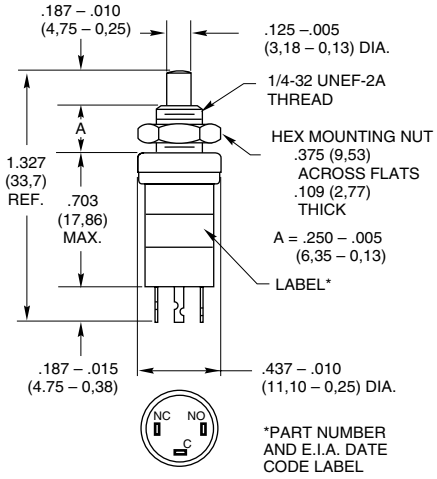
SERIES 46
SPST and DPDT, 1/4 Amp

FEATURES
- Long Wipe Contact Assures High Reliability
- 250,000 Cycles of Operation

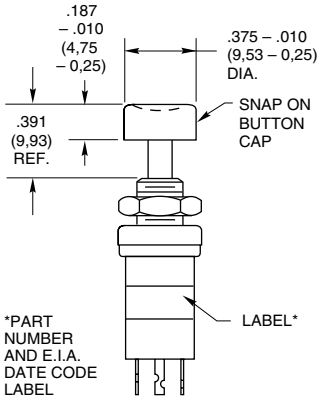
DIMENSIONS in inches (and millimeters)

Single Pole/Double Throw

46-101* (BBM)
46-110* (MBB)



46-102* (BBM)
46-111* (MBB)

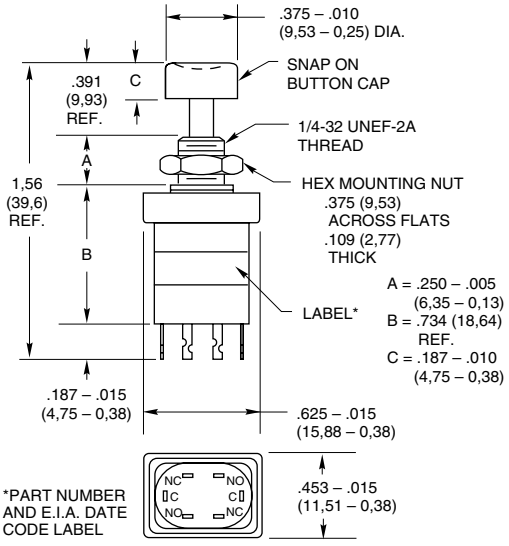


Rating at 115 Vac Resistive	Rating at 220 Vac Resistive	Operations at Rated Load	*Complete Part Number	Button or Cap Color
1/4 Amp	1/8 Amp	250,000	46-101 RED	Red
			46-101 BLK	Black
			46-102 RED	Red
			46-102 BLK	Black
			46-110 RED	Red
			46-110 BLK	Black
			46-111 RED	Red
			46-111 BLK	Black

Action	Total Travel	Bottoming Force (oz.)	Mtg. Hole
Momentary	.180 (4,57) Min.	17 ± 5	17/64" (6,75)

Double Pole/Double Throw

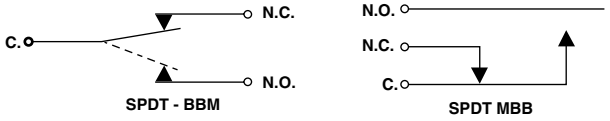
46-200* (BBM)
46-201* (MBB)

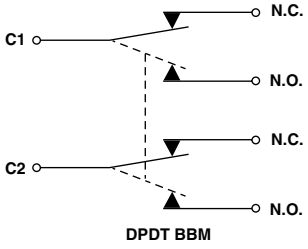


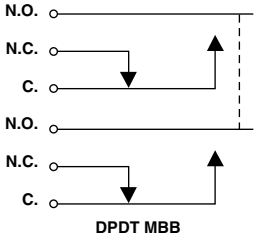
Rating at 115 Vac Resistive	Rating at 220 Vac Resistive	Operations at Rated Load	*Complete Part Number	Cap Color
1/4 Amp	1/8 Amp	250,000	46-200 RED	Red
			46-200 BLK	Black
			46-201 RED	Red
			46-201 BLK	Black

Action	Total Travel	Bottoming Force (oz.)	Mtg. Hole
Momentary	.180 (4,57) Min.	35 ± 9	17/64" (6,75)

CIRCUITRY







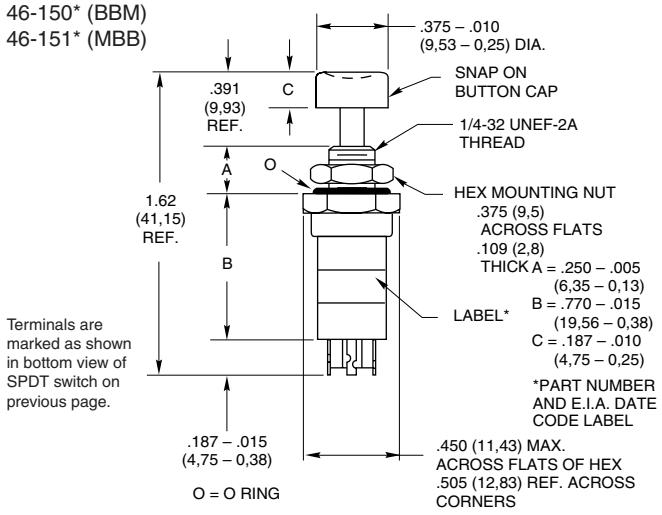
SERIES 46
SPST and DPDT, 1/4 Amp

FEATURES
- Bushing and Button Seal
- Environmentally Sealed

DIMENSIONS in inches (and millimeters)

Sealed Bushing and Button
Single Pole/Double Throw

46-150* (BBM)
46-151* (MBB)

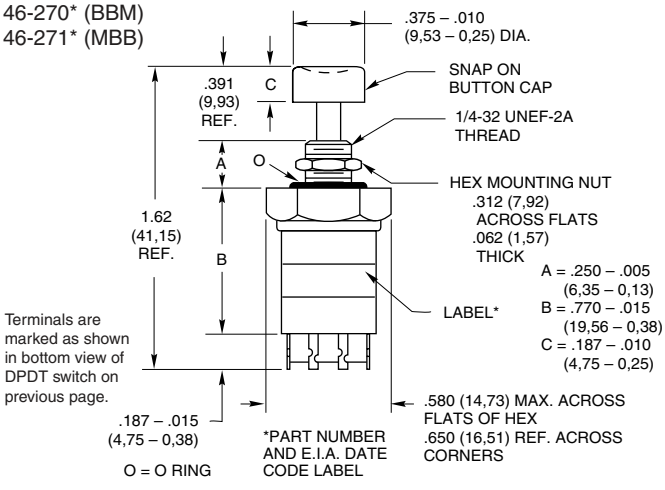


Rating at 115 Vac Resistive	Rating at 220 Vac Resistive	Operations at Rated Load	*Complete Part Number	Cap Color
1/4 Amp	1/8 Amp	100,000	46-150 RED 46-150 BLK 46-151 RED 46-151 BLK	Red Black Red Black

Action	Total Travel	Bottoming Force (oz.)	Mtg. Hole
Momentary	.180 (4,57) Min.	24 ± 4	17/64" (6,75)

Sealed Bushing and Button
Double Pole/Double Throw

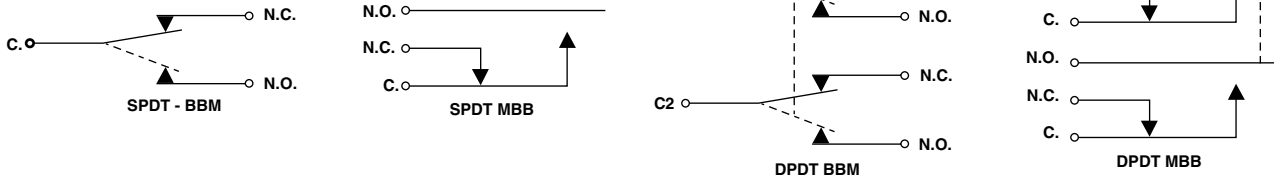
46-270* (BBM)
46-271* (MBB)



Rating at 115 Vac Resistive	Rating at 220 Vac Resistive	Operations at Rated Load	*Complete Part Number	Cap Color
1/4 Amp	1/8 Amp	100,000	46-270 RED 46-270 BLK 46-271 RED 46-271 BLK	Red Black Red Black

Action	Total Travel	Bottoming Force (oz.)	Mtg. Hole
Momentary	.180 (4,57) Min.	48 ± 4	17/64" (6,75)

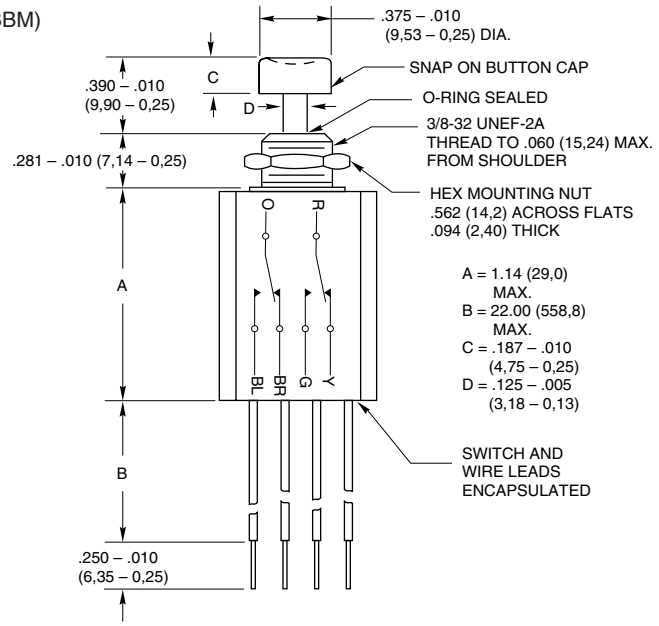
CIRCUITRY

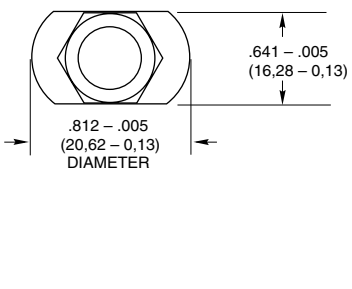


DIMENSIONS in inches (and millimeters)

Environmentally Sealed
Double Pole/Double Throw

46-260* (BBM)

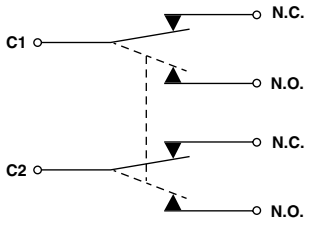




Rating at 115 Vac Resistive	Rating at 220 Vac Resistive	Operations at Rated Load	*Complete Part Number	Cap Color
1/4 Amp	1/8 Amp	250,000	46-260 RED 46-260 BLK	Red Black

Action	Total Travel	Bottoming Force (oz.)	Mtg. Hole
Momentary	.180 (4,57) Min.	Approx. 45	25/64" (9,92)

CIRCUITRY



DPDT BBM

ACCESSORY

Decorative Mounting Nut
Part No. 30C1023-1
Fits .250" (6,35) Bushing

ORDERING INFORMATION

Description	Part No.
SPDT, BBM, Red Button	**46-101 RED**
SPDT, BBM, Black Button	**46-101 BLK**
SPDT, BBM, Red Cap	**46-102 RED**
SPDT, BBM, Black Cap	**46-102 BLK**
SPDT, MBB, Red Button	**46-110 RED**
SPDT, MBB, Black Button	**46-110 BLK**
SPDT, MBB, Red Cap	**46-111 RED**
SPDT, MBB, Black Cap	**46-111 BLK**
SPDT, BBM, Red Cap	**46-150 RED**
SPDT, BBM, Black Cap	**46-150 BLK**
SPDT, MBB, Red Cap	**46-151 RED**
SPDT, MBB, Black Cap	**46-151 BLK**
DPDT, BBM, Red Cap	**46-200 RED**
DPDT, BBM, Black Cap	**46-200 BLK**
DPDT, MBB, Red Cap	**46-201 RED**
DPDT, MBB, Black Cap	**46-201 BLK**
DPDT, BBM, Red Cap	**46-270 RED**
DPDT, BBM, Black Cap	**46-270 BLK**
DPDT, MBB, Red Cap	**46-271 RED**
DPDT, MBB, Black Cap	**46-271 BLK**
DPDT, BBM, Sealed, Red	**46-260 RED**
DPDT, BBM, Sealed, Black	**46-260 BLK**
ACCESSORY	
Decorative Nut	**30C1023-1**

SPECIFICATIONS

Rating Criteria

Contact Resistance: Less than 25 milliohms at the switch initially. Less than 4 milliohms/inch of wire.
Voltage Breakdown: 1,000 Vac between mutually insulated parts
Insulation Resistance: 1,000 megohms minimum

Materials and Finishes

Cover, Bushing, Mounting Nut: Brass, tin zinc
Shorting Bar: Phosphor bronze, silver-plated.
Terminals: Phosphor bronze, silver contact surface. Terminal ends are tin/silver
Base or Potting Shell: Phenolic per MIL-M-14, type CFG
Spring: Tinned music wire
Button Cap: Polyethylene
Button: Polyphenylene sulfide (PPS) for 46-200 and 46-201. Polycarbonate for all other unsealed versions. Aluminum for all sealed versions.
O-Ring Seal: Nitrile per MIL-P-5516, class B
Seal Adapter and Hex Nut (46-260): Brass, zinc trivalent chromate-plated
Wire Leads (46-260): Per MIL-W-16878 type E. #26 AWG, insulated teflon, copper stranded wire

Operating Features

Break-Before-Make: Rest position to N.C. break .020" (0,51) minimum. Rest position to N.O. Make .140" (3,35) maximum.
Make-Before-Break: Rest position to N.O. make .065" ± .015 (1,65 ± 0,38). Rest position to N.C. break .130" ± .015 (3,30 ± 0,38).
Operating Temperature: -40°C to +85°C

STANDARD OPTIONS

Epoxy sealed terminals and wire leads
Decorative mountings

Pushbutton Engineering Information

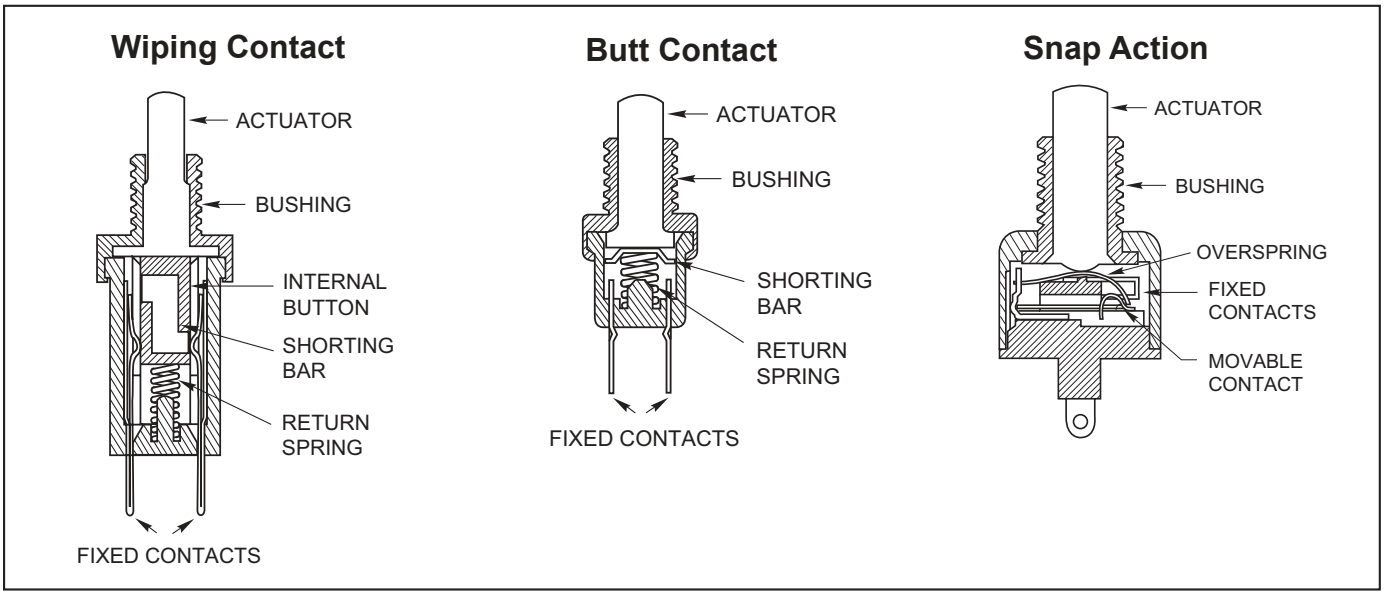
Pushbutton switches are selected not only by their ratings, but also by their contact type. While nearly all rotary switches and DIP switches have wiping contacts, pushbutton switches may have either wiping or butt contacts (see internal views below).

Wiping Contacts are self-cleaning and usually provide a low resistance in circuits where contact resistance is critical. However, the wiping action creates mechanical wear and conductive wear products.

Butt Contacts have less wear than wiping contacts and therefore, have a longer life. They are also smaller. Butt contacts are not self-cleaning, so their contact resistance can vary from operation to operation.

Snap Action switches are basically butt contact switches with a spring mechanism which provides the make and break. The mechanism controls both the operating point and the rate of operation, but adds to the wear of the switch. The rapid rate of make and break means that these switches are appropriate for high current loads. They usually have a slight wiping action and contact surfaces made of precious metals to minimize their disadvantages.

Internal Views of Pushbutton Switches



Switch Terminology

Actuator: The part of the switch to which an external force is applied to operate the switch.

Alternate Action (Push-Push) Switch: A switch in which the operable position is maintained after the first actuation, and then disengaged with the second operation.

Break-Before-Make Switch (BBM): A double throw switch in which the moving contact breaks the connection with the first circuit before making contact with the second; also called non-shorting switch.

Double Throw Switch: A switch which has a normally open as well as a normally closed circuit per pole.

Joystick Action Switch: (From Joystick, the control for an airplane). A lever switch which operates with momentary action in 4 directions, and is disengaged in the upright position.

Make-Before-Break Switch (MBB): A double throw switch in which the contacts makes connection with the second circuit before breaking contact with the first; also called shorting switch.

Maintained Contact Switch: A switch in which the actuator remains in a position until it is actuated to another position where it also remains until actuated. Example: Push-Pull Switch.

Momentary Contact Switch: A switch in which the shorting bar returns from its operated position to its normal or free position when the actuating force is removed.

Operating Position or Point: The position of the actuator when the desired electrical action (make or break of contact) occurs.

N.C., Normally Closed: Switch in which the circuit is closed without actuation (with actuator in the "normal" position).

N.O., Normally Open: Switch in which the circuit is open without actuation (with actuator in the "normal" position).

Overtravel: The distance or angle between the operating position and the extreme position to which the actuator may be moved.

Pole: An electrically isolated circuit within a switch; a common terminal and all the selected terminals to which it connects.

Pretravel: The distance or angle through which the actuator moves from its free position to its electrical operating position.

Single Throw Switch: A switch which has only one normally open or one normally closed circuit per pole.

Throw: See Single Throw and Double Throw.

Butt Contact

Circuitry*		Rating (Amps at 115 Vac Res.)	Operations At Rating	Maximum Width*** inch (mm)	Features	Series
SPST	N.O. or N.C.	5	6,000	3/8 (9,53)	UL Listed	30
	N.O. or N.C.	1	1,000,000	3/8 (9,53)	Momentary, Terminal Seal, (Wire Leads Optnl.)	30
	N.O.	1	500,000	3/8 (9,53)	Overtravel, Terminal Seal, (Wire Leads Optnl.)	30
	N.O.	1	200,000	11/16 (17,46)	Positive Feel, Overtravel, Terminal Seal, (Wire Leads Optional)	30
	On or Off	1	100,000	11/16 (17,46)	Push/Pull Action (Maintained)	30
	N.O. or N.C.	1	250,000	1/2 (12,7)	Watertight, Terminal Seal, (Wire Leads Optnl.)	30
	N.O.	1	1,000,000	11/16 (17,46)	Square & Round Bezels	30
	N.O. or N.C	1	1,000,000	1+ (25,4)	Square Bezel Panel Mount	30
	N.O.	1	200,000	11/16 (17,46)	Pos. Feel, Overtravel, Square & Round Bezels	30
	N.O.	1	200,000	11/16 (17,46)	Pos. Feel, Overtravel, Sq. Bezel Panel Mount	30
	N.O.	.020**	80,000	5/16+ (8,13)	Miniature, Surface Mount	38
	N.O.	.020**	80,000	5/16+ (8,13)	Miniature, Horizontal PC Mount	38
	N.O.	.020**	80,000	5/16+ (8,13)	Miniature, Vertical to PC Mount	38
	N.O. or N.C.	.250	100,000	1/4 (6,35)	Sealed Plunger, Stackable with LEDs	32
	N.O.	.500	1,000,000	1/4 (6,35)	Miniature	39
	N.O.	.500	500,000	1/2 (12,7)	Overtravel, Miniature Limit Switch, (Wire Leads Optional)	39
	N.O.	.500	100,000	1/2 (12,7)	Overtravel, Miniature, (Wire Leads Optional)	39
	N.O.	.500	250,000	5/16 (7,94)	Watertight Seal, Miniature, (Wire Leads Optional)	39
	N.C.	.250	250,000	1/4 (6,35)	Miniature (Wire Leads Optional)	39
	N.C.	.250	100,000	5/16 (7,94)	Watertight Seal, Miniature, (Wire Leads Optnl.)	39
	N.C.	.250	100,000	1/2 (12,7)	Actuator Seal, Miniature Limit Switch (Wire Leads Optional)	39
	N.O.	.150**	1,000,000	1/4 (6,35)	PC Mount, Miniature, Sealed	39
	N.O.	.150**	1,000,000	1/4 (6,35)	PC Mount, Miniature, Right Angle, Cap Seal	39
	N.O.	.150**	100,000	1/4 (6,35)	PC Mount, Miniature, Overtravel	39
	N.O.	.020, .150**	1,000,000	3/8 (9,53)	Economical Contact Plating	30
	N.O.	.020, .150**	1,000,000	3/8 (9,53)	Econ. Plating, Square Bezel Panel Mount	30
	N.O.	.020, .150**	1,000,000	1/4 (6,35)	Economical Contact Plating	39
	N.O.	.020, .150**	100,000	1/2 (12,7)	Actuator Seal, Overtravel, Miniature Limit Switch, (Wire Leads Optional)	39
SPDT	BBM	.250	100,000	1/4 (6,35)	SPST AND SPDT, Stackable w/LEDs	32
	BBM	.250	500,000	1/2 (12,7)	PC Mount, 2 Circuits, Right Angle, Total Seal	39
	BBM	.020**	80,000	5/16 (8,13)	Miniature, Surface Mount	38

Wiping Contact

SPST	N.O. or N.C.	3	6,000	13/16 (20,6)	Decorator Line	4000/10
	N.O. or N.C.	1	100,000	13/16 (20,6)	Momentary Action & Positive Feel Types	4000/10
	N.O.	.250	100,000	1/2 (12,7)	Momentary Action & Terminal Seal Types	23
	N.O.	.4VA	40,000	.177 (4,5)	Process Sealed, Subminiture	49
SPDT	BBM or MBB	.250	250,000	7/16 (11,11)	Momentary Action	46
	BBM or MBB	.250	250,000	1+ (25,4+)	Square Bezel Panel Mount	46
	BBM or MBB	.250	100,000	1/2 (12,7)	Watertight Seal	46
	BBM	.250	250,000	11/16 (17,46)	Square & Round Bezels	46
	BBM	.250	250,000	11/16 (17,46)	Alternate Action, Square & Round Bezels	46
	BBM	.250	250,000	1+ (25,4+)	Alternate Action, Square Bezel Panel Mount	46
	N.O.	.4VA	40,000	.177 (4,5)	Process Sealed, Subminiature	49
DPDT	BBM or MBB	.250	100,000	5/8 (15,88)	Momentary Action	46
	BBM	.250	250,000	13/16 (20,6)	Environmental Seal/Wire Leads	46
	BBM or MBB	.250	100,000	11/16 (17,46)	Watertight Seal	46
	BBM	.250	250,000	11/16 (17,46)	Square & Round Bezel & Positive Feel Types	46
	BBM	.250	250,000	11/16 (17,46)	Alternate Action, Square & Round Bezels	46
	BBM or MBB	.250	250,000	1+ (25,4+)	Alternate Action, Square Bezel Panel Mount	46

Snap Action Contact

SPST	N.O. or N.C.	1, 3	25,000	7/8 (22,23)	SPST, 1 and 3 Amp	4000/10
SPDT	BBM	5, 10	25,000	7/8 (22,23)	Audible Click	2000/7

* BBM is Break-Before-Make (Non-Shorting). MBB is Make-Before-Break (Shorting).
** Rated for 28 Vdc and/or 5 Vdc (.150 A) and 20 Vdc (.020 A).
*** Maximum width behind panel or above PC board rounded to next highest 1/16" (1,59 mm).

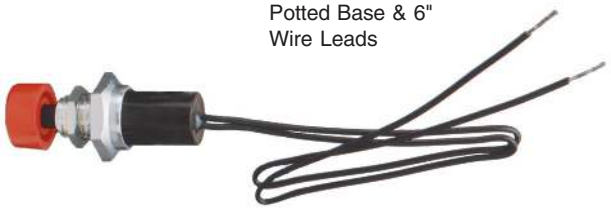
SEALED TERMINAL AND WIRE LEAD OPTIONS

OPTION -E AND -EW

FEATURES

- 1/4, 1/2, and 1 Amp
- Limit, Overtravel, or Panel Seal
- Butt or Wiping Contact
- Normally Open or Normally Closed
- Momentary or Push/Pull
- Series 23, 30, 39 and 46

Option -E
Epoxy-Sealed
Terminals



Option -EW,
Potted Base & 6"
Wire Leads

SPECIFICATIONS

Rating Criteria

Make and Break Current Rating: See page for standard part number
Contact Resistance: 25 milliohms maximum on a new switch. Less than 4 milliohms per inch of wire for wire lead option styles.
Insulation Resistance: 1,000 megohms minimum between mutually insulated parts
Voltage Breakdown: 1,000 Vac minimum between mutually insulated parts

Materials and Finishes

Potting Sleeve (Series 39): Thermoset Plastic
Wire Leads: #26AWG, (.99mm diameter) insulated Teflon, Copper stranded wire, per MIL-W-16878,Type E. Ends are stripped 0.250" (6.35) and solder dipped. For other specifications, see Page References.

Standard Part Number Red Button	Standard Part Number Black Button	Choices of Suffix	Length Behind Panel In inches (and millimeters)	
			Standard Switch & Terminals	-EW Style Body
23-1	23-4	-E	0.665 (16,89)	——
30-1	30-3	-E, -EW	0.592 (15,04)	0.645 (16,38)
30-15	30-37	-E, -EW	0.679 (17,25)	0.728 (18,49)
30-17 RED	30-17 BLK	-E, -EW	0.958 (24,33)	1.007 (25,58)
30-16 RED	30-16 BLK	-E, -EW	0.958 (24,33)	1.007 (25,58)
30-251 RED	30-251 BLK	-E, -EW	0.632 (16,05)	0.685 (17,40)
30-252 RED	30-252 BLK	-E, -EW	0.645 (16,38)	0.700 (17,78)
30-32 RED	30-32 BLK	-E, -EW	0.867 (22,02)	0.896 (22,76)
30-6	30-2	-E, -EW	0.605 (15,37)	0.640 (16,26)
30-601 RED	30-601 BLK	-E, -EW	0.592 (15,04)	0.645 (16,38)
39-1*	39-3*	-EW**	0.315 (8,00)	0.440 (11,18)
——	39-2	-E,- EW	0.490 (12,45)	0.575 (14,61)
39-12*	39-24*	-EW**	0.455 (11,56)	0.575 (14,61)
39-101	——	-EW**	0.650 (16,51)	0.775 (19,69)
39-351 RED	39-351 BLK	-EW**	0.350 (8,89)	0.450 (11,43)
39-352 RED*	39-352 BLK*	-E, -EW	0.529 (13,44)	0.630 (16,00)
39-601 RED	39-601 BLK	-EW*	0.315 (8,00)	0.440 (11,18)
39-701***	——	-EW**	0.800 (20,32)	0.925 (23,50)
39-702***	——	-E, -EW	0.510 (12,95)	0.750 (19,05)
46-101 RED	46-101 BLK	-E, -EW	0.890 (22,61)	0.957 (24,31)
46-102 RED	46-102 BLK	-E, -EW	0.890 (22,61)	0.957 (24,31)
46-110 RED	46-110 BLK	-E, -EW	0.890 (22,61)	0.957 (24,31)
46-111 RED	46-111 BLK	-E, -EW	0.890 (22,61)	0.957 (24,31)
46-150 RED	46-150 BLK	-E, -EW	0.957 (24,31)	1.024 (26,01)
46-151 RED	46-151 BLK	-E, -EW	0.957 (24,31)	1.024 (26,01)
46-200 RED	46-200 BLK	-E	0.921 (23,39)	——
46-201 RED	46-201 BLK	-E	0.921 (23,39)	——
46-270 RED	46-270 BLK	-E	0.957 (24,31)	——
46-271 RED	46-271 BLK	-E	0.957 (24,31)	——

*Epoxy potting sleeve enlarges the diameter of the -EW style to 0.300 (7,62).
**Sealed terminal (-E) option is not necessary; terminals have sealed construction.
***Natural Color Button
†Adjustable from 1.214 (30,84) to 1.334 (33,88) dependent on button height, see switch pages.

ORDERING INFORMATION

Use the Selector Charts at the beginning of the section to select a series. Use the pages listed there or referenced here to select a switch.

To order epoxy sealed terminals, add the suffix -E to the selected part number as allowed in the chart. ***Example:*** *30-1-E*.

To order the epoxy-potted version with 6-inch wire leads, use the suffix -EW as allowed in the chart. ***Example:*** *39-1-EW*

Available From Your Local Grayhill Distributors. For prices and discounts, contact a local Sales Office, an authorized local Distributor or Grayhill.

Standard Part Number Without Options Choice of Button Color (see switch pages)	Standard Part Number Choice of Button Color (see switch pages)	Choices of Options	Length Behind Panel In inches (and millimeters)	
			Standard Switch & Terminals	-EW Style Body
———	30-001-A-XX	-E, -EW	1.119 (28,42)	1.172 (29,77)
———	30-002-A-XX	-E, -EW	1.132 (28,75)	1.167 (29,64)
———	30-015-A-XX	-E, -EW	1.204 (30,58)	1.253 (31,83)
———	30-017-A-XX	-E, -EW	Adjustable†	Adjustable†
30-01-01-500-XX	30-1-1-50-XX	-E, -EW	1.100 (27,94)	1.153 (29,29)
30-01-04-500-XX	30-1-4-50-XX	-E, -EW	1.257 (31,93)	1.310 (33,27)
30-05-01-502-XX	30-5-1-52-XX	-E, -EW	0.930 (23,62)	0.983 (24,97)
30-05-04-502-XX	30-5-4-52-XX	-E, -EW	1.130 (28,70)	1.183 (30,05)
———	30-601-A-XX	-E, -EW	1.119 (28,42)	1.172 (29,77)
46-01-05-500-XX	46-1-5-50-XX	-E, -EW	1.361 (34,57)	1.428 (36,27)
46-01-07-500-XX	46-1-7-50-XX	-E, -EW	1.451 (36,86)	1.518 (38,56)
46-01-08-500-XX	46-1-8-50-XX	-E	1.381 (35,08)	———
46-01-09-500-XX	46-1-9-50-XX	-E	1.381 (35,08)	———
46-05-05-502-XX	46-5-5-52-XX	-E, -EW	1.179 (29,95)	1.246 (31,65)
46-05-07-502-XX	46-5-7-52-XX	-E, -EW	1.465 (37,21)	1.532 (38,91)
46-05-08-502-XX	46-5-8-52-XX	-E	1.188 (30,18)	———
46-05-09-502-XX	46-5-9-52-XX	-E	1.317 (33,45)	———
———	46-102-A-XX	-E, -EW	1.417 (35,99)	1.484 (37,69)
———	46-111-A-XX	-E, -EW	1.417 (35,99)	1.484 (37,69)
———	46-200-A-XX	-E	1.448 (36,78)	———
———	46-201-A-XX	-E	1.448 (36,78)	———

*Epoxy potting sleeve enlarges the diameter of the -EW style to 0.300 (7,62).
**Sealed terminal (-E) option is not necessary; terminals have sealed construction.
***Natural Color Button
†Adjustable from 1.214 (30,84) to 1.334 (33,88) dependent on button height, see switch pages.

CIRCUITRY: Series 46