



OTTO[®]

Expect Excellence.

CATALOG 111

Complete Line of Switches, Grips & Joysticks



Expect Excellence

Since 1961 OTTO has been designing and manufacturing precision switches and operator controls for some of the most demanding applications, ranging from fork lift trucks to the space shuttle. Offering one of the most extensive lines of products from traditional snap-action switches to state-of-the-art J1939 & CANopen® Communication Protocols, OTTO is constantly recognized worldwide for superior performance and innovative products.

Every control is expertly designed, every detail meticulously managed. The people who make OTTO products are as dedicated as the people who use them. Our innovative designs have no tolerance for second best—each piece, right down to the smallest component, is crafted with precision. We've put all our expertise into designing and crafting equipment you can rely on.



Molding & Machine Shop

OTTO is a vertically integrated manufacturer with over 200,000 square feet of manufacturing capabilities; providing in-house injection molding, stamping, multi axis CNC machining, cable over molding and final assembly work cells.

Engineering

OTTO offers strong mechanical, electrical and RF design engineering capability, utilizing ProEngineer 3D modeling, COSMOS FEA and MoldFlow plastics analysis software to complete virtual prototyping. Rapid physical prototyping is accomplished via CNC machining and state-of-the-art SLA/SLS technologies.

Test Lab

OTTO's reliability testing facilities, quality systems and fabrications assembly areas are world class. OTTO houses a complete MIL-I-45208 as well as ISO 17025 (A2LA) test lab facility onsite; with environmental, mechanical, electrical and audio test capabilities.

Registration to ISO 9001:2000, AS9100B and FAR Part 145 Repair Station are just a sampling of the various in-house tools which comprise OTTO's Total Quality Management system. Real time SPC techniques, FMEAs, online data acquisition systems and computer controlled production line testing monitor and maintain our core Quality System...unmatched in the industry.

Customer Service

Customer service is synonymous with OTTO. Providing unprecedented service to our customers is not a goal, it is a way of doing business.

Our staff of highly trained Customer Service Representatives is available to provide technical support, pricing and delivery information. In addition, product specifications and pricing are available 24/7 via our web site at www.ottoexcellence.com. OTTO supports a full network of authorized distributors worldwide, providing just in time inventory, value added programs and vendor consolidation.



It is the buyer's responsibility to determine the suitability of the particular device for its application. Use of this catalog is for reference purposes only. Dimensional drawings are available upon request—contact your Customer Service Representative.



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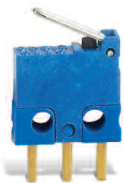


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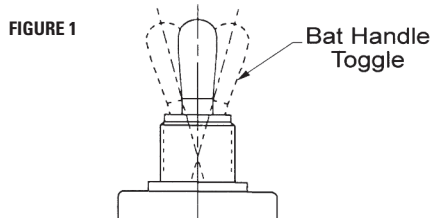
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Actuator: Device which causes the switch to operate.

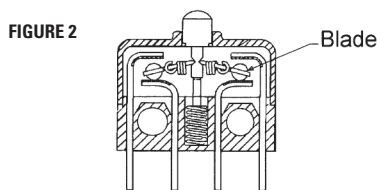
Alternate Action: A pushbutton switch which alternatively changes from ON to OFF and OFF to ON when actuated, but stays in the desired electrical state after the button is released.

Bat Handle: Toggle lever shaped like a baseball bat. (See Figure 1)



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)



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 interrupt 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, and environmental and consumer protection.

Chatter: Rapid opening and closing of contacts, usually exhibited during extreme vibration and/or shock.

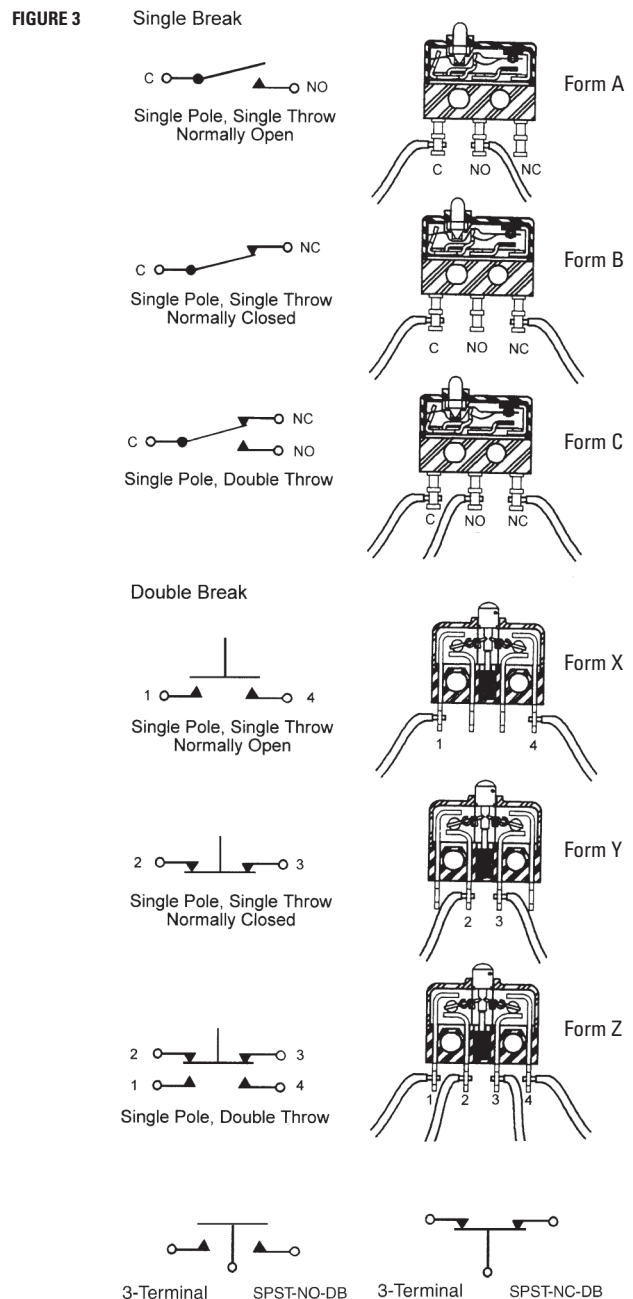
Clearance: Distance through air between electrically live parts of opposite polarity or ground.

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)



Contact Force: The force that the moveable contact in a switch exerts on the fixed terminal.

Contact Gap: The distance that separates two contacts when the circuit is open.

Contact Resistance (CR): Resistance, measured in milliohms, of an electrical circuit caused by the contacts.

CSA (Canadian Standards Agency): A testing and safety certification agency.

Cyclic: A grip used to control the left/right or forward/backward movement of an aircraft.

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 feedback 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.

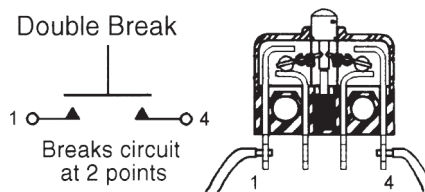
Differential: Distance the button travels between actuation and reset point.

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.

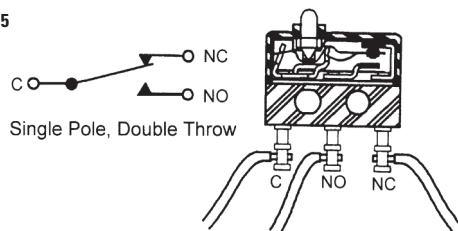
Double Break: A mechanism that breaks a circuit at two points simultaneously. The B3 is a double break switch. (See Figure 4)

FIGURE 4



Double Throw: Contact arrangement that allows current to flow from the common terminal to a normally closed terminal; 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 operate at a specified or full rated load.

Electrical Load: The amount of electricity that is applied to the switch or the circuit.

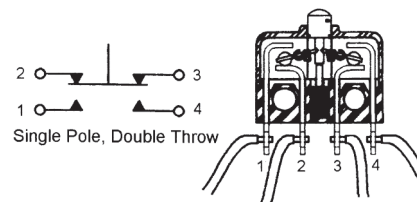
Environmentally Sealed Switch: A switch that is sealed to protect the internal contacts from the external environment.

Flash Plating: Plating thickness of 10 micro inches (0.00001) or less, typically done with gold plate.

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 push button switch.

Form Z: A two circuit double break switch such as a Single Pole Double Throw double break switch. (See Figure 6)

FIGURE 6



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 that 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 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 sealed against splashing water.

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.

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 operation 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.

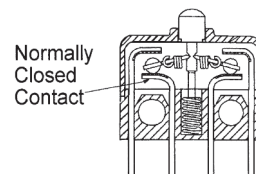
Momentary Action: Switch that requires the operator to hold the button or lever in the operating position. The button or toggle will return to the free position (rest position) when released.

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).

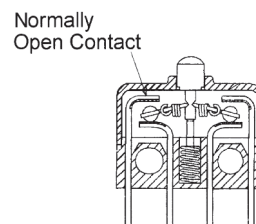
Normally Closed (N.C.): A normally closed circuit allows electricity to flow through the switch when the switch is in its free position; it prevents the electrical flow when actuated. (See Figure 7)

FIGURE 7



Normally Open (N.O.): A normally open circuit prevents the flow of electricity to flow through the circuit in its free position; it allows the electrical flow when it is actuated. (See Figure 8)

FIGURE 8



Null Hysteresis: The measure of output after release from deflected position; usually only used in transducers.

Null Output: Voltage output of a device at rest; usually measured in transducers.

OEM: Original Equipment Manufacturer.

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 Parts List): A government report that lists which companies are approved to make a particular product for military use.

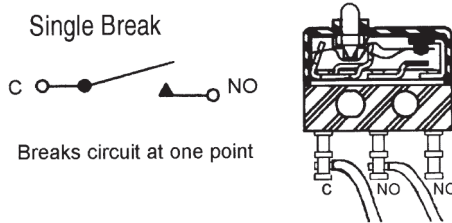
Resistive Load: An electrical load in which the current instantly rises to its steady state when applied and instantly drops to zero when discontinued.

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.

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)

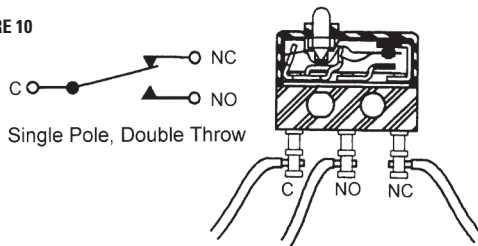
FIGURE 9



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)

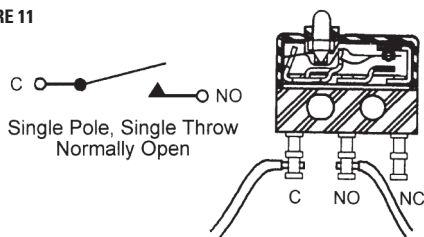
FIGURE 10



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" long.

Sub-subminiature: A switch that is smaller than 1/2" long.

Tactile Feedback: The feeling of increased or decreased force, transmitted through the button or toggle of a switch when actuated. The snap feel of a switch.

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.

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 at which the switch operates.

UL (Underwriters Laboratories): A testing and safety certification agency for consumer products.

Ungated: Omnidirectional.

Watertight: A seal rating that indicates that water cannot ingress when the item is submerged in 3 feet of water.

Wiping Action: The travel of the moveable contact over the fixed contact as the switch operates. This action helps clean the contacts of contamination.

It is the buyer's responsibility to determine the suitability of the particular device for its application. Use of this catalog is for reference purposes only. Dimensional drawings are available upon request—contact your Customer Service Representative.

Basic Switches



SERIES	FEATURE	MAX RATING (Resistive)	MECHANICAL LIFE	APPROVALS	CIRCUITRY
B1	Ultra Small	2A	1,000,000	N/A	SPST, SPDT
B1-5	Levers	2A	1,000,000	N/A	SPST, SPDT
B2	Subminiature	7A	250,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST, SPDT
B2-5	Subminiature with Integral Levers	7A	100,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST, SPDT
B3	Subminiature	8A	1,000,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST, SPDT, SPST-DB, SPDT-DB
B5	Miniature	10A	1,000,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	SPST, SPDT, SPST-DB, SPDT-DB
B5-7	Two Pole	10A	100,000	UL (E61705), CSA (LR43865), DSCC (QPL8805)	DPDT-DB

SINGLE BREAK, COMMERCIAL & MILITARY GRADES

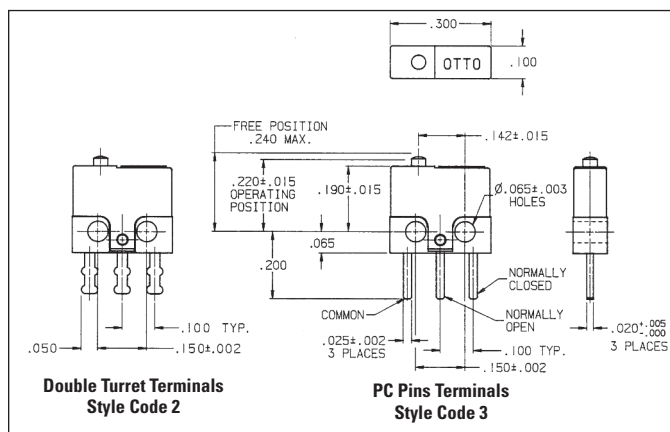
The B1 series basic switches are ultra-subminiature in size, designed to reliably switch low level logic signals as well as up to 2 amps switching capacity for a minimum of 25,000 cycles. Mechanical life expectancy is in excess of 1 million cycles.

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

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

Features:

- **Ultra-compact:** only 0.300" w x 0.250" h x 0.100" thk
- **1 million cycle life**
- **Low level logic switching capability**
- **Designed to meet requirements of MIL-PRF-8805/94**
- **Available in Commercial & Military grades**
- **Choice of solder or PC molded-in terminals**
- **Precision operating points**



ORDERING INFORMATION:

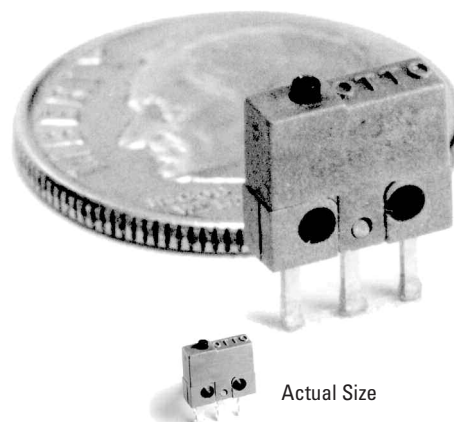
B1 Basic

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, default integer and gold flash silver contacts.

B1 PART NUMBER CODE

B1	-	X	X	X	X	X
Construction Grade		Terminal Style	Operating Force	Movement Differential	Contact Material	
1. Military 2. Commercial		2. Double Turret 3. PC Pins	1. 6 oz max	1. 0.005" max	1. Silver/Gold Flash 3. Silver/Gold Plate	



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	1050Vrms	400Vrms
Low Level	30mV max and 10mA max	30mV and 10mA max

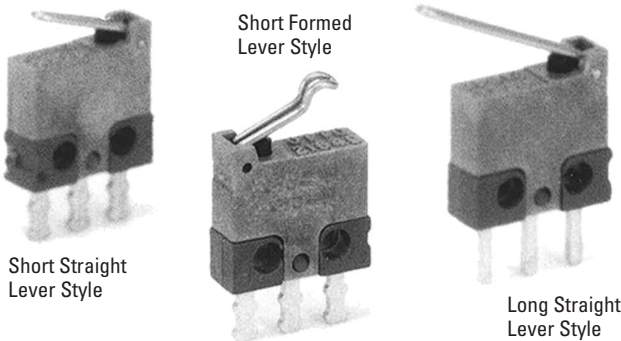
*L/R = 0.026

Electrical Life:	25,000 cycles
Mechanical Life:	1 million 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:	Brass, gold over nickel
Contacts:	Stationary: Silver with gold flash Moveable: Silver with gold plate
Terminal Hardware:	None provided
Mounting Hardware:	None provided

SNAP-ACTION, SINGLE BREAK BASIC SWITCHES



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)	Move't Differ'l (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

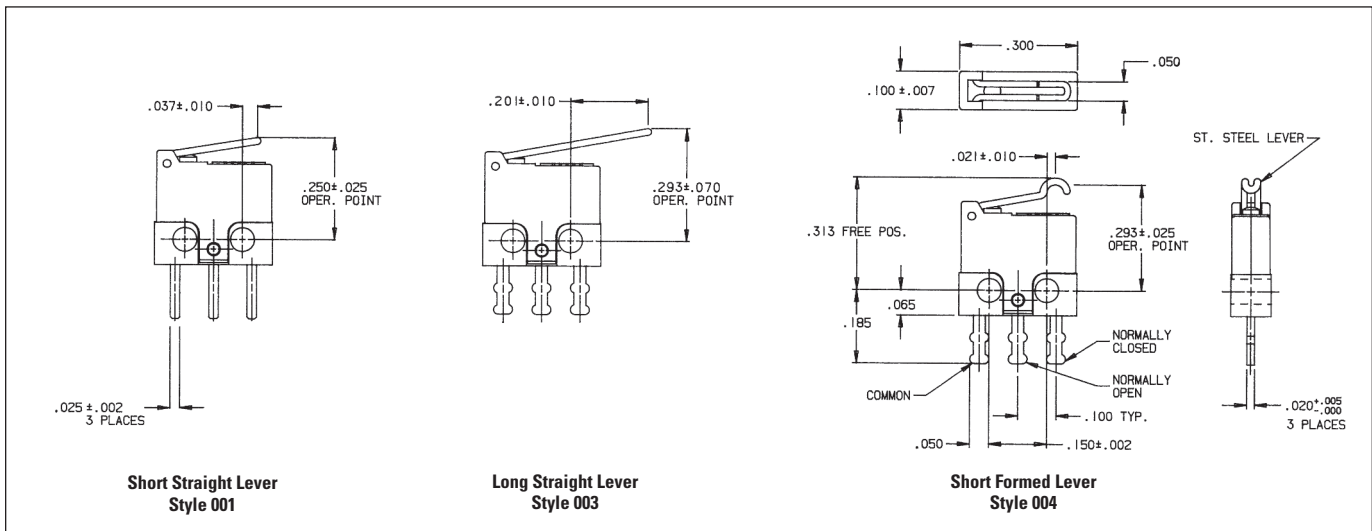
Actuator Identifier	Lever Style	Terminal Style	Contact Material
B1-5	XXX	X	X
Integral Lever Actuator Style	001. Short Straight 003. Long Straight 004. Short Formed (Other lever lengths and styles available.)	1. Double Turret 2. PC Pin 0.140" lg.	1. Silver/Gold Flash 3. Silver/Gold Plate

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 gold flash silver contacts.



SINGLE BREAK, COMMERCIAL & MILITARY GRADES, TWO WIDTHS

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

The B2 series is also available with integral lever actuators as the B2-5 series. These are in addition to the A2 series auxiliary lever actuators 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.

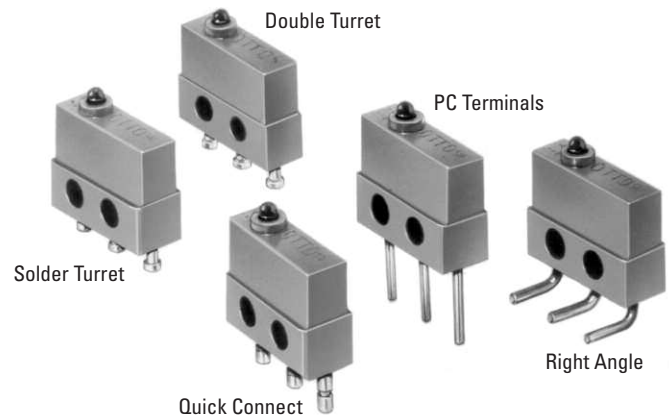
A choice of turret, quick connect and three lengths of printed circuit style terminals are available for both the 0.156" and 0.200" wide models.

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

The OTTO B2 sub-miniature 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 eight terminal styles
- Long operating life
- Qualified under MIL-PRF-8805/4, MIL-PRF-8805/106 & MIL-PRF-8805/109
- UL recognized & CSA certified



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Rating – Sea Level	Rating – 50,000 feet
115/250VAC, 60Hz silver contacts with gold flash		
Resistive	7A	N/A
Inductive	4A	N/A
Lamp	2A	N/A
28VDC, silver contacts with gold flash		
Resistive	7A	4A
Inductive	4A	2.5A
Lamp	2.5A	2.5A
28VDC, gold plate contacts		
Resistive	1A	1A
Inductive	0.5A	0.5A
Lamp	N/A	N/A
DVV	1050Vrms	400Vrms

Electrical Life:	25,000 cycles
Mechanical Life:	250,000 cycles
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 flash or silver with gold plate Moveable: Silver or gold flash
Terminal Hardware:	None provided
Mounting Hardware:	None provided

SINGLE BREAK, COMMERCIAL & MILITARY GRADES, TWO WIDTHS

MILITARY APPROVALS

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

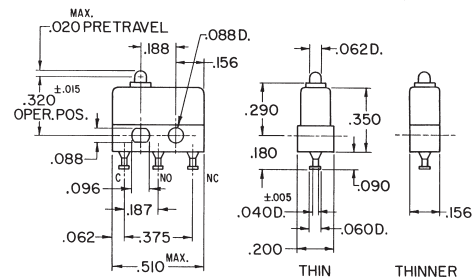
Certain OTTO B2 models have been qualified to the military specification for these parts. The following is the latest listing.

ELECTRICAL: (SPDT)

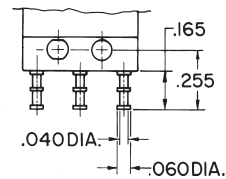
MILITARY NO. **OTTO P/N**

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

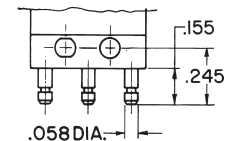
**Basic Switch
shown with
Single Solder
Turret
Terminals
Terminal
Style 1**



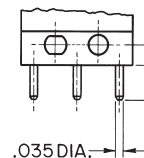
**Double Solder
Turret
Terminals
Terminal
Style 2**



**Quick
Connect
Terminals
Terminal
Style 3**

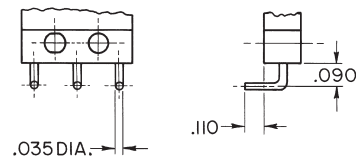


**Printed
Circuit Pin
3 Lengths
Terminal
Styles 4, 5 & 6**



Dim. "A"	Dim. "B"	Terminal Style
0.150"	0.240"	4
0.270"	0.360"	5
0.090"	0.180"	6

**Right Angle
Printed
Circuit
Terminal
Style 7**



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 flash contacts.

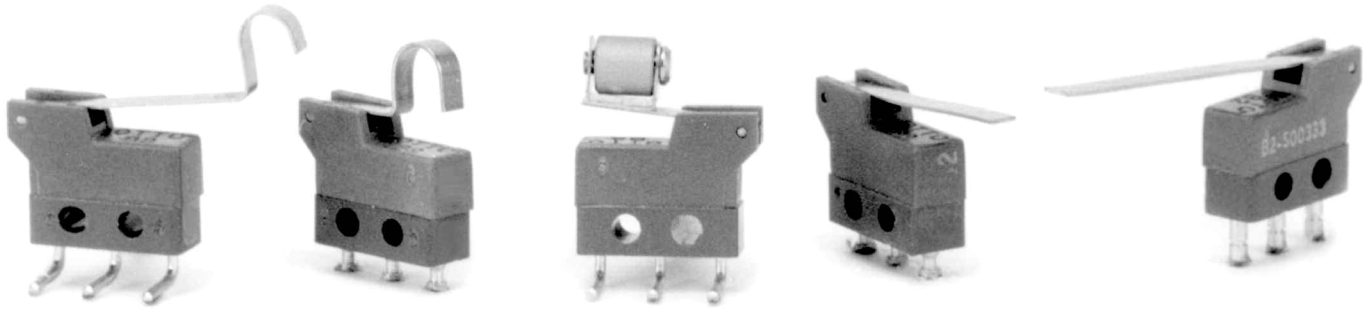
B2 PART NUMBER CODE

Bold Code numbers signify standard features with best availability.

B2	—	X	X	X	X	X
Model (Width/Constr.)	Actuator Style	Terminal Style	Operating Force	Movement Differential	Contact Material	
1. 0.156" (MIL Grade)	1. Button	1. Turret	3. 5 oz max	2. 0.002"	1. Silver/ Gold Flash	
2. 0.200" (MIL Grade)		2. Double Turret	4. 6 oz max	3. 0.003"	3. Gold	
3. 0.156" (Com'l Grade)		3. Q.C. Tab ①		4. 0.004"		
4. 0.200" (Com'l Grade)		4. PC Pin 0.150" lg.		5. 0.005"		
		5. PC Pin 0.270" lg.		6. 0.006"		
		6. PC Pin 0.090" lg.				
		7. Right Angle PC				
		9. Right Angle, Opposite of 7				

① Mates with AMP 0.058" receptacles.

CHOICE OF STRAIGHT, FORMED OR ROLLER LEVERS



B2-500571

B2-500411

B2-501691

B2-500211

B2-500333

Shown are examples of available lever styles.

B2-5 PART NUMBER CODE

Actuator Identifier	Lever Style	Terminal Style ①	Contact Material
Integral Lever Actuator Style	001. Short Straight 002. Medium Straight 003. Long Straight 004. Short Formed 005. Long Formed 016. Roller Lever Sideways 019. Roller Lever In Line	1. Turret 2. Double Turret 3. Q.C. Tab ② 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	1. Silver/Gold Flash 3. Gold

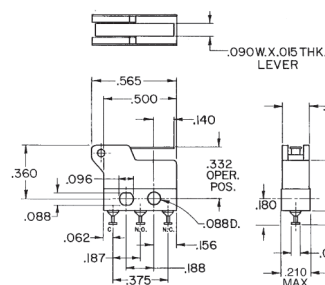
B2-5 Integral Lever Basic Switches

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

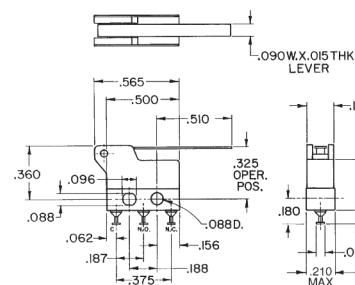
Making the lever actuator an integral part of the basic switch case makes sense and saves money, too. Better precision, no auxiliary parts for you to assemble, and more variety add up to a cost saving proposition.

① For dimensional details for the other standard terminal styles available, consult the B2 information.
② Mates with AMP 0.058" receptacles.

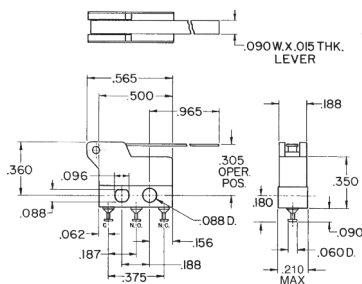
Lever Style	Catalog Number	STANDARD OPERATIONAL CHARACTERISTICS					
		Operating Force (max ounces)	Release Force (min ounces)	Pretravel (max inches)	Overtravel (min inches)	Move't Differ'l (max inches)	Operating Point (inches)
Short Lever	B2-500111	1.76	0.32	0.065	0.014	0.020	0.332 +/- 0.045
Medium Lever	B2-500211	1.10	0.18	0.115	0.025	0.035	0.325 +/- 0.075
Long Lever	B2-500311	0.71	0.11	0.185	0.046	0.060	0.305 +/- 0.115
Short Formed Lever	B2-500411	2.10	0.39	0.050	0.010	0.015	0.545 +/- 0.036
Long Formed Lever	B2-500511	1.10	0.18	0.105	0.022	0.035	0.559 +/- 0.065



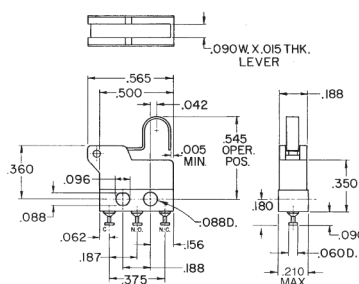
Short Straight Lever B2-500111



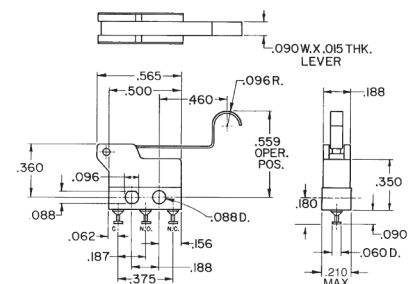
Medium Straight Lever B2-500211



Long Straight Lever B2-500311



Short Formed Lever B2-500411



Long Formed Lever B2-500511

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

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

OTTO's B3-22000 series is a sub-subminiature switch that meets all requirements of 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 25m Ω , contact pressure, contact bounce and overall cycle life. For MIL-PRF-8805/76 requirements, B3-22141 has standard silver with gold flash contacts, SPDT double break two circuit (Form Z), solder terminals in thermoset case material. Gold plate contacts are available for non-military applications. UL recognized and CSA certified models available.

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

For your really difficult projects, try OTTO'S B3 series. They meet 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-8805/76s 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, higher than normal contact pressures, 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 flash contacts and SPDT double break (Form Z) contact. For commercial applications, a variety of contact forms, special forces and gold plate contacts are available. Most versions are also UL recognized and CSA certified.

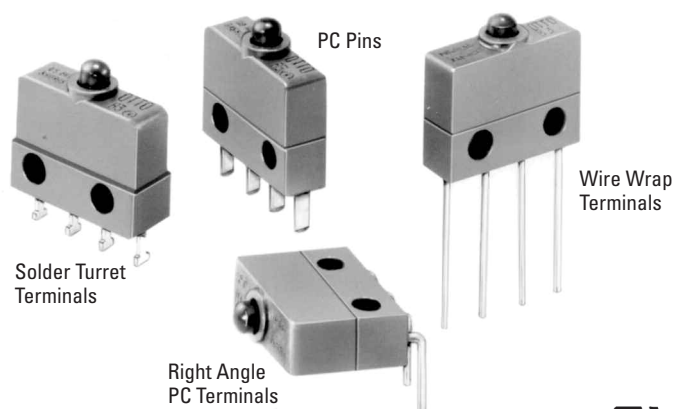
Great circuit versatility is available with either switch style. You have your choice of normally open (Form X) or closed (Form Y), 3 terminal (Form C) and 4 terminal (Form Z) SPDT double break.

Features:

- Low level switching capability
- Less than 25m Ω 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 six standard terminal styles
- Available in Commercial & Military grades
- UL recognized & CSA certified
- Qualified under MIL-PRF-8805/76 & MIL-PRF-8805/101

APPLICATIONS

OTTO sub-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 can be provided.

**Standard Characteristics/Ratings:****ELECTRICAL RATINGS:**

Circuitry	Load	Sea Level @ 28VDC	70,000 feet @ 28VDC	Sea Level @ 115VAC, 60/400Hz
SPST-NO	Resistive	8A	8A	8A
SPDT-DB		5A	5A	5A
SPDT		5A	5A	5A
Gold Contacts		5A	5A	N/A
SPST-NC	Inductive*	5A	3A	5A
Form Z		3A	2A	3A
Form C		2.5A	1.5A	3A
Gold Contacts		3A	2A	N/A
Double Break Lamp		1A	N/A	1A
2 Circuit		N/A	N/A	1A
*L/R = 0.026				
Lamp		1A	N/A	1A
Motor		5A	N/A	
DWV		1050Vrms	400Vrms	

Low Level: Gold contacts 10mA @ 30mV

Electrical Life: 50,000 cycles at full load

Mechanical Life: 1 million cycles

Seal: Unsealed

Operating Temp Range: -65°C to +125°C

Operating Force: 5 oz +/- 2 oz typical to 6 oz max

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, gold over nickel

Contacts: Stationary: Silver with gold flash
Moveable: Silver with gold plate

Terminal Hardware: None provided

Mounting Hardware: None provided

BASICS

www.ottoexcellence.com 9

SUBMINIATURE DOUBLE BREAK, SNAP-ACTION COMMERCIAL & MILITARY GRADES

B5 series basic switches are subminiature in size and feature up to 10 amps switching capability of 100,000 cycles. Mechanical life is 1 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.

A variety of actuators for pushbutton, toggle and lever actuation are available in standard and custom configurations.

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 three standard terminal styles
- UL recognized
- B5-21141 QPL to MS27217-1



Quick Connect
Terminal Style



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Circuitry	Load	Sea Level @ 28VDC or @ 115VAC, 60Hz	70,000 feet @ 28VDC or @ 115VAC, 60Hz	Sea Level @ 125/250VAC, 60Hz
SPNO-DB & SPNC-DB	Resistive	10A	10A	10.1A
	Inductive*	7.5A	3.5A	5A
SPDT-DB 2 Circuit	Lamp	4A	N/A	3A
	Resistive	10A	10A	10.1A
SPDT	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

Electrical Life: 100,000 cycles

Mechanical Life: 1 million 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: End or front solder type brass with bright acid tin plating

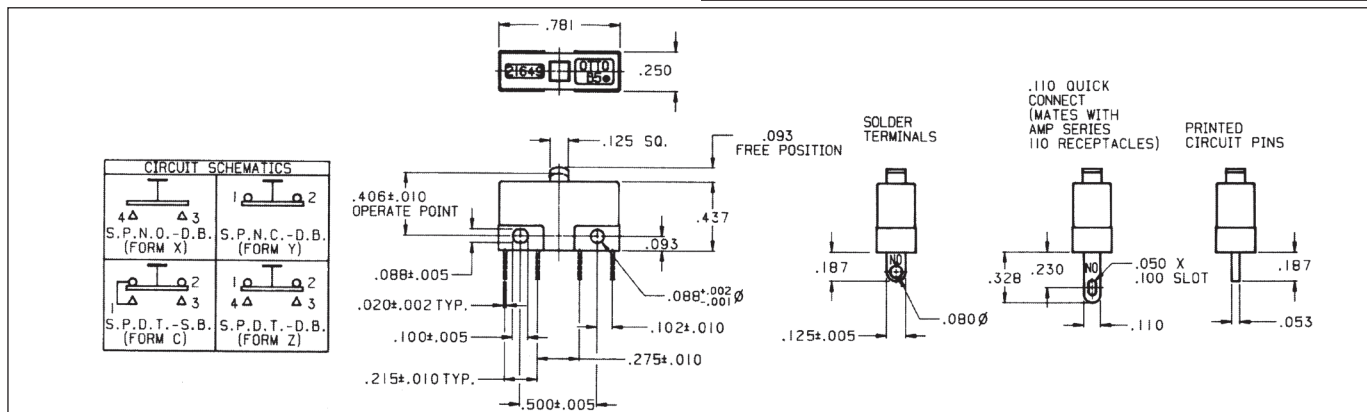
Contacts: Stationary: Silver with gold flash or silver with gold plate
Moveable: Silver or gold flash

Terminal Hardware: None provided

Mounting Hardware: None provided

B5	-	X	X	X	X	X
Model		Terminal Style	Operating Force	Circuitry	Contact Material	
1. Commercial		1. Solder	1.5 ⁺³ / ₋₂ oz	1. SPNO-DB, Form X	1. Silver/Gold Flash	
2. Military		3. 0.110 Quick Connect ①	2. 6 oz max	2. SPNC-DB, Form Y	2. Silver/Gold Plate	
		4. PC Pin	3. 3 oz min	3. SPDT, Form C		
				4. SPDT-DB, Form Z		

① Mates with AMP Series 110 receptacles.



DOUBLE POLE, 4 CIRCUIT SUBMINIATURE

COMMERCIAL & MILITARY GRADES, SNAP-ACTION, DOUBLE BREAK BASIC SWITCHES

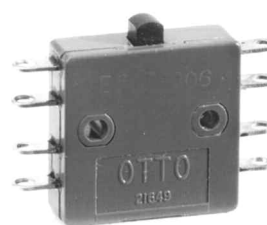
Two switches in one case! The B5-7 series basic switches are subminiature in size but feature up to 10 amps switching capability of 100,000 cycles.

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.

A variety of custom configured actuators for pushbutton, toggle and lever actuation are available.

Features:

- Up to 10 amps switching capability
- Simultaneity of both poles to within 0.004"
- Button accepts actuation directly from cam
- Constructed in accordance with MIL-PRF-8805
- Available in Commercial & Military grades
- Gold flash or gold plate contacts
- Choice of end or front terminals



End Terminal Style



Front Terminal Style

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 flash

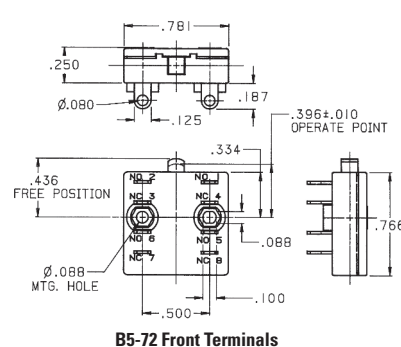
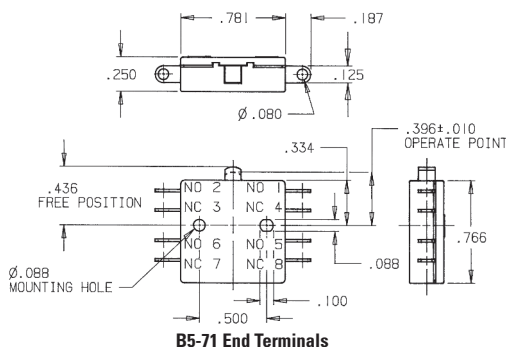
Terminal Hardware: None provided

Mounting Hardware: None provided

Catalog Number	Type of Load	Sea Level @ 28VDC DPDT	Sea Level @ 28VDC 4 Circuit	Sea Level @ 115VAC, 60Hz DPDT	Sea Level @ 115VAC, 60Hz 4 Circuit	70,000 feet @ 28VDC DPDT	70,000 feet @ 28VDC 4 Circuit	Contact Plating Over Silver
B5-71001 & B5-72001	Resistive	10A	10A	7.5A	5A	10A	10A	
B5-71001	Inductive*	7.5A	5A	5A	5A	3.5A	2A	Gold Flash
B5-72001	Inductive	5A	2A	5A	5A	3.5A	2A	Gold Flash
B5-71001 & B5-72001	Lamp	4A	3A	3A	1.5A	N/A	N/A	
B5-71004	Resistive	5A	5A	N/A	N/A	5A	5A	Gold Plate
B5-72004	Inductive*	3A	3A	N/A	N/A	3A	3A	Gold Plate
B5-71002 Low Level	Resistive	1A	1A	N/A	N/A	1A	1A	Gold Plate
B5-72002 Low Level	Inductive*	0.5A	0.5A	N/A	N/A	0.5A	0.5A	Gold Plate
Dielectric Withstand:		1050Vrms	1050Vrms	1050Vrms	1050Vrms	400Vrms	400Vrms	

*L/R = 0.026

Circuit Schematic
DPDT-DB (Form ZZ)



MILITARY GROUND SUPPORT & FLIGHT CONTROL GRIPS

For over 45 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), on-site test lab facility with environmental, mechanical, electrical and audio test capabilities. Registration to ISO 9001:2000, AS9100B and FAA Part 145 Repair Station. Our experience and know-how in the design and manufacturing of precision switches and grips have made us a supplier to all flight control manufacturers. With an emphasis on sealed-switch technology and custom electromechanical switch design and development, OTTO has a solution to meet the most demanding applications.

Military Ground Support Grips

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

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



Cyclic Grip



Military Ground Support Grip



B8 Style Grip



Cobra Style Grip



Collective Grip



Throttle Grips



HELICOPTER CYCLIC & COLLECTIVE GRIPS



Exploded View

Helicopter Cyclic & Collective Grips

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



Collective Grip with
Thumbwheel Switch
and NVG Backlighting



Helicopter
Cyclic Grips



Cyclic Grip with
Custom Switch Guards



Systems Grip

MODULAR DESIGN

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 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 series Hall Effect Joystick. Both the G3-0100 Small Universal Grip and the G3-0101 Medium Universal Grip are easily customized with multiple switch configurations, quickly and without tooling charges.

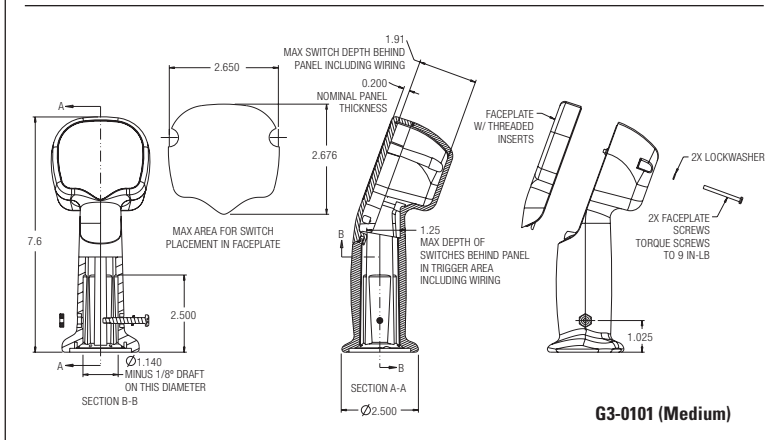
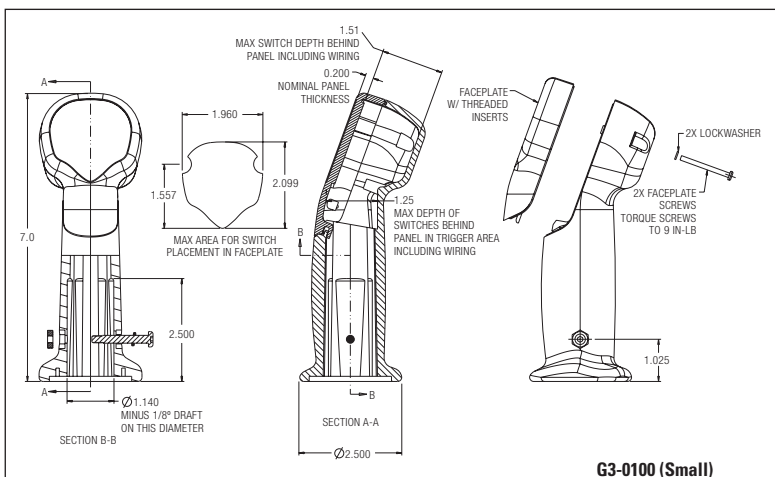
- **Modular design eliminates the need for tooling charges**
- **Compatible with the OTTO JH series Hall Effect Joystick**
- **Small & medium sizes available**
- **Accommodates a full line of pushbutton, rocker, toggle, HP Hall Effect & HPL proportional output series of switches**
- **Various mounting & termination options available**



Small Universal Grip
Shown Unpopulated
and with Pushbutton
and Rocker Switches



Medium Universal Grip
Shown with Pushbutton
and Rocker Switches



Internal View



Custom Mounting
Adapters Available



Custom
Terminations Available

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 3-D 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 rapid prototyping; in-house precision machining; progressive die stamping; injection, insert and compression molding; cable and over-molding assembly capabilities. All OTTO products are manufactured under an ISO 9001:2000 approved quality system, ensuring the greatest value and the highest performance for our customers.

Heavy Equipment & Material Handling Grips

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

Tractor Grips

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

Agricultural Grips

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

G3 Soft Touch Grip



Tractor Grips



Agricultural Grip



Palm Grip



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, two digital output channels and I/O extension for up to 40 digital input channels, eight analog input channels and 40 digit output channels by means of 1°C interface. 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 9 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 in the market.

Features:

- Outstanding EMI/RFI immunity
- Heavy gauge, corrosion-resistant metal
- Proven contactless analog output Hall Effect technology
- 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 & WEEE compliant



Bidirectional
Foot Pedal

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life:	9,000,000 cycles
Drop:	1 meter max to concrete
Vibration:	10g 10Hz to 2KHz swept sinusoidal

TRAVEL ANGLE:

Degrees:	13 nominal
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) @ 5V Vcc	VDC	-0.15	N/A	+0.15
Analog Output Voltage Tolerance at Full Travel (see graph for output values)	VDC	-0.15	N/A	+0.15
Limit Switch Supply Voltage (if applicable)	V	5	N/A	30
Limit Switch Actuation (if applicable)	Degrees	1°	2°	3°
Analog Output Pretravel	Degrees	0.5°	1°	1.5°
Analog Output Overtravel	Degrees	0.5°	1°	1.5°

ELECTRONICS:

Seal Integrity:	Electronics IP68S
RFI:	Withstand 100V/M, 14KHz to 1GHz (excludes output options 3 & 5)
EMC:	Withstand per MIL-STD-46 ID/SAE J1113-22

ENVIRONMENTAL:

Operating Temp Range:	-40°C to +85°C
Storage Temp Range:	-55°C to +105°C
Humidity:	96% RH, 70°C, 96 hours
Sand/Dust:	Withstand per SAE J1455

MATERIALS:

Foot Pedal Plate:	Plated steel
Housing:	Glass filled thermoplastic
Cable:	22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket
Mounting Hardware:	None provided

HALL EFFECT FOOT PEDAL

HJFC
HALL EFFECT
FOOT PEDAL

UNIDIRECTIONAL & BIDIRECTIONAL

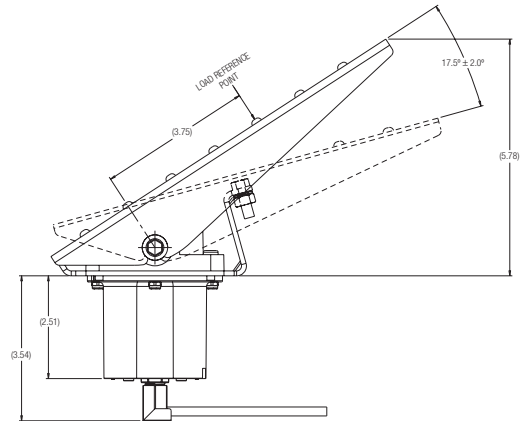
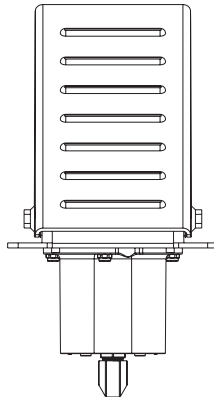
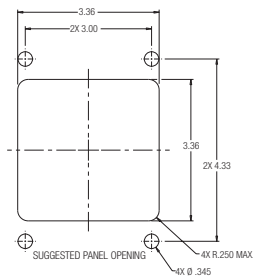
HJFC PART NUMBER CODE

Direction	Travel	Output*	Sealing	Power	Termination	Pedal
1. Uni	1. 15 Degrees Unidirectional	1. Unidirectional Analog Output: (Rest/Full) 0.5/4.5VDC	1. Fully Sealed	1. Requires 5VDC Clean Supply, No Reverse Polarity Protection	1. 0.225" Dia., 12" Cable, Untermated	1. Narrow Mounting**
2. Bi	2. 13 Degrees Bidirectional	2. Bidirectional Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC	2. Unsealed	2. Regulated 12VDC Power Supply with Reverse Polarity Protection		2. Wide Mounting
		3. Bidirectional Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC & Bidirectional Position Indication	3. Plate Seal			
		4. Bidirectional Dual Analog Output 1: (CTR/FWD) 0.5/4.5VDC Output 2: (REV/CTR) 4.5/0.5VDC	4. Shaft Seal			
		5. Unidirectional Analog Output: (Rest/Full) 0.5/4.5VDC & Unidirectional Position Indication				
		6. Unidirectional Dual Analog Output 1: (Rest/Full) 0.5/4.5VDC Output 2: (Rest/Full) 4.5/0.5VDC				
		7. Bidirectional Analog Output 1: (REV/CTR/FWD) 0.5/2.5/4.5VDC Output 2: (REV/CTR/FWD) 0.5/2.5/4.5VDC				

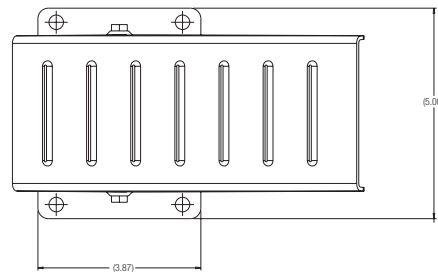
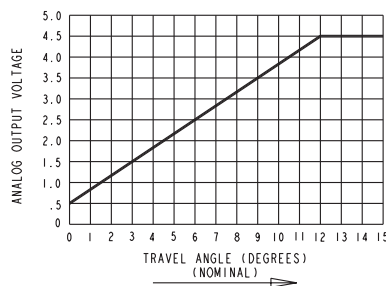
* Additional configurations are available. Contact factory.

** Unidirectional not available in Narrow Mounting.

UNIDIRECTIONAL



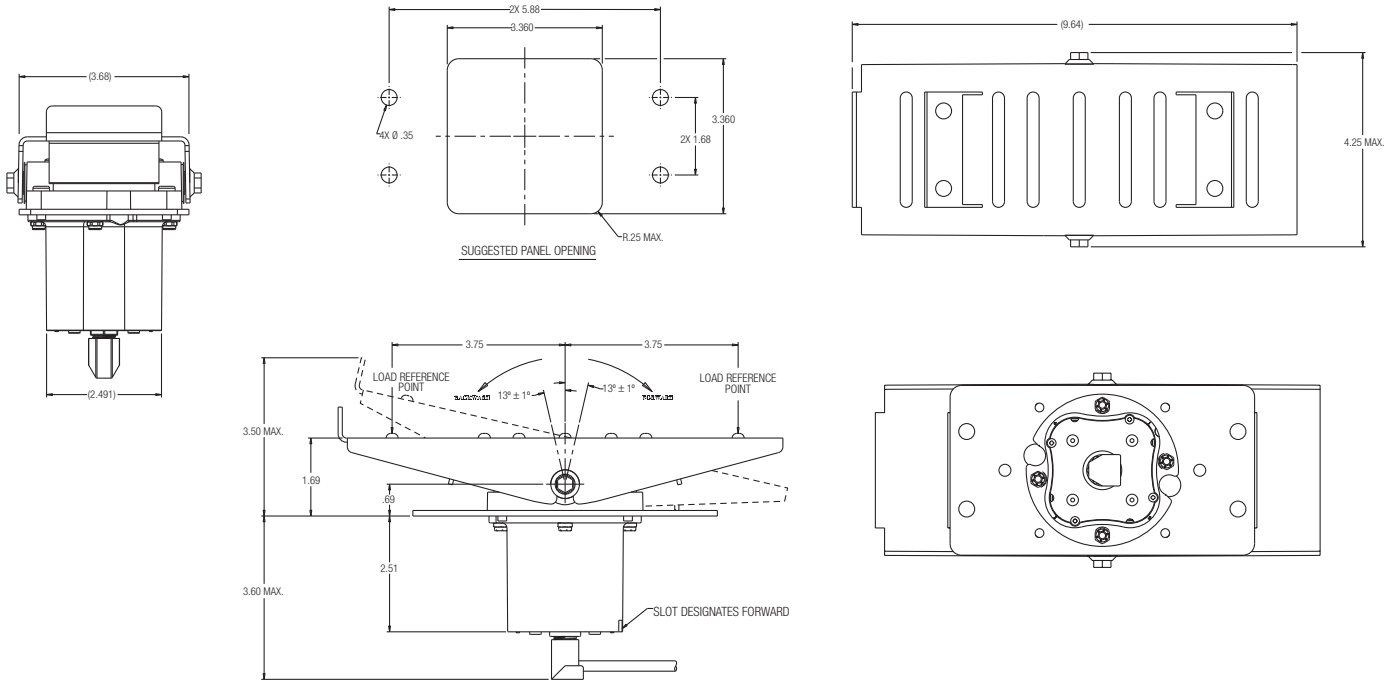
Option 1



Wide mounting version shown

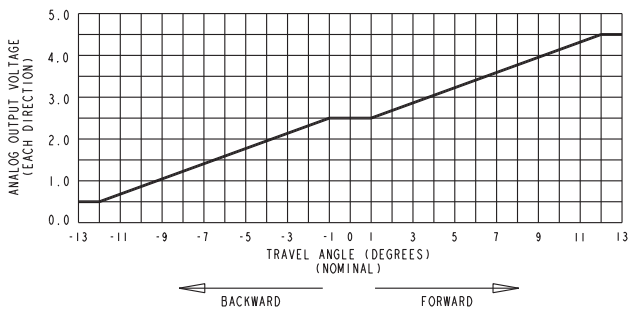
UNIDIRECTIONAL & BIDIRECTIONAL

BIDIRECTIONAL

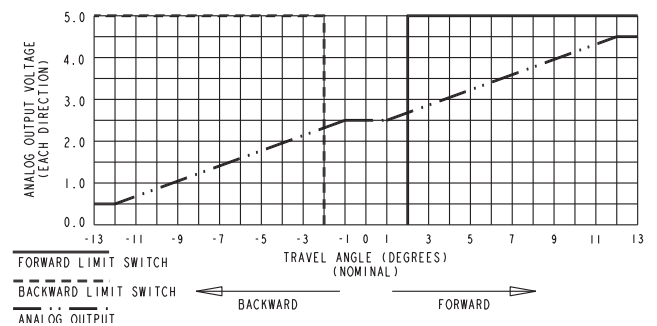


Narrow mounting version shown

Option 2



Option 3



HALL EFFECT PUSHBUTTON SWITCHES

HP7
HALL EFFECT
PUSHBUTTONS

10 MILLION CYCLES, CONTACTLESS HALL EFFECT TECHNOLOGY

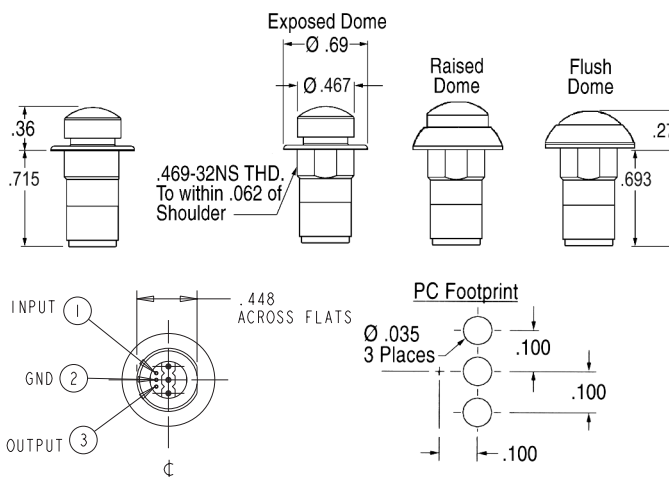
Designated the HP7 series, these momentary pushbutton switches utilize Hall Effect sensor technology for long life contactless switching, with 10 million cycles. Available in dusttight and moistureproof sealed configurations, these switches can also be watertight sealed to IP68S. The stylish dome-shaped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

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 to specification.

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 of such 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 sensor technology for long life
- Moistureproof & dusttight to IP64 or watertight to IP68S
- Stylish dome-shaped buttons in nine colors
- Momentary action
- Choice of termination styles
- Mechanical detent available for tactile feedback
- RoHS & WEEE 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	4.5	24
Reverse Output Voltage	VDC	N/A	0.5
Supply Current	mA	N/A	9
Continuous Output Current	mA	N/A	25
Reverse Battery Protection	VDC	N/A	-30

ELECTRONICS:

Seal Integrity:	IP64 or IP68S
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ENVIRONMENTAL:

Operating Temp Range:	-40°C to +85°C
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Storage Temp Range:	-55°C to +105°C
----------------------------	-----------------

MATERIALS:

Button:	Thermoplastic
Case:	Aluminum alloy
Mounting Hardware:	Hex nut & lockwasher

HP7 PART NUMBER CODE

HP7	-	X	X	X	X	X
Dome Style		Action	Terminal Style	Seal Level	Case Color	Button Color
DF. Flush Dome		1. Normally High Momentary	3. 3 Pin Header	2. Dusttight & Moistureproof	1. Clear	1. Red
DR. Raised Dome		2. Normally High Momentary with Detent	5. 18" Potted 26 AWG Wire Leads	3. Watertight	2. Black	2. Black
DE. Exposed Dome		3. Normally Low Momentary				3. Orange
		4. Normally Low Momentary with Detent				4. Yellow
						5. Green
						6. Blue
						7. Purple
						8. Gray
						9. White

10 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

The HPL Hall Effect Linear Output Pushbutton Switch is a revolutionary switch utilizing Hall Effect technology to provide the user an output proportional to the travel of the button. The HPL delivers up to 10 million cycles. This rugged switch is ideal for applications where a simple on/off control is insufficient and a linear output is desired. Using the HPL, an operator can control the motion of a device as well as the speed of the movement. The HPL switch is an ideal control device for valves and variable speed drives, and can be used in industrial control, heavy equipment and material handling applications.

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

Features:

- **Programmable outputs of 0.5 to 4.5 volts**
- **10 million cycles**
- **Hall Effect for reliable contactless switching**
- **Watertight per IP68S available**
- **Front or behind panel mounting**
- **Choice of termination styles**
- **Rocker version available**



HPL4-4 15/32" Thread
Rear Mount shown
with Wire Leads



HPL-R Hall
Effect Rocker

HPL PART NUMBER CODE

Case Style	Output	Terminal Style	Seal Level	Case Color	Button Color	Button Style*
1. Press Fit	1. 1.0 - 4.0VDC	1. 3 Pin, 0.025" SQ. Pins, 0.100" Centers	1. IP64 Splashproof	1. Clear Anodized	1. Red	1. 0.375" OD (Case Styles 1, 3, 4 & 6)
3. Front Mount 5/8" Thread	2. 4.0 - 1.0VDC	2. 18" Potted 22 AWG Wire Leads	2. IP68S Watertight	2. Black Anodized	2. Black	2. 0.500" OD Domed (Case Styles 1, 3 & 6)
4. Rear Mount 15/32" Thread	3. 0.5 - 4.5VDC				3. Orange	R. Rocker Assembly (Case Style R)
6. Rear Mount 5/8" Thread	4. 4.5 - 0.5VDC				4. Yellow	
R. Rocker Assembly					5. Green	
					6. Blue	
					7. Purple	
					8. Gray	
					9. White	

* For availability of larger button diameters, contact factory.

HALL EFFECT LINEAR OUTPUT PUSHBUTTONS

HPL
LINEAR OUTPUT
PUSHBUTTONS

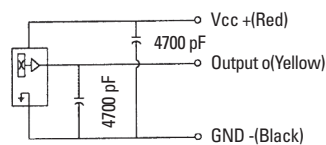
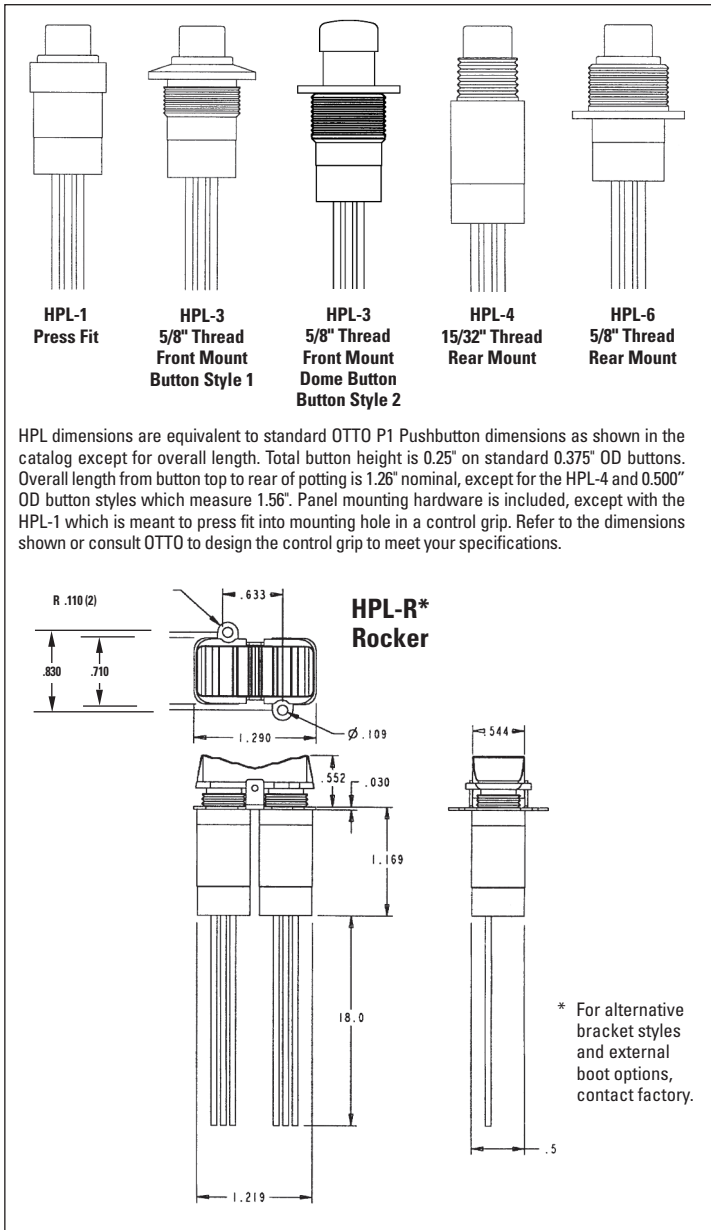
10 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

HALL EFFECT

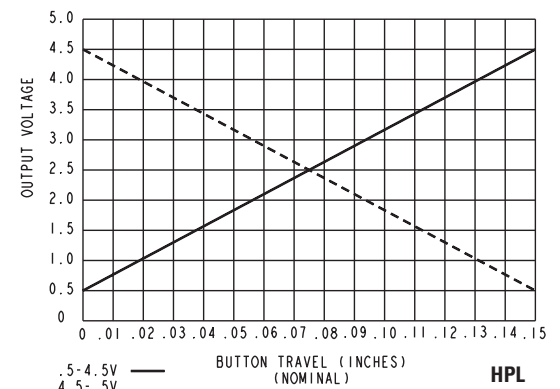
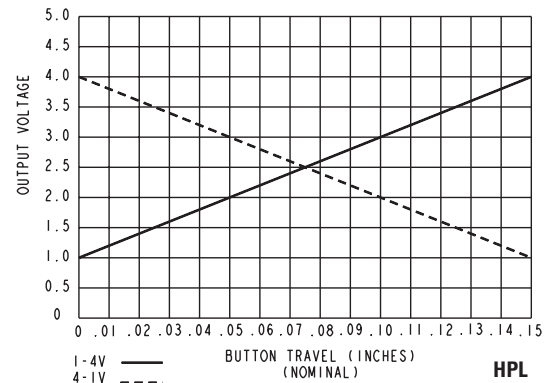
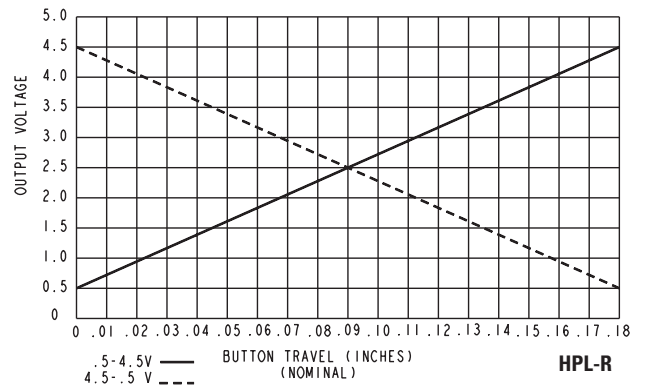
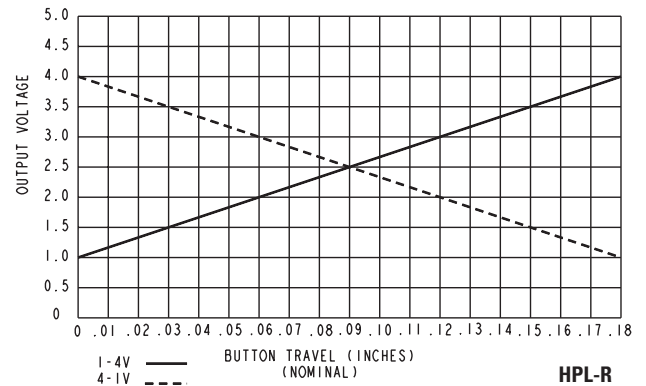
Standard Characteristics/Ratings:													
MECHANICAL:													
Mechanical Life:	1,000,000 cycles full stroke per button, IP68S rated 10,000,000 cycles full stroke per button, IP64 rated												
Button Travel:	0.135 inches min to 0.160 inches max												
Full Travel Force:	0.15 inches, 3.0 lbs. typical to 3.8 lbs. max @ 25°C												
Reset Force:	5 oz min @ 25°C												
Drop:	3 feet max to concrete												
Electrical Life:	10,000,000 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 (Io ≤ -2mA)	Ω	N/A	1	10	N/A	1	10	N/A	1	10	N/A	1	10
ELECTRONICS:													
Seal Integrity:	IP64 or IP68S												
ENVIRONMENTAL:													
Operating Temp Range:	-40°C to +85°C												
Storage Temp Range:	-55°C to +105°C												
Humidity:	96% RH, 70°C, 96 hours												
MATERIALS:													
Housing:	Aluminum alloy												
Button Cap:	Thermoplastic												
Mounting Hardware:	Lockwasher, hex nut, washer when applicable												

10 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

Case Styles



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



2 & 4-WAY LINEAR HALL EFFECT TOGGLE



HTL4 with Castle
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 protected against 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
- RoHS & WEEE compliant

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life: 1,000,000 all directions

Travel Angle: 23° min to 27° max

Operating Force with Boot: 16 oz typical to 20 oz max (at top of button) @ 25°C

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

Max Allowable Torque on Button: 7.5 lbs.

ELECTRICAL RATINGS:

HTL2: 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 <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current per Sensor	mA	N/A	8	10
Output Source Current	mA	-1	N/A	1
Output Resistance (Io ≤ 2mA)	Ω	N/A	1	10

HTL4: 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 <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current per Sensor	mA	N/A	8	10
Output Source Current Limit	mA	-1	N/A	+1

ELECTRONICS:

Seal Integrity: Electronics IP68S

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Storage Temp Range: -40°C to +85°C

RFI: Withstand 100V/M, 14Hz to 1GHz

EMI: Withstand per MIL-STD-46 ID/SAE J1113-22 at 50Hz and 60Hz

MATERIALS:

Boot: Elastomer

Button: Thermoplastic, black

Case: Thermoplastic, black

Flange: Thermoplastic, black

Wires: 22 AWG

Mounting Hardware: Panel fastener assembly

2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL2 PART NUMBER CODE										
HTL2	-	X	X	X	X	1	X	XX	X	X
Button Style	Case Style	Seal	Travel	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color		
1. Castle	1. 0.970" SQ.	1. Dusttight	1. 25°	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads	2. Black		
2. External Castle Boot		2. Watertight			BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. Pins			
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				
7. Long Concave Y Axis Button					GG. 0.5 - 4.5VDC	0.5 - 4.5VDC				
					HH. 1.0 - 4.0VDC	1.0 - 4.0VDC				

① Outputs are from the center to the full travel position. 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.

HTL4 PART NUMBER CODE									
HTL4	-	X	X	X	X	X	XX	X	X
Button Style	Case Style	Seal	Travel	Gating	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color
1. Castle	1. 0.970" SQ.	1. Dusttight	1. 25°	1. Ungated ③	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads	2. Black
2. External Castle Boot		2. Watertight		2. Gated ④		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	22 AWG 18"	
3. Short Double Stadium				3. Ungated Smooth Feel		CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	2. Pins	
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		
						HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		

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.

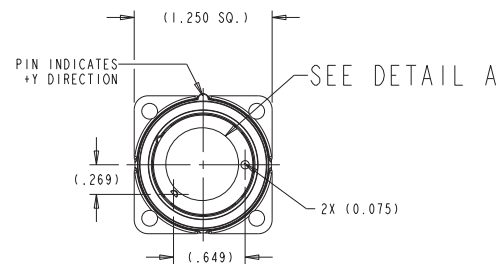
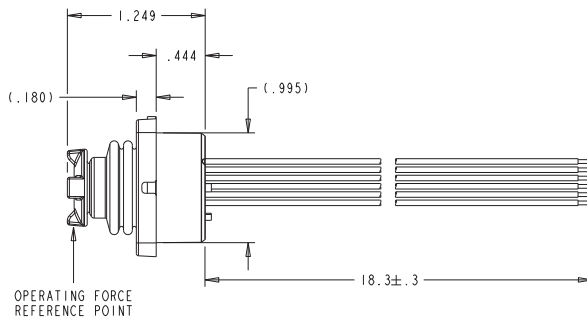
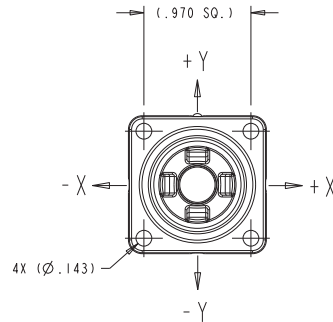
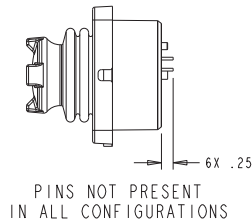
③ Ungated = Omnidirectional

④ Gated = Restricted movement in XY axis only

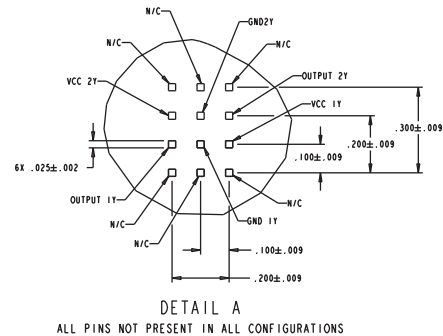
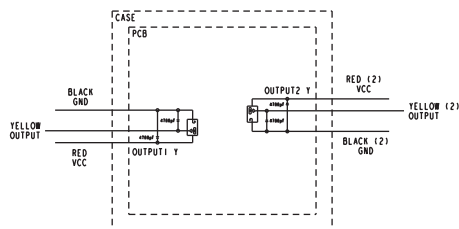
LINEAR HALL EFFECT TOGGLE

HTL
HALL EFFECT
TOGGLE

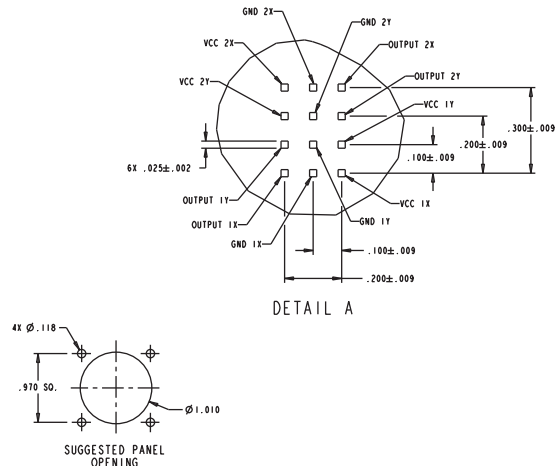
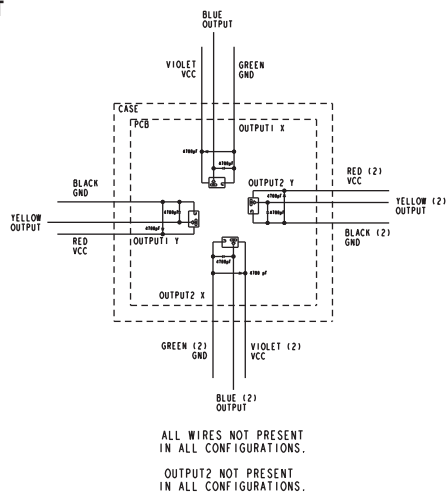
2 & 4-WAY LINEAR HALL EFFECT TOGGLE



HTL2 FOOTPRINT



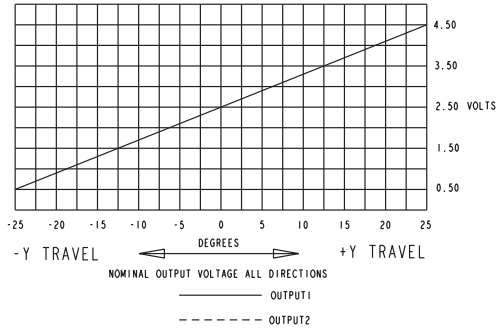
HTL4 FOOTPRINT



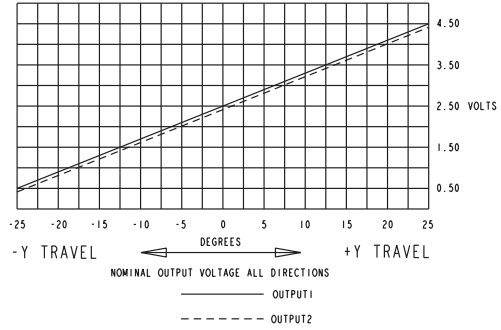
2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL2 OUTPUTS

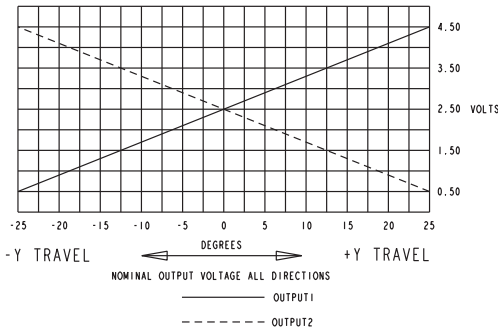
OPTION AA



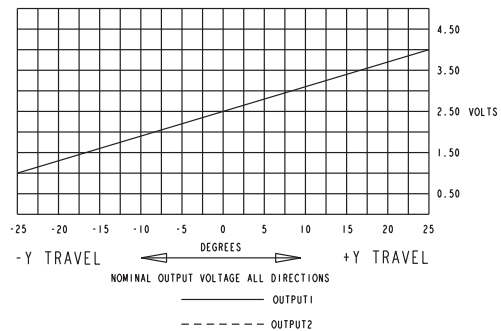
OPTION BB



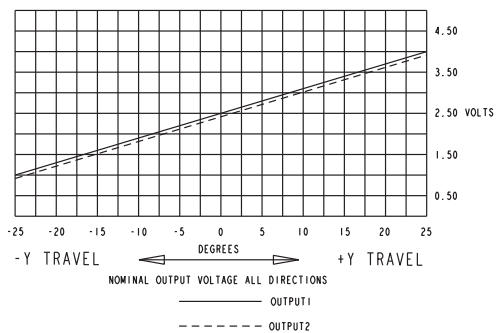
OPTION CC



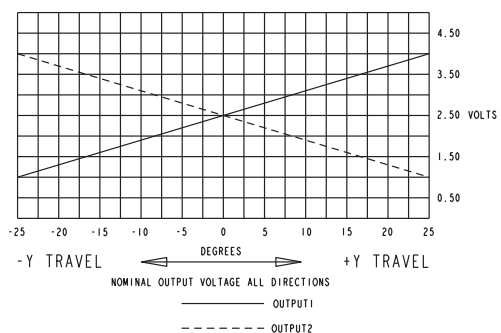
OPTION DD



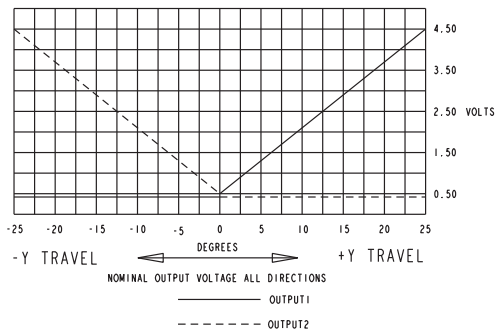
OPTION EE



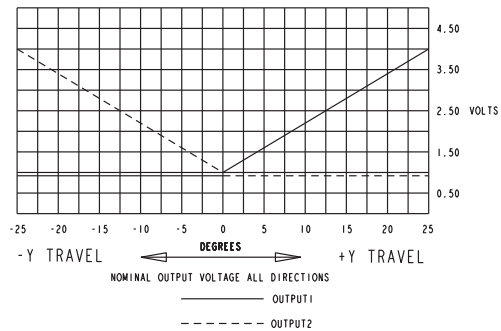
OPTION FF



OPTION GG



OPTION HH



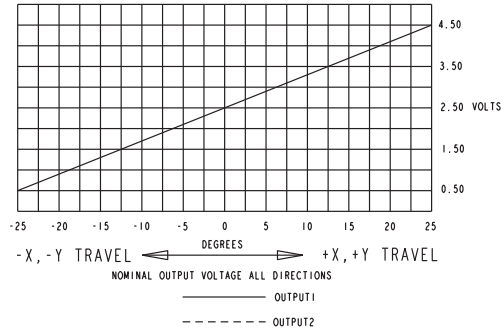
LINEAR HALL EFFECT TOGGLE

HTL
HALL EFFECT
TOGGLE

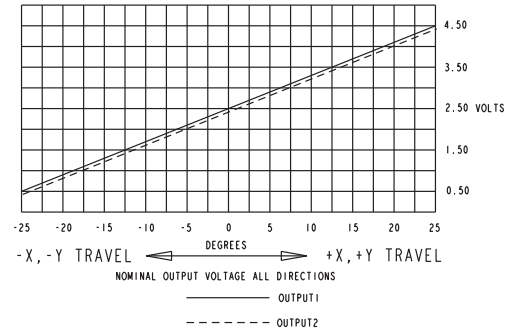
2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL4 OUTPUTS

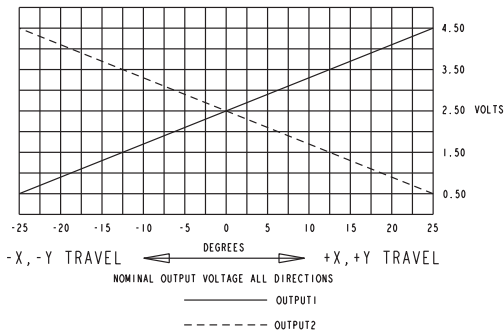
OPTION AA



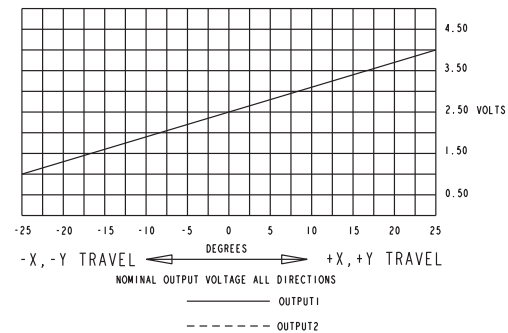
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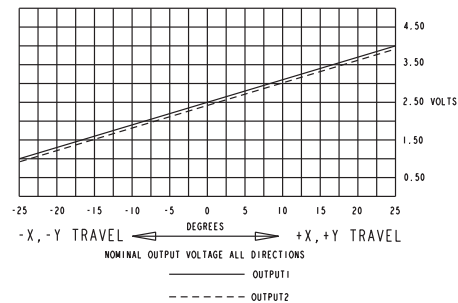
OPTION CC



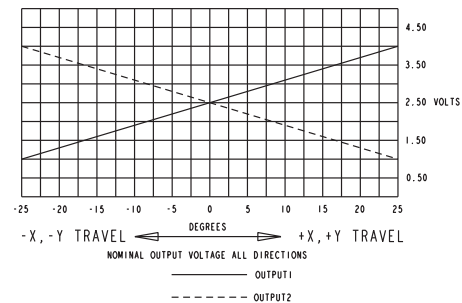
OPTION DD



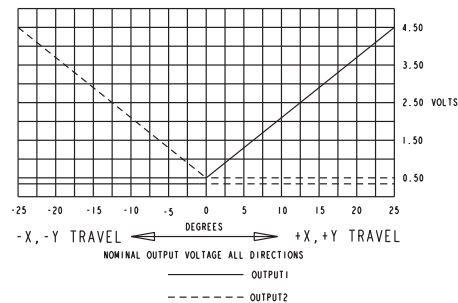
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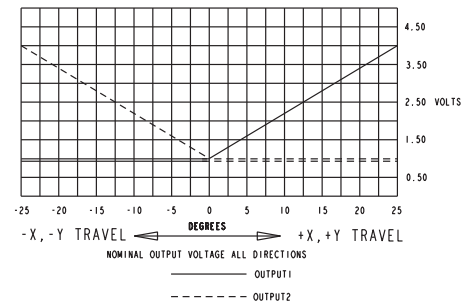
OPTION FF



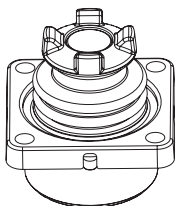
OPTION GG



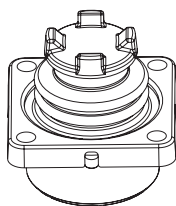
OPTION HH



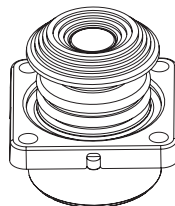
BUTTON STYLE



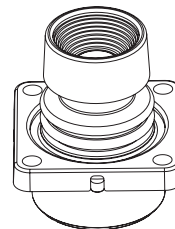
BUTTON STYLE 1
(CASTLE)



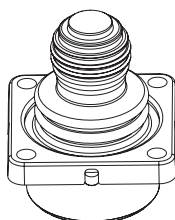
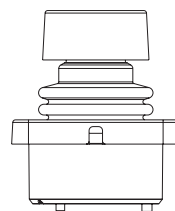
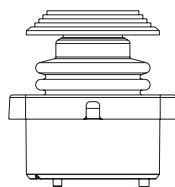
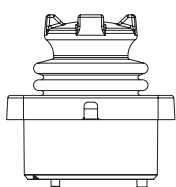
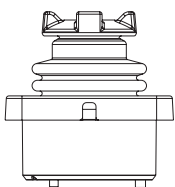
BUTTON STYLE 2
(EXTERNAL CASTLE BOOT)



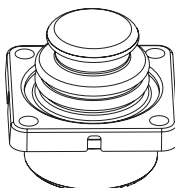
BUTTON STYLE 3
(SHORT DOUBLE STADIUM)



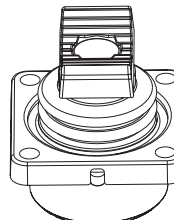
BUTTON STYLE 4
(TALL CONCAVE STADIUM)



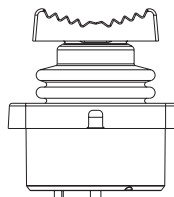
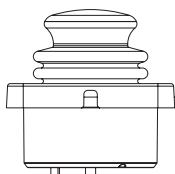
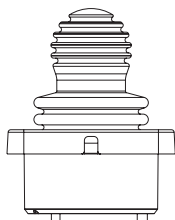
BUTTON STYLE 5
(EXTERNAL BAT
HANDLE BOOT)



BUTTON STYLE 6
(EXTERNAL SMOOTH BOOT)



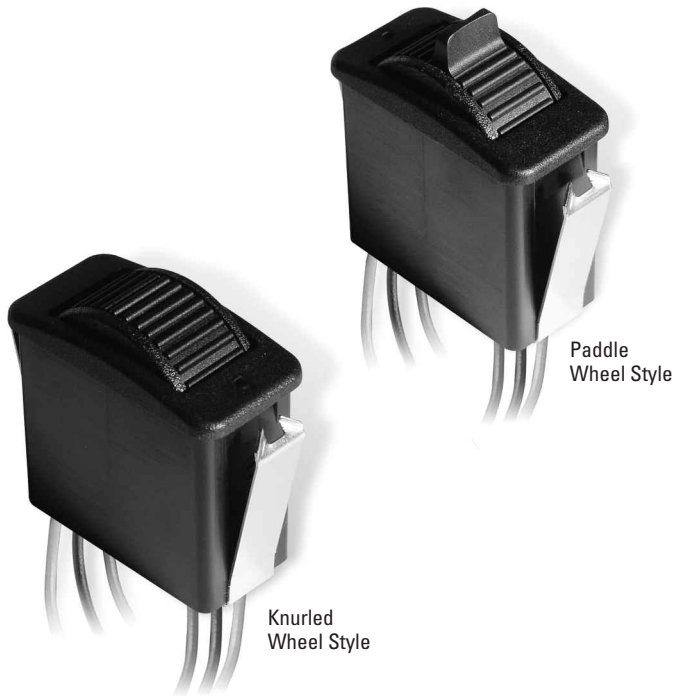
BUTTON STYLE 7
(LONG CONCAVE
Y AXIS BUTTON)



PROPORTIONAL OUTPUT THUMBWHEEL

HTW
HALL EFFECT
THUMBWHEEL

3 MILLION CYCLE ROTATIONAL LIFE



The HTW Hall Effect Proportional Output Thumbwheel is a self-centering, 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 3 million cycle rotational life, sealed to IP68S and excellent EMI immunity per MIL-STD-46 ID/SAE J1113-22, and will withstand RFI of 100V/M 14Hz to 1GHz.

Features:

- Eight output options
- Self-centering 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
- RoHS & WEEE 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.

Drop: 3 feet max to concrete

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 at Center (for detent version A only)	VDC @ 5V Vcc	-0.25	N/A	+0.25
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

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

Sand/Dust: Per SAE J1455

EMI: Withstand per MIL-STD-461D/SAE J1113-22

RFI: Withstand 100V/M 14Hz to 1GHz

MATERIALS:

Button: Thermoplastic

Bezel: Thermoplastic

Snap Arms: Stainless steel

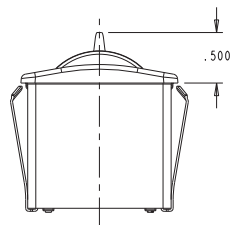
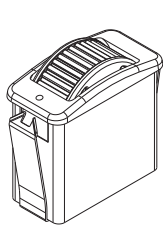
Mounting Hardware: None provided

3 MILLION CYCLE ROTATIONAL LIFE

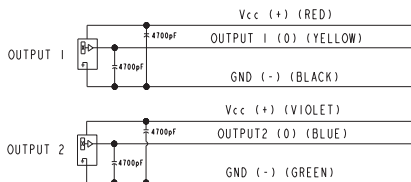
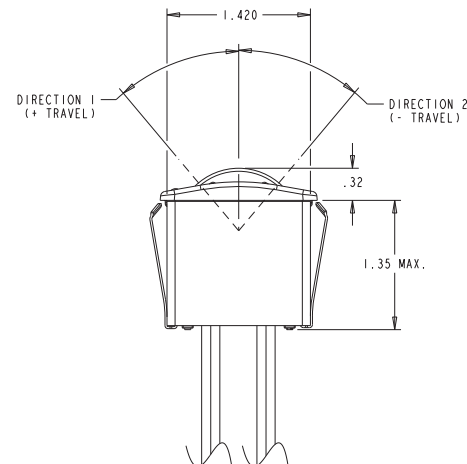
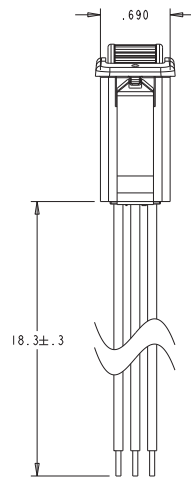
HTW PART NUMBER CODE

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. 0.5 lb.	1. Knurled Wheel	A. 18 AWG Wires 18" Long, Stripped and Pinned 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	B. 0.025" S.Q. 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		

* Only available with Travel option 2.



PADDLE WHEEL
BUTTON STYLE

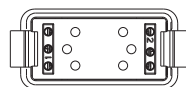
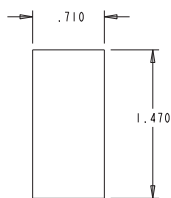


OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

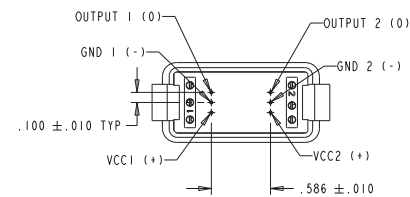
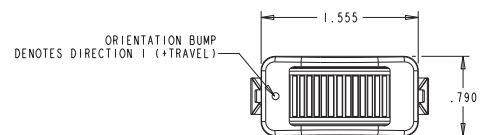
MOUNTING:

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

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



NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



PINNED
TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

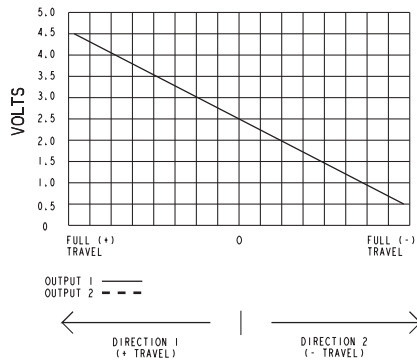
PROPORTIONAL OUTPUT THUMBWHEEL

HTW
HALL EFFECT
THUMBWHEEL

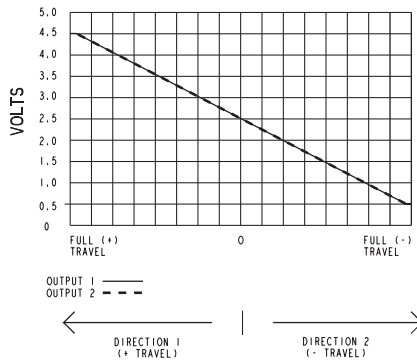
3 MILLION CYCLE ROTATIONAL LIFE

HALL EFFECT

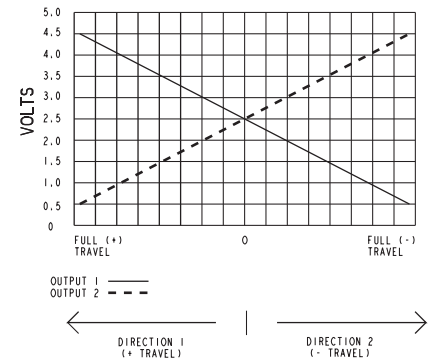
OPTION A



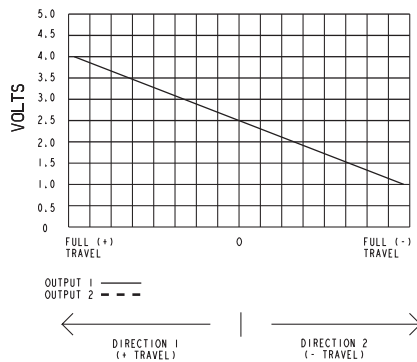
OPTION B



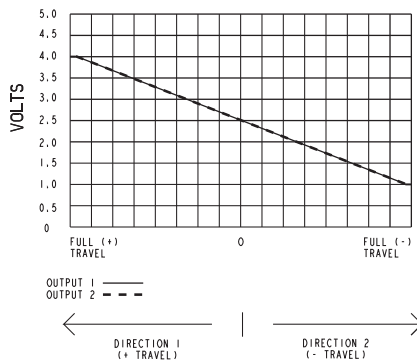
OPTION C



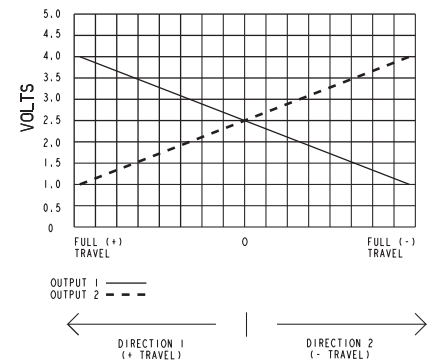
OPTION D



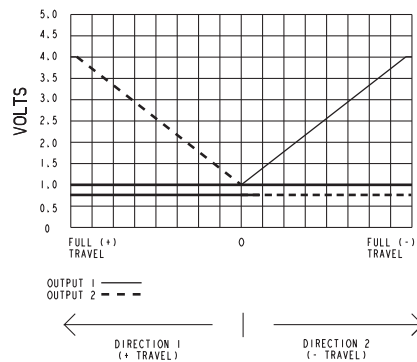
OPTION E



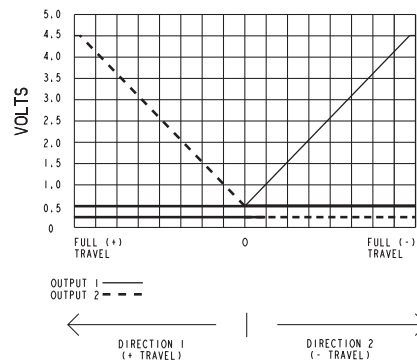
OPTION F



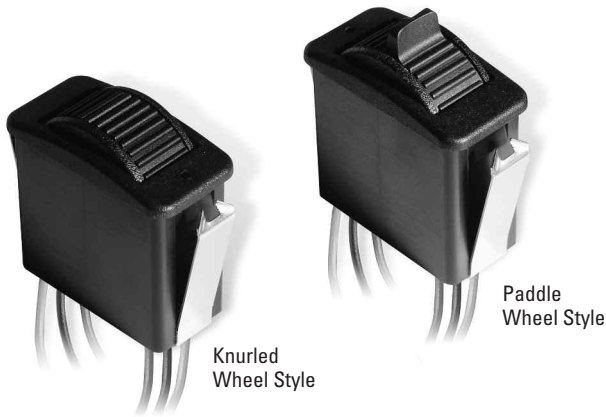
OPTION G



OPTION H



FRICION ACTUATION STYLE THUMBWHEEL



The HTWF Friction 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, is 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

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.

Drop: 3 feet max to concrete

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 IP68S

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Humidity: 96% RH, 70°C, 96 hours

Vibration: Per MIL-810F minimum integrity

Sand/Dust: Per SAE J1455

EMI: Withstand per MIL-STD-461D/SAE J1113-22

RFI: Withstand 100V/M 14Hz to 1GHz

MATERIALS:

Button: Thermoplastic

Bezel: Thermoplastic

Snap Arms: Stainless steel

Mounting Hardware: None provided

HTWF PART NUMBER CODE

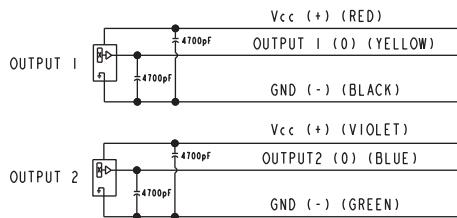
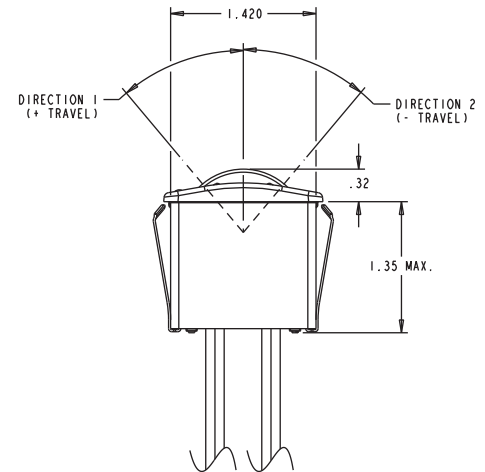
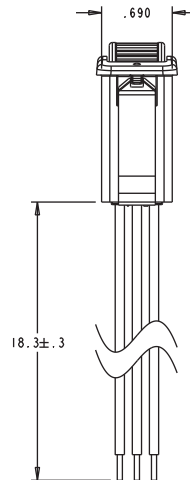
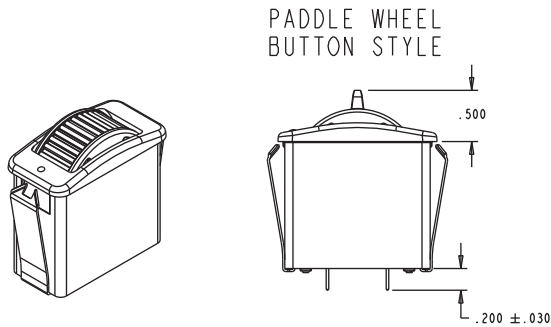
HTWF	X	X	X	X	X	X	X	X
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	Detent (if required)
1. +/- 30°	A. 2.5 +/- 2.0VDC B. 2.5 +/- 2.0VDC C. 2.5 +/- 2.0VDC D. 2.5 +/- 1.5VDC E. 2.5 +/- 1.5VDC F. 2.5 +/- 1.5VDC G. 1.0 - 4.0VDC H. 0.5 - 4.5VDC	NONE 2.5 +/- 2.0VDC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

PROPORTIONAL OUTPUT THUMBWHEEL

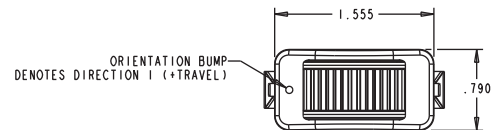
HTWF
HALL EFFECT
THUMBWHEEL

FRICION ACTUATION STYLE THUMBWHEEL

HALL EFFECT



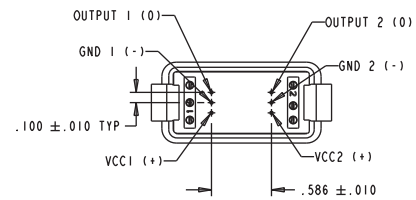
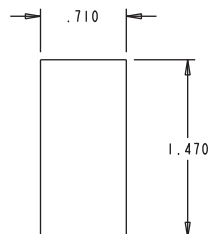
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS



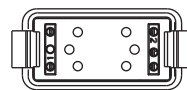
MOUNTING:

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

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



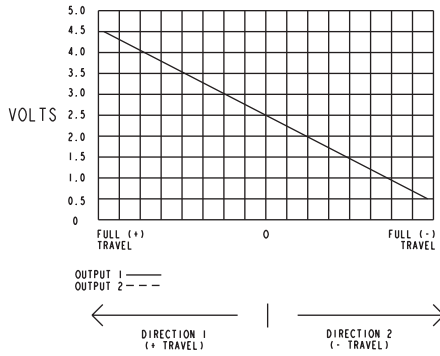
**PINNED
TERMINATION**
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



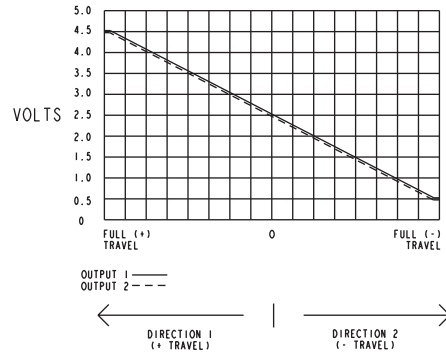
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

FRICION ACTUATION STYLE THUMBWHEEL

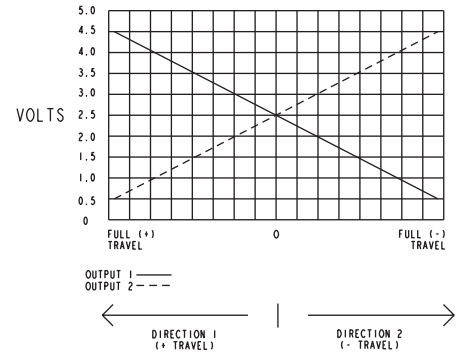
OPTION A



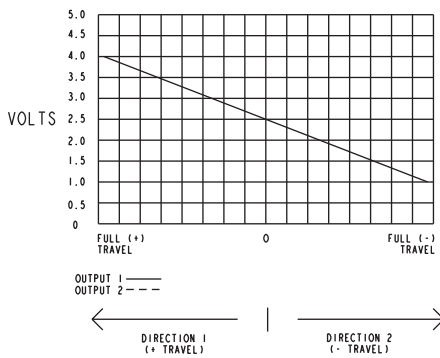
OPTION B



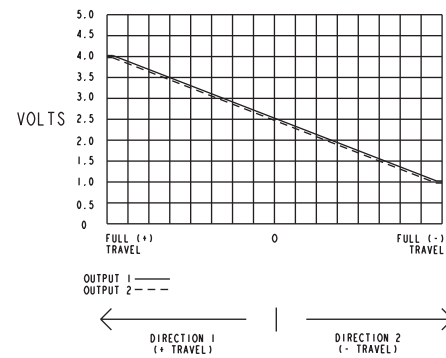
OPTION C



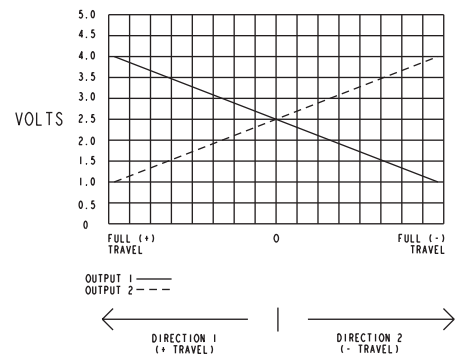
OPTION D



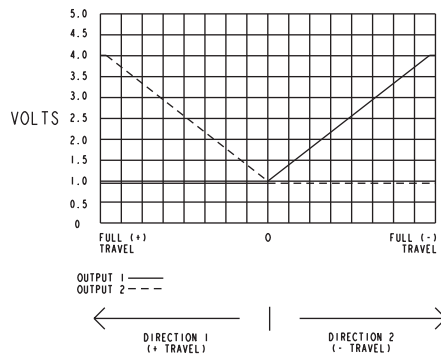
OPTION E



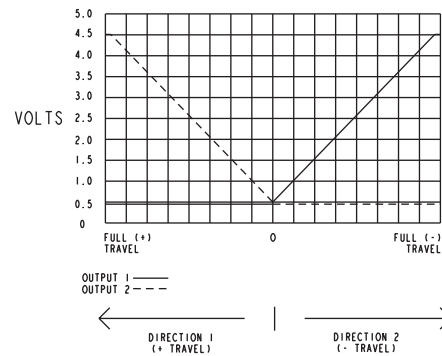
OPTION F



OPTION G



OPTION H



MINI PROPORTIONAL OUTPUT THUMBWHEEL

SHORTER BEHIND PANEL DEPTH



The HTWM offers the same performance as the standard HTW Proportional Thumbwheel but with a much shorter behind panel depth. Available with eight output options, the HTWM offers a self-centering, 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 3 million cycle rotational life. The HTWM electronics are sealed to IP68S and have excellent EMI/RFI immunity ideal for use in grip, armrest and panel applications.

Features:

- Shorter behind panel depth: 0.096"
- Eight output options
- Self-centering single axis actuator
- Rocker switch style mounting
- 3 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS & WEEE compliant

Standard Characteristics/Ratings:

MECHANICAL:

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

Max Allowable Radial Load: 30.0 lbs.

Drop: 3 feet max to concrete

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 <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel <i>(see graph for output values)</i>	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

Sand/Dust: Per SAE J1455

EMI: Withstand per MIL-STD-461D/SAE J1113-22

RFI: Withstand 100V/M 14Hz to 1GHz

MATERIALS:

Button: Thermoplastic

Bezel: Thermoplastic

Mounting Hardware: None provided

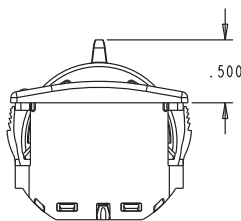
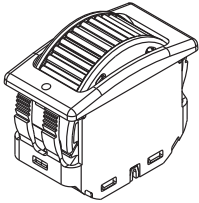
SHORTER BEHIND PANEL DEPTH

HTWM PART NUMBER CODE

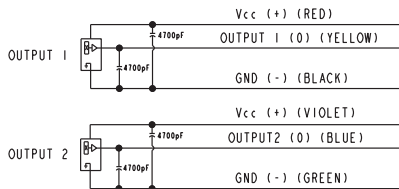
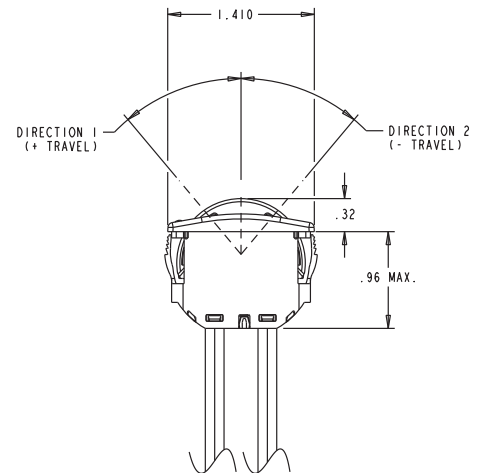
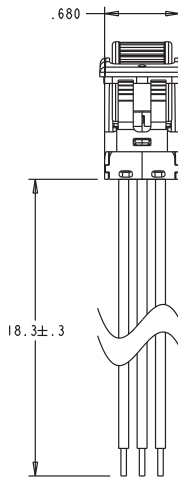
HTWM	-	X	X	X	X	X	X	X
Travel	Output 1*	Output 2**	Operating Force	Button Style	Termination	Bezel Color	Button Color	
1. +/- 40°	A. 2.5 +/- 2.0VDC B. 2.5 +/- 2.0VDC C. 2.5 +/- 2.0VDC D. 2.5 +/- 1.5VDC E. 2.5 +/- 1.5VDC F. 2.5 +/- 1.5VDC G. 1.0 - 4.0VDC H. 0.5 - 4.5VDC	NONE 2.5 +/- 2.0VDC 2.5 +/- 2.0VDC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

* 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 & H provide increasing voltages in both directions from two separate outputs.

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



PADDLE WHEEL
BUTTON STYLE



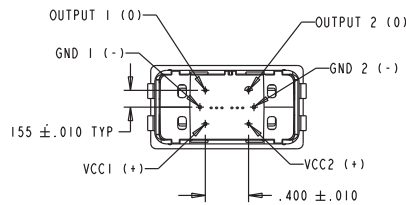
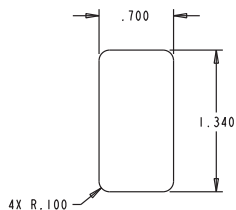
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

MOUNTING:

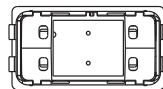
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS
(0.040 MIN. - 0.200 MAX.)

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

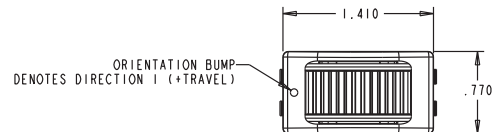
RECOMMENDED PANEL RADII: 0.100 OPTIMUM
(0.090 - 0.110 MAX.)



PINNED
TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

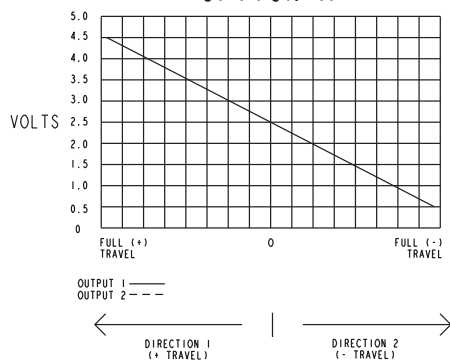


MINI PROPORTIONAL OUTPUT THUMBWHEEL

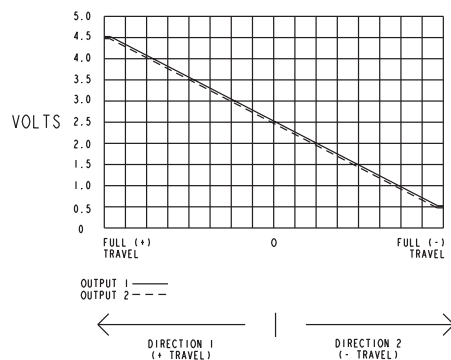
SHORTER BEHIND PANEL DEPTH

HALL EFFECT

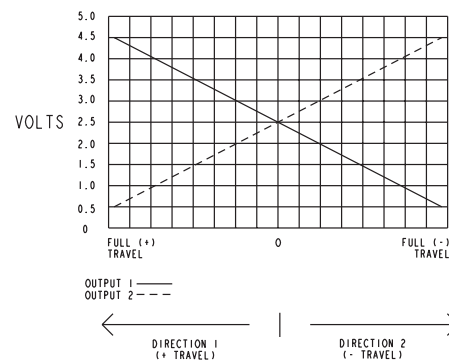
OPTION A



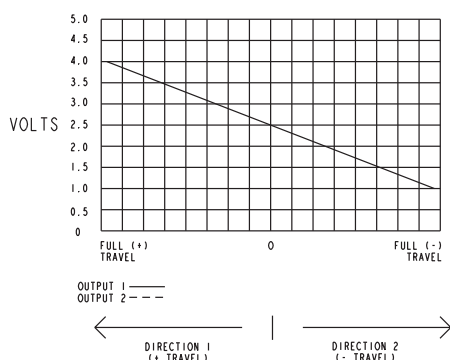
OPTION B



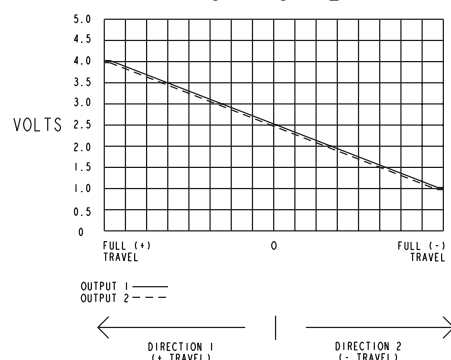
OPTION C



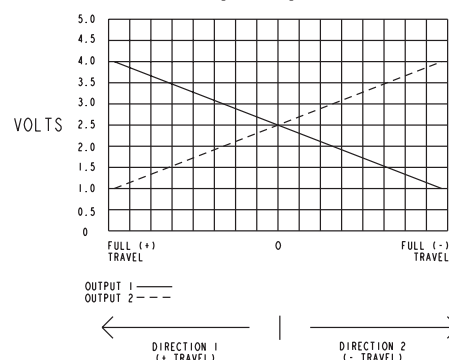
OPTION D



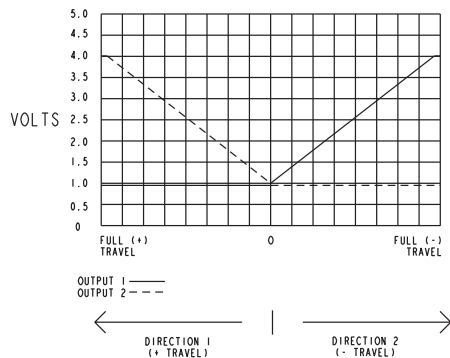
OPTION E



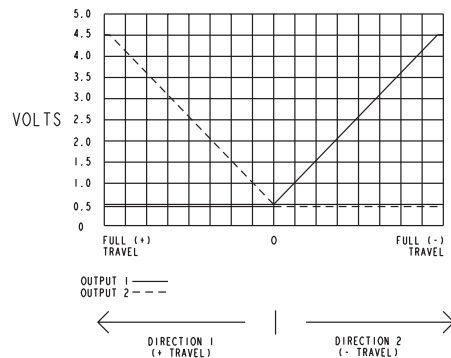
OPTION F



OPTION G



OPTION H



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
- 300.0 lbs. static load strength at grip
- Electronics sealed to IP68S
- EMI/RFI shielding up to 100V/M
- Factory programmable pretravel & overtravel
- Analog, CANbus, USB & other custom output options available
- Redundant outputs available
- Fail safe & neutral indicator
- Single, dual and Z axis available



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

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS



JHM with Center
P9 Switch



JHM with Hall
Effect Rocker

The JHM series Medium Hall Effect Joystick is a full function operator control in a package that will fit in an armrest or on a panel. It utilizes OTTO's patented Hall Effect technology for unmatched life and reliability. Electronics are sealed and it has an operational life of 10 million cycles in all directions. Additional options include CANopen® and CAN J1939 versions, multiple analog and digital auxiliary control outputs, redundant sensors and a variety of output configurations, along with a variety of grip and switch options.

Features:

- Designed for armrest & panel mounting
- Proven contactless analog output Hall Effect technology
- Electronics sealed 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

Standard Characteristics/Ratings:

GENERAL:

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

Design: Contactless sensing

Magnet: Dual bar permanent magnet

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 +Y, -Y, +X, -X 0° Deflection	VDC @ 5V Vcc	-0.25	N/A	-0.25
Output Voltage Tolerance at Full Travel +Y, -Y, +X, -X Direction	VDC @ 5V Vcc	-0.25	N/A	-0.25
Supply Current Per Sensor	mA	N/A	N/A	10
Output Source Current Limit	mA	-1	N/A	1

MECHANICAL:

Mechanical Life: In all directions, 1,000,000 cycles min up to 10,000,000 cycles depending on configuration

Travel Angle: 18° min to 22° max

Overtravel Angle: 0.5° min to 1.5° max

Operating Force: With bellows, 20°C to 85°C at grip 0.5 lb. min to 3.5 lbs. max

ENVIRONMENTAL:

Operating Temp Range: Low force -20°C to +85°C
High force -40°C to +85°C

Drop: 1 meter max to concrete

Panel: Sealed to IP64

Electronics: Sealed to IP68S

RFI: Withstand 100V/M, 14KHz to 1GHz

EMI: Withstand per MIL-STD-461D/SAE J1113-22

MATERIALS:

Housing: Thermoplastic, black

Bellows: Neoprene or silicone, black

Wires: Per customer application

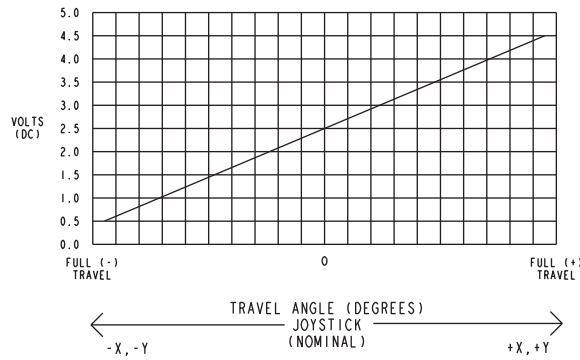
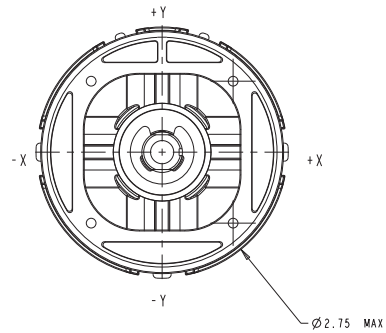
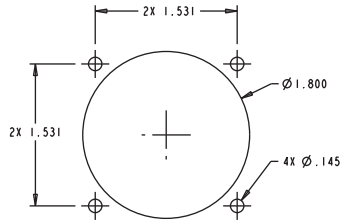
Mounting Hardware: Panhead screws

MEDIUM HALL EFFECT JOYSTICK

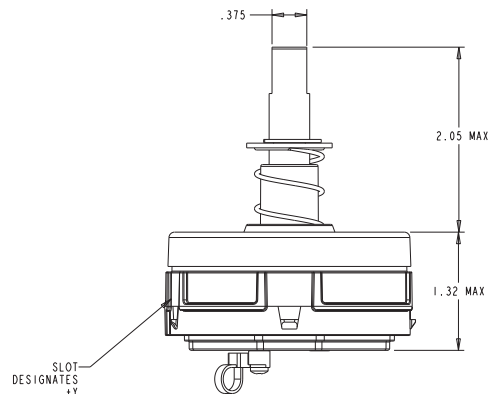
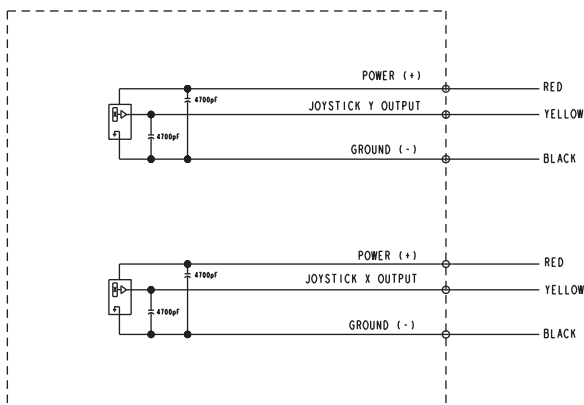
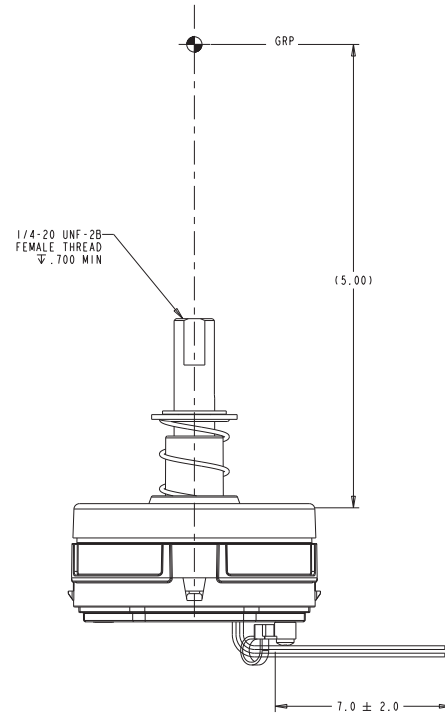
JHM
MEDIUM
JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

SUGGESTED PANEL OPENING:
RECOMMENDED PANEL THICKNESS: .050 TO .150



Shown is an example of one output per axis configuration. For additional output configurations, contact factory. Redundant sensors are available, please contact factory.



USB, 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, Hall Effect devices, pushbuttons and mini joysticks 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 systems running with 250Kbit/sec processing a message approximately every 10ms. J1939 can be configured into three variations (50, 51, 52 are the default addresses). An external resistor change at the connector pins allows multiple OTTO joysticks to be used on the same bus. Additional joystick addresses can be added by assigning a unique identification during configuration.

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

Features:

- **Standard configuration for both is three analog input channels & 12 digital input channels with two digital output channels**
- **CAN power accommodates a 9–32VDC power supply**
- **I/O extension for up to 40 digital inputs, eight analog inputs & multiple digital outputs by I²C interface**
- **Both J1939 & CANopen® versions include a failure monitoring feature**
- **EMI/RFI per ISO 11898 89/336 ECC, tested to 100V/M**
- **Operating temperature -40°C to +85°C**
- **Storage temperature -65°C to +105°C**
- **All designs are RoHS compliant**



CANbus Joystick



HJFC Foot Pedal
with CANbus Interface

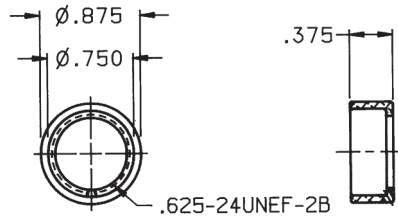
SHROUDS, PANEL SEALS & MOUNTING HARDWARE

Shrouds

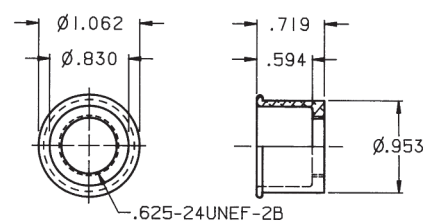
Shrouds are added to pushbutton switches to guard against inadvertent actuation. The actuating device must be inserted into the shroud in order to actuate the switch. We have an assortment from which to choose shown here. We are also able to design and fabricate a shape to meet your specifications and application needs.



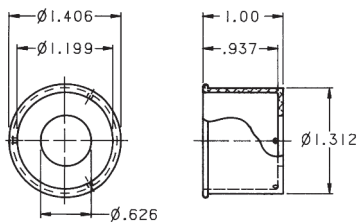
Material: Aluminum alloy, machined to specification.
Finish: Black anodized. For other color options, contact factory.



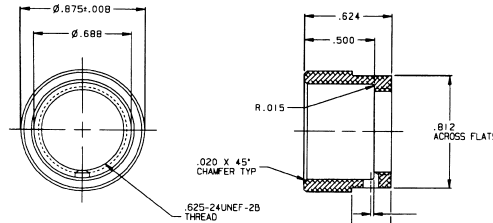
OTTO P/N C300793



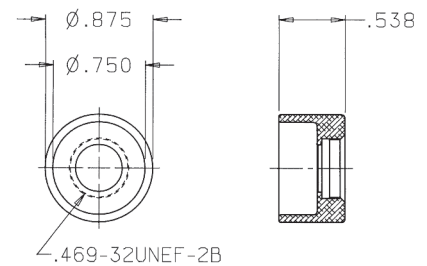
OTTO P/N C300514



OTTO P/N C300302



OTTO P/N C300871



OTTO P/N C300426

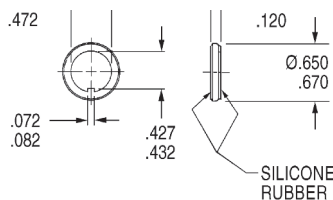
Panel Seals

Stainless Steel/Silicone Rubber Washer
Stainless steel cup washer with silicone rubber seal assures proper watertight panel seal. Withstands 20 PSI water pressure. Mounts behind panel.
Approved to MIL-DTL-5423/16. Designed for sealing 15/32" bushing with keyway.

OTTO P/N: 710196

MIL P/N: M5423/16-001
(was MS25196-1)

Thickness of bushing seal is reduced to 0.080" when mounted to panel.



Gaskets

OTTO P/N	I.D.
700117	0.250"
700110	0.469"
700109	0.625"

O-Rings (Buna)

OTTO P/N	I.D.
802568-010	0.250"
802568-015	0.500"
802568-016	0.625"

Mounting Hardware

MILITARY P/N

KEYWAY WASHERS

MILITARY P/N	OTTO P/N	BUSHING SIZE (inches)
MS25081-C0	710081-C0	0.250"
MS25081-C4	710081-C4	0.469"
MS25081-C6	710081-C6	0.625"

INTERNAL TOOTH LOCKWASHERS

MILITARY P/N	OTTO P/N	BUSHING SIZE (inches)
MS35333-135	710333-135	0.250"
MS35333-136	710333-136	0.469"
MS35333-138	710333-138	0.625"

HEX NUTS—STANDARD

MILITARY P/N	OTTO P/N	BUSHING SIZE (inches)
MS25082-C14	710082-C14	0.250-40
MS25082-C21	710082-C21	0.469-32
MS25082-B11	710082-B11	0.625-24

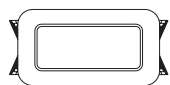
HEX NUTS—WIRE LOCKING

MILITARY P/N	OTTO P/N	BUSHING SIZE (inches)
MS21340-04	710340-04	0.469-32
MS21340-05	710340-05	0.625-24

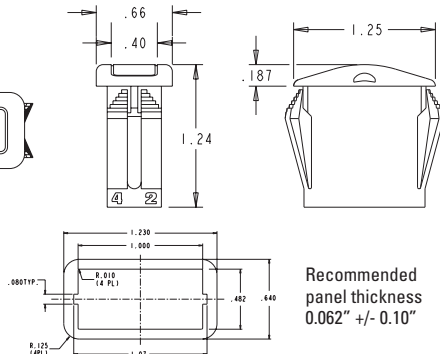
All hardware is stainless steel except MS25082-B11 which is brass, black oxide plated.

GASKETS, PANEL PLUGS & CONNECTORS

K1 Panel Plug

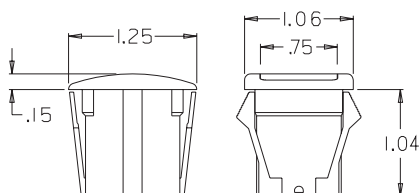
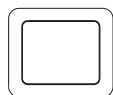


K1 Gasket

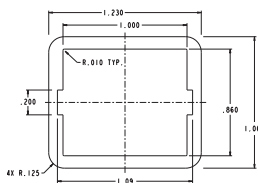


Recommended
panel thickness
0.062" +/- 0.10"

K2 Panel Plug

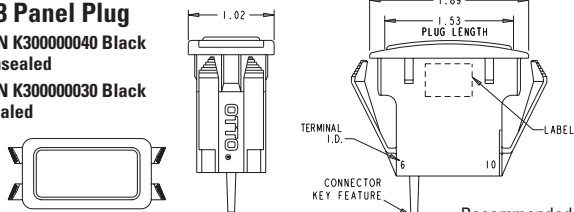


K2 Gasket



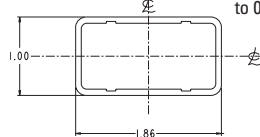
Recommended
panel thickness
0.062"

K3 Panel Plug

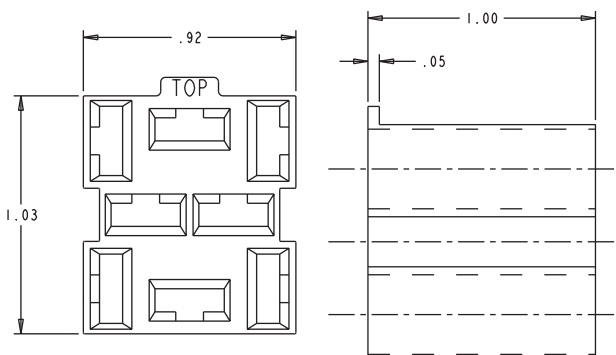


Recommended panel
thickness 0.025" min
to 0.187" max

K3 Panel Seal Gasket



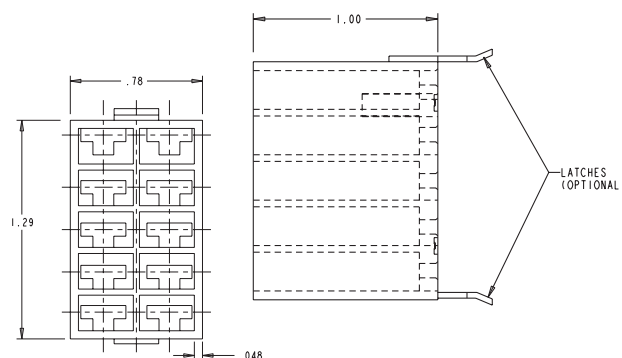
K2, K4, T7 Connector



Recommended Quick Connect Terminals

AMP 60253-2 for 12-16 AWG wire with 0.160" to 0.210" insulation OD
AMP 42100-2 for 14-18 AWG wire with 0.100" to 0.170" insulation OD

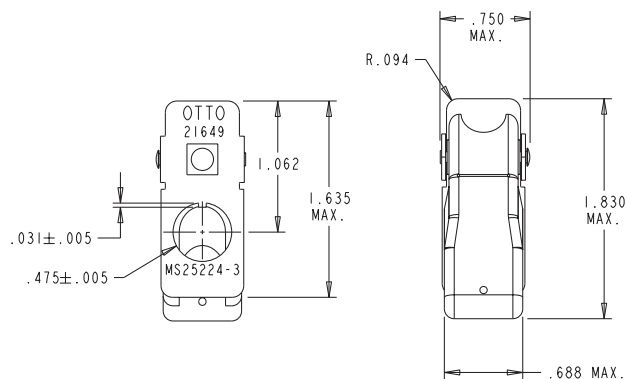
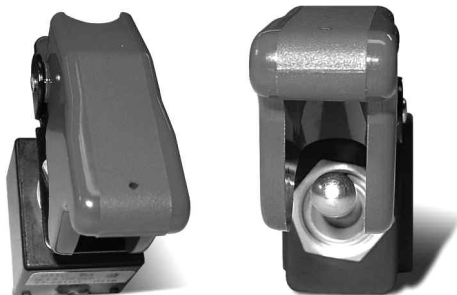
K3, K5, R2 Connector



Recommended Quick Connect Terminals

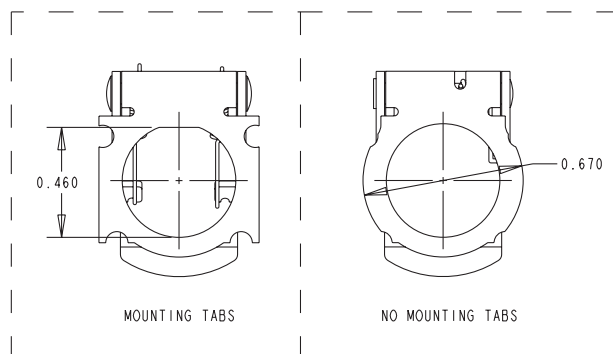
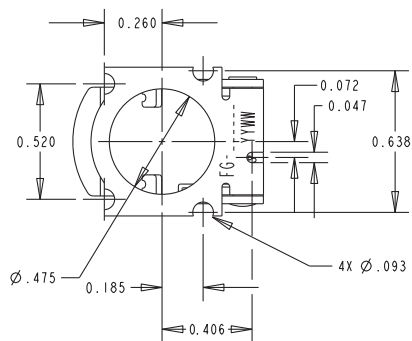
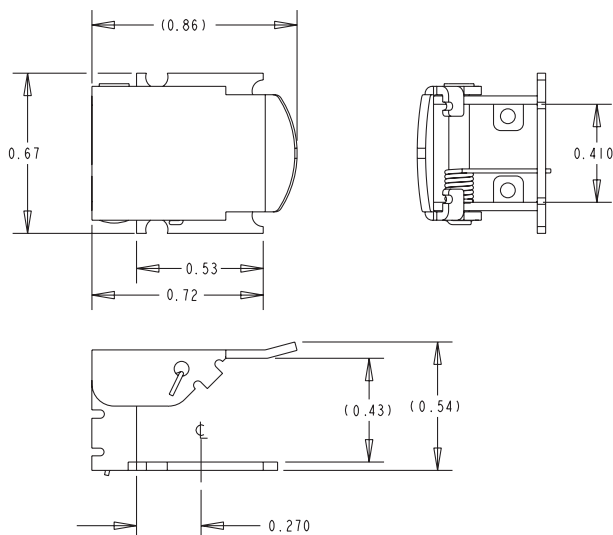
AMP 60253-2 for 12-16 AWG wire
AMP 42100-2 for 14-18 AWG wire

Toggle Guard



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

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

SEALED AGAINST IMMERSION & CORROSIVE ATMOSPHERES



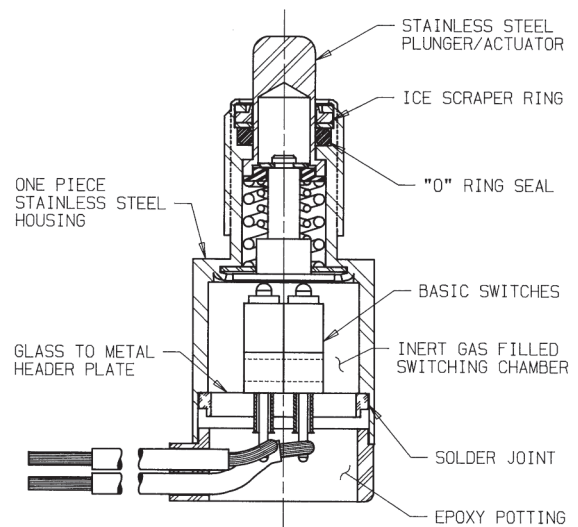
P6 series switches are sealed against immersion and corrosive atmospheres. These switches are designed for rugged duty both mechanically and electrically. A one-piece stainless steel housing, sealed at the plunger with an O-ring seal and at the base with a glass-to-metal header provides true environment-free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

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

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

Features:

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

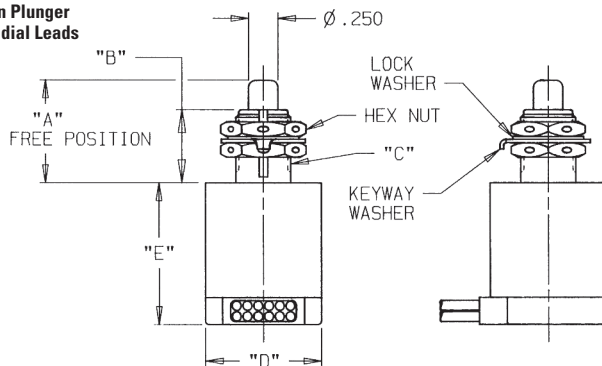


Cross section example of OTTO P6-24XXX series.

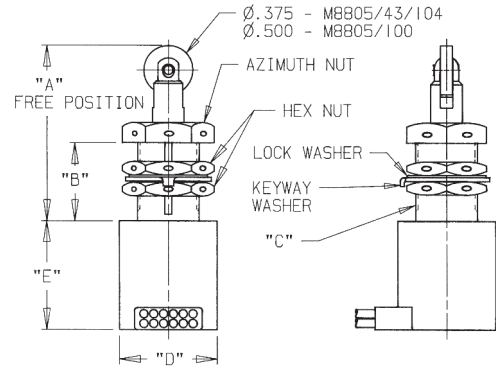
FEATURING OTTO B2 & B3 SERIES BASIC SWITCHES



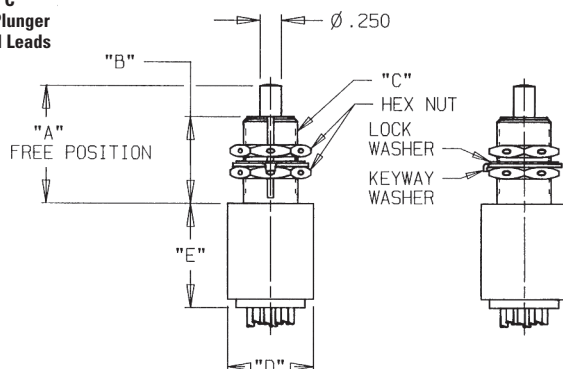
Style A
Pin Plunger
Radial Leads



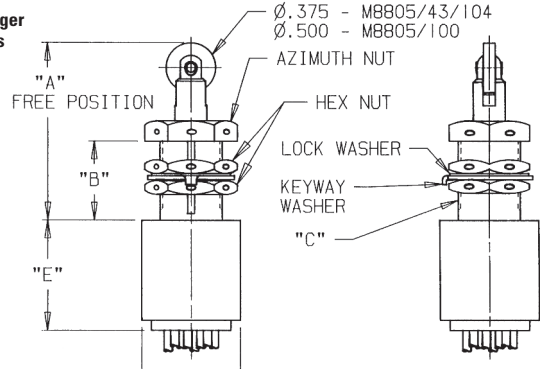
Style B
Roller Plunger
Radial Leads



Style C
Pin Plunger
Axial Leads



Style D
Roller Plunger
Axial Leads



SEALED LIMIT SWITCHES

P6
LIMIT
SWITCHES

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	2A	2A
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-S-8805/39, /40, /43: 0.040 inches
MIL-S-8805/100: 0.070 inches
MIL-S-8805/104: 0.050 inches

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

Overtravel:
MIL-S-8805/39, /40, /100: 0.250 inches
MIL-S-8805/43, /104: 0.125 inches

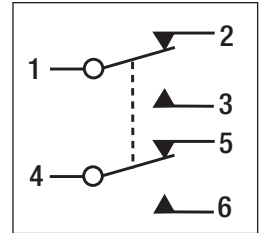
Wire Type:
Per MIL-W-22759/7
Marked per MIL-W-5088.
Standard length: 6 feet. Other lengths available.

Operating Temp Range: -55°C to 85°C

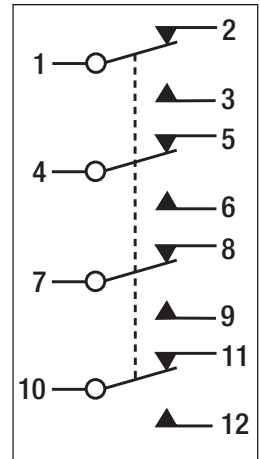
Mounting/Termination:

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-S-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-S-8805/40									
2PDT	A-Pin/Radial	1.375	1.000	0.625-24	1.015	0.980	3	MS24331-1	P6-24002
MIL-S-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	1.295	N/A	0.469-32	0.720	1.000	1	MS27240-3	P6-14000
4PDT	B-Roller/Radial ①	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	1.295	N/A	0.469-32	0.720	1.000	4	MS27240-7	P6-14002
4PDT	B-Roller/Radial ①	1.295	N/A	0.469-32	1.031	1.200	4	MS27240-8	P6-14003
MIL-S-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/Radial	1.375	1.000	0.625-24	1.030	1.200	2	MIL-PRF-8805/100-008	P6-24044
4PDT	B-Roller/Axial	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 ②	1.781	0.794	0.625-24	1.030	1.100	2	MIL-PRF-8805/100-017	P6-14005
4PDT	D-Roller/Axial ②	1.781	0.794	0.625-24	1.030	1.200	2	MIL-PRF-8805/100-018	P6-14006
MIL-S-8805/104									
4PDT	A-Pin/Radial	1.375	1.000	0.469-32	0.850	1.100	2	MIL-PRF-8805/104-001	P6-20001
4PDT	B-Roller/Radial ①	1.719	0.895	0.469-32	0.850	1.100	2	MIL-PRF-8805/104-002	P6-10002
4PDT	C-Pin/Axial	1.375	1.000	0.469-32	0.850	1.100	2	MIL-PRF-8805/104-003	P6-20002
4PDT	D-Roller/Axial ①	1.719	0.895	0.469-32	0.850	1.200	2	MIL-PRF-8805/104-004	P6-10003

① Roller diameter is 0.375 inches. ② Roller diameter is 0.500 inches.

NOTE: SEE MILITARY QPL CROSS REFERENCE LISTING IN APPENDIX.

APPLICATION-SPECIFIC MODIFIED PRODUCTS

Modified Military Styles

These switches are special designs meeting the requirements of MIL-S-8805/104.



Circuitry	Free Position (inches)	Bushing Length (inches)	Overall Length (inches)	Catalog Number
Pin Plunger, Radial Lead Exit				
2PDT	1.375	1.000	2.325	P6-20077
2PDT	1.575	1.200	2.525	P6-20084
2PDT	0.875	0.625	1.825	P6-20076
4PDT	1.285	1.000	2.485	P6-20055
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				
2PDT	1.295	0.675	2.295	P6-10007
2PDT	1.295	0.675	2.245	P6-10016
2PDT	1.980	1.095	2.930	P6-10060
Roller Plunger, Axial Lead Exit				
2PDT	1.295	0.675	2.670	P6-10070
4PDT	1.700	1.000	3.000	P6-10050

Environment-Free Plunger

Rugged sealed two pole switch features a small rectangular case only 0.500" thick. Bushing is 15/32-32.

Total Travel: 0.220" min
Operating Force: 10.0 lbs. max
Release Force: 4.0 lbs. min
Circuit: 2PDT
Rating: 7 amps Resistive
 3 amps Inductive
Contacts: Gold plate
P6-20054



Flange Mount

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

Operating Force: 4.0 lbs. to 9.0 lbs.
Release Force: 2.0 lbs. min
Circuit: 4PST N.C.
Rating: 0.5 amps Resistive for 100,000 cycles
Contacts: Gold plate
P6-20090



Longer Bushing

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

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 plate
P6-20005



Rubber Bonded Leads

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

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 plate
P6-20050



SUBMINIATURE WATERTIGHT SEALED

P6-3
LIMIT
SWITCHES

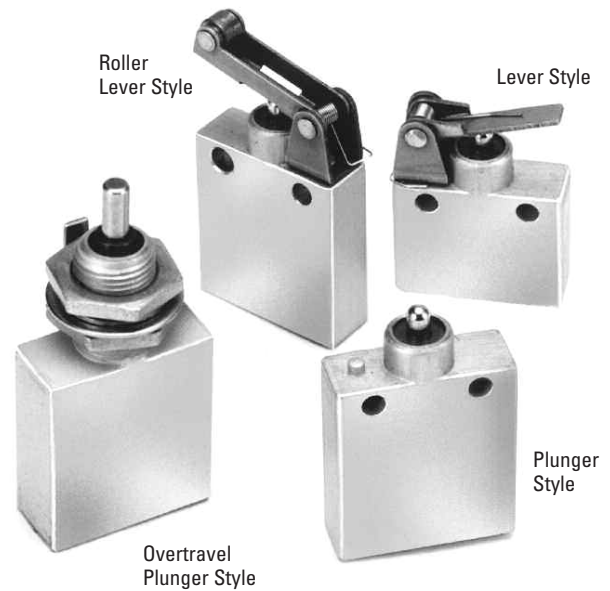
FEATURING OTTO B5 SERIES BASIC SWITCHES

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

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

Features:

- **Compact design**
- **Watertight to MIL-PRF-8805**
- **Choice of four actuator styles**
- **Choice of two termination styles**
- **Up to 10 amps switching capability**
- **High contact pressure for low levels**
- **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	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" max	0.060" max	0.020" max	0.080" max	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							

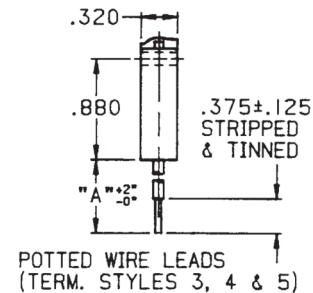
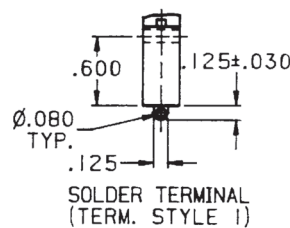
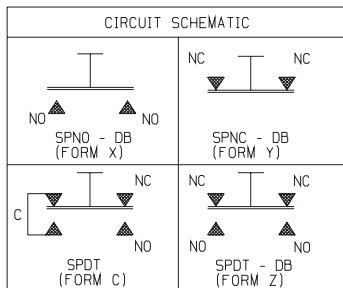
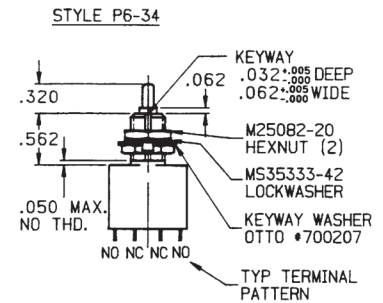
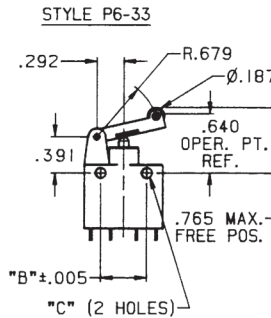
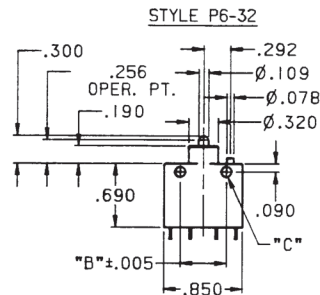
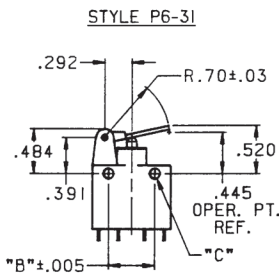
FEATURING OTTO B5 SERIES BASIC SWITCHES

P6-3 PART NUMBER CODE

Single Pole

Actuator Style	Terminal Style	Circuitry	Mounting Holes (See drawing below.)	Serial Digit
P6-3 1. Lever 2. Plunger 3. Roller Lever 4. Overtravel Plunger ①	X 1. Solder Terminals 2. 1' Potted Leads 3. 3' Potted Leads 5. 6' Potted Leads	X 1. SPNO-DB, Form X 2. SPNC-DB, Form Y 3. SPDT-SB, Form C 4. SPDT-DB, Form Z	X 1. No Holes ① 2. 1/2" Centers for #4-40 Screws 4. 3/8" Centers for #2-56 Screws	X 0. 0 Except for Specials

① Overtravel model does not have mounting holes; it is bushing mounted.



POTTED WIRE LEADS	MOUNTING HOLES:	DIM. "B" CNTRS.	DIM. "C" DIA.
STYLE	"A" DIM.		
3	12"	CODE 2 FOR 4-40 SCREWS .500	.112
4	36"	CODE 4 FOR 2-56 SCREWS .375	.086
5	72"		

P6-3

LIMIT SWITCHES

P6-3 PART NUMBER CODE

P6-3

X

X

X

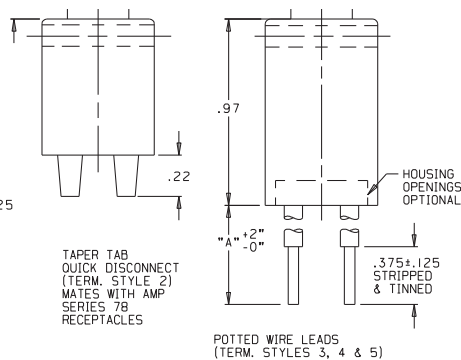
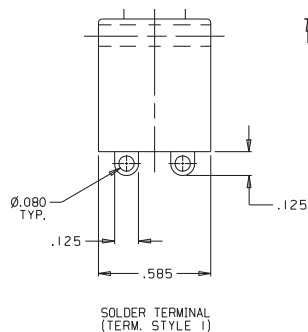
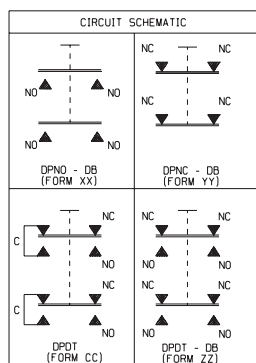
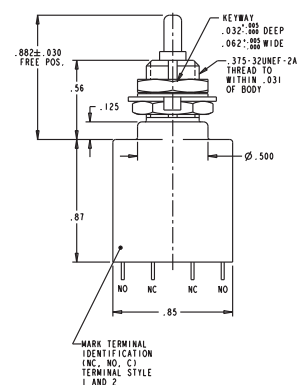
X

X

Serial Digit

- 0.0 Except for
Specials**

STYLE P6-38



POTTED WIRE LEADS		MOUNTING HOLES:		DIM. "B" CNTRS.	DIM. "C" DIA.
STYLE	"A" DIM.				
3	12"	CODE 2 FOR 4-40	SCREWS	.500	.112
4	36"	CODE 4 FOR 2-56	SCREWS	.375	.086
5	72"				

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 72" coiled cord. Sealed against dust and moisture.

Rating: 10 amps Resistive @ 28VDC

Button: Green nylon

Housing: Black anodized aluminum

Cable: 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.

U2-076



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

U2-096



SEALED & UNSEALED

The U7 series pendant switches are rugged, high performance pendant switches designed for use under severe conditions found in medical, appliance, heavy equipment and industrial control applications.

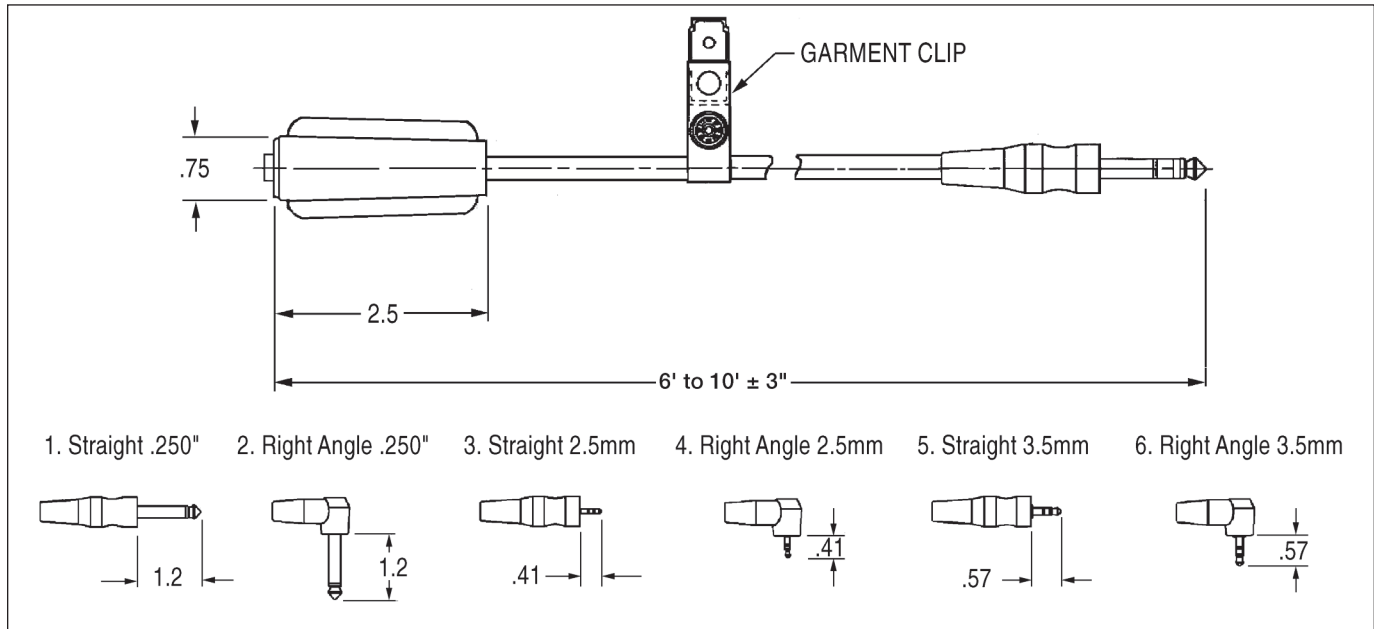
The U7 series is offered in single and dual switch configurations with single plugs. Connector options include straight and right angle mono plugs in 1/4", 2.5mm and 3.5mm sizes. Cable options include 0.250" diameter for 60.0 lbs. pull strength, 0.130" diameter cable for 25.0 lbs. pull strength, and 0.102" diameter cable for 15.0 lbs. pull strength. Cables are available in a choice of five colors.

Features:

- **Durable cables available in a choice of colors**
- **Switches logic level circuits**
- **Choice of button, bezel & handle colors**
- **Choice of six plug types**
- **Withstands extreme shock & vibration**
- **Available in sealed & unsealed versions**
- **RoHS & WEEE compliant**



SEALED & UNSEALED



How To Specify An OTTO Part Number For U7 Series Pendant Switches:

Select the options available and use the code to build a pendant switch assembly part number. For example: a single pendant with 6' cable (1), moistureproof seal (2), black button (2), red bezel (1), black handle (2), 0.250" diameter cable (1), black cable outer jacket overmold (2), and 0.250" right angle mono plug (2) would have a complete part number of U712212122.

PENDANT PART NUMBER CODE

U7	X	X	X	X	X	X	X	X
Pendant Style	Seal Type	Button Color	Bezel Color	Handle Color	Cable Dia.	Cable Color	Connector Dia./Style	
1. Single Pendant, Single Plug, 6' Length	1. Unsealed	1. Red	1. Red	1. Beige	1. 0.250" Dia., 60.0 lbs. Pull Strength	1. Beige	1. 0.250" Straight Mono Plug	
2. Dual Pendant, Single Plug, 6' Length	2. Moistureproof and Dusttight	2. Black	2. Black	2. Black	2. 0.130" Dia., 25.0 lbs. Pull Strength	2. Black	2. 0.250" Right Angle Mono Plug	
3. Single Pendant, Single Plug, 10' Length	3. Watertight	9. White	9. White	6. Blue	3. 0.102" Dia., 15.0 lbs. Pull Strength	6. Blue	3. 2.5mm Straight Mono Plug*	
4. Dual Pendant, Single Plug, 10' Length				8. Gray		8. Gray	4. 2.5mm Right Angle Mono Plug*	
				9. White		9. White	5. 3.5mm Straight Mono Plug*	
							6. 3.5mm Right Angle Mono Plug*	

* 2.5mm and 3.5mm plugs not available in 0.250" diameter cable.

NOTE: For standard colors, cables and connectors, contact factory. Significant order minimums and lead times required for some options.

Pushbutton Switches



SERIES	FEATURE	ACTUATION	MAX RATING (Resistive @ 120VAC, 28VDC)	SEAL RATING	APPROVALS	MOUNTING	CIRCUITRY
LP3	LED Lighted	Momentary Action	5A	IP64, IP68S	UL (E61705)	5/8", 15/32" dia. Threaded, Press Fit	SPST-DB, SPDT-DB
LP3-V	LED Lighted, Vandal Resistant	Momentary Action	5A	IP64, IP68S	UL (E61705)	5/8", 3/4" dia. Threaded	SPST, SPDT-DB
LP5	LED Lighted	Alternate Action	5A	IP64, IP68S	UL (E61705)	5/8", 15/32" dia. Threaded, Press Fit	SPST, SPDT
LP5-V	LED Lighted, Vandal Resistant	Alternate Action	5A	IP64, IP68S	UL Recognized Component, UL1500 Ignition Protected	5/8", 3/4" dia. Threaded	SPST, SPDT
LP9	LED Lighted	Momentary Action	5A	IP68S	UL (E61705)	15/32" dia. Threaded, Snap-In	SPST-DB, SPDT-DB
P1	Mil Grade	Momentary Action, Push-Pull	10A	IP64, MIL-PRF-8805 Design 2, IP68S	UL (E61705), CSA (LR43865)	5/8", 15/32" dia. Press Fit	SPDT-DB, SPST-DB
P3	Commercial	Momentary Action, Push-Pull	20A	IP64, IP68S	UL (E61705), CSA (LR43865)	5/8", 15/32" dia. Press Fit	SPDT-DB, SPST-DB
P3-D	Dome Shape	Momentary Action	15A	IP64, IP68S	UL (E61705)	5/8" dia. Threaded	SPST-DB, SPDT-DB
P4	1 to 4 Poles, Custom Pushbutton	Momentary Action, Two Step	8A	IP64	N/A	1/4", 15/32", 5/8" dia. Threaded, Press Fit	1 to 4 Poles SPDT, DPDT
P5	Commercial & Mil Grades	Alternate Action	20A	IP64, MIL-PRF-8805 Design 2, IP68S	UL (E61705)	5/8", 15/32" dia. Threaded, Press Fit	SPST, SPDT
P5-D	Dome Shape, Commercial & Mil Grades	Alternate Action	20A	IP64, MIL-PRF-8805 Design 2, IP68S	UL (E61705)	5/8" dia. Threaded	SPST, SPDT
P5-V	Vandal Resistant	Alternate Action	20A	IP64, MIL-PRF-8805 Design 2, IP68S	UL (E61705)	5/8", 3/4" dia. Threaded	SPST, SPDT
P6	Limit Switch, Mil Grade	(Pin, Roller) Momentary Action	7A	M8805 Design 3 & 4, MIL-PRF-8804	N/A	5/8", 15/32" dia. Threaded	1, 2, & 4 Poles
P6-3	Subminiature Limit Switch	(Lever, Plunger, Roller) Momentary Action	10A	MIL-PRF-8805, Design 3	N/A	3/8", 1/2" dia. Mounting Holes	1, 2 & 3 Poles
P7	Subminiature, Mil Grade	Momentary Action	5A	IP64, MIL-PRF-8805 Design 2 & 3, IP68S	UL (E61705), CSA (LR43865)	1/4", 15/32" dia. Threaded, Press Fit	SPST-DB, SPDT-DB
P7-D	Dome Shape	Momentary Action	5A	IP64, IP68S	UL (E61705)	15/32" dia. Threaded	SPST-DB, SPDT-DB
P8	Shorter Behind Panel Depth	Momentary Action, Push-Pull	20A	IP64, IP68S	UL (E61705), CSA (LR43865)	5/8", 15/32", 1/2" dia. Threaded, Press Fit	SPST-DB, SPDT-DB
P8-V	Vandal Resistant	Momentary Action	20A	IP64, IP68S	UL (E61705)	5/8", 3/4" dia. Threaded	SPST-DB, SPDT-DB
P9	Dome Shape	Momentary Action	5A	IP64, IP68S	UL (E61705), CSA (LR43865)	15/32" dia. Threaded, Snap-In	SPST-DB, SPDT-DB

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

The LP3 offers rugged, sealed construction with the added benefit of reliable LED illumination.

The LP3 is a precision snap-action switch 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, amazingly low (25mΩ max, standard) contact resistance and extremely low contact bounce are all the result of the OTTO patented snap-action mechanism. Extra long electrical life and precise trip point offer added value and precision operation.

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 permitting sublimated & pad printed legends**
- **Less than 25mΩ contact resistance**
- **Quick disconnect terminals**
- **15/32" & 5/8" thread, press fit & dome case styles available**



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DVV	1050Vrms
Low Level	10mA @ 30mV
Electrical Life:	25,000 cycles

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

Mechanical Life:	250,000 cycles @ +85°C 25,000 cycles @ -55°C
Seal:	IP64 or IP68S
Operating Temp Range:	-55°C to +85°C
Operating Force:	2.5 +/- 1.5 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 silver plate with optional gold plating for low level applications
Mounting Hardware:	Hex nut, lockwasher and panel gasket when applicable

LP3 PART NUMBER CODE

Case Style	Circuit Rating	Light Source Type* w/ Rev. Pol Protection	Seal Level	Operating Force	Case Color	Button Color	Legend Style
E. Exposed Dome	1. SPST N.O./Std.	A. 2V Red LED	1. Unsealed	2. 2.5 lbs.	1. Silver	A. Amber, Translucent (use Amber LED)	Refer to Legend Table for legend codes in Appendix. Legends will be printed in white on amber and red buttons and in black on white buttons.
F. Flush Dome	2. SPST N.C./Std.	B. 2V Green LED	2. Dusttight	5. 5.0 lbs.	2. Black	R. Red, Translucent (use Red LED)	
R. Raised Dome	3. SPST 2 Circuit/Std.	C. 2V Amber LED	3. Watertight			W. White, Translucent	
1. Press Fit Mount	4. SPST N.O./Low Level	D. 6V Red LED					
3. 5/8" Thread Front Mount	5. SPST N.C./Low Level	E. 6V Green LED					
4. 15/32" Thread Rear Mount	6. SPST 2 Circuit/Low Level	F. 6V Amber LED					
6. 5/8" Thread Rear Mount		G. 12V Red LED					
		H. 12V Green LED					
		J. 12V Amber LED					
		K. 24V Red LED					
		L. 24V Green LED					
		M. 24V Amber LED					

* For super bright LEDs, contact factory.

STOP HERE for
illuminated switches
without legends.

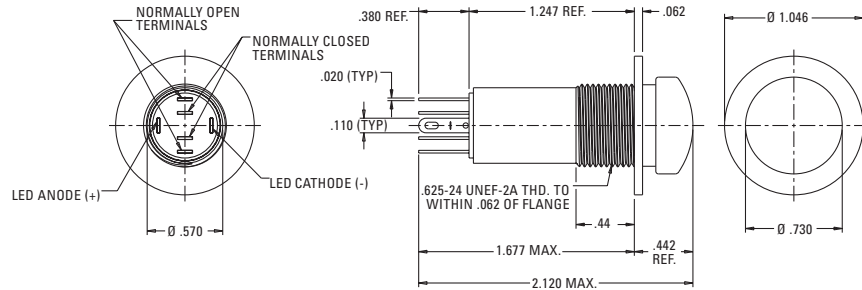
ILLUMINATED & SEALED PUSHBUTTONS

LP3
ILLUMINATED
PUSHBUTTONS

MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

LP3-E

Momentary, Exposed Dome Button

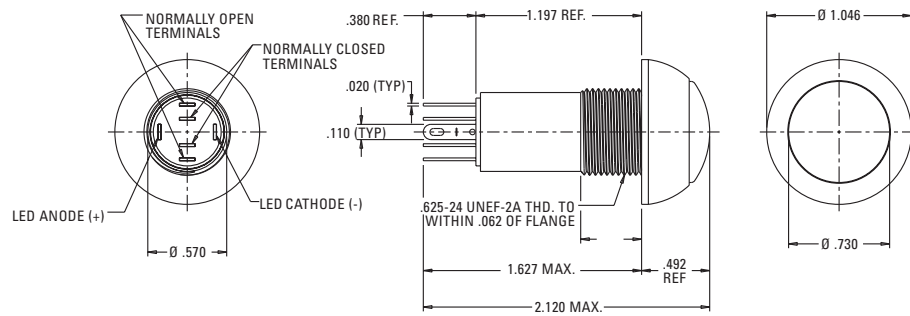


NOTE:

For indicator light only, see LP5 series.

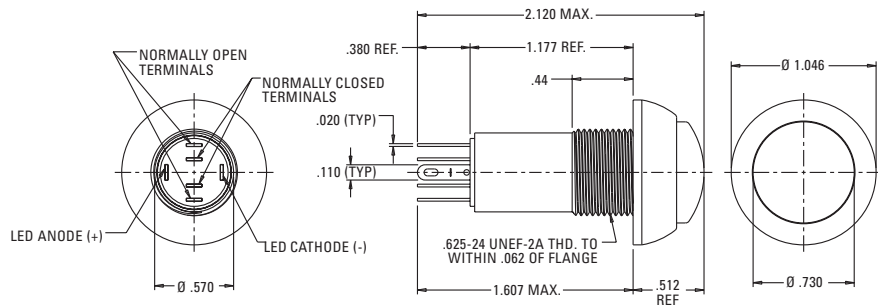
LP3-F

Momentary, Flush Dome Button



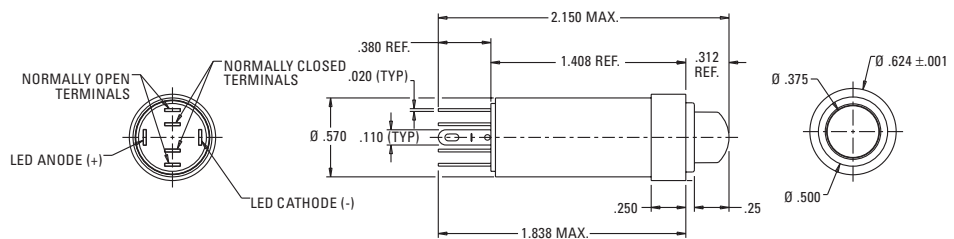
LP3-R

Momentary, Raised Dome Button



LP3-1

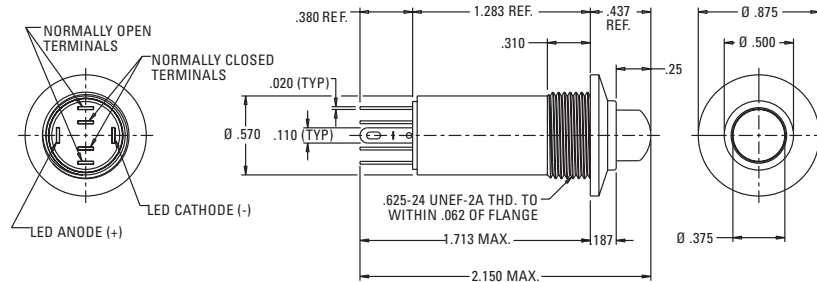
Momentary, Press Fit Mount



MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & SEALED

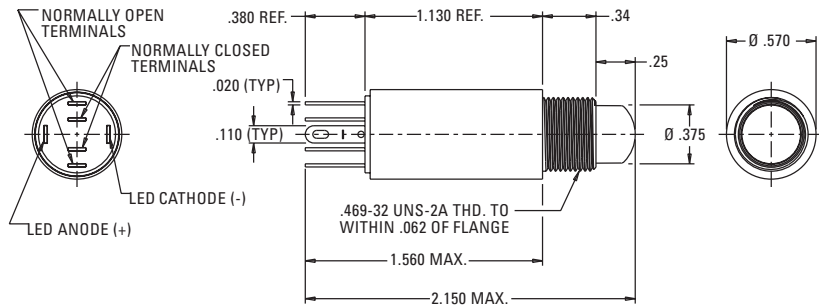
LP3-3

Momentary, 5/8" Threaded Front Mount



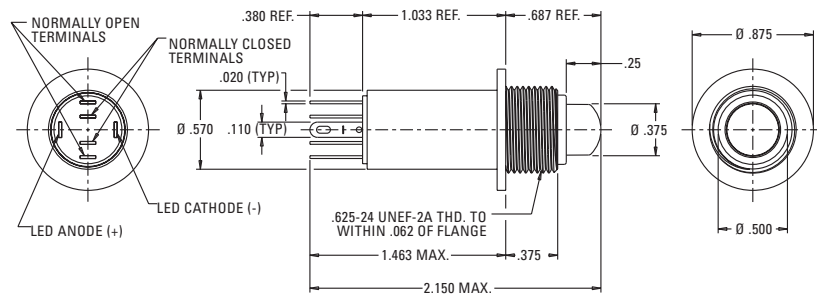
LP3-4

Momentary, 15/32" Threaded Rear Mount



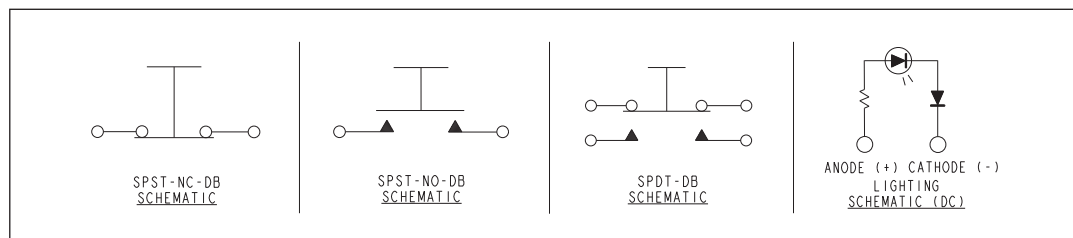
LP3-6

Momentary, 5/8" Threaded Rear Mount



NOTE:

For indicator light only, see LP5 series.



ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

LP3-V
ILLUMINATED
VANDAL RESISTANT
PUSHBUTTONS

MOMENTARY ACTION RING ILLUMINATED, STAINLESS STEEL CASE & BUTTON



High Profile
Curved Button

The LP3-V is a momentary 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. Alternate action is available in the LP5-V series.

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

This switch offers positive tactile feedback, less than 25mΩ contact resistance, 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**
- **Ring illuminated**
- **Watertight to IP68S**
- **RoHS & WEEE compliant**
- **Less than 25mΩ contact resistance**
- **Variety of button options**
- **Variety of LED colors**
- **Drop in replacement to the P8-V series**

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DWV	1050Vrms
Low Level	10mA @ 30mV

Electrical Life: 25,000 cycles

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

Mechanical Life: 250,000 cycles @ +85°C
25,000 cycles @ -55°C

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 or anodized aluminum alloy

Button: Thermoplastic

Center Cap: Stainless steel or anodized aluminum alloy

Terminals: Standard silver plate with optional gold plate for low level applications

Mounting Hardware: Hex nut, lockwasher and panel gasket when applicable

LP3-V PART NUMBER CODE

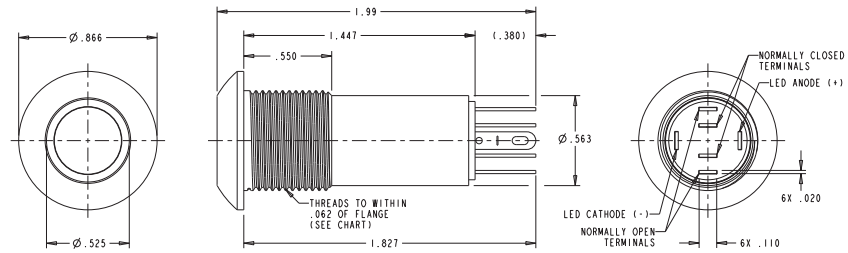
Type	Case Style	Circuit Rating	Light Source Type* w/ Rev. Pol Protection	Seal Level	Operating Force	Case/Center Cap Color	Button Profile
A. Aluminum	1. 5/8-24 & Hex Nut	1. SPST N.O./Std.	A. 2V Red LED	2. Dusttight	2. 2.5 lbs.	1. Silver	1. High Profile Flat Button
V. Stainless	2. 5/8-24 & Knurl Nut	2. SPST N.C./Std.	B. 2V Green LED	3. Watertight	5. 5.0 lbs.	2. Black**	2. High Profile Curved Button
	3. 5/8-24 W/D-Flat & Hex Nut	3. SPST 2 Circuit/Std.	C. 2V Amber LED				3. Low Profile Flat Button
	4. 5/8-24 W/D-Flat & Knurl Nut	4. SPST N.O./Low Level	D. 6V Red LED				4. Low Profile Curved Button
	5. 3/4-20 & Hex Nut	5. SPST N.C./Low Level	E. 6V Green LED				5. Flush Profile Flat Button
	6. 3/4-20 & Knurl Nut	6. SPST 2 Circuit/Low Level	F. 6V Amber LED				
	7. 3/4-20 W/D-Flat & Hex Nut		G. 12V Red LED				
	8. 3/4-20 W/D-Flat & Knurl Nut		H. 12V Green LED				
			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				

* For additional LED lighting options, contact factory.

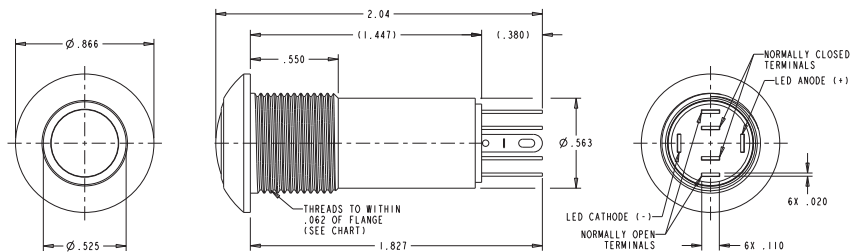
** Only available on LP3-A styles.

MOMENTARY ACTION RING ILLUMINATED, STAINLESS STEEL CASE & BUTTON

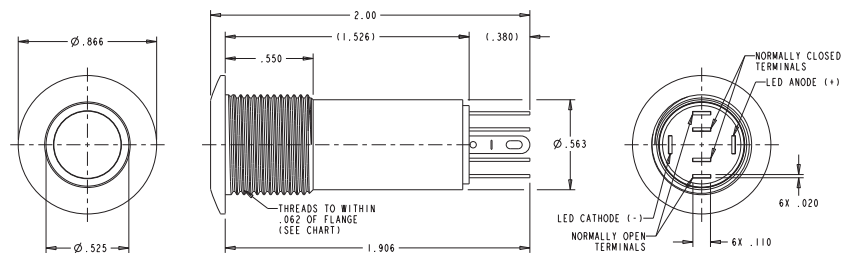
LP3-1
High Profile Flat Button



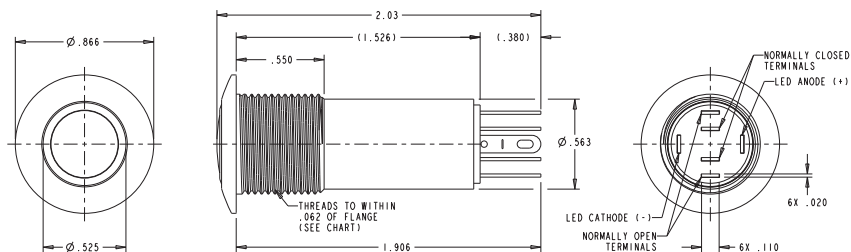
LP3-2
High Profile Curved Button



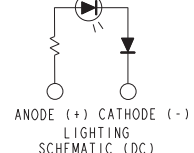
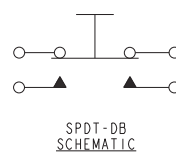
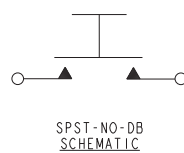
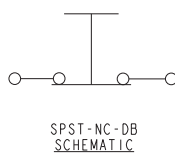
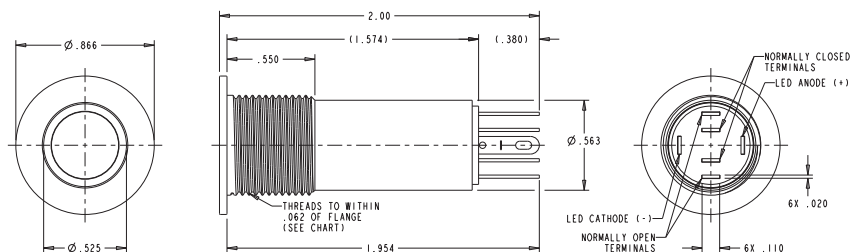
LP3-3
Low Profile Flat Button



LP3-4
Low Profile Curved Button



LP3-5
Flush Profile Flat Button



ALTERNATE ACTION, LED ILLUMINATED & SEALED

The LP5 offers the same rugged, sealed construction as the proven P5 series with the added benefit of reliable LED illumination.

The LP5 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 permitting sublimated & pad printed legends**
- **Less than 25mΩ contact resistance**
- **Quick disconnect terminals**
- **15/32" & 5/8" thread, press fit & dome case styles available**
- **RoHS & WEEE compliant**



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DWV	1050Vrms
Low Level	10mA @ 30mV

Electrical Life: 25,000 cycles

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

Mechanical Life: 200,000 cycles

Seal: 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

Terminals: Standard silver plate with optional gold plate for low level applications

Mounting Hardware: Hex nut, lockwasher and panel gasket when applicable

LP5 PART NUMBER CODE

Size	Case Style	Circuit Rating	Light Source Type* w/ Rev. Pol Protection	Seal Level	Case Color	Button Color	Legend Style
5. P5 Size L. Indicator Light	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	0. Indicator Light 1. SPST/Std. 2. SPDT/Std. 3. SPST/Low Level 4. SPDT/Low Level	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	1. Unsealed 2. Dusttight 3. Watertight	1. Silver 2. Black	A. Amber, Translucent (use Amber LED) R. Red, Translucent (use Red LED) W. White, Translucent	Refer to Legend Table for legend codes in Appendix. Legends will be printed in white on amber and red buttons and in black on white buttons.

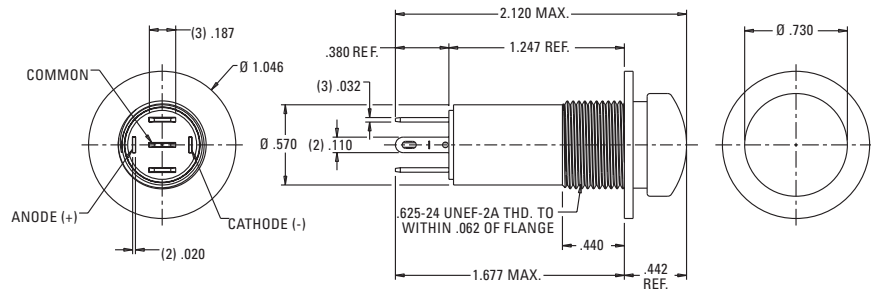
* For super bright LEDs, contact factory.

STOP HERE for
illuminated switches
without legends.

ALTERNATE ACTION, LED ILLUMINATED & SEALED

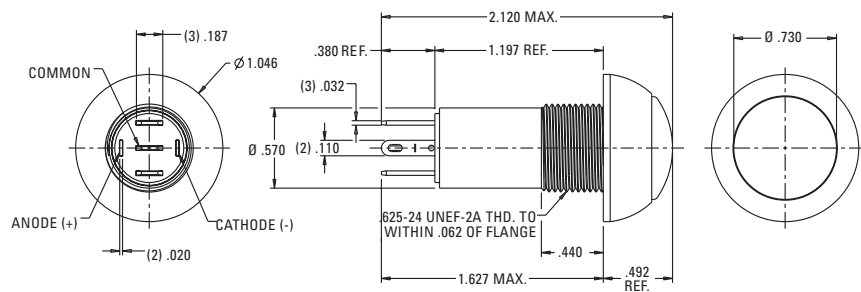
LP5-E

Alternate Action, Exposed Dome Button



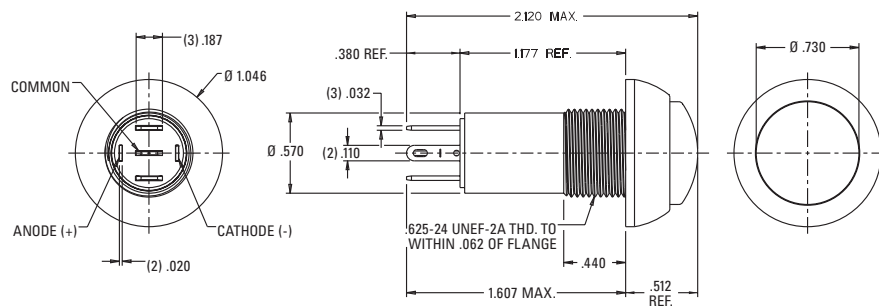
LP5-F

Alternate Action, Flush Dome Button



LP5-R

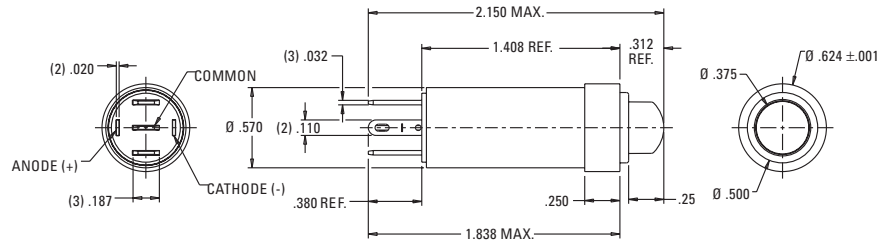
Alternate Action, Raised Dome Button



ALTERNATE ACTION, LED ILLUMINATED & SEALED

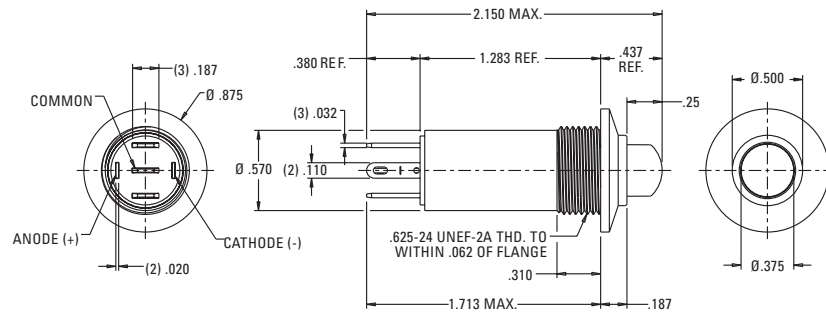
LP5-1

Alternate Action, Press Fit Mount



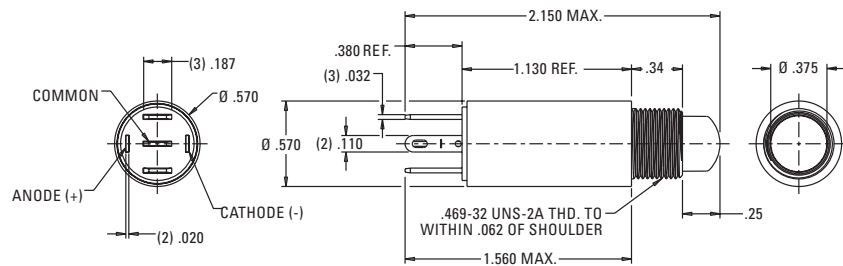
LP5-3

Alternate Action, 5/8" Threaded Front Mount



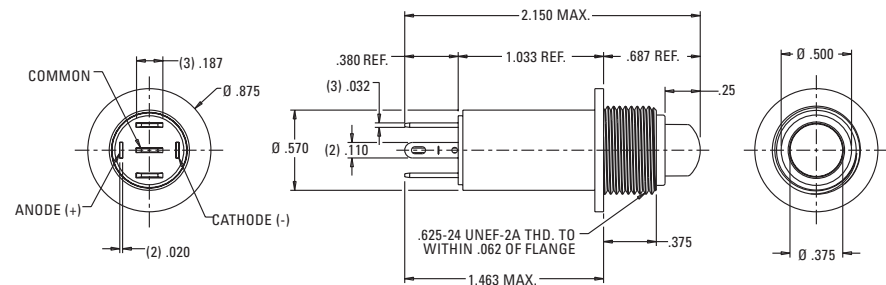
LP5-4

Alternate Action, 15/32" Threaded Rear Mount



LP5-6

Alternate Action, 5/8" Threaded Rear Mount



ALTERNATE ACTION RING ILLUMINATED, STAINLESS STEEL CASE & BUTTON



High Profile
Curved Button

The LP5-V series is an alternate action switch that has been 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. Momentary action is available in the LP3-V series.

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

This switch offers positive tactile feedback, less than 25mΩ contact resistance, 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**
- **Ring illuminated**
- **Watertight to IP68S**
- **RoHS & WEEE compliant**
- **Less than 25mΩ contact resistance**
- **Variety of button options**
- **Variety of LED colors**
- **Drop in replacement to the P5-V series**
- **UL component recognized**
- **UL1500 ignition protected**

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
Motor	3A
DVV	1050Vrms
Low Level	10mA @ 30mV

Electrical Life: 25,000 cycles

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

Mechanical Life: 200,000 cycles

Seal: 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:	Stainless steel
Button:	Thermoplastic
Center Cap:	Stainless steel or aluminum
Terminals:	Standard silver plate with optional gold plating for low level applications
Mounting Hardware:	Hex nut, lockwasher and panel seal gasket

LP5-V PART NUMBER CODE

Type	Case Style	Circuit Rating	Light Source Type* w/ Rev. Pol Protection	Seal Level	Case/Center Cap Color	Button Profile
A. Aluminum	1. 5/8-24 & Hex Nut	0. Indicator Light	A. 2V Red LED	2. Dusttight	1. Silver	1. High Profile
V. Stainless	2. 5/8-24 & Knurl Nut	1. SPST/Std.	B. 2V Green LED	3. Watertight	2. Black**	Flat Button
	3. 5/8-24 W/D-Flat & Hex Nut	2. SPDT/Std.	C. 2V Amber LED			2. High Profile
	4. 5/8-24 W/D-Flat & Knurl Nut	3. SPST/Low Level	D. 6V Red LED			Curved Button
	5. 3/4-20 & Hex Nut	4. SPDT/Low Level	E. 6V Green LED			3. Low Profile
	6. 3/4-20 & Knurl Nut		F. 6V Amber LED			Flat Button
	7. 3/4-20 W/D-Flat & Hex Nut		G. 12V Red LED			4. Low Profile
	8. 3/4-20 W/D-Flat & Knurl Nut		H. 12V Green LED			Curved Button
			J. 12V Amber LED			5. Flush Profile
			K. 24V Red LED			Flat Button
			L. 24V Green LED			
			M. 24V Amber LED			
			N. 2V Blue LED			
			P. 6V Blue LED			
			Q. 12V Blue LED			
			R. 24V Blue LED			

* For additional LED lighting options, contact factory.
** Only available on LP5-A styles.

ILLUMINATED VANDAL RESISTANT PUSHBUTTONS

LP5-V
ILLUMINATED
VANDAL RESISTANT
PUSHBUTTONS

ALTERNATE ACTION RING ILLUMINATED, STAINLESS STEEL CASE & BUTTON

LP5-1 High Profile Flat Button	Technical drawing of LP5-1 High Profile Flat Button. Front view shows outer diameter $\varnothing .866$ and inner diameter $\varnothing .525$. Side view shows a threaded section with a length of 1.99 (1.447) and a total length of 1.827. The button has a diameter of $\varnothing .563$. Top view shows three sets of terminals: 3X .187, 2X .020, and 2X .032. The electrical connections are labeled ANODE (+), COMMON, and CATHODE (-).	
LP5-2 High Profile Curved Button	Technical drawing of LP5-2 High Profile Curved Button. Front view shows outer diameter $\varnothing .866$ and inner diameter $\varnothing .525$. Side view shows a threaded section with a length of 2.04 (1.447) and a total length of 1.827. The button has a diameter of $\varnothing .563$. Top view shows three sets of terminals: 3X .187, 2X .020, and 2X .032. The electrical connections are labeled ANODE (+), COMMON, and CATHODE (-).	
LP5-3 Low Profile Flat Button	Technical drawing of LP5-3 Low Profile Flat Button. Front view shows outer diameter $\varnothing .866$ and inner diameter $\varnothing .525$. Side view shows a threaded section with a length of 2.00 (1.526) and a total length of 1.906. The button has a diameter of $\varnothing .563$. Top view shows three sets of terminals: 3X .187, 2X .020, and 2X .032. The electrical connections are labeled ANODE (+), COMMON, and CATHODE (-).	
LP5-4 Low Profile Curved Button	Technical drawing of LP5-4 Low Profile Curved Button. Front view shows outer diameter $\varnothing .866$ and inner diameter $\varnothing .525$. Side view shows a threaded section with a length of 2.03 (1.526) and a total length of 1.906. The button has a diameter of $\varnothing .563$. Top view shows three sets of terminals: 3X .187, 2X .020, and 2X .032. The electrical connections are labeled ANODE (+), COMMON, and CATHODE (-).	
LP5-5 Flush Profile Flat Button	Technical drawing of LP5-5 Flush Profile Flat Button. Front view shows outer diameter $\varnothing .866$ and inner diameter $\varnothing .525$. Side view shows a threaded section with a length of 2.00 (1.574) and a total length of 1.954. The button has a diameter of $\varnothing .563$. Top view shows three sets of terminals: 3X .187, 2X .020, and 2X .032. The electrical connections are labeled ANODE (+), COMMON, and CATHODE (-).	
SPST ALTERNATE ACTION SCHEMATIC SPDT ALTERNATE ACTION SCHEMATIC ANODE (+) CATHODE (-) LIGHTING SCHEMATIC (DC)		

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.

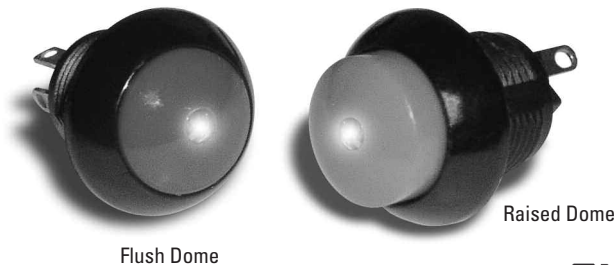
The LP9 series offers a positive tactile feedback, signaling the operator when the switch is operated with the added benefit of reliable LED illumination. The LP9 series offers four button versions; flush and raised profile with either a glossy or matte finish. It also comes with a threaded case for 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 of 5 amps resistive or 3 amps inductive; 500,000 operations at 500mA/200mA resistive.

The LP9 series are momentary snap-action double break switches, available in standard and low operate forces. The LED is available in five colors and has the ability to accommodate 2 or 12VDC.

Features:

- **Watertight to IP68S**
- **LED lighted with the ability to accommodate 2 or 12VDC**
- **LED available in five colors**
- **Flush & raised button style**
- **Matte & glossy button finish**
- **Positive tactile feedback contact transfer**
- **Withstands extreme shock & vibration**
- **Short behind panel depth**



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:		Sea Level @ 28VDC or 115VAC, 60/400Hz	
Load	N.O./N.C.	Cycles	Operating Force
Resistive	5A	25,000	Standard
Inductive	3A	25,000	Standard
Resistive	500mA	500,000	Standard
Resistive	200mA	500,000	Low or Standard
DVV	1050Vrms		
Low Level	10mA @ 30mV	25,000	
Electrical Life:	See Rating Chart		
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 +/- 0.5 lb. (standard force) 12 +/- 4 oz (low force)		
Total Travel:	0.080 inches max		
Overtravel:	0.010 inches min		
MATERIALS:			
Case:	Thermoplastic		
Button:	Thermoplastic		
Terminals:	Brass with gold plate over silver plate		
Mounting Hardware:	Hex nut and lockwasher for round/threaded style case only Panel gasket for snap-in style case only		

LP9 PART NUMBER CODE

LP9	-	X	X	X	X	X	X	X
Button Style*	Case Style*	Terminal Style	Circuit Form	Operating Force	Light Source	Case Color	Button Color	
1. Flush	1. Round/Threaded	1. Solder	1. N.O.	1. Standard Snap-Action	A. 2V Red LED	1. Red	1. Red	
2. Raised	2. Snap-In	2. PC Pin	2. N.C.	2. Low Force Snap-Action	B. 2V Green LED	2. Black	2. Black	
3. Flush Matte			3. 2 Circuit		C. 2V Amber LED	3. Orange**	3. Orange	
4. Raised Matte					D. 2V Blue LED	4. Yellow**	4. Yellow	
					E. 2V White LED	5. Green**	5. Green	
					F. 12V Red LED	6. Blue**	6. Blue	
					G. 12V Green LED	7. Violet**	7. Violet	
					H. 12V Amber LED	8. Gray**	8. Gray	
					J. 12V Blue LED	9. White	9. White	
					K. 12V White LED			

* Button and case will be of the same texture.

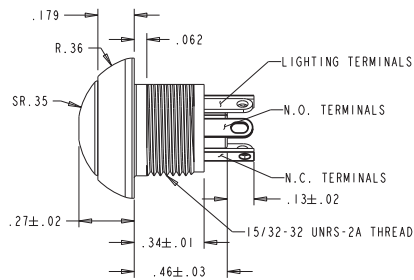
For all mixed gloss/matte combination options, contact factory.

** For minimum requirement, contact factory.

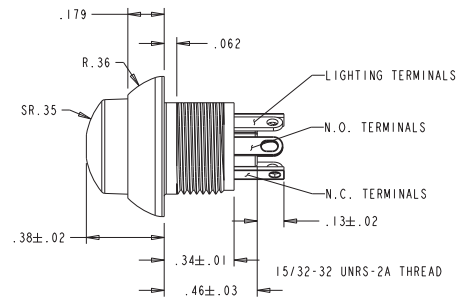
ILLUMINATED SEALED DOME PUSHBUTTONS

LP9
ILLUMINATED
PUSHBUTTONS

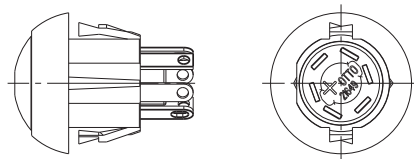
MOMENTARY ACTION COMMERCIAL GRADE LED ILLUMINATED & WATERTIGHT SEALED



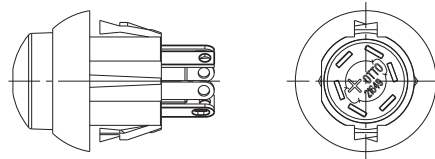
Round Threaded Case Style, Flush Button



Round Threaded Case Style, Raised Button

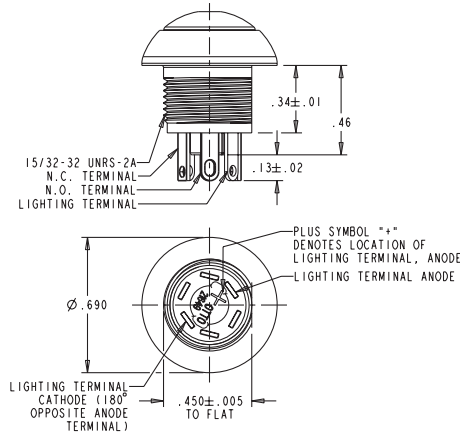


Snap-In Case Style, Flush Button

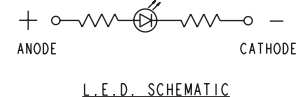
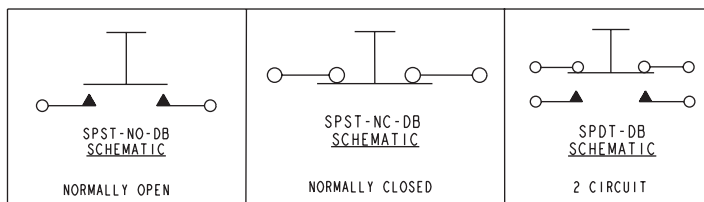
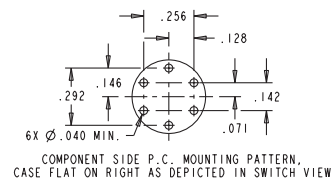
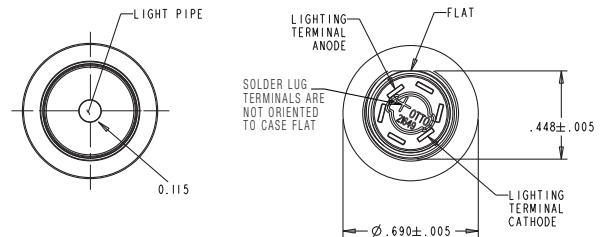
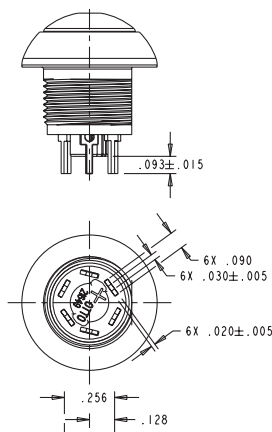


Snap-In Case Style, Raised Button

Standard Terminals (Terminals not oriented to flat.)



PC Terminals (Oriented to case flats as shown.)



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 dual 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 pressure (120g/4.2 oz), low contact resistance (25mΩ max) and short contact bounce (5ms max) result from our patented 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 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 & WEEE 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
Motor	3A	N/A
Center Contact	3A max	N/A
DWV	1050Vrms	400Vrms
Low Level	10mA @ 30mV max DC or peak AC	

Electrical Life: 25,000 cycles

Mechanical Life: 50,000 cycles, circuit forms 3, 4, & 5
250,000 cycles, circuit forms 1, 2 & 6

Seal: MIL-PRF-8805 Design 2 or IP68S

Operating Temp Range: -55°C to +85°C

Operating Force: 2.5 lbs. or 4.0 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: Anodized aluminum alloy

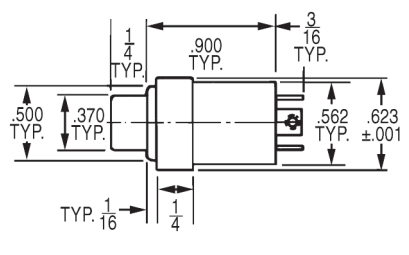
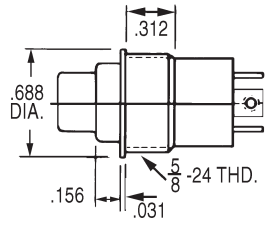
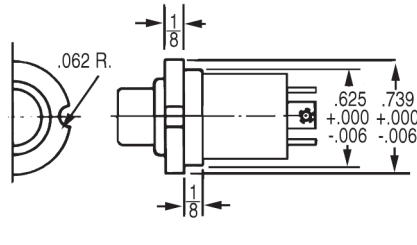
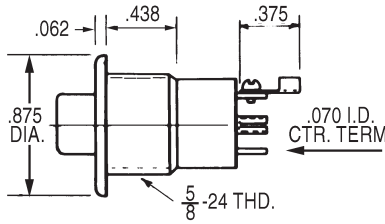
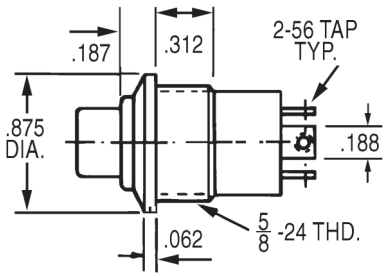
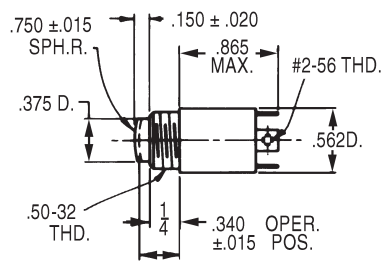
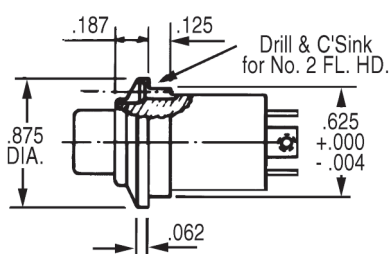
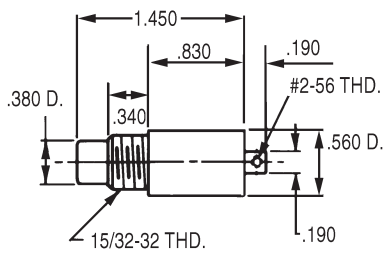
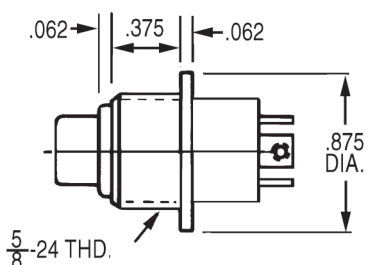
Button: Thermoplastic

Terminals: Brass with silver plate, gold plate for low level

Terminal Hardware: Screws, lockwasher and solder lugs for screw terminal option

Mounting Hardware: Hex nut and lockwasher, panel seal on watertight switches

MOMENTARY ACTION, LOW LEVEL UP TO 10 AMPS

P1-1 (MIL-A) 	 Dimensions: .500 TYP., .370 TYP., .900 TYP., $\frac{1}{4}$ TYP., $\frac{3}{16}$ TYP., .562 TYP., .623 $\pm .001$, TYP. $\frac{1}{16}$, $\frac{1}{4}$	P1-7 (MIL-G) 	 Dimensions: .312, .688 DIA., .156, $\frac{5}{8}$-24 THD., .031	
P1-2 (MIL-B) 	 Dimensions: .062 R., $\frac{1}{8}$, .625 $^{+.000}_{-.006}$, .739 $^{+.000}_{-.006}$, $\frac{1}{8}$	P1-8 (MIL-H) 	 Dimensions: .062, .438, .375, .875 DIA., $\frac{5}{8}$-24 THD., .070 I.D. CTR. TERM.	
P1-3 (MIL-C) 	 Dimensions: .187, .312, 2-56 TAP TYP., .875 DIA., .188, .062, $\frac{5}{8}$-24 THD.	Unsealed P1-90013 Operating Force: 5.0 lbs. max Circuit: SPDT-DB Case: Black anodized aluminum Button: Black nylon 		 Dimensions: .750 $\pm .015$ SPH.R., .150 $\pm .020$, .865 MAX., #2-56 THD., .375 D., .50-32 THD., $\frac{1}{4}$, .340 OPER. $\pm .015$ POS., .562 D.
P1-5 (MIL-E) 	 Dimensions: .187, .125, Drill & C'Sink for No. 2 FL. HD., .875 DIA., .625 $^{+.000}_{-.004}$, .062	Watertight P1-90024 Dusttight P1-90014 Operating Force: 4.0 +/- 1.0 lb. Circuit: SPST-N.O. Case: Black anodized aluminum Button: Red nylon 		 Dimensions: 1.450, .830, .190, .380 D., .340, #2-56 THD., .560 D., .190, 15/32-32 THD.
P1-6 (MIL-F) 	 Dimensions: .062, .375, .062, .875 DIA., $\frac{5}{8}$-24 THD.			

MOMENTARY ACTION, LOW LEVEL UP TO 10 AMPS

P1 PART NUMBER CODE

P1	—	X	X	X	X	*	
Case Style			Terminal Style		Circuit Form	Switch Action	Button Color
1. Style A			1. Solder/Std.		1. N.O.	1. 2.5 lbs. Momentary	1. Red
2. Style B			2. Screw/Std.		2. N.C.	2. 4.0 lbs. Momentary ②	2. Black
3. Style C			3. Solder/Low Level		3. N.C. 3 Terminal ①	3. Push-Pull	3. Orange
5. Style E			4. Screw/Low Level		4. N.O. 3 Terminal ①		4. Yellow
6. Style F					5. 5 Terminal ①		5. Green
7. Style G					6. 2 Circuit		6. Blue
8. Style H							7. Purple
							8. Gray
							9. White

* Add "W" for watertight to IP86S. (For watertight seal to MIL-PRF-8805 Design 3, please contact factory.)

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.

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 S.S.
Housing: Black anodized aluminum
P1-10047



Long Pushbutton

Dusttight per MIL-S-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" body. 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 and nine colors of buttons
- Watertight to IP68S
- 10 amp resistive rating



NOTE: Refer to Standard Legends Chart in Appendix for available symbols.



P1-10142-X

MOMENTARY ACTION, SEALED, SNAP-ACTION, DOUBLE BREAK

Makes and breaks every time! Less than 25mΩ contact resistance because 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 pressure (120g/4.2 oz), low contact resistance (25mΩ max) and short contact bounce (5ms max) are the result of our patented snap-action mechanism. These characteristics provide exceptional current carrying capabilities over the life of the switch. With the optional low 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
- Less than 25mΩ contact resistance
- Ideal for low level switching as well as up to 20 amp duty
- Positive tactile feedback
- Variety of mounting styles
- Engraved buttons & bezels available
- UL recognized
- 1 million mechanical cycle life
- Watertight to IP68S available
- RoHS & WEEE compliant



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz	50,000 feet @ 28VDC or 115VAC, 60/400Hz	Cycles
Resistive	10A	N/A	100,000
Resistive	20A	N/A	25,000
Inductive	5A	5A	100,000
Lamp	3A	N/A	100,000
Center Contact	3A max	N/A	100,000
DVV	1050Vrms	400Vrms	
Low Level	10mA @ 30mV max DC or peak AC		

Electrical Life:

See Rating Chart

Mechanical Life: 1 million cycles, circuit forms 1, 2 & 6
100,000 cycles, circuit forms 3, 4 & 5

Seal: IP64 or IP68S

Shock: MIL-STD-202, method 207

Operating Temp Range: -55°C to +85°C

Operating Force: 2.5 lbs. or 4.0 lbs.

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 plate, gold plate for low level

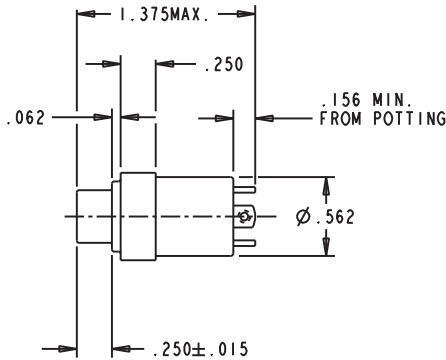
Terminal Hardware: Screws, lockwasher and terminal lug for screw terminal option

Mounting Hardware: Hex nut, lockwasher and panel seal when applicable

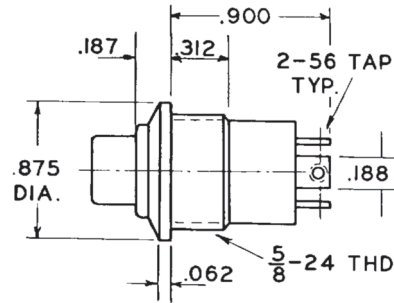
SEALED COMMERCIAL GRADE

P3
COMMERCIAL
PUSHBUTTONS

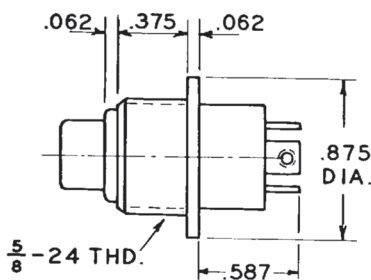
IDEAL FOR USE IN HEAVY MACHINERY & COMMERCIAL APPLICATIONS



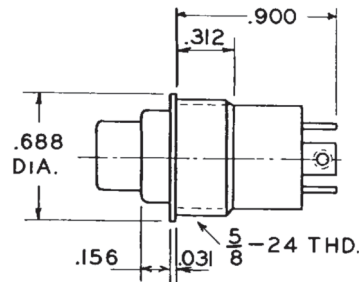
Style P3-1



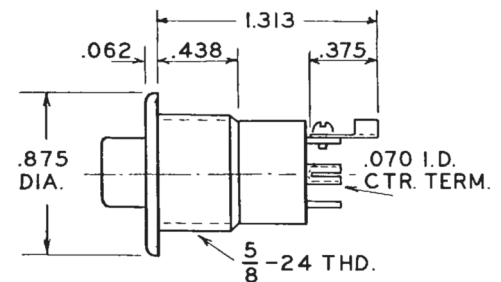
Style P3-3



Style P3-6



Style P3-7



Style P3-8

ORDERING INFORMATION:

Select the OTTO P3 switch to match your application requirements. Combinations of features are almost unlimited.

Example: P3-31111 is style 3 case, solder terminals, standard contact rating, SPST-N.O. contact configuration, 2.5 lbs. operating force, red button. For low level switching capability, specify P3-33111.

P3 PART NUMBER CODE

P3	-	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/Low Level	3. N.C. 3 Terminal	3. Push-Pull	3. Orange	
7. Style 7		4. Screw/Low Level	4. N.O. 3 Terminal		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 IP66S.

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: 1,000,000 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: 1,000,000 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: 1,000,000 cycles
Button: Black polyester
Housing: Clear anodized aluminum
P3-90037



Large Diameter Button

Gray nylon button is 1.187". Snaps on to special style body with leads. Dusttight sealed.
Operating Force: 2.5, +0.5, -1.0 lb.
Mechanical Life: 1,000,000 cycles
Rating: 10 amps Resistive
Circuit: SPDT 2 circuit
P3-30101-8



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



SEALED PUSHBUTTON SWITCHES

P3-D
DOME
PUSHBUTTONS

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 (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 low 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 low contact resistance for low level switching capability as well as full rated service.

The P3-D Dome is a quality precision snap-action switch designed for use in panels, control sticks, computers, instruments, heavy equipment and other demanding applications where attractive, rugged pushbutton switches are required.

Features:

- Attractive dome style button
- Two 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 available
- RoHS & WEEE compliant



Flush Dome Button



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz	Cycles
Resistive	10A	100,000
Resistive	15A	25,000
Inductive	5A	100,000
Lamp	3A	100,000
Center Contact	3A max	100,000
DVV	1050Vrms	
Low Level	10mA @ 30mV	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

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:

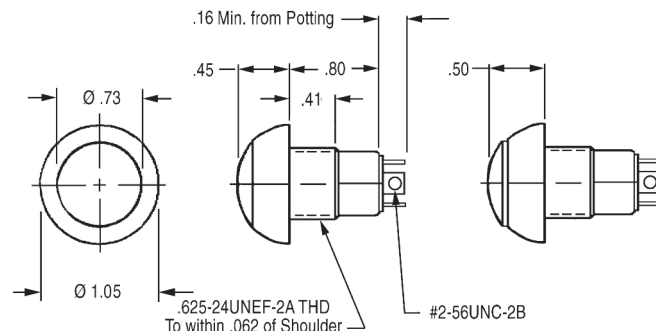
Case: Anodized aluminum alloy

Button: Thermoplastic

Terminals: Brass with silver plate, gold plate for low level

Terminal Hardware: Screws, lockwasher and terminal lugs

Mounting Hardware: Hex nut, lockwasher and panel seal when applicable



P3-D PART NUMBER CODE

P3-D	X	X	X	X	X	X	*
Button Style	Terminal Style/Rating	Circuit Form	Operating Force/Action	Bezel Color	Button Color		
1. Flush Dome	1. Solder/Std.	1. N.O.	1. 2.5 lbs./Momentary	1. Clear	1. Red		
2. Raised Dome	2. Screw/Std.	2. N.C.	2. 4.0 lbs./Momentary	2. Black	2. Black		
	3. Solder/Low Level	3. N.C. 3 Terminal			3. Orange		
	4. Screw/Low Level	4. N.O. 3 Terminal			4. Yellow		
		5. 5 Terminal			5. Green		
		6. 2 Circuit			6. Blue		
					7. Purple		
					8. Gray		
					9. White		

* Add "W" suffix for watertight to IP68S.

Example of building an OTTO Part Number: P3-D113124 is a switch with flush dome button, solder terminals, standard rating; N.C. 3 terminal circuit; 2.5 lbs. operating force, momentary action; black bezel; yellow color button.

BUSHING MOUNT PUSHBUTTONS FOR OTTO B2 & B3 BASICS



Sealed Construction

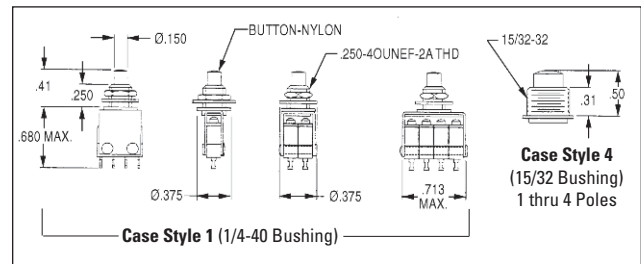
P4 series auxiliary actuators are designed to work with OTTO B2 (single break) and B3 (double break) basic switches. Auxiliary type actuators offer a wide variety of styles and types. Special basic switch characteristics can be specified to match your application needs. All case styles, except 1 and 4, feature OTTO's patented "rolling sleeve" principle and are sealed to IP64.



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

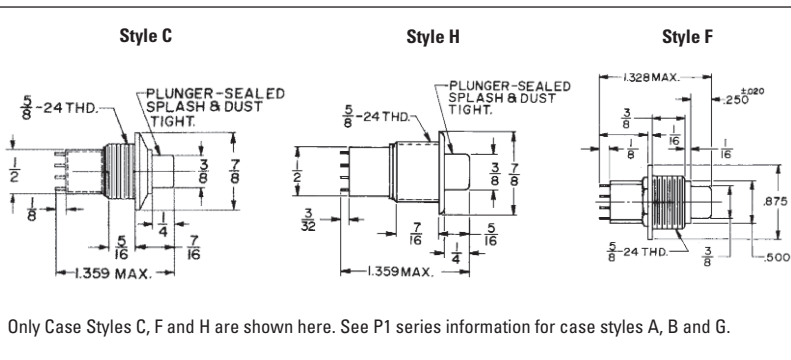


Sealed Construction

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, H and F are illustrated here. For styles A, B and G, see P1 series information. Buttons are available in nine colors. Basic switches are per MIL-PRF-8805/101.

Operating Force: 4.0 lbs. max

Use Part Number Code below to specify your requirements.



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, in two pole momentary action. Case styles are illustrated at left. The plunger seal is dusttight and moistureproof. Basic switches per MIL-PRF-8805/101.

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 ③		2. Turret	2. SPDT 4 Terminal		2. Two Step ②	2. Black	2. Black
3. Style C		3. Wire Wrap	3. DPDT 6 Terminal		3. RFI Shielded ② (Momentary)		3. Orange
4. 15/32-32 THD			4. DPDT 8 Terminal				4. Yellow
5. Style A ③			5. 3PDT 9 Terminal ①				5. Green
6. Style F			6. 3PDT 12 Terminal ①				6. Blue
7. Style G ③			7. 4PDT 12 Terminal ①				7. Purple
8. Style H			8. 4PDT 16 Terminal ①				8. Gray
							9. White

① Available in case styles 1 and 4 only.

② Not available in case styles 1 and 4.

③ See P1 Series information for front panel appearance details.

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.

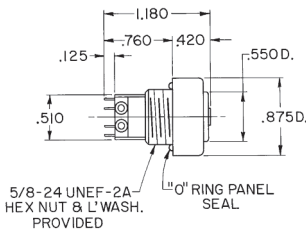
Operating Force:

1 Pole: 2.5 lbs. max

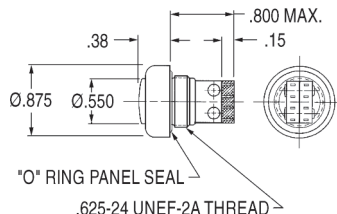
2 Pole: 4.0 lbs.

To order, please use table.

Part No. SPDT-DB	Part No. DPDT-DB	Button Color
P4-10050-1	P4-10149-1	Red
P4-10050-2	P4-10149-2	Black
N/A	P4-10149-3	Orange
N/A	P4-10149-4	Yellow
N/A	P4-10149-6	Blue
N/A	P4-10149-7	Purple
N/A	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:

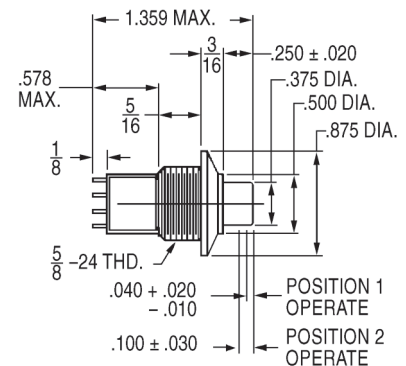
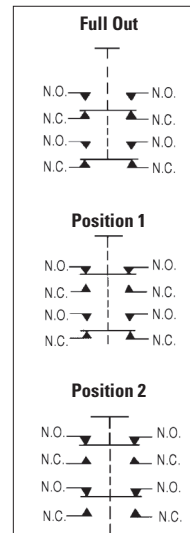
Position 1: 2.25 lbs. max

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, 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: Gold plate per MIL-PRF-8805/101-010

Button: Black nylon

P4-10044



BUSHING MOUNT PUSHBUTTONS FOR B2 & B3 BASICS

Square Button, Single Pole, 2 Circuit

This subminiature pushbutton switch features a button molded of Lexan.

Operating Force: 24 +/- 4 oz

Rating: 5 amps Resistive
3 amps Inductive

Contacts: Gold plate

White and other colors available.

P4-300015

**Vandal Resistant**

Brass plated dull nickel housing and button is watertight sealed. Ideal for unattended machines operated by the public.

Total Travel: 0.10" max

Operating Force: 4.0 lbs. max

Circuit: DPNO-DB

Mechanical Life: 250,000 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-S-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)

**Shroud Protected Button, 2 Pole**

Button is protected against accidental actuation by a black anodized shroud.

Operating Force: 4.0 lbs. +/- 1.0 lb.

Rating: 5 amps Resistive
2 amps Inductive @ 28VDC

Button: Red nylon

P4-900013

**Miniature with Shrouded Pushbutton, Unsealed**

Total Travel: 0.070" max

Operating Force: 2.5 lbs. max

Circuit: DPDT-DB

Rating: 8 amps Resistive @ 28VDC

Button: Black nylon

Housing: Clear anodized aluminum

Plunger: Unsealed

P4-10090

**Miniature with Shrouded Pushbutton, Dusttight Sealed**

Total Travel: 0.100" max

Operating Force: 4.0 lbs. max

Circuit: DPDT-DB

Rating: 8 amps Resistive @ 28VDC

Button: Black nylon

Housing: Black anodized aluminum

Plunger: Dusttight sealed

P4-900019



SEALED AGAINST DUST & MOISTURE

The P5 Alternate Action switches match the P1, P3 and P8 Momentary Action Pushbutton models for mixed function with common panel appearance. Now you can design panels with both alternate and momentary action switches and have uniform panel appearance. The P5 features alternate action in the same pushbutton and housing configuration as the momentary P1 and P3 and as a bonus, the P5 requires less behind the panel space than the P1 and P3 momentary versions.

Push and the P5 switch turns "on." Push again and the P5 switch turns "off." Positive tactile feedback is featured so the operator is clearly aware the switch mode has been executed. The button returns to the original position after each actuation.

To guard against front panel splash and dirt, the P5 series is sealed at the button with OTTO's patented "rolling sleeve" principle. The terminals are sealed with epoxy, providing a seal against flux during wiring and behind panel dirt and moisture. The combination of sealing provides smooth operation over a wide temperature range. Watertight sealing to IP68S is available.

A vandal resistant style is available in the P5-V series. Custom housings, shrouded buttons, contact configurations and materials 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 patented "rolling sleeve" principle
- Contact area sealed at case & terminals
- Moistureproof & dusttight to IP64 & MIL-PRF-8805 Design 2 or watertight to IP68S
- Less than 25mΩ contact resistance
- Handles low level up to 10 amps
- Variety of mounting styles
- Engraved buttons available
- Choice of nine button & three bezel colors
- Panel appearance matches most other OTTO momentary pushbutton switches
- Unsealed construction also available

"Push On, Push Off" action



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	10A
Inductive	5A
Lamp	1A
Motor	3A
DWV	1050Vrms
Low Level	10mA @ 30mV

Electrical Life: 25,000 cycles

Mechanical Life: 1,000,000 cycles

Seal: IP64 & MIL-PRF-8805 Design 2 or 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 low level

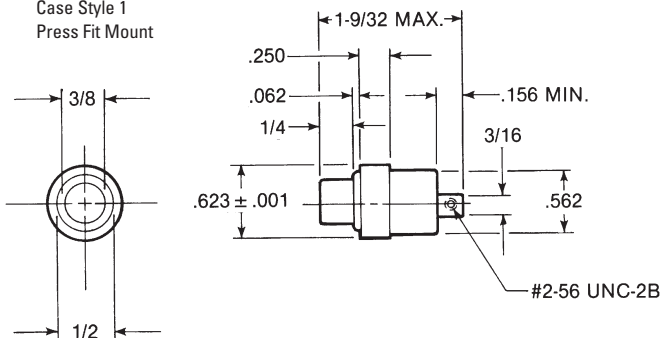
Terminal Hardware: Terminal lugs, lockwasher and screw for screw terminal option

Mounting Hardware: Hex nut, lockwasher and panel seal on watertight switches

SEALED AGAINST DUST & MOISTURE

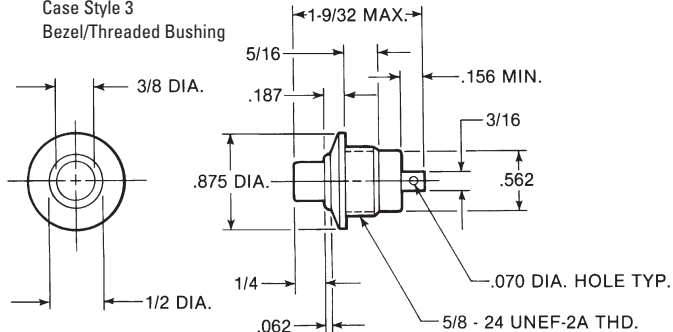
P5-1 Series

Case Style 1
Press Fit Mount



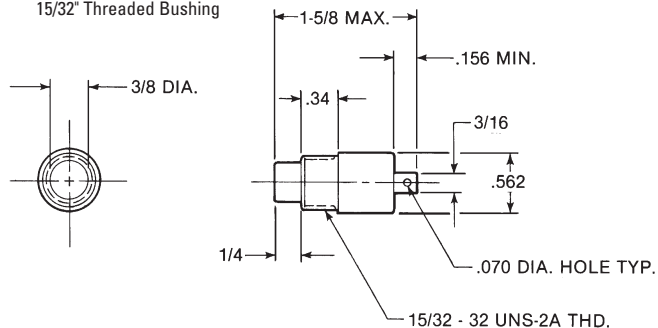
P5-3 Series

Case Style 3
Bezel/Threaded Bushing



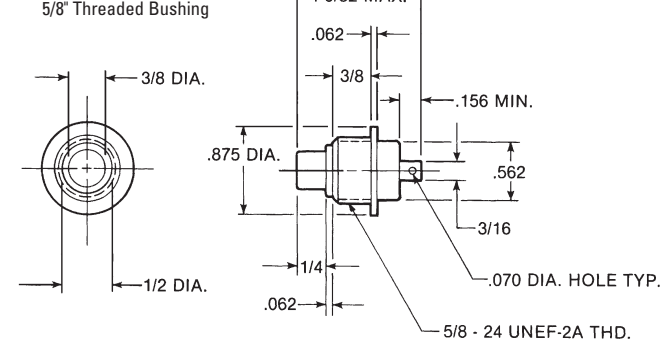
P5-4 Series

Case Style 4
15/32" Threaded Bushing



P5-6 Series

Case Style 6
5/8" Threaded Bushing



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. Silver	1. Red
3. Style 3	2. Screw ①	2. SPST/Gold/Commercial	2. Dusttight	2. Black	2. Black
4. Style 4		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

① Screw terminals available on SPST circuit forms only.

ORDERING INFORMATION:

Select the OTTO P5 series switch to match your application requirements. Combinations of features are almost unlimited. When ordering, specify the OTTO Part Number using the codes shown above.

Example: P5-111221 specifies case style 1, solder terminals, SPST form with silver contacts, commercial grade, sealed construction, black housing and red button.

ALTERNATE ACTION PUSHBUTTONS

P5-D
ALTERNATE
ACTION

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 1 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.

“Push On, Push Off” action



Flush Dome Button



Features:

- Two contoured button styles
- Button sealed with patented “rolling sleeve” principle
- Contact area sealed at case & terminals
- Less than 25mΩ contact resistance
- Handles low level up to 10 amps
- Choice of nine button colors
- Moistureproof & dusttight to IP64 & MIL-PRF-8805 Design 2 or watertight to IP68S options
- Unsealed construction also available

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	10A
Inductive	5A
Lamp	1A
Motor	3A
DWV	1050Vrms

Electrical Life: 25,000 cycles

Mechanical Life: 1,000,000 cycles

Seal: IP64 & MIL-PRF-8805 Design 2 or 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:

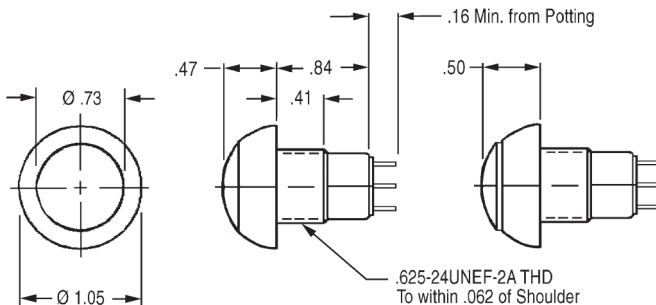
Case: Anodized aluminum alloy

Button: Thermoplastic

Terminals: Brass with gold plate over silver plate

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	Circuit Form/Contact Material/Grade	Seal Level	Bezel 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. 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 Screw terminals 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 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 or dusttight & moistureproof to IP64**
- **Less than 25mΩ contact resistance**
- **Handles low level up to 10 amps**
- **1 million mechanical cycle life**
- **RoHS & WEEE compliant**



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	10A
Inductive	5A
Lamp	1A
Motor	3A
DVV	1050Vrms
Low Level	10mA @ 30mV
Electrical Life:	25,000 cycles
Mechanical Life:	1,000,000 cycles
Seal:	IP64 or IP68S
Operating Temp Range:	-55°C to +85°C
Operating Force:	3.0 lbs. +/-0.5 lb.
Total Travel:	0.180 inches max
Overtravel:	0.012 inches min

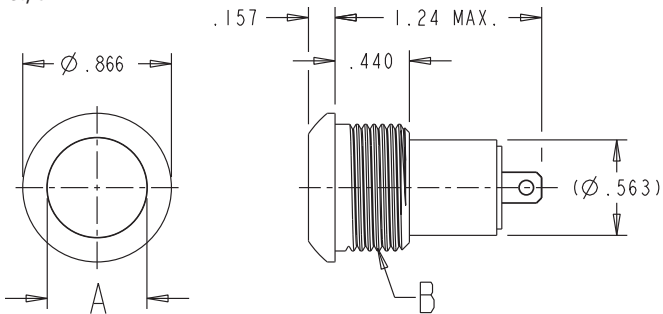
MATERIALS:

Case:	Anodized aluminum alloy or stainless steel
Button:	Anodized aluminum alloy or stainless steel
Terminals:	Brass with gold plate over silver plate
Terminal Hardware:	Screw, lockwasher and terminal lug when applicable
Mounting Hardware:	Hex nut or knurl nut, lockwasher and panel seal when applicable

SEALED AGAINST DUST & MOISTURE

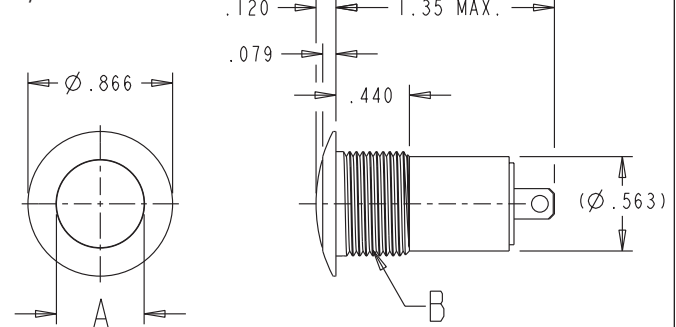
High Profile, Flat Button

Style 1



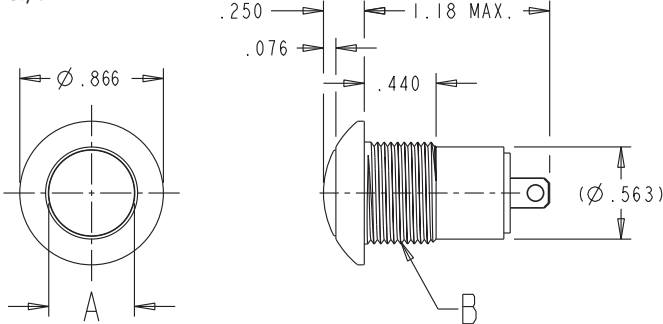
Low Profile, Curved Button

Style 4



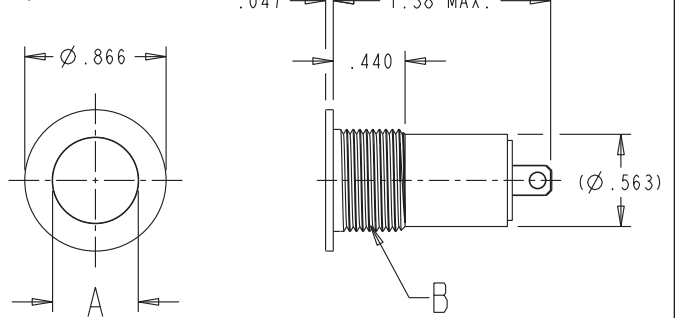
High Profile, Curved Button

Style 2



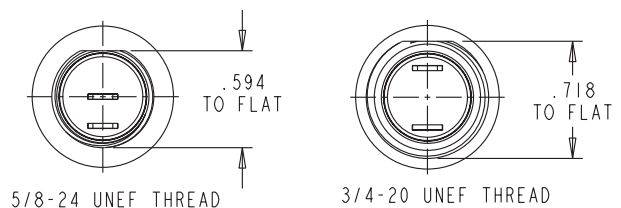
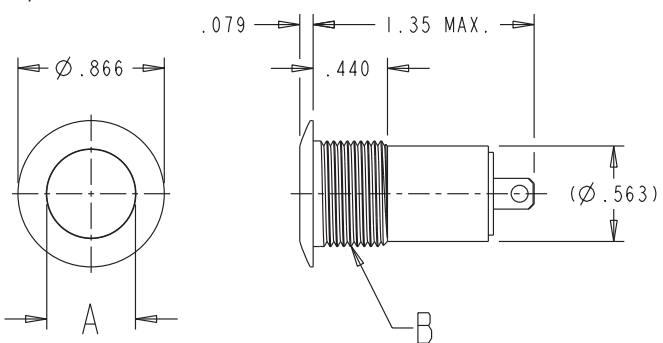
Flush Mount, Flat Button

Style 5



Low Profile, Flat Button

Style 3



Case Style		
Dimension	1 - 4	5 - 8
A (Button Dia.)	.525	.590
B (Thread)	0.625-24 UNEF-2A	0.750-20 UNEF-2A
D-Flat	.594	.718

P5 PART NUMBER CODE

Type	Thread	Terminal Style/ Bezel Color	Circuit Form/ Contact Material	Seal	Bezel Profile/ Button
V. Stainless A. Aluminum	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	1. Solder Terminal/Silver 2. Screw Terminal/Silver ② 3. Solder Terminal/Black ① 4. Screw Terminal/Black ①②	1. SPST/Silver 2. SPST/Gold 3. SPDT/Silver 4. SPDT/Gold	1. Dusttight 2. Watertight	1. High Profile/Flat Button 2. High Profile/Curved Button 3. Low Profile/Flat Button 4. Low Profile/Curved Button 5. Flush Profile

① Only Available on P5-A Styles.

② Screw terminals available on SPST circuits only.

MOMENTARY ACTION, SEALED SUB-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 allow the switch density today's technologies require in control grips and panels.

The long life snap-action design is protected from the environment by a silicon rubber boot, operating on a "rolling sleeve" principle that gives long sealed life and smooth operation.

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 case style has 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 contact resistance
- High contact pressure
- Six circuit variations
- Positive tactile feedback
- Variety of mounting styles
- Qualified to MIL-PRF-8805/110
- Moistureproof & dusttight to IP64 & MIL-PRF-8805 Design 2 or watertight to IP68S & MIL-PRF-8805 Design 3



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:		Sea Level @ 28VDC			50,000 feet @ 28VDC		
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
DVV		1050Vrms			400Vrms		
Center Contact					3A max		
Low Level					10mA @ 30mV		
Electrical Life:		25,000 cycles					
Mechanical Life:		1,000,000 cycles					
Seal:		IP64 and MIL-PRF-8805 Design 2 or 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 plate over silver plate					
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																																																																																																									
PC Pin Mounting Pattern (As viewed from switch bottom. See above drawings for terminal identification.)		P7 PART NUMBER CODE <table><tr><th>P7</th><th>-</th><th>X</th><th>X</th><th>X</th><th>X</th><th>X</th><th>X</th></tr><tr><th>Case Style</th><th>Terminal Style/Construction Grade</th><th>Circuit Form</th><th>Contact Rating</th><th>Bezel Color/Button Dia.</th><th>Button Color</th><th></th><th></th></tr><tr><td>1. Style 1</td><td>A. Std. Commercial Solder</td><td>1. N.O.</td><td>1. Std.</td><td>1. Clear/Std.</td><td>1. Red</td><td></td><td></td></tr><tr><td>2. Style 2</td><td>B. Std. Watertight</td><td>2. N.C.</td><td>2. Low Level</td><td>2. Black/Std.</td><td>2. Black</td><td></td><td></td></tr><tr><td>3. Style 3</td><td>Commercial Solder</td><td>3. N.C. 3 Terminal</td><td></td><td>3. Clear/0.312 ①</td><td>3. Orange</td><td></td><td></td></tr><tr><td>5. Style 5</td><td>1. Solder/Military/Short</td><td>4. N.O. 3 Terminal</td><td></td><td>4. Black/0.312 ①</td><td>4. Yellow</td><td></td><td></td></tr><tr><td>6. Style 6</td><td>2. Solder/Commercial/Short</td><td>5. 5 Terminal</td><td></td><td></td><td>5. Green</td><td></td><td></td></tr><tr><td>7. Style 7</td><td>3. Solder/Mil. Watertight/Short</td><td>6. 2 Circuit</td><td></td><td></td><td>6. Blue</td><td></td><td></td></tr><tr><td>8. Style 8</td><td>4. PC Pin/Commercial</td><td></td><td></td><td></td><td>7. Purple</td><td></td><td></td></tr><tr><td></td><td>5. PC Pin/Military</td><td></td><td></td><td></td><td>8. Gray</td><td></td><td></td></tr><tr><td></td><td>6. PC Pin/Mil. Watertight</td><td></td><td></td><td></td><td>9. White</td><td></td><td></td></tr><tr><td></td><td>7. Solder/Com. Watertight/Short</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>8. PC Pin/Com. Watertight</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>		P7	-	X	X	X	X	X	X	Case Style	Terminal Style/Construction Grade	Circuit Form	Contact Rating	Bezel Color/Button Dia.	Button Color			1. Style 1	A. Std. Commercial Solder	1. N.O.	1. Std.	1. Clear/Std.	1. Red			2. Style 2	B. Std. Watertight	2. N.C.	2. Low Level	2. Black/Std.	2. Black			3. Style 3	Commercial Solder	3. N.C. 3 Terminal		3. Clear/0.312 ①	3. Orange			5. Style 5	1. Solder/Military/Short	4. N.O. 3 Terminal		4. Black/0.312 ①	4. Yellow			6. Style 6	2. Solder/Commercial/Short	5. 5 Terminal			5. Green			7. Style 7	3. Solder/Mil. Watertight/Short	6. 2 Circuit			6. Blue			8. Style 8	4. PC Pin/Commercial				7. Purple				5. PC Pin/Military				8. Gray				6. PC Pin/Mil. Watertight				9. White				7. Solder/Com. Watertight/Short								8. PC Pin/Com. Watertight						
P7	-	X	X	X	X	X	X																																																																																																				
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① Not available with Case Styles 1, 2 & 5.

EXAMPLES OF CUSTOMIZED P7 SEALED PUSHBUTTONS

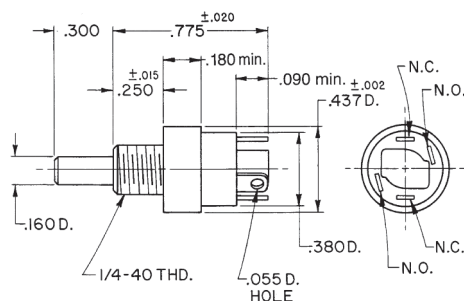


Special Longer Length Button

Panel seal gasket and watertight enclosure. Button is black nylon. Bezel is black anodized aluminum alloy.

Actuation
Momentary

OTTO Part Number
P7-500001



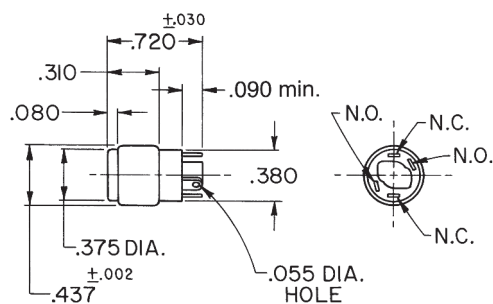
Special Large Button, Press Fit

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

Color
Red
Black
White

OTTO Part Number
P7-900001
P7-900002
P7-900009

Contact factory for additional button color options.



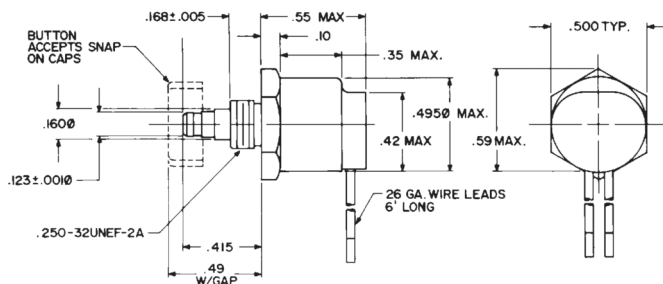
Special Snap-On Button, Wire Leads

Features changeable snap-on button caps available in two diameters and in a range of colors. Switch is splashproof sealed per MIL-S-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.



SEALED PUSHBUTTON SWITCHES

P7-D
DOME
PUSHBUTTONS

MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The P7-D pushbutton switch is a momentary switch with a contoured dome style pushbutton. Two design versions are offered; flush dome and raised dome button profile. The P7-D features a shorter behind panel depth, dusttight and moisture-proof sealed construction excellent mechanical and electrical performance while operating under the most severe conditions. 1 million operations at 1 amp resistive, 50,000 at full rated load of 5 amps resistive or 3 amps inductive.

The P7-D is a double break switch with momentary circuit, the 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. High contact pressure and unique contact design provide low contact resistance for low level switching capability as well as full rated service.

This quality precision snap-action switch is designed for use in instrument panels, grips, computers, heavy equipment and other applications where attractive rugged pushbutton switches are required.

Features:

- Attractive dome style buttons
- Low level switching capability
- Less than 25mΩ contact resistance
- High contact pressure
- Six circuit variations
- Positive tactile feedback
- Variety of mounting styles
- Constructed in accordance with MIL-PRF-8805/110 (no QPL)
- UL recognized
- Dusttight to IP64 & MIL-PRF-8805 Design 2 or watertight to IP68S

Raised Dome Button



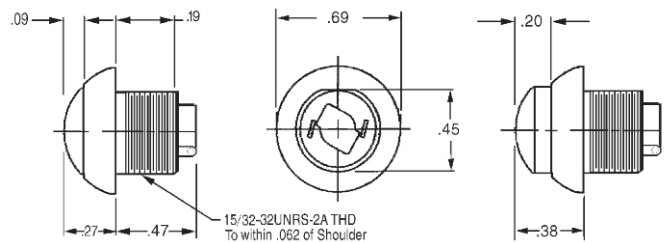
Flush Dome Button



Standard Characteristics/Ratings:

ELECTRICAL RATINGS: Sea Level @ 28VDC or 115VAC, 60/400Hz		
Load	N.O./N.C.	Life Cycles
Resistive	1A	1,000,000
Resistive	5A	50,000
Inductive	3A	50,000
DWV	1050Vrms	
Low Level	10mA @ 30mV max	25,000
Electrical Life: See Rating Chart		
Mechanical Life: 1,000,000 cycles		
Seal: IP64 & MIL-PRF-8805 Design 2 or IP68S		
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 plate over silver plate		
Terminal Hardware: None provided		
Mounting Hardware: Hex nut, lockwasher and panel seal on watertight versions		

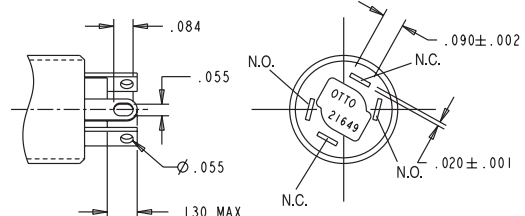
Terminal Style Short



P7-D PART NUMBER CODE

P7-D	X	X	X	X	X	X
Button Style	Terminal Style/Construction Grade	Circuit Form	Contact Rating	Bezel Color	Button Color	
F. Flush	A. Std. Commercial Solder	1. N.O.	1. Std.	1. Clear	1. Red	
R. Raised	B. Std. Watertight Commercial Solder	2. N.C.	2. Low Level	2. Black	2. Black	
	1. Solder/Military/Short	3. N.C. 3 Terminal			3. Orange	
	2. Solder/Commercial/Short	4. N.O. 3 Terminal			4. Yellow	
	3. Solder/Mil. Watertight/Short	5. 5 Terminal			5. Green	
	4. PC Pin/Commercial	6. 2 Circuit			6. Blue	
	5. PC Pin/Military				7. Purple	
	6. PC Pin/Mil. Watertight				8. Gray	
	7. Solder/Com. Watertight/Short				9. White	
	8. PC Pin/Com. Watertight					

Terminal Style "A" & "B"



Standard

NOTE: For PC mounting pattern, see P7 series.

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 pressure (120g/4.2 oz), low contact resistance (25mΩ max) and short contact bounce (5ms max) are the result of our patented 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 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
- Less than 25mΩ contact resistance
- 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



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	10A
Inductive	5A
Lamp	3A
Low Level	10mA @ 30mV
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 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

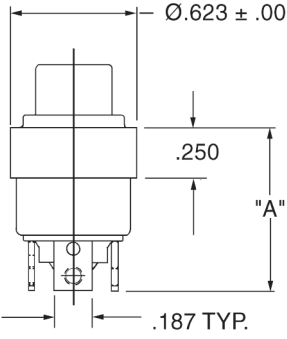
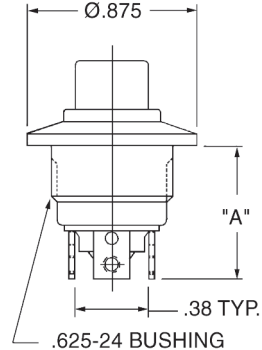
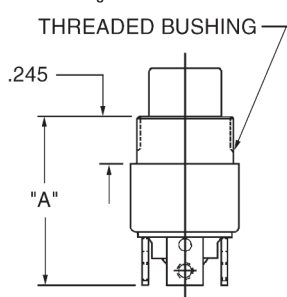
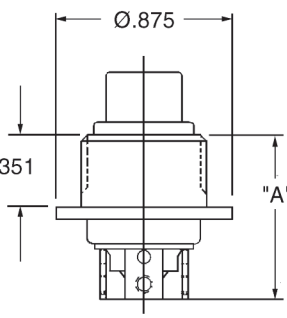
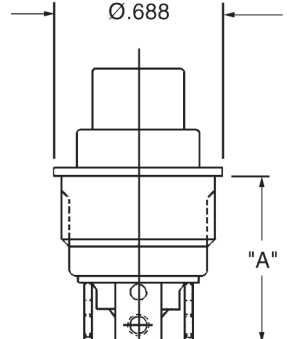
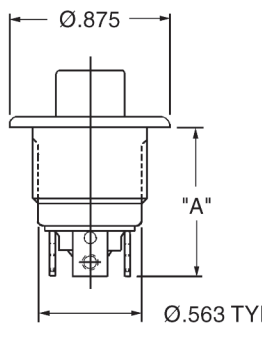
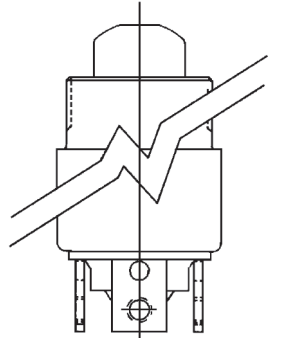
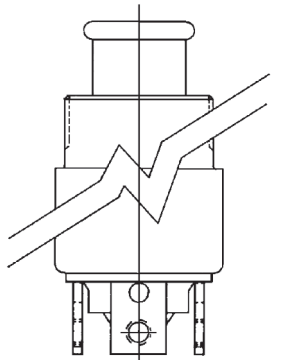
MATERIALS:

Case:	Anodized aluminum alloy
Button:	Thermoplastic
Terminals:	Brass with silver plate, gold plate for low level
Terminal Hardware:	Terminal lugs, screws and lockwasher where applicable
Mounting Hardware:	Hex nut, lockwasher, panel seal gasket when applicable

PUSHBUTTON SWITCHES

P8
COMPACT
PUSHBUTTONS

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"  <table><tr><th>Terminal Styles</th><th>"A" (inches)</th></tr><tr><td>1, 2, 4 & 5</td><td>0.808</td></tr><tr><td>3 & 6</td><td>0.922</td></tr></table>	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"  <table><tr><th>Terminal Styles</th><th>"A" (inches)</th></tr><tr><td>1, 2, 4 & 5</td><td>0.683</td></tr><tr><td>3 & 6</td><td>0.797</td></tr></table>	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" THREADED BUSHING  <table><tr><th>Model</th><th>Terminal Styles</th><th>"A" (inches)</th></tr><tr><td>P8-4</td><td>1, 2, 4 & 5</td><td>0.870</td></tr><tr><td></td><td>3 & 6</td><td>0.984</td></tr><tr><td>P8-5</td><td>1, 2, 4 & 5</td><td>1.097</td></tr><tr><td></td><td>3 & 6</td><td>1.211</td></tr></table>	Model	Terminal Styles	"A" (inches)	P8-4	1, 2, 4 & 5	0.870		3 & 6	0.984	P8-5	1, 2, 4 & 5	1.097		3 & 6	1.211	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"  <table><tr><th>Terminal Styles</th><th>"A" (inches)</th></tr><tr><td>1, 2, 4 & 5</td><td>0.808</td></tr><tr><td>3 & 6</td><td>0.922</td></tr></table>	Terminal Styles	"A" (inches)	1, 2, 4 & 5	0.808	3 & 6	0.922
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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"  <table><tr><th>Terminal Styles</th><th>"A" (inches)</th></tr><tr><td>1, 2, 4 & 5</td><td>0.683</td></tr><tr><td>3 & 6</td><td>0.797</td></tr></table>	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"  <table><tr><th>Terminal Styles</th><th>"A" (inches)</th></tr><tr><td>1, 2, 4 & 5</td><td>0.810</td></tr><tr><td>3 & 6</td><td>0.924</td></tr></table>	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. 																					
Terminal Styles	"A" (inches)																																			
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3 & 6	0.924																																			

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. For low level switching option, specify P8-316529B.

P8 PART NUMBER CODE

P8	—	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./Moistureproof	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. Low Level/Moistureproof ③		4. Yellow	D. 0.375"/0.187"/Dome	
6. Style F	5. Screw/Black		5. Low Level/Watertight ③		5. Green	E. 0.312"/0.250"/Flat	
7. Style G	6. Faston/Black ①		6. Std./Dusttight		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 low level current duty.

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

The P8 Vandal Resistant series is a durable, robust switch, offering the same quality and precision tactile feedback found in the standard P8 series. With a variety of case, mounting and terminal styles and a mechanical life of 1,000,000 cycles, this stainless steel sealed switch is ideal for door access security systems, public transit systems, emergency phones, traffic signals, industrial and process control environments and anywhere that ruggedness, durability and security are crucial.

OTTO P8 series pushbutton switches feature a shortened back of panel depth while offering all the features of the regular size P1 and P3 series switches. P8 series switches offer vastly improved electrical and mechanical life under extreme conditions found in most military and industrial environments.

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

High contact pressure (120g/4.2 oz), low contact resistance (25mΩ) and short contact bounce (5ms max) are all a result of our patented snap-action mechanism. These characteristics provide exceptional current carrying capabilities over the life of the switch. Optional low 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 or moistureproof & dusttight to IP64**
- **Positive tactile feedback**
- **Less than 25mΩ contact resistance**
- **Variety of case and button styles available**
- **Mechanical life 1 million cycles**
- **UL recognized**
- **UL1500 ignition protected**



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
Low Level	10mA @ 30mV

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 lbs. +0.5 /-1.0 lb. to 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

Button: Anodized aluminum alloy or stainless steel

Terminals: Standard silver plate with optional gold plate for low level applications

Terminal Hardware: Terminal lugs, screws and lockwasher when applicable

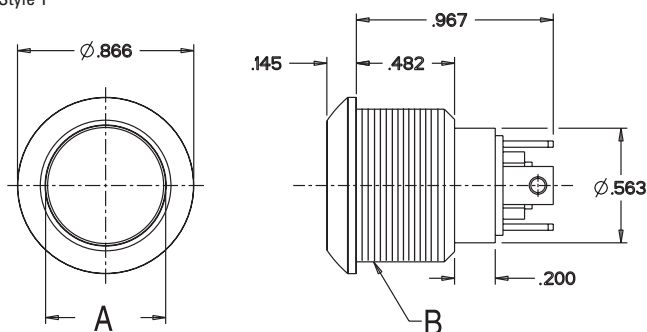
Mounting Hardware: Hex nut, lockwasher and panel seal gasket

VANDAL RESISTANT PUSHBUTTON SWITCHES

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

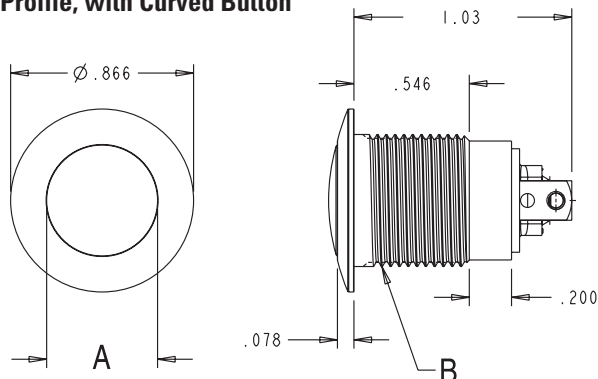
High Profile, with Flat Button

Style 1



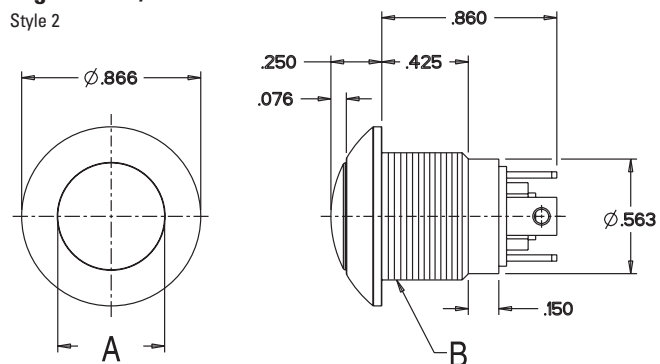
Low Profile, with Curved Button

Style 4



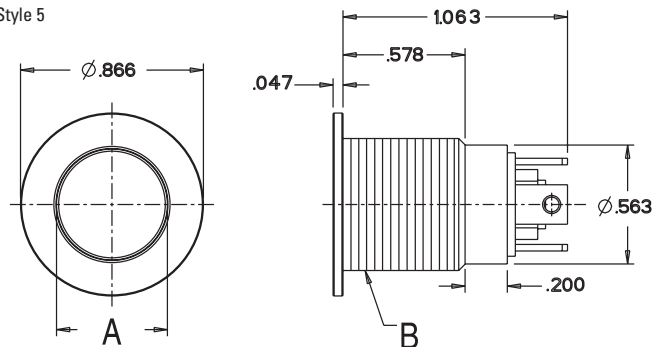
High Profile, with Curved Button

Style 2



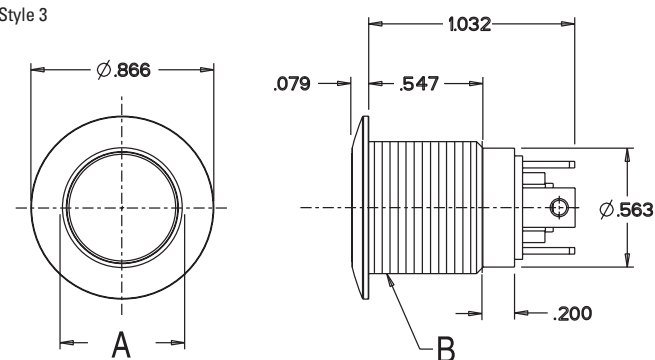
Flush Mount

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

Type	Case Style & Mounting	Terminal Style/ Case Color	Circuit Form	Current Rating/Seal	Operating Force	Button Profile
V. Vandal Resistant (SS Case & Button)	1. 5/8-24 & Hex Nut	1. Solder Terminal/Silver	1. N.O.	2. Std./Splashproof	1. 2.5 lbs.	1. High Profile/Flat Button
A. Security Level (AL Case & Button)	2. 5/8-24 & Knurl Nut	2. Screw Terminal/Silver	2. N.C.	3. Std./Watertight	2. 4.0 lbs.	2. High Profile/Curved Button
	3. 5/8-24 W/D-Flat & Hex Nut	3. Faston Terminal/Silver ②③	6. 2 Circuit	4. Low Level/Splashproof		3. Low Profile/Flat Button
	4. 5/8-24 W/D-Flat & Knurl Nut	4. Solder Terminal/Black ①		5. Low Level/Watertight		4. Low Profile/Curved Button
	5. 3/4-20 & Hex Nut	5. Screw Terminal/Black ①				5. Flush Profile
	6. 3/4-20 & Knurl Nut	6. Faston Terminal/Black ①②③				
	7. 3/4-20 W/D-Flat & Hex Nut					
	8. 3/4-20 W/D-Flat & Knurl Nut					

① Only available on P8-A Styles

② Overall length +0.12" for faston terminals

③ Faston receptacles: 0.187" on N.O.; 0.110" on N.C. terminals

MOMENTARY ACTION, ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The P9 Dome series pushbutton switches feature a contoured dome style pushbutton and share similar size and characteristics to the P7 series. Major differences are plastic housing construction and the availability of a shorting bar contact arrangement. There are two button versions: low button profile and high button profile. 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. They also offer excellent mechanical and electrical performance while operating under severe conditions found in demanding applications.

The P9 Dome series is offered in dusttight and moistureproof sealed construction. 1 million mechanical operations and an electrical life of 25,000 operations at full rated load of 5 amps resistive or 3 amps inductive.

Watertight sealing is available simply by adding a "W" suffix to the part number to specify IP68S rating.

The P9 Dome series is available in standard and low-force double break snap-action and non-snap shorting bar models. All are momentary action. Special contact variations are available. High contact pressure and unique contact design provide low contact resistance for low level switching capability as well as full rated service. Solder, PC Pin, and 0.110" Quick Connect termination options are available.

Positive tactile feedback signaling the operator when the switch is operated is available in snap-action models but not shorting bar models.

The P9 Dome series is a quality precision switch designed for use in panels, control grips, computers, instruments, heavy equipment and other demanding applications where attractive, rugged pushbutton switches are required.

Features:

- Attractive dome style button
- Two button heights
- Double break or shorting bar, 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
- Solder, PC Pin & 0.110" Quick Connect terminal styles
- Moistureproof & dusttight to IP64 or watertight to IP68S



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
DWV	1050Vrms
Low Level	10mA @ 30mV

Electrical Life: 25,000 cycles 5A @ 28VDC resistive snap-action

Mechanical Life: 1,000,000 cycles

Seal: IP64 or IP68S

Operating Temp Range: -55°C to +85°C

Operating Force: Standard: 1.7 lbs. +/- 0.5 lb.
Low Force: 12 oz +/- 4 oz
Shorting Bar: 18 oz +/- 6 oz

Total Travel: 0.080 inches max

Overtravel: 0.010 inches min

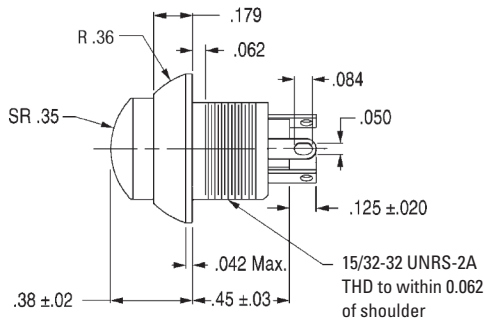
MATERIALS:

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

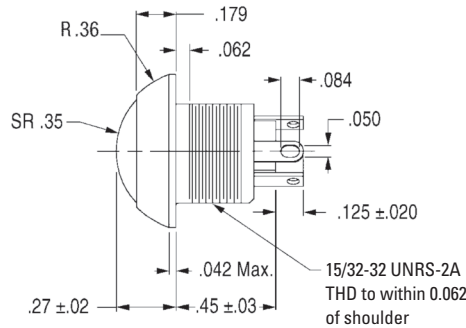
SEALED DOME PUSHBUTTON SWITCHES

P9
DOME
PUSHBUTTONS

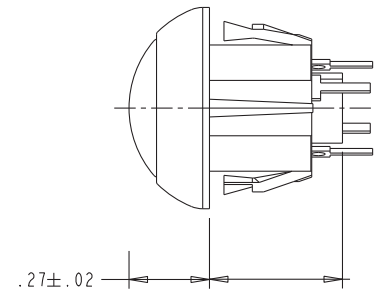
CHOICE OF SNAP-ACTION & SHORTING BAR ACTION



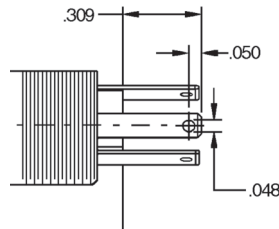
Raised Dome Button Style



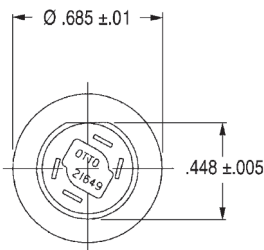
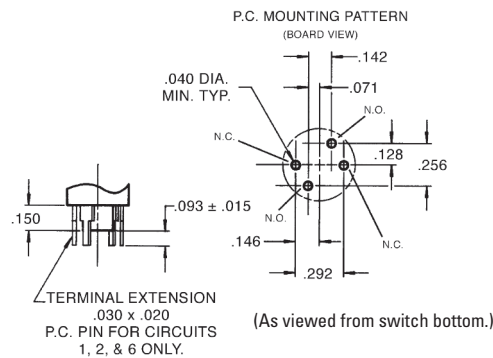
Flush Dome Button Style



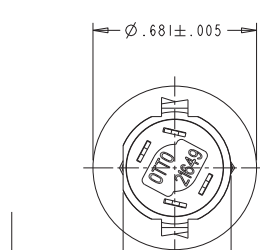
Snap-In Case
(PC Terminals Shown)



0.110" Quick Connect Detail



Solder Terminals
(Terminals not orientated to flat)



PC Pin
(Orientated to case flats as shown)

Recommended Panel Openings		
*Panel Thickness	Recommended Ø	DIM. Across D-Flat
0.024*	0.505	0.460
0.031	0.505	0.460
0.118*	0.505	0.460
0.125	0.505	0.460

* Must use panel gasket 401669 supplied with the switch.

- Snap-in case allows front panel mounting into 0.024" or 0.118" thick panels using panel gasket 401669 or into 0.031" and 0.125" thick panels
- 0.110" Quick Connect terminals allow reliable, solderless wire connections
- Flush Neoprene Boot P/N 402339
- Raised Neoprene Boot P/N 402246

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.

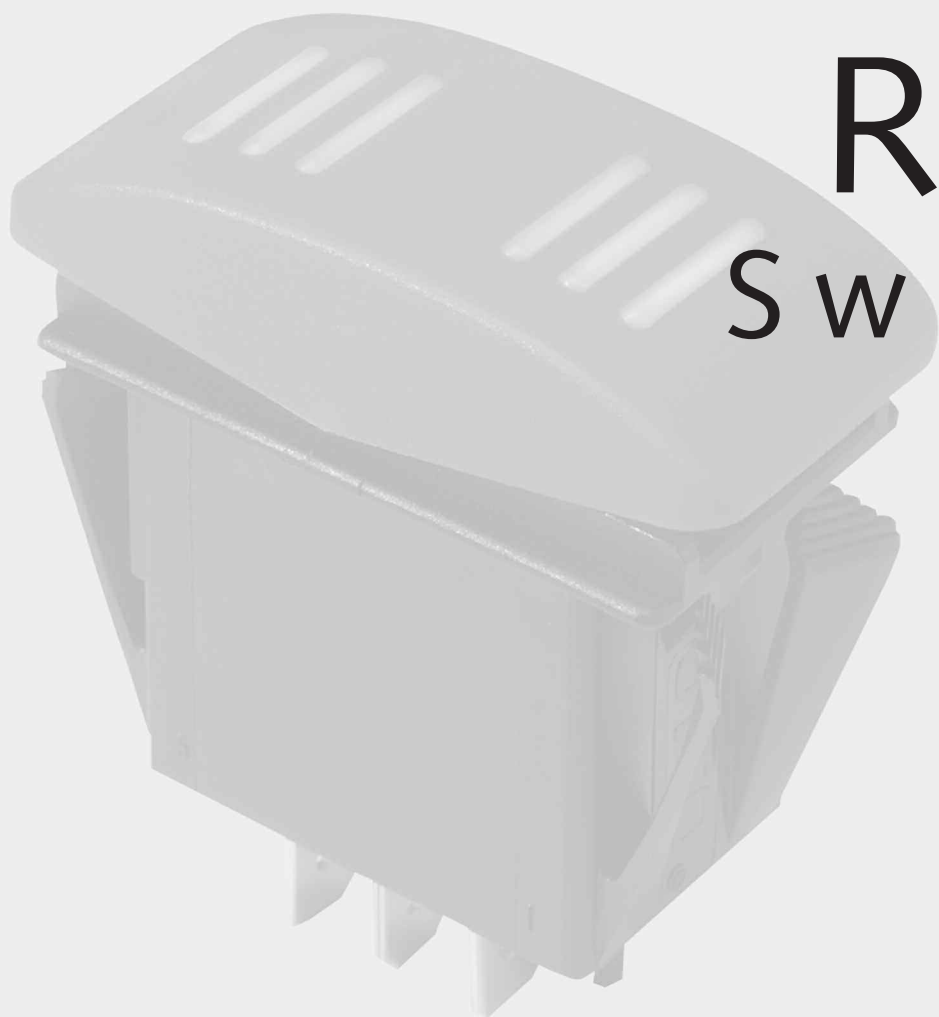
P9 PART NUMBER CODE						
P9	—	X	X	X	X	X *
Button & Case Style***		Terminal Style	Circuit Form	Switch Action	Case/ Bezel Color	Button Color
1. Flush Dome & Threaded Case, Std. Finish		1. Solder	1. N.O.	1. Standard Snap-Action	1. Red	1. Red
2. Raised Dome & Threaded Case, Std. Finish		2. PC Pin	2. N.C. ①	2. Low Force Snap-Action	2. Black	2. Black
3. Flush Dome & Snap-In Case, Std. Finish		3. 0.110"	3. 2 Circuit ①	3. Non-Snap Shorting Bar	3. Orange**	3. Orange
4. Raised Dome & Snap-In Case, Std. Finish		Quick Connect			4. Yellow**	4. Yellow
5. Flush Dome & Threaded Case, Matte Finish					5. Green**	5. Green
6. Raised Dome & Threaded Case, Matte Finish					6. Blue**	6. Blue
7. Flush Dome & Snap-In Case, Matte Finish					7. Purple**	7. Purple
8. Raised Dome & Snap-In Case, Matte Finish					8. Gray**	8. Gray
					9. White	9. White

① Not available in Shorting Bar version.

* Add "W" suffix for watertight to IP68S.

** Contact factory for minimum requirement.

*** Contact factory for std./matte button/case combination options.



Rocker Switches

SERIES	FEATURE	MAX RATING (Resistive @ 120VAC, 28VDC)	SEAL RATING	APPROVALS	MOUNTING (Panel Opening)	CIRCUITRY
K1	Sealed, Illuminated	16A	IP68S	UL (E61705), CSA (LR43865), DEMKO (97-01807), (UL1500), Ignition Protected, RoHS & WEEE Compliant	1.115" x 0.515"	SPST, SPDT
K2	Sealed, Illuminated	16A	IP68S	UL (E61705), CSA (LR43865), DEMKO (97-01807), (UL1500), Ignition Protected, RoHS & WEEE Compliant	1.115" x 0.900"	SPST, SPDT DPST, DPDT
K3	Sealed, Illuminated	20A	IP68S	RoHS & WEEE Compliant	1.750" x 0.915"	SPST, SPDT DPST, DPDT, SPTT
K4	Snap-In Toggle, Illuminated	16A	IP68S	RoHS & WEEE Compliant	1.115" x 0.900"	SPST, SPDT DPST, DPDT
K5	Sealed, Illuminated	20A	IP68S	RoHS & WEEE Compliant	1.475" x 0.875"	SPST, DPDT SPDT, DPDT, SPTT

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. Sealed to IP68S with an optional panel seal available.

The K1 series is offered in single pole configuration while the K2 series is available in 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 specified.

A choice of models are offered to handle power levels to 16 amps, 1/2 HP and low level electronic switching applications.

OTTO can provide custom colors upon request. Value-added assemblies with wire leads are also available. Please consult the factory for assistance.



K1 Series
Single Pole



K2 Series
Single & Double Pole



Features:

- Withstands direct water spray
- Watertight to IP68S
- 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 and 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 & CSA recognized
- Ignition protected
- RoHS & WEEE compliant

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 125/250VAC, 60Hz	Cycles
Resistive	16A	25,000
Resistive	10A	50,000
Inductive	10A	25,000
Lamp	5A	25,000
Motor	0.5HP	25,000
DWV	1050Vrms except across light terminals	
Low Level	10mA @ 30mV	

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

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 low 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

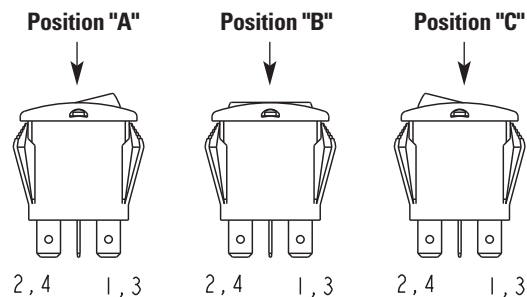
LOW COST, SNAP-IN ROCKER FOR WET & DUSTY ENVIRONMENTS

K1 PART

K1	X	X
Terminal Style/ Switch Rating	Actuator Color/Style	
A. Q.C./Std.	A. Red/Rocker	
B. Screw/Std.	B. Black/Rocker	
C. Solder/Std.	C. White/Rocker	
D. Q.C./Low Level	D. Red/Paddle	
E. Screw/Low Level	E. Black/Paddle	
F. Solder/Low Level	F. White/Paddle	
G. PC Pin/Std.	G. Red/Rocker Pinned	
H. PC Pin/Low Level	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	

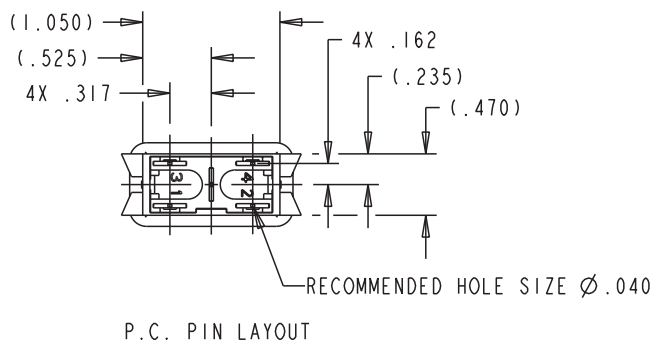
	Switch Action/Circuit			
	Position "A"	Position "B"	Position "C"	Circuit
A.	ON	None	OFF	SPST
B.	ON	None	ON	SPDT
C.	(ON)	None	OFF	SPST
D.	(ON)	None	ON	SPDT
E.	(ON)	OFF	(ON)	SPDT
F.	ON	OFF	ON	SPDT
G.	(ON)	OFF	ON	SPDT

NOTE: () denotes momentary action.



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.
- K1 panel plug P/N C401561-XX. Contact factory for color selection.
- 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.
- OTTO-02 denotes Mexico manufacturing location.



SEALED, ILLUMINATED ROCKER SWITCHES

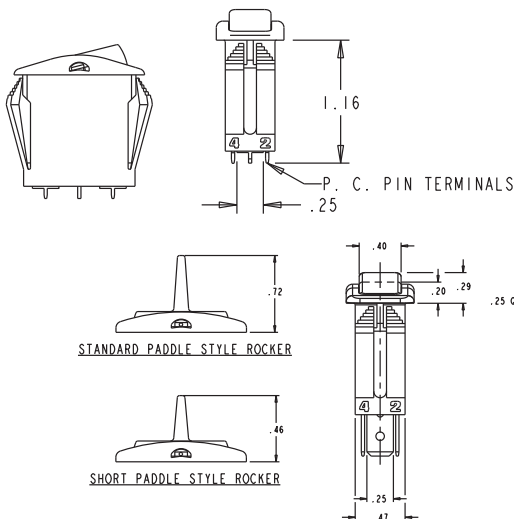
K1
SNAP-IN
ROCKERS

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

NUMBER CODE

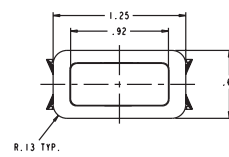
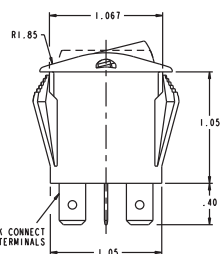
X Light Type A. No Light B. 6V Incandescent C. 12V Incandescent D. 24V Incandescent E. 125VAC Neon F. 250VAC Neon G. 2V Red LED H. 2V Green LED J. 2V Amber LED K. 6V Red LED L. 6V Green LED M. 6V Amber LED N. 12V Red LED P. 12V Green LED Q. 12V Amber LED R. 24V Red LED S. 24V Green LED T. 24V Amber LED	X X Lens Color Position "A" A. No Lens B. Red C. Green D. Amber E. Clear Position "C" A. No Lens B. Red C. Green D. Amber E. Clear	X Light/Circuit Location A. No Light B. Dependent Light ON in position "A" Wired to terms 1 & 3 C. Dependent Light ON in position "C" Wired to terms 2 & 4 D. Independent Light at position "A" Wired to terms 3 & 4 E. Independent Light at position "C" Wired to terms 3 & 4 F. Dependent Light ON in position "A" Wired to terms 1 & 3 G. Dependent Light ON in position "C" Wired to terms 2 & 4 H. Independent Light at position "A" Wired to terms 3 & 4 I. Independent Light at position "C" Wired to terms 3 & 4 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.	X Legend & Orientation A. None B. C. D. E. F. G. H. J. K. L. M. N. P. R.
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K1 Series

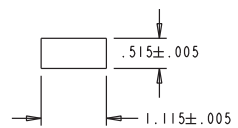


Panel cutout dimensions are for reference only. Differences in panel material and thickness may require changes to the panel cutout for optimum fit.

Optional Panel Gasket 0.062" thickness P/N 807039-1
0.031" thickness P/N 807039-2



RECOMMENDED PANEL THICKNESS: .025 MIN. - .187 MAX
DIMENSION SHOWN FOR .125 THK PLASTIC PANEL.
SPECIFIC PANEL OPENING DIMENSION RANGE
DEPENDENT ON PANEL THICKNESS AND MATERIAL.



TERMINAL STYLES

ALL TERMINALS ARE .032 THICK

SCREW	QUICK CONNECT	SOLDER LUG	P.C. PIN
#6-32 THD	Ø.000	Ø.11	Ø.10
.25	.25	.25	.25

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

K2 PART

K2 **X**

**Terminal Style/
Switch Rating**

A. Q.C./Std.
B. Screw/Std.
C. Solder/Std.
D. Q.C./Low Level
E. Screw/Low Level
F. Solder/Low Level

X **X**

Actuator Color/Style

A. Red/Rocker
B. Black/Rocker
C. White/Rocker
D. Red/Paddle
E. Black/Paddle
F. White/Paddle
G. Red/Short Paddle Pinned
H. Black/Short Paddle Pinned
J. White/Short Paddle Pinned
K. Red/Paddle Pinned Std.
L. Black/Paddle Pinned Std.
M. White/Paddle Pinned Std.
N. Red/Rocker Pinned
P. Black/Rocker Pinned
R. White/Rocker Pinned

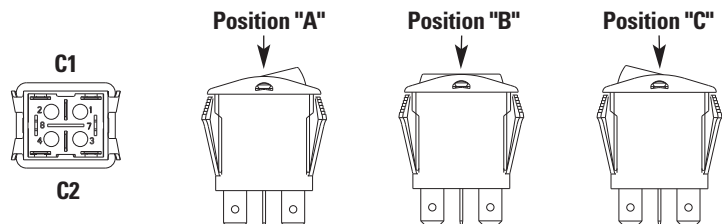
NOTE: For custom colors, contact factory.

X

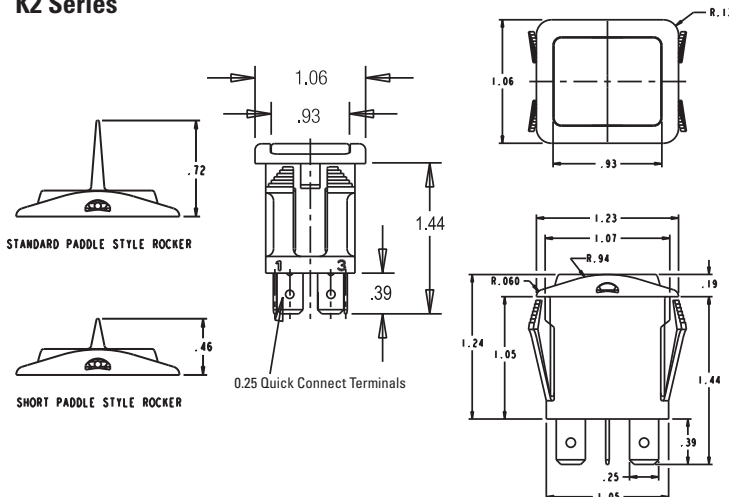
Switch Action/Circuit

	Position "A"	Position "B"	Position "C"	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.	ON	None	OFF	DPST
J.	ON	None	ON	DPDT
K.	(ON)	None	OFF	DPST
L.	(ON)	None	ON	DPDT
M.	(ON)	OFF	(ON)	DPDT
N.	ON	OFF	ON	DPDT
P.	(ON)	OFF	ON	DPDT
Q.	ON	None	(ON)	SPDT
R.	OFF	None	(ON)	SPST
S.	ON	None	(ON)	DPDT
T.	OFF	None	(ON)	DPST
U.	ON	OFF	(ON)	SPDT
V.	ON	OFF	(ON)	DPDT

NOTE: () denotes momentary action.



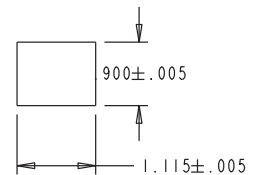
K2 Series



Panel cutout dimensions are for reference only. Differences in panel material and thickness may require changes to the panel cutout for optimum fit.

Optional Panel Gasket 0.062" thickness P/N 807038-1
0.031" thickness P/N 807038-2

PANEL THICKNESS: .025 MIN. - .187 MAX.
DIMENSION SHOWN FOR .125 THK PLASTIC PANEL.
SPECIFIC PANEL OPENING DIMENSION RANGE
DEPENDENT ON PANEL THICKNESS AND MATERIAL.



TERMINAL STYLES
ALL TERMINALS ARE .032 THICK

SCREW	QUICK CONNECT	SOLDER LUG
 #6-32 THD	 Ø.080	 Ø.11

SEALED, ILLUMINATED ROCKER SWITCHES

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

NUMBER CODE

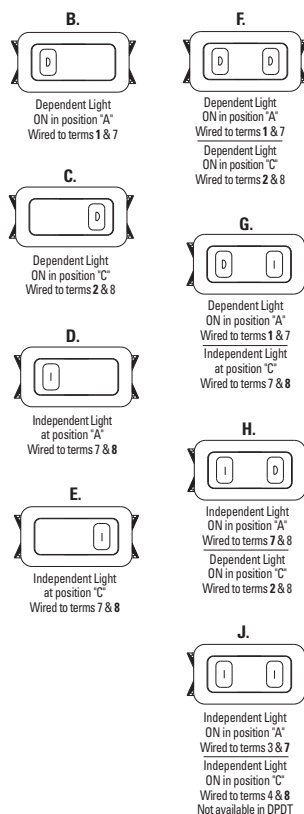
X Light Type	X Lens Color	
	Position "A"	Position "C"
A. No Light	A. No Lens	A. No Lens
B. 6V Incandescent	B. Red	B. Red
C. 12V Incandescent	C. Green	C. Green
D. 24V Incandescent	D. Amber	D. Amber
E. 125VAC Neon	E. Clear	E. Clear
F. 250VAC Neon		
G. 2V Red LED		
H. 2V Green LED		
J. 2V Amber LED		
K. 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 lamp only to be coded with clear or amber lenses.
- LED lenses must be clear or same color as LED.
- K2 connector P/N C801765.
- 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
- K2 panel plug P/N C100695-X. Contact factory for color selection.
- 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.
- OTTO-02 denotes Mexico manufacturing location.

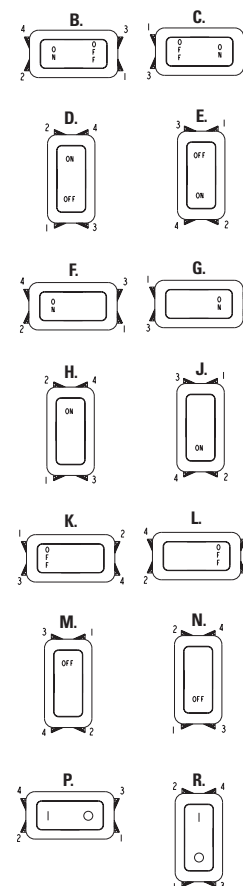
Light/Circuit Location

A. No Light



Legend & Orientation

A. None



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.

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

The 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 low 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 low 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
- 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
- Low level up to 20 amp switch
- Configurable Single Pole Triple Throw (SPTT) with external jumpers
- RoHS & WEEE compliant



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 12/28VDC, 60Hz	Sea Level @ 125VAC, 60Hz
Resistive	20A	16A
Inductive	15A	15A
Lamp	5A	5A
Motor	0.5HP @ 110VAC	
DWV	1050Vrms except across light terminals	
Low Level	10mA @ 30mV	

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

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 low 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

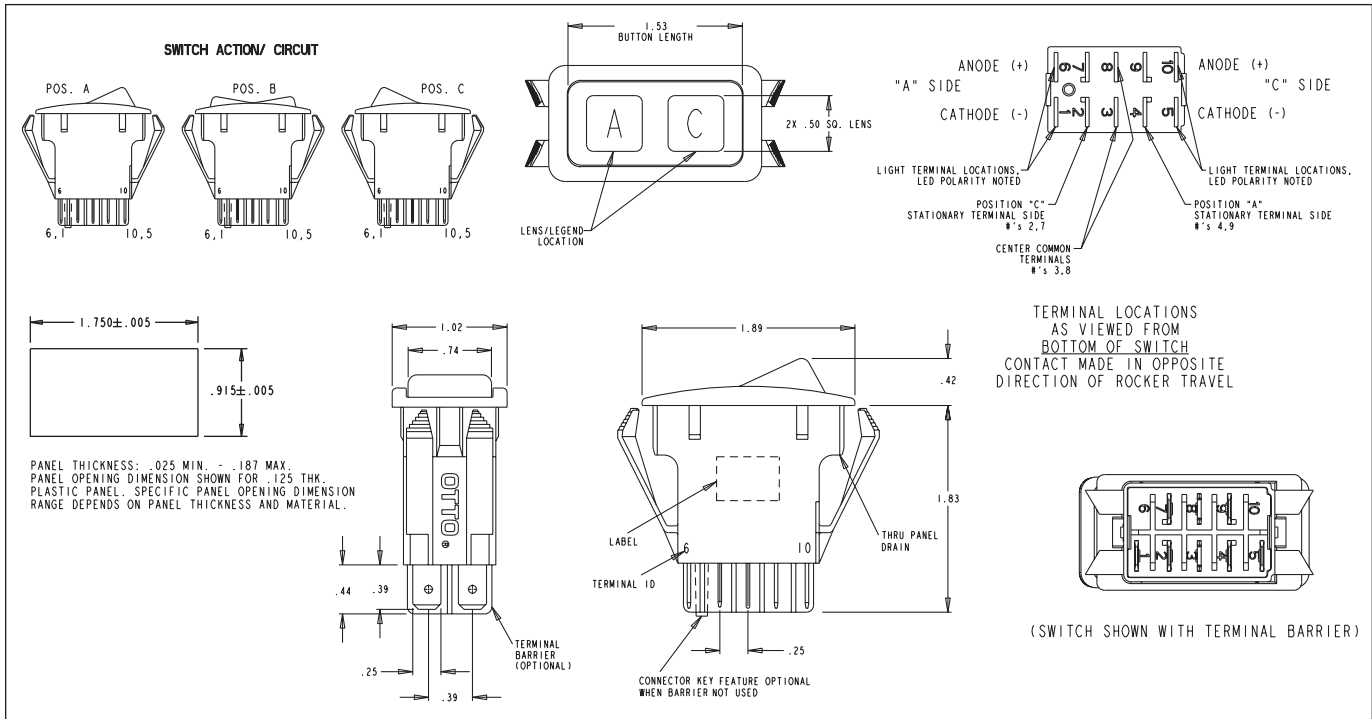
SNAP-IN PANEL MOUNTING

Standard Legends Per SAE Specifications

A1  ANCHOR	K2  UNLOCK	P5  BILGE BLOWER
B1  BATTERY	L1  LIGHT	R1  LIFT
B2  ELECTRIC POWER	L2  MASTER LIGHTING SWITCH	R2  LOWER
C1  AC/COOLING SYSTEMS	L3  HEADLIGHTS	R3  UP
C2  DEHUMIDIFIER	L4  HEADLIGHTS-LOW/ DIPPED BEAM	R4  DOWN
C3  HEATER/INTERIOR HEATING	L5  HEADLIGHTS-HIGH/ UPPER BEAM	R5  RIGHT
D1  WINDSHIELD DEFROSTER	L6  PARKING LIGHT	R6  LEFT
D2  REAR WINDOW DEFROSTER	L7  WORK LAMP	R7 FWD FORWARD
D3  MIRROR DEFROSTER	L8  WORK LAMP	R8 REV REVERSE
E1  ENGINE/START	L9  INTERIOR DOME LIGHT	S1  RADIO
E2  ENGINE/STOP	M1  BEACON	S2  MUTE
E3  ON/START	M2  HAZARD/POSITION LIGHTS	T1  FAST
E4  OFF/STOP	M3  CLEARANCE LIGHTS	T2  SLOW
E5 ON ON	M4  SIDE MARKER LIGHT	T3  TRIM TAB/ TRIMMING OPERATION
E6 OFF OFF	M5  RUNNING LIGHTS (UNDER POWER)	T4  TRANSMISSION
E7  ENGINE ELECTRIC PREHEAT	M6  ANCHOR LIGHT	V1  VENTILATING/AC FAN
E8  ENGINE-GAS INJECTION	M7  RUNNING/ANCHOR LIGHTS	W1  WINDSHIELD WIPER
F1  FRONT FOG LIGHTS	M8  SEARCH LIGHT	W2  WINDSHIELD-WASHER
F2  REAR FOG LIGHTS	M9  LEFT TURN SIGNAL	W3  WINDSHIELD-WASHER/WIPER
G1  FUEL	MA  RIGHT TURN SIGNAL	W4  REAR WINDOW WIPER
H1  HORN	P1  BILGE PUMP #1	W5  REAR WINDOW-WASHER
H2  HORN REAR	P2  BILGE PUMP #2	W6  REAR WINDOW-WASHER/WIPER
K1  LOCK	P3  BILGE PUMP #3	ZZ NO LEGEND
	P4  BILGE PUMP	

For legends not shown, please consult an OTTO representative.

SNAP-IN PANEL MOUNTING



K3 SERIES

K3		X		XX		X		X	
Base Options		Case Style/Button Color		Switch Action/Circuit		Light Source Type		Light Circuit	
A. With Keying Pin Only Standard Rating Silver Plate		A. Case With Drain Holes Button Color: Black		Position "A"	Position "B"	Position "C"	Circuit	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	Circuit Terminal Connections
B. Without Barriers or Pin Standard Rating Silver Plate		B. Case Without Drain Holes Button Color: Black		1A. 3-4	None	OFF	SPST	A. None B. Dep. in "A"	None 1(-) & 4(+)
C. With Terminal Barriers Only Standard Rating Silver Plate		C. Case With Drain Holes Button Color: Red		2A. 3-4/8-9	None	OFF	DPST	C. Dep. in "C"	2(+) & 5(-)
D. With Keying Pin Only Low Level Rating Gold Plate		D. Case Without Drain Holes Button Color: Red		1B. 3-4	None	3&2	SPDT	D. Ind. in "A"	1(-) & 6(+)
E. Without Barriers or Pin Low Level Rating Gold Plate		E. Case With Drain Holes Button Color: White		2B. 3-4/8-9	None	3-2/8-7	DPDT	E. Ind. in "C"	5(-) & 10(+)
F. With Terminal Barriers Only Low Level Rating Gold Plate		F. Case Without Drain Holes Button Color: White		1C. (3-4)	None	OFF	SPST	F. Dep. in "A"	1(-) & 4(+)
G. With Keying Pin Only Standard Rating No Plate		NOTE: Switch case is black for all options below:		2C. (3-4)/(8-9)	None	OFF	DPST	G. Dep. in "C"	2(+) & 5(-)
H. Without Barriers or Pin Standard Rating No Plate		1. Case With Drain Holes Button Not Included		1D. (3-4)	None	3-2	SPDT	H. Ind. in "A"	1(-) & 6(+)
J. With Terminal Barriers Only Standard Rating No Plate		2. Case Without Drain Holes Button Not Included		2D. (3-4)/(8-9)	None	3-2/8-7	DPDT	I. Dep. in "C"	2(+) & 5(-)
				1E. (3-4)	OFF	(3-2)	SPDT	J. Ind. in "A"	1(-) & 6(+)
				2E. (3-4)/(8-9)	OFF	(3-2)/(8-7)	DPDT	Ind. in "C"	5(-) & 10(+)
				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		

SEALED, ILLUMINATED ROCKER SWITCHES

K3
SEALED
ROCKERS

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

K3..1M...	K3..2A...	K3..2B...	K3..2C...	K3..2D...
GENERAL SCHEMATIC INFORMATION ○ INDICATES MAINTAIN ACTION (FIXED POSITION) ▼ INDICATES MOMENTARY ACTION (AUTOMATIC RETURN POSITION) FOR OTHER LIGHTING SCHEMATICS REPLACE FOLLOWING SYMBOLS: INCANDESCENT (REPLACE RESISTOR & LED) NEON (REPLACE LED)	K3..2E...	K3..2F...	K3..2G...	K3..2BNC-Z
K3..2BND-Z	K3..2BNE-Z	K3..2BNF...	K3..2BNG...	K3..2BNH...

PART NUMBER CODE

Lens Color		Legend Style		Legend Color		Legend Orientation	
Position "A"	Position "C"	Position "A"	Position "C"	Position "A"	Position "C"	Position "A"	Position "C"
1. Transparent Red	1. Transparent Red	ZZ. No Legend	ZZ. No Legend	1. Red	1. Red	1. Std.	A C
2. Transparent Green	2. Transparent Green			2. Black	2. Black	2. 90°	A C
3. Transparent Amber ①	3. Transparent Amber ①			9. White	9. White	3. 180°	A C
4. Clear ①	4. Clear ①			B. Backlight/Daylight White ④	B. Backlight/Daylight White ④	4. 270°	A C
5. Translucent White ②	5. Translucent White ②			D. Backlight/Deadfront ④	D. Backlight/Deadfront ④		
Z. No Lens ③	Z. No Lens ③			Z. No Legend	Z. No Legend		

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.

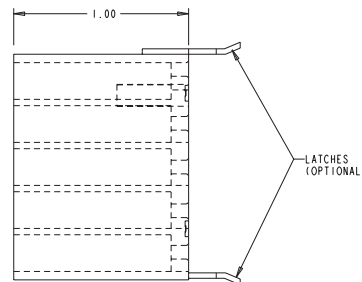
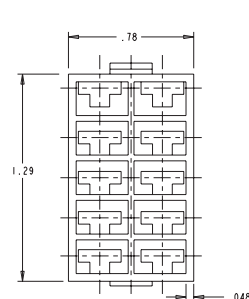
- ① Recommended for neon lamps.
② Special Order: Ultra bright green LED to be used with translucent white lenses.
③ Legend colors "B" & "D" are only available on lens color "Z".

STOP HERE for
lighted switches
without legends.

Example: K3AAIFNH-44

STOP HERE for
unlighted switches
without legends.

Example: K3AAIFAA



Recommended Quick Connect Terminals:
AMP 60253-2 for 12-16 AWG
AMP 42100-2 for 14-18 AWG

K3 Connector

P/N 801775-2A Without Latches
P/N 801775-2B With Latches

Panel Seal Gasket

P/N 807037

Order separately for use with switches without drain holes.

Panel Plug

P/N K300000040 Black Unsealed
P/N K300000030 Black Sealed

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 low 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 low 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
- 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
- Low level up to 20 amp switch
- Configurable Single Pole Triple Throw (SPTT) with external jumpers
- Soft Touch rocker style available
- RoHS & WEEE compliant



Raised Bars Shown

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC, 60/400Hz	Sea Level @ 115VAC, 60/400Hz
Resistive	20A	16A
Inductive	15A	15A
Lamp	5A	5A
Motor	0.5HP @ 110VAC	
DVV	1050Vrms except across light terminals	
Low Level	10mA @ 30mV	

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

Operating Temp Range: -40°C to +85°C

MATERIALS:

Case:	Thermoplastic
Button:	Thermoplastic
Terminals/Contact:	Brass, silver alloy with silver plate, gold flash for low 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

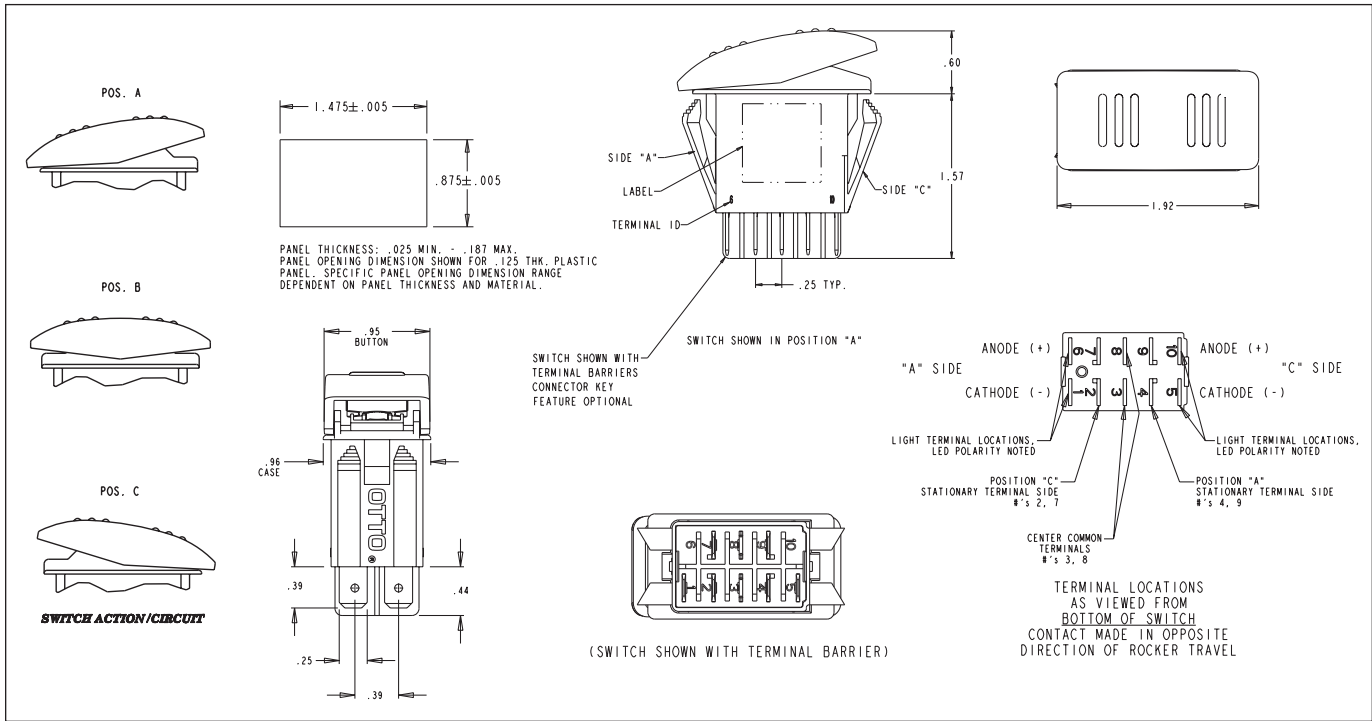
SNAP-IN PANEL MOUNTING

Standard Legends Per SAE Specifications

A1  ANCHOR	K2  UNLOCK	P5  BILGE BLOWER
B1  BATTERY	L1  LIGHT	R1  LIFT
B2  ELECTRIC POWER	L2  MASTER LIGHTING SWITCH	R2  LOWER
C1  AC/COOLING SYSTEMS	L3  HEADLIGHTS	R3  UP
C2  DEHUMIDIFIER	L4  HEADLIGHTS-LOW/ DIPPED BEAM	R4  DOWN
C3  HEATER/INTERIOR HEATING	L5  HEADLIGHTS-HIGH/ UPPER BEAM	R5  RIGHT
D1  WINDSHIELD DEFROSTER	L6  PARKING LIGHT	R6  LEFT
D2  REAR WINDOW DEFROSTER	L7  WORK LAMP	R7 FWD FORWARD
D3  MIRROR DEFROSTER	L8  WORK LAMP	R8 REV REVERSE
E1  ENGINE/START	L9  INTERIOR DOME LIGHT	S1  RADIO
E2  ENGINE/STOP	M1  BEACON	S2  MUTE
E3  ON/START	M2  HAZARD/POSITION LIGHTS	T1  FAST
E4  OFF/STOP	M3  CLEARANCE LIGHTS	T2  SLOW
E5 ON ON	M4  SIDE MARKER LIGHT	T3  TRIM TAB/ TRIMMING OPERATION
E6 OFF OFF	M5  RUNNING LIGHTS (UNDER POWER)	T4  TRANSMISSION
E7  ENGINE ELECTRIC PREHEAT	M6  ANCHOR LIGHT	V1  VENTILATING/AC FAN
E8  ENGINE-GAS INJECTION	M7  RUNNING/ANCHOR LIGHTS	W1  WINDSHIELD WIPER
F1  FRONT FOG LIGHTS	M8  SEARCH LIGHT	W2  WINDSHIELD-WASHER
F2  REAR FOG LIGHTS	M9  LEFT TURN SIGNAL	W3  WINDSHIELD-WASHER/WIPER
G1  FUEL	MA  RIGHT TURN SIGNAL	W4  REAR WINDOW WIPER
H1  HORN	P1  BILGE PUMP #1	W5  REAR WINDOW-WASHER
H2  HORN REAR	P2  BILGE PUMP #2	W6  REAR WINDOW-WASHER/WIPER
K1  LOCK	P3  BILGE PUMP #3	ZZ NO LEGEND
	P4  BILGE PUMP	

For legends not shown, please consult an OTTO representative.

SNAP-IN PANEL MOUNTING



K5 SERIES

K5		X	X	X	X	XX	X	X				
Base Options		Rocker Color*/Style		Rocker Features		Switch Action/Circuit		Light Source Type	Light Circuit			
A. With Keying Pin Only Standard Rating Silver Plate		A. Black/Plastic Rocker		Position "A"	Position "C"	Position "A"	Position "B"	Position "C"	Circuit	A. No Illumination	Circuit	Terminal Connections
B. Without Barriers or Pin Standard Rating Silver Plate		B. Black/Soft Touch Rocker		1. No Feature	1. No Feature	1A. 3-4	None	OFF	SPST	B. 6V Incandescent	A. None	None
C. With Terminal Barriers Only Standard Rating Silver Plate		C. Red/Plastic Rocker		2. Lens	2. Lens	2A. 3-4/8-9	None	OFF	DPST	D. 24V Incandescent	B. Dep. in "A"	1(-) & 4(+)
D. With Keying Pin Only Low Level Rating Gold Plate		D. Red/Soft Touch Rocker		3. Raised Bars	3. Raised Bars	1B. 3-4	None	3&2	SPDT	E. 125VAC Neon	C. Dep. in "C"	2(+)& 5(-)
E. Without Barriers or Pin Low Level Rating Gold Plate		E. White/Plastic Rocker		4. Raised Lit Bars	4. Raised Lit Bars	2B. 3-4/8-9	None	3-2/8-7	DPDT	F. 250VAC Neon	D. Ind. in "A"	1(-) & 6(+)
F. With Terminal Barriers Only Low Level Rating Gold Plate		F. White/Soft Touch Rocker				1C. (3-4)	None	OFF	SPST	G. 2V Red LED	E. Ind. in "C"	5(-) & 10(+)
G. With Keying Pin Only Standard Rating No Plate		*Additional colors available, contact factory.		NOTE: Soft Touch rockers require same color lenses/ lit bars for both positions.		2C. (3-4)/(8-9)	None	OFF	DPST	H. 2V Green LED	F. Dep. in "A"	1(-) & 4(+)
H. Without Barrier or Pin Standard Rating No Plate						1D. (3-4)	None	3-2	SPDT	J. 2V Amber LED	Dep. in "C"	2(+)& 5(-)
J. With Terminal Barriers Only Standard Rating No Plate						2D. (3-4)/(8-9)	None	3-2/8-7	DPDT	K. 6V Red LED	G. Dep. in "A"	1(-) & 4(+)
						1E. (3-4)	OFF	(3-2)	SPDT	L. 6V Green LED	Ind. in "C"	5(-) & 10(+)
						2E. (3-4)/(8-9)	OFF	(3-2)/(8-7)	DPDT	M.6V Amber LED	H. Ind. in "A"	1(-) & 6(+)
						1F. 3-4	OFF	3-2	SPDT	N. 12V Red LED	Dep. in "C"	2(+)& 5(-)
						2F. 3-4/8-9	OFF	3-2/8-7	DPDT	P. 12V Green LED	J. Ind. in "A"	1(-) & 6(+)
						1G. (3-4)	OFF	3-2	SPDT	Q. 12V Amber LED	Ind. in "C"	5(-) & 10(+)
						2G. (3-4)/(8-9)	OFF	3-2/8-7	DPDT	R. 24V Red LED	NOTE: Polarity only applies to LED circuits.	
										S. 24V Green LED		
										T. 24V Amber LED		

SEALED, ILLUMINATED ROCKER SWITCHES

K5
SEALED
ROCKERS

ATTRACTIVE & RUGGED FOR WET & DUSTY ENVIRONMENTS

POS "A" POS "B" POS "C" SPECIAL CIRCUIT - ON-ON-ON SCHEMATIC		K5....1M....	K5....2A.... DPST-ON-NONE-OFF SCHEMATIC	K5....2B.... DPDT-ON-NONE-ON SCHEMATIC	K5....2C.... DPST-(ON)-NONE-OFF SCHEMATIC	K5....2D.... DPDT-(ON)-NONE-ON SCHEMATIC
GENERAL SCHEMATIC INFORMATION ○ INDICATES MAINTAIN ACTION (FIXED POSITION) ▼ INDICATES MOMENTARY ACTION (AUTOMATIC RETURN POSITION) FOR OTHER LIGHTING SCHEMATICS REPLACE FOLLOWING SYMBOLS: INCANDESCENT (REPLACE RESISTOR & LED) NEON (REPLACE LED)		K5....2E.... DPDT-(ON)-OFF-(ON) SCHEMATIC	K5....2F.... DPDT-ON-OFF-ON SCHEMATIC	K5....2G.... DPDT-(ON)-OFF-ON SCHEMATIC	K5....2BNC-Z DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A"	K5....2BNC-Z DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "C"
K5....2BND-Z DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A"		K5....2BNE-Z DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "C"	K5....2BNF... DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A" & "C"	K5....2BNG... DPDT-ON-NONE-ON SCHEMATIC W/DEPENDENT LED IN "A" & INDEPENDENT LED IN "C"	K5....2BNH... DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A" & DEPENDENT LED IN "C"	K5....2BNJ... DPDT-ON-NONE-ON SCHEMATIC W/INDEPENDENT LED IN "A" & "C"

PART NUMBER CODE



Lens Color

Position "A"

- Transparent Red
- Transparent Green
- Transparent Amber ①
- Clear ①
- Translucent White ②
- No Lens

Position "C"

- Transparent Red
- Transparent Green
- Transparent Amber ①
- Clear ①
- Translucent White ②
- 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 lighted switches without legends.

Example:
K5AA331FNH-44



Legend Style

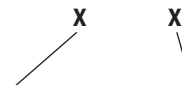
Position "A"

ZZ. No Legend

Position "C"

ZZ. No Legend

NOTE: For all other legend options, refer to the legend table, find the two digit code and enter the code in the appropriate position(s).



Legend Color

Position "A"

- Red
- Black
- White
- Backlight/Daylight White ③
- Backlight/Deadfront ③
- No Legend

Position "C"

- Red
- Black
- White
- Backlight/Daylight White ③
- Backlight/Deadfront ③
- No Legend

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



Legend Orientation

Position "A"

1. Std.

A C

2. 90°

A C

3. 180°

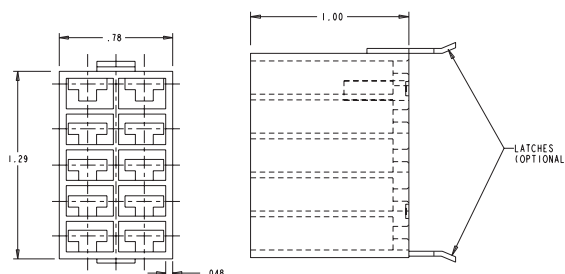
A C

4. 270°

A C

STOP HERE for unlighted switches without legends.

Example:
K5AA331BAA



K5 Connector
P/N 801775-2A Without Latches
P/N 801775-2B With Latches

Recommended Quick Connect Terminals
AMP 60253-2 for 12-16 AWG
AMP 42100-2 for 14-18 AWG

Panel Seal Gasket
P/N 807109

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 so the switch can withstand direct water spray and submersion, even during operation. Sealed to IP68S with an optional panel seal available.

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.

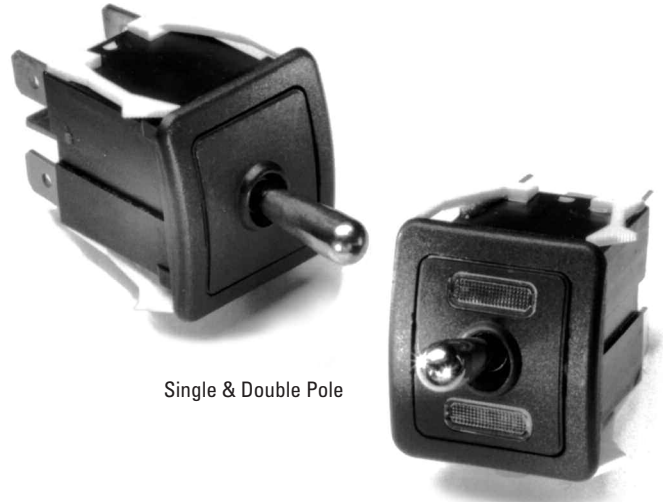
Mounting is simple and quick; snaps into panel from the front. The OTTO snap-in design supports a variety of panel thicknesses with just one cutout size specified.

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 low level electronic switching levels.

Features:

- Withstands direct water spray
- Sealed to IP68S
- 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 and center OFF
- RoHS & WEEE compliant



Single & Double Pole

LED, Neon or
Incandescent Illumination

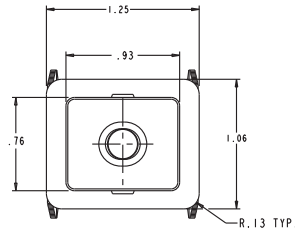
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS:		
Load	Sea Level @ 28VDC or 125/250VAC, 60Hz	Cycles
Resistive	16A	25,000
Resistive	10A	50,000
Inductive	10A	25,000
Lamp	5A	25,000
Motor	0.5HP	25,000
DVV	1050Vrms except across light terminals	
Low Level	10mA @ 30mV	100,000
Electrical Life:		See 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
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 low 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

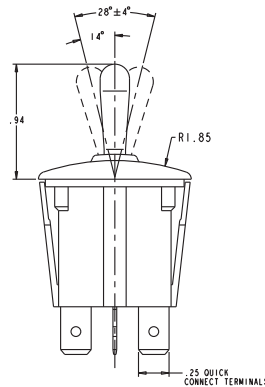
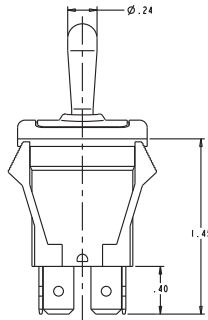
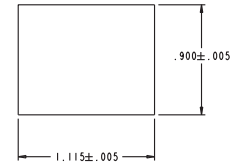
K4
SNAP-IN
TOGGLES

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

K4 Series



RECOMMENDED PANEL THICKNESS: .025 MIN. - .187 MAX.
DIMENSION SHOWN FOR .125 THK PLASTIC PANEL.
SPECIFIC PANEL OPENING DIMENSION RANGE
DEPENDENT ON PANEL THICKNESS AND MATERIAL.



TERMINAL STYLES
ALL TERMINALS ARE .032 THICK

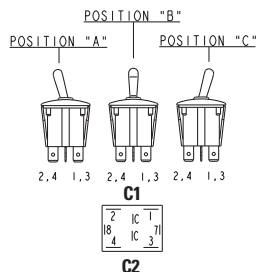
SCREW	QUICK CONNECT	SOLDER LUG

K4 SERIES PART NUMBER CODE

K4	X	X	X	X	X	X	X			
Terminal Style/ Switch Rating	Actuator Style	Switch Action/Circuit				Light Type	Lens Color	Light/Circuit Location	Legend & Orientation ①	
A. Q.C./Std. B. Screw/Std. C. Solder/Std. D. Q.C./Low Level E. Screw/Low Level F. Solder/Low Level	A. Bat Handle	Position "A"	Position "B"	Position "C"	Circuit	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	Position "A" A. No Lens B. Red C. Green D. Amber E. Clear	Position "B" A. No Lens B. Red C. Green D. Amber E. Clear	A. No Light B. Dependent Light ON in position "A" Wired to terms 1 & 7 C. Dependent Light ON in position "C" Wired to terms 2 & 8 D. Independent Light at position "A" Wired to terms 7 & 8 E. Independent Light at position "A" Wired to terms 7 & 8 F. Independent Light at position "C" Wired to terms 7 & 8 G. Independent Light at position "C" Wired to terms 7 & 8 H. Independent Light at position "A" Wired to terms 7 & 8 J. Independent Light at position "C" Wired to terms 7 & 8	A. No Legend B. Legend C. Legend D. Legend E. Legend F. Legend G. Legend H. Legend J. Legend
NOTE: () denotes momentary action.										

Optional Panel Gasket:
P/N 807038-1 .062" thickness
P/N 807038-2 .031" thickness

K4 Connector P/N C801765



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.

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.

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

D = Dependent Light
I = Independent Light

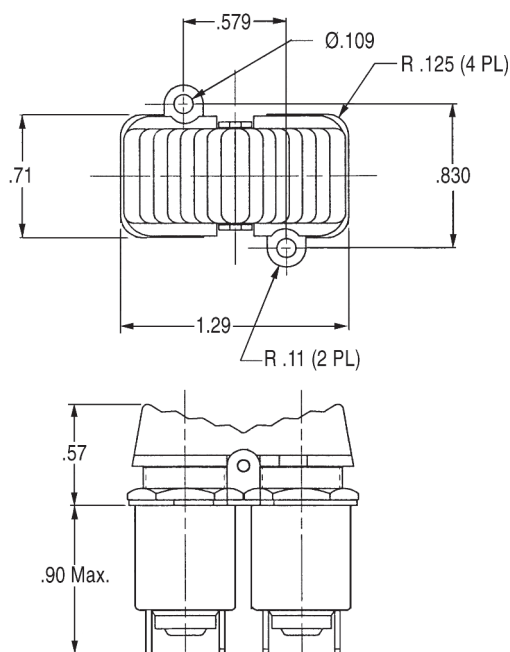
① All legends are white. Legend cannot be on the same side as the lens.

ONE MILLION CYCLE SEALED ROCKER SWITCH

The U2-277 (low 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
- Low level up to 10 amps switching capability



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC
Resistive	10A
Inductive	5A
Lamp	3A
Low Level	10mA @ 30mV

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: 0.080 inches max

Overtravel: 0.012 inches min

MATERIALS:

Button:	Nylon black
Bracket:	Stainless steel
Contacts:	Fine silver, standard Fine silver, gold plate for low level
Terminal Hardware:	None provided
Mounting Hardware:	None provided

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

Used in the heavy equipment, marine, process control and instrumentation markets, the R2 rotary switch is an excellent replacement for rocker switches, offering improved visual position indication, additional lighting options and different styling opportunities on front panels. The R2 is a sealed, lighted rotary switch which snaps into a 1.475" x 0.875" industry standard rocker switch panel opening. The rotary knob snaps onto a shaft and can be installed by the panel builder for those desiring that flexibility. The R2 rotary switch provides up to three positions in all combinations of momentary and maintained action. It is capable of handling loads from logic level up to 20 amps resistive. Sealing is to IP68S via a shaft O-ring seal in front and a potted base in the back. Termination options include 0.250" faston or a snap-on modular connector. The R2 offers unique lighting options including up to three independent LED light positions which illuminate a lens on the rotary knob. This design provides more lighting options than traditional rocker switches, handles the full range of electrical loads and is robust enough to survive in the most demanding applications.

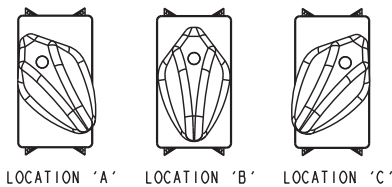
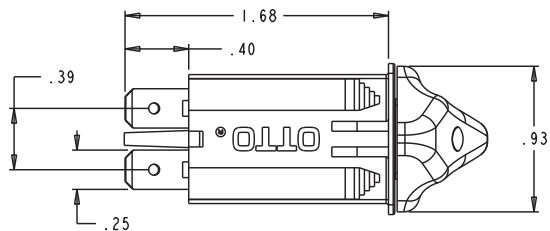
Features:

- **Sealed watertight per IP68S**
- **Snap-in panel mounting into industry standard 1.475" x 0.875" panel cutout**
- **Unique lighting options—up to three 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**



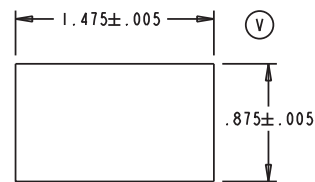
Standard Characteristics/Ratings:		
ELECTRICAL RATINGS:		
Load	Sea Level @ 12/28VDC	Sea Level @ 110VAC
Resistive	20A	16A
Inductive	15A	15A
Lamp	4A	4A
Motor	N/A	0.5HP
DWV	1050Vrms	
Low Level	10mA @ 30mV	
Electrical Life:	25,000 cycles at full load	
Lighting:	LED 2V, 6V, 12V, 24V (VDC)	
Mechanical Life:	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 low level	
Contacts:	Silver alloy, gold plate for low 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



LOCATION 'A' LOCATION 'B' LOCATION 'C'

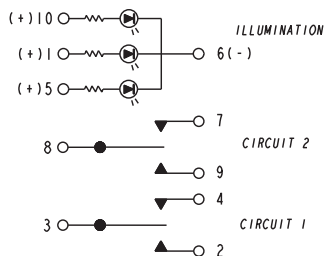
KNOB LOCATION DETAILS



PANEL OPENING DETAIL

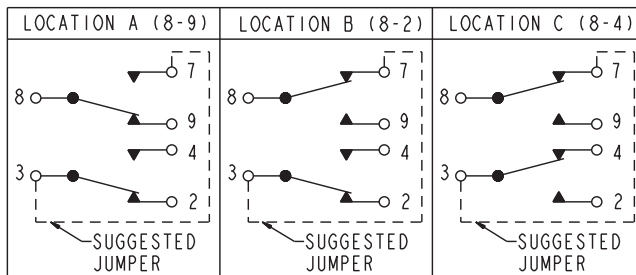
PANEL THICKNESS: .025 MIN. TO .187 MAX.

ELECTRICAL SCHEMATICS



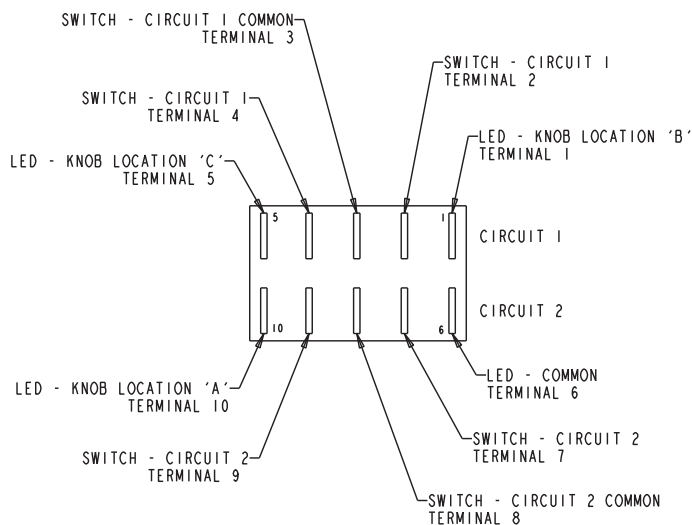
GENERIC SWITCH SCHEMATIC

USE TERMINALS AS APPLICABLE
TO PART NUMBER

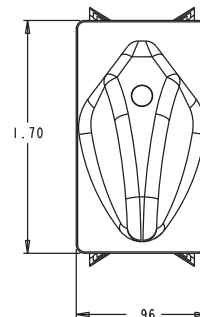
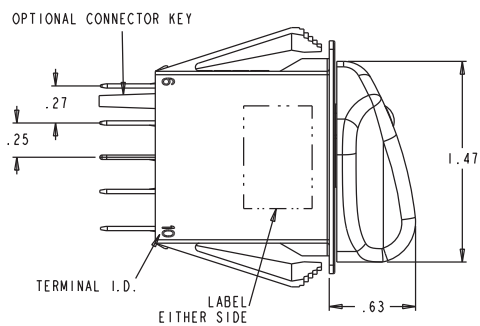


SPTT SCHEMATIC

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)



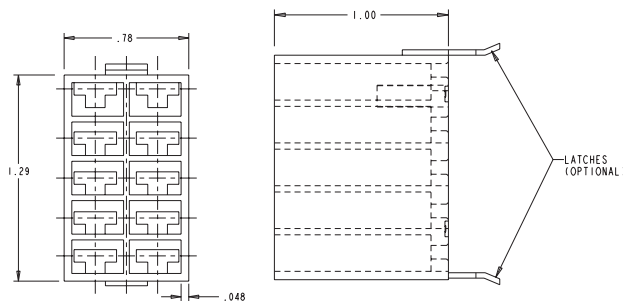
TERMINAL LOCATION AS VIEWED
FROM THE BOTTOM OF THE SWITCH



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

R2 SERIES PART NUMBER CODE

R2	X	X	XX	X	X	X	X	X	X	X				
Terminal Style/ Switch Rating	Knob Color & Texture	Switch Action			Switch Circuit 1 Terminals 2, 3, 4			Switch Circuit 2 Terminals 7, 8, 9			LED Light Source Voltage	Light Source Color		
A. Without Terminal Barriers With Connector Keying Pin/Std. Rating	A. Black Plastic	Knob Location "A"	Knob Location "B"	Knob Location "C"	Knob Location "A"	Knob Location "B"	Knob Location "C"	Knob Location "A"	Knob Location "B"	Knob Location "C"	N. None A. 2V B. 6V C. 12V D. 24V	Location "A"	Location "B"	Location "C"
B. Without Terminal Barriers Without Connector Keying Pin/Std. Rating	B. Black Soft	2-Position Switch, Knob Locations A/B			2-Position Switch, Knob Locations A/B			N. None (Single Pole)				N. None	N. None	N. None
C. Without Terminal Barriers With Connector Keying Pin/Low Level Rating	C. White Plastic	11. Maintain	Maintain	N/A	1. 3-2	OFF	N/A	1. 8-9	OFF	N/A		1. Red	1. Red	1. Red
D. Without Terminal Barriers Without Connector Keying Pin/Low Level Rating	D. White Soft Touch	12. Maintain	Momentary	N/A	2. OFF	3-4	N/A	2. OFF	8-7	N/A		2. Green	2. Green	2. Green
		13. Momentary	Maintain	N/A	3. 3-2	3-4	N/A	3. 8-9	8-7	N/A		3. Amber	3. Amber	3. Amber
		2-Position Switch, Knob Locations A/C			2-Position Switch, Knob Locations A/C			2-Position Switch, Knob Locations A/B						
		21. Maintain	N/A	Maintain	1. 3-2	N/A	OFF	1. 8-9	N/A	OFF				
		22. Maintain	N/A	Momentary	2. OFF	N/A	3-4	2. OFF	N/A	8-7				
		23. Momentary	N/A	Maintain	3. 3-2	N/A	3-4	3. 8-9	N/A	8-7				
		2-Position Switch, Knob Locations B/C			2-Position Switch, Knob Locations B/C			2-Position Switch, Knob Locations B/C						
		31. N/A	Maintain	Maintain	1. N/A	3-2	OFF	1. N/A	8-9	OFF				
		32. N/A	Maintain	Momentary	2. N/A	OFF	3-4	2. N/A	OFF	8-7				
		33. N/A	Momentary	Maintain	3. N/A	3-2	3-4	3. N/A	8-9	8-7				
		3-Position Switch, Knob Locations A/B/C			3-Position Switch			3-Position Switch						
		44. Maintain	Maintain	Maintain	4. OFF	3-4	3-4	4. OFF	8-7	8-7				
		45. Momentary	Maintain	Momentary	5. 3-2	OFF	3-4	5. 8-9	OFF	8-7				
		46. Maintain	Maintain	Momentary	6. 3-2	3-2	OFF	6. 8-9	8-9	OFF				
		47. Momentary	Maintain	Maintain	7. 3-2	3-2	3-4	7. 8-9	8-7	8-7				
					8. 3-2	OFF	OFF	8. 8-9	OFF	OFF				
					9. OFF	OFF	3-4	9. OFF	OFF	8-7				



R2 Connector

P/N 801775-2A Without Latches

P/N 801775-2B With Latches

Recommended Quick Connect Terminals

AMP 60253-2 for 12-16 AWG

AMP 42100-2 for 14-18 AWG

Panel Seal Gasket

P/N 807109

Features:

- MIL-S-3786/20 style available
- 1/2" diameter
- Optional seal for PC board assembly & cleaning available
- Choice of 36°, 45°, 60° & 90° angles of throw
- PC or solder lug termination
- Positive shaft grounding for EMI/RFI shielding available
- Screwdriver slotted shaft style available



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	@ 28VDC	@ 115VAC	@ 220VAC	Cycles
Resistive	200mA	N/A	N/A	25,000
Resistive	N/A	150mA	N/A	25,000
Inductive	30mA	N/A	N/A	25,000
Lamp	100mA	N/A	N/A	25,000
Lamp	N/A	N/A	75mA	25,000
DWV	600VAC min			
Low Level	10mA @ 30mV			
Contact Resistance	50mΩ max			

Electrical Life: See chart above

Mechanical Life: 25,000 cycles

Seal: Front panel seal
Front panel seal and behind panel terminal seal

Operating Temp Range: -65°C to +85°C

Rotational Torque: 8 to 24 inch-ounces

Detent Angles: 36°, 45°, 60° and 90°

Stop Strength: 7.5 inch-pounds min

Contact Type: Shorting or non-shorting wiping contacts

Shaft Flat Orientation: Flat opposite contacting positions of pole number one

Terminals: Switches are provided with the full circle of terminals, regardless of the number of active positions

Bushing Mounting: Required for switches with stops and recommended for switches without stops

MATERIALS:

Switch Base: Thermoset

Bushing: Zinc, cadmium plate

Terminals: Brass, gold plate over silver plate

Panel Seal: Silicone rubber

Shaft Seal: Fluorosilicone

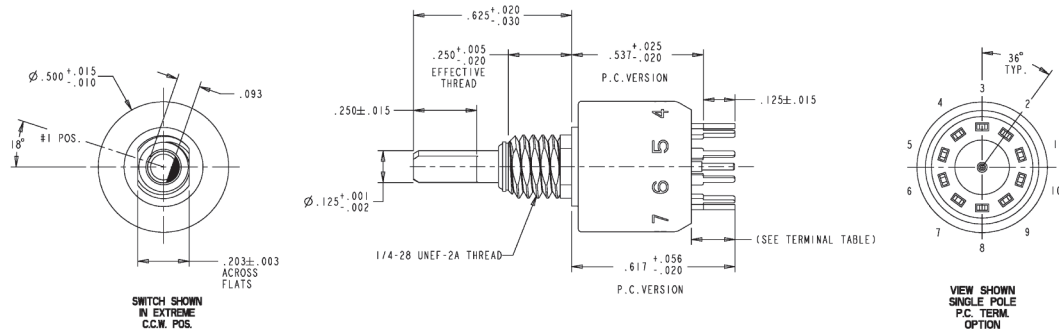
Terminal Hardware: None provided

Mounting Hardware: One mounting nut 0.089 inch thick by 0.375 inch across flats, one internal tooth lockwasher and panel seal when applicable

1/2" DIAMETER MINIATURE ROTARY

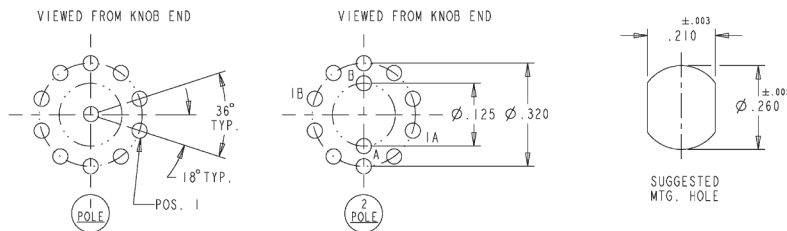
R50
MINIATURE
ROTARY

COMMERCIAL & MILITARY GRADES



NOTE: TERMINAL TABLE NOT TO SCALE, DIMENSIONS FOR REFERENCE ONLY.

TERMINAL TYPE	OUTER TERMINALS	COMMON TERMINALS
SOLDER LUG		
PC TERMINAL		



Angle of Throw	Number of Poles	Number of Positions Per Pole
36°	1	02 thru 10
	2	02 thru 05
45°	1	02 thru 08
	2	02 thru 04
60°	1	02 thru 06
	2	02 thru 03
90°	1	02 thru 04
	2	02

NOTE: 45°, 60° and 90° drawings available upon request.

R50 PART NUMBER CODE (36°)

R5	X	—	X	X	X	36	—	XX	X	XX	X	—	X
Size	Grade	Terminal Style	Bushing Length	Seal	Angle of Throw	Decks	Poles Per Deck	Positions Per Pole	Contact Type	Spec. Options			
Q. 0.500" OD	C. Commercial M. Military*	A. Solder/Std. P. PC Tails/Std. W.Solder/Low Level M.PC/Low Level	A. 0.312" B. 0.292" C. 0.250" D. 0.312" With Pos. Shaft Grd. E. 0.292" With Pos. Shaft Grd. F. 0.250" With Pos. Shaft Grd.	A. Unsealed B. Front Panel Seal C. Front Panel Seal and Behind Panel Terminal Seal	36°	01. 1 Deck	1. 1 Pole 2. 2 Poles	02. 2 03. 3 04. 4 05. 5 06. 6 Single Pole Only 07. 7 Single Pole Only 08. 8 Single Pole Only 09. 9 Single Pole Only 10. 10 Single Pole Only CT. Continuous/Single Pole Only	N. Non-Shorting S. Shorting	S. Screwdriver Actuated (see Slotted Shaft Detail)			

* Only bushing length options C and F apply.

* Only bushing length options C and F apply.

COMMERCIAL & MILITARY GRADES

R50 PART NUMBER CODE (45°)

Size	Grade	Terminal Style	Bushing Length	Seal	Angle of Throw	Decks	Poles Per Deck	Positions Per Pole	Contact Type	Spec. Options
0.500" OD	C. Commercial M. Military*	A. Solder/Std. P. PC Tails/Std. W. Solder/Low Level M. PC/Low Level	A. 0.312" B. 0.292" C. 0.250" D. 0.312" With Pos. Shaft Grd. E. 0.292" With Pos. Shaft Grd. F. 0.250" With Pos. Shaft Grd.	A. Unsealed B. Front Panel Seal C. Front Panel Seal and Behind Panel Terminal Seal	45°	01. 1 Deck	1. 1 Pole 2. 2 Poles	02. 2 03. 3 04. 4 05. 5 Single Pole Only 06. 6 Single Pole Only 07. 7 Single Pole Only 08. 8 Single Pole Only CT. Continuous/Single Pole Only	N. Non-Shorting S. Shorting	S. Screwdriver Actuated (see Slotted Shaft Detail)

* Only bushing length options C and F apply.

R50 PART NUMBER CODE (60°)

Size	Grade	Terminal Style	Bushing Length	Seal	Angle of Throw	Decks	Poles Per Deck	Positions Per Pole	Contact Type	Spec. Options
0.500" OD	C. Commercial M. Military*	A. Solder/Std. P. PC Tails/Std. W. Solder/Low Level M. PC/Low Level	A. 0.312" B. 0.292" C. 0.250" D. 0.312" With Pos. Shaft Grd. E. 0.292" With Pos. Shaft Grd. F. 0.250" With Pos. Shaft Grd.	A. Unsealed B. Front Panel Seal C. Front Panel Seal and Behind Panel Terminal Seal	60°	01. 1 Deck	1. 1 Pole 2. 2 Poles	02. 2 03. 3 04. 4 Single Pole Only 06. 6 Single Pole Only CT. Continuous/Single Pole Only	N. Non-Shorting S. N/A	S. Screwdriver Actuated (see Slotted Shaft Detail)

* Only bushing length options C and F apply.

R50 PART NUMBER CODE (90°)

Size	Grade	Terminal Style	Bushing Length	Seal	Angle of Throw	Decks	Poles Per Deck	Positions Per Pole	Contact Type	Spec. Options
0.500" OD	C. Commercial M. Military*	A. Solder/Std. P. PC Tails/Std. W. Solder/Low Level M. PC/Low Level	A. 0.312" B. 0.292" C. 0.250" D. 0.312" With Pos. Shaft Grd. E. 0.292" With Pos. Shaft Grd. F. 0.250" With Pos. Shaft Grd.	A. Unsealed B. Front Panel Seal C. Front Panel Seal and Behind Panel Terminal Seal	90°	01. 1 Deck	1. 1 Pole 2. 2 Poles	02. 2 03. 3 Single Pole Only 04. 4 Single Pole Only CT. Continuous/Single Pole Only	N. Non-Shorting S. N/A	S. Screwdriver Actuated (see Slotted Shaft Detail)

* Only bushing length options C and F apply.

COMMERCIAL & MILITARY GRADES



Features:

- Single & double pole, double throw switch configuration
- Low 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 & WEEE compliant

Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC, 60/400Hz
Resistive	5A
Inductive	3A
Lamp	1A
DWV	1050Vrms
Low Level	10mA @ 30mV
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:	Beryllium copper with silver plate, gold flash over silver plate for low level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut and lockwasher

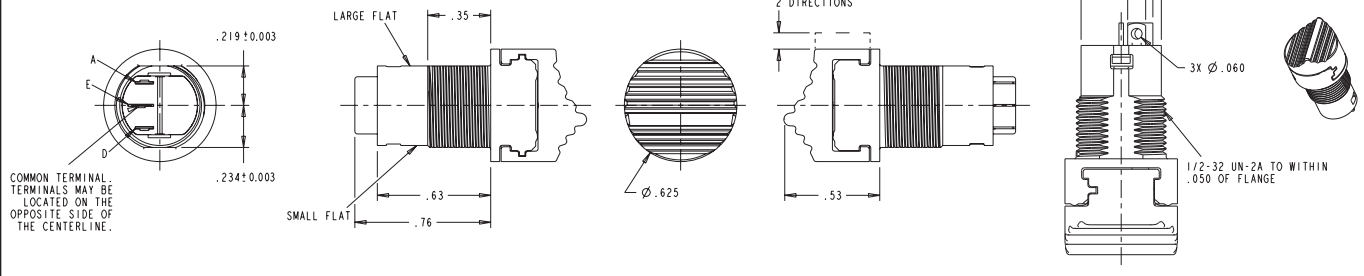
SL PART NUMBER CODE

SL		X		X		X		X		X		X		X		
Number of Poles		Button Style		Case Style		Seal		Grade		Current Rating		Switch Action/Circuit			Button Color	
1. Single 2. Double		1. Raised 2. Flush		1. Front Mount 1/2-32 Thread 2. Front Mount 1/2-32 Thread With 0.062" Spacer		1. Dusttight MIL-PRF-8805 Design 2		C. Commercial M. Military		1. Std. 2. Low Level		A. ON OFF ON B. (ON) OFF (ON) C. ON OFF (ON) D. (ON) OFF ON			1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Purple 8. Gray 9. White	

NOTE: () denotes momentary action.

SL Slide Switch

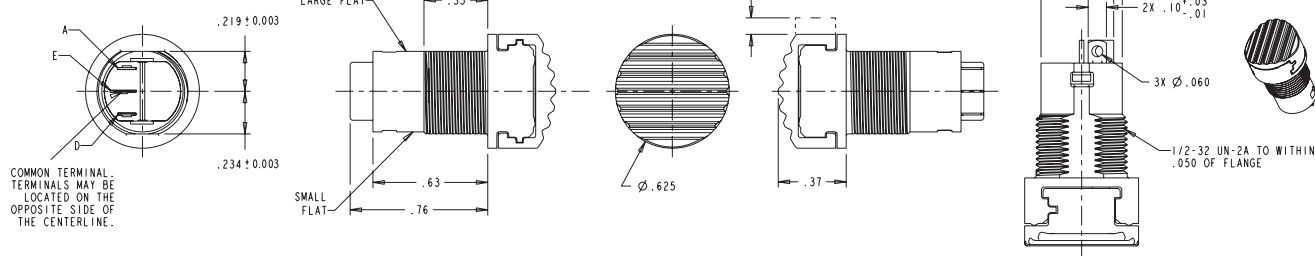
3-Position, Center OFF
SL-1111 Series



COMMERCIAL & MILITARY GRADES

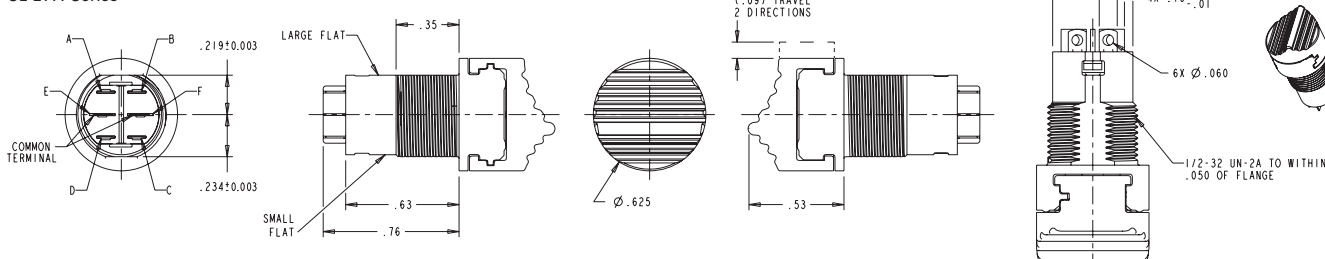
SL Slide Switch

3-Position, Center OFF
SL-1211 Series



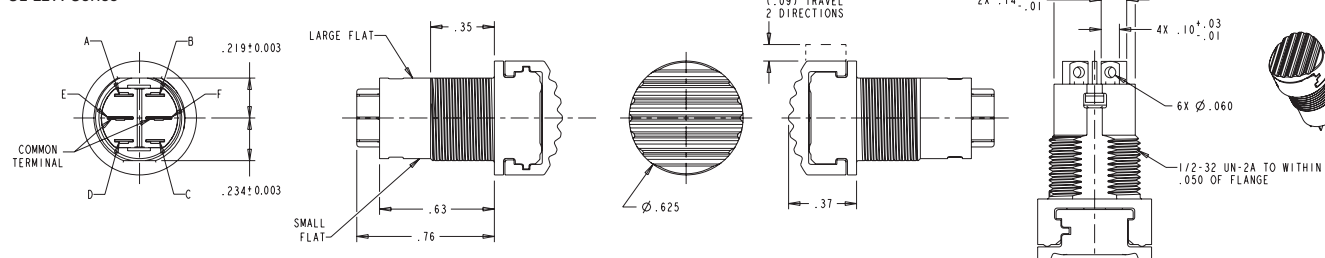
SL Slide Switch

3-Position, Center OFF
SL-2111 Series



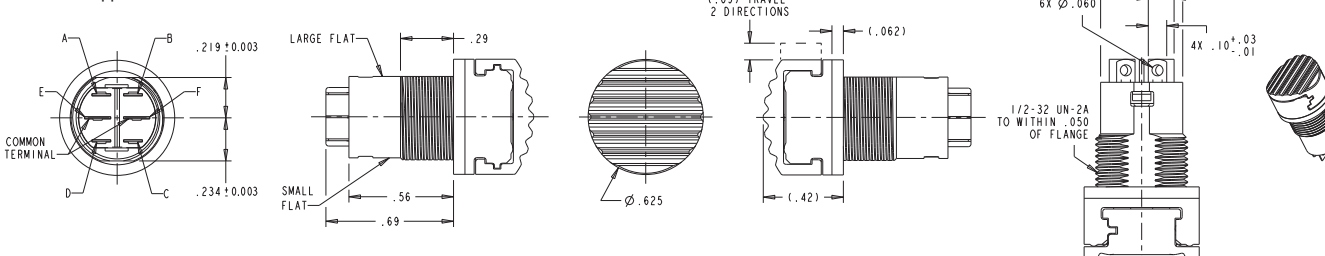
SL Slide Switch

3-Position, Center OFF
SL-2211 Series



SL Slide Switch

3-Position, Center OFF
SL-2221 Series
FAA-PMA Approved



EXAMPLES OF APPLICATION SPECIFIC DESIGNS

Emergency Pushbutton

To prevent inadvertent actuation, the operator's finger must be directed into the protective cup before the OTTO high-force pushbutton switch can be energized. Designed as an aircraft jettison switch, this deep shrouded configuration can be adapted and applied wherever precise, no-error pushbutton switching is required.

P1-90166



Edge backlighted for night vision operation available as P1-90158

Trigger Switch

This precision trigger switch has an actuating force of 2.25 lbs. to make the first pole; 6.5 lbs. passing through a detent to actuate the second pole. Housing is black, button is red. Two models.

Cat. No.	MILITARY No.	Width (inches)
U2-016	M8805/111-01	0.641 +/- 0.016
U2-025	M8805/111-04	0.762 +/- 0.025

Rating: 7 amps @ 28VDC



Two-Step Sealed Trigger Switch

This precision trigger switch offers two level operation with positive detent between levels. First level operates with 2.5 lbs. of force. It is moistureproof and dusttight sealed per MIL-PRF-8805, Sym. 2. The switch also provides electromagnetic pulse shielding. Trigger color is gray. Body is black. Features OTTO B3 basic switches per MIL-PRF-8805.

Rating: 8 amps Resistive @ 28VDC

U2-037



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

U2-326



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-S-8805/101
- Low level switching (10mA @ 30mV) or standard rating (see B3 page)
- Black anodized housing
- Black molded button

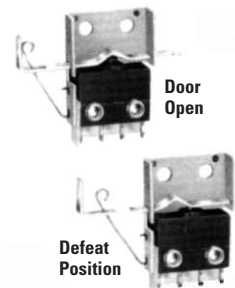
U2-351



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. See B3 page.

U2-053



Hall Effect Rocker

This Linear 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



Custom Control Module

The redesigned U2-472 utilizes HP7 Hall Effect switches and flex circuit with an on board connector, replacing traditional P9s and discrete wiring to increase life and speed up installation.

- HP7 switches with 10 million cycle life
- Flex circuit reduces assembly labor and cost
- Customer termination via onboard connector
- Designed and tooled to customer's specifications
- Finite Element Analysis (FEA) utilized to optimize assembly life

U2-472



FNR

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. Enhanced visibility with backlit lighting so switching is easy to see in poor or nighttime lighting. The internal switch has a mechanical life of 1 million cycles.

HFNR-XX Hall Effect 3-position rocker with backlighting

FNR-1002 Standard 3-position rocker with 36" 20 AWG wire leads

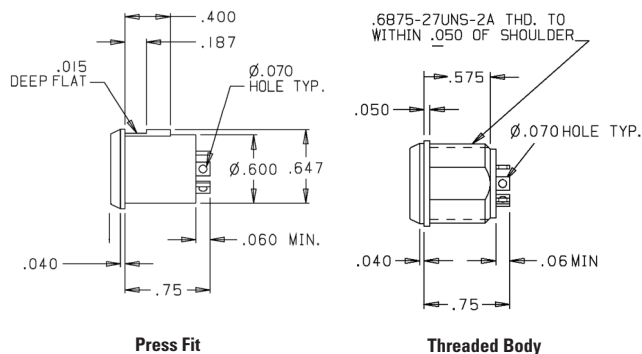


2-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

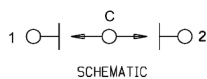
OTTO Mini Trims are toggle switches available in 2-way, 4-way, 4-way plus pushbutton, and 8-way versions. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



Typical Dimensions



T1



Standard Characteristics/Ratings:

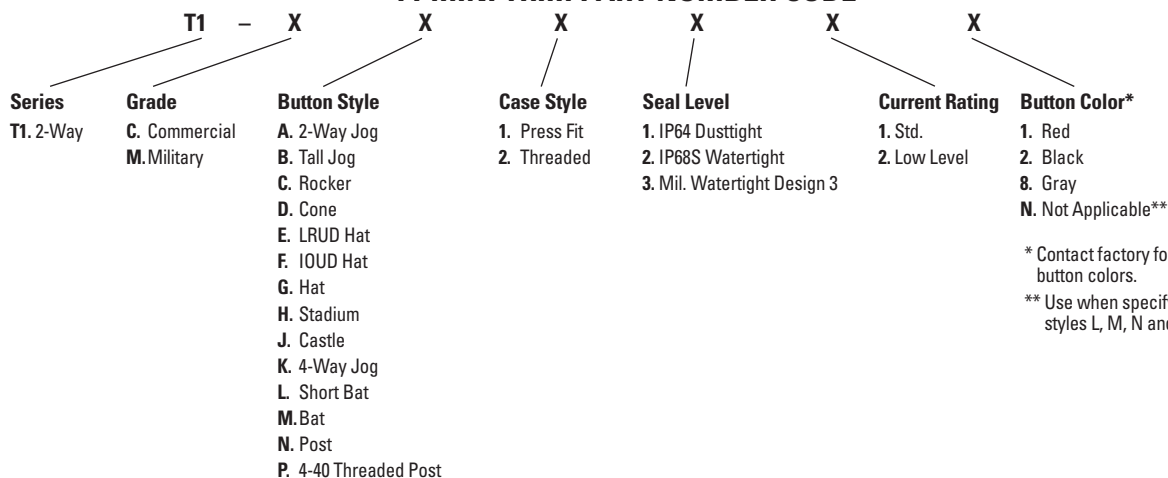
ELECTRICAL RATINGS:

Load	Rating
Resistive	10mA @ 5VDC (low level)
Inductive	1A @ 28VDC
DVV	1050Vrms
Low 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 low level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut and tooth lockwasher

T1 MINI TRIM PART NUMBER CODE



T4 MINI TRIM SWITCHES

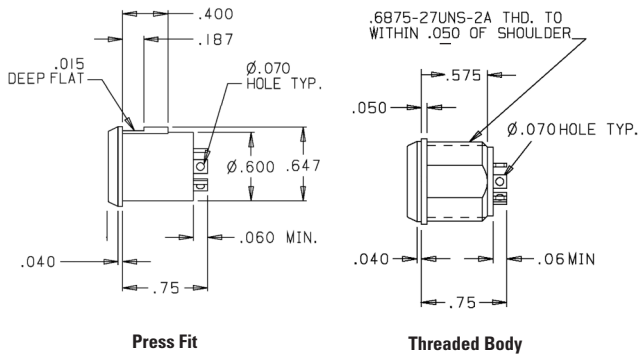
MT
T4 MINI TRIM
SWITCHES

4-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

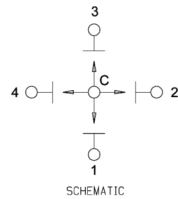
OTTO Mini Trims are toggle switches available in 2-way, 4-way, 4-way plus pushbutton, and 8-way versions. Numerous button styles are available on both the Commercial and Military grade switch versions. Mini Trims are typically press fit into control grips or panel mounted using versions with an 11/16" threaded case. Mini Trims are also available with multiple sealing levels to fit all applications.



Typical Dimensions



T4



Standard Characteristics/Ratings:

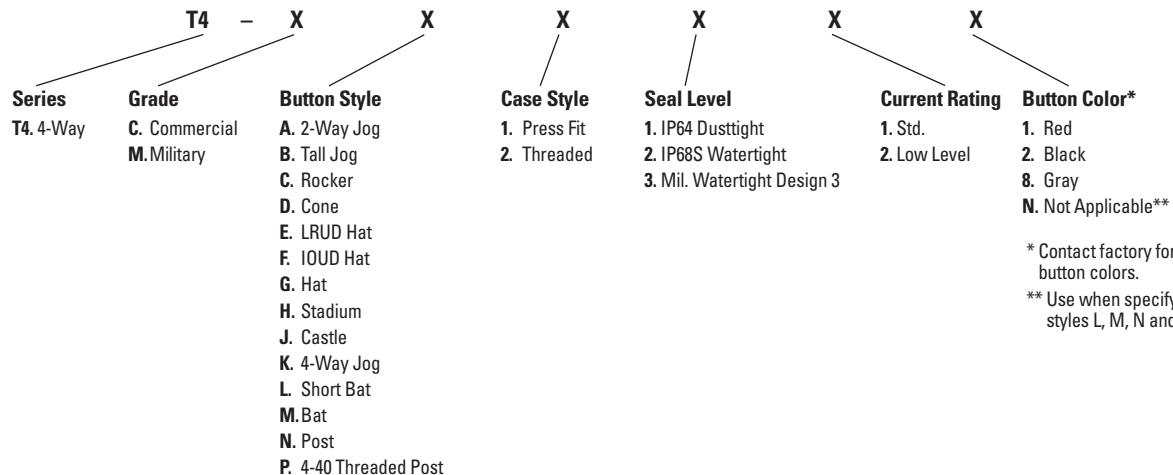
ELECTRICAL RATINGS:

Load	Rating
Resistive	10mA @ 5VDC (low level)
Inductive	1A @ 28VDC
DWV	1050Vrms
Low 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 20.0 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 low level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher, panel seal gasket where applicable

T4 MINI TRIM PART NUMBER CODE



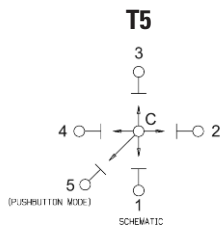
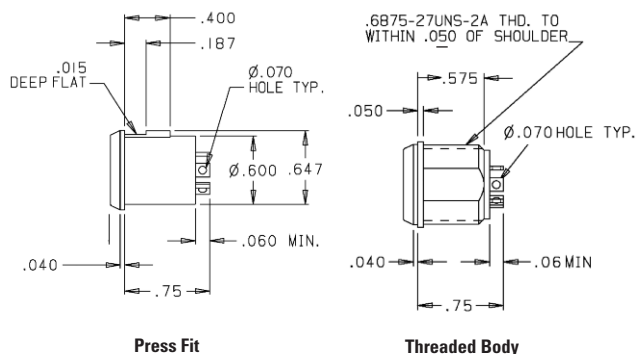
* Contact factory for additional button colors.
** Use when specifying button styles L, M, N and P

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

OTTO Mini Trims are toggle switches available in 2-way, 4-way, 4-way plus pushbutton, and 8-way versions. 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:

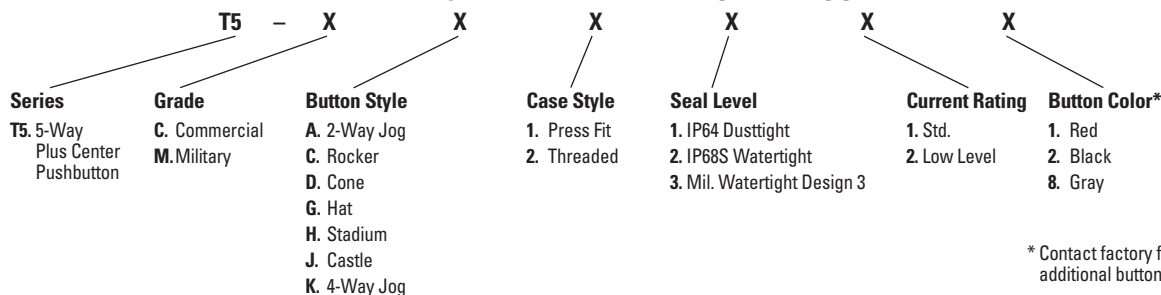
ELECTRICAL RATINGS:

Load	Rating
Resistive	10mA @ 5VDC (low level)
Inductive	1A @ 28VDC
DWV	1050Vrms
Low Level	10mA Resistive @ 5VDC
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 Gold over silver over brass for low level
Terminal Hardware:	None provided
Mounting Hardware:	Hex nut, tooth lockwasher, panel seal gasket where applicable

T5 MINI TRIM PART NUMBER CODE



* Contact factory for additional button colors.

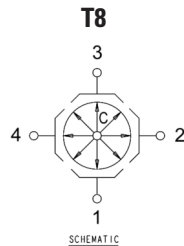
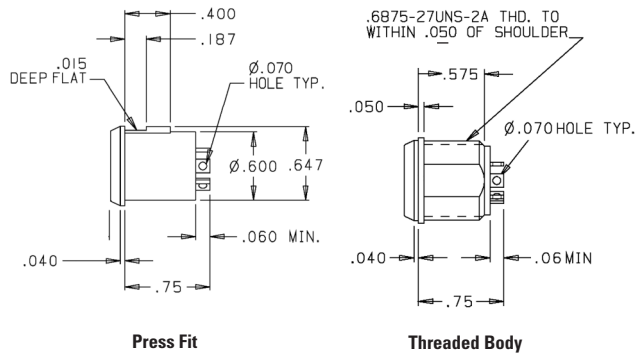
T8 MINI TRIM SWITCHES

MT
T8 MINI TRIM
SWITCHES

8-WAY MINI TRIM, COMMERCIAL & MILITARY GRADES

OTTO Mini Trims are toggle switches available in 2-way, 4-way, 4-way plus pushbutton, and 8-way versions. 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	10mA @ 5VDC (low level)
Inductive	1A @ 28VDC
DWV	1050Vrms
Low Level	10mA Resistive @ 5VDC
Electrical Life:	100,000 cycles 1A Inductive @ 28VDC
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:

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

T8 MINI TRIM PART NUMBER CODE

Series	Grade	Button Style	Case Style	Seal Level	Current Rating	Button Color*
T8 - 8-Way	C. Commercial M. Military	A. 2-Way Jog B. Tall Jog C. Rocker D. Cone E. LRUD Hat F. IOUD Hat G. Hat H. Stadium J. Castle K. 4-Way Jog L. Short Bat M. Bat N. Post P. 4-40 Threaded Post	1. Press Fit 2. Threaded	1. IP64 Dusttight 2. IP68S Watertight 3. Mil. Watertight Design 3	1. Std. 2. Low Level	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

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	

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. The T4-T series provides Commercial and Military grade switching with a positive click action, ideal for grip applications in aircraft and off-road equipment.

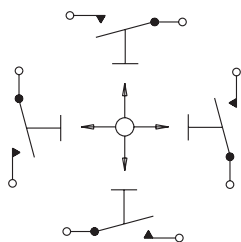
Features:

- **Positive detent**
- **4-way momentary toggle action**
- **Positive click action**
- **Low level switching**
- **Water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip)**
- **Available in Commercial & Military grades**
- **Variety of button styles & colors available**

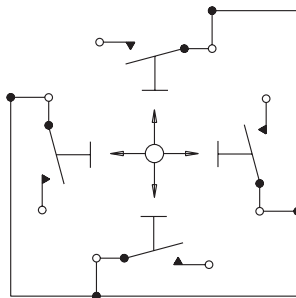


Standard Characteristics/Ratings:	
ELECTRICAL RATINGS:	
Load	Sea Level @ 28VDC
Resistive	2A
Inductive	1A
DVV	1050Vrms
Low Level	10mA @ 30mV
Electrical Life:	100,000 cycles
Mechanical Life:	500,000 cycles
Seal:	Water resistant per MIL-STD-810F, method 506.4, procedure 3 (drip)
Operating Temp Range:	-55°C to +85°C
Operating Force:	0.75 lb. +/- 0.25 lb.
Overtravel:	1.5° min
Pretravel:	9.5° max
Return Point:	4° min
MATERIALS:	
Case:	Glass filled polyester black
Button:	Nylon
Terminals:	Silver
Mounting Hardware:	None provided

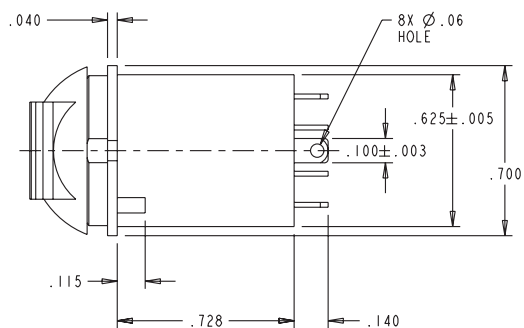
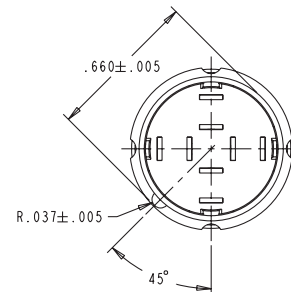
4-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE



SPST-NO
4 WAY
SCHEMATIC



SPST-NO
4 WAY WITH JUMPER
SCHEMATIC



(2-Way Jog Button Shown)

T4-T PART NUMBER CODE

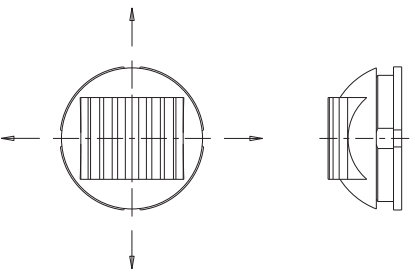
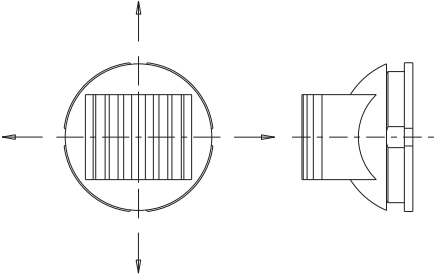
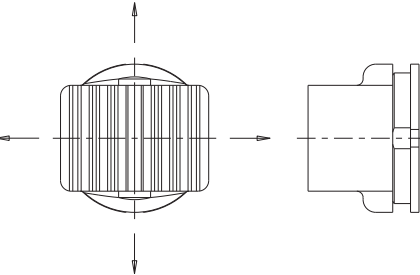
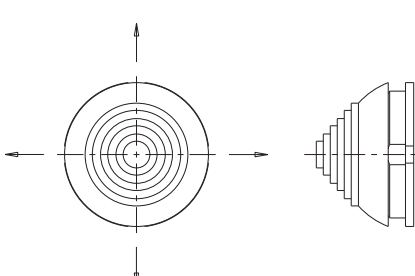
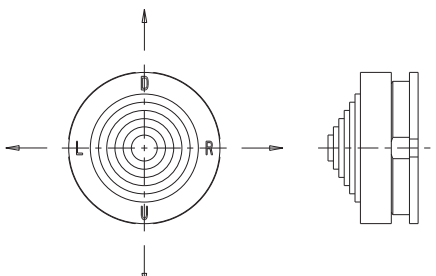
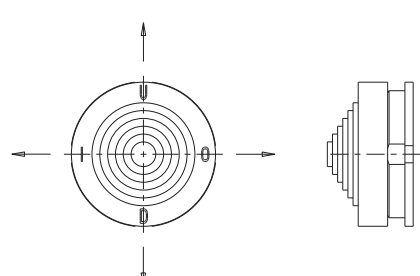
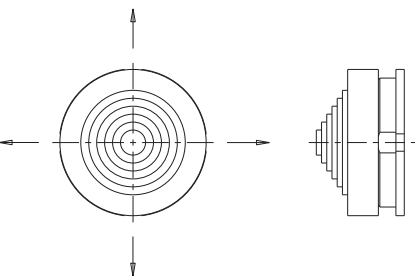
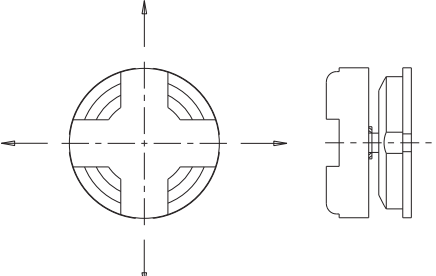
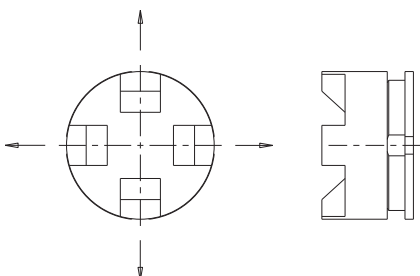
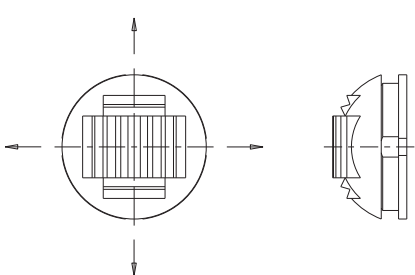
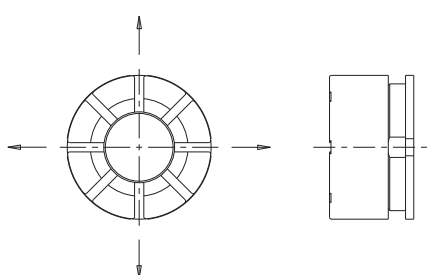
Series	Grade	Button Style	Case Style	Seal	Current Rating	Button Color*
T4-T T4-T 4-Way	X C. Commercial M. Military	X A. 2-Way Jog B. Tall Jog C. Rocker D. Cone E. LRUD Hat F. IOUD Hat G. Hat H. Stadium J. Castle K. 4-Way Jog L. Inverse Hat	X 3. Press Fit	X 3. Unsealed	X 1. Std. 2. Low Level 3. Std. With Internal Jumper 4. Low Level With Internal Jumper	X 1. Red 2. Black 8. Gray

* Contact factory for additional colors.

T4-T BUTTON STYLES

T4-T
TACTILE
MINI TRIM

4-WAY MOMENTARY TOGGLE WITH TACTILE RESPONSE

A - 2-WAY JOG 	B - TALL JOG 	C - ROCKER 
D - CONE 	E - LRUD HAT 	F - IOUD HAT 
G - HAT 	H - STADIUM 	J - CASTLE 
K - JOG 	L - INVERSE H AT 	

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: DPST-NO, ON-OFF-ON
 No pushbutton function
Rating: 5 amps Resistive
 3 amps Inductive
 1 amp Lamp
 Low Level: 2mA @ 15VDC
Mechanical Life: 100,000 cycles
Electrical Life: 100,000 cycles
Seal: Enclosure Design 4, resilient per MIL-S-8805
Button: Gray thermoplastic
Case: Black anodized aluminum



T2-0034

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 4.5 lbs.
Circuit: Toggle: SPST-NO, ON-OFF-ON
 Pushbutton: SPNO double break
Rating: 1A to 50mA Resistive @ 4-28VDC
Electrical Life: 100,000 cycles
Seal: Enclosure Design 2, dusttight per MIL-S-8805
Button: Gray nylon
Case: Black anodized aluminum alloy



T2-0008

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 4.5 lbs.
Circuit: Toggle: SPST-NO, ON-OFF-ON
 Pushbutton: DPST-NO double break
Rating: Toggle: 10 amps Resistive / 5 amps Inductive
 Pushbutton: 10 amps Resistive / 3 amps Inductive
Electrical Life: 50,000 cycles
Button: Black nylon
Case: Black anodized aluminum



T2-0018

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 4.5 lbs.
Circuit: Toggle: SPST-NO, ON-OFF-ON
 Pushbutton: DPST-NO double break
Rating: 1 amp Resistive
 0.5 amp Inductive
Electrical Life: 50,000 cycles
Seal: Enclosure Design 4, resilient per MIL-S-8805
Button: Black nylon
Case: Black anodized aluminum alloy



T2-0009

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 4.5 lbs.
Circuit: Toggle: SPST-NO, ON-OFF-ON
 Pushbutton: DPST-NO double break
Rating: Toggle: 10 amps Resistive / 5 amps Inductive
 Pushbutton: 10 amps Resistive / 3 amps Inductive
Electrical Life: 50,000 cycles
Seal: Enclosure Design 4, resilient per MIL-S-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-S-8805
Button: Black nylon
Case: Dry black chrome plated aluminum alloy



T2-0015

Operating Force: Toggle: 5.0 lbs.
 Pushbutton: 4.0 lbs.
Circuit: Toggle: SPST-NO, 4-position, center OFF, momentary
 Pushbutton: DPST-NO
Rating: 2 amps Resistive
 2 amps Inductive
Electrical Life: 50,000 cycles
Seal: Enclosure Design 4, resilient per MIL-PRF-8805
Button: Black nylon
Case: Black anodized aluminum alloy



T2-0044

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 3.75 lbs.
Circuit: Toggle: DPST-NO, ON-OFF-ON
 Pushbutton: DPST-NO double break
Rating: 0.1mA to 500mA Resistive @ 5-32VDC
 0.1mA to 500mA Inductive @ 5-32VDC
Electrical Life: 50,000 cycles
Seal: Enclosure Design 2, dusttight per MIL-S-8805
Button: Black nylon
Case: Dry black chrome plated aluminum alloy



T2-0016

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 4.5 lbs.
Circuit: Toggle: SPST-NO, ON-OFF-ON
 Pushbutton: DPST-NO
Rating: 1mA to 250mA Resistive @ 12-28VDC
Electrical Life: 50,000 cycles
Seal: Enclosure Design 4, resilient per MIL-S-8805
Button: Black nylon
Case: Black anodized aluminum alloy



T2-0045

Operating Force: Toggle: 2.5 lbs.
 Pushbutton: 4.5 lbs.
Circuit: Toggle: SPST-NO, ON-OFF-ON
 Pushbutton: DPST-NO double break
Rating: 1mA to 250mA Resistive @ 12-28VDC
Electrical Life: 50,000 cycles
Seal: Enclosure Design 4, resilient per MIL-S-8805
Button: Black nylon
Case: Dry black chrome plated aluminum alloy



LARGE TRIM SWITCHES, 4 & 5-WAY

T4/T5
4-WAY
TOGGLES

4-WAY TOGGLE SWITCHES WITH OR WITHOUT CENTER PUSHBUTTON

TRIM SWITCHES

T4-0010

Actuation: Center position maintained, all other positions momentary

Rating: 5 amps Resistive @ 30VDC sea level
3 amps Inductive @ 30VDC sea level
DMV: 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
DMV: 1050Vrms

Electrical Life: 50,000 cycles

Enclosure: Dusttight per MIL-PRF-8805 Design 2

Button: Black thermoplastic

Case: 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
DMV: 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



T5-0015

Actuation: Toggle & Pushbutton: center position maintained, all other positions momentary

Rating: 2 amps Resistive @ 28VDC or 115VAC/60Hz
DMV: 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
DMV: 1050Vrms @ sea level

Electrical Life: 50,000 cycles

Enclosure: Resilient per MIL-PRF-8805 Design 4

Button: Black thermoplastic

Case: Aluminum alloy



T5-0018

Actuation: Toggle & Pushbutton: center position maintained, all other positions momentary

Rating: 2 amps Resistive @ 28VDC or 115VAC/60Hz
DMV: 1050Vrms

Electrical Life: 50,000 cycles

Enclosure: Dusttight per MIL-PRF-8805 Design 2

Button: Black thermoplastic



T5-0028

Actuation: Toggle & Pushbutton: center position maintained, all other positions momentary

Rating: 2 amps Resistive @ 28VDC or 115VAC/60Hz
DMV: 1050Vrms

Electrical Life: 50,000 cycles

Enclosure: Dusttight per MIL-PRF-8805 Design 2

Button: Black thermoplastic

Case: Anodized aluminum alloy



T5-0035

Actuation: Toggle & Pushbutton: center position maintained, all other positions momentary

Rating: 2 amps Resistive @ 28VDC or 115VAC/60Hz
DMV: 1050Vrms

Electrical Life: 50,000 cycles

Enclosure: Dusttight per MIL-PRF-8805 Design 2

Button: Black thermoplastic

Case: Black chrome aluminum alloy



NOTE: Contact factory for additional configurations.

PANEL SEALED PER MIL-PRF-83731

3-Position, 4 Pole, Lever Lock

Basic Switches: Per MIL-PRF-8805/101

Enclosure: Sealed per MIL-PRF-83731

Rating: 5 amps Resistive @ 28VDC
1 amp Inductive @ 28VDC
1 amp Lamp @ 28VDC
2 amps Motor @ 28VDC

Action: Maintained

Cap: Nylon

Handle: Stainless steel

*Lever Lock configurations A thru P available.



T1-0216 (*)

T1-0185 (*)

2-Position, 3 Pole, Lever Lock

Basic Switches: Per MIL-PRF-8805/109

Enclosure: Sealed per MIL-PRF-83731

Rating: 1 amp Resistive @ 28VDC
0.5 amp Inductive @ 28VDC

Action: Maintained-momentary

Handle: Stainless steel, dull nickel plate

Cap, Handle: Brass, dull nickel

Bushing: Stainless steel with black oxide finish

T1-0175 (*)

*Lever Lock configurations D, F and G available.



3-Position, 8 Pole, Lever Lock

Basic Switches: Per MIL-PRF-8805/101

Enclosure: Sealed per MIL-PRF-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

T1-0210 (*)

*Lever Lock configurations A thru P available.



2-Position, 3 Pole, Lever Lock

Basic Switches: Per MIL-PRF-8805/101

Enclosure: Sealed per MIL-PRF-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

Handle: Stainless steel

Cap, Handle: Brass, dull nickel plate

Bushing: Stainless steel, passivated

T1-0214 (*)

*Lever Lock configuration is G.



2-Position, 2 Pole

Toggle Seal: Per MIL-PRF-83731

Basic Switch: Per MIL-PRF-8805/109

Enclosure: Sealed per MIL-PRF-83731

Operating Force: 2.0 lbs. to 5.0 lbs. max

Rating: 1 amp Resistive @ 28VDC
0.5 amp Inductive @ 28VDC

Action: Maintained-maintained

Bat, Handle, Bushing & Bracket: Stainless steel

T1-0051-1



2-Position, 3 Pole, Lever Lock

Basic Switches: Per MIL-PRF-8805/101

Enclosure: Toggle seal per MIL-PRF-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



3-Position, 8 Pole, "T" Lever Lock

Basic Switch: Per MIL-PRF-8805

Enclosure: Sealed per MIL-PRF-83731

Rating: 5 amps Resistive @ 28VDC
1 amp Inductive @ 28VDC
1 amp Lamp @ 28VDC
2 amps Motor @ 28VDC

Action: Maintained

Bushing, Cap & Handle: Stainless steel

T1-0215 (*)

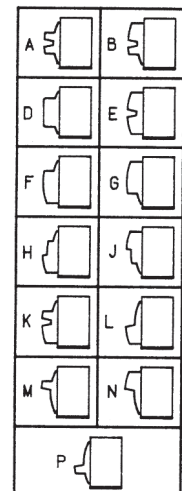
*Lever Lock configurations A thru P available.



Lever Lockout Configuration Codes

Figures A thru P are schematics to illustrate lockout configurations and momentary positions. They do not represent details of construction.

- A** Locked in all three positions
- B** Locked in Center and Keyway Side position
- D** Locked out of Center position
- E** Locked in Center position
- F** Locked in Opposite Keyway position
- G** Locked in Keyway Side position
- H** Locked out of Center and Keyway Side Position
- J** Locked out of Center and Opposite Keyway position
- K** Locked in Center and Opposite Keyway position
- L** Locked out of Keyway Side position
- M** Locked out of and into Opposite Keyway position
- N** Locked out of Opposite Keyway position
- P** Locked out of and into Keyway Side position



UNSEALED TOGGLE SWITCHES

T1
UNSEALED
TOGGLES

FEATURING B2 & B3 BASIC SWITCHES

3-Position, 6 Pole, Lever Lock

SPECIFICATIONS:

Position	Circuit	Force	Action
1	3PNO, 3PNC	Switch OFF	Maintained
2	6PNO	2.0 lbs. to 6.0 lbs.	Momentary
3	6PNC	2.0 lbs. to 6.0 lbs.	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.

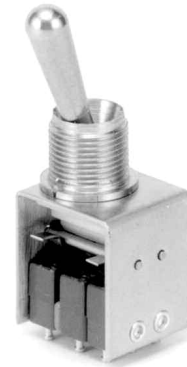
Basic Switches: Per MIL-PRF-8805/4

Operating Force: 1.0 lb. to 5.0 lbs.

Rating: 0.5 amp Inductive @ 28VDC
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



Stainless Steel/Silicone Rubber Washer

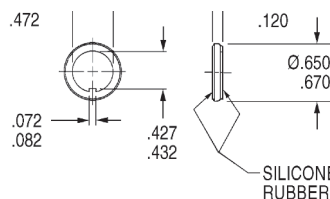
Stainless steel cup washer with silicone rubber seal assures proper watertight panel seal. Withstands 20 PSI water pressure. Mounts behind panel.

Approved to MIL-DTL-5423/16. Designed for sealing 15/32" bushing with keyway.

OTTO P/N: 710196

MIL P/N: M5423/16-01
(was MS25196-1)

Thickness of bushing seal is reduced to 0.080" when mounted to panel.



Mounting Hardware

MILITARY P/N

KEYWAY WASHERS

MS25081-C0

710081-C0

0.250"

MS25081-C4

710081-C4

0.468"

INTERNAL TOOTH LOCKWASHERS

MS35333-135

710333-135

0.250"

MS35333-136

710333-136

0.468"

HEX NUTS—STANDARD

MS25082-C14

710082-C14

0.250-40

MS25082-C21

710082-C21

0.468-32

FEATURING OTTO'S UNIQUE SNAP-IN MECHANISM

These miniature toggles are rugged, highly reliable switches offering positive detent action for safe switching operation. Featuring the unique OTTO snap-action switch mechanism in conjunction with a unique toggle actuator design, the T3 series offers non-teasible contact transfer.

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-PRF-83731.

In addition to the single turret solder terminal specified in MIL-PRF-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:

- **Non-teasible snap-action contact actuation**
- **Shorter behind panel depth**
- **Superior wiping action keeps contacts clean**
- **Positive tactile response prevents operating errors**
- **Weights up to 25% less than competitive products**
- **More contact/terminal plating choices**
- **Highly reliable, simpler design, less parts**



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC & 115VAC, 400Hz	@ 65,000 Feet
Resistive	5A	N/A
Inductive	2A	N/A
Lamp	1A	N/A
Motor	1050Vrms	400Vrms

Electrical Life: 30,000 cycles

Mechanical Life: 100,000 cycles

Seal: MIL-PRF-83731 (15/32-32 bushing style only)

Operating Temp Range: -65°C to +85°C

MATERIALS:

Handle: 303 Stainless

Bushing: Per MIL-PRF-83731

Body: Per MIL-PRF-83731

Terminal Hardware: None required

Mounting Hardware: Hex nuts, lockwasher and keyway washer

T3 PART NUMBER CODE

Bushing Style	Terminal Style	Circuitry	Circuit Made With Lever At:			Contact Material	Lockout Feature	Button Color (for bushing styles 4 & 5 only)
T3 - X X X X X X - or X								
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	1. Single Turret 4. PC Pin 0.150" lg. 5. PC Pin 0.270" lg.	1. Single Pole 2. Double Pole	Keyway Side 1. ON 2. OFF 3. ON 4. (ON) 5. (ON) 6. (ON)	Center OFF None None None OFF	Opposite Keyway ON ON ON ON (ON) ON	1. Silver/Gold Flash 2. Gold Plate	Lockout feature configuration code letters A-P for bushing style 3 only. Otherwise omit.	1. Red 2. Black 8. Grey

NOTE: () denotes momentary action.

① Add appropriate lockout feature configuration code letter (A thru P) for bushing style 3.

② Button color codes (1, 2 and 8) for bushing styles 4 and 5 at end of Part Number.

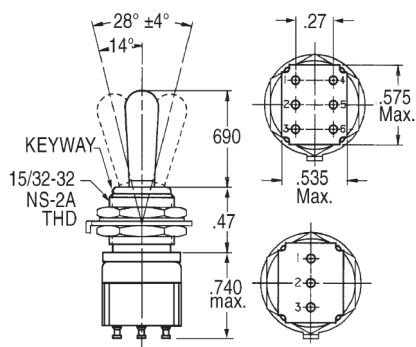
MEETS MIL-S-83731, COMMERCIAL & MILITARY GRADES

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.

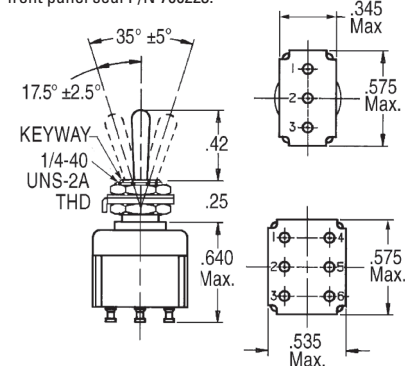
Standard Toggle, 15/32-32 Bushing

Sealed front panel construction.



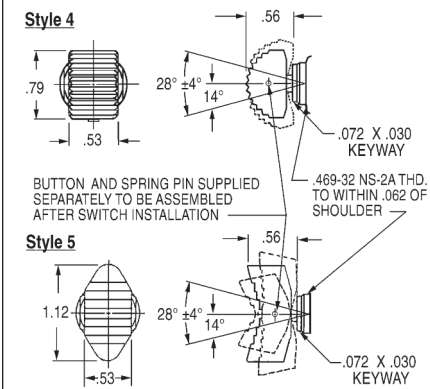
Standard Toggle, 1/4-40 Bushing

Unsealed front panel construction. Optional front panel seal P/N 700223.



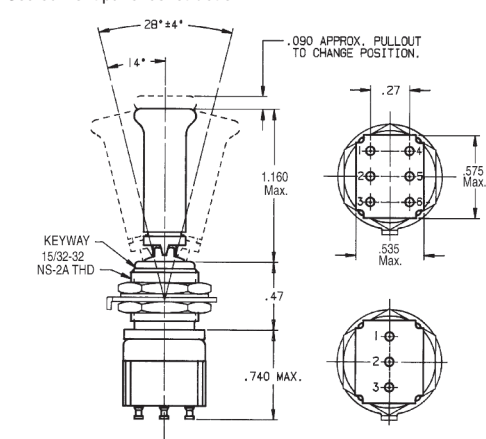
Thumb Actuators, 15/32-32 Bushing

Sealed front panel construction. Behind-panel dimensions same as 15/32-32 Bushing style.



Lever Lockout Toggle, 15/32-32 Bushing

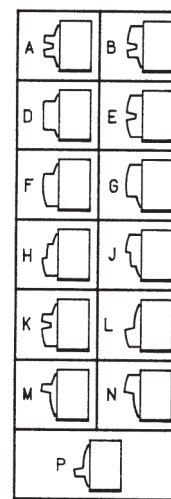
Sealed front panel construction.



Lever Lockout Configuration Codes

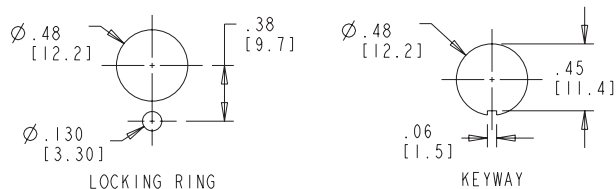
Figures A thru P are schematics to illustrate lockout configurations and momentary positions. They do not represent details of construction.

- A Locked in all three positions
- B Locked in Center and Keyway Side position
- D Locked out of Center position
- E Locked in Center position
- F Locked in Opposite Keyway position
- G Locked in Keyway Side position
- H Locked out of Center and Keyway Side Position
- J Locked out of Center and Opposite Keyway position
- K Locked in Center and Opposite Keyway position
- L Locked out of Keyway Side position
- M Locked out of and into Opposite Keyway position
- N Locked out of Opposite Keyway position
- P Locked out of and into Keyway Side position

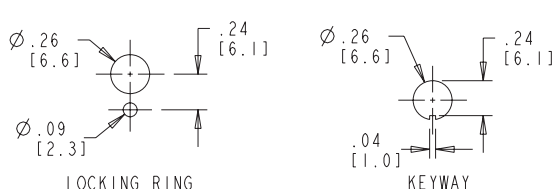


TOGGLE SWITCH MOUNTING DIMENSIONS (FOR REFERENCE ONLY)

MOUNTING DETAIL FOR 15/32" DIA. BUSHING SWITCHES



MOUNTING DETAIL FOR 1/4" DIA. BUSHING SWITCHES



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. They are totally sealed so the switch can withstand direct water spray and submersion, even during operation. They are designed to meet the international submersion specification level IP68S. 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 low level electronic switching applications.

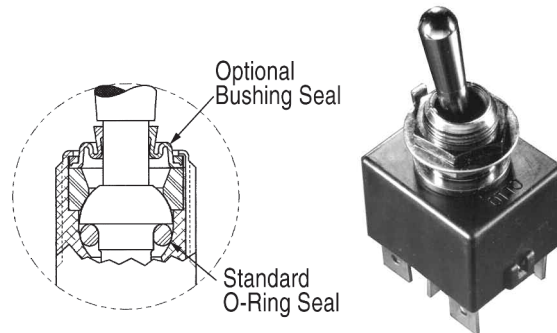
These toggles feature positive detent action for safe switching operation. In conjunction with the unique OTTO snap-action switch mechanism, the T7 offers non-teasible contact transfer.

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 gasket is also available, see panel seals located in the hardware section of this catalog.

Features:

- Withstands direct water spray
- Submersible to IP68S
- 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 & CSA recognized
- RoHS & WEEE compliant



Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Load	Sea Level @ 28VDC or 115VAC	Cycles
Resistive	16A	25,000
Resistive	10A	50,000
Inductive	10A	25,000
Motor	0.5HP	25,000
DWV	1050Vrms	N/A
Low Level	10mA max @ 30mV max DC Resistive for 50,000 cycles	

Electrical Life: See Rating Chart

Mechanical Life: 100,000 cycles

Seal: IP68S

Operating Temp Range: -30°C to +85°C

MATERIALS:

Case: Thermoplastic

Bushing: Anodized aluminum alloy

Toggle: Stainless steel

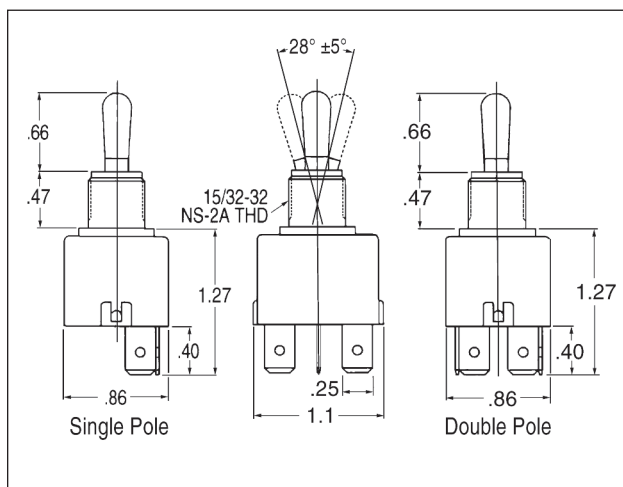
Terminals: Brass

Contacts: Fine silver/silver cadmium oxide

Low Level: Gold flash/silver plate

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, non-turn washer



T7 PART NUMBER CODE

T 7 - X	X	X	X	X	X
Circuitry	Terminal Style	Contact Rating	Circuit Made With Actuator At:	Toggle Style	Button Color
1. 1 Pole 2. 2 Pole	1. 250° Q.C. 2. Screw 3. Solder 4. PC Pin (consult factory)	1. Std. 2. Low Level	Keyway Side Center Opposite Keyway	1. Bat Handle 2. Lever Lockout (consult factory) 3. Dome Button 4. Rocker Button 5. Bat Handle With Bushing Seal	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Purple 8. Gray 9. White
			A. ON 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.

T7 Connector P/N C801765

ENVIRONMENTALLY SEALED TOGGLE

The T9 Toggle Switch is an ideal switch for demanding applications. Qualified to MIL-PRF-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-PRF-3950
- Sealed per IP68S
- Lever lockout option available
- UL, CSA & CE approvals (pending)
- Maintained & momentary toggle action
- Optional panel seal
- RoHS & WEEE compliant



Standard Characteristics/Ratings:

ELECTRICAL RATINGS: See Product Family Table

Electrical Life: 20,000 cycles

Mechanical Life: 40,000 cycles

Seal: IP68S

Operating Temp Range: -65°C to +71°C

MATERIALS:

Toggle: Stainless steel, passivated

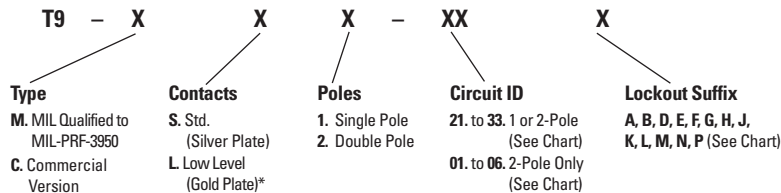
Bushing & Cover: Aluminum, clear anodized or zinc alloy

Case: Thermoset plastic

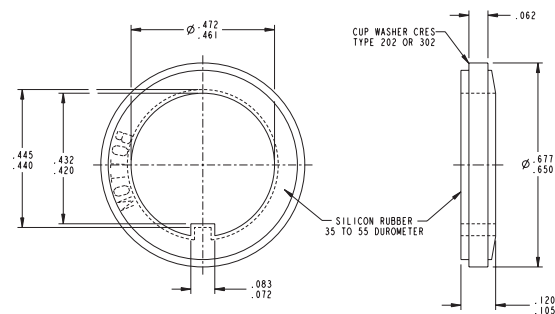
Terminal Hardware: None required

Mounting Hardware: Hex nuts, lockwasher, keyway washer, 0.138-32 UNC-2A screw with lockwasher

T9 PART NUMBER CODE



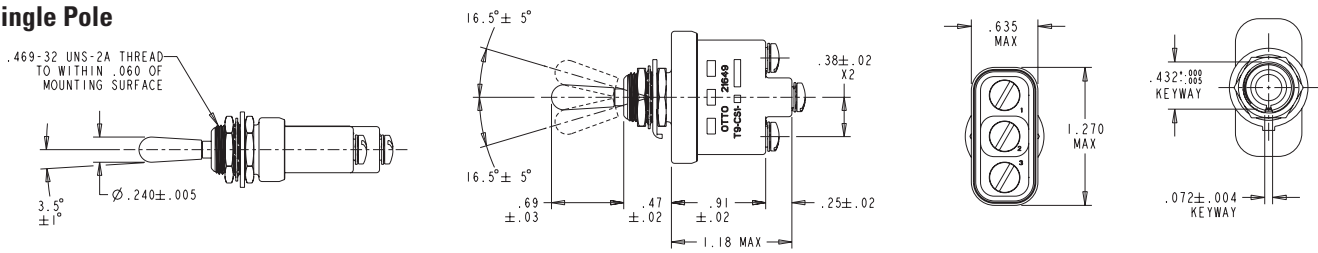
* Available in commercial only.



Optional Panel Seal P/N 710196

PRODUCT FAMILY TABLE

Single Pole

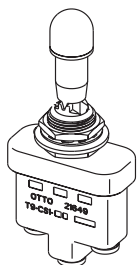
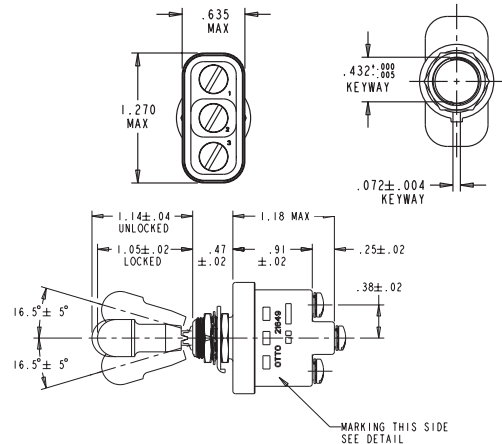
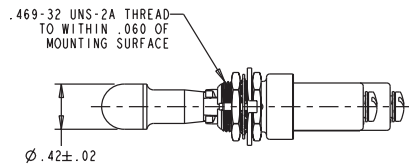
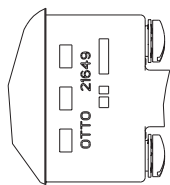


Low level 10mA @ 30mV (commercial version only)

OTTO PART NO.	MILITARY NO.	DASH NO.	CIRCUIT BY TOGGLE LEVER POSITION			ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
			KEYWAY 1-2	CENTER	OPP. KEYWAY 2-3	28 VDC			115 VAC		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MSI -	MS24523-	21	ON	OFF	ON	5	20	15	3	15	10
		22	OFF	NONE	ON						
		23	ON	NONE	ON						
		24	NONE	OFF	ON						
		25	NONE	MOM OFF	ON						
		26	MOM ON	NONE	ON	4	15	10	2	15	7
		27	MOM ON	OFF	MOM ON						
		28	MOM ON	OFF	NONE						
		29	MOM OFF	NONE	ON						
		30	MOM ON	NONE	OFF						
		31	MOM ON	OFF	ON						
OTTO PART NO.	MILITARY NO.	DASH NO.	KEYWAY	CENTER 1-2	OPP. KEYWAY 2-3	28 VDC			115 VAC		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MSI -	MS24523-	32	NONE	ON	MOM ON	4	15	10	2	15	7
		33	NONE	ON	ON	5	20	15	3	15	10

Lever/Lock Single Pole

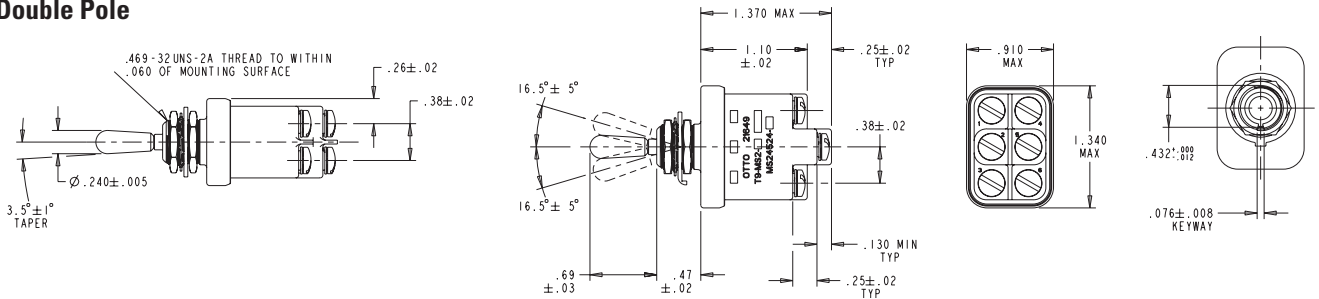
LOCKING CONFIGURATIONS							
LOCKED IN THREE POSITIONS	LOCKED IN CENTER & KEYWAY SIDE POSITION	LOCKED OUT OF CENTER POSITION	LOCKED IN CENTER POSITION	LOCKED IN OPPOSITE KEYWAY POSITION	LOCKED IN KEYWAY SIDE POSITION	LOCKED OUT OF CENTER & KEYWAY SIDE POSITION	
A	B	D	E	F	G	H	
LOCKED OUT OF CENTER & OPPOSITE KEYWAY POSITION	LOCKED IN CENTER & OPPOSITE KEYWAY POSITION	LOCKED OUT OF KEYWAY SIDE POSITION	LOCKED OUT OF & INTO OPPOSITE KEYWAY POSITION	LOCKED OUT OF OPPOSITE KEYWAY POSITION	LOCKED OUT OF & INTO KEYWAY SIDE POSITION	FIGURES A THRU P DO NOT REPRESENT DETAILS OF CONSTRUCTION. THEY SCHEMATICALLY ILLUSTRATE LOCKING CONFIGURATIONS & MOM. POSITIONS.	
J	K	L	M	N	P		



OTTO BASE PART NO.	MILITARY NO.	DASH NO.	AVAILABLE LOCKOUTS (SEE CHART)	CIRCUIT BY TOGGLE LEVER POSITION			ELECTRICAL RATINGS - SEA LEVEL & 65,000 FT					
				KEYWAY 1-2	CENTER	OPP. KEYWAY 2-3	28 VDC			115 VAC		
							LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-	MS24658-	21	ALL	ON	OFF	ON	5	20	15	3	15	10
		22	D F G	OFF	NONE	ON						
		23	D F G	ON	NONE	ON						
		24	E F K M	NONE	OFF	ON						
		25	F	NONE	OFF (M)	ON						
		26	F	MOM ON	NONE	ON	4	15	10	2	15	7
		27	E L N	MOM ON	OFF	MOM ON						
		28	E	MOM ON	OFF	NONE						
		29	F	MOM OFF	NONE	ON						
		30	F	MOM ON	NONE	OFF						
		31	E F K L M N	MOM ON	OFF	ON						
OTTO BASE NO.	MILITARY NO.	DASH NO.	AVAILABLE LOCKOUT	KEYWAY	CENTER 1-2	OPP. KEYWAY 2-3	28 VDC			115 VAC		
							LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS1-	MS24658-	32	E	NONE	ON	MOM ON	4	15	10	2	15	7
		33	E F K M	NONE	ON	ON	5	20	15	3	15	10

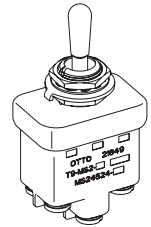
PRODUCT FAMILY TABLE

Double Pole



Low level 10mA @ 30mV (commercial version only)

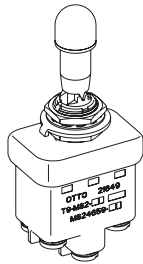
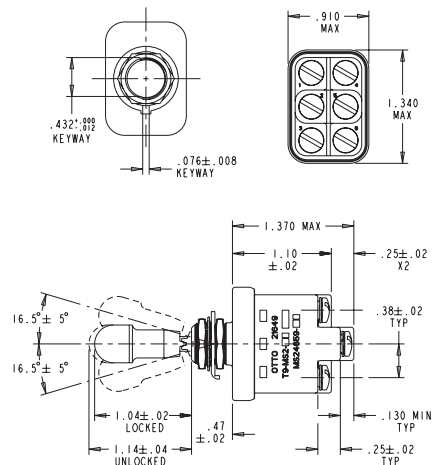
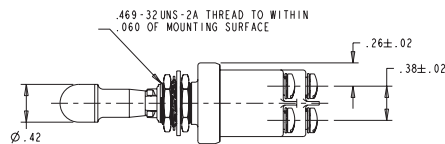
OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	CIRCUIT CONFIGURATION			ELECTRICAL CURRENT RATINGS (AMPS) - SEA LEVEL & 65,000 F					
			KEYWAY 1-2 / 4-5	CENTER	OPP. KEYWAY 2-3 / 5-6	28 VDC			115 VAC, 60Hz & 400Hz		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS2-	MS24524-	21	ON	OFF	ON	7	20	15	4	15	10
		22	OFF	NONE	ON						
		23	ON	NONE	ON						
		24	NONE	OFF	ON						
		25	NONE	MOM OFF	ON						
		26	MOM ON	NONE	ON	5	18	10	2	11	8
		27	MOM ON	OFF	MOM ON						
		28	MOM ON	OFF	NONE						
		29	MOM OFF	NONE	ON						
		30	MOM ON	NONE	OFF						
		31	MOM ON	OFF	ON						
OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	KEYWAY	CENTER 1-2 / 4-5	OPP. KEYWAY 2-3 / 5-6	28 VDC			115 VAC		
						LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS2-	MS24524-	32	NONE	ON	MOM ON	5	18	10	2	11	8
		33	NONE	ON	ON	7	20	15	4	15	15



TOGGLE SWITCHES

Lever/Lock Double Pole

LOCKING CONFIGURATIONS							
LOCKED IN THREE POSITIONS	LOCKED IN CENTER & KEYWAY SIDE POSITION	LOCKED OUT OF CENTER POSITION	LOCKED IN CENTER POSITION	LOCKED IN OPPOSITE KEYWAY POSITION	LOCKED IN KEYWAY SIDE POSITION	LOCKED OUT OF CENTER & KEYWAY SIDE POSITION	
A	B	D	E	F	G	H	
LOCKED OUT OF CENTER & OPPOSITE KEYWAY POSITION	LOCKED IN CENTER & OPPOSITE KEYWAY POSITION	LOCKED OUT OF KEYWAY SIDE POSITION	LOCKED OUT OF & INTO OPPOSITE KEYWAY POSITION	LOCKED OUT OF OPPOSITE KEYWAY POSITION	LOCKED OUT OF KEYWAY SIDE POSITION	FIGURES A THRU P DO NOT REPRESENT DETAILS OF CON- STRUCTION. THEY SCHEMATICALLY ILLUSTRATE LOCKING CONFIGURATIONS & MOM. POSITIONS.	
J	K	L	M	N	P		



OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	AVAILABLE LOCKOUTS (SEE CHART)	CIRCUIT CONFIGURATION			ELECTRICAL CURRENT RATINGS (AMPS) - 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	7	20	15	4	15	10
		22	D, F, G	OFF	NONE	ON						
		23	D, F, G	ON	NONE	ON						
		24	E, F, K, M	NONE	OFF	ON						
		25	F	NONE	MOM OFF	ON						
		26	F	MOM ON	NONE	ON	5	18	10	2	11	8
		27	E, L, N	MOM ON	OFF	MOM ON						
		28	E	MOM ON	OFF	NONE						
		29	F	MOM OFF	NONE	ON						
		30	F	MOM ON	NONE	OFF						
		31	E, F, K, L, M, N	MOM ON	OFF	ON						
OTTO BASE PART NO.	MILITARY STANDARD	DASH NO.	E	KEYWAY	CENTER 1-2 / 4-5	OPP. KEYWAY 2-3 / 5-6	28 VDC			115 VAC		
							LAMP	RESISTIVE	INDUCTIVE	LAMP	RESISTIVE	INDUCTIVE
T9-MS2-	MS24659-	32	E	NONE	ON	MOM ON	5	18	10	2	11	8
		33	F, F, K, M	NONE	ON	ON	7	20	15	4	15	15

POSITIVE ACTION NON-TEASIBLE TOGGLE

The TE series is a MIL qualified, snap-action, non-teasible, positive make and break, panel mount toggle switch.

The non-teasible mechanism assures that the switch will actuate and not "hang up" even when actuated very slowly. A fluorosilicone O-ring seals 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 circuit, low level and power switching applications.

Features:

- Positive action miniature toggle
- Wiping action contacts
- Momentary & maintained toggle action
- Panel mount
- Solder lug termination
- Single & double pole
- Sealed per MIL-DTL-8834
- MIL qualified MS90310-211/221/231/271/311
MS90311-211/221/231/271/311
MS24655-211/221/231/271/311
MS24656-11/221/231/271/311/331/341/351
- RoHS & WEEE compliant



1/4-40 Bushing Style



15/32-32 Bushing Style

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: Aluminum alloy (15/32) or stainless steel (1/4-40)

Cover: Stainless steel

Mounting Hardware: Hex nuts, lockwasher and keyway washer
Silicone seal when applicable

TE PART NUMBER CODE

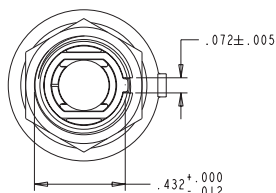
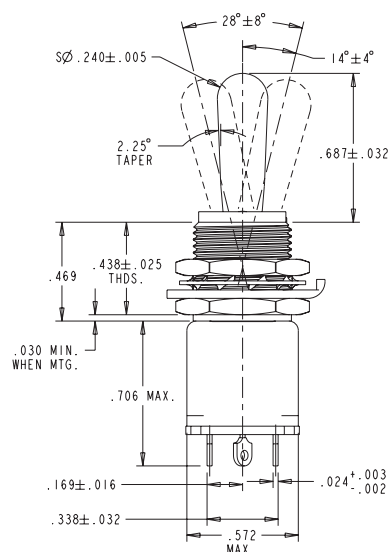
TE	—	X	X	X	X	X
Bushing Size	Terminal Style	Circuitry	Action (Lever Position)			Contact Material
1. 15/32-32 2. 1/4-40	1. Solder Lug	1. Single Pole 2. Double Pole	Opposite Keyway	Center	Keyway Side	1. Silver/Gold Plate
			1. ON	OFF	ON	
			2. ON	None	OFF	
			3. ON	None	ON	
			5. (ON)	OFF	(ON)	
			6. ON	OFF	(ON)	
			7. ON	ON	ON	
			8. (ON)	ON	(ON)	
			9. ON	ON	(ON)	
Optional Panel Seal Gasket P/N 710196 per MS-25196-1						

Optional Panel Seal Gasket
P/N 710196 per MS-25196-1

NOTE: () denotes momentary action.

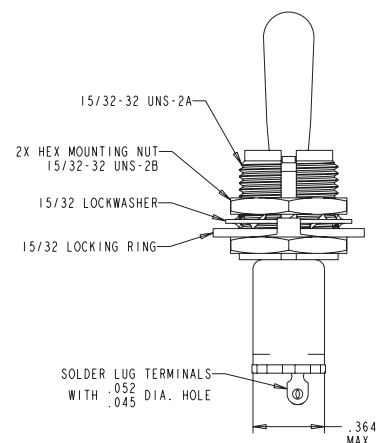
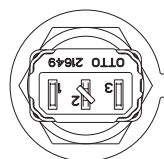
POSITIVE ACTION NON-TEASIBLE TOGGLE

TE-111 15/32-32, Single Pole MS90310

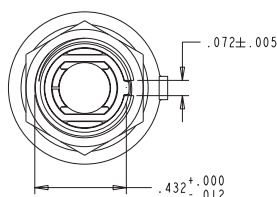
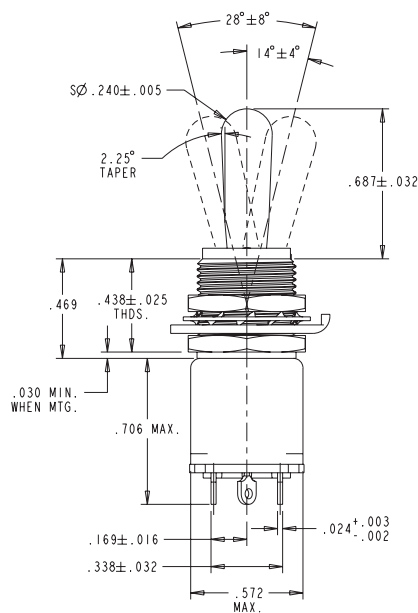


CIRCUITS MADE WITH LEVER IN THESE POSITIONS:			
	Opposite Keyway	Center	Keyway
1.	ON 2-3	OFF	ON 1-2
2.	ON 2-3	None	OFF
3.	ON 2-3	None	ON 1-2
5.	(ON) 2-3	OFF	(ON) 1-2
6.	ON 2-3	OFF	(ON) 1-2

NOTE: () denotes momentary action.

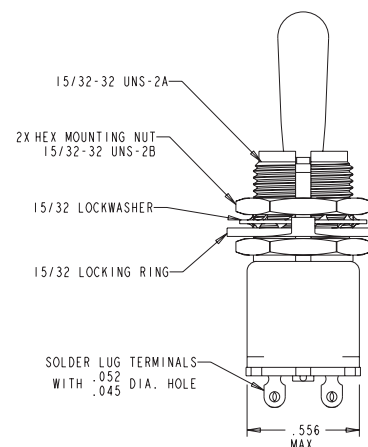
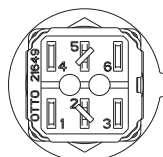


TE-112 15/32-32, Double Pole MS90311



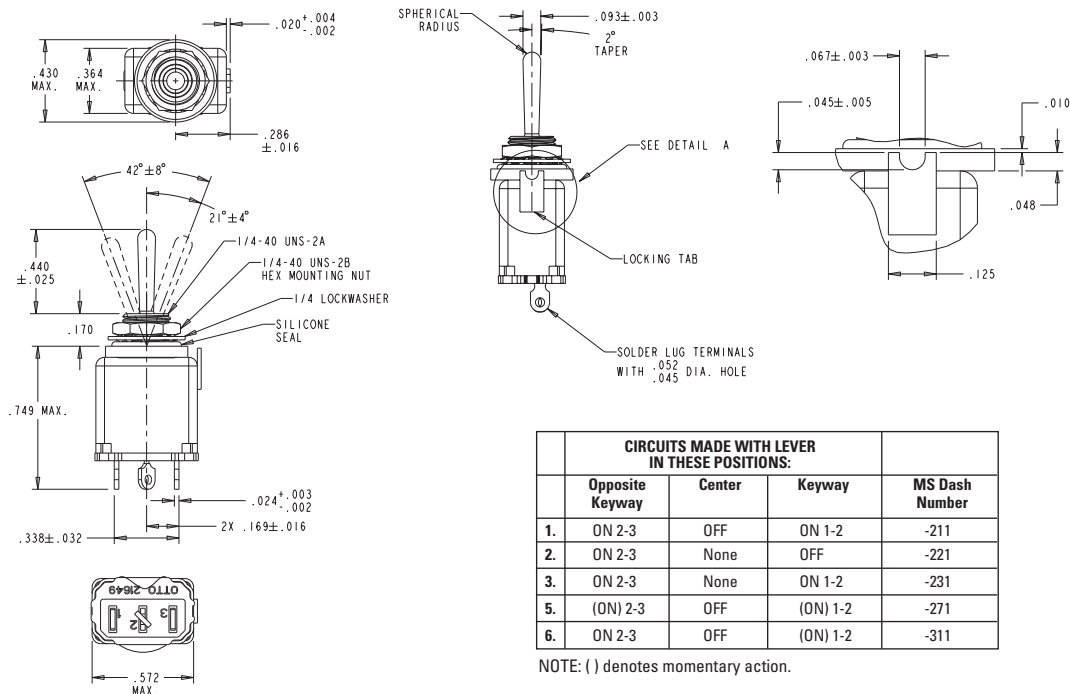
CIRCUITS MADE WITH LEVER IN THESE POSITIONS:			
	Opposite Keyway	Center	Keyway
1.	ON 2-3, 5-6	OFF	ON 1-2, 4-5
2.	ON 2-3, 5-6	None	OFF
3.	ON 2-3, 5-6	None	ON 1-2, 4-5
5.	(ON) 2-3, 5-6	OFF	(ON) 1-2, 4-5
6.	ON 2-3, 5-6	OFF	(ON) 1-2, 4-5

NOTE: () denotes momentary action.

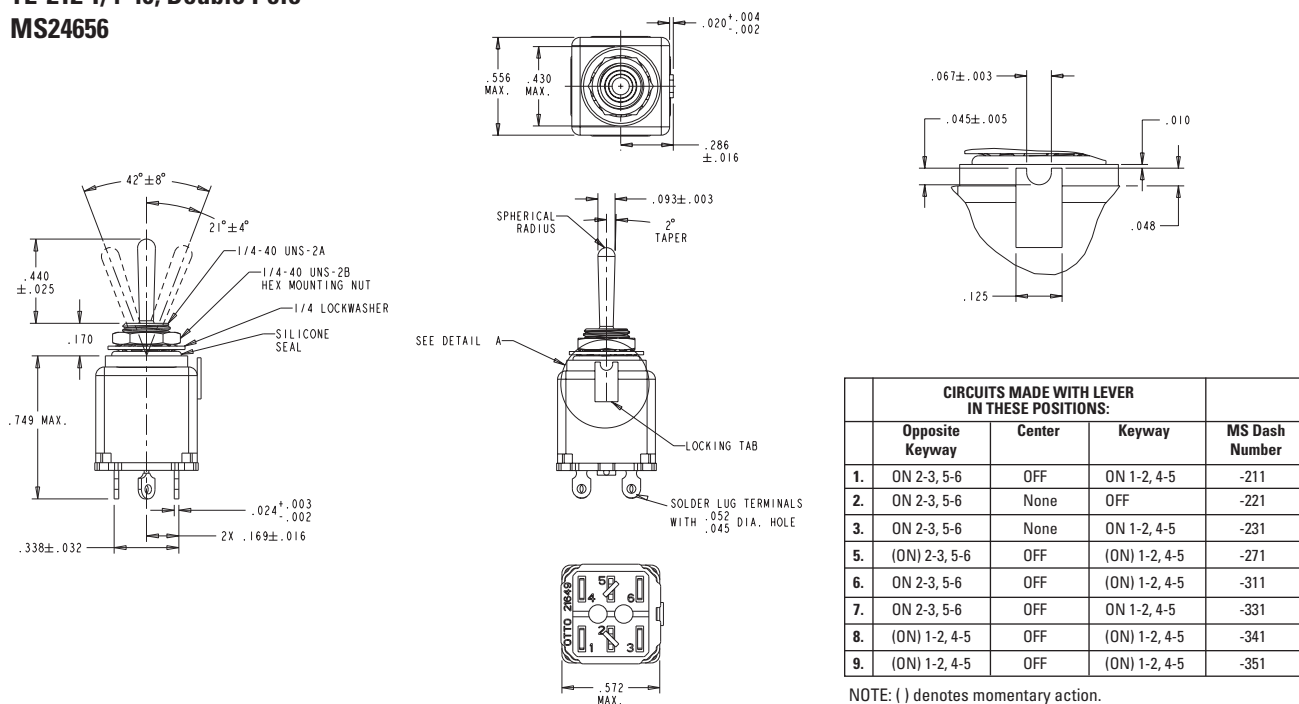


POSITIVE ACTION NON-TEASIBLE TOGGLE

TE-211 1/4-40 Bushing, Single Pole MS24655



TE-212 1/4-40, Double Pole MS24656



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.

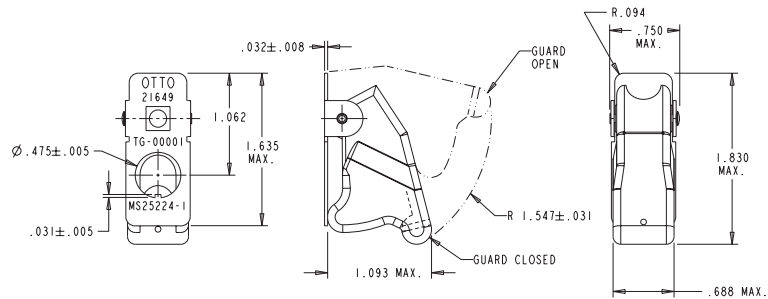
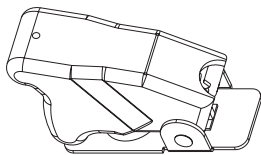
The toggle guard is easily installed on the switch from the front panel with two mounting hex nuts and may be used with an optional panel seal provided with each switch.

Features:

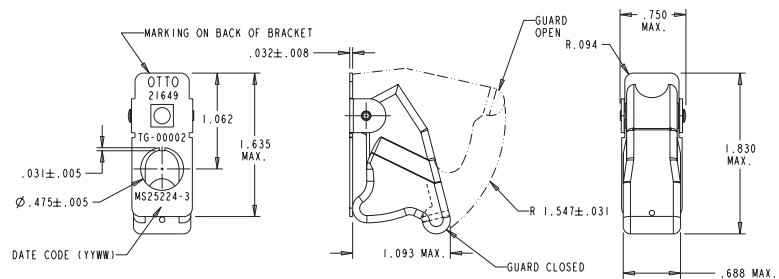
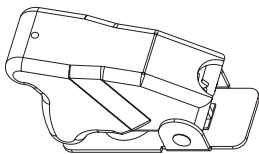
- MS approved & QPL'd
- Cover: Red molded plastic
- Bracket: Black painted steel



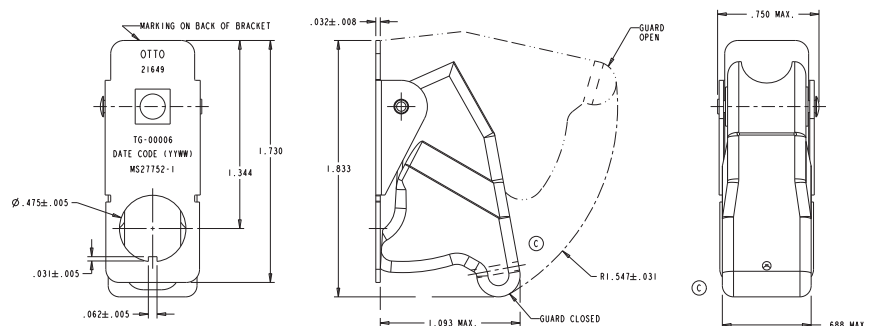
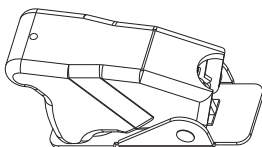
TG-00001 MS25224-1



TG-00002 MS25224-3



TG-00006 MS27752-1



0.750" DIAMETER FLANGE MOUNT, SHORT TRAVEL



Conical Hat
Shown

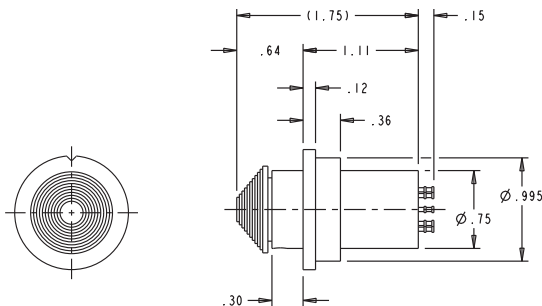
Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

Insulation Resistance:	100M Ω min @ 50VDC
Null Temp Coefficient:	+/- 0.04% of full scale per degree C max
Hysteresis:	+/- 0.5% of full scale within 1 second after release
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

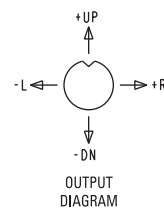
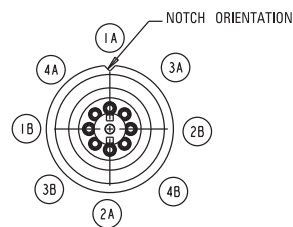
MATERIALS:

Button:	Thermoplastic or anodized aluminum
Terminals:	Tin plate over copper plate over brass
Wire:	MIL-W-16878/4, 12 inches min, 24 AWG
Hardware:	None provided

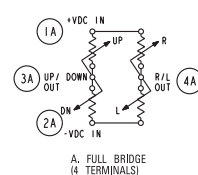


A. CONICAL HAT

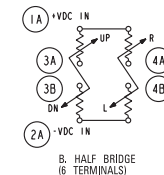
B. FLAT BUTTON



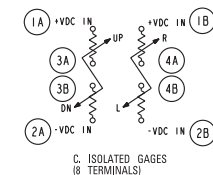
AVAILABLE CIRCUITS



A. FULL BRIDGE
(4 TERMINALS)



B. HALF BRIDGE
(6 TERMINALS)



C. ISOLATED GAGES
(8 TERMINALS)

J2-S1 PART NUMBER CODE

Circuit Type	Electrical I/O (See Table)	Termination	Button Style	Color
A. Full Bridge	B1.	1. Wire Leads	A. Conical Hat	P1. Red Thermoplastic ①
B. Half Bridge	B2.	2. Terminals	B. Flat Button	P2. Black Thermoplastic ①
C. Isolated	B3.			P8. Gray Thermoplastic ①
	B4.			BA. Black Anodized Aluminum ②
	B5.			CA. Clear Anodized Aluminum ②
	B6.			
	B7.			
	G1.			
	G2.			
	G3.			
	G4.			
	G5.			
	G6.			
	G7.			

① Conical hat only.
② Flat button only.

EXCITATION VOLTAGE TABLE

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	+/- 12.0	+/- 0.45	+/- 1.40	+/- 0.12		0.2
G1	+ 24.0	+/- 0.45	+/- 1.40		12.0 +/- 0.12	0.2
B2	+/- 10.0	+/- 0.45	+/- 1.40	+/- 0.12		0.2
G2	+ 20.0	+/- 0.45	+/- 1.40		10.0 +/- 0.12	0.2
B3	+/- 7.5	+/- 0.45	+/- 1.40	+/- 0.10		0.3
G3	+ 15.0	+/- 0.45	+/- 1.40		7.5 +/- 0.10	0.3
B4	+/- 6.0	+/- 0.45	+/- 1.40	+/- 0.10		0.2
G4	+ 12.0	+/- 0.45	+/- 1.40		6.0 +/- 0.10	0.2
B5	+/- 6.0	+/- 0.33	+/- 1.03	+/- 0.06		1.0
G5	+ 12.0	+/- 0.33	+/- 1.03		6.0 +/- 0.06	1.0
B6	+/- 5.0	+/- 0.33	+/- 1.03	+/- 0.05		1.0
G6	+ 10.0	+/- 0.33	+/- 1.03		5.0 +/- 0.05	1.0
B7	+/- 5.0	+/- 0.25	+/- 0.78	+/- 0.05		2.0
G7	+ 10.0	+/- 0.25	+/- 0.78		5.0 +/- 0.05	2.0

0.655" DIAMETER FLANGE MOUNT, SHORT TRAVEL



Flat Button Shown

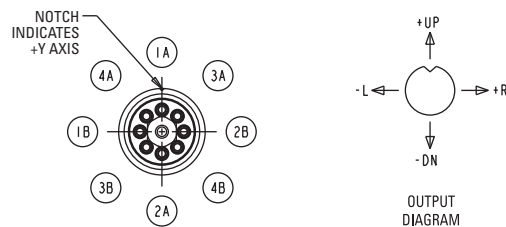
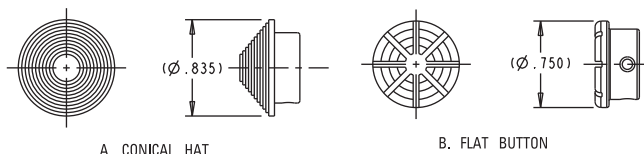
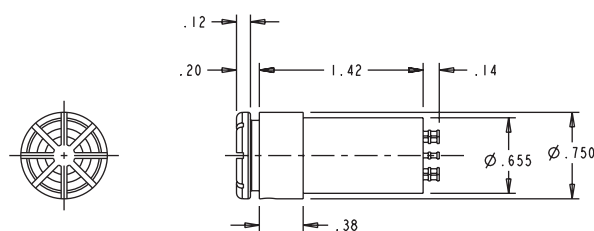
Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

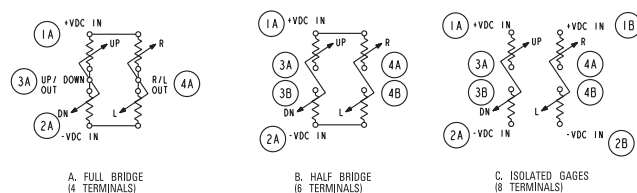
Insulation Resistance:	100MΩ min @ 50VDC
Null Temp Coefficient:	+/- 0.04% of full scale per degree C max
Hysteresis:	+/- 0.5% of full scale within 1 second after release
Sensitivity Temp Coefficient:	+/- 0.2% full scale per degree C
Resolution:	Infinite
Seal:	Enclosure dusttight per MIL-PRF-8805 Design 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
Terminals:	Tin plate over copper plate over brass
Wire:	MIL-W-16878/4, 12 inches min, 24 AWG
Hardware:	None provided



AVAILABLE CIRCUITS



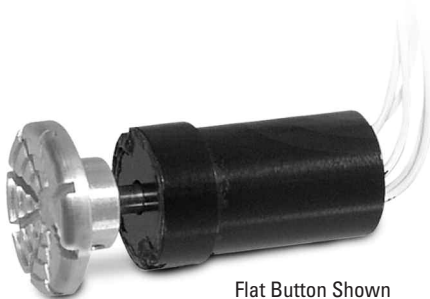
J2-S2 PART NUMBER CODE

J2-S2	X	XX	X	X	XX
Circuit Type	Electrical I/O (See Table)	Termination	Button Style	Color	
A. Full Bridge	B1.	1. Wire Leads	A. Conical Hat	P1. Red Thermoplastic ①	
B. Half Bridge	B2.	2. Terminals	B. Flat Button	P2. Black Thermoplastic ①	
C. Isolated	B3.			P8. Gray Thermoplastic ①	
	B4.			BA. Black Anodized Aluminum ②	
	B5.			CA. Clear Anodized Aluminum ②	
	B6.				
	B7.				
	G1.			① Conical hat only.	
	G2.			② Flat button only.	
	G3.				
	G4.				
	G5.				
	G6.				
	G7.				

EXCITATION VOLTAGE TABLE

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 ³)
B1	+/- 12.0	+/- 0.45	+/- 1.40	+/- 0.12		0.2
G1	+ 24.0	+/- 0.45	+/- 1.40		12.0 +/- 0.12	0.2
B2	+/- 10.0	+/- 0.45	+/- 1.40	+/- 0.12		0.2
G2	+ 20.0	+/- 0.45	+/- 1.40		10.0 +/- 0.12	0.2
B3	+/- 7.5	+/- 0.45	+/- 1.40	+/- 0.10		0.3
G3	+ 15.0	+/- 0.45	+/- 1.40		7.5 +/- 0.10	0.3
B4	+/- 6.0	+/- 0.45	+/- 1.40	+/- 0.10		0.2
G4	+ 12.0	+/- 0.45	+/- 1.40		6.0 +/- 0.10	0.2
B5	+/- 6.0	+/- 0.33	+/- 1.03	+/- 0.06		1.0
G5	+ 12.0	+/- 0.33	+/- 1.03		6.0 +/- 0.06	1.0
B6	+/- 5.0	+/- 0.33	+/- 1.03	+/- 0.05		1.0
G6	+ 10.0	+/- 0.33	+/- 1.03		5.0 +/- 0.05	1.0
B7	+/- 5.0	+/- 0.25	+/- 0.78	+/- 0.05		2.0
G7	+ 10.0	+/- 0.25	+/- 0.78		5.0 +/- 0.05	2.0

0.560" DIAMETER FLANGE MOUNT, SHORT TRAVEL



Flat Button Shown

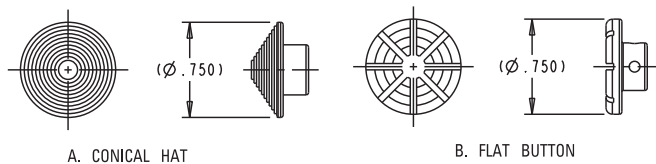
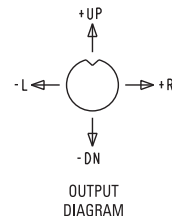
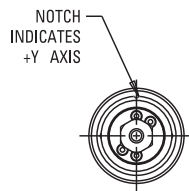
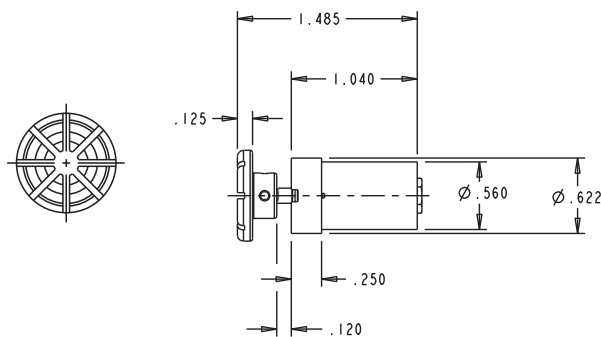
Standard Characteristics/Ratings:

ELECTRICAL RATINGS:

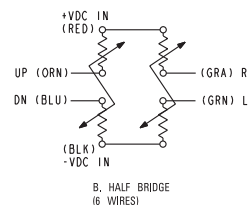
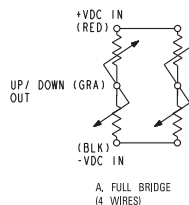
Insulation Resistance:	100M Ω min @ 50VDC
Null Temp Coefficient:	+/- 0.04% of full scale per degree C max
Hysteresis:	+/- 0.5% of full scale within 1 second after release
Sensitivity Temp Coefficient:	+/- 0.2% full scale per degree C
Resolution:	Infinite
Seal:	Enclosure dusttight per MIL-PRF-8805 Design 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:

Wire:	MIL-W-16878/4, 12 inches min 24 AWG
Button:	Thermoplastic or anodized aluminum
Hardware:	None provided



AVAILABLE CIRCUITS



J2-S3 PART NUMBER CODE

Circuit Type	Electrical I/O (See Table)	Termination	Button Style	Color
A. Full Bridge B. Half Bridge	B1. B2. B3. B4. B5. G1. G2. G3. G4. G5.	1. Wire Leads	A. Conical Hat B. Flat Button	P1. Red Thermoplastic ① P2. Black Thermoplastic ① P8. Gray Thermoplastic ① BA. Black Anodized Aluminum ② CA. Clear Anodized Aluminum ②

① Conical hat only.
② Flat button only.

EXCITATION VOLTAGE TABLE

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 ³)
B1	+/- 7.5	+/- 0.45	+/- 1.40	+/- 0.10		0.3
G1	+ 15.0	+/- 0.45	+/- 1.40		7.5 +/- 0.10	0.3
B2	+/- 6.0	+/- 0.45	+/- 1.40	+/- 0.10		0.2
G2	+ 12.0	+/- 0.45	+/- 1.40		6.0 +/- 0.10	0.2
B3	+/- 6.0	+/- 0.33	+/- 1.03	+/- 0.06		1.0
G3	+ 12.0	+/- 0.33	+/- 1.03		6.0 +/- 0.06	1.0
B4	+/- 5.0	+/- 0.33	+/- 1.03	+/- 0.05		1.0
G4	+ 10.0	+/- 0.33	+/- 1.03		5.0 +/- 0.05	1.0
B5	+/- 5.0	+/- 0.25	+/- 0.78	+/- 0.05		2.0
G5	+ 10.0	+/- 0.25	+/- 0.78		5.0 +/- 0.05	2.0

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.
M8805/99		M8805/104		M8805/110-1151	P7-115121	M8805/110-1329	P7-152129
M8805/99-009	PE2-11121	M8805/104-001	P6-20001	M8805/110-1152	P7-115122	M8805/110-1361	P7-156121
M8805/99-010	PE2-21121	M8805/104-002	P6-10002	M8805/110-1153	P7-115123	M8805/110-1362	P7-156122
M8805/99-011	PE2-31121	M8805/104-003	P6-20002	M8805/110-1154	P7-115124	M8805/110-1369	P7-156129
M8805/99-013	PE2-11111	M8805/104-004	P6-10003	M8805/110-1155	P7-115125	M8805/110-1411	P7-111221
M8805/99-014	PE2-21111			M8805/110-1156	P7-115126	M8805/110-1412	P7-111222
M8805/99-015	PE2-31111	M8805/106		M8805/110-1154	P7-115127	M8805/110-1418	P7-111228
M8805/99-025	PE2-11221	M8805/106-01	B2-200031	M8805/110-1158	P7-115128	M8805/110-1419	P7-111229
M8805/99-026	PE2-21221	M8805/106-02	B2-200032	M8805/110-1159	P7-115129	M8805/110-1421	P7-112221
M8805/99-027	PE2-31221			M8805/110-1161	P7-116121	M8805/110-1422	P7-112222
M8805/99-029	PE2-11211	M8805/109		M8805/110-1162	P7-116122	M8805/110-1429	P7-112229
M8805/99-030	PE2-21211	M8805/109-01	B2-111351	M8805/110-1163	P7-116123	M8805/110-1431	P7-113221
M8805/99-031	PE2-31211	M8805/109-02	B2-112351	M8805/110-1164	P7-116124	M8805/110-1432	P7-113222
M8805/99-037	PE2-11131	M8805/109-03	B2-111353	M8805/110-1165	P7-116125	M8805/110-1439	P7-113229
M8805/99-038	PE2-21131	M8805/109-04	B2-112353	M8805/110-1166	P7-116126	M8805/110-1442	P7-114222
M8805/99-039	PE2-31131			M8805/110-1167	P7-116127	M8805/110-1449	P7-114229
M8805/99/045	PE2-11231	M8805/110		M8805/110-1168	P7-116128	M8805/110-1451	P7-115221
M8805/99-046	PE2-21231	M8805/110-1111	P7-111121	M8805/110-1169	P7-116129	M8805/110-1452	P7-115222
M8805/99-047	PE2-31231	M8805/110-1112	P7-111122	M8805/110-1211	P7-131121	M8805/110-1459	P7-115229
		M8805/110-1113	P7-111123	M8805/110-1212	P7-131122	M8805/110-1461	P7-116221
M8805/100		M8805/110-1114	P7-111124	M8805/110-1213	P7-131123	M8805/110-1462	P7-116222
M8805/100-007	P6-24043	M8805/110-1115	P7-111125	M8805/110-1214	P7-131124	M8805/110-1469	P7-116229
M8805/100-008	P6-24044	M8805/110-1116	P7-111126	M8805/110-1215	P7-131125	M8805/110-1511	P7-131221
M8805/100-009	P6-14035	M8805/110-1117	P7-111127	M8805/110-1216	P7-131126	M8805/110-1512	P7-131222
M8805/100-010	P6-14036	M8805/110-1118	P7-111128	M8805/110-1217	P7-131127	M8805/110-1516	P7-131226
M8805/100-015	P6-24007	M8805/110-1119	P7-111129	M8805/110-1218	P7-131128	M8805/110-1519	P7-131229
M8805/100-016	P6-24008	M8805/110-1121	P7-112121	M8805/110-1219	P7-131129	M8805/110-1521	P7-132221
M8805/100-017	P6-14005	M8805/110-1122	P7-112122	M8805/110-1221	P7-132121	M8805/110-1522	P7-132222
M8805/100-018	P6-14006	M8805/110-1123	P7-112123	M8805/110-1222	P7-132122	M8805/110-1529	P7-132229
		M8805/110-1124	P7-112124	M8805/110-1223	P7-132123	M8805/110-1531	P7-133221
M8805/101		M8805/110-1125	P7-112125	M8805/110-1224	P7-132124	M8805/110-1532	P7-133222
M8805/101-001	B3-10064	M8805/110-1126	P7-112126	M8805/110-1225	P7-132125	M8805/110-1539	P7-133229
M8805/101-002	B3-10065	M8805/110-1127	P7-112127	M8805/110-1226	P7-132126	M8805/110-1541	P7-134221
M8805/101-003	B3-10066	M8805/110-1128	P7-112128	M8805/110-1227	P7-132127	M8805/110-1542	P7-134222
M8805/101-004	B3-10067	M8805/110-1129	P7-112129	M8805/110-1228	P7-132128	M8805/110-1549	P7-134229
M8805/101-005	B3-10063	M8805/110-1131	P7-113121	M8805/110-1229	P7-132129	M8805/110-1551	P7-135221
M8805/101-006	B3-10072	M8805/110-1132	P7-113122	M8805/110-1231	P7-133121	M8805/110-1552	P7-135222
M8805/101-007	B3-11141	M8805/110-1133	P7-113123	M8805/110-1232	P7-133122	M8805/110-1559	P7-135229
M8805/101-008	B3-11142	M8805/110-1134	P7-113124	M8805/110-1239	P7-133129	M8805/110-1561	P7-136221
M8805/101-009	B3-12141	M8805/110-1135	P7-113125	M8805/110-1241	P7-134121	M8805/110-1562	P7-136222
M8805/101-010	B3-12142	M8805/110-1136	P7-113126	M8805/110-1242	P7-134122	M8805/110-1611	P7-151221
M8805/101-011	B3-15141	M8805/110-1137	P7-113127	M8805/110-1249	P7-134129	M8805/110-1612	P7-151222
M8805/101-012	B3-15142	M8805/110-1138	P7-113128	M8805/110-1251	P7-135121	M8805/110-1613	P7-151223
M8805/101-013	B3-13141	M8805/110-1139	P7-113129	M8805/110-1252	P7-135122	M8805/110-1619	P7-151229
M8805/101-014	B3-13142	M8805/110-1141	P7-114121	M8805/110-1259	P7-135129	M8805/110-1621	P7-152221
M8805/101-015	B3-11131	M8805/110-1142	P7-114122	M8805/110-1261	P7-136121	M8805/110-1622	P7-152222
M8805/101-016	B3-11132	M8805/110-1143	P7-114123	M8805/110-1262	P7-136122	M8805/110-1629	P7-152229
M8805/101-017	B3-12131	M8805/110-1144	P7-114124	M8805/110-1269	P7-136129	M8805/110-1661	P7-156221
M8805/101-018	B3-12132	M8805/110-1145	P7-114125	M8805/110-1311	P7-151121	M8805/110-1662	P7-156222
M8805/101-019	B3-15131	M8805/110-1146	P7-114126	M8805/110-1312	P7-151122	M8805/110-1669	P7-156229
M8805/101-020	B3-15132	M8805/110-1147	P7-114127	M8805/110-1319	P7-151129	M8805/110-1761	P7-166121
M8805/101-021	B3-13131	M8805/110-1148	P7-114128	M8805/110-1321	P7-152121	M8805/110-2111	P7-211121
M8805/101-022	B3-13132	M8805/110-1149	P7-114129	M8805/110-1322	P7-152122	M8805/110-2112	P7-211122

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.
M8805/110-2113	P7-211123	M8805/110-2429	P7-212229	M8805/110-3132	P7-313122	M8805/110-3432	P7-313222
M8805/110-2114	P7-211124	M8805/110-2431	P7-213221	M8805/110-3139	P7-313129	M8805/110-3439	P7-313229
M8805/110-2115	P7-211125	M8805/110-2432	P7-213222	M8805/110-3141	P7-314121	M8805/110-3441	P7-314221
M8805/110-2119	P7-211129	M8805/110-2439	P7-213229	M8805/110-3142	P7-314122	M8805/110-3442	P7-314222
M8805/110-2121	P7-212121	M8805/110-2441	P7-214221	M8805/110-3149	P7-314129	M8805/110-3449	P7-314229
M8805/110-2122	P7-212122	M8805/110-2449	P7-214229	M8805/110-3151	P7-315121	M8805/110-3451	P7-315221
M8805/110-2128	P7-212128	M8805/110-2451	P7-215221	M8805/110-3152	P7-315122	M8805/110-3452	P7-315222
M8805/110-2129	P7-212129	M8805/110-2452	P7-215222	M8805/110-3159	P7-315129	M8805/110-3459	P7-315229
M8805/110-2131	P7-213121	M8805/110-2459	P7-215229	M8805/110-3161	P7-316121	M8805/110-3461	P7-316221
M8805/110-2132	P7-213122	M8805/110-2461	P7-216221	M8805/110-3162	P7-316122	M8805/110-3462	P7-316222
M8805/110-2139	P7-213129	M8805/110-2462	P7-216222	M8805/110-3168	P7-316128	M8805/110-3469	P7-316229
M8805/110-2141	P7-214121	M8805/110-2468	P7-216228	M8805/110-3169	P7-316129	M8805/110-3511	P7-331221
M8805/110-2142	P7-214122	M8805/110-2469	P7-216229	M8805/110-3211	P7-331121	M8805/110-3512	P7-331222
M8805/110-2149	P7-214129	M8805/110-2511	P7-231221	M8805/110-3212	P7-331122	M8805/110-3515	P7-331225
M8805/110-2151	P7-215121	M8805/110-2512	P7-231222	M8805/110-3213	P7-331123	M8805/110-3519	P7-331229
M8805/110-2152	P7-215122	M8805/110-2518	P7-231228	M8805/110-3214	P7-331124	M8805/110-3521	P7-332221
M8805/110-2159	P7-215129	M8805/110-2519	P7-231229	M8805/110-3215	P7-331125	M8805/110-3522	P7-332222
M8805/110-2161	P7-216121	M8805/110-2521	P7-232221	M8805/110-3216	P7-331126	M8805/110-3531	P7-333221
M8805/110-2162	P7-216122	M8805/110-2522	P7-232222	M8805/110-3218	P7-331128	M8805/110-3532	P7-333222
M8805/110-2168	P7-216128	M8805/110-2529	P7-232229	M8805/110-3219	P7-331129	M8805/110-3541	P7-334221
M8805/110-2169	P7-216129	M8805/110-2531	P7-233221	M8805/110-3221	P7-332121	M8805/110-3542	P7-334222
M8805/110-2211	P7-231121	M8805/110-2532	P7-233222	M8805/110-3222	P7-332122	M8805/110-3549	P7-334229
M8805/110-2212	P7-231122	M8805/110-2539	P7-233229	M8805/110-3224	P7-332124	M8805/110-3551	P7-335221
M8805/110-2218	P7-231128	M8805/110-2541	P7-234221	M8805/110-3229	P7-332129	M8805/110-3552	P7-335222
M8805/110-2219	P7-231129	M8805/110-2542	P7-234222	M8805/110-3231	P7-333121	M8805/110-3559	P7-335229
M8805/110-2221	P7-232121	M8805/110-2549	P7-234229	M8805/110-3232	P7-333122	M8805/110-3561	P7-336221
M8805/110-2222	P7-232122	M8805/110-2551	P7-235221	M8805/110-3239	P7-333129	M8805/110-3562	P7-336222
M8805/110-2229	P7-232129	M8805/110-2552	P7-235222	M8805/110-3241	P7-334121	M8805/110-3564	P7-336224
M8805/110-2231	P7-233121	M8805/110-2559	P7-235129	M8805/110-3242	P7-334122	M8805/110-3569	P7-336229
M8805/110-2232	P7-233122	M8805/110-2559	P7-235229	M8805/110-3249	P7-334129	M8805/110-3611	P7-351221
M8805/110-2241	P7-234121	M8805/110-2561	P7-236221	M8805/110-3251	P7-335121	M8805/110-3612	P7-351222
M8805/110-2242	P7-234122	M8805/110-2562	P7-236222	M8805/110-3252	P7-335122	M8805/110-3619	P7-351229
M8805/110-2249	P7-234129	M8805/110-2569	P7-236229	M8805/110-3259	P7-335219	M8805/110-3621	P7-352221
M8805/110-2251	P7-235121	M8805/110-2611	P7-251221	M8805/110-3261	P7-336121	M8805/110-3622	P7-352222
M8805/110-2252	P7-238122	M8805/110-2612	P7-251222	M8805/110-3262	P7-336122	M8805/110-3629	P7-352229
M8805/110-2261	P7-236121	M8805/110-2619	P7-251229	M8805/110-3269	P7-336129	M8805/110-3661	P7-356221
M8805/110-2262	P7-236122	M8805/110-2621	P7-252221	M8805/110-3311	P7-351121	M8805/110-3662	P7-356222
M8805/110-2269	P7-236129	M8805/110-2622	P7-252222	M8805/110-3312	P7-351122	M8805/110-3711	P7-361121
M8805/110-2311	P7-251121	M8805/110-2629	P7-252229	M8805/110-3319	P7-351129	M8805/110-3712	P7-361122
M8805/110-2312	P7-251122	M8805/110-2661	P7-256221	M8805/110-3321	P7-352121	M8805/110-3721	P7-362121
M8805/110-2319	P7-251129	M8805/110-2661	P7-256221	M8805/110-3322	P7-352122	M8805/110-5111	P7-511121
M8805/110-2321	P7-252121	M8805/110-2662	P7-256222	M8805/110-3329	P7-352129	M8805/110-5112	P7-511122
M8805/110-2322	P7-252122	M8805/110-2669	P7-256229	M8805/110-3361	P7-356121	M8805/110-5114	P7-511124
M8805/110-2329	P7-252129	M8805/110-3111	P7-311121	M8805/110-3362	P7-356122	M8805/110-5115	P7-511125
M8805/110-2339	P7-234121	M8805/110-3112	P7-311122	M8805/110-3369	P7-356129	M8805/110-5118	P7-511128
M8805/110-2361	P7-256121	M8805/110-3113	P7-311123	M8805/110-3411	P7-311221	M8805/110-5119	P7-511129
M8805/110-2362	P7-256122	M8805/110-3114	P7-311124	M8805/110-3412	P7-311222	M8805/110-5121	P7-512121
M8805/110-2369	P7-256129	M8805/110-3116	P7-311126	M8805/110-3415	P7-311225	M8805/110-5122	P7-512122
M8805/110-2411	P7-211221	M8805/110-3119	P7-311129	M8805/110-3419	P7-311229	M8805/110-5129	P7-512129
M8805/110-2412	P7-211222	M8805/110-3121	P7-312121	M8805/110-3421	P7-312221	M8805/110-5131	P7-513121
M8805/110-2419	P7-211229	M8805/110-3122	P7-312122	M8805/110-3422	P7-312222	M8805/110-5132	P7-512122
M8805/110-2421	P7-212221	M8805/110-3129	P7-312129	M8805/110-3429	P7-312229	M8805/110-5139	P7-513129
M8805/110-2422	P7-212222	M8805/110-3131	P7-313121	M8805/110-3431	P7-313221	M8805/110-5141	P7-514121

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.
M8805/110-5142	P7-514122	M8805/110-5369	P7-556129	M8805/110-5722	P7-562122	M8805/110-6421	P7-612221
M8805/110-5149	P7-514129	M8805/110-5411	P7-511221	M8805/110-5812	P7-561222	M8805/110-6422	P7-612222
M8805/110-5151	P7-515121	M8805/110-5412	P7-511222	M8805/110-6111	P7-611121	M8805/110-6429	P7-612229
M8805/110-5152	P7-515122	M8805/110-5418	P7-511228	M8805/110-6112	P7-611122	M8805/110-6431	P7-613221
M8805/110-5158	P7-515128	M8805/110-5419	P7-511229	M8805/110-6119	P7-611129	M8805/110-6432	P7-613222
M8805/110-5159	P7-515129	M8805/110-5421	P7-512221	M8805/110-6121	P7-612121	M8805/110-6439	P7-613229
M8805/110-5161	P7-516121	M8805/110-5422	P7-512222	M8805/110-6122	P7-612122	M8805/110-6441	P7-614221
M8805/110-5162	P7-516122	M8805/110-5428	P7-512228	M8805/110-6129	P7-612129	M8805/110-6442	P7-614222
M8805/110-5164	P7-516124	M8805/110-5429	P7-512229	M8805/110-6131	P7-613121	M8805/110-6449	P7-614229
M8805/110-5166	P7-516126	M8805/110-5431	P7-513221	M8805/110-6132	P7-613122	M8805/110-6451	P7-615221
M8805/110-5169	P7-516129	M8805/110-5432	P7-513222	M8805/110-6139	P7-613129	M8805/110-6452	P7-615222
M8805/110-5211	P7-531121	M8805/110-5439	P7-513229	M8805/110-6141	P7-614121	M8805/110-6459	P7-615229
M8805/110-5212	P7-531122	M8805/110-5441	P7-514221	M8805/110-6142	P7-614122	M8805/110-6461	P7-616221
M8805/110-5215	P7-531125	M8805/110-5442	P7-514222	M8805/110-6149	P7-615121	M8805/110-6462	P7-616222
M8805/110-5216	P7-531126	M8805/110-5449	P7-514229	M8805/110-6151	P7-615121	M8805/110-6468	P7-616228
M8805/110-5218	P7-531128	M8805/110-5451	P7-515221	M8805/110-6152	P7-615122	M8805/110-6469	P7-616229
M8805/110-5219	P7-531129	M8805/110-5452	P7-515222	M8805/110-6159	P7-615129	M8805/110-6511	P7-631221
M8805/110-5221	P7-532121	M8805/110-5459	P7-515229	M8805/110-6161	P7-616121	M8805/110-6512	P7-631222
M8805/110-5222	P7-532122	M8805/110-5461	P7-516221	M8805/110-6162	P7-616122	M8805/110-6514	P7-631224
M8805/110-5229	P7-532129	M8805/110-5462	P7-516222	M8805/110-6168	P7-616128	M8805/110-6519	P7-631229
M8805/110-5231	P7-533121	M8805/110-5468	P7-516228	M8805/110-6169	P7-616129	M8805/110-6521	P7-632221
M8805/110-5232	P7-533122	M8805/110-5469	P7-516229	M8805/110-6211	P7-631121	M8805/110-6522	P7-632222
M8805/110-5239	P7-533129	M8805/110-5511	P7-531221	M8805/110-6212	P7-631122	M8805/110-6529	P7-632229
M8805/110-5241	P7-534121	M8805/110-5512	P7-531222	M8805/110-6219	P7-631129	M8805/110-6531	P7-633221
M8805/110-5241	P7-534121	M8805/110-5515	P7-531225	M8805/110-6221	P7-632121	M8805/110-6532	P7-633222
M8805/110-5242	P7-534122	M8805/110-5519	P7-531229	M8805/110-6222	P7-632122	M8805/110-6539	P7-633229
M8805/110-5249	P7-534129	M8805/110-5521	P7-532221	M8805/110-6224	P7-632124	M8805/110-6541	P7-634221
M8805/110-5251	P7-535121	M8805/110-5522	P7-532222	M8805/110-6229	P7-632129	M8805/110-6542	P7-634222
M8805/110-5251	P7-535121	M8805/110-5529	P7-532229	M8805/110-6231	P7-633121	M8805/110-6549	P7-634229
M8805/110-5252	P7-535122	M8805/110-5531	P7-533221	M8805/110-6232	P7-633122	M8805/110-6551	P7-635221
M8805/110-5252	P7-535122	M8805/110-5532	P7-533222	M8805/110-6239	P7-633129	M8805/110-6552	P7-635222
M8805/110-5259	P7-535129	M8805/110-5539	P7-533229	M8805/110-6241	P7-634121	M8805/110-6555	P7-635225
M8805/110-5259	P7-535129	M8805/110-5541	P7-534221	M8805/110-6242	P7-634122	M8805/110-6559	P7-635229
M8805/110-5261	P7-536121	M8805/110-5542	P7-534222	M8805/110-6249	P7-634129	M8805/110-6561	P7-636221
M8805/110-5261	P7-536121	M8805/110-5549	P7-534229	M8805/110-6251	P7-635121	M8805/110-6562	P7-636222
M8805/110-5262	P7-536122	M8805/110-5551	P7-535221	M8805/110-6252	P7-635122	M8805/110-6569	P7-636229
M8805/110-5262	P7-536122	M8805/110-5552	P7-535222	M8805/110-6259	P7-635129	M8805/110-6611	P7-651221
M8805/110-5264	P7-536124	M8805/110-5559	P7-535229	M8805/110-6261	P7-636121	M8805/110-6612	P7-651222
M8805/110-5268	P7-536128	M8805/110-5561	P7-536221	M8805/110-6262	P7-636122	M8805/110-6619	P7-651229
M8805/110-5269	P7-536129	M8805/110-5562	P7-536222	M8805/110-6269	P7-636129	M8805/110-6621	P7-652221
M8805/110-5269	P7-536129	M8805/110-5566	P7-536126	M8805/110-6311	P7-651121	M8805/110-6622	P7-652222
M8805/110-5311	P7-551121	M8805/110-5569	P7-536229	M8805/110-6312	P7-651122	M8805/110-6629	P7-652229
M8805/110-5311	P7-551121	M8805/110-5611	P7-551221	M8805/110-6319	P7-651129	M8805/110-6661	P7-656221
M8805/110-5312	P7-551122	M8805/110-5612	P7-551222	M8805/110-6321	P7-652121	M8805/110-6662	P7-656222
M8805/110-5312	P7-551122	M8805/110-5619	P7-551229	M8805/110-6322	P7-652122	M8805/110-6669	P7-656229
M8805/110-5317	P7-551129	M8805/110-5621	P7-552221	M8805/110-6329	P7-652129	M8805/110-6712	P7-661122
M8805/110-5319	P7-551129	M8805/110-5622	P7-552222	M8805/110-6361	P7-656121	M8805/110-6812	P7-661222
M8805/110-5321	P7-533121	M8805/110-5629	P7-552229	M8805/110-6362	P7-656122	M8805/110-7111	P7-711121
M8805/110-5321	P7-552121	M8805/110-5661	P7-556221	M8805/110-6369	P7-656129	M8805/110-7112	P7-711122
M8805/110-5322	P7-552122	M8805/110-5662	P7-556222	M8805/110-6411	P7-611221	M8805/110-7119	P7-711129
M8805/110-5329	P7-552129	M8805/110-5669	P7-556229	M8805/110-6412	P7-611222	M8805/110-7121	P7-712121
M8805/110-5361	P7-556121	M8805/110-5711	P7-561121	M8805/110-6416	P7-611226	M8805/110-7122	P7-712122
M8805/110-5362	P7-556122	M8805/110-5712	P7-561122	M8805/110-6419	P7-611229	M8805/110-7129	P7-712129

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.
M8805/110-7131	P7-713121	M8805/110-7439	P7-713229	M8805/110-8149	P7-814129	M8805/110-8459	P7-815229
M8805/110-7132	P7-713122	M8805/110-7441	P7-714221	M8805/110-8151	P7-815121	M8805/110-8461	P7-816221
M8805/110-7139	P7-713129	M8805/110-7442	P7-714222	M8805/110-8152	P7-815122	M8805/110-8462	P7-816222
M8805/110-7141	P7-714121	M8805/110-7449	P7-714229	M8805/110-8154	P7-815124	M8805/110-8468	P7-816228
M8805/110-7142	P7-714122	M8805/110-7451	P7-715221	M8805/110-8159	P7-815129	M8805/110-8469	P7-816229
M8805/110-7149	P7-714129	M8805/110-7452	P7-715222	M8805/110-8161	P7-816121	M8805/110-8511	P7-813221
M8805/110-7151	P7-715121	M8805/110-7459	P7-715229	M8805/110-8162	P7-816122	M8805/110-8512	P7-831222
M8805/110-7152	P7-715122	M8805/110-7461	P7-716221	M8805/110-8168	P7-816128	M8805/110-8519	P7-831229
M8805/110-7152	P7-715122	M8805/110-7462	P7-716222	M8805/110-8169	P7-816129	M8805/110-8521	P7-832221
M8805/110-7154	P7-715124	M8805/110-7469	P7-716229	M8805/110-8169	P7-816129	M8805/110-8522	P7-832222
M8805/110-7159	P7-715129	M8805/110-7511	P7-731221	M8805/110-8211	P7-831121	M8805/110-8529	P7-832229
M8805/110-7161	P7-716121	M8805/110-7512	P7-731222	M8805/110-8212	P7-831122	M8805/110-8531	P7-833221
M8805/110-7162	P7-716122	M8805/110-7519	P7-731229	M8805/110-8218	P7-831128	M8805/110-8532	P7-833222
M8805/110-7168	P7-716128	M8805/110-7521	P7-732221	M8805/110-8219	P7-831129	M8805/110-8539	P7-833229
M8805/110-7169	P7-716129	M8805/110-7522	P7-732222	M8805/110-8221	P7-832121	M8805/110-8541	P7-834221
M8805/110-7211	P7-731121	M8805/110-7529	P7-732229	M8805/110-8222	P7-832122	M8805/110-8542	P7-834222
M8805/110-7212	P7-731122	M8805/110-7531	P7-733221	M8805/110-8229	P7-832129	M8805/110-8549	P7-834229
M8805/110-7215	P7-731125	M8805/110-7532	P7-733222	M8805/110-8231	P7-833121	M8805/110-8551	P7-835221
M8805/110-7219	P7-731129	M8805/110-7539	P7-733229	M8805/110-8232	P7-833122	M8805/110-8552	P7-835222
M8805/110-7221	P7-732121	M8805/110-7541	P7-734221	M8805/110-8239	P7-833129	M8805/110-8559	P7-835229
M8805/110-7222	P7-732122	M8805/110-7542	P7-734222	M8805/110-8241	P7-834121	M8805/110-8561	P7-836211
M8805/110-7229	P7-732129	M8805/110-7549	P7-734229	M8805/110-8242	P7-834122	M8805/110-8562	P7-836222
M8805/110-7231	P7-733121	M8805/110-7551	P7-735221	M8805/110-8249	P7-834129	M8805/110-8569	P7-836229
M8805/110-7232	P7-733122	M8805/110-7552	P7-735222	M8805/110-8251	P7-835121	M8805/110-8611	P7-851221
M8805/110-7239	P7-733129	M8805/110-7559	P7-735229	M8805/110-8252	P7-835122	M8805/110-8612	P7-851222
M8805/110-7241	P7-734121	M8805/110-7561	P7-736221	M8805/110-8259	P7-835129	M8805/110-8619	P7-851229
M8805/110-7242	P7-734122	M8805/110-7562	P7-736222	M8805/110-8261	P7-836121	M8805/110-8621	P7-852221
M8805/110-7249	P7-734129	M8805/110-7569	P7-736229	M8805/110-8262	P7-836122	M8805/110-8622	P7-852222
M8805/110-7251	P7-735121	M8805/110-7611	P7-751221	M8805/110-8269	P7-836129	M8805/110-8629	P7-852229
M8805/110-7252	P7-735122	M8805/110-7612	P7-751222	M8805/110-8311	P7-851121	M8805/110-8661	P7-856221
M8805/110-7259	P7-735129	M8805/110-7619	P7-751229	M8805/110-8312	P7-851122	M8805/110-8662	P7-856222
M8805/110-7261	P7-736121	M8805/110-7621	P7-752221	M8805/110-8319	P7-851129	M8805/110-8669	P7-856229
M8805/110-7262	P7-736122	M8805/110-7622	P7-752222	M8805/110-8321	P7-852121		
M8805/110-7269	P7-736129	M8805/110-7629	P7-752229	M8805/110-8322	P7-852122	M8805/111	
M8805/110-7311	P7-751121	M8805/110-7661	P7-756221	M8805/110-8329	P7-852129	M8805/111-01	U2-016
M8805/110-7312	P7-751122	M8805/110-7662	P7-756222	M8805/110-8361	P7-856121	M8805/111-02	U2-081
M8805/110-7312	P7-751122	M8805/110-7669	P7-756229	M8805/110-8362	P7-856122	M8805/111-03	U2-082
M8805/110-7319	P7-751129	M8805/110-7711	P7-761121	M8805/110-8369	P7-856129	M8805/111-04	U2-025
M8805/110-7321	P7-752121	M8805/110-7712	P7-761122	M8805/110-8411	P7-811221	M8805/111-05	U2-083
M8805/110-7322	P7-752122	M8805/110-7714	P7-761124	M8805/110-8412	P7-811222	M8805/111-06	U2-084
M8805/110-7329	P7-752129	M8805/110-8111	P7-811121	M8805/110-8418	P7-811228		
M8805/110-7361	P7-756121	M8805/110-8112	P7-811122	M8805/110-8419	P7-811229	M94192/2	
M8805/110-7362	P7-756122	M8805/110-8116	P7-811126	M8805/110-8421	P7-812221	M9419/2-001	T4-0015
M8805/110-7369	P7-756129	M8805/110-8119	P7-811129	M8805/110-8422	P7-812222	M9419/2-002	T4-0043
M8805/110-7411	P7-711121	M8805/110-8119	P7-811129	M8805/110-8429	P7-812229	M9419/2-003	T4-0042
M8805/110-7412	P7-711122	M8805/110-8121	P7-812121	M8805/110-8431	P7-813221	M9419/2-004	T4-0020
M8805/110-7412	P7-711122	M8805/110-8122	P7-812122	M8805/110-8432	P7-813222	M9419/2-005	T4-0041
M8805/110-7419	P7-711129	M8805/110-8129	P7-812129	M8805/110-8439	P7-813229	M9419/2-006	T4-0078
M8805/110-7421	P7-712221	M8805/110-8131	P7-813121	M8805/110-8441	P7-814221		
M8805/110-7422	P7-712222	M8805/110-8132	P7-813122	M8805/110-8442	P7-814222	MS21321	
M8805/110-7429	P7-712229	M8805/110-8139	P7-813129	M8805/110-8449	P7-814229	MS21321-1	P6-24000
M8805/110-7431	P7-713221	M8805/110-8141	P7-814121	M8805/110-8451	P7-815221	MS21321-2	P6-24001
M8805/110-7432	P7-713222	M8805/110-8142	P7-814122	M8805/110-8452	P7-815222		

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.
MS21340		MS25089-1FL	P1-64122	MS25089-2CR-1L	P1-34231	MS25089-3AWL	P1-14629
MS21340-04	710340-04	MS25089-1FR	P1-62121	MS25089-2CRL	P1-34221	MS25089-3B	P1-22622
MS21340-05	710340-05	MS25089-1FR-1	P1-62131	MS25089-2CW	P1-32229	MS25089-3BL	P1-24622
		MS25089-1FR-1L	P1-64131	MS25089-2CW-1	P1-32239	MS25089-3BR	P1-22621
MS24331		MS25089-1FRL	P1-64121	MS25089-2CW-1L	P1-34239	MS25089-3BRL	P1-24621
MS24331-1	P6-24002	MS25089-1FW	P1-62129	MS25089-2CWL	P1-34229	MS25089-3BW	P1-22629
		MS25089-1FW-1	P1-62139	MS25089-2E	P1-52222	MS25089-3BWL	P1-24629
MS24547		MS25089-1FW-1L	P1-64139	MS25089-2EL	P1-54222	MS25089-3C	P1-32622
MS24547-1	B2-211351	MS25089-1FWL	P1-64129	MS25089-2ER	P1-52221	MS25089-3C-1	P1-32632
MS24547-2	B2-211353	MS25089-1G	P1-72122	MS25089-2ERL	P1-54221	MS25089-3C-1L	P1-34632
MS24547-4	B2-212351	MS25089-1G-1	P1-72132	MS25089-2EW	P1-52229	MS25089-3CL	P1-34622
MS24547-5	B2-212353	MS25089-1G-1L	P1-74132	MS25089-2EWL	P1-54229	MS25089-3CR	P1-32621
MS24547-6	B2-200029	MS25089-1GL	P1-74122	MS25089-2F	P1-62222	MS25089-3CR-1	P1-32631
MS24547-7	B2-200030	MS25089-1GR	P1-72121	MS25089-2F-1	P1-62232	MS25089-3CR-1L	P1-34631
		MS25089-1GR-1	P1-72131	MS25089-2F-1L	P1-64232	MS25089-3CRL	P1-34621
MS25081		MS25089-1GR-1L	P1-74131	MS25089-2FGL	P1-64222	MS25089-3CW	P1-32629
MS25081-C0	710081-C0	MS25089-1GR1	P1-74121	MS25089-2FL	P1-64222	MS25089-3CW-1	P1-32639
MS25081-C4	710081-C4	MS25089-1GW	P1-72129	MS25089-2FR	P1-62221	MS25089-3CW-1L	P1-34639
MS25081-C6	710081-C6	MS25089-1GW-1	P1-72139	MS25089-2FR-1	P1-62231	MS25089-3CWL	P1-34629
		MS25089-1GW-1L	P1-74139	MS25089-2FRL	P1-64221	MS25089-3E	P1-52622
MS25089		MS25089-1GWL	P1-74129	MS25089-2FW	P1-62229	MS25089-3EL	P1-54622
MS25089-1A	P1-12122	MS25089-1H	P1-82122	MS25089-2FW-1	P1-62239	MS25089-3ER	P1-52621
MS25089-1AL	P1-14122	MS25089-1H-1	P1-82132	MS25089-2FW-1L	P1-64239	MS25089-3ERL	P1-54621
MS25089-1AR	P1-12121	MS25089-1H-1L	P1-84132	MS25089-2FWL	P1-64229	MS25089-3EW	P1-52629
MS25089-1ARL	P1-14121	MS25089-1HL	P1-84122	MS25089-2G	P1-72222	MS25089-3EWL	P1-54629
MS25089-1AW	P1-12129	MS25089-1HR	P1-82121	MS25089-2G-1	P1-72232	MS25089-3F	P1-62622
MS25089-1AWL	P1-14129	MS25089-1HR-1	P1-82131	MS25089-2G-1L	P1-74232	MS25089-3F-1	P1-62632
MS25089-1B	P1-22122	MS25089-1HR-1L	P1-84131	MS25089-2GL	P1-74222	MS25089-3F1L	P1-64632
MS25089-1BL	P1-24122	MS25089-1HRL	P1-84121	MS25089-2GR	P1-72221	MS25089-3FL	P1-64622
MS25089-1BR	P1-22121	MS25089-1HRL	P1-84121	MS25089-2GR-1	P1-72231	MS25089-3FR	P1-62621
MS25089-1BRL	P1-24121	MS25089-1HW	P1-82129	MS25089-2GR-1L	P1-74231	MS25089-3FR	P1-62631
MS25089-1BWL	P1-24129	MS25089-1HW-1	P1-82139	MS25089-2GRL	P1-74221	MS25089-3FR-1L	P1-64631
MS25089-1C	P1-32122	MS25089-1HW-1L	P1-84139	MS25089-2GW	P1-72229	MS25089-3FRL	P1-64621
MS25089-1C-1	P1-32132	MS25089-1HWL	P1-84129	MS25089-2GW-1	P1-72239	MS25089-3FW	P1-62629
MS25089-1C-1L	P1-34132	MS25089-21FR-1L	P1-64231	MS25089-2GW-1L	P1-74239	MS25089-3FW-1	P1-62639
MS25089-1CL	P1-34122	MS25089-2A	P1-12222	MS25089-2GWL	P1-74229	MS25089-3FW-1L	P1-64639
MS25089-1CR	P1-32121	MS25089-2AL	P1-14222	MS25089-2H	P1-82222	MS25089-3FWL	P1-64629
MS25089-1CR-1	P1-32131	MS25089-2AR	P1-12221	MS25089-2H-1	P1-82232	MS25089-3G	P1-72622
MS25089-1CR-1L	P1-34131	MS25089-2ARL	P1-14221	MS25089-2H-1L	P1-84232	MS25089-3G-1	P1-72632
MS25089-1CRL	P1-34121	MS25089-2AW	P1-12229	MS25089-2HL	P1-84222	MS25089-3G-1L	P1-74632
MS25089-1CW	P1-32129	MS25089-2AWL	P1-14229	MS25089-2HR	P1-82221	MS25089-3GL	P1-74622
MS25089-1CW-1	P1-32139	MS25089-2B	P1-22222	MS25089-2HR-1	P1-82231	MS25089-3GR	P1-72621
MS25089-1CW-1L	P1-34139	MS25089-2BL	P1-24222	MS25089-2HR-1L	P1-84231	MS25089-3GR-1	P1-72631
MS25089-1CWL	P1-34129	MS25089-2BR	P1-22221	MS25089-2HRL	P1-84221	MS25089-3GR-1L	P1-74631
MS25089-1E	P1-52122	MS25089-2BRL	P1-24221	MS25089-2HW	P1-82229	MS25089-3GW	P1-72629
MS25089-1EL	P1-54122	MS25089-2BW	P1-22229	MS25089-2HW-1	P1-82239	MS25089-3GW	P1-72629
MS25089-1ER	P1-52121	MS25089-2BWL	P1-24229	MS25089-2HW-1L	P1-84239	MS25089-3GW-1	P1-72639
MS25089-1ERL	P1-54121	MS25089-2C	P1-32222	MS25089-2HWL	P1-84229	MS25089-3GW-1L	P1-74639
MS25089-1EW	P1-52129	MS25089-2C-1	P1-32232	MS25089-3A	P1-12622	MS25089-3GWL	P1-74629
MS25089-1EWL	P1-54129	MS25089-2C-1L	P1-34232	MS25089-3AL	P1-14622	MS25089-3H	P1-82622
MS25089-1F	P1-62122	MS25089-2CL	P1-34222	MS25089-3AR	P1-12621	MS25089-3H-1	P1-82632
MS25089-1F-1	P1-62132	MS25089-2CR	P1-32221	MS25089-3ARL	P1-14621	MS25089-3H-1L	P1-84632
MS25089-1F-1L	P1-64132	MS25089-2CR-1	P1-32231	MS25089-3AW	P1-12629	MS25089-3HL	P1-84622

CROSS REFERENCE: MILITARY TO OTTO

MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.	MILITARY PART NO.	OTTO PART NO.
MS25089-3HR	P1-82621	MS25089-4GW	P1-72429	MS25089-5FW	P1-62329	MS27717	
MS25089-3HR-1	P1-82631	MS25089-4GW-1	P1-72439	MS25089-5FW-1	P1-62339	MS27717-21-1	T3-21211
MS25089-3HR-1L	P1-84631	MS25089-4GW-1L	P1-74439	MS25089-5FW-1L	P1-64339	MS27717-22-1	T3-21221
MS25089-3HRL	P1-84621	MS25089-4GWL	P1-74429	MS25089-5FWL	P1-64329	MS27717-23-1	T3-21231
MS25089-4A	P1-12422	MS25089-4H	P1-82422	MS25089-5G	P1-72322	MS27717-26-1	T3-21241
MS25089-4AL	P1-14422	MS25089-4H-1	P1-82432	MS25089-5G-1	P1-72332	MS27717-27-1	T3-21251
MS25089-4AR	P1-12421	MS25089-4H-1L	P1-84432	MS25089-5G-1L	P1-74332	MS27717-31-1	T3-21261
MS25089-4AW	P1-12429	MS25089-4HL	P1-84422	MS25089-5GL	P1-74322		
MS25089-4AWL	P1-14429	MS25089-4HR	P1-82421	MS25089-5GR	P1-72321		
MS25089-4B	P1-22422	MS25089-4HR-1	P1-82431	MS25089-5GR-1	P1-72331	MS27718	
MS25089-4BL	P1-24422	MS25089-4HR-1L	P1-84331	MS25089-5GR-1L	P1-74331	MS27718-21-1	T3-11111
MS25089-4BR	P1-22421	MS25089-4HRL	P1-84421	MS25089-5GRL	P1-74321	MS27718-22-1	T3-11121
MS25089-4BRL	P1-24421	MS25089-4HW	P1-82429	MS25089-5GW	P1-72329	MS27718-23-1	T3-11131
MS25089-4BW	P1-22429	MS25089-4HW-1	P1-82439	MS25089-5GW-1	P1-72239	MS27718-26-1	T3-11141
MS25089-4BWL	P1-24429	MS25089-4HW-1L	P1-84439	MS25089-5GW-1L	P1-74339	MS27718-27-1	T3-11151
MS25089-4C	P1-32422	MS25089-4HWL	P1-84429	MS25089-5GWL	P1-74329	MS27718-31-1	T3-11161
MS25089-4C-1	P1-32432	MS25089-5A	P1-12322	MS25089-5H	P1-82322		
MS25089-4C-1L	P1-34432	MS25089-5AL	P1-14322	MS25089-5H-1	P1-82332	MS27719	
MS25089-4CL	P1-34422	MS25089-5AR	P1-12321	MS25089-5H-1L	P1-84332	MS27719-21-1	T3-11211
MS25089-4CR	P1-32421	MS25089-5ARL	P1-14321	MS25089-5HL	P1-84322	MS27719-22-1	T3-11221
MS25089-4CR-1	P1-32431	MS25089-5AW	P1-12329	MS25089-5HR	P1-82321	MS27719-23-1	T3-11231
MS25089-4CR-1L	P1-34431	MS25089-5AWL	P1-14329	MS25089-5HR-1	P1-82331	MS27719-26-1	T3-11241
MS25089-4CRL	P1-34421	MS25089-5B	P1-22322	MS25089-5HRL	P1-84321	MS27719-27-1	T3-11251
MS25089-4CW	P1-32429	MS25089-5BL	P1-24322	MS25089-5HW	P1-82329	MS27719-31-1	T3-11261
MS25089-4CW-1	P1-32439	MS25089-5BR	P1-22321	MS25089-5HW-1	P1-82339		
MS25089-4CW-1L	P1-34439	MS25089-5BRL	P1-24321	MS25089-5HW-1L	P1-84339	MS27720	
MS25089-4CWL	P1-34429	MS25089-5BW	P1-22329	MS25089-5HWL	P1-84329	MS27720-21-1A	T3-31111A
MS25089-4E	P1-52422	MS25089-5BWL	P1-24329			MS27720-21-1D	T3-31111D
MS25089-4EL	P1-54422	MS25089-5C	P1-32322	MS27217		MS27720-21-1E	T3-31111E
MS25089-4ER	P1-52421	MS25089-5C-1	P1-32332	MS27217-1	B5-21141	MS27720-21-1L	T3-31111L
MS25089-4ERL	P1-54421	MS25089-5C-1L	P1-34332			MS27720-21-1P	T3-31111P
MS25089-4EW	P1-52429	MS25089-5CL	P1-34322	MS27240		MS27720-22-1D	T3-31121D
MS25089-4EWL	P1-54429	MS25089-5CR	P1-32321	MS27240-1	P6-24003	MS27720-22-1F	T3-31121F
MS25089-4F	P1-62422	MS25089-5CR	P1-32331	MS27240-2	P6-24004	MS27720-22-1G	T3-31121G
MS25089-4F-1	P1-62432	MS25089-5CR-1L	P1-34331	MS27240-3	P6-14000	MS27720-23-1D	T3-31131D
MS25089-4F-1L	P1-64432	MS25089-5CRL	P1-34321	MS27240-4	P6-14001	MS27720-23-1F	T3-31131F
MS25089-4FL	P1-64422	MS25089-5CW	P1-32329	MS27240-5	P6-24005	MS27720-23-1G	T3-31131G
MS25089-4FR	P1-62421	MS25089-5CW-1	P1-32339	MS27240-6	P6-24006	MS27720-26-1F	T3-31141F
MS25089-4FR-1	P1-62431	MS25089-5CW-1L	P1-34339	MS27240-7	P6-14002	MS27720-27-1E	T3-31151E
MS25089-4FR-1L	P1-64431	MS25089-5E	P1-52322	MS27240-8	P6-14003	MS27720-27-1N	T3-31151N
MS25089-4FW	P1-62429	MS25089-5EL	P1-54322			MS27720-31-1F	T3-31161F
MS25089-4FW-1	P1-62439	MS25089-5ER	P1-52321	MS27257		MS27720-31-1K	T3-31161K
MS25089-4FW-1L	P1-64439	MS25089-5ERL	P1-54321	MS27257-1	B3-26141	MS27720-31-1M	T3-31161M
MS25089-4FWL	P1-64429	MS25089-5EW	P1-52329	MS27257-2	B3-22141	MS27720-31-1N	T3-31161N
MS25089-4G	P1-72422	MS25089-5EWL	P1-54329				
MS25089-4G-1	P1-72432	MS25089-5F	P1-62322	MS27716		MS27721	
MS25089-4G-1L	P1-74432	MS25089-5F-1	P1-62332	MS27716-21-1	T3-21111	MS27721-21-1A	T3-31211A
MS25089-4GL	P1-74422	MS25089-5F-1L	P1-64332	MS27716-22-1	T3-21121	MS27721-21-1D	T3-31211D
MS25089-4GR	P1-72421	MS25089-5FL	P1-64322	MS27716-23-1	T3-21131	MS27721-21-1E	T3-31211E
MS25089-4GR-1	P1-72431	MS25089-5FR	P1-62321	MS27716-26-1	T3-21141	MS27721-21-1F	T3-31211F
MS25089-4GR-1L	P1-74431	MS25089-5FR-1L	P1-64321	MS27716-27-1	T3-21151	MS27721-21-1G	T3-31211G
MS25089-4GRL	P1-64421	MS25089-5FR-1L	P1-64331	MS27716-31-1	T3-21161	MS27721-21-1P	T3-31211P
MS25089-4GRL	P1-74421	MS25089-5FRL	P1-64321			MS27721-22-1D	T3-31221D

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.
MS27721-22-1G	T3-31221G	MS24656-231	TE-21231	MS24659-21F	T9-MS2-21F	MS35333-136	710333-136
MS27721-23-1D	T3-31231D	MS24656-271	TE-21251	MS24659-21G	T9-MS2-21G	MS35333-138	710333-138
MS27721-23-1F	T3-31231F	MS24656-311	TE-21261	MS24659-21H	T9-MS2-21H		
MS27721-23-1G	T3-31231G			MS24659-21J	T9-MS2-21J	MS90310	
MS27721-26-1F	T3-31241F	MS24658		MS24659-21K	T9-MS2-21K	MS90310-211	TE-11111
MS27721-27-1E	T3-31251E	MS24658-21A	T9-MS1-21A	MS24659-21L	T9-MS2-21L	MS90310-221	TE-11121
MS27721-27-1N	T3-31251N	MS24658-21B	T9-MS1-21B	MS24659-21M	T9-MS2-21M	MS90310-231	TE-11131
MS27721-31-1E	T3-31261E	MS24658-21D	T9-MS1-21D	MS24659-21N	T9-MS2-21N	MS90310-271	TE-11151
MS27721-31-1F	T3-31261F	MS24658-21E	T9-MS1-21E	MS24659-21P	T9-MS2-21P	MS90310-311	TE-11161
MS27721-31-1K	T3-31261K	MS24658-21F	T9-MS1-21F	MS24659-22D	T9-MS2-22D		
MS27721-31-1M	T3-31261M	MS24658-21G	T9-MS1-21G	MS24659-22F	T9-MS2-22F	MS90311	
MS27721-31-1N	T3-31261N	MS24658-21H	T9-MS1-21H	MS24659-22G	T9-MS2-22G	MS90311-211	TE-11211
		MS24658-21J	T9-MS1-21J	MS24659-23D	T9-MS2-23D	MS90311-221	TE-11221
MS24523		MS24658-21K	T9-MS1-21K	MS24659-23F	T9-MS2-23F	MS90311-231	TE-11231
MS24523-21	T9-MS1-21	MS24658-21L	T9-MS1-21L	MS24659-23G	T9-MS2-23G	MS90311-271	TE-11251
MS24523-22	T9-MS1-22	MS24658-21M	T9-MS1-21M	MS24659-24E	T9-MS2-24E	MS90311-311	TE-11261
MS24523-23	T9-MS1-23	MS24658-21N	T9-MS1-21N	MS24659-24F	T9-MS2-24F		
MS24523-24	T9-MS1-24	MS24658-21P	T9-MS1-21P	MS24659-24K	T9-MS2-24K		
MS24523-25	T9-MS1-25	MS24658-22D	T9-MS1-22D	MS24659-24M	T9-MS2-24M		
MS24523-26	T9-MS1-26	MS24658-22F	T9-MS1-22F	MS24659-25F	T9-MS2-25F		
MS24523-27	T9-MS1-27	MS24658-22G	T9-MS1-22G	MS24659-26F	T9-MS2-26F		
MS24523-28	T9-MS1-28	MS24658-23D	T9-MS1-23D	MS24659-27E	T9-MS2-27E		
MS24523-29	T9-MS1-29	MS24658-23F	T9-MS1-23F	MS24659-27L	T9-MS2-27L		
MS24523-30	T9-MS1-30	MS24658-23G	T9-MS1-23G	MS24659-27N	T9-MS2-27N		
MS24523-31	T9-MS1-31	MS24658-24E	T9-MS1-24E	MS24659-28E	T9-MS2-28E		
MS24523-32	T9-MS1-32	MS24658-24F	T9-MS1-24F	MS24659-29F	T9-MS2-29F		
MS24523-33	T9-MS1-33	MS24658-24K	T9-MS1-24K	MS24659-30F	T9-MS2-30F		
		MS24658-24M	T9-MS1-24M	MS24659-31E	T9-MS2-31E		
MS24524		MS24658-25F	T9-MS1-25F	MS24659-31F	T9-MS2-31F		
MS24524-21	T9-MS2-21	MS24658-26F	T9-MS1-26F	MS24659-31K	T9-MS2-31K		
MS24524-22	T9-MS2-22	MS24658-27E	T9-MS1-27E	MS24659-31L	T9-MS2-31L		
MS24524-23	T9-MS2-23	MS24658-27L	T9-MS1-27L	MS24659-31M	T9-MS2-31M		
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MS24524-25	T9-MS2-25	MS24658-28E	T9-MS1-28E	MS24659-32E	T9-MS2-32E		
MS24524-26	T9-MS2-26	MS24658-29F	T9-MS1-29F	MS24659-33E	T9-MS2-33E		
MS24524-27	T9-MS2-27	MS24658-30F	T9-MS1-30F	MS24659-33F	T9-MS2-33F		
MS24524-28	T9-MS2-28	MS24658-31E	T9-MS1-31E	MS24659-33K	T9-MS2-33K		
MS24524-29	T9-MS2-29	MS24658-31F	T9-MS1-31F	MS24659-33M	T9-MS2-33M		
MS24524-30	T9-MS2-30	MS24658-31K	T9-MS1-31K				
MS24524-31	T9-MS2-31	MS24658-31L	T9-MS1-31L	MS25082			
MS24524-32	T9-MS2-32	MS24658-31M	T9-MS1-31M	MS25082-C14	710082-C14		
MS24524-33	T9-MS2-33	MS24658-31N	T9-MS1-31N	MS25082-C21	710082-C21		
		MS24658-32E	T9-MS1-32E	MS25082-B11	710082-B11		
MS24655		MS24658-33E	T9-MS1-33E				
MS24655-211	TE-21111	MS24658-33F	T9-MS1-33F	MS25224			
MS24655-221	TE-21121	MS24658-33K	T9-MS1-33K	MS25224-1	TG-00001		
MS24655-231	TE-21131	MS24658-33M	T9-MS1-33M	MS25224-3	TG-00002		
MS24655-271	TE-21151						
MS24655-311	TE-21161	MS24659		MS27752			
		MS24659-21A	T9-MS2-21A	MS27752-1	TG-00006		
MS24656		MS24659-21B	T9-MS2-21B				
MS24656-211	TE-21211	MS24659-21D	T9-MS2-21D	MS35333			
MS24656-221	TE-21221	MS24659-21E	T9-MS2-21E	MS35333-135	710333-135		

STANDARD LEGENDS PER SAE SPECIFICATIONS

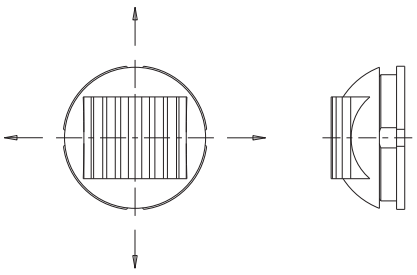
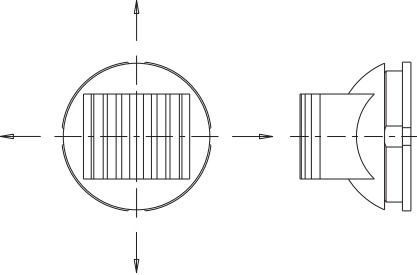
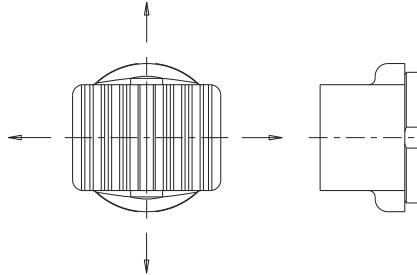
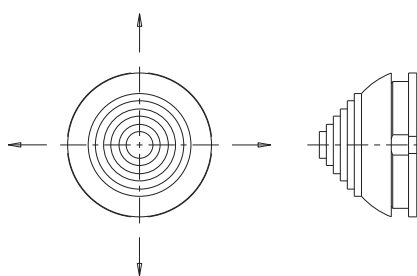
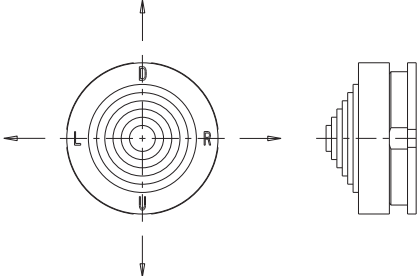
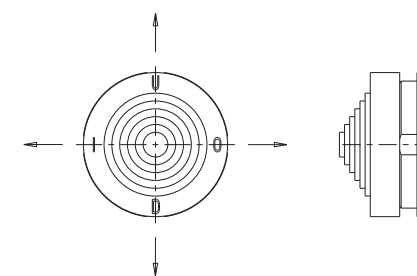
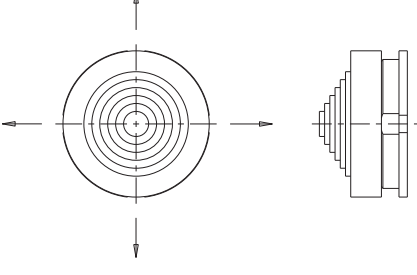
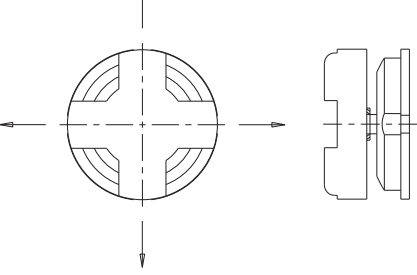
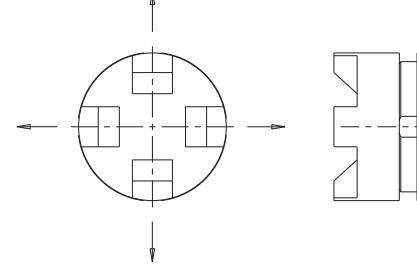
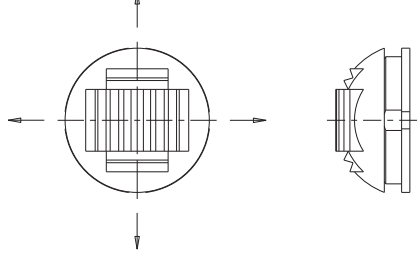
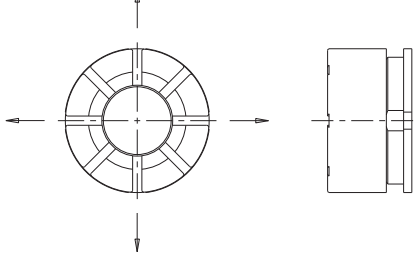
A1  ANCHOR	K2  UNLOCK	P5  BILGE BLOWER
B1  BATTERY	L1  LIGHT	R1  LIFT
B2  ELECTRIC POWER	L2  MASTER LIGHTING SWITCH	R2  LOWER
C1  AC/COOLING SYSTEMS	L3  HEADLIGHTS	R3  UP
C2  DEHUMIDIFIER	L4  HEADLIGHTS-LOW/ DIPPED BEAM	R4  DOWN
C3  HEATER/INTERIOR HEATING	L5  HEADLIGHTS-HIGH/ UPPER BEAM	R5  RIGHT
D1  WINDSHIELD DEFROSTER	L6  PARKING LIGHT	R6  LEFT
D2  REAR WINDOW DEFROSTER	L7  WORK LAMP	R7 FWD FORWARD
D3  MIRROR DEFROSTER	L8  WORK LAMP	R8 REV REVERSE
E1  ENGINE/START	L9  INTERIOR DOME LIGHT	S1  RADIO
E2  ENGINE/STOP	M1  BEACON	S2  MUTE
E3  ON/START	M2  HAZARD/POSITION LIGHTS	T1  FAST
E4  OFF/STOP	M3  CLEARANCE LIGHTS	T2  SLOW
E5 ON ON	M4  SIDE MARKER LIGHT	T3  TRIM TAB/ TRIMMING OPERATION
E6 OFF OFF	M5  RUNNING LIGHTS (UNDER POWER)	T4  TRANSMISSION
E7  ENGINE ELECTRIC PREHEAT	M6  ANCHOR LIGHT	V1  VENTILATING/AC FAN
E8  ENGINE-GAS INJECTION	M7  RUNNING/ANCHOR LIGHTS	W1  WINDSHIELD WIPER
F1  FRONT FOG LIGHTS	M8  SEARCH LIGHT	W2  WINDSHIELD-WASHER
F2  REAR FOG LIGHTS	M9  LEFT TURN SIGNAL	W3  WINDSHIELD-WASHER/WIPER
G1  FUEL	MA  RIGHT TURN SIGNAL	W4  REAR WINDOW WIPER
H1  HORN	P1  BILGE PUMP #1	W5  REAR WINDOW-WASHER
H2  HORN REAR	P2  BILGE PUMP #2	W6  REAR WINDOW-WASHER/WIPER
K1  LOCK	P3  BILGE PUMP #3	ZZ NO LEGEND
	P4  BILGE PUMP	

For legends not shown, please consult an OTTO representative.

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	

T4-T 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 - JOG	L - INVERSE HAT	
		



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