MSP Multiple Set Point Switch

Principle of Operation

The pulser disc (or wrap), that provides 16 magnetic targets of alternating polarity, is attached to the monitored shaft. As the magnets on the disc (or wrap) rotate past the sensor, the Hall Effect device switches high and low to produce a digital signal with a frequency proportional to shaft speed. The signal is transmitted to the MSP, which converts the digital signal into a 0-10 VDC reference voltage. Prior to operation, the set points are calibrated to a threshold voltage (between 0 and 10 VDC). The shaft speed reference voltage is compared to the set point threshold voltage and the relays are actuated when the set point threshold is crossed. Relays energize above the set point in under-speed mode and are de-energized below the set point in over-speed mode.

ESI Pulser Disc

Pulser Discs can be used with all ESI sensors. To mount the pulser disc, center drill the monitored shaft to a depth of 1/2" with a No. 21 drill and tap it for a 10-32UNF screw. Apply LoctiteTM, or a similar adhesive, on the screw threads to keep the pulser disc tight. Attach the disc, decal side out, with the 10-32UNF machine screw provided.

ESI Pulser Wrap (optional)

Pulser Wraps can be used with all ESI sensors. The pulser wraps are custom manufactured to fit the specific diameter of the shaft on which they will be mounted. To mount the wrap, remove the 4 Allen-head cap screws holding the halves of the wrap together, place the halves around the shaft, and reinsert the screws. Tighten the screws to 8-ft. lbs.

ESI Transducer Installation

The standard transducer is supplied with a mounting bracket and two jam nuts. The explosion-proof transducer is supplied with a slotted mounting bracket. The transducer should be installed so that the center of the transducer passes through the centerline of the magnets as they rotate. When using the pulser disc, the center of the magnetized area of the disc, shown as dimension "B" in figures 1 and 3, is 1 3/4 inches from the center hole of the disc. The gap distance between the sensor and the disc or wrap, Dimension "A" in the diagrams, can be from 1/16" to 3/8". The proper gap distance is achieved by adjusting the jam nuts on the standard transducer and by adjusting the position of the explosion proof transducer using the slots on the mounting bracket.

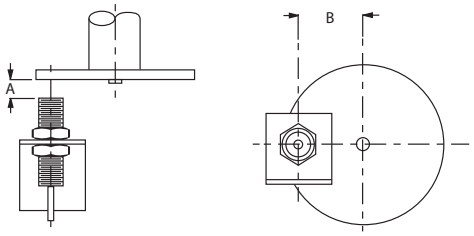

Figure 1: Standard 906 Sensor and Pulser Disc

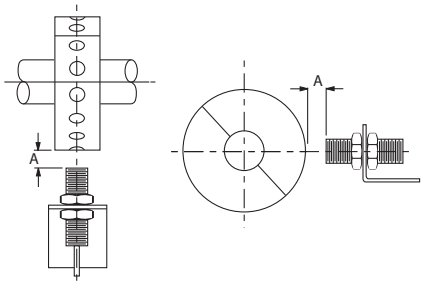

Figure 2: Standard 906 Sensor and Pulser Wrap

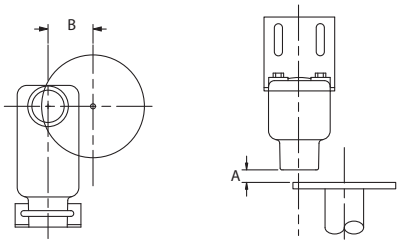

Figure 3: Explosion proof Sensor and Pulser Disc

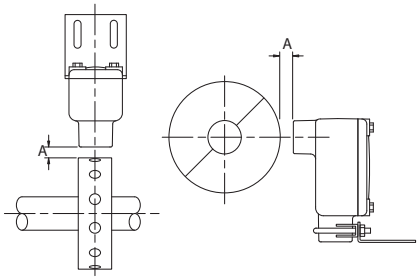

Figure 4: Explosion proof Sensor and Pulser Wrap

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Input Power

Input power connections are made via terminal strip TB9. Refer to the table below for the terminal locations.

Terminal	115 VAC	230 VAC
TB9-1	Hot	Hot (L1)
TB9-2	Neutral	Hot (L2)
TB9-3	Earth Ground	Earth Ground

Transducer

Transducer connections are made via terminal strip TB10. Refer to the table below for terminal designations.

Terminal	Description	ESI 906 & 907	Other ESI Sensors	ESI Prox
TB10-1	Supply	Red	Red	Brown
TB10-2	Signal	Black	Clear	Black
TB10-3	Ground	Clear & Shield	Black & Shield	Blue

Calibration

Note: Factory calibration is recommended to assure highest possible accuracy. Refer to tables below for all calibration adjustments. To calibrate the MSP accurately, a voltmeter in the 0-10 VDC range must be used. Connect the voltmeter to the 0-10 VDC output terminals observing the proper polarity (TB11-5 is positive and TB11-6 is negative). With the voltmeter attached, 115 VAC input power applied, and the monitored system off, place the Range Selector Switch (S2) in the position within which the actual operating speed falls (i.e. 175 RPM would be within the 0-200 range, 500 RPM would be within the 0-2000 range. See below). Place the OP/SP Selector Switch (S3) in the "0" position. Turn the 0-10 VDC Zero Adjustment Potentiometer (R47) counterclockwise to decrease or clockwise to increase until a reading of zero (0 VDC) is attained on the voltmeter. Next, run the monitored shaft at maximum operating speed and turn the 0-10 VDC Gain Potentiometer (R25) clockwise to increase or counterclockwise to decrease until a reading of 10 VDC is shown on the voltmeter. Because there is a slight interaction between the zero and gain adjustments, repeat the calibration procedure to assure maximum accuracy.

Set Point Adjustment

Each relay set point on the MSP must be individually adjusted to the desired threshold voltage, which determines the actuation speed. The threshold voltage represents an exact RPM based on the original 0-10 VDC calibration. For example, if the maximum speed of the monitored shaft that was calibrated as 10 VDC were 200 RPM, a threshold voltage of 5 VDC would equal a set point speed of 100 RPM. See below and the following page for all terminal and adjustment locations. With the voltmeter attached to the 0-10 VDC output terminals (TB11-5 = positive, TB11-6 = negative, use the OP/SP Selector Switch to select the number of the set point to be calibrated. The voltmeter will display the existing threshold voltage. Use the adjustment potentiometer corresponding to the set point to adjust the threshold voltage to the level representing the desired set point level (see example above). The formula for converting the desired set point speed to threshold voltage is:

$$\frac{\text{Desired Set Point Speed}}{\text{Maximum Speed}} \times 10 = \text{Set Point Range}$$

Use the Over / Under Speed Switch (S1) to select over or under speed actuation. The number on the switch matches the set-point. In under speed mode the relay will de-energize when the shaft speed is below the set point speed. In over speed mode the relay will de-energize when the shaft speed is above the set point speed. A green LED will illuminate when the relay is energized. Potentiometer Adjustment

Relay Connections	
TB1 - 8	Connection
1	N.C.
2	Com
3	N.O.

Input Power	
TB9	Connection
1	Hot
2	Neutral
3	Ground

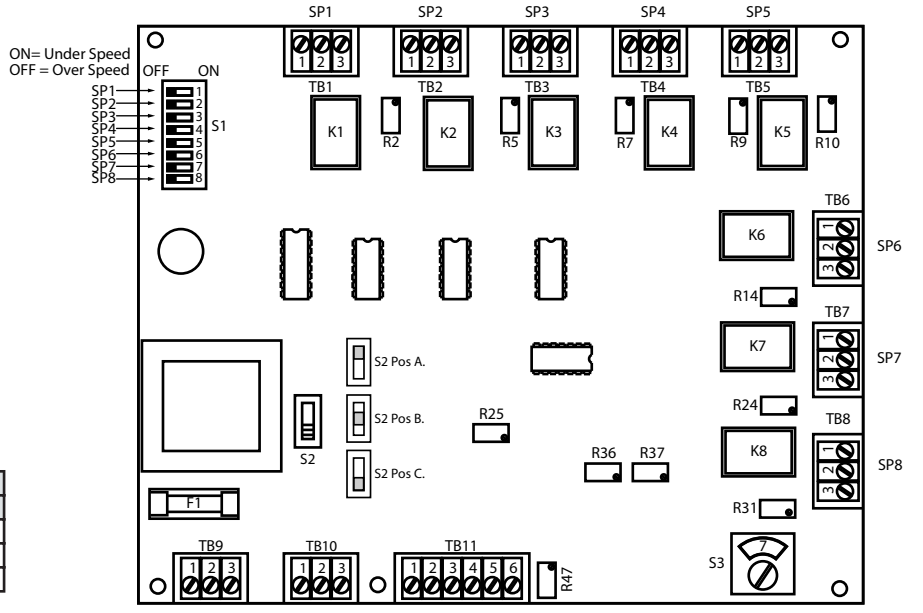
Pot	Function
R2	SP1 Adjust
R5	SP2 Adjust
R7	SP3 Adjust
R9	SP4 Adjust
R10	SP5 Adjust
R14	SP6 Adjust
R24	SP7 Adjust
R31	SP8 Adjust
R36	4-20mA Offset Adjust
R37	4-20mA Gain Adjust
R47	0-10Vdc Zero Adjust
R25	0-10Vdc Gain Adjust
R35	Start Delay (Optional)

Sensing Head	
TB10	Connection
1	Supply
2	Signal
3	Ground

Output Options	
TB11	Connection
1	N/C
2	N/C
3	4-20mA +
4	4-20mA -
5	0-10Vdc +
6	0-10Vdc -

OP/SP Selector	
S3	Position
0	Operate
1-8	SP1 to 8
9	Not Used

S2 RPM Range Selector	
RPM	S2 Pos
0-200	A
0-2,000	B
0-20,000	C



(S3 Switch setting)	Potentiometer to Adjust
0 = Operate	
1 = Set-Point 1	R2
2 = Set-Point 2	R5
3 = Set-Point 3	R7
4 = Set-Point 4	R9
5 = Set-Point 5	R10
6 = Set-Point 6	R14
7 = Set-Point 7	R24
8 = Set-Point 8	R31

4-20 mA Output (Optional)

This option provides a 4-20 mA current output proportional to speed for interfacing with a PLC or other device. To calibrate the output, connect a milliammeter in series with the external monitoring device. Make sure proper polarity is observed: TB11-3 is positive, TB11-4 is negative. Apply 115 VAC power to the MSP. With the monitored system off, set the offset level to a reading of 4 mA by turning the 4-20 mA Offset Adjustment (R36) — counterclockwise to decrease, clockwise to increase. To set the gain, run the monitored shaft at full speed. Adjust the output to a reading of 20 mA using the 4-20 mA Gain Adjustment (R37) turn clockwise to increase, counterclockwise to decrease. Note: Because there is interaction between the offset and gain potentiometers, the process should be repeated to ensure accuracy.

Digital or Analog Meter (Optional)

Note: When purchasing an analog or digital meter, supplemental literature with installation instructions will be provided. Use the following meter calibration instructions instead of the normal Calibration instructions. The optional meters are used to display shaft speed. Calibration procedures when using the meters are different than the normal calibration procedure because the voltage output is used to generate the desired reading on the display, not to generate a precise 0-10 VDC output. With the monitored shaft stopped, adjust the 0-10 VDC Zero Potentiometer (R47) until zero (0) is displayed on the meter.

Run the monitored shaft at maximum speed - (this speed should be a known RPM or engineering unit value). Adjust the 0-10 VDC Gain Potentiometer until the display shows the value desired. When adjusting set points using a properly calibrated ESI meter, the display will show the set point speed (in RPM or engineering units) instead of the threshold voltage. Because there is interaction between the zero and gain potentiometers, repeat the process for better accuracy. The analog meter does not require 115 VAC power. It is 50-graduation taut band meter movement scaled to customer specifications. After attaching the 0-10 VDC output (TB11-5 to meter positive, TB11-6 to meter negative); follow the digital “meter calibration instructions above.

WARNING!

During a stopped condition, even a slight movement of the shaft or magnetic disc could energize the control relay and start the motor if the Motor Starter Auxiliary Normally Open Contact (MS Aux N.O.) is not wired in series as shown In these typical wiring diagrams. This situation could cause equipment damage or PERSONAL INJURY! To prevent starting the motor accidentally, ALWAYS USE PROPER LOCKOUT — TAG-OUT PROCEDURES.

Wiring Diagram Key

MS Motor Starter (not supplied)
OL Overload Contacts
N. O. Normally open (relay is in a de-energized state)
TDR Time Delay “OFF” Relay (not supplied)
If the shaft being monitored comes up to speed slowly, a **TDR** can be use so the operator will not have to hold the START button in.

Troubleshooting guide

Problem	Troubleshooting step / Solution
Unit dead	Check for blown fuse / replace if bad
Unstable output	Check the sensor / adjust sensor gap and alignment as necessary
No Output	Check the sensor / adjust sensor gap and alignment as necessary
	Check for sensor signal at board / replace sensor if the gap and alignment are good and board has a good sensor supply and unit works with a generator.
	Check for sensor signal at board / replace unit if the input to the MSP has a good sensor supply of 15 Vdc and signal is present, 15 Vdc squarewave, but there is no analog or relay activity.
Unable to calibrate unit	Verify Unit is set to correct range / Set if necessary

MSP Series General Specifications

Input Voltage	Parameters
Power	• 115 Vac ±10% Standard • 230 Vac ±10%
Frequency	50-60Hz Optional
Wattage	12A
Fuse	1/8 Amp Slo-Blo, 115 Vac 1/16 Amp Slo-Blo, 230 Vac

Input Signal	Parameters
Type	Open Collector/Logic
Amplitude	15 Vdc nom., 8 V min.
Impedance	2200 Ohms to 15 VDC
Frequency	3.33 Hz min, 2.66 KHz max.

Output Signal	Parameters
Type	0-10 VDC Standard (calibration)
Additional Output	4-20 mA Optional
Accuracy	± 0.5% @ Midrange
Calibration	Selection of 3 ranges: 0-200 RPM 0-2,000 RPM 0-20,000 RPM
0-10 Calibration Voltage	22 Turn Zero and Gain adjustment potentiometers

Set Point Data	Parameters
Number Available	3 Min, 8 Max
Adjustments	22 Turn Potentiometers
Hysteresis	0.1% of Full Scale
Range	0% to 100% Full Scale
Mode	Selectable: Over or Under Speed
Response Time	0-200 RPM 1.5 seconds 0-2,000 RPM 0.5 seconds 0-20,000 RPM 0.5 seconds

Relay Output	Parameters
Contact Configuration	1 Form C (SPDT) Per Relay
Rating	5 amp @ 28 Vdc or 115 Vac Resistive
Energized Indication	Green LED

Physical/Environment	Parameters
Mounting	Chassis (See Drawing)
Operating Temperature	0ºC to +70ºC
Storage Temperature	-40ºC to +85ºC
Electrical Connections	Terminal Strip

Pulser Disc	Parameters
Material	Nylon 12 Std, Aluminum Opt.
Dimensions	4-inch diameter x 1/4-inch thick
Operating Temperature	0ºC to +60ºC*
Maximum Speed	Consult factory

Pulser Wrap (Optional)	Parameters
Material	Consult factory or our web site
Operating Temperature	-40ºC to +60ºC
Maximum Speed	Consult factory or our web site

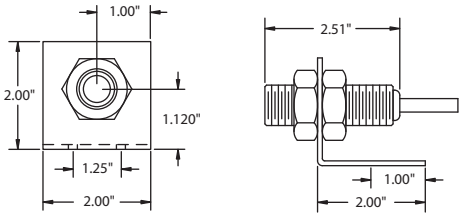
Standard Sensor (906)	Parameters
Material Sensor Body	Aluminum 3/4 - 16 UNF thread
Material Mount Bracket	Plate steel
Output Types	Quadrature, NPN open collector current sinking 20 mA max

Signal Cable	4-conductor shielded, 10 feet length
Operating Temperature	0ºC to + 75ºC*
Air Gap	1/16 inch to 1/4 inch

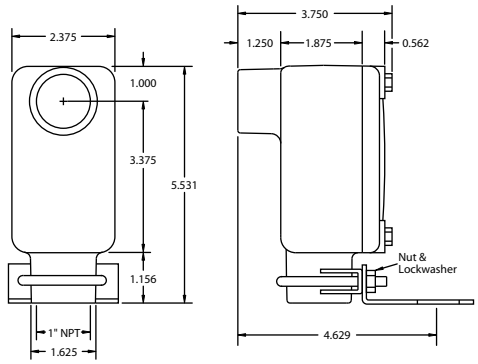
Explosionproof Sensor	Parameters
Housing and Cover	Cast aluminum, C.S.A. and FM, Approved UL, Rated Class I Group C, D; Class II Group E, F, G; Class III

Specifications are subject to change without notice.

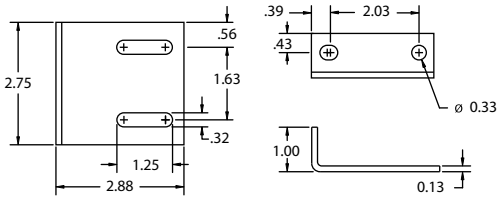
Dimensional Drawings



Standard 906 Sensor



Standard XP Sensor



XP Sensor Bracket