



Torque and Speed Transducer Model: PTO2

Installation Manual





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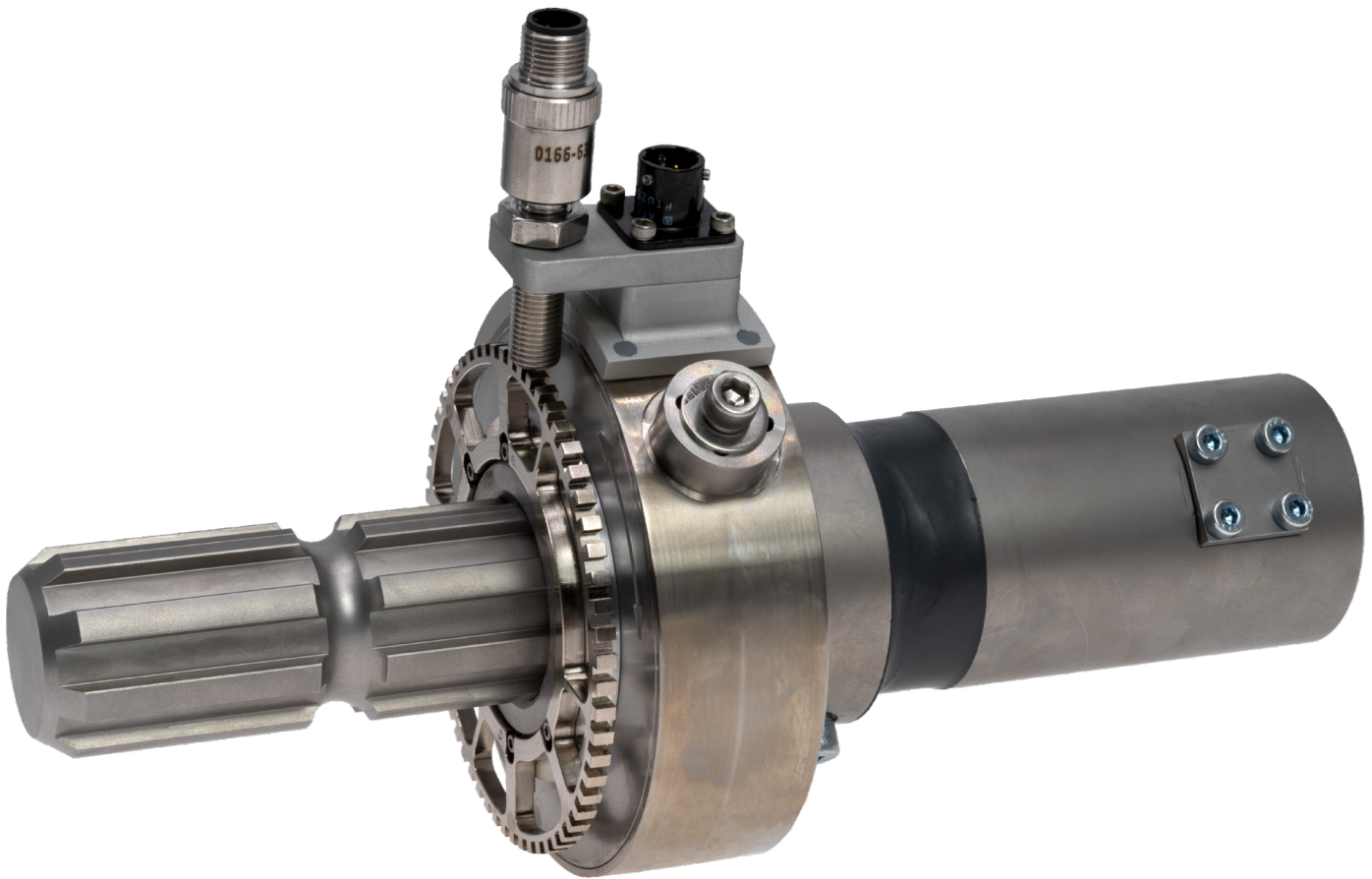
PTO2 Torque and Speed Transducer

- Measures torque and speed of PTO shaft
- Integrated slip ring and encoder system
- Rugged construction
- Weather resistant
- Pre-calibrated
- Cost effective design

System Overview

PTO2 Torque and Speed Transducer Assembly

The PTO2 Torque and Speed Transducer Assembly is a strain gauge based transducer that is gauged and wired to measure torque and speed. A male PTO splined shaft is inserted into one end of the transducer, which has female PTO splines machined into it. A slip ring and Spline Locking Blocks are also attached to the transducer.



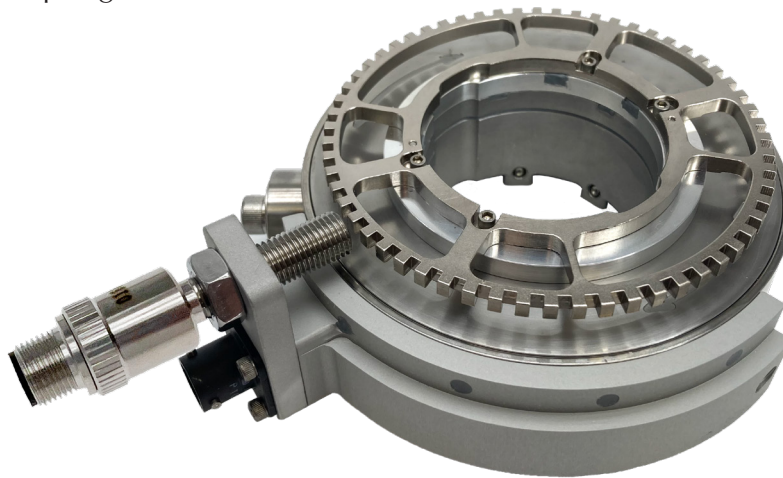
PTO2 Torque Transducer

The PTO2 Torque Transducer component of the assembly is the long tubular component with female PTO splines. Each PTO2 Torque Transducer is designed specifically for one fixed spline type. The Type 3 (1-3/4"-20) PTO2 Torque Transducer can be seen below.



Slip Ring

A slip ring is mounted onto the PTO2 Torque Transducer to transfer the torque signal from the rotating transducer. The standard PTO2 Torque Transducer comes with a Michigan Scientific B4-2W/E60 Slip Ring. The B4-2W/E60 Slip Ring has a 60 tooth tone wheel attached to the slip ring rotor and a Spectec Hall Effect speed sensor attached to the slip ring stator.



WARNING

Because the slip ring seals are “non-contacting”, this assembly is not considered a sealed unit. The seals are very effective at keeping out weather and water spray, but will not protect the assembly if it becomes submerged. Only expose the assembly to weather while in use.

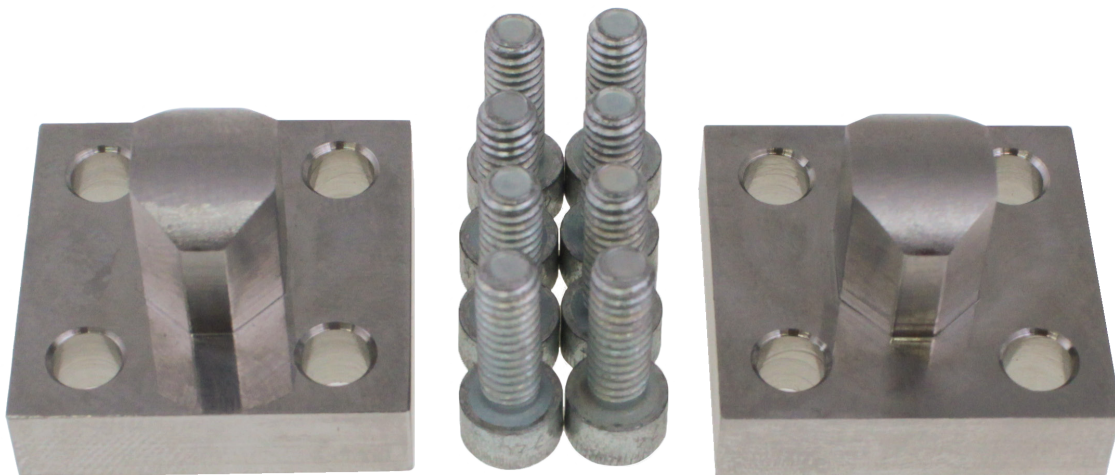
Male PTO Splined Shaft

A mating Male PTO Splined Shaft is bolted to the PTO2 Torque Transducer. The Male PTO Splined Shaft mates with the female spline of an implement powered by a tractor's PTO output shaft. The image below shows 1-3/8"-6 (Type 1), 1-1/2"-8, and 1-3/4"-20 (Type 3) Male PTO Splined Shafts used with the 1-3/8"-6, 1-1/2"-8, and 1-3/4"-20 PTO2 Torque Transducers respectively.



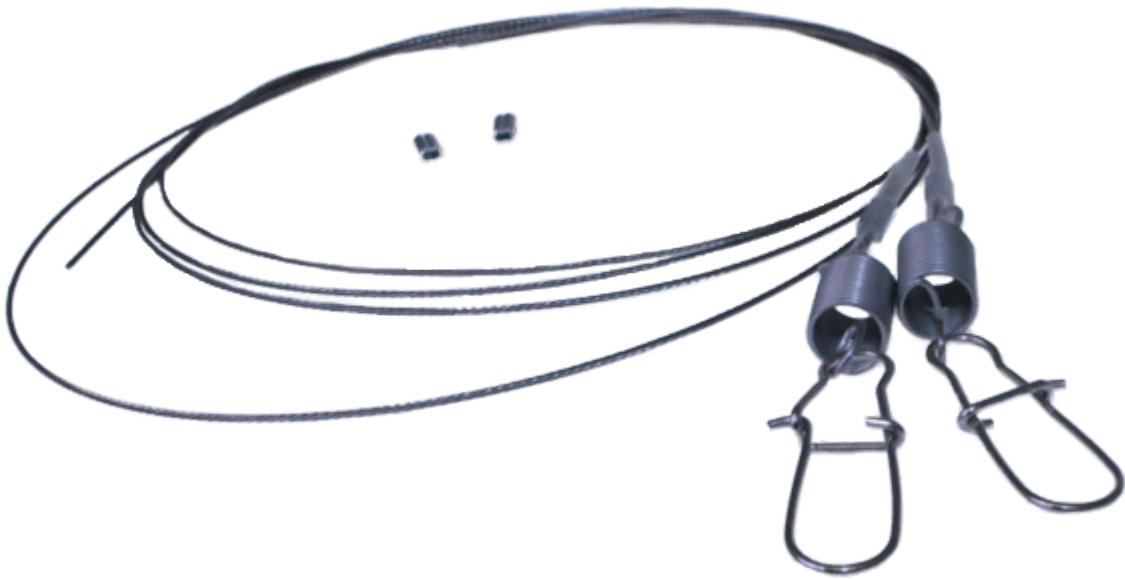
Spline Locking Blocks

Spline Locking Blocks get fastened to one end of the PTO2 Torque Transducer in order to prevent any axial movement relative to the mating male tractor PTO output shaft.



Spring-Loaded Restraint Cables

Two Spring-Loaded Restraint Cables with safety pins and compression sleeves are supplied so that the slip ring stator can be held stationary relative to the slip ring rotor. The Spring-Loaded Restraint Cables need to be flexible in order to prevent large loads from being applied to the slip ring bearings.

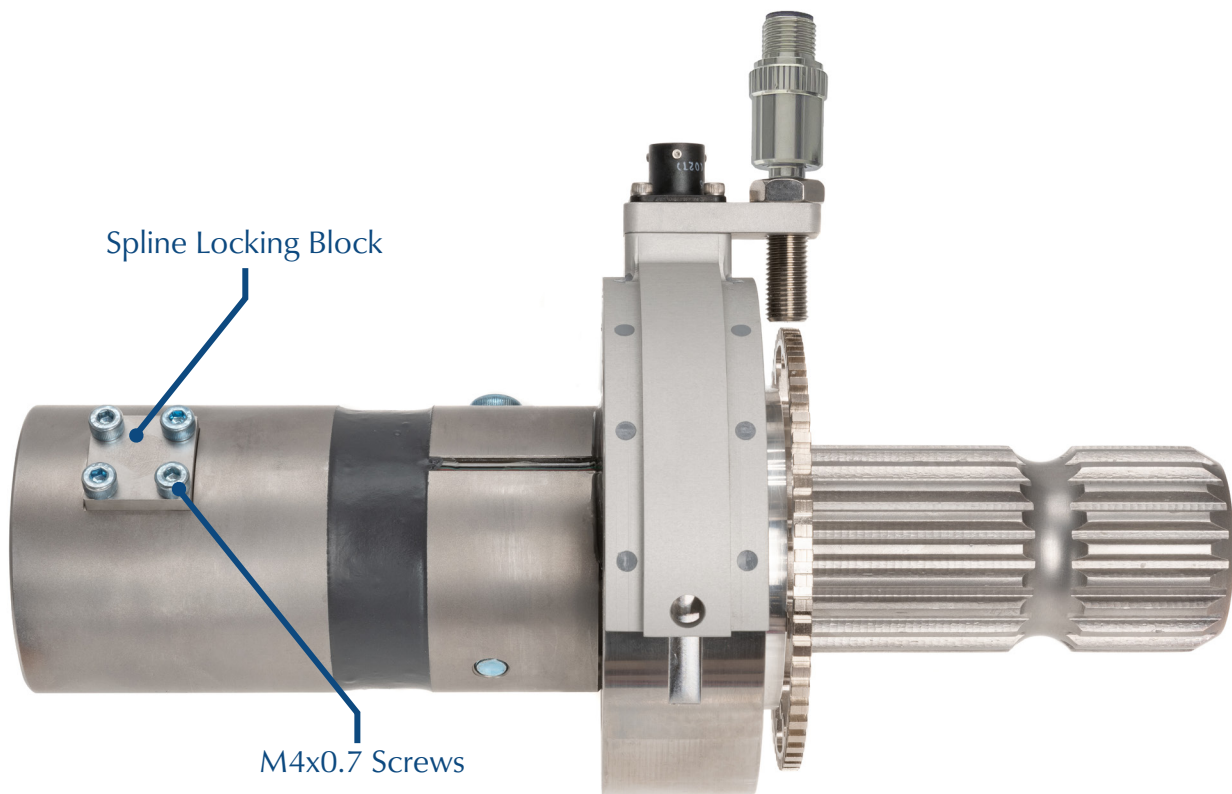


WARNING

If a rigid slip ring stator restraint is used, damage to the slip ring will occur.

PTO2 Assembly Installation

Remove the eight screws holding the two Spline Locking Blocks to the PTO2 Torque Transducer. Next, mate the female spline of the PTO2 Torque Transducer with the male PTO splined tractor output shaft. Align the Spline Locking Block holes in the PTO2 Torque Transducer with the groove machined into the mating male PTO splined tractor output shaft. Insert the Spline Locking Blocks and tighten the M4x0.7 screws to 32 in · lbf after applying blue Loctite 243 threadlocker to the M4x0.7 screw threads.

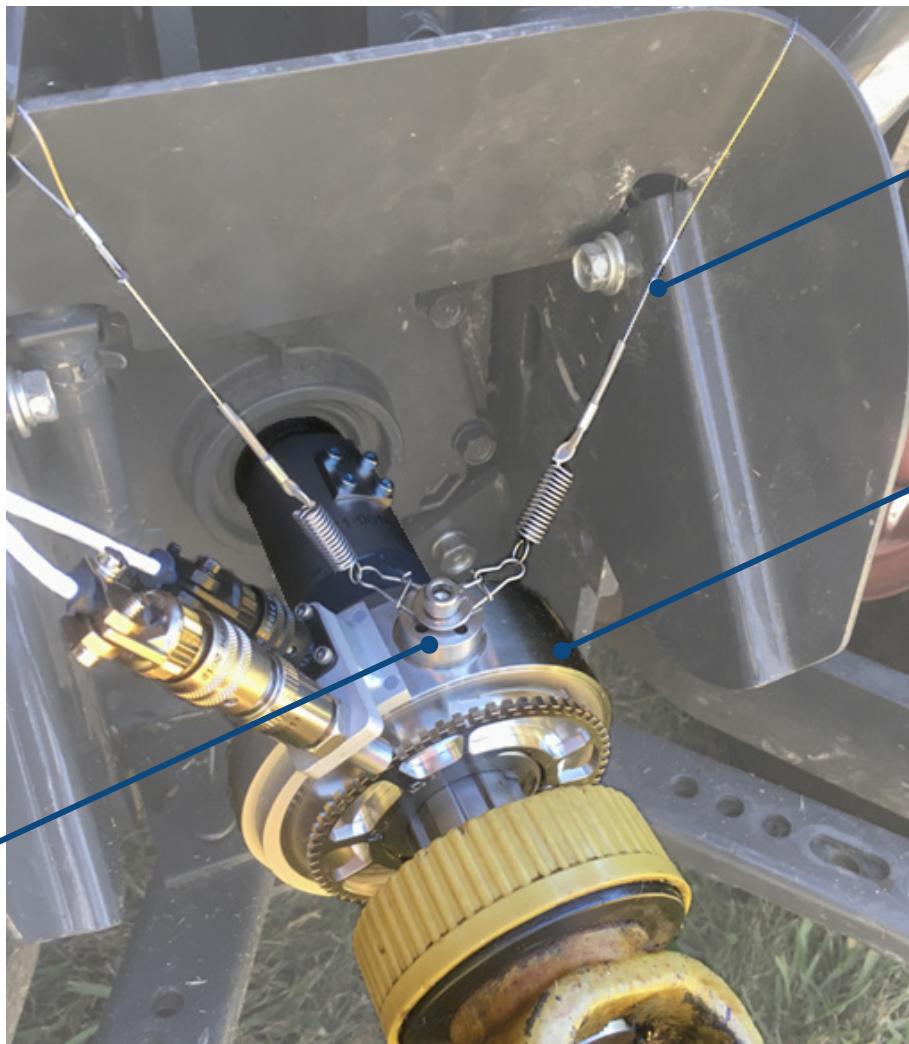


Connect the female spline from the tractor implement drive shaft to the Male PTO Splined Shaft that is bolted to the PTO2 Torque Transducer as shown below.



Female Spline of Tractor Implement

Use Spring-Loaded Restraint Cables or other flexible restraint to prevent the slip ring stator from spinning during PTO operation. Attach each cable's safety pin to the slip ring stator restraint boss with the supplied bolt and washer. Then wrap each restraint cable around a fixed component of the tractor and install and crush the compression sleeves. Make sure to route the cables in opposite directions as shown in the image below. This ensures that the slip ring stator will be restrained properly when spinning clockwise and counterclockwise.



Slip Ring Stator Boss

Spring-Loaded Restraint Cable

Slip Ring Stator

WARNING

Do not rigidly attach the slip ring stator to the tractor or slip ring damage will occur.

Connect the black lead wire connector (torque signal) to the black connector found on the slip ring stator. Connect the silver lead wire connector (speed signal) to the mating silver connector found on the Hall Effect speed sensor. Shown in the tables below are the wire assignments for the tinned wires on the opposite ends of the wires.

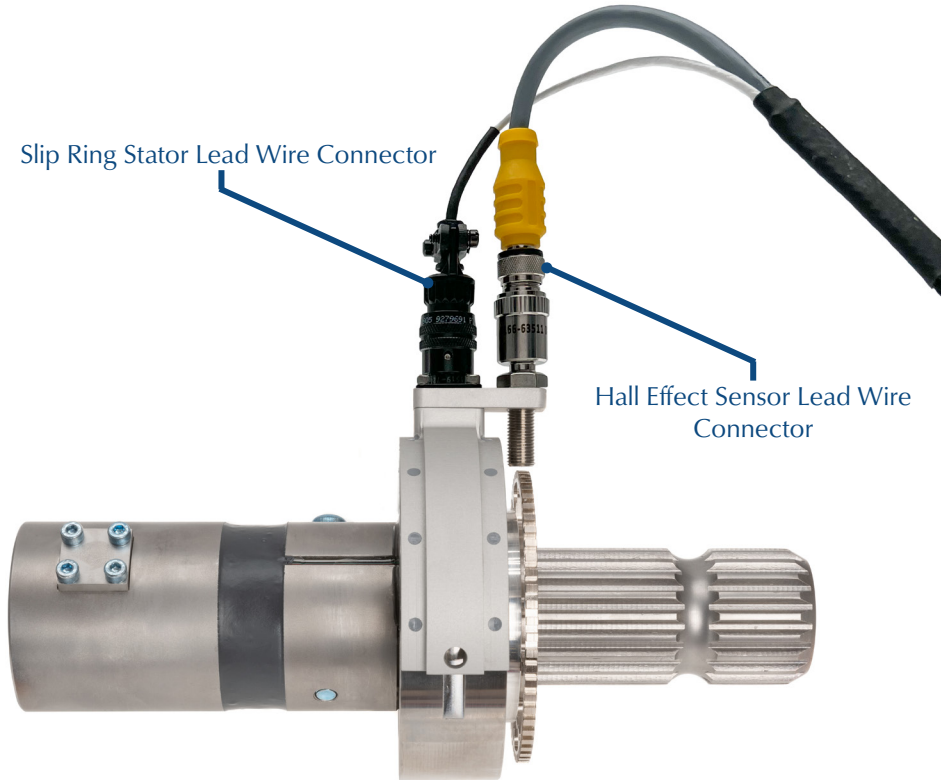


Table 1: PTO2 Torque Cable Lead Wire Assignment

Wire Color	Function
Red	P+
White	S-
Green	S+
Black	P-

Table 2: PTO2 Speed Cable Lead Wire Assignment

Wire Color	Function
Brown	Supply (+)
Blue	Ground (-)
Black	Signal

Transducer Zero

Before recording data with the PTO2 Torque Transducer it is necessary to null or zero any voltage offsets in the signal under no-load condition. This establishes a zero output at zero load reference.

First ensure that there is zero torque on the PTO2 Torque Transducer. Then zero out the transducer output using your data acquisition software.

Transducer Sensitivity and Shunt Calibration

The conversion from transducer output signal (mV/V) to engineering units (lb · ft or Nm) can be obtained using either the transducer sensitivity (mV/V/lb · ft or mV/V/Nm) or shunt calibration method. The transducer sensitivity and 100 k Ω shunt can be found in the transducer calibration documentation.

Rated Torque Range	
1-3/8"-6 Splines (Type 1)	± 1850 lb · ft (2508 Nm)
1-3/8"-21 Splines (Type 2)	± 1850 lb · ft (2508 Nm)
1-3/4"-20 Splines (Type 3)	± 3700 lb · ft (5017 Nm)
1-1/2"-8 Splines	± 2250 lb · ft (3050 Nm)
Speed Range	0 to 7000 R/Min (Maximum Slip Ring Speed)
Speed Sensor	Spectec Hall Effect Speed Sensor Part # 0166-63511 set to a 0.05 in Height Above the Tone Wheel
Bridge Resistance	Torque: 700 Ω
Operating Temperature	-40 °C to 120 °C (-40 °F to 248 °F)

Speed Sensor Datasheet

SPECTEC

THUNDERBIRD INTERNATIONAL CORPORATION
P.O. Box 360, Emigrant, MT 59027 USA
(406) 333-4967 FAX: (406) 333-4259
www.spectecensors.com

0166 • 0167
DIGISPEC PROXIMITY/ZERO SPEED HF SENSOR
SINGLE OUTPUT, FERROUS TARGET/GEAR ACTUATED
3/8, M10

PRODUCT DESCRIPTION

SPECTEC's Zero Speed sensors are designed to switch in the presence of ferrous targets such as gear teeth, blade tips, ect. Gear teeth as small as module 0.5 or 48 DP can be sensed.

The standard output is NPN Supply Tracking 0-Vs, provided from a 3k Ohm internal pull-up resistor to a collector, which can sink 25 mA. The output is normally high with no target present. Other output signal options are available; please see Page 2 for details.

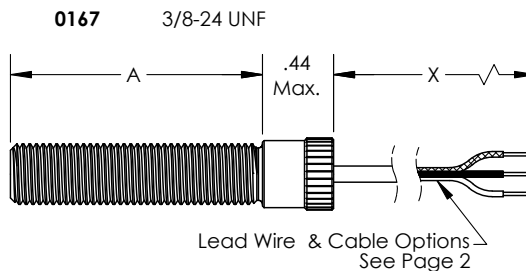
For intrinsically safe versions refer to bulletin: IS170 & IS171.

SPECIFICATIONS

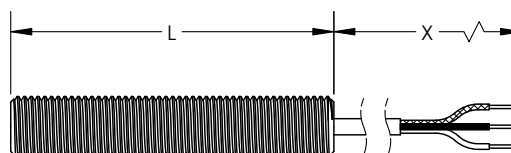
Orientation:	Single: No orientation required. Differential: The alignment mark must be in line with the rotation of the gear.
Vs, Supply Voltage:	4.0 to 30 Vdc @ ≤ 18 mA 4.0 to 27 Vdc @ ≤ 30 mA 4.0 to 24 Vdc @ ≤ 24 mA (Differential) Reverse Polarity Protected
Vo, Signal Out:	Output signal is typically 'Normally High' except for PNP output which is 'Normally Low'
Operating Freq.:	0 to ~20 kHz (Standard) ~15 Hz to ~30 kHz (Differential)
Air Gap:	24 DP / Module 1: .050" (1.3mm) 12 DP / Module 2: .080" (2.0mm) 5 DP / Module 5: .160" (4.0mm)
Magnetization:	Standard: ~1500 Gauss Low Mag: ~500 Gauss
Rise/Fall Time:	0.10 μs to 2 μs <small>*Dependent on Configuration</small>
Temperature Range:	2TE: -40° to 221°F (-40° to 105°C) <small>*May be reduced based on options selected</small> 3TE: -40° to 300°F (-40° to 150°C) <small>*May be reduced based on options selected</small>
Construction:	300 Series S.S. Housing & Face Solid Epoxy Encapsulation
Connectors & Pin Assignments:	See Page 2 All have Gold Plated Pin Contacts
Lead Wires & Assignments:	2TE: PVC 22-24 AWG (105°C) 3TE: TFE 22 AWG (150°C) Brown: Supply Blue: Ground Black: Signal Bare: Cable Shielding
CE-Compliance:	EN55011, EN50082-2

OPTIONS

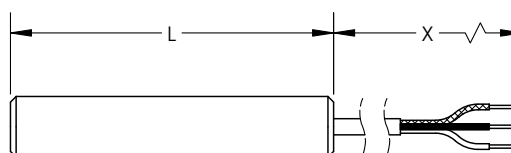
Custom configurations, thread sizes including metric, special, materials of construction, special output circuits including short circuit protection, and temperature probe (NT10, RTD100, or others). Please contact sales.



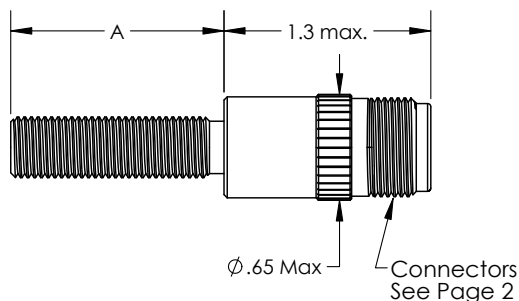
0167A 3/8-24 UNF
0167M M10 x 1.25
0167M1 M10 x 1



0167S Ø3/8" (9.5 mm) Smooth Shell

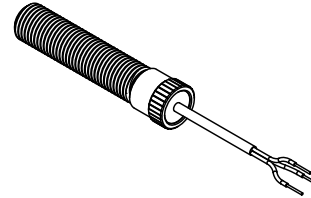


0166 3/8-24 UNF
0166M M10 x 1.25

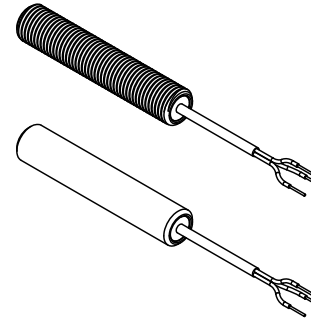


ORDER INFORMATION

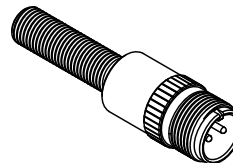
STYLE:	OPTIONS:	THREADS/DIA.:
0167	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	3/8-24 UNF
Thread Length(A):		1 - 0.8" (20mm) A - 1.3" (33mm) 2 - 2.0" (51mm) 3 - 2.5" (63mm) 4 - 3.0" (76mm) 6 - 4.0" (102mm)
Temperature Range:		1 - 2TE: -40° to +221°F (-40° to +105°C) 6 - 3TE: -40° to +302°F (-40° to +150°C)
Vo, Signal Out:		1 - 0 - Vs, NPN w/3.1 k Ohm pull-up [Normally High] 2 - 0 - Vs, NPN, OC (Open Collector) [Normally High] 3 - 0 - Vs, PNP, OC [Normally Low] 5 - 0 - 5V, NPN [TTL] [Normally High]
Sensor Type:		3 - Standard Type Single Sensor (HF) 4 - Differential Type (HFd)
Lead Wire(X):		1 - 1' (.3m) Single Leads (Shield is not connected to sensors shell; 7 - 3' (1m) Shielded Cable shield is intended to be connected to 9 - 10' (3m) Shielded Cable instrument panel ground.)



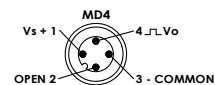
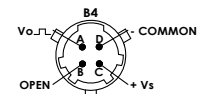
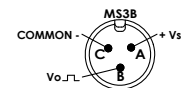
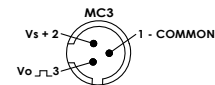
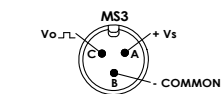
0167A	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	3/8-24 UNF
0167M	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	M10 x 1.25
0167M1	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	M10 x 1.0
0167S	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Ø3/8" (10mm) Smooth Shell
Length(L):		2 - 1.0" (25mm) 3 - 1.25" (32mm) 4 - 1.5" (38mm) 5 - 2.0" (51mm) 6 - 2.5" (63mm) 7 - 3.0" (76mm) 8 - 4.0" (102mm) 9 - 5.0" (127mm) A - 6.0" (152mm)
	SAME AS ABOVE	



0166	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	3/8-24 UNF
0166M	- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	M10 x 1.25
Thread Length(A):		1 - 1.3" (33mm) 2 - 2.0" (51mm) 3 - 3.0" (76mm)
	SAME AS ABOVE	
Connector:		1 - MS3: 3 Pin MS3106-10SL-3P (see Bulletin 3000) 2 - MC3: 3 Pin Micro-C (see Bulletin 3004) 3 - MS3B: 3 Pin MS3102-10SL-3P (see Bulletin 3000) 4 - B4: 4 Pin Bayonet, MS3113-H8A4P (see Bulletin 3001) 6 - MD4: 4 Pin Micro DIN (see Bulletin 3005)



Connector Pinout



Note: The magnetization level for special or low mag. Sensors is designated as a suffix to the P/N. i.e.: 0167-11111-500G designating a gauss level of 500(±50). (Standard mag. Level will not have a suffix)

A Normally Low output signal is available for the NPN output signal option (TTL, Supply Tracking and Open Collector) by adding '-NL' to the end of the part number.

Similarly, a Normally High output signal is available for the PNP output signal option by adding '-NH' to the end of the part number.