

UDS1000 Speed Switch

Reverse Rotation Detector

Principles of operation

The UDS1000 reverse rotation detector switch is a complete system, designed to detect when the shaft rotates in the reverse direction. During operation, the UDS1000 energizes its 5-Amp DPDT relay either when the shaft being monitored is at rest or rotating in the desired direction. The relay contacts can be used to enable the motor starter circuit, or provide a visual indication that the start up or process is possible. When the motor's shaft rotates in the reverse direction or wrong direction, the relay de-energizes, preventing the motor or process from starting.

A typical application would be to prevent damage to a pump motor and transmission. When the monitored shaft rotates backwards, the UDS1000 relay contacts are wired to lockout, or disable the pump-motor circuit; due to a leaky check valve or some other malfunction.

Installing sensors

Pulser disc

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

Pulser wrap (optional)

Pulser Wraps are custom manufactured to fit the shaft they will be mounted on. When the wrap is shipped, 4-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 5 foot-pounds.

Installing sensors

A bi-directional Hall Effect sensor is provided with the UDS1000. Two types of bi-directional sensors are available: The standard sensor model 906B, which has a threaded aluminum body Figures 1 and 2; and the optional explosionproof sensor, model 907B, Figures 3 and 4. Each bi-directional sensor incorporates two separate Hall Effect sensors. As the pulser disc or wrap's target magnets rotate past the first transistor or element, then the second two individual signals are generated. These signals are slightly out-of-phase with each other, which the UDS1000 uses to determine direction.

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 centerline 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.

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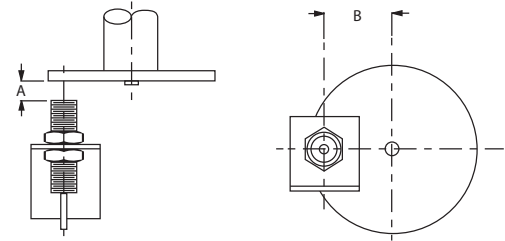


Figure 1: Standard 906B Sensor with 255 Pulser Disc

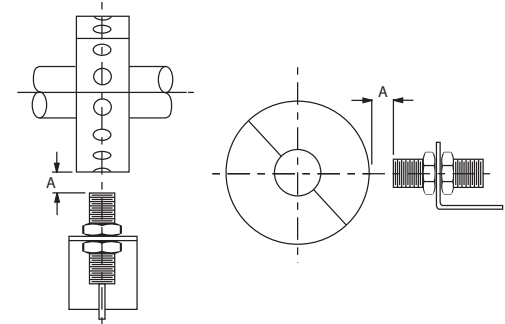


Figure 2: Standard 906B Sensor with optional Pulser Wrap

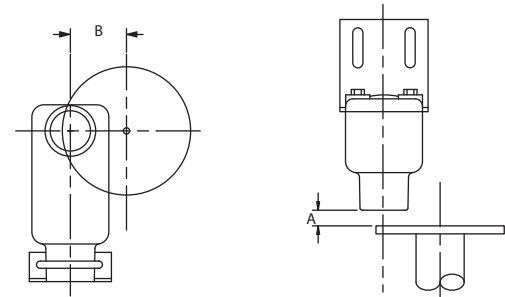


Figure 3: Explosionproof 907B Sensor with 255 Pulser Disc

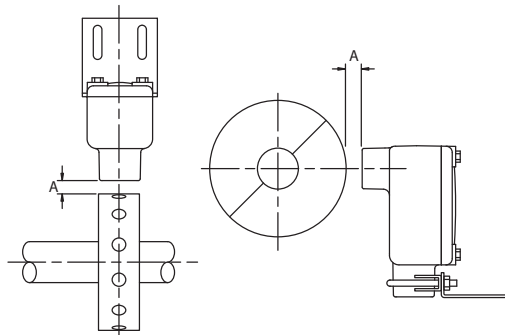


Figure 4: Explosionproof 907B Sensor with Pulser Wrap

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The gap distance between the sensor and the disc or wrap, dimension A shown in Figures 1 through 4, can be 1/4 inch +/- 1/8 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.

Aligning Hall Effect transistor or elements

Aligning the Hall Effect transistor or elements to the target magnets is critical to proper operation. See Figure 5.

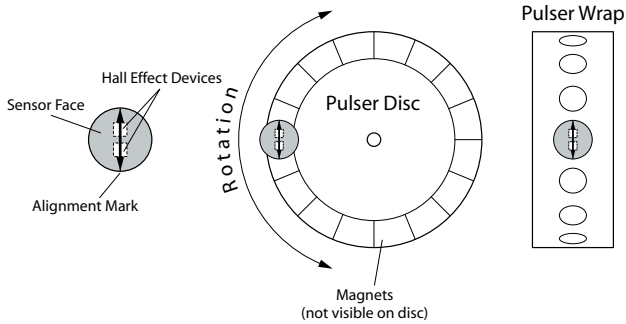


Figure 5: Sensor Disc Wrap Diagram

Sensor Dimensions

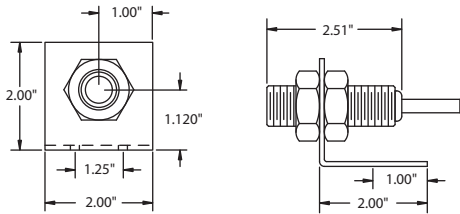


Figure 6: Standard 906B Sensor dimension

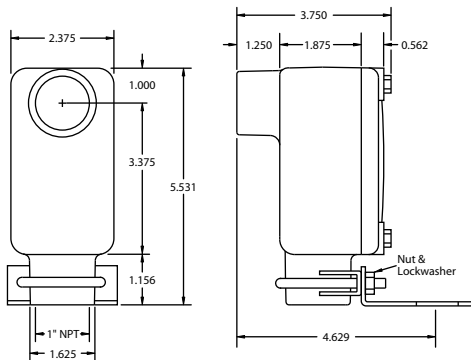


Figure 7: Explosionproof 907B Sensor dimensions

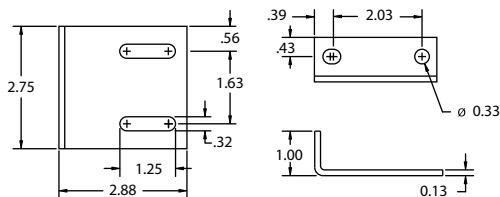


Figure 8: Explosionproof sensor bracket dimensions

Pulser disc and UDS1000 explosionproof enclosure dimensions

Figure 9 shows the dimensions of the 255 pulser disc.

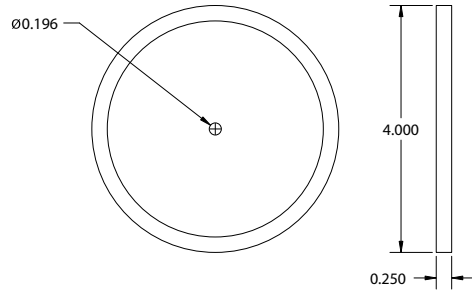


Figure 9: 255 Pulser Disc Dimensions in Inches

Figure 10 shows the dimensions of the explosionproof enclosure dimensions

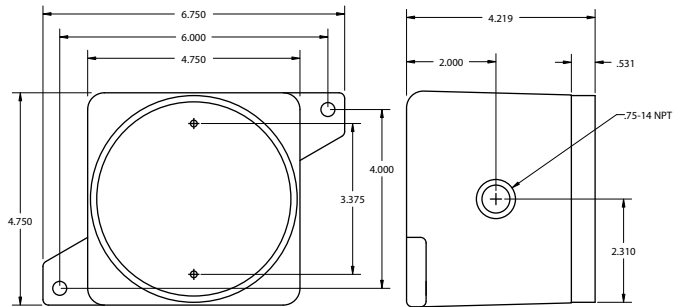


Figure 10: UDS1000 Enclosure Dimensions in Inches

Mounting the enclosure

The enclosure can be mounted either horizontally or vertically using two 1/4-inch bolts. The distance between the enclosure and the sensor can be up to 1500 feet. **DO NOT** mount the housing where water might enter it. Make sure that there is access to the terminal strip and switch adjustments.

Setup

The UDS1000 circuit board is equipped with an LED that indicates the state of the relay. When the LED is ON, the relay is energized. The relay must be energized when the shaft is rotating forward. For the UDS1000 electronics to distinguish forward from reverse rotation, the UDS1000 assumes the leading edge of the “A Phase” pulse precedes the leading edge of the “B Phase” pulse when the shaft is rotating forward.

To determine which signal wire is serving as the “A Phase,” connect the green signal wire to terminal TB2-2, and the black signal wire to TB2-3. With the power applied to the UDS1000, run the monitored shaft in the normal direction. If the LED on the circuit board is illuminated (*relay energized*) while the shaft is rotating, the signal wires are properly connected. If the LED is not ON, reverse the sensor signal wires and repeat the process to verify the result—mark the wires for future reference.

The factory sets the speed at which the relay de-energizes to its minimum, so that the reversal is indicated as soon as it is

detected. This will provide the best reversal protection from the UDS1000—no further adjustment is necessary to get the best performance from the unit.

It is possible to adjust the UDS1000 so that the relay does not de-energize until a higher reverse speed is reached. For example, the unit can be calibrated to keep the relay energized until the monitored shaft is running at 50 rpm in reverse. For this type of calibration, see RPM Range Settings.

The UDS circuit board

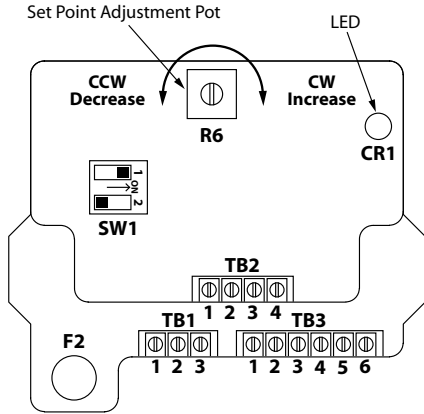


Figure 11: UDS1000 Circuit Board

UDS	Description
CR1	LED when relay is energized
R6	Set point pot, CW increase, CCW decrease (270° single turn)
SW1	RPM range switch
F2	Input Power Fuse, see specifications on back page

UDS1000 wiring guide for TB1, TB2, and TB3

TB1 is used to connect input power to the UDS circuit board.

TB1			
Power	1	2	3
115 Vac	Line	Neu	Gnd
230 Vac	Line	Line	Gnd
12 Vdc	Pos	Neg	Gnd
24 Vdc	Pos	Neg	Gnd

TB2 is used to connect sensors to the UDS circuit board.

	TB2			
	1	2	3	4
	Power	Signal A	Signal B	Common
906B & 907B	Red	Black	Green	White Shield
Other ESI	Red	White	Green	Black Shield

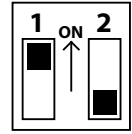
Note: If signal is reversed, switch Signal A and Signal B.

TB3 is used to connect the relay outputs to the UDS circuit board.

TB3					
1	2	3	4	5	6
NC1	COM1	NO1	NC2	COM2	NO2

UDS SW1 RPM Range Switch Settings

SW1 Positions		
1	2	RPM Range
ON	ON	0.5 - 5
OFF	ON	5 - 50
ON	OFF	50 - 500
OFF	OFF	500 - 5000



IMPORTANT

Most applications require the lowest setting possible for reverse detection, thus the 0.5 to 5 range with the pot turned CCW will achieve a setting of about 0.5 RPM. Unless a specific set point is desired, follow this recommendation. Ranges are calculated using 8 PPR, rescale for other PPR.

Sample motor shutdown circuit

Figure 12 shows a typical wiring diagram for a Motor Shutdown Control circuit with an alarm for a digital speed switch such as the UDS1000.

DISCLAIMER

The circuit shown in Figure 12 is provided for REFERENCE ONLY. Electro-Sensors accepts no responsibility for the use of this circuit or any circuit used for the purpose of Motor Shutdown.

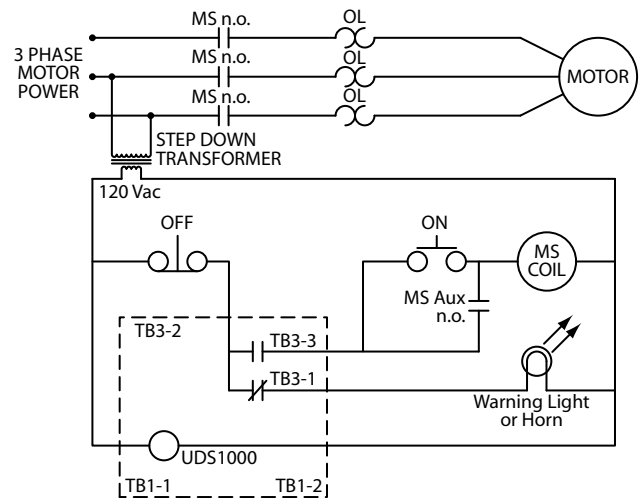


Figure 12: Sample Reference Motor Shutdown Circuit

Wiring diagram keys:

MS	Motor starter (not supplied)
OL	Overload contacts
n.o.	Normally open (relay is in a de-energized state)

WARNING!

During a stopped condition, any slight movement of the shaft or magnetic disc could energize the control relay and start the motor—if the Motor Auxiliary Normally Open Contact (MS Aux n.o.) is not wired in series as shown Figure 12, the reference circuit. Failure to observe this warning could result in damage to the equipment or injury to persons. Always use proper Lock-Out-Tag-Out procedures.

Troubleshooting



Problem	Possible Solution
Relay will not energize; LED does not light up	<ul style="list-style-type: none"> - Input power is not supplied to TB1 - See wiring schemes TB1 and observe marking on unit (<i>input power</i>)
LED does not de-energize during reverse rotation	<ul style="list-style-type: none"> - The sensor wiring or sensor gap may be incorrect, see Figures 1 through 4 - Normal shaft rotation may be CCW reverse "A" and "B" channels (<i>signal</i>) - Sensor supply or signals not present - Check for 12 Vdc on TB2-1 and 4, and pulsing DC between TB2-2 and 4, and TB2-3 and 4.

UDS1000 speed switch specifications

Input Power	Input Current	Fuse Type (F2)
115 Vac, 60Hz (std)	1/16 Amp	Sloblo .063A 5X20
230 Vac, 60Hz (opt)	1/32 Amp	Sloblo .032A 5X20
12 Vdc (opt)	1/8 Amp	Sloblo .125A 5X20
24 Vdc (opt)	1/8 Amp	Sloblo .125A 5X20

Input Signal	Parameters
Type	Quadrature, NPN open collector
Amplitude	12 V nom., 8 V min., 40 V max.
Pull-Up	2.2 K ohms
Repeatability	0.5%
Max Frequency	666 Hz (5000 RPM @ 8 PPR)
Min. Pulse Width	750 µsec



Relay Output Data	Parameters
Number Available	1 DPDT Form C
Actuation	Energized when shaft is rotating in normal direction, or not rotating De-energized when shaft rotates in reverse above set point (<i>factory set @ 0.5 RPM</i>)
Relay Contact Rating	5 Amp @ 30 Vdc, or 120 Vac resistive

Physical/Environment	Parameters
 Class I, Div 1, Group C, D Class II, Div 1, Group E, F, G UL File: E249019 	
Enclosure Dimensions	See Figure 10
Enclosure Material	Cast Aluminium, NEMA 4X
Operating Temperature	-40°C to +65°C*
Storage Temperature	-40°C to +65°C*
Shipping Weight	7 lbs

255 Pulsar Disc (std.)	Parameters **
Material	Nylon 12 Std, (opt; PVC, Alum, Stainless-Steel)
Dimensions	4-inch diameter x 1/4-inch thick
Operating Temperature	-40°C to +60°C* (Nylon, PVC)
Operating Temperature	-40°C to +150°C* (Alum, SS)

Pulsar Wrap (optional)	Parameters **
Material	PVC Std. (opt; Aluminum or Stainless-Steel)
Operating Temperature	-40°C to +60°C* (PVC)
Operating Temperature	-40°C to +150°C* (Aluminum, SS)

906B Sensor (Std)	Parameters **
Material Sensor Body	Aluminum 3/4 - 16UNF thread
Material Mount Bracket	Plate steel
Output Type	Quadrature NPN open collector current sinking 20 mA max
Signal Cable	4-conductor shielded, 10 feet length std. (50 ft. or 100 ft. optional)
Operating Temperature	-40°C to + 60°C*
Air Gap	1/4 inch +/- 1/8 inch

907B Explosionproof Sensor (optional)	Parameters **
 Class I, Div 1, Group D Class II, Div 1, Groups E, F, G UL File: E249019 	
Mounting Bracket Material	Plate Steel U-Bolt Assembly
Other Specifications	Similar to 906B standard sensor

Specifications are subject to change without notice.

***For higher or lower temperature ranges, consult factory.**

**** For details on Discs, Wraps and Sensors, consult factory or visit our website.**