RT9CN

0–90° to 0–50 Turns • CANbus J1939

Industrial Grade Rotational Position Sensor
Absolute Rotary Position up to 50 turns
Aluminum or Stainless Steel Enclosure Options
IP68 / NEMA 6

GENERAL

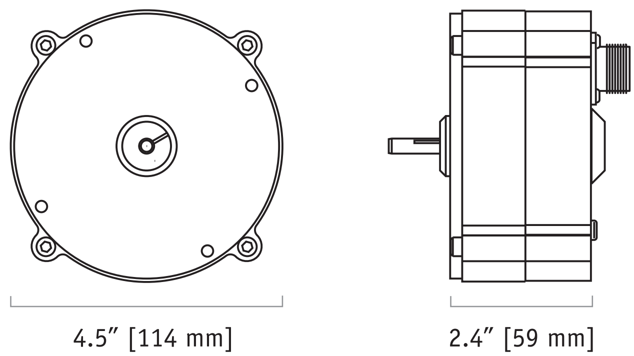
Full Stroke Range Options	0-0.25 to 0-50 turns
Electrial Interface	CANbus SAE J1939
Protocol	Proprietary B
Accuracy	see ordering information
Repeatability	± 0.05% full stroke
Resolution	essentially infinite
Enclosure Material Options	powder-painted aluminum or stainless steel
Sensor	plastic-hybrid precision potentiometer
Potentiometer Cycle Life	see ordering information
Shaft Loading	up to 35 lbs. radial and 5 lbs. axial
Weight, Aluminum (Stainless Steel) Enclosure	5 lbs. (10 lbs.) max.

ELECTRICAL

Input Voltage	see ordering information
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)
Thermal Effects, Span	0.01% f.s./°F, max.

ENVIRONMENTAL

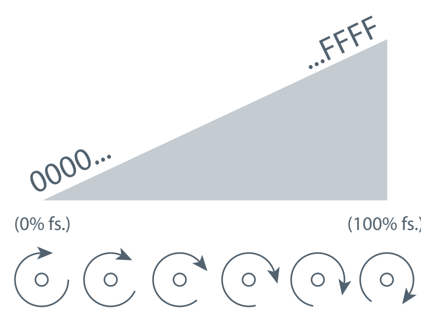
Enclosure	NEMA 4/4X/6, IP 67/68
Operating Temperature	-40° to 200°F (-40° to 90°C)
Vibration	up to 10 g to 2000 Hz maximum



Our model RT9CN 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 is designed to meet tough NEMA-4 and IP67 environmental standards, is available in full-stroke measurement ranges of 1/4 to 50 turns.

Output Signal:



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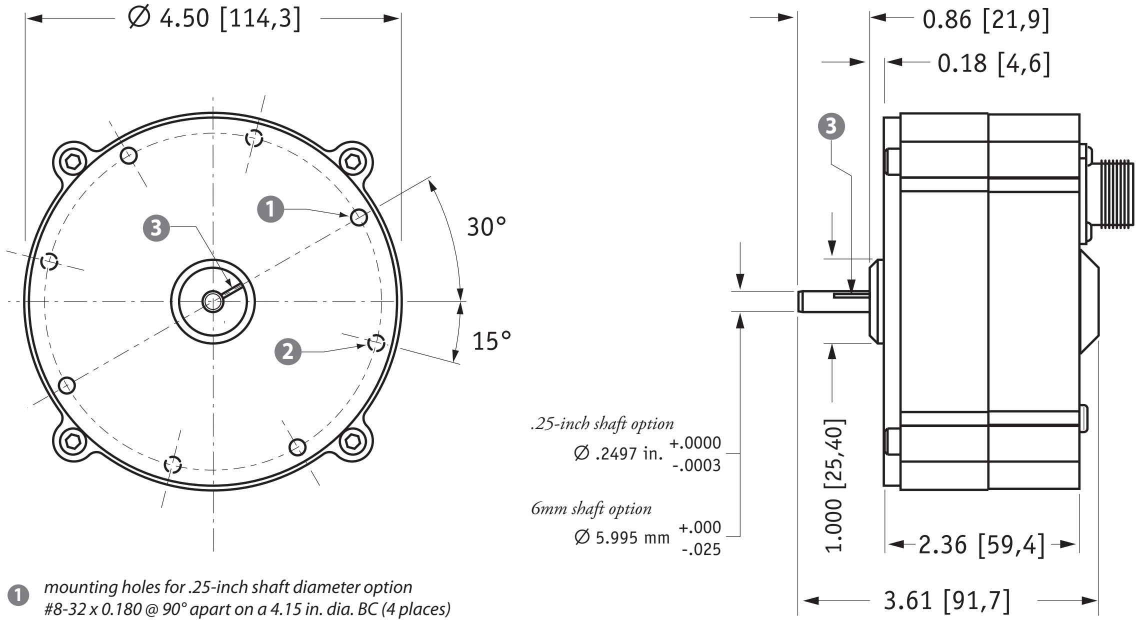
Outline Drawing:



1. *mounting holes for .25-inch shaft diameter option*
   #8-32 x 0.180 @ 90° apart on a 4.15 in. dia. BC (4 places)
2. *mounting holes for 6-mm shaft diameter option*
   M4 x 4,5 mm @ 90° apart on a 105,4 mm dia. BC (4 places)
3. *reference mark*
   full counter-clockwise position - align mark on shaft to mark on face for start of measurement range

DIMENSIONS ARE IN INCHES [MM]
tolerances are ±0.02 in. [±0,5 mm] unless otherwise noted

Ordering Information:

Model Number:

RT9CN - ___ - ___ - ___ - **J** - ___ - ___ - ___

order code: R A B C D E F

Sample Model Number:

RT9CN - 30 - AL - 25 - J - 500 - 32 - SC5

R	range:	30 turns
A	enclosure:	powder-painted aluminum
B	shaft:	.25-in diameter
C	interface:	CANbus SAE J1939
D	baud rate:	500 k bits/sec.
E	node ID:	32
F	electrical connection:	5-meter cordset with straight plug

Full Stroke Range:

R *order code:*	R25	R50	1	2	3	5	10	20	30	50
clockwise shaft rotations, min:	0.25	0.50	1	2	3	5	10	20	30	50
accuracy (% of f.s.):	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.15%	0.15%	0.15%	0.15%
potentiometer cycle life*:	2.5×10^6	2.5×10^6	2.5×10^6	2.5×10^6	2.5×10^6	5×10^5	2.5×10^5	2.5×10^5	2.5×10^5	2.5×10^5

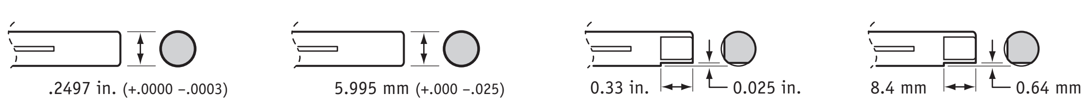
**–number of times the sensor shaft can be cycled back and forth from beginning to end and back to the beginning before any measurable signal degradation may occur.*

Enclosure Material:

A *order code:*	AL	SS
	powder-painted aluminum	303 stainless steel

Shaft Diameter:

B *order code:*	25	6	25F	6F
	0.25-in. diameter	6 mm diameter	0.25-in. dia. w/flats	6 mm dia. w/flats



Ordering Information (cont.):

Baud Rate:

D order code:

125	250	500
125 kbaud	250 kbaud	500 kbaud

Node ID:

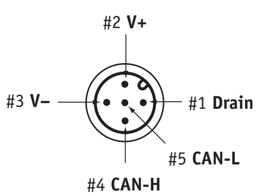
E order code: **0 1 2 ... 62 63**

select address (0 - 63 Decimal)

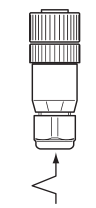
Electrical Connection:

F order code:

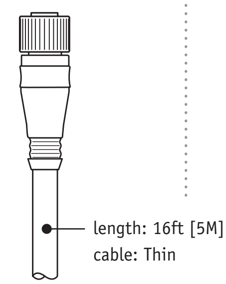
blank	MC5	SC5	NC5
5-pin micro-connector *(no mating plug supplied)*	5-pin micro-connector w/ mating plug	5-pin micro-connector and 5 meter length cordset w/straight mating plug	5-pin micro-connector and 5 meter length cordset w/90° mating plug

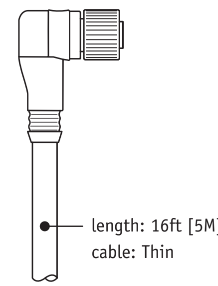


connector
(contact view)

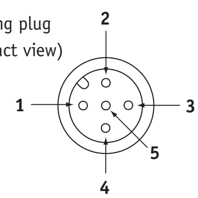


0.16" - 0.32" OD Cable (THIN)





mating plug
(contact view)



pin	signal	wire color
1	drain	brown
2	V+	white
3	V-	blue
4	Can-H	black
5	Can-L	grey

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.

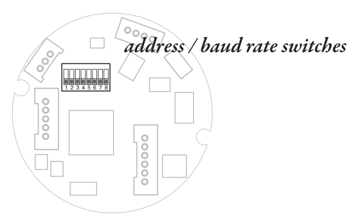
The DIP switch settings are binary starting with switch number **1** (= 2^0) and ending with switch number **6** (= 2^5).

Baud Rate

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

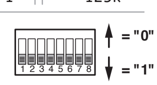
The baud rate can be set using switches **7** & **8** on the 8-pole DIP switch found on the DeviceNET controller board located inside the transducer.

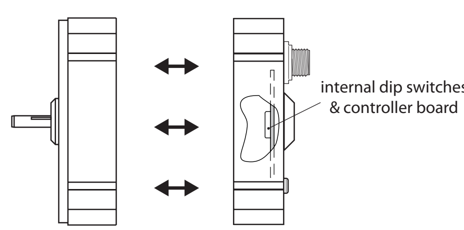
CANBus Controller Board



DIP-1 (2^0)	DIP-2 (2^1)	DIP-3 (2^2)	DIP-4 (2^3)	DIP-5 (2^4)	DIP-6 (2^5)	*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

I/O Format and Settings

Interframe Space	Start of Frame	**Identifier**	RTR Bit	Control Field	**Data Field**	CRC Sequence	CRC Delimiter	Ack Slot	Ack Delimiter	End of Frame	Interframe Space
	1 bit	29 bits	1 bit	6 bits	**0-8 bytes**	15 bits	1 bit	1 bit	1 bit	7 bits	3 bits

repetition = 8 msec.

• 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	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				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_0 = LSB current % of measurement range byte
B_1 = MSB current % of measurement range byte

B_2 = LSB current measurement count byte
B_3 = MSB current measurement count byte

B_4 = error flag
B_5 = error flag

B_6 = LSB velocity data byte
B_7 = MSB velocity data byte

Velocity Data		Error Flags		Current Measurement Count		Current % of Measurement Range	
B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0

B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0

Current Measurement Count

The **C**urrent **M**easurement **C**ount (**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_2** and **B_3** of the data field. **B_2** is the **LSB** (least significant byte) and **B_3** 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:

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

Example:

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

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

B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0

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%

B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_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.

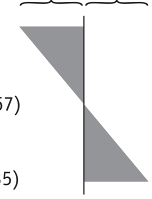
If either error flag occurs within the full stroke range of the sensor, the unit should be returned to the factory for repair and recalibration.

B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0

Velocity

Data in bytes **B_7 - B_6** 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.

B_7 - B_6 HEX (Decimal)	*max "reverse" velocity*	*max "forward" velocity*	**Velocity** (cts./100 msec.)
0x0000 (0)			– 32767 counts
0x7FFF (32767)			"0" counts (no change)
0xFFFF (65535)			32767 counts



Velocity Calculation

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

Sample Calculations

Clockwise Shaft Rotation (positive direction):

B_7–B_6 = 0x89C6 (43462 Dec.), **full stroke = 1 Turn**

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

Counter-Clockwise Shaft Rotation (negative direction):

B_7–B_6 = 0x61A8 (25000 Dec.), **full stroke = 1 Turn**

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

version: **6.0** last updated: **March 1, 2014**