OTTO®

CATALOG 115A

FULL LINE PRODUCT CATALOG

PUSHBUTTON
GRIP
JOYSTICK
TOGGLE
SWITCH
HALL EFFECT
CANBUS
ENGINEERIN
CUSTO
ROCKER
INDUSTRIAL
TRIGGER

CONTROLS SOLUTIONS

TESTING
TRANSDUCER

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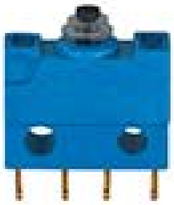
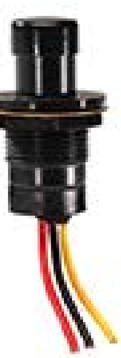


BASIC SWITCHES

GRIPS



HALL EFFECT TECHNOLOGY

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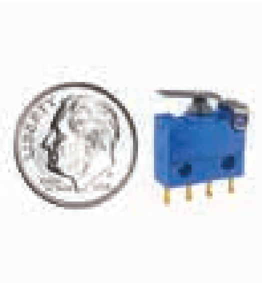

GRIPS

HALL EFFECT TECHNOLOGY

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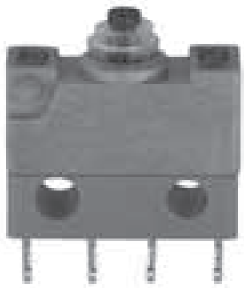
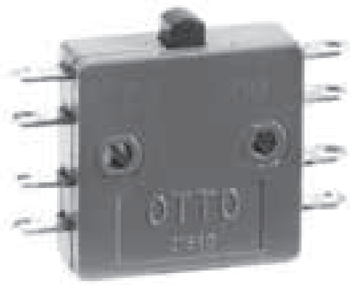
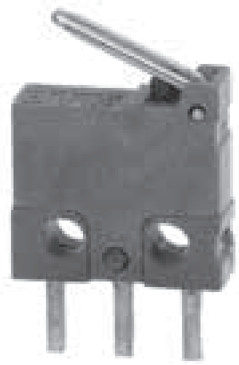
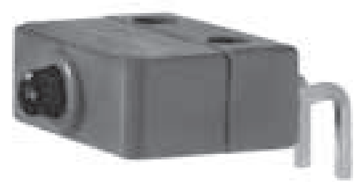
Basic Switches









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), DSCC (QPL8805)	SPST, SPDT
B2-5	Subminiature with Integral Levers	7A @ 28VDC or 1A @ 28VDC (low level)	100,000	UL (E61705), 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), 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	DSCC (QPL8805)	DPDT-DB

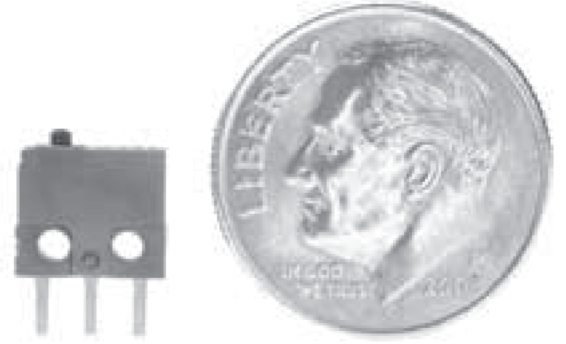
ULTRA SMALL SUBMINIATURE BASICS

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.

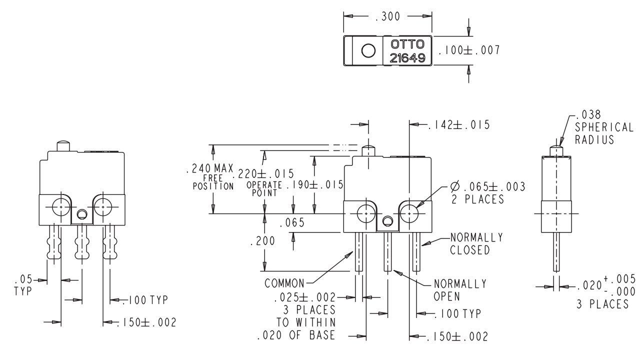
The B1 series is also available with integral lever actuators as B1-5 series.



Actual Size

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**
- **Momentary action**
- **RoHS compliant**



Double Turret Terminals Style Code 2

PC Pins Terminals Style Code 3

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

B1 PART NUMBER CODE

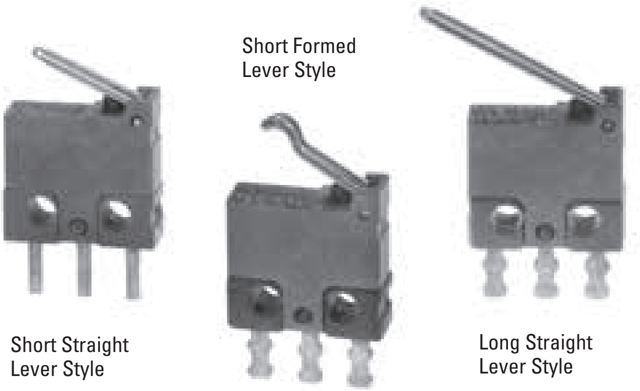
B1 – X X X X X

Construction Grade	**Terminal Style***	**Operating Force**	**Movement Differential**	**Contact Material**
1. Military	**2.** Double Turret	**1.** 6 oz max	**1.** 0.005” max	**1.** Silver/Gold – High Current
2. Commercial	**3.** PC Pins			**3.** Silver/Gold – Low Current

* Wire leads available, contact factory.

B1 BASICS WITH INTEGRAL LEVERS

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

B1-5 XXX X X

Actuator Identifier
Integral Lever Actuator Style

Lever Style
001. Short Straight
003. Long Straight
004. Short Formed
(Other lever lengths and styles available.)

Terminal Style*
1. Double Turret
2. PC Pin 0.140" lg.

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

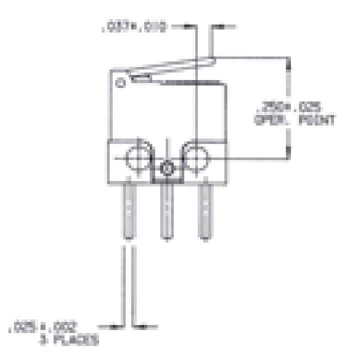
* Wire leads available, contact factory.

ORDERING INFORMATION:

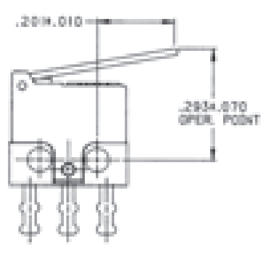
B1-5 Series, Basic Switch with Integral Lever Actuator

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.

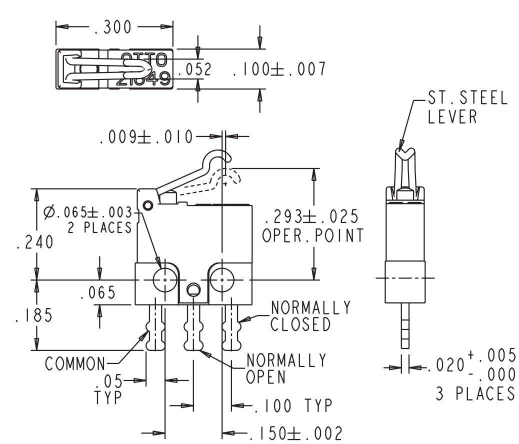
Example: B1-500111 specifies short straight integral lever, double turret terminals and silver/gold high current contacts.



Short Straight Lever
B1-50012X



Long Straight Lever
B1-50031X



Short Formed Lever
B1-50041X

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:

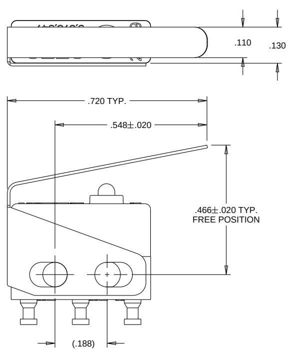
- **Choice of 0.156" & 0.200" wide models**
- **Up to 7 amps switching**
- **Sensitive movement differentials**
- **Low operating forces**
- **Choice of 8 terminal styles or wire leads**
- **Long operating life**
- **Qualified under MIL-PRF-8805/4, MIL-PRF-8805/106 & MIL-PRF-8805/109**
- **Momentary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

Auxiliary Lever Actuators for B2

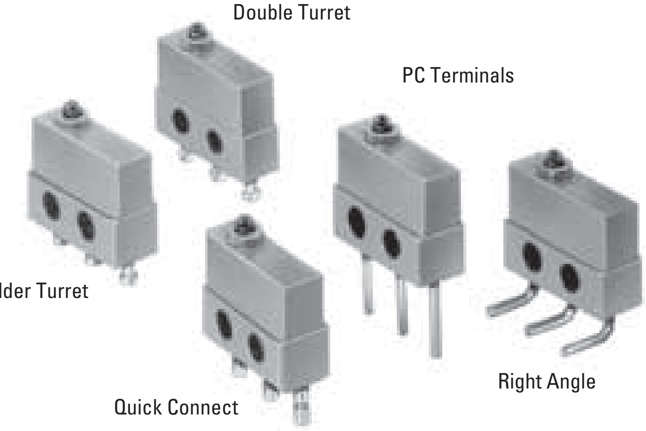
Catalog Number	Number of Poles
A1-115-01	1
A2-109	2

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

For additional options, contact factory.



A1-115-01 Shown



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

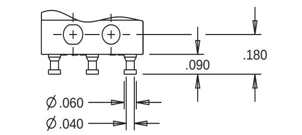
SUBMINIATURE BASIC SWITCHES

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

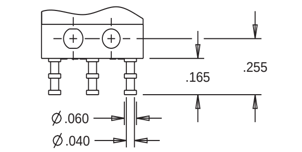
MILITARY APPROVALS
(MIL-PRF-8805/4, MIL-PRF-8805/106 & MIL-PRF-8805/109)

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

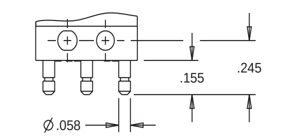
MILITARY NO.	OTTO P/N
M8805/106-01	B2-200031
M8805/106-02	B2-200032
M8805/109-01	B2-111351
M8805/109-02	B2-112351
M8805/109-03	B2-111353
M8805/109-04	B2-112353
MS24547-1 (M8805/4)	B2-211351
MS24547-2 (M8805/4)	B2-211353
MS24547-4 (M8805/4)	B2-212351
MS24547-5 (M8805/4)	B2-212353
MS24547-6 (M8805/4)	B2-200029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



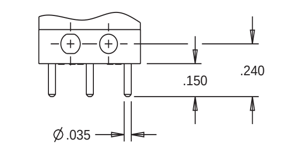
TERMINAL STYLE 1
SINGLE SOLDER TURRET



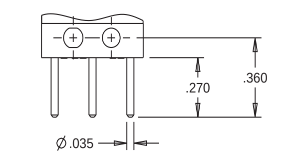
TERMINAL STYLE 2
DOUBLE SOLDER TURRET



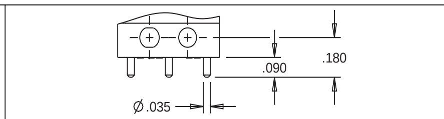
TERMINAL STYLE 3
QUICK CONNECT
MATES WITH AMP .058" RECEPTACLES



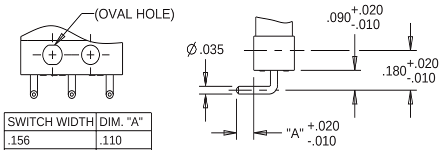
TERMINAL STYLE 4
PRINTED CIRCUIT PIN 0.150" LONG



TERMINAL STYLE 5
PRINTED CIRCUIT PIN 0.270" LONG

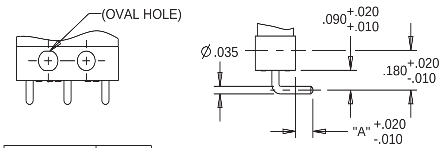


TERMINAL STYLE 6
PRINTED CIRCUIT PIN 0.090" LONG



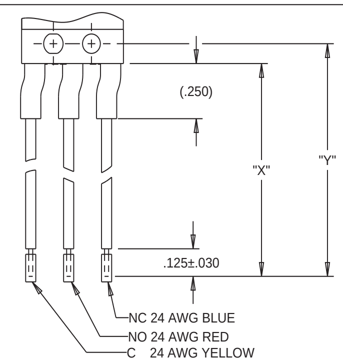
SWITCH WIDTH	DIM. "A"
.156	.110
.200	.085

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 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

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

Model (Width/Constr.)
- **1. 0.156" (MIL Grade)**
- **2. 0.200" (MIL Grade)**
- 3. 0.156" (Com'l Grade)
- 4. 0.200" (Com'l Grade)

Actuator Style
- **1. Button**

Terminal Style
- **1. Single Turret**
- **2. Double Turret**
- **3. Q.C. Tab ①**
- **4. PC Pin 0.150" lg.**
- **5. PC Pin 0.270" lg.**
- **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.

Operating Force
- **3. 5 oz max**
- 4. 6 oz max

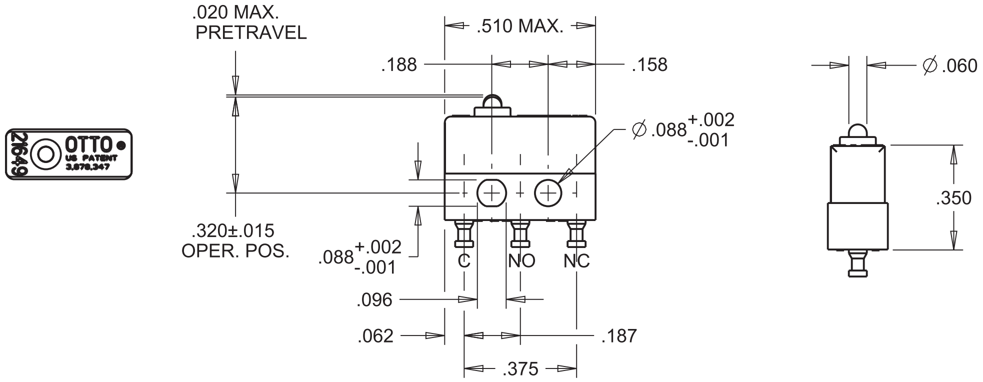
Movement Differential
- 2. 0.002"
- 3. 0.003"
- 4. 0.004"
- **5. 0.005"**
- 6. 0.006"

Contact Material
- **1. Silver/Gold – High Current**
- **3. Silver/Gold – Low Current**

① Mates with AMP 0.058" receptacles.

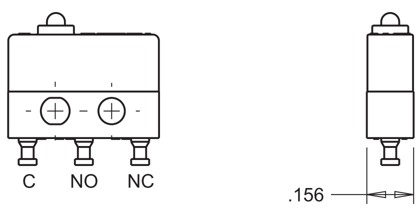
SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS

BASIC SWITCH
(APPLIES TO ALL SWITCHES ON THIS PAGE)

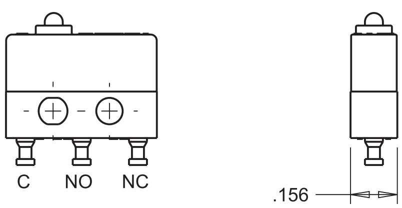


MODEL (WIDTH/CONSTRUCTION) 1
0.156" (MILITARY GRADE)

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

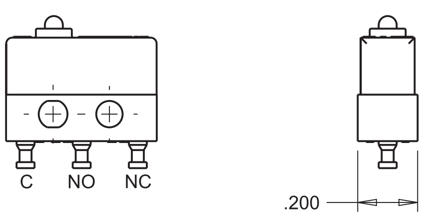


MODEL (WIDTH/CONSTRUCTION) 3
0.156" (COMMERCIAL GRADE)

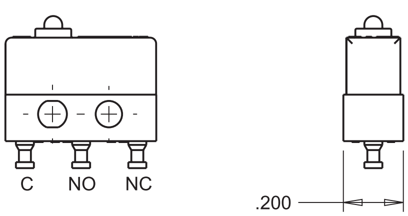


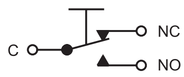
MODEL (WIDTH/CONSTRUCTION) 2
0.200" (MILITARY GRADE)

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)

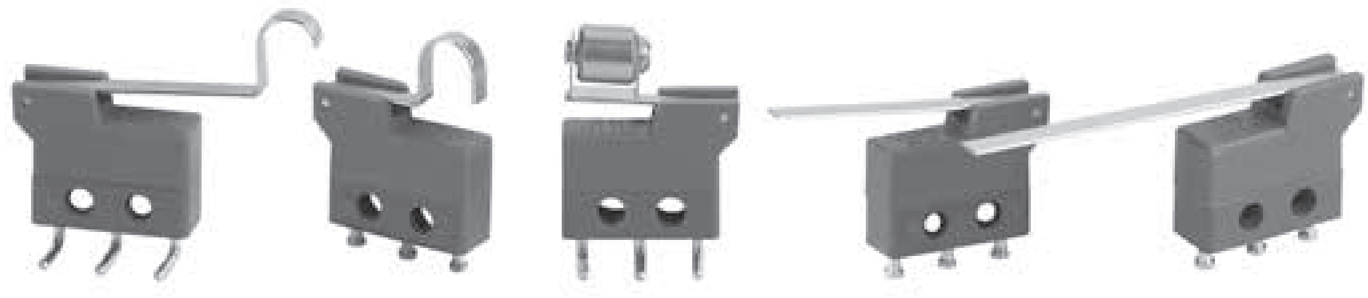




SPDT-FORM C
SCHEMATIC

B2 BASICS WITH INTEGRAL LEVERS

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



B2-500571 B2-500411 B2-501691 B2-500211 B2-500333

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 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

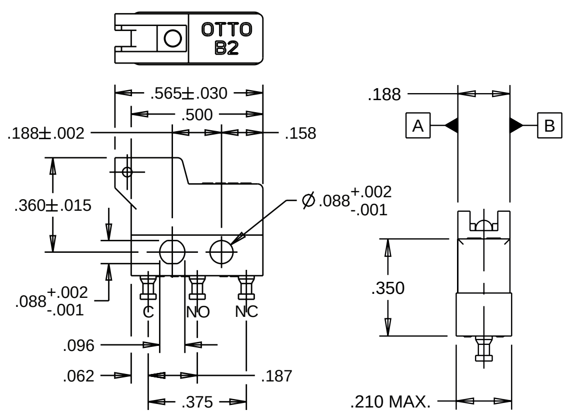
Terminal Style or Wire Length
1. Single Solder Turret
2. Double Solder Turret
3. Quick Connect*
4. PC Pin 0.150” lg.
5. PC Pin 0.270” lg.
6. PC Pin 0.090” lg.
7. Right Angle PC Pin
9. Right Angle**
A. With Wires 06.0” lg.
B. With Wires 12.0” lg.
C. With Wires 18.0” lg.
D. With Wires 24.0” lg.
E. With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

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

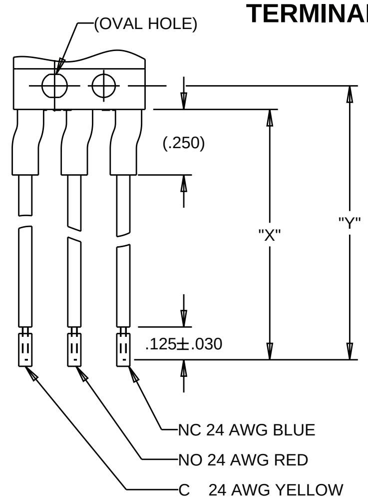
* Mates with AMP .058” receptacles
** Opposite of 7

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

BASIC SWITCH
(APPLIES TO ALL B2-5 SWITCHES)

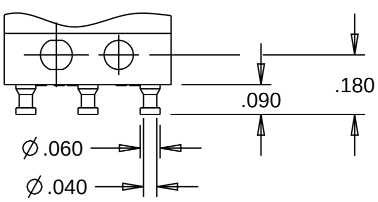


TERMINAL STYLES AND WIRE LENGTHS

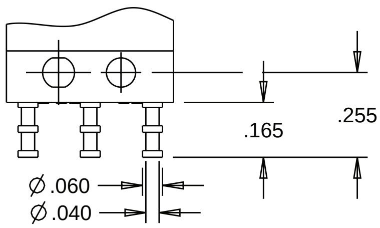


WIRE LENGTH FOR A, B, C, D & E

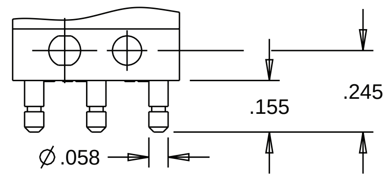
WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00± .38	06.09± .38
B	12.00± .50	12.09± .50
C	18.00± .50	18.09± .50
D	24.00± .50	24.09± .50
E	30.00± .75	30.09± .75



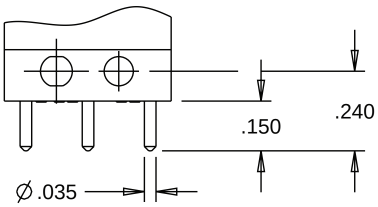
TERMINAL STYLE 1
SINGLE SOLDER TURRET



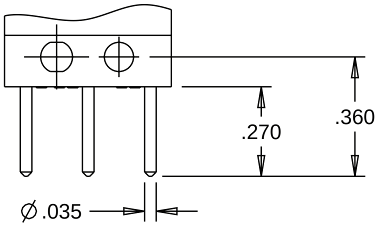
TERMINAL STYLE 2
DOUBLE SOLDER TURRET



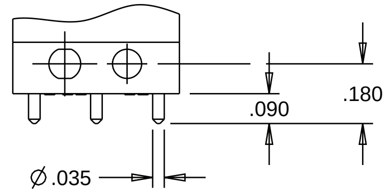
TERMINAL STYLE 3
QUICK CONNECT
MATES WITH AMP .058 INCH RECEPTACLES



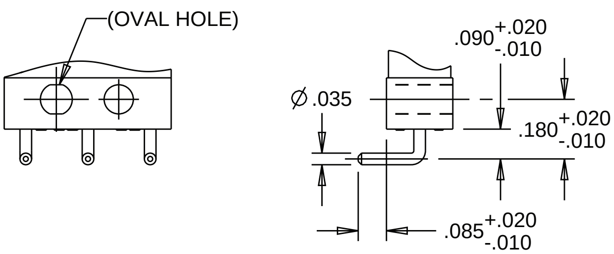
TERMINAL STYLE 4
PRINTED CIRCUIT PIN 0.150" LONG



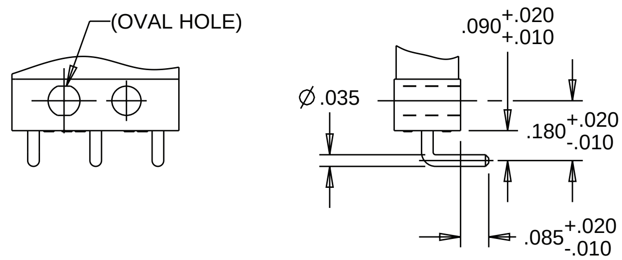
TERMINAL STYLE 5
PRINTED CIRCUIT PIN 0.270" LONG



TERMINAL STYLE 6
PRINTED CIRCUIT PIN 0.090" LONG



TERMINAL STYLE 7
RIGHT ANGLE PRINTED CIRCUIT PIN



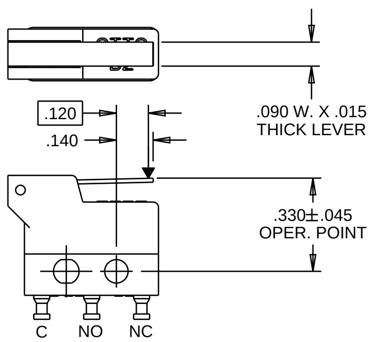
TERMINAL STYLE 9
RIGHT ANGLE, OPPOSITE OF 7

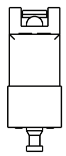
B2 BASICS WITH INTEGRAL LEVERS

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

B2-5 LEVER STYLES

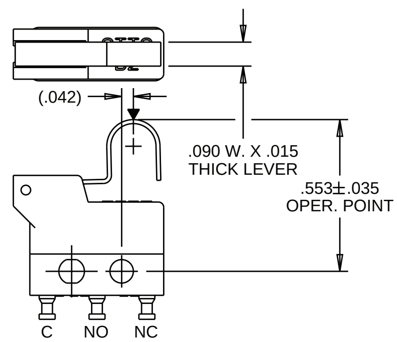
OPERATE FORCE: 1.76 OZ. MAX.
RELEASE FORCE: .32 OZ. MIN.
PRETRAVEL: .065 MAX.
OVERTRAVEL: .014 MIN.
MOVE'T DIFFER'L: .020 MAX.
OPERATE POINT AT END OF LEVER: (.329)

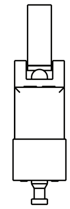




LEVER STYLE 001 SHORT LEVER

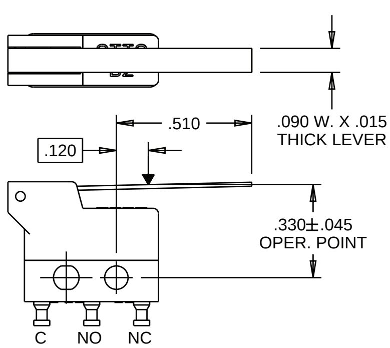
OPERATE FORCE 2.10 OZ. MAX.
RELEASE FORCE: .39 OZ. MIN.
PRETRAVEL: .050 MAX.
OVERTRAVEL: .010 MIN.
MOVE'T DIFFER'L: .015 MAX.

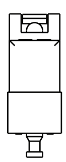




LEVER STYLE 004 SHORT FORMED "U" LEVER

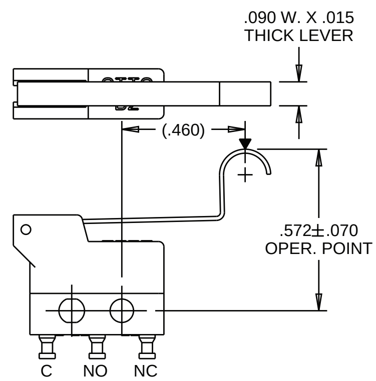
OPERATE FORCE: 1.76 OZ. MAX.
RELEASE FORCE: .32 OZ. MIN.
PRETRAVEL: .065 MAX.
OVERTRAVEL: .014 MIN.
MOVE'T DIFFER'L: .020 MAX.
OPERATE POINT AT END OF LEVER: (.323)

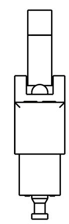




LEVER STYLE 002 MEDIUM LEVER

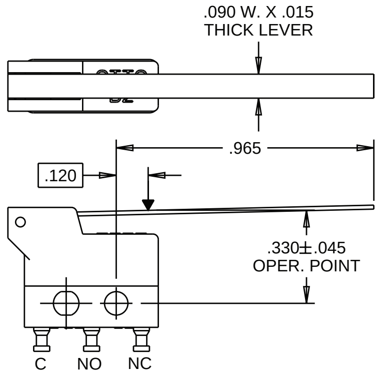
OPERATE FORCE 1.10 OZ. MAX.
RELEASE FORCE: .18 OZ. MIN.
PRETRAVEL: .105 MAX.
OVERTRAVEL: .022 MIN.
MOVE'T DIFFER'L: .035 MAX.

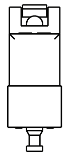




LEVER STYLE 005 LONG FORMED "U" LEVER

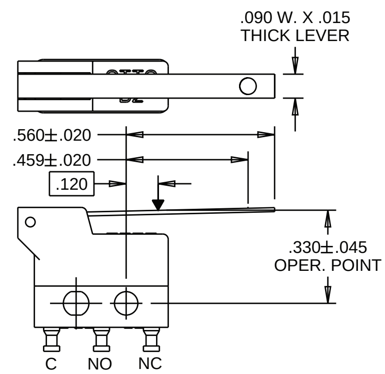
OPERATE FORCE: 1.76 OZ. MAX.
RELEASE FORCE: .32 OZ. MIN.
PRETRAVEL: .065 MAX.
OVERTRAVEL: .014 MIN.
MOVE'T DIFFER'L: .020 MAX.
OPERATE POINT AT END OF LEVER: (.315)

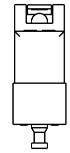




LEVER STYLE 003 LONG LEVER

OPERATE FORCE: 1.76 OZ. MAX.
RELEASE FORCE: .32 OZ. MIN.
PRETRAVEL: .065 MAX.
OVERTRAVEL: .014 MIN.
MOVE'T DIFFER'L: .020 MAX.
OPERATE POINT AT END OF LEVER: (.322)

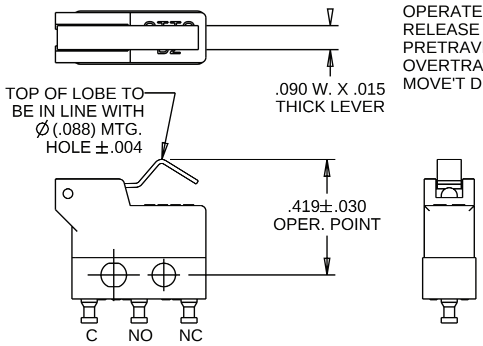




LEVER STYLE 006 WITH HOLE

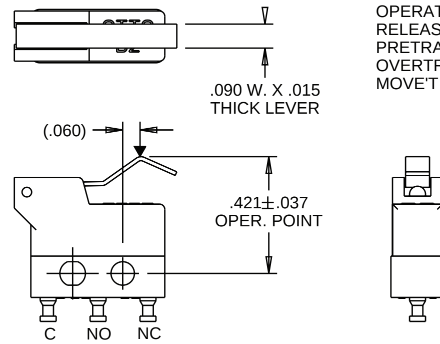
SINGLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE, TWO WIDTHS, INTEGRAL LEVERS

B2-5 LEVER STYLES



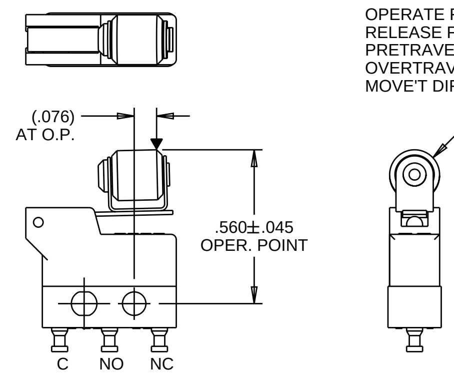
OPERATE FORCE: 3.00 OZ. MAX.
RELEASE FORCE: .57 OZ. MIN.
PRETRAVEL: .042 MAX.
OVERTRAVEL: .010 MIN.
MOVE'T DIFFER'L: .010 MAX.

LEVER STYLE 012 SHORT "V"



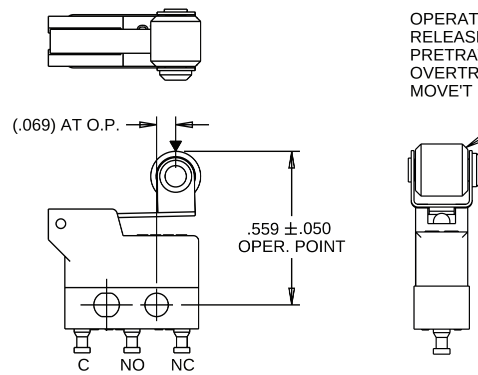
OPERATE FORCE 2.20 OZ. MAX.
RELEASE FORCE: .40 OZ. MIN.
PRETRAVEL: .049 MAX.
OVERTRAVEL: .010 MIN.
MOVE'T DIFFER'L: .015 MAX.

LEVER STYLE 018 SHORT FLAT "V"



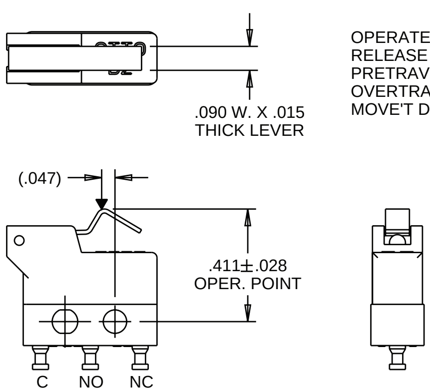
OPERATE FORCE: 2.29 OZ. MAX.
RELEASE FORCE: .43 OZ. MIN.
PRETRAVEL: .065 MAX.
OVERTRAVEL: .008 MIN.
MOVE'T DIFFER'L: .020 MAX.

LEVER STYLE 016 ROLLER SLEEVE SIDEWAYS



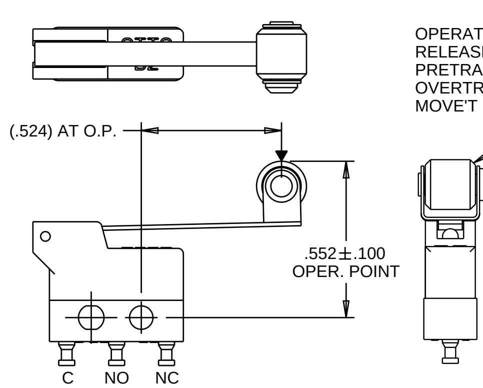
OPERATE FORCE 2.29 OZ. MAX.
RELEASE FORCE: .43 OZ. MIN.
PRETRAVEL: .070 MAX.
OVERTRAVEL: .008 MIN.
MOVE'T DIFFER'L: .020 MAX.

LEVER STYLE 019 ROLLER LEVER IN LINE



OPERATE FORCE: 3.00 OZ. MAX.
RELEASE FORCE: .57 OZ. MIN.
PRETRAVEL: .036 MAX.
OVERTRAVEL: .008 MIN.
MOVE'T DIFFER'L: .009 MAX.

LEVER STYLE 017 SHORT "L"



OPERATE FORCE: 1.00 OZ. MAX.
RELEASE FORCE: .17 OZ. MIN.
PRETRAVEL: .125 MAX.
OVERTRAVEL: .020 MIN.
MOVE'T DIFFER'L: .040 MAX.

LEVER STYLE 020 LONG ROLLER LEVER IN LINE

B2 BASICS WITH REDUCED DEAD BREAK

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.

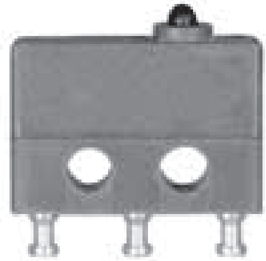
There are 13 terminal styles which include single turret solder style, double turret solder style, Quick Connect, PC pins and wires.

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**
- **Momentary action**
- **RoHS compliant**



B2D Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

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

Electrical Life:	50,000 cycles
Mechanical Life:	50,000 cycles
Seal:	Unsealed
Operating Temp Range:	-55°C to +85°C
Operating Force:	10 oz max
Release Force:	1.0 oz min
Operate Point:	0.320 +/- 0.015 inches from mounting holes
Overtravel:	0.004 inches min
Movement Differential:	0.003 inches max
Pretravel:	0.020 inches max
Initial Dead Break:	0.0004 inches max

MATERIALS:

Cover:	Thermoplastic, blue
Button:	Thermoplastic, black
Terminal Hardware:	None provided
Mounting Hardware:	None provided

B2D PART NUMBER CODE

B2D – X X X X X X

Model (Width/ Construction)
1. 0.156" Wide
2. 0.200" Wide

Actuator Style
1. Button

Terminal Style
1. Single Solder Turret
2. Double Solder Turret
3. Quick Connect
4. PC Pin 0.150" long
5. PC Pin 0.270" long
6. PC Pin 0.090" long
7. Right Angle PC Pin
9. Right Angle, Opposite of 7
A. With 24 AWG Wires 06.0" long
B. With 24 AWG Wires 12.0" long
C. With 24 AWG Wires 18.0" long
D. With 24 AWG Wires 24.0" long
E. With 24 AWG Wires 30.0" long

Operating Force/Max. Initial Dead Break
2. 10 oz max / 0.0004"

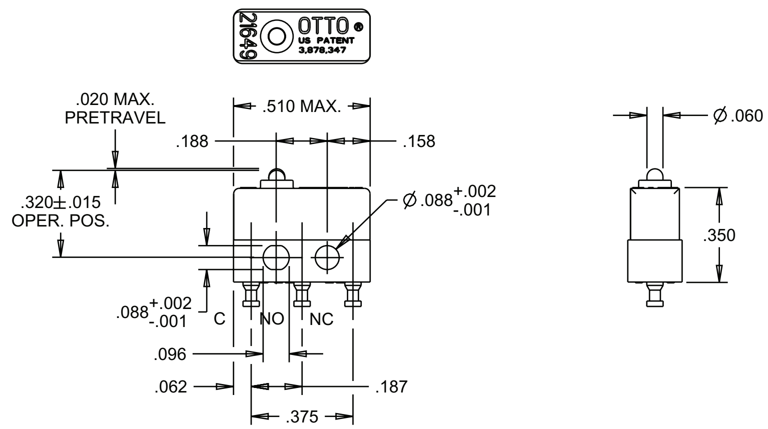
Movement Differential
1. 0.003" max

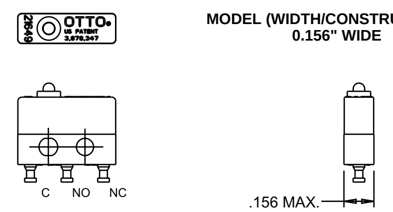
Switch Ratings
1. High Level Ratings
3. Logic Level Ratings

B2 BASICS WITH REDUCED DEAD BREAK

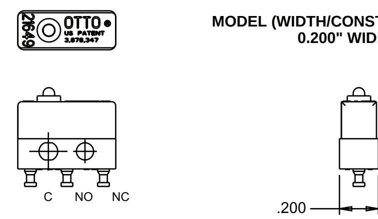
REDUCED DEAD BREAK, SINGLE BREAK, SNAP-ACTION, SUBMINIATURE, TWO WIDTHS

BASIC SWITCH
(APPLIES TO ALL SWITCHES IN THIS DRAWING)

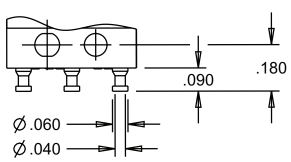




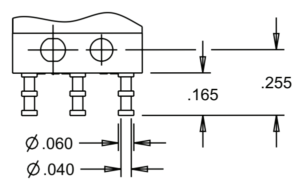
MODEL (WIDTH/CONSTRUCTION) 1
0.156" WIDE



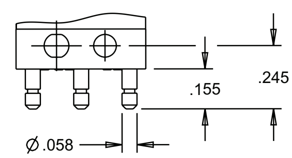
MODEL (WIDTH/CONSTRUCTION) 2
0.200" WIDE



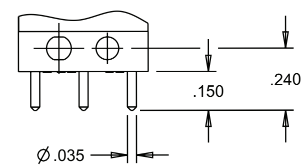
TERMINAL STYLE 1
SINGLE SOLDER TURRET



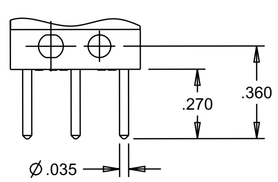
TERMINAL STYLE 2
DOUBLE SOLDER TURRET



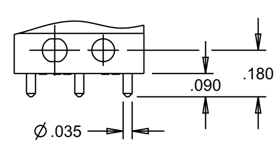
TERMINAL STYLE 3
QUICK CONNECT
MATES WITH AMP .058" RECEPTACLES



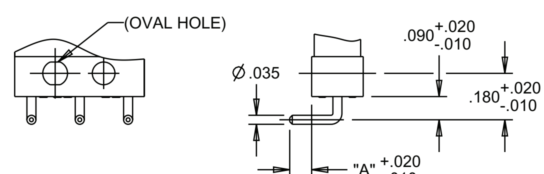
TERMINAL STYLE 4
PRINTED CIRCUIT PIN 0.150" LONG



TERMINAL STYLE 5
PRINTED CIRCUIT PIN 0.270" LONG

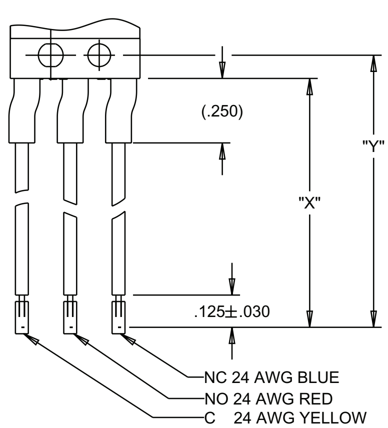


TERMINAL STYLE 6
PRINTED CIRCUIT PIN 0.090" LONG

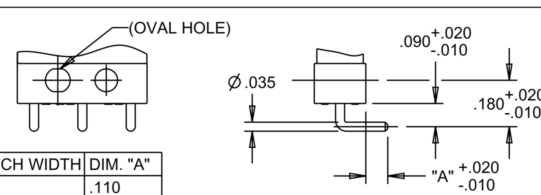


SWITCH WIDTH	DIM. "A"
.156	.110
.200	.085

TERMINAL STYLE 7
RIGHT ANGLE PRINTED CIRCUIT PIN



WIRE TERMINAL STYLES



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

TERMINAL STYLE 9
RIGHT ANGLE, OPPOSITE OF 7

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

SUBMINIATURE BASIC SWITCHES

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 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.

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.

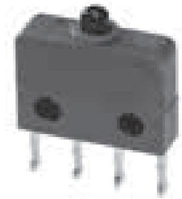
Features:

- **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**
- **Momentary action**
- **UL recognized**
- **RoHS compliant**

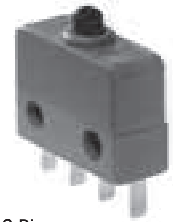
APPLICATIONS

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.

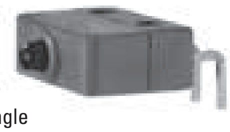
Wire Wrap
Terminals



Solder Turret
Terminals



PC Pins



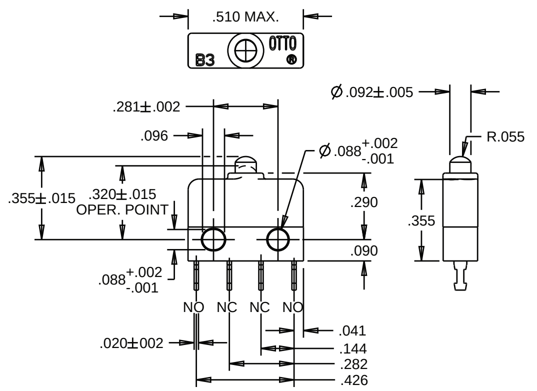
Right Angle
PC Terminals

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 +3/-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

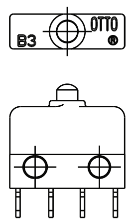
DOUBLE BREAK, SNAP-ACTION, COMMERCIAL & MILITARY GRADES, SUBMINIATURE

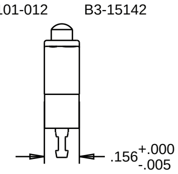
BASIC SWITCH
(APPLIES TO ALL SWITCHES IN THIS DRAWING)



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

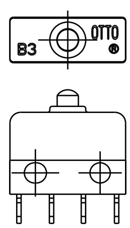
MILITARY NO.	OTTO NO.
M8805/101-015	B3-11131
M8805/101-017	B3-12131
M8805/101-021	B3-13131
M8805/101-019	B3-15131
M8805/101-016	B3-11132
M8805/101-018	B3-12132
M8805/101-022	B3-13132
M8805/101-020	B3-15132
M8805/101-007	B3-11141
M8805/101-009	B3-12141
M8805/101-013	B3-13141
M8805/101-011	B3-15141
M8805/101-008	B3-11142
M8805/101-010	B3-12142
M8805/101-014	B3-13142
M8805/101-012	B3-15142

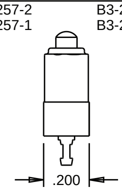




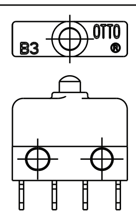
MODEL (WIDTH/CONSTRUCTION) 2
0.200" (MILITARY GRADE)

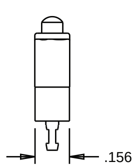
MILITARY NO.	OTTO NO.
MS27257-2	B3-22141
MS27257-1	B3-26141



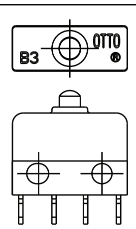


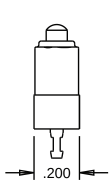
MODEL (WIDTH/CONSTRUCTION) 3
0.156" (COMMERCIAL GRADE)

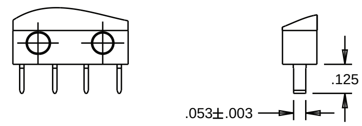




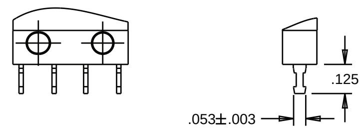
MODEL (WIDTH/CONSTRUCTION) 4
0.200" (COMMERCIAL GRADE)



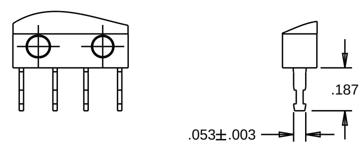




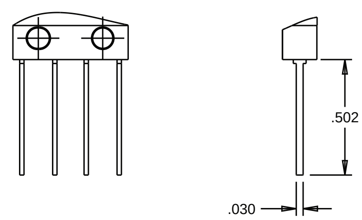
TERMINAL STYLE 1
PC PINS



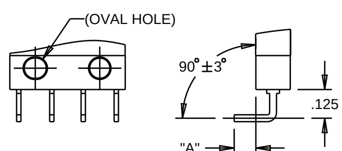
TERMINAL STYLE 2
TURRET, 1/8" LONG



TERMINAL STYLE 3
TURRET, 3/16" LONG

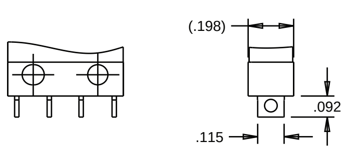


TERMINAL STYLE 4
WIRE WRAP

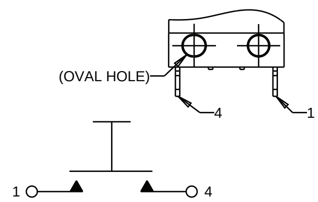


SWITCH WIDTH	DIM. "A"
.156	.092
.200	.070

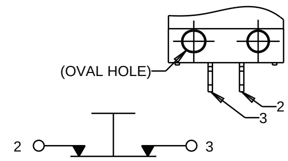
TERMINAL STYLE 5
RIGHT ANGLE PC PINS



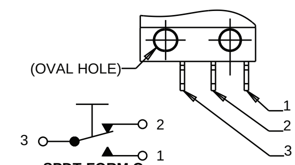
TERMINAL STYLE 6
SOLDER
(AVAILABLE ON THE 0.200" WIDE MODELS ONLY)



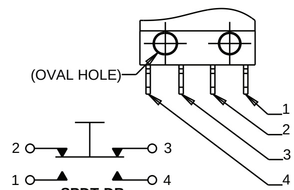
SPST-NO-DB
SCHEMATIC
CIRCUIT STYLE 1
SPNO -DB, FORM X



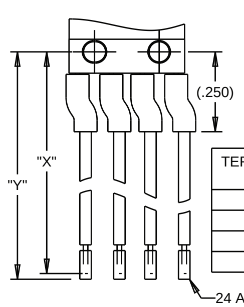
SPST-NC-DB
SCHEMATIC
CIRCUIT STYLE 2
SPNC-DB, FORM Y



SPDT-FORM C
SCHEMATIC
CIRCUIT STYLE 3
SPDT, FORM C



SPDT-DB
SCHEMATIC
CIRCUIT STYLE 4
SPDT-DB, FORM Z



TERMINAL NO.	WIRE COLOR
1	BROWN
2	YELLOW
3	RED
4	BLUE

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

SUBMINIATURE BASIC SWITCHES

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.

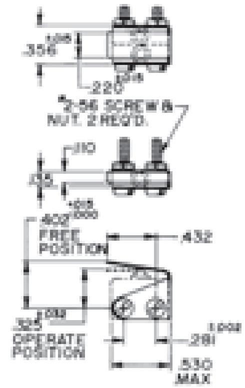
MILITARY APPROVALS

(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 X X X X

Model

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

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.

Operating Force

1. 5 $^{+3}_{-2}$ oz
2. 5 oz min
3. 6 oz max

Circuitry

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

Contact Material

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

① Available on 0.200" wide models only.

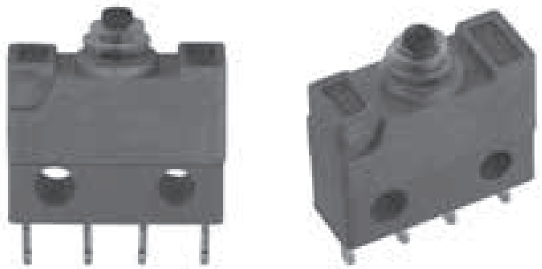
SEALED SUBMINIATURE BASIC SWITCHES

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**
- **Momentary action**
- **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		
Mechanical Life:	1,000,000 cycles		
Seal:	IP68S		
Operating Temp Range:	-40°C to +85°C		
Operating Force:	6 ± 2 oz.		
Overtravel:	.004 min.		
Release Force:	1 oz. min.		
Movement Differential:	.018 +/- .008		
MATERIALS:			
Cover:	Blue Thermoplastic		
Case:	Blue Thermoset		
Boot:	Silicone Rubber		

B3S PART NUMBER CODE

B3S – X X X X X

Switch Width/ Actuator
1. 0.200" Wide, Straight Plunger

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. Not Used

A. With Wires 6.0" Long
B. With Wires 12.0" Long
C. With Wires 18.0" Long
D. With Wires 24.0" Long
E. With Wires 30.0" Long

Operating Force
1. 6 +/- 2 oz

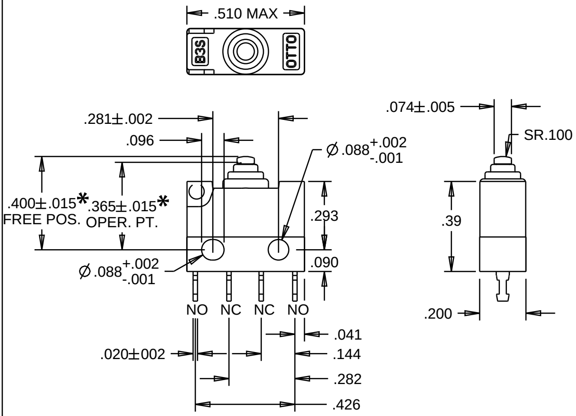
Circuitry
1. SPNO-DB, Form X
2. SPNC-DB, Form Y
3. SPDT, Form C
4. SPDT-DB, Form Z

Contact Rating
1. High Level Ratings
2. Logic Level Ratings

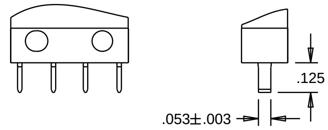
SEALED SUBMINIATURE BASIC SWITCHES

SEALED, DOUBLE BREAK, SNAP-ACTION, SUBMINIATURE

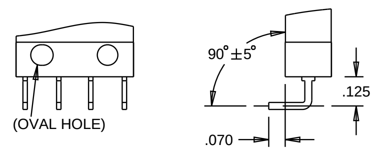
BASIC SWITCH
(APPLIES TO ALL SWITCHES IN THIS DRAWING)



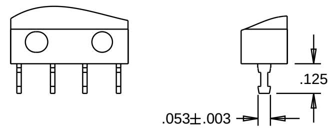
* Please note: The free position and operate point are not the same as the B3.



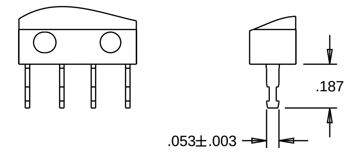
TERMINAL STYLE 1
PC PINS



TERMINAL STYLE 5
RIGHT ANGLE PC PINS

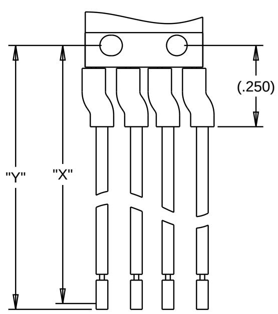


TERMINAL STYLE 2
TURRET, 1/8" LONG



TERMINAL STYLE 3
TURRET, 3/16" LONG

WIRE TERMINAL STYLES

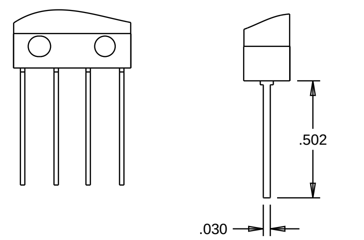


24 AWG

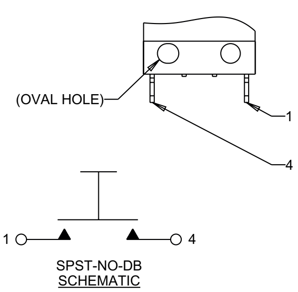
TERMINAL NO.	WIRE COLOR
1	BROWN
2	YELLOW
3	RED
4	BLUE

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

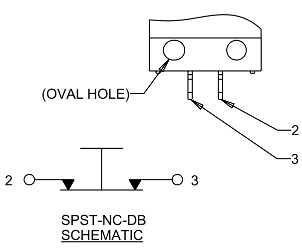
WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00± .38	06.09± .38
B	12.00± .50	12.09± .50
C	18.00± .50	18.09± .50
D	24.00± .50	24.09± .50
E	30.00± .75	30.09± .75



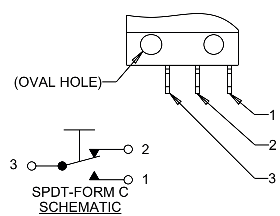
TERMINAL STYLE 4
WIRE WRAP



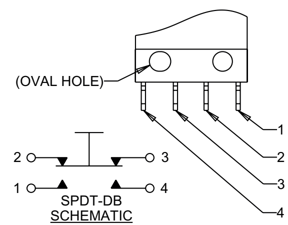
SPST-NO-DB
SCHEMATIC
CIRCUIT STYLE 1
SPNO -DB, FORM X



SPST-NC-DB
SCHEMATIC
CIRCUIT STYLE 2
SPNC-DB, FORM Y



SPDT-FORM C
SCHEMATIC
CIRCUIT STYLE 3
SPDT, FORM C



SPDT-DB
SCHEMATIC
CIRCUIT STYLE 4
SPDT-DB, FORM Z

SEALED BASIC SWITCH WITH LEVERS

SEALED, DOUBLE BREAK, SNAP-ACTION, SUBMINIATURE, INTEGRAL LEVERS

The B3S-5 sealed, subminiature basic switch is made with an integral actuating lever, combining the switch and actuator into one assembly. Sealed to IP68S, the snap-action switch is tested to 1 million cycles at logic level, offering reliable operation in demanding applications and precision in terms of accuracy and repeatability.

The B3S-5 subminiature switch is designed for use in places where space is limited, including internally within toggle, pushbutton and limit switches. It works well in the aerospace, industrial and material handling markets for applications such as conveyor belts, forklifts, ON/OFF switches, door latching mechanisms, fire suppression systems, and timing devices.

In-Line Roller
Lever Style 3

"U" Shaped
Lever Style 2

Standard Straight
Lever Style 1

Features:

- **Integral Lever Actuators**
- **Sealed to IP68S**
- **Double break circuit**
- **Logic level switching option tested to 1 million electrical cycles**
- **0.200" switch width**
- **Choice of 11 standard terminal styles or wire leads**
- **Momentary action**
- **RoHS compliant**

B3S-5 Standard Characteristics/Ratings:

ELECTRICAL RATINGS:	**Sea Level @ 28VDC**		
Rating	**Load**	**Current**	**Life Cycles**
High Level N.C. or N.O. Form X or Y	Resistive	8A	50,000
High Level SPDT Form C or Z	Resistive	5A	50,000
Logic Level @ 5VDC	Resistive	10mA	1,000,000
DWV	1000Vrms		
Mechanical Life:	1,000,000 cycles		
Seal:	IP68S		
Operating Temp Range:	-40°C to +85°C		
Operating Force:	See Part Number		
MATERIALS:			
Cover:	Blue Thermoplastic		
Case:	Blue Thermoset		
Boot:	Silicone Rubber		

B3S- 5 PART NUMBER CODE

B3S – X X X X X

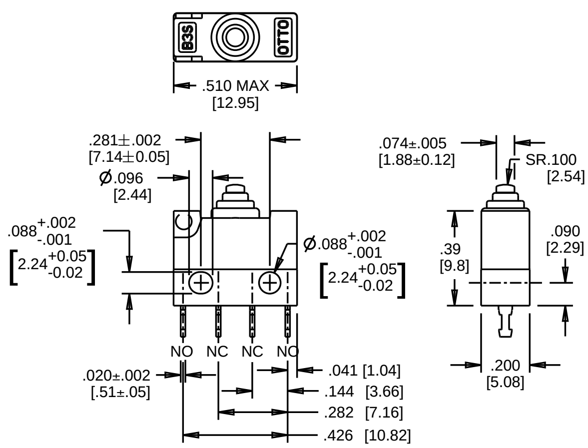
Switch Width/ Actuator	Terminal Style	Lever Type and Force	Circuitry	Contact Rating
5. 0.200" Wide, Lever Actuator	0. Special - See Separate Product Drawing 1. PC Pins 2. Turret, 1/8" Long 3. Turret, 3/16" Long 4. Wire Wrap 5. Right Angle PC Pins A. With Wires 6.0" Long B. With Wires 12.0" Long C. With Wires 18.0" Long D. With Wires 24.0" Long E. With Wires 30.0" Long	1. Standard Straight 5.5 oz. Max Oper. Force 2. "U" Shaped 5.5 oz. Max Oper. Force 3. In-Line Roller 6.4 oz. Max Oper. Force	1. SPNO-DB, Form X 2. SPNC-DB, Form Y 3. SPDT, Form C 4. SPDT-DB, Form Z	1. High Level Ratings 2. Logic Level Ratings

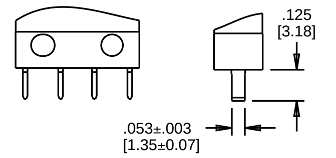
SEALED BASIC SWITCH WITH LEVERS

SEALED, DOUBLE BREAK, SNAP-ACTION, SUBMINIATURE, INTEGRAL LEVERS

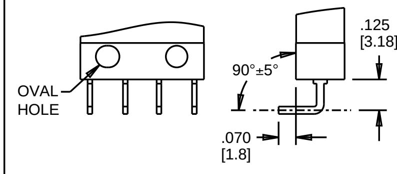
BASIC SWITCH DIMENSIONS

(APPLIES TO ALL SWITCHES IN THIS DRAWING)

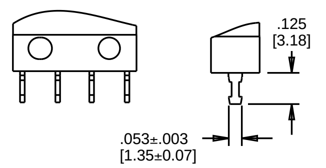




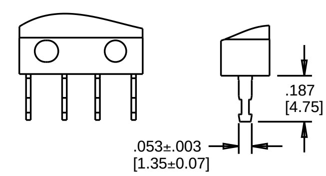
TERMINAL STYLE 1
PC PINS



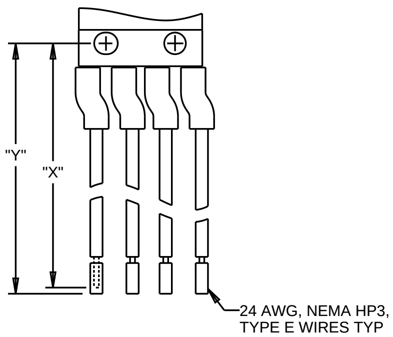
TERMINAL STYLE 5
RIGHT ANGLE PC PINS



TERMINAL STYLE 2
TURRET, 1/8" LONG



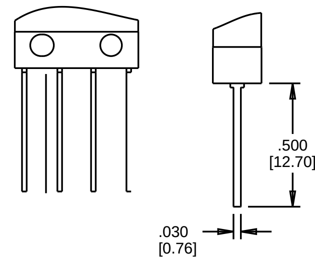
TERMINAL STYLE 3
TURRET, 3/16" LONG



TERMINAL NO.	WIRE COLOR
1	BROWN
2	YELLOW
3	RED
4	BLUE

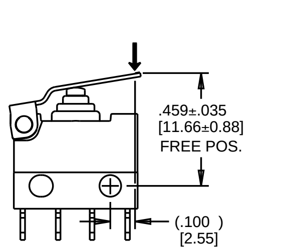
WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	6.00±.38 [152.4±9.7]	6.09±.38 [154.7±9.7]
B	12.00±.50 [304.8±12.7]	12.09±.50 [307.1±12.7]
C	18.00±.50 [457.2±12.7]	18.09±.50 [459.5±12.7]
D	24.00±.50 [609.6±12.7]	24.09±.50 [611.9±12.7]
E	30.00±.75 [762.0±19.05]	30.09±.75 [764.3±19.05]

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



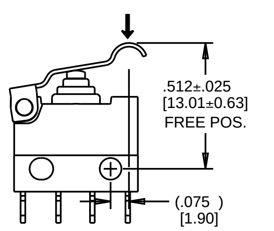
TERMINAL STYLE 4
WIRE WRAP

OPER. POINT: .378±.029
OVERTRAVEL: .010 MIN.
MOVE. DIFF.: .038±.019



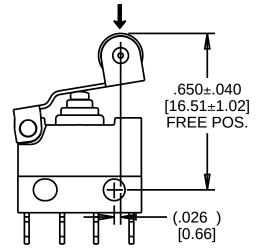
STANDARD STRAIGHT LEVER
(LEVER TYPE OPTION 1)

OPER. POINT: .448±.025
OVERTRAVEL: .010 MIN.
MOVE. DIFF.: .033±.017



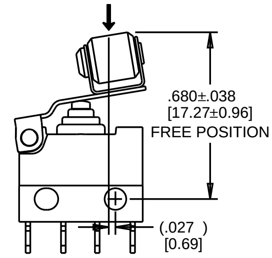
"U" SHAPED LEVER
(LEVER TYPE OPTION 2)

OPER. POINT: .585±.030
OVERTRAVEL: .010 MIN.
MOVE. DIFF.: .036±.020

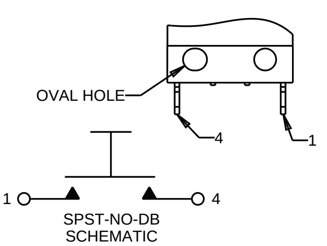


IN-LINE ROLLER LEVER
(LEVER TYPE OPTION 3)

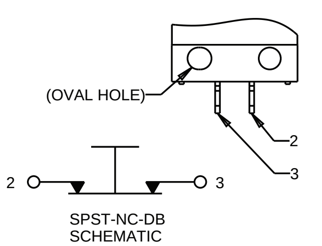
OPER. POINT: .609±.029
OVERTRAVEL: .010 MIN.
MOVE. DIFF.: .034±.019



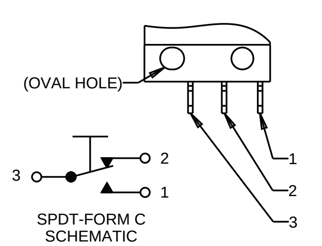
PERPENDICULAR ROLLER LEVER
(LEVER TYPE OPTION 4)



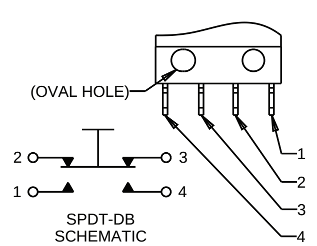
CIRCUIT STYLE 1
SPNO -DB, FORM X



CIRCUIT STYLE 2
SPNC-DB, FORM Y



CIRCUIT STYLE 3
SPDT, FORM C



CIRCUIT STYLE 4
SPDT-DB, FORM Z

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**
- **Momentary action**
- **RoHS compliant**

B5 PART NUMBER CODE

B5 – X X X X X

Model	Terminal Style or Wire Length	Operating Force	Circuitry	Contact Material
1. Commercial **2.** Military	**1.** Solder **2.** Taper Tab Quick Connect **3.** 0.110 Quick Connect ① **4.** PC Pin **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.	**1.** 5^{+3}_{-2} oz **2.** 6 oz max **3.** 5 oz min	**1.** SPNO-DB, Form X **2.** SPNC-DB, Form Y **3.** SPDT, Form C **4.** SPDT-DB, Form Z	**1.** Silver/Gold – High Current **2.** Silver/Gold – Low Current

① Mates with AMP Series 110 receptacles.

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Circuitry	Load	Sea Level @ 28VDC	70,000 feet @ 28VDC	Sea Level @ 115VAC, 60Hz
SPNO-DB &	Resistive	10A	10A	10.1A
SPNC-DB	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

DWV	1000Vrms	400Vrms

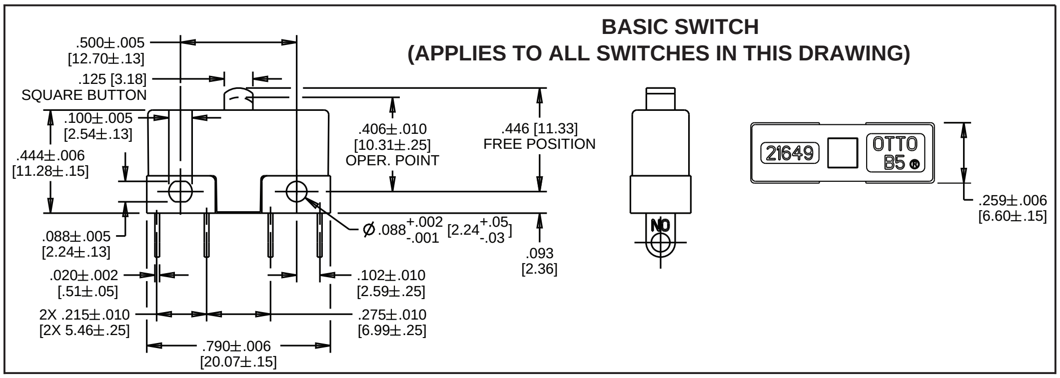
Electrical Life:	100,000 cycles
Mechanical Life:	1,000,000 cycles
Seal:	Unsealed
Operating Temp Range:	-65°C to +125°C
Operating Force:	5 oz, +3/-2 oz or 6 oz max or 3 oz min
Release Force:	2 oz min
Operate Point:	0.406 +/- 0.010 inches from mounting holes
Overtravel:	0.012 inches min
Movement Differential:	0.020 +/- 0.005 inches
Pretravel:	0.050 inches max

MATERIALS:

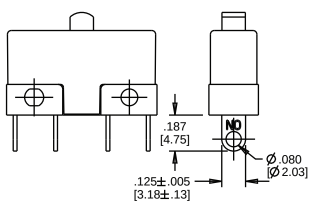
Case:	Thermoset, blue
Cover:	Thermoset, blue
Button:	Thermoplastic, black
Terminals:	Brass with bright acid tin plating
Contacts:	Stationary: Silver with gold Moveable: Silver with gold
Terminal Hardware:	None provided, optional wires
Mounting Hardware:	None provided

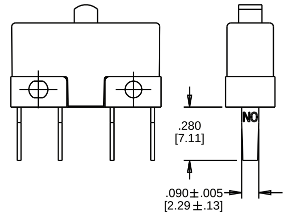
MINIATURE BASIC SWITCHES

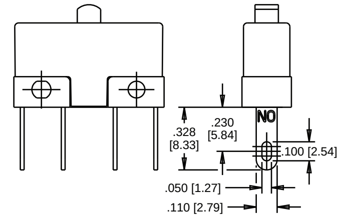
DOUBLE BREAK, SNAP-ACTION COMMERCIAL & MILITARY GRADES, MINIATURE

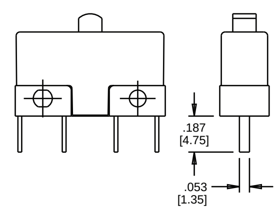


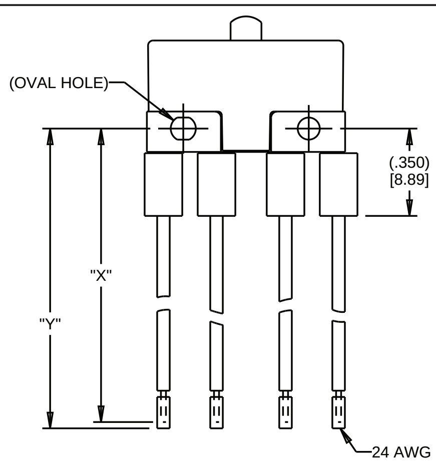
TERMINAL STYLE 1	TERMINAL STYLE 2	TERMINAL STYLE 3	TERMINAL STYLE 4
SOLDER	TAPER TAB Q. C. TERMINALS MATES W/AMP SERIES 78 RECEPTACLES	.110 QUICK CONNECT TERMINALS MATES/AMP SERIES 110 RECEPTACLES	PRINTED CIRCUIT PINS







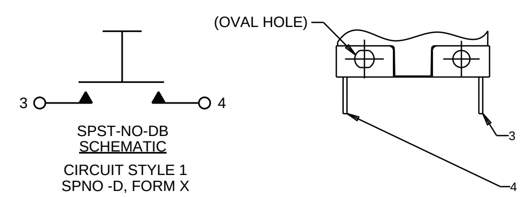




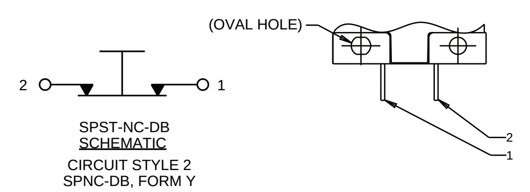
WIRE LENGTH FOR A, B, C & D

WIRE LENGTH CODE	DIM. "X"	DIM. "Y"
A	06.00±.38 [152.4±9.7]	06.09±.38 [157.7±9.7]
B	12.00±.50 [304.8±12.7]	12.09±.50 [307.1±12.7]
C	18.00±.50 [457.2±12.7]	18.09±.50 [459.5±12.7]
D	24.00±.50 [609.6±12.7]	24.09±.50 [611.9±12.7]
E	30.00±.75 [762.0±19.1]	30.09±.75 [764.3±19.1]

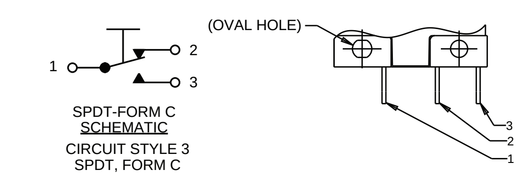
TERMINAL NO.	WIRE COLOR
1	BROWN
2	YELLOW
3	RED
4	BLUE



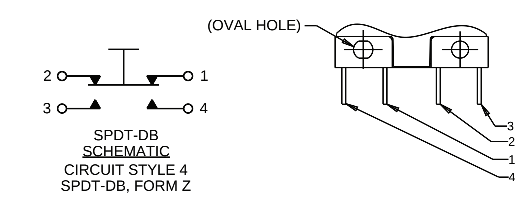
SPST-NO-DB
SCHEMATIC
CIRCUIT STYLE 1
SPNO -D, FORM X



SPST-NC-DB
SCHEMATIC
CIRCUIT STYLE 2
SPNC-DB, FORM Y



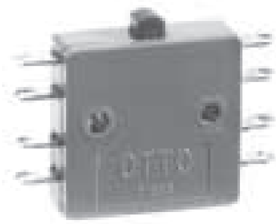
SPDT-FORM C
SCHEMATIC
CIRCUIT STYLE 3
SPDT, FORM C



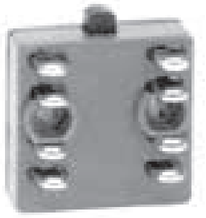
SPDT-DB
SCHEMATIC
CIRCUIT STYLE 4
SPDT-DB, FORM Z

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.

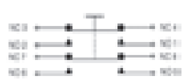
Features:

- **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**
- **Momentary action**
- **RoHS compliant**

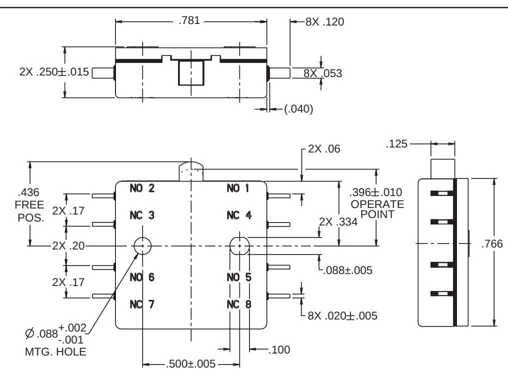
Standard Characteristics/Ratings:	
ELECTRICAL RATINGS: See chart below	
Electrical Life:	50,000 cycles
Mechanical Life:	100,000 cycles
Seal:	Unsealed
Operating Temp Range:	-65°C to +125°C
Operating Force:	12 +/- 4 oz
Release Force:	5 oz min
Operate Point:	0.396 +/- 0.010 inches from mounting holes
Overtravel: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

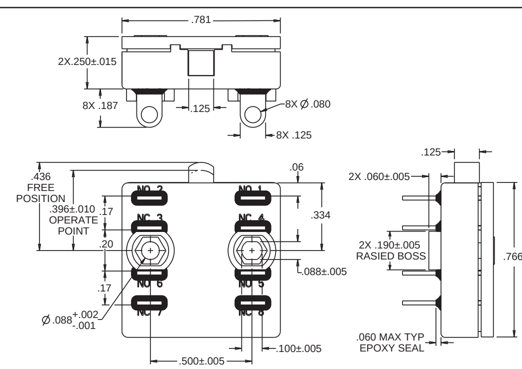
*L/R = 0.026



Circuit Schematic
DPDT-DB (Form ZZ)



B5-71 End Terminals



B5-72 Front Terminals

G2 and G3
Grips

G2 AEROSPACE & MILITARY CONTROL 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.

Cyclic Grips

Military Ground Support Grips

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**

B8 Style Grips

Cobra Style Grips

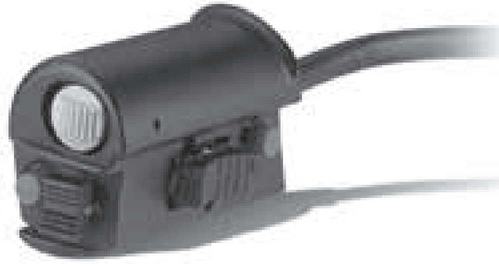
Military Flight Control Grips

- **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



Throttle Grips

G2 AEROSPACE & MILITARY CONTROL 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

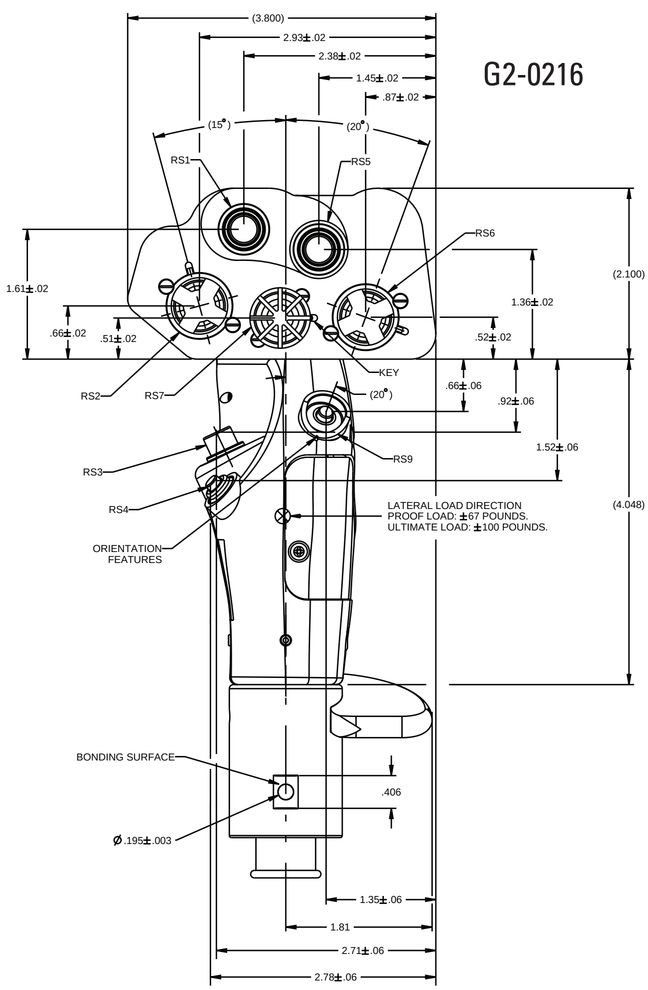
Systems Grip

G2 FLIGHT CONTROL GRIPS

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.



G2-0216

G2-0216

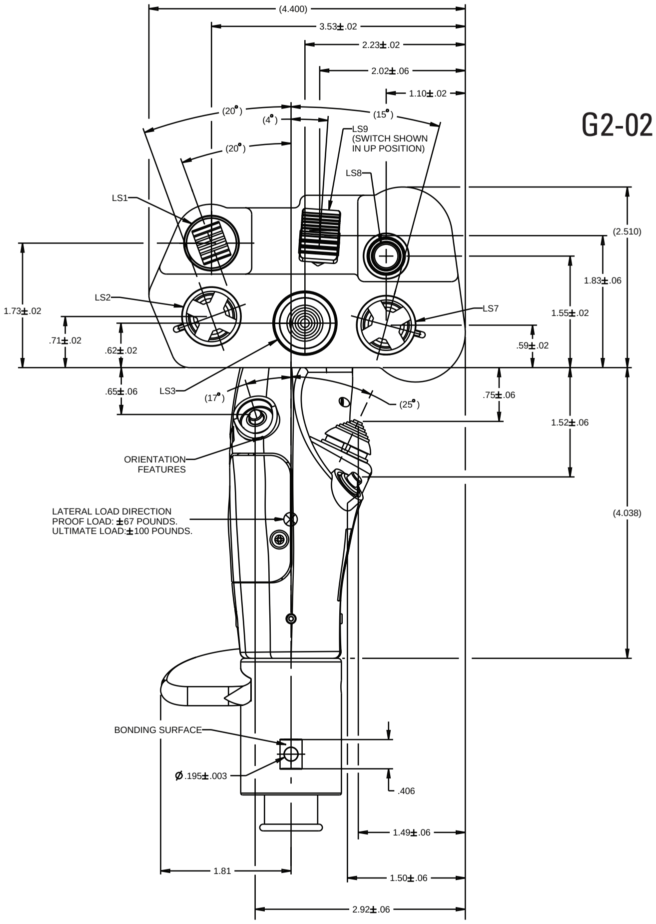
Features:

- **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.

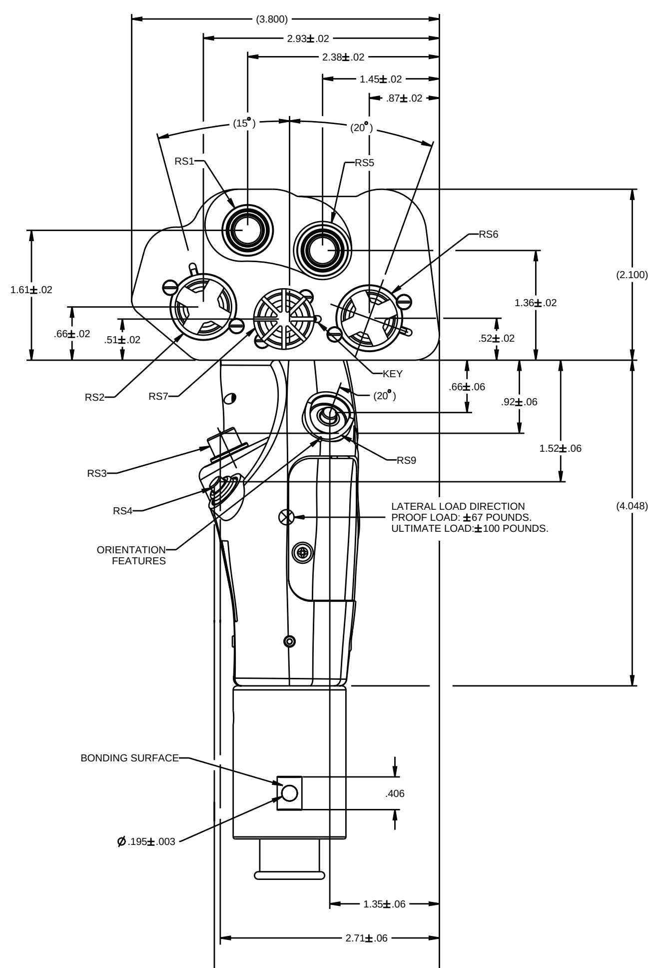
G2 FLIGHT CONTROL GRIPS

RUGGED DESIGN



G2-0217

G2-0218



G2 COMMANDER GRIPS

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 body 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.

Commander Grip
with Brow Shown

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)**

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

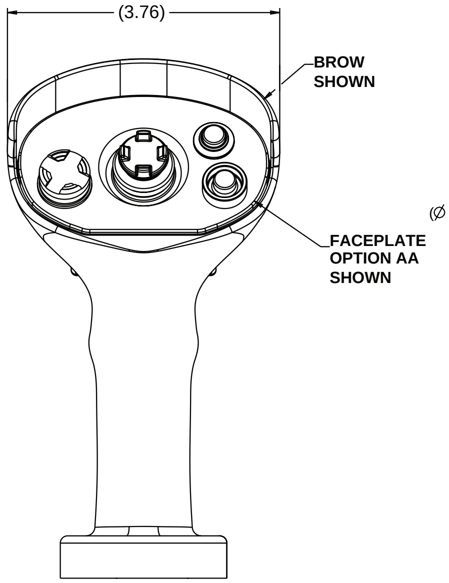
Trigger With Guard	Operator Presence	Faceplate Option*	Grip Head Brow	Grip Head Switches Back	Grip Head Switches Top	Grip Head Switches Side*	Handle Switches	Cable Output	Paint
1. None **2.** Yes	**1.** None **2.** Yes	**AA** **AB** **AC** **AD** **AE** **AF** **AG** **AH** **AJ**	**1.** None **2.** 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

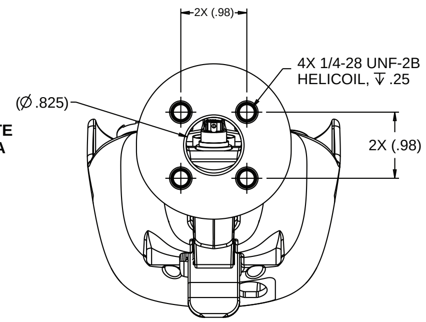
* See Faceplate Configurations on Pages 33-34.
Faceplate options AB, AD and AH not available with grip head switches side, option 2 & 4.
Faceplate options AE and AF not available with grip head switches side, option 3 & 4.
**Faceplate options AC and AF not available with USB Cable Output option.

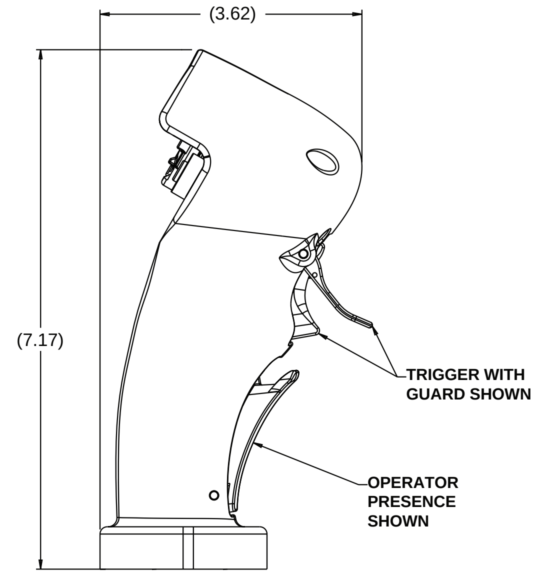
G2 COMMANDER GRIPS

RUGGED DESIGN

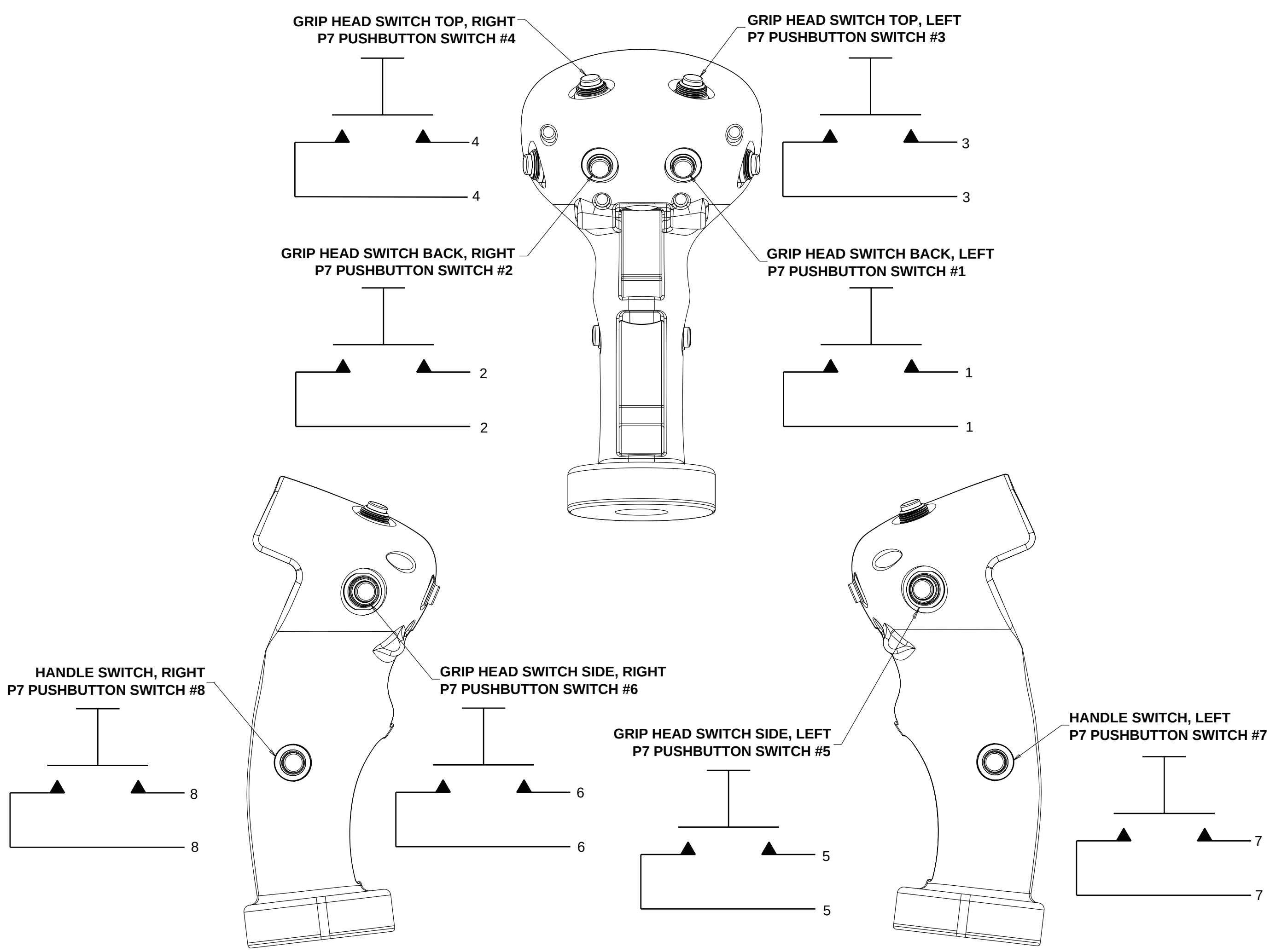
STANDARD DIMENSIONS







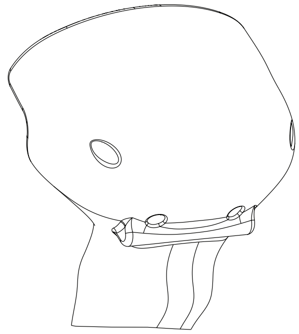
GRIP HEAD AND HANDLE SWITCH OPTIONS



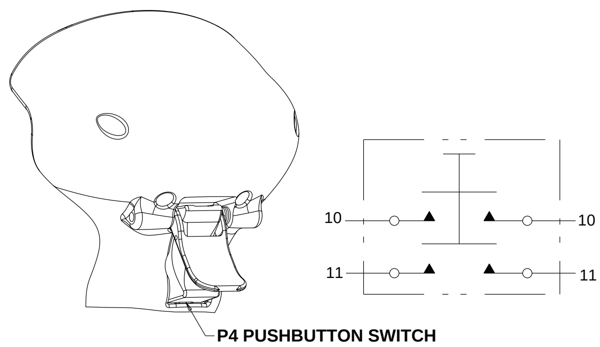
Specifications Subject To Change Without Notice

TRIGGER, BROW AND OPERATOR PRESENCE OPTIONS

TRIGGER OPTIONS

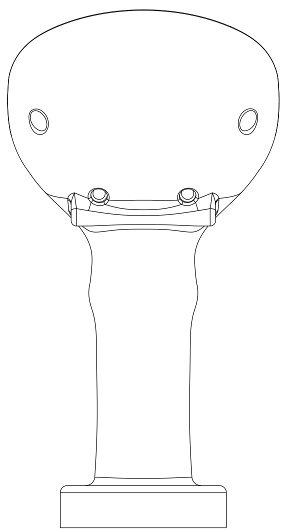


NO TRIGGER

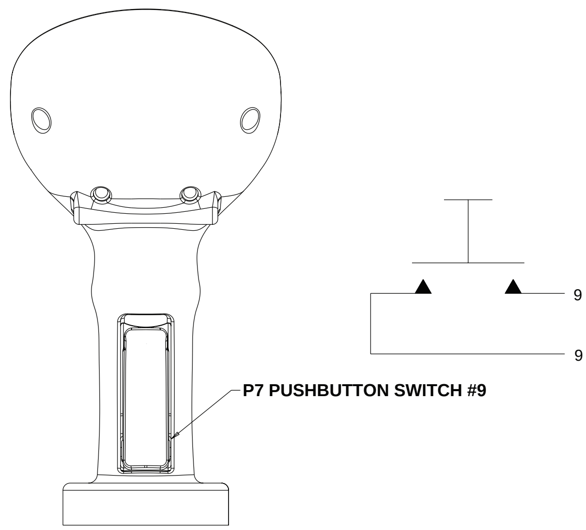


TRIGGER WITH GUARD

OPERATOR PRESENCE OPTIONS

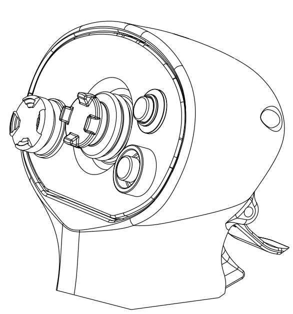


NO OPERATOR PRESENCE

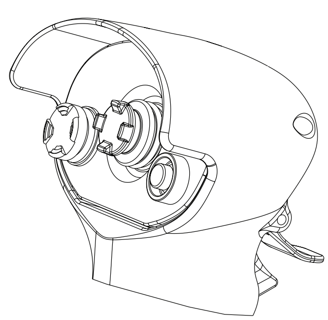


OPERATOR PRESENCE

BROW OPTIONS



NO BROW

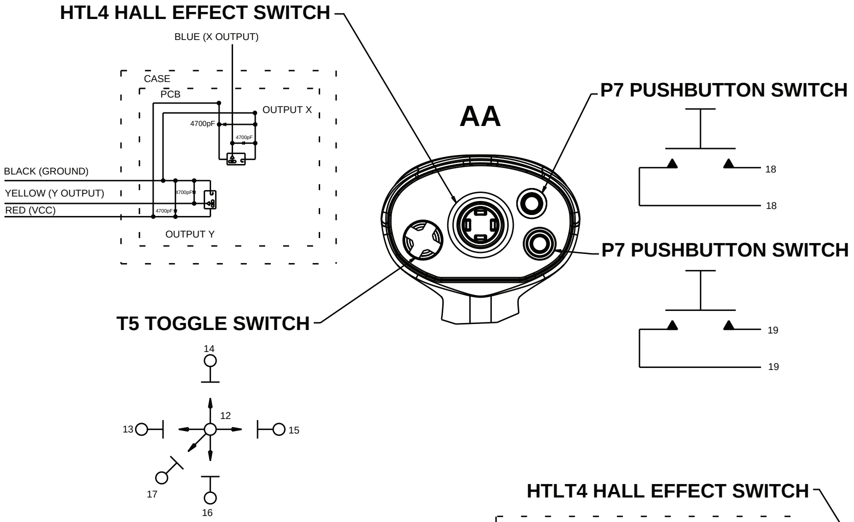


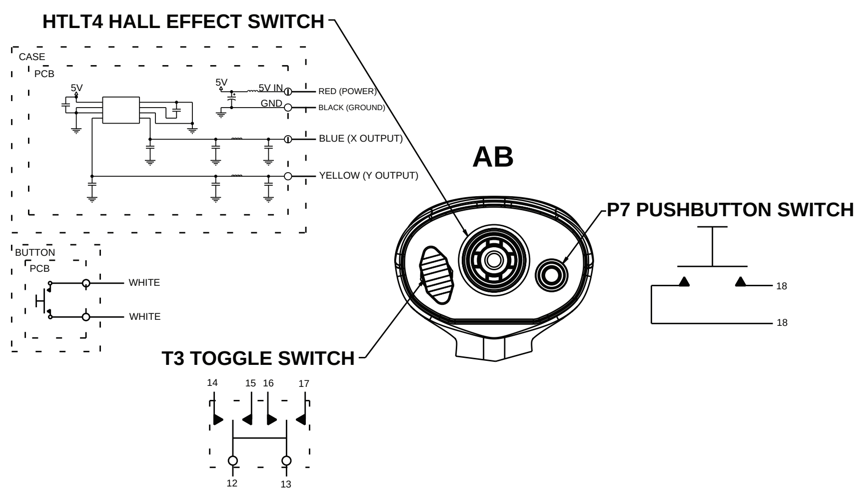
WITH BROW

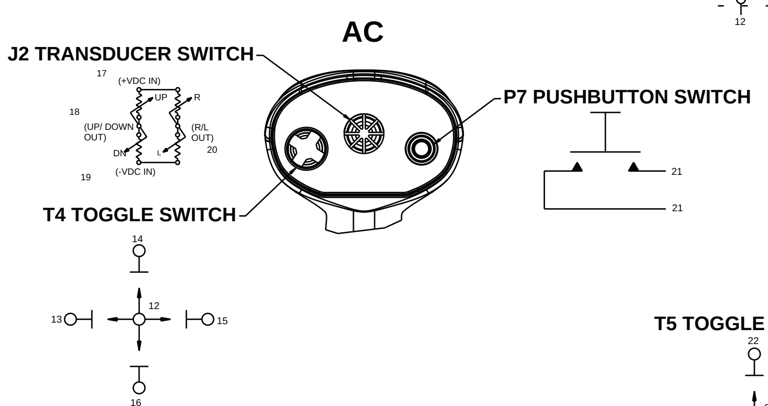
G2 COMMANDER GRIPS

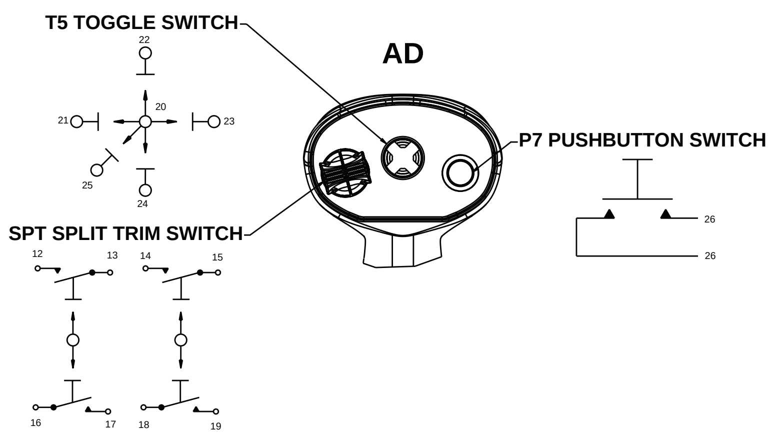
STANDARD CONFIGURABLE FACEPLATE OPTIONS

FACEPLATE OPTIONS



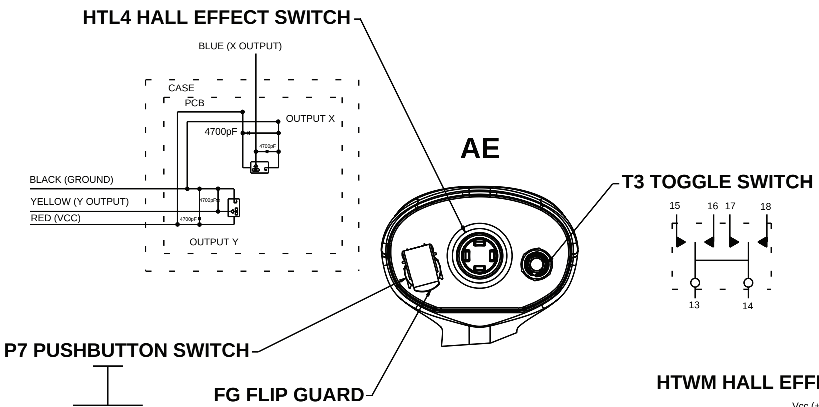


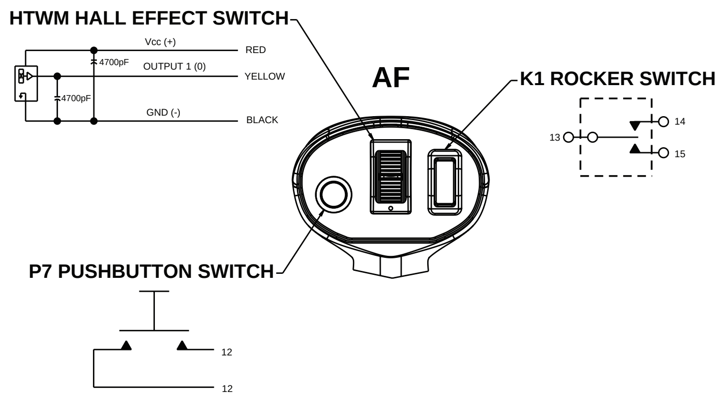


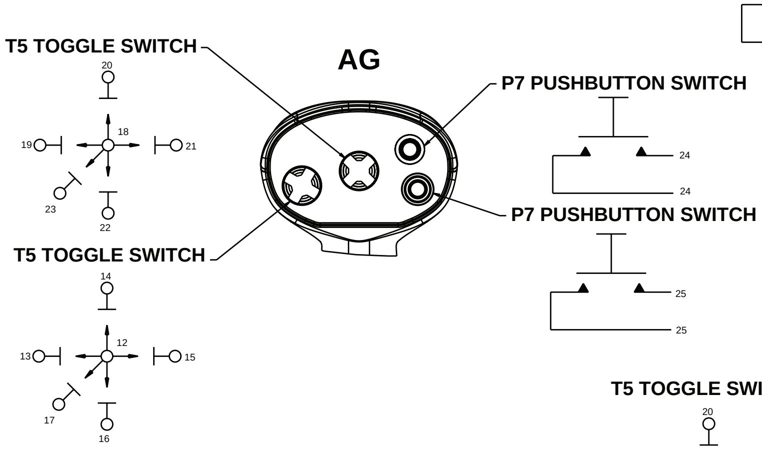


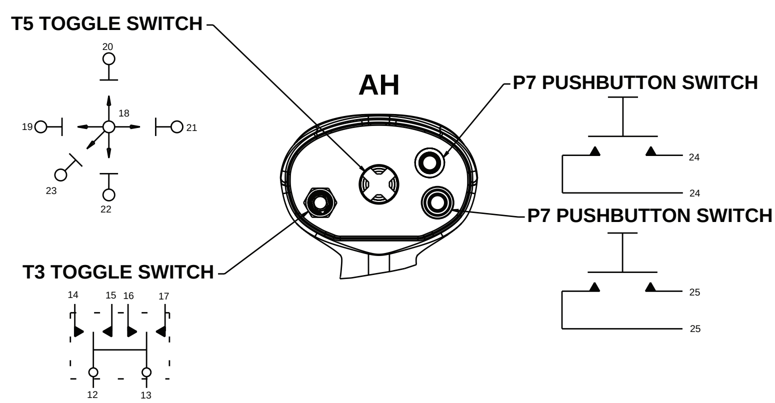
STANDARD CONFIGURABLE FACEPLATE OPTIONS

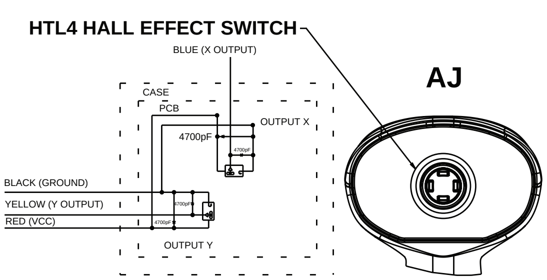
FACEPLATE OPTIONS











G3 UNIVERSAL GRIPS

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 with Blank AS Faceplate

G3-B Universal Grip with Custom Faceplate

G3-A Universal Grip with AB Faceplate

G3-B Universal Grip with BC Faceplate

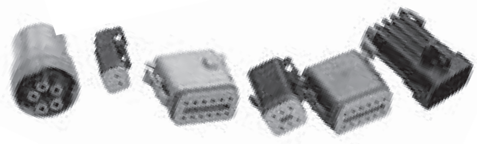
Internal View

G3-CK Universal Grip with Backlighted 8-Button Faceplate Keypad and 10-Button Side Keypad

G3-C Universal Grip with CP Faceplate

Custom Mounting Adapters Available

G3 Contour Grip Available in Left-hand and Right-hand Options

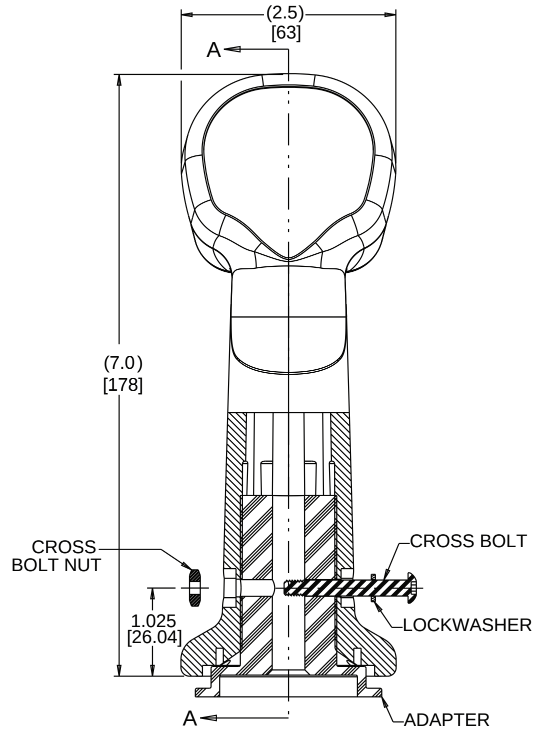


Custom Terminations Available

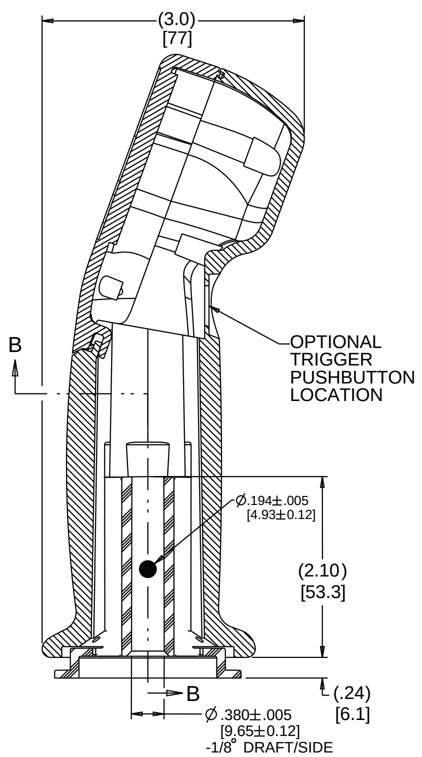
G3-A UNIVERSAL GRIP

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

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



SECTION B-B



SECTION A-A

Note: All dimensions are for reference only.

HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

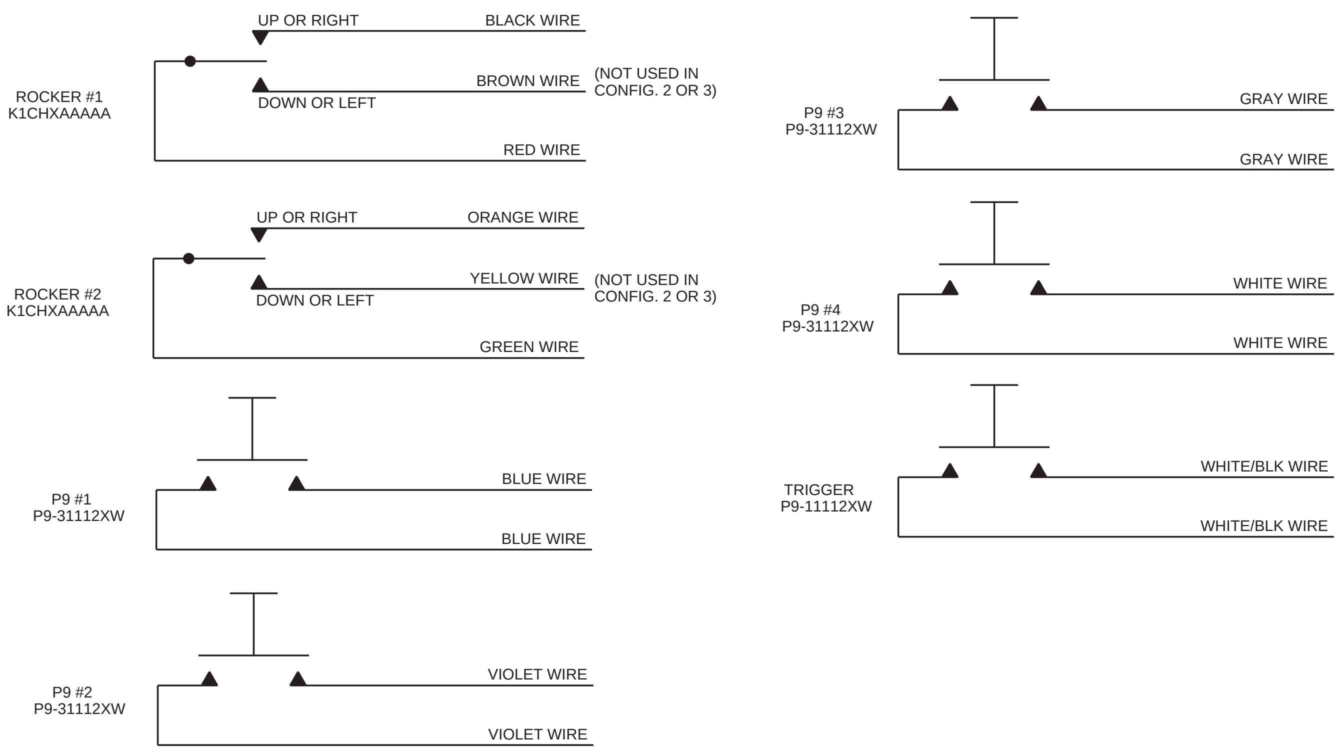
G3-A UNIVERSAL GRIP PART NUMBER CODE

G3-A X XX X X X X X X 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.** Red	**1.** Red	**1.** Red	**1.** Red
2. Grip Without Adapter		**2.** Black	**2.** On-Off	**2.** On-Off	**2.** Black	**2.** Black	**2.** Black	**2.** Black
		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

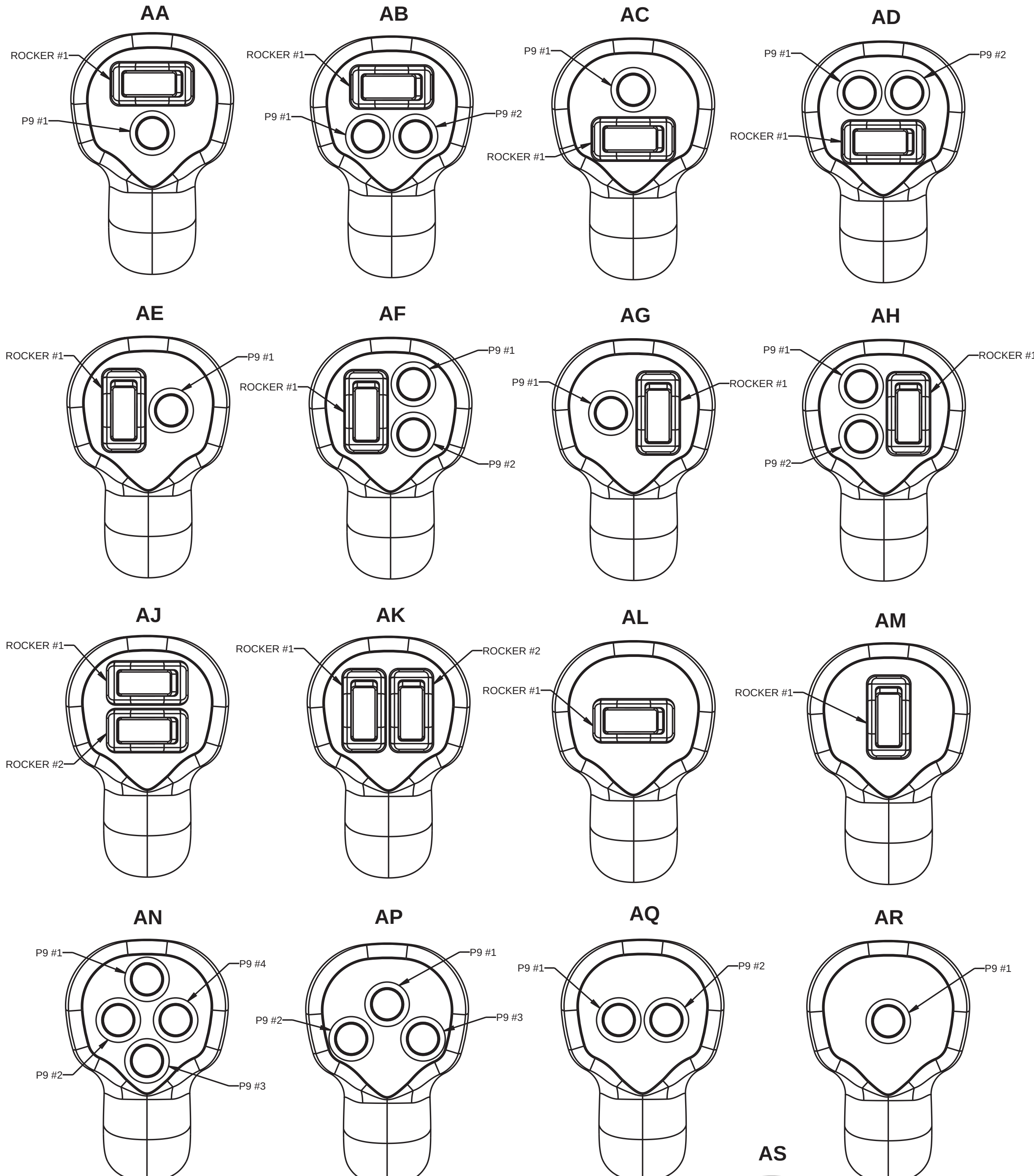
***** ( ) denotes momentary. On position or momentary position is up or to the right. Contact factory for rocker legends and additional color options.

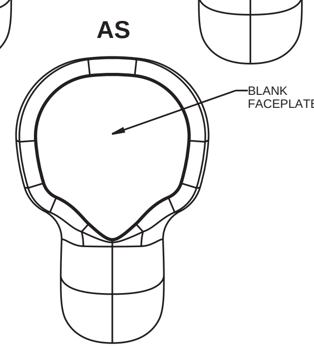
G3-A UNIVERSAL GRIP SCHEMATICS



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.

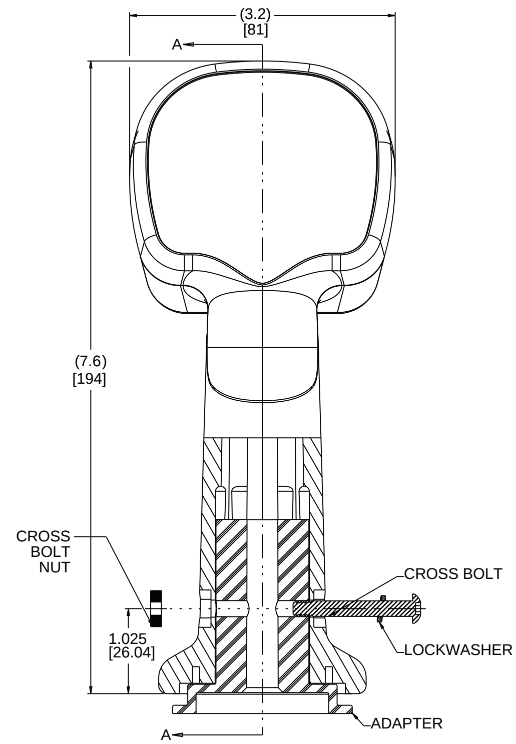
G3-B UNIVERSAL GRIPS

HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

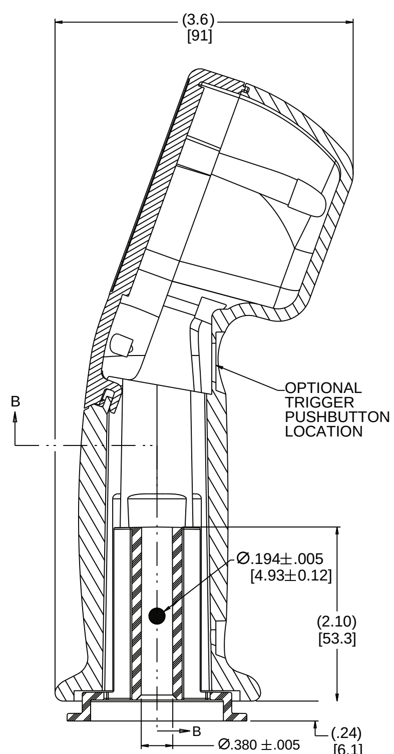
G3-B UNIVERSAL GRIP

Standard Characteristics/Ratings:				
ELECTRICAL RATINGS:	**Full Load**		**Logic Level**	
K1 Switches	@ 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	
P9 Switches	@ 28VDC		@5VDC	
Electrical Rating	5 AMP Resistive Load 3 AMP Inductive Load		10mA Resistive Load	
Electrical Life	25,000 Cycles		1,250,000 Cycles	
Thumbwheels				
Rated at Vcc=5V@20˚C; Load = 1ma (4-7K)	**Units M**	**In**	**Typ**	**Max**
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
MECHANICAL RATINGS				
K1 Switches				
Mechanical Life	100,000 Cycles			
P9 Switches				
Mechanical Life	1,250,000 Cycles			
Thumbwheels				
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)			
	Units	**Min**	**Typ**	**Max**
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			
ENVIRONMENTAL:	**Units**	**Min**	**Typ**	**Max**
Operating Temperature:	° C	-40*	20	85
K1 Switches				
Switch Seal Integrity	Watertight per IP68S (1 meter) and IP69K			
P9 Switches				
Switch Seal Integrity	Watertight per IP68S (1 meter) and IP69K			
Thumbwheels				
Electronics Seal Integrity	Watertight per IP68S (1 meter)			
Mechanical Seal Integrity	Unsealed			
Grip				
Seal Integrity	Unsealed			
MATERIALS:				
Handle	Thermoplastic, Glass Reinforced, Black			
Faceplate	Thermoplastic, Glass Reinforced, Black			
Mounting Hardware	#10 Crossbolt with Nut and Lockwasher			
Wires	22 AWG, UL Style 1569, (20” Long)			

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



SECTION B-B



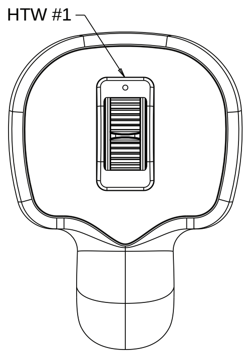
SECTION A-A

Note: All dimensions are for reference only.

STANDARD FACEPLATES

G3-B UNIVERSAL GRIP SWITCH CONFIGURATIONS

BA



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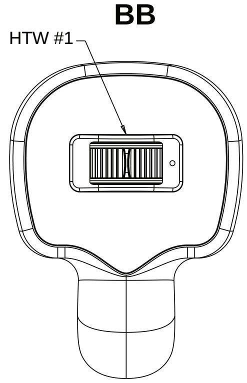

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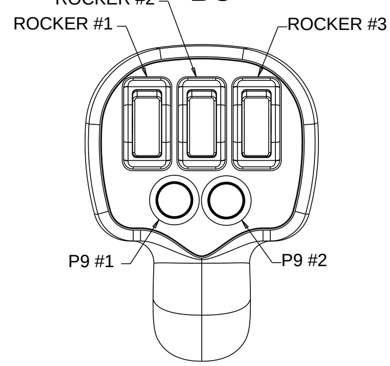

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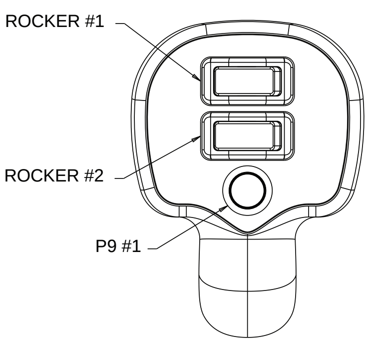

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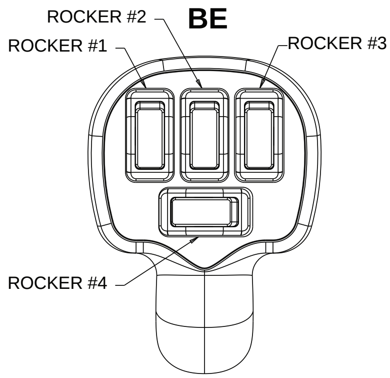

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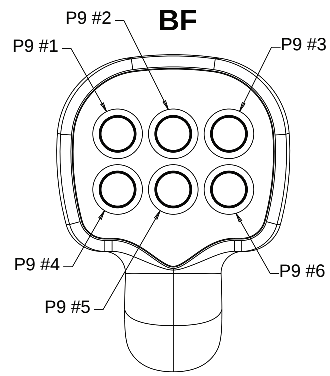

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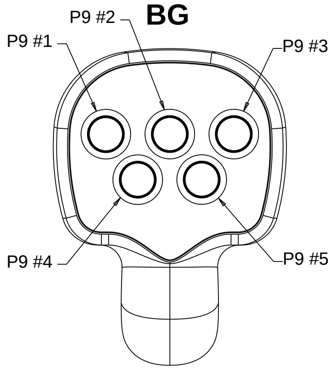

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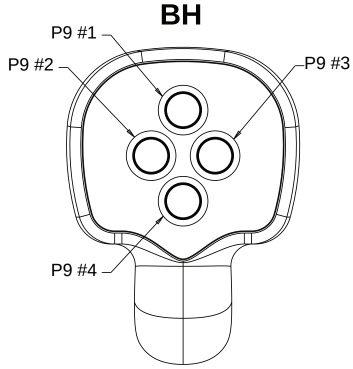
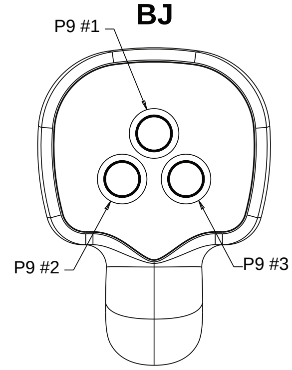


BJ



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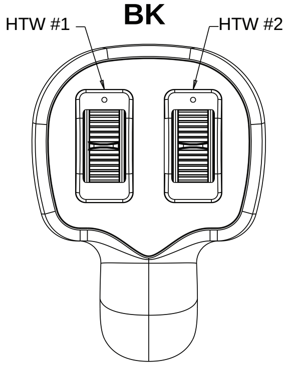

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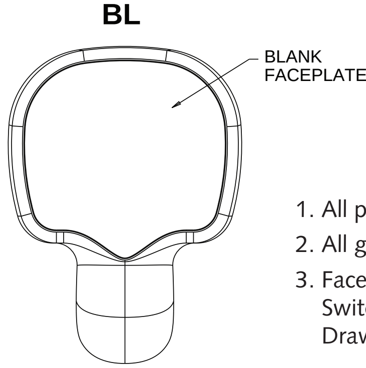


1. All pushbuttons are normally open (NO).
2. All grips have flying leads, 22 AWG & 20″ long.
3. Faceplates and switches are not actual size. Switches are not proportional to the faceplates. Drawings are for configuration reference only.

G3-B UNIVERSAL GRIPS

G3-B UNIVERSAL GRIP PART NUMBER CODE

G3-B X XX X X X X X — Part Number Code Continued Below

Configuration	Switches	Trigger Pushbutton in Handle	K1 Rocker #1 Style - Black *	K1 Rocker #2 Style - Black *	K1 Rocker #3 Style - Black *	K1 Rocker #4 Style - Black *
1. Grip With Adapter **2.** Grip Without Adapter	See Configuration Sheet on next page	**1.** None **2.** Black **3.** Red	**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)

***** ( ) 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

Cont. X X X X X X X X

HTW #1**	HTW #2**	P9 Button #1 Color	P9 Button #2 Color	P9 Button #3 Color	P9 Button #4 Color	P9 Button #5 Color	P9 Button #6 Color
1. None **2.** Return to Center[1] **3.** Friction[2] **4.** Return to End[3]	**1.** None **2.** Return to Center[1] **3.** Friction[2] **4.** Return to End[3]	**1.** Red **2.** Black **3.** Orange **4.** Yellow **5.** Green **6.** Blue **7.** Violet **8.** Gray **9.** White **N.** None	**1.** Red **2.** Black **3.** Orange **4.** Yellow **5.** Green **6.** Blue **7.** Violet **8.** Gray **9.** White **N.** None	**1.** Red **2.** Black **3.** Orange **4.** Yellow **5.** Green **6.** Blue **7.** Violet **8.** Gray **9.** Whit **N.** None	**1.** Red **2.** Black **3.** Orange **4.** Yellow **5.** Green **6.** Blue **7.** Violet **8.** Gray **9.** White **N.** None	**1.** Red **2.** Black **3.** Orange **4.** Yellow **5.** Green **6.** Blue **7.** Violet **8.** Gray **9.** White **N.** None	**1.** Red **2.** Black **3.** Orange **4.** Yellow **5.** Green **6.** Blue **7.** Violet **8.** Gray **9.** White **N.** None

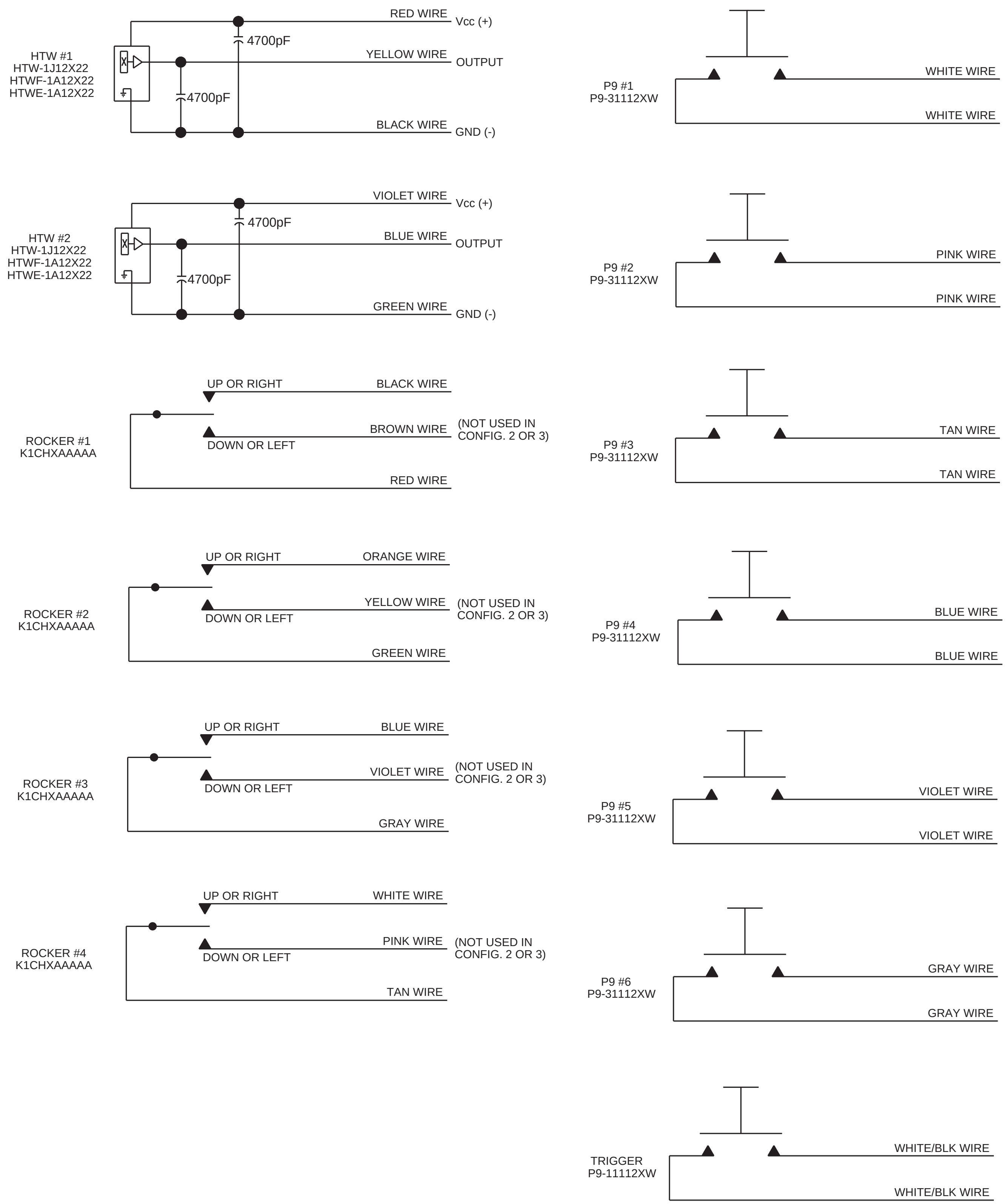
1 = HTW-1J12X22***
2 = HTWF-1A12X22***
3 = HTWE-1A12X22***

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

 Specifications Subject To Change Without Notice

HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

G3-B UNIVERSAL GRIP SCHEMATICS



G3-C UNIVERSAL GRIPS

HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

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 Backlighted 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:

ELECTRICAL RATINGS:

K1 Switches				
Electrical Rating @ 28 VDC	16 AMP Resistive Load; 7 AMP Inductive Load			
Electrical Life	25,000 Cycles at Full Load			
Keypads				
Circuit Configuration	SPST N.O.			
Voltage	1–32 VDC			
Current	10–100mA Resistive			
P9 Switches, Single and Dual Trigger				
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
HTWM Switches				
Rated at Vcc = 5V @ 25˚C; Load = 1ma (4-7KΩ)	**Units**	**Min**	**Typ**	**Max**
Supply Voltage	VDC	4.50	5.00	5.50
Output Voltage - Return to Center Tolerance at Center	VDC @ 5V Vcc	-.15	N/A	+.15
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, Iout=0	mA	N/A	N/A	10
HTWS Switches				
Rated at Vcc = 5V @ 25˚C; Load = 1ma (4-7KΩ)	**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 Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	20
HTLT4 Switches				
Rated at Vcc = 5V @ 25˚C; Load = 1ma (4-7KΩ)	**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 Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
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			
Grip Touch Switch				
Rated at Vcc = 5V @ 25˚C; Load = 1ma (4-7KΩ)	**Units**	**Min**	**Typ**	**Max**
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):

MECHANICAL RATINGS

K1 Switches	
Mechanical Life	100,000 Cycles
Keypads	
Mechanical Life	3,000,000 Cycles
P9 Switches, Single and Dual Trigger	
Mechanical Life	1,250,000 Cycles
HTWM Switches	
Mechanical Life (Full Forward to Full Back)	3,000,000 Cycles (Return to Center) 1,000,000 Cycles (Return to End)
HTWS Switches	
Mechanical Life (Full Forward to Full Back)	3,000,000 Cycles
HTLT4 Switches	
Mechanical Life	3,000,000 Cycles
TC-5 Switches	
Mechanical Life	3,000,000 Cycles

ENVIRONMENTAL:

	Units	**Min**	**Typ**	**Max**
Operating Temperature:	° C	-40*	20	85

K1 Switches	
Switch Seal Integrity	Watertight per IP68S and IP69K
Keypads	
Switch Seal Integrity	Watertight per IP68S and IP69K
P9 Switches, Single and Dual Trigger	
Switch Seal Integrity	Watertight per IP68S and IP69K
HTWM Switches	
Electronics Seal Integrity	Watertight per IP68S and IP69K
HTWS Switches	
Electronics Seal Integrity	Watertight per IP68S and IP69K
HTLT4 Switches	
Electronics Seal Integrity	Watertight per IP68S and IP69K
TC-5 Switches	
Electronics Seal Integrity	Watertight per IP68S and IP69K
Grip	
Seal Integrity	Unsealed

MATERIALS:

Handle	Thermoplastic, Glass Reinforced, Black
Faceplate	Thermoplastic, Glass Reinforced, Black
Keypads	Silicone Rubber, Black
Keypads, Lighted	Silicone Rubber, Black with White Graphic
Wires	22 AWG
Side Keypad Wires	24 AWG
Wire Length	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.

G3-C UNIVERSAL GRIPS

HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-C UNIVERSAL GRIP PART NUMBER CODE

G3-C X XX X X X X — **Part Number Code Continues Below**

Configuration

1. Grip With Adapter
2. Grip Without Adapter
3. Grip with Adapter, with Grip Touch Switch
4. Grip without Adapter, with Grip Touch Switch

Faceplate

See Configuration Sheet

Trigger in Handle

1. None
2. One Pushbutton, Black
3. Two Pushbuttons, Black
4. HTWS*
5. Single Direction Momentary
6. Dual Direction Momentary
7. Dual Direction Maintained

PB in Grip Head - Black

1. None
2. Left
3. Right
4. Left & Right

K1 Rocker #1 Style - Black **

1. None
2. ON-OFF
3. (ON)-OFF
4. ON-OFF-ON
5. (ON)-OFF-(ON)

K1 Rocker #2 Style - Black **

1. None
2. ON-OFF
3. (ON)-OFF
4. ON-OFF-ON
5. (ON)-OFF-(ON)

* 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

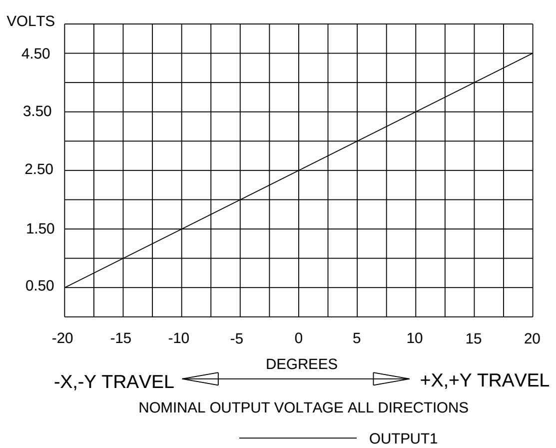
X X X X X X X X X X

HTWM #1***	HTWM #2***	P9 Button #1 Color	P9 Button #2 Color	P9 Button #3 Color	P9 Button #4 Color	P9 Button #5 Color	P9 Button #6 Color	P9 Button #7 Color	P9 Button #8 Color
1. None	**1.** None	**1.** Red	**1.** Red	**1.** Red	**1.** Red	**1.** Red	**1.** Red	**1.** Red	**1.** Red
2. Return to Center[1]	**2.** Return to Center[1]	**2.** Black	**2.** Black	**2.** Black	**2.** Black	**2.** Black	**2.** Black	**2.** Black	**2.** Black
3. Return to End[2]	**3.** Return to End[2]	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange
		4. Yellow	**4.** Yellow	**4.** Yellow	**4.** Yellow	**4.** Yellow	**4.** Yellow	**4.** Yellow	**4.** Yellow
		5. Green	**5.** Green	**5.** Green	**5.** Green	**5.** Green	**5.** Green	**5.** Green	**5.** Green
		6. Blue	**6.** Blue	**6.** Blue	**6.** Blue	**6.** Blue	**6.** Blue	**6.** Blue	**6.** Blue
		7. Violet	**7.** Violet	**7.** Violet	**7.** Violet	**7.** Violet	**7.** Violet	**7.** Violet	**7.** Violet
		8. Gray	**8.** Gray	**8.** Gray	**8.** Gray	**8.** Gray	**8.** Gray	**8.** Gray	**8.** Gray
1 = HTWM-1J12X22****		**9.** White	**9.** White	**9.** White	**9.** White	**9.** White	**9.** White	**9.** White	**9.** White
2 = HTWME-1A12X22****		**N.** None	**N.** None	**N.** None	**N.** None	**N.** None	**N.** None	**N.** None	**N.** None

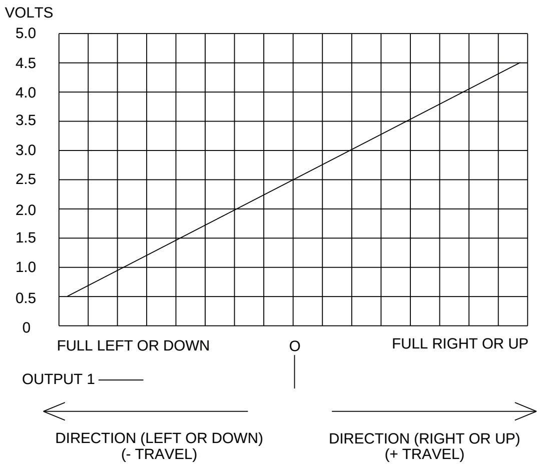
*** Positive travel is up or to the right. Contact factory for additional options.
**** Contact factory for additional options.

G3-C UNIVERSAL GRIP OUTPUT

HTLT4 OUTPUT

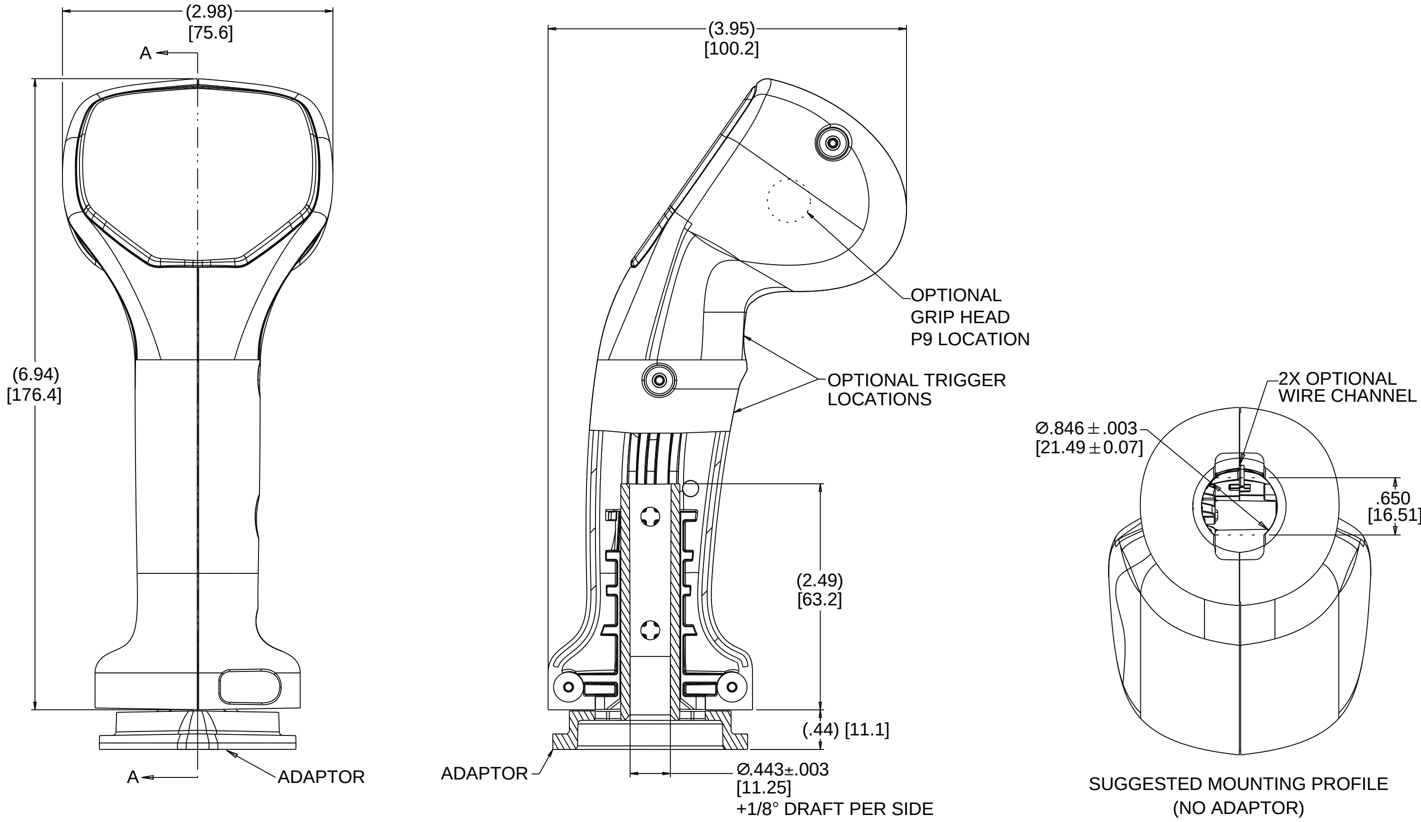


HTWM & HTWS OUTPUT

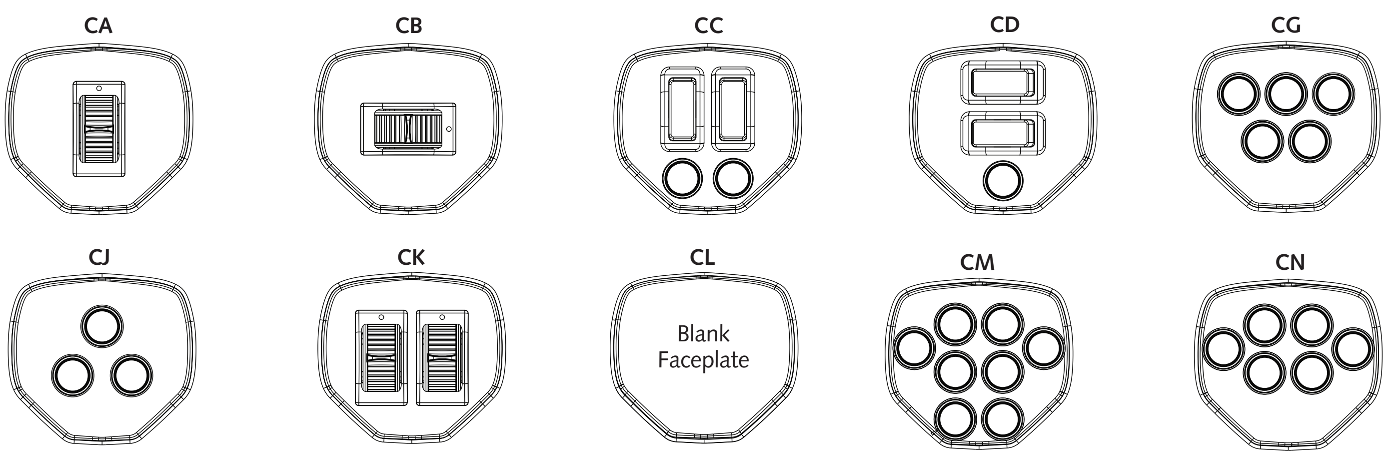


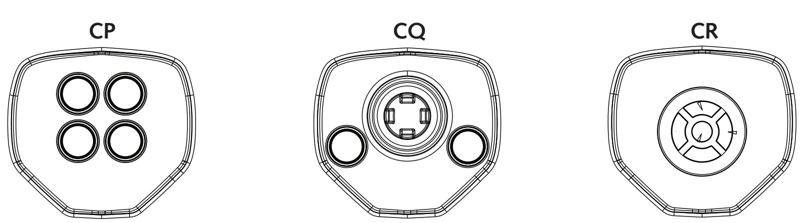
HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

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.

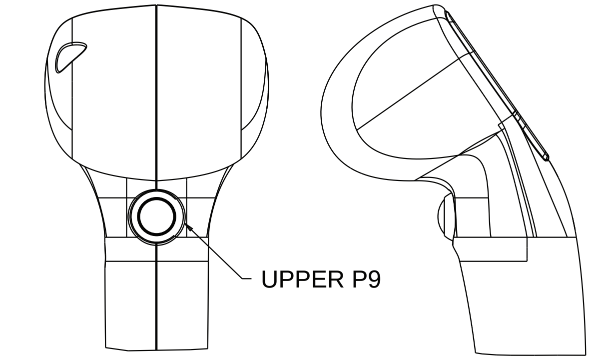
GRIPS

G3-C UNIVERSAL GRIPS

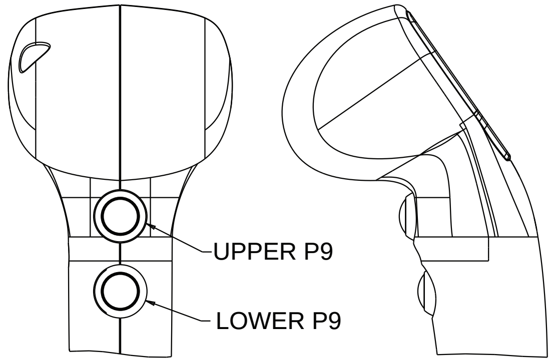
HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-C UNIVERSAL TRIGGER CONFIGURATIONS

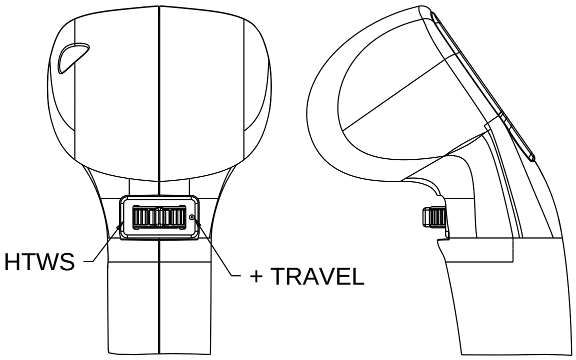
CONFIGURATION #2



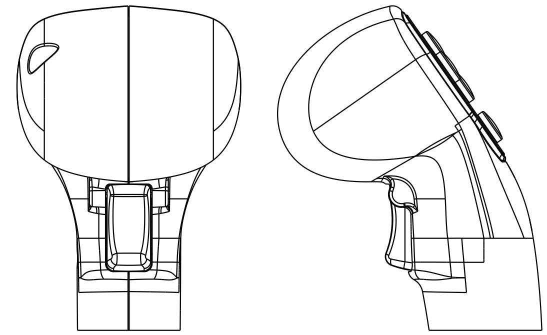
CONFIGURATION #3



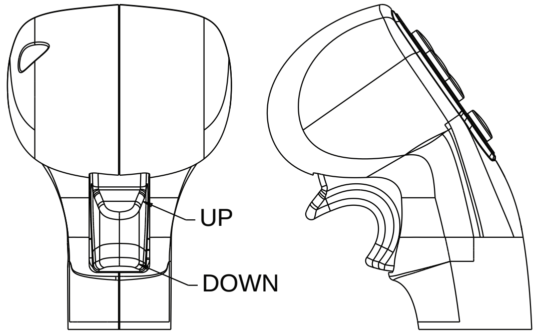
CONFIGURATION #4



CONFIGURATION #5

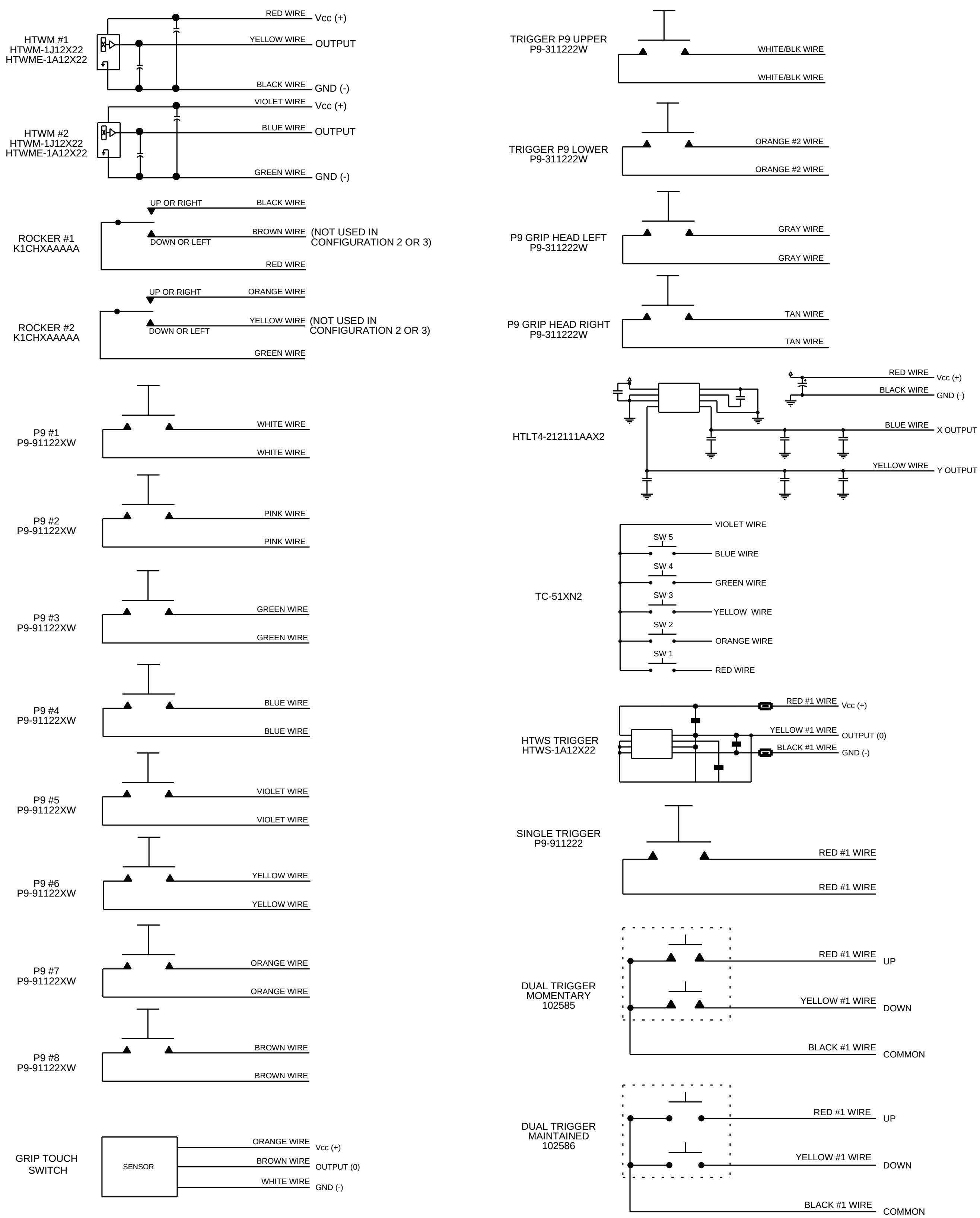


CONFIGURATION #6, 7



HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-C UNIVERSAL GRIP SCHEMATICS



G3-CK UNIVERSAL GRIPS WITH KEYPADS

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

1. No Adapter
2. With Adapter
3. Grip without Adapter, with Grip Touch Switch
4. Grip with Adapter, with Grip Touch Switch

Faceplate Keypad Configuration

4. 4 Buttons
6. 6 Buttons
8. 8 Buttons

Side Keypad Configuration

1. None
L. Left Hand
R. Right Hand

Back Lighting*

N. None
L. Lighted Faceplate Keypad & Side Keypad
F. Lighted Faceplate Keypad Only
S. Lighted Side Keypad Only

Trigger Option

1. None
2. One Pushbutton – Black
3. One Pushbutton – Red
4. Single
5. Dual Momentary
6. Dual Maintained
7. Two Pushbuttons – Black
8. Two Pushbuttons – Red
9. HTWS

P9 In Head (Black)

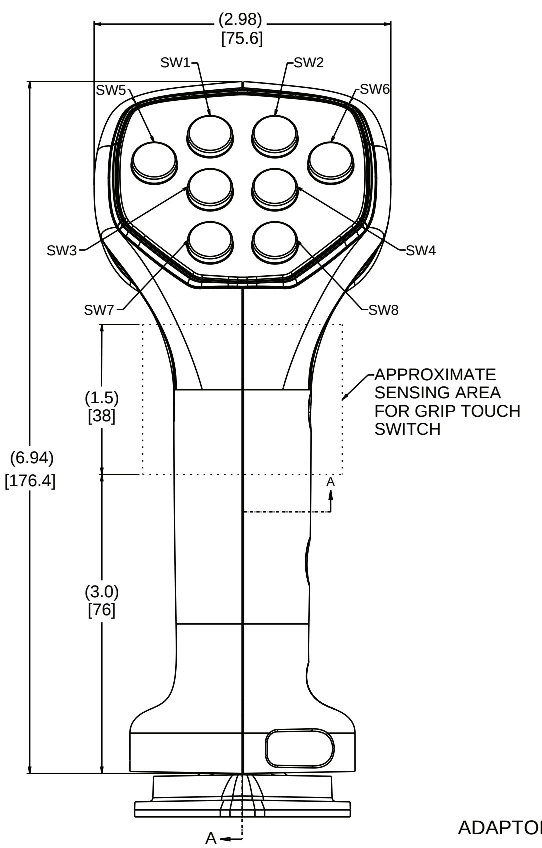
1. None
2. Left Hand
3. Right Hand
4. Both

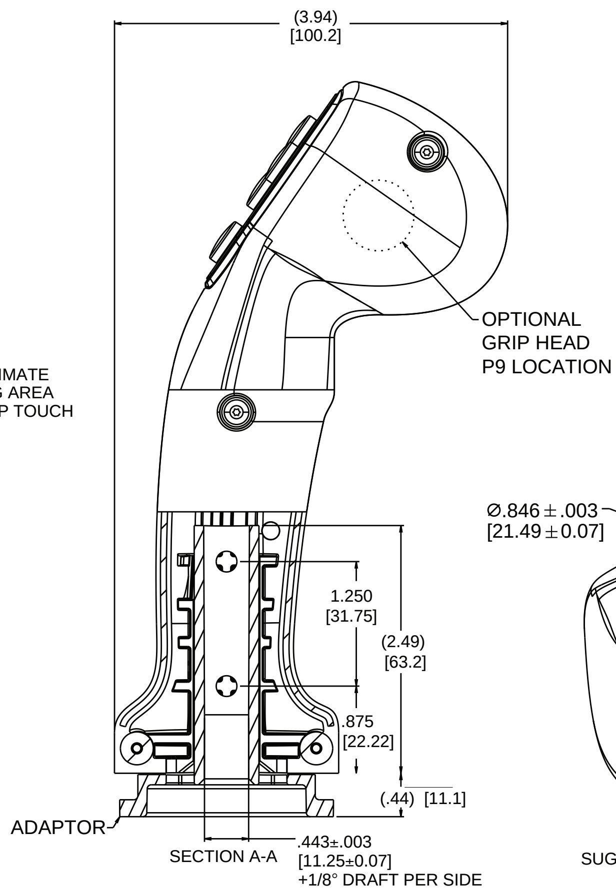
Grip Touch Switch**

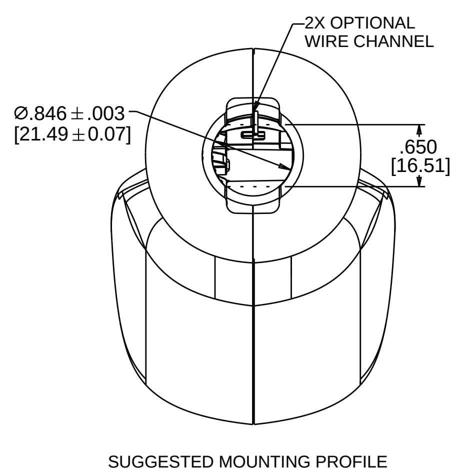
1. None
2. Handle

***** 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



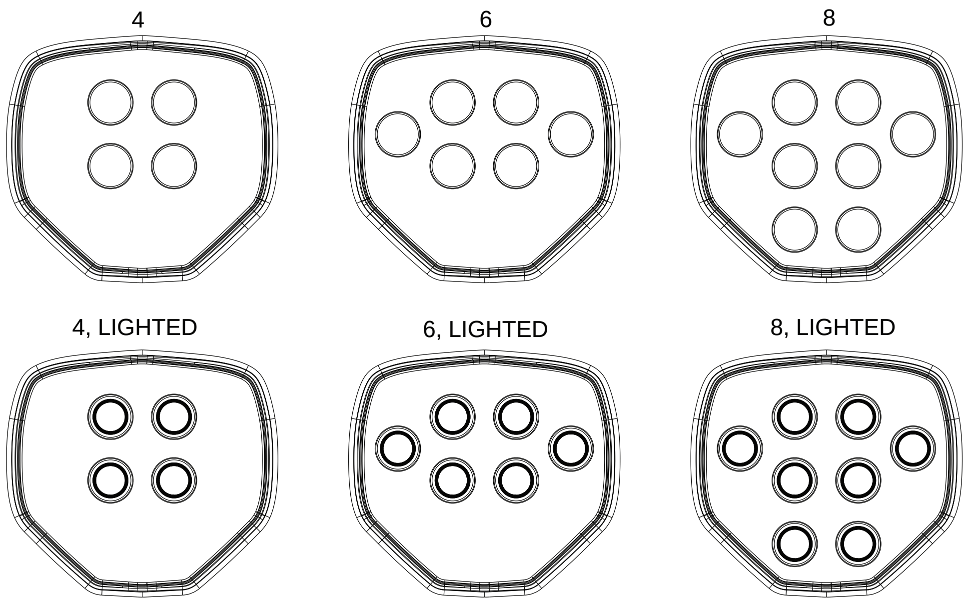




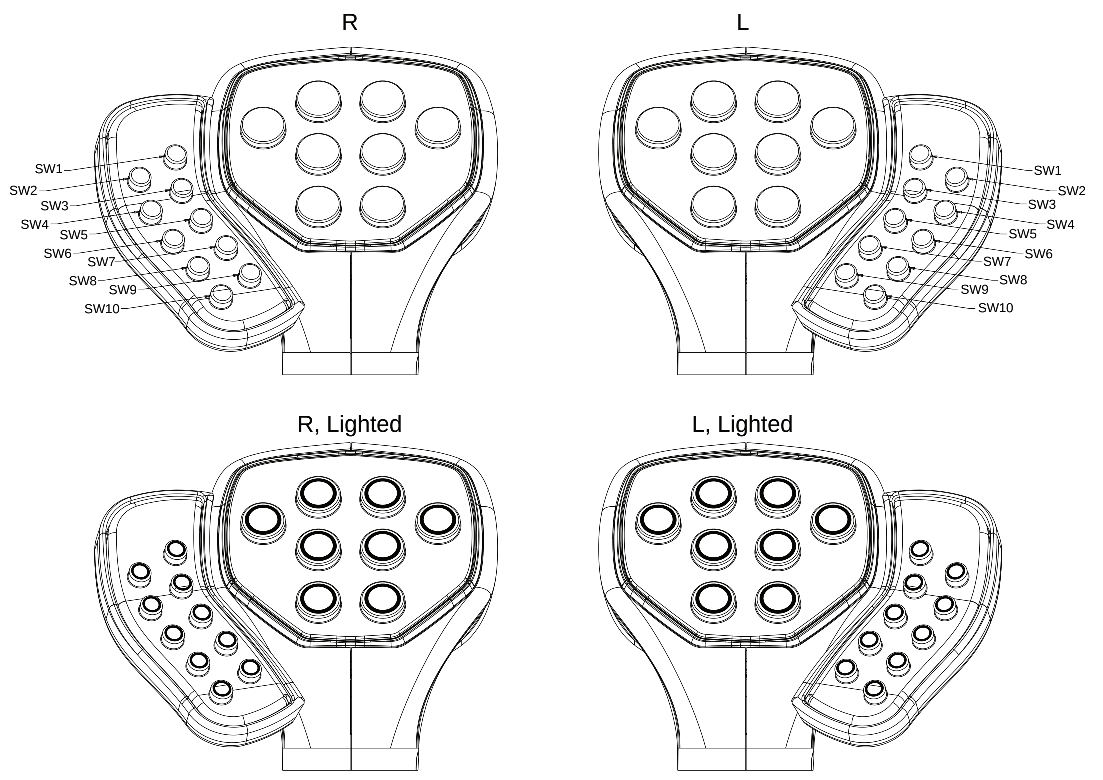
SUGGESTED MOUNTING PROFILE
(NO ADAPTOR)

HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-CK UNIVERSAL KEYPAD CONFIGURATIONS



CENTER KEYPAD CONFIGURATIONS



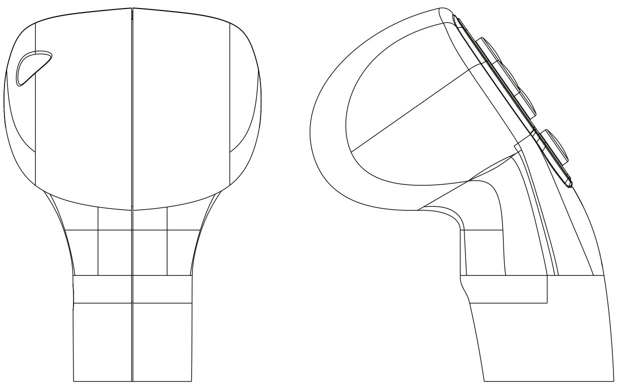
SIDE KEYPAD CONFIGURATIONS

G3-CK UNIVERSAL GRIPS WITH KEYPADS

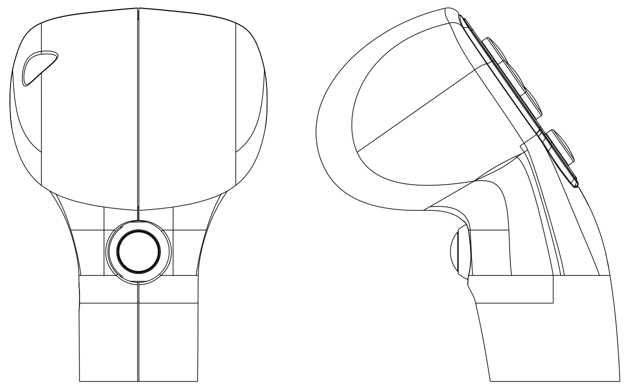
HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-CK UNIVERSAL TRIGGER CONFIGURATIONS

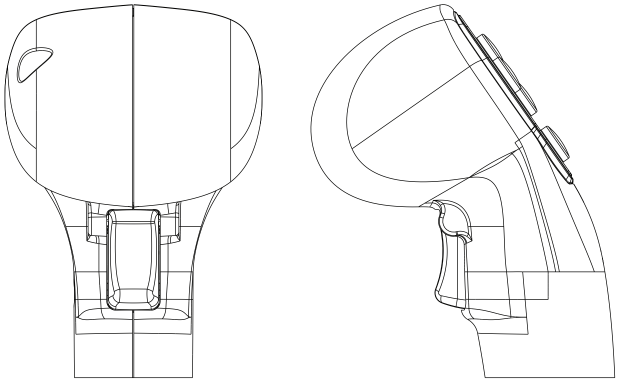
CONFIGURATION #1



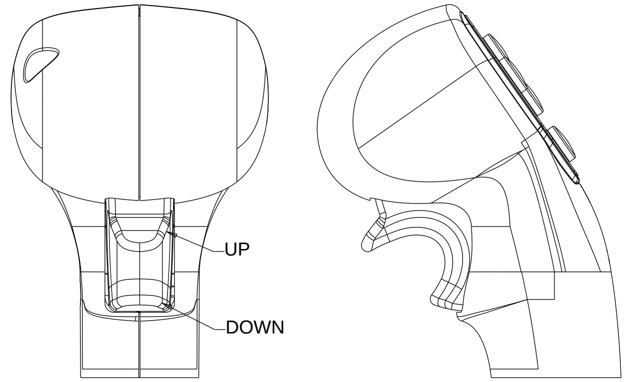
CONFIGURATION #2, 3



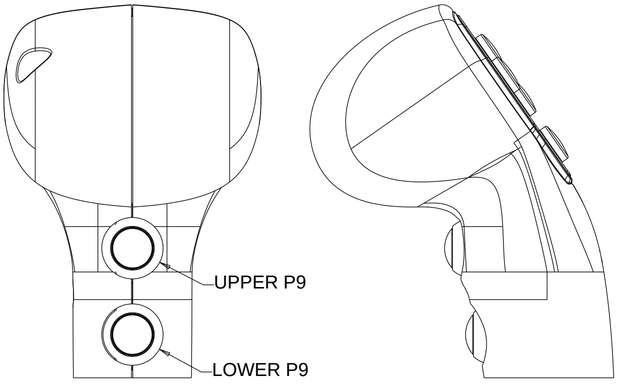
CONFIGURATION #4



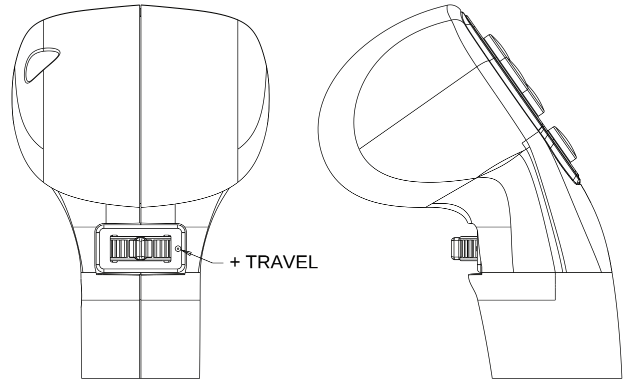
CONFIGURATION #5, 6



CONFIGURATION #7, 8



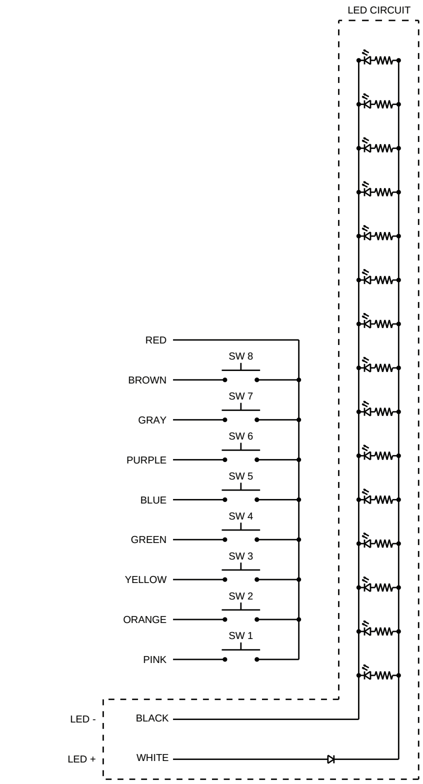
CONFIGURATION #9



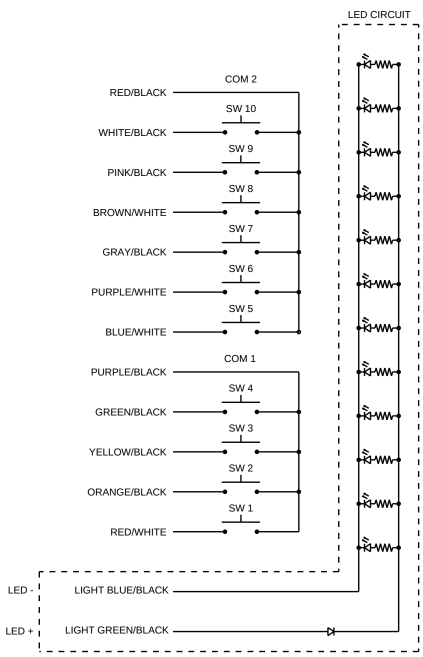
Specifications Subject To Change Without Notice

HIGH PERFORMANCE, HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-CK UNIVERSAL SCHEMATICS

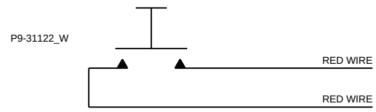


CENTER KEYPAD SCHEMATIC
WITH OPTIONAL LED
CIRCUIT SHOWN

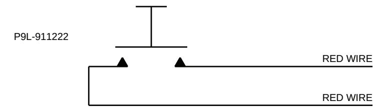


SIDE KEYPAD SCHEMATIC
WITH OPTIONAL LED
CIRCUIT SHOWN

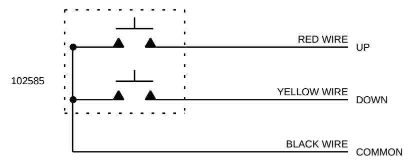
P9 TRIGGER



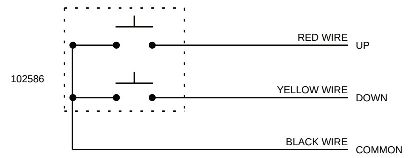
SINGLE TRIGGER



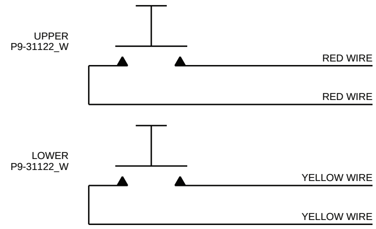
DUAL TRIGGER
MOMENTARY



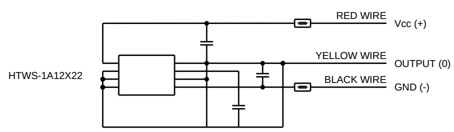
DUAL TRIGGER
MAINTAINED



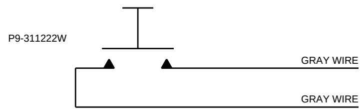
2 P9'S TRIGGER



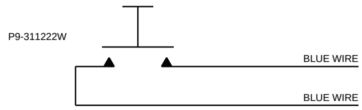
HTWS TRIGGER



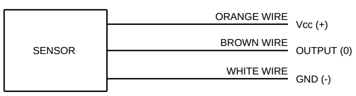
HEAD P9, LEFT



HEAD P9, RIGHT



GRIP TOUCH SWITCH



HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

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.

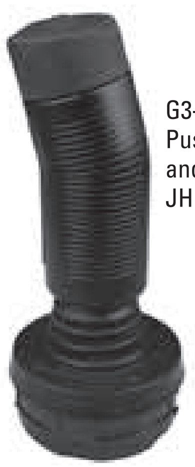
The G3-D Control Grip works well in industrial, agricultural, mining, utility and construction applications such as aerial work platforms, scissor lifts, bucket trucks, telehandlers, trenchers and track trucks.

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

G3-D PART NUMBER CODE

G3-D **X** **XX** **X** **X**

Mounting

1. Top Mount
2. Bottom Mount

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

OP & PB Configuration

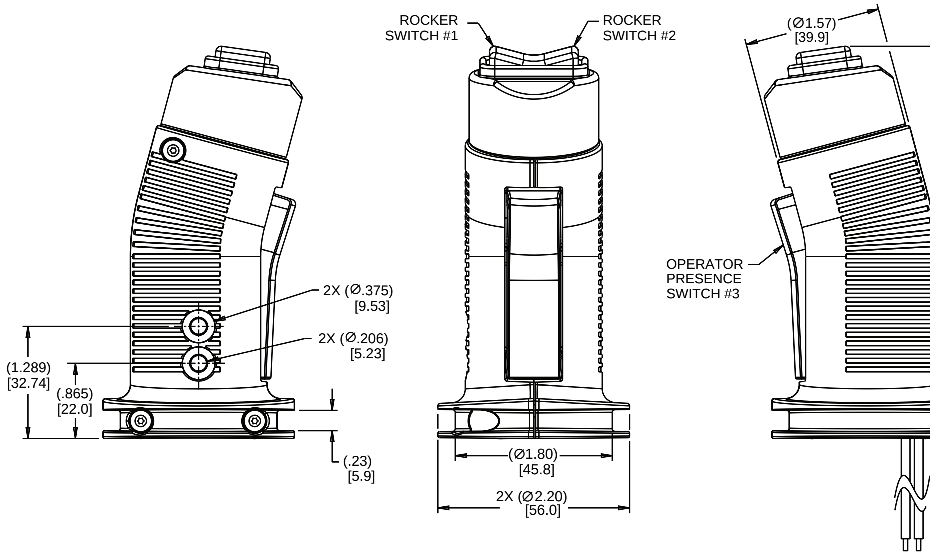
1. None*
2. Normally Open (NO)
3. 2 Circuit (NO/NC)**
4. 2 Circuit (NO/NC)***

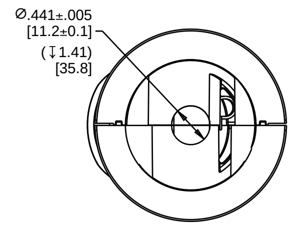
Termination

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

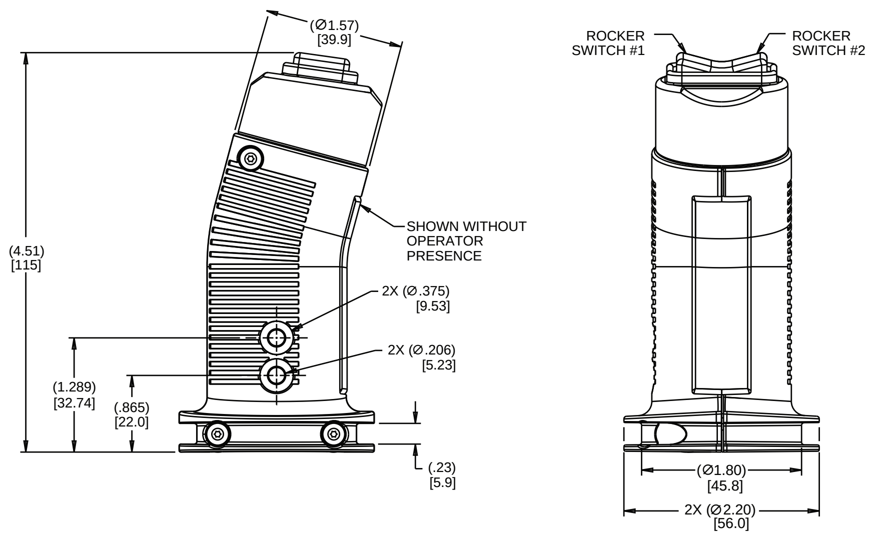


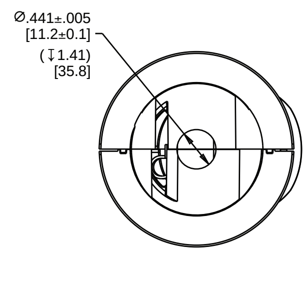


TOP MOUNT

CONFIGURATION 11:
ROCKER AND OPERATOR PRESENCE

Wires not shown in all views for clarity

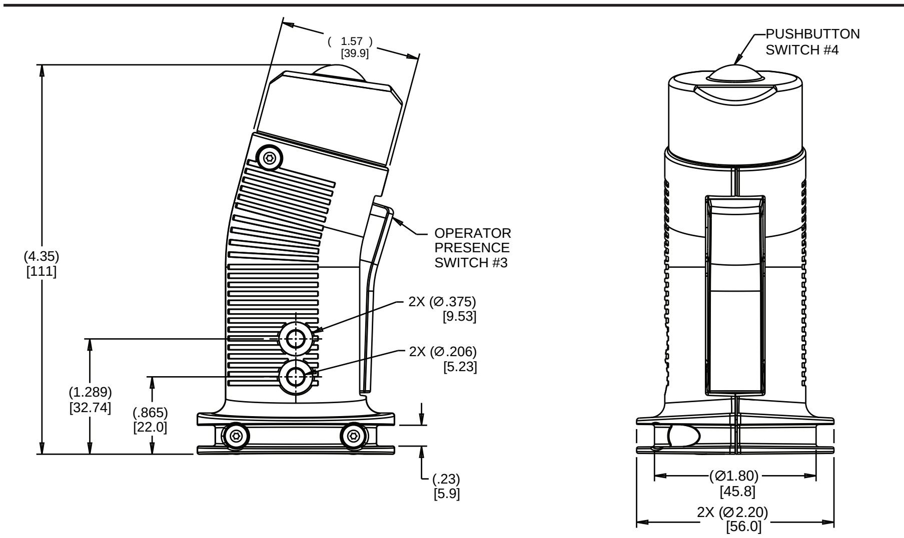


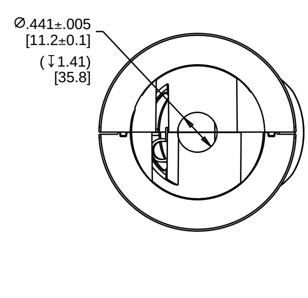


TOP MOUNT

CONFIGURATION 22:
ROCKER AND NO OPERATOR PRESENCE

Wires not shown for clarity





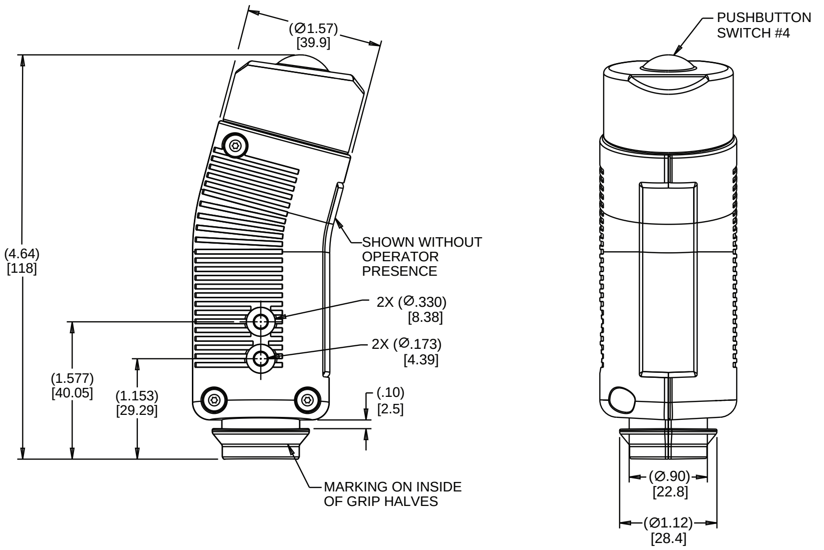
TOP MOUNT

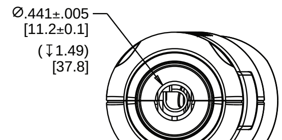
CONFIGURATION 33:
ONE PUSHBUTTON AND OPERATOR PRESENCE

Wires not shown for clarity

G3-D CONTROL GRIP

HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

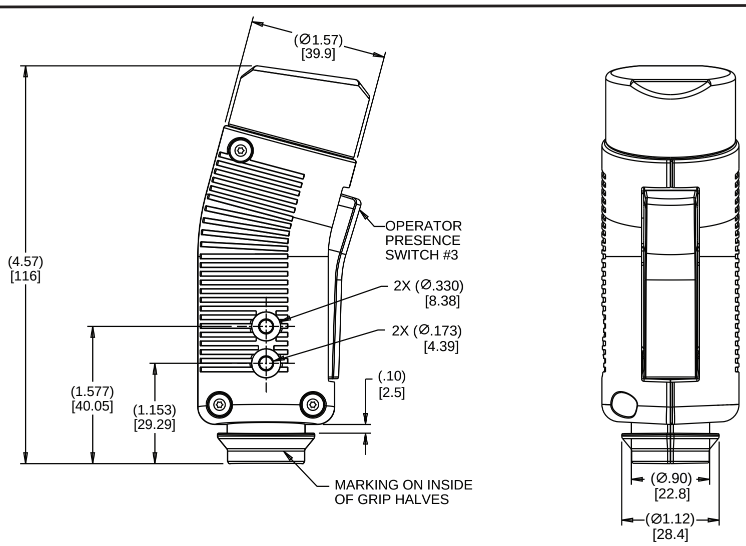


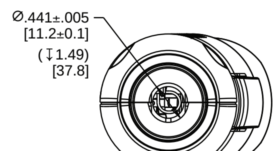


BOTTOM MOUNT

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

Wires not shown for clarity

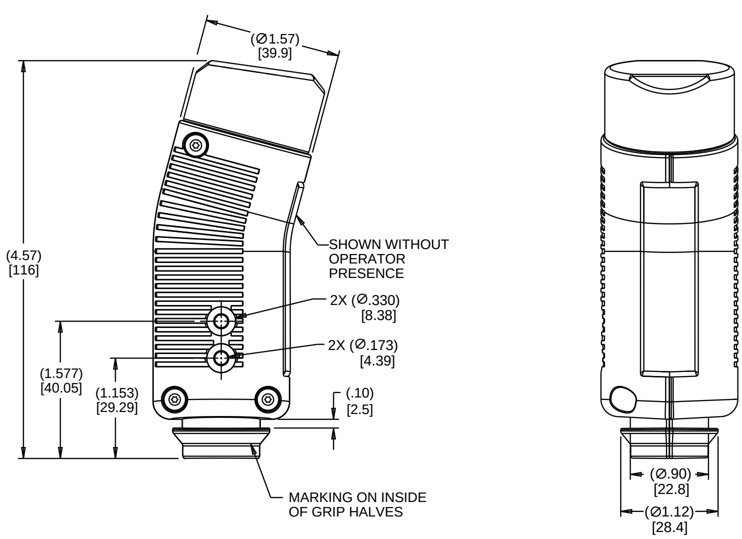


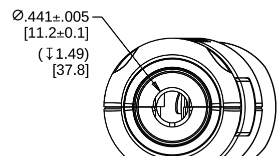


BOTTOM MOUNT

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

Wires not shown for clarity





BOTTOM MOUNT

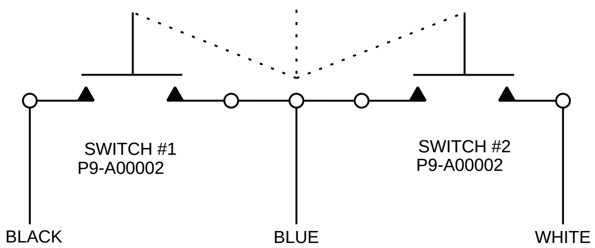
**CONFIGURATION 66:
NO PUSHBUTTON, NO ROCKER
AND NO OPERATOR PRESENCE**

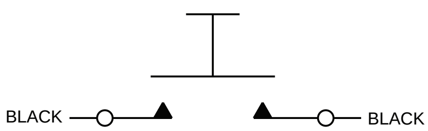
Wires not shown for clarity

G3-D CONTROL GRIP SCHEMATICS

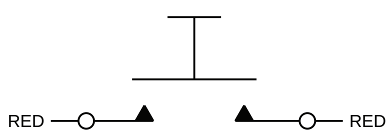
NORMALLY OPEN (NO) CIRCUITS

ROCKER



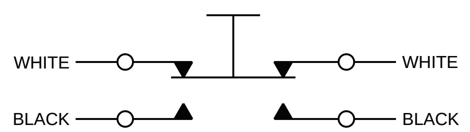


PUSHBUTTON
SWITCH #4
P9-A00002

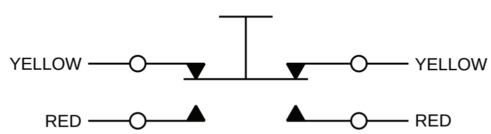


OPERATOR PRESENCE
SWITCH #3
P9-A00002

NORMALLY OPEN/NORMALLY CLOSED (NO/NC) CIRCUITS



PUSHBUTTON
SWITCH #4
P9-A00003



OPERATOR PRESENCE
SWITCH #3
P9-A00003

HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-E CONTROL GRIP

5-Button Left-Handed Grip

7-Button Right-Handed 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:				
ELECTRICAL RATINGS:				
U2 Hall Effect Rocker				
Rated @ Vcc = 5V @ 25˚C Load = 1ma (4-7Ω)	**Units**	**Min**	**Typ**	**Max**
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
Pushbuttons				
Electrical Rating @ 12 VDC	.050 AMP Resistive Load			
Circuit	SPST-NO			
MECHANICAL RATINGS				
U2 Hall Effect Rocker				
Mechanical Life 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
Pushbuttons				
Mechanical Life	3,000,000 Cycles			
Operating Force at 25˚ C	OZ	4	8	12
	N	1.1	2.2	2.3
ENVIRONMENTAL:	**Units**	**Min**	**Typ**	**Max**
Operating Temperature:	°C	-40	20	85
U2 Hall Effect Rocker				
Electronics Enclosure Design	IP68S			
Pushbuttons				
Electronics Enclosure Design	IP68S			
MATERIALS:				
Wires	26 AWG, MIL-W-22759/33, Color Per Schematic			

G3-E PART NUMBER CODE

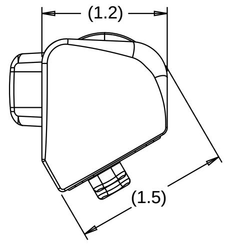
G3-E X X XX X X

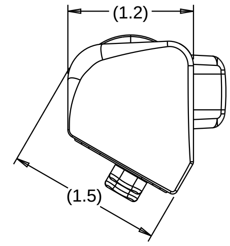
Configuration	**Grip Orientation**	**Rocker Output 1***	**Rocker Output 2****	**Operate Force**	**Termination**
1. 5-Button	**1.** Right	**AA.** 2.5 +/- 2.0 Vdc	None	**1.** Standard	**1.** Flying Leads
2. 7-Button	**2.** Left	**BB.** 2.5 +/- 2.0 Vdc	2.5 +/- 2.0 Vdc		
		CC. 2.5 +/- 2.0 Vdc	2.5 +/- 2.0 Vdc		
		DD. 2.5 +/- 1.5 Vdc	None		
		EE. 2.5 +/- 1.5 Vdc	2.5 +/- 1.5 Vdc		
		FF. 2.5 +/- 1.5 Vdc	2.5 +/- 1.5 Vdc		
		GG. 1.0 - 4.0 Vdc	1.0 - 4.0 Vdc		
		HH. 0.5 - 4.5 Vdc	0.5 - 4.5 Vdc		

* 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.

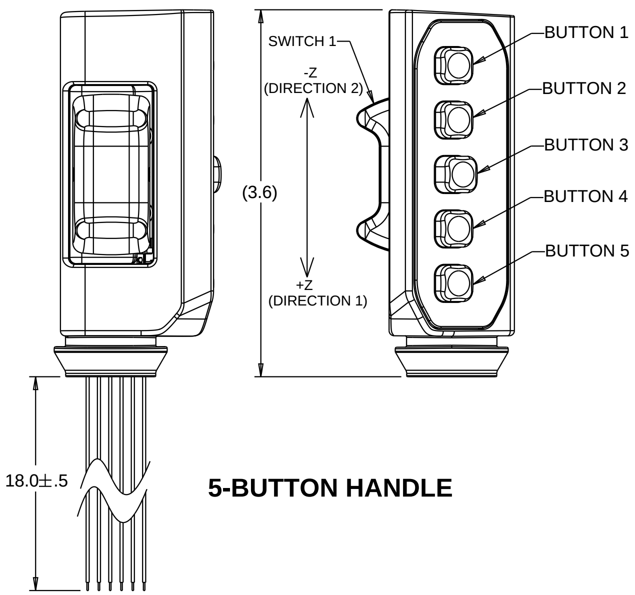
**Option "BB" and "EE" provide redundant output 2 which duplicates output 1. Option "CC" and "FF" provide redundant output 2 which is inverse of output 1.

G3-E CONTROL GRIP



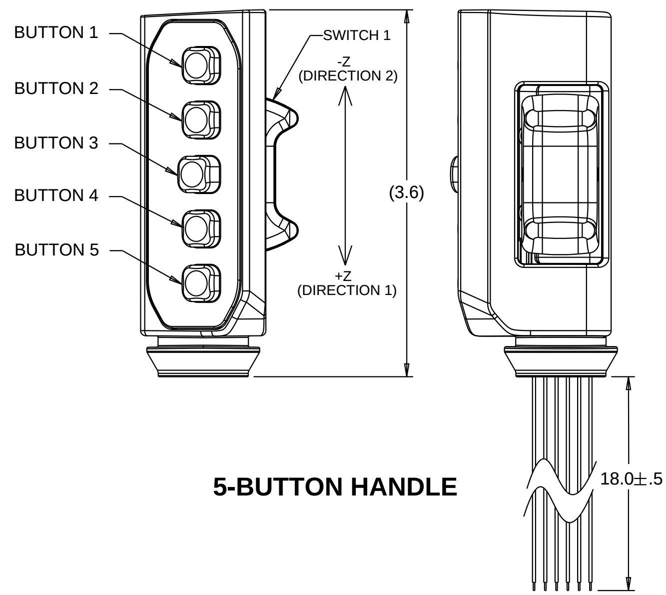


GRIP ORIENTATION LEFT

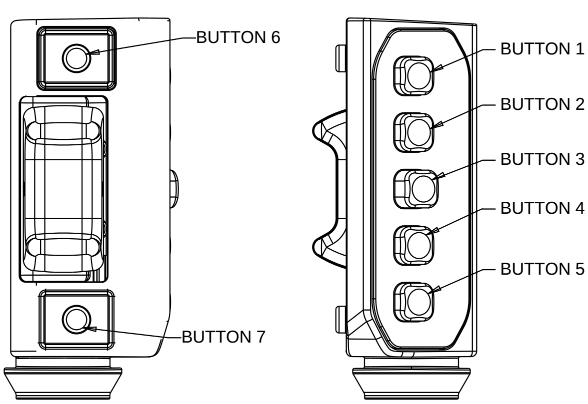


5-BUTTON HANDLE

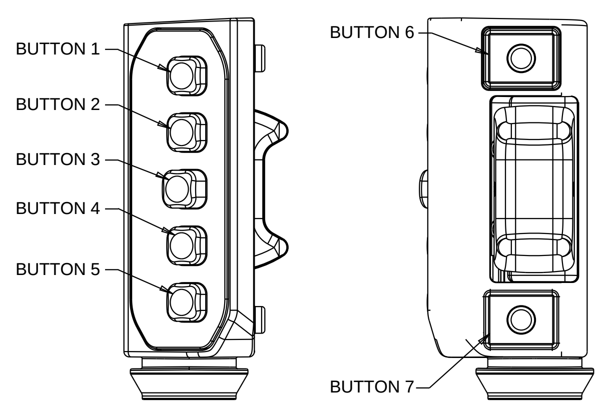
GRIP ORIENTATION RIGHT



5-BUTTON HANDLE



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



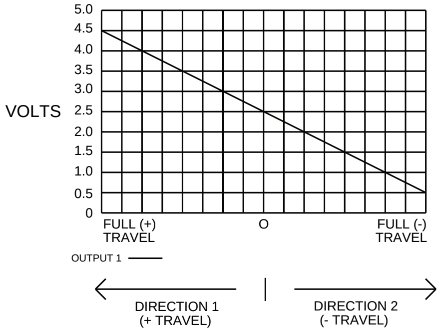
7-BUTTON HANDLE
(Switch and wire info same as 5-Button)

G3-E CONTROL GRIP

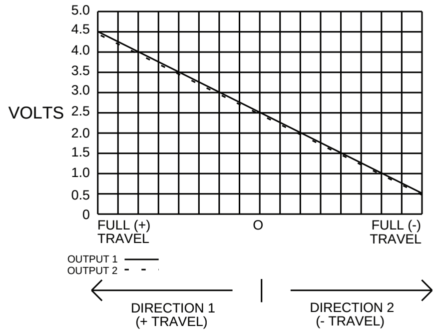
HEAVY EQUIPMENT AND MATERIAL HANDLING GRIPS

G3-E CONTROL GRIP OUTPUT

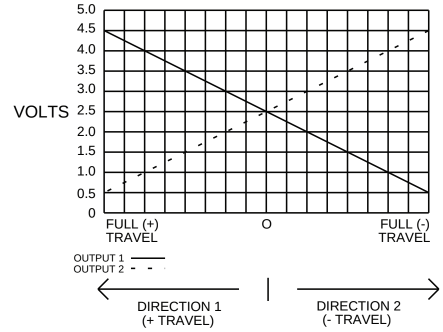
OPTION AA



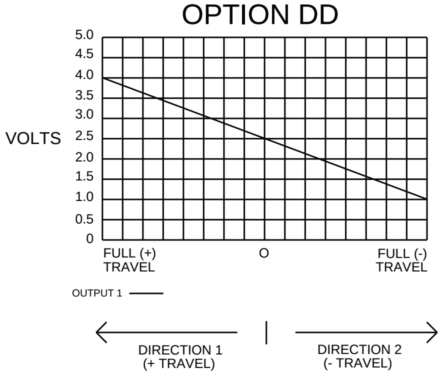
OPTION BB



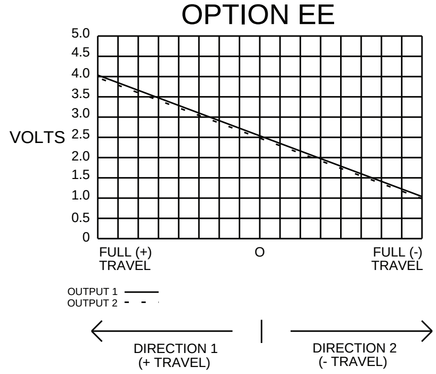
OPTION CC



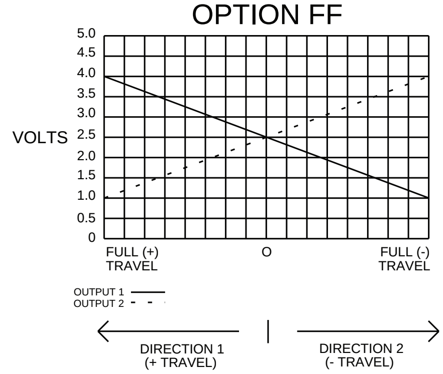
OPTION DD



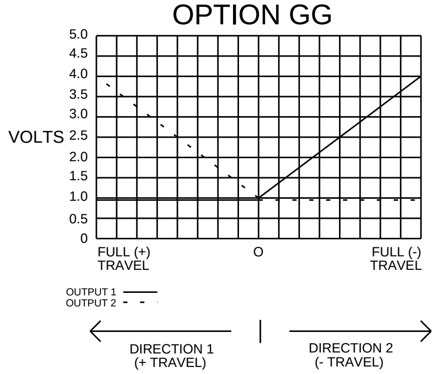
OPTION EE



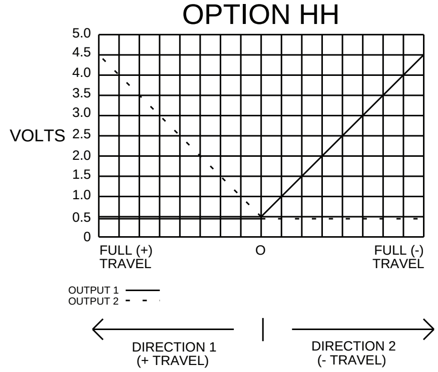
OPTION FF



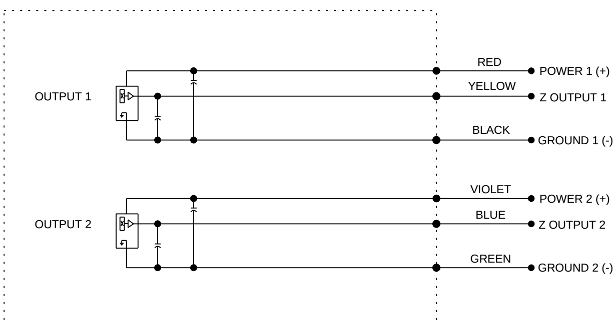
OPTION GG



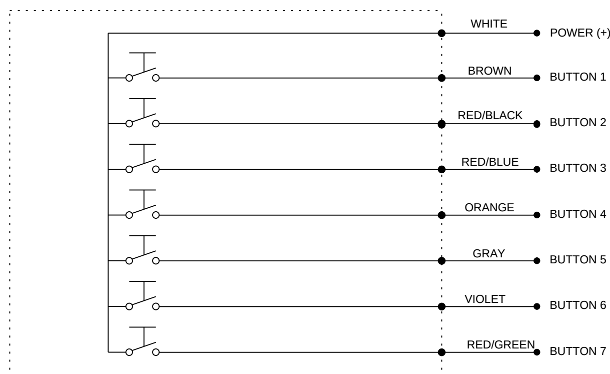
OPTION HH



G3-E CONTROL GRIP SCHEMATICS



SWITCH 1 SCHEMATIC
(OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS)



PUSHBUTTON SCHEMATIC
(BUTTONS 6 AND 7 NOT PRESENT IN ALL CONFIGURATIONS)

G3 DUAL GRIP REMOTE

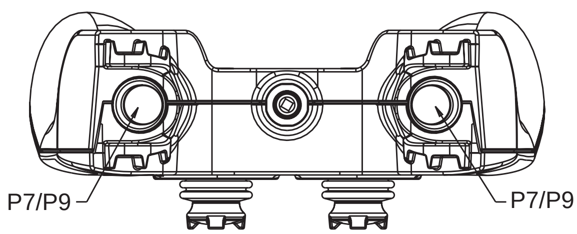
TWO-HANDED GAME STYLE GRIP, ERGONOMIC DESIGN

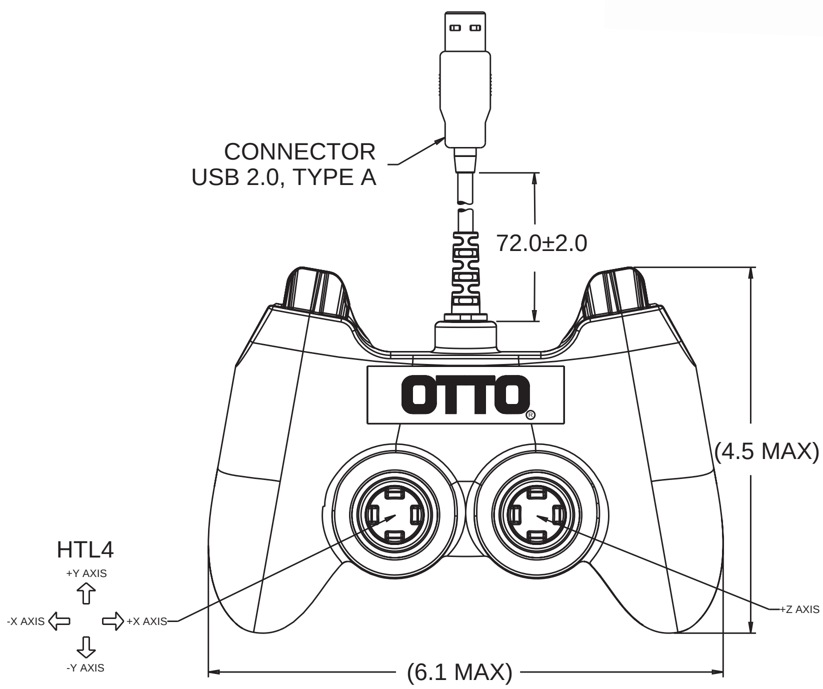
The G3 Dual Grip remote is a durable, lightweight, two-handed game style grip. Its ergonomic design allows for comfortable extended use and its molded body eliminates the need for tooling charges. The G3 dual grip remote accommodates OTTO's standard HTL and P7/P9 series switches, with your choice of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

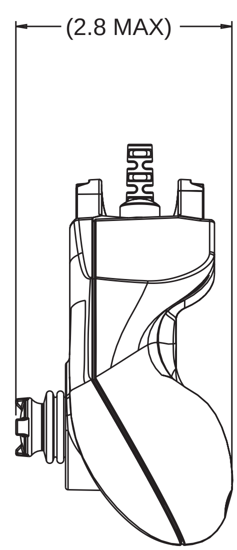
Standard Configuration
Shown (G3-0360)

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**







G3 COMMERCIAL GRIPS

HEAVY EQUIPMENT & MATERIAL HANDLING GRIPS

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.

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.

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**

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

HALL EFFECT FORWARD/NEUTRAL/REVERSE ROCKER

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:

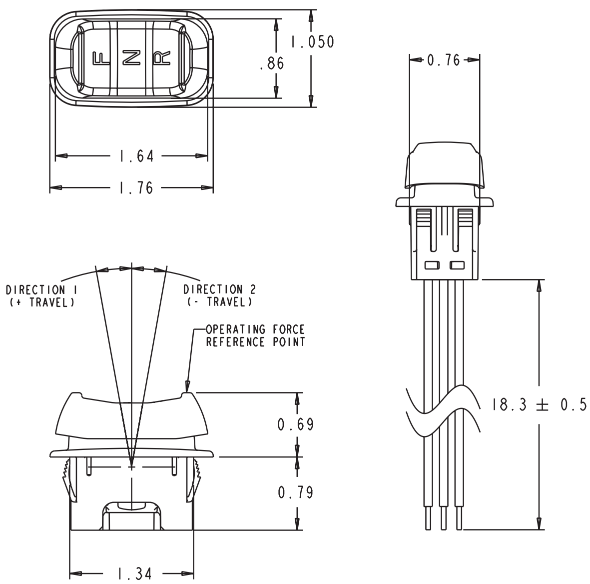
Operating Temp Range:	-40°C to +85°C
Humidity:	96% RH, 70°C, 96 hours
Vibration:	Per MIL-810F minimum integrity
EMI:	Withstand per SAE J1113 (contact factory for details)
RFI:	Withstand per SAE J1113 (contact factory for details)

MATERIALS:

Button:	Thermoplastic
Bezel:	Thermoplastic
Mounting Hardware:	None provided

HALL EFFECT FORWARD/NEUTRAL/REVERSE ROCKER

3-POSITION ANALOG OUTPUT SNAP-IN ROCKER WITH BACKLIGHTING

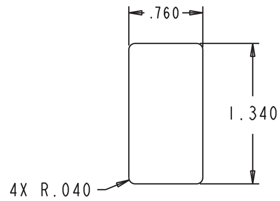


MOUNTING:

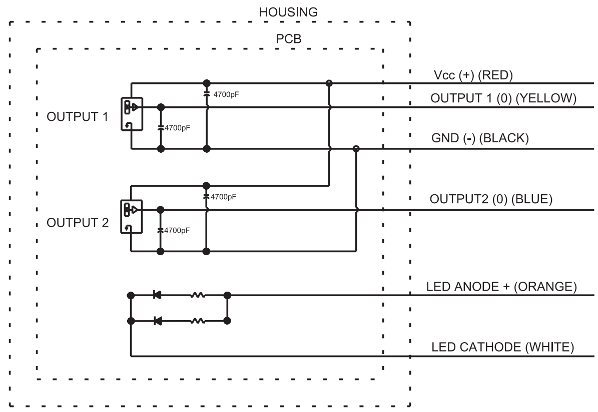
RECOMMENDED PANEL THICKNESS: 0.112 OPTIMUM THICKNESS
(0.040 MIN. - 0.205 MAX.)

RECOMMENDED PANEL OPENING: 0.760 X 1.340 OPTIMUM
(0.760/.770 X 1.335/1.345)

RECOMMENDED PANEL RADII: 0.040 OPTIMUM
(0.070 MAX.)

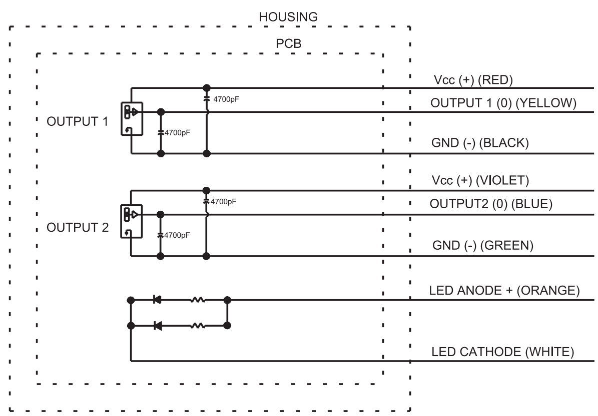


WIRING OPTION 1
COMMON POWER AND GROUND



OUTPUT 2 AND LED ARE NOT PRESENT IN ALL CONFIGURATIONS

WIRING OPTION 2
SEPARATE POWER AND GROUND



OUTPUT 2 AND LED ARE NOT PRESENT IN ALL CONFIGURATIONS

HFNR PART NUMBER CODE

HFNR – X X X X X X X X X

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	FNR 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	**1.** Red	**A.** NONE
B. 2V Green LED	**B.** 4.5/2.5/0.5VDC	4.5/2.5/0.5VDC	**2.** Separate Power and Ground				**2.** Black	**2.** Black ①	**B.** FNR/White ①
C. 2V Amber LED	**C.** 4.5/2.5/0.5VDC	0.5/2.5/4.5VDC					**4.** Yellow	**3.** Orange	
D. 5V Green LED	**D.** 4.0/2.5/1.0VDC	NONE ④					**6.** Blue	**4.** Yellow	
E. 5V Amber LED	**E.** 4.0/2.5/1.0VDC	4.0/2.5/1.0VDC					**8.** Gray	**5.** Green	
F. 12V Green LED	**F.** 4.0/2.5/1.0VDC	1.0/2.5/4.0VDC						**6.** Blue	
G. 12V Amber LED	**G.** 1.0/2.5/4.0VDC	4.0/2.5/1.0VDC						**7.** Violet	
H. 24V Green LED	**H.** 1.0/1.0/4.0VDC	4.0/1.0/1.0VDC						**8.** Gray	
J. 24V Amber LED								**9.** White	

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.

HALL EFFECT FOOT PEDAL

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.

Bidirectional
(Dual Direction)
Foot Pedal

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**

Standard Characteristics/Ratings:

MECHANICAL:	
Mechanical Life:	9,000,000 cycles
Vibration:	10g. 24Hz to 2KHz swept sinusoidal
TRAVEL ANGLE:	
Degrees:	13° nominal dual direction, 15° nominal single direction
Operating Force (lbs.):	14.0 lbs. typical -40°C to +85°C at load reference point
Electrical Life:	9,000,000 cycles

ELECTRICAL RATINGS:

Electrical	Units	Min	Typ	Max
Supply Current Per Sensor	mA	N/A	N/A	10
Output Resistance (Io ≤ -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°

Note: Limit switch outputs will source limit switch supply voltage when actuated.

ELECTRONICS:	
Seal:	Electronics IP68S
RFI:	Withstand per SAE J1113
EMI:	Withstand per SAE J1113
ENVIRONMENTAL:	
Operating Temp Range:	-40°C to +85°C
Humidity:	96% RH, 70°C, 96 hours
Drop:	1 Ft. Max. to Concrete
Vibration:	10g. 24Hz - 2KHz; Swept Sinusoidal
Sand/Dust:	Withstand per SAE J1455
MATERIALS:	
Foot Pedal Plate:	Zinc and high corrosion trivalent chromate
Housing:	PPE/PA
Cable:	22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket
Mounting Hardware:	None provided

HALL EFFECT FOOT PEDAL

SINGLE DIRECTION & DUAL DIRECTION

HJFC PART NUMBER CODE

HJFC – X X X X X X X

Direction
1. Single
2. Dual

Travel
1. 15 Degrees Single Direction
2. 13 Degrees Dual Direction

Output*
1. Single Direction Analog Output: (Rest/Full) 0.5/4.5VDC
2. Dual Direction Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC
3. Dual Direction Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC & Dual Direction Position Indication
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

Sealing
1. Fully Sealed
2. Unsealed

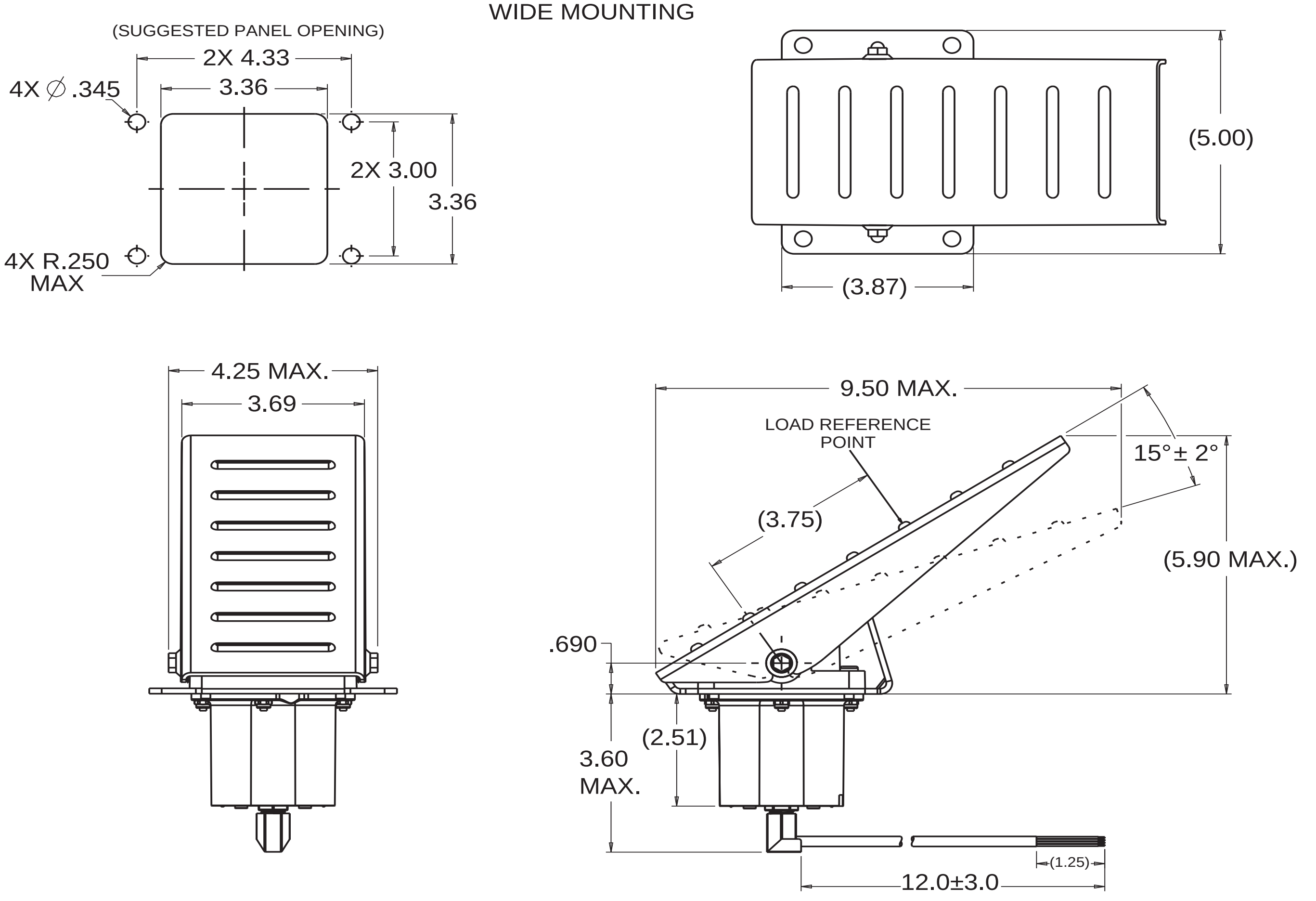
Power
1. Regulated 5VDC Clean Supply, No Reverse Polarity Protection
2. 12VDC Power Supply with Reverse Polarity Protection
3. 24VDC Power Supply with Reverse Polarity Protection

Termination
1. 0.225” Dia., 12” Cable, Unterminated

Pedal
1. Narrow Mounting**
2. Wide Mounting

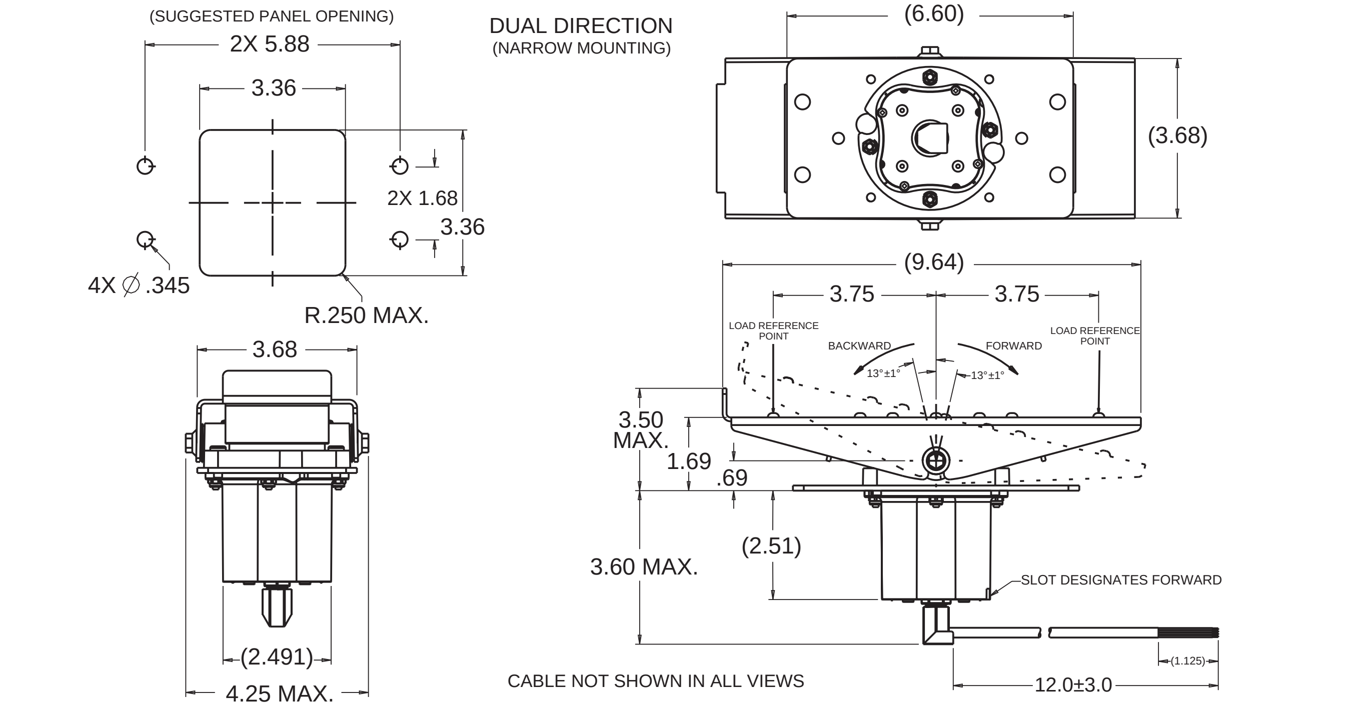
* Additional configurations are available. Contact factory.
** Single direction not available in narrow mounting.

SINGLE DIRECTION
WIDE MOUNTING

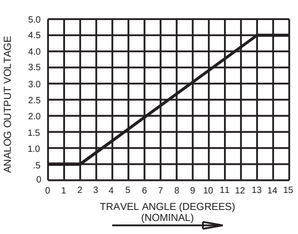


HALL EFFECT FOOT PEDAL

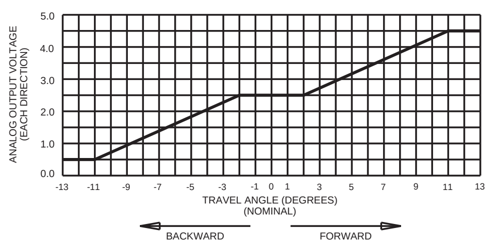
SINGLE DIRECTION & DUAL DIRECTION



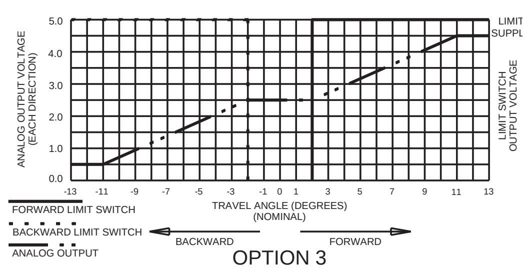
OUTPUT OPTIONS



OPTION 1



OPTION 2



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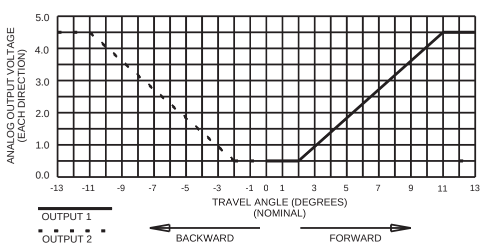
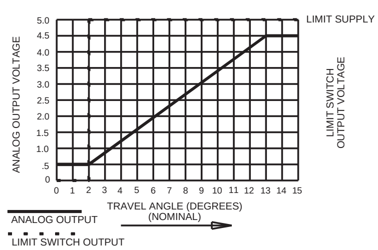
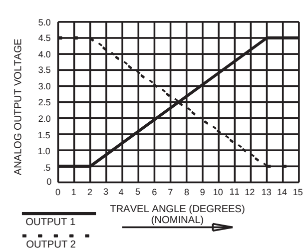


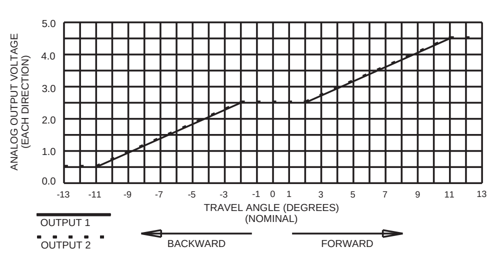
OPTION 4



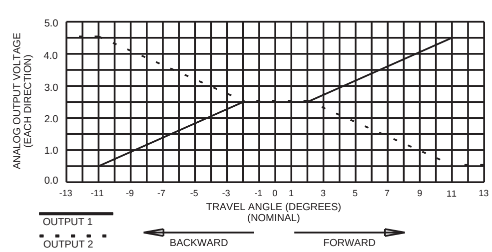
OPTION 5



OPTION 6



OPTION 7



OPTION 8

HALL EFFECT PUSHBUTTON SWITCHES

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**

Raised Dome with 3 PIN Header

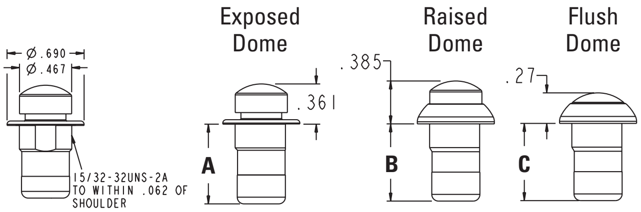
Exposed Dome with Wire Leads

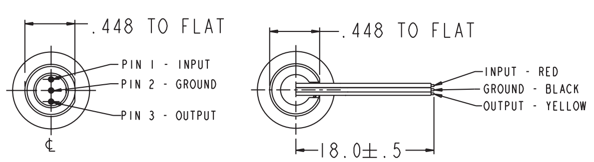
Standard Characteristics/Ratings:	
MECHANICAL:	
Mechanical Life:	10,000,000 cycles without detent
Button Travel:	0.080 inches max
Overtravel:	0.010 inches min
Operating Force:	Without detent: 16 oz +/- 8 oz With detent: 28 oz +/- 8 oz
Operating Point:	0.040 inches +/- 0.010
Electrical Life:	10,000,000 cycles

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

Electrical	Units	Min	Max
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

ELECTRONICS:	
Seal:	IP64 or IP68S
ENVIRONMENTAL:	
Operating Temp Range:	-40°C to +85°C
Storage Temp Range:	-60°C to +105°C
MATERIALS:	
Button:	Thermoplastic
Case:	Aluminum alloy
Mounting Hardware:	Hex nut & lockwasher





	PIN HEAD TERMINATION	WIRE LEAD TERMINATION
A - Exposed Dome	.736	.652
B - Raised Dome	.713	.628
C - Flush Dome	.713	.628

HP7 PART NUMBER CODE

HP7 – X X X X X X

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

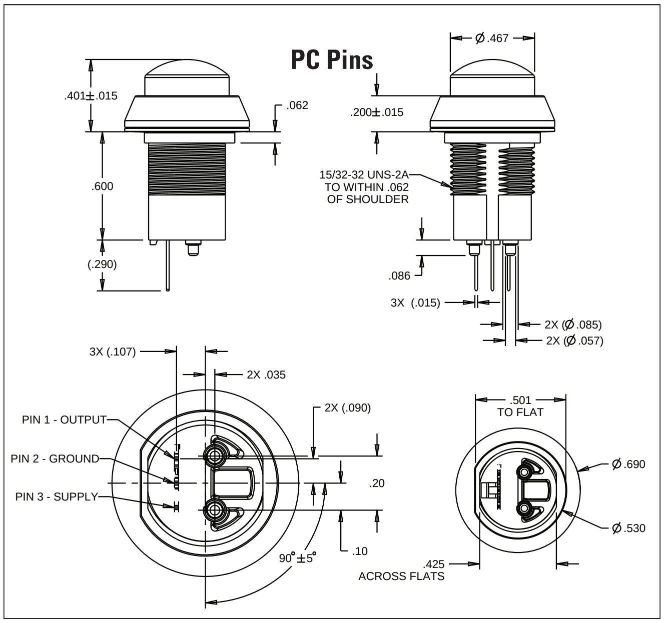
HALL EFFECT PUSHBUTTON SWITCHES

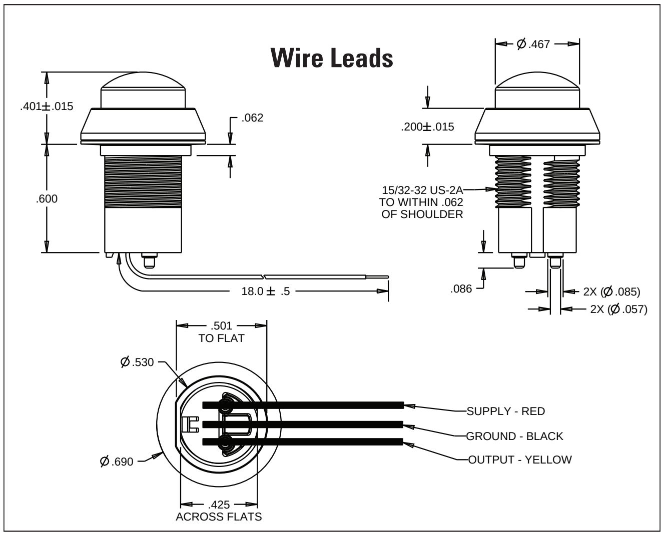
10 MILLION CYCLES, CONTACTLESS HALL EFFECT TECHNOLOGY

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:			
MECHANICAL:			
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		
ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)			
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
ENVIRONMENTAL:			
Operating Temp Range:	-40°C to +85°C		
Storage Temp Range:	-40°C to +105°C		
Electronic Enclosure Design:	IP68S		
MATERIALS:			
Button:	Nylon		
Case & Bezel:	Thermoplastic		
Mounting Hardware:	Hex nut & lockwasher		

HP7C PART NUMBER CODE

HP7C – X X X 1 X X

Button Style	**Circuit Style**	**Terminal Style**	**Seal Level**	**Bezel Color**	**Button Color**
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

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.

HPL-4
15/32" – 32 Thread
Rear Mount

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-R
Hall Effect Rocker

HPL-3
5/8" Front Mount

HPL PART NUMBER CODE

HPL – X X X X X X X

Case Style
1. Press Fit
3. Front Mount 5/8" Thread
4. Rear Mount 15/32" Thread
6. Rear Mount 5/8" Thread
R. Rocker Assembly

Output
1. 1.0 - 4.0VDC
2. 4.0 - 1.0VDC
3. 0.5 - 4.5VDC
4. 4.5 - 0.5VDC

Terminal Style
1. 3 Straight Pins, 0.100" Centers
2. 18" Potted 22 AWG Wire Leads

Seal Level
1. IP65 Splashproof
2. IP68S Watertight

Case Color
1. Clear Anodized
2. Black Anodized

Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple
8. Gray
9. White

Button Style*
1. 0.375" OD (Case Styles 1, 3, 4 & 6)
2. 0.500" OD Domed (Case Styles 1, 3 & 6)
R. Rocker Assembly (Case Style R)

* For availability of larger button diameters, contact factory.

HALL EFFECT LINEAR OUTPUT PUSHBUTTONS

1 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

Standard Characteristics/Ratings:

MECHANICAL:

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

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

Electrical		1 - 4 Volts			4 - 1 Volts			0.5 - 4.5 Volts			4.5 - 0.5 Volts		
	Units	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 (lo ≤ -2mA)	Ω	N/A	1	10	N/A	1	10	N/A	1	10	N/A	1	10

ELECTRONICS:

Seal Integrity:	IP65 or IP68S

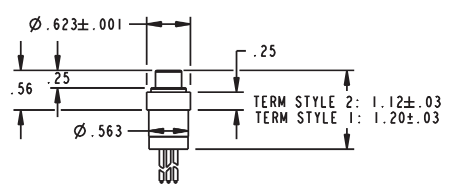
ENVIRONMENTAL:

Operating Temp Range:	-40°C to +85°C
Humidity:	96% RH, 70°C, 96 hours

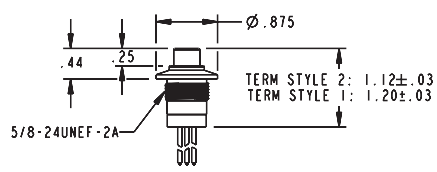
MATERIALS:

Housing:	Anodized Aluminum alloy
Button Cap:	Thermoplastic
Mounting Hardware:	Lockwasher, hex nut, washer when applicable

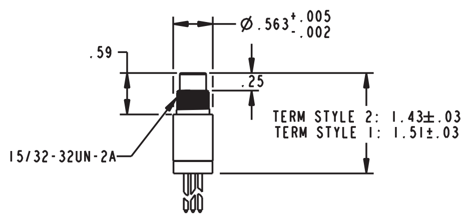
.375" O.D. Button Style



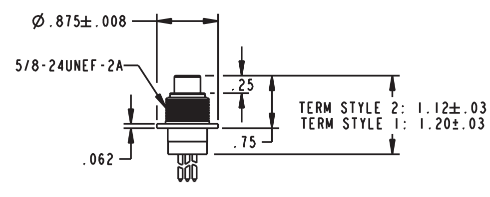
HPL-1XXXXX1
PRESS FIT



HPL-3XXXXX1
5/8" THREAD
FRONT MOUNT



HPL-4XXXXX1
15/32" THREAD
REAR MOUNT

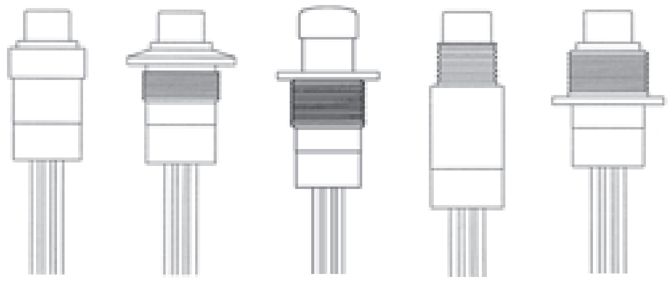


HPL-6XXXXX1
5/8" THREAD
REAR MOUNT

HALL EFFECT LINEAR OUTPUT PUSHBUTTONS

1 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

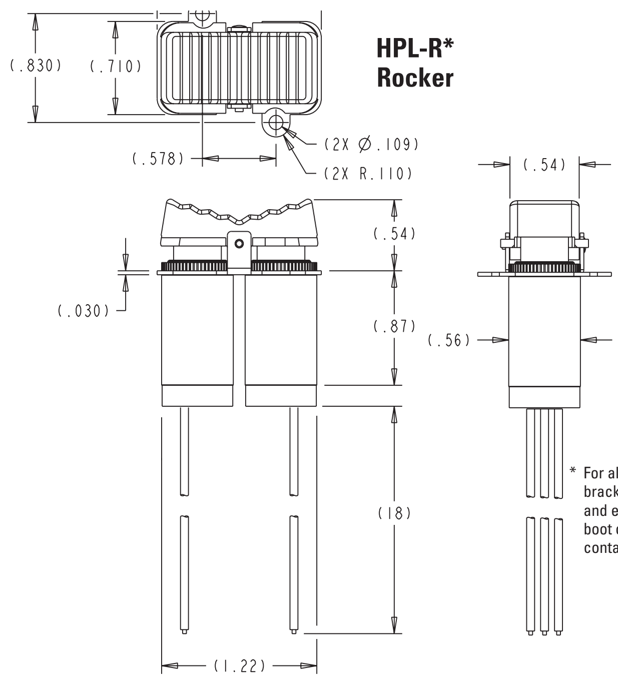
Case Styles



HPL-1	HPL-3	HPL-3	HPL-4	HPL-6
Press Fit	5/8" Thread Front Mount Button Style 1	5/8" Thread Front Mount Dome Button Button Style 2	15/32" Thread Rear Mount	5/8" Thread Rear Mount

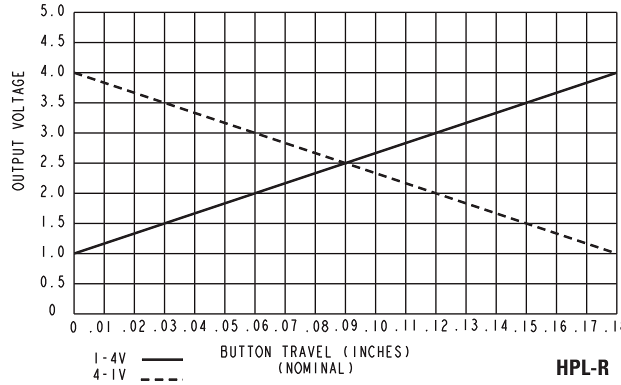
HPL dimensions are equivalent to standard OTTO P1 Pushbutton dimensions as shown in the catalog except for overall length. Total button height is 0.25" on standard 0.375" OD buttons. Overall length from button top to rear of potting is 1.26" nominal, except for the HPL-4 and 0.500" OD button styles which measure 1.56". Panel mounting hardware is included, except with the HPL-1 which is meant to press fit into mounting hole in a control grip. Refer to the dimensions shown or consult OTTO to design the control grip to meet your specifications.

HPL-R*
Rocker

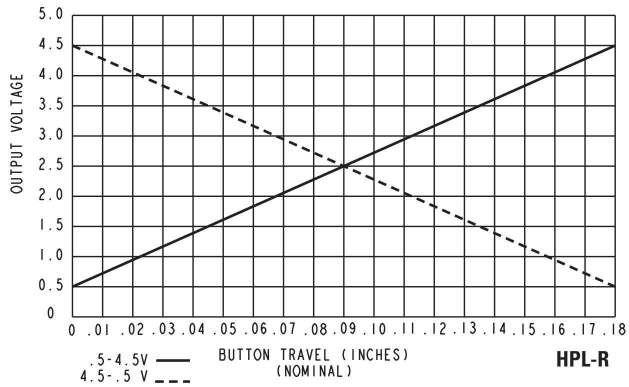


* For alternative bracket styles and external boot options, contact factory.

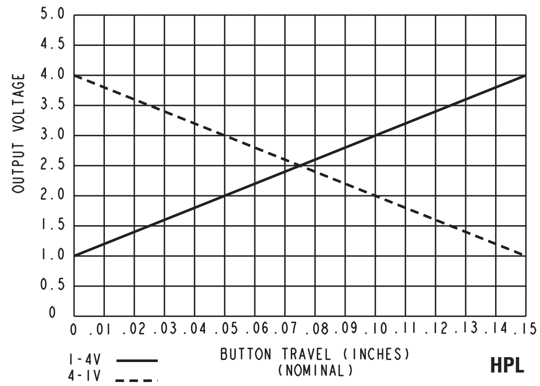
Linear Output Graphs (Vcc = 5V @ 20°C)



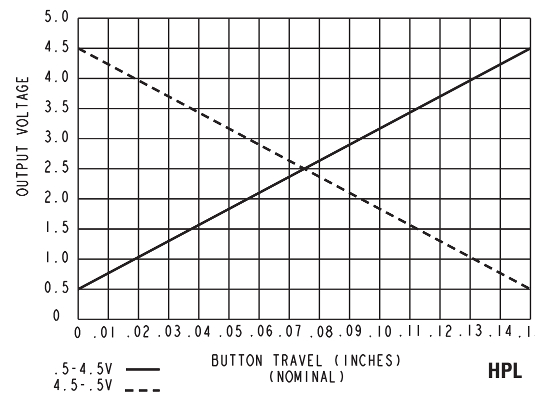
HPL-R



HPL-R

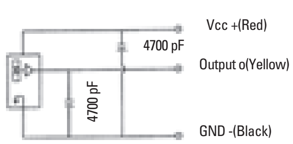


HPL

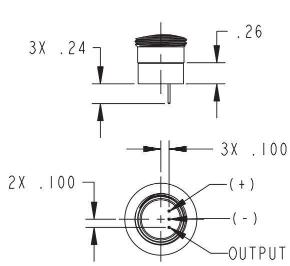


HPL

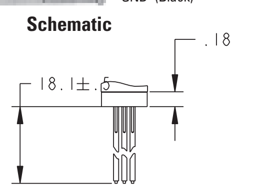
Terminal Styles



Schematic



TERMINAL STYLE 1
3 STRAIGHT PINS
.100 CENTERS



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

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:

MECHANICAL:	
Mechanical Life with Detent:	Up to 2,000,000 cycles full forward to full back
Mechanical Life without Detent:	Up to 5,000,000 cycles full forward to full back
Travel:	Full travel angle each direction from center to 25° typical
Operating Force:	HPW-1 is 4 oz typical @ 25° HPW-2 and HPW-3 are 3 oz typical @ 25°
Max Allowable Radial Load:	30.0 lbs.

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

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

ENVIRONMENTAL:	
Operating Temp Range:	-40°C to +85°C
Electronic Enclosure:	IP68S
Mechanical Enclosure:	Unsealed
RFI/EMI:	Withstand per SAE J1113

HPW PART NUMBER CODE

HPW – X X X X X X X

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) 3 oz (HPW-2 and HPW-3)	**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	**2.** 5 oz (HPW-2 and HPW-3)	**B.** 0.025" SQ. Pins, Phosphor Bronze Alloy, Tin Plated	**2.** Black	**2.** Black	**A.** ±18º
3. Lever Style #3 (Ergonomic Lever)	**C.** 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC			**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.

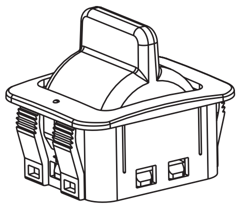
* Outputs are from the center position to the full travel position in each direction. Options A–F provide increasing voltage in Direction 1 and decreasing voltage in Direction 2 from a single output. Options G and H provide increasing voltages in both directions from two separate outputs.

** 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.

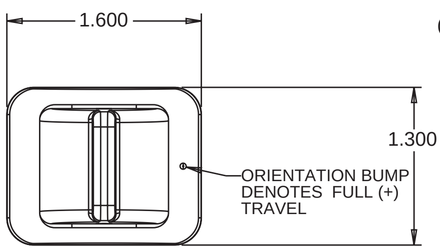
*** Options J, K, L, M, N and P are identical to Options A, B, C, D, E and F respectively, except with a tighter center tolerance.

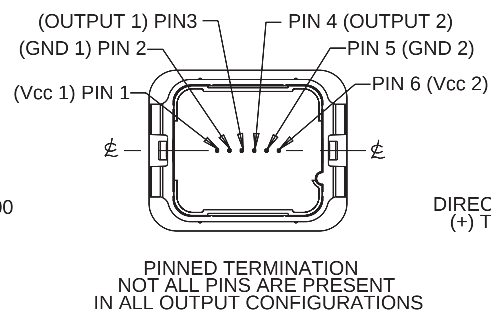
HALL EFFECT SINGLE AXIS PADDLE

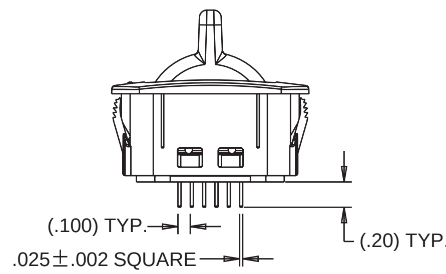
UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS

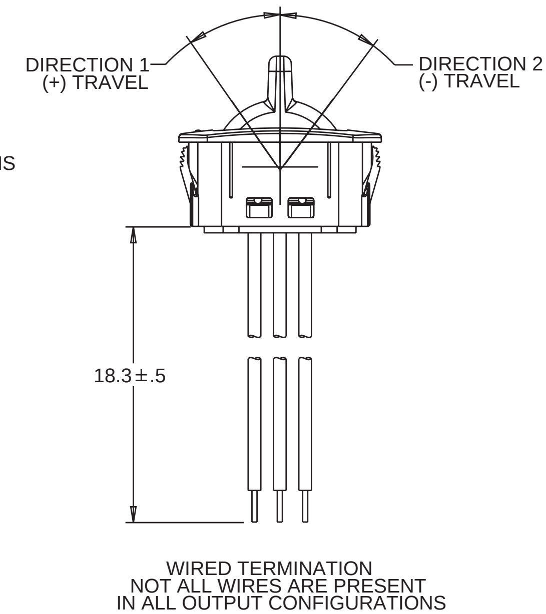


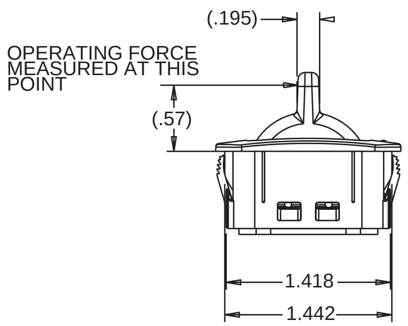
LEVER STYLE #1
(Paddle)

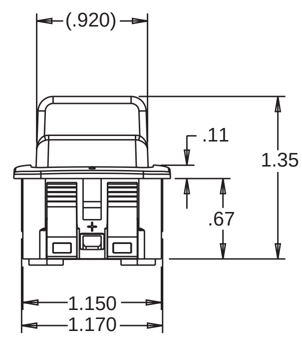


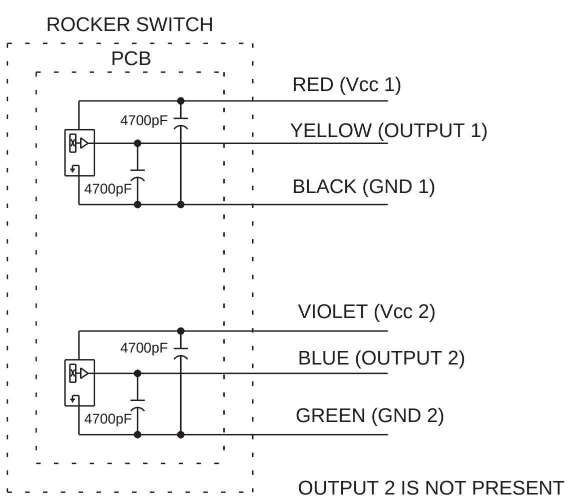








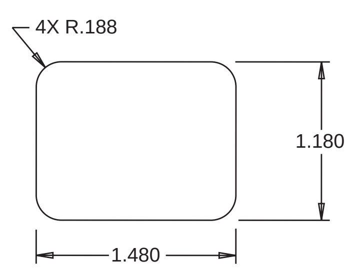




OUTPUT 2 IS NOT PRESENT
IN ALL CONFIGURATIONS

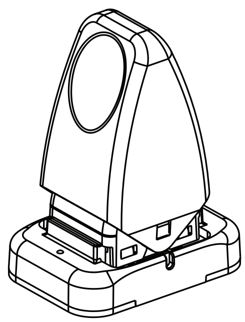
RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS
(0.065 MIN. - 0.175 MAX.)

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

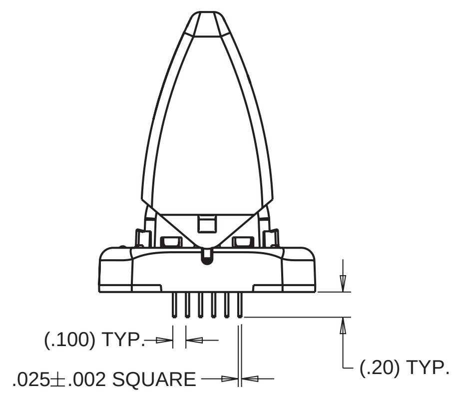


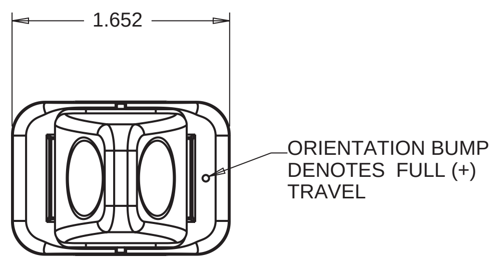
HALL EFFECT SINGLE AXIS PADDLE

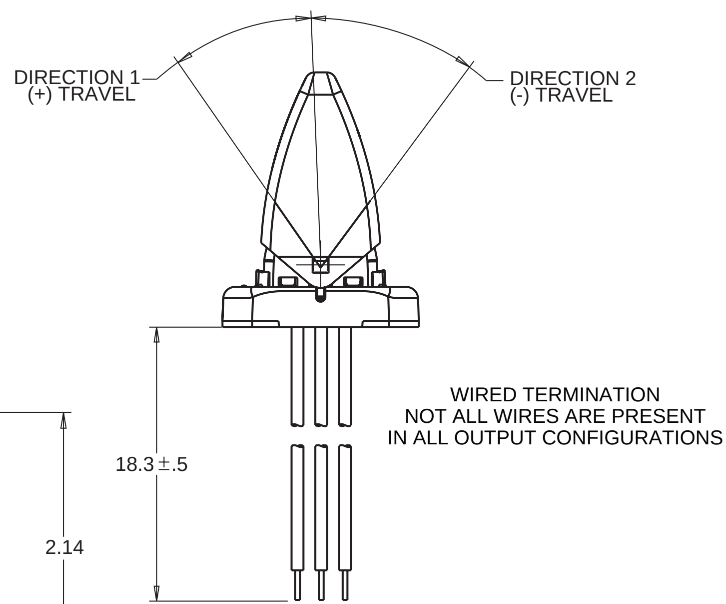
UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS

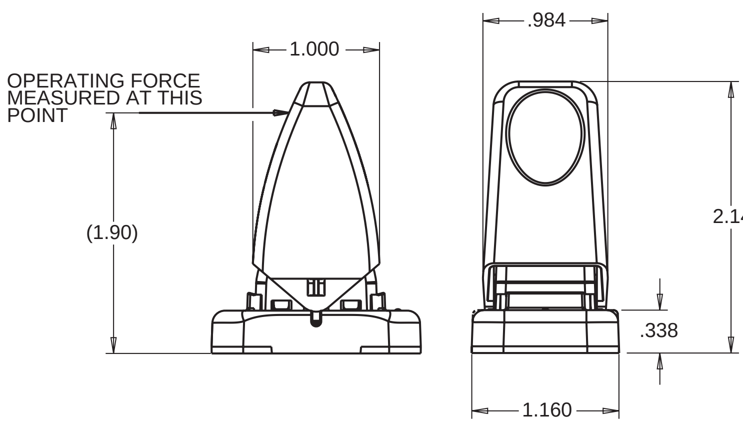


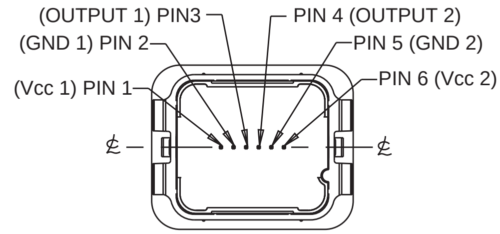
LEVER STYLE #2
(Standard Lever)







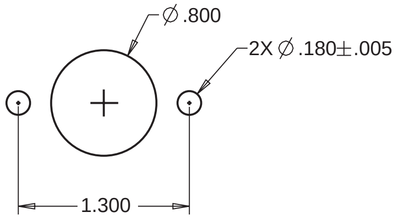


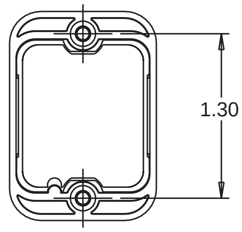


PINNED TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

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

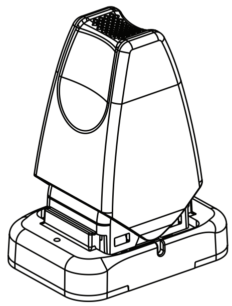
RECOMMENDED PANEL OPENING: ∅0.800 OPTIMUM
(0.750 MIN. - 0.850 MAX)



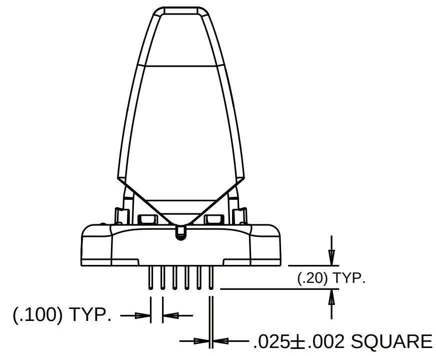


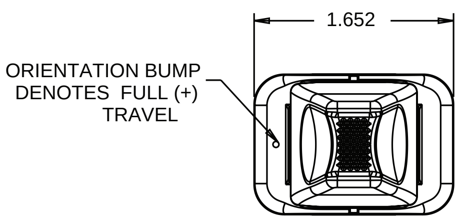
HALL EFFECT SINGLE AXIS PADDLE

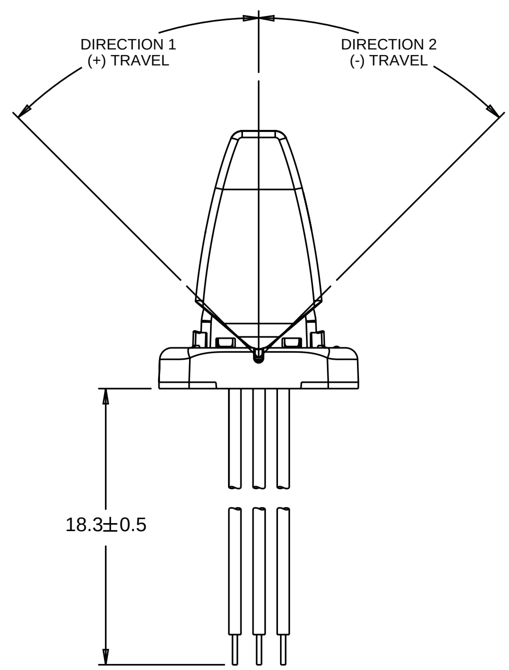
UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS



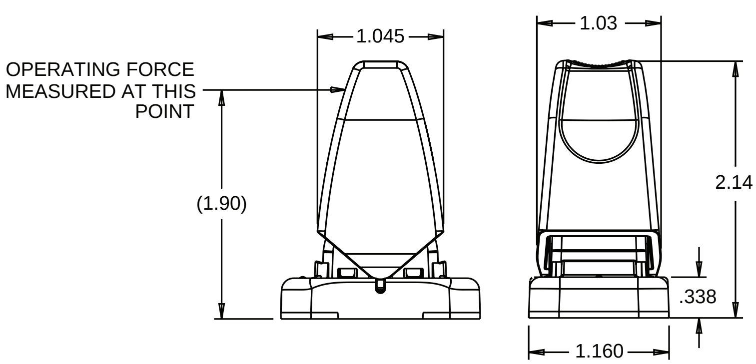
LEVER STYLE #3
(Ergonomic Lever)





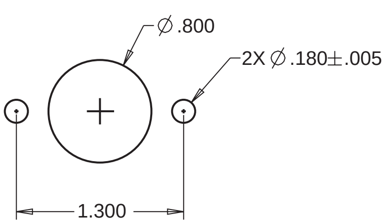


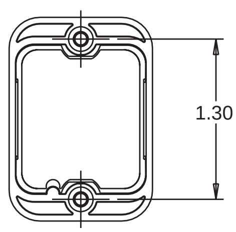
WIRED TERMINATION
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

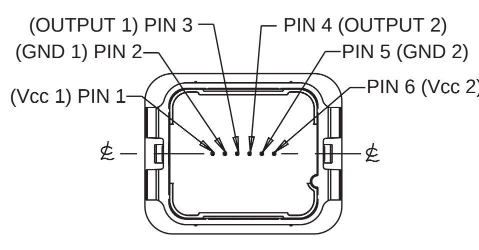


RECOMMENDED PANEL THICKNESS: 0.130 OPTIMUM THICKNESS
(0.125 MIN. - 0.135 MAX.)

RECOMMENDED PANEL OPENING: ∅0.800 OPTIMUM
(0.750 MIN. - 0.850 MAX)





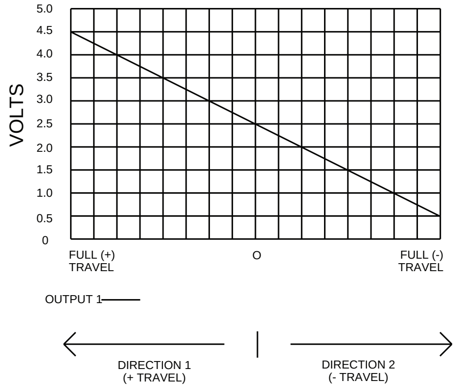


PINNED TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

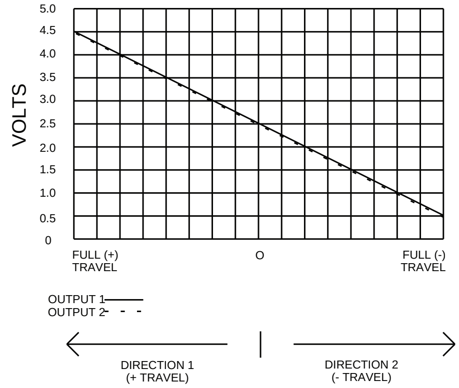
HALL EFFECT SINGLE AXIS PADDLE

UP TO 5 MILLION CYCLE MECHANICAL LIFE, 14 OUTPUT OPTIONS

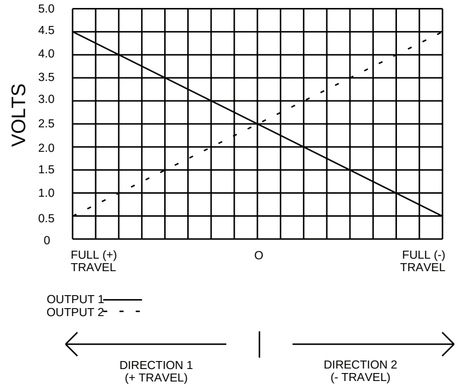
OPTION A & J



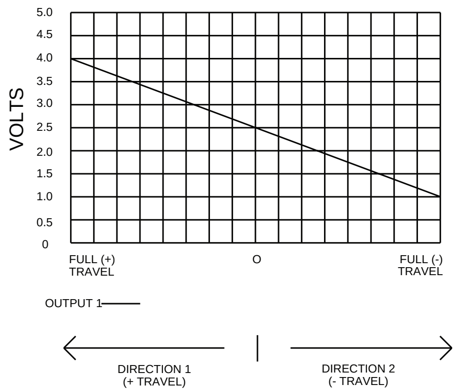
OPTION B & K



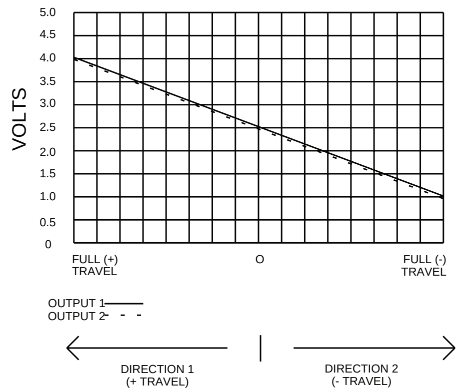
OPTION C & L



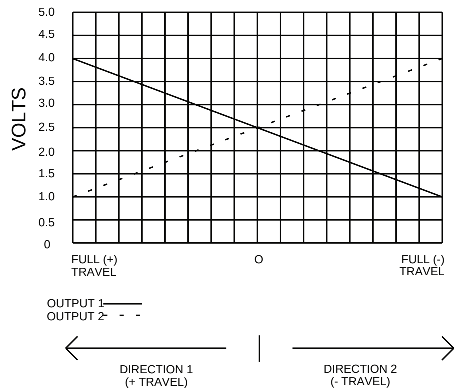
OPTION D & M



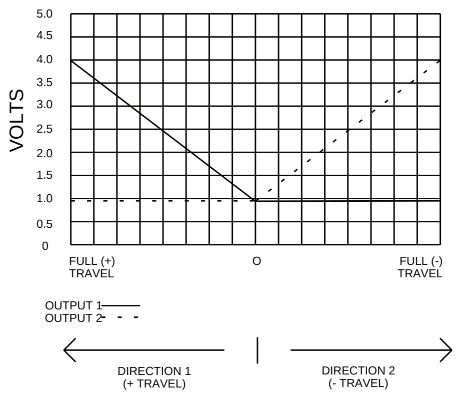
OPTION E & N



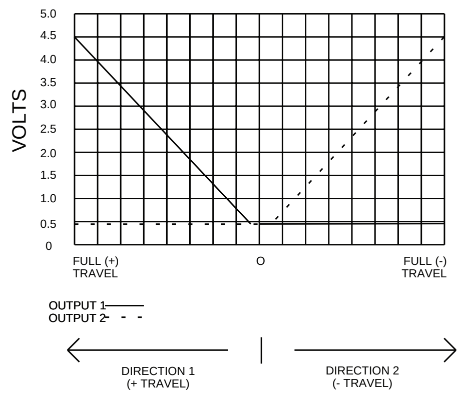
OPTION F & P



OPTION G



OPTION H



LINEAR HALL EFFECT FINGER 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

LINEAR HALL EFFECT FINGER JOYSTICK

2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL2 PART NUMBER CODE

HTL2 – X 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 22 AWG, UL 1569	**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	**2.** Pins	
3. Short Double Stadium						**CC.** 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC	**3.** Wire Leads 24 AWG, SAE AS22759	
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		
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 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 22 AWG UL 1569	**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	**2.** Pins	
3. Short Double Stadium				**3.** Omnidirectional; Round; Smooth Feel		**CC.** 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC	**3.** Wire Leads 24 AWG SAE AS22759	
4. Tall Concave Stadium				**4.** Omnidirectional; Round; On-Axis Guided Feel		**DD.** 2.5 +/- 1.5VDC	NONE	**4.** Wire Leads 22 AWG, UL 1569 shared powers and grounds (see schematic)	
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	**5.** Wire Leads 24 AWG, SAE AS22759 shared powers and grounds (see schematic)	
6. External Smooth Boot				**6.** Omnidirectional; Round; Smooth Feel with Detent at 50% Travel		**FF.** 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC		
				7. Omnidirectional; Round; On-Axis Guided Feel with Detent at 50% Travel		**GG.** 0.5 - 4.5VDC	0.5 - 4.5VDC		
						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**		

***** 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.

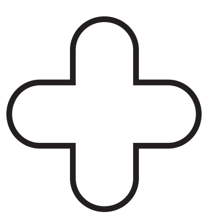
*******Gating options 5, 6 and 7 not available with button style 7.

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.

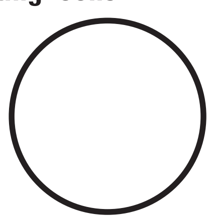
② Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

Gating Icons

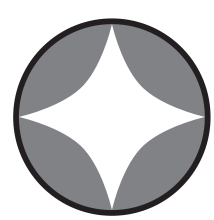
Omnidirectional
Square On-Axis
and Off-Axis
Guided Feel****



Gated
Two Axis
Return to Center



Omnidirectional
Round
Smooth Feel



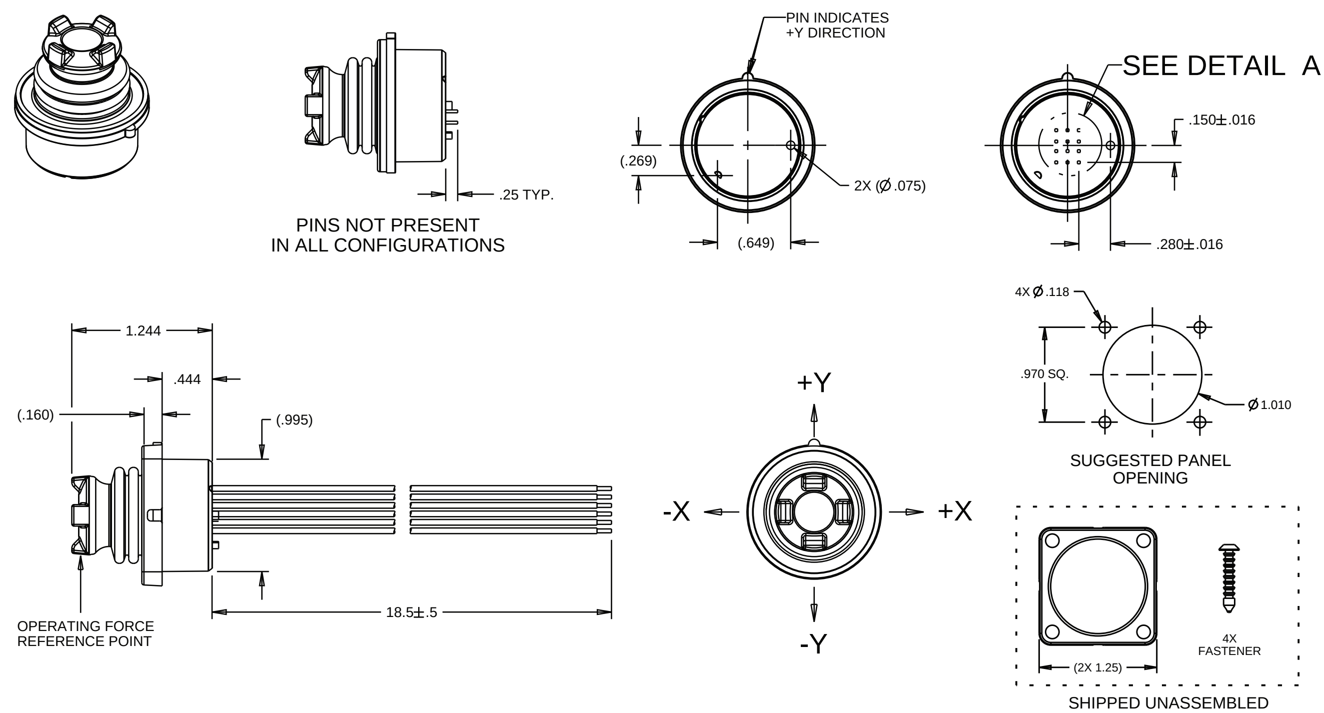
Omnidirectional
Round On-Axis
Guided Feel****

Single Axis
(HTL2 version)

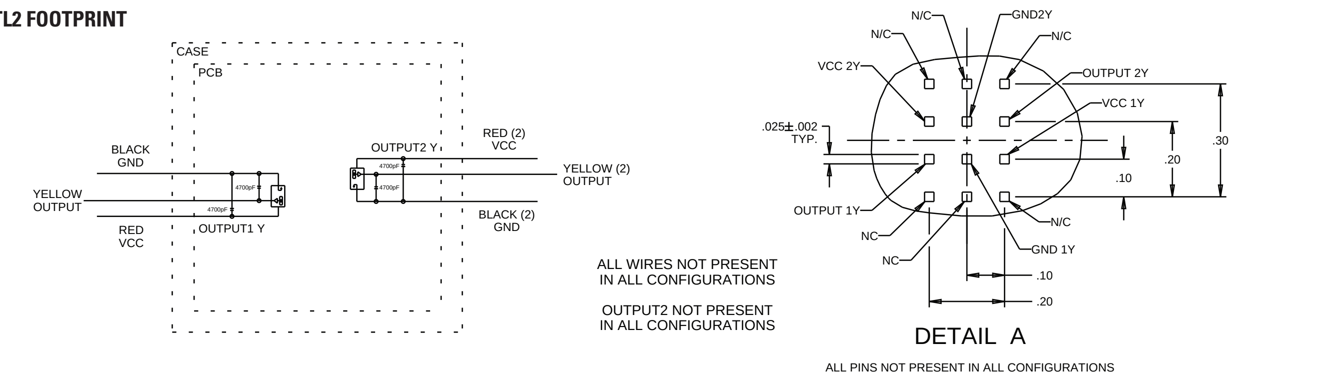
********Feel defined by shading.

LINEAR HALL EFFECT FINGER JOYSTICK

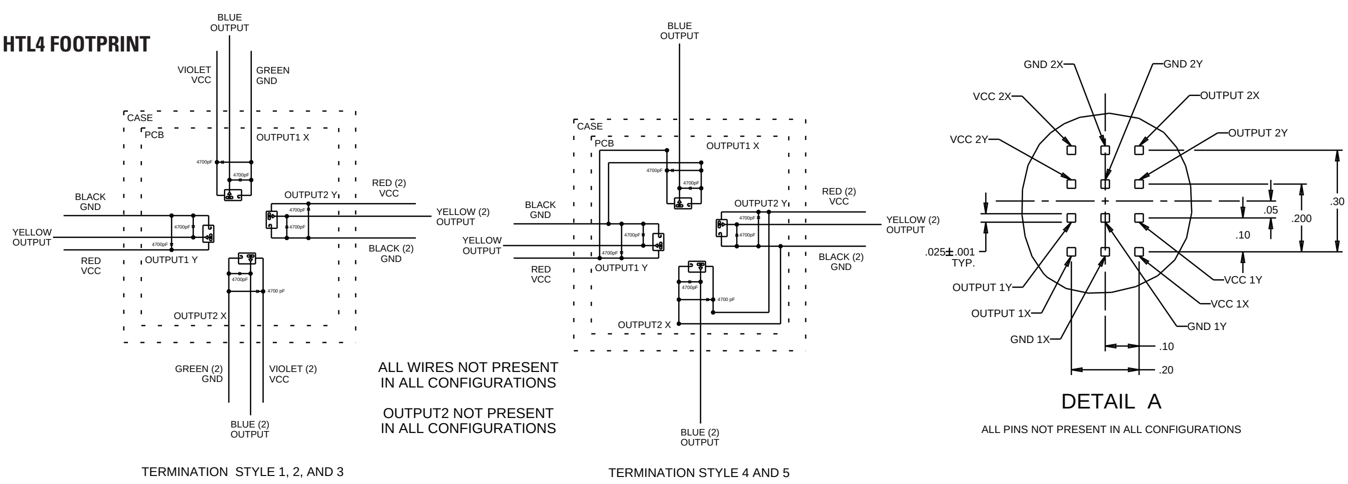
2 & 4-WAY LINEAR HALL EFFECT TOGGLE



HTL2 FOOTPRINT



HTL4 FOOTPRINT

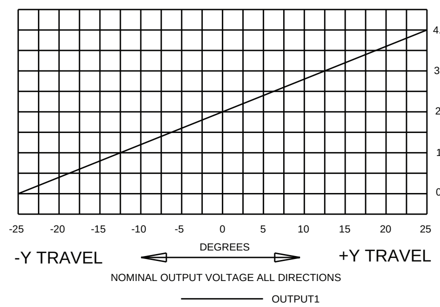


LINEAR HALL EFFECT FINGER JOYSTICK

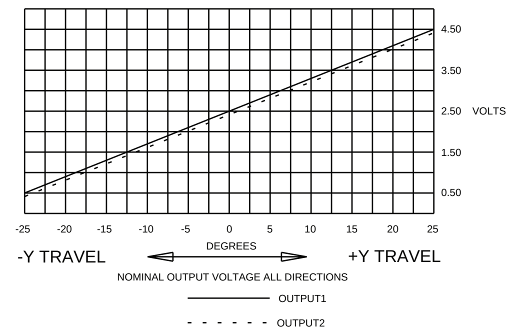
2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL2 OUTPUTS

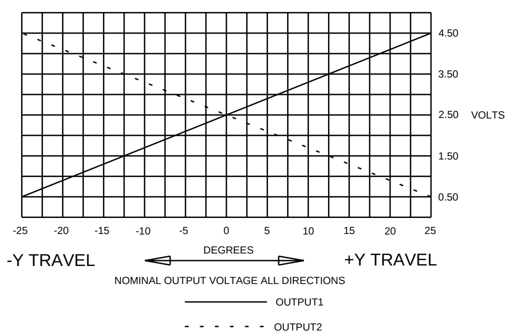
OPTION AA & AT



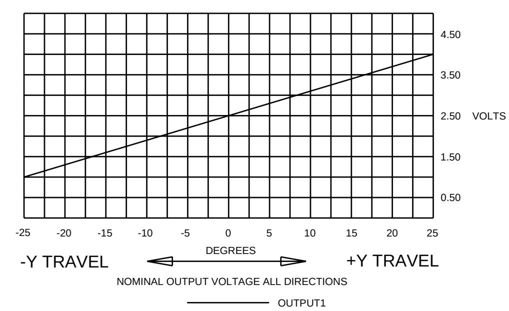
OPTION BB & BT



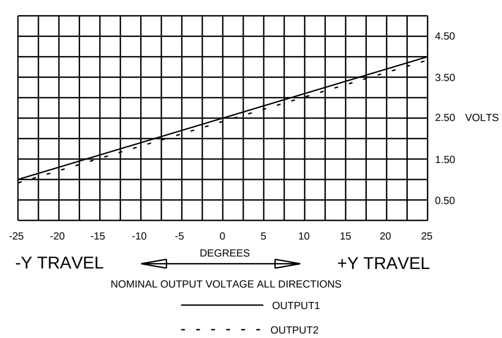
OPTION CC & CT



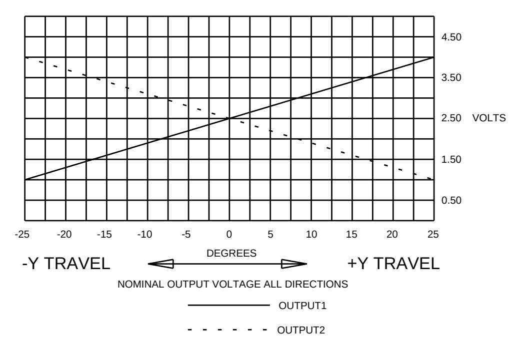
OPTION DD & DT



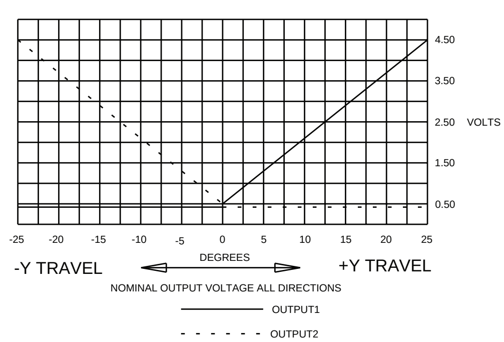
OPTION EE & ET



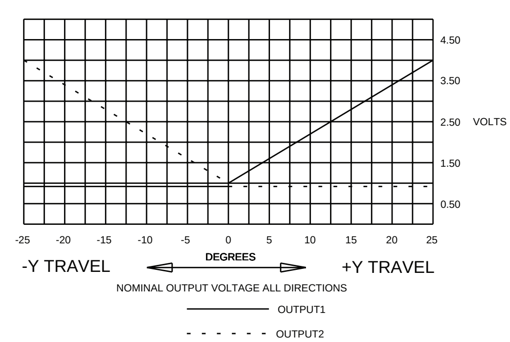
OPTION FF & FT



OPTION GG



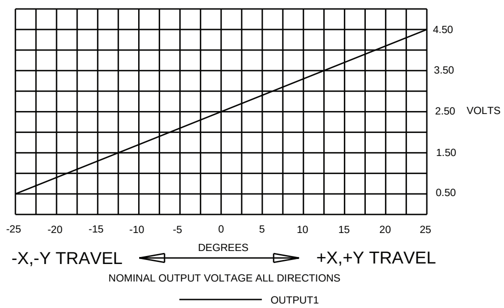
OPTION HH



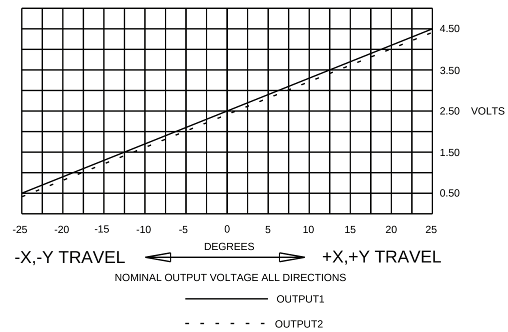
2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL4 OUTPUTS

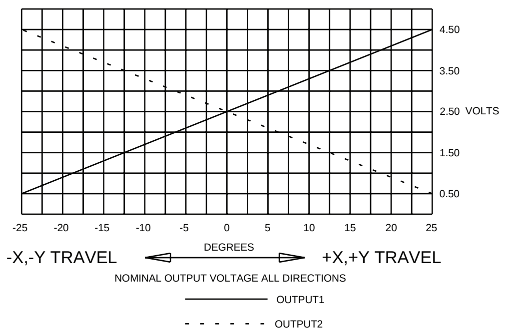
OPTION AA & AT



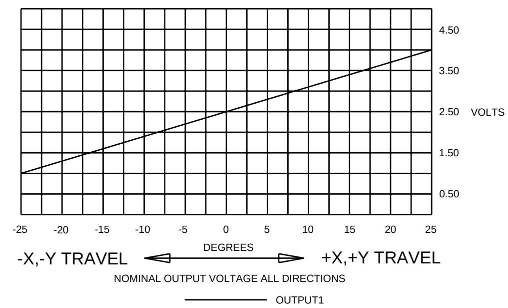
OPTION BB & BT



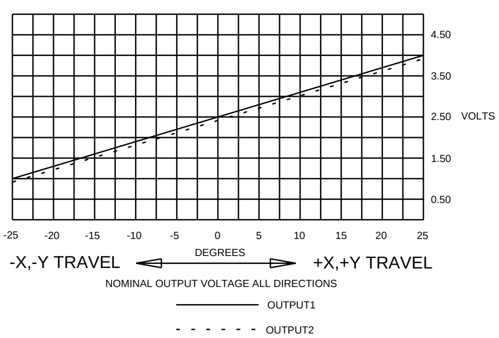
OPTION CC & CT



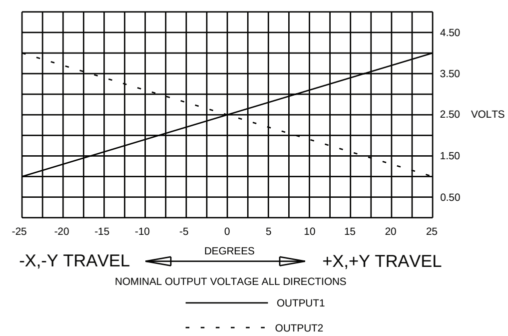
OPTION DD & DT



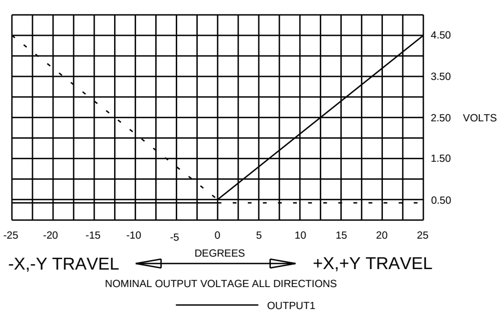
OPTION EE & ET



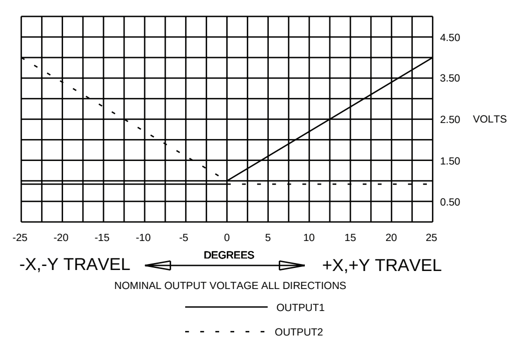
OPTION FF & FT



OPTION GG

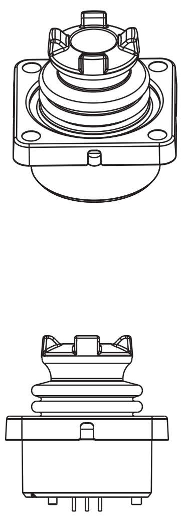


OPTION HH

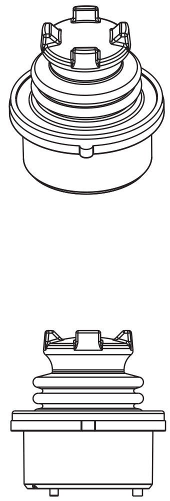


LINEAR HALL EFFECT FINGER JOYSTICK

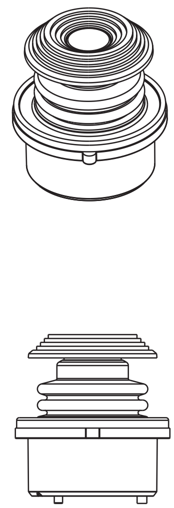
BUTTON CONFIGURATIONS



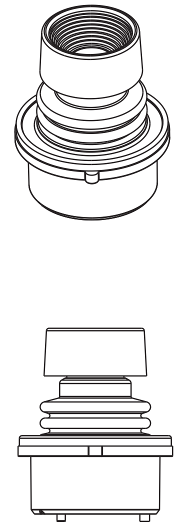
BUTTON STYLE 1
(CASTLE)



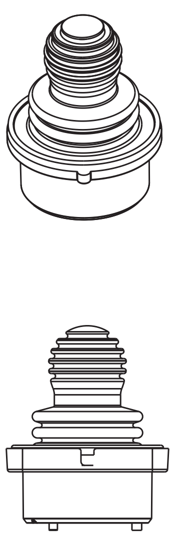
BUTTON STYLE 2
(EXTERNAL CASTLE BOOT)



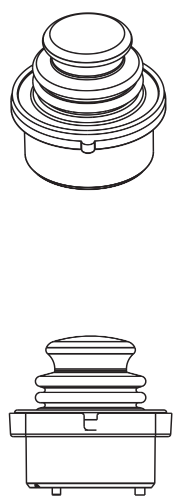
BUTTON STYLE 3
(SHORT DOUBLE STADIUM)



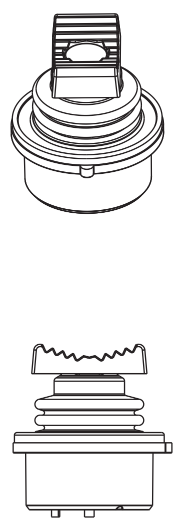
BUTTON STYLE 4
(TALL CONCAVE STADIUM)



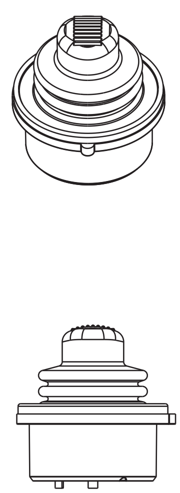
BUTTON STYLE 5
(EXTERNAL BAT
HANDLE BOOT)



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

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 360º**
- **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 + Flange:	Thermoplastic			
Button:	Thermoplastic			
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			

FINGER JOYSTICK WITH PUSHBUTTON OPTION

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		
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 +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.

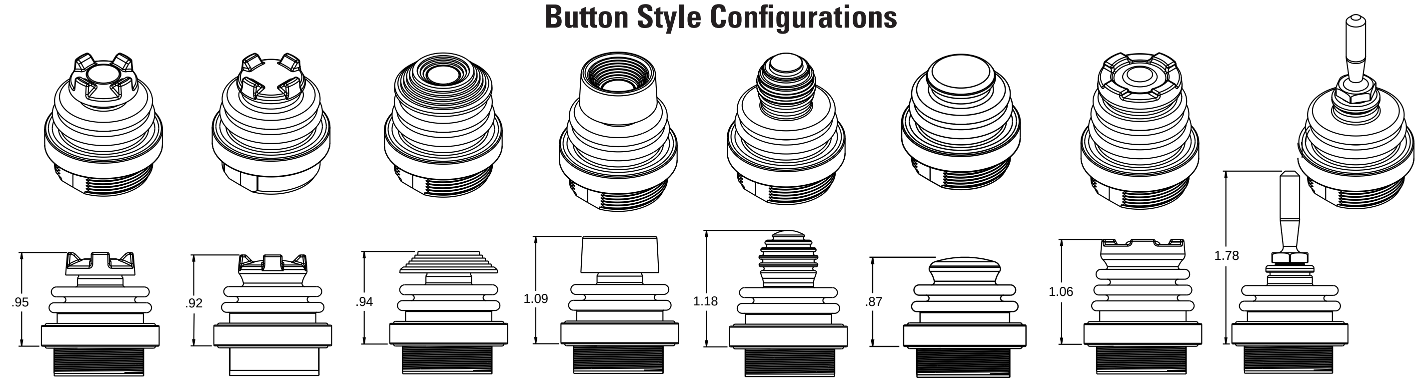
HTLT4 PART NUMBER CODE

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.** 8 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.

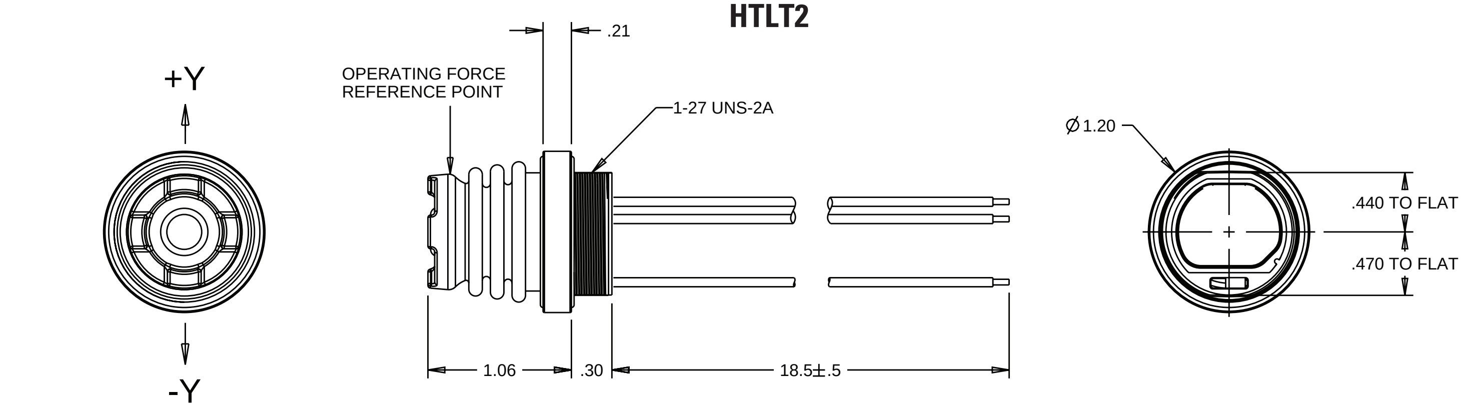
Button Style Configurations



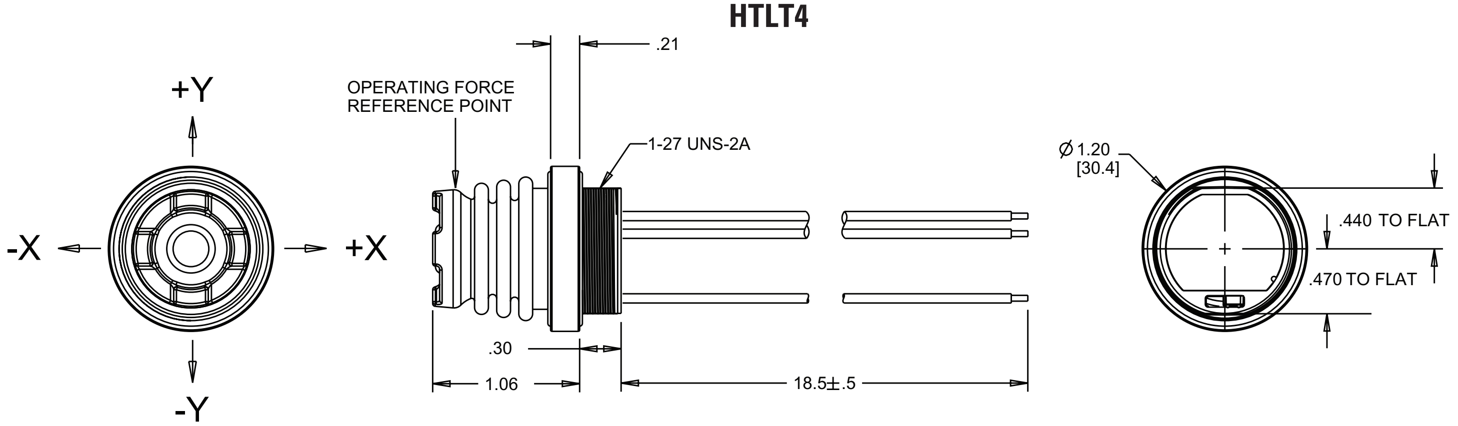
BUTTON STYLE 1 (CASTLE) | BUTTON STYLE 2 (EXTERNAL CASTLE BOOT) (SMOOTH CASE SHOWN) | BUTTON STYLE 3 (SHORT DOUBLE STADIUM) | BUTTON STYLE 4 (TALL CONCAVE) | BUTTON STYLE 5 (EXTERNAL BAT BOOT) | BUTTON STYLE 6 (EXTERNAL SMOOTH BOOT) | BUTTON STYLE 8 AND 9 (EXTERNAL CASTLE BOOT WITH PUSHBUTTON) | BUTTON STYLE A (TALL METAL BAT HANDLE)

3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

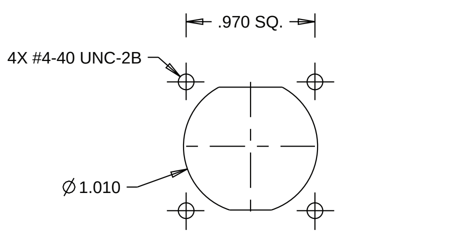
HTLT2



HTLT4



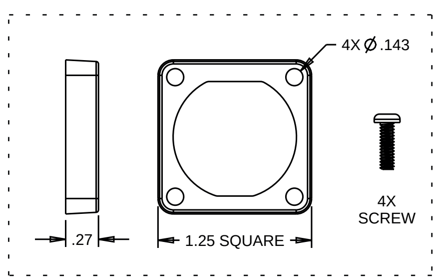
HTLT2 and HTLT4 Panel Footprint



SUGGESTED PANEL OPENING
WHEN USING FLANGE AND SCREWS.

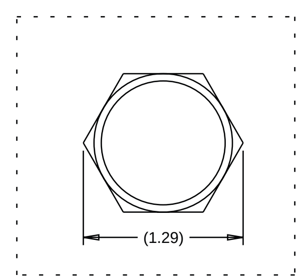
MAX. PANEL THICKNESS OF 0.125
FOR BOTTOM MOUNT

MIN. PANEL THICKNESS OF .100
FOR TOP MOUNT

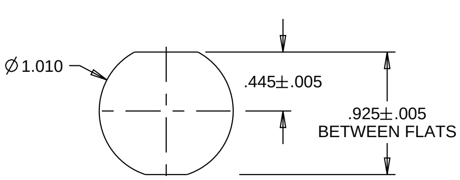


1" SMOOTH CASE STYLE HARDWARE
SHIPPED UNASSEMBLED

OR



1-27 THREAD CASE STYLE HARDWARE
SHIPPED UNASSEMBLED

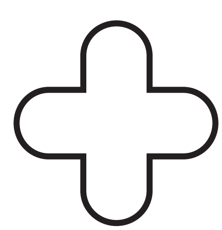


SUGGESTED PANEL OPENING
WHEN USING 1-27 NUT.

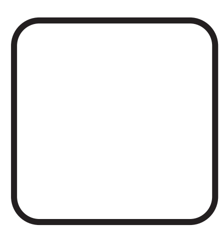
MAX. PANEL THICKNESS OF 0.125

HTLT4 Gating Icons

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



Gated;
Two Axis
Return to Center



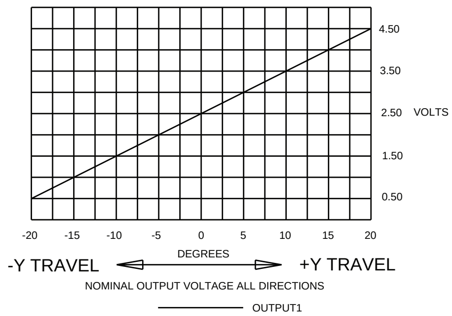
Omnidirectional;
Square;
Smooth Feel

FINGER JOYSTICK WITH PUSHBUTTON OPTION

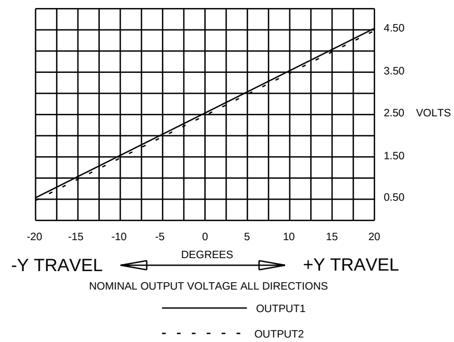
3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

HTLT2

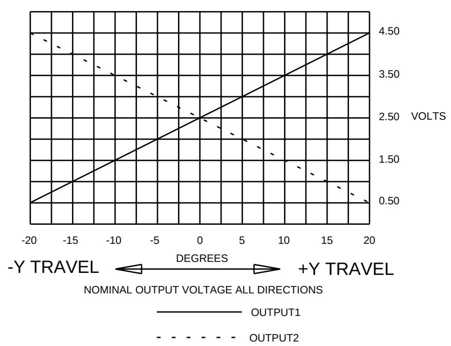
OPTION AA



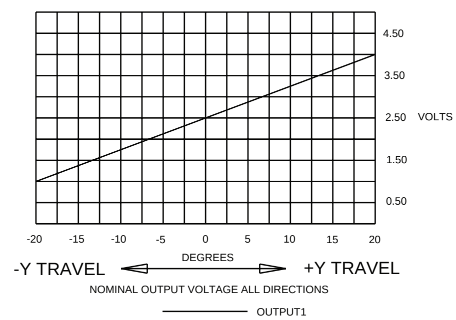
OPTION BB



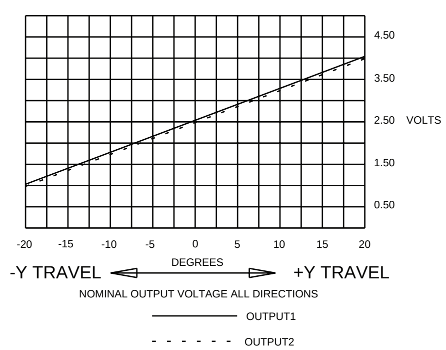
OPTION CC



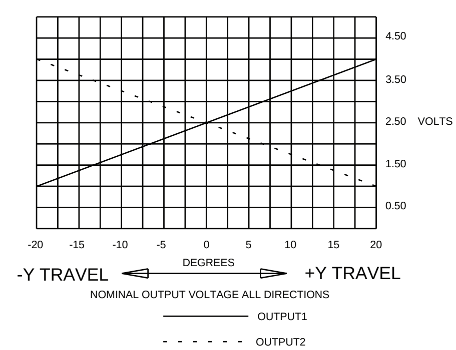
OPTION DD



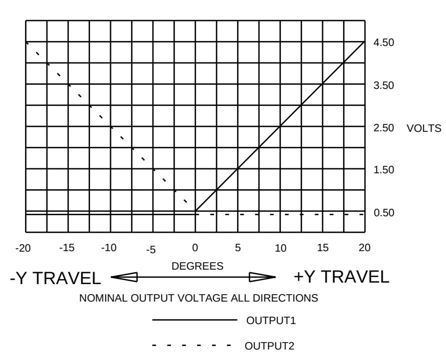
OPTION EE



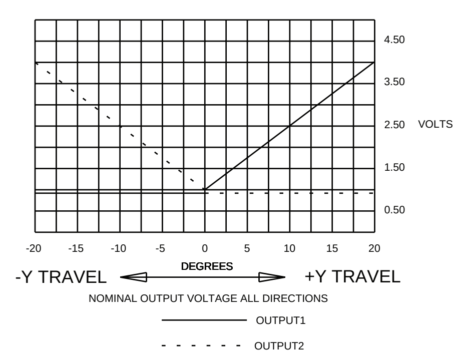
OPTION FF



OPTION GG



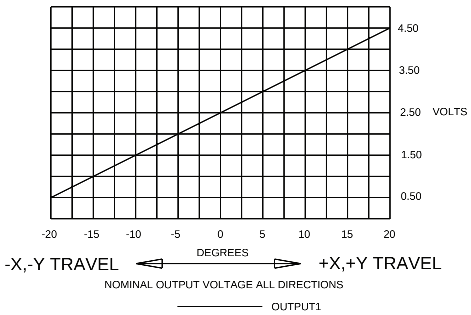
OPTION HH



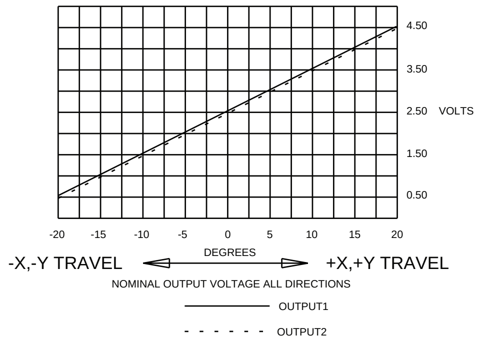
3 MILLION CYCLE MECHANICAL LIFE, PUSHBUTTON OPTION

HTLT4

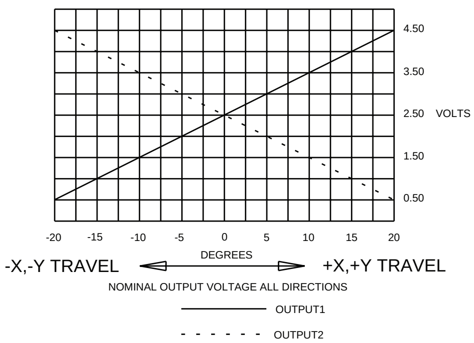
OPTION AA



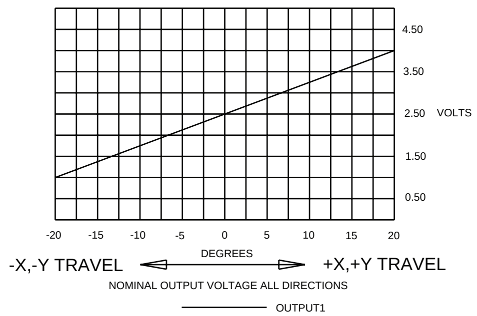
OPTION BB



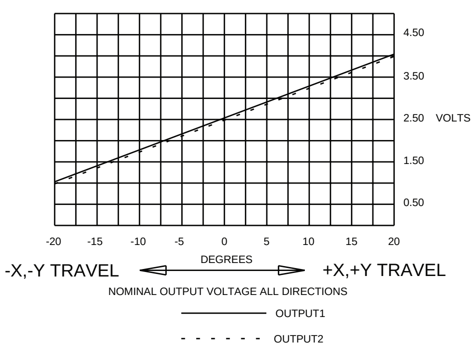
OPTION CC



OPTION DD



OPTION EE



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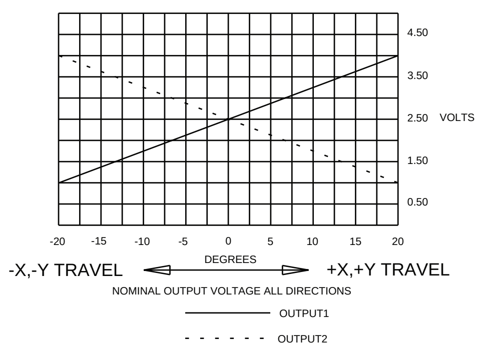
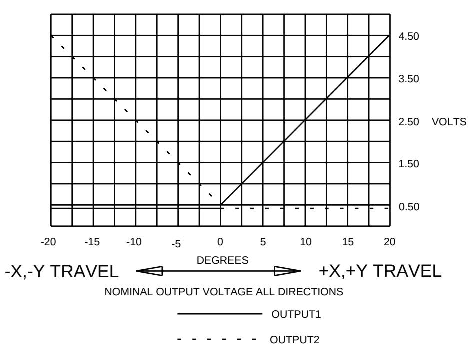
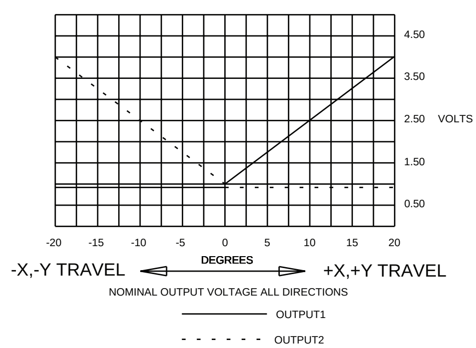


OPTION GG



OPTION HH



PROPORTIONAL OUTPUT THUMBWHEEL

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

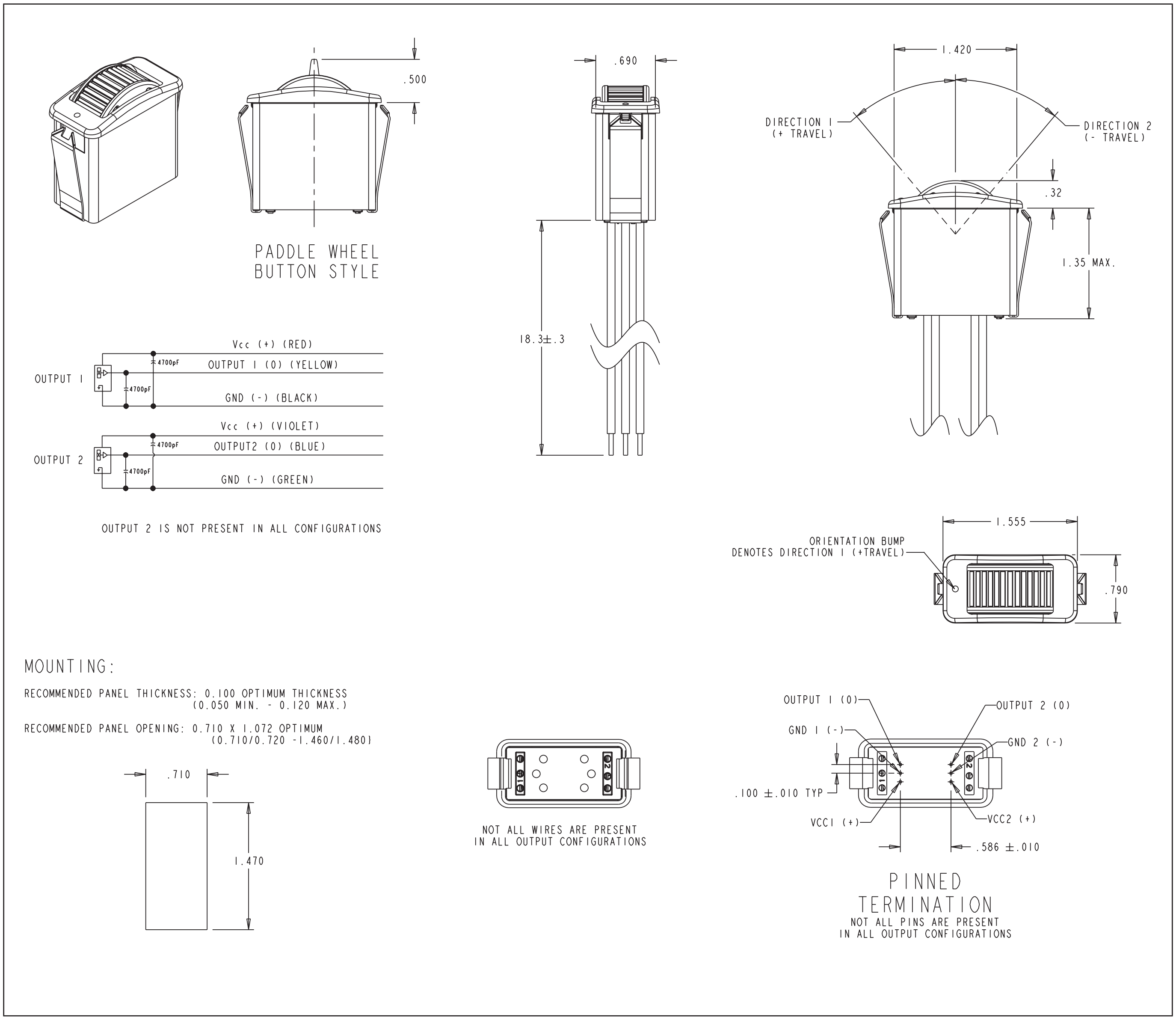
3 MILLION CYCLE ROTATIONAL LIFE

HTW PART NUMBER CODE

HTW – X X X X X X X 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	**A.** 18 AWG Wires 18.3" Long, Stripped Ends	**1.** Red	**1.** Red	**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		**2.** Paddle Wheel		**2.** Black	**2.** Black	
	C. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC				**3.** Orange	**3.** Orange	
	D. 2.5 +/- 1.5VDC	NONE			**B.** 0.025" SQ. Pins	**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***						

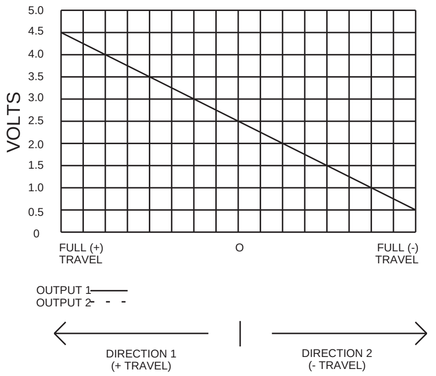
***** Detented switch full travel is ±30° max. Detented switches reach full output before engaging detents.
****** Only available with Travel option 2.
******* Options J, K, L, M, N and P are identical to options A, B, C, D, E and F respectively, except with a tighter center tolerance.



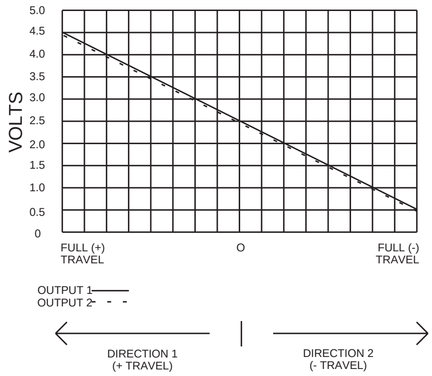
PROPORTIONAL OUTPUT THUMBWHEEL

3 MILLION CYCLE ROTATIONAL LIFE

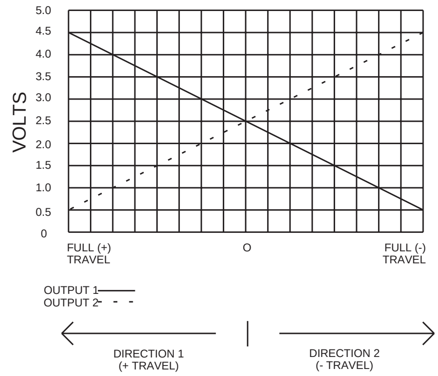
OPTION A & J



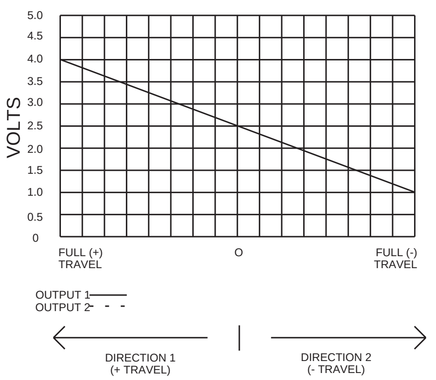
OPTION B & K



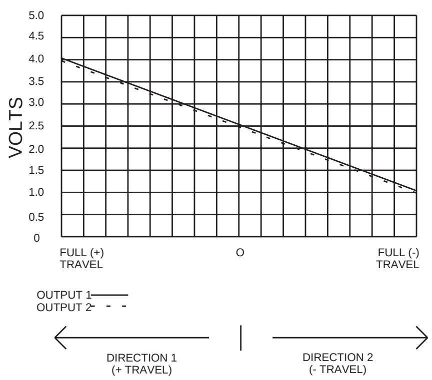
OPTION C & L



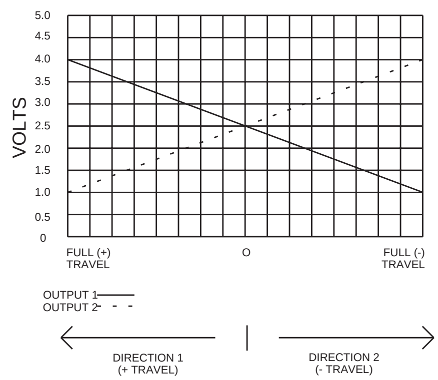
OPTION D & M



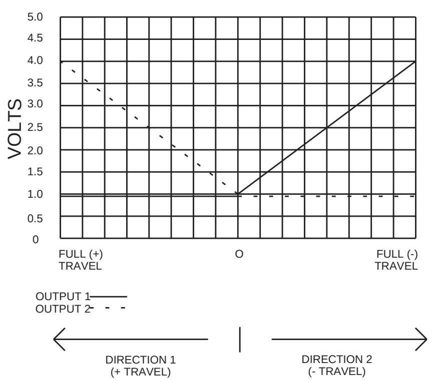
OPTION E & N



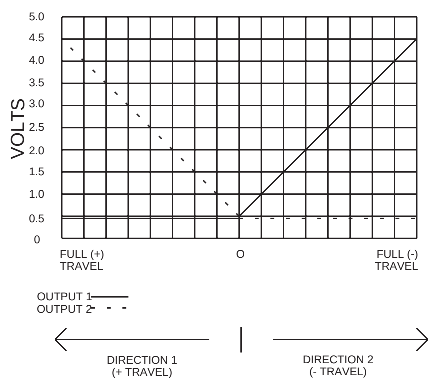
OPTION F & P



OPTION G



OPTION H



RETURN TO END STANDARD THUMBWHEEL

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

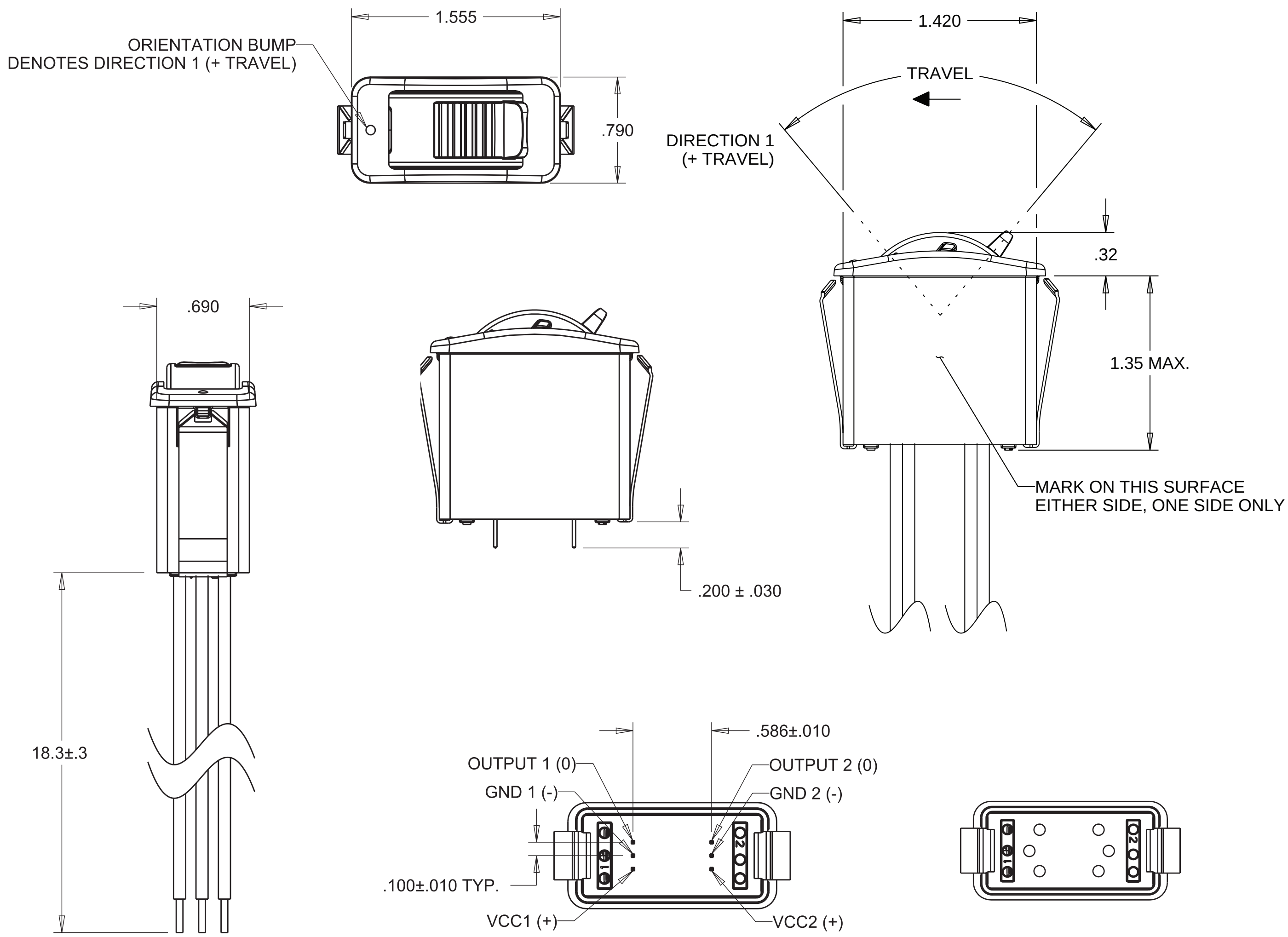
HTWE – X X* X X X X X

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.

RETURN TO END STANDARD THUMBWHEEL

PROPORTIONAL OUTPUT THUMBWHEEL

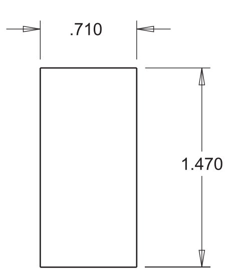


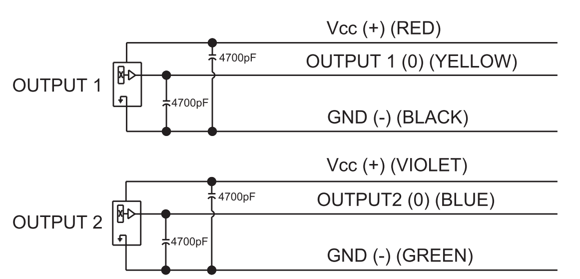
PINNED
TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

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}

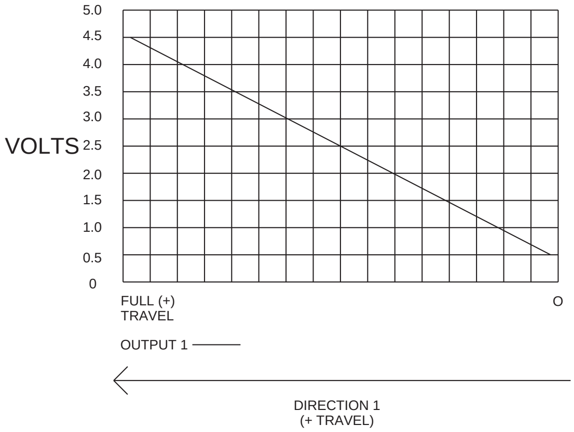




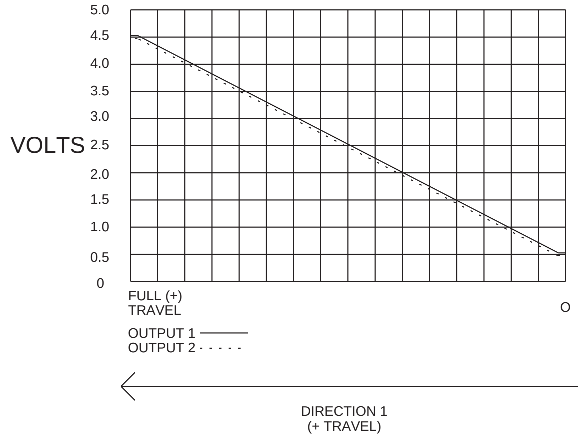
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

PROPORTIONAL OUTPUT THUMBWHEEL

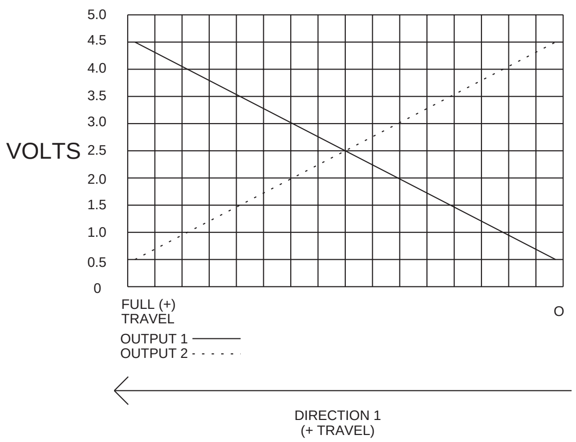
OPTION A



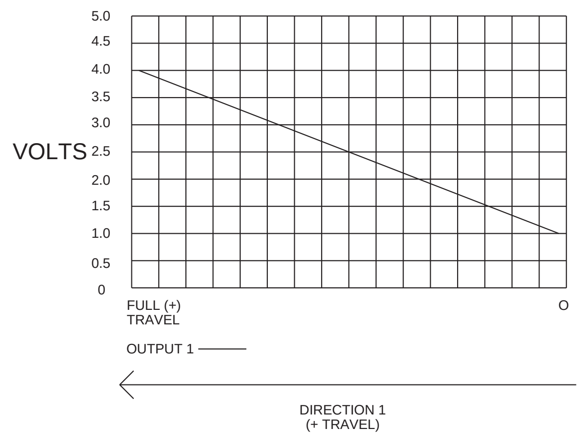
OPTION B



OPTION C



OPTION D



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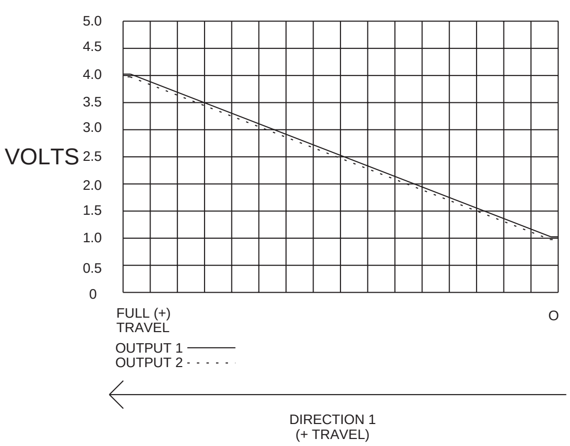
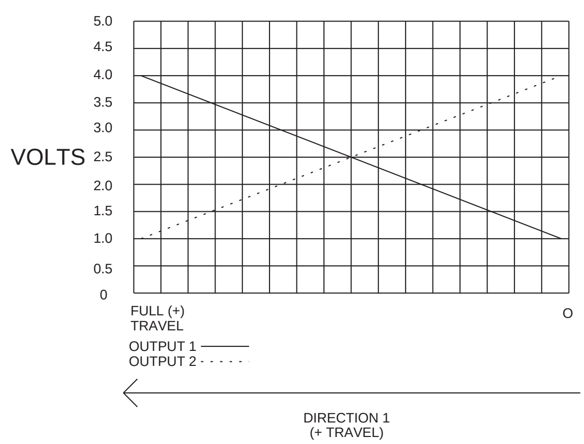


OPTION F



PROPORTIONAL OUTPUT THUMBWHEEL

FRICTION 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:				
MECHANICAL:				
Mechanical Life: 250,000 full forward to full back with center detent				
Initial Operating Force at Top of Roller: 2 oz min to 6 oz max @ 25°C				
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	4.5	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
ELECTRONICS:				
Seal Integrity:	Electronics watertight per IP68S, 1 meter			
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			

HTWF PART NUMBER CODE

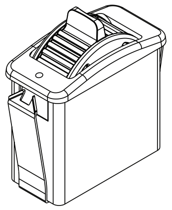
HTWF – X X X X X X X X

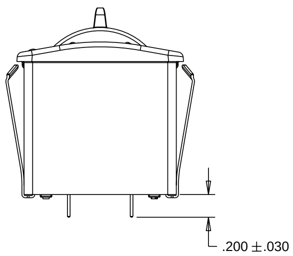
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	Detent (if required)
1. +/- 30°	**A.** 2.5 +/- 2.0VDC	NONE	**1.** 4.0 oz.	**1.** Knurled Wheel	**A.** 18 AWG Wires, 18.3" Long, Stripped Ends	**1.** Red	**1.** Red	**A.** Detent 2 oz increase out of center in both directions*
	B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		**2.** Paddle Wheel	**B.** 0.025" SQ. Pins	**2.** Black	**2.** Black	
	C. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC				**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	
						9. White	**9.** White	

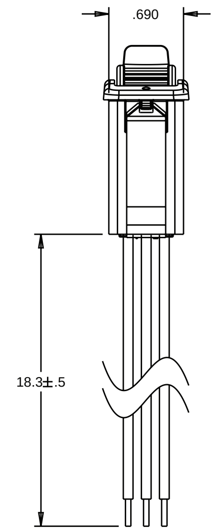
* Output options A–F do not have a tolerance on the center outputs unless a center detent is selected. Output options G and H are only available with center detent.

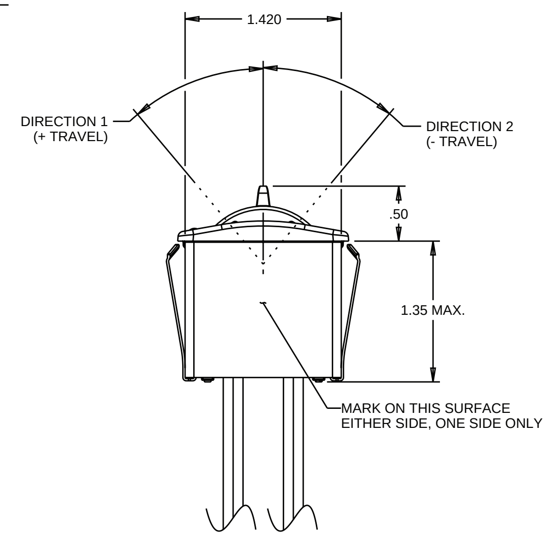
FRICTION HOLD ACTUATION STYLE THUMBWHEEL

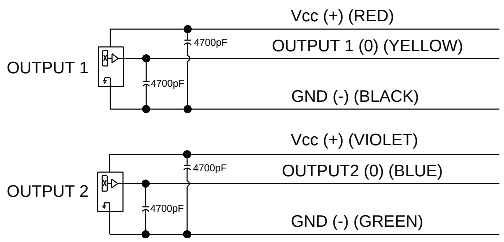
HTWF - Paddle Wheel Style Thumbwheel Shown



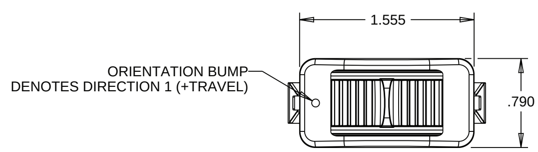


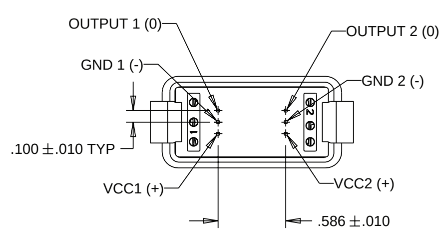






OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS





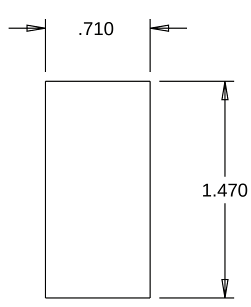
PINNED TERMINATION

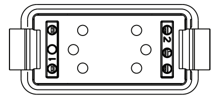
NOT ALL PINS ARE PRESENT IN ALL OUTPUT CONFIGURATIONS

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}



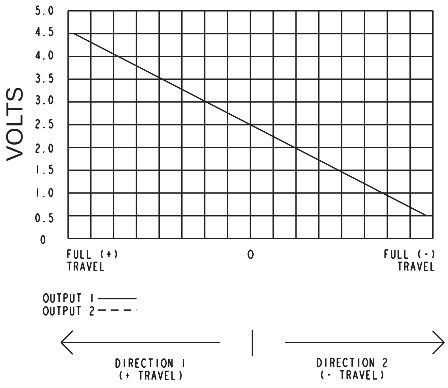


NOT ALL WIRES ARE PRESENT IN ALL OUTPUT CONFIGURATIONS

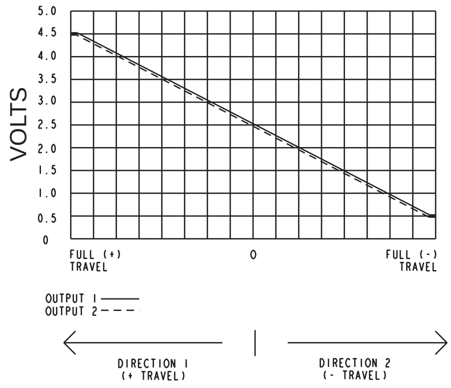
PROPORTIONAL OUTPUT THUMBWHEEL

FRICTION HOLD ACTUATION STYLE THUMBWHEEL

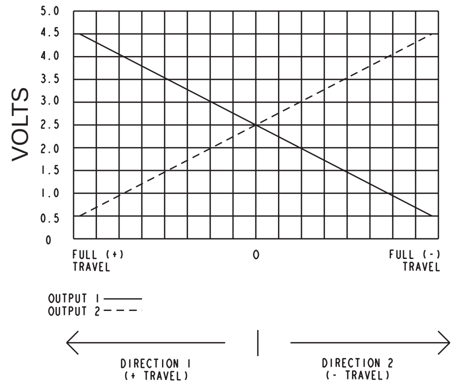
OPTION A



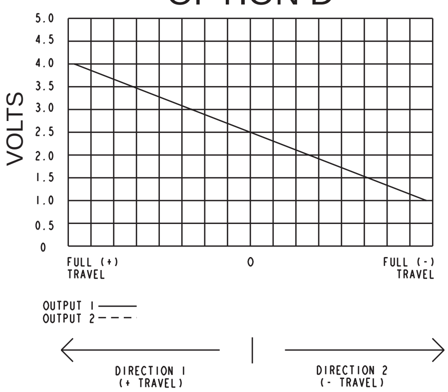
OPTION B



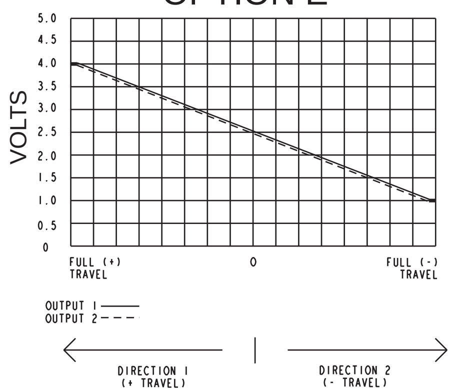
OPTION C



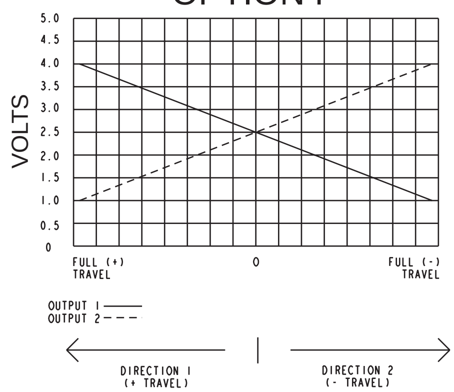
OPTION D



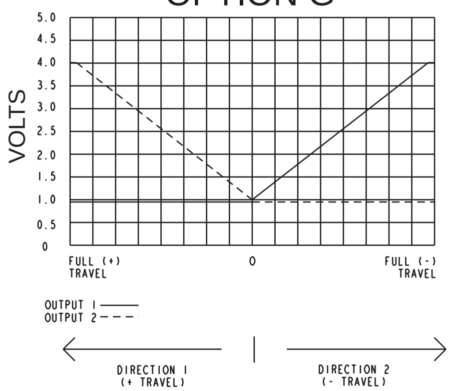
OPTION E



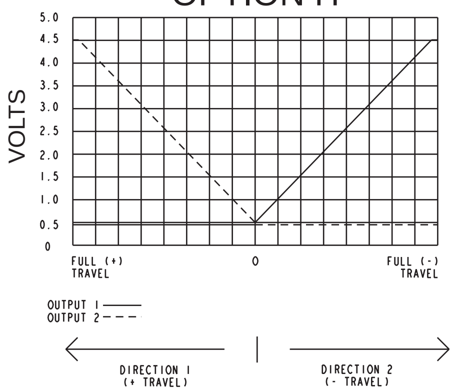
OPTION F



OPTION G



OPTION H



MINI PROPORTIONAL OUTPUT 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

MINI PROPORTIONAL OUTPUT THUMBWHEEL

SHORTER BEHIND PANEL DEPTH

HTWM PART NUMBER CODE

HTWM – X X X X X X X

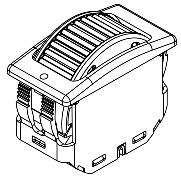
Travel	Output 1*	Output 2**	Operating Force	Button Style	Termination	Bezel Color	Button Color
1. +/- 40°	**A.** 2.5 +/- 2.0VDC	NONE	**1.** 5.0 oz.	**1.** Knurled Wheel	**A.** 18 AWG Wires, 18.3" Long, Stripped Ends	**1.** Red	**1.** Red
	B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		**2.** Paddle Wheel	**B.** 0.025" SQ. Pins	**2.** Black	**2.** Black
	C. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC				**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***					

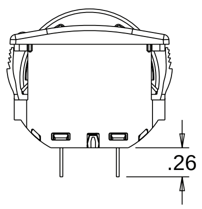
***** Outputs are from the center position to the full travel position in each direction. Options A–F provide increasing voltage in Direction 1 and decreasing voltage in Direction 2 from a single output. Options G and H provide increasing voltages in both directions from two separate outputs.

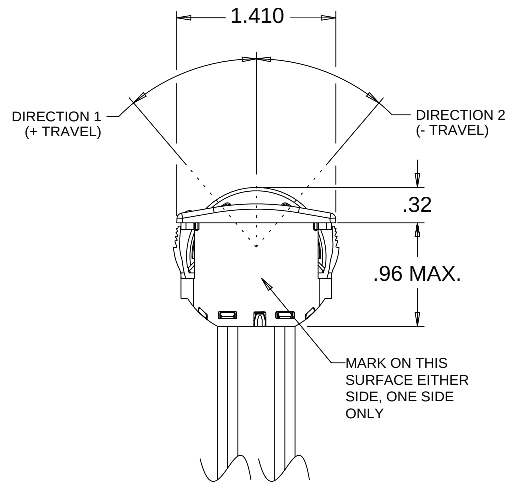
****** Options B and E provide redundant output 2 which duplicates output 1. Options C and F provide redundant output 2 which is inverse of output 1.

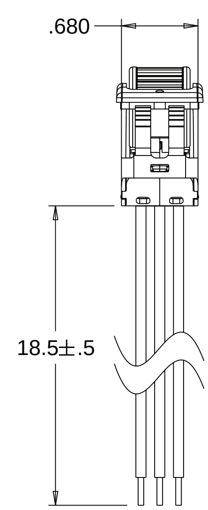
******* Options J, K, L, M, N and P are identical to options A, B, C, D, E and F respectively, except with a tighter center tolerance.

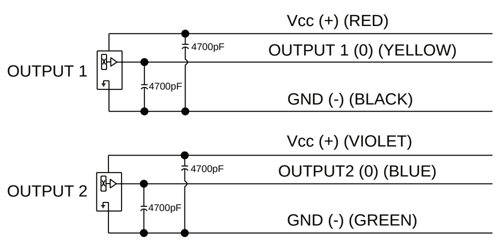
HTWM Knurled Wheel Style Thumbwheel Shown



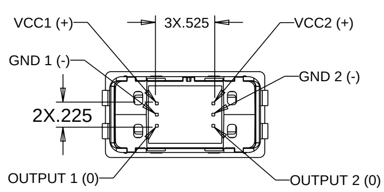








OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS



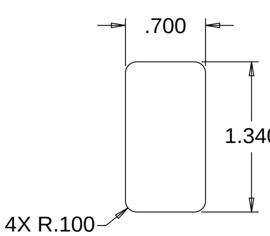
PINNED TERMINATION
NOT ALL PINS ARE PRESENT IN ALL OUTPUT CONFIGURATIONS

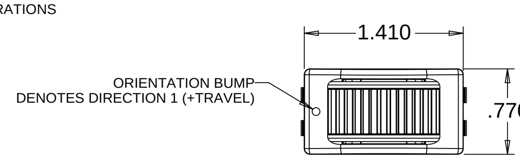
MOUNTING:

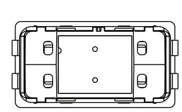
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS (0.040 MIN. - 0.200 MAX.)

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.)

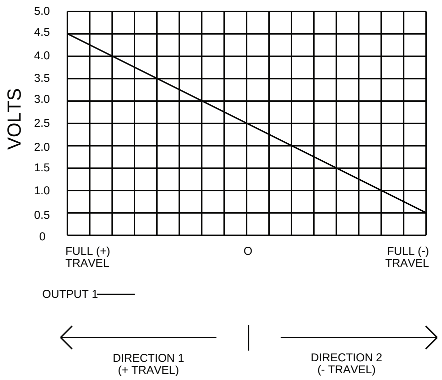


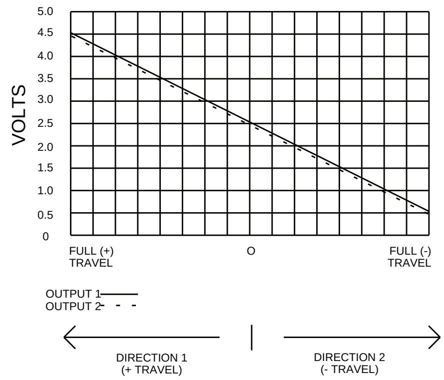


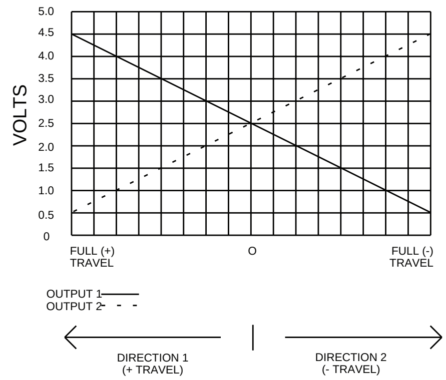


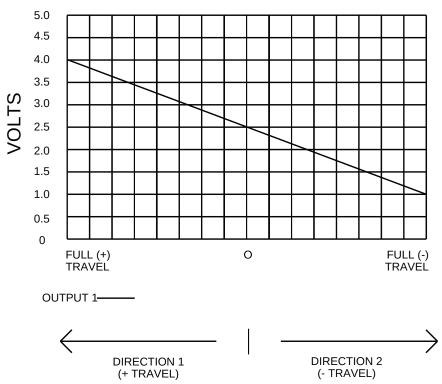
NOT ALL WIRES ARE PRESENT IN ALL OUTPUT CONFIGURATIONS

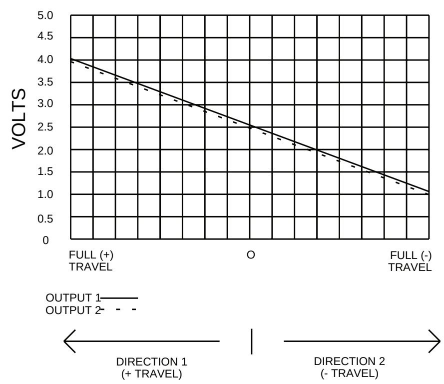
SHORTER BEHIND PANEL DEPTH

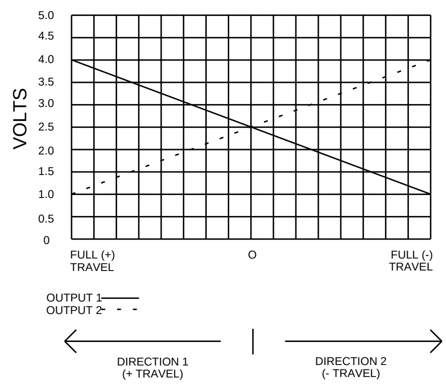
OPTION A & J


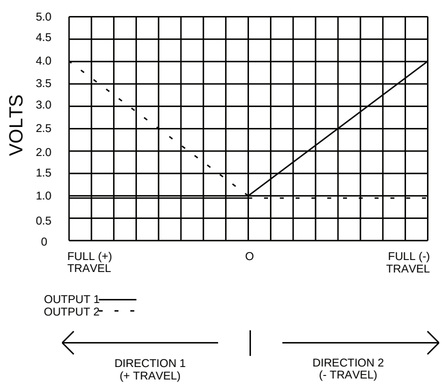
OPTION B & K


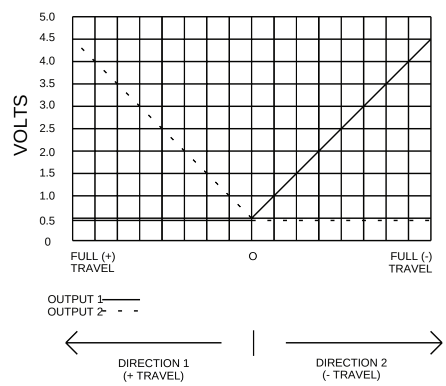
OPTION C & L


OPTION D & M


OPTION E & N


OPTION F & P


OPTION G


OPTION H


RETURN TO END MINI THUMBWHEEL

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:

MECHANICAL:

Mechanical Life:	1,000,000 full forward to full back
Max Allowable Radial Load:	30.0 lbs.

ELECTRICAL RATINGS: Rated at 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 Senor	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:	Thermoplastic
Wires:	18 AWG

HTWME RETURN TO END MINIATURE THUMBWHEEL PART NUMBER CODE

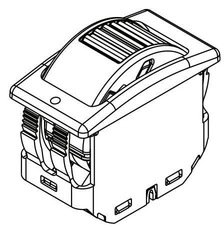
HTWME – X X* X X X X X

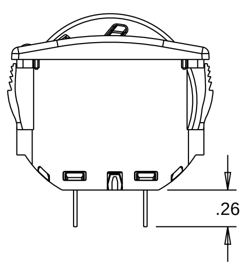
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color
1. 80°	**A.** 0.5 - 4.5VDC	NONE	**1.** 10 oz. typ.	**1.** Knurled Wheel	**A.** 18 AWG Wire, 18.3" Long, Stripped and Tinned Ends	**1.** Red	**1.** Red
	B. 0.5 - 4.5VDC	0.5 - 4.5VDC		**2.** Paddle Wheel	**B.** 0.025" 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

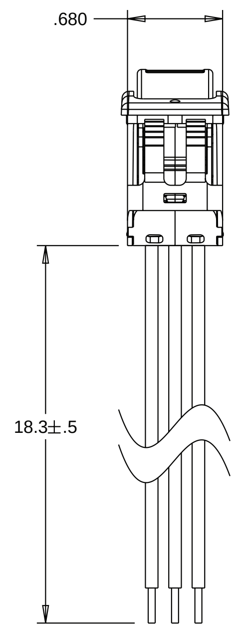
* Output options B and E provide redundant output 2 which duplicates output 1. Output options C and F provide redundant output 2 which is inverse output 1.

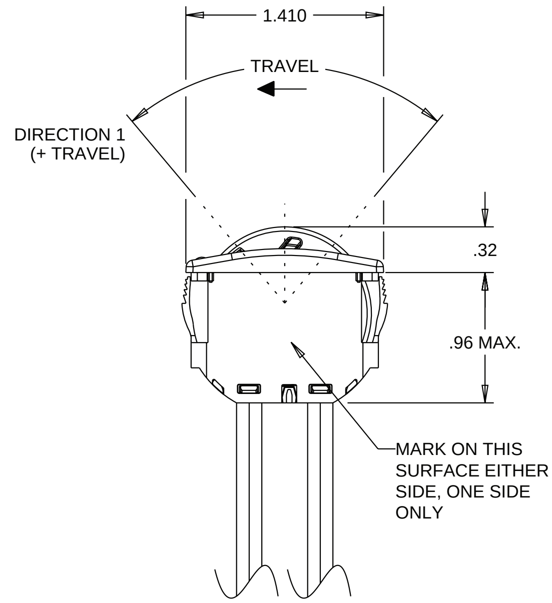
SHORTER BEHIND PANEL DEPTH

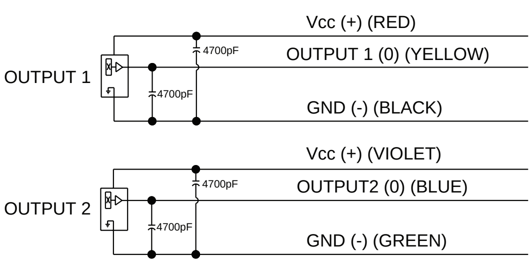
**HTWM Knurled Wheel Style
Thumbwheel Shown**



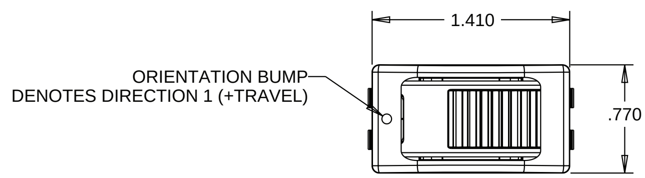








OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

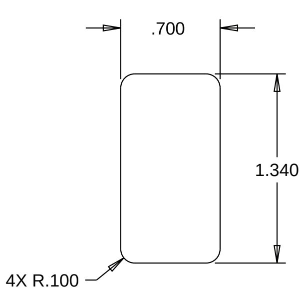


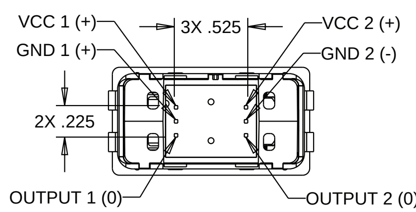
MOUNTING:

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

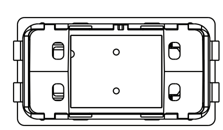
RECOMMENDED PANEL OPENING: 0.700 X 1.340 OPTIMUM
(0.695/0.705 X 1.335/1.345}

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





PINNED
TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



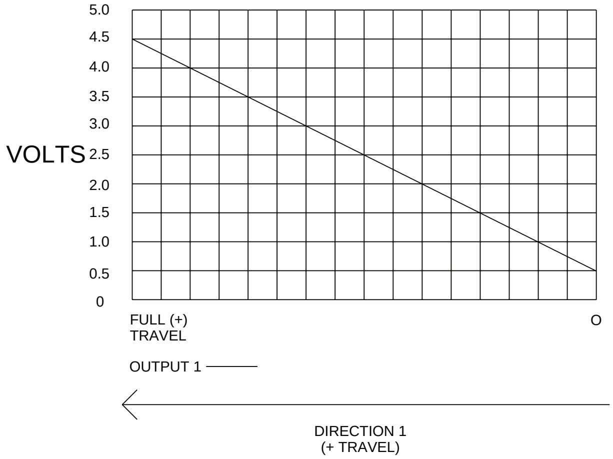
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

HALL EFFECT CONTROLS

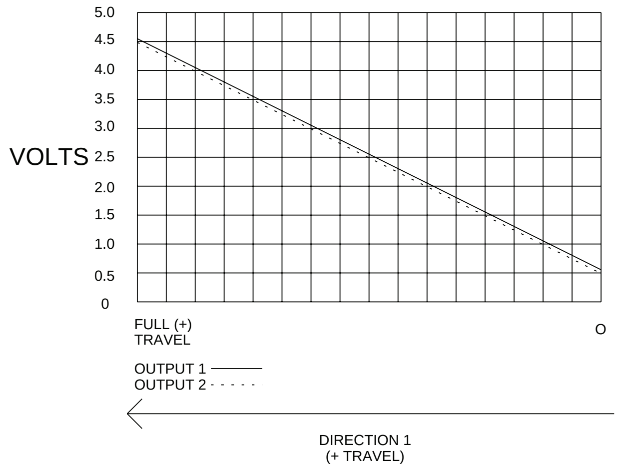
RETURN TO END MINI THUMBWHEEL

SHORTER BEHIND PANEL DEPTH

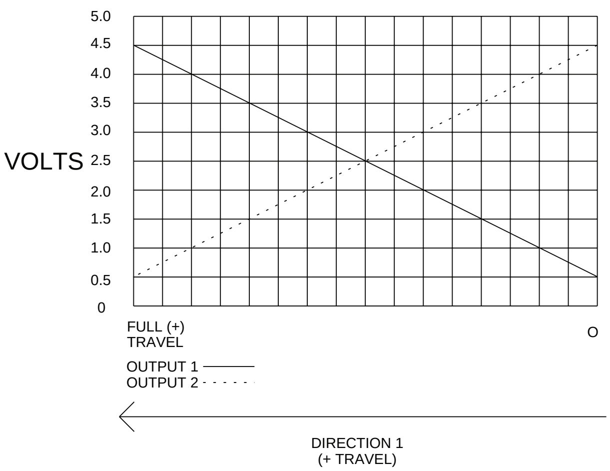
OPTION A



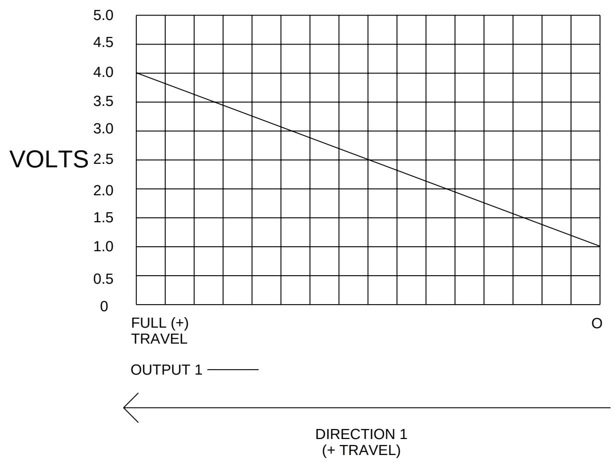
OPTION B



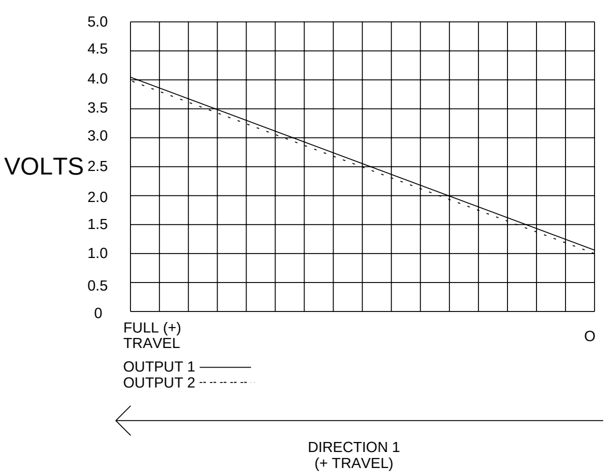
OPTION C



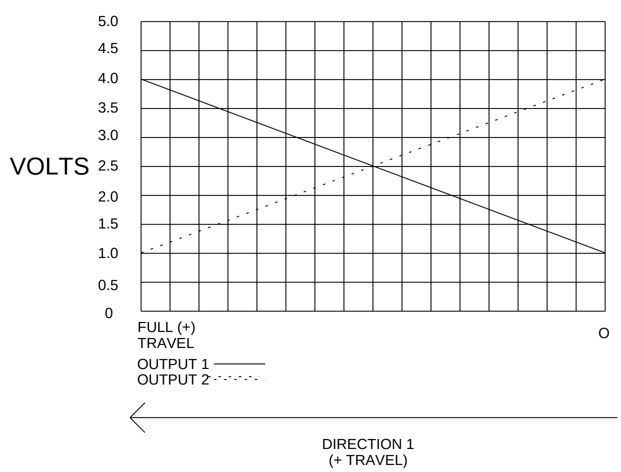
OPTION D



OPTION E



OPTION F



PROPORTIONAL OUTPUT 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**

Knurled Wheel

Paddle Wheel with Seal Boot

Standard Characteristics/Ratings:

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

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5.0	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 Per Senor B=0, Vcc=5V, Iout=0	mA	N/A	N/A	20

MECHANICAL:

Mechanical Life:	3,000,000 full forward to full back (button styles 1, 2) 1,000,000 full forward to full back (button style 3)
Max Allowable Radial Load:	15.0 lbs. (button styles 1, 2); 10.0 lbs (button style 3)

ENVIRONMENTAL:

Operating Temp Range:	-40°C to +85°C
Humidity:	96% RH, 70°C, 96 hours
Vibration:	Per MIL-810F minimum integrity
Electronics Enclosure:	IP58S (button styles 1, 2) IP68S (button style 3)
Mechanical Enclosure:	Unsealed (button styles 1, 2)
Mechanical Enclosure: (above panel)	IP68S (button style 3)
Mechanical Enclosure: (below panel)	Unsealed (button style 3)
RFI:	ISO 11452-2 & ISO 11452-4 (Single Output) SAE J1113-21 & SAE J1113-22 (Dual Output)
EMI:	ISO 11452-8 (Single Output) SAE J1113-22 (Dual Output)
ESD (Powered & Un-Powered):	ISO 10605 (Single Output) SAE J1113-13 (Dual Output)

MATERIALS:

Button Top:	Thermoplastic
Bezel:	Thermoplastic
Boot:	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 AWG UL 1569 (Single Output Only)	**1.** Red	**1.** Red
2. +/-45°*	**B.** 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	**2.** 8.5 oz. typ.	**2.** Paddle Wheel	**B.** Wire Leads, 22 AWG UL 1569, (Dual Output Only)	**2.** Black	**2.** Black
	C. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC	**3.** 12 oz. typ.	**3.** Paddle Wheel with Seal Boot***			**3.** Orange
	D. 2.5 +/- 1.5VDC	NONE					**4.** Yellow
	E. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC					**5.** Green
	F. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC					**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

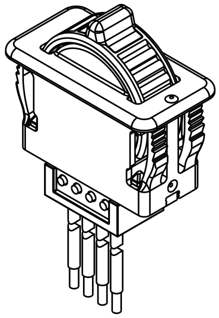
**** Contact Factory for additional bezel color choices.

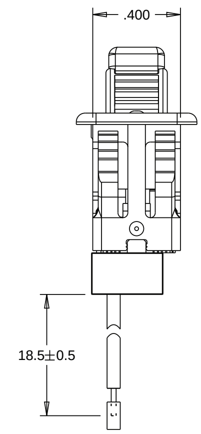
***** Minimums may apply to colors other than red and black.

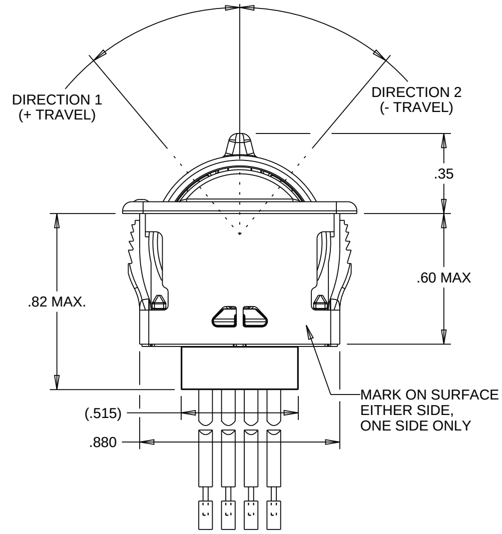
PROPORTIONAL OUTPUT THUMBWHEEL

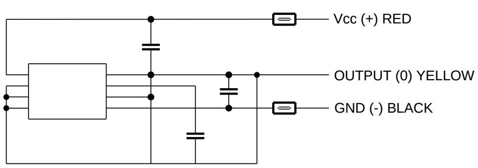
SUBMINIATURE PROPORTIONAL OUTPUT THUMBWHEEL WITH OPTIONAL SEAT BOOT

HTWS Paddle Wheel Style Shown

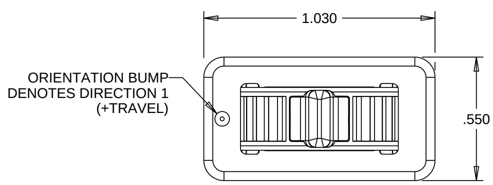


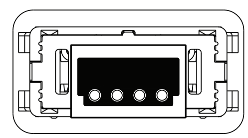




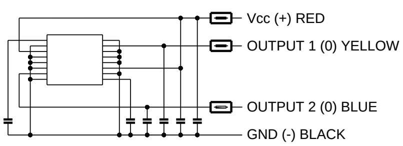


SINGLE OUTPUT SCHEMATIC





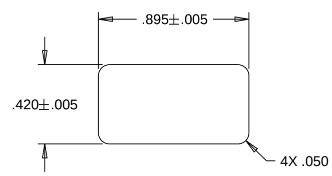
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



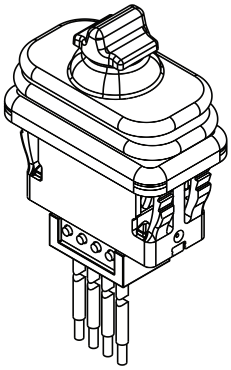
DUAL OUTPUT
COMMON POWER & GROUND
SCHEMATIC

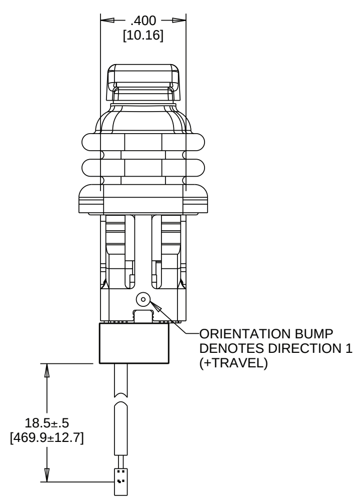
MOUNTING:

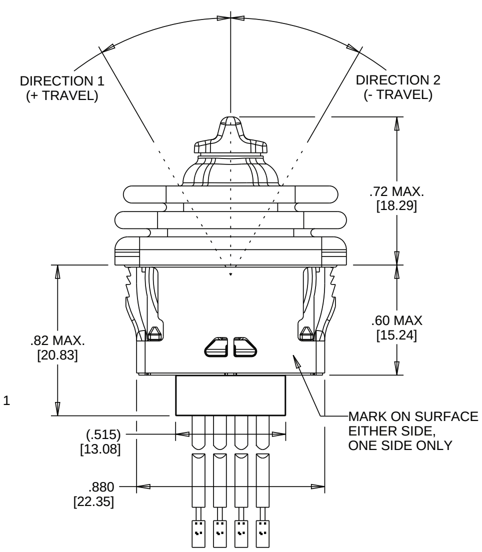
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS

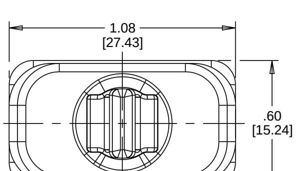


HTWS Paddle Wheel with Boot Style Shown



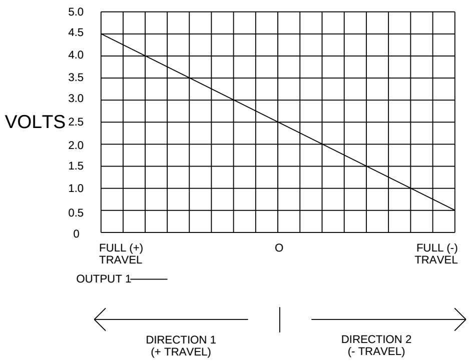




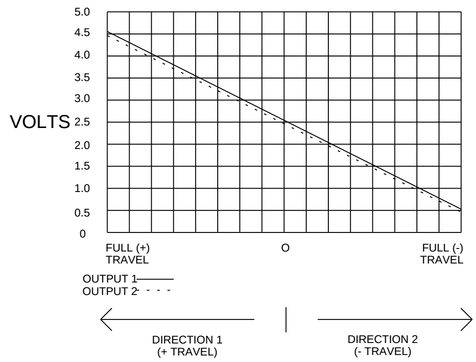


SUBMINIATURE PROPORTIONAL OUTPUT THUMBWHEEL WITH OPTIONAL SEAT BOOT

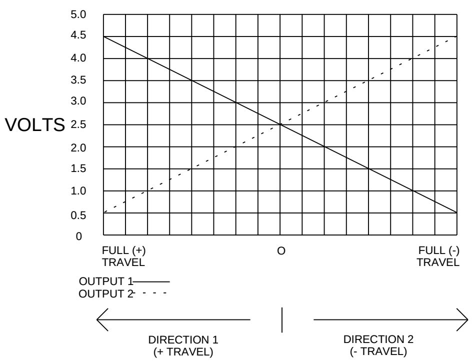
OPTION A



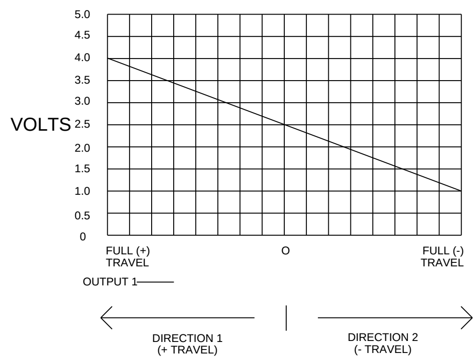
OPTION B



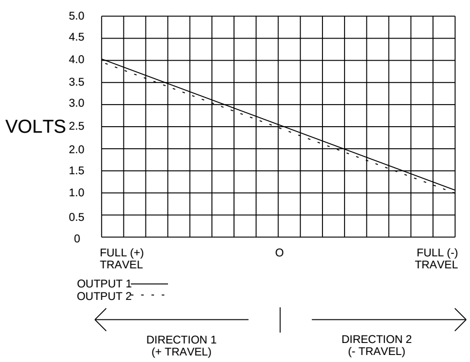
OPTION C



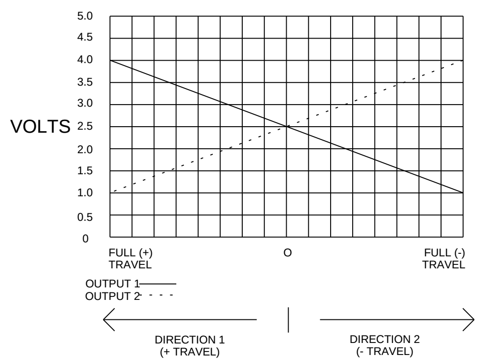
OPTION D



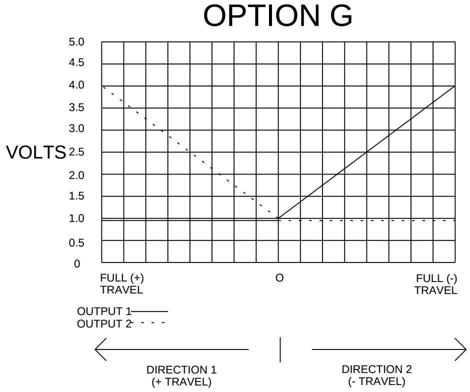
OPTION E



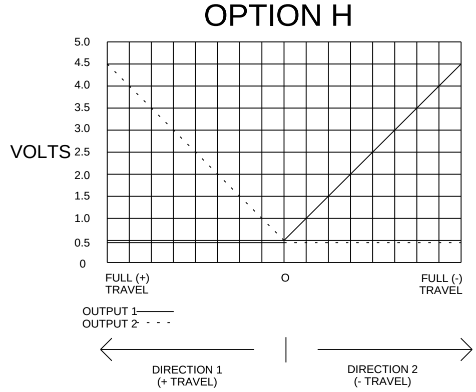
OPTION F



OPTION G



OPTION H



JOYSTICKS

HALL EFFECT TECHNOLOGY JOYSTICK

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° Deflection Tolerance at Center @5V Vcc	VDC	-0.15	N/A	+0.15
Output Voltage 19° to 20° Deflection Tolerance at Full Load @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:

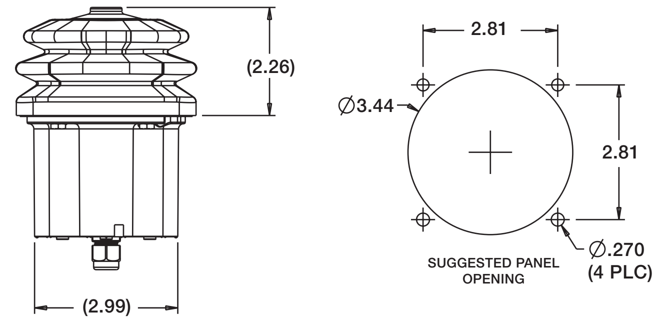
Mechanical Life:	5,000,000 min. up to 15,000,000 in all directions depending on configuration
Travel Angle:	20° typical
Operating Force:	With bellows, 20°C to 85°C at grip, 1 lbs. min to 7 lbs. max With bellows, -40°C at grip, 13.0 lbs. min to 18.0 lbs. max depending on selected spring

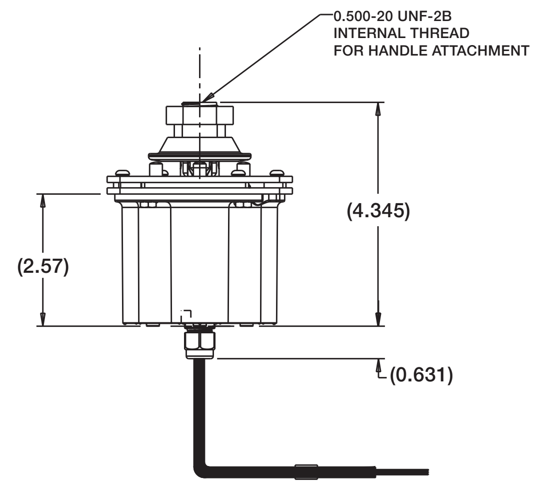
ENVIRONMENTAL:

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

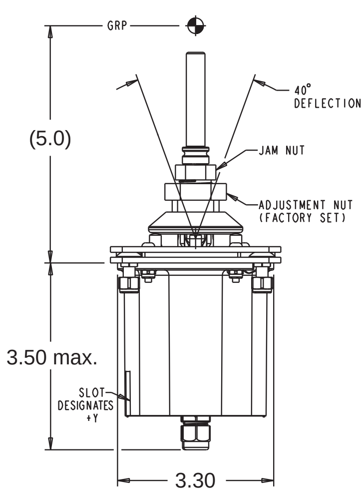
MATERIALS:

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

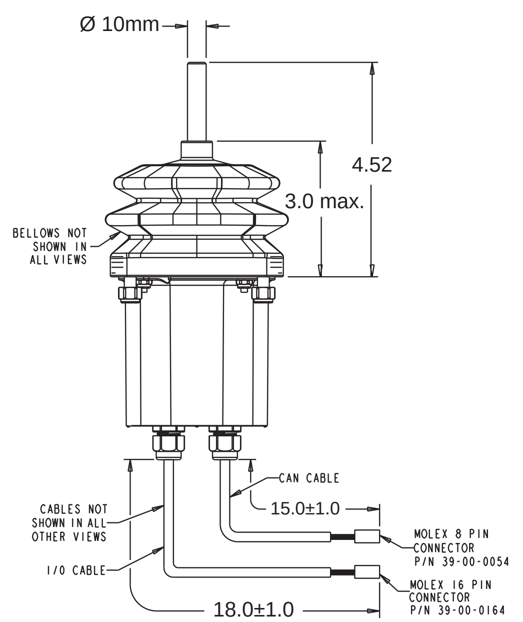




Analog Hall Joystick



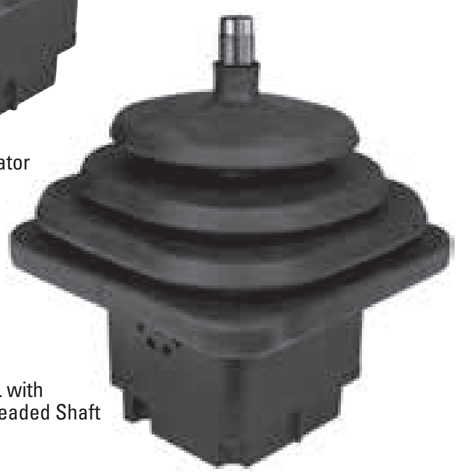
CANbus Technology Joystick
(22 or 24 AWG)



LARGE HALL EFFECT JOYSTICK

HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

JHL with Ball Actuator



JHL with
Threaded Shaft

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 EFI/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**
- **CANbus J1939 and CANopen outputs with integral Deutsch connector option**

Standard Characteristics/Ratings:

ELECTRICAL RATINGS

Joystick				
Rated at 5V @ 20°C, Load = 1ma (4.7kΩ)	**Units**	**Min**	**Typ**	**Max**
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				
Mechanical Life	6,000,000 Cycles (1,000,000 cycles, with detent)			
Mech. (Operating Force w/Bellows)	**Units**	**Min**	**Typ**	**Max**
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				
Operating Temperature	˚C	-40	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

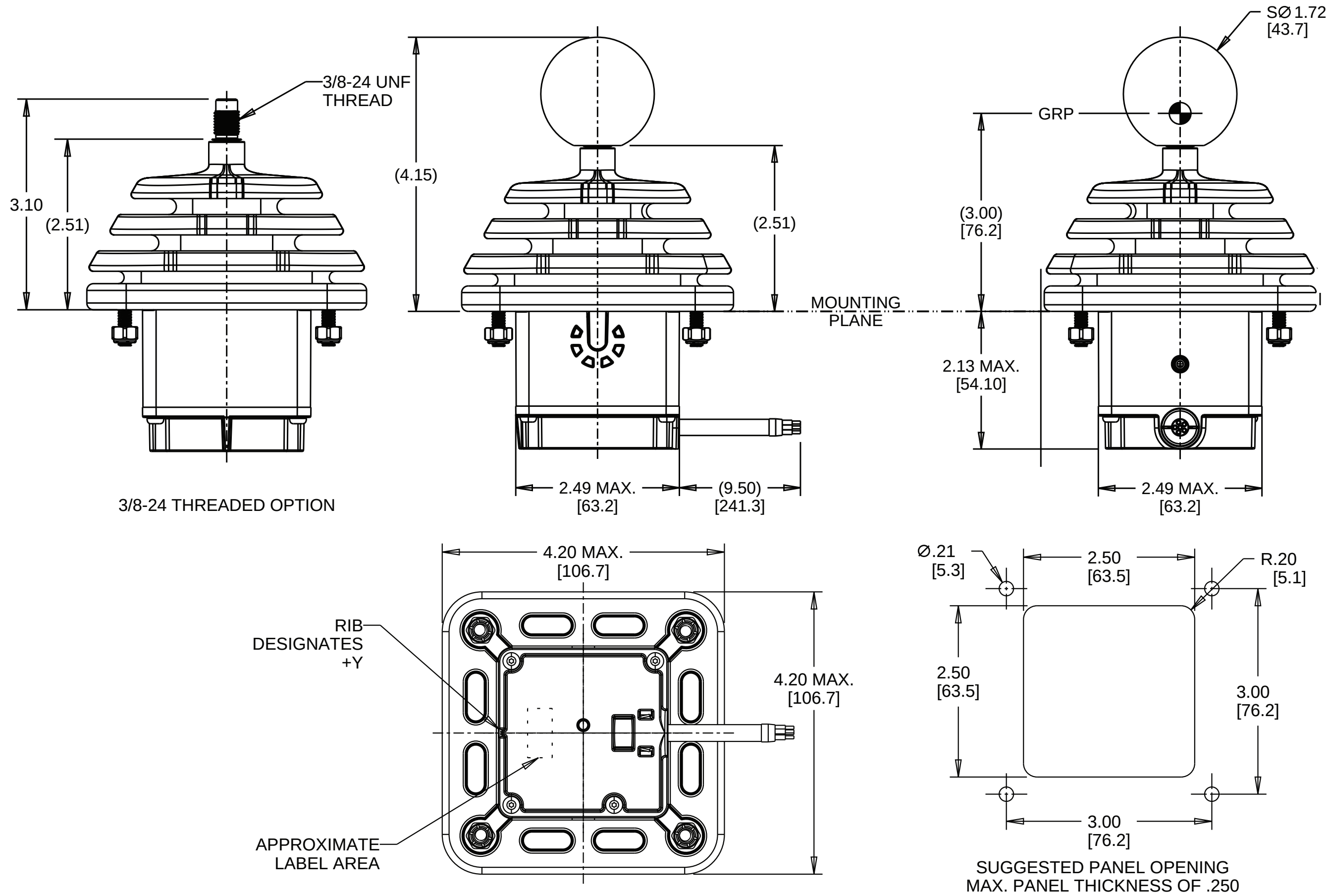
Joystick	
Plunger	Thermoplastic
Housing	Thermoplastic, Black
Bellows	Silicone, Black
Ball Knob	Thermoset, Black
Cable	Output Option AA, DD, JJ & KK: 22 AWG PVC/Polyurethane Blend Outer Jacket Output Option BB, CC, EE, FF, GG & HH: 22 AWG PVC/Polyurethane Blend Outer Jacket
Mounting Hardware	#10-24 x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

Specifications Subject To Change Without Notice

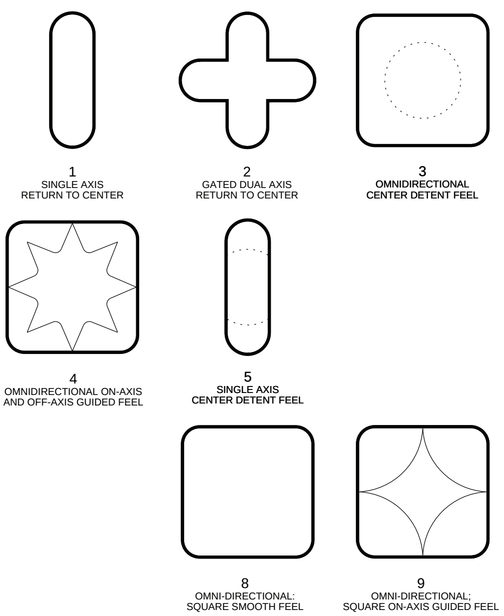
LARGE HALL EFFECT JOYSTICK

HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

JHL DRAWINGS



JHL GATING ICONS



JHL PART NUMBER CODE

JHL – X X XX X

Actuator Options

1. 3/8-24 Threaded
2. 1.72 Ball Knob

Gating Options

1. Gated Single Y-Axis: Return to Center
2. Gated; Dual Axis – Return to Center
3. Omni-directional; Center Detent Feel
4. Omni-directional: On-Axis and Off-Axis Guided Feel
5. Gated Single Y-Axis: Center Detent Feel
8. Omni-directional: Square Smooth Feel
9. Omni-directional: Square On-axis Guided Feel

Code	Joystick Output 1*	Joystick Output 2**
AA.	2.5 +/- 2.0VDC	NONE
BB.	2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC.	2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD.	2.5 +/- 1.5VDC	NONE
EE.	2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF.	2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG.	0.5 - 4.5VDC	0.5 - 4.5VDC
HH.	1.0 - 4.0VDC	1.0 - 4.0VDC
JJ.	CANbus J1939	NONE
KK.	CANopen	NONE
LL.	CANbus J1939 w/ Deutsch Connector	NONE
MM.	CANopen w/ Deutsch Connector	NONE

Force

1. Low
2. Medium
3. High

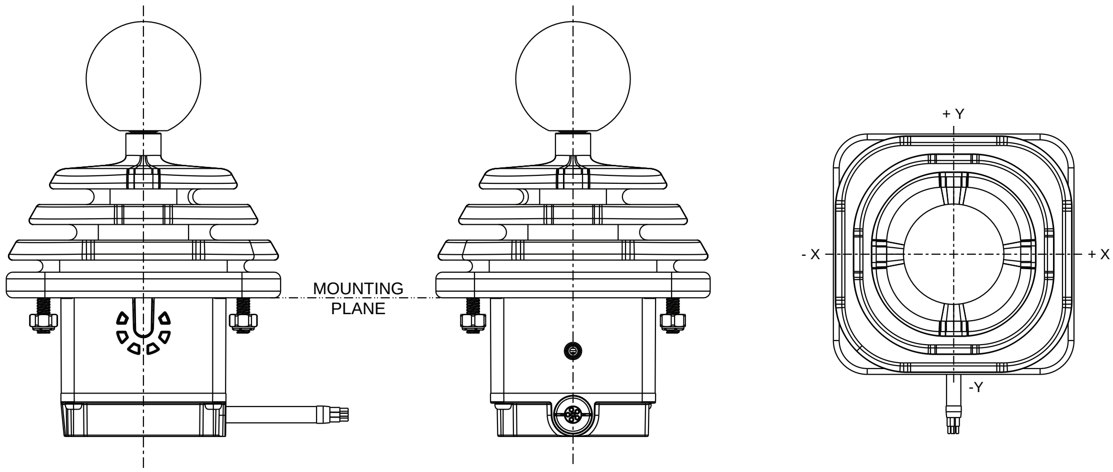
*Outputs are from the center to the full travel position in each direction. Options "AA", "BB", "CC", "DD", "EE", "FF" provide increased voltage in +x, +y; and decreasing voltage in -x, -y direction from 1 output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+x, +y, -x,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

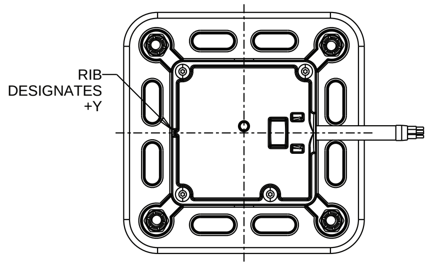
**Options "BB"and "EE" provide redundant output 2 which duplicates output 1.
Options "CC"and "FF"provide redundant output 2 which is inverse of output 1.

LARGE HALL EFFECT JOYSTICK

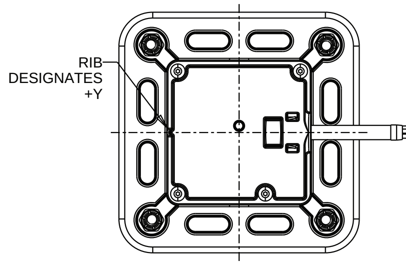
HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

JHL OUTPUT DRAWINGS



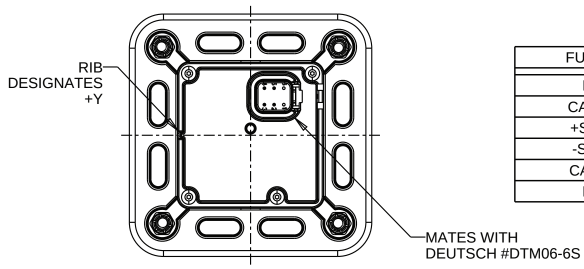


OUTPUTS AA-HH SHOWN



OUTPUTS JJ AND KK SHOWN

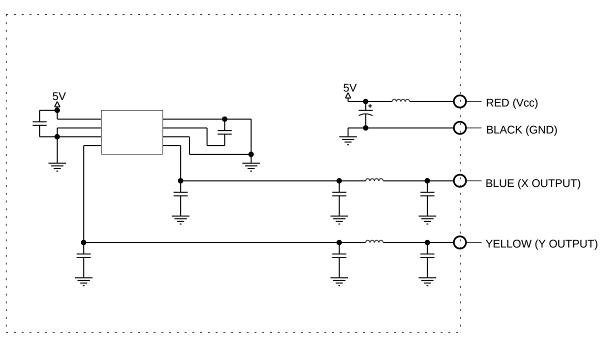
FUNCTION	COLOR
CAN HIGH	YELLOW
+SUPPLY	RED
-SUPPLY	BLACK
CAN LOW	GREEN



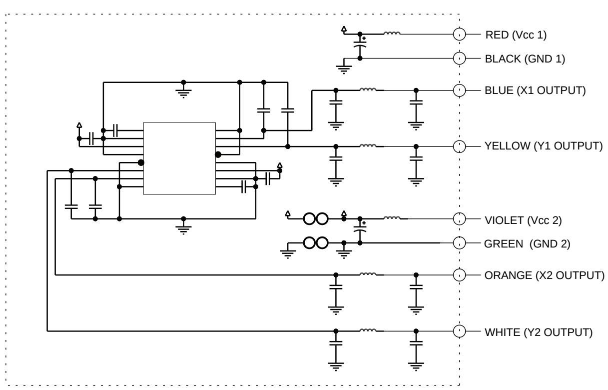
FUNCTION	COLOR
NONE	PIN 1
CAN HIGH	PIN 2
+SUPPLY	PIN 3
-SUPPLY	PIN 4
CAN LOW	PIN 5
NONE	PIN 6

OUTPUTS LL AND MM SHOWN

JHL SCHEMATICS



JOYSTICK SCHEMATIC
(AA AND DD OUTPUTS)



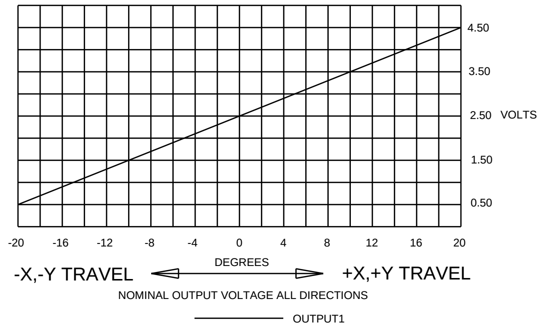
JOYSTICK SCHEMATIC
(BB, CC, EE, FF, GG, & HH OUTPUTS)

LARGE HALL EFFECT JOYSTICK

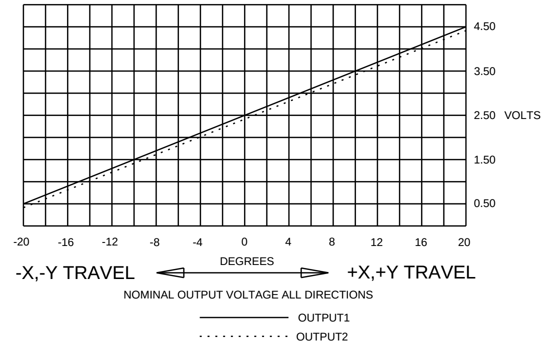
HIGH PERFORMANCE, COST-EFFECTIVE, SEALED

JHL OUTPUTS

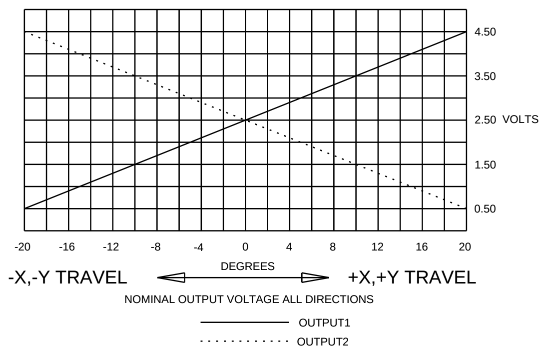
OPTION AA



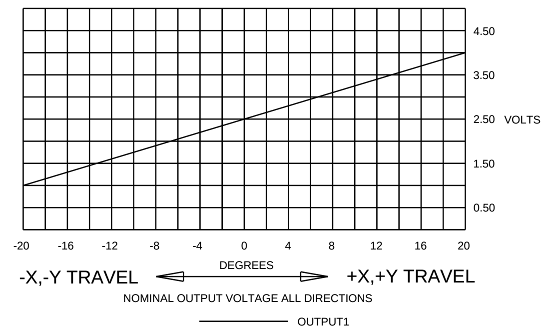
OPTION BB



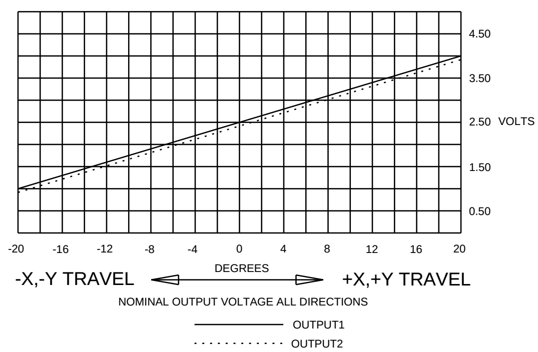
OPTION CC



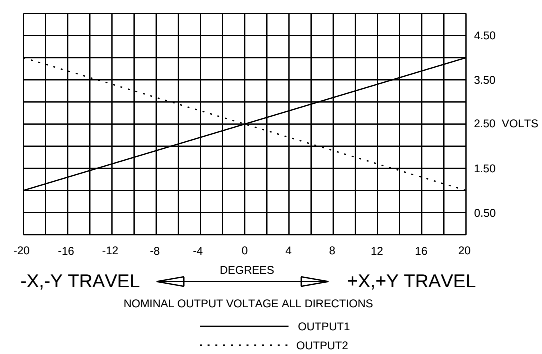
OPTION DD



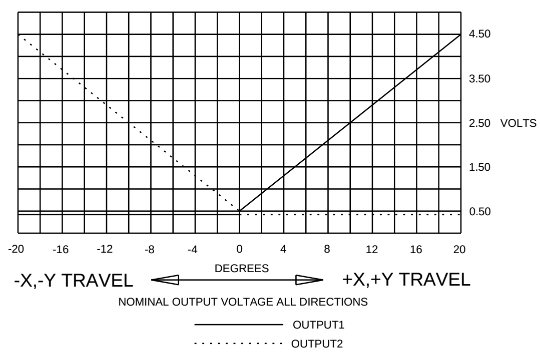
OPTION EE



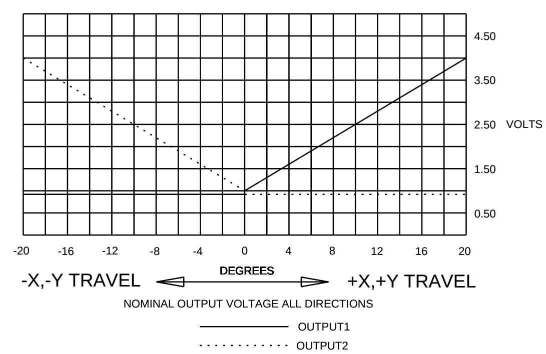
OPTION FF



OPTION GG



OPTION HH



JOYSTICK WITH GRIP OPTIONS

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**
- **CANbus J1939 and CANopen outputs with integral Deutsch connector option**

JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH GRIP

Standard Characteristics/Ratings:

ELECTRICAL:

Joystick				
Rated at Vcc = 5V @ 20˚C	**Units**	**Min**	**Typ**	**Max**
Load = 1 ma (4.7 KΩ)				
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
Joystick CAN Open				
Supply Voltage	VDC	9	N/A	32
Node Identifier	Dec.		10	
Baud Rate	B/S		125K	
Joystick J1939				
Supply Voltage	VDC	9	N/A	32
Source Address	Dec.		51	
Baud Rate	B/S		250K	
Grip Touch Switch*				
Supply Voltage	VDC	3.15	NA	5.5
Output Active (Low)	VDC	NA	NA	0.60
Output Current Sink	mA	N/A	NA	10
Operator Presence				
Electrical Rating	10mA Resistive Load @ 5VDC			
Logic Level Electrical Life	1,250,000 Cycles			
Keypads				
Circuit Configuration	SPST N.O.			
Voltage	1–32 VDC			
Current	10–100 mA Resistive			
P9 Switches				
Electrical Rating	10mA Resistive Load @ 5VDC			
Logic Level Electrical Life	1,250,000 Cycles			
K1 Switches				
Electrical Rating	10mA Resistive Load @ 5VDC			
Electrical Life	100,000 Cycles			
HTW Switches				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-.15	NA	+.15
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
HTWM Switches				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-.25	NA	+.25
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
HTWS Switches				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-.25	NA	+.25
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):

HTLT4 Switches				
Supply Voltage	VDC	4.5	5.0	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-.25	NA	+.25
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
TC-5 Switches				
Electrical Rating @ 1-32 VDC	10-100mA			
Electrical Life	3,000,000 Cycles			

MECHANICAL:

Joystick	Units	Min	Typ	Max
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.
Keypads				
Mechanical Life	3 ,000,000 Cycles			
P9 Switches				
Mechanical Life	1,250,000 Cycles			
K1 Switches				
Mechanical Life	100,000 Cycles			
HTW Switches				
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			
HTWM Switches				
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
HTWS Switches				
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

JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH GRIP

Standard Characteristics/Ratings (continued):

HTLT4 Switches				
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
TC-5 Switches				
Mechanical Life	3,000,000 Cycles			
Operating Force	Oz.	8.0	16.0	24.0

ENVIRONMENTAL:

Joystick	**Units**	**Min**	**Typ**	**Max**
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)			
Keypads	**Units**	**Min**	**Typ**	**Max**
Operating Temperature	˚C	-40	20	85
Faceplate and Side Keypad Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
P9 Switches	**Units**	**Min**	**Typ**	**Max**
Operating Temperature	˚C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
K1 Switches	**Units**	**Min**	**Typ**	**Max**
Operating Temperature	˚C	-30	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
HTW Switches	**Units**	**Min**	**Typ**	**Max**
Operating Temperature	˚C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
HTWM Switches				
Operating Temperature	˚C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
HTWS Switches				
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)			
HTLT Switches				
Operating Temperature	˚C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
TC-5 Switches				
Operating Temperature	˚C	-40	20	85
Electrical Enclosure Design	ISO 20653, IP6K8S – Dusttight, Continuous Immersion, 1 meter for 31 minutes, Stationary during test(s)			
Grip	**Units**	**Min**	**Typ**	**Max**
Operating Temperature	˚C	-40	20	85
Electrical Enclosure Design	Unsealed			

Standard Characteristics/Ratings (continued):

MATERIAL:

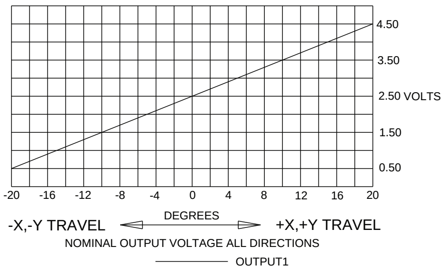
Joystick	
Plunger	Thermoplastic
Housing	Thermoplastic, Black
Bellows	Silicone, Black
Cable	Output Option AA, DD, JJ & KK: 22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane Blend Outer Jacket Output Option BB, CC, EE, FF, GG & HH: 22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane Blend Outer Jacket
Mounting Hardware	#10–24 x 3/4 Carriage Bolts Self Locking Nuts
Keypads	
Keypads	Silicone Rubber, Black
Keypads, Lighted	Silicone Rubber, Black with White Graphic
P9 Switches	
Button	Thermoplastic
Housing	Thermoplastic
K1 Switches	
Button	Thermoplastic
Housing	Thermoplastic
HTW Switches	
Button Top	Thermoplastic
Housing	Thermoplastic
HTWM Switches	
Button Top	Thermoplastic
Housing	Thermoplastic
HTWS Switches	
Button Top	Thermoplastic
Housing	Thermoplastic
HTLT4 Switches	
Housing and Flange	Thermoplastic
Bellows	Silicone, Black
TC-5 Switches	
Housing	PBT
Keypad	Silicone Rubber
Grip	
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.

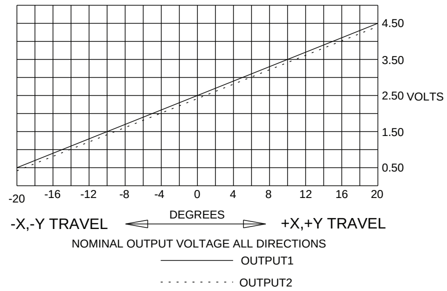
HALL EFFECT JOYSTICK WITH GRIP

HJLG3 OUTPUT CONFIGURATIONS

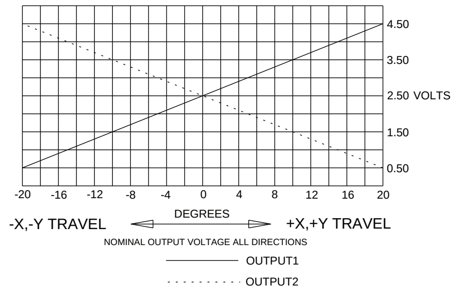
OPTION AA



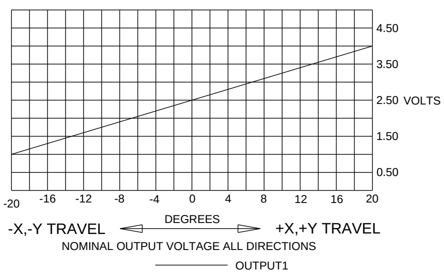
OPTION BB



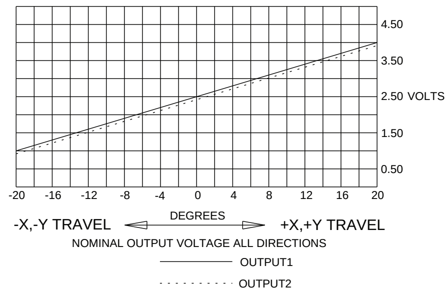
OPTION CC



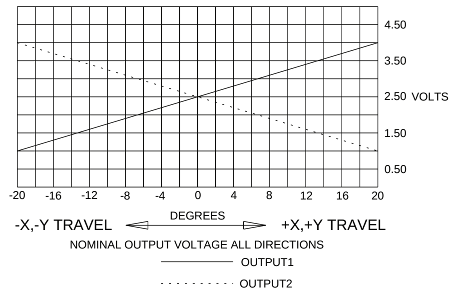
OPTION DD



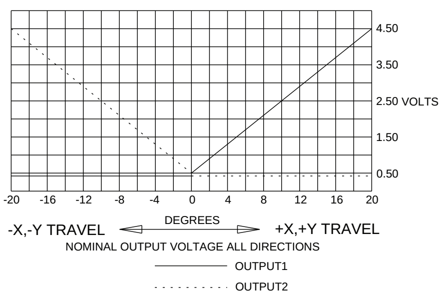
OPTION EE



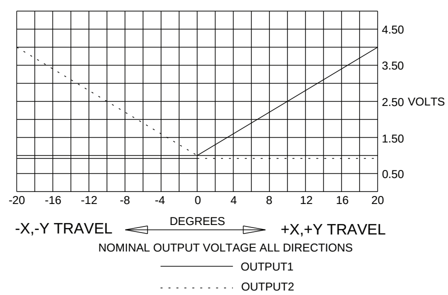
OPTION FF



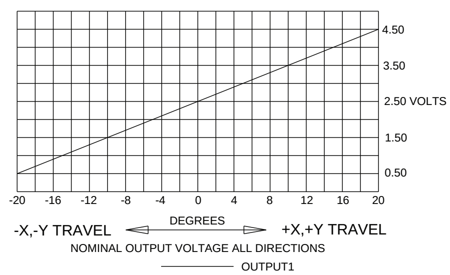
OPTION GG



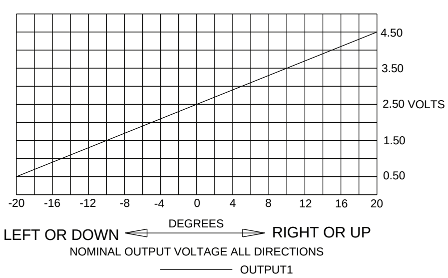
OPTION HH



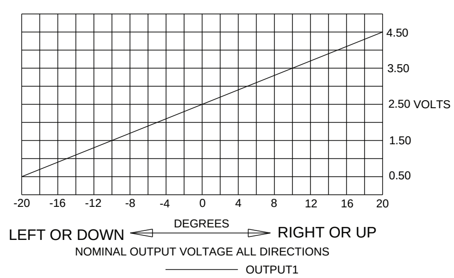
HTLT4 OUTPUT



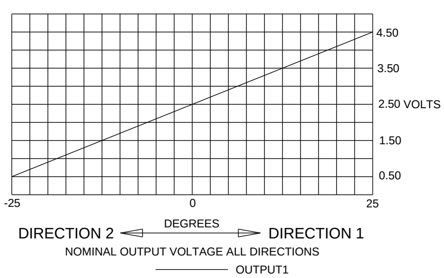
HTWM OUTPUT



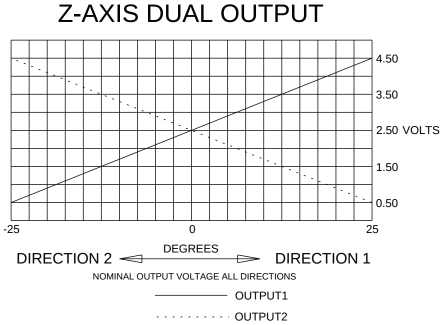
HTWS OUTPUT



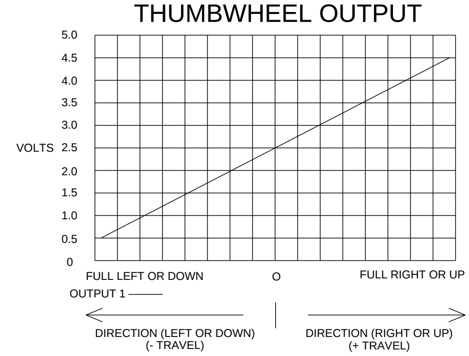
Z-AXIS SINGLE OUTPUT



Z-AXIS DUAL OUTPUT



THUMBWHEEL OUTPUT



HALL EFFECT CONTROLS

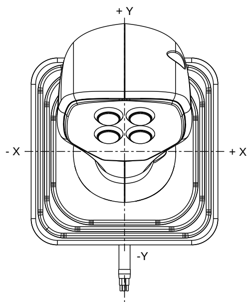
JOYSTICK WITH GRIP OPTIONS

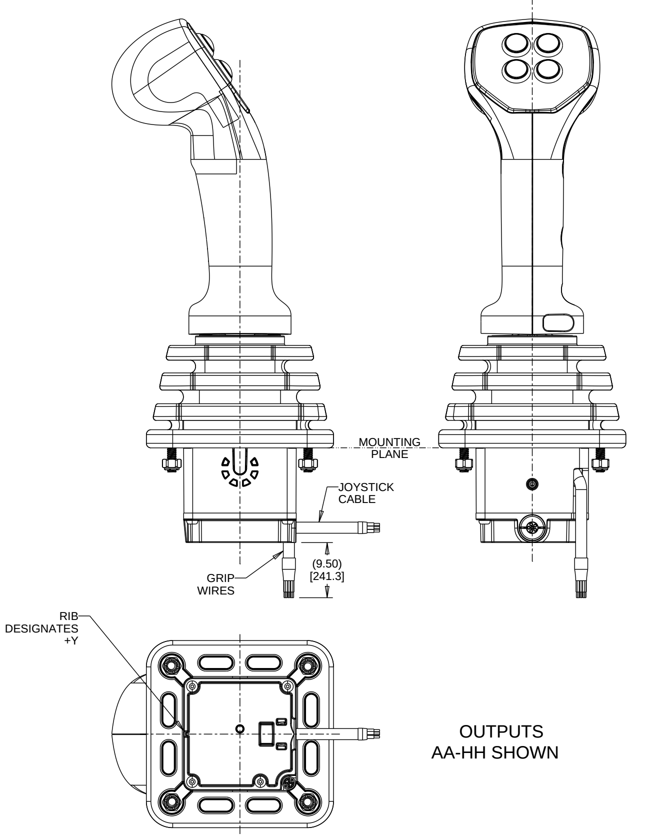
HALL EFFECT JOYSTICK WITH GRIP

OUTPUTS AND JOYSTICK SCHEMATICS

HJLG3-C with Faceplate shown

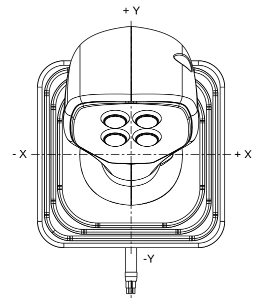
Analog Outputs

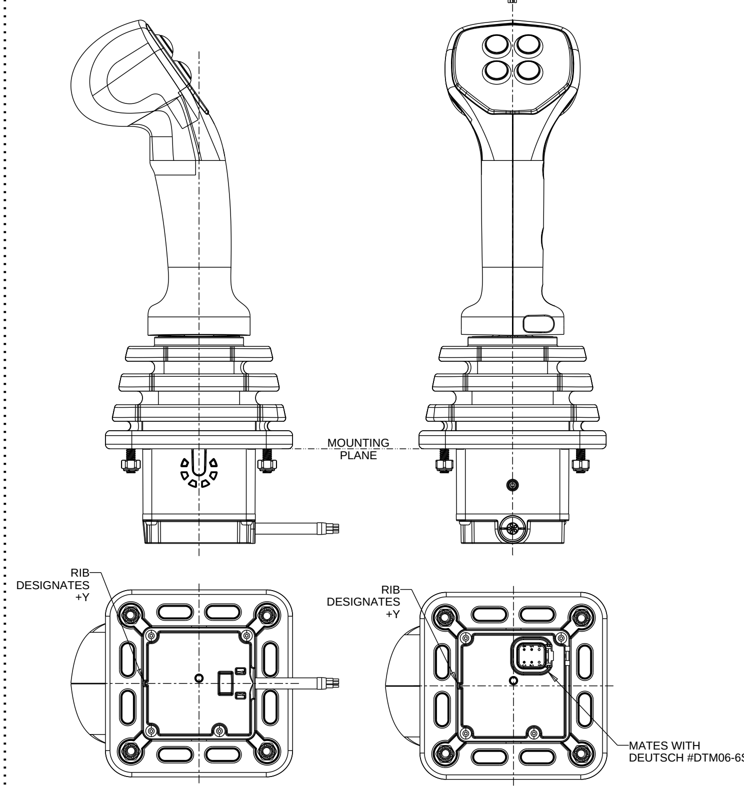




OUTPUTS AA-HH SHOWN

CAN Outputs



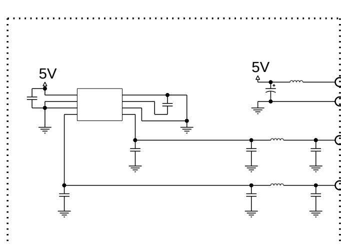


OUTPUTS JJ AND KK SHOWN

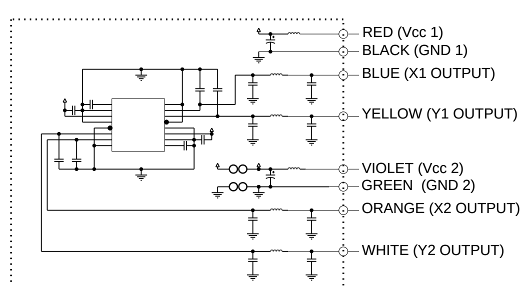
FUNCTION	COLOR
CAN HIGH	YELLOW
+SUPPLY	RED
-SUPPLY	BLACK
CAN LOW	GREEN

OUTPUTS LL AND MM SHOWN

FUNCTION	COLOR
NONE	PIN 1
CAN HIGH	PIN 2
+SUPPLY	PIN 3
-SUPPLY	PIN 4
CAN LOW	PIN 5
NONE	PIN 6



JOYSTICK SCHEMATIC
(AA AND DD OUTPUTS)

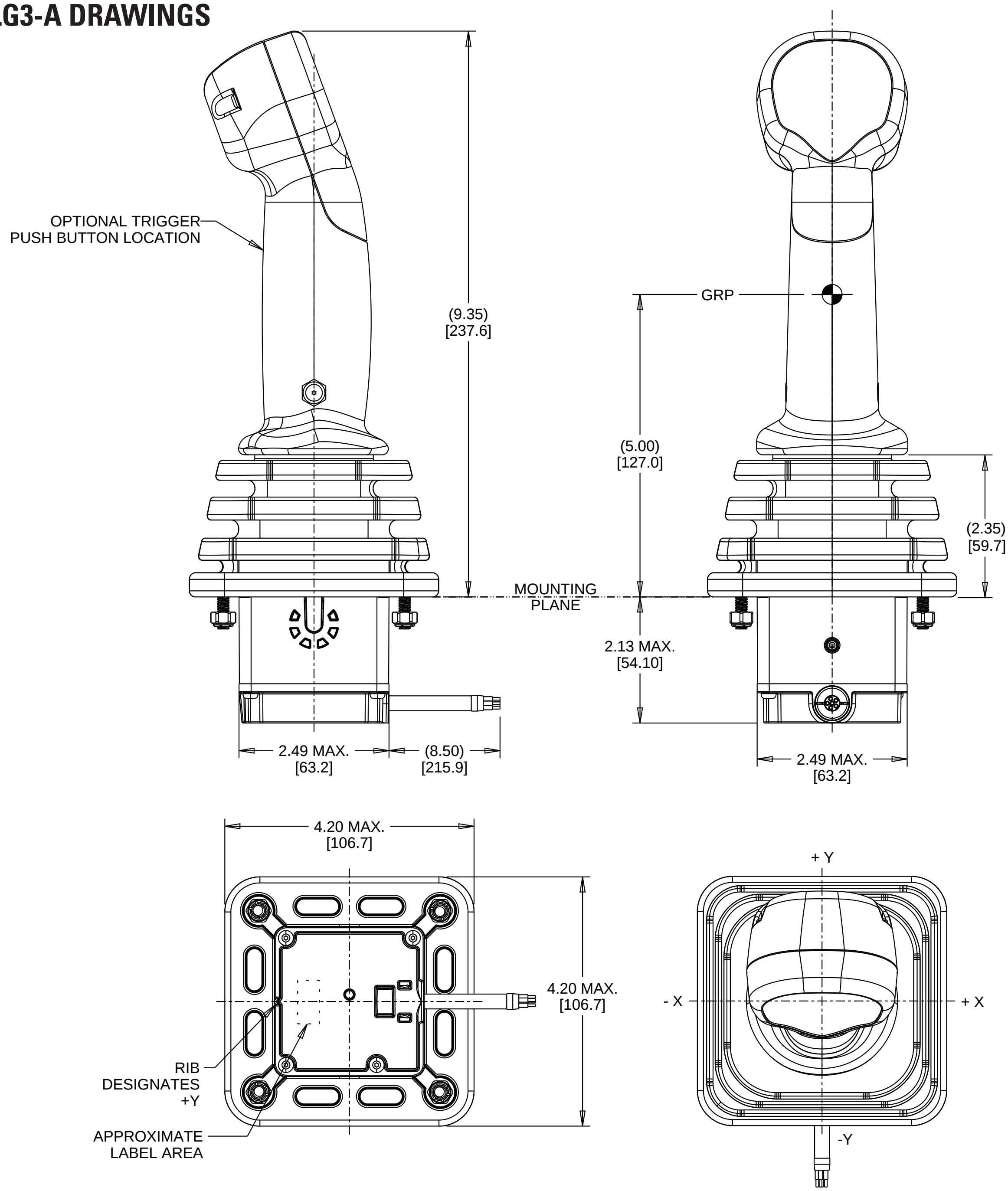


JOYSTICK SCHEMATIC
(BB, CC, EE, FF, GG, & HH OUTPUTS)

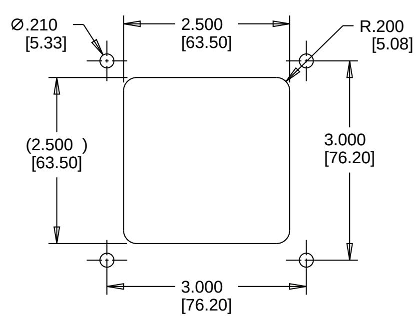
Specifications Subject To Change Without Notice

HALL EFFECT JOYSTICK WITH G3-A UNIVERSAL GRIP

HJLG3-A DRAWINGS



HJLG3 SUGGESTED PANEL OPENING

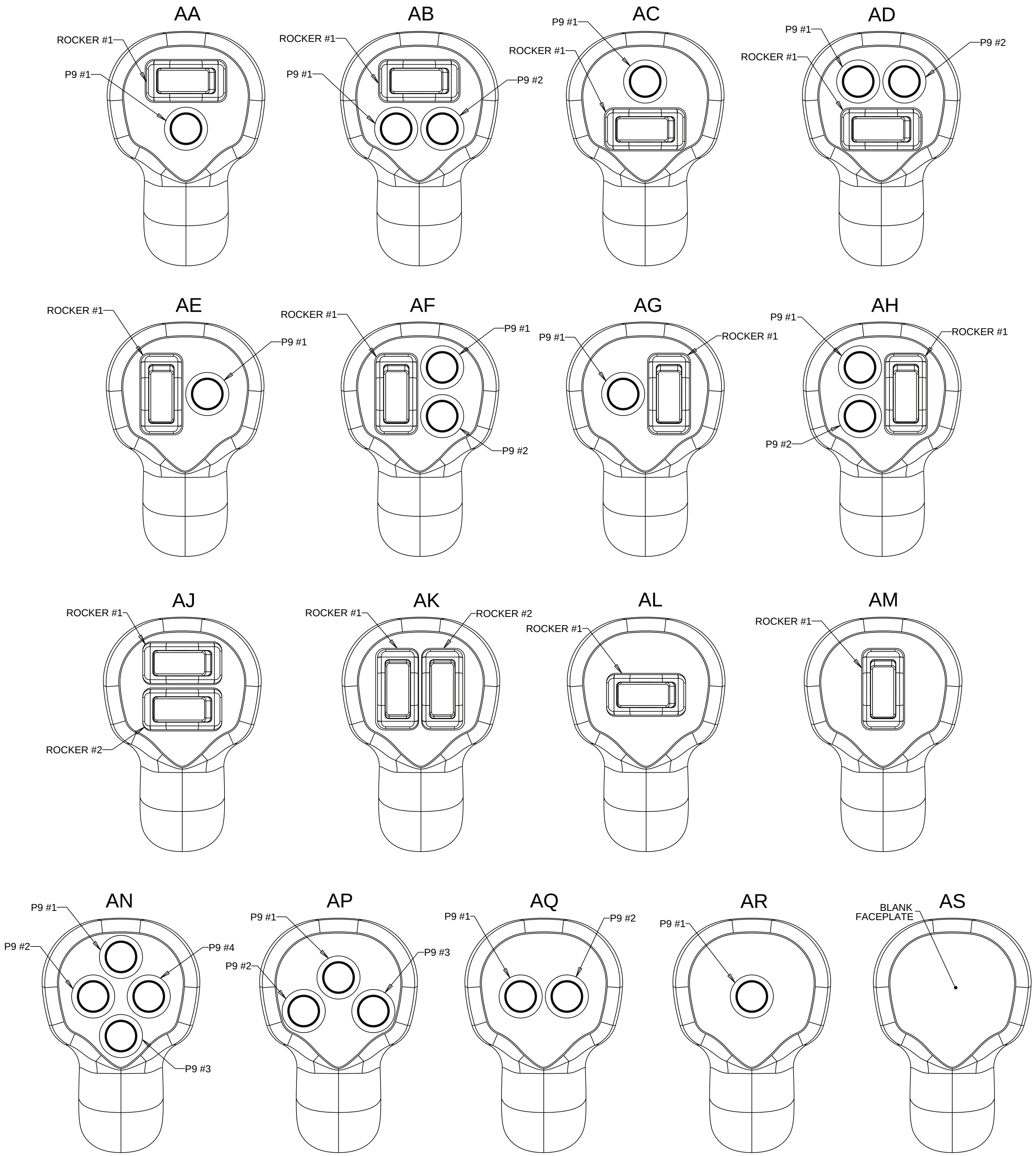


SUGGESTED PANEL OPENING
MAX. PANEL THICKNESS OF .250

JOYSTICK WITH GRIP OPTIONS

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

1. Gated Single Y-Axis; Return to Center
2. Gated Dual Axis; Return to Center
3. Omni-directional; Center Detent Feel
4. Omni-directional; On-Axis and Off-Axis Guided Feel
5. Gated Single Y-Axis; Center Detent Feel
8. Omni-directional; Square Smooth Feel
9. Omni-directional; Square On-Axis Guided Feel

	Joystick Output 1*	Joystick Output 2**
AA.	2.5 +/- 2.0VDC	NONE
BB.	2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC.	2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD.	2.5 +/- 1.5VDC	NONE
EE.	2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF.	2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG.	0.5 - 4.5VDC	0.5 - 4.5VDC
HH.	1.0 - 4.0VDC	1.0 - 4.0VDC
JJ.	CANbus J1939	NONE
KK.	CANopen	NONE
LL.	CANbus J1939 w/ Deutsch Connector	NONE
MM.	CANopen w/ Deutsch Connector	NONE

Operate Force

2. Medium
3. High

Trigger Pushbutton

1. None
2. P9 - Black
3. P9 - Red

Faceplate

AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, AL, AM, AN, AP, AQ, AR, AS

K1 Rocker #1 Style - Black*

1. None
2. On-Off
3. (On)-Off
4. On-Off-On
5. (On)-Off-(On)

K1 Rocker #2 Style - Black*

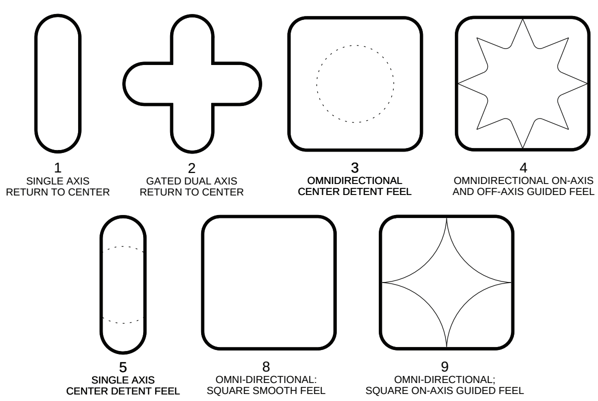
1. None
2. On-Off
3. (On)-Off
4. On-Off-On
5. (On)-Off-(On)

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.

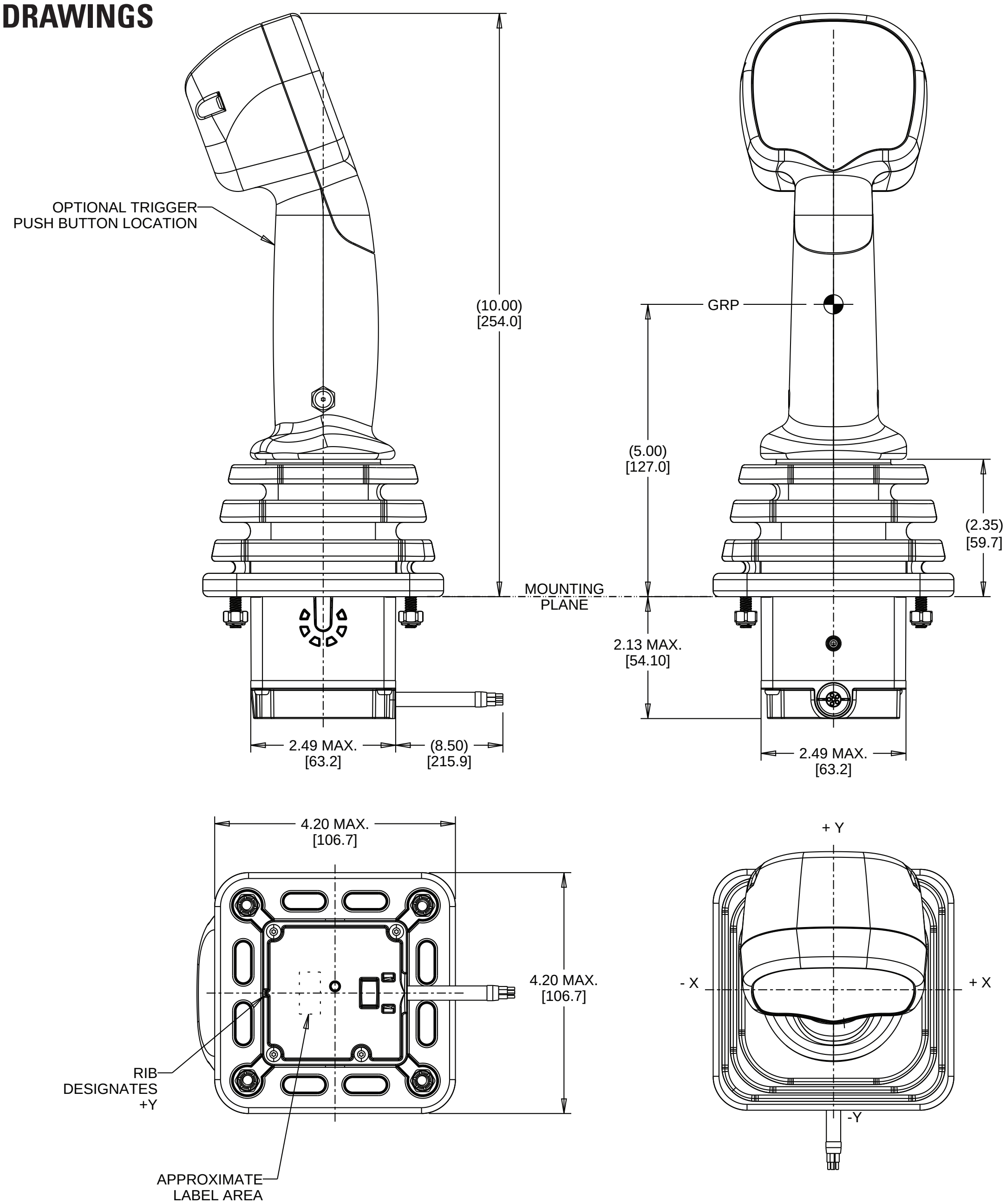
**Options “BB”and “EE” provide redundant output 2 which duplicates output 1. Options “CC”and “FF”provide redundant output 2 which is inverse of output 1.

*** 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.

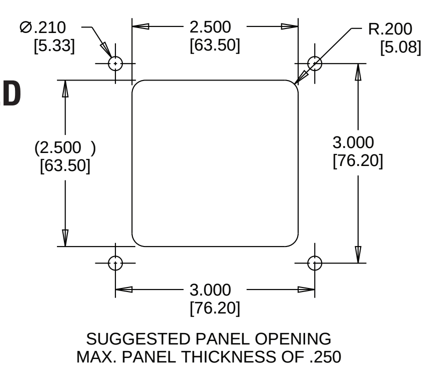
JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-B UNIVERSAL GRIP

HJLG3-B DRAWINGS



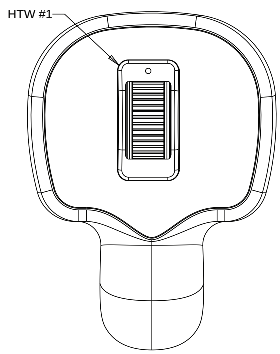
HJLG3 SUGGESTED PANEL OPENING



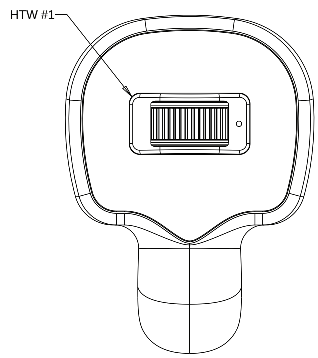
HALL EFFECT JOYSTICK WITH G3-B UNIVERSAL GRIP

HJLG3-B FACEPLATES

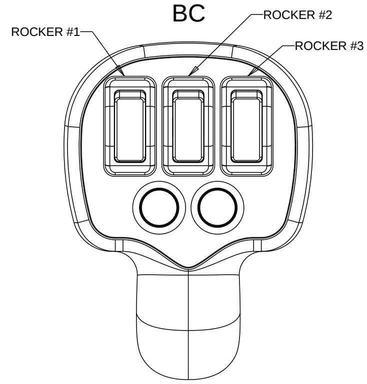
BA



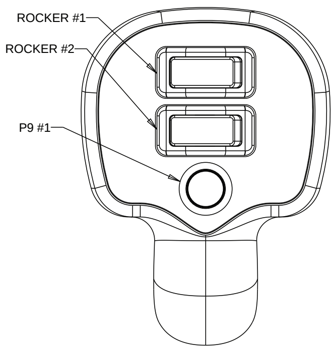
BB



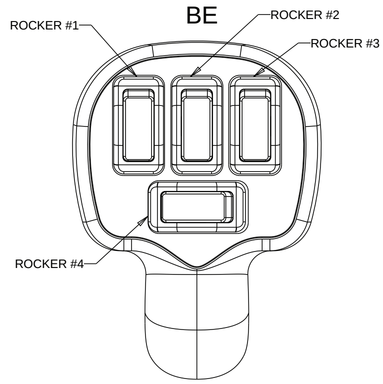
BC



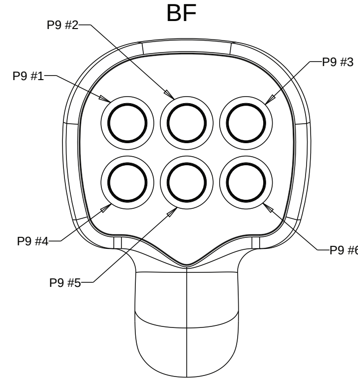
BD



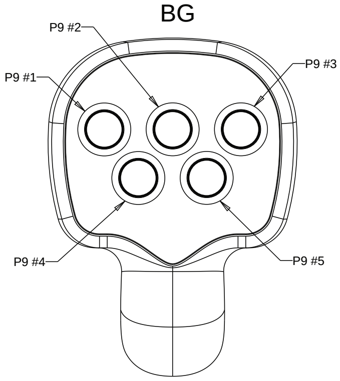
BE



BF



BG



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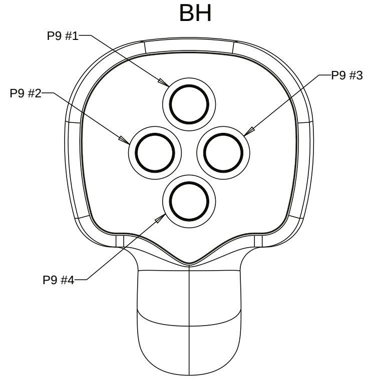
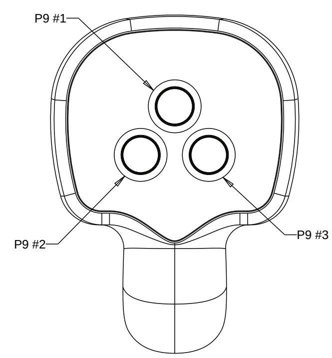
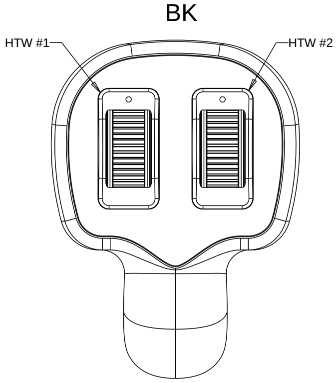


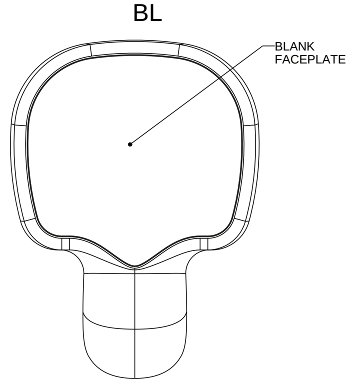
BJ



BK



BL



JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-B UNIVERSAL GRIP

HJLG3-B PART NUMBER CODE

HJLG3-B – X XX X X XX 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
2. Gated Dual Axis; Return to Center	**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
3. Omni-directional; Center Detent Feel	**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
4. Omni-directional; On-Axis and Off-Axis Guided Feel	**DD.** 2.5 +/- 1.5VDC	NONE			**BD**	**4.** On-Off-On	**4.** On-Off-On	**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			**BE**	**5.** (On)-Off-(On)	**5.** (On)-Off-(On)	**5.** (On)-Off-(On)	**5.** (On)-Off-(On)
8. Omni-directional; Square Smooth Feel	**FF.** 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC			**BF**				
9. Omni-directional; Square On-Axis Guided Feel	**GG.** 0.5 - 4.5VDC	0.5 - 4.5VDC			**BG**				
	HH. 1.0 - 4.0VDC	1.0 - 4.0VDC			**BH**				
	JJ. CANbus J1939	NONE			**BJ**				
	KK. CANopen	NONE			**BK**				
	LL. CANbus J1939 w/ Deutsch Connector	NONE			**BL**				
	MM. CANopen w/ Deutsch Connector	NONE							

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 Center①	**2.** Return to Center	**2.** Black	**2.** Black	**2.** Black	**2.** Black	**2.** Black	**2.** Black
3. Friction②	**3.** Friction	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange	**3.** Orange
4. Return to End③	**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.

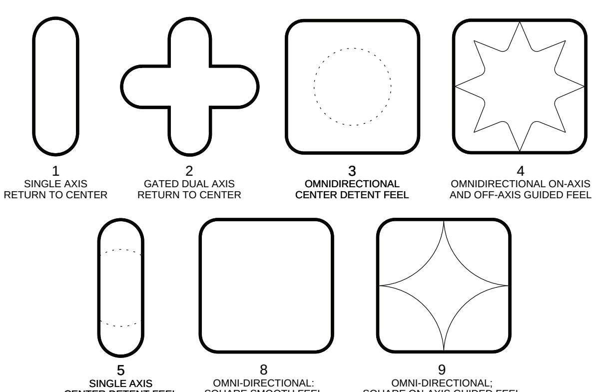
*Outputs are from the center to the full travel position in each direction. Options “AA”, “BB”, “CC”, “DD”, “EE”, “FF” provide increased voltage in +x, +y; and decreasing voltage in -x, -y from 1 output per axis. Options “GG” and “HH” provide increasing voltages in all directions (+x, +y, -x, -y) from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

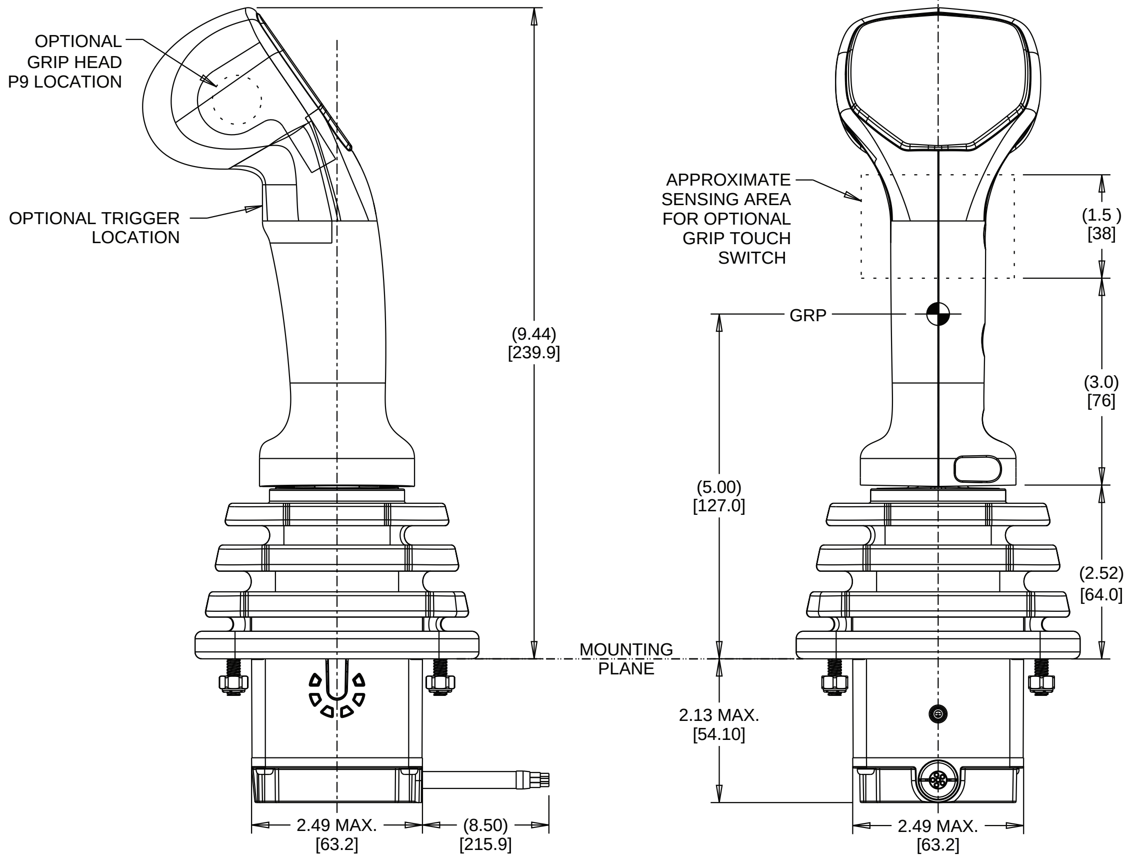
HJLG3 GATING ICONS

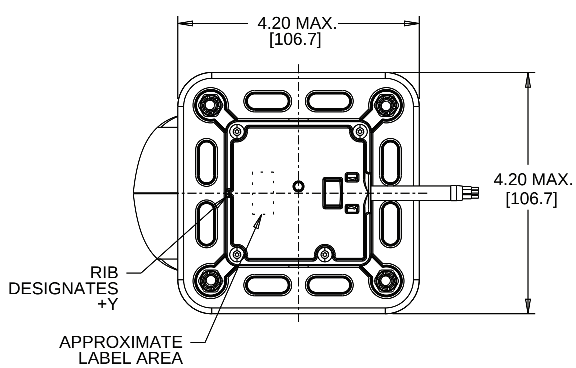


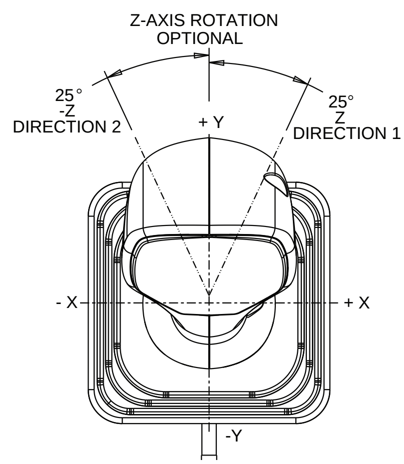
JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

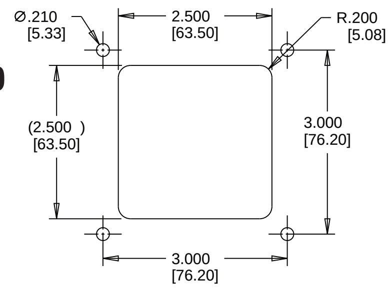
HJLG3-C DRAWINGS







HJLG3 SUGGESTED PANEL OPENING



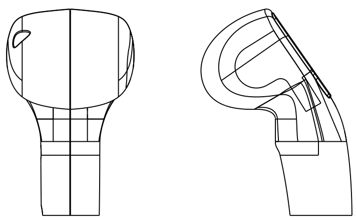
SUGGESTED PANEL OPENING
MAX. PANEL THICKNESS OF .250

JOYSTICK WITH GRIP OPTIONS

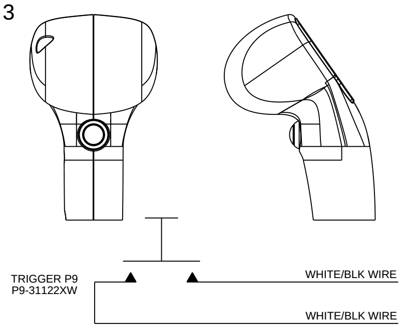
HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

HJLG3-C TRIGGER OPTIONS

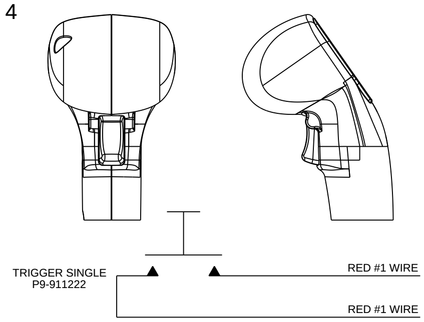
1



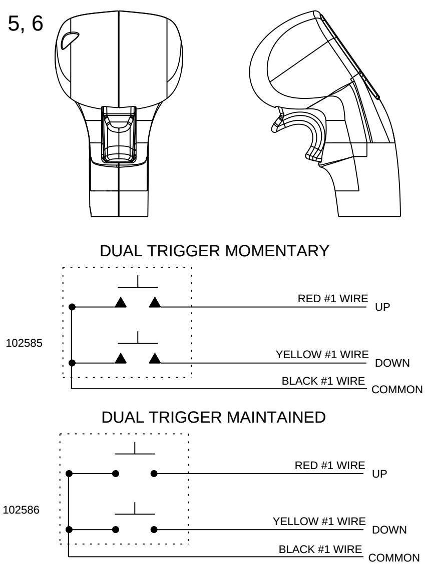
2, 3



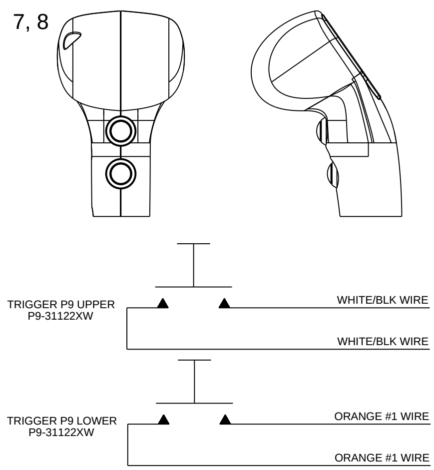
4



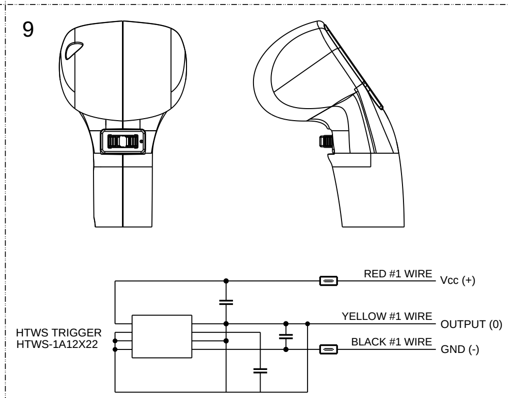
5, 6



7, 8

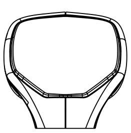


9

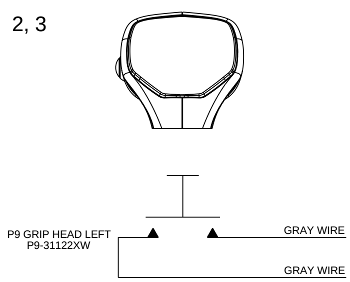


HJLG3-C HEAD PUSHBUTTON OPTIONS

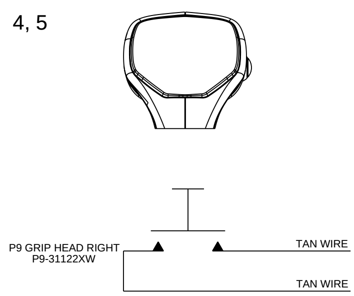
1



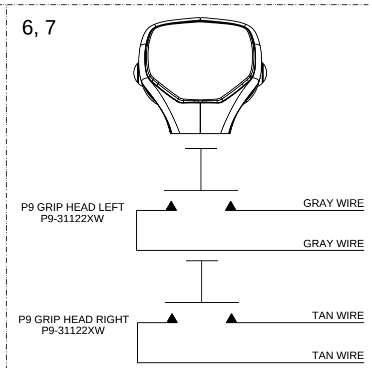
2, 3



4, 5



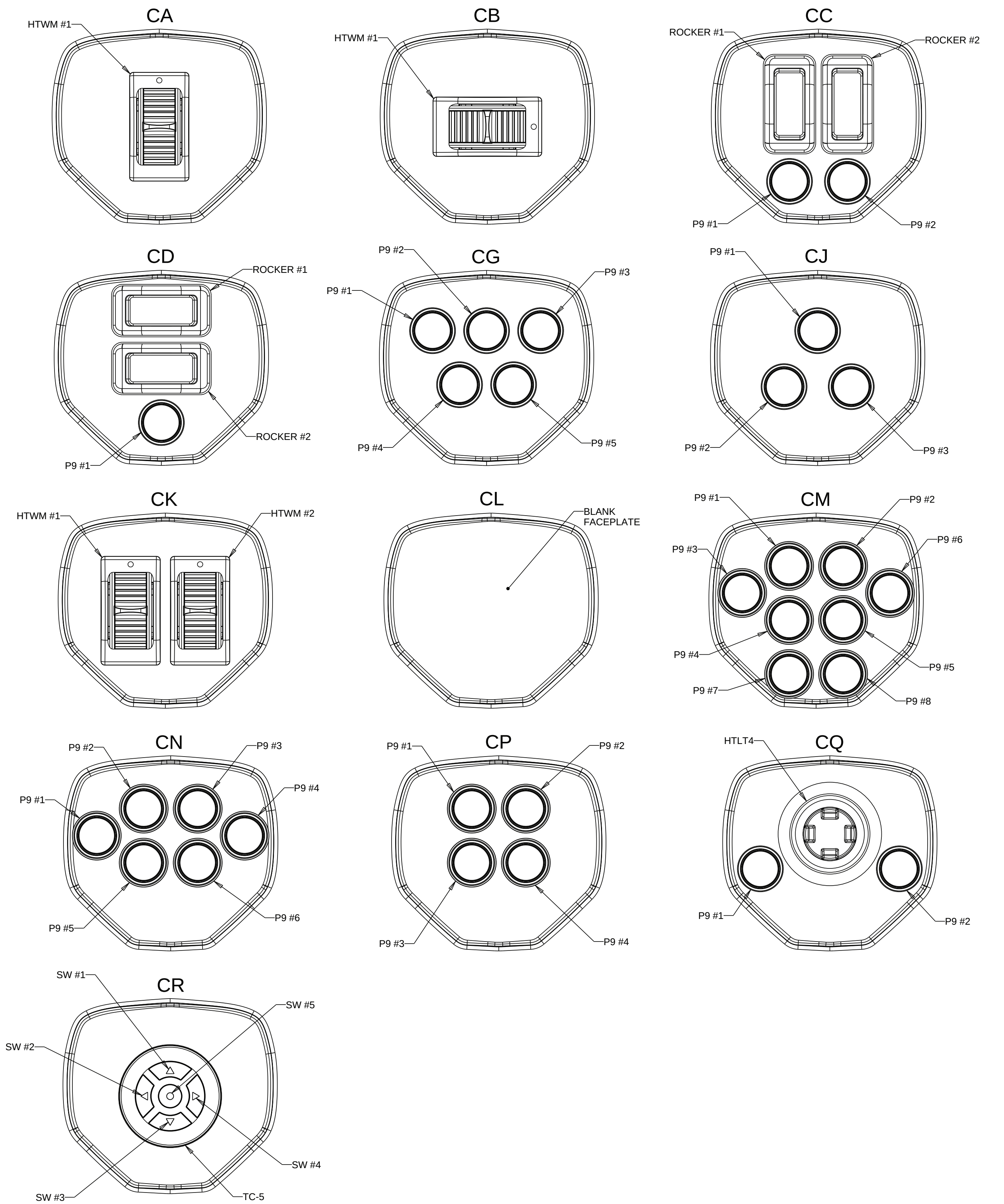
6, 7



JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

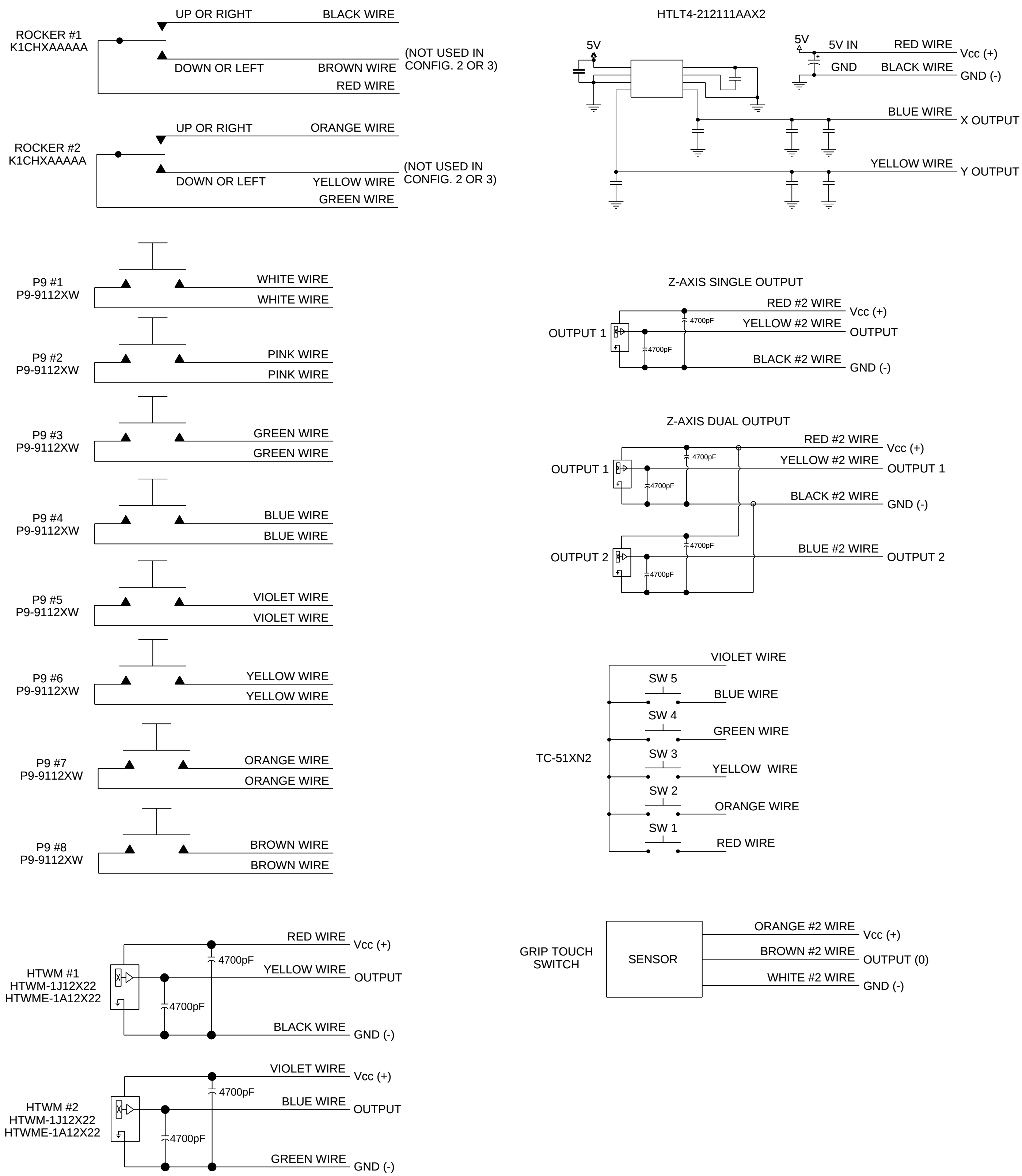
HJLG3-C FACEPLATES



JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-C UNIVERSAL GRIP

HJLG3-C FACEPLATE SCHEMATICS



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

1. No Z-Axis with No Grip Touch
2. No Z-Axis with Grip Touch* ① ②
3. Z-Axis (Single Output) with No Grip Touch
4. Z-Axis (Dual Output) with No Grip Touch
5. Z-Axis (Single Output) with Grip Touch* ① ②
6. Z-Axis (Dual Output) with Grip Touch* ① ②

Gating

1. Gated Single Y-Axis; Return to Center
2. Gated Dual Axis; Return to Center
3. Omni-directional; Center Detent Feel
4. Omni-directional; On-Axis and Off-Axis Guided Feel
5. Gated Single Y-Axis; Center Detent Feel
8. Omni-directional; Square Smooth Feel
9. Omni-directional; Square On-Axis Guided Feel

	Joystick Output 1**	Joystick Output 2***
AA.	2.5 +/- 2.0VDC	NONE
BB.	2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC.	2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD.	2.5 +/- 1.5VDC	NONE
EE.	2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF.	2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG.	0.5 - 4.5VDC	0.5 - 4.5VDC
HH.	1.0 - 4.0VDC	1.0 - 4.0VDC
JJ.	CANbus J1939	NONE
KK.	CANopen	NONE
LL.	CANbus J1939 w/ Deutsch Connector	NONE
MM.	CANopen w/ Deutsch Connector	NONE

Operate Force

2. Medium
3. High

Trigger in Handle

1. None
2. P9 - Black
3. P9 - Red
4. Single
5. Dual Momentary*
6. Dual Maintained*
7. 2 P9s - Black
8. 2 P9s - Red
9. HTWS - Black③

Grip Head Pushbutton

1. None
2. Left (Black)
3. Left (Red)
4. Right (Black)
5. Right (Red)
6. Left and Right (Black)
7. Left and Right (Red)

Faceplate

CA
CB
CC
CD
CG
CJ
CK
CL
CM
CN
CP
CQ
CR

HJLG3-C PART NUMBER CODE CONTINUED

Cont. X X X X X

K1 Rocker #1 Style - Black④

1. None
2. On-Off
3. (On)-Off
4. On-Off-On
5. (On)-Off-(On)

K1 Rocker #2 Style - Black④

1. None
2. On-Off
3. (On)-Off
4. On-Off-On
5. (On)-Off-(On)

HTWM #1 Roller - Black⑤

1. None
2. Return to Center[1]
3. Return to End[2]

1= HTWM-1J12X22
2= HTWME-1A12X22

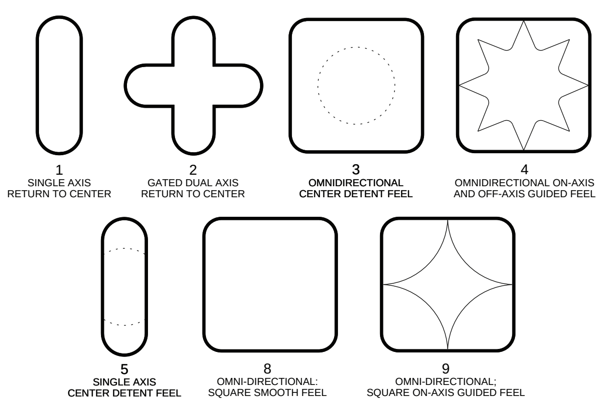
HTWM #2 Roller - Black⑤

1. None
2. Return to Center
3. Return to End

P9 Faceplate Button Color

1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Violet
8. Gray
9. White
N. None

HJLG3 GATING ICONS



*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.

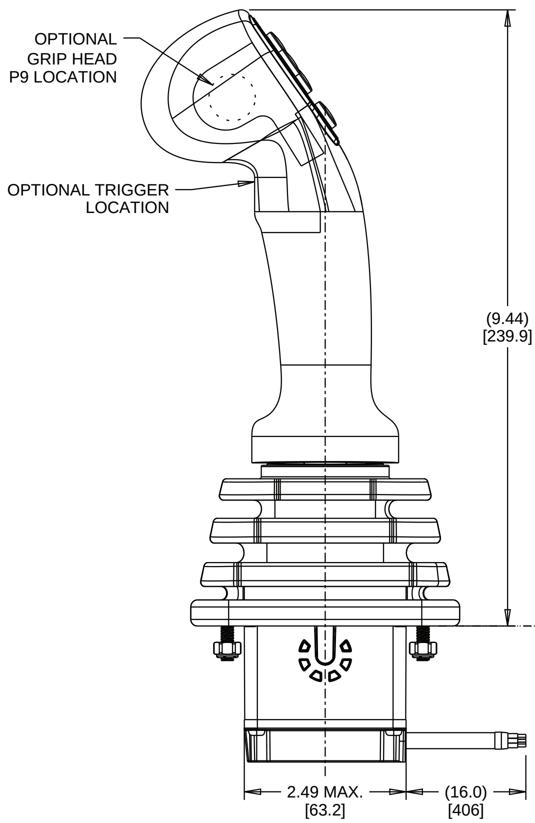
④ K1 Rocker Switches: on position or momentary position is up or to the right and ( ) denotes momentary action. Contact factory for rocker legends and additional color options.

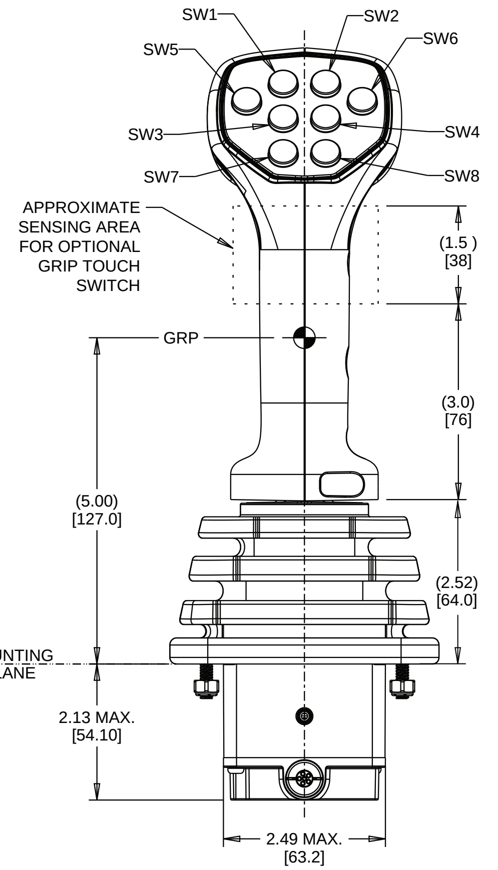
⑤ HTWM Roller Switches: positive travel is up or to the right. Contact factory for additional options.

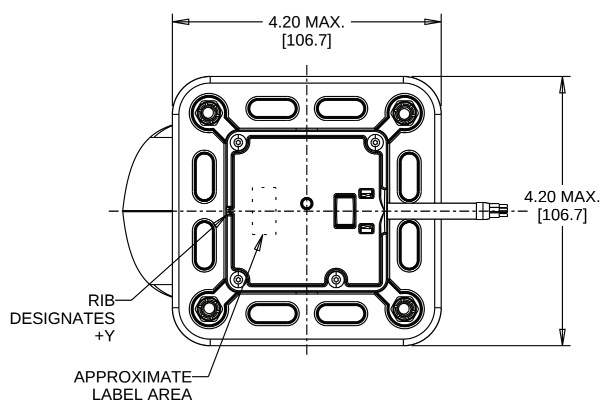
JOYSTICK WITH GRIP OPTIONS

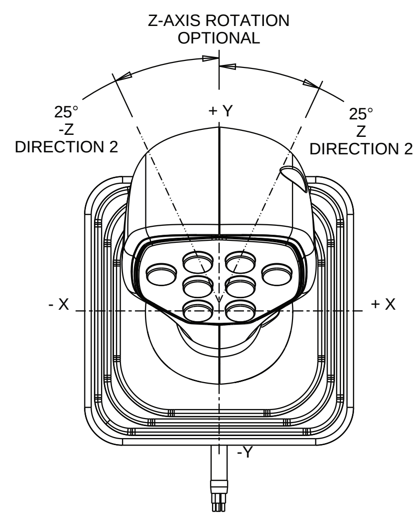
HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

HJLG3-CK DRAWINGS

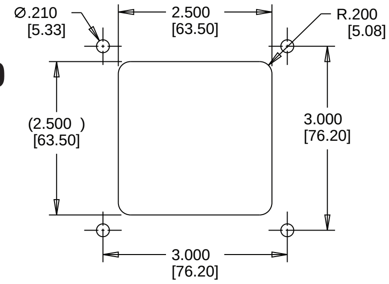








HJLG3 SUGGESTED PANEL OPENING

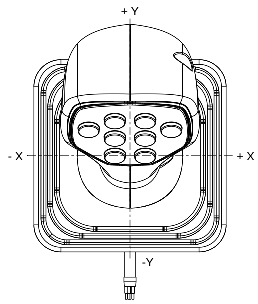


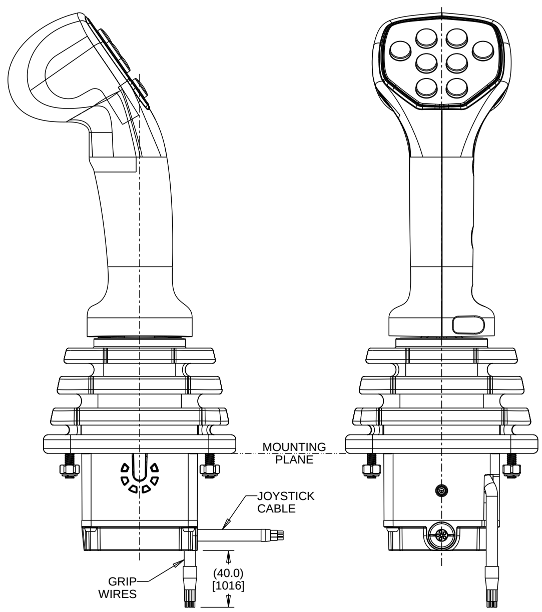
SUGGESTED PANEL OPENING
MAX. PANEL THICKNESS OF .250

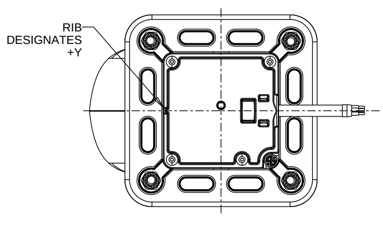
HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

HJLG3-CK OUTPUTS AND JOYSTICK SCHEMATICS

Analog Outputs

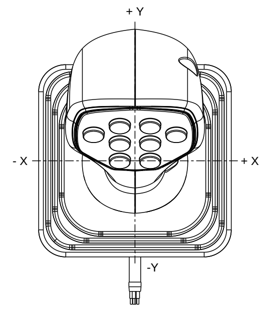


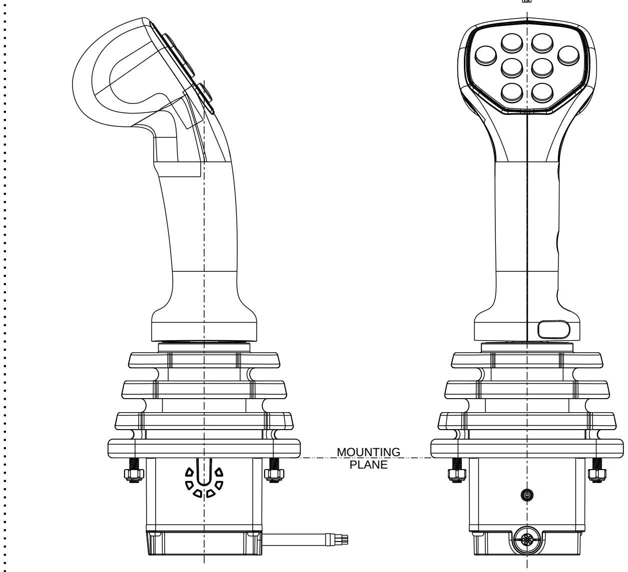


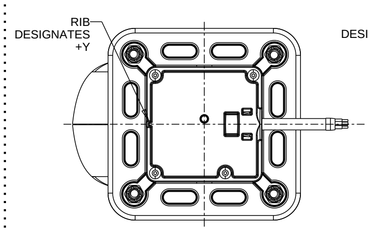


OUTPUTS
AA-HH SHOWN
FACEPLATE
8 BUTTONS SHOWN

CAN Outputs

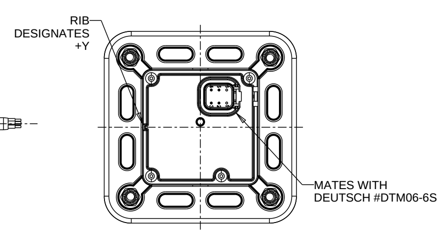






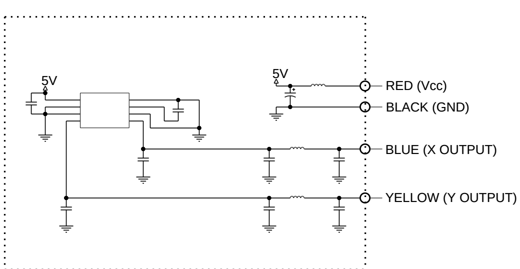
OUTPUTS JJ AND KK SHOWN

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

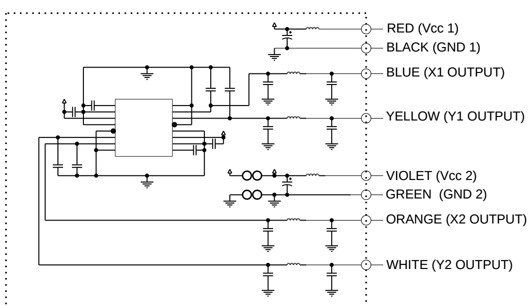


OUTPUTS LL AND MM SHOWN

FUNCTION	COLOR
NONE	PIN 1
CAN HIGH	PIN 2
+SUPPLY	PIN 3
-SUPPLY	PIN 4
CAN LOW	PIN 5
NONE	PIN 6



JOYSTICK SCHEMATIC
(AA AND DD OUTPUTS)



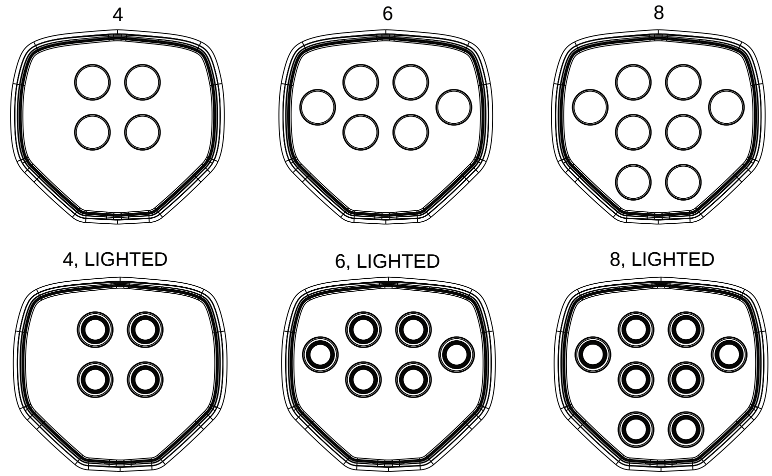
JOYSTICK SCHEMATIC
(BB, CC, EE, FF, GG, & HH OUTPUTS)

JOYSTICK WITH GRIP OPTIONS

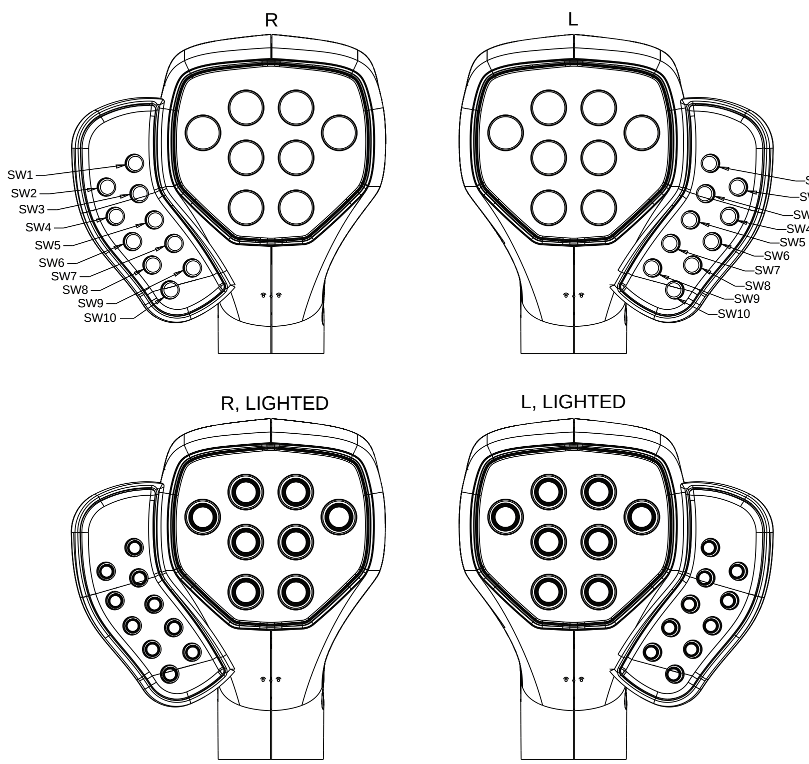
HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

HJLG3-CK KEYPAD CONFIGURATIONS AND SCHEMATICS

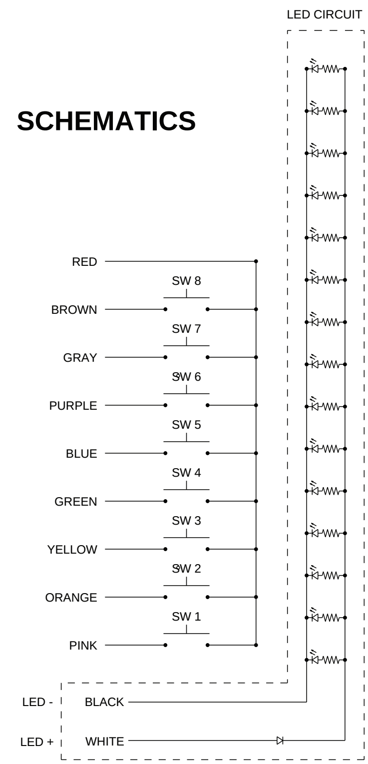
CENTER KEYPAD CONFIGURATIONS



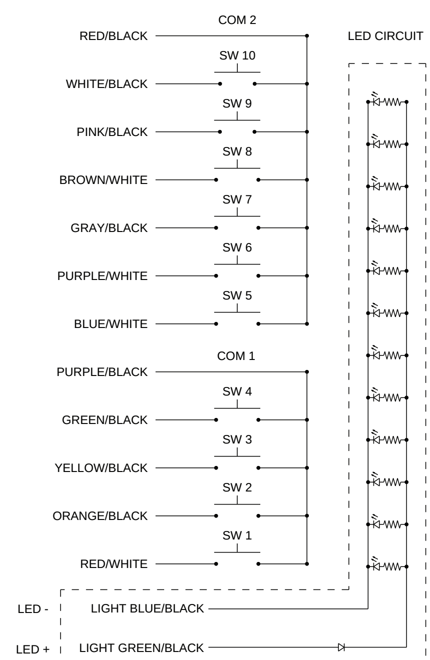
SIDE KEYPAD CONFIGURATIONS



SCHEMATICS

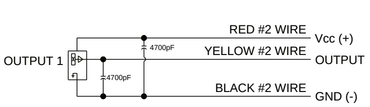


FACEPLATE KEYPAD SCHEMATIC
WITH OPTIONAL LED CIRCUIT SHOWN

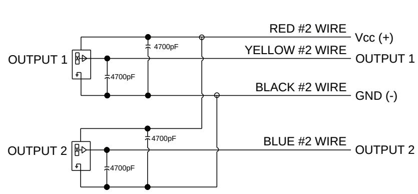


SIDE KEYPAD SCHEMATIC
WITH OPTIONAL LED CIRCUIT SHOWN

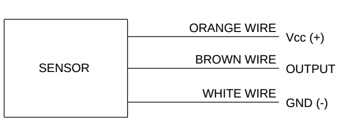
Z-AXIS SINGLE OUTPUT



Z-AXIS DUAL OUTPUT



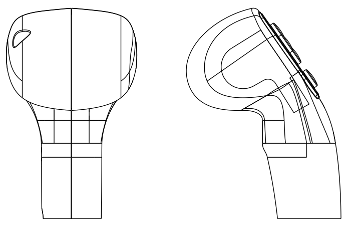
GRIP TOUCH SWITCH



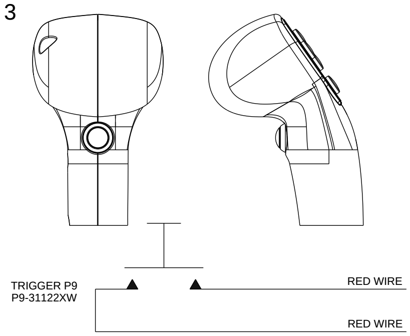
HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

HJLG3-CK TRIGGER OPTIONS

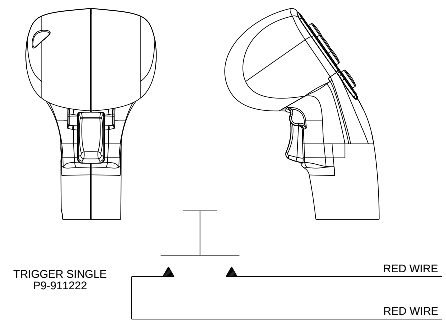
1



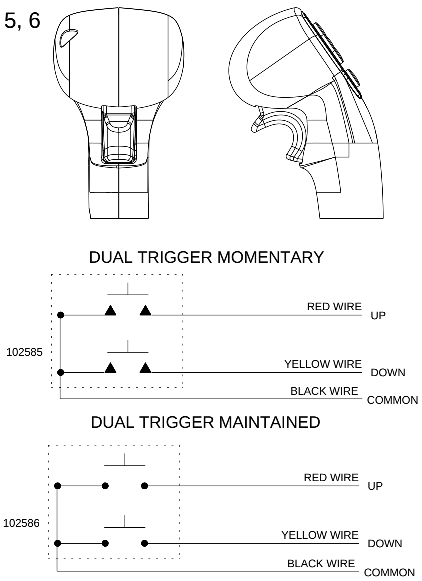
2, 3



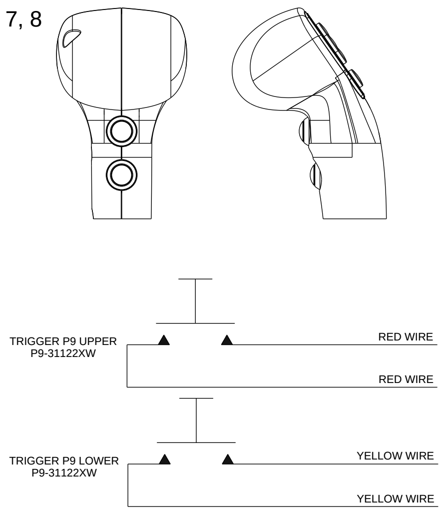
4



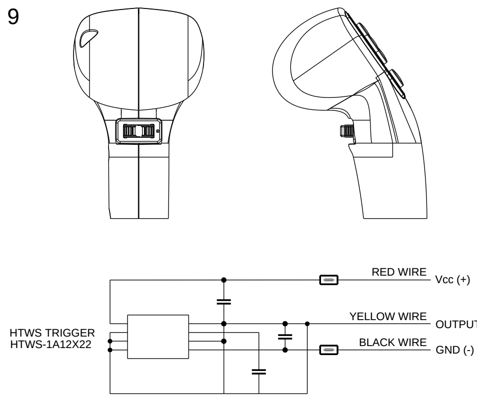
5, 6



7, 8

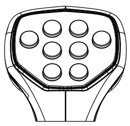


9

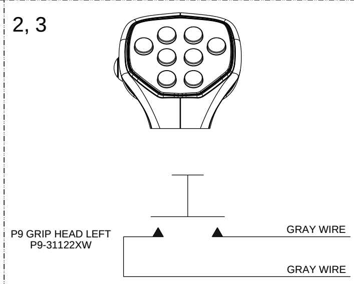


HJLG3-CK HEAD PUSHBUTTON OPTIONS

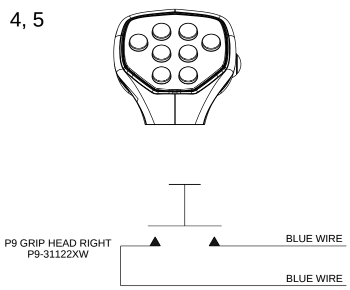
1



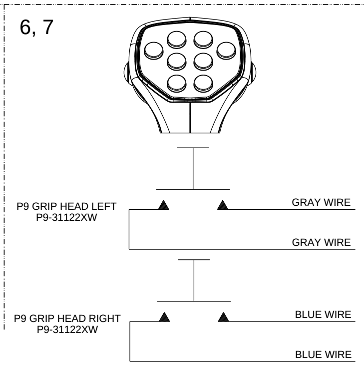
2, 3



4, 5



6, 7



JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-CK UNIVERSAL GRIP

HJLG3-CK PART NUMBER CODE

HJLG3-CK – X X XX X X X **Continued Below**

Z-Axis/Grip Touch Switch*

1. No Z-Axis with No Grip Touch Switch
2. No Z-Axis with Grip Touch Switch** ① ②
3. Z-Axis (Single Output) with No Grip Touch Switch
4. Z-Axis (Dual Output) with No Grip Touch Switch
5. Z-Axis (Single Output) with Grip Touch Switch** ① ②
6. Z-Axis (Dual Output) with Grip Touch Switch** ① ②

Gating

1. Gated Single Y-Axis; Return to Center
2. Gated Dual Axis; Return to Center
3. Omni-directional; Center Detent Feel
4. Omni-directional; On-Axis and Off-Axis Guided Feel
5. Gated Single Y-Axis; Center Detent Feel
8. Omni-directional; Square Smooth Feel
9. Omni-directional; Square On-Axis Guided Feel

Code	Joystick Output 1***	Joystick Output 2****
AA.	2.5 +/- 2.0VDC	NONE
BB.	2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC.	2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD.	2.5 +/- 1.5VDC	NONE
EE.	2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF.	2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG.	0.5 - 4.5VDC	0.5 - 4.5VDC
HH.	1.0 - 4.0VDC	1.0 - 4.0VDC
JJ.	CANbus J1939	NONE
KK.	CANopen	NONE
LL.	CANbus J1939 w/ Deutsch Connector	NONE
MM.	CANopen w/ Deutsch Connector	NONE

Operate Force

2. Medium
3. High

Trigger in Handle*

1. None
2. P9 - Black
3. P9 - Red
4. Single
5. Dual Momentary
6. Dual Maintained
7. 2 P9s - Black
8. 2 P9s - Red
9. HTWS - Black③

Grip Head Pushbutton*

1. None
2. Left (Black)
3. Left (Red)
4. Right (Black)
5. Right (Red)
6. Left and Right (Black)
7. Left and Right (Red)

HJLG3-CK PART NUMBER CODE CONTINUED

Cont. X X X

Faceplate Keypad Configuration

- **4.** 4 Buttons
- **6.** 6 Buttons
- **8.** 8 Buttons

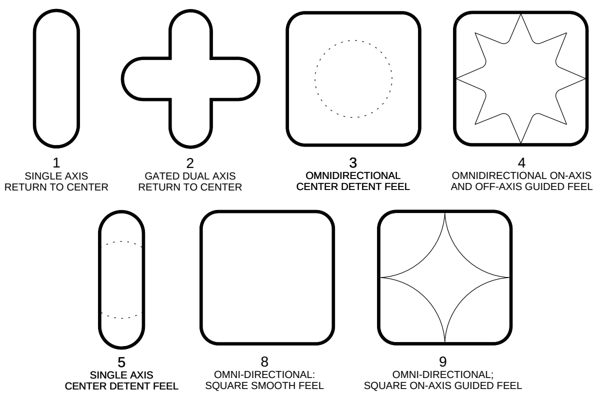
Side Keypad Configuration

- **1.** None
- **L.** Left Hand
- **R.** Right Hand

Back Lighting ④

- **N.** None
- **L.** Lighted Faceplate Keypad & Side Keypad
- **F.** Lighted Faceplate Keypad Only
- **S.** Lighted Side Keypad Only

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.

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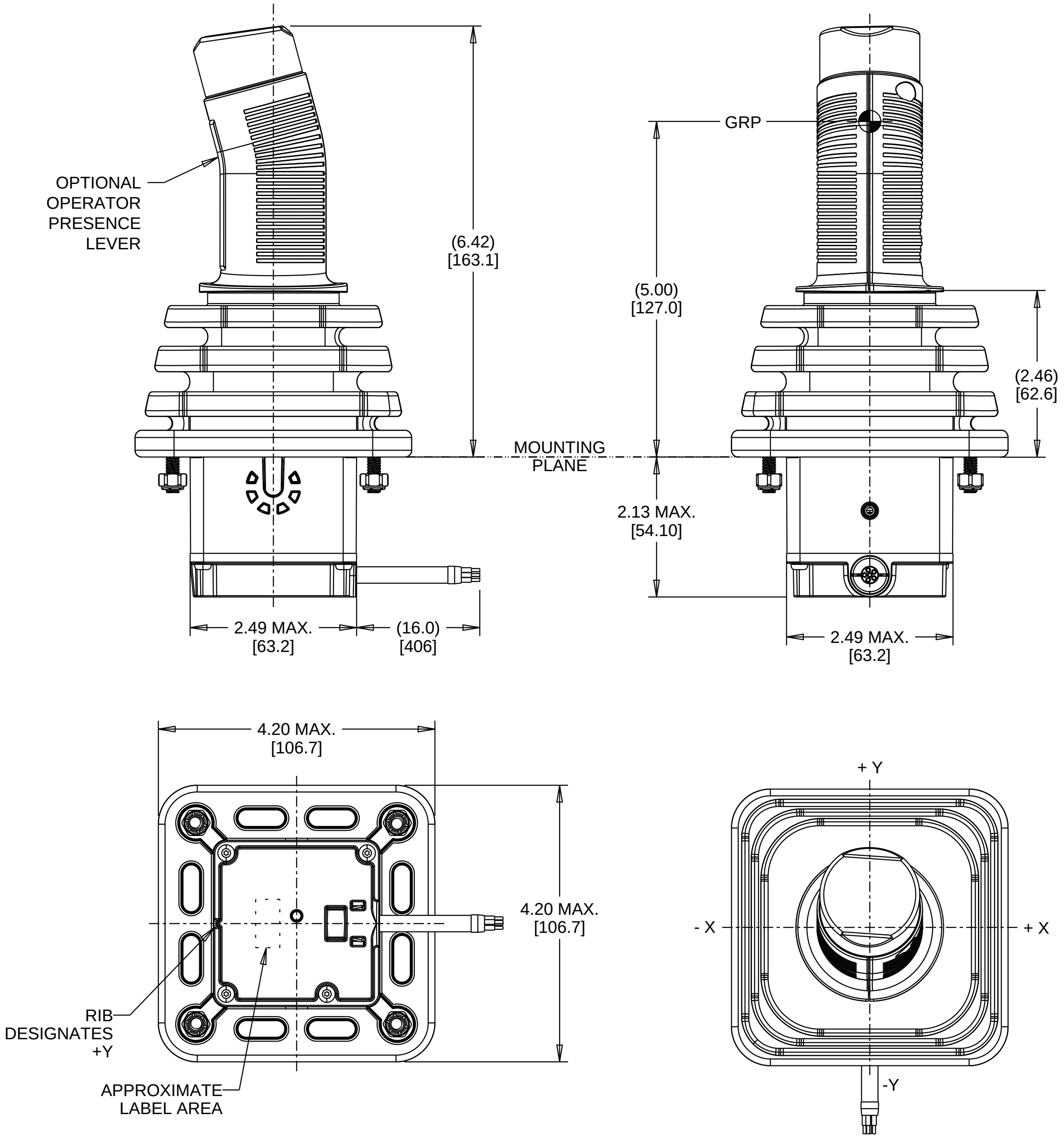
③ HTWS Trigger Switches: positive travel is to the right. Contact factory for additional options.

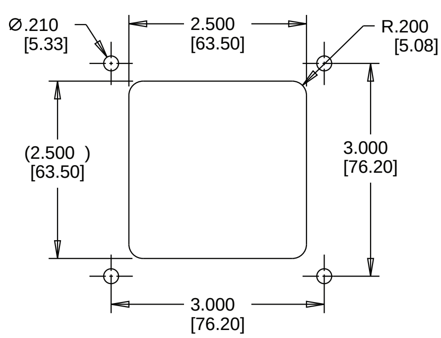
④ White LED’s

HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

HJLG3-D DRAWINGS



HJLG3 SUGGESTED PANEL OPENING



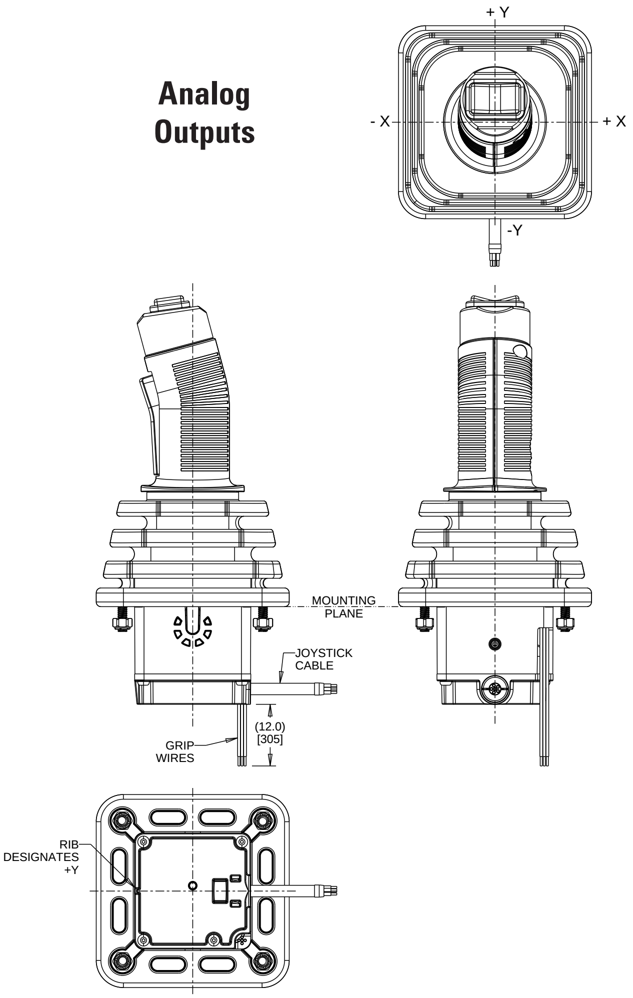
SUGGESTED PANEL OPENING
MAX. PANEL THICKNESS OF .250

JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

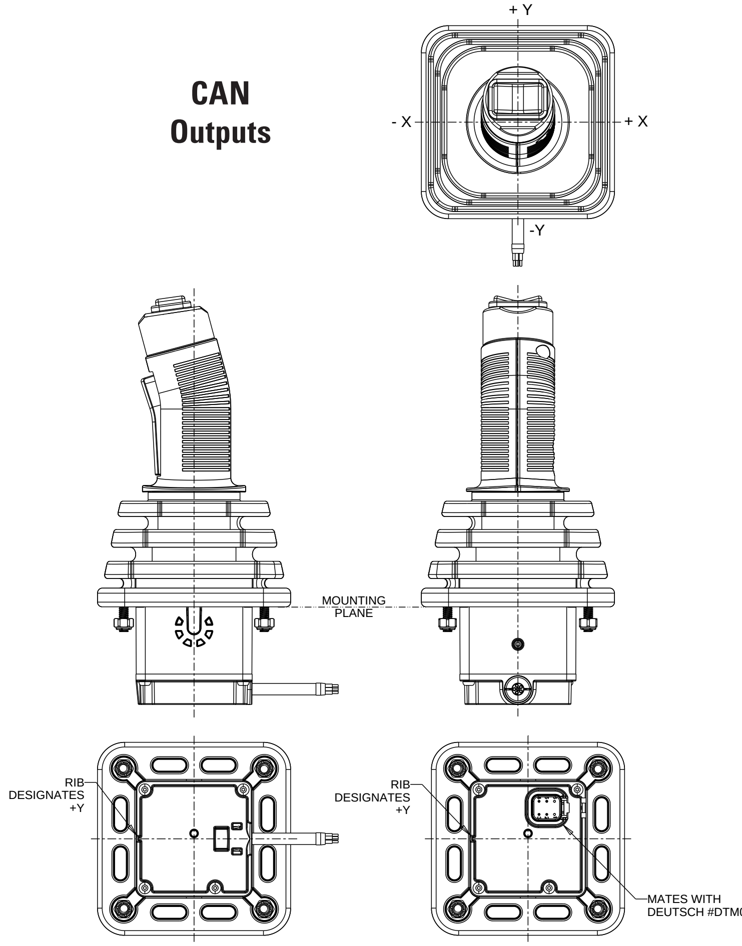
HJLG3-D OUTPUTS AND JOYSTICK SCHEMATICS

Analog Outputs



OUTPUTS AA - HH SHOWN

CAN Outputs

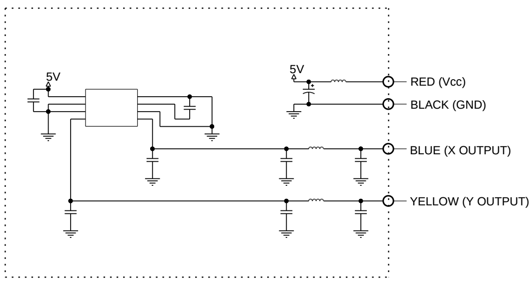


OUTPUTS JJ AND KK SHOWN

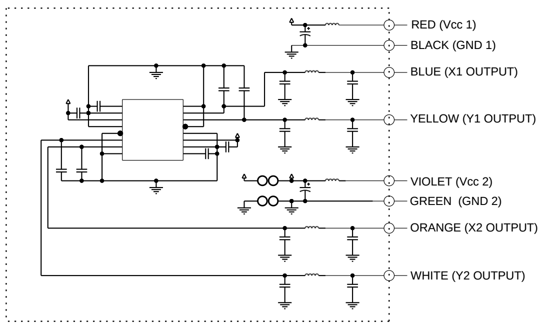
FUNCTION	COLOR
CAN HIGH	YELLOW
+SUPPLY	RED
-SUPPLY	BLACK
CAN LOW	GREEN

OUTPUTS LL AND MM SHOWN

FUNCTION	COLOR
NONE	PIN 1
CAN HIGH	PIN 2
+SUPPLY	PIN 3
-SUPPLY	PIN 4
CAN LOW	PIN 5
NONE	PIN 6



JOYSTICK SCHEMATIC
(AA AND DD OUTPUTS)



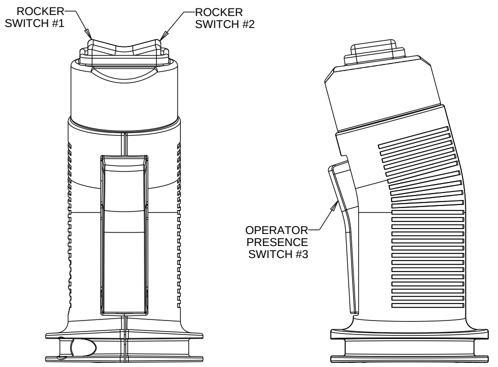
JOYSTICK SCHEMATIC
(BB, CC, EE, FF, GG, & HH OUTPUTS)

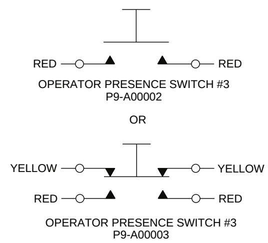
JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

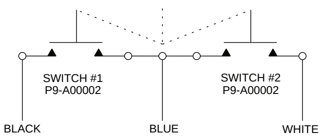
HJLG3-D FACEPLATE OPTIONS

ROCKER AND OPERATOR PRESENCE

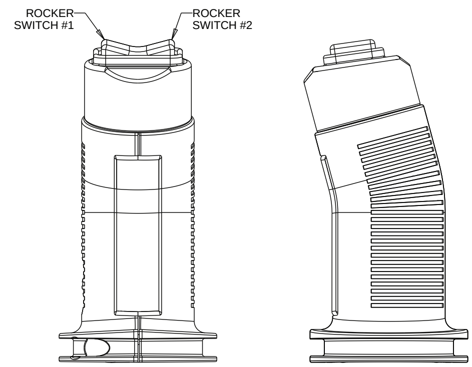




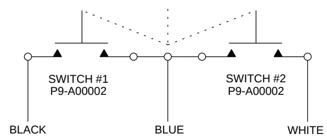
ROCKER



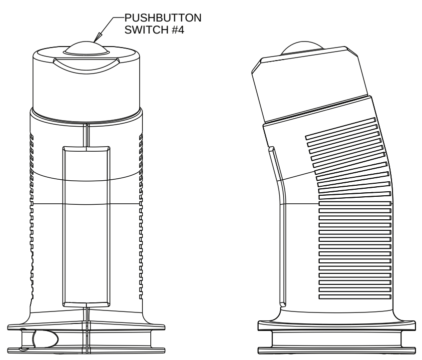
ROCKER

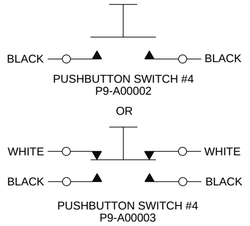


ROCKER

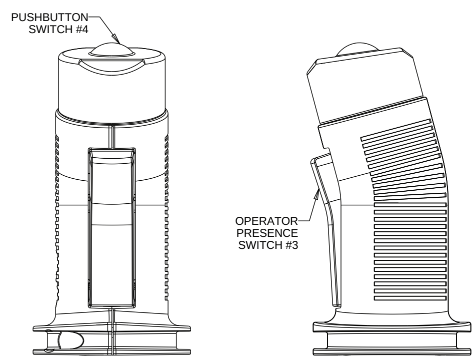


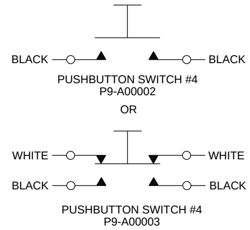
ONE PUSHBUTTON

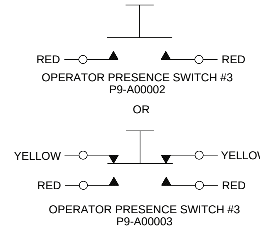




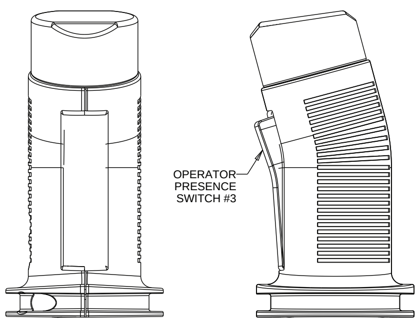
ONE PUSHBUTTON AND OPERATOR PRESENCE

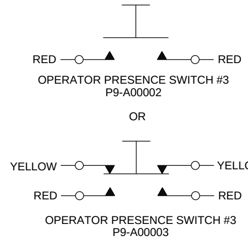






NO PUSHBUTTON AND OPERATOR PRESENCE





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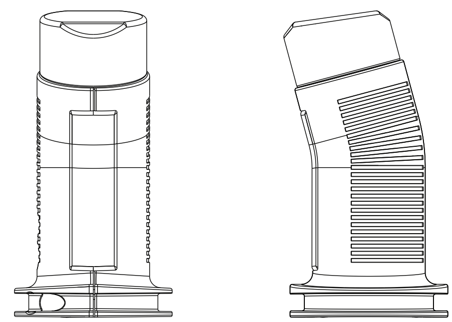


JOYSTICK WITH GRIP OPTIONS

HALL EFFECT JOYSTICK WITH G3-D CONTROL GRIP

HJLG3-D PART NUMBER CODE

HJLG3-D – X XX X XX X

Gating

1. Gated Single Y-Axis; Return to Center
2. Gated Dual Axis; Return to Center
3. Omni-directional; Center Detent Feel
4. Omni-directional; On-Axis and Off-Axis Guided Feel
5. Gated Single Y-Axis; Center Detent Feel
8. Omni-directional; Square Smooth Feel
9. Omni-directional; Square On-Axis Guided Feel

Joystick Output

	Joystick Output 1*	Joystick Output 2**
AA.	2.5 +/- 2.0VDC	NONE
BB.	2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC.	2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD.	2.5 +/- 1.5VDC	NONE
EE.	2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF.	2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG.	0.5 - 4.5VDC	0.5 - 4.5VDC
HH.	1.0 - 4.0VDC	1.0 - 4.0VDC
JJ.	CANbus J1939	NONE
KK.	CANopen	NONE
LL.	CANbus J1939 w/ Deutsch Connector	NONE
MM.	CANopen w/ Deutsch Connector	NONE

Operate Force

1. Low
2. Medium
3. High

Faceplate Options

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

OP & PB Configuration

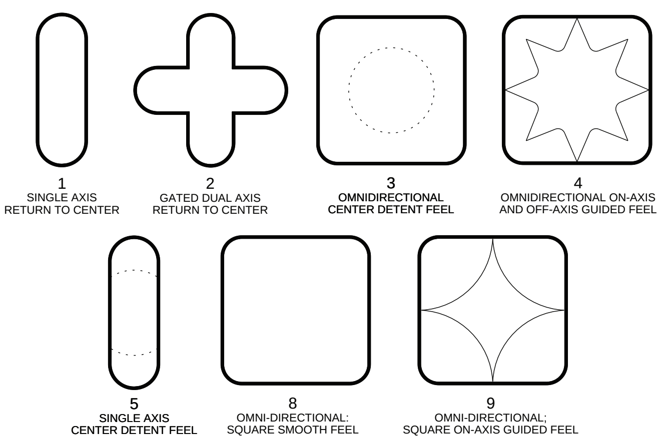
1. None①
2. Normally Open (NO)
3. 2 Circuit (NO/NC)②
4. 2 Circuit (NO/NC)③

① Can only be used with configurations 22 and 66.
② For options 11 (Operator Presence), 44, 55.
③ 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, 1o=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)	**Units**	**Min**	**Typ**	**Max**
Travel Angle	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	**Units**	**Min**	**Typ**	**Max**
Operating Force	Oz.	3.5	6.5	9.5
MECHANICAL (P9 SWITCH): 1,250,000 Cycle Mechanical Life				
Mechanical	**Units**	**Min**	**Typ**	**Max**
Operating Force	Oz.	8	12	16
MECHANICAL (KEYPAD PUSHBUTTONS): 3,000,000 Cycle Mechanical Life				
Mechanical	**Units**	**Min**	**Typ**	**Max**
Operating Force	Oz.	2	8	10
ENVIRONMENTAL				
Electronics (Handles 11, 12, 21, 35, 41, 53, 71, 72)	IP68S			
Seal	Handle styles 34 and 35 panel sealed to IP68S			
RFI / EMI	Withstand per SAE J1113			

HALL EFFECT CONTROLS

MEDIUM HALL EFFECT JOYSTICK

HALL EFFECT TECHNOLOGY JOYSTICK

JHM PART NUMBER CODE

JHM – XX X X XX X

Handle Style*

- **11.** No Handle ①
- **12.** Standard - Blank ①
- **21.** With Hall effect Rocker
- **31.** With Pushbutton-Top Handle, Half Boot
- **32.** With 2 Pushbuttons - Handle
- **33.** With 3 Pushbuttons
- **34.** With Pushbutton - Top Handle, Full Boot ②
- **35.** No Pushbutton - Top Handle, Full Boot ①②
- **41.** Lockout ①
- **51.** G3-D, Rocker and Operator Presence ②
- **52.** G3-D, Rocker ③
- **53.** G3-D, Blank ①③
- **54.** G3-D, Operator Presence
- **61.** 5-Button Keypad & Hall Rocker Right ③⑤
- **62.** 5-Button Keypad & Hall Rocker Left ③⑤
- **63.** 7-Button Keypad & Hall Rocker Right ⑤
- **64.** 7-Button Keypad & Hall Rocker Left ⑤
- **71.** Ball Handle, Large, Thermoset ①
- **72.** Ball Handle, Small, Rubber ①

Gating

- **1.** Gated; Single axis – Return to Center
- **2.** Gated; Dual axis – Return to Center
- **3.** Omni-directional; Round Smooth Feel
- **4.** Omni-directional; On-Axis and Off-Axis Guided Feel
- **5.** Omni-directional; Round On-Axis Guided Feel
- **6.** Friction - Single axis ①④
- **7.** Friction Y-axis; Return to Center X-axis ①④
- **8.** Omni-directional; Square Smooth Feel
- **9.** Omni-directional; Square On-axis Guided Feel

Force

- **1.** Low ④
- **2.** High

Output 1**	**Output 2**
AA. 2.5 +/- 2.0VDC	NONE
BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD. 2.5 +/- 1.5VDC	NONE
EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG. 0.5 - 4.5VDC	0.5 - 4.5VDC
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
JJ. CANbus J1939	NONE⑤
KK. CANopen	NONE⑤
LL. PWM	NONE
MM. USB	NONE⑤

Termination***

- **1.** Wire Leads 24 AWG SAE AS22759 ③
- **2.** Cable, 22AWG (19/34), PVC/Polyurethane Outer Jacket
- **3.** USB 2.0 HID Joystick USB Mini B

***** 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.

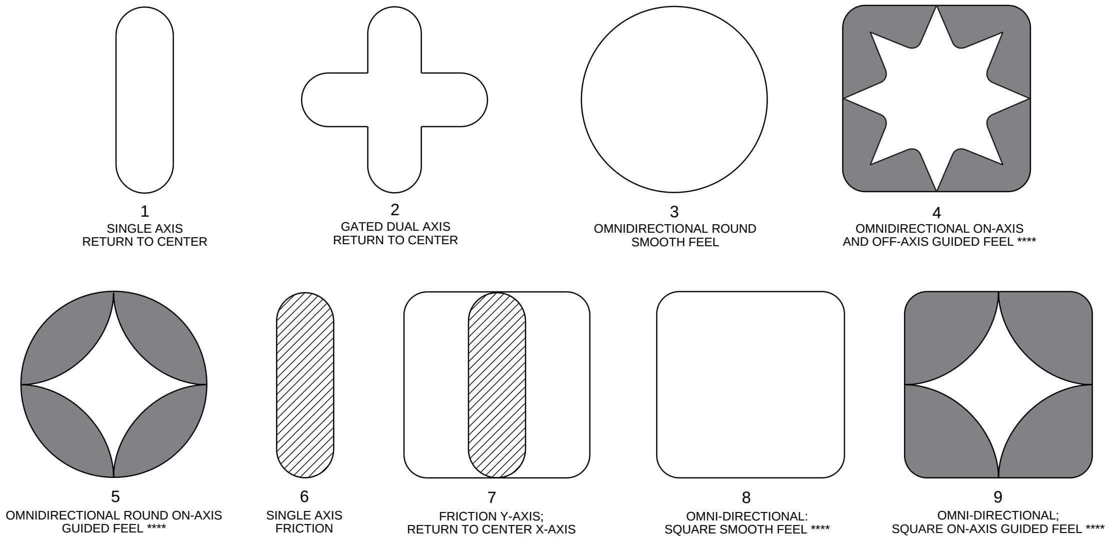
② Watertight panel seal applies to handle style 34 and 35.

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

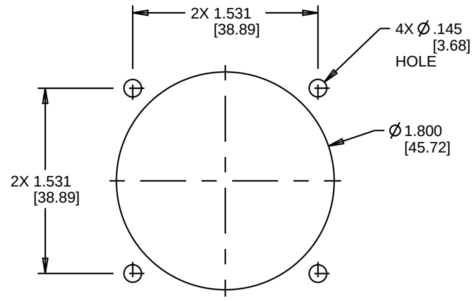


**** FEEL DEFINED BY SHADING

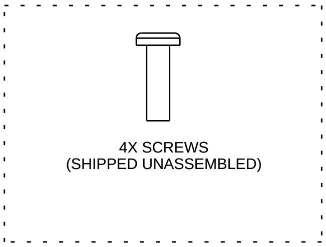
MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

JHM Suggested Panel Opening

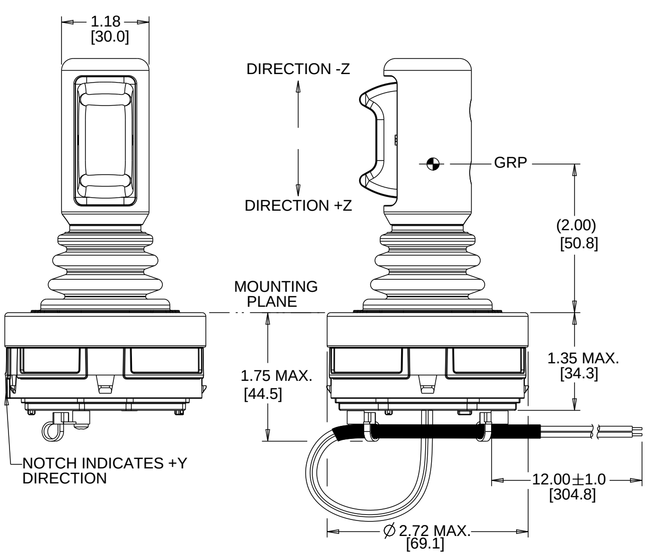


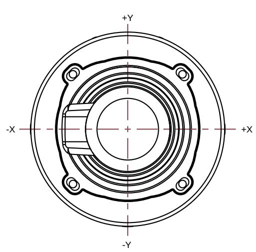
SUGGESTED PANEL OPENING
REAR MOUNT
(ALL HANDLE STYLES EXCEPT HANDLE 51)
PANEL THICKNESS .06



Mounting Hardware Information

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

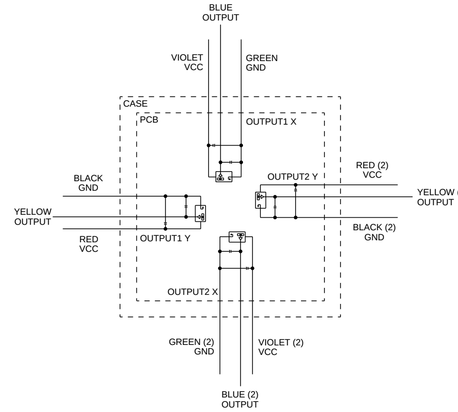




JHM Outputs AA-FT and LL

(Output Graph at end of JHM section)

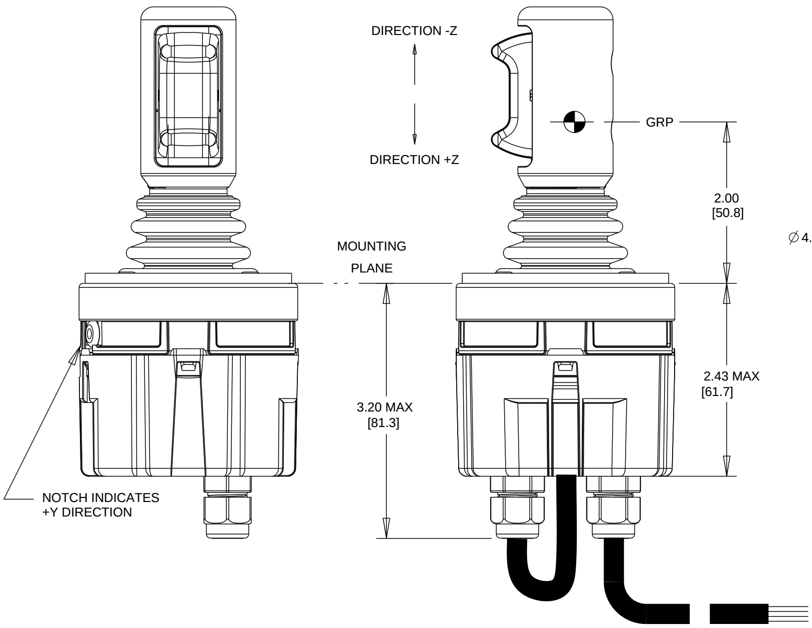
PWM PRODUCT SPECIFICATIONS				
ELECTRICAL:				
	PWM INTERFACE			
SUPPLY VOLTAGE, Vcc	VDC	4.5	N/A	18.0
OUTPUT FREQUENCY	Hz	460	500	540
AMPLITUDE LOW	A	0.0	N/A	.020
AMPLITUDE HIGH PULLUP REQUIRED	VDC	3.0	N/A	12.0
PWM OUTPUT @ +X AND +Y FULL TRAVEL	%	80.0	90.0	92.0
PWM OUTPUT @ ZERO TRAVEL	%	42.0	50.0	58.0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



MEDIUM HALL EFFECT JOYSTICK

HALL EFFECT TECHNOLOGY JOYSTICK

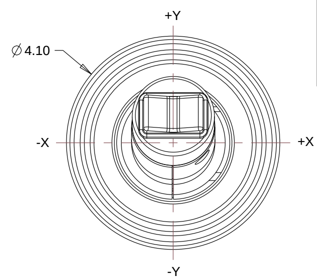
Rear Mount Style

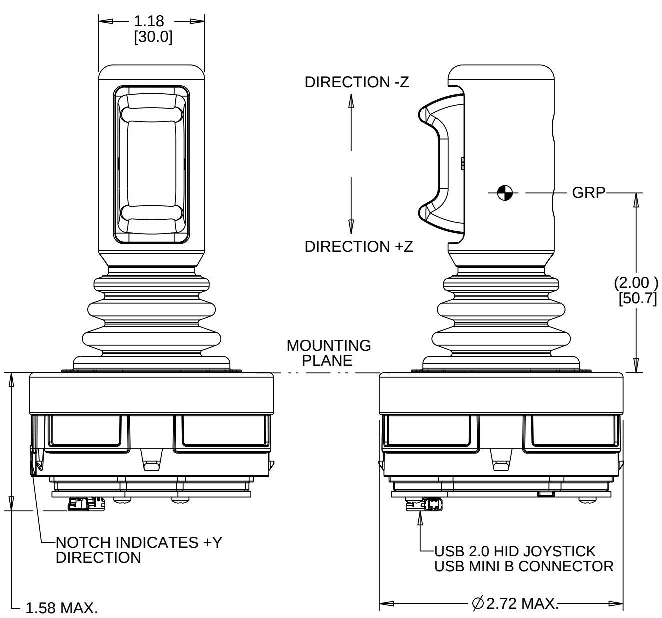


JHM Outputs JJ and KK

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

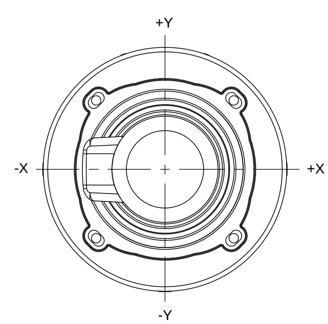
PRODUCT SPECIFICATIONS				
ELECTRICAL:				
JOYSTICK CAN OPEN				
	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	9	N/A	32
NODE IDENTIFIER	10 DECIMAL			
BAUD RATE	125K bits/s			
TRANSMISSION REPETITION RATE	100 ms			
JOYSTICK J1939				
	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	9	N/A	32
SOURCE ADDRESS	51 DECIMAL			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





JHM Output MM

PRODUCT SPECIFICATIONS	
ELECTRICAL:	
	JOYSTICK POWERED BY STANDARD USB INTERFACE

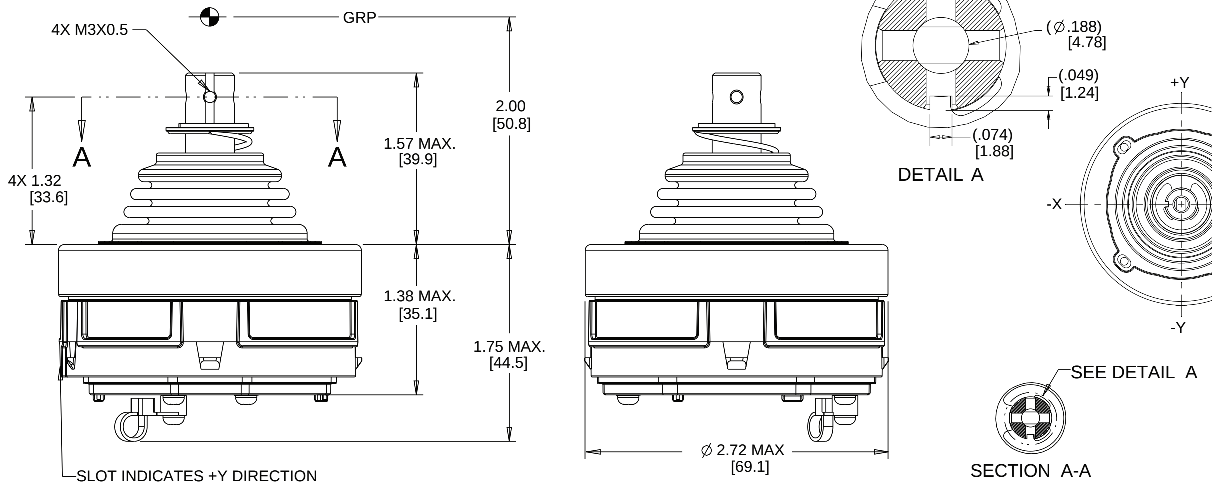


Wires and Strain Relief not shown in all views for clarity.

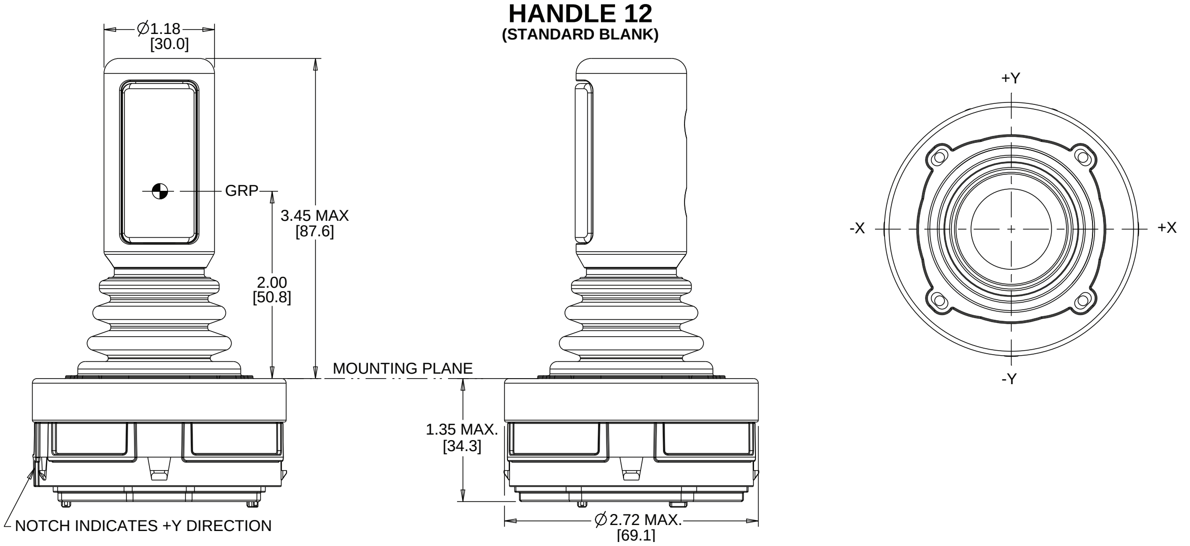
MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

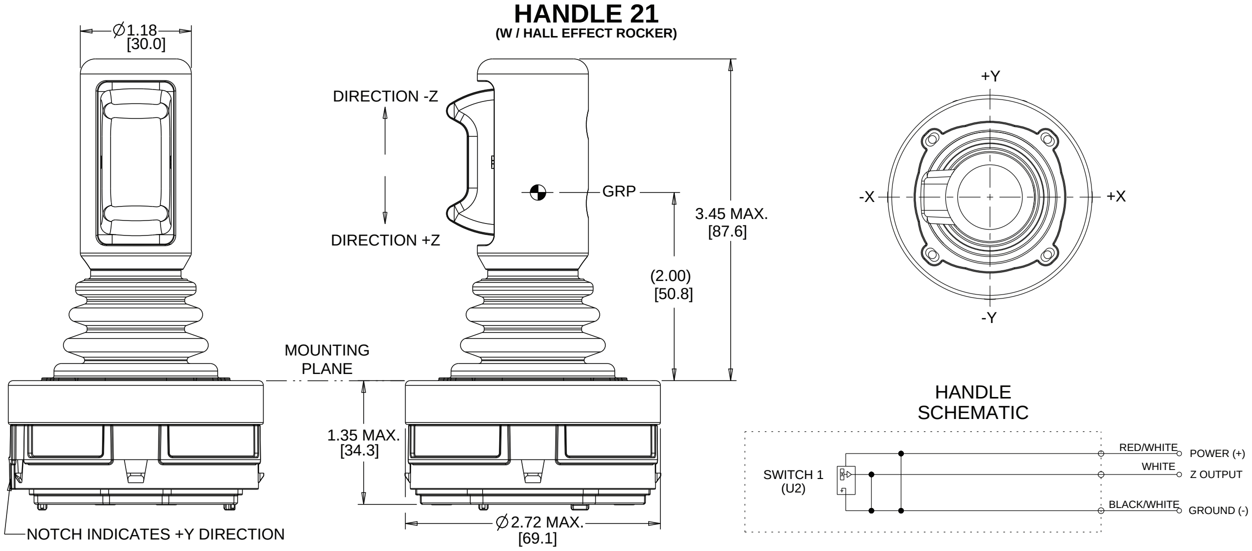
HANDLE 11
(No Handle)



HANDLE 12
(STANDARD BLANK)



HANDLE 21
(W / HALL EFFECT ROCKER)

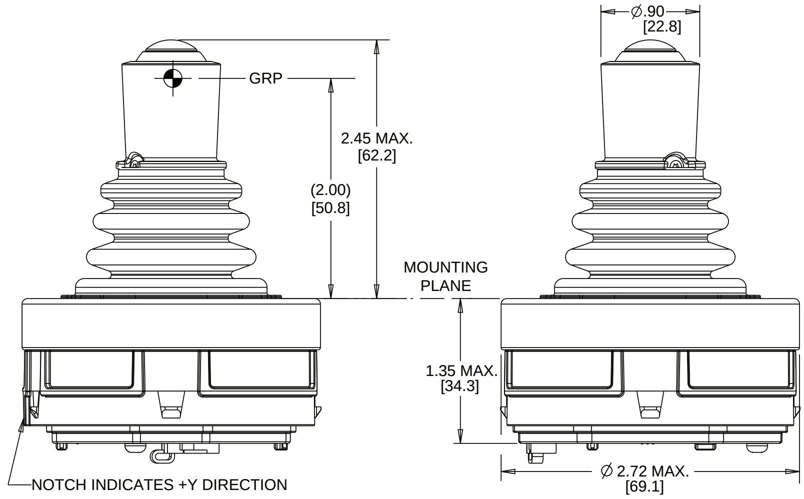


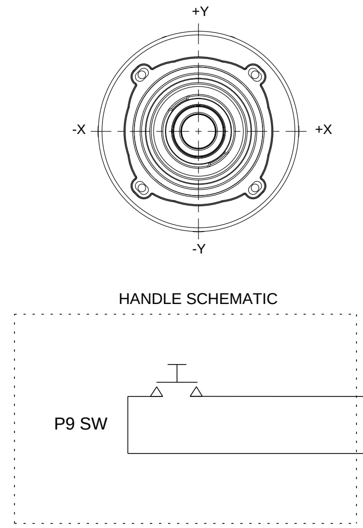
Wires and Strain Relief not shown in all views for clarity.

MEDIUM HALL EFFECT JOYSTICK

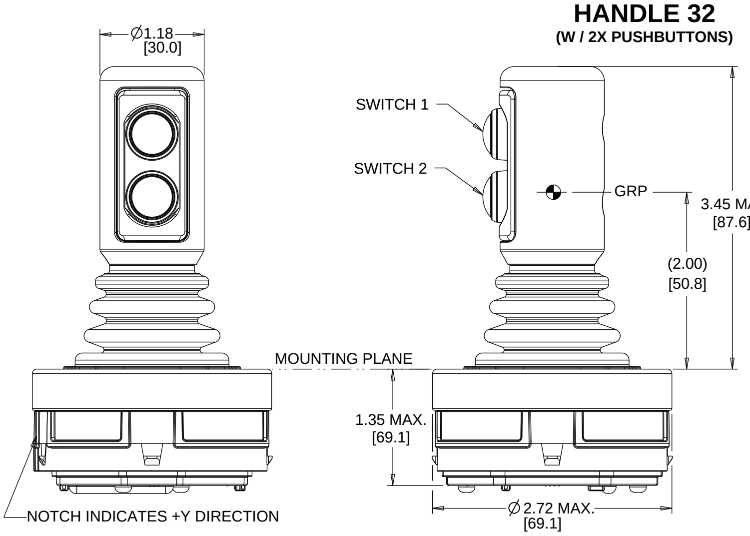
HALL EFFECT TECHNOLOGY JOYSTICK

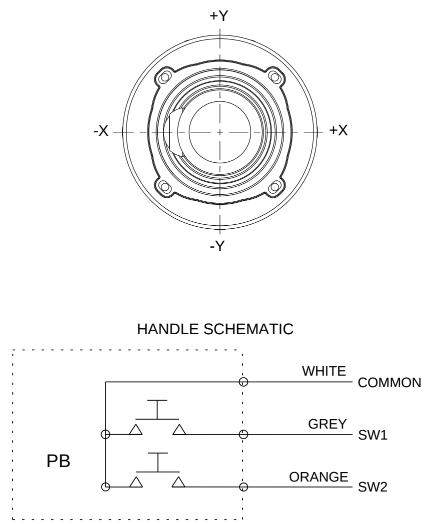
HANDLE 31
(W / PUSHBUTTON, TOP HANDLE, HALF BOOT)



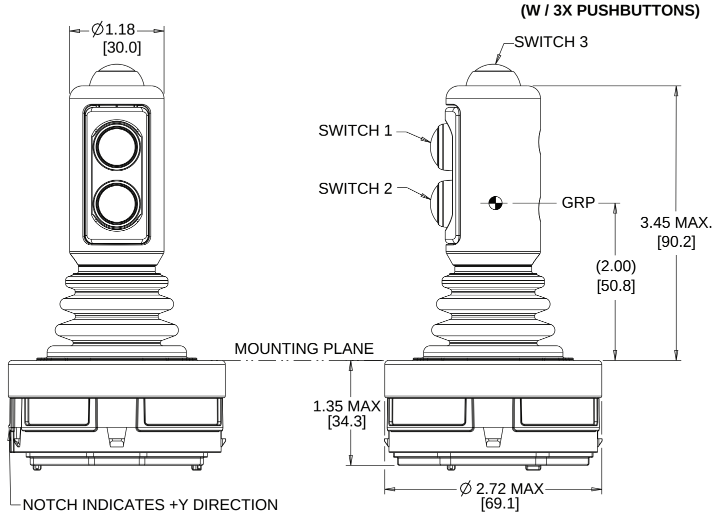


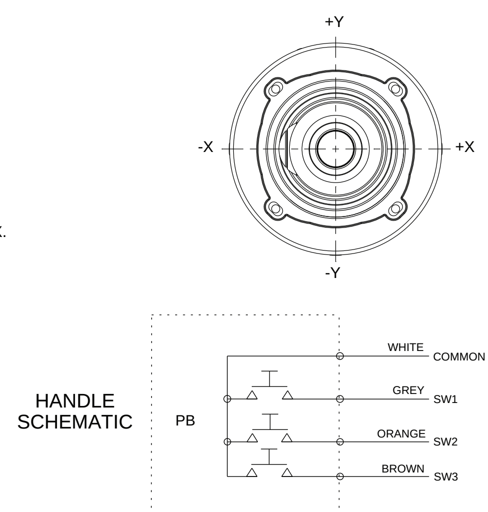
HANDLE 32
(W / 2X PUSHBUTTONS)





HANDLE 33
(W / 3X PUSHBUTTONS)

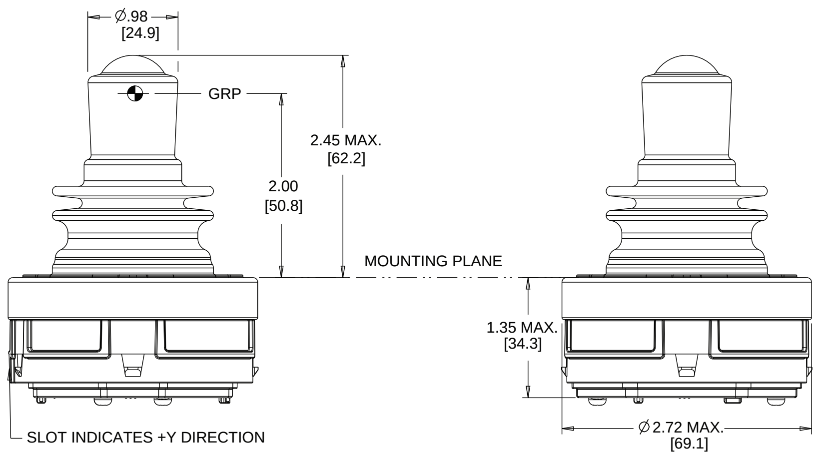


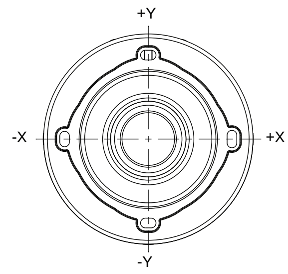


Wires and Strain Relief not shown in all views for clarity.

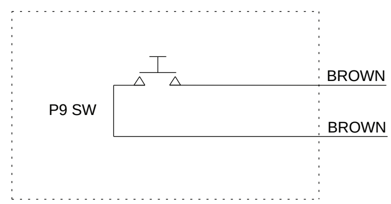
UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

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

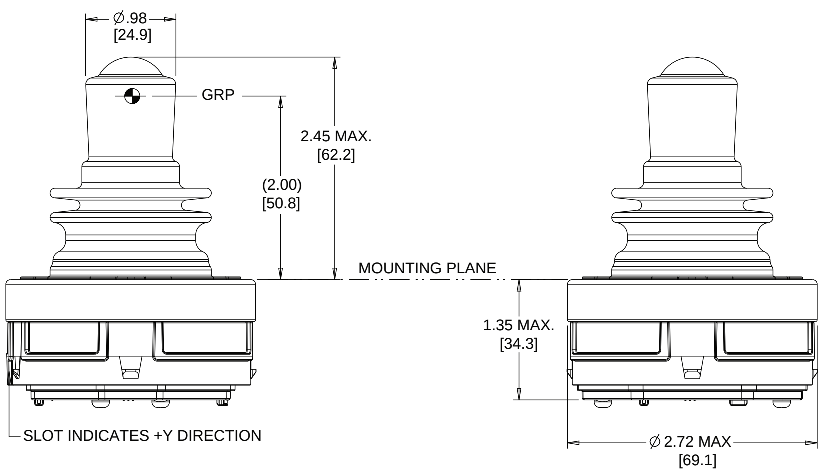


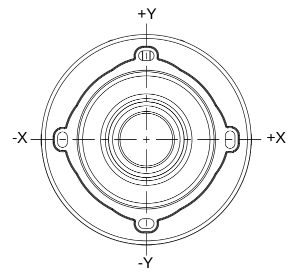


HANDLE SCHEMATIC

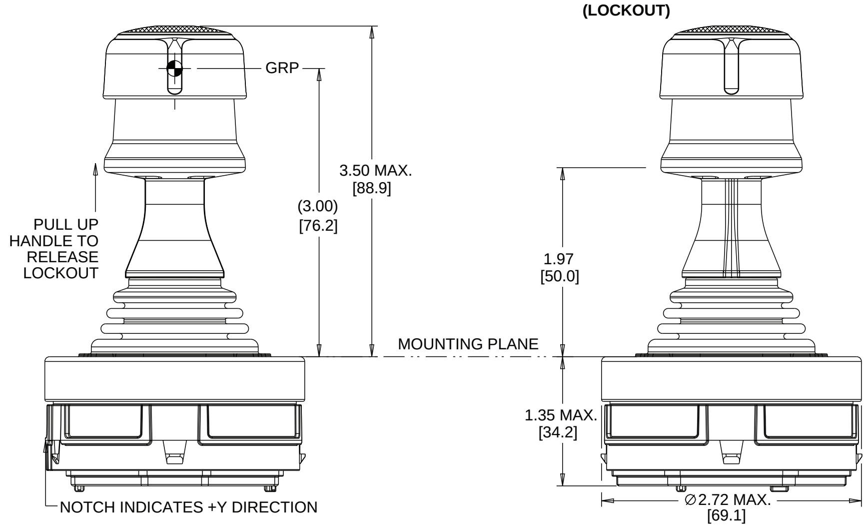


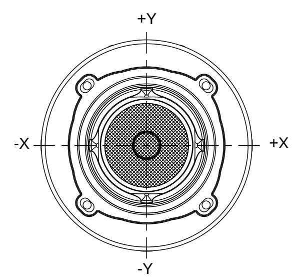
HANDLE 35
(NO PUSHBUTTON, TOP HANDLE, FULL BOOT)





HANDLE 41
(LOCKOUT)





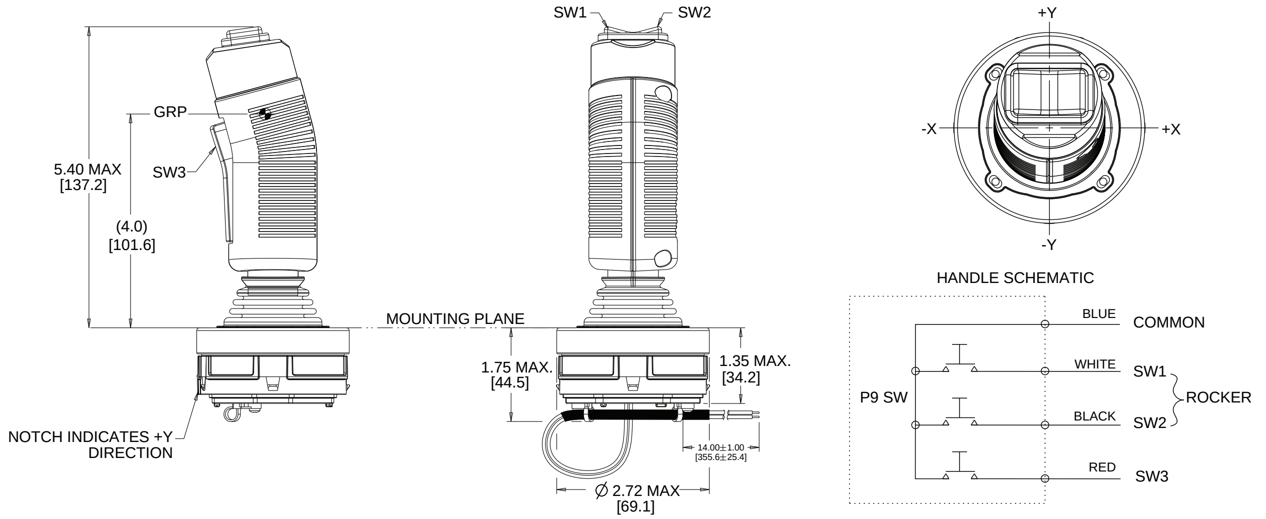
Wires and Strain Relief not shown in all views for clarity.

MEDIUM HALL EFFECT JOYSTICK

HALL EFFECT TECHNOLOGY JOYSTICK

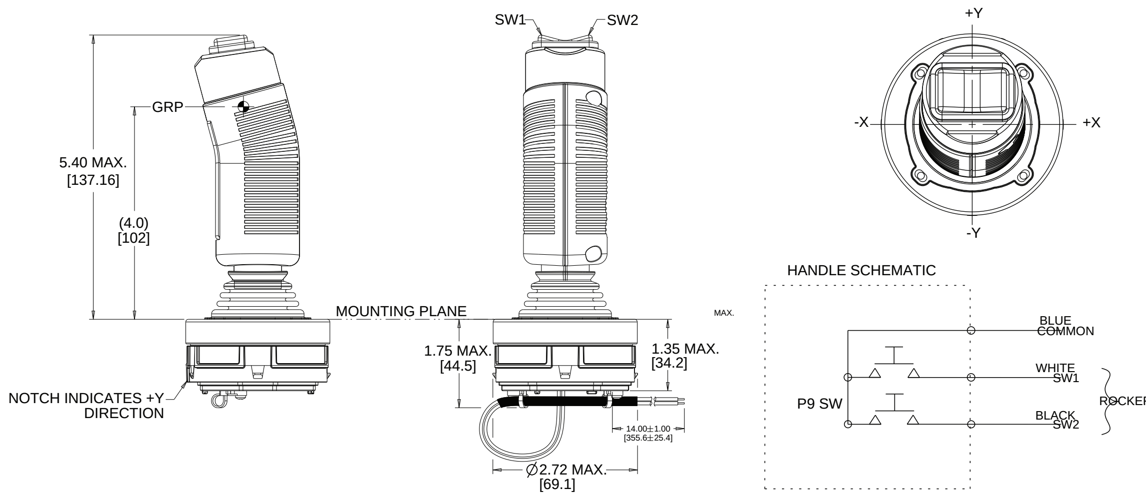
HANDLE 51

(G3-D WITH ROCKER AND OPERATOR PRESENCE)



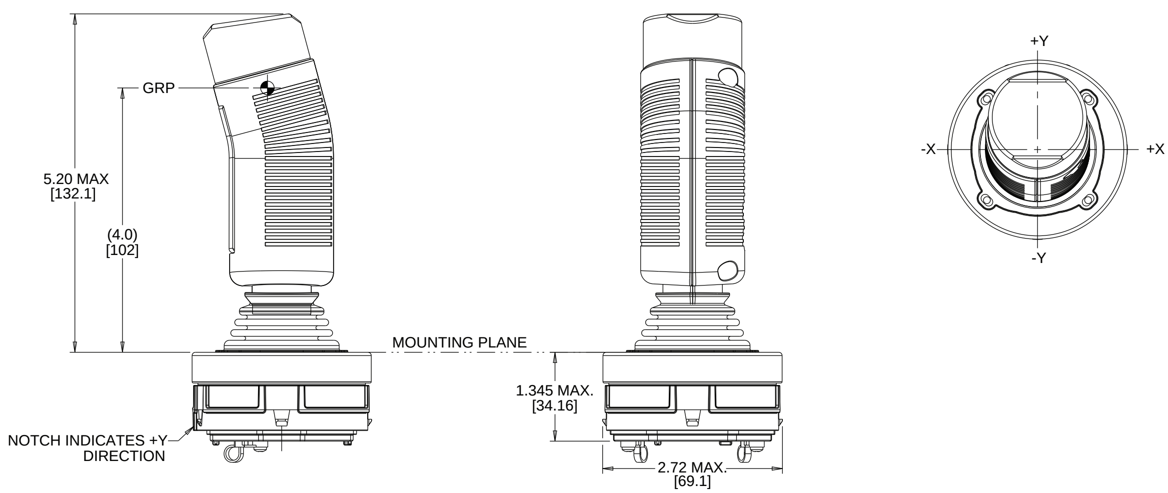
HANDLE 52

(G3-D WITH ROCKER)



HANDLE 53

(G3-D)

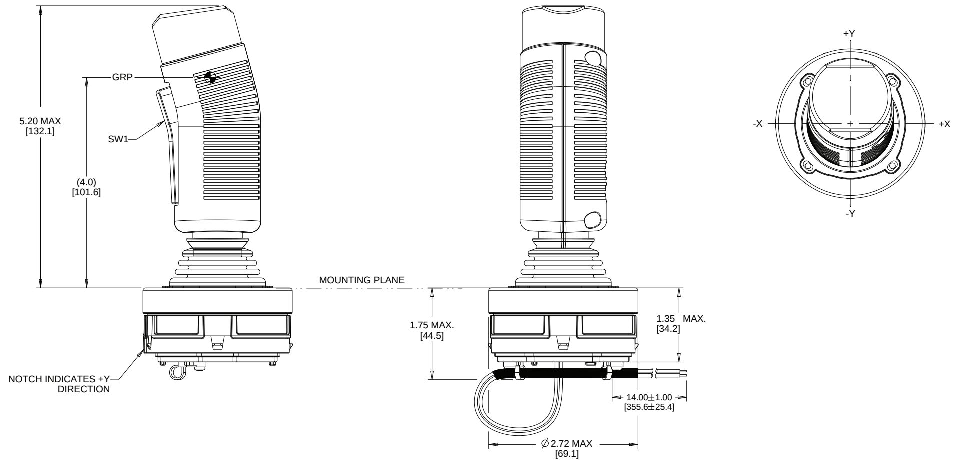


Wires and Strain Relief not shown in all views for clarity.

HALL EFFECT TECHNOLOGY JOYSTICK

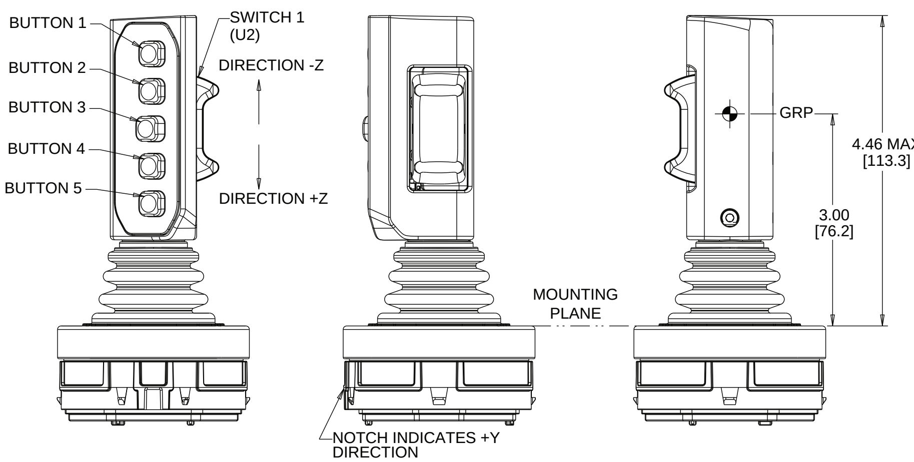
HANDLE 54

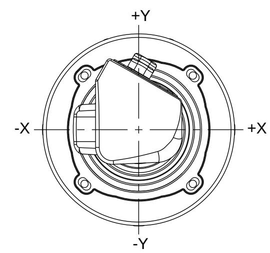
(G3-D WITH OPERATOR PRESENCE)



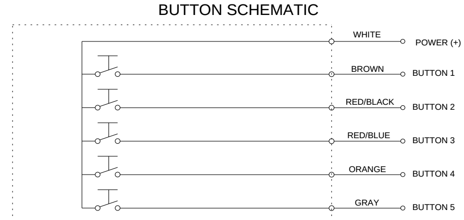
HANDLE 61

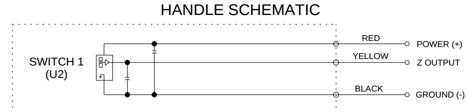
(5-BUTTON KEYPAD & HALL ROCKER RIGHT)





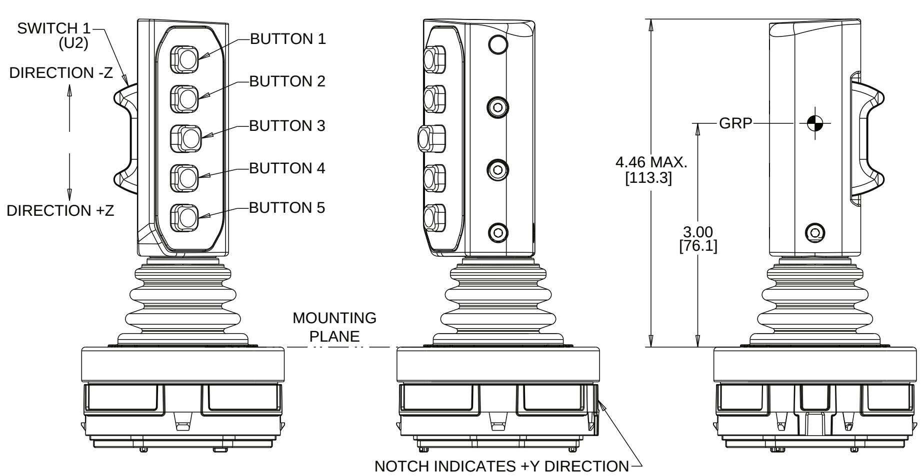
Right-Handed Version

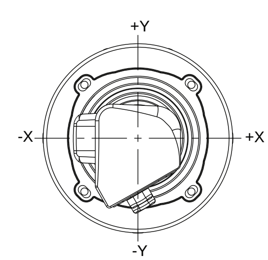




HANDLE 62

(5-BUTTON KEYPAD & HALL ROCKER LEFT)





Left-Handed Version

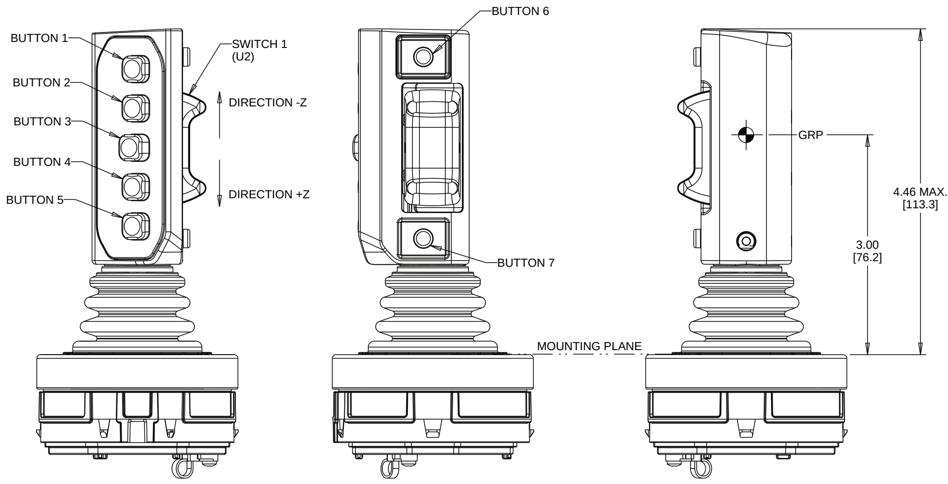
Wires and Strain Relief not shown in all views for clarity.

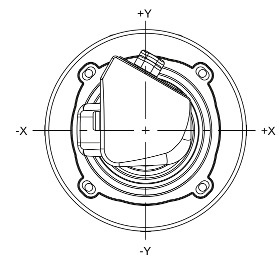
MEDIUM HALL EFFECT JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

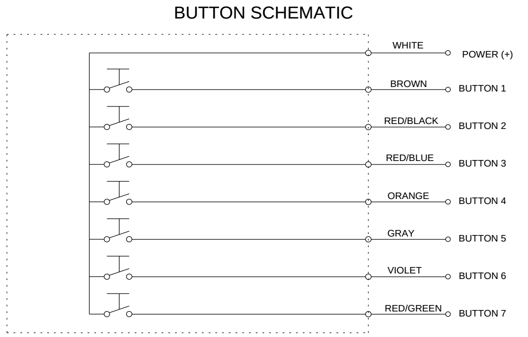
HANDLE 63

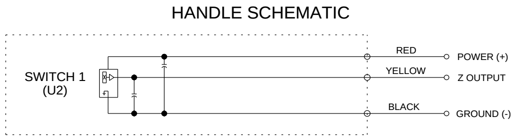
(7-BUTTON KEYPAD & HALL ROCKER RIGHT)





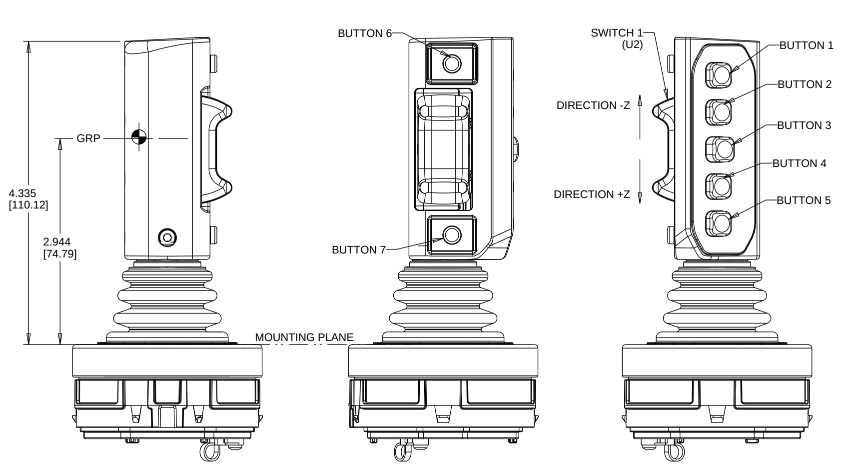
Right-Handed Version

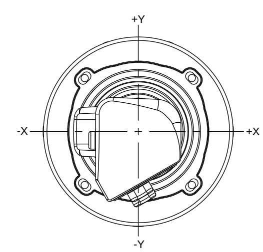




HANDLE 64

(7-BUTTON KEYPAD & HALL ROCKER LEFT)



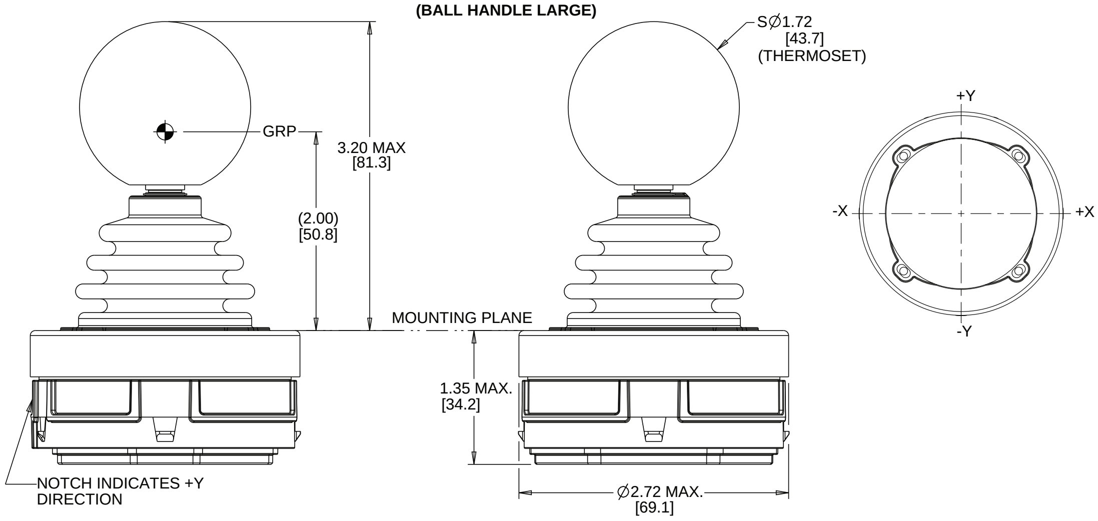


Left-Handed Version

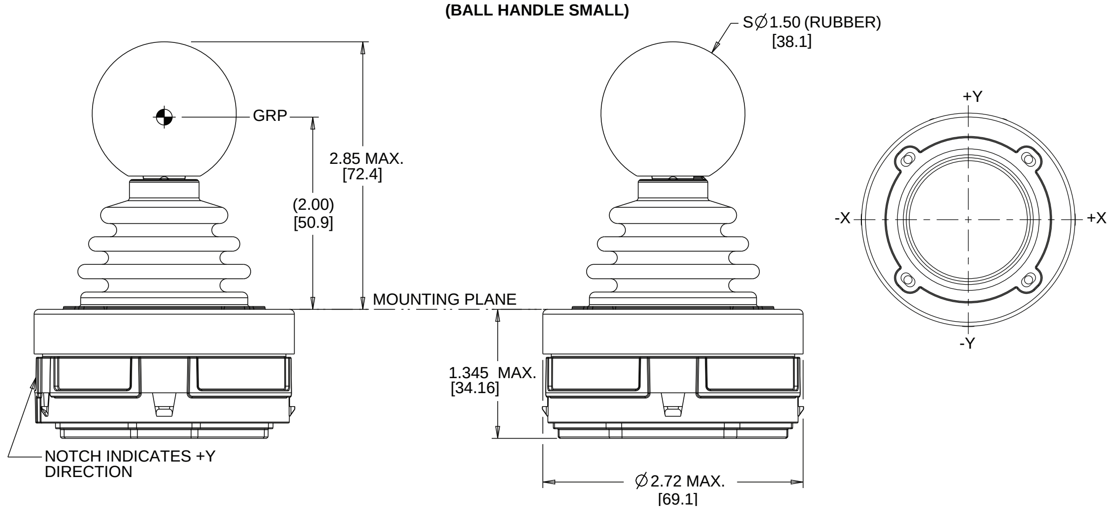
Wires and Strain Relief not shown in all views for clarity.

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

HANDLE 71
(BALL HANDLE LARGE)



HANDLE 72
(BALL HANDLE SMALL)

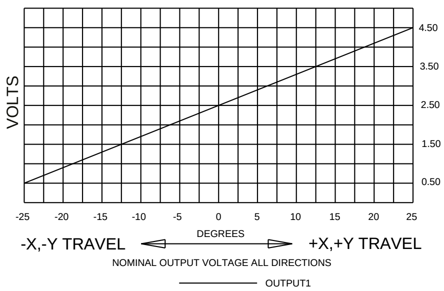


MEDIUM HALL EFFECT JOYSTICK

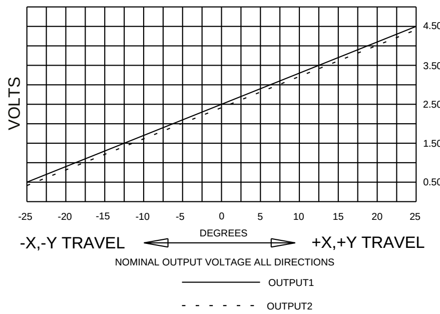
UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

JHM OUTPUTS

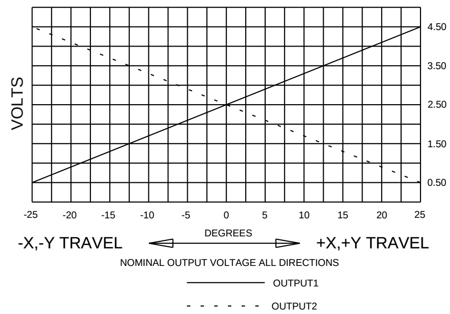
OPTION AA & AT



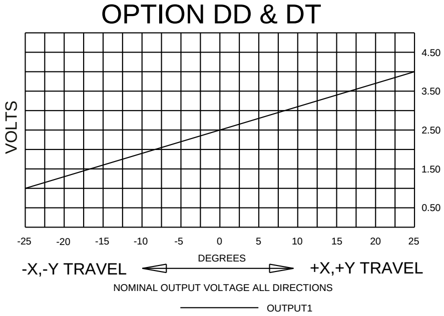
OPTION BB & BT



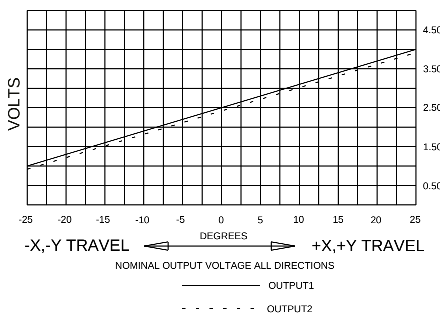
OPTION CC & CT



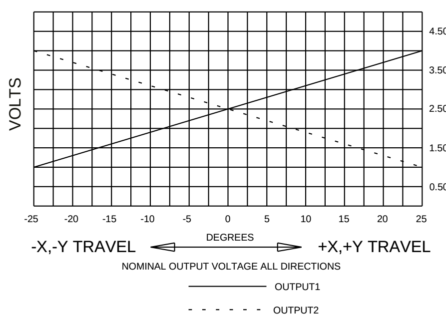
OPTION DD & DT



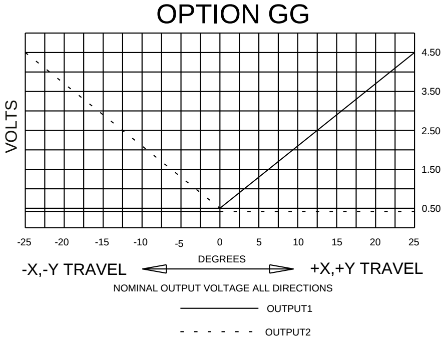
OPTION EE & ET



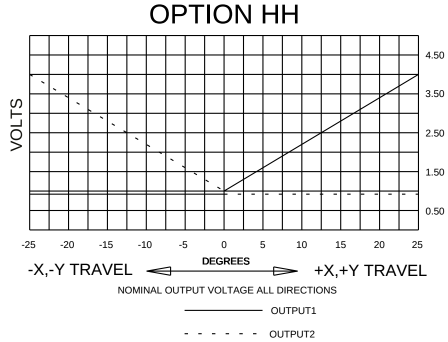
OPTION FF & FT



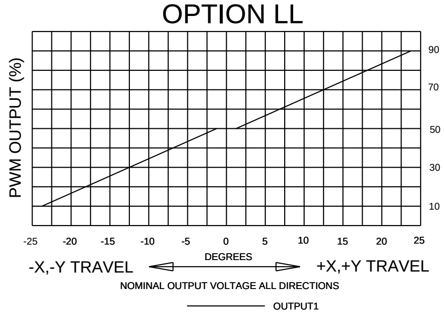
OPTION GG



OPTION HH



OPTION LL



JOYSTICK WITH GRIP OPTIONS

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**

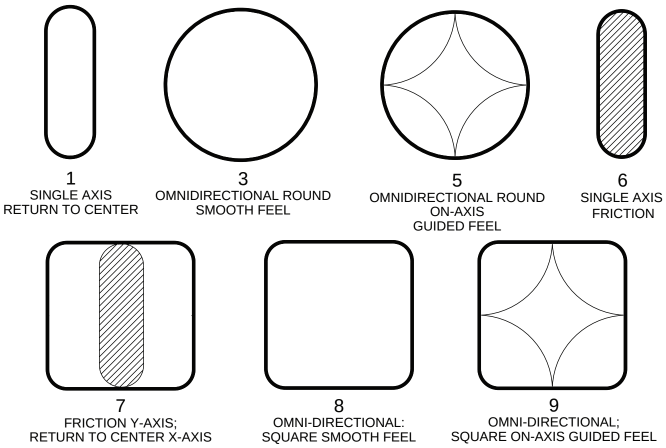
HJMG3 Joystick with G3-D Grip

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	-.25	N/A	+.25
AA, BB, CC, DD, EE, FF, GG, HH	@ 5V Vcc			
Output Voltage Tolerance at Center	VDC	-.15	N/A	+.15
AT, BT, CT, DT, ET, FT	@ 5V Vcc			
Output Voltage Tolerance at	VDC	-.25	N/A	+.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	1250,000 Cycles			
HTW Switches				
Supply Voltage, Vcc	VDC	4.5	5.0	5.5
Output Voltage	VDC	-.15	NA	+.15
Tolerance at Center	@ 5V Vcc			
Output Voltage	VDC	-.25	N/A	+.25
Tolerance at Full Travel	@ 5V Vcc			
Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
HTWM and HTLT4 Switches				
Output Voltage	VDC	-.25	NA	+.25
Tolerance at Center	@ 5V Vcc			
Output Voltage	VDC	-.25	N/A	+.25
Tolerance at Full Travel	@ 5V Vcc			
HTWM Supply Current B=0, Vcc=5V, Iout=0	mA	N/A	N/A	10
HTLT4 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
HTLT4 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

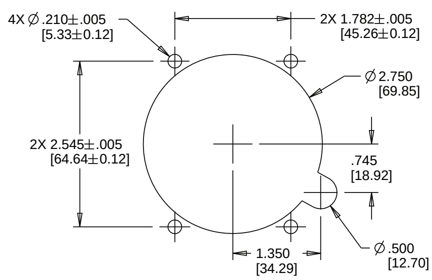
JOYSTICK WITH GRIP OPTIONS

UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

HJMG3 Gating Icons



HJMG3 Suggested Panel Opening



SUGGESTED PANEL OPENING
MAX. PANEL THICKNESS = 0.15 INCHES

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			
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 XX X X XX X X X

Gating*

1. Gated; Single Axis – Return to Center
3. Omni-directional; Round Smooth Feel
5. Omni-directional; Round On-Axis Guided Feel
8. Omni-directional; Square Smooth Feel
9. Omni-directional; Square On-Axis Guided Feel

Output 1**	Output 2***
AA. 2.5 +/- 2.0VDC	NONE
BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD. 2.5 +/- 1.5VDC	NONE
EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG. 0.5 - 4.5VDC	0.5 - 4.5VDC
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
JJ. CANbus J1939	NONE
KK. CANopen	NONE
LL. PWM	NONE
MM. USB	NONE

Force

1. Low
2. High

Grip

A. G3-A Universal
B. G3-B Universal
C. G3-C Universal
D. G3-D Control Grip
E. G3-C with Z-Axis, Single Output
F. G3-C with Z-Axis, Dual Output

Faceplate

AN	CG
AP	CJ
AQ	CK
AR	CL
AS	CM
BA	CN
BB	CP
BF	CQ
BG	CR
BH	DA
BJ	DB
BK	DC
BL	DD
CA	DE
CB	DF

Trigger PB Color

1. None
2. Black
3. Red

P9 Button Grip Head (Black)****

1. None
2. Left
3. Right
4. Left and Right

P9 Button Color (Faceplate)

N. None
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Violet
8. Gray
9. White

* Contact factory for friction held versions

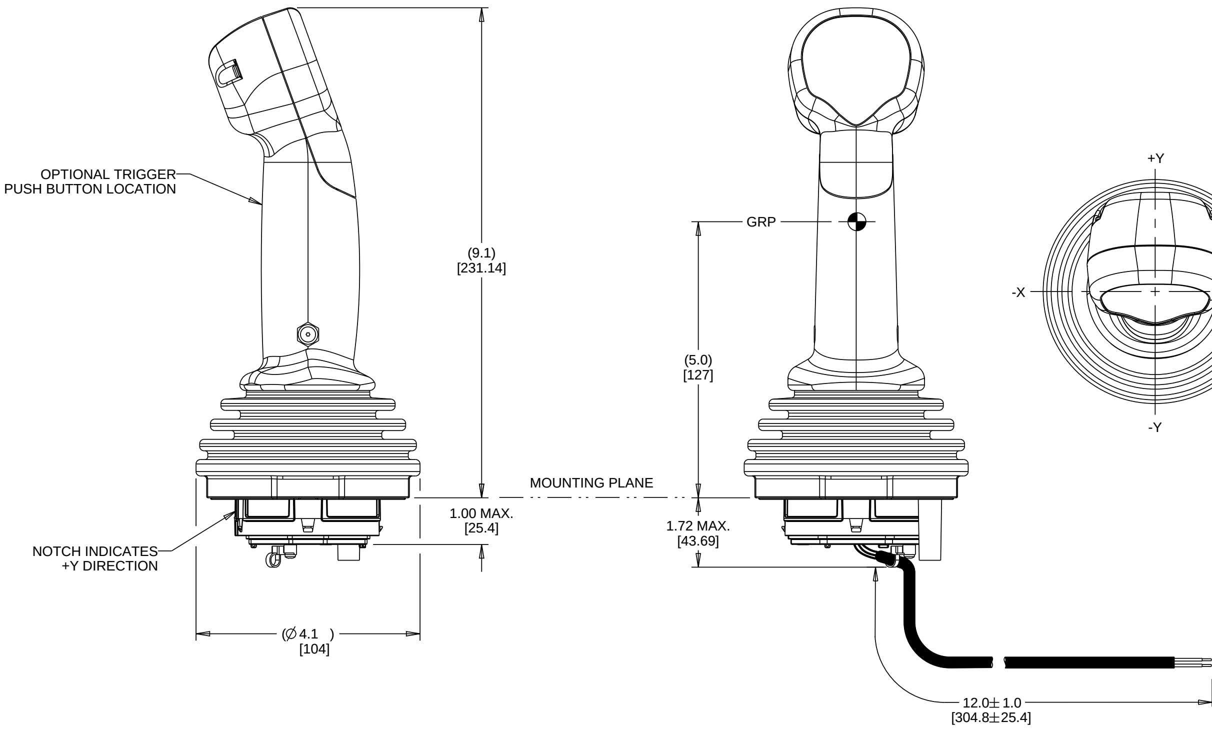
** Outputs are from the center to the full travel position in each direction. Options “AA”, “BB”, “CC”, “DD”, “EE”, “FF”, “AT”, “BT”, “CT”, “DT”, “ET” and “FT” provide increased voltage in +x, +y; and decreasing voltage in -x, -y for output 1. Options “GG” and “HH” provide increasing voltages in all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

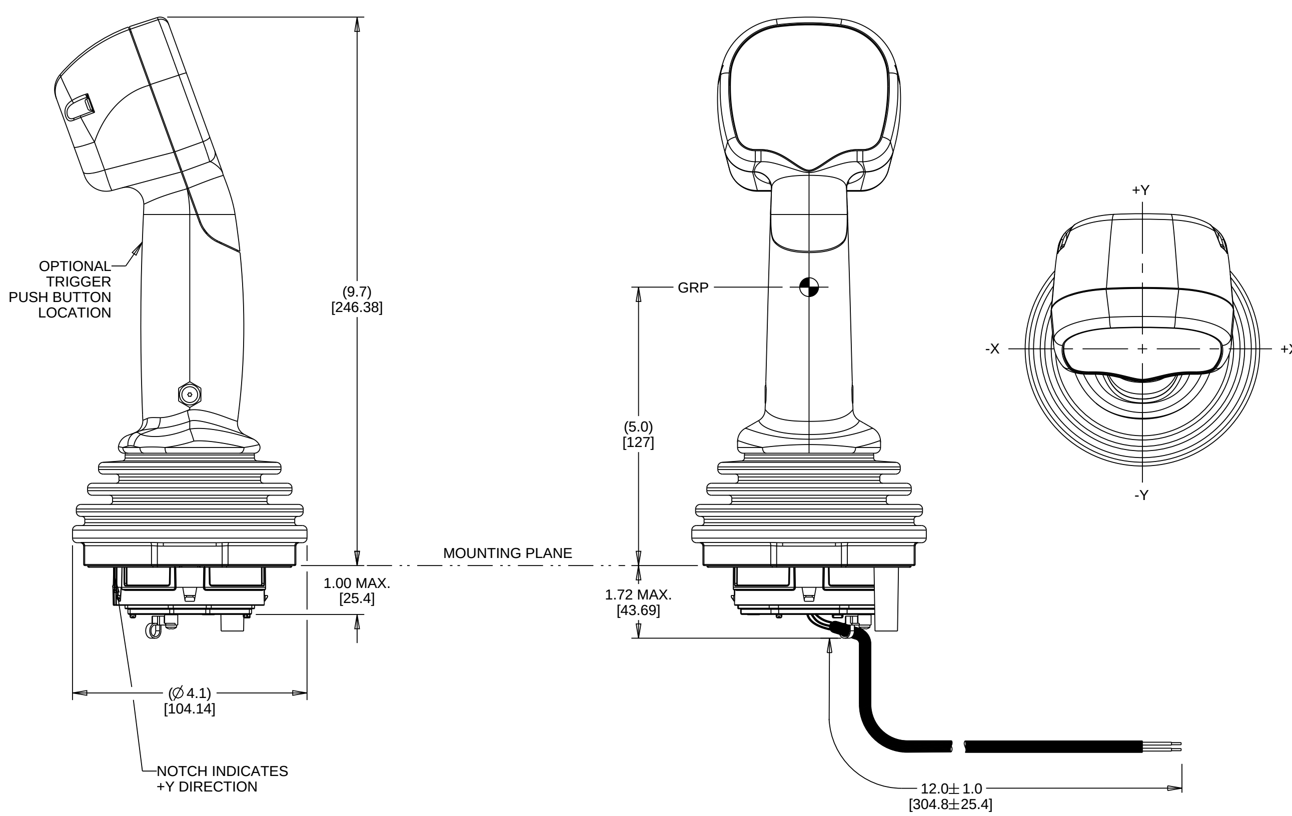
**** Switches on grip head are available for "C" grip version only

LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

G3-A Universal Grip with AS Faceplate



G3-B Universal Grip with BL Faceplate

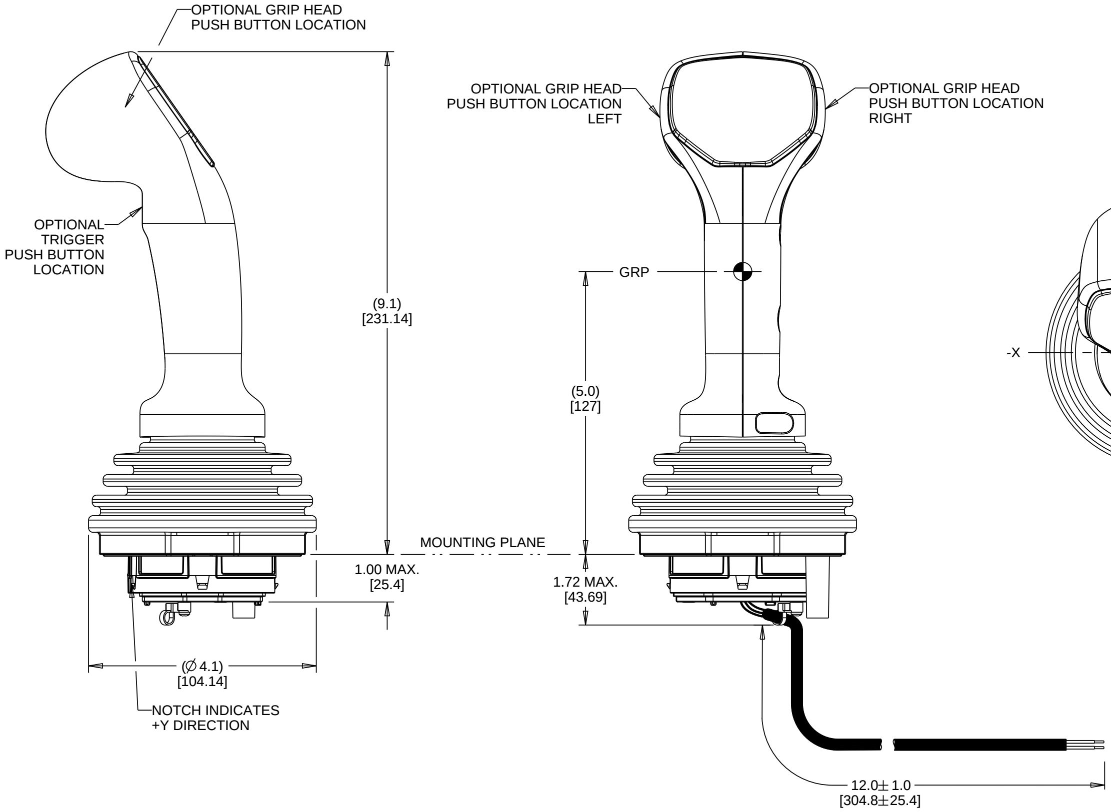


Wires and strain relief not shown in all views for clarity.
Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

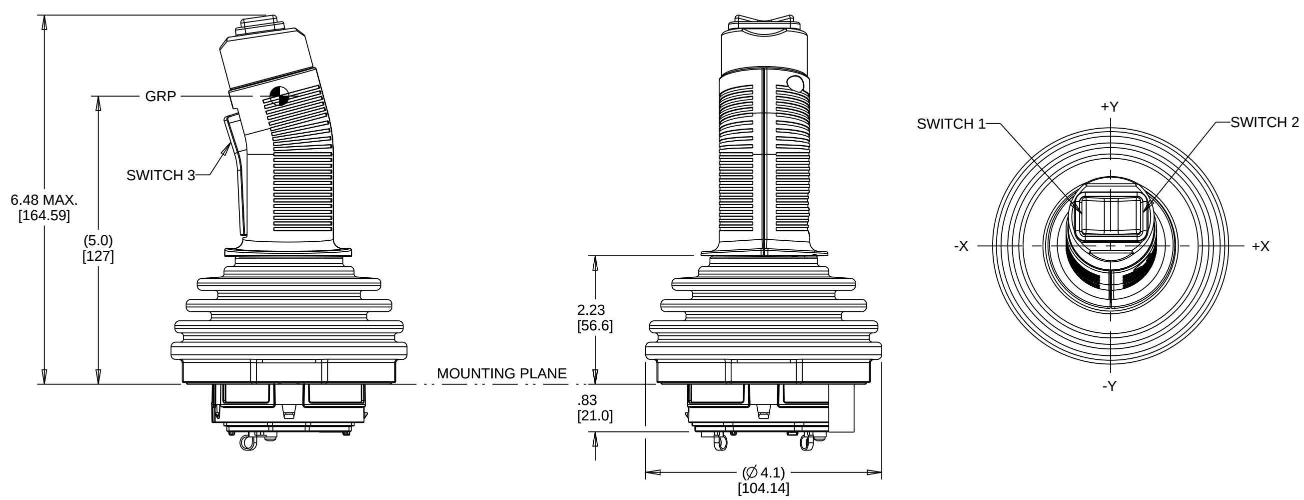
JOYSTICK WITH GRIP OPTIONS

UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

G3-C Universal Grip with CL Faceplate



G3-D Control Grip with DA Faceplate

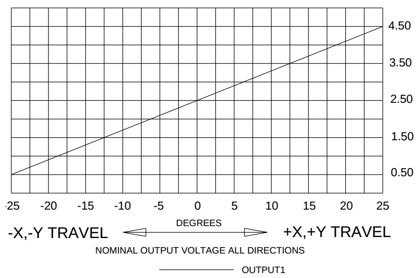


Wires and strain relief not shown in all views for clarity.
Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

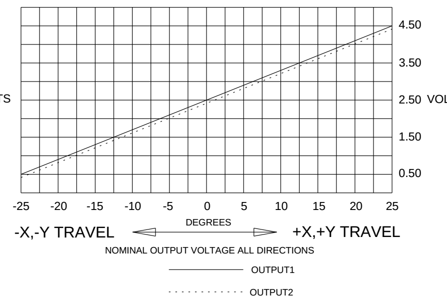
LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

HJMG3 OUTPUT

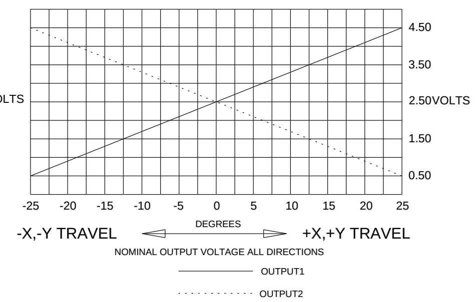
OPTION AA & AT



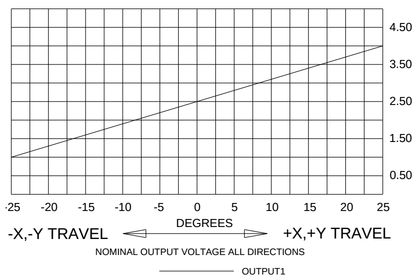
OPTION BB & BT



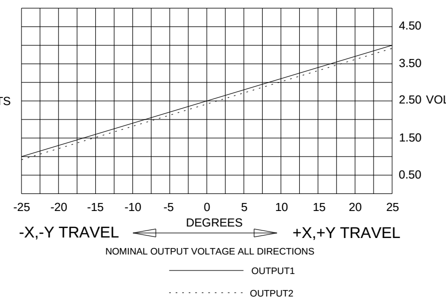
OPTION CC & CT



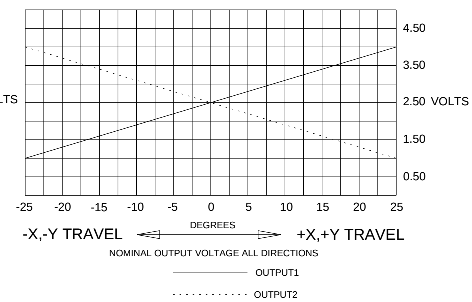
OPTION DD & DT



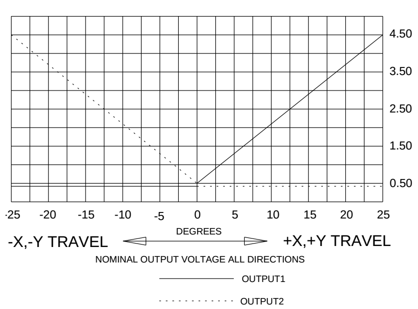
OPTION EE & ET



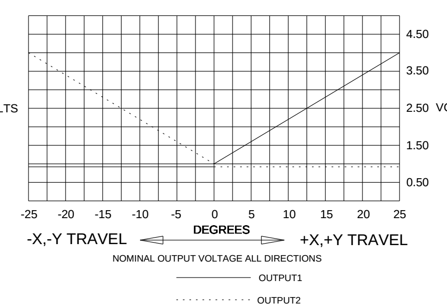
OPTION FF & FT



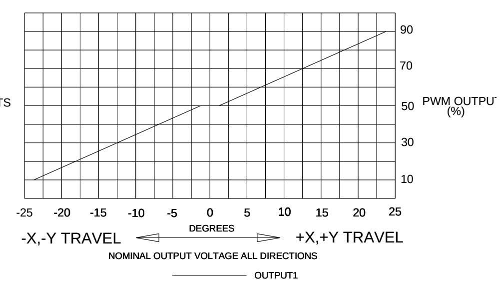
OPTION GG



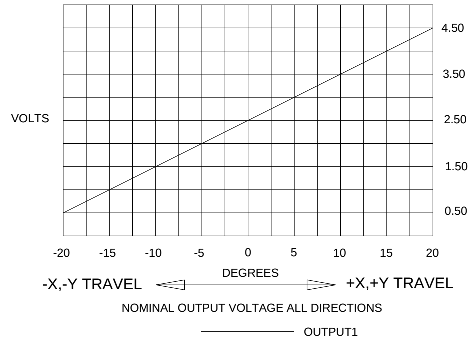
OPTION HH



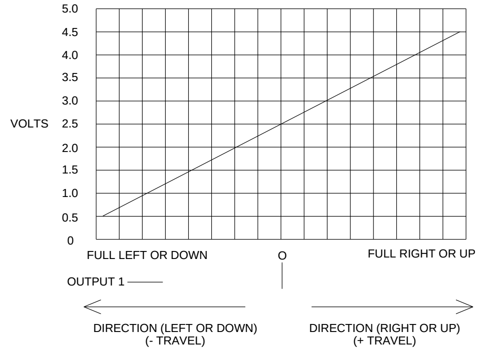
OPTION LL



HTLT4 OUTPUT



HTW & HTWM OUTPUT

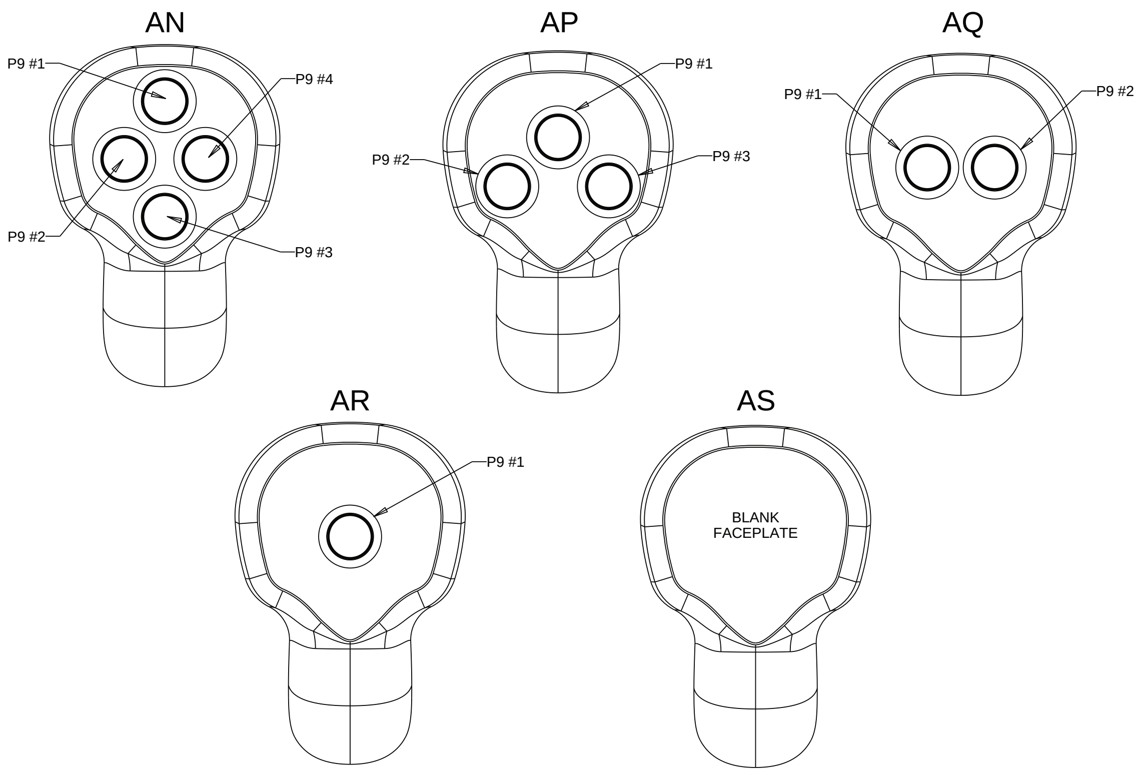


HALL EFFECT CONTROLS

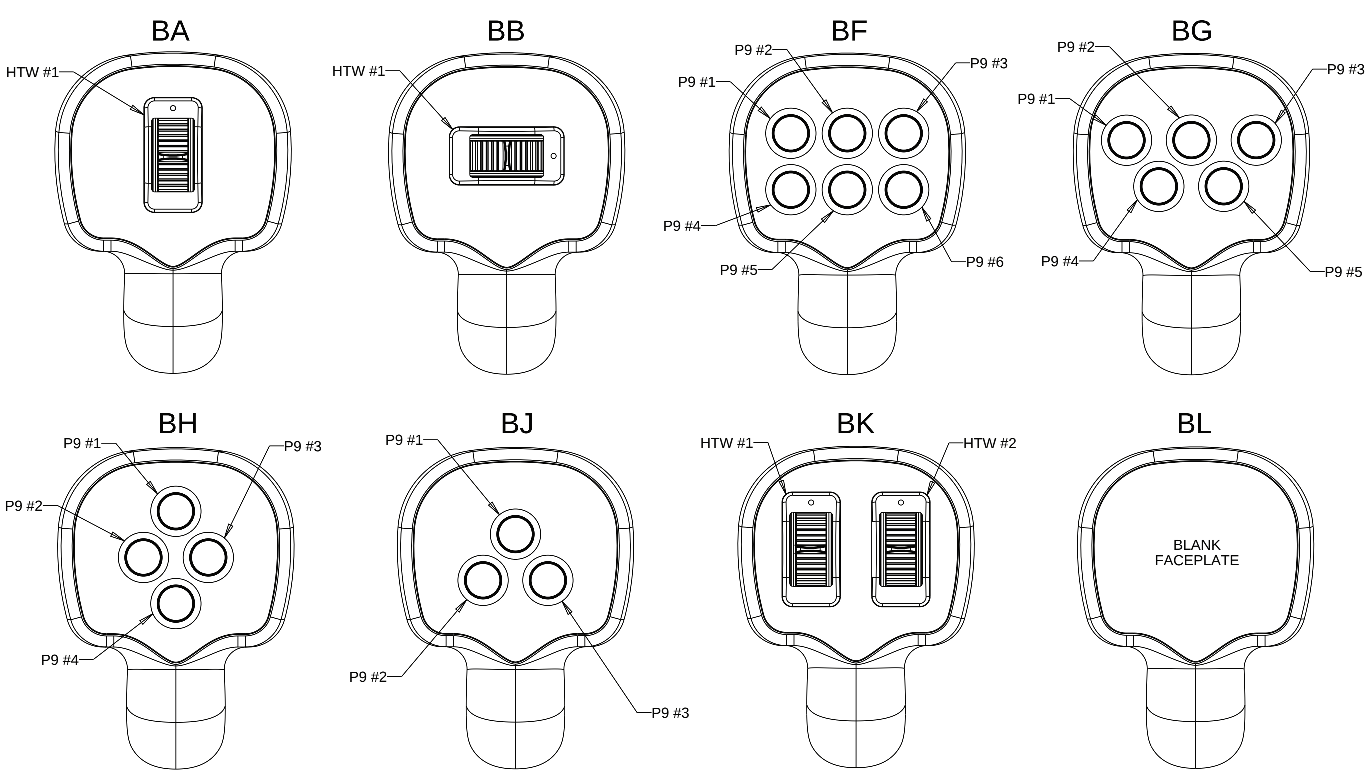
JOYSTICK WITH GRIP OPTIONS

UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

FACEPLATES GROUP A

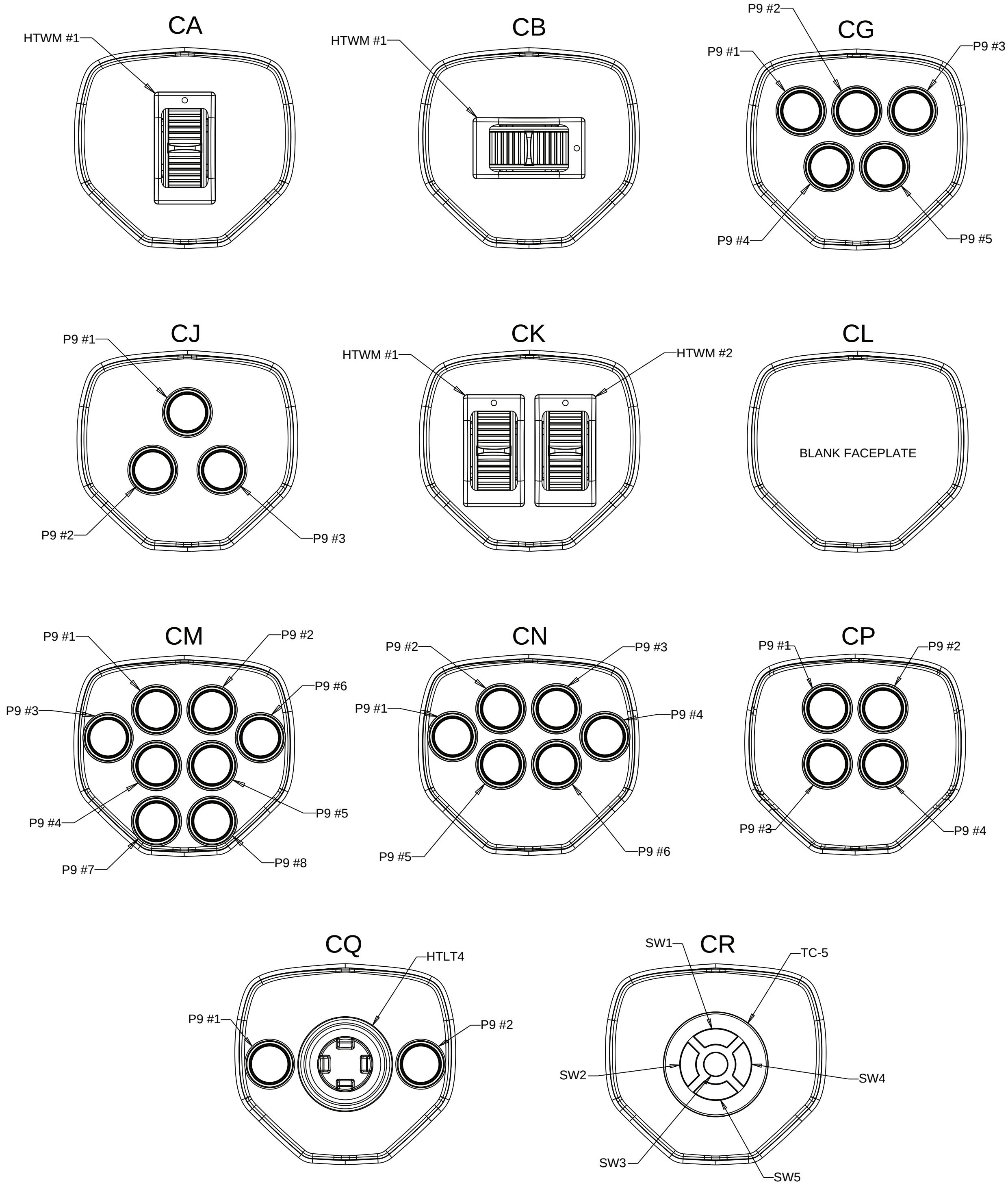


FACEPLATES GROUP B



LONG LIFE, HALL EFFECT TECHNOLOGY JOYSTICK

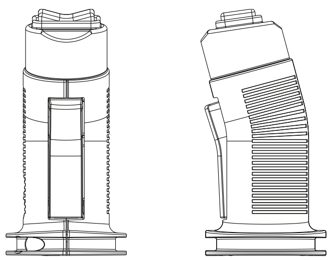
FACEPLATES GROUP C



JOYSTICK WITH GRIP OPTIONS

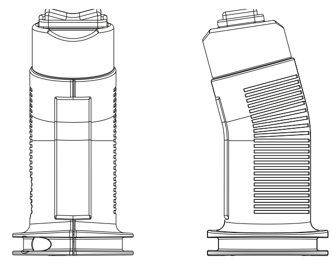
UP TO 5 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

FACEPLATES GROUP D



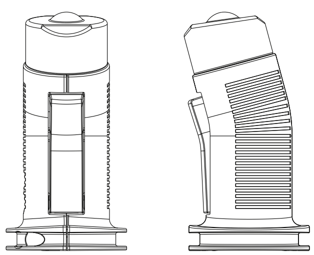
DA

ROCKER
AND OPERATOR PRESENCE



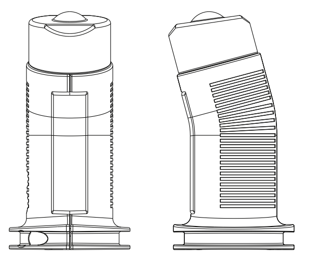
DB

ROCKER



DC

ONE PUSHBUTTON
AND OPERATOR PRESENCE



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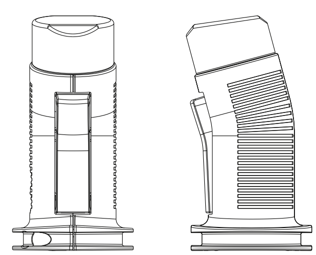
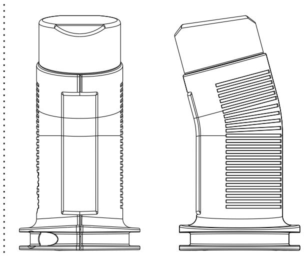
ONE PUSHBUTTON



DE

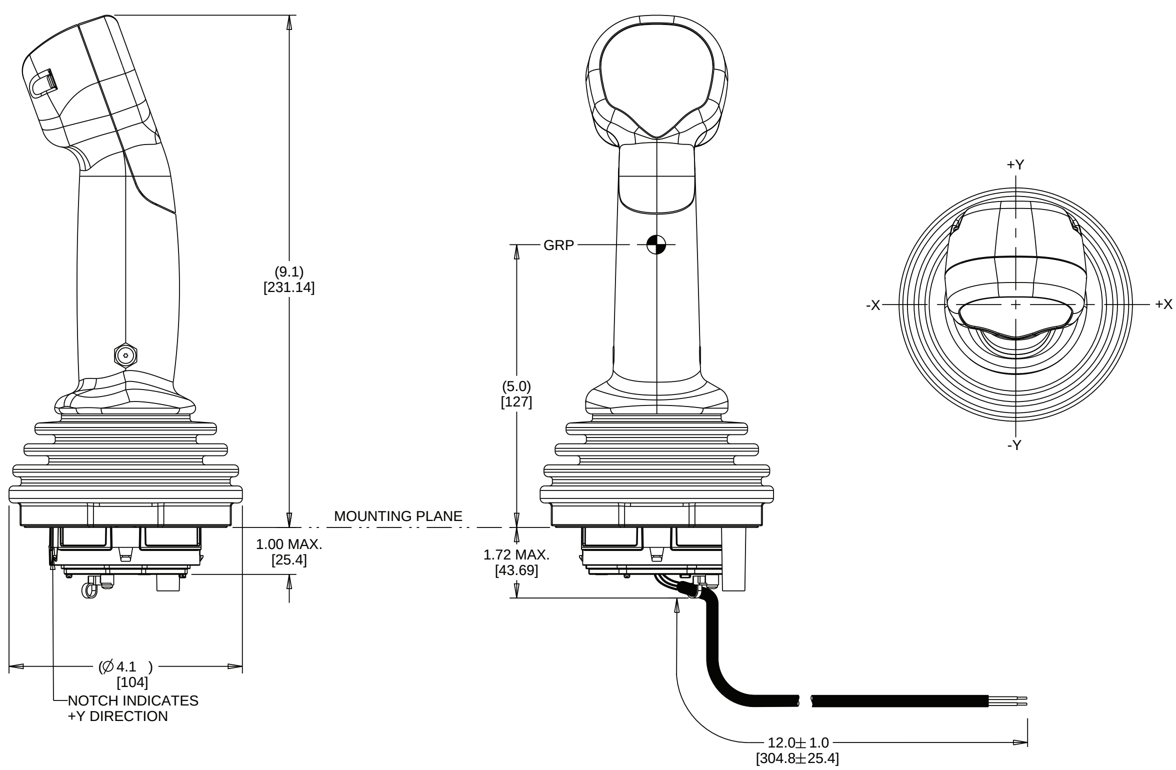
NO PUSHBUTTON
AND OPERATOR PRESENCE



DF

BLANK

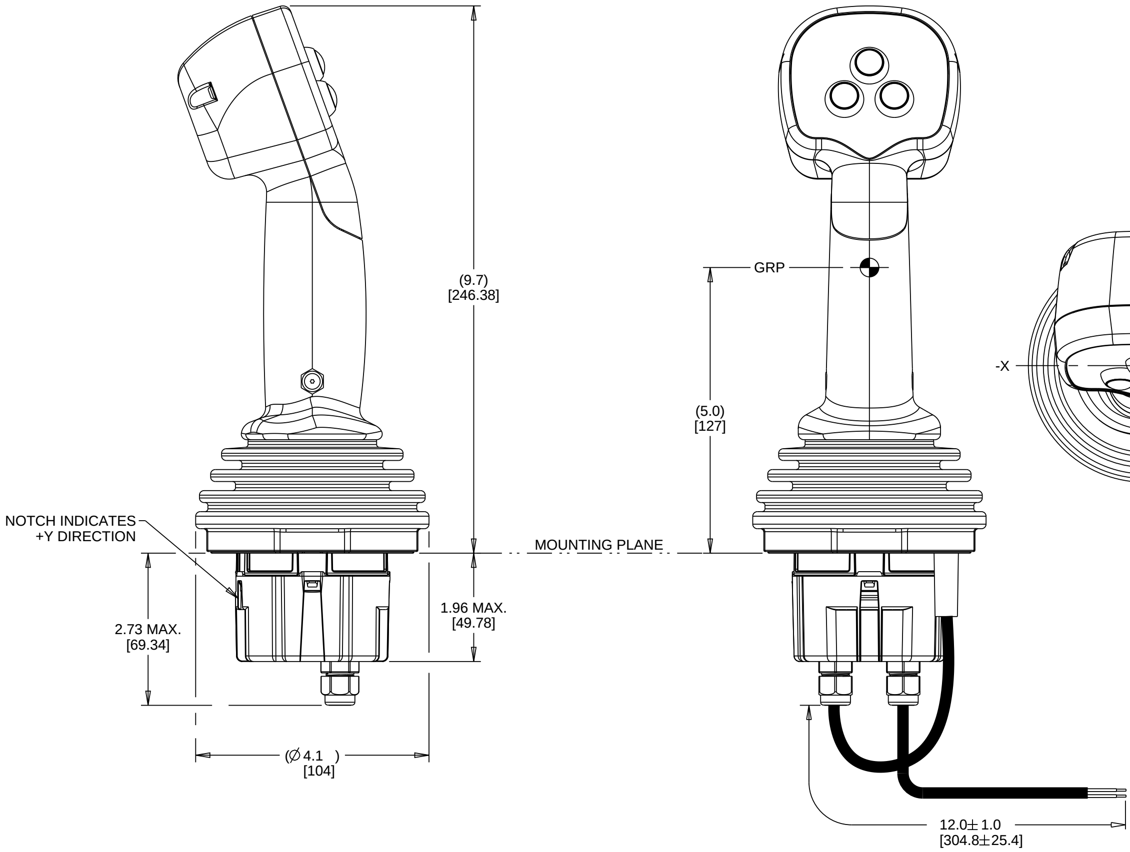
OUTPUTS AA-FT AND LL



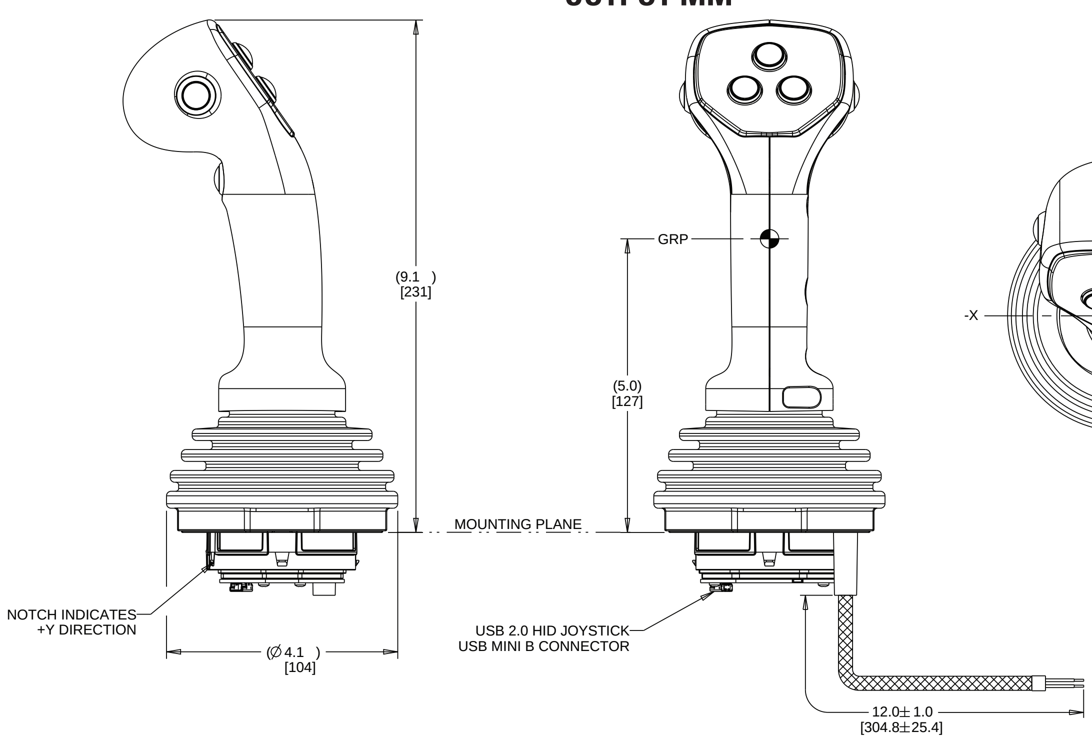
Wires and strain relief not shown in all views for clarity.
Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.

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 JOYSTICK WITH FRICTION HOLD

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:

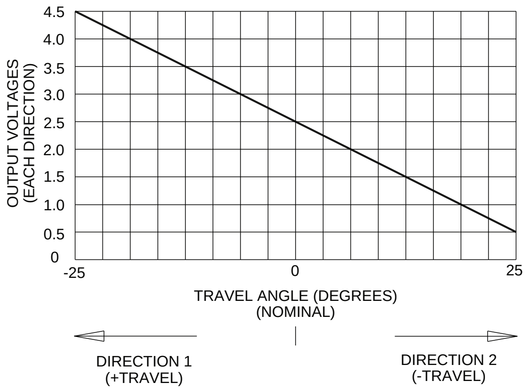
ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)

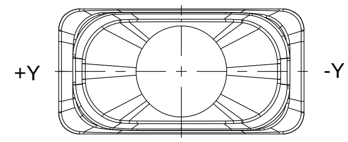
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Tolerance at Full Travel Direction 1 (+ Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Output Tolerance at Full Travel Direction 2 (- Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current Per Sensor (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10

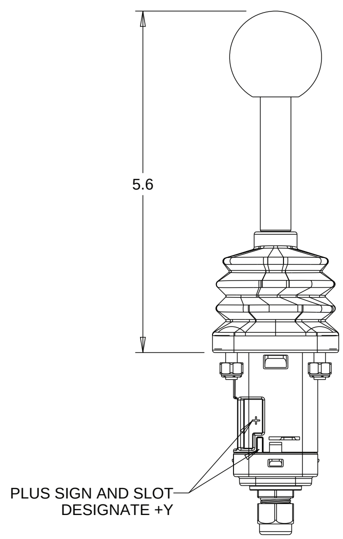
ELECTRONICS:	
Seal Integrity:	Electronics watertight per IP68S
MECHANICAL:	
Mechanical Life:	500,000 cycles
Travel Angle:	25° typical, 24° min to 26° max
Operating Force:	3.5 lbs. typical, 2.0 lbs. min to 5.0 lbs. max
ENVIRONMENTAL:	
Operating Temp Range:	-40°C to +85°C
Humidity:	96% RH, 70°C, 96 hours
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

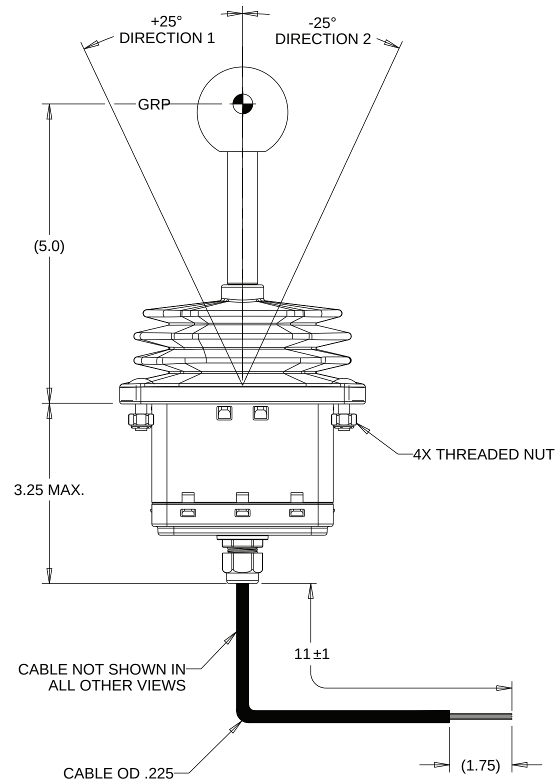
SINGLE AXIS JOYSTICK WITH FRICTION HOLD

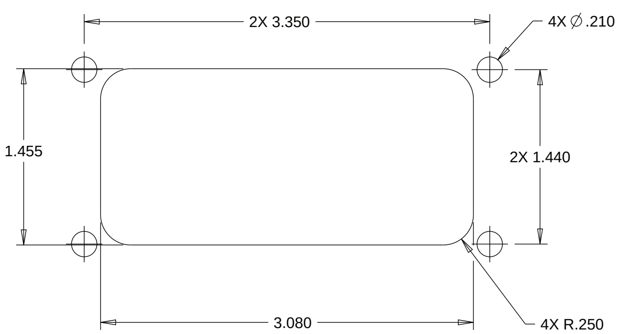
SINGLE AXIS HALL EFFECT JOYSTICK WITH FRICTION HOLD

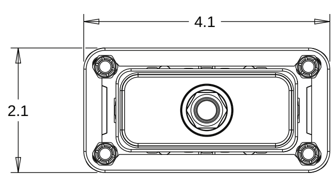












SINGLE AXIS RETURN TO CENTER JOYSTICK

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	-.25	N/A	+.25
Output Tolerance at Full Travel Direction 2 (- Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Output Tolerance at Center	VDC @ 5V Vcc	-.25	N/A	+.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:	4 million cycles
Travel Angle:	25° typical, 24° min to 26° max
Operating Force:	2.5 lbs. typical, 1.5 lbs. min to 3.5 lbs. max

ENVIRONMENTAL:

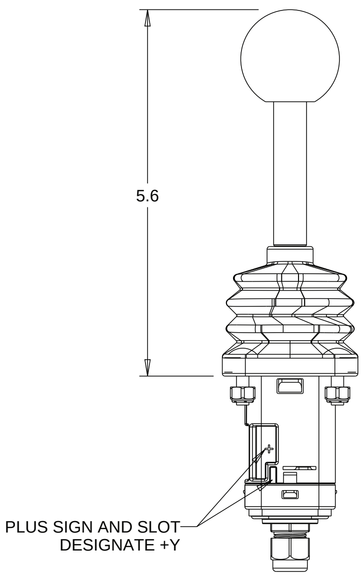
Operating Temp Range:	-40°C to +85°C
Humidity:	96% RH, 70°C, 96 hours
Vibration:	Per MIL-810F min integrity
RFI:	Withstand per SAE J1113
EMI:	Withstand per SAE J1113

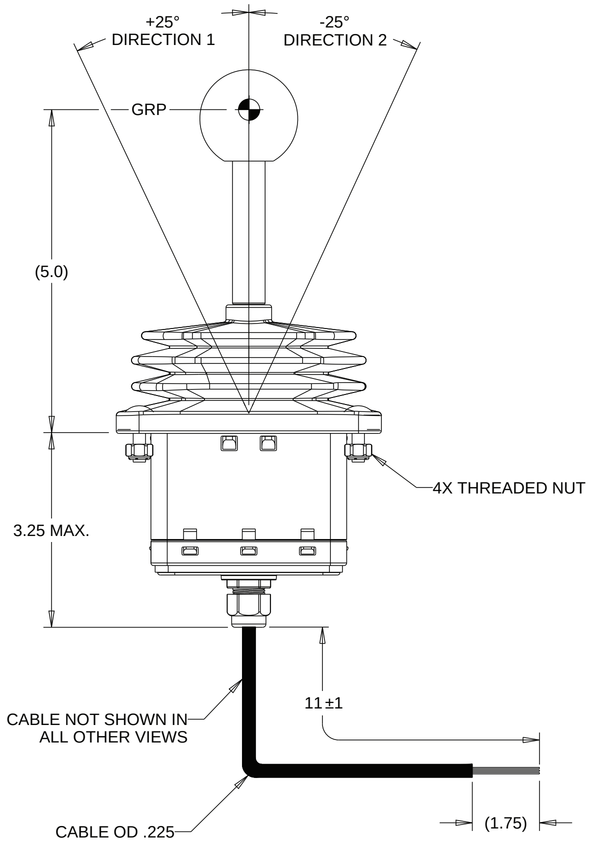
MATERIALS:

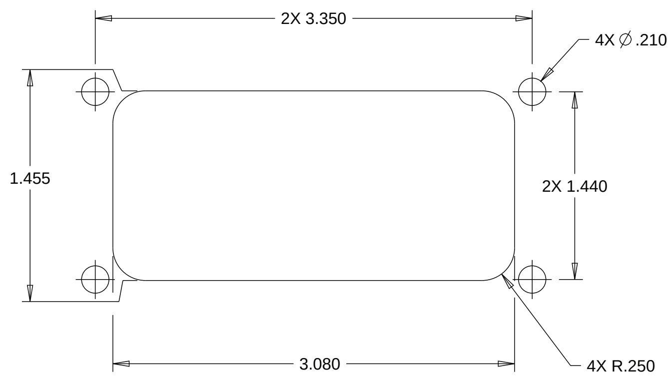
Housing:	Thermoplastic
Bellows:	EPDM, black (typical)
Cable:	3/22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket
Mounting Hardware:	10-24 x 3/4 carriage bolts, self-locking nuts

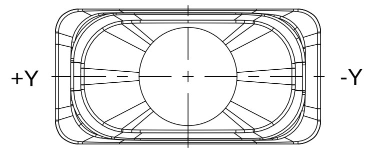
SINGLE AXIS RETURN TO CENTER JOYSTICK

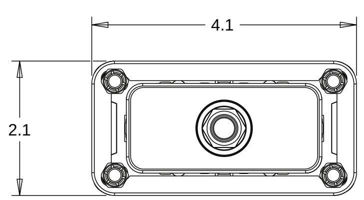
SINGLE AXIS HALL EFFECT JOYSTICK WITH RETURN TO CENTER FEATURE

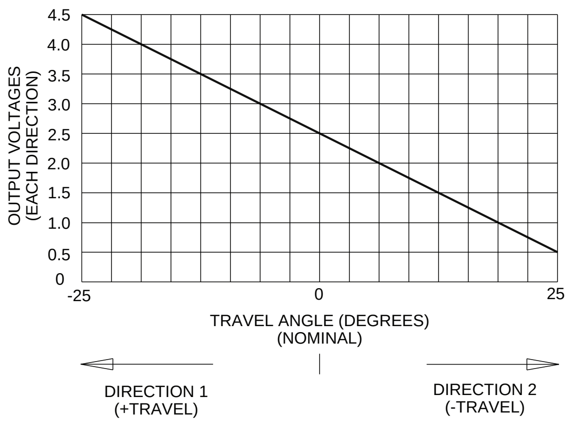












MINIATURE HALL EFFECT JOYSTICK

COMPACT DESIGN

Full Boot

Half Boot with P9 Pushbutton

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. See JHT Z-axis pages for z-axis options.

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:

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	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.

MECHANICAL:

Joystick Mechanical Life:	5,000,000 cycles in all directions
P9 Mechanical Life:	1,250,000 cycles
Travel Angle:	18° min to 22° max, 20° typical
Overtravel Angle:	0.5° min to 1.5° max, 1° typical
Joystick Operating Force:	With bellows, at grip 0.5 lb. min to 1.5 lbs. max over temperature range
P9 Operating Force:	@20°C 8 oz min to 16 oz max, 12 oz typical

ENVIRONMENTAL:

Operating Temp Range:	-40°C to +85°C
Seal:	Electronics seal to IP68S
RFI/EMI:	Withstand per SAE J1113

MATERIALS:

Housing:	Thermoplastic, black
Bellows:	Silicone, black. Additional materials available, contact factory.

JHT PART NUMBER CODE

JHT – XX X X XX X X

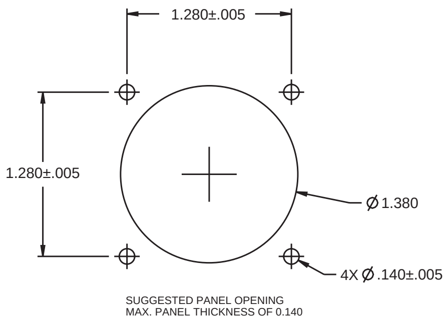
Switch/Boot Style	Gating*	Operating Force	Output 1	Output 2	Termination	P9 Button Color**
11. With P9 Pushbutton & Full Boot	**1.** Gated: Single axis – Return to Center	**1.** 1 lb	**AA.** 2.5 +/- 2.0VDC	NONE	**1.** 24 AWG Wire Leads	**N.** None
12. With P9 Pushbutton & Half Boot	**2.** Gated: Two axis – Return to Center		**BB.** 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		**1.** Red
21. Without Pushbutton & with Full Boot	**3.** Omni-directional; Round Smooth Feel		**CC.** 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC		**2.** Black
Watertight panel seal available for Boot Styles 11 and 21	**4.** Omni-directional; Round On-Axis and Off-Axis Guided Feel		**DD.** 2.5 +/- 1.5VDC	NONE		**3.** Orange
	5. Omni-directional; Round On-Axis Guided Feel		**EE.** 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		**4.** Yellow
			FF. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC		**5.** Green
			GG. 0.5 - 4.5VDC	0.5 - 4.5VDC		**6.** Blue
			HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		**7.** Purple
			JJ. SPI, 3.3V Supply***	NONE		**8.** Gray
			KK. SPI, 5V Supply***	NONE		**9.** White

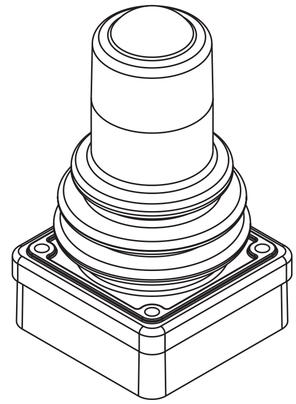
***Gated = Restricted movement in XY axis only. Gating icons appear on page 111.
****Applies only to half boot with pushbutton option.
*****P9'S are not part of the SPI output.

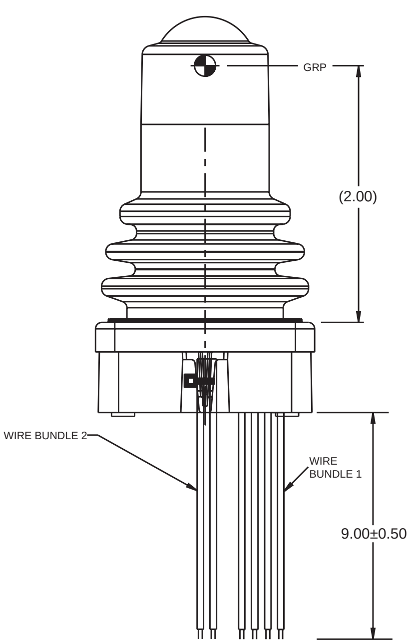
NOTES:
- Outputs are from the center to the full travel position in each direction.
- Options "AA," "BB," "CC," "DD," "EE" and "FF" provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis.
- Options "GG" and "HH" provide increasing voltages in all directions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

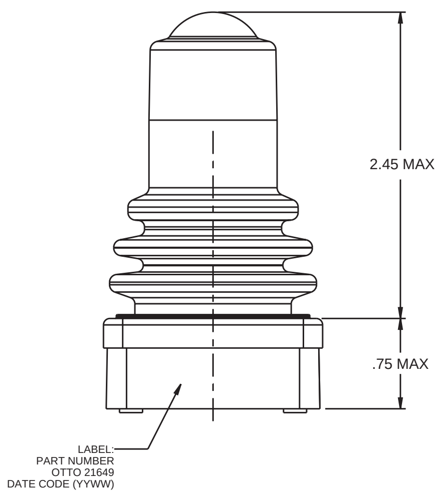
COMPACT DESIGN

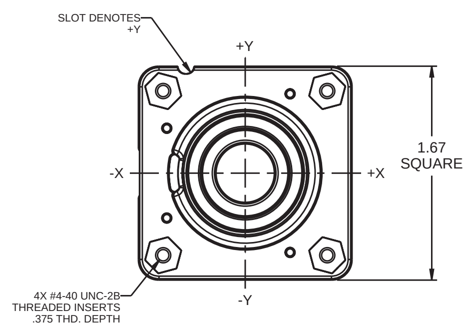
Full Boot Version Shown

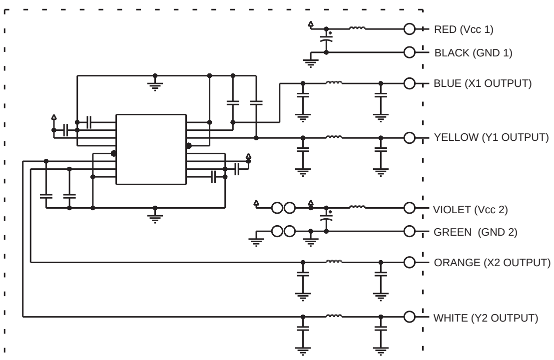




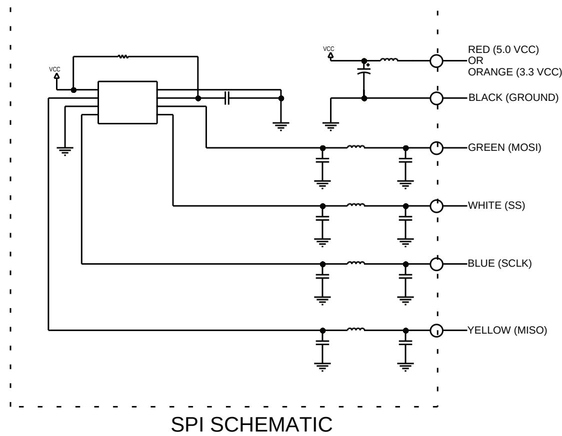




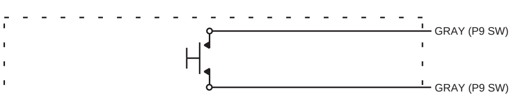




GENERAL SCHEMATIC
(WIRE BUNDLE 1)
ALL OUTPUTS ARE NOT PRESENT IN ALL CONFIGURATIONS



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

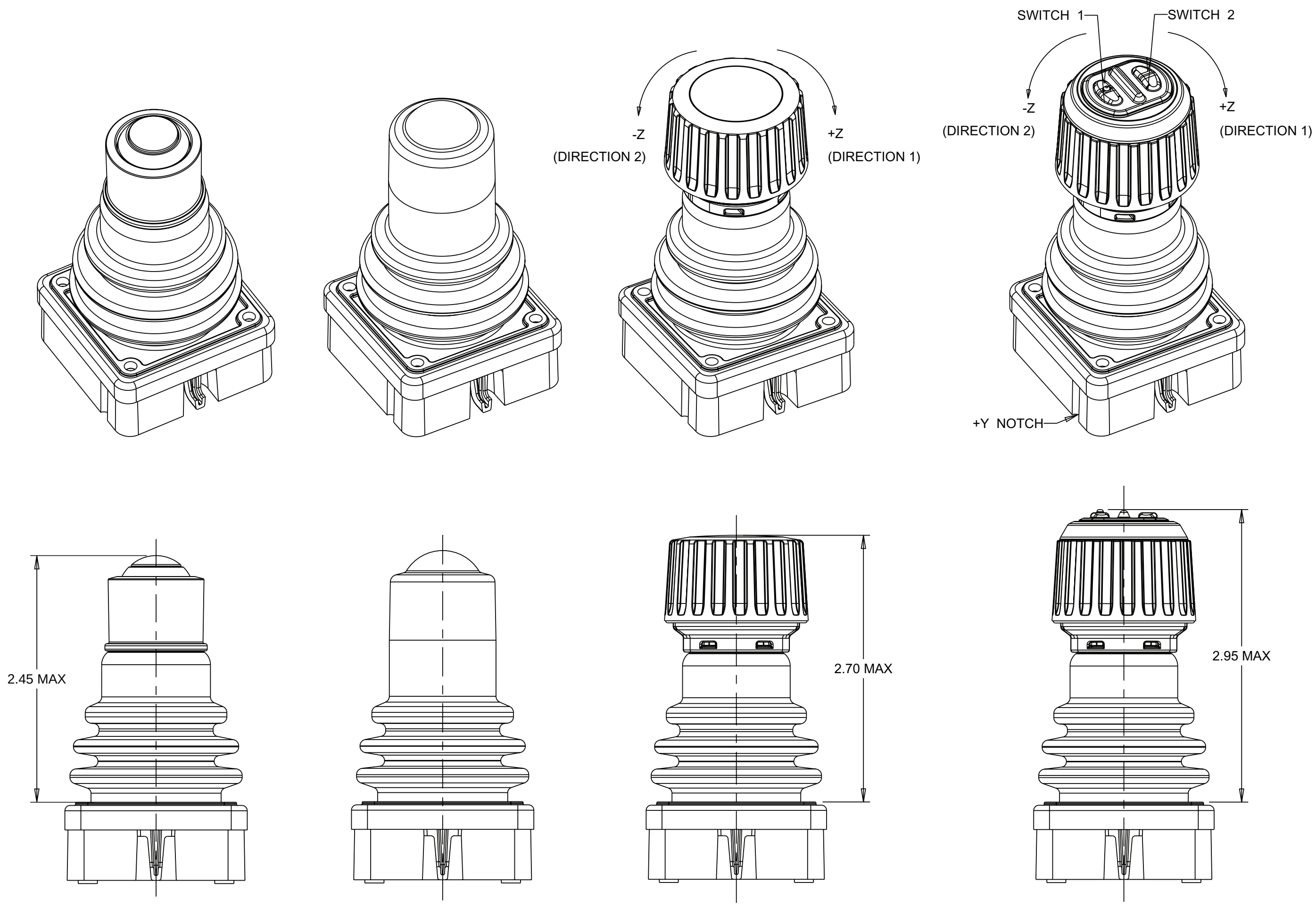


PUSHBUTTON SCHEMATIC
(WIRE BUNDLE 2)
ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS

MINIATURE HALL EFFECT JOYSTICK

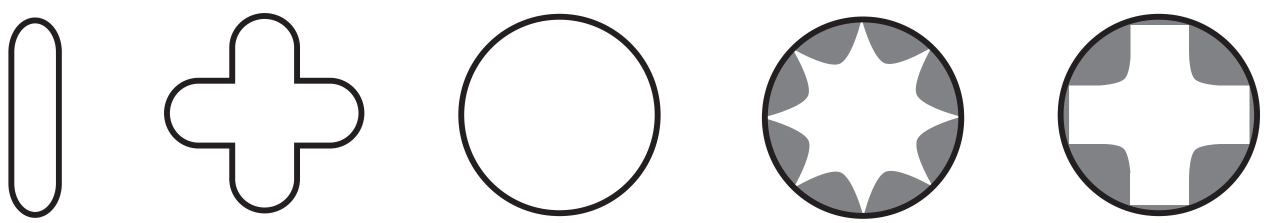
COMPACT DESIGN

JHT Switch/Style Boot Configuration



HALF BOOT | **FULL BOOT** | **Z AXIS** | **Z AXIS WITH PUSHBUTTONS**

JHT and JHT Z-Axis Icons Demonstrating Feel*

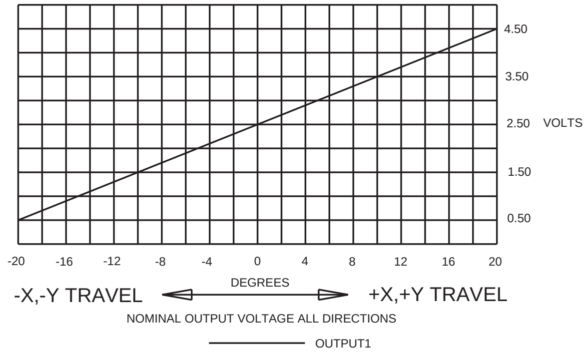


Gated; Single Axis - Return to Center | Gated; Two Axis - Return to Center | Omnidirectional; Round Smooth Feel | Omnidirectional; Round On-Axis and Off-Axis Guided Feel** | Omnidirectional; Round On-Axis Guided Feel

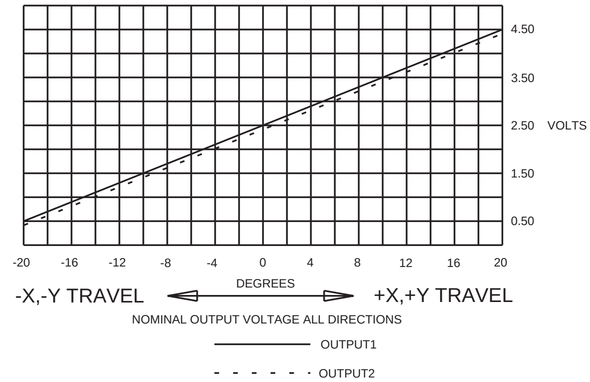
*Feel defined by shading.
**Full output available in all directions. Contact factory for details.

COMPACT DESIGN

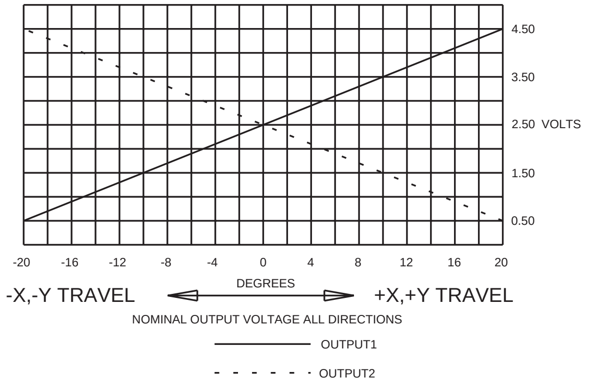
OPTION AA



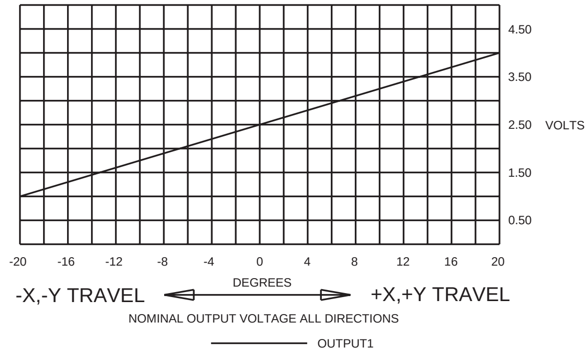
OPTION BB



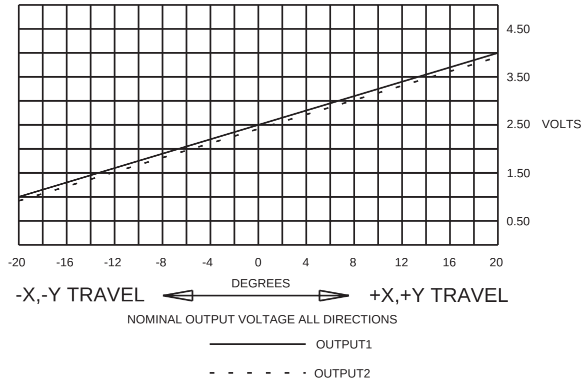
OPTION CC



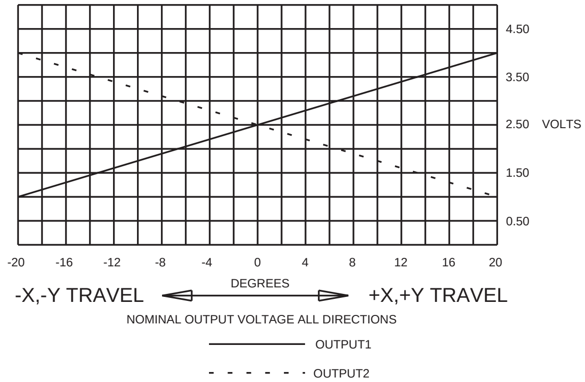
OPTION DD



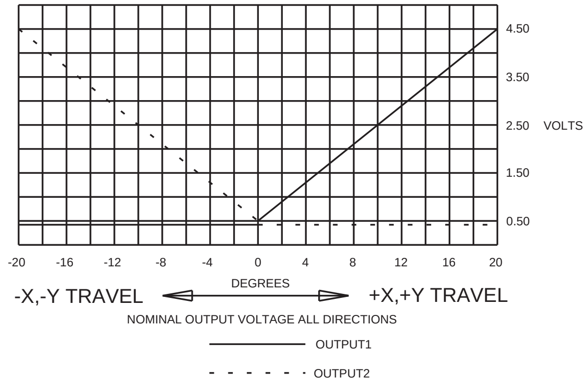
OPTION EE



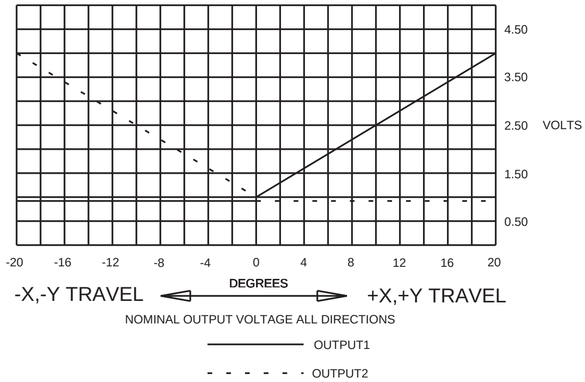
OPTION FF



OPTION GG



OPTION HH



MINIATURE Z-AXIS HALL EFFECT JOYSTICK

COMPACT DESIGN

JHT Z-Axis

With Pushbuttons

Without Pushbuttons

The z-axis mechanism of the miniature Hall effect joystick knob means that it can rotate horizontally up to 60°. 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 surgical equipment, remote control boxes and surveillance cameras.

Features:

- **60° rotational movement of the ergonomic 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 SPI & 5V SPI or Analog 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, 1o = 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, 1o = 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, 1o = 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

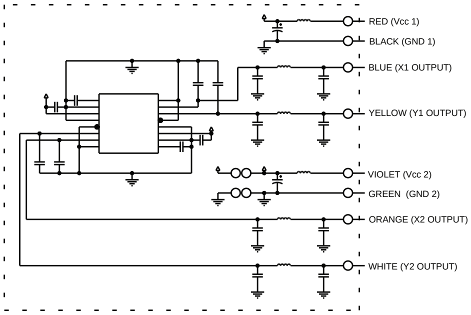
	Units	Min	Typ	Max
Travel Angle	Degrees	18	20	22
Over Travel Angle	Degrees	0.5	1.0	1.5
Max Allowable Radial Force (Styles 11, 12 & 21) @ GRP	Lbs.	N/A	N/A	50
Max Allowable Radial Force (All Other Styles) @ GRP	Lbs.	N/A	N/A	15

Z-Axis

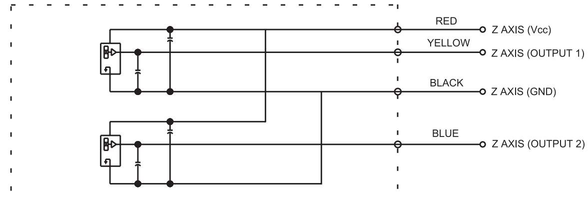
Mechanical Life: 1,000,000 cycles in all directions

	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

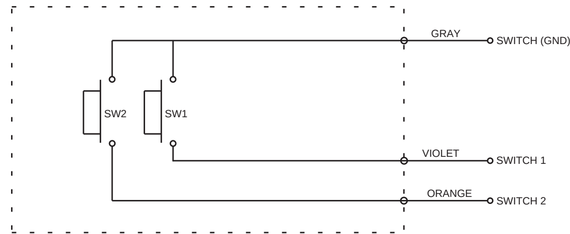
COMPACT DESIGN



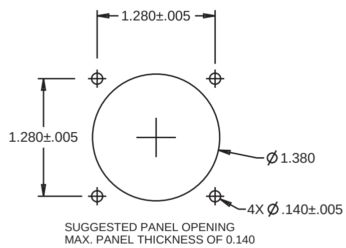
GENERAL SCHEMATIC
(WIRE BUNDLE 1)
ALL OUTPUTS ARE NOT PRESENT IN ALL CONFIGURATIONS

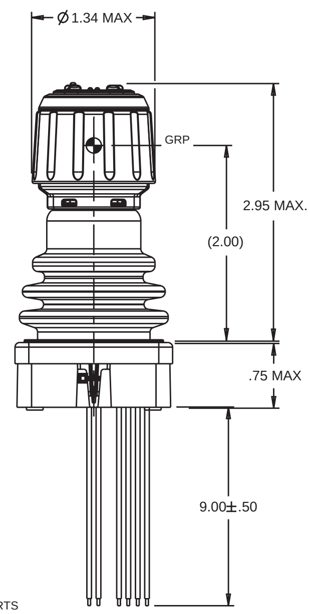


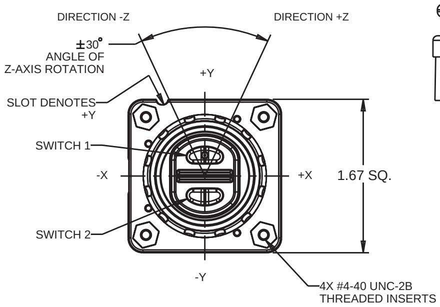
Z AXIS SCHEMATIC
(WIRE BUNDLE 2)
ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS

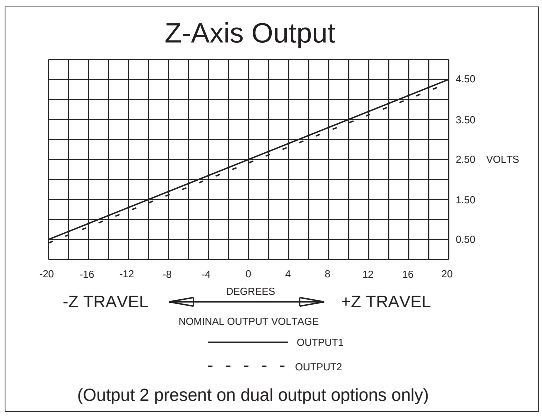


KEYPAD SCHEMATIC









JHT Z-AXIS PART NUMBER CODE

JHT – XX X X XX X N

Switch/Boot Style (All Half Boot)
- **32.** Z-Axis with Detent, Single Output
- **42.** Z-Axis with Friction Hold, Single Output
- **52.** Z-Axis Return to Center, Single Output
- **62.** Z-Axis with Detent, Dual Output
- **72.** Z-Axis with Friction Hold, Dual Output
- **82.** Z-Axis Return to Center, Dual Output
- **92.** Z-Axis with Detent, Single Output wtih Two Pushbuttons
- **A2.** Z-Axis with Friction, Single Output with Two Pushbuttons
- **B2.** Z-Axis Return to Center, Single Output with Two Pushbuttons
- **C2.** Z-Axis with Detent, Dual Output with Two Pushbuttons
- **D2.** Z-Axis with Friction, Dual Output with Two Pushbuttons
- **E2.** Z-Axis Return to Center, Dual Output with Two Pushbuttons

Gating*
- **1.** Gated; Single axis – Return to Center
- **2.** Gated: Two axis – Return to Center
- **3.** Omni-directional; Round Smooth Feel
- **4.** Omni-directional; Round On-Axis and Off-Axis Guided Feel
- **5.** Omni-directional; Round On-Axis Guided Feel

Operating Force
- **1.** 1 lb

Joystick Output 1	Joystick Output 2
AA. 2.5 +/- 2.0VDC	NONE
BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC
CC. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC
DD. 2.5 +/- 1.5VDC	NONE
EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC
FF. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC
GG. 0.5 - 4.5VDC	0.5 - 4.5VDC
HH. 1.0 - 4.0VDC	1.0 - 4.0VDC
JJ. SPI, 3.3V Supply**	NONE
KK. SPI, 5V Supply**	NONE

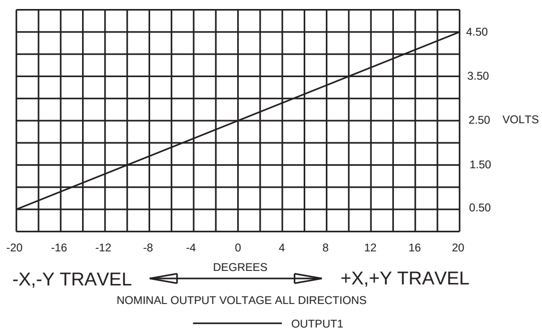
Termination
- **1.** 24 AWG Wire Leads

*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.

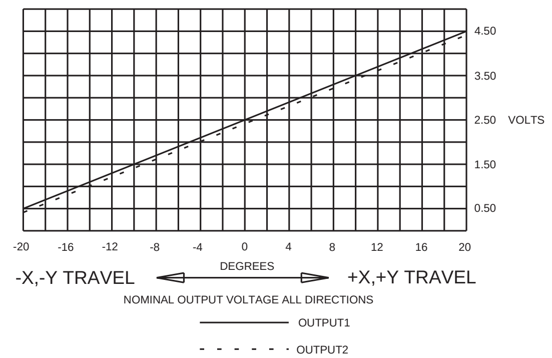
NOTES (Applies to Joystick Output Only):
- Outputs are from the center to the full travel position in each direction.
- Options “AA”, “BB”, “CC”, “DD”, “EE” and “FF” provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis.
- Options “GG” and “HH” provide 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.

Joystick Output Configuration

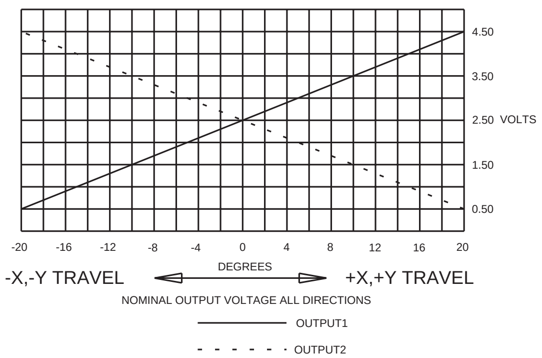
OPTION AA



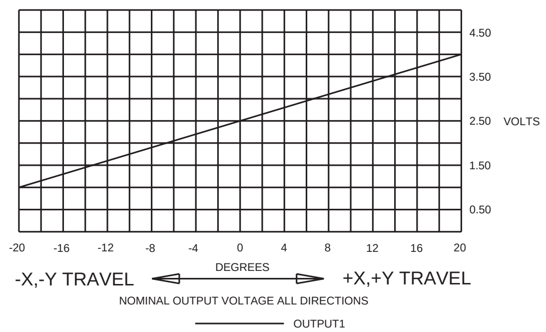
OPTION BB



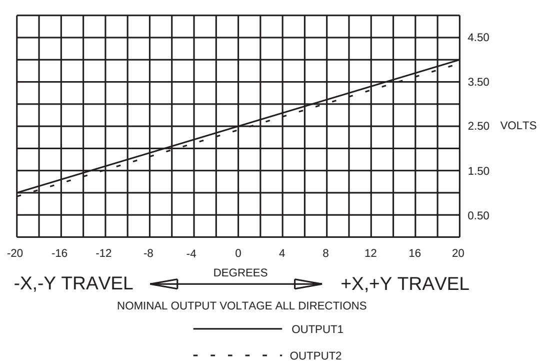
OPTION CC



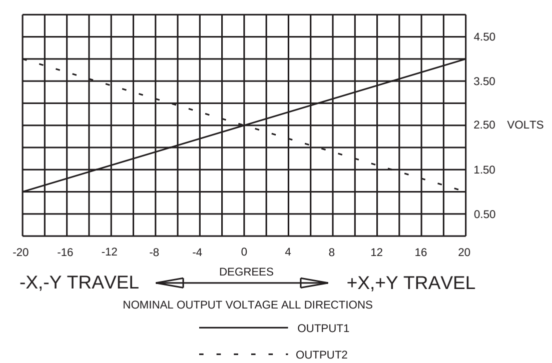
OPTION DD



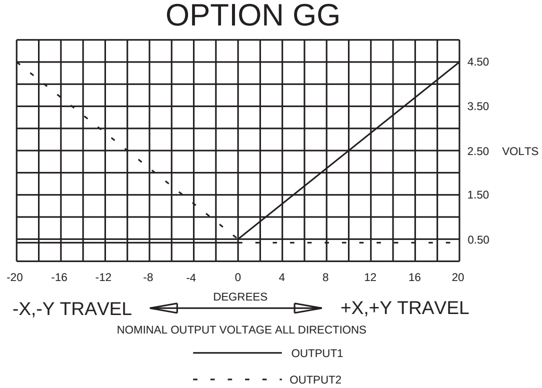
OPTION EE



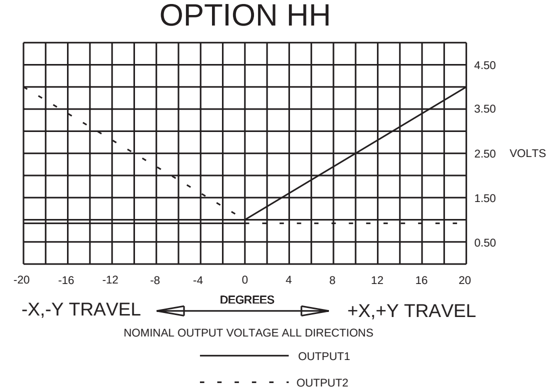
OPTION FF



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.

CANbus JH Joystick

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**

HJFC Foot Pedal
with CANbus Interface

CAPACITIVE TOUCH SWITCH

SEALED SWITCH WITH HIGH CYCLE LIFE

Capacitive Switch
Concave Button
CS-1

Capacitive Switch
Raised Button
CS-2

Standard Characteristics/Ratings:						
Sensing Distance: (from surface)	1/16" to 1/8"					
Cycle Life:	50M cycles					
Operate Force:	0 lbs.					
Operating Temperature:	-40˚C to +85˚C					
Enclosure Seal:	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:						
EMI:	CISPR 25 (contact factory for more details)					
ESD:	ISO 10605 (contact factory for more details)					
MATERIALS:						
Housing Material:	Thermoplastic					
Wires:	24 AWG (x3)					

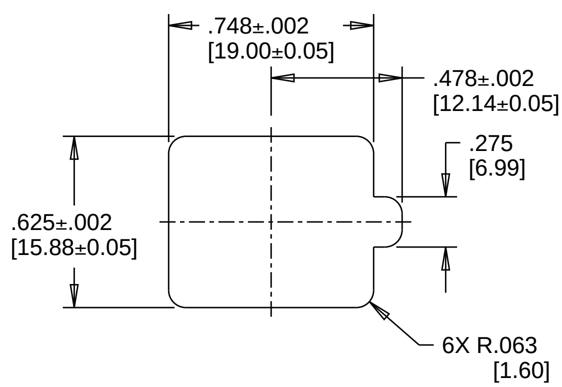
The New CS Series Capacitive Touch Sensor Switch is designed for applications where control functions are needed for an unobtrusive style. The switch changes output level with the presence of a finger or hand (gloved or ungloved) which makes it ideal for use as an on-off switch.

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.

SUGGESTED PANEL CUTOUT



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**

CAPACITIVE SWITCH PART NUMBER CODE

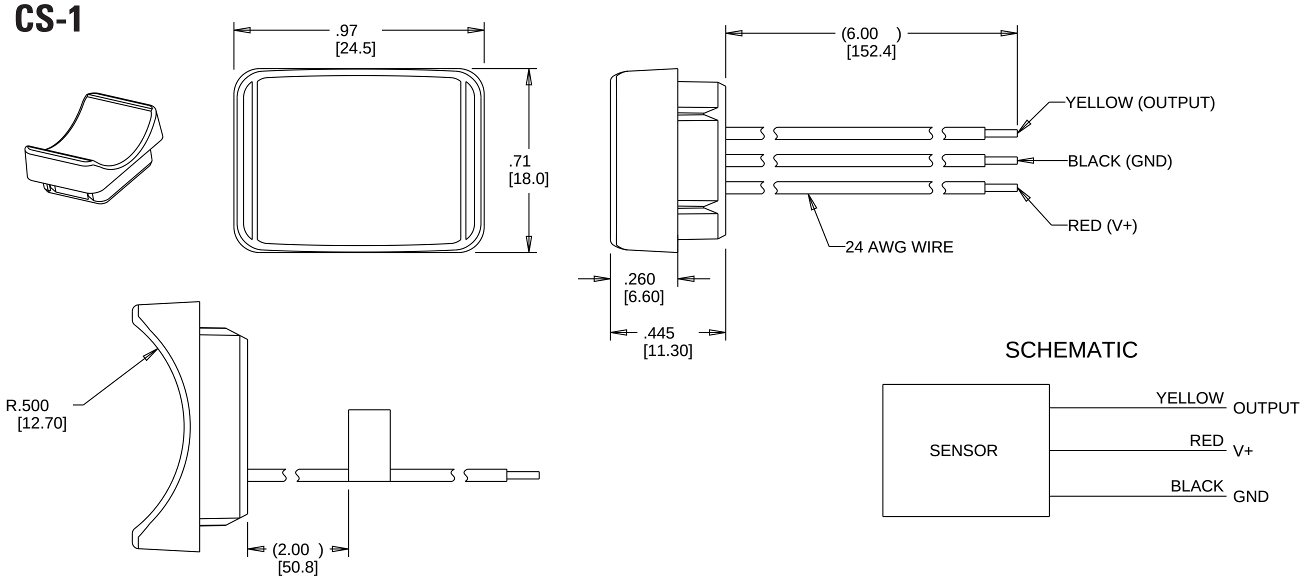
CS – X X X X X

Configuration	**Output**	**Sensitivity**	**Color**	**Termination**
1. Concave	**1.** Active Low	**1.** High	**2.** Black	**1.** Flying Leads 6"
2. Raised		**2.** Medium		

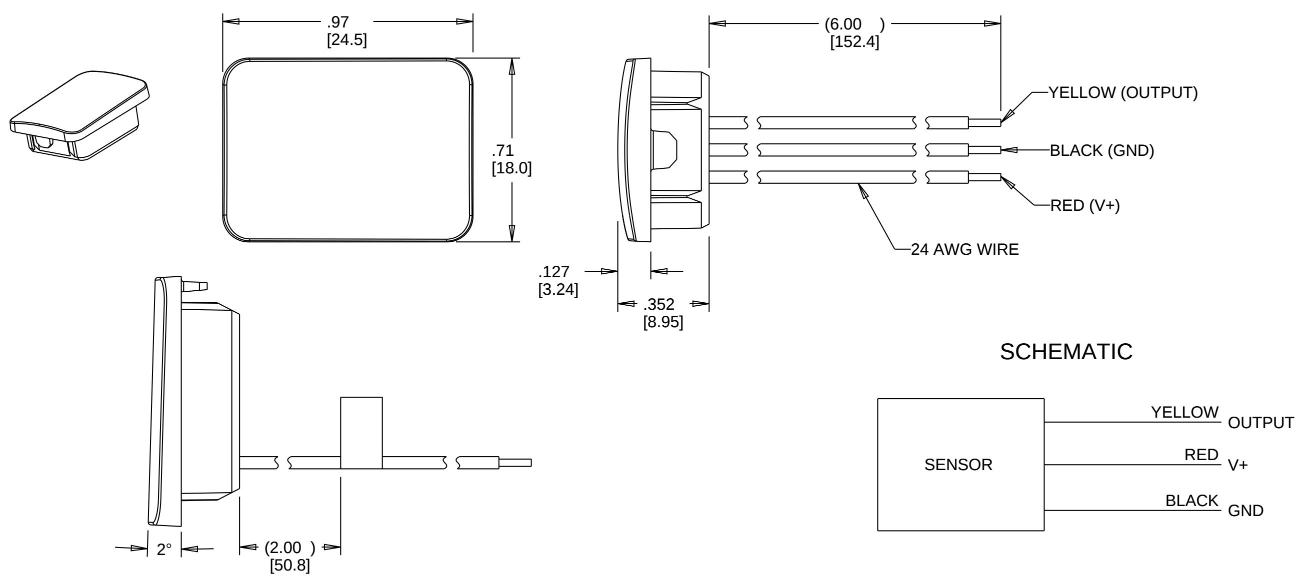
CAPACITIVE TOUCH SWITCH

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 FPC, 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.


TC-4


TC-3

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

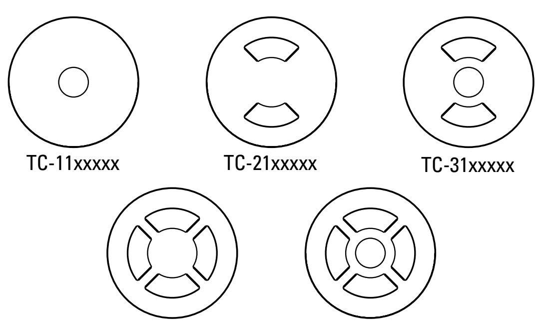
Features:

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

TC-5


TC-5 with standard legend used in a Contour Grip

TC Switch Module Keypad Configurations



TC PART NUMBER CODE

TC – X X X X X X X

Position
1. 1 Position
2. 2 Position
3. 3 Position
4. 4 Position
5. 5 Position

Mounting
1. Top Mount
2. Rear Mount (Behind Panel)

Termination
1. FPC, UL 20798
2. Flying Leads, UL 1569, 24 AWG
3. FFC, UL 20624
4. Ribbon Cable, UL 2651, & AMP 215083-8 Connector
5. Ribbon Cable, UL 2651, Blunt Cut

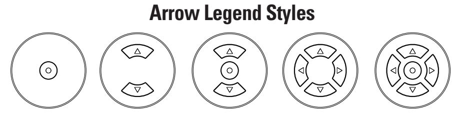
Backlight
N. None
9. White

Color
2. Black

Legend*
None
A. Arrows

Not Used

Arrow Legend Styles

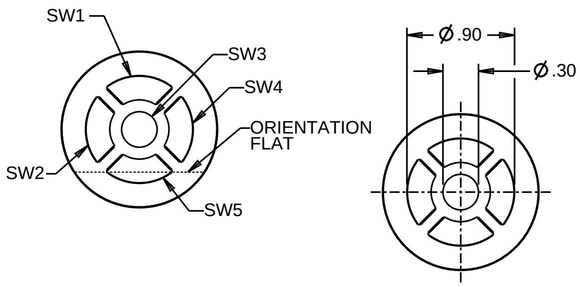


* Color = White

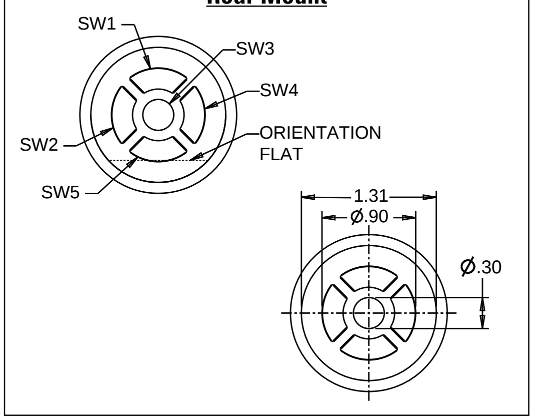
Specifications Subject To Change Without Notice

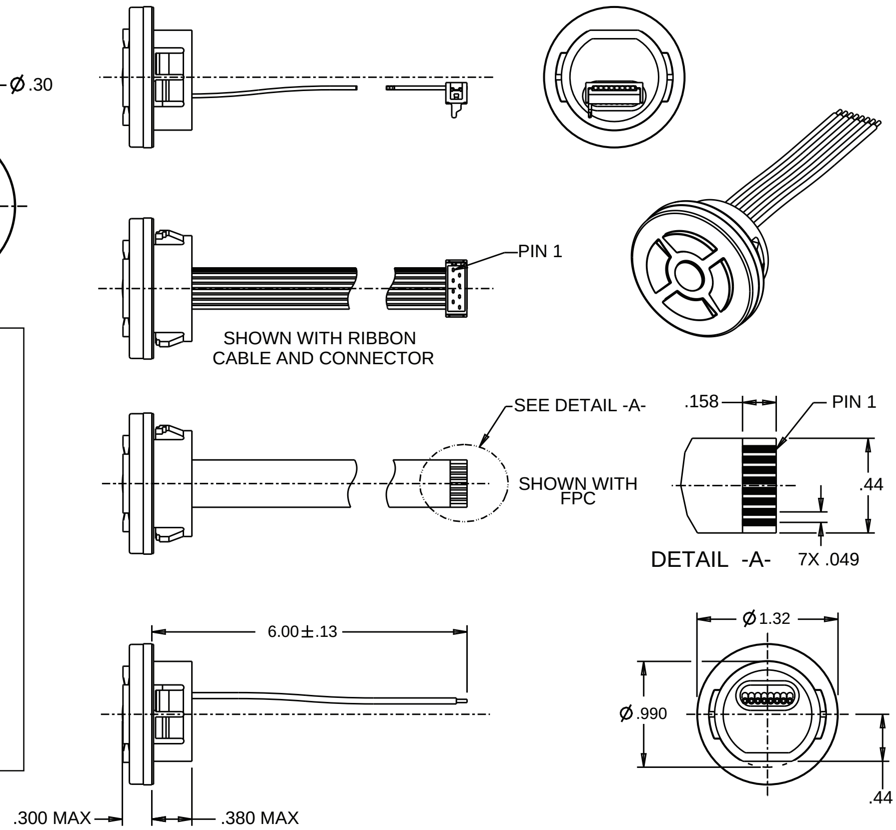
SELF-CONTAINED, LONG-LIFE, SEALED SWITCH MODULE WITH UP TO 5 POSITIONS

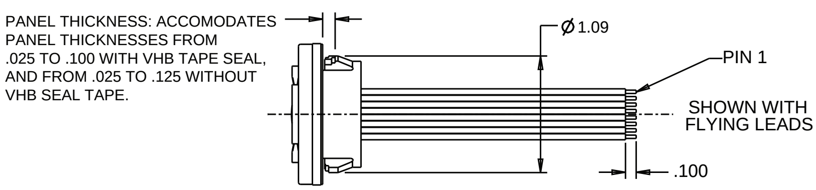
TC-51xxxxx
Top Mount, 5 Position Module



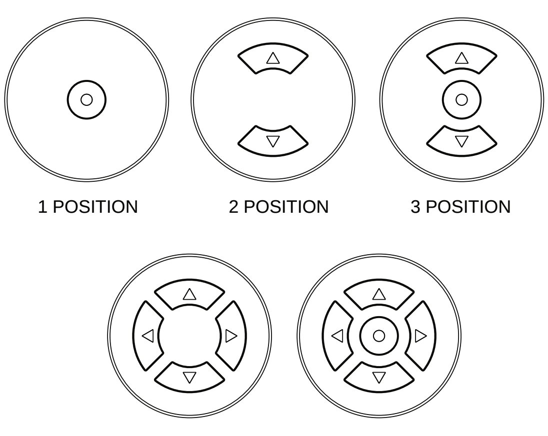
Rear Mount



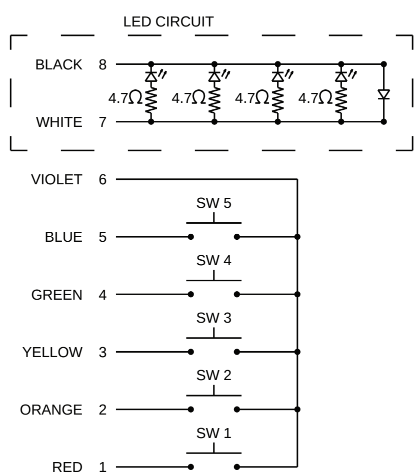




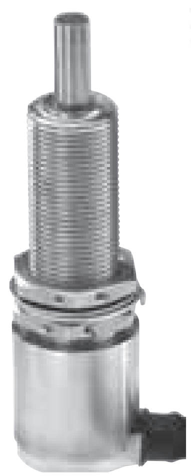
Standard Arrow Legend Styles

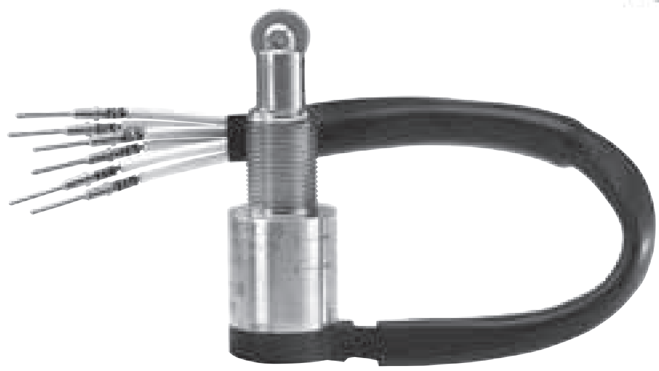


Schematic
with optional LED circuit shown



Limit Switches





SERIES	FEATURE	ACTUATION	MAX RATING (Resistive @ 115VAC, 28VDC)	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

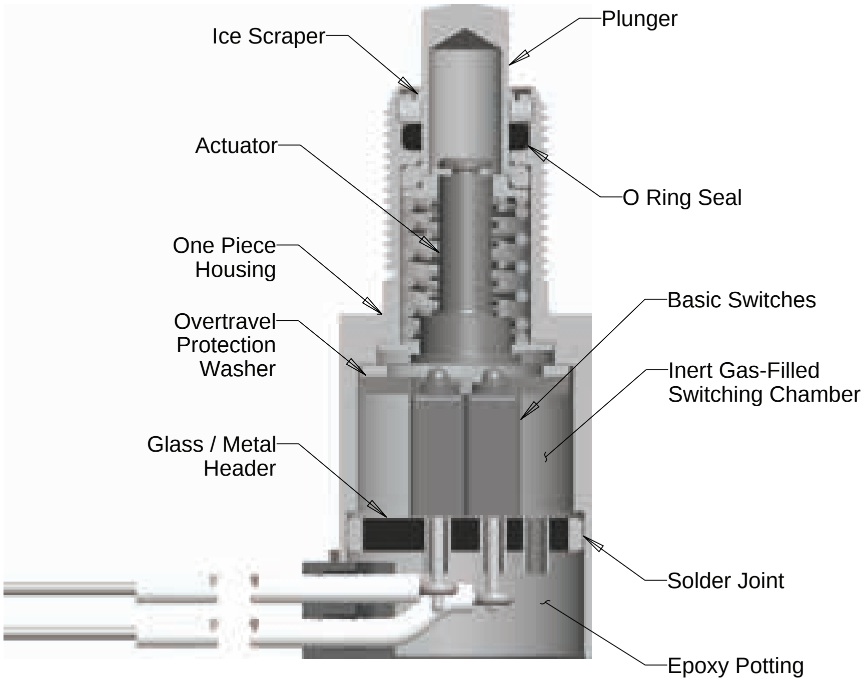
P6 series switches are sealed against immersion and corrosive atmospheres. These switches are designed for rugged duty both mechanically and electrically. A one-piece nickel plated stainless steel or brass housing, sealed at the plunger with an O-ring and at the base with a glass-to-metal header option 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**

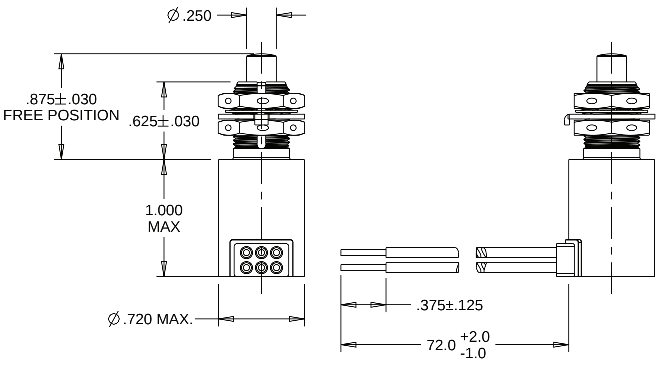


Cross section example of OTTO P6-24XXX series.

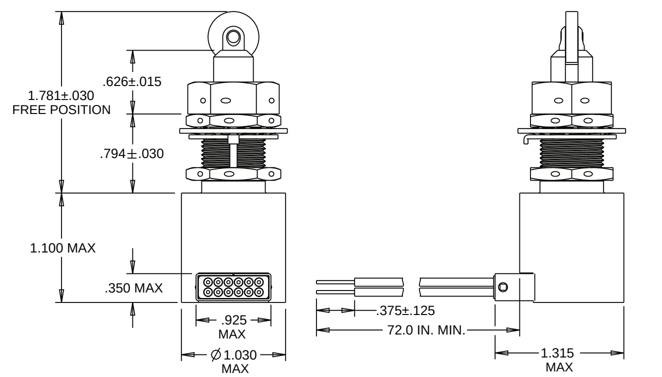
SEALED LIMIT SWITCHES

FEATURING OTTO B2 & B3 SERIES BASIC SWITCHES

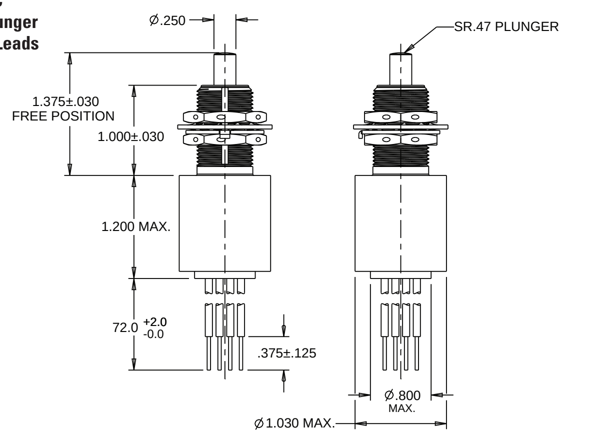
Style A
Pin Plunger
Radial Leads



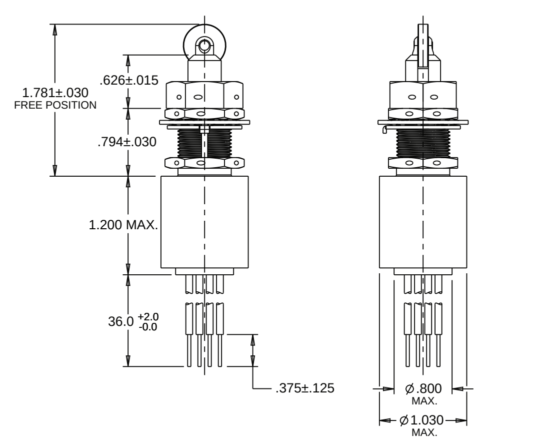
Style B
Roller Plunger
Radial Leads



Style C
Pin Plunger
Axial Leads



Style D
Roller Plunger
Axial Leads



FEATURING OTTO B2 & B3 SERIES BASIC SWITCHES

SPECIFICATIONS: Standard Models

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC	50,000 feet @ 28VDC
RATING TABLE 1		
Resistive	7A	7A
Inductive	4A	2.5A
Motor	4A	(4A)
DWV	1000Vrms	400Vrms
RATING TABLE 2		
Resistive	7A	7A
Inductive	3A	3A
Motor	4A	4A
Lamp	2A	1A
DWV	1250Vrms	600Vrms
RATING TABLE 3		
Resistive	4A	4A
Inductive	2A	2A
Motor	4A	4A
DWV	1000Vrms	400Vrms

RATING TABLE 4

Load Type	Power Circuit	Elex Logic	Low Level	Power Circuit	Elex Logic
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

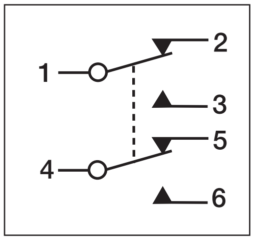
Wire Type:
Per MIL-W-22759/7
Marked per MIL-W-5088.
Standard length: 6 feet. Other lengths available.

Operating Temp Range: -55°C to 85°C

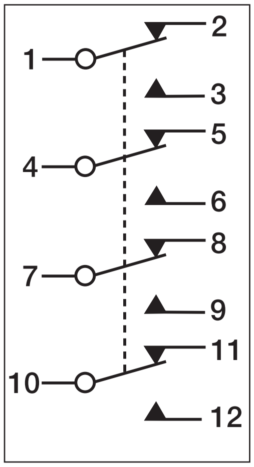
Mounting/Termination:

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
MIL-PRF-8805/39									
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
MIL-PRF-8805/40									
2PDT	A-Pin/Radial	1.375	1.000	0.625-24	1.015	0.980	3	MS24331-1	P6-24002
MIL-PRF-8805/43									
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
MIL-PRF-8805/100									
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.

LIMIT SWITCH NOTEWORTHY DESIGNS

APPLICATION-SPECIFIC MODIFIED PRODUCTS

Modified Military Styles

Circuitry	Free Position (inches)	Bushing Length (inches)	Overall Length (inches)	Catalog Number
Pin Plunger, Radial Lead Exit				
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
Pin Plunger, Axial Lead Exit				
2PDT	0.875	0.625	2.250	P6-20003
2PDT	1.575	1.200	2.950	P6-20005
Roller Plunger, Radial Lead Exit				
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
Roller Plunger, Axial Lead Exit				
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

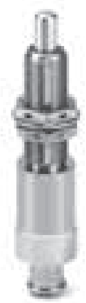
Actuating Force: 6.0 +3.0/-2.0 lbs.
Release Force: 2.0 lbs. min
Circuit: 4PST N.C.
Rating: 0.5 amps Resistive for 100,000 cycles
Contacts: Silver/Gold

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 sleaved wires.

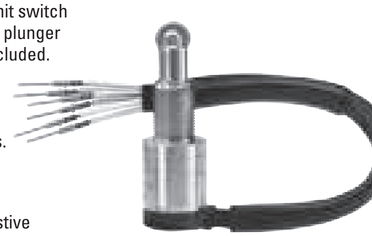
P6-24111

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.

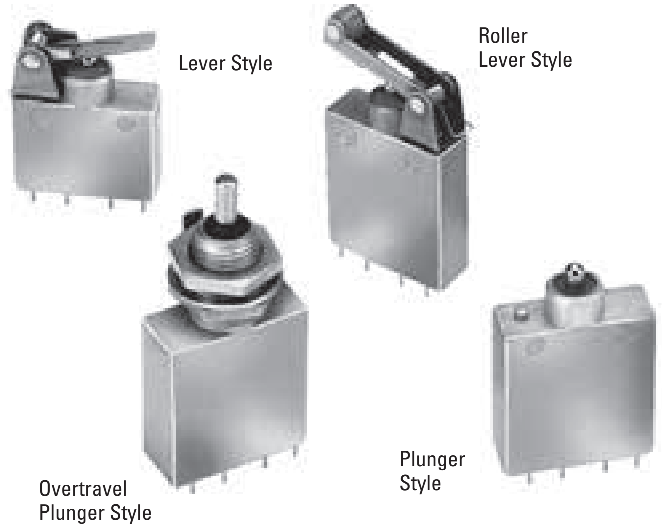
Overtravel: 0.125” min
Operating Force: 9.0 +/- 3.0 lbs.
Release Force: 4.0 lbs. min
Circuit: 2PDT
Rating: 7 amps Resistive
4 amps Inductive
Contacts: Gold



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**	
Load	**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**
Operating Force:	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
Release Force:	4 oz min	8 oz min	4 oz min	8 oz min	4 oz min	24 oz min	4 oz min	8 oz min
Movement Differential:	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
Pretravel:	0.125″ max	0.050″ max	0.125″ max	0.070″ max	0.125″ max	0.050″ max	0.125″ max	0.070″ max
Overtravel:	0.025″ min	0.012″ min	0.025″ min	0.187″ min	0.025″ min	0.012″ min	0.025″ min	0.187″ min
Strength of Actuator:	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

SUBMINIATURE WATERTIGHT SEALED

FEATURING OTTO B5 SERIES BASIC SWITCHES

P6-3 PART NUMBER CODE

Single Pole

P6-3 X X X X X

Actuator Style
- **1.** Lever
- **2.** Plunger
- **3.** Roller Lever
- **4.** Overtravel Plunger*

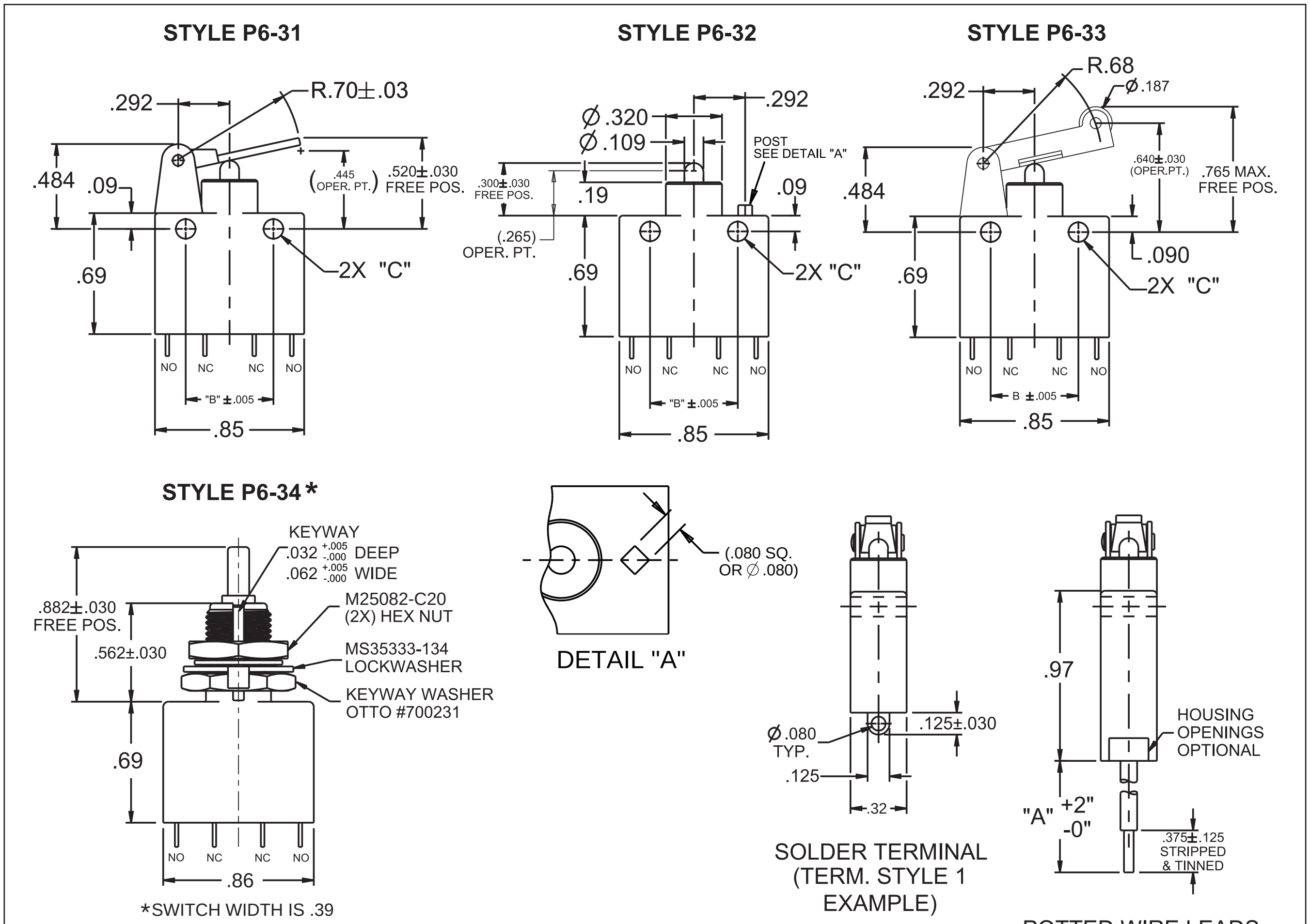
Terminal Style
- **1.** Solder Terminals
- **3.** 1' Potted Leads
- **4.** 3' Potted Leads
- **5.** 6' Potted Leads

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

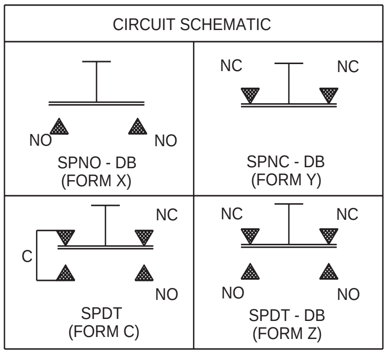
Mounting Holes (See drawing below.)
- **1.** No Holes
- **2.** 1/2" Centers for #4-40 Screws
- **4.** 3/8" Centers for #2-56 Screws

Serial Digit
- **0.** 0 Except for Specials

* No mounting holes are offered in models with threaded bushing



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



POTTED WIRE LEADS STYLE	DIM "A"
3	12"
4	36"
5	72"

MOUNTING HOLES:	DIM "B" CNTRS.	DIM "C" DIA.
CODE 2 FOR 4-40 SCREWS	.500	Ø.112 ± .003
CODE 4 FOR 2-56 SCREWS	.375	Ø.089 ± .003

FEATURING OTTO B5 SERIES BASIC SWITCHES

P6-3 PART NUMBER CODE

Double Pole

P6-3 X X X X X

Actuator Style
- **5.** Lever
- **6.** Plunger
- **7.** Roller Lever
- **8.** Overtravel Plunger*

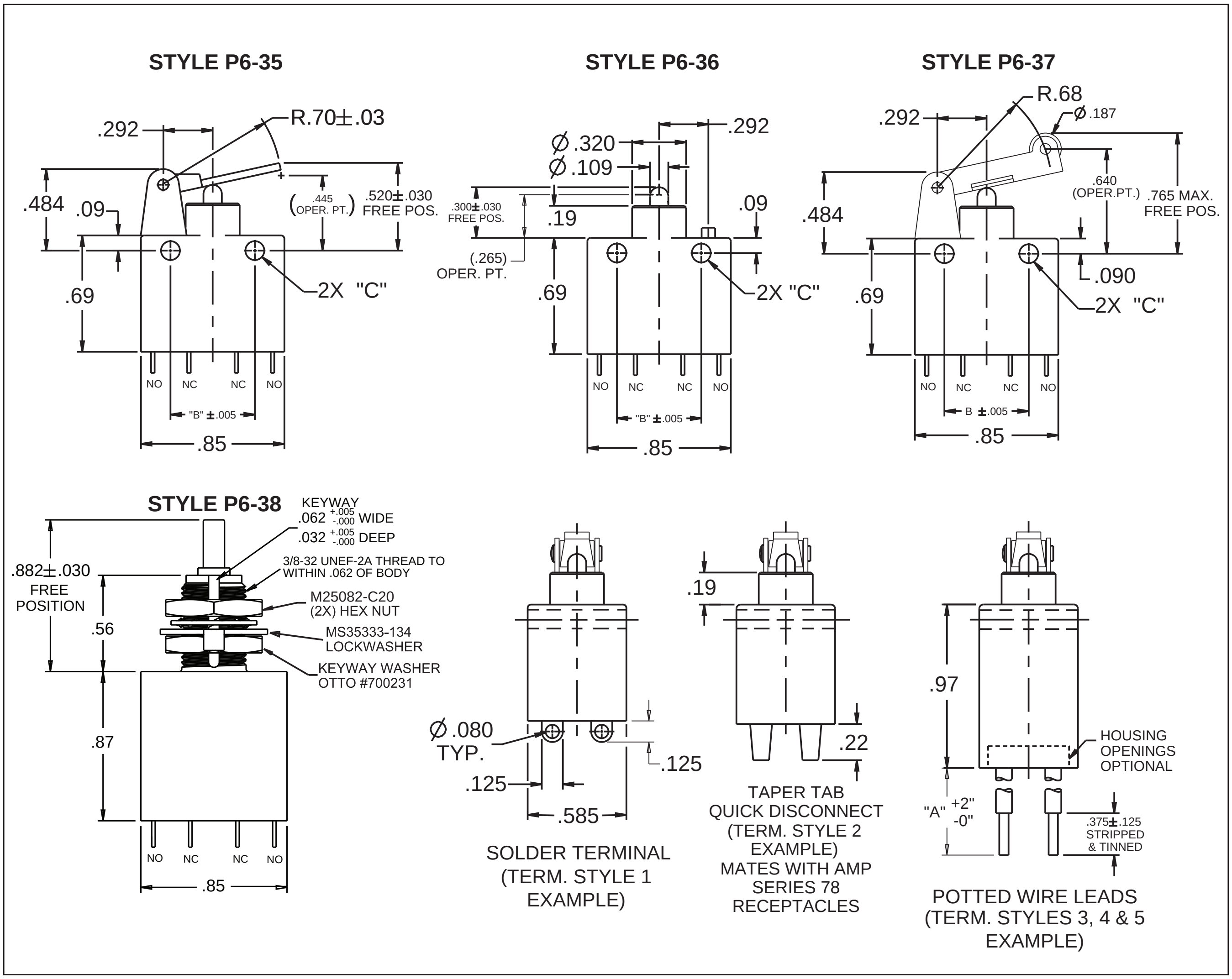
Terminal Style
- **1.** Solder Terminals
- **2.** Taper Tab, Quick Disconnect
- **3.** 1' Potted Leads
- **4.** 3' Potted Leads
- **5.** 6' Potted Leads

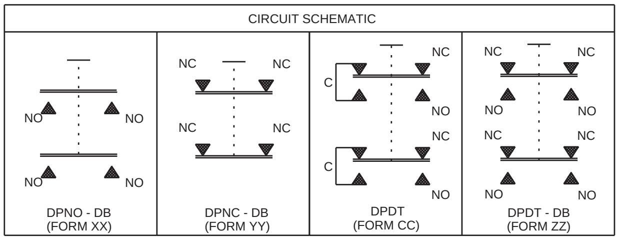
Circuitry
- **1.** DPNO-DB, Form XX
- **2.** DPNC-DB, Form YY
- **3.** DPDT, Form CC
- **4.** DPDT-DB, Form ZZ

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	
STYLE	DIM "A"
3	12"
4	36"
5	72"

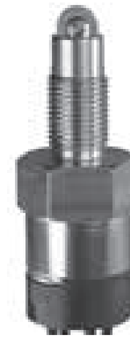
MOUNTING HOLES:	DIM "B" CNTRS.	DIM "C" DIA.
CODE 2 FOR 4-40 SCREWS	.500	Ø.112 ± .003
CODE 4 FOR 2-56 SCREWS	.375	Ø.089 ± .003

WATERTIGHT 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.

Ball Plunger
Actuator Style



Roller Plunger
Actuator Style

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:

ELECTRICAL RATINGS:

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		

MECHANICAL:

Pretravel:	0.055 max
Actuating Force:	3.5 +/- 1.5 lbs or 5.5 +/- 2.0 lbs
Overtravel:	0.125
Full Overtravel Force:	17.0 lb. max
Releasing Force:	1.0 lb. min
Mechanical Life:	100,000 cycles

ENVIRONMENTAL:

Temperature Range:	-55˚C to 105˚C

MATERIALS:

Actuator:	Stainless steel
Case:	Stainless steel (303)
Seal:	IP68S and IP69K
Mounting Hardware:	Hex nut and lockwasher
Terminal Hardware:	Screw and lockwasher (only with screw terminal switches)

P6-4 PART NUMBER CODE

P6-4 X X X X X * *

Actuator Style
1. Ball
2. Roller

Terminal Style
1. Solder
2. Screw
3. 12" Potted Leads
4. 36" Potted Leads
5. 72" Potted Leads

Circuitry
11. 1 pole SPST-NO-DB, FORM X
12. 1 pole SPST-NC-DB, FORM Y
13. 1 pole SPDT-DB, FORM Z*
24. 2 pole DPST-NO-DB, FORM X
25. 2 pole DPST-NC-DB, FORM Y
26. 2 pole DPDT-DB, FORM Z*
27. 2 pole SPST-NO-DB & SPST-NC-BD

Actuation Force
1. 3.5 +/- 1.5 LBS
2. 5.5 +/- 2.0 LBS

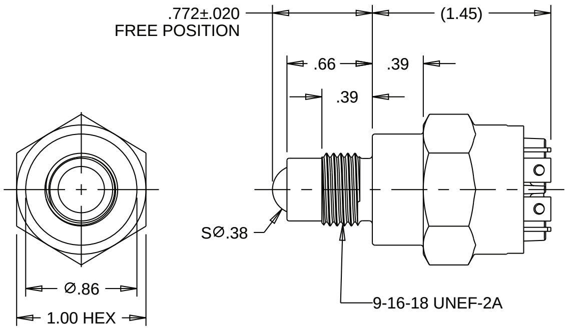
Not Used

Not Used

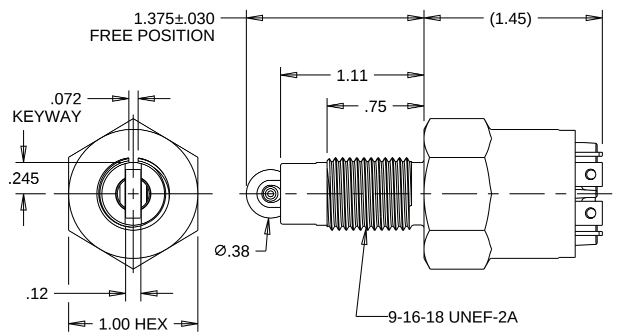
* Options not available for Screw Terminal Style (2)

COMMERCIAL, SEALED LIMIT SWITCH

ACTUATOR STYLE

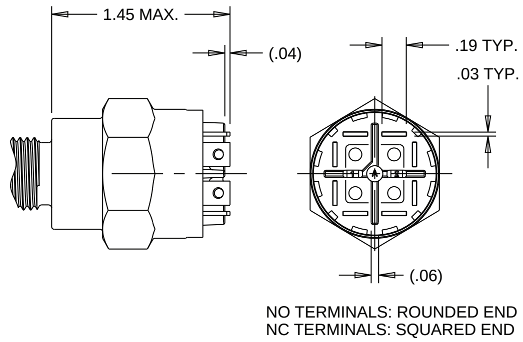


BALL ACTUATOR STYLE

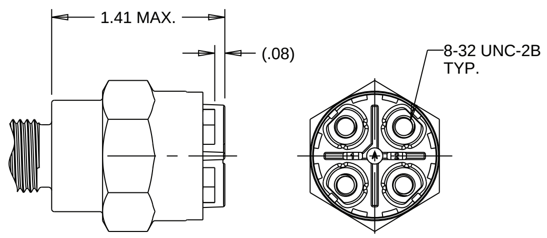


ROLLER ACTUATOR STYLE

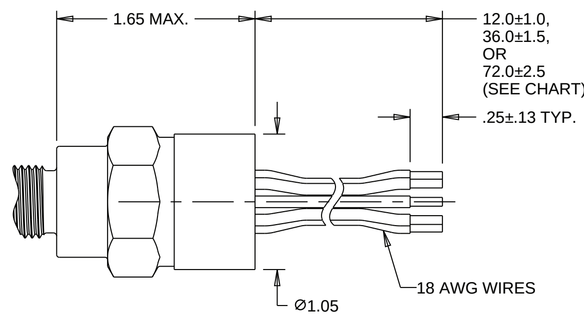
TERMINAL STYLE



SOLDER TERMINAL STYLE

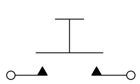


SCREW TERMINAL STYLE

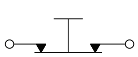


POTTED LEADS STYLE

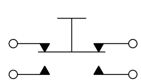
CIRCUITRY OPTIONS



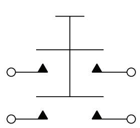
SPST-NO-DB
FORM X
SCHEMATIC



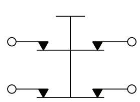
SPST-NC-DB
FORM Y
SCHEMATIC



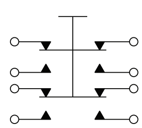
SPDT-DB
FORM Z
SCHEMATIC



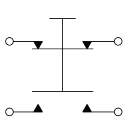
DPST-NO-DB
FORM X
SCHEMATIC



DPST-NC-DB
FORM Y
SCHEMATIC



DPDT-DB
FORM Z
SCHEMATIC



SPST-NO-DB &
SPST-NC-DB
SCHEMATIC

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)	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),	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)	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)	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)	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

ILLUMINATED & SEALED PUSHBUTTONS

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

Raised Dome

Front Mount

The LP3 offers rugged, sealed construction with the added benefit of reliable LED illumination. This precision snap-action switch is designed for use in off-highway, material handling, industrial controls, marine, medical and demanding commercial applications. Choose from the standard mounting styles and electrical ratings, or contact us for custom configurations.

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

Features:

- **Watertight to IP68S or moistureproof & dusttight to IP64**
- **LED lighted with the ability to accommodate 2, 6, 12 & 24VDC power & includes reverse voltage protection**
- **Tall & dome style buttons permitting sublimated & pad printed legends**
- **Quick disconnect terminals**
- **15/32” & 5/8” thread, press fit & dome case options**
- **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
Electrical Life:	25,000 cycles

LIGHTING (See LED Voltage Chart in Appendix for more details):

Light Source Voltage (DC)	Typ. Forward Voltage (DC)	Voltage Max (DC)
2*	1.9 to 3.3 (dep. on color)	2.5 to 4 (dep. on color)
6	6	8
12	12	14.5
24	24	28.6

Mechanical Life:	250,000 cycles @ ambient and +85°C 25,000 cycles @ -55°C
Seal:	Unsealed, IP64 or IP68S
Operating Temp Range:	-55°C to +85°C
Operating Force:	2.5 +/- .5 lbs. or 5.0 +/- 1.0 lb.
Total Travel:	0.080 inches max
Overtravel:	0.010 inches min

MATERIALS:

Case:	Anodized aluminum alloy
Button:	Thermoplastic
Terminals:	Standard and logic level options available
Mounting Hardware:	Hex nut and lockwasher (panel gasket for watertight switches)

LP3 PART NUMBER CODE

LP3 – X X X X X X X – XX

Case Style

- **E.** Exposed Dome
- **F.** Flush Dome
- **R.** Raised Dome
- **1.** Press Fit Mount
- **3.** 5/8” Thread Front Mount
- **4.** 15/32” Thread Rear Mount
- **6.** 5/8” Thread Rear Mount

Circuit Rating

- **1.** SPST N.O./Std.
- **2.** SPST N.C./Std.
- **3.** SPDT 2 Circuit/Std.
- **4.** SPST N.O./Logic Level
- **5.** SPST N.C./Logic Level
- **6.** SPDT 2 Circuit/Logic Level

Light Source Type w/ Rev. Pol Protection

- **A.** 2V Red LED*
- **B.** 2V Green LED*
- **C.** 2V Amber LED*
- **D.** 6V Red LED
- **E.** 6V Green LED
- **F.** 6V Amber LED
- **G.** 12V Red LED
- **H.** 12V Green LED
- **J.** 12V Amber LED
- **K.** 24V Red LED
- **L.** 24V Green LED
- **M.** 24V Amber LED
- **N.** 2V Blue LED*
- **P.** 6V Blue LED
- **Q.** 12V Blue LED
- **R.** 24V Blue LED
- **S.** 2V Deep Green LED*
- **T.** 6V Deep Green LED
- **U.** 12V Deep Green LED
- **V.** 24V Deep Green LED

Seal Level

- **1.** Unsealed
- **2.** Dusttight
- **3.** Watertight

Operating Force

- **2.** 2.5 ± .5 lbs.
- **5.** 5.0 ± 1 lbs.

Case Color

- **1.** Silver
- **2.** Black

Button Color

- **A.** Amber, Translucent (use Amber LED)
- **R.** Red, Translucent (use Red LED)
- **W.** White, Translucent
- **G.** Green, Translucent (use Green LED)
- **B.** Blue, Translucent (use Blue LED)

Legend Style

Refer to Legend Table for SAE legend codes in Appendix. Legends will be printed in white on amber, red, green and blue buttons and in black on white buttons.

STOP HERE for illuminated switches without legends.

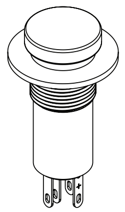
* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

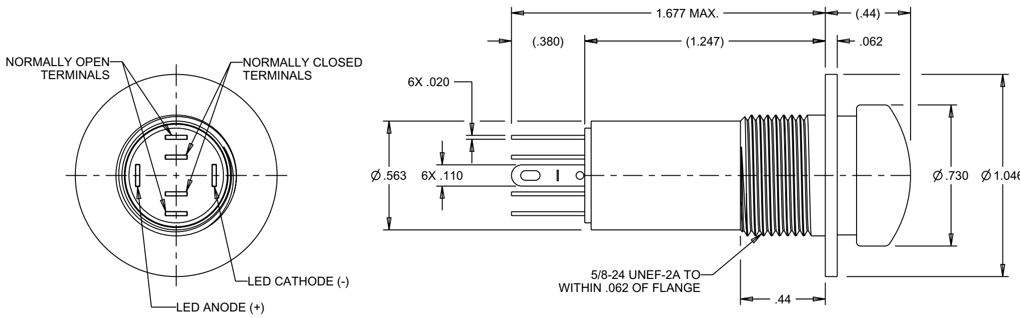
For super bright LEDs, contact factory.

ILLUMINATED & SEALED PUSHBUTTONS

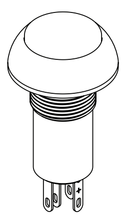
MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

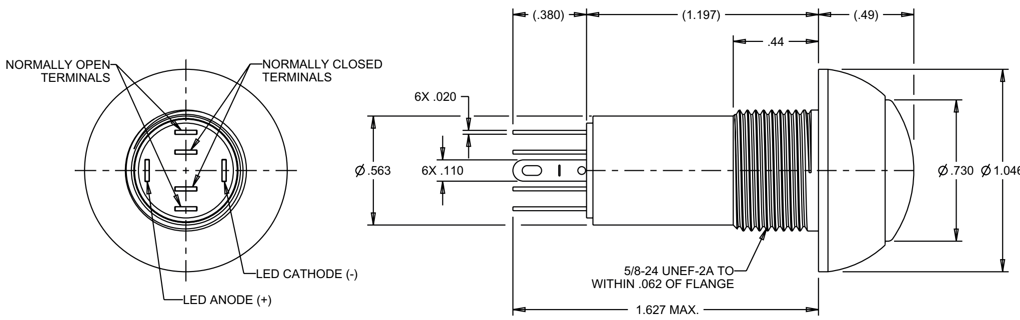
LP3-EXXXXXX
Momentary, Exposed Dome Button



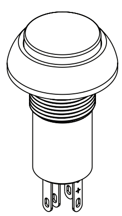


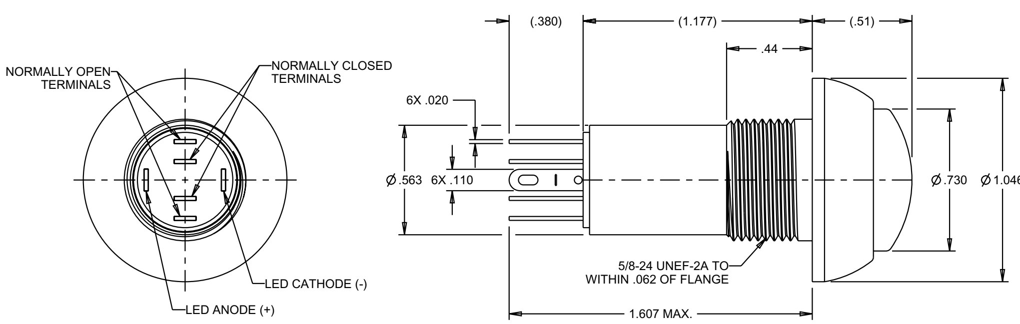
LP3-FXXXXXX
Momentary, Flush Dome Button



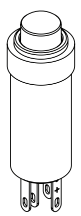


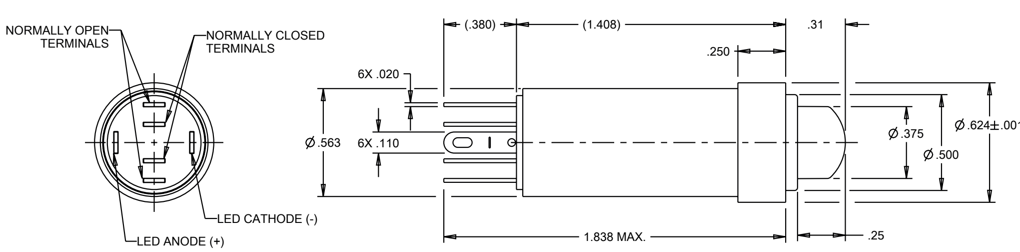
LP3-RXXXXXX
Momentary, Raised Dome Button





LP3-1XXXXXX
Momentary, Press Fit Mount

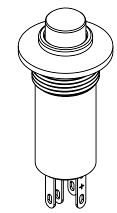


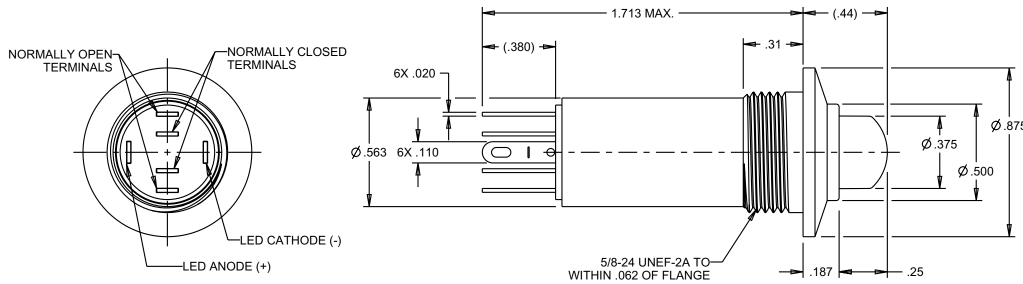


MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

LP3-3XXXXXX

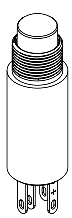
Momentary, 5/8" Threaded Front Mount

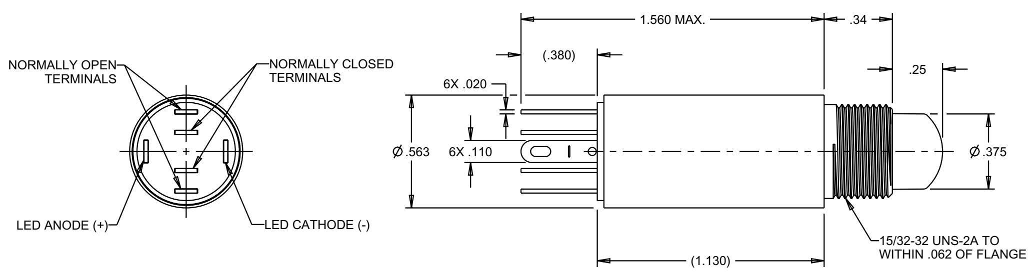




LP3-4XXXXXX

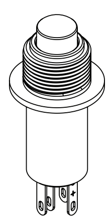
Momentary, 15/32" Threaded Rear Mount

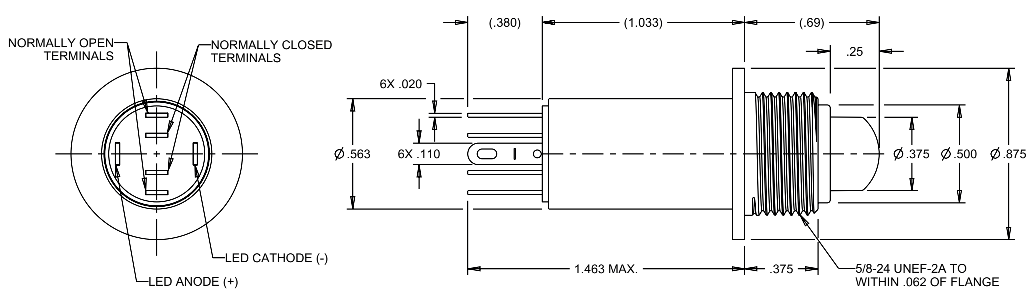




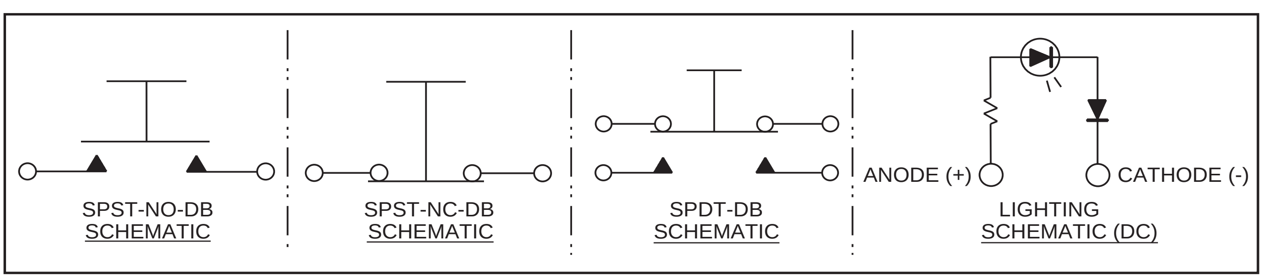
LP3-6XXXXXX

Momentary, 5/8" Threaded Rear Mount





NOTE:
For indicator light only,
see LPL indicator light.



SHORTER ILLUMINATED PUSHBUTTONS

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.

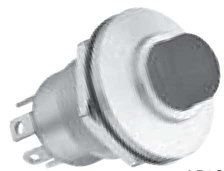
High contact pressure and extremely low contact bounce are the result of the OTTO snap-action mechanism. Extra long electrical life and precise trip point offer added value and precision operation.

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.

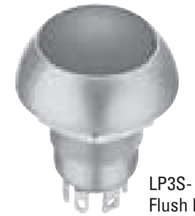
Standard LED illumination color choices include red, green, amber, blue, deep green and white. This precision snap-action switch is designed for use in grips and other applications with limited space in off-highway, material handling, industrial controls, marine, medical and demanding commercial industries.

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
DWV	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

Mechanical Life:	250,000 cycles
Seal:	Unsealed, IP64 or IP68S and IP69K
Operating Temp Range:	-55°C to +85°C
Operating Force:	2.5 +/- 0.5 lb. or 4.0 +/- 1.0 lb.
Total Travel:	0.080 inches +/- 0.015
Overtravel:	0.010 inches min

MATERIALS:

Case:	Anodized aluminum alloy
Button:	Thermoplastic
Center Cap:	Anodized aluminum alloy
Mounting Hardware:	Hex nut, lockwasher and panel seal gasket (watertight only)

LP3S PART NUMBER CODE

LP3S – X X X X X X X – XX

Type

E. Exposed Flush Dome Button
F. Flush Dome
R. Raised Dome
1. Press Fit Mount
3. Front Mount
6. Rear Mount

Circuit Rating

1. SPST N.O./Std.
3. SPDT 2 Circuit/Std.
4. SPST N.O./Logic Level
6. SPDT 2 Circuit/Logic Level

Light Source Type*

A. 2V Red LED
B. 2V Green LED
C. 2V Amber LED
G. 12V Red LED
H. 12V Green LED
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

Seal Level

1. Unsealed
2. Dusttight
3. Watertight

Operating Force

2. 2.5 +/- 0.5 lbs.
4. 4.0 +/- 1.0 bs.

Case Color

1. Silver
2. Black

Translucent Button Color

A. Amber
R. Red
W. White

Legend Style

Refer to Legend Table for SAE legend codes in Appendix. Legends will be printed in white on amber, red, green and blue buttons and in black on white buttons.

STOP HERE for illuminated switches without legends.

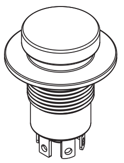
*2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.
Green and Blue LEDS are recommended for use with Translucent Button color (W. White) only

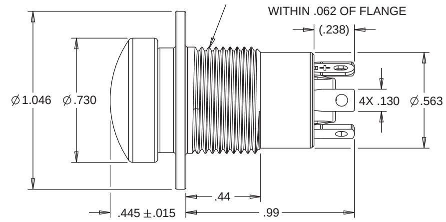
For additional LED lighting options, contact factory.

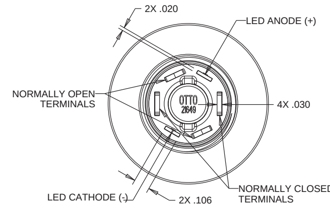
Specifications Subject To Change Without Notice

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

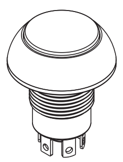
LP3S-EXXXXXX
Exposed Flush Dome Button

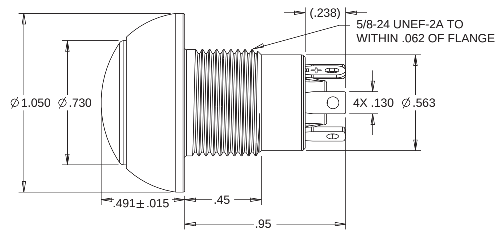


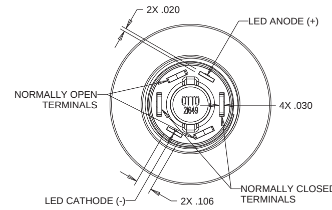




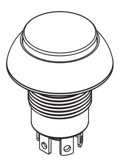
LP3S-FXXXXXX
Flush Dome Button

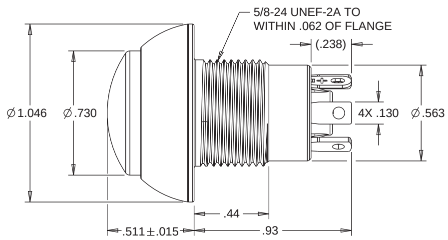


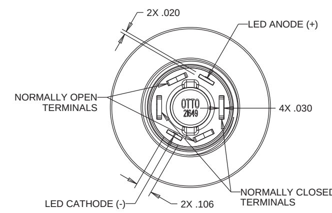




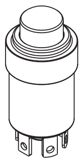
LP3S-RXXXXXX
Raised Dome Button

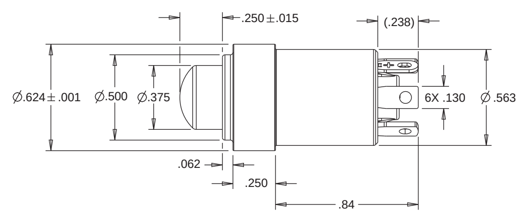


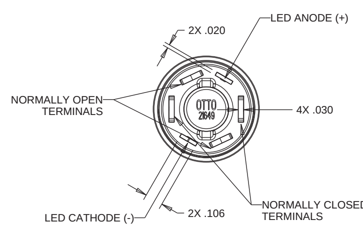




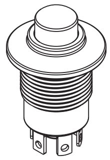
LP3S-1XXXXXX
Press Fit Mount

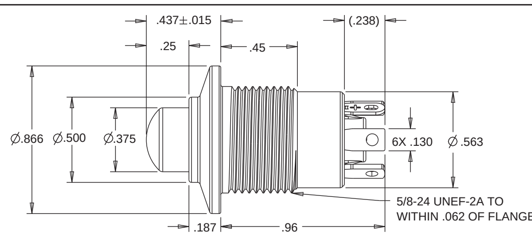


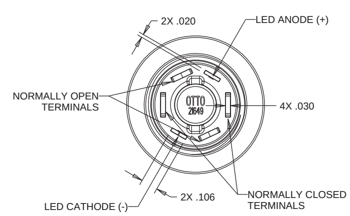




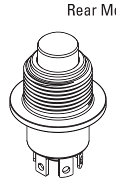
LP3S-3XXXXXX
Front Mount

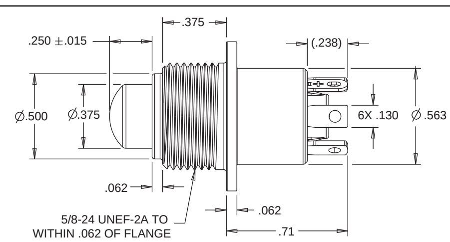


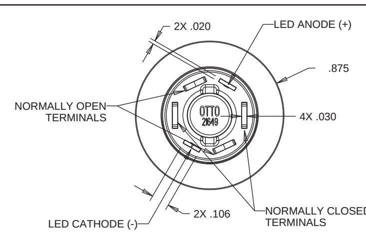


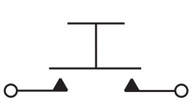


LP3S-6XXXXXX
Rear Mount









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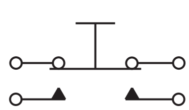
SCHEMATIC



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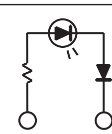
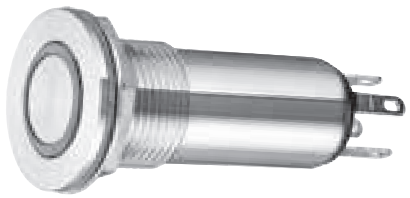


ANODE (+) CATHODE (-)
LIGHTING
SCHEMATIC (DC)

ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

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
Electrical Life:	25,000 cycles, Logic Level 250,000 cycles
Lighting: See LED Voltage Chart in Appendix for more details	
Mechanical Life:	250,000 cycles
Seal:	IP64 or IP68S
Operating Temp Range:	-55°C to +85°C
Operating Force:	2.5 +/- 0.5 lb. or 5.0 +/- 1.0 lb.
Total Travel:	0.080 inches max
Overtravel:	0.010 inches min
MATERIALS:	
Case:	Stainless steel (316) or anodized aluminum alloy
Button:	Ring lit, clear thermoplastic Fully illuminated, translucent thermoplastic
Center Cap:	Stainless steel (316) or anodized aluminum alloy
Terminals:	Standard and logic level options available
Mounting Hardware:	Hex or knurl nut, lockwasher and panel gasket when applicable

LP3-V PART NUMBER CODE

LP3 – X X X X X X X X – X X

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 **V.** Stainless	**1.** 5/8-24 & Hex Nut **3.** 5/8-24 W/D–Flat & Hex Nut **5.** 3/4-20 & Hex Nut **7.** 3/4-20 W/D–Flat & Hex Nut	**1.** SPST N.O./Std. **2.** SPST N.C./Std. **3.** SPDT 2 Circuit/Std. **4.** SPST N.O./Logic Level **5.** SPST N.C./Logic Level **6.** SPDT 2 Circuit/Logic Level	**A.** 2V Red **B.** 2V Green*** **C.** 2V Amber **D.** 6V Red **E.** 6V Green*** **F.** 6V Amber **G.** 12V Red **H.** 12V Green*** **J.** 12V Amber **K.** 24V Red **L.** 24V Green*** **M.** 24V Amber **N.** 2V Blue **P.** 6V Blue **Q.** 12V Blue **R.** 24V Blue **S.** 2V Deep Green **T.** 6V Deep Green **U.** 12V Deep Green **V.** 24V Deep Green	**2.** Dusttight **3.** Watertight	**2.** 2.5 lbs. (± 0.5 lbs.) **5.** 5.0 lbs. (± 1.0 lbs.)	**1.** Silver **2.** Black① **3.** Silver/Translucent (Fully Illuminated)② **4.** Black/Translucent (Fully Illuminated) ①②	**1.** High Profile Flat Button **2.** High Profile Curved Button **3.** Low Profile Flat Button **4.** Low Profile Curved Button **5.** Flush Profile Flat Button	**1.** Silver **2.** Black	SAE Legend, Two Digit Code: please refer to Appendix

STOP HERE for lighted switches without legends

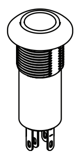
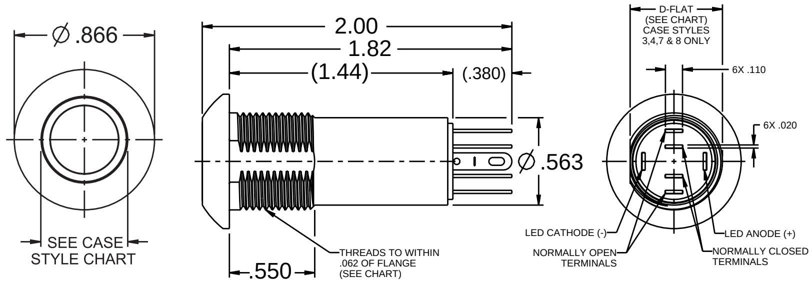
* Contact factory for Knurl Nut options.
** 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.
For additional LED lighting options, contact factory.
*** Light source not available with fully illuminated center cap
① Only available on LP3-A styles.
② Not offered in case styles 5, 6, 7, and 8.

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

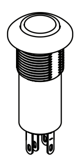
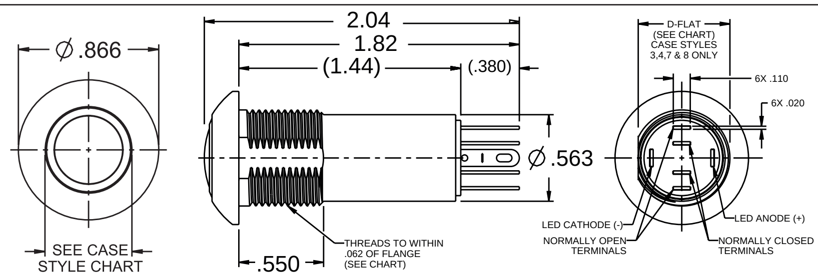
 Specifications Subject To Change Without Notice

MOMENTARY ACTION RING ILLUMINATED, VANDAL RESISTANT CASE & BUTTON

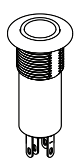
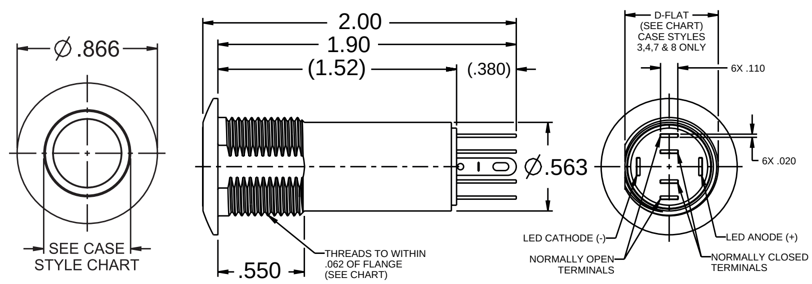
LP3-XXXXXXX1
High Profile Flat Button

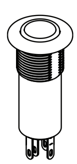
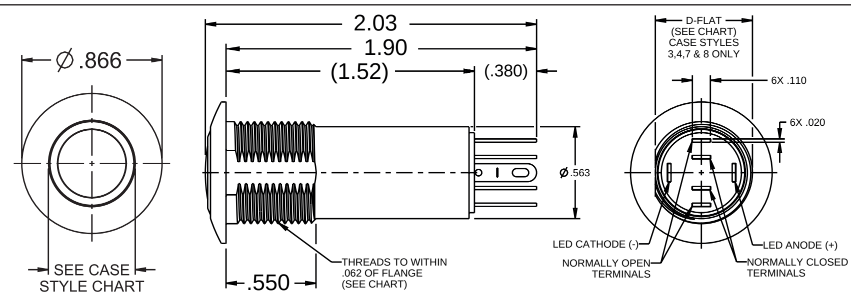
LP3-XXXXXXX2
High Profile Curved Button

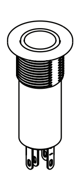
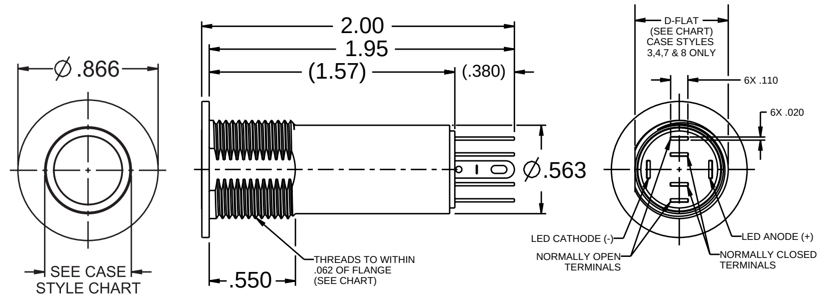
LP3-XXXXXXX3
Low Profile Flat Button

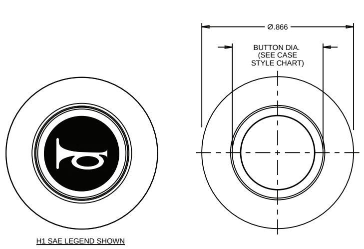



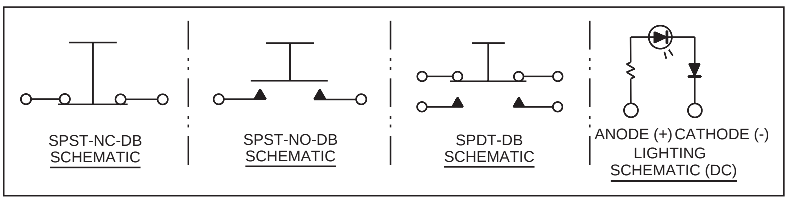
LP3-XXXXXXX4
Low Profile Curved Button

LP3-XXXXXXX5
Flush Profile Flat Button





ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

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
DWV	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

Mechanical Life:	250,000 cycles
Seal:	IP64 or IP68S and IP69K
Operating Temp Range:	-55°C to +85°C
Operating Force:	2.5 +/- 0.5 lb. or 4.0 +/- 1.0 lb.
Total Travel:	0.080 inches +/- 0.015
Overtravel:	0.010 inches min

MATERIALS:

Case:	Stainless steel (316) or anodized aluminum alloy
Button:	Thermoplastic
Center Cap:	Stainless steel (316) or anodized aluminum alloy
Mounting Hardware:	Hex nut, lockwasher and panel seal gasket (watertight only)

LP3S-V PART NUMBER CODE

LP3S – X X X X X X X X

Type
- **A.** Aluminum
- **V.** Stainless

Case Style*
- **1.** 5/8-24 & Hex Nut
- **3.** 5/8-24 W/D–Flat & Hex Nut
- **5.** 3/4-20 & Hex Nut
- **7.** 3/4-20 W/D–Flat & Hex Nut

*For Knurl nut options, consult factory

Circuit Rating
- **1.** SPST N.O./Std.
- **3.** SPDT 2 Circuit/Std.
- **4.** SPST N.O./Logic Level
- **6.** SPDT 2 Circuit/Logic Level

Light Source Type w/ Rev. Pol Protection**
- **A.** 2V Red LED
- **B.** 2V Green LED
- **C.** 2V Amber LED
- **G.** 12V Red LED
- **H.** 12V Green LED
- **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

Seal Level
- **2.** Dusttight
- **3.** Watertight

Operating Force
- **2.** 2.5±0.5 lbs.
- **4.** 4.0 ±1.0 lbs.

Case/Center Cap Color
- **1.** Silver
- **2.** Black***

Button Profile
- **1.** High Profile Flat Button
- **2.** High Profile Curved Button
- **3.** Low Profile Flat Button
- **4.** Low Profile Curved Button
- **5.** Flush Profile Flat Button

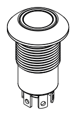
CASE STYLE		
DIMENSION	1 & 3	5 & 7
(BUTTON DIA.)	0.525	0.590
(THREAD)	5/8-24 UNEF-2A	3/4-20 UNEF-2A
FLAT	0.594	0.718

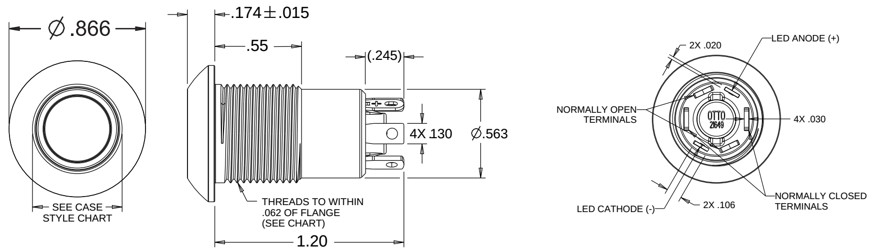
**2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.
For additional LED lighting options, contact factory.

*** Only available on LP3S-A styles.

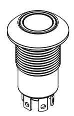
SHORTER MOMENTARY ACTION RING ILLUMINATED, VANDAL RESISTANT CASE & BUTTON

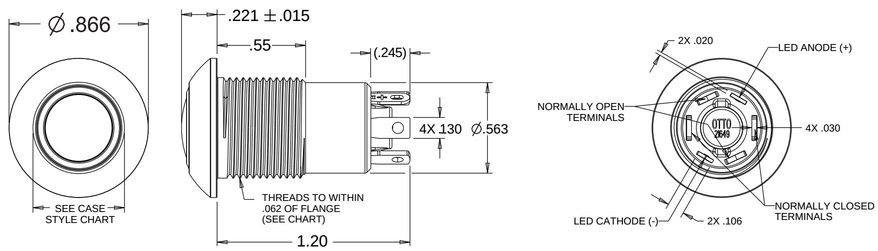
LP3S-XXXXXXX1
High Profile Flat Button



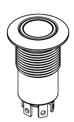


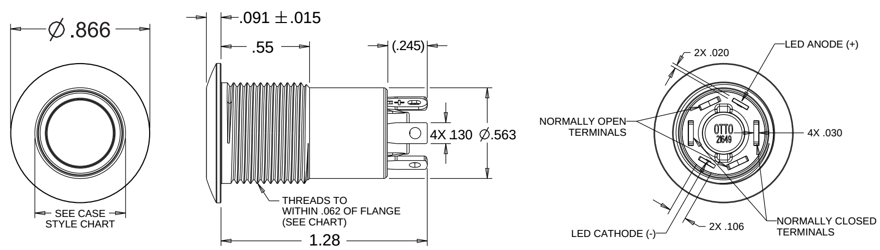
LP3S-XXXXXXX2
High Profile Curved Button



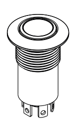


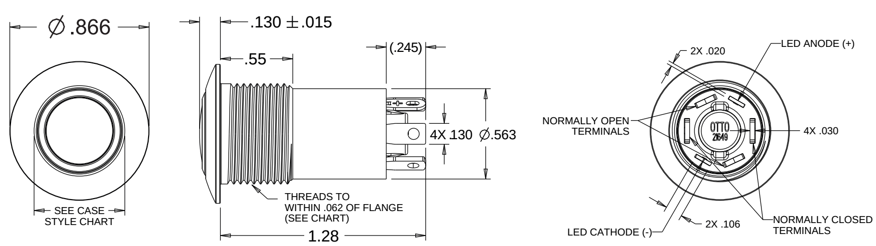
LP3S-XXXXXXX3
Low Profile Flat Button



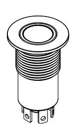


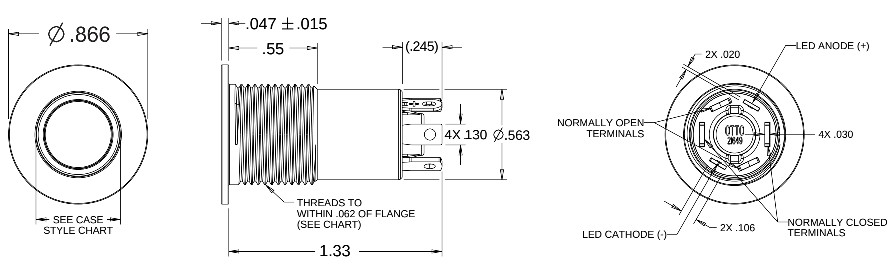
LP3S-XXXXXXX4
Low Profile Curved Button

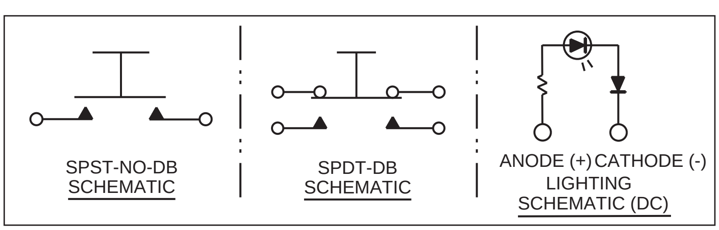




LP3S-XXXXXXX5
Flush Profile Flat Button







ILLUMINATED ALTERNATE ACTION PUSHBUTTONS

ALTERNATE ACTION, LED ILLUMINATED & SEALED

Front Mount

Raised Dome

The LP5 offers the same rugged, sealed construction as the proven P5 series with the added benefit of reliable LED illumination. It is a precision snap-action switch designed for use in off-highway, material handling, industrial controls, marine, medical and other demanding Commercial applications. Choose from the standard mounting styles and electrical ratings, or contact us for custom configurations.

Now you can design panels with both alternate and momentary action switches and have uniform panel appearance. The OTTO LP5 series features alternate action in the same pushbutton and housing configurations as the OTTO momentary LP3 series.

Push and the LP5 series switch turns "on." Push again and the LP5 switch turns "off." Positive tactile feedback is featured so the operator is clearly aware the switch mode has been actuated. The button returns to the original position after each actuation.

Features:

- **Watertight to IP68S; moistureproof & dusttight to IP64**
- **LED lighted with the ability to accommodate 2, 6, 12 & 24VDC power & includes reverse voltage protection**
- **Tall & dome style buttons in translucent white, red, amber, green and blue permitting sublimated & pad printed legends**
- **Quick disconnect terminals**
- **15/32" & 5/8" thread, press fit & dome case options**
- **RoHS compliant**

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	**Sea Level @ 28VDC or 115VAC**
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DWV	1000Vrms through switch contacts only
Logic Level	10mA @ 5VDC
Electrical Life:	Standard 25,000 cycles, Logic Level 200,000 cycles

LIGHTING:

Light Source Voltage (DC)	**Typ. Forward Voltage (DC)**	**Voltage Max (DC)**
2*	1.9 to 3.3 (dep. on color)	2.5 to 4 (dep. on color)
6	6	8
12	12	14.5
24	24	28.6

Mechanical Life:	200,000 cycles
Seal:	Unsealed, IP64 or IP68S
Operating Temp Range:	-55°C to +85°C
Operating Force:	3.0 lbs. +1.0/-0.5 lb.
Total Travel:	0.180 inches max
Overtravel:	0.012 inches min

MATERIALS:

Case:	Anodized aluminum alloy
Button:	Thermoplastic
Mounting Hardware:	Hex nut, lockwasher, and panel gasket (watertight only)

LP5 PART NUMBER CODE

LP5 – X X X X X X – XX

Case Style

E. Exposed Dome
F. Flush Dome
R. Raised Dome
1. Press Fit Mount
3. 5/8" Thread Front Mount
4. 15/32" Thread Rear Mount
6. 5/8" Thread Rear Mount

Circuit Rating

1. SPST/Std.
2. SPDT/Std.
3. SPST/Logic Level
4. SPDT/Logic Level

Light Source Type w/ Rev. Pol Protection

A. 2V Red LED*
B. 2V Green LED*
C. 2V Amber LED*
D. 6V Red LED
E. 6V Green LED
F. 6V Amber LED
G. 12V Red LED
H. 12V Green LED
J. 12V Amber LED
K. 24V Red LED
L. 24V Green LED
M. 24V Amber LED
N. 2V Blue LED*
P. 6V Blue LED
Q. 12V Blue LED
R. 24V Blue LED
S. 2V Deep Green LED*
T. 6V Deep Green LED
U. 12V Deep Green LED
V. 24V Deep Green LED

Seal Level

1. Unsealed
2. Dusttight
3. Watertight

Case Color

1. Silver
2. Black

Button Color

A. Amber, Translucent (use Amber LED)
R. Red, Translucent (use Red LED)
W. White, Translucent
G. Green, Translucent (use Green LED)
B. Blue, Translucent (use Blue LED)

Legend Style

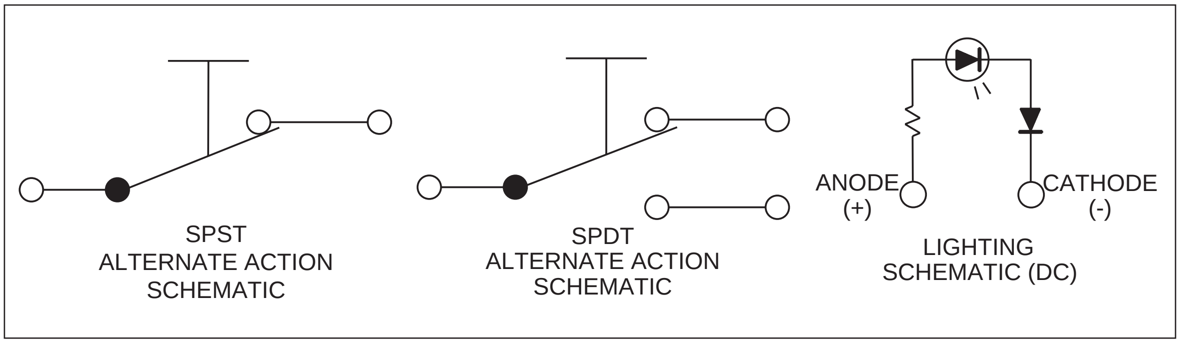
Refer to Legend Table for legend codes in Appendix. Legends will be printed in white on amber, red, green, and blue buttons and in black on white buttons.

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. See appendix for complete voltage/ratings table.

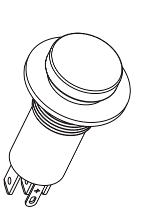
For super bright LEDs, contact factory.

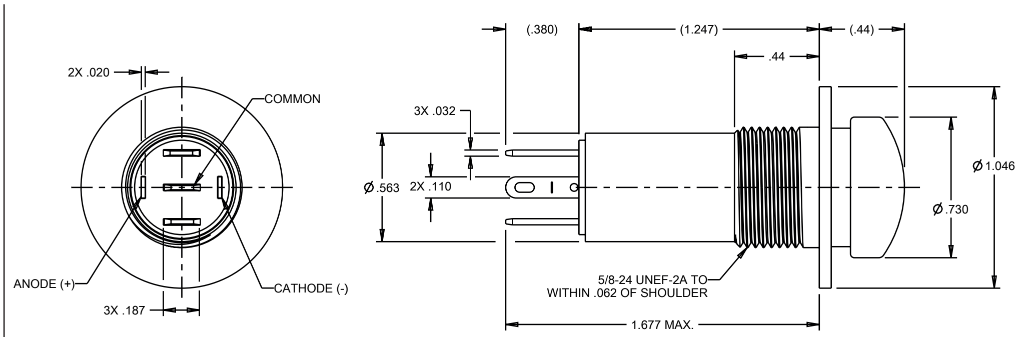
ALTERNATE ACTION, LED ILLUMINATED & SEALED



LP5-EXXXXX

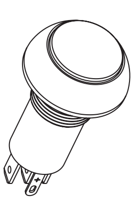
Alternate Action, Exposed Dome Button

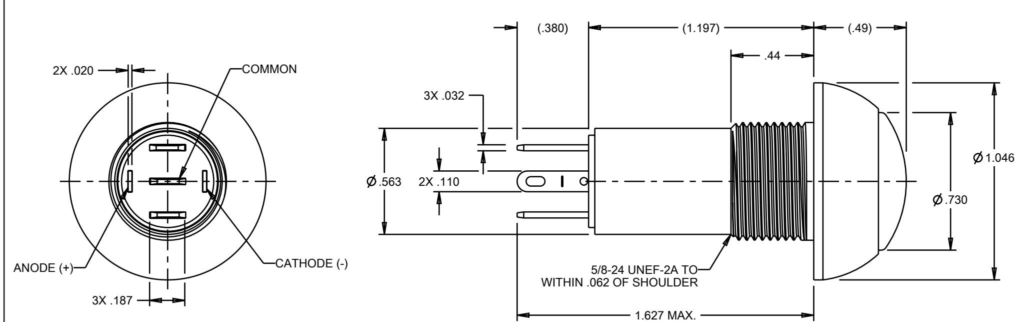




LP5-FXXXXX

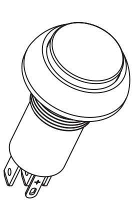
Alternate Action, Flush Dome Button

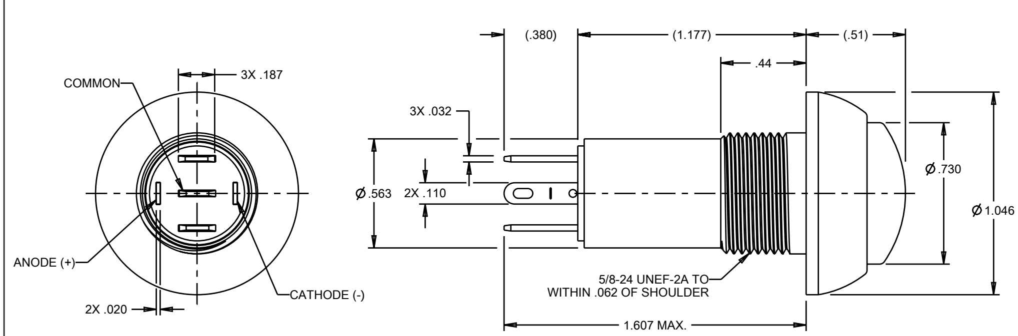




LP5-RXXXXX

Alternate Action, Raised Dome Button



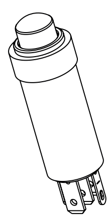


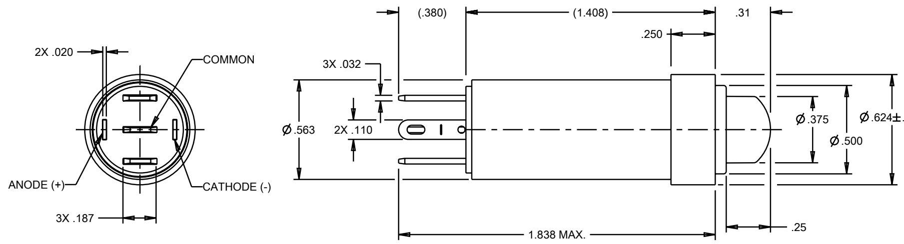
ILLUMINATED ALTERNATE ACTION PUSHBUTTONS

ALTERNATE ACTION, LED ILLUMINATED & SEALED

LP5-1XXXXX

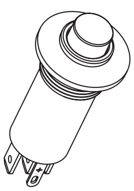
Alternate Action, Press Fit Mount

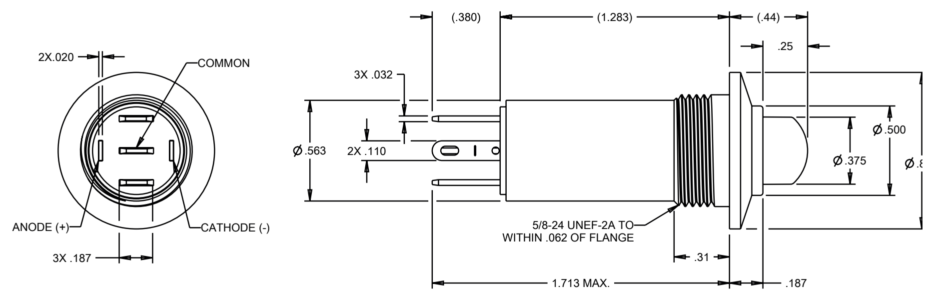




LP5-3XXXXX

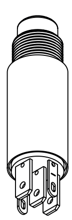
Alternate Action, 5/8" Threaded Front Mount

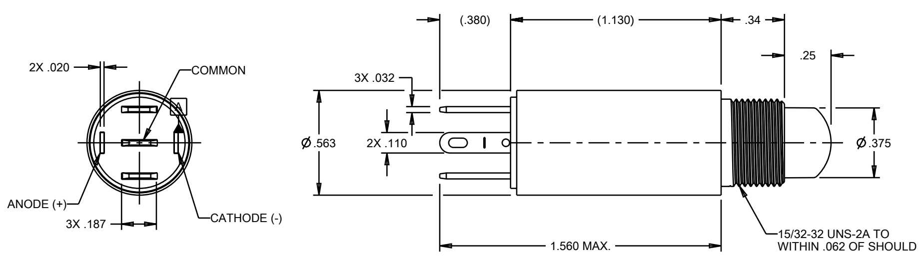




LP5-4XXXXX

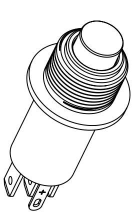
Alternate Action, 15/32" Threaded Rear Mount

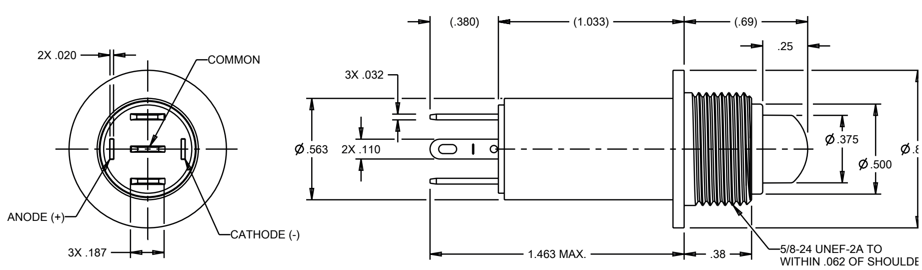




LP5-6XXXXX

Alternate Action, 5/8" Threaded Rear Mount

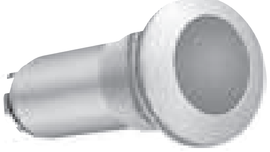


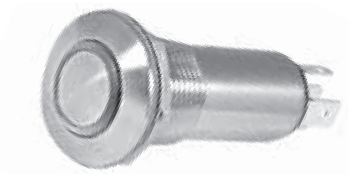


NOTE:
For indicator light only,
see LPL indicator light pages 153-155.

ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

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:

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
Electrical Life:	25,000 cycles; 200,000 cycles logic level

LIGHTING:

Light Source Voltage (DC)	Typ. Forward Voltage (DC)	Voltage Max (DC)
2**	2	2.5
6	6	8
12	12	14
24	24	28.6

Mechanical Life:	200,000 cycles
Seal:	IP64 or IP68S
Operating Temp Range:	-55°C to +85°C
Operating Force:	3.5 lbs. +1.5/-1.0 lbs.
Total Travel:	0.180 inches max
Overtravel:	0.012 inches min

MATERIALS:

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

LP5-V PART NUMBER CODE

LP5 – X X X X X X X – X XX

Type
- **A.** Aluminum
- **V.** Stainless

Case Style
- **1.** 5/8-24 & Hex Nut
- **2.** 5/8-24 & Knurl Nut*
- **3.** 5/8-24 W/D– Flat & Hex Nut
- **4.** 5/8-24 W/D– Flat & Knurl Nut*
- **5.** 3/4-20 & Hex Nut
- **6.** 3/4-20 & Knurl Nut*
- **7.** 3/4-20 W/D– Flat & Hex Nut
- **8.** 3/4-20 W/D– Flat & Knurl Nut*

Circuit Rating
- **0.** Indicator Light
- **1.** SPST/Std.
- **2.** SPDT/Std.
- **3.** SPST/Logic Level
- **4.** SPDT/Logic Level

Light Source Type w/ Rev. Pol Protection**
- **A.** 2V Red LED
- **B.** 2V Green LED④
- **C.** 2V Amber LED
- **D.** 6V Red LED
- **E.** 6V Green LED④
- **F.** 6V Amber LED
- **G.** 12V Red LED
- **H.** 12V Green LED④
- **J.** 12V Amber LED
- **K.** 24V Red LED
- **L.** 24V Green LED④
- **M.** 24V Amber LED
- **N.** 2V 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

Seal Level
- **2.** Dusttight
- **3.** Watertight

Case/Center Cap Color
- **1.** Silver/Silver① (Ring Lit)
- **2.** Black/Black①② (Ring Lit)
- **3.** Silver/White③ (Fully Illuminated)
- **4.** Black/White②③ (Fully Illuminated)

Button Profile
- **1.** High Profile Flat Button
- **2.** High Profile Curved Button
- **3.** Low Profile Flat Button
- **4.** Low Profile Curved Button
- **5.** Flush Profile Flat Button

STOP HERE for lighted switches without legends

Legend① Color
- **1.** Silver
- **2.** Black

Legend①

SAE Legend, Two Digit Code: please refer to Appendix

* 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.

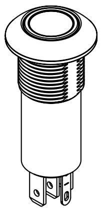
③ Only available in case styles 1, 2, 3, and 4.

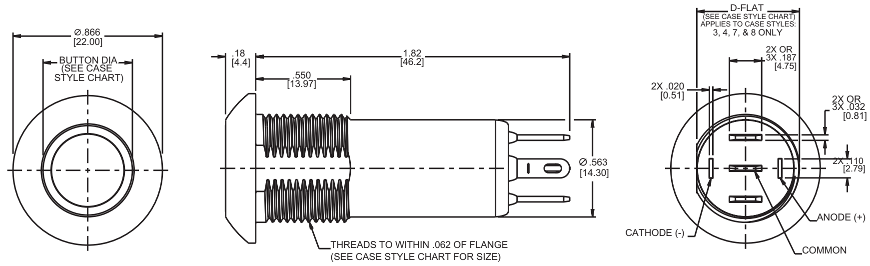
④ Not available in fully illuminated center cap option.

ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

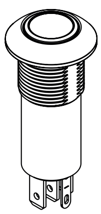
ALTERNATE ACTION, RING OR FULLY ILLUMINATED, METAL CASE & BUTTON, OPTIONAL LEGENDS

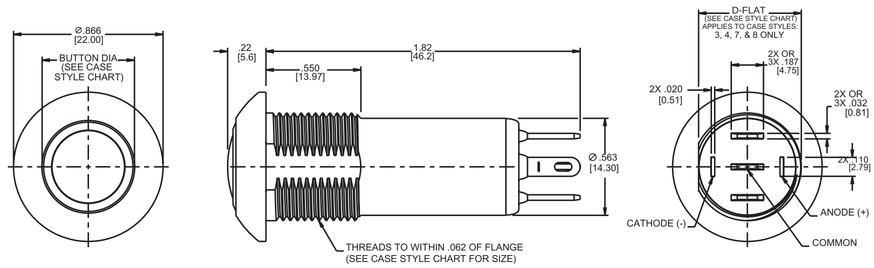
High Profile Flat Button
Button Profile Style 1



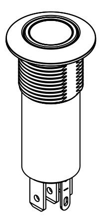


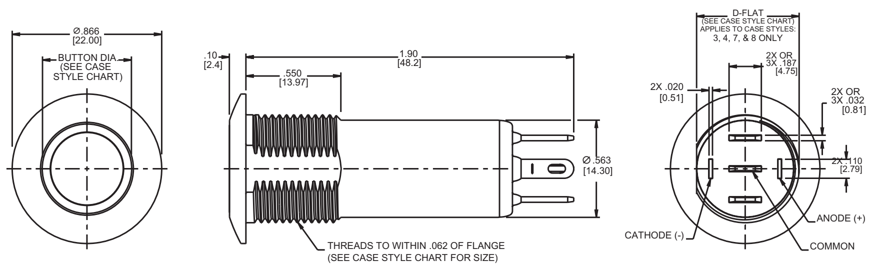
High Profile Curved Button
Button Profile Style 2



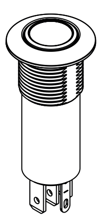


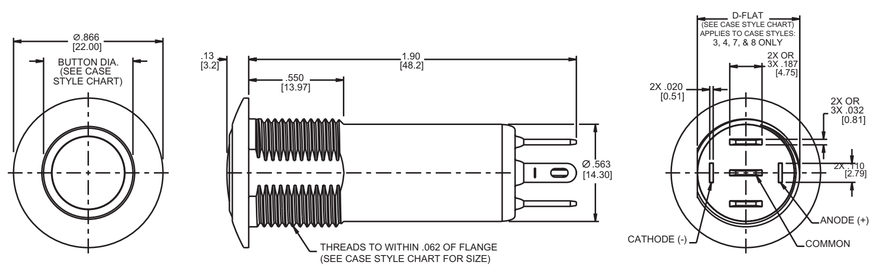
Low Profile Flat Button
Button Profile Style 3



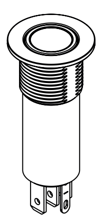


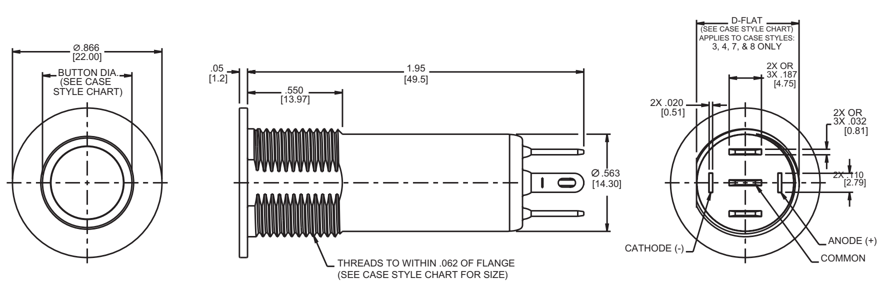
Low Profile Curved Button
Button Profile Style 4

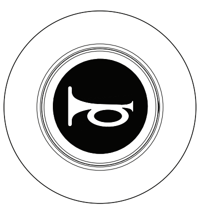




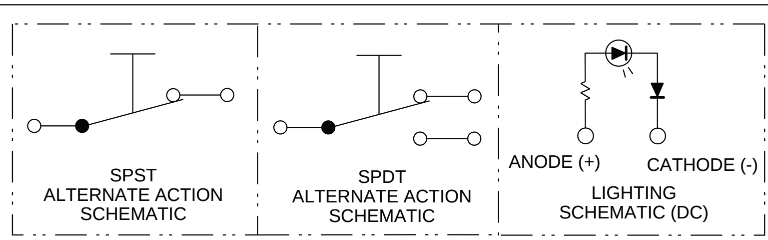
Flush Profile Flat Button
Button Profile Style 5







H1 SAE LEGEND SHOWN



 Specifications Subject To Change Without Notice

SEALED 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.

Raised Dome

Also available with Flush Dome

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**

Standard Characteristics/Ratings:			
ELECTRICAL RATINGS:	**Sea Level @ 28VDC or 115VAC**		
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		
Electrical Life:	25,000 cycles		
LIGHTING:			
Light Source Voltage (DC)	**Actual Voltage Nominal (DC)**	**Voltage Max (DC)**	
2*	2	2.6	
12	13.5	14.5	
Mechanical Life:	1,000,000 cycles		
Seal:	IP68S		
Operating Temp Range:	-55°C to +85°C		
Operating Force:	1.7 lbs. ± 0.5 lbs. Standard Force, 12 oz. ± 4 oz. Low Force		
Total Travel:	.080 inches max		
Overtravel:	.010 inches min		
MATERIALS:			
Case:	Anodized aluminum alloy		
Button:	Thermoplastic		
Terminals:	Gold plate		
Contacts:	Gold plated silver alloy		
Mounting Hardware:	None		

LP7 PART NUMBER CODE

LP7 – X X X X X X X X

Button Style
1. Flush
2. Raised
3. Flush Matte
4. Raised Matte

Case Style
1. Short Bezel Press Fit

Terminal Style
1. Solder

Circuit Form
1. N.O.
2. N.C.
3. 2 Circuit

Switch Action
1. Standard Force Snap-Action
2. Low Force Snap-Action

Light Source*
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

Case Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Violet
8. Gray
9. Clear

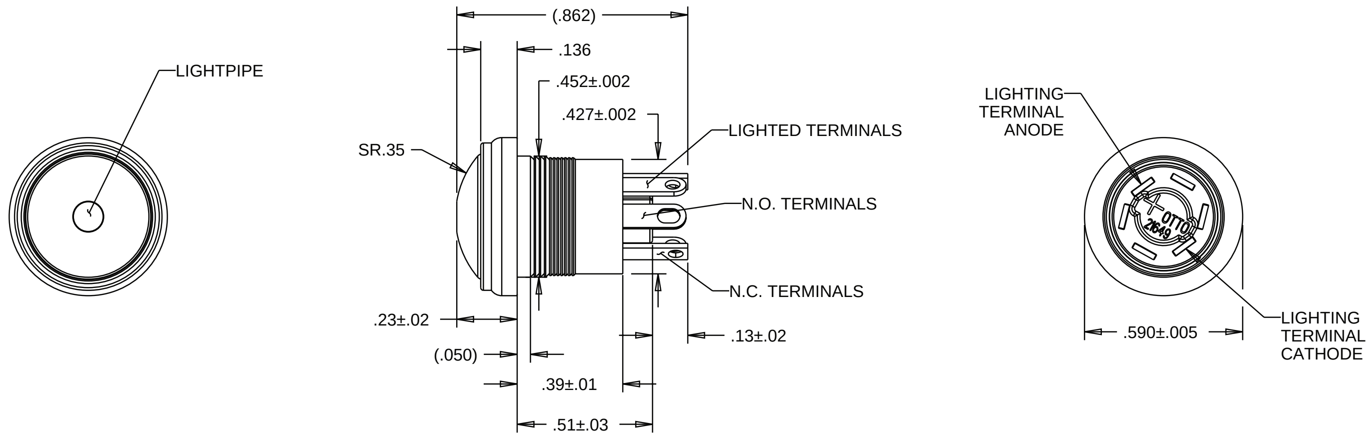
Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Violet
8. Gray
9. White

*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.

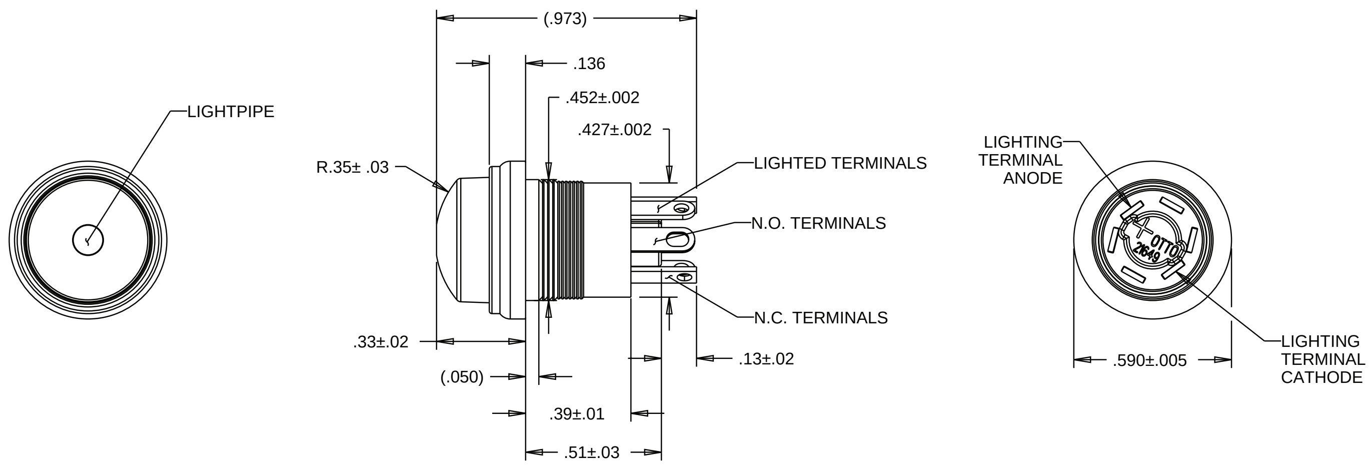
SEALED ILLUMINATED PUSHBUTTONS

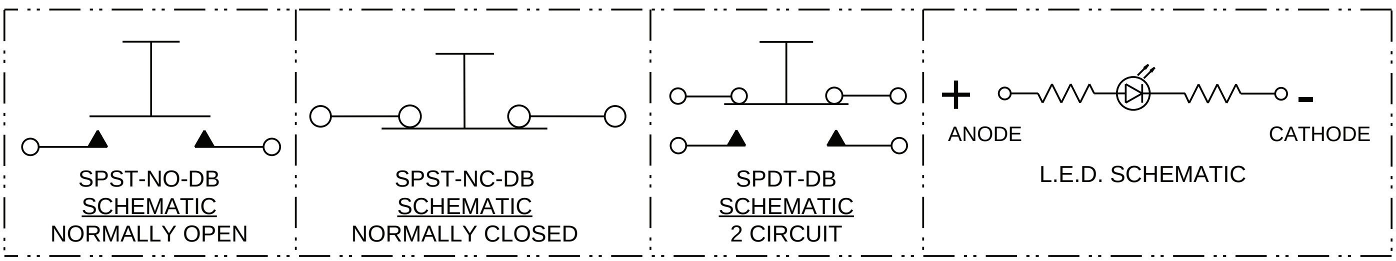
MOMENTARY ACTION, SEALED TO IP68S, COMPACT BEZEL

Flush Button - Short Bezel



Raised Button - Short Bezel





SEALED ILLUMINATED DOME 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	
Electrical Life:	25,000 cycles	
LIGHTING:		
Light Source Voltage (DC)	**Actual Voltage Nominal (DC)**	**Voltage Max (DC)**
2**	2	2.6
12	13.5	14.5
Mechanical Life:	1,000,000 cycles	
Seal:	IP64 or IP68S	
Operating Temp Range:	-40°C to +85°C	
Operating Force:	1.7 lbs. ± 0.5 lbs.	
Total Travel:	0.080 inches max	
Overtravel:	0.010 inches min	
MATERIALS:		
Case:	Anodized aluminum alloy	
Button:	Thermoplastic	
Terminals:	Silver with gold plate	
Mounting Hardware:	Hex nut, lockwasher and panel seal gasket when applicable	

LP7-D PART NUMBER CODE

LP7-D X X X X X X X

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*

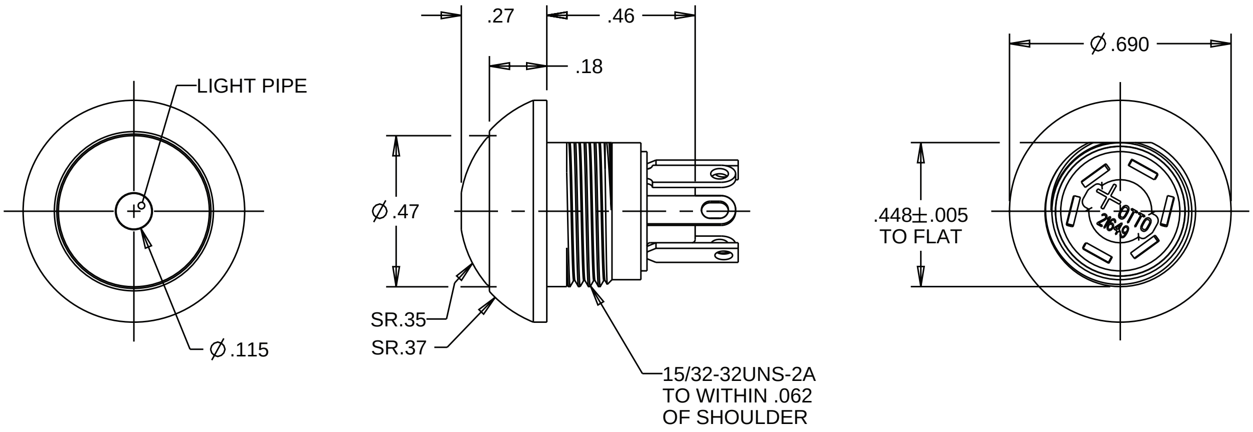
***** Full illumination button styles available with translucent Button Color selection A only.
****** 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

SEALED ILLUMINATED DOME PUSHBUTTONS

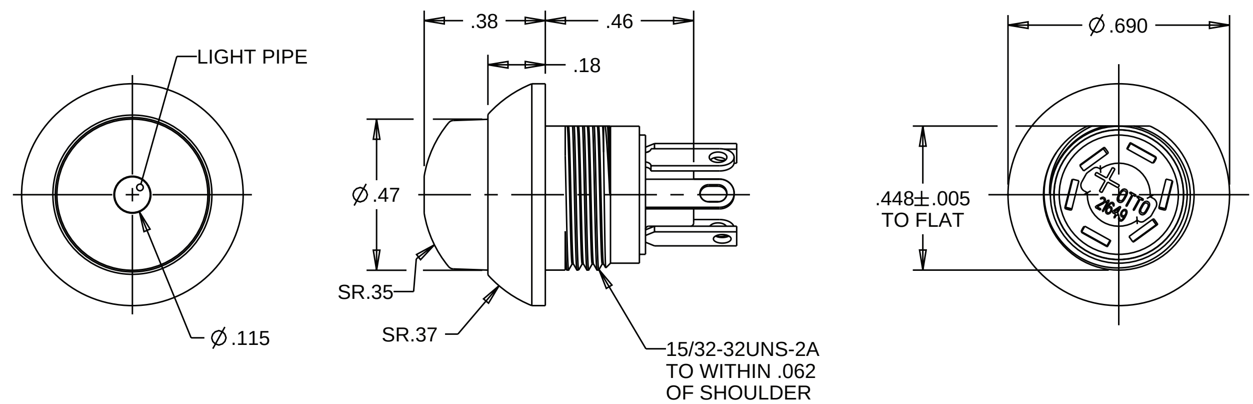
MOMENTARY ACTION, ATTRACTIVE & HIGHLY RUGGEDIZED FOR WET & DUSTY ENVIRONMENTS

Button Options

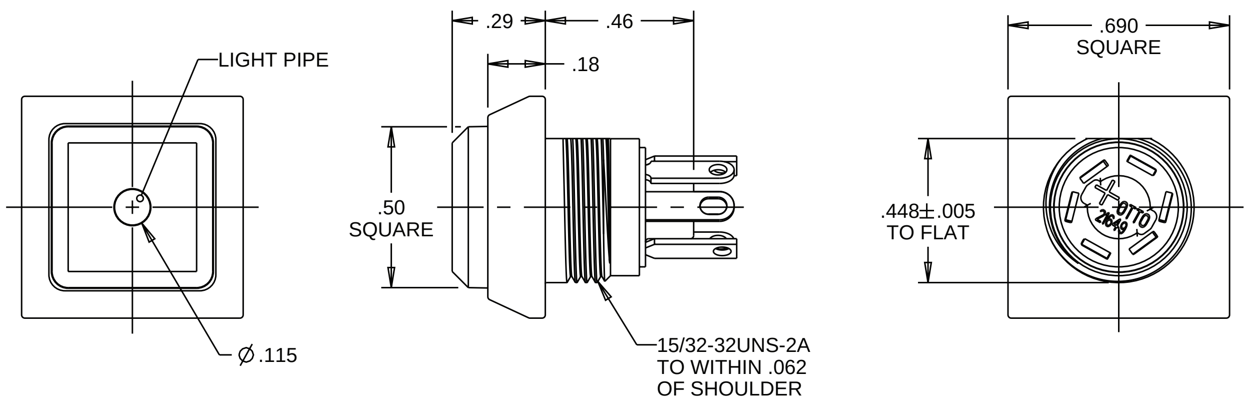
FLUSH DOME
(STYLE 1 & 3)



RAISED DOME
(STYLE 2 & 4)



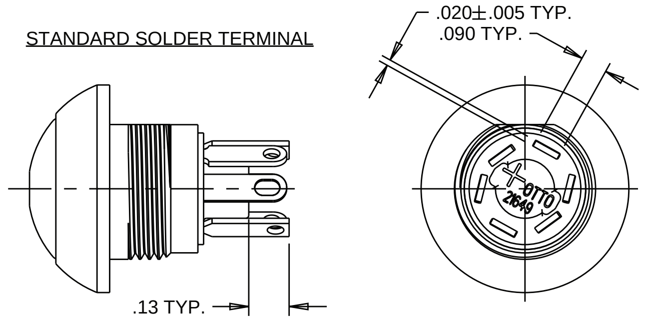
SQUARE DOME
(STYLE 5)



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

Terminal Options

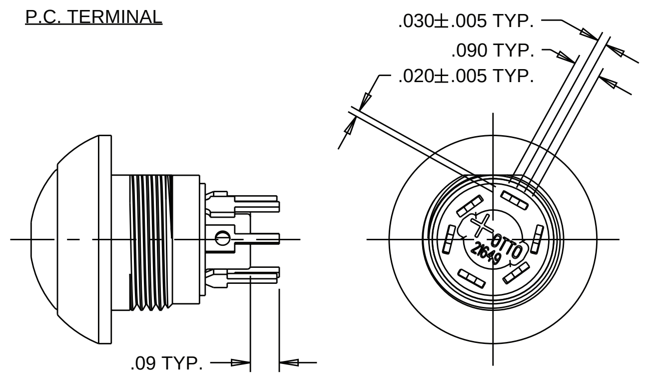
STANDARD SOLDER TERMINAL



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

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

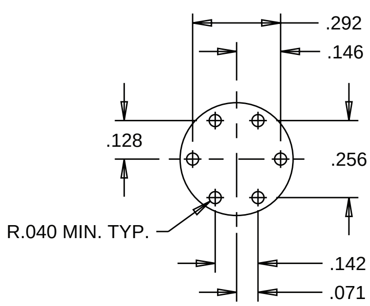
P.C. TERMINAL



N.O. TERMINALS: ROUND HOLE (Ø .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)

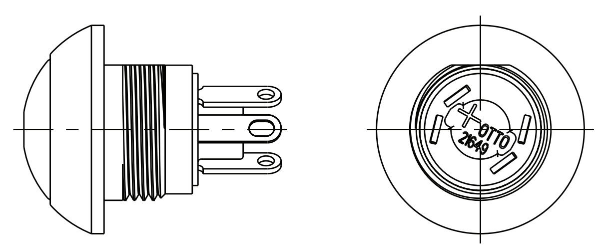
TERMINALS ORIENTED TO CASE FLAT AS SHOWN WITHIN ±10°
(P.C. TERMINALS ONLY)

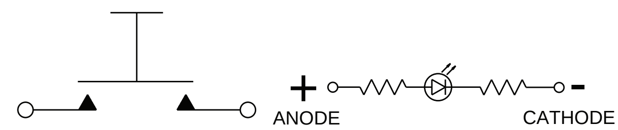


COMPONENT SIDE P.C. MOUNTING PATTERN, CASE FLAT ON ABOVE AS DEPICTED IN SWITCH VIEW

Circuit Options

NORMALLY OPEN

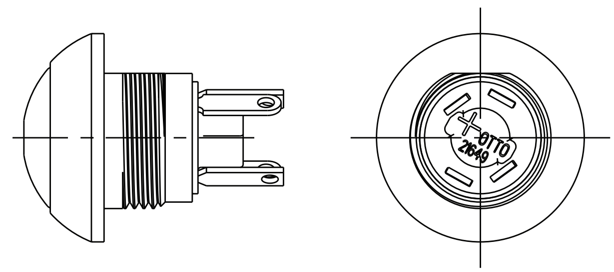


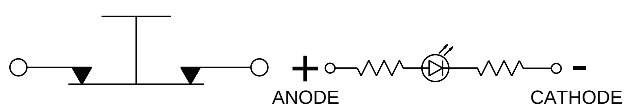


SPST-NO-DB SCHEMATIC

L.E.D. SCHEMATIC

NORMALLY CLOSED

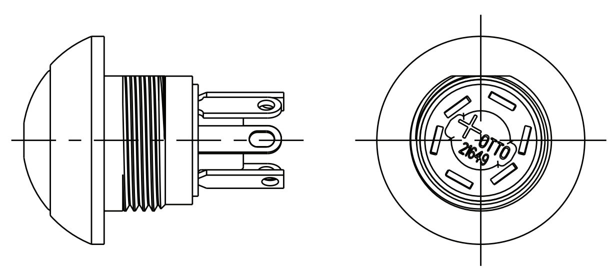


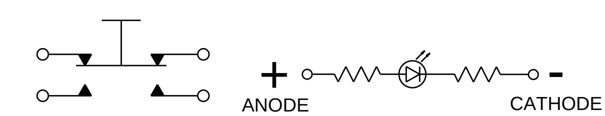


SPST-NC-DB SCHEMATIC

L.E.D. SCHEMATIC

2 CIRCUIT





SPDT-DB SCHEMATIC

L.E.D. SCHEMATIC

PUSHBUTTON SWITCHES

SEALED ILLUMINATED DOME PUSHBUTTONS

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED

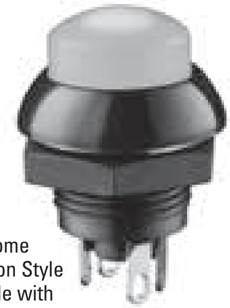
The OTTO LP9 Lighted Dome series is a quality precision switch designed for use in panels, control grips, instruments, heavy equipment and other demanding applications where attractive, rugged, lighted pushbutton switches are required.

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.

Flush Dome
Also available with
Raised Dome



Raised Dome
Full Illumination Style
Also available with
Flush Dome

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**

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	
Electrical Life:	See Rating Chart			

MECHANICAL:

Mechanical Life:	1,000,000 cycles
Seal:	IP68S
Operating Temp Range:	-40°C to +85°C
Operating Force:	1.7 +/- 0.5 lb. (standard force) 0.75 +/- 0.25 lb. (low force)
Total Travel:	0.080 inches max
Overtravel:	0.010 inches min

MATERIALS:

Case:	Thermoplastic
Button:	Thermoplastic
Terminals:	Brass with gold
Mounting Hardware:	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

Button Style*
1. Flush Dome Standard Finish - Lightpipe
2. Raised Dome Standard Finish - Lightpipe
3. Flush Dome Matte Finish Lightpipe
4. Raised Dome Matte Finish Lightpipe
5. Flush Dome Standard Finish - Fully Illuminated ①
6. Raised Dome Standard Finish - Fully Illuminated ①

Case Style*
1. Standard Round Bezel Threaded
2. Standard Round Bezel Snap-In

Terminal Style
1. Solder
2. PC Pin

Circuit Form
1. N.O.
2. N.C.
3. 2 Circuit

Operating Force
1. Standard Force Snap-Action
2. Low Force Snap-Action

Light Source
- **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

Case Color
1. Red
2. Black
3. Orange ①
4. Yellow ①
5. Green ①
6. Blue ①
7. Violet ①
8. Gray ①
9. White

Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Violet
8. Gray
9. White

- **A.** Translucent White ②

* Button and case will be of the same texture.
For all mixed gloss/matte combination options, contact factory.

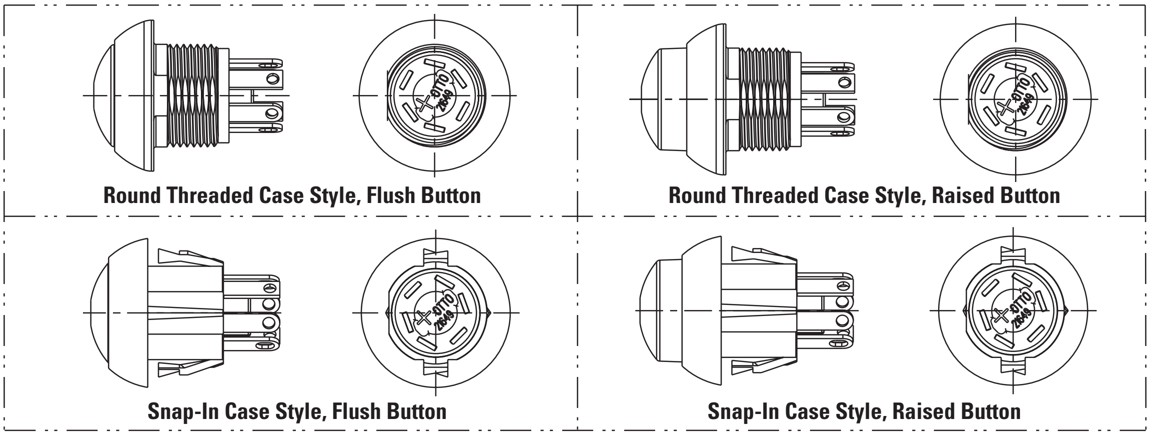
** 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

① For minimum requirement, contact factory.

② Full illumination button styles available with translucent Button Color selection A only.

SEALED ILLUMINATED DOME PUSHBUTTONS

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED



Round Threaded Case Style, Flush Button

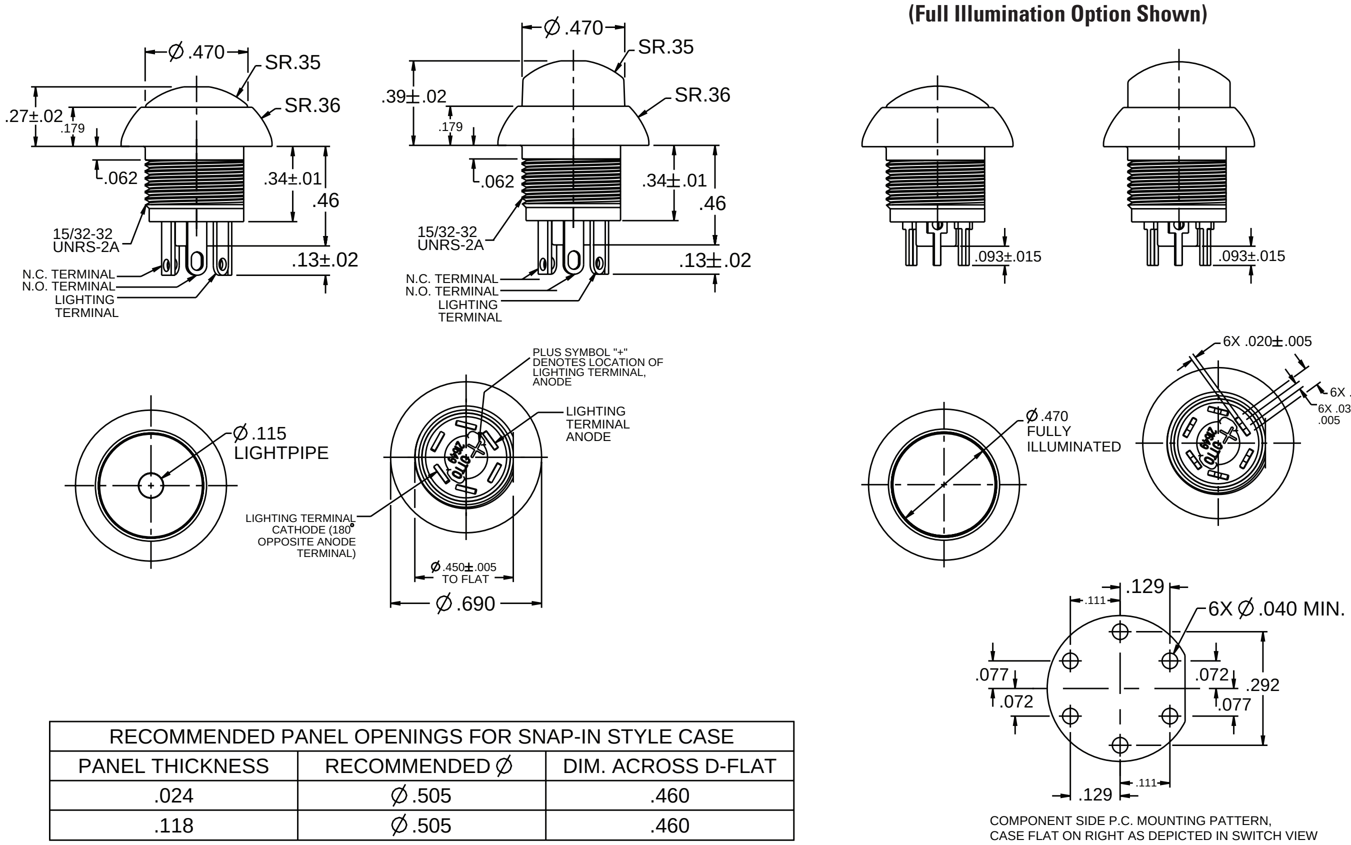
Round Threaded Case Style, Raised Button

Snap-In Case Style, Flush Button

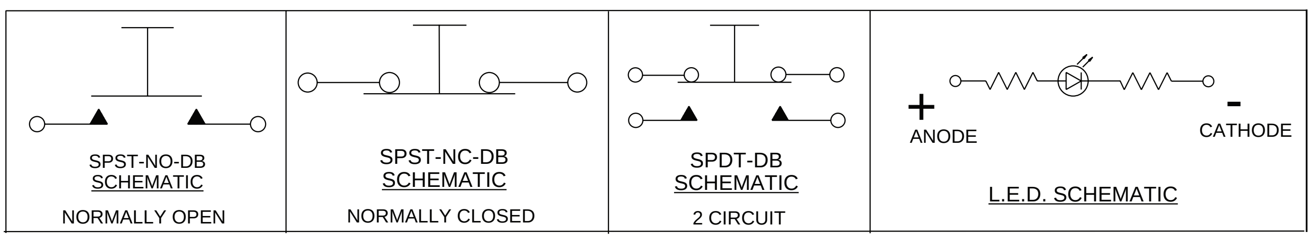
Snap-In Case Style, Raised Button

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



ILLUMINATED SEALED DOME PUSHBUTTONS

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.

Raised Dome

Also available with Flush Dome

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**

Standard Characteristics/Ratings:		
ELECTRICAL RATINGS:		
Load		
Logic Level:	10mA @ 5VDC (Resistive)	
DWV:	1050Vrms through switch contacts only	
Electrical Life:	1,000,000 cycles	
LIGHTING:		
Light Source Voltage (DC)	**Actual Voltage Nominal (DC)**	**Voltage Max (DC)**
2**	2	2.6
12	13.5	14.5
Mechanical Life:	1,000,000 cycles	
Seal:	IP68S	
Operating Temp Range:	-40°C to +85°C	
Operating Force:	1.7 +/- 0.5 lb. (standard force) .75 +/- .25 lb. (low force)	
Total Travel:	0.080 inches max	
Overtravel:	0.010 inches min	
MATERIALS:		
Case:	Thermoplastic	
Button:	Thermoplastic	
Terminals:	Brass with gold over silver	
Mounting Hardware:	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

Button Style*
1. Flush Dome Standard Finish
2. Raised Dome Standard Finish
3. Flush Dome Matte Finish
4. Raised Dome Matte Finish

Case Style*
1. Standard Round Bezel Threaded
2. Standard Round Bezel Snap-In

Terminal Style
1. Solder
2. PC Pin

Circuit Form
1. N.O.
2. N.C.
3. 2 Circuit

Operating Force
1. Standard Force Snap-Action
2. Low Force Snap-Action

Light Source**
- **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

Case 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

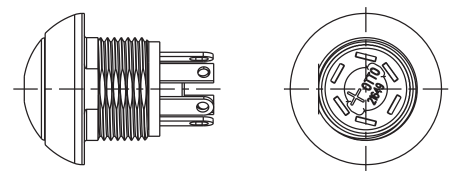
* Button and case will be of the same texture.
For all mixed gloss/matte combination options, contact factory.

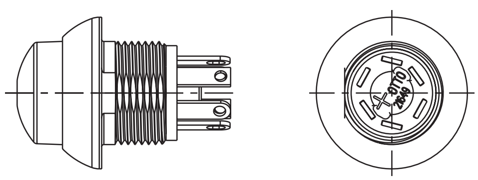
** 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.

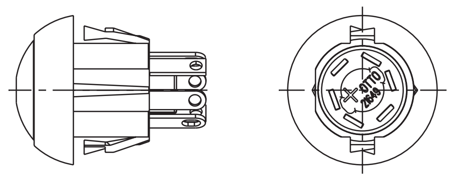
*** For minimum requirement, contact factory.

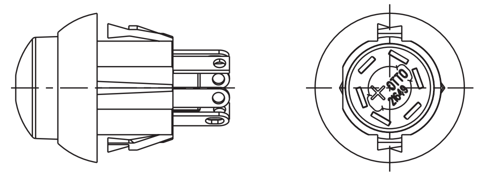
ILLUMINATED SEALED DOME PUSHBUTTONS

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED

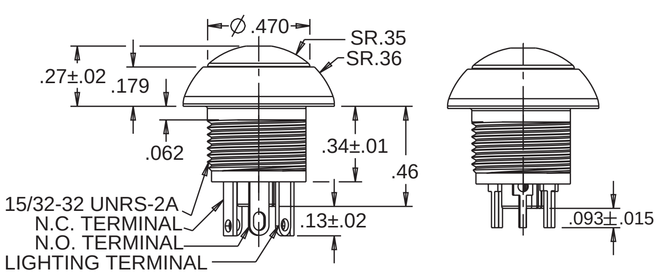

Round Threaded Case Style, Flush Button


Round Threaded Case Style, Raised Button


Snap-In Case Style, Flush Button

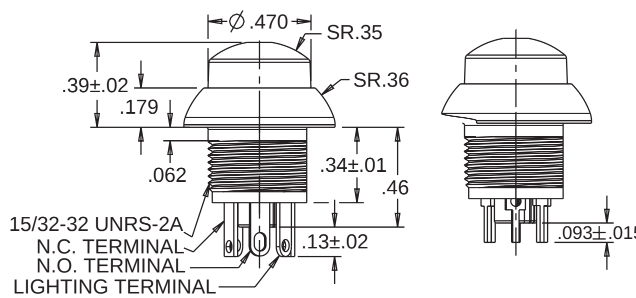

Snap-In Case Style, Raised Button

Standard Terminals **P.C. Terminals**

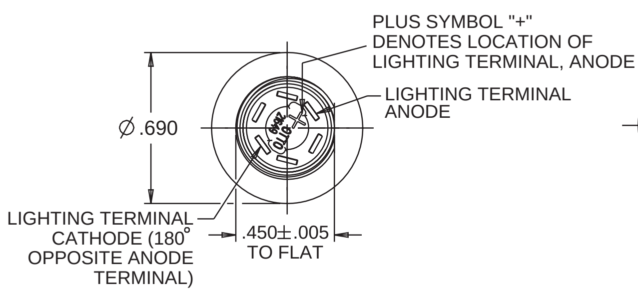


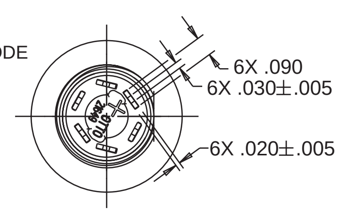
FLUSH BUTTON ROUND THREADED

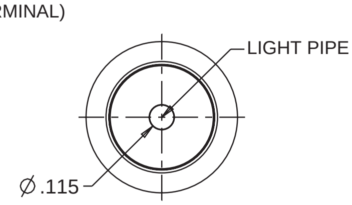
Standard Terminals **P.C. Terminals**

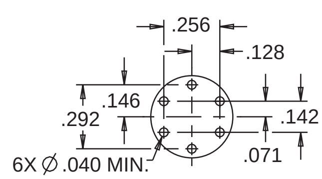


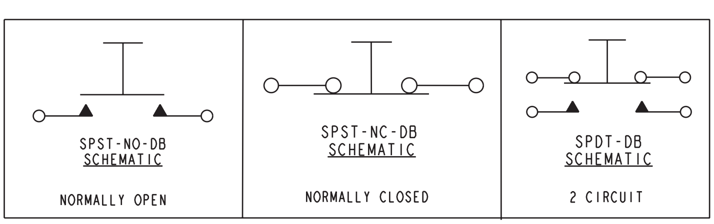
RAISED BUTTON ROUND THREADED

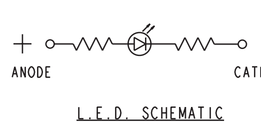












LPL INDICATOR LIGHTS

INDICATOR LIGHTS FOR LP3 & LP5 SERIES

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:		
LIGHTING:		
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
Seal:	Options include: • Watertight per MIL-PRF-8805, Design 3 and IP68S • Dusttight per MIL-PRF-8805, Design 2 and IP64 • Unsealed	
Operating Temp Range:	-55°C to +85°C	
MATERIALS:		
Case:	Anodized aluminum alloy	
Button:	Thermoplastic	
Terminals:	Brass	
Mounting Hardware:	Hex nut, lockwasher and panel gasket when applicable	

LPL PART NUMBER CODE

LPL – X 0 (zero) X X X X – XX

Case Style
- **E.** Exposed Dome
- **F.** Flush Dome
- **R.** Raised Dome
- **1.** Press Fit Mount
- **3.** 5/8” Thread Front Mount
- **4.** 15/32” Thread Rear Mount
- **6.** 5/8” Thread Rear Mount

Light Source Type*
- **A.** 2V Red LED
- **B.** 2V Green LED
- **C.** 2V Amber LED
- **D.** 6V Red LED
- **E.** 6V Green LED
- **F.** 6V Amber LED
- **G.** 12V Red LED
- **H.** 12V Green LED
- **J.** 12V Amber LED
- **K.** 24V Red LED
- **L.** 24V Green LED
- **M.** 24V Amber LED
- **N.** 2V Blue LED
- **P.** 6V Blue LED
- **Q.** 12V Blue LED
- **R.** 24V Blue LED
- **S.** 2V Deep Green LED
- **T.** 6V Deep Green LED
- **U.** 12V Deep Green LED
- **V.** 24V Deep Green LED

Seal Level
- **1.** Unsealed
- **2.** Dusttight
- **3.** Watertight

Case Color
- **1.** Silver
- **2.** Black

Button Color
- **A.** Amber, Translucent (use Amber LED)
- **R.** Red, Translucent (use Red LED)
- **W.** White, Translucent

Legend Style

Refer to Legend Table in appendix for legend codes. Legends will be printed in white on amber and red buttons and in black on white buttons.

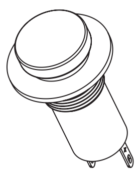
The characters are absent from the part number if there is no legend.

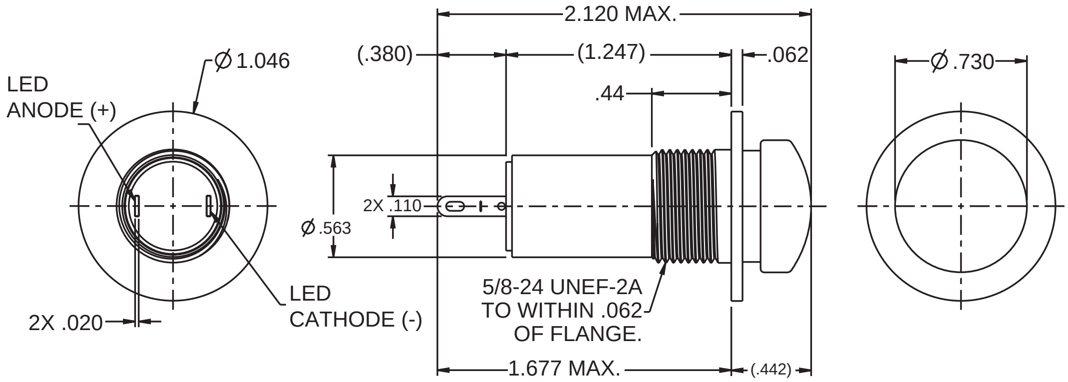
* 2V LED's are intended for use with an external resistor. See LED voltage chart in appendix for details on the approximate value of the resistor.
All green and blue LEDs are recommended for use with translucent button color white only.
For super bright LEDs, contact factory.

LPL INDICATOR LIGHTS

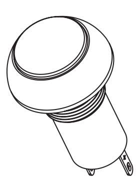
LED ILLUMINATED & SEALED

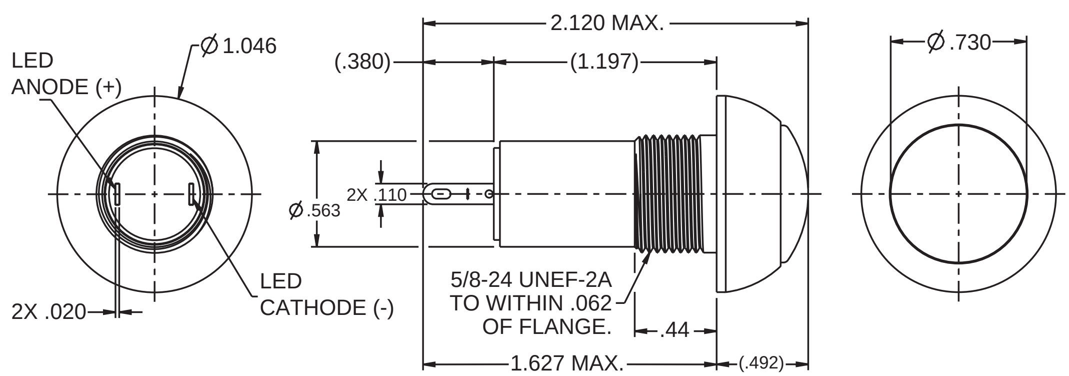
LPL-EO
Exposed Dome Button



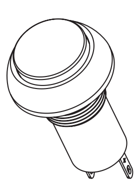


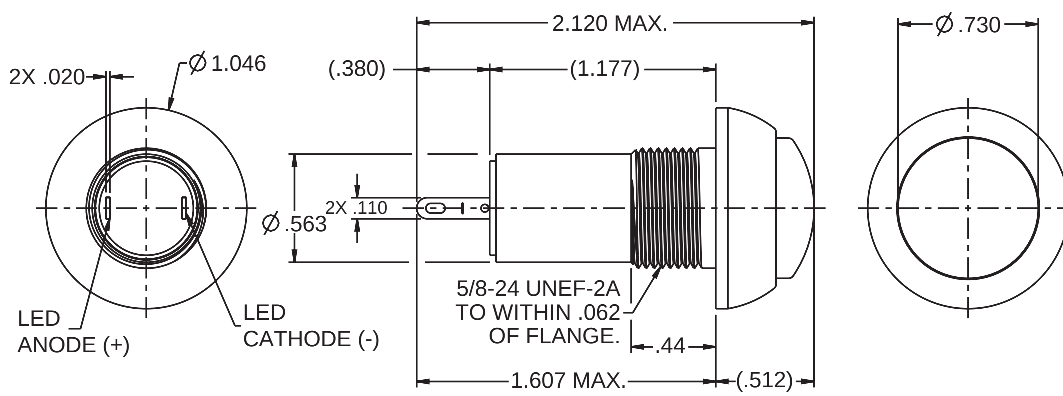
LPL-FO
Flush Dome Button





LPL-RO
Raised Dome Button

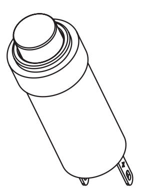


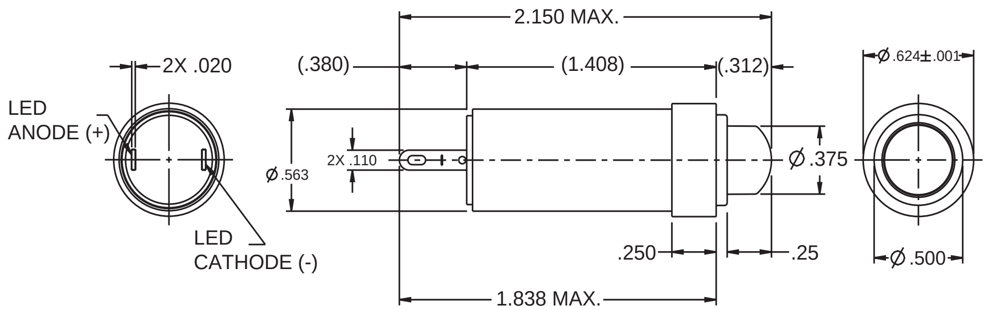


LPL INDICATOR LIGHTS

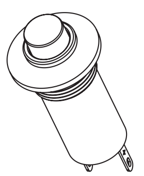
LED ILLUMINATED & SEALED

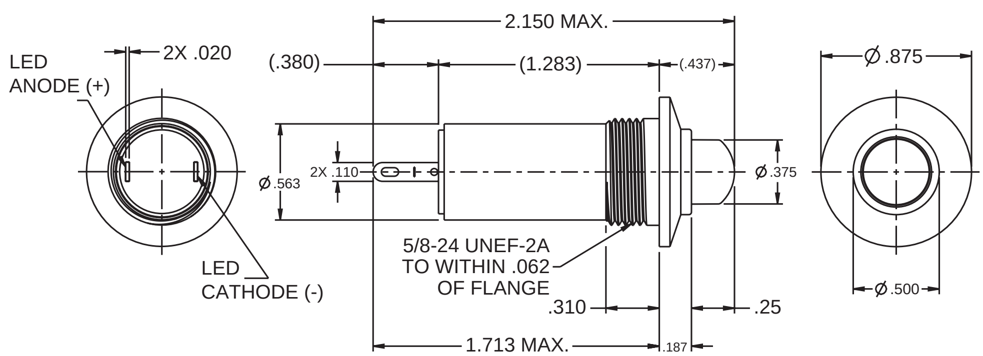
LPL-10
Press Fit Mount



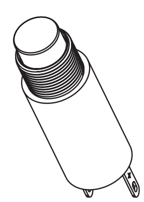


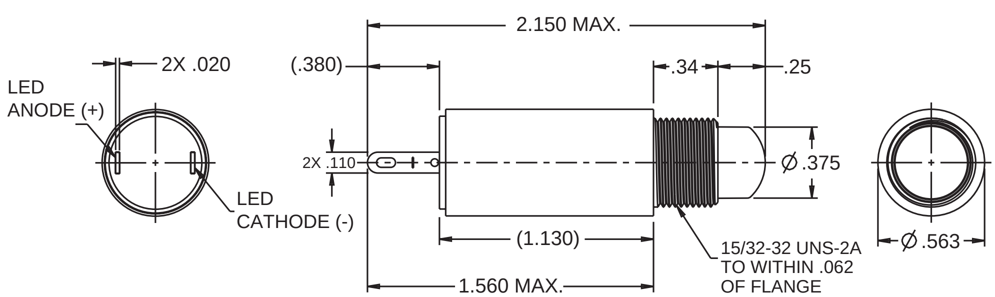
LPL-30
5/8" Threaded Front Mount



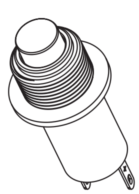


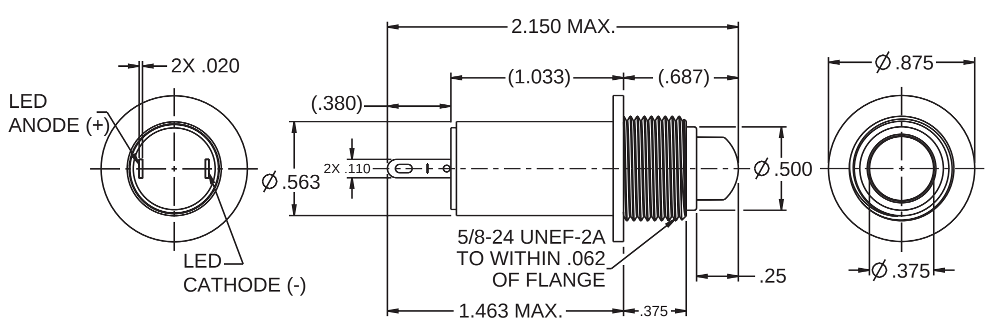
LPL-40
15/32" Threaded Rear Mount





LPL-60
5/8" Threaded Rear Mount





PUSHBUTTONS PER MIL-PRF-8805/3 (MS25089)

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**
- **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

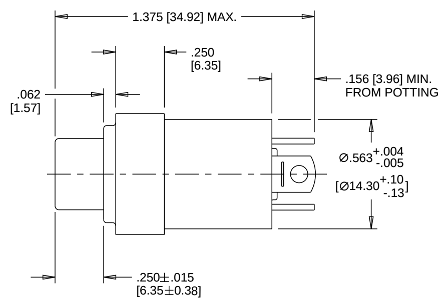
MATERIALS:

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

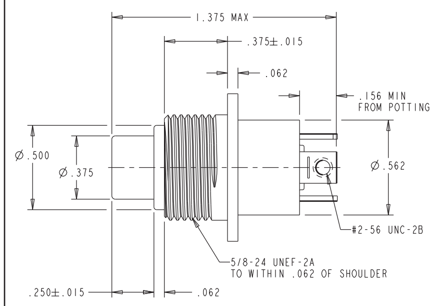
PUSHBUTTONS PER MIL-PRF-8805/3 (MS25089)

MOMENTARY ACTION, LOW LEVEL UP TO 10 AMPS

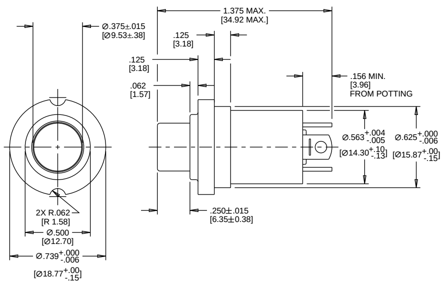
P1-1 (MIL-A)



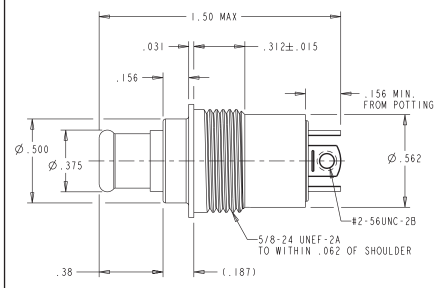
P1-6 (MIL-F)



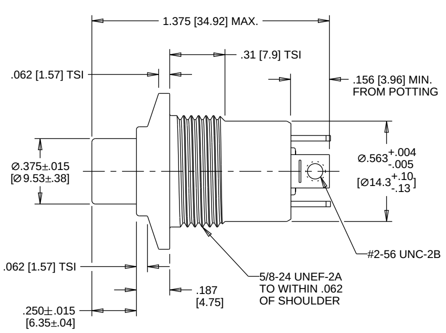
P1-2 (MIL-B)



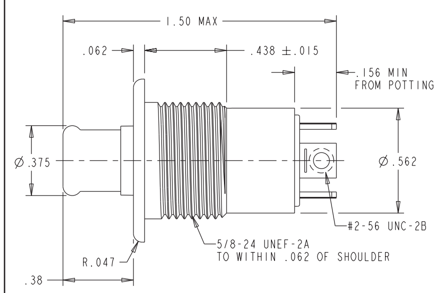
P1-7 (MIL-G)



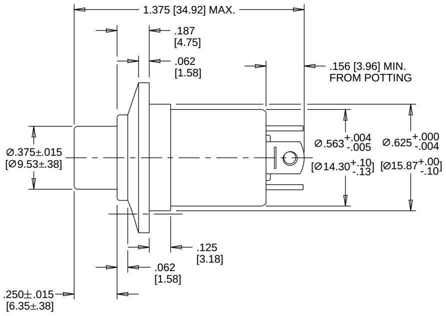
P1-3 (MIL-C)
Push-Pull Style Shown



P1-8 (MIL-H)



P1-5 (MIL-E)



 Specifications Subject To Change Without Notice

MOMENTARY ACTION, LOW LEVEL UP TO 10 AMPS

P1 PART NUMBER CODE

P1 – X X X X X *

Case Style
1. Style A
2. Style B
3. Style C
5. Style E
6. Style F
7. Style G
8. Style H

Terminal Style
1. Solder/Std.
2. Screw/Std.
3. Solder/Low Level
4. Screw/Low Level

Circuit Form
1. N.O.
2. N.C.
3. N.C. 3 Terminal ①
4. N.O. 3 Terminal ①
5. 5 Terminal ①
6. 2 Circuit

Switch Action
1. 2.5 lbs. Momentary
2. 4.0 lbs. Momentary ②
3. Push-Pull

Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple
8. Gray
9. White

*** 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.

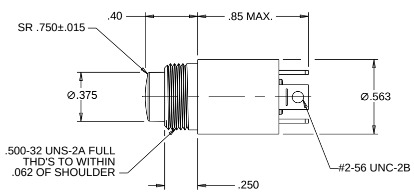
ORDERING INFORMATION:

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.

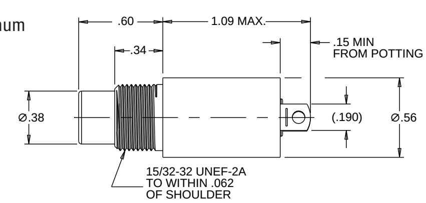
Unsealed P1-90013

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



P1 NOTEWORTHY DESIGNS

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” bo
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.

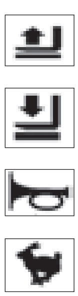
Operating Force: 2.5, +1.0, -0.5 lb.
Circuit: SPNO-DB
Mechanical Life: 250,000 cycles
Bezel: 1.5” dia.
Button: 0.812” dia.

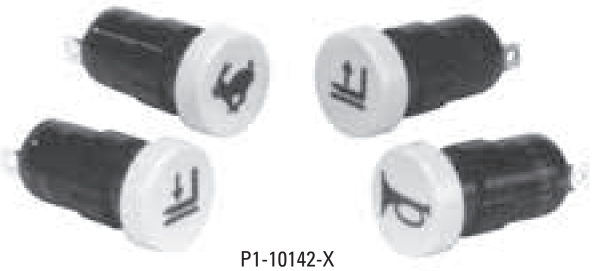
P1-90135-2

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

 Specifications Subject To Change Without Notice

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.

P2-1

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.

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:	
ELECTRICAL RATINGS:	
Load	Sea Level @ 28VDC or 125VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	2A
DWV	1000Vrms Initial
Logic Level	10mA @ 5VDC Resistive
Electrical Life:	25,000 cycles
Mechanical Life:	25,000 cycles
Seal:	Watertight per MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Operating Forces:	Pole One: 3.0 lbs. ± 1.0 lbs. Pole Two: 5.0 lbs. ± 1.5 lbs.
Release Forces:	Pole One: .75 lbs. min. Pole Two: 1.0 lbs. min.
Total Travel:	One Step Style .125 max, Two Step Style .250 max
Overtravel:	0.015 inches min.
Pretravel:	0.020 inches min.
MATERIALS:	
Case:	Black anodized aluminum alloy
Button:	Thermoplastic
Mounting Hardware:	Hex nut, lockwasher and panel seal gasket for case styles 3 and 6

P2 PART NUMBER CODE

P2 – X X XX X X

Case Style	Terminal Style	Circuit Form	Action	Button Color
1. Style 1	**1.** Solder	**11.** 2-SPST - N.O.	**1.** One Step	**1.** Red
3. Style 3		**22.** 2-SPST - N.C.	**2.** Two Step	**2.** Black
6. Style 6		**33.** 2-SPDT - Form C (Break before Make)		**3.** Orange
(See diagrams on next page)		**44.** 1-SPST - N.O. 1-SPST - N.C.		**4.** Yellow
		55. 1-SPST - N.C. 1-SPST - N.O.		**5.** Green
		66. 2-SPDT - MBB* (Make before Break)		**6.** Blue
				7. Purple
				8. Gray
				9. White

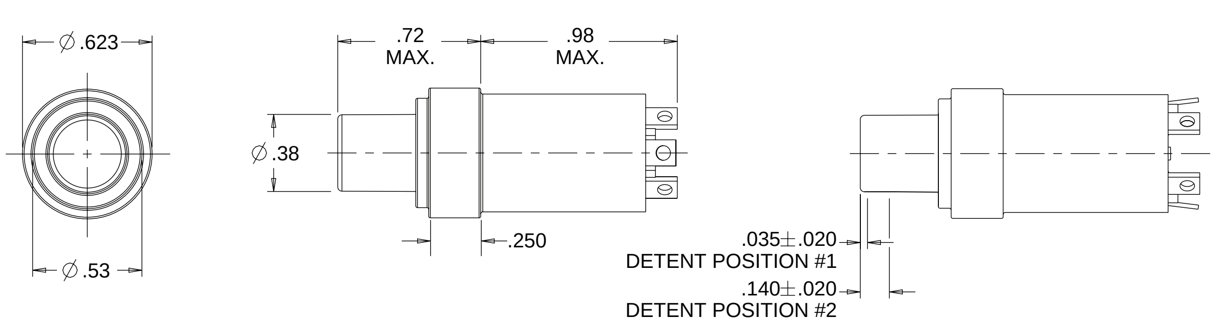
*** Available with Two Step version only.**

PUSHBUTTON SWITCHES

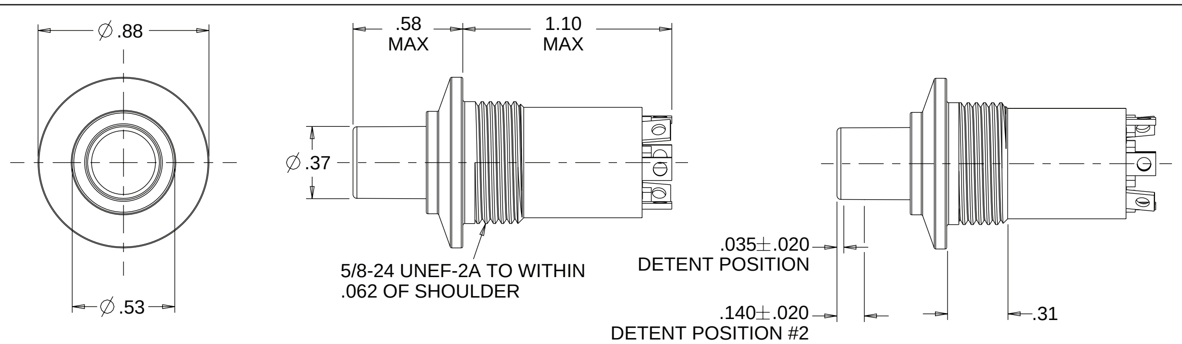
COMMERCIAL GRADE PUSHBUTTONS

3-POSITION MOMENTARY ACTION, ONE OR TWO STEP

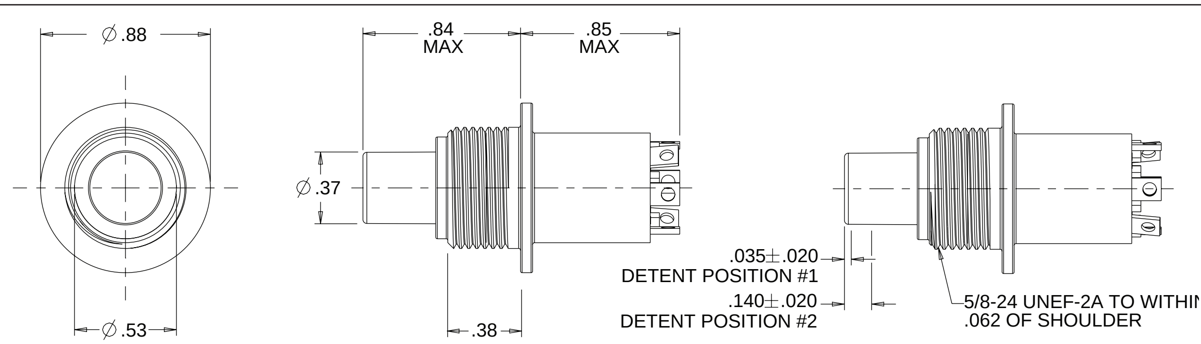
CASE STYLE 1

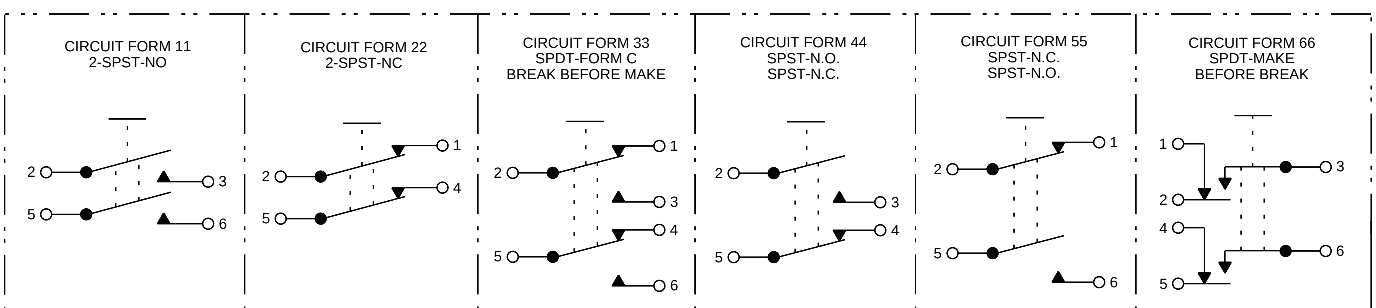


CASE STYLE 3



CASE STYLE 6





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**
- **1 million mechanical cycle life**
- **Watertight to IP68S available in all versions**
- **Watertight to IP69K available in non push-pull versions**
- **RoHS compliant**

P3 PART NUMBER CODE

P3 – X X X X X *

Case Style	Terminal Style/Rating	Circuit Form	Operating Force/Action	Button Color
1. Style 1	**1.** Solder/Std.	**1.** N.O.	**1.** 2.5 lbs./Momentary	**1.** Red
3. Style 3	**2.** Screw/Std.	**2.** N.C.	**2.** 4.0 lbs./Momentary	**2.** Black
6. Style 6	**3.** Solder/Logic Level	**3.** N.C. 3 Terminal	**3.** Push-Pull	**3.** Orange
7. Style 7	**4.** Screw/Logic Level	**4.** N.O. 3 Terminal	**4.** Push-Pull High Force**	**4.** Yellow
8. Style 8		**5.** 5 Terminal		**5.** Green
		6. 2 Circuit		**6.** Blue
				7. Purple
				8. Gray
				9. White

* 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.

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
DWV	1000Vrms	400Vrms	
Logic Level	10mA @ 5VDC		

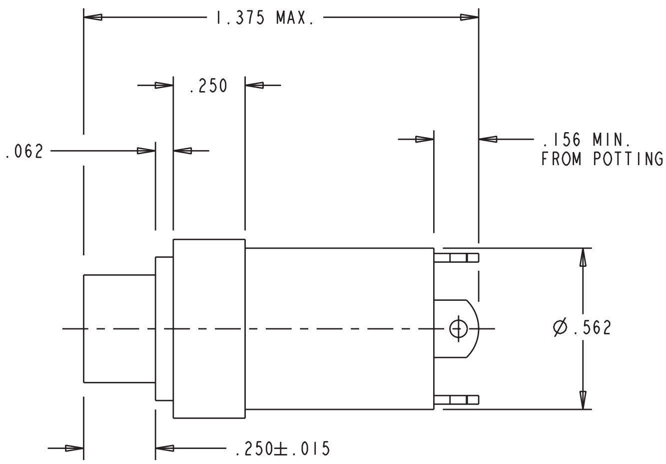
Electrical Life:	25,000 or 100,000 cycles (depending on configuration) High Force Push Pull 5,000 cycles
Mechanical Life:	1 million cycles, circuit forms 1, 2 & 6 100,000 cycles, circuit forms 3, 4 & 5 High Force Push Pull 5,000 cycles
Seal:	IP64 or IP68S and IP69K IP64 or IP68S on push-pull versions
Shock:	MIL-STD-202, method 207
Operating Temp Range:	-55°C to +85°C, High Force Push Pull -40°C to +85°C
Operating Force:	2.5 lbs. or 4.0 lbs. Push-Pull: .5 to 2.0 lbs. Push-Pull High Force: 3.0 lbs. min.
Reset Force:	0.75 lb. min or 1.0 lb.
Total Travel:	0.085 +/- 0.015 inches
Overtravel:	0.012 inches min
Movement Differential:	0.015 inches min

MATERIALS:

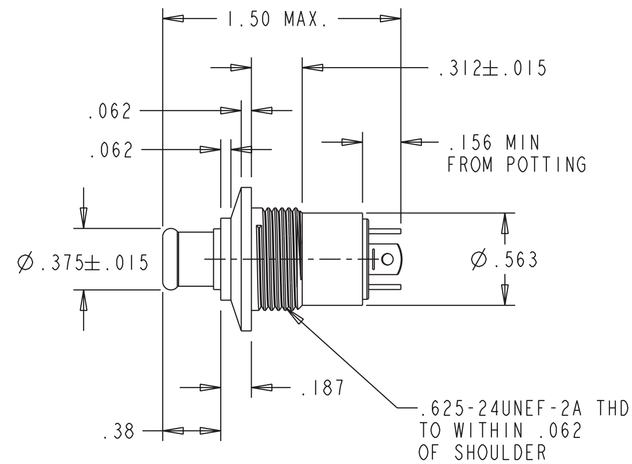
Case:	Anodized aluminum alloy
Button:	Thermoplastic
Terminals:	Brass with silver, gold for logic level
Terminal Hardware:	Screws, lockwasher and terminal lug for screw terminal option
Mounting Hardware:	Hex nut, lockwasher and panel seal when applicable

SEALED COMMERCIAL GRADE PUSHBUTTONS

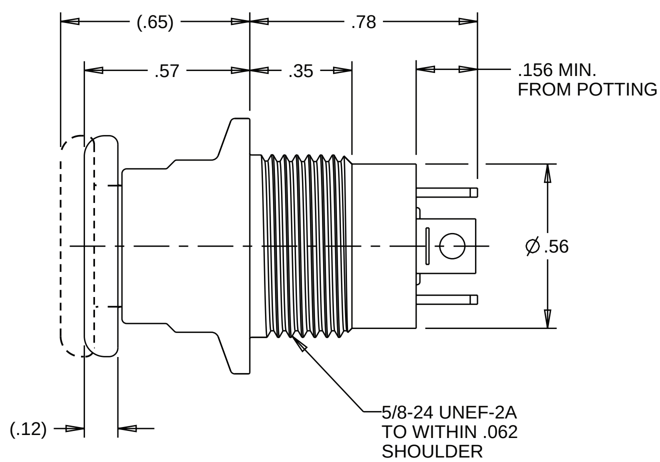
IDEAL FOR USE IN HEAVY MACHINERY & COMMERCIAL APPLICATIONS



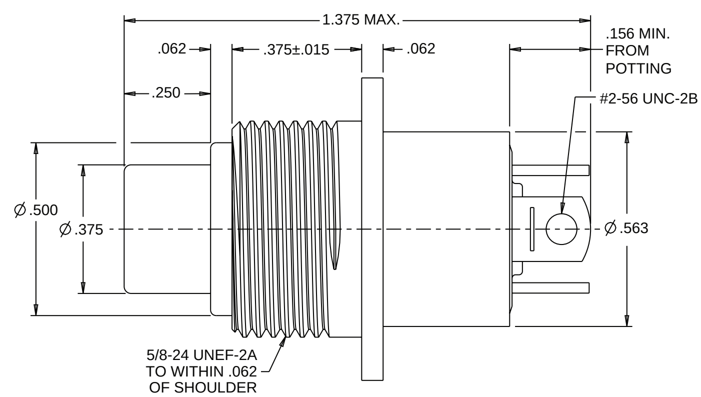
Style P3-11_2



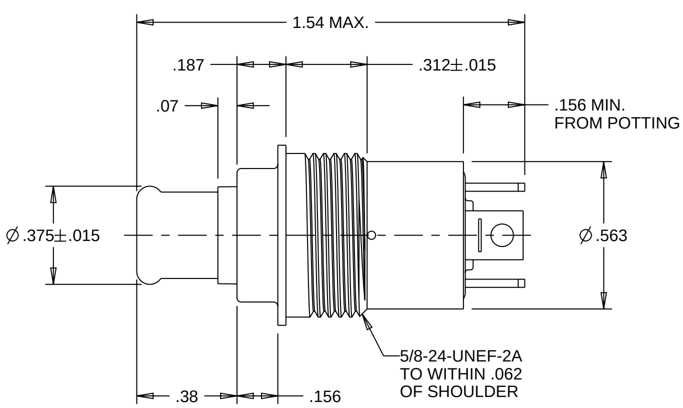
Style P3-33_3 Push-Pull



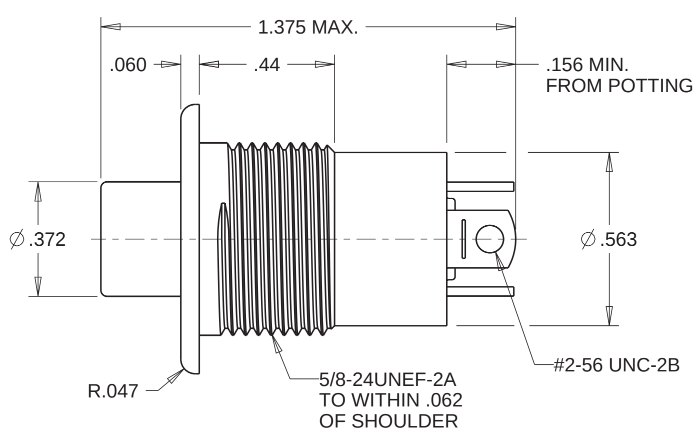
Style P3-33_4 Push-Pull High Force



Style P3-61_1



Style P3-71_3



Style P3-83_1

NOTEWORTHY DESIGNS

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

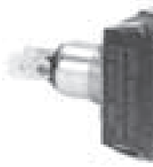
P3-60024

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.

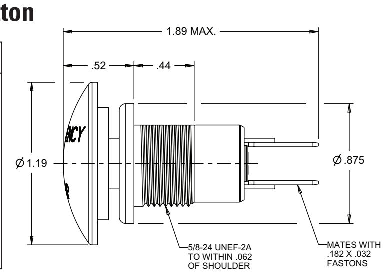
Same ratings and sealing characteristics as the standard P3 series.

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



PUSHBUTTON SWITCHES

SEALED DOME PUSHBUTTON SWITCHES

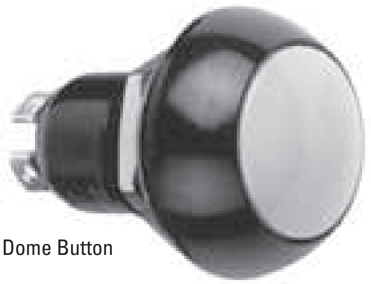
MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

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.

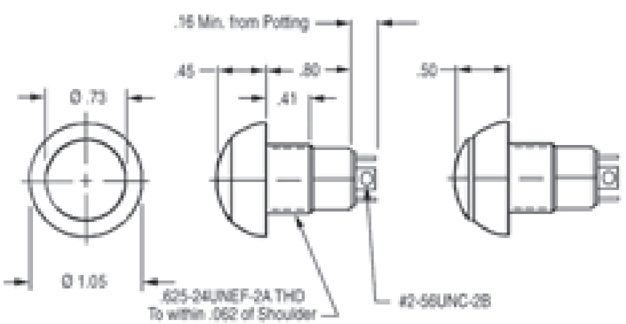


Flush Dome Button

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**

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
Electrical Life:	See Rating Chart	
Mechanical Life:	1,000,000 cycles, circuit forms 1, 2 & 6 100,000 cycles, circuit forms 3, 4 & 5	
Seal:	IP64 or IP68S and IP69K	
Operating Temp Range:	-55°C to +85°C	
Operating Force:	2.0 lbs. to 4.0 lbs., +0.5/-1.0 lb.	
Total Travel:	0.075 +/- 0.015 inches	
Overtravel:	0.012 inches min	
Movement Differential:	0.015 inches min	
MATERIALS:		
Case:	Anodized aluminum alloy	
Button:	Thermoplastic	
Terminals:	Brass with silver plate, gold plate for logic level	
Terminal Hardware:	Screws, lockwasher and terminal lugs	
Mounting Hardware:	Hex nut, lockwasher and panel seal when applicable	



Flush Raised

P3-D PART NUMBER CODE

P3-D X X X X X X *

Button Style
1. Flush Dome
2. Raised Dome

Terminal Style/Rating
1. Solder/Std.
2. Screw/Std.
3. Solder/Logic Level
4. Screw/Logic Level

Circuit Form
1. N.O.
2. N.C.
3. N.C. 3 Terminal
4. N.O. 3 Terminal
5. 5 Terminal
6. 2 Circuit

Operating Force/Action
1. 2.5 lbs./Momentary
2. 4.0 lbs./Momentary

Bezel Color
1. Clear
2. Black

Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple
8. Gray
9. White

* Add "W" suffix for watertight to IP68S and IP69K.

BUSHING MOUNT PUSHBUTTONS FOR OTTO B2 & B3 BASICS

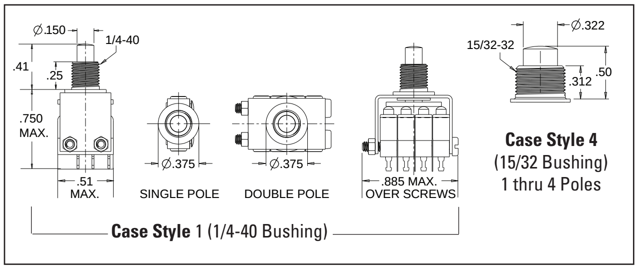
IP68S Sealed Construction

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



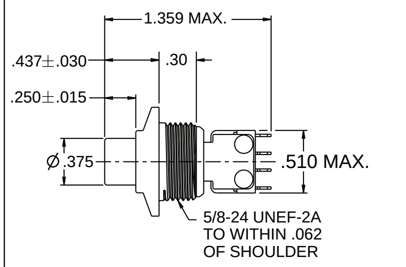
Sealed Construction

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.

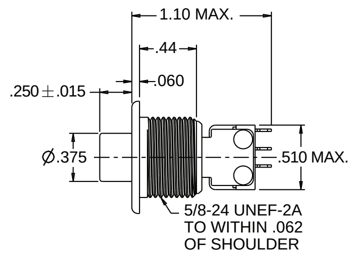
Operating Force: 4.0 lbs. max

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 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 (Momentary)		**3.** Orange
4. 15/32-32 THD		**4.** DPDT 8 Terminal			**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)

ACTUATORS FOR BASIC SWITCHES

BUSHING MOUNT PUSHBUTTONS FOR B2 & B3 BASICS

P4-10050-x

P4-10149-x

Rugged Sealed Panel

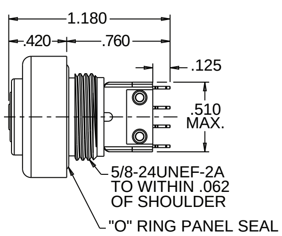
These rugged, sealed aluminum pushbutton actuators are anodized in a variety of colors. Available in one and two pole models. An O-ring provides the panel seal to keep out water and dust from the basic switches behind the panel.

Operating Force:
1 Pole: 2.5 lbs. max
2 Pole: 4.0 lbs.

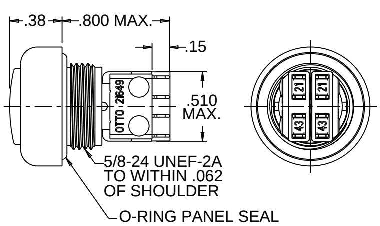
To order, please use Table A.

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

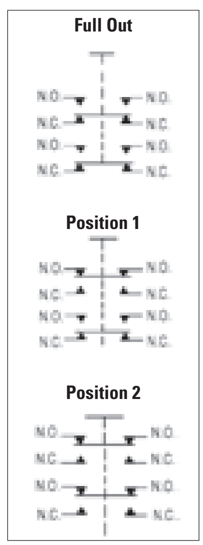
Standard Sealed TwoStep™

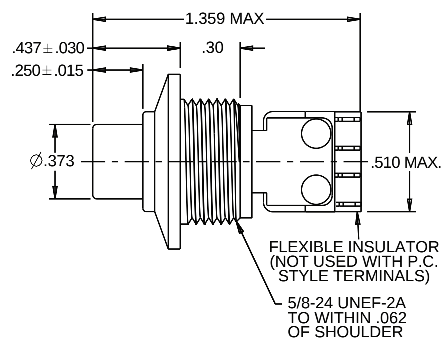
Ideal for applications requiring three modes of operation: "OFF," Level 1 and Level 2. Plunger seal is dusttight and moistureproof. Available in P1 series bezel styles C, F and H. Two pole only.

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

NOTEWORTHY PUSHBUTTON ACTUATORS

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.

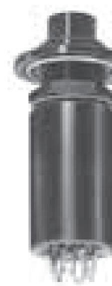
P4-10155-2

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

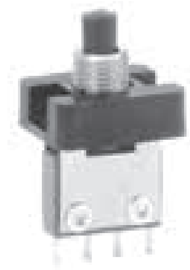
Rating: 8 amps Resistive @ 28VDC

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.

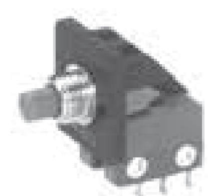
Operating Force: 24 +/- 4 oz

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.

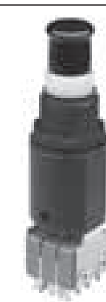
Operating Force: 3 lbs. min.

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

ALTERNATE ACTION PUSHBUTTONS

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.

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**

"Push On, Push Off" action

Standard Characteristics/Ratings:			
ELECTRICAL RATINGS:			
Load	**Sea Level @ 28VDC or 115VAC, 60/400Hz**		
Resistive	5A		
Inductive	3A		
Lamp	1A		
Motor	3A		
DWV	1000Vrms		
Logic Level	10mA @ 5VDC		
Electrical Life:	25,000 cycles at full load		
Mechanical Life:	1,000,000 cycles		
Seal:		**Military**	**Commercial**
	Unsealed	Symbol 1	Unsealed
	Dusttight	Symbol 2	IP64
	Watertight	Symbol 3	IP68S
Operating Temp Range:	-55°C to +85°C		
Operating Force:	3.0 lbs. +1/-0.5 lb.		
Total Travel:	0.180 inches max		
Overtravel:	0.012 inches min		
MATERIALS:			
Case:	Anodized aluminum alloy		
Button:	Thermoplastic		
Terminals:	Brass, silver plate or gold plate for logic level		
Terminal Hardware:	Terminal lugs, lockwasher and screw for screw terminal option		
Mounting Hardware:	Hex nut, lockwasher and panel seal on watertight switches		

P5 PART NUMBER CODE

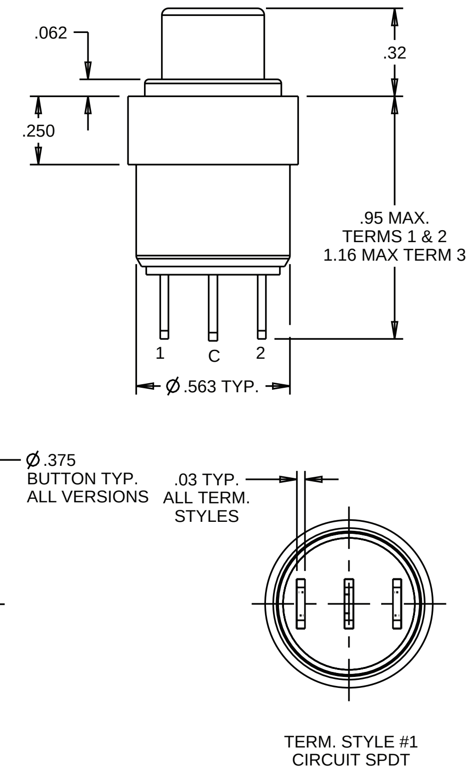
P5 – X X X X X X

Case Style	Terminal Style	Circuit Form/Contact Material/Grade	Seal Level	Bezel Color	Button Color
1. Style 1	**1.** Solder	**1.** SPST/Silver/Commercial	**1.** Unsealed	**1.** Clear	**1.** Red
3. Style 3	**2.** Screw (SPST only)	**2.** SPST/Gold/Commercial	**2.** Dusttight	**2.** Black	**2.** Black
4. Style 4	**3.** .250" Quick Connect (SPST only)	**3.** SPDT/Silver/Commercial	**3.** Watertight	**3.** Red	**3.** Orange
6. Style 6		**4.** SPDT/Gold/Commercial			**4.** Yellow
		5. SPST/Silver/Military Grade			**5.** Green
		6. SPST/Gold/Military Grade			**6.** Blue
		7. SPDT/Silver/Military Grade			**7.** Purple
		8. SPDT/Gold/Military Grade			**8.** Gray
					9. White

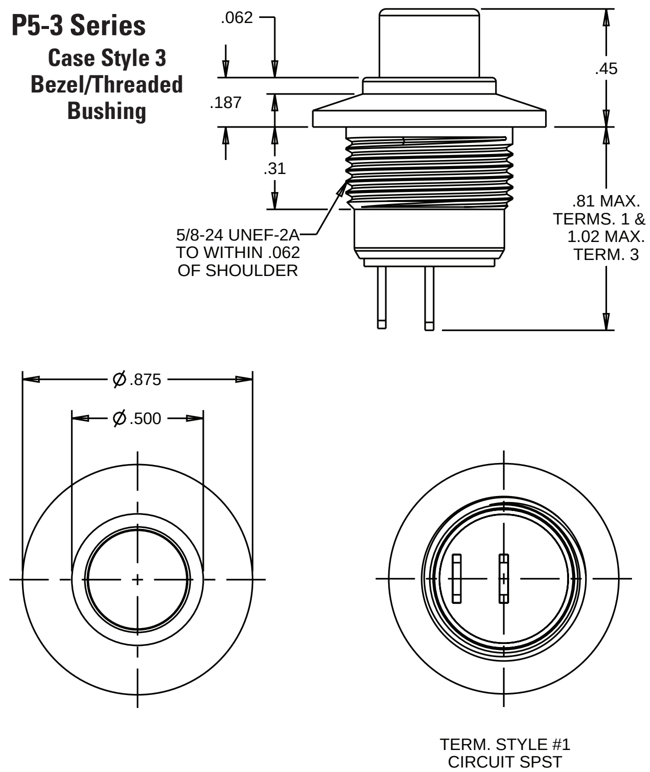
ALTERNATE ACTION PUSHBUTTONS

SEALED AGAINST DUST & MOISTURE

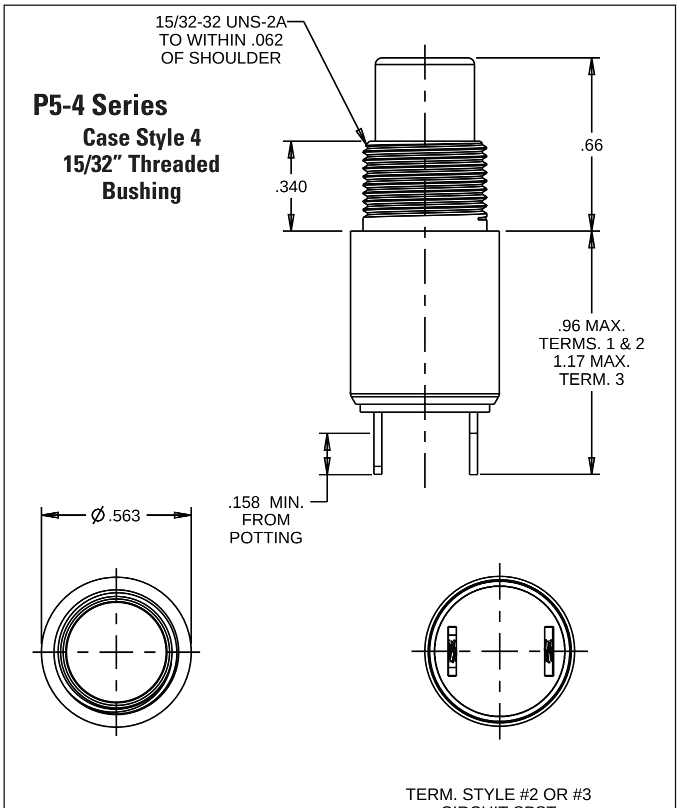
P5-1 Series
Case Style 1
Press Fit Mount



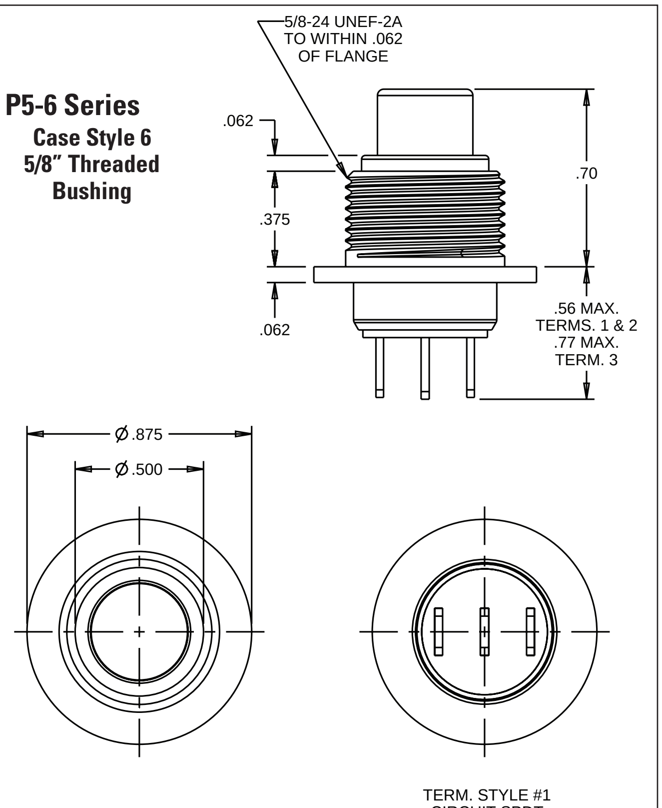
P5-3 Series
Case Style 3
Bezel/Threaded
Bushing



P5-4 Series
Case Style 4
15/32″ Threaded
Bushing



P5-6 Series
Case Style 6
5/8″ Threaded
Bushing



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.

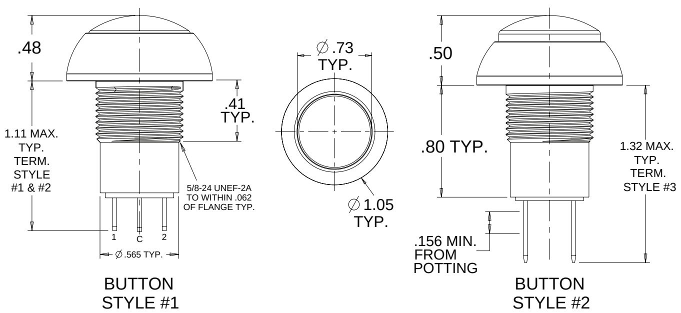
The P5-D is a quality precision, snap-action switch designed for use in panels, instruments and other demanding applications where attractive, rugged pushbutton switches are required.

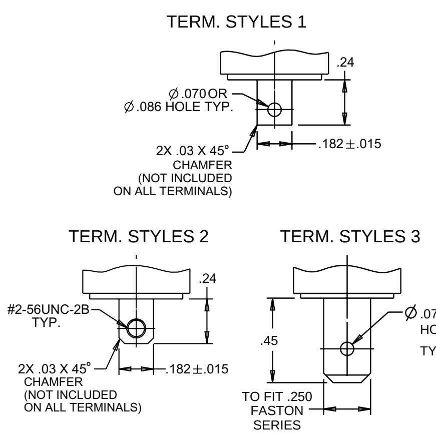
Flush Dome Button,
Also available with
Raised Dome

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**

Standard Characteristics/Ratings:			
ELECTRICAL RATINGS:			
Load	**Sea Level @ 28VDC or 115VAC**		
Resistive	5A		
Inductive	3A		
Lamp	1A		
Motor	3A		
DWV	1000Vrms		
Logic Level	10mA @ 5VDC		
Electrical Life:	25,000 cycles at full load		
Mechanical Life:	1,000,000 cycles		
Seal:		**Military**	**Commercial**
	Unsealed	Symbol 1	Unsealed
	Dusttight	Symbol 2	IP64
	Watertight	Symbol 3	IP68S
Operating Temp Range:	-40°C to +85°C		
Operating Force:	3.0 lbs. +1/-0.5 lb.		
Total Travel:	0.180 inches max		
Overtravel:	0.012 inches min		
MATERIALS:			
Case:	Anodized aluminum alloy		
Button:	Thermoplastic		
Terminals:	Brass with gold over silver		
Terminal Hardware:	Screws, lockwashers and terminal lugs for screw terminal option		
Mounting Hardware:	Hex nut, lockwasher		





P5-D PART NUMBER CODE

P5-D X X X X X X

Button Style	**Terminal Style/Rating**	**Circuits/Contacts/ Grade**	**Seal Level**	**Case Color**	**Button Color**
1. Flush	**1.** Solder	**1.** SPST/Silver/Commercial	**1.** Unsealed	**1.** Clear	**1.** Red
2. Raised	**2.** Screw ①	**2.** SPST/Gold/Commercial	**2.** Dusttight	**2.** Black	**2.** Black
	3. 0.250" Quick Connect ①	**3.** SPDT/Silver/Commercial	**3.** Watertight		**3.** Orange
		4. SPDT/Gold/Commercial			**4.** Yellow
		5. SPST/Silver/Military Grade			**5.** Green
		6. SPST/Gold/Military Grade			**6.** Blue
		7. SPDT/Silver/Military Grade			**7.** Purple
		8. SPDT/Gold/Military Grade			**8.** Gray
					9. White

① Available on SPST circuit forms only.

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.

High Profile
Flat Button

High Profile
Curved Button

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**

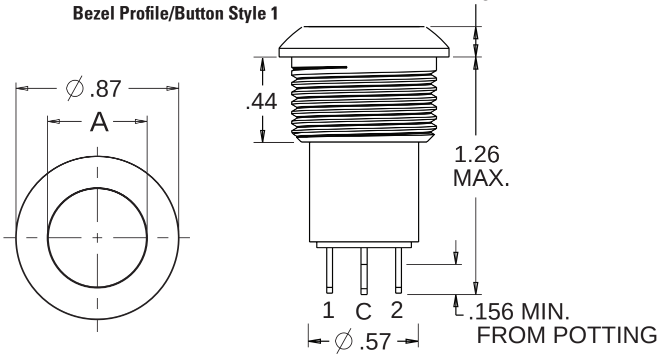
Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Sea Level @ 28VDC or 115VAC**
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DWV	1000Vrms
Logic Level	10mA @ 5VDC
Electrical Life:	25,000 cycles (1,000,000 logic level)
Mechanical Life:	1,000,000 cycles
Seal:	IP64 or IP68S and IP69K
Operating Temp Range:	-40°C to +85°C
Operating Force:	3.0 lbs. +1/-0.5 lb.
Total Travel:	0.180 inches max
Overtravel:	0.012 inches min
MATERIALS:	
Case:	Anodized aluminum alloy or stainless steel (303)
Button:	Anodized aluminum alloy or stainless steel (303)
Terminals:	Brass with gold over silver
Terminal Hardware:	Screw, lockwasher and terminal lug when applicable
Mounting Hardware:	Hex nut, lockwasher and panel seal when applicable

VANDAL RESISTANT PUSHBUTTONS

SEALED AGAINST DUST & MOISTURE

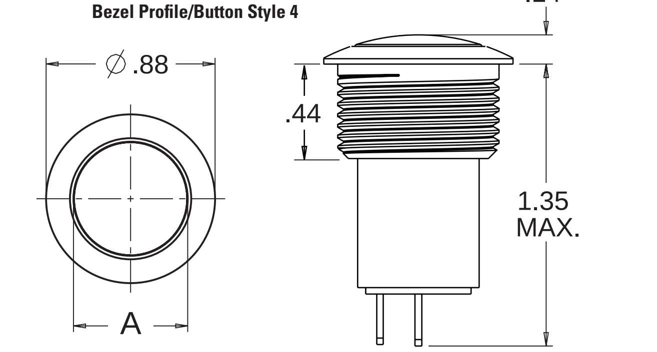
High Profile, Flat Button

Bezel Profile/Button Style 1



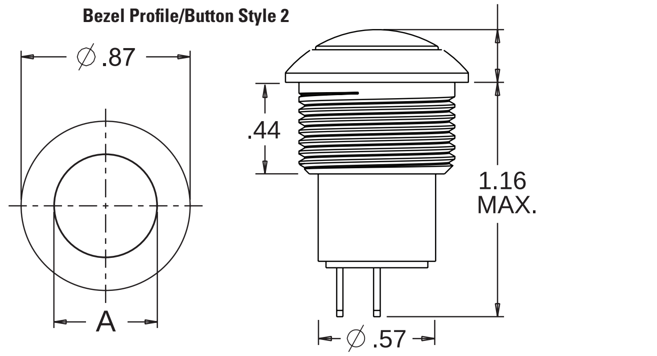
Low Profile, Curved Button

Bezel Profile/Button Style 4



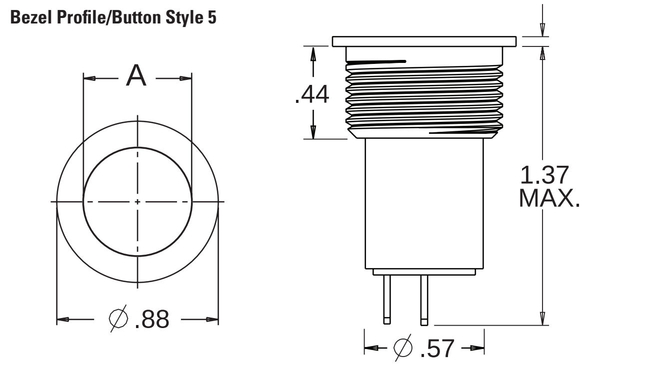
High Profile, Curved Button

Bezel Profile/Button Style 2



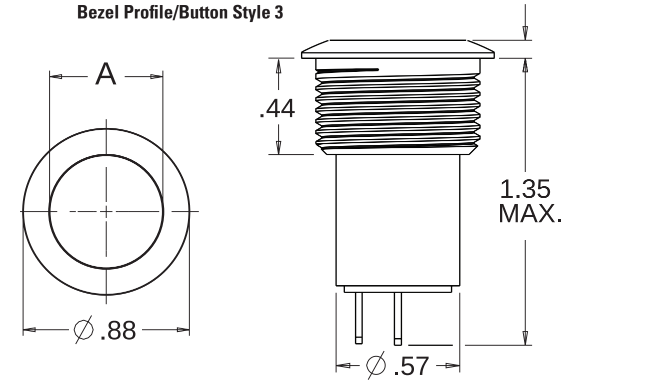
Flush Mount, Flat Button

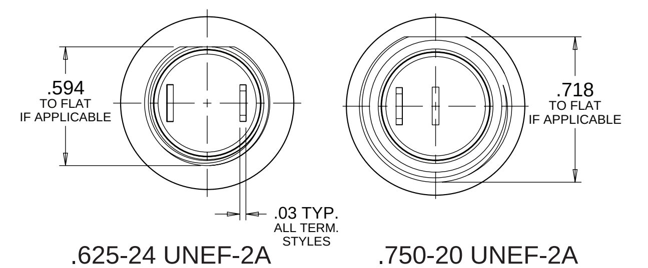
Bezel Profile/Button Style 5



Low Profile, Flat Button

Bezel Profile/Button Style 3





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	0.718

P5-V PART NUMBER CODE

P5 – X X X X X X

Type
- **V.** Stainless
- **A.** Aluminum

Thread*
- **1.** 5/8-24 & Hex Nut
- **3.** 5/8-24 W/D–Flat & Hex Nut
- **5.** 3/4-20 & Hex Nut
- **7.** 3/4-20 W/D–Flat & Hex Nut

Terminal Style/ Case Color
- **1.** Solder Terminal/Silver
- **2.** Screw Terminal/Silver ②
- **3.** Solder Terminal/Black ①
- **4.** Screw Terminal/Black ① ②

Circuit / Contacts
- **1.** SPST/Silver
- **2.** SPST/Gold
- **3.** SPDT/Silver
- **4.** SPDT/Gold

Seal
- **1.** Dusttight
- **2.** Watertight

Bezel Profile/ Button
- **1.** High Profile/Flat Button
- **2.** High Profile/Curved Button
- **3.** Low Profile/Flat Button
- **4.** Low Profile/Curved Button
- **5.** Flush Profile

***** For Knurl Nut Thread options, contact factory.
① Only Available on P5-A Styles.
② Screw terminals available on SPST circuits only.

 Specifications Subject To Change Without Notice

MINI-SIZED PER MIL-PRF-8805/110

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					

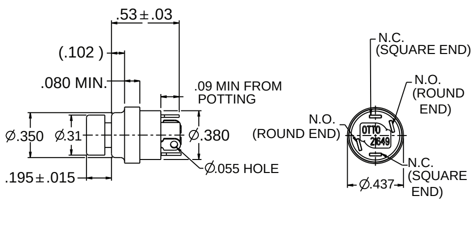
Electrical Life:	50,000 cycles full load (25,000 low level)
Mechanical Life:	2,000,000 cycles
Seal:	Moistureproof and dusttight to IP64 and MIL-PRF-8805 Design 2 or Watertight to IP68S and MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Operating Force:	1.7 +/- 0.5 lb.
Total Travel:	0.080 inches max
Overtravel:	0.010 inches min
MATERIALS:	
Case:	Anodized aluminum alloy
Button:	Thermoplastic
Terminals:	Brass with gold over silver
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, lockwasher and panel gasket when applicable

SEALED AGAINST DUST & MOISTURE, LOW LEVEL SWITCHING OPTION

P7-1 Series

Case Style 1
Press Fit Mount

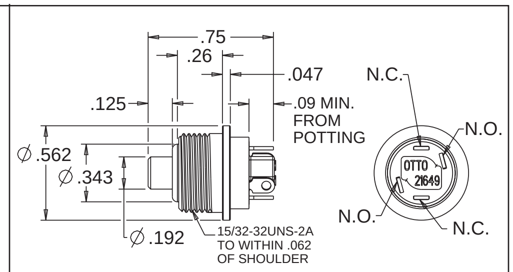
Also available with PC terminals.



P7-6 Series

Case Style 6
15/32″ Threaded Bushing

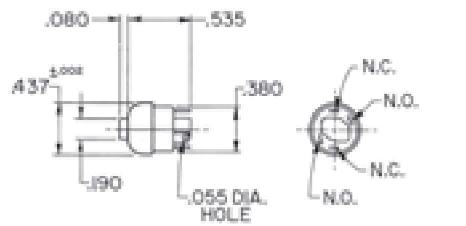
Also available with PC pins.



P7-2 Series

Case Style 2
Press Fit Mount

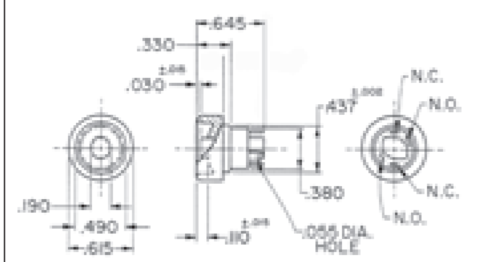
Also available with PC pins.



P7-7 Series

Case Style 7
Press Fit Mount

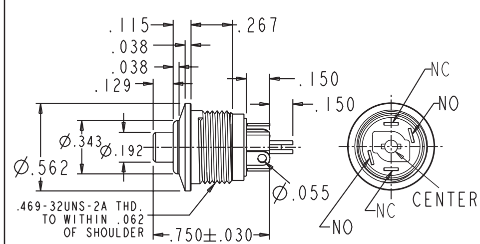
Also available with PC pins.



P7-3 Series

Case Style 3
Bezel/Threaded Bushing

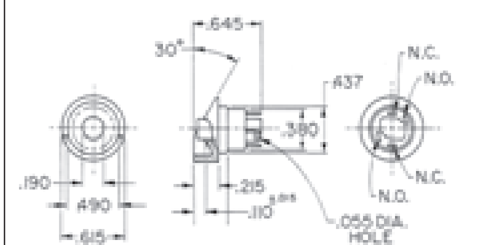
Also available with PC pins.



P7-8 Series

Case Style 8
Press Fit Mount
Guarded Button

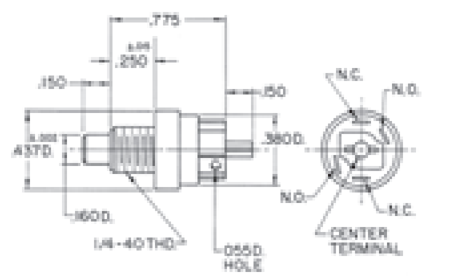
Also available with PC pins.



P7-5 Series

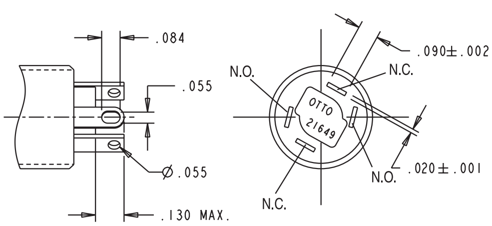
Case Style 5
1/4″ Threaded Bushing

Also available with PC pins.



Terminal Style "A" & "B"

Standard

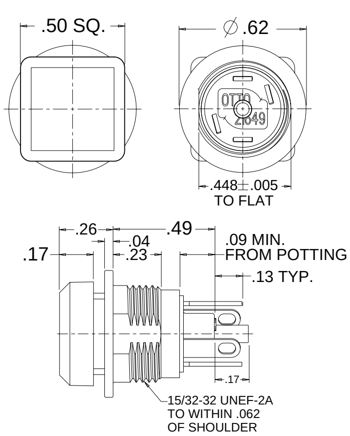


P7-A Series

Case Style A
15/32″ Threaded Bushing
Square Button Shown

Also available with PC pins and round buttons.

Round Button versions do not have a D-flat.



Important Note: 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.

P7 PART NUMBER CODE

P7 – X X X X X X

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 Commercial	**2.** N.C.	**2.** Low Level	**2.** Black/Std.	**2.** Black
3. Style 3	**1.** Solder/Military/Short	**3.** N.C. 3 Terminal		**3.** Clear/0.312 ①	**3.** Orange
5. Style 5	**2.** Solder/Commercial/Short	**4.** N.O. 3 Terminal		**4.** Black/0.312 ①	**4.** Yellow
6. Style 6	**3.** Solder/Mil. Watertight/Short	**5.** 5 Terminal		**5.** Clear/ Square .50 ②	**5.** Green
7. Style 7	**4.** PC Pin/Commercial	**6.** 2 Circuit		**6.** Black/ Square .50 ②	**6.** Blue
8. Style 8	**5.** PC Pin/Military				**7.** Purple
A. Style A	**6.** PC Pin/Mil. Watertight				**8.** Gray
	7. Solder/Com. Watertight/Short				**9.** White
	8. PC Pin/Com. Watertight				

① Not available with Case Styles 2 & 5
② Available with Case Style A only

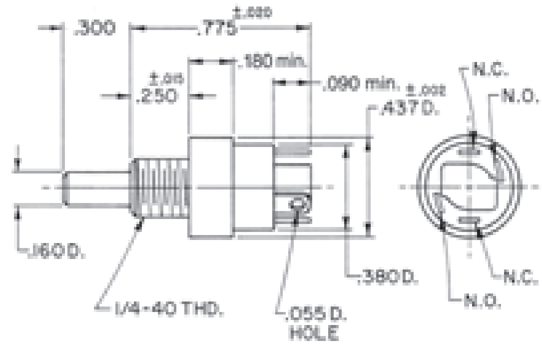
Specifications Subject To Change Without Notice

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	OTTO Part Number
Momentary	P7-500001

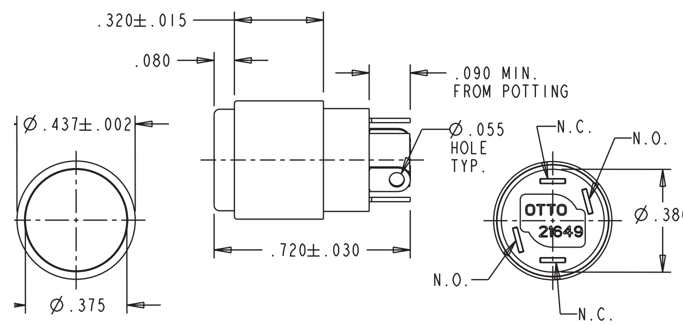


Special Large Button, Press Fit

Available with a 0.375” dia. button with three color options.

Color	OTTO Part Number
Red	P7-900001
Black	P7-900002
White	P7-900009

Contact factory for additional button color options.



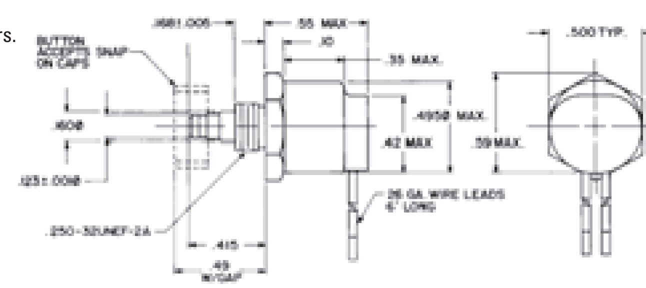
Special Snap-On Button, Wire Leads

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

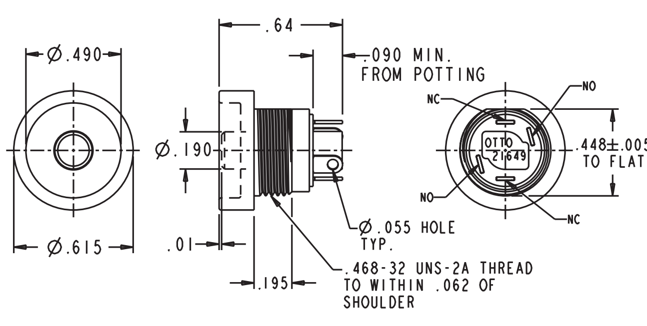
Contact factory for additional button color options.



Mini Pushbutton, Shrouded

This shrouded pushbutton is designed to reduce the chance of inadvertant actuation. Button size is .19”. Enclosure design is watertight per IP68S.

Actuation	OTTO Part Number
Momentary	P7-900196



SEALED DOME PUSHBUTTONS

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.

Raised Dome Button

Flush Dome Button

Raised Matte Square Button

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:		
ELECTRICAL RATINGS:	**Sea Level @ 28VDC or 115VAC, 60/400Hz**	
Load	**N.O./N.C.**	**Life Cycles**
Resistive	1A	50,000
Resistive	5A	50,000
Inductive	3A	50,000
DWV	1050Vrms	
Logic Level	10mA @ 5VDC	2,000,000
Mechanical Life:	2,000,000 cycles	
Seal:	IP64, MIL-PRF-8805 Design 2, IP68S or MIL-PRF-8805 Design 3	
Operating Temp Range:	-55°C to +85°C	
Operating Force:	1.7 +/- 0.5 lb. (standard force)	
Total Travel:	0.080 inches max	
MATERIALS:		
Case:	Anodized aluminum alloy	
Button:	Thermoplastic	
Contacts:	Brass with gold over silver	
Terminal Hardware:	None provided	
Mounting Hardware:	Hex nut, lockwasher and panel seal on watertight versions	

P7-D PART NUMBER CODE

P7-D X X X X X X

Button Style
F. Flush Round Gloss
2. Flush Round Matte
R. Raised Round Gloss
4. Raised Round Matte
5. Raised Square Matte

Terminal Style/ Construction Grade
A. Std. Commercial Solder
B. Std. Watertight Commercial Solder
1. Solder/Military/Short
2. Solder/Commercial/Short
3. Solder/Mil. Watertight/Short
4. PC Pin/Commercial
5. PC Pin/Military
6. PC Pin/Mil. Watertight
7. Solder/Com. Watertight/Short
8. PC Pin/Com. Watertight

Circuit Form
1. N.O.
2. N.C.
3. N.C. 3 Terminal
4. N.O. 3 Terminal
5. 5 Terminal
6. 2 Circuit

Contact Rating
1. Standard
2. Logic Level

Bezel Color
1. Clear
2. Black

Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple
8. Gray
9. White

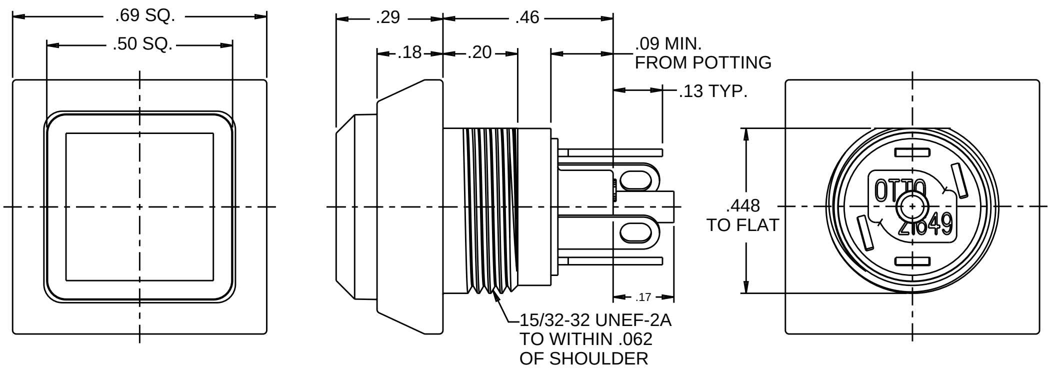
 Specifications Subject To Change Without Notice

SEALED DOME PUSHBUTTONS

MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

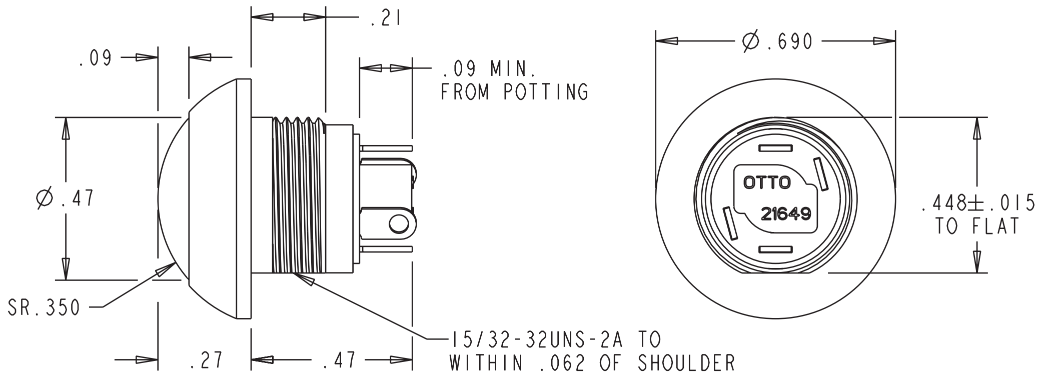
P7-D5A Series

Commercial Grade
Solder Terminals
Square Button



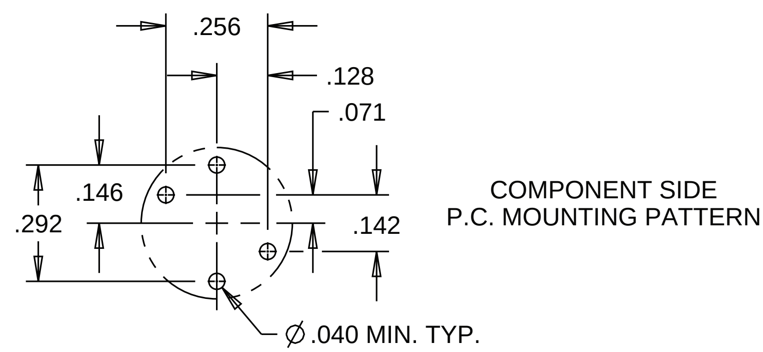
P7-DF1 Series

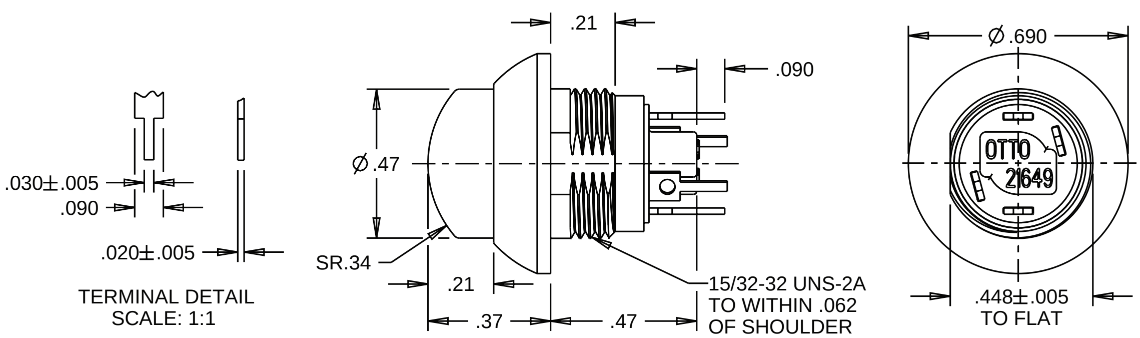
Military Grade
Short Solder Terminals
Round Flush Button



P7-DR6 Series

Military Grade
P.C. Pin Terminals
Round Raised Button





PUSHBUTTON SWITCHES

COMPACT PUSHBUTTONS

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.

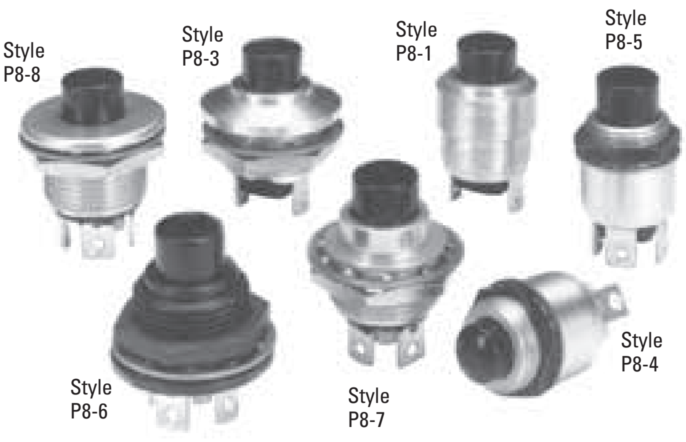
On sealed models, a silicone boot operating on our patented "rolling sleeve" principle protects the contact area against contamination at the button area. This boot provides long life and smooth operation over a wide temperature range. Sealed terminals protect the contact area from hostile environments 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:

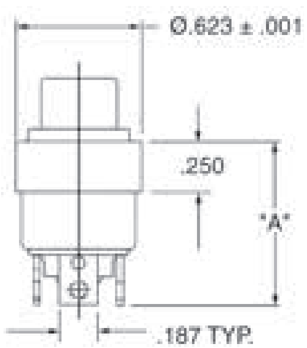
- **Shorter behind panel depth than OTTO's P1/P3**
- **Patented "rolling sleeve" button seal**
- **Contact area sealed at button & terminals**
- **Positive tactile feedback**
- **Variety of mounting styles**
- **Variety of button lengths & shapes**
- **Engraved buttons & bezels available**
- **Mechanical life 1 million cycles**
- **UL recognized**
- **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

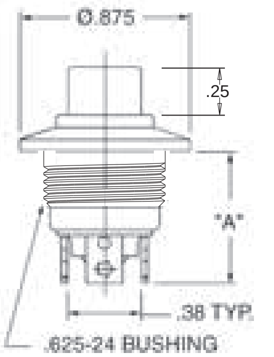
MOMENTARY OR PUSH-PULL ACTION, SHORTER BEHIND PANEL, SUBMINIATURE DOUBLE BREAK

P8-1, Style A Bezel
Press Fit Bushing
Flat Button Shape Shown
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"



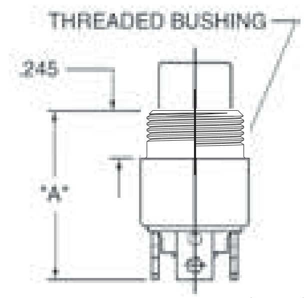
Terminal Styles	"A" (inches)
1, 2, 4 & 5	0.808
3 & 6	0.922

P8-3, Style C Bezel
0.625-24 Bushing
Flat Button Shape Shown
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"



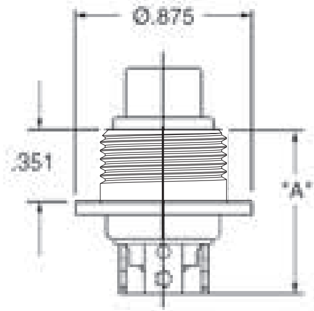
Terminal Styles	"A" (inches)
1, 2, 4 & 5	0.683
3 & 6	0.797

Small Bushing
P8-4: 0.500-32 Bushing
P8-5: 0.469-32 Bushing
Flat Button Shape Shown
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"



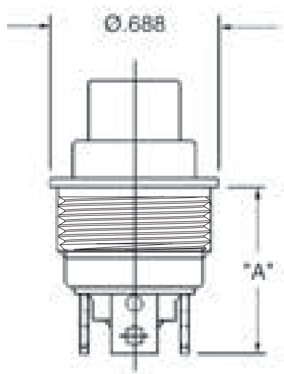
Model	Terminal Styles	"A" (inches)
P8-4	1, 2, 4 & 5	0.870
	3 & 6	0.984
P8-5	1, 2, 4 & 5	1.097
	3 & 6	1.211

P8-6, Style F Bezel
0.625-24 Bushing
Flat Button Shape Shown
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"



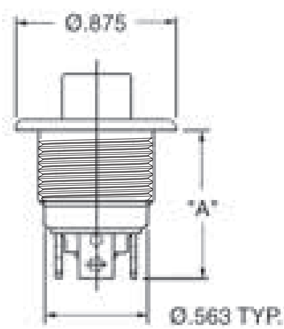
Terminal Styles	"A" (inches)
1, 2, 4 & 5	0.808
3 & 6	0.922

P8-7, Style G Bezel
0.625-24 Bushing
Flat Button Shape Shown
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"



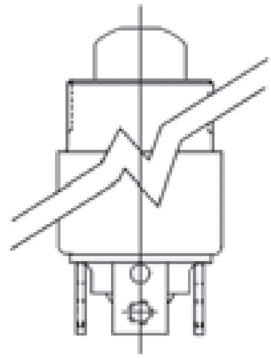
Terminal Styles	"A" (inches)
1, 2, 4 & 5	0.683
3 & 6	0.797

P8-8, Style H Bezel
0.625-24 Bushing
Flat Button Shape Shown
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"

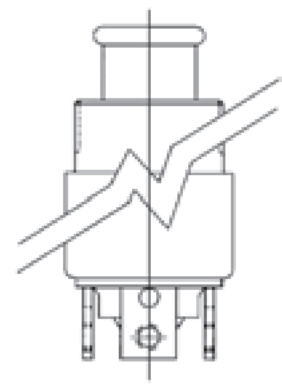


Terminal Styles	"A" (inches)
1, 2, 4 & 5	0.810
3 & 6	0.924

Dome
Button Shape
Specify Dia.: 0.312" or 0.375"
Height: 0.187" or 0.250"



Push-Pull
Button Shape
Available as Button Style P only.



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

P8 – X X X X X X X

Bezel Style	Terminal Style/ Case Color	Circuit Form	Current Rating Level/ Seal Type	Operating Force/Action	Button Color	Button Diameter/ Length/Shape ②
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.

VANDAL RESISTANT PUSHBUTTONS

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**
- **UL1500 ignition protected**
- **RoHS compliant**

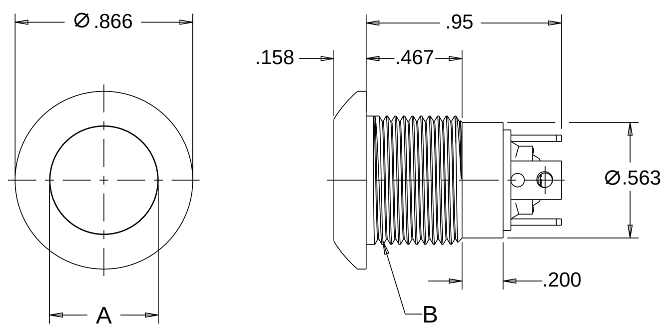
Flush Mount,
5/8” Thread Shown

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:	IP64 or IP68S and IP69K
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
Movement Differential:	0.015 inches min
MATERIALS:	
Case:	Anodized aluminum alloy or stainless steel (303)
Button:	Anodized aluminum alloy or stainless steel (303)
Terminals:	Standard silver plate or optional gold plate for logic level applications
Terminal Hardware:	Terminal lugs, screws and lockwasher when applicable
Mounting Hardware:	Hex nut, lockwasher and panel seal gasket when applicable

MOMENTARY ACTION, SHORTER BEHIND PANEL, SUBMINIATURE DOUBLE BREAK, SNAP-ACTION

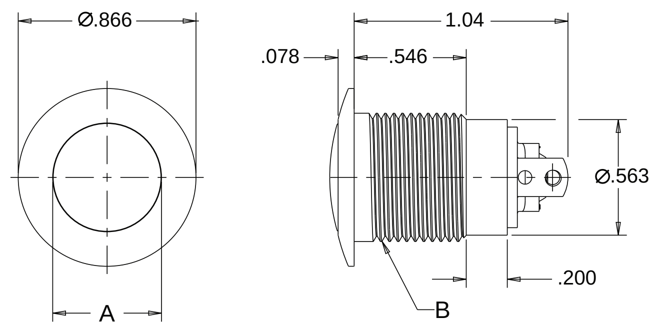
High Profile, with Flat Button

Style 1



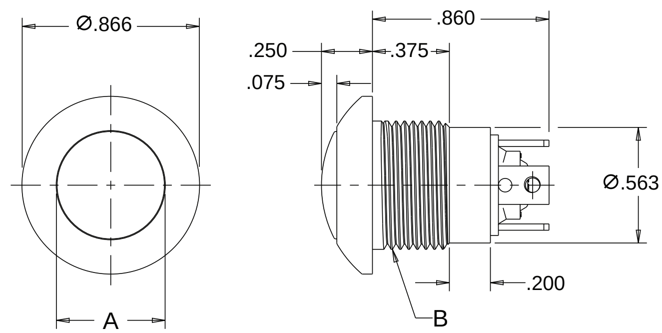
Low Profile, with Curved Button

Style 4



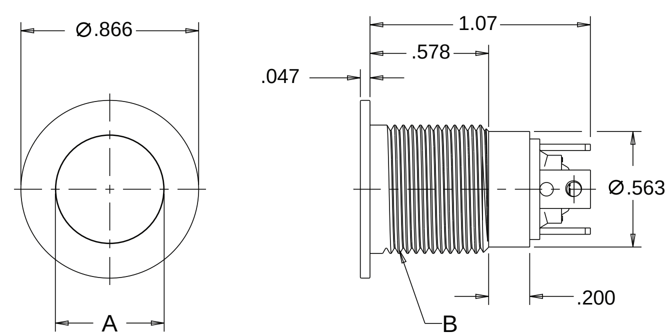
High Profile, with Curved Button

Style 2



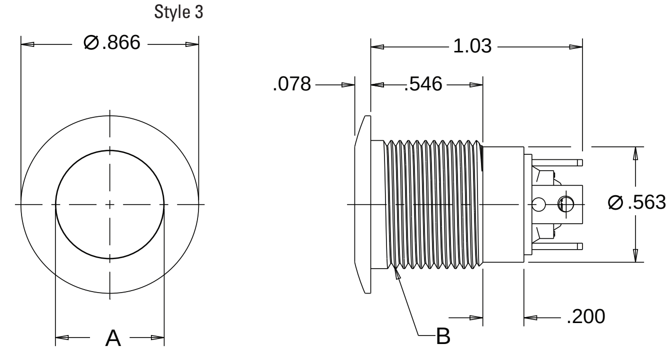
Flush Mount

Style 5



Low Profile, with Flat Button

Style 3



	Case Style	
Dimension	**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

V. Vandal Resistant (SS Case & Button)
A. Security Level (AL Case & Button)

Case Style & Mounting*

1. 5/8-24 & Hex Nut
3. 5/8-24 W/D–Flat & Hex Nut
5. 3/4-20 & Hex Nut
7. 3/4-20 W/D–Flat & Hex Nut

Terminal Style/ Case Color

1. Solder Terminal/Silver
2. Screw Terminal/Silver
3. Faston Terminal/Silver ②③
4. Solder Terminal/Black ①
5. Screw Terminal/Black ①
6. Faston Terminal/Black ①②③

Circuit Form

1. N.O.
2. N.C.
6. 2 Circuit

Current Rating/Seal

2. Std./Splashproof
3. Std./Watertight
4. Logic Level/Splashproof
5. Logic Level/Watertight

Operating Force

1. 2.5 lbs.
2. 4.0 lbs.

Button Profile

1. High Profile/Flat Button
2. High Profile/Curved Button
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

SEALED DOME PUSHBUTTON SWITCHES

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.

Raised Dome with Threaded Case

Flush Dome with Threaded Case

Small Bezel Option

Raised Dome with Snap-In Case and 0.110" Quick Connect Terminals

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:

ELECTRICAL RATINGS:

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

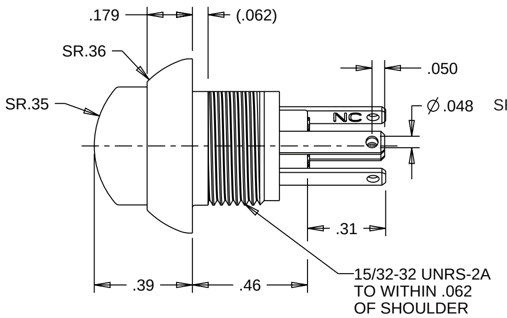
Mechanical Life:	1,250,000 cycles
Seal:	IP64 or IP68S and IP69K
Operating Temp Range:	-40°C to +85°C
Operating Force:	Standard: 1.7 lbs. +/- 0.5 lb. Low Force: 12 oz +/- 4 oz
Total Travel:	0.080 inches max
Overtravel:	0.010 inches min

MATERIALS:

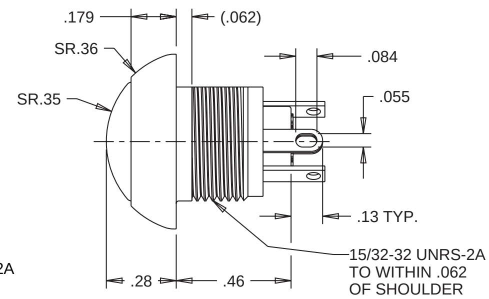
Case:	Thermoplastic
Button:	Thermoplastic
Terminals:	Brass with gold
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, lockwasher Panel gasket when applicable

SEALED DOME PUSHBUTTON SWITCHES

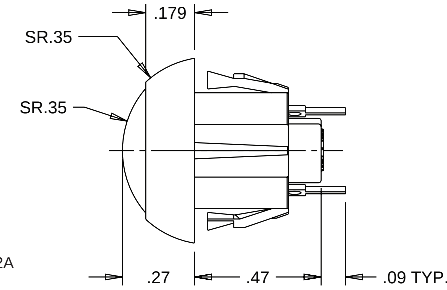
CHOICE OF SNAP-ACTION & SHORTING BAR ACTION



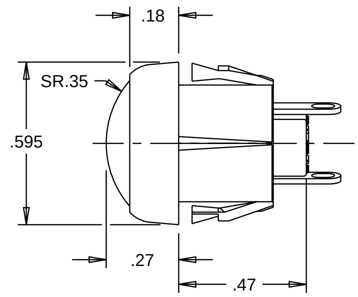
Raised Dome Button Style



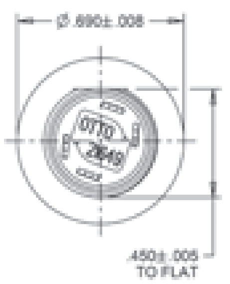
Flush Dome Button Style



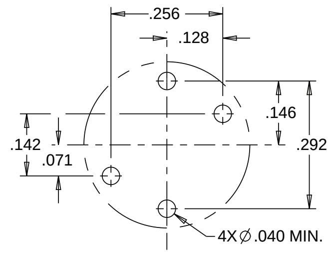
Snap-In Case
(PC Terminals Shown)



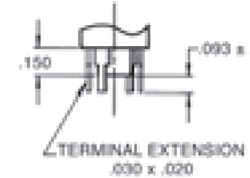
Flush Dome Small Bezel Style

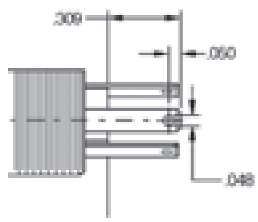


Threaded Case Terminal Detail

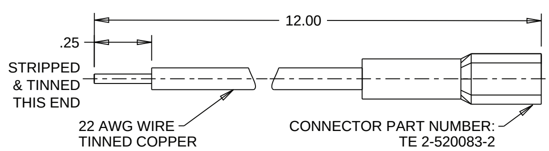


Component Side
P.C. Mounting Pattern
(As viewed from switch bottom)





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

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.

P9 PART NUMBER CODE

P9 – X X X X X X *

Button & Case Style**	Terminal Style	Circuit Form	Switch Action	Case/ Bezel Color	Button Color
1. Flush Dome & Threaded Case, Std. Finish	**1.** Solder	**1.** N.O.	**1.** Standard Snap-Action	**1.** Red	**1.** Red
2. Raised Dome & Threaded Case, Std. Finish	**2.** PC Pin	**2.** N.C. ③	**2.** Low Force Snap-Action	**2.** Black	**2.** Black
3. Flush Dome & Snap-In Case, Std. Finish	**3.** 0.110" Quick Connect (QC)	**3.** 2 Circuit ③	**3.** Non-Snap Shorting Bar	**3.** Orange***	**3.** Orange
4. Raised Dome & Snap-In Case, Std. Finish	**4.** 0.110" QC with 2 Wire Leads ①			**4.** Yellow***	**4.** Yellow
5. Flush Dome & Threaded Case, Matte Finish	**5.** 0.110" QC with 4 Wire Leads ②			**5.** Green***	**5.** Green
6. Raised Dome & Threaded Case, Matte Finish				**6.** Blue***	**6.** Blue
7. Flush Dome & Snap-In Case, Matte Finish				**7.** Violet***	**7.** Violet
8. Raised Dome & Snap-In Case, Matte Finish				**8.** Gray***	**8.** Gray
9. Flush Dome & Snap-In Case, Std. Finish, Small Bezel				**9.** White	**9.** White
A. Raised Dome & Snap-In Case, Std. Finish, Small Bezel					

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.

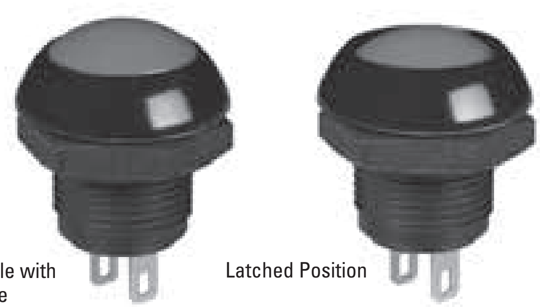
LATCHING PUSHBUTTON

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.



Flush Dome
Also available with
Raised Dome

Latched Position

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		

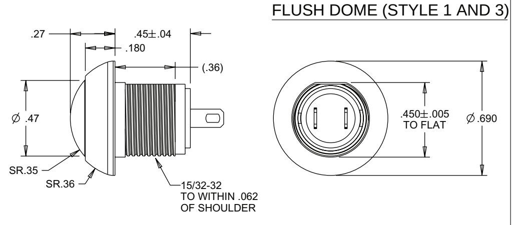
Electrical Life:	See Rating Chart
Mechanical Life:	200,000 cycles
Seal:	IP68S
Operating Temp Range:	-40°C to +85°C
Operating Force:	12+/-6 ounces
Total Travel:	.071+/-.015 inches
Contact Resistance:	0.050 Ω max. initial
Insulation Resistance:	1 GΩ min. at 500 VDC

MATERIALS:

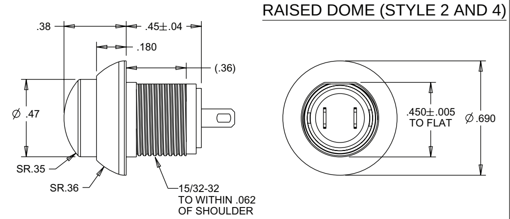
Case:	Thermoplastic
Button:	Thermoplastic
Contacts:	Silver with gold
Mounting Hardware:	Hex nut, lockwasher and panel seal

BUTTON & CASE OPTIONS

FLUSH DOME (STYLE 1 AND 3)



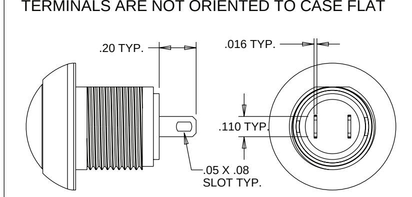
RAISED DOME (STYLE 2 AND 4)



TERMINAL OPTIONS

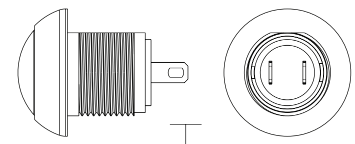
SOLDER

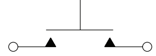
TERMINALS ARE NOT ORIENTED TO CASE FLAT



CIRCUIT OPTIONS

NORMALLY OPEN





SPST-NO-DB
SCHEMATIC

P9M PART NUMBER CODE

P9M – X X X X X X

Button Style	Case Style	Case Finish	Terminal Style	Case Color	Button Color
1. Flush Dome with Standard Gloss Finish	**1.** Threaded 15/32-32	**1.** Gloss Finish	**1.** Solder	**2.** Black	**1.** Red
2. Raised Dome with Standard Gloss Finish		**2.** Matte Finish			**2.** Black
3. Flush Dome with Matte Finish					**3.** Orange
4. Raised Dome with Matte Finish					**4.** Yellow
					5. Green
					6. Blue
					7. Violet
					8. Gray
					9. White

PUSHBUTTONS PER MIL-PRF-8805/96

MOMENTARY ACTION NORMALLY OPEN OR NORMALLY CLOSED

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

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**

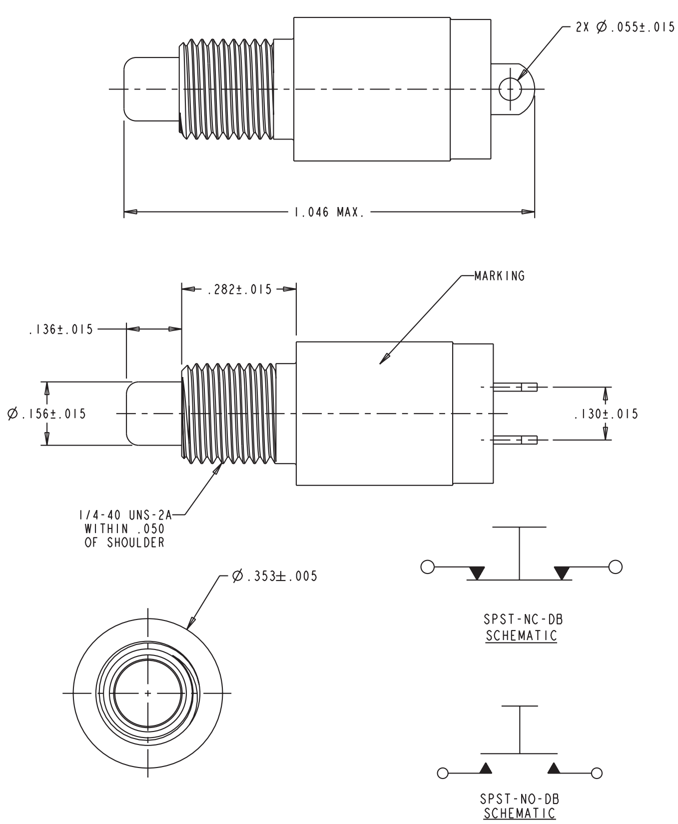
Momentary, Normally Open

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	BLACY

PE-1 Series Shown



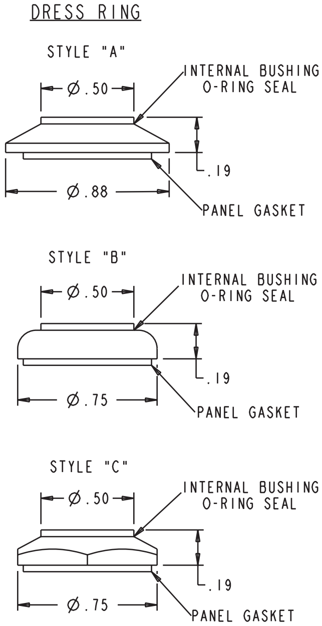
PUSHBUTTONS PER MIL-PRF-8805/99

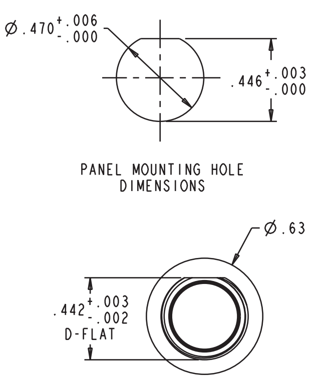
MOMENTARY ACTION

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:

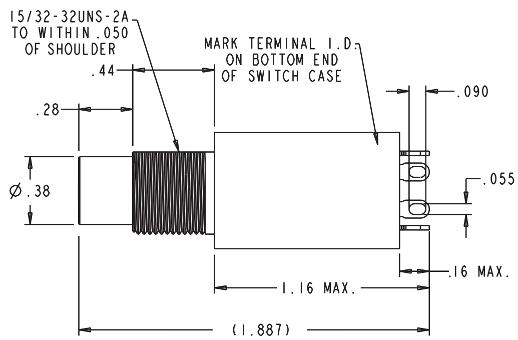
- **MIL-PRF-8805/99 qualified**
- **Momentary snap-action**
- **Black, white or red button colors available**
- **Splashproof**
- **RoHS compliant**

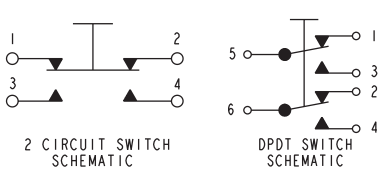


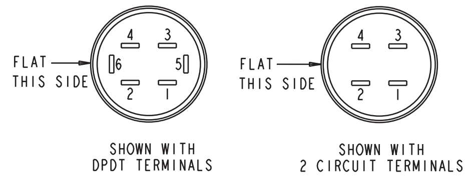


Standard Characteristics/Ratings:

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
DWV	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

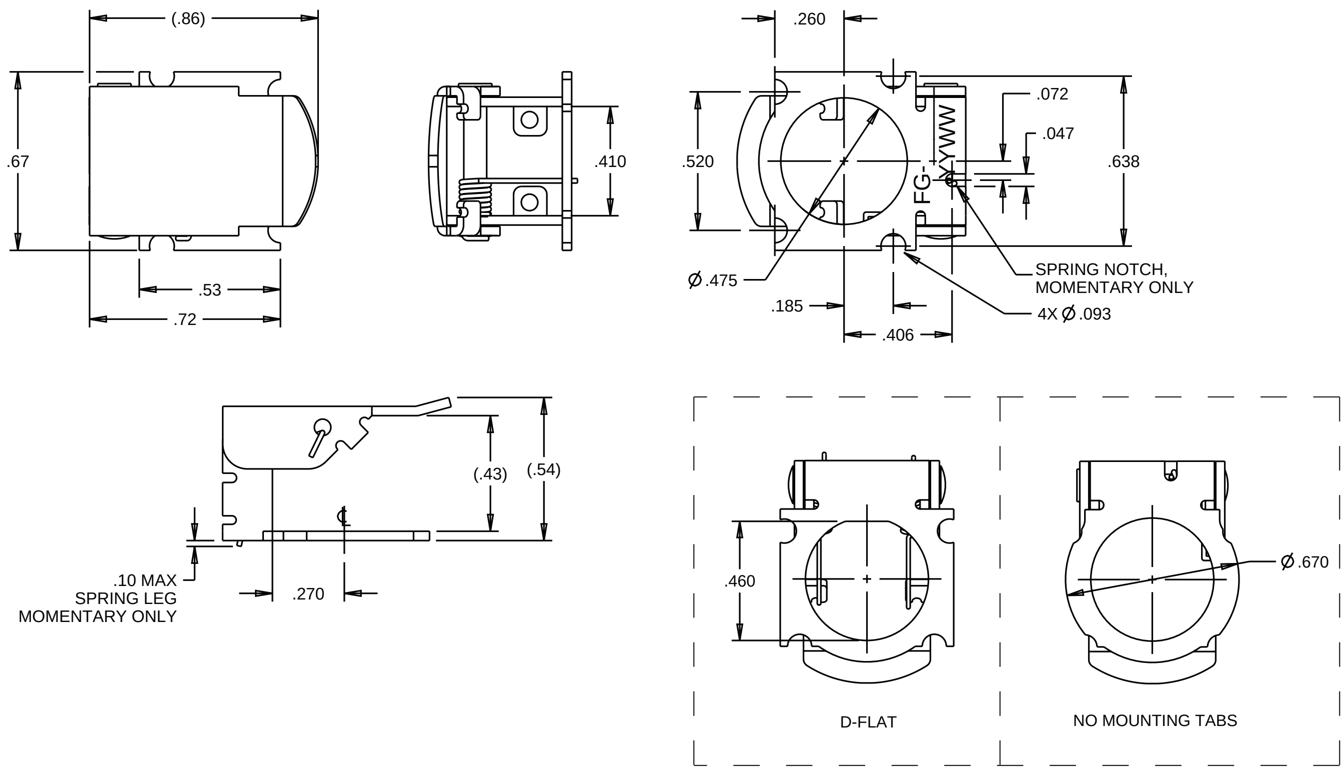
PE2 – X X X X X

Dress Ring	Switch Action	Circuit Type	Button Color	Terminal Type
1. Style A	**1.** Momentary	**1.** 2 Circuit	**1.** Red	**1.** Solder Lug
2. Style B		**2.** DPDT	**2.** Black	
3. Style C			**3.** White	

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

FG – X X X X X X

Actuation	Cover	Label	Base Style	Orientation	Flip Guard Color
1. Maintained	**1.** Flat	**1.** None	**1.** Mounting Tabs	**1.** None	**1.** Red
2. Momentary			**2.** No Mounting Tabs	**2.** D-Flat	**2.** Black

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), (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, DPTT
K2	Sealed, Illuminated Double Pole	16A	IP68S & IP69K	UL (E61705), (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	20mA	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

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.

K1 Series
Single Pole

K2 Series
Single & Double Pole

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**
- **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:			
Case:	Thermoplastic		
Button:	Thermoplastic		
Base:	Thermoplastic		
Terminals/Contact:	Brass, silver alloy with silver plate, gold flash for logic level		
Terminal Hardware:	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		
Mounting Hardware:	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

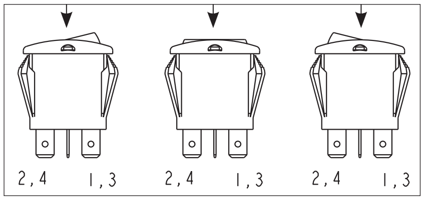
Actuator Color/Style
- **A.** Red/Rocker
- **B.** Black/Rocker
- **C.** White/Rocker
- **D.** Red/Paddle
- **E.** Black/Paddle
- **F.** White/Paddle
- **G.** Red/Rocker Pinned
- **H.** Black/Rocker Pinned
- **J.** White/Rocker Pinned
- **K.** Red/Short Paddle Pinned
- **L.** Black/Short Paddle Pinned
- **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.

Position "A" **Position "B"** **Position "C"**



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

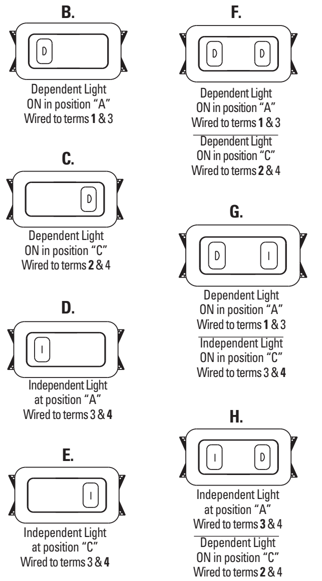
K1 Continued X X X X

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

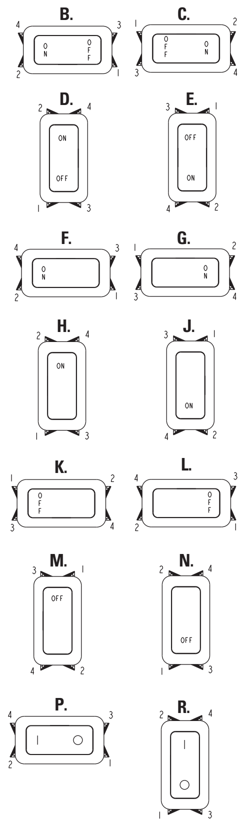


D = Dependent Light
I = Independent Light

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.

Legend & Orientation

A. None

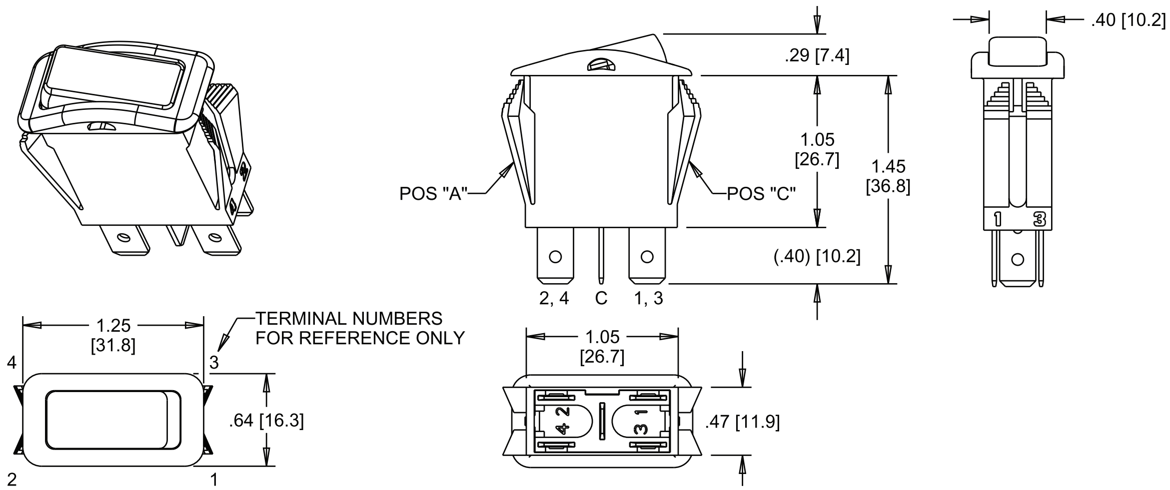


NOTES:
- No momentary switches with dependent lights.
- Neon lamps only to be coded with clear or amber lenses.
- LED lenses must be clear or same color as LED.
- No dependent light in OFF position.
- All legends printed on actuators without lens(es) will be white except actuator codes C, F, J, M & R.
- All legends printed on lenses will be white except on clear lens(es) will be black.

- **K1 panel plugs available as shown in Panel Plugs (PP) section.**

SEALED, ILLUMINATED ROCKER SWITCHES

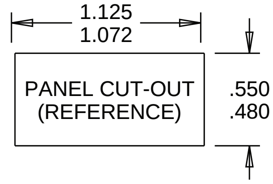
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS



PANEL THICKNESS AND MOUNTING OPENING GUIDELINES:

PANEL THICKNESS RANGE OF .025 - .105
(GASKET RECOMMENDED)

PANEL THICKNESS RANGE OF .105 - .187
(GASKET NOT REQUIRED)

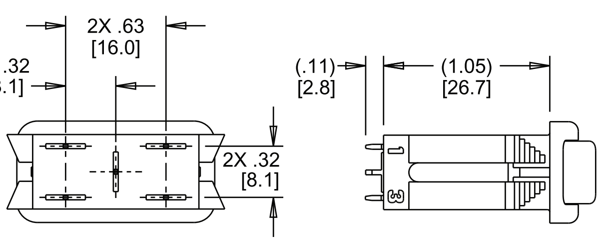


OPTIONAL PANEL GASKET:

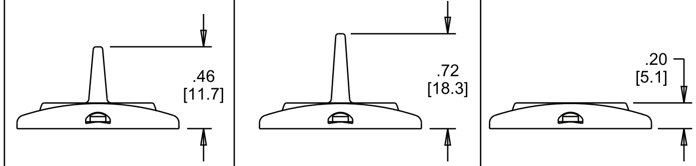
0.062" THICKNESS = P/N C807039-25-1

0.031" THICKNESS = P/N C807039-25-2

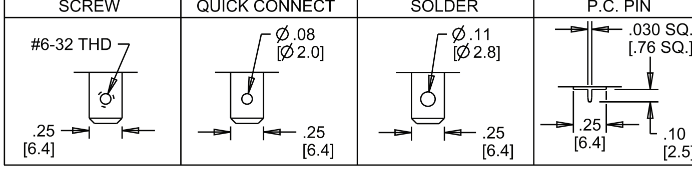
P.C. PIN LAYOUT



PADDLE STYLES



TERMINAL STYLES (.032 [.81] THICK)



K1 AND T71 CONNECTOR PART NUMBER CODE

C405041 - XX XXXX

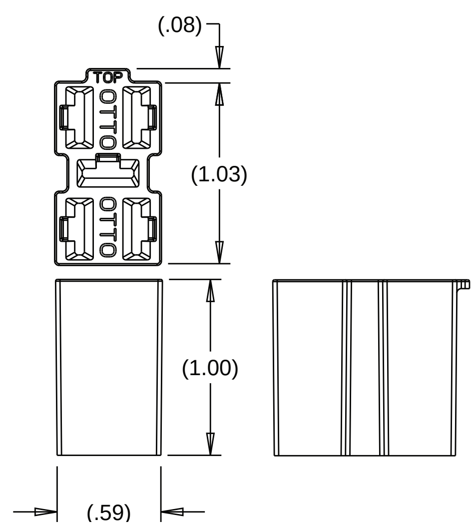
Connector Color

- **01.** Red
- **02.** Black
- **03.** Orange*
- **04.** Yellow*
- **05.** Green*
- **06.** Blue*
- **07.** Violet*
- **08.** Gray*
- **09.** White

* Contact Factory

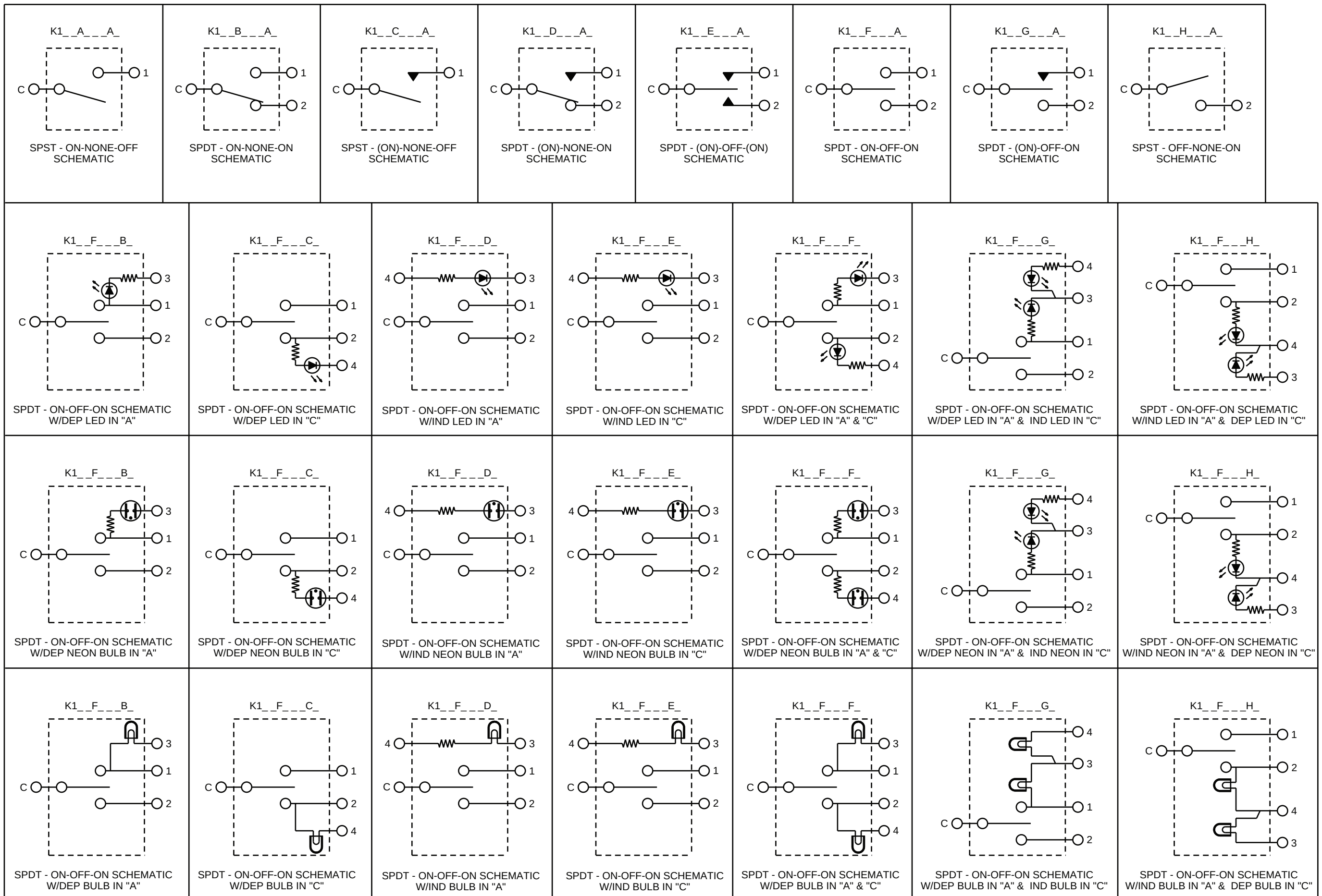
Packaging Quantity

- **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



GENERAL SCHEMATIC INFORMATION

INDICATES MAINTAIN ACTION (FIXED POSITION)

INDICATES MOMENTARY ACTION (AUTOMATIC RETURN POSITION)

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.**

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

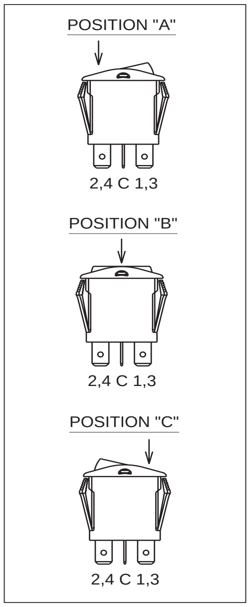
Actuator Color/Style

- **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

Lens Color

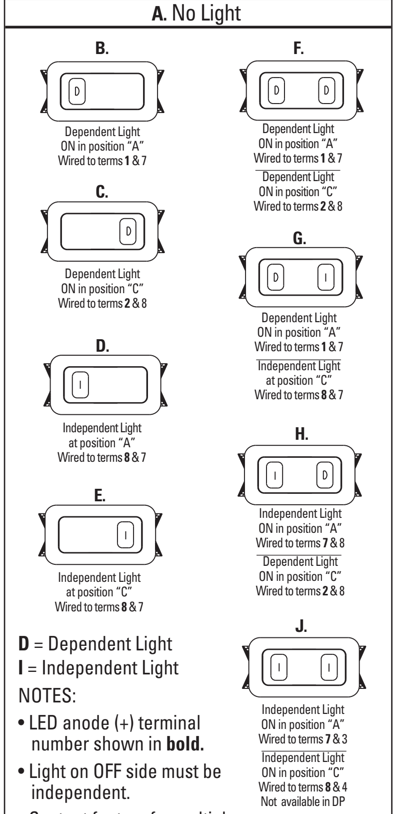
Position "A"	Position "C"
A. No Lens	**A.** No Lens
B. Red	**B.** Red
C. Green	**C.** Green
D. Amber	**D.** Amber
E. Clear	**E.** Clear

***See appendix for complete voltage/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.
- **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.**

Light/Circuit Location

A. No Light

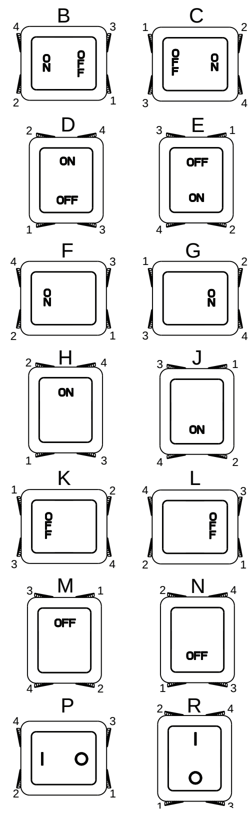


D = Dependent Light
I = Independent Light

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.

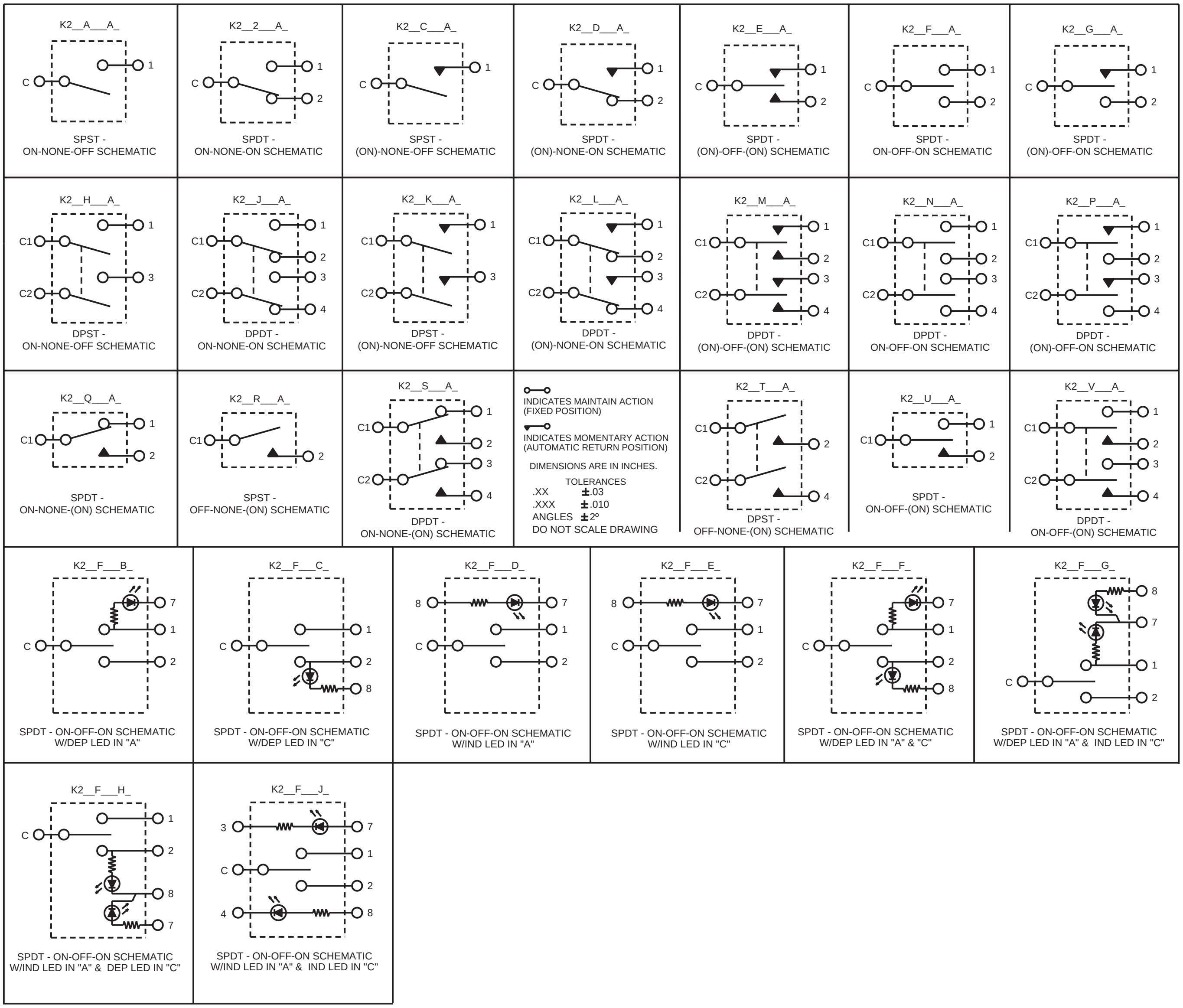
Legend & Orientation

A. None



SEALED, ILLUMINATED ROCKER SWITCHES

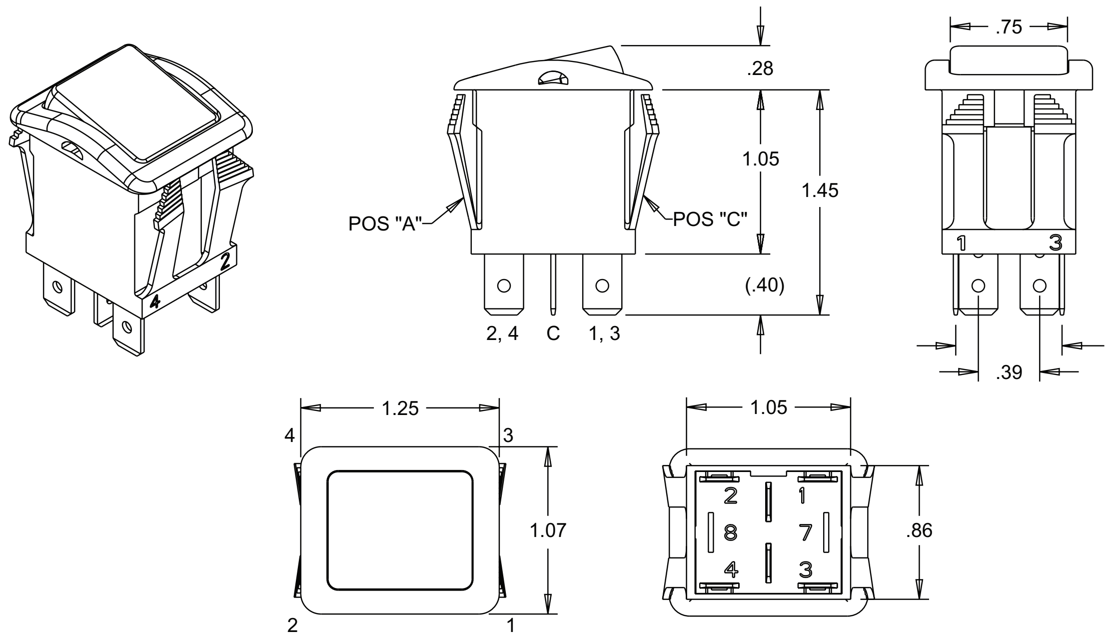
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES



Specifications Subject To Change Without Notice

SEALED, ILLUMINATED ROCKER SWITCHES

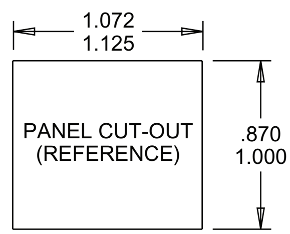
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES



PANEL THICKNESS AND MOUNTING OPENING GUIDELINES:

PANEL THICKNESS RANGE OF .025 - .105
(GASKET RECOMMENDED)

PANEL THICKNESS RANGE OF .105 - .187
(GASKET NOT REQUIRED)

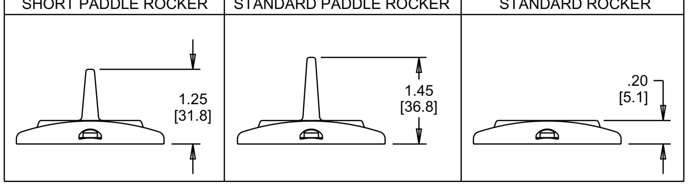


OPTIONAL PANEL GASKET:

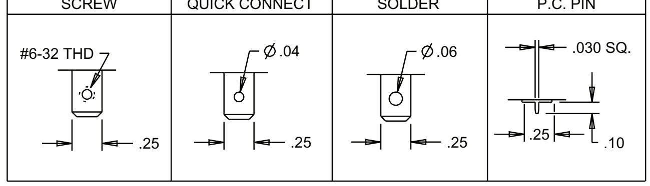
0.062” THICKNESS = P/N C807038-25-1

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

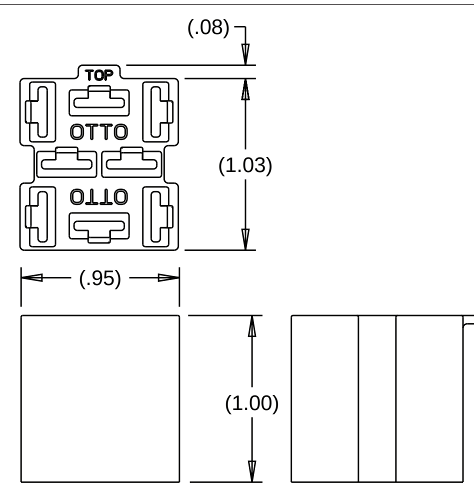
Connector Color

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



HIGH CYCLE LIFE, SEALED ROCKER SWITCHES

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.


Standard Rocker Top View

Larger Rocker with FNR Legend


Standard Rocker Side Front View

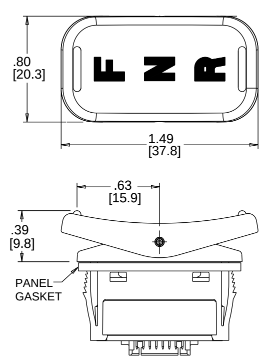


Optional Rubber Boots in Clear and Black

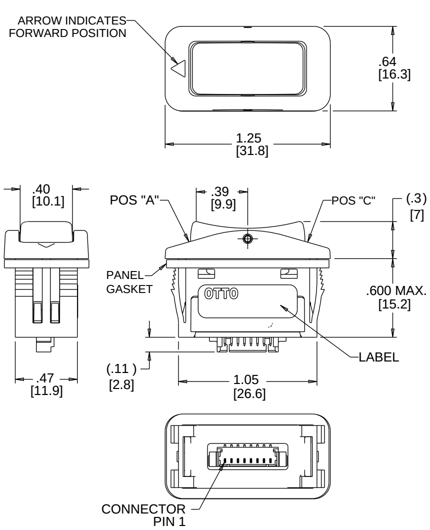
Features:

- **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**

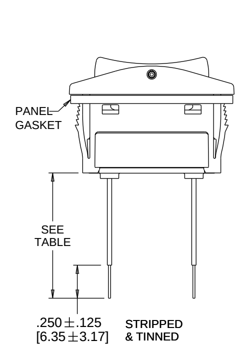
Standard Characteristics/Ratings:	
ELECTRICAL:	
Electrical Ratings:	10mA @ 5VDC max. Logic Level
Electrical Life:	1,000,000 cycles
Max Power:	0.5 VA
Max Voltage:	32VDC
Min Voltage:	20mV
Max Current:	50mA
Min Current:	1mA
DWV:	250 Vrms
MECHANICAL:	
Mechanical Life:	1,000,000 cycles
Switch Contact Seal:	IP68S (Panel Seal IP68S with Optional Boot)
ENVIRONMENTAL:	
Temperature Range:	-40°C to +85°C
MATERIALS:	
Base:	Black Thermoplastic
Button:	Black Thermoplastic
Bezel:	Black Thermoplastic
Wire:	26 AWG UL 11028 Wire
Gasket:	EPDM



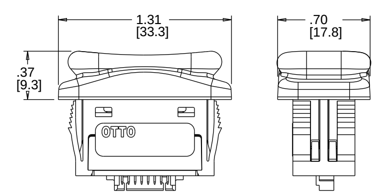
LARGE ROCKER VERSION
"F N R" LEGEND SHOWN



STANDARD ROCKER



K1S WIRED
26 AWG WIRE



IP68S PANEL SEAL WITH
OPTIONAL RUBBER BOOT

Specifications Subject To Change Without Notice

SNAP-IN PANEL MOUNTING, ON-ON-ON MAINTAINED ACTION, 1 AND 2 POLES

K1S PART NUMBER CODE

Part Number Code Continues Below

K1S X X X XX XX XX

Connection Style

A. 6 PIN Connector ①*
B. 8 PIN Connector ②**
E. 18" Wires [457] ③

Rocker Color/Style

A. Red Rocker
B. Black Rocker
C. White Rocker
D. Large Red Rocker ④
E. Large Black Rocker ④
F. Large White Rocker ④
G. Yellow Rocker
H. Large Yellow Rocker ④
J. Large Black Rocker with Embossed FNR (White) ④⑤⑥
K. Large Yellow Rocker with Embossed FNR (Black) ④⑤⑥
L. Red Rocker with Translucent Boot
M. Black Rocker with Black Boot ⑤⑦
P. Black Rocker with Translucent Boot
T. White Rocker with Translucent Boot
V. Yellow Rocker with Translucent Boot

Switch Action / Circuit

	Position "A"	Position "B"	Position "C"	Circuit
H.	ON	ON	ON	SPTT**
T.	ON	ON	ON	DPTT *

Legend Style

Position "A"	Position "B"	Position "C"
ZZ. No Legend	**ZZ.** No Legend	**ZZ.** No Legend

NOTE: For all other Legend Options, refer to Standard Legend Table below. Find the two digit code and enter the code in the appropriate positions

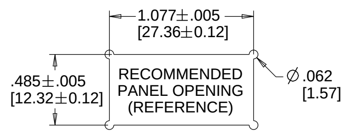
GASKET PART NUMBER (INCLUDED)

C807039-25-1

PANEL THICKNESS AND MOUNTING OPENING GUIDELINES③

PANEL THICKNESS: .086±.003 [2.18±0.08]
RECOMMENDED PANEL THICKNESS REQUIRES EITHER THE PANEL GASKET OR THE OPTIONAL RUBBER BOOT FOR PROPER FITMENT.

PANEL OPENING:



K1S PART NUMBER CODE - Continued From Above

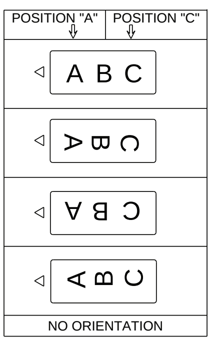
XXX X

Legend Color***

Position A / B / C
1. Red
2. Black
9. White
Z. No Legend

Legend Orientation

1. Std.
2. 90˚
3. 180˚
4. 270˚
Z.



① Mating Connector: MOLEX 51021-0600
② Mating Connector: MOLEX 51021-0800
③ Unless otherwise specified, all dimensions are in inch [metric]. In the event of a conflict, the inch nominal value and tolerance will take precedence.
④ Rubber boot not available
⑤ Legend is not available. Legend Style is ZZ and Legend Color is Z
⑥ Legend Orientation is 4
⑦ Legend Orientation is Z
* 6 PIN Connector not available with DPTT Circuit
** 8 PIN Connector not available with SPTT Circuit
*** Legend color cannot be same color as button color (i.e. Red Button color cannot have Red Legend color)

OPTIONAL BOOT PART NUMBER

C405810-25-12 (Translucent)
C405810-25-2 (Black)

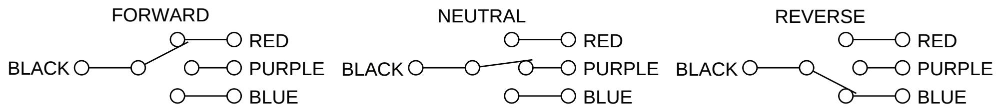
STANDARD LEGENDS PER SAE SPECIFICATIONS

Code	Legend	Code	Legend	Code	Legend
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 F	FORWARD	M9	LEFT TURN SIGNAL	W4	REAR WINDOW WIPER
F4 N	NEUTRAL	MA	RIGHT TURN SIGNAL	W5	REAR WINDOW-WASHER
F5 R	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		

SNAP-IN PANEL MOUNTING, ON-ON-ON MAINTAINED ACTION, 1 AND 2 POLES

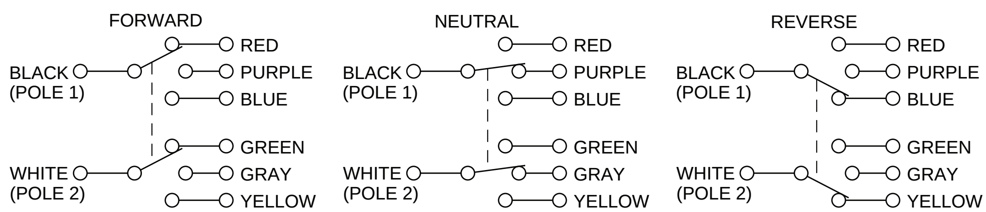
WIRED CIRCUIT DIAGRAM

K1SE _ H _ _ _ _ _



SPTT - ON-ON-ON WIRED SCHEMATIC

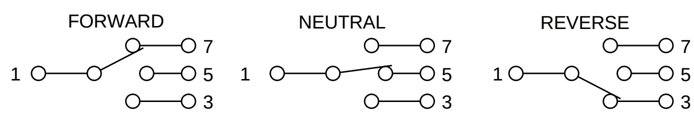
K1SE _ T _ _ _ _ _



DPTT - ON-ON-ON WIRED SCHEMATIC

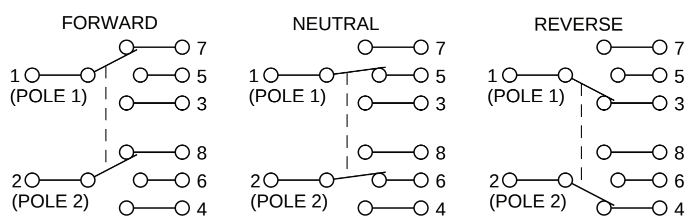
CONNECTOR CIRCUIT DIAGRAM

K1SB _ H _ _ _ _ _



SPTT - ON-ON-ON SCHEMATIC W/CONNECTOR PIN OUT

K1SB _ T _ _ _ _ _



DPTT - ON-ON-ON SCHEMATIC W/CONNECTOR PIN OUT

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:		
ELECTRICAL RATINGS:		
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)	
Electrical Life:	25,000 cycles	
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:	-40°C to +85°C	
MATERIALS:		
Case:	Thermoplastic, black	
Button:	Thermoplastic	
Terminals/Contact:	Brass, silver alloy with silver plate, gold flash for logic level	
Terminal Hardware:	K3 series recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG	
Mounting Hardware:	None provided	

SEALED, ILLUMINATED ROCKER SWITCHES

K3 SERIES PART NUMBER CODE

Part Number Code Continued Below

K3 X X XX X X

Base Options

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 Barriers or Pin
Standard Rating
No Plate

J. With Terminal Barriers Only
Standard Rating
No Plate

Case Style/Button Color

A. Case With Drain Holes
Button Color: Black

B. Case Without Drain Holes
Button Color: Black

C. Case With Drain Holes
Button Color: Red

D. Case Without Drain Holes
Button Color: Red

E. Case With Drain Holes
Button Color: White

F. Case Without Drain Holes
Button Color: White

NOTE: Switch case is black for all options below:

1. Case With Drain Holes
Button Not Included

2. Case Without Drain Holes
Button Not Included

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 ON/ON/OFF
2S.	(3-4)/8-9	OFF/8-9	OFF/OFF	(ON)/OFF/OFF ON/ON/OFF

NOTE: ( ) denotes momentary action.

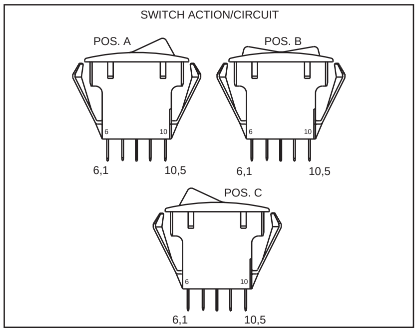
Light Source Type*

A. No Illumination
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

Light Circuit

	Circuit	Terminal Connections
A.	None	None
B.	Dep. in "A"	1(-) & 4(+)
C.	Dep. in "C"	2(+) & 5(-)
D.	Ind. in "A"	1(-) & 6(+)
E.	Ind. in "C"	5(-) & 10(+)
F.	Dep. in "A" Dep. in "C"	1(-) & 4(+) 2(+) & 5(-)
G.	Dep. in "A" Ind. in "C"	1(-) & 4(+) 5(-) & 10(+)
H.	Ind. in "A" Dep. in "C"	1(-) & 6(+) 2(+) & 5(-)
J.	Ind. in "A" Ind. in "C"	1(-) & 6(+) 5(-) & 10(+)

NOTE: Polarity only applies to LED circuits.



***See appendix for complete voltage/current ratings table.**

K3 PART NUMBER CODE - CONTINUED FROM ABOVE

– X X XX XX X 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 White②	**5.** Translucent White ②
Z. No Lens ③	**Z.** No Lens ③

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 LED to be used with translucent white lenses.
③ Legend colors "B" & "D" are only available on lens color "Z".

STOP HERE for unlighted switches without legends.

Example: K3AAIFAA

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: K3AAIFNH-44

Legend Color

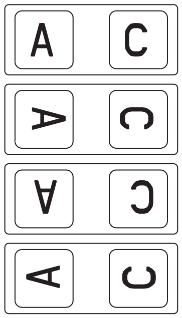
Position "A"	Position "C"
1. Red	**1.** Red
2. Black	**2.** Black
9. White	**9.** White
B. Backlight/ Daylight White ④	**B.** Backlight/ Daylight White ④
D. Backlight/ Deadfront ④	**D.** Backlight/ Deadfront ④
Z. No Legend	**Z.** No Legend

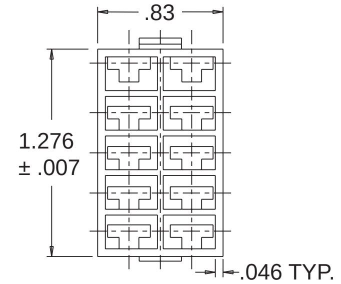
④ For legend color "B" and "D", please use button color "A" & "B" and lens color "Z" for each position.

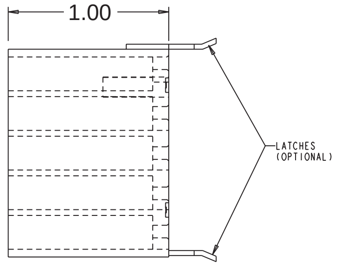
Legend Orientation

Position "A" Position "C"

1. Std.
2. 90°
3. 180°
4. 270°







• **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

K3 Connector

P/N C801775-2A Without Latches
P/N C801775-2B With Latches

Panel Seal Gasket

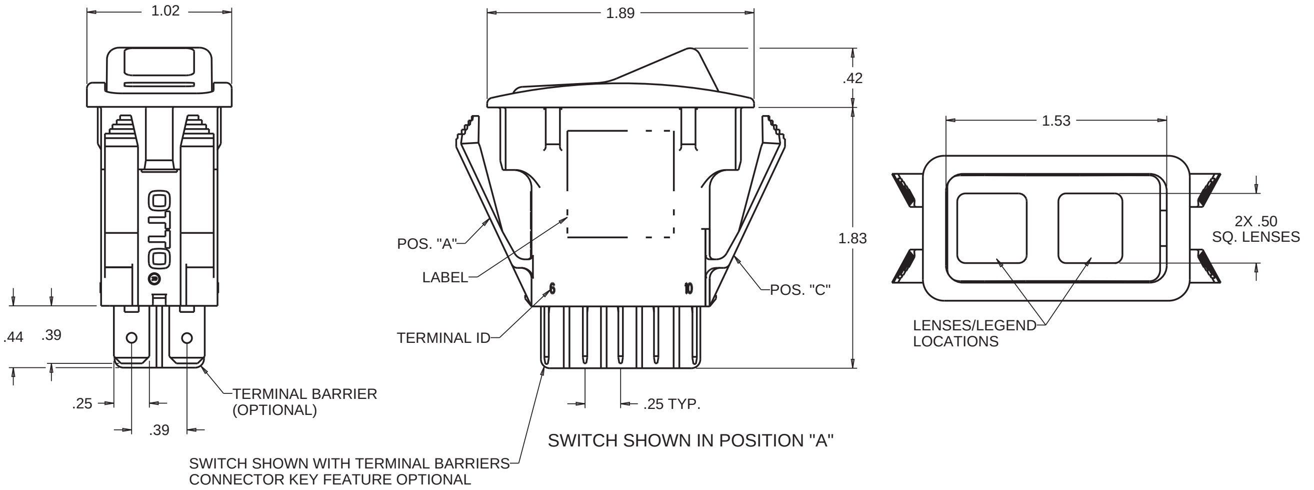
P/N C807037-25
Order separately for use with switches without drain holes.

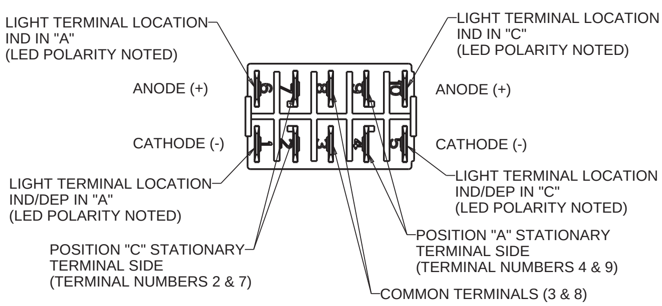
Panel Plug

See Panel Plug (PP) page.

SEALED, ILLUMINATED ROCKER SWITCHES

SNAP-IN PANEL MOUNTING, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

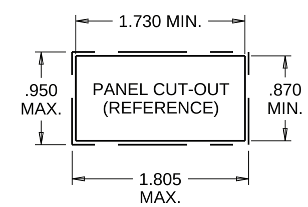


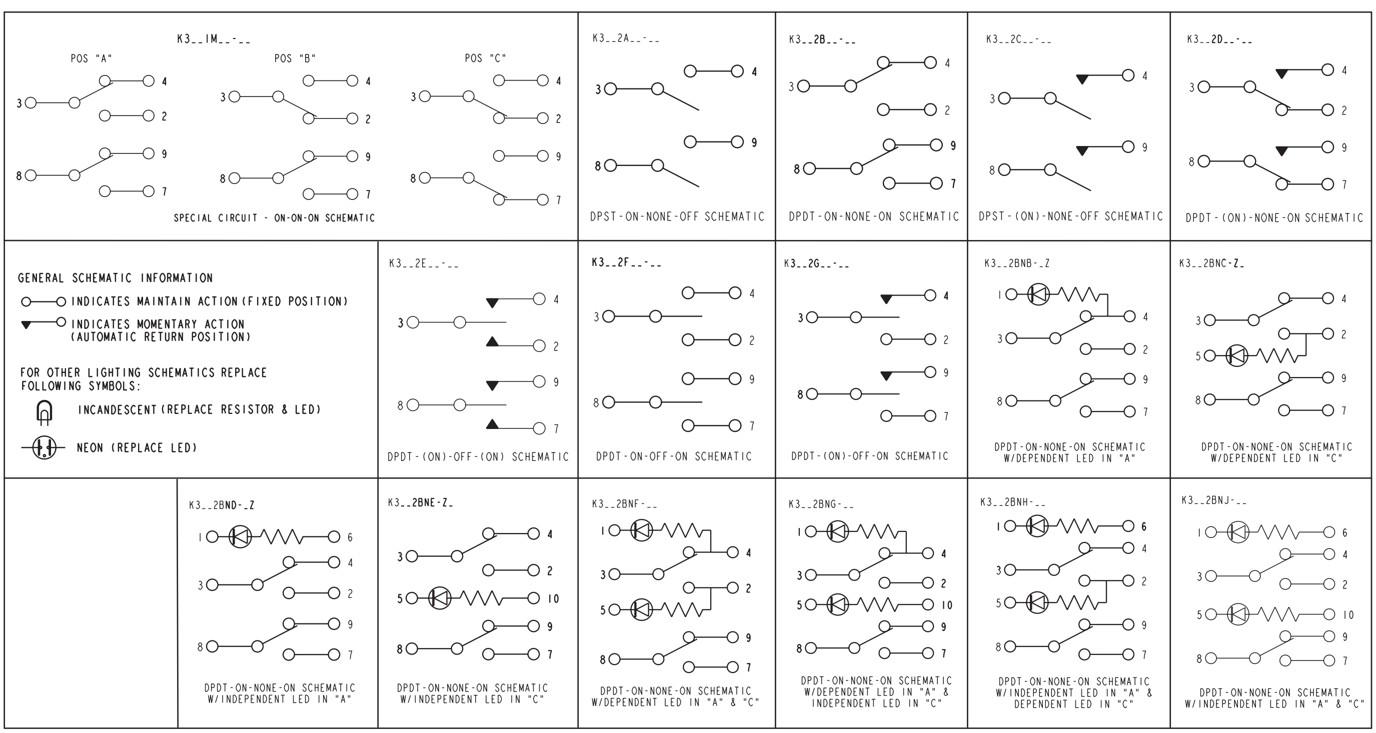


TERMINAL LOCATIONS AS VIEWED FROM
BOTTOM OF SWITCH (CASE REMOVED FOR CLARITY)
CONTACT MADE IN OPPOSITE DIRECTION OF ROCKER TRAVEL

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





ILLUMINATED PANEL PLUG INDICATORS

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
MATERIALS:	
Case and Base:	Black Thermoplastic
Button:	Black Thermoplastic
Terminals:	Brass Alloy

K3P PART NUMBER CODE

K3P – X X X X X

Light Source Position "A"
- **1.** Red
- **2.** Green
- **3.** Amber
- **4.** Blue
- **Z.** No Illumination

Light Source Position "C"
- **1.** Red
- **2.** Green
- **3.** Amber
- **4.** Blue
- **Z.** No Illumination

Lens Color Position "A"
- **1.** Transparent Red
- **2.** Transparent Green
- **3.** Transparent Amber
- **4.** Clear
- **5.** Translucent White
- **6.** Transparent Blue
- **Z.** No Lens

Lens Color Position "C"
- **1.** Transparent Red
- **2.** Transparent Green
- **3.** Transparent Amber
- **4.** Clear
- **5.** Translucent White
- **6.** Transparent Blue
- **Z.** No Lens

LED DC Voltage*
- **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

– XX XX X X X

Legend Style

Position "A"
ZZ. No Legend

Position "C"
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).

Legend Color

Position "A"
- **1.** Red
- **2.** Black
- **9.** White
- **B.** Backlight/ Daylight White ①
- **D.** Backlight/ Deadfront ①
- **Z.** No Legend

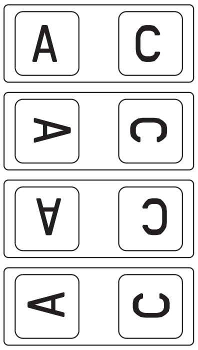
Position "C"
- **1.** Red
- **2.** Black
- **9.** White
- **B.** Backlight/ Daylight White ①
- **D.** Backlight/ Deadfront ①
- **Z.** No Legend

① Legend colors "B" and "D" use lens color "Z" for each position.

Legend Orientation

Position "A" **Position "C"**

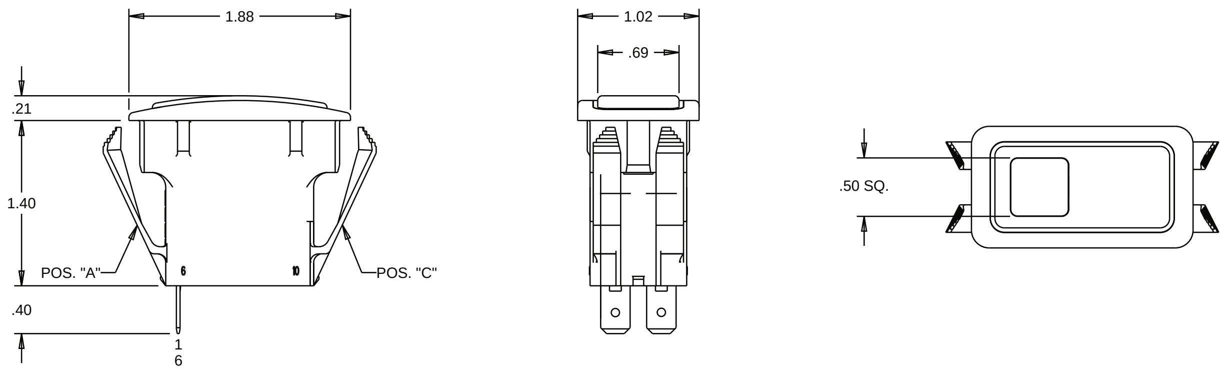
1. Std.
2. 90°
3. 180°
4. 270°

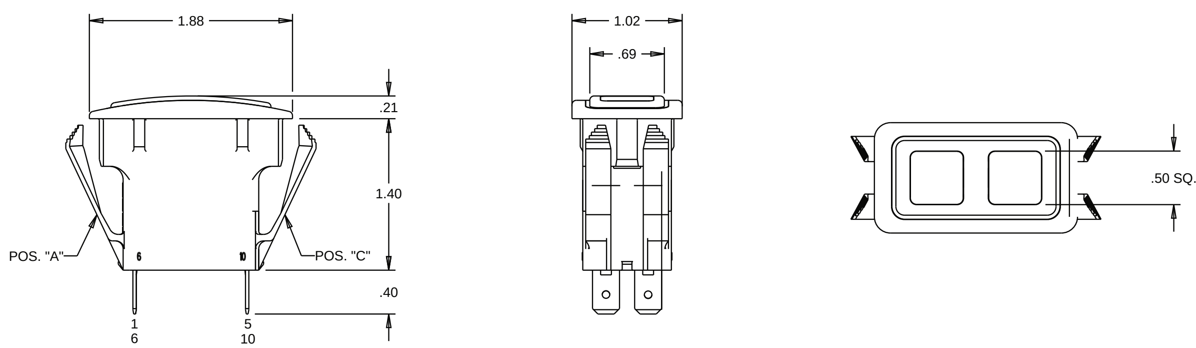


Specifications Subject To Change Without Notice

PANEL PLUG WITH INDICATOR LIGHTS

SNAP-IN PANEL MOUNTING, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

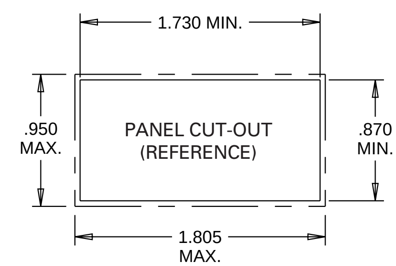


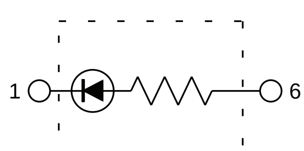


<u>MOUNTING OPENING:</u>
PANEL THICKNESS RANGE OF .025 - .105 PANEL SEAL
GASKET P/N C807037-25 IS RECOMMENDED

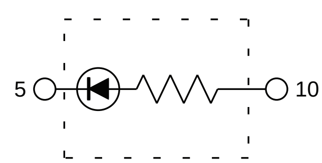
PANEL THICKNESS RANGE OF .105 - .187 W/O GASKET

PANEL OPENING:	MIN.	TYP.	MAX.
WIDTH	.870	.937	.950
LENGTH	1.730	1.768	1.805

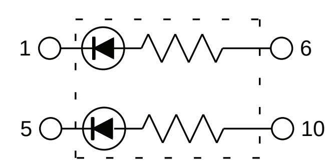




IND. LIGHT IN "A"
<u>SCHEMATIC</u>



IND. LIGHT IN "C"
<u>SCHEMATIC</u>



DUAL IND. LIGHT
<u>SCHEMATIC</u>

SEALED, ILLUMINATED SNAP-IN TOGGLE

LOW COST, SNAP-IN TOGGLE FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES

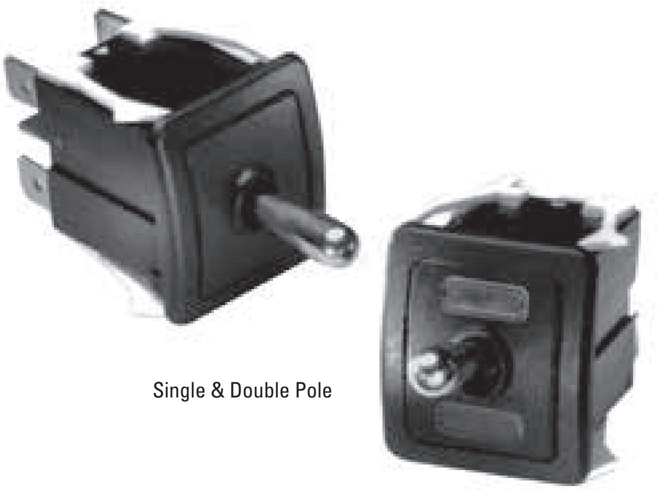
The K4 series snap-in toggle switches are rugged, high performance sealed switches designed for use under severe conditions found in marine, appliance, heavy equipment and industrial control applications. They are totally sealed to IP68S and IP69K so the switch can withstand direct water spray and submersion. 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.



Single & Double Pole

LED, Neon or
Incandescent Illumination

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**

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

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 (void if logic level load(s) exceeded at any time)		100,000
Electrical Life:	See Rating Chart		

LIGHTING:

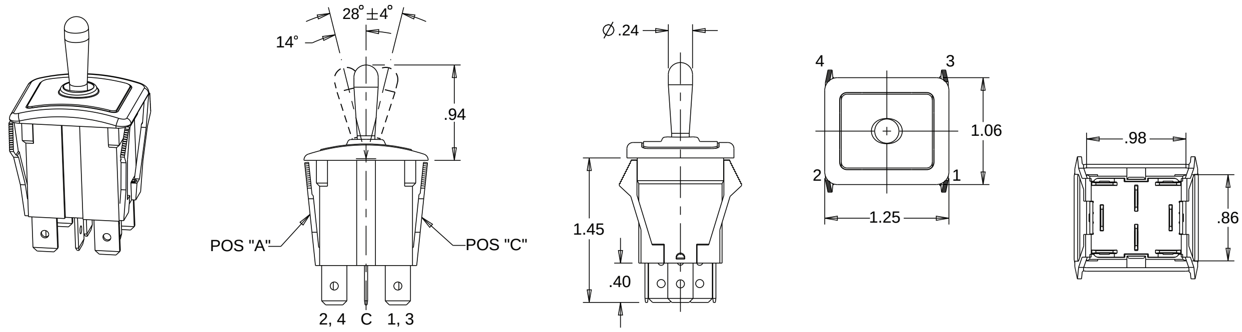
Light Source	Rating
Incandescent	(VDC) 6V, 12V, 24V
Neon	(VAC) 125V, 250V
LED	(VDC) 2V, 6V, 12V, 24V
Mechanical Life:	100,000 cycles
Seal:	IP68S and IP69K
Operating Temp Range:	-30°C to +85°C

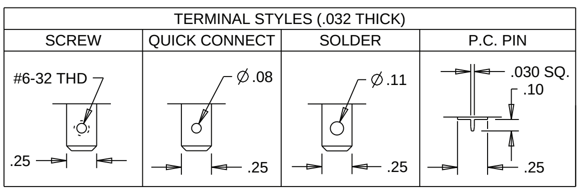
MATERIALS:

Case:	Thermoplastic
Toggle:	Stainless steel
Terminals/Contact:	Brass, silver alloy with silver plate, gold plate for logic level
Terminal Hardware:	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
Mounting Hardware:	None provided

SEALED, ILLUMINATED SNAP-IN TOGGLE

LOW COST, SNAP-IN TOGGLE FOR WET & DUSTY ENVIRONMENTS, 1 & 2 POLES

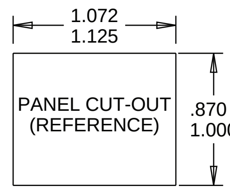




PANEL THICKNESS AND MOUNTING OPENING GUIDELINES:

PANEL THICKNESS RANGE OF .025 - .105 (GASKET RECOMMENDED)

PANEL THICKNESS RANGE OF .105 - .187 (GASKET NOT REQUIRED)



K4 SERIES PART NUMBER CODE

K4 X X X X X 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.** P.C. Pin/Standard
- **H.** P.C. Pin/Logic Level

NOTE: Contact factory for panel recommendations on switches with potting cups.

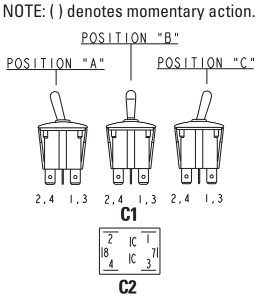
Rocker Style

- **A.** Bat Handle

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

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

NOTES:

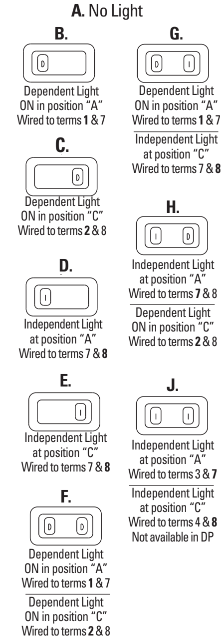
- No momentary switches with dependent lights.
- Neon lamps only to be coded with clear or amber lenses.
- LED lenses must be clear or same color as LED.
- No legends on lamp side of switch.
- No dependent light in OFF positions.
- All legends printed on actuators without lens(es) will be white except actuator codes C, F, J, M & R.
- All legends printed on lenses will be white except on clear lens(es) will be black.

Lens Color

Position "A"	Position "B"
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

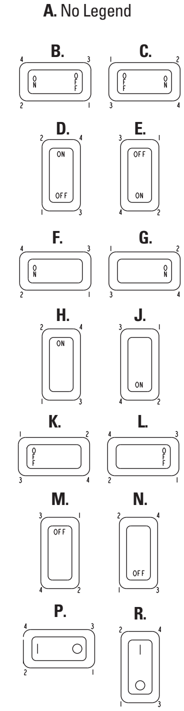


NOTE: LED anode (+) terminal number shown in **bold.**

D = Dependent Light
I = Independent Light

Legend & Orientation

A. No Legend



① All legends are white. Legend cannot be on the same side as the lens.

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.**

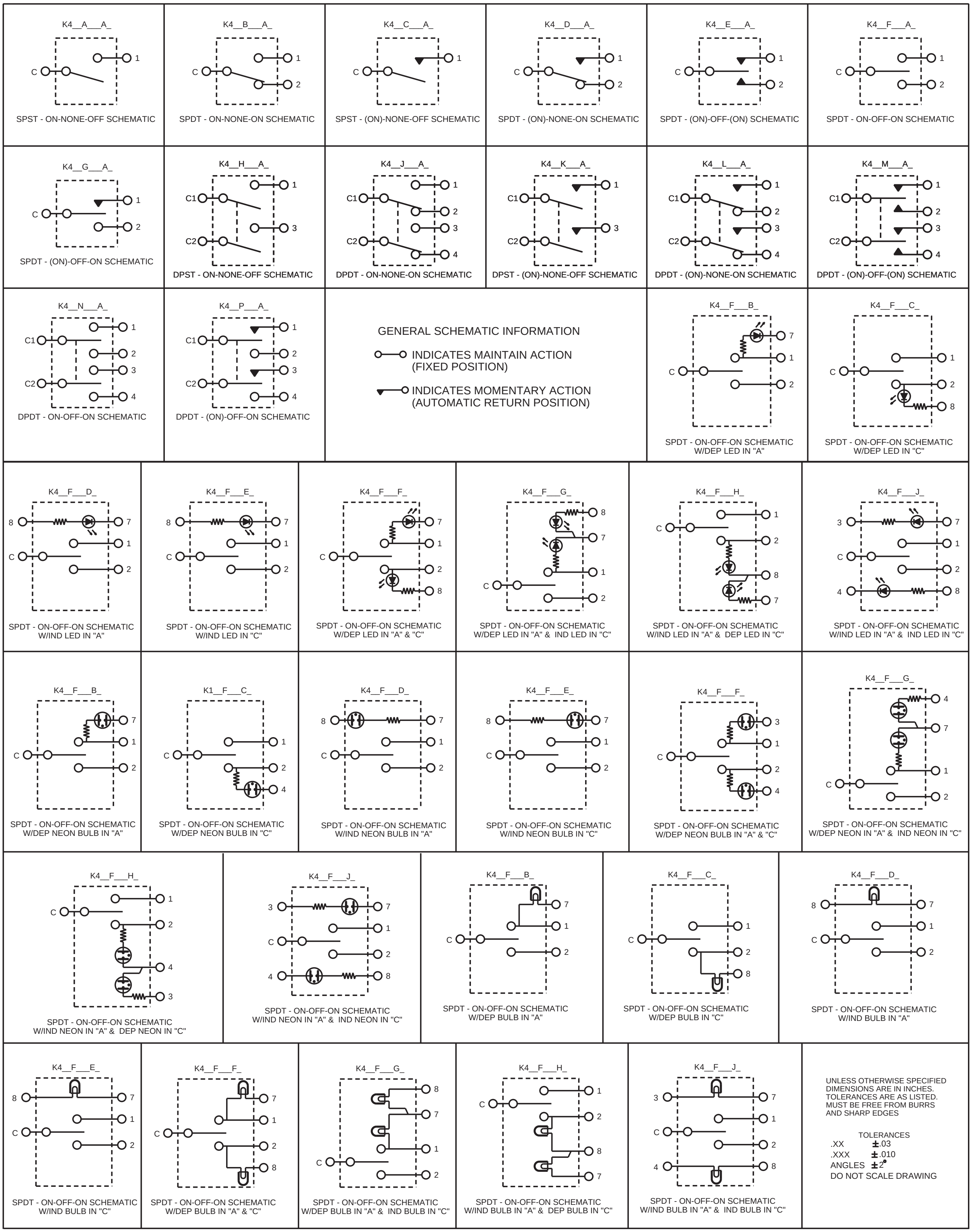
ORDERING INFORMATION

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.**

SEALED, ILLUMINATED SNAP-IN TOGGLE

K4 SCHEMATICS



SEALED, ILLUMINATED ROCKER SWITCHES

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:		
Case:	Thermoplastic	
Button:	Thermoplastic	
Terminals/Contact:	Brass, silver alloy with silver plate, gold flash for logic level	
Terminal Hardware:	K5 series recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG	
Mounting Hardware:	None provided	

SEALED, ILLUMINATED ROCKER SWITCHES

SNAP-IN PANEL MOUNTING

K5 SERIES PART NUMBER CODE

Part Number Code Continued Below

K5 X X X X XX X X

Base Options

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

NOTE: All code combinations are not feasible. Consult factory for product availability.

Rocker Color*/Style

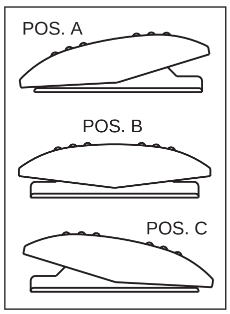
A. Black Plastic Rocker
B. Black "Soft Touch" Rocker
C. Red Plastic Rocker
D. Red "Soft Touch" Rocker
E. White Plastic Rocker
F. White "Soft Touch" Rocker
H. Green Plastic Rocker
J. Orange Plastic Rocker
K. Blue Plastic Rocker
L. Gray "Soft Touch" Rocker
M. Gray Plastic Rocker

*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 ON/ON/OFF
2S.	(3-4)/8-9	OFF/8-9	OFF/OFF	(ON)/OFF/OFF ON/ON/OFF

NOTE: ( ) denotes momentary action.

Light Source Type*

A. No Illumination
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**

Light Circuit

	Circuit	Terminal Connections
A.	NONE	NONE
B.	Dep. in "A"	1(-) & 4(+)
C.	Dep. in "C"	2(+) & 5(-)
D.	Ind. in "A"	1(-) & 6(+)
E.	Ind. in "C"	5(-) & 10(+)
F.	Dep. in "A"	1(-) & 4(+)
	Dep. in "C"	2(+) & 5(-)
G.	Dep. in "A"	1(-) & 4(+)
	Ind. in "C"	5(-) & 10(+)
H.	Ind. in "A"	1(-) & 6(+)
	Dep. in "C"	2(+) & 5(-)
J.	Ind. in "A"	1(-) & 6(+)
	Ind. in "C"	5(-) & 10(+)

NOTE: Polarity only applies to LED circuits.

K5 PART NUMBER CODE - CONTINUED FROM ABOVE

X X XX XX X 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 lens.

STOP HERE for unlighted switches without legends.

Example:
K5AA331BAA

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

Legend Color

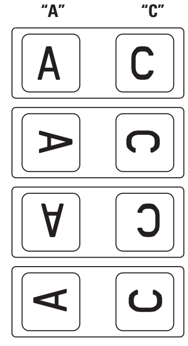
Position "A"	Position "C"
1. Red	**1.** Red
2. Black	**2.** Black
9. White	**9.** White
B. Backlight/ Daylight White ③	**B.** Backlight/ Daylight White ③
D. Backlight/ Deadfront ③	**D.** Backlight/ Deadfront ③
Z. No Legend	**Z.** No Legend

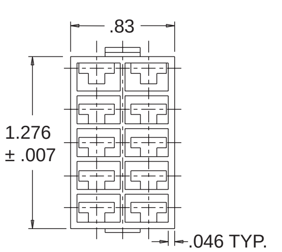
③ Only available on Rocker Style "A" & Rocker Features "1" and lens color "Z" for each position.

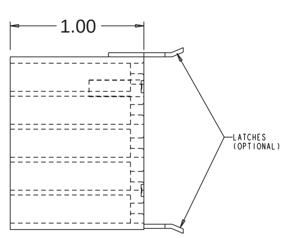
Legend Orientation

Position "A" Position "C"

1. Std.
2. 90°
3. 180°
4. 270°







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

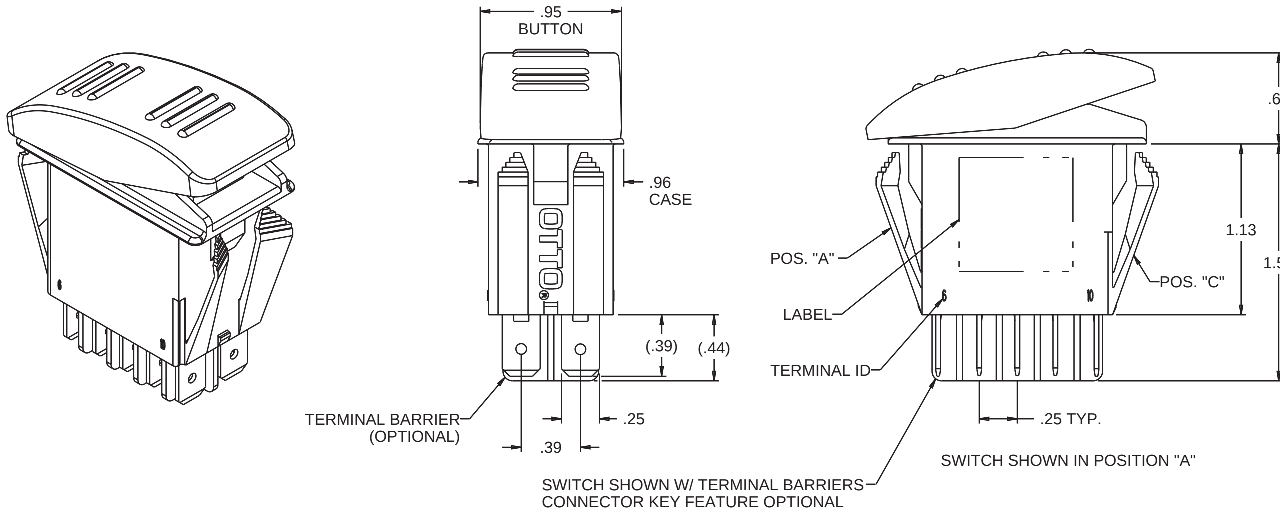
Panel Seal Gasket
Silicone: P/N C807109-25-1
Buna-N: P/N C807618-25-1

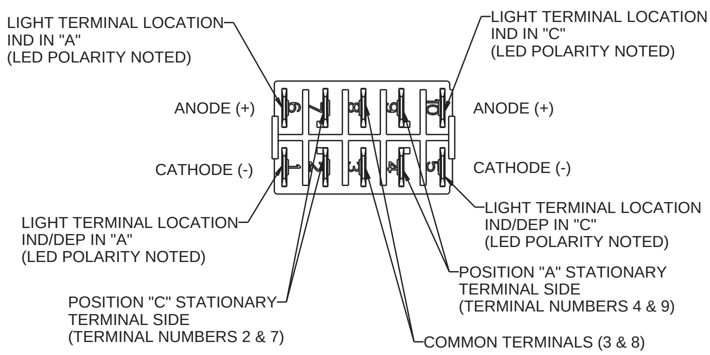
- **K5 panel plugs available as shown in Panel Plugs (PP) section.**

 Specifications Subject To Change Without Notice

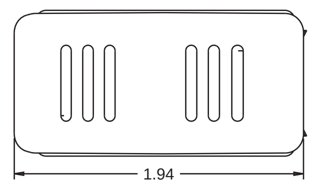
SEALED, ILLUMINATED ROCKER SWITCHES

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS





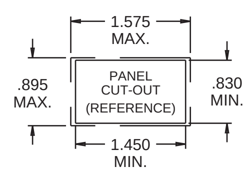
TERMINAL LOCATIONS AS VIEWED FROM BOTTOM OF SWITCH
(CASE REMOVED FOR CLARITY)
CONTACT MADE IN OPPOSITE DIRECTION OF ROCKER TRAVEL

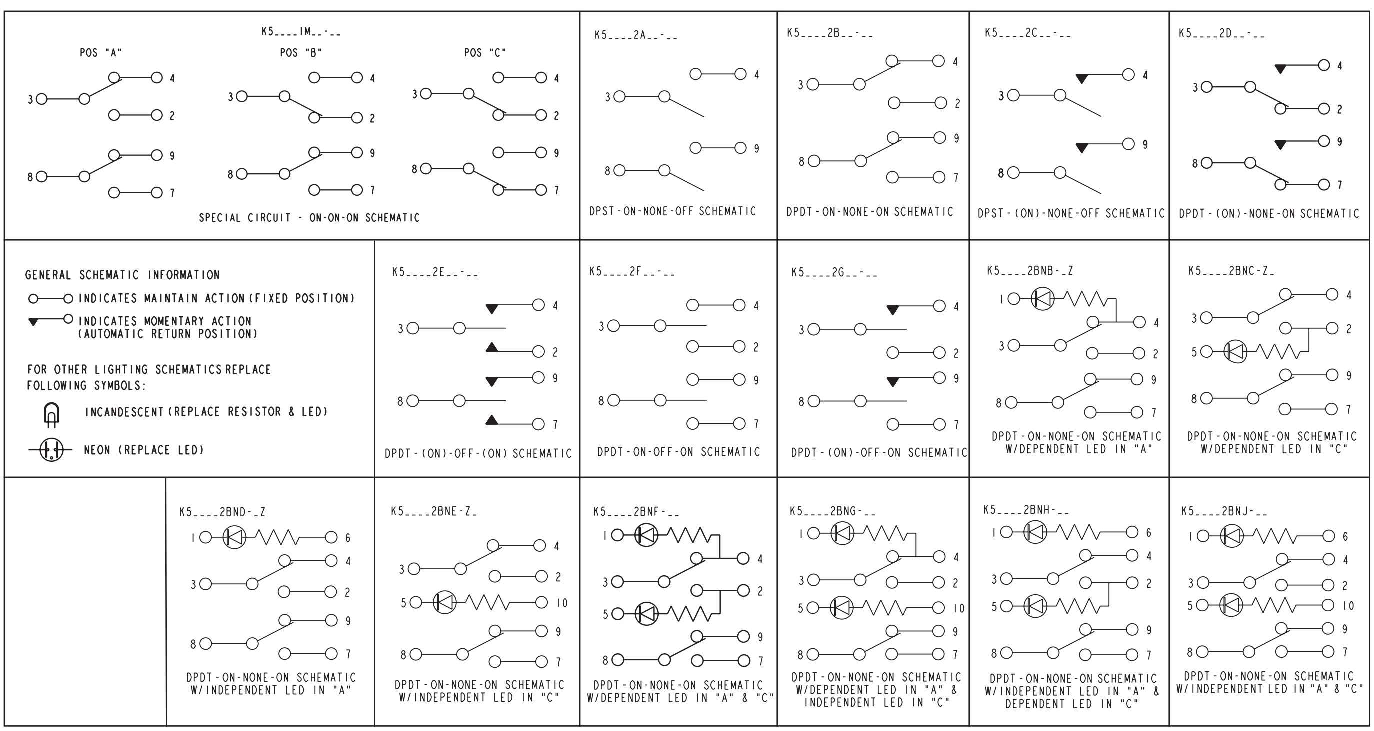


MOUNTING OPENING:

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	.830	.863	.895
LENGTH	1.450	1.513	1.575





STANDARD LEGENDS PER SAE

SNAP-IN PANEL MOUNTING

Standard Legends Per SAE Specifications

STANDARD LEGENDS PER SAE SPECIFICATIONS								
A1		ANCHOR	H2	R	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	F	FORWARD	M9		LEFT TURN SIGNAL	W4		REAR WINDOW WIPER
F4	N	NEUTRAL	MA		RIGHT TURN SIGNAL	W5		REAR WINDOW-WASHER
F5	R	REVERSE	P1	1	BILGE PUMP #1	W6		REAR WINDOW-WASHER/WIPER
G1		FUEL	P2	2	BILGE PUMP #2	ZZ		NO LEGEND
H1		HORN	P3	3	BILGE PUMP #3			

For legends not shown, please consult an OTTO representative.

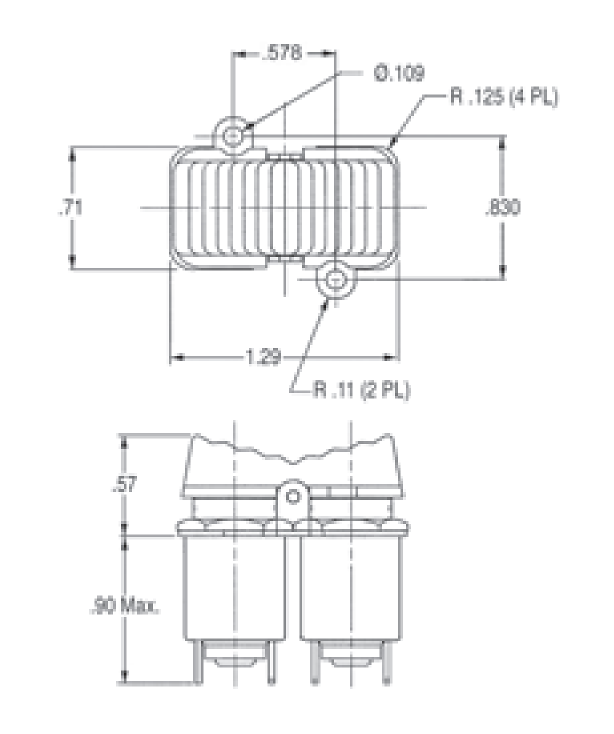
ONE MILLION CYCLE SEALED ROCKER SWITCH

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



ROTARY SWITCH

UP TO 3 POSITIONS WITH 3 OPTIONAL, INDEPENDENT LED LIGHT POSITIONS

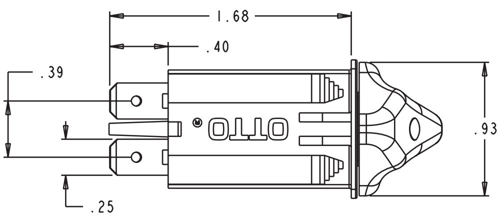
Used in the heavy equipment, marine, process control and instrumentation markets, the R2 rotary switch is an excellent replacement for rocker switches, offering improved visual position indication, additional lighting options and different styling opportunities on front panels. The R2 is a sealed, lighted 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.

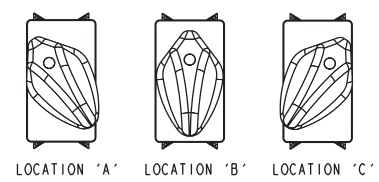
Features:

- **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:		
ELECTRICAL RATINGS:		
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)	
Electrical Life:	25,000 cycles at full load	
Lighting:	LED 2V, 6V, 12V, 24V (VDC)	
Mechanical Life:	100,000 cycles	
Seal:	IP68S	
Operating Temp Range:	-40°C to +85°C	
MATERIALS:		
Case:	Thermoplastic	
Knob:	Thermoplastic	
Lens:	Thermoplastic, clear	
Terminals:	Copper, silver plate, gold plate for logic level	
Contacts:	Silver alloy, gold plate for logic level	
Terminal Hardware:	R2 recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG	
Mounting Hardware:	None provided	

UP TO 3 POSITIONS WITH 3 OPTIONAL, INDEPENDENT LED LIGHT POSITIONS

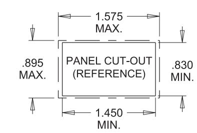




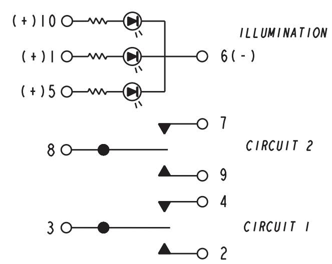
KNOB LOCATION DETAILS

PANEL THICKNESS RANGE OF .025 - .105 A GASKET IS RECOMMENDED
PANEL THICKNESS RANGE OF .105 - .187 W/O GASKET

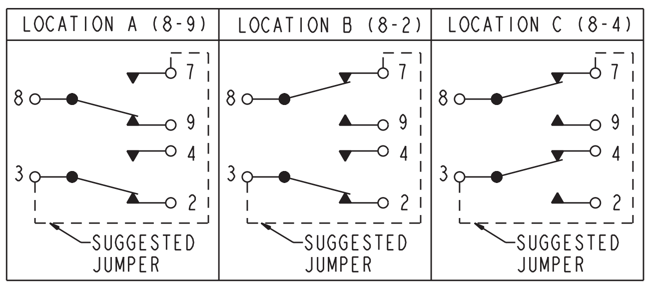
PANEL OPENING:	MIN.	TYP.	MAX.
WIDTH	.830	.863	.895
LENGTH	1.450	1.513	1.575



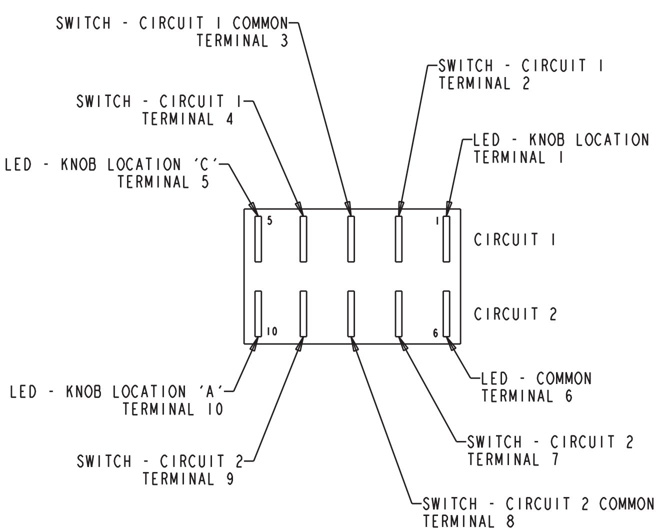
ELECTRICAL SCHEMATICS



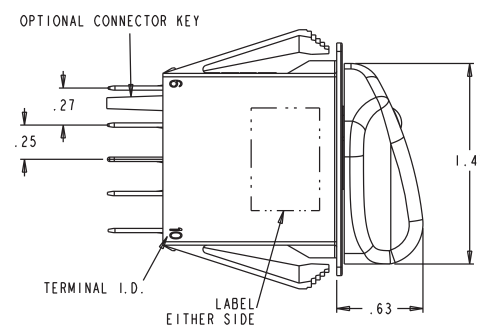
GENERIC SWITCH SCHEMATIC
USE TERMINALS AS APPLICABLE
TO PART NUMBER

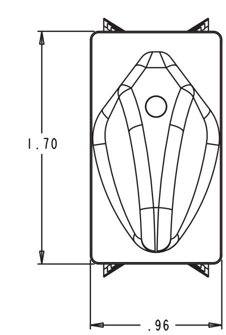


SPTT SCHEMATIC
USE R2XXXX77XXXX FOR (8-9),(8-2),(8-4)
USE R2XXXX74XXXX FOR (OFF),(8-2),(8-4)
USE R2XXXX67XXXX FOR (8-9),(8-2),(OFF)



TERMINAL LOCATION AS VIEWED
FROM THE BOTTOM OF THE SWITCH





• **R2 panel plugs available as shown in Panel Plugs (PP) section.**

ROTARY SWITCH

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

Terminal Style/ Switch Rating

A. Without Terminal Barriers, With Connector Keying Pin, Standard Rating
B. Without Terminal Barriers ,Without Connector Keying Pin, Standard Rating
C. Without Terminal Barriers, With Connector Keying Pin, Logic Level Rating
D. Without Terminal Barriers ,Without Connector Keying Pin, Logic Level Rating

Knob Color & Texture

A. Black Plastic
B. Black Soft Touch
C. White Plastic
D. White Soft Touch
E. Red Plastic
F. Red Soft Touch

Switch Action

	Knob Location "A"	Knob Location "B"	Knob Location "C"
2-Position Switch, Knob Locations A/B			
11.	Maintain	Maintain	N/A
12.	Maintain	Momentary	N/A
13.	Momentary	Maintain	N/A
2-Position Switch, Knob Locations A/C			
21.	Maintain	N/A	Maintain
22.	Maintain	N/A	Momentary
23.	Momentary	N/A	Maintain
2-Position Switch, Knob Locations B/C			
31.	N/A	Maintain	Maintain
32.	N/A	Maintain	Momentary
33.	N/A	Momentary	Maintain
3-Position Switch, Knob Locations A/B/C			
44.	Maintain	Maintain	Maintain
45.	Momentary	Maintain	Momentary
46.	Maintain	Maintain	Momentary
47.	Momentary	Maintain	Maintain

Switch Circuit 1 Terminals 2, 3, 4

	Knob Location "A"	Knob Location "B"	Knob Location "C"
2-Position Switch, Knob Locations A/B			
1.	3-2	OFF	N/A
2.	OFF	3-4	N/A
3.	3-2	3-4	N/A
2-Position Switch, Knob Locations A/C			
1.	3-2	N/A	OFF
2.	OFF	N/A	3-4
3.	3-2	N/A	3-4
2-Position Switch, Knob Locations B/C			
1.	N/A	3-2	OFF
2.	N/A	OFF	3-4
3.	N/A	3-2	3-4
3-Position Switch			
4.	OFF	3-4	3-4
5.	3-2	OFF	3-4
6.	3-2	3-2	OFF
7.	3-2	3-2	3-4
8.	3-2	OFF	OFF
9.	OFF	OFF	3-4

Switch Circuit 2 Terminals 7, 8, 9

	Knob Location "A"	Knob Location "B"	Knob Location "C"
N. NONE (Single Pole)			
2-Position Switch, Knob Locations A/B			
1.	8-9	OFF	N/A
2.	OFF	8-7	N/A
3.	8-9	8-7	N/A
2-Position Switch, Knob Locations A/C			
1.	8-9	N/A	OFF
2.	OFF	N/A	8-7
3.	8-9	N/A	8-7
2-Position Switch, Knob Locations B/C			
1.	N/A	8-9	OFF
2.	N/A	OFF	8-7
3.	N/A	8-9	8-7
3-Position Switch			
4.	OFF	8-7	8-7
5.	8-9	OFF	8-7
6.	8-9	8-9	OFF
7.	8-9	8-7	8-7
8.	8-9	OFF	OFF
9.	OFF	OFF	8-7

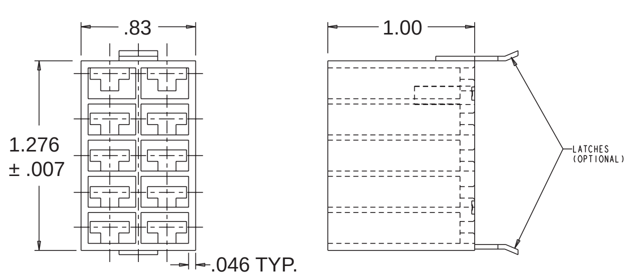
LED Light Source Voltage*

N. NONE
A. 2V
B. 6V
C. 12V
D. 24V

Light Source Color

Location "A"	Location "B"	Location "C"
N. NONE	**N.** NONE	**N.** NONE
1. Red	**1.** Red	**1.** Red
2. Green	**2.** Green	**2.** Green
3. Amber	**3.** Amber	**3.** Amber

***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

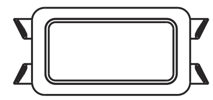
PANEL PLUGS FOR ROCKER & R2 SERIES

K1 THROUGH K5 ROCKER SWITCH & R2 ROTARY SWITCH PANEL PLUGS

K5 & R2 Panel Plug (K5-PA) with Optional Panel Gasket Shown

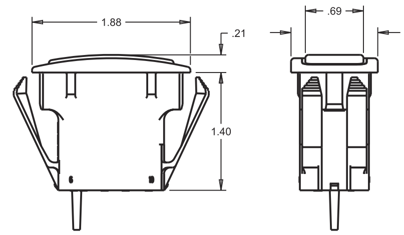
K3 Panel Plug (K3-PB)

Assembled Plug



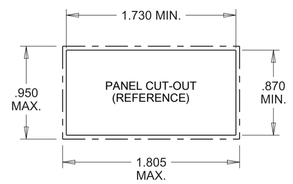
OPTIONAL PANEL GASKET:

P/N C807037-25



MOUNTING HOLE

RECOMMENDED PANEL THICKNESS:



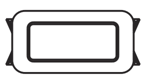
RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED

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

K1 Panel Plug (K1-PA)

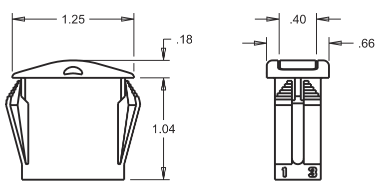
One Piece Molded



OPTIONAL PANEL GASKET:

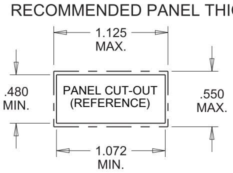
0.062” THICKNESS = P/N C807039-25-1

0.031” THICKNESS = P/N C807039-25-2



MOUNTING HOLE

RECOMMENDED PANEL THICKNESS:



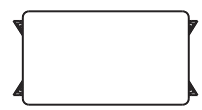
RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED

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

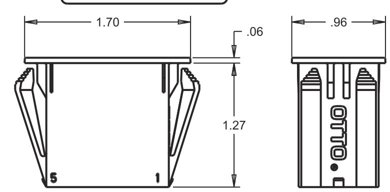
K5 & R2 Panel Plug (K5-PA)

One Piece Molded



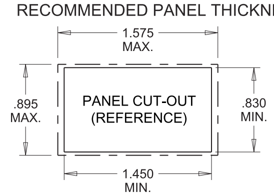
OPTIONAL PANEL GASKET:

P/N C807109-25-1



MOUNTING HOLE

RECOMMENDED PANEL THICKNESS:



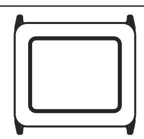
RANGE 0.025 - 0.105 OPTIONAL PANEL GASKET RECOMMENDED

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

K2 & K4 Panel Plug (K2-PB)

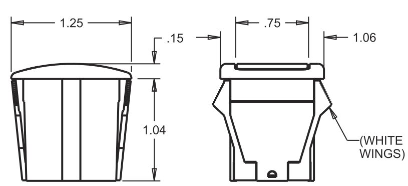
Assembled Plug



OPTIONAL PANEL GASKET:

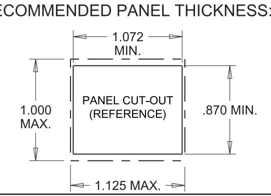
0.062” THICKNESS = P/N C807038-25-1

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

PANEL PLUG PART NUMBER CODE

X – X X X X

Series	Plug	Style	Plug Color ③	Button Insert ③
K1. K1 ①	**P.**	**A.** One Piece Molded	**1.** Red	**1.** Red*
K2. K2 & K4 ②		**B.** Assembled Plug	**2.** Black	**2.** Black*
K3. K3 ②			**9.** White	**9.** White*
K5. K5 & R2 ①				**Z.** NONE**

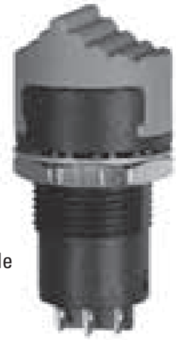
*K3 series only.
**Molded plug only.

① Available in Style A only.
② Available in Style B only.
③ Additional colors available. Contact factory.

SLIDE SWITCH

COMMERCIAL & MILITARY GRADES

Flush Button Style



Raised Button Style

Features:

- Single & double pole, double throw switch configuration
- Logic level rating available with gold plate contacts & terminals
- 3-position center OFF with momentary or maintained switch action in any combination
- Dusttight to MIL-PRF-8805 Design 2
- Raised & flush button contours available
- Choice of button color
- FAA/PMA available (contact factory)
- RoHS compliant

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
Electrical Life:	100,000 cycles
Mechanical Life:	100,000 cycles
Seal:	Dusttight per MIL-PRF-8805 Design 2
Operating Temp Range:	-55°C to +85°C
Operating Force:	24 oz +/- 10 oz
Return Force:	10 oz +8 oz/-3 oz to center from maintained position
Total Travel:	0.120 inches max two directions
Overtravel:	0.010 inches min
MATERIALS:	
Case:	Thermoplastic
Button:	Thermoplastic
Terminals:	Copper with silver Gold over silver for logic level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut and lockwasher

SL PART NUMBER CODE

SL – X X X X X X X X

Number of Poles
1. Single
2. Double

Button Style
1. Raised
2. Flush

Case Style
1. Front Mount 1/2-32 Thread
2. Front Mount 1/2-32 Thread With 0.062" Spacer

Seal
1. Dusttight MIL-PRF-8805 Design 2

Grade
C. Commercial
M. Military

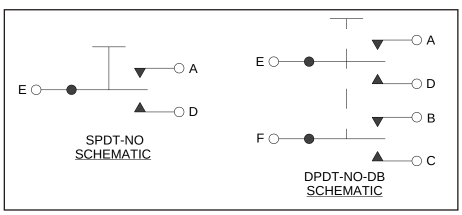
Current Rating
1. Standard
2. Logic Level

Switch Action/Circuit

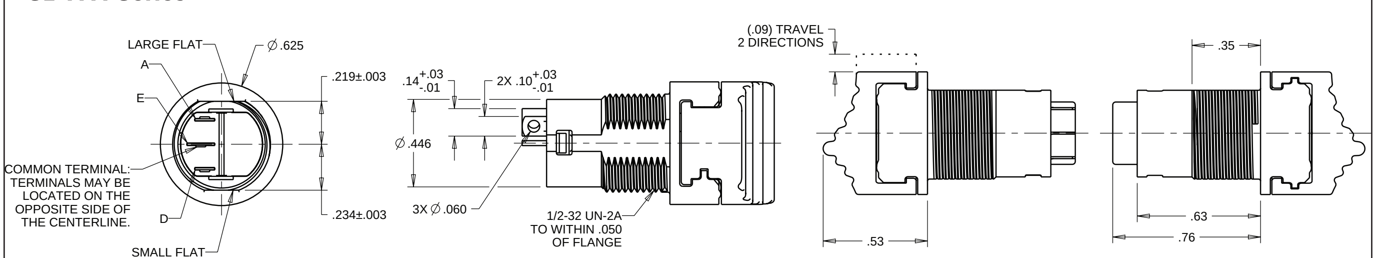
	Large Flat Position	Center Position	Small Flat Position
A.	ON	OFF	ON
B.	(ON)	OFF	(ON)
C.	ON	OFF	(ON)
D.	(ON)	OFF	ON

Button Color
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple
8. Gray
9. White

NOTE: ( ) denotes momentary action.



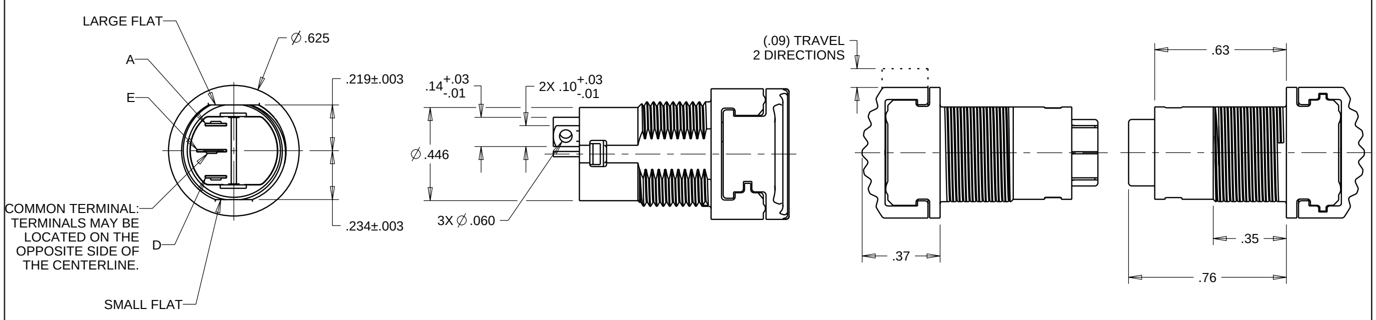
SL-1111 Series



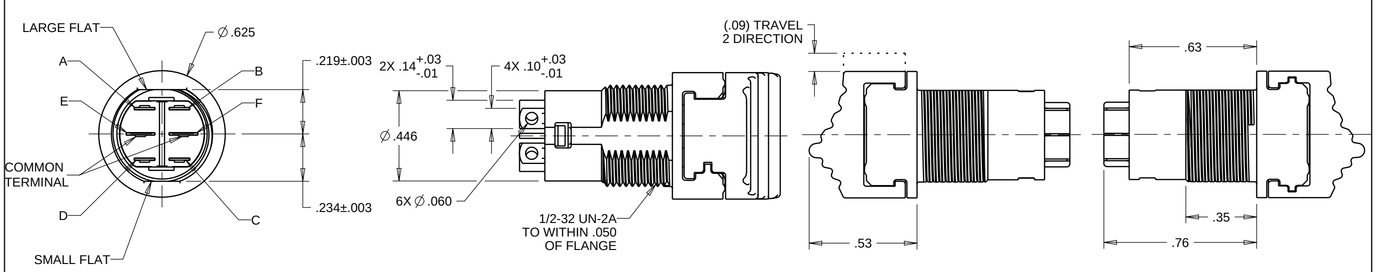
 Specifications Subject To Change Without Notice

COMMERCIAL & MILITARY GRADES

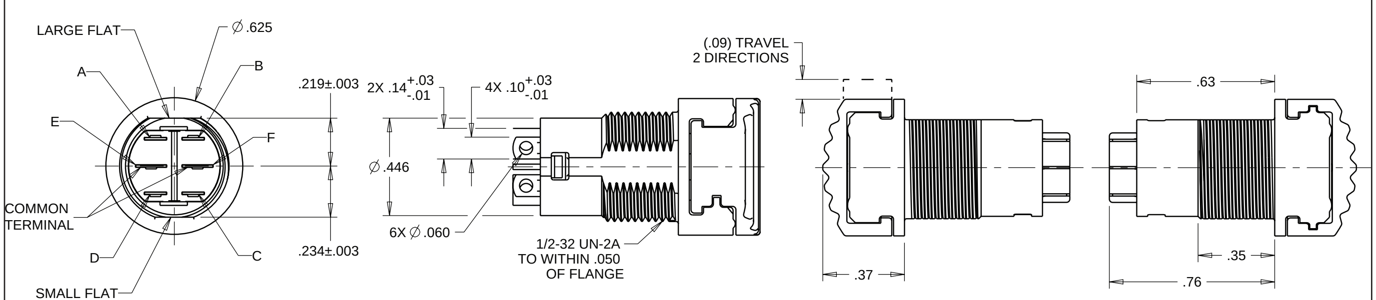
SL-1211 Series



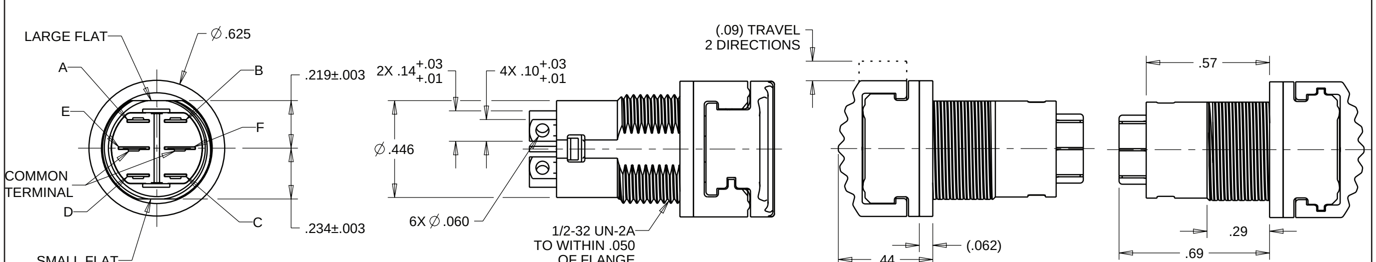
SL-2111 Series



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

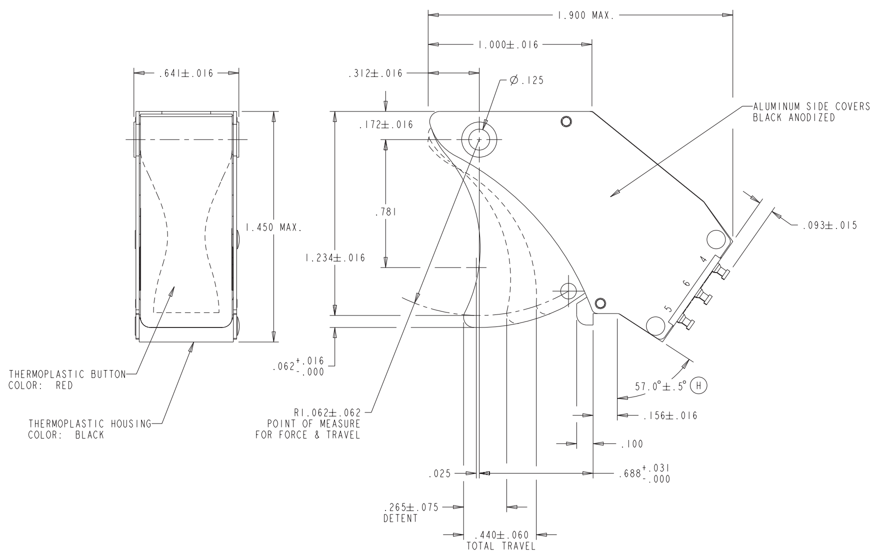
MILITARY QUALIFIED TRIGGER SWITCHES

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.

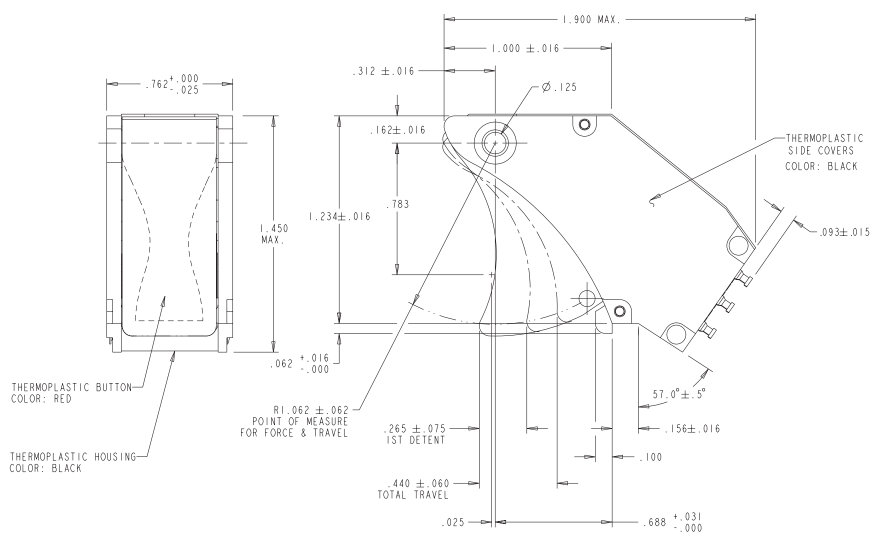
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
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:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
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.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black thermoplastic	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	



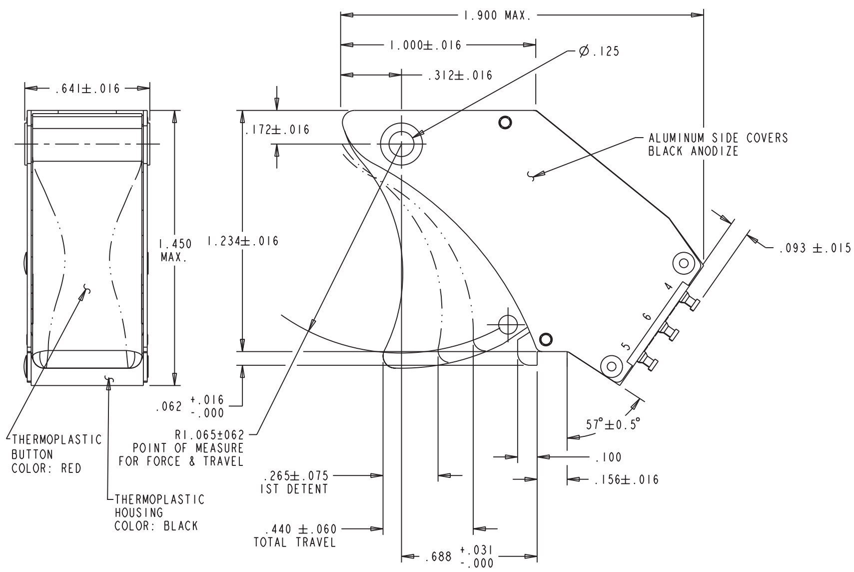
MILITARY QUALIFIED TRIGGER SWITCHES

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.

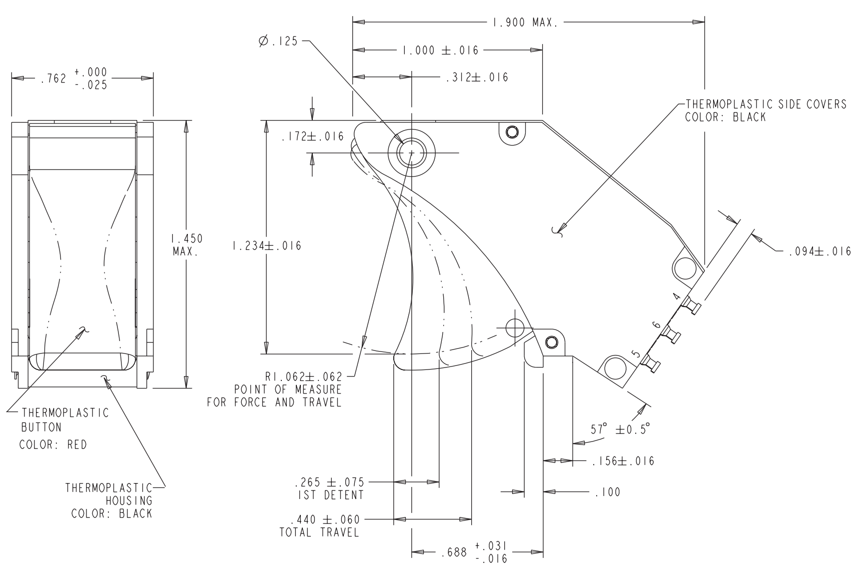
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
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:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
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.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	



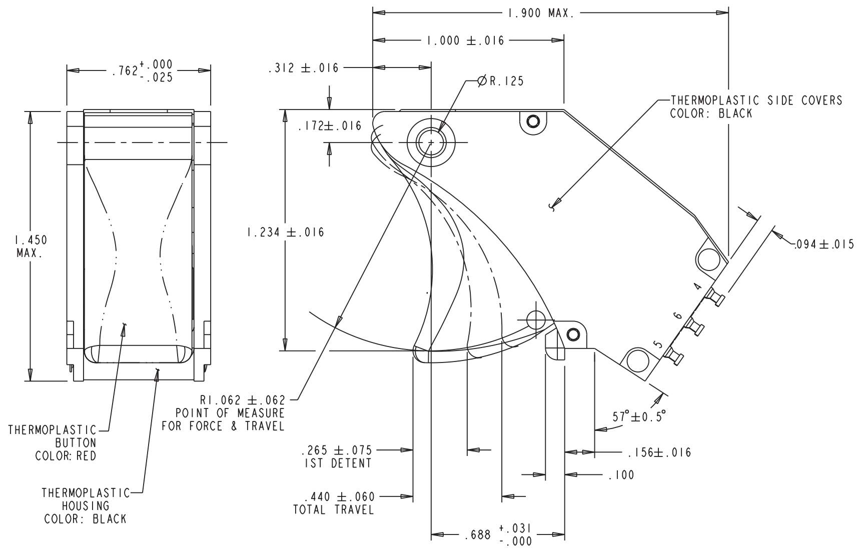
 Specifications Subject To Change Without Notice

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.

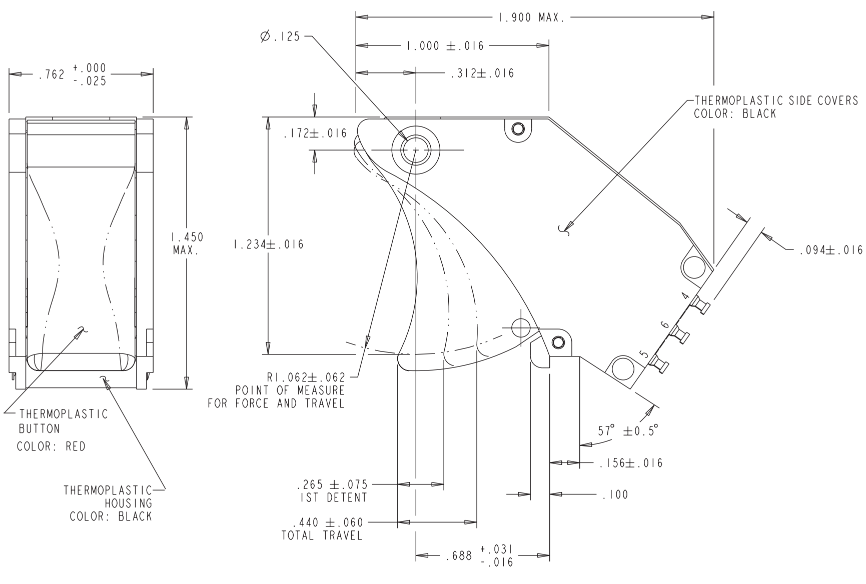
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: 2.250 lbs. ± .500 lbs. Pass through Detent: 6.500 lbs. ± .750 lbs. Pole Two: 6, +0/-3 .lbs.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black thermoplastic	
ENVIRONMENTAL:		
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:		
ELECTRICAL RATINGS (@28 VDC):		
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	
MECHANICAL:		
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.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	

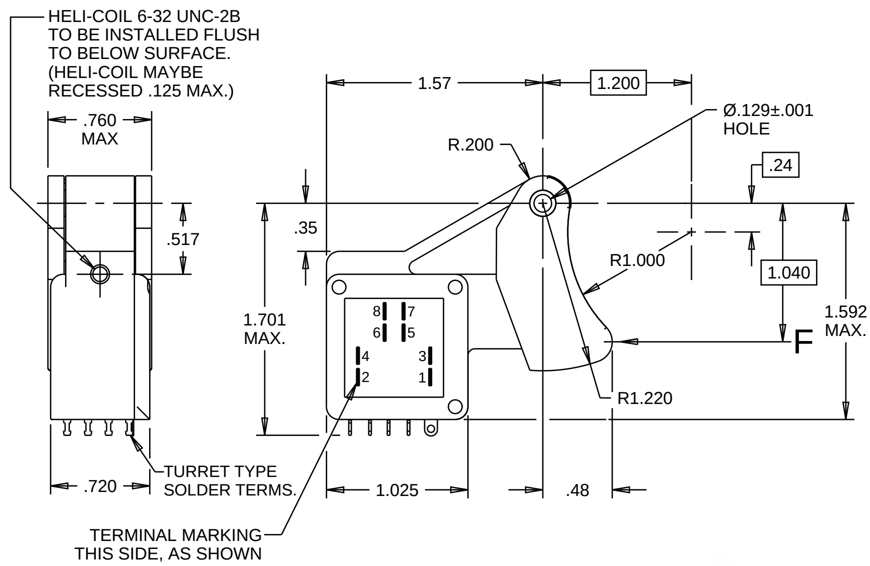


ONE-STEP AND TWO-STEP, PRECISE, COMMERCIAL GRADE

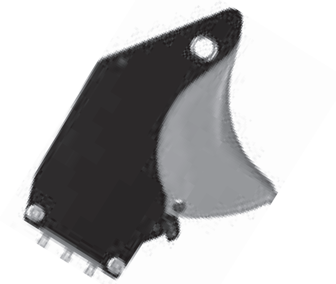
U2-037

The U2-037 is a precision trigger switch that offers two levels of operation with positive detent between levels. The switch has an actuating force of 3.0 lbs. to make the first pole, and an additional 5.0 lbs. 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. The switch features OTTO B3 basic switches per MIL-PRF-8805.

Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	70,000 ft.
Resistive:	8A	8A
Inductive:	5A	5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	50,000 cycles	
Operating Force:	Pole One: 3.0 lbs. ± 1.7 lbs. Pass through Detent: .187 lbs. ± 0.20 lbs. Pole Two: 8.0 lbs. ± 3.0 lbs.	
MATERIALS:		
Button:	Gray thermoplastic	
ENVIRONMENTAL:		
Temperature Range:	-40˚C to +85˚C	
Seal:	Dusttight per MIL-PRF-8805, Design 2	

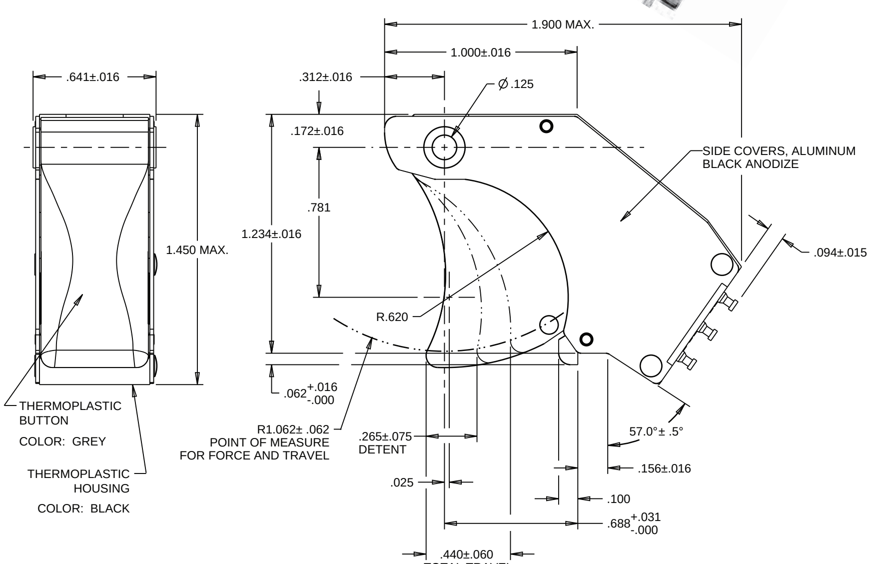


U2-054



The U2-054 is a single-step trigger switch and an excellent choice when a two-step trigger is not required. Actuating force is 3 lbs. to pass through the detent and will continue travel after the detent. It is designed to handle resistive electrical loads up to 7A at 28VDC. The U2-054 is 7 amps resistive @ 28VDC.

Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Operating Force:	3.0 lbs. ± .5 lbs.	
MATERIALS:		
Button:	Gray thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	

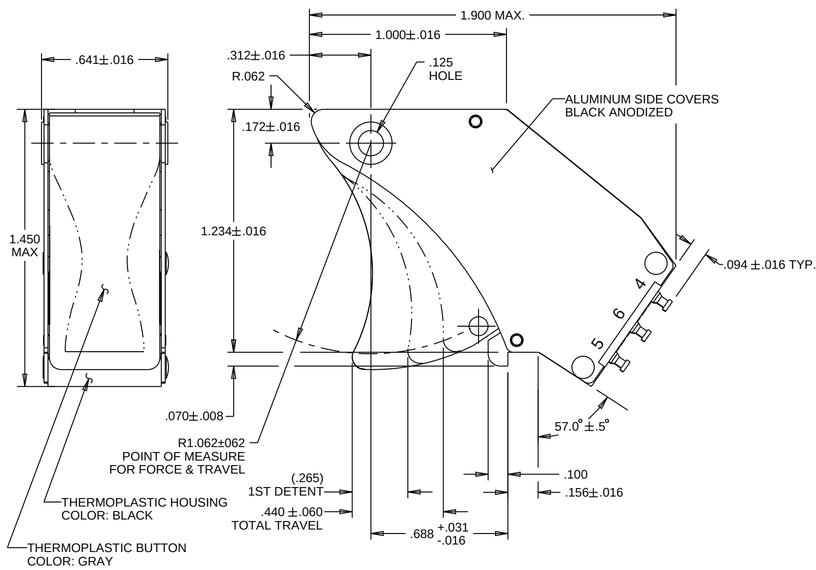


ONE-STEP AND TWO-STEP, PRECISE, COMMERCIAL GRADE

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.

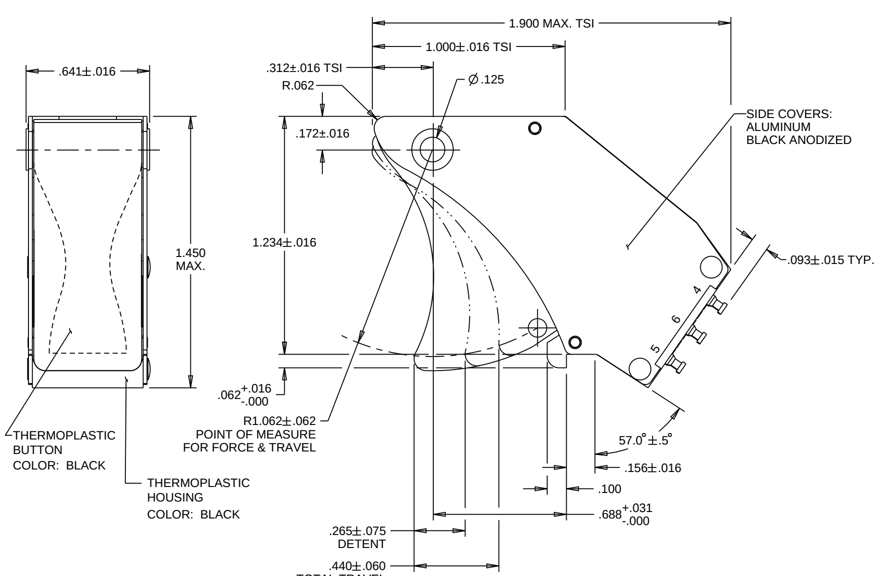
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	4A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	25,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Operating Force:	Pole One: Pretravel: .130 min from Full Out Overtravel: .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	
MATERIALS:		
Button:	Gray thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	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:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	5A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
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, +0, -3 lbs.	
MATERIALS:		
Button:	Black thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	



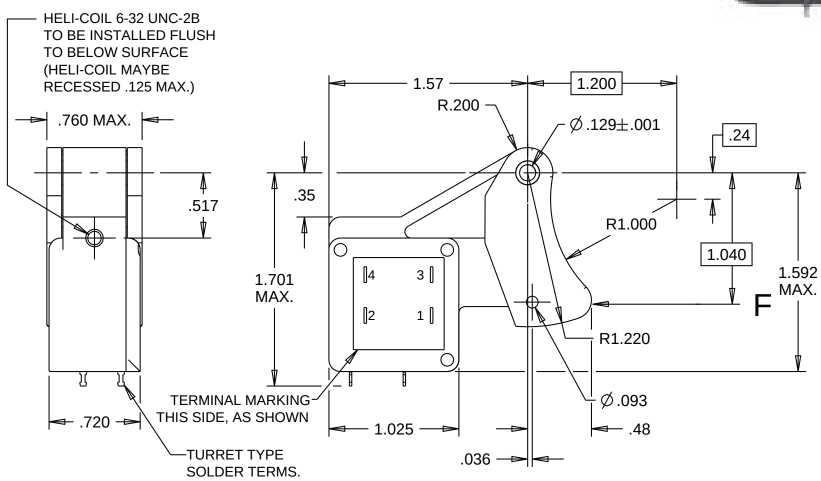
COMMERCIAL GRADE TRIGGER SWITCHES

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.

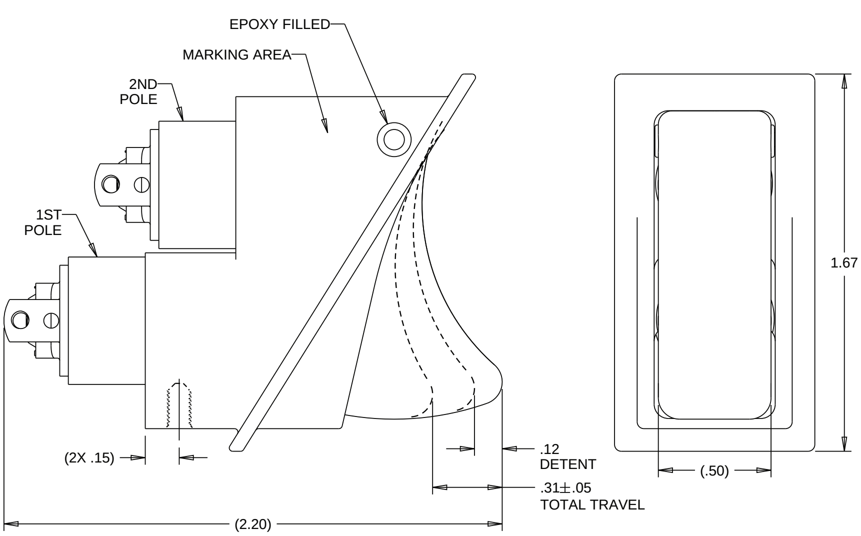
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	70,000 ft.
Resistive:	8A	8A
Inductive:	5A	5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	50,000 cycles	
Operating Force:	Pole One: 3.1 lbs. ± 1.7 lbs. Pass through Detent: .187 lbs. ± .020 lbs. Pole Two: 7.5 lbs. ± 2.0 lbs.	
MATERIALS:		
Button:	Red thermoplastic	
ENVIRONMENTAL:		
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:	
ELECTRICAL RATINGS (@28 VDC):	
Load	Sea Level
Resistive:	10A
Inductive:	5A
Lamp:	3A
DWV:	1050 VRMS
Electrical Life:	25,000 cycle
MECHANICAL:	
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.
MATERIALS:	
Button:	Red anodized aluminum
Housing:	Black anodized aluminum
ENVIRONMENTAL:	
Temperature Range:	-40˚C to +85˚C
Seal:	Sealed to IP68S



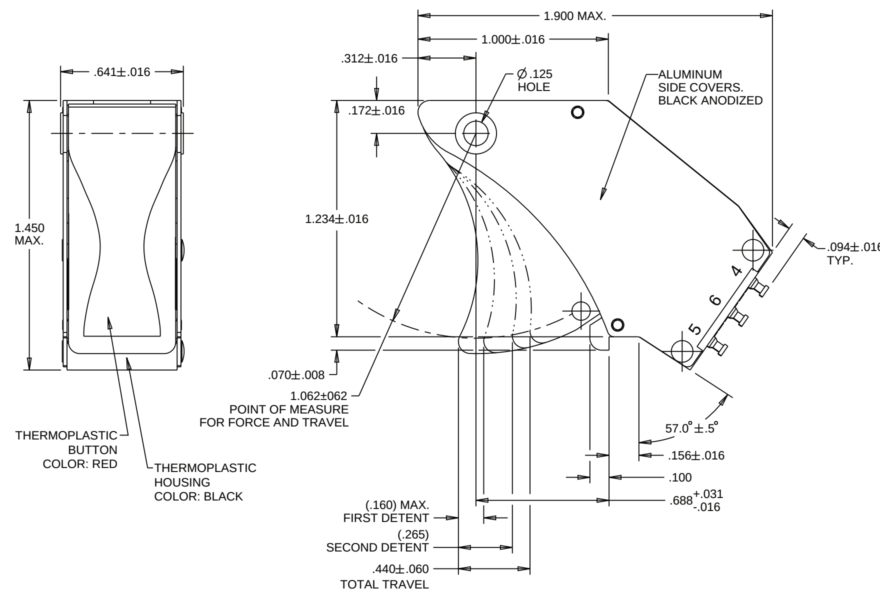
COMMERCIAL GRADE TRIGGER SWITCHES

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.

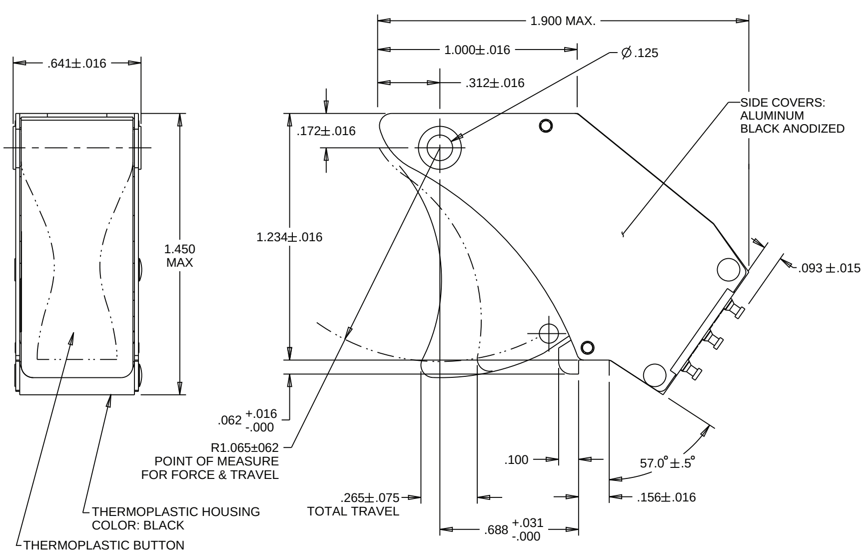
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	1A	1A
Inductive:	.5A	.5A
Logic Level:	10mA @ 5V	
DWV:	1050 VRMS	400 VRMS
Electrical Life:	25,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Operating Force:	Pre-Travel Detent One: 2.50 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.	
MATERIALS:		
Button:	Red thermoplastic	
Housing:	Black thermoplastic	
Side Covers:	Black anodized aluminum	
ENVIRONMENTAL:		
Temperature Range:	-55˚C to +85˚C	
Seal:	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:		
ELECTRICAL RATINGS (@28 VDC):		
Load	Sea Level	50,000 ft.
Resistive:	7A	4A
Inductive:	4A	2.5A
DWV:	1050 VRMS	400 VRMS
Electrical Life:	50,000 cycle	
MECHANICAL:		
Mechanical Life:	100,000 cycles	
Pretravel:	.130 min. from Full Out	
Overtravel:	.015 min. before Detent	
Actuation Force:	2.250 lbs. ± 0.500 lbs.	
MATERIALS:		
Button:	Gray Thermoplastic	
Housing:	Black Thermoplastic	
Side Covers:	Black Anodized Aluminum	
ENVIRONMENTAL:		
Temperature Range:	-40˚C to +85˚C	
Seal:	Unsealed per MIL-PRF-8805, Design 1	



TRIGGER SWITCHES

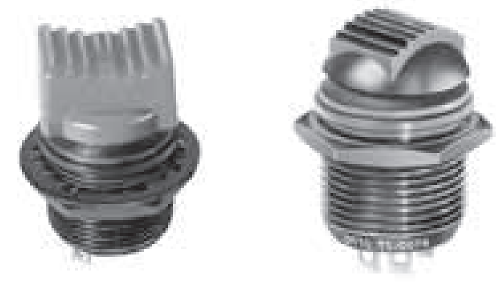
Trim Switches

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

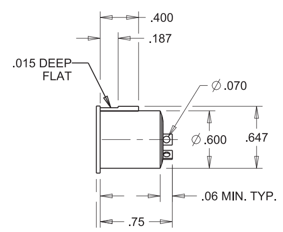
T1 MINI TRIM SWITCHES

2-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

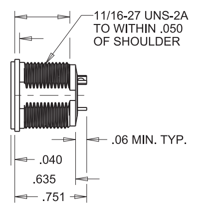
The T1 Mini Trim is a single pole, double throw, center off, momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16” threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



Typical Dimensions

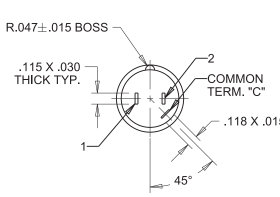


Press Fit

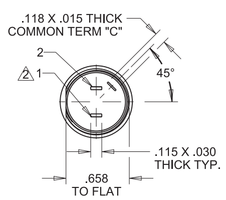


Threaded Body

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
Electrical Life:	100,000 cycles 1A Inductive @ 28VDC
Lever Travel:	15° max from center OFF
Seal:	IP64 or IP68S or MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Operating Force:	16 oz +/- 6 oz
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:	
Case:	Aluminum alloy or thermoplastic
Button:	Thermoplastic
Terminals:	Silver over brass Gold over silver over brass for logic level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher and panel gasket where applicable

T1 MINI TRIM PART NUMBER CODE

T1 – X X X X X X

Series
- **T1.** 2-Way

Grade
- **C.** Commercial
- **M.** Military

Button Style
- **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

Case Style
- **1.** Press Fit
- **2.** Threaded

Seal Level
- **1.** IP64 Dusttight
- **2.** IP68S Watertight
- **3.** Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419

Current Rating
- **1.** Standard
- **2.** Logic Level

Button Color*
- **1.** Red
- **2.** Black
- **8.** Gray
- **N.** Not Applicable**

* Contact factory for additional button colors.
** Use when specifying button styles L, M, N and P.

T1 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

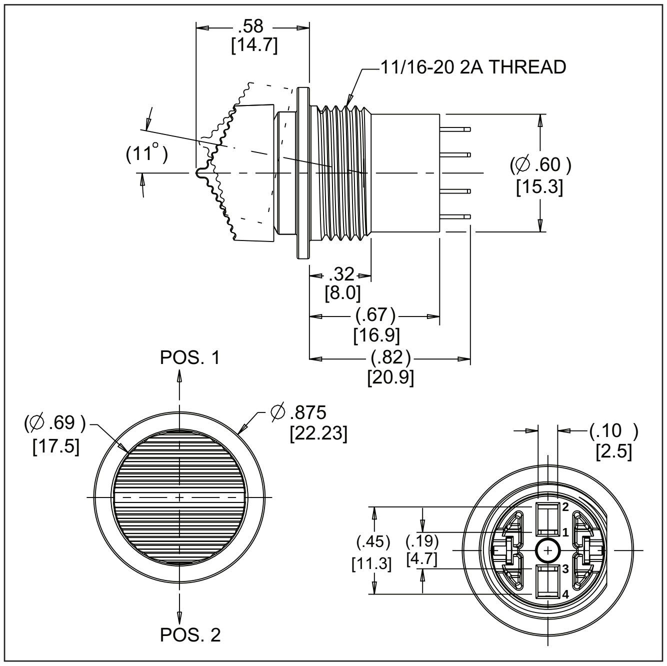
T1-T MINI TRIM SWITCHES

2-WAY MINI TRIM, COMMERCIAL GRADE

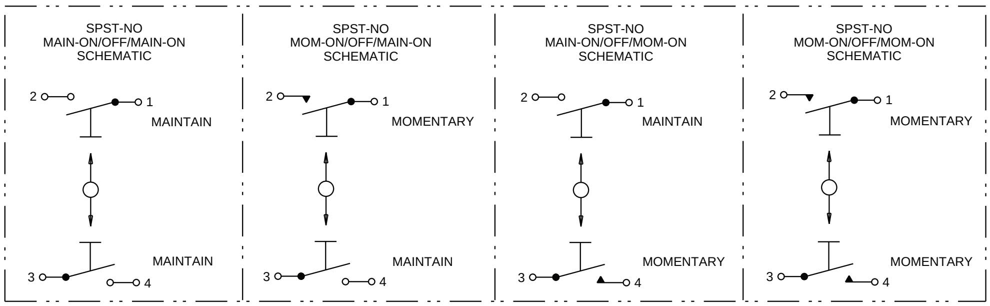
The T1-T Mini Trim is a latching, single pole, single throw, center off, momentary/maintained action contact switch. The T1-T has an 11/16" threaded case making it ideal for panel or control grip mounting. The switch provides a 2-way momentary/maintained toggle action with a positive click action. Four 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
Electrical Life:	100,000 cycles
Mechanical Life:	100,000 cycles
Seal:	Water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip)
Operating Temp Range:	-55°C to +85°C
Pretravel:	9.5° max
Overtravel:	1.5° min
Return Point:	4° min
Operating Force:	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:	
Case:	Anodized aluminum
Button:	Thermoplastic
Mounting Hardware:	Hex nut and lockwasher



T1-T MINI TRIM PART NUMBER CODE

T1-T – X X X X X *

Series
T1-T. 2-Way

Grade
C. Commercial

Switch Action/Circuit
A. MAIN-ON / OFF / MAIN-ON
B. MOM-ON / OFF / MAIN-ON
C. MAIN-ON / OFF / MOM-ON
D. MOM-ON / OFF / MOM-ON

Case Style
1. Threaded with D-Flat, Black
2. Threaded with Double D-Flat, Black
3. Threaded with D-Flat, Clear
4. Threaded with Double D-Flat, Clear

Current Rating
1. Standard
2. Logic Level

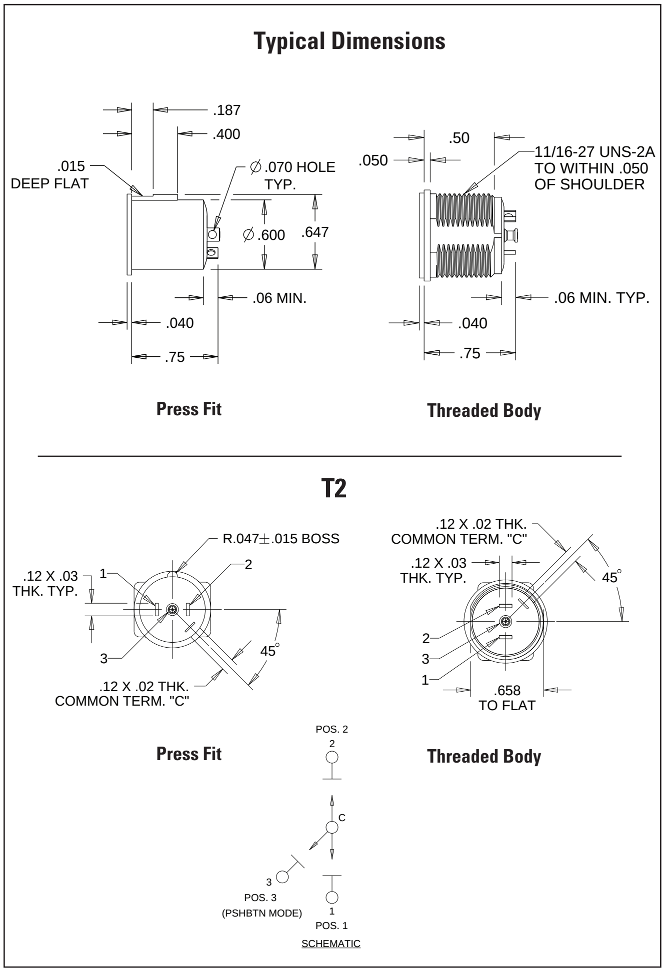
Button Color
1. Red
2. Black
8. Gray

Not Used
Leave Blank

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.



Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Rating**
Resistive (logic level)	10mA @ 5VDC
Inductive	1A @ 28VDC
DWV	1050Vrms
Electrical Life:	100,000 cycles
Lever Travel:	Toggle: 15° max from center OFF Pushbutton: 0.020 inches min
Seal:	IP64 or IP68S or MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Actuating Force:	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:	
Case:	Aluminum alloy or thermoplastic
Button:	Thermoplastic
Terminals:	Silver over brass Brass with gold over silver for logic level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher, panel seal gasket where applicable

T2 MINI TRIM PART NUMBER CODE

T2 – X X X X X X

Series
T2. 2-Way Plus Center Pushbutton

Grade
- **C.** Commercial
- **M.** Military
- **D.** Commercial - Lenient Center*
- **N.** Military - Lenient Center*

Button Style
- **B.** Tall Jog
- **C.** Rocker
- **D.** Cone
- **G.** Hat
- **H.** Stadium
- **J.** Castle
- **Q.** Rotated Stadium

Case Style
- **1.** Press Fit
- **2.** Threaded

Seal Level
- **1.** IP64 Dusttight
- **2.** IP68S Watertight
- **3.** Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419

Current Rating
- **1.** Standard
- **2.** Logic Level

Button Color*
- **1.** Red
- **2.** Black
- **8.** Gray
- **N.** Not Applicable

* Contact factory for additional button colors.

* Wider angle of operation for center pushbutton.

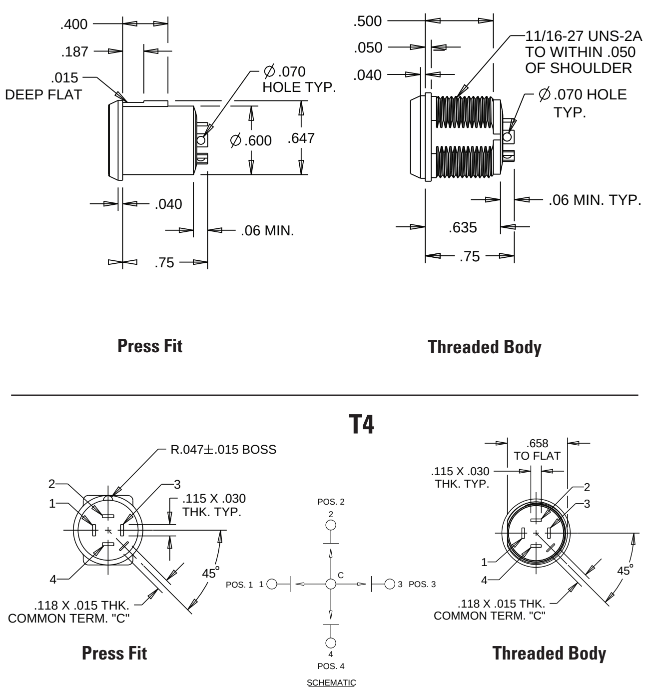
T2 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

T4 MINI TRIM SWITCHES

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.

Typical Dimensions



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Rating
Resistive (low level)	10mA @ 30mV
Inductive	1A @ 28VDC
DWV	1050Vrms
Electrical Life:	100,000 cycles 1A Inductive @ 28VDC
Lever Travel:	15° max from center OFF
Seal:	IP64 or IP68S or MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Actuating Force:	16 oz +/- 6 oz
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:

Case:	Aluminum alloy or thermoplastic
Button:	Thermoplastic
Terminals:	Silver over brass Brass with gold over silver for low level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher, panel seal gasket where applicable

T4 MINI TRIM PART NUMBER CODE

T4 – X X X X X X

Series
T4. 4-Way

Grade
C. Commercial
M. Military

Button Style
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

Case Style
1. Press Fit
2. Threaded

Seal Level
1. IP64 Dusttight
2. IP68S Watertight
3. Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419 ①

Current Rating
1. Standard
2. Low Level

Button Color*
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.

T4-T TACTILE MINI TRIM

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.

Short Hat Button Style

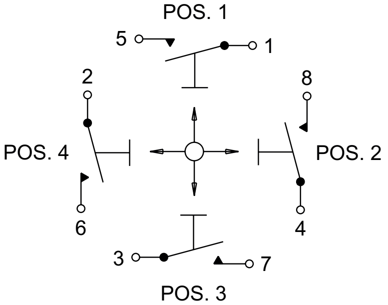
Castle Button Style

Inverse Hat Button Style

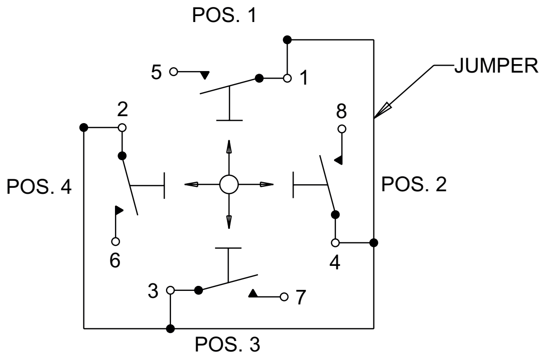
(Unsealed Versions Shown)

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**



SPST-NO
4 WAY
SCHEMATIC

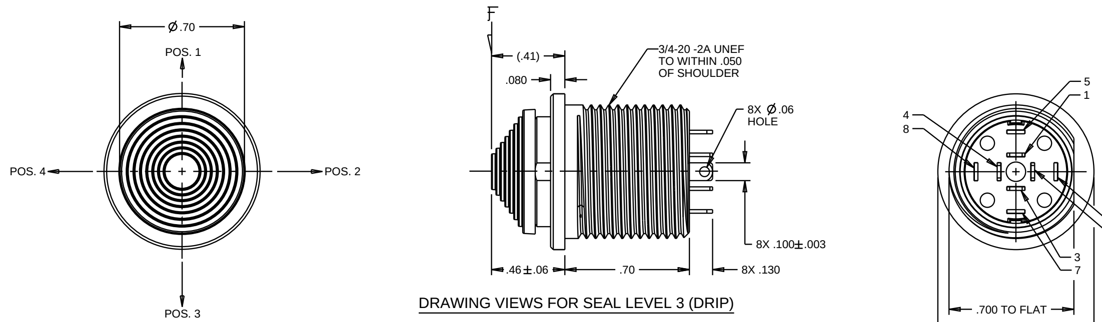


SPST-NO
4 WAY WITH COMMON JUMPER
SCHEMATIC

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

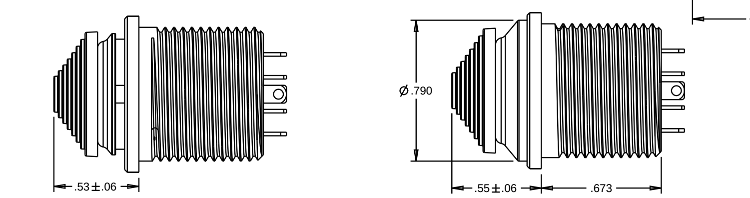
T4-T TACTILE MINI TRIM

4-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE



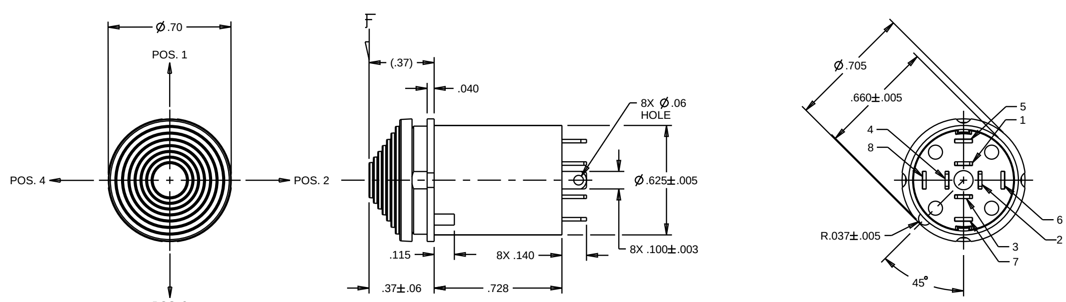
DRAWING VIEWS FOR SEAL LEVEL 3 (DRIP)

Short Hat Button Style with Threaded Case



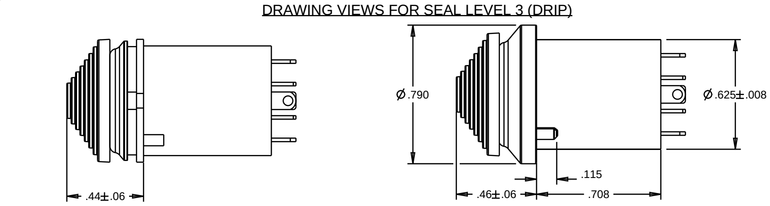
DRAWING VIEW FOR SEAL LEVEL 1 (IP64)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

DRAWING VIEW FOR SEAL LEVEL 2 (IP68S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)



DRAWING VIEWS FOR SEAL LEVEL 3 (DRIP)

Short Hat Button Style with Press Fit Case



DRAWING VIEW FOR SEAL LEVEL 1 (IP6K4S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

DRAWING VIEW FOR SEAL LEVEL 2 (IP6K8S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

T4-T PART NUMBER CODE

T4-T	X	X	X	X	X	X
Series	**Grade**	**Button Style***	**Case Style**	**Seal**	**Current Rating**	**Button Color****
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.

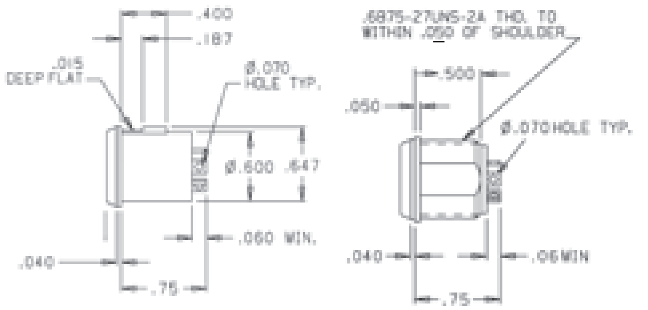
Specifications Subject To Change Without Notice

T5 MINI TRIM SWITCHES

4-WAY PLUS CENTER PUSHBUTTON MINI TRIM, COMMERCIAL & MILITARY GRADES

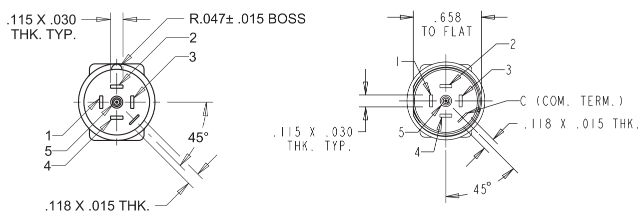
The T5 Mini Trim is a single pole, 5 throw Center off momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.

Typical Dimensions

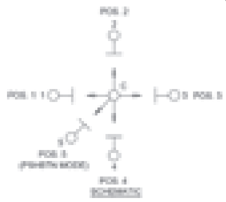


Press Fit　　Threaded Body

T5



Press Fit　　Threaded Body



Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Rating**
Resistive	10mA @ 5VDC (logic level)
Inductive	1A @ 28VDC
DWV	1050Vrms
Electrical Life:	100,000 cycles 1A Inductive @ 28VDC
Lever Travel:	Toggle: 15° max from center OFF Pushbutton: 0.020 inches min
Seal:	IP64 or IP68S or MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Operating Force:	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:	
Case:	Aluminum alloy or thermoplastic
Button:	Thermoplastic
Terminals:	Silver over brass Brass with gold over silver for logic level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher, panel seal gasket where applicable

T5 MINI TRIM PART NUMBER CODE

T5 – X X X X X X

Series
- **T5.** 4-Way Plus Center Pushbutton

Grade
- **C.** Commercial
- **M.** Military
- **D.** Commercial - Lenient Center*
- **N.** Military - Lenient Center*

Button Style
- **B.** Tall Jog
- **C.** Rocker
- **D.** Cone
- **E.** LRUD Hat
- **G.** Hat
- **H.** Stadium
- **J.** Castle
- **K.** 4-Way Jog
- **P.** 4-40 Threaded Post
- **Q.** Rotated Stadium

Case Style
- **1.** Press Fit
- **2.** Threaded

Seal Level
- **1.** IP64 Dusttight
- **2.** IP68S Watertight
- **3.** Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419

Current Rating
- **1.** Standard
- **2.** Logic Level

Button Color*
- **1.** Red
- **2.** Black
- **8.** Gray
- **N.** Not Applicable**

* Contact factory for additional button colors.

* 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.

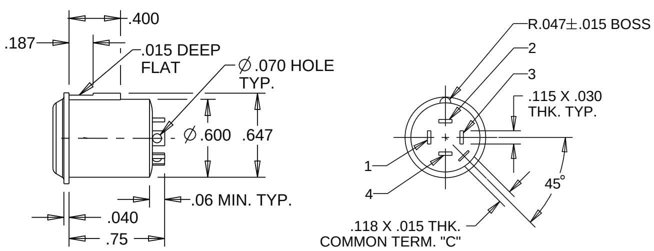
T8 MINI TRIM SWITCHES

8-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

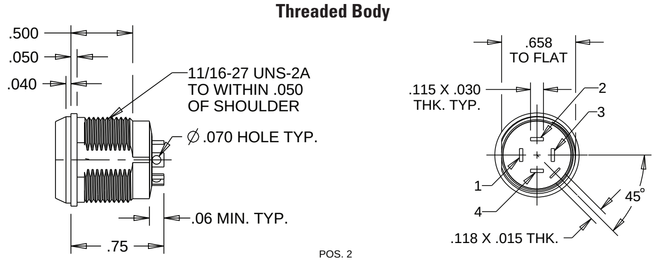
The T8 Mini Trim is a single pole, 8 throw, center off momentary contact (self return to center off) switch. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.

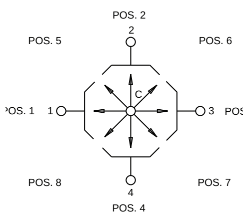
Typical Dimensions

Press Fit



Threaded Body





Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Rating**
Resistive	10mA @ 5VDC (logic level)
Inductive	1A @ 28VDC
DWV	1050Vrms
Electrical Life:	100,000 cycles
Lever Travel:	Toggle: 15° max from center OFF
Seal:	IP64 or IP68S or MIL-PRF-8805 Design 3
Operating Temp Range:	-55°C to +85°C
Operating Force:	Toggle: 16 oz +/- 6 oz
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:	
Button:	Thermoplastic
Case:	Black anodized aluminum alloy
Terminals:	Silver over brass Brass with gold over silver for logic level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher, panel seal gasket where applicable

T8 MINI TRIM PART NUMBER CODE

T8 – X X X X X X

Series
T8. 8-Way

Grade
C. Commercial
M. Military

Button Style
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

Case Style
1. Press Fit
2. Threaded

Seal Level
1. IP64 Dusttight
2. IP68S Watertight
3. Design Symbol 3 Watertight per MIL-PRF-8805 and Meets Environmental Testing per MIL-DTL-9419

Current Rating
1. Standard
2. Logic Level

Button Color*
1. Red
2. Black
8. Gray
N. Not Applicable**

* Contact factory for additional button colors.
** Use when specifying button styles L, M, N and P

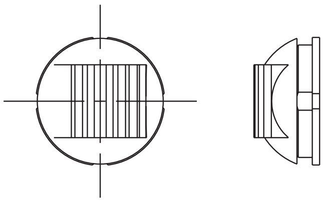
T8 Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

 Specifications Subject To Change Without Notice

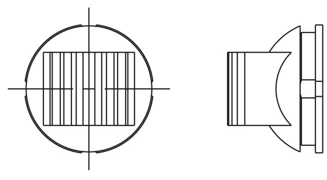
T1, T2, T4, T5 & T8 MINI TRIM BUTTON STYLES

T1, T2, T4, T5 AND T8 MINI TRIM BUTTON STYLES

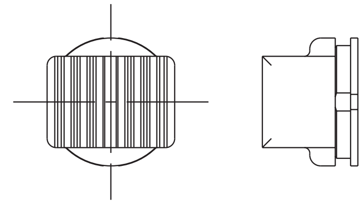
A - 2-WAY JOG



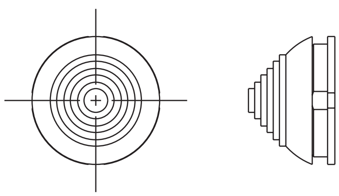
B - TALL JOG



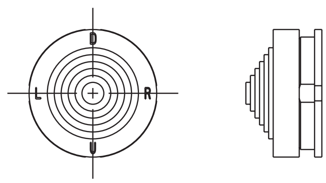
C - ROCKER



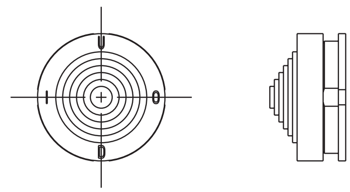
D - CONE



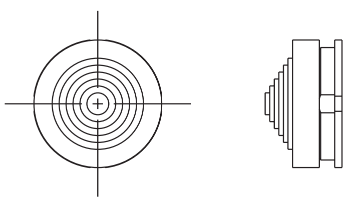
E - LRUD HAT



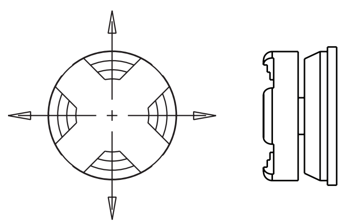
F - IOUD HAT



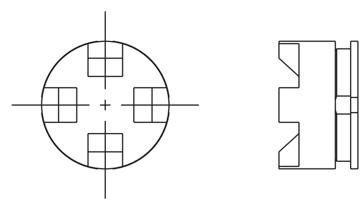
G - HAT



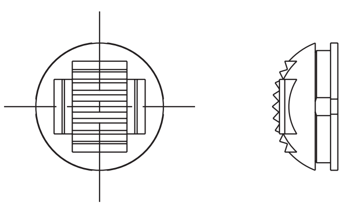
H - STADIUM



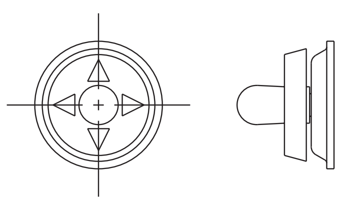
J - CASTLE



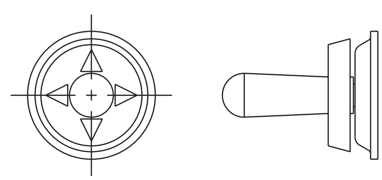
K - 4-WAY JOG



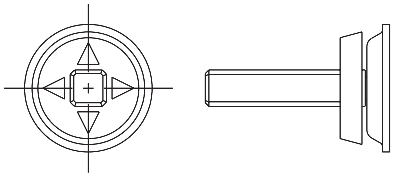
L - SHORT BAT



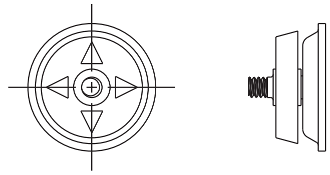
M - LONG BAT



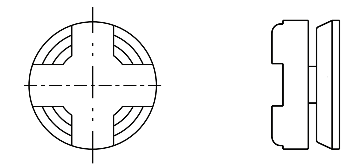
N - POST



P - 4-40 THREADED POST



Q - ROTATED STADIUM



T8-T TACTILE MINI TRIM

8-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE

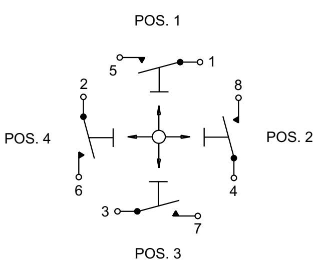
The T8-T toggle switch provides an 8-way momentary toggle action with detent providing a positive click action that indicates circuit transfer to the operator. The T8-T series provides commercial and military grade switching with sealing up to IP68S, and is ideal for grip applications in aircraft and off-road equipment.

Hat Button Style
with Press Fit Case

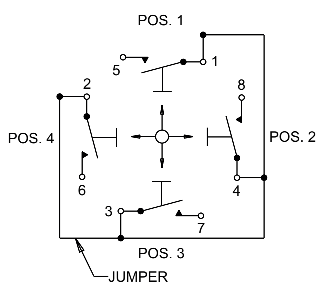
Inverse Hat Button Style
with Threaded Case

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**



8-WAY SCHEMATIC



8-WAY SCHEMATIC
WITH JUMPER

Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Sea Level @ 28VDC**
Resistive	2A
Inductive	1A
DWV	1000Vrms
Logic Level	10mA @ 5VDC
Electrical Life:	30,000 cycles (Military), 50,000 cycles (Commercial)
Mechanical Life:	150,000 cycles
Seal:	IP64, IP68S or unsealed
Operating Temp Range:	-55°C to +85°C
Operating Force:	1.2 lb. +/- 0.5 lb.
Button Strength:	4.5 lbs. min pull
Overtravel:	1° min
Pretravel:	9.5° max
Return Point:	3.5° min
MATERIALS:	
Case:	Black Thermoplastic
Button:	Thermoplastic
Bushing:	Black anodized aluminum alloy
Mounting Hardware:	Hexnut, lockwasher, and panel seal (level 1 and 2 only)

T8-T PART NUMBER CODE

T8-T X X X X X X

Series
T8-T 8-Way

Grade
C. Commercial
M. Military

Button Style
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

Case Style
3. Press Fit
4. Threaded

Seal*
1. IP64
2. IP68S
3. Unsealed

Current Rating
1. Standard
2. Logic Level
3. Standard With Internal Jumper
4. Logic Level With Internal Jumper

Button Color**
1. Red
2. Black
8. Gray

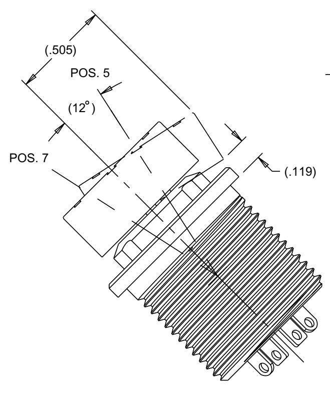
* Panel seal only
** Contact factory for additional colors.

T8-T Mini Trim button styles are shown on the Button Styles page and in the appendix.

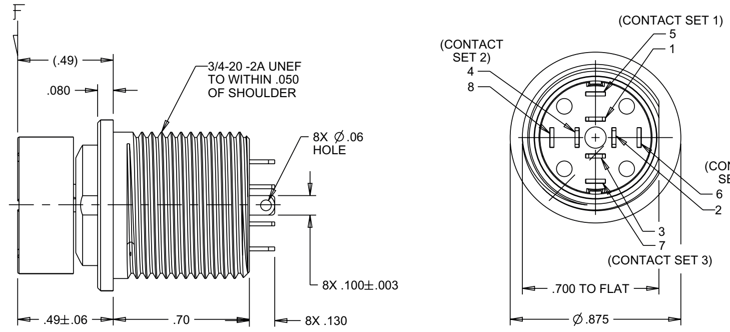
 Specifications Subject To Change Without Notice

8-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE

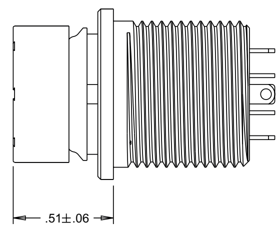
Inverse Hat Button with Threaded Case Style



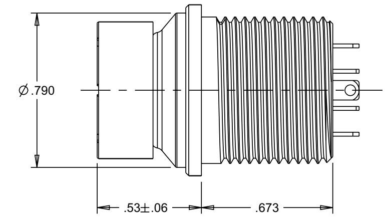
VIEW PROJECTED FROM PLANE CREATED BETWEEN POSITIONS 7 AND 5.



DRAWING VIEWS FOR SEAL LEVEL 3 (UNSEALED)

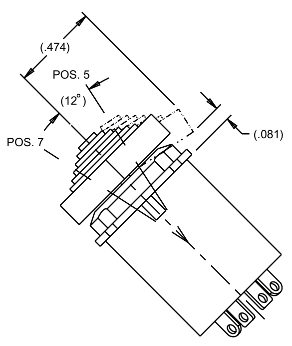


DRAWING VIEW FOR SEAL LEVEL 1 (IP64)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

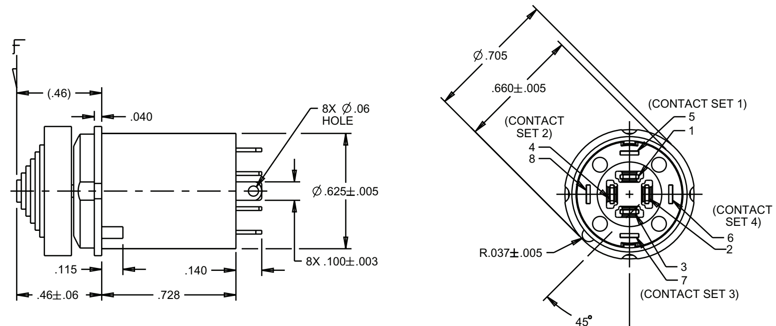


DRAWING VIEW FOR SEAL LEVEL 2 (IP68S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

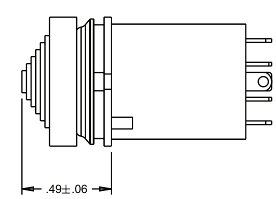
Hat Button with Press Fit Case Style



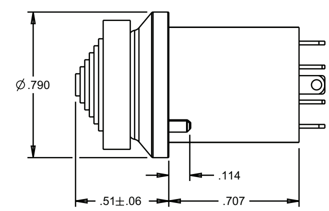
VIEW PROJECTED FROM PLANE CREATED BETWEEN POSITIONS 7 AND 5.



DRAWING VIEWS FOR SEAL LEVEL 3 (UNSEALED)

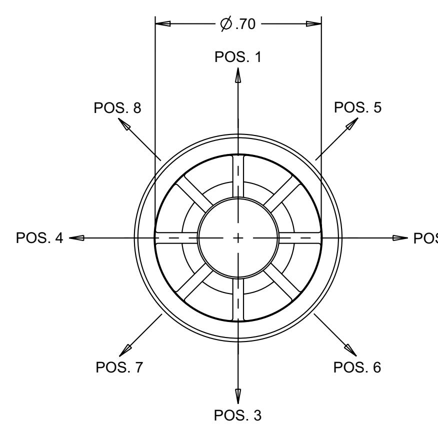


DRAWING VIEW FOR SEAL LEVEL 1 (IP6K4S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)



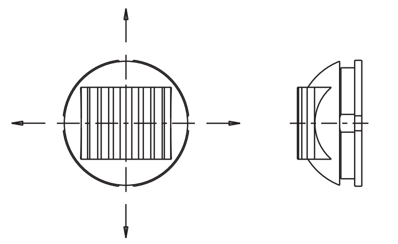
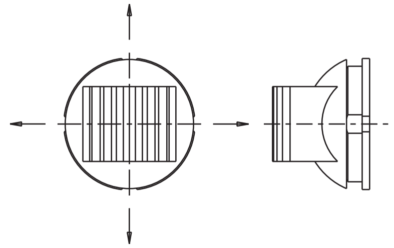
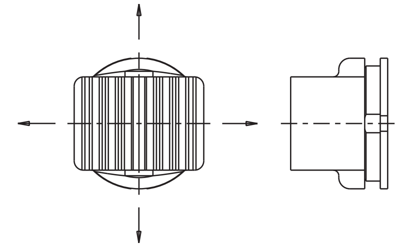
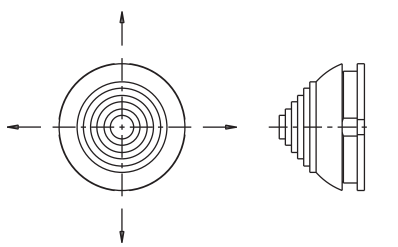
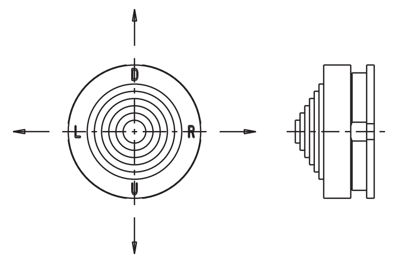
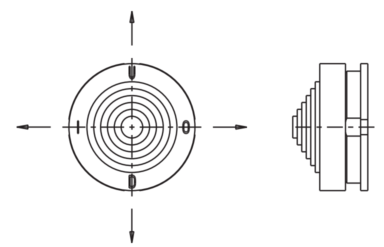
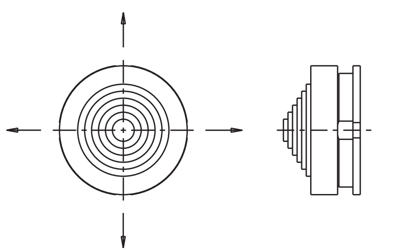
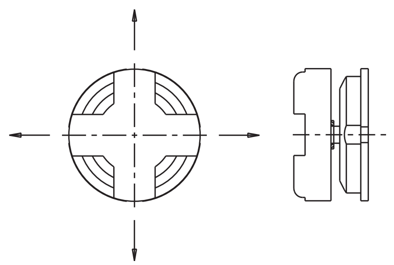
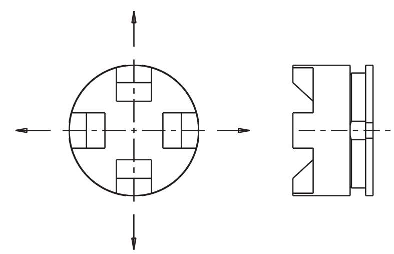
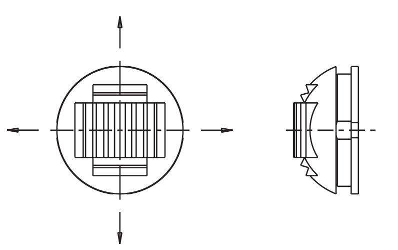
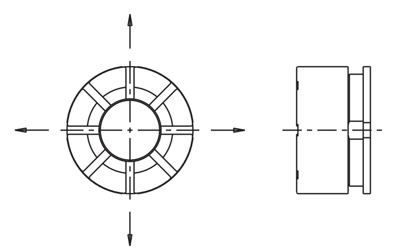
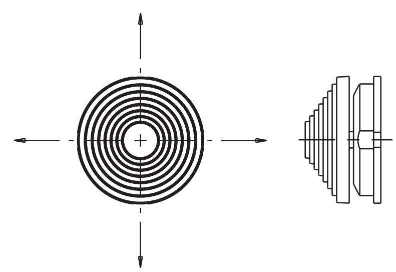
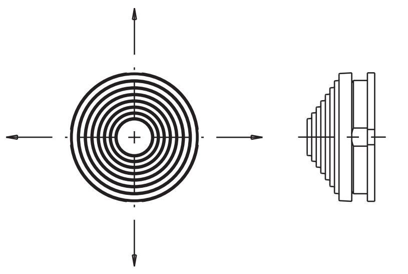
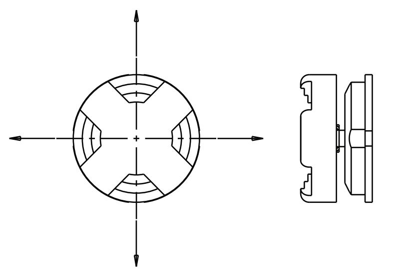
DRAWING VIEW FOR SEAL LEVEL 2 (IP6K8S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

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



T4-T AND 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)	
		

Specifications Subject To Change Without Notice

SHORTER, LOGIC LEVEL TACTILE MINI TRIM

LOGIC LEVEL 4-WAY OR 4-WAY PLUS CENTER PUSHBUTTON TACTILE MINI TRIM

TK with
Molex Connector

TK 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.

Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Rating**
Resistive	50mA max @ 12VDC
Electrical Life:	1,000,000 cycles
Mechanical Life:	1,000,000 cycles
Seal:	IP64, IP68S or unsealed
Operating Temp Range:	-40°C to +85°C
Operating Force:	1.0 lb. +/- 0.5 lb.
Total Travel Angle:	18° +/- 4°
Pushbutton Operating Force:	1.5 lb. +/- 0.5 lb.
Total Pushbutton Travel:	.05 lb. +/- .02 lb.
Max. Allowable Force:	22 lbs. in any direction
MATERIALS:	
Case:	Thermoplastic, black
Button:	Thermoplastic
Bellows:	Black silicone
Connection:	Connector or wire leads
Mounting Hardware:	Hex nut

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**

TK MINI TRIM PART NUMBER CODE

TK – X X X X X X

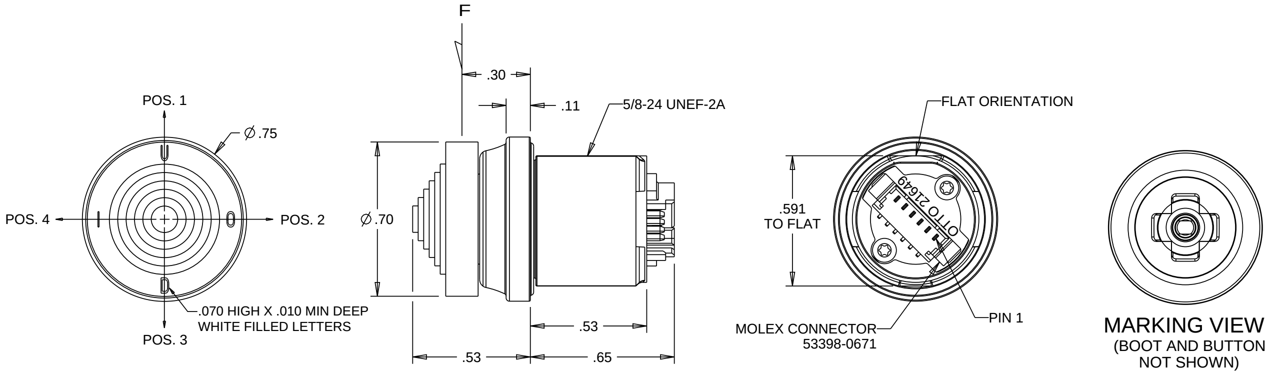
Series	Function	Button Style	Case Style	Panel Seal Level	Connection	Button Color*
TK. Tactile	**4.** 4-Way (Center OFF) **5.** 4-Way with Center Pushbutton	**D.** Cone **E.** LRUD Hat **F.** IOUD Hat **G.** Hat **H.** Stadium **J.** Castle **K.** 4-Way Jog **L.** Inverse Hat **M.** Tall Hat **N.** Short Hat **P.** Rotated Stadium	**4.** Threaded	**1.** Unsealed **2.** IP64 **3.** IP68S	**1.** Molex Connector 53398-0671 **2.** Wire Leads, 26 SAE, UL 1213 (available in 4 weeks)	**1.** Red **2.** Black **8.** Gray

* Contact factory for additional button colors.

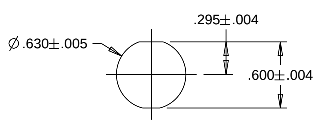
TK Mini Trim Button Styles are shown on the Button Styles page and in the appendix.

SHORTER, LOGIC LEVEL TACTILE MINI TRIM

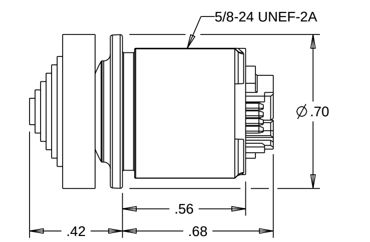
LOGIC LEVEL 4-WAY OR 4-WAY PLUS CENTER PUSHBUTTON TACTILE MINI TRIM



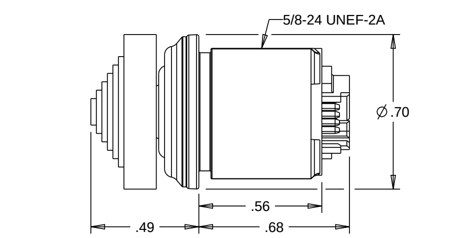
DRAWING VIEWS FOR PANEL SEAL LEVEL 3 (IP6K8S) MOLEX CONNECTOR CONNECTION



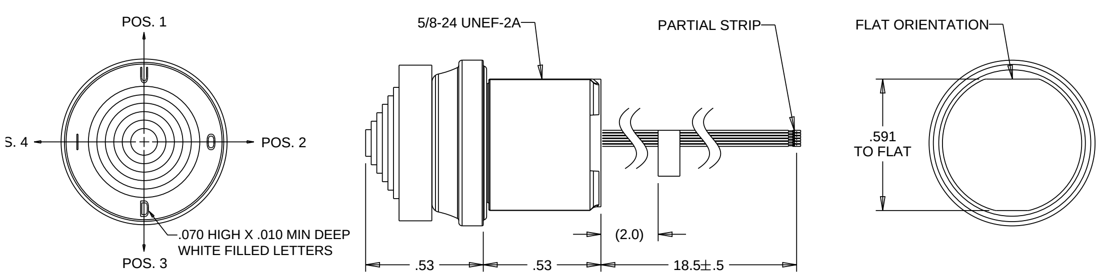
SUGGESTED PANEL OPENING



DRAWING VIEW FOR PANEL SEAL LEVEL 1 (UNSEALED)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

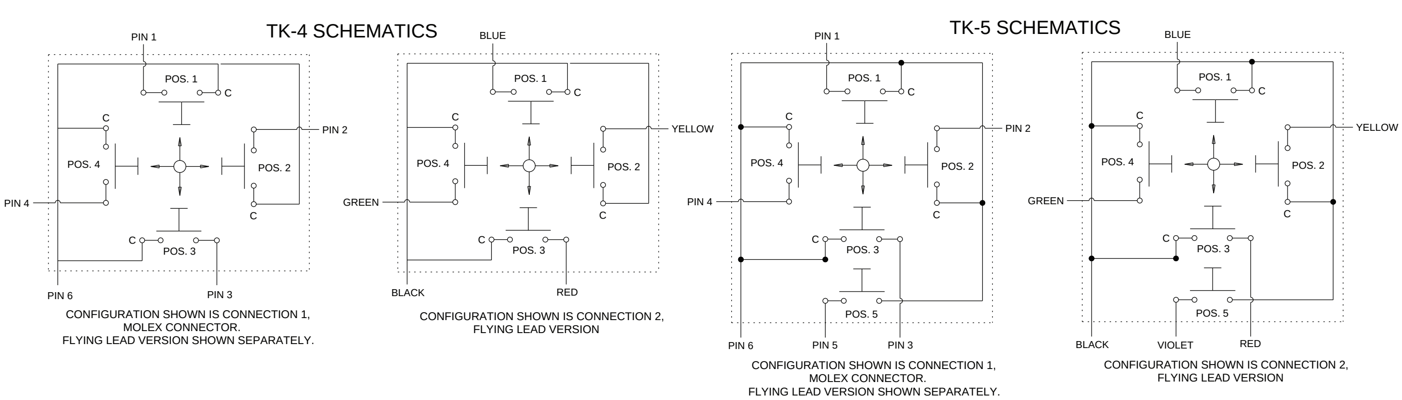


DRAWING VIEW FOR PANEL SEAL LEVEL 2 (IP6K4S)
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)



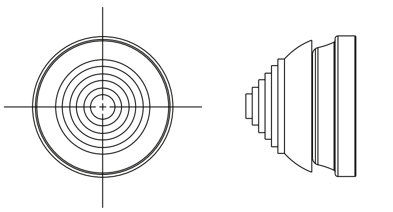
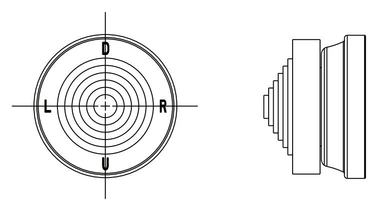
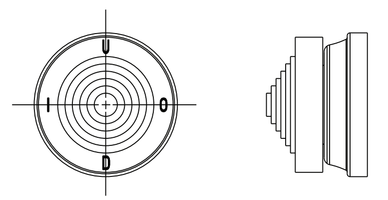
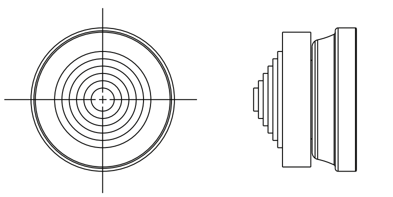
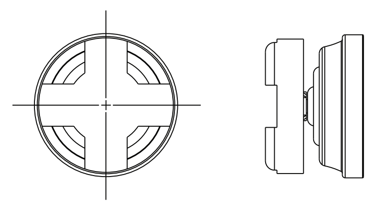
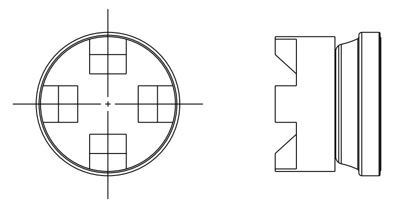
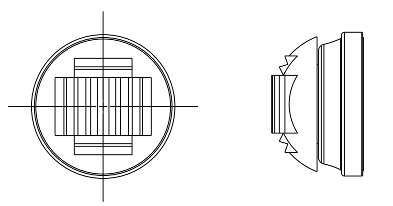
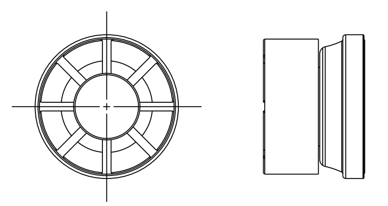
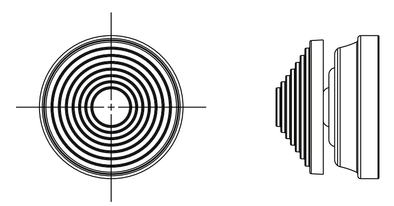
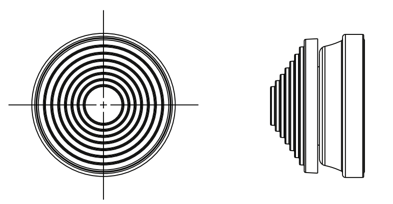
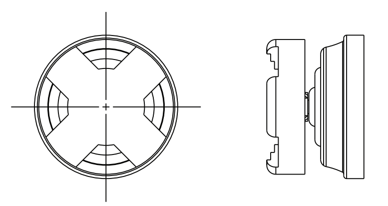
DRAWING VIEWS FOR SEAL LEVEL 3 (IP6K8S) FLYING LEAD CONNECTION
(FOR FEATURES NOT DIMENSIONED SEE MAIN DRAWING VIEWS)

TK Series Schematics



TK MINI TRIM BUTTON STYLES

TK Mini Trim Button Styles

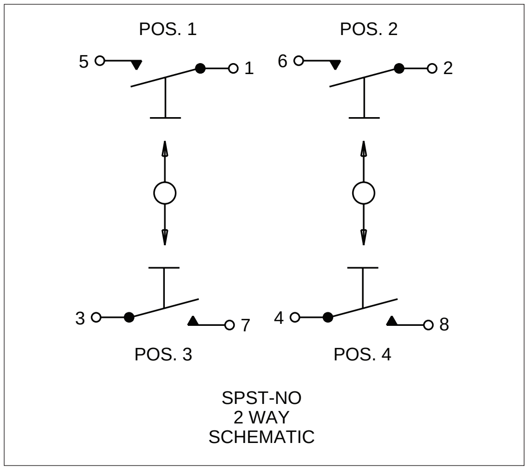
D – CONE	E – LRUD HAT	F – IOUD HAT
		
G – HAT	**H – STADIUM**	**J – CASTLE**
		
K – 4-WAY JOG	**L – INVERSE HAT**	**M – TALL HAT**
		
N – SHORT HAT	**P – STADIUM ROTATED**	
		

SPLIT TRIM

(2) TWO-WAY MOMENTARY TRIMS WITH TACTILE RESPONSE

Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	**Sea Level @ 28VDC**
Resistive	2A
Inductive	1A
DWV	1050Vrms
Logic Level	10mA @ 5VDC
Electrical Life:	150,000 cycles commercial, 100,000 cycles military
Mechanical Life:	200,000 cycles
Seal:	Water resistant per MIL-STD-810F, method 506.4 procedure 3 (drip)
Operating Temp Range:	-40°C to +85°C
Operating Force:	0.75 +/- 0.25 lbs.
Return Point:	4° minimum
Pretravel:	9.5° maximum
Overtravel:	1.5° minimum
MATERIALS:	
Case:	Black Anodized Aluminum
Button:	Delrin
Terminals:	Beryllium copper or brass Gold over silver for logic level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut and lockwasher

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**

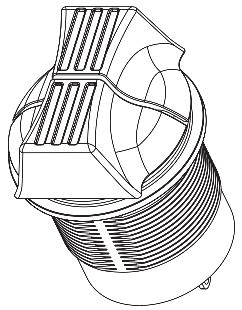
SPLIT TRIM PART NUMBER CODE

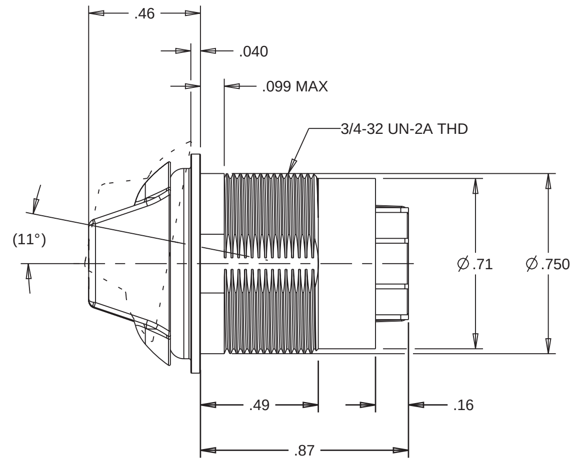
SPT – X X X X X X

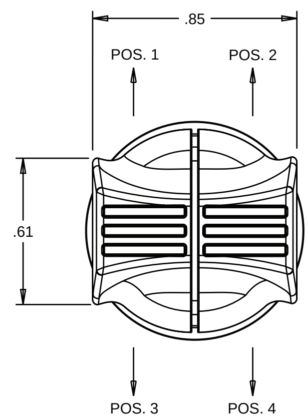
Series	Grade	Button Style	Case Style*	Seal Level	Current Rating	Button Color**
SPT. Split Trim	**C.** Commercial **M.**Military	**A.** Split Jog	**1.** Threaded with D-Flat **2.** Threaded with Double D-Flat	**1.** Unsealed (water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip))	**1.** Standard **2.** Logic Level	**1.** Red **2.** Black **8.** Gray

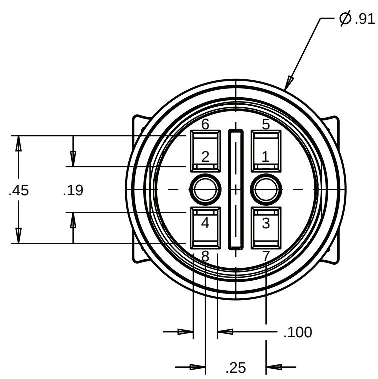
*Contact factory for press fit case.
**Additional button colors are available.

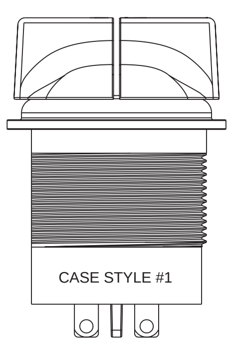
(2) TWO-WAY MOMENTARY TRIMS WITH TACTILE RESPONSE

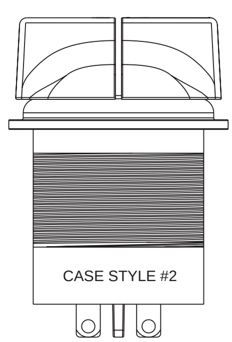




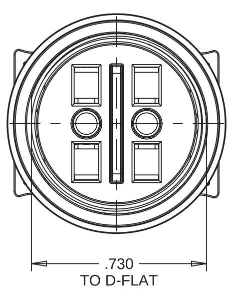




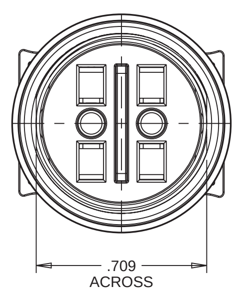




Single D-Flat



Double D-Flat



LARGE TRIM, 2-WAY PUSHBUTTON

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

T2-0008

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

T2-0009

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

T2-0015

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

T2-0016

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

T2-0034

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

T2-0018

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

T2-0047

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

T2-0044

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

T2-0045

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

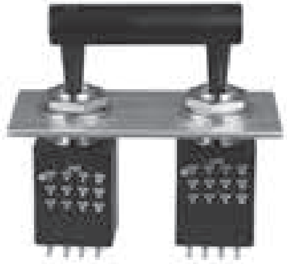
Switches

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)



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.

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, 2 Pole

Basic Switch: Per MIL-PRF-8805/109 (except terminals)
Enclosure: Toggle seal 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.

3-Position, 4 Pole with Phosphorescent Dot

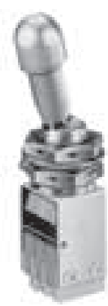
Basic Switches: Per MIL-PRF-8805/109-04 except terminals
Toggle: Sealed per MIL-DTL-83731
Rating: 1 amp Resistive @ 28VDC
.5 amp Inductive @ 28VDC
Operating Force: 1 to 6 lbs.
Action: Maintained
Cap/Handle: Stainless steel, painted
Housing: Polyester
Bushing: Stainless steel, black oxide finish

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.

2-Position, 3 Pole, Lever Lock

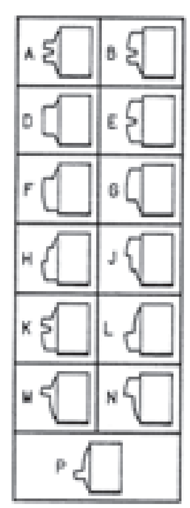
Basic Switches: Per MIL-PRF-8805/101
Enclosure: Toggle seal per MIL-DTL-83731
Operating Force: 5.0 lbs. max
Rating: 150mA Resistive @ 28VDC
Mechanical Life: 100,000 cycles
Action: Maintained-maintained
Handle: Stainless steel, dull nickel plate
Cap, Handle: Brass, dull nickel plate
Bushing & Bracket: Stainless steel
T1-0081D*
***Lever Lock configurations D, F and G available.



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



UNSEALED TOGGLE SWITCHES

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

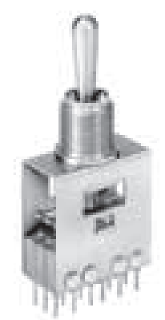
T1-0041

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)
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″
MS35333-138	C710333-138	0.625″
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

All hardware is stainless steel except MS25082-B11 which is brass, black oxide coated.

COMMERCIAL & MIL MINIATURE TOGGLES

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.

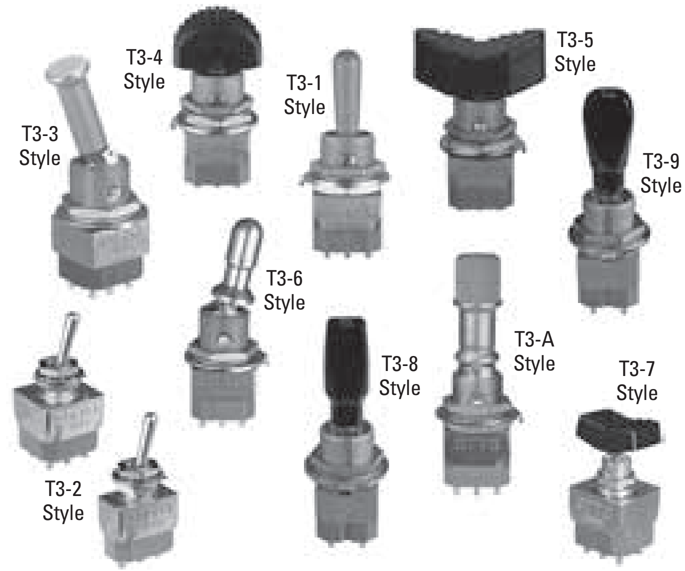
High contact pressure and superior wiping action of the OTTO design makes the T3 series an excellent choice for switching loads from logic level up to 5 amps.

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.



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**

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	
Electrical Life:	30,000 cycles	
Mechanical Life:	100,000 cycles	
Seal:	MIL-DTL-83731 (15/32-32 bushing style only)	
Operating Temp Range:	-65°C to +85°C	
MATERIALS:		
Handle:	303 Stainless	
Bushing:	Per MIL-DTL-83731	
Body:	Per MIL-DTL-83731	
Terminal Hardware:	None required	
Mounting Hardware:	Hex nuts, lockwasher and keyway washer	

T3 PART NUMBER CODE

T3 – X X X X X X – or X

Bushing Style

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

Terminal Style

1. Single Turret
4. PC Pin 0.150" lg.
5. PC Pin 0.270" lg.

Circuitry

1. Single Pole
2. Double Pole

Circuit Made With Lever At:

	Keyway Side	Center	Opposite Keyway
1.	ON	OFF	ON
2.	OFF	NONE	ON
3.	ON	NONE	ON
4.	(ON)	NONE	ON
5.	(ON)	OFF	(ON)
6.	(ON)	OFF	ON

NOTE: ( ) denotes momentary action.

Contact Material

1. Silver/Gold Flash
2. Gold Plate

Lockout Feature

Lockout feature configuration code letters A–P for bushing styles 3, 6 and A only. Otherwise omit.

Button Color ②
For bushing styles 4, 5 and 7

1. Red
2. Black
8. Gray

Lever Color

For bushing styles 1 & 2 - bat handle & bushing
A. Black
No Selection. Clear

For bushing styles 3 & 6 - bat handle & bushing (available only in clear)
No Selection. Clear

For bushing styles 8 & 9 - bat handle only
1. Clear
2. Red
No Selection. Black

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.

COMMERCIAL & MIL MINIATURE TOGGLES

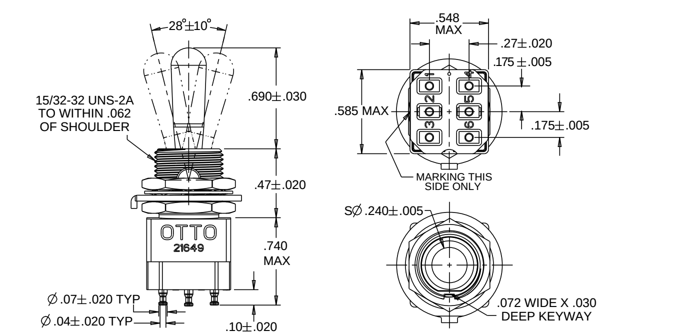
MEETS MIL-DTL-83731, COMMERCIAL & MILITARY GRADES

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.

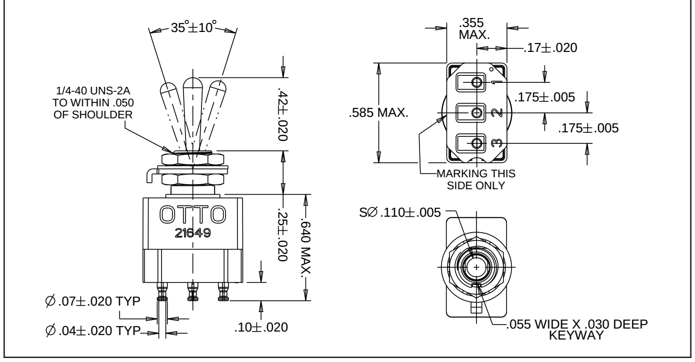
T3-1 Standard Toggle, 15/32-32 Bushing

Sealed front panel construction.



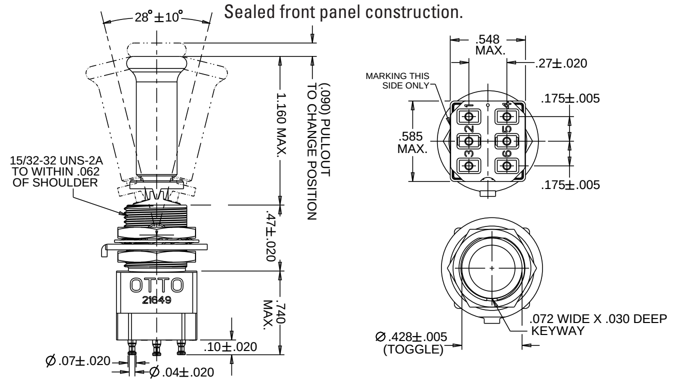
T3-2 Standard Toggle, 1/4-40 Bushing

Unsealed front panel construction. Optional front panel seal P/N C700223.



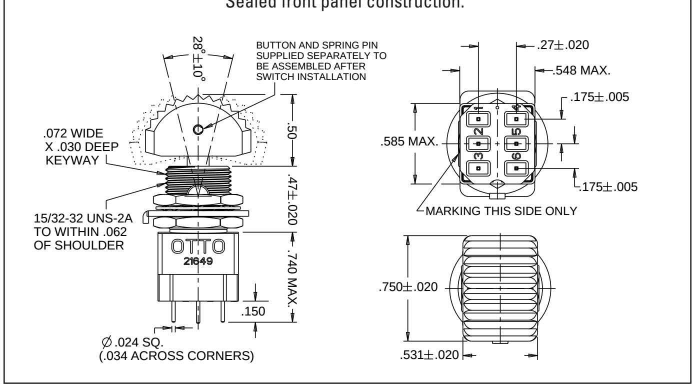
T3-3 Standard Toggle with Lockout, 15-32/32 Bushing

Sealed front panel construction.



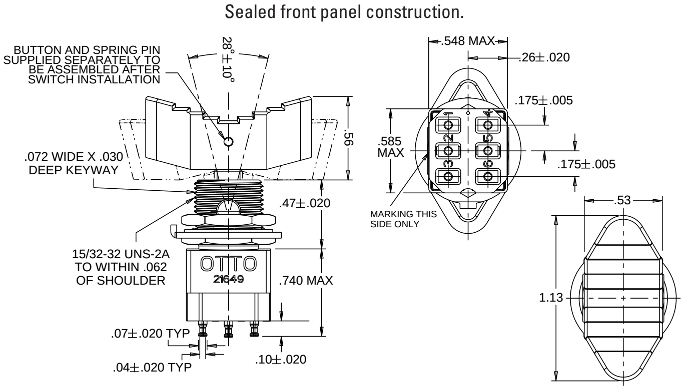
T3-4 Standard Toggle with Convex Button, 15/32-32 Bushing

Sealed front panel construction.



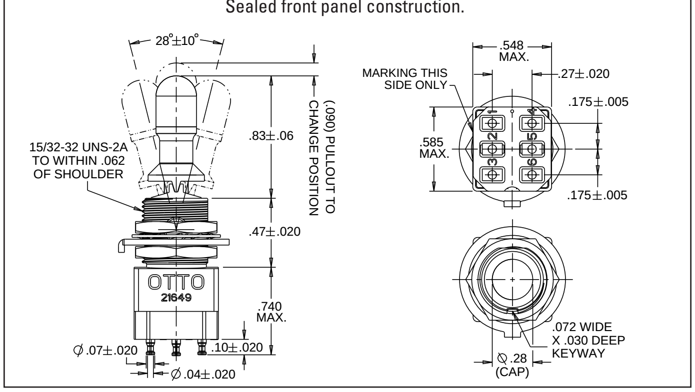
T3-5 Standard Toggle with Concave Button, 15/32-32 Bushing

Sealed front panel construction.



T3-6 Toggle with Lockout and Smaller Bat Handle, 15/32-32 Bushing

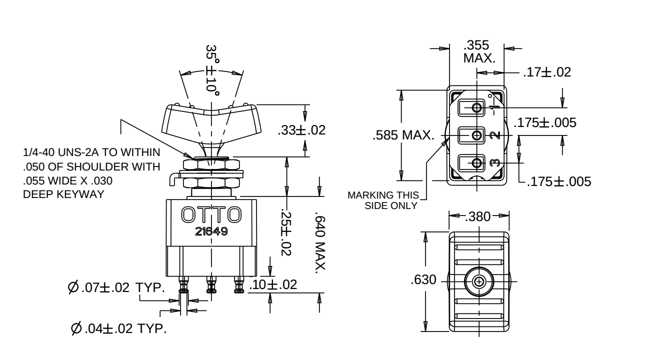
Sealed front panel construction.



FEATURING OTTO'S UNIQUE SNAP-ACTION ACTUATION

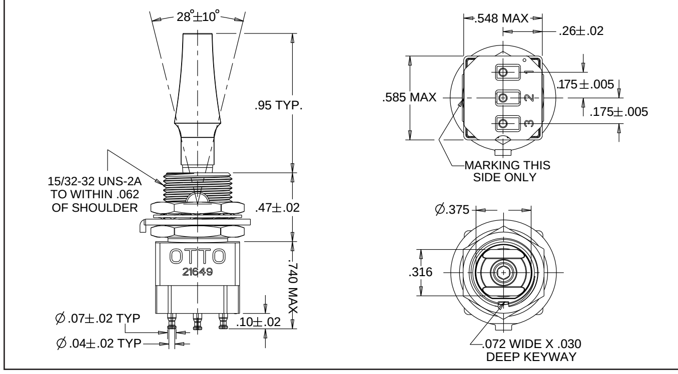
T3-7 Standard Toggle with Rocker Button, 1/4-40 Bushing

Unsealed front panel construction. Optional front panel seal P/N C700223.



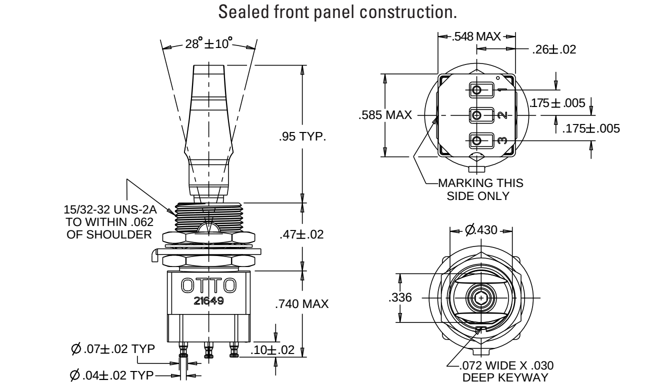
T3-8 Small Paddle Bat Handle Toggle, 15/32-32 Bushing

Sealed front panel construction.



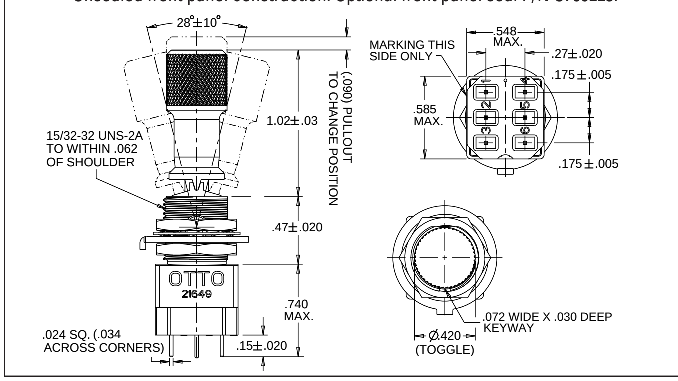
T3-9 Large Paddle Bat Handle Toggle, 15/32-32 Bushing

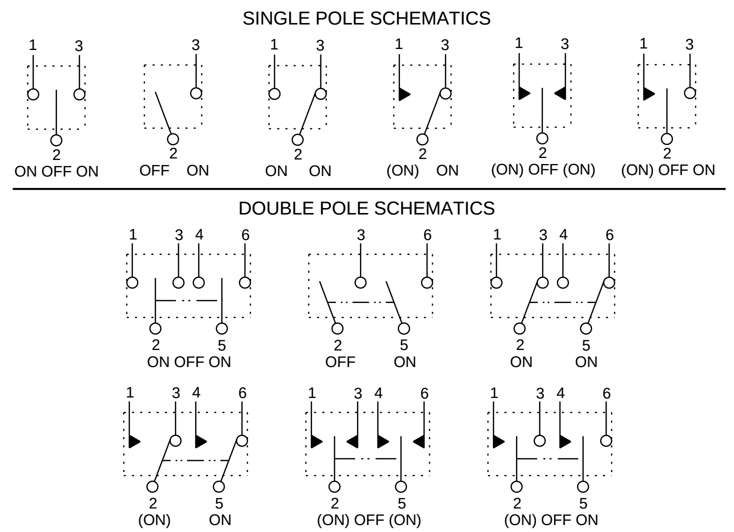
Sealed front panel construction.



T3-A Standard Toggle, 1/4-40 Bushing

Unsealed front panel construction. Optional front panel seal P/N C700223.

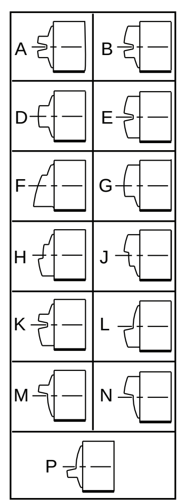




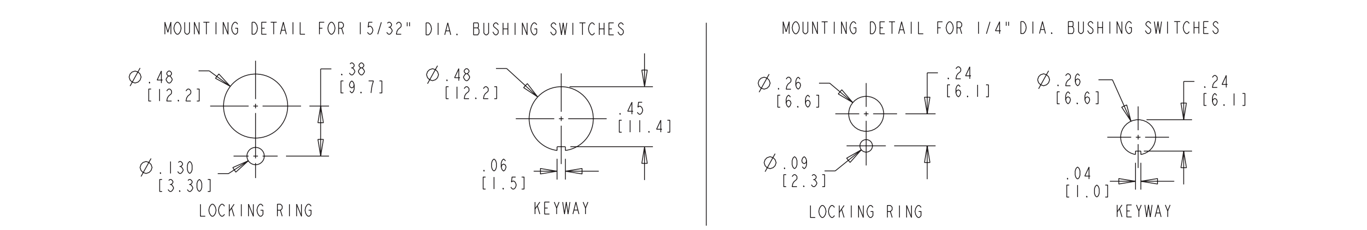
Lever Lockout Configuration Codes

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)



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.

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**
- **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	1000 VRMS	1000 VRMS	1000 VRMS
Logic Level	10mA @ 5VDC	N/A	50,000

Electrical Life:	See Rating Chart
Mechanical Life:	100,000 cycles
Seal:	IP68S and IP69K
Operating Temp Range:	-30°C to +85°C

MATERIALS:

Case:	Thermoplastic
Bushing:	Anodized aluminum alloy
Toggle:	Stainless steel
Contacts:	Fine silver/silver cadmium oxide
Logic Level:	Gold over silver
Terminal Hardware:	6-32 screw when applicable T7 recommended Quick Connect terminals: AMP 60253-2 for 12-16 AWG AMP 42100-2 for 14-18 AWG
Mounting Hardware:	Hex nuts, lockwasher, keyway washer

T7 PART NUMBER CODE

T7 – X X X X X X

Circuitry
1. 1 Pole
2. 2 Pole

Terminal Style
1. .250" Q.C.
2. Screw
3. Solder
4. PC Pin (consult factory)

Contact Rating
1. Std.
2. Logic Level

Circuit Made With Toggle At:

	Keyway Side	Center	Opposite Keyway
A.	ON	NONE	OFF
B.	ON	NONE	ON
C.	(ON)	NONE	OFF
D.	(ON)	NONE	ON
E.	(ON)	OFF	(ON)
F.	ON	OFF	ON
G.	(ON)	OFF	ON
H.	OFF	NONE	ON
J.	OFF	NONE	(ON)
K.	ON	OFF	(ON)

NOTE: ( ) denotes momentary action.

Toggle Style
1. Bat Handle
2. Lever Lockout (consult factory)*
3. Dome Button
4. Rocker Button
5. Bat Handle With Bushing Seal

Button Color**
1. Red
2. Black
3. Orange
4. Yellow
5. Green
6. Blue
7. Purple
8. Gray
9. White

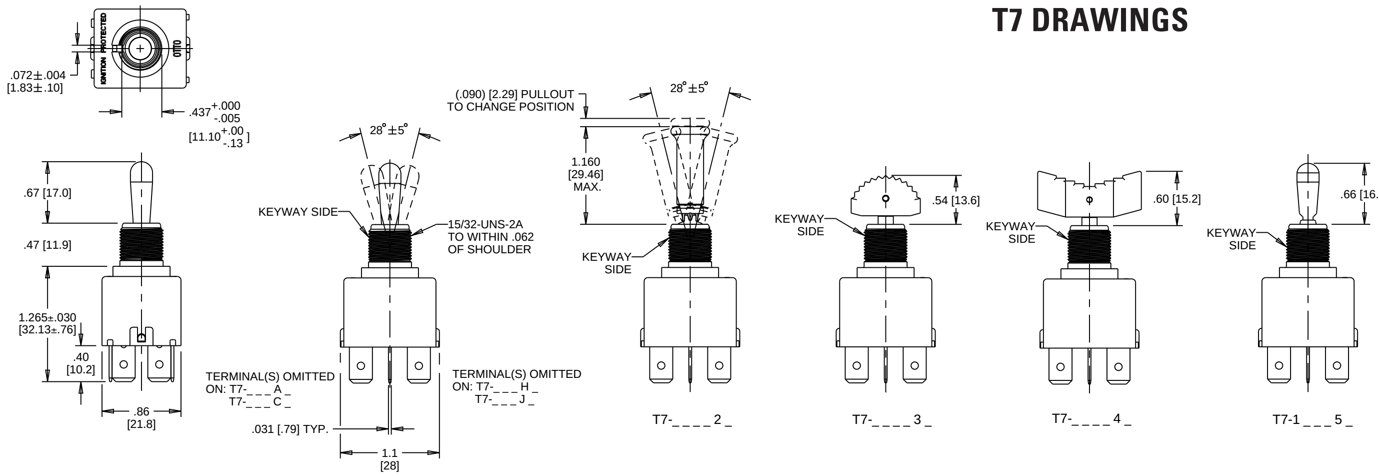
*See Lockout Configuration Codes

** Only applicable to Toggle Styles 3 & 4; otherwise omit.

T7 Connector P/N C801765
(See Connector page in Hardware & Accessories section)

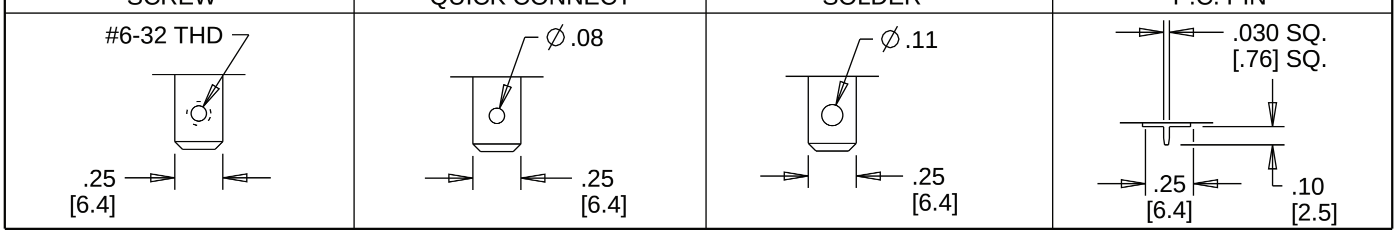
LOW COST TOGGLE FOR WET & DUSTY ENVIRONMENTS

T7 DRAWINGS

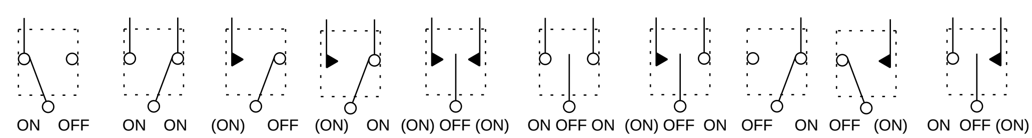


LOCKING COLLAR CONFIGURATIONS						
LOCKED IN THREE POSITIONS A	LOCKED IN CENTER & KEYWAY SIDE POSITION B	LOCKED OUT OF CENTER POSITION D	LOCKED IN CENTER POSITION E	LOCKED IN OPPOSITE KEYWAY POSITION F	LOCKED IN KEYWAY SIDE POSITION G	LOCKED OUT OF CENTER & KEYWAY SIDE POSITION H
LOCKED OUT OF CENTER & OPPOSITE KEYWAY POSITION J	LOCKED IN CENTER & OPPOSITE KEYWAY POSITION K	LOCKED OUT OF KEYWAY SIDE POSITION L	LOCKED OUT OF & INTO OPPOSITE KEYWAY POSITION M	LOCKED OUT OF OPPOSITE KEYWAY POSITION N	LOCKED OUT OF & INTO KEYWAY SIDE POSITION P	FIGURES A THRU P DO NOT REPRESENT DETAILS OF CONSTRUCTION. THEY SCHEMATIC ILLUSTRATE LOCKING CONFIGURATIONS & MOM. POSITIONS

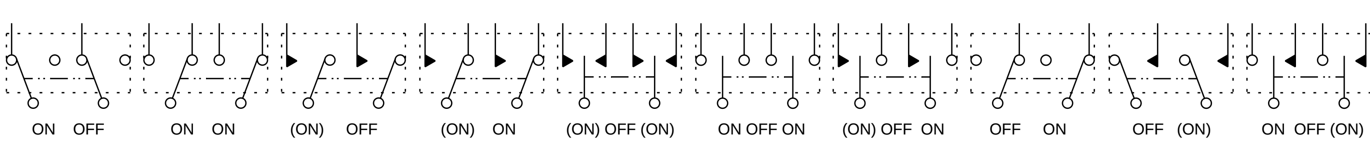
TERMINAL STYLES (.031 [.78] THICK)			
SCREW	QUICK CONNECT	SOLDER	P.C. PIN



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

Electrical Life:	See Rating Chart
Mechanical Life:	100,000 cycles
Seal:	IP68S and IP69K
Operating Temp Range:	-30°C to +85°C

MATERIALS:

Case:	Thermoplastic
Bushing:	Anodized aluminum alloy
Toggle:	Stainless steel
Contacts:	Fine silver/silver cadmium oxide
Logic Level Contacts:	Gold over silver
Mounting Hardware:	Hex nuts, lockwasher, keyway washer

T71 PART NUMBER CODE

T71 – X X X X X *

Circuitry
1. 1 Pole

Terminal Style
1. .250" Q.C.
2. Screw
3. Solder
4. PC Pin (consult factory)

Contact Rating
1. Std.
2. Logic Level

Circuit Made With Toggle At:

	Keyway Side	Center	Opposite Keyway	Circuit
A.	ON	NONE	OFF	SPST
B.	ON	NONE	ON	SPDT
C.	(ON)	NONE	OFF	SPST
D.	(ON)	NONE	ON	SPDT
E.	(ON)	OFF	(ON)	SPDT
F.	ON	OFF	ON	SPDT
G.	(ON)	OFF	ON	SPDT
H.	OFF	NONE	ON	SPST
J.	OFF	NONE	(ON)	SPST
K.	ON	OFF	(ON)	SPDT

NOTE: ( ) denotes momentary action.

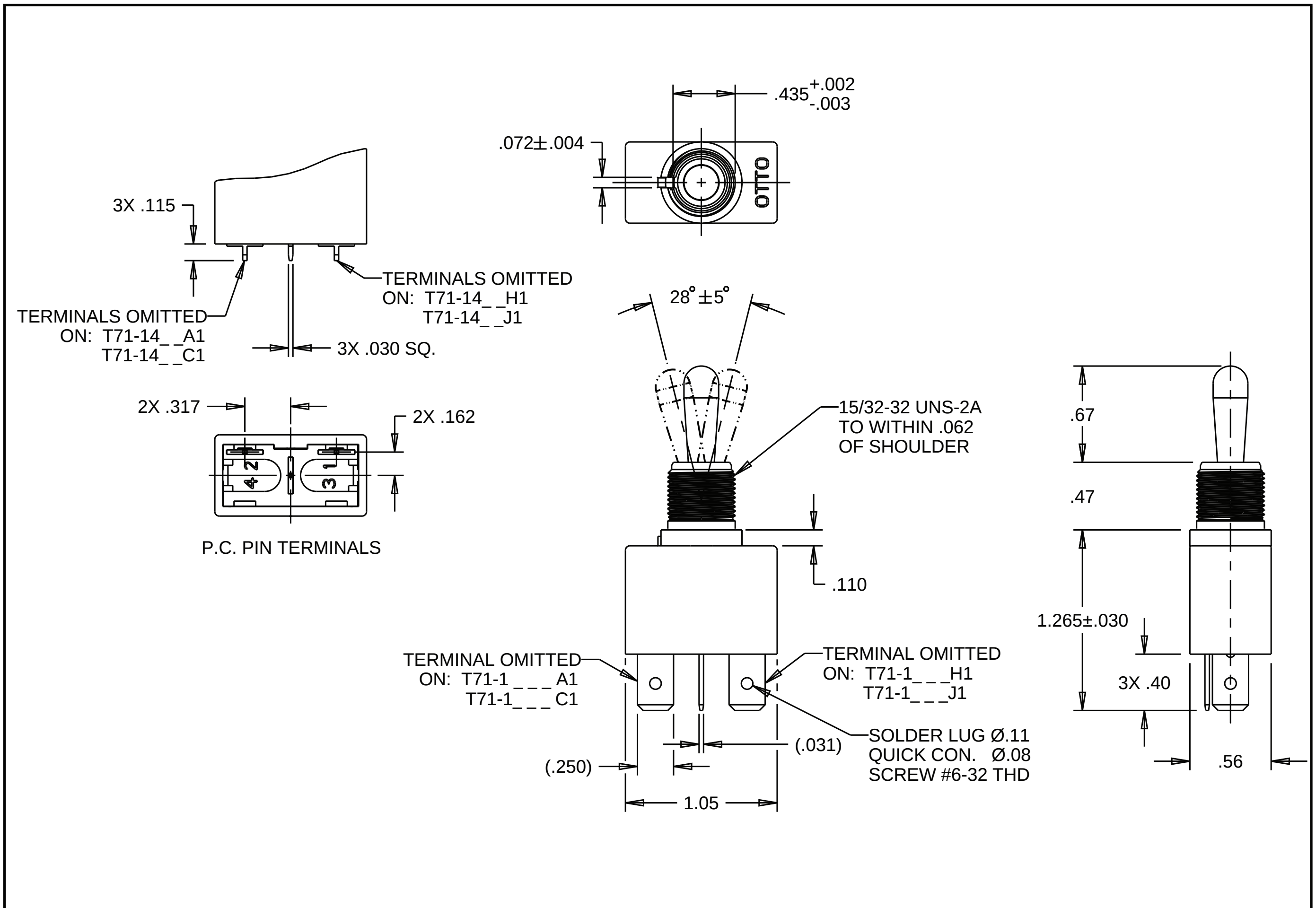
Toggle Style
1. Bat Handle

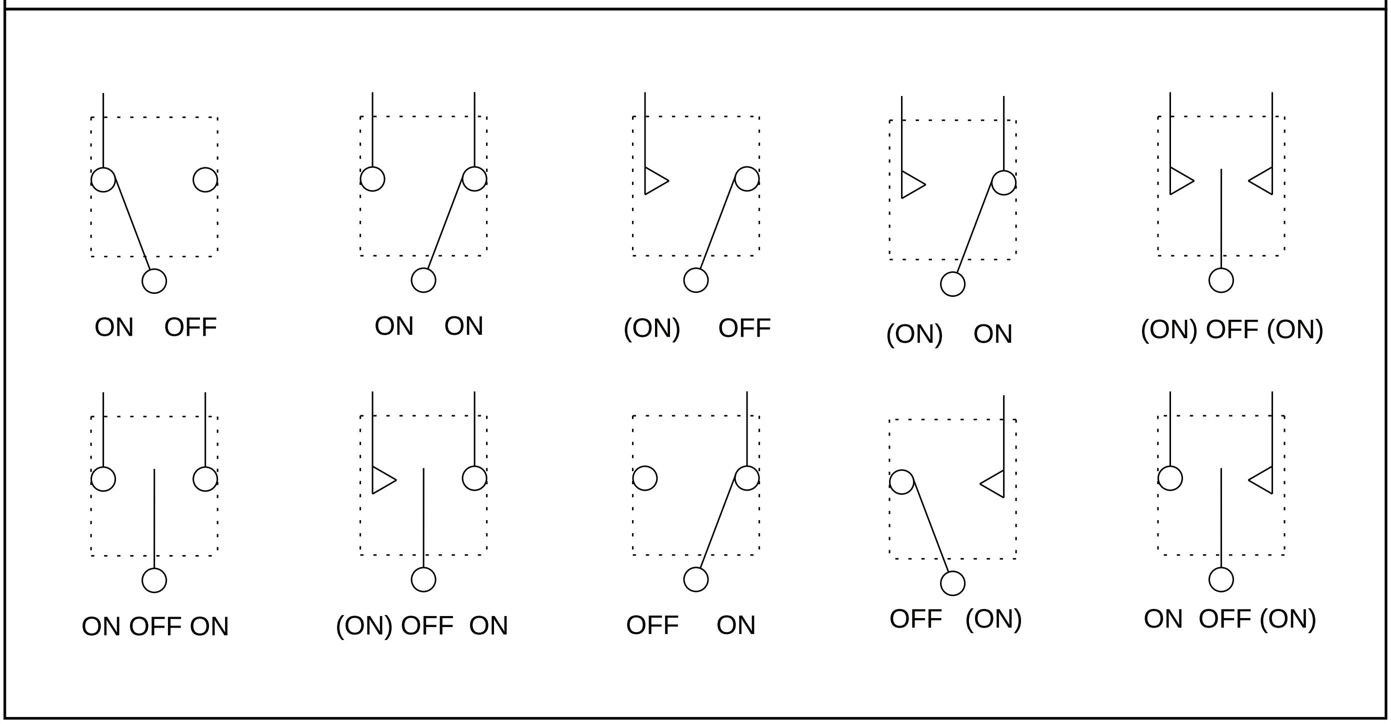
Not Used
Leave Blank

T71 Connector
P/N C405041-XXXXXX

SEALED TOGGLE SWITCHES

DESIGNED FOR TIGHT SPACES AND SEVERE CONDITIONS





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.**

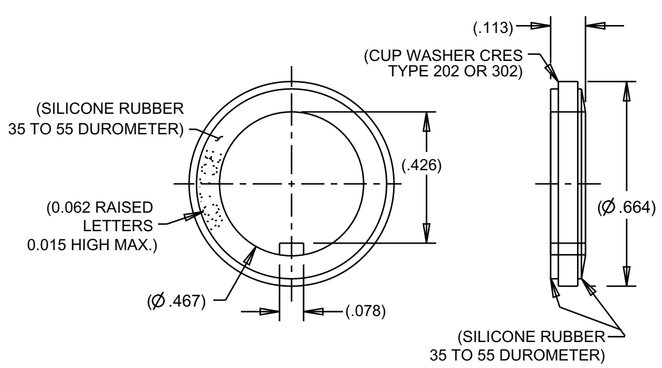
Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	See Product Family Table
Electrical Life:	20,000 cycles
Mechanical Life:	40,000 cycles
Seal:	IP68S and per MIL-DTL-3950
Operating Temp Range:	-65°C to +71°C
MATERIALS:	
Toggle:	Stainless steel, passivated
Bushing & Cover:	Aluminum, clear anodized or zinc alloy
Case:	Thermoset plastic
Terminal Hardware:	Included
Mounting Hardware:	Hardware is not installed on switches. Hex nuts, MS35333-136 lockwasher, MS25081-C4 keyway washer, 0.138-32 UNC-2A screw with lockwasher (as required).

T9 PART NUMBER CODE

T9 – X X X – XX X

Type	Contacts	Poles	Circuit ID	Lockout Suffix
M. MIL Qualified to MIL-PRF-3950 **C.** Commercial Version	**S.** Std. (Silver Plate) **L.** Low Level (Gold Plate)*	**1.** Single Pole **2.** Double Pole	**21.** to **33.** 1 or 2-Pole (See Chart) **01.** to **06.** 2-Pole Only (See Chart)	**A, B, D, E, F, G, H, J, K, L, M, N, P** (See Chart, otherwise omit)

* Available in commercial only.

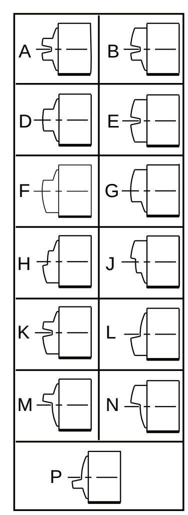


Optional Panel Seal P/N C710196, MIL-DTL- 5423/16

Lever Lockout Configuration Codes

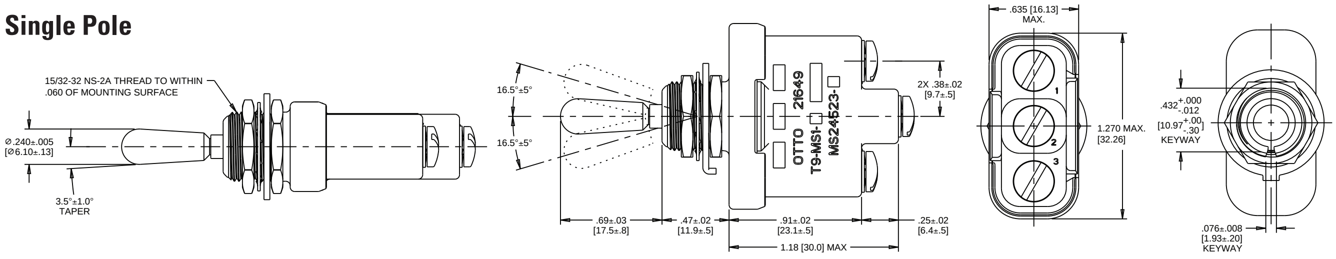
Figures A thru P are schematics to illustrate lockout configurations and momentary positions. They do not represent details of construction.

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

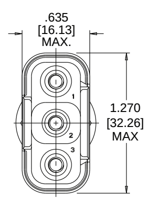


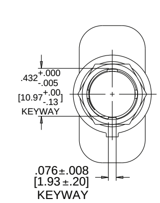
Low level 10mA @ 30mV

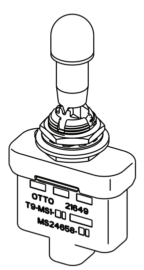
OTTO PART NO.	MILITARY NO.	CIRCUIT BY TOGGLE LEVER POSITION			SWITCH POSITION MARKING	ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
		KEYWAY 1-2	CENTER	OPP. KEYWAY 2-3		28 VDC			115 VAC		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-21	MS24523-21	ON	OFF	ON	ON OFF ON	5	20	15	3	15	10
T9-MS1-22	MS24523-22	OFF	NONE	ON	OFF ON						
T9-MS1-23	MS24523-23	ON	NONE	ON	ON ON						
T9-MS1-24	MS24523-24	NONE	OFF	ON	OFF ON						
T9-MS1-25	MS24523-25	NONE	MOM OFF	ON	OFF ON	4	15	10	2	15	7
T9-MS1-26	MS24523-26	MOM ON	NONE	ON	ON ON						
T9-MS1-27	MS24523-27	MOM ON	OFF	MOM ON	ON OFF ON						
T9-MS1-28	MS24523-28	MOM ON	OFF	NONE	ON OFF						
T9-MS1-29	MS24523-29	MOM OFF	NONE	ON	OFF ON						
T9-MS1-30	MS24523-30	MOM ON	NONE	OFF	ON OFF						
T9-MS1-31	MS24523-31	MOM ON	OFF	ON	ON OFF ON						
OTTO PART NO.	MILITARY NO.	KEYWAY	CENTER 1-2	OPP. KEYWAY 2-3	SWITCH POSITION MARKING	28 VDC			115 VAC		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-32	MS24523-32	NONE	ON	MOM ON	ON ON	4	15	10	2	15	7
T9-MS1-33	MS24523-33	NONE	ON	ON	ON ON	5	20	15	3	15	10

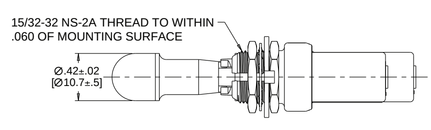
Lever/Lock Single Pole

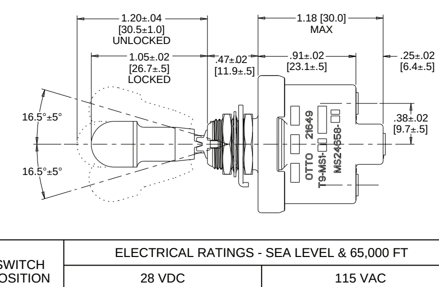
LOCKING CONFIGURATIONS						
LOCKED IN THREE POSITIONS	LOCKED IN CENTER & KEYWAY SIDE POSITION	LOCKED OUT OF CENTER POSTION	LOCKED IN CENTER POSITION	LOCKED IN OPPOSITE KEYWAY POSITION	LOCKED IN KEYWAY SIDE POSITION	LOCKED OUT OF CENTER & KEYWAY SIDE POSITION
A	B	D	E	F	G	H
LOCKED OUT OF CENTER & OPPOSITE 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	







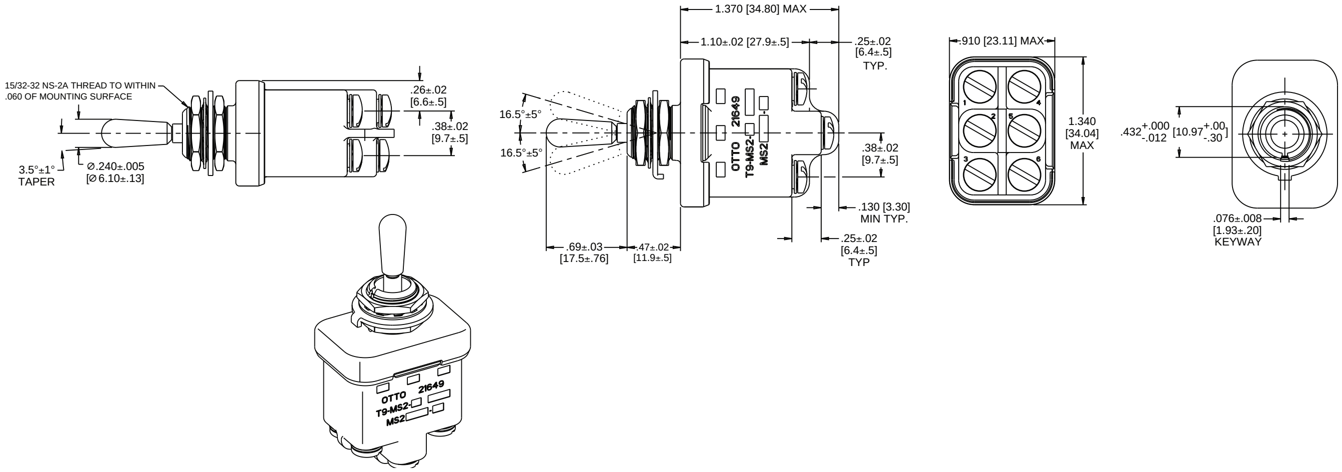




OTTO BASE PART NO.	MILITARY NO.	DASH NO.	AVAILABLE LOCKOUTS (SEE CHART)	CIRCUIT BY TOGGLE LEVER POSITION			SWITCH POSITION MARKING	ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
				KEYWAY 1-2	CENTER	OPP. KEYWAY 2-3		28 VDC			115 VAC		
								LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-	MS24658-	21	ALL	ON	OFF	ON	ON OFF ON	5	20	15	3	15	10
		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	OFF (M)	ON	OFF ON	4	15	10	2	15	7
		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 NO.	MILITARY NO.	DASH NO.	AVAILABLE LOCKOUT	KEYWAY	CENTER 1-2	OPP. KEYWAY 2-3	SWITCH POSITION MARKING	28 VDC			115 VAC		
								LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-	MS24658-	32	E	NONE	ON	MOM ON	ON ON	4	15	10	2	15	7
		33	E F K M	NONE	ON	ON	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: KEYWAY 1-2 / 4-5	CENTER	OPP. KEYWAY 2-3 / 5-6	SWITCH POSITION MARKING	ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT: 28 VDC LAMP	RESISTIVE	INDUCTIVE	115 VAC, 60Hz & 400Hz 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	5	18	10	2	11	8
		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						

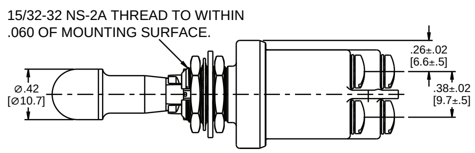
OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	KEYWAY	CENTER 1-2 / 4-5	OPP. KEYWAY 2-3 / 5-6	SWITCH POSITION MARKING	28 VDC LAMP	RESISTIVE	INDUCTIVE	115 VAC LAMP	RESISTIVE	INDUCTIVE
T9-MS2-	MS24524-	32	NONE	ON	MOM ON	ON ON	5	18	10	2	11	8
		33	NONE	ON	ON	ON ON	7	20	15	4	15	15

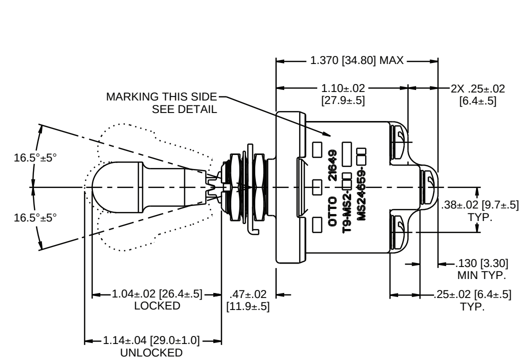
OTTO PART NO.	MILITARY STANDARD	DASH NO.	KEYWAY	CENTER	OPPOSITE KEYWAY	SWITCH POSITION MARKING	28 VDC LAMP	RESISTIVE	INDUCTIVE	115 VAC, 60Hz & 400Hz LAMP	RESISTIVE	INDUCTIVE
T9-MS2-01	MS27407-	1	1-2 ON 4-5	2-3 ON 4-5	2-3 ON 5-6	ON ON ON	7	20	15	4	15	15
T9-MS2-02		2	MOM. 1-2 ON 4-5	2-3 ON 4-5	2-3 ON 5-6	ON ON ON	5	18	10	2	11	8
T9-MS2-03		3	MOM. 1-2 ON 4-5	2-3 ON 4-5	MOM. 2-3 ON 5-6	ON ON ON						
T9-MS2-04		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
T9-MS2-05		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
T9-MS2-06		6	MOM. 1-2 ON 4-5	1-2 ON 5-6	MOM. 2-3 ON 5-6	ON ON ON						

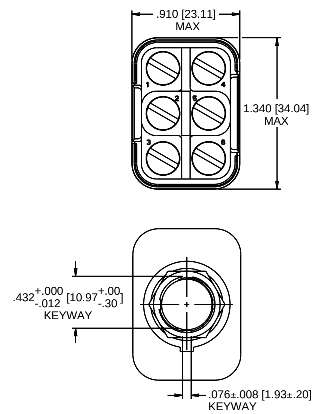
PRODUCT FAMILY TABLE

Lever/Lock

Double Pole

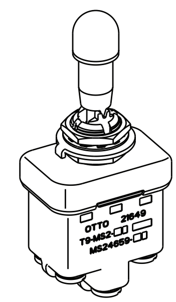






LOCKING CONFIGURATIONS

LOCKED IN THREE POSITIONS A	LOCKED IN CENTER & KEYWAY SIDE POSITION B	LOCKED OUT OF CENTER POSTION D	LOCKED IN CENTER POSITION E	LOCKED IN OPPOSITE KEYWAY POSITION F	LOCKED IN KEYWAY SIDE POSITION G	LOCKED OUT OF CENTER & KEYWAY SIDE POSITION H
LOCKED OUT OF CENTER & OPPOSITE KEYWAY POSITION J	LOCKED IN CENTER & OPPOSITE KEYWAY POSITION K	LOCKED OUT OF KEYWAY SIDE POSITION L	LOCKED OUT OF & INTO OPPOSITE KEYWAY POSITION M	LOCKED OUT OF OPPOSITE KEYWAY POSITION N	LOCKED OUT OF & INTO KEYWAY SIDE POSITION P	FIGURES A THRU P DO NOT REPRESENT DETAILS OF CONSTRUCTION. THEY SCHEMATICALLY ILLUSTRATE LOCKING CONFIGURATIONS & MOM. POSITIONS.



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

COMMERCIAL & MIL MINIATURE TOGGLE

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.

1/4-40 Bushing Style

15/32-32 Bushing Style

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.**

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

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

Electrical Life:	20,000 cycles
Mechanical Life:	40,000 cycles
Seal:	Per MIL-DTL-8834
Operating Temp Range:	-55°C to +71°C

MATERIALS:

Handle:	Stainless steel with lusterless finish
Bushing:	Zinc alloy (15/32) or stainless steel
Cover:	Zinc alloy or stainless steel
Mounting Hardware:	Hex nuts, lockwasher and keyway washer. Silicone panel seal when applicable

TE PART NUMBER CODE

TE – X X X X X

Bushing Size
1. 15/32-32
2. 1/4-40
3. 15/32-32 w/ black bushing & black toggle
4. 1/4-40 w/ black bushing & black toggle

Terminal Style
1. Solder Lug

Circuitry
1. Single Pole
2. Double Pole

Action (Lever Position)

	Opposite Keyway	Center	Keyway Side
1.	ON	OFF	ON
2.	ON	NONE	OFF
3.	ON	NONE	ON
5.	(ON)	OFF	(ON)
6.	ON	OFF	(ON)

NOTE: ( ) denotes momentary action.

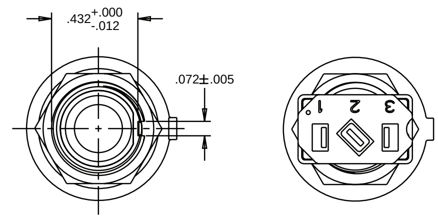
Contact Material
1. Silver/Gold Plate

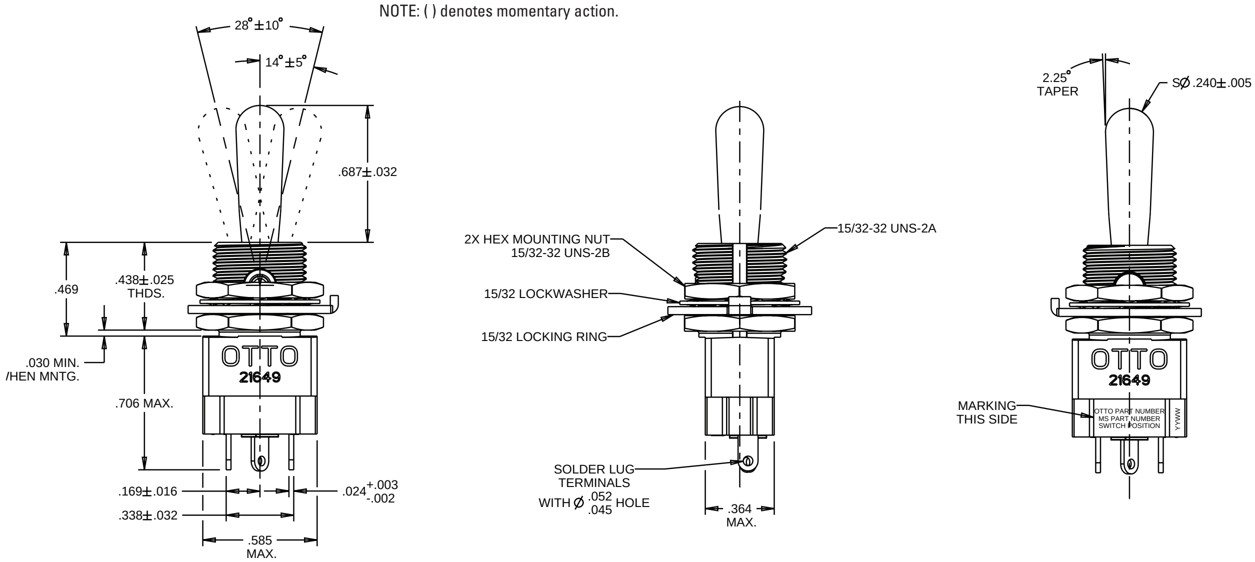
Optional Panel Seal Gasket for 15/32-32 bushing
P/N C710196 per MIL. P/N M5423/16-01

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.

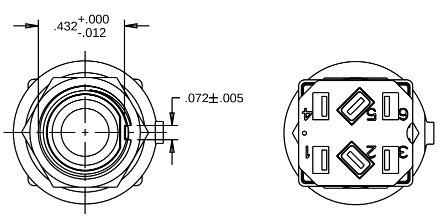


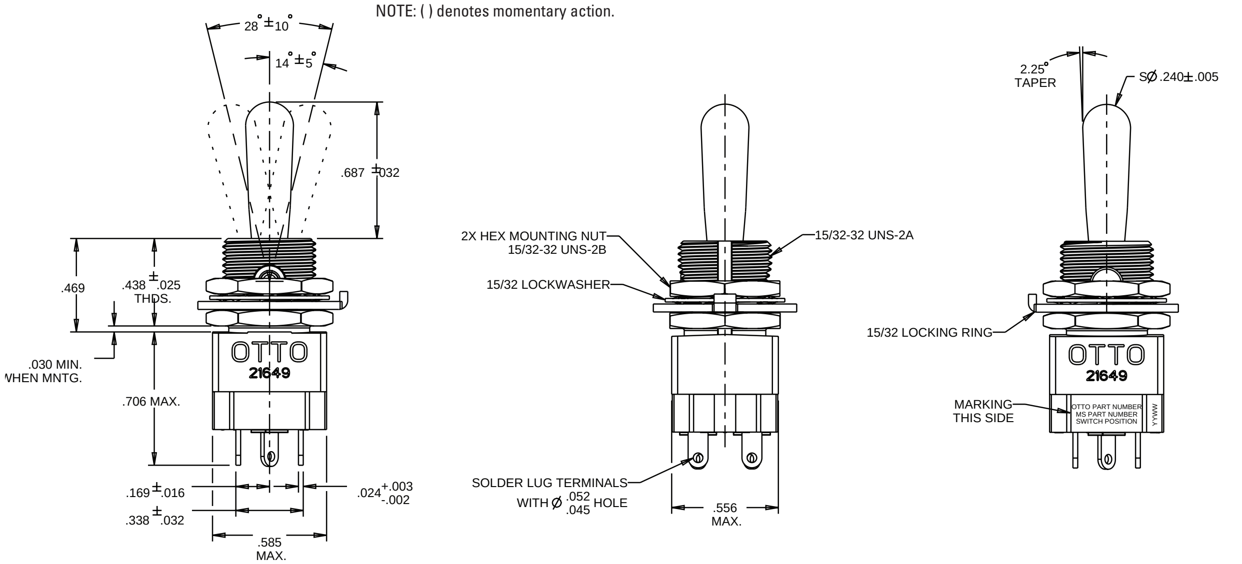


TE-112 15/32-32, Double Pole MS90311

	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.

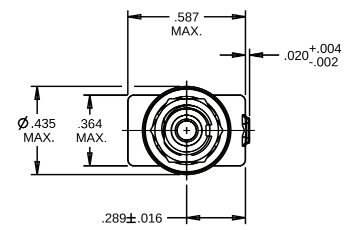




COMMERCIAL & MIL MINIATURE TOGGLE

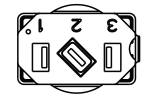
POSITIVE ACTION NON-TEASIBLE TOGGLE

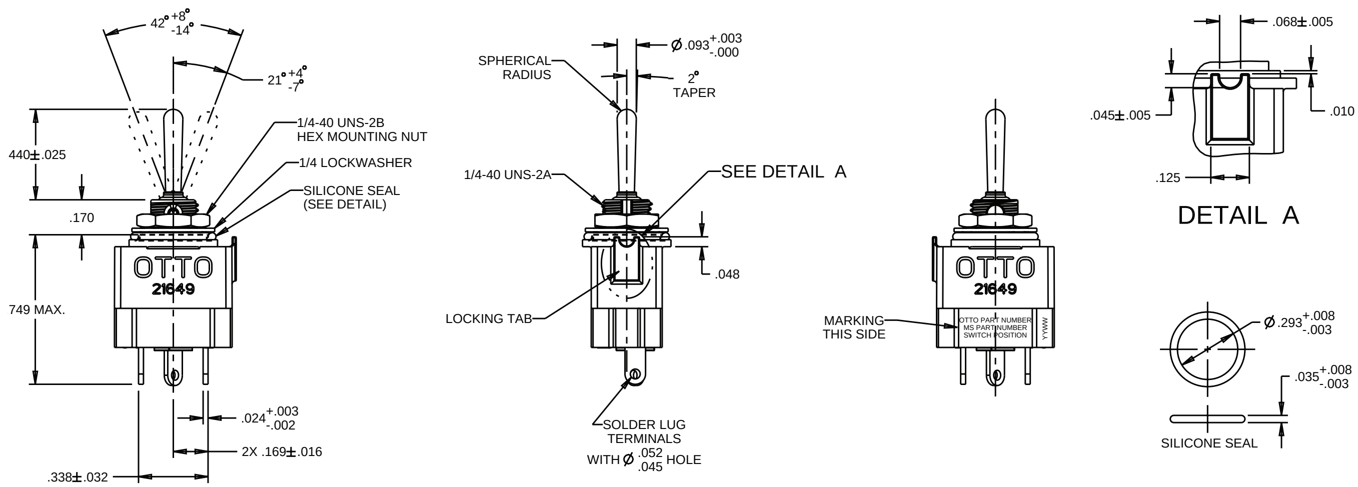
TE-211 1/4-40 Bushing
Single Pole
MS24655



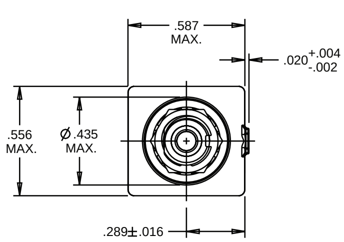
	CIRCUITS MADE WITH LEVER IN THESE POSITIONS:			
	Opposite Keyway	Center	Keyway	MS Dash Number
1.	ON 2-3	OFF	ON 1-2	-211
2.	ON 2-3	NONE	OFF	-221
3.	ON 2-3	NONE	ON 1-2	-231
5.	(ON) 2-3	OFF	(ON) 1-2	-271
6.	ON 2-3	OFF	(ON) 1-2	-311

NOTE: ( ) denotes momentary action.



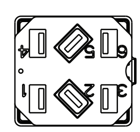


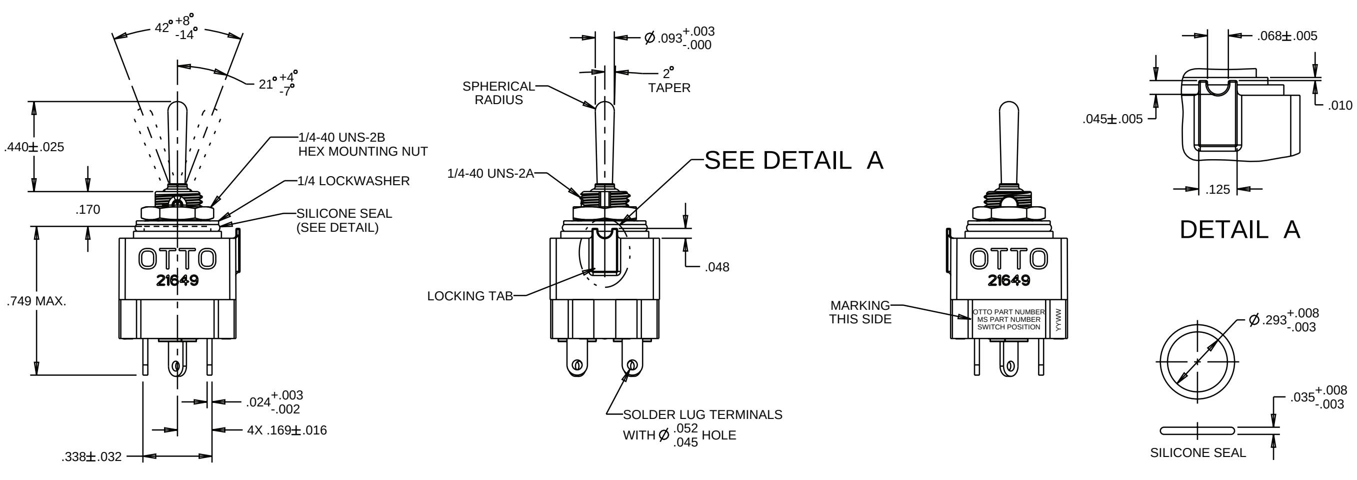
TE-212 1/4-40
Double Pole
MS24656



	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.



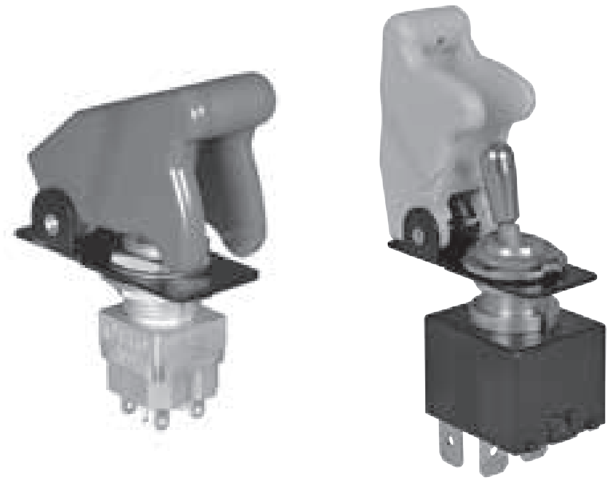


COMMERCIAL & MIL TOGGLE GUARDS

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.

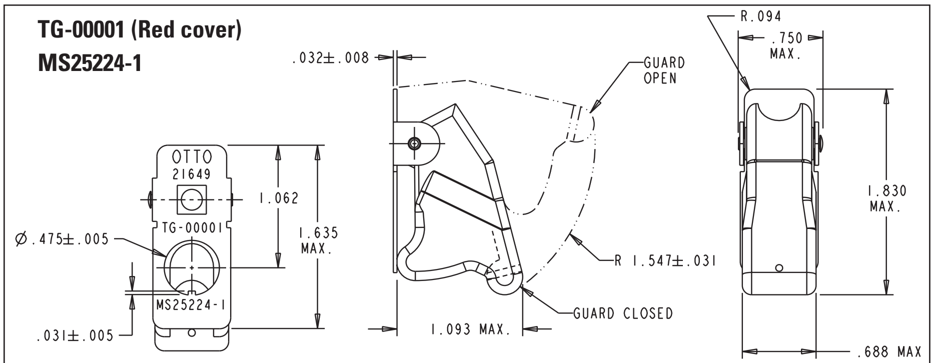
The toggle guard is easily installed on the switch from the front panel with two mounting hex nuts and may be used with an optional panel seal provided with each switch.



Features:

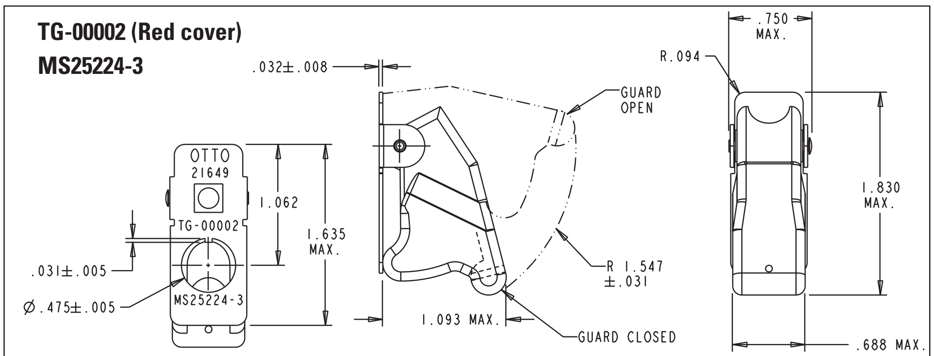
- **MS approved & QPL'd choices**
- **Molded plastic cover - multiple color choices**
- **Bracket: Black painted steel**

TG-00001 (Red cover)
MS25224-1



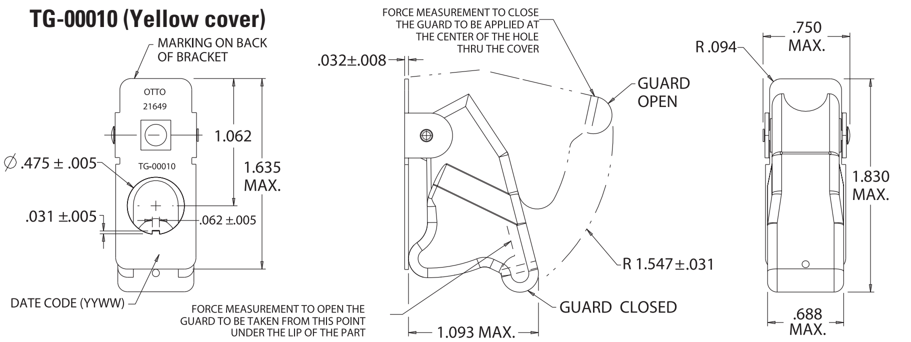
Note: Closing the guard may change position of the switch contacts depending on switch toggle lever position.

TG-00002 (Red cover)
MS25224-3



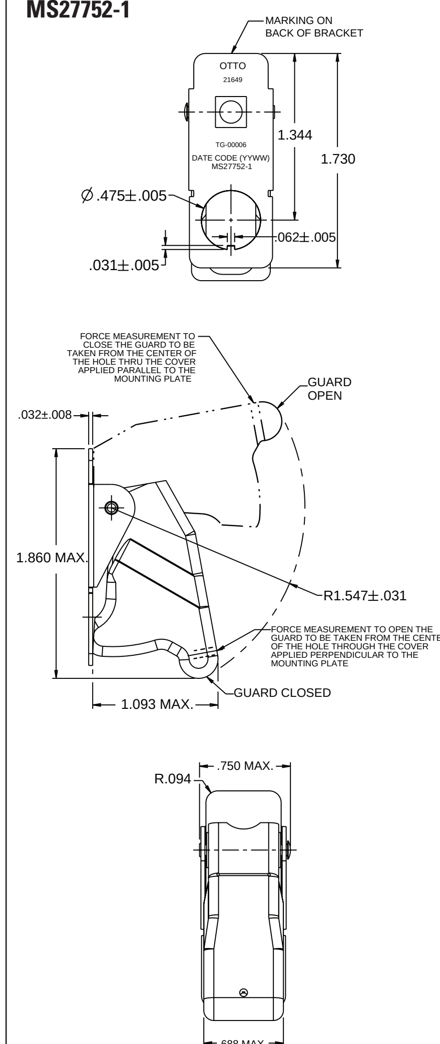
Note: Closing the guard may change position of the switch contacts depending on switch toggle lever position.

TG-00010 (Yellow cover)



Note: Closing the guard may change position of the switch contacts depending on switch toggle lever position.

TG-00006 (Red cover)
MS27752-1

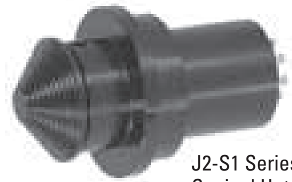


Note: Opening or closing the guard shall not change position of the switch contacts.

Transducers

J2 SERIES

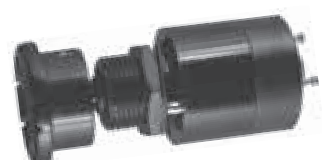
The J2 Series transducer takes a force input of up to 3 lbs. and converts it into a linear voltage output on a X and Y axis. Utilizing strain gauges in a Wheatstone bridge configuration, very small changes in force can be detected to produce a corresponding output voltage. Output voltages are ratiometric (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.



J2-S1 Series
Conical Hat Shown

J2-S2 Series
Flat Button Shown

J2-S3 Series
Flat Button Shown



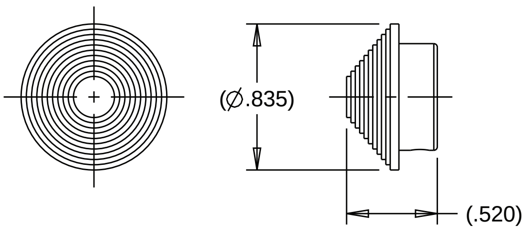
J2-S4 Series
Flat Button Shown

Features:

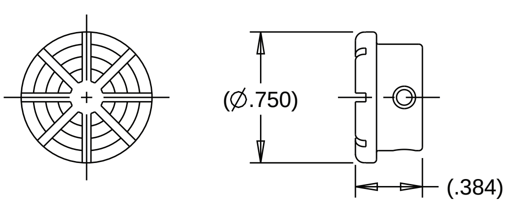
- **Short (.05 max) or long (.20 typ.) travel options**
- **Available with or without pushbutton**
- **Custom cases and buttons available**
- **Applications include:**
  - **Flight control grips**
  - **Cursor control**
  - **Target acquisition**
- **Small null hysteresis useful for applications requiring a consistent center voltage**

Series Standard Characteristics/Ratings:	
ELECTRICAL RATINGS: S1 – S2 – S3	
Insulation Resistance:	100MΩ min @ 50VDC
Null Hysteresis:	+/- 1% of full scale output within 1 second after release
Null Temp Coefficient:	+/- .08% full scale per degree C max
Sensitivity Temp Coefficient:	+/- 0.2% full scale per degree C
Resolution:	Infinite
Seal:	Enclosure dusttight per MIL-PRF-8805 Design 2
Operating Force:	3.0 lbs.
Operating Temp Range:	-40°C to +71°C
Storage Temp Range:	-55°C to +85°C
Travel:	To mechanical stop 0.05 inches max
MATERIALS:	
Button:	Thermoplastic or anodized aluminum
Wire:	MIL-W-16878/4, 12 inches min, 24 AWG
Hardware:	None provided

J2-S1 and J2-S2 Series

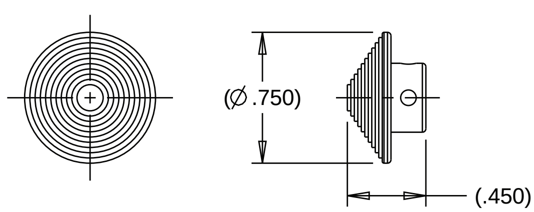


A. CONICAL HAT

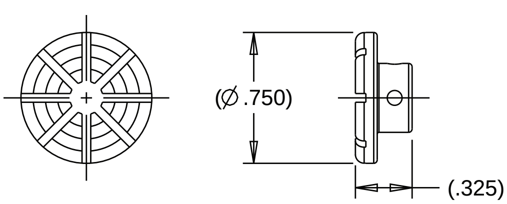


B. FLAT BUTTON

J2-S3 Series



A. CONICAL HAT

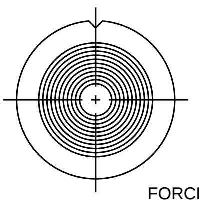


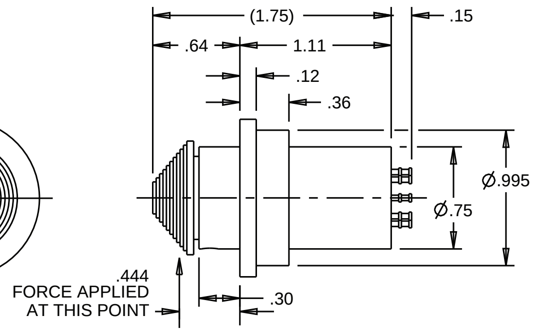
B. FLAT BUTTON

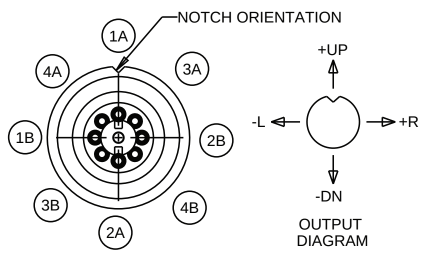
TRANSDUCER

STRAIN GAUGE,FLANGE MOUNT, SHORT TRAVEL

J2-S1





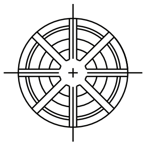


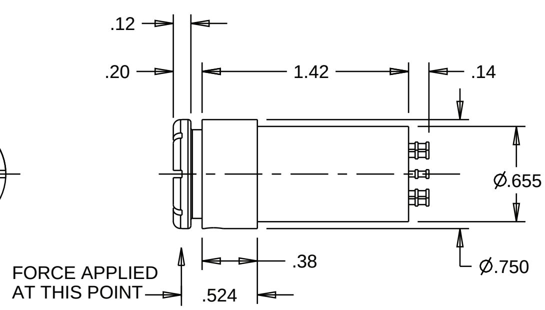
J2-S1 PART NUMBER CODE

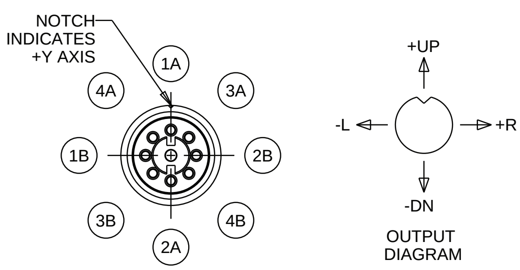
J2-S1 X XX X XXX

Circuit Type	Electrical I/O (See Table)	Termination	Button Style and Color
A. Full Bridge	**B3.**	**1.** Wire Leads	**AP1.** Conical Hat, Red Thermoplastic
B. Half Bridge	**B4.**	**2.** Terminals	**AP2.** Conical Hat, Black Thermoplastic
C. Isolated	**B5.**		**AP8.** Conical Hat, Gray Thermoplastic
	B6.		**BBA.** Flat Button, Black Anodized Aluminum
	B7.		**BCA.** Flat Button, Clear Anodized Aluminum
	G3.		
	G4.		
	G5.		
	G6.		
	G7.		

J2-S2







J2-S2 PART NUMBER CODE

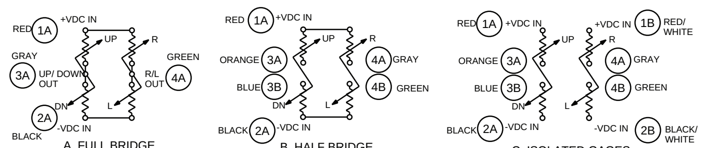
J2-S2 X XX X XXX

Circuit Type	Electrical I/O (See Table)	Termination	Button Style and Color
A. Full Bridge	**B3.**	**1.** Wire Leads	**AP1.** Conical Hat, Red Thermoplastic
B. Half Bridge	**B4.**	**2.** Terminals	**AP2.** Conical Hat, Black Thermoplastic
C. Isolated	**B5.**		**AP8.** Conical Hat, Gray Thermoplastic
	B6.		**BBA.** Flat Button, Black Anodized Aluminum
	B7.		**BCA.** Flat Button, Clear Anodized Aluminum
	G3.		
	G4.		
	G5.		
	G6.		
	G7.		

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 10⁶)
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



A. FULL BRIDGE
(4 TERMINALS)

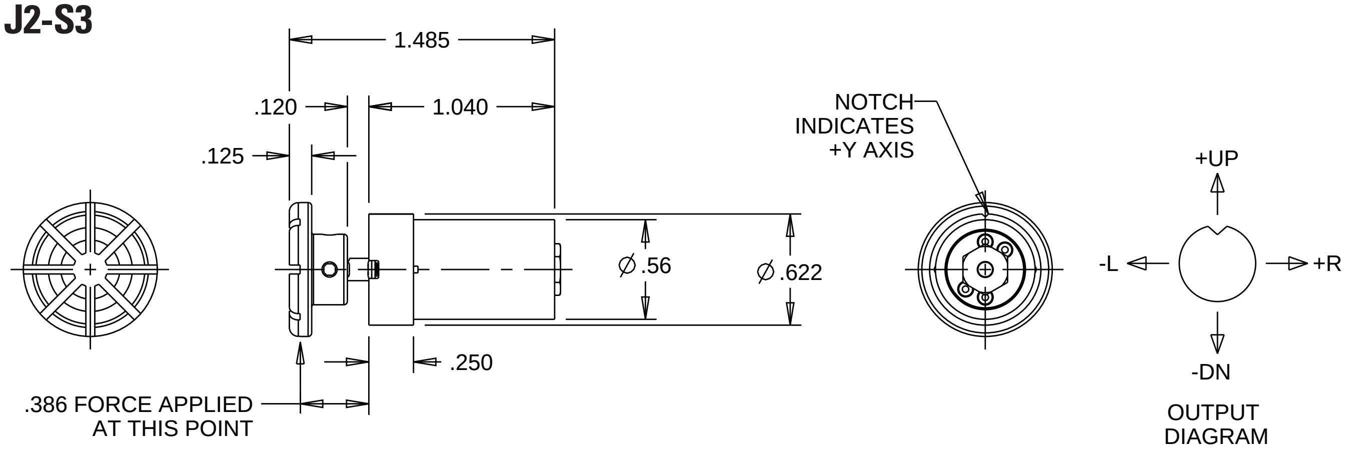
B. HALF BRIDGE
(6 TERMINALS)

C. ISOLATED GAGES
(8 TERMINALS)

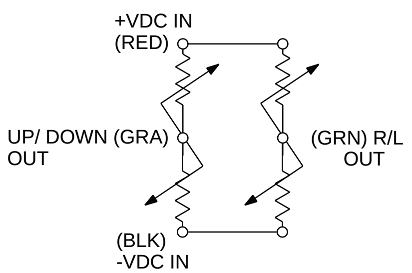
 Specifications Subject To Change Without Notice

STRAIN GAUGE,FLANGE MOUNT, SHORT TRAVEL

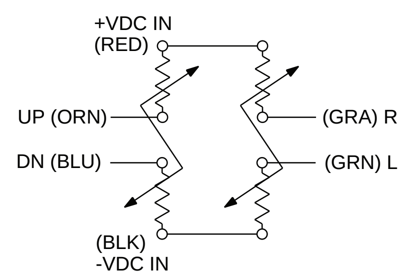
J2-S3



AVAILABLE CIRCUITS



A. FULL BRIDGE
(4 WIRES)



B. HALF BRIDGE
(6 WIRES)

J2-S3 PART NUMBER CODE

J2-S3 X XX X XXX

Circuit Type	Electrical I/O (See Table)	Termination	Button Style and Color
A. Full Bridge	**B1.**	**1.** Wire Leads	**AP1.** Conical Hat, Red Thermoplastic
B. Half Bridge	**B2.**		**AP2.** Conical Hat, Black Thermoplastic
	B3.		**AP8.** Conical Hat, Gray Thermoplastic
	B4.		**BBA.** Flat Button, Black Anodized Aluminum
	B5.		**BCA.** Flat Button, Clear Anodized Aluminum
	G1.		
	G2.		
	G3.		
	G4.		
	G5.		

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 10^6)
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

TRANSDUCER

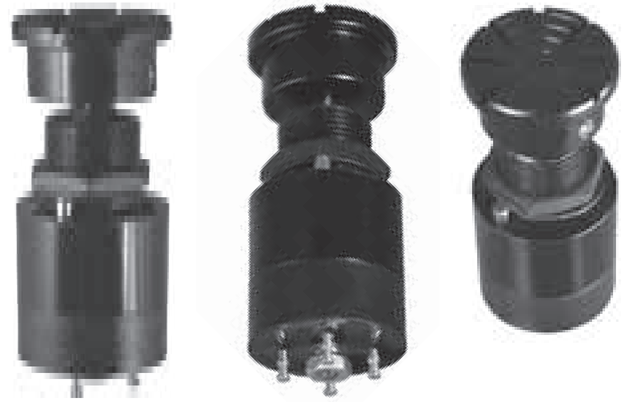
FULL BRIDGE CIRCUIT TYPE, SHORT TRAVEL

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.

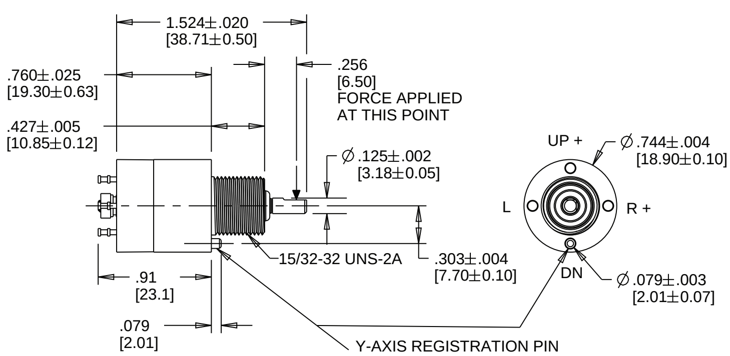


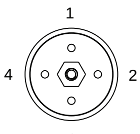
J2-S4 Transducer

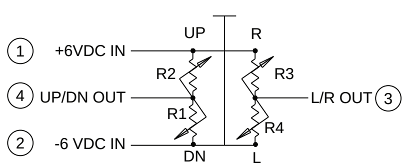
Features:

- **Full bridge circuit type**
- **1 million cycle life**
- **Short travel in each direction**
- **Watertight to IP68S**
- **Shorter behind panel**
- **Multiple button types available**

Standard Characteristics/Ratings:	
ELECTRICAL RATINGS (+/- 6 VDC):	
Sensitivity	.50 Volts per lb. typical
Insulation Resistance:	100MΩ min @ 50VDC
Null Temp Coefficient:	+/- .08% full scale per degree C max
Null Hysteresis:	+/- .006 VDC within 1 second after release
Sensitivity Temp Coefficient:	+/- .2% full scale per degree C
Null Output:	0VDC +/- .100VDC
Resolution:	Infinite
Element Resistance:	1000Ω +/- 15%
Seal:	IP68S Watertight
Operating Force:	3.0 lbs. typical
Operating Temp Range:	-54°C to +71°C
Storage Temp Range:	-57°C to +85°C
Travel:	.05" max travel each direction
Cycle Life:	1,000,000 cycles; 1 cycle = max travel & return
MATERIALS:	
Button:	Anodized aluminum or plastic
Case:	Black anodized aluminum
Hardware:	Lockwasher, hex nut and button set screws





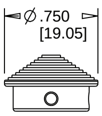


A. FULL BRIDGE

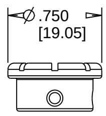
J2-S4 PART NUMBER CODE

J2-S4 X XX X XXX

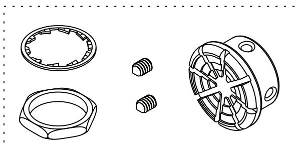
Circuit Type	Electrical I/O (See Table)	Termination	Button Style and Color
A. Full Bridge	**B6.**	**2.** Terminals	**AP2.** Conical Hat, Black Thermoplastic **BBA.** Flat Button, Black Anodized Aluminum **BCA.** Flat Button, Clear Anodized Aluminum



A. CONICAL HAT



B. FLAT BUTTON



SHIPPED UNASSEMBLED
(BUTTON GEOMETRY MAY VARY)

EXCITATION VOLTAGE					
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)	FULL SCALE TRAVEL CYCLES EACH DIRECTION (UNITS x10^6)
B6	±6.0	±0.50	±1.80	±0.10	1.0

 Specifications Subject To Change Without Notice

HALL EFFECT TRANSDUCER

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.

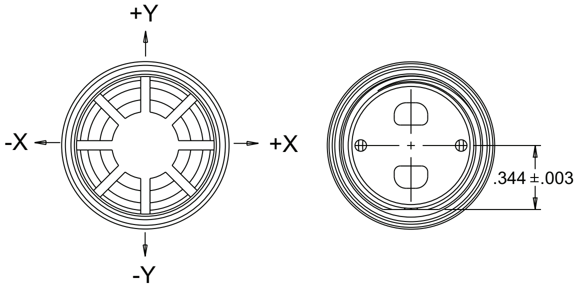
The J4's shorter travel offers the benefit of minimal movement required for analog voltage output change. In addition, the J4 offers the benefit of a higher output voltage than a traditional strain gauge based transducer with the same input voltage.

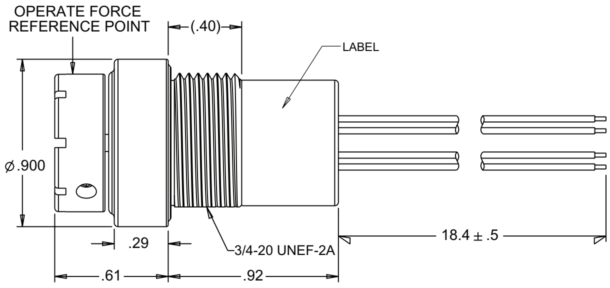
The J4 can be used for applications such as cursor control, target acquisition or any place precise input control is required. The J4's short behind panel depth means it can be used in an OTTO grip or can be panel mounted.

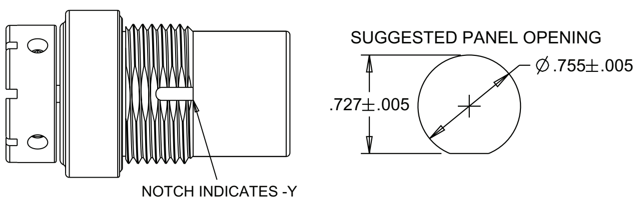
J4-100001
Transducer

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**







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:

Mechanical Life All Directions	250,000 cycles			
Mechanical	**Units**	**Min**	**Typ**	**Max**
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:

Operating Temperature:	°C	-20	20	71
Electronics Enclosure Design:	ISO 20653, Dusttight and watertight per IP68S			
Drop:	1 meter max to concrete			
EMI Withstand:	Per ISO 11452			
RFI Withstand:	Per ISO 11452-8 15Hz-100kHz			
DC Magnetic Field Withstand:	3000 A/m per ISO 11452-8			

MATERIALS:

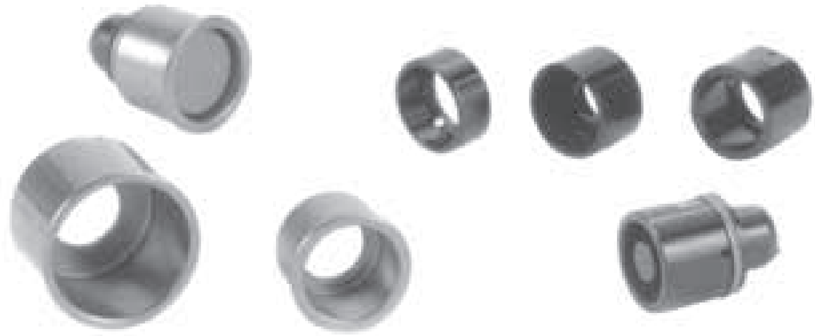
Button:	Thermoplastic, black
Case:	Black anodized aluminum
Boot:	Silicone rubber, black
Wires:	24 AWG, NEMA HP3, Type E
Mounting Hardware:	Hex nut (.13 thick) and lockwasher

SHROUDS, PANEL SEALS AND HARDWARE

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.

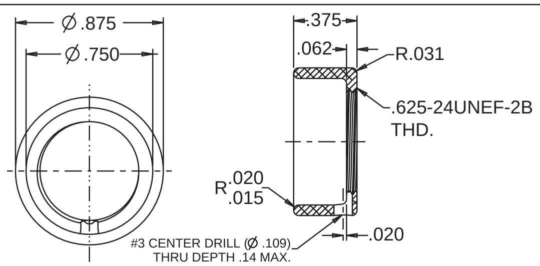


Material:

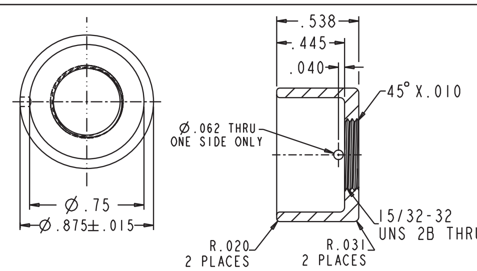
Aluminum alloy, machined to specification.

Finish:

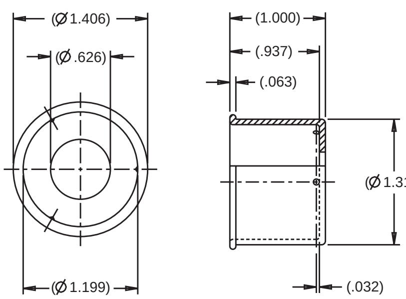
Black anodized. For other color options, contact factory.



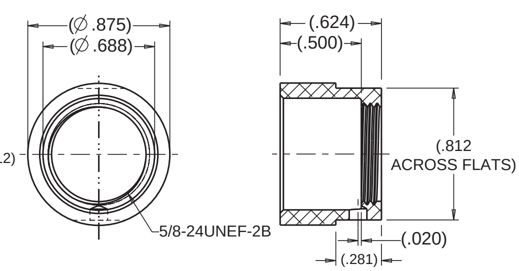
OTTO P/N C300793



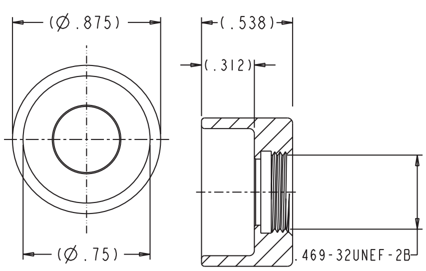
OTTO P/N C300428



OTTO P/N C300302



OTTO P/N C300871

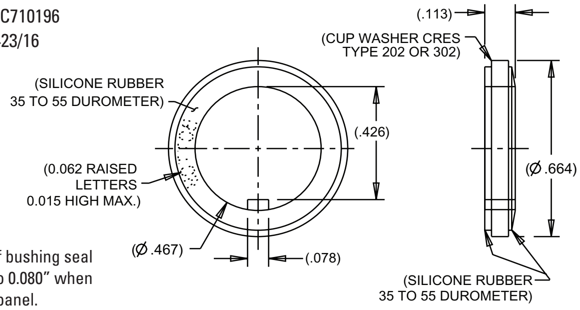


OTTO P/N C300426

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.	O-Rings (Buna) OTTO P/N	I.D.
C700117-25	0.250"	C801568-010	0.250"
C700110-25	0.469"	C802568-015	0.500"
C700109-25	0.625"	C802568-016	0.625"

Mounting Hardware

MILITARY P/N	OTTO P/N	BUSHING SIZE (inches)
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

CONNECTORS FOR SWITCH ASSEMBLY

Connectors for K1 Rockers and T71 Toggles

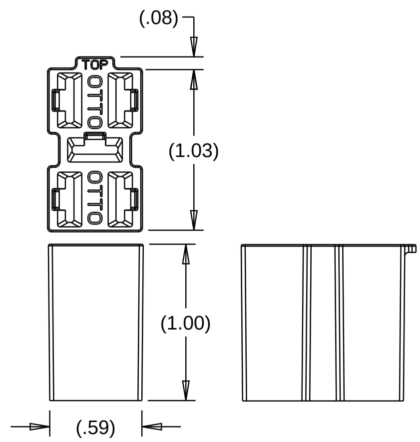
K1 AND T71 CONNECTOR PART NUMBER CODE

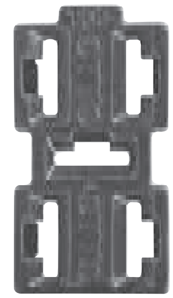
C405041 - **XX** **XXXX**

Connector Color
- **01.** Red
- **02.** Black
- **03.** Orange*
- **04.** Yellow*
- **05.** Green*
- **06.** Blue*
- **07.** Violet*
- **08.** Gray*
- **09.** White

* Contact Factory

Packaging Quantity
- **0025 -** 25 Pcs per Package
- **0050 -** 50 Pcs per Package
- **0100 -** 100 Pcs per Package





Connectors for K2 & K4 Rockers and T7 Toggles

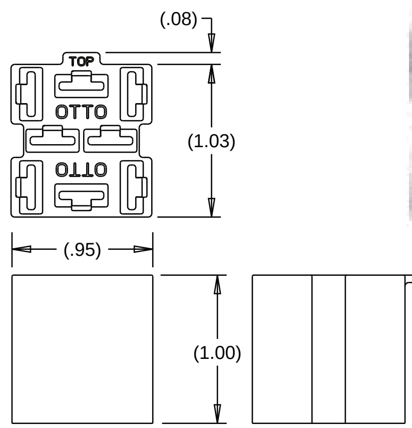
K2 AND K4 AND T7 CONNECTOR PART NUMBER CODE

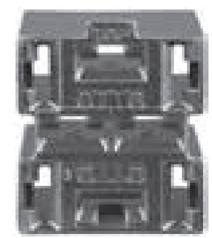
C801765 - **XX** **XXXX**

Connector Color
- **01.** Red
- **02.** Black
- **03.** Orange*
- **04.** Yellow*
- **05.** Green*
- **06.** Blue*
- **07.** Violet*
- **08.** Gray*
- **09.** White

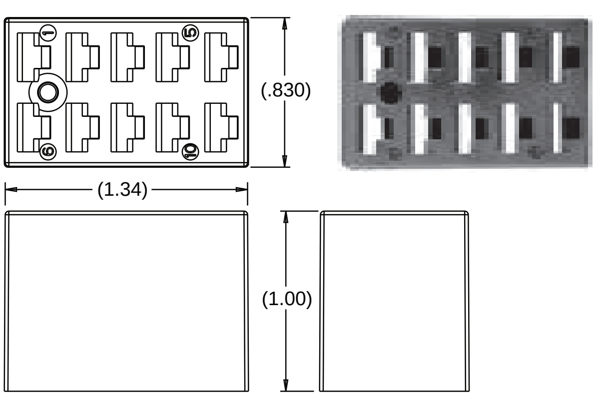
* Contact Factory

Packaging Quantity
- **0025 -** 25 Pcs per Package
- **0050 -** 50 Pcs per Package
- **0100 -** 100 Pcs per Package

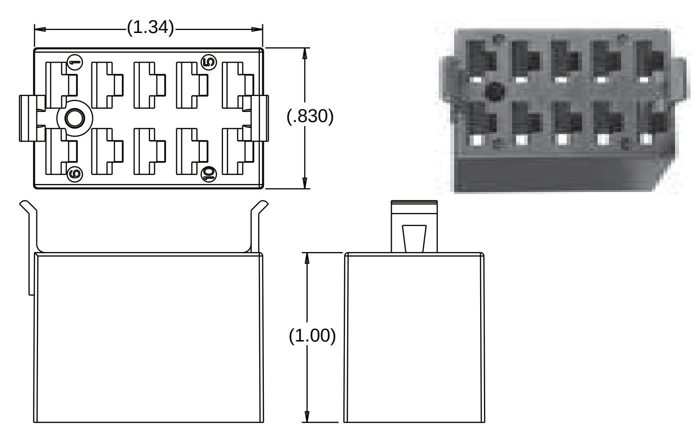




Connectors for K3 & K5 Rockers



C801775-2A (Without Latch)



C801775-2B (With Latch)

HARDWARE & ACCESSORIES

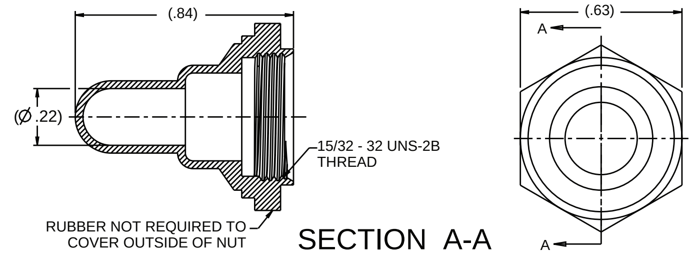
SEALING BOOTS

BOOTS FOR PUSHBUTTONS AND, TOGGLE SWITCHES

C740191

T9 Toggle Boot with 15/32" Thread

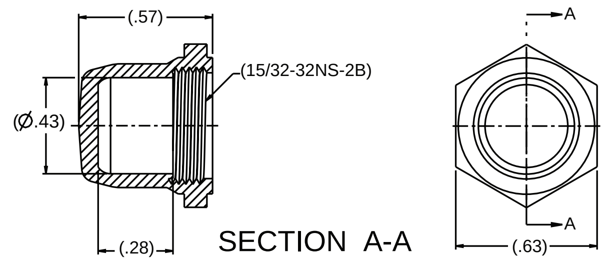
Boot: Black Silicone Rubber
Nut: Brass, Nickel Plated



C740144

P4-4 Switch Boot with Threaded Insert

Boot: Black Silicone Rubber
Insert: Brass, Nickel Plated



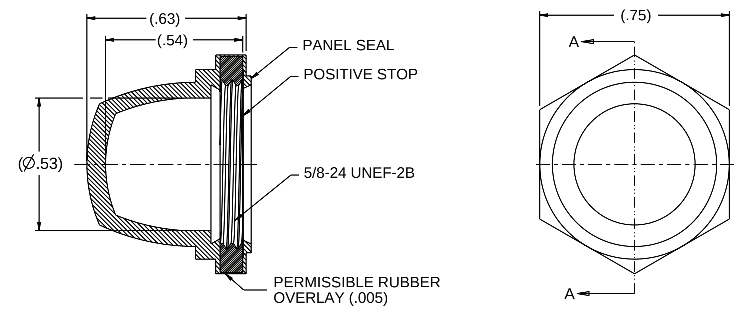
C700179

P3-6 Switch Boot

MIL-DTL-5423/7 Type B, Style 2, Size 4

Material: Silicone Rubber

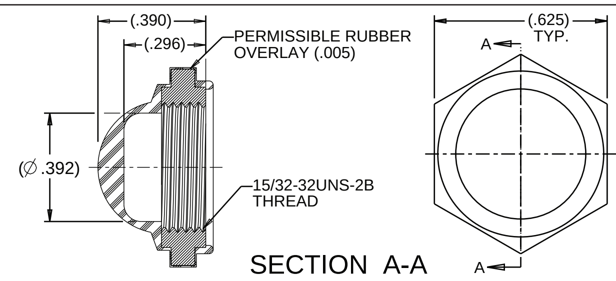
C700179-2S = Black
C700179-4S = Yellow
C700179-8S = Gray



C701211

P7-6 Pushbutton Boot Hex Nut

Material: Black Silicone
Thread: 15/32"

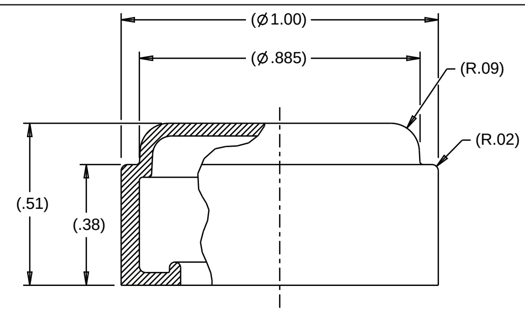


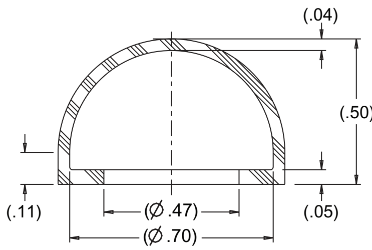
C405192-025

Boot Primarily Intended for Custom P3's
and P8's with a .875" Case Diameter

Boot: Clear Silicone Rubber

Bagged in Lots of 25

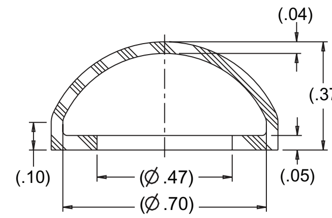




P7/P9 Sealing Boots

For Raised Dome	For Flush Dome
C402611-1-50 Clear	**C402599-1-50 Clear**
C402611-2-50 Black	**C402599-2-50 Black**

Material: Silicone



 Specifications Subject To Change Without Notice

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	F	FORWARD	M9		LEFT TURN SIGNAL	W4		REAR WINDOW WIPER
F4	N	NEUTRAL	MA		RIGHT TURN SIGNAL	W5		REAR WINDOW-WASHER
F5	R	REVERSE	P1	1	BILGE PUMP #1	W6		REAR WINDOW-WASHER/WIPER
G1		FUEL	P2	2	BILGE PUMP #2	ZZ		NO LEGEND
H1		HORN	P3	3	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.

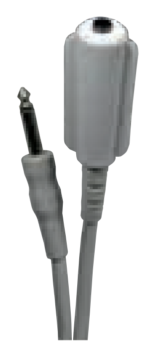
Switch Rating: 10 amps Resistive @ 28VDC
Button: Red thermoplastic
Housing: Black anodized aluminum
Cord: Black polyurethane, 28 AWG

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

NOTEWORTHY DESIGNS

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

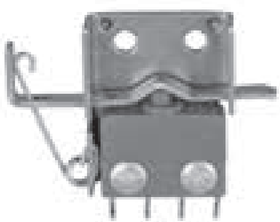
Buttons: Black anodized aluminum

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

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:

$$\textbf{RESISTOR SIZE} = \frac{\textbf{POWER SUPPLY VOLTAGE - LED FORWARD VOLTAGE}}{\textbf{LED FORWARD CURRENT}}$$

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			
	WHITE			
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				
	WHITE				
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:

$$\text{RESISTOR SIZE} = \frac{\text{POWER SUPPLY VOLTAGE} - \text{LED FORWARD VOLTAGE}}{\text{LED FORWARD CURRENT}}$$

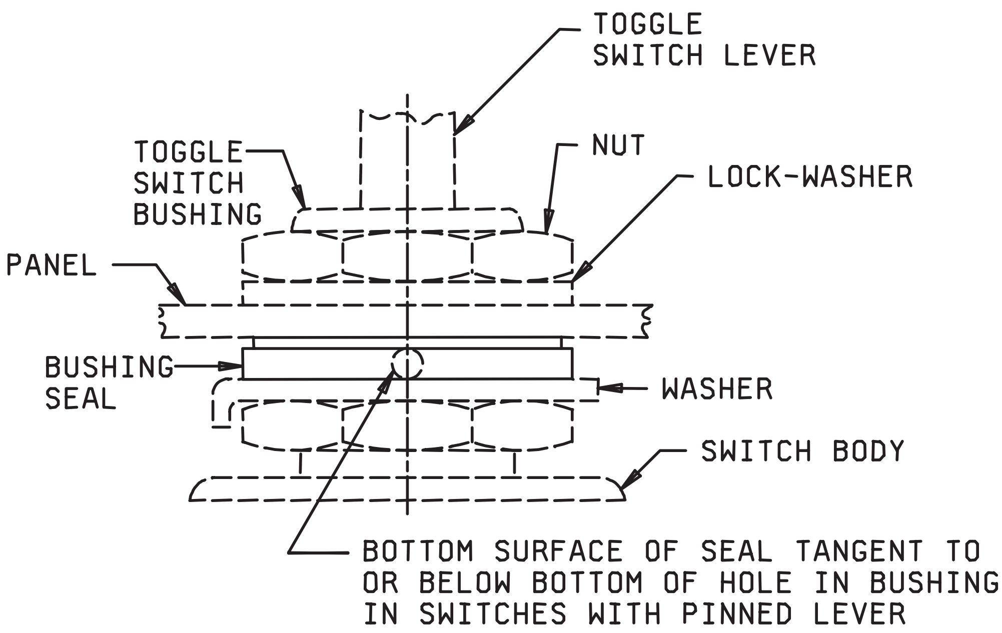
TOGGLE HARDWARE STANDARD CONFIGURATION

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

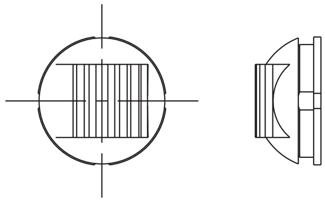
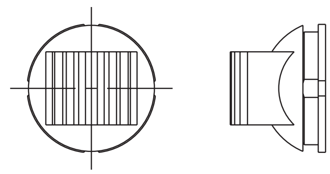
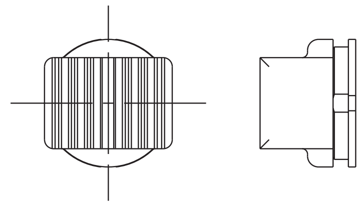
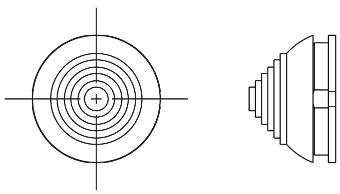
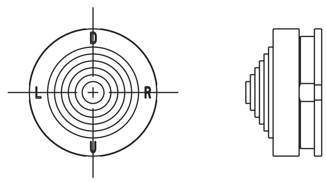
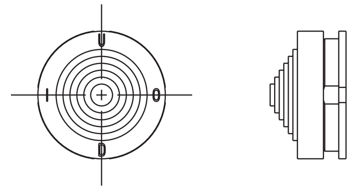
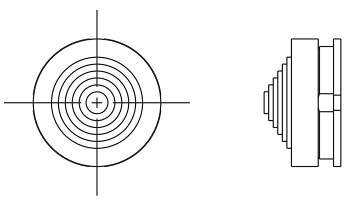
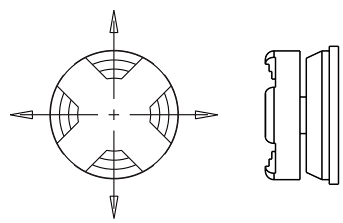
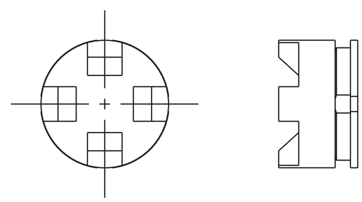
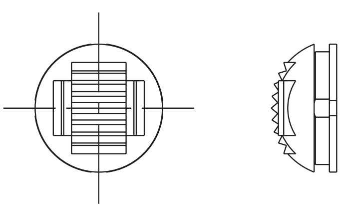
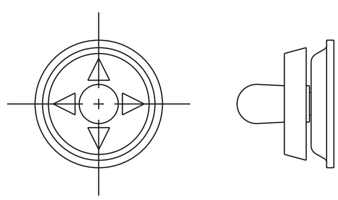
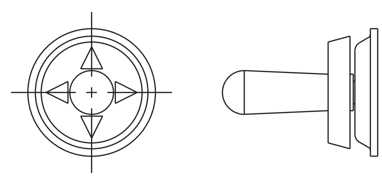
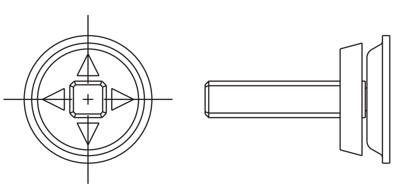
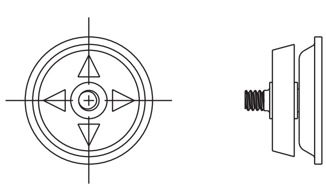
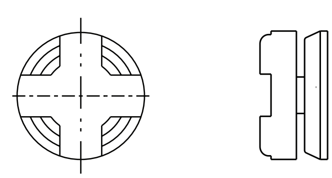


Note: Not applicable with all configurations.

Customer is responsible for keying the switch to the panel.

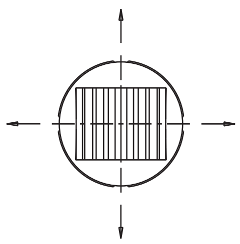
T1, T2, T4, T5 & T8 MINI TRIM BUTTON STYLES

T1, T2, T4, T5 AND T8 MINI TRIM BUTTON STYLES

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 - LONG BAT**
		
N - POST	**P - 4-40 THREADED POST**	**Q - ROTATED STADIUM**
		

T4-T AND T8-T MINI TRIM BUTTON STYLES

A - 2-WAY JOG (T4-T ONLY)



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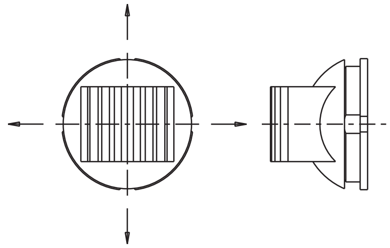
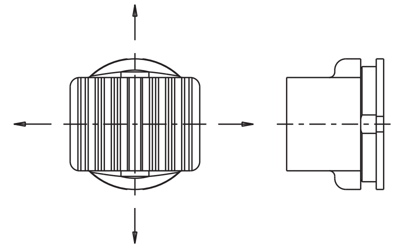
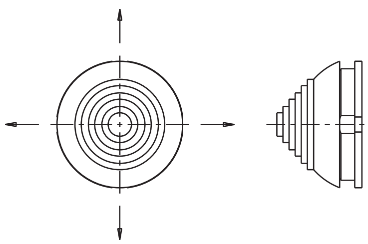


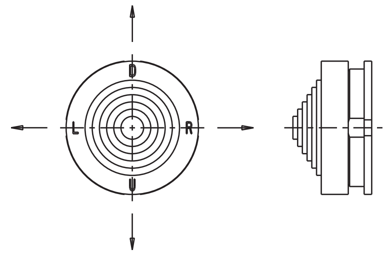
C - ROCKER (T4-T ONLY)



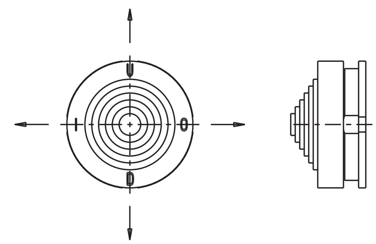
D - CONE (T4-T AND T8-T)



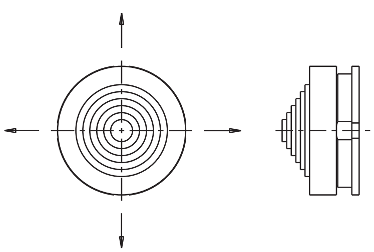
E - LRUD HAT (T4-T AND T8-T)



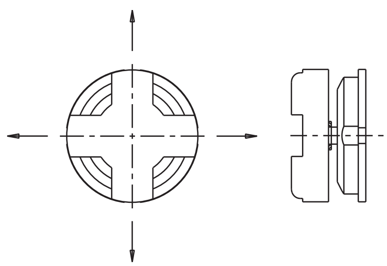
F - IOUD HAT (T4-T AND T8-T)



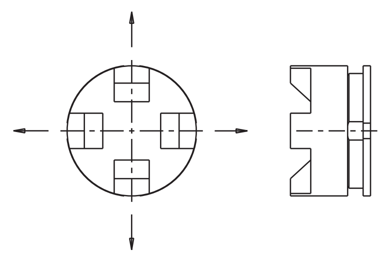
G - HAT (T4-T AND T8-T)



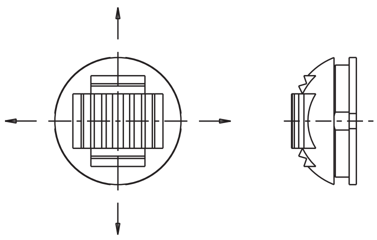
H - STADIUM (T4-T AND T8-T)



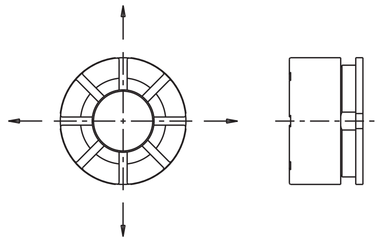
J - CASTLE (T4-T AND T8-T)



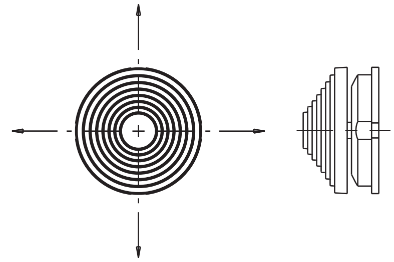
K - 4-WAY JOG (T4-T AND T8-T)



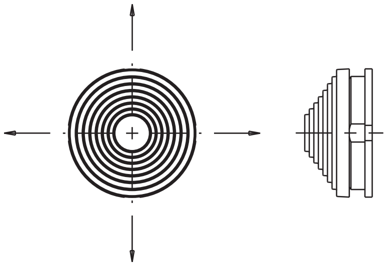
L - INVERSE HAT (T4-T) and R (T8-T)



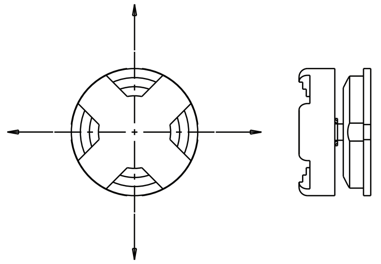
M - TALL HAT (T4-T) and S (T8-T)



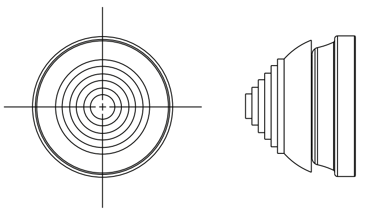
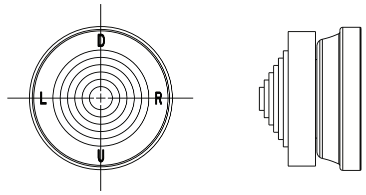
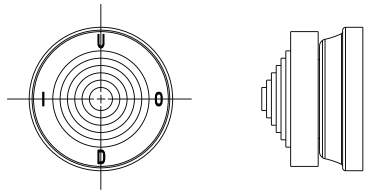
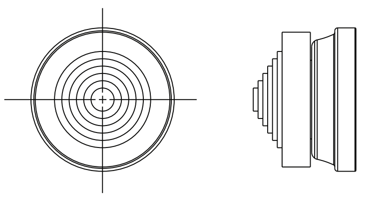
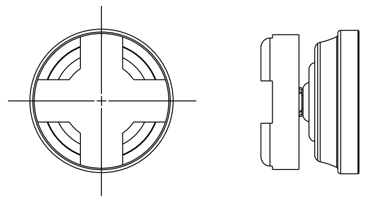
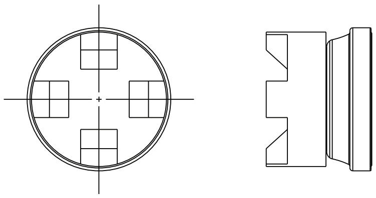
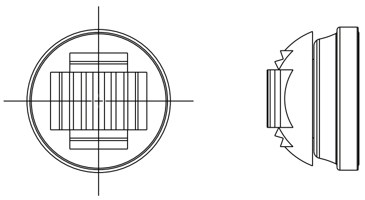
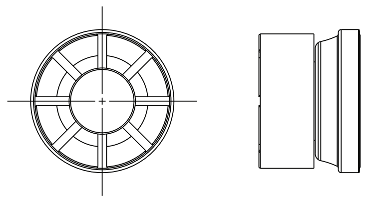
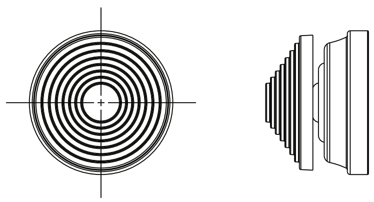
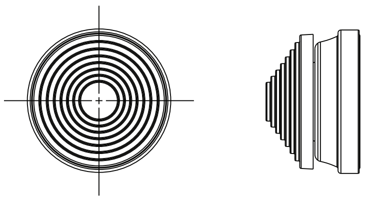
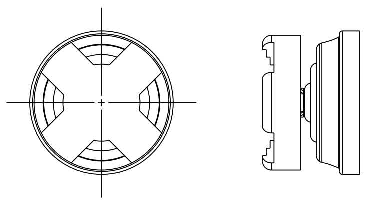
N - SHORT HAT (T4-T) and T (T8-T)



P - STADIUM ROTATED (T4-T) and Q (T8-T)



TK Mini Trim Button Styles

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 – STADIUM ROTATED**	
		

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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

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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	P7-212221
M8805/110-1858	P7-165228	M8805/110-2163	P7-216123	M8805/110-2317	P7-251127	M8805/110-2422	P7-212222
M8805/110-1859	P7-165229	M8805/110-2164	P7-216124	M8805/110-2318	P7-251128	M8805/110-2423	P7-212223
M8805/110-1861	P7-166221	M8805/110-2165	P7-216125	M8805/110-2319	P7-251129	M8805/110-2424	P7-212224
M8805/110-1862	P7-166222	M8805/110-2166	P7-216126	M8805/110-2321	P7-252121	M8805/110-2425	P7-212225
M8805/110-1863	P7-166223	M8805/110-2167	P7-216127	M8805/110-2322	P7-252122	M8805/110-2426	P7-212226
M8805/110-1864	P7-166224	M8805/110-2168	P7-216128	M8805/110-2323	P7-252123	M8805/110-2427	P7-212227
M8805/110-1865	P7-166225	M8805/110-2169	P7-216129	M8805/110-2324	P7-252124	M8805/110-2428	P7-212228
M8805/110-1866	P7-166226	M8805/110-2211	P7-231121	M8805/110-2325	P7-252125	M8805/110-2429	P7-212229
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
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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
M8805/110-2521	P7-232221	M8805/110-2625	P7-252225	M8805/110-2729	P7-262129	M8805/110-2834	P7-263224
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

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-2863	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
M8805/110-3131	P7-313121	M8805/110-3245	P7-334125	M8805/110-3349	P7-354129	M8805/110-3454	P7-315224
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
M8805/110-3139	P7-313129	M8805/110-3254	P7-335124	M8805/110-3358	P7-355128	M8805/110-3463	P7-316223
M8805/110-3141	P7-314121	M8805/110-3255	P7-335125	M8805/110-3359	P7-355129	M8805/110-3464	P7-316224
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

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-3531	P7-333221	M8805/110-3635	P7-353225	M8805/110-3739	P7-363129	M8805/110-3844	P7-364224
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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M8805/110-5151	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
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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
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M8805/110-5251	P7-535121	M8805/110-5355	P7-555125	M8805/110-5459	P7-515229	M8805/110-5564	P7-536224
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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
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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
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CROSS REFERENCE: MILITARY TO OTTO

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M8805/110-6146	P7-614126
M8805/110-6147	P7-614127
M8805/110-6148	P7-614128
M8805/110-6149	P7-614129
M8805/110-6151	P7-615121
M8805/110-6152	P7-615122
M8805/110-6153	P7-615123
M8805/110-6154	P7-615124
M8805/110-6155	P7-615125
M8805/110-6156	P7-615126
M8805/110-6157	P7-615127
M8805/110-6158	P7-615128
M8805/110-6159	P7-615129
M8805/110-6161	P7-616121
M8805/110-6162	P7-616122
M8805/110-6163	P7-616123
M8805/110-6164	P7-616124
M8805/110-6165	P7-616125
M8805/110-6166	P7-616126
M8805/110-6167	P7-616127
M8805/110-6168	P7-616128
M8805/110-6169	P7-616129
M8805/110-6211	P7-631121
M8805/110-6212	P7-631122
M8805/110-6213	P7-631123
M8805/110-6214	P7-631124
M8805/110-6215	P7-631125
M8805/110-6216	P7-631126
M8805/110-6217	P7-631127
M8805/110-6218	P7-631128
M8805/110-6219	P7-631129
M8805/110-6221	P7-632121
M8805/110-6222	P7-632122
M8805/110-6223	P7-632123
M8805/110-6224	P7-632124
M8805/110-6225	P7-632125
M8805/110-6226	P7-632126
M8805/110-6227	P7-632127
M8805/110-6228	P7-632128
M8805/110-6229	P7-632129
M8805/110-6241	P7-634121
M8805/110-6242	P7-634122
M8805/110-6243	P7-634123

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.
M8805/110-6244	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

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-6662	P7-656222	M8805/110-6766	P7-666126	M8805/110-7111	P7-711121	M8805/110-7215	P7-731125
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

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-7329	P7-752129	M8805/110-7434	P7-713224	M8805/110-7538	P7-733228	M8805/110-7643	P7-754223
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

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MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
M8805/110-7747	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
M8805/110-7815	P7-761225	M8805/110-8119	P7-811129	M8805/110-8224	P7-832124	M8805/110-8338	P7-853128
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

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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
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M8805/110-8425	P7-812225	M8805/110-8529	P7-832229	M8805/110-8634	P7-853224	M8805/110-8738	P7-863128
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CROSS REFERENCE: MILITARY TO OTTO

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MS24655-271	TE-21151
MS24655-271W	TE-21151W
MS24655-311	TE-21161
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CROSS REFERENCE: MILITARY TO OTTO

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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
MS25089-1E	P1-52122	MS25089-2CR	P1-32221	MS25089-3BR	P1-22621	MS25089-4A	P1-12422
MS25089-1EL	P1-54122	MS25089-2CR-1	P1-32231	MS25089-3BRL	P1-24621	MS25089-4AL	P1-14422
MS25089-1ER	P1-52121	MS25089-2CR-1L	P1-34231	MS25089-3BW	P1-22629	MS25089-4AR	P1-12421
MS25089-1ERL	P1-54121	MS25089-2CRL	P1-34221	MS25089-3BWL	P1-24629	MS25089-4ARL	P1-14421
MS25089-1EW	P1-52129	MS25089-2CW	P1-32229	MS25089-3C	P1-32622	MS25089-4AW	P1-12429
MS25089-1EWL	P1-54129	MS25089-2CW-1	P1-32239	MS25089-3C-1	P1-32632	MS25089-4AWL	P1-14429
MS25089-1F	P1-62122	MS25089-2CW-1L	P1-34239	MS25089-3C-1L	P1-34632	MS25089-4B	P1-22422
MS25089-1F-1	P1-62132	MS25089-2CWL	P1-34229	MS25089-3CL	P1-34622	MS25089-4BL	P1-24422
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MS25089-1FW-1	P1-62139	MS25089-2F-1	P1-62232	MS25089-3CWL	P1-34629	MS25089-4CL	P1-34422
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MS25089-1G	P1-72122	MS25089-2FR	P1-62221	MS25089-3ER	P1-52621	MS25089-4CR-1L	P1-34431
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MS25089-1G-1L	P1-74132	MS25089-2FR-1L	P1-64231	MS25089-3EW	P1-52629	MS25089-4CW	P1-32429
MS25089-1GL	P1-74122	MS25089-2FRL	P1-64221	MS25089-3EWL	P1-54829	MS25089-4CW-1	P1-32439
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MS25089-1GW	P1-72129	MS25089-2G	P1-72222	MS25089-3FR	P1-62621	MS25089-4ER	P1-52421
MS25089-1GW-1	P1-72139	MS25089-2G-1	P1-72232	MS25089-3FR-1	P1-62631	MS25089-4ERL	P1-54421
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MS25089-1GWL	P1-74129	MS25089-2GL	P1-74222	MS25089-3FRL	P1-64621	MS25089-4EWL	P1-54429
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MS25089-1H-1L	P1-84132	MS25089-2GR-1L	P1-74231	MS25089-3FW-1L	P1-64639	MS25089-4F-1L	P1-64421
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MS25089-2BR	P1-22221	MS25089-3A	P1-12622	MS25089-3HR	P1-82621	MS25089-4GW	P1-72429
MS25089-2BRL	P1-24221	MS25089-3AL	P1-14622	MS25089-3HR-1	P1-82631	MS25089-4GW-1	P1-72439
MS25089-2BW	P1-22229	MS25089-3AR	P1-12621	MS25089-3HR-1L	P1-84631	MS25089-4GW-1L	P1-74439
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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
MS25089-4HRL	P1-84421
MS25089-4HW	P1-82429
MS25089-4HW-1	P1-82439
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MS25089-5BWL	P1-24329
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MS25089-5GR	P1-72321

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MS25224-1	TG-00001
MS25224-3	TG-00002
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MS27217-1	B5-21141
MS27240	
MS27240-1	P6-24003
MS27240-2	P6-24004
MS27240-3	P6-14000
MS27240-4	P6-14001
MS27240-5	P6-24005
MS27240-6	P6-24006
MS27240-7	P6-14002
MS27240-8	P6-14003
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MS27257-2	B3-22141
MS27407	
MS27407-1	T9-MS2-01
MS27407-2	T9-MS2-02
MS27407-3	T9-MS2-03
MS27407-4	T9-MS2-04
MS27407-5	T9-MS2-05
MS27407-6	T9-MS2-06
MS27716	
MS27716-21-1	T3-21111
MS27716-22-1	T3-21121
MS27716-23-1	T3-21131
MS27716-26-1	T3-21141
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MS27716-31-1	T3-21161

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MS27717-27-1	T3-21251
MS27717-31-1	T3-21261
MS27718	
MS27718-21-1	T3-11111
MS27718-22-1	T3-11121
MS27718-23-1	T3-11131
MS27718-26-1	T3-11141
MS27718-27-1	T3-11151
MS27718-31-1	T3-11161
MS27719	
MS27719-21-1	T3-11211
MS27719-22-1	T3-11221
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MS27720-21-1M	T3-31111M
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MS27720-22-1G	T3-31121G
MS27720-23-1D	T3-31131D
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MS27720-27-1N	T3-31151N
MS27720-31-1E	T3-31161E
MS27720-31-1F	T3-31161F
MS27720-31-1K	T3-31161K
MS27720-31-1L	T3-31161L
MS27720-31-1M	T3-31161M
MS27720-31-1N	T3-31161N

MILITARY PART NO.	OTTO PART NO.
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MS27721-21-1B	T3-31211B
MS27721-21-1D	T3-31211D
MS27721-21-1E	T3-31211E
MS27721-21-1F	T3-31211F
MS27721-21-1G	T3-31211G
MS27721-21-1H	T3-31211H
MS27721-21-1J	T3-31211J
MS27721-21-1K	T3-31211K
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MS27721-23-1D	T3-31231D
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MS27721-31-1E	T3-31261E
MS27721-31-1F	T3-31261F
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MS27721-31-1M	T3-31261M
MS27721-31-1N	T3-31261N
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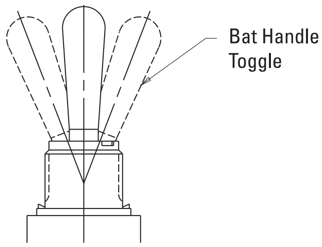
MS27752-1	TG-00006
MS90310	
MS90310-211	TE-11111
MS90310-221	TE-11121
MS90310-231	TE-11131
MS90310-271	TE-11151
MS90310-311	TE-11161
MS90311	
MS90311-211	TE-11211
MS90311-221	TE-11221
MS90311-231	TE-11231
MS90311-271	TE-11251
MS90311-311	TE-11261

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)

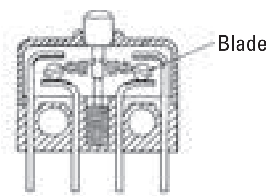
Figure 1



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.

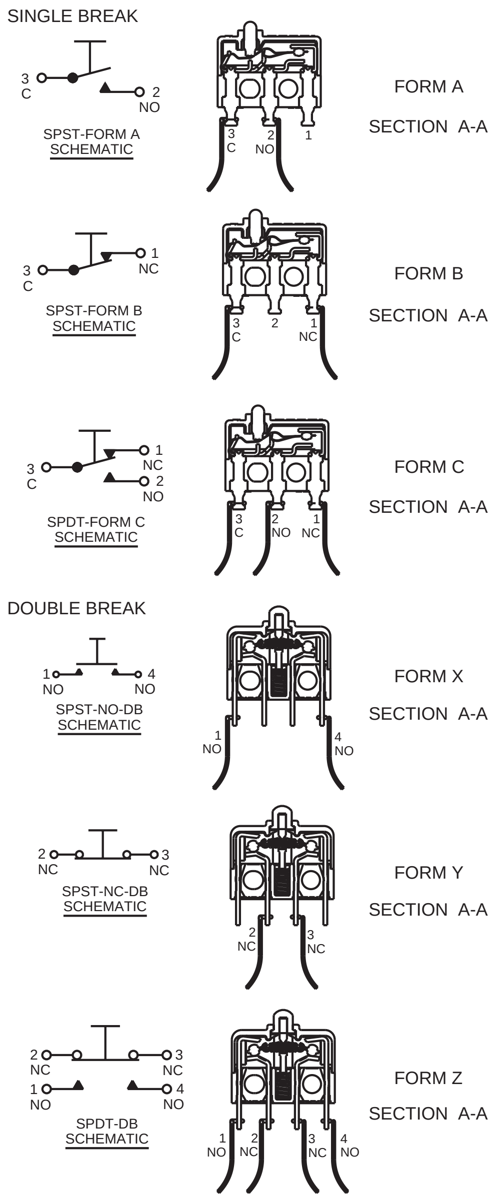
Collective: A grip used to control the up/down movement of an aircraft.

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



GLOSSARY OF TERMS

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.

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.

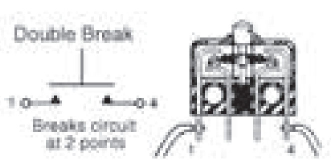
Differential: Distance the button travels between actuation and reset point.

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.

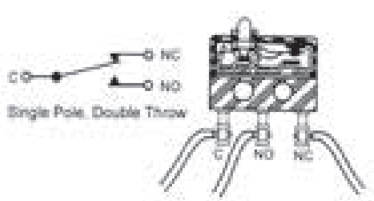
Double Break: A mechanism that breaks the circuit at two points simultaneously. The B3 is a double break switch. (See Figure 4)

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)

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.

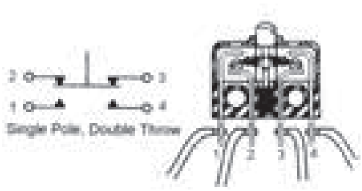
Electrical Load: The amount of electricity that is applied to the switch or the circuit.

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/m² 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.

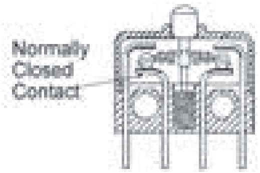
Momentary Action: Switch that requires the operator to hold the button or lever in the operating position. The button or toggle will return to the free position (rest position) when it is let go.

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).

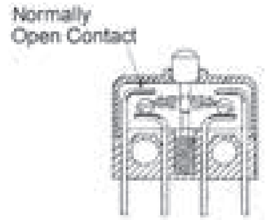
Normally Closed (NC): A normally closed circuit allows electricity to flow through when the switch is in its free position; it prevents the electrical flow when actuated. (See Figure 7)

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 Hysterisis: 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.

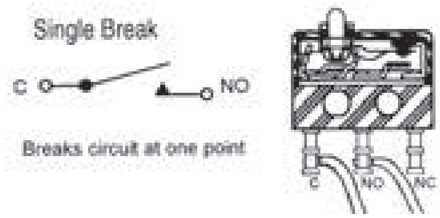
Shroud: A wall or housing that surrounds a switch, button or toggle to protect the switch from accidental operation.

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)

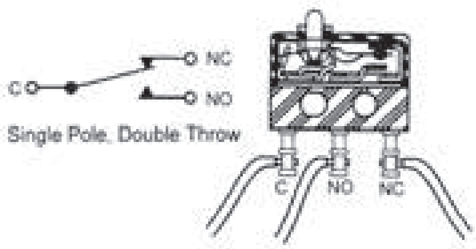
Figure 9



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)

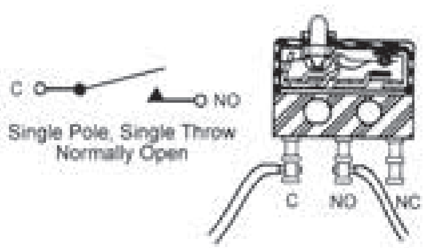
Figure 10



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

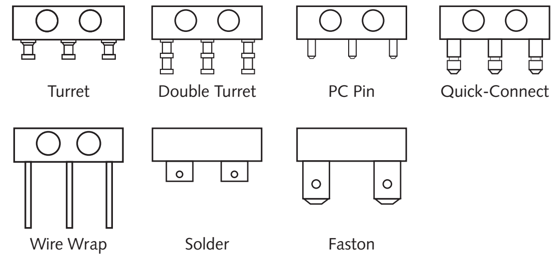


Subminiature: A switch that is smaller than 1 inch long.

Sub-subminiature: A switch that is smaller than ½ 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.

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