

# Rotational Position Transducer

CANbus • SAE J1939

Ranges: 0-45° to 0-200 Turns

Industrial Grade

# RT8CN

## Specification Summary:

### GENERAL

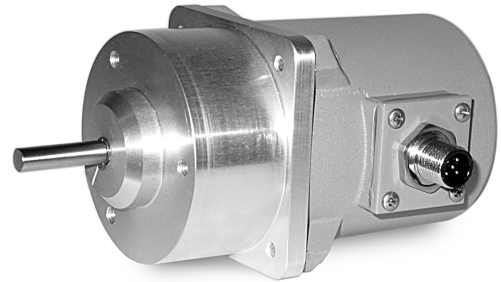
Full Stroke Ranges ..... 0-0.125 to 0-200 turns  
 Electrical Interface ..... CANbus SAE J1939  
 Protocol ..... Proprietary B  
 Accuracy ..... *see ordering information*  
 Repeatability .....  $\pm 0.02\%$  full stroke  
 Resolution .....  $\pm 0.003\%$  full stroke  
 Enclosure Material ..... powder-painted aluminum or stainless steel  
 Sensor ..... plastic-hybrid precision potentiometer  
 Shaft Loading ..... up to 10 lbs. radial and 5 lbs. axial  
 Starting Torque (25°C) ..... 2.0 in-oz., max  
 Weight, Aluminum (Stainless Steel) Enclosure ..... 3 lbs. (6 lbs.), max.

### ELECTRICAL

Input Voltage ..... 7 - 18 VDC  
 Input Current ..... 60 mA max.  
 Address Setting (Node ID) ..... 0..63 set via DIP Switches  
 Baud Rate ..... 125K, 250K or 500K set via DIP Switches  
 Update Rate ..... 10 ms. (20 ms. available—*contact factory*)

### ENVIRONMENTAL

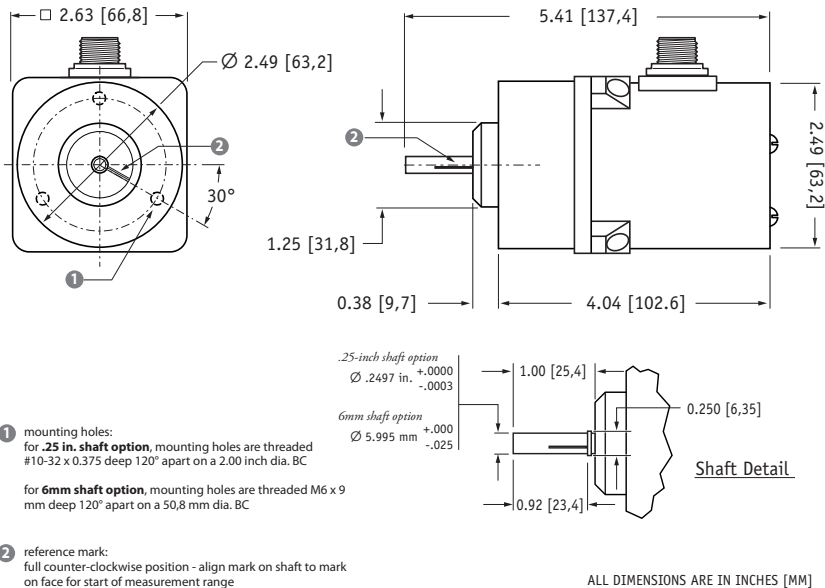
Environmental Suitability ..... NEMA 4/4X/6, IP67/68  
 Operating Temperature ..... -40° to 185°F  
 Vibration ..... up to 10 G's to 2000 Hz maximum



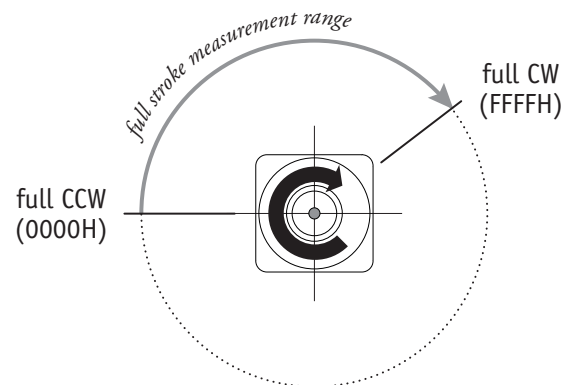
Celesco's model RT8CN communicates rotational position feedback to your PLC via the CANbus SAE J1939 interface. The heart of this sensor is a precision plastic-hybrid position potentiometer which provides a "absolute" position and does not ever have to be reset to a "home" position after a power loss or planned shutdown.

This innovative sensor from Celesco, designed to meet tough NEMA-4 and IP67 environmental standards, is available in full-stroke measurement ranges of 1/8 to 200 turns.

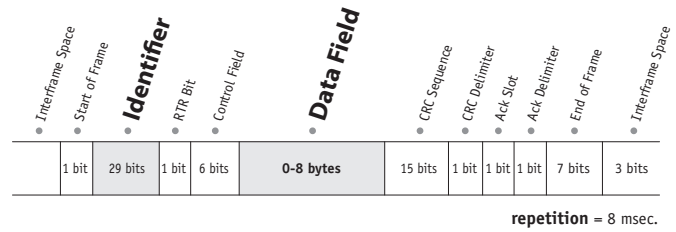
### Outline Drawing



### Output Signal



# I/O Format and Settings



## • Identifier

	Message Priority					Future Use		J1939 Reference Proprietary B								Data Field Type*								Not Used		Node ID**							
Example	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	0	0	1	1	1	1	1	1
Identifier Bit No.	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				
Hex Value	0					F		F								5								3		F							

\*Sensor field data can be factory set to customer specific value. \*\*Customer defined, set via Dips 1-6. Bit values shown for example only, see Address Setting below.

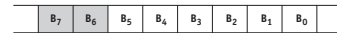
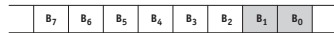
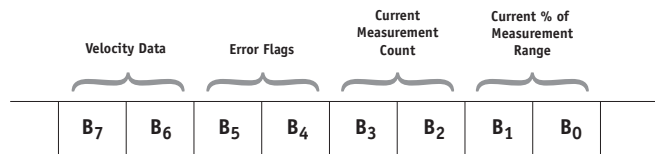
## • Data Field

**B<sub>0</sub>** = LSB current % of measurement range byte  
**B<sub>1</sub>** = MSB current % of measurement range byte

**B<sub>2</sub>** = LSB current measurement count byte  
**B<sub>3</sub>** = MSB current measurement count byte

**B<sub>4</sub>** = error flag  
**B<sub>5</sub>** = error flag

**B<sub>6</sub>** = LSB velocity data byte  
**B<sub>7</sub>** = MSB velocity data byte



### Current Measurement Count

The Current Measurement Count (CMC) is the output data that indicates the present position of the measuring cable. The CMC is a 16-bit value that occupies bytes **B<sub>2</sub>** and **B<sub>3</sub>** of the data field. **B<sub>2</sub>** is the **LSB** (least significant byte) and **B<sub>3</sub>** is the **MSB** (most significant byte).

The CMC starts at **0x0000** with the shaft in the full counter-clockwise position (at reference mark) and continues upward to the end of the stroke range stopping at **0xFFFF**. This holds true for all ranges.

### Converting CMC to Degrees

If required, the CMC can easily be converted a rotary measurement expressed in degrees instead of simply counts.

This is accomplished by first dividing the CMC by 65,535 (total counts over the range) and then multiplying that value by the FSR:

$$\left( \frac{\text{CMC}}{65,535} \right) \times \text{FSR}$$

Example:

If the full stroke range is **1 turn (360 degrees)** and the current position is **0x0FF2 (4082 Decimal)** then,

$$\left( \frac{4082}{65,535} \right) \times 360 \text{ degrees} = 22.4 \text{ degrees}$$

### Current % of Measurement Range

The Current % of Measurement Range is a 2-byte value that expresses the current linear position as a percentage of the entire full stroke range. Resolution is **.1 %** of the full stroke measurement range.

This value starts at **0x0000** at the beginning of the stroke and ends at **0x03E8**.

Example:

Hex	Decimal	Percent
0000	0000	0.0%
0001	0001	0.1%
0002	0002	0.2%
...	...	...
03E8	1000	100.0%



### Error Flags

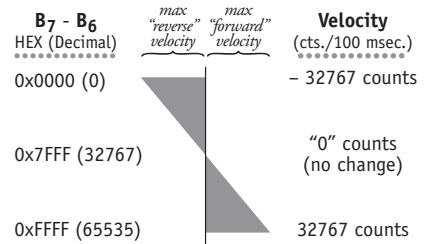
**0x55** (yellow LED on controller board) indicates that the sensor has begun to travel beyond the calibrated range of the internal position potentiometer.

**0xAA** (red LED on controller board) indicates that the sensor has moved well beyond the calibrated range of the internal position potentiometer.

If either error flag occurs within the full stroke range of the sensor, the unit should be returned to the factory for repair and recalibration.

### Velocity

Data in bytes **B<sub>7</sub>** - **B<sub>6</sub>** is the change and direction of the CMC (current measurement count) over a 100 msec time period. This data can then be used to calculate velocity and direction in a post processing operation.



### Velocity Calculation

$$\left( \frac{\text{count change} - 32767}{.1 \text{ sec. time period}} \right) \times \left( \frac{\text{full stroke range}}{65,535} \right)$$

### Sample Calculations

Clockwise Shaft Rotation (positive direction):

**B<sub>7</sub>-B<sub>6</sub> = 0x89C6 (43462 Dec.), full stroke = 1 Turn**

$$\left( \frac{35270 - 32767}{.1 \text{ sec}} \right) \times \left( \frac{1 \text{ Turn}}{65,535} \right) = .38 \text{ turns/sec.}$$

Counter-Clockwise Shaft Rotation (negative direction):

**B<sub>7</sub>-B<sub>6</sub> = 0x61A8 (25000 Dec.), full stroke = 1 Turn**

$$\left( \frac{25000 - 32767}{.1 \text{ sec}} \right) \times \left( \frac{1 \text{ Turn}}{65,535} \right) = -1.2 \text{ turns/sec.}$$

**Setting the Address (Node ID) and Baud Rate**

**Address Setting (Node ID)**

The Address Setting (Node ID) is set via 6 switches located on the 8-pole DIP switch found on the DeviceNET controller board located inside the transducer.

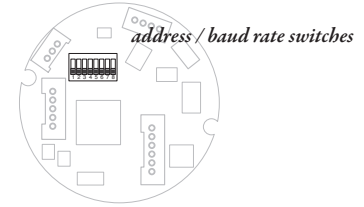
The DIP switch settings are binary starting with switch number 1 (= 2<sup>0</sup>) and ending with switch number 6 (= 2<sup>5</sup>).

**Baud Rate**

The transmission baud rate may be either factory preset at the time of order or set manually at the time of installation.

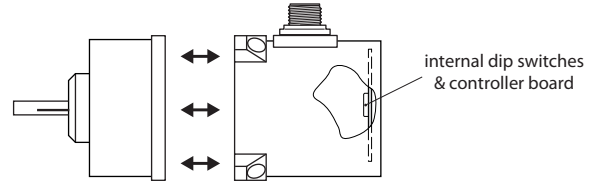
The baud rate can be set using switches 7 & 8 on the 8-pole DIP switch found on the DeviceNET controller board located inside the transducer.

**CANBus Controller Board**



DIP-1 (2 <sup>0</sup> )	DIP-2 (2 <sup>1</sup> )	DIP-3 (2 <sup>2</sup> )	DIP-4 (2 <sup>3</sup> )	DIP-5 (2 <sup>4</sup> )	DIP-6 (2 <sup>5</sup> )	address (decimal)
0	0	0	0	0	0	0
1	0	0	0	0	0	1
0	1	0	0	0	0	2
...	...	...	...	...	...	...
1	1	1	1	1	1	63

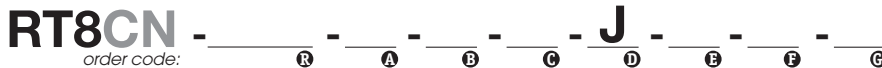
DIP-7	DIP-8	baud rate
0	0	125k
1	0	250k
0	1	500k
1	1	125k



to gain access to the controller board, remove four Allen-Head Screws and separate case halves

**Ordering Information:**

**Model Number:**



Sample Model Number:

**RT8CN - 100 - AL - 25 - FL - J - 500 - 32 - SC**

- R** range: 100 turns
- A** enclosure: powder-painted aluminum
- B** shaft: .25-in diameter
- C** mounting style: flange
- D** interface: CANbus SAE J1939
- E** baud rate: 500 k bits/sec.
- F** node ID: 32
- G** electrical connection: 5-meter cordset with straight plug

**Full Stroke Range:**

<b>R</b> order code:	<b>R125</b>	<b>R25</b>	<b>R50</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>5</b>	<b>10</b>	<b>20</b>
clockwise shaft rotations, min:	0.125	0.25	0.50	1	2	3	5	10	20
accuracy (% of f.s.):	1.25%	1.25%	0.5%	0.5%	0.5%	0.2%	0.2%	0.15%	0.15%
potentiometer cycle life*:	2.5 x 10 <sup>6</sup>	2.5 x 10 <sup>6</sup>	2.5 x 10 <sup>6</sup>	2.5 x 10 <sup>6</sup>	2.5 x 10 <sup>6</sup>	5 x 10 <sup>5</sup>	5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>

<b>R</b> order code:	<b>30</b>	<b>40</b>	<b>50</b>	<b>80</b>	<b>100</b>	<b>120</b>	<b>140</b>	<b>180</b>	<b>200</b>
clockwise shaft rotations, min:	30	40	50	80	100	120	140	180	200
accuracy (% of f.s.):	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%
potentiometer cycle life*:	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>	2.5 x 10 <sup>5</sup>





\*-number of times the sensor shaft can be cycled back and forth from beginning to end and back to the beginning before any measurable signal degradation may occur.

**Enclosure Material:**

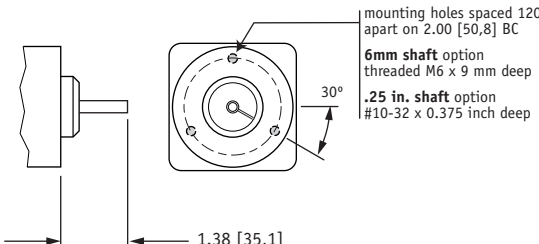
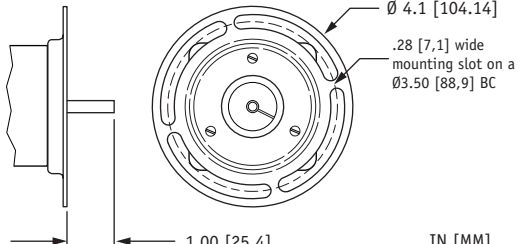
<b>A</b> order code:	<b>AL</b>	<b>SS</b>
	powder-painted aluminum	303 stainless steel

**Ordering Information:**

**Shaft Diameter:**

<b>B</b> order code:	<b>25</b>	<b>6</b>	<b>25F</b>	<b>6F</b>
	0.25-in. diameter	6 mm diameter	0.25-in. dia. w/flats	6 mm dia. w/flats
				
	.2497 in. (+.0000 -.0003)	5.995 mm (+.000 -.025)	0.33 in. $\leftarrow$ 0.025 in.	8.4 mm $\leftarrow$ 0.64 mm

**Mounting Style:**

<b>C</b> order code:	<b>FA</b>	<b>FM</b>
	face mount	flange mount
		
	mounting holes spaced 120° apart on 2.00 [50,8] BC 6mm shaft option threaded M6 x 9 mm deep .25 in. shaft option #10-32 x 0.375 inch deep	Ø 4.1 [104.14] .28 [7,1] wide mounting slot on a Ø3.50 [88,9] BC
	1.38 [35,1]	1.00 [25,4]
		IN [MM]

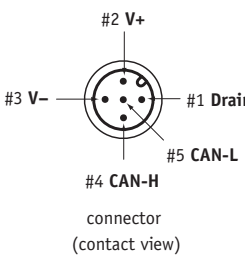


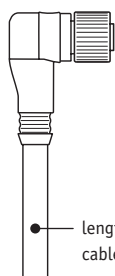
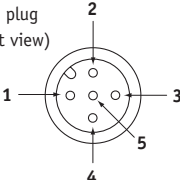
**Baud Rate:**

<b>E</b> order code:	<b>125</b>	<b>250</b>	<b>500</b>
	125 kbaud	250 kbaud	500 kbaud

**Node ID:**

<b>F</b> order code:	<b>0</b>	<b>1</b>	<b>2</b>	<b>...</b>	<b>62</b>	<b>63</b>
	select address (0 - 63 Decimal)					

**Electrical Connection:**

<b>G</b> order code:	<b>blank</b>	<b>MC5</b>	<b>SC5</b>	<b>NC5</b>																		
	5-pin micro-connector (no mating plug supplied)	5-pin micro-connector w/ mating plug	5-pin micro-connector and 5 meter length cordset w/straight mating plug	5-pin micro-connector and 5 meter length cordset w/90° mating plug																		
																						
		0.16" - 0.32" OD Cable (THIN)	length: 16ft [5M] cable: Thin	length: 16ft [5M] cable: Thin																		
																						
			<table border="1"> <thead> <tr> <th>pin</th> <th>signal</th> <th>wire color</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>drain</td> <td>brown</td> </tr> <tr> <td>2</td> <td>V+</td> <td>white</td> </tr> <tr> <td>3</td> <td>V-</td> <td>blue</td> </tr> <tr> <td>4</td> <td>Can-H</td> <td>black</td> </tr> <tr> <td>5</td> <td>Can-L</td> <td>grey</td> </tr> </tbody> </table>	pin	signal	wire color	1	drain	brown	2	V+	white	3	V-	blue	4	Can-H	black	5	Can-L	grey	
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