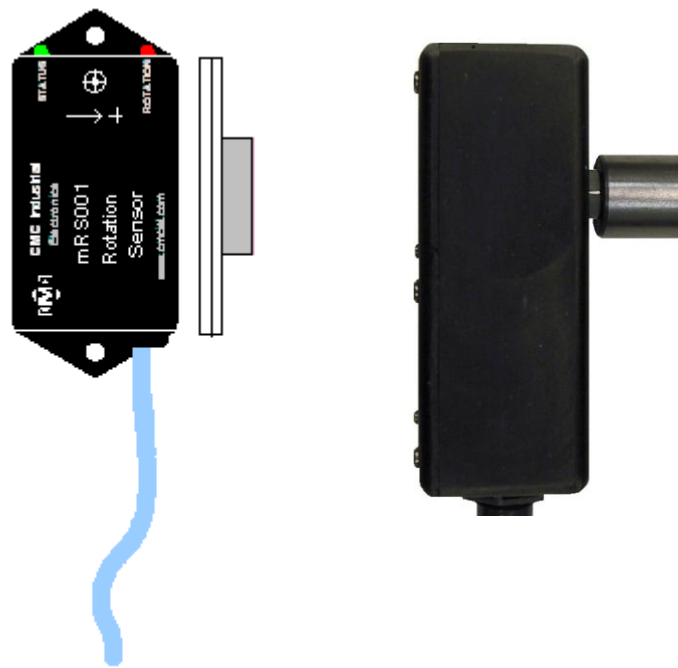




ROTATION SENSOR
1-WIRE[®] INTRINSICALLY SAFE

mRS001

mRS001 Rotation Sensor



Document No. 10678, Revision F

December 2010

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Revision Notes

First Release – January 21, 2005

Revision A – May 11, 2005

- Miscellaneous text changes and update dimensions drawing

Revision B – May 20, 2005

- Update mechanical installation details to include grommet mounting system

Revision C – May 20, 2005

- Update illustration showing new code wheel

Revision D – April 17, 2008

- Add the mRS001-EK to the manual

Revision E – December 17, 2010

- Update exploded view drawing 11031

Revision F – January 24, 2012

- Update parts list drawing 11031



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1. Overview

The mRS001 Rotation Sensor is designed to determine the shaft speed of rotating devices. Measurements from 1 to 1000 RPM are possible. The device uses a unique code wheel that attaches to the shaft with a single ¼" or 6mm screw. A rugged shaft mounted housing, the mRS001-EK, is available to facilitate mounting to the machine's output shaft. The housing is free hanging and does not require any brackets or safety shields. Alternately a high force magnet assembly, the mRS001-MG, is available to attach the code wheel to the machine's output shaft.

Each sensor has a unique digital serial number and will be automatically recognized by CMCIEL Bus Converters. Communications utilize the Dallas 1-Wire[®] bus standard. Power for the sensor is supplied by the bus system.

The sensors are packaged in an industrial grade plastic housing utilizing a fully potted construction. Each sensor comes complete with 2 meters of heavy-duty industrial cable rated for use in direct sunlight. The cable is terminated with an RJ-11 connector for direct connection to CMCIEL wiring accessories.

When used with the mBC081 Bus Converter the device is Intrinsically Safe.



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2. Description of Indicators

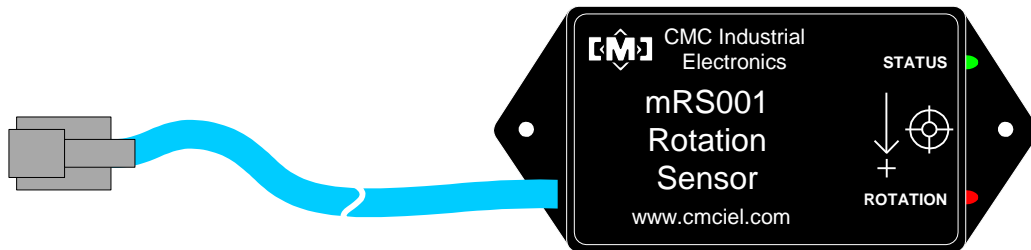


Figure 1 - Illustration of Indicators

The sensor requires no settings. There are 2 indicator lamps:

Description	Color	Flash Rate	Operation
Status	Green	1	Ok, no communications
		2	Ok, communication active
		3	Power on self test fault
		4	Calibration parameter fault
		5	Firmware fault
		6	Serial number fault
Rotation	Red	-	Flashes whenever a code wheel magnet crossing is detected



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3. Installation

The rotation sensor can be mounted using a fabricated bracket or a factory manufactured enclosure kit, the mRS001-EK. The mRS001-EK is a free-standing enclosure that hangs from the drive shaft of the device. No brackets or guards are required.

3.1 Mounting using the mRS001-EK

The following is required before attempting installation:

1. The shaft of the rotating device must be drilled and tapped with a 1/2" x 13 threaded hole to a depth of at least 1.5". It is extremely important to ensure this hole is centered and parallel to shaft. Excessive eccentricity will cause excess bearing wear or damage;
2. A field interconnect must be located within 1.8m of the rotation sensor;
3. The direction of the rotating shaft must be known.

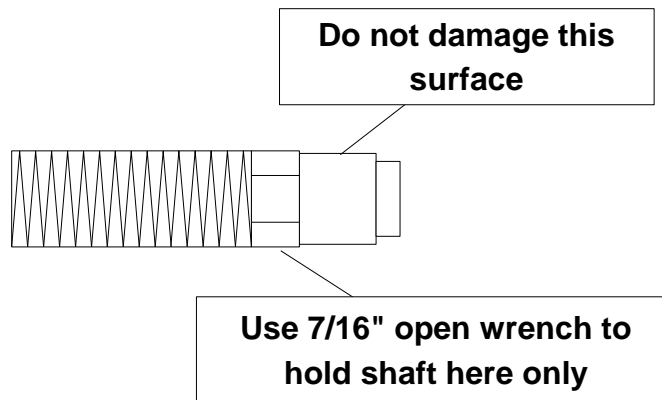
See drawing 11031 in Appendix 1 for an exploded view of the enclosure with item numbers and mounting details. The following steps are required to install the housing:

1. Unpack the mRS001 Rotation Sensor and the mRS001-EK Housing Kit and check the supplied parts with the parts list on page 3 of drawing 11031.
2. Install the drive shaft (item 1) in the machine's output shaft. Thread the shaft as far as possible into the shaft. Secure the shaft with a 7/16" open end wrench and tighten the jam nut (item 20) to secure the shaft;

Caution:

Do not clamp, hold or damage the drive shaft seal area shown below.

Damaging these surfaces will destroy the shaft seal.





- Determine the direction of rotation of the shaft. The rotation sensor can be mounted either on the main housing or on the lid depending on the direction of rotation.

If the shaft is turning counter-clockwise when facing the installed sensor drive shaft, mount the rotation sensor in the main housing. First pass the sensors cable through the conduit opening in the base of the enclosure and place the sensor in position in the housing. The rubber grommets should be against the inside of the housing. Use the 2 - 4-40 x 1" screws (item 2) supplied with the rotation sensor to mount the sensor. Install the screws from the outside of the main housing; pass them through the sensor; the flat washer (item 7) and finally the ny-lock nut (item 8). Tighten to compress the rubber grommets 1/16". Use the 2 - 4-40 x 3/4" screws (item 17) and nylock nuts (item 19) supplied with the enclosure to plug the 2 small holes in the enclosures lid.

If the shaft is turning clockwise when facing the installed sensor drive shaft, mount the rotation sensor in the lid of the housing. Do not install the cable in the housing at this time. Use the 2 - 4-40 x 3/4" screws (item 17) supplied with the housing to mount the sensor. Install the screws from the outside of the lid, pass them through the sensor, the flat washer (item 7) and finally the ny-lock nut (item 19). Tighten to compress the rubber grommets 1/16". Use the 2 - 4-40 x 1" screws (item 2) and nylock nuts (item 8) supplied with the sensor to plug the 2 small holes in the main housing.

Caution:

Using the 1" screws to mount the sensor in the lid will cause permanent damage to the code wheel assembly.

- Prepare the code wheel assembly by placing the star washer (item 12) and flat washer (item 21) on the 1/4" x 20 x 1.5" socket head cap screw (item no. 13) and then threading the screw into the code wheel. The screw head should be on the recessed side of the code wheel with the flat washer against the code wheel. Slide the bushing (item no. 10) on the screw with the narrow end of the bushing away from the code wheel.
- Inspect the code wheel shaft and housing seal for damage, if either is damaged do not install the housing. Carefully push the housing on the drive shaft. Be careful not to damage the rubber seal in the housing. Rock the housing back and forth to ensure the seal is free and not pinched by the shaft as you are pressing the shaft into the seal and bearing.
- Apply removable thread locking compound to the threads of the code wheel screw and thread it into the drive shaft. Ensure the bearing and seal have not been damaged and that the drive shaft and bushing are fully engaged in the bearing. Tighten the screw to 50 inch-pounds of torque. The enclosure should rotate freely back and forth on the drive shaft.



Caution:

Over tightening the shaft screw will permanently damage the plastic code wheel. Use a torque wrench to tighten the screw to the required 50 inch-pounds torque and be certain to use removable thread locking compound on the screw threads. Failure to observe these requirements may result in the shaft separating from the machine.

7. If the sensor was installed in the lid, thread the cable into the conduit opening on the bottom of the housing. Carefully apply the gasket to the lid using the screws to hold the gasket in place. Screw the lid to the main housing using the 6 - #8 x 1" self-tapping screws. Tighten the screws carefully to compress the gasket. Do not over tighten the screws. Examine the lid of the enclosure to insure the gasket remained in place and is fully compressed.
8. Start the machine and observe the shaft and housing. There should be a minimum of eccentricity and the housing should stationary and free of vibration. Verify the sensors output with the known speed of rotation of the shaft.



Figure 2 – Typical mRS001-EK Mounting



3.2 Mounting using a fabricated bracket

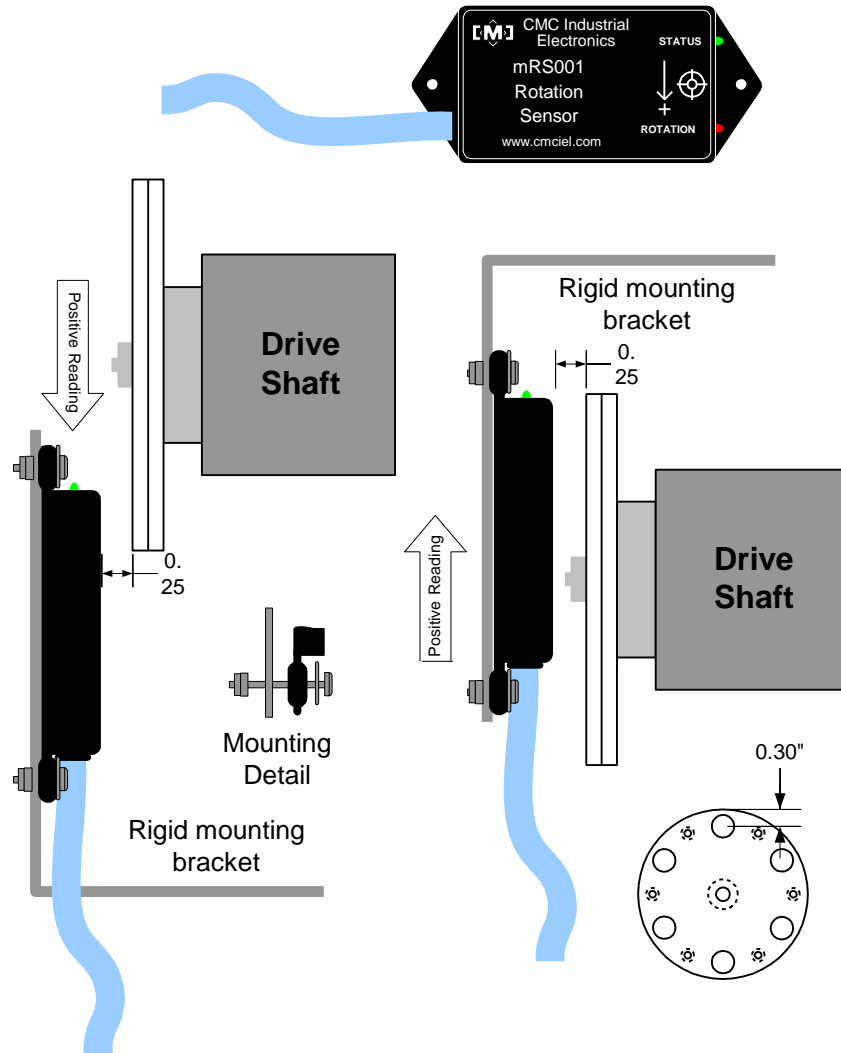


Figure 3 - Typical Fabricated Installations

The encoder wheel target is located on the sensors face. Mount the sensor to the bracket using the supplied 4-40 x 1" screws with flat washers and nylon locking nut as shown above. Tighten screws to compress the grommet 1/16". Do not over tighten the screws. Install the

sensor so the code wheel magnet centers pass over the sensor's target mark with an average distance from the code wheel of 0.25" to 0.40". The direction the magnets move across the sensor face sensor determines the rotation direction. Observe the direction arrow on the face of



the sensor. An optional magnet assembly is available to attach the code wheel to the machines shaft. Order part number mRS001-MG.

***** IMPORTANT SAFETY NOTICE *****

1. **The mounting bracket for sensor must be rigid and able to withstand loads from unexpected sources such as personnel standing or leaning against the bracket.**
2. **The mounting surface for the code wheel must be flat and perpendicular to the shaft.**
3. **Safety guards may be required to protect from personal injury from rotating components or the disengagement of the code wheel.**

It is the sole responsibility of the installer to ensure the mounting method and safety guards meet the requirements of the local building codes and safety agencies.

***** PERSONAL INJURY WARNING *****

The optional magnet used to attach the code wheel to the shaft has a very strong attractive force and will move suddenly and with great force towards any ferrous or magnetic material. Use extreme caution when handling the code wheel.



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4. Communications

The mRS001 Rotation Sensor is a fully compliant Dallas 1-Wire[®] device. The sensor is supplied with 2m of cable terminated with a RJ-11 plug. The sensor connects to the CMCIEL wiring system through a CMCIEL Field Interconnect.

The output of the sensor is a single signed 16 bit word. The resolution is 1 RPM and the range is 1 to 1000 RPM. The reading is averaged and updated once per second for RPM's greater than 10. For RPM's less than 10, the pulse frequency determines the update rate.

The sensor detects the direction of rotation and will provide a negative value for reverse rotations. Observe the arrow next to the target on the sensor to determine the positive rotation direction.

The sensor requires a bus converter to convert the Dallas 1-Wire[®] signaling system to a system recognized by commercial programmable controllers. The Bus Converters provide a Modbus485 RTU interface. CMCIEL manufactures Bus Converters for both commercial and hazardous areas. The RPM is represented as a single signed word in the Bus Converter Modbus register map. The Bus Converters will automatically acquire the serial number of the sensor on request.

As a Dallas 1-Wire[®] device, the sensor value is returned using the read scratch function as 3 bytes, the first 2 bytes a signed word containing the RPM and the 3rd byte the Dallas 1-Wire[®] - 8 bit CRC. The family code for the sensor is 160 decimal or A0 Hex. The sensor responds to the following Dallas function codes:

Code Decimal	Code Hex	Function
240	F0	Search ROM
85	55	Match ROM
15	0F	Read ROM
51	33	Read ROM
204	CC	Skip ROM
190	BE	Read Scratch, 3 bytes, low byte + high byte + Dallas 8 bit CRC

Refer to Dallas Semiconductor documentation for complete details on the operation of the Dallas 1-Wire[®] signaling system.

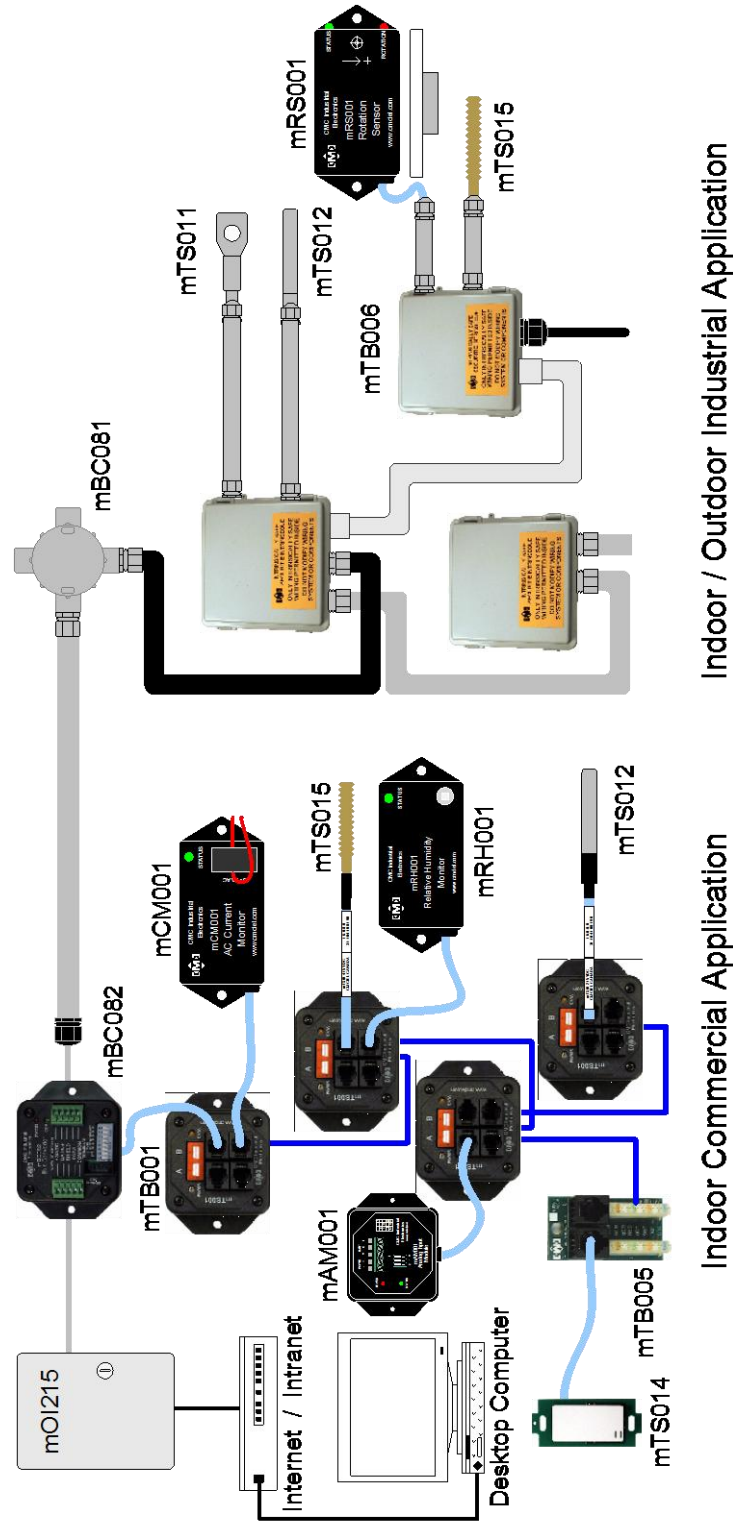


Figure 4 - Typical Network Layout



5. Specifications

Description	Characteristic
Sensor bus	
Voltage	5 VDC
Current	3.0 mA max
Communications	1-Wire [®] Bus
Position	
Resolution	1 - 1000 RPM
Accuracy	1.0% full scale
Quadrature Magnetic Encoder	6 divisions/revolution
Environment	
Temperature	-40 to 70°C (-40 to 158°F)
Relative Humidity	0 to 95% non-condensing
Sensor Dimensions	
Length	74mm (2.9in)
Width	33mm (1.3in)
Depth	12mm (0.45in)
Housing Kit Dimensions	
Length	152mm (6.0in)
Width	102mm (4.0in)
Depth	51mm (2.0in)



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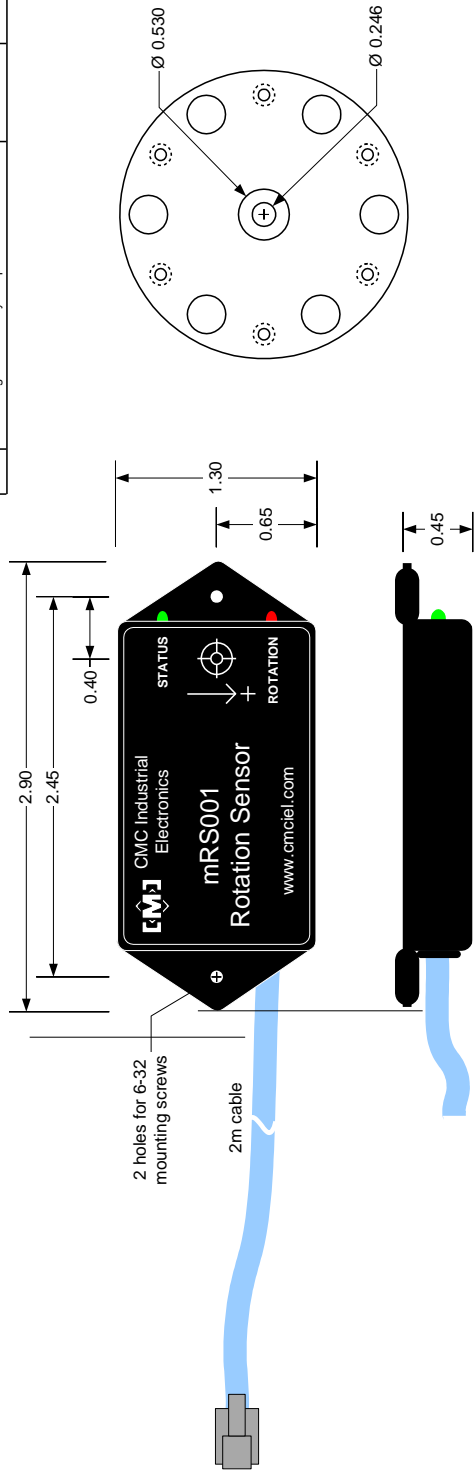
Appendix 1 - Installation Drawings

The following is a list of the installation drawings in this appendix:

10679C	Dimension Details
10704C	Installation Details
11031	Shaft Mount Housing Exploded View

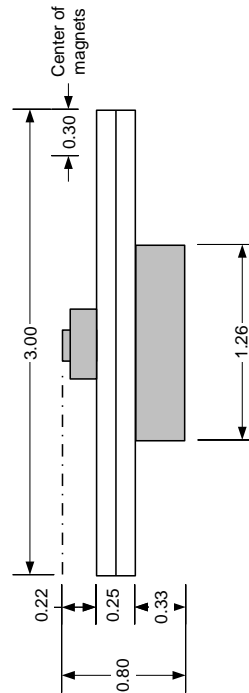


REV	DESCRIPTION	DATE	APP.
A	Update dimensions	MAY 11/05	DMF
B	Update code wheel and strain relief	FEB 15/07	DMF
C	Show magnet assembly as optional	APR 21/08	DMF



***** PERSONAL INJURY WARNING *****

The optional magnet assembly, part no mRS001-MG, that can be used to attach the code wheel, has a very strong attractive force and will move suddenly and with great force towards any ferrous or magnetic material. Use extreme caution when handling the code wheel if the magnet assembly is attached.



Code wheel shown with optional mRS001-MG magnet assembly attached

- Notes:
 1) Face of sensor module to be 0.25" to 0.40" from face of code wheel with target centered over magnets.

 CMC Industrial Electronics Ltd. Burnaby, BC Canada	
mRS001 Rotation Sensor Dimension Details	
DO NOT SCALE	DRAWN BY: DMF
DATE: JAN 21, 2005	CHECKED BY: TCG
COPYRIGHT 2005	APPROVED BY: DMF
REF:	DRAWING NO: 10679
	REV: C
	PAGE: 1 OF 1



REV	DESCRIPTION	DATE	APP.
B	Update code wheel	FEB 15/07	DMF
C	Show code wheel magnet, remove 2nd flat washer	APR 21/08	DMF

***** PERSONAL INJURY WARNING *****

The optional magnet assembly, part no mRS001-MG, used to attach the pickup wheel has a very strong attractive force and will move suddenly and with great force towards any ferrous or magnetic material. Use extreme caution when handling the pickup wheel if the magnet assembly is used.

Code Wheel Magnet Center Location

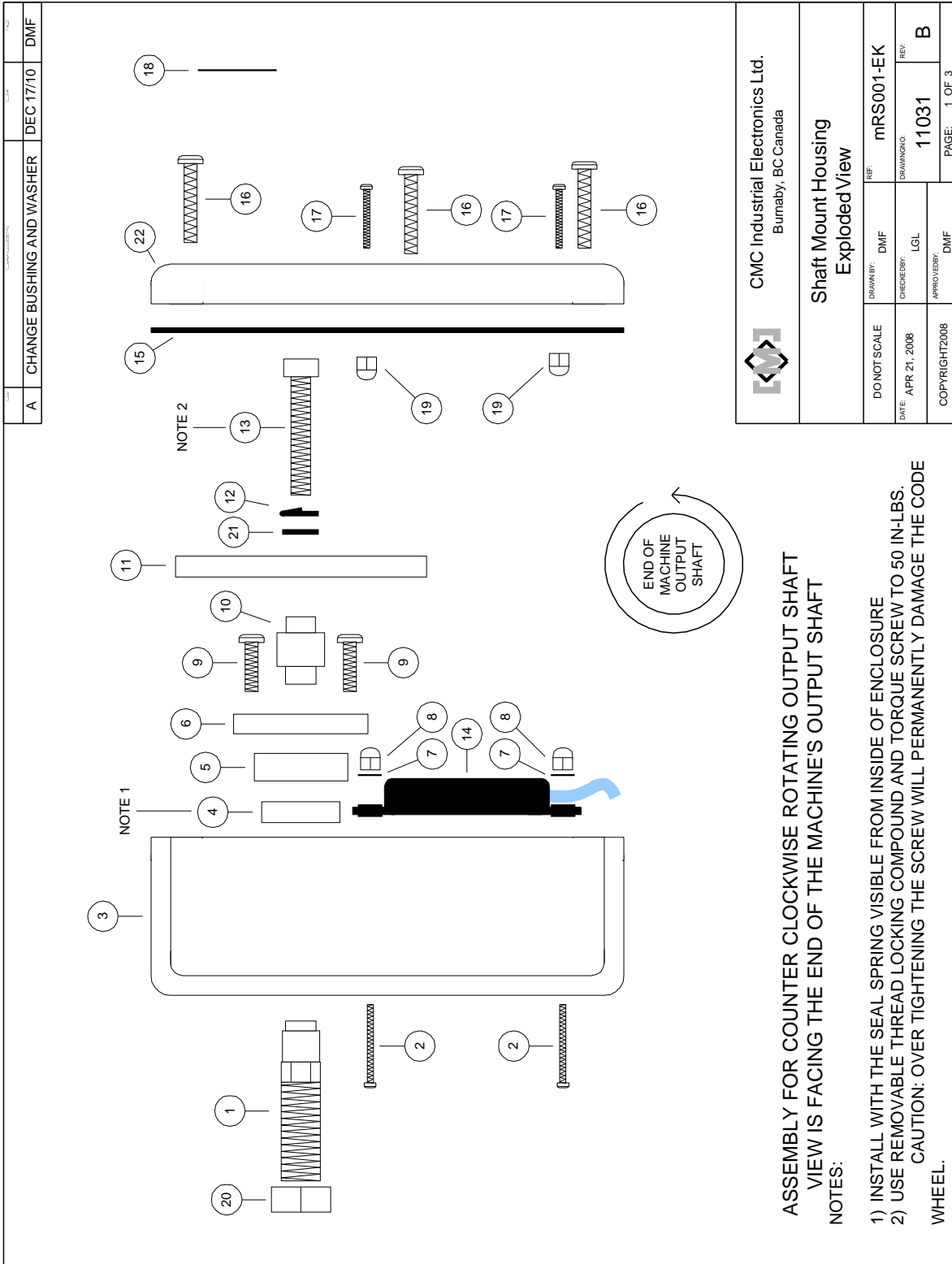
Mounting Detail

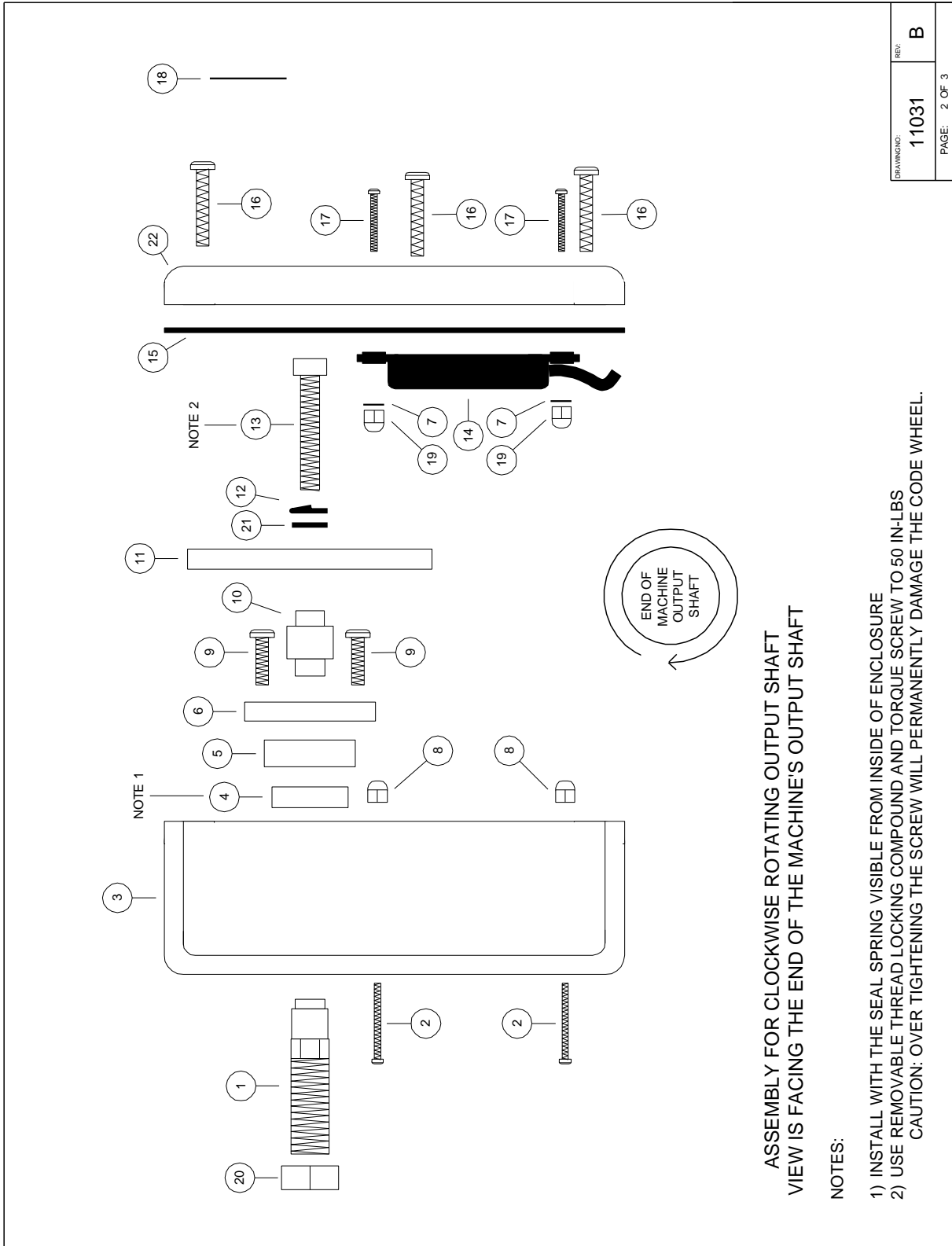
Mount the sensor to the bracket using the supplied 4-40 x 1" screws with flat washers and nylon locking nuts as shown. Tighten screws to compress grommet 1/16". Do not over tighten the screws. Install the sensor so the code wheel magnet centers pass over the sensor's target mark with an average distance from the code wheel of 0.25" to 0.40".

CMC Industrial Electronics Ltd.
Burnaby, BC Canada

**mRS001 Rotation Sensor
Installation Details**

DO NOT SCALE	DRAWN BY: DMF	REF:
DATE: MAY 20, 2005	CHECKED BY: IS	DRAWING NO: 10704
COPYRIGHT 2005	APPROVED BY: DMF	REV: C
		PAGE: 1 OF 1







Item	Part no.	Quantity	Description
1	11275	1	Drive shaft, 1/2" x 13 threads
2	4-40PHSS1.0	2	#4-40 x 1" pan head machine screw (supplied with mRS001)
3	11278	1	Housing
4	S012025070TC	1	Shaft seal
5	6200-2RSH/C3	1	Bearing
6	11277	1	Bearing retainer
7	4FWSS	2	#4 flat washer (supplied with mRS001)
8	4-40NYLSS	2	#4 - 1/4" hex nylock nut (supplied with mRS001)
9	8PH_PHIL_TYPEB_0.625SS	4	#8 x 5/8" Type B self tapping screws
10	11274	1	Bushing
11	10604-2	1	Code wheel (supplied with mRS001)
12	14SLWSS	1	1/4" Spring lock washer
13	14-20HCx1.5_SS	1	1/4" x 20 x 1.5" socket head cap screw
14	mRS001	1	mRS001 Rotation Sensor
15	11276	1	Gasket
16	8PH_PHIL_TYPEB_1.00SS	6	#8 x 1" type B self tapping screws
17	4-40PHSS0.75	2	#4-40 x 3/4" pan head machine screw
18	11012	1	Product label
19	4-40NYLSS	2	#4 - 1/4" hex nylock nut
20	1/2-13SSJN	1	1/2" x 13 hex jam nut
21	14FWSSAN	1	1/4" flat washer Type AN, nominal 0.50"OD
22	11279	1	Lid

DRAWING NO:	11031	REV:	B
PAGE:		3 OF 3	