

# Installation, Operating and Maintenance Instructions for Series 387 Analogue Transmitter



ISSUE 1 01/12



## DESCRIPTION

Series 387 Transmitters/transducers employ strain gauge pressure sensing and a precision amplifier providing a 4 to 20 mA current output capable of being used in control and indicating loops without further amplification.

Each instrument is coded to provide a complete description of the facilities offered.

## IMPORTANT INFORMATION

Delta Controls cannot guarantee performance, standards compliance, or accept liability for any eventuality arising if the instrument is installed or operated in any way contrary to the guidance contained herein.

## ENCLOSURES AND CERTIFICATION

All Models are enclosed in an investment cast, 316 Stainless Steel enclosure, giving environmental protection to IP66 (NEMA 4X). Ensure that the Model chosen is appropriate to the environment and that codes of practice for the installation of electrical apparatus have been followed.

**4-387** Certified Intrinsically Safe when powered via a suitable Barrier device or Isolator. The unit is rated

Ga Ex ia IIC T4 (Tamb = -20°C to +90°C)  
Ga Ex ia IIC T5  
Ex iaD 20 T120 (Tamb = -20°C to +90°C)  
Ex iaD 20 T90

This model is suitable for use in Zone 0 Hazardous Areas when installed in accordance with the proper Codes of Practice.

## SPECIAL CONDITIONS OF SAFE USE (4-387 only)

1. The transmitter may not be capable of withstanding the 500V insulation test required by clause 6.3.12 of EN 60079-11 and this must be taken into account when installing the apparatus
2. A conduit/cable gland or an integral cable when fitted to the transmitter must provide a degree of protection of at least IP6X

**R-387** Explosion-proof/Weather-proof and rated

⊗ II 2 GD Ex tD A21 IP6X T85°C

And

⊗ II 2 GD Ex tD A21 IP6X T135°C (Tamb = -20°C to +90° C)

This model is suitable for use in Zone 1/21 Hazardous Areas (Gas and Dust) when installed in accordance with the proper Codes of Practice. Particular attention should be given to the cable gland or conduit attachment.

The instrument must be isolated from the power supply before the cover is removed, and the cover must be screwed fully down (hand right) and locked with the grub screw before power is restored.

**A-387** Weather-proof only. Suitable for outdoor use in all industrial environments, including offshore.

**F-387** Listed by Factory Mutual Research as being suitable for use in Hazardous areas as follows:

Explosionproof	Class I Division 1 Groups B, C & D
Dust Ignitionproof	Class II & III Division 1 Groups E, F & G
Intrinsically Safe	Class I, II & III Division 1 Groups A, B, C, D, E, F & G
Non-Incendive	Class I, II & III Division 2 Groups A, B, C, D, F & G

## ELECTRICAL ENTRY AND CONNECTION (Fig 1)

For reasons of Explosion containment, Explosion-proof approval is confined to ranges 0 to 10 bar (160 psi) and above. Intrinsic Safety operation are available over the full set of pressure ranges offered.

The instrument is designed for ease of electrical connection combined with compact overall size, even with 2 mm<sup>2</sup> (16 AWG) solid wire. Cable inserted through threaded entry clears the terminal block and passes out through the cover aperture, enabling termination and connection to be carried out with minimum effort.

Cable to be braid, double-braid, or braid & foil screened.

Cable gland to terminate the cable screen through a 360° connection. Ideally the gland would be made from the same material as the instrument housing, 316 stainless steel. The instrument requires an earth bond to the instrument enclosure.

## MAINTENANCE

No maintenance is normally necessary or required on these instruments. Should the cover be removed for adjustment, ensure that the O-ring seal is not damaged. Light greasing is recommended. Maintenance should only be conducted in a dry ambient environment to prevent water ingress, which can cause damage to sensitive internal components.

## WARRANTY

This instrument is guaranteed against faulty workmanship and material for a period of one year from the date of delivery. The company undertakes to repair, free of charge, ex-works any instrument found to be defective within the specified period provided the instrument has been used within the specification in accordance with these instructions and has not been misused in any way. Detailed notice of such defects and satisfactory proof thereof must be given to the company immediately after the discovery and the goods have to be returned free of charge to the company, carefully packed and accompanied by a detailed failure report.

To comply with health and safety requirements, the instrument must be clean and safe to handle and accompanied by a formal statement to that effect duly signed by an authorised officer of the user company. Any instrument returned without certification will be quarantined and no action will occur until cleared.

On ranges below 10 bar gauge (160 psi), it is recommended that the cable incorporates a breather tube to permit pressure equalisation during changing atmospheric conditions. This is not permitted with Exd and FM Explosion-proof installations, but as these are limited to higher pressures, any error introduced will be negligible. A suitable cable gland must be fitted if the unit is to be wired with flexible or armoured cable.

For Weather-proof and Intrinsically Safe units, the gland must seal to an environmental rating not less than that of the instrument (IP66/NEMA 4X). In addition, for Exd and FM Explosion-proof units, it must be of a type approved for the Zone/Division and Hazards applications, it must be capable of withstanding a pull of 160 Newtons (36 pounds force).

Two optional threads are offered as standard for attachment of conduit or gland.

These are: Code 1 Female Thread M20 x 1.5 ISO  
Code 2 Female Thread ½" NPT

#### WETTED PARTS

A variety of wetted parts is available, dependent upon the user's needs and, to some extent, on the pressure range required.

**Code S** For pressure ranges 10 bar (160 psi) and upwards, the standard combination is a diaphragm of 15-5 PH or 17-4 PH stainless steel, mounted on a pressure entry of 316 stainless steel. This offers an optimum combination of high accuracy with corrosion resistance. Thin-film strain gauge sensors are bonded directly to the 'dry' side of the diaphragm and are laser-trimmed for accuracy and stability. Maximum Working Pressure 2 x Upper Range Limit.

**Code T** Monel diaphragm and pressure entry. The low chemical reactivity of this Nickel-copper alloy allows the instrument to be used with chemicals that attack stainless steel. Its tensile strength limits the amount of overpressure the instrument can take without suffering a permanent shift in calibration. Maximum Working Pressure 1.5 x Upper Range Limit compatible with the requirements of NACE.

**Code U** Hastelloy diaphragm and pressure entry. This offers the best chemical resistance, but performance limits apply as to NACE and Monel units. Maximum Working Pressure 1.5 x Upper Range Limit compatible with the requirements of NACE.

**Code C** Hastelloy diaphragm and annealed 316 Stainless Steel pressure entry. This offers the chemical resistance of Hastelloy on the critical measuring parts, but uses SS for the more massive Pressure Connection. This is the recommended version for NACE applications. Performance limits apply as Monel units. Maximum Working Pressure 1.5 x Upper Range Limit.

**Code R** From 0 to 1 bar up to 0 to 10 bar, the sensor is a piezoresistive silicon sensor protected by a 316 stainless steel diaphragm. Maximum Working Pressure 2 x Upper Range Limit.

While a limited amount of advice can be given regarding suitability of the wetted-parts options available, the wide range of chemical processes to which Delta Controls Transmitters/transducers are applied requires that the final decision for compatibility must lie with the user.

#### RANGES AND UNITS OF MEASURE

Definitions.

**Upper Range Limit (URL).** The maximum pressure to which the 20 mA output may correspond. In effect, this is recommended as the maximum pressure that may continuously be applied to the instrument.

**Upper Range Value (URV).** The pressure which, according to the setting of the instrument, corresponds to 20 mA output. For this range of instruments, it will lie between 25% and 100% of the URL (4:1 turn down).

**Maximum Working Pressure.** The pressure that may be occasionally applied during test or abnormal conditions without detriment to the performance of the instrument. Continuous operation above the URL, particularly if the pressure is cyclic, will shorten the useful life of the instrument and should be avoided

#### OUTPUT SIGNAL (Fig 2)

The transmitters/transducers use the standard 4 to 20 mA two wire system in which the power supply, transmitter and load are in series. This means, therefore, that for a constant voltage at the power supply, as the signal level rises, the drop across the load reduces the voltage available at the transmitter, which should at all times lie between 12V and 36V. The attached load/voltage diagram shows the permitted range of supply voltage for satisfactory operation of the instrument.

On intrinsically safe versions the maximum voltage is 28V DC.

Two levels of insulation can be offered:

**Code 6** 50 VDC maximum between electrical circuits and earth (Ground).

**Code M** 500 V ac test between electrical circuits and earth (Ground).

Where the instruments are certified Intrinsically Safe for use in hazardous areas, they must be powered from a suitable source in accordance with the System Certificate or Control Drawing. Where Zener Barriers are used on Code 6 Signal Option, the instrument must be earthed using the terminal provided with a conductor not less than 4 mm<sup>2</sup> cross section and a total resistance to earth not exceeding 1 ohm.

If a galvanically isolated repeater / power supply is employed, or Signal Code M is specified, no such earth is necessary. While the instruments have high resistance to EM and RF interference, it is strongly recommended that for long cable runs, the instrument leads be screened.

For RF suppression to be fully effective, the instrument enclosure should be grounded.

#### PROCESS CONNECTIONS

Ensure that the pressure range and maximum working pressures selected are compatible with the expected pressures in the system.

The method of installation should ensure that very high temperature media are not allowed in direct contact with the instrument by fitting an adequate length of impulse line or a syphon. Precautions should also be taken so that under low temperature conditions the process medium cannot freeze within the instrument sensor. The instrument may be mounted in any position and is normally self supporting by the pipe work. The pressure connector should be tightened using a 45 mm (1 ¾") AF spanner on the hexagon provided, and the appropriate spanner on the pipe work connector.

#### DO NOT USE A COMPRESSION WRENCH ON THE INSTRUMENT BODY.

**Code J** ½" NPT external.

**Code N** G1/2A to ISO 228 (½" BSP Parallel External spigotted)

Note: Codes J & N are subject to a maximum average pressure of 1200 bar / 17500 psi or the value given in 'wetted parts' which ever is less.

**Code V** Nominal ¼" HP Cone and thread. This fitting is recommended for pressures over 10,000 psi (690 bar).

A wide range of alternative connectors is available; refer to contract specification if necessary.

#### ADJUSTMENT

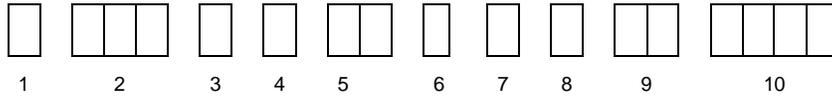
The 387 transmitter has a 4:1 turndown facility, enabling an instrument with a nominal range of 0 to 10bar to be re-ranged to a value as low as 2.5 bar. A standard instrument is supplied with a fine adjustment control for trimming the zero (4mA) point and both a coarse and a fine control for adjusting the span (20mA) point. Those instruments requiring an elevated zero may be fitted with an additional coarse zero control.

To adjust the span, use a calibrated pressure source to apply a pressure corresponding to the desired upper range value (URV) and adjust the coarse span until an output close to 20mA is achieved. Use the fine span control to make small adjustments to set the URV at exactly 20mA.

**Due to the resolution of the controls, it is sometimes possible that a particular position of the span control results in an unstable output. If an unstable output is noticed, the URV should be adjusted away from 20mA with the coarse span control and then the fine span control used to adjust the 20mA back to the desired URV.**

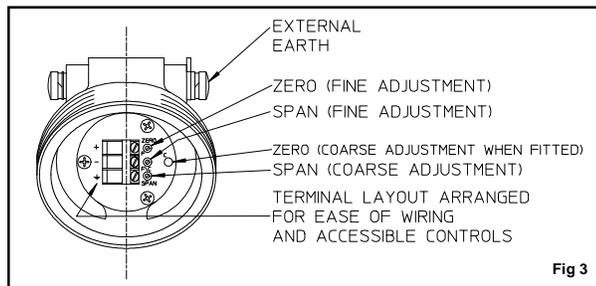
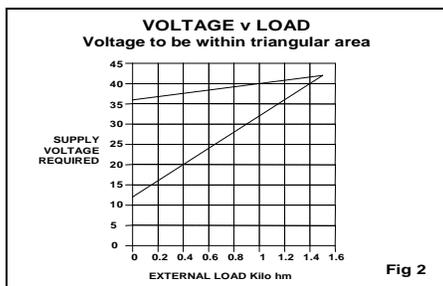
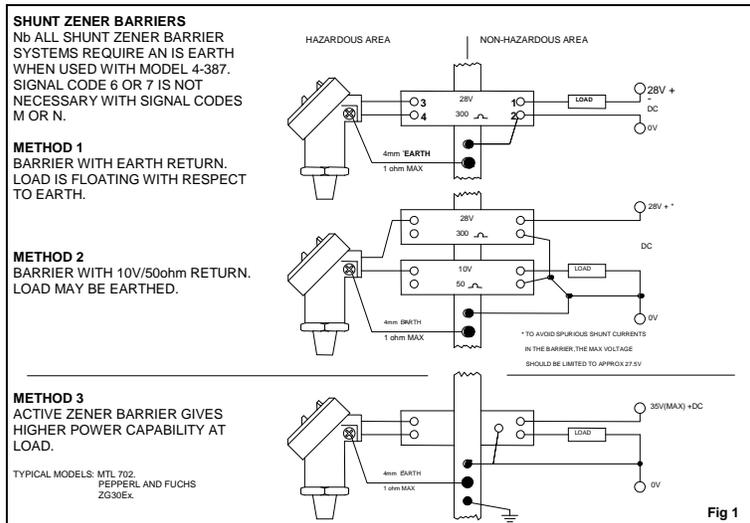
Range, span and zero controls are accessible by removal of the threaded lid (refer to fig 3) first loosening the grub screw. Disconnection of the electrical wiring is not necessary for the functioning of the instrument, but proper site practices should be followed when working on an instrument which is 'live' with respect to power or process. For example, under no circumstances may an Explosion-proof instrument operating in a Zone 1 / Division 1 Hazardous area have its lid removed when the electrical circuit is live without a permit.

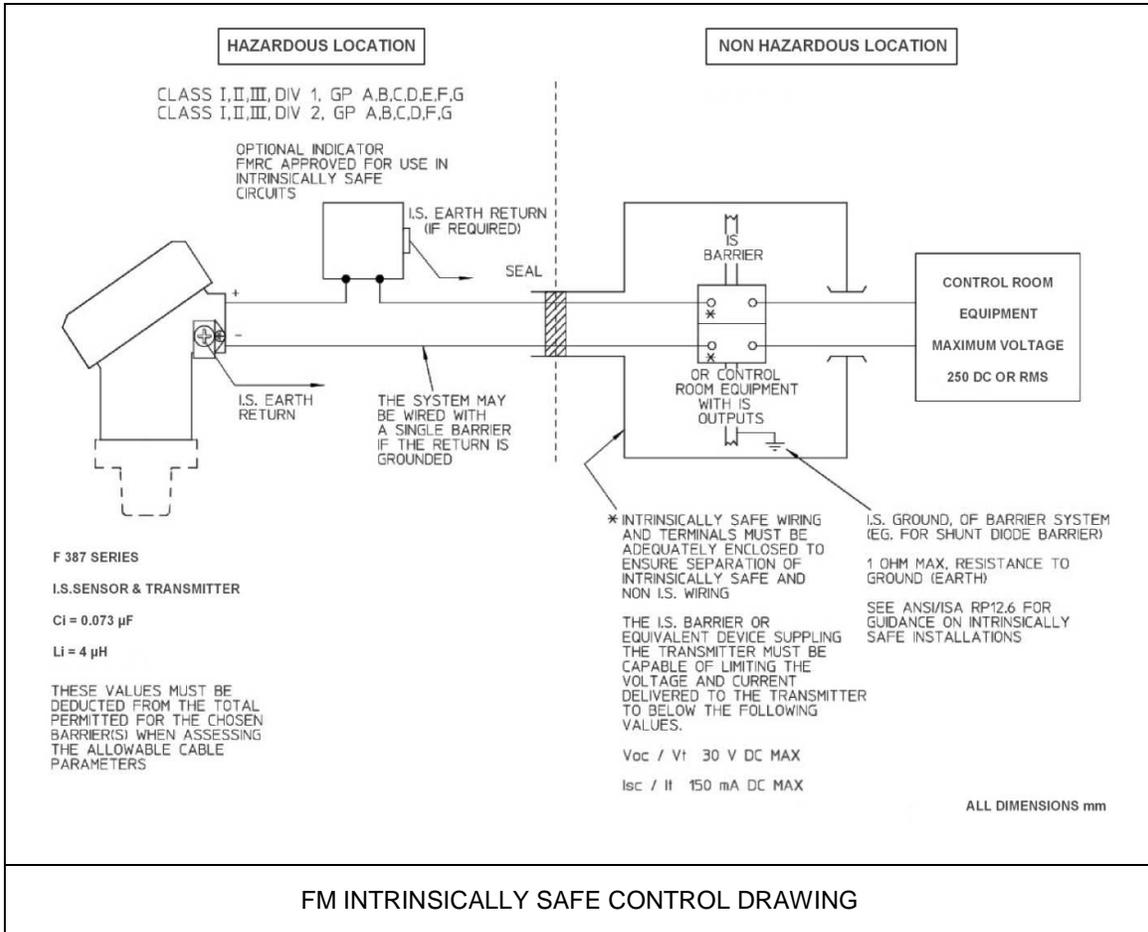
**PRODUCT CODE**



Note that not all options are available on all models!

1 :-	Enclosure	4	=	Ex ia (Intrinsically Safe)		
		R	=	Ex d		
		A	=	Weatherproof		
		F	=	Factory Mutual approved		
2 :-	Model,	387	=	Gauge and Absolute Pressure		
3 :-	Electrical Entry	1	=	M20 Internal		
		2	=	½" NPT Internal		
4 :-	Wetted Parts	R	=	All 316 Stainless Steel		
		S	=	17-4PH or 15-5 PH Sensor, 316 Process connection		
		U	=	All Hastelloy (NACE)		
		C	=	Hastelloy sensor, 316 Process connection		
5 :-	Ranges (Bar)	DA	=	1	D2 = 2	DE = 6
		EA	=	10	EB = 16	ED = 40
		FA	=	100	FD = 400	FE = 600
		GA	=	1000		
6 :-	Pressure Reference	G	=	Gauge		
		A	=	Absolute		
7 :-	Signal Output	6	=	4 – 20 mA - 50 Volt Isolation		
		M	=	4 – 20 mA - 500 Volt Isolation		
8 :-	Process Connection	J	=	½" NPT External		
		N	=	G ½" A to ISO 228		
		V	=	"Autoclave" High pressure connections		
9 :-	Options and Treatments	Codes on Application				
10 :-	Special Engineering	Codes on Application				





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