Data Sheet

Absolute contacting encoders (ACE™)

RS **stock number 263-2918**

Absolute encoder/gray code output

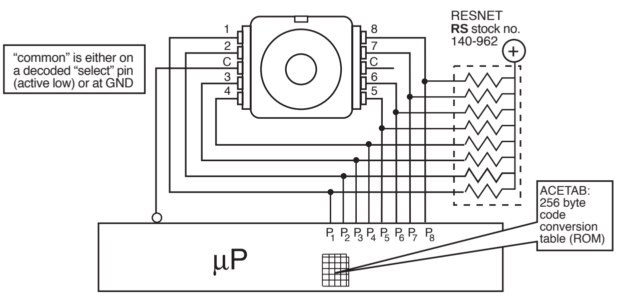
Features

- Digital output
- High operating temperature capabilities - up to 125ºC
- Sturdy construction
- Bushing mount
- PC board mounting bracket available

  Horizontal (RS stock no. 263-2867)

  Vertical (RS stock no. 263-2851).

Figure 1 Recommended control diagram



The Bourns Absolute Contacting Encoder (ACE™) is an absolute encoder implemented in a contacting technology.

The ACE-128 provides 128 angular positions that are directly converted to an 8-bit binary output. The ACE™ encoder emits a gray-code output sequence ensuring single bit transitions between states. The breakthrough technology on the ACE™ encoder places the code pattern on a single track. This ACE-128 design results in a compact footprint and a very economical product.

A special feature of an ACE™ encoder is that it assigns a unique, digitally encoded signal to each measured increment, which prevents erroneous readings. For example, if a power failure or transient malfunction occurs, the position can be ready when the power is restored without moving back to a reference position, as would be required with incremental encoders.

Unlike a traditional potentiometer which requires an A/D converter, the ACE™ encoder provides an absolute digital output. The absolute digital output simplifies the electronic circuit by allowing the micro-processor to be directly linked to the ACE™ encoder.

Prior to the development of the ACE™ encoder, digital absolute output could only be achieved by utilising a multitrack concept. Typically, multitrack encoders tend to be expensive, large, and much more complicated than the single track, gray-code concept used in the ACE™ encoder.

Since the ACE™ encoder offers a unique absolute output, sample rates can be much lower than traditional quadrature incremental encoders. This lower sample rate requires much less microprocessor time, resulting in lower overall power consumption.

Generally, the ACE™ encoder is well suited to any application where an absolute output must be interfaced with digital circuitry. Options include a direct connection to an 8-bit databus or an 8-bit input port, or to a serial bus via a dedicated expansion IC.

Applications include:

- Automotive climate controls
- Electronic toys and arcade games
- Measurement devices and gauges
- Mouse/trackball and joystick components
- Oscilloscope sensitivity, sweep, position and cursor controls
- Adjustment controls for radios
- Fader control on audio consoles
- Thermostat controls
- Any digital control bus-based system.

Some of the advantages of absolute encoders:

- Elimination of the A/D converter that is required with a potentiometer
- Detented lower resolutions could be used as function control switches, lowering overall cost when compared to traditional rotary switches
- Cost-effective pricing
- Compact, robust design
- Available in rotary or linear function control
- Simplified design - single-track gray code
- Adaptability of the sensor components and the shaft for customised solutions.

Dimensions

Figure 2 Bushing mounted

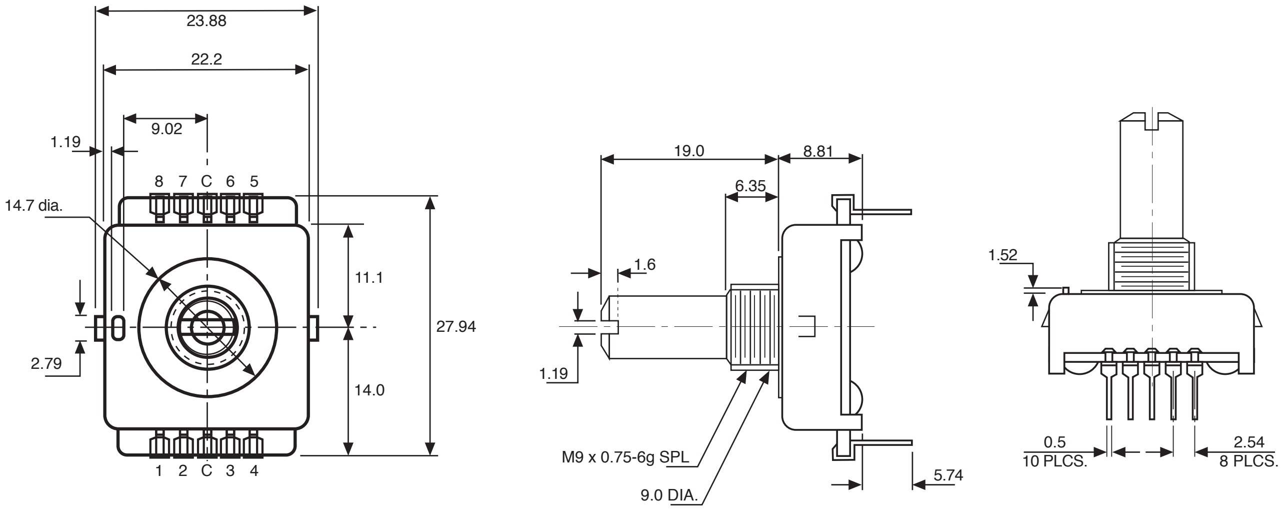


Figure 3 Shaft style B

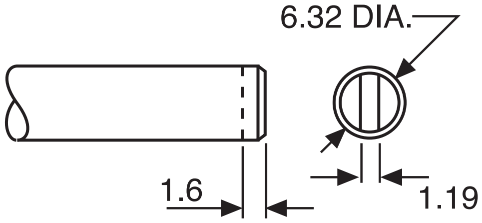


Figure 4 Panel hole dimensions

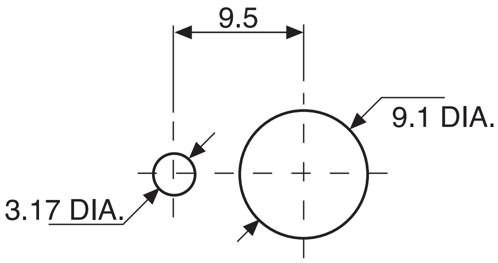
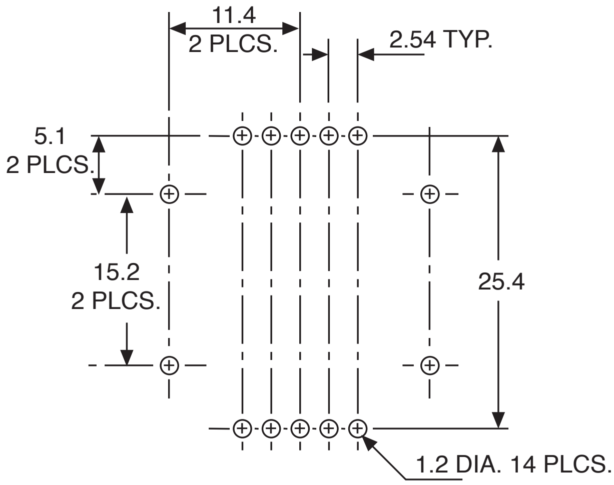


Figure 5 PCS board hole pattern W/PCB bracket



Pin output code

Bit/Pin correlation: 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

Specifications

Electrical characteristics

Output ________________8-bit gray code with absolute states
Closed circuit resistance ________________________5Ω max.
Open circuit resistance_______________________100KΩ Min.
Contact rating __________10mA (@ 10Vdc or 0.1 watt max.)
Insulation resistance (500Vdc) _____________1,000MΩ min.
Dielectric withstanding voltage __MIL-STD-202, method 301
Sea level _____________________________1,000Vac min.
Electrical travel ______________________________continuous
Contact bounce (60 RPM)_____________________2.7ms max.
RPM (operating)_______________________________120 max.

Environmental characteristics

Storage temperature range______________-40°C to +140°C
Operating temperature range____________-25°C to +125°C
Humidity _________MIL-STD-202, method 103B, condition B
Vibration ____15G
Contact bounce __________________________0.1ms max.
Shock ____50G
contact bounce __________________________0.1ms max.
Rotational life _____________________50,000 shaft revolutions

Mechanical characteristics

Mechanical angle ____________________________continuous
Weight _________________________________approx. 0.50oz.
Torque _______________________________0.75 to 2.50oz-in.
Mounting torque ___________________________7in-lbs. max.
Shaft side load (static) _______________________10lbs. min.

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