G005

APPLICATION

- Certified [Ex ia Ga] IIC [AEx ia Ga]IIC
  [Ex ia Da] IIIC [Ex ia Da] IIIC
  IS Associated Apparatus for supply to
  Class I, Division 1, Groups A, B, C, D;
  Class II, Division 1, Groups E, F, G;
  Class III, Division 1;
- Super fast 4.7kHz (-3dB) bandwidth
- Wide power supply range
- Voltage and current output options
- Three or Five wire mode connection

The G005 Galvanic Isolation Amplifier has been designed specifically for use with Althen Intrinsically Safe position sensors in hazardous applications. Althen IS 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 G005 Galvanic Isolation Amplifier provides a regulated and resistively limited +5V dc power supply required by Althen IS sensors, it can be connected in three or five wire modes. Used in five wire mode positive and negative sense inputs enable the G005 to dynamically adjust the sensor supply thus ensuring the correct voltage across the sensor. Connected in this way the G005 can compensate for 15Ω conductor resistance. The sense terminals are linked internally so the end user can use the G005 in three wire or five wire mode without the need to fit or remove external links.

The G005 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 G005 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 G005 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;

G005-545	0.5 to 9.5V
G005-546	9.5 to 0.5V
G005-425	4 to 20mA
G005-426	20 to 4mA

Versions are also available for potentiometer inputs.

The screw terminal connector plugs are coded to eliminate cross connection.

SPECIFICATIONS

Power Supply **Voltage** **Current consumption (24V supply)**	(J4 pins 1 {0V} and 3 {+V}) 24V dc Nom. 12V - 30V approx. 50mA [Voltage O/P] approx. 70mA [Current O/P]
Input Circuit	(J1 pins 1,2,3 & J2 pins 1 & 2) Transformer isolated
Intrinsic Safety **Tamb.**	[Ex ia Ga] IIC [AEx ia Ga] IIC, [Ex ia Da] IIIC [AEx ia Da] IIIC IS Associated Apparatus for supply to Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III, Division 1; Ta = -20°C ≤Ta ≤+60°C

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SPECIFICATIONS (CONTINUED)

Safety Parameters	Umax. 30Vdc, Imax. 200mA, Uo / Voc 10.66V, Io / Isc 50.5mA, Po / Pout 121mW
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)
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 IEC/EN 60715 top-hat rail
Connector Conductor Size	0.2 to 2.5mm2 (26-12 AWG)
Weight	120g approx.

THREE OR FIVE-WIRE MODE CONNECTION

The aim of this document is to help readers who do not understand what is meant by three or five wire modes of connection between the galvanic isolation amplifier and sensor, and the factors behind them. It is by no means an in-depth technical analysis of the subject.

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

Interconnecting cables are not perfect conductors and offer resistance to current flow, the magnitude of resistance† depends on conductors resistivity, which changes with temperature, cross sectional area‡ and length. If the voltage were to be measured at both ends of a length of wire it would be found they are different, this is known as volts drop. Volts drop changes with current flow and can be calculated using Ohm's law, it should be noted that volts drop occurs in both positive and negative conductors. The effects of volts drop can be reduced by increasing the conductors cross sectional area, this does not however eliminate the effects due to temperature variation. There are instances where large cross-section cables are not practical; for example most standard industrial connectors of the type used for sensors have a maximum conductor capacity of 0.75mm², copper prices and ease of installation are other considerations.

This is important because the effects of volts drop can significantly alter the perceived accuracy of the sensor which is ratiometric i.e. the output signal is directly affected by the voltage across the sensor. Changes in temperature will also be seen as gain variation in the sensor output.

Three wire mode 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 10m, volts drop can reduced by introducing a terminal box close to the sensor and using a larger cross-section cable for a majority of the cable run. Sensors supplied with three core cable are calibrated with the cable fitted which largely eliminates errors due to conductor resistance at room temperature however, as mentioned above, small gain errors due to temperature fluctuations should be expected.

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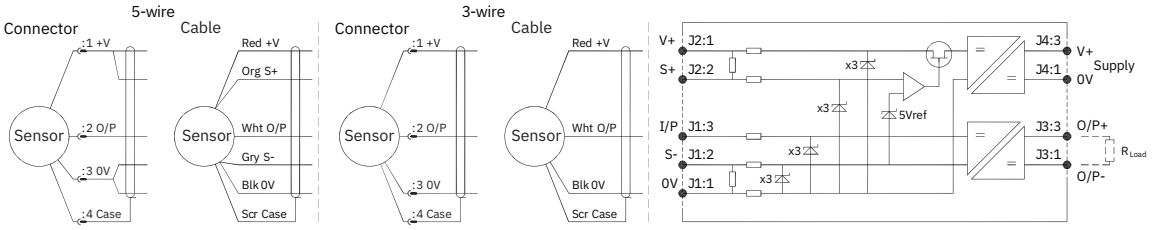
Five wire mode connections have significant benefits as losses in the positive and negative conductors are compensated for by the galvanic isolation amplifier which can 'sense' the voltage across the sensor and dynamically adjust the output voltage so that the voltage across the sensor is correct. The effects of cable resistance and associated temperature coefficients are eliminated allowing for smaller conductors than a three wire connection for the same cable run. The amplifier can compensate for up to 15Ω per conductor with a current flow of 15mA, which is more than adequate for 150m of 0.25 mm² cable, longer lengths will require larger conductors.

For this reason Althen recommends five wire connections for cable lengths exceeding 10 metres in 0.25 mm² cable to preserve the full accuracy of the sensor.

See illustrations below for examples of connecting a sensor to the galvanic isolation amplifier.



Cable Length (metres)	Up to 150	150 - 300	300 - 450	450 - 600	600 - 900	900 - 1000
Cross Section (mm²)	0.25	0.5	0.75	1.0	1.5	2.0

The table above shows recommended conductor sizes with respect to cable length for both three and five wire connections, based on copper conductors. Three wire connections 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.)

It should be noted that the maximum cable length, as specified in the sensor certification, takes **precedence** and **must not** be exceeded.

Althen sensors are supplied with three core 0.25 mm² cable as standard, however five core 0.25 mm² cable can be supplied on request. The galvanic isolation amplifier is available as;

G005-*** for 'G' and 'H' prefix sensors

X005-*** for 'E', 'M' and 'X' prefix sensors

† R = ρL/A ρ is the resistivity of the conductor (Ωm) L is the length of conductor (m) A is the conductor cross-sectional area (m²).

‡It is presumed that direct current flow is uniform across the cross-section of the wire, the galvanic isolation amplifier and sensor are a dc system.

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INSTALLATION INFORMATION

CSA Certificate number CSA 12.2534055			[Ex ia Ga] IIC [AEx ia Ga] IIC, [Ex ia Da] IIIC [AEx ia Da] IIIC IS Associated Apparatus for supply to Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III, Division 1;		
Base Part N°	**Module Supply Voltage**	**Module Supply Current: (Nom.)**	**Sensor Supply Voltage**	**Sensor Supply Current**	**Conductor Resistance Compensation**
G005-	24V Nom. (12-30V)	50mA Voltage O/P 70mA Current O/P	5V nom.	15mA max.	15Ω five wire mode
Option Code	**Output Signal**	**Calibration**	**Comments**		
545	0.5 to 9.5V	Standard Output	For Positek Z000 coded sensors		
546	9.5 to 0.5V	Reverse Output			
425	4 to 20mA	Standard Output			
426	20 to 4mA	Reverse Output			
010	0.5 to 9.5V	Standard Output	For sensors previously manufactured for use with BX002 i.e. Z010 Note: G005 does not have the same pin connections as BX002		
420	4 to 20mA	Standard Output	For sensors previously manufactured for use with BX003 i.e. Z420 Note: G005 does not have the same pin connections as BX003		
001	0.5 to 9.5V	Standard Output	For Potentiometers		
002	9.5 to 0.5V	Reverse Output			
003	4 to 20mA	Standard Output			
004	20 to 4mA	Reverse Output			

PUTTING INTO SERVICE

This module must only be installed, operated and maintained by competent and suitably trained personnel. The installation and maintenance must be carried out in accordance with all appropriate international, national and local standard codes of practice and site regulations for intrinsically safe apparatus. The use, installation, or maintenance of the module, in any other way than intended, may impair its operation or the protection it provides.

This module **must not** be installed in a position where;

- It may be exposed to excessive accumulation of dust.
- It may be attacked by aggressive substances.
- It may be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation.

MECHANICAL MOUNTING

The module is designed to mounted on 35x7.5 mm IEC/EN 60715 top-hat rail.

The module is designed for indoor use and should be mounted in a suitably rated enclosure in a designated safe area. It **must not** be installed in the hazardous area **without** the further provision of suitable certified hazardous area protection.

ENVIRONMENTAL CONDITIONS

Pollution degree: 2

Installation category: I

Altitude: up to 2000m

Humidity 80% to temperatures up to 31 °C decreasing linearly to 50% rH at 40 °C; /// max 80% rh, non condensing.

SAFETY PARAMETERS

Tamb.	=	(-20°C≤Ta+60°C)
Umax.	=	30Vdc
Imax.	=	200mA
Uo / Voc	=	10.66V
Io / Isc	=	50.5mA
Po / Pout	=	121mW

Lo / La	=	14mH	53mH	112mH
Group		**IIC**	**IIB**	**IIA**
Co / Ca	=	2.23µF	15.6µF	69.0µF
or L/R Ratio	=	295µH/Ω	1178µH/Ω	2357µH/Ωl

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USE

The G005 Galvanic Isolation Amplifier is designed to supply a sensor, operating in hazardous environment, with an isolated and resistively limited dc supply and also isolate and amplify the sensor output for transmission in the safe area. This module has been designed to meet the requirements of Associate Apparatus for Category 'ia'.

MAINTENANCE

Access to the circuitry **must not** be made during operation.

This module **cannot** be repaired by the user and **must** be replaced by another suitably certified part. Repairs can only be carried out by the manufacturer or approved repairer.

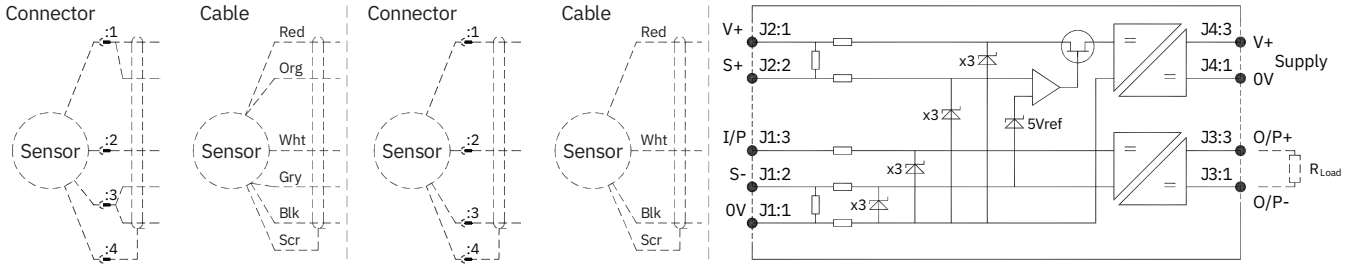
ELECTRICAL CONNECTIONS

The screw terminal connector blocks can be removed to simplify panel wiring or replacement of a damaged module. The connector blocks are key coded to reduce the chance of cross connection and can accommodate conductors with a cross section of 0.2 to 2.5mm² (26-12 AWG).

This module has been designed to drive a sensor, or potentiometer, in either three or five wire mode.

In three wire mode conductor resistance is not compensated, which can result in perceived inaccuracies due to volts drop down the cable. Increasing conductor cross section reduces some of the effects of conductor resistance.

In five wire mode up to 15Ω resistance in each conductor can be compensated for, while providing the sensor with a current of 15mA. This mode is recommended for all applications requiring high degrees of accuracy and / or where the cable length between module and sensor is greater than 10 metres.



Cable Length (metres)	Up to 150	150 - 300	300 - 450	450 - 600	600 - 900	900 - 1000
Cross Section (mm²)	0.25	0.5	0.75	1.0	1.5	2.0

To ensure correct operation of both Amplifier and sensor, the following restrictions on conductor cross section and cable length limits are set out in the table above (figures are based on copper conductors);

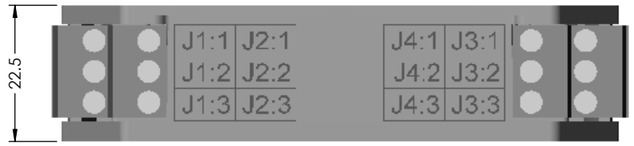
OUTPUT CHARACTERISTIC

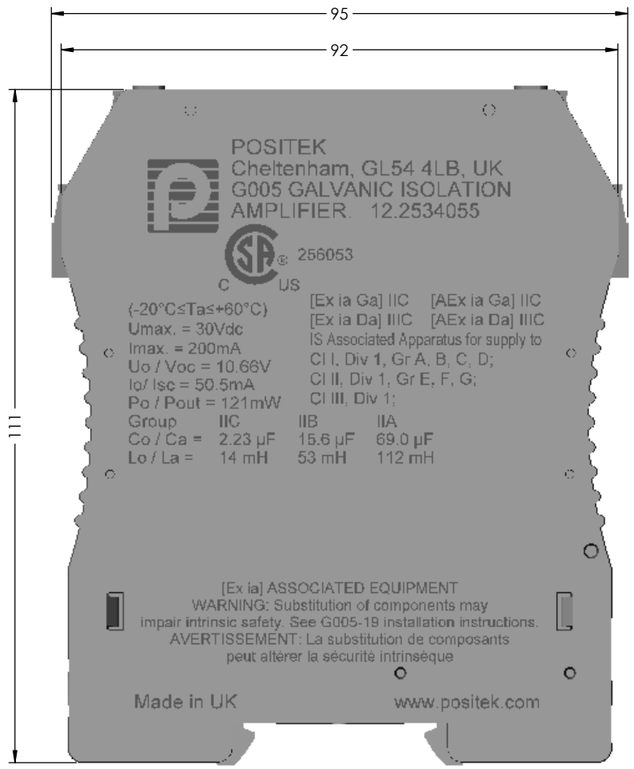
The safe area output changes with respect to the hazardous area input, span and slope dependant on selected option code, see table on page 1.

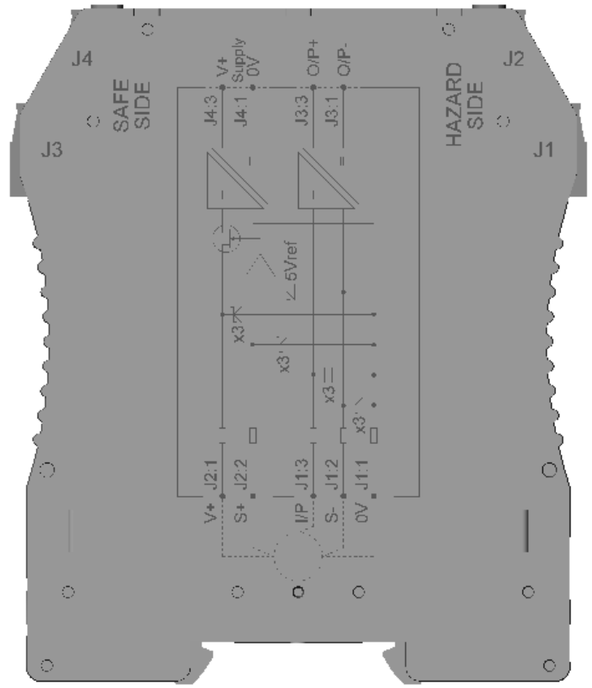
INCORRECT CONNECTION PROTECTION

Safe area connections are reverse polarity protected.

NOTES:-
BEFORE USE READ INSTALLATION SHEET G005-19 FOR FULL INSTRUCTIONS.







DRAWINGS NOT TO BE CHANGED WITHOUT REFERENCE TO THE CHANGE PROCEDURE.
CHANGES TO PARTS USED IN INTRINSICALLY SAFE PRODUCT MUST BE APPROVED BY THE AUTHORISED PERSON.
THIS IS AN UNCONTROLLED PRINT AND WILL NOT BE UPDATED.

REV	CHANGE HISTORY	DR'WN	DATE	CHK'D
D	RAN1362 APPROVALS UPDATE ETC	PDM	20/05/2024	PDM

APPROVED BY	REV		
RDM	D		X ±0.4 X.X ±0.2 X.XX ±0.1 DIMS mm

DESCRIPTION
POSITEK GALVANIC ISOLATION AMPLIFIER CSA APPROVAL

SCALE	DRAWING NUMBER
1:1 A3	G005-11 SHEET 1 OF 1