

\*RoHS COMPLIANT  
VERSIONS  
AVAILABLE



**BOURNS®**

## Features

- Features one-piece molded plastic shaft and rotor assembly
- Available in a variety of pin-out configurations
- Virtually infinite electrical circuit isolation
- Model 96 sealed for board wash
- Metal shaft available as special feature
- RoHS compliant versions available\*

**91, 92, 93, 94, 95, 96, 99 - 5/8" Square Single-Turn Panel Control**  
**99 - 5/8" Square Single-Turn Panel Control with Rotary Switch**

## Potentiometer Specifications

Initial Electrical Characteristics <sup>1</sup>	Conductive Plastic Element	Cermet Element
Standard Resistance Range		
Linear Tapers (A, B, E, & H) .....	(B & E) 1 K ohms to 1 megohm .....	(A & H) 100 ohms to 1 megohm
Audio Tapers (C, D, F, G, S, & T).....	(D,G,S, & T) 1 K ohms to 1 megohm .....	(C & F) 1 K ohms to 1 megohm
Total Resistance Tolerance .....	10 % or 20 % .....	5% or 10%
Independent Linearity .....	±5 % .....	±5 %
Absolute Minimum Resistance .....	2 ohms maximum.....	2 ohms maximum
Effective Electrical Angle .....	(Linear tapers) 240 ° ± 5 ° .....	(Linear tapers) 240 ° ± 6 °
	(Audio tapers) 225 ° ± 5 ° .....	(Audio tapers) 225 ° ± 6 °
Contact Resistance Variation .....	±1 % .....	±1 % or 3 ohms (whichever is greater)
Dielectric Withstanding Voltage (MIL-STD-202, Method 301)		
Sea Level.....	1,500 VAC minimum.....	1,500 VAC minimum
70,000 Feet .....	500 VAC minimum.....	500 VAC minimum
Insulation Resistance (500 VDC) .....	1,000 megohms minimum.....	1,000 megohms minimum
Power Rating (Voltage Limited By Power Dissipation or 350 VAC, Whichever Is Less)		
+70 °C Single Section Assembly .....	(Linear tapers) 0.5 watt.....	(Linear tapers) 2 watts
	(Audio tapers) 0.25 watt .....	(Audio tapers) 1 watt
+70 °C Multiple Section Assembly.....	(Linear tapers) 0.5 watt/section.....	(Linear tapers) 1 watt/section
	(Audio tapers) 0.25 watt/section .....	(Audio tapers) 0.5 watt/section
+125 °C .....	0 watt.....	0 watt
Theoretical Resolution .....	Essentially infinite .....	Essentially infinite
<b>Environmental Characteristics<sup>1</sup></b>		
Operating Temperature Range .....	-40 °C to +125 °C.....	-40 °C to +125 °C
Storage Temperature Range.....	-55 °C to +125 °C.....	-55 °C to +125 °C
Temperature Coefficient Over Storage Temperature Range.....	±1,000 ppm/°C.....	±150 ppm/°C
Vibration (Single Section).....	15 G.....	15 G
Total Resistance Shift.....	±2 % maximum .....	±2 % maximum
Voltage Ratio Shift .....	±5 % maximum .....	±5 % maximum
Shock (Single Section).....	30 G.....	30 G
Total Resistance Shift.....	±2 % maximum .....	±2 % maximum
Voltage Ratio Shift .....	±5 % maximum .....	±5 % maximum
Load Life.....	1,000 hours .....	1,000 hours
Total Resistance Shift.....	±10 % maximum .....	±5 % maximum
Rotational Life (No Load).....	100,000 cycles .....	100,000 cycles
Total Resistance Shift.....	(Linear tapers) 10 ohms or ±15 % TRS max. ....	(All tapers) ±5 % TRS max.
	(whichever is greater)	
	(Audio tapers) ±20 % maximum	
Contact Resistance Variation @ 50,000 cycles .....	(Linear tapers) ±2 % .....	±2 %
	(Audio tapers) ±3 % .....	±3 %
Moisture Resistance (MIL-STD-303, Method 103, Condition B)		
Total Resistance Shift.....	(Linear tapers) ±10 % TRS maximum .....	(All tapers) ±5 % TRS maximum
	(Audio tapers) ±20 % TRS maximum	
Insulation Resistance (500 VDC).....	100 megohms minimum.....	100 megohms minimum
IP Rating (Model 96) .....	IP 65 .....	IP 65
(All Others).....	IP 40 .....	IP 40

\*RoHS Directive 2002/95/EC Jan 27 2003 including Annex  
 Specifications are subject to change without notice.

Customers should verify actual device performance in their specific applications.

**91, 92, 93, 94, 95, 96, 99 - 5/8 " Square Single-Turn Panel Control  
99 - 5/8 " Square Single-Turn Panel Control with Rotary Switch**

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**Potentiometer Specifications**

**Mechanical Characteristics<sup>1</sup>**

Stop Strength (1/4 " D shaft).....	45.19 N-cm (4 lb.-in.)
(1/8 " D shaft) .....	33.89 N-cm (3 lb.-in.)
Mechanical Angle .....	300 ° ±5 °
Torque	
Starting .....	0.3 max. above average running torque
Running Torque	
Single or Dual Section (A ,D & R Bushings) .....	0.21 to 1.06 N-cm (0.3 to 1.5 oz.-in.)
Single or Dual Section (C & U Bushings) .....	0.14 to 1.06 N-cm (0.2 to 1.5 oz.-in.)
Mounting .....	(Metal Bushing) 1.7-2.0 N-m (15-18 lb.-in.) maximum
	Plastic Bushing) 56-79 N-cm (5-7 lb.-in.) maximum
Variation .....	0.35 N-cm (0.5 oz.-in.) maximum in 45 ° shaft travel
Weight (Single Section) .....	7 grams maximum
(Each Additional Section) .....	4 grams maximum
Terminals .....	Printed circuit terminals, J-Hooks or solder lugs
Soldering Condition .....	Recommended hand soldering using Sn95/Ag5 no clean solder, 0.025 " wire diameter.
	Maximum temperature 399 °C (750 °F) for 3 seconds. No wash process to be used with no clean flux.
Marking.....	Manufacturer's trademark, date code, resistance, manufacturer's part number
Ganging (Multiple Section Potentiometers) .....	2 cups maximum
Hardware .....	One lockwasher and one mounting nut is shipped with each potentiometer, except where noted in the part number.

NOTE: ALL MODEL 90 PERFORMANCE SPECIFICATIONS DO NOT APPLY TO UNITS SUBJECTED TO PRINTED CIRCUIT BOARD CLEANING PROCEDURES, EXCEPT FOR THE SEALED VERSION (MODEL 96).

<sup>1</sup>AT ROOM AMBIENT: +25 °C NOMINAL AND 50 % RELATIVE HUMIDITY NOMINAL, EXCEPT AS NOTED.

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**Rotary Switch Specifications**

**Initial Electrical Characteristics<sup>1</sup>**

Contacts:	
DPST .....	N.O./N.O., N.C./N.C. or N.O./N.C.
DPDT .....	2 N.O./N.C. (break before make)
Power Rating (Resistive Load):	
DPST .....	2 A @ 125 volts RMS-60 Hz or 2 A @ 28 VDC, 1 A @ 250 volts RMS-60 Hz
DPDT .....	1 A @ 125 volts RMS-60 Hz or 1 A @ 28 VDC
Contact Resistance (0.1 VDC-10 mA) .....	10 milliohms nominal
Contact Bounce .....	5 milliseconds maximum
Dielectric Withstanding Voltage (MIL-STD-202, Method 301)	
Sea Level .....	1500 VAC minimum
Insulation Resistance .....	1000 megohms minimum

**Environmental Characteristics<sup>1</sup>**

Operating Temperature Range .....	0 °C to +70 °C
Exposure Temperature Range .....	-65 °C to +125 °C
Vibration (Dual Section) .....	8 G
Contact Resistance .....	10 milliohms maximum
Contact Bounce .....	0.1 millisecond maximum
Shock (Dual Section) .....	20 G
Contact Resistance .....	10 milliohms maximum
Contact Bounce .....	0.1 millisecond maximum
Rotational Life .....	25,000 cycles
Switch Actuating Torque (50% Duty cycle @ Rated Power Load) .....	1.41 to 4.94 N-cm (2 to 7 oz.-in.)
Contact Resistance .....	100 milliohms maximum
Moisture Resistance (MIL-STD-202, Method 106, Condition B)	
Contact Resistance (0.1 VDC-10 mA) .....	10 milliohms maximum
Insulation Resistance (After 24 Hours @ Room Temperature) (500 VDC) .....	100 megohms minimum
Housing Material .....	High temperature, flame retardant, thermosetting plastic

**Mechanical Characteristics<sup>1</sup>**

Actuating Torque (Each Section, Switch Module Only) .....	3.53 to 10.59 N-cm (5 to 15 oz.-in.)
Running Torque (Out of Detent, 2-4 Module Assembly) .....	0.21 to 1.41 N-cm (0.3 to 2 oz.-in.)
Detent .....	CW or CCW standard
Actuation Angle .....	20 ° ±5 °
Contact Materials .....	Fine silver with gold overlay
Terminal Styles .....	Solder lug only
Standard Orientation .....	In-line with control terminals
Optional .....	Rotated 90 ° CCW from standard
Terminal Strength (Before and After Soldering Heat Exposure) .....	0.9 kg (2 lbs.) minimum

NOTE: Model 99 performance specifications do not apply to units subjected to printed circuit board cleaning procedures.

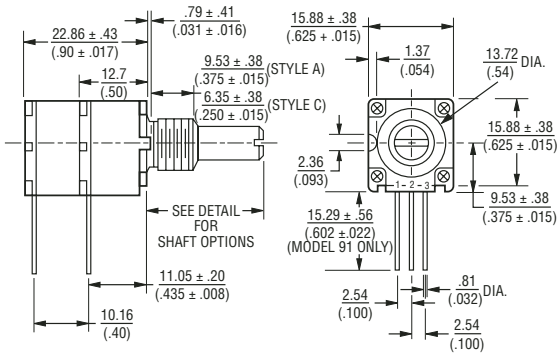
<sup>1</sup>At room ambient: +25 °C nominal and 50 % relative humidity nominal, except as noted.

# 91, 92, 93, 94, 95, 96, 99 - 5/8" Square Single-Turn

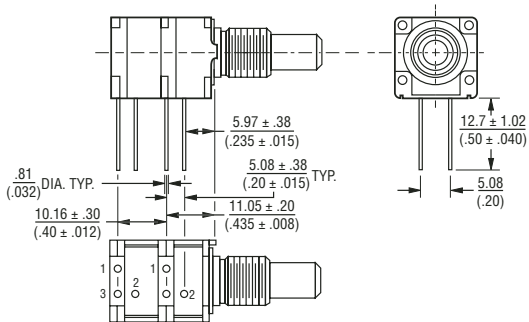
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## Product Dimensions

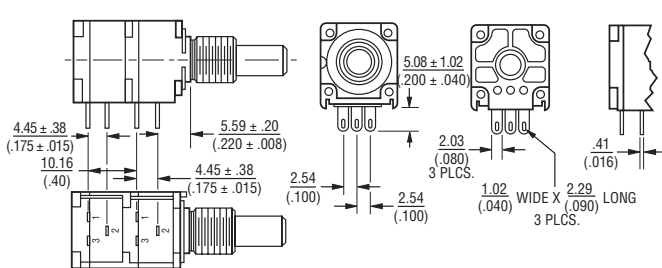
### Model 91 & 96 PC Pin Terminals, In-Line



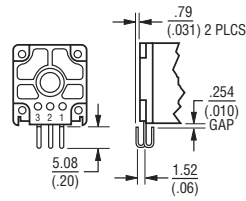
### Model 93 PC Pin Terminals, "L" Pattern



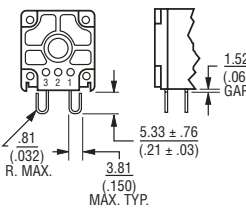
### Model 95 Solder Lug Terminals, "Triangular" Pattern



### Model 92 J-Hooked Terminals, In-Line

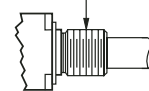


### Model 94 J-Hooked Terminals, "L" Pattern

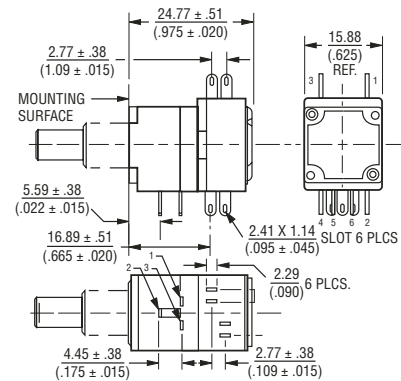


### Bushing Styles

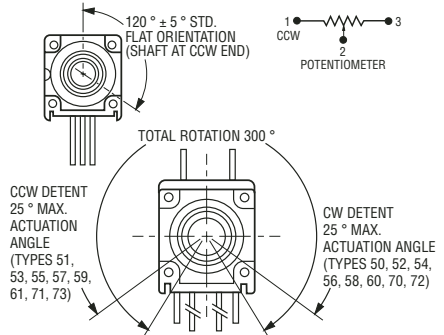
- 3/8 THREADLESS (9.53 mm) (STYLE "D")
- 3/8-32 UNEF (9.53 mm) (STYLE "A")
- 1/4-32 UNEF (6.35 mm) (STYLE "C")
- M10 X 0.75-6g (STYLE "R")
- M7 X 0.75-6g (STYLE "U")



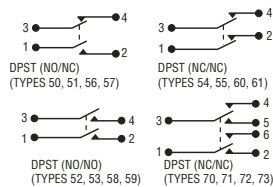
### Model 99 1st Cup Same As Model 95 (2nd Cup - Switch)



### Switch Module Variations Shaft Flat Orientation

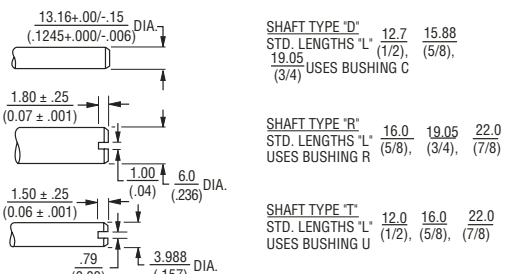
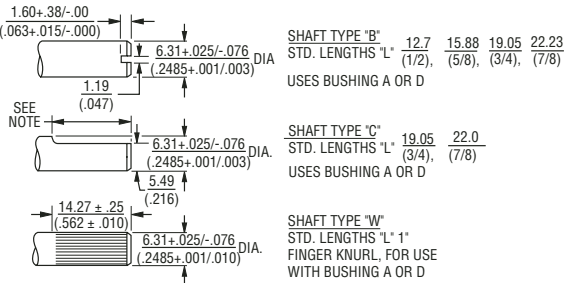


NOTE: Switch terminals shown in vertical position.



Switch contacts shown in detent position.

### Shaft Styles



TOLERANCES EXCEPT AS SHOWN: DECIMAL .XXX ± .128 FRACTION ± 1/64  
 .XX ± .005 ANGLE ± 5°

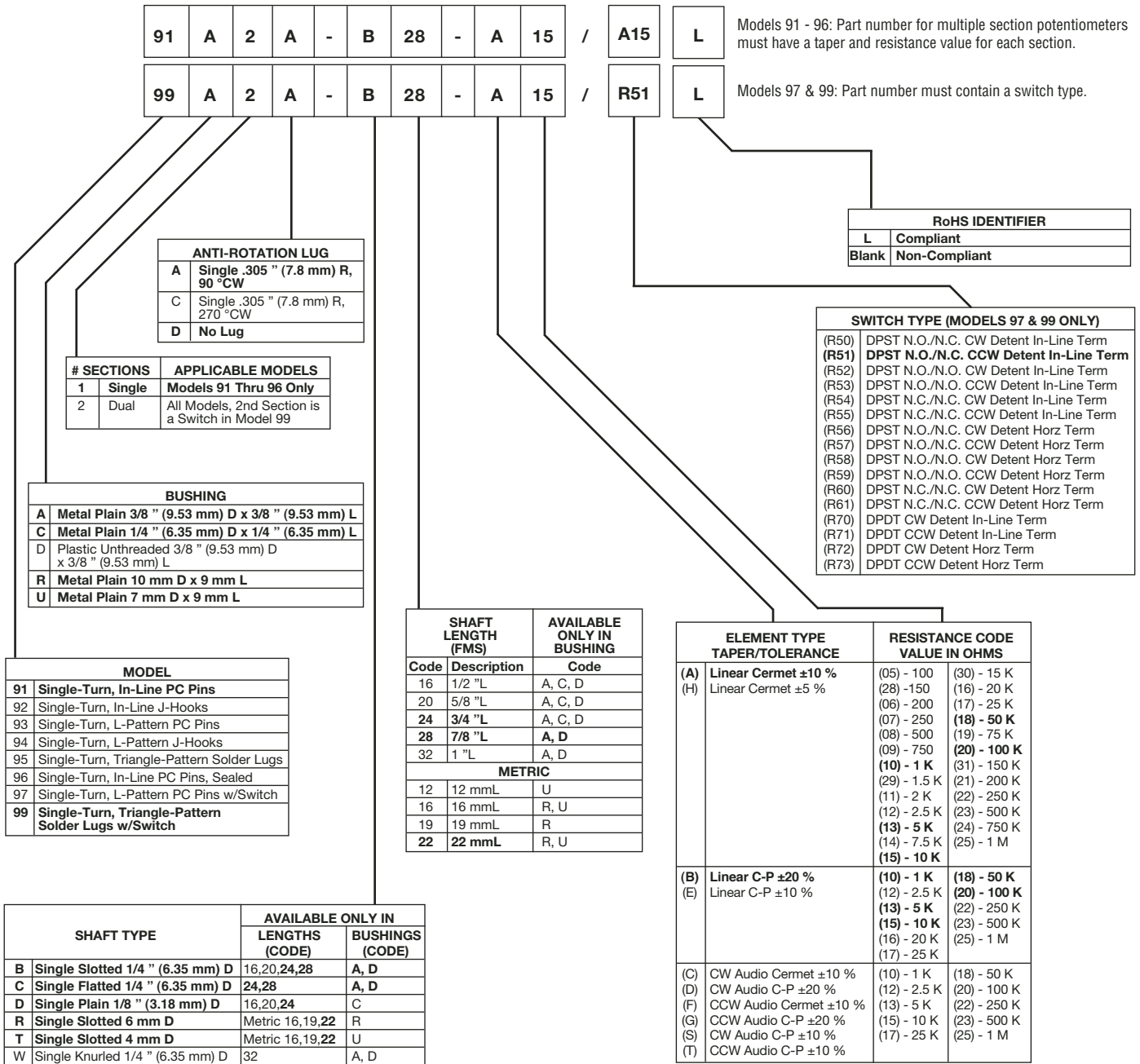
DIMENSIONS ARE:  $\frac{\text{MM}}{\text{(INCHES)}}$

\* DIMENSIONS ARE IN MM NOTE: FOR 19.05 (750) SHAFT - FLAT LENGTH IS 7.95 (.313)  
 FOR 22.23 (875) SHAFT - FLAT LENGTH IS 11.18 (.440)

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# How to Order 90 Series Panel Controls

**BOURNS®**



*Boldface features are Bourns standard options.  
All others are available with higher minimum order quantities.*