



HART
COMMUNICATION PROTOCOL

I NaK

MAIN FEATURES

- Pressure ranges from: 0-20 to 0-1000 bar / 0-300 to 0-15000 psi
- Accuracy: < $\pm 1.0\%$ 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

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).

TECHNICAL SPECIFICATIONS

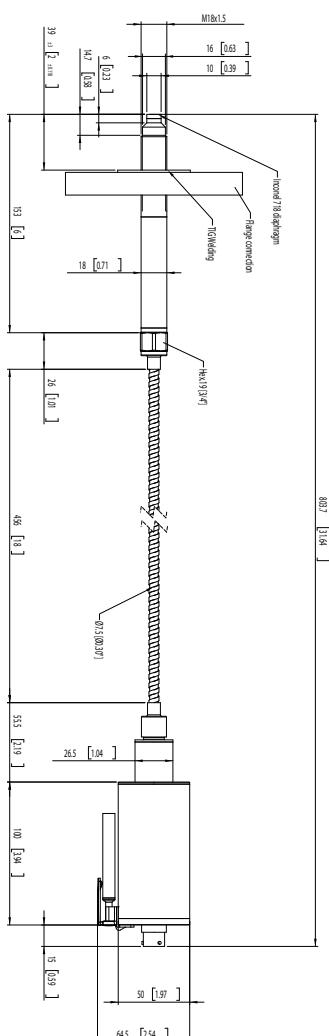
Accuracy (1)	< $\pm 1.0\%$ F.S (L)
Resolution	16 bit
Measurement range	0-20 to 0-1000 bar / 0-300 to 0-15000 psi
Rangeability	3:1
Maximum overpressure (without degrading performances)	2 x FS 1.5 x FS above 700bar/10000psi
Measurement principle	Extensimetric
Power supply	13...30Vdc
Maximum current absorption	23mA (40mA with relay optional)
Output signal Full Scale (FS)	20mA
Zero balance (tolerance $\pm 0.25\%$ 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 :

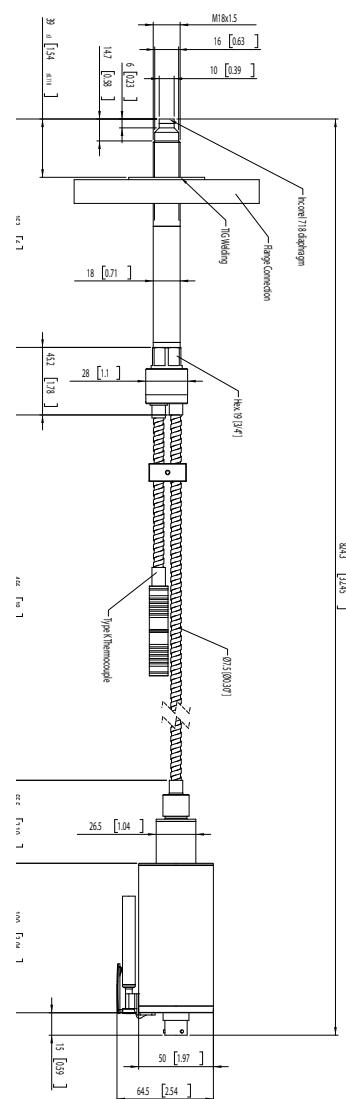
(1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability (according to IEC 62828-2)

MECHANICAL DIMENSIONS HART PROTOCOL OUTPUT 4-20mA

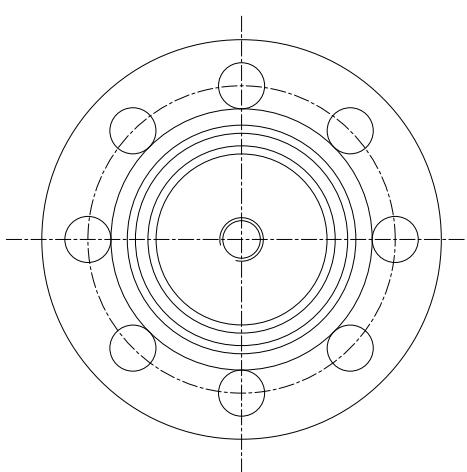
CSP-H-1



CSP-H-J/K



FLANGE



PROCESS CONNECTIONS

DIMENSIONS

C	1" (DN25)
F	2" (DN50)
G	4" (DN100)

MATERIAL

A	AISI 316
C	AISI 347zH

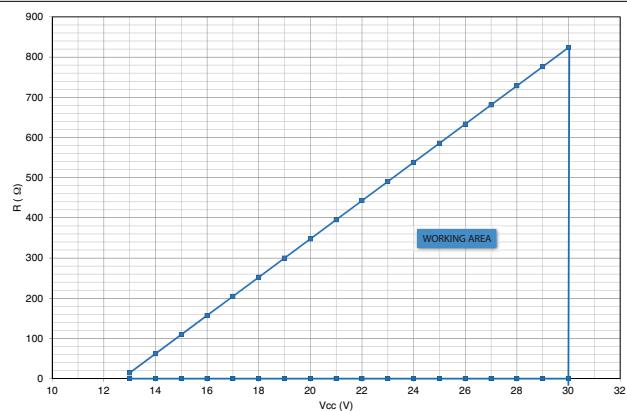
TYPE

F	Raised Face (RF)
J	Ring Type Joint (RTJ)

CLASS

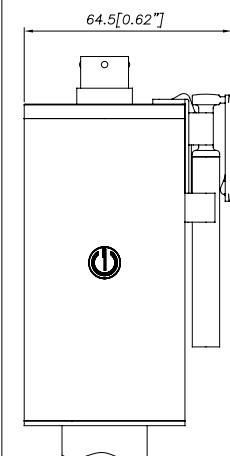
B	300
D	600
E	900
F	1500

LOAD DIAGRAM



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.

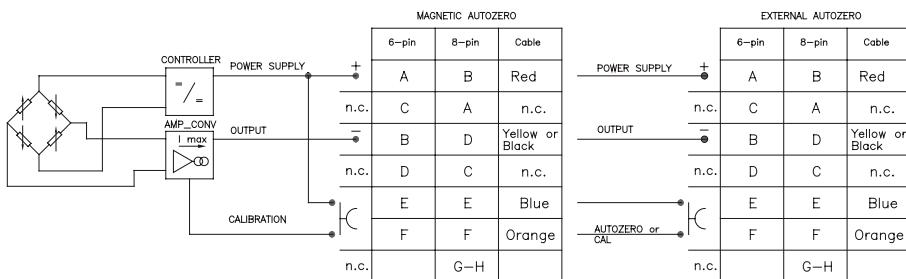
AUTOZERO FUNCTION



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.

ELECTRICAL CONNECTIONS

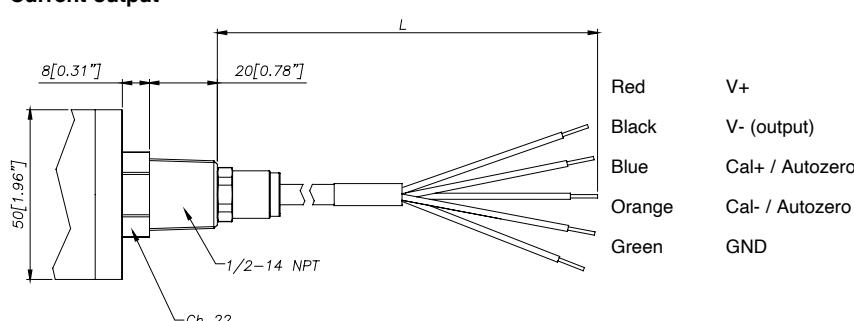
CURRENT OUTPUT



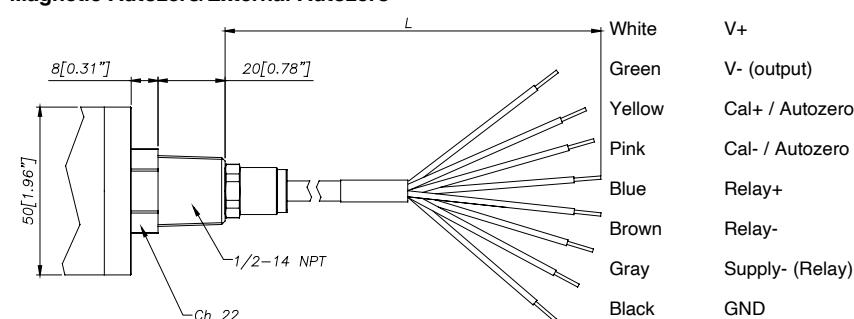
The cable shield is tied to both sides, i.e. to the sensor connector and to the controller

CABLE OUTPUT (1/2 14-NPT) L = 1 m

Current output

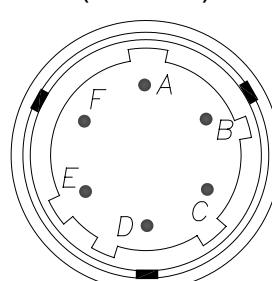


Relay output Magnetic Autozero/External Autozero

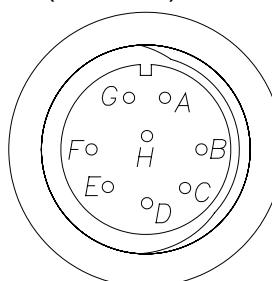


CONNECTOR OUTPUT

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



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



INSTALLATION

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 effect has been optimized and minimized to $< 0.5\text{bar}/100^\circ\text{C}$ 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 $\pm 100 \text{ mbar}$ (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).

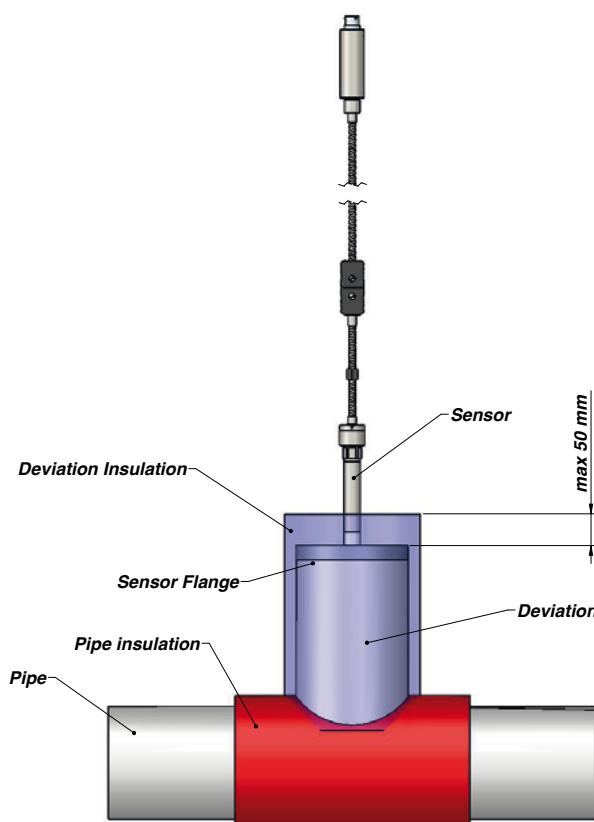
The insulation of the piezometric deviation should embrace the adapter only.

Keep the deviation heated at a temperature $> 250^\circ\text{C}$ (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 pressurized pipe.



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:

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

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 [$\frac{\text{mbar}}{\text{°C}}$]
- FS is the pressure range (i.e. Full Scale) of the sensor expressed in [bar] or [psi]

ACCESSORIES

Connectors

6-pin female connector (IP66 protection degree)

8-pin female connector

Extension cables

6-pin connector with 8m (25 ft) cable

6-pin connector with 15m(50 ft) cable

6-pin connector with 25m (75 ft) cable

6-pin connector with 30m (100 ft) cable

8-pin connector with 15m (50 ft) cable

8-pin connector with 25m (75 ft) cable

8-pin connector with 30m (100 ft) cable

Other lengths

Accessories

Mounting bracket

Dummy plug for M18x1,5

Drill kit for M18 x 1,5

Cleaning kit for M18x1,5

CON300

CON307

C08WLS

C15WLS

C25WLS

C30WLS

E15WLS

E25WLS

E30WLS

on request

Cable color code	
Conn.	Wire
A	Red
B	Black
C	White
D	Green
E	Blue
F	Orange

SF18

SC18

KF18

CT18

ORDER CODE

CSP - H - X - X - L - X X X X - X - X - I - O - X - X - X - X X X X		XXX																																												
VERSION Rigid + Flexible stem 1 With thermocouple J J With thermocouple K K		XXX= Standard version Special or customized versions available on request																																												
CONNECTOR 6 pin 6 8 pin 8 Cable NPT L. 1m N		CLASS B 300 D 600 E 900 F 1500																																												
MEASUREMENT RANGE <table border="1"> <thead> <tr> <th colspan="2">bar</th> <th colspan="2">psi</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>B02D</td> <td>300</td> <td>P03C</td> </tr> <tr> <td>35</td> <td>B35U</td> <td>500</td> <td>P05C</td> </tr> <tr> <td>50</td> <td>B05D</td> <td>750</td> <td>P75D</td> </tr> <tr> <td>70</td> <td>B07D</td> <td>1000</td> <td>P1M</td> </tr> <tr> <td>100</td> <td>B01C</td> <td>1500</td> <td>P15C</td> </tr> <tr> <td>200</td> <td>B02C</td> <td>3000</td> <td>P03M</td> </tr> <tr> <td>350</td> <td>B35D</td> <td>5000</td> <td>P05M</td> </tr> <tr> <td>500</td> <td>B05C</td> <td>7500</td> <td>P75C</td> </tr> <tr> <td>700</td> <td>B07C</td> <td>10000</td> <td>P10M</td> </tr> <tr> <td>1000</td> <td>B01M</td> <td>15000</td> <td>P15M</td> </tr> </tbody> </table>		bar		psi		20	B02D	300	P03C	35	B35U	500	P05C	50	B05D	750	P75D	70	B07D	1000	P1M	100	B01C	1500	P15C	200	B02C	3000	P03M	350	B35D	5000	P05M	500	B05C	7500	P75C	700	B07C	10000	P10M	1000	B01M	15000	P15M	TYPE F Raised Face (RF) J Ring Type Joint (RTJ)
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RIGID STEM LENGTH 153 mm/6" 4 318 mm/12.5" 5		MATERIAL A AISI 316 C AISI 347H																																												
FLEXIBLE STEM LENGTH 76 mm/3" A 152 mm/6" B 300 mm/12" C 457 mm/18" D 610 mm/24" E 760 mm/30" F 914 mm/36" G 1067 mm/42" H 1220 mm/48" I 1372 mm/54" J 1520 mm/60" K		DIMENSIONS C 1" (DN25) F 2" (DN50) G 4" (DN100)																																												
AUTOZERO Magnetic Autozero 0 External Autozero E		DOCUMENTATION 0 Standard 1 STD +cert 3.1 2 STD +cert 3.1 + cert 2.1																																												
		TAG PLATE 0 No Tag-Plate 1 Sensor Tag 2 Sensor tag + TC tag																																												

Sensors are manufactured in compliance with:

- EMC 2004/108/CE compatibility directive
- RoHS 2002/95/CE directive

Electrical installation requirements and conformity certificate are available on our web site: www.gefran.com

GEFRAN spa reserves the right to make any kind of design or functional modification at any moment without prior notice

GEFRAN spa
 via Sebina, 74
 25050 PROVAGLIO D'ISEO (BS) - ITALIA
 tel. 0309888.1 - fax. 0309839063
 Internet: <http://www.gefran.com>

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