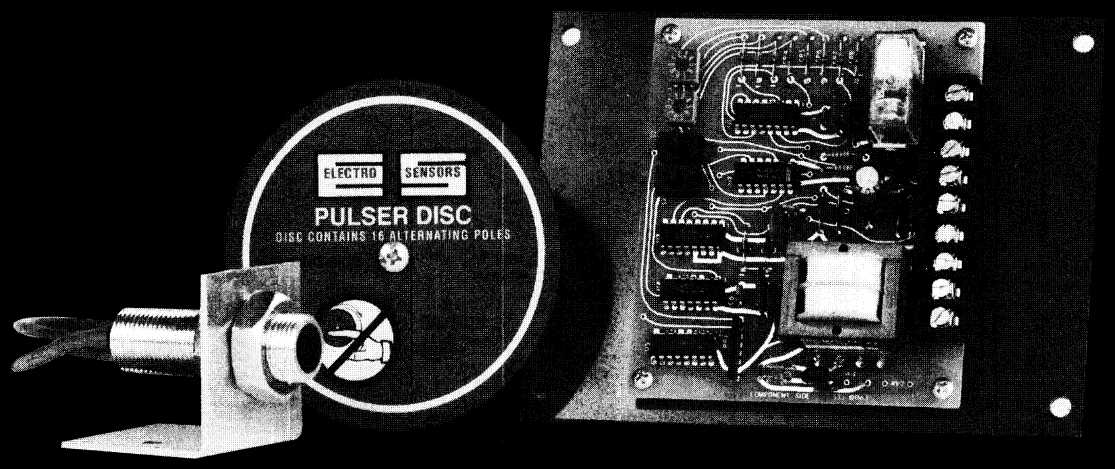
Slow Speed Switch

ELECTRO SENSORS SS100



Features:

- **Field Adjustable Set Point from 0.01 to 10.00 rpm**
- **Non-Contact Sensor System**
- **Detects Shaft Speeds Down to 1/100 rpm**
- **Optional Explosionproof Sensor and Switch Enclosure**

Description:

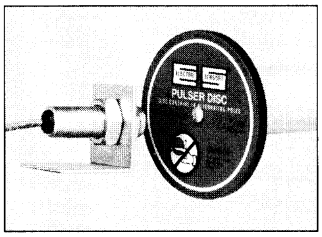
The Electro-Sensors' Model SS100 Slow Speed Switch allows accurate underspeed detection within the 1/100–10 rpm range. Processes dependent on the relationship between speed and time for product quality or machine safety, can be monitored with this system at speeds as low as 0–99 minutes per revolution. Actual minutes per revolution are compared to a presettable minutes per revolution setting within the switch.

Principle of Operation:

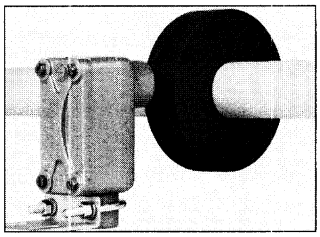
While the monitored shaft is rotating, the pulser disc or wrap mounted on the shaft, generates an alternating magnetic field whose frequency is proportional to the speed of the monitored shaft. This magnetic field is detected by the sensor and is transmitted to the SS100 switch. The incoming frequency is then compared to the minutes per revolution speed setting which determines the output relay status.

Pulser Disc:

The end of the shaft to be monitored must be center drilled to a depth of 1/2-inch with a No. 21 drill and tapped for 10-32 UNF. After applying Loctite® or a similar adhesive on the threads to keep the pulser disc tight, the pulser disc should be attached, decal side out, with the supplied 10-32 UNF machine screw and lock washer.



Sensing Head and Pulser Disc



Optional Explosionproof Sensor and Pulser Wrap

Pulser Wrap (optional):

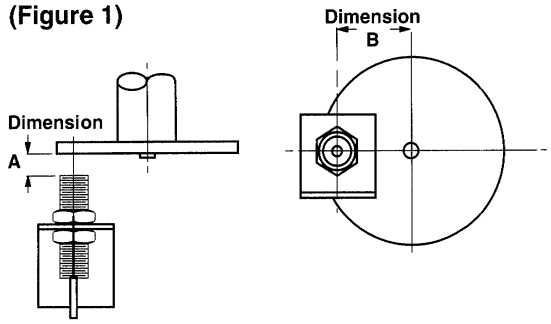
Pulser Wraps are custom manufactured to fit the shaft they will be mounted on. When the wrap is shipped, four Allen head cap screws hold the two halves of the wrap together. These screws must be removed so that the wrap is in two halves. Place the halves around the shaft, reinsert the screws and torque them to 8 foot pounds.

Sensor Installation:

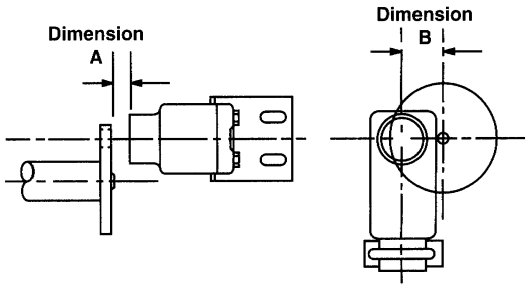
The standard sensor is supplied with a mounting bracket and two jam nuts. The explosionproof sensor is supplied with a slotted mounting bracket. Sensors should be installed so the center line of the magnets pass in front of the center of the sensor as the disc or wrap rotates. When using the pulser disc, 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 figures 1–4, can be from 1/16 inch to 1/4 inch. To achieve the proper gap distance, adjust the jam nuts holding the standard sensor in the mounting bracket or adjust the position of the explosionproof sensor using the slots on its mounting bracket.

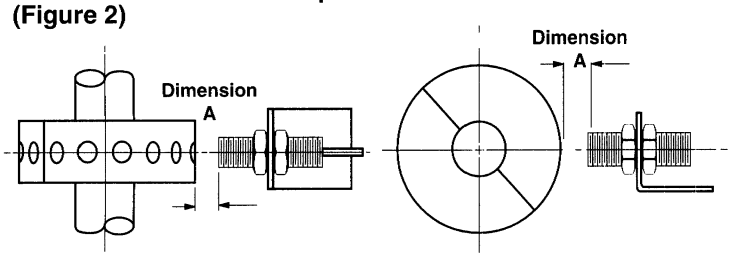
Standard Sensor and Disc (Figure 1)



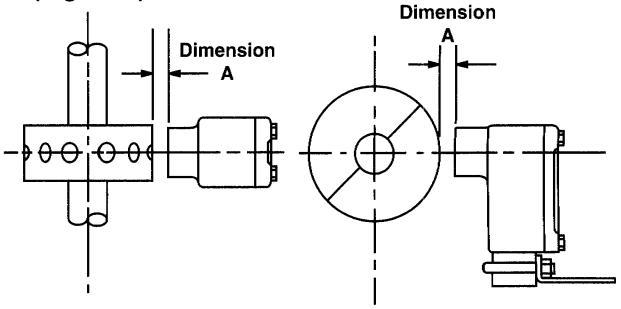
Explosionproof Sensor and Disc (Figure 3)



Standard Sensor and Wrap (Figure 2)



Explosionproof Sensor and Wrap (Figure 4)



Calibration:

Refer to figure 6 for the calibration adjustments for the SS100 Slow Speed Switch. It should first be determined whether the monitored shaft requires an overspeed or underspeed relay output. It is important to note that when overspeed sensing is selected, the relay will actuate when power is applied to the SS100. The relay will then drop out when the speed setting is exceeded. When underspeed detection is selected, the relay is actuated only above the set point speed setting, and drops out below the set point speed. Overspeed and underspeed detection is selectable via the two-position slide switch S-3. See figure 6.

Because of the slow speed capabilities of the SS100, it is recommended to think of RPM in terms of minutes per revolution (MPR). You can see from the conversion tables that, (figure 5, and the accompanying formulas) RPM and MPR are inversely proportional to each other.

The two primary sensing ranges of the SS100 Slow Speed Switch are: 0 to 9.9 minutes per revolution, and 0 to 99 minutes per revolution. Determine which sensing range is best suited for the speed characteristics of your shaft. For example: a shaft that takes 60 minutes to complete one revolution would be in the 0 to 99 minutes per revolution range. Conversely, a shaft that rotates at 45 seconds per revolution, would be set in the 0 to 9.9 minutes per revolution range. Locate switch S4 in figure 6. Set this switch to the "A" position for a time of 0 to 9.9 minutes per revolution. Set the switch to position "B" for a time of 0 to 99 minutes per revolution.

To adjust the final set point, refer to the formulas and tables in figure 5, to determine the closest value in minutes per revolution that corresponds to the RPM you want to detect. Enter this value into switches S1 and S2.

Depending on the range position setting of switch S4, switch S1 will represent either "ones" or "tenths" of a minute, and switch S2 will be "tens" or "ones."

Each monitored shaft's acceleration or deceleration rate will be influenced by a variety of factors including: torque, inertia, friction, and the environment. Update or response time should be calculated to determine stability for each application. Should the desired (MPR) detection setting require a quicker response time, you may choose a shorter (MPR) setting that will provide the quicker response needed.

For more on special application requirements, consult your Electro-Sensors Application Specialist.

Example: A conveyor shaft in a casting oven requires underspeed detection at 0.5 rpm or 20 mpr.

Switch	Switch Setting
S3	B Position
S4	B Position
S1	0
S2	2

Conversion Table:

Figure 5

RPM	MPR	RPM	MPR	RPM	MPR
10	.1	.9	1.1	.09	11
5	.2	.8	1.2	.08	12
3.3	.3	.7	1.4	.07	13–14
2.5	.4	.6	1.7	.06	15–16
2	.5	.5	2.0	.05	17–20
1.7	.6	.4	2.5	.04	21–25
1.43	.7	.3	3.3	.03	26–33
1.25	.8	.2	5.0	.02	34–50
1.11	.9	.1	10	.01	51–99
1.0	1.0				

Formulas:

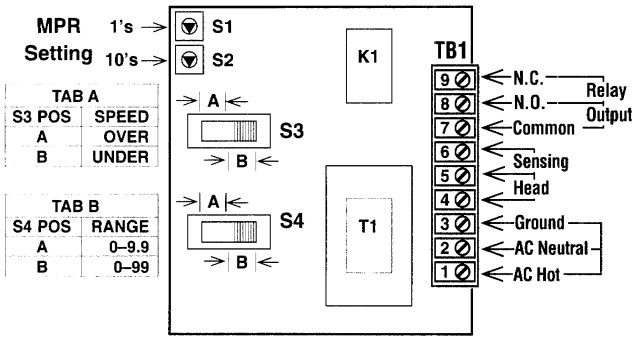
$$\text{Minutes per Revolution} = \frac{1}{\text{RPM}}$$

$$\text{Update Time In Seconds} = \frac{60}{(16 \times \text{RPM})}$$

$$\text{Revolutions per Minute} = \frac{1}{\text{MPR}}$$

Sensor Wire Connections:

Figure 6



Note: Unit Not Failsafe In Overspeed Mode

Sensor:

Sensor connections are made via terminal strip TB1. Refer to the table below for proper connections.

Terminal	Description	Sensor Model 906 - 907	All Other Sensor Models
TB1-4	Supply	Red	Red
TB1-5	Signal	Black	Clear
TB1-6	Ground	Clear/Shield	Black/Shield

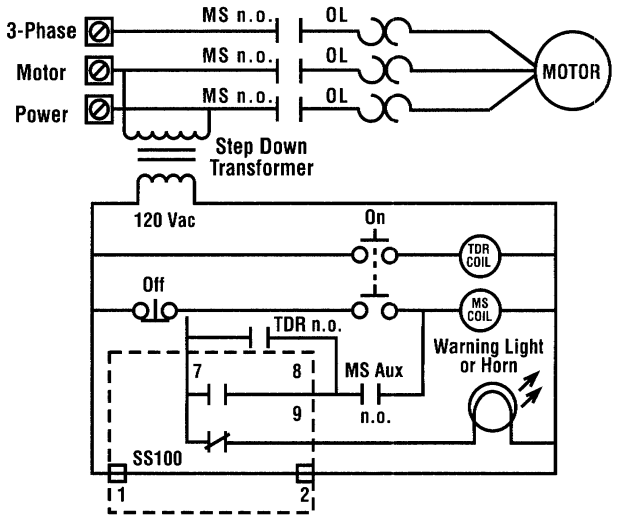
Note: Up to 1500 feet of 3-conductor, shielded cable may be run.

Power Connections:

Apply 115 Vac power to terminal strip TB1 by attaching the hot lead to terminal 1, the neutral lead to terminal 2, and the ground lead to terminal 3. (see figure 6)

Wiring Diagrams:
Motor Shutdown Control with Alarm

This is a typical wiring diagram using the maximum capabilities of the SS100. Other circuits may be used and some equipment may require different wiring. The time delay relay is not practical for all applications.



Wiring Diagram Key

MS Motor Starter (Not Supplied)
OL Overload Contacts
N.O. Normally Open (Relay is in De-Energized State)
TDR Time Delay "OFF" Relay (not supplied)
If the shaft being monitored comes up to speed slowly a **TDR** can be used so the operator will not have to hold the START button in.
MS AUX. Motor Starter Auxilliary Contacts

Troubleshooting Guide:

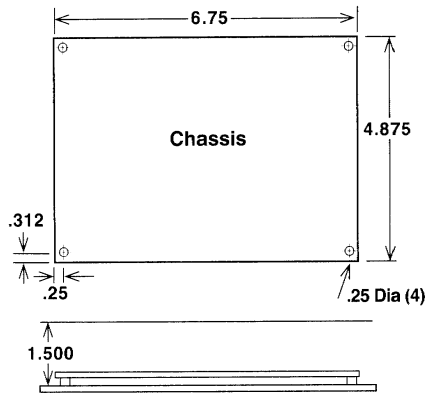
Symptom: Relay will not Energize, LED does not "Light Up"

Probable Causes:	Possible Solutions:
1. AC power is not applied to the SS100 terminal block correctly.	See page 3, Input Power
2. Sensing head is not aligned, or gapped properly.	See page 2, Figures 1-4
3. The set point is not in the proper range.	See page 3, Switch Setting
4. The set point potentiometer is not turned fully counterclockwise.	See page 3, Figure 6
5. Shaft is not turning at proper speed.	Check actual RPM
6. Sensing head is not wired correctly to the SS100 Speed Switch.	See page 3, Figure 6
7. Sensor supply voltage is not present.	Check for approx.15Vdc between TB1-4 and TB1-6
8. SS100 Speed Switch is not receiving signal.	Check for approx. 7.5Vdc between TB1-5 and TB1-6 with shaft running

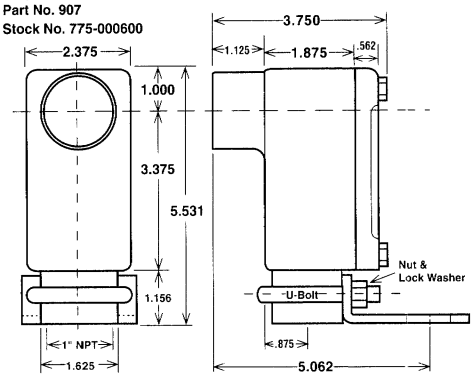
WARNING

During a stopped condition, even a slight movement of the shaft magnet 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 the typical wiring diagrams above. This situation could cause equipment damage or PERSONAL INJURY! To prevent starting the motor accidentally, ALWAYS USE PROPER LOCK-OUT/TAG-OUT PROCEDURES.

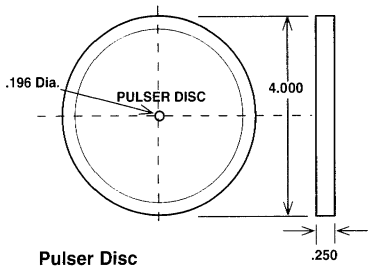
SS100 Dimensional Drawings: Dimensions in Inches



Explosionproof Sensor
Part No. 907
Stock No. 775-000600

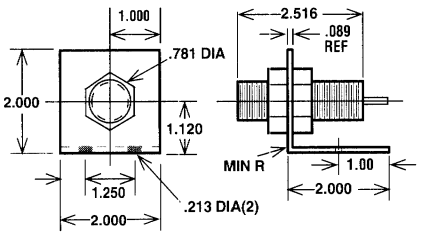


*Sensing Head Dimensions are ±.062

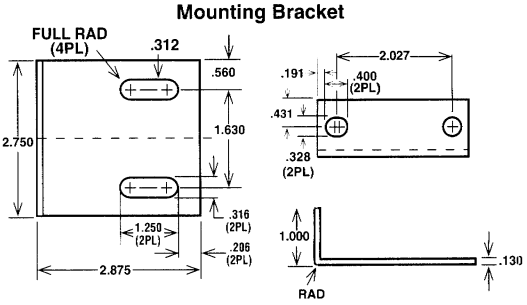


Pulser Disc
Part No. 255
Stock No. 700-000200

Digital Sensing Head
Part No. 906
Stock No. 775-000500



Mounting Bracket



SS100 General Specifications:

Power:

Voltage	115 Vac ±10%, Standard 230 Vac ±10%, Optional
Frequency	50 – 60 Hz
Wattage	2.4 Va
Fuse	1/8 Amp slo-blo 115 Vac 1/16 Amp slo-blo 230 Vac

Input Signal:

Type	Open Collector/Logic
Input Impedance	220 Ω
Nominal Amplitude	15 Volts
Minimum Amplitude	7.5 Volts

Output Signal:

Transducer Supply	15 Volts 10 mA Maximum
Relay	5 A, SPDT, Form C Contacts

Electrical Connections:

Barrier Strip	Screw Type with Wire Clamping Plate

Physical/Environmental:

Chassis Dimensions	2.5-Inch Component Height, 4-7/8-Inch Width, 6-3/4-Inch Length
Operating Temperature	0°C to +70°C
Storage Temperature	-65°C to +125°C*
Shipping Weight (System)	2 lb

Pulser Disc:

Material	Nylon® 12 (Standard)
Dimensions	4 inch Diameter X 1/4-inch Thick
Operating Temperature	-40°C to +60°C*
Maximum Speed Range	Consult Factory

Pulser Wrap:

Material	PVC, Standard
Dimensions	O.D. = shaft I.D. +3.00-inch x 1.500-inch width
Operating Temperature	-40°C to +60°C
Maximum Speed	Consult Factory

Sensor:

Material (Sensor Body)	Aluminum
Material (Mounting Bracket)	Steel
Thread Size (Stan. Sensor)	3/4-16 UNF
Output Type	Open Collector, Current Sinking, 20 mA Maximum
Signal Cable	3-Conductor Shielded, 10-feet Supplied
Maximum Cable Length	1500-Feet
Operating Temperature	-40°C to +60°C*
Air Gap	1/16 inch to 1/4 inch

Optional Explosionproof Sensor:

Signal Cable	3-Conductor Shield, 10-feet Included
Housing and Cover	Cast Aluminum, C.S.A. Approved U.L. Rated: Class I Group D; Class II Group E, F, G; Class III

**Higher Temperature Ranges Available. Consult Factory*

Spare Parts List	Stock No.	Part No.
Pulser Disc (Nylon 12)	700-000200	255
Pulser Disc (Aluminum)	700-001500	255A
Standard Digital Sensing Head	775-000500	906
XP Digital Sensing Head	775-000600	907
SS100 Circuit Board	750-009300	
Pulser Wraps	Consult Factory	
Sensor Cable	610-000200	213-A
Male Conduit Adapter for Sensor	271-000100	259-M
NEMA 4 Enclosure	285-000100	
NEMA 12 Enclosure	287-000300	

Specifications Subject to Change Without Notice.

CALL TOLL FREE FOR MORE INFORMATION

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