GEFRAN

PRESSURE SENSORS FOR HIGH TEMPERATURE – CSP

INSTRUCTION MANUAL

cod. *80809A Edit.* ***10/2025*** *- ENG*

ATTENTION!

This manual is an integral part of the product, and must always be available to operators.

This manual must always accompany the product, including if it is transferred to another user.

Installation and/or maintenance workers MUST read this manual and scrupulously follow all of the instructions in it and in its attachments.

GEFRAN will not be liable for damage to persons and/or property, or to the product itself, if the following terms and conditions are disregarded.

The customer must respect trade secrets.

Therefore, this manual and its attachments may not be tampered with, changed, reproduced, or transferred to third parties without **GEFRAN's** authorization.

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1. GENERAL INFORMATION

1.1. MELT PRESSURE SENSORS FOR CSP

Melt Gefran CSP series sensors, are pressure transmitters designed for use in high temperature environments. The key feature is that they can read fluid pressure up to temperatures of 600°C. The construction principle is based on the hydraulic transmission of pressure; the transfer of mechanical stress, from the contact diaphragm to the measuring diaphragm, is via an incompressible transmission fluid (NaK - Sodium/Potassium).

The sensing element consists of a Wheatstone bridge pattern strain gauge, based on thick film technology.The design of the CSP series, ensures the remoteness of the circuit area, through a rigid stem plus flexible sheath. The process connection is flange type.

1.2. THICK FILM TECHNOLOGY

Through the “screen printing process” technique, the insulating layers (dielectric), the conductive layer (cermet) and the resistive layer are deposited on the steel membrane to make the “Wheatstone bridge.” The thickness of the membrane determines the measuring range, and heat treatment in various stages from 200°C to 900°C makes the sensor extremely robust and reliable.

1.3. CSP-E SERIES

MAIN FEATURES

- Pressure ranges from: 0-20 to 0-1000bar / 0-300 to 0-15.000psi
- Max working temperature: 600°C
- Accuracy: < ± 1% FS (L)
- Output signal 4-20mA
- Hydraulic transmission system for pressure signal guarantees stability at working temperature (NaK)

1.4. CSP-H SERIES

MAIN FEATURES

- Pressure ranges from: 0-20 to 0-1000bar / 0-300 to 0-15.000psi
- Max working temperature: 600°C
- Accuracy: < ± 1% FS (L)
- Output signal 4-20mA HART Protocol
- Hydraulic transmission system for pressure signal guarantees stability at working temperature (NaK)

2. TECHNICAL SPECIFICATIONS

2.1. CSP-E TECHNICAL SPECIFICATIONS

CONCENTRATING SOLAR POWER APPLICATIONS

The pressure sensors of the CSP series have been developed for use on concentrating solar power plants. Applications requiring high accuracy in measuring the of process pressure for operating temperatures of up to 600°C.
High measurement accuracy is ensured by using bonded strain gauge sensing technology. Pressure transmission from the contact diaphragm to the measuring diaphragm is via a filling fluid called NaK (sodium potassium).

MAIN FEATURES

- Pressure ranges from:
  0-20 to 0-1000bar / 0-300 to 0-15.000psi
- Accuracy: < ±1.0% FS (L)
- Hydraulic transmission system for pressure signal guarantees stability at working temperature.
- NaK is conformed to RoHS Directive.
- NaK is defined as a safe substance (GRAS) by FDA
- NaK contained quantity: 40mm³ (0.00244 in³)
- Flange connection
- Autozero function on board / external option
- Inconel 718 corrugated diaphragm
- Stem material: Inconel 718

GTP+ (advanced protection)
Coating with high resistance against corrosion, abrasion and high temperature

TECHNICAL SPECIFICATIONS

Accuracy (1)	< ±1.0% FS (L)
Resolution	Infinite
Measurement range	0-20 to 0-1000bar / 0-300 to 0-15.000psi
Maximum overpressure (without degrading performances)	2 x FS 1.5 x FS over 700bar/10000psi
Measurement principle	Extensimetric
Power supply	10..30Vdc
Maximum current absorption	32mA
Insulation resistance (at 50Vdc)	>1000 MOhm
Output signal Full Scale FS	20mA
Zero balance (tolerance ± 0.25% FS)	4mA
Zero signals adjustment (tolerance ± 0.25% FS)	“Autozero” function
Span adjustment within ± 5% FS	See Melt Manual
Maximum allowed load	See chart
Electronic response time (10...90% FS)	~ 1ms
Output noise (RMS 10-400Hz)	< 0.025% FS
Calibration signal	80% FS
Output short circuit and reverse polarity protection	YES
Compensated temperature range	0...+85°C
Operating temperature range	-30...+105°C
Storage temperature range	-40...+125°C
Thermal drift in compesated range: Zero / Calibration / Sensibility	< 0.02% FS/°C
Diaphragm maximum temperature	600°C/ 1112°F
Zero drift (zero)	< 0.5 bar/100°C < 7.5 psi/100°F
Thermocouple (model CSP-E)	STD : tipo “J” (isolated junction)
Protection degree (with 6-pole female connector CON300)	IP66
FS = Full Scale Output (1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability (according to IEC 62828-2).	

2.2. CSP-H TECHNICAL SPECIFICATIONS

CONCENTRATING SOLAR POWER APPLICATIONS

The pressure sensors of the CSP series have been developed for use on concentrating solar power plants. Applications requiring high accuracy in measuring the of process pressure for operating temperatures of up to 600°C.

High measurement accuracy is ensured by using bonded strain gauge sensing technology. Pressure transmission from the contact diaphragm to the measuring diaphragm is via a filling fluid called NaK (sodium potassium).

MAIN FEATURES

- Pressure ranges from:
  0-20 to 0-1000bar / 0-300 to 0-15.000psi
- Accuracy: < ±1.0% FS (L)
- Hydraulic transmission system for pressure signal guarantees stability at working temperature.
- NaK is conformed to RoHS Directive.
- NaK is defined as a safe substance (GRAS) by FDA
- NaK contained quantity: 40mm³ (0.00244 in³)
- Flange connection
- Autozero function on board / external option
- Inconel 718 corrugated diaphragm
- Stem material: Inconel 718

GTP+ (advanced protection)
Coating with high resistance against corrosion, abrasion and high temperature

TECHNICAL SPECIFICATIONS

Accuracy (1)	< ±1.0% F.S (L)
Resolution	16 bit
Measurement range	0-20 to 0-1000bar / 0-300 to 0-15.000psi
Rangeability	3:1
Maximum overpressure (without degrading performances)	2 x FS 1.5 x FS above 700bar/10000psi
Measurement principle	Extensimetric
Power supply	13...30Vdc
Maximum current absorption	23mA (40mA with relay optional)
Output signal Full Scale (FS)	20mA
Zero balance (tollerance ± 0.25% FS)	4mA
Calibration signal	80% FS
Power supply polarity reverse protection	YES
Compensated temperature range housing	0...+85°C
Operating temperature range housing	-30...+85°C
Storage temperature range housing	-40...+125°C
Thermal drift in compensated range: Zero / Calibration / Sensibility	< 0.02% FS/°C
Diaphragm maximum temperature	600°C/ 1112°F
Zero drift due to change in process temperature (zero)	< 0.5 bar/100°C < 7.5 psi/100°F
Thermocouple (model CSP-H)	STD: type “J” (isolated junction)
Protection degree (with 6-pole female connector CON300)	IP66

FS = Full scale output :
(1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability (according to IEC 62828-2)

3. FLANGE DESIGN

Flange connections are widely used in piping applications to connect pipelines to each other and when an access tor equipment or sensing systems is needed, as this type of connection makes it easier to separate pipes when required.

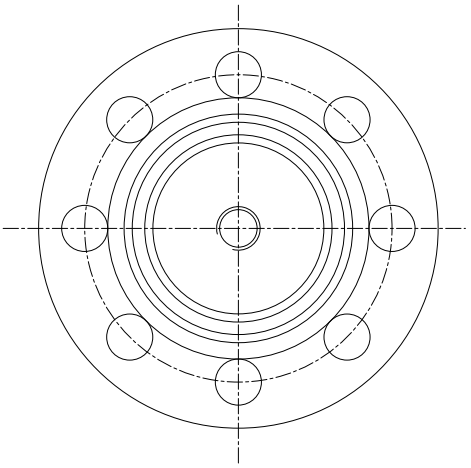
A flange connection consists of two flanges (flange and counter-flange), a gasket and bolts.

The joint between the two flanges creates a seal, preventing fluid or gas leaks and protecting the internal environment from external contamination.

Gefran CSP Pressure Transmitters are available with two types of fl.ange connection:

- **Raised Face Flanges (RF)**: The most widely used type of flange. RF Flanges have a raised circular area above the bolting circle, where the gasket is placed. The raised area increases the surface contact area tor the gasket, improving sealing performance and pressure resistance. RF Flanges are relatively easy to install due to their simple design and the broad availability of gaskets on the market. They are particularly useful in applications where pressure and temperature are moderate, and ease of maintenance is important.

- **Ring Type Joint Flanges (RTJ)**: Ring Type Joint Flanges feature a precisely machined hexagonal groove, designed to hold a metal gasket, that forms a metal-to-metal seal when the bolts are tightened. This type of flange is specifically engineered to provide a highly reliable and robust seal in extreme conditions, where very high pressures and temperatures are present, preventing leaks even under severe operational conditions. Although RTJ flanges require more precise installation compared to Raised Face Fl.anges, their enhanced sealing capabilities make them the preferred choice for demanding environments.



PROCESS CONNECTIONS	
DIMENSIONS	
C	1” (DN25)
F	2” (DN50)
G	4” (DN100)
MATERIAL	
A	AISI 316
C	AISI 347zH
TYPE	
F	Raised Face (RF)
J	Ring Type Joint (RTJ)
CLASS	
B	300
D	600
E	900
F	1500

3.1. FLANGE MATERIAL

AISI 316/316L (1.4401/1.4404)

Austenitic Stainless Steel containing molybdenum, which provides resistance to corrosion from salts. The composition of AISl316 make it suitable tor applications in aggressive environments, with temperature up to 800 °C.

The AISI 316L variant (1.4404), with its lowest carbon content, minimizes carbide precipitation enhancing corrosion resistance.

ASME Flanges made of AISI 316/316L steel are listed in table 2.2 accordingto ASME B16.5

347H (1.4961)

Austenitic chromium-nickel stainless steel with small percentage of titanium. This steel offers a good resistance to intergranular corrosion and excellent high-temperature performance.

ASME Flanges made of 347H steel are listed in table 2.5 according to ASME B16.5

4. INSTALLATION GUIDE

GEFRAN EXPERTISE: OUR SOLUTIONS FOR CSP APPLICATIONS

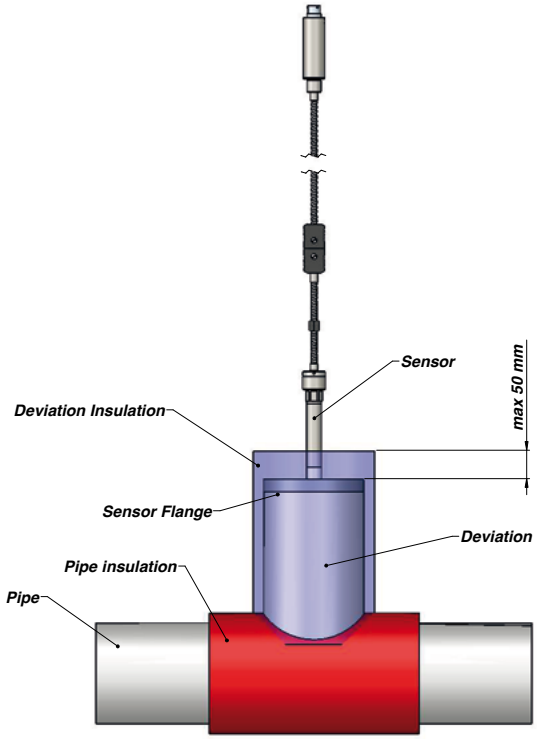
Process pressure is transmitted to the measuring diaphragm by means of a capillary tube filled with NaK. The in-contact diaphragm works as a separator between the process fluid (Molten Salt) and the filling fluid (NaK).
According to the temperature of the “hot side” of the sensor, the expansion of the filling fluid has an influence on the zero thermal drift of the sensor.
This effects has been optimized and minimized to < 0.5bar/100°C in order to meet the CSP applications’ requirements.

INFLUENCE OF ENVIRONMENTAL TEMPERATURE (DAY - NIGHT CYCLE)

A contribution to the zero drift is also due to the influence of the temperature on the “cold side” of the sensor. This effect has been minimized too.
Typically, the Day-Night cycle can be responsible for a zero drift of ±100 mbar (1.5 psi). Suggestions for minimizing the influence of the external temperature on the offset drift: • Do not expose the sensor to the direct radiation of the sun keep it shaded • Possibly mount the sensor horizontally, so that there are not heated parts below it

INSTALLATION TIPS

Do not put the sensor tip directly on the main pipe inside the salt flow. Use a piezometric deviation (as shown in the picture below). The insulation of the piezometric deviation should embrace the adapter only. Keep the deviation heated at a temperature > 250°C (e.g. 300°C). This can help the sensor installation and calibration. The longer is the deviation, the lower will be the sensor working temperature. An interception valve across the deviation should be useful to isolate the sensor from the pressured pipe.



4.1. CALIBRATION PROCEDURE GUIDELINE

Insert the sensor into its designated position in the system; ensure that the system is properly vented.

1. Heat the mounting location to a temperature close to the operating temperature (T > 250 °C if the process fluid is salt).
2. Allow the sensor to reach a stable temperature (wait at least 30 minutes).
3. Measure T_0, that is the temperature at the calibration point (T_0 can be measured with the optional internal thermocouple);
4. "Measure" Out_0, that is the mA output at the calibration point (be sure that the plant is vented!);
5. The process pressure P, corrected with the compensation of the zero drift, can be evaluated, at any temperature T, with the following algorithm:

$$P = (\mathrm{Out} - \mathrm{Out}_0) \cdot \frac{\mathrm{FS}}{16} - \frac{k(T - T_0)}{1000} [\mathrm{bar}]$$

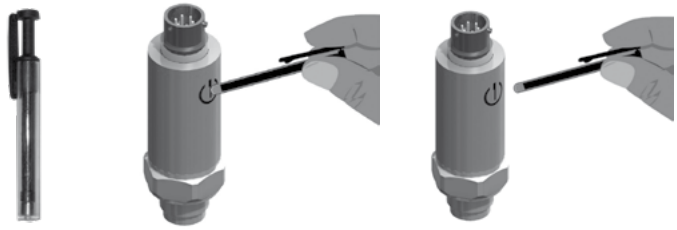
Where:

- T and T_0 are expressed in [°C];
- Out_0 [mV] is the output signal at temperature T_0;
- Out [mV] is the output signal at temperature T;
- k is the coefficient of pressure drift expressed in $[\frac{\mathrm{mbar}}{^\circ\mathrm{C}}]$
- FS is the pressure range (i.e. Full Scale) of the sensor expressed in [bar] or [psi]

5. AUTOZERO FUNCTION

AUTOZERO

All signal variations in the absence of pressure can be eliminated by using the Autozero function.
The function is activated by closing a magnetic contact located in the transmitter housing (function cannot be activated when machine is in operation).
The device used for the reset control is a magnet located on the outside of the housing, attached to it by a plastic support. This system provides total reliability and easy use.
On sensors configured in a dedicated manner, the Autozero function can be activated externally by short-circuiting pins E and F on the connector.
By using the reset control, setting the Zero signal with a trimmer becomes obsolete; the same is true for the Span signal, for which the sensor can be recalibrated via software



1: machine pressure = 0 bar and transducer powered
2: put magnetic pointer on marked spot (1…10sec)
3: remove magnetic pointer
4: ready !

Magnetic pointer 1.0,10 sec remove marked spot

ACTIVATION OF AUTOZERO AFTER THE FIRST INSTALLATION

The Autozero function makes it much easier to run calibrations after the first installation.
With the sensor installed and with the extruder at work temperature, wait 1 minute before running Autozero.
This delay is requie to allow the system temperature to stabilize.
If the transmitter is kept powered, additional Autozero activations can ber un immediately; on the other hand, you will have to wait 1 minute each time the system is switched on again.

AUTOZERO FUNCTION

Application mode	Limits	Result
The Autozero function is activated by: 1) positioning the magnet near the Autozero label on the shell of the sensor. 2) Short-circuiting the pin E-F (external Autozero version). The magnet has to be maintained on the Autozero position for a time within 1 to 10 sec.	The whole Zero unbalancement in comparison to the zero done by the manufacturer, has to be ± 10% FS (*)	The Autozero effect will be visible after waiting 2 sec after the start of the function. The precision of the zero value will be defined by the accuracy class of the sensor. The Autozero function doesn't work outside the defined limits.

NOTE:

(*): This value has to be considered typical. Higher limits value will be allowed for different range.
During the Autozero phase, the current output for the ME/WE transmitter series, will increase around 7mA.
That's a short variation only visible during the Autozero phase; it won't have any effects on the final signal.

5.1. PARTIAL RESET

Application mode	Limits	Result
The magnet has to be maintained on the Autozero position for a time within 30 to 60 sec.		The Zero of the transmitter will be recalibrated to the factory settings; furthermore an Autozero will be done automatically. The Span calibration will be maintained.

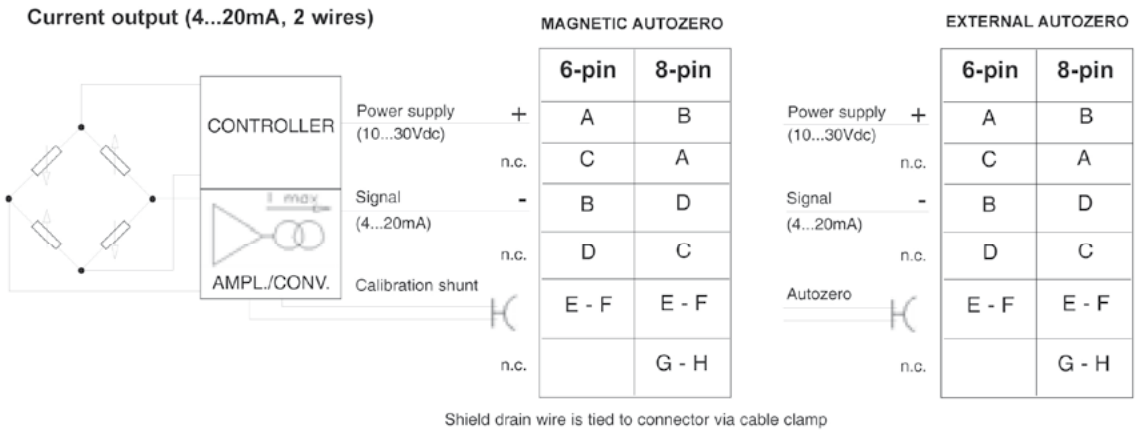
NOTE:
During the total reset phase, the current output for the ME/WE transmitter series, will increase around 7mA

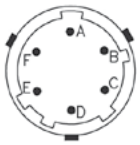
5.2. TOTAL RESET

Application mode	Limits	Result
The magnet has to be maintained on the Autozero position for a time over 60 sec		The Zero and Span of the transmitter will be recalibrated to the factory settings.

NOTE:
During the total reset phase, the current output for the ME/WE transmitter series, will increase around 7mA

6. CSP-E ELECTRICAL CONNECTIONS

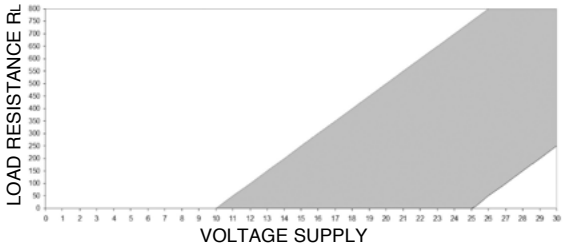




6-pin connector
VPT07RA10-6PT2
(PT02A-10-6P)

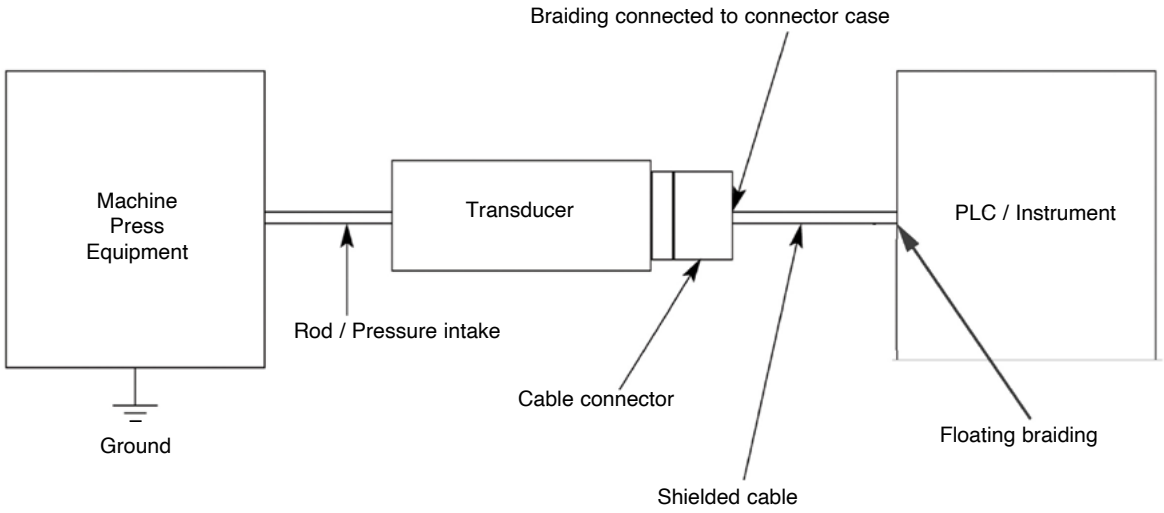
8-pin connector
PC02E-12-8P Bendix

LOAD DIAPHGRAM



The diagram shows the optimum ratio between load and power supply for transmitters with 4…20mA output.
For correct function, use a combination of load resistance and voltage that falls within the two lines in the graph above.

STANDARD INSTALLATION (RECOMMENDED)



7. CSP-H ELECTRICAL CONNECTIONS

WIRING AND CALIBRATION

Connections

The sensors have to be connected as shown in the diagram at chapter 7.

To obtain a higher immunity from field noise, connect the cable shield to the female connector case on sensor side.

Calibration procedure using the magnetic pen/Pin CAL

Bring the system to the working temperature with the transmitter installed and connected to the measurement instrument without any pressure applied.

The measurement chain connected to the transmitter is calibrated as follows:

1) To reset the offset on the instrument by eliminating the thermal drift with the autozero function.
With the sensor installed and the extruder at working temperature, wait until the temperature itself is stable, with a possible variation of ± 1°C. Consequently Autozero can be activated.
This allows to compensate all the signal drifts caused by tightening and temperature.
Additional Autozero activations could be run once the temperature stability is reached, with ± 1°C of possible variation.

2) Calibrate the instrument activating the CAL function. The transducer brings its output to the calibration value shown on the transducer data plate (80% of full scale default, if changed with HART command it could be different).
With the external Autozero function the calibration procedure is not feasible.

3) If the instrument does not exactly indicate zero, repeat points 1) and 2).
In this way, the instrument is calibrated to give the exact indication in the chosen engineering unit.

Calibration procedure using HART communication

Bring the system to the working temperature with the transmitter installed and connected to the measurement instrument without any pressure applied.

1) Connect Communicator to the loop. In case it's not sure on how to do this, please refer to "Connecting the HART Handheld Communicator" (Fig. 8.1).

2) Switch on HART Communicator. Please refer to HART Command tree on Ready-to-Use guide.

3) From the Main Menu:
a. Enter Tag (Fast Key 1, 3, 1)
b. Set Pressure Units (Fast Key 1, 3, 3), if needed
c. Set URV (Fast Key 1, 3, 4) if output turndown (rescaling), is needed
d. Perform Autozero (Fast Key 1, 2, 6, 3, 1)

4) Check loop output is zero (4mA).

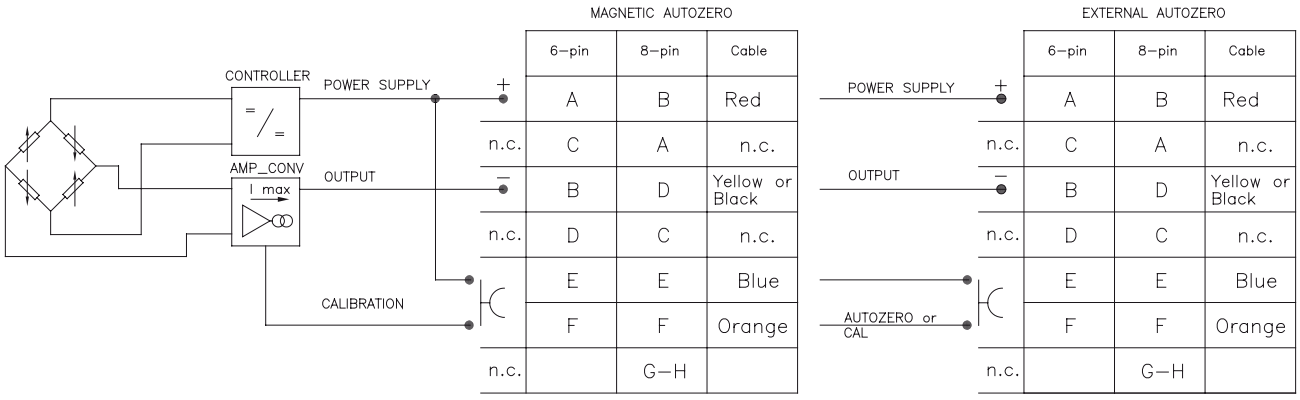
5) Remove HART Communicator from loop.

The interface to controller can be:

- the multi-polar connector type VEAM VP07RA10-6PT2 (code GEFRAN CON301),
- the multi-polar connector type BENDIX PC02E-12-8P 8 poles (code GEFRAN CON356)
- the multi-polar cable outlet with conduit output type ½ 14-NPT as illustrated in fig 7.1.

where are also pointed out the connections (2 wires connection current amplified). In the case of relay output with retransmitted output in current (2 wires) the connections are shown in fig. 7.2.

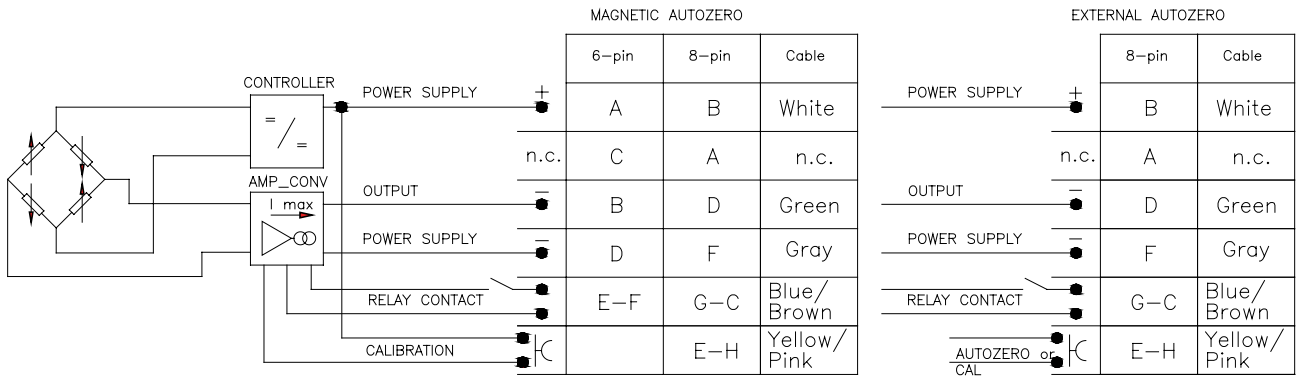
CURRENT OUTPUT (NO RELAY)



	6–pin	8–pin	Cable
+	A	B	Red
n.c.	C	A	n.c.
−	B	D	Yellow or Black
n.c.	D	C	n.c.
	E	E	Blue
	F	F	Orange
n.c.		G–H	

The cable shield is tied to both sides, i.e. to the sensor connector and to the controller

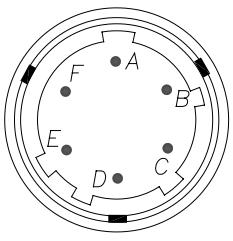
RELAY OUTPUT



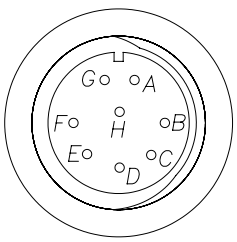
	6–pin	8–pin	Cable
+	A	B	White
n.c.	C	A	n.c.
−	B	D	Green
−	D	F	Gray
	E–F	G–C	Blue/ Brown
		E–H	Yellow/ Pink

The cable shield is tied to both sides, i.e. to the sensor connector and to the controller

6 pin Connector VPT07RA10-6PT2 (PT02A-10-6P)

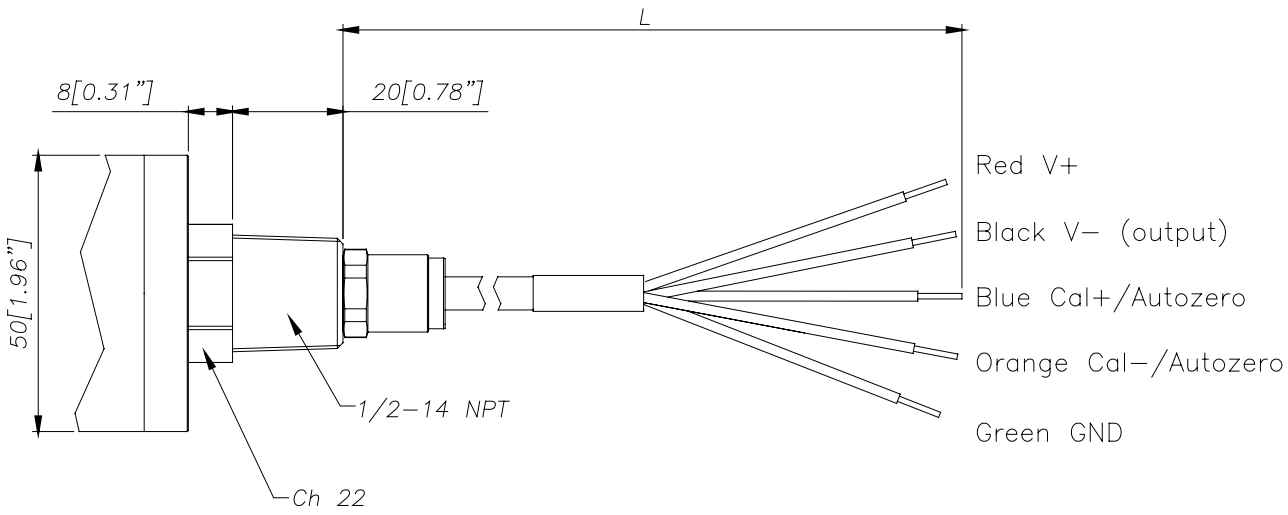


8 pin Connector (PC02E-12-8P) Bendix



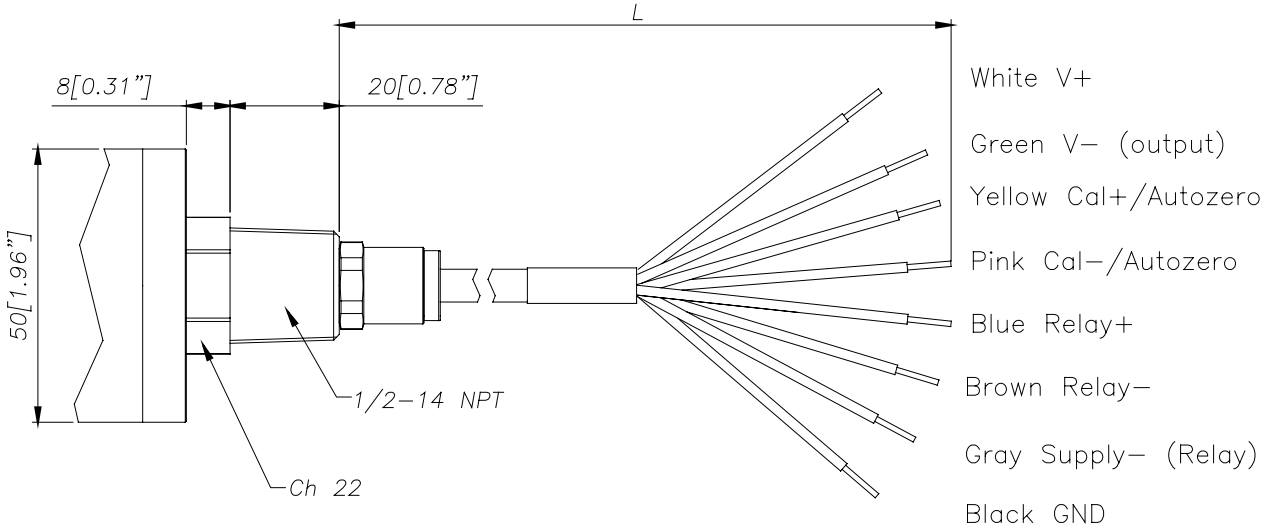
Cable outlet (1/2 14-NPT) L = 1 m

Current output

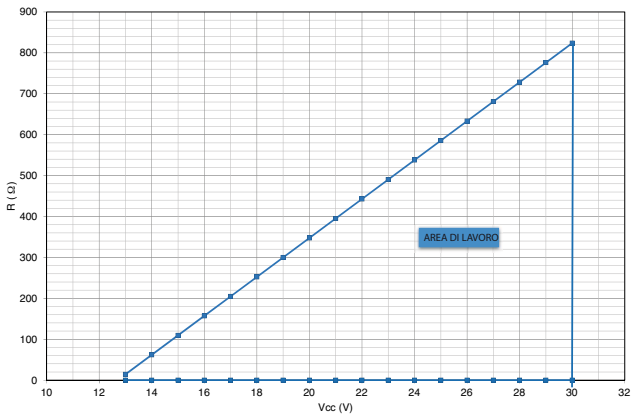


Cable outlet (1/2 14-NPT) L = 1 m

Relay output - Magnetic Autozero/External Autozero

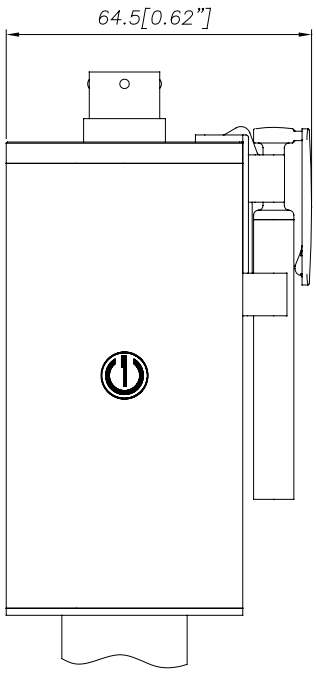


LOAD DIAPHGRAM



The diagram shows the optimum ratio between load and power supply for transmitters with 4…20mA output.
For correct function, use a combination of load resistance and voltage that falls within the two lines in the graph above.

AUTOZERO FUNCTION



The Autozero function is activated through a magnetic contact (external magnet supplied with the sensor).
The Autozero function can be activated through HART command as well.
See the manual for a complete Autozero function explanation.

8. USING HART COMMUNICATION

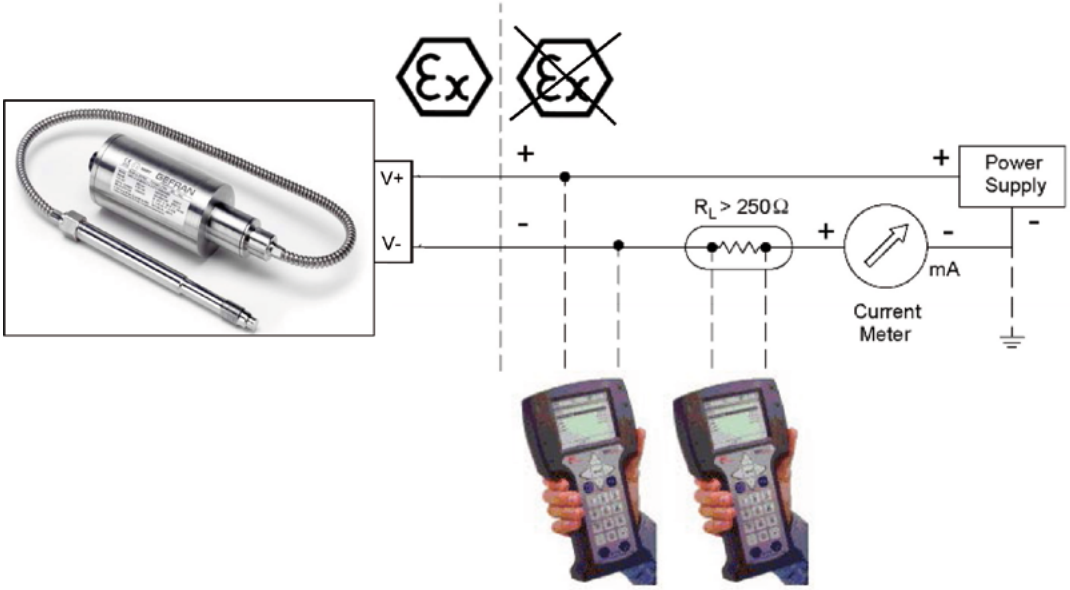
During HART Handheld Communicator connection

In case of hazardous areas please refer to the handheld communicator user manual for instructions for using HART Communicator correctly.

Please consider a minimum of 250 Ohm resistance has to be present in the loop. The loop current is not measured directly by the HART Communicator.

Anywhere along the 4-20 mA wire the HART Communicator can interface with the device.

Please see the picture below (Fig 8.1).



Procedure

1. Connect Power Supply and HART Communicator as in the above drawing.
2. In case of commissioning on the bench with a dead weight tester or with a calibrated pressure generator, please check pressure connection is not leaking.
3. Apply power to the transmitter and switch on the HART Communicator by pressing using the ON/OFF key. The HART Communicator LCD display should show H Pressure Transmitter in the upper left corner. If this is not present, please refer to chapter 9. ”Safety”, Troubleshooting section.
4. Set PV Units (Fast Key 1, 3, 3) to proper pressure unit (e.g. bar, psi, kgf/cm², MPa, etc.).
5. Set Tag (Fast Key 1, 3, 1).
6. In case the transmitter output has to be re-ranged, fix the proper LRV (Fast Key 7,1) and URV (Fast Key 8, 1).

Note: URV can’t be turned down below the PV Minimum span (Fast Key 1, 3, 4).
Attention: after modification of LRV and/or URV value/s, it's needed to verify that the parameterization process has been successfully concluded, through a reference of pressure at LRV and URV values.

7. Fix Lower Trim with device variable trim method (Fast Key 1, 2, 6, 3, 3).
8. Check transmitter output. Zero pressure output should read 4 mA.

Attention:
The following phases are not part of a standard system setup and should be carried out by qualified personnel only.
According to this please consider the transmitter is very steady and it’ s been accurately calibrated in our factory using precise pressure sources. Such a task should only be carried out using these type of devices.

9. By means of calibrated pressure generator, apply the same pressure already set in URV during step 6. Output should equal 20mA. In case output isn’t 20 mA, please go to step 10.
10. In order to calibrate full scale output, please apply firstly pressure equal to full scale pressure. Then you can proceed to set Upper Trim value with Device Variable Trim method (fast key 1, 2, 6, 3, 3; anyhow please consider Lower Trim value has to be done). Now output should be the same of the full scale pressure.
11. When transmitter Output Damping is needed, please set PV Damping (fast key 1, 3, 6) to the proper value.
12. Press the left arrow key until the HART Communicator is off-line. Then switch off the power. At this point the pressure transmitter can be installed in the process.

Autozero using HART communication

With the transmitter installed and connected to the measurement instrument without any pressure applied and with the system at the working temperature, once temperature itself is stable, i.e. with a possible variation of ± 1°C, Autozero can be performed. If the zero trim function is selected (fast key 1, 2, 6, 3, 1) the output will be modified to show zero pressure. Such a task is carried out by the transmitter electronics automatically by regulating digital PV to zero while analog output will be 4 mA.

Usually an Autozero is all that is needed once installation is completed as the transmitter span has been calibrated at the factory.

In case the Full Scale Output is not correct when tested with a calibrated pressure source or dead weight tester, the transmitter span can be regulated using the Device Variable Trim method (fast key 1, 2, 6, 3, 3).

Please apply Zero Pressure firstly and follow the prompts on the handheld HART Communicator. Once completed, please apply a known calibrated full scale pressure to the transmitter and follow the prompts on the handheld HART Communicator. Once completed, the digital PV will be corrected to full scale output.

Transmitter functions using HART communication (with fast key sequences)

Autozero (1, 2, 6, 3, 1)
Digital modification to zero: it affects both the digital and analog output. Please consider this operation is different from Lower Sensor Trim as Autozero has to be done ONLY at zero pressure.

Reset Autozero (1, 2, 6, 3, 2)
Reset Autozero correction.

Device Variable Trim (1, 2, 6, 3, 3)
Digital modification to zero and full scale: it affects both the digital and analog output.
Please consider this operation is different from Autozero as Lower Sensor Trim can be made at positive pressures, i.e. above zero.
Note: *Such an operation has to be carried out with a known calibrated pressure source only.*

D/A trim (1, 2, 6, 2)
This function is used to match the digital representation of the analog output with its real analog loop current.
Note: *Such an operation should be carried out with a known calibrated current (mA) meter only*.

Re-range
The 4mA and 20mA points, i.e. LRV and URV respectively, can be regulated in order to improve output resolution. This means a Re-range (also called “Turndown”) ratio of 3:1 is possible.
Please consider accuracy data is reliant upon the Full Sensor Range without applying any turndown.

Note: *In case pressure applied to the transmitter is not in the range of the 3:1 turndown ratio, the transmitter will refuse the command.*
Such a condition will be shown by the output not adjusting to 20mA after a few requests.

LRV Rerange (7, 1)
This function is the pressure at which the transmitter will display a 4 mA output as entered directly by the operator. LRV variation affects the transmitter span so the range is restricted by the minimum span value found in fast key (1, 3, 4, 3).

URV Rerange (8, 1)
This is the pressure at which the transmitter will display a 20 mA output as entered directly by the operator. This range is restricted by the minimum span value found in fast key (1, 3, 4, 3).

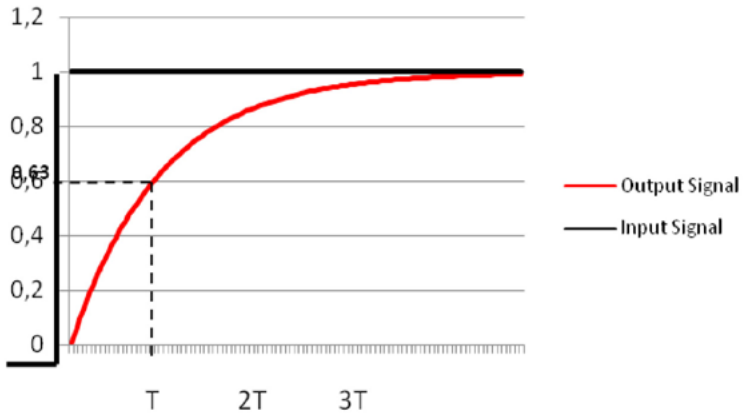
LRV Rerange by applying a known pressure (1, 2, 6, 1, 2)
Such a function is performed by applying a known pressure and starting the procedure in order to set the 4mA point according to the pressure reference value.
Note: *Such an operation should be carried out with a calibrated pressure source only.*

URV Rerange by applying a known pressure (1, 2, 6, 1, 2)
Such a function is performed by applying a known pressure and starting the procedure in order to set the 20mA point according to the pressure reference value.
Note: *Such an operation should be carried out with a calibrated pressure source only*.

Device Variable Trim reset (1, 2, 6, 4)
This function is used to restore the Zero, Lower, and Upper Trim to the factory setting values.

R-Cal (1, 2, 6, 5)
Activating R-Cal, the output will be fixed to the percentage of span fixed by such function.
80% is default value.

Damping (1, 3, 6)
The damping time constant affects the speed with which the output signal reacts to changes in pressure as shown in the figure on the next page.
By default damping is off, but values between 0 and 30 seconds can be fixed using the handheld communicator. Only one decimal digit is allowed.



Status (1, 2, 1, 1)
Reads Device Status.

The status is shown in 3 bytes:

Standardized Device Status:

Bit	Function
0	Reserved
1	Non volatile memory failure
2	Not used
3	Watchdog reset executed
4	Voltage conditions out of range
5	Not used
6	Not used
7	Not used

Sensor Status 1:

Bit	Function
0	Input stage error
1	Sensor overrange
2	Sensor broken
3	Micro controller overheated
4	Error parameter
5	Voltage error
6	Watchdog error
7	Cycle error

Sensor Status 2:

Bit	Function
0	Reserved
1	Sensor under range
2	Low loop voltage
3	Not used
4	Not used
5	Not used
6	Not used
7	Not used

PV Unit (1, 3, 3)
The PV unit sets the unit of measure that the pressure related parameters are transmitted. The transmitter can be configured using several engineering units such as psi, bar, MPa, and kgf/cm² and many others.
After setting a new pressure unit, all entries for pressure are converted to the new unit, using the following rules:

1 psi = 0.068947 bar = 0.0068947 MPa = 0.070309 kgf/cm²

Tag (1, 3, 1)
An inventory “Tag” identification number may be stored in transmitter memory (8 characters maximum). Software tag is a single question mark by default.

Long Tag (1, 3, 2)
An inventory “Long Tag” string (32 byte) may be stored in transmitter memory.

Descriptor (1, 3, 5, 2)
For further transmitter description, e.g. location, function, position, etc., a 16 character text can be input.

Message (1, 3, 5, 3)
A 20 character message can be fixed and displayed on the Hart Communicator.

SV Electronics Temperature (1, 1, 4)
Electronics temperature, i.e. the temperature measured on the electronics housing, is used for reference and factory diagnostics only.

TV Snout Temperature (1, 1, 5)
Temperature measured on Transducer Snout, only for fluid-free models (HI), otherwise it equals to 0.

Poll Address (1, 4, 2, 3, 1)
Multidrop mode allows to have more than one transmitter (up to 15) on a single loop. When this value is different from zero, the transmitter is in Multidrop mode.

For instance a Multidrop mode would be a group of Hart devices wired in parallel on a single fed loop and each device being assigned a unique poll address (1-15).
The Hart communicator would prompt for the single transmitter address to communicate with and would poll that particular device only. All others would remain unvaried.

Burst configuration (1, 4, 2, 3, 4)
If the transmitter is used in Burst Mode, the sensor displays one-way digital communications from the transmitter to the host.
In this case communication speed is faster as the transmitter has not to be polled to send information. Data transmitted in Burst Mode include Pressure Variable, Analog Output value, pressure in percentage of range and Diagnostic Data.
Access to other information can still be obtained through normal Hart command.

Reset to factory default (1, 2, 4)
The transmitter factory settings (including zero and span) can be restored. The list of parameters restored is reported below:

1. Restore LRV and URV to their values at shipment.
2. Restore the Pressure Unit (bar, psi, etc.) to its value at shipment.
3. Set the Analog Output Alarm Level to Low.
4. Remove all Pressure Damping.
5. Clear all Sensor and Analog Output Trim values.
6. Clear Burst Mode.
7. Restore the Address to Zero.
8. Restore the R-Cal option to its value at shipment.

HART Communicator Fast Key Sequences
The Hart Communicator Fast Key sequences are reported in the following table. Please consider Fast Keys as shortcuts to rapidly moving through the menu tree.

HART Communicator Fast Key Sequences

Function	Fast Key Sequence
Read PV Pressure	1, 1, 1
Read % of Full Scale	1, 1, 2
Read Analog Output	1, 1, 3
Read SV Electronics Temperature	1, 1, 4
Read TV Snout Temperature	1, 1, 5
Read Peak Pressure Value	1, 2, 1, 3
Read Peak Temperature Value	1, 2, 1, 2
Read Sensor Diagnostic Status	1, 2, 1, 1
Read PV Minimum Span	1, 3, 4
Perform Sensor Self-Test	1, 2, 2
Perform Sensor Master Reset	1, 2, 3
Perform Loop Test	1, 2, 5
Perform D/A Trim	1, 2, 6, 2
Perform Autozero	1, 2, 6, 3, 1
Reset Autozero	1, 2, 6, 3, 2
Perform Device variable trim	1, 2, 6, 3, 3
Device variable trim reset	1, 2, 6, 4
Set Rcal	1, 2, 6, 5
Set Tag	1, 3, 1
Set Long Tag	1, 3, 2

Function	Fast Key Sequence
Set PV Unit	1, 3, 3
Set Lower Range Value (LRV)	1, 3, 4, 5
Set Upper Range Value (URV)	1, 3, 4, 4
Display Lower Set Limit (LSL)	1, 3, 4, 1
Display Upper Set Limit (USL)	1, 3, 4, 2
Set Date	1, 3, 5, 1
Set Descriptor	1, 3, 5, 2
Set Message	1, 3, 5, 3
Set PV Dampening	1, 3, 6
Set PV Analog Output Alarm Type	1, 4, 2, 2, 2
Set Poll Address	1, 4, 2, 3, 1
Set Burst Configuration	1, 4, 2, 3, 4

Alarm and Saturation values burst mode

No special requirements are defined for the burst mode.

Alarm and Saturation values in multidrop mode

If the device is in multidrop mode, the NAMUR levels are no longer achievable. Instead thefail safe condition is indicated by the field device status and by the additional diagnostics.

9. EMC E ROHS REQUIREMENTS

The Melt transmitters by Gefran, series CSP-E and CSP-H, are manufactured in compliance with the RoHS directive and the EMC directive.

It is important to note that the above results refer to tests run under the working conditions stated in the catalog. The types of connections used for the power cable sheathing are particularly important.

For transducers with non-amplified output, the cable sheathing must be connected to the instrument side; for transmitters with 4-20mA. 0-1OV amplified output. the cable sheathing must be connected to the connector side.