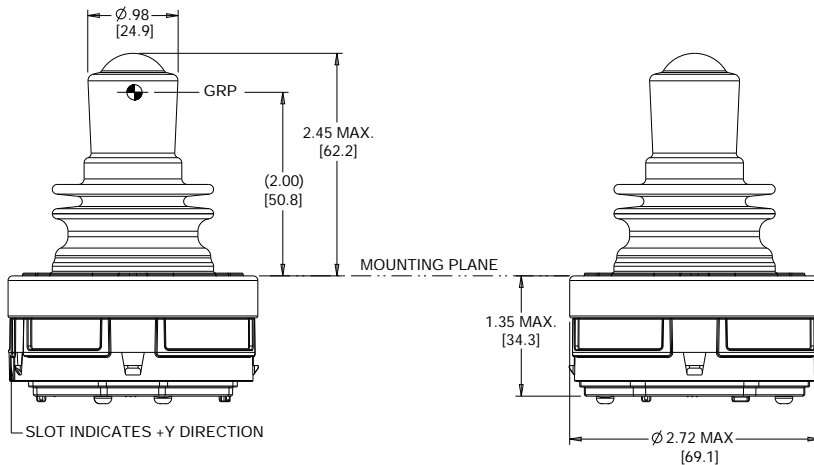
# MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

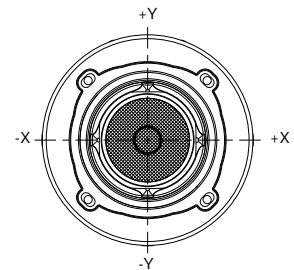
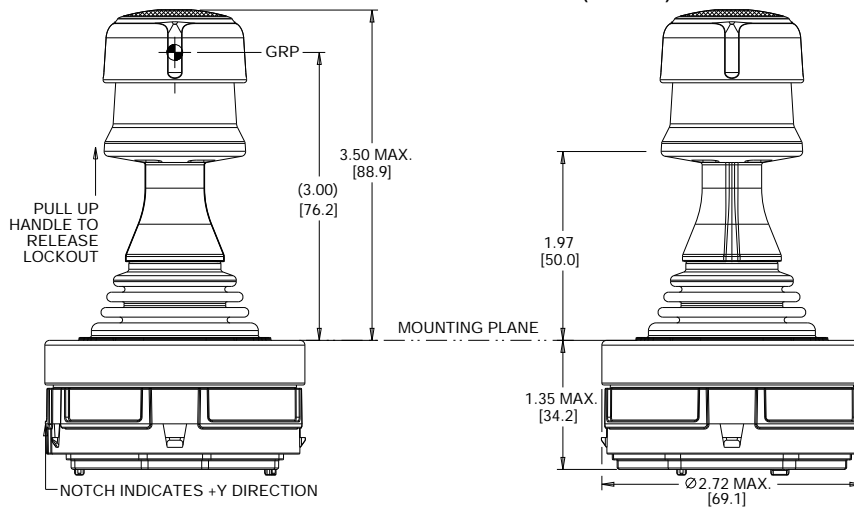
## HANDLE 34 (W / PUSHBUTTON, TOP HANDLE, FULL BOOT)



## HANDLE 35 (NO PUSHBUTTON, TOP HANDLE, FULL BOOT)



## HANDLE 41 (LOCKOUT)

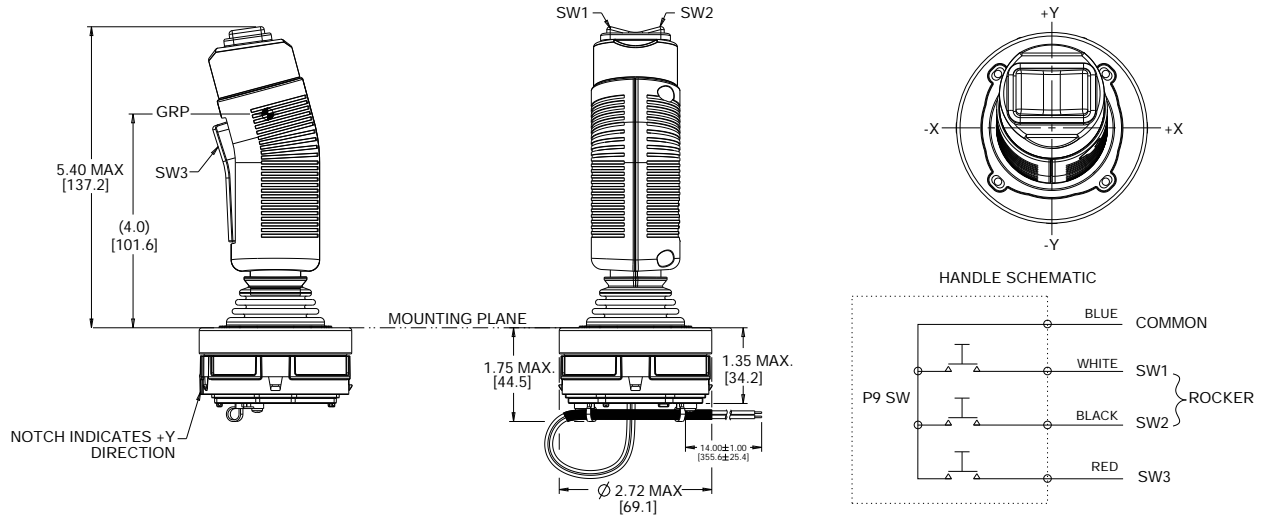


Wires and Strain Relief not shown in all views for clarity.

## HALL EFFECT TECHNOLOGY JOYSTICK

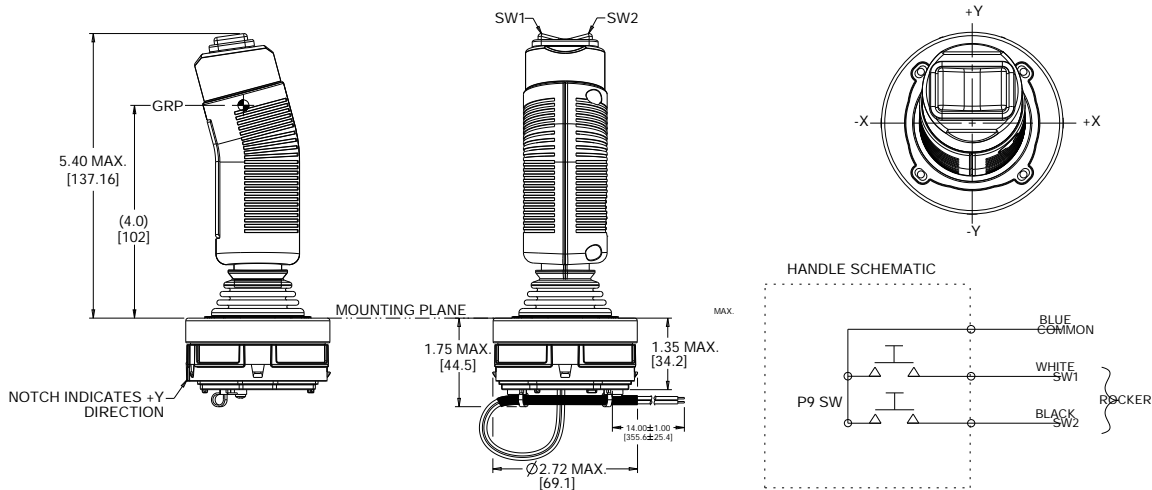
### HANDLE 51

(G3-D WITH ROCKER AND OPERATOR PRESENCE)



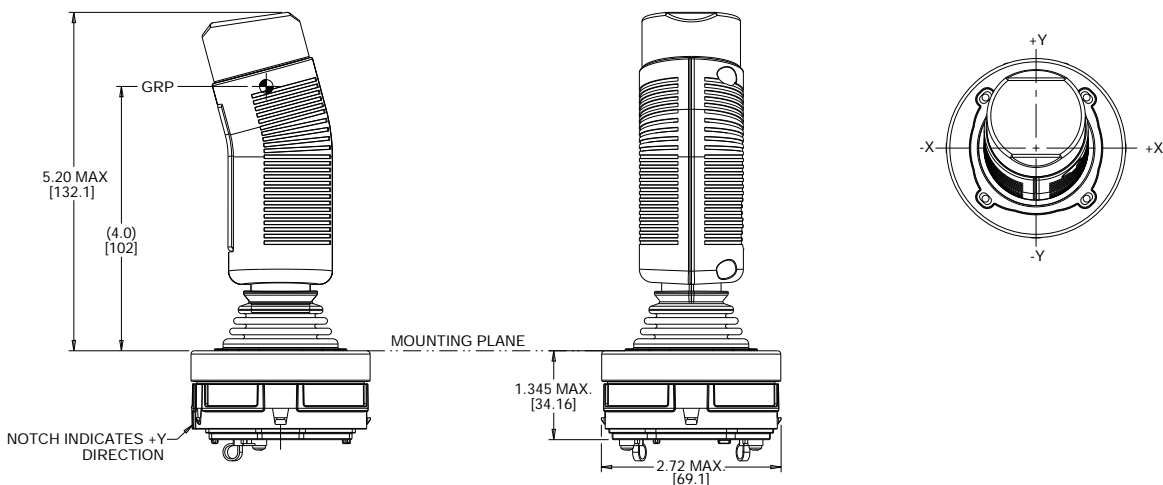
### HANDLE 52

(G3-D WITH ROCKER)



### HANDLE 53

(G3-D)

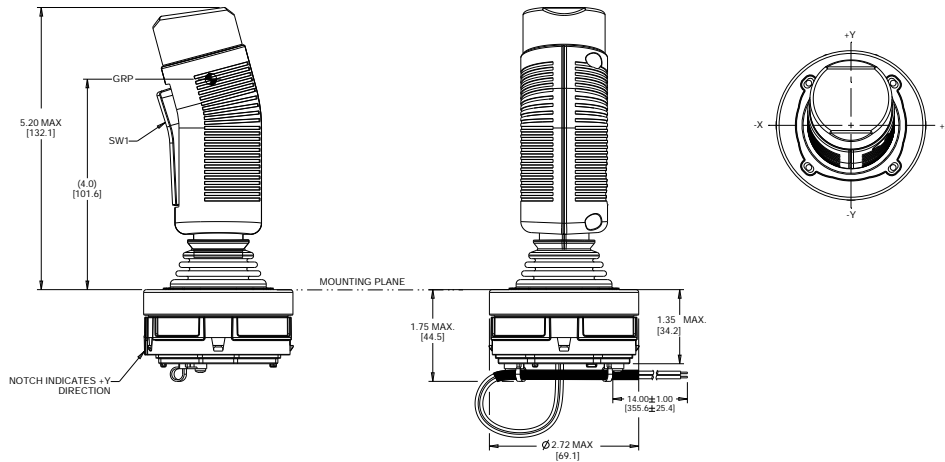


Wires and Strain Relief not shown in all views for clarity.

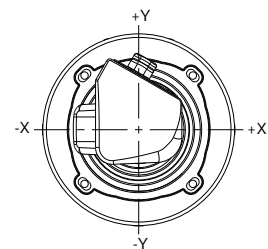
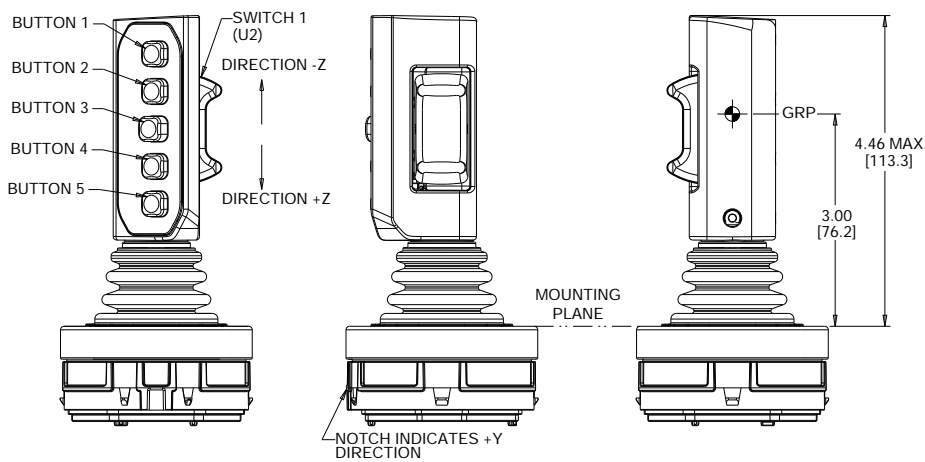
# MEDIUM HALL EFFECT JOYSTICK

## HALL EFFECT TECHNOLOGY JOYSTICK

### HANDLE 54 (G3-D WITH OPERATOR PRESENCE)

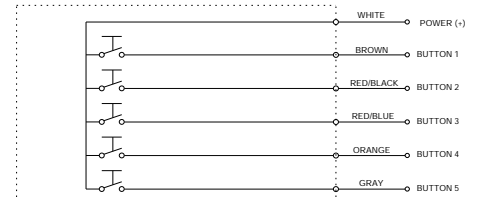


### HANDLE 61 (5-BUTTON KEYPAD & HALL ROCKER RIGHT)

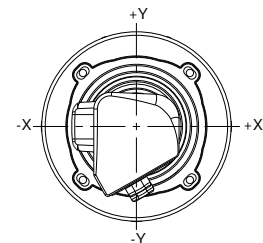
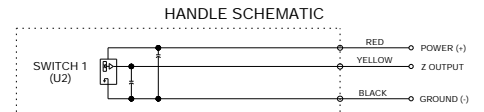
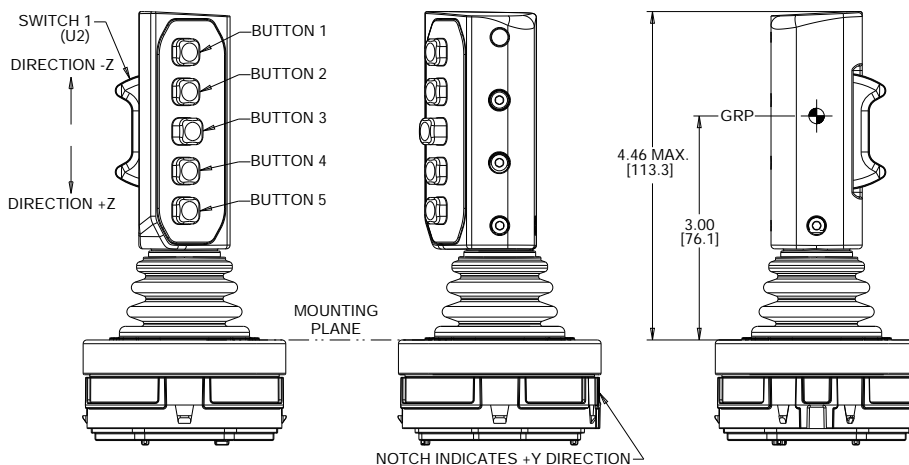


**Right-Handed Version**

#### BUTTON SCHEMATIC



### HANDLE 62 (5-BUTTON KEYPAD & HALL ROCKER LEFT)



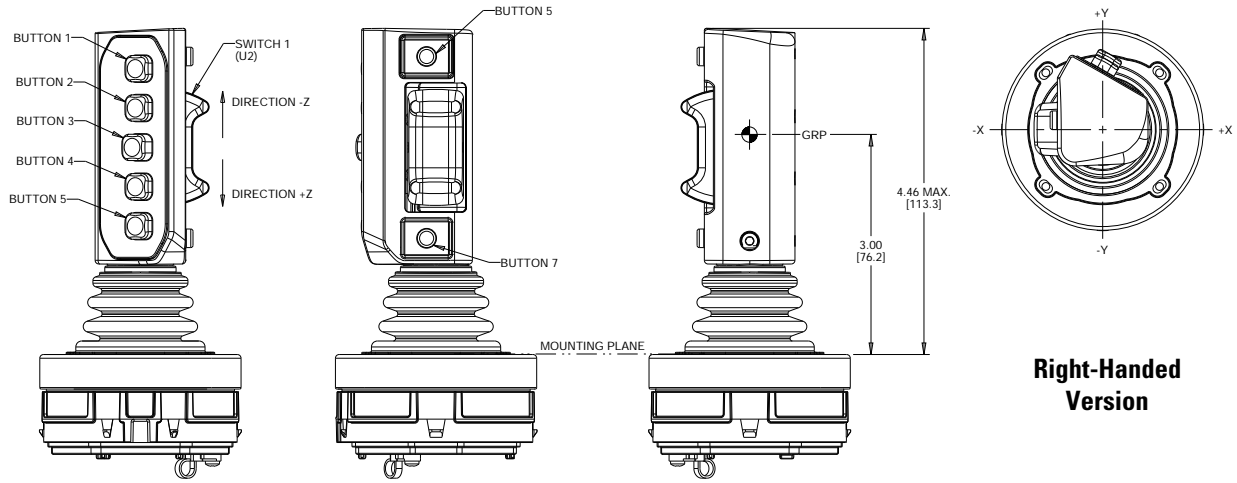
**Left-Handed Version**

**Wires and Strain Relief not shown in all views for clarity.**

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

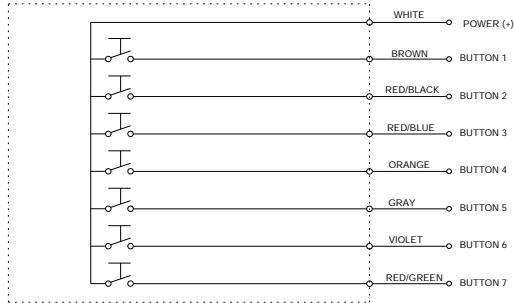
## HANDLE 63

(7-BUTTON KEYPAD & HALL ROCKER RIGHT)

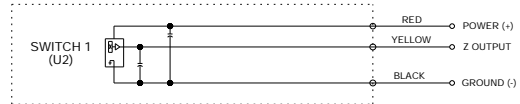


**Right-Handed  
Version**

### BUTTON SCHEMATIC

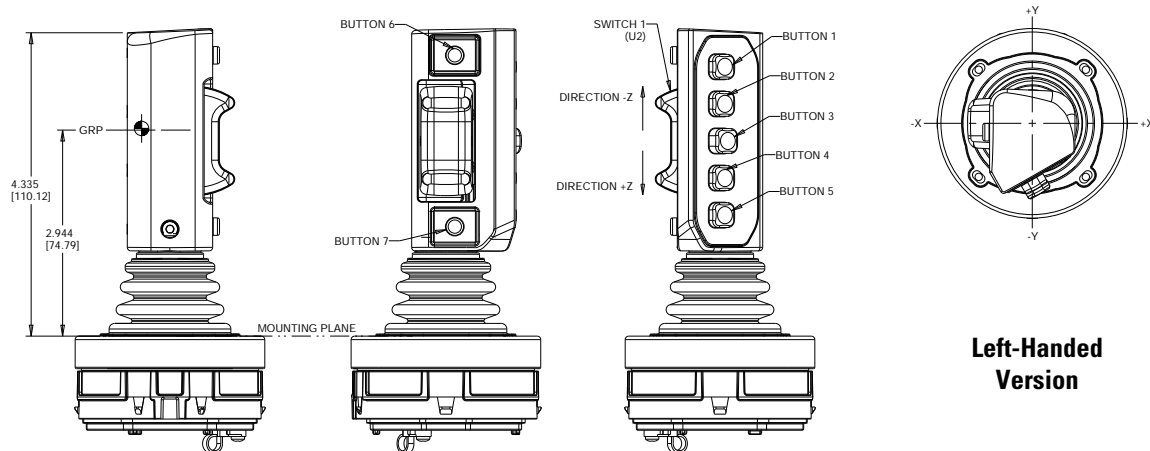


### HANDLE SCHEMATIC



## HANDLE 64

(7-BUTTON KEYPAD & HALL ROCKER LEFT)



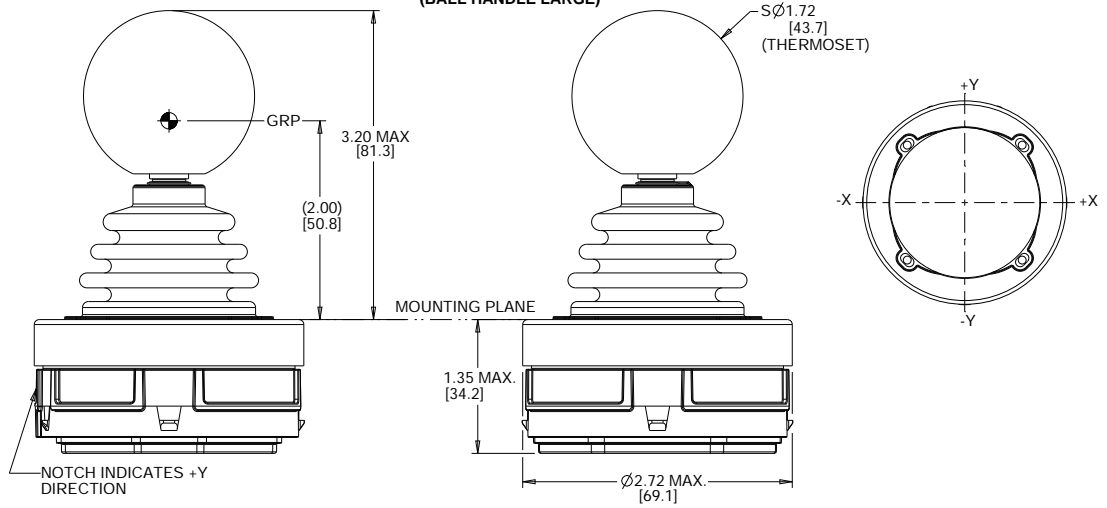
**Left-Handed  
Version**

**Wires and Strain Relief not shown in all views for clarity.**

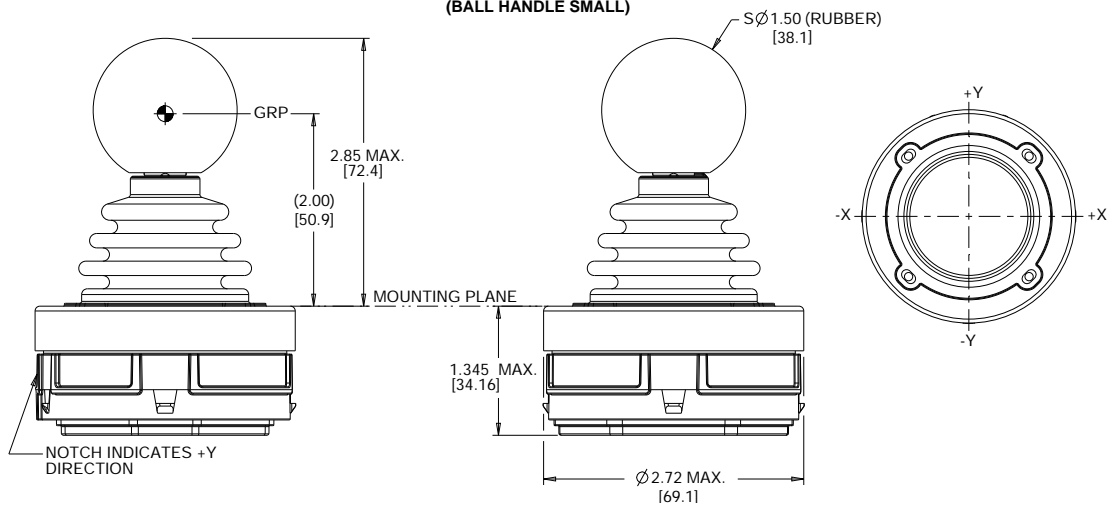
# MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

## HANDLE 71 (BALL HANDLE LARGE)



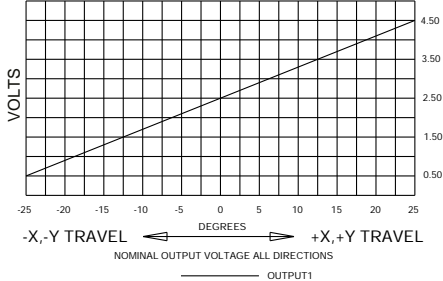
## HANDLE 72 (BALL HANDLE SMALL)



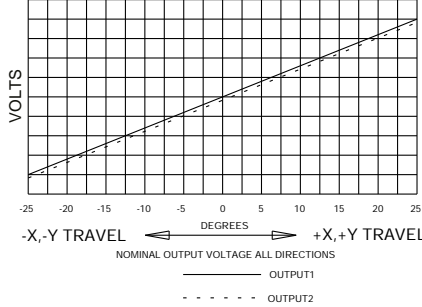
UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

## JHM OUTPUTS

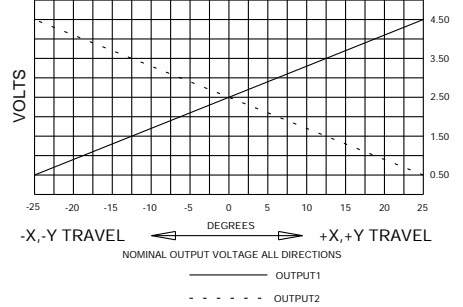
OPTION AA & AT



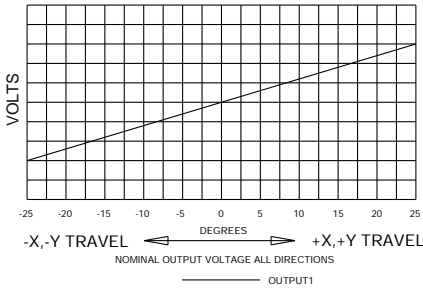
OPTION BB & BT



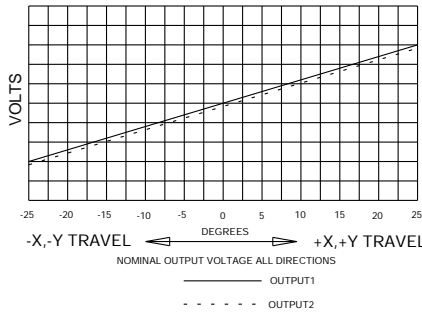
OPTION CC & CT



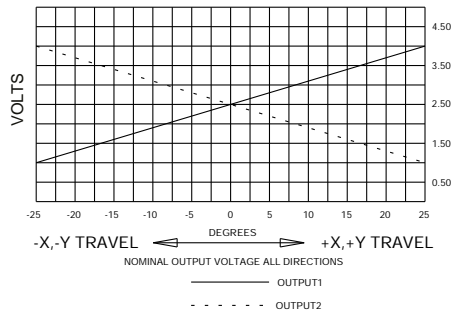
OPTION DD & DT



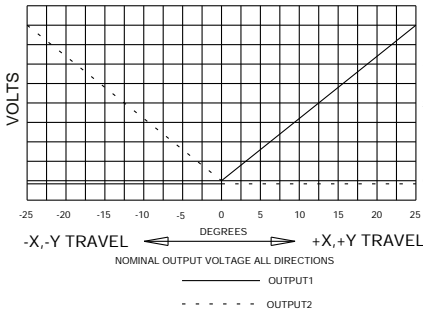
OPTION EE & ET



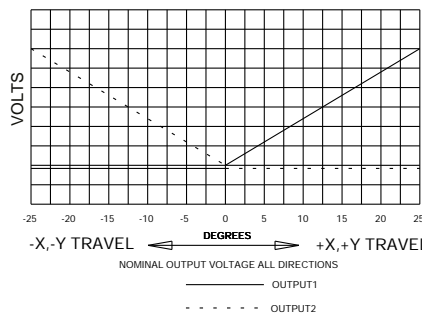
OPTION FF & FT



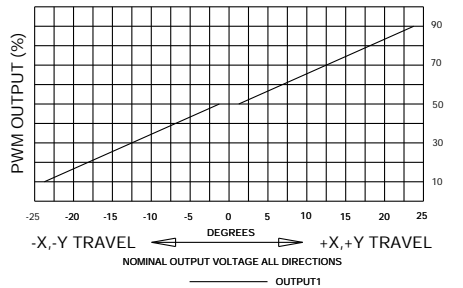
OPTION GG



OPTION HH



OPTION LL



# JOYSTICK WITH GRIP OPTIONS

**HJMG3**  
MEDIUM  
JOYSTICK  
WITH GRIP

LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK



HJMG3 Joysticks with Universal Grips

The HJMG3 is a top mount JHM medium Hall effect joystick with a variety of grip, faceplate, output and gating options. The HJMG3 allows you to easily create a catalog codable joystick with grip. Grip choices include the G3-A, G3-B and G3-C Universal and the G3-D Control Grips, with a total of 30 faceplate design options.

Analog and digital control outputs, CANopen, CANbus J1939, PWM, USB, and redundant sensor output selections are available. Gating options are single axis, dual axis, friction y-axis, and various omnidirectional selections that include round smooth feel, on-axis and off-axis guided feel and square on-axis guided feel.

The HJMG3 can be configured for top-of-the-line machines requiring high switch content, or to provide very basic functions on lower tier units, and can be manufactured with an almost unlimited variety of switches, custom termination and custom mounting options. The HJMG3 serves agriculture, construction, off-highway, material handling and specialized industrial equipment markets.

## Features:

- Designed for armrest and panel mounting
- Contactless Hall effect technology
- Multiple output options, both analog and digital
- Electronics sealed to IP68S
- Redundant sensors available
- Variety of gating options
- RoHS compliant



HJMG3 Joystick with G3-D Grip

### Standard Characteristics/Ratings:

#### ELECTRICAL: Output options AA-FT and LL

Joystick				
Rated at Vcc = 5V @ 20°C	Units	Min	Typ	Max
Load = 1 ma (4.7 KΩ)				
Supply Voltage, Vcc	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center	VDC	-0.25	N/A	+0.25
AA, BB, CC, DD, EE, FF, GG, HH	@ 5V Vcc			
Output Voltage Tolerance at Center	VDC	-0.15	N/A	+0.15
AT, BT, CT, DT, ET, FT	@ 5V Vcc			
Output Voltage Tolerance at Full Travel	VDC	-0.25	N/A	+0.25
Full Travel	@ 5V Vcc			
Supply Current Per Sensor B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
Output Source Current Limit B=X*, Vo=0	mA	-1.20	N/A	1.20

#### P9 Switches

Electrical Rating	10mA Resistive Load @ 5VDC
Electrical Life	1,000,000 Cycles

#### HTW Switches

Supply Voltage, Vcc	VDC	4.5	5.0	5.5
Output Voltage	VDC	-0.15	NA	+0.15
Tolerance at Center	@ 5V Vcc			
Output Voltage	VDC	-0.25	N/A	+0.25
Tolerance at Full Travel	@ 5V Vcc			
Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10

#### HTWM and HRTL4 Switches

Output Voltage	VDC	-0.25	NA	+0.25
Tolerance at Center	@ 5V Vcc			
Output Voltage	VDC	-0.25	N/A	+0.25
Tolerance at Full Travel	@ 5V Vcc			
HTWM Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
HRTL4 Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	10	12

#### TC-5 Switches

Electrical Rating @ 1-32 VDC	10-100mA
Electrical Life	3,000,000 Cycles

#### MECHANICAL:

##### Joystick

Mechanical Life	5,000,000 cycles; 250,000 cycles (Friction)			
Travel Angle	Degrees	18	20	22
Op. Force (w/Boot) High Force @ GRP, Ret. to Ctr.	Lbs.	1.5	2.5	3.5
Op. Force (w/Boot) Low Force @ GRP, Ret. to Ctr.	Lbs.	1.0	2.0	3.0
Op. Force (w/Boot) High Force @ GRP, Friction	Lbs.	1.0	2.5	4.0

##### P9 Switches

Mechanical Life	1,250,000 cycles
Operating Force	Oz. 1.2 1.7 2.2

##### HTW and HTWM Switches

Mechanical Life Full Forward to Full Back	3,000,000 cycles			
Travel Angle	+/- 40°			
Operating Force 25°C at Top of Roller	Oz.	2	5	8
Maximum Allowable Radial Load	Lbs.	N/A	N/A	30

##### HRTL4 Switches

Mechanical Life	3,000,000 cycles			
Travel Angle	Degrees	19	20	21
Operating Force (w/Boot) at Top of Button, @ 20° C	Oz.	5	8	16
Max Allowable Vertical Force on Button	Lbs.	N/A	N/A	25
Max Allowable Radial Force on Top of Knob	Lbs.	N/A	N/A	25
Max Allowable Torque on Button about Shaft Axis	In-Lbs.	N/A	N/A	5.5

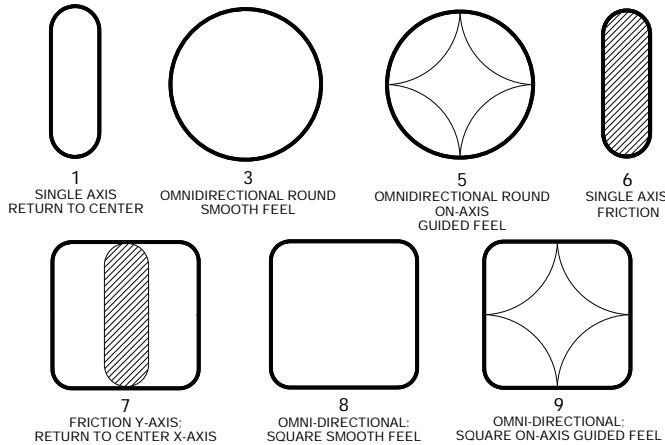
##### TC-5 Switches

Mechanical Life	3,000,000 cycles			
Operating Force	Oz.	8	16	24

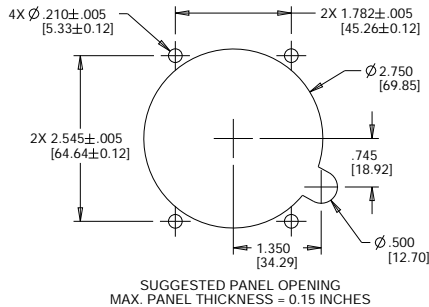
# JOYSTICK WITH GRIP OPTIONS

UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

## HJMG3 Gating Icons



## HJMG3 Suggested Panel Opening



## Standard Characteristics/Ratings:

### ENVIRONMENTAL

#### Joystick

	Units	Min	Typ	Max
Operating Temperature	°C	-40	20	85
Enclosure Design	Sealed to IP68S			
EMI/RFI Withstand	Per SAE J1113. Contact factory for details			

#### P9 Switches

Enclosure Design	Sealed to IP68S
------------------	-----------------

#### HTW Switches

Electronics Seal Integrity	IP68S
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#### HTWM Switches

Electronics Seal Integrity	IP68S
Mechanical Seal Integrity	Unsealed

#### HTLT4 Switches

Electronics Seal Integrity	IP68S
----------------------------	-------

#### TC-5 Switches

Electronics Seal Integrity	IP68S
----------------------------	-------

#### Grip

Seal Integrity	Unsealed
----------------	----------

Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

## HJMG3 PART NUMBER CODE

HJMG3 - X

Gating\*

	XX	X	X	XX	X	X	X	
	Output 1**	Output 2***	Force	Grip	Faceplate	Trigger PB Color	P9 Button Grip Head (Black)****	P9 Button Color (Faceplate)
1. Gated; Single Axis – Return to Center	AA. 2.5 +/- 2.0VDC	NONE	1. Low	A. G3-A Universal	AN CG	1. None	1. None	N. None
2. Gated; Single Axis – Friction	BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. High	B. G3-B Universal	AP CJ	2. Black	2. Left	1. Red
3. Omni-directional; Round Smooth Feel	CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		C. G3-C Universal	AQ CK	3. Red	3. Right	2. Black
4. Omni-directional; Round Smooth Feel	DD. 2.5 +/- 1.5VDC	NONE		D. G3-D Control Grip	AR CL		4. Left and Right	3. Orange
5. Omni-directional; Round On-Axis Guided Feel	EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			AS CM			4. Yellow
6. Omni-directional; Round On-Axis Guided Feel	FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			BA CN			5. Green
7. Omni-directional; Square Smooth Feel	GG. 0.5 - 4.5VDC	0.5 - 4.5VDC			BB CP			6. Blue
8. Omni-directional; Square Smooth Feel	HH. 1.0 - 4.0VDC	1.0 - 4.0VDC			BF CQ			7. Violet
9. Omni-directional; Square On-Axis Guided Feel	AT. 2.5 +/- 2.0VDC*	NONE			BG CR			8. Gray
	BT. 2.5 +/- 2.0VDC*	2.5 +/- 2.0VDC			BH DA			9. White
	CT. 2.5 +/- 2.0VDC*	2.5 +/- 2.0VDC			BJ DB			
	DT. 2.5 +/- 1.5VDC*	NONE			BK DC			
	ET. 2.5 +/- 1.5VDC*	2.5 +/- 1.5VDC			BL DD			
	FT. 2.5 +/- 1.5VDC*	2.5 +/- 1.5VDC			CA DE			
	JJ. CANbus J1939	NONE			CB DF			
	KK. CANopen	NONE						
	LL. PWM	NONE						
	MM. USB	NONE						

\* Contact factory for friction held versions

\*\* Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF", "AT", "BT", "CT", "DT", "ET" and "FT" provide increased voltage in +x, +y; and decreasing voltage in -x, -y for output 1. Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x, -y) for output 1 and output 2.

Options "AT", "BT", "CT", "DT", "ET" and "FT" are identical to options "AA", "BB", "CC", "DD", "EE", and "FF" respectively except with a tighter center tolerance.

\*\*\* Options "BB", "EE", "BT", "ET" provide redundant output 2 which duplicates output 1. Options "CC", "FF", "CT", "FT" provide redundant output 2 which is inverse of output 1.

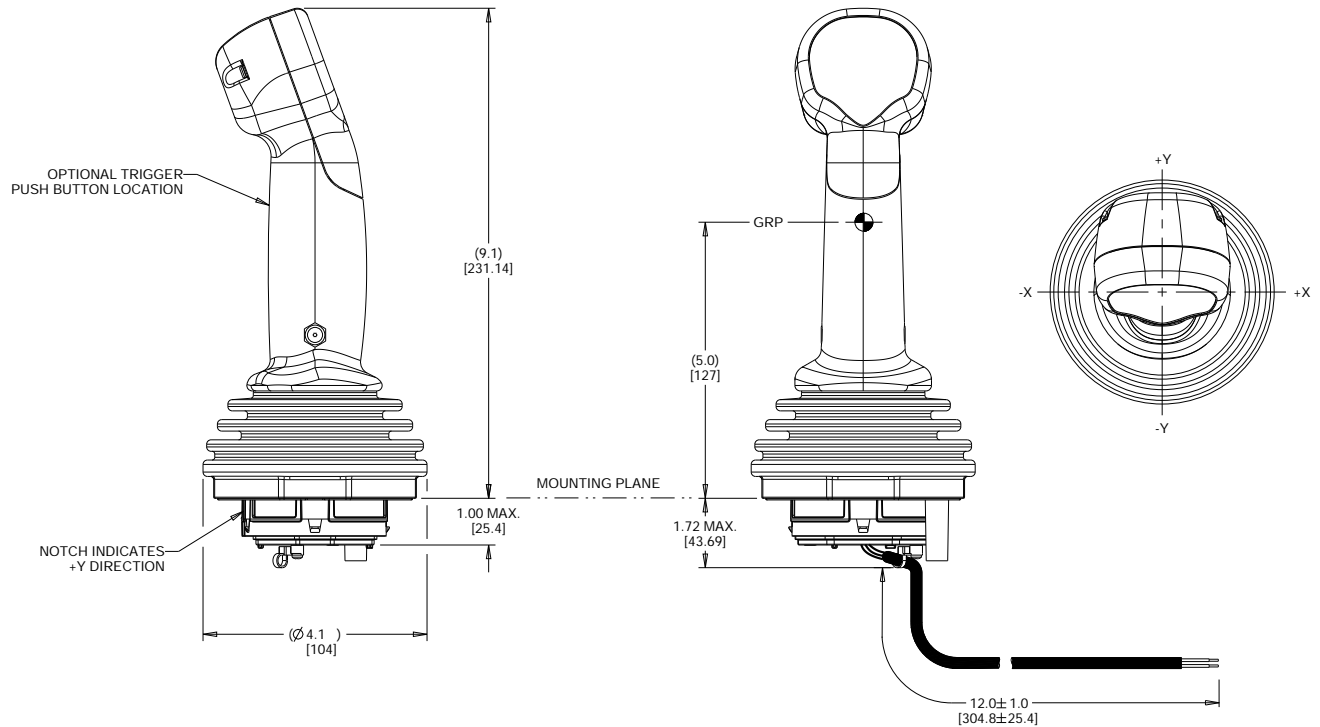
\*\*\*\* Switches on grip head are available for "C" grip version only



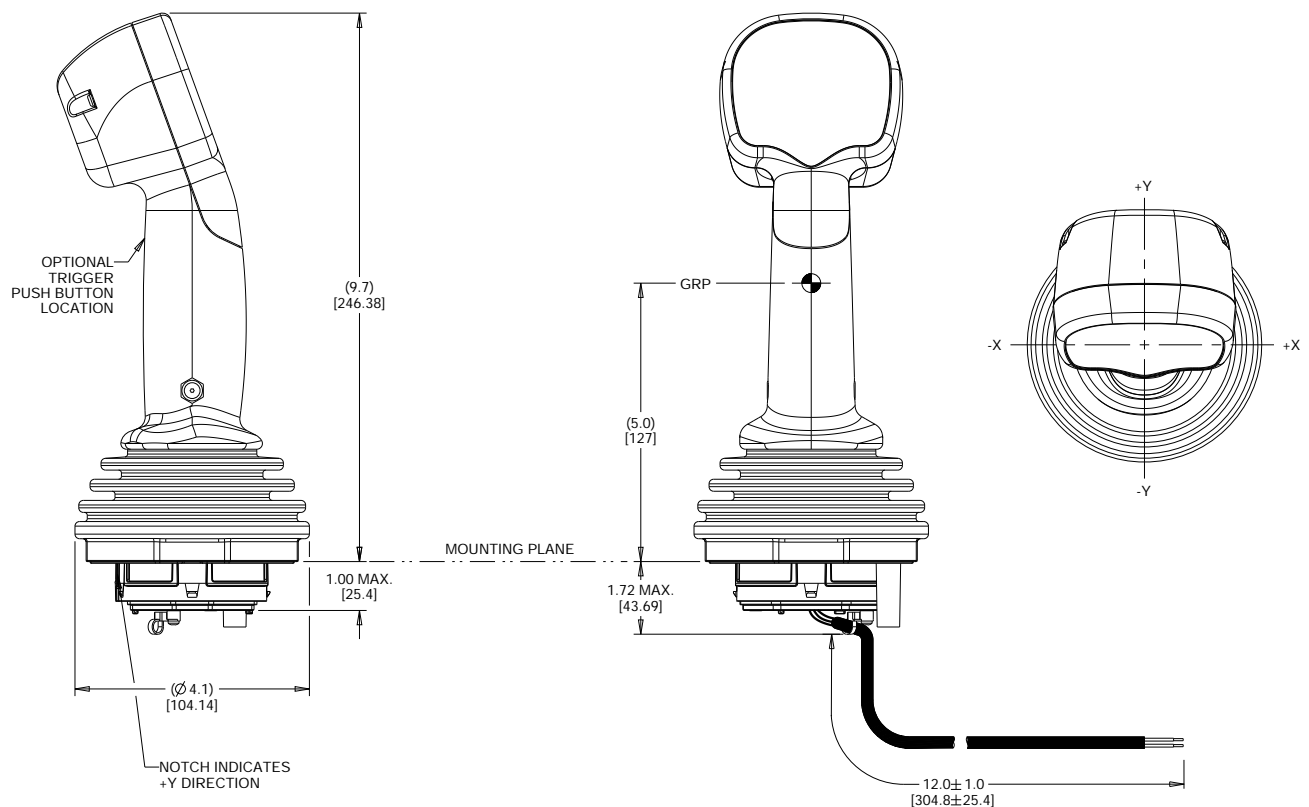
# JOYSTICK WITH GRIP OPTIONS

LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

## G3-A Universal Grip with AS Faceplate



## G3-B Universal Grip with BL Faceplate

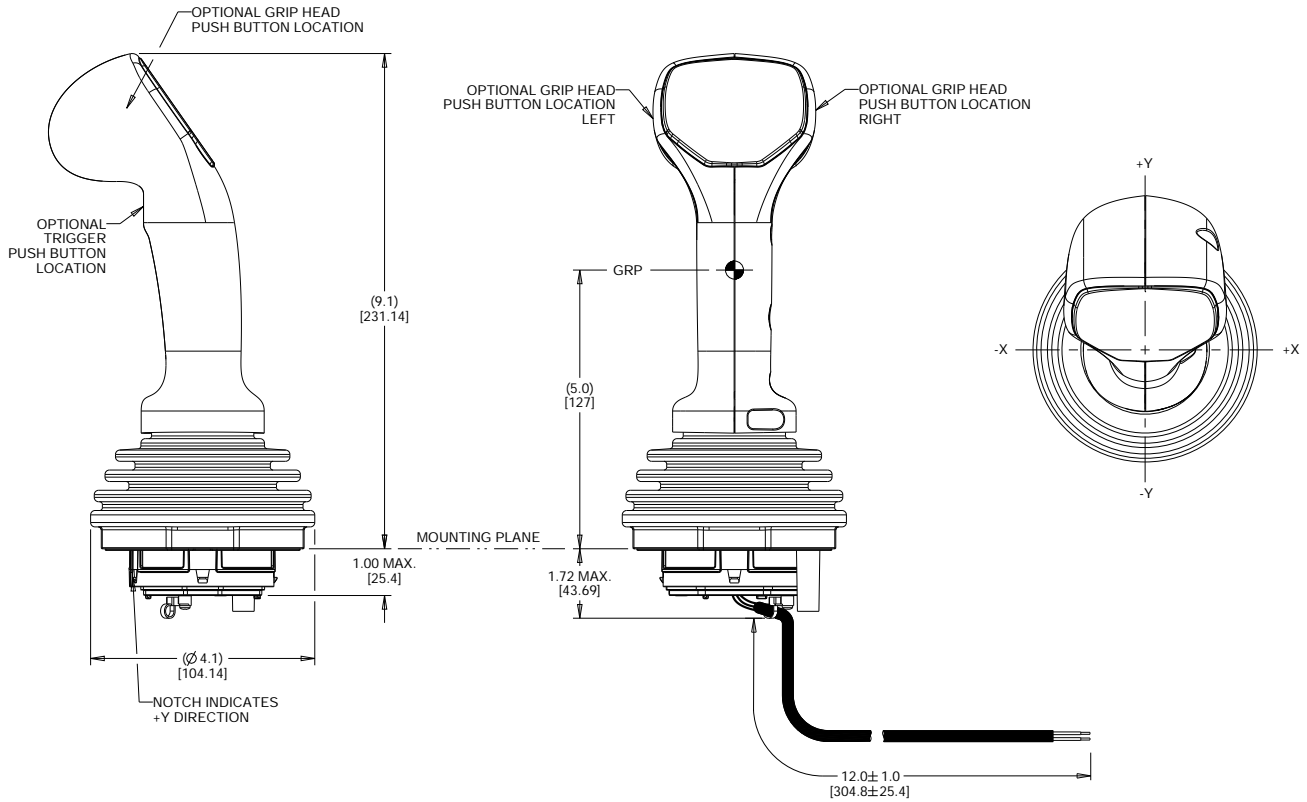


Wires and strain relief not shown in all views for clarity.

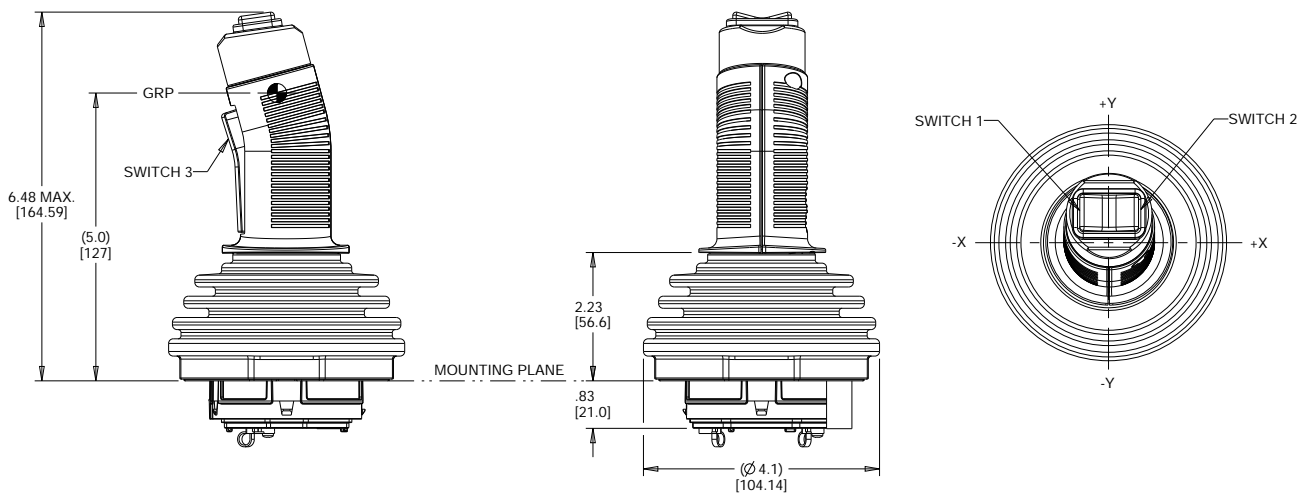
Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

## G3-C Universal Grip with CL Faceplate



## G3-D Control Grip with DA Faceplate



Wires and strain relief not shown in all views for clarity.

Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

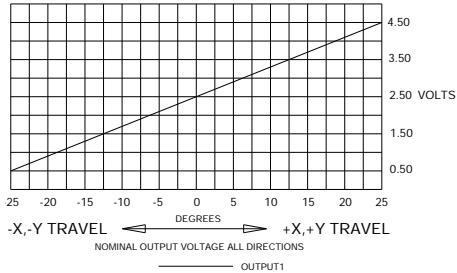
# JOYSTICK WITH GRIP OPTIONS

**HJMG3**  
MEDIUM  
JOYSTICK  
WITH GRIP

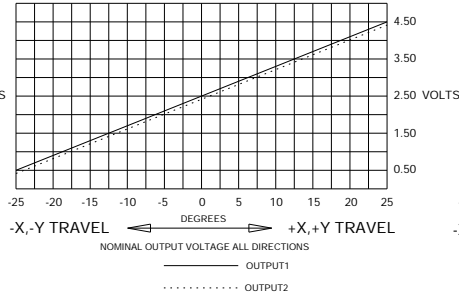
LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

## HJMG3 OUTPUT

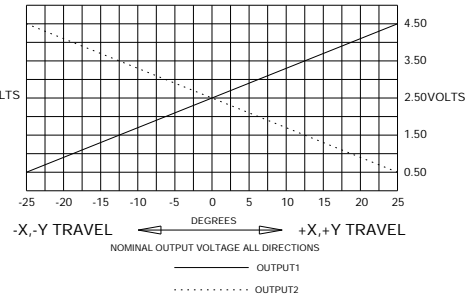
OPTION AA & AT



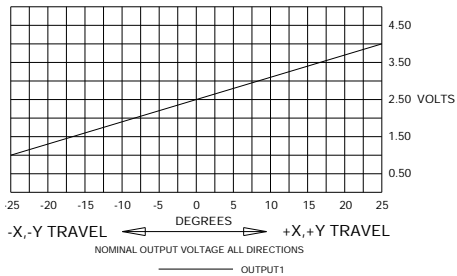
OPTION BB & BT



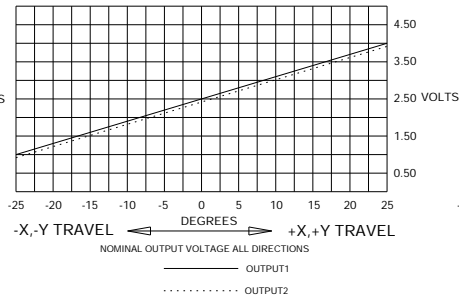
OPTION CC & CT



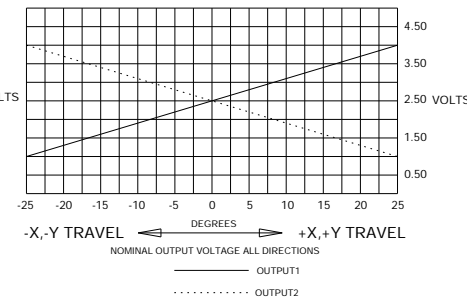
OPTION DD & DT



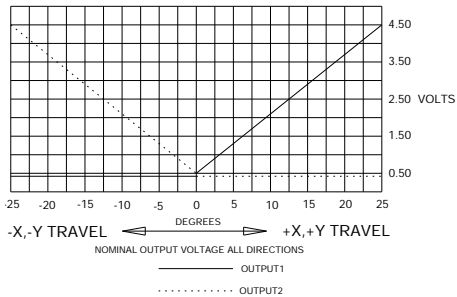
OPTION EE & ET



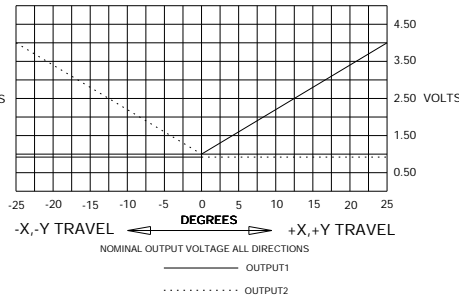
OPTION FF & FT



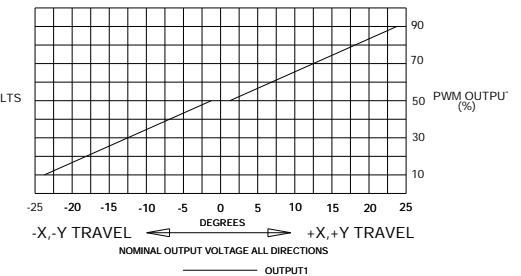
OPTION GG



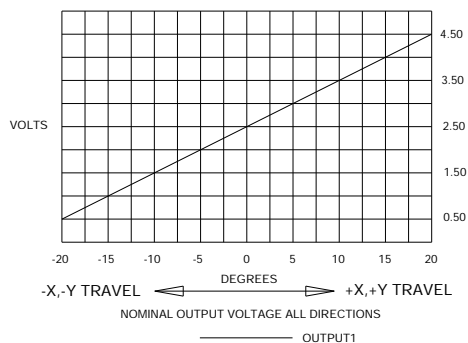
OPTION HH



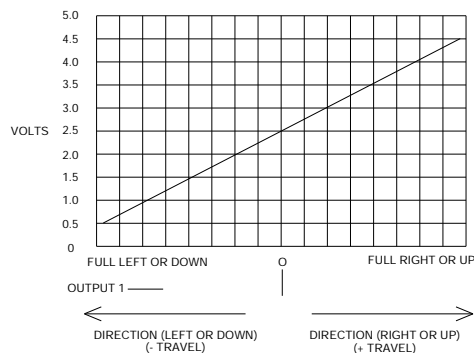
OPTION LL



HTLT4 OUTPUT

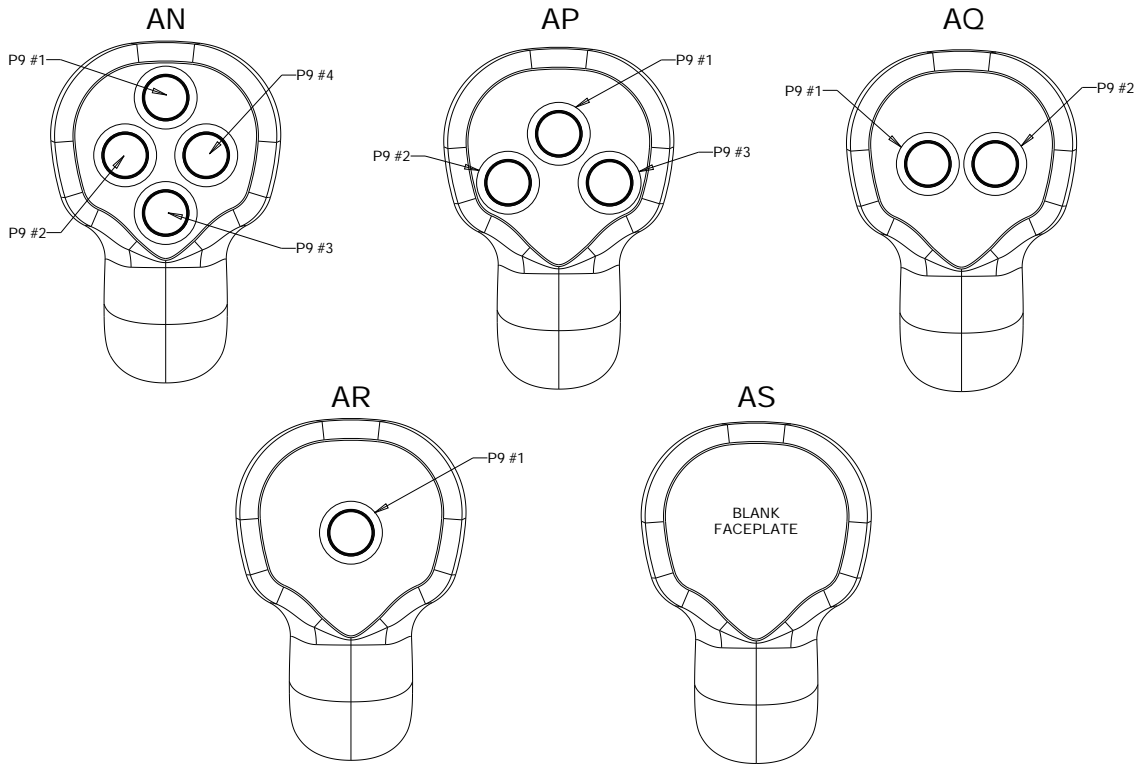


HTW & HTWM OUTPUT

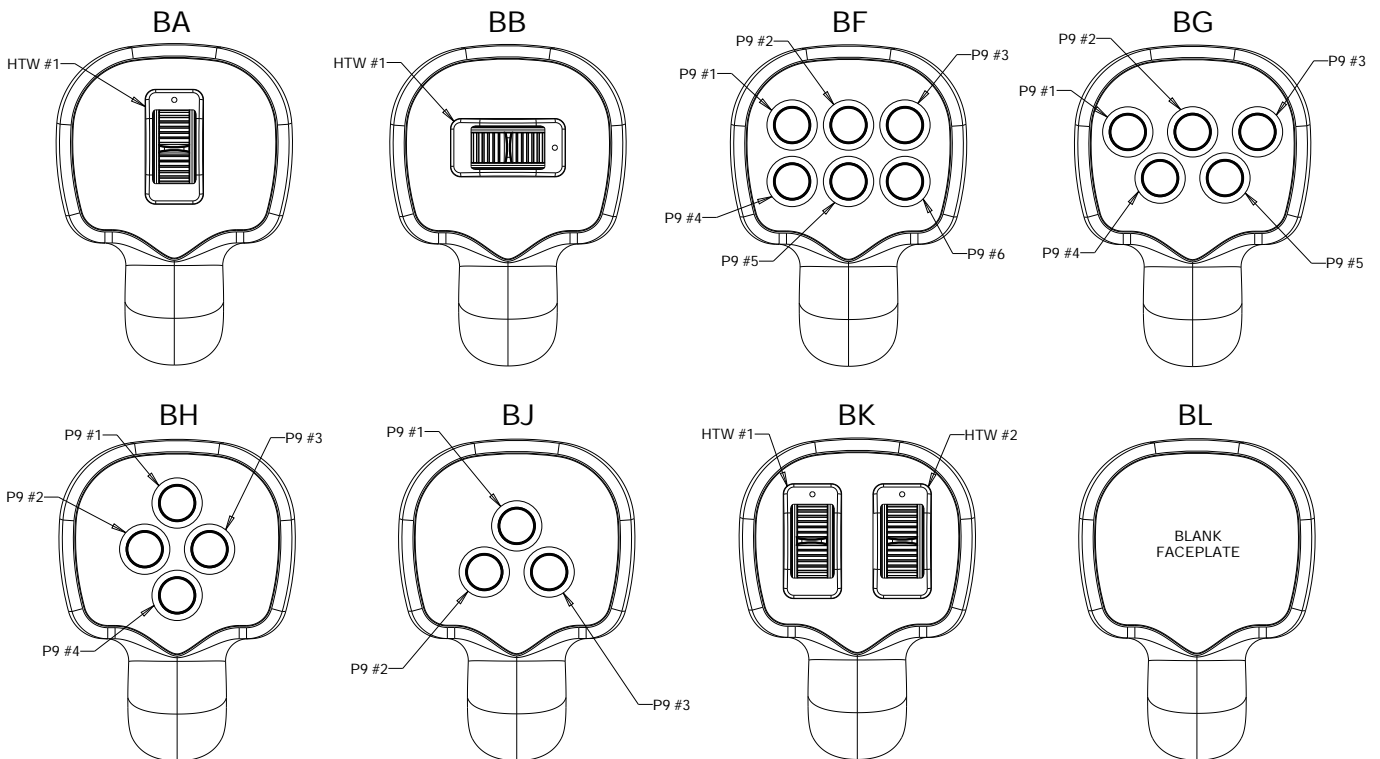


UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

## FACEPLATES GROUP A



## FACEPLATES GROUP B

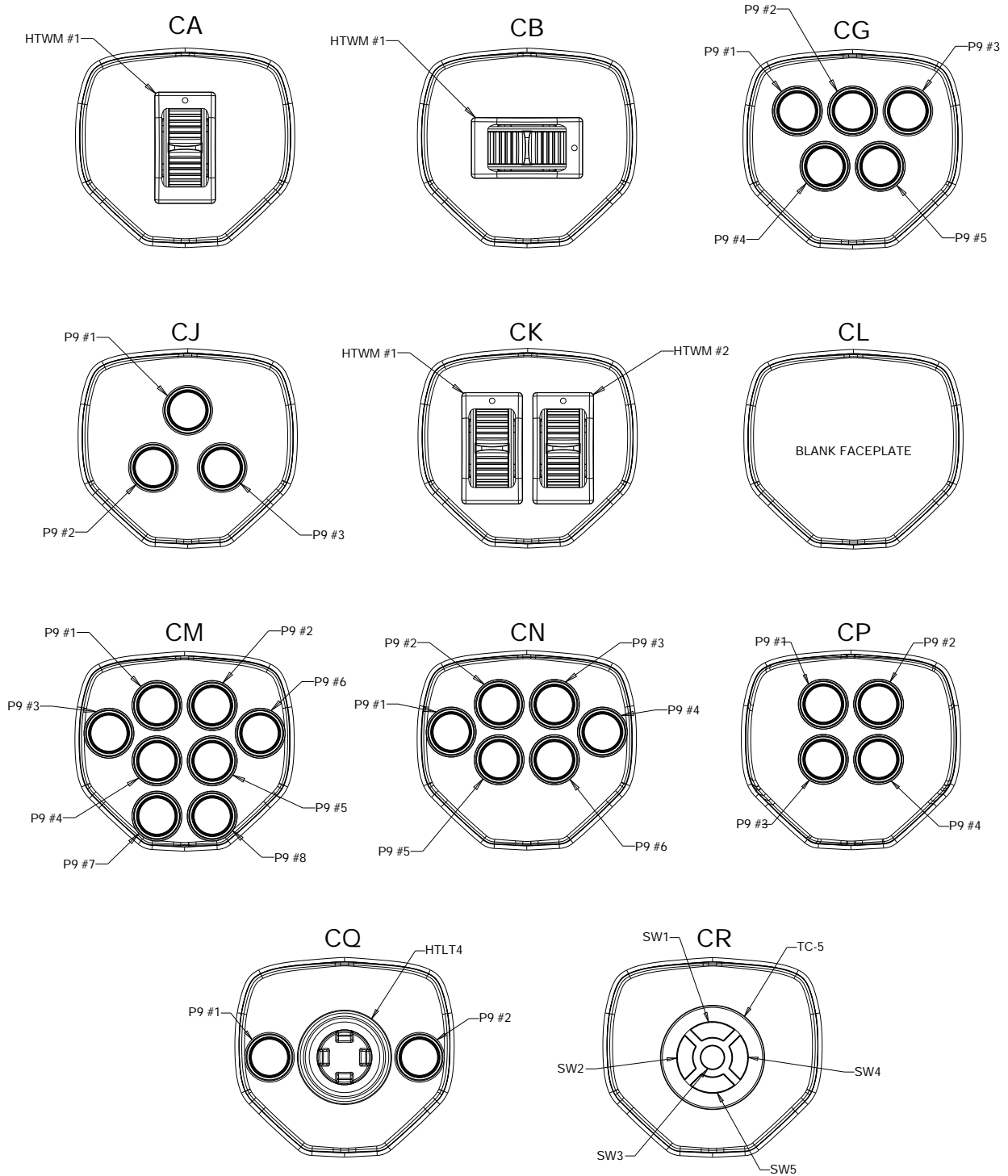


# JOYSTICK WITH GRIP OPTIONS

**HJMG3**  
MEDIUM  
JOYSTICK  
WITH GRIP

LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

## FACEPLATES GROUP C

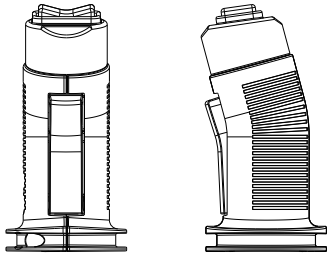


HALL EFFECT CONTROLS

# JOYSTICK WITH GRIP OPTIONS

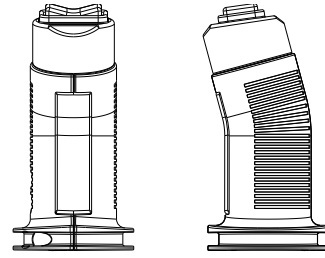
UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

## FACEPLATES GROUP D



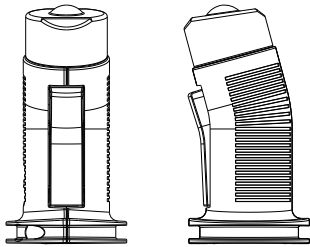
DA

ROCKER  
AND OPERATOR PRESENCE



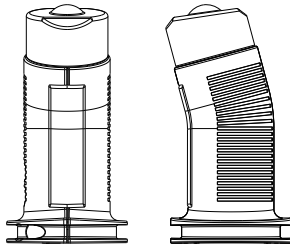
DB

ROCKER



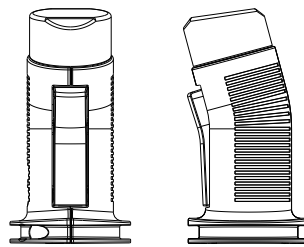
DC

ONE PUSHBUTTON  
AND OPERATOR PRESENCE



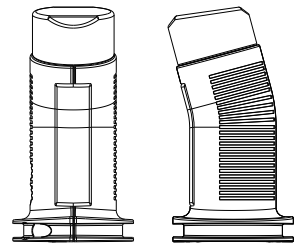
DD

ONE PUSHBUTTON



DE

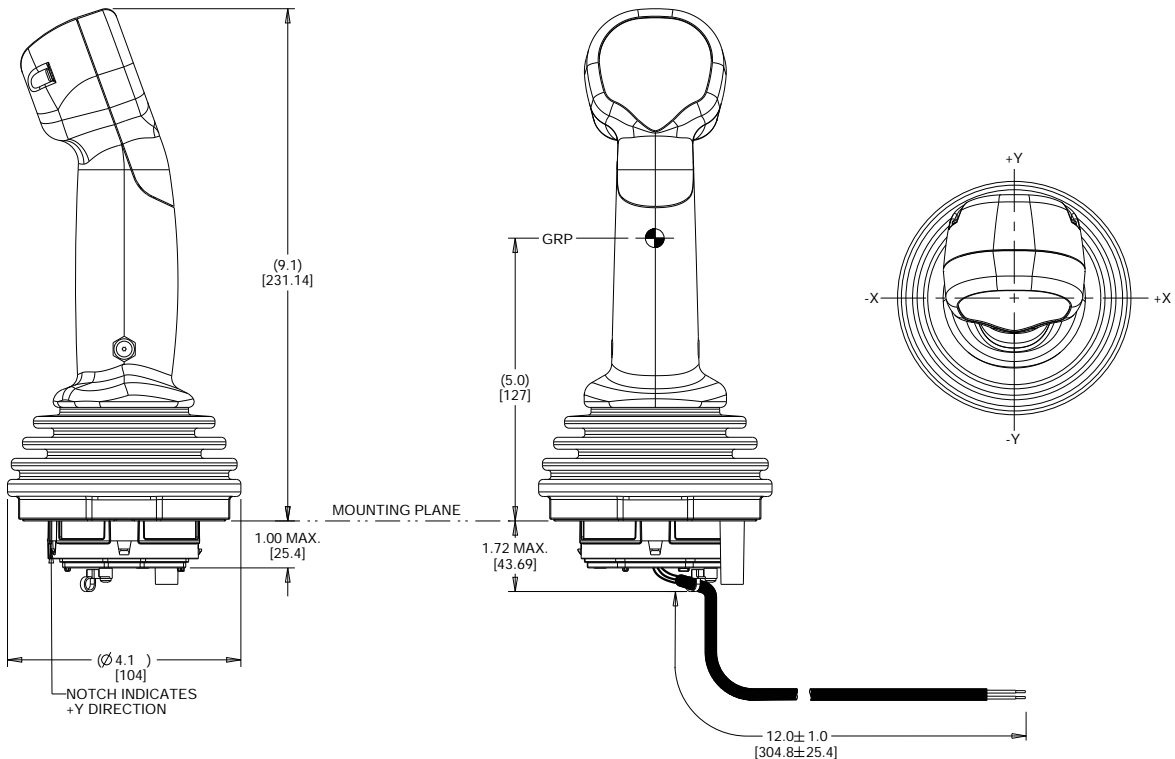
NO PUSHBUTTON  
AND OPERATOR PRESENCE



DF

BLANK

## OUTPUTS AA-FT AND LL



Wires and strain relief not shown in all views for clarity.

Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

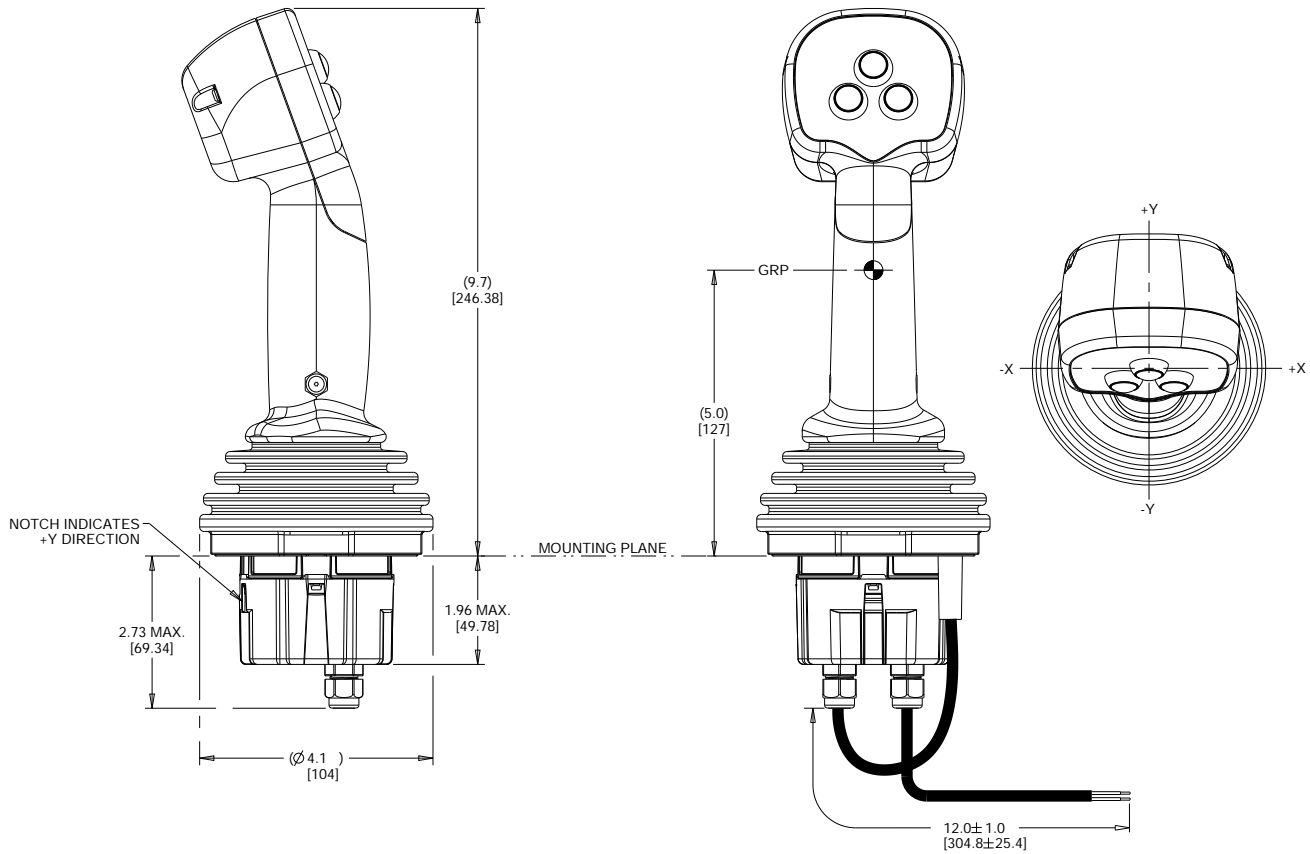
# JOYSTICK WITH GRIP OPTIONS

**HJMG3**

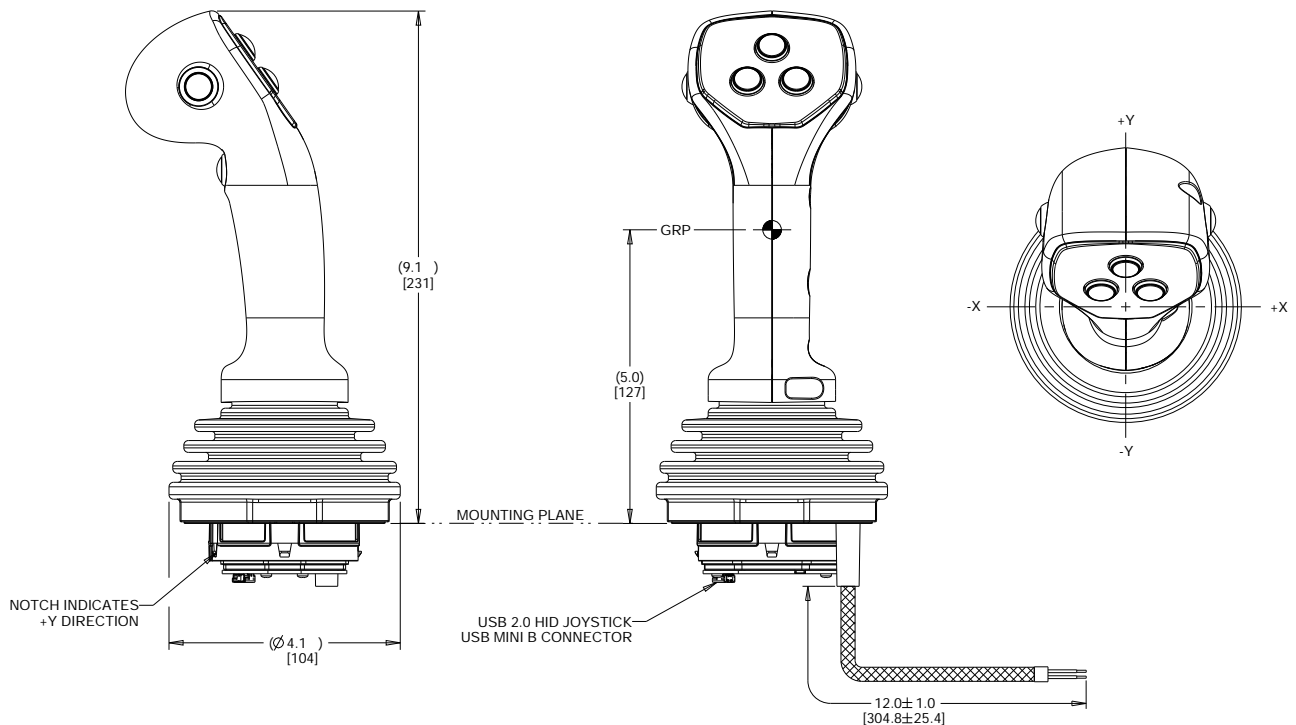
MEDIUM  
JOYSTICK  
WITH GRIP

LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

## OUTPUTS JJ AND KK



## OUTPUT MM



Wires and strain relief not shown in all views for clarity.

Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

SINGLE AXIS HALL EFFECT JOYSTICK WITH FRICTION HOLD



The JHS-F0001 is a single axis, friction hold joystick that was designed for the construction equipment and off-road vehicle market. The key feature of the JHS-F0001 joystick is that the lever does not return to center when released. Designed for use in applications where the output is used to control the speed or direction of the machine or mechanism, allowing the operator to set the speed of movement to focus on steering or other tasks. Favored for its compact size, strength and reliability, the JHS-F0001 is manufactured with non-contacting Hall effect sensors; the electronics are sealed to IP68S. It offers excellent immunity to RFI and EMI per SAE J1113; standard 0.5 to 4.5VDC proportional output and a mechanical life of 500,000 cycles.

## Features:

- **Rugged compact design**
- **Hall effect contactless sensing**
- **Electronics sealed to IP68S**
- **Excellent proportional control**
- **Outstanding EMI/RFI immunity**
- **Redundant output available**
- **RoHS compliant**

### Standard Characteristics/Ratings:

**ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)**

Electrical				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Tolerance at Full Travel Direction 1 (+ Travel)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Tolerance at Full Travel Direction 2 (- Travel)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10

### ELECTRONICS:

**Seal Integrity:** Electronics watertight per IP68S

### MECHANICAL:

**Mechanical Life:** 500,000 cycles

**Travel Angle:** 25° typical, 24° min to 26° max

**Operating Force:** 3.5 lbs. typical, 2.0 lbs. min to 5.0 lbs. max

### ENVIRONMENTAL:

**Operating Temp Range:** -40°C to +85°C

**Humidity:** 96% RH, 70°C, 96 hours

**Vibration:** Per MIL-810F min integrity

**RFI:** Withstand per SAE J1113

**EMI:** Withstand per SAE J1113

### MATERIALS:

**Basic Handle:** Polyphenylene Blend

**Housing:** Thermoplastic

**Bellows:** EPDM, black (typical)

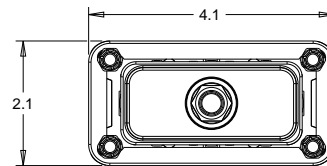
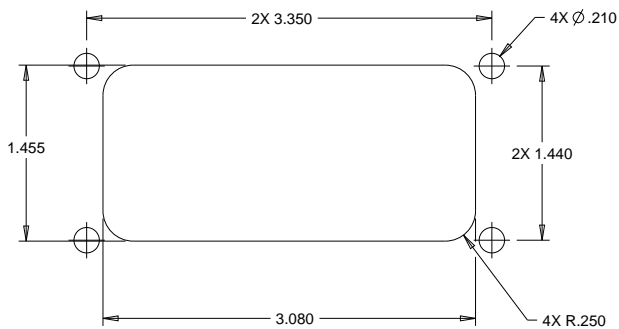
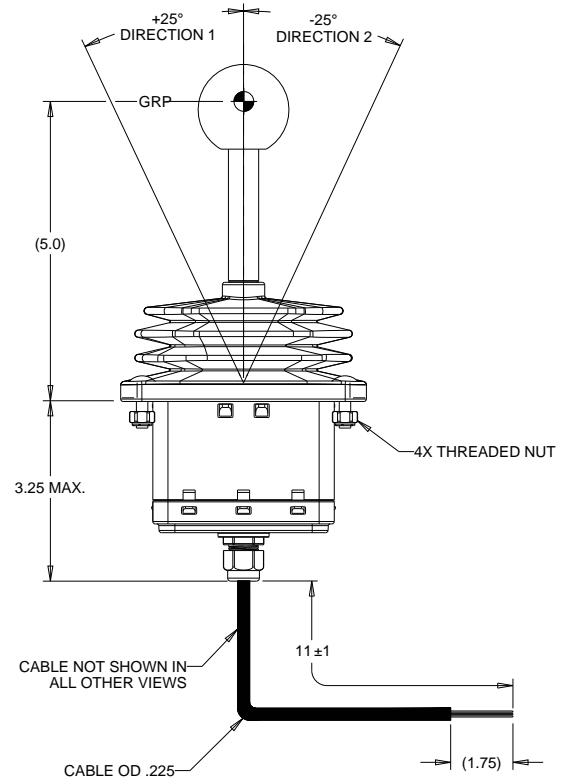
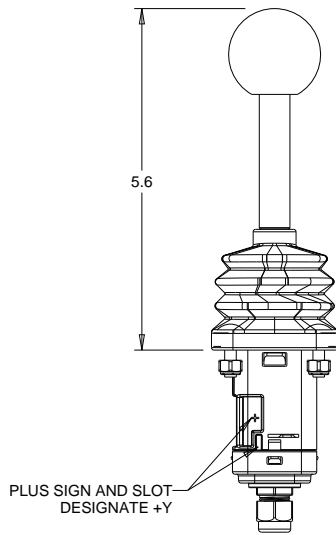
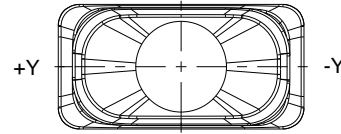
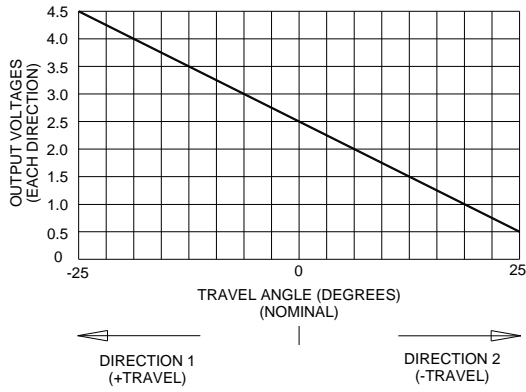
**Cable:** 3/22 AWG (19 strands of 34 AWG TSC)  
 PVC/Polyurethane blend outer jacket

**Mounting Hardware:** 10-24 x 3/4 carriage bolts, self-locking nuts



# SINGLE AXIS JOYSTICK WITH FRICTION HOLD

## SINGLE AXIS HALL EFFECT JOYSTICK WITH FRICTION HOLD



SINGLE AXIS HALL EFFECT JOYSTICK WITH RETURN TO CENTER FEATURE



The JHS-RC0001 is a high reliability single axis, spring-return-to-center joystick, resistant to the levels of temperature, shock, vibration and EMI/RFI typically found in off-highway construction environments. The contactless Hall effect sensor eliminates many of the failures associated with traditional joystick technology. The JHS-RC has been tested to four million cycles with no sign of boot wear and no degradation of electrical performance. The electronics are sealed to IP68S. It offers immunity to RFI and EMI per SAE J1113; standard 0.5 to 4.5VDC proportional output. The JHS-RC is recommended for the construction and off-road vehicle market.

## Features:

- Rugged compact design
- Hall effect contactless sensing
- Tested to 4 million cycles
- Smooth spring return to center
- +/- 25° travel in a rugged housing
- Outstanding EMI/RFI immunity
- Redundant output available
- RoHS compliant

### Standard Characteristics/Ratings:

**ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)**

Electrical				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Tolerance at Full Travel Direction 1 (+ Travel)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Tolerance at Full Travel Direction 2 (- Travel)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Tolerance at Center	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10

### ELECTRONICS:

**Seal Integrity:** Electronics watertight per IP68S

### MECHANICAL:

<b>Mechanical Life:</b>	4 million cycles
<b>Travel Angle:</b>	25° typical, 24° min to 26° max
<b>Operating Force:</b>	2.5 lbs. typical, 1.5 lbs. min to 3.5 lbs. max

### ENVIRONMENTAL:

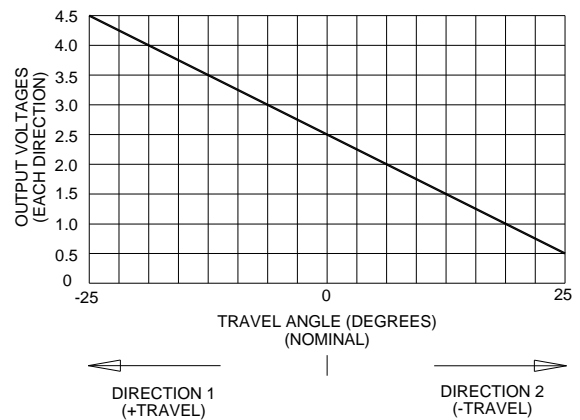
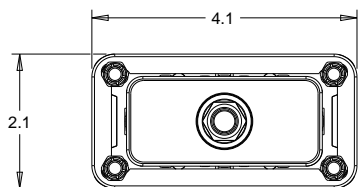
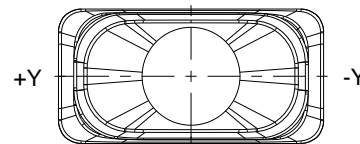
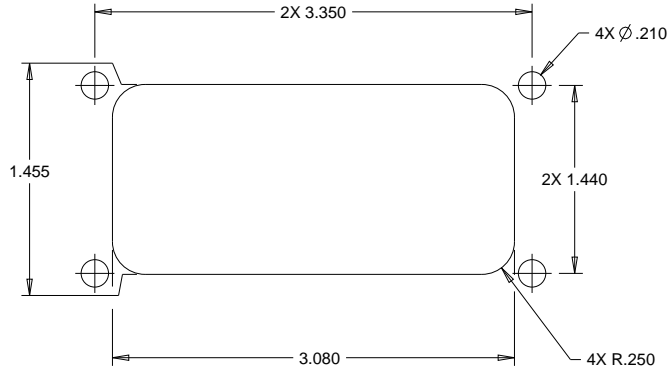
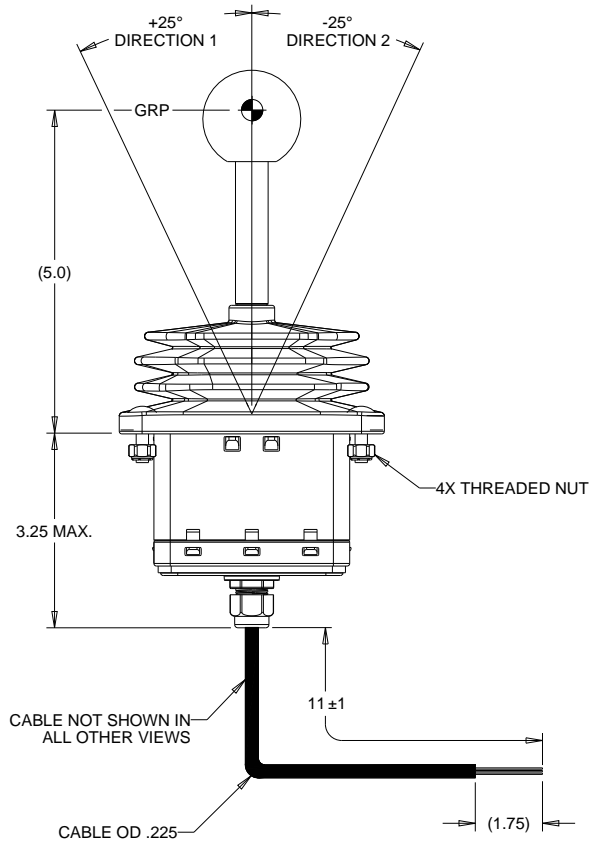
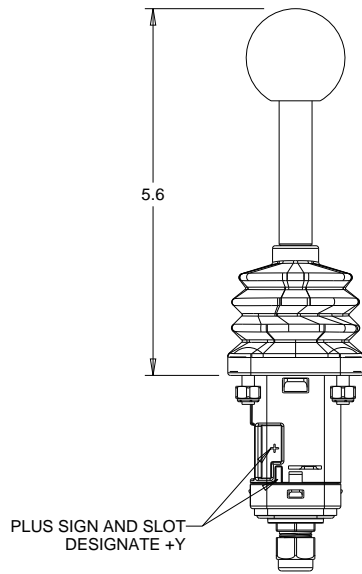
<b>Operating Temp Range:</b>	-40°C to +85°C
<b>Humidity:</b>	96% RH, 70°C, 96 hours
<b>Vibration:</b>	Per MIL-810F min integrity
<b>RFI:</b>	Withstand per SAE J1113
<b>EMI:</b>	Withstand per SAE J1113

### MATERIALS:

<b>Housing:</b>	Thermoplastic
<b>Bellows:</b>	EPDM, black (typical)
<b>Cable:</b>	3/22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket
<b>Mounting Hardware:</b>	10-24 x 3/4 carriage bolts, self-locking nuts

# SINGLE AXIS RETURN TO CENTER JOYSTICK

## SINGLE AXIS HALL EFFECT JOYSTICK WITH RETURN TO CENTER FEATURE



COMPACT DESIGN



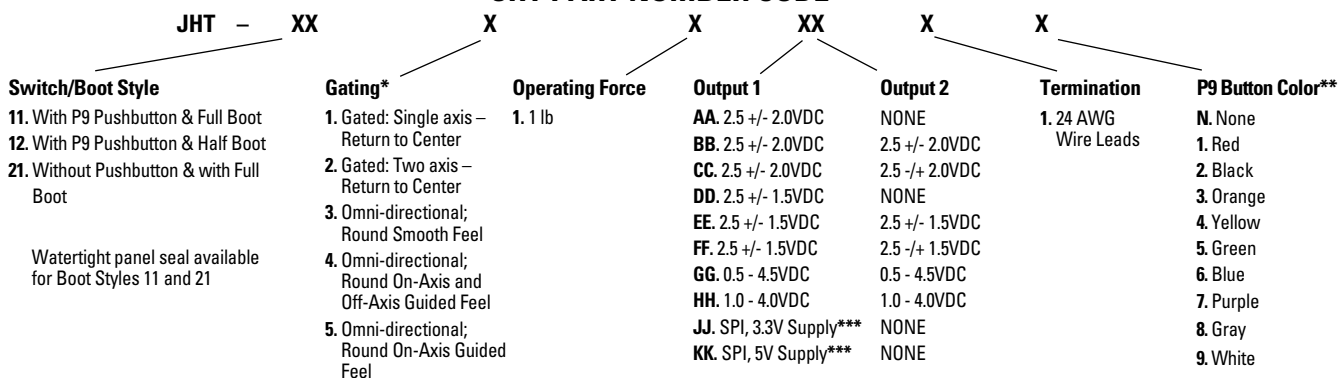
The JHT miniature series Hall effect joystick's compact design and robust construction is the ideal solution where space is limited and precision control is required. Ideal applications include: robotics, construction equipment, hydraulic controls, medical and surgery equipment, security and surveillance video cameras. The JHT has been tested to five million cycles with no degradation of electrical performance or boot wear. Electronics are sealed to IP68S and EMI/RFI immunity are per SAE J1113 specifications.

## Features:

- Compact design excellent for armrest & panel mounting
- Proven contactless analog output Hall effect technology
- 5 million operational cycles in all directions
- Electronics sealed per IP68S
- Single or omni-directional
- Optional pushbutton switch(es) available
- RoHS compliant

Standard Characteristics/Ratings:				
<b>GENERAL:</b>				
<b>Sensor Type:</b>	Hall effect analog, factory programmed ground and supply line break detection; over voltage and reverse voltage protection			
<b>Design:</b>	Contactless sensing			
<b>ELECTRICAL RATINGS: Rated at Vcc = 5V @ 20°C Load = 1ma (4.7KΩ)</b>				
<b>Electrical</b>				
	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current* (B = 0, Vcc = 5V, Io = 0)	mA	N/A	10	12
Output Impedance	kΩ	N/A	1	N/A
*Single output per axis. Dual output per axis available. Supply current 20mA typical.				
<b>MECHANICAL:</b>				
<b>Joystick Mechanical Life:</b> 5,000,000 cycles in all directions				
<b>P9 Mechanical Life:</b>	1,250,000 cycles			
<b>Travel Angle:</b>	18° min to 22° max, 20° typical			
<b>Overtravel Angle:</b>	0.5° min to 1.5° max, 1° typical			
<b>Joystick Operating Force:</b>	With bellows, at grip 0.5 lb. min to 1.5 lbs. max over temperature range			
<b>P9 Operating Force:</b>	@20°C 8 oz min to 16 oz max, 12 oz typical			
<b>ENVIRONMENTAL:</b>				
<b>Operating Temp Range:</b> -40°C to +85°C				
<b>Seal:</b>	Electronics seal to IP68S			
<b>RFI/EMI:</b>	Withstand per SAE J1113			
<b>MATERIALS:</b>				
<b>Housing:</b>	Thermoplastic, black			
<b>Bellows:</b>	Silicone, black. Additional materials available, contact factory.			

## JHT PART NUMBER CODE



\*Gated = Restricted movement in XY axis only. Gating icons appear on page 111.

\*\*Applies only to half boot with pushbutton option.

\*\*\*P9'S are not part of the SPI output.

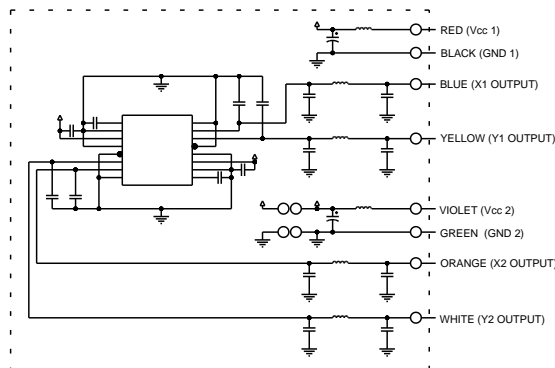
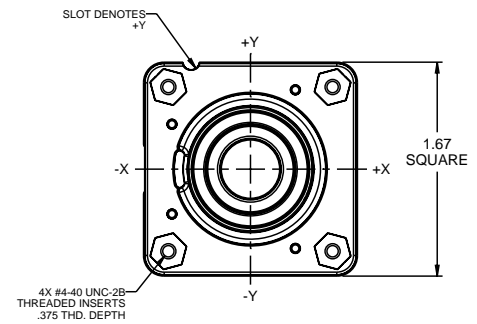
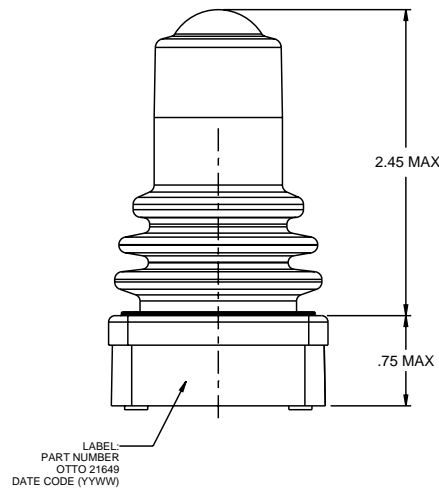
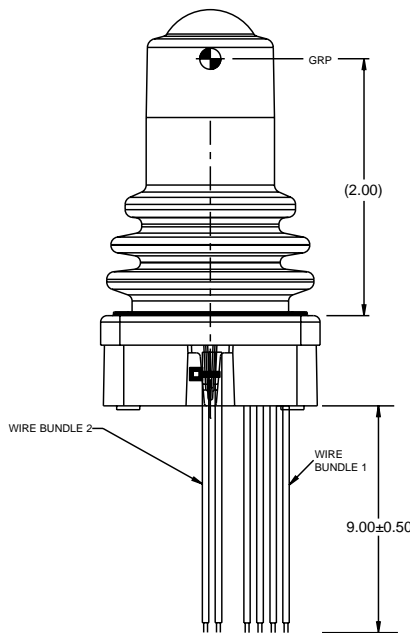
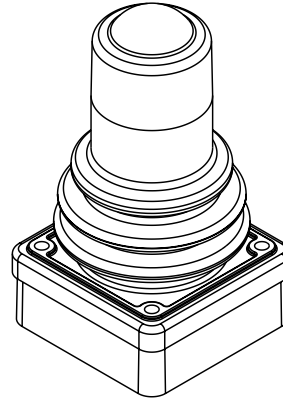
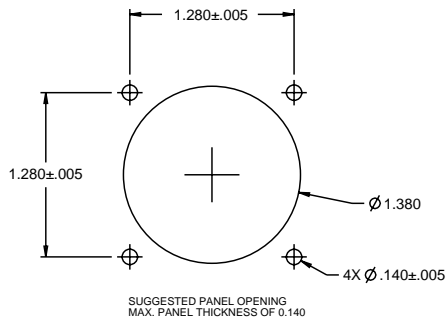
**NOTES:**

- Outputs are from the center to the full travel position in each direction.
- Options "AA," "BB," "CC," "DD," "EE" and "FF" provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis.
- Options "GG" and "HH" provide increasing voltages in all directions (+X, +Y, -X, -Y) from 2 outputs per axis.
- Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

# MINIATURE HALL EFFECT JOYSTICK

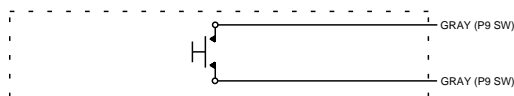
COMPACT DESIGN

## Full Boot Version Shown



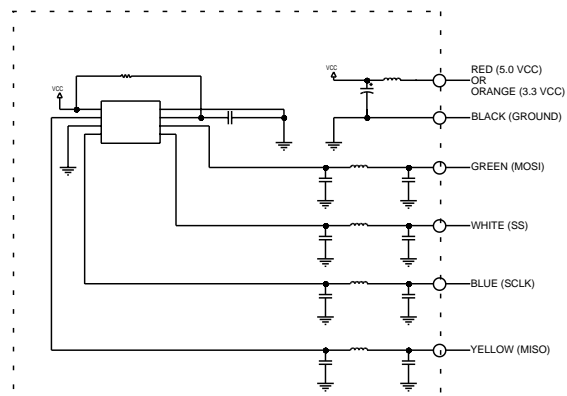
### GENERAL SCHEMATIC

(WIRE BUNDLE 1)  
ALL OUTPUTS ARE NOT PRESENT IN ALL CONFIGURATIONS



### PUSHBUTTON SCHEMATIC

(WIRE BUNDLE 2)  
ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS

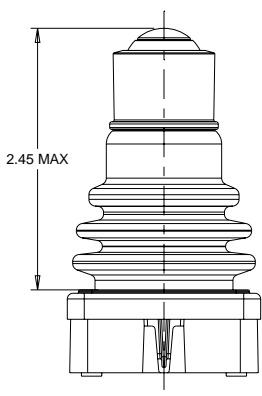
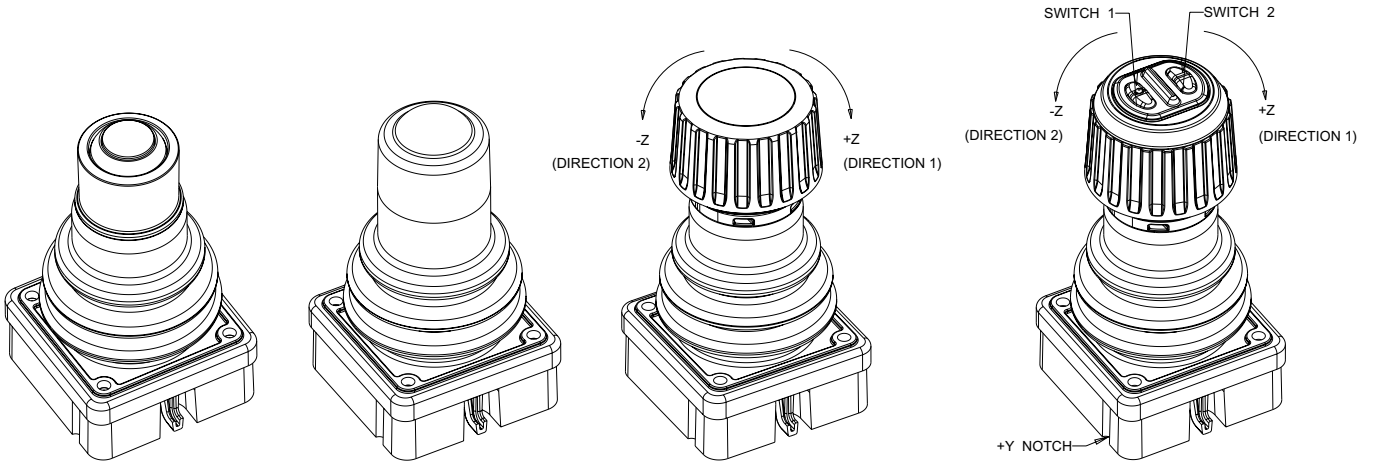


### SPI SCHEMATIC

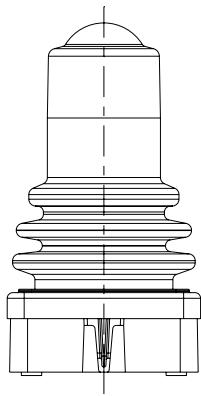
(WIRE BUNDLE 1)  
ONLY ONE SUPPLY WIRE IS PRESENT WITH EACH CONFIGURATION

COMPACT DESIGN

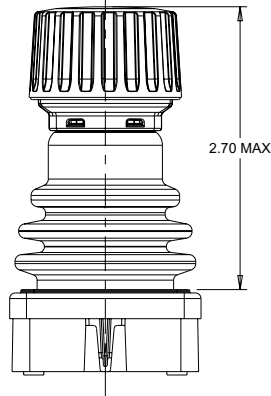
## JHT Switch/Style Boot Configuration



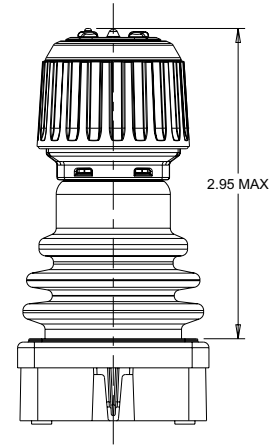
**HALF BOOT**



**FULL BOOT**



**Z AXIS**

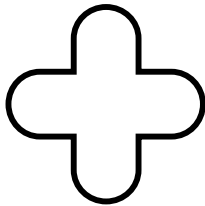


**Z AXIS WITH  
PUSHBUTTONS**

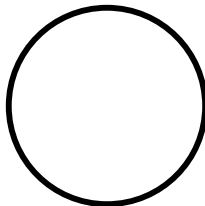
## JHT and JHT Z-Axis Icons Demonstrating Feel\*



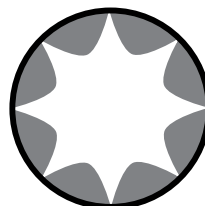
Gated;  
Single Axis -  
Return to Center



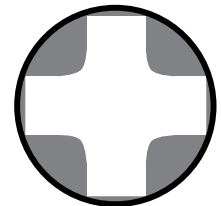
Gated;  
Two Axis -  
Return to Center



Omnidirectional;  
Round Smooth Feel



Omnidirectional;  
Round On-Axis and  
Off-Axis Guided Feel\*\*



Omnidirectional;  
Round On-Axis  
Guided Feel

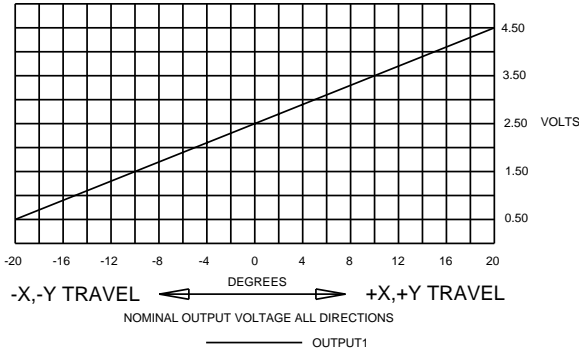
\*Feel defined by shading.

\*\*Full output available in all directions. Contact factory for details.

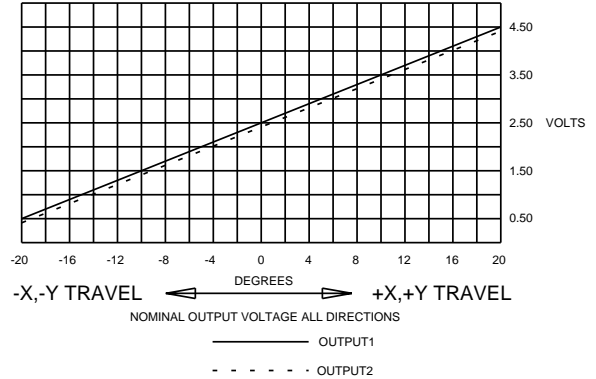
# MINIATURE HALL EFFECT JOYSTICK

## COMPACT DESIGN

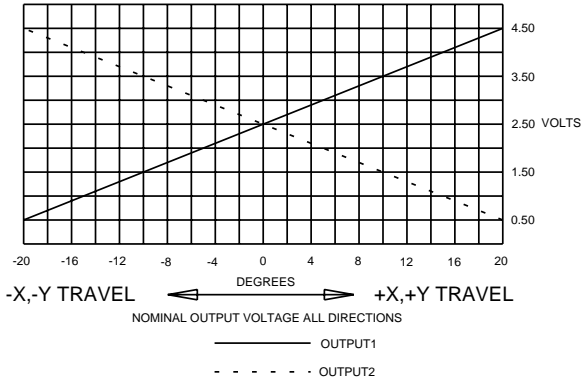
### OPTION AA



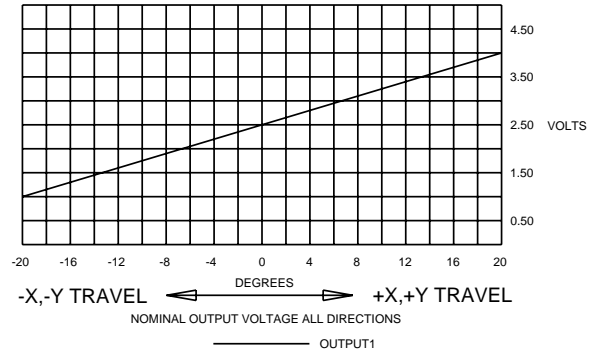
### OPTION BB



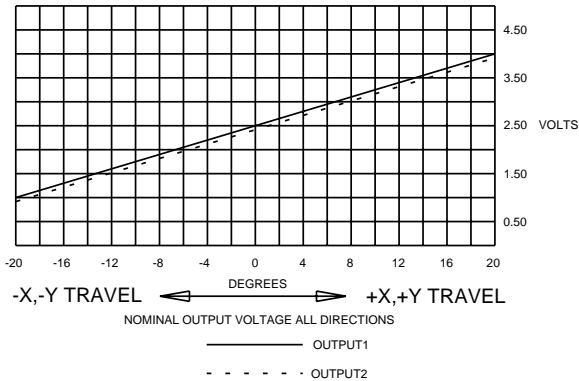
### OPTION CC



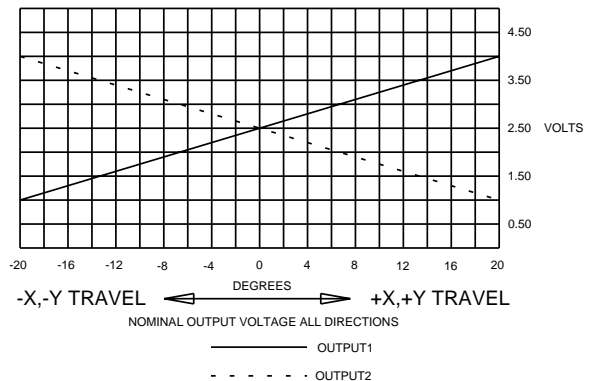
### OPTION DD



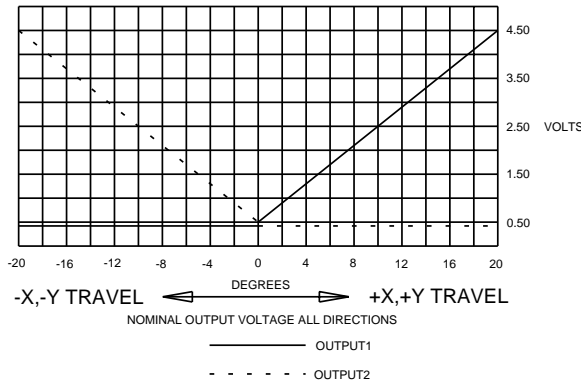
### OPTION EE



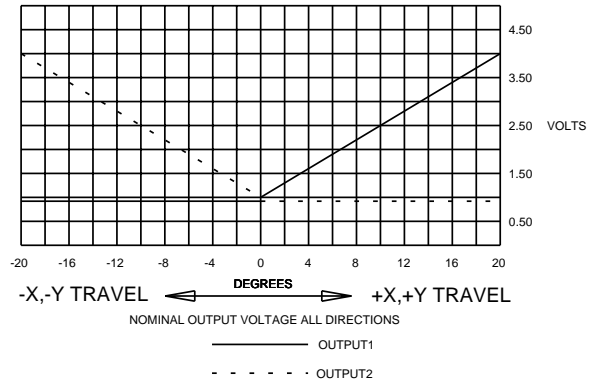
### OPTION FF



### OPTION GG



### OPTION HH



COMPACT DESIGN



With Pushbuttons

Without Pushbuttons

The JHT Z-Axis Miniature Series Hall Effect Joystick allows for a 60° rotational movement of the knob at the top of the joystick. Z-Axis options include detent, friction hold or spring return to center. Its compact design is the ideal solution where space is limited and precision control is required, while its robust construction is suited for demanding applications. The JHT joystick has been tested to five million cycles in all directions with no degradation of performance. The Z-Axis and/or pushbuttons have been tested to one million cycles. Various gating options are also available. The JHT Z-Axis electronics are sealed to IP68S and can withstand EMI/RFI per SAE J1113 specifications. The JHT Z-Axis has numerous applications and is ideal for construction equipment, unmanned vehicles, hydraulic controls, industrial vehicle controls, medical and surgery equipment and surveillance video cameras.

## Features:

- 60° rotational movement of the knob
- Compact design
- Contactless analog output Hall effect technology
- 5 million operational cycles in all directions (Joystick)
- Joystick electronics sealed per IP68S
- Optional pushbutton switches available
- 3.3V and 5V SPI Output Options
- RoHS compliant

### Environmental Ratings and Materials:

**ENVIRONMENTAL:**

**Operating Temp Range:** -40°C to +85°C

**Seal:** Joystick electronics without pushbutton sealed to IP68S  
Keypad electronics sealed to IP65S

**EMI/RFI:** Withstand per SAE J1113

**MATERIALS:**

**Housing:** Thermoplastic, black

**Bellows:** Silicone, black. Additional materials available, contact factory.

### Standard Characteristics/Ratings:

**GENERAL:**

**Sensor Type:** Hall effect analog, factory programmed ground and supply line break detection; over voltage and reverse voltage protection

**Design:** Contactless sensing

**ELECTRICAL RATINGS:** Rated at Vcc = 5V @ 20°C Load = 1ma (4.7KΩ)

**Electrical - Analog Joystick**

	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-25	N/A	+25
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-25	N/A	+25
Supply Current* (B = 0, Vcc = 5V, Io = 0)	mA	N/A	10	12
Output Impedance	kΩ	N/A	1	N/A

\*Single output per axis. Dual output per axis available. Supply current 20mA typical.

**Electrical - Joystick Z-Axis Return to Center**

	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output 1+2 Voltage, +Z, -Z 0° Deflection	VDC @ 5V Vcc	2.25	2.50	2.75
Output 1+2 at Full Travel +Z Direction	VDC @ 5V Vcc	4.25	4.50	4.55
Output 1+2 at Full Travel -Z Direction	VDC @ 5V Vcc	0.45	0.50	0.75
Supply current (per sensor) B = 0, Vcc = 5V, Io = 0	mA	N/A	N/A	10.0
Output - Source Current Limit B = -X, Vo = 0	mA	-1.0	N/A	1.0

**Electrical - Joystick Z-Axis Friction**

	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output 1+2 at Full Travel +Z Direction	VDC @ 5V Vcc	4.25	4.50	4.55
Output 1+2 at Full Travel -Z Direction	VDC @ 5V Vcc	0.45	0.50	0.75
Supply Current (per sensor) (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10
Output - Source Current Limit B = -X, Vo = 0	mA	-1.0	N/A	1.0

**Electrical - Joystick Z-Axis 3 Detent**

	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output 1+2 Voltage, +Z, -Z 0° Deflection	VDC @ 5V Vcc	2.25	2.50	2.75
Output 1+2 at Full Travel +Z Direction	VDC @ 5V Vcc	4.25	4.50	4.55
Output 1+2 at Full Travel -Z Direction	VDC @ 5V Vcc	0.45	0.50	0.75
Supply current (per sensor) B = 0, Vcc = 5V, Io = 0	mA	N/A	N/A	10.0
Output - Source Current Limit B = -X, Vo = 0	mA	-1.0	N/A	1.0

**Joystick**

Mechanical Life: 5,000,000 cycles in all directions

	Units	Min	Typ	Max
Travel Angle	Degrees	18	20	22
Over Travel Angle	Degrees	0.5	1.0	1.5
Max Allowable Radial Force (Styles 11, 12 & 21) @ GRP	Lbs.	N/A	N/A	50
Max Allowable Radial Force (All Other Styles) @ GRP	Lbs.	N/A	N/A	15

**Z-Axis**

Mechanical Life: 1,000,000 cycles in all directions

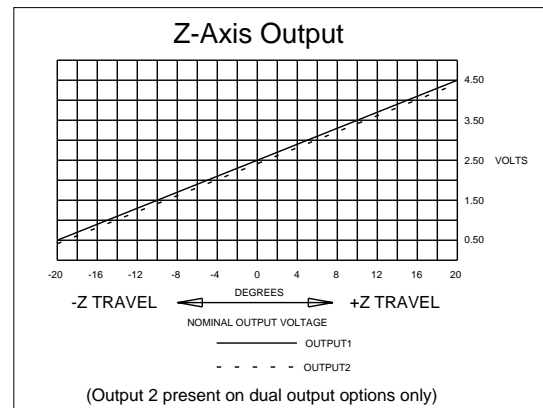
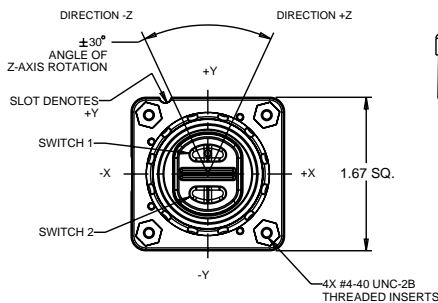
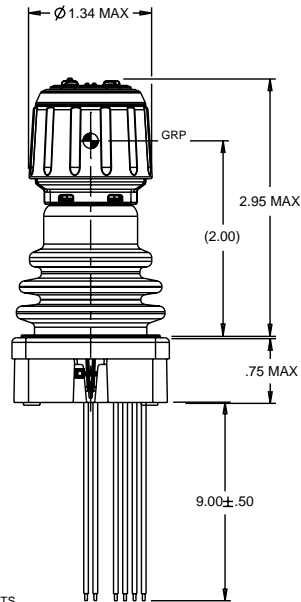
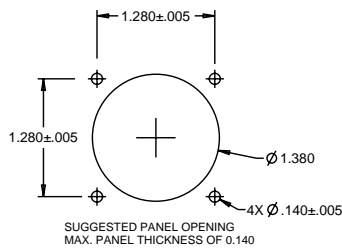
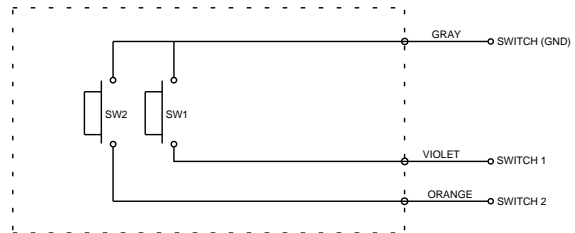
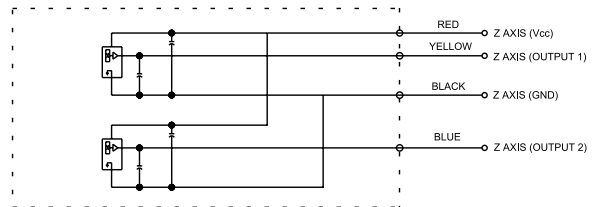
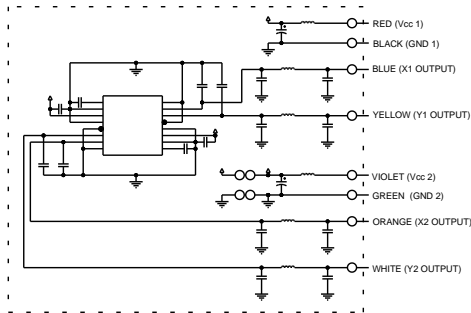
	Units	Min	Typ	Max
Travel Angle (Total)	Degrees	56	60	64
Operational Torque with Detent	OZ	10	20	30
Operational Torque with Friction Hold	OZ	1.0	4.0	7.0
Operational Torque Return to Center	OZ	8.0	16	24



# MINIATURE Z-AXIS HALL EFFECT JOYSTICK

**JHT**  
Z-AXIS MINI  
JOYSTICK

## COMPACT DESIGN



## JHT Z-AXIS PART NUMBER CODE

JHT - XX	X	X	XX	X	N
Switch/Boot Style (All Half Boot)	Gating*	Operating Force	Joystick Output 1	Joystick Output 2	Termination
<b>32.</b> Z-Axis with Detent, Single Output	<b>1.</b> Gated; Single axis – Return to Center	<b>1.1 lb</b>	<b>AA.</b> 2.5 +/- 2.0VDC	NONE	<b>1.24 AWG</b> Wire Leads
<b>42.</b> Z-Axis with Friction Hold, Single Output	<b>2.</b> Gated; Two axis – Return to Center		<b>BB.</b> 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	
<b>52.</b> Z-Axis Return to Center, Single Output	<b>3.</b> Omni-directional; Round Smooth Feel		<b>CC.</b> 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	
<b>62.</b> Z-Axis with Detent, Dual Output	<b>4.</b> Omni-directional; Round On-Axis and Off-Axis Guided Feel		<b>DD.</b> 2.5 +/- 1.5VDC	NONE	
<b>72.</b> Z-Axis with Friction Hold, Dual Output	<b>5.</b> Omni-directional; Round On-Axis Guided Feel		<b>EE.</b> 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	
<b>82.</b> Z-Axis Return to Center, Dual Output			<b>FF.</b> 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	
<b>92.</b> Z-Axis with Detent, Single Output with Two Pushbuttons			<b>GG.</b> 0.5 - 4.5VDC	0.5 - 4.5VDC	
<b>A2.</b> Z-Axis with Friction, Single Output with Two Pushbuttons			<b>HH.</b> 1.0 - 4.0VDC	1.0 - 4.0VDC	
<b>B2.</b> Z-Axis Return to Center, Single Output with Two Pushbuttons			<b>JJ.</b> SPI, 3.3V Supply**	NONE	
<b>C2.</b> Z-Axis with Detent, Dual Output with Two Pushbuttons			<b>KK.</b> SPI, 5V Supply**	NONE	
<b>D2.</b> Z-Axis with Friction, Dual Output with Two Pushbuttons					
<b>E2.</b> Z-Axis Return to Center, Dual Output with Two Pushbuttons					

\*Gated = Restricted movement in XY axis only. Gating Icons shown on page 111 in the JHT mini joystick section.  
\*\*Z-Axis and Pushbuttons are not part of the SPI message.

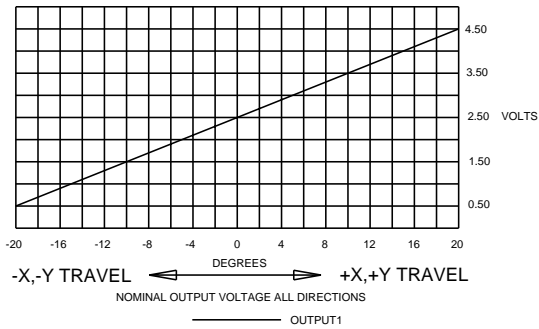
NOTES (Applies to Joystick Output Only):

- Outputs are from the center to the full travel position in each direction.
- Options "AA", "BB", "CC", "DD", "EE" and "FF" provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis.
- Options "GG" and "HH" provide increasing voltages in all directions (+X, +Y, -X, -Y) from 2 outputs per axis.
- Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

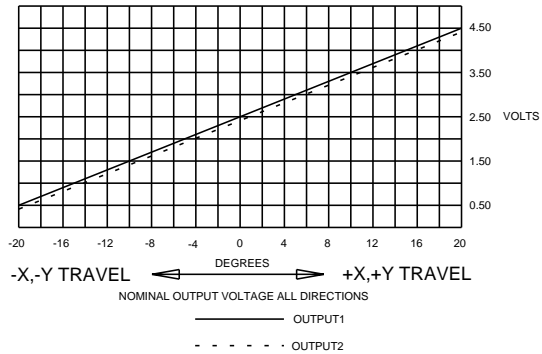
COMPACT DESIGN

## Joystick Output Configuration

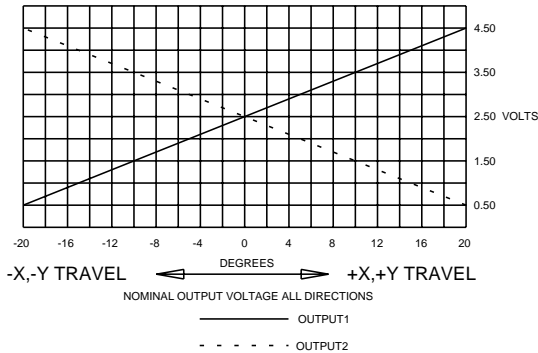
**OPTION AA**



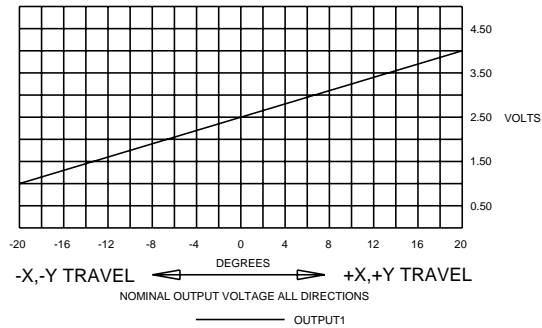
**OPTION BB**



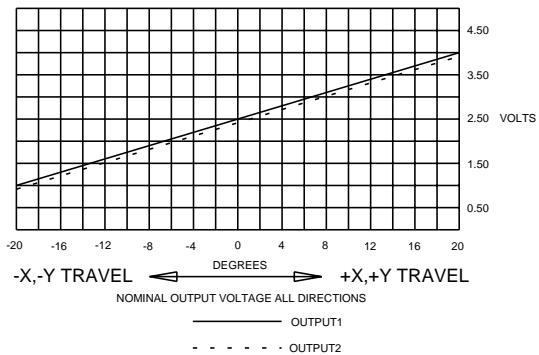
**OPTION CC**



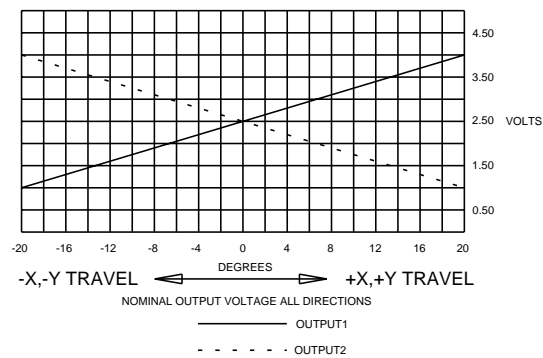
**OPTION DD**



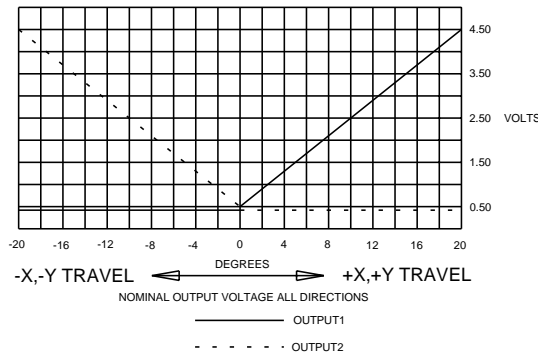
**OPTION EE**



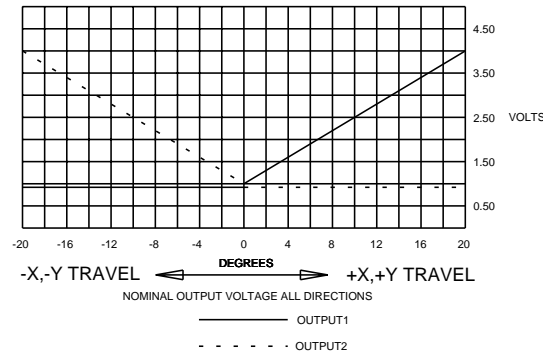
**OPTION FF**



**OPTION GG**



**OPTION HH**



## CANopen® & J1939 COMMUNICATION PROTOCOLS AVAILABLE

OTTO is an industry leader in the integration of J1939 and CANopen® serial bus communications in on and off-highway operator controls. OTTO has extensive experience implementing CAN operating systems in conjunction with the latest generation of operator controls; replacing traditional electromechanical and hydraulic systems with solid state, digital and analog electro-hydraulic control systems. OTTO's product line of electro-mechanical switches including pushbuttons, rockers, toggles and Hall effect devices mated to our Hall effect joysticks and control handles provide a CAN based integrated solution for any application.

J1939 offers an industry standard set of defined codes for consistent system integration.

The OTTO J1939 Joystick will work in processing messages every 20ms. J1939 can be field reconfigured to one of three factory set CAN addresses using an external resistor. The default factory addresses are 51, 52, 53. Additional joystick addresses can be added by assigning a unique identification during configuration.

CANopen® provides a greater degree of flexibility in defining device IDs and can be remotely configured. CANopen® can also be configured to run with other system baud rates.

### Features:

- **Standard configuration for both is three analog input channels & 12 digital input channels with two digital output channels**
- **CAN power accommodates a 9–32VDC power supply input**
- **I/O extension for up to 32 digital inputs, eight analog inputs & 32 digital outputs by LIN interface**
- **Both J1939 & CANopen® versions include a failure monitoring feature**
- **EMI/RFI per SAE J1113, tested to 100V/M**
- **Operating temperature -40°C to +85°C**
- **Available on JH, JHM or HJFC**
- **All designs are RoHS compliant**



CANbus JH Joystick



HJFC Foot Pedal  
with CANbus Interface

SEALED SWITCH WITH HIGH CYCLE LIFE



Capacitive Switch  
Concave Button  
CS-1



Capacitive Switch  
Raised Button  
CS-2

The New CS Series Capacitive Touch Sensor Switch is designed for applications where control functions are needed for an unobtrusive style. The switch changes output level with the presence of a finger or hand (gloved or ungloved) which makes it ideal for use as an on-off switch.

The switch sensing area can be a concave surface or a slightly raised surface. It can also be customized to accommodate surfaces of irregular shape. The CS is designed to be mounted in a panel, grip, armrest or other surface.

The switch can be used as a single device or in combination with additional CS switches and controlled by software programming. Another unique feature for the CS series is that it can be painted over and still function. This makes it ideal for customers who want to place their own pad printed icon or clear adhesive icons.

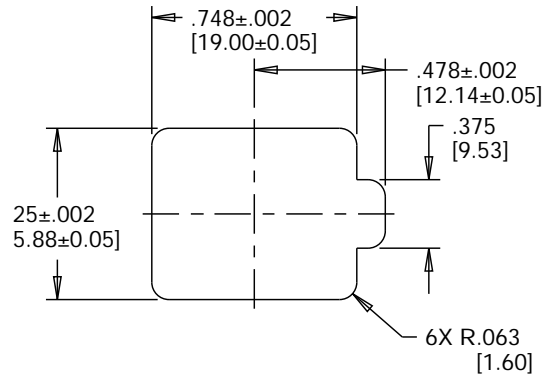
The CS series comes standard sealed to IP68S.

## Features:

- Operates by touch with a gloved or ungloved hand
- Two standard shapes, but can be customized
- Active low output
- No moving parts to wear out
- Wide operating temperature range
- Completely sealed to IP68S
- RoHS compliant

Standard Characteristics/Ratings:						
<b>Sensing Distance:</b> (from surface)		1/16" to 1/8"				
<b>Cycle Life:</b>		50M cycles				
<b>Operate Force:</b>		0 lbs.				
<b>Operating Temperature:</b>		-40°C to +85°C				
<b>Enclosure Seal:</b>		IP68S				
ELECTRICAL RATINGS:						
Nominal DC Specifications						
Parameter	Description	Min.	Typ	Max.	Units	Notes
VDD	Supply Voltage	1.8		5.5	V	
IDD	Supply Current		4.0	4.5	mA	
VOL	Low Output Voltage			0.6	V	Out, 4mA SINK
ENVIRONMENTAL:						
<b>EMI:</b>		CISPR 25 (contact factory for more details)				
<b>ESD:</b>		ISO 10605 (contact factory for more details)				
MATERIALS:						
<b>Housing Material:</b>		Thermoplastic				
<b>Wires:</b>		24 AWG (x3)				

## SUGGESTED PANEL CUTOUT



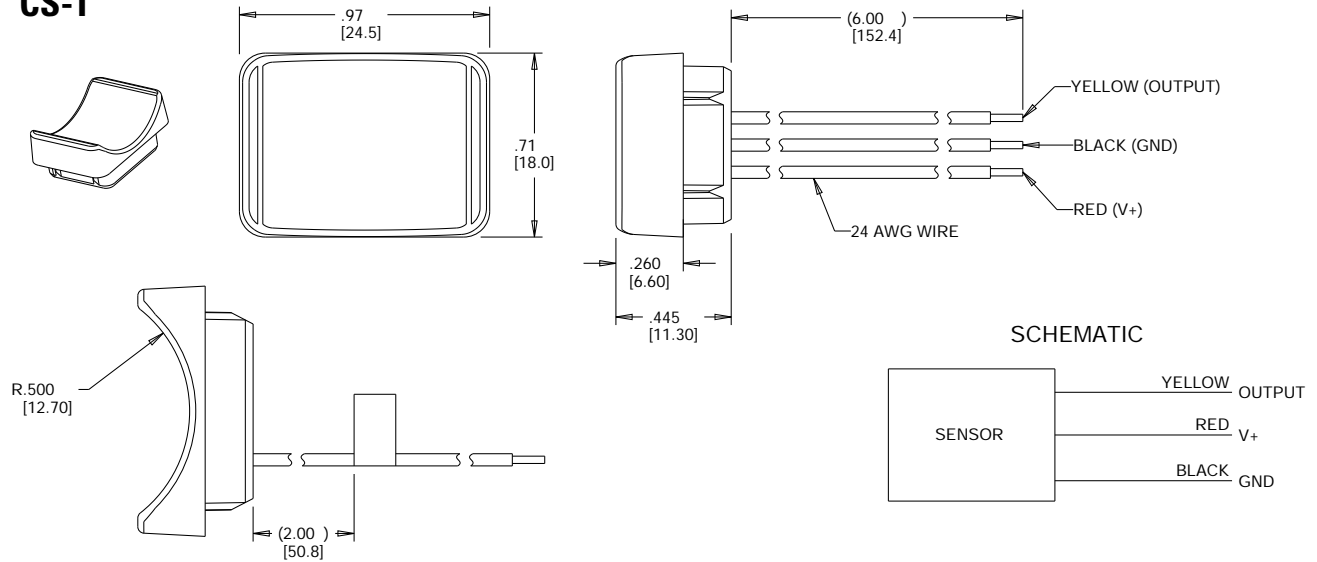
## CAPACITIVE SWITCH PART NUMBER CODE

CS	-	X		X		X
<b>Configuration</b>		<b>Output</b>		<b>Sensitivity</b>		<b>Color</b>
1. Concave 2. Raised		1. Active Low		1. High 2. Medium		2. Black
						<b>Termination</b>
						1. Flying Leads 6"

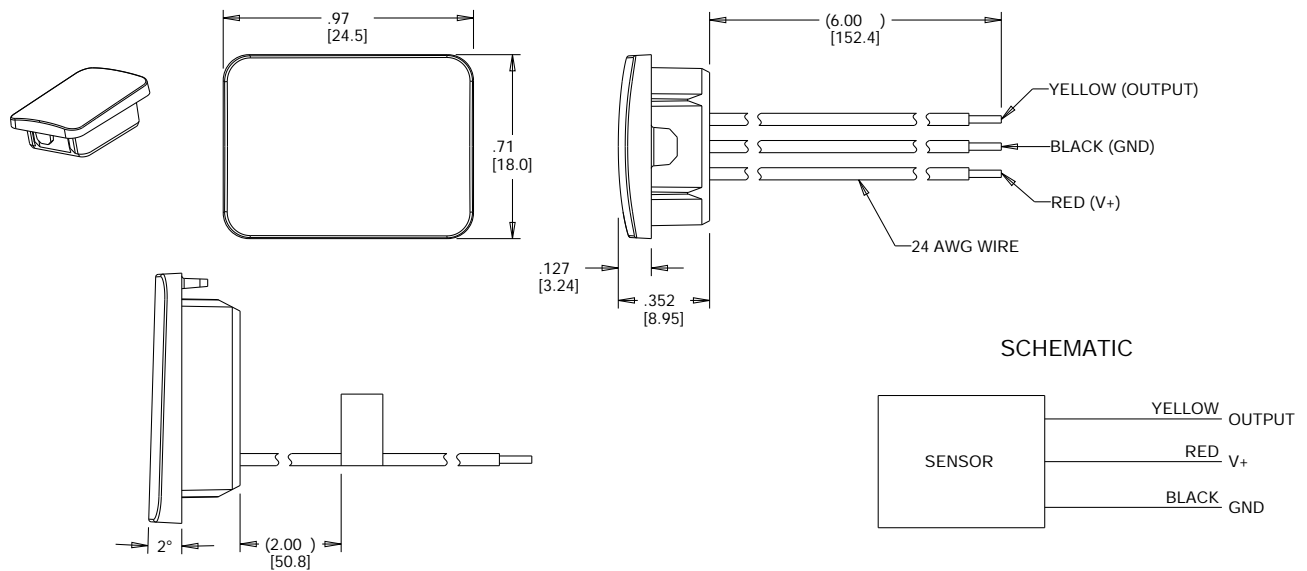
# CAPACITIVE TOUCH SWITCH

SEALED SWITCH WITH HIGH CYCLE LIFE

## CS-1



## CS-2



Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

# SEALED SWITCH MODULE

SELF-CONTAINED, LONG-LIFE, SEALED SWITCH MODULE WITH UP TO 5 POSITIONS

The TC is a self contained, sealed switch module with up to 5 positions. It can be utilized in numerous applications that require a compact switch module and long life.

At slightly over an inch in diameter, it can be used in a grip, front panel, or hand held device, just to name a few applications. It is available in either a top mount or rear mount.

The advantage of the TC switch module is that it incorporates keypad functionality within a very small footprint. Standard or custom legends are available and can be LED backlit.

Standard termination options include flying leads, ribbon cable (with or without AMP connector) and FFC (flexible flat cable). Tested to three million cycles, the TC switch module has an operating temperature range of -40°C to 85°C and it is sealed to IP68S.

The TC can be used in panel or grip applications and is especially useful in cursor control or data entry applications. Applications include construction, agriculture, industrial, material handling and medical.

## Features:

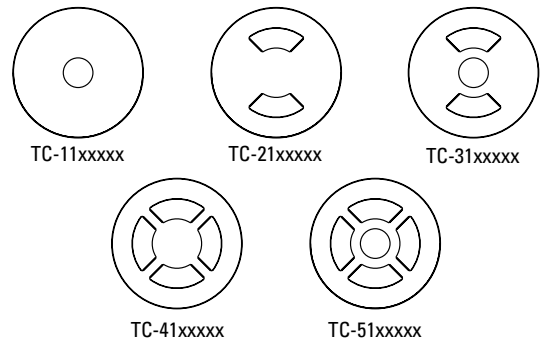
- **Watertight to IP68S**
- **Great for grips and panels**
- **3 million cycle electrical life**
- **LED backlight option**



TC Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	1-28 VDC @ Sea Level
<b>Load:</b>	10-100mA Resistive
<b>Electrical Life:</b>	3,000,000 cycles
<b>LED Voltage Rating:</b>	2.0 VDC
<b>Mechanical Life:</b>	3,000,000 cycles
<b>Seal:</b>	IP68S
<b>Operating Temp Range:</b>	-40°C to +85°C
<b>Operating Force:</b>	1.0 +/- .5 lbs.
<b>Pushout Force:</b>	5 lbs. min.
<b>MATERIALS:</b>	
<b>Housing:</b>	PBT
<b>Keypad:</b>	Silicone Rubber
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	VHB tape





## TC Switch Module Keypad Configurations



## TC PART NUMBER CODE

TC	-	X	X	X	X	X	X	X		
<b>Position</b>		<b>Mounting</b>		<b>Termination</b>		<b>Backlight</b>		<b>Color</b>	<b>Legend*</b>	<b>Not Used</b>
1. 1 Position		1. Top Mount		2. Flying Leads, UL 1569, 24 AWG		N. None		2. Black	None	
2. 2 Position		2. Rear Mount (Behind Panel)		3. FFC, UL 20624		9. White			A. Arrows (5 position)	
3. 3 Position				4. Ribbon Cable, UL 2651, & AMP 215083 Connector					B. Arrows (4 position)	
4. 4 Position				5. Ribbon Cable, UL 2651, Blunt Cut						
5. 5 Position										

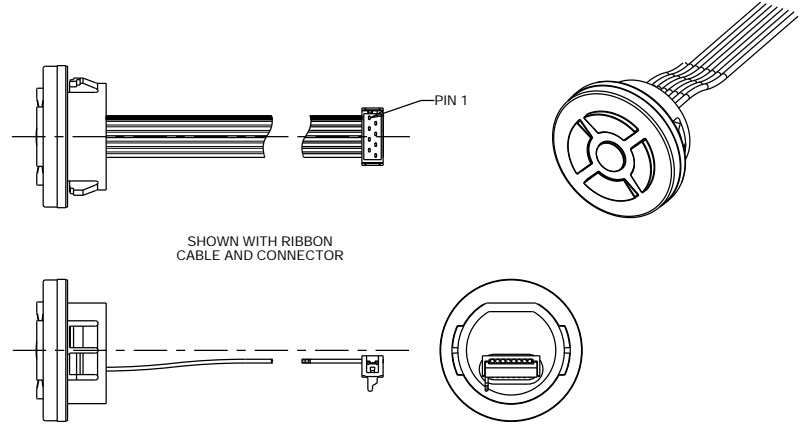
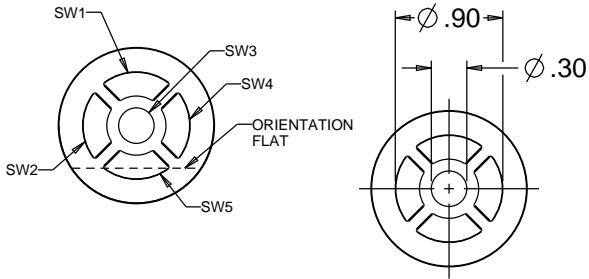



\* Color = White

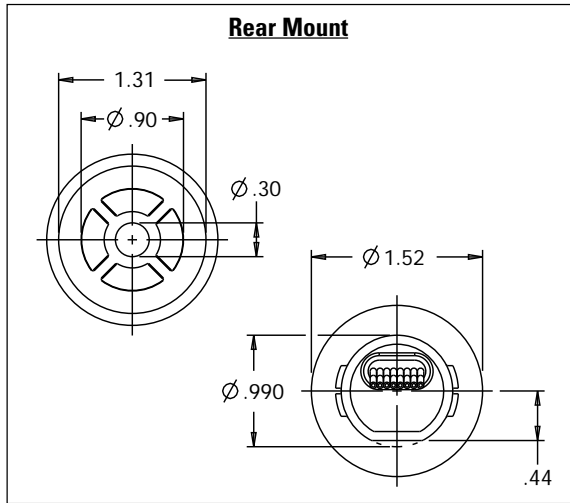
# SEALED SWITCH MODULE

SELF-CONTAINED, LONG-LIFE, SEALED SWITCH MODULE WITH UP TO 5 POSITIONS

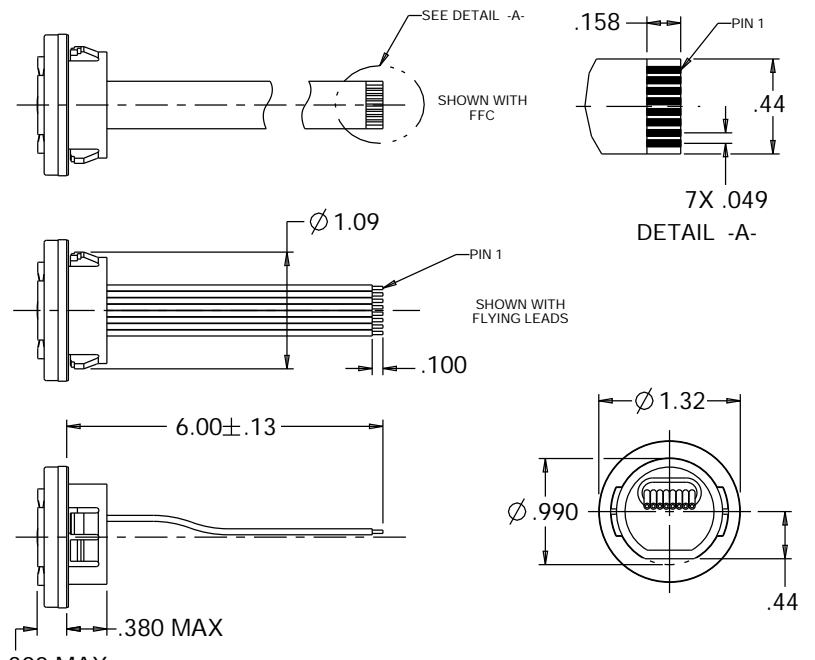
**TC-51xxxxx**  
**Top Mount, 5 Position Module**



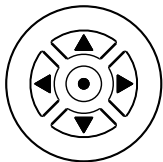
SHOWN WITH RIBBON  
CABLE AND CONNECTOR



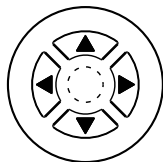
**Rear Mount**



**Standard Legend Configurations**



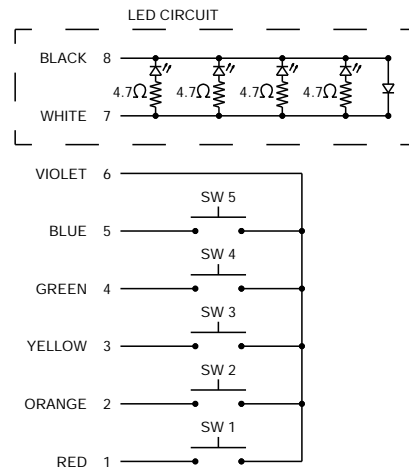
CODE -A-  
5 POSITION



CODE -B-  
4 POSITION

\*Available with TC-4  
and TC-5 versions

**Schematic**  
with optional LED circuit shown



# Limit Switches



SERIES	FEATURE	ACTUATION	MAX RATING <small>(Resistive @ 115VAC, 28VDC)</small>	SEAL RATING	MOUNTING	CIRCUITRY
P6	Mil Grade, Sealed	(Pin, Roller) Momentary Action	7A	MIL-PRF 8805 Symbol 3 or Symbol 4	5/8", 15/32" Threaded	1, 2, & 4 Poles
P6-3	Subminiature, Sealed	(Lever, Plunger, Roller) Momentary Action	10A	MIL-PRF-8805 Symbol 3	3/8", 1/2" dia. Mounting Holes	1, 2 & 3 Poles
P6-4	Commercial, Sealed	(Ball, Roller) Momentary Action	4A	IP68S	9/16" Threaded	1 or 2 Poles



SEALED AGAINST IMMERSION & CORROSIVE ATMOSPHERES



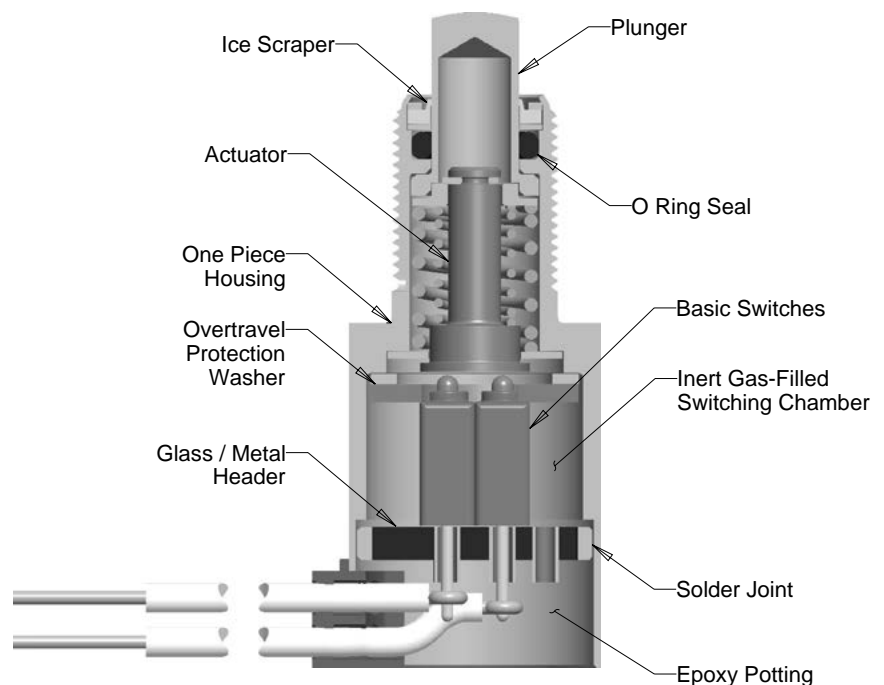
P6 series switches are sealed against immersion and corrosive atmospheres. These switches are designed for rugged duty both mechanically and electrically. A one-piece nickel plated stainless steel or brass housing, sealed at the plunger with an O-ring and at the base with a glass-to-metal header option provides true environment-free sealing to comply with MIL-PRF-8805/39, MIL-PRF-8805/40, MIL-PRF-8805/43, and MIL-PRF-8805/100. Most case parts are grounded for EMI reduction.

The P6 series is available with roller plunger styles for cam or slide actuation and pin plunger for in-line actuation. Contact factory for additional designs.

P6 series features the OTTO B2, B3 or B5 series snap-action basic switch. High contact pressure and unique contact design provides low contact resistance for low level switching as well as full rated service.

## Features:

- Complies with MIL-PRF-8805 sealing
- One-piece housing
- Sealed at plunger with O-rings
- Sealed at base with a glass seal
- EMI reduction construction
- Choice of pin or roller plunger
- Choice of axial or radial leads

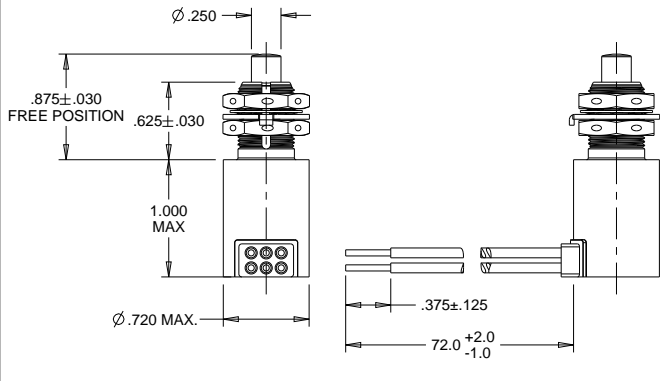


Cross section example of OTTO P6-24XXX series.

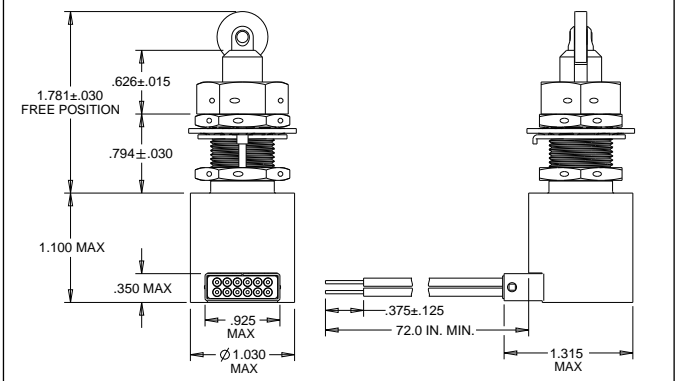
FEATURING OTTO B2 & B3 SERIES BASIC SWITCHES



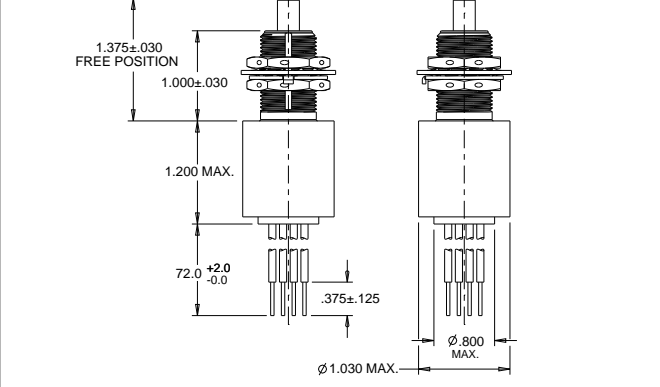
**Style A**  
Pin Plunger  
Radial Leads



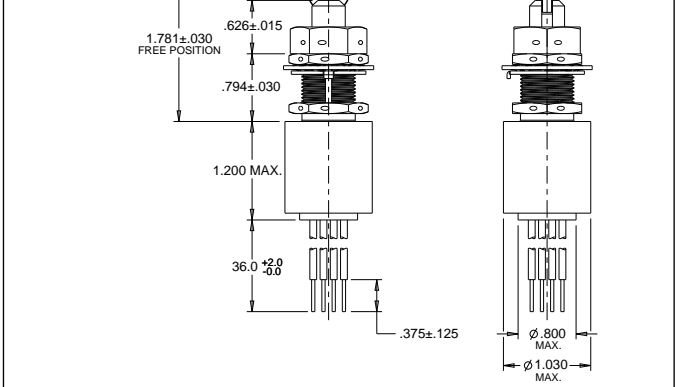
**Style B**  
Roller Plunger  
Radial Leads



**Style C**  
Pin Plunger  
Axial Leads



**Style D**  
Roller Plunger  
Axial Leads



# SEALED LIMIT SWITCHES

**P6**  
SEALED LIMIT SWITCHES

FEATURING OTTO B2 & B3 SERIES BASIC SWITCHES

SPECIFICATIONS: Standard Models					
<b>ELECTRICAL RATINGS:</b>					
<b>Load</b>	<b>Sea Level @ 28VDC</b>	<b>50,000 feet @ 28VDC</b>			
<b>RATING TABLE 1</b>					
Resistive	7A	7A			
Inductive	4A	2.5A			
Motor	4A	(4A)			
DWV	1000Vrms	400Vrms			
<b>RATING TABLE 2</b>					
Resistive	7A	7A			
Inductive	3A	3A			
Motor	4A	4A			
Lamp	2A	1A			
DWV	1250Vrms	600Vrms			
<b>RATING TABLE 3</b>					
Resistive	4A	4A			
Inductive	2A	2A			
Motor	4A	4A			
DWV	1000Vrms	400Vrms			
<b>RATING TABLE 4</b>					
<b>Load Type</b>	<b>Power Circuit</b>	<b>Elex Logic</b>	<b>Low Level</b>	<b>Power Circuit</b>	<b>Elex Logic</b>
Resistive	1A	0.01A	0.01A	1A	0.01A
Inductive	0.5A	N/A	N/A	0.5A	N/A
DWV	1000Vrms			400Vrms	

**Electrical Life:** 25,000 cycles  
**Low Level Life:** 25,000 cycles  
**Contact Resistance:** Per MIL-PRF-8805  
**Operating Force:** 6.0 lbs. to 12.0 lbs. standard. Other forces available.  
**Overtravel Force:** 30.0 lbs. max  
**Release Force:** 4.0 lbs. min

**Pretravel:**  
 MIL-PRF-8805/39, /40, /43: 0.040 inches  
 MIL-PRF-8805/100: 0.070 inches  
 MIL-PRF-8805/104: 0.050 inches

**Movement Differential:**  
 MIL-PRF-8805/39, /40, /43: 0.020 inches  
 MIL-PRF-8805/100: 0.035 inches  
 MIL-PRF-8805/104: 0.030 inches

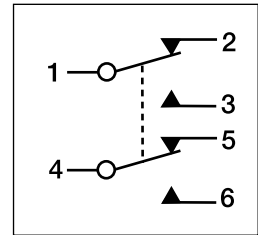
**Overtravel:**  
 MIL-PRF-8805/39, /40, /100: 0.250 inches

**Wire Type:**  
 Per MIL-W-22759/7  
 Marked per MIL-W-5088.  
 Standard length: 6 feet. Other lengths available.

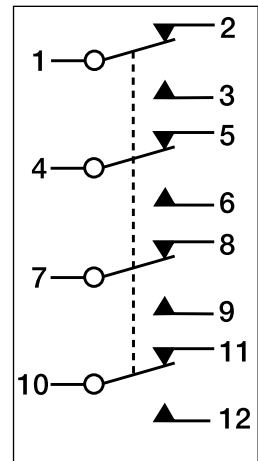
**Operating Temp Range:** -55°C to 85°C

**Mounting/Termination:**  
 Bushing mounting with positive, non-turn features. Wire leads potted at terminal base for strain relief and added insulation. Each wire is marked with circuit identification.

For specific details not shown above, please consult the appropriate military specification sheet or OTTO's product drawing.



2PDT Schematic



4PDT Schematic

Circuitry	Plunger/Lead Exit Style	Dim. A Free Position (inches +/- 0.030)	Dim. B Bushing Length (inches +/- 0.030)	Dim. C Thread (inches)	Dim. D Body Dia. (max inches)	Dim. E Body Length (max inches)	Electrical Rating Table	Military Number	Catalog Number
<b>MIL-PRF-8805/39</b>									
2PDT	A-Pin/Radial	1.375	1.000	0.625-24	0.720	0.980	1	MS21321-1	P6-24000
4PDT	A-Pin/Radial	1.375	1.000	0.625-24	1.031	1.200	1	MS21321-2	P6-24001
<b>MIL-PRF-8805/40</b>									
2PDT	A-Pin/Radial	1.375	1.000	0.625-24	1.015	0.980	3	MS24331-1	P6-24002
<b>MIL-PRF-8805/43</b>									
2PDT	A-Pin/Radial	0.875	0.625	0.469-32	0.720	1.000	1	MS27240-1	P6-24003
4PDT	A-Pin/Radial	0.875	0.625	0.469-32	1.031	1.200	1	MS27240-2	P6-24004
2PDT	B-Roller/Radial *	1.295	N/A	0.469-32	0.720	1.000	1	MS27240-3	P6-14000
4PDT	B-Roller/Radial *	1.295	N/A	0.469-32	1.031	1.200	1	MS27240-4	P6-14001
2PDT	A-Pin/Radial	0.875	0.625	0.469-32	0.720	1.000	4	MS27240-5	P6-24005
4PDT	A-Pin/Radial	0.875	0.625	0.469-32	1.031	1.200	4	MS27240-6	P6-24006
2PDT	B-Roller/Radial *	1.295	N/A	0.469-32	0.720	1.000	4	MS27240-7	P6-14002
4PDT	B-Roller/Radial *	1.295	N/A	0.469-32	1.031	1.200	4	MS27240-8	P6-14003
<b>MIL-PRF-8805/100</b>									
4PDT	A-Pin/Radial	1.375	1.000	0.625-24	1.030	1.100	2	MIL-PRF-8805/100-007	P6-24043
4PDT	C-Pin/Axial	1.375	1.000	0.625-24	1.030	1.200	2	MIL-PRF-8805/100-008	P6-24044
4PDT	B-Roller/Radial **	1.781	0.794	0.625-24	0.925	1.100	2	MIL-PRF-8805/100-009	P6-14035
4PDT	D-Roller/Axial **	1.781	0.794	0.625-24	1.030	1.200	2	MIL-PRF-8805/100-010	P6-14036
4PDT	A-Pin/Radial	1.375	1.000	0.625-24	1.030	1.100	2	MIL-PRF-8805/100-015	P6-24007
4PDT	C-Pin/Axial	1.375	1.000	0.625-24	1.030	1.200	2	MIL-PRF-8805/100-016	P6-24008
4PDT	B-Roller/Radial **	1.781	0.794	0.625-24	1.030	1.100	2	MIL-PRF-8805/100-017	P6-14005
4PDT	D-Roller/Axial **	1.781	0.794	0.625-24	1.030	1.200	2	MIL-PRF-8805/100-018	P6-14006

\* Roller diameter is 0.375 inches. \*\* Roller diameter is 0.500 inches.

**NOTE: SEE MILITARY QPL CROSS REFERENCE LISTING IN APPENDIX.**

APPLICATION-SPECIFIC MODIFIED PRODUCTS

**Modified Military Styles**



Circuitry	Free Position (inches)	Bushing Length (inches)	Overall Length (inches)	Catalog Number
<b>Pin Plunger, Radial Lead Exit</b>				
2PDT	1.375	1.000	2.375	P6-20077
2PDT	1.575	1.200	2.575	P6-20084
2PDT	0.875	0.625	1.875	P6-20076
4PDT	1.375	1.000	2.475	P6-20115
<b>Pin Plunger, Axial Lead Exit</b>				
2PDT	0.875	0.625	2.250	P6-20003
2PDT	1.575	1.200	2.950	P6-20005
<b>Roller Plunger, Radial Lead Exit</b>				
4PDT	1.781	0.794	2.781	P6-14010
2PDT	1.295	0.630	2.295	P6-14020
2PDT	1.980	1.095	2.980	P6-10060
<b>Roller Plunger, Axial Lead Exit</b>				
2PDT	1.700	0.860	3.200	P6-10057
4PDT	2.150	0.794	3.800	P6-14084

**Custom Paint**

Design 4 (Resilient) sealed single pole switch features polyurethane paint on the switch body and has a military style connector. Bushing is 15/32-32.

- Actuating Force:** 9.0 +/- 3.0 lbs.
- Release Force:** 4.0 lbs. min
- Overtravel:** 0.125" min
- Circuit:** SPDT
- Rating:** 7 amps Resistive  
4 amps Inductive
- Contacts:** Gold



**Flange Mount**

Low profile four pole switch features flange mounted stainless steel housing with an 8 pin connector.

- P6-20121**
- Actuating Force:** 6.0 +3.0/-2.0 lbs.
- Release Force:** 2.0 lbs. min
- Circuit:** 4PST N.C.
- Rating:** 0.5 amps Resistive for 100,000 cycles
- Contacts:** Silver/Gold



**Longer Bushing**

This two pole switch features an extra long mounting bushing. Bushing is 15/32-32.

- P6-20005**
- Overtravel:** 0.250" min
- Operating Force:** 9.0 +/- 3.0 lbs.
- Release Force:** 4.0 lbs. min
- Circuit:** 2PDT
- Rating:** 7 amps Resistive  
3 amps Inductive
- Contacts:** Gold



**Rubber Bonded Leads**

Aircraft switch features special 48" leads with a Fluorosilicone rubber bonded to wire leads.

- P6-20050**
- Total Travel:** 0.300" min
- Operating Force:** 11.0 +/- 5.0 lbs.
- Release Force:** 4.0 lbs. min
- Circuit:** 4PDT
- Rating:** 0.04 amps to 0.5 amps Inductive
- Contacts:** Gold



**Sleaved Wires**

This two pole switch features a lower spring force and sleeved wires.

- P6-24111**
- Overtravel:** 0.500" min
- Operating Force:** 3.0 to 6.0 lbs.
- Release Force:** 2.0 lbs. min
- Circuit:** 2PDT
- Rating:** 7 amps Resistive  
4 amps Inductive
- Contacts:** Gold



**Adjustable Roller Plunger**

Design 4 (Resilient) sealed 2PDT limit switch with adjustable orientation of roller plunger at 45° increments. 72" wire leads included.

- P6-14000**
- Overtravel:** 0.125" min
- Operating Force:** 9.0 +/- 3.0 lbs.
- Release Force:** 4.0 lbs. min
- Circuit:** 2PDT
- Rating:** 7 amps Resistive  
4 amps Inductive
- Contacts:** Gold



# SUBMINIATURE WATERTIGHT SEALED

**P6-3**  
LIMIT SWITCHES

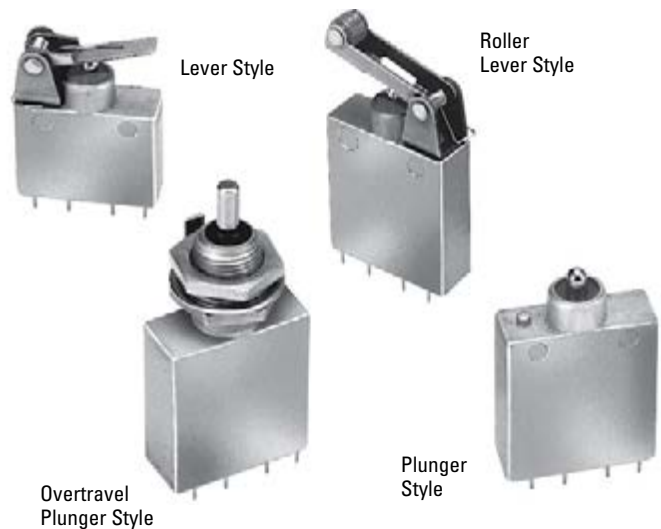
## FEATURING OTTO B5 SERIES BASIC SWITCHES

These subminiature sealed switches are contained in a rugged aluminum housing with choice of lever, roller or plunger. Featuring the B5 series basic switch, the P6-3 series is able to switch up to 10 amps. The high contact pressure and superior wiping action of the OTTO design also makes the P6-3 series an excellent choice when switching logic level loads.

Sealing against water and other liquids is per MIL-PRF-8805. Wire leaded models feature potted leads. The solder terminals are epoxy sealed.

### Features:

- Compact design
- Watertight to MIL-PRF-8805
- Choice of four actuator styles
- Choice of wire lead or solder termination styles
- Up to 10 amps switching capability
- High contact pressure
- Precision operating points



### Standard Characteristics/Ratings:

ELECTRICAL RATINGS:	Sea Level @ 28VDC		50,000 feet @ 28VDC	
	Single Circuit N.O. or N.C.	2 Circuit Per Pole	Single Circuit N.O. or N.C.	2 Circuit Per Pole
Resistive	10A	10A	10A	10A
Inductive	7.5A	5A	3.5A	2A
Motor	4A	2A	N/A	N/A
DWV	1000Vrms		500Vrms	

**Electrical Life:** 50,000 cycles

**Mechanical Life:** 50,000 cycles

OPERATIONAL:	P6-31	P6-32	P6-33	P6-34	P6-35	P6-36	P6-37	P6-38
<b>Operating Force:</b>	16 oz max	40 oz max	20 oz max	40 oz max	32 oz max	40 - 60 oz max	20 oz max	48 oz max
<b>Release Force:</b>	4 oz min	8 oz min	4 oz min	8 oz min	4 oz min	24 oz min	4 oz min	8 oz min
<b>Movement Differential:</b>	0.060" max	0.020"±0.010" max	0.060" max	0.020"±0.010" max	0.080" max	0.010" - 0.035" max	0.080" max	0.040" max
<b>Pretravel:</b>	0.125" max	0.050" max	0.125" max	0.070" max	0.125" max	0.050" max	0.125" max	0.070" max
<b>Overtravel:</b>	0.025" min	0.012" min	0.025" min	0.187" min	0.025" min	0.012" min	0.025" min	0.187" min
<b>Strength of Actuator:</b>	10.0 lbs.	25.0 lbs.	10.0 lbs.	25.0 lbs.	10.0 lbs.	25.0 lbs.	10.0 lbs.	25.0 lbs.

**Temperature Range:** -55°C to +85°C

**Seal:** Enclosure Design 3, watertight per MIL-PRF-8805

### MATERIALS:

**Plunger:** Corrosion resistant steel

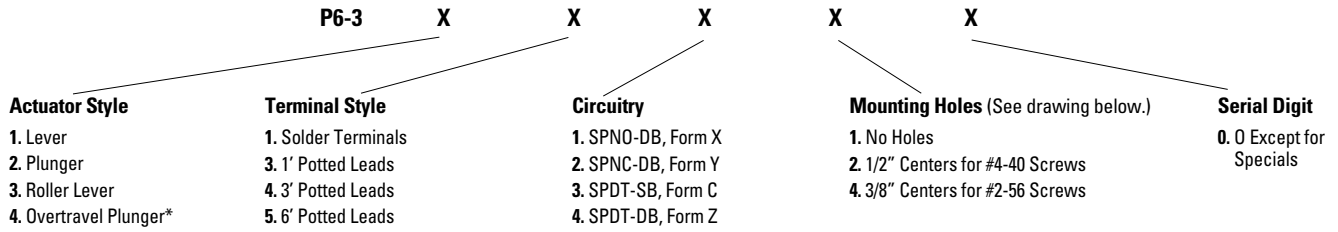
**Lever:** Corrosion resistant steel (where applicable)

**Mounting Hardware:** None provided except Actuator Style options 4 and 8 include hex nut, lockwasher and keyway washer

FEATURING OTTO B5 SERIES BASIC SWITCHES

## P6-3 PART NUMBER CODE

Single Pole



\* No mounting holes are offered in models with threaded bushing

### STYLE P6-31

### STYLE P6-32

### STYLE P6-33

### STYLE P6-34 \*

\*SWITCH WIDTH IS .39

### DETAIL "A"

### SOLDER TERMINAL (TERM. STYLE 1 EXAMPLE)

### POTTED WIRE LEADS (TERM. STYLES 3, 4 & 5 EXAMPLE)

### CIRCUIT SCHEMATIC

 SPNO - DB (FORM X)	 SPNC - DB (FORM Y)
 SPDT (FORM C)	 SPDT - DB (FORM Z)

POTTED WIRE LEADS		MOUNTING HOLES:	
STYLE	DIM "A"	CODE 2 FOR 4-40 SCREWS	CODE 4 FOR 2-56 SCREWS
3	12"	.500	.375
4	36"	Ø.112 ± .003	Ø.089 ± .003
5	72"		

# SUBMINIATURE WATERTIGHT SEALED

**P6-3**  
LIMIT SWITCHES

FEATURING OTTO B5 SERIES BASIC SWITCHES

## P6-3 PART NUMBER CODE

Double Pole

P6-3 X X X X X X

### Actuator Style

- 5. Lever
- 6. Plunger
- 7. Roller Lever
- 8. Overtravel Plunger\*

### Terminal Style

- 1. Solder Terminals
- 2. Taper Tab, Quick Disconnect
- 3. 1' Potted Leads
- 4. 3' Potted Leads
- 5. 6' Potted Leads

### Circuitry

- 1. DPNO-DB, Form XX
- 2. DPNC-DB, Form YY
- 3. DPDT, Form CC
- 4. DPDT-DB, Form ZZ

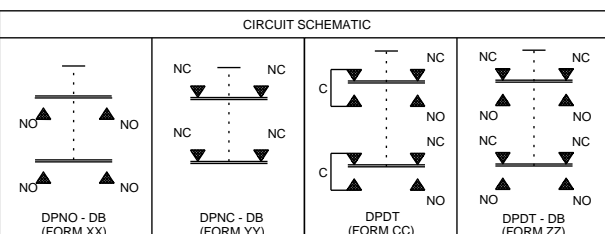
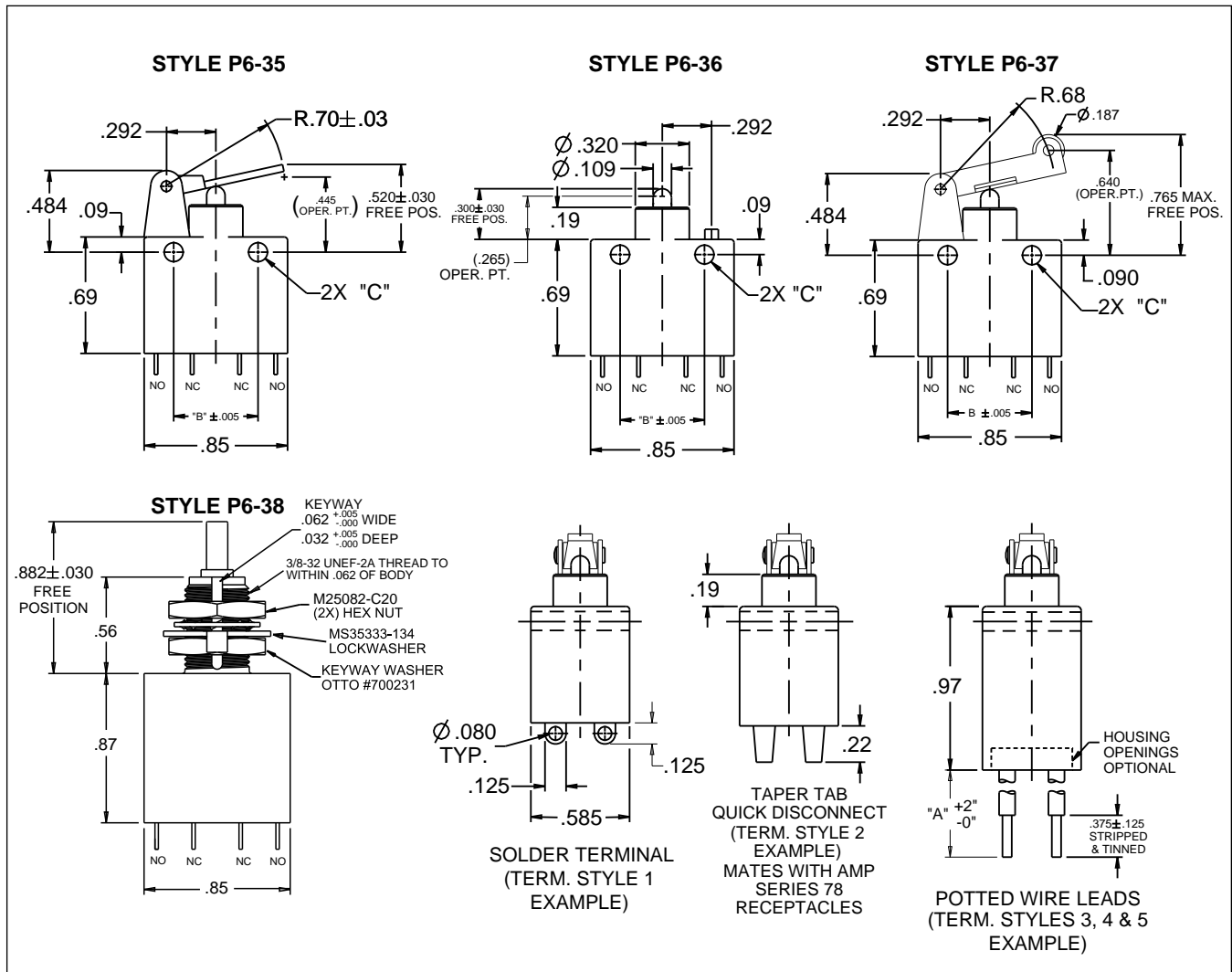
### Mounting Holes (See drawing below.)

- 1. No Holes
- 2. 1/2" Centers for #4-40 Screws
- 4. 3/8" Centers for #2-56 Screws

### Serial Digit

- 0. 0 Except for Specials

\* No mounting holes are offered in models with threaded bushing



POTTED WIRE LEADS		MOUNTING HOLES:	
STYLE	DIM "A"	CODE 2 FOR 4-40 SCREWS	CODE 4 FOR 2-56 SCREWS
3	12"	.500	Ø.112 ± .003
4	36"	.375	Ø.089 ± .003
5	72"		

LIMIT SWITCHES

## COMMERCIAL, SEALED LIMIT SWITCH

The P6-4 series switches are commercial grade limit switches that are watertight and completely sealed to IP68S and IP69K. They are designed to be operated in extreme temperature ranges and with their stainless steel housing, are for use in the most rugged, harsh environments. These switches are available with either a ball or roller plunger actuation method. In addition, these switches can be configured as single pole and double pole plus single throw and double throw. The P6-4 offers three connection methods, solder or screw terminal plus flying wire leads.



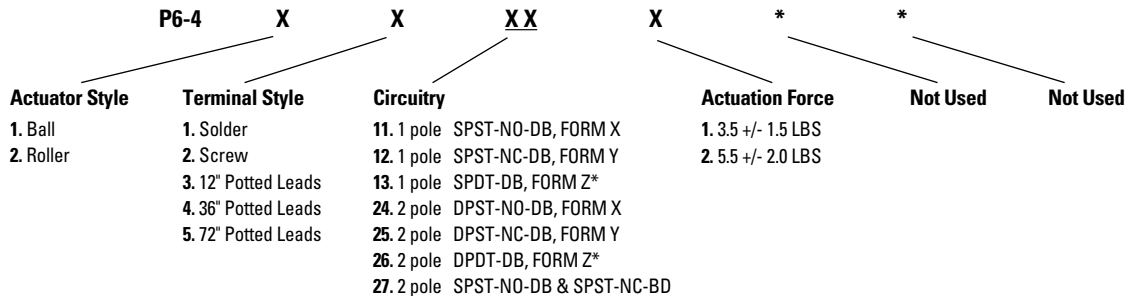
### Features:

- Sealed watertight to IP68S and IP69K
- One-piece Stainless Steel housing
- Built to withstand extreme temperatures
- Choice of ball or roller plunger
- Three connection method options

POTTED LEADS IDENTIFICATION	
SPST-NO-DB, FORM X	2 WHITE WIRE (NO POLE-1)
SPST-NC-DB, FORM Y	2 BLACK WIRE (NC POLE-1)
SPDT-DB, FORM Z	2 WHITE WIRE (NO POLE-1) 2 BLACK WIRE (NC POLE-1)
DPST-NO-DB, FORM X	2 WHITE WIRE (NO POLE-1) 2 RED WIRE (NO POLE-2)
DPST-NC-DB, FORM Y	2 BLACK WIRE (NC POLE-1) 2 YELLOW WIRE (NC POLE-2)
DPDT-DB, FORM Z	2 WHITE WIRE (NO POLE-1) 2 BLACK WIRE (NC POLE-1) 2 RED WIRE (NO POLE-2) 2 YELLOW WIRE (NC POLE-2)
SPST-NO-DB & SPST-NC-DB	2 WHITE WIRE (NO POLE-1) 2 YELLOW WIRE (NO POLE-2)

Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
Load	Sea Level @ 28VDC	Sea Level 115VAC, 60Hz	Cycles
Standard Resistive	4A	4A	50,000
Standard Inductive	2A	2A	50,000
Logic Level Resistive	10mA @ 5VDC	NA	100,000
DWV	1000Vrms		
<b>MECHANICAL:</b>			
<b>Pretravel:</b>	0.055 max		
<b>Actuating Force:</b>	3.5 +/- 1.5 lbs or 5.5 +/- 2.0 lbs		
<b>Overtravel:</b>	0.125		
<b>Full Overtravel Force:</b>	17.0 lb. max		
<b>Releasing Force:</b>	1.0 lb. min		
<b>Mechanical Life:</b>	100,000 cycles		
<b>ENVIRONMENTAL:</b>			
<b>Temperature Range:</b>	-55°C to 105°C		
<b>MATERIALS:</b>			
<b>Actuator:</b>	Stainless steel		
<b>Case:</b>	Stainless steel (303)		
<b>Seal:</b>	IP68S and IP69K		
<b>Mounting Hardware:</b>	Hex nut and lockwasher		
<b>Terminal Hardware:</b>	Screw and lockwasher (only with screw terminal switches)		

### P6-4 PART NUMBER CODE



\* Options not available for Screw Terminal Style (2)



# WATERTIGHT LIMIT SWITCHES

COMMERCIAL, SEALED LIMIT SWITCH

ACTUATOR STYLE			TERMINAL STYLE		
<p><b>BALL ACTUATOR STYLE</b></p>			<p><b>SOLDER TERMINAL STYLE</b></p> <p>NO TERMINALS: ROUNDED END NC TERMINALS: SQUARED END</p>		
<p><b>ROLLER ACTUATOR STYLE</b></p>			<p><b>SCREW TERMINAL STYLE</b></p>		
<b>CIRCUITRY OPTIONS</b>					
<p>SPST-NO-DB FORM X SCHEMATIC</p>	<p>SPST-NC-DB FORM Y SCHEMATIC</p>	<p>SPDT-DB FORM Z SCHEMATIC</p>	<p><b>POTTED LEADS STYLE</b></p>		
<p>DPST-NO-DB FORM X SCHEMATIC</p>	<p>DPST-NC-DB FORM Y SCHEMATIC</p>	<p>DPDT-DB FORM Z SCHEMATIC</p>			
<p>SPST-NO-DB &amp; SPST-NC-DB SCHEMATIC</p>					

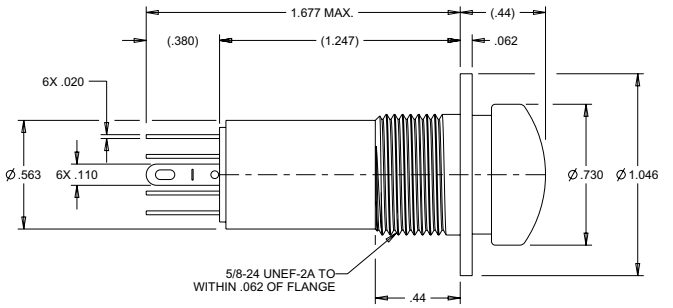
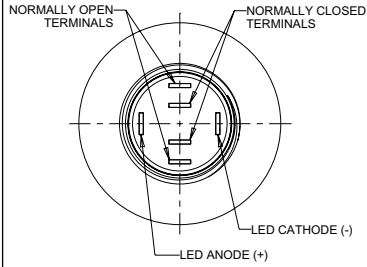
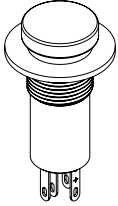
# PUSHBUTTON SWITCHES OVERVIEW

SERIES	FEATURE	ACTUATION	MAX RATING (Resistive @ 28VDC)	SEAL RATING	APPROVALS	MOUNTING	CIRCUITRY
LP3	LED Lighted	Momentary Action	5A	Unsealed, IP64 or IP68S	UL (E61705)	5/8" or 15/32" Threaded or Press Fit	SPST-DB, SPDT-DB
LP3S	Shorter LED Lighted	Momentary Action	5A	Unsealed, IP64 or IP68S and IP69K	N/A	5/8" Threaded or Press Fit	SPST-DB, SPDT-DB
LP3-V	LED Lighted, Vandal Resistant	Momentary Action	5A	IP64 or IP68S	UL (E61705)	5/8" or 3/4" Threaded	SPST, SPDT-DB
LP3S-V	Shorter LED Lighted Vandal Resistant	Momentary Action	5A	IP64 or IP68S and IP69K	N/A	5/8" or 3/4" Threaded	SPST-DB, SPDT-DB
LP5	LED Lighted	Alternate Action	5A	Unsealed, IP64 or IP68S	UL (E61705)	5/8" or 15/32" Threaded or Press Fit	SPST, SPDT
LP5-V	LED Lighted, Vandal Resistant	Alternate Action	5A	IP64 or IP68S	UL Recognized Component, UL1500 Ignition Protected	5/8" or 3/4" Threaded	SPST, SPDT
LP7	Dome Shape, Compact Bezel	Momentary Action	5A	IP68S	N/A	Press Fit	SPST-DB, SPDT-DB
LP7-D	Dome Shape, Anodized Case	Momentary Action	5A	IP64 or IP68S	N/A	15/32" Threaded	SPST-DB, SPDT-DB
LP9	LED Lighted	Momentary Action	5A	IP68S	N/A	15/32" Threaded Snap-In	SPST-DB, SPDT-DB
LP9L	LED Lighted, Dome Shape, Logic Level	Momentary Snap Action	50mA	IP68S	N/A	15/32" Threaded	SPST-DB, SPDT-DB
LPL	Indicator Light	N/A	N/A	Unsealed, IP64 or IP68S	N/A	5/8" or 15/32" Threaded or Press Fit	N/A
P1	Mil Grade	Momentary Action, Push-Pull Option	10A	MIL-PRF-8805 Design 2, 3 or IP68S	UL (E61705), CSA (LR43865)	5/8" or 15/32" Threaded or Press Fit	SPDT-DB, SPST-DB
P2	Commercial	Momentary Action, Two Step	5A	MIL-PRF-8805 Design 2 and Design 3	N/A	5/8" Threaded or Press Fit	DPST, DPDT
P3	Commercial	Momentary Action, Push-Pull Option	10A	IP64 or IP68S & IP69K (except push-pull)	UL (E61705), CSA (LR43865)	5/8" or 15/32" Threaded or Press Fit	SPDT-DB, SPST-DB
P3-D	Dome Shape	Momentary Action	15A	IP64 or IP68S & IP69K	UL (E61705)	5/8" Threaded	SPST-DB, SPDT-DB
P4	1 to 4 Poles, Custom Pushbutton	Momentary Action, Two Step	8A	IP64 or IP68S	N/A	1/4" or 15/32" or 5/8" Threaded or Press Fit	1 to 4 Poles
P5	Commercial & Mil Grades	Alternate Action	5A	Unsealed, IP64 & MIL-PRF-8805 Design 2 or IP68S	UL (E61705)	5/8" or 15/32" Threaded or Press Fit	SPST, SPDT
P5-D	Dome Shape, Commercial & Mil Grades	Alternate Action	5A	Unsealed, IP64 & MIL-PRF-8805 Design 2 or IP68S	UL (E61705)	5/8" Threaded	SPST, SPDT
P5-V	Vandal Resistant	Alternate Action	5A	IP64 or IP68S & IP69K	UL (E61705)	5/8" or 3/4" Threaded	SPST, SPDT
P7	Subminiature, Mil Grade	Momentary Action	5A	IP64 & MIL-PRF-8805 Design 2 or IP68S & MIL-PRF-8805 Design 3	UL (E61705), CSA (LR43865)	1/4" or 15/32" Threaded or Press Fit	SPST-DB, SPDT-DB
P7-D	Dome Shape	Momentary Action	5A	IP64 & MIL-PRF-8805 Design 2 or IP68S	UL (E61705)	15/32" Threaded	SPST-DB, SPDT-DB
P8	Shorter Behind Panel Depth	Momentary Action, Push-Pull Option	10A	Unsealed, IP64 or IP68S	UL (E61705), CSA (LR43865)	5/8" or 15/32" or 1/2" Threaded or Press Fit	SPST-DB, SPDT-DB
P8-V	Vandal Resistant	Momentary Action	10A	IP64 or IP68S & IP69K	UL (E61705)	5/8" or 3/4" Threaded	SPST-DB, SPDT-DB
P9	Dome Shape	Momentary Action	5A	IP64 or IP68S & IP69K	UL (E61705), CSA (LR43865)	15/32" Threaded or Snap-In	SPST-DB, SPDT-DB
P9M	Latching	Alternate Action	4A @12VDC	IP68S	N/A	15/32" Threaded	SPST-DB
PE	Mil Grade	Momentary Action	5A	Unsealed or MIL-PRF-8805 Design 2	N/A	1/4" Threaded	SPST-DB, SPST-DB
PE2	Mil Grade	Momentary Action	2A	Splashproof per MIL-PRF-8805 Symbol 6	N/A	15/32" Threaded	2 Circuit, DPDT

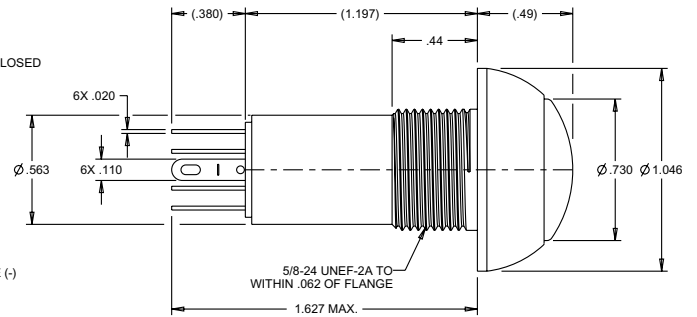
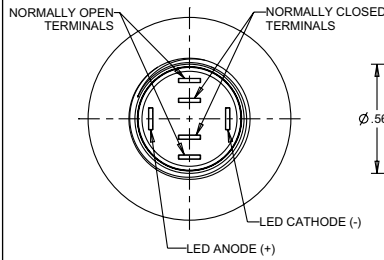
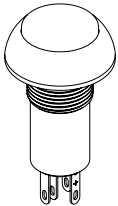


MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

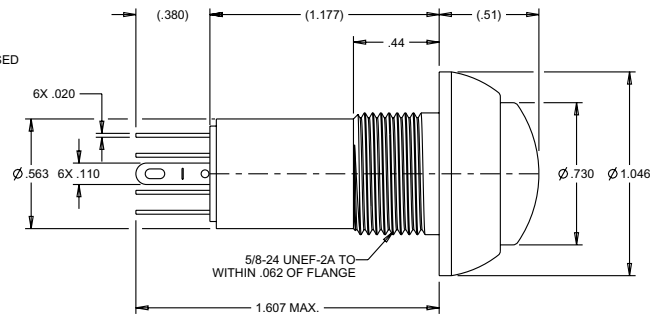
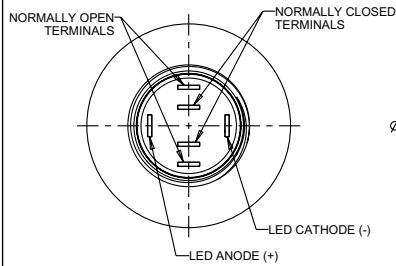
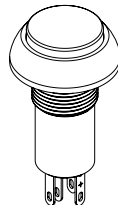
**LP3-EXXXXXX**  
Momentary, Exposed Dome Button



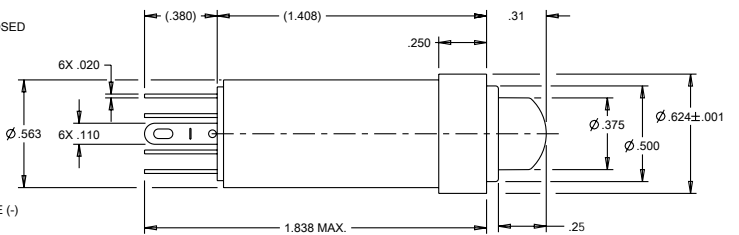
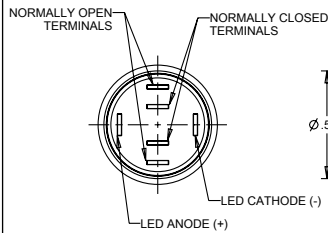
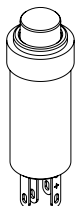
**LP3-FXXXXXX**  
Momentary, Flush Dome Button



**LP3-RXXXXXX**  
Momentary, Raised Dome Button



**LP3-1XXXXXX**  
Momentary, Press Fit Mount



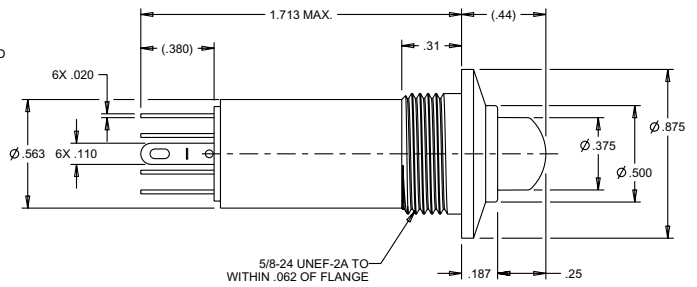
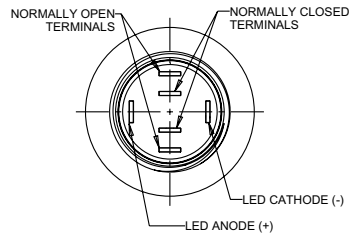
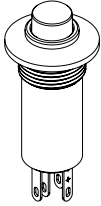
# ILLUMINATED & SEALED PUSHBUTTONS

**LP3**  
ILLUMINATED  
PUSHBUTTONS

## MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

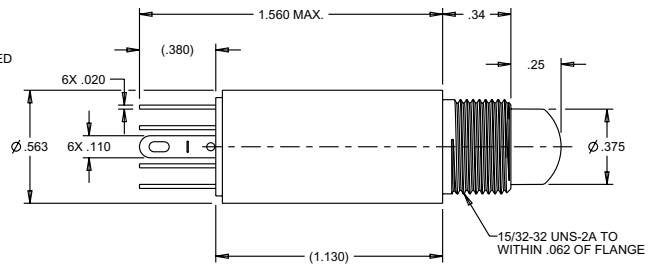
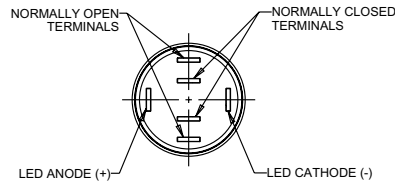
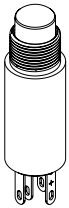
### LP3-3XXXXXX

Momentary, 5/8" Threaded Front Mount



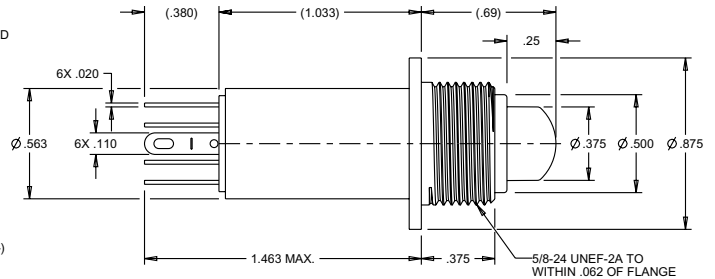
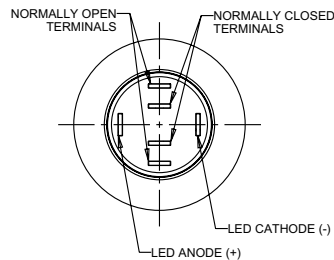
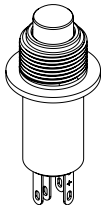
### LP3-4XXXXXX

Momentary, 15/32" Threaded Rear Mount



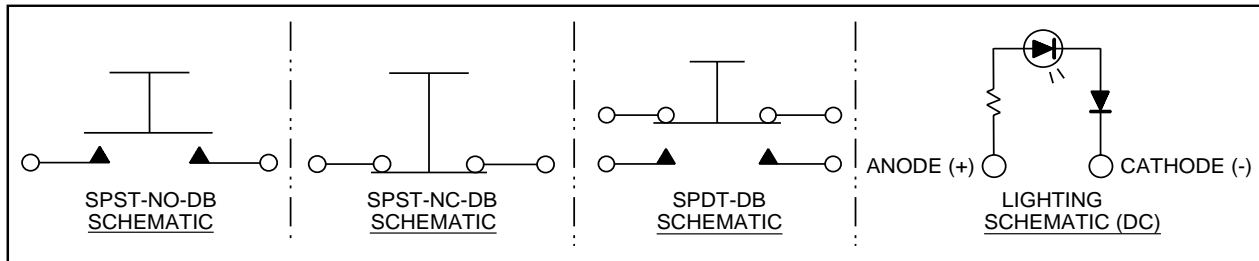
### LP3-6XXXXXX

Momentary, 5/8" Threaded Rear Mount



**NOTE:**

For indicator light only,  
see LPL indicator light.



PUSHBUTTON SWITCHES

SHORTER, SEALED, MOMENTARY ACTION, COMMERCIAL GRADE, LED ILLUMINATED

The LP3S series of momentary action, LED illuminated pushbutton switches offer most of the same features as the LP3 series, but are about 5/8" shorter behind panel.

High contact pressure and extremely low contact bounce are the result of the OTTO snap-action mechanism. Extra long electrical life and precise trip point offer added value and precision operation.

On sealed models, a silicone boot protects the contact area against contamination. This boot provides long life and smooth operation over a wide temperature range. Sealed terminals protect the contact area from hostile environments and solder flux on both sealed and unsealed models.

Standard LED illumination color choices include red, green, amber, blue, deep green and white. This precision snap-action switch is designed for use in grips and other applications with limited space in off-highway, material handling, industrial controls, marine, medical and demanding commercial industries.

## Features:

- Shorter version of OTTO's LP3 series
- Watertight to IP68S and IP69K, moistureproof & dust-tight to IP64, or unsealed
- LED lighted with the ability to accommodate 2, 12 & 24VDC power & includes reverse voltage protection
- Tall & dome style buttons permitting printed legends
- Logic level option
- Quick disconnect terminals
- 5/8" thread, press fit & dome case options
- RoHS compliant



LP3S-3  
Front Mount



LP3S-F  
Flush Dome

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

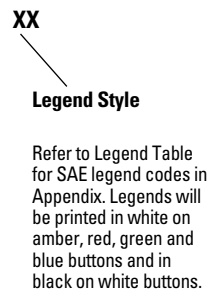
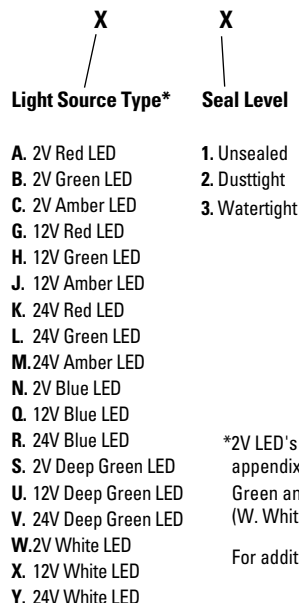
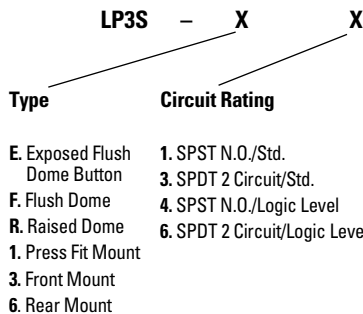
Load	Sea Level @ 28VDC	Cycles
Resistive	5A	25,000
Inductive	3A	25,000
Lamp	1A	25,000
Motor	3A	25,000
DVV	1000Vrms through switch contacts only	
Logic Level	10mA @ 5VDC	250,000

#### LIGHTING:

Light Source Voltage (DC)	Actual Voltage Nominal (DC)	Voltage Max (DC)
2*	2	2.5
12	12	14
24	24	28.6

<b>Mechanical Life:</b>	250,000 cycles
<b>Seal:</b>	Unsealed, IP64 or IP68S and IP69K
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	2.5 +/- 0.5 lb. or 4.0 +/- 1.0 lb.
<b>Total Travel:</b>	0.080 inches +/- 0.015
<b>Overtravel:</b>	0.010 inches min
<b>MATERIALS:</b>	
<b>Case:</b>	Anodized aluminum alloy
<b>Button:</b>	Thermoplastic
<b>Center Cap:</b>	Anodized aluminum alloy
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal gasket (watertight only)

## LP3S PART NUMBER CODE



**STOP HERE** for illuminated switches without legends.

\*2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor. Green and Blue LEDs are recommended for use with Translucent Button color (W. White ) only

For additional LED lighting options, contact factory.

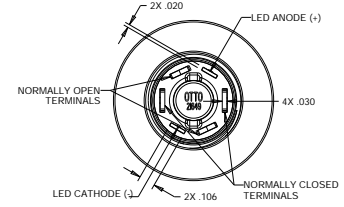
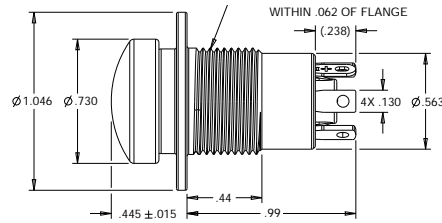
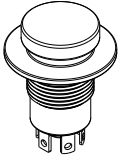
# SHORTER ILLUMINATED PUSHBUTTONS

**LP3S**  
ILLUMINATED  
PUSHBUTTONS

SHORTER, SEALED, MOMENTARY ACTION, COMMERCIAL GRADE, LED ILLUMINATED

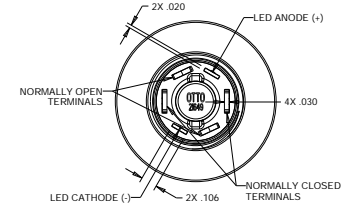
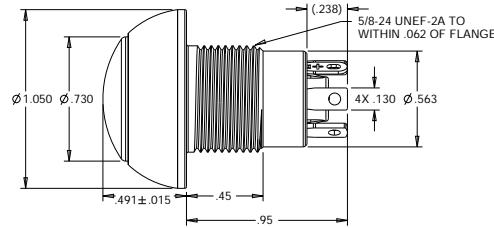
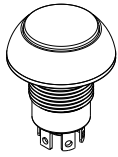
## LP3S-EXXXXXX

Exposed Flush Dome Button



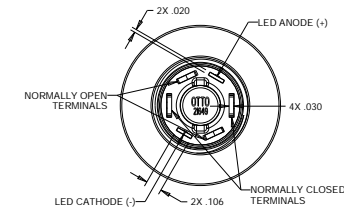
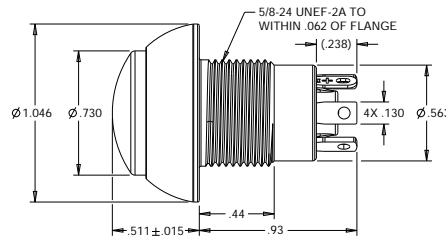
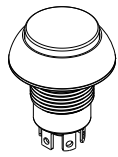
## LP3S-FXXXXXX

Flush Dome Button



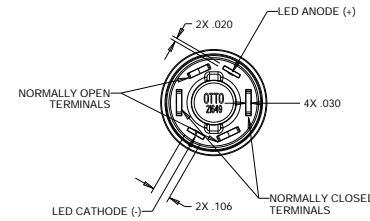
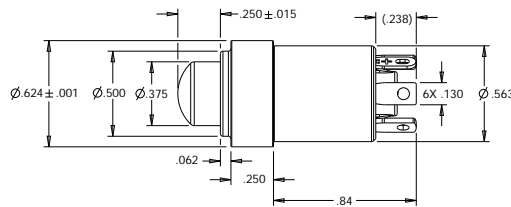
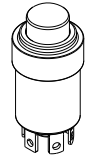
## LP3S-RXXXXXX

Raised Dome Button



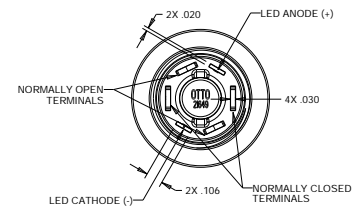
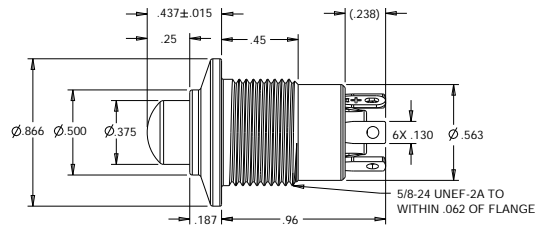
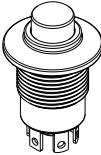
## LP3S-1XXXXXX

Press Fit Mount



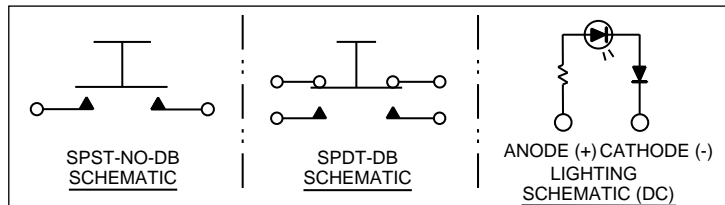
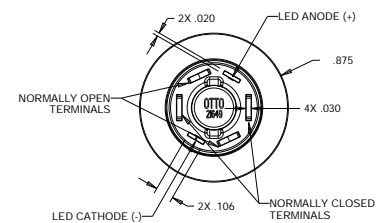
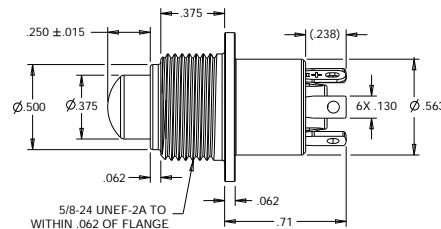
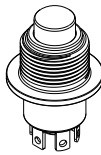
## LP3S-3XXXXXX

Front Mount



## LP3S-6XXXXXX

Rear Mount



MOMENTARY ACTION, FULLY ILLUMINATED, VANDAL RESISTANT CASE AND BUTTON WITH LEGEND



The LP3-V is an illuminated, vandal-resistant, momentary action switch designed to provide attractive, lighted position indication for applications in harsh environments, where security and reliability are paramount. The series features both aluminum and stainless steel cases watertight to IP68S.

The LP3-V series offers positive tactile feedback and a variety of LED colors available in both flat and domed actuator bezel shapes. Illumination options include ring lit, full illumination and full illumination with legends. Standard offerings include 69 legends per SAE in silver or black. Custom legends, lettering and logos are also available.

This high reliability switch offers the durability and ruggedness our customers have come to expect with the added benefit of illumination. The LP3-V is ideal for marine, off-highway and industrial control applications that require an illuminated switch.

## Features:

- Security (aluminum) or vandal resistant (stainless steel) case & button
- Ring or full illumination
- Watertight to IP68S option
- Drop in replacement to the P8-V series of pushbuttons
- RoHS compliant

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DWV	1000Vrms through switch contacts only
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	25,000 cycles, Logic Level 250,000 cycles
<b>Lighting:</b>	See LED Voltage Chart in Appendix for more details
<b>Mechanical Life:</b>	250,000 cycles
<b>Seal:</b>	IP64 or IP68S
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	2.5 +/- 0.5 lb. or 5.0 +/- 1.0 lb.
<b>Total Travel:</b>	0.080 inches max
<b>Overtravel:</b>	0.010 inches min

#### MATERIALS:

<b>Case:</b>	Stainless steel (316) or anodized aluminum alloy
<b>Button:</b>	Ring lit, clear thermoplastic Fully illuminated, translucent thermoplastic
<b>Center Cap:</b>	Stainless steel (316) or anodized aluminum alloy
<b>Terminals:</b>	Standard and logic level options available
<b>Mounting Hardware:</b>	Hex or knurl nut, lockwasher and panel gasket when applicable

### LP3-V PART NUMBER CODE

Type	Case Style*	Circuit Rating	LED Light Source Type w/ Rev. Pol Protection**	Seal Level	Operating Force	Case/Center Cap Color	Button Profile	Legend Color	Legend
A. Aluminum	1. 5/8-24 & Hex Nut	1. SPST N.O./Std.	A. 2V Red	L. 24V Green***	2. Dusttight	2. 2.5 lbs. (± 0.5 lbs.)	1. High Profile Flat Button	1. Silver	SAE Legend, Two Digit Code: please refer to Appendix
V. Stainless	3. 5/8-24 W/D-Flat & Hex Nut	2. SPST N.C./Std.	B. 2V Green***	M. 24V Amber	3. Watertight	5. 5.0 lbs. (± 1.0 lbs.)	2. High Profile Curved Button	2. Black <sup>①</sup>	
	5. 3/4-20 & Hex Nut	3. SPDT 2 Circuit/Std.	C. 2V Amber	N. 2V Blue			3. Low Profile Flat Button	3. Silver/Translucent (Fully Illuminated) <sup>②</sup>	
	7. 3/4-20 W/D-Flat & Hex Nut	4. SPST N.O./Logic Level	D. 6V Red	P. 6V Blue			4. Low Profile Curved Button	4. Black/Translucent (Fully Illuminated) <sup>①②</sup>	
		5. SPST N.C./Logic Level	E. 6V Green***	Q. 12V Blue			5. Flush Profile Flat Button		
		6. SPDT 2 Circuit/Logic Level	F. 6V Amber	R. 24V Blue					
			G. 12V Red	S. 2V Deep Green					
			H. 12V Green***	T. 6V Deep Green					
			J. 12V Amber	U. 12V Deep Green					
			K. 24V Red	V. 24V Deep Green					

**STOP HERE**  
for lighted switches  
without legends

CASE STYLE		
DIMENSION (BUTTON DIA.)	1 - 4	5 - 8
(THREAD)	5/8-24 UNEF-2A	3/4-20 UNEF-2A
FLAT	0.594	0.718

\* Contact factory for Knurl Nut options.

\*\* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.  
For additional LED lighting options, contact factory.

\*\*\* Light source not available with fully illuminated center cap

① Only available on LP3-A styles.

② Not offered in case styles 5, 6, 7, and 8.

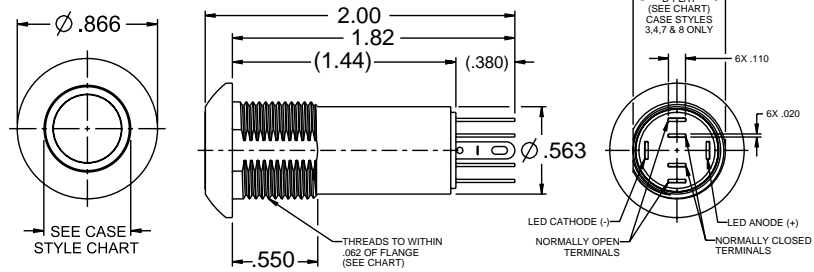
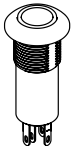


# ILLUMINATED VANDAL RESISTANT WITH LEGEND

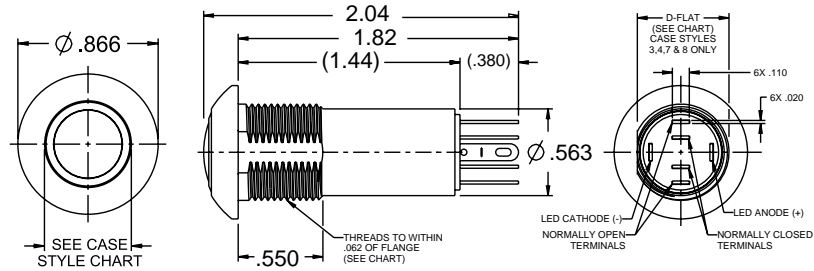
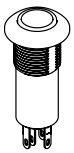
**LP3-V**  
ILLUMINATED  
VANDAL RESISTANT  
PUSHBUTTONS

## MOMENTARY ACTION RING ILLUMINATED, VANDAL RESISTANT CASE & BUTTON

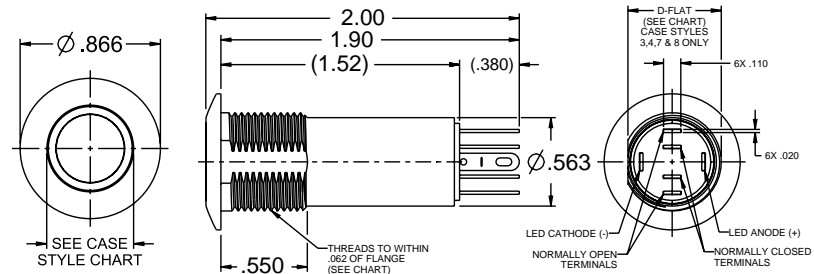
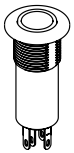
**LP3-XXXXXXX1**  
High Profile Flat Button



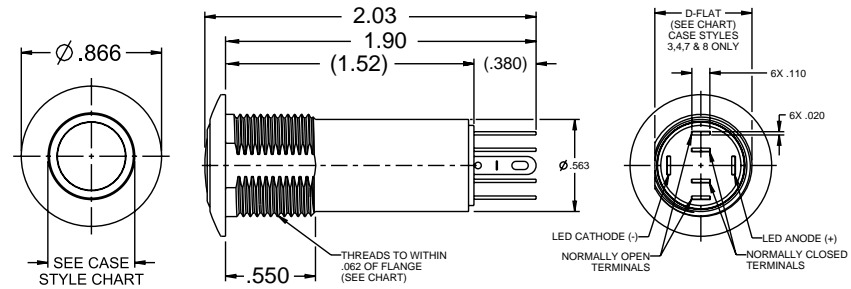
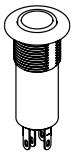
**LP3-XXXXXXX2**  
High Profile Curved Button



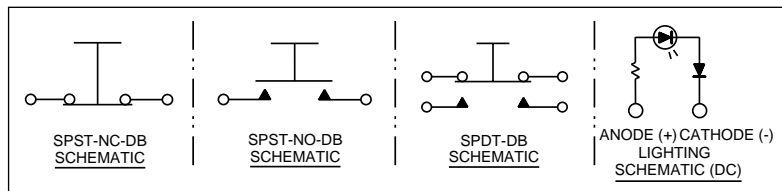
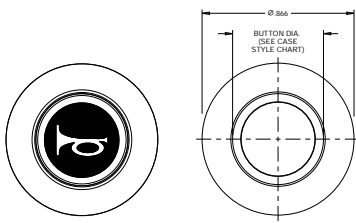
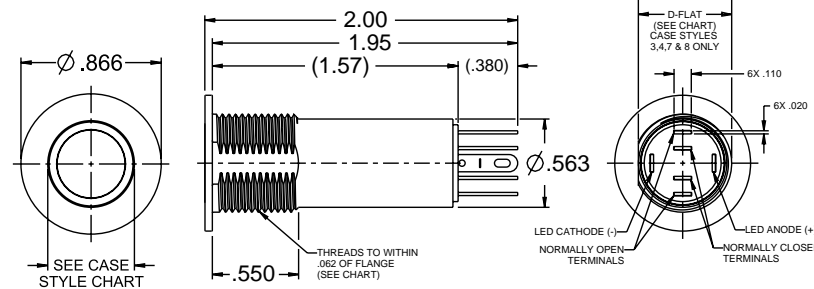
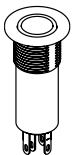
**LP3-XXXXXXX3**  
Low Profile Flat Button



**LP3-XXXXXXX4**  
Low Profile Curved Button



**LP3-XXXXXXX5**  
Flush Profile Flat Button



SHORTER, MOMENTARY ACTION, RING ILLUMINATED, VANDAL RESISTANT CASE & BUTTON

OTTO's LP3S-V series of vandal resistant, momentary action pushbutton switches are a shorter behind panel version of OTTO's LP3-V series. The LP3S-V offers the same case styles, circuit ratings and button types as the LP3-V, but with shorter construction. An excellent choice when space is limited, the LP3S-V switch is designed to provide attractive, lighted position indication for demanding applications, where security and reliability are crucial. The series features both aluminum and stainless steel cases with a watertight to IP68S and IP69K option.

This shorter, yet highly reliable switch offers the durability and ruggedness our customers have come to expect with the added benefit of illumination. The LP3S-V is ideal for marine, off-highway and industrial control applications that require a rugged sealed illuminated switch.

This switch offers positive tactile feedback and a variety of LED colors available in both flat and domed actuator bezel shapes.

## Features:

- Security (aluminum) or vandal resistant (stainless steel case & button)
- Shorter behind panel version of OTTO's LP3-V
- Ring illuminated
- Watertight to IP68S and IP69K option
- Variety of button options and LED colors
- Drop in replacement to the LP3-V and P8-V series
- RoHS compliant



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC	Cycles
Resistive	5A	25,000
Inductive	3A	25,000
Lamp	1A	25,000
Motor	3A	25,000
DVV	1000Vrms through switch contacts only	
Logic Level	10mA @ 5VDC	250,000

#### LIGHTING:

Light Source Voltage (DC)	Actual Voltage Nominal (DC)	Voltage Max (DC)
2**	2	2.5
12	12	14
24	24	28.6

<b>Mechanical Life:</b>	250,000 cycles
<b>Seal:</b>	IP64 or IP68S and IP69K
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	2.5 +/- 0.5 lb. or 4.0 +/- 1.0 lb.
<b>Total Travel:</b>	0.080 inches +/- 0.015
<b>Overtravel:</b>	0.010 inches min
<b>MATERIALS:</b>	
<b>Case:</b>	Stainless steel (316) or anodized aluminum alloy
<b>Button:</b>	Thermoplastic
<b>Center Cap:</b>	Stainless steel (316) or anodized aluminum alloy
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal gasket (watertight only)

## LP3S-V PART NUMBER CODE

	LP3S	-	X	X	X	X	X	X
<b>Type</b>	<b>Case Style*</b>		<b>Circuit Rating</b>	<b>Light Source Type** w/ Rev. Pol Protection</b>	<b>Seal Level</b>	<b>Operating Force</b>	<b>Case/Center Cap Color</b>	<b>Button Profile</b>
A. Aluminum	1. 5/8-24 & Hex Nut		1. SPST N.O./Std.	A. 2V Red LED	2. Dusttight	2. 2.5±0.5 lbs.	1. Silver	1. High Profile Flat Button
V. Stainless	3. 5/8-24 W/D-Flat & Hex Nut		3. SPDT 2 Circuit/Std.	B. 2V Green LED	3. Watertight	4. 4.0±1.0 lbs.	2. Black***	2. High Profile Curved Button
	5. 3/4-20 & Hex Nut		4. SPST N.O./Logic Level	C. 2V Amber LED				3. Low Profile Flat Button
	7. 3/4-20 W/D-Flat & Hex Nut		6. SPDT 2 Circuit/Logic Level	G. 12V Red LED				4. Low Profile Curved Button
				H. 12V Green LED				5. Flush Profile Flat Button
				J. 12V Amber LED				
				K. 24V Red LED				
				L. 24V Green LED				
				M. 24V Amber LED				
				N. 2V Blue LED				
				Q. 12V Blue LED				
				R. 24V Blue LED				
				S. 2V Deep Green LED				
				U. 12V Deep Green LED				
				V. 24V Deep Green LED				
				W. 2V White LED				
				X. 12V White LED				
				Y. 24V White LED				

\*For Knurl nut options, consult factory

CASE STYLE		
DIMENSION (BUTTON DIA.)	1 & 3	5 & 7
(THREAD)	0.525	0.590
FLAT	5/8-24 UNEF-2A	3/4-20 UNEF-2A
	0.594	0.718

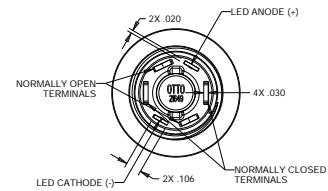
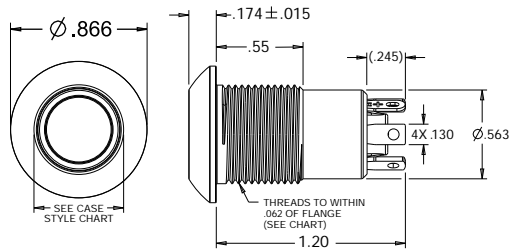
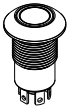
\*\*2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.  
For additional LED lighting options, contact factory.

\*\*\* Only available on LP3S-A styles.

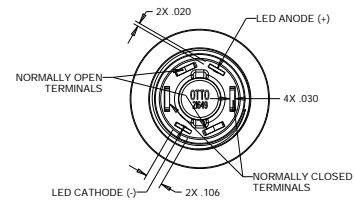
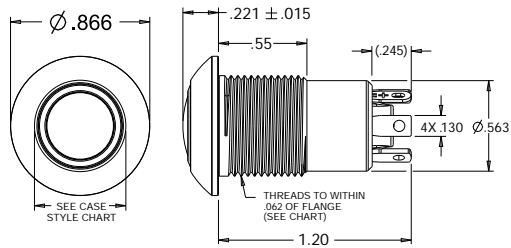
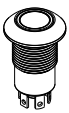
# ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

## SHORTER MOMENTARY ACTION RING ILLUMINATED, VANDAL RESISTANT CASE & BUTTON

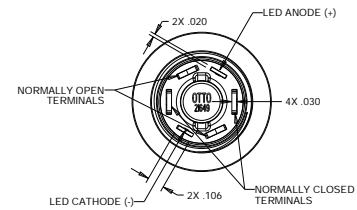
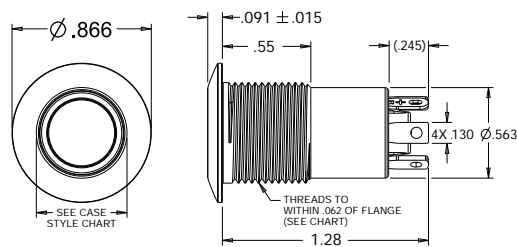
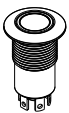
**LP3S-XXXXXXX1**  
High Profile Flat Button



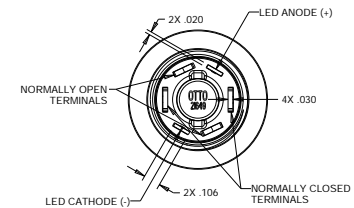
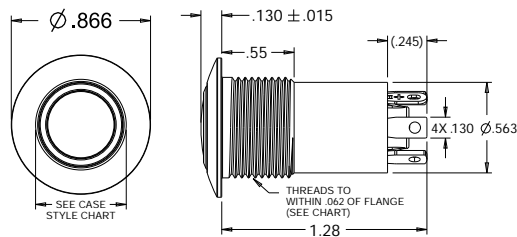
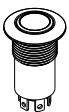
**LP3S-XXXXXXX2**  
High Profile Curved Button



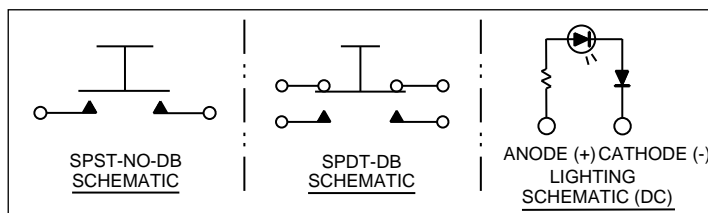
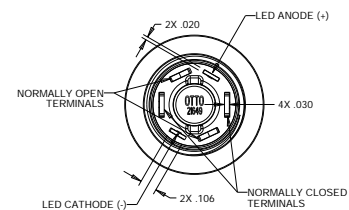
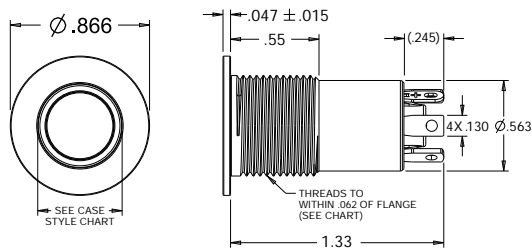
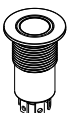
**LP3S-XXXXXXX3**  
Low Profile Flat Button



**LP3S-XXXXXXX4**  
Low Profile Curved Button



**LP3S-XXXXXXX5**  
Flush Profile Flat Button



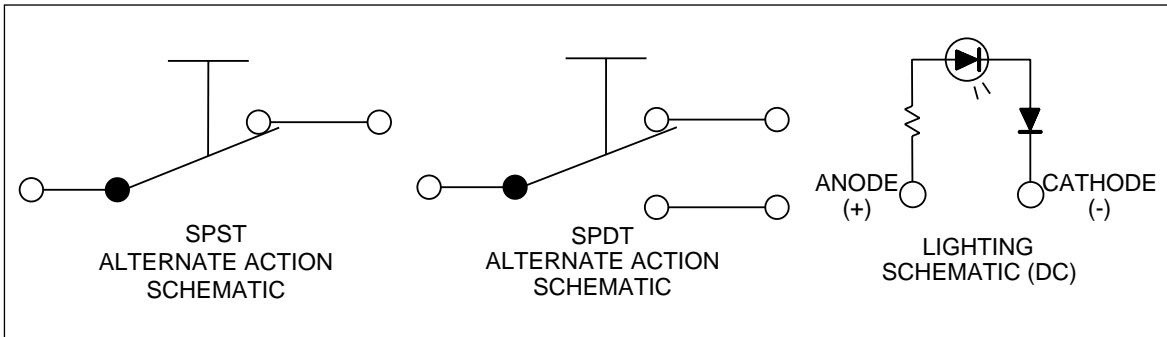
PUSHBUTTON SWITCHES



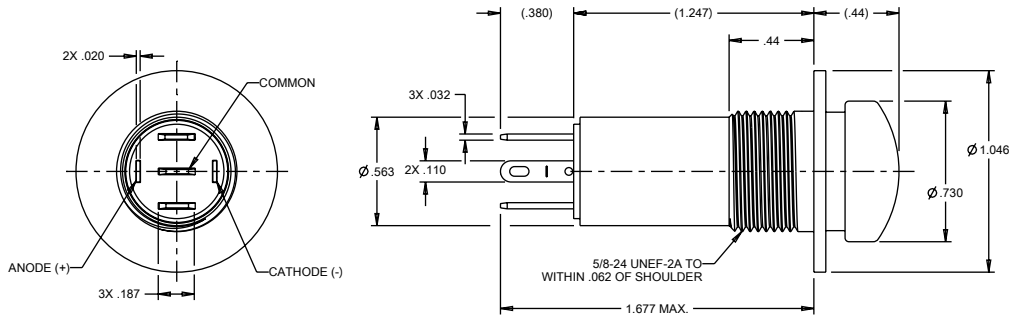
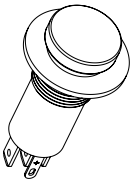
# ILLUMINATED ALTERNATE ACTION PUSHBUTTONS

**LP5**  
ILLUMINATED  
PUSHBUTTONS

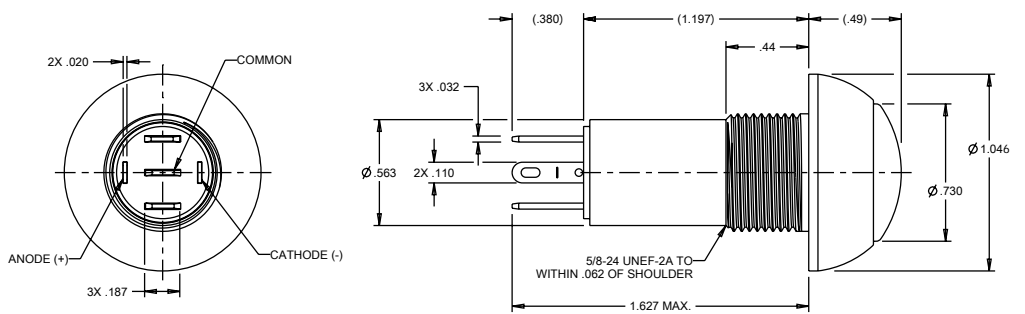
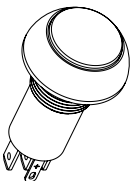
## ALTERNATE ACTION, LED ILLUMINATED & SEALED



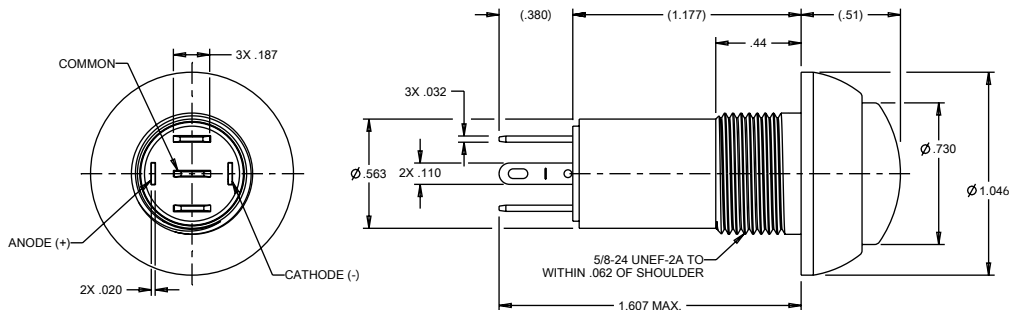
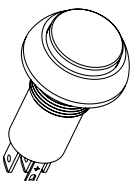
**LP5-EXXXXX**  
Alternate Action, Exposed Dome Button



**LP5-FXXXXX**  
Alternate Action, Flush Dome Button



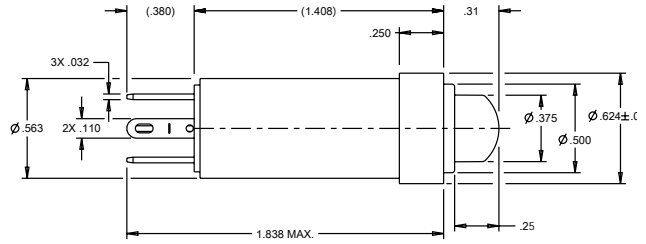
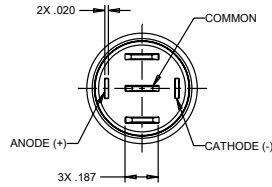
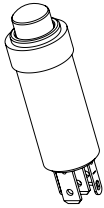
**LP5-RXXXXX**  
Alternate Action, Raised Dome Button



ALTERNATE ACTION, LED ILLUMINATED & SEALED

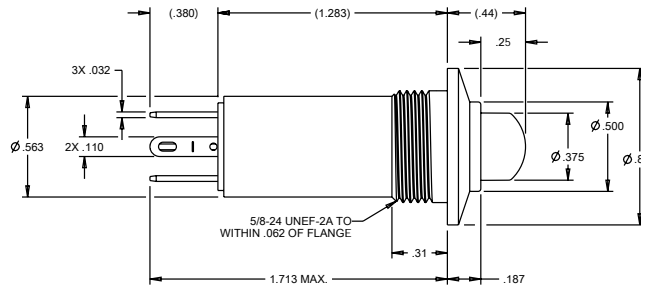
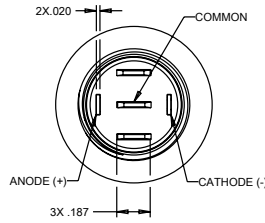
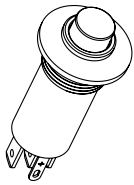
**LP5-1XXXXX**

Alternate Action, Press Fit Mount



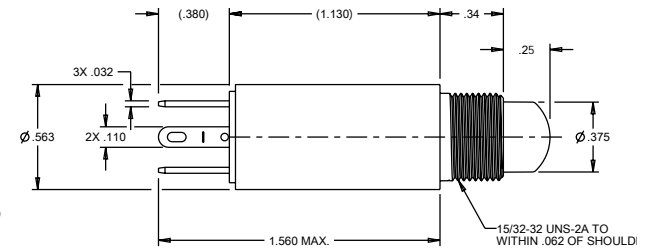
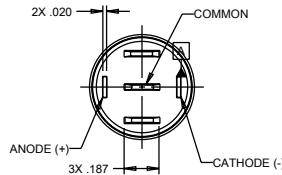
**LP5-3XXXXX**

Alternate Action, 5/8" Threaded Front Mount



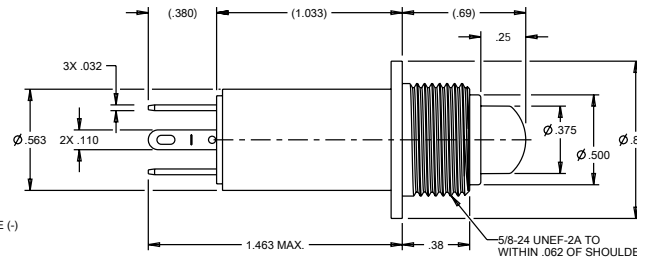
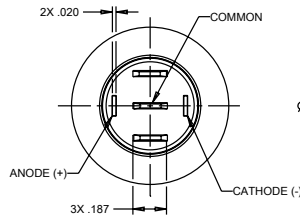
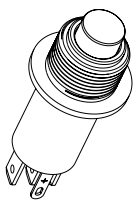
**LP5-4XXXXX**

Alternate Action, 15/32" Threaded Rear Mount



**LP5-6XXXXX**

Alternate Action, 5/8" Threaded Rear Mount



**NOTE:**  
For indicator light only,  
see LPL indicator light pages 153-155.

# ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

**LP5-V**  
ILLUMINATED  
VANDAL RESISTANT  
PUSHBUTTONS

ALTERNATE ACTION, RING OR FULLY ILLUMINATED, METAL CASE & BUTTON, OPTIONAL LEGENDS



The LP5-V series is an alternate action pushbutton switch that has been designed to provide attractive, lighted position indication for applications in harsh environments, where security and reliability are paramount.

This high reliability switch offers the durability and ruggedness our customers have come to expect with the added benefit of ring-lit or full illumination with optional legends.

The series features both aluminum and stainless steel cases watertight to IP68S and is UL1500 ignition protected. Momentary action is available in the LP3-V series.

The LP5-V offers positive tactile feedback and a variety of LED colors available in both flat and domed actuator bezel shapes. The switch is ideal for marine, off-highway and industrial control applications that require an illuminated switch.

## Features:

- Security (aluminum) or vandal resistant (stainless steel) case & button
- Ring or full illumination with optional legends
- Dusttight to IP64 or watertight to IP68S
- Variety of button options and LED colors
- Choose from 73 standard legends per SAE or create your own
- Drop in replacement to the P5-V series
- UL recognized
- RoHS compliant

Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>		
<b>Load</b>	Sea Level @ 28VDC or 115VAC, 60/400Hz	
Resistive	5A	
Inductive	3A	
Lamp	1A	
Motor	3A	
DVV	1000Vrms through switch contacts only	
Logic Level	10mA @ 5VDC	
<b>Electrical Life:</b>	25,000 cycles; 200,000 cycles logic level	
<b>LIGHTING:</b>		
<b>Light Source Voltage (DC)</b>	<b>Typ. Forward Voltage (DC)</b>	<b>Voltage Max (DC)</b>
2**	2	2.5
6	6	8
12	12	14
24	24	28.6
<b>Mechanical Life:</b>	200,000 cycles	
<b>Seal:</b>	IP64 or IP68S	
<b>Operating Temp Range:</b>	-55°C to +85°C	
<b>Operating Force:</b>	3.5 lbs. +1.5/-1.0 lbs.	
<b>Total Travel:</b>	0.180 inches max	
<b>Overtravel:</b>	0.012 inches min	
<b>MATERIALS:</b>		
<b>Case:</b>	Stainless steel (316) or anodized aluminum alloy	
<b>Button:</b>	Ring lit, clear thermoplastic Fully illuminated, translucent thermoplastic	
<b>Center Cap:</b>	Stainless steel (316) or anodized aluminum alloy	
<b>Terminals:</b>	Standard and logic level options available	
<b>Mounting Hardware:</b>	Hex or knurl nut, lockwasher and panel seal gasket when applicable	

## LP5-V PART NUMBER CODE

Type	Case Style	Circuit Rating	Light Source Type** w/ Rev. Pol Protection	Seal Level	Case/Center Cap Color	Button Profile	Legend <sup>①</sup> Color	Legend <sup>①</sup>
A. Aluminum	1. 5/8-24 & Hex Nut	0. Indicator Light	A. 2V Red LED	2. Dusttight	1. Silver/Silver <sup>①</sup> (Ring Lit)	1. High Profile Flat Button	1. Silver	SAE Legend, Two Digit Code: please refer to Appendix
V. Stainless	2. 5/8-24 & Knurl Nut*	1. SPST/Std.	B. 2V Green LED <sup>④</sup>	3. Watertight	2. Black/Black <sup>①②</sup> (Ring Lit)	2. High Profile Curved Button	2. Black	
	3. 5/8-24 W/D-Flat & Hex Nut	2. SPDT/Std.	C. 2V Amber LED		3. Silver/White <sup>③</sup> (Fully Illuminated)	3. Low Profile Flat Button		
	4. 5/8-24 W/D-Flat & Knurl Nut*	3. SPST/Logic Level	D. 6V Red LED		4. Black/White <sup>②③</sup> (Fully Illuminated)	4. Low Profile Curved Button		
	5. 3/4-20 & Hex Nut	4. SPDT/Logic Level	E. 6V Green LED <sup>④</sup>			5. Flush Profile Flat Button		
	6. 3/4-20 & Knurl Nut*		F. 6V Amber LED					
	7. 3/4-20 W/D-Flat & Hex Nut		G. 12V Red LED					
	8. 3/4-20 W/D-Flat & Knurl Nut*		H. 12V Green LED <sup>④</sup>					
			I. 2V Blue LED					
			J. 12V Amber LED					
			K. 24V Red LED					
			L. 24V Green LED <sup>④</sup>					
			M. 24V Amber LED					
			N. 2V Blue LED					
			O. 6V Blue LED					
			P. 6V Blue LED					
			Q. 12V Blue LED					
			R. 24V Blue LED					
			S. 2V Deep Green					
			T. 6V Deep Green					
			U. 12V Deep Green					
			V. 24V Deep Green					

\* Contact factory for Knurl Nut option

\*\* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor. For additional LED lighting options, contact factory.

① Legends only available in fully illuminated center cap option.

② Black is only available on LP5-A styles.

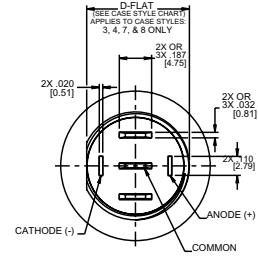
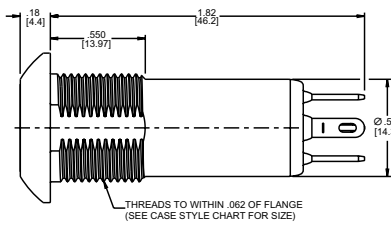
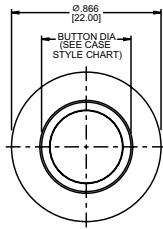
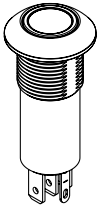
③ Only available in case styles 1, 2, 3, and 4.

④ Not available in fully illuminated center cap option.

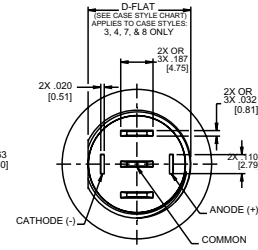
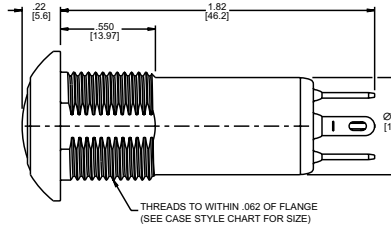
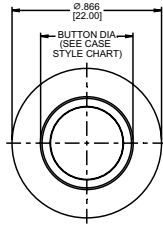
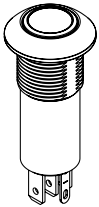
**STOP HERE**  
for lighted switches without legends

ALTERNATE ACTION, RING OR FULLY ILLUMINATED, METAL CASE & BUTTON, OPTIONAL LEGENDS

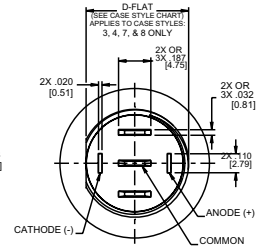
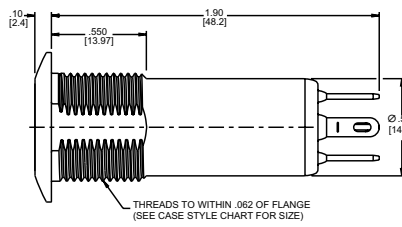
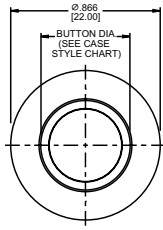
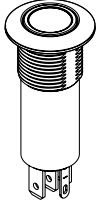
High Profile Flat Button  
Button Profile Style 1



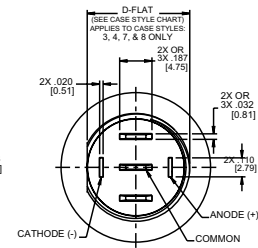
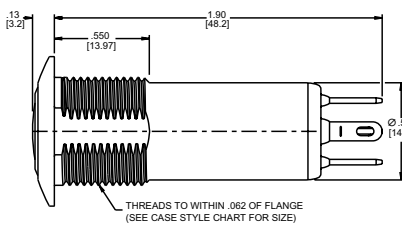
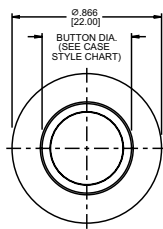
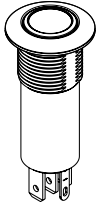
High Profile Curved Button  
Button Profile Style 2



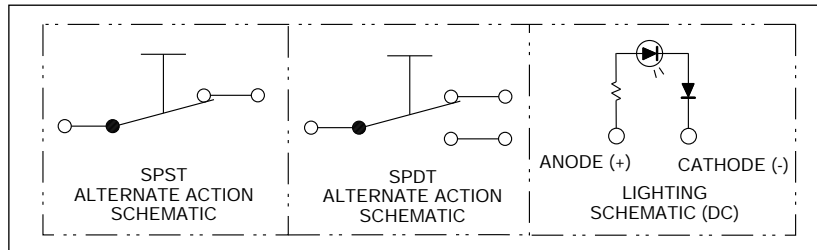
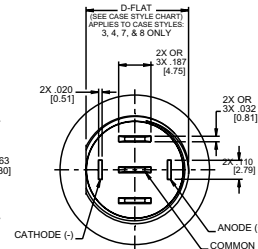
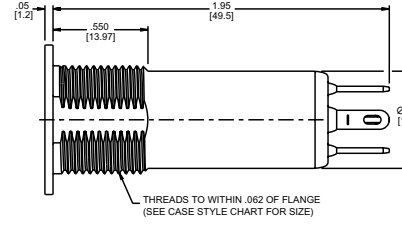
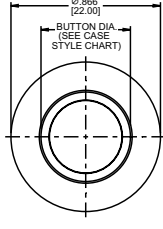
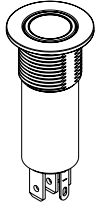
Low Profile Flat Button  
Button Profile Style 3



Low Profile Curved Button  
Button Profile Style 4



Flush Profile Flat Button  
Button Profile Style 5





# SEALED ILLUMINATED PUSHBUTTONS

**LP7**  
ILLUMINATED  
PUSHBUTTONS

MOMENTARY ACTION, SEALED TO IP68S, COMPACT BEZEL

While sharing similar size and characteristics to the P9 and LP7-D series pushbutton switches, the LP7 series illuminated momentary action pushbutton switches have a compact bezel for a lower above-panel profile.

The LP7 is manufactured to the highest standards and built to withstand harsh environments, offering excellent mechanical and electrical performance while operating under severe conditions found in demanding applications. Built with an anodized aluminum alloy case, the LP7 is tested to one million mechanical operations and has an electrical life of 25,000 cycles.

The LP7 series offers LED lighting in a variety of colors and can accommodate 2 & 12VDC power. Button versions include flush dome and raised dome.

With a watertight to IP68S seal, the LP7 is a quality precision switch designed for use in panels, control grips, computers, instruments, heavy equipment and other demanding applications where attractive, highly ruggedized pushbutton switches are required.

## Features:

- **Compact bezel**
- **Watertight to IP68S**
- **LED illuminated with the ability to accommodate 2 & 12VDC power**
- **Standard and logic level options**
- **Flush and raised buttons in glossy or matte finish available in a variety of colors**
- **RoHS compliant**



Raised Dome

Also available with  
Flush Dome

Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS: Sea Level @ 28VDC or 115VAC</b>			
Load	N.O./N.C.	Cycles	Operating Force
Resistive	5A	25,000	Standard Force
Inductive	3A	25,000	Standard Force
Resistive	500mA	500,000	Standard Force
Resistive	200mA	500,000	Low Force
DWV	1050Vrms through switch contacts only		
Logic Level	10mA @ 5VDC		
<b>Electrical Life:</b>	25,000 cycles		
<b>LIGHTING:</b>			
Light Source Voltage (DC)	Actual Voltage	Nominal (DC)	Voltage Max (DC)
2*	2		2.6
12	13.5		14.5
<b>Mechanical Life:</b>	1,000,000 cycles		
<b>Seal:</b>	IP68S		
<b>Operating Temp Range:</b>	-55°C to +85°C		
<b>Operating Force:</b>	1.7 lbs. ± 0.5 lbs. Standard Force, 12 oz. ± 4 oz. Low Force		
<b>Total Travel:</b>	.080 inches max		
<b>Overtravel:</b>	.010 inches min		
<b>MATERIALS:</b>			
<b>Case:</b>	Anodized aluminum alloy		
<b>Button:</b>	Thermoplastic		
<b>Terminals:</b>	Gold plate		
<b>Contacts:</b>	Gold plated silver alloy		
<b>Mounting Hardware:</b>	None		

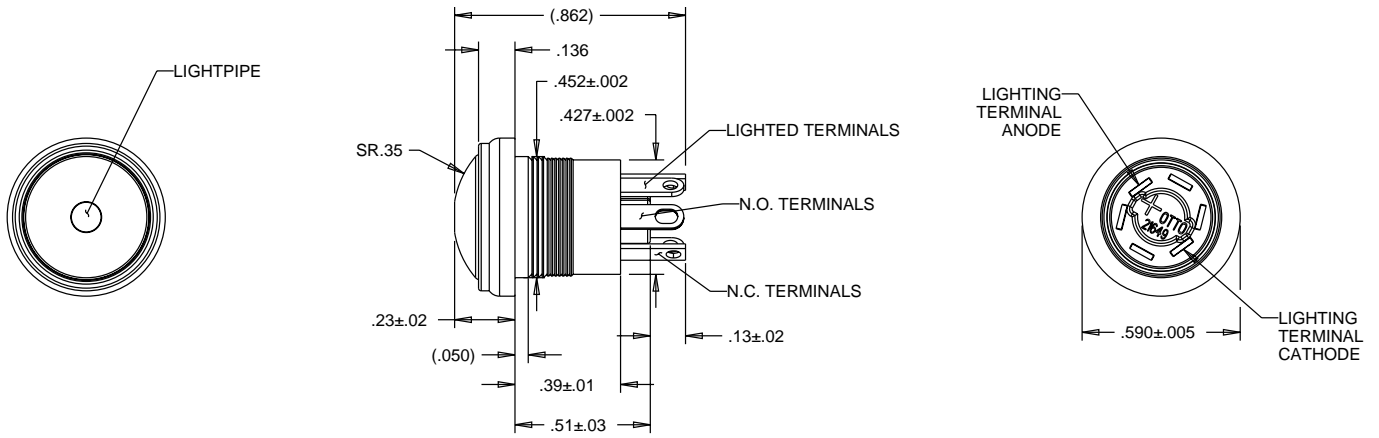
## LP7 PART NUMBER CODE

LP7	-	X	X	X	X	X	X	X
<b>Button Style</b>	<b>Case Style</b>	<b>Terminal Style</b>	<b>Circuit Form</b>	<b>Switch Action</b>	<b>Light Source*</b>	<b>Case Color</b>	<b>Button Color</b>	
1. Flush 2. Raised 3. Flush Matte 4. Raised Matte	1. Short Bezel Press Fit	1. Solder	1. N.O. 2. N.C. 3. 2 Circuit	1. Standard Force Snap-Action 2. Low Force Snap-Action	A. 2V Red LED B. 2V Green LED C. 2V Amber LED D. 2V Blue LED E. 2V White LED F. 12V Red LED G. 12V Green LED H. 12V Amber LED J. 12V Blue LED K. 12V White LED	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. Clear	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	

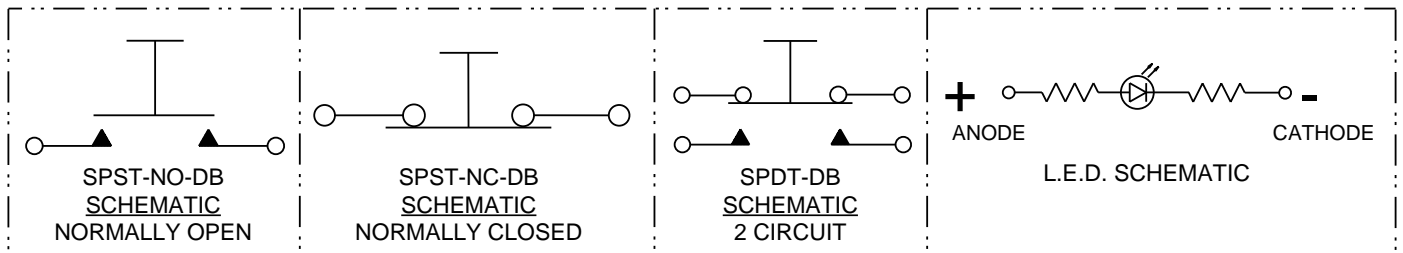
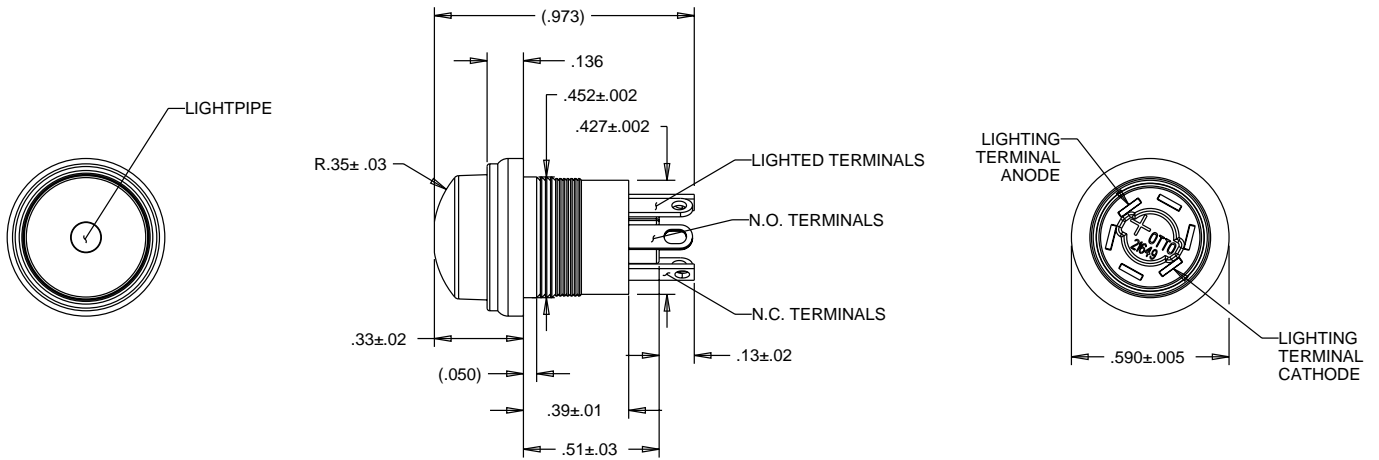
\*2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor. For additional LED lighting options, contact factory.

MOMENTARY ACTION, SEALED TO IP68S, COMPACT BEZEL

## Flush Button - Short Bezel



## Raised Button - Short Bezel



# SEALED ILLUMINATED DOME PUSHBUTTONS

**LP7-D**  
ILLUMINATED  
PUSHBUTTONS

MOMENTARY ACTION, ATTRACTIVE & HIGHLY RUGGEDIZED FOR WET & DUSTY ENVIRONMENTS

The LP7-D series pushbutton switches feature a contoured round dome style or square pushbutton. While sharing similar size and characteristics to the P9 series, the LP7-D offers added durability with its anodized aluminum alloy case.

Button versions include flush or raised round dome in glossy or matte finish and raised square in matte finish. The switch series features short behind panel depth. It also offers excellent mechanical and electrical performance while operating under severe conditions found in demanding applications.

The LP7-D Dome series offers one million mechanical operations and an electrical life of 25,000 operations.

The LP7-D series is manufactured to the highest standards and built to withstand harsh environments, offering anodized aluminum alloy cases with seal options of dusttight to IP64 or watertight to IP68S. The LP7-D series offers long life LED lighting in a variety of colors and can accommodate 2 & 12VDC power.

The LP7-D Dome series is a quality precision switch designed for use in panels, control grips, computers, instruments, heavy equipment and other demanding applications where attractive, highly ruggedized pushbutton switches are required.

## Features:

- Flush and raised round buttons with glossy or matte finish in a variety of colors
- Raised square button option with matte finish in a variety of colors
- Watertight to IP68S; dusttight to IP64
- LED illuminated with the ability to accommodate 2 & 12VDC power
- 15/32" threaded case style
- RoHS compliant



Flush Dome  
Also available with  
Raised Dome



Square Dome  
with Matte Finish

Standard Characteristics/Ratings:		
ELECTRICAL RATINGS:		Sea Level @ 28VDC or 115VAC
Load	N.O./N.C.	S.P.D.T
Resistive	5A	4A
Inductive	3A	2A
Motor	3A	N/A
DWV	1050Vrms through switch contacts only	
Logic Level	10mA @ 5VDC	
<b>Electrical Life:</b>	25,000 cycles	
LIGHTING:		
Light Source Voltage (DC)	Actual Voltage Nominal (DC)	Voltage Max (DC)
2**	2	2.6
12	13.5	14.5
<b>Mechanical Life:</b>	1,000,000 cycles	
<b>Seal:</b>	IP64 or IP68S	
<b>Operating Temp Range:</b>	-40°C to +85°C	
<b>Operating Force:</b>	1.7 lbs. ± 0.5 lbs.	
<b>Total Travel:</b>	0.080 inches max	
<b>Overtravel:</b>	0.010 inches min	
MATERIALS:		
<b>Case:</b>	Anodized aluminum alloy	
<b>Button:</b>	Thermoplastic	
<b>Terminals:</b>	Silver with gold plate	
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal gasket when applicable	

## LP7-D PART NUMBER CODE

Button Style	Terminal Style/Seal	Circuit Form	Contact Rating	Light Source**	Case Color	Button Color
1. Flush Dome Standard Finish - Lightpipe	1. Standard Solder Terminal Dusttight	1. N.O.	1. Standard Current	A. 2V Red LED	1. Clear Anodized	1. Red
2. Raised Dome Standard Finish - Lightpipe	2. Standard Solder Terminal Watertight	2. N.C.	2. Logic Level Current	B. 2V Green LED	2. Black Anodized	2. Black
3. Flush Dome Matte Finish - Lightpipe	3. P.C. Pin Terminal Dusttight	3. 2 Circuit		C. 2V Amber LED		3. Orange
4. Raised Dome Matte Finish - Lightpipe	4. P.C. Pin Terminal Watertight			D. 2V Blue LED		4. Yellow
5. Raised Square Matte Finish - Lightpipe				E. 2V White LED		5. Green
6. Flush Dome Standard Finish - Fully Illuminated*				F. 12V Red LED		6. Blue
7. Raised Dome Standard Finish - Fully Illuminated*				G. 12V Green LED		7. Violet
				H. 12V Amber LED		8. Gray
				J. 12V Blue LED		9. White
				K. 12V White LED		A. Translucent White*

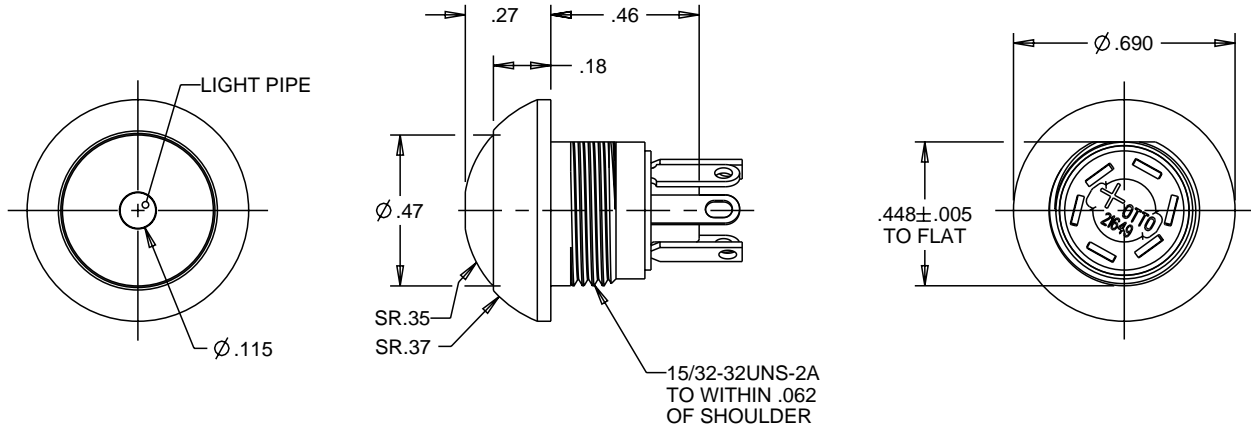
\* Full illumination button styles available with translucent Button Color selection A only.

\*\* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

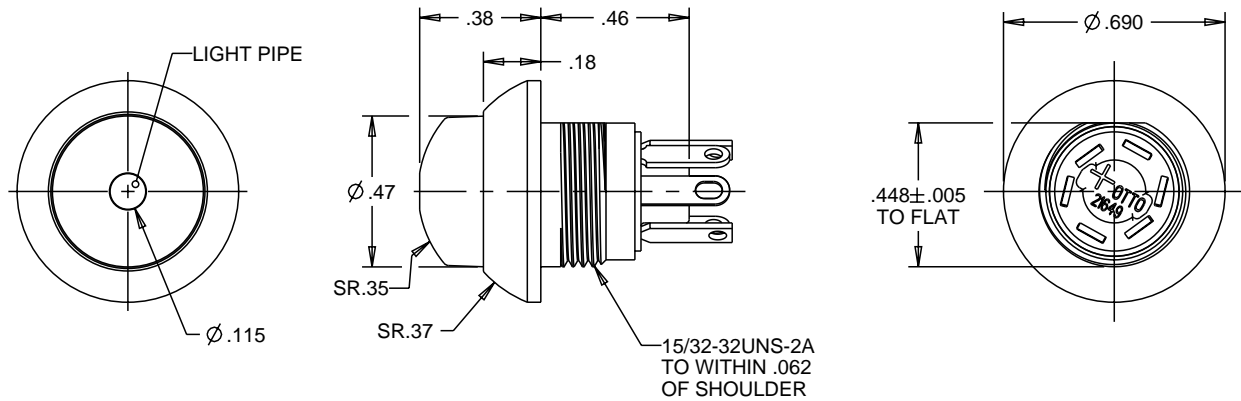
MOMENTARY ACTION, ATTRACTIVE & HIGHLY RUGGEDIZED FOR WET & DUSTY ENVIRONMENTS

## Button Options

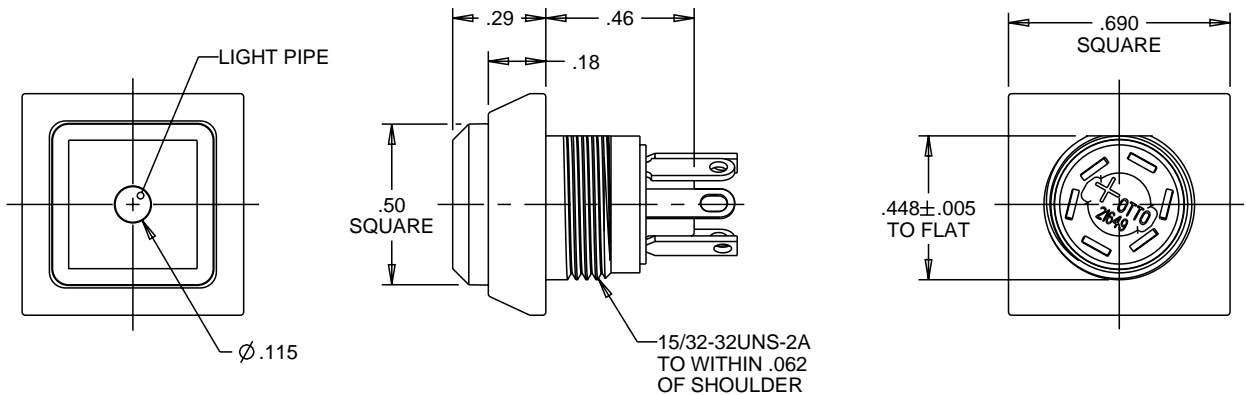
**FLUSH DOME  
(STYLE 1 & 3)**



**RAISED DOME  
(STYLE 2 & 4)**



**SQUARE DOME  
(STYLE 5)**



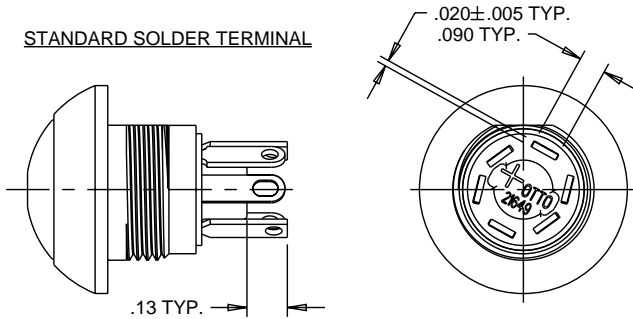
# SEALED ILLUMINATED DOME PUSHBUTTONS

**LP7-D**  
ILLUMINATED  
PUSHBUTTONS

MOMENTARY ACTION, ATTRACTIVE & HIGHLY RUGGEDIZED FOR WET & DUSTY ENVIRONMENTS

## Terminal Options

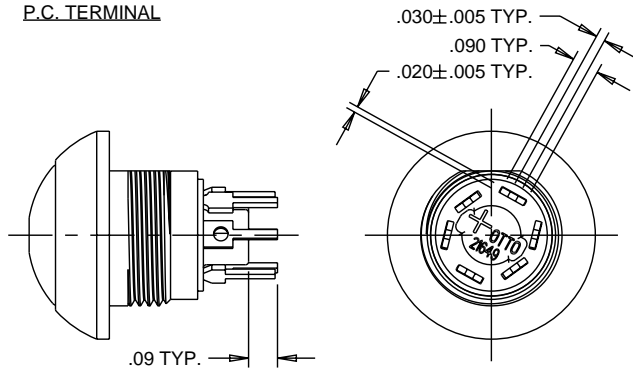
### STANDARD SOLDER TERMINAL



N.O. TERMINALS: ROUND END, SLOTTED HOLE (.084 X .055)  
N.C. TERMINALS: SQUARE END, ROUND HOLE (∅ .055)  
LED TERMINALS: ROUND END, ROUND HOLE (∅ .055)

(PLUS SYMBOL "+" DENOTES LOCATION OF LED TERMINAL ANODE AND LED TERMINAL CATHODE IS 180° OPPOSITE OF ANODE TERMINAL)

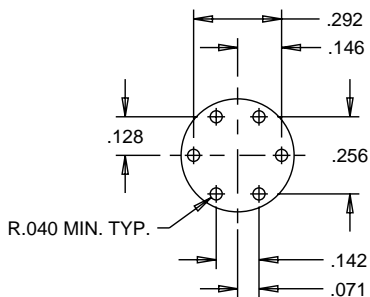
### P.C. TERMINAL



N.O. TERMINALS: ROUND HOLE (∅ .048)  
N.C. TERMINALS: NO HOLE  
LED TERMINALS: ROUND END, ROUND HOLE

(PLUS SYMBOL "+" DENOTES LOCATION OF LED TERMINAL ANODE AND LED TERMINAL CATHODE IS 180° OPPOSITE OF ANODE TERMINAL)

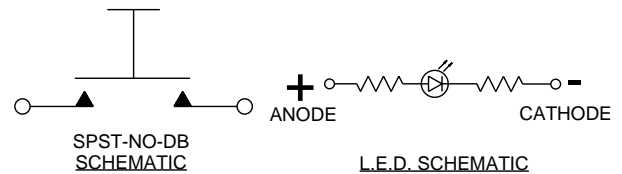
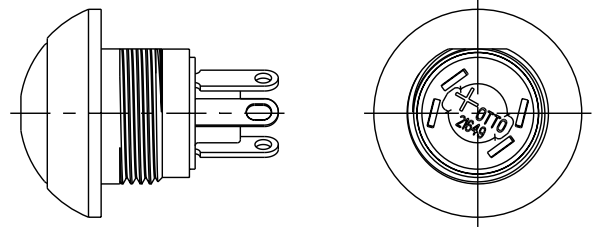
TERMINALS ORIENTED TO CASE FLAT AS SHOWN WITHIN ± 10°  
(P.C. TERMINALS ONLY)



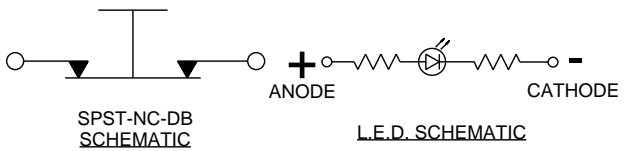
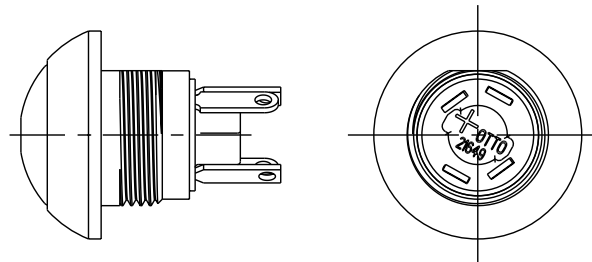
COMPONENT SIDE P.C. MOUNTING  
PATTERN, CASE FLAT ON ABOVE  
AS DEPICTED IN SWITCH VIEW

## Circuit Options

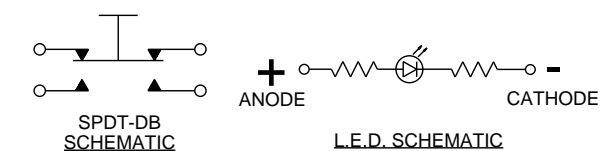
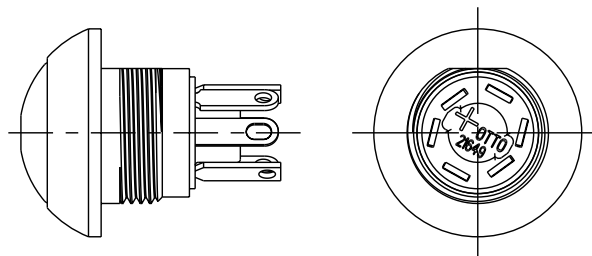
### NORMALLY OPEN



### NORMALLY CLOSED



### 2 CIRCUIT



MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED

The OTTO LP9 Lighted Dome series is a quality precision switch designed for use in panels, control grips, instruments, heavy equipment and other demanding applications where attractive, rugged, lighted pushbutton switches are required.

The LP9 series offers a positive tactile feedback, signaling the operator when the switch is operated with the added benefit of reliable LED illumination. The LP9 series offers four button versions; flush and raised profile with either a glossy or matte finish. It also comes with a threaded case for hex nut mounting while providing a short behind panel depth.

The LP9 series is constructed to meet IP68S watertight seal. Expect 25,000 operations at full rated load.

These momentary snap-action double break switches are available in standard and low operate forces. The LED is available in six colors and has the ability to accommodate 2 or 12VDC.

## Features:

- **Watertight to IP68S**
- **LED lighting available in 6 colors with the ability to accommodate 2 or 12VDC**
- **Flush & raised button style**
- **Matte or glossy button finish**
- **Full button illumination style available with glossy button finish**
- **Positive tactile feedback contact transfer**
- **Withstands shock & vibration**
- **Short behind panel depth**
- **RoHS compliant**



**Flush Dome**  
Also available with  
Raised Dome

**Raised Dome**  
Full Illumination Style  
Also available with  
Flush Dome

Standard Characteristics/Ratings:				
ELECTRICAL RATINGS: Ratings at 28 VDC or 115 VAC				
Load	N.O./N.C.	2 Circuit	Cycles	Operating Force
Resistive:	5A	4A	25,000	Standard
Inductive:	3A	2A	25,000	Standard
Resistive:	500mA	—	500,000	Standard
Resistive:	200mA	—	500,000	Low
DWV	1000Vrms through switch contacts only			
Logic Level	10mA @ 5VDC		1,000,000	
<b>Electrical Life:</b>	See Rating Chart			
<b>MECHANICAL:</b>				
<b>Mechanical Life:</b>	1,000,000 cycles			
<b>Seal:</b>	IP68S			
<b>Operating Temp Range:</b>	-40°C to +85°C			
<b>Operating Force:</b>	1.7 +/- 0.5 lb. (standard force) 0.75 +/- 0.25 lb. (low force)			
<b>Total Travel:</b>	0.080 inches max			
<b>Overtravel:</b>	0.010 inches min			
<b>MATERIALS:</b>				
<b>Case:</b>	Thermoplastic			
<b>Button:</b>	Thermoplastic			
<b>Terminals:</b>	Brass with gold			
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel gasket for round/threaded style case Panel gasket for snap-in style case only			

## LP9 PART NUMBER CODE

LP9	-	X	X	X	X	X	X	X	X
<b>Button Style*</b>		<b>Case Style*</b>	<b>Terminal Style</b>	<b>Circuit Form</b>	<b>Operating Force</b>	<b>Light Source</b>		<b>Case Color</b>	<b>Button Color</b>
1. Flush Dome Standard Finish - Lightpipe		1. Standard Round Bezel Threaded	1. Solder	1. N.O.	1. Standard Force Snap-Action	A. 2V Red LED**		1. Red	1. Red
2. Raised Dome Standard Finish - Lightpipe		2. Standard Round Bezel Snap-In	2. PC Pin	2. N.C.	2. Low Force Snap-Action	B. 2V Green LED**		2. Black	2. Black
3. Flush Dome Matte Finish Lightpipe				3. 2 Circuit		C. 2V Amber LED**		3. Orange ①	3. Orange
4. Raised Dome Matte Finish Lightpipe						D. 2V Blue LED**		4. Yellow ①	4. Yellow
5. Flush Dome Standard Finish - Fully Illuminated ①						E. 2V White LED**		5. Green ①	5. Green
6. Raised Dome Standard Finish - Fully Illuminated ①						F. 12V Red LED		6. Blue ①	6. Blue
						G. 12V Green LED		7. Violet ①	7. Violet
						H. 12V Amber LED		8. Gray ①	8. Gray
						J. 12V Blue LED		9. White	9. White
						K. 12V White LED			A. Translucent White ②

\* Button and case will be of the same texture.  
For all mixed gloss/matte combination options, contact factory.

\*\* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

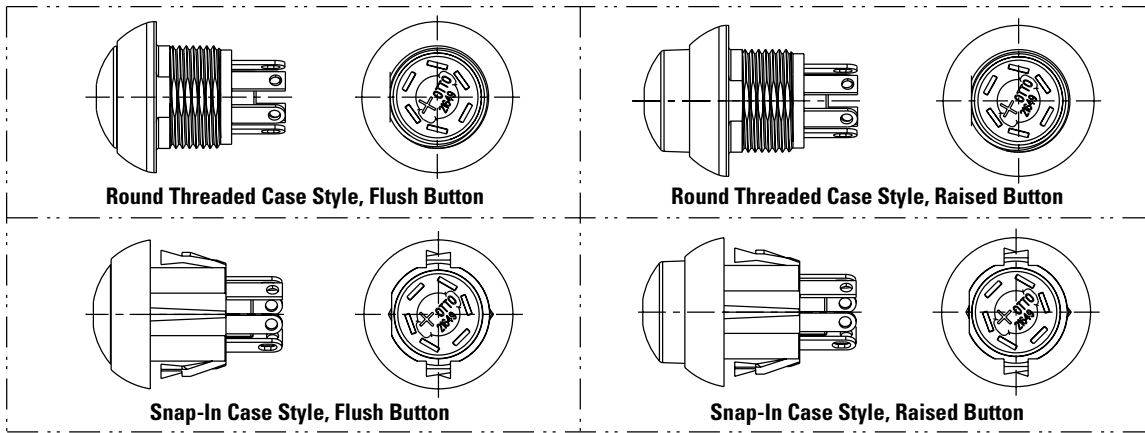
① For minimum requirement, contact factory.

② Full illumination button styles available with translucent Button Color selection A only.

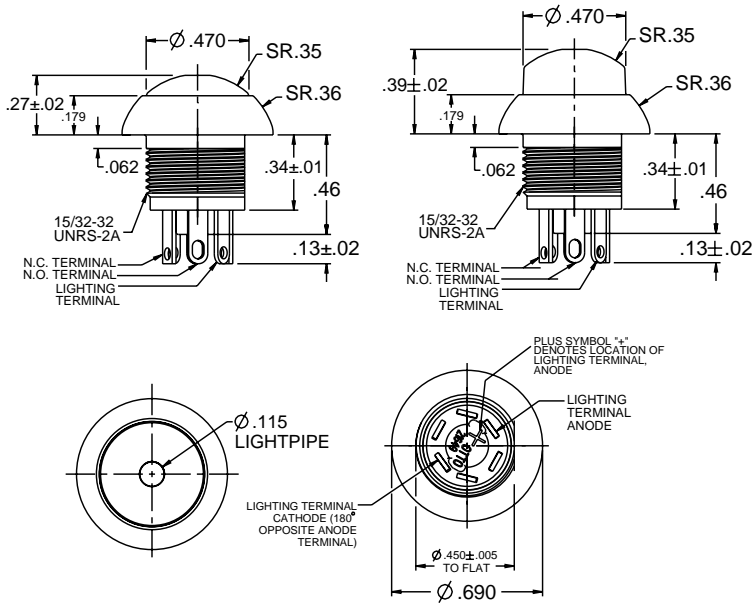
# SEALED ILLUMINATED DOME PUSHBUTTONS

**LP9**  
ILLUMINATED  
PUSHBUTTONS

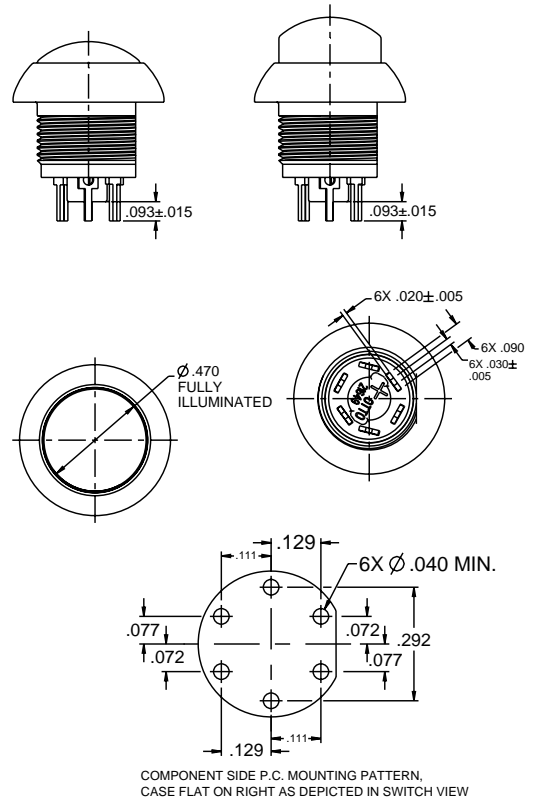
MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED



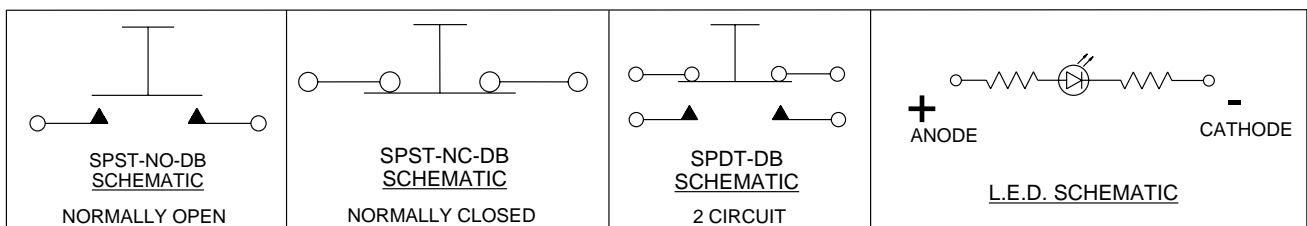
### Standard Terminals



### PC Pin Terminals (Full Illumination Option Shown)



RECOMMENDED PANEL OPENINGS FOR SNAP-IN STYLE CASE		
PANEL THICKNESS	RECOMMENDED Ø	DIM. ACROSS D-FLAT
.024	Ø .505	.460
.118	Ø .505	.460



LOGIC LEVEL MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED

The OTTO LP9L Lighted Dome series is a quality precision switch designed for use in panels, control grips, instruments and other demanding applications where attractive, rugged, lighted logic level pushbutton switches are required.

The LP9L series offers a positive tactile feedback, signaling the operator when the switch is operated with the added benefit of reliable LED illumination. The LP9L series offers four button versions; flush and raised profile with either a glossy or matte finish. Featuring short behind panel depth, it comes with either a snap-in case or a threaded case for hex nut mounting.

The LP9L series is constructed to meet IP68S watertight seal. Expect 1,000,000 operations at 50mA resistive.

The LP9L series are momentary snap-action double break switches, available in standard and low operate forces. The LED is available in five colors and has the ability to accommodate 2 or 12VDC.

## Features:

- Logic level switch
- Watertight to IP68S
- LED lighted with the ability to accommodate 2 or 12VDC
- LED available in 6 colors
- Flush & raised button style
- Matte or glossy button finish
- Positive tactile feedback contact transfer
- Withstands shock & vibration
- Short behind panel depth
- RoHS compliant



Raised Dome

Also available with Flush Dome

Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
<b>Load</b>			
Logic Level:	10mA @ 5VDC (Resistive)		
DWV:	1050Vrms through switch contacts only		
<b>Electrical Life:</b>	1,000,000 cycles		
<b>LIGHTING:</b>			
<b>Light Source Voltage (DC)</b>	<b>Actual Voltage Nominal (DC)</b>	<b>Voltage Max (DC)</b>	
2**	2	2.6	
12	13.5	14.5	
<b>Mechanical Life:</b>	1,000,000 cycles		
<b>Seal:</b>	IP68S		
<b>Operating Temp Range:</b>	-40°C to +85°C		
<b>Operating Force:</b>	1.7 +/- 0.5 lb. (standard force) .75 +/- .25 lb. (low force)		
<b>Total Travel:</b>	0.080 inches max		
<b>Overtravel:</b>	0.010 inches min		
<b>MATERIALS:</b>			
<b>Case:</b>	Thermoplastic		
<b>Button:</b>	Thermoplastic		
<b>Terminals:</b>	Brass with gold over silver		
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal gasket (threaded version) Panel seal gasket (snap-in version)		

## LP9L PART NUMBER CODE

LP9L	-	X	X	X	X	X	X	X	X
<b>Button Style*</b>		<b>Case Style*</b>		<b>Terminal Style</b>	<b>Circuit Form</b>	<b>Operating Force</b>	<b>Light Source**</b>	<b>Case Color</b>	<b>Button Color</b>
1. Flush Dome Standard Finish		1. Standard Round Bezel Threaded		1. Solder	1. N.O.	1. Standard Force Snap-Action	A. 2V Red LED	1. Red	1. Red
2. Raised Dome Standard Finish		2. Standard Round Bezel Snap-In		2. PC Pin	2. N.C.	2. Low Force Snap-Action	B. 2V Green LED	2. Black	2. Black
3. Flush Dome Matte Finish					3. 2 Circuit		C. 2V Amber LED	3. Orange***	3. Orange
4. Raised Dome Matte Finish							D. 2V Blue LED	4. Yellow***	4. Yellow
							E. 2V White LED	5. Green***	5. Green
							F. 12V Red LED	6. Blue***	6. Blue
							G. 12V Green LED	7. Violet***	7. Violet
							H. 12V Amber LED	8. Gray***	8. Gray
							I. 12V Blue LED	9. White	9. White
							K. 12V White LED		

\* Button and case will be of the same texture.

For all mixed gloss/matte combination options, contact factory.

\*\* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

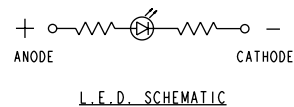
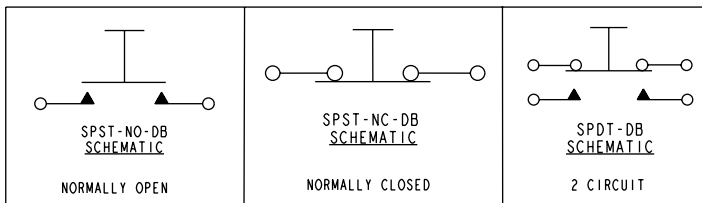
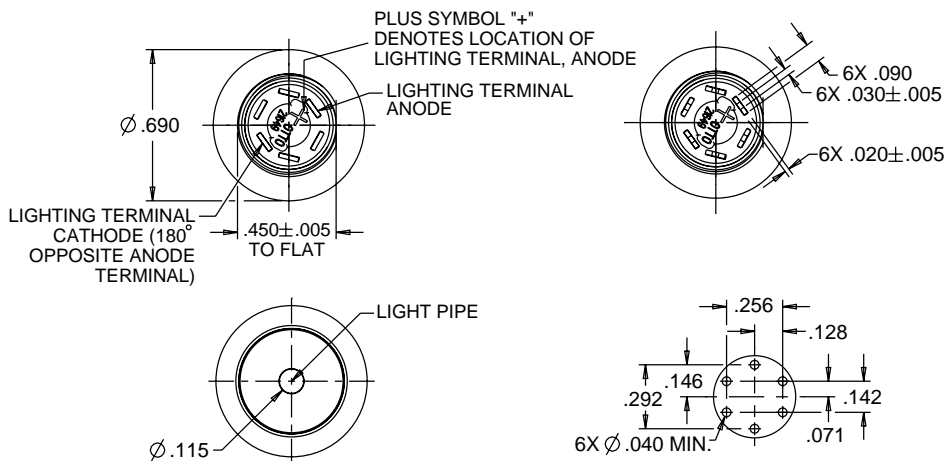
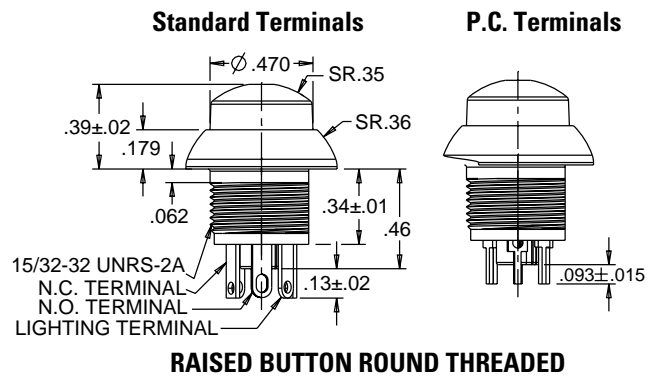
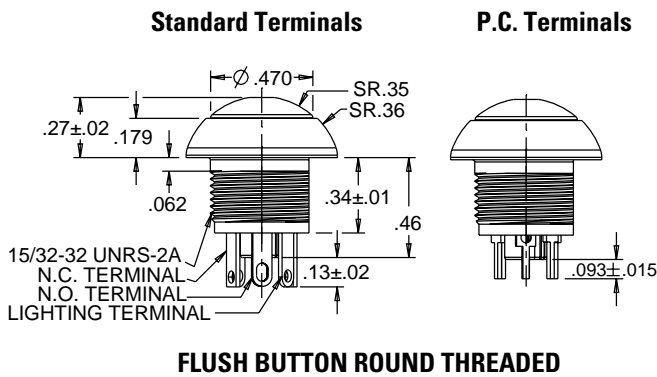
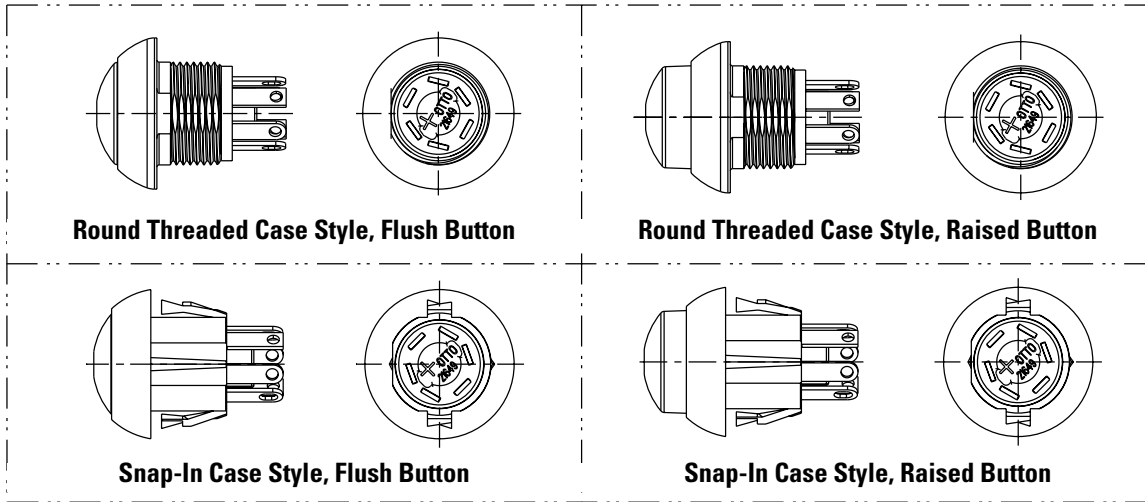
\*\*\* For minimum requirement, contact factory.



# ILLUMINATED SEALED DOME PUSHBUTTONS

**LP9L**  
ILLUMINATED  
PUSHBUTTONS

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED



The LPL Indicator Light series offers an excellent means of indicating the activity of a circuit by providing a visual on/off indication of process conditions. The LPL series is ideally suited as part of a panel mounted indicator for control panels, instrumentation and front panel fault indicators.

The LPL series is manufactured to the highest standards and built to withstand harsh environments, offering anodized aluminum alloy cases with seal options of moistureproof and dusttight to IP64 or watertight to IP68S. The LPL series offers long life LED lighting in a variety of colors and can accommodate 2 to 24VDC power.

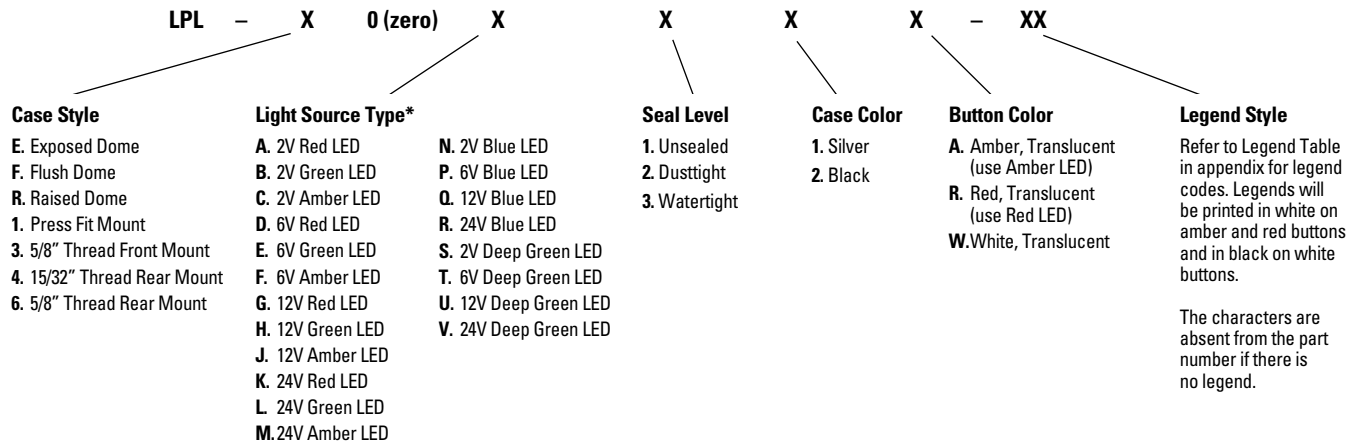
## Features:

- **Seal options include:**
  1. **Watertight per MIL-PRF-8805, Design 3 and watertight 1 meter to IP68S**
  2. **Dusttight per MIL-PRF-8805, Design 2 and Dusttight/protected against splashing water per IP64**
  3. **Unsealed**
- **LED lighted with the ability to accommodate 2, 6, 12 & 24VDC power and includes reverse voltage protection**
- **Tall and dome style buttons in translucent white, red & amber permitting sublimated & pad printed legends**
- **15/32" & 5/8" thread, press fit & dome case styles available**
- **Built-in current limiting resistor & reverse polarity protection**
- **Looks identical to the LP3 & LP5 series to provide a cohesive panel look**
- **RoHS compliant**



Standard Characteristics/Ratings:		
<b>LIGHTING:</b>		
Light Source Voltage (DC)	Actual Voltage Nominal (DC)	Voltage Max (DC)
2*	2	2.6
6	7	8
12	13.5	14.5
24	28	28.6
<b>Seal:</b>	Options include: <ul style="list-style-type: none"> <li>• Watertight per MIL-PRF-8805, Design 3 and IP68S</li> <li>• Dusttight per MIL-PRF-8805, Design 2 and IP64</li> <li>• Unsealed</li> </ul>	
<b>Operating Temp Range:</b> -55°C to +85°C		
<b>MATERIALS:</b>		
<b>Case:</b>	Anodized aluminum alloy	
<b>Button:</b>	Thermoplastic	
<b>Terminals:</b>	Brass	
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel gasket when applicable	

## LPL PART NUMBER CODE



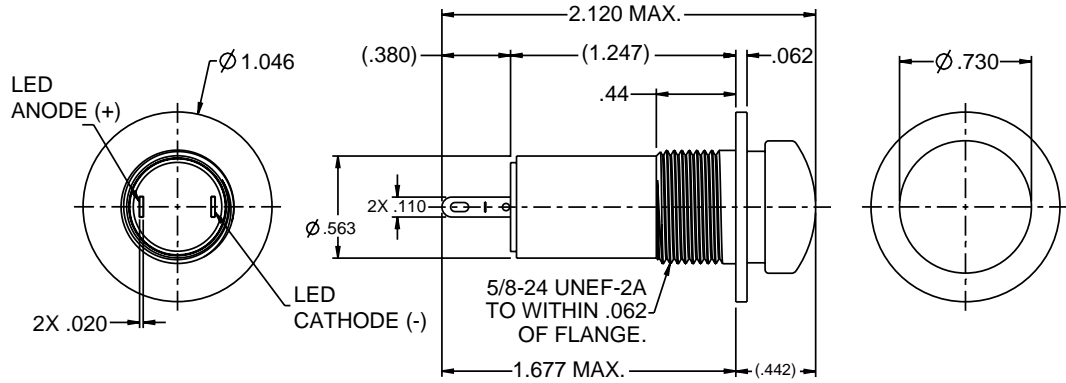
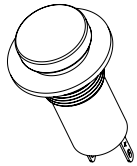
\* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.  
All green and blue LEDs are recommended for use with translucent button color white only.  
For super bright LEDs, contact factory.

# LPL INDICATOR LIGHTS

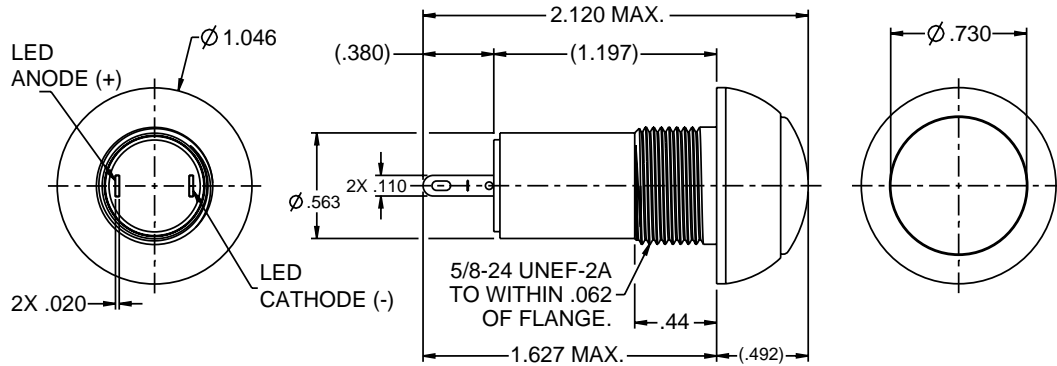
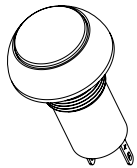
LPL  
INDICATOR  
LIGHTS

## LED ILLUMINATED & SEALED

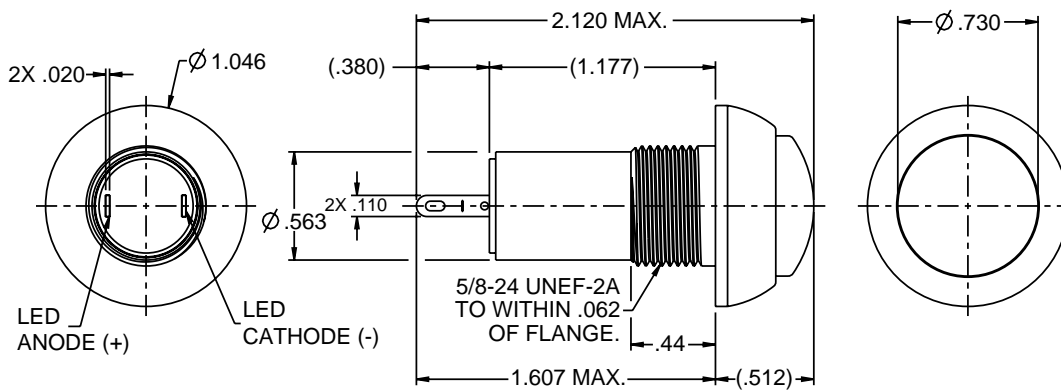
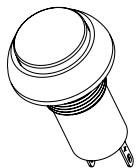
**LPL-EO**  
Exposed Dome Button



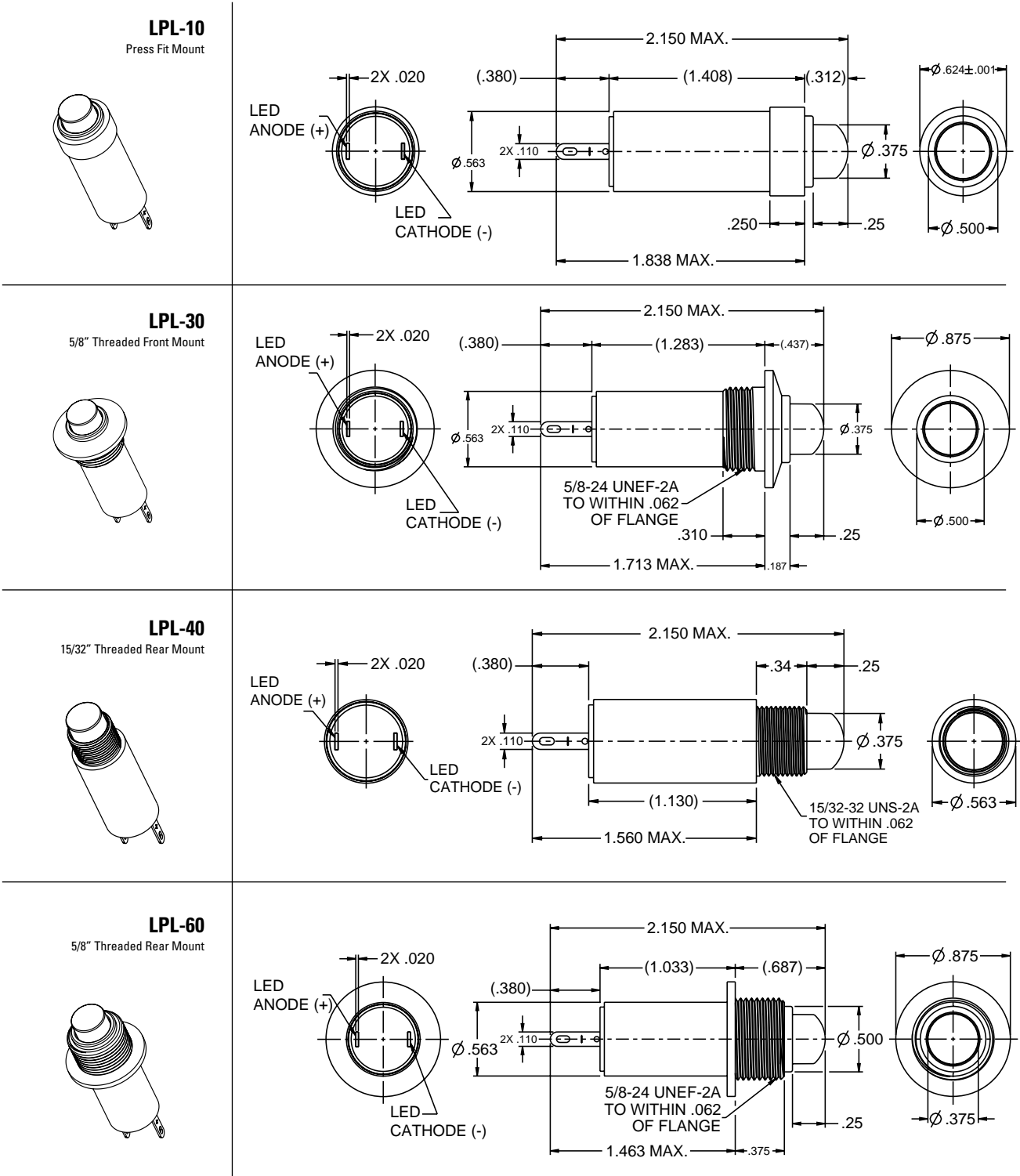
**LPL-FO**  
Flush Dome Button



**LPL-RO**  
Raised Dome Button



LED ILLUMINATED & SEALED



## MOMENTARY ACTION, SEALED, SNAP-ACTION, DOUBLE BREAK

The P1 offers a mechanical life that is well beyond the 50,000 cycles required by MIL-PRF-8805. The double break switching mechanism has an incredibly fast transfer time, reducing arcing and increasing contact life. The inherent wiping action breaks welds and scrubs the contacts clean on every actuation.

The P1 switch offers vastly improved life under extreme conditions found in most military environments. Moistureproofing is accomplished in two ways. The pushbutton is sealed with a silicone boot operating on our patented "rolling sleeve," providing longer life and smoother operation over a wide temperature range. Epoxy seals protect the contacts and terminals from hostile environments and solder flux.

Watertight sealing to Commercial (IP68S) and Military (MIL-PRF-8805 Design 3) standards are available. This watertight design is also available in commercial construction as the P3 series (add "W" to your part number).

High contact force (120g/4.2 oz), low contact resistance (25mΩ max initial) and short contact bounce result from our snap-action mechanism. These characteristics guarantee exceptional current carrying capabilities over the life of the switch. With the optional low level (gold plate) configuration, the P1 is well suited to interface directly to computers and other solid state devices.

The P1 switch is a quality precision snap-action switch designed for use in panel boards, control grips, computers, instruments, pressure switches and other hand or machine operated applications where sealed pushbutton switches are required. Its precision permits the P1 to be used as a limit switch with unique size, high electrical ratings and a wide choice of mounting styles.

### Features:

- Button sealed with patented "rolling sleeve" principle
- Contact area sealed at button & terminals
- Less than 25mΩ initial contact resistance
- Ideal for low level switching as well as up to 10 amp duty
- Positive tactile feedback
- Variety of mounting styles
- Engraved buttons & bezels available
- UL recognized & CSA certified
- Watertight to IP68S available
- RoHS compliant



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz	50,000 feet @ 28VDC or 115VAC, 60/400Hz
Resistive	10A	N/A
Inductive	5A	5A
Lamp	3A	N/A
Center Contact	3A	N/A
DWV	1000Vrms	
Low Level	10mA @ 30mV	

**Electrical Life:** 25,000 cycles or 5,000 cycles at 50,000 feet

**Mechanical Life:** 50,000 cycles, circuit forms 3, 4, & 5  
250,000 cycles, circuit forms 1, 2 & 6

**Seal:** Dusttight per MIL-PRF-8805 Design 2 or Watertight per IP68S or MIL-PRF-8805 Design 3

**Operating Temp Range:** -55°C to +85°C

**Operating Force:** 2.5 lbs. or 4.0 lbs.  
Push-Pull: .5 to 2.0 lbs.

**Reset Force:** 0.75 lb. or 1.0 lb.

**Total Travel:** 0.085 +/- 0.015 inches

**Overtravel:** 0.012 inches min

**Movement Differential:** 0.015 inches min

#### MATERIALS:

**Case:** Black anodized aluminum alloy


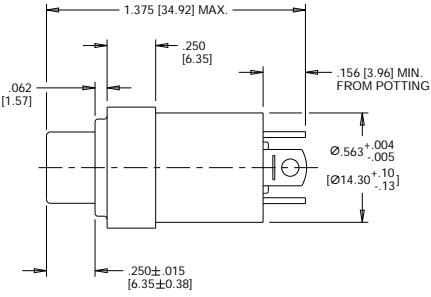

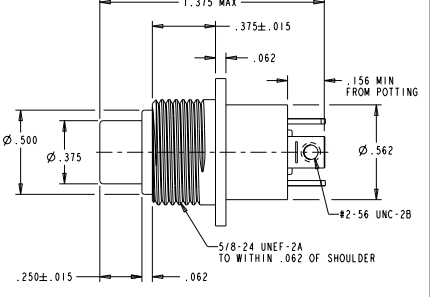

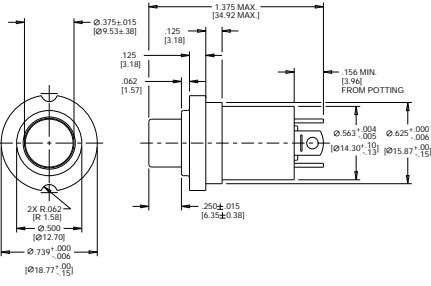

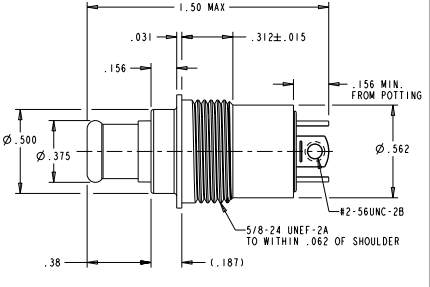

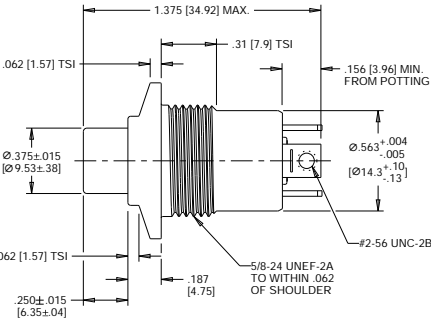

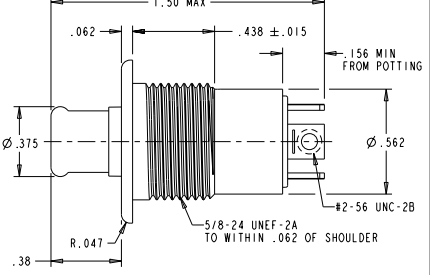

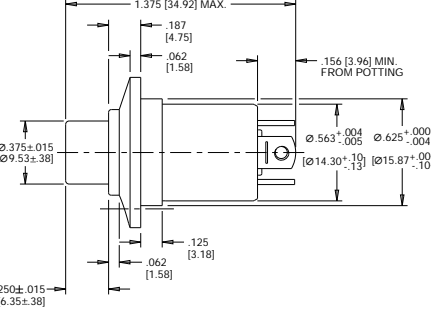
**Button:** Thermoplastic

**Terminals:** Brass with silver plate, gold plate for low level

**Terminal Hardware:** Screws, lockwasher and solder lugs for screw terminal option

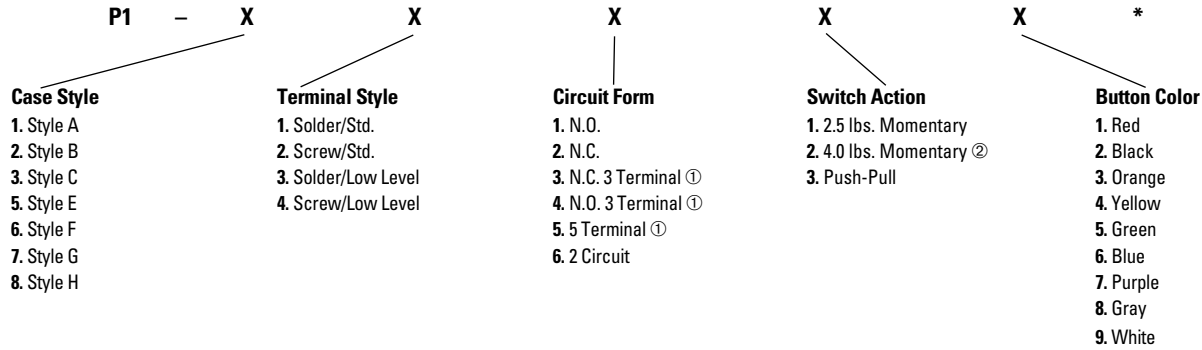
**Mounting Hardware:** Hex nut and lockwasher, panel seal on watertight switches

MOMENTARY ACTION, LOW LEVEL UP TO 10 AMPS

<p><b>P1-1 (MIL-A)</b></p> 	 <p>1.375 [34.92] MAX.          .062 [1.57]          .250 [6.35]          .156 [3.96] MIN. FROM POTTING  <math>\phi .563^{+.004}_{-.005}</math>  <math>[\phi 14.30^{+.10}_{-.13}]</math>  <math>\phi .563^{+.004}_{-.005}</math>  <math>[\phi 14.30^{+.10}_{-.13}]</math>          .250 ± .015 [6.35 ± 0.38]</p>	<p><b>P1-6 (MIL-F)</b></p> 	 <p>1.375 MAX.          .375 ± .015          .062          .156 MIN. FROM POTTING  <math>\phi .562</math>  <math>\phi .500</math>  <math>\phi .375</math>          5/8-24 UNEF-2A TO WITHIN .062 OF SHOULDER  <math>\phi 2-56 \text{ UNC-2B}</math>          .250 ± .015          .062</p>
<p><b>P1-2 (MIL-B)</b></p> 	 <p>1.375 MAX. [34.92 MAX.]  <math>\phi .375 \pm .015</math> [9.53 ± .38]          .125 [3.18]          .062 [1.57]          .156 MIN. [3.96] FROM POTTING  <math>\phi .563^{+.004}_{-.005}</math>  <math>\phi .625^{+.000}_{-.006}</math>  <math>[\phi 14.30^{+.10}_{-.13}]</math> <math>[\phi 15.87^{+.00}_{-.15}]</math>  <math>\phi .563^{+.004}_{-.005}</math>  <math>[\phi 14.30^{+.10}_{-.13}]</math>          .250 ± .015 [6.35 ± 0.38]          3X R.062 [R 1.58]  <math>\phi .500</math> [12.7]  <math>\phi .739^{+.000}_{-.006}</math> [18.77 ± .05]</p>	<p><b>P1-7 (MIL-G)</b></p> 	 <p>1.50 MAX.          .031          .156          .156 MIN. FROM POTTING  <math>\phi .562</math>  <math>\phi .500</math>  <math>\phi .375</math>          5/8-24 UNEF-2A TO WITHIN .062 OF SHOULDER  <math>\phi 2-56 \text{ UNC-2B}</math>          .38          (.187)</p>
<p><b>P1-3 (MIL-C)</b> Push-Pull Style Shown</p> 	 <p>1.375 [34.92] MAX.          .062 [1.57] TSI          .31 [7.9] TSI          .156 [3.96] MIN. FROM POTTING  <math>\phi .563^{+.004}_{-.005}</math>  <math>[\phi 14.3^{+.10}_{-.13}]</math>  <math>\phi .563^{+.004}_{-.005}</math>  <math>[\phi 14.3^{+.10}_{-.13}]</math>          .062 [1.57] TSI          .187 [4.75]          5/8-24 UNEF-2A TO WITHIN .062 OF SHOULDER  <math>\phi 2-56 \text{ UNC-2B}</math>          .250 ± .015 [6.35 ± 0.04]</p>	<p><b>P1-8 (MIL-H)</b></p> 	 <p>1.50 MAX.          .062          .156          .438 ± .015          .156 MIN. FROM POTTING  <math>\phi .562</math>  <math>\phi .375</math>          R.047          5/8-24 UNEF-2A TO WITHIN .062 OF SHOULDER  <math>\phi 2-56 \text{ UNC-2B}</math>          .38</p>
<p><b>P1-5 (MIL-E)</b></p> 	 <p>1.375 [34.92] MAX.          .187 [4.75]          .062 [1.58]          .156 [3.96] MIN. FROM POTTING  <math>\phi .563^{+.004}_{-.005}</math>  <math>\phi .625^{+.000}_{-.004}</math>  <math>[\phi 14.30^{+.10}_{-.13}]</math> <math>[\phi 15.87^{+.00}_{-.10}]</math>  <math>\phi .563^{+.004}_{-.005}</math>  <math>[\phi 14.30^{+.10}_{-.13}]</math>          .250 ± .015 [6.35 ± 0.38]          .125 [3.18]          .062 [1.58]</p>		

## MOMENTARY ACTION, LOW LEVEL UP TO 10 AMPS

### P1 PART NUMBER CODE



\* Add "W" for watertight seal to MIL-PRF-8805 Design 3

① Circuit styles with 3 and 5 terminals have 50,000 cycle mechanical life per MIL-PRF-8805.

② Military standard is 4.0 lbs.

### ORDERING INFORMATION:

Select the OTTO P1 series switch to match your application requirements. Combinations of features are almost unlimited. When ordering, specify the Military (MS) Number and/or OTTO Part Number.

**Example:** P1-32629 is MS25089-3CW, "C" style case, 2 circuit contact configuration, 4.0 lbs. operating force, white button. For low level model, specify P1-34629, MS25089-3CWL. A partial cross reference list of Military (MS) Numbers to OTTO Part Numbers may be found in the back section of this catalog.

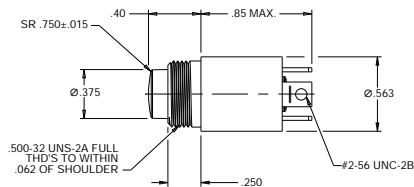
#### Unsealed P1-90013

**Operating Force:** 4.0 +/- 1.0 lb.

**Circuit:** SPDT-DB

**Case:** Black anodized aluminum

**Button:** Black nylon



#### Watertight P1-90024

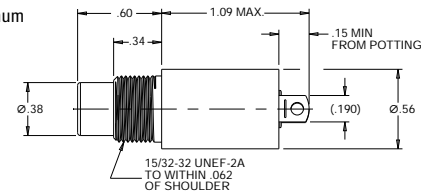
**Dusttight P1-90014**

**Operating Force:** 4.0 +/- 1.0 lb.

**Circuit:** SPST-N.O.

**Case:** Black anodized aluminum

**Button:** Red nylon



## EXAMPLES OF CUSTOMIZED P1 SERIES SEALED PUSHBUTTONS

### Special Cap On Press Fit Case

**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 4.0 +/- 1.0 lb.  
**Reset Force:** 1.0 lb. min  
**Circuit:** SPDT 2 circuit  
**Mechanical Life:** 250,000 cycles  
**Button:** Black oxide #303 Stainless Steel  
**Housing:** Black anodized aluminum  
**P1-10047**



### Long Pushbutton

Dusttight per MIL-PRF-8805, this extra long button is installed in a Type P1 "C" case style.  
**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 4.0 lbs.  
**Circuit:** SPNO-DB  
**Rating:** 10 amps Resistive  
**Mechanical Life:** 250,000 cycles  
**Electrical Life:** 25,000 cycles  
**P1-30074**



### Special Push-Pull Switch

**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 0.5 lb. to 2.0 lbs.  
**Circuit:** SPNO-DB  
**Mechanical Life:** 250,000 cycles  
**Button:** Black on white nylon  
**Housing:** Black anodized aluminum  
**Case:** Style "C"  
**P1-30052**



### Large Diameter Button

Button diameter is 1.187" and is red anodized aluminum mounted on a Type P1 style "C" button case. Button is free to rotate 360°.  
**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 2.5, +0.5, -1.0 lb.  
**Circuit:** SPDT 2 circuit  
**Rating:** 10 amps Resistive  
**Mechanical Life:** 250,000 cycles  
**Electrical Life:** 25,000 cycles  
**P1-30075**



### Special Knurled Shroud

**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 4.0 +/- 1.0 lb.  
**Rest Force:** 1.0 lb. min  
**Circuit:** SPDT 2 circuit  
**Mechanical Life:** 250,000 cycles  
**Button:** Red nylon  
**Housing:** Black anodized aluminum  
**P1-90108**



### Vandal Resistant

Stainless steel housing and button are watertight sealed. Ideal for unattended machines operated by the public.  
**Operating Force:** 2.5, +1.0, -0.5 lb.  
**Circuit:** SPNO-DB  
**Mechanical Life:** 250,000 cycles  
**Bezel:** 1.5" dia.  
**Button:** 0.812" dia.  
**P1-90135-2**



For smaller 0.969" dia., DPDT-DB design, see P4-10155-2.

- Large buttons, up to 0.765" diameter
- Symbols & 9 colors of buttons
- Watertight to IP68S
- 10 amp resistive rating

NOTE: Refer to Standard Legends Chart in Appendix for available symbols.



P1-10142-X



## 3-POSITION MOMENTARY ACTION, ONE OR TWO STEP

OTTO'S unique 3-position P2 pushbutton offers two levels (steps) of momentary switch action plus "rest" (or "off") for applications requiring three modes of operation.

Each detent operates an independent set of SPDT contacts rated to 5A @ 28VDC or 125 VAC wrapped up in a watertight and dusttight package.

The OTTO P2 series works like this: Upon actuation, level one is reached with a positive tactile feel transmitted back to the operator. The operator has the option of either releasing the pushbutton, which will return to the normal (off) position, or continuing to level two. Upon release, the pushbutton returns to the normal position.

Designed for applications in the commercial market such as the control of two-speed motors, the P2 also works well in numerous military applications.



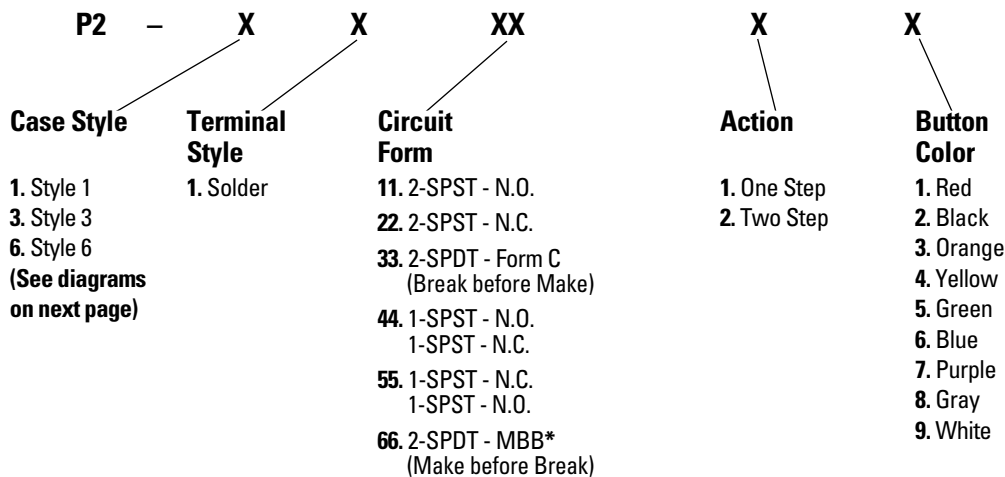
P2-1

### Features:

- **Unique three-mode design**
- **Sequential DPDT contact action**
- **One Step and Two Step versions**
- **6 circuit forms**
- **Watertight and dusttight**
- **25,000 mechanical cycles**

Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	
<b>Load</b>	Sea Level @ 28VDC or 125VAC, 60/400Hz
<b>Resistive</b>	5A
<b>Inductive</b>	3A
<b>Lamp</b>	2A
<b>DVV</b>	1000Vrms Initial
<b>Logic Level</b>	10mA @ 5VDC Resistive
<b>Electrical Life:</b>	25,000 cycles
<b>Mechanical Life:</b>	25,000 cycles
<b>Seal:</b>	Watertight per MIL-PRF-8805 Design 3
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Forces:</b>	Pole One: 3.0 lbs. ± 1.0 lbs. Pole Two: 5.0 lbs. ± 1.5 lbs.
<b>Release Forces:</b>	Pole One: .75 lbs. min. Pole Two: 1.0 lbs. min.
<b>Total Travel:</b>	One Step Style .125 max, Two Step Style .250 max
<b>Overtravel:</b>	0.015 inches min.
<b>Pretravel:</b>	0.020 inches min.
<b>MATERIALS:</b>	
<b>Case:</b>	Black anodized aluminum alloy
<b>Button:</b>	Thermoplastic
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal gasket for case styles 3 and 6

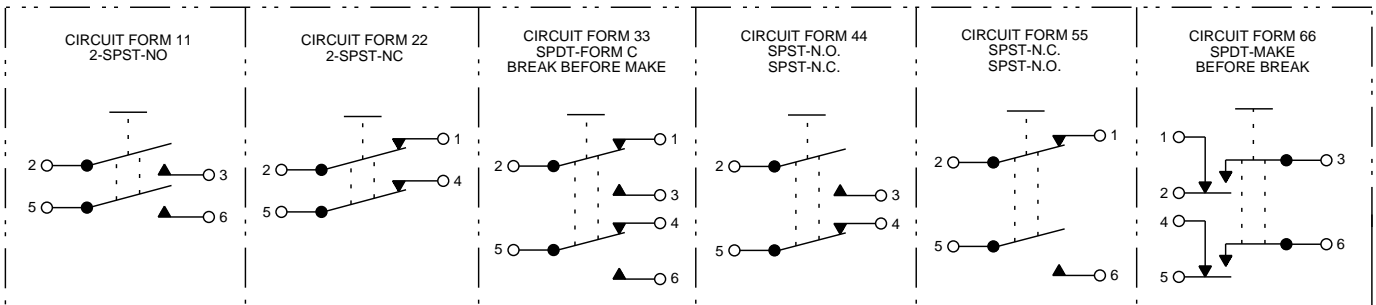
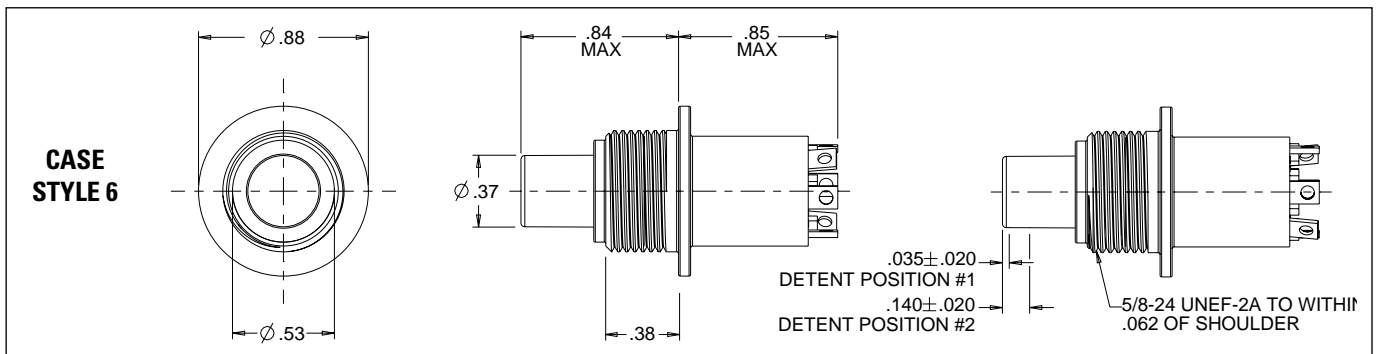
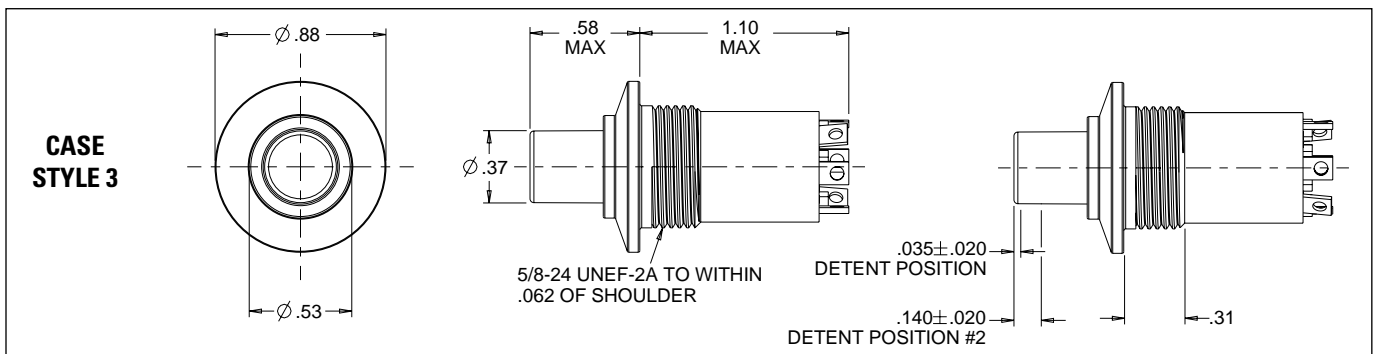
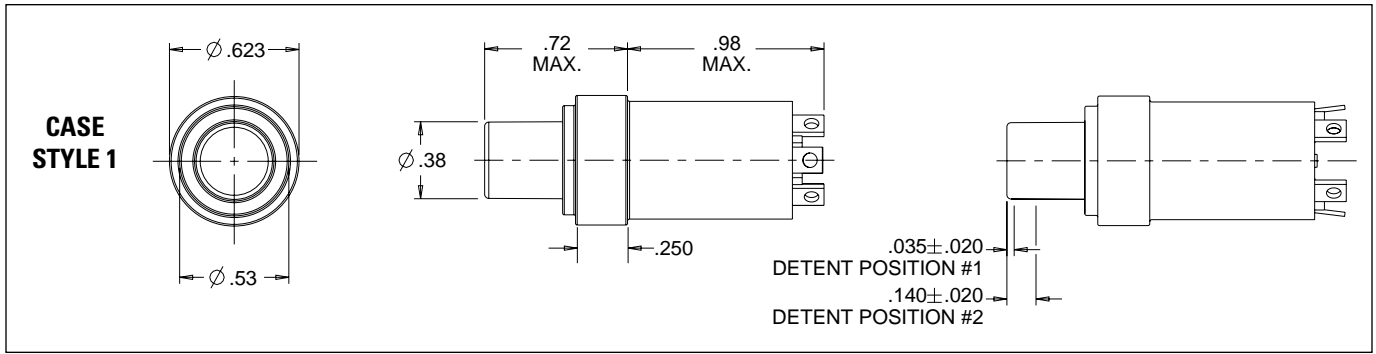
### P2 PART NUMBER CODE



\* Available with Two Step version only.

# COMMERCIAL GRADE PUSHBUTTONS

3-POSITION MOMENTARY ACTION, ONE OR TWO STEP



**For two step switches:**

Circuit 1-2-3 operates and resets between the first and second detent.

Circuit 4-5-6 operates and resets between the second detent and full travel.

# SEALED COMMERCIAL GRADE PUSHBUTTONS

MOMENTARY ACTION, SEALED, SNAP-ACTION, DOUBLE BREAK

Makes and breaks every time! The OTTO design features inherent rocking action that breaks welds and wipes contacts clean.

The P3 is the commercial version of the P1 Pushbutton switch, offering vastly improved life under extreme conditions found in some industrial environments. The pushbutton is sealed by a silicone boot operating on our patented "rolling sleeve," providing longer life and smoother operation over a wide temperature range. Epoxy protects the contacts and terminals from hostile environments and solder flux.

High contact force (120g/4.2 oz) and short contact bounce are the result of our snap-action mechanism. These characteristics provide exceptional current carrying capabilities over the life of the switch. With the optional logic level (gold plate) configuration, the P3 is well suited to interface directly to computers and other solid state devices.

Watertight sealing is available by simply adding "W" to your part number. Because the P3 is a double break switch, wide connection possibilities, longer life and greater capacity are offered. The P3 design provides a unique terminal connection to the moving element for added flexibility. Special versions can be provided with five terminals to control up to four circuits.

## Features:

- Button sealed with patented "rolling sleeve" principle
- Contact area sealed at button & terminals
- Positive tactile feedback
- Engraved buttons & bezels available
- UL recognized & CSA certified
- 1 million mechanical cycle life
- Watertight to IP68S available in all versions
- Watertight to IP69K available in non push-pull versions
- RoHS compliant

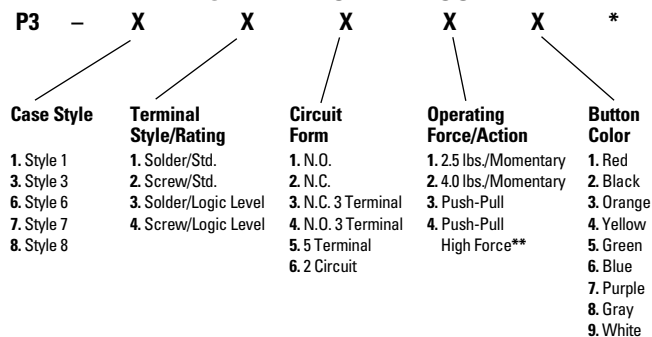


### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz	50,000 feet @ 28VDC or 115VAC, 60/400Hz	Cycles
Resistive	10A	N/A	100,000
Inductive	5A	5A	100,000
Lamp	3A	N/A	100,000
Center Contact	3A max	N/A	100,000
DVV	1000Vrms	400Vrms	
Logic Level	10mA @ 5VDC		
<b>Electrical Life:</b>	25,000 or 100,000 cycles (depending on configuration) High Force Push Pull 5,000 cycles		
<b>Mechanical Life:</b>	1 million cycles, circuit forms 1, 2 & 6 100,000 cycles, circuit forms 3, 4 & 5 High Force Push Pull 5,000 cycles		
<b>Seal:</b>	IP64 or IP68S and IP69K IP64 or IP68S on push-pull versions		
<b>Shock:</b>	MIL-STD-202, method 207		
<b>Operating Temp Range:</b>	-55°C to +85°C, High Force Push Pull -40°C to +85°C		
<b>Operating Force:</b>	2.5 lbs. or 4.0 lbs. Push-Pull: .5 to 2.0 lbs. Push-Pull High Force: 3.0 lbs. min.		
<b>Reset Force:</b>	0.75 lb. min or 1.0 lb.		
<b>Total Travel:</b>	0.085 +/- 0.015 inches		
<b>Overtravel:</b>	0.012 inches min		
<b>Movement Differential:</b>	0.015 inches min		
<b>MATERIALS:</b>			
<b>Case:</b>	Anodized aluminum alloy		
<b>Button:</b>	Thermoplastic		
<b>Terminals:</b>	Brass with silver, gold for logic level		
<b>Terminal Hardware:</b>	Screws, lockwasher and terminal lug for screw terminal option		
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal when applicable		

### P3 PART NUMBER CODE

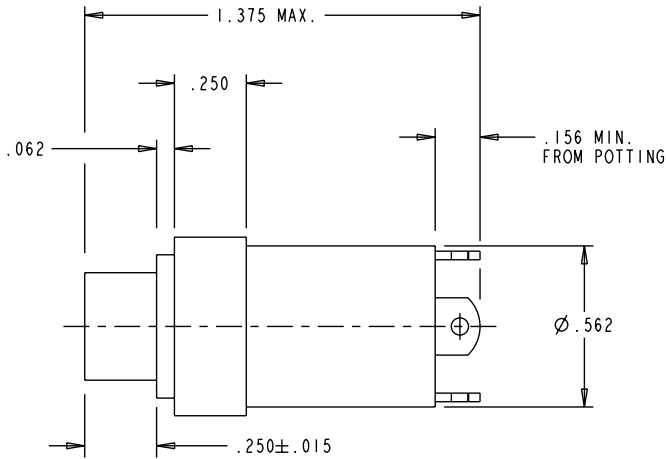


\* Add "W" suffix for watertight to IP68S and IP69K for Operating Force/Action selections 1 and 2.

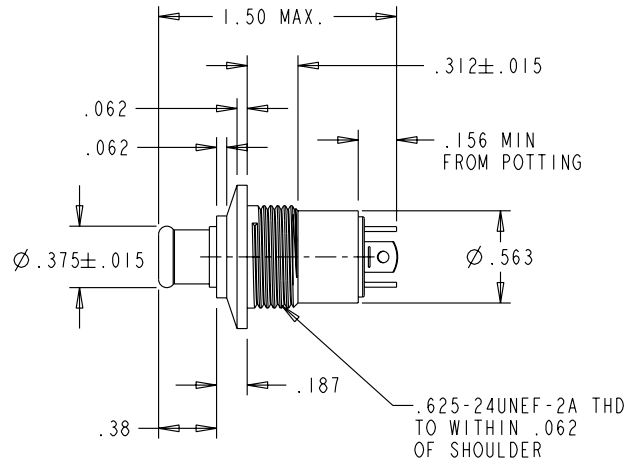
Add "W" suffix for watertight to IP68S for Operating Force/Action selections 3 and 4.

\*\*Available in Case Style 3 only.

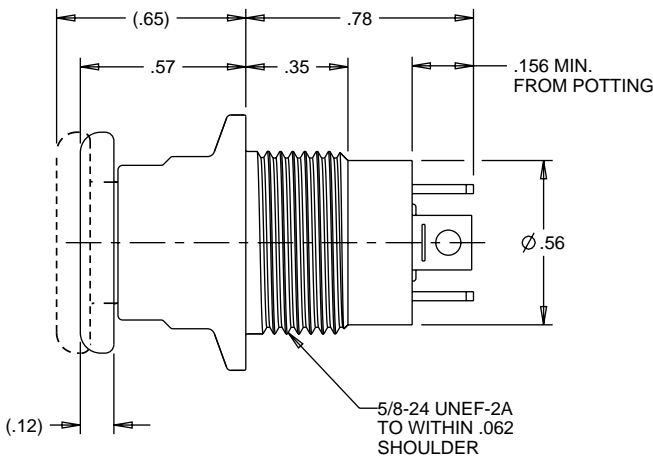
IDEAL FOR USE IN HEAVY MACHINERY & COMMERCIAL APPLICATIONS



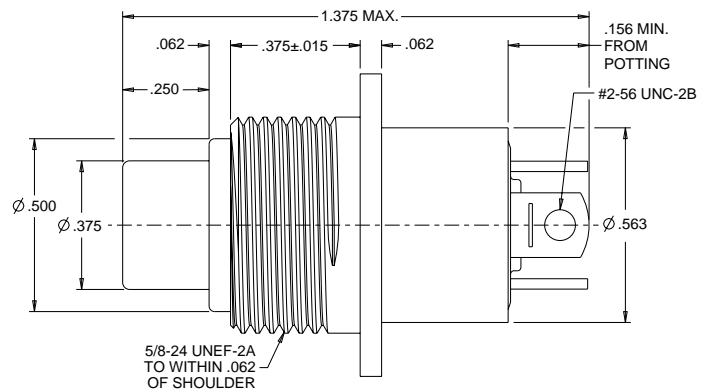
**Style P3-11\_2**



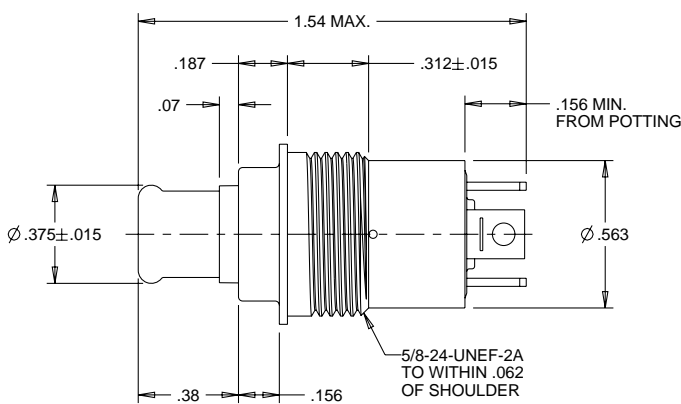
**Style P3-33\_3 Push-Pull**



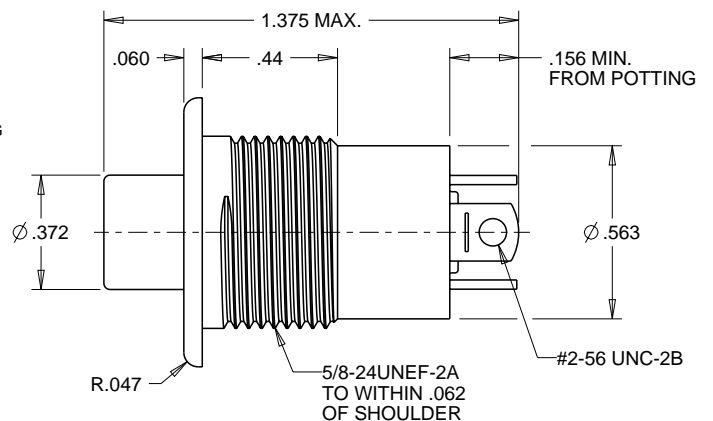
**Style P3-33\_4 Push-Pull High Force**



**Style P3-61\_1**



**Style P3-71\_3**



**Style P3-83\_1**

## EXAMPLES OF CUSTOMIZED P3 SERIES SEALED PUSHBUTTONS

### Special Shaped Bezel

**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 2.5, +0.5, -1.0 lb.  
**Reset Force:** 0.75 lb. min  
**Circuit:** SPNO-DB (Other circuits available)  
**Mechanical Life:** 1,000,000 cycles  
**Button:** Red nylon  
**Housing:** Clear anodized aluminum  
**P3-30017**



### Special Journaled Button

Watertight to IP68S, black anodized case and thermoplastic button available in nine colors.  
**Circuit:** SPNO-DB  
**Mechanical Life:** 1,000,000 cycles  
**Electrical Life:** 100,000 cycles  
**P3-90308-X**  
 (X denotes button color)



### Special Large Round Button, Quick Connect Tab Terminals

**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 4.0 +/- 1.0 lb.  
**Reset Force:** 1.0 lb. min  
**Circuit:** SPNO-DB (Other circuits available)  
**Mechanical Life:** 100,000 cycles  
**Button:** Black nylon  
**Housing:** Clear anodized aluminum  
**P3-30031**



### Large Diameter Button

Nine different button colors, black anodized protective shroud, watertight to IP68S.  
**Circuit:** SPNO-DB  
**Mechanical Life:** 1,000,000 cycles  
**Electrical Life:** 100,000 cycles at full load  
**P3-90207-X**  
 (X denotes button color)



### Special Right Angle, Quick Connect Tabs, P3-6 Style

**Total Travel:** 0.085" +/- 0.015"  
**Operating Force:** 2.5, +0.5, -1.0 lb.  
**Reset Force:** 0.75 lb. min  
**Circuit:** SPNO-DB  
**Mechanical Life:** 50,000 cycles  
**Button:** Red nylon  
**Housing:** Clear anodized aluminum  
**P3-60024**



### Special "H" Case with Round Shaped Button

**Operating Force:** 4.0 +/- 1.0 lb.  
**Reset Force:** 1.0 lb. min  
**Circuit:** SPNC-DB (Other circuits available)  
**Mechanical Life:** 1,000,000 cycles  
**Button:** Red nylon  
**Housing:** Black anodized aluminum  
**P3-80016**



### Special Snap-In, Panel-Sealed, Rectangular Shaped Button

**Total Travel:** 0.125" max  
**Operating Force:** 4.0 +/- 1.0 lb.  
**Reset Force:** 1.0 lb. min  
**Circuit:** SPNO-DB (Other circuits available)  
**Mechanical Life:** 50,000 cycles  
**Button:** Black polyester  
**Housing:** Black polyester  
**P3-90037**



### Large Diameter Button

Nylon button is 1.187". Snaps on to special style body with leads. Dusttight to IP64.  
**Operating Force:** 2.5, +0.5, -1.0 lb.  
**Mechanical Life:** 1,000,000 cycles  
**Rating:** 10 amps Resistive  
**Circuit:** SPDT 2 circuit  
**P3-30101-X**



### Protective Shroud

This pushbutton is designed to avoid accidental actuation of the switch. The shroud requires the operator to purposely operate the switch. The actuation occurs below the height of the protective shroud, thus protecting against unintentional actuation.

Same ratings and sealing characteristics as the standard P3 series.

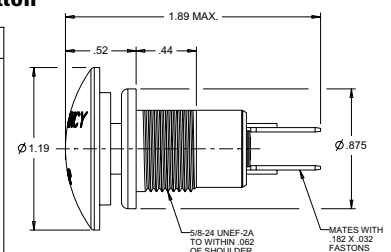
SPNC is shown.

**P3-90009**



### Emergency Stop Pushbutton

PART NUMBER	BUTTON COLOR
P330115-1	RED
P330115-2	BLACK
P330115-3	ORANGE
P330115-4	YELLOW
P330115-5	GREEN
P330115-6	BLUE
P330115-7	VIOLET
P330115-8	GRAY
P330115-9	WHITE
P330115-18	CHEVRON BLUE



MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

Rugged pushbutton switches with new contoured dome styling. There are two design versions: flush dome and raised dome button profile. They also offer excellent mechanical and electrical performance while operating under severe conditions found in demanding applications.

The P3-D Dome features dusttight and moistureproof or watertight sealed construction to IP68S and IP69K (add "W" to your part number for watertight seal). 100,000 operations at rated load of 10 amps resistive or 5 amps inductive; up to a million mechanical operations in logic level switching applications.

The P3-D Dome is available in standard and low operating force double break snap-action models. All are momentary action. Special contact variations are available. High contact pressure and unique contact design provide for logic level switching capability as well as full rated service.

The P3-D Dome is a quality precision snap-action switch designed for use in panels, control sticks, computers, instruments, heavy equipment and other demanding applications where attractive, rugged pushbutton switches are required.

## Features:

- Attractive dome style button
- 2 contoured button styles
- Double break momentary action
- Withstands extreme shock & vibration
- Positive tactile feedback
- Solder & screw terminal styles
- Moistureproof & dusttight to IP64
- Watertight to IP68S and IP69K available
- RoHS compliant

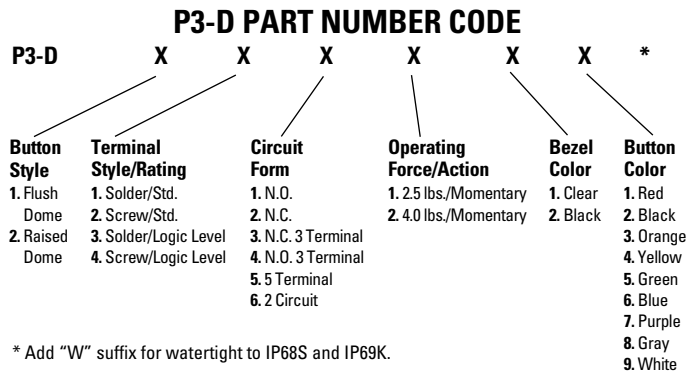
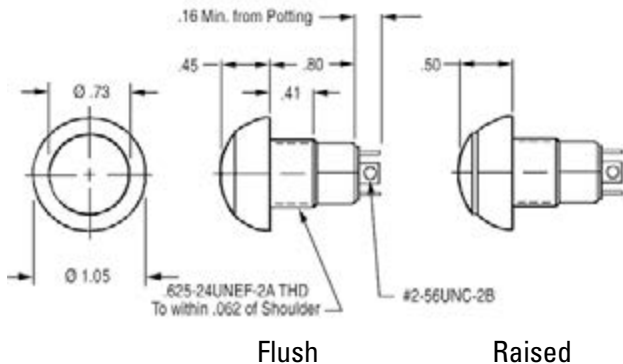


Flush Dome Button



### Standard Characteristics/Ratings:

ELECTRICAL RATINGS:		
Load	Sea Level @ 28VDC or 115VAC, 60/400Hz	Cycles
Resistive	10A	100,000
Resistive	15A	25,000
Inductive	5A	100,000
Lamp	3A	100,000
Center Contact	3A max	100,000
DWV	1000Vrms	
Logic Level	10mA @ 5VDC	100,000
<b>Electrical Life:</b>	See Rating Chart	
<b>Mechanical Life:</b>	1,000,000 cycles, circuit forms 1, 2 & 6 100,000 cycles, circuit forms 3, 4 & 5	
<b>Seal:</b>	IP64 or IP68S and IP69K	
<b>Operating Temp Range:</b>	-55°C to +85°C	
<b>Operating Force:</b>	2.0 lbs. to 4.0 lbs., +/-0.5/-1.0 lb.	
<b>Total Travel:</b>	0.075 +/- 0.015 inches	
<b>Overtravel:</b>	0.012 inches min	
<b>Movement Differential:</b>	0.015 inches min	
<b>MATERIALS:</b>		
<b>Case:</b>	Anodized aluminum alloy	
<b>Button:</b>	Thermoplastic	
<b>Terminals:</b>	Brass with silver plate, gold plate for logic level	
<b>Terminal Hardware:</b>	Screws, lockwasher and terminal lugs	
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal when applicable	



## BUSHING MOUNT PUSHBUTTONS FOR OTTO B2 & B3 BASICS

### IP68S Sealed Construction



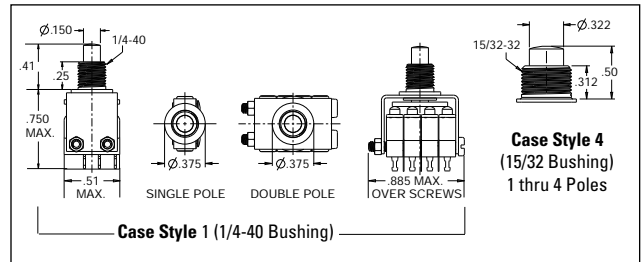
P4 series auxiliary actuators are designed to work with OTTO B2 (single break) and B3 (double break) basic switches. Auxiliary type actuators offer a wide variety of styles and types. Special basic switch characteristics can be specified to match your application needs. All case styles, except 1 and 4, feature OTTO's patented "rolling sleeve" principle and are sealed to IP68S.

### Unsealed Construction



These unsealed pushbutton actuators feature a choice of 1/4" and 15/32" mounting bushings with nylon buttons available in nine colors. Choose single, two, three and four pole models. To order standard models, use the Part Number Code shown below.

Number of Poles	Operating Force (oz)	Release Force (oz)
1	8	2
2	16	2
3	24	3
4	32	4



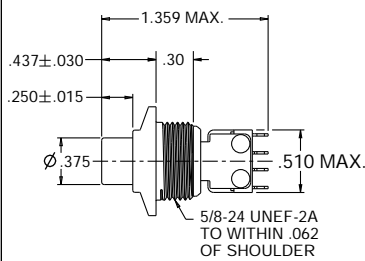
### Sealed Construction

Moistureproof at the front panel. Choice of one and two pole configurations. Select from a variety of six bezel/bushing mount case styles in clear (silver) or black anodized aluminum. Styles C, F and H are illustrated here. For styles A, B and G, see P1 series information. Buttons are available in nine colors.

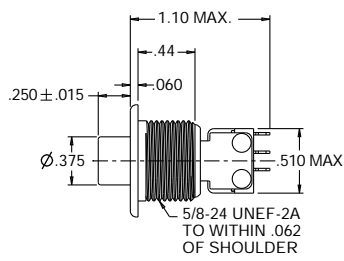
**Operating Force:** 4.0 lbs. max

Use Part Number Code below to specify your requirements.

**P4-3 Case Style C Example**



**P4-8 Case Style H Example**



**Plunger Seal: Watertight and Dusttight. See P1 series information for case styles A,B, F and G.**

### RFI Shielding Option with Moistureproof Panel Seal

RFI shielding can be included along with the moistureproof sealing feature in all case styles (except styles 1 and 4) and in single or double pole momentary action. Case styles are illustrated at left. The plunger seal above panel is dusttight and watertight.

**Operating Force:** 5.0 lbs. max

To order, see Part Number Code below.

## ORDERING INFORMATION:

### Standard Auxiliary Actuator Assemblies for Basics

Select the OTTO P4 pushbutton switch assembly to match your specific application needs. Standard and special features are shown at right. Specify your choice by building the OTTO Part Number Code.

**Example:** P4-614121 features the style "F" case, DPDT (4 terminals each), PC terminals, single step momentary action, black bezel with red button.

### P4 PART NUMBER CODE

P4	-	X	X	X	X	X	*
Case Style	Terminal Style	Circuit Form	Switching Action	Bezel Color	Button Color		
1. 1/4-40 THD	1. PC Terminal	1. SPDT 3 Terminal	1. Momentary	1. Silver	1. Red		
2. Style B ①	2. Turret	2. SPDT 4 Terminal	2. Two Step ③ ④	2. Black	2. Black		
3. Style C	3. Wire Wrap	3. DPDT 6 Terminal	3. RFI Shielded ③		3. Orange		
4. 15/32-32 THD		4. DPDT 8 Terminal	(Momentary)		4. Yellow		
5. Style A ①		5. 3PDT 9 Terminal ②			5. Green		
6. Style F		6. 3PDT 12 Terminal ②			6. Blue		
7. Style G ①		7. 4PDT 12 Terminal ②			7. Purple		
8. Style H		8. 4PDT 16 Terminal ②			8. Gray		
					9. White		

① See P1 Series information for front panel appearance details.

② Available in case styles 1 and 4 only.

③ Not available in case styles 1 and 4.

④ Available in circuit form 3 and 4 only.

\* Add "W" suffix for watertight to IP68S (not available in case styles 1 and 4)

## BUSHING MOUNT PUSHBUTTONS FOR B2 & B3 BASICS



P4-10050-x



P4-10149-x

### Rugged Sealed Panel

These rugged, sealed aluminum pushbutton actuators are anodized in a variety of colors. Available in one and two pole models. An O-ring provides the panel seal to keep out water and dust from the basic switches behind the panel.

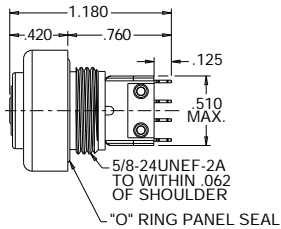
#### Operating Force:

- 1 Pole: 2.5 lbs. max
- 2 Pole: 4.0 lbs.

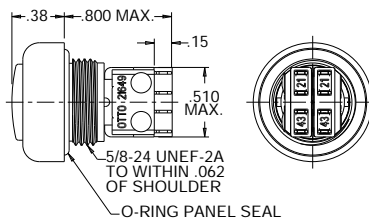
To order, please use Table A.

Table A

Part No. SPDT-DB	Part No. DPDT-DB	Button Color
P4-10050-1	P4-10149-1	Red
P4-10050-2	P4-10149-2	Black
P4-10050-3	P4-10149-3	Orange
P4-10050-4	P4-10149-4	Yellow
P4-10050-5	P4-10149-5	Green
P4-10050-6	P4-10149-6	Blue
P4-10050-7	P4-10149-7	Violet
P4-10050-8	P4-10149-8	Gray
P4-10050-9	P4-10149-9	Clear



P4-10050-X



P4-10149-X

### Standard Sealed TwoStep™

Ideal for applications requiring three modes of operation: "OFF," Level 1 and Level 2. Plunger seal is dusttight and moistureproof. Available in P1 series bezel styles C, F and H. Two pole only.

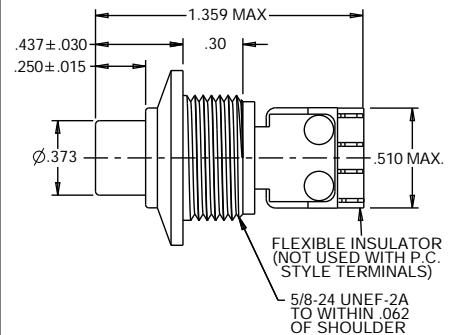
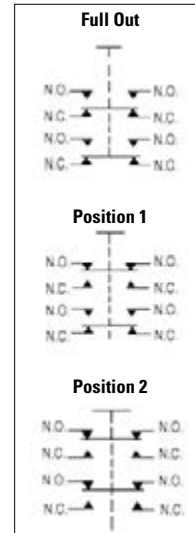


#### Standard Operating Force:

- Position 1: 2.25 lbs. max
- Position 2: 3.25 lbs. max

Total Travel: 0.140 inches max

#### Sequence of Action



### Miniature, Offset Pushbutton

This miniature switch features an offset pushbutton to clear back of panel interference, stainless steel bushing and natural acetal button.

- Operating Force:** 8 oz max
- Circuit:** SPDT
- Rating:** 1 amp Resistive
- Mechanical Life:** 50,000 cycles
- Electrical Life:** 25,000 cycles
- P4-900027**



### Special TwoStep™ Pushbutton, Dusttight Sealed

Switch "A" operates at Level 1; stays "on" when Level 2 operates Switch "B".

- Circuit:** SPDT 2 circuit
- Rating:** 5 amps Resistive  
3 amps Inductive @ 28VDC
- Operating Force:** Level 1: 1.75 +/- 0.5 lb.  
Level 2: 2.75 +/- 0.5 lb.
- Button:** Red nylon
- P4-20002**



### Style F, Panel Sealed, 2 Pole

Moistureproof and dusttight sealed switch features the "F" style bezel, as illustrated on previous page. Button is molded of gray nylon.

- Total Travel:** 0.100" max
- Operating Force:** 4.0 lbs. +/- 1.0 lb.
- Circuit:** DPNO-DB
- Rating:** 10 amps Resistive  
5 amps Inductive
- Mechanical Life:** 50,000 cycles
- Electrical Life:** 25,000 cycles
- P4-600009**



### Splash and Dusttight Sealed, 2 Pole, 4 Circuit

- Operating Force:** 4.0 lbs. +/- 1.0 lb.
- Circuit:** DPDT 4 circuit
- Rating:** 5 amps Resistive  
3 amps Inductive
- Contacts:** Basic switches:  
Qualified per MIL-PRF-8805/101-009
- Button:** Black nylon
- P4-10044**





## BUSHING MOUNT PUSHBUTTONS FOR B2 & B3 BASICS

### Square Button, Single Pole, 2 Circuit

This subminiature pushbutton switch features a button molded of Lexan.

**Operating Force:** 24 +/- 4 oz

**Rating:** 5 amps Resistive  
3 amps Inductive

**Contacts:** Gold plate

White and other colors available.

**P4-300015**



### Vandal Resistant

Brass plated dull nickel housing and button is watertight sealed. Ideal for unattended machines operated by the public.

**Total Travel:** 0.10" max

**Operating Force:** 4.0 lbs. max

**Circuit:** DPNO-DB

**Mechanical Life:** 50,000 cycles

**Bezel:** 0.969" dia.

**Button:** 0.600" dia.

**P4-10155-2**

For larger 1.5" dia., SPNO-DB design, see P1-90135-2.



### Watertight Panel Sealed Double Pole

Dress ring has O-ring provision for watertight panel seal. Button and case are black. Switch uses MIL-PRF-8805/101 basics. Seal is watertight. Operating force is 4.0 lbs.

**P4-900003**



### 1/4-40 Bushing, SPDT 2 Circuit

This subminiature pushbutton switch features an anti-turn device to facilitate installation.

**Operating Force:** 10 oz max

**Rating:** 8 amps Resistive @ 28VDC

**Bushing:** Stainless steel

**Bracket:** Stainless steel

**Button:** Nylon

**P4-10029**



### 6 Pole, Right Angle, PC Mount

Solders into printed circuit board. Basic switches per MIL-PRF-8805/4.

**Operating Force:** 3.5 lbs. max

**Rating:** 1 amp Resistive

**Contacts:** Gold

**Button Color:** Choice of nine colors

**P4-10073-X**

(X denotes button color)



### 2 Pole, Right Angle, Bushing Mount—Single and TwoStep™ Versions

Right angle bushing mount assembly of basic switches. Either 2-mode momentary or 3-mode. TwoStep™ (OFF-Level 1-Level 2) action.

**Operating Force:** 24 +/- 4 oz

**Rating:** 8 amps Resistive

**Plunger:** Red nylon (Other colors available)

**Bushing:** Stainless steel

**Single Level:** P4-10022    **TwoStep™:** P4-20003



### 8 Pole, Positive Detent, Sealed

**Circuit:** 8 PDT

**Rating:** 1 amp Resistive  
0.5 amps Inductive

**Bracket:** Stainless steel

**Bushing:** Aluminum black anodized

**Button:** Nylon, choice of nine colors

**P4-10082-X**

(X denotes button color)



### Push-Pull Button, 3 Pole

When the button is pushed down, a locking mechanism holds the pushbutton in the operated state. When the button is pulled up to release the lock, the pushbutton returns to its original position.

**Total Travel:** .200" max.

**Operating Force:** 3 lbs. min.

**Circuit:** SPDT-DB

**Rating:** 2 amps Resistive @ 28VDC

**Button:** Black thermoplastic

**P4-900124**



### Miniature with Shrouded Pushbutton, Unsealed

**Total Travel:** 0.070" max

**Operating Force:** 2.5 lbs. max

**Circuit:** DPDT-DB

**Rating:** 8 amps Resistive @ 28VDC

**Button:** Black nylon

**Housing:** Clear anodized aluminum

**Plunger:** Unsealed

**P4-10090**



### Miniature with Shrouded Pushbutton, Dusttight Sealed

**Total Travel:** 0.100" max

**Operating Force:** 4.0 lbs. max

**Circuit:** DPDT-DB

**Rating:** 8 amps Resistive @ 28VDC

**Button:** Black nylon

**Housing:** Black anodized aluminum

**Plunger:** Dusttight sealed

**P4-900019**



SEALED AGAINST DUST & MOISTURE

The P5 Alternate Action switches match the P1, P3 and P8 Momentary Action Pushbutton models for mixed function with common panel appearance. Now you can design panels with both alternate and momentary action switches and have uniform panel appearance. The P5 features alternate action in the same pushbutton and housing configuration as the momentary P1 and P3 and as a bonus, the P5 requires less behind the panel space than the P1 and P3 momentary versions.

Push and the P5 switch turns "on." Push again and the P5 switch turns "off." Positive tactile feedback is featured so the operator is clearly aware the switch mode has been executed. The button returns to the original position after each actuation.

To guard against front panel splash and dirt, the P5 series is sealed at the button with OTTO's patented "rolling sleeve" principle. The terminals are sealed with epoxy, providing a seal against flux during wiring and behind panel dirt and moisture. The combination of sealing provides smooth operation over a wide temperature range. Watertight sealing to IP68S is available.

A vandal resistant style is available in the P5-V series. Custom housings, shrouded buttons, contact configurations and materials are available to suit your application requirements. We also provide custom button engraving with epoxy ink backfill, watertight versions and other special characteristics.

"Push On, Push Off" action

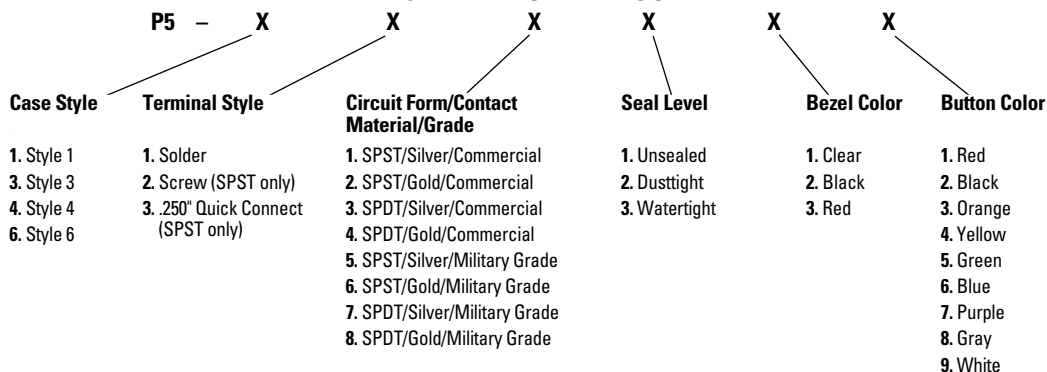


Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
<b>Load</b>	Sea Level @ 28VDC or 115VAC, 60/400Hz		
Resistive	5A		
Inductive	3A		
Lamp	1A		
Motor	3A		
DVV	1000Vrms		
Logic Level	10mA @ 5VDC		
<b>Electrical Life:</b>	25,000 cycles at full load		
<b>Mechanical Life:</b>	1,000,000 cycles		
<b>Seal:</b>	<b>Military</b>	<b>Commercial</b>	
	Unsealed	Symbol 1	Unsealed
	Dusttight	Symbol 2	IP64
	Watertight	Symbol 3	IP68S
<b>Operating Temp Range:</b>	-55°C to +85°C		
<b>Operating Force:</b>	3.0 lbs. +/-0.5 lb.		
<b>Total Travel:</b>	0.180 inches max		
<b>Overtravel:</b>	0.012 inches min		
<b>MATERIALS:</b>			
<b>Case:</b>	Anodized aluminum alloy		
<b>Button:</b>	Thermoplastic		
<b>Terminals:</b>	Brass, silver plate or gold plate for logic level		
<b>Terminal Hardware:</b>	Terminal lugs, lockwasher and screw for screw terminal option		
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal on watertight switches		

## Features:

- Button sealed with "rolling sleeve" principle
- Contact area sealed at case & terminals
- Moistureproof & dusttight to IP64 & MIL-PRF-8805 Symbol 2, Symbol 3 or watertight to IP68S
- Handles logic level up to 5 amps
- Engraved buttons available
- Choice of 9 button & 3 bezel colors
- Panel appearance matches most other OTTO momentary pushbutton switches
- Unsealed construction also available
- RoHS compliant

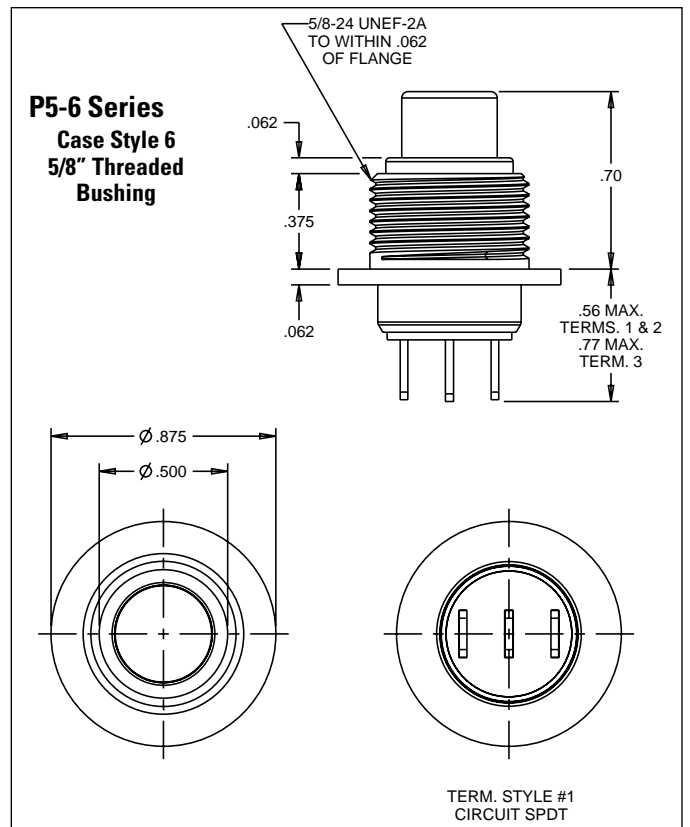
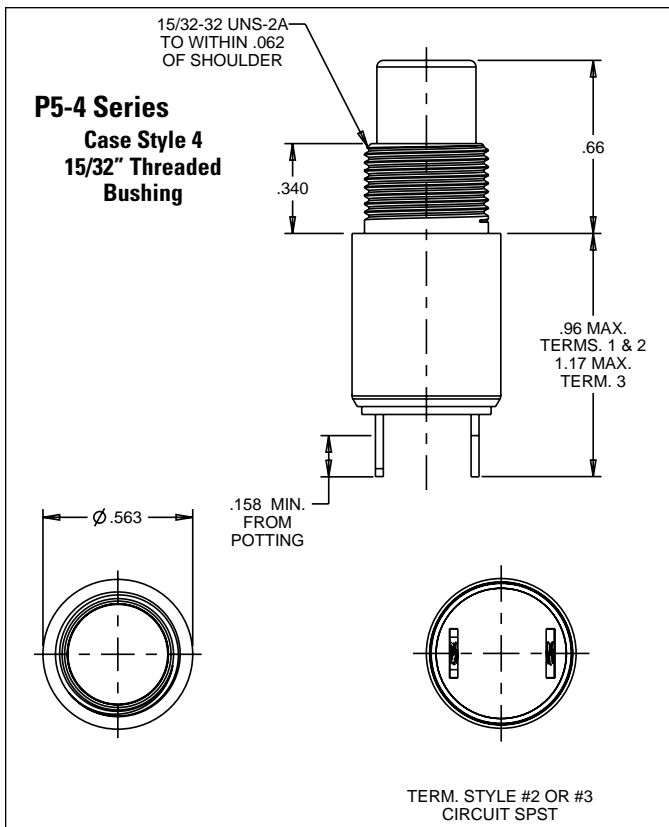
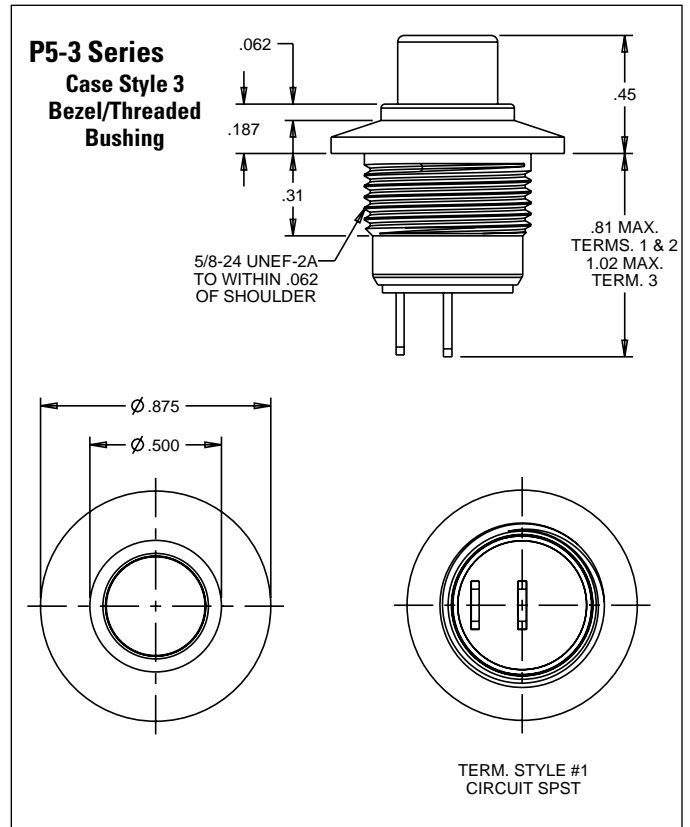
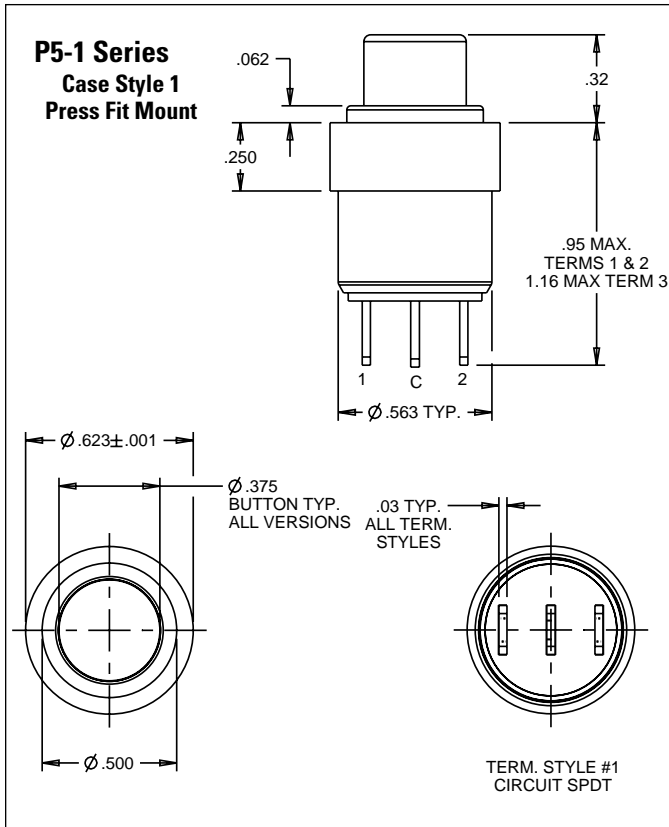
## P5 PART NUMBER CODE



# ALTERNATE ACTION PUSHBUTTONS

**P5**  
ALTERNATE  
ACTION

SEALED AGAINST DUST & MOISTURE



# ALTERNATE ACTION DOME PUSHBUTTONS

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The rugged P5-D switch is an alternate action "push on, push off" pushbutton switch with contoured dome styling. With two design versions, a flush dome and raised dome button profile, the P5-D offers excellent mechanical and electrical performance while operating under severe conditions found in demanding applications.

The P5-D features unsealed, dusttight, moistureproof and watertight seal options. A mechanical life of one million cycles, 25,000 cycles at full load.

The P5-D is a quality precision, snap-action switch designed for use in panels, instruments and other demanding applications where attractive, rugged pushbutton switches are required.

## Features:

- 2 contoured button styles
- Button sealed with patented "rolling sleeve" principle
- Contact area sealed at case & terminals
- Handles logic level up to 5 amps
- Moistureproof & dusttight to IP64 & MIL-PRF-8805 Symbol 2, Symbol 3 or watertight to IP68S
- Unsealed construction also available
- RoHS compliant

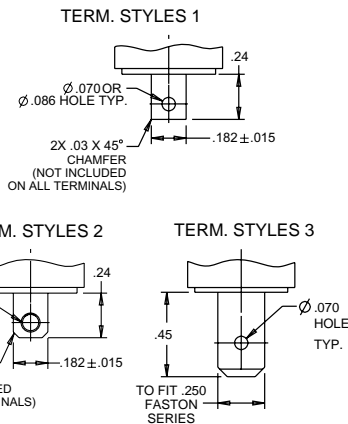
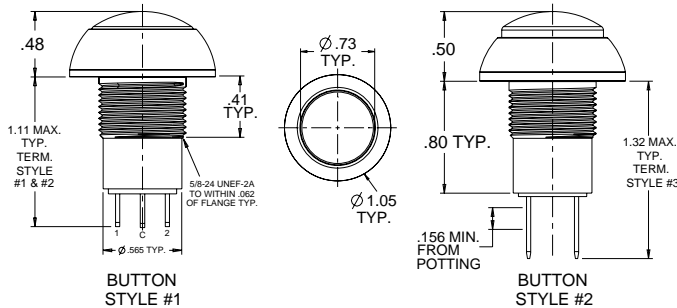
"Push On, Push Off" action



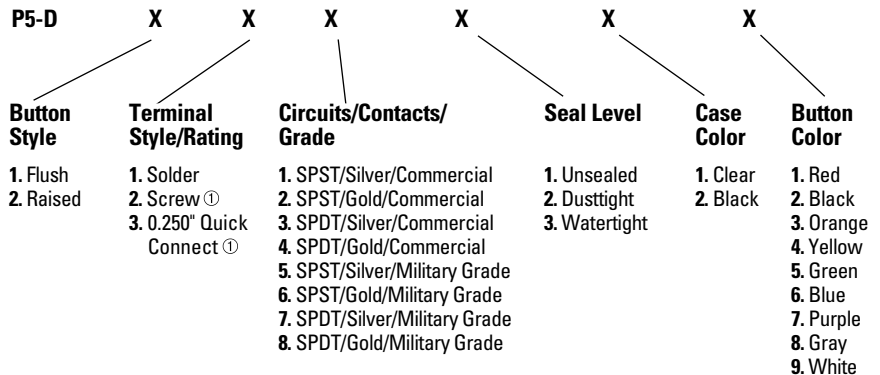
Flush Dome Button,  
Also available with  
Raised Dome



Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
<b>Load</b>	<b>Sea Level @ 28VDC or 115VAC</b>		
Resistive	5A		
Inductive	3A		
Lamp	1A		
Motor	3A		
DWV	1000Vrms		
Logic Level	10mA @ 5VDC		
<b>Electrical Life:</b>	25,000 cycles at full load		
<b>Mechanical Life:</b>	1,000,000 cycles		
<b>Seal:</b>	<b>Military</b>	<b>Commercial</b>	
	Unsealed	Symbol 1	Unsealed
	Dusttight	Symbol 2	IP64
	Watertight	Symbol 3	IP68S
<b>Operating Temp Range:</b>	-40°C to +85°C		
<b>Operating Force:</b>	3.0 lbs. +1/-0.5 lb.		
<b>Total Travel:</b>	0.180 inches max		
<b>Overtravel:</b>	0.012 inches min		
<b>MATERIALS:</b>			
<b>Case:</b>	Anodized aluminum alloy		
<b>Button:</b>	Thermoplastic		
<b>Terminals:</b>	Brass with gold over silver		
<b>Terminal Hardware:</b>	Screws, lockwashers and terminal lugs for screw terminal option		
<b>Mounting Hardware:</b>	Hex nut, lockwasher		



## P5-D PART NUMBER CODE



① Available on SPST circuit forms only.

# VANDAL RESISTANT PUSHBUTTONS

**P5-V**  
VANDAL  
RESISTANT  
PUSHBUTTONS

## ALTERNATE ACTION, SEALED AGAINST DUST & MOISTURE

The P5-V switch gives you all the functionality of the P5 Alternate Action switch with the added benefit of an aluminum security level case and button or a stainless steel vandal resistant case and button.

Push and the P5-V switch turns "on." Push again and the switch turns "off." Positive tactile feedback is featured so the operator is clearly aware the switch has been actuated. The button returns to the original position after each actuation.

To guard against front panel splash and dirt the P5-V is sealed at the button with OTTO's patented "rolling sleeve" design. The terminals are sealed with epoxy, providing a seal against flux during wiring and behind panel dirt and moisture. The combination of sealing provides smooth operation over a wide temperature range. Watertight sealing to IP68S and IP69K is also available.

We are able to provide custom button engraving with epoxy ink backfill and other special characters, shrouded buttons, contact configurations and materials to suit your application requirements.

### Features:

- **Security (aluminum) or vandal resistant (stainless steel) case & button**
- **Button sealed with patented "rolling sleeve" design**
- **Contact area sealed at case & terminals**
- **Watertight to IP68S and IP69K or dusttight & moistureproof to IP64**
- **Handles logic level up to 5 amps**
- **1 million mechanical cycle life**
- **RoHS compliant**



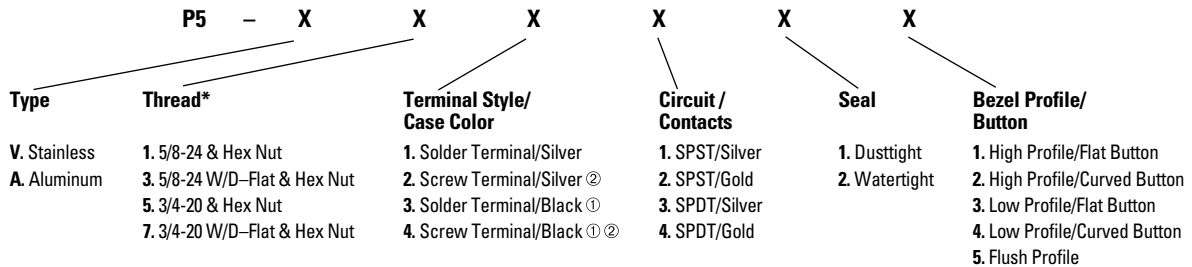
Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	
<b>Load</b>	<b>Sea Level @ 28VDC or 115VAC</b>
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DWV	1000Vrms
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	25,000 cycles (1,000,000 logic level)
<b>Mechanical Life:</b>	1,000,000 cycles
<b>Seal:</b>	IP64 or IP68S and IP69K
<b>Operating Temp Range:</b>	-40°C to +85°C
<b>Operating Force:</b>	3.0 lbs. +1/-0.5 lb.
<b>Total Travel:</b>	0.180 inches max
<b>Overtravel:</b>	0.012 inches min
<b>MATERIALS:</b>	
<b>Case:</b>	Anodized aluminum alloy or stainless steel (303)
<b>Button:</b>	Anodized aluminum alloy or stainless steel (303)
<b>Terminals:</b>	Brass with gold over silver
<b>Terminal Hardware:</b>	Screw, lockwasher and terminal lug when applicable
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal when applicable

# VANDAL RESISTANT PUSHBUTTONS

SEALED AGAINST DUST & MOISTURE

<p><b>High Profile, Flat Button</b> Bezel Profile/Button Style 1</p>	<p><b>Low Profile, Curved Button</b> Bezel Profile/Button Style 4</p>															
<p><b>High Profile, Curved Button</b> Bezel Profile/Button Style 2</p>	<p><b>Flush Mount, Flat Button</b> Bezel Profile/Button Style 5</p>															
<p><b>Low Profile, Flat Button</b> Bezel Profile/Button Style 3</p>	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th colspan="3">Case Style</th> </tr> <tr> <th>Dimension</th> <th>1 - 4</th> <th>5 - 8</th> </tr> </thead> <tbody> <tr> <td>A (Button Dia.)</td> <td>Ø .525</td> <td>Ø .590</td> </tr> <tr> <td>B (Thread)</td> <td>0.625-24 UNEF-2A</td> <td>0.750-20 UNEF-2A</td> </tr> <tr> <td>D-Flat</td> <td>.594</td> <td>.718</td> </tr> </tbody> </table>	Case Style			Dimension	1 - 4	5 - 8	A (Button Dia.)	Ø .525	Ø .590	B (Thread)	0.625-24 UNEF-2A	0.750-20 UNEF-2A	D-Flat	.594	.718
Case Style																
Dimension	1 - 4	5 - 8														
A (Button Dia.)	Ø .525	Ø .590														
B (Thread)	0.625-24 UNEF-2A	0.750-20 UNEF-2A														
D-Flat	.594	.718														

## P5-V PART NUMBER CODE



\* For Knurl Nut Thread options, contact factory.  
① Only Available on P5-A Styles.  
② Screw terminals available on SPST circuits only.

## MOMENTARY ACTION, SEALED SUBMINIATURE PUSHBUTTON SNAP-ACTION SWITCHES

The P7 series incorporates OTTO's patented double break design in a significantly smaller package than the P1 series. These subminiature switches embrace today's technology requirements by allowing for a large number of switches to fit within a faceplate or a small panel space.

The long life snap-action design offers low contact resistance (25mΩ max initial) and is protected from the environment by a silicone rubber boot, operating on a "rolling sleeve" principle that gives long sealed life and smooth operation. Mechanical life is 2 million operations.

The P7 series is designed to meet the requirements of MIL-PRF-8805 including low level switching (10mA @ 30mV) with power switching up to 5 amps at 28VDC as well.

A variety of mounting styles are offered to best match the application. The P7-1, P7-2, P7-7 and P7-8 case styles feature a swaged bushing shape to allow press fit installation in aircraft flight control and hand grips and similar applications. The other styles feature threaded bushing mounting. The P7-3 and P7-A case styles have a front panel bezel, while the P7-5 and P7-6 have conventional bushings for rear panel mounted installations. Silver or black bezels are standard. Other colors available on special order.

Pushbuttons are available in a choice of nine colors. Excellent tactile feedback assures the operator that contact transfer has been made.

A choice of MIL-SPEC and commercial versions of these switches are offered: Moistureproof and dusttight to IP64 and MIL-PRF-8805 Design 2 or watertight to IP68S and to MIL-PRF-8805 Design 3.

### Features:

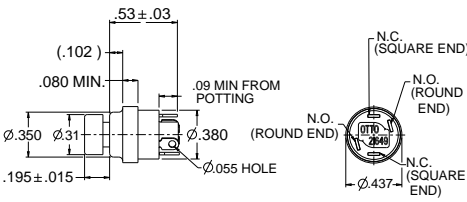
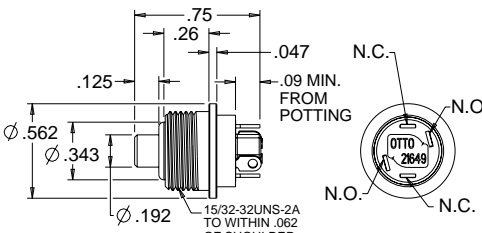
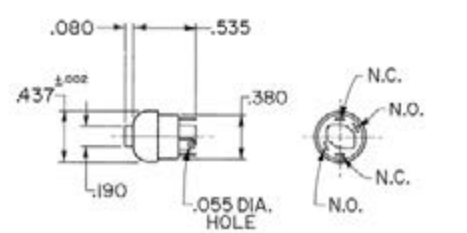
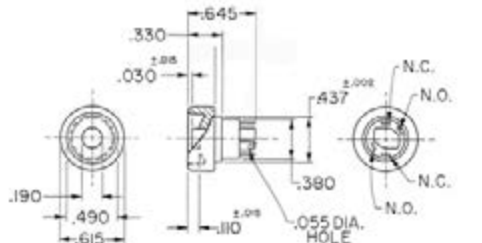
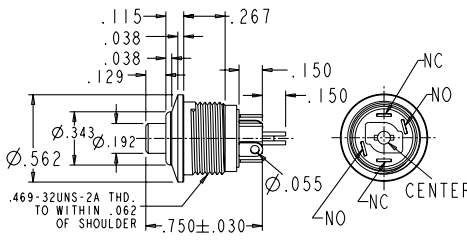
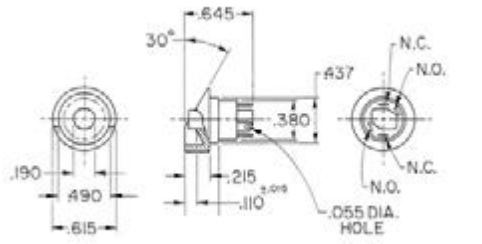
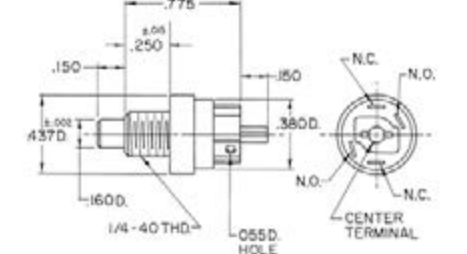
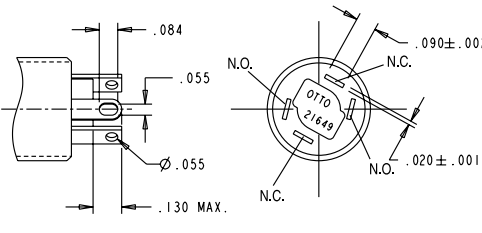
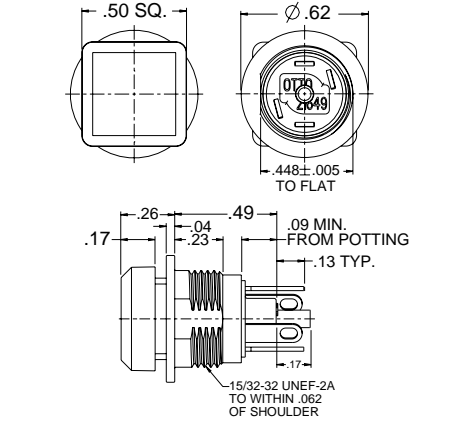
- Low level switching capability
- Less than 25mΩ initial contact resistance
- High contact pressure
- 6 circuit variations
- Positive tactile feedback
- Variety of mounting styles
- Square button option with case style A
- Qualified to MIL-PRF-8805/110
- Mechanical life is 2 million cycles
- Moistureproof and dusttight to IP64 and MIL-PRF-8805 Design 2 or Watertight to IP68S and MIL-PRF-8805 Design 3
- RoHS compliant



### Standard Characteristics/Ratings:

ELECTRICAL RATINGS:		Sea Level @ 28VDC or 115VAC, 60Hz			50,000 feet @ 28VDC or 115VAC, 60Hz		
Load	Circuits:	1 & 2	3-5	6	1 & 2	3-5	6
Resistive		5A	2.5A	4A	5A	2.5A	4A
Inductive		3A	1.5A	2A	3A	1.5A	2A
Lamp		1A	0.5A	N/A	N/A	N/A	N/A
Motor		3A	1.5A	N/A	N/A	N/A	N/A
DWV			1050Vrms			400Vrms	
Center Contact							3A max
Low Level							10mA @ 30mV
<b>Electrical Life:</b>		50,000 cycles full load (25,000 low level)					
<b>Mechanical Life:</b>		2,000,000 cycles					
<b>Seal:</b>		Moistureproof and dusttight to IP64 and MIL-PRF-8805 Design 2 or Watertight to IP68S and MIL-PRF-8805 Design 3					
<b>Operating Temp Range:</b>		-55°C to +85°C					
<b>Operating Force:</b>		1.7 +/- 0.5 lb.					
<b>Total Travel:</b>		0.080 inches max					
<b>Overtravel:</b>		0.010 inches min					
<b>MATERIALS:</b>							
<b>Case:</b>		Anodized aluminum alloy					
<b>Button:</b>		Thermoplastic					
<b>Terminals:</b>		Brass with gold over silver					
<b>Terminal Hardware:</b>		None provided					
<b>Mounting Hardware:</b>		Hex nut, lockwasher and panel gasket when applicable					

SEALED AGAINST DUST & MOISTURE, LOW LEVEL SWITCHING OPTION

<p><b>P7-1 Series</b></p> <p><b>Case Style 1</b> <b>Press Fit Mount</b></p> <p>Also available with PC terminals.</p>		<p><b>P7-6 Series</b></p> <p><b>Case Style 6</b> <b>15/32" Threaded Bushing</b></p> <p>Also available with PC pins.</p>																																																																									
<p><b>P7-2 Series</b></p> <p><b>Case Style 2</b> <b>Press Fit Mount</b></p> <p>Also available with PC pins.</p>		<p><b>P7-7 Series</b></p> <p><b>Case Style 7</b> <b>Press Fit Mount</b></p> <p>Also available with PC pins.</p>																																																																									
<p><b>P7-3 Series</b></p> <p><b>Case Style 3</b> <b>Bezel/Threaded Bushing</b></p> <p>Also available with PC pins.</p>		<p><b>P7-8 Series</b></p> <p><b>Case Style 8</b> <b>Press Fit Mount Guarded Button</b></p> <p>Also available with PC pins.</p>																																																																									
<p><b>P7-5 Series</b></p> <p><b>Case Style 5</b> <b>1/4" Threaded Bushing</b></p> <p>Also available with PC pins.</p>		<p><b>Terminal Style "A" &amp; "B"</b></p> <p><b>Standard</b></p>																																																																									
<p><b>P7-A Series</b></p> <p><b>Case Style A</b> <b>15/32" Threaded Bushing Square Button Shown</b></p> <p>Also available with PC pins and round buttons.</p> <p>Round Button versions do not have a D-flat.</p>		<p><b>Important Note:</b> Because the base case interface has epoxy applied over it, dimensions to this surface are difficult to measure. This surface is not recommended as a hard stop, due to the extra variation of the epoxy surface.</p> <p><b>P7 PART NUMBER CODE</b></p> <p>P7 - X X X X X X</p> <table border="0"> <thead> <tr> <th>Case Style</th> <th>Terminal Style/Construction Grade</th> <th>Circuit Form</th> <th>Contact Rating</th> <th>Case Color/Button Dia.</th> <th>Button Color</th> </tr> </thead> <tbody> <tr> <td>1. Style 1</td> <td>A. Solder/Commercial</td> <td>1. N.O.</td> <td>1. Std.</td> <td>1. Clear/Std.</td> <td>1. Red</td> </tr> <tr> <td>2. Style 2</td> <td>B. Solder/Watertight</td> <td>2. N.C.</td> <td>2. Low Level</td> <td>2. Black/Std.</td> <td>2. Black</td> </tr> <tr> <td>3. Style 3</td> <td>Commercial</td> <td>3. N.C. 3 Terminal</td> <td></td> <td>3. Clear/0.312 ①</td> <td>3. Orange</td> </tr> <tr> <td>5. Style 5</td> <td>1. Solder/Military/Short</td> <td>4. N.O. 3 Terminal</td> <td></td> <td>4. Black/0.312 ①</td> <td>4. Yellow</td> </tr> <tr> <td>6. Style 6</td> <td>2. Solder/Commercial/Short</td> <td>5. 5 Terminal</td> <td></td> <td>5. Clear/Square .50 ②</td> <td>5. Green</td> </tr> <tr> <td>7. Style 7</td> <td>3. Solder/Mil. Watertight/Short</td> <td>6. 2 Circuit</td> <td></td> <td>6. Black/Square .50 ②</td> <td>6. Blue</td> </tr> <tr> <td>8. Style 8</td> <td>4. PC Pin/Commercial</td> <td></td> <td></td> <td></td> <td>7. Purple</td> </tr> <tr> <td>A. Style A</td> <td>5. PC Pin/Military</td> <td></td> <td></td> <td></td> <td>8. Gray</td> </tr> <tr> <td></td> <td>6. PC Pin/Mil. Watertight</td> <td></td> <td></td> <td></td> <td>9. White</td> </tr> <tr> <td></td> <td>7. Solder/Com. Watertight/Short</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>8. PC Pin/Com. Watertight</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Case Style	Terminal Style/Construction Grade	Circuit Form	Contact Rating	Case Color/Button Dia.	Button Color	1. Style 1	A. Solder/Commercial	1. N.O.	1. Std.	1. Clear/Std.	1. Red	2. Style 2	B. Solder/Watertight	2. N.C.	2. Low Level	2. Black/Std.	2. Black	3. Style 3	Commercial	3. N.C. 3 Terminal		3. Clear/0.312 ①	3. Orange	5. Style 5	1. Solder/Military/Short	4. N.O. 3 Terminal		4. Black/0.312 ①	4. Yellow	6. Style 6	2. Solder/Commercial/Short	5. 5 Terminal		5. Clear/Square .50 ②	5. Green	7. Style 7	3. Solder/Mil. Watertight/Short	6. 2 Circuit		6. Black/Square .50 ②	6. Blue	8. Style 8	4. PC Pin/Commercial				7. Purple	A. Style A	5. PC Pin/Military				8. Gray		6. PC Pin/Mil. Watertight				9. White		7. Solder/Com. Watertight/Short						8. PC Pin/Com. Watertight				
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① Not available with Case Styles 2 & 5  
② Available with Case Style A only



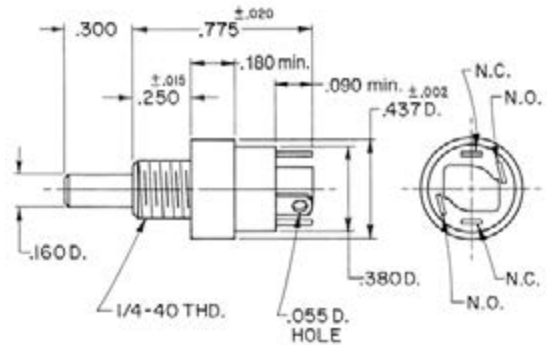
## EXAMPLES OF CUSTOMIZED P7 SEALED PUSHBUTTONS



### Special Longer Length Button

Panel seal gasket and watertight enclosure.  
Button is black nylon. Bezel is black anodized aluminum alloy.

**Actuation** Momentary  
**OTTO Part Number** P7-500001



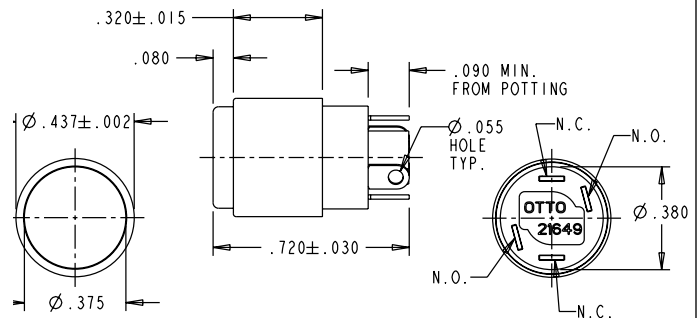
### Special Large Button, Press Fit

Available with a 0.375" dia. button with three color options.

**Color**  
Red  
Black  
White

**OTTO Part Number**  
P7-900001  
P7-900002  
P7-900009

Contact factory for additional button color options.



### Special Snap-On Button, Wire Leads

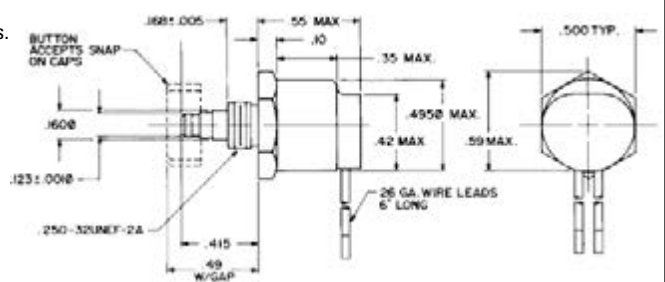
Features changeable snap-on button caps available in two diameters and in a range of colors. Switch is splashproof sealed per MIL-PRF-8805 and is supplied with a silicone panel gasket.

**Part Number:** P7-500018

**Button Color**

	0.440" Dia.	0.375" Dia.
Red	C400725-1	C400723-1
Black	C400725-2	C400723-2
Orange	C400725-3	C400723-3
White	C400725-9	C400723-9

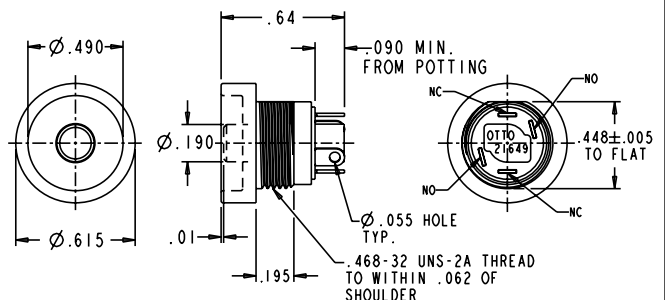
Contact factory for additional button color options.



### Mini Pushbutton, Shrouded

This shrouded pushbutton is designed to reduce the chance of inadvertent actuation. Button size is .19". Enclosure design is watertight per IP68S.

**Actuation** Momentary  
**OTTO Part Number** P7-900196



MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The P7-D pushbutton is a double break, momentary switch with a contoured dome style round or square pushbutton. Button versions include flush or raised round in glossy finish and raised square in matte finish. The P7-D features a shorter behind panel depth, dusttight and moistureproof sealed construction, and an excellent mechanical and electrical performance while operating under the most severe conditions. Its cycle life is 2 million operations at logic level and 50,000 at full rated load of 5 amps resistive or 3 amps inductive.

The P7-D's positive tactile feedback signals the operator when the switch is operated. Multiple contact variations are available as well as a variety of special order button legends. The high contact pressure and unique contact design provides low contact resistance for logic level switching capability as well as full rated service.

This quality precision snap-action switch is designed for use in instrument panels, grips, computers, heavy equipment and other applications where attractive rugged pushbutton switches are required.

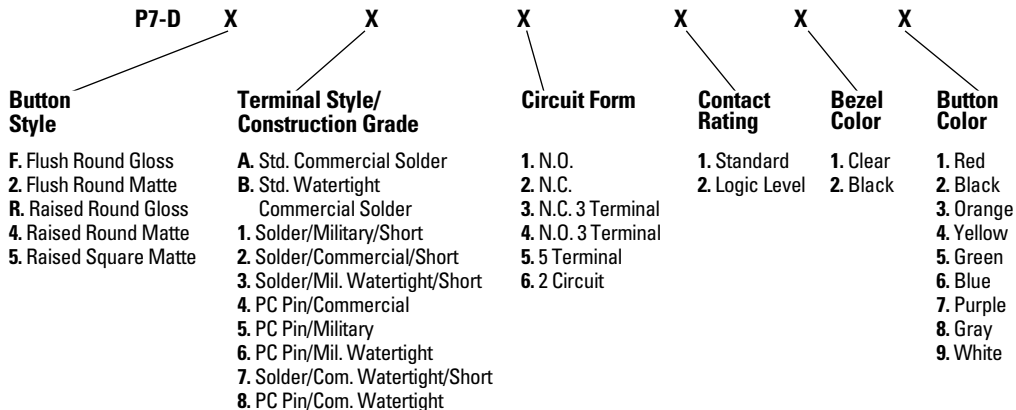


## Features:

- Flush or raised round button in glossy finish and raised square button in matte finish available in a variety of colors
- Logic level switching capability
- High contact pressure
- 6 circuit variations
- Positive tactile feedback
- Variety of mounting styles
- Constructed in accordance with MIL-PRF-8805/110 (no QPL)
- Mechanical life is 2 million cycles
- UL recognized
- Dusttight to IP64 & MIL-PRF-8805 Design 2, or watertight to IP68S
- RoHS compliant

Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>	Sea Level @ 28VDC or 115VAC, 60/400Hz	
<b>Load</b>	<b>N.O./N.C.</b>	<b>Life Cycles</b>
Resistive	1A	50,000
Resistive	5A	50,000
Inductive	3A	50,000
DWV	1050Vrms	
Logic Level	10mA @ 5VDC	2,000,000
<b>Mechanical Life:</b>	2,000,000 cycles	
<b>Seal:</b>	IP64, MIL-PRF-8805 Design 2, IP68S or MIL-PRF-8805 Design 3	
<b>Operating Temp Range:</b>	-55°C to +85°C	
<b>Operating Force:</b>	1.7 +/- 0.5 lb. (standard force)	
<b>Total Travel:</b>	0.080 inches max	
<b>MATERIALS:</b>		
<b>Case:</b>	Anodized aluminum alloy	
<b>Button:</b>	Thermoplastic	
<b>Contacts:</b>	Brass with gold over silver	
<b>Terminal Hardware:</b>	None provided	
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal on watertight versions	

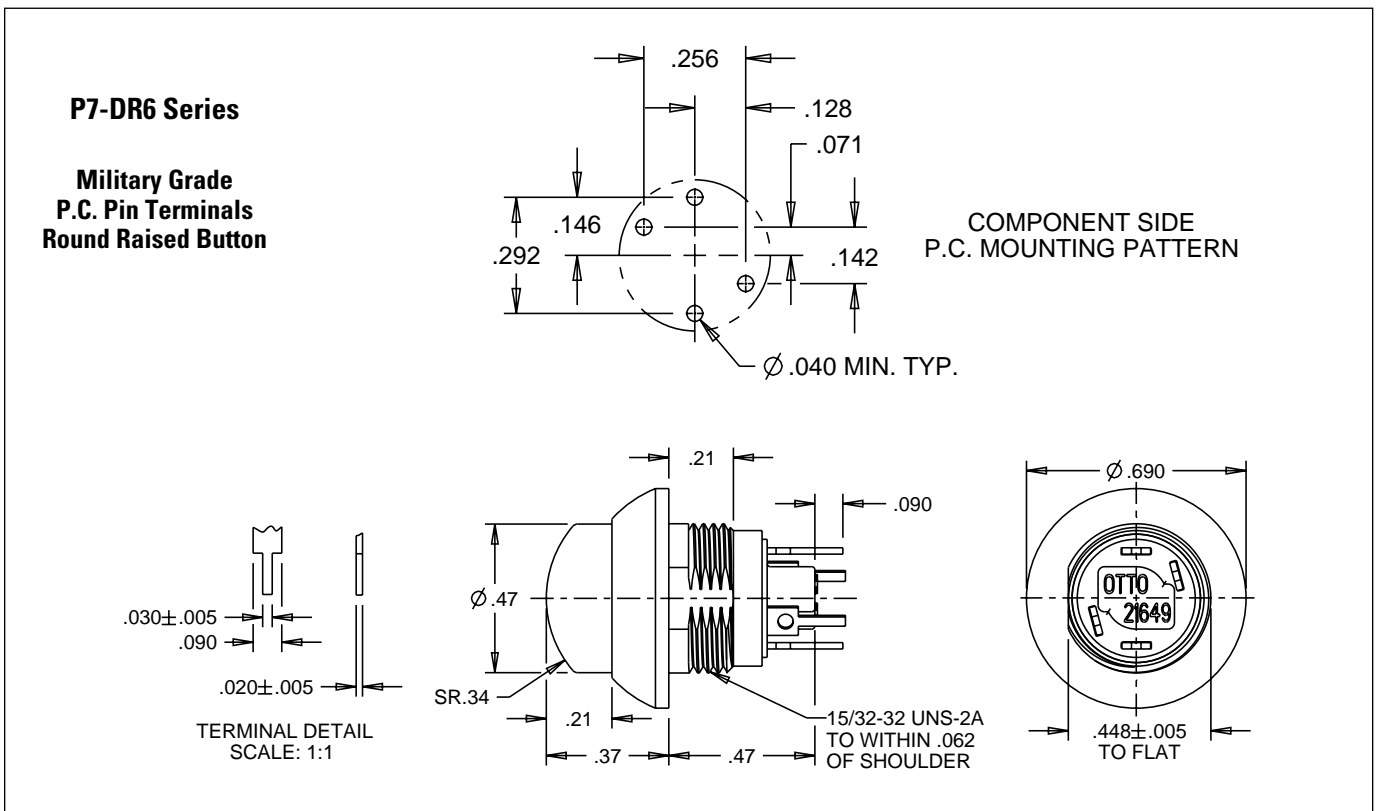
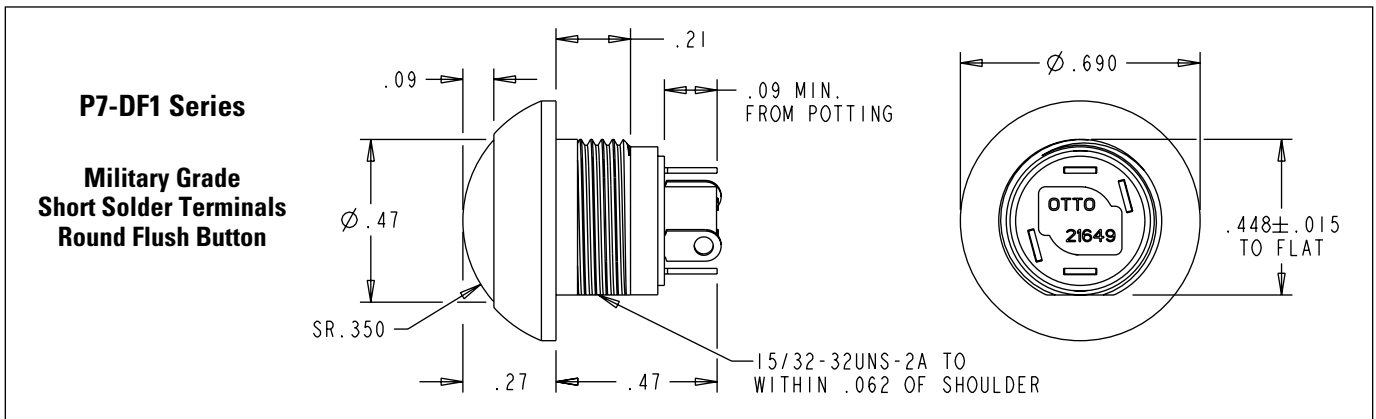
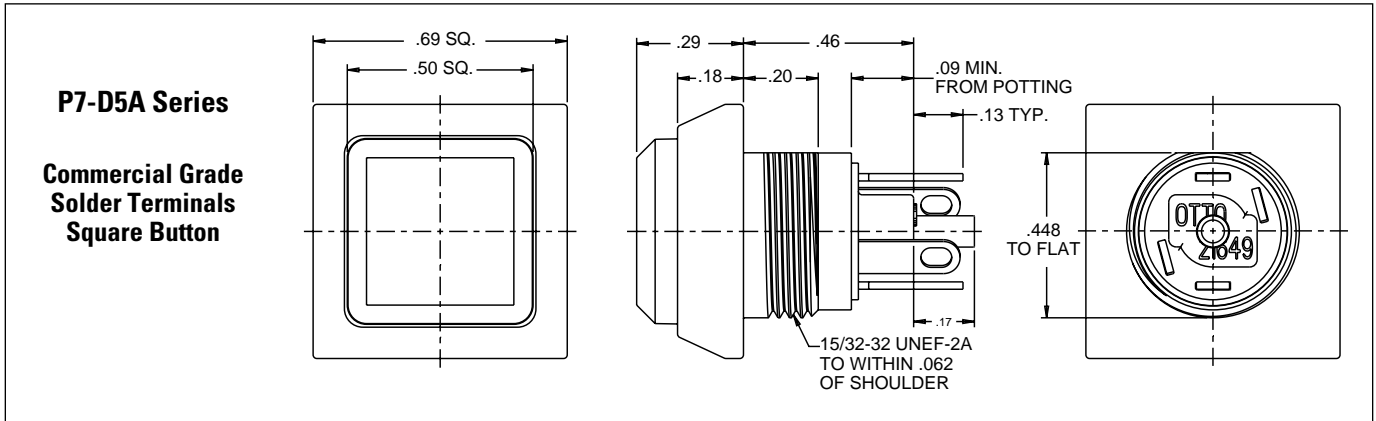
## P7-D PART NUMBER CODE



# SEALED DOME PUSHBUTTONS

**P7-D**  
DOME  
PUSHBUTTONS

MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS



MOMENTARY OR PUSH-PULL ACTION, SHORTER BEHIND PANEL, SUBMINIATURE DOUBLE BREAK

**Makes and breaks every time!**  
OTTO's inherent rocking action  
breaks welds and wipes contacts clean.

The P8 series pushbutton switches feature a shortened back panel depth while offering all the features of the regular size P1 and P3 series switches. P8 series switches offer vastly improved electrical and mechanical life under extreme conditions found in most military and industrial environments.

On sealed models, a silicone boot operating on our patented "rolling sleeve" principle protects the contact area against contamination at the button area. This boot provides long life and smooth operation over a wide temperature range. Sealed terminals protect the contact area from hostile environments and solder flux on both sealed and unsealed models.

High contact force (120g/4.2 oz), low contact resistance and short contact bounce are the result of our snap-action mechanism. These characteristics guarantee exceptional current carrying capabilities over the life of the switch. With the optional logic level configuration the P8 is well suited to interface directly to computers and other solid state devices.

The P8 series is a quality precision snap-action switch designed for use in panel boards, control sticks, computers, instruments, pressure switches and other hand or machine operated applications where rugged pushbutton switches are required. In addition, its precision permits the OTTO P8 to also be used as a limit switch. The P8 offers unique size, high electrical ratings and a wide choice of mounting styles.

## Features:

- Shorter behind panel depth than OTTO's P1/P3
- Patented "rolling sleeve" button seal
- Contact area sealed at button & terminals
- Positive tactile feedback
- Variety of mounting styles
- Variety of button lengths & shapes
- Engraved buttons & bezels available
- Mechanical life 1 million cycles
- UL recognized & CSA certified
- Sealed to IP64 or IP68S
- RoHS compliant



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	10A
Inductive	5A
Lamp	3A
DWV	1000Vrms
Logic Level	10mA @ 5VDC

**Electrical Life:** 100,000 cycles (1,000,000 logic level)

**Mechanical Life:** 1,000,000 cycles

**Seal:** Unsealed, IP64 or IP68S

**Operating Temp Range:** -55°C to +85°C

**Operating Force:** 2.5 lbs. +0.5 /-1.0 lb. or 4.0 lbs. +/- 1.0 lb.

**Total Travel:** 0.085 +/- 0.015 inches

**Overtravel:** 0.012 inches min

#### MATERIALS:

**Case:** Anodized aluminum alloy

**Button:** Thermoplastic

**Terminals:** Brass with silver or brass with gold over silver for logic level

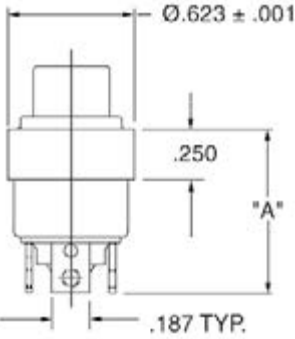
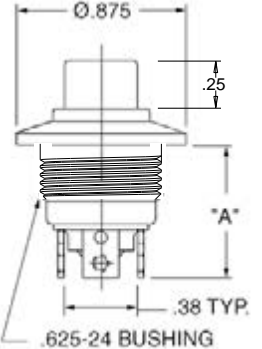
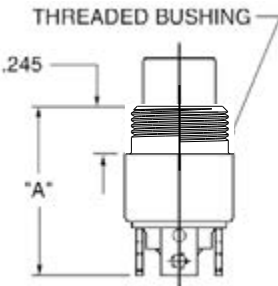
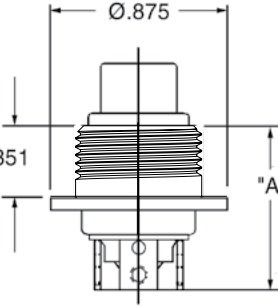
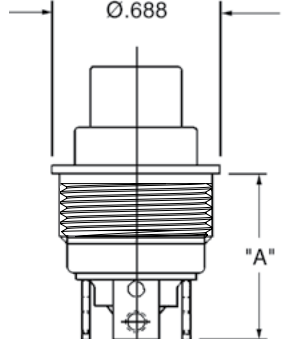
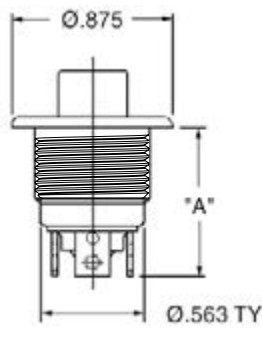
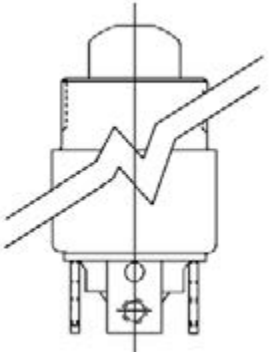
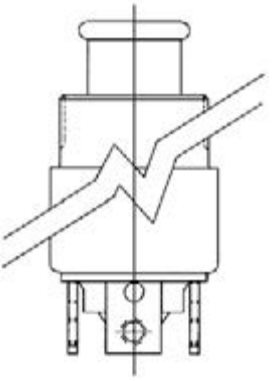
**Terminal Hardware:** Terminal lugs, screws and lockwasher where applicable

**Mounting Hardware:** Hex nut, lockwasher, panel seal gasket, flat washer when applicable

# COMPACT PUSHBUTTONS

**P8**  
COMPACT  
PUSHBUTTONS

MOMENTARY OR PUSH-PULL ACTION, SHORTER BEHIND PANEL, SUBMINIATURE DOUBLE BREAK

<p><b>P8-1, Style A Bezel</b> <b>Press Fit Bushing</b> Flat Button Shape Shown Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p>  <table border="1" data-bbox="151 793 443 861"> <thead> <tr> <th>Terminal Styles</th> <th>"A" (inches)</th> </tr> </thead> <tbody> <tr> <td>1, 2, 4 &amp; 5</td> <td>0.808</td> </tr> <tr> <td>3 &amp; 6</td> <td>0.922</td> </tr> </tbody> </table>	Terminal Styles	"A" (inches)	1, 2, 4 & 5	0.808	3 & 6	0.922	<p><b>P8-3, Style C Bezel</b> <b>0.625-24 Bushing</b> Flat Button Shape Shown Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p>  <table border="1" data-bbox="495 793 755 861"> <thead> <tr> <th>Terminal Styles</th> <th>"A" (inches)</th> </tr> </thead> <tbody> <tr> <td>1, 2, 4 &amp; 5</td> <td>0.683</td> </tr> <tr> <td>3 &amp; 6</td> <td>0.797</td> </tr> </tbody> </table>	Terminal Styles	"A" (inches)	1, 2, 4 & 5	0.683	3 & 6	0.797	<p><b>Small Bushing</b> <b>P8-4: 0.500-32 Bushing</b> <b>P8-5: 0.469-32 Bushing</b> Flat Button Shape Shown Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p>  <table border="1" data-bbox="820 751 1144 861"> <thead> <tr> <th>Model</th> <th>Terminal Styles</th> <th>"A" (inches)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">P8-4</td> <td>1, 2, 4 &amp; 5</td> <td>0.870</td> </tr> <tr> <td>3 &amp; 6</td> <td>0.984</td> </tr> <tr> <td rowspan="2">P8-5</td> <td>1, 2, 4 &amp; 5</td> <td>1.097</td> </tr> <tr> <td>3 &amp; 6</td> <td>1.211</td> </tr> </tbody> </table>	Model	Terminal Styles	"A" (inches)	P8-4	1, 2, 4 & 5	0.870	3 & 6	0.984	P8-5	1, 2, 4 & 5	1.097	3 & 6	1.211	<p><b>P8-6, Style F Bezel</b> <b>0.625-24 Bushing</b> Flat Button Shape Shown Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p>  <table border="1" data-bbox="1193 793 1469 861"> <thead> <tr> <th>Terminal Styles</th> <th>"A" (inches)</th> </tr> </thead> <tbody> <tr> <td>1, 2, 4 &amp; 5</td> <td>0.808</td> </tr> <tr> <td>3 &amp; 6</td> <td>0.922</td> </tr> </tbody> </table>	Terminal Styles	"A" (inches)	1, 2, 4 & 5	0.808	3 & 6	0.922
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<p><b>P8-7, Style G Bezel</b> <b>0.625-24 Bushing</b> Flat Button Shape Shown Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p>  <table border="1" data-bbox="151 1365 443 1438"> <thead> <tr> <th>Terminal Styles</th> <th>"A" (inches)</th> </tr> </thead> <tbody> <tr> <td>1, 2, 4 &amp; 5</td> <td>0.683</td> </tr> <tr> <td>3 &amp; 6</td> <td>0.797</td> </tr> </tbody> </table>	Terminal Styles	"A" (inches)	1, 2, 4 & 5	0.683	3 & 6	0.797	<p><b>P8-8, Style H Bezel</b> <b>0.625-24 Bushing</b> Flat Button Shape Shown Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p>  <table border="1" data-bbox="495 1365 755 1438"> <thead> <tr> <th>Terminal Styles</th> <th>"A" (inches)</th> </tr> </thead> <tbody> <tr> <td>1, 2, 4 &amp; 5</td> <td>0.810</td> </tr> <tr> <td>3 &amp; 6</td> <td>0.924</td> </tr> </tbody> </table>	Terminal Styles	"A" (inches)	1, 2, 4 & 5	0.810	3 & 6	0.924	<p><b>Dome Button Shape</b> Specify Dia.: 0.312" or 0.375" Height: 0.187" or 0.250"</p> 	<p><b>Push-Pull Button Shape</b> Available as Button Style P only.</p> 																			
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## ORDERING INFORMATION:

Select the OTTO P8 series switch to match your application requirements. Combinations of features are almost limitless. When ordering, please use the OTTO Part Number.

**Example:** P8-316329B specifies a "C" style bezel, silver color case, solder terminals, 2 circuit contact configuration, standard contact rating, watertight seal construction, 4.0 lbs. operating force momentary action, white button 0.375" diameter by 0.250" long, dome shaped.

## P8 PART NUMBER CODE

Bezel Style	Terminal Style/Case Color	Circuit Form	Current Rating Level/Seal Type	Operating Force/Action	Button Color	Button Diameter/Length/Shape
1. Style A	1. Solder/Silver	1. N.O.	1. Std./Unsealed ③	1. 2.5 lbs./Momentary	1. Red	A. 0.375"/0.250"/Flat
3. Style C	2. Screw/Silver	2. N.C.	2. Std./Dusttight per IP64	2. 4.0 lbs./Momentary	2. Black	B. 0.375"/0.250"/Dome
4. 0.50-32 THD	3. Faston/Silver ①	6. 2 Circuit	3. Std./Watertight	3. Push-Pull ②	3. Orange	C. 0.375"/0.187"/Flat
5. 0.469-32 THD	4. Solder/Black		4. Logic Level/Dusttight per IP64		4. Yellow	D. 0.375"/0.187"/Dome
6. Style F	5. Screw/Black		5. Logic Level/Watertight		5. Green	E. 0.312"/0.250"/Flat
7. Style G	6. Faston/Black ①		6. Std./Dusttight per MIL-PRF-8805, Design 2		6. Blue	F. 0.312"/0.250"/Dome
8. Style H					7. Purple	G. 0.312"/0.187"/Flat
					8. Gray	H. 0.312"/0.187"/Dome
					9. White	P. 0.375"/0.250"/Flat ②

- ① Faston receptacles: 0.187" on N.O.; 0.110" on N.C. terminals.  
② Push-pull action available in button style "P" only.  
③ Unsealed units are not recommended for logic level current duty.

MOMENTARY ACTION, SHORTER BEHIND PANEL, SUBMINIATURE DOUBLE BREAK, SNAP-ACTION

The P8 Vandal Resistant series is a durable, robust switch, offering the same quality and precision tactile feedback found in the standard P8 series. With a variety of case, mounting and terminal styles and a mechanical life of 1,000,000 cycles, this stainless steel sealed switch is ideal for door access security systems, public transit systems, emergency phones, traffic signals, industrial and process control environments and anywhere that ruggedness, durability and security are crucial.

OTTO P8 series pushbutton switches feature a shortened back of panel depth while offering all the features of the regular size P1 and P3 series switches. P8 series switches offer vastly improved electrical and mechanical life under extreme conditions found in most military and industrial environments.

On sealed models, a silicone boot operating on our patented "rolling sleeve" principle protects the contact area against contamination at the button area. This boot provides long life and smooth operation over a wide temperature range. Sealed terminals protect the contact area from hostile environments and solder flux on both sealed and unsealed models.

High contact force (120g/4.2 oz), low contact resistance and short contact bounce (5ms max) are all a result of our snap-action mechanism. These characteristics provide exceptional current carrying capabilities over the life of the switch. Optional logic level (gold plate) configuration makes the P8-V switches well suited to interface directly to computers and other solid state devices.

## Features:

- **Stainless steel vandal resistant case**
- **Aluminum security level case**
- **Watertight to IP68S and IP69K or moistureproof & dusttight to IP64**
- **Positive tactile feedback**
- **Variety of case and button styles available**
- **Mechanical life 1 million cycles**
- **UL recognized & CSA certified**
- **UL1500 ignition protected**
- **RoHS compliant**



Flush Mount,  
5/8" Thread Shown



Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	
<b>Load</b>	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	10A
Inductive	5A
Lamp	3A
DWV	1000Vrms
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	100,000 cycles (1,000,000 logic level)
<b>Mechanical Life:</b>	1,000,000 cycles
<b>Seal:</b>	IP64 or IP68S and IP69K
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	2.5 lbs. +0.5/-1.0 lb. or 4.0 lbs. +/- 1.0 lb.
<b>Total Travel:</b>	0.085 +/- 0.015 inches
<b>Overtravel:</b>	0.012 inches min
<b>Movement Differential:</b>	0.015 inches min
<b>MATERIALS:</b>	
<b>Case:</b>	Anodized aluminum alloy or stainless steel (303)
<b>Button:</b>	Anodized aluminum alloy or stainless steel (303)
<b>Terminals:</b>	Standard silver plate or optional gold plate for logic level applications
<b>Terminal Hardware:</b>	Terminal lugs, screws and lockwasher when applicable
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal gasket when applicable

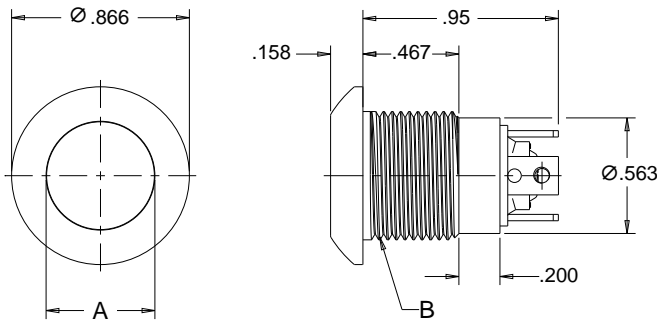
# VANDAL RESISTANT PUSHBUTTONS

**P8-V**  
COMPACT  
PUSHBUTTONS

MOMENTARY ACTION, SHORTER BEHIND PANEL, SUBMINIATURE DOUBLE BREAK, SNAP-ACTION

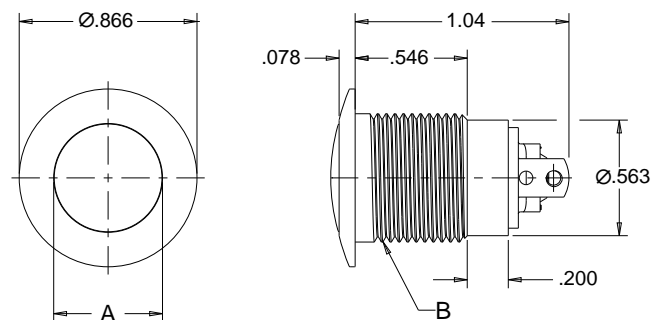
## High Profile, with Flat Button

Style 1



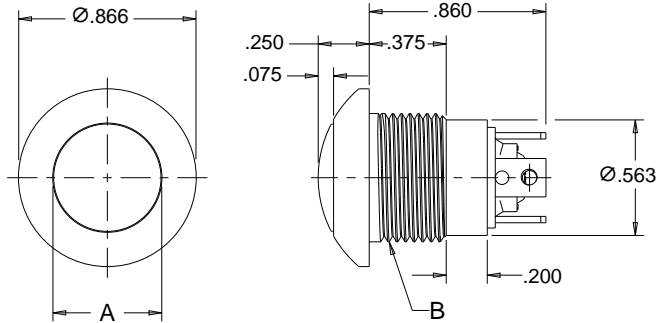
## Low Profile, with Curved Button

Style 4



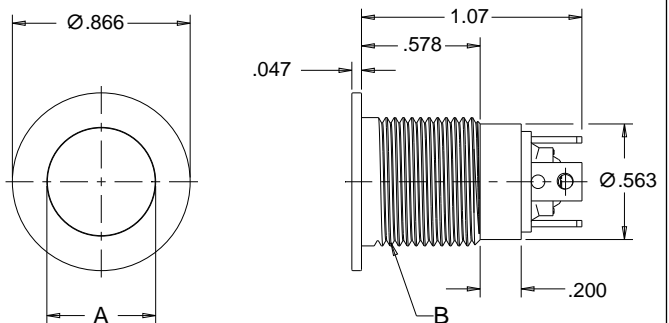
## High Profile, with Curved Button

Style 2



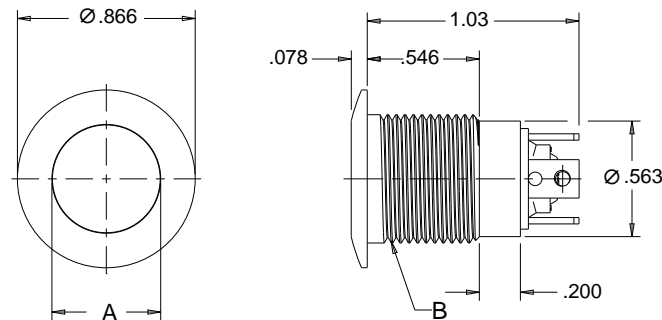
## Flush Mount

Style 5



## Low Profile, with Flat Button

Style 3



Dimension	Case Style	
	1 - 4	5 - 8
A (Button Dia.)	0.525	0.590
B (Thread)	0.625-24	0.750-20
D-Flat	0.594	0.718

## P8-V PART NUMBER CODE

P8 - X X X X X X X

Type	Case Style & Mounting*	Terminal Style/ Case Color	Circuit Form	Current Rating/Seal	Operating Force	Button Profile
<b>V.</b> Vandal Resistant (SS Case & Button)	1. 5/8-24 & Hex Nut 3. 5/8-24 W/D-Flat & Hex Nut	1. Solder Terminal/Silver 2. Screw Terminal/Silver	1. N.O. 2. N.C.	2. Std./Splashproof 3. Std./Watertight	1. 2.5 lbs. 2. 4.0 lbs.	1. High Profile/Flat Button 2. High Profile/Curved Button
<b>A.</b> Security Level (AL Case & Button)	5. 3/4-20 & Hex Nut 7. 3/4-20 W/D-Flat & Hex Nut	3. Faston Terminal/Silver ②③ 4. Solder Terminal/Black ① 5. Screw Terminal/Black ① 6. Faston Terminal/Black ①②③	6. 2 Circuit	4. Logic Level/Splashproof 5. Logic Level/Watertight		3. Low Profile/Flat Button 4. Low Profile/Curved Button 5. Flush Profile

\* For Knurl Nut options, contact factory.

① Only available on P8-A Styles

② Overall length +0.12" for faston terminals

③ Faston receptacles: 0.187" on N.O.; 0.110" on N.C. terminals

MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The P9 Dome switches feature a contoured dome style pushbutton and share similar size and characteristics to the P7-D series. There are two button versions: flush button profile and raised button profile, and two bezel versions: standard and small.

The P9 comes with a threaded case for hex nut mounting or with a snap-in case. The switch series features short behind panel depth and offers excellent mechanical and electrical performance while operating under severe conditions.

The P9 Dome series is offered in dusttight and moistureproof sealed construction. Mechanical life is 1.25 million operations and the electrical life is 25,000 operations at full rated load.

Watertight sealing to IP68S and IP69K is available simply by adding a "W" suffix to the part number.

The P9 Dome series is available in standard and low-force double break snap-action. All are momentary action. Special contact variations are available. High contact pressure and unique contact design provide low contact resistance for logic level switching capability as well as full rated service. Solder, PC Pin, and 0.110" Quick Connect termination options are also available.

Positive tactile feedback signals the operator when the switch is actuated.

The P9 Dome series is a quality precision switch designed for use in panels, control grips, computers, instruments, heavy equipment and other demanding applications where attractive, rugged pushbutton switches are required.

## Features:

- **Flush and raised dome button styles in gloss or matte finish**
- **Small bezel option**
- **Double break, momentary action**
- **All plastic housing & button construction**
- **Threaded body or snap-in panel mounting**
- **Withstands extreme shock & vibration**
- **Positive tactile feedback contact transfer on snap-action models**
- **Mechanical life is 1.25 million cycles**
- **Solder, PC Pin & 0.110" Quick Connect terminal styles**
- **Moistureproof & dusttight to IP64 or watertight to IP68S and IP69K**
- **RoHS compliant**



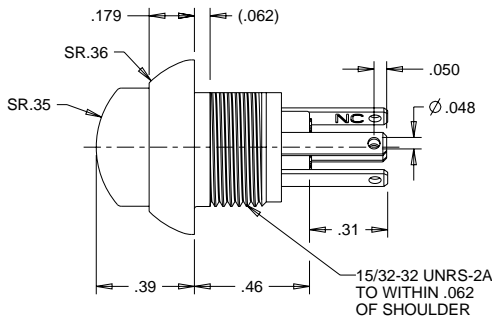
Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
Load	N.O./N.C.	2 Circuit	Life
Resistive: 28VDC	5A	4A	25,000 cycles
Resistive: 115VAC, 60Hz	3A	1A	25,000 cycles
Inductive: 28VDC	2A	2A	25,000 cycles
DWV	1050Vrms		
Logic Level	10mA @ 5 VDC		1,250,000 cycles
<b>Mechanical Life:</b>	1,250,000 cycles		
<b>Seal:</b>	IP64 or IP68S and IP69K		
<b>Operating Temp Range:</b>	-40°C to +85°C		
<b>Operating Force:</b>	Standard: 1.7 lbs. +/- 0.5 lb. Low Force: 12 oz +/- 4 oz		
<b>Total Travel:</b>	0.080 inches max		
<b>Overtravel:</b>	0.010 inches min		
<b>MATERIALS:</b>			
<b>Case:</b>	Thermoplastic		
<b>Button:</b>	Thermoplastic		
<b>Terminals:</b>	Brass with gold		
<b>Terminal Hardware:</b>	None provided		
<b>Mounting Hardware:</b>	Hex nut, lockwasher Panel gasket when applicable		



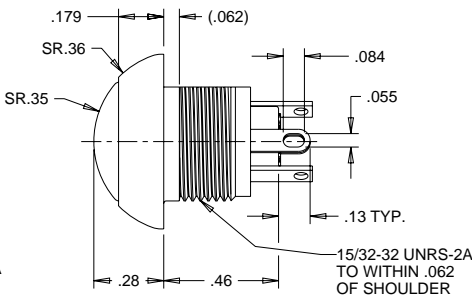
# SEALED DOME PUSHBUTTON SWITCHES

**P9**  
DOME  
PUSHBUTTONS

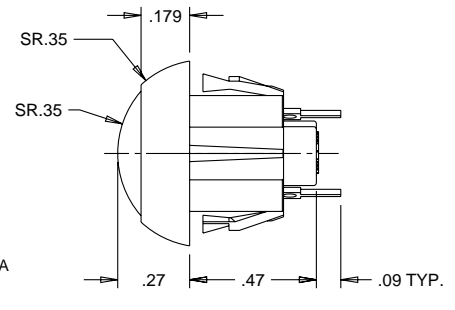
## CHOICE OF SNAP-ACTION & SHORTING BAR ACTION



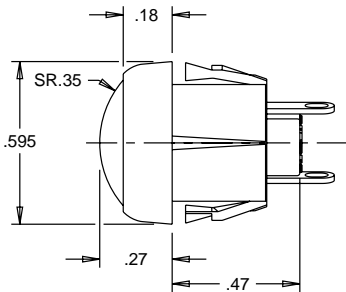
**Raised Dome Button Style**



**Flush Dome Button Style**



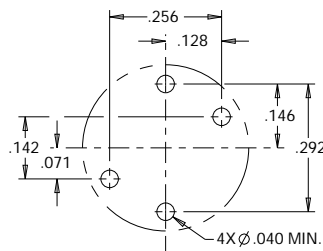
**Snap-In Case**  
(PC Terminals Shown)



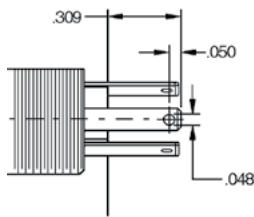
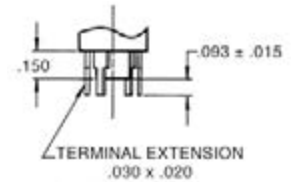
**Flush Dome Small Bezel Style**



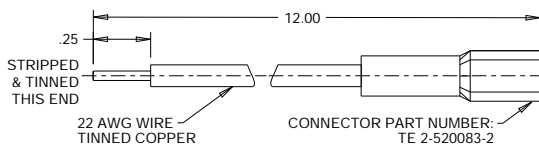
**Threaded Case Terminal Detail**



**Component Side**  
P.C. Mounting Pattern  
(As viewed from switch bottom)



**0.110" Quick Connect Detail**



**Wire Leads with Quick Connect**

Recommended Panel Openings		
*Panel Thickness	Recommended Ø	DIM. Across D-Flat
0.024*	Ø 0.505	0.460
0.031	Ø 0.505	0.460
0.118*	Ø 0.505	0.460
0.125	Ø 0.505	0.460

\* Must use panel gasket C401669-000025 supplied with the switch.

- Snap-in case allows front panel mounting into 0.024" or 0.118" thick panels using panel gasket C401669-000025 (C807516-000025 for case styles 9 and A) or into 0.031" and 0.125" thick panels
- 0.110" Quick Connect terminals allow reliable, solderless wire connections
- Flush Neoprene Black Boot P/N C402339
- Raised Neoprene Black Boot P/N C402246
- Flush Silicone Translucent Boot P/N C402599-1
- Raised Silicone Translucent Boot P/N C402611-1

## P9 PART NUMBER CODE

P9 - X

X

X

X

X

X

\*

## ORDERING INFORMATION:

Select the OTTO P9 series features that match your specific application. Standard and special features are shown at right. Specify your choice by building the OTTO Part Number code.

**Example:** P9-211121 specifies raised dome style button, threaded case, solder terminals, N.O. circuit form, standard snap-action, black case/bezel, red button.

### Button & Case Style\*\*

1. Flush Dome & Threaded Case, Std. Finish
2. Raised Dome & Threaded Case, Std. Finish
3. Flush Dome & Snap-In Case, Std. Finish
4. Raised Dome & Snap-In Case, Std. Finish
5. Flush Dome & Threaded Case, Matte Finish
6. Raised Dome & Threaded Case, Matte Finish
7. Flush Dome & Snap-In Case, Matte Finish
8. Raised Dome & Snap-In Case, Matte Finish
9. Flush Dome & Snap-In Case, Std. Finish, Small Bezel
- A. Raised Dome & Snap-In Case, Std. Finish, Small Bezel

### Terminal Style

1. Solder
2. PC Pin
3. 0.110" Quick Connect (QC)
4. 0.110" QC with 2 Wire Leads ①
5. 0.110" QC with 4 Wire Leads ②

① For Circuit Form 1 and 2. (1 black & 1 white lead)

② For Circuit Form 3. (2 black & 2 white leads)

③ Not available in Shorting Bar version.

\* Add "W" suffix for watertight to IP68S and IP69K (will include panel gasket).

\*\* Contact factory for std./matte button/case combination options.

\*\*\* Contact factory for minimum requirement.

### Circuit Form

1. N.O.
2. N.C. ③
3. 2 Circuit ③

### Switch Action

1. Standard Snap-Action
2. Low Force Snap-Action
3. Non-Snap Shorting Bar

### Case/Bezel Color

1. Red
2. Black
3. Orange\*\*\*
4. Yellow\*\*\*
5. Green\*\*\*
6. Blue\*\*\*
7. Violet\*\*\*
8. Gray\*\*\*
9. White

### Button Color

1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Violet
8. Gray
9. White

## SEALED, LATCHING PUSHBUTTON

The P9M pushbutton is a small, sealed, normally open, latching switch, ideal for basic ON/OFF functions. Push the button to latch it into position, push again to unlatch. Flush dome and raised dome button profiles are available in either gloss or matte finish.

The P9M comes with a standard 15/32" threaded case for hex nut mounting and features short behind panel depth. It also offers excellent performance while operating under severe conditions found in demanding applications.

The P9M is a quality precision switch designed for use in control panels, grips, computers, instruments and other applications where attractive, rugged, long life pushbutton switches are required.

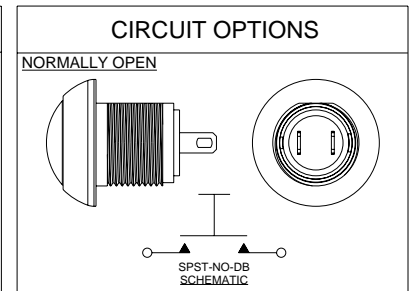
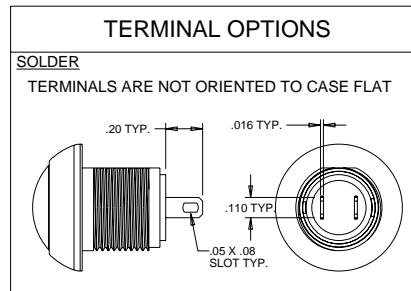
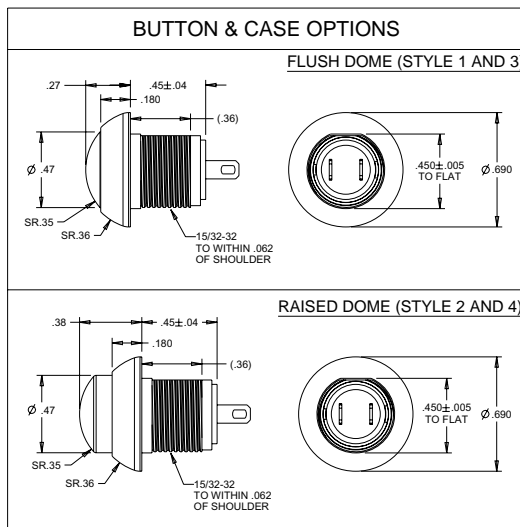
### Features:

- Sealed to IP68S
- All plastic housing & button construction
- 15/32" standard bushing
- Flush and raised dome button styles in gloss or matte finish
- RoHS compliant

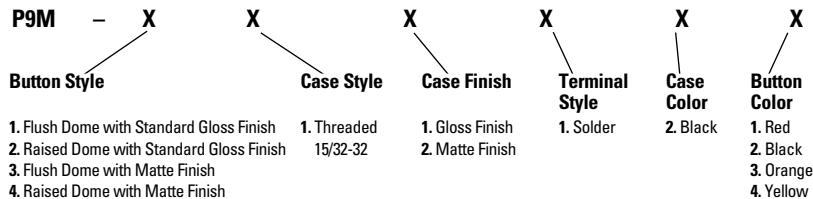


### Standard Characteristics/Ratings:

ELECTRICAL RATINGS: @ Sea Level			
Load	Voltage	Current	Life Cycles
Resistive	12VDC	4A	200,000
Resistive	48VDC	1A	200,000
Resistive	48VDC	2A	100,000
Resistive	48VDC	3A	75,000
Logic Level	5VDC	10mA	200,000
DWV	1000Vrms		
<b>Electrical Life:</b>	See Rating Chart		
<b>Mechanical Life:</b>	200,000 cycles		
<b>Seal:</b>	IP68S		
<b>Operating Temp Range:</b>	-40°C to +85°C		
<b>Operating Force:</b>	12+/-6 ounces		
<b>Total Travel:</b>	.071+/--.015 inches		
<b>Contact Resistance:</b>	0.050 Ω max. initial		
<b>Insulation Resistance:</b>	1 GΩ min. at 500 VDC		
<b>MATERIALS:</b>			
<b>Case:</b>	Thermoplastic		
<b>Button:</b>	Thermoplastic		
<b>Contacts:</b>	Silver with gold		
<b>Mounting Hardware:</b>	Hex nut, lockwasher and panel seal		



### P9M PART NUMBER CODE



# PUSHBUTTONS PER MIL-PRF-8805/96

**PE**  
MILITARY  
PUSHBUTTONS

MOMENTARY ACTION NORMALLY OPEN OR NORMALLY CLOSED



## Features:

- MIL-PRF-8805/96 qualified
- Momentary snap-action
- Sealed or unsealed
- Compact, space-saving design
- Black or red button colors available
- Clear or black case colors available
- RoHS compliant

## Standard Characteristics/Ratings:

### ELECTRICAL RATINGS:

**Load** Sea Level @ 28VDC or 115VAC, 60/400Hz

Resistive 5A

Inductive 2A

DWV 1000Vrms

**Electrical Life:** 25,000 cycles

**Mechanical Life:** 50,000 cycles

**Seal:** Unsealed per MIL-PRF-8805 Design 1  
or Dusttight per MIL-PRF-8805 Design 2

**Operating Temp Range:** -55°C to +85°C

**Operating Force:** 1.5 lbs. +/- 0.5 lb. (unsealed)  
1.75 lbs. +/- 0.5 lb. (dusttight)

**Total Travel:** 0.095 inches +/- 0.015 inches

**Overtravel:** 0.010 inches min

**Pretravel:** 0.010 inches min

### MATERIALS:

**Case:** Anodized aluminum alloy, clear or black

**Button:** Thermoplastic

**Terminals:** Silver alloy

**Mounting Hardware:** Hex nut and lockwasher

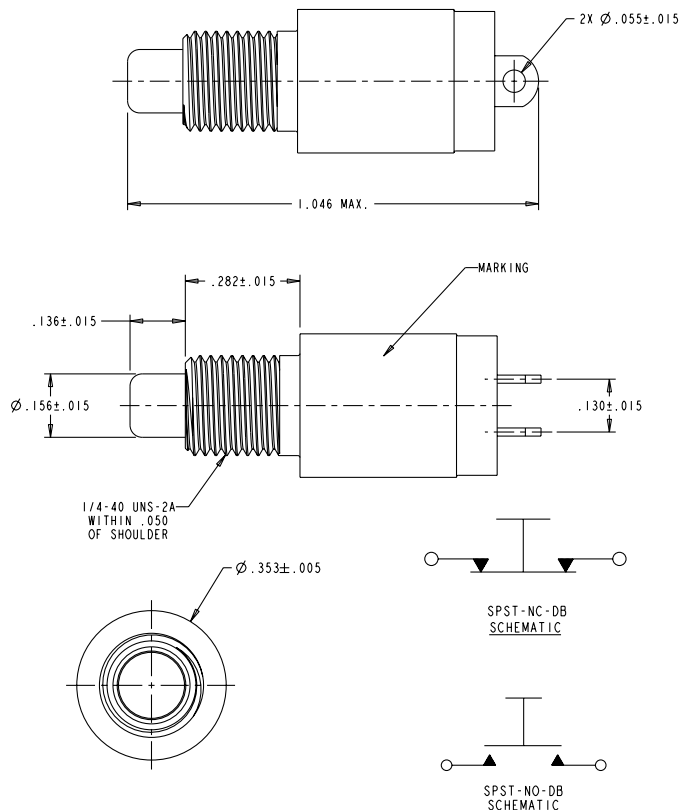
## Momentary, Normally Open

OTTO PART NUMBER	MILITARY PART NUMBER	SEAL	CASE COLOR	BUTTON COLOR
PE-1111	M8805/96-001	UNSEALED	CLEAR	RED
PE-1112	M8805/96-002	UNSEALED	CLEAR	BLACK
PE-1121	M8805/96-005	UNSEALED	BLACK	RED
PE-1122	M8805/96-006	UNSEALED	BLACK	BLACK
PE-1211	M8805/96-009	DUST TIGHT	CLEAR	RED
PE-1212	M8805/96-010	DUST TIGHT	CLEAR	BLACK
PE-1221	M8805/96-013	DUST TIGHT	BLACK	RED
PE-1222	M8805/96-014	DUST TIGHT	BLACK	BLACK

## Momentary, Normally Closed

OTTO PART NUMBER	MILITARY PART NUMBER	SEAL	CASE COLOR	BUTTON COLOR
PE-2111	M8805/96-003	UNSEALED	CLEAR	RED
PE-2112	M8805/96-004	UNSEALED	CLEAR	BLACK
PE-2121	M8805/96-007	UNSEALED	BLACK	RED
PE-2122	M8805/96-008	UNSEALED	BLACK	BLACK
PE-2211	M8805/96-011	DUST TIGHT	CLEAR	RED
PE-2212	M8805/96-012	DUST TIGHT	CLEAR	BLACK
PE-2221	M8805/96-015	DUST TIGHT	BLACK	RED
PE-2222	M8805/96-016	DUST TIGHT	BLACK	BLACK

## PE-1 Series Shown



## MOMENTARY ACTION

The PE2 with solder termination is qualified under MIL-PRF-8805/99. The PE2 is a rugged sealed switch; it meets high shock and vibration requirements and is ideal for tough environments. A variety of button colors and easy panel mounting options are provided. The PE2 is a momentary 2 circuit or DPDT, and has a 2A resistive 1.5A inductive 28VDC/115VAC rating. Splashproof with panel seal dress ring per MIL-PRF-8805, symbol 6.

### Features:

- MIL-PRF-8805/99 qualified
- Momentary snap-action
- Black, white or red button colors available
- Splashproof
- RoHS compliant



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz	70,000 feet @ 28VDC or 115VAC, 60/400Hz
Resistive	2A	2A
Inductive	1.5A	1.5A
Lamp	0.5A	0.5A
DVV	1000Vrms	500Vrms

**Electrical Life:** 25,000 cycles at full load

**Mechanical Life:** 50,000 cycles

**Seal:** Splashproof with panel seal dress ring per MIL-PRF-8805, symbol 6

**Operating Temp Range:** -55°C to +85°C

**Operating Force:** 4.5 lbs. +/- 1.5 lbs.

**Total Travel:** 0.176 inches max

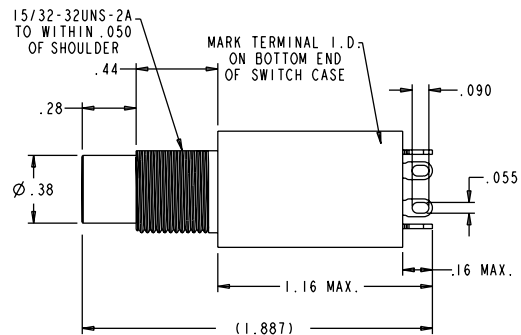
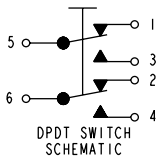
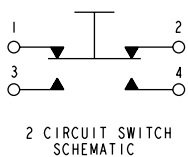
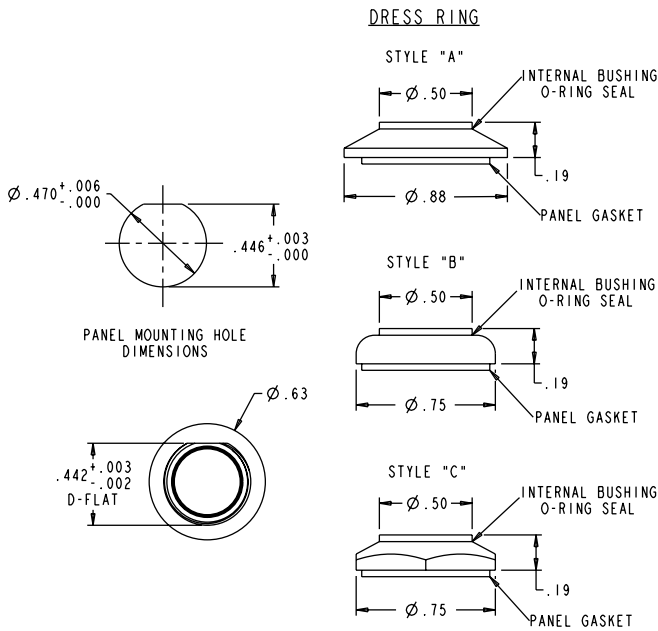
#### MATERIALS:

**Case:** Anodized aluminum alloy, black

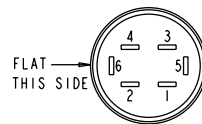
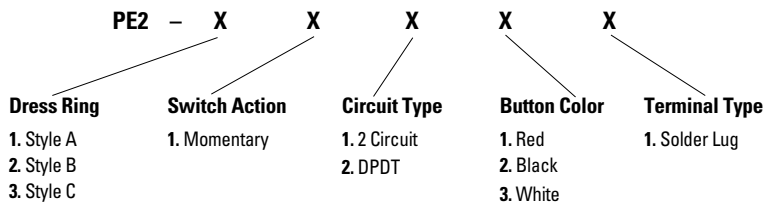
**Button:** Thermoplastic

**Terminals:** Brass, silver plate

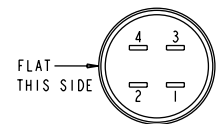
**Mounting Hardware:** Hex nut, lockwasher, keying washer, dress ring with O-ring seal, panel gasket when applicable



### PE2 PART NUMBER CODE



SHOWN WITH DPDT TERMINALS

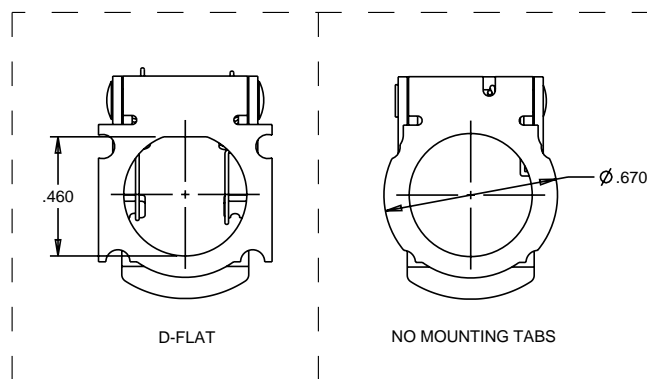
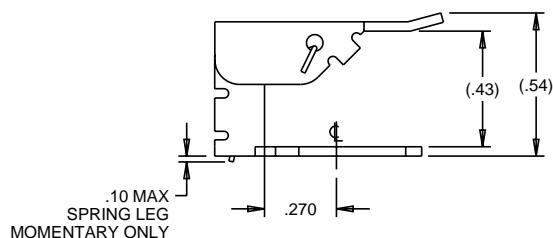
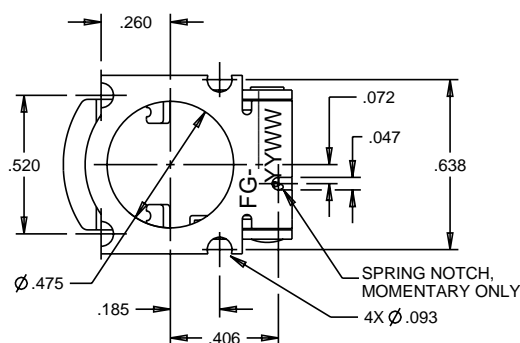
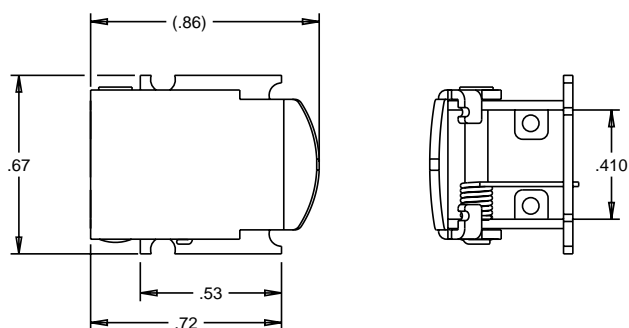


SHOWN WITH 2 CIRCUIT TERMINALS

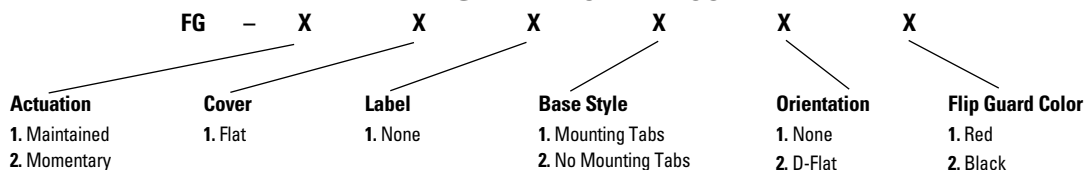
# FLIP GUARD FOR PUSHBUTTONS

## MAINTAINED OR MOMENTARY ACTION FLIP GUARD

The FG Flip Guard assembly offers a maintained or momentary actuation for pushbutton switches with a 15/32 threaded bushing. The FG flip guard's main feature is a spring-loaded cover that locks in either an open or closed position. In the open position the switch operates freely; in the closed position the switch is protected from accidental operation. The momentary open option prevents the guard from remaining in an open position, reducing the chance of accidental actuation. The flip guard is easily installed from the front panel and offers an optional D-flat or mounting tabs to prevent any rotation during assembly.



### FG PART NUMBER CODE



# Rocker Switches



SERIES	FEATURE	MAX RATING (Resistive @ 28VDC)	SEAL RATING	APPROVALS	MOUNTING (Panel Opening)	CIRCUITRY
K1	Sealed, Illuminated Single Pole	16A	IP68S & IP69K	UL (E61705), CSA (LR43865), (UL1500), Ignition Protected, RoHS Compliant	1.115" x 0.515"	SPST, SPDT
K1S	Sealed, ON-ON-ON, Single or Double Pole	10mA @ 5VDC	IP68S	RoHS Compliant (based on configuration)	1.077" x 0.485"	SPTT, DPST
K2	Sealed, Illuminated Double Pole	16A	IP68S & IP69K	UL (E61705), CSA (LR43865), (UL1500), Ignition Protected, RoHS Compliant	1.115" x 0.900"	SPST, SPDT DPST, DPDT
K3	Sealed, Illuminated	20A	IP68S & IP69K	RoHS Compliant	1.750" x 0.915"	SPST, SPDT DPST, DPDT, SPTT
K3P	Panel Plug Indicators (LED)	N/A	IP68S	RoHS Compliant	1.750" x 0.915"	Lighting: Ind A, Ind C, Ind A & C
K4	Snap-in Toggle, Sealed, Illuminated	16A	IP68S & IP69K	RoHS Compliant	1.115" x 0.900"	SPST, SPDT DPST, DPDT
K5	Sealed, Illuminated	20A	IP68S & IP69K	RoHS Compliant	1.475" x 0.875"	SPST, DPDT SPDT, DPDT, SPTT
U2	Sealed, High Cycle Life	10A (10mA @ 5VDC logic level)	IP64 or IP68S	RoHS Compliant	1.125" X 0.690"	SPST

# SEALED, ILLUMINATED ROCKER SWITCHES

**K1/K2**  
SNAP-IN  
ROCKERS

LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS

The K series rockers are rugged, high performance sealed switches designed for use under severe conditions found in marine, appliance, heavy equipment and industrial control applications.

The K1 and K2 series are sealed to IP68S and IP69K and panel sealed with an optional panel gasket.

The K1 series is offered in single pole configuration and the K2 series is available in both single and double pole configurations. Both series offer illuminated models. Illumination can be independent or dependent of the switch position or a combination of both. A choice of red, green, clear or amber colored lenses are offered in illuminated models. Illumination options include incandescent, LED or neon light sources.

Mounting is simple and quick; snaps into panel from the front. The OTTO snap-in design supports a variety of panel thicknesses with just one cutout size.

A choice of models are offered to handle high power levels and logic level electronic switching applications.

Custom colors are available upon request. Value-added assemblies with wire leads are also available. Please contact our factory for assistance.



## Features:

- Sealed to IP68S and IP69K
- Fits industry standard panel openings for drop-in replacement of panel sealed & unsealed switches
- Snap-in feature accommodates a wide range of panel cutouts
- UV & solvent resistant
- Withstands extreme shock & vibration
- Custom legends available
- 2 & 3-position, momentary & maintained action
- Incandescent, LED & neon illumination with independent & dependent light source options
- UL recognized & CSA certified
- Ignition protected
- Optional one-piece connector
- Optional panel gasket available
- RoHS compliant

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC	Sea Level @ 125/250 VAC, 60/400Hz	Cycles
Resistive	16A	5A	25,000
Resistive	10A	N/A	50,000
Inductive	7A	2A	25,000
DWV	1000Vrms except across light terminals		
Logic Level	10mA @ 5VDC, max D.C. logic level ratings (void if logic level load(s) exceeded at any time)		

**Electrical Life:** See Rating Chart

#### LIGHTING:

Light Source	Rating (see appendix for complete voltage/current ratings table)
Incandescent	(VDC) 6V, 12V, 24V
Neon	(VAC) 125V, 250V
LED	(VDC) 2V, 6V, 12V, 24V

**Mechanical Life:** 100,000 cycles

**Seal:** IP68S and IP69K

**Operating Temp Range:** -30°C to +85°C

#### MATERIALS:

<b>Case:</b>	Thermoplastic
<b>Button:</b>	Thermoplastic
<b>Base:</b>	Thermoplastic
<b>Terminals/Contact:</b>	Brass, silver alloy with silver plate, gold flash for logic level
<b>Terminal Hardware:</b>	Screws and lockwashers provided when applicable K1/K2 series recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG
<b>Mounting Hardware:</b>	None provided

# SEALED, ILLUMINATED ROCKER SWITCHES

LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS

## K1 PART NUMBER CODE

Part Number Code Continued Below

K1

X

X

X

X

### Terminal Style/ Switch Rating

- A. Q.C./Std.
- B. Screw/Std.
- C. Solder/Std.
- D. Q.C./Logic Level
- E. Screw/Logic Level
- F. Solder/Logic Level
- G. PC Pin/Std.
- H. PC Pin/Logic Level

### Actuator Color/Style

- A. Red/Rocker
- B. Black/Rocker
- C. White/Rocker
- D. Red/Paddle
- E. Black/Paddle
- F. White/Paddle
- G. Red/Rocker Pinned
- H. Black/Rocker Pinned
- J. White/Rocker Pinned
- K. Red/Short Paddle Pinned
- L. Black/Short Paddle Pinned
- M. White/Short Paddle Pinned
- N. Red/Standard Paddle Pinned
- P. Black/Standard Paddle Pinned
- R. White/Standard Paddle Pinned
- T. Red/Short Paddle
- U. Black/Short Paddle
- V. White/Short Paddle

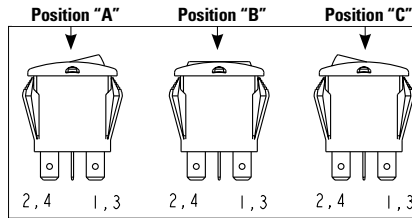
### Switch Action/Circuit

	Position "A"	Position "B"	Position "C"	Circuit
A.	1-C	NONE	OFF	SPST
B.	1-C	NONE	2-C	SPDT
C.	(1-C)	NONE	OFF	SPST
D.	(1-C)	NONE	2-C	SPDT
E.	(1-C)	OFF	(2-C)	SPDT
F.	1-C	OFF	2-C	SPDT
G.	(1-C)	OFF	2-C	SPDT
H.	OFF	NONE	2-C	SPST

NOTE: ( ) denotes momentary action.

### Light Type\*

- A. No Light
- B. 6V Incandescent
- C. 12V Incandescent
- D. 24V Incandescent
- E. 125VAC Neon
- F. 250VAC Neon
- G. 2V Red LED
- H. 2V Green LED
- J. 2V Amber LED
- K. 6V Red LED
- L. 6V Green LED
- M. 6V Amber LED
- N. 12V Red LED
- P. 12V Green LED
- Q. 12V Amber LED
- R. 24V Red LED
- S. 24V Green LED
- T. 24V Amber LED



\*See appendix for complete voltage/ratings table

## K1 PART NUMBER CODE CONTINUED FROM ABOVE

K1 Continued

X

X

X

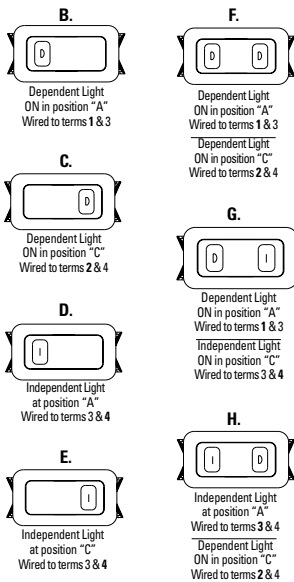
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### Lens Color

- | Position "A" | Position "C" |
|--------------|--------------|
| A. No Lens   | A. No Lens   |
| B. Red       | B. Red       |
| C. Green     | C. Green     |
| D. Amber     | D. Amber     |
| E. Clear     | E. Clear     |

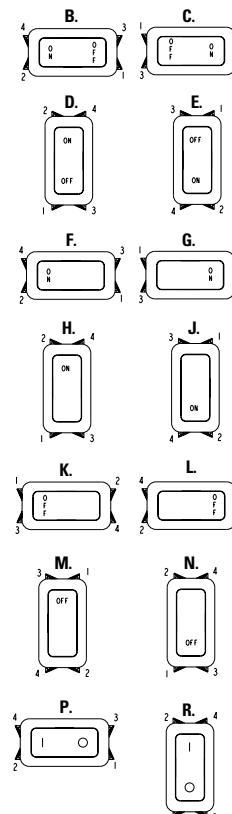
### Light/Circuit Location

A. No Light



### Legend & Orientation

A. None



#### NOTES:

- No momentary switches with dependent lights.
- Neon lamps only to be coded with clear or amber lenses.
- LED lenses must be clear or same color as LED.
- No dependent light in OFF position.
- All legends printed on actuators without lens(es) will be white except actuator codes C, F, J, M & R.
- All legends printed on lenses will be white except on clear lens(es) will be black.

D = Dependent Light  
I = Independent Light

#### NOTES:

- LED anode (+) terminal number shown in **bold**.
- Light on OFF side must be independent.
- Contact factory for multiple light types in the same switch.

• K1 panel plugs available as shown in Panel Plugs (PP) section.

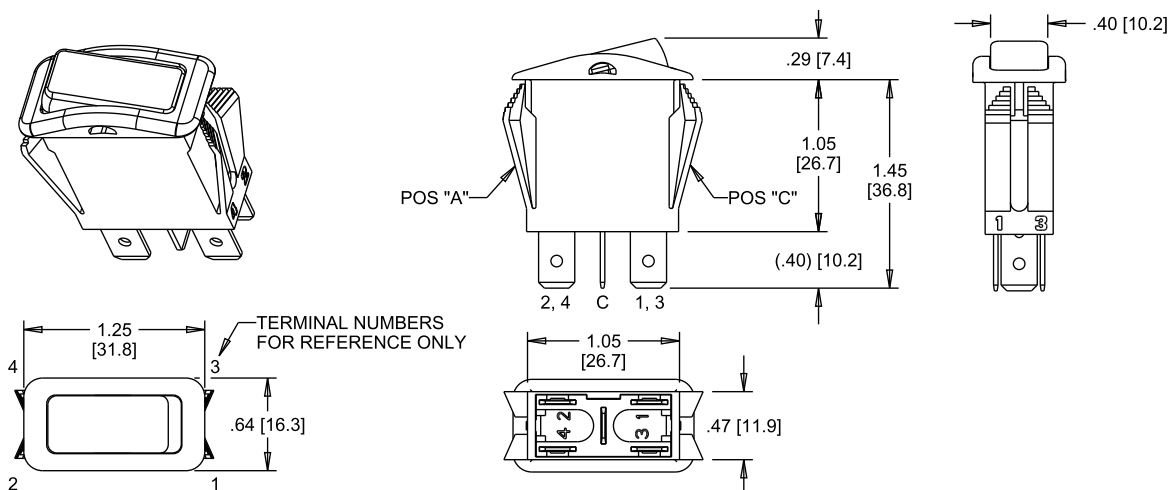
Specifications Subject To Change Without Notice



# SEALED, ILLUMINATED ROCKER SWITCHES

**K1**  
SNAP-IN  
ROCKERS

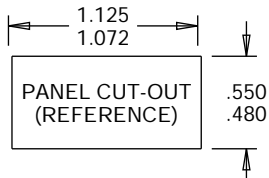
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS



**PANEL THICKNESS AND MOUNTING OPENING GUIDELINES:**

PANEL THICKNESS RANGE OF .025 - .105  
(GASKET RECOMMENDED)

PANEL THICKNESS RANGE OF .105 - .187  
(GASKET NOT REQUIRED)



**OPTIONAL PANEL GASKET:**

0.062" THICKNESS = P/N C807036-25-1

0.031" THICKNESS = P/N C807039-25-2

P.C. PIN LAYOUT		PADDLE STYLES		
		SHORT PADDLE ROCKER	STANDARD PADDLE ROCKER	STANDARD ROCKER
TERMINAL STYLES (.032 [.81] THICK)				
SCREW	QUICK CONNECT	SOLDER	P.C. PIN	

**K1 AND T71 CONNECTOR PART NUMBER CODE**

C405041 -

XX

XXXX

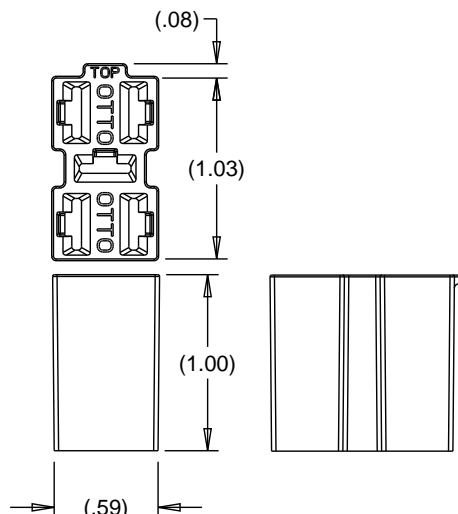
**Connector Color**

- 01. Red
- 02. Black
- 03. Orange\*
- 04. Yellow\*
- 05. Green\*
- 06. Blue\*
- 07. Violet\*
- 08. Gray\*
- 09. White

\* Contact Factory

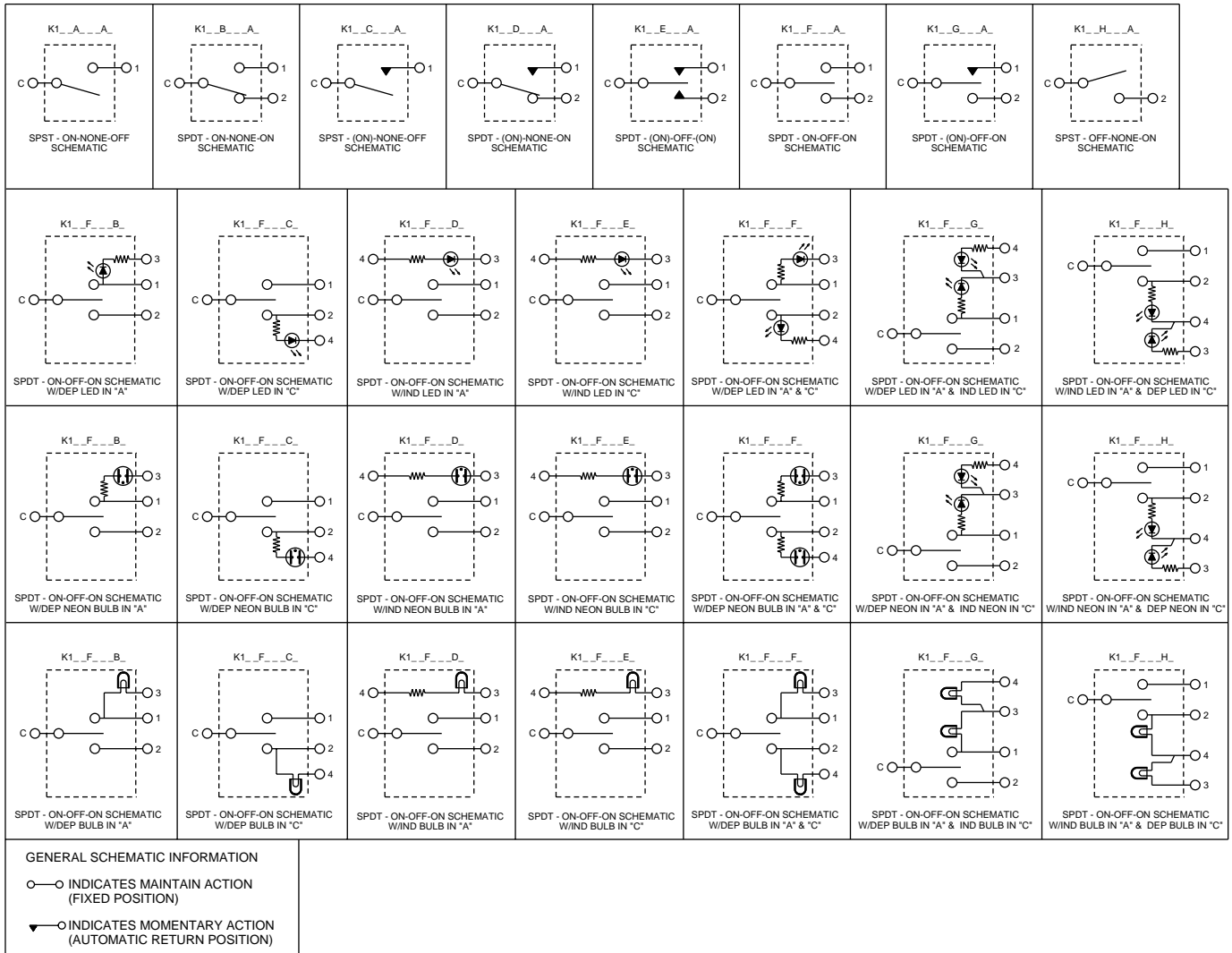
**Packaging Quantity**

- 0025 - 25 Pcs per Package
- 0050 - 50 Pcs per Package
- 0100 - 100 Pcs per Package



# SEALED, ILLUMINATED ROCKER SWITCHES

LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS



## K1, K2, K3P and K4 LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LIGHT SOURCE COLOR	FORWARD CURRENT	TYPICAL FORWARD/NOMINAL VOLTAGE (DC)	MAX. FORWARD VOLTAGE (DC)
6VDC INCANDESCENT	WHITE	.2A	6V	8V
12VDC INCANDESCENT	WHITE	.08A	12V	14V
24VDC INCANDESCENT	WHITE	.04A	24V	28V
125VAC NEON	AMBER	1.9mA	125V	125V
250VAC NEON	AMBER	1.9mA	250V	250V
2V LED*	RED	20mA	1.9V	2.5V
	GREEN	20mA	2.15V	2.5V
	AMBER	20mA	1.95V	2.5V
	BLUE	20mA	3.5V	4.0V
6VDC LED	SEE CHART	20mA	6V	8V
12VDC LED	SEE CHART	20mA	12V	14V
24VDC LED	SEE CHART	20mA	24V	28V

\* See Appendix for complete Voltage/Ratings Table.

# SEALED, ILLUMINATED ROCKER SWITCHES

**K2**  
SNAP-IN  
ROCKERS

LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES

## K2 PART NUMBER CODE

Part Number Code Continued Below

**K2**                    **X**

**X**

**X**

### Terminal Style/ Switch Rating

- A. Quick Connect/Standard
- B. Screw/Standard
- C. Solder/Standard
- D. Quick Connect/Logic Level
- E. Screw/Logic Level
- F. Solder/Logic Level
- G. PC Pin/Standard
- H. PC Pin/Logic Level

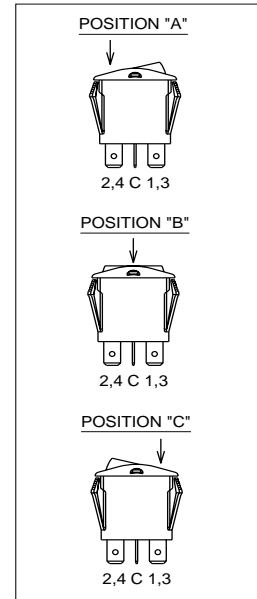
### Actuator Color/Style

- A. Red Standard
- B. Black Standard
- C. White Standard
- D. Red Standard Paddle
- E. Black Standard Paddle
- F. White Standard Paddle
- G. Red Short Paddle Pinned
- H. Black Short Paddle Pinned
- J. White Short Paddle Pinned
- K. Red Standard Paddle Pinned
- L. Black Standard Paddle Pinned
- M. White Standard Paddle Pinned
- N. Red Standard Pinned
- P. Black Standard Pinned
- R. White Standard Pinned

NOTE: For custom colors, contact factory.

### Switch Action/Circuit

	Position "A"	Position "B"	Position "C"	Circuit
A.	1-C1	NONE	OFF	SPST
B.	1-C1	NONE	2-C1	SPDT
C.	(1-C1)	NONE	OFF	SPST
D.	(1-C1)	NONE	2-C1	SPDT
E.	(1-C1)	OFF	(2-C1)	SPDT
F.	1-C1	OFF	2-C1	SPDT
G.	(1-C1)	OFF	2-C1	SPDT
H.	1-C1/3-C2	NONE	OFF	DPST
J.	1-C1/3-C2	NONE	2-C1/4-C2	DPDT
K.	(1-C1)/(3-C2)	NONE	OFF	DPST
L.	(1-C1)/(3-C2)	NONE	2-C1/4-C2	DPDT
M.	(1-C1)/(3-C2)	OFF	(2-C1)/(4-C2)	DPDT
N.	1-C1/3-C2	OFF	2-C1/4-C2	DPDT
P.	(1-C1)/(3-C2)	OFF	2-C1/4-C2	DPDT
Q.	1-C1	NONE	(2-C1)	SPDT
R.	OFF	NONE	(2-C1)	SPST
S.	1-C1/3-C2	NONE	(2-C1)/(4-C2)	DPDT
T.	OFF	NONE	(2-C1)/(4-C2)	DPST
U.	1-C1	OFF	(2-C1)	SPDT
V.	1-C1/3-C2	OFF	(2-C1)/(4-C2)	DPDT



## K2 PART NUMBER CODE - CONTINUED FROM ABOVE

**X**

**X**

**X**

**X**

**X**

### Light Type\*

- A. No Light
- B. 6V Incandescent
- C. 12V Incandescent
- D. 24V Incandescent
- E. 125 VAC Neon
- F. 250 VAC Neon
- G. 2V Red LED
- H. 2V Green LED
- J. 2V Amber LED
- K. 6V Red LED
- L. 6V Green LED
- M. 6V Amber LED
- N. 12V Red LED
- P. 12V Green LED
- Q. 12V Amber LED
- R. 24V Red LED
- S. 24V Green LED
- T. 24V Amber LED

### Position "A"

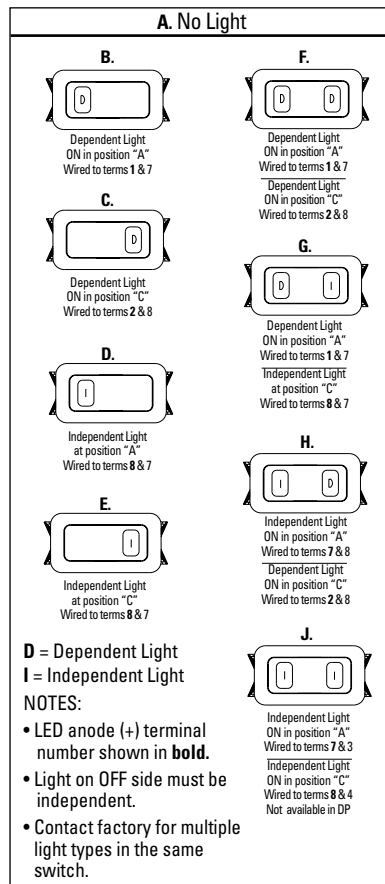
- A. No Lens
- B. Red
- C. Green
- D. Amber
- E. Clear

### Position "C"

- A. No Lens
- B. Red
- C. Green
- D. Amber
- E. Clear

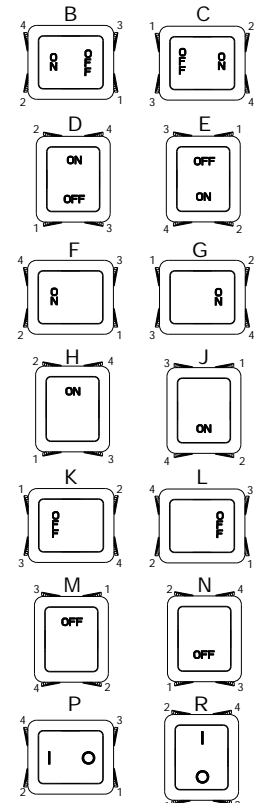
\*See appendix for complete voltage/ratings table

### Light/Circuit Location



### Legend & Orientation

A. None



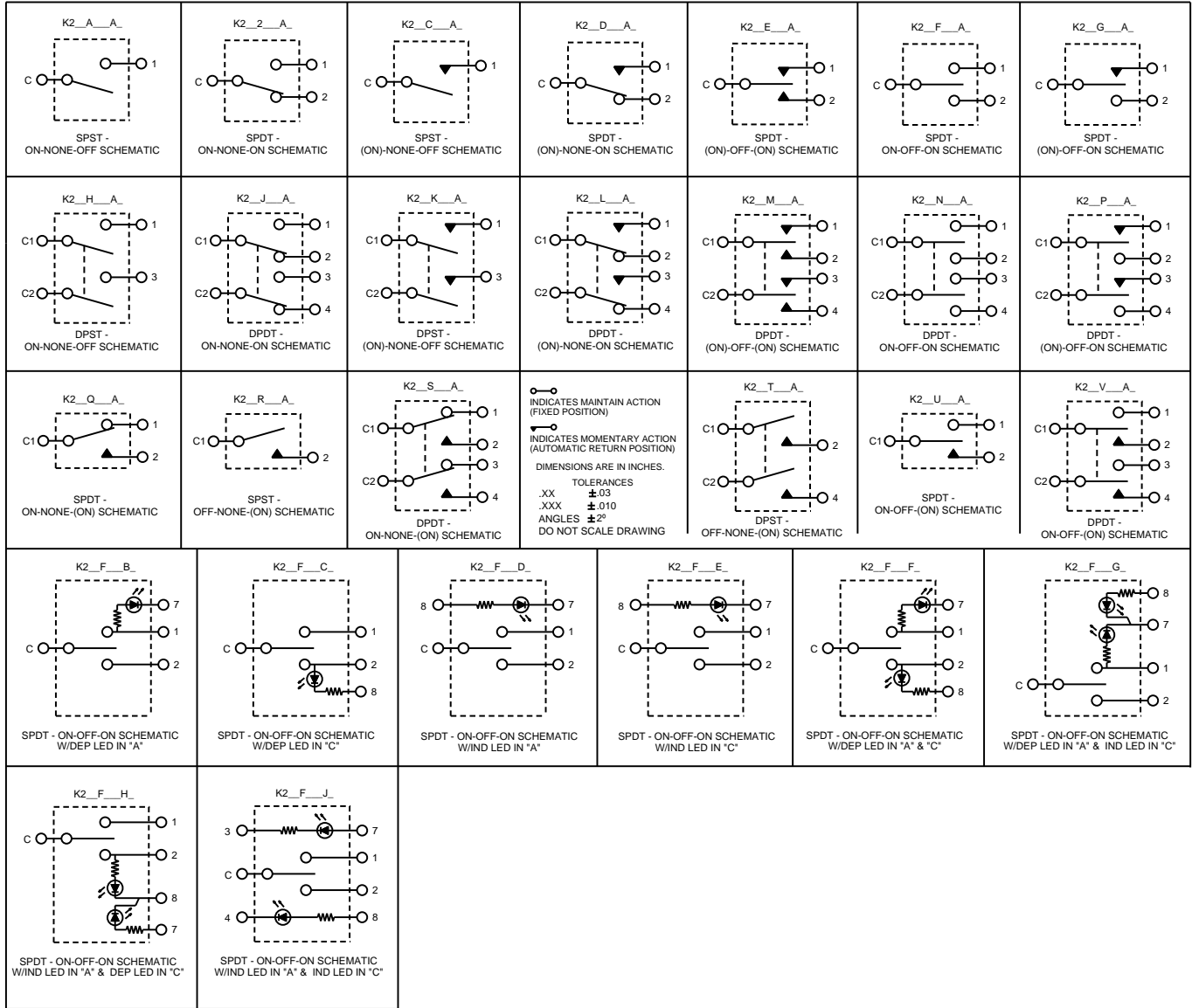
### NOTES:

- No momentary switches with dependent lights.
- Neon lamps only to be coded with clear or amber lenses.
- LED lenses must be clear or same color as LED.
- **K2 connector P/N C801765. (See Connector page in Hardware & Accessories Section)**
- Recommended Quick Connect Terminals:  
AMP 60253-2 for 12-16 AWG wire with 0.160" -0.210" insulation OD  
AMP 42100-2 for 14-18 AWG wire with 0.100" -0.170" insulation OD
- No dependent light in OFF position.
- All legends printed on actuators without lens(es) will be white except actuator codes C, F, J, M & R.
- All legends printed on lenses will be white except on clear lens(es) will be black.
- **K2 panel plugs available as shown in Panel Plugs (PP) section.**

- LED anode (+) terminal number shown in **bold**.
- Light on OFF side must be independent.
- Contact factory for multiple light types in the same switch.

# SEALED, ILLUMINATED ROCKER SWITCHES

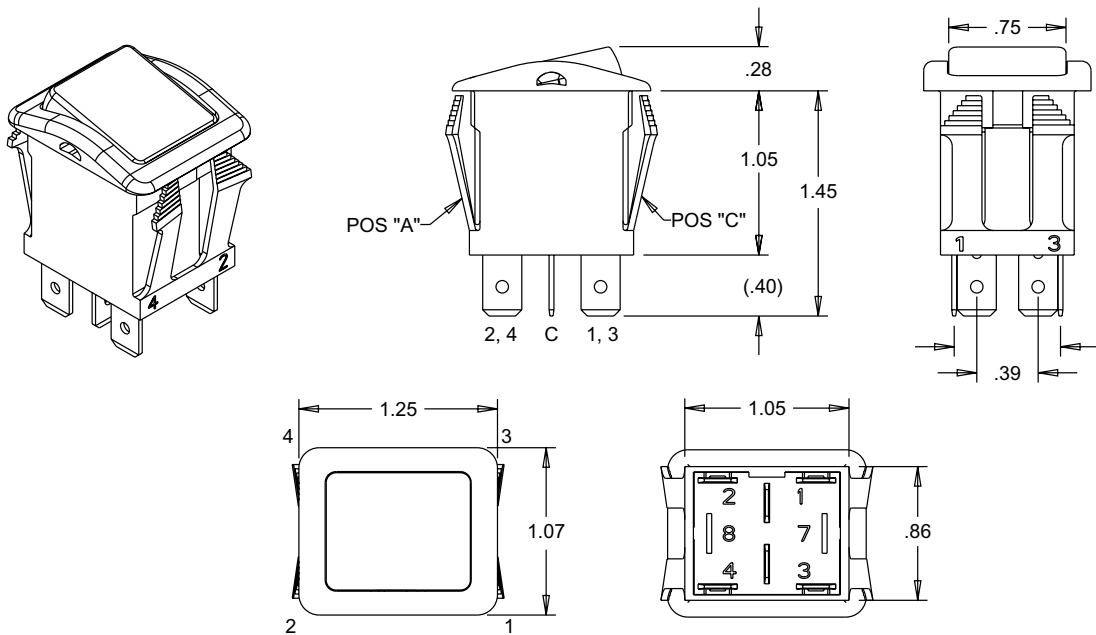
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES



# SEALED, ILLUMINATED ROCKER SWITCHES

**K2**  
SNAP-IN  
ROCKERS

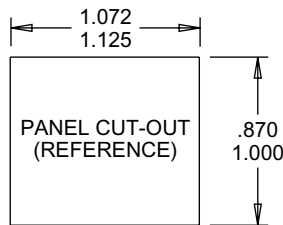
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES



**PANEL THICKNESS AND MOUNTING OPENING GUIDELINES:**

PANEL THICKNESS RANGE OF .025 - .105  
(GASKET RECOMMENDED)

PANEL THICKNESS RANGE OF .105 - .187  
(GASKET NOT REQUIRED)



**OPTIONAL PANEL GASKET:**

0.062" THICKNESS = P/N C807038-25-1

0.031" THICKNESS = P/N C807038-25-2

ROCKER STYLES		
SHORT PADDLE ROCKER	STANDARD PADDLE ROCKER	STANDARD ROCKER

TERMINAL STYLES (.032 THICK)			
SCREW	QUICK CONNECT	SOLDER	P.C. PIN

**K2 AND K4 AND T7 CONNECTOR PART NUMBER CODE**

C801765 -

XX

XXXX

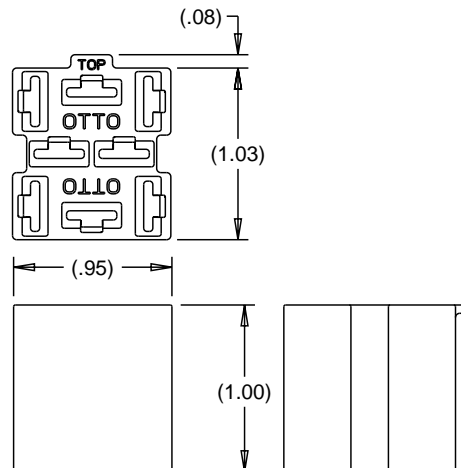
**Connector Color**

- 01. Red
- 02. Black
- 03. Orange\*
- 04. Yellow\*
- 05. Green\*
- 06. Blue\*
- 07. Violet\*
- 08. Gray\*
- 09. White

\* Contact Factory

**Packaging Quantity**

- 0025 - 25 Pcs per Package
- 0050 - 50 Pcs per Package
- 0100 - 100 Pcs per Package



SNAP-IN PANEL MOUNTING, ON-ON-ON MAINTAINED ACTION, 1 AND 2 POLES

The industry's smallest ON-ON-ON triple throw rocker switch is a sealed, logic level switch offering 1M cycle life in a short, snap-in package. Available in both single and double pole configurations, with maintained action, this ON-ON-ON rocker is perfect for use as a Forward-Neutral-Reverse (FNR) switch. The double pole version offers redundancy for each switch state providing increased safety. Termination options include a Molex connector or wire leads.

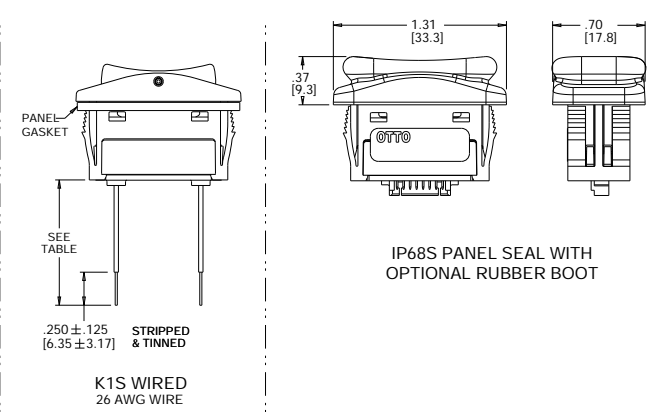
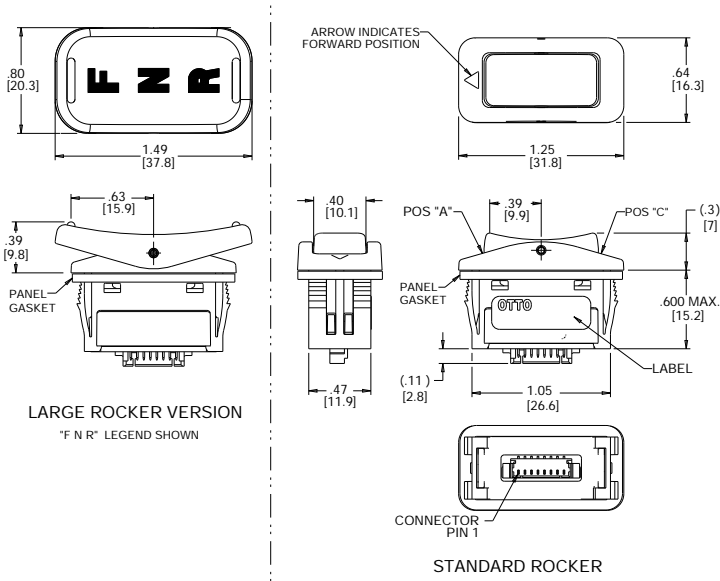
The K1S contact system is sealed to IP68S and uses a flow-thru design. With an optional boot, the switch is panel sealed to IP68S. The rugged K1S is shorter behind panel than OTTO's K1 rocker series, making it an ideal choice for use in grips and panels. The K1S also consists of two rocker button style/size options for best user comfort. Only one panel opening size is required, regardless of button size. Choose from a set of 73 standard legend choices which are offered with both normal and large-size rocker top styles, or add a custom logo, lettering or legend.

## Features:

- Shorter behind panel depth
- High cycle life, 1,000,000 cycles
- Maintained action
- Single or double pole, ON-ON-ON triple throw switch
- Switch contacts sealed to IP68S (panel sealed to IP68S with optional rubber boot for standard rocker only)
- Logic level only
- 2 sizes of rocker styles, standard and large
- 2 termination types, connector and wire leads
- Choose from 73 standard legends per SAE or create your own
- RoHS compliant



Standard Characteristics/Ratings:	
<b>ELECTRICAL:</b>	
Electrical Ratings:	10mA @ 5VDC max. Logic Level
Electrical Life:	1,000,000 cycles
Max Power:	0.5 VA
Max Voltage:	32VDC
Min Voltage:	20mV
Max Current:	50mA
Min Current:	1mA
DWV:	250 Vrms
<b>MECHANICAL:</b>	
Mechanical Life:	1,000,000 cycles
Switch Contact Seal:	IP68S (Panel Seal IP68S with Optional Boot)
<b>ENVIRONMENTAL:</b>	
Temperature Range:	-40°C to +85°C
<b>MATERIALS:</b>	
Base:	Black Thermoplastic
Button:	Black Thermoplastic
Bezel:	Black Thermoplastic
Wire:	26 AWG UL 11028 Wire
Gasket:	EPDM





SNAP-IN PANEL MOUNTING, ON-ON-ON MAINTAINED ACTION, 1 AND 2 POLES

WIRED CIRCUIT DIAGRAM	K1SE_H _ _ _ _ _
	<p style="text-align: center;">SPTT - ON-ON-ON WIRED SCHEMATIC</p>
CONNECTOR CIRCUIT DIAGRAM	K1SE_T _ _ _ _ _
	<p style="text-align: center;">DPTT - ON-ON-ON WIRED SCHEMATIC</p>
CONNECTOR CIRCUIT DIAGRAM	K1SB_H _ _ _ _ _
	<p style="text-align: center;">SPTT - ON-ON-ON SCHEMATIC W/CONNECTOR PIN OUT</p>
CONNECTOR CIRCUIT DIAGRAM	K1SB_T _ _ _ _ _
	<p style="text-align: center;">DPTT - ON-ON-ON SCHEMATIC W/CONNECTOR PIN OUT</p>



# SEALED, ILLUMINATED ROCKER SWITCHES

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

Sealed to IP68S and IP69K, the OTTO K3 rocker switch is a quality, precision switch designed to comply with standards established for appliance, marine (ignition protection) and off-road vehicles along with other demanding applications where rugged rocker switches are required.

K3 sealed rocker switches snap into industry-standard panel cutouts. Choose illuminated and printed legends, thru-panel drain option and switching compatibility from logic level to 20 amps.

The K3 offers a choice of LED, incandescent and neon illumination. Legends can be stamped onto a non-illuminated button, stamped onto an illuminated lens or laser etched into the lens and backlit.

Available in standard and logic level contact ratings, the K3 rockers will fit a wide range of applications. Expect a minimum of 25,000 cycles at a full rated load of 20 amps resistive or 15 amps inductive. 100,000 cycles mechanical. A full complement of switch operation is available including momentary and maintained action in 2 or 3-position switches in SPST, SPDT, SPTT, DPST and DPDT circuit arrangements.

OTTO can provide custom colors upon request. Value-added assemblies with wire leads are also available. Please consult the factory for assistance.

## Features:

- Sealed watertight per IP68S and IP69K
- Snap-in panel mounting into industry standard panel cutout
- Optional panel seal gasket
- Thru-panel drain option
- LED, neon & incandescent lighting
- 0.250" Quick Connect terminals
- Optional one-piece connector
- Optional terminal barriers
- Logic level up to 20 amp switch
- Configurable Single Pole Triple Throw (SPTT) with external jumpers
- RoHS compliant



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>		
Load	Sea Level @ 12/28VDC	Sea Level @ 125VAC, 60Hz
Resistive	20A	16A
Inductive	15A	15A
Lamp	5A	5A
Motor	0.5HP @ 110VAC	
DWV	1050Vrms except across light terminals	
Logic Level	10mA @ 5VDC, max D.C. logic level ratings (void if logic level load(s) exceeded at any time)	
<b>Electrical Life:</b>	25,000 cycles	
<b>LIGHTING:</b>		
<b>Light Source</b>	Rating (see appendix for complete voltage/current ratings table)	
Incandescent	(VDC) 6V, 12V, 24V	
Neon	(VAC) 125V, 250V	
LED	(VDC) 2V, 6V, 12V, 24V	
<b>Mechanical Life:</b>	100,000 cycles	
<b>Seal:</b>	IP68S and IP69K	
<b>Operating Temp Range:</b>	-40°C to +85°C	
<b>MATERIALS:</b>		
<b>Case:</b>	Thermoplastic, black	
<b>Button:</b>	Thermoplastic	
<b>Terminals/Contact:</b>	Brass, silver alloy with silver plate, gold flash for logic level	
<b>Terminal Hardware:</b>	K3 series recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG	
<b>Mounting Hardware:</b>	None provided	

# SEALED, ILLUMINATED ROCKER SWITCHES

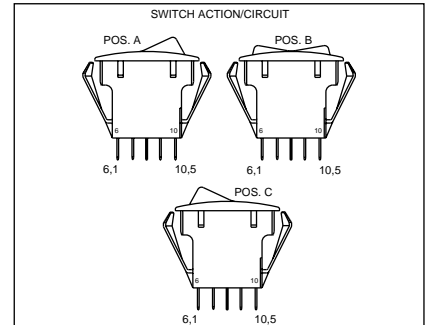
## K3 SERIES PART NUMBER CODE

Part Number Code Continued Below

<b>K3</b>	<b>X</b>	<b>X</b>	<b>XX</b>	<b>X</b>	<b>X</b>																																																																																				
<b>Base Options</b>		<b>Case Style/Button Color</b>		<b>Switch Action/Circuit</b>																																																																																					
<p><b>A.</b> With Keying Pin Only Standard Rating Silver Plate</p> <p><b>B.</b> Without Barriers or Pin Standard Rating Silver Plate</p> <p><b>C.</b> With Terminal Barriers Only Standard Rating Silver Plate</p> <p><b>D.</b> With Keying Pin Only Logic Level Rating Gold Plate</p> <p><b>E.</b> Without Barriers or Pin Logic Level Rating Gold Plate</p> <p><b>F.</b> With Terminal Barriers Only Logic Level Rating Gold Plate</p> <p><b>G.</b> With Keying Pin Only Standard Rating No Plate</p> <p><b>H.</b> Without Barriers or Pin Standard Rating No Plate</p> <p><b>J.</b> With Terminal Barriers Only Standard Rating No Plate</p>		<p><b>A.</b> Case With Drain Holes Button Color: Black</p> <p><b>B.</b> Case Without Drain Holes Button Color: Black</p> <p><b>C.</b> Case With Drain Holes Button Color: Red</p> <p><b>D.</b> Case Without Drain Holes Button Color: Red</p> <p><b>E.</b> Case With Drain Holes Button Color: White</p> <p><b>F.</b> Case Without Drain Holes Button Color: White</p> <p>NOTE: Switch case is black for all options below:</p> <p><b>1.</b> Case With Drain Holes Button Not Included</p> <p><b>2.</b> Case Without Drain Holes Button Not Included</p>		<table border="0"> <tr> <td style="text-align: center;"><b>Position "A"</b></td> <td style="text-align: center;"><b>Position "B"</b></td> <td style="text-align: center;"><b>Position "C"</b></td> <td style="text-align: center;"><b>Circuit</b></td> </tr> <tr> <td><b>1A.</b> 3-4</td> <td>NONE</td> <td>OFF</td> <td>SPST</td> </tr> <tr> <td><b>2A.</b> 3-4/8-9</td> <td>NONE</td> <td>OFF</td> <td>DPST</td> </tr> <tr> <td><b>1B.</b> 3-4</td> <td>NONE</td> <td>3-2</td> <td>SPDT</td> </tr> <tr> <td><b>2B.</b> 3-4/8-9</td> <td>NONE</td> <td>3-2/8-7</td> <td>DPDT</td> </tr> <tr> <td><b>1C.</b> (3-4)</td> <td>NONE</td> <td>OFF</td> <td>SPST</td> </tr> <tr> <td><b>2C.</b> (3-4)/(8-9)</td> <td>NONE</td> <td>OFF</td> <td>DPST</td> </tr> <tr> <td><b>1D.</b> (3-4)</td> <td>NONE</td> <td>3-2</td> <td>SPDT</td> </tr> <tr> <td><b>2D.</b> (3-4)/(8-9)</td> <td>NONE</td> <td>3-2/8-7</td> <td>DPDT</td> </tr> <tr> <td><b>1E.</b> (3-4)</td> <td>OFF</td> <td>(3-2)</td> <td>SPDT</td> </tr> <tr> <td><b>2E.</b> (3-4)/(8-9)</td> <td>OFF</td> <td>(3-2)/(8-7)</td> <td>DPDT</td> </tr> <tr> <td><b>1F.</b> 3-4</td> <td>OFF</td> <td>3-2</td> <td>SPDT</td> </tr> <tr> <td><b>2F.</b> 3-4/8-9</td> <td>OFF</td> <td>3-2/8-7</td> <td>DPDT</td> </tr> <tr> <td><b>1G.</b> (3-4)</td> <td>OFF</td> <td>3-2</td> <td>SPDT</td> </tr> <tr> <td><b>2G.</b> (3-4)/(8-9)</td> <td>OFF</td> <td>3-2/8-7</td> <td>DPDT</td> </tr> </table>		<b>Position "A"</b>	<b>Position "B"</b>	<b>Position "C"</b>	<b>Circuit</b>	<b>1A.</b> 3-4	NONE	OFF	SPST	<b>2A.</b> 3-4/8-9	NONE	OFF	DPST	<b>1B.</b> 3-4	NONE	3-2	SPDT	<b>2B.</b> 3-4/8-9	NONE	3-2/8-7	DPDT	<b>1C.</b> (3-4)	NONE	OFF	SPST	<b>2C.</b> (3-4)/(8-9)	NONE	OFF	DPST	<b>1D.</b> (3-4)	NONE	3-2	SPDT	<b>2D.</b> (3-4)/(8-9)	NONE	3-2/8-7	DPDT	<b>1E.</b> (3-4)	OFF	(3-2)	SPDT	<b>2E.</b> (3-4)/(8-9)	OFF	(3-2)/(8-7)	DPDT	<b>1F.</b> 3-4	OFF	3-2	SPDT	<b>2F.</b> 3-4/8-9	OFF	3-2/8-7	DPDT	<b>1G.</b> (3-4)	OFF	3-2	SPDT	<b>2G.</b> (3-4)/(8-9)	OFF	3-2/8-7	DPDT	<p><b>Light Source Type*</b></p> <p><b>A.</b> No Illumination <b>B.</b> 6V Incandescent <b>C.</b> 12V Incandescent <b>D.</b> 24V Incandescent <b>E.</b> 125VAC Neon <b>F.</b> 250VAC Neon <b>G.</b> 2V Red LED <b>H.</b> 2V Green LED <b>J.</b> 2V Amber LED <b>K.</b> 6V Red LED <b>L.</b> 6V Green LED <b>M.</b> 6V Amber LED <b>N.</b> 12V Red LED <b>P.</b> 12V Green LED <b>Q.</b> 12V Amber LED <b>R.</b> 24V Red LED <b>S.</b> 24V Green LED <b>T.</b> 24V Amber LED</p>		<p><b>Light Circuit</b></p> <table border="0"> <tr> <td style="text-align: center;"><b>Circuit</b></td> <td style="text-align: center;"><b>Terminal Connections</b></td> </tr> <tr> <td><b>A.</b> None</td> <td>None</td> </tr> <tr> <td><b>B.</b> Dep. in "A"</td> <td>1(-) &amp; 4(+)</td> </tr> <tr> <td><b>C.</b> Dep. in "C"</td> <td>2(+) &amp; 5(-)</td> </tr> <tr> <td><b>D.</b> Ind. in "A"</td> <td>1(-) &amp; 6(+)</td> </tr> <tr> <td><b>E.</b> Ind. in "C"</td> <td>5(-) &amp; 10(+)</td> </tr> <tr> <td><b>F.</b> Dep. in "A"</td> <td>1(-) &amp; 4(+)</td> </tr> <tr> <td><b>G.</b> Dep. in "C"</td> <td>2(+) &amp; 5(-)</td> </tr> <tr> <td><b>H.</b> Ind. in "A"</td> <td>1(-) &amp; 6(+)</td> </tr> <tr> <td><b>J.</b> Ind. in "C"</td> <td>5(-) &amp; 10(+)</td> </tr> </table> <p>NOTE: Polarity only applies to LED circuits.</p>		<b>Circuit</b>	<b>Terminal Connections</b>	<b>A.</b> None	None	<b>B.</b> Dep. in "A"	1(-) & 4(+)	<b>C.</b> Dep. in "C"	2(+) & 5(-)	<b>D.</b> Ind. in "A"	1(-) & 6(+)	<b>E.</b> Ind. in "C"	5(-) & 10(+)	<b>F.</b> Dep. in "A"	1(-) & 4(+)	<b>G.</b> Dep. in "C"	2(+) & 5(-)	<b>H.</b> Ind. in "A"	1(-) & 6(+)	<b>J.</b> Ind. in "C"	5(-) & 10(+)
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		<b>1J.</b> 3-4/8-9	8-9	NONE	ON/ON/NONE																																																																																				
		<b>1K.</b> (3-4)/(8-9)	8-9	OFF	(ON)/ON/OFF																																																																																				
		<b>1L.</b> (3-4)/(8-9)	8-9	NONE	(ON)/ON/NONE																																																																																				
		<b>1M.</b> 3-4/8-9	3-2/8-9	3-2/8-7	ON/ON/ON																																																																																				
		<b>1N.</b> (3-4)/(8-9)	3-2/8-9	3-2/8-7	(ON)/ON/ON																																																																																				
		<b>1P.</b> (3-4)/(8-9)	3-2/8-9	(3-2)/(8-7)	(ON)/ON/(ON)																																																																																				
		<b>2R.</b> 3-4/8-9	OFF/8-9	OFF/OFF	ON/OFF/OFF																																																																																				
					ON/ON/OFF																																																																																				
		<b>2S.</b> (3-4)/8-9	OFF/8-9	OFF/OFF	(ON)/OFF/OFF																																																																																				
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\*See appendix for complete voltage/current ratings table.

NOTE: ( ) denotes momentary action.



## K3 PART NUMBER CODE - CONTINUED FROM ABOVE

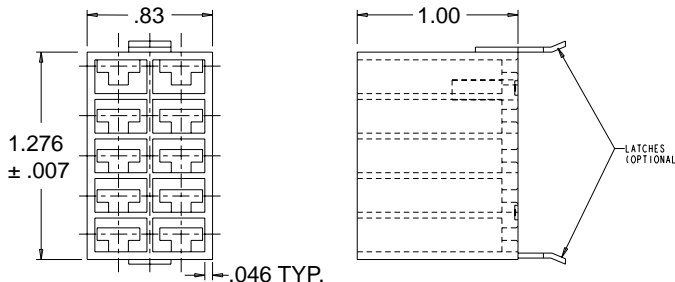
<b>X</b>	<b>X</b>	<b>XX</b>	<b>XX</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Lens Color</b>		<b>Legend Style</b>		<b>Legend Color</b>		<b>Legend Orientation</b>
<b>Position "A"</b>	<b>Position "C"</b>	<b>Position "A"</b>	<b>Position "C"</b>	<b>Position "A"</b>	<b>Position "C"</b>	<b>Position "A"</b> <b>Position "C"</b>
<p><b>1.</b> Transparent Red</p> <p><b>2.</b> Transparent Green</p> <p><b>3.</b> Transparent Amber ①</p> <p><b>4.</b> Clear ①</p> <p><b>5.</b> Translucent White ②</p> <p><b>Z.</b> No Lens ③</p>	<p><b>1.</b> Transparent Red</p> <p><b>2.</b> Transparent Green</p> <p><b>3.</b> Transparent Amber ①</p> <p><b>4.</b> Clear ①</p> <p><b>5.</b> Translucent White ②</p> <p><b>Z.</b> No Lens ③</p>	<p><b>ZZ.</b> No Legend</p>	<p><b>ZZ.</b> No Legend</p>	<p><b>1.</b> Red</p> <p><b>2.</b> Black</p> <p><b>9.</b> White</p> <p><b>B.</b> Backlight/Daylight White ④</p> <p><b>D.</b> Backlight/Deadfront ④</p> <p><b>Z.</b> No Legend</p>	<p><b>1.</b> Red</p> <p><b>2.</b> Black</p> <p><b>9.</b> White</p> <p><b>B.</b> Backlight/Daylight White ④</p> <p><b>D.</b> Backlight/Deadfront ④</p> <p><b>Z.</b> No Legend</p>	<p><b>1.</b> Std.</p> <p><b>2.</b> 90°</p> <p><b>3.</b> 180°</p> <p><b>4.</b> 270°</p>
<p>NOTE: It is not recommended to use green LEDs with translucent white lenses. This will reduce light intensity. Use clear lenses with green LEDs for maximum light intensity.</p> <p>① Recommended for neon lamps.</p> <p>② Special Order: Ultra bright green LED to be used with translucent white lenses.</p> <p>③ Legend colors "B" &amp; "D" are only available on lens color "Z".</p>		<p>NOTE: For all other legend options, refer to the legend table in the appendix, find the two digit code and enter the code in the appropriate position(s).</p>		<p>④ For legend color "B" and "D", please use button color "A" &amp; "B" and lens color "Z" for each position.</p>		

**STOP HERE** for lighted switches without legends.

Example: K3AAIFNH-44

**STOP HERE** for unlighted switches without legends.

Example: K3AAIFAA



**K3 Connector**  
P/N C801775-2A Without Latches  
P/N C801775-2B With Latches

**Panel Seal Gasket**  
P/N C807037-25  
Order separately for use with switches without drain holes.

**Panel Plug**  
See Panel Plug (PP) page.

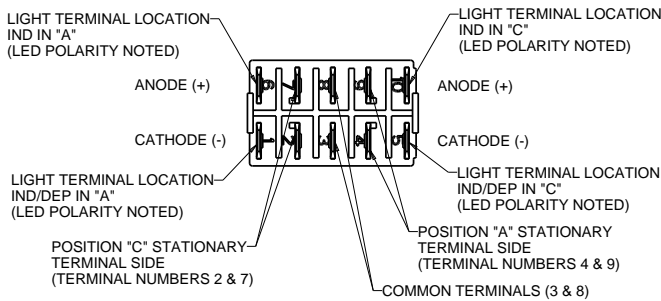
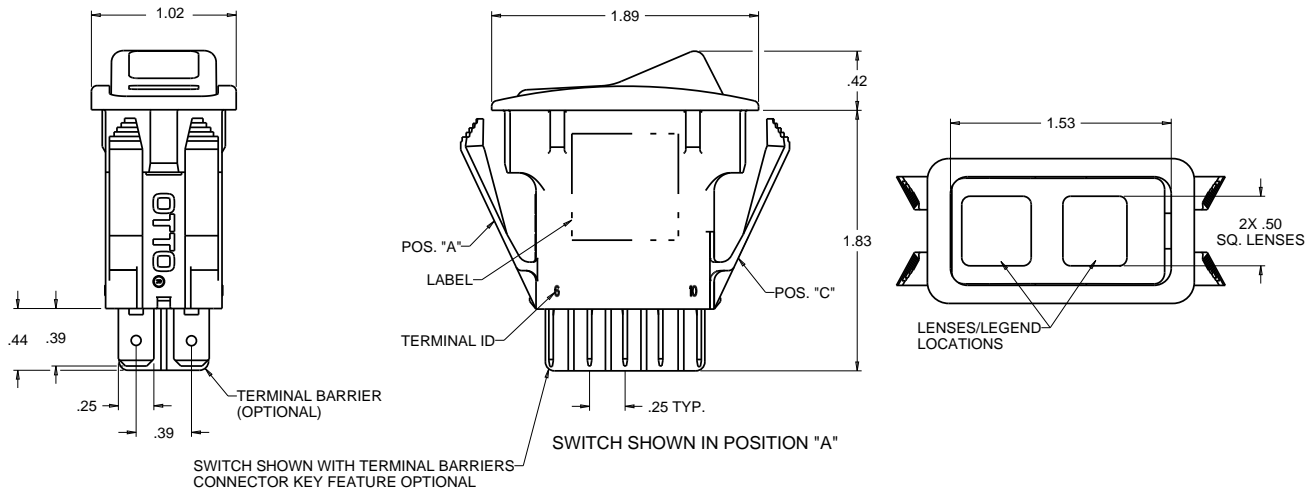
• K3 panel plugs available as shown in Panel Plugs (PP) section.

Recommended Quick Connect Terminals:  
AMP 60253-2 for 12-16 AWG  
AMP 42100-2 for 14-18 AWG

# SEALED, ILLUMINATED ROCKER SWITCHES

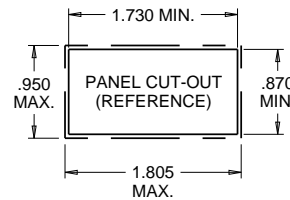
**K3**  
SEALED  
ROCKERS

SNAP-IN PANEL MOUNTING, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS



TERMINAL LOCATIONS AS VIEWED FROM BOTTOM OF SWITCH (CASE REMOVED FOR CLARITY)  
CONTACT MADE IN OPPOSITE DIRECTION OF ROCKER TRAVEL

**MOUNTING OPENING:**  
PANEL THICKNESS RANGE OF .025 - .105 A GASKET IS RECOMMENDED  
PANEL THICKNESS RANGE OF .105 - .187 W/O GASKET  
PANEL OPENING: MIN. TYP. MAX.  
WIDTH .870 .937 .950  
LENGTH 1.730 1.768 1.805



<p>K3...1M... POS "A" POS "B" POS "C"</p> <p>SPECIAL CIRCUIT - ON-ON-ON SCHEMATIC</p>	<p>K3...2A... DPST-ON-NONE-OFF SCHEMATIC</p>	<p>K3...2B... DPDT-ON-NONE-ON SCHEMATIC</p>	<p>K3...2C... DPST-(ON)-NONE-OFF SCHEMATIC</p>	<p>K3...2D... DPDT-(ON)-NONE-ON SCHEMATIC</p>	
<p><b>GENERAL SCHEMATIC INFORMATION</b></p> <ul style="list-style-type: none"> <li>○ INDICATES MAINTAIN ACTION (FIXED POSITION)</li> <li>▼ INDICATES MOMENTARY ACTION (AUTOMATIC RETURN POSITION)</li> </ul> <p><b>FOR OTHER LIGHTING SCHEMATICS REPLACE FOLLOWING SYMBOLS:</b></p> <ul style="list-style-type: none"> <li>Ⓜ INCANDESCENT (REPLACE RESISTOR &amp; LED)</li> <li>Ⓝ NEON (REPLACE LED)</li> </ul>	<p>K3...2E... DPDT-(ON)-OFF-(ON) SCHEMATIC</p>	<p>K3...2F... DPDT-ON-OFF-ON SCHEMATIC</p>	<p>K3...2G... DPDT-(ON)-OFF-ON SCHEMATIC</p>	<p>K3...2BNB-Z DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A"</p>	<p>K3...2BNC-Z DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "C"</p>
<p>K3...2BND-Z DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A"</p>	<p>K3...2BNE-Z DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "C"</p>	<p>K3...2BNF... DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A" &amp; "C"</p>	<p>K3...2BNG... DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A" &amp; INDEPENDENT LED IN "C"</p>	<p>K3...2BNH... DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A" &amp; DEPENDENT LED IN "C"</p>	<p>K3...2BNJ... DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A" &amp; "C"</p>

SNAP-IN PANEL MOUNTING, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

Sealed to IP68S, the K3P series of panel plugs with LED indicator lights provides reliable visual feedback to control operators. The K3P panel plugs and OTTO's K3 rocker switches share the same panel cutout size and snap-in front panel mounting method. This allows you to create a uniform panel appearance in your applications. Choose up to 70 different standard legends, 6 lens colors, 5 legend colors and 4 LED colors with 4 voltage options.



Standard Characteristics/Ratings:	
Seal:	IP68S
Operating Temp Range:	-40°C to +85°C
<b>MATERIALS:</b>	
Case and Base:	Black Thermoplastic
Button:	Black Thermoplastic
Terminals:	Brass Alloy

### K3P PART NUMBER CODE

<b>K3P</b>	-	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Light Source Position "A"</b>		<b>Light Source Position "C"</b>		<b>Lens Color Position "A"</b>		<b>Lens Color Position "C"</b>
1. Red 2. Green 3. Amber 4. Blue Z. No Illumination		1. Red 2. Green 3. Amber 4. Blue Z. No Illumination		1. Transparent Red 2. Transparent Green 3. Transparent Amber 4. Clear 5. Translucent White 6. Transparent Blue Z. No Lens		1. Transparent Red 2. Transparent Green 3. Transparent Amber 4. Clear 5. Translucent White 6. Transparent Blue Z. No Lens
						<b>LED DC Voltage*</b>
						1. 2V 2. 6V 3. 12V 4. 24V

**STOP HERE** for lighted indicator without legends.

For legends, continue with part number code below.

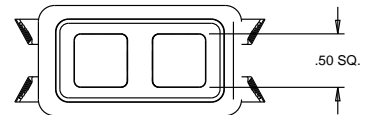
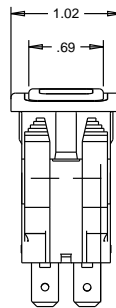
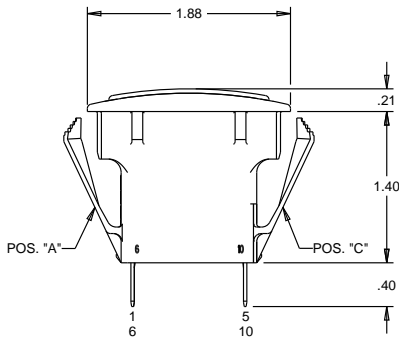
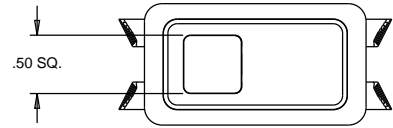
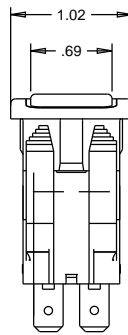
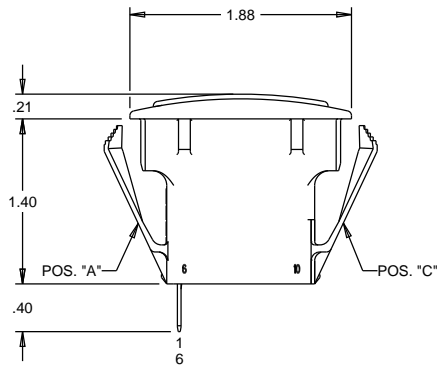
\*See appendix for complete voltage/current ratings table.

### K3P PART NUMBER CODE - CONTINUED FOR LIGHTED INDICATORS WITH LEGENDS

-	<b>XX</b>	<b>XX</b>	<b>X</b>	<b>X</b>	<b>X</b>								
	<b>Legend Style</b>		<b>Legend Color</b>		<b>Legend Orientation</b>								
	<b>Position "A"</b>	<b>Position "C"</b>	<b>Position "A"</b>	<b>Position "C"</b>	<b>Position "A"</b>								
	ZZ. No Legend	ZZ. No Legend	1. Red 2. Black 9. White B. Backlight/ Daylight White ① D. Backlight/ Deadfront ① Z. No Legend	1. Red 2. Black 9. White B. Backlight/ Daylight White ① D. Backlight/ Deadfront ① Z. No Legend	1. Std. 2. 90° 3. 180° 4. 270°								
					<table border="1"> <tr> <td>A</td> <td>C</td> </tr> <tr> <td>A</td> <td>C</td> </tr> <tr> <td>A</td> <td>C</td> </tr> <tr> <td>A</td> <td>C</td> </tr> </table>	A	C	A	C	A	C	A	C
A	C												
A	C												
A	C												
A	C												
			① Legend colors "B" and "D" use lens color "Z" for each position.										

# PANEL PLUG WITH INDICATOR LIGHTS

SNAP-IN PANEL MOUNTING, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS



**MOUNTING OPENING:**

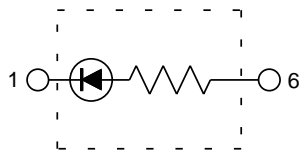
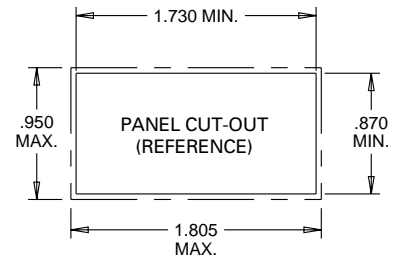
PANEL THICKNESS RANGE OF .025 - .105 PANEL SEAL GASKET P/N C807037-25 IS RECOMMENDED

PANEL THICKNESS RANGE OF .105 - .187 W/O GASKET

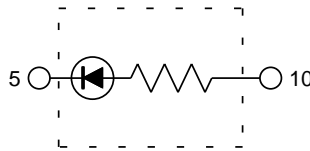
PANEL OPENING: MIN. TYP. MAX.

WIDTH .870 .937 .950

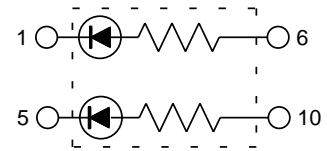
LENGTH 1.730 1.768 1.805



**IND. LIGHT IN "A"  
 SCHEMATIC**



**IND. LIGHT IN "C"  
 SCHEMATIC**



**DUAL IND. LIGHT  
 SCHEMATIC**

LOW COST, SNAP-IN TOGGLE FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES

The K4 series snap-in toggle switches are rugged, high performance sealed switches designed for use under severe conditions found in marine, appliance, heavy equipment and industrial control applications. They are totally sealed to IP68S and IP69K so the switch can withstand direct water spray and submersion. With the optional panel seal gasket, the K4 is also panel sealed.

The K4 series is offered in single and double pole configurations. Toggle action includes 2 and 3-position, momentary and maintained operation in a combination of 13 variations.

Mounting is simple and quick; snaps into panel from the front. The OTTO snap-in design supports a variety of panel thicknesses with just one cutout size specified.

Existing unsealed applications are easily upgraded to sealed functionality because the K series drops into existing panel cutouts.

A choice of models are offered to handle current from 16 amps to logic level electronic switching levels.

## Features:

- Withstands direct water spray
- Sealed to IP68S and IP69K
- Fits industry standard panel openings for drop-in replacement of panel sealed & unsealed switches
- Snap-in feature accommodates a wide range of panel cutouts
- Switches up to 16 amps
- UV & solvent resistant
- Withstands extreme shock & vibration
- Legends & illuminated function indicators available
- 2 & 3-position, momentary, maintained action & center OFF
- RoHS compliant



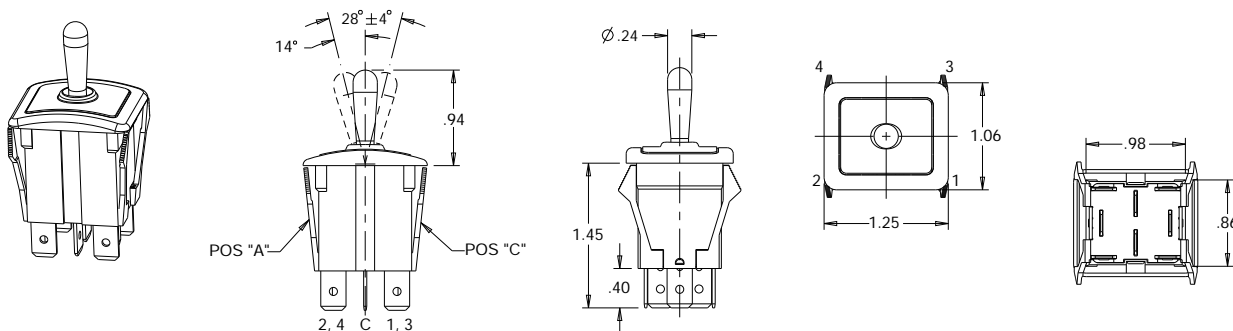
Single & Double Pole

LED, Neon or  
Incandescent Illumination

Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
Load	Sea Level @ 28VDC	Sea Level @125VAC, 60Hz	Cycles
Resistive	16A	5A	25,000
Resistive	10A	N/A	50,000
Inductive	7A	2A	25,000
DWV	1000Vrms except across light terminals		
Logic Level	10mA @ 5VDC, max D.C. logic level ratings 100,000 (void if logic level load(s) exceeded at any time)		
<b>Electrical Life:</b>	See Rating Chart		
<b>LIGHTING:</b>			
Light Source	Rating		
Incandescent	(VDC) 6V, 12V, 24V		
Neon	(VAC) 125V, 250V		
LED	(VDC) 2V, 6V, 12V, 24V		
<b>Mechanical Life:</b>	100,000 cycles		
<b>Seal:</b>	IP68S and IP69K		
<b>Operating Temp Range:</b>	-30°C to +85°C		
<b>MATERIALS:</b>			
<b>Case:</b>	Thermoplastic		
<b>Toggle:</b>	Stainless steel		
<b>Terminals/Contact:</b>	Brass, silver alloy with silver plate, gold plate for logic level		
<b>Terminal Hardware:</b>	Screws and lockwashers provided when applicable K4 series recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG		
<b>Mounting Hardware:</b>	None provided		

# SEALED, ILLUMINATED SNAP-IN TOGGLE

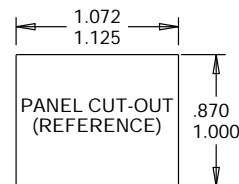
LOW COST, SNAP-IN TOGGLE FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES



**PANEL THICKNESS AND MOUNTING OPENING GUIDELINES:**

PANEL THICKNESS RANGE OF .025 - .105 (GASKET RECOMMENDED)  
 PANEL THICKNESS RANGE OF .105 - .187 (GASKET NOT REQUIRED)

TERMINAL STYLES (.032 THICK)			
SCREW	QUICK CONNECT	SOLDER	P.C. PIN
#6-32 THD Ø.25	Ø.08 Ø.25	Ø.11 Ø.25	.030 SQ. Ø.10 Ø.25

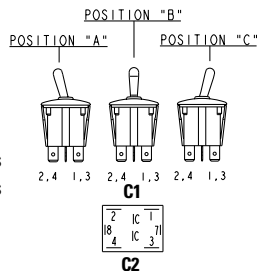


## K4 SERIES PART NUMBER CODE

<b>K4</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	
<b>Terminal Style/ Switch Rating</b>	<b>Rocker Style</b>	<b>Switch Action/Circuit</b>			<b>Light Type*</b>	<b>Lens Color</b>		<b>Light/Circuit Location</b>	<b>Legend &amp; Orientation</b>
<b>A.</b> Quick Connect/ Standard	<b>A.</b> Bat Handle	<b>Position "A"</b>	<b>Position "B"</b>	<b>Position "C"</b>	<b>Circuit</b>	<b>Position "A"</b>	<b>Position "B"</b>	<b>A.</b> No Light	<b>A.</b> No Legend
<b>B.</b> Screw/Standard		<b>A.</b> 1-C1	<b>NONE</b>	<b>OFF</b>	<b>SPST</b>	<b>A.</b> No Lens	<b>A.</b> No Lens	<b>B.</b> Dependent Light ON in position "A" Wired to terms 1 & 7	<b>B.</b> ?
<b>C.</b> Solder/Standard		<b>B.</b> 1-C1	<b>NONE</b>	<b>2-C1</b>	<b>SPDT</b>	<b>B.</b> Red	<b>B.</b> Red	<b>C.</b> Dependent Light ON in position "A" Wired to terms 1 & 7	<b>C.</b> ?
<b>D.</b> Quick Connect/ Logic Level		<b>C.</b> (1-C1)	<b>NONE</b>	<b>OFF</b>	<b>SPST</b>	<b>C.</b> Green	<b>C.</b> Green	<b>D.</b> Independent Light at position "A" Wired to terms 2 & 8	<b>D.</b> ON
<b>E.</b> Screw/Logic Level		<b>D.</b> (1-C1)	<b>NONE</b>	<b>2-C1</b>	<b>SPDT</b>	<b>D.</b> Amber	<b>D.</b> Amber	<b>E.</b> Independent Light at position "C" Wired to terms 7 & 8	<b>E.</b> OFF
<b>F.</b> Solder/Logic Level		<b>E.</b> (1-C1)	<b>OFF</b>	<b>(2-C1)</b>	<b>SPDT</b>	<b>E.</b> Clear	<b>E.</b> Clear	<b>F.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>F.</b> ON
<b>G.</b> P.C. Pin/Standard		<b>F.</b> 1-C1	<b>OFF</b>	<b>2-C1</b>	<b>DPDT</b>			<b>G.</b> Independent Light at position "C" Wired to terms 2 & 8	<b>G.</b> ON
<b>H.</b> P.C. Pin/Logic Level		<b>G.</b> (1-C1)	<b>OFF</b>	<b>2-C1</b>	<b>DPDT</b>			<b>H.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>H.</b> ON
		<b>H.</b> 1-C1/3-C2	<b>NONE</b>	<b>OFF</b>	<b>DPST</b>			<b>I.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>I.</b> ON
		<b>J.</b> 1-C1/3-C2	<b>NONE</b>	<b>2-C1/4-C2</b>	<b>DPDT</b>			<b>J.</b> Independent Light at position "C" Wired to terms 2 & 8	<b>J.</b> ON
		<b>K.</b> (1-C1)/(3-C2)	<b>NONE</b>	<b>OFF</b>	<b>DPST</b>			<b>K.</b> Independent Light at position "A" Wired to terms 3 & 7	<b>K.</b> ?
		<b>L.</b> (1-C1)/(3-C2)	<b>NONE</b>	<b>2-C1/4-C2</b>	<b>DPDT</b>			<b>L.</b> Independent Light at position "C" Wired to terms 4 & 8	<b>L.</b> ?
		<b>M.</b> (1-C1)/(3-C2)	<b>OFF</b>	<b>(2-C1)/(4-C2)</b>	<b>DPDT</b>			<b>M.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>M.</b> OFF
		<b>N.</b> 1-C1/3-C2	<b>OFF</b>	<b>2-C1/4-C2</b>	<b>DPDT</b>			<b>N.</b> Independent Light at position "C" Wired to terms 2 & 8	<b>N.</b> OFF
		<b>P.</b> (1-C1)/(3-C2)	<b>OFF</b>	<b>2-C1/4-C2</b>	<b>DPDT</b>			<b>O.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>O.</b> ON
								<b>P.</b> Independent Light at position "C" Wired to terms 2 & 8	<b>P.</b> ON
								<b>Q.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>Q.</b> ON
								<b>R.</b> Independent Light at position "C" Wired to terms 2 & 8	<b>R.</b> ON
								<b>S.</b> Independent Light at position "A" Wired to terms 7 & 8	<b>S.</b> ON
								<b>T.</b> Independent Light at position "C" Wired to terms 2 & 8	<b>T.</b> ON

NOTE: Contact factory for panel recommendations on switches with potting cups.

NOTE: ( ) denotes momentary action.



**Optional Panel Gasket:**  
 P/N C807038-25-1 0.062" thickness  
 P/N C807038-25-2 0.031" thickness

**K4 connector P/N C801765**  
 (See Connector page in Hardware & Accessories section)

• K4 panel plugs available as shown in Panel Plugs (PP) section.

## ORDERING INFORMATION

**Example:** K4AAKEEABA specifies Q.C. terminals, standard rating; bat handle; DPST two position momentary ON, maintained OFF; 125VAC neon light; clear lens in positions "A", no lens in position "C"; dependent light ON in position "A", wired to terminals 1 & 7; no legend.

\*See Appendix for complete voltage/current ratings table.

- NOTES:**
- No momentary switches with dependent lights.
  - Neon lamps only to be coded with clear or amber lenses.
  - LED lenses must be clear or same color as LED.
  - No legends on lamp side of switch.
  - No dependent light in OFF positions.
  - All legends printed on actuators without lens(es) will be white except actuator codes C, F, J, M & R.
  - All legends printed on lenses will be white except on clear lens(es) will be black.

NOTE: LED anode (+) terminal number shown in **bold**.

**D** = Dependent Light  
**I** = Independent Light

① All legends are white. Legend cannot be on the same side as the lens.

## K4 SCHEMATICS

<p>K4_A_A_A SPST - ON-NONE-OFF SCHEMATIC</p>	<p>K4_B_A_A SPDT - ON-NONE-ON SCHEMATIC</p>	<p>K4_C_A_A SPST - (ON)-NONE-OFF SCHEMATIC</p>	<p>K4_D_A_A SPDT - (ON)-NONE-ON SCHEMATIC</p>	<p>K4_E_A_A SPDT - (ON)-OFF-(ON) SCHEMATIC</p>	<p>K4_F_A_A SPDT - ON-OFF-ON SCHEMATIC</p>
<p>K4_G_A_A SPDT - (ON)-OFF-ON SCHEMATIC</p>	<p>K4_H_A_A DPST - ON-NONE-OFF SCHEMATIC</p>	<p>K4_J_A_A DPDT - ON-NONE-ON SCHEMATIC</p>	<p>K4_K_A_A DPST - (ON)-NONE-OFF SCHEMATIC</p>	<p>K4_L_A_A DPDT - (ON)-NONE-ON SCHEMATIC</p>	<p>K4_M_A_A DPDT - (ON)-OFF-(ON) SCHEMATIC</p>
<p>K4_N_A_A DPDT - ON-OFF-ON SCHEMATIC</p>	<p>K4_P_A_A DPDT - (ON)-OFF-ON SCHEMATIC</p>	<p>GENERAL SCHEMATIC INFORMATION</p> <p>○ INDICATES MAINTAIN ACTION (FIXED POSITION)</p> <p>◀ INDICATES MOMENTARY ACTION (AUTOMATIC RETURN POSITION)</p>		<p>K4_F_B SPDT - ON-OFF-ON SCHEMATIC W/DEP LED IN 'A'</p>	<p>K4_F_C SPDT - ON-OFF-ON SCHEMATIC W/DEP LED IN 'C'</p>
<p>K4_F_D SPDT - ON-OFF-ON SCHEMATIC W/IND LED IN 'A'</p>	<p>K4_F_E SPDT - ON-OFF-ON SCHEMATIC W/IND LED IN 'C'</p>	<p>K4_F_F SPDT - ON-OFF-ON SCHEMATIC W/DEP LED IN 'A' &amp; 'C'</p>	<p>K4_F_G SPDT - ON-OFF-ON SCHEMATIC W/DEP LED IN 'A' &amp; IND LED IN 'C'</p>	<p>K4_F_H SPDT - ON-OFF-ON SCHEMATIC W/IND LED IN 'A' &amp; DEP LED IN 'C'</p>	<p>K4_F_J SPDT - ON-OFF-ON SCHEMATIC W/IND LED IN 'A' &amp; IND LED IN 'C'</p>
<p>K4_F_B SPDT - ON-OFF-ON SCHEMATIC W/DEP NEON BULB IN 'A'</p>	<p>K4_F_C SPDT - ON-OFF-ON SCHEMATIC W/DEP NEON BULB IN 'C'</p>	<p>K4_F_D SPDT - ON-OFF-ON SCHEMATIC W/IND NEON BULB IN 'A'</p>	<p>K4_F_E SPDT - ON-OFF-ON SCHEMATIC W/IND NEON BULB IN 'C'</p>	<p>K4_F_F SPDT - ON-OFF-ON SCHEMATIC W/DEP NEON BULB IN 'A' &amp; 'C'</p>	<p>K4_F_G SPDT - ON-OFF-ON SCHEMATIC W/DEP NEON IN 'A' &amp; IND NEON IN 'C'</p>
<p>K4_F_H SPDT - ON-OFF-ON SCHEMATIC W/IND NEON IN 'A' &amp; DEP NEON IN 'C'</p>	<p>K4_F_J SPDT - ON-OFF-ON SCHEMATIC W/IND NEON IN 'A' &amp; IND NEON IN 'C'</p>	<p>K4_F_B SPDT - ON-OFF-ON SCHEMATIC W/DEP BULB IN 'A'</p>	<p>K4_F_C SPDT - ON-OFF-ON SCHEMATIC W/DEP BULB IN 'C'</p>	<p>K4_F_D SPDT - ON-OFF-ON SCHEMATIC W/IND BULB IN 'A'</p>	
<p>K4_F_E SPDT - ON-OFF-ON SCHEMATIC W/IND BULB IN 'C'</p>	<p>K4_F_F SPDT - ON-OFF-ON SCHEMATIC W/DEP BULB IN 'A' &amp; 'C'</p>	<p>K4_F_G SPDT - ON-OFF-ON SCHEMATIC W/DEP BULB IN 'A' &amp; IND BULB IN 'C'</p>	<p>K4_F_H SPDT - ON-OFF-ON SCHEMATIC W/IND BULB IN 'A' &amp; DEP BULB IN 'C'</p>	<p>K4_F_J SPDT - ON-OFF-ON SCHEMATIC W/IND BULB IN 'A' &amp; IND BULB IN 'C'</p>	<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE AS LISTED. MUST BE FREE FROM BURRS AND SHARP EDGES</p> <p>TOLERANCES .XX ±.03 .XXX ±.010 ANGLES ±2° DO NOT SCALE DRAWING</p>



# SEALED, ILLUMINATED ROCKER SWITCHES

**K5**  
SEALED  
ROCKERS

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The OTTO K5 series is a quality, precision switch designed to comply with standards established for appliance, marine (ignition protection) and off-road vehicles along with other demanding applications where rugged rocker switches are required.

K5 series sealed rocker switches snap into industry-standard panel cutouts. Choose illuminated and printed legends, thru-panel drain option and switching compatibility from logic level up to 20 amps.

The K5 series offers a choice of LED, incandescent and neon illumination. Legends can be stamped onto a non-illuminated button, stamped onto an illuminated lens or laser etched into the lens and backlit.

Available in standard and logic level contact ratings, the K5 rockers will fit a wide range of applications. Expect a minimum of 25,000 cycles at a full rated load of 20 amps resistive or 15 amps inductive. 100,000 cycles mechanical. A full complement of switch operation is available including momentary and maintained action in 2 or 3-position switches in SPST, SPDT, SPTT, DPST and DPDT circuit arrangements.

OTTO can provide custom colors upon request. Value-added assemblies with wire leads are also available. Please consult the factory for assistance.

## Features:

- Sealed watertight per IP68S and IP69K
- Snap-in panel mounting into industry standard panel cutout
- Optional panel seal gasket
- LED, neon & incandescent lighting
- 0.250" Quick Connect terminals
- Optional one-piece connector
- Optional terminal barriers
- Logic level up to 20 amp switch
- Configurable Single Pole Triple Throw (SPTT) with external jumpers
- Soft Touch button available
- RoHS compliant



Raised Bars Shown

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC	Sea Level @ 125VAC, 60/400Hz
Resistive	20A	16A
Inductive	15A	15A
Lamp	5A	5A
Motor	0.5HP @ 110VAC	
DWV	1000Vrms except across light terminals	
Logic Level	10mA @ 5VDC, max D.C. logic level ratings (void if logic level load(s) exceeded at any time)	

**Electrical Life:** 25,000 cycles

#### LIGHTING:

Light Source	Rating
Incandescent	(VDC) 6V, 12V, 24V
Neon	(VAC) 125V, 250V
LED	(VDC) 2V, 6V, 12V, 24V

**Mechanical Life:** 100,000 cycles

**Seal:** IP68S and IP69K

**Operating Temp Range:** -40°C to +85°C

#### MATERIALS:

<b>Case:</b>	Thermoplastic
<b>Button:</b>	Thermoplastic
<b>Terminals/Contact:</b>	Brass, silver alloy with silver plate, gold flash for logic level
<b>Terminal Hardware:</b>	K5 series recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG
<b>Mounting Hardware:</b>	None provided

# SEALED, ILLUMINATED ROCKER SWITCHES

## SNAP-IN PANEL MOUNTING

### K5 SERIES PART NUMBER CODE

**K5**      **X**      **X**  
Base Options      Rocker Color\*/Style

- A. With Keying Pin Only  
Standard Rating  
Silver Plate
- B. Without Barriers or Pin  
Standard Rating  
Silver Plate
- C. With Terminal  
Barriers Only  
Standard Rating  
Silver Plate
- D. With Keying Pin Only  
Logic Level Rating  
Gold Plate
- E. Without Barriers or Pin  
Logic Level Rating  
Gold Plate
- F. With Terminal  
Barriers Only  
Logic Level Rating  
Gold Plate
- G. With Keying Pin Only  
Standard Rating  
No Plate
- H. Without Barrier or Pin  
Standard Rating  
No Plate
- J. With Terminal  
Barriers Only  
Standard Rating  
No Plate

Rocker Color\*/Style

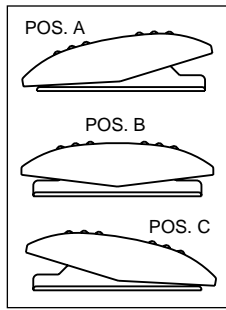
- A. Black Plastic Rocker
- B. Black "Soft Touch" Rocker
- C. Red Plastic Rocker
- D. Red "Soft Touch" Rocker
- E. White Plastic Rocker
- F. White "Soft Touch" Rocker
- H. Green Plastic Rocker
- J. Orange Plastic Rocker
- K. Blue Plastic Rocker
- L. Gray "Soft Touch" Rocker
- M. Gray Plastic Rocker

\*Additional colors available.  
Contact factory.

Rocker Features

- | Position "A"       | Position "C"       |
|--------------------|--------------------|
| 1. No Feature      | 1. No Feature      |
| 2. Lens            | 2. Lens            |
| 3. Raised Bars     | 3. Raised Bars     |
| 4. Raised Lit Bars | 4. Raised Lit Bars |

NOTE: Raised Lit Bars are available with the Soft Touch rocker styles. Soft Touch rockers require same color lenses/lit bars for both positions.



Switch Action/Circuit

	Position "A"	Position "B"	Position "C"	Circuit
1A.	3-4	NONE	OFF	SPST
2A.	3-4/8-9	NONE	OFF	DPST
1B.	3-4	NONE	3-2	SPDT
2B.	3-4/8-9	NONE	3-2/8-7	DPDT
1C.	(3-4)	NONE	OFF	SPST
2C.	(3-4)/(8-9)	NONE	OFF	DPST
1D.	(3-4)	NONE	3-2	SPDT
2D.	(3-4)/(8-9)	NONE	3-2/8-7	DPDT
1E.	(3-4)	OFF	(3-2)	SPDT
2E.	(3-4)/(8-9)	OFF	(3-2)/(8-7)	DPDT
1F.	3-4	OFF	3-2	SPDT
2F.	3-4/8-9	OFF	3-2/8-7	DPDT
1G.	(3-4)	OFF	3-2	SPDT
2G.	(3-4)/(8-9)	OFF	3-2/8-7	DPDT

Special Circuits

	Position "A"	Position "B"	Position "C"	Special Circuits
1H.	3-4/8-9	8-9	OFF	ON/ON/OFF
1J.	3-4/8-9	8-9	NONE	ON/ON/NONE
1K.	(3-4)/(8-9)	8-9	OFF	(ON)/ON/OFF
1L.	(3-4)/(8-9)	8-9	NONE	(ON)/ON/NONE
1M.	3-4/8-9	3-2/8-9	3-2/8-7	ON/ON/ON
1N.	(3-4)/(8-9)	3-2/8-9	3-2/8-7	(ON)/ON/ON
1P.	(3-4)/(8-9)	3-2/8-9	(3-2)/(8-7)	(ON)/ON/(ON)
2R.	3-4/8-9	OFF/8-9	OFF/OFF	ON/OFF/OFF
2S.	(3-4)/8-9	OFF/8-9	OFF/OFF	(ON)/OFF/OFF

NOTE: ( ) denotes momentary action.

NOTE: All code combinations are not feasible.  
Consult factory for product availability.

Part Number Code Continued Below

**X**      **X**  
Light Source Type\*      Light Circuit

- | Light Source Type*  | Circuit        | Terminal Connections |
|---------------------|----------------|----------------------|
| A. No Illumination  | A. NONE        | NONE                 |
| B. 6V Incandescent  | B. Dep. in "A" | 1(-) & 4(+)          |
| C. 12V Incandescent | C. Dep. in "C" | 2(+) & 5(-)          |
| D. 24V Incandescent | D. Ind. in "A" | 1(-) & 6(+)          |
| E. 125VAC Neon      | E. Ind. in "C" | 5(-) & 10(+)         |
| F. 250VAC Neon      | F. Dep. in "A" | 1(-) & 4(+)          |
| G. 2V Red LED       | G. Dep. in "C" | 2(+) & 5(-)          |
| H. 2V Green LED     | H. Ind. in "A" | 1(-) & 6(+)          |
| J. 2V Amber LED     | J. Dep. in "C" | 2(+) & 5(-)          |
| K. 6V Red LED       | J. Ind. in "A" | 1(-) & 6(+)          |
| L. 6V Green LED     | Ind. in "C"    | 5(-) & 10(+)         |
| M. 6V Amber LED     |                |                      |
| N. 12V Red LED      |                |                      |
| P. 12V Green LED    |                |                      |
| Q. 12V Amber LED    |                |                      |
| R. 24V Red LED      |                |                      |
| S. 24V Green LED    |                |                      |
| T. 24V Amber LED    |                |                      |

NOTE: Polarity only applies to LED circuits.

\*See appendix for complete voltage/ratings table

### K5 PART NUMBER CODE - CONTINUED FROM ABOVE

**X**      **X**  
Lens Color

- | Position "A"           | Position "C"           |
|------------------------|------------------------|
| 1. Transparent Red     | 1. Transparent Red     |
| 2. Transparent Green   | 2. Transparent Green   |
| 3. Transparent Amber ① | 3. Transparent Amber ① |
| 4. Clear ①             | 4. Clear ①             |
| 5. Translucent White ② | 5. Translucent White ② |
| Z. No Lens             | Z. No Lens             |

NOTE: It is not recommended to use green LEDs with translucent white lenses. This will reduce light intensity. Use clear lenses with green LEDs for maximum light intensity.

- ① Recommended for neon lamps.
- ② Special Order: Ultra bright green LEDs to be used with translucent white lenses.

**XX**      **XX**  
Legend Style

- | Position "A"  | Position "C"  |
|---------------|---------------|
| ZZ. No Legend | ZZ. No Legend |

NOTE: For all other legend options, refer to the legend table in the appendix, find the two digit code and enter the code in the appropriate position(s).

**STOP HERE** for lighted switches without legends.

Example:  
K5AA331FNH-44

**X**      **X**  
Legend Color

- | Position "A"                  | Position "C"                  |
|-------------------------------|-------------------------------|
| 1. Red                        | 1. Red                        |
| 2. Black                      | 2. Black                      |
| 9. White                      | 9. White                      |
| B. Backlight/Daylight White ③ | B. Backlight/Daylight White ③ |
| D. Backlight/Deadfront ③      | D. Backlight/Deadfront ③      |
| Z. No Legend                  | Z. No Legend                  |

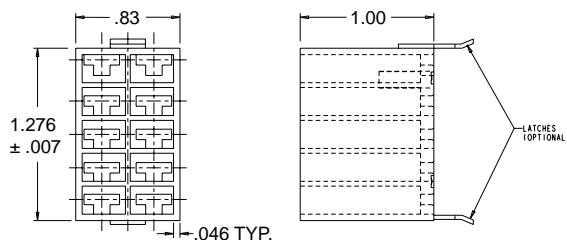
③ Only available on Rocker Style "A" & Rocker Features "1" and lens color "Z" for each position.

**X**  
Legend Orientation

- | Position "A" | Position "C" |
|--------------|--------------|
| 1. Std.      |              |
| 2. 90°       |              |
| 3. 180°      |              |
| 4. 270°      |              |

**STOP HERE** for unlighted switches without legends.

Example:  
K5AA331BAA



**K5 Connector**  
P/N C801775-2A Without Latches  
P/N C801775-2B With Latches

**Recommended Quick Connect Terminals**  
AMP 60253-2 for 12-16 AWG  
AMP 42100-2 for 14-18 AWG

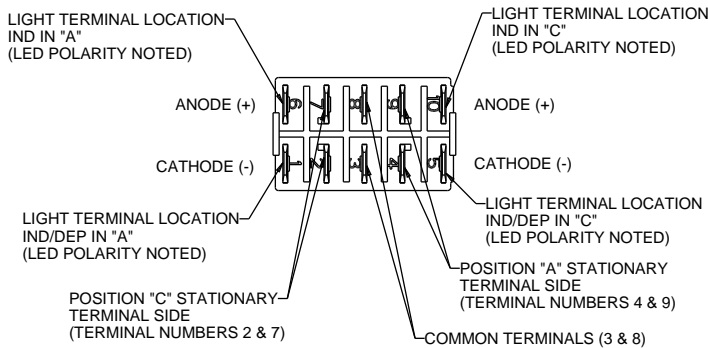
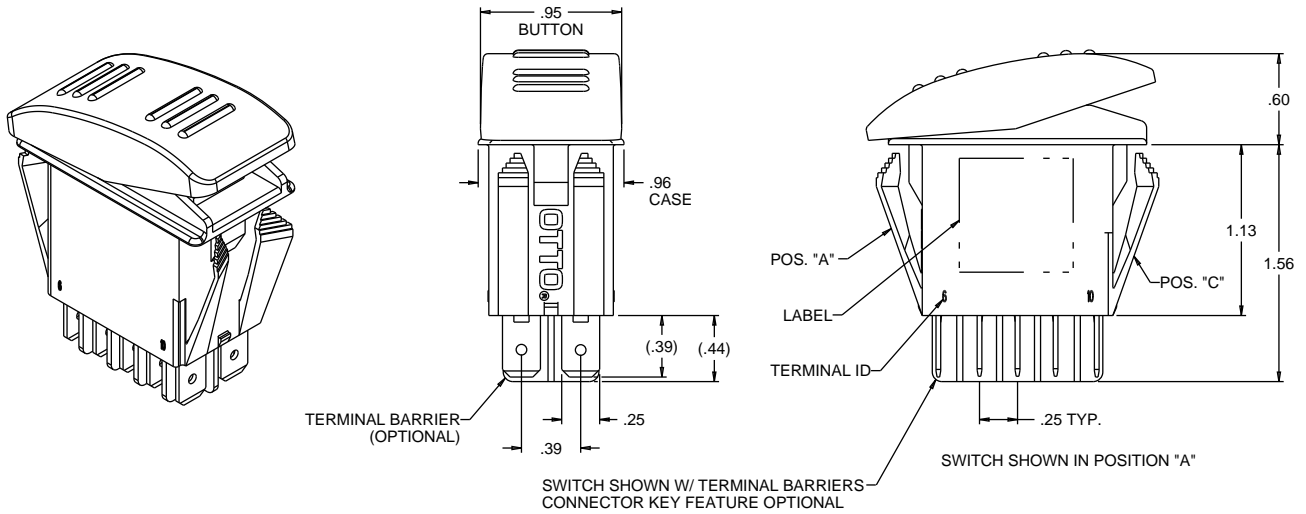
**Panel Seal Gasket**  
Silicone: P/N C807109-25-1  
Buna-N: P/N C807618-25-1

• K5 panel plugs available as shown in Panel Plugs (PP) section.

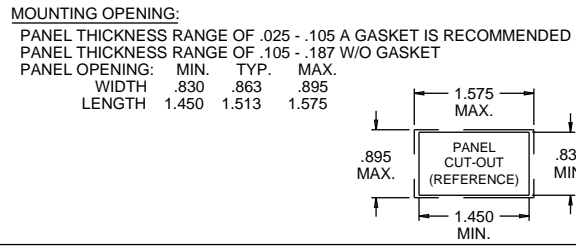
# SEALED, ILLUMINATED ROCKER SWITCHES

**K5**  
SEALED  
ROCKERS

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS



TERMINAL LOCATIONS AS VIEWED FROM BOTTOM OF SWITCH  
(CASE REMOVED FOR CLARITY)  
CONTACT MADE IN OPPOSITE DIRECTION OF ROCKER TRAVEL



<p>POS "A"</p>	<p>POS "B"</p>	<p>POS "C"</p>	<p>DPST-ON-NONE-OFF SCHEMATIC</p>	<p>DPDT-ON-NONE-ON SCHEMATIC</p>	<p>DPST-(ON)-NONE-OFF SCHEMATIC</p>	<p>DPDT-(ON)-NONE-ON SCHEMATIC</p>
<p><b>GENERAL SCHEMATIC INFORMATION</b></p> <p>○ ○ INDICATES MAINTAIN ACTION (FIXED POSITION)              ▼ ○ INDICATES MOMENTARY ACTION (AUTOMATIC RETURN POSITION)</p> <p>FOR OTHER LIGHTING SCHEMATICS REPLACE FOLLOWING SYMBOLS:</p> <p> INCANDESCENT (REPLACE RESISTOR &amp; LED)   NEON (REPLACE LED)</p>	<p>K5...2E...</p>	<p>K5...2F...</p>	<p>K5...2G...</p>	<p>K5...2BNB-Z</p>	<p>K5...2BNC-Z</p>	<p>DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A"</p>
<p>K5...2BND-Z</p>	<p>K5...2BNE-Z</p>	<p>K5...2BNF...</p>	<p>K5...2BNG...</p>	<p>K5...2BNH...</p>	<p>K5...2BNJ...</p>	<p>DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A"</p> <p>DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A" &amp; "C"</p>

SNAP-IN PANEL MOUNTING

## Standard Legends Per SAE Specifications

STANDARD LEGENDS PER SAE SPECIFICATIONS								
A1		ANCHOR	H2		HORN REAR	P4		BILGE PUMP
B1		BATTERY	K1		LOCK	P5		BILGE BLOWER
B2		ELECTRIC POWER	K2		UNLOCK	R1		LIFT
C1		AC/COOLING SYSTEMS	L1		LIGHT	R2		LOWER
C2		DEHUMIDIFIER	L2		MASTER LIGHTING SWITCH	R3		UP
C3		HEATER/INTERIOR HEATING	L3		HEADLIGHTS	R4		DOWN
D1		WINDSHIELD DEFROSTER	L4		HEADLIGHTS-LOW / DIPPED BEAM	R5		RIGHT
D2		REAR WINDOW DEFROSTER	L5		HEADLIGHTS-HIGH / UPPER BEAM	R6		LEFT
D3		MIRROR DEFROSTER	L6		PARKING LIGHT	R7	FWD	FORWARD
E1		ENGINE/START	L7		WORK LAMP	R8	REV	REVERSE
E2		ENGINE/STOP	L8		WORK LAMP	S1		RADIO
E3		ON/START	L9		INTERIOR DOME LIGHT	S2		MUTE
E4	○	OFF/STOP	M1		BEACON	T1		FAST
E5	ON	ON	M2		HAZARD/POSITION LIGHTS	T2		SLOW
E6	OFF	OFF	M3		CLEARANCE LIGHTS	T3		TRIM TAB / TRIMMING OPERATION
E7		ENGINE ELECTRIC PREHEAT	M4		SIDE MARKER LIGHT	T4		TRANSMISSION
E8		ENGINE-GAS INJECTION	M5		RUNNING LIGHTS (UNDER POWER)	V1		VENTILATING / AC FAN
E9		POWER	M6		ANCHOR LIGHT	W1		WINDSHIELD WIPER
F1		FRONT FOG LIGHTS	M7		RUNNING/ANCHOR LIGHTS	W2		WINDSHIELD-WASHER
F2		REAR FOG LIGHTS	M8		SEARCH LIGHT	W3		WINDSHIELD-WASHER/WIPER
F3	<b>F</b>	FORWARD	M9		LEFT TURN SIGNAL	W4		REAR WINDOW WIPER
F4	<b>N</b>	NEUTRAL	MA		RIGHT TURN SIGNAL	W5		REAR WINDOW-WASHER
F5	<b>R</b>	REVERSE	P1		BILGE PUMP #1	W6		REAR WINDOW-WASHER/WIPER
G1		FUEL	P2		BILGE PUMP #2	ZZ		NO LEGEND
H1		HORN	P3		BILGE PUMP #3			

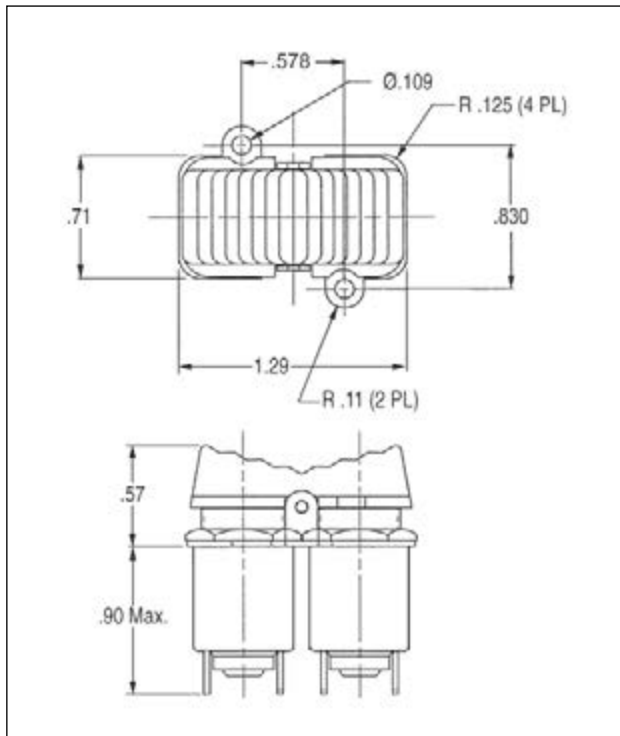
For legends not shown, please consult an OTTO representative.

## ONE MILLION CYCLE SEALED ROCKER SWITCH

The U2-277 (logic level) and U2-278 rocker switches are designed to run a minimum of one million mechanical cycles and withstand extreme environmental conditions. Ideal for use in material handling, heavy equipment, off-road and construction equipment, and other outdoor applications where severe conditions are typically encountered. These momentary action, ON-OFF-ON switches provide crisp tactile feedback and are moistureproof and dusttight to IP64. Watertight to IP68S option is also available. The optional watertight seal will withstand direct water spray and the durable construction provides protection against extreme shock and vibration.

### Features:

- **One million cycle life**
- **Moistureproof & dusttight to IP64**
- **Optional IP68S watertight seal available**
- **Momentary action (ON-OFF-ON)**
- **Crisp tactile feedback**
- **Vibration & shock resistant**
- **Logic level up to 10 amps switching capability**
- **RoHS compliant**



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC
Resistive	10A
Inductive	5A
Lamp	3A
Logic Level	10mA @ 5VDC

**Electrical Life:** 100,000 cycles

**Mechanical Life:** 1,000,000 cycles

**Seal:** IP64 or IP68S

**Operating Temp Range:** -55°C to +85°C

**Operating Force:** 2.5 +0.5/-1.0 lb.

**Reset Force:** 0.75 lb. min

**Total Travel:** 0.140 inches max

**Overtravel:** 0.012 inches min

#### MATERIALS:

**Button:** Nylon black

**Bracket:** Stainless steel

**Contacts:** Silver, standard  
Silver, gold for logic level

**Terminal Hardware:** None provided

**Mounting Hardware:** None provided

UP TO 3 POSITIONS WITH 3 OPTIONAL, INDEPENDENT LED LIGHT POSITIONS

Used in the heavy equipment, marine, process control and instrumentation markets, the R2 rotary switch is an excellent replacement for rocker switches, offering improved visual position indication, additional lighting options and different styling opportunities on front panels. The R2 is a sealed, lighted rotary switch which snaps into a 1.475" x 0.875" industry standard rocker switch panel opening. The rotary knob snaps onto a shaft and can be installed by the panel builder for those desiring that flexibility. The R2 rotary switch provides up to three positions in all combinations of momentary and maintained action. It is capable of handling loads from logic level up to 20 amps resistive. Sealing is to IP68S via a shaft O-ring seal in front and a potted base in the back. Termination options include 0.250" faston or a snap-on modular connector. The R2 offers unique lighting options including up to three independent LED light positions which illuminate a lens on the rotary knob. This design provides more lighting options than traditional rocker switches, handles the full range of electrical loads and is robust enough to survive in the most demanding applications.



## Features:

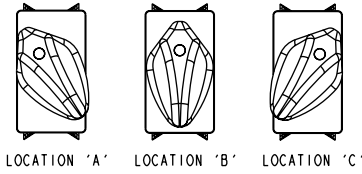
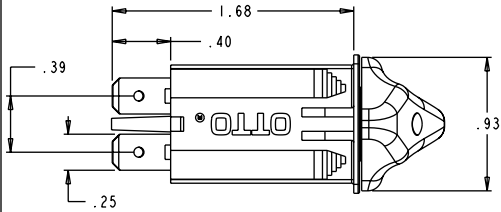
- **Sealed watertight per IP68S**
- **Snap-in panel mounting into industry standard 1.475" x 0.875" panel cutout**
- **Unique lighting options—up to 3 independent LED light positions**
- **Plastic or Soft Touch knob options available**
- **2 or 3 positions in all combinations of momentary & maintained action**
- **Termination can be used as 0.250" faston or with snap-on modular connector**

Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS:</b>		
Load	Sea Level @ 12/28VDC	Sea Level @ 125VAC
Resistive	20A	16A
Inductive	15A	15A
Lamp	4A	4A
Motor	0.5HP @ 110VAC	
DWV	1000Vrms except across light terminals	
Logic Level	10mA @ 5VDC, max D.C. logic level ratings (void if logic level load(s) exceeded at any time)	
<b>Electrical Life:</b>	25,000 cycles at full load	
<b>Lighting:</b>	LED 2V, 6V, 12V, 24V (VDC)	
<b>Mechanical Life:</b>	100,000 cycles	
<b>Seal:</b>	IP68S	
<b>Operating Temp Range:</b>	-40°C to +85°C	
<b>MATERIALS:</b>		
<b>Case:</b>	Thermoplastic	
<b>Knob:</b>	Thermoplastic	
<b>Lens:</b>	Thermoplastic, clear	
<b>Terminals:</b>	Copper, silver plate, gold plate for logic level	
<b>Contacts:</b>	Silver alloy, gold plate for logic level	
<b>Terminal Hardware:</b>	R2 recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG	
<b>Mounting Hardware:</b>	None provided	

# ROTARY SWITCH

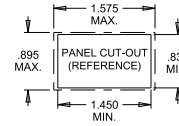
**R2**  
LIGHTED  
ROTARY

UP TO 3 POSITIONS WITH 3 OPTIONAL, INDEPENDENT LED LIGHT POSITIONS

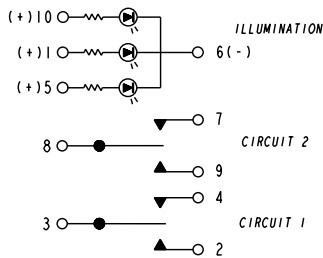


KNOB LOCATION DETAILS

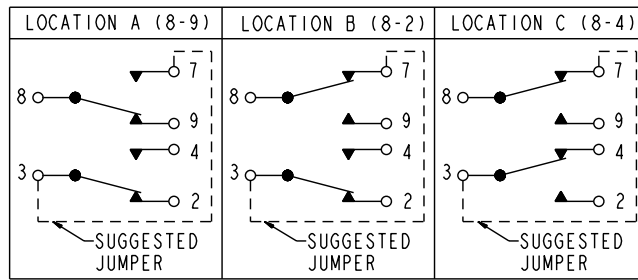
PANEL THICKNESS RANGE OF .025 - .105 A GASKET IS RECOMMENDED  
PANEL THICKNESS RANGE OF .105 - .187 W/O GASKET  
PANEL OPENING: MIN. TYP. MAX.  
WIDTH .830 .863 .895  
LENGTH 1.450 1.513 1.575



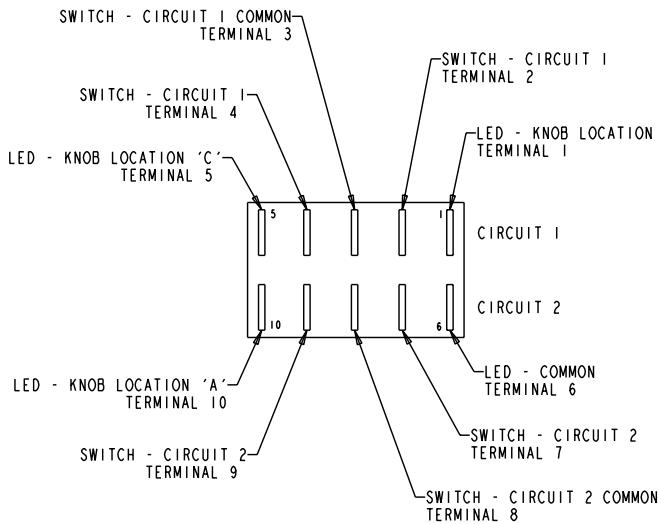
## ELECTRICAL SCHEMATICS



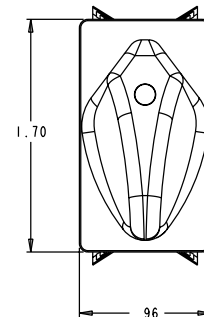
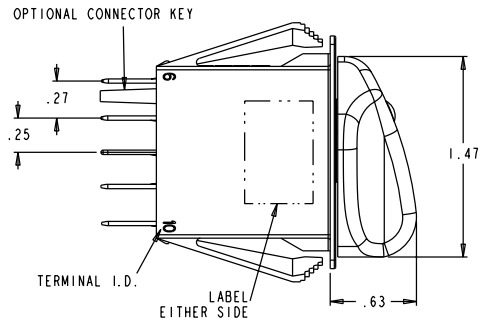
GENERIC SWITCH SCHEMATIC  
USE TERMINALS AS APPLICABLE  
TO PART NUMBER



SPTT SCHEMATIC  
USE R2XXXX77XXXX FOR (8-9),(8-2),(8-4)  
USE R2XXXX74XXXX FOR (OFF),(8-2),(8-4)  
USE R2XXXX67XXXX FOR (8-9),(8-2),(OFF)



TERMINAL LOCATION AS VIEWED  
FROM THE BOTTOM OF THE SWITCH



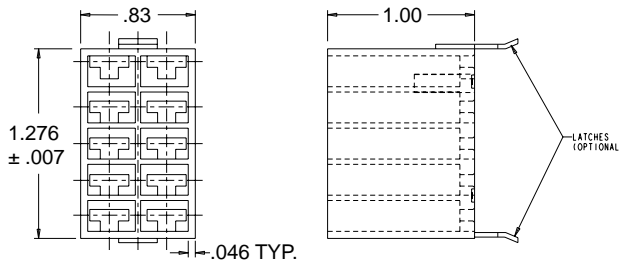
• R2 panel plugs available as shown in Panel Plugs (PP) section.

UP TO 3 POSITIONS WITH 3 OPTIONAL, INDEPENDENT LED LIGHT POSITIONS

## R2 SERIES PART NUMBER CODE

R2	X	X	XX	X	X	X	X	X	X	X				
Terminal Style/ Switch Rating	Knob Color & Texture	Switch Action			Switch Circuit 1 Terminals 2, 3, 4			Switch Circuit 2 Terminals 7, 8, 9			LED Light Source Voltage*	Light Source Color		
		Knob Location "A"	Knob Location "B"	Knob Location "C"	Knob Location "A"	Knob Location "B"	Knob Location "C"	Knob Location "A"	Knob Location "B"	Knob Location "C"	N. NONE A. 2V B. 6V C. 12V D. 24V	Location "A"	Location "B"	Location "C"
<b>A.</b> Without Terminal Barriers, With Connector Keying Pin, Standard Rating	<b>A.</b> Black Plastic	<b>2-Position Switch, Knob Locations A/B</b>			<b>2-Position Switch, Knob Locations A/B</b>			<b>N. NONE (Single Pole)</b>				<b>1.</b> NONE	<b>1.</b> NONE	<b>1.</b> NONE
<b>B.</b> Without Terminal Barriers, Without Connector Keying Pin, Standard Rating	<b>B.</b> Black Soft Touch	<b>11.</b> Maintain	Maintain	N/A	<b>1.</b> 3-2	OFF	N/A	<b>1.</b> 8-9	OFF	N/A		<b>2.</b> Green	<b>2.</b> Green	<b>2.</b> Green
<b>C.</b> Without Terminal Barriers, With Connector Keying Pin, Logic Level Rating	<b>C.</b> White Plastic	<b>12.</b> Maintain	Momentary	N/A	<b>2.</b> OFF	3-4	N/A	<b>2.</b> OFF	8-7	N/A		<b>3.</b> Amber	<b>3.</b> Amber	<b>3.</b> Amber
<b>D.</b> Without Terminal Barriers, Without Connector Keying Pin, Logic Level Rating	<b>D.</b> White Soft Touch	<b>13.</b> Momentary	Maintain	N/A	<b>3.</b> 3-2	3-4	N/A	<b>3.</b> 8-9	8-7	N/A				
	<b>E.</b> Red Plastic	<b>2-Position Switch, Knob Locations A/C</b>			<b>2-Position Switch, Knob Locations A/C</b>			<b>2-Position Switch, Knob Locations A/B</b>						
	<b>F.</b> Red Soft Touch	<b>21.</b> Maintain	N/A	Maintain	<b>1.</b> 3-2	N/A	OFF	<b>1.</b> 8-9	N/A	OFF				
		<b>22.</b> Maintain	N/A	Momentary	<b>2.</b> OFF	N/A	3-4	<b>2.</b> OFF	N/A	8-7				
		<b>23.</b> Momentary	N/A	Maintain	<b>3.</b> 3-2	N/A	3-4	<b>3.</b> 8-9	N/A	8-7				
		<b>2-Position Switch, Knob Locations B/C</b>			<b>2-Position Switch, Knob Locations B/C</b>			<b>2-Position Switch, Knob Locations A/C</b>						
		<b>31.</b> N/A	Maintain	Maintain	<b>1.</b> N/A	3-2	OFF	<b>1.</b> N/A	N/A	OFF				
		<b>32.</b> N/A	Maintain	Momentary	<b>2.</b> N/A	OFF	3-4	<b>2.</b> N/A	N/A	8-7				
		<b>33.</b> N/A	Momentary	Maintain	<b>3.</b> N/A	3-2	3-4	<b>3.</b> N/A	N/A	8-7				
		<b>3-Position Switch, Knob Locations A/B/C</b>			<b>3-Position Switch</b>			<b>3-Position Switch</b>						
		<b>44.</b> Maintain	Maintain	Maintain	<b>4.</b> OFF	3-4	3-4	<b>4.</b> OFF	8-7	8-7				
		<b>45.</b> Momentary	Maintain	Momentary	<b>5.</b> 3-2	OFF	3-4	<b>5.</b> 8-9	OFF	8-7				
		<b>46.</b> Maintain	Maintain	Momentary	<b>6.</b> 3-2	3-2	OFF	<b>6.</b> 8-9	8-9	OFF				
		<b>47.</b> Momentary	Maintain	Maintain	<b>7.</b> 3-2	3-2	3-4	<b>7.</b> 8-9	8-7	8-7				
					<b>8.</b> 3-2	OFF	OFF	<b>8.</b> 8-9	OFF	OFF				
					<b>9.</b> OFF	OFF	3-4	<b>9.</b> OFF	OFF	8-7				

\*See appendix for complete voltage/ratings table



### R2 Connector

P/N C801775-2A Without Latches  
P/N C801775-2B With Latches

### Recommended Quick Connect Terminals

AMP C60253-2 for 12-16 AWG  
AMP C42100-2 for 14-18 AWG

### Panel Seal Gasket

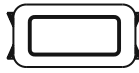
P/N C807109-25-1



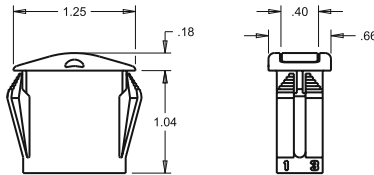
# PANEL PLUGS FOR ROCKER & R2 SERIES

## K1 THROUGH K5 & R2 PANEL PLUGS

### K1-PA Panel Plug One Piece Molded

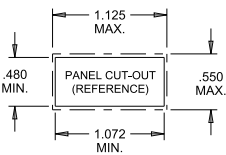


**OPTIONAL PANEL GASKET:**  
**0.062" THICKNESS =**  
**P/N C807039-25-1**  
**0.031" THICKNESS =**  
**P/N C807039-25-2**



**MOUNTING HOLE**

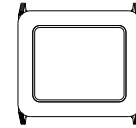
RECOMMENDED PANEL THICKNESS:



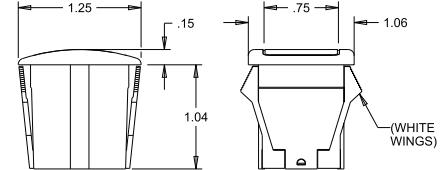
RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED  
 RANGE 0.105 - 0.187 WITHOUT GASKET

Panel Opening:	Min.	Typ.	Max.
Width	0.480	0.515	0.550
Length	1.072	1.099	1.125

### K2-PB Panel Plug Assembled Plug

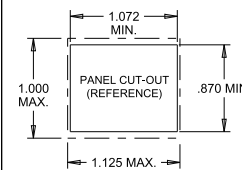


**OPTIONAL PANEL GASKET:**  
**0.062" THICKNESS =**  
**P/N C807038-25-1**  
**0.031" THICKNESS =**  
**P/N C807038-25-2**



**MOUNTING HOLE**

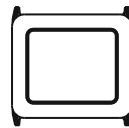
RECOMMENDED PANEL THICKNESS:



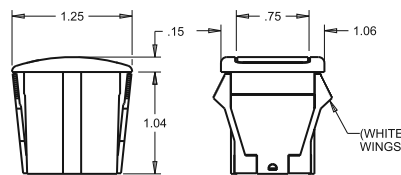
RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED  
 RANGE 0.105 - 0.187 WITHOUT GASKET

Panel Opening:	Min.	Typ.	Max.
Width	0.870	0.937	1.00
Length	1.072	1.099	1.125

### K4-PB Panel Plug Assembled Plug

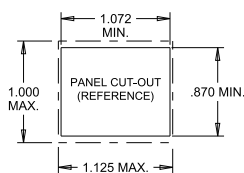


**OPTIONAL PANEL GASKET:**  
**0.062" THICKNESS =**  
**P/N C807038-25-1**  
**0.031" THICKNESS =**  
**P/N C807038-25-2**



**MOUNTING HOLE**

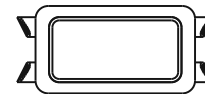
RECOMMENDED PANEL THICKNESS:



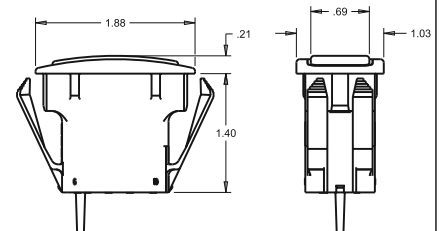
RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED  
 RANGE 0.105 - 0.187 WITHOUT GASKET

Panel Opening:	Min.	Typ.	Max.
Width	0.870	0.937	1.00
Length	1.072	1.099	1.125

### K3-PB Panel Plug Assembled Plug

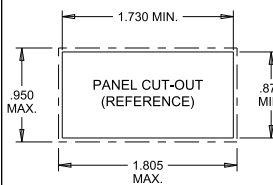


**OPTIONAL PANEL GASKET:**  
**P/N C807037-25**



**MOUNTING HOLE**

RECOMMENDED PANEL THICKNESS:

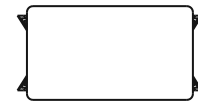


RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED  
 RANGE 0.102 - 0.187 WITHOUT GASKET

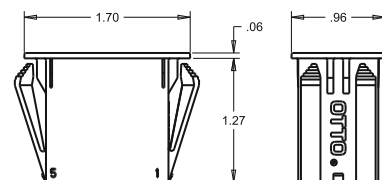
Panel Opening:	Min.	Typ.	Max.
Width	0.870	0.937	0.950
Length	1.730	1.768	1.805

### K5-PA Panel Plug One Piece Molded

Also Fits R2 Rotary Switches

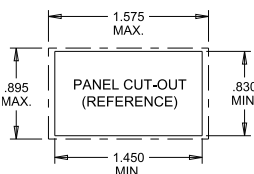


**OPTIONAL PANEL GASKET:**  
**P/N C807109-25-1**



**MOUNTING HOLE**

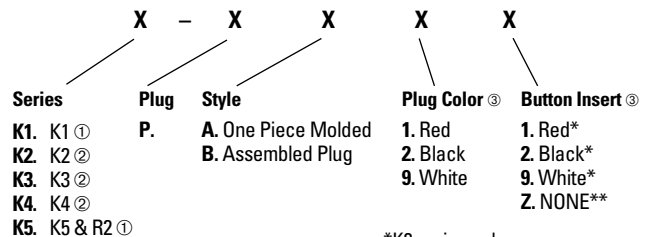
RECOMMENDED PANEL THICKNESS:



RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED  
 RANGE 0.105 - 0.187 WITHOUT GASKET

Panel Opening:	Min.	Typ.	Max.
Width	0.830	0.863	0.895
Length	1.450	1.513	1.575

### PANEL PLUG PART NUMBER CODE



\*K3 series only.  
 \*\*Molded plug only.

- ① Available in Style A only.
- ② Available in Style B only.
- ③ Additional colors available. Contact factory.

COMMERCIAL & MILITARY GRADES



Flush Button Style



Raised Button Style

**Standard Characteristics/Ratings:**

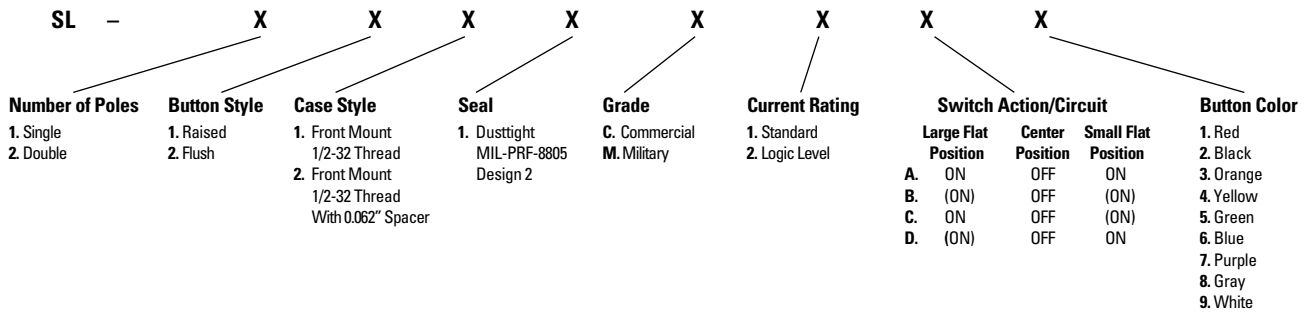
**ELECTRICAL RATINGS:**

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
DWV	1050Vrms
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	100,000 cycles
<b>Mechanical Life:</b>	100,000 cycles
<b>Seal:</b>	Dusttight per MIL-PRF-8805 Design 2
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	24 oz +/- 10 oz
<b>Return Force:</b>	10 oz +8 oz/-3 oz to center from maintained position
<b>Total Travel:</b>	0.120 inches max two directions
<b>Overtravel:</b>	0.010 inches min

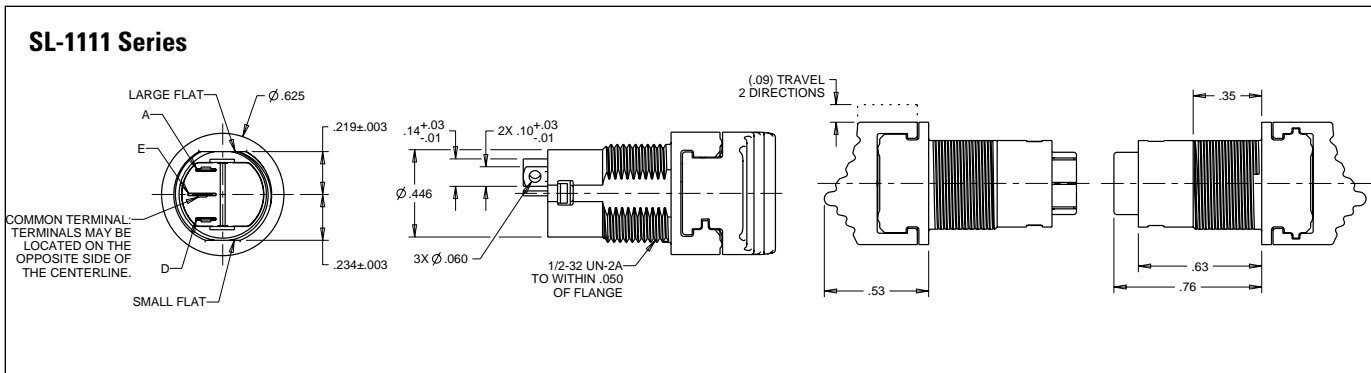
**MATERIALS:**

<b>Case:</b>	Thermoplastic
<b>Button:</b>	Thermoplastic
<b>Terminals:</b>	Copper with silver Gold over silver for logic level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut and lockwasher

**SL PART NUMBER CODE**

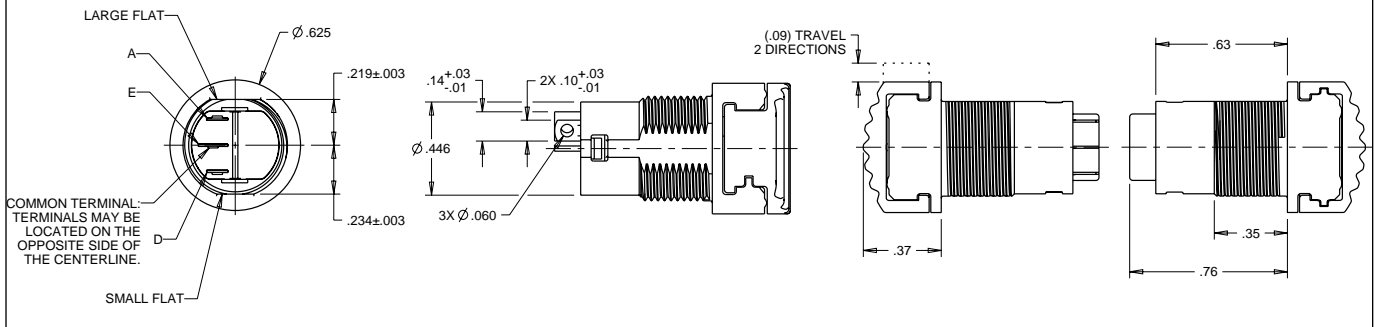


NOTE: ( ) denotes momentary action.

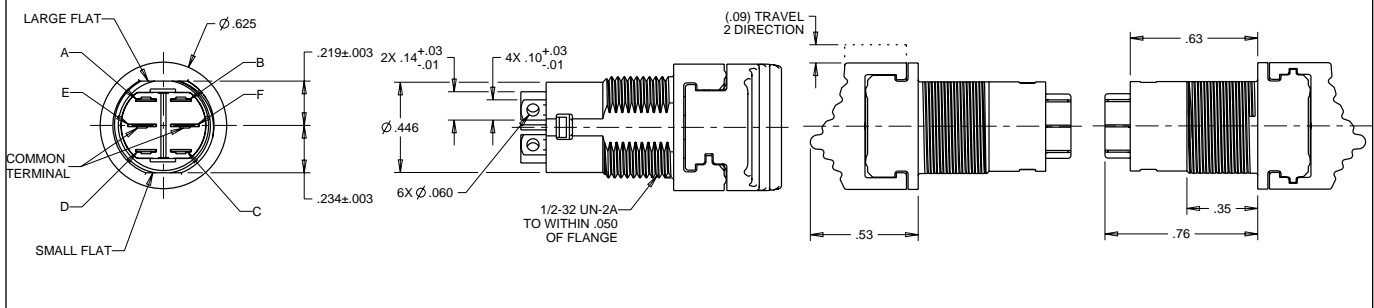


COMMERCIAL & MILITARY GRADES

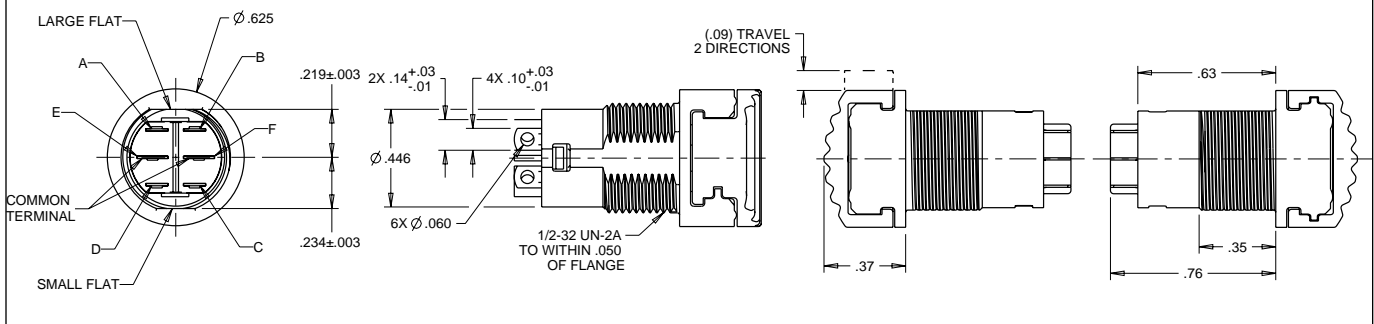
### SL-1211 Series



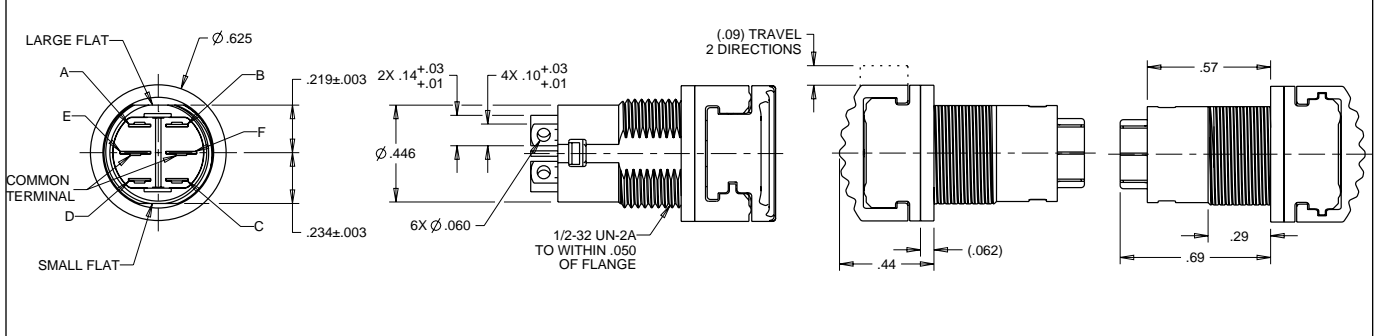
### SL-2111 Series



### SL-2211 Series



### SL-2221 Series



# Trigger Switches



PART NUMBER	FEATURE	ACTUATION	TRIGGER COLOR	MAX RATING (Resistive @ 28VDC)	SEAL RATING	CIRCUITRY
U2-016	Military Qualified	Two-Step	Red	7A	Unsealed	DPDT
U2-025	Military Qualified	Two-Step	Red	7A	Unsealed	DPDT
U2-037	Commercial Grade	Two-Step	Gray	8A	Dusttight	4PDT
U2-054	Commercial Grade	One-Step	Gray	7A	Unsealed	DPDT
U2-081	Military Qualified	Two-Step	Red	7A	Unsealed	DPDT
U2-082	Military Qualified	Two-Step	Red	7A	Unsealed	DPDT
U2-083	Military Qualified	Two-Step	Red	7A	Unsealed	DPDT
U2-084	Military Qualified	Two-Step	Red	Low Level	Unsealed	DPDT
U2-093	Commercial Grade	One-Step	Gray	7A	Unsealed	DPDT
U2-169	Commercial Grade	Two-Step	Black	7A	Unsealed	DPDT
U2-273	Commercial Grade	Two-Step	Red	8A	Dusttight	4PDT
U2-605	Commercial Grade	Two-Step	Red Anodized	10A	IP68S	DPST
U2-618	Commercial Grade	Two-Step	Red	Logic Level	Unsealed	DPDT
U2-664	Commercial Grade	One-Step	Gray	7A	Unsealed	SPDT

# MILITARY QUALIFIED TRIGGER SWITCHES

**U2**  
TRIGGER SWITCHES

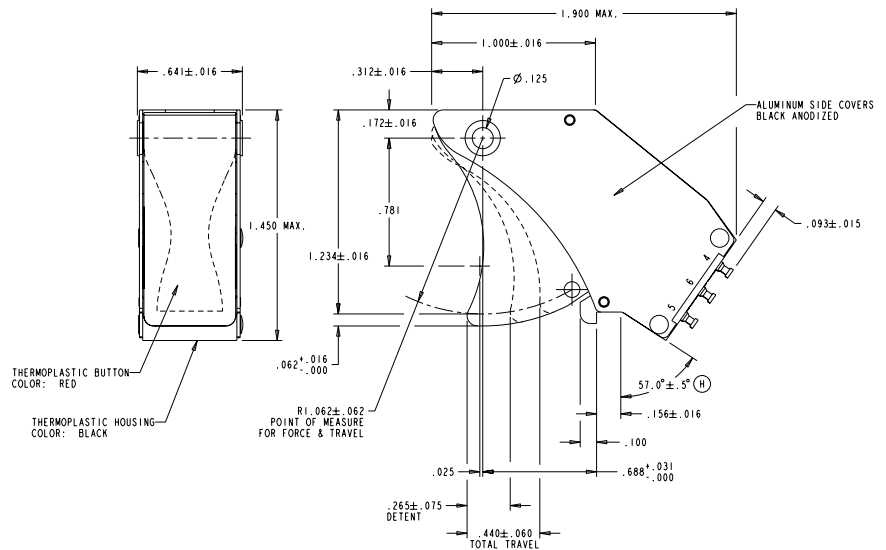
ONE-STEP AND TWO-STEP, PRECISE, MILITARY QUALIFIED

## U2-016

The U2-016 is a precision trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. to pass through the detent, and 6.0 lbs. to continue travel after the detent. It is designed to handle resistive electrical loads up to 7A at 28VDC. The U2-016 is military qualified to M8805/111-01.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-55°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	

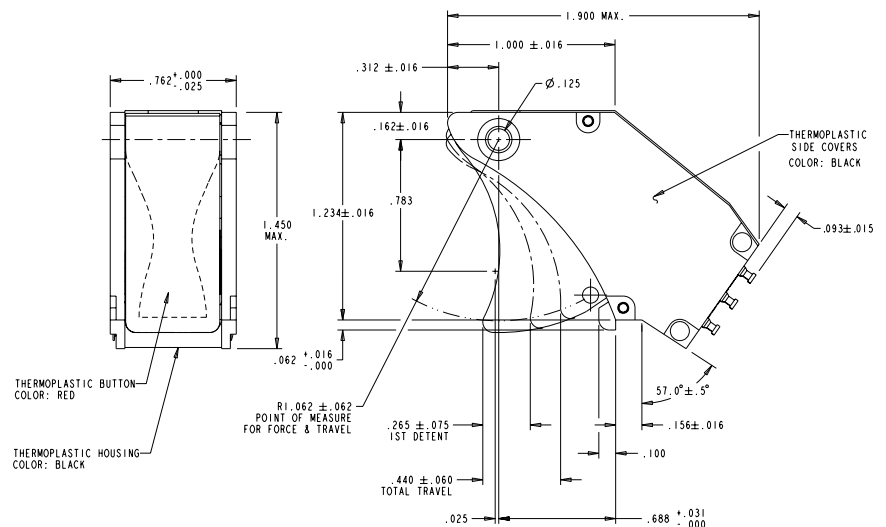


## U2-025

The U2-025 is a precision two-step trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. passing through a detent to actuate the second pole. It is designed to handle resistive electrical loads up to 7A at 28VDC. The U2-025 is military qualified to M8805/111-04.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black thermoplastic	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-55°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	



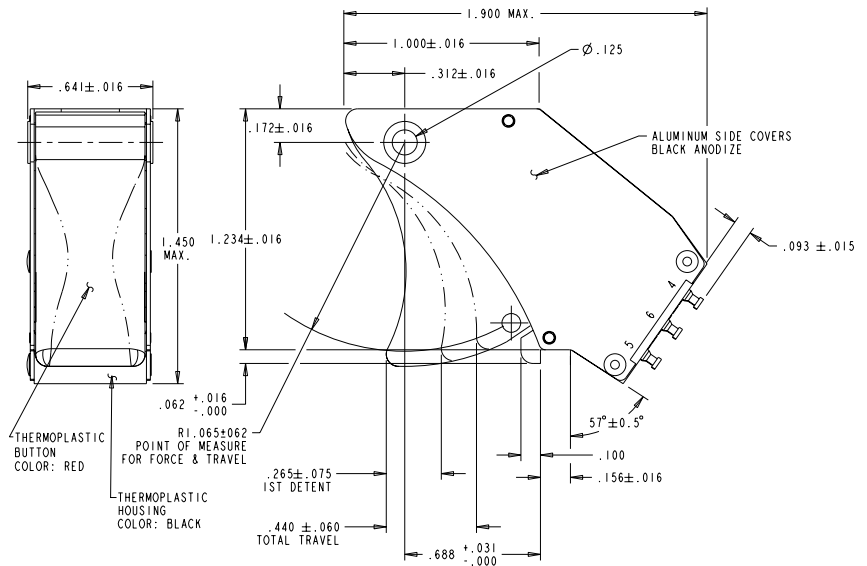
ONE-STEP AND TWO-STEP, PRECISE, MILITARY QUALIFIED

## U2-081

The U2-081 is a precision two-step trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. to pass through the detent, and 6.0 lbs. to continue travel after the detent. It is designed to handle resistive electrical loads up to 7A at 28VDC. The U2-081 is military qualified to M8805/111-02.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-55°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	

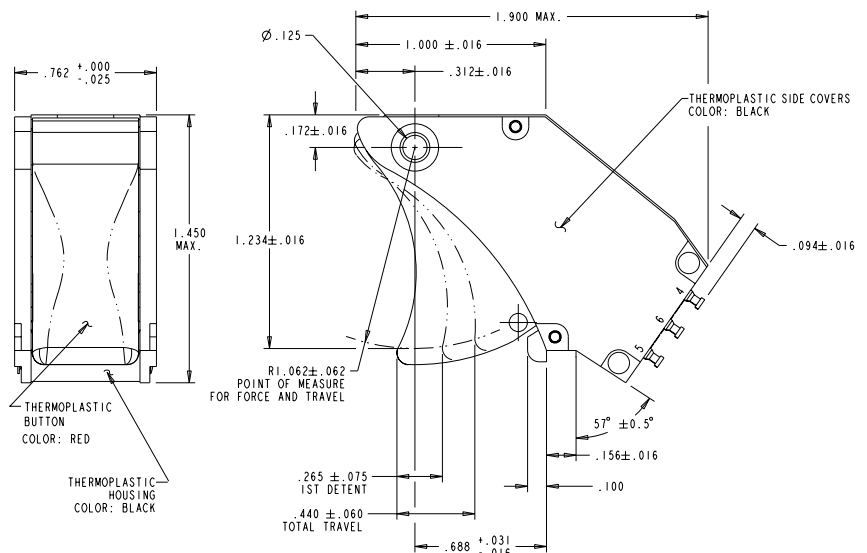


## U2-082

The U2-082 is a precision two-step trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. passing through a detent to actuate the second pole. It is designed to handle resistive electrical loads up to 7A at 28VDC. The U2-082 is military qualified to M8805/111-03.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-55°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	



# MILITARY QUALIFIED TRIGGER SWITCHES

**U2**  
TRIGGER SWITCHES

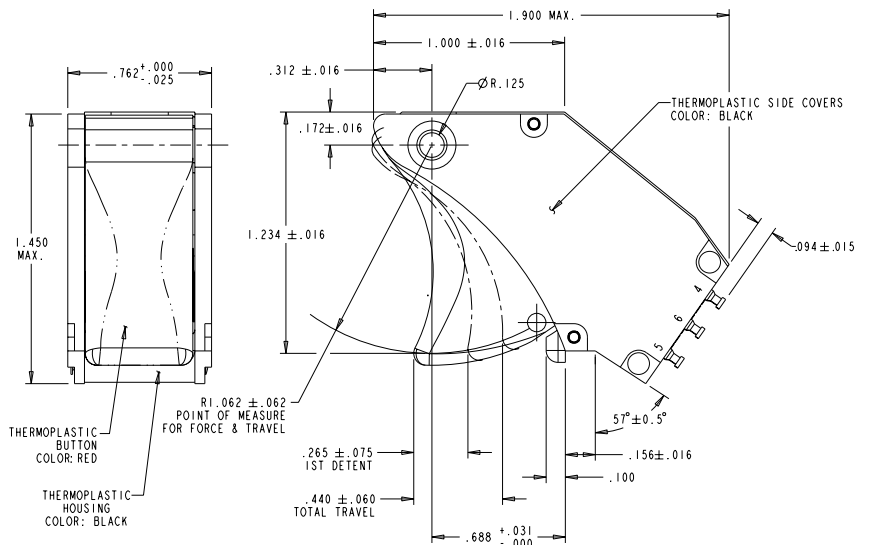
ONE-STEP AND TWO-STEP, PRECISE, MILITARY QUALIFIED

## U2-083

The U2-083 is a precision two-step trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. to pass through the detent, and 6.0 lbs. to continue travel after the detent. It is designed to handle resistive electrical loads up to 7A at 28VDC. The U2-083 is military qualified to M8805/111-05.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black thermoplastic	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-55°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	

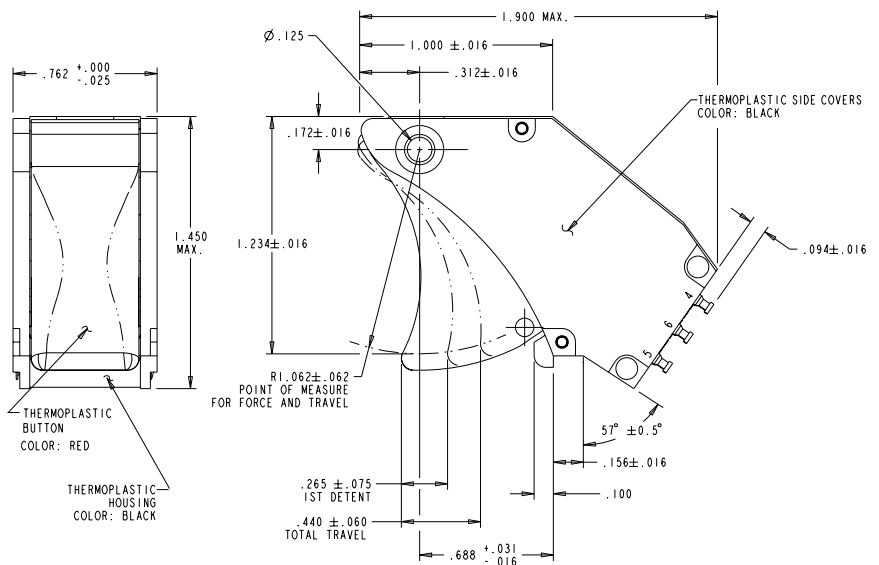


## U2-084

The U2-084 is a precision two-step, low level trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. passing through a detent to actuate the second pole. The U2-084 is military qualified to M8805/111-06.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	50,000 ft.
Resistive:	1A	1A
Inductive:	.5A	.5A
Low Level:	10mA @ 30mV	
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-55°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	







# COMMERCIAL GRADE TRIGGER SWITCHES

**U2**  
TRIGGER SWITCHES

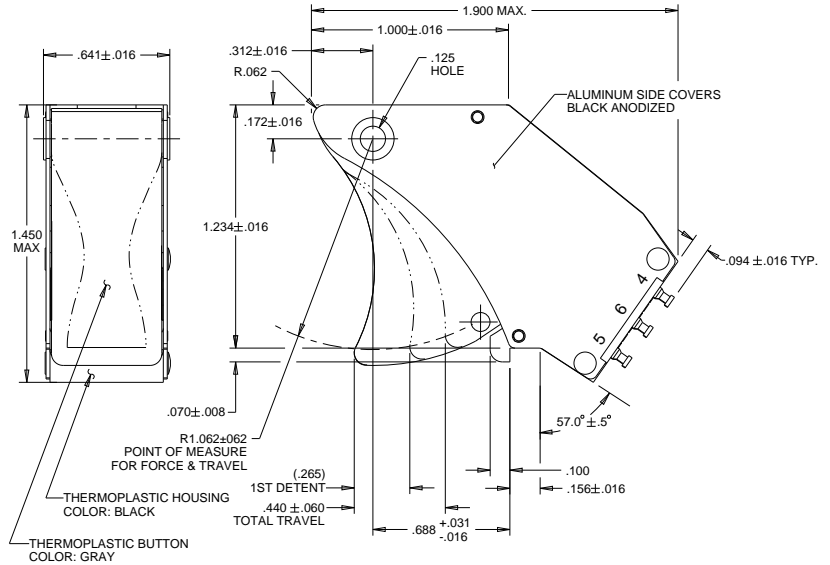
ONE-STEP AND TWO-STEP, PRECISE, COMMERCIAL GRADE

## U2-093

The U2-093 is a precision trigger switch with an actuating force of 6.5 lbs. and is designed to handle resistive electrical loads up to 7A at 28VDC.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
<b>Load</b>	Sea Level	50,000 ft.
<b>Resistive:</b>	7A	4A
<b>Inductive:</b>	4A	2.5A
<b>DWV:</b>	1050 VRMS	400 VRMS
<b>Electrical Life:</b>	25,000 cycle	
<b>MECHANICAL:</b>		
<b>Mechanical Life:</b>	100,000 cycles	
<b>Operating Force:</b>	Pole One: Pretravel: .130 min from Full Out Overtravel: .015 min. before First Detent Detent: 6.50 lbs. ± .75 lbs. Pole Two: Pretravel: .020 min beyond First Detent Overtravel: .030 min. before Total Travel	
<b>MATERIALS:</b>		
<b>Button:</b>	Gray thermoplastic	
<b>Housing:</b>	Black thermoplastic	
<b>Side Covers:</b>	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
<b>Temperature Range:</b>	-55°C to +85°C	
<b>Seal:</b>	Unsealed per MIL-PRF-8805, Design 1	

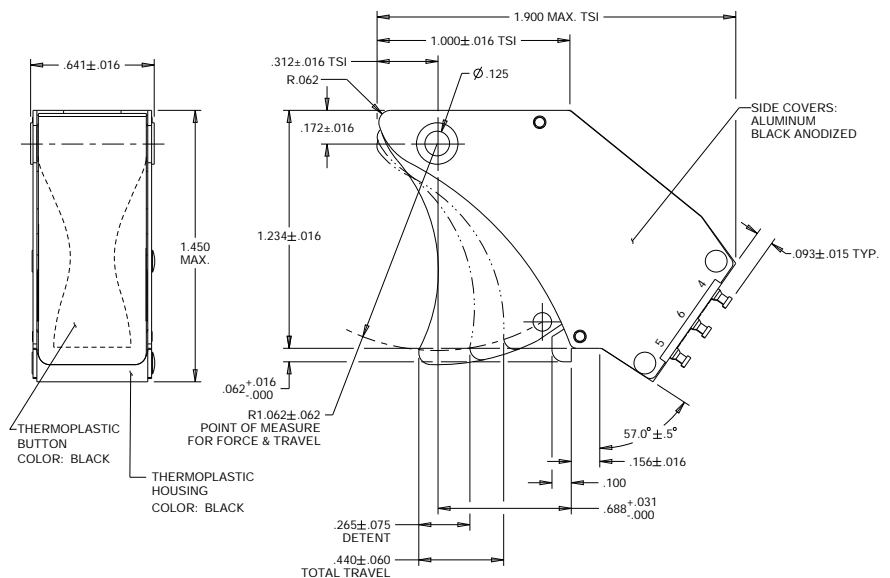


## U2-169

The U2-169 is a precision two-step trigger switch with an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. is required to pass through the detent, and 6.0 lbs. to continue travel after the detent. It is designed to handle resistive electrical loads up to 7A at 28VDC.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
<b>Load</b>	Sea Level	50,000 ft.
<b>Resistive:</b>	7A	4A
<b>Inductive:</b>	5A	2.5A
<b>DWV:</b>	1050 VRMS	400 VRMS
<b>Electrical Life:</b>	50,000 cycle	
<b>MECHANICAL:</b>		
<b>Mechanical Life:</b>	100,000 cycles	
<b>Operating Force:</b>	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6.0, +0, -3 lbs.	
<b>MATERIALS:</b>		
<b>Button:</b>	Black thermoplastic	
<b>Housing:</b>	Black thermoplastic	
<b>Side Covers:</b>	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
<b>Temperature Range:</b>	-55°C to +85°C	
<b>Seal:</b>	Unsealed per MIL-PRF-8805, Design 1	



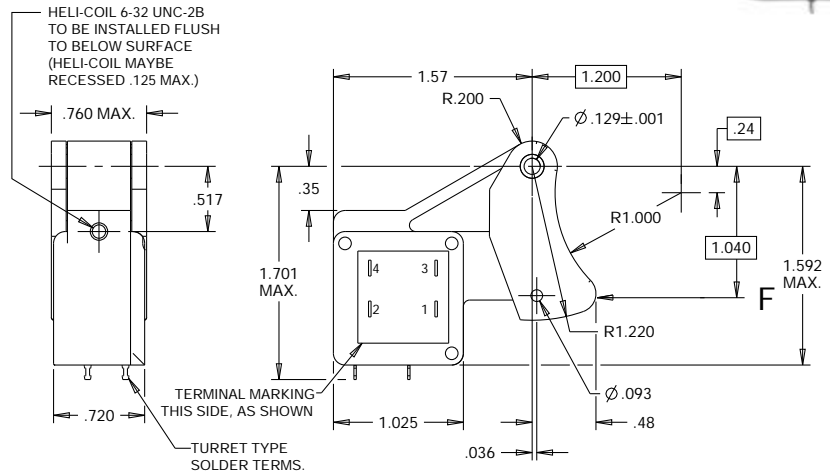
ONE-STEP AND TWO-STEP, PRECISE, COMMERCIAL GRADE

## U2-273

The U2-273 is a precision two-step trigger switch with an actuating force of 3.1 lbs. to make the first pole and 7.5 lbs. passing through a detent to actuate the second pole. It is designed to handle resistive electrical loads up to 8A at 28VDC. The U2-037 is dusttight per MIL-PRF-8805 Design 2 and also provides magnetic shielding.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
Load	Sea Level	70,000 ft.
Resistive:	8A	8A
Inductive:	5A	5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
<b>MECHANICAL:</b>		
Mechanical Life:	50,000 cycles	
Operating Force:	Pole One: 3.1 lbs. ± 1.7 lbs. Pass through Detent: .187 lbs. ± .020 lbs. Pole Two: 7.5 lbs. ± 2.0 lbs.	
<b>MATERIALS:</b>		
Button:	Red thermoplastic	
<b>ENVIRONMENTAL:</b>		
Temperature Range:	-40°C to +85°C	
Seal:	Unsealed per MIL-PRF-8805, Design 2	

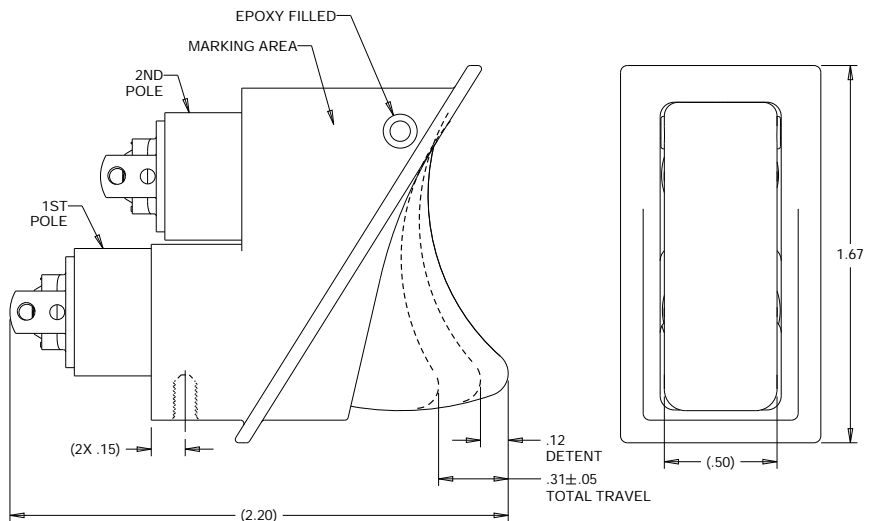


## U2-605

Sealed to IP68S, the U2-605 is a two-step trigger switch designed for use in a grip - specifically for sealed grip applications. This switch has an actuating force of 3.0 lbs. to make the first pole, 6.5 lbs. passing through a detent to actuate the second pole, and 6.0 lbs. to continue travel after the detent. It is designed to handle resistive electrical loads up to 10A at 28VDC.



Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS (@28 VDC):</b>	
Load	Sea Level
Resistive:	10A
Inductive:	5A
Lamp:	3A
DWV:	1050 VRMS
Electrical Life:	25,000 cycle
<b>MECHANICAL:</b>	
Mechanical Life:	100,000 cycles
Operating Force:	Pole One: 3.00 lbs. ± .75 lbs. Pass through Detent: 6.50 lbs. ± .75 lbs. Pole Two: 6.0, +0, -3 lbs.
<b>MATERIALS:</b>	
Button:	Red anodized aluminum
Housing:	Black anodized aluminum
<b>ENVIRONMENTAL:</b>	
Temperature Range:	-40°C to +85°C
Seal:	Sealed to IP68S



# COMMERCIAL GRADE TRIGGER SWITCHES

**U2**  
TRIGGER SWITCHES

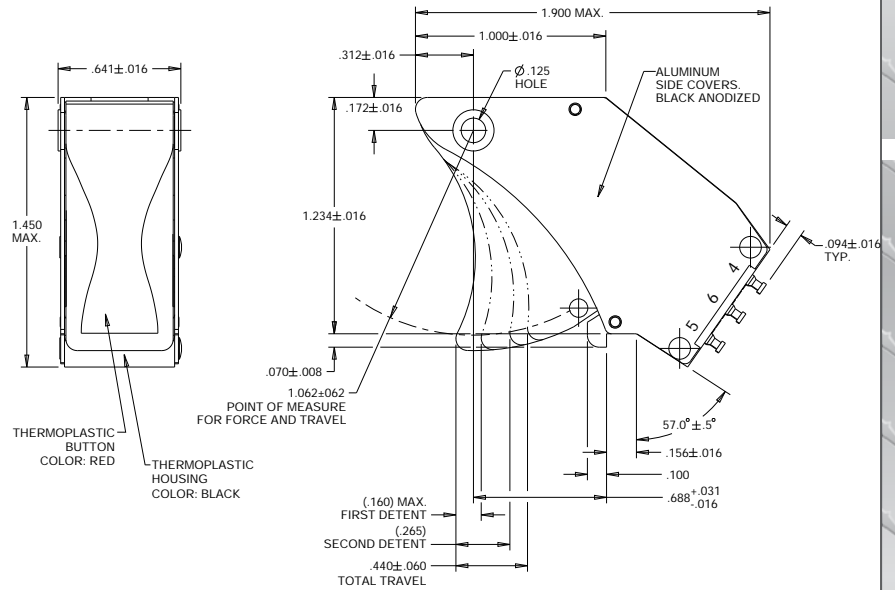
ONE-STEP AND TWO-STEP, PRECISE, COMMERCIAL GRADE

## U2-618

The U2-618 is a precision two-step, logic level trigger switch offering two levels of operation with positive detent between levels. The switch has an actuating force of 2.50 lbs. to make the first pole, and an additional 4.5 lbs. to actuate the second pole.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
<b>Load</b>	Sea Level	50,000 ft.
<b>Resistive:</b>	1A	1A
<b>Inductive:</b>	.5A	.5A
<b>Logic Level:</b>	10mA @ 5V	
<b>DWV:</b>	1050 VRMS	400 VRMS
<b>Electrical Life:</b>	25,000 cycle	
<b>MECHANICAL:</b>		
<b>Mechanical Life:</b>	100,000 cycles	
<b>Operating Force:</b>	Pre-Travel Detent One: 2.50 lbs. ± 0.75 lbs. Pole One: 2.50 lbs. ± 0.75 lbs. Pass through Detent Two: .265 lbs. ± .075 lbs. Pole Two: 4.50 lbs. ± 1.00 lbs.	
<b>MATERIALS:</b>		
<b>Button:</b>	Red thermoplastic	
<b>Housing:</b>	Black thermoplastic	
<b>Side Covers:</b>	Black anodized aluminum	
<b>ENVIRONMENTAL:</b>		
<b>Temperature Range:</b>	-55°C to +85°C	
<b>Seal:</b>	Unsealed per MIL-PRF-8805, Design 1	

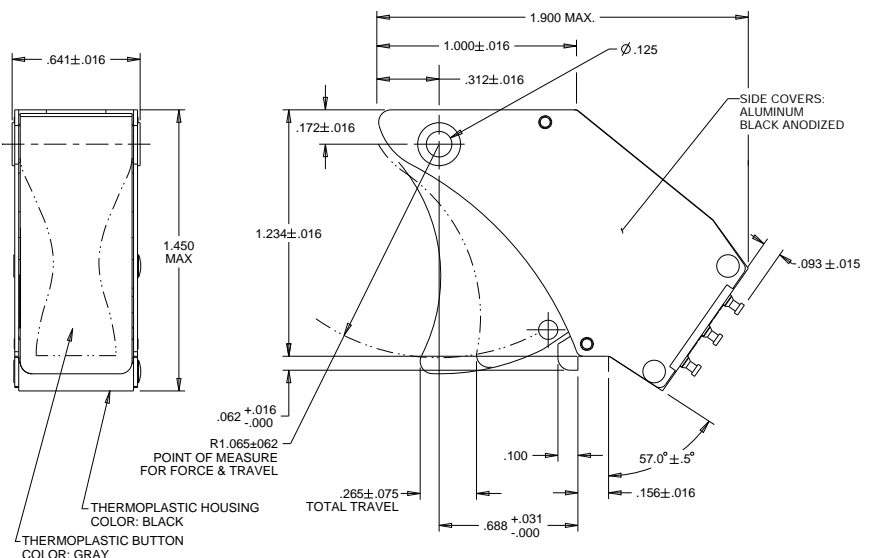


## U2-664

The U2-664 is a precision, single pole trigger switch with an actuating force of 2.25 lbs. and no detent. It is designed to handle resistive electrical loads up to 7A at 28VDC.



Standard Characteristics/Ratings:		
<b>ELECTRICAL RATINGS (@28 VDC):</b>		
<b>Load</b>	Sea Level	50,000 ft.
<b>Resistive:</b>	7A	4A
<b>Inductive:</b>	4A	2.5A
<b>DWV:</b>	1050 VRMS	400 VRMS
<b>Electrical Life:</b>	50,000 cycle	
<b>MECHANICAL:</b>		
<b>Mechanical Life:</b>	100,000 cycles	
<b>Pretravel:</b>	.130 min. from Full Out	
<b>Overtravel:</b>	.015 min. before Detent	
<b>Actuation Force:</b>	2.250 lbs. ± 0.500 lbs.	
<b>MATERIALS:</b>		
<b>Button:</b>	Gray Thermoplastic	
<b>Housing:</b>	Black Thermoplastic	
<b>Side Covers:</b>	Black Anodized Aluminum	
<b>ENVIRONMENTAL:</b>		
<b>Temperature Range:</b>	-40°C to +85°C	
<b>Seal:</b>	Unsealed per MIL-PRF-8805, Design 1	



# Trim Switches



SERIES	FEATURE	ACTUATION	MAX RATING (Resistive)	SEAL RATING	MOUNTING	CIRCUITRY
T1 (mini)	2-Way Quiet Operation	Momentary	10mA @ 5VDC (logic level)	IP64, IP68S, Watertight per MIL-PRF-8805 Design 3	11/16" dia. Threaded or Press Fit	SPST (x2)
T1-T (mini)	2-Way Tactile Feedback	Momentary/ Maintained	2A @ 28VDC or 10mA @ 5VDC (logic level)	Water Resistant per MIL-PRF-810F, Method 506.4 Procedure 3 (Drip)	11/16" dia. Threaded	SPST (x2)
T2 (mini)	2-Way Quiet Operation Center Pushbutton	Momentary	10mA @ 5VDC (logic level)	IP64, IP68S, Watertight per MIL-PRF-8805 Design 3	11/16" dia. Threaded or Press Fit	SPST (x3)
T4 (mini)	4-Way Quiet Feedback	Momentary	10mA @ 30mV (low level)	IP64, IP68S, Watertight per MIL-PRF-8805 Design 3	11/16" dia. Threaded or Press Fit	SPST (x4)
T4-T (mini)	4-Way Tactile Feedback	Momentary with Tactile Feel	2A @ 28VDC or 10mA @ 5VDC (logic level)	IP64, IP68S, Water Resistant per MIL-PRF-810F, Method 506.4 Procedure 3 (Drip)	3/4" dia. Threaded or Press Fit	SPST (x4)
T5 (mini)	4-Way Quiet Operation Center Pushbutton	Momentary, Lenient Option	10mA @ 5VDC (logic level)	IP64, IP68S, Watertight per MIL-PRF-8805 Design 3	11/16" dia. Threaded or Press Fit	SPST (x5)
T8 (mini)	8-Way Quiet Operation	Momentary	10mA @ 5VDC (logic level)	IP64, IP68S, Watertight per MIL-PRF-8805 Design 3	11/16" dia. Threaded or Press Fit	SPST (x8)
T8-T (mini)	8-Way Tactile Feedback	Momentary with Tactile Feel	2A @ 28VDC or 10mA @ 5VDC (logic level)	IP64, IP68S, Water Resistant per MIL-PRF-810F, Method 506.4 Procedure 3 (Drip)	3/4" dia. Threaded or Press Fit	SPST (x8)
TK (mini)	4-Way or 4-Way w/ Center Pushbutton Tactile Feedback	Momentary with Tactile Feel	50mA @ 12VDC (logic level)	IP64, IP68S, or Unsealed	5/8" dia. Threaded	SPST (x4) or SPST (x5)
SPT (split trim)	Two 2-Way Trim Switches	Momentary with Tactile Feel	2A @ 28VDC or 0.6mA @ 15VDC (logic level)	Water Resistant per MIL-PRF-810F, Method 506.4 Procedure 3 (Drip)	3/4" dia. Threaded	Two SPST (x2)
T2 (large)	2-Way, Center Pushbutton Option	Momentary with Tactile Feel	10A @ 28VDC	MIL-PRF-8805 - Dusttight per Design 2, Resilient per Design 4	Threaded or Press Fit	SPST, DPST Double Break (x3)
T4 (large)	4-Way	Momentary with Tactile Feel	5A @ 30VDC	MIL-PRF-8805 - Dusttight per Design 2, Resilient per Design 4	Press Fit	SPST (x4) Multi-Pole Option
T5 (large)	4-Way plus Center Pushbutton	Center Maintained, Momentary with Tactile Feel	2A @ 28VDC	MIL-PRF-8805 - Dusttight per Design 2	Threaded or Press Fit	SPST (x5) Multi-Pole Option

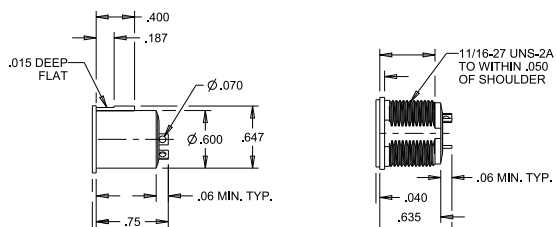
# T1 MINI TRIM SWITCHES

## 2-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

The T1 Mini Trim is a single pole, double throw, center off, momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



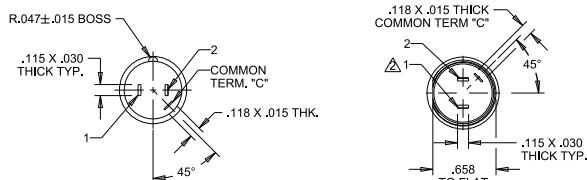
### Typical Dimensions



Press Fit

Threaded Body

### T1



Press Fit

Threaded Body

### Standard Characteristics/Ratings:

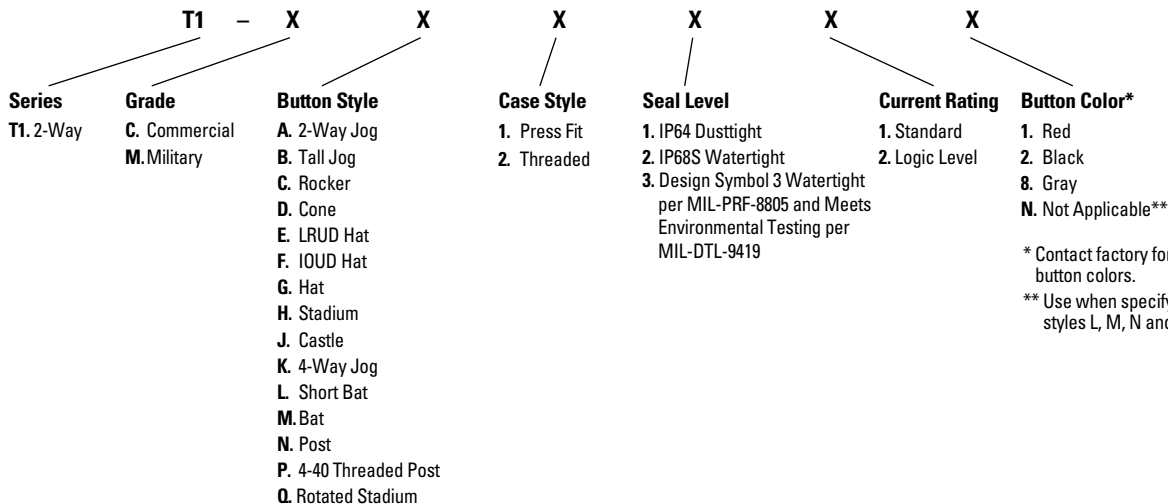
#### ELECTRICAL RATINGS:

Load	Rating
Resistive	10mA @ 5VDC (logic level)
Inductive	1A @ 28VDC
DWV	1050Vrms
Logic Level	10mA Resistive @ 5VDC
<b>Electrical Life:</b>	100,000 cycles 1A Inductive @ 28VDC
<b>Lever Travel:</b>	15° max from center OFF
<b>Seal:</b>	IP64 or IP68S or MIL-PRF-8805 Design 3
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	16 oz +/- 6 oz
<b>Lever Pivot &amp; Stop Strength:</b>	Switch is capable of withstanding a force of 25.0 lbs. applied to the actuating button. The button also withstands 15.0 lbs. minimum pull force.

#### MATERIALS:

<b>Case:</b>	Aluminum alloy or thermoplastic
<b>Button:</b>	Thermoplastic
<b>Terminals:</b>	Silver over brass Gold over silver over brass for logic level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut, tooth lockwasher and panel gasket where applicable

### T1 MINI TRIM PART NUMBER CODE



T1 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

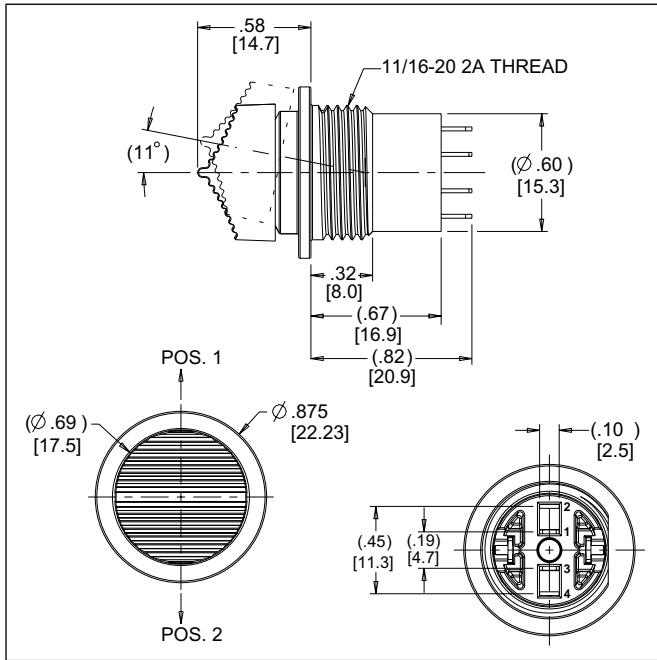
2-WAY MINI TRIM, COMMERCIAL GRADE

The T1-T Mini Trim is a latching, single pole, single throw, center off, momentary/maintained action contact switch. The T1-T has an 11/16" threaded case making it ideal for panel or control grip mounting. The switch provides a 2-way momentary/maintained toggle action with a positive click action. Four switch action/circuit options provide you with the choice you need for your application in aerospace, off-highway and all other demanding applications.



Center Off Position

Maintained Position



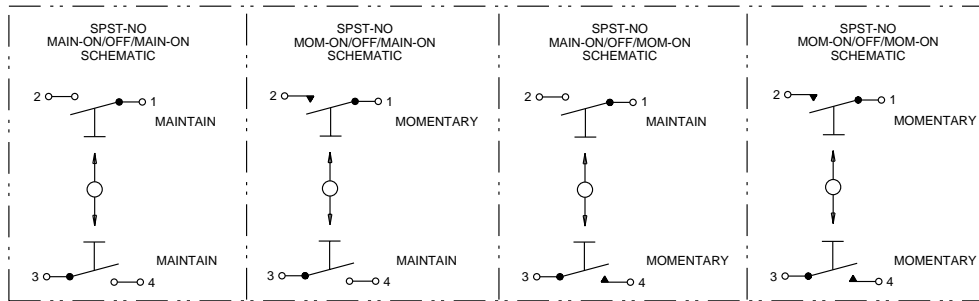
**Standard Characteristics/Ratings:**

**ELECTRICAL RATINGS:**

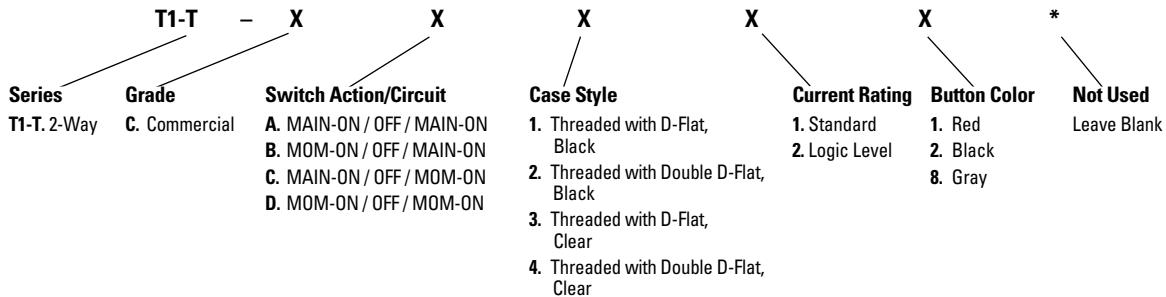
Load	Sea Level @ 28VDC
Resistive	2A
Inductive	1A
DWV	1050Vrms
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	100,000 cycles
<b>Mechanical Life:</b>	100,000 cycles
<b>Seal:</b>	Water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip)
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Pretravel:</b>	9.5° max
<b>Overtravel:</b>	1.5° min
<b>Return Point:</b>	4° min
<b>Operating Force:</b>	1.00 ± 0.50 to make contact in momentary position 0.90 ± 0.45 to make contact in maintained position 0.45 ± 0.30 to return to neutral position from maintained position

**MATERIALS:**

<b>Case:</b>	Anodized aluminum
<b>Button:</b>	Thermoplastic
<b>Mounting Hardware:</b>	Hex nut and lockwasher



**T1-T MINI TRIM PART NUMBER CODE**



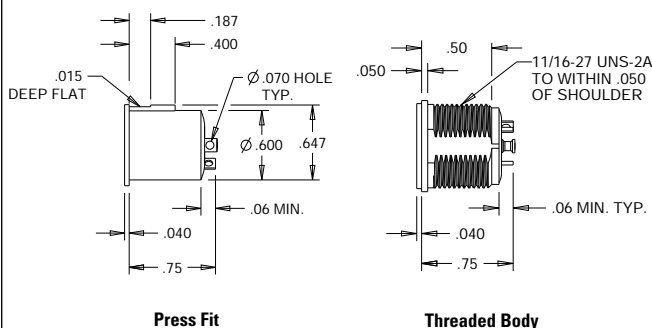
# T2 MINI TRIM SWITCHES

2-WAY PLUS CENTER PUSHBUTTON MINI TRIM, COMMERCIAL & MILITARY GRADES

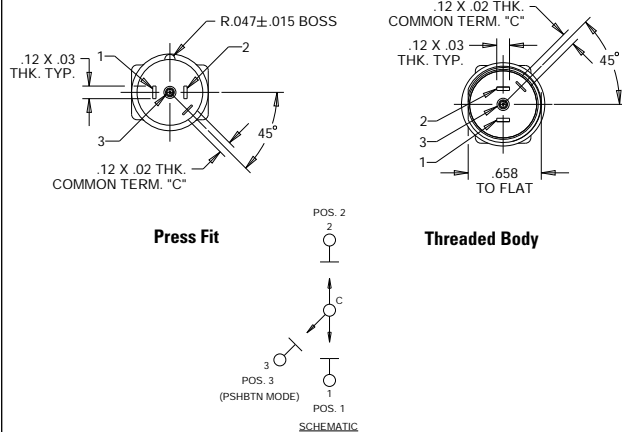
The T2 Mini Trim is a single pole, 3 throw Center off momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



### Typical Dimensions



### T2



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

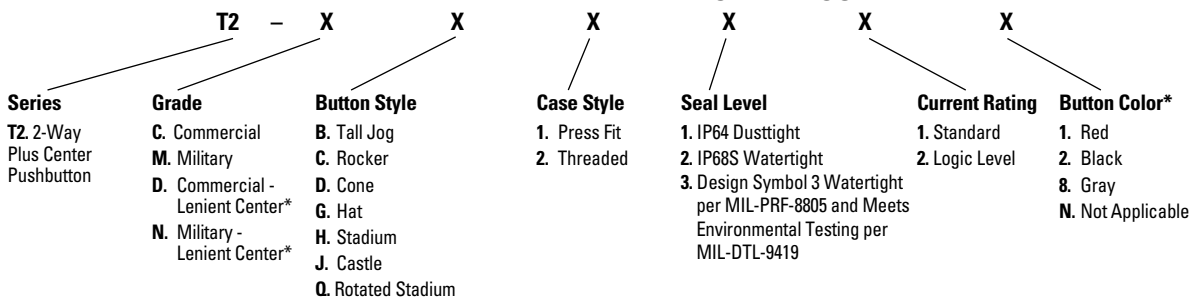
Load	Rating
Resistive (logic level)	10mA @ 5VDC
Inductive	1A @ 28VDC
DWV	1050Vrms
<b>Electrical Life:</b>	100,000 cycles
<b>Lever Travel:</b>	Toggle: 15° max from center OFF Pushbutton: 0.020 inches min
<b>Seal:</b>	IP64 or IP68S or MIL-PRF-8805 Design 3
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Actuating Force:</b>	Toggle: 16 oz +/- 6 oz Pushbutton: 5.0 lbs. max

**Lever Pivot & Stop Strength:** Switch is capable of withstanding a force of 25.0 lbs. applied to the actuating button. The button also withstands 15.0 lbs. minimum pull force.

#### MATERIALS:

<b>Case:</b>	Aluminum alloy or thermoplastic
<b>Button:</b>	Thermoplastic
<b>Terminals:</b>	Silver over brass Brass with gold over silver for logic level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut, tooth lockwasher, panel seal gasket where applicable

### T2 MINI TRIM PART NUMBER CODE



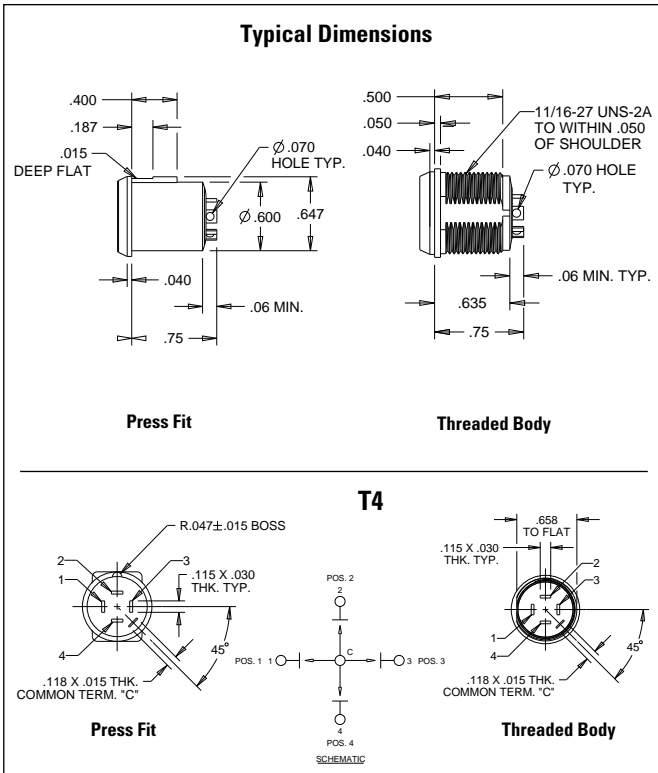
\* Wider angle of operation for center pushbutton.

T2 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

\* Contact factory for additional button colors.

4-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

The T4 Mini Trim is a single pole, 4 throw, center off, momentary contact (self return to center off). Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	
<b>Load</b>	<b>Rating</b>
Resistive (low level)	10mA @ 30mV
Inductive	1A @ 28VDC
DWV	1050Vrms
<b>Electrical Life:</b>	100,000 cycles 1A Inductive @ 28VDC
<b>Lever Travel:</b>	15° max from center OFF
<b>Seal:</b>	IP64 or IP68S or MIL-PRF-8805 Design 3
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Actuating Force:</b>	16 oz +/- 6 oz
<b>Lever Pivot &amp; Stop Strength:</b>	Switch is capable of withstanding a force of 25.0 lbs. applied to the actuating button. The button also withstands 15.0 lbs. minimum pull force.
<b>MATERIALS:</b>	
<b>Case:</b>	Aluminum alloy or thermoplastic
<b>Button:</b>	Thermoplastic
<b>Terminals:</b>	Silver over brass Brass with gold over silver for low level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut, tooth lockwasher, panel seal gasket where applicable

### T4 MINI TRIM PART NUMBER CODE

<b>T4</b>	-	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	
<b>Series</b>		<b>Grade</b>	<b>Button Style</b>	<b>Case Style</b>	<b>Seal Level</b>	<b>Current Rating</b>	<b>Button Color*</b>
T4. 4-Way		C. Commercial M. Military	A. 2-Way Jog B. Tall Jog C. Rocker D. Cone E. LRUD Hat F. IOUD Hat G. Hat H. Stadium J. Castle K. 4-Way Jog L. Short Bat M. Bat N. Post P. 4-40 Threaded Post Q. Rotated Stadium	1. Press Fit 2. Threaded	1. IP64 Dusttight 2. IP68S Watertight 3. Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419 ①	1. Standard 2. Low Level	1. Red 2. Black 8. Gray N. Not Applicable**

① Only available with military grade.  
\* Contact factory for additional button colors.  
\*\* Use when specifying button styles L, M, N and P.

T4 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.



## 4-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE

Tactile switches remain a favorite among design engineers because the positive detent indicates circuit transfer to the operator. The T4-T toggle switch provides a 4-way momentary toggle action with detent providing a positive click action.

T4-T seal options include IP64, IP68S and water resistant per MIL-STD-810F; method 506.4, procedure 3 (drip).

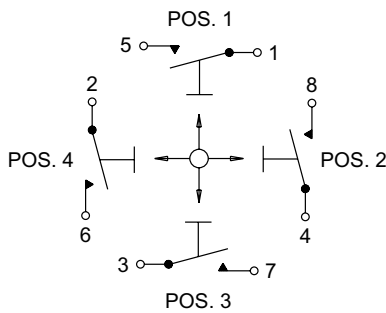
The T4-T series provides Commercial and Military grade switching with a positive click action, ideal for grip applications in aircraft and off-road equipment.

### Features:

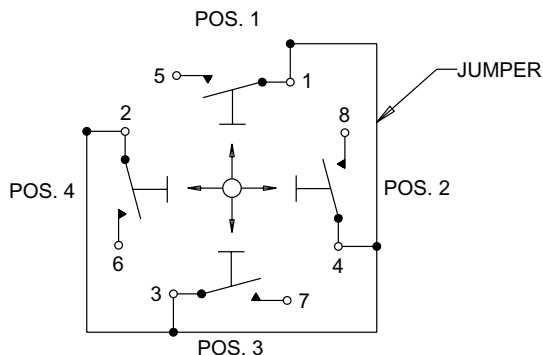
- Positive detent
- 4-way momentary toggle action
- Positive click action
- Enclosure sealed to IP64, IP68S or water resistant per MIL-STD-810F; method 506.4, procedure 3 (drip)
- Logic level options
- Available in Commercial & Military grades
- Variety of button styles & colors available
- RoHS compliant



(Unsealed Versions Shown)



SPST-NO  
4 WAY  
SCHEMATIC



SPST-NO  
4 WAY WITH COMMON JUMPER  
SCHEMATIC

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC
Resistive	2A
Inductive	1A
DWV	1000Vrms
Logic Level	10mA @ 5VDC

**Electrical Life:** 100,000 cycles min. (Military)  
150,000 cycles min. (Commercial)

**Mechanical Life:** 500,000 cycles

**Seal:** IP64, IP68S or water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip)

**Operating Temp Range:** -55°C to +85°C

**Operating Force:** 0.75 lb. +/- 0.25 lb.

**Button Strength:** 4.5 lb. minimum pull

**Overtravel:** 1.5° min

**Pretravel:** 9.5° max

**Return Point:** 4° min

#### MATERIALS:

**Case:** Black Thermoplastic

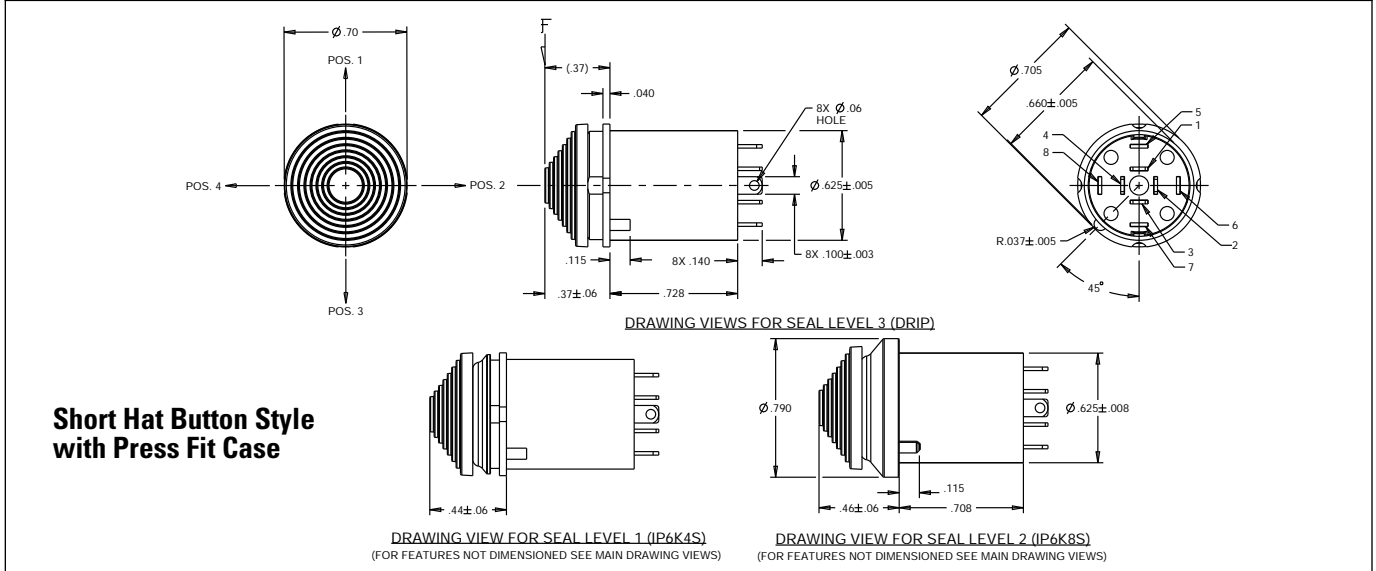
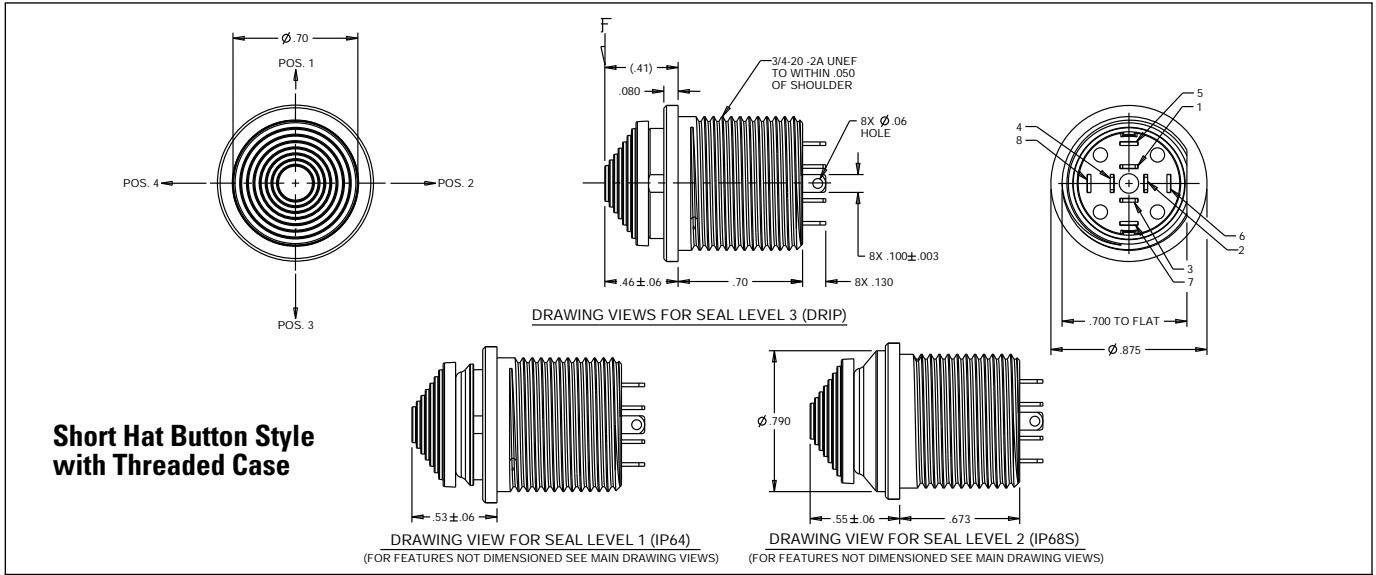
**Button:** Thermoplastic

**Terminals:** Copper or brass  
Gold over silver for logic level

**Bushing:** Black anodized aluminum alloy

**Mounting Hardware:** Hexnut, lockwasher and panel seal gasket where applicable

## 4-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE



### T4-T PART NUMBER CODE

	<b>T4-T</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Series</b>	<b>Grade</b>	<b>Button Style*</b>	<b>Case Style</b>	<b>Seal</b>	<b>Current Rating</b>	<b>Button Color**</b>	
T4-T 4-Way	C. Commercial M. Military	A. 2-Way Jog B. Tall Jog C. Rocker D. Cone E. LRUD Hat F. IOUD Hat G. Hat H. Stadium J. Castle K. 4-Way Jog L. Inverse Hat M. Tall Hat N. Short Hat P. Rotated Stadium	3. Press Fit 4. Threaded	1. IP64 Dusttight 2. IP68S Watertight 3. Water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip)	1. Standard 2. Logic Level 3. Standard With Internal Jumper 4. Logic Level With Internal Jumper	1. Red 2. Black 8. Gray	

\*\*Contact factory for additional colors.

\*T4-T Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

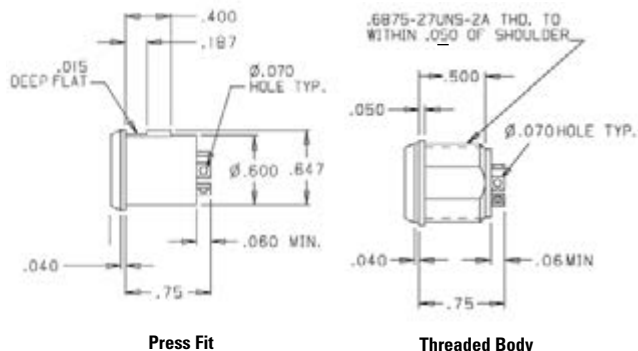
# T5 MINI TRIM SWITCHES

4-WAY PLUS CENTER PUSHBUTTON MINI TRIM, COMMERCIAL & MILITARY GRADES

The T5 Mini Trim is a single pole, 5 throw Center off momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



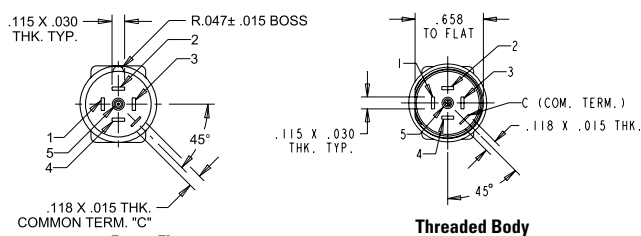
### Typical Dimensions



Press Fit

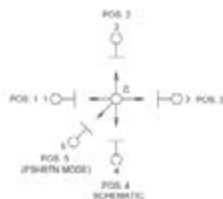
Threaded Body

### T5



Press Fit

Threaded Body



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Load	Rating
Resistive	10mA @ 5VDC (logic level)
Inductive	1A @ 28VDC
DWV	1050Vrms
<b>Electrical Life:</b>	100,000 cycles 1A Inductive @ 28VDC
<b>Lever Travel:</b>	Toggle: 15° max from center OFF Pushbutton: 0.020 inches min
<b>Seal:</b>	IP64 or IP68S or MIL-PRF-8805 Design 3
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	Toggle: 16 oz +/- 6 oz Pushbutton: 5.0 lbs. max
<b>Lever Pivot &amp; Stop Strength:</b>	Switch is capable of withstanding a force of 25.0 lbs. applied to the actuating button. The button also withstands 15.0 lbs. minimum pull force.

#### MATERIALS:

<b>Case:</b>	Aluminum alloy or thermoplastic
<b>Button:</b>	Thermoplastic
<b>Terminals:</b>	Silver over brass Brass with gold over silver for logic level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut, tooth lockwasher, panel seal gasket where applicable

### T5 MINI TRIM PART NUMBER CODE

Series	Grade	Button Style	Case Style	Seal Level	Current Rating	Button Color*
T5 - X	C. Commercial	B. Tall Jog	1. Press Fit	1. IP64 Dusttight	1. Standard	1. Red
	M. Military	C. Rocker	2. Threaded	2. IP68S Watertight	2. Logic Level	2. Black
	D. Commercial - Lenient Center*	D. Cone		3. Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419		8. Gray
	N. Military - Lenient Center*	E. LRUD Hat				N. Not Applicable**
		G. Hat				
		H. Stadium				
		J. Castle				
		K. 4-Way Jog				
		P. 4-40 Threaded Post				
		Q. Rotated Stadium				

\* Wider angle of operation for center pushbutton.

\*\*Use when specifying Button Style P

T5 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

\* Contact factory for additional button colors.

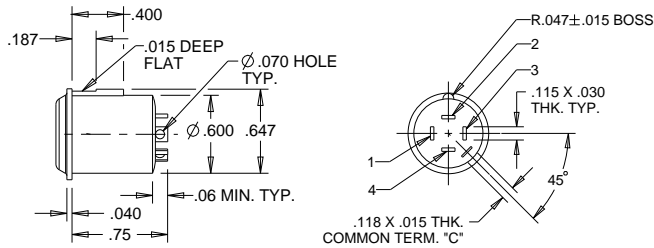
# T8 MINI TRIM SWITCHES

## 8-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

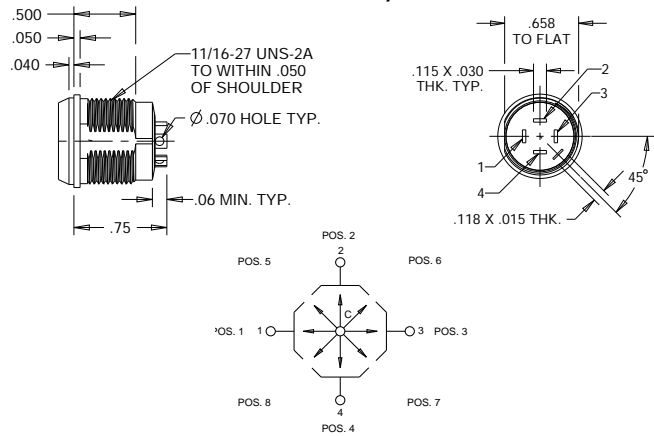
The T8 Mini Trim is a single pole, 8 throw, center off momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.

### Typical Dimensions

#### Press Fit



#### Threaded Body



### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

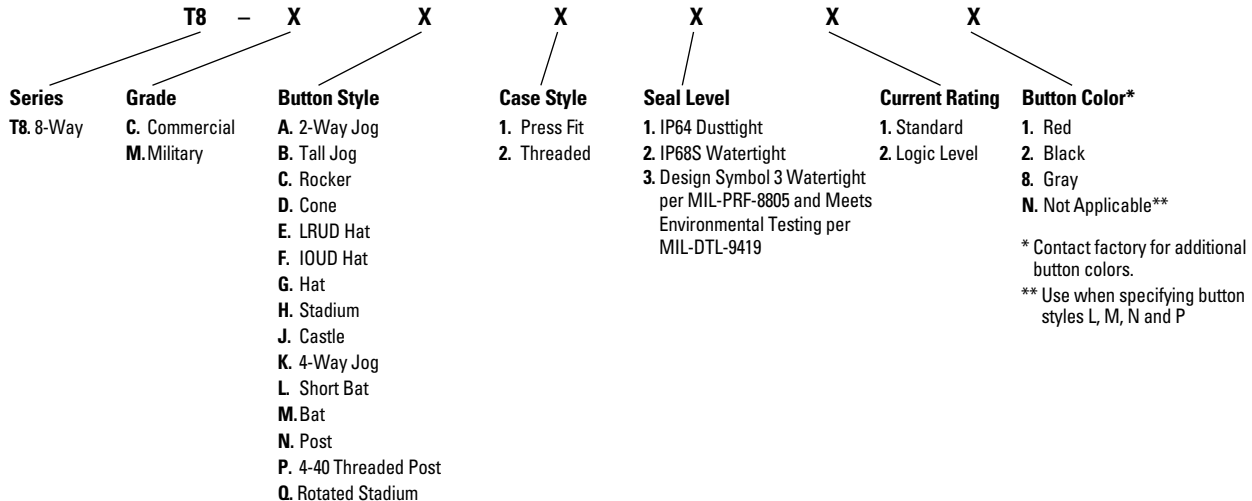
Load	Rating
Resistive	10mA @ 5VDC (logic level)
Inductive	1A @ 28VDC
DWV	1050Vrms

<b>Electrical Life:</b>	100,000 cycles
<b>Lever Travel:</b>	Toggle: 15° max from center OFF
<b>Seal:</b>	IP64 or IP68S or MIL-PRF-8805 Design 3
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	Toggle: 16 oz +/- 6 oz
<b>Lever Pivot &amp; Stop Strength:</b>	Switch is capable of withstanding a force of 25.0 lbs. applied to the actuating button. The button also withstands 15.0 lbs. minimum pull force.

#### MATERIALS:

<b>Button:</b>	Thermoplastic
<b>Case:</b>	Black anodized aluminum alloy
<b>Terminals:</b>	Silver over brass Brass with gold over silver for logic level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut, tooth lockwasher, panel seal gasket where applicable

### T8 MINI TRIM PART NUMBER CODE



T8 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

# T8-T TACTILE MINI TRIM

**T8-T**  
TACTILE  
MINI TRIM

## 8-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE

The T8-T toggle switch provides an 8-way momentary toggle action with detent providing a positive click action that indicates circuit transfer to the operator. The T8-T series provides commercial and military grade switching with sealing up to IP68S, and is ideal for grip applications in aircraft and off-road equipment.

### Features:

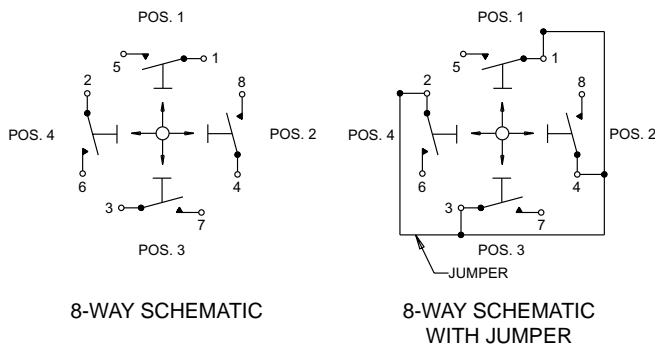
- Positive detent
- 8-way momentary toggle action
- Panel sealed to IP64, IP68S or unsealed
- Positive click action
- Logic level switching option
- Available in commercial & military grades
- Variety of button styles & colors available
- RoHS compliant



Hat Button Style  
with Press Fit Case



Inverse Hat Button Style  
with Threaded Case



Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	
<b>Load</b>	<b>Sea Level @ 28VDC</b>
Resistive	2A
Inductive	1A
DWV	1000Vrms
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	30,000 cycles (Military), 50,000 cycles (Commercial)
<b>Mechanical Life:</b>	150,000 cycles
<b>Seal:</b>	IP64, IP68S or unsealed
<b>Operating Temp Range:</b>	-55°C to +85°C
<b>Operating Force:</b>	1.2 lb. +/- 0.5 lb.
<b>Button Strength:</b>	4.5 lbs. min pull
<b>Overtravel:</b>	1° min
<b>Pretravel:</b>	9.5° max
<b>Return Point:</b>	3.5° min
<b>MATERIALS:</b>	
<b>Case:</b>	Black Thermoplastic
<b>Button:</b>	Thermoplastic
<b>Bushing:</b>	Black anodized aluminum alloy
<b>Mounting Hardware:</b>	Hexnut, lockwasher, and panel seal (level 1 and 2 only)

### T8-T PART NUMBER CODE

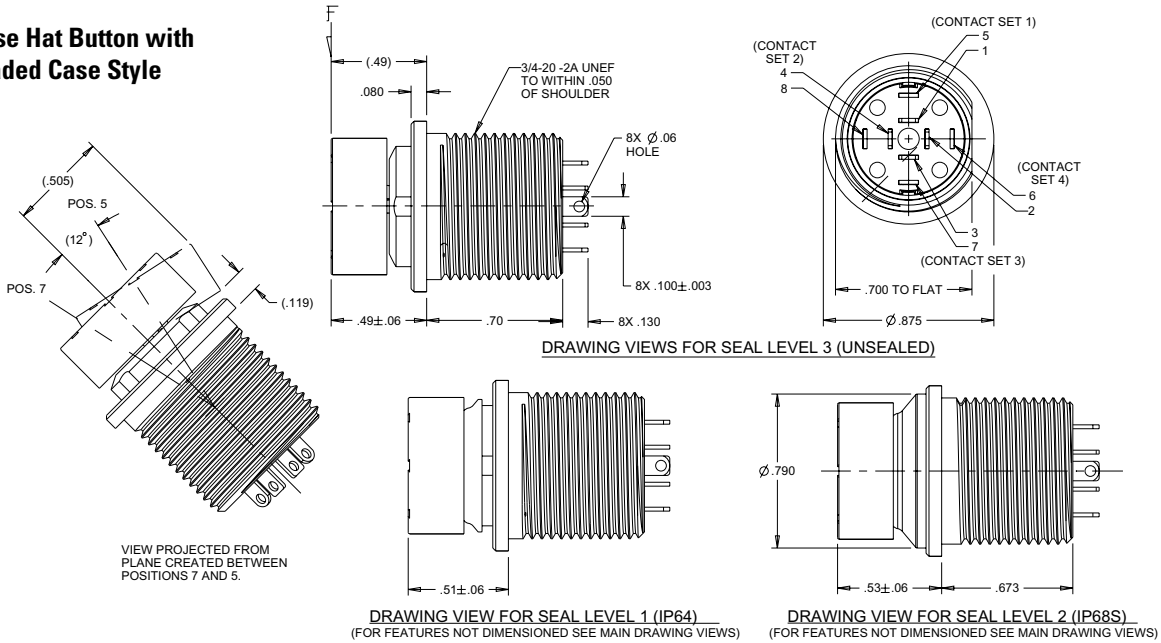
<b>T8-T</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Series</b>	<b>Grade</b>	<b>Button Style</b>	<b>Case Style</b>	<b>Seal*</b>	<b>Current Rating</b>
T8-T 8-Way	C. Commercial M. Military	D. Cone E. LRUD Hat F. IOUD Hat G. Hat H. Stadium J. Castle K. 4-Way Jog R. Inverse Hat S. Tall Hat T. Short Hat Q. Stadium Rotated	3. Press Fit 4. Threaded	1. IP64 2. IP68S 3. Unsealed	1. Standard 2. Logic Level 3. Standard With Internal Jumper 4. Logic Level With Internal Jumper
					<b>Button Color**</b>
					1. Red 2. Black 8. Gray

\* Panel seal only  
\*\* Contact factory for additional colors.

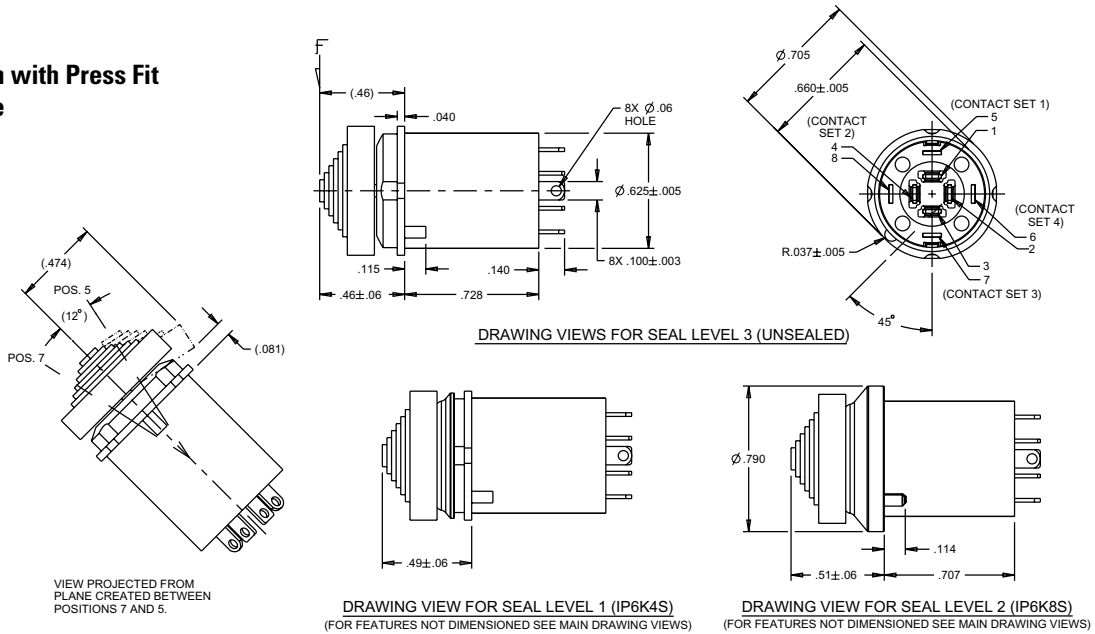
T8-T Mini Trim button styles are shown on the Button Styles page and in the appendix.

## 8-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE

### Inverse Hat Button with Threaded Case Style

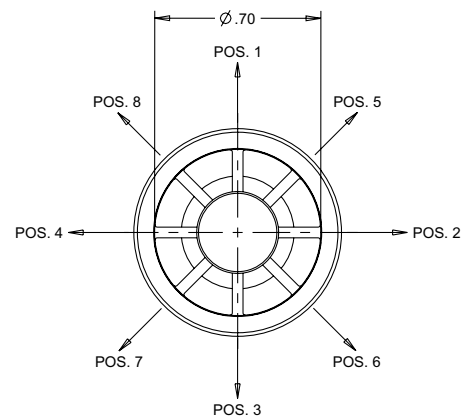


### Hat Button with Press Fit Case Style



BUTTON POSITION/SWITCH ACTION (ALL MOMENTARY CONTACTS - ALL OTHER CONTACT SETS NOT SHOWN ARE OPEN)

BUTTON POSITION	CONTACT SET 1	CONTACT SET 2	CONTACT SET 3	CONTACT SET 4
1	5 ○ —●— 1			
2		8 ○ —●— 4		
3			7 ○ —●— 3	
4				6 ○ —●— 2
5	5 ○ —●— 1	8 ○ —●— 4		
6		8 ○ —●— 4	7 ○ —●— 3	
7			7 ○ —●— 3	6 ○ —●— 2
8	5 ○ —●— 1			6 ○ —●— 2



## SHORTER, LOGIC LEVEL TACTILE MINI TRIM

## LOGIC LEVEL 4-WAY OR 4-WAY PLUS CENTER PUSHBUTTON TACTILE MINI TRIM

TK with  
Molex ConnectorTK with  
Wire Leads  
(Coming Soon)

The TK Mini Trim is a tactile, 4-way, logic level, momentary contact switch with a center pushbutton option designed to fit easily in grips and control panels. The TK's shorter behind panel length is nearly 2/10" shorter than OTTO's traditional T4-T Mini Trim allowing for increased functionality and efficiency in any application.

The TK offers three panel sealing level choices: unsealed, dusttight to IP64, or watertight to IP68S.

The TK is a tactile switch which offers the operator a positive click action indicating actuation, and is ideal for grip applications in aircraft, off-road and material handling.

## Features:

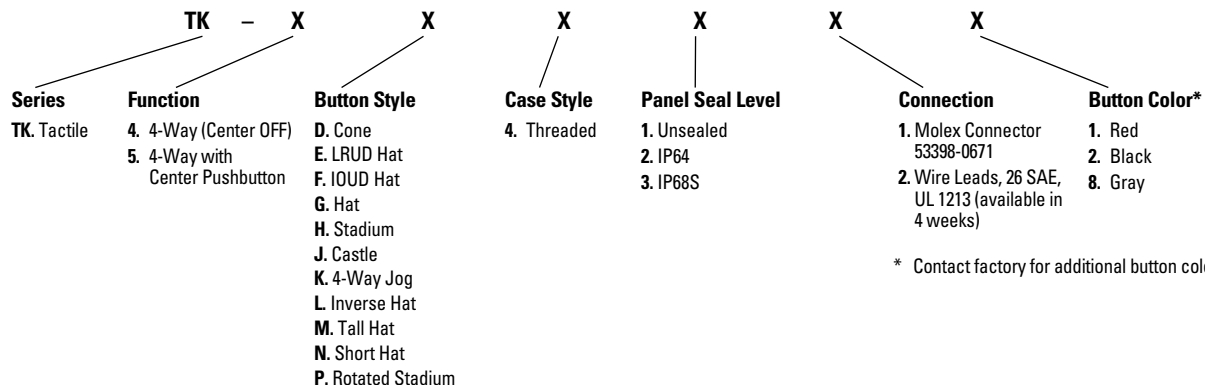
- Logic level, normally open
- Shorter behind panel
- 4-way or 4-way with center pushbutton momentary toggle action
- Positive click action indicates actuation
- Panel sealed to IP64, IP68S or unsealed
- Wire leads or Molex connector
- RoHS compliant

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

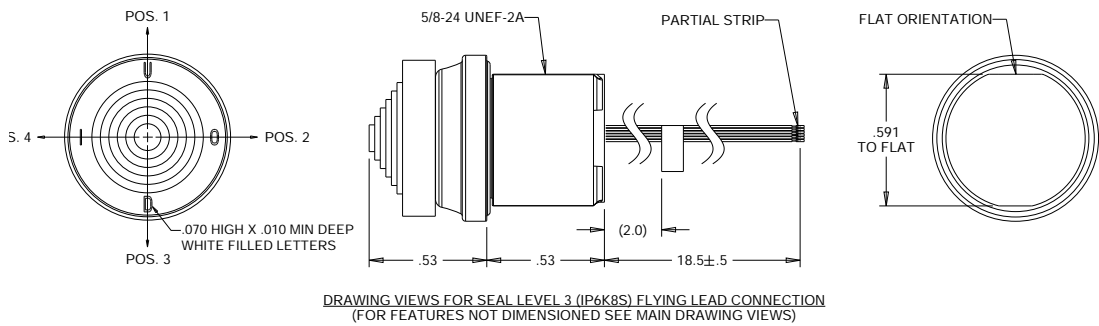
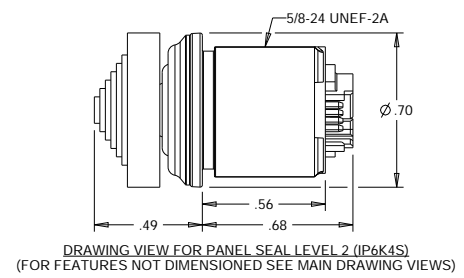
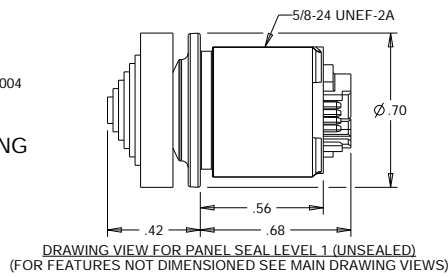
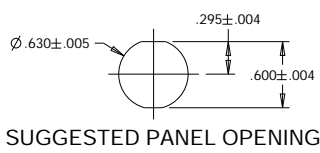
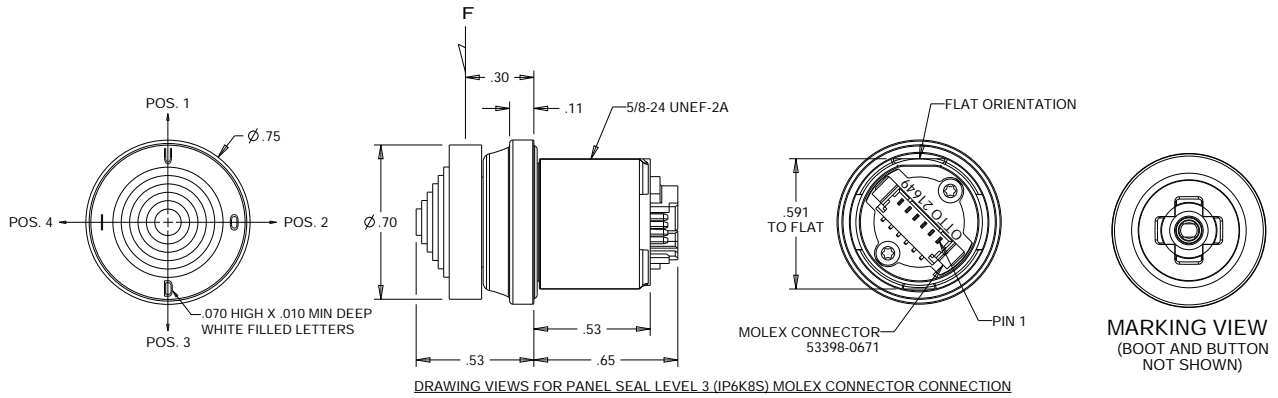
Load	Rating
Resistive	50mA max @ 12VDC
<b>Electrical Life:</b>	1,000,000 cycles
<b>Mechanical Life:</b>	1,000,000 cycles
<b>Seal:</b>	IP64, IP68S or unsealed
<b>Operating Temp Range:</b>	-40°C to +85°C
<b>Operating Force:</b>	1.0 lb. +/- 0.5 lb.
<b>Total Travel Angle:</b>	18° +/- 4°
<b>Pushbutton Operating Force:</b>	1.5 lb. +/- 0.5 lb.
<b>Total Pushbutton Travel:</b>	.05 lb. +/- .02 lb.
<b>Max. Allowable Force:</b>	22 lbs. in any direction
<b>MATERIALS:</b>	
<b>Case:</b>	Thermoplastic, black
<b>Button:</b>	Thermoplastic
<b>Bellows:</b>	Black silicone
<b>Connection:</b>	Connector or wire leads
<b>Mounting Hardware:</b>	Hex nut

### TK MINI TRIM PART NUMBER CODE



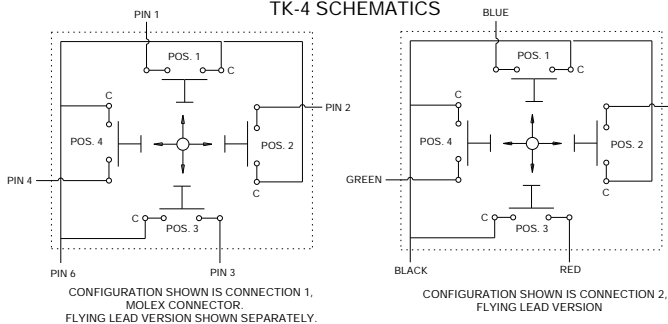
TK Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

## LOGIC LEVEL 4-WAY OR 4-WAY PLUS CENTER PUSHBUTTON TACTILE MINI TRIM

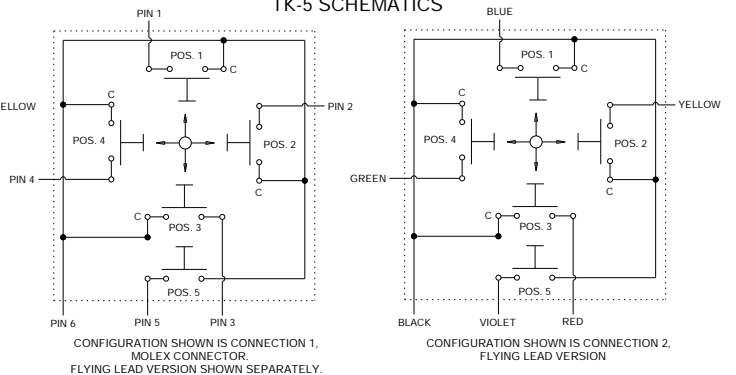


### TK Series Schematics

#### TK-4 SCHEMATICS



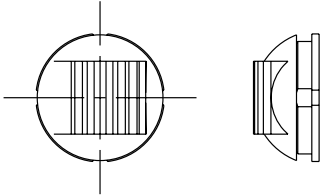
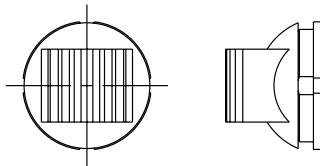
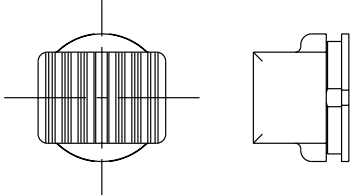
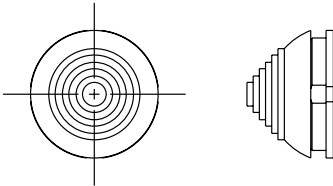
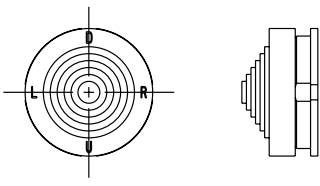
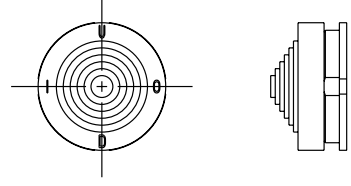
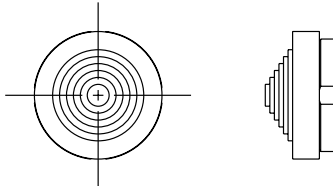
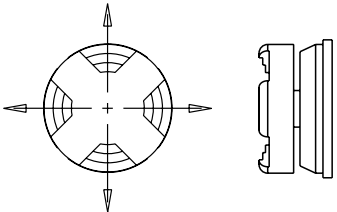
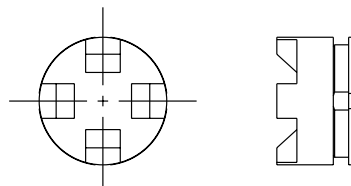
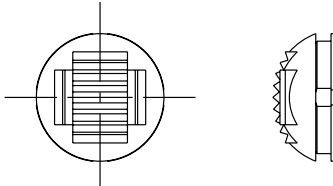
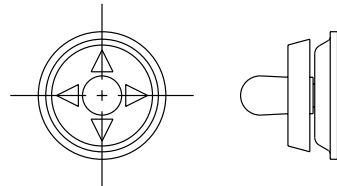
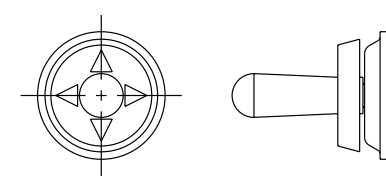
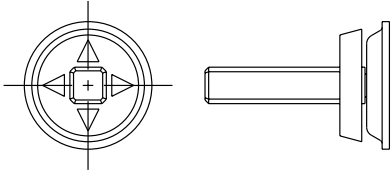
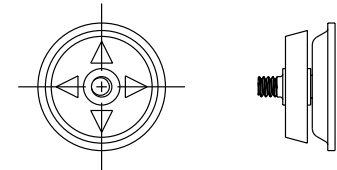
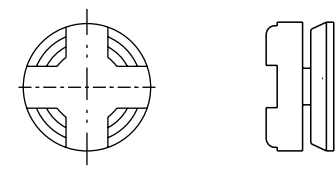
#### TK-5 SCHEMATICS





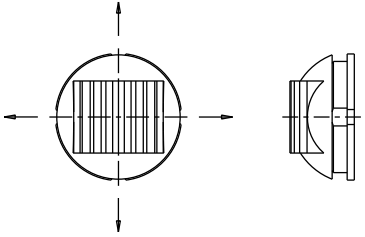
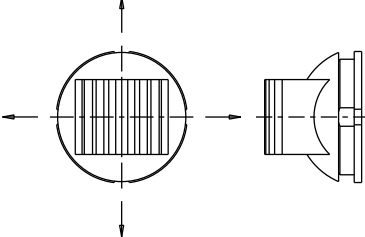
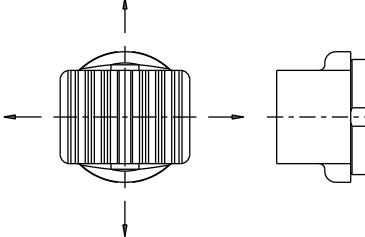
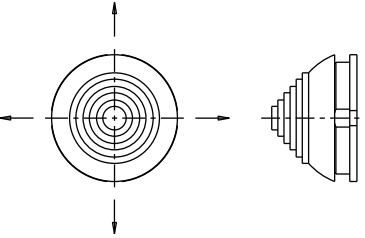
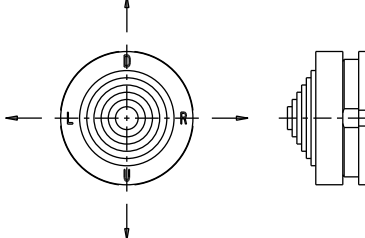
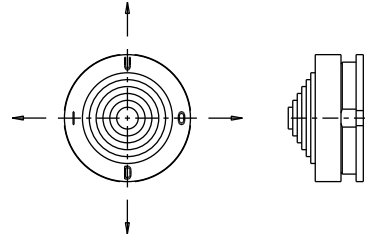
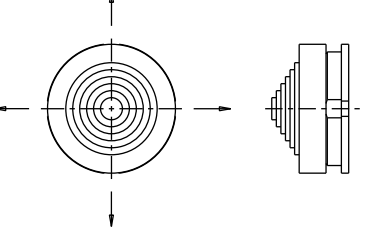
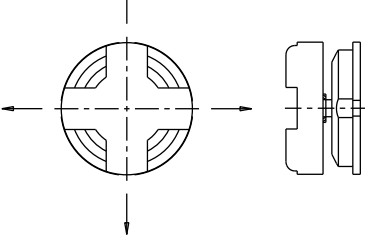
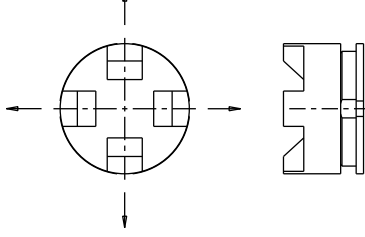
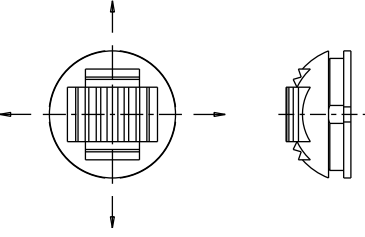
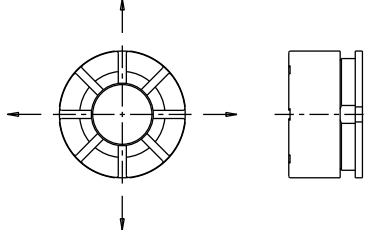
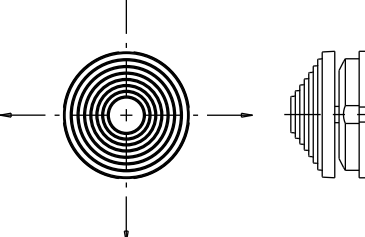
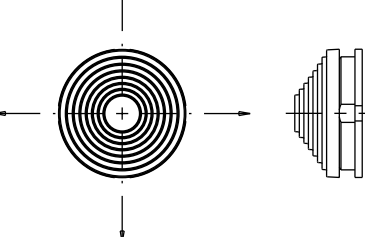
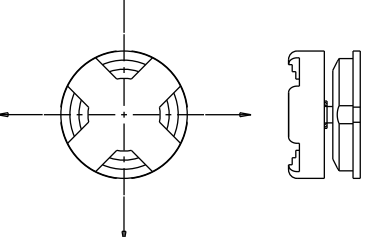
# T1, T2, T4, T5 & T8 MINI TRIM BUTTON STYLES

## T1, T2, T4, T5 AND T8 MINI TRIM BUTTON STYLES

<p><b>A - 2-WAY JOG</b></p> 	<p><b>B - TALL JOG</b></p> 	<p><b>C - ROCKER</b></p> 
<p><b>D - CONE</b></p> 	<p><b>E - LRUD HAT</b></p> 	<p><b>F - IOUD HAT</b></p> 
<p><b>G - HAT</b></p> 	<p><b>H - STADIUM</b></p> 	<p><b>J - CASTLE</b></p> 
<p><b>K - 4-WAY JOG</b></p> 	<p><b>L - SHORT BAT</b></p> 	<p><b>M - LONG BAT</b></p> 
<p><b>N - POST</b></p> 	<p><b>P - 4-40 THREADED POST</b></p> 	<p><b>Q - ROTATED STADIUM</b></p> 

# T4-T AND T8-T MINI TRIM BUTTON STYLES

## T4-T AND T8-T MINI TRIM BUTTON STYLES

<p><b>A - 2-WAY JOG (T4-T ONLY)</b></p> 	<p><b>B - TALL JOG (T4-T ONLY)</b></p> 	<p><b>C - ROCKER (T4-T ONLY)</b></p> 
<p><b>D - CONE (T4-T AND T8-T)</b></p> 	<p><b>E - LRUD HAT (T4-T AND T8-T)</b></p> 	<p><b>F - IOUD HAT (T4-T AND T8-T)</b></p> 
<p><b>G - HAT (T4-T AND T8-T)</b></p> 	<p><b>H - STADIUM (T4-T AND T8-T)</b></p> 	<p><b>J - CASTLE (T4-T AND T8-T)</b></p> 
<p><b>K - 4-WAY JOG (T4-T AND T8-T)</b></p> 	<p><b>L - INVERSE HAT (T4-T) and R (T8-T)</b></p> 	<p><b>M - TALL HAT (T4-T) and S (T8-T)</b></p> 
<p><b>N - SHORT HAT (T4-T) and T (T8-T)</b></p> 	<p><b>P - STADIUM ROTATED (T4-T) and Q (T8-T)</b></p> 	

(2) TWO-WAY MOMENTARY TRIMS WITH TACTILE RESPONSE

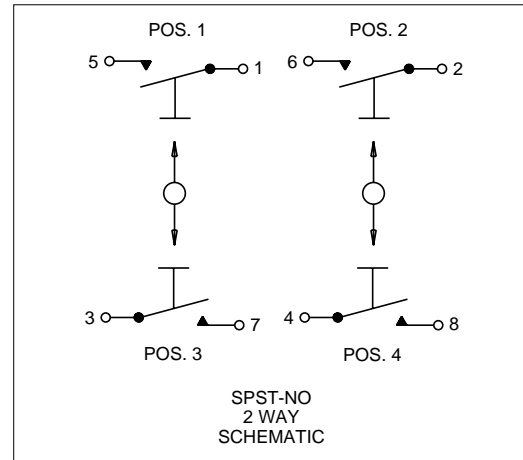


OTTO's Split Trim switch uses 2 single-pole-single-throw momentary toggles with detent providing a positive click action. Each two-way switch can operate independently or simultaneously. OTTO's Split Trim switches are available in both commercial and military grades and are most ideal for applications in aircraft, but can also be used in medical, unmanned vehicle, construction and agricultural equipment.

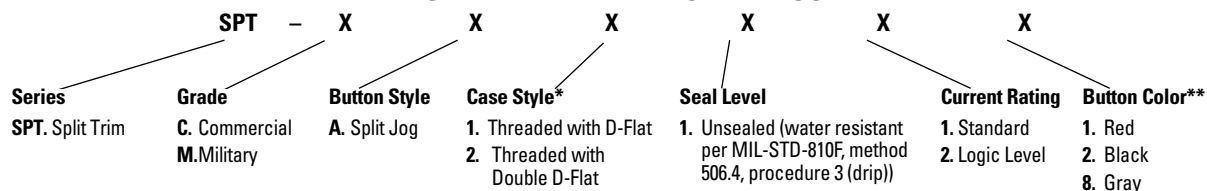
### Features:

- Tactile Feedback
- 2-way momentary actuation of each switch
- Logic level switching option
- Water resistant per MIL-STD-810F; method 506.4, procedure 3 (drip)
- Available in Commercial & Military grades
- Choice of button colors
- Choice of case styles
- RoHS compliant

Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	
<b>Load</b>	<b>Sea Level @ 28VDC</b>
Resistive	2A
Inductive	1A
DWV	1050Vrms
Logic Level	10mA @ 5VDC
<b>Electrical Life:</b>	150,000 cycles commercial, 100,000 cycles military
<b>Mechanical Life:</b>	200,000 cycles
<b>Seal:</b>	Water resistant per MIL-STD-810F, method 506.4 procedure 3 (drip)
<b>Operating Temp Range:</b>	-40°C to +85°C
<b>Operating Force:</b>	0.75 +/- 0.25 lbs.
<b>Return Point:</b>	4° minimum
<b>Pretravel:</b>	9.5° maximum
<b>Overtravel:</b>	1.5° minimum
<b>MATERIALS:</b>	
<b>Case:</b>	Black Anodized Aluminum
<b>Button:</b>	Delrin
<b>Terminals:</b>	Beryllium copper or brass Gold over silver for logic level
<b>Terminal Hardware:</b>	None provided
<b>Mounting Hardware:</b>	Hex nut and lockwasher



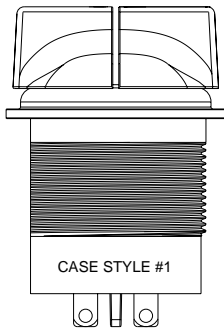
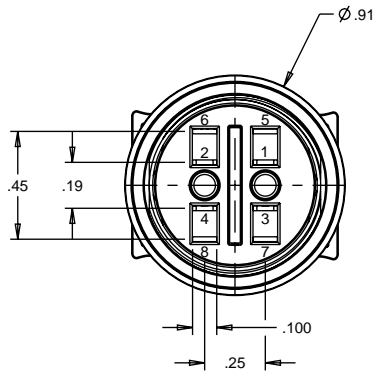
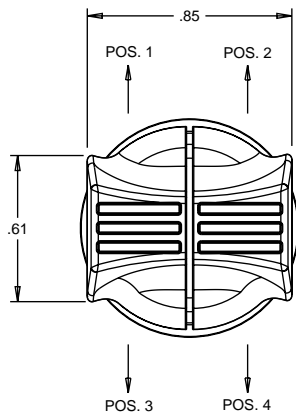
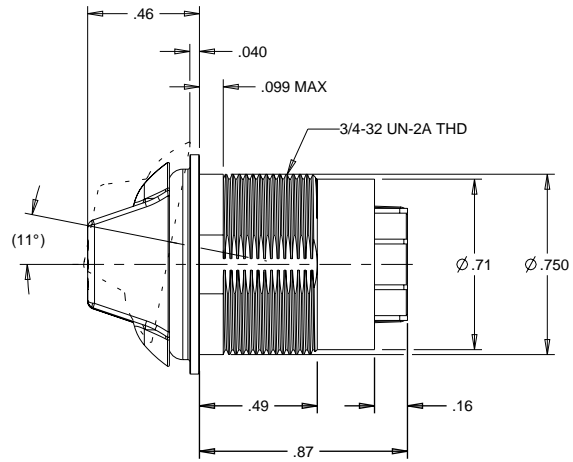
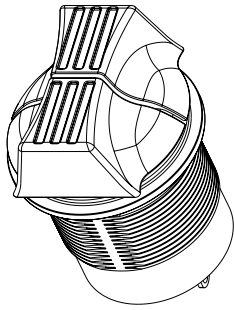
### SPLIT TRIM PART NUMBER CODE



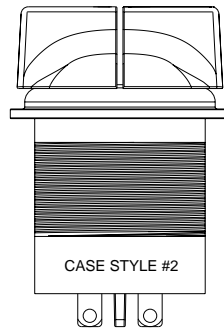
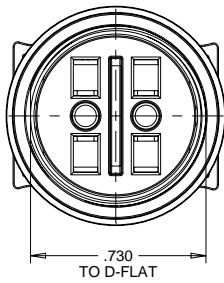
\*Contact factory for press fit case.

\*\*Additional button colors are available.

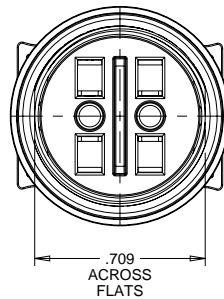
(2) TWO-WAY MOMENTARY TRIMS WITH TACTILE RESPONSE



Single D-Flat



Double D-Flat



# LARGE TRIM, 2-WAY PUSHBUTTON

**T2**  
PUSHBUTTON  
TOGGLES

## MULTI-POSITION TOGGLE PLUS PUSHBUTTON, COMMERCIAL & MILITARY GRADES

The T2 series provides two functions in one compact switch: toggle and pushbutton action. Features toggle lockout when pushbutton mode is actuated and pushbutton lockout when in toggle mode. A resilient seal in the plunger provides splashproof and dusttight seal.

### T2-0004

**Operating Force:** 24 +/- 10 oz

**Circuit:** DPDT-NO, ON-OFF-ON  
No pushbutton function

**Rating:** 5 amps Resistive  
3 amps Inductive  
1 amp Lamp  
Logic Level: 2mA @ 15VDC

**Mechanical Life:** 100,000 cycles

**Electrical Life:** 100,000 cycles

**Seal:** Enclosure Design 4, resilient per MIL-PRF-8805

**Button:** Gray thermoplastic

**Case:** Black anodized aluminum



### T2-0034

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: SPNO double break

**Rating:** 1A to 50mA Resistive @ 4-28VDC

**Electrical Life:** 100,000 cycles

**Seal:** Enclosure Design 2, dusttight per MIL-PRF-8805

**Button:** Gray nylon

**Case:** Black anodized aluminum alloy



### T2-0008

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** Toggle: 10 amps Resistive / 5 amps Inductive  
Pushbutton: 10 amps Resistive / 3 amps Inductive

**Electrical Life:** 50,000 cycles

**Button:** Black nylon

**Case:** Black anodized aluminum



### T2-0018

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** 1 amp Resistive  
0.5 amp Inductive

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 4, resilient per MIL-PRF-8805

**Button:** Black nylon

**Case:** Black anodized aluminum alloy



### T2-0009

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** Toggle: 10 amps Resistive / 5 amps Inductive  
Pushbutton: 10 amps Resistive / 3 amps Inductive

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 4, resilient per MIL-PRF-8805

**Button:** Black nylon

**Case:** Black anodized aluminum alloy



### T2-0047

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** 0.1mA to 500mA Resistive @ 5-32VDC  
0.1mA to 500mA Inductive @ 5-32VDC

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 4, resilient per MIL-PRF-8805

**Button:** Black nylon

**Case:** Dry black chrome plated aluminum alloy



### T2-0015

**Operating Force:** Toggle: 5.0 lbs.  
Pushbutton: 4.0 lbs.

**Circuit:** Toggle: SPST-NO, 4-position, center OFF, momentary  
Pushbutton: SPST-NO

**Rating:** 2 amps Resistive  
2 amps Inductive

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 4, resilient per MIL-PRF-8805

**Button:** Black nylon

**Case:** Black anodized aluminum alloy



### T2-0044

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 3.75 lbs.

**Circuit:** Toggle: DPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** 0.1mA to 500mA Resistive @ 5-32VDC  
0.1mA to 500mA Inductive @ 5-32VDC

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 2, dusttight per MIL-PRF-8805

**Button:** Black nylon

**Case:** Dry black chrome plated aluminum alloy



### T2-0016

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** 1mA to 250mA Resistive @ 12-28VDC

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 4, resilient per MIL-PRF-8805

**Button:** Black nylon

**Case:** Black anodized aluminum alloy



### T2-0045

**Operating Force:** Toggle: 2.5 lbs.  
Pushbutton: 4.5 lbs.

**Circuit:** Toggle: SPST-NO, ON-OFF-ON  
Pushbutton: DPST-NO double break

**Rating:** 1mA to 250mA Resistive @ 12-28VDC

**Electrical Life:** 50,000 cycles

**Seal:** Enclosure Design 3, watertight per MIL-PRF-8805

**Button:** Black nylon

**Case:** Black anodized aluminum alloy



## 4-WAY TOGGLE SWITCHES WITH OR WITHOUT CENTER PUSHBUTTON

### T4-0010

**Actuation:** Center position maintained, all other positions momentary  
**Rating:** 5 amps Resistive @ 30VDC sea level  
 3 amps Inductive @ 30VDC sea level  
 DWV: 1050Vrms @ sea level  
 400Vrms @ 70,000 feet  
**Electrical Life:** 100,000 cycles  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Black thermoplastic  
**Case:** Black anodized aluminum alloy



### T5-0004

**Actuation:** Toggle & Pushbutton: center position maintained, all other positions momentary  
**Rating:** 2 amps Resistive @ 28VDC or 115VAC/60Hz  
 DWV: 1050Vrms  
**Electrical Life:** 50,000 cycles  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Black nylon  
**Case:** Black anodized aluminum alloy



### T4-0065

**Actuation:** Center position maintained, all other positions momentary  
**Rating:** 5 amps Resistive @ 30VDC sea level  
 2.5 amps Resistive @ 70,000 feet  
 3 amps Inductive @ 30VDC sea level  
 1.5 amps Inductive @ 70,000 feet  
 DWV: 1050Vrms @ sea level  
 400Vrms @ 70,000 feet  
**Electrical Life:** 100,000 cycles  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Black nylon  
**Case:** Black anodized aluminum alloy



### T5-0015

**Actuation:** Toggle & Pushbutton: center position maintained, all other positions momentary  
**Rating:** 2 amps Resistive @ 28VDC or 115VAC/60Hz  
 DWV: 1050Vrms  
**Electrical Life:** 50,000 cycles  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Gray thermoplastic



### T4-0082

**Actuation:** Toggle: center position maintained, all other positions momentary  
**Rating:** 5 amps Resistive @ 30VDC sea level  
 3 amps Inductive @ 30VDC sea level  
 DWV: 1050Vrms @ sea level  
**Electrical Life:** 50,000 cycles  
**Enclosure:** Resilient per MIL-PRF-8805 Design 4  
**Button:** Black nylon  
**Case:** Aluminum alloy



### T5-0018

**Actuation:** Toggle & Pushbutton: center position maintained, all other positions momentary  
**Rating:** 2 amps Resistive @ 28VDC or 115VAC/60Hz  
 DWV: 1050Vrms  
**Electrical Life:** 50,000 cycles  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Black thermoplastic  
**Case:** Black anodized aluminum alloy



### T4-0111

**Actuation:** Toggle: center position maintained, all other positions momentary  
**Rating:** 2 amps Resistive @ 28 VDC sea level  
 .5 amps Inductive @ 28 VDC sea level  
 DWV: 1050Vrms @ sea level  
**Electrical Life:** 100,000 cycles, each direction  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Black Nylon  
**Case:** Black anodized aluminum alloy



### T5-0028

**Actuation:** Toggle & Pushbutton: center position maintained, all other positions momentary  
**Rating:** 2 amps Resistive @ 28VDC or 115VAC/60Hz  
 DWV: 1050Vrms  
**Electrical Life:** 50,000 cycles  
**Enclosure:** Dusttight per MIL-PRF-8805 Design 2  
**Button:** Black thermoplastic  
**Case:** Black anodized aluminum alloy



NOTE: Contact factory for additional configurations.

# Toggle Switches



SERIES	FEATURE	ACTUATION	MAX RATING (Resistive @ 28VDC)	SEAL RATING	MOUNTING	CIRCUITRY
T1	2 or 3 Position, 1 to 8 Poles, Lever Lock Option	Momentary, Maintained	8A	MIL-PRF-83731	15/32" or 7/16" Threaded	Multi-Pole B2, B3 Basics
T3	Snap Action, Lever Lock Option	Momentary, Maintained	5A	MIL-PRF-83731 - 15/32" Threaded Only	15/32" or 1/4" Threaded	SPST, DPST
T7	Lower Cost, Sealed	Momentary, Maintained	16A	IP68S & IP69K	15/32" Threaded	SPST, SPDT DPST, DPDT
T71	Thinner T7 Sealed	Momentary, Maintained	16A	IP68S & IP69K	15/32" Threaded	SPST, SPDT
T9	High Performance Lever Lock Option	Momentary, Maintained	20A	IP68S or MIL-DTL-3950	15/32" Threaded	SPST, SPDT DPST, DPDT
TE	Snap Action, Non-Teasible	Momentary, Maintained	5A	MIL-DTL-8834	15/32" or 1/4" Threaded	SPST, DPST

PANEL SEALED PER MIL-PRF-83731

### 2-Position, 4 Pole

**Basic Switches:** Per MIL-PRF-8805/101  
**Enclosure:** Sealed per MIL-DTL-83731  
**Rating:** 5 amps Resistive @ 28VDC  
 2 amps Inductive @ 28VDC  
**Action:** Maintained  
**Handle:** Stainless steel with black chrome  
**Housing:** Thermoplastic  
**Lever:** Stainless steel with black chrome  
**U2-583** (incorporating two T1 toggles)



### 3-Position, 4 Pole with Phosphorescent Dot

**Basic Switches:** Per MIL-PRF-8805/109-04 except terminals  
**Toggle:** Sealed per MIL-DTL-83731  
**Rating:** 1 amp Resistive @ 28VDC  
 .5 amp Inductive @ 28VDC  
**Operating Force:** 1 to 6 lbs.  
**Action:** Maintained  
**Cap/Handle:** Stainless steel, painted  
**Housing:** Polyester  
**Bushing:** Stainless steel, black oxide finish



### T1 Toggle with IWTS Termination

Choose an integrated wire termination system (IWTS) for ease of installation. By using a special tool, there is no need to solder. Select from a variety of bat handles. T1 base shown here.



### 2-Position, 8 Pole, Lever Lock

**Basic Switches:** Per MIL-PRF-8805/101  
**Enclosure:** Sealed per MIL-DTL-83731  
**Operating Force:** 6.0 lbs. max  
**Rating:** 5 amps Resistive @ 28VDC  
 1 amp Inductive @ 28VDC  
 1 amp Lamp @ 28VDC  
 2 amps Motor @ 28VDC  
**Action:** Maintained  
**Cap, Handle:** Brass, dull nickel plate  
**Handle:** Stainless steel  
**T1-0436\***



\*Available with lever lock configuration G only.

### 3-Position, 8 Pole

**Rating:** 5 amps Resistive @ 28VDC  
 2 amps Inductive @ 28VDC  
**Action:** Maintained  
**Cap:** Brass, dull nickel plate  
**Handle:** Stainless steel, dull nickel plate  
**Housing:** Thermoplastic  
**Bushing:** In accordance with MIL-DTL-3950  
**T1-0423**



### 2-Position, 3 Pole, Lever Lock

**Basic Switches:** Per MIL-PRF-8805/101  
**Enclosure:** Toggle seal per MIL-DTL-83731  
**Operating Force:** 5.0 lbs. max  
**Rating:** 150mA Resistive @ 28VDC  
**Mechanical Life:** 100,000 cycles  
**Action:** Maintained-maintained  
**Handle:** Stainless steel, dull nickel plate  
**Cap, Handle:** Brass, dull nickel plate  
**Bushing & Bracket:** Stainless steel  
**T1-0081D\***



\*Lever Lock configurations D, F and G available.

### 2-Position, 2 Pole

**Basic Switch:** Per MIL-PRF-8805/109 (except terminals)  
**Enclosure:** Sealed per MIL-DTL-83731  
**Operating Force:** 2 to 5 lbs. max  
**Rating:** 1 amp Resistive @ 28VDC  
 0.5 amp Inductive @ 28VDC  
**Action:** Maintained-maintained  
**Bat, Handle, Bushing & Bracket:** Stainless steel  
**T1-0051-1**



### 3-Position, 8 Pole, "T" Lever Lock

**Basic Switch:** Per MIL-PRF-8805  
**Enclosure:** Sealed per MIL-DTL-83731  
**Rating:** 5 amps Resistive @ 28VDC  
 1 amp Inductive @ 28VDC  
 1 amp Lamp @ 28VDC  
 2 amps Motor @ 28VDC  
**Action:** Maintained  
**Bushing, Cap & Handle:** Stainless steel  
**T1-0215\***

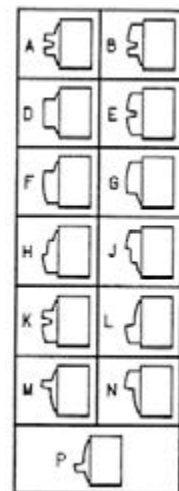


\*Lever Lock configurations A thru P available.

### Lever Lockout Configuration Codes

Figures A thru P are schematics to illustrate lockout configurations and momentary positions. They do not represent details of construction.

- A** Locked in all three positions
- B** Locked in Center and Keyway Side position
- D** Locked out of Center position
- E** Locked in Center position
- F** Locked in Opposite Keyway position
- G** Locked in Keyway Side position
- H** Locked out of Center and Keyway Side Position
- J** Locked out of Center and Opposite Keyway position
- K** Locked in Center and Opposite Keyway position
- L** Locked out of Keyway Side position
- M** Locked out of and into Opposite Keyway position
- N** Locked out of Opposite Keyway position
- P** Locked out of and into Keyway Side position





FEATURING B2 & B3 BASIC SWITCHES

### 3-Position, 6 Pole, Lever Lock

**SPECIFICATIONS:**

Position	Circuit	Action
1	3PNO, 3PNC	Maintained
2	6PNO	Momentary
3	6PNC	Locked

**Basic Switches:** Per MIL-PRF-8805/4 (except with integral lever)

**Operating Force:** 1.5 lbs. to 2.5 lbs.

**Rating:** 0.1mA to 1 amp Resistive @ 28VDC  
0.5 amp Inductive @ 28VDC

**Handle:** Stainless steel, dull nickel plate

**Cap, Handle:** Brass, dull nickel plate

**Bushing:** Stainless steel with black oxide finish

**Bracket:** Stainless steel



T1-0125

### 3-Position, 3 Pole

**SPECIFICATIONS:**

Position	Actuation
Up	N.C., N.C., N.C.
Center	N.C., N.O., N.C.
Down	N.O., N.C., N.O.

**Basic Switches:** Per MIL-PRF-8805/4

**Operating Force:** 1.0 lb. to 6.0 lbs.

**Rating:** 300mA @ 5VDC Resistive  
Higher ratings available

**Mechanical Life:** 25,000 cycles



T1-0041

### 3-Position, 6 Pole

**SPECIFICATIONS:**

Position	Circuit	Force	Action
1	3PNC, 3PNO	2.0 lbs. to 6.0 lbs.	Maintained
2	6PNC	N/A	N/A
3	3PNO, 3PNC	2.0 lbs. to 6.0 lbs.	Maintained

**Rating:** 1 amp Resistive @ 28VDC  
0.5 amp Inductive @ 28VDC

**Mechanical Life:** 25,000 cycles

**Bushing, Bracket & Lever:** Stainless steel



T1-0050-1

### Mounting Hardware

MILITARY P/N	OTTO P/N	BUSHING SIZE (inches)
<b>KEYWAY WASHERS</b>		
MS25081-C0	C710081-C0	0.250"
MS25081-C4	C710081-C4	0.469"
MS25081-C6	C710081-C6	0.625"
<b>INTERNAL TOOTH LOCKWASHERS</b>		
MS35333-135	C710333-135	0.250"
MS35333-136	C710333-136	0.469"
MS35333-138	C710333-138	0.625"
<b>HEX NUTS—STANDARD</b>		
MS25082-C14	C710082-C14	0.250-40
MS25082-C21	C710082-C21	0.469-32
MS25082-B11	C710082-B11	0.625-24
<b>HEX NUTS—WIRE LOCKING</b>		
MS21340-04	C710340-04	0.469-32
MS21340-05	C710340-05	0.625-24

All hardware is stainless steel except MS25082-B11 which is brass, black oxide coated.

FEATURING OTTO'S UNIQUE SNAP-ACTION ACTUATION

These miniature toggles are rugged, highly reliable switches offering positive detent action for safe switching operation, and feature the unique OTTO snap-action switch actuation in conjunction with a unique toggle actuator design.

High contact pressure and superior wiping action of the OTTO design makes the T3 series an excellent choice for switching loads from logic level up to 5 amps.

Choose sealed one or two pole circuitry, 15/32-32 sealed or 1/4-40 unsealed bushing construction, momentary and/or maintained operation. The 15/32-32 bushing model is also available with lever lockout toggle feature or thumb button actuators.

Molded-in terminals seal the contacts against moisture and solder flux wicking. The front-panel side of 15/32-32 bushing models are sealed against water and other liquids per MIL-DTL-83731.

In addition to the single turret solder terminal specified in MIL-DTL-83731, we also offer two different lengths of pins for printed circuit soldering.

Mounting hardware provided includes two hex nuts, one lockwasher and one keyway washer.



Standard Characteristics/Ratings:		
ELECTRICAL RATINGS:		
Load	Sea Level @ 28VDC or 115VAC, 400Hz	@ 65,000 Feet
Resistive	5A	5A
Inductive	2A	2A
Lamp	1A	N/A
DWV	1200Vrms	400Vrms
Contact Resistance	25 mΩ max initial	
<b>Electrical Life:</b>	30,000 cycles	
<b>Mechanical Life:</b>	100,000 cycles	
<b>Seal:</b>	MIL-DTL-83731 (15/32-32 bushing style only)	
<b>Operating Temp Range:</b>	-65°C to +85°C	
MATERIALS:		
<b>Handle:</b>	303 Stainless	
<b>Bushing:</b>	Per MIL-DTL-83731	
<b>Body:</b>	Per MIL-DTL-83731	
<b>Terminal Hardware:</b>	None required	
<b>Mounting Hardware:</b>	Hex nuts, lockwasher and keyway washer	

## Features:

- Snap-action actuation
- Shorter behind panel depth
- Superior wiping action keeps contacts clean
- Positive tactile response prevents operating errors
- Weighs up to 25% less than competitive products
- More contact/terminal plating choices
- Highly reliable, simpler design, fewer parts
- Black matte finish available. Contact factory.
- RoHS compliant

## T3 PART NUMBER CODE

T3	-	X	X	X	X	X	X	-	or	X
<b>Bushing Style</b>		<b>Terminal Style</b>	<b>Circuitry</b>	<b>Circuit Made With Lever At:</b>			<b>Contact Material</b>	<b>Lockout Feature</b>		<b>Button Color</b> ②
1. 15/32-32 2. 1/4-40 3. 15/32-32 With Lockout ① 4. 15/32-32 With Convex Button ② 5. 15/32-32 With Concave Button ② 6. 15/32-32 With Lockout and Smaller Bat Handle ① 7. 1/4-40 with Rocker Button ② 8. 15/32-32 with Small Paddle Bat Handle 9. 15/32-32 with Large Paddle Bat Handle A. 15/32-32 With Lockout and Knurled Lockout Handle		1. Single Turret 4. PC Pin 0.150" lg. 5. PC Pin 0.270" lg.	1. Single Pole 2. Double Pole	<b>Keyway Side</b>	<b>Center</b>	<b>Opposite Keyway</b>	1. Silver/Gold Flash 2. Gold Plate	Lockout feature configuration code letters A-P for bushing styles 3, 6 and A only. Otherwise omit.		For bushing styles 4, 5 and 7 1. Red 2. Black 8. Gray <b>Lever Color</b> For bushing styles 1 & 2 - bat handle & bushing A. Black <b>No Selection. Clear</b>  For bushing styles 3 & 6 - bat handle & bushing (available only in clear) <b>No Selection. Clear</b>  For bushing styles 8 & 9 - bat handle only 1. Clear 2. Red <b>No Selection. Black</b>
				1. ON 2. OFF 3. ON 4. (ON) 5. (ON) 6. (ON)	OFF NONE NONE NONE OFF OFF	ON ON ON ON (ON) ON				

NOTE: ( ) denotes momentary action.

① Add appropriate lockout feature configuration code letter (A thru P) for bushing styles 3 and 6 only.  
② Button color codes (1, 2 and 8) for bushing styles 4, 5 and 7 at end of Part Number.

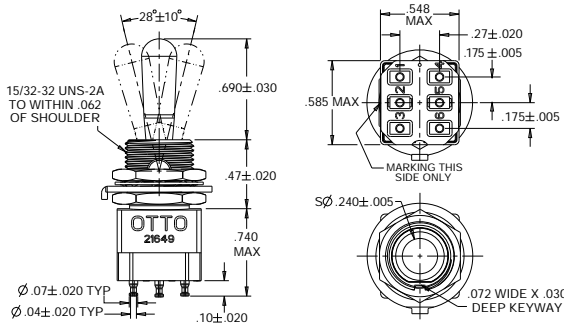
MEETS MIL-DTL-83731, COMMERCIAL & MILITARY GRADES

Circuit Made With Lever At				15/32" Bushing (Sealed)		1/4-40" Bushing (Unsealed)		Lever Lock-15/32" Bushing (Sealed)		
No. Poles	Keyway Side 1-2 4-5	Center Position	Opposite Keyway 2-3 5-6	MIL-SPEC Part Number	OTTO Part Number	MIL-SPEC Part Number	OTTO Part Number	MIL-SPEC Part Number	OTTO Part Number	Suffix for Lockout Feature
1	ON	OFF	ON	MS27718-21-1	T3-11111	MS27716-21-1	T3-21111	MS27720-21-1	T3-31111	All
1	OFF	None	ON	MS27718-22-1	T3-11121	MS27716-22-1	T3-21121	MS27720-22-1	T3-31121	D, F, G
1	ON	None	ON	MS27718-23-1	T3-11131	MS27716-23-1	T3-21131	MS27720-23-1	T3-31131	D, F, G
1	(ON)	None	ON	MS27718-26-1	T3-11141	MS27716-26-1	T3-21141	MS27720-26-1	T3-31141	F
1	(ON)	OFF	(ON)	MS27718-27-1	T3-11151	MS27716-27-1	T3-21151	MS27720-27-1	T3-31151	E, L, N
1	(ON)	OFF	ON	MS27718-31-1	T3-11161	MS27716-31-1	T3-21161	MS27720-31-1	T3-31161	E, F, K, L, M, N
2	ON	OFF	ON	MS27719-21-1	T3-11211	MS27717-21-1	T3-21211	MS27721-21-1	T3-31211	All
2	OFF	None	ON	MS27719-22-1	T3-11221	MS27717-22-1	T3-21221	MS27721-22-1	T3-31221	D, F, G
2	ON	None	ON	MS27719-23-1	T3-11231	MS27717-23-1	T3-21231	MS27721-23-1	T3-31231	D, F, G
2	(ON)	None	ON	MS27719-26-1	T3-11241	MS27717-26-1	T3-21241	MS27721-26-1	T3-31241	F
2	(ON)	OFF	(ON)	MS27719-27-1	T3-11251	MS27717-27-1	T3-21251	MS27721-27-1	T3-31251	E, L, N
2	(ON)	OFF	ON	MS27719-31-1	T3-11261	MS27717-31-1	T3-21261	MS27721-31-1	T3-31261	E, F, K, L, M, N

NOTE: ( ) denotes momentary action.

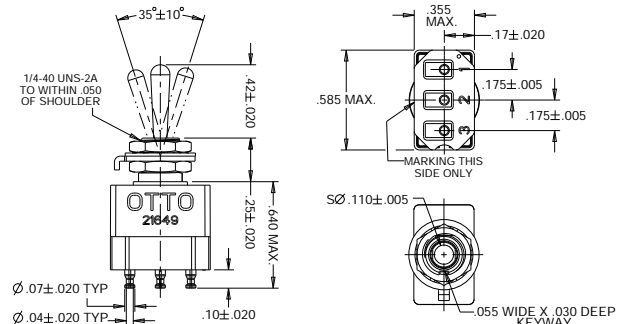
### T3-1 Standard Toggle, 15/32-32 Bushing

Sealed front panel construction.



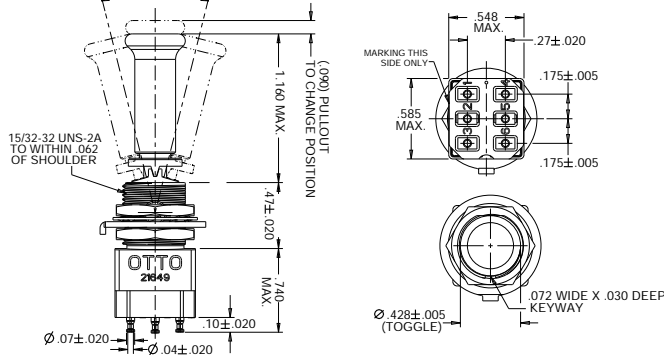
### T3-2 Standard Toggle, 1/4-40 Bushing

Unsealed front panel construction. Optional front panel seal P/N C700223.



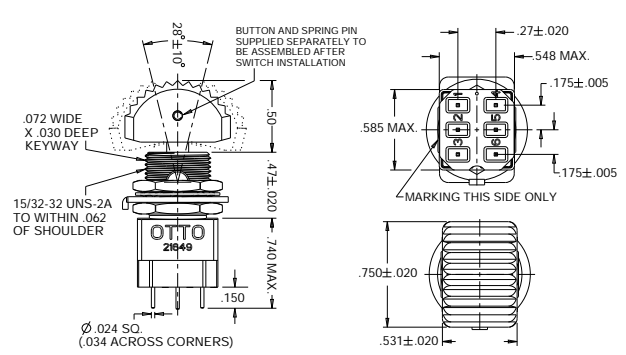
### T3-3 Standard Toggle with Lockout, 15-32/32 Bushing

Sealed front panel construction.



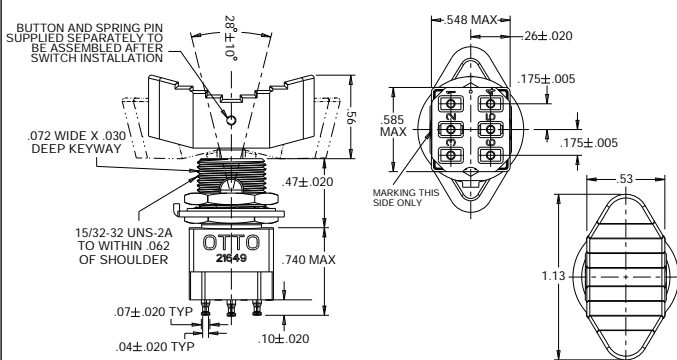
### T3-4 Standard Toggle with Convex Button, 15/32-32 Bushing

Sealed front panel construction.



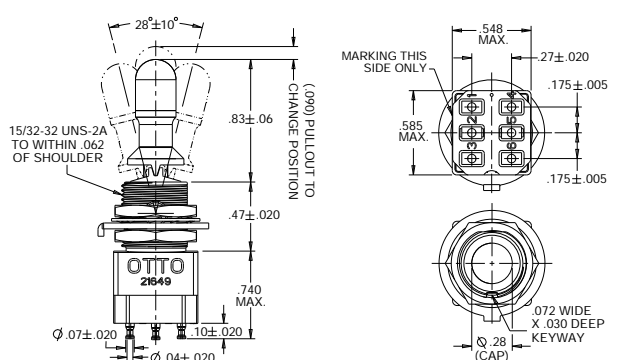
### T3-5 Standard Toggle with Concave Button, 15/32-32 Bushing

Sealed front panel construction.



### T3-6 Toggle with Lockout and Smaller Bat Handle, 15/32-32 Bushing

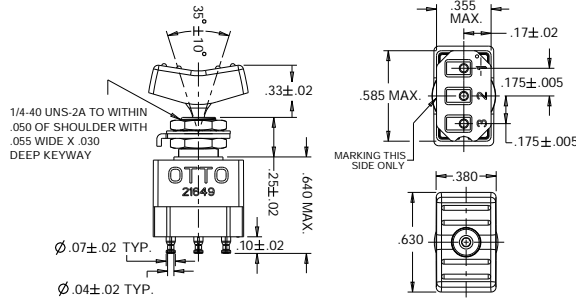
Sealed front panel construction.



FEATURING OTTO'S UNIQUE SNAP-ACTION ACTUATION

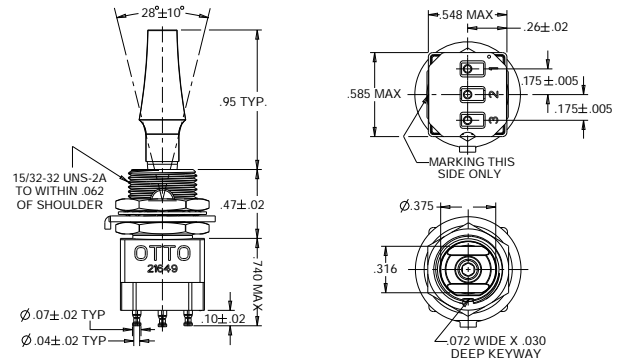
### T3-7 Standard Toggle with Rocker Button, 1/4-40 Bushing

Unsealed front panel construction. Optional front panel seal P/N C700223.



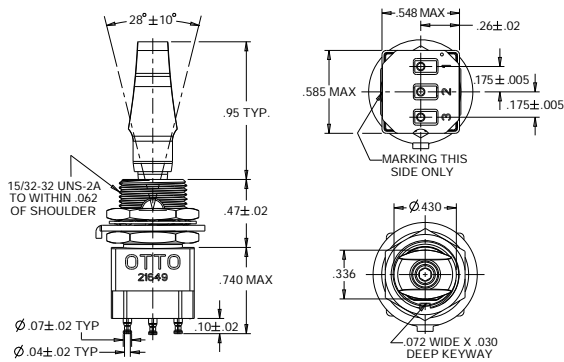
### T3-8 Small Paddle Bat Handle Toggle, 15/32-32 Bushing

Sealed front panel construction.



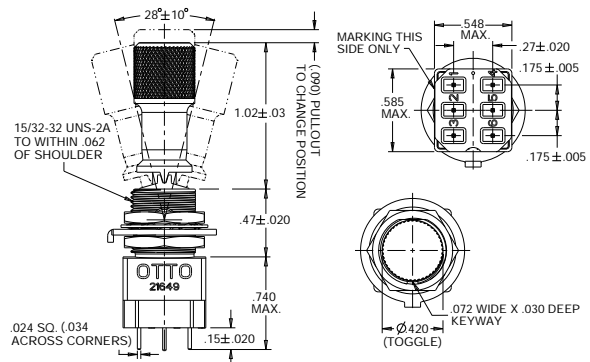
### T3-9 Large Paddle Bat Handle Toggle, 15/32-32 Bushing

Sealed front panel construction.

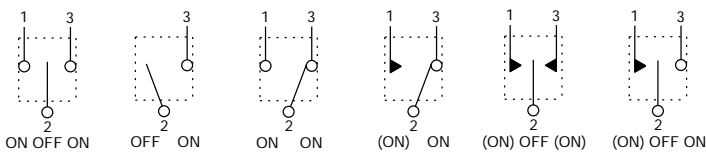


### T3-A Standard Toggle, 1/4-40 Bushing

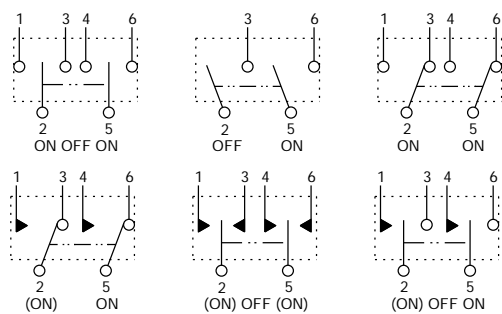
Unsealed front panel construction. Optional front panel seal P/N C700223.



#### SINGLE POLE SCHEMATICS



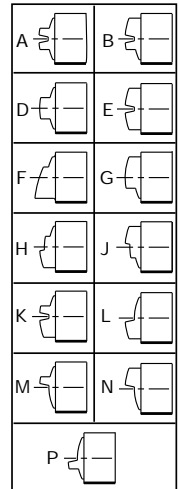
#### DOUBLE POLE SCHEMATICS



#### Lever Lockout Configuration Codes

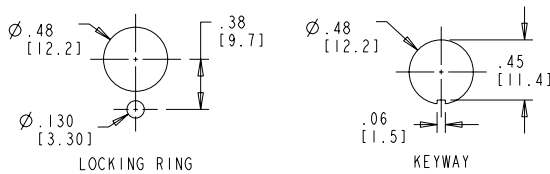
Figures A thru P are schematics to illustrate lockout configurations and momentary positions. They do not represent details of construction.

- A** Locked in all three positions
- B** Locked in Center and Keyway Side position
- D** Locked out of Center position
- E** Locked in Center position
- F** Locked in Opposite Keyway position
- G** Locked in Keyway Side position
- H** Locked out of Center and Keyway Side Position
- J** Locked out of Center and Opposite Keyway position
- K** Locked in Center and Opposite Keyway position
- L** Locked out of Keyway Side position
- M** Locked out of and into Opposite Keyway position
- N** Locked out of Opposite Keyway position
- P** Locked out of and into Keyway Side position

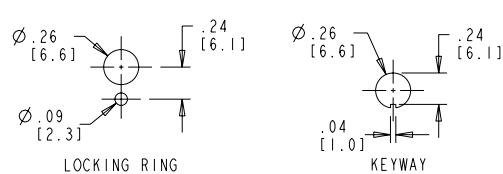


#### TOGGLE SWITCH MOUNTING DIMENSIONS (FOR REFERENCE ONLY)

##### MOUNTING DETAIL FOR 15/32" DIA. BUSHING SWITCHES



##### MOUNTING DETAIL FOR 1/4" DIA. BUSHING SWITCHES



# SEALED TOGGLE SWITCHES

LOW COST TOGGLE FOR WET & DUSTY ENVIRONMENTS

These toggle switches are rugged, high performance sealed switches designed for use under severe conditions found in heavy equipment, industrial control, marine and appliance applications. The T7 series is sealed to both IP68S and IP69K. OTTO's front panel seal is accomplished with an O-ring under the bat handle. However, now a secondary visible bushing seal is offered as an option.

T7 toggles are offered in single and double pole configurations. A choice of models are offered to handle power levels to 16 amps, 0.5HP and logic level electronic switching applications.

These toggles feature positive detent action for safe switching operation. In conjunction with the unique OTTO snap-action switch mechanism, the T7 offers non-teasible contact transfer.

High contact pressure and superior contact wiping action of the OTTO design makes the T7 an excellent choice for switching loads from logic level up to 16 amps.

Mounting hardware provided includes two hex nuts, one lockwasher and one keyway washer. An optional panel seal is available, P/N C710196, MIL. P/N M5423/16-01.



Standard Characteristics/Ratings:			
<b>ELECTRICAL RATINGS:</b>			
Load	Sea Level @ 28VDC	Sea Level @ 125VAC 60/400 Hz	Cycles
Resistive	16A	5A	25,000
Resistive	10A	N/A	50,000
Inductive	7A	2A	25,000
DWV	1000 VRMS	1000 VRMS	1000 VRMS
Logic Level	10mA @ 5VDC	N/A	50,000
<b>Electrical Life:</b>	See Rating Chart		
<b>Mechanical Life:</b>	100,000 cycles		
<b>Seal:</b>	IP68S and IP69K		
<b>Operating Temp Range:</b>	-30°C to +85°C		
<b>MATERIALS:</b>			
<b>Case:</b>	Thermoplastic		
<b>Bushing:</b>	Anodized aluminum alloy		
<b>Toggle:</b>	Stainless steel		
<b>Contacts:</b>	Fine silver/silver cadmium oxide		
<b>Logic Level:</b>	Gold over silver		
<b>Terminal Hardware:</b>	6-32 screw when applicable T7 recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG		
<b>Mounting Hardware:</b>	Hex nuts, lockwasher, keyway washer		

## Features:

- Sealed to IP68S and IP69K
- Switches up to 16 amps
- Withstands extreme shock & vibration
- Positive detent, non-teasible contact transfer
- 2 & 3-position, momentary & maintained action
- Choice of terminal styles
- UL recognized & CSA certified
- RoHS compliant
- Black matte finish available (contact factory)

**T7 PART NUMBER CODE**

T7 -	X	X	X	X	X	X	
<b>Circuitry</b>	<b>Terminal Style</b>	<b>Contact Rating</b>	<b>Circuit Made With Toggle At:</b>			<b>Toggle Style</b>	<b>Button Color**</b>
1. 1 Pole 2. 2 Pole	1. .250" Q.C. 2. Screw 3. Solder 4. PC Pin (consult factory)	1. Std. 2. Logic Level	<b>Keyway Side</b>	<b>Center</b>	<b>Opposite Keyway</b>	1. Bat Handle 2. Lever Lockout (consult factory)* 3. Dome Button 4. Rocker Button 5. Bat Handle With Bushing Seal	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Purple 8. Gray 9. White
			A. ON B. ON C. (ON) D. (ON) E. (ON) F. ON G. (ON) H. OFF J. OFF K. ON	NONE NONE NONE NONE OFF OFF NONE NONE OFF	OFF ON OFF ON (ON) ON ON ON (ON) (ON)		

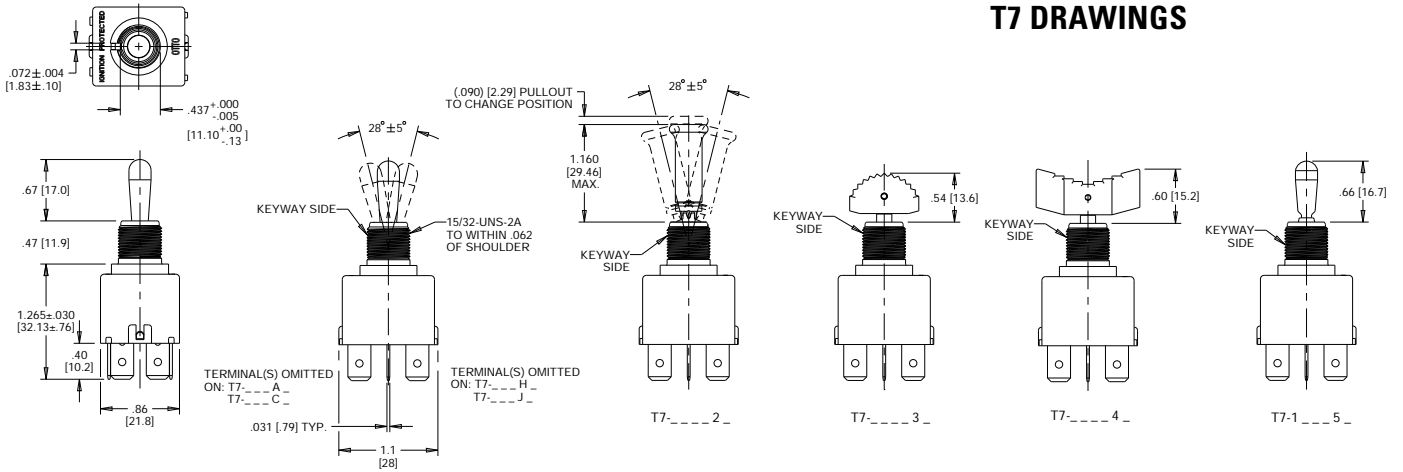
NOTE: ( ) denotes momentary action.

\*See Lockout Configuration Codes  
\*\* Only applicable to Toggle Styles 3 & 4; otherwise omit.

**T7 Connector P/N C801765**  
(See Connector page in Hardware & Accessories section)

LOW COST TOGGLE FOR WET & DUSTY ENVIRONMENTS

## T7 DRAWINGS



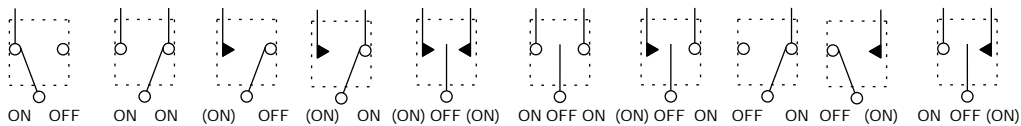
### LOCKING COLLAR CONFIGURATIONS

<p>LOCKED IN THREE POSITIONS</p> <p><b>A</b></p>	<p>LOCKED IN CENTER &amp; KEYWAY SIDE POSITION</p> <p><b>B</b></p>	<p>LOCKED OUT OF CENTER POSITION</p> <p><b>D</b></p>	<p>LOCKED IN CENTER POSITION</p> <p><b>E</b></p>	<p>LOCKED IN OPPOSITE KEYWAY POSITION</p> <p><b>F</b></p>	<p>LOCKED IN KEYWAY SIDE POSITION</p> <p><b>G</b></p>	<p>LOCKED OUT OF CENTER &amp; KEYWAY SIDE POSITION</p> <p><b>H</b></p>
<p>LOCKED OUT OF CENTER &amp; OPPOSITE KEYWAY POSITION</p> <p><b>J</b></p>	<p>LOCKED IN CENTER &amp; OPPOSITE KEYWAY POSITION</p> <p><b>K</b></p>	<p>LOCKED OUT OF KEYWAY SIDE POSITION</p> <p><b>L</b></p>	<p>LOCKED OUT OF &amp; INTO OPPOSITE KEYWAY POSITION</p> <p><b>M</b></p>	<p>LOCKED OUT OF OPPOSITE KEYWAY POSITION</p> <p><b>N</b></p>	<p>LOCKED OUT OF &amp; INTO KEYWAY SIDE POSITION</p> <p><b>P</b></p>	<p>FIGURES A THRU P DO NOT REPRESENT DETAILS OF CONSTRUCTION. THEY SCHEMATIC ILLUSTRATE LOCKING CONFIGURATIONS &amp; MOM. POSITIONS</p>

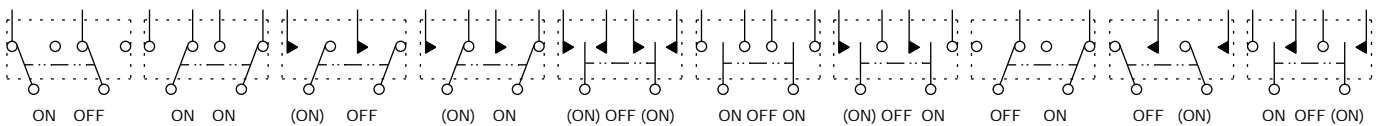
### TERMINAL STYLES (.031 [.78] THICK)

SCREW	QUICK CONNECT	SOLDER	P.C. PIN
<p>#6-32 THD</p> <p>.25 [6.4]</p>	<p>∅.08</p> <p>.25 [6.4]</p>	<p>∅.11</p> <p>.25 [6.4]</p>	<p>.030 SQ. [.76] SQ.</p> <p>.25 [6.4] .10 [2.5]</p>

### SINGLE POLE SCHEMATICS



### DOUBLE POLE SCHEMATICS



# SEALED TOGGLE SWITCHES

NARROW SINGLE POLE TOGGLE FOR USE WHERE SPACE IS LIMITED

The T71 toggle is ~35 percent narrower than OTTO's T7 toggle making it a great alternative for use in rugged, high-demanding applications where space is limited.

Sealed to both IP68S and IP69K, the thinner T71 series is available in single pole single throw (SPST) and single pole double throw (SPDT) configurations. High contact pressure and superior contact wiping action of the OTTO design makes the T71 an excellent choice for switching loads from logic level up to 16 amps. These toggles feature positive detent action for safe switching operation. In conjunction with the unique OTTO snap-action switch mechanism, the T71 offers non-teasible contact transfer.

Designed for tight spaces in control panels and grips, the T71 can be used under severe conditions found in heavy equipment, industrial control, marine and appliance applications.

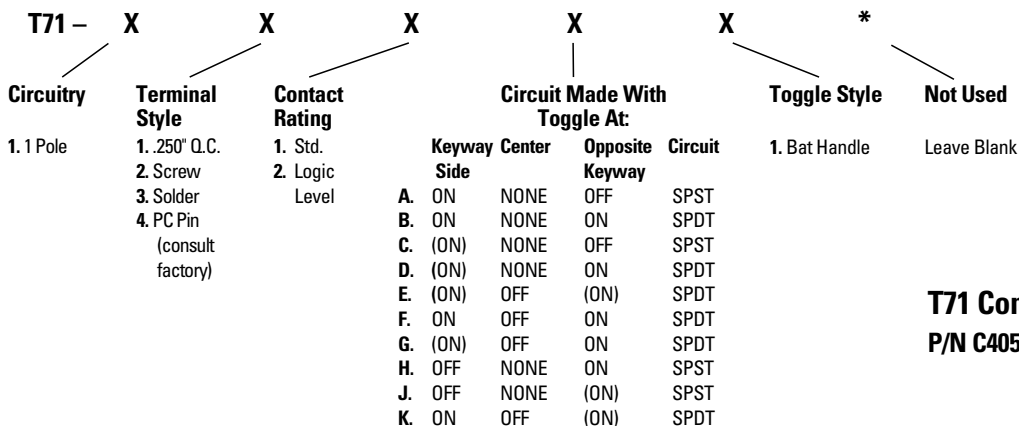
## Features:

- Thin version of OTTO's T7 toggle
- Single pole only
- Sealed to IP68S and IP69K
- Switches logic level up to 16 amps
- Withstands extreme shock & vibration
- Positive detent, non-teasible contact transfer
- 2 & 3 position, momentary & maintained action
- Choice of terminal styles
- RoHS compliant
- Black matte finish available (contact factory)



Standard Characteristics/Ratings:			
ELECTRICAL RATINGS:			
Load	Sea Level @ 28VDC	Sea Level @ 125VAC 60/400 Hz	Cycles
Resistive	16A	5A	25,000
Resistive	10A	N/A	50,000
Inductive	7A	2A	25,000
DWV	1000Vrms	1000Vrms	1000Vrms
Logic Level	10mA @ 5VDC	N/A	50,000
<b>Electrical Life:</b>	See Rating Chart		
<b>Mechanical Life:</b>	100,000 cycles		
<b>Seal:</b>	IP68S and IP69K		
<b>Operating Temp Range:</b>	-30°C to +85°C		
MATERIALS:			
<b>Case:</b>	Thermoplastic		
<b>Bushing:</b>	Anodized aluminum alloy		
<b>Toggle:</b>	Stainless steel		
<b>Contacts:</b>	Fine silver/silver cadmium oxide		
<b>Logic Level Contacts:</b>	Gold over silver		
<b>Mounting Hardware:</b>	Hex nuts, lockwasher, keyway washer		

## T71 PART NUMBER CODE

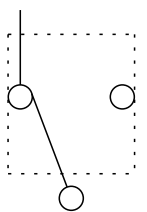
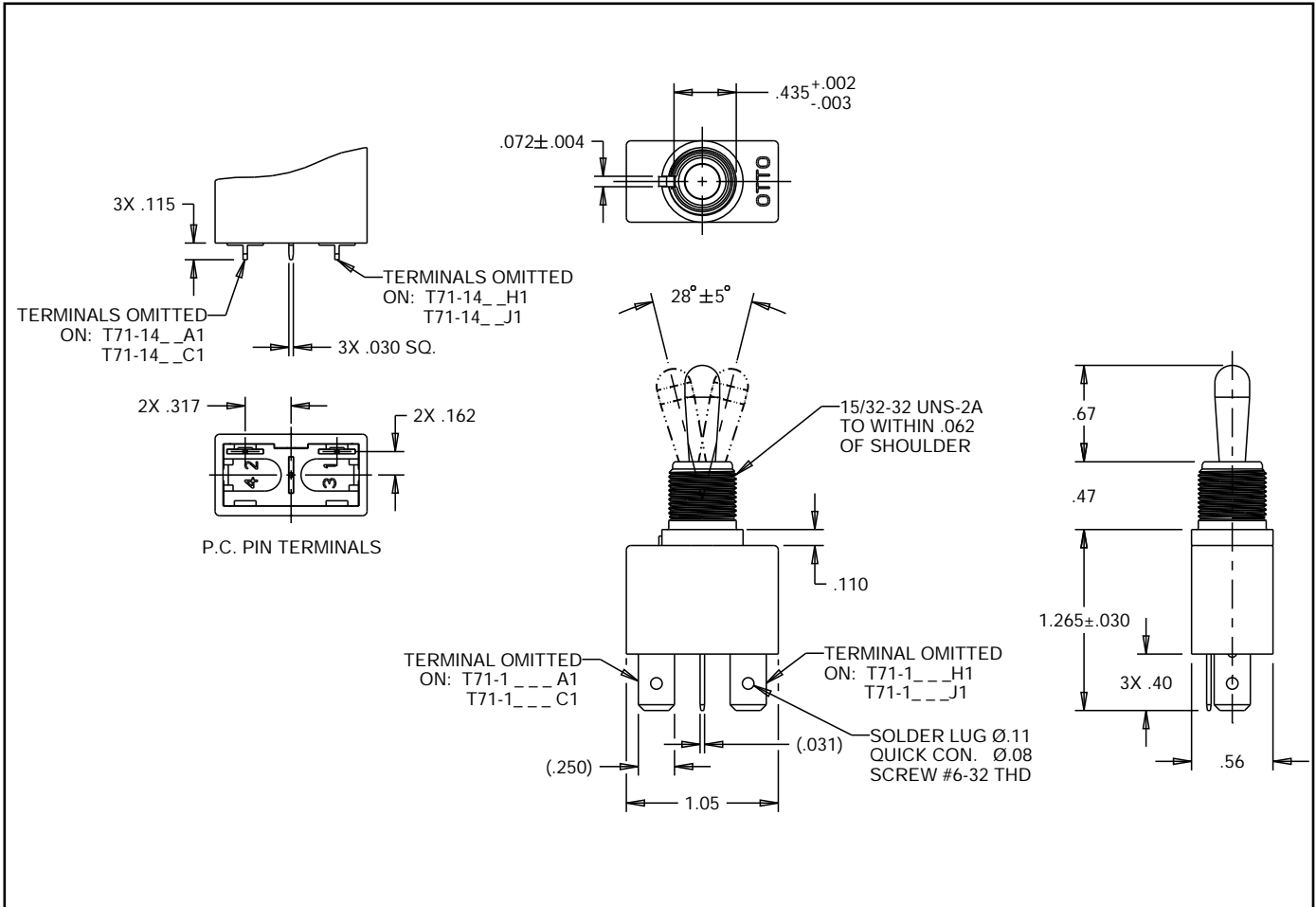


NOTE: ( ) denotes momentary action.

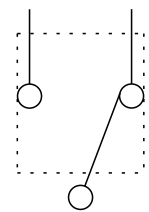
**T71 Connector**  
P/N C405041-XXXXXX

# SEALED TOGGLE SWITCHES

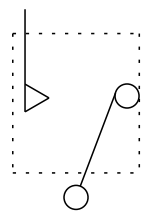
DESIGNED FOR TIGHT SPACES AND SEVERE CONDITIONS



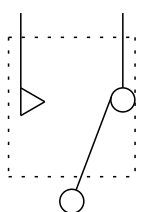
ON OFF



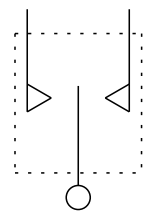
ON ON



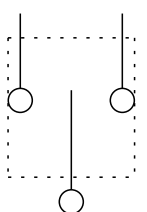
(ON) OFF



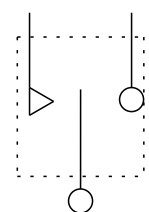
(ON) ON



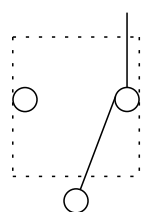
(ON) OFF (ON)



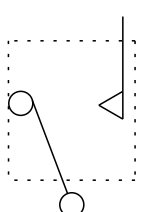
ON OFF ON



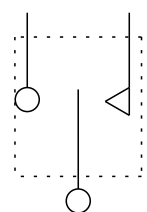
(ON) OFF ON



OFF ON



OFF (ON)



ON OFF (ON)



# COMMERCIAL & MIL TOGGLE SWITCHES

## ENVIRONMENTALLY SEALED TOGGLE

The T9 Toggle Switch is an ideal switch for demanding applications. Qualified to MIL-DTL-3950, this high performance switch is a logical choice for use in environments where sealing and resistance to shock and vibration are required. The T9 is particularly suitable for applications in military, off-highway, aviation, commercial and industrial equipment. This compact, environmentally sealed switch is available in single and double pole configurations with a lever lockout option. Circuitry configurations include two or three positions with many combinations of OFF-ON in momentary and maintained action including ON-ON-ON.

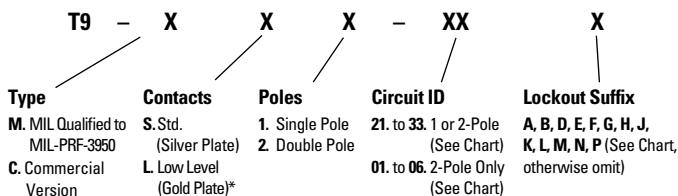
### Features:

- Qualified to MIL-DTL-3950
- Commercial version is sealed per IP68S
- Lever lockout option available
- Maintained & momentary toggle action
- Optional panel seal
- RoHS compliant
- Black matte finish available. Contact factory.

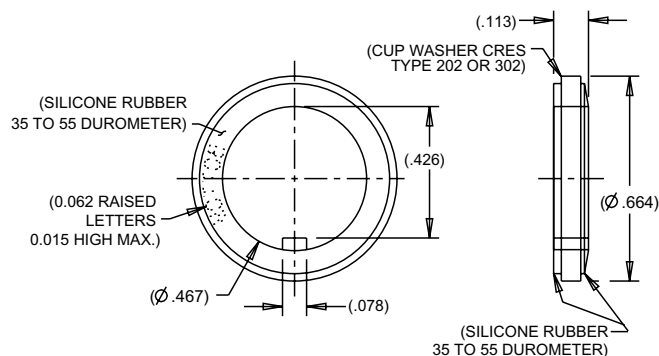


Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS:</b>	See Product Family Table
<b>Electrical Life:</b>	20,000 cycles
<b>Mechanical Life:</b>	40,000 cycles
<b>Seal:</b>	IP68S and per MIL-DTL-3950
<b>Operating Temp Range:</b>	-65°C to +71°C
<b>MATERIALS:</b>	
<b>Toggle:</b>	Stainless steel, passivated
<b>Bushing &amp; Cover:</b>	Aluminum, clear anodized or zinc alloy
<b>Case:</b>	Thermoset plastic
<b>Terminal Hardware:</b>	Included
<b>Mounting Hardware:</b>	Hex nuts, lockwasher, keyway washer, 0.138-32 UNC-2A screw with lockwasher

### T9 PART NUMBER CODE



\* Available in commercial only.

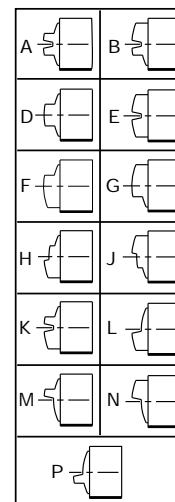


Optional Panel Seal P/N C710196, MIL-DTL- 5423/16

### Lever Lockout Configuration Codes

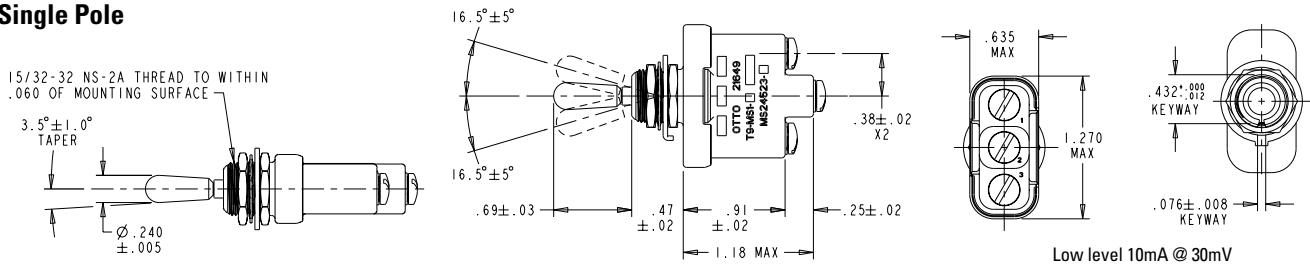
Figures A thru P are schematics to illustrate lockout configurations and momentary positions. They do not represent details of construction.

- A** Locked in all three positions
- B** Locked in Center and Keyway Side position
- D** Locked out of Center position
- E** Locked in Center position
- F** Locked in Opposite Keyway position
- G** Locked in Keyway Side position
- H** Locked out of Center and Keyway Side Position
- J** Locked out of Center and Opposite Keyway position
- K** Locked in Center and Opposite Keyway position
- L** Locked out of Keyway Side position
- M** Locked out of and into Opposite Keyway position
- N** Locked out of Opposite Keyway position
- P** Locked out of and into Keyway Side position



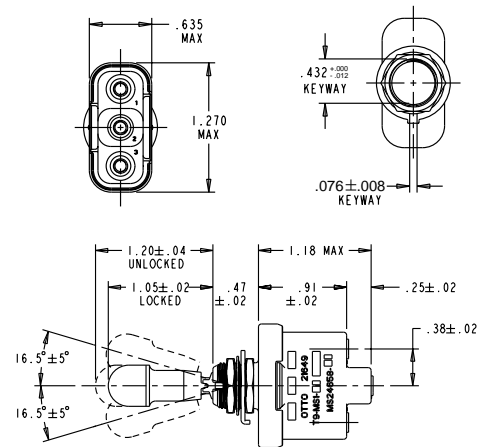
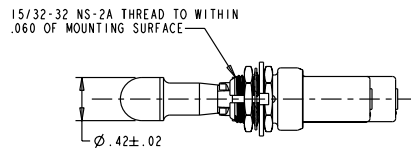
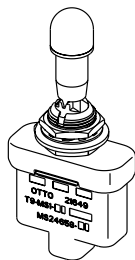
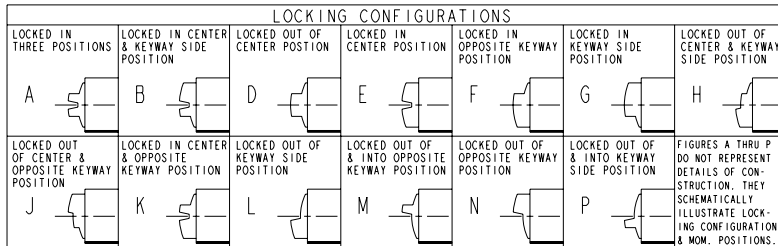
## PRODUCT FAMILY TABLE

### Single Pole



OTTO PART NO.	MILITARY NO.	DASH NO.	CIRCUIT BY TOGGLE LEVER POSITION			ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
			KEYWAY 1-2	CENTER	OPP. KEYWAY 2-3	28 VDC			115 VAC		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-	MS24523-	21	ON	OFF	ON	5	20	15	3	15	10
		22	OFF	NONE	ON						
		23	ON	NONE	ON						
		24	NONE	OFF	ON						
		25	NONE	MOM OFF	ON						
		26	MOM ON	NONE	ON	4	15	10	2	15	7
		27	MOM ON	OFF	MOM ON						
		28	MOM ON	OFF	NONE						
		29	MOM OFF	NONE	ON						
		30	MOM ON	NONE	OFF						
		31	MOM ON	OFF	ON						
OTTO PART NO.	MILITARY NO.	DASH NO.	KEYWAY	CENTER 1-2	OPP. KEYWAY 2-3	28 VDC			115 VAC		
T9-MS1-	MS24523-	32	NONE	ON	MOM ON	4	15	10	2	15	7
		33	NONE	ON	ON	5	20	15	3	15	10

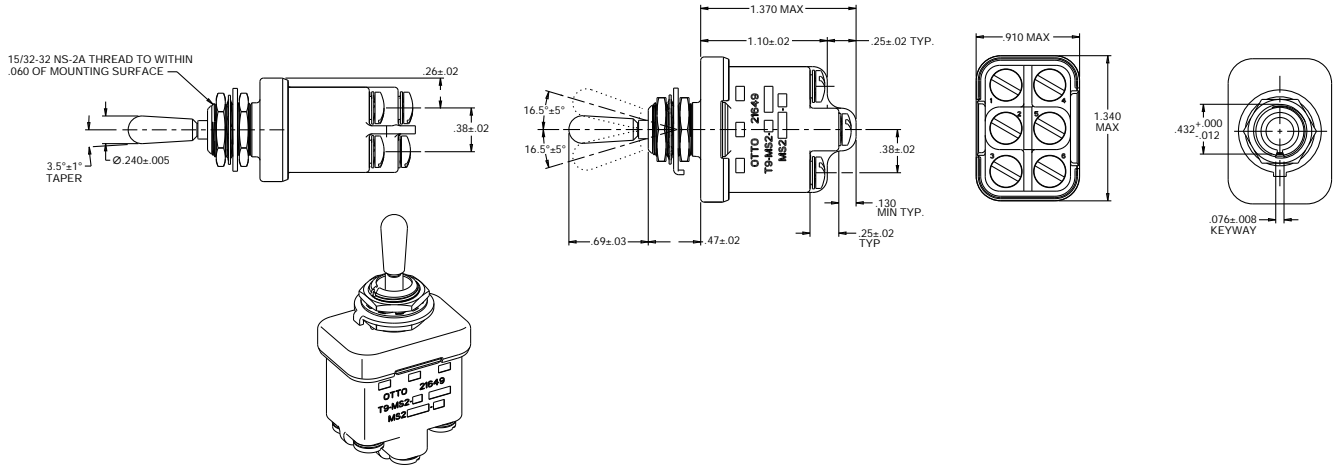
### Lever/Lock Single Pole



OTTO BASE PART NO.	MILITARY NO.	DASH NO.	AVAILABLE LOCKOUTS (SEE CHART)	CIRCUIT BY TOGGLE LEVER POSITION			ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
				KEYWAY 1-2	CENTER	OPP. KEYWAY 2-3	28 VDC			115 VAC		
							LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-	MS24658-	21	ALL	ON	OFF	ON	5	20	15	3	15	10
		22	D F G	OFF	NONE	ON						
		23	D F G	ON	NONE	ON						
		24	E F K M	NONE	OFF	ON						
		25	F	NONE	OFF (M)	ON						
		26	F	MOM ON	NONE	ON	4	15	10	2	15	7
		27	E L N	MOM ON	OFF	MOM ON						
		28	E	MOM ON	OFF	NONE						
		29	F	MOM OFF	NONE	ON						
		30	F	MOM ON	NONE	OFF						
				31	E F K L M N	MOM ON	OFF	ON				
OTTO BASE NO.	MILITARY NO.	DASH NO.	AVAILABLE LOCKOUT	KEYWAY	CENTER 1-2	OPP. KEYWAY 2-3	28 VDC			115 VAC		
T9-MS1-	MS24658-	32	E	NONE	ON	MOM ON	4	15	10	2	15	7
		33	E F K M	NONE	ON	ON	5	20	15	3	15	10

PRODUCT FAMILY TABLE

**Double Pole**



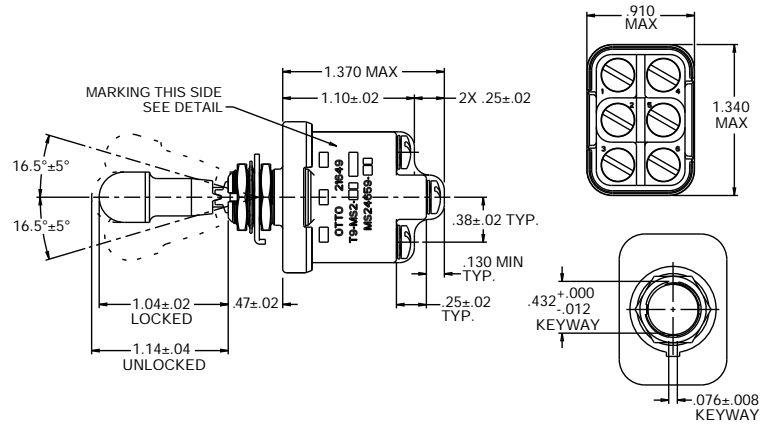
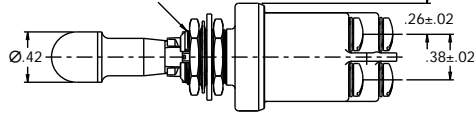
Low level 10mA @ 30mV

OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	CIRCUIT CONFIGURATION				SWITCH POSITION MARKING	ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
			KEYWAY 1-2 / 4-5	CENTER	OPP. KEYWAY 2-3 / 5-6	28 VDC			115 VAC, 60Hz & 400Hz				
						LAMP		RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE	
T9-MS2-	MS24524-	21	ON	OFF	ON	ON OFF ON	7	20	15	4	15	15	
		22	OFF	NONE	ON	OFF ON							
		23	ON	NONE	ON	ON ON							
		24	NONE	OFF	ON	OFF ON							
		25	NONE	MOM OFF	ON	OFF ON							
		26	MOM ON	NONE	ON	ON ON							
		27	MOM ON	OFF	MOM ON	ON OFF ON							
		28	MOM ON	OFF	NONE	ON OFF							
		29	MOM OFF	NONE	ON	OFF ON							
		30	MOM ON	NONE	OFF	ON OFF							
31	MOM ON	OFF	ON	ON OFF ON									
T9-MS2-	MS24524-	32	NONE	ON	MOM ON	ON ON	5	18	10	2	11	8	
		33	NONE	ON	ON	ON ON	7	20	15	4	15	15	
T9-MS2-01 T9-MS2-02 T9-MS2-03 T9-MS2-04 T9-MS2-05 T9-MS2-06	MS27407-	1	1-2 ON 4-5	2-3 ON 4-5	2-3 ON 5-6	ON ON ON	7	20	15	4	15	15	
		2	MOM. 1-2 ON 4-5	2-3 ON 4-5	2-3 ON 5-6	ON ON ON	5	18	10	2	11	8	
		3	MOM. 1-2 ON 4-5	2-3 ON 4-5	MOM. 2-3 ON 5-6	ON ON ON							
		4	1-2 ON 4-5	1-2 ON 5-6	2-3 ON 5-6	ON ON ON	7	20	15	4	15	15	
		5	MOM. 1-2 ON 4-5	1-2 ON 5-6	2-3 ON 5-6	ON ON ON	5	18	10	2	11	8	
		6	MOM. 1-2 ON 4-5	1-2 ON 5-6	MOM. 2-3 ON 5-6	ON ON ON							

PRODUCT FAMILY TABLE

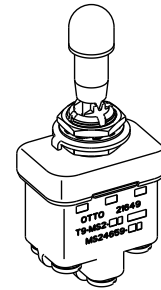
**Lever/Lock  
Double Pole**

15/32-32 NS-2A THREAD TO WITHIN  
.060 OF MOUNTING SURFACE.



**LOCKING CONFIGURATIONS**

LOCKED IN THREE POSITIONS	LOCKED IN CENTER & KEYWAY SIDE POSITION	LOCKED OUT OF CENTER POSITION	LOCKED IN CENTER POSITION	LOCKED IN OPPOSITE KEYWAY POSITION	LOCKED IN KEYWAY SIDE POSITION	LOCKED OUT OF CENTER & KEYWAY SIDE POSITION
A	B	D	E	F	G	H
LOCKED OUT OF CENTER & OPPOSITE KEYWAY POSITION	LOCKED IN CENTER & OPPOSITE KEYWAY POSITION	LOCKED OUT OF KEYWAY SIDE POSITION	LOCKED OUT OF & INTO OPPOSITE KEYWAY POSITION	LOCKED OUT OF OPPOSITE KEYWAY POSITION	LOCKED OUT OF & INTO KEYWAY SIDE POSITION	FIGURES A THRU P DO NOT REPRESENT DETAILS OF CONSTRUCTION. THEY SCHEMATICALLY ILLUSTRATE LOCKING CONFIGURATIONS & MOM. POSITIONS.
J	K	L	M	N	P	



OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	AVAILABLE LOCKOUTS (SEE CHART)	CIRCUIT CONFIGURATION			SWITCH POSITION MARKING	ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
				KEYWAY 1-2 / 4-5	CENTER	OPP. KEYWAY 2-3 / 5-6		28 VDC			115 VAC, 60Hz & 400Hz		
								LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS2-	MS24659-	21	ALL	ON	OFF	ON	ON OFF ON	7	20	15	4	15	15
		22	D,F,G	OFF	NONE	ON	OFF ON						
		23	D,F,G	ON	NONE	ON	ON ON						
		24	E,F,K,M	NONE	OFF	ON	OFF ON						
		25	F	NONE	MOM OFF	ON	OFF ON	5	18	10	2	11	8
		26	F	MOM ON	NONE	ON	ON ON						
		27	E,L,N	MOM ON	OFF	MOM ON	ON OFF ON						
		28	E	MOM ON	OFF	NONE	ON OFF						
		29	F	MOM OFF	NONE	ON	OFF ON						
		30	F	MOM ON	NONE	OFF	ON OFF						
31	E,F,K,L,M,N	MOM ON	OFF	ON	ON OFF ON								
OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	AVAILABLE LOCKOUT	KEYWAY	CENTER 1-2 / 4-5	OPP. KEYWAY 2-3 / 5-6	SWITCH POSITION MARKING	28 VDC			115 VAC		
								LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS2-	MS24659-	32	E	NONE	ON	MOM ON	ON ON	5	18	10	2	11	8
		33	E,F,K,M	NONE	ON	ON	ON ON	7	20	15	4	15	15

## POSITIVE ACTION NON-TEASIBLE TOGGLE

The TE series is a MIL qualified, snap-action, non-teasible, positive make and break, panel mount toggle switch.

The positive action mechanism assures that the switch will actuate even when actuated very slowly. A silicone seal protects the contact area from contaminants such as dust, moisture and sand. All metal components are corrosion resistant and designed to exceed all military requirements.

This environmentally sealed switch is available in single and double pole configurations with 15/32 or 1/4-40 bushings. The TE series is ideal in applications for dry circuits, low level and power switching applications.

### Features:

- Positive action miniature toggle
- Wiping action contacts
- Momentary & maintained toggle action
- Panel mount
- Solder lug termination
- Single & double pole
- Sealed per MIL-DTL-8834
- MIL qualified MS90310-211/221/231/271/311  
MS90311-211/221/231/271/311  
MS24655-211/221/231/271/311  
MS24656-  
211/221/231/271/311/331/341/351
- RoHS compliant
- Black matte finish available. Contact factory.

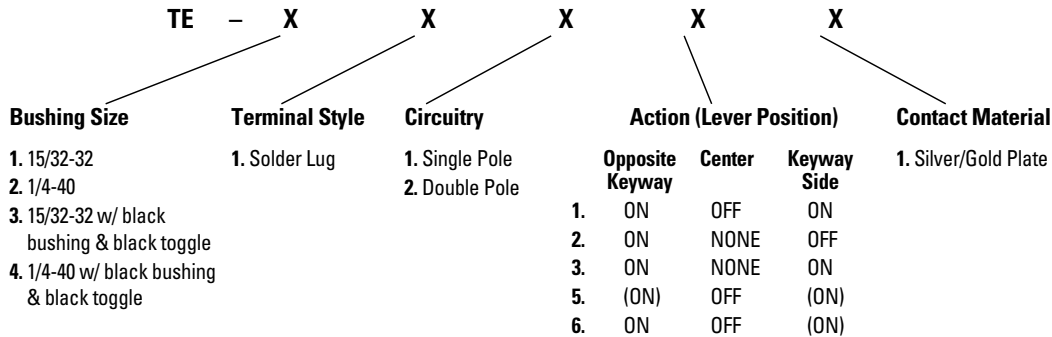


1/4-40 Bushing Style

15/32-32 Bushing Style

Standard Characteristics/Ratings:				
<b>ELECTRICAL RATINGS:</b>				
Load	Sea Level @ 28VDC	Sea Level @ 115VAC, 60Hz	Sea Level @ 115VAC, 400Hz	Sea Level Low Level @ 5mV
Resistive	5A	2A	3A	25mA
Inductive	1A	1A	2A	25mA
<b>Electrical Life:</b>		20,000 cycles		
<b>Mechanical Life:</b>		40,000 cycles		
<b>Seal:</b>		Per MIL-DTL-8834		
<b>Operating Temp Range:</b>		-55°C to +71°C		
<b>MATERIALS:</b>				
<b>Handle:</b>		Stainless steel with lusterless finish		
<b>Bushing:</b>		Zinc alloy (15/32)		
<b>Cover:</b>		Zinc alloy		
<b>Mounting Hardware:</b>		Hex nuts, lockwasher and keyway washer Silicone panel seal when applicable		

### TE PART NUMBER CODE



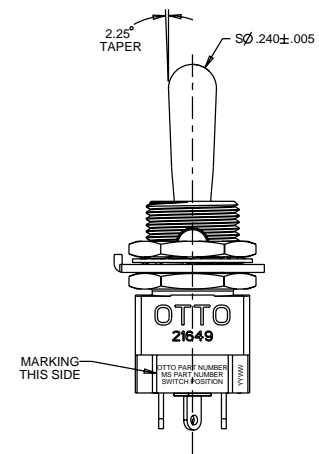
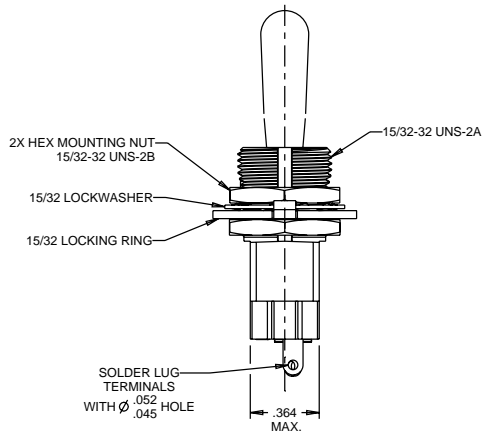
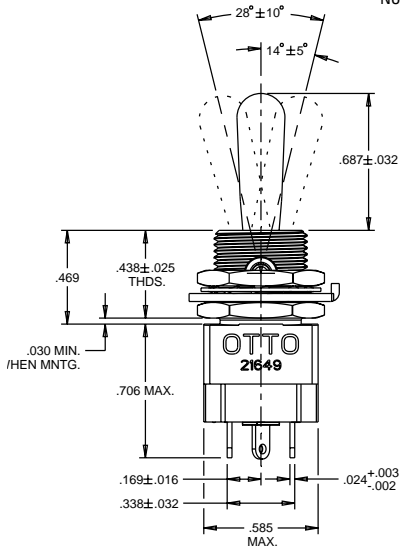
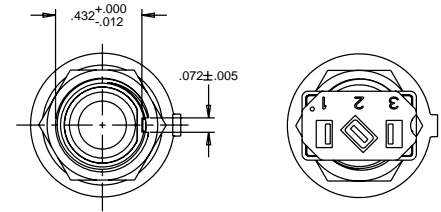
Optional Panel Seal Gasket for 15/32-32 bushing  
P/N C710196 per MIL. P/N M5423/16-01

NOTE: ( ) denotes momentary action.

## TE-111 15/32-32, Single Pole MS90310

CIRCUITS MADE WITH LEVER IN THESE POSITIONS:				
	Opposite Keyway	Center	Keyway	MS Dash Number
1.	ON 2-3	OFF	ON 1-2	-211
2.	ON 2-3	NONE	OFF	-221
3.	ON 2-3	NONE	ON 1-2	-231
5.	(ON) 2-3	OFF	(ON) 1-2	-271
6.	ON 2-3	OFF	(ON) 1-2	-311

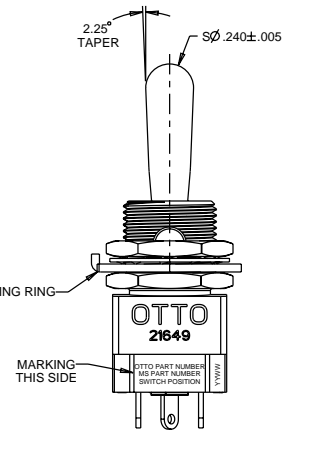
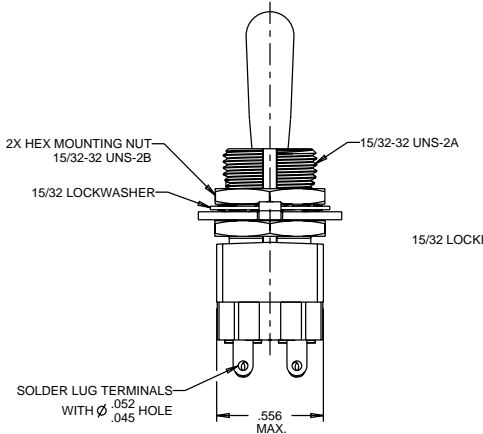
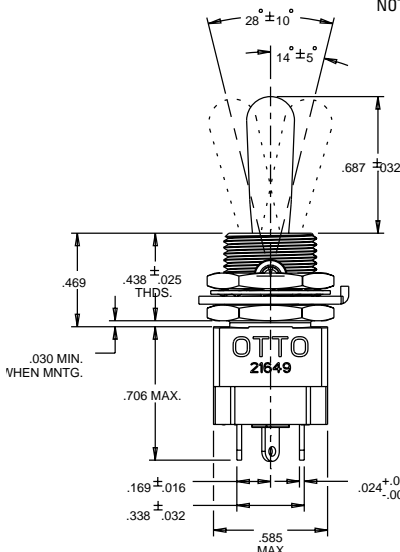
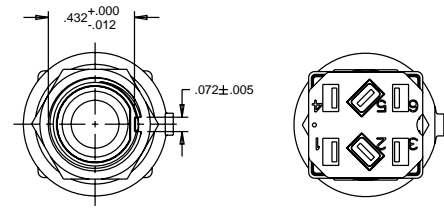
NOTE: ( ) denotes momentary action.



## TE-112 15/32-32, Double Pole MS90311

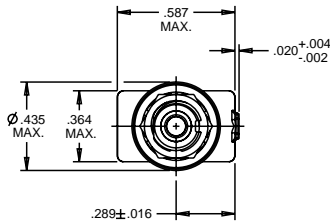
CIRCUITS MADE WITH LEVER IN THESE POSITIONS:				
	Opposite Keyway	Center	Keyway	MS Dash Number
1.	ON 2-3, 5-6	OFF	ON 1-2, 4-5	-211
2.	ON 2-3, 5-6	NONE	OFF	-221
3.	ON 2-3, 5-6	NONE	ON 1-2, 4-5	-231
5.	(ON) 2-3, 5-6	OFF	(ON) 1-2, 4-5	-271
6.	ON 2-3, 5-6	OFF	(ON) 1-2, 4-5	-311

NOTE: ( ) denotes momentary action.



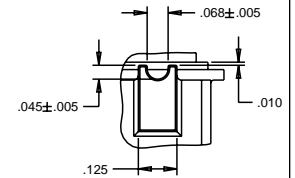
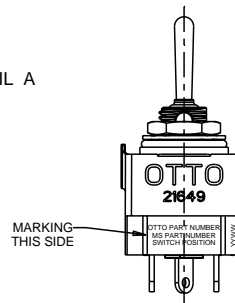
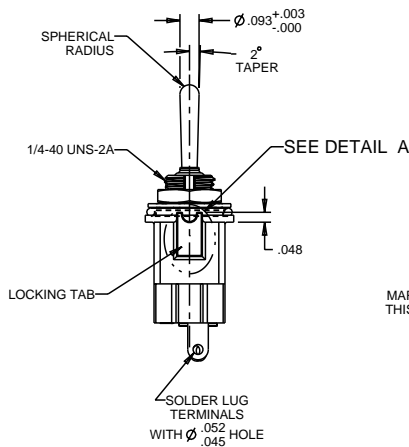
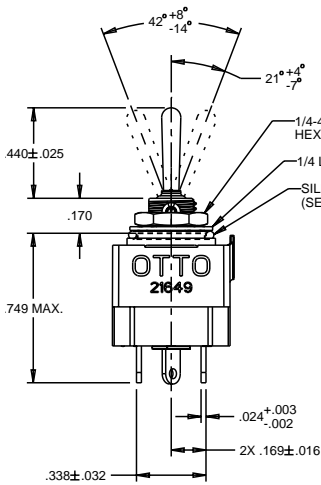
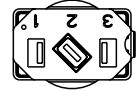
## POSITIVE ACTION NON-TEASIBLE TOGGLE

### TE-211 1/4-40 Bushing Single Pole MS24655

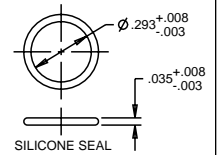


CIRCUITS MADE WITH LEVER IN THESE POSITIONS:			
Opposite Keyway	Center	Keyway	MS Dash Number
1. ON 2-3	OFF	ON 1-2	-211
2. ON 2-3	NONE	OFF	-221
3. ON 2-3	NONE	ON 1-2	-231
5. (ON) 2-3	OFF	(ON) 1-2	-271
6. ON 2-3	OFF	(ON) 1-2	-311

NOTE: ( ) denotes momentary action.

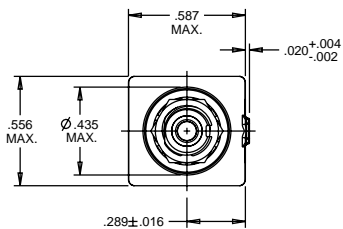


DETAIL A



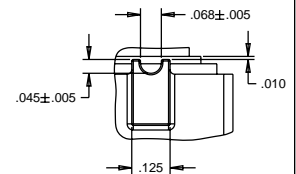
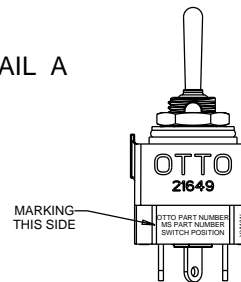
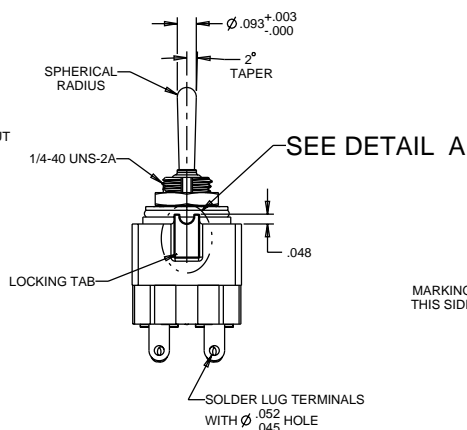
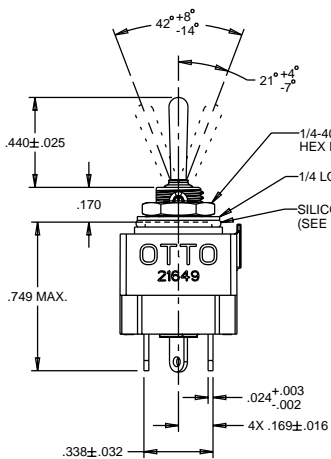
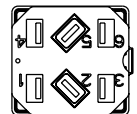
SILICONE SEAL

### TE-212 1/4-40 Double Pole MS24656

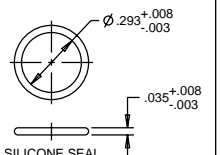


CIRCUITS MADE WITH LEVER IN THESE POSITIONS:			
Opposite Keyway	Center	Keyway	MS Dash Number
1. ON 2-3, 5-6	OFF	ON 1-2, 4-5	-211
2. ON 2-3, 5-6	NONE	OFF	-221
3. ON 2-3, 5-6	NONE	ON 1-2, 4-5	-231
5. (ON) 2-3, 5-6	OFF	(ON) 1-2, 4-5	-271
6. ON 2-3, 5-6	OFF	(ON) 1-2, 4-5	-311

NOTE: ( ) denotes momentary action.



DETAIL A



SILICONE SEAL

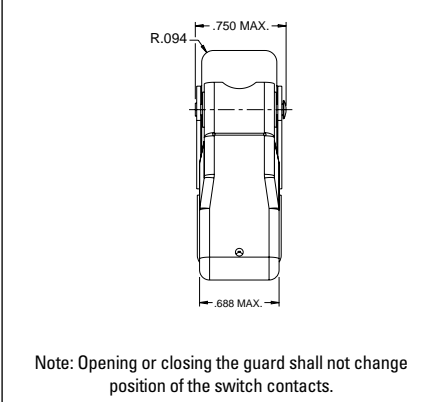
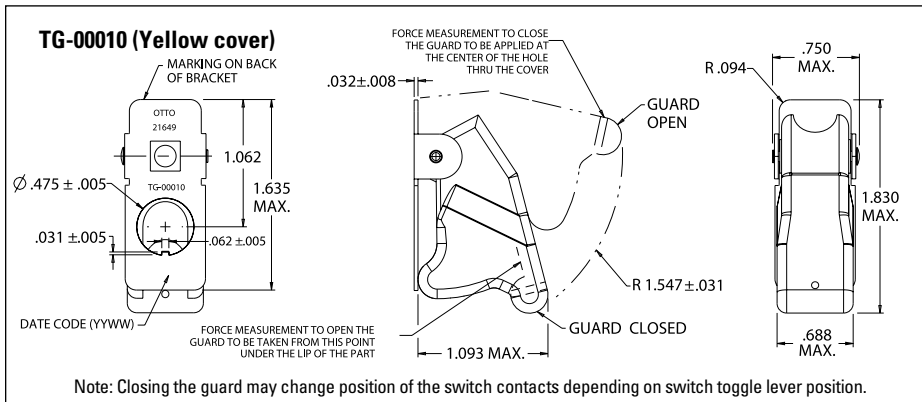
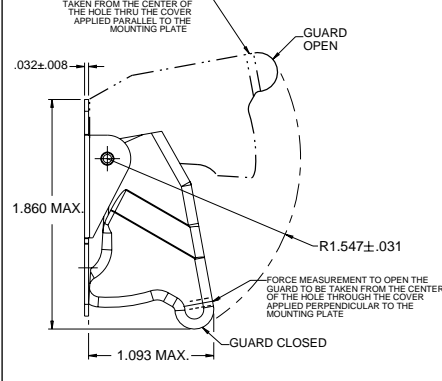
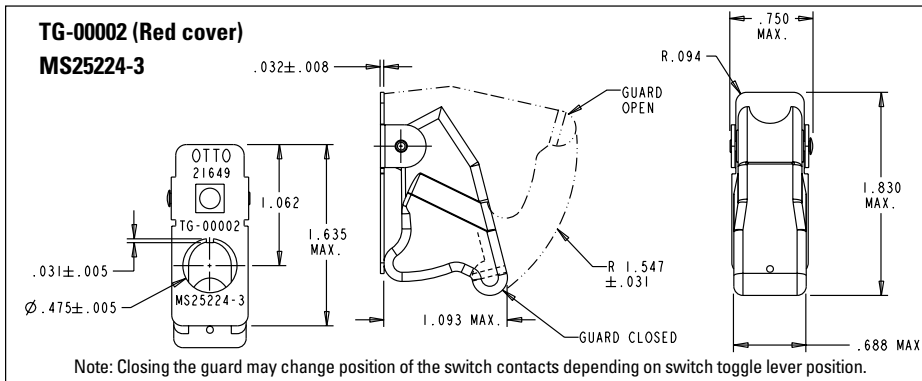
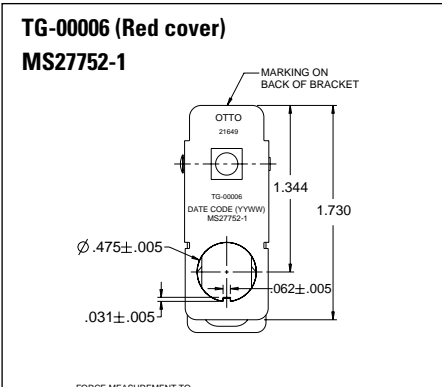
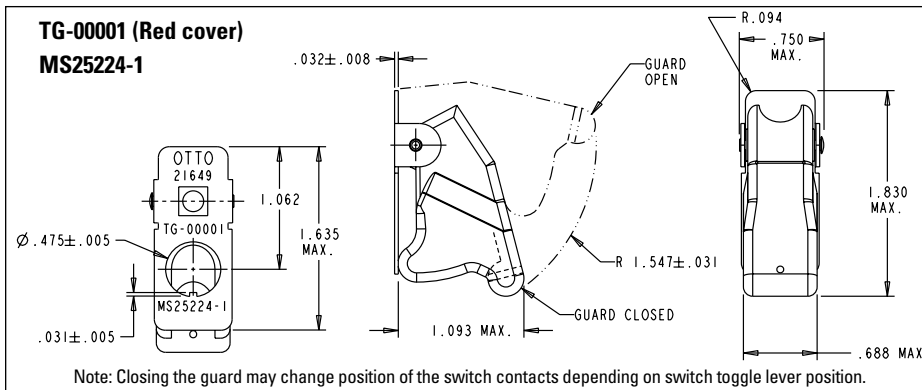
TG SERIES

The TG series toggle guards are offered for 2 and 3-position switches with 15/32-32 threaded bushings and slotted or flat keyways. All models feature spring loaded covers that lock in either the open or closed positions. In the open position the switch actuator operates on all positions freely, in the closed position, the switch actuator is locked in the desired position.

The toggle guard is easily installed on the switch from the front panel with two mounting hex nuts and may be used with an optional panel seal provided with each switch.

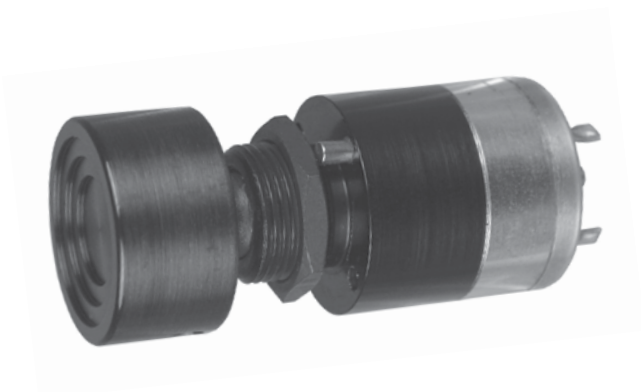
### Features:

- MS approved & QPL'd choices
- Molded plastic cover - multiple color choices
- Bracket: Black painted steel





# Transducers



J2 SERIES

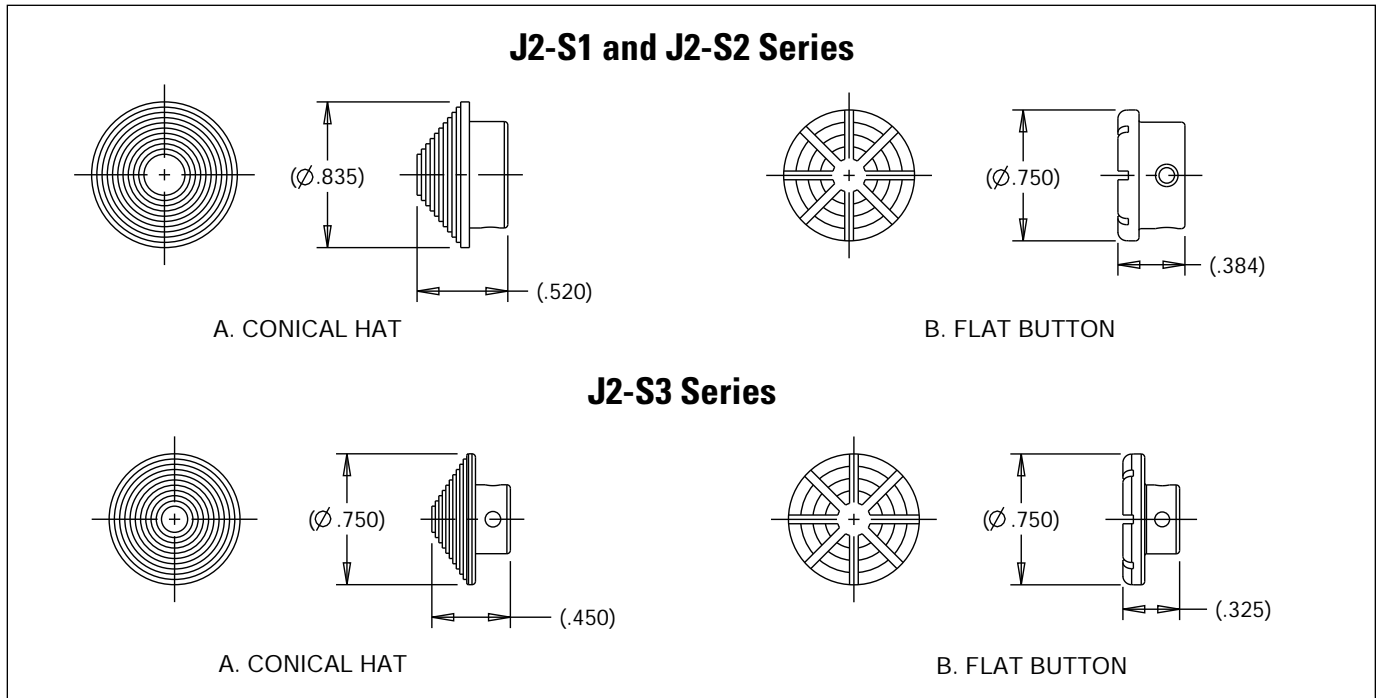
The J2 Series transducer takes a force input of up to 3 lbs. and converts it into a linear voltage output on a X and Y axis. Utilizing strain gauges in a Wheatstone bridge configuration, very small changes in force can be detected to produce a corresponding output voltage. Output voltages are ratiometric (proportional) to the supplied input voltage. Circuit type choices include full bridge, half bridge and isolated. We offer short travel, short travel with a pushbutton, long travel, and long travel with a pushbutton. Custom cases, buttons, and wires are available upon request. Tested to military standards, the J2 is used in aerospace, off-highway, military and other demanding applications.



**Features:**

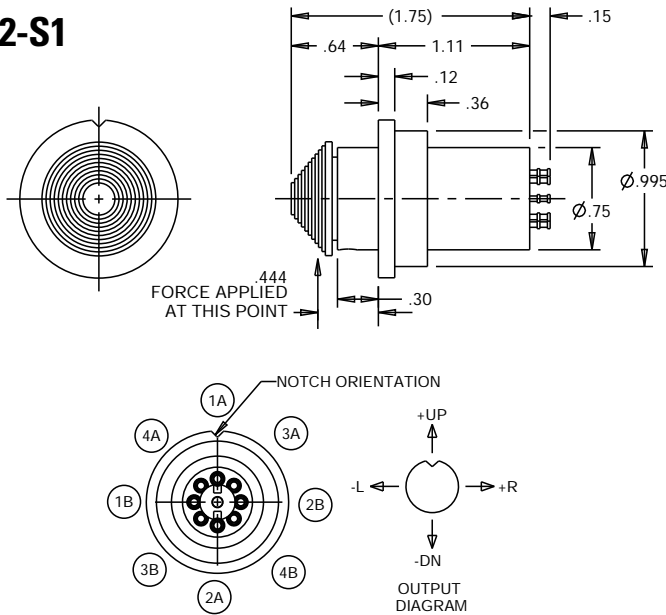
- **Short (.05 max) or long (.20 typ.) travel options**
- **Available with or without pushbutton**
- **Custom cases and buttons available**
- **Applications include:**
  - Flight control grips**
  - Cursor control**
  - Target acquisition**
- **Small null hysteresis useful for applications requiring a consistent center voltage**

Series Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS: S1 – S2 – S3</b>	
<b>Insulation Resistance:</b>	100MΩ min @ 50VDC
<b>Null Hysteresis:</b>	+/- 1% of full scale output within 1 second after release
<b>Null Temp Coefficient:</b>	+/- .08% full scale per degree C max
<b>Sensitivity Temp Coefficient:</b>	+/- 0.2% full scale per degree C
<b>Resolution:</b>	Infinite
<b>Seal:</b>	Enclosure dusttight per MIL-PRF-8805 Design 2
<b>Operating Force:</b>	3.0 lbs.
<b>Operating Temp Range:</b>	-40°C to +71°C
<b>Storage Temp Range:</b>	-55°C to +85°C
<b>Travel:</b>	To mechanical stop 0.05 inches max
<b>MATERIALS:</b>	
<b>Button:</b>	Thermoplastic or anodized aluminum
<b>Wire:</b>	MIL-W-16878/4, 12 inches min, 24 AWG
<b>Hardware:</b>	None provided



## STRAIN GAUGE, FLANGE MOUNT, SHORT TRAVEL

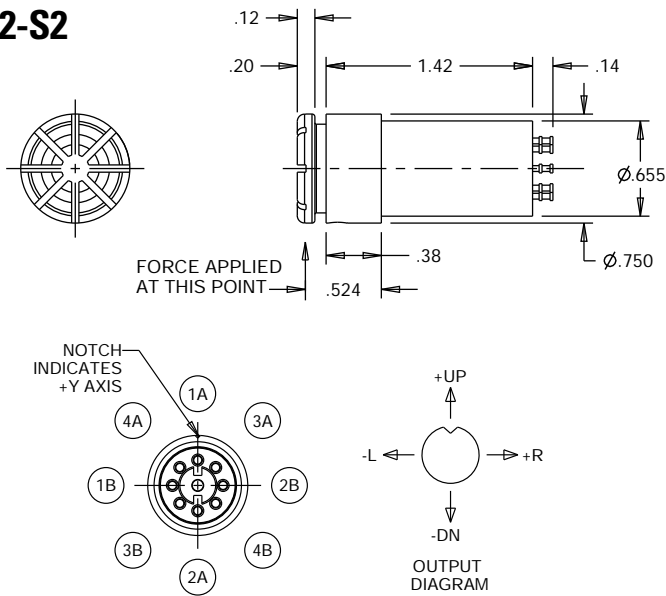
### J2-S1



### J2-S1 PART NUMBER CODE

J2-S1	X	XX	X	XXX
<b>Circuit Type</b>	<b>Electrical I/O (See Table)</b>	<b>Termination</b>	<b>Button Style and Color</b>	
A. Full Bridge B. Half Bridge C. Isolated	B3. B4. B5. B6. B7. G3. G4. G5. G6. G7.	1. Wire Leads 2. Terminals	AP1. Conical Hat, Red Thermoplastic AP2. Conical Hat, Black Thermoplastic AP8. Conical Hat, Gray Thermoplastic BBA. Flat Button, Black Anodized Aluminum BCA. Flat Button, Clear Anodized Aluminum	

### J2-S2



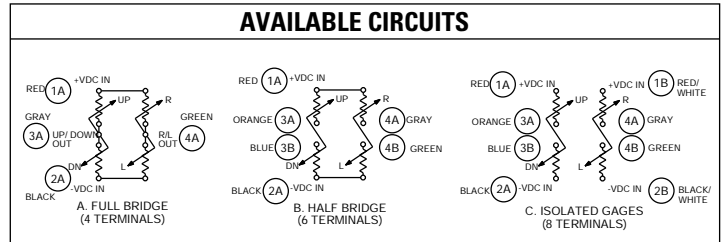
### J2-S2 PART NUMBER CODE

J2-S2	X	XX	X	XXX
<b>Circuit Type</b>	<b>Electrical I/O (See Table)</b>	<b>Termination</b>	<b>Button Style and Color</b>	
A. Full Bridge B. Half Bridge C. Isolated	B3. B4. B5. B6. B7. G3. G4. G5. G6. G7.	1. Wire Leads 2. Terminals	AP1. Conical Hat, Red Thermoplastic AP2. Conical Hat, Black Thermoplastic AP8. Conical Hat, Gray Thermoplastic BBA. Flat Button, Black Anodized Aluminum BCA. Flat Button, Clear Anodized Aluminum	

EXCITATION VOLTAGE TABLE FOR J2-S1 AND J2-S2

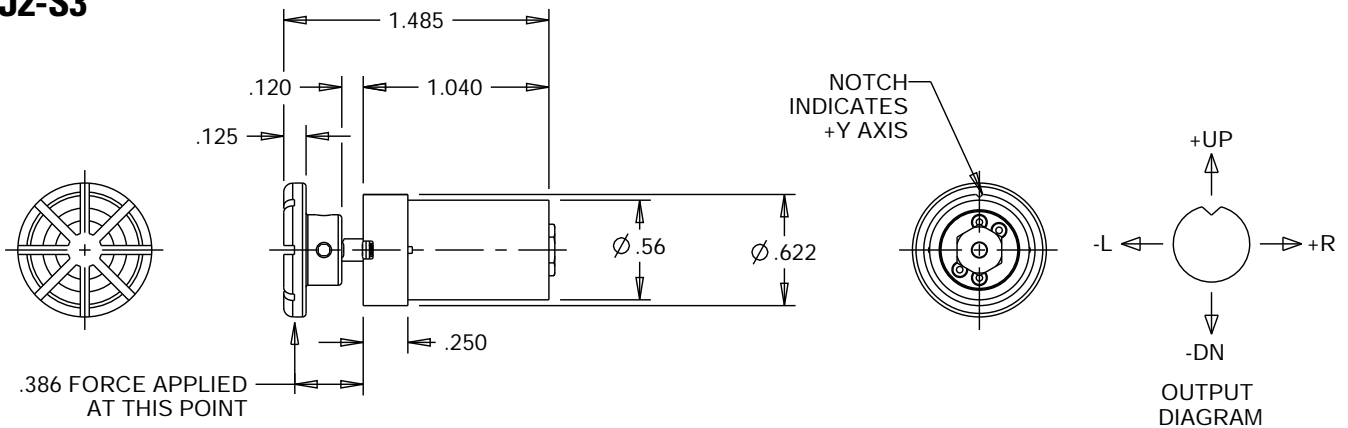
Circuit Configuration	Excitation Voltage (Units VDC)	Sensitivity Until Stop (Units VDC/lb. +/- 20%)	Max Output at Stop (Units VDC)	Null Output at 25°C Bipolar (Units VDC)	Null Output at 25°C Supply to Ground (Units VDC)	Full Scale Travel Cycles (Units x 10 <sup>6</sup> )
B3	+/- 7.5	+/- 0.45	+/- 1.62	+/- 0.10		0.2
G3	+ 15.0	+/- 0.45	+/- 1.62		7.5 +/- 0.10	0.2
B4	+/- 6.0	+/- 0.45	+/- 1.62	+/- 0.10		0.2
G4	+ 12.0	+/- 0.45	+/- 1.62		6.0 +/- 0.10	0.2
B5	+/- 6.0	+/- 0.33	+/- 1.19	+/- 0.06		1.0
G5	+ 12.0	+/- 0.33	+/- 1.19		6.0 +/- 0.06	1.0
B6	+/- 5.0	+/- 0.33	+/- 1.19	+/- 0.05		1.0
G6	+ 10.0	+/- 0.33	+/- 1.19		5.0 +/- 0.05	1.0
B7	+/- 5.0	+/- 0.25	+/- 0.90	+/- 0.05		1.0
G7	+ 10.0	+/- 0.25	+/- 0.90		5.0 +/- 0.05	1.0

### AVAILABLE CIRCUITS

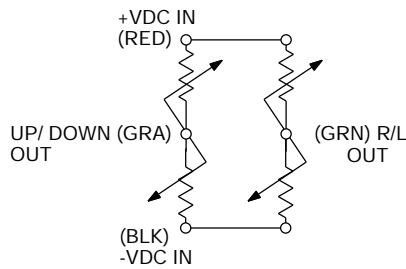


STRAIN GAUGE, FLANGE MOUNT, SHORT TRAVEL

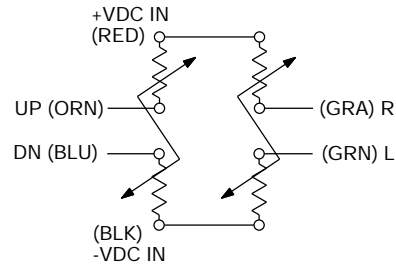
## J2-S3



### AVAILABLE CIRCUITS

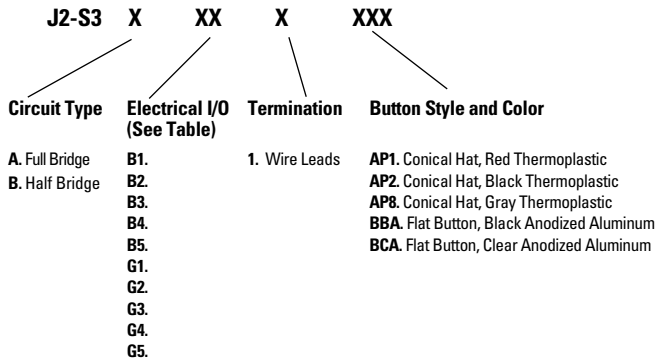


A. FULL BRIDGE  
(4 WIRES)



B. HALF BRIDGE  
(6 WIRES)

### J2-S3 PART NUMBER CODE



EXCITATION VOLTAGE TABLE FOR J2-S3

Circuit Configuration	Excitation Voltage (Units VDC)	Sensitivity Until Stop (Units VDC/lb. +/- 20%)	Max Output at Stop (Units VDC)	Null Output at 25°C Bipolar (Units VDC)	Null Output at 25°C Supply to Ground (Units VDC)	Full Scale Travel Cycles (Units x 10 <sup>6</sup> )
B1	+/- 7.5	+/- 0.45	+/- 1.62	+/- 0.10		0.3
G1	+ 15.0	+/- 0.45	+/- 1.62		7.5 +/- 0.10	0.3
B2	+/- 6.0	+/- 0.45	+/- 1.62	+/- 0.10		0.2
G2	+ 12.0	+/- 0.45	+/- 1.62		6.0 +/- 0.10	0.2
B3	+/- 6.0	+/- 0.33	+/- 1.19	+/- 0.06		1.0
G3	+ 12.0	+/- 0.33	+/- 1.19		6.0 +/- 0.06	1.0
B4	+/- 5.0	+/- 0.33	+/- 1.19	+/- 0.05		1.0
G4	+ 10.0	+/- 0.33	+/- 1.19		5.0 +/- 0.05	1.0
B5	+/- 5.0	+/- 0.25	+/- 0.90	+/- 0.05		1.0
G5	+ 10.0	+/- 0.25	+/- 0.90		5.0 +/- 0.05	1.0

## FULL BRIDGE CIRCUIT TYPE, SHORT TRAVEL

The J2-S4 Series of strain gauge based force transducers provides analog output proportional to the force applied to the button. The J2-S4 bottom mount transducer offers short travel, full bridge circuit, a flat button style, and 1 million cycle life.

The strain gauge transducer compensates for outside influences, like temperature, allowing the transducer to maintain accuracy even in the most demanding environments.

The J2-S4's threaded bushing case offers a secure switch retention method for a wide range of panel thicknesses.

Applications include flight control, operating ground vehicles, and cursor control or target acquisition.

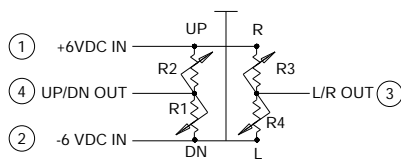
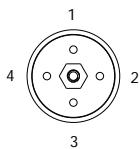
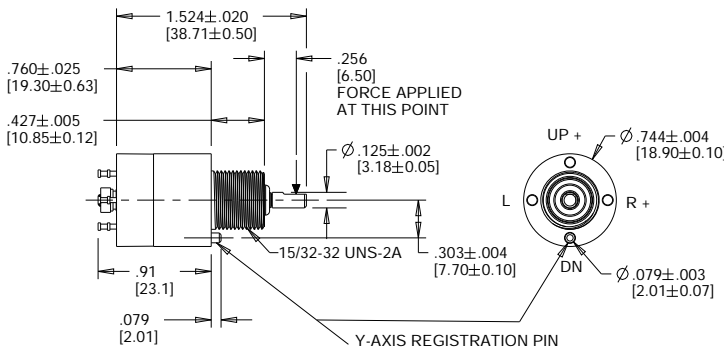
### Features:

- Full bridge circuit type
- 1 million cycle life
- Short travel in each direction
- Watertight to IP68S
- Shorter behind panel
- Multiple button types available

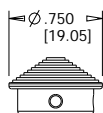


J2-S4 Transducer

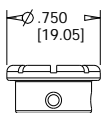
Standard Characteristics/Ratings:	
<b>ELECTRICAL RATINGS (+/- 6 VDC):</b>	
<b>Sensitivity</b>	.50 Volts per lb. typical
<b>Insulation Resistance:</b>	100MΩ min @ 50VDC
<b>Null Temp Coefficient:</b>	+/- .08% full scale per degree C max
<b>Null Hysteresis:</b>	+/- .006 VDC within 1 second after release
<b>Sensitivity Temp Coefficient:</b>	+/- .2% full scale per degree C
<b>Null Output:</b>	0VDC +/- .100VDC
<b>Resolution:</b>	Infinite
<b>Element Resistance:</b>	1000Ω +/- 15%
<b>Seal:</b>	IP68S Watertight
<b>Operating Force:</b>	3.0 lbs. typical
<b>Operating Temp Range:</b>	-54°C to +71°C
<b>Storage Temp Range:</b>	-57°C to +85°C
<b>Travel:</b>	.05" max travel each direction
<b>Cycle Life:</b>	1,000,000 cycles; 1 cycle = max travel & return
<b>MATERIALS:</b>	
<b>Button:</b>	Anodized aluminum or plastic
<b>Case:</b>	Black anodized aluminum
<b>Hardware:</b>	Lockwasher, hex nut and button set screws



A. FULL BRIDGE



A. CONICAL HAT



B. FLAT BUTTON



### J2-S4 PART NUMBER CODE

J2-S4 X XX X XXX

**Circuit Type**    **Electrical I/O (See Table)**    **Termination**    **Button Style and Color**

**A.** Full Bridge    **B6.**    **2.** Terminals    **AP2.** Conical Hat, Black Thermoplastic  
**BBA.** Flat Button, Black Anodized Aluminum  
**BCA.** Flat Button, Clear Anodized Aluminum

CIRCUIT CONFIGURATION	EXCITATION VOLTAGE				
	EXCITATION VOLTAGE (UNITS VDC)	SENSITIVITY UNTIL STOP (UNITS VDC/LB. ±20%)	MAX OUTPUT AT STOP (UNITS VDC)	NULL OUTPUT AT 25°C BIPOLAR (UNITS VDC)	FULL SCALE TRAVEL CYCLES (UNITS x10 <sup>6</sup> )
B6	±6.0	±0.50	±1.80	±0.10	0.2

## MINI JOYSTICK

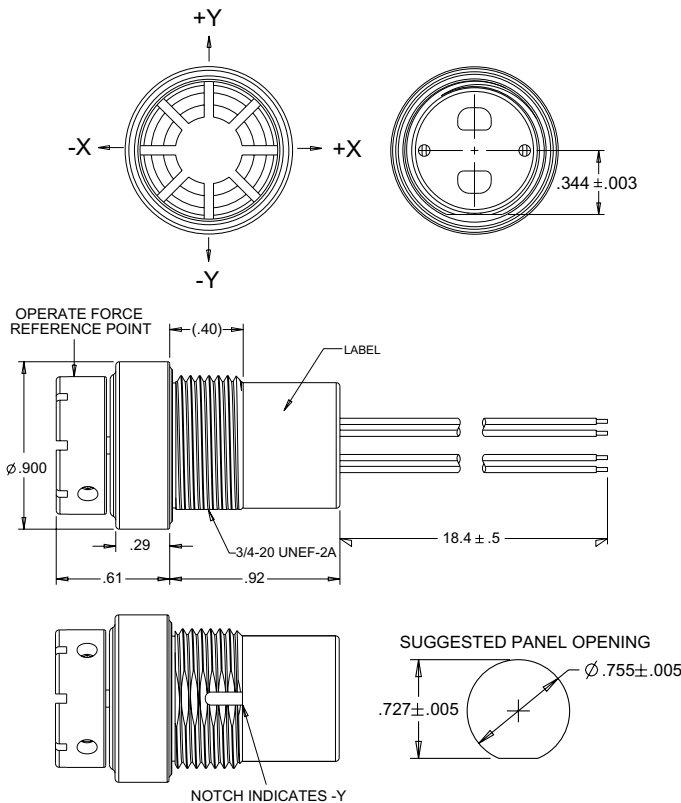
The J4 Hall effect transducer, like a strain gauge based transducer, converts an input force to a linear output voltage. However, the J4 is a cost effective alternative to a strain gauge type transducer. The J4 construction is rugged enough for the most demanding applications.

The J4's shorter travel offers the benefit of minimal movement required for analog voltage output change. In addition, the J4 offers the benefit of a higher output voltage than a traditional strain gauge based transducer with the same input voltage.

The J4 can be used for applications such as cursor control, target acquisition or any place precise input control is required. The J4's short behind panel depth means it can be used in an OTTO grip or can be panel mounted.

### Features:

- A cost effective alternative to strain gauge based technology
- Mini joystick function
- 5V DC input
- Proven Hall effect technology
- Magnetic shielding in case offers excellent external EMI protection
- Rugged construction for demanding applications



J4-100001  
Transducer

### Standard Characteristics/Ratings:

#### ELECTRICAL RATINGS:

Rated at Vcc = 5V, Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.50	5.00	5.50
Output Voltage, +Y,-Y,+X,-X 0° Deflection:	VDC @ 5V Vcc	2.40	2.50	2.60
Output at Full Travel -X,-Y Direction:	VDC @ 5V Vcc	1.35	1.50	1.65
Output at Full Travel +X,+Y Direction:	VDC @ 5V Vcc	3.35	3.50	3.65
Null Temperature Coefficient: 25°C to -20°C	+/- .005V per degree C max			
Null Temperature Coefficient: 25°C to 71°C	+/- .001V per degree C max			
Supply Current B=0, Vcc=5V, Io=0:	mA	N/A	20	24
Output Impedance:	kΩ	N/A	1.0	N/A

#### MECHANICAL RATINGS:

<b>Mechanical Life All Directions</b>	250,000 cycles			
<b>Mechanical</b>	<b>Units</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>
Operating Force (w/ Boot) at Top of Button @ 20° C:	LBS	N/A	3.0	3.1
Max Allowable Vertical Force on Button:	LBS	N/A	N/A	10
Max Allowable Radial Force on Top of Knob:	LBS	N/A	N/A	5

#### ENVIRONMENTAL:

<b>Operating Temperature:</b>	°C	-20	20	71
<b>Electronics Enclosure Design:</b>	ISO 20653, Dusttight and watertight per IP68S			
<b>Drop:</b>	1 meter max to concrete			
<b>EMI Withstand:</b>	Per ISO 11452			
<b>RFI Withstand:</b>	Per ISO 11452-8 15Hz-100kHz			
<b>DC Magnetic Field Withstand:</b>	3000 A/m per ISO 11452-8			

#### MATERIALS:

<b>Button:</b>	Thermoplastic, black
<b>Case:</b>	Black anodized aluminum
<b>Boot:</b>	Silicone rubber, black
<b>Wires:</b>	24 AWG, NEMA HP3, Type E
<b>Mounting Hardware:</b>	Hex nut (.13 thick) and lockwasher

FOR PUSHBUTTON AND TOGGLE SWITCHES

## Shrouds

Shrouds are added to pushbutton switches to guard against inadvertent actuation. The actuating device must be inserted into the shroud in order to actuate the switch. We have an assortment from which to choose shown here. We are also able to design and fabricate a shape to meet your specifications and application needs.

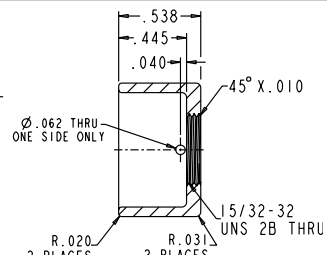
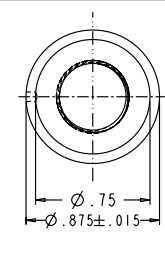
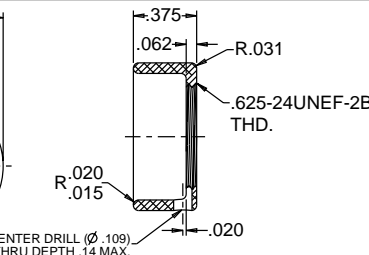
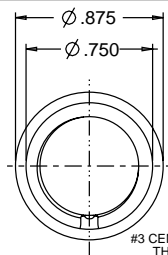


### Material:

Aluminum alloy, machined to specification.

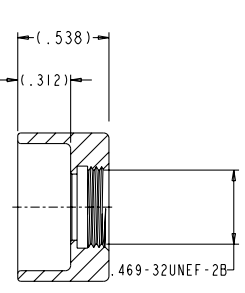
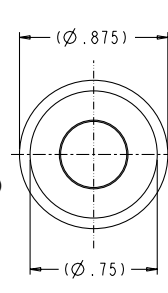
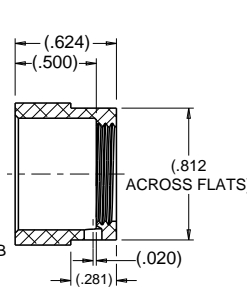
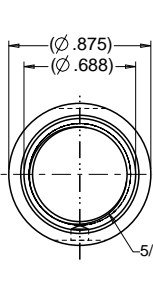
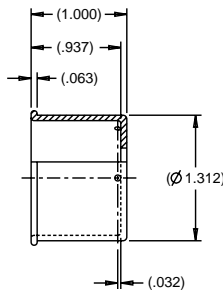
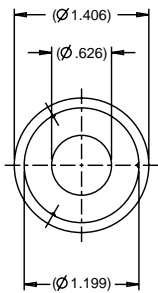
### Finish:

Black anodized. For other color options, contact factory.



OTTO P/N C300793

OTTO P/N C300428



OTTO P/N C300302

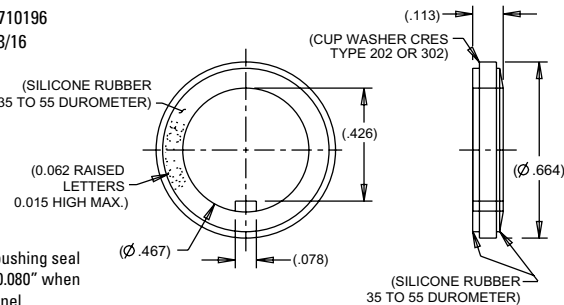
OTTO P/N C300871

OTTO P/N C300426

## Panel Seals

Stainless steel cup washer with silicone rubber seal assures proper watertight panel seal. Mounts behind panel. Approved to MIL-DTL-5423/16. Designed for sealing 15/32" bushing with keyway. Available in packages of 25.

OTTO P/N: C710196  
MIL-DTL-5423/16



Thickness of bushing seal is reduced to 0.080" when mounted to panel.

### Gaskets

OTTO P/N	I.D.
C700117-25	0.250"
C700110-25	0.469"
C700109-25	0.625"

### O-Rings (Buna)

OTTO P/N	I.D.
C801568-010	0.250"
C802568-015	0.500"
C802568-016	0.625"

## Mounting Hardware

### MILITARY P/N

#### KEYWAY WASHERS

MS25081-C0	C710081-C0	0.250"
MS25081-C4	C710081-C4	0.469"
MS25081-C6	C710081-C6	0.625"

#### INTERNAL TOOTH LOCKWASHERS

MS35333-135	C710333-135	0.250"
MS35333-136	C710333-136	0.469"

#### HEX NUTS—STANDARD

MS25082-C14	C710082-C14	0.250-40
MS25082-C21	C710082-C21	0.469-32
MS25082-B11	C710082-B11	0.625-24

#### HEX NUTS—WIRE LOCKING

MS21340-04	C710340-04	0.469-32
MS21340-05	C710340-05	0.625-24

### OTTO P/N BUSHING SIZE (inches)

C710081-C0	0.250"
C710081-C4	0.469"
C710081-C6	0.625"

C710333-135	0.250"
C710333-136	0.469"

C710082-C14	0.250-40
C710082-C21	0.469-32
C710082-B11	0.625-24

C710340-04	0.469-32
C710340-05	0.625-24

CONNECTORS FOR SWITCH ASSEMBLY

## Connectors for K1 Rockers and T71 Toggles

### K1 AND T71 CONNECTOR PART NUMBER CODE

C405041 -

XX

XXXX

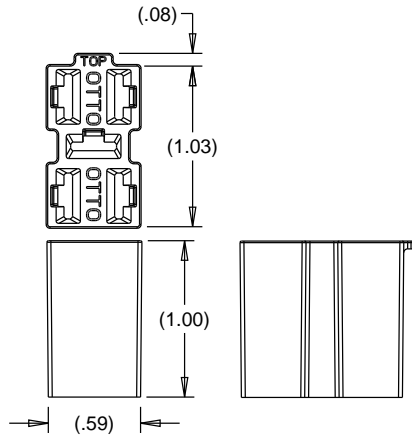
**Connector Color**

- 01. Red
- 02. Black
- 03. Orange\*
- 04. Yellow\*
- 05. Green\*
- 06. Blue\*
- 07. Violet\*
- 08. Gray\*
- 09. White

**Packaging Quantity**

- 0025 - 25 Pcs per Package
- 0050 - 50 Pcs per Package
- 0100 - 100 Pcs per Package

\* Contact Factory



## Connectors for K2 & K4 Rockers and T7 Toggles

### K2 AND K4 AND T7 CONNECTOR PART NUMBER CODE

C801765 -

XX

XXXX

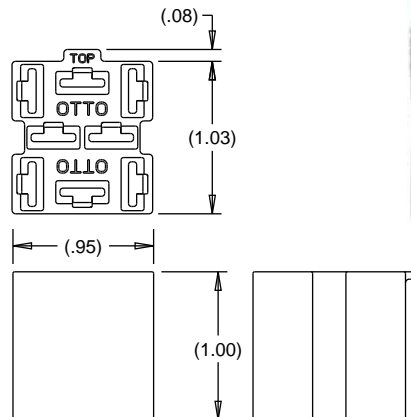
**Connector Color**

- 01. Red
- 02. Black
- 03. Orange\*
- 04. Yellow\*
- 05. Green\*
- 06. Blue\*
- 07. Violet\*
- 08. Gray\*
- 09. White

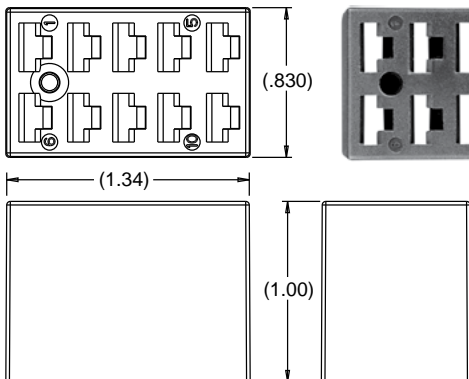
**Packaging Quantity**

- 0025 - 25 Pcs per Package
- 0050 - 50 Pcs per Package
- 0100 - 100 Pcs per Package

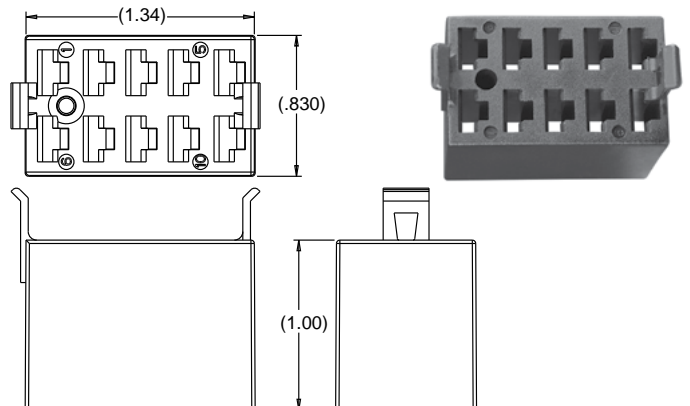
\* Contact Factory



## Connectors for K3 & K5 Rockers



C801775-2A (Without Latch)



C801775-2B (With Latch)

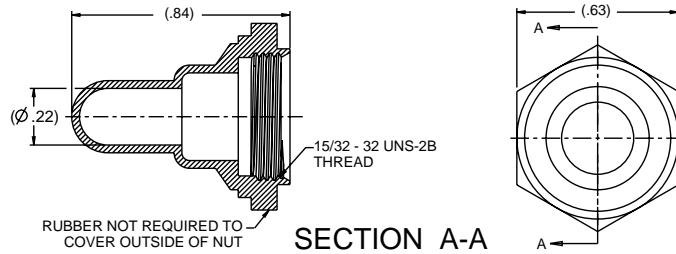


BOOTS FOR PUSHBUTTONS AND, TOGGLE SWITCHES

**C740191**

T9 Toggle Boot with 15/32" Thread

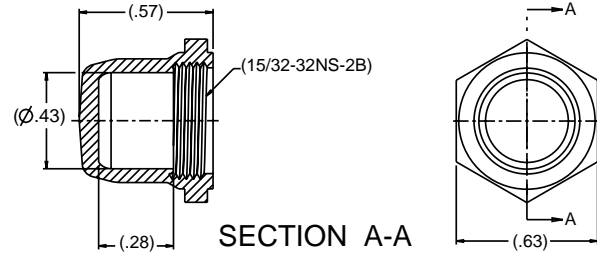
Boot: Black Silicone Rubber  
Nut: Brass, Nickel Plated



**C740144**

P4-4 Switch Boot with Threaded Insert

Boot: Black Silicone Rubber  
Insert: Brass, Nickel Plated



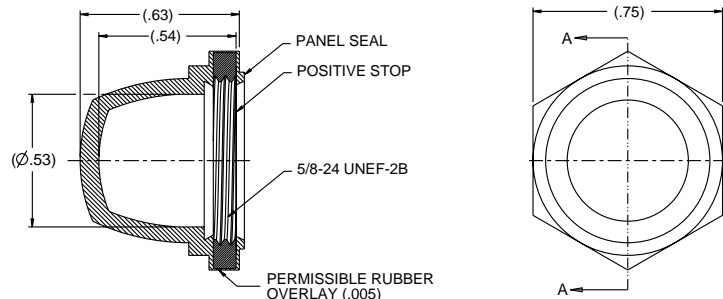
**C700179**

P3-6 Switch Boot

MIL-DTL-5423/7 Type B, Style 2, Size 4

Material: Silicone Rubber

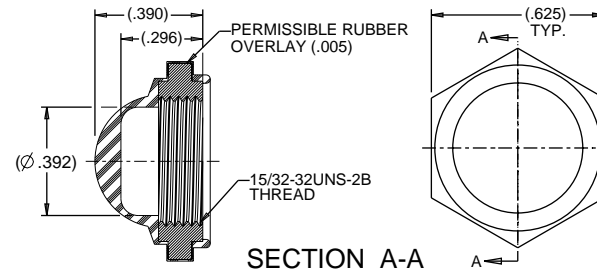
C700179-2S = Black  
C700179-4S = Yellow  
C700179-8S = Gray



**C701211**

P7-6 Pushbutton Boot Hex Nut

Material: Black Silicone  
Thread: 15/32"

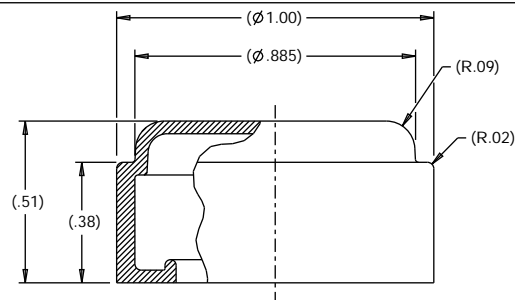


**C405192-025**

Boot Primarily Intended for Custom P3's and P8's with a .875" Case Diameter

Boot: Clear Silicone Rubber

Bagged in Lots of 25



**P7/P9 Sealing Boots**

For Raised Dome

**C402611-1-50 Clear**

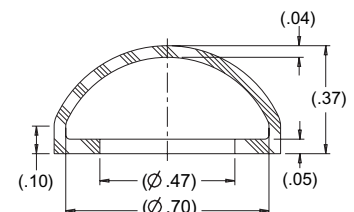
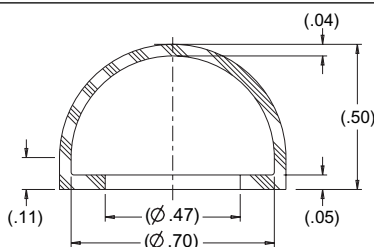
**C402611-2-50 Black**

For Flush Dome

**C402599-1-50 Clear**

**C402599-2-50 Black**

Material: Silicone



# STANDARD LEGENDS PER SAE SPECIFICATIONS

## STANDARD LEGENDS PER SAE SPECIFICATIONS

STANDARD LEGENDS PER SAE SPECIFICATIONS								
A1		ANCHOR	H2		HORN REAR	P4		BILGE PUMP
B1		BATTERY	K1		LOCK	P5		BILGE BLOWER
B2		ELECTRIC POWER	K2		UNLOCK	R1		LIFT
C1		AC/COOLING SYSTEMS	L1		LIGHT	R2		LOWER
C2		DEHUMIDIFIER	L2		MASTER LIGHTING SWITCH	R3		UP
C3		HEATER/INTERIOR HEATING	L3		HEADLIGHTS	R4		DOWN
D1		WINDSHIELD DEFROSTER	L4		HEADLIGHTS-LOW / DIPPED BEAM	R5		RIGHT
D2		REAR WINDOW DEFROSTER	L5		HEADLIGHTS-HIGH / UPPER BEAM	R6		LEFT
D3		MIRROR DEFROSTER	L6		PARKING LIGHT	R7	FWD	FORWARD
E1		ENGINE/START	L7		WORK LAMP	R8	REV	REVERSE
E2		ENGINE/STOP	L8		WORK LAMP	S1		RADIO
E3		ON/START	L9		INTERIOR DOME LIGHT	S2		MUTE
E4	○	OFF/STOP	M1		BEACON	T1		FAST
E5	ON	ON	M2		HAZARD/POSITION LIGHTS	T2		SLOW
E6	OFF	OFF	M3		CLEARANCE LIGHTS	T3		TRIM TAB / TRIMMING OPERATION
E7		ENGINE ELECTRIC PREHEAT	M4		SIDE MARKER LIGHT	T4		TRANSMISSION
E8		ENGINE-GAS INJECTION	M5		RUNNING LIGHTS (UNDER POWER)	V1		VENTILATING / AC FAN
E9		POWER	M6		ANCHOR LIGHT	W1		WINDSHIELD WIPER
F1		FRONT FOG LIGHTS	M7		RUNNING/ANCHOR LIGHTS	W2		WINDSHIELD-WASHER
F2		REAR FOG LIGHTS	M8		SEARCH LIGHT	W3		WINDSHIELD-WASHER/WIPER
F3	<b>F</b>	FORWARD	M9		LEFT TURN SIGNAL	W4		REAR WINDOW WIPER
F4	<b>N</b>	NEUTRAL	MA		RIGHT TURN SIGNAL	W5		REAR WINDOW-WASHER
F5	<b>R</b>	REVERSE	P1		BILGE PUMP #1	W6		REAR WINDOW-WASHER/WIPER
G1		FUEL	P2		BILGE PUMP #2	ZZ		NO LEGEND
H1		HORN	P3		BILGE PUMP #3			

For legends not shown, please consult an OTTO representative.

# NOTEWORTHY PENDANT SWITCHES

## EXAMPLES OF APPLICATION-SPECIFIC DESIGNS

### Pendant Switch

Remote hand held pushbutton switch with coiled cord that extends to approximately 3'.

**Circuit:** SPNO-DB

**Rating:** 10 amps Resistive @ 28VDC

**Button:** Black nylon

**Housing:** Black nylon

**Cord:** Black polyurethane, 28 AWG

**U2-098**



### Coiled Cord Switch

Remote hand held pushbutton switch with a 6' coiled cord. Sealed against dust and moisture.

**Rating:** 10 amps Resistive @ 28VDC

**Button:** Green nylon

**Housing:** Black anodized aluminum

**Cord:** 6' extended, 18 AWG

**P3-80012**



### Grip Switch Assembly

Switch is built into a grip designed for rugged outdoor use. Automotive type connector.

**Circuit:** SPNC-DB

**Rating:** 10 amps Resistive @ 28VDC

**Button:** Red nylon

**Housing:** Black nylon

**Cord:** Black polyurethane, 18 AWG

Left and right hand operation with various connection types available.

**U2-707**



### Pendant Switch

Remote hand held pushbutton switch with 24" coiled cord that extends to approximately 15'. Terminated with a 1/4" right angle molded phone plug (optional).

**Circuit:** SPNO-DB

**Rating:** 5 amps Resistive @ 28VDC

**Button:** Black nylon

**Housing:** Black nylon

**Cord:** Black polyurethane, 22 AWG

**U2-034**



### Pendant Switch

Remote hand held pushbutton switch with 7.0" +/- 1.0" wire leads.

**Circuit:** SPST Alternate Action

**Rating:** 5 amps Resistive @ 28VDC

**Button:** Red nylon

**Housing:** Black nylon

**Cord:** Black polyurethane, 18 AWG

**U2-150**



### Pendant Switch

Remote hand held pushbutton switch with coiled cord that extends to approximately 20'. Terminated with a connector.

**Circuit:** SPNO-DB

**Rating:** 5 amps Resistive @ 28VDC

**Button:** Red nylon

**Housing:** Black nylon

**Cord:** Black neoprene, 18 AWG

**Connector:** Deutsch



### Pendant Switch

Remote hand held P8 pushbutton switch with a 3' coiled cord. Switch is dusttight per MIL-PRF-8805, Design 2.

**Switch Rating:** 10 amps Resistive @ 28VDC

**Button:** Red thermoplastic

**Housing:** Black anodized aluminum

**Cord:** Black polyurethane, 28 AWG

**U2-331**



### Pendant Switch

The U7 series is offered in single plug configuration or can be customized to a dual switch configuration. Cable options include 0.250" diameter for 60.0 lbs. pull strength or 0.130" diameter cable for 25.0 lbs. pull strength.

**Circuit:** SPST-NO-DB

**Rating:** 10-100mA @ 3-28 VDC, Max D.C.

**Button and Bezel:** Thermoplastic

**Cord:** Flex cable

**U712298111**



For more options contact factory.

EXAMPLES OF APPLICATION SPECIFIC DESIGNS

### Flight Grip Rocker Switch

Compact lightweight design for flight grips and other space sensitive installations.

- Shallow mounting depth
- ON-OFF-ON spring return to center
- 2 circuit (N.O.–N.C.) switches
- Utilizes OTTO B3 Basic switches per MIL-PRF-8805/101
- Low level switching (10mA @ 30mV) or standard rating (see B3 pages)
- Black anodized housing
- Black molded button



**U2-621**

### Rocker Switch with Pushbuttons

This rocker switch with a beveled button style offers short behind panel depth by using two P8 momentary action, subminiature, double break pushbuttons. IP68S version available.

- Button:** Black Nylon
- Standard Rating:** 10 amps Resistive @ 28VDC
- Logic Level:** 10mA @ 5VDC
- U2-278**



### Hall Effect Rocker

This linear output Hall effect rocker switch will meet your needs when long life is required. Rated for 2.5 million cycles, it was designed for demanding applications and is fully protected against electromagnetic and radio frequency interference (EMI and RFI) up to 100V/M.



**U2-452**

### FNR - 3-Position Rocker

Compact, robust and reliable for grip or panel mount. The FNR is a 3-position switch that provides operator comfort by reducing the movement required to change direction and switch gears. The switch has a mechanical life of 1 million cycles.



**FNR-1002** Standard 3-position rocker with 36" 20 AWG wire leads

### Integrated Flip Guard

Combines a pushbutton and flip guard into one assembly, offering a reliable panel seal up to IP68S. The guard can be maintained open or closed or have spring return to close. Available for both commercial and military applications. It can be assembled with an OTTO P1, P3, P4 (up to 2 poles) or P5 series pushbutton.

- Electrical Life:** 25,000 cycles
- Button:** Thermoplastic
- Case:** Black hard coat anodized aluminum
- Rating:** 10 amps Resistive @ 28VDC



### Park Brake

This heavy duty push-pull switch was designed specifically for off-road heavy duty equipment. With an electrical life of 200,000 cycles and watertight to IP68S, the U2-326 park brake switch can withstand the most demanding applications.

- Push Force:** 13.0 (58 N) +/- 50%
- Pull Force:** 6.1 (27 N) +/- 50%
- Seal:** Watertight to IP68S
- Electrical Life:** 200,000 cycles
- Button:** Aluminum alloy, red anodized
- Housing:** Aluminum alloy, black anodized
- U2-651**



## EXAMPLES OF APPLICATION SPECIFIC DESIGNS

### 4-Way Toggle with Large Bat Handle

This T4 toggle switch is a momentary return to center 4-way toggle with a large cone-shaped bat handle.

**Enclosure Design:** MIL-DTL-8805, Symbol 2 - Dusttight

**Electrical Life:** 50,000 cycles

**Lever:** Stainless Steel

**Case & Mounting Plate:** Black anodized aluminum alloy

**Rating:** 5 amps Resistive @ 30VDC



### Low Level, Three-Position Trim Switch

This low level trim switch is a double pole, double throw, center-off, three-position momentary switch. Poles may be operated independently. Made with three B2 basic switches, this switch is ideal for the aviation industry.

**Bezel:** Black chromium aluminum

**Buttons:** Black anodized aluminum

**Rating:** 10mA @ 30mV

**U2-652**



### Door Interlock Switch

Features a defeat function for special purpose applications. Normal logic requires the assembly to be mounted so the switch button is engaged by the actuator when the door is closed. When the door is opened, the spring disengages the actuator to turn off the machine. The assembly features an OTTO B3 double break snap-action basic switch.

**U2-053**



### Miniature Toggle with Jeweled Handle

The jeweled handle on this miniature T3 toggle makes the switch easy to visually locate on a panel in low-light conditions. Works well in aviation applications or in any application where a control panel is populated with a large number of switches.

**Seal:** Sealed per MIL-DTL-83731

**Handle & Lever:** Stainless steel

**Bushing:** In accordance with MIL-DTL-3950

**Rating:** 5 amps Resistive @ 28VDC

**T3-10129**



### Emergency Pushbutton

This emergency pushbutton switch is designed to prevent inadvertent actuation. The operator's finger must be directed into the protective cup before the OTTO 4 pole pushbutton switch can be actuated. Edge backlighted.

**Enclosure Design:** MIL-DTL-8805, Symbol 2 - Dusttight

**Operate Force:** 7 +/- 1 lb.

**Rating:** 10 amps Resistive @ 28VDC



### T3 Toggle with Custom Engraved Bat Handle

Add a custom engraved legend, lettering or logo to the bat handle of this miniature toggle with snap-action contact actuation. This toggle, with a 15/32-32 bushing, is an excellent choice for switching loads from logic level up to 5 amps.

**Bat Handle:** Anodized aluminum in a variety of colors

**Rating:** 5 amps Resistive @ 28VDC



# LED VOLTAGE/CURRENT RATINGS TABLE

## ROCKER AND ROTARY SWITCH VOLTAGE/CURRENT RATINGS TABLES

### K1, K2, K3P and K4 LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LIGHT SOURCE COLOR	FORWARD CURRENT	TYPICAL FORWARD/ NOMINAL VOLTAGE	MAX. FORWARD VOLTAGE
6VDC INCANDESCENT	WHITE	.2A	6V	8V
12VDC INCANDESCENT	WHITE	.08A	12V	14V
24VDC INCANDESCENT	WHITE	.04A	24V	28V
125VAC NEON	AMBER	1.9mA	125V	125V
250VAC NEON	AMBER	1.9mA	250V	250V
2V LED*	RED	20mA	1.9V	2.5V
	GREEN	20mA	2.15V	2.5V
	AMBER	20mA	1.95V	2.5V
	BLUE	20mA	3.5V	4.0V
6VDC LED	SEE CHART	20mA	6V	8V
12VDC LED	SEE CHART	20mA	12V	14V
24VDC LED	SEE CHART	20mA	24V	28V

### K3/K5 LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LIGHT SOURCE COLOR	FORWARD CURRENT	TYPICAL FORWARD/ NOMINAL VOLTAGE	MAX. FORWARD VOLTAGE
6VDC INCANDESCENT	WHITE	.2A	6V	8V
12VDC INCANDESCENT	WHITE	.08A	12V	14V
24VDC INCANDESCENT	WHITE	.04A	24V	28V
125VAC NEON	AMBER	1.9mA	125V	125V
250VAC NEON	AMBER	1.9mA	250V	250V
2V LED*	RED	20mA	2V	2.5V
	GREEN	20mA	2.2V	2.6V
	AMBER	20mA	2.1V	2.5V
6V LED	SEE CHART	20mA	6V	8V
12V LED	SEE CHART	20mA	12V	14V
24V LED	SEE CHART	20mA	24V	28V

### R2 LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LED LIGHT SOURCE COLOR	FORWARD CURRENT	TYPICAL FORWARD/ NOMINAL VOLTAGE (DC)	MAX. FORWARD VOLTAGE (DC)
2V*	RED	20mA	2V	2.5V
	GREEN	20mA	2.2V	2.6V
	AMBER	20mA	2.1V	2.5V
6V	SEE CHART	20mA	6V	8V
12V	SEE CHART	20mA	12V	14V
24V	SEE CHART	20mA	24V	28V

\*Intended for use with external resistor. The "2 volt" switches are intended to have a resistor added in series into the lighting circuit by the customer. To determine the approximate value of the resistor, use the equation below:

$$\text{RESISTOR SIZE} = \frac{\text{POWER SUPPLY VOLTAGE} - \text{LED FORWARD VOLTAGE}}{\text{LED FORWARD CURRENT}}$$

# LED VOLTAGE/CURRENT RATINGS TABLE

## ILLUMINATED PUSHBUTTON SWITCH & INDICATOR LIGHTS VOLTAGE/CURRENT RATINGS TABLES

### LP3, LP5 AND LPL SERIES

#### LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LED COLOR	FORWARD CURRENT	TYP. FORWARD VOLTAGE (DC)	MAX. FORWARD VOLTAGE (DC)
2V*	RED	20mA	1.9V	2.5V
	GREEN	20mA	2.2V	2.6V
	AMBER			
	BLUE	20mA	3.3V	4V
	DEEP GREEN			
6V	ALL COLORS	20mA	6V	8V
12V	ALL COLORS	20mA	12V	14.5V
24V	ALL COLORS	20mA	24V	28.6V

### LP3S AND LP3S-V SERIES

#### LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LED COLOR	FORWARD CURRENT	TYP. FORWARD VOLTAGE (DC)	MAX. FORWARD VOLTAGE (DC)
2V*	RED	20mA	2V	2.5V
	GREEN			
	AMBER			
	BLUE	20mA	3.2V	4V
	DEEP GREEN			
12V	ALL COLORS	20mA	12V	14V
24V	ALL COLORS	20mA	24V	28.6V

### LP3-V AND LP5-V VANDAL RESISTANT SERIES

#### LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LED COLOR	FORWARD CURRENT	MAX. FORWARD CURRENT	TYP. FORWARD VOLTAGE (DC)	MAX. FORWARD VOLTAGE (DC)
2V*	RED	20mA	30mA	2V	2.5V
	GREEN				
	AMBER				
	BLUE	20mA	30mA	3.2V	4V
	DEEP GREEN				
6V	ALL COLORS	20mA	30mA	6V	8V
12V	ALL COLORS	20mA	30mA	12V	14V
24V	ALL COLORS	20mA	30mA	24V	28.6V

### LP7, LP7-D AND LP9 SERIES

#### LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LED COLOR, WAVELENGTH (nm)	FORWARD CURRENT	TYP. FORWARD VOLTAGE	MAX. FORWARD VOLTAGE
2V LIGHTPIPE STYLE*	RED (631)	20mA	2V	2.4V
	GREEN (525)	20mA	3.2V	3.6V
	AMBER (591)	20mA	2.1V	2.4V
	BLUE (470)	20mA	3.3V	3.8V
	WHITE	5mA	2.9V	3.15V
2V, TRANSLUCENT FULLY ILLUMINATED STYLE*	RED (630)	20mA	1.95V	2.5V
	GREEN (525)	20mA	3.3V	4.1V
	AMBER (601)	20mA	2.1V	2.5V
	BLUE (465)	20mA	3.3V	4V
	WHITE	5mA	2.85V	3.1V
12V ALL PRODUCTS	ALL COLORS, SAME AS 2V	(20mA)	12V	14V

### LP9L SERIES

#### LIGHTING VOLTAGE/CURRENT COMPONENTS RATINGS

LIGHT SOURCE VOLTAGE CATEGORY	LED COLOR, WAVELENGTH (nm)	FORWARD CURRENT	TYP. FORWARD VOLTAGE	MAX. FORWARD VOLTAGE
2V	RED (631)	20mA	2V	2.4V
	GREEN (525)	20mA	3.2V	3.6V
	AMBER (591)	20mA	2.1V	2.4V
	BLUE (470)	20mA	3.3V	3.8V
	WHITE	5mA	2.9V	3.15V
12V	ALL COLORS, SAME AS 2V	(20mA)	12V	14V

\*Intended for use with external resistor. The "2 volt" switches are intended to have a resistor added in series into the lighting circuit by the customer. To determine the approximate value of the resistor, use the equation below:

$$\text{RESISTOR SIZE} = \frac{\text{POWER SUPPLY VOLTAGE} - \text{LED FORWARD VOLTAGE}}{\text{LED FORWARD CURRENT}}$$

# TOGGLE HARDWARE ASSEMBLY

TOGGLE HARDWARE STANDARD CONFIGURATION

## TOGGLE HARDWARE STANDARD ASSEMBLY CONFIGURATION

WHEN USING PANEL SEALS

MIL-DTL-5423/16E

17 February 2009

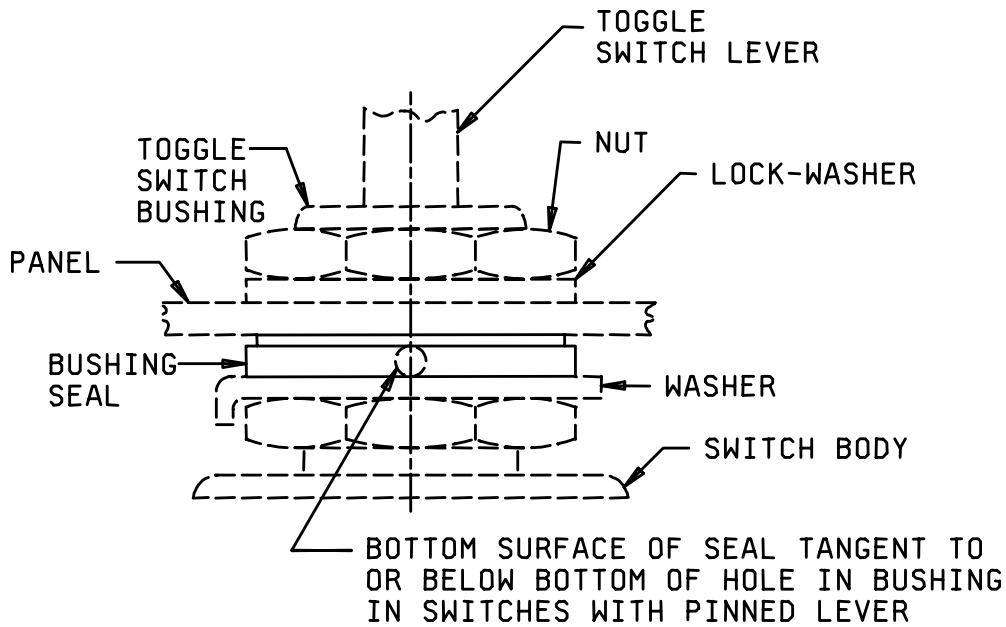
SUPERSEDING

MIL-DTL-5423/16D

AMENDMENT 1

12 May 2003

MIL-DTL-5423/16E



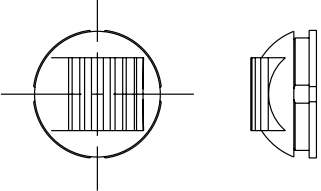
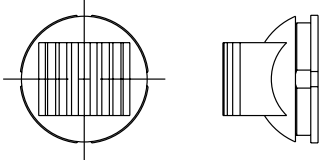
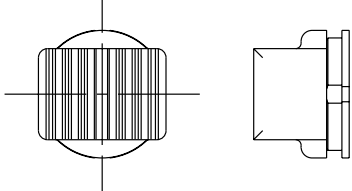
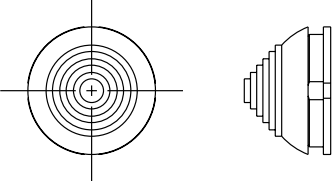
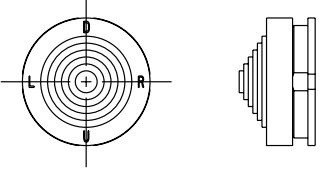
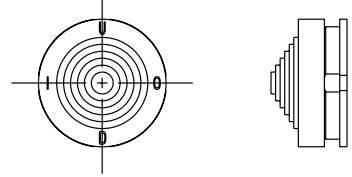
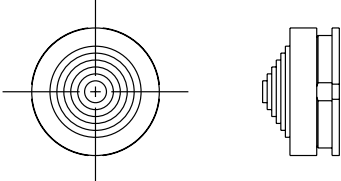
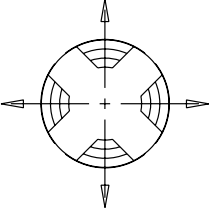
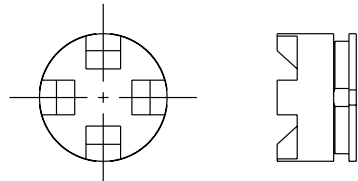
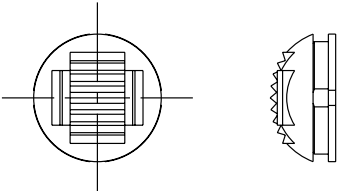
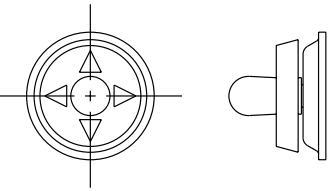
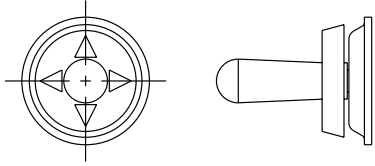
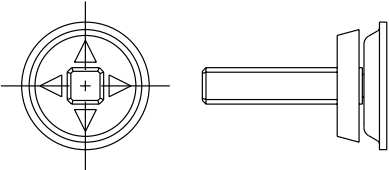
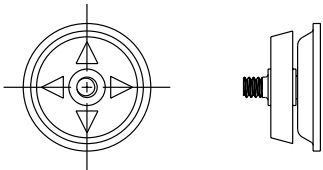
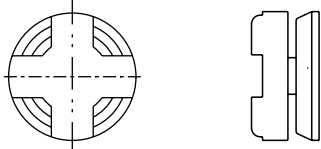
Note: Not applicable with all configurations.

Customer is responsible for keying the switch to the panel.



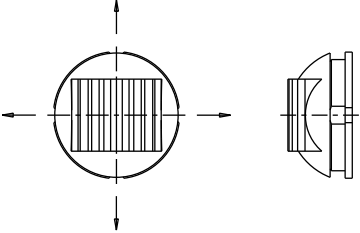
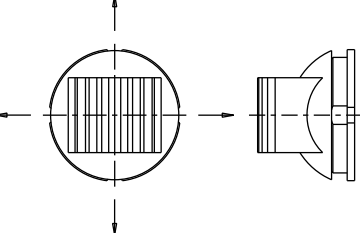
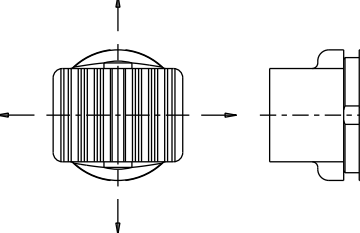
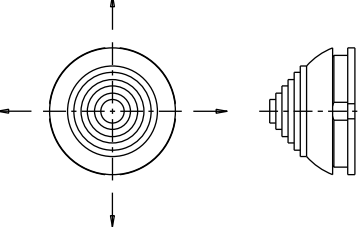
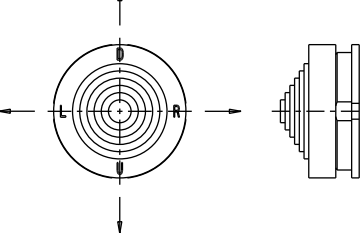
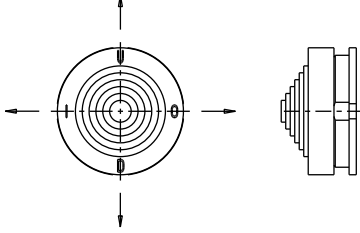
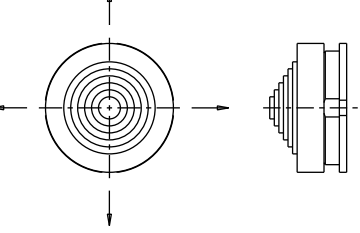
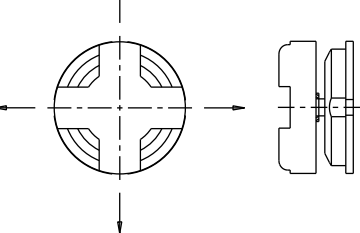
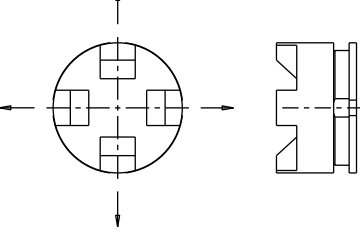
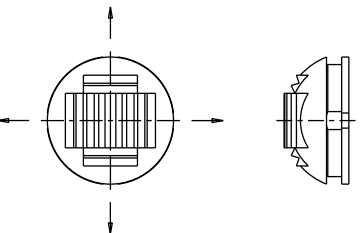
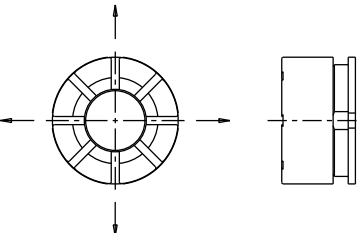
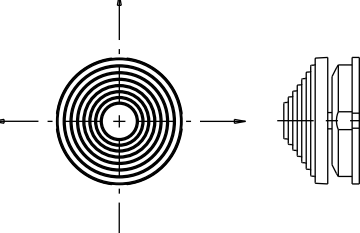
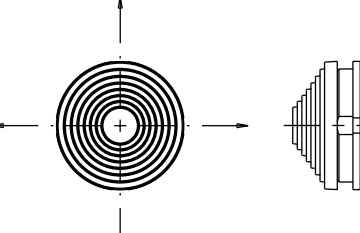
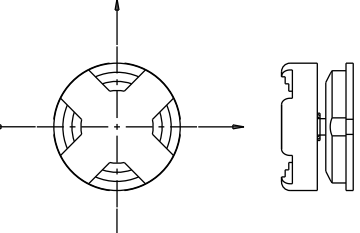
# T1, T2, T4, T5 & T8 MINI TRIM BUTTON STYLES

## T1, T2, T4, T5 AND T8 MINI TRIM BUTTON STYLES

<p><b>A - 2-WAY JOG</b></p> 	<p><b>B - TALL JOG</b></p> 	<p><b>C - ROCKER</b></p> 
<p><b>D - CONE</b></p> 	<p><b>E - LRUD HAT</b></p> 	<p><b>F - IOUD HAT</b></p> 
<p><b>G - HAT</b></p> 	<p><b>H - STADIUM</b></p> 	<p><b>J - CASTLE</b></p> 
<p><b>K - 4-WAY JOG</b></p> 	<p><b>L - SHORT BAT</b></p> 	<p><b>M - LONG BAT</b></p> 
<p><b>N - POST</b></p> 	<p><b>P - 4-40 THREADED POST</b></p> 	<p><b>Q - ROTATED STADIUM</b></p> 

# T4-T & T8-T MINI TRIM BUTTON STYLES

## T4-T AND T8-T MINI TRIM BUTTON STYLES

A - 2-WAY JOG (T4-T ONLY)	B - TALL JOG (T4-T ONLY)	C - ROCKER (T4-T ONLY)
		
D - CONE (T4-T AND T8-T)	E - LRUD HAT (T4-T AND T8-T)	F - IOUD HAT (T4-T AND T8-T)
		
G - HAT (T4-T AND T8-T)	H - STADIUM (T4-T AND T8-T)	J - CASTLE (T4-T AND T8-T)
		
K - 4-WAY JOG (T4-T AND T8-T)	L - INVERSE HAT (T4-T) and R (T8-T)	M - TALL HAT (T4-T) and S (T8-T)
		
N - SHORT HAT (T4-T) and T (T8-T)	P - STADIUM ROTATED (T4-T) and Q (T8-T)	
		

# CROSS REFERENCE: MILITARY TO OTTO

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
<b>M8805/96</b>		M8805/101-010	B3-12142	M8805/110-1147	P7-114127	M8805/110-1262	P7-136122
M8805/96-001	PE-1111	M8805/101-011	B3-15141	M8805/110-1148	P7-114128	M8805/110-1263	P7-136123
M8805/96-002	PE-1112	M8805/101-012	B3-15142	M8805/110-1149	P7-114129	M8805/110-1264	P7-136124
M8805/96-003	PE-2111	M8805/101-013	B3-13141	M8805/110-1151	P7-115121	M8805/110-1265	P7-136125
M8805/96-004	PE-2112	M8805/101-014	B3-13142	M8805/110-1152	P7-115122	M8805/110-1266	P7-136126
M8805/96-005	PE-1121	M8805/101-015	B3-11131	M8805/110-1153	P7-115123	M8805/110-1267	P7-136127
M8805/96-006	PE-1122	M8805/101-016	B3-11132	M8805/110-1154	P7-115124	M8805/110-1268	P7-136128
M8805/96-007	PE-2121	M8805/101-017	B3-12131	M8805/110-1155	P7-115125	M8805/110-1269	P7-136129
M8805/96-008	PE-2122	M8805/101-018	B3-12132	M8805/110-1156	P7-115126	M8805/110-1311	P7-151121
M8805/96-009	PE-1211	M8805/101-019	B3-15131	M8805/110-1157	P7-115127	M8805/110-1312	P7-151122
M8805/96-010	PE-1212	M8805/101-020	B3-15132	M8805/110-1158	P7-115128	M8805/110-1313	P7-151123
M8805/96-011	PE-2211	M8805/101-021	B3-13131	M8805/110-1159	P7-115129	M8805/110-1314	P7-151124
M8805/96-012	PE-2212	M8805/101-022	B3-13132	M8805/110-1161	P7-116121	M8805/110-1315	P7-151125
M8805/96-013	PE-1221			M8805/110-1162	P7-116122	M8805/110-1316	P7-151126
M8805/96-014	PE-1222	<b>M8805/106</b>		M8805/110-1163	P7-116123	M8805/110-1317	P7-151127
M8805/96-015	PE-2221	M8805/106-01	B2-200031	M8805/110-1164	P7-116124	M8805/110-1318	P7-151128
M8805/96-016	PE-2222	M8805/106-02	B2-200032	M8805/110-1165	P7-116125	M8805/110-1319	P7-151129
				M8805/110-1166	P7-116126	M8805/110-1321	P7-152121
				M8805/110-1167	P7-116127	M8805/110-1322	P7-152122
<b>M8805/99</b>		<b>M8805/109</b>		M8805/110-1168	P7-116128	M8805/110-1323	P7-152123
M8805/99-009	PE2-11121	M8805/109-01	B2-111351	M8805/110-1169	P7-116129	M8805/110-1324	P7-152124
M8805/99-010	PE2-21121	M8805/109-02	B2-112351	M8805/110-1211	P7-131121	M8805/110-1325	P7-152125
M8805/99-011	PE2-31121	M8805/109-03	B2-111353	M8805/110-1212	P7-131122	M8805/110-1326	P7-152126
M8805/99-013	PE2-11111	M8805/109-04	B2-112353	M8805/110-1213	P7-131123	M8805/110-1327	P7-152127
M8805/99-014	PE2-21111			M8805/110-1214	P7-131124	M8805/110-1328	P7-152128
M8805/99-015	PE2-31111	<b>M8805/110</b>		M8805/110-1215	P7-131125	M8805/110-1329	P7-152129
M8805/99-025	PE2-11221	M8805/110-1111	P7-111121	M8805/110-1216	P7-131126	M8805/110-1331	P7-153121
M8805/99-026	PE2-21221	M8805/110-1112	P7-111122	M8805/110-1217	P7-131127	M8805/110-1332	P7-153122
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M8805/99-029	PE2-11211	M8805/110-1114	P7-111124	M8805/110-1219	P7-131129	M8805/110-1334	P7-153124
M8805/99-030	PE2-21211	M8805/110-1115	P7-111125	M8805/110-1221	P7-132121	M8805/110-1335	P7-153125
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M8805/99-037	PE2-11131	M8805/110-1117	P7-111127	M8805/110-1223	P7-132123	M8805/110-1337	P7-153127
M8805/99-038	PE2-21131	M8805/110-1118	P7-111128	M8805/110-1224	P7-132124	M8805/110-1338	P7-153128
M8805/99-039	PE2-31131	M8805/110-1119	P7-111129	M8805/110-1225	P7-132125	M8805/110-1339	P7-153129
M8805/99-045	PE2-11231	M8805/110-1121	P7-112121	M8805/110-1226	P7-132126	M8805/110-1341	P7-154121
M8805/99-046	PE2-21231	M8805/110-1122	P7-112122	M8805/110-1227	P7-132127	M8805/110-1342	P7-154122
M8805/99-047	PE2-31231	M8805/110-1123	P7-112123	M8805/110-1228	P7-132128	M8805/110-1343	P7-154123
		M8805/110-1124	P7-112124	M8805/110-1229	P7-132129	M8805/110-1344	P7-154124
<b>M8805/100</b>		M8805/110-1125	P7-112125	M8805/110-1241	P7-134121	M8805/110-1345	P7-154125
M8805/100-007	P6-24043	M8805/110-1126	P7-112126	M8805/110-1242	P7-134122	M8805/110-1346	P7-154126
M8805/100-008	P6-24044	M8805/110-1127	P7-112127	M8805/110-1243	P7-134123	M8805/110-1347	P7-154127
M8805/100-009	P6-14035	M8805/110-1128	P7-112128	M8805/110-1244	P7-134124	M8805/110-1348	P7-154128
M8805/100-010	P6-14036	M8805/110-1129	P7-112129	M8805/110-1245	P7-134125	M8805/110-1349	P7-154129
M8805/100-015	P6-24007	M8805/110-1131	P7-113121	M8805/110-1246	P7-134126	M8805/110-1351	P7-155121
M8805/100-016	P6-24008	M8805/110-1132	P7-113122	M8805/110-1247	P7-134127	M8805/110-1352	P7-155122
M8805/100-017	P6-14005	M8805/110-1133	P7-113123	M8805/110-1248	P7-134128	M8805/110-1353	P7-155123
M8805/100-018	P6-14006	M8805/110-1134	P7-113124	M8805/110-1249	P7-134129	M8805/110-1354	P7-155124
		M8805/110-1135	P7-113125	M8805/110-1251	P7-135121	M8805/110-1355	P7-155125
<b>M8805/101</b>		M8805/110-1136	P7-113126	M8805/110-1252	P7-135122	M8805/110-1356	P7-155126
M8805/101-001	B3-10064	M8805/110-1137	P7-113127	M8805/110-1253	P7-135123	M8805/110-1357	P7-155127
M8805/101-002	B3-10065	M8805/110-1138	P7-113128	M8805/110-1254	P7-135124	M8805/110-1358	P7-155128
M8805/101-003	B3-10066	M8805/110-1139	P7-113129	M8805/110-1255	P7-135125	M8805/110-1359	P7-155129
M8805/101-004	B3-10067	M8805/110-1141	P7-114121	M8805/110-1256	P7-135126	M8805/110-1361	P7-156121
M8805/101-005	B3-10063	M8805/110-1142	P7-114122	M8805/110-1257	P7-135127	M8805/110-1362	P7-156122
M8805/101-006	B3-10072	M8805/110-1143	P7-114123	M8805/110-1258	P7-135128	M8805/110-1363	P7-156123
M8805/101-007	B3-11141	M8805/110-1144	P7-114124	M8805/110-1259	P7-135129	M8805/110-1364	P7-156124
M8805/101-008	B3-11142	M8805/110-1145	P7-114125	M8805/110-1261	P7-136121	M8805/110-1365	P7-156125
M8805/101-009	B3-12141	M8805/110-1146	P7-114126				

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-1366	P7-156126	M8805/110-1511	P7-131221	M8805/110-1615	P7-151225	M8805/110-1719	P7-161129
M8805/110-1367	P7-156127	M8805/110-1512	P7-131222	M8805/110-1616	P7-151226	M8805/110-1721	P7-162121
M8805/110-1368	P7-156128	M8805/110-1513	P7-131223	M8805/110-1617	P7-151227	M8805/110-1722	P7-162122
M8805/110-1369	P7-156129	M8805/110-1514	P7-131224	M8805/110-1618	P7-151228	M8805/110-1723	P7-162123
M8805/110-1411	P7-111221	M8805/110-1515	P7-131225	M8805/110-1619	P7-151229	M8805/110-1724	P7-162124
M8805/110-1412	P7-111222	M8805/110-1516	P7-131226	M8805/110-1621	P7-152221	M8805/110-1725	P7-162125
M8805/110-1413	P7-111223	M8805/110-1517	P7-131227	M8805/110-1622	P7-152222	M8805/110-1726	P7-162126
M8805/110-1414	P7-111224	M8805/110-1518	P7-131228	M8805/110-1623	P7-152223	M8805/110-1727	P7-162127
M8805/110-1415	P7-111225	M8805/110-1519	P7-131229	M8805/110-1624	P7-152224	M8805/110-1728	P7-162128
M8805/110-1416	P7-111226	M8805/110-1521	P7-132221	M8805/110-1625	P7-152225	M8805/110-1729	P7-162129
M8805/110-1417	P7-111227	M8805/110-1522	P7-132222	M8805/110-1626	P7-152226	M8805/110-1731	P7-163121
M8805/110-1418	P7-111228	M8805/110-1523	P7-132223	M8805/110-1627	P7-152227	M8805/110-1732	P7-163122
M8805/110-1419	P7-111229	M8805/110-1524	P7-132224	M8805/110-1628	P7-152228	M8805/110-1733	P7-163123
M8805/110-1421	P7-112221	M8805/110-1525	P7-132225	M8805/110-1629	P7-152229	M8805/110-1734	P7-163124
M8805/110-1422	P7-112222	M8805/110-1526	P7-132226	M8805/110-1631	P7-153221	M8805/110-1735	P7-163125
M8805/110-1423	P7-112223	M8805/110-1527	P7-132227	M8805/110-1632	P7-153222	M8805/110-1736	P7-163126
M8805/110-1424	P7-112224	M8805/110-1528	P7-132228	M8805/110-1633	P7-153223	M8805/110-1737	P7-163127
M8805/110-1425	P7-112225	M8805/110-1529	P7-132229	M8805/110-1634	P7-153224	M8805/110-1738	P7-163128
M8805/110-1426	P7-112226	M8805/110-1531	P7-133221	M8805/110-1635	P7-153225	M8805/110-1739	P7-163129
M8805/110-1427	P7-112227	M8805/110-1532	P7-133222	M8805/110-1636	P7-153226	M8805/110-1741	P7-164121
M8805/110-1428	P7-112228	M8805/110-1533	P7-133223	M8805/110-1637	P7-153227	M8805/110-1742	P7-164122
M8805/110-1429	P7-112229	M8805/110-1534	P7-133224	M8805/110-1638	P7-153228	M8805/110-1743	P7-164123
M8805/110-1431	P7-113221	M8805/110-1535	P7-133225	M8805/110-1639	P7-153229	M8805/110-1744	P7-164124
M8805/110-1432	P7-113222	M8805/110-1536	P7-133226	M8805/110-1641	P7-154221	M8805/110-1745	P7-164125
M8805/110-1433	P7-113223	M8805/110-1537	P7-133227	M8805/110-1642	P7-154222	M8805/110-1746	P7-164126
M8805/110-1434	P7-113224	M8805/110-1538	P7-133228	M8805/110-1643	P7-154223	M8805/110-1747	P7-164127
M8805/110-1435	P7-113225	M8805/110-1539	P7-133229	M8805/110-1644	P7-154224	M8805/110-1748	P7-164128
M8805/110-1436	P7-113226	M8805/110-1541	P7-134221	M8805/110-1645	P7-154225	M8805/110-1749	P7-164129
M8805/110-1437	P7-113227	M8805/110-1542	P7-134222	M8805/110-1646	P7-154226	M8805/110-1751	P7-165121
M8805/110-1438	P7-113228	M8805/110-1543	P7-134223	M8805/110-1647	P7-154227	M8805/110-1752	P7-165122
M8805/110-1439	P7-113229	M8805/110-1544	P7-134224	M8805/110-1648	P7-154228	M8805/110-1753	P7-165123
M8805/110-1441	P7-114221	M8805/110-1545	P7-134225	M8805/110-1649	P7-154229	M8805/110-1754	P7-165124
M8805/110-1442	P7-114222	M8805/110-1546	P7-134226	M8805/110-1651	P7-155221	M8805/110-1755	P7-165125
M8805/110-1443	P7-114223	M8805/110-1547	P7-134227	M8805/110-1652	P7-155222	M8805/110-1756	P7-165126
M8805/110-1444	P7-114224	M8805/110-1548	P7-134228	M8805/110-1653	P7-155223	M8805/110-1757	P7-165127
M8805/110-1445	P7-114225	M8805/110-1549	P7-134229	M8805/110-1654	P7-155224	M8805/110-1758	P7-165128
M8805/110-1446	P7-114226	M8805/110-1551	P7-135221	M8805/110-1655	P7-155225	M8805/110-1759	P7-165129
M8805/110-1447	P7-114227	M8805/110-1552	P7-135222	M8805/110-1656	P7-155226	M8805/110-1761	P7-166121
M8805/110-1448	P7-114228	M8805/110-1553	P7-135223	M8805/110-1657	P7-155227	M8805/110-1762	P7-166122
M8805/110-1449	P7-114229	M8805/110-1554	P7-135224	M8805/110-1658	P7-155228	M8805/110-1763	P7-166123
M8805/110-1451	P7-115221	M8805/110-1555	P7-135225	M8805/110-1659	P7-155229	M8805/110-1764	P7-166124
M8805/110-1452	P7-115222	M8805/110-1556	P7-135226	M8805/110-1661	P7-156221	M8805/110-1765	P7-166125
M8805/110-1453	P7-115223	M8805/110-1557	P7-135227	M8805/110-1662	P7-156222	M8805/110-1766	P7-166126
M8805/110-1454	P7-115224	M8805/110-1558	P7-135228	M8805/110-1663	P7-156223	M8805/110-1767	P7-166127
M8805/110-1455	P7-115225	M8805/110-1559	P7-135229	M8805/110-1664	P7-156224	M8805/110-1768	P7-166128
M8805/110-1456	P7-115226	M8805/110-1561	P7-136221	M8805/110-1665	P7-156225	M8805/110-1769	P7-166129
M8805/110-1457	P7-115227	M8805/110-1562	P7-136222	M8805/110-1666	P7-156226	M8805/110-1811	P7-161221
M8805/110-1458	P7-115228	M8805/110-1563	P7-136223	M8805/110-1667	P7-156227	M8805/110-1812	P7-161222
M8805/110-1459	P7-115229	M8805/110-1564	P7-136224	M8805/110-1668	P7-156228	M8805/110-1813	P7-161223
M8805/110-1461	P7-116221	M8805/110-1565	P7-136225	M8805/110-1669	P7-156229	M8805/110-1814	P7-161224
M8805/110-1462	P7-116222	M8805/110-1566	P7-136226	M8805/110-1711	P7-161121	M8805/110-1815	P7-161225
M8805/110-1463	P7-116223	M8805/110-1567	P7-136227	M8805/110-1712	P7-161122	M8805/110-1816	P7-161226
M8805/110-1464	P7-116224	M8805/110-1568	P7-136228	M8805/110-1713	P7-161123		
M8805/110-1465	P7-116225	M8805/110-1569	P7-136229	M8805/110-1714	P7-161124		
M8805/110-1466	P7-116226	M8805/110-1611	P7-151221	M8805/110-1715	P7-161125		
M8805/110-1467	P7-116227	M8805/110-1612	P7-151222	M8805/110-1716	P7-161126		
M8805/110-1468	P7-116228	M8805/110-1613	P7-151223	M8805/110-1717	P7-161127		
M8805/110-1469	P7-116229	M8805/110-1614	P7-151224	M8805/110-1718	P7-161128		

# CROSS REFERENCE: MILITARY TO OTTO

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-1817	P7-161227	M8805/110-2122	P7-212122	M8805/110-2226	P7-232126	M8805/110-2341	P7-254121
M8805/110-1818	P7-161228	M8805/110-2123	P7-212123	M8805/110-2227	P7-232127	M8805/110-2342	P7-254122
M8805/110-1819	P7-161229	M8805/110-2124	P7-212124	M8805/110-2228	P7-232128	M8805/110-2343	P7-254123
M8805/110-1821	P7-162221	M8805/110-2125	P7-212125	M8805/110-2229	P7-232129	M8805/110-2344	P7-254124
M8805/110-1822	P7-162222	M8805/110-2126	P7-212126	M8805/110-2241	P7-234121	M8805/110-2345	P7-254125
M8805/110-1823	P7-162223	M8805/110-2127	P7-212127	M8805/110-2242	P7-234122	M8805/110-2346	P7-254126
M8805/110-1824	P7-162224	M8805/110-2128	P7-212128	M8805/110-2243	P7-234123	M8805/110-2347	P7-254127
M8805/110-1825	P7-162225	M8805/110-2129	P7-212129	M8805/110-2244	P7-234124	M8805/110-2348	P7-254128
M8805/110-1826	P7-162226	M8805/110-2131	P7-213121	M8805/110-2245	P7-234125	M8805/110-2349	P7-254129
M8805/110-1827	P7-162227	M8805/110-2132	P7-213122	M8805/110-2246	P7-234126	M8805/110-2351	P7-255121
M8805/110-1828	P7-162228	M8805/110-2133	P7-213123	M8805/110-2247	P7-234127	M8805/110-2352	P7-255122
M8805/110-1829	P7-162229	M8805/110-2134	P7-213124	M8805/110-2248	P7-234128	M8805/110-2353	P7-255123
M8805/110-1831	P7-163221	M8805/110-2135	P7-213125	M8805/110-2249	P7-234129	M8805/110-2354	P7-255124
M8805/110-1832	P7-163222	M8805/110-2136	P7-213126	M8805/110-2251	P7-235121	M8805/110-2355	P7-255125
M8805/110-1833	P7-163223	M8805/110-2137	P7-213127	M8805/110-2252	P7-235122	M8805/110-2356	P7-255126
M8805/110-1834	P7-163224	M8805/110-2138	P7-213128	M8805/110-2253	P7-235123	M8805/110-2357	P7-255127
M8805/110-1835	P7-163225	M8805/110-2139	P7-213129	M8805/110-2254	P7-235124	M8805/110-2358	P7-255128
M8805/110-1836	P7-163226	M8805/110-2141	P7-214121	M8805/110-2255	P7-235125	M8805/110-2359	P7-255129
M8805/110-1837	P7-163227	M8805/110-2142	P7-214122	M8805/110-2256	P7-235126	M8805/110-2361	P7-256121
M8805/110-1838	P7-163228	M8805/110-2143	P7-214123	M8805/110-2257	P7-235127	M8805/110-2362	P7-256122
M8805/110-1839	P7-163229	M8805/110-2144	P7-214124	M8805/110-2258	P7-235128	M8805/110-2363	P7-256123
M8805/110-1841	P7-164221	M8805/110-2145	P7-214125	M8805/110-2259	P7-235129	M8805/110-2364	P7-256124
M8805/110-1842	P7-164222	M8805/110-2146	P7-214126	M8805/110-2261	P7-236121	M8805/110-2365	P7-256125
M8805/110-1843	P7-164223	M8805/110-2147	P7-214127	M8805/110-2262	P7-236122	M8805/110-2366	P7-256126
M8805/110-1844	P7-164224	M8805/110-2148	P7-214128	M8805/110-2263	P7-236123	M8805/110-2367	P7-256127
M8805/110-1845	P7-164225	M8805/110-2149	P7-214129	M8805/110-2264	P7-236124	M8805/110-2368	P7-256128
M8805/110-1846	P7-164226	M8805/110-2151	P7-215121	M8805/110-2265	P7-236125	M8805/110-2369	P7-256129
M8805/110-1847	P7-164227	M8805/110-2152	P7-215122	M8805/110-2266	P7-236126	M8805/110-2411	P7-211221
M8805/110-1848	P7-164228	M8805/110-2153	P7-215123	M8805/110-2267	P7-236127	M8805/110-2412	P7-211222
M8805/110-1849	P7-164229	M8805/110-2154	P7-215124	M8805/110-2268	P7-236128	M8805/110-2413	P7-211223
M8805/110-1851	P7-165221	M8805/110-2155	P7-215125	M8805/110-2269	P7-236129	M8805/110-2414	P7-211224
M8805/110-1852	P7-165222	M8805/110-2156	P7-215126	M8805/110-2311	P7-251121	M8805/110-2415	P7-211225
M8805/110-1853	P7-165223	M8805/110-2157	P7-215127	M8805/110-2312	P7-251122	M8805/110-2416	P7-211226
M8805/110-1854	P7-165224	M8805/110-2158	P7-215128	M8805/110-2313	P7-251123	M8805/110-2417	P7-211227
M8805/110-1855	P7-165225	M8805/110-2159	P7-215129	M8805/110-2314	P7-251124	M8805/110-2418	P7-211228
M8805/110-1856	P7-165226	M8805/110-2161	P7-216121	M8805/110-2315	P7-251125	M8805/110-2419	P7-211229
M8805/110-1857	P7-165227	M8805/110-2162	P7-216122	M8805/110-2316	P7-251126	M8805/110-2421	P7-211221
M8805/110-1858	P7-165228	M8805/110-2163	P7-216123	M8805/110-2317	P7-251127	M8805/110-2422	P7-211222
M8805/110-1859	P7-165229	M8805/110-2164	P7-216124	M8805/110-2318	P7-251128	M8805/110-2423	P7-211223
M8805/110-1861	P7-166221	M8805/110-2165	P7-216125	M8805/110-2319	P7-251129	M8805/110-2424	P7-211224
M8805/110-1862	P7-166222	M8805/110-2166	P7-216126	M8805/110-2321	P7-252121	M8805/110-2425	P7-211225
M8805/110-1863	P7-166223	M8805/110-2167	P7-216127	M8805/110-2322	P7-252122	M8805/110-2426	P7-211226
M8805/110-1864	P7-166224	M8805/110-2168	P7-216128	M8805/110-2323	P7-252123	M8805/110-2427	P7-211227
M8805/110-1865	P7-166225	M8805/110-2169	P7-216129	M8805/110-2324	P7-252124	M8805/110-2428	P7-211228
M8805/110-1866	P7-166226	M8805/110-2211	P7-231121	M8805/110-2325	P7-252125	M8805/110-2429	P7-211229
M8805/110-1867	P7-166227	M8805/110-2212	P7-231122	M8805/110-2326	P7-252126	M8805/110-2431	P7-213221
M8805/110-1868	P7-166228	M8805/110-2213	P7-231123	M8805/110-2327	P7-252127	M8805/110-2432	P7-213222
M8805/110-1869	P7-166229	M8805/110-2214	P7-231124	M8805/110-2328	P7-252128	M8805/110-2433	P7-213223
M8805/110-2111	P7-211121	M8805/110-2215	P7-231125	M8805/110-2329	P7-252129	M8805/110-2434	P7-213224
M8805/110-2112	P7-211122	M8805/110-2216	P7-231126	M8805/110-2331	P7-253121	M8805/110-2435	P7-213225
M8805/110-2113	P7-211123	M8805/110-2217	P7-231127	M8805/110-2332	P7-253122	M8805/110-2436	P7-213226
M8805/110-2114	P7-211124	M8805/110-2218	P7-231128	M8805/110-2333	P7-253123	M8805/110-2437	P7-213227
M8805/110-2115	P7-211125	M8805/110-2219	P7-231129	M8805/110-2334	P7-253124	M8805/110-2438	P7-213228
M8805/110-2116	P7-211126	M8805/110-2221	P7-232121	M8805/110-2335	P7-253125	M8805/110-2439	P7-213229
M8805/110-2117	P7-211127	M8805/110-2222	P7-232122	M8805/110-2336	P7-253126	M8805/110-2441	P7-214221
M8805/110-2118	P7-211128	M8805/110-2223	P7-232123	M8805/110-2337	P7-253127	M8805/110-2442	P7-214222
M8805/110-2119	P7-211129	M8805/110-2224	P7-232124	M8805/110-2338	P7-253128	M8805/110-2443	P7-214223
M8805/110-2121	P7-212121	M8805/110-2225	P7-232125	M8805/110-2339	P7-253129	M8805/110-2444	P7-214224

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-2445	P7-214225	M8805/110-2549	P7-234229	M8805/110-2654	P7-255224	M8805/110-2758	P7-265128
M8805/110-2446	P7-214226	M8805/110-2551	P7-235221	M8805/110-2655	P7-255225	M8805/110-2759	P7-265129
M8805/110-2447	P7-214227	M8805/110-2552	P7-235222	M8805/110-2656	P7-255226	M8805/110-2761	P7-266121
M8805/110-2448	P7-214228	M8805/110-2553	P7-235223	M8805/110-2657	P7-255227	M8805/110-2762	P7-266122
M8805/110-2449	P7-214229	M8805/110-2554	P7-235224	M8805/110-2658	P7-255228	M8805/110-2763	P7-266123
M8805/110-2451	P7-215221	M8805/110-2555	P7-235225	M8805/110-2659	P7-255229	M8805/110-2764	P7-266124
M8805/110-2452	P7-215222	M8805/110-2556	P7-235226	M8805/110-2661	P7-256221	M8805/110-2765	P7-266125
M8805/110-2453	P7-215223	M8805/110-2557	P7-235227	M8805/110-2662	P7-256222	M8805/110-2766	P7-266126
M8805/110-2454	P7-215224	M8805/110-2558	P7-235228	M8805/110-2663	P7-256223	M8805/110-2767	P7-266127
M8805/110-2455	P7-215225	M8805/110-2559	P7-235229	M8805/110-2664	P7-256224	M8805/110-2768	P7-266128
M8805/110-2456	P7-215226	M8805/110-2561	P7-236221	M8805/110-2665	P7-256225	M8805/110-2769	P7-266129
M8805/110-2457	P7-215227	M8805/110-2562	P7-236222	M8805/110-2666	P7-256226	M8805/110-2811	P7-261221
M8805/110-2458	P7-215228	M8805/110-2563	P7-236223	M8805/110-2667	P7-256227	M8805/110-2812	P7-261222
M8805/110-2459	P7-215229	M8805/110-2564	P7-236224	M8805/110-2668	P7-256228	M8805/110-2813	P7-261223
M8805/110-2461	P7-216221	M8805/110-2565	P7-236225	M8805/110-2669	P7-256229	M8805/110-2814	P7-261224
M8805/110-2462	P7-216222	M8805/110-2566	P7-236226	M8805/110-2711	P7-261121	M8805/110-2815	P7-261225
M8805/110-2463	P7-216223	M8805/110-2567	P7-236227	M8805/110-2712	P7-261122	M8805/110-2816	P7-261226
M8805/110-2464	P7-216224	M8805/110-2568	P7-236228	M8805/110-2713	P7-261123	M8805/110-2817	P7-261227
M8805/110-2465	P7-216225	M8805/110-2569	P7-236229	M8805/110-2714	P7-261124	M8805/110-2818	P7-261228
M8805/110-2466	P7-216226	M8805/110-2611	P7-251221	M8805/110-2715	P7-261125	M8805/110-2819	P7-261229
M8805/110-2467	P7-216227	M8805/110-2612	P7-251222	M8805/110-2716	P7-261126	M8805/110-2821	P7-262221
M8805/110-2468	P7-216228	M8805/110-2613	P7-251223	M8805/110-2717	P7-261127	M8805/110-2822	P7-262222
M8805/110-2469	P7-216229	M8805/110-2614	P7-251224	M8805/110-2718	P7-261128	M8805/110-2823	P7-262223
M8805/110-2511	P7-231221	M8805/110-2615	P7-251225	M8805/110-2719	P7-261129	M8805/110-2824	P7-262224
M8805/110-2512	P7-231222	M8805/110-2616	P7-251226	M8805/110-2721	P7-262121	M8805/110-2825	P7-262225
M8805/110-2513	P7-231223	M8805/110-2617	P7-251227	M8805/110-2722	P7-262122	M8805/110-2826	P7-262226
M8805/110-2514	P7-231224	M8805/110-2618	P7-251228	M8805/110-2723	P7-262123	M8805/110-2827	P7-262227
M8805/110-2515	P7-231225	M8805/110-2619	P7-251229	M8805/110-2724	P7-262124	M8805/110-2828	P7-262228
M8805/110-2516	P7-231226	M8805/110-2621	P7-252221	M8805/110-2725	P7-262125	M8805/110-2829	P7-262229
M8805/110-2517	P7-231227	M8805/110-2622	P7-252222	M8805/110-2726	P7-262126	M8805/110-2831	P7-263221
M8805/110-2518	P7-231228	M8805/110-2623	P7-252223	M8805/110-2727	P7-262127	M8805/110-2832	P7-263222
M8805/110-2519	P7-231229	M8805/110-2624	P7-252224	M8805/110-2728	P7-262128	M8805/110-2833	P7-263223
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M8805/110-2522	P7-232222	M8805/110-2626	P7-252226	M8805/110-2731	P7-263121	M8805/110-2835	P7-263225
M8805/110-2523	P7-232223	M8805/110-2627	P7-252227	M8805/110-2732	P7-263122	M8805/110-2836	P7-263226
M8805/110-2524	P7-232224	M8805/110-2628	P7-252228	M8805/110-2733	P7-263123	M8805/110-2837	P7-263227
M8805/110-2525	P7-232225	M8805/110-2629	P7-252229	M8805/110-2734	P7-263124	M8805/110-2838	P7-263228
M8805/110-2526	P7-232226	M8805/110-2631	P7-253221	M8805/110-2735	P7-263125	M8805/110-2839	P7-263229
M8805/110-2527	P7-232227	M8805/110-2632	P7-253222	M8805/110-2736	P7-263126	M8805/110-2841	P7-264221
M8805/110-2528	P7-232228	M8805/110-2633	P7-253223	M8805/110-2737	P7-263127	M8805/110-2842	P7-264222
M8805/110-2529	P7-232229	M8805/110-2634	P7-253224	M8805/110-2738	P7-263128	M8805/110-2843	P7-264223
M8805/110-2531	P7-233221	M8805/110-2635	P7-253225	M8805/110-2739	P7-263129	M8805/110-2844	P7-264224
M8805/110-2532	P7-233222	M8805/110-2636	P7-253226	M8805/110-2741	P7-264121	M8805/110-2845	P7-264225
M8805/110-2533	P7-233223	M8805/110-2637	P7-253227	M8805/110-2742	P7-264122	M8805/110-2846	P7-264226
M8805/110-2534	P7-233224	M8805/110-2638	P7-253228	M8805/110-2743	P7-264123	M8805/110-2847	P7-264227
M8805/110-2535	P7-233225	M8805/110-2639	P7-253229	M8805/110-2744	P7-264124	M8805/110-2848	P7-264228
M8805/110-2536	P7-233226	M8805/110-2641	P7-254221	M8805/110-2745	P7-264125	M8805/110-2849	P7-264229
M8805/110-2537	P7-233227	M8805/110-2642	P7-254222	M8805/110-2746	P7-264126	M8805/110-2851	P7-265221
M8805/110-2538	P7-233228	M8805/110-2643	P7-254223	M8805/110-2747	P7-264127	M8805/110-2852	P7-265222
M8805/110-2539	P7-233229	M8805/110-2644	P7-254224	M8805/110-2748	P7-264128	M8805/110-2853	P7-265223
M8805/110-2541	P7-234221	M8805/110-2645	P7-254225	M8805/110-2749	P7-264129	M8805/110-2854	P7-265224
M8805/110-2542	P7-234222	M8805/110-2646	P7-254226	M8805/110-2751	P7-265121	M8805/110-2855	P7-265225
M8805/110-2543	P7-234223	M8805/110-2647	P7-254227	M8805/110-2752	P7-265122	M8805/110-2856	P7-265226
M8805/110-2544	P7-234224	M8805/110-2648	P7-254228	M8805/110-2753	P7-265123	M8805/110-2857	P7-265227
M8805/110-2545	P7-234225	M8805/110-2649	P7-254229	M8805/110-2754	P7-265124	M8805/110-2858	P7-265228
M8805/110-2546	P7-234226	M8805/110-2651	P7-255221	M8805/110-2755	P7-265125	M8805/110-2859	P7-265229
M8805/110-2547	P7-234227	M8805/110-2652	P7-255222	M8805/110-2756	P7-265126	M8805/110-2861	P7-266221
M8805/110-2548	P7-234228	M8805/110-2653	P7-255223	M8805/110-2757	P7-265127	M8805/110-2862	P7-266222

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-2863	P7-266223	M8805/110-3167	P7-316127	M8805/110-3322	P7-352122	M8805/110-3426	P7-312226
M8805/110-2864	P7-266224	M8805/110-3168	P7-316128	M8805/110-3323	P7-352123	M8805/110-3427	P7-312227
M8805/110-2865	P7-266225	M8805/110-3169	P7-316129	M8805/110-3324	P7-352124	M8805/110-3428	P7-312228
M8805/110-2866	P7-266226	M8805/110-3211	P7-331121	M8805/110-3325	P7-352125	M8805/110-3429	P7-312229
M8805/110-2867	P7-266227	M8805/110-3212	P7-331122	M8805/110-3326	P7-352126	M8805/110-3431	P7-313221
M8805/110-2868	P7-266228	M8805/110-3213	P7-331123	M8805/110-3327	P7-352127	M8805/110-3432	P7-313222
M8805/110-2869	P7-266229	M8805/110-3214	P7-331124	M8805/110-3328	P7-352128	M8805/110-3433	P7-313223
M8805/110-3111	P7-311121	M8805/110-3215	P7-331125	M8805/110-3329	P7-352129	M8805/110-3434	P7-313224
M8805/110-3112	P7-311122	M8805/110-3216	P7-331126	M8805/110-3331	P7-353121	M8805/110-3435	P7-313225
M8805/110-3113	P7-311123	M8805/110-3217	P7-331127	M8805/110-3332	P7-353122	M8805/110-3436	P7-313226
M8805/110-3114	P7-311124	M8805/110-3218	P7-331128	M8805/110-3333	P7-353123	M8805/110-3437	P7-313227
M8805/110-3115	P7-311125	M8805/110-3219	P7-331129	M8805/110-3334	P7-353124	M8805/110-3438	P7-313228
M8805/110-3116	P7-311126	M8805/110-3221	P7-332121	M8805/110-3335	P7-353125	M8805/110-3439	P7-313229
M8805/110-3117	P7-311127	M8805/110-3222	P7-332122	M8805/110-3336	P7-353126	M8805/110-3441	P7-314221
M8805/110-3118	P7-311128	M8805/110-3223	P7-332123	M8805/110-3337	P7-353127	M8805/110-3442	P7-314222
M8805/110-3119	P7-311129	M8805/110-3224	P7-332124	M8805/110-3338	P7-353128	M8805/110-3443	P7-314223
M8805/110-3121	P7-312121	M8805/110-3225	P7-332125	M8805/110-3339	P7-353129	M8805/110-3444	P7-314224
M8805/110-3122	P7-312122	M8805/110-3226	P7-332126	M8805/110-3341	P7-354121	M8805/110-3445	P7-314225
M8805/110-3123	P7-312123	M8805/110-3227	P7-332127	M8805/110-3342	P7-354122	M8805/110-3446	P7-314226
M8805/110-3124	P7-312124	M8805/110-3228	P7-332128	M8805/110-3343	P7-354123	M8805/110-3447	P7-314227
M8805/110-3125	P7-312125	M8805/110-3229	P7-332129	M8805/110-3344	P7-354124	M8805/110-3448	P7-314228
M8805/110-3126	P7-312126	M8805/110-3241	P7-334121	M8805/110-3345	P7-354125	M8805/110-3449	P7-314229
M8805/110-3127	P7-312127	M8805/110-3242	P7-334122	M8805/110-3346	P7-354126	M8805/110-3451	P7-315221
M8805/110-3128	P7-312128	M8805/110-3243	P7-334123	M8805/110-3347	P7-354127	M8805/110-3452	P7-315222
M8805/110-3129	P7-312129	M8805/110-3244	P7-334124	M8805/110-3348	P7-354128	M8805/110-3453	P7-315223
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M8805/110-3132	P7-313122	M8805/110-3246	P7-334126	M8805/110-3351	P7-355121	M8805/110-3455	P7-315225
M8805/110-3133	P7-313123	M8805/110-3247	P7-334127	M8805/110-3352	P7-355122	M8805/110-3456	P7-315226
M8805/110-3134	P7-313124	M8805/110-3248	P7-334128	M8805/110-3353	P7-355123	M8805/110-3457	P7-315227
M8805/110-3135	P7-313125	M8805/110-3249	P7-334129	M8805/110-3354	P7-355124	M8805/110-3458	P7-315228
M8805/110-3136	P7-313126	M8805/110-3251	P7-335121	M8805/110-3355	P7-355125	M8805/110-3459	P7-315229
M8805/110-3137	P7-313127	M8805/110-3252	P7-335122	M8805/110-3356	P7-355126	M8805/110-3461	P7-316221
M8805/110-3138	P7-313128	M8805/110-3253	P7-335123	M8805/110-3357	P7-355127	M8805/110-3462	P7-316222
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M8805/110-3142	P7-314122	M8805/110-3256	P7-335126	M8805/110-3361	P7-356121	M8805/110-3465	P7-316225
M8805/110-3143	P7-314123	M8805/110-3257	P7-335127	M8805/110-3362	P7-356122	M8805/110-3466	P7-316226
M8805/110-3144	P7-314124	M8805/110-3258	P7-335128	M8805/110-3363	P7-356123	M8805/110-3467	P7-316227
M8805/110-3145	P7-314125	M8805/110-3259	P7-335129	M8805/110-3364	P7-356124	M8805/110-3468	P7-316228
M8805/110-3146	P7-314126	M8805/110-3261	P7-336121	M8805/110-3365	P7-356125	M8805/110-3469	P7-316229
M8805/110-3147	P7-314127	M8805/110-3262	P7-336122	M8805/110-3366	P7-356126	M8805/110-3511	P7-331221
M8805/110-3148	P7-314128	M8805/110-3263	P7-336123	M8805/110-3367	P7-356127	M8805/110-3512	P7-331222
M8805/110-3149	P7-314129	M8805/110-3264	P7-336124	M8805/110-3368	P7-356128	M8805/110-3513	P7-331223
M8805/110-3151	P7-315121	M8805/110-3265	P7-336125	M8805/110-3369	P7-356129	M8805/110-3514	P7-331224
M8805/110-3152	P7-315122	M8805/110-3266	P7-336126	M8805/110-3411	P7-311221	M8805/110-3515	P7-331225
M8805/110-3153	P7-315123	M8805/110-3267	P7-336127	M8805/110-3412	P7-311222	M8805/110-3516	P7-331226
M8805/110-3154	P7-315124	M8805/110-3268	P7-336128	M8805/110-3413	P7-311223	M8805/110-3517	P7-331227
M8805/110-3155	P7-315125	M8805/110-3269	P7-336129	M8805/110-3414	P7-311224	M8805/110-3518	P7-331228
M8805/110-3156	P7-315126	M8805/110-3311	P7-351121	M8805/110-3415	P7-311225	M8805/110-3519	P7-331229
M8805/110-3157	P7-315127	M8805/110-3312	P7-351122	M8805/110-3416	P7-311226	M8805/110-3521	P7-332221
M8805/110-3158	P7-315128	M8805/110-3313	P7-351123	M8805/110-3417	P7-311227	M8805/110-3522	P7-332222
M8805/110-3159	P7-315129	M8805/110-3314	P7-351124	M8805/110-3418	P7-311228	M8805/110-3523	P7-332223
M8805/110-3161	P7-316121	M8805/110-3315	P7-351125	M8805/110-3419	P7-311229	M8805/110-3524	P7-332224
M8805/110-3162	P7-316122	M8805/110-3316	P7-351126	M8805/110-3421	P7-312221	M8805/110-3525	P7-332225
M8805/110-3163	P7-316123	M8805/110-3317	P7-351127	M8805/110-3422	P7-312222	M8805/110-3526	P7-332226
M8805/110-3164	P7-316124	M8805/110-3318	P7-351128	M8805/110-3423	P7-312223	M8805/110-3527	P7-332227
M8805/110-3165	P7-316125	M8805/110-3319	P7-351129	M8805/110-3424	P7-312224	M8805/110-3528	P7-332228
M8805/110-3166	P7-316126	M8805/110-3321	P7-352121	M8805/110-3425	P7-312225	M8805/110-3529	P7-332229

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-3532	P7-333222	M8805/110-3636	P7-353226	M8805/110-3741	P7-364121	M8805/110-3845	P7-364225
M8805/110-3533	P7-333223	M8805/110-3637	P7-353227	M8805/110-3742	P7-364122	M8805/110-3846	P7-364226
M8805/110-3534	P7-333224	M8805/110-3638	P7-353228	M8805/110-3743	P7-364123	M8805/110-3847	P7-364227
M8805/110-3535	P7-333225	M8805/110-3639	P7-353229	M8805/110-3744	P7-364124	M8805/110-3848	P7-364228
M8805/110-3536	P7-333226	M8805/110-3641	P7-354221	M8805/110-3745	P7-364125	M8805/110-3849	P7-364229
M8805/110-3537	P7-333227	M8805/110-3642	P7-354222	M8805/110-3746	P7-364126	M8805/110-3851	P7-365221
M8805/110-3538	P7-333228	M8805/110-3643	P7-354223	M8805/110-3747	P7-364127	M8805/110-3852	P7-365222
M8805/110-3539	P7-333229	M8805/110-3644	P7-354224	M8805/110-3748	P7-364128	M8805/110-3853	P7-365223
M8805/110-3541	P7-334221	M8805/110-3645	P7-354225	M8805/110-3749	P7-364129	M8805/110-3854	P7-365224
M8805/110-3542	P7-334222	M8805/110-3646	P7-354226	M8805/110-3751	P7-365121	M8805/110-3855	P7-365225
M8805/110-3543	P7-334223	M8805/110-3647	P7-354227	M8805/110-3752	P7-365122	M8805/110-3856	P7-365226
M8805/110-3544	P7-334224	M8805/110-3648	P7-354228	M8805/110-3753	P7-365123	M8805/110-3857	P7-365227
M8805/110-3545	P7-334225	M8805/110-3649	P7-354229	M8805/110-3754	P7-365124	M8805/110-3858	P7-365228
M8805/110-3546	P7-334226	M8805/110-3651	P7-355221	M8805/110-3755	P7-365125	M8805/110-3859	P7-365229
M8805/110-3547	P7-334227	M8805/110-3652	P7-355222	M8805/110-3756	P7-365126	M8805/110-3861	P7-366221
M8805/110-3548	P7-334228	M8805/110-3653	P7-355223	M8805/110-3757	P7-365127	M8805/110-3862	P7-366222
M8805/110-3549	P7-334229	M8805/110-3654	P7-355224	M8805/110-3758	P7-365128	M8805/110-3863	P7-366223
M8805/110-3551	P7-335221	M8805/110-3655	P7-355225	M8805/110-3759	P7-365129	M8805/110-3864	P7-366224
M8805/110-3552	P7-335222	M8805/110-3656	P7-355226	M8805/110-3761	P7-366121	M8805/110-3865	P7-366225
M8805/110-3553	P7-335223	M8805/110-3657	P7-355227	M8805/110-3762	P7-366122	M8805/110-3866	P7-366226
M8805/110-3554	P7-335224	M8805/110-3658	P7-355228	M8805/110-3763	P7-366123	M8805/110-3867	P7-366227
M8805/110-3555	P7-335225	M8805/110-3659	P7-355229	M8805/110-3764	P7-366124	M8805/110-3868	P7-366228
M8805/110-3556	P7-335226	M8805/110-3661	P7-356221	M8805/110-3765	P7-366125	M8805/110-3869	P7-366229
M8805/110-3557	P7-335227	M8805/110-3662	P7-356222	M8805/110-3766	P7-366126	M8805/110-5111	P7-511121
M8805/110-3558	P7-335228	M8805/110-3663	P7-356223	M8805/110-3767	P7-366127	M8805/110-5112	P7-511122
M8805/110-3559	P7-335229	M8805/110-3664	P7-356224	M8805/110-3768	P7-366128	M8805/110-5113	P7-511123
M8805/110-3561	P7-336221	M8805/110-3665	P7-356225	M8805/110-3769	P7-366129	M8805/110-5114	P7-511124
M8805/110-3562	P7-336222	M8805/110-3666	P7-356226	M8805/110-3811	P7-361221	M8805/110-5115	P7-511125
M8805/110-3563	P7-336223	M8805/110-3667	P7-356227	M8805/110-3812	P7-361222	M8805/110-5116	P7-511126
M8805/110-3564	P7-336224	M8805/110-3668	P7-356228	M8805/110-3813	P7-361223	M8805/110-5117	P7-511127
M8805/110-3565	P7-336225	M8805/110-3669	P7-356229	M8805/110-3814	P7-361224	M8805/110-5118	P7-511128
M8805/110-3566	P7-336226	M8805/110-3711	P7-361121	M8805/110-3815	P7-361225	M8805/110-5119	P7-511129
M8805/110-3567	P7-336227	M8805/110-3712	P7-361122	M8805/110-3816	P7-361226	M8805/110-5121	P7-512121
M8805/110-3568	P7-336228	M8805/110-3713	P7-361123	M8805/110-3817	P7-361227	M8805/110-5122	P7-512122
M8805/110-3569	P7-336229	M8805/110-3714	P7-361124	M8805/110-3818	P7-361228	M8805/110-5123	P7-512123
M8805/110-3611	P7-351221	M8805/110-3715	P7-361125	M8805/110-3819	P7-361229	M8805/110-5124	P7-512124
M8805/110-3612	P7-351222	M8805/110-3716	P7-361126	M8805/110-3821	P7-362221	M8805/110-5125	P7-512125
M8805/110-3613	P7-351223	M8805/110-3717	P7-361127	M8805/110-3822	P7-362222	M8805/110-5126	P7-512126
M8805/110-3614	P7-351224	M8805/110-3718	P7-361128	M8805/110-3823	P7-362223	M8805/110-5127	P7-512127
M8805/110-3615	P7-351225	M8805/110-3719	P7-361129	M8805/110-3824	P7-362224	M8805/110-5128	P7-512128
M8805/110-3616	P7-351226	M8805/110-3721	P7-362121	M8805/110-3825	P7-362225	M8805/110-5129	P7-512129
M8805/110-3617	P7-351227	M8805/110-3722	P7-362122	M8805/110-3826	P7-362226	M8805/110-5131	P7-513121
M8805/110-3618	P7-351228	M8805/110-3723	P7-362123	M8805/110-3827	P7-362227	M8805/110-5132	P7-513122
M8805/110-3619	P7-351229	M8805/110-3724	P7-362124	M8805/110-3828	P7-362228	M8805/110-5133	P7-513123
M8805/110-3621	P7-352221	M8805/110-3725	P7-362125	M8805/110-3829	P7-362229	M8805/110-5134	P7-513124
M8805/110-3622	P7-352222	M8805/110-3726	P7-362126	M8805/110-3831	P7-363221	M8805/110-5135	P7-513125
M8805/110-3623	P7-352223	M8805/110-3727	P7-362127	M8805/110-3832	P7-363222	M8805/110-5136	P7-513126
M8805/110-3624	P7-352224	M8805/110-3728	P7-362128	M8805/110-3833	P7-363223	M8805/110-5137	P7-513127
M8805/110-3625	P7-352225	M8805/110-3729	P7-362129	M8805/110-3834	P7-363224	M8805/110-5138	P7-513128
M8805/110-3626	P7-352226	M8805/110-3731	P7-363121	M8805/110-3835	P7-363225	M8805/110-5139	P7-513129
M8805/110-3627	P7-352227	M8805/110-3732	P7-363122	M8805/110-3836	P7-363226	M8805/110-5141	P7-514121
M8805/110-3628	P7-352228	M8805/110-3733	P7-363123	M8805/110-3837	P7-363227	M8805/110-5142	P7-514122
M8805/110-3629	P7-352229	M8805/110-3734	P7-363124	M8805/110-3838	P7-363228	M8805/110-5143	P7-514123
M8805/110-3631	P7-353221	M8805/110-3735	P7-363125	M8805/110-3839	P7-363229	M8805/110-5144	P7-514124
M8805/110-3632	P7-353222	M8805/110-3736	P7-363126	M8805/110-3841	P7-364221	M8805/110-5145	P7-514125
M8805/110-3633	P7-353223	M8805/110-3737	P7-363127	M8805/110-3842	P7-364222	M8805/110-5146	P7-514126
M8805/110-3634	P7-353224	M8805/110-3738	P7-363128	M8805/110-3843	P7-364223	M8805/110-5147	P7-514127



# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-5148	P7-514128	M8805/110-5263	P7-536123	M8805/110-5367	P7-556127	M8805/110-5512	P7-531222
M8805/110-5149	P7-514129	M8805/110-5264	P7-536124	M8805/110-5368	P7-556128	M8805/110-5513	P7-531223
M8805/110-5151	P7-515121	M8805/110-5265	P7-536125	M8805/110-5369	P7-556129	M8805/110-5514	P7-531224
M8805/110-5152	P7-515122	M8805/110-5266	P7-536126	M8805/110-5411	P7-511221	M8805/110-5515	P7-531225
M8805/110-5153	P7-515123	M8805/110-5267	P7-536127	M8805/110-5412	P7-511222	M8805/110-5516	P7-531226
M8805/110-5154	P7-515124	M8805/110-5268	P7-536128	M8805/110-5413	P7-511223	M8805/110-5517	P7-531227
M8805/110-5155	P7-515125	M8805/110-5269	P7-536129	M8805/110-5414	P7-511224	M8805/110-5518	P7-531228
M8805/110-5156	P7-515126	M8805/110-5311	P7-551121	M8805/110-5415	P7-511225	M8805/110-5519	P7-531229
M8805/110-5157	P7-515127	M8805/110-5312	P7-551122	M8805/110-5416	P7-511226	M8805/110-5521	P7-532221
M8805/110-5158	P7-515128	M8805/110-5313	P7-551123	M8805/110-5417	P7-511227	M8805/110-5522	P7-532222
M8805/110-5159	P7-515129	M8805/110-5314	P7-551124	M8805/110-5418	P7-511228	M8805/110-5523	P7-532223
M8805/110-5161	P7-516121	M8805/110-5315	P7-551125	M8805/110-5419	P7-511229	M8805/110-5524	P7-532224
M8805/110-5162	P7-516122	M8805/110-5316	P7-551126	M8805/110-5421	P7-512221	M8805/110-5525	P7-532225
M8805/110-5163	P7-516123	M8805/110-5317	P7-551127	M8805/110-5422	P7-512222	M8805/110-5526	P7-532226
M8805/110-5164	P7-516124	M8805/110-5318	P7-551128	M8805/110-5423	P7-512223	M8805/110-5527	P7-532227
M8805/110-5165	P7-516125	M8805/110-5319	P7-551129	M8805/110-5424	P7-512224	M8805/110-5528	P7-532228
M8805/110-5166	P7-516126	M8805/110-5321	P7-552121	M8805/110-5425	P7-512225	M8805/110-5529	P7-532229
M8805/110-5167	P7-516127	M8805/110-5322	P7-552122	M8805/110-5426	P7-512226	M8805/110-5531	P7-533221
M8805/110-5168	P7-516128	M8805/110-5323	P7-552123	M8805/110-5427	P7-512227	M8805/110-5532	P7-533222
M8805/110-5169	P7-516129	M8805/110-5324	P7-552124	M8805/110-5428	P7-512228	M8805/110-5533	P7-533223
M8805/110-5211	P7-531121	M8805/110-5325	P7-552125	M8805/110-5429	P7-512229	M8805/110-5534	P7-533224
M8805/110-5212	P7-531122	M8805/110-5326	P7-552126	M8805/110-5431	P7-513221	M8805/110-5535	P7-533225
M8805/110-5213	P7-531123	M8805/110-5327	P7-552127	M8805/110-5432	P7-513222	M8805/110-5536	P7-533226
M8805/110-5214	P7-531124	M8805/110-5328	P7-552128	M8805/110-5433	P7-513223	M8805/110-5537	P7-533227
M8805/110-5215	P7-531125	M8805/110-5329	P7-552129	M8805/110-5434	P7-513224	M8805/110-5538	P7-533228
M8805/110-5216	P7-531126	M8805/110-5331	P7-553121	M8805/110-5435	P7-513225	M8805/110-5539	P7-533229
M8805/110-5217	P7-531127	M8805/110-5332	P7-553122	M8805/110-5436	P7-513226	M8805/110-5541	P7-534221
M8805/110-5218	P7-531128	M8805/110-5333	P7-553123	M8805/110-5437	P7-513227	M8805/110-5542	P7-534222
M8805/110-5219	P7-531129	M8805/110-5334	P7-553124	M8805/110-5438	P7-513228	M8805/110-5543	P7-534223
M8805/110-5221	P7-532121	M8805/110-5335	P7-553125	M8805/110-5439	P7-513229	M8805/110-5544	P7-534224
M8805/110-5222	P7-532122	M8805/110-5336	P7-553126	M8805/110-5441	P7-514221	M8805/110-5545	P7-534225
M8805/110-5223	P7-532123	M8805/110-5337	P7-553127	M8805/110-5442	P7-514222	M8805/110-5546	P7-534226
M8805/110-5224	P7-532124	M8805/110-5338	P7-553128	M8805/110-5443	P7-514223	M8805/110-5547	P7-534227
M8805/110-5225	P7-532125	M8805/110-5339	P7-553129	M8805/110-5444	P7-514224	M8805/110-5548	P7-534228
M8805/110-5226	P7-532126	M8805/110-5341	P7-554121	M8805/110-5445	P7-514225	M8805/110-5549	P7-534229
M8805/110-5227	P7-532127	M8805/110-5342	P7-554122	M8805/110-5446	P7-514226	M8805/110-5551	P7-535221
M8805/110-5228	P7-532128	M8805/110-5343	P7-554123	M8805/110-5447	P7-514227	M8805/110-5552	P7-535222
M8805/110-5229	P7-532129	M8805/110-5344	P7-554124	M8805/110-5448	P7-514228	M8805/110-5553	P7-535223
M8805/110-5241	P7-534121	M8805/110-5345	P7-554125	M8805/110-5449	P7-514229	M8805/110-5554	P7-535224
M8805/110-5242	P7-534122	M8805/110-5346	P7-554126	M8805/110-5451	P7-515221	M8805/110-5555	P7-535225
M8805/110-5243	P7-534123	M8805/110-5347	P7-554127	M8805/110-5452	P7-515222	M8805/110-5556	P7-535226
M8805/110-5244	P7-534124	M8805/110-5348	P7-554128	M8805/110-5453	P7-515223	M8805/110-5557	P7-535227
M8805/110-5245	P7-534125	M8805/110-5349	P7-554129	M8805/110-5454	P7-515224	M8805/110-5558	P7-535228
M8805/110-5246	P7-534126	M8805/110-5351	P7-555121	M8805/110-5455	P7-515225	M8805/110-5559	P7-535229
M8805/110-5247	P7-534127	M8805/110-5352	P7-555122	M8805/110-5456	P7-515226	M8805/110-5561	P7-536221
M8805/110-5248	P7-534128	M8805/110-5353	P7-555123	M8805/110-5457	P7-515227	M8805/110-5562	P7-536222
M8805/110-5249	P7-534129	M8805/110-5354	P7-555124	M8805/110-5458	P7-515228	M8805/110-5563	P7-536223
M8805/110-5251	P7-535121	M8805/110-5355	P7-555125	M8805/110-5459	P7-515229	M8805/110-5564	P7-536224
M8805/110-5252	P7-535122	M8805/110-5356	P7-555126	M8805/110-5461	P7-516221	M8805/110-5565	P7-536225
M8805/110-5253	P7-535123	M8805/110-5357	P7-555127	M8805/110-5462	P7-516222	M8805/110-5566	P7-536226
M8805/110-5254	P7-535124	M8805/110-5358	P7-555128	M8805/110-5463	P7-516223	M8805/110-5567	P7-536227
M8805/110-5255	P7-535125	M8805/110-5359	P7-555129	M8805/110-5464	P7-516224	M8805/110-5568	P7-536228
M8805/110-5256	P7-535126	M8805/110-5361	P7-556121	M8805/110-5465	P7-516225	M8805/110-5569	P7-536229
M8805/110-5257	P7-535127	M8805/110-5362	P7-556122	M8805/110-5466	P7-516226	M8805/110-5611	P7-551221
M8805/110-5258	P7-535128	M8805/110-5363	P7-556123	M8805/110-5467	P7-516227	M8805/110-5612	P7-551222
M8805/110-5259	P7-535129	M8805/110-5364	P7-556124	M8805/110-5468	P7-516228	M8805/110-5613	P7-551223
M8805/110-5261	P7-536121	M8805/110-5365	P7-556125	M8805/110-5469	P7-516229	M8805/110-5614	P7-551224
M8805/110-5262	P7-536122	M8805/110-5366	P7-556126	M8805/110-5511	P7-531221	M8805/110-5615	P7-551225

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-5616	P7-551226	M8805/110-5721	P7-562121	M8805/110-5825	P7-562225	M8805/110-6129	P7-612129
M8805/110-5617	P7-551227	M8805/110-5722	P7-562122	M8805/110-5826	P7-562226	M8805/110-6131	P7-613121
M8805/110-5618	P7-551228	M8805/110-5723	P7-562123	M8805/110-5827	P7-562227	M8805/110-6132	P7-613122
M8805/110-5619	P7-551229	M8805/110-5724	P7-562124	M8805/110-5828	P7-562228	M8805/110-6133	P7-613123
M8805/110-5621	P7-552221	M8805/110-5725	P7-562125	M8805/110-5829	P7-562229	M8805/110-6134	P7-613124
M8805/110-5622	P7-552222	M8805/110-5726	P7-562126	M8805/110-5831	P7-563221	M8805/110-6135	P7-613125
M8805/110-5623	P7-552223	M8805/110-5727	P7-562127	M8805/110-5832	P7-563222	M8805/110-6136	P7-613126
M8805/110-5624	P7-552224	M8805/110-5728	P7-562128	M8805/110-5833	P7-563223	M8805/110-6137	P7-613127
M8805/110-5625	P7-552225	M8805/110-5729	P7-562129	M8805/110-5834	P7-563224	M8805/110-6138	P7-613128
M8805/110-5626	P7-552226	M8805/110-5731	P7-563121	M8805/110-5835	P7-563225	M8805/110-6139	P7-613129
M8805/110-5627	P7-552227	M8805/110-5732	P7-563122	M8805/110-5836	P7-563226	M8805/110-6141	P7-614121
M8805/110-5628	P7-552228	M8805/110-5733	P7-563123	M8805/110-5837	P7-563227	M8805/110-6142	P7-614122
M8805/110-5629	P7-552229	M8805/110-5734	P7-563124	M8805/110-5838	P7-563228	M8805/110-6143	P7-614123
M8805/110-5631	P7-553221	M8805/110-5735	P7-563125	M8805/110-5839	P7-563229	M8805/110-6144	P7-614124
M8805/110-5632	P7-553222	M8805/110-5736	P7-563126	M8805/110-5841	P7-564221	M8805/110-6145	P7-614125
M8805/110-5633	P7-553223	M8805/110-5737	P7-563127	M8805/110-5842	P7-564222	M8805/110-6146	P7-614126
M8805/110-5634	P7-553224	M8805/110-5738	P7-563128	M8805/110-5843	P7-564223	M8805/110-6147	P7-614127
M8805/110-5635	P7-553225	M8805/110-5739	P7-563129	M8805/110-5844	P7-564224	M8805/110-6148	P7-614128
M8805/110-5636	P7-553226	M8805/110-5741	P7-564121	M8805/110-5845	P7-564225	M8805/110-6149	P7-614129
M8805/110-5637	P7-553227	M8805/110-5742	P7-564122	M8805/110-5846	P7-564226	M8805/110-6151	P7-615121
M8805/110-5638	P7-553228	M8805/110-5743	P7-564123	M8805/110-5847	P7-564227	M8805/110-6152	P7-615122
M8805/110-5639	P7-553229	M8805/110-5744	P7-564124	M8805/110-5848	P7-564228	M8805/110-6153	P7-615123
M8805/110-5641	P7-554221	M8805/110-5745	P7-564125	M8805/110-5849	P7-564229	M8805/110-6154	P7-615124
M8805/110-5642	P7-554222	M8805/110-5746	P7-564126	M8805/110-5851	P7-565221	M8805/110-6155	P7-615125
M8805/110-5643	P7-554223	M8805/110-5747	P7-564127	M8805/110-5852	P7-565222	M8805/110-6156	P7-615126
M8805/110-5644	P7-554224	M8805/110-5748	P7-564128	M8805/110-5853	P7-565223	M8805/110-6157	P7-615127
M8805/110-5645	P7-554225	M8805/110-5749	P7-564129	M8805/110-5854	P7-565224	M8805/110-6158	P7-615128
M8805/110-5646	P7-554226	M8805/110-5751	P7-565121	M8805/110-5855	P7-565225	M8805/110-6159	P7-615129
M8805/110-5647	P7-554227	M8805/110-5752	P7-565122	M8805/110-5856	P7-565226	M8805/110-6161	P7-616121
M8805/110-5648	P7-554228	M8805/110-5753	P7-565123	M8805/110-5857	P7-565227	M8805/110-6162	P7-616122
M8805/110-5649	P7-554229	M8805/110-5754	P7-565124	M8805/110-5858	P7-565228	M8805/110-6163	P7-616123
M8805/110-5651	P7-555221	M8805/110-5755	P7-565125	M8805/110-5859	P7-565229	M8805/110-6164	P7-616124
M8805/110-5652	P7-555222	M8805/110-5756	P7-565126	M8805/110-5861	P7-566221	M8805/110-6165	P7-616125
M8805/110-5653	P7-555223	M8805/110-5757	P7-565127	M8805/110-5862	P7-566222	M8805/110-6166	P7-616126
M8805/110-5654	P7-555224	M8805/110-5758	P7-565128	M8805/110-5863	P7-566223	M8805/110-6167	P7-616127
M8805/110-5655	P7-555225	M8805/110-5759	P7-565129	M8805/110-5864	P7-566224	M8805/110-6168	P7-616128
M8805/110-5656	P7-555226	M8805/110-5761	P7-566121	M8805/110-5865	P7-566225	M8805/110-6169	P7-616129
M8805/110-5657	P7-555227	M8805/110-5762	P7-566122	M8805/110-5866	P7-566226	M8805/110-6211	P7-631121
M8805/110-5658	P7-555228	M8805/110-5763	P7-566123	M8805/110-5867	P7-566227	M8805/110-6212	P7-631122
M8805/110-5659	P7-555229	M8805/110-5764	P7-566124	M8805/110-5868	P7-566228	M8805/110-6213	P7-631123
M8805/110-5661	P7-556221	M8805/110-5765	P7-566125	M8805/110-5869	P7-566229	M8805/110-6214	P7-631124
M8805/110-5662	P7-556222	M8805/110-5766	P7-566126	M8805/110-6111	P7-611121	M8805/110-6215	P7-631125
M8805/110-5663	P7-556223	M8805/110-5767	P7-566127	M8805/110-6112	P7-611122	M8805/110-6216	P7-631126
M8805/110-5664	P7-556224	M8805/110-5768	P7-566128	M8805/110-6113	P7-611123	M8805/110-6217	P7-631127
M8805/110-5665	P7-556225	M8805/110-5769	P7-566129	M8805/110-6114	P7-611124	M8805/110-6218	P7-631128
M8805/110-5666	P7-556226	M8805/110-5811	P7-561121	M8805/110-6115	P7-611125	M8805/110-6219	P7-631129
M8805/110-5667	P7-556227	M8805/110-5812	P7-561122	M8805/110-6116	P7-611126	M8805/110-6221	P7-632121
M8805/110-5668	P7-556228	M8805/110-5813	P7-561123	M8805/110-6117	P7-611127	M8805/110-6222	P7-632122
M8805/110-5669	P7-556229	M8805/110-5814	P7-561124	M8805/110-6118	P7-611128	M8805/110-6223	P7-632123
M8805/110-5711	P7-561121	M8805/110-5815	P7-561125	M8805/110-6119	P7-611129	M8805/110-6224	P7-632124
M8805/110-5712	P7-561122	M8805/110-5816	P7-561126	M8805/110-6121	P7-612121	M8805/110-6225	P7-632125
M8805/110-5713	P7-561123	M8805/110-5817	P7-561127	M8805/110-6122	P7-612122	M8805/110-6226	P7-632126
M8805/110-5714	P7-561124	M8805/110-5818	P7-561128	M8805/110-6123	P7-612123	M8805/110-6227	P7-632127
M8805/110-5715	P7-561125	M8805/110-5819	P7-561129	M8805/110-6124	P7-612124	M8805/110-6228	P7-632128
M8805/110-5716	P7-561126	M8805/110-5821	P7-562221	M8805/110-6125	P7-612125	M8805/110-6229	P7-632129
M8805/110-5717	P7-561127	M8805/110-5822	P7-562222	M8805/110-6126	P7-612126	M8805/110-6241	P7-634121
M8805/110-5718	P7-561128	M8805/110-5823	P7-562223	M8805/110-6127	P7-612127	M8805/110-6242	P7-634122
M8805/110-5719	P7-561129	M8805/110-5824	P7-562224	M8805/110-6128	P7-612128	M8805/110-6243	P7-634123

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-6244	P7-634124	M8805/110-6348	P7-654128	M8805/110-6453	P7-615223	M8805/110-6557	P7-635227
M8805/110-6245	P7-634125	M8805/110-6349	P7-654129	M8805/110-6454	P7-615224	M8805/110-6558	P7-635228
M8805/110-6246	P7-634126	M8805/110-6351	P7-655121	M8805/110-6455	P7-615225	M8805/110-6559	P7-635229
M8805/110-6247	P7-634127	M8805/110-6352	P7-655122	M8805/110-6456	P7-615226	M8805/110-6561	P7-636221
M8805/110-6248	P7-634128	M8805/110-6353	P7-655123	M8805/110-6457	P7-615227	M8805/110-6562	P7-636222
M8805/110-6249	P7-634129	M8805/110-6354	P7-655124	M8805/110-6458	P7-615228	M8805/110-6563	P7-636223
M8805/110-6251	P7-635121	M8805/110-6355	P7-655125	M8805/110-6459	P7-615229	M8805/110-6564	P7-636224
M8805/110-6252	P7-635122	M8805/110-6356	P7-655126	M8805/110-6461	P7-616221	M8805/110-6565	P7-636225
M8805/110-6253	P7-635123	M8805/110-6357	P7-655127	M8805/110-6462	P7-616222	M8805/110-6566	P7-636226
M8805/110-6254	P7-635124	M8805/110-6358	P7-655128	M8805/110-6463	P7-616223	M8805/110-6567	P7-636227
M8805/110-6255	P7-635125	M8805/110-6359	P7-655129	M8805/110-6464	P7-616224	M8805/110-6568	P7-636228
M8805/110-6256	P7-635126	M8805/110-6361	P7-656121	M8805/110-6465	P7-616225	M8805/110-6569	P7-636229
M8805/110-6257	P7-635127	M8805/110-6362	P7-656122	M8805/110-6466	P7-616226	M8805/110-6611	P7-651221
M8805/110-6258	P7-635128	M8805/110-6363	P7-656123	M8805/110-6467	P7-616227	M8805/110-6612	P7-651222
M8805/110-6259	P7-635129	M8805/110-6364	P7-656124	M8805/110-6468	P7-616228	M8805/110-6613	P7-651223
M8805/110-6261	P7-636121	M8805/110-6365	P7-656125	M8805/110-6469	P7-616229	M8805/110-6614	P7-651224
M8805/110-6262	P7-636122	M8805/110-6366	P7-656126	M8805/110-6511	P7-631221	M8805/110-6615	P7-651225
M8805/110-6263	P7-636123	M8805/110-6367	P7-656127	M8805/110-6512	P7-631222	M8805/110-6616	P7-651226
M8805/110-6264	P7-636124	M8805/110-6368	P7-656128	M8805/110-6513	P7-631223	M8805/110-6617	P7-651227
M8805/110-6265	P7-636125	M8805/110-6369	P7-656129	M8805/110-6514	P7-631224	M8805/110-6618	P7-651228
M8805/110-6266	P7-636126	M8805/110-6411	P7-611221	M8805/110-6515	P7-631225	M8805/110-6619	P7-651229
M8805/110-6267	P7-636127	M8805/110-6412	P7-611222	M8805/110-6516	P7-631226	M8805/110-6621	P7-652221
M8805/110-6268	P7-636128	M8805/110-6413	P7-611223	M8805/110-6517	P7-631227	M8805/110-6622	P7-652222
M8805/110-6269	P7-636129	M8805/110-6414	P7-611224	M8805/110-6518	P7-631228	M8805/110-6623	P7-652223
M8805/110-6311	P7-651121	M8805/110-6415	P7-611225	M8805/110-6519	P7-631229	M8805/110-6624	P7-652224
M8805/110-6312	P7-651122	M8805/110-6416	P7-611226	M8805/110-6521	P7-632221	M8805/110-6625	P7-652225
M8805/110-6313	P7-651123	M8805/110-6417	P7-611227	M8805/110-6522	P7-632222	M8805/110-6626	P7-652226
M8805/110-6314	P7-651124	M8805/110-6418	P7-611228	M8805/110-6523	P7-632223	M8805/110-6627	P7-652227
M8805/110-6315	P7-651125	M8805/110-6419	P7-611229	M8805/110-6524	P7-632224	M8805/110-6628	P7-652228
M8805/110-6316	P7-651126	M8805/110-6421	P7-612221	M8805/110-6525	P7-632225	M8805/110-6629	P7-652229
M8805/110-6317	P7-651127	M8805/110-6422	P7-612222	M8805/110-6526	P7-632226	M8805/110-6631	P7-653221
M8805/110-6318	P7-651128	M8805/110-6423	P7-612223	M8805/110-6527	P7-632227	M8805/110-6632	P7-653222
M8805/110-6319	P7-651129	M8805/110-6424	P7-612224	M8805/110-6528	P7-632228	M8805/110-6633	P7-653223
M8805/110-6321	P7-652121	M8805/110-6425	P7-612225	M8805/110-6529	P7-632229	M8805/110-6634	P7-653224
M8805/110-6322	P7-652122	M8805/110-6426	P7-612226	M8805/110-6531	P7-633221	M8805/110-6635	P7-653225
M8805/110-6323	P7-652123	M8805/110-6427	P7-612227	M8805/110-6532	P7-633222	M8805/110-6636	P7-653226
M8805/110-6324	P7-652124	M8805/110-6428	P7-612228	M8805/110-6533	P7-633223	M8805/110-6637	P7-653227
M8805/110-6325	P7-652125	M8805/110-6429	P7-612229	M8805/110-6534	P7-633224	M8805/110-6638	P7-653228
M8805/110-6326	P7-652126	M8805/110-6431	P7-613221	M8805/110-6535	P7-633225	M8805/110-6639	P7-653229
M8805/110-6327	P7-652127	M8805/110-6432	P7-613222	M8805/110-6536	P7-633226	M8805/110-6641	P7-654221
M8805/110-6328	P7-652128	M8805/110-6433	P7-613223	M8805/110-6537	P7-633227	M8805/110-6642	P7-654222
M8805/110-6329	P7-652129	M8805/110-6434	P7-613224	M8805/110-6538	P7-633228	M8805/110-6643	P7-654223
M8805/110-6331	P7-653121	M8805/110-6435	P7-613225	M8805/110-6539	P7-633229	M8805/110-6644	P7-654224
M8805/110-6332	P7-653122	M8805/110-6436	P7-613226	M8805/110-6541	P7-634221	M8805/110-6645	P7-654225
M8805/110-6333	P7-653123	M8805/110-6437	P7-613227	M8805/110-6542	P7-634222	M8805/110-6646	P7-654226
M8805/110-6334	P7-653124	M8805/110-6438	P7-613228	M8805/110-6543	P7-634223	M8805/110-6647	P7-654227
M8805/110-6335	P7-653125	M8805/110-6439	P7-613229	M8805/110-6544	P7-634224	M8805/110-6648	P7-654228
M8805/110-6336	P7-653126	M8805/110-6441	P7-614221	M8805/110-6545	P7-634225	M8805/110-6649	P7-654229
M8805/110-6337	P7-653127	M8805/110-6442	P7-614222	M8805/110-6546	P7-634226	M8805/110-6651	P7-655221
M8805/110-6338	P7-653128	M8805/110-6443	P7-614223	M8805/110-6547	P7-634227	M8805/110-6652	P7-655222
M8805/110-6339	P7-653129	M8805/110-6444	P7-614224	M8805/110-6548	P7-634228	M8805/110-6653	P7-655223
M8805/110-6341	P7-654121	M8805/110-6445	P7-614225	M8805/110-6549	P7-634229	M8805/110-6654	P7-655224
M8805/110-6342	P7-654122	M8805/110-6446	P7-614226	M8805/110-6551	P7-635221	M8805/110-6655	P7-655225
M8805/110-6343	P7-654123	M8805/110-6447	P7-614227	M8805/110-6552	P7-635222	M8805/110-6656	P7-655226
M8805/110-6344	P7-654124	M8805/110-6448	P7-614228	M8805/110-6553	P7-635223	M8805/110-6657	P7-655227
M8805/110-6345	P7-654125	M8805/110-6449	P7-614229	M8805/110-6554	P7-635224	M8805/110-6658	P7-655228
M8805/110-6346	P7-654126	M8805/110-6451	P7-615221	M8805/110-6555	P7-635225	M8805/110-6659	P7-655229
M8805/110-6347	P7-654127	M8805/110-6452	P7-615222	M8805/110-6556	P7-635226	M8805/110-6661	P7-656221

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-6663	P7-656223	M8805/110-6767	P7-666127	M8805/110-7112	P7-711122	M8805/110-7216	P7-731126
M8805/110-6664	P7-656224	M8805/110-6768	P7-666128	M8805/110-7113	P7-711123	M8805/110-7217	P7-731127
M8805/110-6665	P7-656225	M8805/110-6769	P7-666129	M8805/110-7114	P7-711124	M8805/110-7218	P7-731128
M8805/110-6666	P7-656226	M8805/110-6811	P7-661221	M8805/110-7115	P7-711125	M8805/110-7219	P7-731129
M8805/110-6667	P7-656227	M8805/110-6812	P7-661222	M8805/110-7116	P7-711126	M8805/110-7221	P7-732121
M8805/110-6668	P7-656228	M8805/110-6813	P7-661223	M8805/110-7117	P7-711127	M8805/110-7222	P7-732122
M8805/110-6669	P7-656229	M8805/110-6814	P7-661224	M8805/110-7118	P7-711128	M8805/110-7223	P7-732123
M8805/110-6711	P7-661121	M8805/110-6815	P7-661225	M8805/110-7119	P7-711129	M8805/110-7224	P7-732124
M8805/110-6712	P7-661122	M8805/110-6816	P7-661226	M8805/110-7121	P7-712121	M8805/110-7225	P7-732125
M8805/110-6713	P7-661123	M8805/110-6817	P7-661227	M8805/110-7122	P7-712122	M8805/110-7226	P7-732126
M8805/110-6714	P7-661124	M8805/110-6818	P7-661228	M8805/110-7123	P7-712123	M8805/110-7227	P7-732127
M8805/110-6715	P7-661125	M8805/110-6819	P7-661229	M8805/110-7124	P7-712124	M8805/110-7228	P7-732128
M8805/110-6716	P7-661126	M8805/110-6821	P7-662221	M8805/110-7125	P7-712125	M8805/110-7229	P7-732129
M8805/110-6717	P7-661127	M8805/110-6822	P7-662222	M8805/110-7126	P7-712126	M8805/110-7241	P7-734121
M8805/110-6718	P7-661128	M8805/110-6823	P7-662223	M8805/110-7127	P7-712127	M8805/110-7242	P7-734122
M8805/110-6719	P7-661129	M8805/110-6824	P7-662224	M8805/110-7128	P7-712128	M8805/110-7243	P7-734123
M8805/110-6721	P7-662121	M8805/110-6825	P7-662225	M8805/110-7129	P7-712129	M8805/110-7244	P7-734124
M8805/110-6722	P7-662122	M8805/110-6826	P7-662226	M8805/110-7131	P7-713121	M8805/110-7245	P7-734125
M8805/110-6723	P7-662123	M8805/110-6827	P7-662227	M8805/110-7132	P7-713122	M8805/110-7246	P7-734126
M8805/110-6724	P7-662124	M8805/110-6828	P7-662228	M8805/110-7133	P7-713123	M8805/110-7247	P7-734127
M8805/110-6725	P7-662125	M8805/110-6829	P7-662229	M8805/110-7134	P7-713124	M8805/110-7248	P7-734128
M8805/110-6726	P7-662126	M8805/110-6831	P7-663221	M8805/110-7135	P7-713125	M8805/110-7249	P7-734129
M8805/110-6727	P7-662127	M8805/110-6832	P7-663222	M8805/110-7136	P7-713126	M8805/110-7251	P7-735121
M8805/110-6728	P7-662128	M8805/110-6833	P7-663223	M8805/110-7137	P7-713127	M8805/110-7252	P7-735122
M8805/110-6729	P7-662129	M8805/110-6834	P7-663224	M8805/110-7138	P7-713128	M8805/110-7253	P7-735123
M8805/110-6731	P7-663121	M8805/110-6835	P7-663225	M8805/110-7139	P7-713129	M8805/110-7254	P7-735124
M8805/110-6732	P7-663122	M8805/110-6836	P7-663226	M8805/110-7141	P7-714121	M8805/110-7255	P7-735125
M8805/110-6733	P7-663123	M8805/110-6837	P7-663227	M8805/110-7142	P7-714122	M8805/110-7256	P7-735126
M8805/110-6734	P7-663124	M8805/110-6838	P7-663228	M8805/110-7143	P7-714123	M8805/110-7257	P7-735127
M8805/110-6735	P7-663125	M8805/110-6839	P7-663229	M8805/110-7144	P7-714124	M8805/110-7258	P7-735128
M8805/110-6736	P7-663126	M8805/110-6841	P7-664221	M8805/110-7145	P7-714125	M8805/110-7259	P7-735129
M8805/110-6737	P7-663127	M8805/110-6842	P7-664222	M8805/110-7146	P7-714126	M8805/110-7261	P7-736121
M8805/110-6738	P7-663128	M8805/110-6843	P7-664223	M8805/110-7147	P7-714127	M8805/110-7262	P7-736122
M8805/110-6739	P7-663129	M8805/110-6844	P7-664224	M8805/110-7148	P7-714128	M8805/110-7263	P7-736123
M8805/110-6741	P7-664121	M8805/110-6845	P7-664225	M8805/110-7149	P7-714129	M8805/110-7264	P7-736124
M8805/110-6742	P7-664122	M8805/110-6846	P7-664226	M8805/110-7151	P7-715121	M8805/110-7265	P7-736125
M8805/110-6743	P7-664123	M8805/110-6847	P7-664227	M8805/110-7152	P7-715122	M8805/110-7266	P7-736126
M8805/110-6744	P7-664124	M8805/110-6848	P7-664228	M8805/110-7153	P7-715123	M8805/110-7267	P7-736127
M8805/110-6745	P7-664125	M8805/110-6849	P7-664229	M8805/110-7154	P7-715124	M8805/110-7268	P7-736128
M8805/110-6746	P7-664126	M8805/110-6851	P7-665221	M8805/110-7155	P7-715125	M8805/110-7269	P7-736129
M8805/110-6747	P7-664127	M8805/110-6852	P7-665222	M8805/110-7156	P7-715126	M8805/110-7311	P7-751121
M8805/110-6748	P7-664128	M8805/110-6853	P7-665223	M8805/110-7157	P7-715127	M8805/110-7312	P7-751122
M8805/110-6749	P7-664129	M8805/110-6854	P7-665224	M8805/110-7158	P7-715128	M8805/110-7313	P7-751123
M8805/110-6751	P7-665121	M8805/110-6855	P7-665225	M8805/110-7159	P7-715129	M8805/110-7314	P7-751124
M8805/110-6752	P7-665122	M8805/110-6856	P7-665226	M8805/110-7161	P7-716121	M8805/110-7315	P7-751125
M8805/110-6753	P7-665123	M8805/110-6857	P7-665227	M8805/110-7162	P7-716122	M8805/110-7316	P7-751126
M8805/110-6754	P7-665124	M8805/110-6858	P7-665228	M8805/110-7163	P7-716123	M8805/110-7317	P7-751127
M8805/110-6755	P7-665125	M8805/110-6859	P7-665229	M8805/110-7164	P7-716124	M8805/110-7318	P7-751128
M8805/110-6756	P7-665126	M8805/110-6861	P7-666221	M8805/110-7165	P7-716125	M8805/110-7319	P7-751129
M8805/110-6757	P7-665127	M8805/110-6862	P7-666222	M8805/110-7166	P7-716126	M8805/110-7321	P7-752121
M8805/110-6758	P7-665128	M8805/110-6863	P7-666223	M8805/110-7167	P7-716127	M8805/110-7322	P7-752122
M8805/110-6759	P7-665129	M8805/110-6864	P7-666224	M8805/110-7168	P7-716128	M8805/110-7323	P7-752123
M8805/110-6761	P7-666121	M8805/110-6865	P7-666225	M8805/110-7169	P7-716129	M8805/110-7324	P7-752124
M8805/110-6762	P7-666122	M8805/110-6866	P7-666226	M8805/110-7211	P7-731121	M8805/110-7325	P7-752125
M8805/110-6763	P7-666123	M8805/110-6867	P7-666227	M8805/110-7212	P7-731122	M8805/110-7326	P7-752126
M8805/110-6764	P7-666124	M8805/110-6868	P7-666228	M8805/110-7213	P7-731123	M8805/110-7327	P7-752127
M8805/110-6765	P7-666125	M8805/110-6869	P7-666229	M8805/110-7214	P7-731124	M8805/110-7328	P7-752128

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-7331	P7-753121	M8805/110-7435	P7-713225	M8805/110-7539	P7-733229	M8805/110-7644	P7-754224
M8805/110-7332	P7-753122	M8805/110-7436	P7-713226	M8805/110-7541	P7-734221	M8805/110-7645	P7-754225
M8805/110-7333	P7-753123	M8805/110-7437	P7-713227	M8805/110-7542	P7-734222	M8805/110-7646	P7-754226
M8805/110-7334	P7-753124	M8805/110-7438	P7-713228	M8805/110-7543	P7-734223	M8805/110-7647	P7-754227
M8805/110-7335	P7-753125	M8805/110-7439	P7-713229	M8805/110-7544	P7-734224	M8805/110-7648	P7-754228
M8805/110-7336	P7-753126	M8805/110-7441	P7-714221	M8805/110-7545	P7-734225	M8805/110-7649	P7-754229
M8805/110-7337	P7-753127	M8805/110-7442	P7-711422	M8805/110-7546	P7-734226	M8805/110-7651	P7-755221
M8805/110-7338	P7-753128	M8805/110-7443	P7-711423	M8805/110-7547	P7-734227	M8805/110-7652	P7-755222
M8805/110-7339	P7-753129	M8805/110-7444	P7-711424	M8805/110-7548	P7-734228	M8805/110-7653	P7-755223
M8805/110-7341	P7-754121	M8805/110-7445	P7-711425	M8805/110-7549	P7-734229	M8805/110-7654	P7-755224
M8805/110-7342	P7-754122	M8805/110-7446	P7-711426	M8805/110-7551	P7-735221	M8805/110-7655	P7-755225
M8805/110-7343	P7-754123	M8805/110-7447	P7-711427	M8805/110-7552	P7-735222	M8805/110-7656	P7-755226
M8805/110-7344	P7-754124	M8805/110-7448	P7-711428	M8805/110-7553	P7-735223	M8805/110-7657	P7-755227
M8805/110-7345	P7-754125	M8805/110-7449	P7-711429	M8805/110-7554	P7-735224	M8805/110-7658	P7-755228
M8805/110-7346	P7-754126	M8805/110-7451	P7-715221	M8805/110-7555	P7-735225	M8805/110-7659	P7-755229
M8805/110-7347	P7-754127	M8805/110-7452	P7-715222	M8805/110-7556	P7-735226	M8805/110-7661	P7-756221
M8805/110-7348	P7-754128	M8805/110-7453	P7-715223	M8805/110-7557	P7-735227	M8805/110-7662	P7-756222
M8805/110-7349	P7-754129	M8805/110-7454	P7-715224	M8805/110-7558	P7-735228	M8805/110-7663	P7-756223
M8805/110-7351	P7-755121	M8805/110-7455	P7-715225	M8805/110-7559	P7-735229	M8805/110-7664	P7-756224
M8805/110-7352	P7-755122	M8805/110-7456	P7-715226	M8805/110-7561	P7-736221	M8805/110-7665	P7-756225
M8805/110-7353	P7-755123	M8805/110-7457	P7-715227	M8805/110-7562	P7-736222	M8805/110-7666	P7-756226
M8805/110-7354	P7-755124	M8805/110-7458	P7-715228	M8805/110-7563	P7-736223	M8805/110-7667	P7-756227
M8805/110-7355	P7-755125	M8805/110-7459	P7-715229	M8805/110-7564	P7-736224	M8805/110-7668	P7-756228
M8805/110-7356	P7-755126	M8805/110-7461	P7-716221	M8805/110-7565	P7-736225	M8805/110-7669	P7-756229
M8805/110-7357	P7-755127	M8805/110-7462	P7-716222	M8805/110-7566	P7-736226	M8805/110-7711	P7-761121
M8805/110-7358	P7-755128	M8805/110-7463	P7-716223	M8805/110-7567	P7-736227	M8805/110-7712	P7-761122
M8805/110-7359	P7-755129	M8805/110-7464	P7-716224	M8805/110-7568	P7-736228	M8805/110-7713	P7-761123
M8805/110-7361	P7-756121	M8805/110-7465	P7-716225	M8805/110-7569	P7-736229	M8805/110-7714	P7-761124
M8805/110-7362	P7-756122	M8805/110-7466	P7-716226	M8805/110-7611	P7-751221	M8805/110-7715	P7-761125
M8805/110-7363	P7-756123	M8805/110-7467	P7-716227	M8805/110-7612	P7-751222	M8805/110-7716	P7-761126
M8805/110-7364	P7-756124	M8805/110-7468	P7-716228	M8805/110-7613	P7-751223	M8805/110-7717	P7-761127
M8805/110-7365	P7-756125	M8805/110-7469	P7-716229	M8805/110-7614	P7-751224	M8805/110-7718	P7-761128
M8805/110-7366	P7-756126	M8805/110-7511	P7-731221	M8805/110-7615	P7-751225	M8805/110-7719	P7-761129
M8805/110-7367	P7-756127	M8805/110-7512	P7-731222	M8805/110-7616	P7-751226	M8805/110-7721	P7-762121
M8805/110-7368	P7-756128	M8805/110-7513	P7-731223	M8805/110-7617	P7-751227	M8805/110-7722	P7-762122
M8805/110-7369	P7-756129	M8805/110-7514	P7-731224	M8805/110-7618	P7-751228	M8805/110-7723	P7-762123
M8805/110-7411	P7-711221	M8805/110-7515	P7-731225	M8805/110-7619	P7-751229	M8805/110-7724	P7-762124
M8805/110-7412	P7-711222	M8805/110-7516	P7-731226	M8805/110-7621	P7-752221	M8805/110-7725	P7-762125
M8805/110-7413	P7-711223	M8805/110-7517	P7-731227	M8805/110-7622	P7-752222	M8805/110-7726	P7-762126
M8805/110-7414	P7-711224	M8805/110-7518	P7-731228	M8805/110-7623	P7-752223	M8805/110-7727	P7-762127
M8805/110-7415	P7-711225	M8805/110-7519	P7-731229	M8805/110-7624	P7-752224	M8805/110-7728	P7-762128
M8805/110-7416	P7-711226	M8805/110-7521	P7-732221	M8805/110-7625	P7-752225	M8805/110-7729	P7-762129
M8805/110-7417	P7-711227	M8805/110-7522	P7-732222	M8805/110-7626	P7-752226	M8805/110-7731	P7-763121
M8805/110-7418	P7-711228	M8805/110-7523	P7-732223	M8805/110-7627	P7-752227	M8805/110-7732	P7-763122
M8805/110-7419	P7-711229	M8805/110-7524	P7-732224	M8805/110-7628	P7-752228	M8805/110-7733	P7-763123
M8805/110-7421	P7-712221	M8805/110-7525	P7-732225	M8805/110-7629	P7-752229	M8805/110-7734	P7-763124
M8805/110-7422	P7-712222	M8805/110-7526	P7-732226	M8805/110-7631	P7-753221	M8805/110-7735	P7-763125
M8805/110-7423	P7-712223	M8805/110-7527	P7-732227	M8805/110-7632	P7-753222	M8805/110-7736	P7-763126
M8805/110-7424	P7-712224	M8805/110-7528	P7-732228	M8805/110-7633	P7-753223	M8805/110-7737	P7-763127
M8805/110-7425	P7-712225	M8805/110-7529	P7-732229	M8805/110-7634	P7-753224	M8805/110-7738	P7-763128
M8805/110-7426	P7-712226	M8805/110-7531	P7-733221	M8805/110-7635	P7-753225	M8805/110-7739	P7-763129
M8805/110-7427	P7-712227	M8805/110-7532	P7-733222	M8805/110-7636	P7-753226	M8805/110-7741	P7-764121
M8805/110-7428	P7-712228	M8805/110-7533	P7-733223	M8805/110-7637	P7-753227	M8805/110-7742	P7-764122
M8805/110-7429	P7-712229	M8805/110-7534	P7-733224	M8805/110-7638	P7-753228	M8805/110-7743	P7-764123
M8805/110-7431	P7-713221	M8805/110-7535	P7-733225	M8805/110-7639	P7-753229	M8805/110-7744	P7-764124
M8805/110-7432	P7-713222	M8805/110-7536	P7-733226	M8805/110-7641	P7-754221	M8805/110-7745	P7-764125
M8805/110-7433	P7-713223	M8805/110-7537	P7-733227	M8805/110-7642	P7-754222	M8805/110-7746	P7-764126

# CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-7747	P7-764127	M8805/110-7852	P7-765222	M8805/110-8156	P7-815126	M8805/110-8311	P7-851121
M8805/110-7748	P7-764128	M8805/110-7853	P7-765223	M8805/110-8157	P7-815127	M8805/110-8312	P7-851122
M8805/110-7749	P7-764129	M8805/110-7854	P7-765224	M8805/110-8158	P7-815128	M8805/110-8313	P7-851123
M8805/110-7751	P7-765121	M8805/110-7855	P7-765225	M8805/110-8159	P7-815129	M8805/110-8314	P7-851124
M8805/110-7752	P7-765122	M8805/110-7856	P7-765226	M8805/110-8161	P7-816121	M8805/110-8315	P7-851125
M8805/110-7753	P7-765123	M8805/110-7857	P7-765227	M8805/110-8162	P7-816122	M8805/110-8316	P7-851126
M8805/110-7754	P7-765124	M8805/110-7858	P7-765228	M8805/110-8163	P7-816123	M8805/110-8317	P7-851127
M8805/110-7755	P7-765125	M8805/110-7859	P7-765229	M8805/110-8164	P7-816124	M8805/110-8318	P7-851128
M8805/110-7756	P7-765126	M8805/110-7861	P7-766221	M8805/110-8165	P7-816125	M8805/110-8319	P7-851129
M8805/110-7757	P7-765127	M8805/110-7862	P7-766222	M8805/110-8166	P7-816126	M8805/110-8321	P7-852121
M8805/110-7758	P7-765128	M8805/110-7863	P7-766223	M8805/110-8167	P7-816127	M8805/110-8322	P7-852122
M8805/110-7759	P7-765129	M8805/110-7864	P7-766224	M8805/110-8168	P7-816128	M8805/110-8323	P7-852123
M8805/110-7761	P7-766121	M8805/110-7865	P7-766225	M8805/110-8169	P7-816129	M8805/110-8324	P7-852124
M8805/110-7762	P7-766122	M8805/110-7866	P7-766226	M8805/110-8211	P7-831121	M8805/110-8325	P7-852125
M8805/110-7763	P7-766123	M8805/110-7867	P7-766227	M8805/110-8212	P7-831122	M8805/110-8326	P7-852126
M8805/110-7764	P7-766124	M8805/110-7868	P7-766228	M8805/110-8213	P7-831123	M8805/110-8327	P7-852127
M8805/110-7765	P7-766125	M8805/110-7869	P7-766229	M8805/110-8214	P7-831124	M8805/110-8328	P7-852128
M8805/110-7766	P7-766126	M8805/110-8111	P7-811121	M8805/110-8215	P7-831125	M8805/110-8329	P7-852129
M8805/110-7767	P7-766127	M8805/110-8112	P7-811122	M8805/110-8216	P7-831126	M8805/110-8331	P7-853121
M8805/110-7768	P7-766128	M8805/110-8113	P7-811123	M8805/110-8217	P7-831127	M8805/110-8332	P7-853122
M8805/110-7769	P7-766129	M8805/110-8114	P7-811124	M8805/110-8218	P7-831128	M8805/110-8333	P7-853123
M8805/110-7811	P7-761221	M8805/110-8115	P7-811125	M8805/110-8219	P7-831129	M8805/110-8334	P7-853124
M8805/110-7812	P7-761222	M8805/110-8116	P7-811126	M8805/110-8221	P7-832121	M8805/110-8335	P7-853125
M8805/110-7813	P7-761223	M8805/110-8117	P7-811127	M8805/110-8222	P7-832122	M8805/110-8336	P7-853126
M8805/110-7814	P7-761224	M8805/110-8118	P7-811128	M8805/110-8223	P7-832123	M8805/110-8337	P7-853127
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M8805/110-7816	P7-761226	M8805/110-8121	P7-812121	M8805/110-8225	P7-832125	M8805/110-8339	P7-853129
M8805/110-7817	P7-761227	M8805/110-8122	P7-812122	M8805/110-8226	P7-832126	M8805/110-8341	P7-854121
M8805/110-7818	P7-761228	M8805/110-8123	P7-812123	M8805/110-8227	P7-832127	M8805/110-8342	P7-854122
M8805/110-7819	P7-761229	M8805/110-8124	P7-812124	M8805/110-8228	P7-832128	M8805/110-8343	P7-854123
M8805/110-7821	P7-762221	M8805/110-8125	P7-812125	M8805/110-8229	P7-832129	M8805/110-8344	P7-854124
M8805/110-7822	P7-762222	M8805/110-8126	P7-812126	M8805/110-8241	P7-834121	M8805/110-8345	P7-854125
M8805/110-7823	P7-762223	M8805/110-8127	P7-812127	M8805/110-8242	P7-834122	M8805/110-8346	P7-854126
M8805/110-7824	P7-762224	M8805/110-8128	P7-812128	M8805/110-8243	P7-834123	M8805/110-8347	P7-854127
M8805/110-7825	P7-762225	M8805/110-8129	P7-812129	M8805/110-8244	P7-834124	M8805/110-8348	P7-854128
M8805/110-7826	P7-762226	M8805/110-8131	P7-813121	M8805/110-8245	P7-834125	M8805/110-8349	P7-854129
M8805/110-7827	P7-762227	M8805/110-8132	P7-813122	M8805/110-8246	P7-834126	M8805/110-8351	P7-855121
M8805/110-7828	P7-762228	M8805/110-8133	P7-813123	M8805/110-8247	P7-834127	M8805/110-8352	P7-855122
M8805/110-7829	P7-762229	M8805/110-8134	P7-813124	M8805/110-8248	P7-834128	M8805/110-8353	P7-855123
M8805/110-7831	P7-763221	M8805/110-8135	P7-813125	M8805/110-8249	P7-834129	M8805/110-8354	P7-855124
M8805/110-7832	P7-763222	M8805/110-8136	P7-813126	M8805/110-8251	P7-835121	M8805/110-8355	P7-855125
M8805/110-7833	P7-763223	M8805/110-8137	P7-813127	M8805/110-8252	P7-835122	M8805/110-8356	P7-855126
M8805/110-7834	P7-763224	M8805/110-8138	P7-813128	M8805/110-8253	P7-835123	M8805/110-8357	P7-855127
M8805/110-7835	P7-763225	M8805/110-8139	P7-813129	M8805/110-8254	P7-835124	M8805/110-8358	P7-855128
M8805/110-7836	P7-763226	M8805/110-8141	P7-814121	M8805/110-8255	P7-835125	M8805/110-8359	P7-855129
M8805/110-7837	P7-763227	M8805/110-8142	P7-814122	M8805/110-8256	P7-835126	M8805/110-8361	P7-856121
M8805/110-7838	P7-763228	M8805/110-8143	P7-814123	M8805/110-8257	P7-835127	M8805/110-8362	P7-856122
M8805/110-7839	P7-763229	M8805/110-8144	P7-814124	M8805/110-8258	P7-835128	M8805/110-8363	P7-856123
M8805/110-7841	P7-764221	M8805/110-8145	P7-814125	M8805/110-8259	P7-835129	M8805/110-8364	P7-856124
M8805/110-7842	P7-764222	M8805/110-8146	P7-814126	M8805/110-8261	P7-836121	M8805/110-8365	P7-856125
M8805/110-7843	P7-764223	M8805/110-8147	P7-814127	M8805/110-8262	P7-836122	M8805/110-8366	P7-856126
M8805/110-7844	P7-764224	M8805/110-8148	P7-814128	M8805/110-8263	P7-836123	M8805/110-8367	P7-856127
M8805/110-7845	P7-764225	M8805/110-8149	P7-814129	M8805/110-8264	P7-836124	M8805/110-8368	P7-856128
M8805/110-7846	P7-764226	M8805/110-8151	P7-815121	M8805/110-8265	P7-836125	M8805/110-8369	P7-856129
M8805/110-7847	P7-764227	M8805/110-8152	P7-815122	M8805/110-8266	P7-836126	M8805/110-8411	P7-811221
M8805/110-7848	P7-764228	M8805/110-8153	P7-815123	M8805/110-8267	P7-836127	M8805/110-8412	P7-811222
M8805/110-7849	P7-764229	M8805/110-8154	P7-815124	M8805/110-8268	P7-836128	M8805/110-8413	P7-811223
M8805/110-7851	P7-765221	M8805/110-8155	P7-815125	M8805/110-8269	P7-836129	M8805/110-8414	P7-811224

# CROSS REFERENCE: MILITARY TO OTTO

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-8415	P7-811225	M8805/110-8519	P7-831229	M8805/110-8624	P7-852224	M8805/110-8728	P7-862128
M8805/110-8416	P7-811226	M8805/110-8521	P7-832221	M8805/110-8625	P7-852225	M8805/110-8729	P7-862129
M8805/110-8417	P7-811227	M8805/110-8522	P7-832222	M8805/110-8626	P7-852226	M8805/110-8731	P7-863121
M8805/110-8418	P7-811228	M8805/110-8523	P7-832223	M8805/110-8627	P7-852227	M8805/110-8732	P7-863122
M8805/110-8419	P7-811229	M8805/110-8524	P7-832224	M8805/110-8628	P7-852228	M8805/110-8733	P7-863123
M8805/110-8421	P7-812221	M8805/110-8525	P7-832225	M8805/110-8629	P7-852229	M8805/110-8734	P7-863124
M8805/110-8422	P7-812222	M8805/110-8526	P7-832226	M8805/110-8631	P7-853221	M8805/110-8735	P7-863125
M8805/110-8423	P7-812223	M8805/110-8527	P7-832227	M8805/110-8632	P7-853222	M8805/110-8736	P7-863126
M8805/110-8424	P7-812224	M8805/110-8528	P7-832228	M8805/110-8633	P7-853223	M8805/110-8737	P7-863127
M8805/110-8425	P7-812225	M8805/110-8529	P7-832229	M8805/110-8634	P7-853224	M8805/110-8738	P7-863128
M8805/110-8426	P7-812226	M8805/110-8531	P7-833221	M8805/110-8635	P7-853225	M8805/110-8739	P7-863129
M8805/110-8427	P7-812227	M8805/110-8532	P7-833222	M8805/110-8636	P7-853226	M8805/110-8741	P7-864121
M8805/110-8428	P7-812228	M8805/110-8533	P7-833223	M8805/110-8637	P7-853227	M8805/110-8742	P7-864122
M8805/110-8429	P7-812229	M8805/110-8534	P7-833224	M8805/110-8638	P7-853228	M8805/110-8743	P7-864123
M8805/110-8431	P7-813221	M8805/110-8535	P7-833225	M8805/110-8639	P7-853229	M8805/110-8744	P7-864124
M8805/110-8432	P7-813222	M8805/110-8536	P7-833226	M8805/110-8641	P7-854221	M8805/110-8745	P7-864125
M8805/110-8433	P7-813223	M8805/110-8537	P7-833227	M8805/110-8642	P7-854222	M8805/110-8746	P7-864126
M8805/110-8434	P7-813224	M8805/110-8538	P7-833228	M8805/110-8643	P7-854223	M8805/110-8747	P7-864127
M8805/110-8435	P7-813225	M8805/110-8539	P7-833229	M8805/110-8644	P7-854224	M8805/110-8748	P7-864128
M8805/110-8436	P7-813226	M8805/110-8541	P7-834221	M8805/110-8645	P7-854225	M8805/110-8749	P7-864129
M8805/110-8437	P7-813227	M8805/110-8542	P7-834222	M8805/110-8646	P7-854226	M8805/110-8751	P7-865121
M8805/110-8438	P7-813228	M8805/110-8543	P7-834223	M8805/110-8647	P7-854227	M8805/110-8752	P7-865122
M8805/110-8439	P7-813229	M8805/110-8544	P7-834224	M8805/110-8648	P7-854228	M8805/110-8753	P7-865123
M8805/110-8441	P7-814221	M8805/110-8545	P7-834225	M8805/110-8649	P7-854229	M8805/110-8754	P7-865124
M8805/110-8442	P7-814222	M8805/110-8546	P7-834226	M8805/110-8651	P7-855221	M8805/110-8755	P7-865125
M8805/110-8443	P7-814223	M8805/110-8547	P7-834227	M8805/110-8652	P7-855222	M8805/110-8756	P7-865126
M8805/110-8444	P7-814224	M8805/110-8548	P7-834228	M8805/110-8653	P7-855223	M8805/110-8757	P7-865127
M8805/110-8445	P7-814225	M8805/110-8549	P7-834229	M8805/110-8654	P7-855224	M8805/110-8758	P7-865128
M8805/110-8446	P7-814226	M8805/110-8551	P7-835221	M8805/110-8655	P7-855225	M8805/110-8759	P7-865129
M8805/110-8447	P7-814227	M8805/110-8552	P7-835222	M8805/110-8656	P7-855226	M8805/110-8761	P7-866121
M8805/110-8448	P7-814228	M8805/110-8553	P7-835223	M8805/110-8657	P7-855227	M8805/110-8762	P7-866122
M8805/110-8449	P7-814229	M8805/110-8554	P7-835224	M8805/110-8658	P7-855228	M8805/110-8763	P7-866123
M8805/110-8451	P7-815221	M8805/110-8555	P7-835225	M8805/110-8659	P7-855229	M8805/110-8764	P7-866124
M8805/110-8452	P7-815222	M8805/110-8556	P7-835226	M8805/110-8661	P7-856221	M8805/110-8765	P7-866125
M8805/110-8453	P7-815223	M8805/110-8557	P7-835227	M8805/110-8662	P7-856222	M8805/110-8766	P7-866126
M8805/110-8454	P7-815224	M8805/110-8558	P7-835228	M8805/110-8663	P7-856223	M8805/110-8767	P7-866127
M8805/110-8455	P7-815225	M8805/110-8559	P7-835229	M8805/110-8664	P7-856224	M8805/110-8768	P7-866128
M8805/110-8456	P7-815226	M8805/110-8561	P7-836221	M8805/110-8665	P7-856225	M8805/110-8769	P7-866129
M8805/110-8457	P7-815227	M8805/110-8562	P7-836222	M8805/110-8666	P7-856226	M8805/110-8811	P7-861221
M8805/110-8458	P7-815228	M8805/110-8563	P7-836223	M8805/110-8667	P7-856227	M8805/110-8812	P7-861222
M8805/110-8459	P7-815229	M8805/110-8564	P7-836224	M8805/110-8668	P7-856228	M8805/110-8813	P7-861223
M8805/110-8461	P7-816221	M8805/110-8565	P7-836225	M8805/110-8669	P7-856229	M8805/110-8814	P7-861224
M8805/110-8462	P7-816222	M8805/110-8566	P7-836226	M8805/110-8711	P7-861121	M8805/110-8815	P7-861225
M8805/110-8463	P7-816223	M8805/110-8567	P7-836227	M8805/110-8712	P7-861122	M8805/110-8816	P7-861226
M8805/110-8464	P7-816224	M8805/110-8568	P7-836228	M8805/110-8713	P7-861123	M8805/110-8817	P7-861227
M8805/110-8465	P7-816225	M8805/110-8569	P7-836229	M8805/110-8714	P7-861124	M8805/110-8818	P7-861228
M8805/110-8466	P7-816226	M8805/110-8611	P7-851221	M8805/110-8715	P7-861125	M8805/110-8819	P7-861229
M8805/110-8467	P7-816227	M8805/110-8612	P7-851222	M8805/110-8716	P7-861126	M8805/110-8821	P7-862221
M8805/110-8468	P7-816228	M8805/110-8613	P7-851223	M8805/110-8717	P7-861127	M8805/110-8822	P7-862222
M8805/110-8469	P7-816229	M8805/110-8614	P7-851224	M8805/110-8718	P7-861128	M8805/110-8823	P7-862223
M8805/110-8511	P7-831221	M8805/110-8615	P7-851225	M8805/110-8719	P7-861129	M8805/110-8824	P7-862224
M8805/110-8512	P7-831222	M8805/110-8616	P7-851226	M8805/110-8721	P7-862121	M8805/110-8825	P7-862225
M8805/110-8513	P7-831223	M8805/110-8617	P7-851227	M8805/110-8722	P7-862122	M8805/110-8826	P7-862226
M8805/110-8514	P7-831224	M8805/110-8618	P7-851228	M8805/110-8723	P7-862123	M8805/110-8827	P7-862227
M8805/110-8515	P7-831225	M8805/110-8619	P7-851229	M8805/110-8724	P7-862124	M8805/110-8828	P7-862228
M8805/110-8516	P7-831226	M8805/110-8621	P7-852221	M8805/110-8725	P7-862125	M8805/110-8829	P7-862229
M8805/110-8517	P7-831227	M8805/110-8622	P7-852222	M8805/110-8726	P7-862126	M8805/110-8831	P7-863221
M8805/110-8518	P7-831228	M8805/110-8623	P7-852223	M8805/110-8727	P7-862127	M8805/110-8832	P7-863222

# CROSS REFERENCE: MILITARY TO OTTO

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-8833	P7-863223	<b>MS24523</b>		MS24656-271	TE-21251	MS24659-21J	T9-MS2-21J
M8805/110-8834	P7-863224	MS24523-21	T9-MS1-21	MS24656-311	TE-21261	MS24659-21K	T9-MS2-21K
M8805/110-8835	P7-863225	MS24523-22	T9-MS1-22	MS24656-311W	TE-21261W	MS24659-21L	T9-MS2-21L
M8805/110-8836	P7-863226	MS24523-23	T9-MS1-23	MS24656-351	TE-21291	MS24659-21M	T9-MS2-21M
M8805/110-8837	P7-863227	MS24523-24	T9-MS1-24	MS24656-351W	TE-21291W	MS24659-21N	T9-MS2-21N
M8805/110-8838	P7-863228	MS24523-25	T9-MS1-25			MS24659-21P	T9-MS2-21P
M8805/110-8839	P7-863229	MS24523-26	T9-MS1-26	<b>MS24658</b>		MS24659-22D	T9-MS2-22D
M8805/110-8841	P7-864221	MS24523-27	T9-MS1-27	MS24658-21A	T9-MS1-21A	MS24659-22F	T9-MS2-22F
M8805/110-8842	P7-864222	MS24523-28	T9-MS1-28	MS24658-21B	T9-MS1-21B	MS24659-22G	T9-MS2-22G
M8805/110-8843	P7-864223	MS24523-29	T9-MS1-29	MS24658-21D	T9-MS1-21D	MS24659-23D	T9-MS2-23D
M8805/110-8844	P7-864224	MS24523-30	T9-MS1-30	MS24658-21E	T9-MS1-21E	MS24659-23F	T9-MS2-23F
M8805/110-8845	P7-864225	MS24523-31	T9-MS1-31	MS24658-21F	T9-MS1-21F	MS24659-23G	T9-MS2-23G
M8805/110-8846	P7-864226	MS24523-32	T9-MS1-32	MS24658-21G	T9-MS1-21G	MS24659-24E	T9-MS2-24E
M8805/110-8847	P7-864227	MS24523-33	T9-MS1-33	MS24658-21H	T9-MS1-21H	MS24659-24F	T9-MS2-24F
M8805/110-8848	P7-864228			MS24658-21J	T9-MS1-21J	MS24659-24K	T9-MS2-24K
M8805/110-8849	P7-864229	<b>MS24524</b>		MS24658-21K	T9-MS1-21K	MS24659-24M	T9-MS2-24M
M8805/110-8851	P7-865221	MS24524-21	T9-MS2-21	MS24658-21L	T9-MS1-21L	MS24659-25F	T9-MS2-25F
M8805/110-8852	P7-865222	MS24524-22	T9-MS2-22	MS24658-21M	T9-MS1-21M	MS24659-26F	T9-MS2-26F
M8805/110-8853	P7-865223	MS24524-23	T9-MS2-23	MS24658-21N	T9-MS1-21N	MS24659-27E	T9-MS2-27E
M8805/110-8854	P7-865224	MS24524-24	T9-MS2-24	MS24658-21P	T9-MS1-21P	MS24659-27L	T9-MS2-27L
M8805/110-8855	P7-865225	MS24524-25	T9-MS2-25	MS24658-22D	T9-MS1-22D	MS24659-27N	T9-MS2-27N
M8805/110-8856	P7-865226	MS24524-26	T9-MS2-26	MS24658-22F	T9-MS1-22F	MS24659-28E	T9-MS2-28E
M8805/110-8857	P7-865227	MS24524-27	T9-MS2-27	MS24658-22G	T9-MS1-22G	MS24659-29F	T9-MS2-29F
M8805/110-8858	P7-865228	MS24524-28	T9-MS2-28	MS24658-23D	T9-MS1-23D	MS24659-30F	T9-MS2-30F
M8805/110-8859	P7-865229	MS24524-29	T9-MS2-29	MS24658-23F	T9-MS1-23F	MS24659-31E	T9-MS2-31E
M8805/110-8861	P7-866221	MS24524-30	T9-MS2-30	MS24658-23G	T9-MS1-23G	MS24659-31F	T9-MS2-31F
M8805/110-8862	P7-866222	MS24524-31	T9-MS2-31	MS24658-24E	T9-MS1-24E	MS24659-31K	T9-MS2-31K
M8805/110-8863	P7-866223	MS24524-32	T9-MS2-32	MS24658-24F	T9-MS1-24F	MS24659-31L	T9-MS2-31L
M8805/110-8864	P7-866224	MS24524-33	T9-MS2-33	MS24658-24K	T9-MS1-24K	MS24659-31M	T9-MS2-31M
M8805/110-8865	P7-866225			MS24658-24M	T9-MS1-24M	MS24659-31N	T9-MS2-31N
M8805/110-8866	P7-866226	<b>MS24547</b>		MS24658-25F	T9-MS1-25F	MS24659-32E	T9-MS2-32E
M8805/110-8867	P7-866227	MS24547-1	B2-211351	MS24658-26F	T9-MS1-26F	MS24659-33E	T9-MS2-33E
M8805/110-8868	P7-866228	MS24547-2	B2-211353	MS24658-27E	T9-MS1-27E	MS24659-33F	T9-MS2-33F
M8805/110-8869	P7-866229	MS24547-4	B2-212351	MS24658-27L	T9-MS1-27L	MS24659-33K	T9-MS2-33K
		MS24547-5	B2-212353	MS24658-27N	T9-MS1-27N	MS24659-33M	T9-MS2-33M
		MS24547-6	B2-200029	MS24658-28E	T9-MS1-28E		
<b>M8805/111</b>		MS24547-7	B2-200030	MS24658-29F	T9-MS1-29F	<b>MS25089</b>	
M8805/111-01	U2-016			MS24658-30F	T9-MS1-30F	MS25089-1A	P1-12122
M8805/111-02	U2-081			MS24658-31E	T9-MS1-31E	MS25089-1AL	P1-14122
M8805/111-03	U2-082	<b>MS24655</b>		MS24658-31F	T9-MS1-31F	MS25089-1AR	P1-12121
M8805/111-04	U2-025	MS24655-211	TE-21111	MS24658-31K	T9-MS1-31K	MS25089-1ARL	P1-14121
M8805/111-05	U2-083	MS24655-211W	TE-21111W	MS24658-31L	T9-MS1-31L	MS25089-1AW	P1-12129
M8805/111-06	U2-084	MS24655-221	TE-21121	MS24658-31M	T9-MS1-31M	MS25089-1AWL	P1-14129
		MS24655-221W	TE-21121W	MS24658-31N	T9-MS1-31N	MS25089-1B	P1-22122
<b>M9419/2</b>		MS24655-231	TE-21131	MS24658-32E	T9-MS1-32E	MS25089-1BL	P1-24122
M9419/2-001	T4-0015	MS24655-231W	TE-21131W	MS24658-33E	T9-MS1-33E	MS25089-1BR	P1-22121
M9419/2-002	T4-0043	MS24655-241	TE-21141	MS24658-33F	T9-MS1-33F	MS25089-1BRL	P1-24121
M9419/2-004	T4-0020	MS24655-241W	TE-21141W	MS24658-33K	T9-MS1-33K	MS25089-1BW	P1-22129
M9419/2-006	T4-0078	MS24655-271	TE-21151	MS24658-33M	T9-MS1-33M	MS25089-1BWL	P1-24129
		MS24655-271W	TE-21151W			MS25089-1C	P1-32122
<b>MS21321</b>		MS24655-311	TE-21161	<b>MS24659</b>		MS25089-1C-1	P1-32132
MS21321-1	P6-24000			MS24659-21A	T9-MS2-21A	MS25089-1C-1L	P1-34132
MS21321-2	P6-24001	<b>MS24656</b>		MS24659-21B	T9-MS2-21B	MS25089-1CL	P1-34122
		MS24656-211	TE-21211	MS24659-21D	T9-MS2-21D	MS25089-1CR	P1-32121
<b>MS21353</b>		MS24656-211W	TE-21211W	MS24659-21E	T9-MS2-21E	MS25089-1CR-1	P1-32131
MS21353-351	TE-11291	MS24656-221	TE-21221	MS24659-21F	T9-MS2-21F	MS25089-1CR-1L	P1-34131
		MS24656-221W	TE-21221W	MS24659-21G	T9-MS2-21G	MS25089-1CRL	P1-34121
<b>MS24331</b>		MS24656-231	TE-21231	MS24659-21H	T9-MS2-21H	MS25089-1CW	P1-32129
MS24331-1	P6-24002	MS24656-231W	TE-21231W				



# CROSS REFERENCE: MILITARY TO OTTO

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
MS25089-1CW-1	P1-32139	MS25089-2C-1	P1-32232	MS25089-3AWL	P1-14629	MS25089-3HW-1	P1-82639
MS25089-1CW-1L	P1-34139	MS25089-2C-1L	P1-34232	MS25089-3B	P1-22622	MS25089-3HW-1L	P1-84639
MS25089-1CWL	P1-34129	MS25089-2CL	P1-34222	MS25089-3BL	P1-24622	MS25089-3HWL	P1-84629
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MS25089-2C	P1-32222	MS25089-3AW	P1-12629	MS25089-3HW	P1-82629	MS25089-4H	P1-82422

# CROSS REFERENCE: MILITARY TO OTTO

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MS25089-4HR-1L	P1-84431	MS25089-5GW-1L	P1-74339	MS27717-27-1	T3-21251	MS27721-21-1F	T3-31211F
MS25089-4HRL	P1-84421	MS25089-5GWL	P1-74329	MS27717-31-1	T3-21261	MS27721-21-1G	T3-31211G
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MS25089-4HW-1	P1-82439	MS25089-5H-1	P1-82332	<b>MS27718</b>		MS27721-21-1J	T3-31211J
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MS25089-5EL	P1-54322			MS27720-21-1N	T3-31111N	MS90310-221	TE-11121
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MS25089-5FW	P1-62329	<b>MS27716</b>		MS27720-31-1F	T3-31161F		
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MS25089-5FW-1L	P1-64339	MS27716-22-1	T3-21121	MS27720-31-1L	T3-31161L		
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MS25089-5G	P1-72322	MS27716-26-1	T3-21141	MS27720-31-1N	T3-31161N		
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MS25089-5G-1L	P1-74332	MS27716-31-1	T3-21161				
MS25089-5GL	P1-74322						
MS25089-5GR	P1-72321						

# GLOSSARY OF TERMS

**Actuator:** Device applied to the button of a switch that causes the switch to operate.

**Alternate Action:** A pushbutton switch which alternatively changes from ON to OFF or OFF to ON when actuated, but stays in the desired electrical state after the button is released.

**Bat Handle:** Toggle lever shaped like a baseball bat. (See Figure 1)

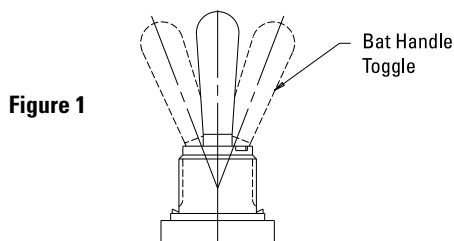


Figure 1

**Bezel Mount:** Switch mounting method from the front of the panel that has an attractive portion of the switch exposed on the front panel.

**Blade:** The moveable component of the switch used to complete the electrical circuit. (See Figure 2)

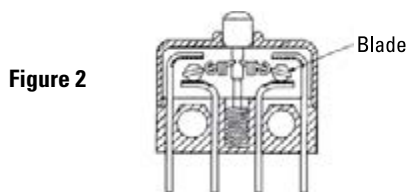


Figure 2

**Boot:** A rubber part used to protect a switch from water or dust. Usually found between the button of a switch and the case inside of the switch. An external boot can be placed over a button or toggle lever to protect the switch from water or dust.

**Bounce:** Rebounding of moving contact from the fixed contact during contact transfer (during switch operation).

**Break:** Interruption of a circuit.

**Break Before Make:** The moving contacts of a double throw switch interrupts one circuit before completing another circuit.

**Bus Bars:** Rigid conductors serving as a connection for two or more circuits.

**Butterfly:** The snap-action mechanism in a switch composed of the spring guide, two switch blades and extension spring: a double break mechanism.

**Capacity:** Usually refers to the current handling capability of a switch.

**CE:** The CE mark is a symbol that indicates a product complies with the "essential requirements" of the European laws. It indicates conformity to the legal requirements of the European Union (EU) Directive with respect to safety, health, environmental, and consumer protection.

**Chatter:** Rapid opening and closing of contacts, usually exhibited during extreme vibration and/or shock.

**Clearance (Spacing):** Distance through air between electrically live parts of opposite polarity or ground.

**Collective:** A grip used to control the up/down movement of an aircraft.

**Common:** The terminal of a switch that is part of both the normally open and the normally closed circuits.

**Common Trip:** A feature on a multi-pole switch in which the operation of any pole will cause all other poles to actuate.

**Contact Forms:** The way the switch contacts are arranged in a switch. There are single and double break arrangements in normally open and normally closed arrangements. (See Figure 3)

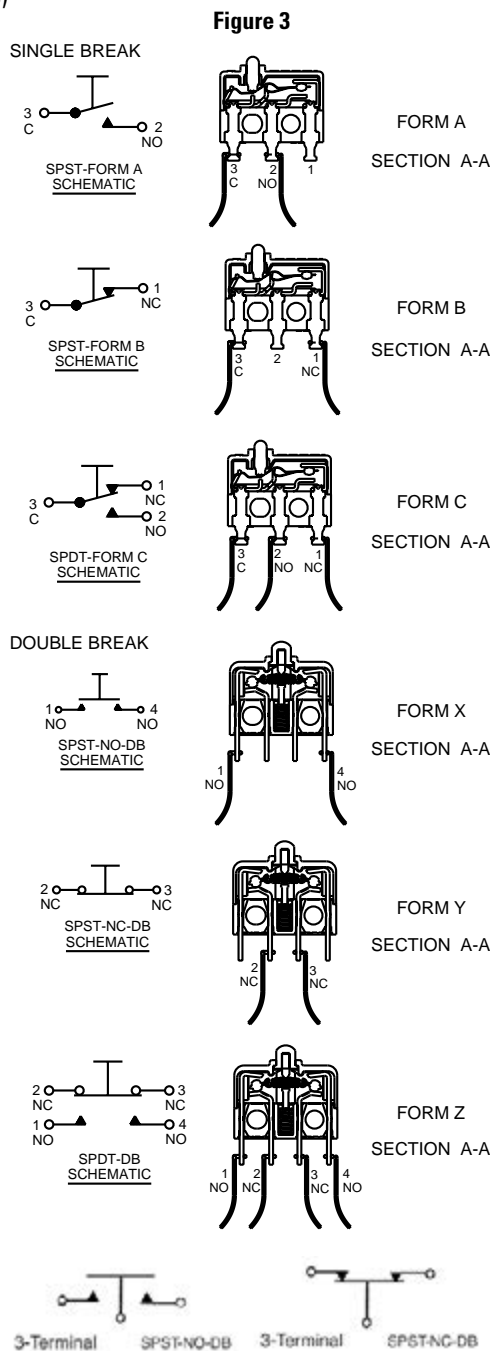


Figure 3

**Contact Force:** The force that the movable contact in a switch exerts on the fixed terminal.

**Contact Gap:** The distance that separates two contacts when the circuit is open.

**Contact Resistance (CR):** Resistance, measured in milliohms, of an electrical circuit caused by the contacts.

**CSA (Canadian Standards Agency):** A testing and safety certification agency.

**Cyclic:** A grip used to control the left/right or forward/backward movement of an aircraft.

**D-Flat:** A flat edge on one side of a cylinder for orientation and anti-rotation.

**Dead Break:** Open circuit condition, usually caused when actuating a switch slowly. Dead break results from low contact pressure, contact lift off or friction in the switch mechanism.

**Detent:** Feature that provides a tactile feel when the switch actuation point has been reached.

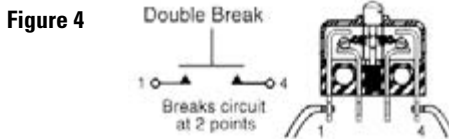
**Dielectric Strength:** Minimum voltage an insulating part of the device will withstand before it starts to conduct electricity.

**Differential:** Distance the button travels between actuation and reset point.

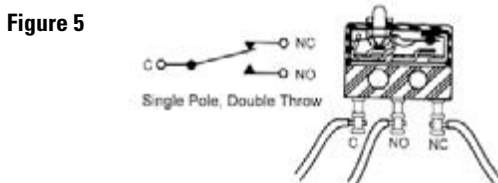
**Direct Current (DC):** Type of electrical current having constant polarity, generally associated with electricity from a battery.

**Double D:** Flat edges on two sides of a cylinder used for orientation and anti rotation.

**Double Break:** A mechanism that breaks the circuit at two points simultaneously. The B3 is a double break switch. (See Figure 4)



**Double Throw:** Contact arrangement that allows current to flow from the common terminal to a normally closed terminal and then to a normally open terminal. (See Figure 5)



**DPDT (Double Pole Double Throw) Switch Configuration:** Double pole means two independent circuits are actuated by the button. Double throw means the common terminal of

each circuit (pole) can transfer current to a normally closed terminal and then alternately to a normally open terminal.

**DPST (Double Pole Single Throw) Switch Configuration:** Double pole means two independent circuits are actuated by the button. Single throw means each circuit only has two terminals and only operates as an on/off switch.

**Dusttight:** Sealed switch that will withstand sand and dust environments per MIL-PRF-8805 Design 2.

**DWV (Dielectric Withstanding Voltage):** The maximum voltage that can be applied to an insulator or switch before it will break down and begin to conduct electricity.

**Electrical Life:** Expected number of cycles a switch will withstand when operated at a specified or full rated load.

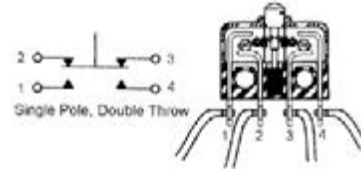
**Electrical Load:** The amount of electricity that is applied to the switch or the circuit.

**Environmentally Sealed Switch:** A switch that is sealed to protect the internal contacts from the external environment.

**Flash Plating:** Plating thickness of 10 micro inches (0.00001) or less, typically done with gold plate.

**Form Z:** A two circuit double break switch such as a Single Pole Double Throw Double Break switch. (See Figure 6)

**Figure 6**



**Free Position:** The position of the button or toggle of a switch in its normal position. The free position is usually measured from the center of the mounting holes to the top of the button on a basic switch or from the top of the button to a reference point on a pushbutton switch.

**Gated:** Restricted movement in XY axis only.

**Hall Effect Sensor:** An electronic device that changes voltage output or its state when exposed to a magnetic field.

**Header:** The part of a switch that groups terminals or wires together to allow entry or exit.

**Hermetic:** An environmental seal specification grade that requires no air, gas or liquid will leak into, or out of, the switch.

**High Inrush:** A brief pulse of very high electrical current, much greater than the design load, that occurs when the electrical load is initially applied to the circuit.

**IC (Integrated Circuit):** An electrical circuit composed of many components etched on a semiconductor chip.

**Immersion Proof:** A switch or product able to withstand submersion in water to a depth of 3 feet or more for 30 minutes without leaking.

**Inductive Load:** A load where the current rises slowly to a steady state.

**IP (Ingress Protection):** Numbers used to rate the environmental seal of an enclosure.

**IP64:** IP rating indicating that the product is dusttight and protected against splashing water.

**IP65:** IP rating indicating that the product is dusttight and protected against water projected by a 6.3 mm nozzle against enclosure for 3 minutes at 100 liters per minute of 100 kN/m<sup>2</sup> at distance of 3 meter.

**IP68S:** IP rating indicating that the product is dusttight and sealed against continuous immersion under 1 meter of water for a minimum of 31 minutes, not operated.

**IP69K:** IP rating indicating the product is protected against for high-pressure, high-temperature wash-down applications. Such enclosures must not only be dusttight, but it must also be able to withstand high-pressure and steam cleaning.

**Lamp Load:** A type of electrical load imposed by the use of incandescent light bulbs.

**LED (Light Emitting Diode):** A solid state device that is capable of emitting light.

**Lever Actuator:** A lever that is attached to a basic switch to allow actuation of the switch from a place other than its button.

**Lever Lock:** A part of the toggle on a switch that keeps the toggle lever from being moved accidentally. Its spring detent requires an outward pull on the toggle lever to operate the switch.

**Limit Switch:** A type of switch used to determine the position of a moving component that activates it.

**Lockout Collar:** Part of the switch bushing that prevents the toggle lever from being moved accidentally. There are many styles to allow for the desired operating features of the switch.

**Logic Level:** An electrical load that simulates a computer input circuit, typically 5 volts at 10 milliamps or less.

**Low Level:** A very small load; 30 millivolts at 10 milliamps.

**Make Before Break:** The moving contacts of a double throw switch complete one circuit before interrupting another circuit.

**Moistureproof:** A seal rating of a switch. Moistureproof seals withstand high humidity and limited exposure to water or liquid spray.

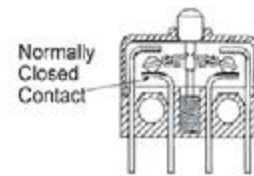
**Momentary Action:** Switch that requires the operator to hold the button or lever in the operating position. The button or toggle will return to the free position (rest position) when it is let go.

**Motor Load:** A switch load that simulates an electric motor, it usually specifies an in-rush current seven times the running current.

**Movement Differential:** The distance the button moves from the operate point to the release point (hysteresis).

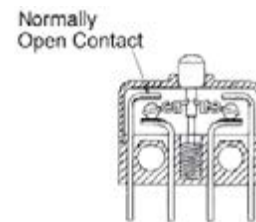
**Normally Closed (NC):** A normally closed circuit allows electricity to flow through when the switch is in its free position; it prevents the electrical flow when actuated. (See Figure 7)

Figure 7



**Normally Open (NO):** A normally open circuit prevents the flow of electricity to flow through the circuit in its free position; it allows the electrical flow when it is actuated. (See Figure 8)

Figure 8



**Null Hysteresis:** The measure of output after release from deflected position; usually only used in transducers.

**Null Output:** Voltage output of a device at rest, usually measured in transducers.

**OEM:** Original Equipment Manufacturer.

**Operate Force:** The amount of force it takes to make the toggle or button operate the switch, measured immediately before the switch operates.

**Operating Point:** The position of the button or toggle of a switch when the switch operates. The operating point is usually measured from the top of the button to the center of the mounting holes in basic switches or from the free position of the button in pushbutton switches.

**Overtravel:** Distance the button travels from the operate point until the button stops.

**Pretravel:** Distance the switch button or toggle travels from the free position until it reaches the operating point.

**QPL (Qualified Products List):** A government report that lists which companies are approved to make a particular product for military use.

**Release Force:** The force that is applied to the button or toggle when the switch contacts return to their unoperated position.

**Resistive Load:** An electrical load in which the current instantly rises to its steady state when applied and instantly drops to zero when discontinued.

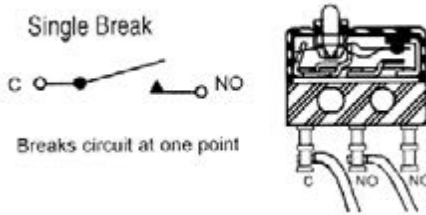
**Shroud:** A wall or housing that surrounds a switch, button or toggle to protect the switch from accidental operation.

**Single Throw:** A switch configuration using a common and only one other contact.

# GLOSSARY OF TERMS

**Single Break:** A switch mechanism with one fixed terminal and one moving terminal that interrupts the flow of electricity at only one place. (See Figure 9)

Figure 9

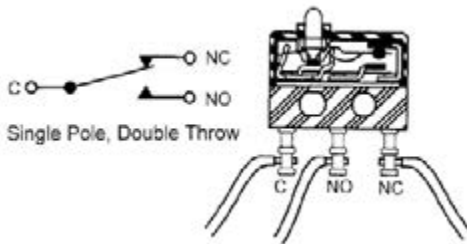


**Snap Action:** The abrupt opening or closing of contacts from one position to another. Snap-action switches operate relatively independent of the speed of the button or actuator.

**SPDT (Single Pole Double Throw) Switch Configuration:**

A single circuit or switch with one common terminal that is capable of switching electricity between two other terminals or circuits. (See Figure 10)

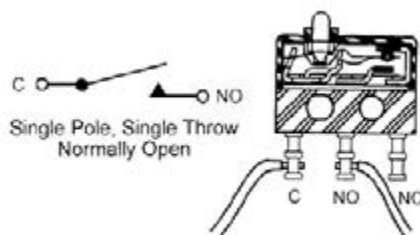
Figure 10



**Splashproof:** A seal rating for a switch that will withstand high humidity and limited exposure to water or liquid spray.

**SPST (Single Pole Single Throw) Switch Configuration:** A single circuit or switch with one common terminal that is only capable of switching between one other terminal for on/off operation of the circuit. (See Figure 11)

Figure 11

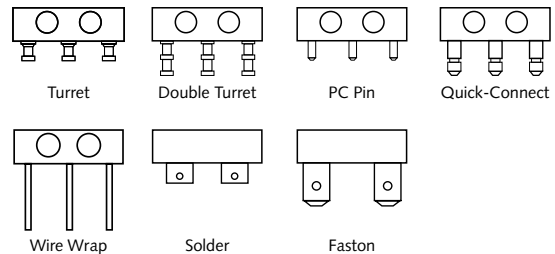


**Subminiature:** A switch that is smaller than 1 inch long.

**Sub-subminiature:** A switch that is smaller than 1/2 inch long

**Tactile Feedback:** The feel of increased or decreased force transmitted through the button or toggle of a switch when actuated. The snap feel of a switch.

**Terminal Configuration:** The type and position of the terminals when they exit a switch.



**Total Travel:** The distance that a button or actuator of a switch travels from the rest or un-operated position until the button stops after actuation.

**Transducer:** A device that converts a mechanical input into an electrical output.

**Travel:** The distance that a switch button moves between events like operate point, reset point or other point of interest when operating the switch.

**Trim Switch:** A switch used to provide 2 or 4-way actuation - often up/down or up down/right left control.

**Trip Point:** The position of the button or toggle of a switch when the switch operates.

**Two Circuit:** Refer to Form Z. Includes single pole, double throw and double break configurations.

**UL (Underwriters Laboratories):** A testing and safety certification agency for consumer products.

**Watertight:** A seal rating that indicates that water cannot get in when the item is submerged in 3 feet of water.

**Wiping Action:** The travel of the moveable contact over the fixed contact as the switch operates. This action helps clean the contacts of contamination.

It is the buyer's responsibility to determine the suitability of the particular device for its application. Use of this catalog is for reference purposes only. Dimensional drawings are available upon request - contact your Customer Service Representative.

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