ALTHEN SENSORS & CONTROLS

X005

Description

Intrinsically safe for hazardous atmosphere

- Approvals ATEX and IECEx
- Certified [Ex ia Ma] I
  [Ex ia Ga Da] IIC
- Super fast 4.7kHz (-3dB) bandwidth
- Wide power supply range
- Voltage and current output options
- Three or Five wire mode connection

The X005 Galvanic Isolation Amplifier has been designed specifically for use with Intrinsically Safe position sensors and is certified intrinsically safe Ex I(M1) and Ex II (1)GD.

Sensors are ratiometric i.e. the output signal scales with the supply voltage, to ensure the safe area signal accurately corresponds with sensor displacement it is important that the sensor supply is correct. The X005 Galvanic Isolation Amplifier provides a regulated and resistively limited +5V dc power supply required by IS sensors, it can be connected in three or five wire modes. Used in five wire mode positive and negative sense inputs enable the X005 to dynamically adjust the sensor supply thus ensuring the correct voltage across the sensor. Connected in this way the X005 can compensate for 150 Ω conductor resistance. The sense terminals are linked internally so the end user can use the X005 in three wire or five wire mode without the need to fit or remove external links. The X005 has an input power supply range of 12 to 30 volts dc, making it suitable for a wide range of hazardous area applications. It is tri-port isolated providing isolation between the amplifier power supply, the hazardous area and the X005 output signal. The sensor supply and output are transformer coupled providing 2.5kV isolation between the safe and hazardous area circuits eliminating the requirement for a high-integrity earth.

The output of the X005 is factory configured to either 0.5 to 9.5V or 4-20mA and has a bandwidth of 4.7kHz, making it ideal for servo control loops.

Output options available;
X005-545 0.5 to 9.5V
X005-546 9.5 to 0.5V
X005-425 4 to 20mA
X005-426 20 to 4mA

Versions are also available for potentiometer inputs. The screw terminal connector plugs are coded to eliminate cross connection.

Specifications

POWER SUPPLY	(J4 pins 1 {0V} and 3 {+V})
Voltage:	24V dc Nom. 12V - 30V
Current consumption (24V supply)	approx. 50mA [Voltage O/P] approx. 70mA [Current O/P]
INPUT CIRCUIT	(J1 pins 1,2,3 & J2 pins 1 & 2)
	Transformer isolated Ex I(M1) / II (1)GD [Ex ia Ma] I Ta = -20°C ≤Ta +60°C [Ex ia Ga Da] IIC Ta = -20°C =Ta =+60°C
SAFETY PARAMETERS	Uo: 10.66V Io: 50.5mA Po: 121mW Li: 0 Ci: 0 Um: 253 V
Sensor supply:	5V @15mA max.
Lead resistance compensation:	15Ω maximum (15mA) all connections
Input resistance (J1 pin 3)	>5MΩ
OUTPUT CIRCUIT	(J3 pins 1 {O/P-} and 3 {O/P+})
Voltage	0.5 to 9.5V
Output resistance	5Ω
Current loop	4 to 20mA
Load resistance	0 - 1kΩ
TRANSFER CHARACTERISTICS	
Non-linearity:	< ± 0.1% FS
Temperature drift:	< 0.01% FS/°C for voltage outputs
Settling time to 1% of span:	< 300µs for 10-90% step change
Rise time:	< 200µs 10-90% of step change
Bandwidth	dc to 4.7kHz (-3dB)
Isolation:	2500V between safe area terminals and hazardous area terminals, 50V between power rail (J4) and output (J3)
ELECTROMAGNETIC COMPATIBILITY	
	EN561236-2-1:2006 (EN31326-1:2006)
EXPLOSIVE ATMOSPHERE	
	EN60079-0:2006 EN60079-11:2007
Certificates;	ATEX: SIRA 10ATEX2204 IECEx: SIR 10.0131
Ambient temperature range:	-20° to 60°C working -40°C to +100°C storage
Housing:	97.3 mm x 22.5 mm x 111.9 mm
Protection class:	IP20
Mounting:	35x7.5 mm top-hat rail (DIN 46277-3)
Connector Conductor Size:	0.2 to 2.5mm^2 (26-12 AWG)
Weight:	120g approx.

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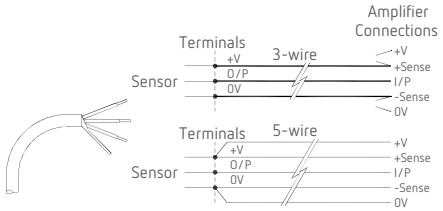
Three of Five-wire Mode Connection

The following discussion about 3 and 5 wire connections between the X005 Galvanic Isolation Amplifier and sensor, is intended as an aid for end-users who are not familiar with the topic.

Whether opting for a pre-wired Intrinsically Safe sensor or one with a connector, choosing the right mode of connection and cable to suit the application requires consideration.

Conductor resistance, a function of conductor cross-section, cable length and temperature, causes volts drop across a cable. As the term implies cables do not transmit the voltage perfectly, depending on conductor cross section and the current drawn from the power supply the voltage at the end of the cable will be less that at the power supply. This can significantly alter the perceived accuracy of the sensor which is ratiometric i.e. the output signal is directly affected by the supply voltage at the sensor. It should be noted that volts drop calculations multiply the cable length by two, this includes the current flow return path to the source.

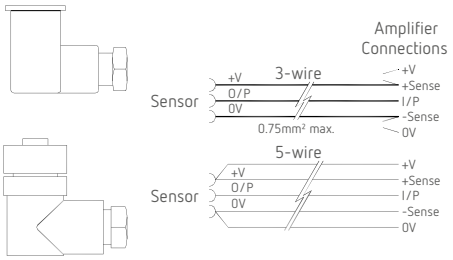
3-wire connections are common and are suitable in most cases with short or moderate cable runs. Applications that do not require a high degree of accuracy but have cable runs, say in excess of 50m, volts drop can reduced by introducing a terminal box close to the sensor and using a larger cross-section cable with for a majority of the intended cable run. Another factor to consider is conductor temperature. Fluctuations in temperature cause minor changes in resistance, the effects of which will be seen as gain variation in the sensor output.



Sensors supplied with cable are calibrated with the cable fitted which negates errors due to conductor resistance at room temperature; however, small gain errors due to temperature fluctuations in the cable should be expected.

There are instances where large cross-section cables are not practical; for example most standard industrial connectors used on sensors have a maximum conductor capacity of 0.75mm^2, copper prices and ease of installation are other considerations.

5-wire connections have significant benefits over three wire connections as losses in the power and ground conductors are compensated for, thus smaller cables can be used. The Galvanic Isolation Amplifier senses and dynamically adjusts the output voltage so that the voltage at the sensor is correct, the effects of cable resistance and associated temperature coefficients are eliminated. The FDX005 amplifier can compensate for up to 15Ω per conductor with a current flow of 15mA, which is more than adequate for 150m of 0.25mm^2 cable.



For this reason Altheris recommends five wire connections for cable lengths exceeding 10 metres in 0.25 mm^2 cable to preserve the full accuracy of the sensor.

See illustrations right for examples of connecting a sensor to the Galvanic Isolation Amplifier.
The barrier will compensate for up to 15 ohms resistance in each conductor so this imposes the following minimum cable sizes:-

0.25 mm^2 up to 150m
0.5 mm^2 150m up to 300m
0.75 mm^2 300m up to 450m
1 mm^2 450m up to 600m
1.5 mm^2 600m up to 900m
2 mm^2 900m up to 1000m

The above lengths and conductor sizes used in a three wire connection will introduce a gain reduction of 5% and a ±1% temperature dependence of gain over the range -40°C to +80°C for the cable temperature. (i.e. about −150 ppm/°C for the maximum lengths shown and less pro rata for shorter lengths.)

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