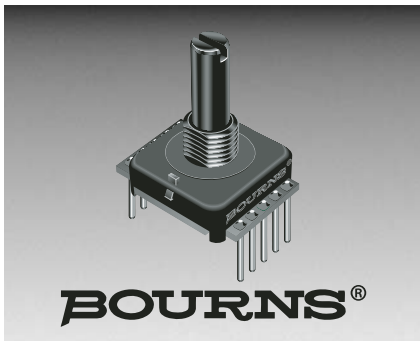




## Features

- Lead free
- Absolute encoder / gray code output
- Digital output
- Sturdy construction
- Bushing mount
- Available with PC board mounting bracket (optional)



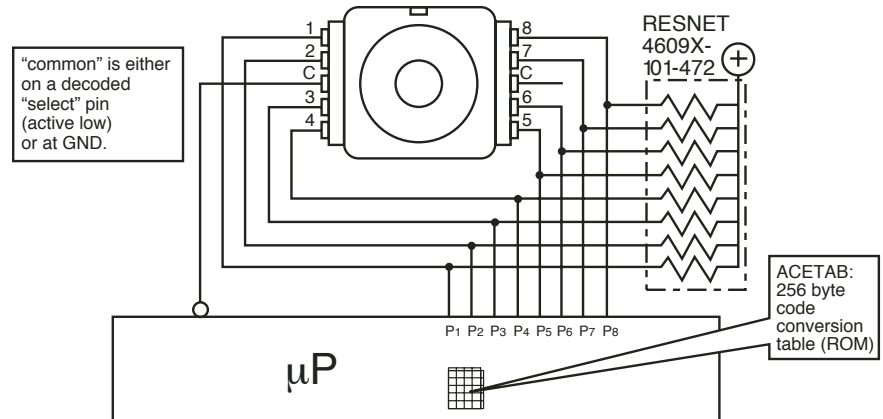
## EAW - Absolute Contacting Encoder (ACE™)

### General Information

Until now, the choice of an absolute encoder meant an expensive, and larger-sized product. Through the use of combinatorial mathematics, the gray-code pattern of the Bourns Absolute Contacting Encoder ACE™ is placed on a single track for a very economical, energy-efficient and compact product. Bourns' ACE™ provides an absolute digital output that will also retain its last position in the event of a power failure.

An intelligent alternative to incremental encoders and potentiometers, the Bourns ACE™ is ideally suited for many industrial, automotive, medical and consumer product applications.

### Recommended Control Diagram for ACE-128



### Electrical Characteristics

|                                                                |                                          |
|----------------------------------------------------------------|------------------------------------------|
| Output .....                                                   | 8-bit gray code with 128 absolute states |
| Closed Circuit Resistance .....                                | 5 ohms maximum                           |
| Open Circuit Resistance .....                                  | 100 K ohms minimum                       |
| Contact Rating .....                                           | 10 milliamp @ 10 VDC or 0.1 watt maximum |
| Insulation Resistance (500 VDC) .....                          | 1,000 megohms minimum                    |
| Dielectric Withstanding Voltage (MIL-STD-202 Method 301) ..... |                                          |
| Sea Level .....                                                | 1,000 VAC minimum                        |
| Electrical Travel .....                                        | Continuous                               |
| Contact Bounce (60 RPM) .....                                  | 2.7 milliseconds maximum*                |
| RPM (Operating) .....                                          | 120 maximum                              |

### Environmental Characteristics

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| Operating Temperature Range ..... | +1 °C to +85 °C (+34 °F to +185 °F)   |
| Storage Temperature Range .....   | -40 °C to +85 °C (-40 °F to +185 °F)  |
| Humidity .....                    | MIL-STD-202, Method 103B, Condition B |
| Vibration .....                   | 15 G                                  |
| Contact Bounce .....              | 0.1 millisecond maximum               |
| Shock .....                       | 50 G                                  |
| Contact Bounce .....              | 0.1 millisecond maximum               |
| Rotational Life .....             | 50,000 shaft revolutions minimum      |
| IP Rating .....                   | IP 40                                 |

### Mechanical Characteristics

|                                |                                                                                                           |
|--------------------------------|-----------------------------------------------------------------------------------------------------------|
| Mechanical Angle .....         | 360 ° Continuous                                                                                          |
| Running Torque .....           | 0.5 to 1.5 N-cm (0.75 to 2.50 oz-in.)                                                                     |
| Mounting Torque .....          | 79 N-cm (7 lb.-in.) maximum                                                                               |
| Shaft Side Load (Static) ..... | 4.5 kg (10 lbs.) minimum                                                                                  |
| Weight .....                   | Approximately 14 gms. (0.50 oz.)                                                                          |
| Terminals .....                | Printed circuit board terminals                                                                           |
| Soldering Condition .....      |                                                                                                           |
| Manual Soldering .....         | 96.5Sn/3.0Ag/0.5Cu solid wire or no-clean rosin cored wire<br>370 °C (700 °F) max. for 3 seconds          |
| Wave Soldering .....           | 96.5Sn/3.0Ag/0.5Cu solder with no-clean flux<br>260 °C (500 °F) max. for 5 seconds                        |
| Wash processes .....           | Not recommended                                                                                           |
| Marking .....                  | Manufacturer's name and trademark, part number, and date code.                                            |
| Hardware .....                 | One lockwasher and one mounting nut are shipped with each encoder, except where noted in the part number. |
| Packaging .....                | 45 pcs/tray                                                                                               |

\*High probability of missing gray codes with maximum bounce.

# EAW - Absolute Contacting Encoder (ACE™)

**BOURNS®**

## Pin Output Code For ACE-128

Bit/Pin correlation: b7 b6 b5 b4 b3 b2 b1 b0 = p8 p7 p6 p5 p4 p3 p2 p1

A binary "1" denotes an "open" switch and a binary "0" denotes a "closed" switch.

Positions 0-127 are seen by a clockwise rotation of the shaft.

| Position | p8 | p7 | p6 | p5 | p4 | p3 | p2 | p1 | Decimal Output |
|----------|----|----|----|----|----|----|----|----|----------------|
| 0        | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 127            |
| 1        | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 63             |
| 2        | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 62             |
| 3        | 0  | 0  | 1  | 1  | 1  | 0  | 1  | 0  | 58             |
| 4        | 0  | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 56             |
| 5        | 1  | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 184            |
| 6        | 1  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 152            |
| 7        | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 24             |
| 8        | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 8              |
| 9        | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 0  | 72             |
| 10       | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 1  | 73             |
| 11       | 0  | 1  | 0  | 0  | 1  | 1  | 0  | 1  | 77             |
| 12       | 0  | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 79             |
| 13       | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 15             |
| 14       | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 47             |
| 15       | 1  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 175            |
| 16       | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 191            |
| 17       | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 159            |
| 18       | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 31             |
| 19       | 0  | 0  | 0  | 1  | 1  | 1  | 0  | 1  | 29             |
| 20       | 0  | 0  | 0  | 1  | 1  | 1  | 0  | 0  | 28             |
| 21       | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 0  | 92             |
| 22       | 0  | 1  | 0  | 0  | 1  | 1  | 0  | 0  | 76             |
| 23       | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 12             |
| 24       | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 4              |
| 25       | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 36             |
| 26       | 1  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 164            |
| 27       | 1  | 0  | 1  | 0  | 0  | 1  | 1  | 0  | 166            |
| 28       | 1  | 0  | 1  | 0  | 0  | 1  | 1  | 1  | 167            |
| 29       | 1  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 135            |
| 30       | 1  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 151            |
| 31       | 1  | 1  | 0  | 1  | 0  | 1  | 1  | 1  | 215            |
| 32       | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 223            |
| 33       | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 207            |
| 34       | 1  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 143            |
| 35       | 1  | 0  | 0  | 0  | 1  | 1  | 1  | 0  | 142            |
| 36       | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 0  | 14             |
| 37       | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 46             |
| 38       | 0  | 0  | 1  | 0  | 0  | 1  | 1  | 0  | 38             |
| 39       | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 6              |
| 40       | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 2              |
| 41       | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 18             |
| 42       | 0  | 1  | 0  | 1  | 0  | 0  | 1  | 0  | 82             |
| 43       | 0  | 1  | 0  | 1  | 0  | 0  | 1  | 1  | 83             |
| 44       | 1  | 1  | 0  | 1  | 0  | 0  | 1  | 1  | 211            |
| 45       | 1  | 1  | 0  | 0  | 0  | 0  | 1  | 1  | 195            |
| 46       | 1  | 1  | 0  | 0  | 1  | 0  | 1  | 1  | 203            |
| 47       | 1  | 1  | 1  | 0  | 1  | 0  | 1  | 1  | 235            |
| 48       | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 239            |
| 49       | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 231            |
| 50       | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 1  | 199            |
| 51       | 0  | 1  | 0  | 0  | 0  | 1  | 1  | 1  | 71             |
| 52       | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 7              |
| 53       | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 23             |
| 54       | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 1  | 19             |
| 55       | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 3              |
| 56       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1              |
| 57       | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 9              |
| 58       | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 1  | 41             |
| 59       | 1  | 0  | 1  | 0  | 1  | 0  | 0  | 1  | 169            |
| 60       | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 1  | 233            |
| 61       | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 1  | 225            |
| 62       | 1  | 1  | 1  | 0  | 0  | 1  | 0  | 1  | 229            |
| 63       | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 1  | 245            |

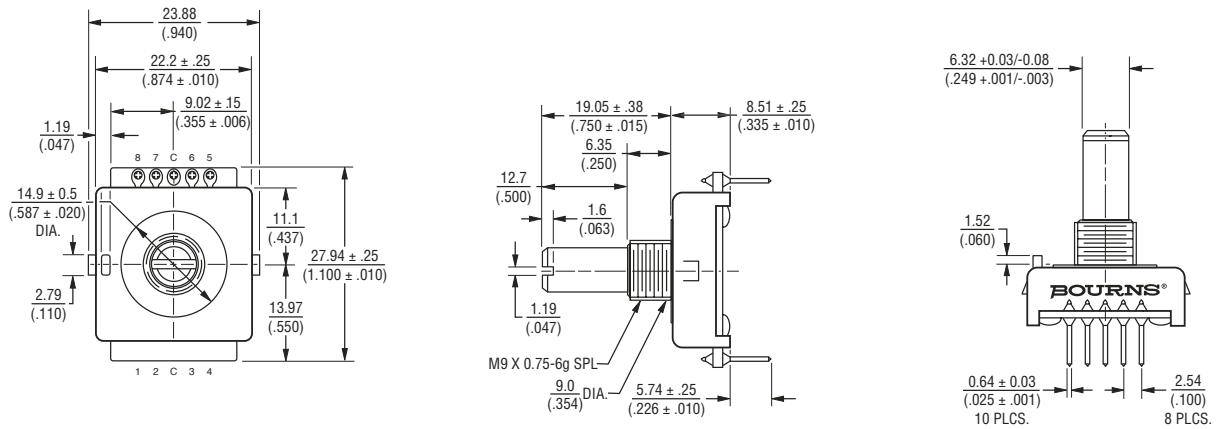
| Position | p8 | p7 | p6 | p5 | p4 | p3 | p2 | p1 | Decimal Output |
|----------|----|----|----|----|----|----|----|----|----------------|
| 64       | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 247            |
| 65       | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 243            |
| 66       | 1  | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 227            |
| 67       | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 1  | 163            |
| 68       | 1  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 131            |
| 69       | 1  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 139            |
| 70       | 1  | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 137            |
| 71       | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 129            |
| 72       | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 128            |
| 73       | 1  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 132            |
| 74       | 1  | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 148            |
| 75       | 1  | 1  | 0  | 1  | 0  | 1  | 0  | 0  | 212            |
| 76       | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 244            |
| 77       | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 240            |
| 78       | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 0  | 242            |
| 79       | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 250            |
| 80       | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 251            |
| 81       | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 249            |
| 82       | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 1  | 241            |
| 83       | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 209            |
| 84       | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 1  | 193            |
| 85       | 1  | 1  | 0  | 0  | 0  | 1  | 0  | 1  | 197            |
| 86       | 1  | 1  | 0  | 0  | 0  | 1  | 0  | 0  | 196            |
| 87       | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 192            |
| 88       | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 64             |
| 89       | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0  | 66             |
| 90       | 0  | 1  | 0  | 0  | 1  | 0  | 1  | 0  | 74             |
| 91       | 0  | 1  | 1  | 0  | 1  | 0  | 1  | 0  | 106            |
| 92       | 0  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 122            |
| 93       | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 120            |
| 94       | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 121            |
| 95       | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 125            |
| 96       | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 253            |
| 97       | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 252            |
| 98       | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 248            |
| 99       | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 232            |
| 100      | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 224            |
| 101      | 1  | 1  | 1  | 0  | 0  | 0  | 1  | 0  | 226            |
| 102      | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 0  | 98             |
| 103      | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 96             |
| 104      | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 32             |
| 105      | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 33             |
| 106      | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 1  | 37             |
| 107      | 0  | 0  | 1  | 1  | 0  | 1  | 0  | 1  | 53             |
| 108      | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 1  | 61             |
| 109      | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 60             |
| 110      | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 188            |
| 111      | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 190            |
| 112      | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 254            |
| 113      | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 126            |
| 114      | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 124            |
| 115      | 0  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 116            |
| 116      | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 112            |
| 117      | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 1  | 113            |
| 118      | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 49             |
| 119      | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 48             |
| 120      | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 16             |
| 121      | 1  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 144            |
| 122      | 1  | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 146            |
| 123      | 1  | 0  | 0  | 1  | 1  | 0  | 1  | 0  | 154            |
| 124      | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 158            |
| 125      | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 30             |
| 126      | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 94             |
| 127      | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 95             |

# EAW - Absolute Contacting Encoder (ACE™)

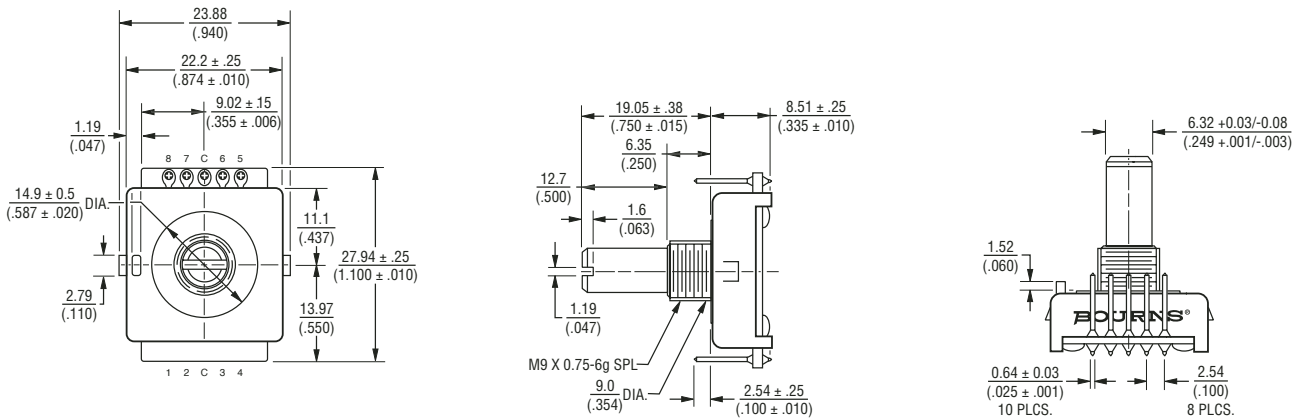
**BOURNS®**

## Dimensional Drawings

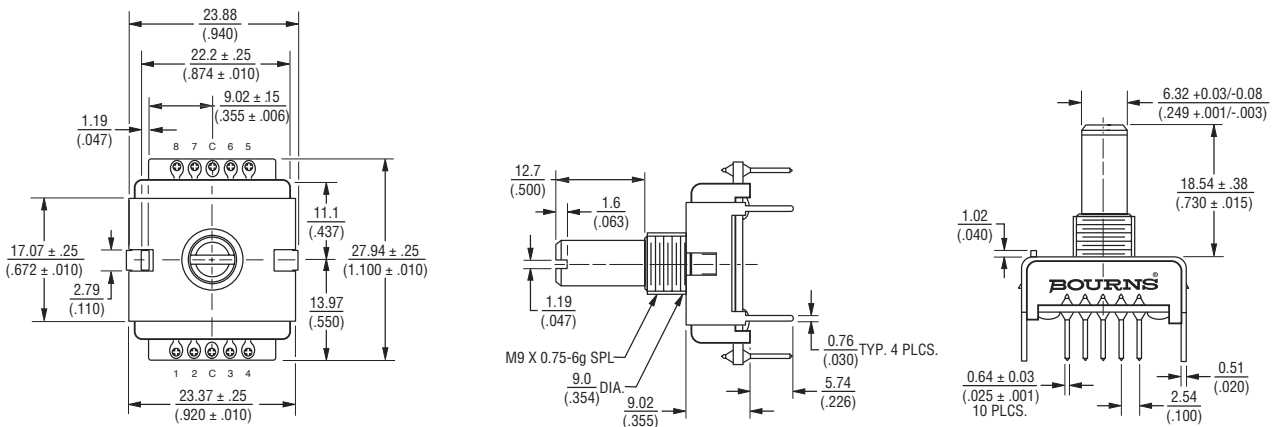
**Bushing Mounted: Housing A with Rear Facing Terminals**



**Bushing Mounted: Housing A with Forward Facing Terminals**



**PCB Bracket Mounted: Housing B**

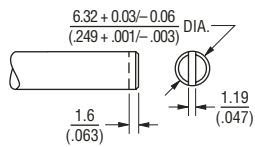


# EAW - Absolute Contacting Encoder (ACE™)

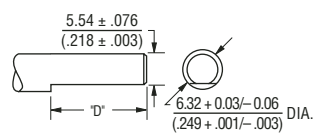
**BOURNS®**

## Dimensional Drawings

Shaft Style **B**

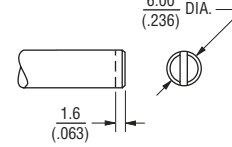


Shaft Style **C**



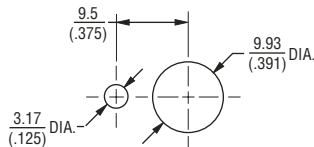
\*D\* DIMENSION EXTENDS FROM SHAFT END TO BUSHING FACE  
\*D\* = (SHAFT LENGTH, FMS) - (BUSHING LENGTH)

Shaft Style **R**

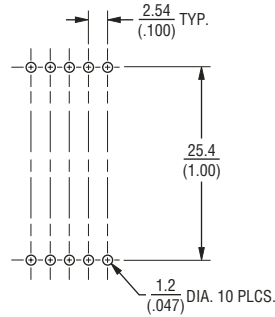


Bushing Mounted: Housing A with Rear Facing Terminals

Panel Hole Dimensions

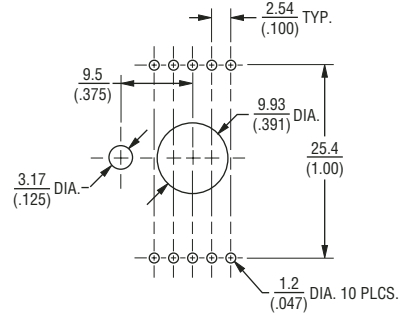


PCB Board Hole Pattern w/PCB Bracket



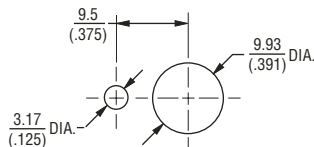
Bushing Mounted: Housing A with Forward Facing Terminals

PCB Board Hole Pattern w/PCB Bracket

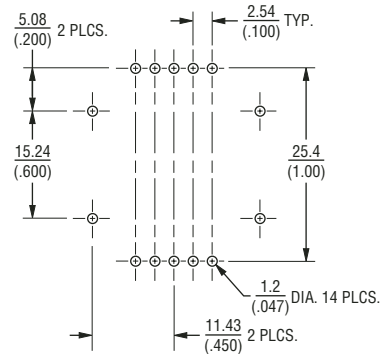


PCB Bracket Mounted: Housing B

Panel Hole Dimensions



PCB Board Hole Pattern w/PCB Bracket



TOLERANCES EXCEPT WHERE NOTED:

.XX = ±  $\frac{.51}{(.02)}$  .XXX = ±  $\frac{.127}{(.005)}$

DIMENSIONS:  $\frac{MM}{(IN)}$

# EAW - Absolute Contacting Encoder (ACE™)

**BOURNS®**

## How to Order

### PART NUMBERING SYSTEM

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | A | W | 0 | J | - | B | 2 | 4 | - | A | E | 0 | 1 | 2 | 8 | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Code | Rotational Life    |
|------|--------------------|
| A    | 50,000 Revolutions |

| BUSHING CONFIGURATION |                                                              |
|-----------------------|--------------------------------------------------------------|
| Code                  | Description                                                  |
| W                     | 9 mm x 1/4 " Length. Threaded M9x0.75                        |
| L                     | 9 mm x 3/8 " Length. Threaded M9x0.75<br>(Use B shaft only.) |

| DETENT CONFIGURATION |              |
|----------------------|--------------|
| Code                 | Description  |
| 0                    | Non-Detented |

| ANTI-ROTATION LUG POSITION |               |
|----------------------------|---------------|
| Code                       | Description   |
| J                          | 9:00 Position |
| D                          | None          |

| SHAFT STYLE (See Outline Drawing for Details) |                                       |
|-----------------------------------------------|---------------------------------------|
| Code                                          | Description                           |
| B                                             | Plain with Inserted Slot (1/4 " Dia.) |
| C                                             | Single Flatted (1/4 " Dia.)           |
| R                                             | Plain with Inserted Slot (6 mm Dia.)  |

| Code | Description |
|------|-------------|
| L    | Lead Free   |

| PERFORMANCE CODE |         |             |
|------------------|---------|-------------|
| Code             | Detents | States/Rev. |
| E0128            | 0       | 128         |

| HOUSING TERMINAL CONFIGURATION<br>(X indicates "Equipped With") |   |   |   |   |   |
|-----------------------------------------------------------------|---|---|---|---|---|
| Code                                                            |   |   |   |   |   |
| Features                                                        | A | B | C | H | K |
| Rear Mount Terminals                                            | X | X | X |   |   |
| Forward Facing Terminals                                        |   |   |   | X | X |
| PCB Bracket                                                     |   | X | X |   |   |
| Hardware Included                                               | X |   | X | X |   |

| SHAFT LENGTH (FMS) |                         |                        |
|--------------------|-------------------------|------------------------|
| Code               | Description             | Available Shaft Styles |
| 24                 | 3/4 " (19.05 mm) Length | B, C                   |
| Metric             |                         |                        |
| 19                 | 19 mm Length            | R                      |

The sample part number demonstrates the identification code for Bourns contacting encoders.  
The part number shown is a commonly used model, typically available from stock.

\*Consult factory concerning special inquiries.



*Sensors & Controls Division*

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