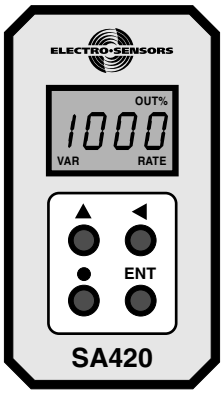
SA420 Signal Conditioner



Description:

Electro-Sensor's SA420 Signal Conditioner provides an analog signal directly proportional to the speed of a monitored shaft. The 0-10 VDC and 4-20 mA outputs can be sent to a chart recorder, digital display, PLC, loop controller, drive speed controller, or other control or monitoring devices. The wide voltage range and wave shape flexibility of the SA420's sensor input circuitry allow it to translate signals from Hall-Effect Sensors, proximity switches, magnetic sensors, and a wide variety of other pulse generator devices into analog outputs.

Sensor Installation:

The standard sensor is supplied with a mounting bracket and two jam nuts. The explosion-proof 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. The gap distance between the sensor and the disc or wrap, Dimension A In the diagrams, is 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 explosion-proof sensor using the slots on its mounting bracket.

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 10-32UNF. 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 10-32UNF 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, 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 5 foot-pounds max.

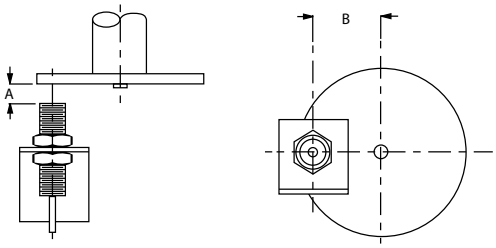


Figure 1: Standard Sensor with 255 Pulser Disc

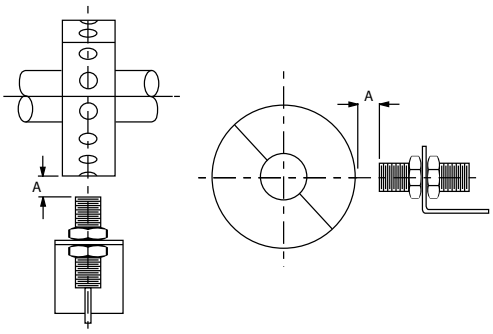


Figure 2: Standard Sensor with optional Pulser Wrap

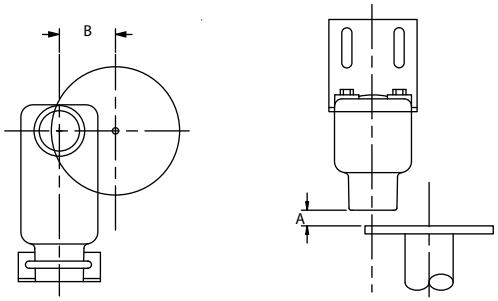


Figure 3: Explosionproof Sensor with 255 Pulser Disc

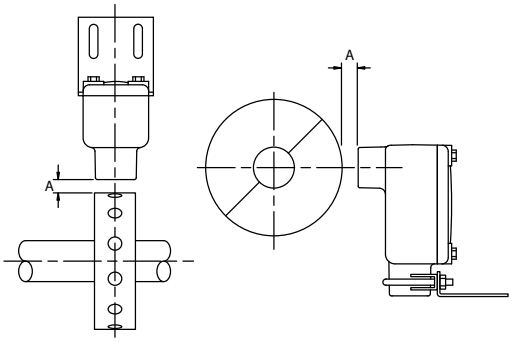


Figure 4: Explosionproof Sensor with Pulser Wrap

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SA420 Signal conditioner

For version 3 hardware with version 5.xx or later firmware

The SA420 now includes the following features:

- Quadrature (directional decoding)
- Bipolar voltage output (units now include +/- 5 VDC and +/- 10 VDC)
- Optional higher NPN input signal trip point (improves operation through IS barrier)
- Programmable lower analog output setpoint (Previously fixed at 0 Hz, now includes forward and reverse offsets) PR (00)
- Programmed to power up and display in the following units PR (04):
  - Hz (default)
  - Percent of maximum output
  - User defined units
- Programmable minimum frequency cutoff. PR (05) (This allows you to decide where the unit zeroes out for faster zeroing)
- More modes of operation:
  - Single channel
  - Quadrature 1X
  - Single channel 2X (new)
  - Quadrature 2X (new)
  - Quadrature 4X (new)
- Security lock variables (viewable but not changeable while locked)
- Ability to improve calibration with user variables which alter the upper and lower calibration point of the analog
- Choice of new menu or revert to basic 3 variable menu for compatibility

Wiring Connections:

Sensor Wire connections:

	5 Supply	6 Signal	7 Common	11 Signal B
ESI 906/ ESI 906B	Red	Black	White & Shield	Green*
ESI 907/907B ESI Prox	Brown	Black	Blue & Shield	White*
Mag Pickup/ ESI 917	N/C	White	Black & Shield	N/C
All Other ESI Sensors	Red	White	Black & Shield	Green*
ESI 907 Old/ ESI 907B Old	Red	Black	White & Shield	Green*

***Bi-directional sensors only**

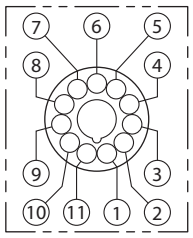
Power Connections:

Terminal	115 VAC Standard	230 VAC Optional	12 VDC Optional	24 VDC Optional
2	Hot	L1 Hot	(+)Positive	(+)Positive
10	Neutral	L2 Hot	(-)Negative	(-)Negative

Analog Output Connections:

Terminal	4-20 mA
3	(+) High
4	(-) Low

Terminal	0-10 VDC
9	(+) Positive
8	(-) Negative



Terminal	Connection
1	No Connect
2	Hot +
3	4-20mA +
4	4-20mA -
5	Sensor Supply
6	Sensor Signal A
7	Sensor Ground
8	0-10 VDC -
9	0-10 VDC +
10	Neutral -
11	Sensor Signal B

Figure 5: Terminal Block wiring

Frequency Calculations

Pertinent formula: Frequency (Hz) = (RPM * PPR)/60

Example: A customer has a motor rotating at 1200 RPM and wants the SA420 to output 20mA at 1250 RPM using a Hall Effect sensor and an ESI 255 disc.

Since the Hall Effect sensors turns on with a south field and off with a north field, the 255 disc's 16 alternating magnets (8 north and 8 south fields) will produce 8 PPR (Pulses Per Revolution). Insert 8 into the equation for PPR.

F = (1250 * 8)/ 60

F = 166.7 Hz [Value used in PR (01)]

Programming:

There are four buttons on the front panel used for calibration:

▲ Up Arrow Button is used to change the value of the position in focus (flashing), while in the calibration mode. While in standard mode, this button will toggle the display between frequency input (hertz) and output percentage.

◄ Left arrow button is used to move the focus to the next position when in the calibration mode of 4-20 mA or 0-10 VDC.

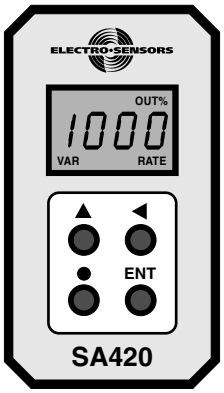
● Decimal Point Button is used to change the position of the decimal point while in the calibration mode.

ENT Enter Button is used to enter or exit the calibration mode.

Programming The Unit:

Standard menu: To enter the calibration mode, push the **ENT** button once. PR0 will be displayed. Press the ▲ (up) button to increment to the desired variable. Press the **ENT** button at which time the value of variable is displayed. The right most digit of the variable will be flashing, which indicates that this digit has the focus and can be changed. Pressing the ▲ (up) button will increment the flashing digit. The ◄ button will advance the focus to the next digit to be changed. The • (DP) button will scroll the decimal point across the display from right to left if that variable has the decimal point enabled. When the correct value is programmed into the variable, press the **ENT** button to store the variables value in memory. The display will show PRxx (the variable you just updated). You can now ▲ (up) button to the next variable you wish to change or continue until you've reached the end of variables and exit to user mode.

Basic menu: To enter the calibration mode, push the **ENT** button once. PR1 will be displayed for one second, and then the value of variable 1 is displayed. This is the Max frequency value. the right most digit of variable 1 will be flashing, which indicates that this digit has the focus and can be changed. Pressing the ▲ button will increment the flashing digit. The ◄ button will advance the focus to the next digit to be changed. The • (DP) button will scroll the decimal point across the display from right to left. When the correct value is programmed into the variable, press the **ENT** button to store the variable into memory and access variable Pr02. Pr02 is the sensor type. You can now change Pr02 to match the sensor output type if necessary or press the **ENT** button and advance to Pr03. Pr03 contains the input pulse buffer. When the value is correct press the **ENT** button to save value and to return to the user mode.



Variable functions

PR (00) Analog Lower Setpoint*
Setpoint for 4mA and 0 VDC value. (-5 or -10VDC if selected). To represent a reverse rate, increment the left most digit until the rate icon flashes. **

PR (01) Analog Upper Setpoint*
Setpoint for 20mA and 10 VDC value. (5 VDC or 10 VDC if selected). To represent a reverse rate, increment the left most digit until the rate icon flashes. **

PR (02) Sensor Type and Level
Used to select your sensor output type. The default is set to 0.

Variable 2 Value	Type of Sensors
0	NPN*
1	PNP
2	Magnetic Pickup
3	Logic Level
4	NPN 6.5V
5	PNP 6.5V

(All Standard ESI sensors are NPN open collector output.)

PR (03) Buffer Size
Ring buffer filtering up to 600 pulses. It is a first-in-first-out configuration. Typically, you would put in the PPR of the sensor/target combination or a supermultiple of the PPR.
Example: Customer using 906 sensor (Hall type with 1 PPR per 2 magnets) and a 255 disc (16 alternating magnets) would generate 8PPR. Normally you would use 8, 16, 24, 32… for the buffer size. Using higher counts makes the output more stable but slows the response down. You need to strike a balance between buffer size and response.

PR (04) User Units
Value to be displayed when operating at PR (01) frequency. (FPM, RPM, etc.) this is the value to display when operating at the frequency entered in variable Pr01.

PR (05) Frequency Cutoff
User can set the frequency cutoff to zero the unit faster. Customers that are reading higher speeds may want to raise the value entered here to quickly zero the unit out. conversely customers that need to read lower speeds may want to reduce this number, so it doesn't zero out too soon.

PR (06) Analog Response
Some applications need slower analog response rates. This variable is where you set the time required to slew from 10-90% analog output

PR (07) Signal Type**
Programming of PR (07) determines the way the signals are handled. There are multiple choices for both single and quadrature operation. 1X uses the rising edge of channel "A". 2X uses the rising and falling edge of channel "A". the quadrature 4X uses both the rising and falling edges of both the "A" and "B" channels. When using 2X or 4X configurations the PPR calculations will be double or quadruple verses the 1X configuration and the user needs to increase the Pr01 (Analog upper setpoint) value upward accordingly.

PR (08) Voltage Output Type
Controls the type of voltage output from the unit. There are multiple options see the table in the variable table on page 6.

PR (09) Menu Option
Controls what program menu is used. User can choice between the current advanced menu or revert for compatibility to the basic menu which has three variables.

All units will start in the new advanced menu unless the user programs it to use the basic menu. A user can get it back to the advanced menu which is the standard menu now by: holding down the decimal button and left arrow button simultaneously while powering on the unit. Then change PR (09) from (0000) to (0001) and press enter. The advanced menu will remain afterwards when restarting the unit.

Keep in mind that advanced features will be retained if you switch from the advanced menu back to the basic menu until you reset the unit. If you change PR (09) to zero (0000) the variables will remain but only PR (01) through PR (03) will be viewable.

PR (10) Display Option
User can set how the feedback is displayed. This enables the display of user to set in user units

PR (11 thru 14) Reserved

PR (15) Security PIN
To advance past this point when going through the menu this PIN must match the password. This will make the variable Read/Write rather than read only.

PR (16) Security Password
User can lock variables. Making PR (15) different from PR (16) will lock the variables and make PR (16) unviewable. It is important to remember the number entered in PR (16).

PR (17) Cal: PIN
To advance past this point when going through the menu this PIN must match the password. This will make the Cal variables accessible.

PR (18) CAL: Password
User can update variables 10-22 if the Cal pin matches the Cal password. Making PR (17) different from PR (18) will lock the calibration variables and make PR (18) unviewable. It is important to remember the number entered in PR (18).

PR (19) CAL: Voltage offset value
Setting that allows the user to adjust the Voltage offset to obtain greater accuracy.
Not implemented yet

PR (20) CAL: Voltage gain value
Setting that allows the user to adjust the Voltage gain to obtain greater accuracy.
Not implemented yet

PR (21) Cal: Current offset value (4.000mA)
Setting PR21 allows the user to adjust the current offset to obtain greater accuracy. The adjustment value is approximately 366nA (0.000366uA) of deviation up or down per single count of change. Example of changing this from 1000 to 980 results in the analog decreasing. It will decrease (20 *0.000366uA) or -0.00732uA. When done after the initial warm up of the unit, about 15 minutes, it can dramatically increase the accuracy of the unit.

PR (22) Cal: Current gain value (20.000mA)
Setting Pr22 allows the user to adjust the current gain value to obtain greater accuracy. The adjustment value is approximately 366nA (0.000366uA) of deviation up or down per single count of change. Example: Changing this value from 1000 to 1010 will result in the analog output increasing. It will increase (10 * 0.000366uA) or 0.00366mA. Adjust the current gain value after the initial warm up of the unit, about 15 minutes, it will increase the output accuracy of the unit.

*Users can program the analog to go up or down as the frequency increases by swapping the lower setpoint [PR (01)] with their upper setpoint [PR (00)].

**Reverse numbers are represented by a flashing “rate” icon and cannot be programmed until PR (07) is set for quadrature operation.

SA420 Advanced Mode Variables

Variable Number and Name	Default Value	Value Range	Coded Number Table	Move Decimal	User Values
(00) ANALOG_LOWER_SP_VAR	0	any number *		Yes	
(01) ANALOG_UPPER_SP_VAR	240.0	any number *		Yes	
(02) SENSOR_TYPE_VAR	0000	0-5	**0 = NPN (2.5 VDC trip level)** **1 = PNP (2.5 VDC trip level)** **2 = Mag (75 mVDC trip level)** **3 = Logic (2.5 VDC trip level)** **4 = NPN (6 VDC trip level)**** **5 = PNP (6 VDC trip level)****	No	
(03) BUFFER_SIZE_VAR	8	1-16		No	
(04) USER_UNITS_VAR	1800	any number *		Yes	
(05) FREQUENCY_CUTOFF_VAR	0.500	0.002-9.999 Hz		No	
(06) ANALOG_RESPONSE_VAR	00.00	00.00-20.00	**Amount of time it takes the analog output to change from 10% to 90%** **Examples:** **00.00 or 00.01 = 00.01 seconds** **00.10 = 0.10 seconds** **00.50 = 00.50 seconds**	No	
(07) SIGNAL_TYPE_VAR	0	0-4	**0 = Single channel operation** **1 = Quadrature operation** **2 = Single channel 2X operation** **3 = Quadrature operation 2X** **4 = Quadrature operation 4X**	No	
(08) VOLTAGE_OUTPUT_TYPE VAR	1	0-3	**0 = 0-5 VDC** **1 = 0-10 VDC** **2 = +/- 5 VDC** **3 = +/- 10 VDC**	No	
(09) MENU_OPTION_VAR	1	0-1	**0 = Basic menu** **1 = Advanced menu (Standard)**	No	
(10) DISPLAY_OPTION_VAR	0	0-2	**0 = Hz** **1 = Percent output** **2 = User units**	No	
(11) reserved for future use (12) reserved for future use (13) reserved for future use (14) reserved for future use				No	
(15) SECUR_PIN_VAR	0420	0000-9999		No	
(16) SECUR_PASS_VAR	0420	0000-9999		No	
(17) SECUR_CAL_PIN_VAR	0	0000-9999		No	
(18) SECUR_CAL_PASS_VAR	0420	0000-9999		No	
(19) CAL: VOLTAGE_OFFSET	1000	0000-2000	Currently not active	No	
(20) CAL: VOLTAGE_GAIN	1000	0000-2000	Currently not active	No	
(21) CAL: CURRENT_OFFSET	1000	0000-2000		No	
(22) CAL: CURRENT_GAIN	1000	0000-2000		No	

** When the 'rate' icon is flashing, the number being programmed is a reverse direction value. A value can only be displayed as a reverse direction value AFTER the unit is programmed to operate in quadrature mode. This prevents errant reverse values from being entered into a single-channel unit.*

*** Recommended quadrature setting for NPN or PNP.*

SA420 Dimensional Drawings:
Dimensions in Inches

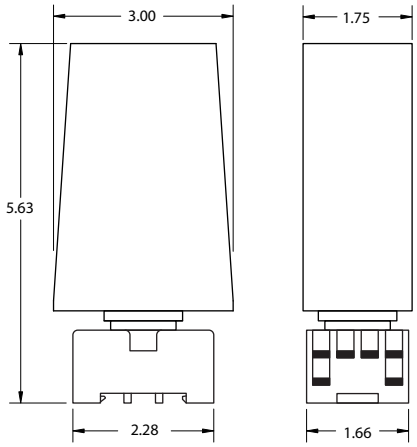


Figure 6: SA-420

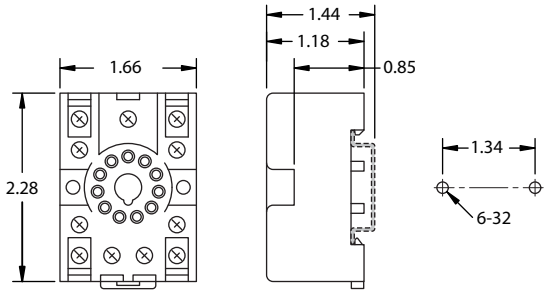


Figure 7: Terminal Block

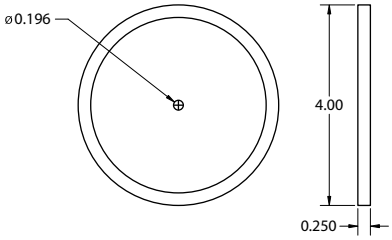


Figure 8: 255 Pulser Disc

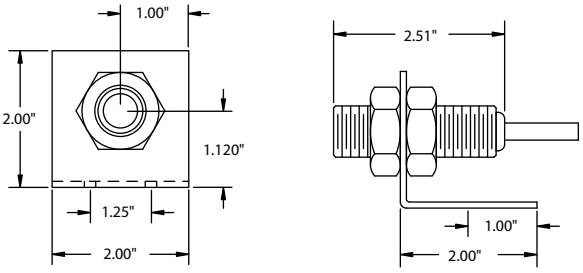


Figure 9: Standard Sensor

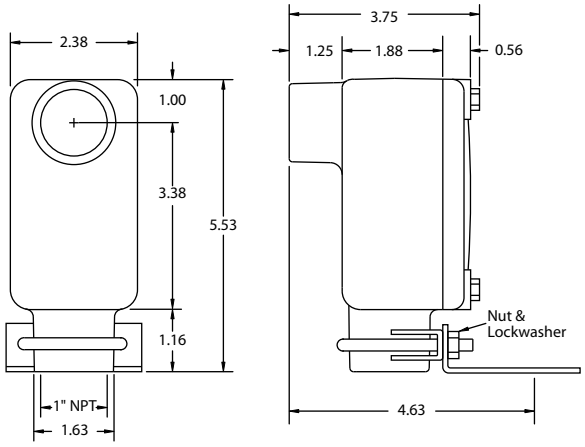


Figure 10: Explosionproof Sensor

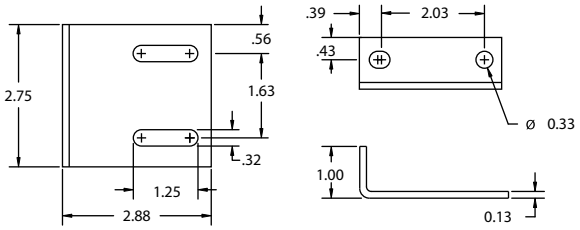


Figure 11: Explosionproof Sensor Bracket

Troubleshooting Guide

Problem	Possible Solution
Unit Dead	Check for proper supply at terminals 2 and 10. See figure 5 on page 3
No Analog out with zero hertz displayed	Check for Sensor supply. It should be Approximately 13.6 VDC
	Check sensor Gap distance
	Check Sensor Type (Variable 2)
Unit displays a frequency but the analog is incorrect	Check that Variable 00, Variable 01, Variable 08 are correct
	Check multimeter probes are on the correct terminals
Analog is unstable	Check sensor gap distance

SA420 General Specifications:

Input Power	Input Current	Fuse Type (F2)
115 Vac, 60Hz (std)	**2.5 VA**	**Sloblo .032A 5X20**
230 Vac, 60Hz (opt)	**2.5 VA**	**Sloblo .032A 5X20**
12 Vdc (opt)	**165 mA**	**Sloblo .250A 5X20**
24 Vdc (opt)	**135 mA**	**Sloblo .200A 5X20**

Input Signal	Parameters
Sensor Supply	12 VDC (unregulated) @50 mA max.
Programmable Types	Open collector NPN / PNP Logic Level 5 V Nom. 3 V Min. Magnetic Sensor +/- 75 MV Min.
Max. Amplitude	25 Vpk-pk Maximum
Frequency Range	0.01 Hz to 10 kHz
Minimum Input for Full Scale Output	0.5 Hz = 3.8 RPM @ 8 PPR *(Lower full scale range is available, consult Factory)*

Analog Output Signal	Parameters
Types	4 - 20 mA with 500Ω load max. 0 - 10 VDC, ±5 VDC, ±10 VDC, 1mA max output
Accuracy (typical)	0.1% Linearity for both outputs

Step Response Time	Parameters
50 Hz Input and above	10 to 90% = 50 ms.
Below 50 Hz Input	10 to 90% = 30 ms + 1/Hz Input frequency

Physical/Envlronment	Parameters
Mounting	DIN rail mount or Stand alone
Operating temperature	0°C to +60°Cz
Storage temperature	-65°C to +125°C
Electrical Connections	11 Position DIN rail terminal block
DIN rail enclosure rating	NEMA 1

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

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

906 Sensor (Standard)	Parameters **
Material Sensor Body	Aluminum 3/4 - 16UNF thread
Material Mount Bracket	Plate steel
Output Types	NPN open collector current sinking 20 mA max
Signal Cable	3-conductor shielded, 10 feet length std. (50 ft. or 100 ft. optional)
Operating Temperature	-40ºC to + 60ºC*
Air Gap	1/4 inch ± 1/8 inch with standard 255 Pulser disc (1/2" magnets)

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