

### 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 0-1000 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: 40mm<sup>3</sup> (0.00244 in<sup>3</sup>)
- 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

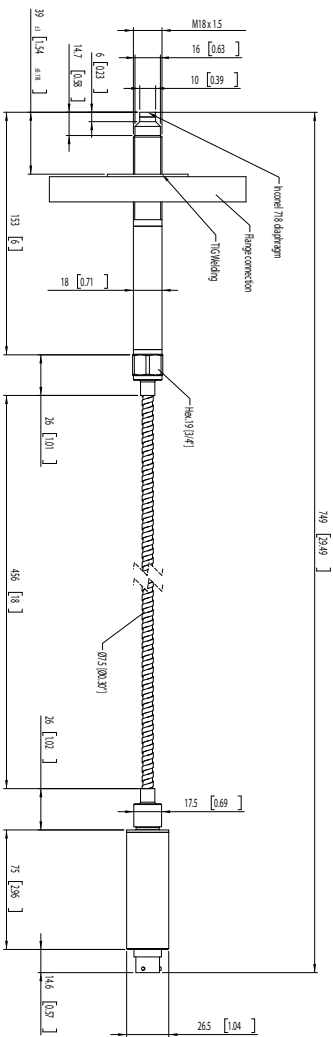
Accuracy (1)	$< \pm 1.0\%$ FS (L)
Resolution	Infinite
Measurement range	0-20 to 0-1000 bar / 0-300 to 0-15000 psi
Maximum overpressure (without degrading performances)	2 x FS 1.5 x FS over 700bar/10000psi
Measurement principle	Extensimetric
Power supply	10...30Vdc
Maximum current absorption	32mA
Insulation resistance (at 50Vdc)	$> 1000$ MOhm
Output signal Full Scale FS	20mA
Zero balance (tolerance $\pm 0.25\%$ FS)	4mA
Zero signals adjustment (tolerance $\pm 0.25\%$ FS)	"Autozero" function
Span adjustment within $\pm 5\%$ 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 compensated 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

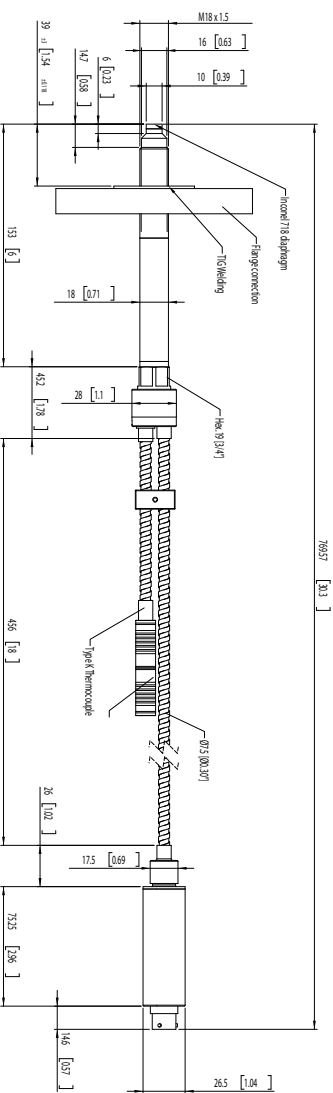
(1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability (according to IEC 62828-2).

MECHANICAL DIMENSIONS

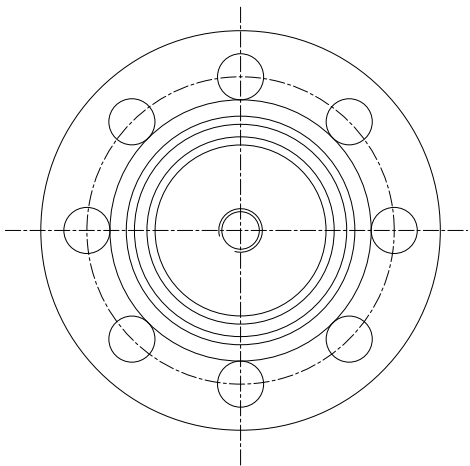
CSP-E-1



CSP-E-J/K



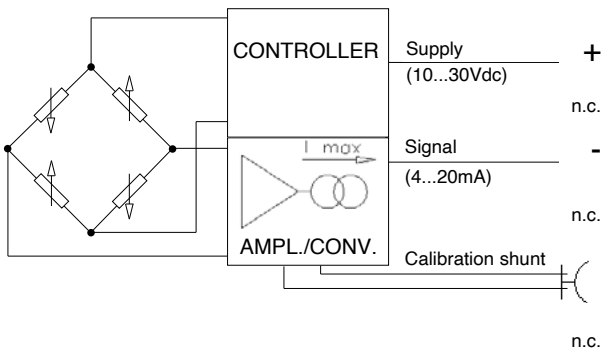
FLANGE



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

# ELECTRICAL CONNECTIONS

## CURRENT OUTPUT (4...20mA, 2 wires)



### MAGNETIC AUTOZERO

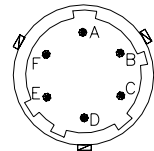
6-pin	8-pin
A	B
C	A
B	D
D	C
E - F	E - F
	G - H

### EXTERNAL AUTOZERO

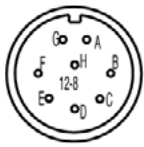
6-pin	8-pin
A	B
C	A
B	D
D	C
E - F	E - F
	G - H

Connect the cable sheathing to the side of the instrument

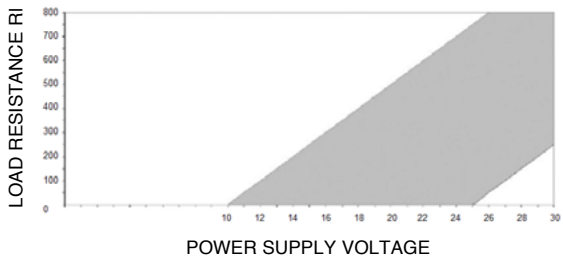
6-pin connector  
VPT07RA10-6PT2  
(PT02A-10-6P)



8-pin connector  
PC02E-12-8P Bendix

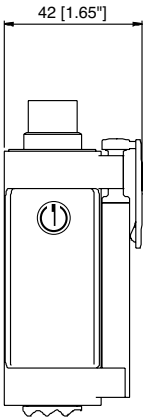


## LOAD DIAGRAM



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 shaded area.

## AUTOZERO FUNCTION



The Autozero function is activated through a magnetic contact (external magnet supplied with the sensor). See the manual for a complete Autozero function explanation.

## 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 effects 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).

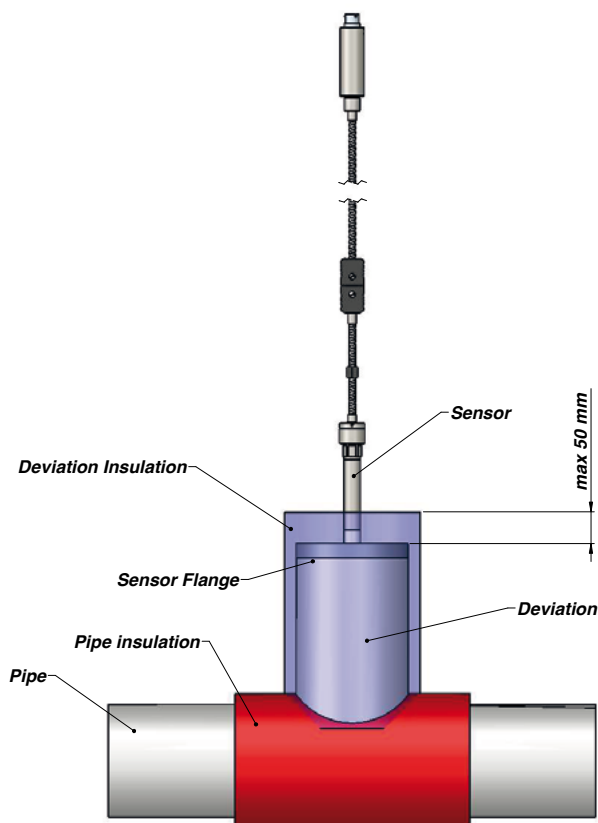
The insulation of the piezometric deviation should embrace the adapter only.

Keep the deviation heated at a temperature  $> 250^{\circ}\text{C}$  (e.g.  $300^{\circ}\text{C}$ ).

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.



## 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 ( $T > 250\text{ }^{\circ}\text{C}$  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:

$$P = (Out - Out_0) \cdot \frac{FS}{16} - \frac{k(T - T_0)}{1000} [\text{bar}]$$

Where:

- $T$  and  $T_0$  are expressed in [ $^{\circ}\text{C}$ ];
- $Out_0$  [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 [ $\frac{\text{mbar}}{^{\circ}\text{C}}$ ]
- $FS$  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

SF18

SC18

KF18

CT18

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

## ORDER CODE

**CSP** - **E** - **X** - **X** - **L** - **X** **X** **X** **X** - **X** - **X** - **I** - **O** - **X** - **X** - **X** - **X** **X** **X** **X**

**XXX**

### VERSION

Rigid + Flexible stem	<b>1</b>
With thermocouple J	<b>J</b>
With thermocouple K	<b>K</b>

### CONNECTOR

6 pin	<b>6</b>
8 pin	<b>8</b>
Cable NPT L. 1m	<b>N</b>

### MEASUREMENT RANGE

bar		psi	
20	<b>B02D</b>	300	<b>P03C</b>
35	<b>B35U</b>	500	<b>P05C</b>
50	<b>B05D</b>	750	<b>P75D</b>
70	<b>B07D</b>	1000	<b>P01M</b>
100	<b>B01C</b>	1500	<b>P15C</b>
200	<b>B02C</b>	3000	<b>P03M</b>
350	<b>B35D</b>	5000	<b>P05M</b>
500	<b>B05C</b>	7500	<b>P75C</b>
700	<b>B07C</b>	10000	<b>P10M</b>
1000	<b>B01M</b>	15000	<b>P15M</b>

### RIGID STEM LENGTH

153 mm/6"	<b>4</b>
318 mm/12.5"	<b>5</b>

### FLEXIBLE STEM LENGTH

76 mm/3"	<b>A</b>
152 mm/6"	<b>B</b>
300 mm/12"	<b>C</b>
457 mm/18"	<b>D</b>
610 mm/24"	<b>E</b>
760 mm/30"	<b>F</b>
914 mm/36"	<b>G</b>
1067 mm/42"	<b>H</b>
1220 mm/48"	<b>I</b>
1372 mm/54"	<b>J</b>
1520 mm/60"	<b>K</b>

### AUTOZERO

Magnetic Autozero	<b>0</b>
External Autozero	<b>E</b>

XXX= Standard version  
Special or customized  
versions available on request

### CLASS

<b>B</b>	300
<b>D</b>	600
<b>E</b>	900
<b>F</b>	1500

### TYPE

<b>F</b>	Raised Face (RF)
<b>J</b>	Ring Type Joint (RTJ)

### MATERIAL

<b>A</b>	AISI 316
<b>C</b>	AISI 347H

### DIMENSIONS

<b>C</b>	1" (DN25)
<b>F</b>	2" (DN50)
<b>G</b>	4" (DN100)

### DOCUMENTATION

<b>0</b>	Standard
<b>1</b>	STD +cert 3.1
<b>2</b>	STD +cert 3.1 + cert 2.1

### TAG PLATE

<b>0</b>	No Tag-Plate
<b>1</b>	Sensor Tag
<b>2</b>	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](http://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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