# SERIES 50 SERIES 51

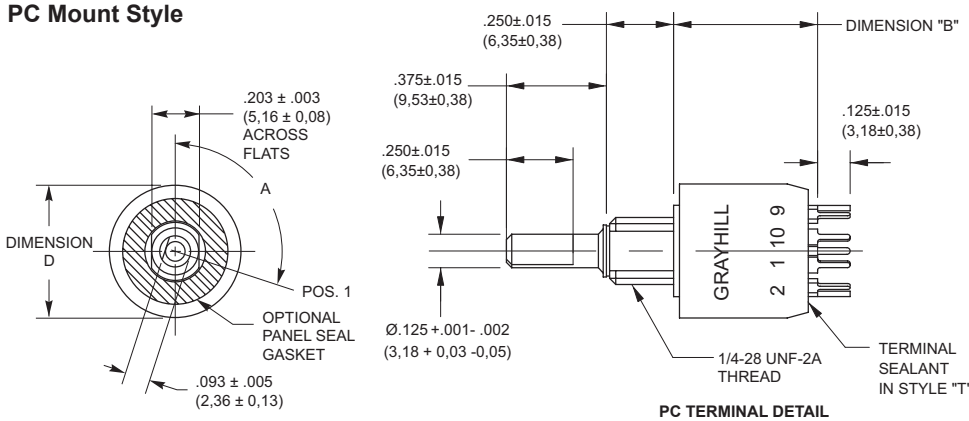
**0.5" Diameter, 200mA,**
**.698" Behind Panel**

## FEATURES

- Optional Complete Seal for PC Board Assembly and Cleaning
- Small 1/2" Diameter
- Choice of 22.5°, 30°, 36°, 45°, 60° and 90° Angles of Throw
- Up to 4 Poles on 1 Deck
- Up to 16 Positions Per Switch
- PC or Solder Lug Termination
- Positive Shaft Grounding for EMI/RFI Shielding

## DIMENSIONS in inches (and millimeters)

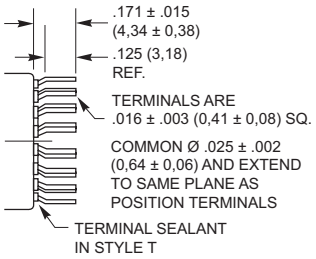
### PC Mount Style



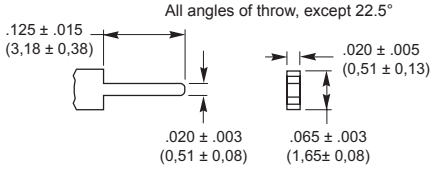

Grayhill part number and date code marked on label. Customer part number marked on request. Military part number marked when required.

### Side View 22.5°

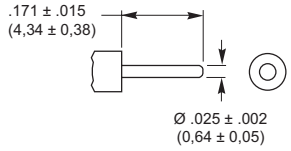
All others as shown at left




**PC TERMINAL DETAIL**
All angles of throw, except 22.5°




**PC COMMON DETAIL**
All angles of throw, except 22.5°

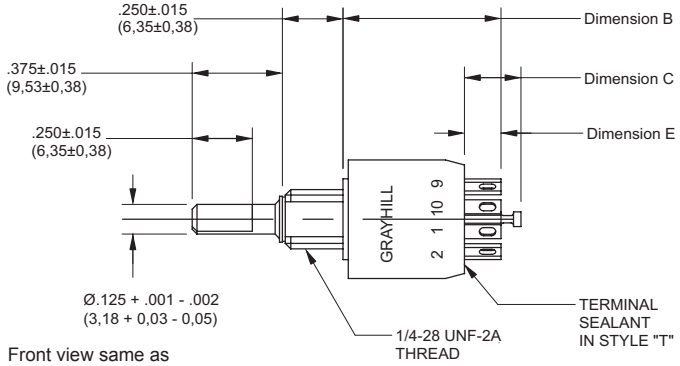



| Angle of Throw | Angle A | Angle of Throw | Angle A |
|---|---|---|---|
| **22.5°** | 101.25° | **45°** | 112.5° |
| **30°** | 105° | **60°** | 120° |
| **36°** | 108° | **90°** | 135° |

| Dimension | Series 50 | Series 51 |
|---|---|---|
| D | .500 ± .015 (12,70 ± 0,38) | .562 ± .015 (14,27 ± 0,38) |

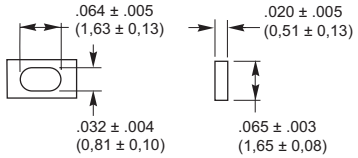
| Dimension | Style T | All Others | All 22.5° |
|---|---|---|---|
| B | .576 ± .015 (14,63 ± 0,38) | .537 ± .015 (13,64 ± 0,38) | .537 ± .015 (13,64 ± 0,38) |

### Solder Lug Style

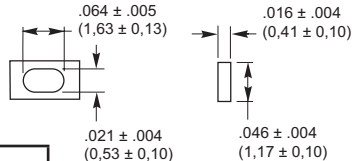



Front view same as PC Mount style.

**SOLDER LUG TERMINAL DETAIL**
All angles of throw, except 22.5°



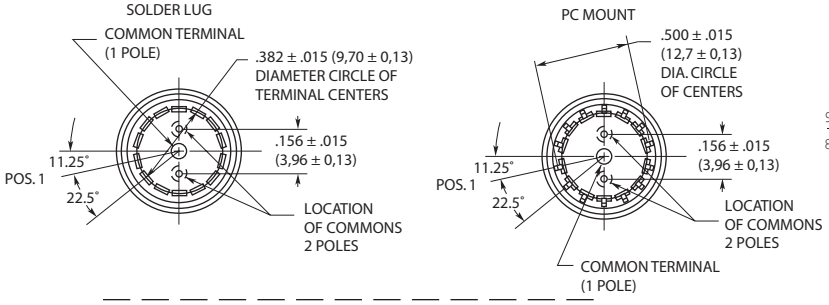

**SOLDER LUG TERMINAL DETAIL 22.5°**

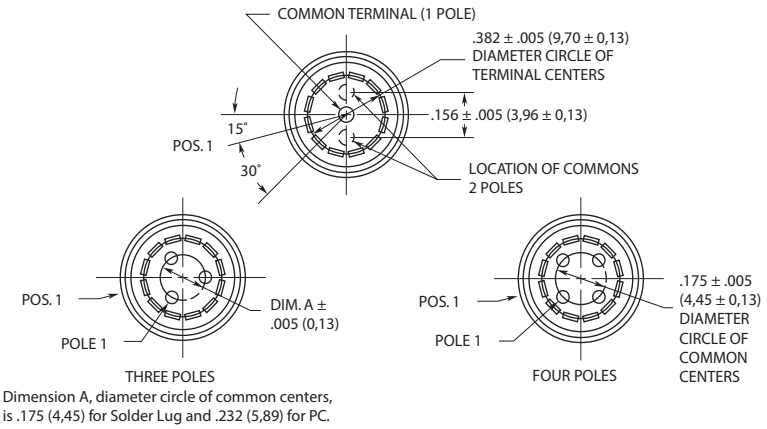



| Dimension | 30°, 36°, 45°, 60°, 90° | 22.5° |
|---|---|---|
| B | .658 ±.015 (16,71 ±0,38) | .591±.020 (15,01±0,50) |
| C | .234 ±.015 (5,94 ±0,38) | .200±.015 (5,08±0,38) |
| E | .153±.015 (3,89±0,38) | .12±.015 (3,05±0,38) |

## CIRCUIT DIAGRAMS AND REAR VIEWS: Solder Lug and PC Mount

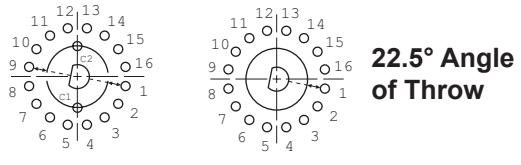
### Rear View



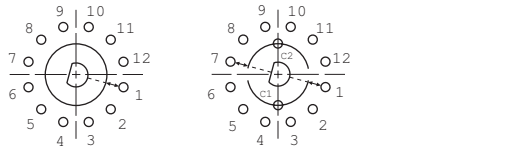




Dimension A, diameter circle of common centers, is .175 (4,45) for Solder Lug and .232 (5,89) for PC.

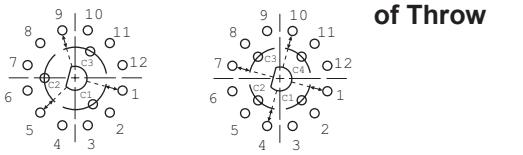
### Circuit as Viewed From Shaft End

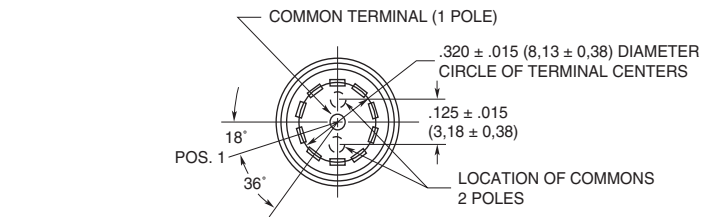


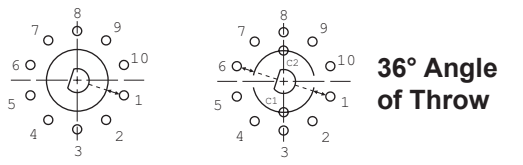

**22.5° Angle of Throw**



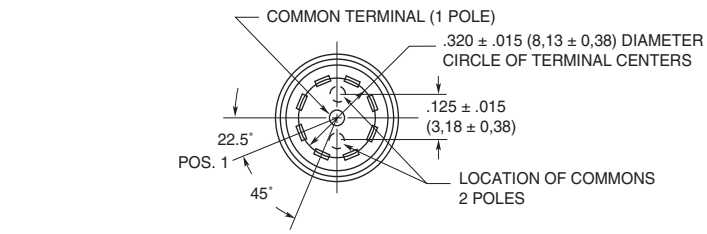

**30° Angle of Throw**

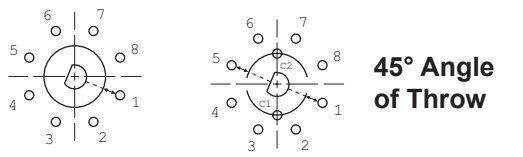


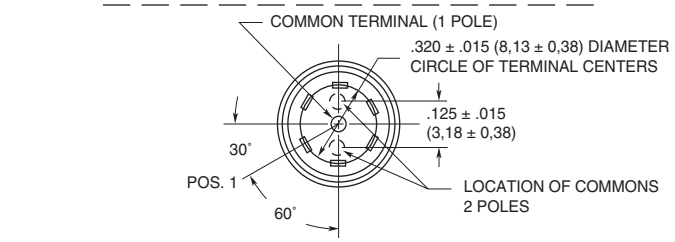



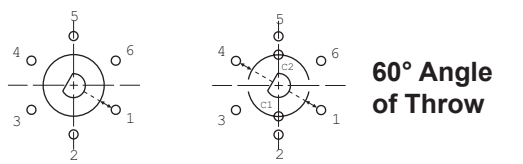

**36° Angle of Throw**



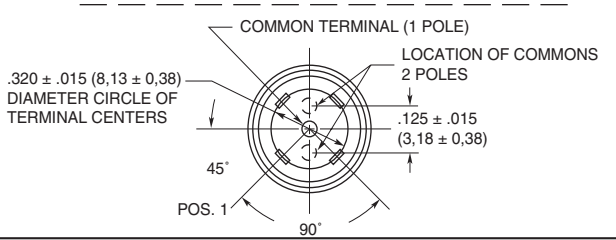



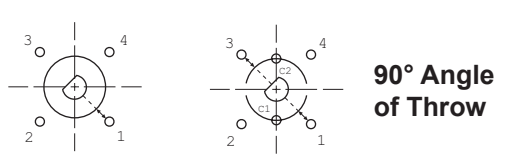

**45° Angle of Throw**




**60° Angle of Throw**




**90° Angle of Throw**

## SPECIFICATIONS

### Military Qualification

The dimensions for qualified switches are the same as those indicated in the drawings of standard switches. Switches with standard variations, such as shaft and bushing length, which do not affect switch performance, can be marked as qualified product. Contact Grayhill for complete information on variations.

**36°, 45°, 60°, 90° (Series 50):** The C and M style switches are qualified to MIL-S-3786/20. They include the following:

Solder lug or PC terminals
With or without panel seal

Series 50 qualified switches may be ordered by the 'M' number or by the Grayhill part number.

**30° (Series 51):** The C and M style switches are qualified to MIL-S-3786/35. They include the following:

Solder lug or PC terminals
With or without panel seal

Series 51 qualified switches may be ordered by the 'M' number or by the Grayhill part number.

### Electrical Ratings

**Life Expectancy:** With the limiting criteria stated here, the Series 50 and 51 with non-shorting contacts will switch the following loads at atmospheric and reduced pressures for 25,000 cycles of operations. One cycle is 360° rotation clockwise and 360° return.

At 85°C, atmospheric pressure

| | | |
|---|---|---|
| 200 mA, | 28 | Vdc resistive |
| 150 mA, | 115 | Vac resistive |
| 30 mA, | 28 | Vdc inductive |
| 100 mA, | 28 | Vdc lamp load |
| 75 mA, | 220 | Vac lamp load |

At 25°C, reduced pressure (70,000 feet)

| | | |
|---|---|---|
| 200 mA, | 28 | Vdc resistive |
| 150 mA, | 115 | Vac resistive |
| 75 mA, | 220 | Vac resistive |

**Contact Resistance:** 20 milliohms maximum, (10 milliohms initially).

**Insulation Resistance:** 1,000 Mohms minimum between mutually insulated parts.
**Voltage Breakdown:** 600 Vac minimum between mutually insulated parts at standard atmospheric pressure.
**Life Expectancy:** Listed for the voltage source and make and break current levels. Contact Grayhill for more information if any of the following is true: the life limiting criteria are more critical than those listed; longer operation is required; a larger make and break current is required; the operating environment includes elevated temperatures or reduced pressures.
**Contact Carry Rating:** Switch will carry 6 amperes continuously with a maximum contact temperature rise of 20°C.

## SPECIFICATIONS: Other

### Additional Characteristics

**Contact Type and Forces:** Shorting or non-shorting wiping contacts with over 80 grams of contact force.
**Shaft Flat Orientation:** Flat opposite contacting position of pole number one (see circuit diagrams).
**Terminals:** Switches have the full circle of terminals, regardless of number of active position.
**Stop Strength:** 7.5 pound-inches minimum
**Rotational Torque:** 8–24 ounce-inches, depending on the number of poles.

### Materials and Finishes

**Switch Base:** Thermoset
**Detent Rotor:** Nylon
**Shaft, Stop Blades, Stop Arm, Thrust washer, and Retaining Ring:** Stainless steel
**Detent Balls:** Steel, nickel-plated
**Bushing:** Zinc, tin-zinc plated
**Detent and Contact Springs:** Stainless steel
**Common Ring:** Brass, gold-plated over silver plate.
**Terminals:** Brass, gold-plated over silver plate and nickel plate
**Rotor Contact:** Precious metal alloy, gold-plated

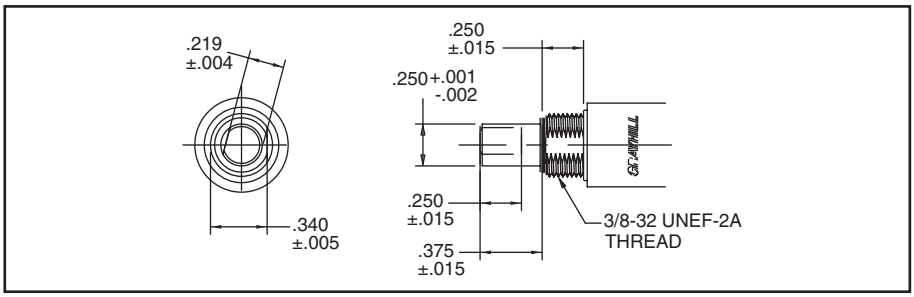
**Panel Seal:** Silicone rubber
**Shaft Seal:** Fluorosilicone
**Mounting Nuts:** Brass, tin-zinc plated
**Mounting Hardware:** One mounting nut .089" thick by .375" across flats and one internal tooth lockwasher are supplied with the switch.
**Maximum Mounting Torque:** 15in-lbs

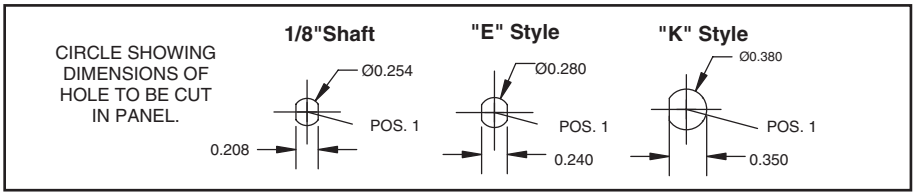
## PROCESS SEALED–Style T

Switch can be mounted on PC board with other components and subjected to wave soldering and conventional board cleaning techniques. No secondary wiring or soldering is necessary.

Bushing is o-ring sealed; epoxy potting seals the terminals and the rear of the switch. Designed for PC assembly, this sealing technique can also be applied to solder lug terminal switches. A bushing to panel seal can also be added to the process sealed versions. Military qualified versions are available, see ordering information.

## 1/4" SHAFT: Style K



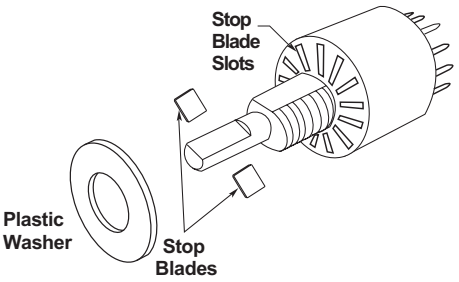
## SUGGESTED ADJUSTABLE STOP SUBSTITUTION GUIDE

| Fixed Stop Style | Adj. Stop Style Equivalent | Fixed Stop Style | Adj. Stop Style Equivalent |
|---|---|---|---|
| 50A | 50D | 51A | 51D |
| 50C | 50CD | 51C | 51CD |
| 50CP | 50CDP | 51CP | 51CDP |
| 50M | 50CD* | 51M | 51CD* |
| 50MP | 50CDP* | 51MP | 51CDP* |
| 50P | 50DP | 51P | 51DP |
| 50S | 50D* | 51S | 51D* |
| 50SP | 50DP* | 51SP | 51DP* |

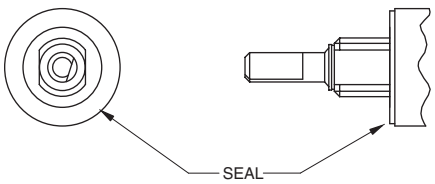
*Form fit and function equivalents, but not watertight sealed to the panel.

## ADJUSTABLE STOPS: Style D

Adjustable stops permit the user to set and reset the number of positions per poles. Shown in the diagram, a plastic washer can be removed to reveal slots at the base of the bushing. Stop blades can be inserted into the appropriate slots to limit switch rotation. Positions per pole configuration can thus be changed to meet the needs of the application. Dimensions are the same as the fixed stop version, when plastic washer is in place. Most desirable for prototype work. Readily available from local distributor.

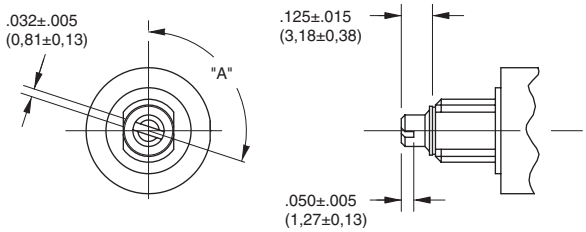



## SHAFT AND PANEL SEAL: Styles S and M



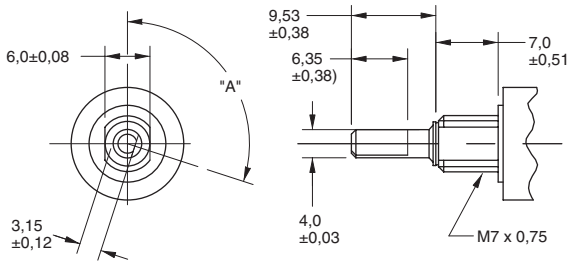

Shaft and panel seal switches are watertight to the panel. They are not totally process sealed like the Style "T". Panel is sealed by a gasket at the base of the bushing. Shaft is sealed by an O-ring inside the bushing. After mounting, seals do not alter switch dimensions. See Style "S" (standard switches) and Style "M" (military switches) in the Choices and Limitations chart.

## SCREWDRIVER SLOTTED SHAFT: Style B




Form, fit and function equivalent to standard shaft switches. The dimensions shown have evolved as the most popular for this type of switch. See Style "B" in the Choices and Limitations chart. Previous users may have ordered these switches by a non-descriptive part number containing a "Y". Contact Grayhill, if in doubt about a cross-reference.

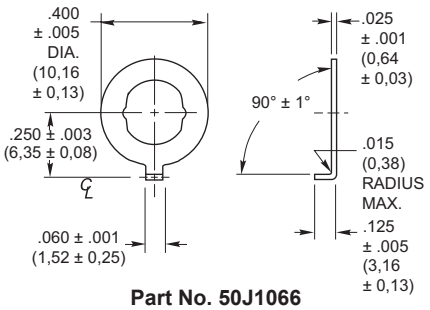
## METRIC SHAFT AND BUSHING: Style E




Metric standard dimensions for the shaft and bushing are shown in the drawing. Other dimensions approximately the same as shown in dimensional drawing. Contact Grayhill for exact dimensions. See Style "E" in the Choices and Limitations chart.

## ACCESSORY: Non-Turn Washers

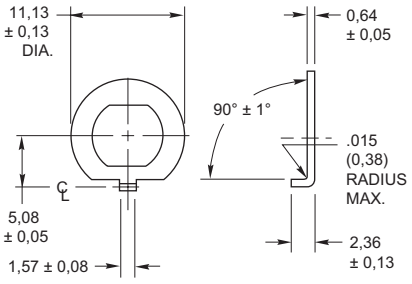
In Inches (and millimeters)




**Part No. 50J1066**

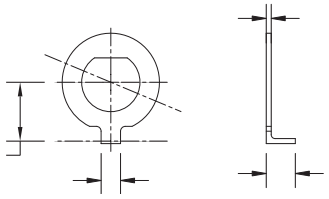
Cut round hole for the bushing and for the non-turn tab. Washer fits the double D bushing flats. Washer is sold only when accompanied by an order for a like number of switches. Washer is 302 stainless steel.

Dimensions are in millimeters




**Part No. 71J1103**

Designed to fit the double flatted bushing of the metric dimensioned bushing, this non-turn washer permits a round hole for the bushing and the tab while still preventing switch rotation. Washer is only sold when accompanied by a like number of switches. Washer is 302 stainless steel.



**Part No. 50J5140-4**

Designed to fit the single flatted bushing of the "K" style switches, this non-turn washer prevents switch rotation when using a full round hole in the panel. Washer is only sold when accompanied by a like number of switches. Washer is 302 stainless steel.

## CHOICES AND LIMITATIONS: Series 50

A = Standard, 1/8" Shaft
B = Screwdriver Slot Shaft
C = Military, Without Panel Seal
D = Adjustable Stop (Adj. Stop)
E = Metric, 4mm Shaft
K = 1/4" Shaft
M = Military
P = PC Mount Terminals
S = Shaft/Panel Seal (S/P Seal)
T = Process Sealed

### Standard Style

| Series | Style Choices[1] Std., 1/8" Shaft | 1/4" Shaft | Metric, 4mm Shaft | Terminals | Angle of Throw | Number of Poles | Number of Positions Per Pole | Shorting or Non-Shorting Contacts |
|---|---|---|---|---|---|---|---|---|
| 50 | A<br>AT<br>B<br>BS<br>BST<br>BT<br>D<br>S<br>ST | K<br>KS<br>KST<br>KT<br>KB<br>KBS<br>KBST<br>KT | E<br>ES<br>EST<br>ET<br>EB<br>EBS<br>EBST<br>EBT | Solder Lug | 36° | 1<br>2 | 02 thru 10<br>02 thru 05 | N or S<br>N or S |
| | | | | | 45° | 1<br>2 | 02 thru 08<br>02 thru 04 | N<br>N |
| | | | | | 60° | 1<br>2 | 02 thru 06<br>02 or 03 | N<br>N |
| | | | | | 90° | 1<br>2 | 02 thru 04<br>02 | N<br>N |
| | BP<br>BPT<br>BSP<br>BSPT<br>DP<br>P<br>PT<br>SP<br>SPT | KP<br>KPT<br>KSP<br>KSPT<br>KBP<br>KBSP<br>KBSPT<br>KBT | EP<br>EPT<br>ESP<br>ESPT<br>EBP<br>EBSP<br>KBSPT<br>EBT | PC Mount | 36° | 1<br>2 | 02 thru 10<br>02 thru 05 | N or S<br>N or S |
| | | | | | 45° | 1<br>2 | 02 thru 08<br>02 thru 04 | N<br>N |
| | | | | | 60° | 1<br>2 | 02 thru 06<br>02 or 03 | N<br>N |
| | | | | | 90° | 1<br>2 | 02 thru 04<br>02 | N<br>N |

### Military Style

| Series | Style Choices Std., 1/8" Shaft | 1/4" Shaft | Metric, 4mm Shaft | Terminals | Angle of Throw | Number of Poles | Number of Positions Per Pole | Shorting or Non-Shorting Contacts |
|---|---|---|---|---|---|---|---|---|
| 50 | C<br>CB<br>CBT<br>CD<br>CT<br>M<br>MB<br>MBT<br>MT | KM<br>KMB<br>KMBT<br>KMT | EM<br>EMB<br>EMBT<br>EMT | Solder Lug | 36° | 1<br>2 | 02 thru 10<br>02 thru 05 | N or S<br>N or S |
| | | | | | 45° | 1<br>2 | 02 thru 08<br>02 thru 04 | N<br>N |
| | | | | | 60° | 1<br>2 | 02 thru 06<br>02 or 03 | N<br>N |
| | | | | | 90° | 1<br>2 | 02 thru 04<br>02 | N<br>N |
| | CBP<br>CBPT<br>CDP<br>CP<br>CPT<br>MBP<br>MBPT<br>MP<br>MPT | KMBP<br>KMBPT<br>KMP<br>KMPT | EMBP<br>EMBPT<br>EMP<br>EMPT | PC Mount | 36° | 1<br>2 | 02 thru 10<br>02 thru 05 | N or S<br>N or S |
| | | | | | 45° | 1<br>2 | 02 thru 08<br>02 thru 04 | N<br>N |
| | | | | | 60° | 1<br>2 | 02 thru 06<br>02 or 03 | N<br>N |
| | | | | | 90° | 1<br>2 | 02 thru 04<br>02 | N<br>N |

## CHOICES AND LIMITATIONS: Series 51

A = Standard, 1/8" Shaft
B = Screwdriver Slot Shaft
C = Military, Without Panel Seal
D = Adjustable Stop (Adj. Stop)
E = Metric, 4mm Shaft
K = 1/4" Shaft
M = Military
P = PC Mount Terminals
S = Shaft/Panel Seal (S/P Seal)
T = Process Sealed

### Standard Style

| Series | Std., 1/8" Shaft | Style Choices[1] 1/4" Shaft | Metric, 4mm Shaft[1] | Terminals | Angle of Throw | Number of Poles | Number of Positions Per Pole | Shorting or Non-Shorting Contacts |
|---|---|---|---|---|---|---|---|---|
| 51 | A AT<br>B BT<br>S ST<br>BS BST | SEE BELOW | SEE BELOW | Solder Lug | 22.5° | 1<br>2 | 02 thru 16<br>02 thru 08 | N or S<br>N or S |
| | A<br>AT<br>B<br>BS<br>BST<br>BT<br>D<br>S<br>ST | K<br>KS<br>KST<br>KT | E<br>ES<br>EST<br>ET | Solder Lug | 30° | 1<br>2<br>3<br>4 | 02 thru 12<br>02 thru 06<br>02 thru 04<br>02 or 03 | N or S<br>N or S<br>N or S<br>N or S |
| | P PT<br>BP BPT<br>SP SPT<br>BSP BSPT | SEE BELOW | SEE BELOW | PC Mount | 22.5° | 1<br>2 | 02 thru 16<br>02 thru 08 | N or S<br>N or S |
| | BP<br>BPT<br>BSP<br>BSPT<br>DP<br>P<br>PT<br>SP<br>SPT | KP<br>KPT<br>KSP<br>KSPT | EP<br>EPT<br>ESP<br>ESPT | PC Mount | 30° | 1<br>2<br>3<br>4 | 02 thru 12<br>02 thru 06<br>02 thru 04<br>02 or 03 | N or S<br>N or S<br>N or S<br>N or S |

### Military Style

| Series | Std., 1/8" Shaft | Style Choices 1/4" Shaft | Metric, 4mm Shaft | Terminals | Angle of Throw | Number of Poles | Number of Positions Per Pole | Shorting or Non-Shorting Contacts |
|---|---|---|---|---|---|---|---|---|
| 51 | C<br>CB<br>CBT<br>CD<br>CT<br>M<br>MB<br>MBT<br>MT | KM<br>KMB<br>KMBT<br>KMT | EM<br>EMB<br>EMBT<br>EMT | Solder Lug | 30° | 1<br>2<br>3<br>4 | 02 thru 12<br>02 thru 06<br>02 thru 04<br>02 or 03 | N or S<br>N or S<br>N or S<br>N or S |
| | CBP<br>CBPT<br>CDP<br>CP<br>CPT<br>MBP<br>MBPT<br>MP<br>MPT | KMBP<br>KMBPT<br>KMP<br>KMPT | EMBP<br>EMBPT<br>EMP<br>EMPT | PC Mount | 30° | 1<br>2<br>3<br>4 | 02 thru 12<br>02 thru 06<br>02 thru 04<br>02 or 03 | N or S<br>N or S<br>N or S<br>N or S |

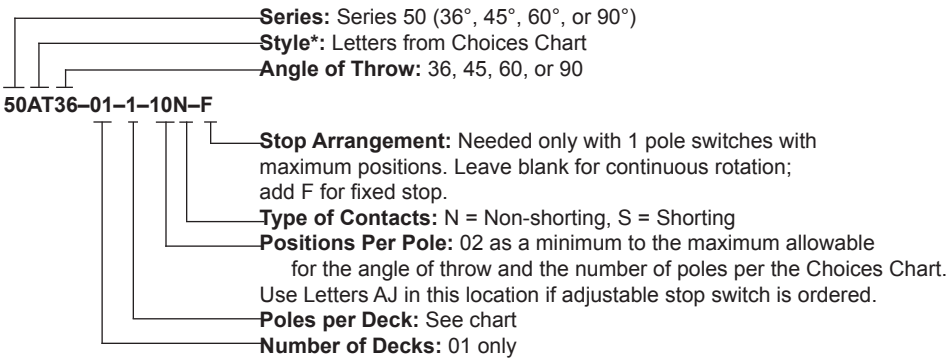
[1] Contact Grayhill if 1/4" or metric shaft required with a 22.5° angle of throw.

## ADDITIONAL FEATURES

Economy keylock switch, isolated position, spring return, and coded switches are available in similar series. See Keylock and Special Function Rotary Switch sections.

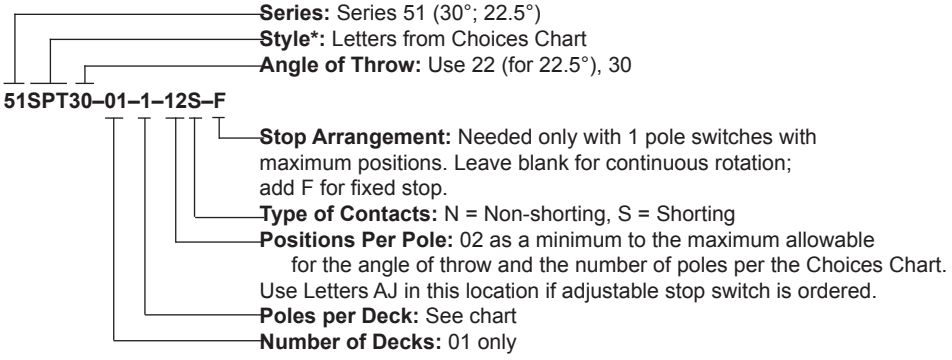
**Available from your local Grayhill Distributor.** For prices and discounts, contact a local Sales Office, an authorized local Distributor, or Grayhill.

## ORDERING INFORMATION: Series 50




* All rotary switches that are required to have military designated markings and testing adhering to MIL-3786 are to be ordered by specifying the military part number identified on the appropriate slash sheet.

## ORDERING INFORMATION: Series 51




* All rotary switches that are required to have military designated markings and testing adhering to MIL-3786 are to be ordered by specifying the military part number identified on the appropriate slash sheet.