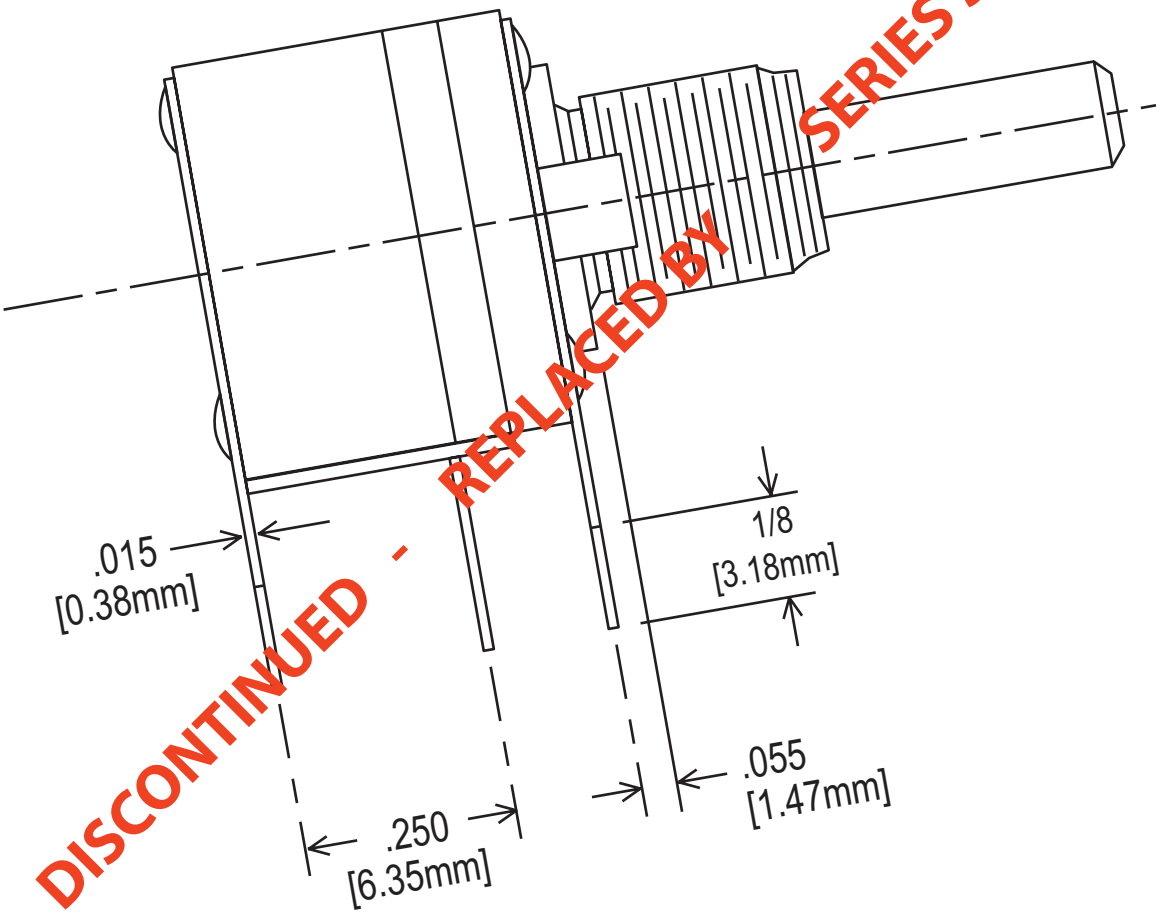
STATE ELECTRONICS

Series 388/389 Custom Potentiometer Designer Guide



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Now almost any special combination potentiometer you specify can be manufactured and shipped soon after your order is received.

Since Mod Pot potentiometers are modular in construction, we can produce prototype quantities of 1/2 or 5/8 inch square, conductive plastic, cermet, or hot molded carbon pots for you in just a few hours . . . . and even production quantities in a matter of days with our VIP (Very Important Potentiometer) service!

Over one billion combinations of single, dual, triple, quad arrangements, push-pull or rotary switches and hundreds of shaft terminal variations can be produced.

If you need a potentiometer and you need it fast, call our product manager or fax us your requirements using the Custom Potentiometer Order Form included in this catalog.

WHY WAIT?

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Series 388 Potentiometer
Conductive Plastic - 1/2 inch square; .5 Watt

Series 389 Potentiometer
Cermet - 1/2 inch square; 1 Watt

Description

The 388 and 389 series are 1/2 in. square, modular, stackable potentiometers. The basic construction suits the series for countless design options.

The 388 and 389 series can be found in a wide range of sophisticated systems in a broad scope of industries.

Features

- **Small size** - 1/2 in. square
- **Stackable** - up to 8 modules
- **Switches** - rotary, push-pull, push-momentary, and schadow.
- **Versatility** - various shaft, bushings, terminal styles, resistance values, tapers and tolerances. Available in Conductive Plastic or Thick Film Cermet
- **RoHS Compliant**

Special Features

- **Detents** - Center detent and 11 position detents available
- **Seals** - mounting and shaft seals
- **Medium torque** - 1 to 6 oz. in.

	Operational Specifications Series 388	Operational Specifications Series 389
Resistance Range	Linear: 100 ohm to 5 Megohm Tapered: 500 ohm to 1 Megohm *See chart, page 7*	Linear: 50 ohm to 5 Megohm Tapered: 100 ohm to 1 Megohm *See chart, page 7*
Resistance Tolerance	Linear: thru 500K ohm , ±10%; above 500K ohm , ±20%. Tapered: thru 100K ohm , ±10%; above 100K ohm ±20%	Linear: ±10%; ±20% special Tapered: ±10% Under 20 ohm ±20%
Taper	See *Taper Curve* charts on page 6 for standard and special tapers available	See *Taper Curve* charts on page 6 for standard and special tapers available
Taper Tolerance	±20% of nominal resistance at 50% ±3% mechanical rotation	±20% of nominal resistance at 50% mechanical rotation
Independent Linearity	±5% standard with specials available	±5% standard with specials available
End Resistance	4 ohms max. each end linear and low side of taper. 1% of total R high side of taper.	2 ohms max. each end (5 ohms - 2.5K ohms) 4 ohms max. each end (above 2.5K)
Dynamic Noise (C.R.V.)	1.5% of total R, standard linear; 1.0% of total R, special linear; 2.2% of total R, tapered.	3.0% of total R, standard linear; 1.5% of total R, special linear (500 ohms and above); 6.0% of total R, tapered.
Static Noise	Up to 30K ohms - 20db; 100K ohms - 12 db; 1 Megohms +3db	Up to 100 ohms - 25db; 10K ohms - 15 db; 100K ohms -10db.

Electrical Specifications continued, next page

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	Operational Specifications Series 388	Operational Specifications Series 389
Power Rating	0.5 Watt @ 70°C bushing mounting 0.25 Watt @ 70°C PC mounting. Derate to 0 watts at 120°C. derate 50% for non-linear tapers and derate multiple sections 1/2 wattage of panel unit.	1.0 Watt @ 85°C bushing mounting 0.5 Watt @ 85°C PC mounting. Derate to 0 watts at 150°C. derate 50% for non-linear tapers and derate multiple sections 1/2 wattage of panel unit.
Working Voltage	350 Vdc across end terminals, but power not to exceed rating.	350 Vdc across end terminals, but power not to exceed rating.
Dielectric Withstanding Voltage (*Glossary Definition Link*)	750 VAC @ ATM pressure -760mm Mercury, equivalent to sea level. 350 VAC @ 3.4 in. - 86.36mm Mercury, equivalent to 50,000 feet.	750 VAC @ ATM pressure - 760mm Mercury, equivalent to sea level 350 VAC @ 3.4 in. 86.36mm Mercury, equivalent to 50,000 feet. 900 VAC single standard module
Insulation Resistance	1000 Megohms minimum for dry, clean conditions @ 25°C	1000 Megohms minimum for dry, clean conditions @ 25°C
Temperature Coefficient	See *Temperature Resistance Change* table on page 7	15 ohms to 100 ohms 250 ppm/°C. 100 ohms to 5 Megohms 150 ppm/°C Temperature range -55°C to 150°C.
Tracking	10% voltage ratio tracking between sections standard. Specials available.	10% voltage ratio tracking between sections standard. Specials available.
Electrical Rotation	295° ±5°	295° ±5°
Effective Rotation	265° ±5° without switch; 240° ±5° with switch.	250° +10° -5° without switch; 225° +10° -5° with switch.
Load Life	10% maximum change in resistance and within end resistance limits with rated power across element, at 70°C ambient temperature. Power applied 1.5 hours "on" 0.5 hours "off" for 1000 hours.	5% maximum change in resistance and within end resistance limits with rated power across element, at 85°C ambient temperature. Power applied 1.5 hours "on" 0.5 hours "off" for 1000 hours.
Rotational Life	Potentiometer: 10% maximum resistance change up to 25,000 cycles under load. Rotary Switch: 15,000 cycles of operation Trimmer: 5,000 cycles	Potentiometer: 10% maximum resistance change up to 25,000 cycles under load. Rotary Switch: 15,000 cycles of operation Trimmer: 5,000 cycles
Low Temperature Operation	Less than 3% change in total R. Operating torque at -40°C is 30 oz. in.	Less than 2% change in total R. Operating torque at -40°C is 30 oz. in.
Rotary Switch	SPDT, 125MA @ 30VDC, CCW or CW Detent	SPDT, 125MA @ 30VDC, CCW or CW Detent
Push-Pull or Push-Momentary Switch	DPST, N.O-N.C, 250MA @ 30VDC SPDT if common is cross-wired	DPST, N.O-N.C, 250MA @ 30VDC SPDT if common is cross-wired

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	Environmental Specifications Series 388	Environmental Specifications Series 389
MIL-R-94 Standard	Series 388 is designed to meet MIL-R-94 performance characteristics where applicable	Series 389 is designed to meet MIL-R-94 and MIL-R-22097 performance characteristics where applicable
Low Temperature Storage	Less than 2% change in total resistance	Less than 2% change in total resistance
Thermal Cycling	Less than 4% total R change as a result of 5 cycles @ -55ºC to +120ºC	Less than 3% total R change as a result of 5 cycles @ -55ºC to +150ºC
Moisture Resistance	10% maximum total R change when tested per method 103 of MIL-STD-202	5% maximum total R change when tested per method 103 of MIL-STD-202
Solderability	Meet the requirements of MIL–STD–202, Method 210, Condition A except immersed within .125 inch of element for 5 seconds.	Meet the requirements of MIL–STD–202, Method 210, Condition A except immersed within .125 inch of element for 5 seconds.
Shock	The total resistance setting change is 2% maximum between left and right terminals and 5% maximum between CCW terminal and center terminal when tested per method 213 condition I of MIL-STD-202.Applicable to single shaft potentiometers only.	The total resistance setting change is 2% maximum between left and right terminals and 5% maximum between CCW terminal and center terminal when tested per method 213 condition I of MIL-STD-202. Applicable to single shaft potentiometers only.
Vibration, High Frequency	No intermittent contacts or open circuits when tested per method 204 Condition C of MIL-STD-202. Resistance setting change is 5% maximum between left (CCW) terminal and center terminal. The total resistance change is 2% maximum between left and right terminals. Applicable to single shaft potentiometers only.	No intermittent contacts or open circuits when tested per method 204 Condition C of MIL-STD-202. Resistance setting change is 5% maximum between left (CCW) terminal and center terminal. The total resistance change is 2% maximum between left and right terminals. Applicable to single shaft potentiometers only.
Washability	Units may be adversely affected if subjected to conventional after-solder board-wash	Units may be adversely affected if subjected to conventional after-solder board-wash

Mechanical Specifications - Series 388 & Series 389

Body Size
Single module: .5 in. square ±.047 in. (except at standoffs)

Terminals
Printed circuit style on 0.100 in. grid in line, 0.250 in. long.
Maximum PC terminal length: .875 in.
Terminal spacing in multiple section controls: 0.300 in..
Solder lugs formed from PC pins to accept 3 - #22 AWG wires.

Housing
Molded thermoplastic

Anti-turn Device
Location 1 supplied unless otherwise specified.
See Chart D.
Anti-turn Device radius: 6.35mm.

Shafts
Single shaft: 1/8 in. or 1/4 in. dia. Nickel-plated brass.
Outer Concentric Shaft: 1/8 in. dia. Stainless Steel.
Inner Concentric Shaft: 0.078 in. dia. Nickel-plated brass.

Seals
Mounting seal and shaft seal for single shafts only.
Caution: These seals are not designed to meet board washing requirements.

Bushing Diameter
1/4 in. x 32NEF-2A standard
3/8 in. x 32NEF-2A optional
When using 3/8 in. diameter bushing, distance from mounting surface to PC terminals is .170 in. *See page 8.*

Bushing Length
Plain: 1/4 in. , 3/8 in. , or 1/2 in
Split-locking style: 3/8 in.

Rotational Torque
Single and dual concentric controls: 0.2 to 3.0 oz. in.
Two Modules: 0.3 to 3.5 oz. in.
Three Modules: 0.5 to 4.5 oz. in.
Four Modules: 0.5 to 5.5 oz. in.
Medium Torque Option for single shaft only: 1 to 6 oz. in.
Torque Variation within a rotation: 1 oz. in. max.

Stop Torque
Single shaft: 3 lb. in. (standard)
High Stop Torque: 5 lb. in. 1/8" shaft with O-ring
8 lb. in. ¼" or 1/8" shaft without O-Ring

Actuating Forces
Pot/BJ Switch: 10-22 oz.; Dual Pot/BJ Switch: 10-25 oz.;
Pot/BJM Switch: 25-40 oz.; Pot/Pot/BJM Switch: 25-43 oz.

Mechanical Specifications continued on next page

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Mechanical Rotation
With or without switch: 295°±5°.

Maximum Shaft Pull Force
.125 in. diameter shaft: 18 lbs (20 lbs Option)
.250in. diameter shaft: 10 lbs (20 lbs Option)
Concentric Front & Rear Shaft: 7.5 lbs.
AJ rotary and BJ Push-Pull Switches: 10 lbs (20 lbs Option)
BJ Push-Pull or BJM Momentary Switches: 20 lbs.

Shaft Radial Play (single shaft potentiometer)
.028 in. maximum 1 in. from mounting surface with .250 in diameter bushing

Shaft End Play
.020 in. maximum

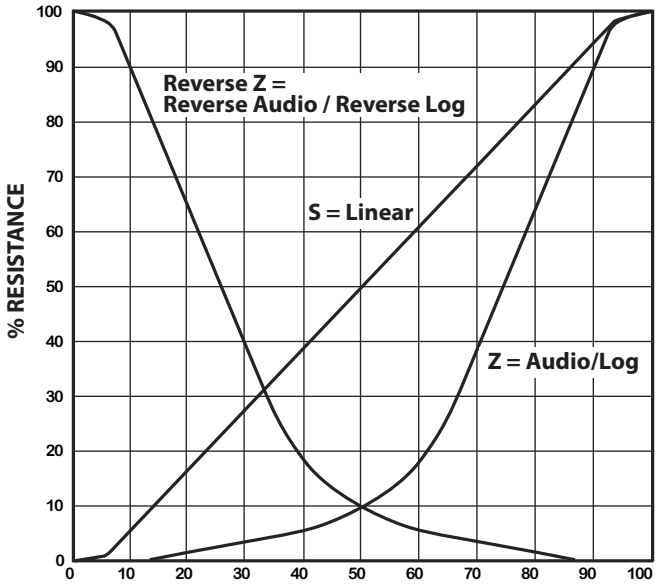
Mounting Torque
Torque applied to the mounting nuts should not exceed 15 to 18 inch-pounds (1.7 to 2.0 N-m) for the .375 inch (9,52 mm) diameter bushing.

Tap Terminal Strength
18 lbs. maximum pull

Hardware
Mounting Hardware available as the following:
A. Hex mounting nut 1/4 in. x 32 thread, 5/16 in. across flats, 1/16 in. thick.
B. Internal tooth lockwasher 13/32 in. OD x .025 in. thick.
C. Jam hex nut 5/16 in. across flats, 5/32 in. thick - supplied with locking type bushings.

Marking
Consisting of State Electronics part number.
Customer part number optional.

Standard Taper Curves



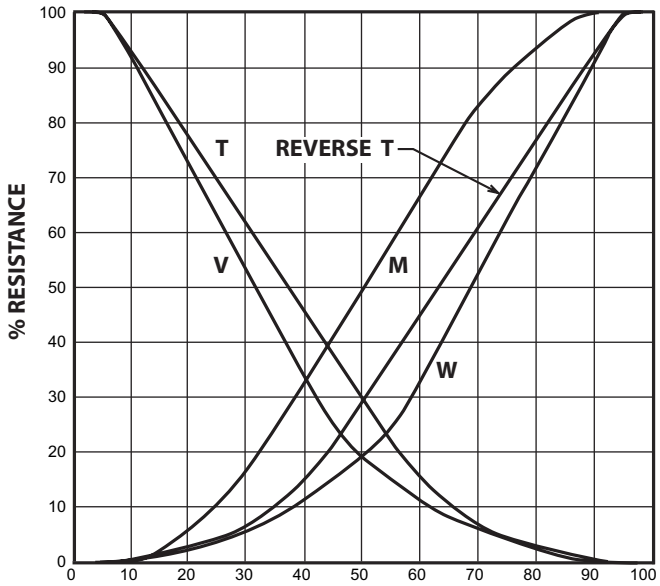
"S" Taper is linear, the change in resistance value being directly proportional to the degree of rotation. It can be used either as right-hand or left-hand taper.

"Z" Taper is measured between the wiper and the counter-clockwise terminals **(pin 1 and 2)** attains 10% resistance value at 50% of clockwise rotation (left hand).

"Reverse Z" Taper is measured between the wiper and the clockwise terminals **(pin 2 and 3)** attains 10% resistance value at 50% of counter-clockwise rotation (right hand).

For conformity and special output curves, consult State Electronics.

Special Taper Curves



"W" Taper attains 20% resistance value at 50% of clockwise rotation (left-hand).

"V" Taper attains 20% resistance value at 50% of counterclockwise rotation (right-handed).

"T" Taper attains 30% resistance value at 50% of clockwise rotation (left-hand).

"Reverse T" Taper attains 30% resistance value at 50% of counterclockwise rotation (right hand).

"M" Taper is such that a "W" taper is attained from either the 1 or 3 terminal to the center of the element.

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Standard Resistance Values

	388 Linear	388 Audio	388 Reverse	389 Linear	389 Audio
50				•	
100	•			•	•
250				•	•
500	•	•	•	•	•
1K	•	•	•	•	•
2.5K	•		•	•	•
5K	•	•	•	•	•
10K	•	•	•	•	•
22K	•				
25K	•	•	•	•	•
50K	•	•		•	•
100K	•	•	•	•	
250K	•	•		•	•
500K	•	•	•	•	•
1M	•	•		•	•
2.5M	•			•	
5M	•			•	

Disclaimer

Due to the unlimited design combinations, certain designs may not perform in accordance with all of the specifications

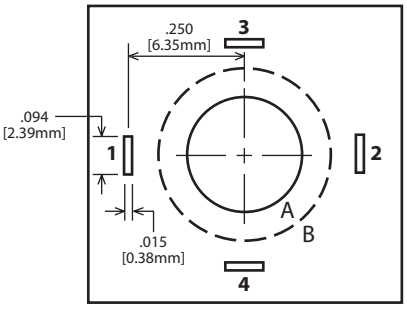
Temperature Resistance Change

Nominal Resistance	Maximum Percent Temporary Resistance Change From 25º						
	-55ºC	-40ºC	0ºC	+25ºC	+85ºC	+105ºC	+120ºC
100 Ohms	±5.0	±4.0	±1.5	0	±1.5	±2.0	±3.5
10K Ohms	+7.0	+5.5	+2.0	0	±1.5	±2.5	±5.5
100K Ohms	+8.0	+6.0	+2.5	0	±2.0	±3.5	±6.0
1 Megohm	+10.0	+8.0	+3.0	0	±2.5	±4.0	±7.5

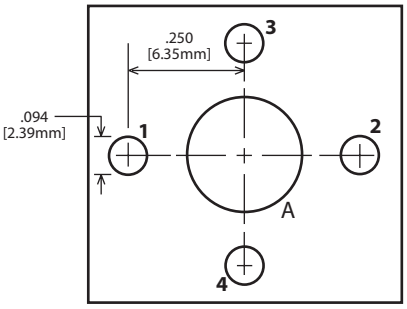
Note: For non-linear tapers, multiply chart values by 1.25

Locating Tab Options

P.C. Board & Panel Mounting Dimensions
Using Slots for Locating Tab(s)



P.C. Board & Panel Mounting Dimensions
Using Holes for Locating Tab(s)



Ref	Bushing	Mounting Panel Hole
A	1/4 – 32-NEF Max Dia. (0.249 [6,32mm])	0.265" [6,76mm]
B	3/8 – 32-NEF Max Dia. (0.375" [9,53mm])	0.390" [9,91mm]

Series 388 Locating Lug Style:
Tab width: .091"
Tab Height: .041±.005" FMS
Spacing: .250"

Option Number
1 = one tab - at 9 o'clock (standard)
2 = one tab - at 3 o'clock
3 = one tab - at 12 o'clock
4 = one tab - at 6 o'clock
5 = two tabs - at 3 and 9 o'clock
6 = two tabs - at 6 and 12 o'clock
7 = No Locating Lug

NOTE: Slots are recommended for the locating tab(s) when using 3/8" diameter bushings because of clearance issues,

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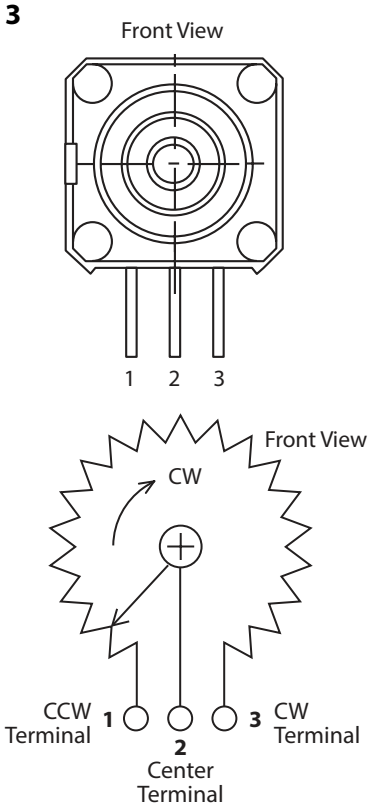
Potentiometer Schematic

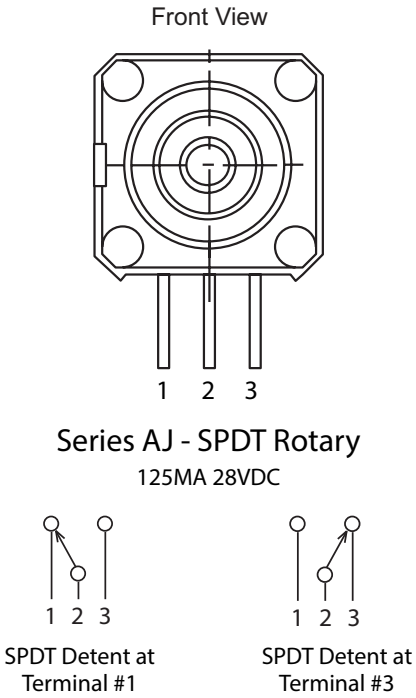
Figure 3



Switch Modules

Figure 4

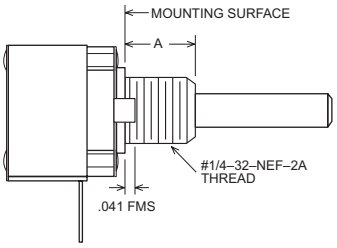
Series AJ Switch: Rotary Style



Series 388/389 Bushings

Figure 6

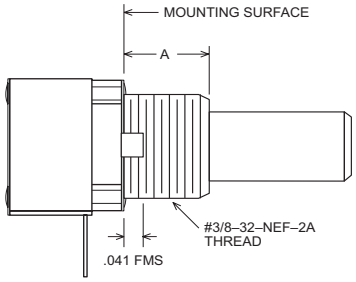
.250 (6.35mm) Diameter Bushing, Plain Shaft



"A" Bushing Lengths for .250" Dia. Bushing:
- .250 [6.35mm] STD
- .375 [9.53mm]
- .500 [12.70mm]

Figure 7

.375 (9.53mm) Diameter Bushing, Plain Shaft



"A" Bushing Lengths for .375" Dia. Bushing:
- .250 [6.35mm] STD
- .375 [9.53mm]
- .500 [12.70mm]

Figure 8

.250 (6.35mm) Diameter, Locking Bushing

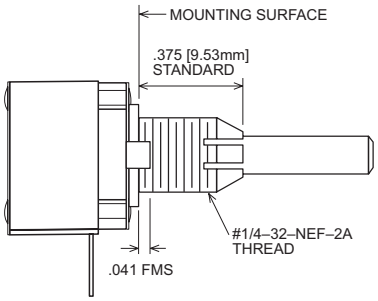
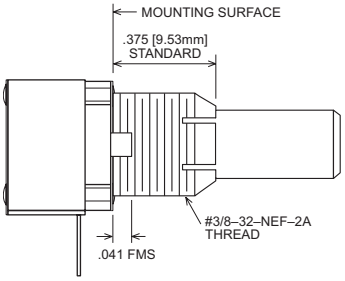


Figure 9

.375 (9.53mm) Diameter, Locking Bushing



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Series 388/389 Shafts

Figure 10

.125 (3.18mm) Diameter - Slotted Shaft

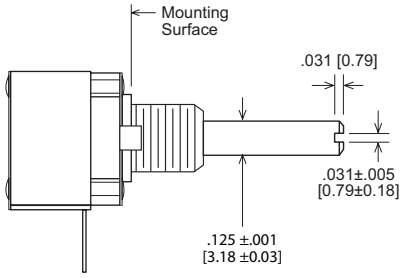


Figure 11

.250 (6.35mm) Diameter - Slotted Shaft

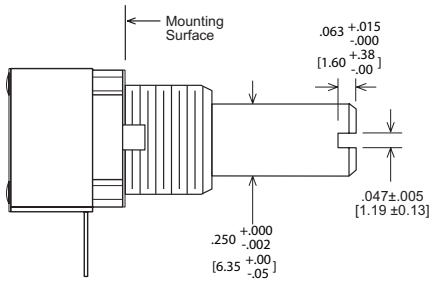
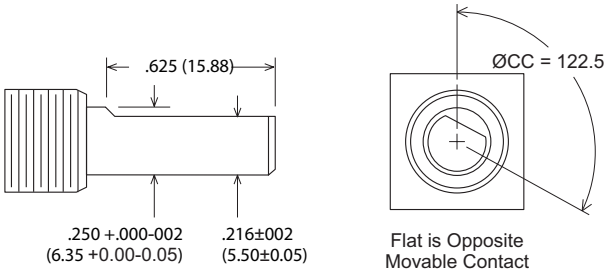


Figure 12

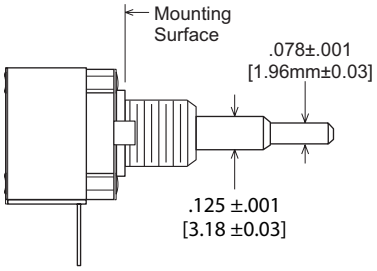
.250 (6.35mm) Diameter, Flatted Shaft



Flat can extend to within .031 (0,79) of mounting bushing where shaft length will not permit standard flat.

Figure 13

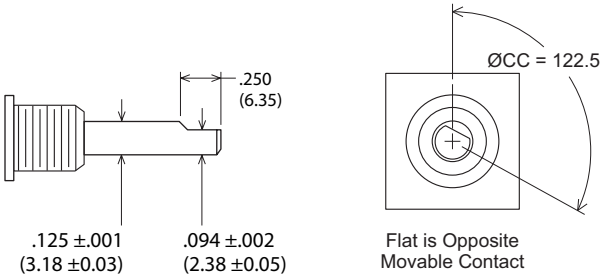
.125 (3.18mm) Diameter - Concentric Shafts



Note: Only Plain Ends are Available for Concentric Shaftz

Figure 14

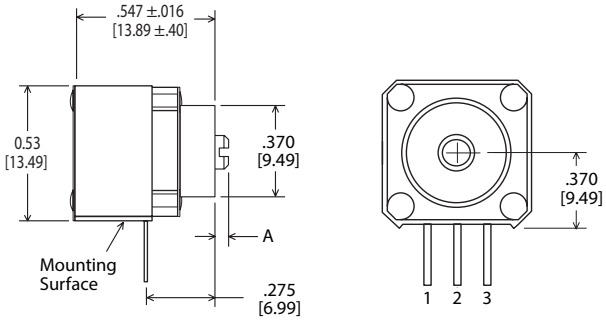
.125 (3.18mm) Diameter, Flatted Shaft



Flat will extend to within .031 (0,79) of mounting bushing where shaft length will not permit standard flat.

Figure 15

Trimmer



Dimension A: .025 (0.64) Standard
Other lengths available to .50 (12.70) Maximum

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Series 388 & 389 controls are assembled from 1/2" square, stackable potentiometer and switch modules. Combine up to 8 modules, with single or concentric metal shafts. Series 388 potentiometer modules have conductive plastic resistive elements, and Series 389 potentiometer modules have cermet resistive elements.

The most common configurations are listed below. Contact your State Electronics sales representative for your custom requirements.

Series 388/389 - Horizontal Mounting Styles

Page

B-22: 1, 2, 3, or 4 Potentiometer or Rotary Switch Modules, PC Pin Terminals 11
B-22: 2 or 3 Potentiometer or Rotary Switch Modules, PC Pin Terminals, Concentric Shafts. 11C
B-24: 1, 2, 3, or 4 Potentiometer or Rotary Switch Modules, PC Pin Terminals, Support Plates 12
B-22: 2 or 3 Potentiometer or Rotary Switch Modules, PC Pin Terminals, Concentric Shafts, Support Plates 12C
B-22: 1, 2, 3, or 4 Potentiometer or Rotary Switch Modules, Solder Hook Terminals 13
B-22: 2 or 3 Potentiometer or Rotary Switch Modules, Solder Hook Terminals, Concentric Shafts. 13C
B-22: Single Potentiometer or Rotary Switch, plus Push-Pull/Momentary Switch, PC Pin Terminals 14
B-22: Single, Dual Pot or Rotary Switch, plus Push-Pull/Momentary Switch, Solder Hook Terminals 14C
B-28: Dual Potentiometer/Rotary switch with (BJ) Push-Pull/(BJM) Momentary Switch; PC Pin Terminals . . . 15

Detent

B-22: Single, Dual Potentiometer with Detent, Valley Style, PC Pin Terminals, Solder Hook Terminals 16
B-24: Single, Dual Potentiometer with Detent, Valley Style, PC Pin Terminals, Support Plates. 17

Schadow Switch

Single, Dual Potentiometer with DPDT Schadow Switch, PC Pin Terminals 18

Series 388/389 - Vertical Mounting Styles

C-8: Single Potentiometer or Rotary Switch, PC Pin Terminals 19
A-18: Single Potentiometer or Rotary Switch, PC Pin Terminals 19
C-15: BBJ Single Push-Pull / BBJM Momentary Switch, PC Pin Terminals 20
A-19, A-20: Dual Potentiometer or Rotary Switch, PC Pin Terminals 20
C-14, A-21, C-9, C-10: Dual Potentiometer or Rotary Switch, PC Pin Terminals 21
A-22, C-15: BBJ Momentary/ BBJM Push-Pull Switch, PC Pin Terminals 21
C-11: Single Potentiometer and BBJ/BBJM Switch, PC Pin Terminals 22

Concentric Shafts

C-9, C-10: Dual Potentiometer, Concentric Shaft, PC Pin Terminals 22

Detent

C-8, A-18, C10, A20: Single, Dual Potentiometer with Detent, Valley Style, PC Pin Terminals 23

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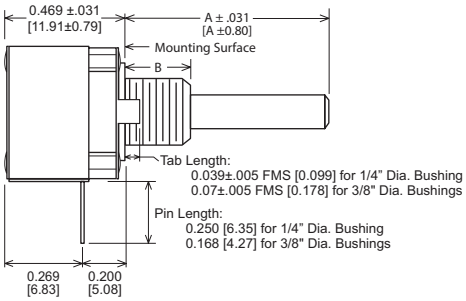
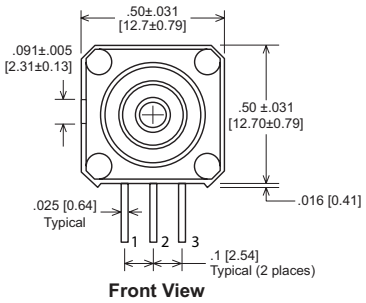
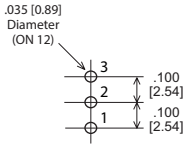
Series 388/389 - Horizontal Mounting Styles

Dwg 11-1: B-22 Single Potentiometer or Rotary Switch, PC Pin Terminals



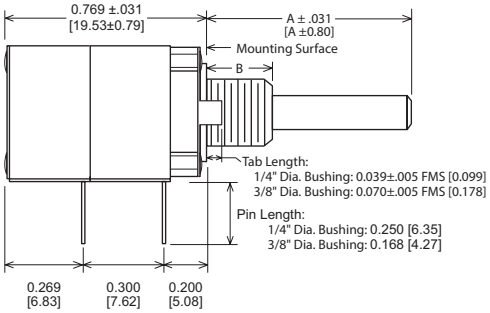


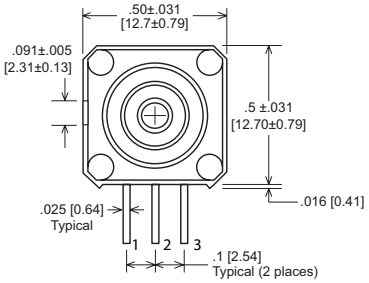
Front View



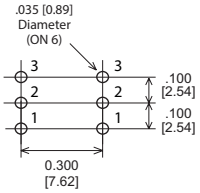
PC Board Layout
(top view)

Dwg 11-2: B-22 Dual Potentiometer or Rotary Switch, PC Pin Terminals



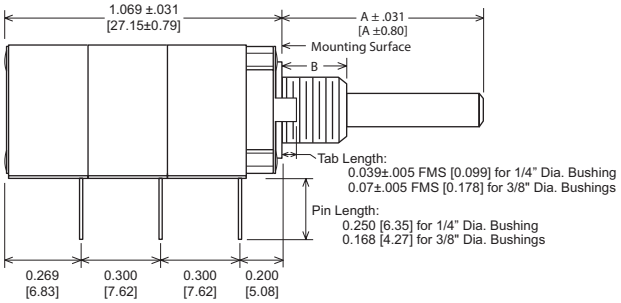


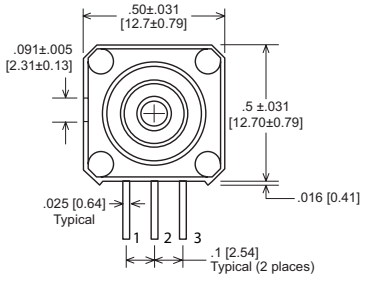
Front View



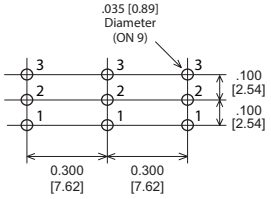
PC Board Layout
(top view)

Dwg 11-3: B-22 Triple Potentiometer or Rotary Switch, PC Pin Terminals



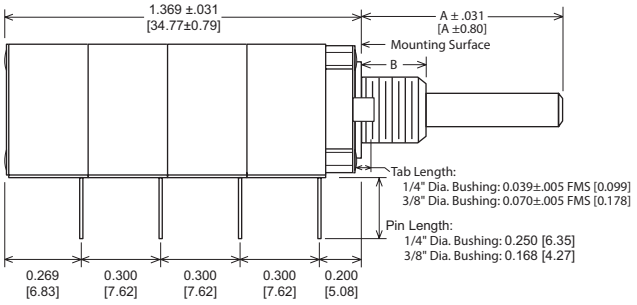


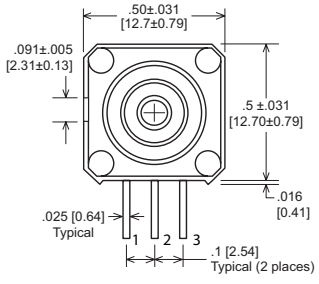
Front View



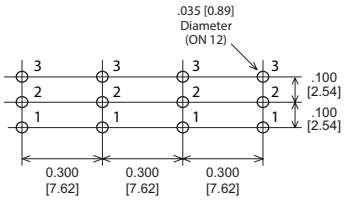
PC Board Layout
(top view)

Dwg 11-4: B-22 Quad Potentiometer or Rotary Switch, PC Pin Terminals





Front View



PC Board Layout
(top view)

Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pin length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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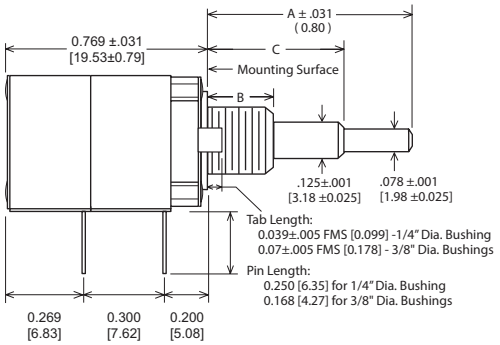
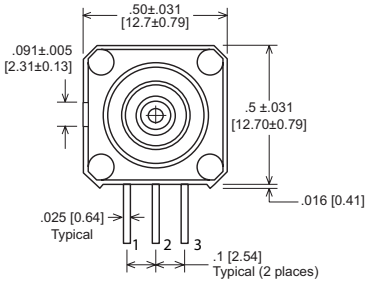
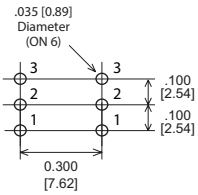
Series 388/389 - Horizontal Mounting Styles (continued)

Drawing 11C-1: B-22 Dual Potentiometer or Rotary Switch, Concentric Shaft, PC Pin Terminals



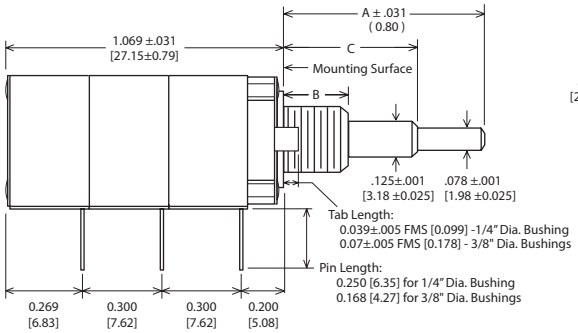


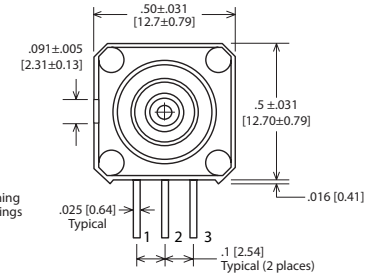
Front View



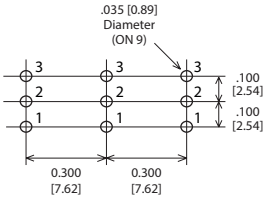
PC Board Layout (top view)

Drawing 11C-2: B-22 Triple Potentiometer or Rotary Switch, Concentric Shaft, PC Pin Terminals





Front View



PC Board Layout (top view)

Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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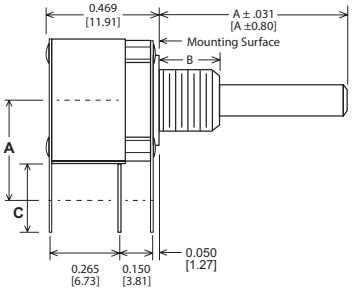
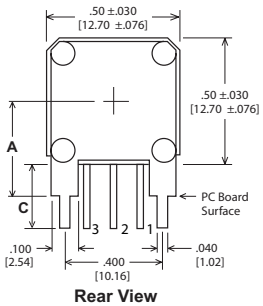
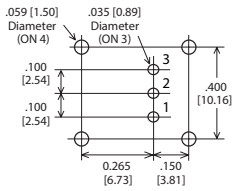
Series 388/389 - Horizontal Mounting Styles (continued)

Dwg 12-1: B-24 Single Potentiometer or Rotary Switch, Support Plates



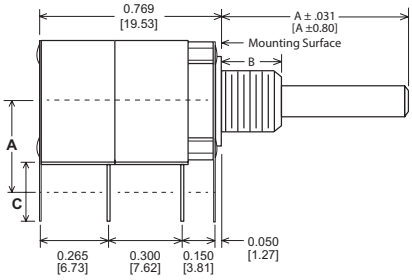


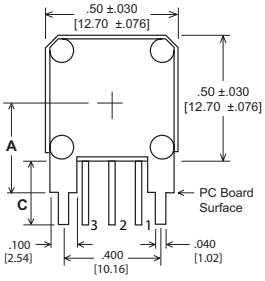
Rear View



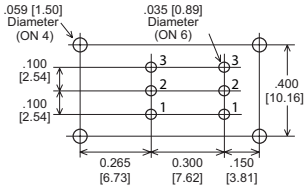
PC Board Layout
(top view)

Dwg 12-2: B-24 Dual Potentiometer or Rotary Switch, Support Plates



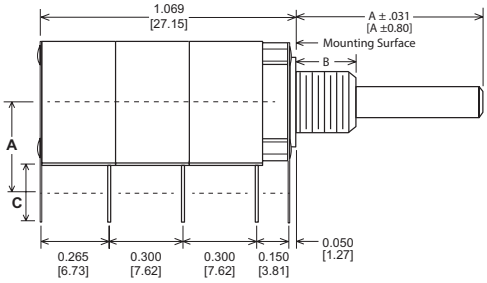


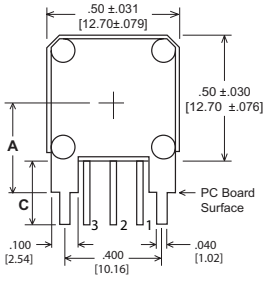
Rear View



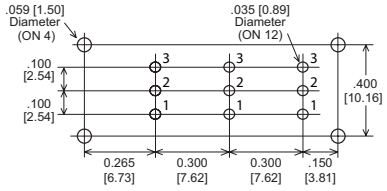
PC Board Layout
(top view)

Dwg 12-3: B-24 Triple Potentiometer or Rotary Switch, Support Plates



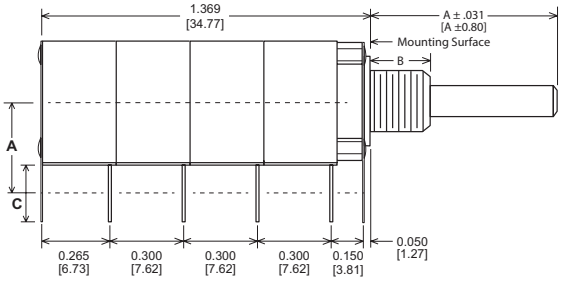


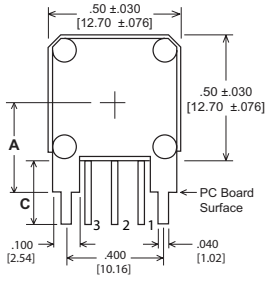
Rear View



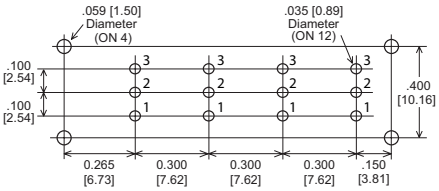
PC Board Layout
(top view)

Dwg 12-4: B-24 Quad Potentiometer or Rotary Switch, Support Plates





Rear View



PC Board Layout
(top view)

Support Plate Dimensions:

Type	"A" Support Plate	"C" Terminal Length
B–24–1	.375 [9.53]	.250 [6.35] STANDARD
B–24–2	.500 [12.70]	.375 [9.53]
B–24–3	.625 [15.88]	.500 [12.70]
B–24–4	.750 [19.05]	.625 [15.88]
B–24–5	.275 [6.98]	.125 [3.18]

Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-24 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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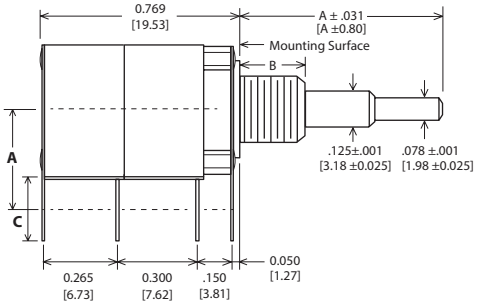
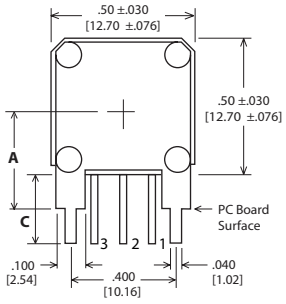
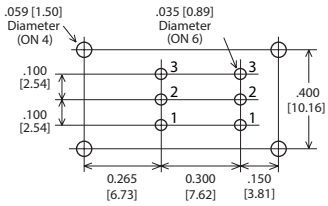
Series 388/389 - Horizontal Mounting Styles (continued)

Dwg 12C-1: B-24 Dual Potentiometer or Rotary Switch, Concentric Shaft, PC Pin Terminals, Support Plates



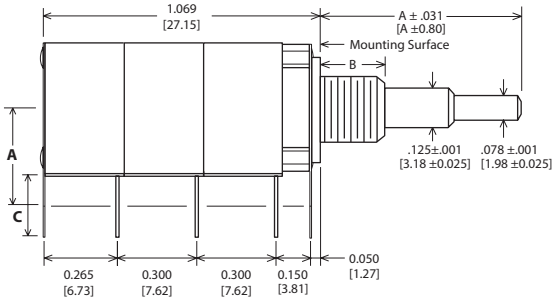


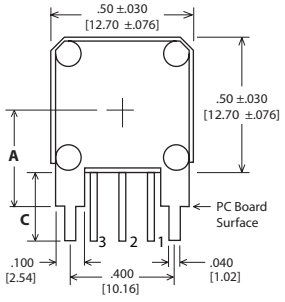
Rear View



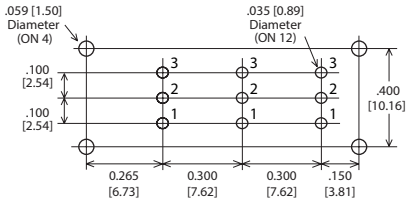
PC Board Layout
(top view)

Dwg 12C-2: B-24 Triple Potentiometer or Rotary Switch, Concentric Shaft, PC Pin Terminals, Support Plates





Rear View



PC Board Layout
(top view)

Support Plate Dimensions:

Type	"A" Support Plate	"C" Terminal Length
B–24–1	.375 [9.53]	.250 [6.35] STANDARD
B–24–2	.500 [12.70]	.375 [9.53]
B–24–3	.625 [15.88]	.500 [12.70]
B–24–4	.750 [19.05]	.625 [15.88]
B–24–5	.275 [6.98]	.125 [3.18]

Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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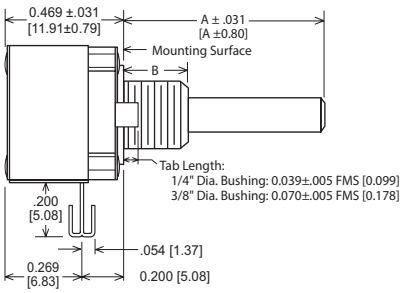
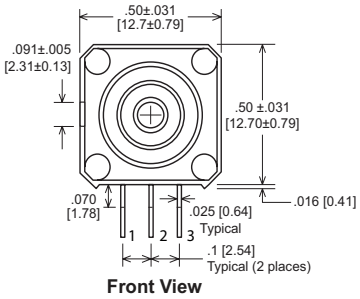
Series 388/389 - Horizontal Mounting Styles (continued)

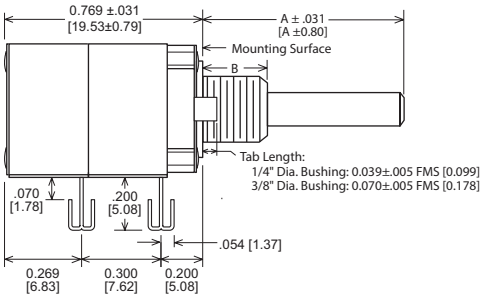
Dwg 13-1: B-22 Single Potentiometer or Rotary Switch, Solder Hook Terminals

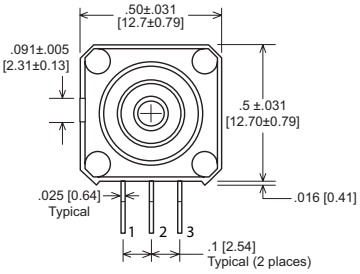




Front View

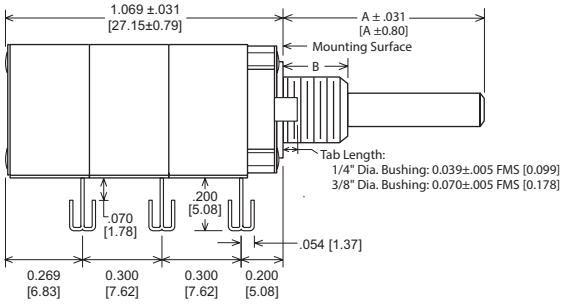
Dwg 13-2: B-22 Dual Potentiometer or Rotary Switch, Solder Hook Terminals

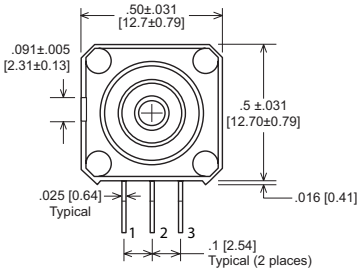




Front View

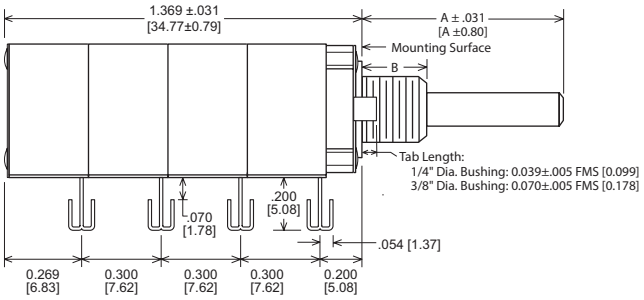
Dwg 13-3: B-22 Triple Potentiometer or Rotary Switch, Solder Hook Terminals

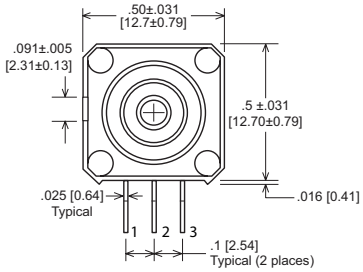




Front View

Dwg 13-4: B-22 Quad Potentiometer or Rotary Switch, Solder Hook Terminals





Front View

NOTE: Solder Hook Terminal receives (3) NO. 22 AWG .025 (0.64mm) solid wires

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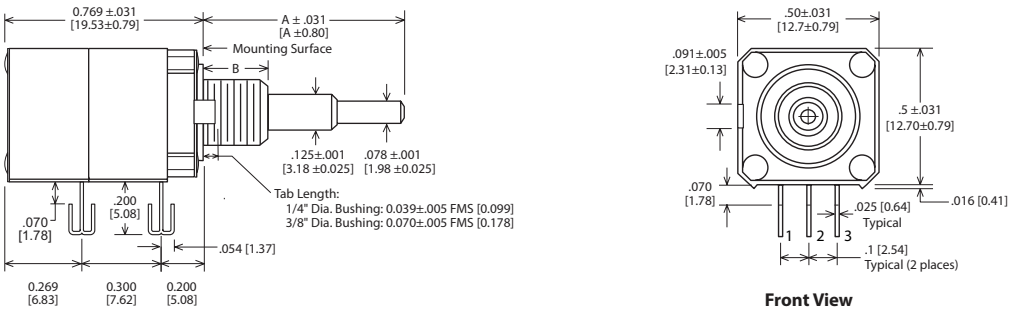
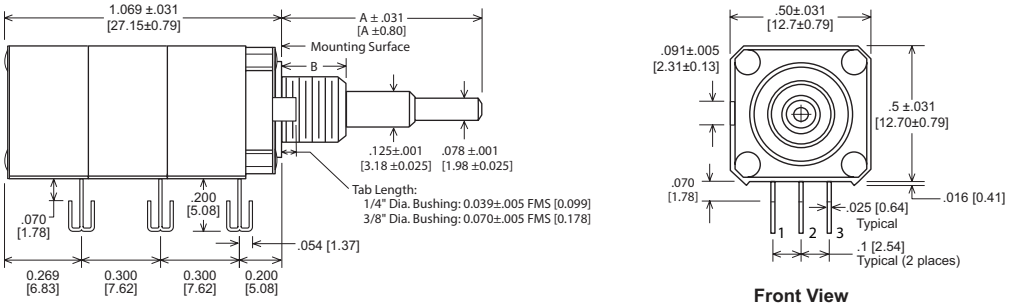
Series 388/389 - Horizontal Mounting Styles (continued)

Dwg 13C-1: B-22 Dual Potentiometer or Rotary Switch, Concentric Shaft, Solder Hook Terminals



Front View

Dwg 13C-2: B-22 Triple Potentiometer or Rotary Switch, Concentric Shaft, Solder Hook Terminals



Front View

Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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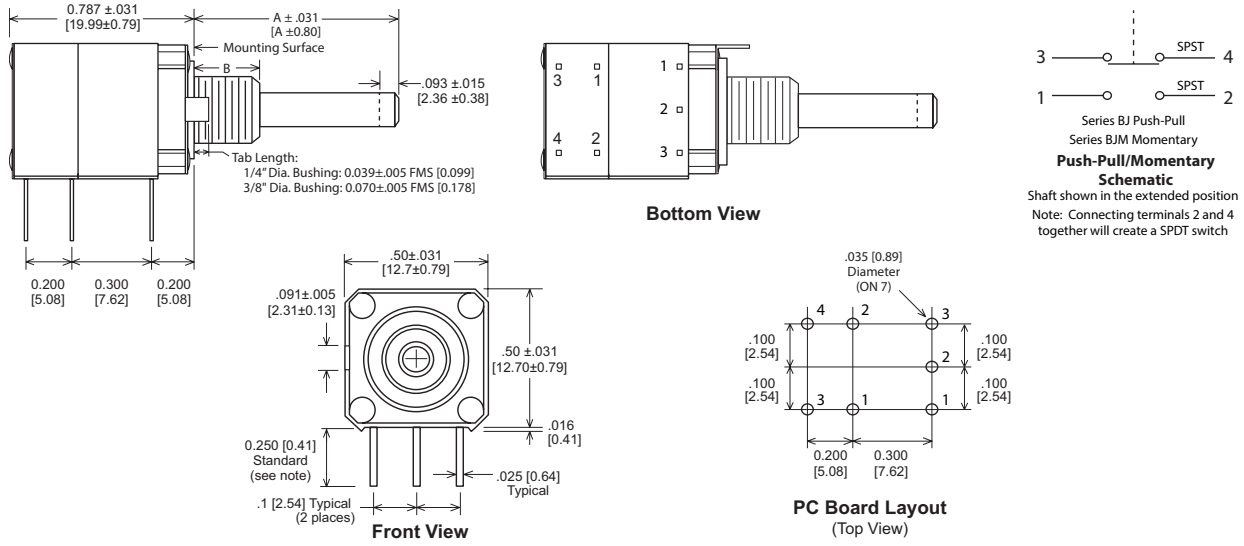
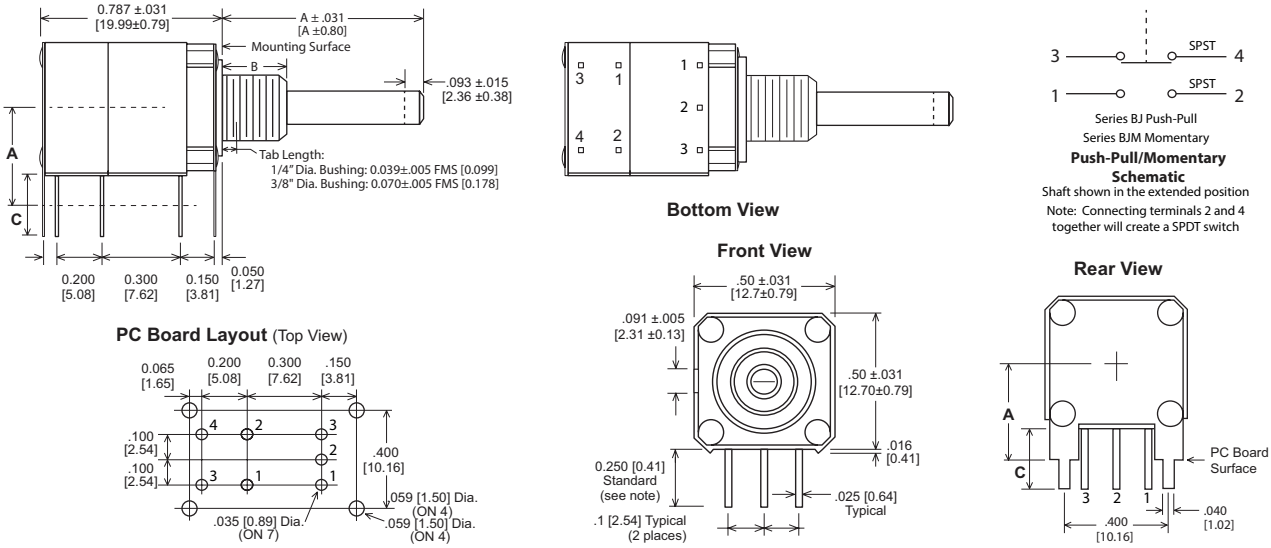
Series 388/389 - Horizontal Mounting Styles (continued)

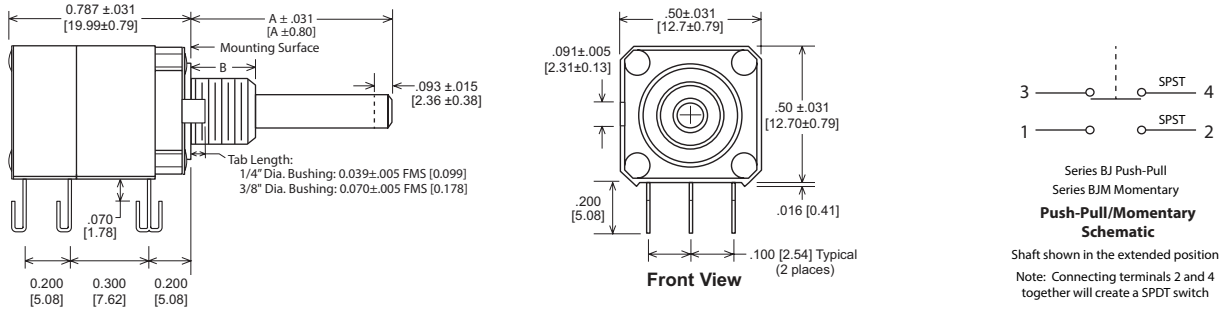
Dwg 14-1A: B-22 Single Module, plus Push-Pull/Momentary Switch, PC Pin Terminals



Dwg 14-1B: B-22 Single Module, plus Push-Pull/Momentary Switch, PC Pin Terminals, Support Plate



Dwg 14-1C: B-22 Single Pot or Rotary Switch, plus Push-Pull/Momentary Switch, Solder Hook Terminals



Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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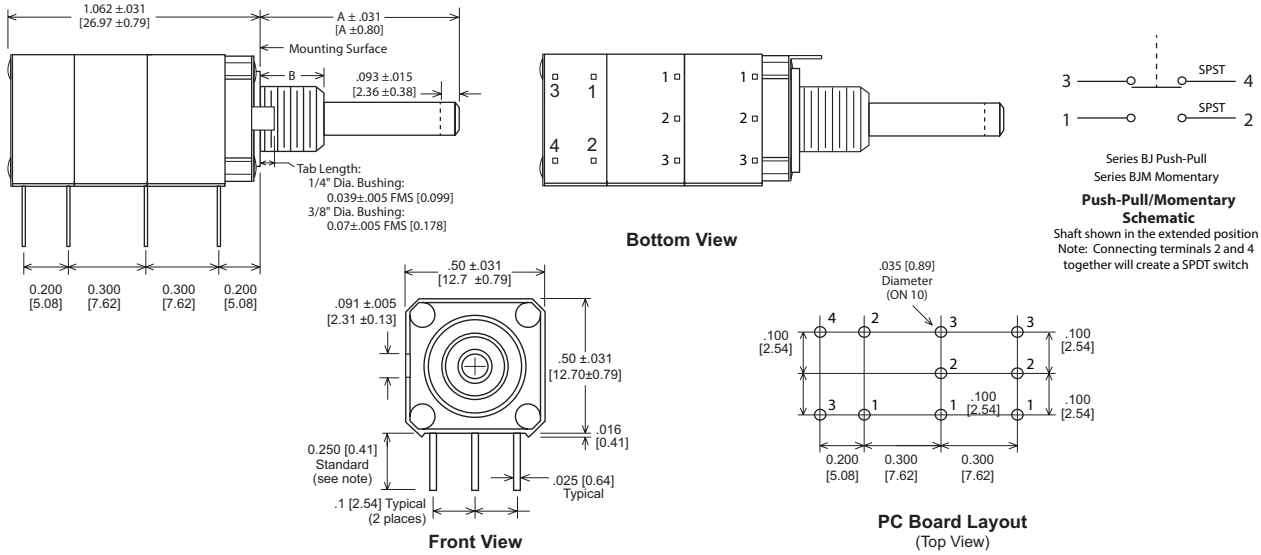
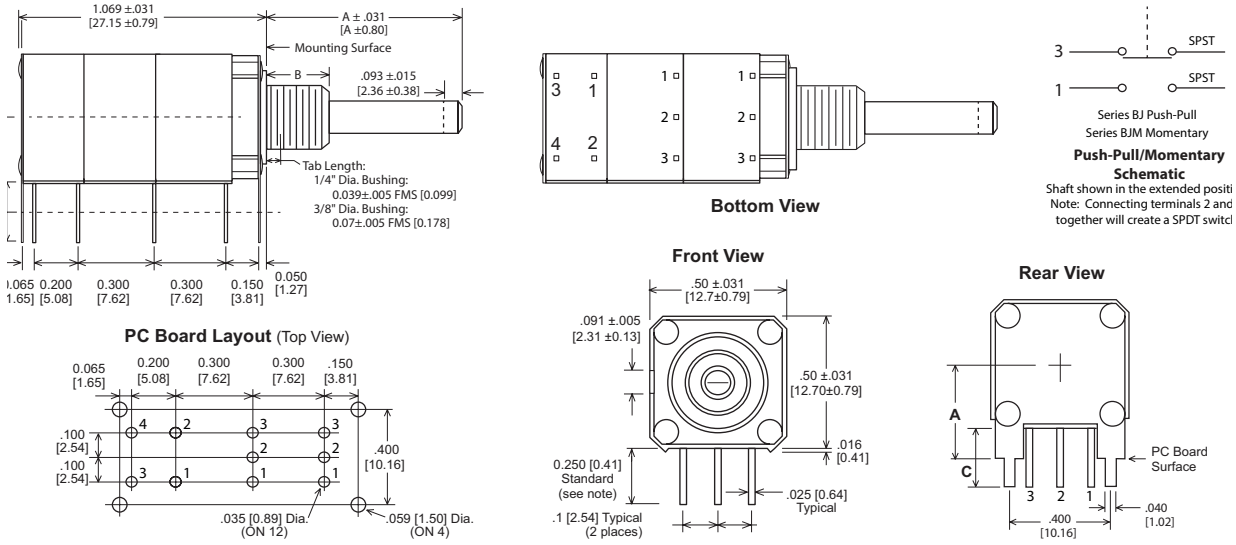
Series 388/389 - Horizontal Mounting Styles (continued)

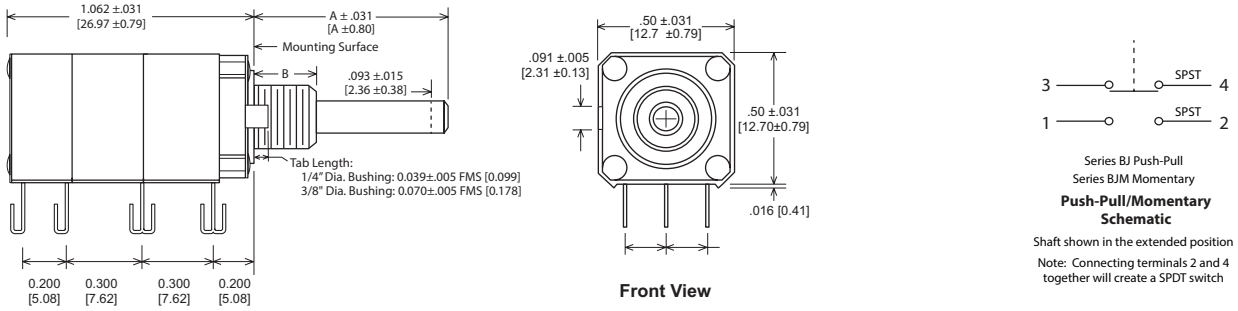
Dwg 14-2A: B-22 Dual Potentiometer or Rotary Switch, plus Push-Pull/Momentary Switch, PC Pin Terminals



Dwg 14-2B: B-22 Dual Potentiometer or Rotary Switch, plus Push-Pull/Momentary Switch, PC Pin Terminals **with Support Plates**



Dwg 14-2C: B-22 Dual Pot or Rotary Switch, plus Push-Pull/Momentary Switch, Solder Hook Terminals



Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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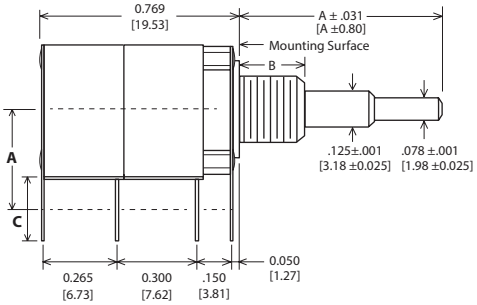
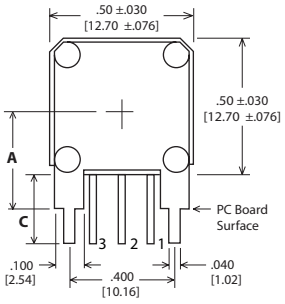
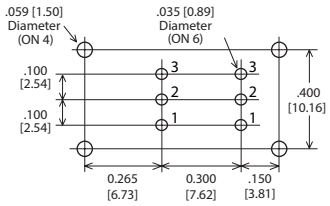
Series 388/389 - Horizontal Mounting Styles (continued)

Dwg 14-3: B-24 Dual Pot or Rotary Switch, **Concentric Shaft, PC Pin Terminals, Support Plates**



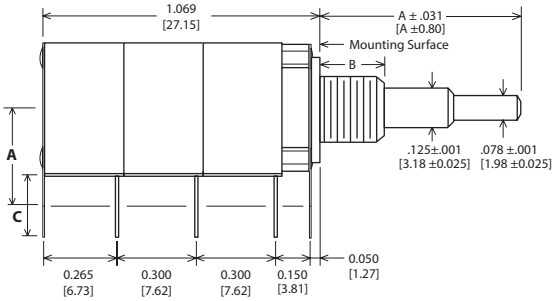


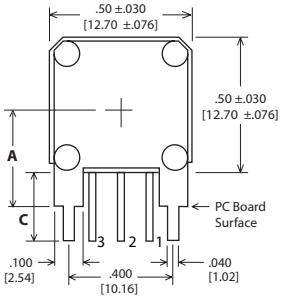
Rear View



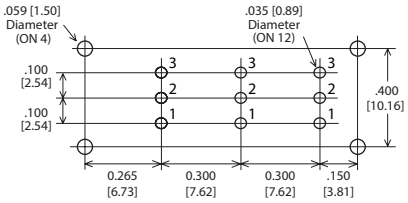
PC Board Layout
(top view)

Dwg 14-3A: B-24 Triple Pot or Rotary Switch, **Concentric Shaft, PC Pin Terminals, Support Plates**





Rear View



PC Board Layout
(top view)

Support Plate Dimensions:

Type	"A" Support Plate	"C" Terminal Length
B–24–1	.375 [9.53]	.250 [6.35] STANDARD
B–24–2	.500 [12.70]	.375 [9.53]
B–24–3	.625 [15.88]	.500 [12.70]
B–24–4	.750 [19.05]	.625 [15.88]
B–24–5	.275 [6.98]	.125 [3.18]

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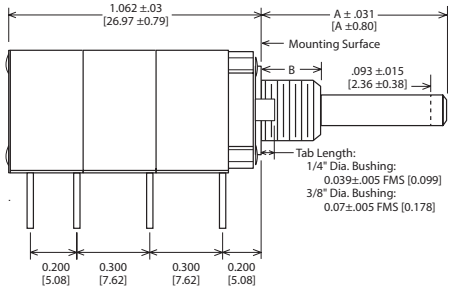
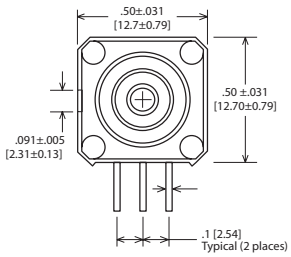
Series 388/389 - Horizontal Mounting Styles (continued)

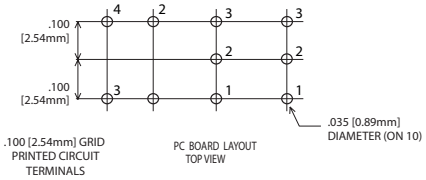
Dwg 15-1: Dual Potentiometer/Rotary switch with (BJ) Push-Pull/(BJM) Momentary Switch; PC Pin Terminals (Support Plates optional)

Locating Lug (no Support Brackets)

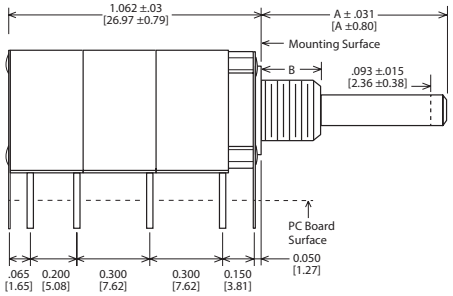


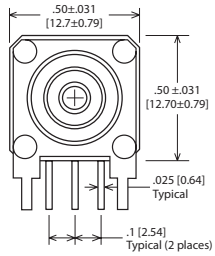


Front View

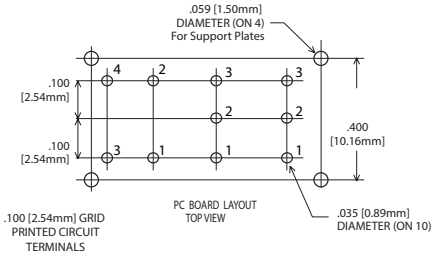


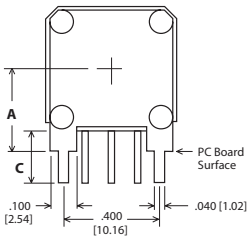
Support Brackets (no Locating Lug)



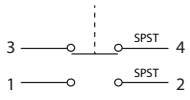


Front View





Rear View



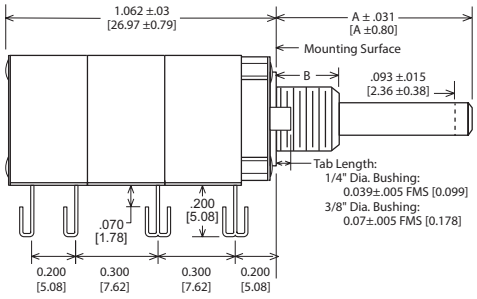
Series BJ Push-Pull
Series BJM Momentary

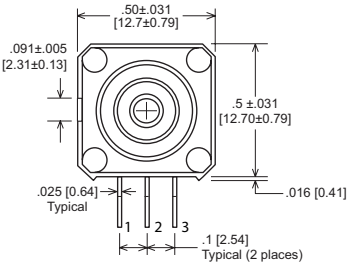
Push-Pull/Momentary Schematic

Shaft shown in the extended position

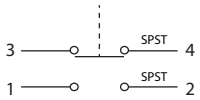
Note: Connecting terminals 2 and 4 together will create a SPDT switch

Dwg 15-2: Dual Potentiometer/Rotary switch with (BJ) Push-Pull/(BJM) Momentary Switch ; Solder Hook Terminals.





Front View



Series BJ Push-Pull
Series BJM Momentary

Push-Pull/Momentary Schematic

Shaft shown in the extended position

Note: Connecting terminals 2 and 4 together will create a SPDT switch

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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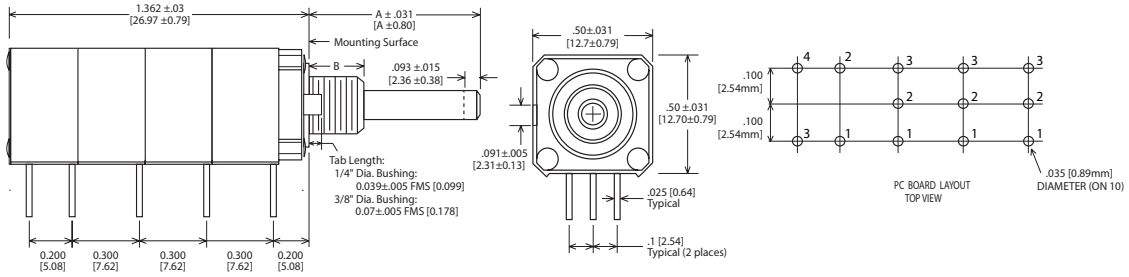
Series 388/389 - Horizontal Mounting Styles (continued)

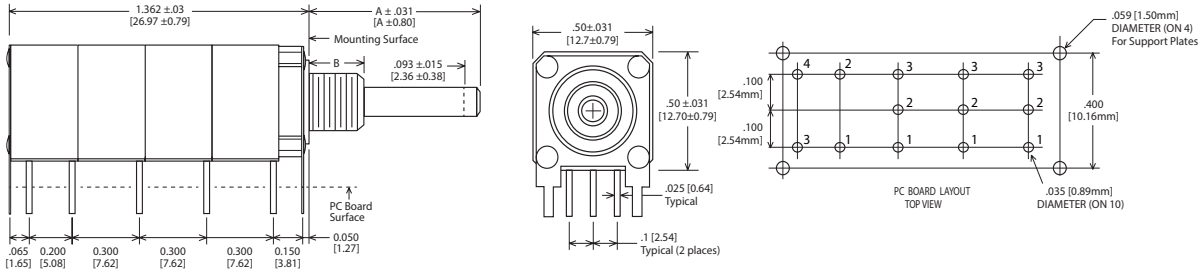
Dwg 15-3: Triple Potentiometer/Rotary switch with (BJ) Push-Pull/(BJM) Momentary Switch; PC Pin Terminals (Support Plates optional)

Locating Lug and no Support Brackets

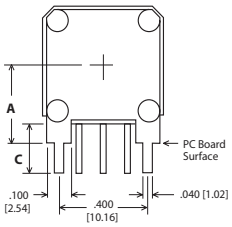


Front View

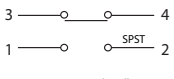
Support Brackets and no Locating Lug



Front View



Rear View



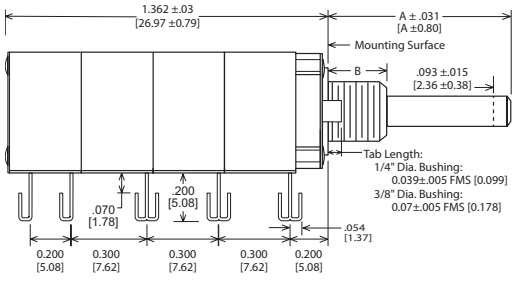
Series BJ Push-Pull
Series BJM Momentary

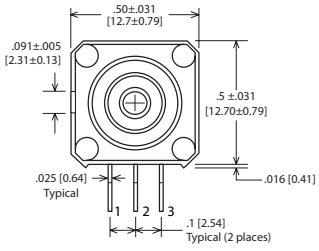
Push-Pull/Momentary Schematic

Shaft shown in the extended position

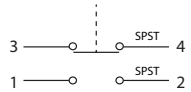
Note: Connecting terminals 2 and 4 together will create a SPDT switch

Dwg 15-4: Triple Potentiometer/Rotary switch with (BJ) Push-Pull/(BJM) Momentary Switch ; Solder Hook Terminals.





Front View



Series BJ Push-Pull
Series BJM Momentary

Push-Pull/Momentary Schematic

Shaft shown in the extended position

Note: Connecting terminals 2 and 4 together will create a SPDT switch

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. B-22 PC pins length standard is 0.250". Maximum 0.875"
3. **Drawings are not to scale.**

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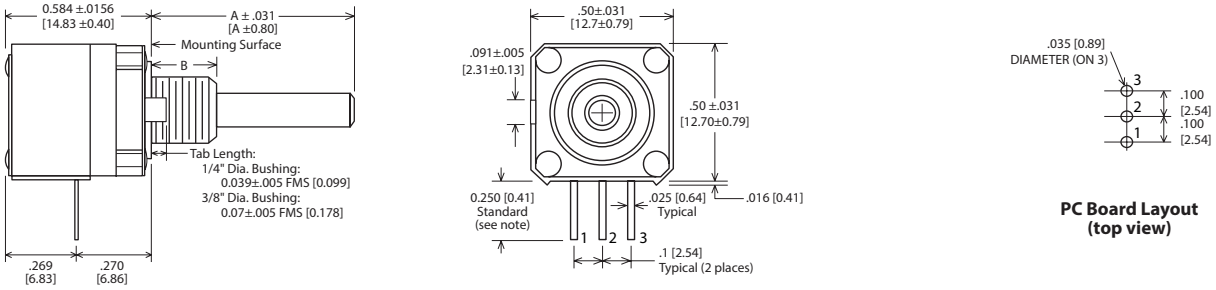
Series 388/389 - Horizontal Mounting Styles (continued)

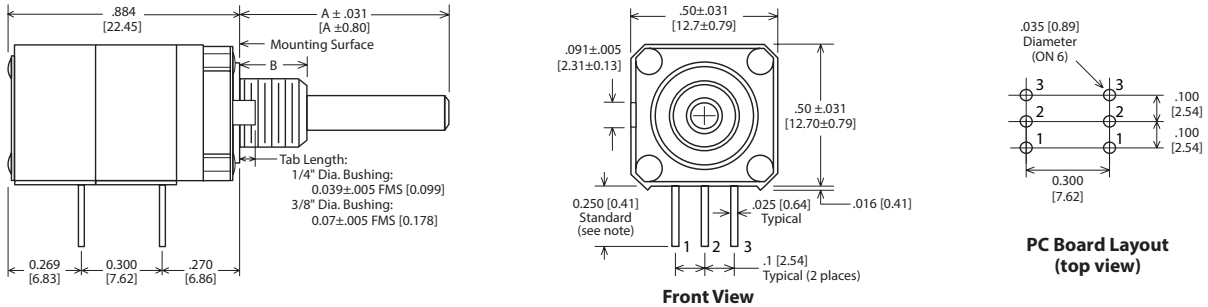
Dwg 16-1: B-22 Single Potentiometer with detent, Valley Style, PC Pin Terminals



Front View

PC Board Layout (top view)

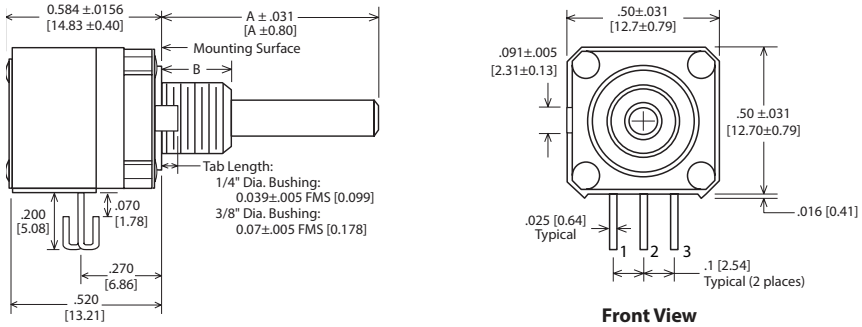
Dwg 16-2: B-22 Dual Potentiometer with detent, Valley Style, PC Pin Terminals



Front View

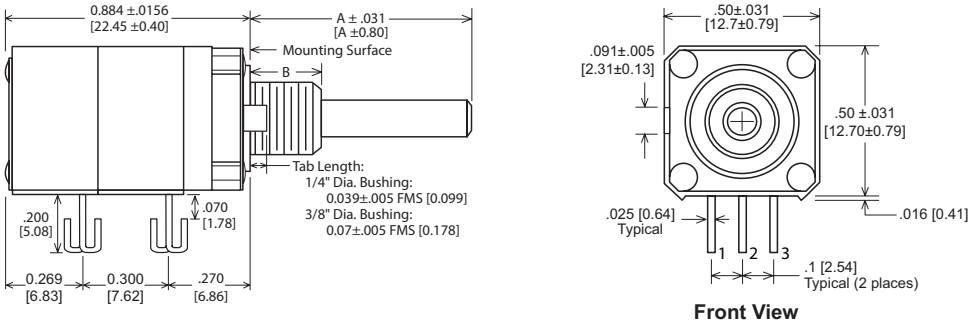
PC Board Layout (top view)

Dwg 16-3: B-22 Single Potentiometer with detent, Valley Style, Solder Hook Terminals



Front View

Dwg 16-4: B-22 Dual Potentiometer with detent, Valley Style, Solder Hook Terminals



Front View

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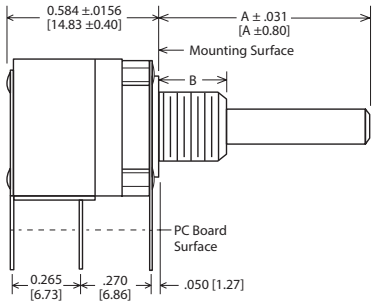
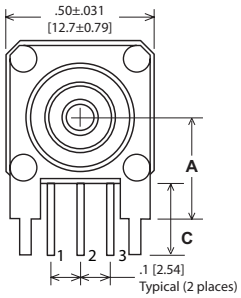
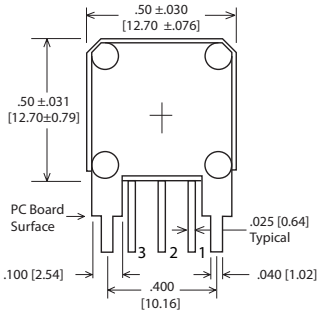
Series 388/389 - Horizontal Mounting Styles (continued)

Dwg 17-1: B-24 Single Potentiometer with detent, Valley Style, PC Pin Terminals, Support Plates

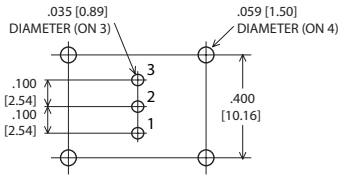




Front View

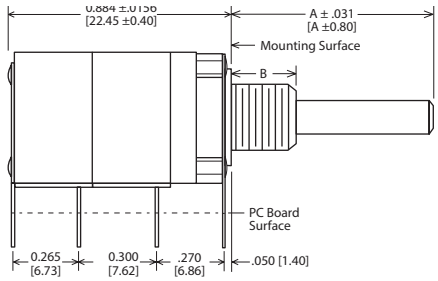


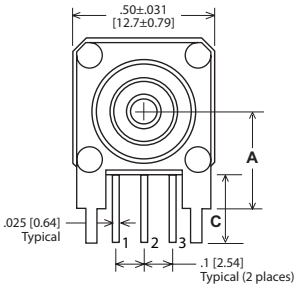
Rear View



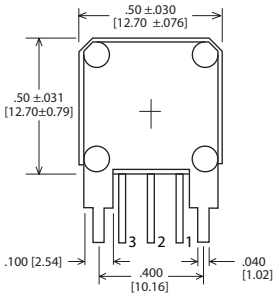
PC Board Layout
(Top View)

Dwg 17-2: B-24 Dual Potentiometer with detent, Valley Style, PC Pin Terminals, Support Plates

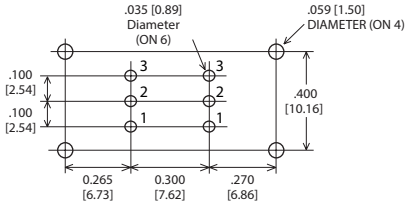




Front View



Rear View



PC Board Layout
(Top View)

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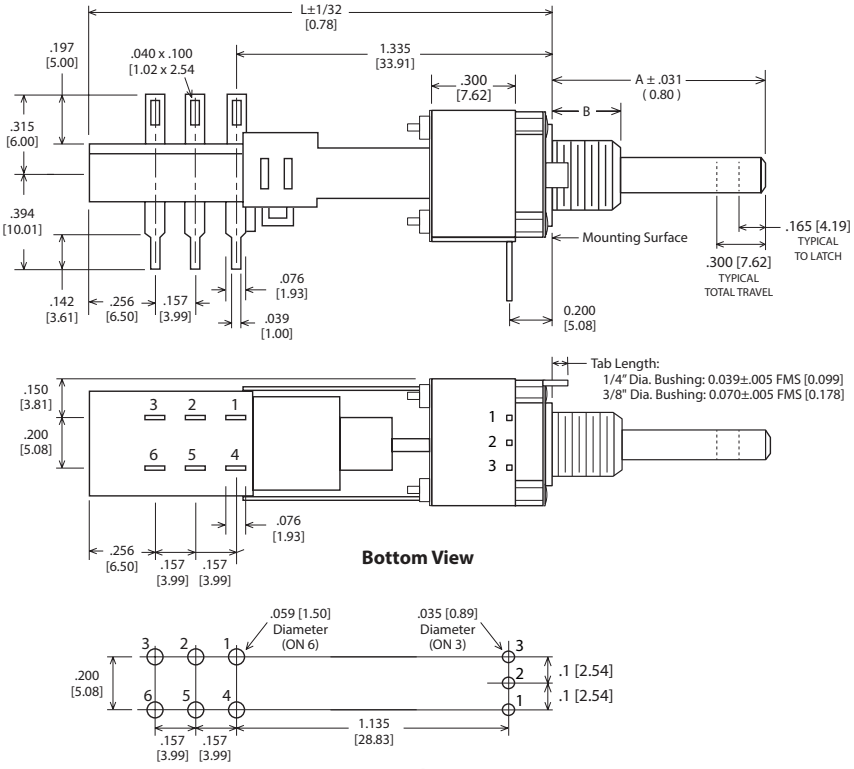
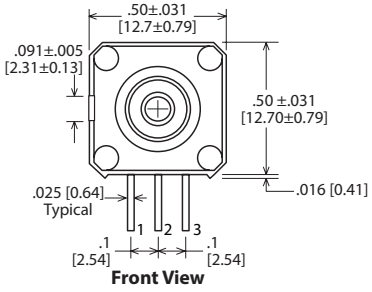
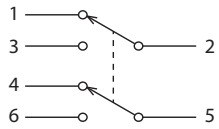
Series 388/389 - Horizontal Mounting Styles (continued)

Dwg 18-1: Single Potentiometer with DPDT Schadow Switch:
Momentary Push or Push On / Push Off.

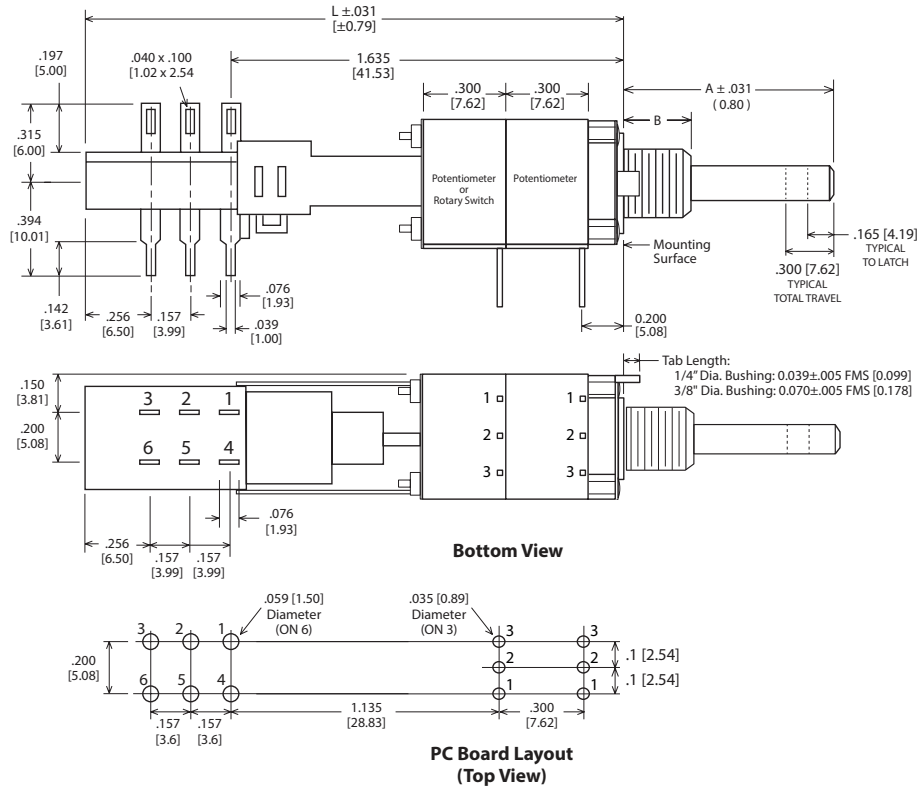


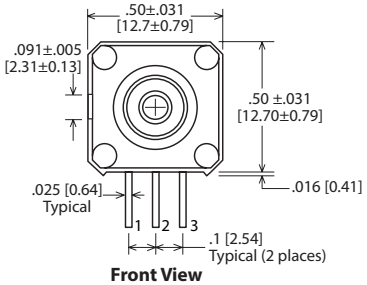


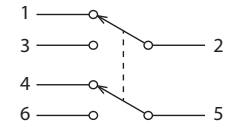


Schadow Switch Schematic
DPDT Push-Pull / Momentary
(Shown with shaft extended)

Dwg 18-2: Dual Potentiometer with DPDT Schadow Switch:
Momentary Push or Push On / Push Off.







Schadow Switch Schematic
DPDT Push-Pull / Momentary
(Shown with shaft extended)

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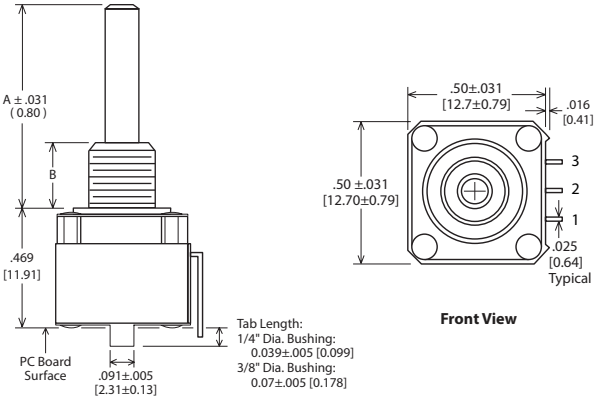
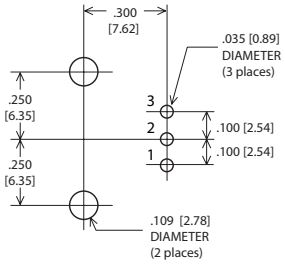
Series 388/389 - Vertical Mounting Styles

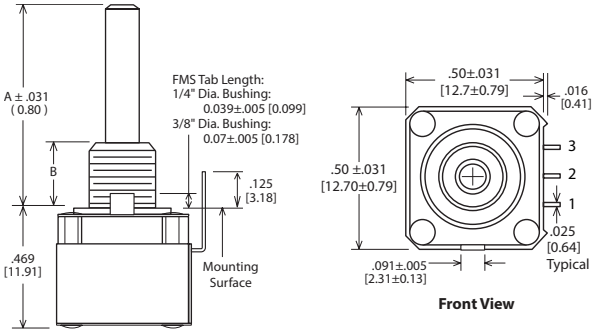
Dwg 19-1: C-8 Single Potentiometer or Rotary Switch, PC Pin Terminals

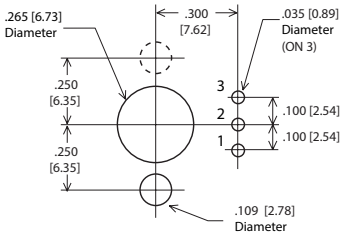




PC Board Layout (top view)
Type C-8

Dwg 19-2: A-18 Single Potentiometer or Rotary Switch, PC Pin Terminals





PC Board Layout (top view)
Type A-18

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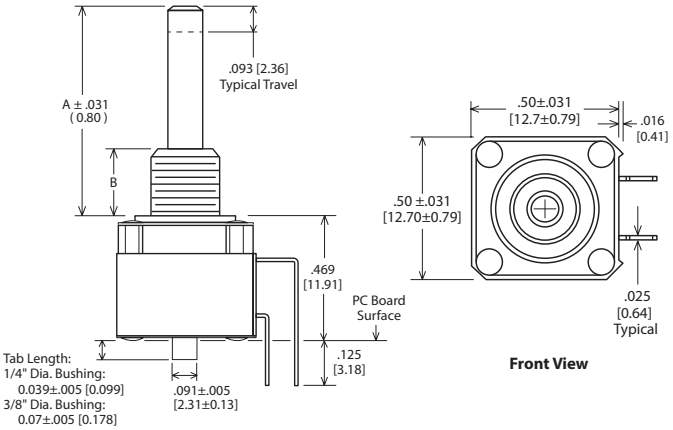
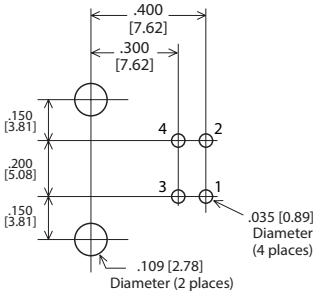
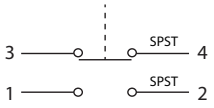
Series 388/389 - Vertical Mounting Styles (continued)

Dwg 20-1: C-15 Single BBJ Push-Pull / BBJM Momentary Switch, PC Pin Terminals





PC Board Layout (top view)
Type C-15



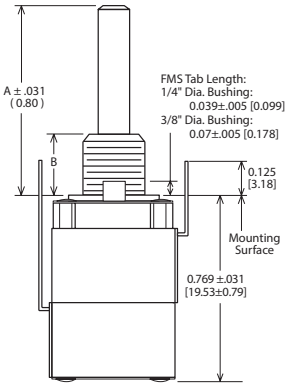
Series BJ Push-Pull
Series BJM Momentary

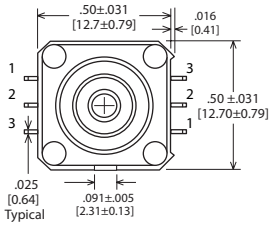
Push-Pull/Momentary Schematic

Shaft shown in the extended position

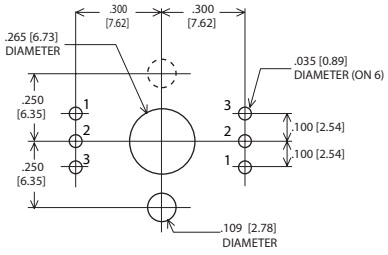
Note: Connecting terminals 2 and 4 together will create a SPDT switch

Dwg 20-2: A-19 Dual Potentiometer or Rotary Switch, PC Pin Terminals



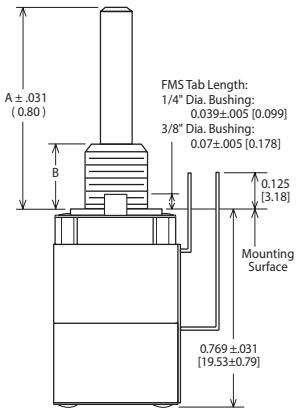


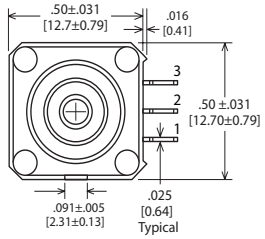
Front View



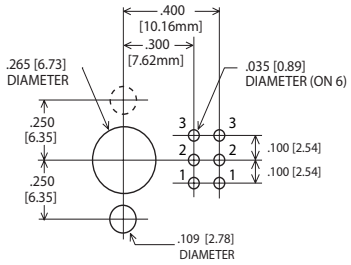
PC BOARD LAYOUT (top view)
Type A-19

Dwg 20-3: A-20 Dual Potentiometer or Rotary Switch, PC Pin Terminals





Front View



PC BOARD LAYOUT (top view)
Type A-20

Notes:

1. Basic dimensions are in inches.
   Dimensions in brackets are in millimeters.
   Dimensional Tolerance ±.016 [0,40], except as specified.
2. **Drawings are not to scale.**

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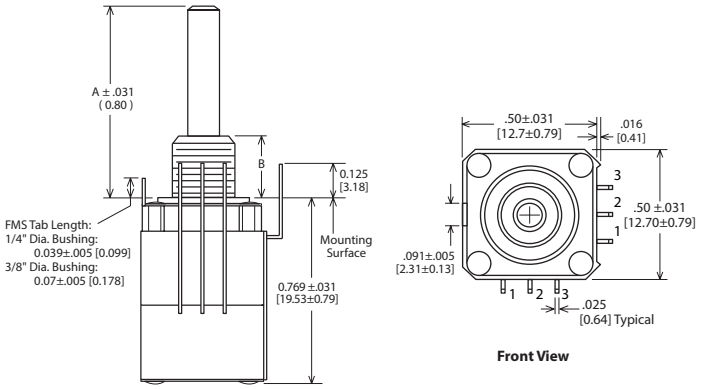
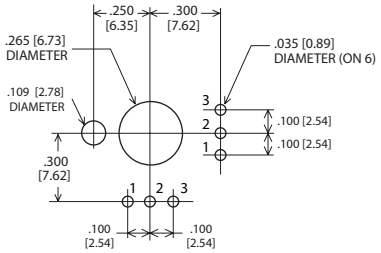
Series 388/389 - Vertical Mounting Styles (continued)

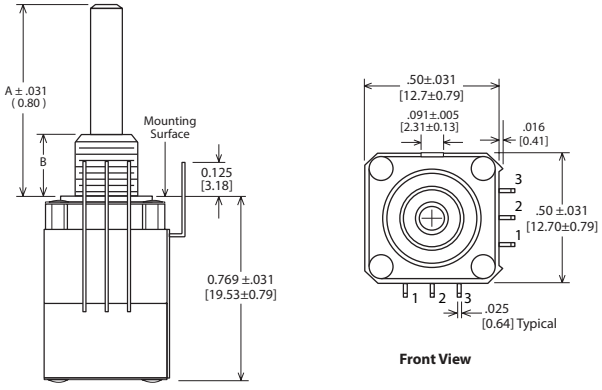
Dwg 21-1: A-21 Dual Potentiometer or Rotary Switch, PC Pin Terminals

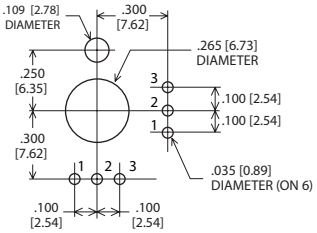




PC BOARD LAYOUT (top view)
Type A-21

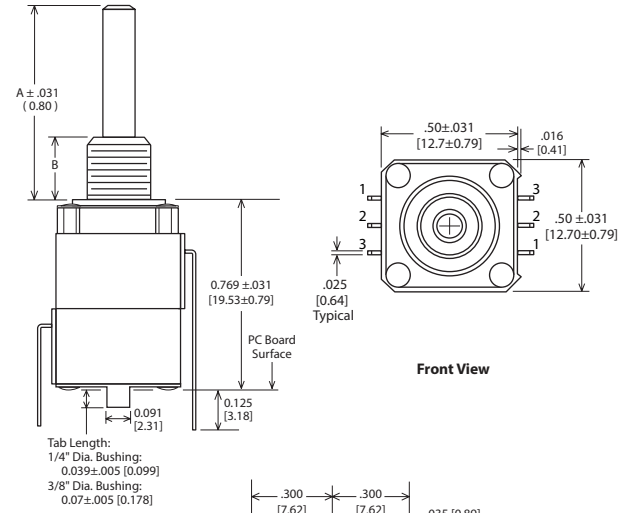
Dwg 21-2: A-20 Dual Potentiometer or Rotary Switch, PC Pin Terminals

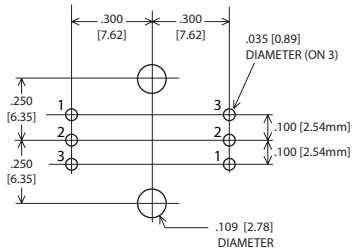




PC BOARD LAYOUT (top view)
Type A-20

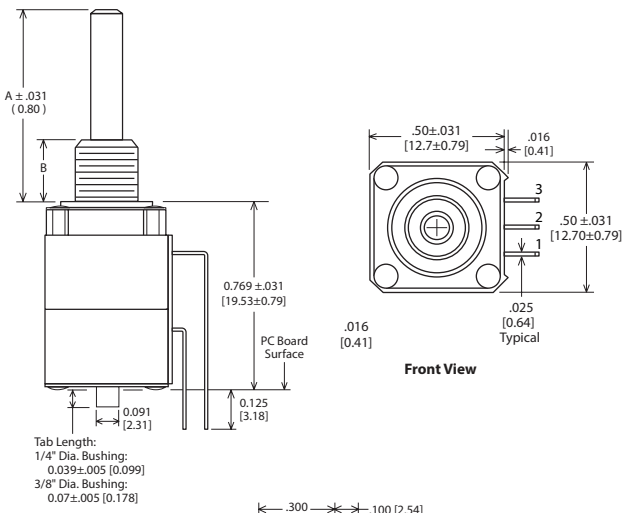
Dwg 21-3: C-9 Dual Potentiometer or Rotary Switch, PC Pin Terminals

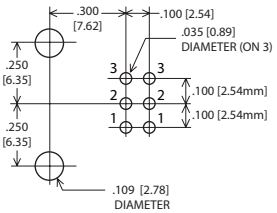




PC BOARD LAYOUT (top view)
Type C-9

Dwg 21-4: C-10 Dual Potentiometer or Rotary Switch, PC Pin Terminals





PC BOARD LAYOUT (top view)
Type C-10

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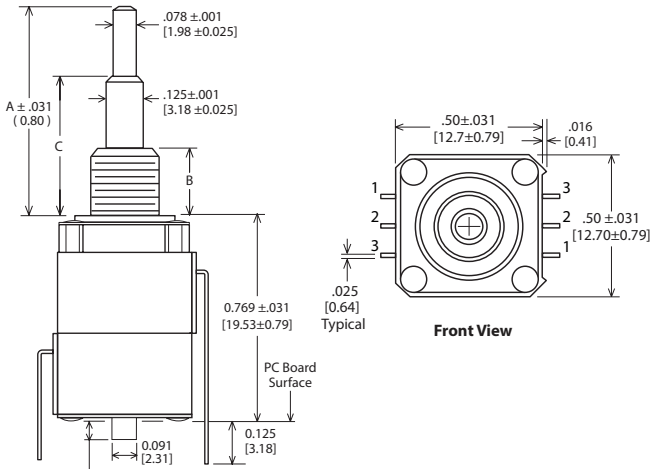
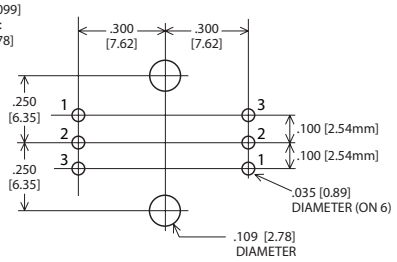
Series 388/389 - Vertical Mounting Styles (continued)

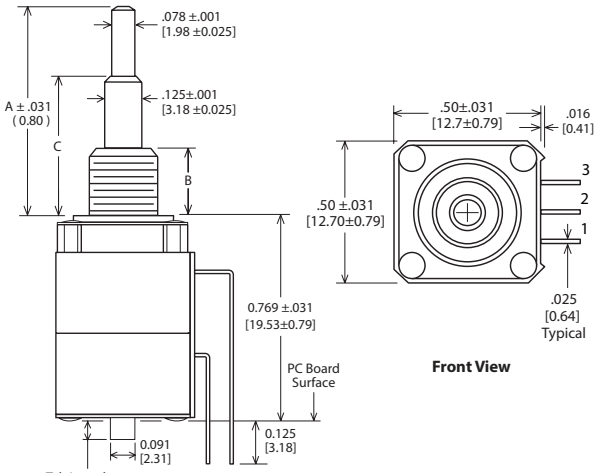
Dwg 22-1: C-9 Dual Potentiometer, Concentric Shaft, PC Pin Terminals

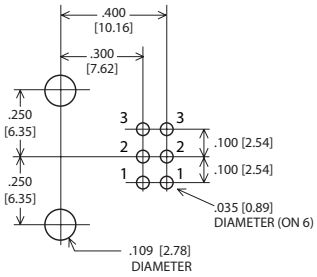




PC BOARD LAYOUT (top view)
Type C-9

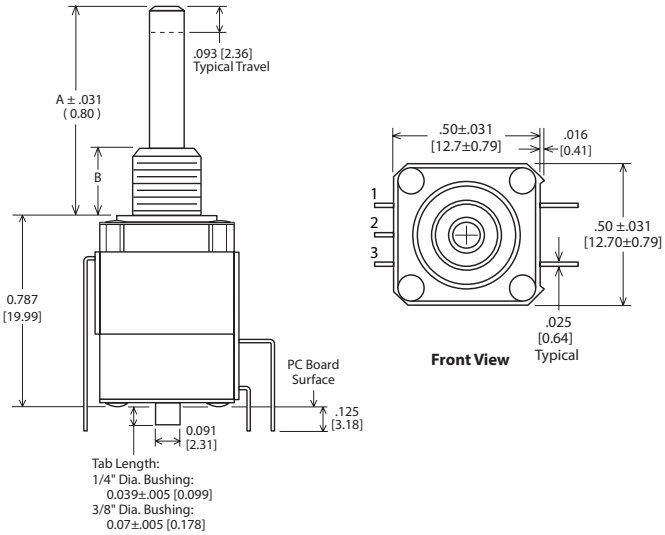
Dwg 22-2: C-10 Dual Potentiometer, Concentric Shaft, PC Pin Terminals

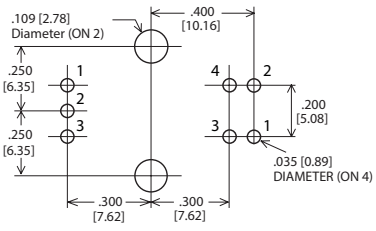




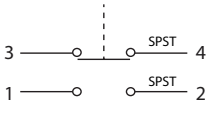
PC BOARD LAYOUT (top view)
Type C-10

Dwg 22-3: C-11 Single Potentiometer and BBJ Momentary/BBJM Push-Pull Switch, PC Pin Terminals





PC BOARD LAYOUT (top view)
Type C-11



Series BJ Push-Pull
Series BJM Momentary

Push-Pull/Momentary Schematic

Shaft shown in the extended position

Note: Connecting terminals 2 and 4 together will create a SPDT switch

DIMENSION NOTES
A= Shaft Length (Out Position)
B = Bushing Length
.250 [6.35mm] STD
.375 [9.53mm]
.500 [12.70mm]

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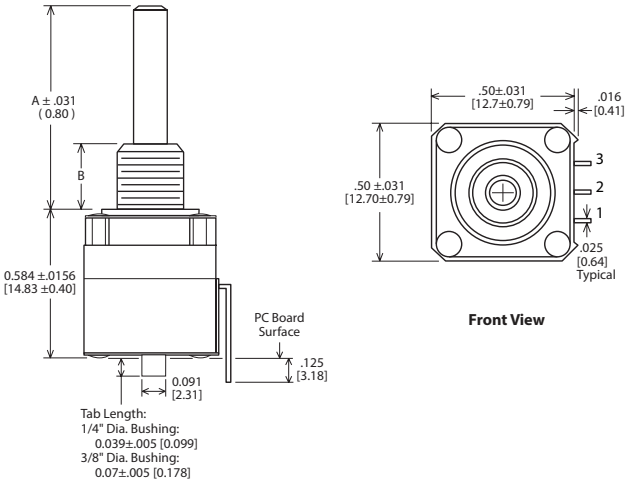
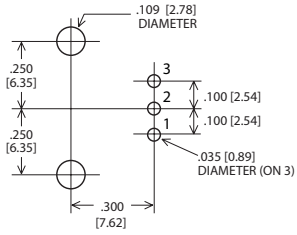
Series 388/389 - Vertical Mounting Styles (continued)

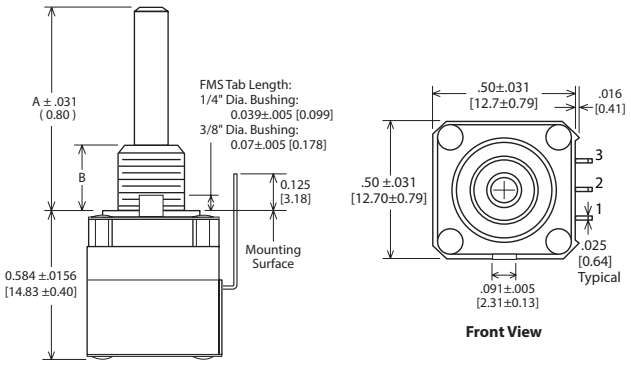
Dwg 23-1: C-8 Single Potentiometer with Detent, PC Pin Terminals

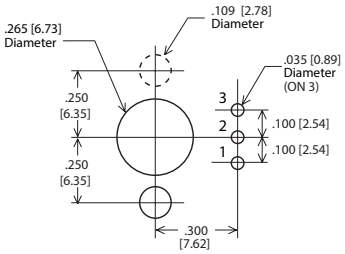




PC Board Layout (top view)
Type C-8

Dwg 23-2: A-18 Single Potentiometer with Detent, PC Pin Terminals

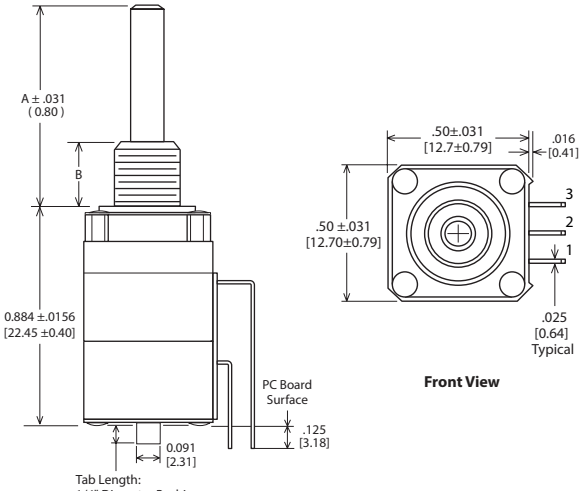


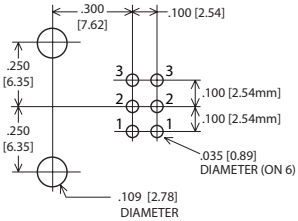


PC Board Layout (top view)
Type A-18

DIMENSION NOTES
B = Bushing Length
.250 [6.35mm] STD
.375 [9.53mm]
.500 [12.70mm]

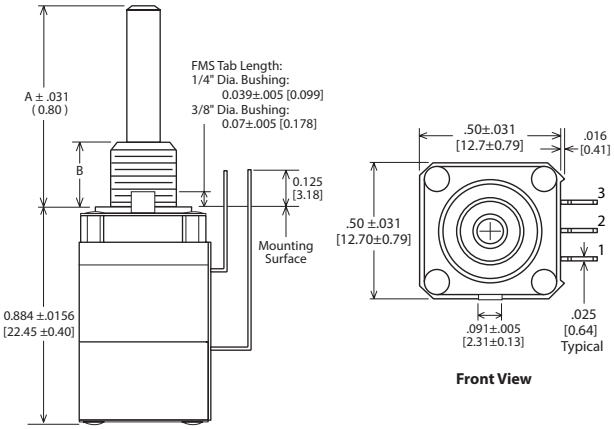
Dwg 23-3: C-10 Dual Potentiometer with Detent, PC Pin Terminals

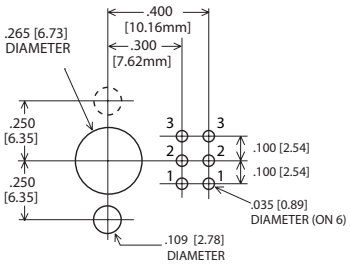




PC BOARD LAYOUT (top view)
Type C-10

Dwg 23-4: A-20 Dual Potentiometer with Detent, PC Pin Terminals





PC BOARD LAYOUT (top view)
Type A-20

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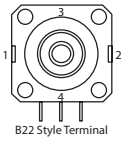
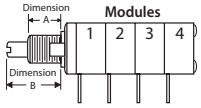
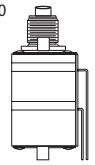
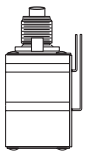
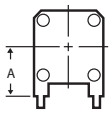
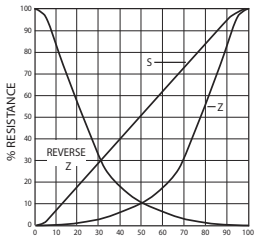
SEE DATA SHEETS FOR ASSEMBLED DIMENSIONS & DETAILED DESCRIPTION OF THE FOLLOWING OPTIONS:

FOLLOW STEPS TO DESCRIBE CONTROL

STEP 1	**RESISTANCE ELEMENT** (Select One)	☐ Conductive Plastic Series 388 ☐ Cermet Series 389	LOCATING LUG OPTIONS  B22 Style Terminal		Printed Circuit Terminal Styles (Check One) C8 ☐ 	A18 ☐ 
STEP 2	**TERMINALS** (Select One)	B22 P.C. Pin Style Terminals (See Other Options At Right) ☐ .350" length ☐ .875" length				
STEP 3	**TAPER** (Insert Taper Designation Letter for Each Resistance Module)	Cermet: **S, Z** Conductive Plastic: **S, Z, RZ** (See Graph Below)	**Module 1**	**Module 2**	**Module 3**	**Module 4**
						C10 ☐  A20 ☐ 
STEP 4	**RESISTANCE VALUE** (Insert for Each Resistance Module)	Nominal Resistance Values in Ohms 100 1K 10K 100K 1.0 Meg 250 2.5K 25K 250K 2.5 Meg 500 5K 50K 500K 5 Meg Other Values Available on Special Order Standard Tolerance: 10%				
STEP 5	**SWITCH MODULES** (Insert for Each Switch Module)	**AJ** Rotary SPDT CW or CCW detent **BJ** Push–Pull SPDT (last section only) **BJM** Momentary SPDT (last section only) Schadow DPDT Momentary (last section only) Schadow DPDT Push–Push (last section only)				
STEP 6	**BUSHING** (Select Length and Diameter)	Length (Dim "A") ☐ 1/4" ☐ 3/8" ☐ Locking 3/8" Bushing Diameter ☐ 1/4" ☐ 3/8"				Optional B-24 Mounting Plate  "A" Dimension ☐ B-24-1 .375 ☐ B-24-2 .500 ☐ B-24-3 .625 ☐ B-24-4 .750 ☐ B-24-5 .275
STEP 7	**SHAFT** (Select Diameter and Length)	Length (Dim "B" Inches): From Mounting Surface (FMS)	1/8" Diameter ☐ 5/16 ☐ 3/8 ☐ 7/16 ☐ 1/2 ☐ 5/8 ☐ 3/4 ☐ 7/8 ☐ 1" ☐ 2" ☐ Other _____ 1/4" Diameter ☐ 1/2 ☐ 3/4 ☐ 7/8 ☐ Other _____			
		Concentric Combinations (Up to 3 modules. Panel module controlled by outer shaft.)	Concentric Shaft Diameter: .125" Outer Diameter .078" Inner Diameter	Outer Shaft Length – Specify ☐ 7/8" ☐ 1 1/2" Other _____ Inner Shaft Length – Specify ☐ 1 1/8" ☐ 1 3/4" Other _____		
STEP 8	**LOCATING LUG OPTIONS** (Select One)	☐ 1 = tab at 9 o'clock (std) ☐ 2 = tab at 3 o'clock ☐ 3 = tab at 12 o'clock ☐ 4 = tab at 6 o'clock ☐ 5 = tabs at 3 and 9 o'clock ☐ 6 = tabs at 6 and 12 o'clock ☐ 7 = No Locating Lug				
STEP 9	**MOUNTING HARDWARE** (Select One)	☐ STANDARD ☐ NONE				
STEP 10	**MARKING** (Select One)	☐ STANDARD ☐ OTHER				
STEP 11	**KNOB**	Indicate Manufacturer and Part Number _____				
STEP 12	**QUANTITY**		**Purchase Order No.**			



NOTE: SELECT THE DIMENSIONS WHICH ARE REQUIRED AND FILL IN ALL APPROPRIATE BOXES

REMARKS AND/OR SPECIAL FEATURES: _____

Date: _____ Issued By: _____ Title: _____ Phone: _____

DISCLAIMER: Due to the unlimited design combinations, certain designs may not perform in accordance with all of the specifications

Fax completed form to: **STATE ELECTRONICS**, 36 Route 10, East Hanover, NJ 07936 • FAX 973-887-1940

For Assistance Contact Clarosystem Product Manager **Toll Free – 800-631-8083**

THE POTENTIOMETER SPECIALISTS®
Updated Jan.20.2021

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MOD-POT®
Series 388/389
Request For Quotation

1/2" Square Modular Potentiometer
Conductive Plastic – 1/2 Watt
Cermet - 1 Watt

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Request Quotation Online at Potentiometer.com

Series 388/389 Custom Ordering Information – Follow Steps to Describe Control

1 Resistance Element (choose one) ☐ Series 388 Conductive Plastic ☐ Series 389 Cermet

2 Terminals OR Support Plates (choose one)

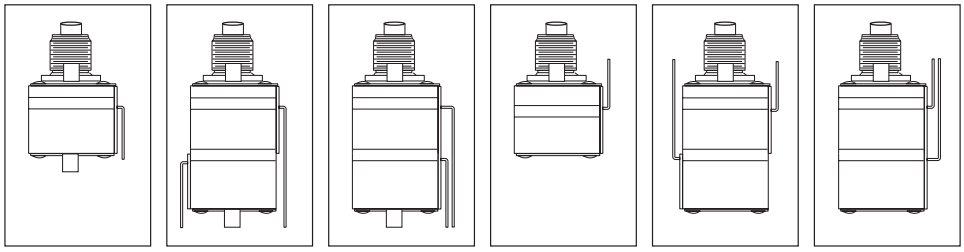
☐ Terminals (choose style)

☐ Solder Hook

☐ PC Pin Style B22 (specify length)
- ☐ .250 in. (6.35mm)
- ☐ .350 in. (8.89mm)
- ☐ .750 in. (19.05mm)
- ☐ .500 in. (12.7mm)
- ☐ .625 in. (15.875mm)
- ☐ .875 in. (22.225mm) Standard

☐ PC Pin Style special configuration (specify)

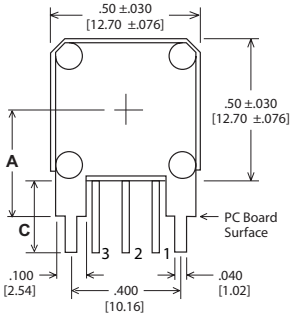
☐ C8 ☐ C9 ☐ C10 ☐ A18 ☐ A19 ☐ A20



☐ Optional Support Plates (choose one type)

Type	"A" Support Plate in.	(mm)	"C" Terminal in.	(mm)
☐ B-24-1	.375	(9.53)	.250	(6.35)
☐ B-24-2	.500	(12.53)	.375	(9.35)
☐ B-24-3	.625	(15.88)	.500	(12.70)
☐ B-24-4	.750	(19.05)	.625	(15.88)
☐ B-24-5	.275	(6.98)	.125	(3.18)
* B-24-6	.2969	(7.54)	.175	(4.45)
* B-24-7	.4375	(11.11)	.315	(8.00)
* B-24-8	.5625	(14.28)	.425	(10.8)

* (Discontinued - For Reference Only)



Rear View

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1/2" Square Modular Potentiometer
Conductive Plastic – 1/2 Watt
Cermet - 1 Watt

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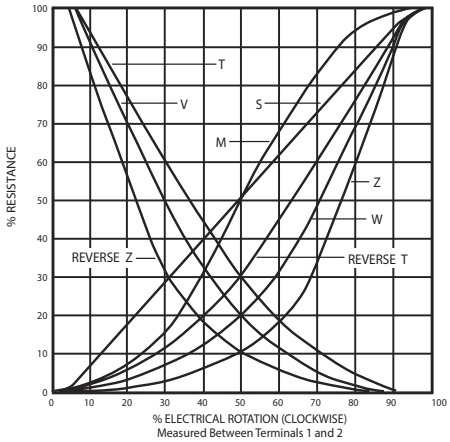

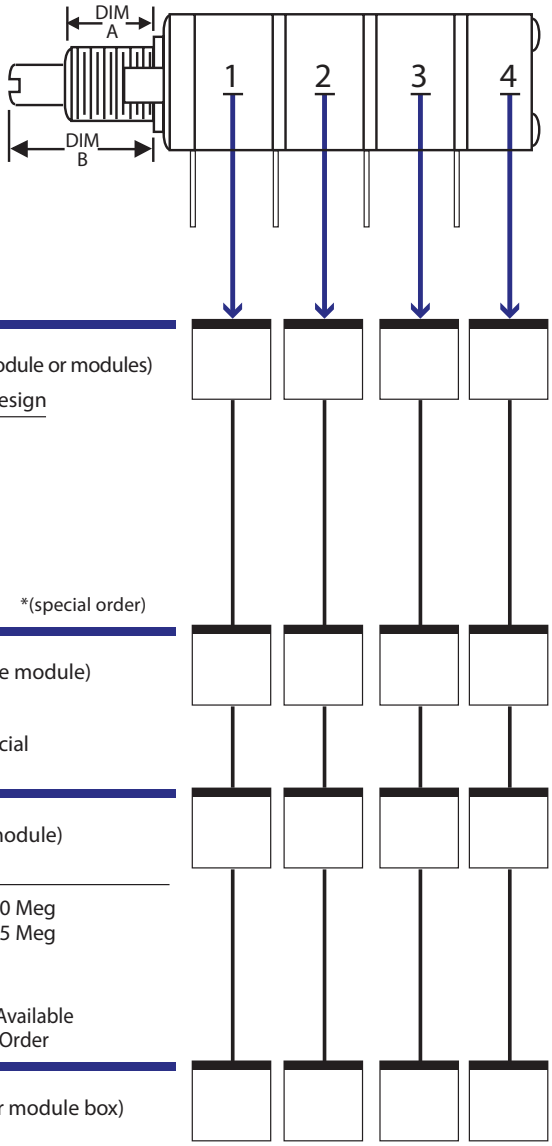

3 Taper (Insert taper designation letter below module or modules)

Cermet or Conductive Plastic	Taper Design
Linear	S
Clockwise Modified Log	Z
Counter Clockwise Modified Log	RZ
Modified Linear	M*
Counter Clockwise Modified Log	V*
Modified Log	W*
Counter Clockwise Modified Log	T*
Modified Log	RT*

*(special order)

4 Tolerance (Insert tolerance for each resistance module)

Cermet: 10% standard; 5% special

Conductive Plastic: 10% standard; 5% special

5 Resistance Value (Insert for each resistance module)

Nominal Resistance Values in Ohms

100	1K	10K	100K	1.0 Meg
250	2.5K	25K	250K	2.5 Meg
500	5K	50K	500K	

Other Values Available on Special Order

6 Switch Modules (Insert designation in proper module box)

- ☐ AJ SPDT Rotary – CCW detent
- ☐ AJ SPDT Rotary – CW detent
- ☐ BJ SPDT Push-Pull (last section only)
- ☐ BJM SPDT Push Momentary (last section only)
- ☐ Schadow DPDT Push-Push (single shaft, last section only)
- ☐ Schadow DPDT Momentary (single shaft, last section only)

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1/2" Square Modular Potentiometer
Conductive Plastic – 1/2 Watt
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7 Special Options (Specify if required)

☐ 8 lb. Stop Torque

8 Bushing (Choose length and diameter)

Length (Dim "A")
☐ Plain .250 in. (6.35mm)
☐ Plain .375 in. (9.53mm)
☐ Plain .500 in (12.70mm)
☐ Locking .375 in (9.53mm)

Diameter
☐ Plain .250 in. (6.35mm)
☐ Plain .375 in. (9.53mm)

9 Shaft

Diameter (Choose one) ☐ .125 in. (3.18mm) (with .250 in. (6.35mm) Dia. bushing)
☐ .250 in. (6.35mm) (with .375 in. (9.53mm) Dia. bushing)

Length (Dim "B") from mounting surface (FMS) (specify) _____

Concentric Shafts (available for Up to 3 modules. Module closest to Panel is controlled by outer shaft.)

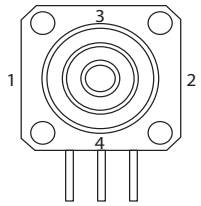
☐ .125 in. (3.18mm) Outer Diameter; .078 in. (1.98mm) Inner Diameter

Length FMS (specify) Outer _____ Inner _____

10 Shaft Ending (Select one) ☐ Plain ☐ Flatted (specify length & thickness) _____
☐ Slotted ☐ Special (specify) _____

11 Locating Lug Options (Select one)

☐ 1 = one tab - at 9 o'clock (standard)
☐ 2 = one tab - at 3 o'clock
☐ 3 = one tab - at 12 o'clock
☐ 4 = one tab - at 6 o'clock
☐ 5 = two tabs - at 3 and 9 o'clock
☐ 6 = two tabs - at 6 and 12 o'clock
☐ 7 = No Locating Lug



12 Mounting Hardware (Specify) ☐ Standard ☐ IP66 Hardware ☐ None

13 Marking (Specify) ☐ Standard ☐ Other _____

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Mod-Pot™ SERIES OPTIONS

	5/8" Square / Modular Design						1/2" Square / Modular Design		
	70		72 - Plastic Bushing / Shaft Non-Magnetic Construction		S159		388	389	S127
Technology	**Conductive Plastic**	**Cermet**	**Conductive Plastic**	**Cermet**	**Conductive Plastic**	**Cermet**	**Conductive Plastic**	**Cermet**	**Conductive Plastic**
Max Wattage Rating	1-Watt	2-Watt	1/2-Watt	1-Watt	1-Watt	2-Watt	1/2-Watt	1	1/2-Watt
Operating Temperature (°C)	-55 ° to 120 °	-55 ° to 150 °	-55 ° to 120 °	-55 ° to 150 °	-40 ° to 125 °	-40 ° to 125 °	-55° to 120°	-55° to 150°	-55° to 125°
Temperature Coefficient (TC)	+/-5% (Typical)	150 PPM °C	+/-5% (Typical)	150 PPM °C	+/-10%	150 PPM °C	+/-5% (Typical)	150 PPM °C	+/-5% (Typical)
Rotational Life	100,000				100,000		50,000	25,000	1,000,000
Sections	6				4		8		4

Center Detent	Not Available	Not Available	Center or	Optional
11 - Detents			11 Detents Only	
21 - Detents			21 Detents Not Available	

Rotary Switch - Counter Clockwise Detent Maximum of 1-Switch per Shaft	2A @125VAC 1 SPST, N.O. + 1 SPST N.C. OR	2A @125VAC, 2A @28VDC, 1A @ 250VAC 1 SPST, N.O. + 1 SPST N.C. OR	125 MA @ 28VDC SPDT	0.5A @ 30VDC SPDT
Rotary Switch - Clockwise Detent Maximum of 1-Switch per Shaft	2A @125VAC 1 SPST, N.O. + 1 SPST N.O	2A @125VAC, 2A @28VDC, 1A @ 250VAC 1 SPST, N.O. + 1 SPST N.O		No CW Detent
Push-Pull Switch (1/8" or 1/4" Dia. Shaft)	Optional	Not Available	250 MA @ 30 VDC	Not Available
Push-Momentary - 1/8" Dia. Shaft	2A @125VAC		1/8" Only 1 SPST N.O. + 1 SPST N.C.	
Push-Momentary - 1/4" Dia. Shaft	2 SPST N.O. + 2 SPST N.C		1/4" Shaft - Not Available	
Push-On / Push-Off - 1/8" Dia. Shaft	Not Available		Optional 500 MA @ 30VDC DPDT	

Max Shaft Single Length - 1/8 Dia.	Metal Shaft 2.5" Plastic Shaft - 3/4"	Metal Shaft 2.5"	2"	2"
Max Shaft Single Length - 1/4 Dia.	Metal Shaft 2.5" Plastic Shaft - 7/8"	Metal Shaft 2.5"		
Concentric Shafts .078 / .125	6-Sections	4-Sections	Maximum 3-Sections,	
			Outer shaft - Panel Pot Only	Not Available
Concentric Shafts .125 / .250	Any Metal Shaft Combination for Inner & Outer Shaft	Any Metal Shaft Combination for Inner & Outer Shaft	.125 / .250 Combination Not Available	

Vernier Drive	Optional	No	No	No
Internal Shaft Seal	Optional	No	Optional	Standard
IP Rated	No	IP40	No	IP67

Stop Torque	4 lb.-in.	4 lb.-in.	3 lb.-in.	2.5 lb.-in.
High Stop Torque	Not Available	Not Available	8 in / pd	Not Available
Rotational Torque Standard (Min / Max) Single section	0.3 / 3.0 oz.-in.	0.2 to 1.5 oz.-in.	0.2 / 3.0 oz.-in.	1.5 Max oz.-in.
Rotational Torque, Meduim Torque Option (Min / Max)	Available - Varies with each configuration	Not Available	1 - 6 oz.-in.	Not Available
Non-Magnetic	N/A Yes - with Plastic shaft and Bushing & Solder Lug Terminals	Not Available	N/A	N/A
Rotary Switch Actuating Torque	20 oz.-in.	2 to 7 oz.-in.	3.3 - 10.5 oz.-in.	2 oz.-in.

Note: Most parameters (wattage rating, rotational torque, etc.) are affected by the total number of sections. Download full specifications for further details.

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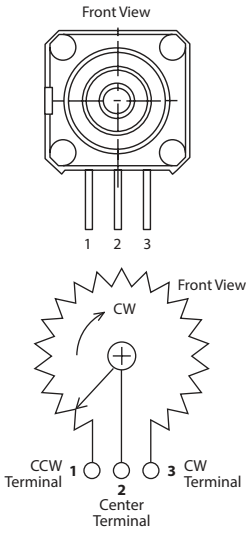
GLOSSARY OF TERMS

Input and Output Terms

Output Voltage
(e) The voltage between the wiper terminal and the designated reference point. Unless otherwise specified, the designated reference point is the CCW terminal (See 3.1).

Figure 1
Circuit and Travel Diagram



Output Ratio
(e/E) The ratio of the output voltage to the designated input reference voltage. Unless otherwise specified, the reference voltage is the total applied voltage.

Rotation and Translation

Total Mechanical Travel
The total travel of the shaft between integral stops, under the specified stop load. In potentiometers without stops, the mechanical travel is continuous.

Mechanical Overtravel - Wirewound
The shaft travel between each End Point (or Theoretical End Point for Absolute Conformity or Linearity units) and its adjacent corresponding limit of Total Mechanical Travel.

Mechanical Overtravel
The shaft travel between each Theoretical End Point and its adjacent corresponding limit of Total Mechanical Travel.

Backlash
The maximum difference in shaft position that occurs when the shaft is moved to the same actual Output Ratio point from opposite directions.

Theoretical Electrical Travel
The specified shaft travel over which the theoretical function characteristic extends between defined Output Ratio limits, as determined from the Index Point.

Electrical Overtravel - Nonwirewound
The shaft travel over which there is continuity between the wiper terminal and the resistance element beyond each end of the Theoretical Electrical Travel.

Electrical Continuity Travel
The total travel of the shaft over which electrical continuity is maintained between the wiper and the resistance element.

Tap Location
The position of a tap relative to some reference. This is commonly expressed in terms of an Output Ration and/or a shaft position. When a shaft position is specified, the Tap Location is the center of the Effective Tap Width.

Resistance

End Resistance
The resistance measured between the wiper terminal and an end terminal with the shaft positioned at the corresponding End Point.

Temperature Coefficient Of Resistance
The unit change in resistance per degree celsius change from a reference temperature, expressed in parts per million per degree celsius as follows:

$$T.C. = \frac{R_2 - R_1}{R_1(T_2 - T_1)} \times 106$$

Where:
R1 = Resistance at reference temperature in ohms.
R2 = Resistance at test temperature in ohms
T1 = Reference temperature in degrees celsius.
T2 = Test temperature in degrees celsius.

Conformity and Linearity

Linearity
A specific type of conformity where the theoretical function characteristic is a straight line.

Mathematically:

$$\frac{e}{E} = f(W) \pm C = A(W) + B \pm C$$

Where:
A is the given slope; B is given intercept at W=0.
W = Angle or slope

Absolute Linearity
The maximum deviation of the actual function characteristic from a fully defined straight reference line. It is expressed as a percentage of the Total Applied Voltage and measured over the Theoretical Electrical Travel. An Index Point on the actual output is required.

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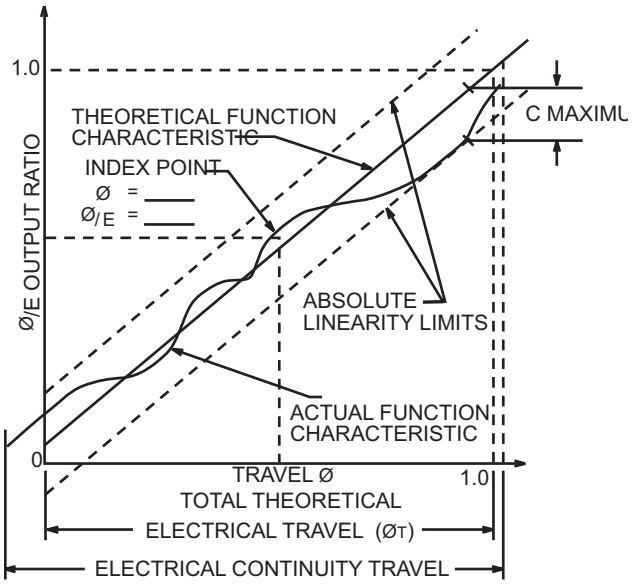
The straight reference line may be fully defined by specifying the low and high theoretical end Output Rations separated by the Theoretical Electrical Travel. Unless otherwise specified, these end Output Rations are 0.0 and 1.0 respectively.

Mathematically:

$$\frac{e}{E} = A(W/W_T) + B \pm C$$

Where:
A is the given slope; B is given intercept at W=0.
Unless otherwise specified: A-1; B=0

Figure 2



Independent Linearity
The maximum deviation, expressed as a percent of the Total Applied Voltage, of the actual function characteristic from a straight reference line with its slope and position chosen to minimize deviations over the Actual Electrical Travel, or any specified portion thereof.

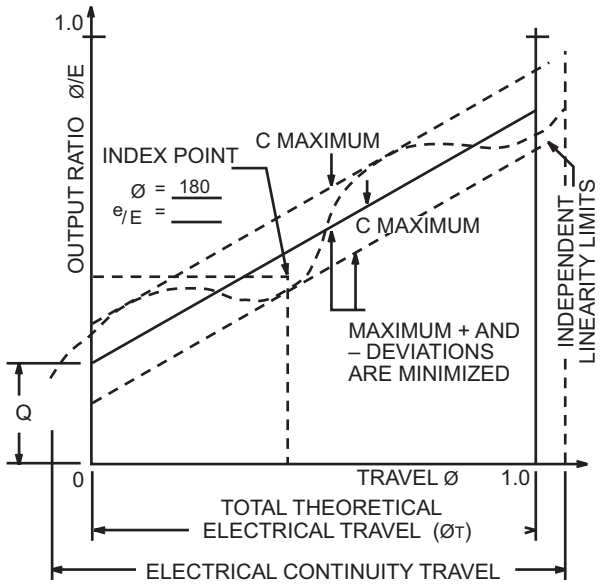
Note: End Voltage requirements, when specified, will limit the slope and position of the reference line.

Mathematically:

$$\frac{e}{E} = P(W/W_A) + Q \pm C$$

Where:
P is unspecified slope; Q is unspecified intercept at W=0. And both are chosen to minimize C but are limited by the End Voltage requirements.

Figure 3
Independent Linearity



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Electrical Characteristics

Noise
Any spurious variation in the electrical output not present in the input, defined quantitatively in terms of an equivalent parasitic, transient resistance in ohms, appearing between the contact and the resistance element when the shaft is rotated or translated. The Equivalent Noise Resistance is defined independently of the resolution, the functional characteristics, and the total travel. The magnitude of the Equivalent Noise Resistance is the maximum departure from a specified reference line. The wiper of the potentiometer is required to be excited by a specified current and moved at a specified speed.

Output Smoothness (Non-wirewound Potentiometers Only)
Output Smoothness is a measurement of any spurious variation in the electrical output not present in the input. It is expressed as a percentage of the Total Applied Voltage and measured for specified travel increments over the Theoretical Electrical Travel. Output Smoothness includes effects of contact resistance variations, resolution, and other micrononlinearities in the output.

Resolution
A measure of the sensitivity to which the Output Ratio of the potentiometer may be set.

Dielectric Strength
Ability to withstand under prescribed conditions, a specified potential of a given characteristic between the terminals of each cup and the exposed conducting surfaces of the potentiometer, or between the terminals of each cup and the terminals of every other cup in the gang without exceeding a specified leakage current value.

Insulation Resistance
The resistance to a specified impressed DC voltage between the terminals of each cup and the exposed conducting surfaces of the potentiometer, or between the terminals of each cup and the terminals of every other cup in the gang, under prescribed conditions.

Power Rating
The maximum power that a potentiometer can dissipate under specified conditions while meeting specified performance requirements.

Power Derating
The modification of the nominal power rating for various considerations such as Load Resistance, Output Slopes, Ganging, nonstandard environmental conditions and other factors.

Life
The number of shaft revolutions or translations obtainable under specific operating conditions and within specified allowable degradations of specific characteristics.

Mechanical Characteristics

Shaft Runout
The eccentricity of the shaft diameter with respect to the rotational axis of the shaft, measured at a specified distance from the end of the shaft. The body of the potentiometer is held fixed and the shaft is rotated with a specified load applied radially to the shaft. The eccentricity is expressed in inches, TIR.

Lateral Runout
The perpendicularity of the mounting surface with respect to the rotational axis of the shaft, measured on the mounting surface at a specified distance from the outside edge of the mounting surface. The shaft is held fixed and the body of the potentiometer is rotated with specified loads applied radially and axially to the body of the pot. The Lateral Runout is expressed in inches.

Shaft Radial Play (single shaft potentiometer)
The total radial excursion of the shaft, measured at a specified distance from the front surface of the unit. A specified radial load is applied alternately in opposite directions at a specified point. Shaft Radial Play is expressed in inches.

Shaft End Play
The total axial excursion of the shaft, measured at the end of the shaft with a specified axial load supplied alternately in opposite directions. Shaft End Play is expressed in inches.

Starting Torque
The maximum moment in the clockwise and counterclockwise directions required to initiate shaft rotation anywhere in the Total Mechanical Travel.

Running Torque
The maximum moment in the clockwise and counterclockwise directions required to sustain uniform shaft rotation at a specified speed throughout the Total Mechanical Travel.

Moment of Inertia
The mass moment of inertia of the rotating elements of the potentiometer about their rotational axis.

Stop Strength

Static Stop Strength
The maximum static load that can be applied to the shaft at each mechanical stop for a specified period of time without permanent change of the stop positions greater than specified.

Dynamic Stop Strength
The inertia load, at a specified shaft velocity and a specified number of impacts, that can be applied to the shaft at each stop without a permanent change of the stop position greater than specified.

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All orders are subject to acceptance by State Electronics, E. Hanover, NJ. No order or contract shall be deemed accepted unless and until such acceptance is made in writing by State Electronics.

All agreements are more contingent upon strikes, accidents or causes of delay beyond our control

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Prices, quotations, specifications and other terms and all statements appearing in the Company's catalogs and advertisements, and otherwise made by the Company, are subject to change without notice. State Electronics reserves the right to make changes in design at any time without incurring any obligation to provide same units previously purchased or to continue to supply discontinued items. The specifications shown in the sales literature are not always the latest version. Certified current specification prints are available upon request.

Unless specifically provided in writing, prices quoted are based upon manufacture of quantities and types originally specified and are subject to revision when interpretation or engineering changes are initiated by the customer. Quoted prices are based upon present cost of materials and labor and are subject to change without notice.

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Delivery promise is based on our best estimate of the date material will be shipped from our factory and we assume no responsibility for losses, damage or consequential damages due to delays.

Terms of Payment

On approved orders, terms are net thirty (30) days from the date of invoice. The Company may at any time, when in its opinion the financial condition of the customer warrants it, either hold or suspend credit. In cases where credit is not established or satisfactory financial information is not available, the terms are cash with order or C.O.D. at the option of the Company. Each shipment will be considered a separate and independent transaction and payment should be made accordingly.

Shipments

All shipments are made F.O.B. shipping point (unless otherwise specified) and packaging for domestic shipment is included in the quoted price. When special domestic or export packaging is specified involving greater expense than is customary, a charge will be made to cover such extra expense. Unless otherwise specified, we will normally use the best, least expensive surface transportation. Reasonable care is exercised in packaging our products for shipment and no responsibility is assumed by the Company for delay, breakage or damage after having made delivery in good order to the carrier. All claims for breakage or damage should be made to the carrier, but will be glad to render all possible assistance in securing satisfactory adjustment of such claims.

Claims and Rejected Material

Claims for defective material must be made within 30-days of the customer's receipt of shipment.
No products may be returned without a return authorization (RMA).

Country of Origin

The 388 / 389 and 70 series Mod-Pot products are assembled in the United States at our facility located in East Hanover, New Jersey, USA, using components parts manufactured by the Sensing and Control Division of Honeywell International headquartered in Morris Township, New Jersey, USA.

Export Information

HARMONIZED TARIFF SCHEDULE (HTS #) - 8533.31.0000

EXPORT CONTROL CLASSIFICATION # (ECCN #) - EAR99

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