



## Features

- Available in a variety of pin-out configurations
- Virtually infinite electrical circuit isolation
- Metal or plastic shaft options
- RoHS compliant\*

## Model 91, 92, 93, 94 & 95 - 5/8 " Square Single-Turn Panel Control

| 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) 1 watt.....                    | (Linear tapers) 2 watts               |
|                                                                                   | (Audio tapers) 0.5 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                  |
| Environmental Characteristics <sup>1</sup>                                        |                                                |                                       |
| 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).....                                                   |                                                |                                       |
| Total Resistance Shift.....                                                       | ±2 % maximum.....                              | ±2 % maximum                          |
| Voltage Ratio Shift.....                                                          | ±5 % maximum.....                              | ±5 % maximum                          |
| Shock (Single Section).....                                                       |                                                |                                       |
| Total Resistance Shift.....                                                       | ±2 % maximum.....                              | ±2 % maximum                          |
| Voltage Ratio Shift.....                                                          | ±5 % maximum.....                              | ±5 % maximum                          |
| Load Life.....                                                                    |                                                |                                       |
| 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-202, 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.....                                                                    | IP 40.....                                     | IP 40                                 |

\*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.  
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## Model 91, 92, 93, 94 & 95 - 5/8 " Square Single-Turn Panel Control

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### 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 & 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 .....                                 | 1.7-2.0 N-m (15-18 lb.-in.) maximum                                                                            |
| Variation.....                                 | 0.35 N-cm (0.5 oz.-in.) maximum in 45 ° shaft travel                                                           |
| Weight (Single Section, Metal Bushing).....    | 12.7 grams nominal                                                                                             |
| (Each Additional Section) .....                | 4 grams nominal                                                                                                |
| 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: 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.

# Model 91, 92, 93, 94 & 95 - 5/8" Square Single-Turn Panel Control **BOURNS®**

## Product Dimensions

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



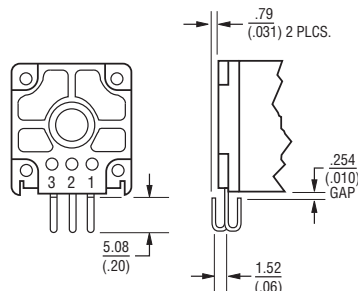
### Model 93 PC Pin Terminals, "L" Pattern



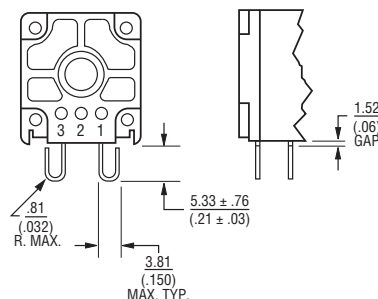
### Model 95 Solder Lug Terminals, "Triangular" Pattern



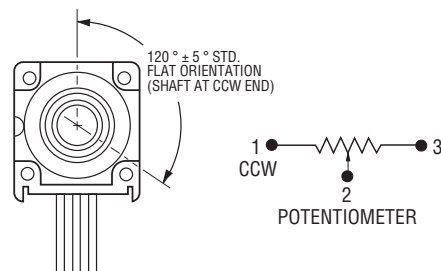
### Model 92 J-Hooked Terminals, In-Line



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



### Shaft Flat Orientation



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# Model 91, 92, 93, 94 & 95 - 5/8" Square Single-Turn Panel Control

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## Product Dimensions

### Plastic Shaft Styles

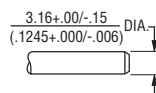
#### SHAFT TYPE "B" (USES BUSHING A)



STD. LENGTHS:

|                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|
| 12.70<br>(.500) | 15.88<br>(.625) | 19.05<br>(.750) | 22.23<br>(.875) |
|-----------------|-----------------|-----------------|-----------------|

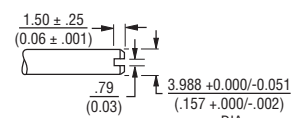
#### SHAFT TYPE "D" (USES BUSHING C)



STD. LENGTHS:

|                 |                 |                 |
|-----------------|-----------------|-----------------|
| 12.70<br>(.500) | 15.88<br>(.625) | 19.05<br>(.750) |
|-----------------|-----------------|-----------------|

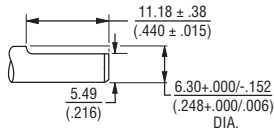
#### SHAFT TYPE "T" (USES BUSHING U)



STD. LENGTHS:

|                |                |
|----------------|----------------|
| 16.0<br>(.630) | 22.0<br>(.866) |
|----------------|----------------|

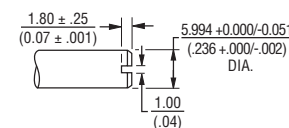
#### SHAFT TYPE "C" (USES BUSHING A)



STD. LENGTHS:

|                 |                 |
|-----------------|-----------------|
| 19.05<br>(.750) | 22.23<br>(.875) |
|-----------------|-----------------|

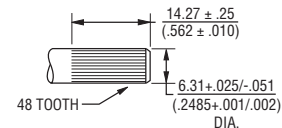
#### SHAFT TYPE "R" (USES BUSHING R)



STD. LENGTHS:

|                |                |
|----------------|----------------|
| 16.0<br>(.630) | 22.0<br>(.866) |
|----------------|----------------|

#### SHAFT TYPE "W" (USES BUSHING A)

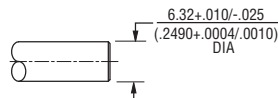


STD. LENGTHS:

|                 |
|-----------------|
| 25.40<br>(1.00) |
|-----------------|

### Metal Shaft Styles

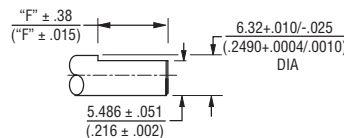
#### SHAFT TYPE "A" (USES BUSHING A)



STD. LENGTHS:

|                 |                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| 12.70<br>(.500) | 15.88<br>(.625) | 19.05<br>(.750) | 22.23<br>(.875) | 25.4<br>(1.000) |
|-----------------|-----------------|-----------------|-----------------|-----------------|

#### SHAFT TYPE "H" (USES BUSHING A)



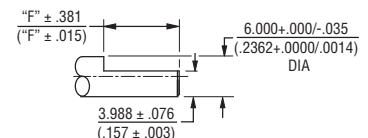
STD. LENGTHS:

|                 |                 |
|-----------------|-----------------|
| 19.05<br>(.750) | 22.23<br>(.875) |
|-----------------|-----------------|

FLAT LENGTH "F":

|                |                 |
|----------------|-----------------|
| 7.95<br>(.313) | 11.13<br>(.438) |
|----------------|-----------------|

#### SHAFT TYPE "S" (USES BUSHING R)



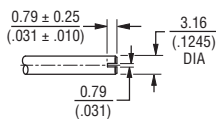
STD. LENGTHS:

|                |                |
|----------------|----------------|
| 16.0<br>(.630) | 22.0<br>(.866) |
|----------------|----------------|

FLAT LENGTH "F":

|                |                 |
|----------------|-----------------|
| 6.99<br>(.275) | 12.98<br>(.511) |
|----------------|-----------------|

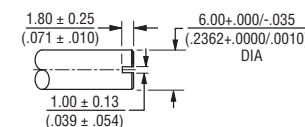
#### SHAFT TYPE "E" (USES BUSHING C)



STD. LENGTHS:

|                |                |                |
|----------------|----------------|----------------|
| 12.0<br>(.500) | 16.0<br>(.625) | 19.0<br>(.750) |
|----------------|----------------|----------------|

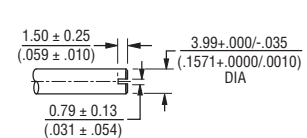
#### SHAFT TYPE "J" (USES BUSHING R)



STD. LENGTHS:

|                |                |
|----------------|----------------|
| 16.0<br>(.630) | 22.0<br>(.866) |
|----------------|----------------|

#### SHAFT TYPE "V" (USES BUSHING U)



STD. LENGTHS:

|                |                |
|----------------|----------------|
| 16.0<br>(.630) | 22.0<br>(.866) |
|----------------|----------------|

#### SHAFT TYPE "G" (USES BUSHING A)



STD. LENGTHS:

|                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|
| 12.70<br>(.500) | 15.88<br>(.625) | 19.05<br>(.750) | 22.23<br>(.875) |
|-----------------|-----------------|-----------------|-----------------|

TOLERANCES EXCEPT AS SHOWN: .XX = ± .02  
 .XXX = ± .005  
 .XXXX = ± .0005  
 .0127

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

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# How to Order Model 91, 92, 93, 94 & 95 Panel Controls

**BOURNS®**

91 A 2 A - A 28 - A 15 / A15 L

Part number for multiple section potentiometers must have a taper and resistance value for each section.

**ANTI-ROTATION LUG**

|   |                                  |
|---|----------------------------------|
| A | Single .305 " (7.8 mm) R, 90 °CW |
| D | No Lug                           |

**# SECTIONS**

|   |        |
|---|--------|
| 1 | Single |
| 2 | Dual   |

**BUSHING**

|   |                                                   |
|---|---------------------------------------------------|
| A | Metal Plain 3/8 " (9.53 mm) D x 3/8 " (9.53 mm) L |
| C | Metal Plain 1/4 " (6.35 mm) D x 1/4 " (6.35 mm) L |
| R | Metal Plain 10 mm D x 9 mm L                      |
| U | Metal Plain 7 mm D x 9 mm L                       |

**MODEL**

|    |                                           |
|----|-------------------------------------------|
| 91 | Single-Turn, In-Line PC Pins              |
| 92 | Single-Turn, In-Line J-Hooks              |
| 93 | Single-Turn, L-Pattern PC Pins            |
| 94 | Single-Turn, L-Pattern J-Hooks            |
| 95 | Single-Turn, Triangle-Pattern Solder Lugs |

**SHAFT LENGTH (FMS)**

| Code | Description | AVAILABLE ONLY IN BUSHING Code |
|------|-------------|--------------------------------|
| 16   | 1/2 "L      | A, C                           |
| 20   | 5/8 "L      | A, C                           |
| 24   | 3/4 "L      | A, C                           |
| 28   | 7/8 "L      | A                              |
| 32   | 1 "L        | A                              |

**METRIC**

|    |        |      |
|----|--------|------|
| 16 | 16 mmL | R, U |
| 22 | 22 mmL | R, U |

**SHAFT TYPE**

|   |                                          | AVAILABLE ONLY IN |                 |
|---|------------------------------------------|-------------------|-----------------|
|   |                                          | LENGTHS (CODE)    | BUSHINGS (CODE) |
| B | Plastic Single Slotted 1/4 " (6.35 mm) D | 16, 20, 24, 28    | A               |
| C | Plastic Single Flatted 1/4" (6.35 mm) D  | 24, 28            | A               |
| D | Plastic Single Plain 1/8" (3.18 mm) D    | 16, 20, 24        | C               |
| R | Plastic Single Slotted 6 mm D            | Metric 16, 22     | R               |
| T | Plastic Single Slotted 4 mm D            | Metric 16, 22     | U               |
| W | Plastic Single Knurled 1/4" (6.35 mm) D  | 32                | A               |
| A | Metal Single Plain 1/4" (6.35 mm) D      | 16, 20, 24        | A               |
| E | Metal Single Slotted 1/8" (3.18 mm) D    | 16, 20, 24        | C               |
| G | Metal Single Slotted 1/4" (6.35 mm) D    | 16, 20, 24, 28    | A               |
| H | Metal Single Flatted 1/4" (6.35 mm) D    | 24, 28            | A               |
| J | Metal Single Slotted 6 mm D              | Metric 16, 22     | R               |
| S | Metal Single Flatted 6 mm D              | Metric 16, 22     | R               |
| V | Metal Single Slotted 4 mm D              | Metric 16, 22     | U               |

**ELEMENT TAPER TYPE/TOLERANCE**

|     |                        |              |              |
|-----|------------------------|--------------|--------------|
| (A) | Linear Cermet ±10 %    | (05) - 100   | (30) - 15 K  |
| (H) | Linear Cermet ±5 %     | (28) - 150   | (16) - 20 K  |
|     |                        | (06) - 200   | (17) - 25 K  |
|     |                        | (07) - 250   | (18) - 50 K  |
|     |                        | (08) - 500   | (20) - 100 K |
|     |                        | (10) - 1 K   | (21) - 200 K |
|     |                        | (11) - 2 K   | (22) - 250 K |
|     |                        | (12) - 2.5 K | (23) - 500 K |
|     |                        | (13) - 5 K   | (25) - 1 M   |
|     |                        | (15) - 10 K  |              |
| (B) | Linear C-P ±20 %       | (10) - 1 K   | (18) - 50 K  |
| (E) | Linear C-P ±10 %       | (12) - 2.5 K | (20) - 100 K |
|     |                        | (13) - 5 K   | (22) - 250 K |
|     |                        | (15) - 10 K  | (23) - 500 K |
|     |                        | (16) - 20 K  | (25) - 1 M   |
|     |                        | (17) - 25 K  |              |
| (C) | CW Audio Cermet ±10 %  | (10) - 1 K   | (18) - 50 K  |
| (D) | CW Audio C-P ±20 %     | (12) - 2.5 K | (20) - 100 K |
| (F) | CCW Audio Cermet ±10 % | (13) - 5 K   | (22) - 250 K |
| (G) | CCW Audio C-P ±20 %    | (15) - 10 K  | (23) - 500 K |
| (S) | CW Audio C-P ±10 %     | (17) - 25 K  | (25) - 1 M   |
| (T) | CCW Audio C-P ± 10 %   |              |              |

**RESISTANCE CODE VALUE IN OHMS**

**RoHS IDENTIFIER**

|   |           |
|---|-----------|
| L | Compliant |
|---|-----------|

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

REV. 05/13

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