GEFRAN

I3 - IE - IN - IX - I7

INSTRUCTION MANUAL

CE

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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.

CONTENTS

1. GENERAL INFORMATION

This manual applies to IN-I3-IX-IE series and to IE - I7 performance level "c" series produced by Gefran spa, via sebina 74-25050 Provaglio di'Iseo - BS- Italy.

1.1 General information

This manual must be kept near the equipment for easy reading and consultation.
It must be read, understood, and strictly follow in order to avoid and prevent accidents and/or malfunctions.
Gefran will not be liable for any injury to people and/or damage to property deriving from disregard of this manual.

1.2 Copyright

Any re production of this document, even partial or for internal use, requires Gefran's approval.

1.3 Correct use

Gefran Melt pressure sensors with amplified or non-amplified electrical output are designed and built to measure the pressure and temperature variable of melted plastic at different temperatures according to the filling fluid used.
The correct temperature range is: 350°C.
If the sensors are used as a safety component in compliance with the Machinery directive, it's necessary to read carefully the "Safety Manual" in annex.

2. MECHANICAL DIMENSIONS

For the mechanical dimensions keep as reference the product datasheets or Gefran website www.gefran.com

TECHNICAL DATA

Extrusion processes require very high temperatures. Extrusion pressure can be checked by means of especially designed transducers.

The IMPACT series sensors are suitable for pressure measurements with high temperature and are based on the piezoresistive technology.

Following advice for extending the sensors lifetime.

a) Avoid shocks and abrasions to the in contact diaphragm. Protect the transducer with its cover each time you remove it from its seat.

b) The seat must be prepared perfectly and with appropriate tools in order to respect the depth and axiality of the holes and tapping.

Pay particular attention to the coaxiality of the holes to the thread, because diaxialities greater than 0.2 mm will break the transducer during assembly.

It is essential that hole depth guarantee the absence of chambers or air pockets in which extrusion material may be trapped.

To prevent contact with the extrusion screw or with tools used to clean the extrusion chamber, the front diaphragm must not extend from the inner wall of the extruder.

c) Before assembling the transducer in machines already in operation, make sure that the housing is clean. Remove any residual with the suitable cleaning device.
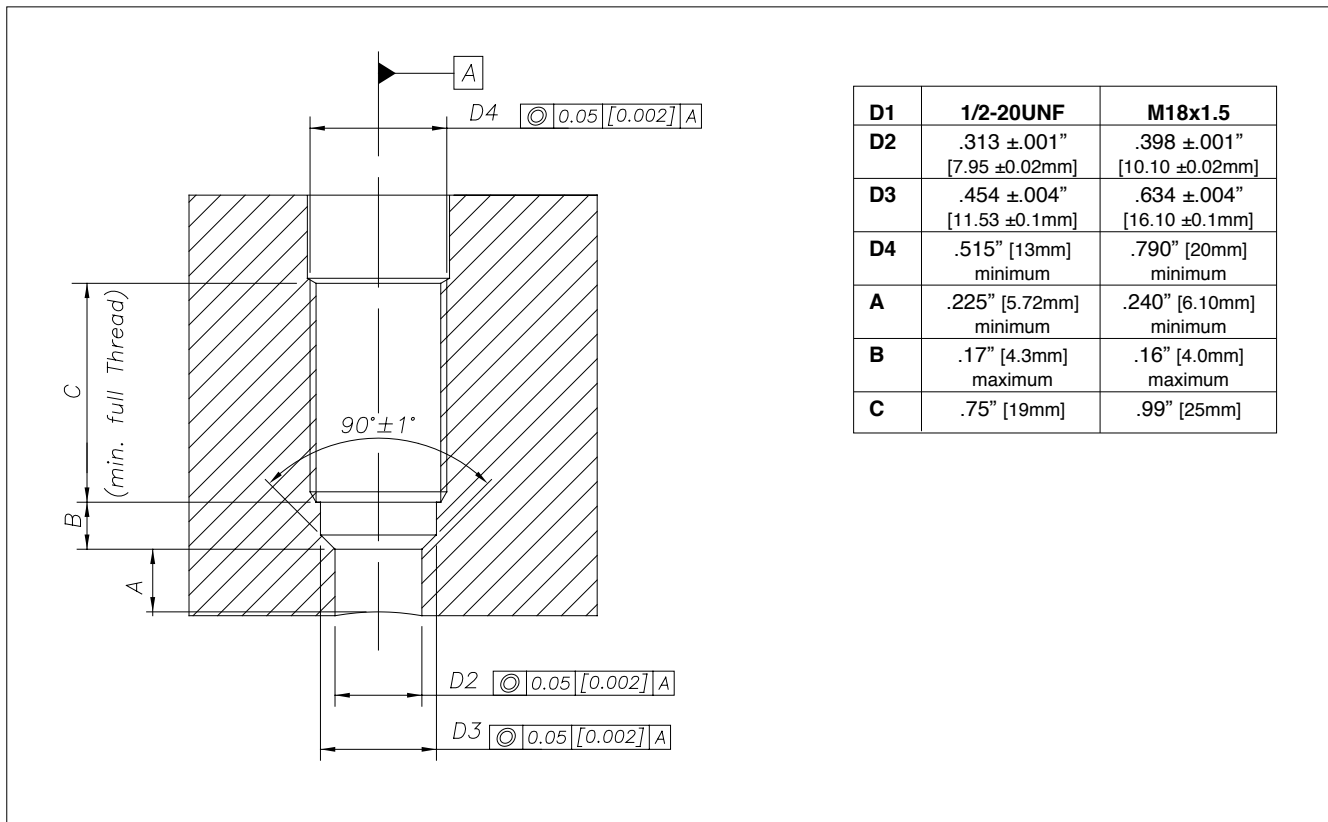
d) The transducer should be removed only with the machine empty (without pressure) but still hot.

e) The transducer should be cleaned with solvents for the material being processed.

Any mechanical action on the contact diaphragm modifies its operation and could break it.

3a - Installation seat

The installation seat has to be realized:

D1	1/2-20UNF	M18x1.5
D2	.313 ±.001" [7.95 ±0.02mm]	.398 ±.001" [10.10 ±0.02mm]
D3	.454 ±.004" [11.53 ±0.1mm]	.634 ±.004" [16.10 ±0.1mm]
D4	.515" [13mm] minimum	.790" [20mm] minimum
A	.225" [5.72mm] minimum	.240" [6.10mm] minimum
B	.17" [4.3mm] maximum	.16" [4.0mm] maximum
C	.75" [19mm]	.99" [25mm]

⚠ Incorrect working or shape of the side can result in properties out of specification, bad behaviour or damage to the sensor.

The side should be clean and without any polymer residual.

Drilling kit

A drilling kit with formed tools for drilling, reaming and tapping is available to facilitate correct preparation of the assembly seat. The assembly seat must be perfect to assure proper transducer function and long lifetime. Drilling kits are available in the following versions: **KF12, KF18**.

Drilling procedure

1) To drill hole (D4) up to a distance from the hole equal to the sum of (A+B+C) (tool 3).
2) Make the pass through hole (D2) by the tool 1.
3) To create the seal seat at a distance from the hole equal to dimension (A) (tool 4).
4) With a roughing tap, create threading 1/2-20UNF-2B (recognizable from the greater number of threads beveled at the mouth) (tool 5).
5) With a finishing tap, go over threading 1/2-20UNF-2B up to a distance from the bottom equal to the sum of (A+B) (tool 6).
6) To ream the hole (D2) with reamer (tool 2).

Installation seat check

The dimensions of the assembly seat have to be checked after preparation and before the transducer installation.
Use dummy plug SC 12/18 as follows:
1) Coat the end of the rod with the appropriate ink.
2) Lubricate the threaded part to prevent friction.
3) Insert the dummy plug and screw it fully down.
4) Remove the rod and examine it.
With the exception of 45° surfaces, the ink should be intact on the entire surface.

DRILLING TOOL KIT

VERSION CODE		KF12	KF18
THREADING TYPE		1/2-20UNF-2B	M18x1.5
1		Ø 7.6	Ø 9.75
2		Ø 7.95	Ø 10.1
3		Ø 13	Ø 20
4		Ø 11.5 with pilot guide	Ø 16 with pilot guide
5		1/2-20UNF-2B roughing	M18x1.5 roughing
6		1/2-20UNF-2B finishing	M18x1.5 finishing

CORRECT INSTALLATION

WRONG

WRONG

WRONG

CORRECT

CORRECT SEAL

contact surface
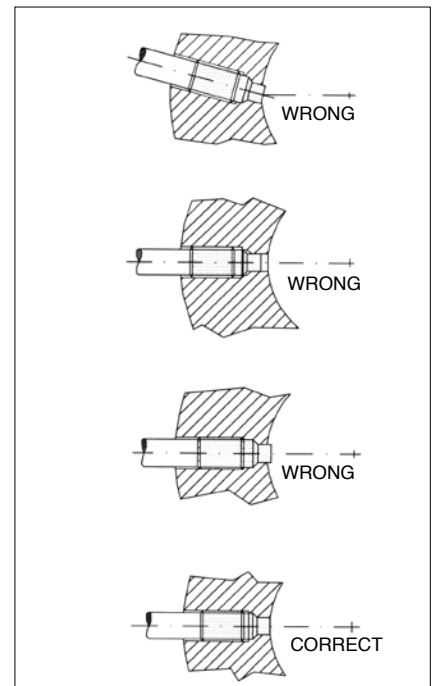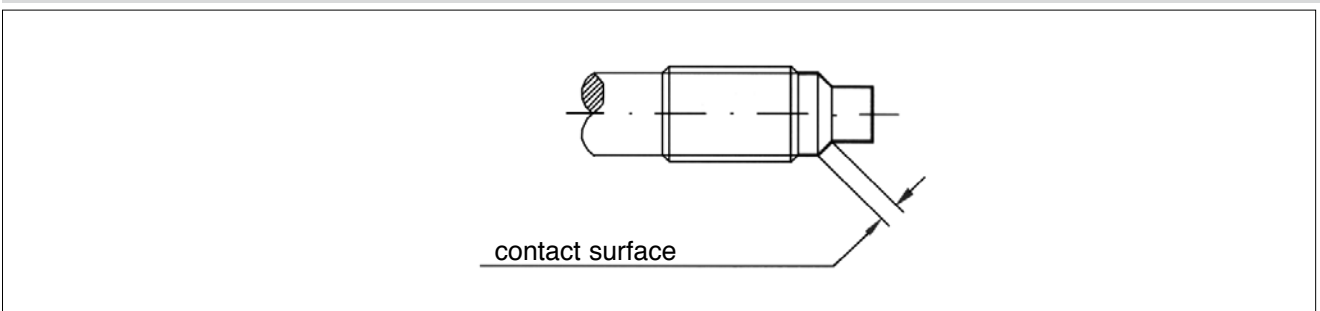
Installation procedure

1) Make sure the drilling procedure has been realized correctly. If the sensor is installed in a previously used hole, make sure the hole is completely clean and free of any plastic residual.
2) Remove the protective cap from the sensor top.
3) Lubrificate the thread with non-grip grease such as Neverseez (Bostik), or C5A (Felpro), or equivalent.
4) Insert firmly the sensor into the hole, first by hand and then with a wrench, 1/4 turn at a time. Recommended torque: 40 Nm.

NOTE: Please pay particular attention to the sensor installation when it's provided in its fixed mechanis configuration.
In this case, during the clamping phase any misalignment. Has tube avoided, otherwise a possible interference of the sensor mechanical coupling can occur.

Removal (Figure 1)

To remove the transducer from its seat and carry on the working process, dummy plugs with identical mechanical dimensions are available.
The dummy plugs differ by type of threading; max pressure range is 2000 bar for all rods.
The dummy plugs are available in the following versions: **SC12** 1/2-20UNF seat - **SC18** M18x1,5 seat

Brackets (Figure 2)

Models with flexible sheaths require the housing precise fixing. Suitable fastening brackets (SF18) are recommended.
Remember that the fastening point must be vibration-free (vibrations affect the measurement) and that temperatures must not exceed the maximum temperature range for the strain gauge housing (as stated on the sensor technical sheet).

Extruder starting

Bring the system to working temperature with the transducer installed and without any pressure applied.
Wait until all the material is at the same temperature to prevent the transducer damage by semi-solid material.

Seat cleaning & Cleaning tool

As mentioned in the notes, the seat must be cleaned before the transducer installation.
The cleaning tool is a hard metal cutting tool specially designed to remove working materials residuals.

Recommended procedure (Figure 3)

The following procedure must be implemented with the material in a fluid condition.
1) Insert the tool in the seat and screw down the cutting rod (normally a 1/4 turn at a time).
2) Turn the pilot cutter clockwise until there is no resistance to cutting.
3) Repeat the procedure until the seat is completely clean.
For constructive reasons, the maximum torque applicable to the cutter is 15 Nm (1.5 Kgm).
If the hole occlusion requires higher torque for removal, use the drilling kit and follow the recommended procedure.
The cleaning tool is available in the following versions: **CT12** 1/2-20UNF seat - **CT18** M18x1,5 seat.
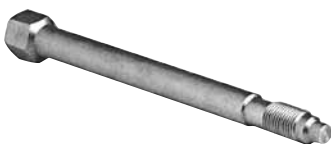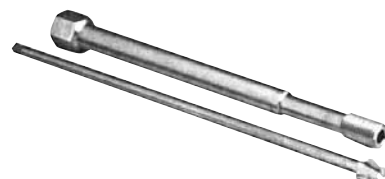
| Figure 1 | Figure 2 | Figure 3 |

ORDER CODES FOR TOOLS and ACCESSORIES

MOUNTING BRACKET		SF 18

CLEANING TOOL KIT		CT	
1/2-20UNF	12		
M18x1,5	18		

DUMMY PLUG		SC	
1/2-20UNF	12		
M18x1,5	18		

DRILL KIT		KF	
1/2-20UNF	12		
M18x1,5	18		

3b - Torquing the sensor

Screw the sensor after checking the correct shape of the side.

Hold the flexible part while screwing the jam bushing.

⚠ For safety operations at least 6 pitch of the jam bushing must be screwed into the hole.

The torque must be 40 Nm.

3c - Connecting amplifier (only for modular versions)

The electronics must be connected to the primary part by aligning the 2 red points on each connector.

Take care not to force the connectors together: check the correct aligning of the 2 red points.

⚠️ Fix the flexible sheath to the machine. Take care not to fix the sheath to parts heated at over than 220°C.

Screw the electrical cable connector to the electronics and switch on the sensor.

Wait 60 seconds before starting to operate the transducer.

To disconnect the electronics from the primary sensor, take care to handle the two connectors next to the red points and not to force the disconnection.

☞ **Remark:**
In modular versions the decoupling between the electronics and the primary element is not allowed.

Connections

The sensors have to be connected as shown in the diagram on the next page.

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

Calibration procedure

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

The measurement chain connected to the transducer 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 delay gives the system time to recognize and 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 and have it display the calibration value shown on the transducer data plate (80% of full scale). 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.

I3 series

MAGNETIC AUTOZERO

6-pin
C
D
A
B
E
F

POWER SUPPLY + / −
OUTPUT + / −
CALIBRATION

EXTERNAL AUTOZERO

6-pin
C
D
A
B
E
F

POWER SUPPLY + / −
OUTPUT + / −
AUTOZERO

ADC µC DAC

IE series

CONTROLLER = / =
AMP_CONV I max

MAGNETIC AUTOZERO

	6-pin	8-pin
POWER SUPPLY +	A	2
n.c.	C	1
OUTPUT −	B	4
n.c.	D	6
CALIBRATION	E	7
	F	3
n.c.		5-8

EXTERNAL AUTOZERO

	6-pin	8-pin
POWER SUPPLY +	A	2
n.c.	C	1
OUTPUT −	B	4
n.c.	D	6
AUTOZERO	E	7
	F	3
n.c.		5-8

CONTROLLER = / =
AMP_CONV I max

MAGNETIC AUTOZERO

	6-pin	8-pin
POWER SUPPLY +	A	2
n.c.	C	1
OUTPUT −	B	4
POWER SUPPLY −	D	6
RELAY CONTACT	E−F	7−3
n.c.		5-8

EXTERNAL AUTOZERO

	8-pin
POWER SUPPLY +	2
n.c.	1
OUTPUT −	4
POWER SUPPLY −	6
RELAY CONTACT	7−3
AUTOZERO	5-8

IN series

IX series

Note: Power feeding through a galvanic isolation barrier.

I7 series

MAGNETIC AUTOZERO

	6-pin	8-pin
POWER SUPPLY +	C	1
POWER SUPPLY −	D	6
OUTPUT +	A	2
OUTPUT −	B	4
CALIBRATION	E	7
	F	3
n.c.		5−8

EXTERNAL AUTOZERO

	6-pin	8-pin
POWER SUPPLY +	C	1
POWER SUPPLY −	D	6
OUTPUT +	A	2
OUTPUT −	B	4
AUTOZERO	E	7
	F	3
n.c.		5−8

MAGNETIC AUTOZERO

	6-pin	8-pin
POWER SUPPLY +	C	1
POWER SUPPLY −	D	6
OUTPUT +	A	2
OUTPUT −	B	4
RELAY CONTACT	E−F	7−3
n.c.		5−8

EXTERNAL AUTOZERO

	8-pin
POWER SUPPLY +	1
POWER SUPPLY −	6
OUTPUT +	2
OUTPUT −	4
RELAY CONTACT	7−3
AUTOZERO	5−8

CONTROLLER
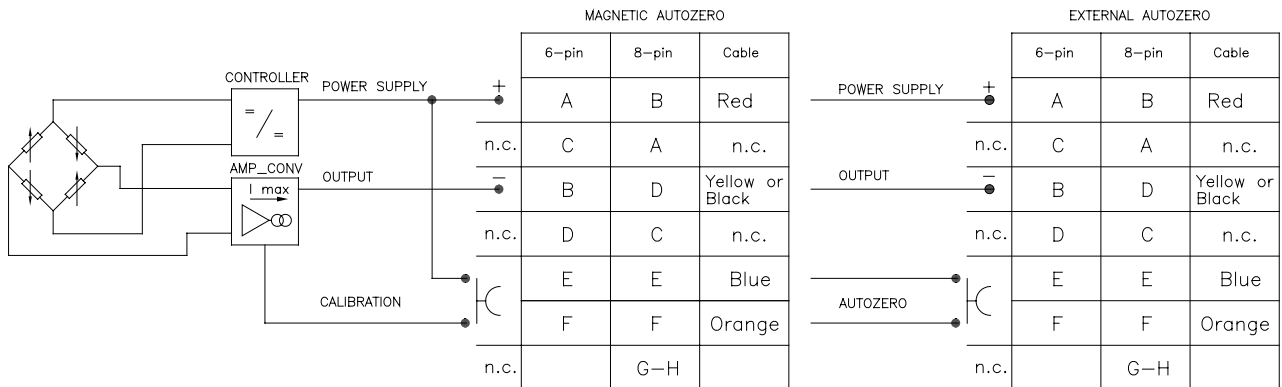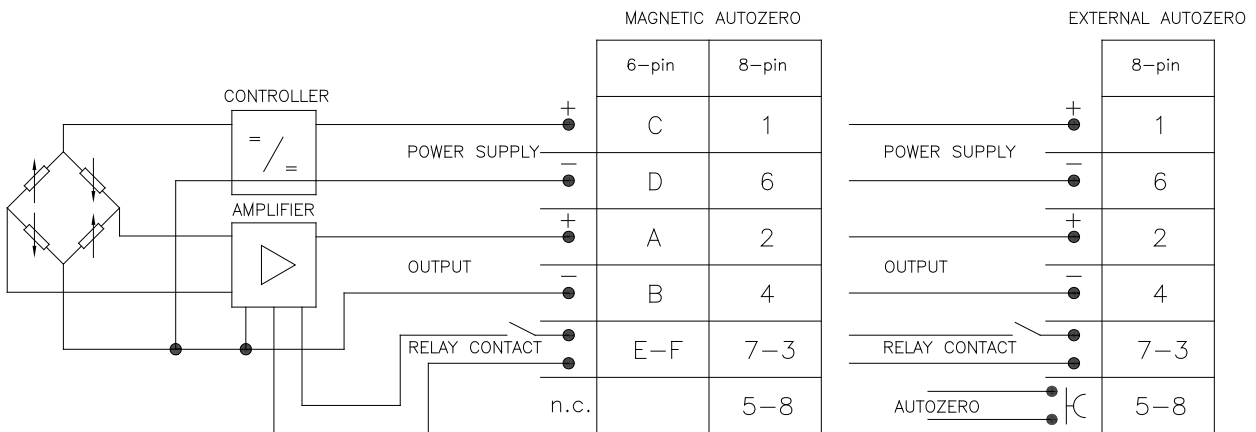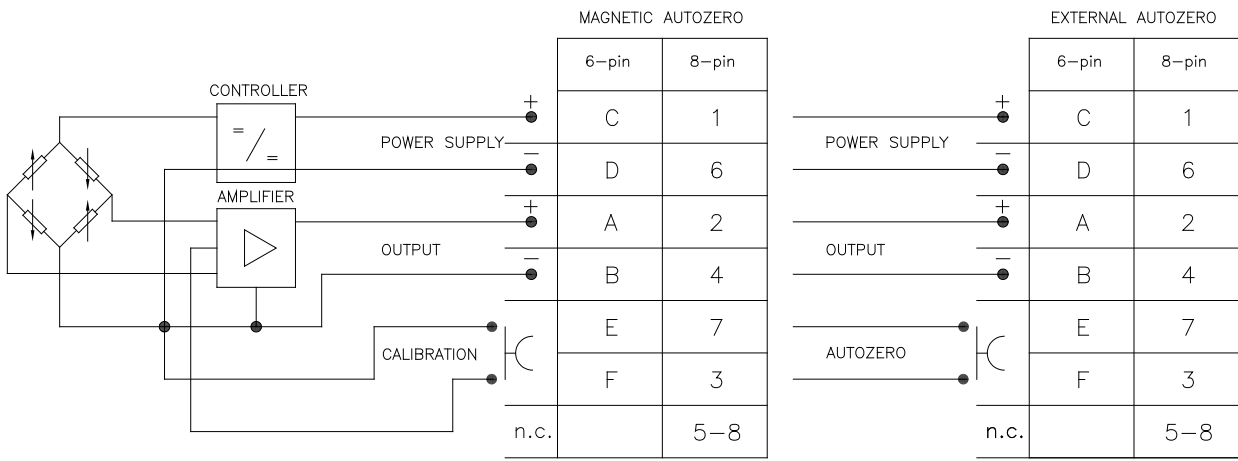AMPLIFIER

8 pin connector PC02E-12-8P Bendix	6 pin connector VPT07RA10-6PT2 (PT02A-10-6P)	8 pin connector (Binder) M16 DIN/EN45326 (09-0173-00-08)	4 pole cable
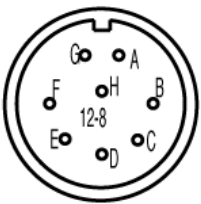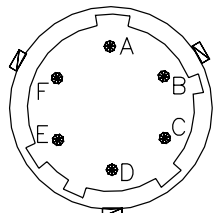
4 pole cable:
Shield
Blue
Orange
Red
Yellow or black
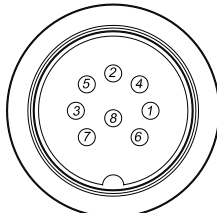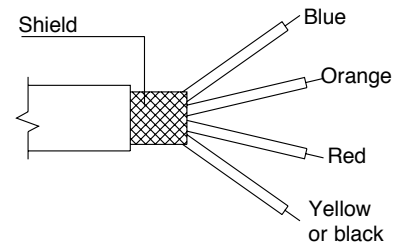
Shielded cable 4x0.25 - 2m.
Protection IP65

IE - LOAD DIAGRAM

R (ohm) vs Vcc (Volt)

IX - LOAD DIAGRAM

LOAD RESISTANCE RL vs SUPPLY VOLTAGE
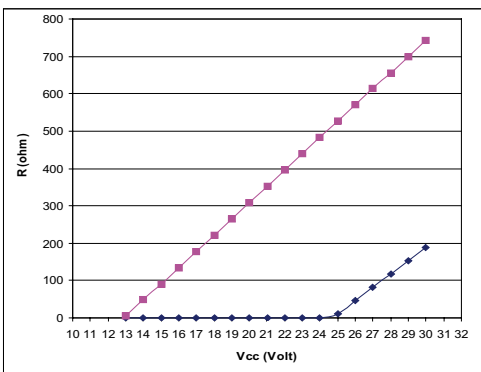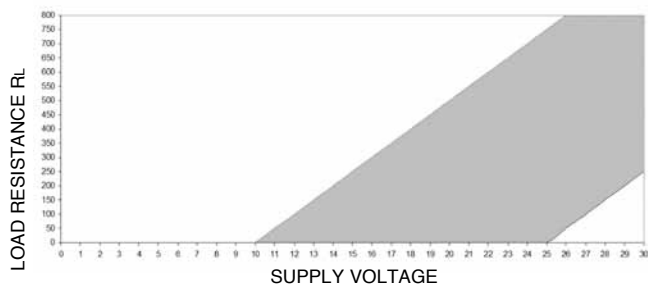
The diagram shows the optimum ratio between load and power supply for transmitters with 4…20mA output.

For correct function, use a combination of load resistance and voltage that falls within the shaded area

3f - Maintenance

Melt pressure sensors must be installed and electrically connected by trained people, following all applicable recommendations, with zero pressure and voltage, and with the machine switched off.

The sensor must be removed with the plastic in melt state and the machine in hot conditions.

Always remove the sensor before cleaning the machine, using steel brushes or similar tools.

Always wear protective gloves and always take adequate ESD precautions to prevent electrostatic discharges that could damage the sensor.

Always use the wrench for the hexagonal nut when installing and removing the sensor.

DO NOT force the electronics housing.

Once the sensor is removed, clean it gently with a soft cloth while the material is still malleable.

3g - Transport, storage and disposal

The melt pressure sensors Impact series are realized with piezoresistive silicon technology completely "fluid free".

Even if these are designed with a thick diaphragm, they must be always transported and stocked with the protection cap and with the package.

Gefran allows melt pressure sensors of own production, also defective units or damage by the use, for the disposal.

4. ELECTRONIC FEATURES AND PROCEDURES

4a - Autozero function

The transmitter remains on the standard operating mode, till an external event happens.
The possible channels to activate the additional functions are the following:

- Pin CAL
- Magnetic pen

The operating manual explains the following features:

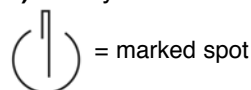1) Autozero
2) Calibration (CAL)
3) Total Reset

The following pages explain the application modality, for all the additional functions.
The contents are related to application limits and aims.

1) AUTOZERO

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 correct pins (e.g. pins E-F for the 6 pin connector) for the external Autozero version. The magnet has to be maintained on the Autozero position for a time within 2 to 5 seconds.	± 40% F.S.	The Autozero effect will be visible after waiting 2 seconds after the start of the function. The precision of the zero value will be defined by the accuracy class of the sensor.

NOTE:
During the Autozero phase, the current output for the IE/IX transmitter series, can increase up to 7 mA. That's a short variation only visible during the Autozero phase; it won't have any effects on the final signal.

| Magnetic pointer | 2...5 seconds | Remove |
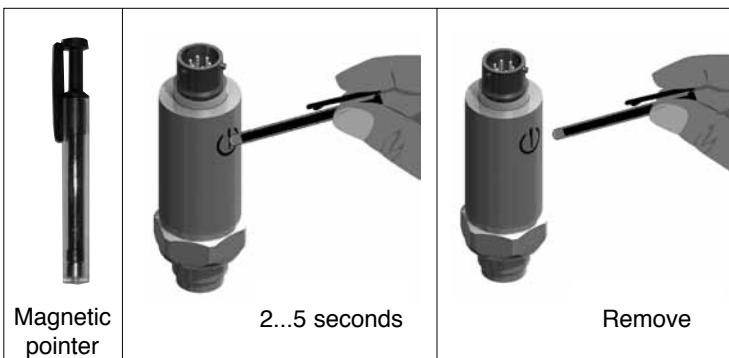
1) Machine pressure = 0 bar and transducer powered
2) Put magnetic pointer on marked spot (2...5 seconds)
3) Remove magnetic pointer
4) Ready !

= 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 gives the system time to recognize and compensate all of the signal drifts caused by tightening and temperature.
If the transmitter is kept powered, additional Autozero activations can be run immediately; on the other hand, you will have to wait 1 minute each time the system is switched on again.

2) CALIBRATION (CAL)

Application mode	Limits	Result
Start CAL: The Calibration function is activated by short-circuiting the pin E – F for a minimum time of 1 second. Stop CAL: Release the E - F short-circuit.	The whole Zero unbalancement in comparison to the zero done by the manufacturer, has to be ± 20%FS.	During the Calibration phase the signal will be unbalanced to the 80% FS. The calibration effect is visible 2 seconds after short-circuiting E - F. The Calibration function doesn't work outside the defined limits.
NOTE: The Calibration function is not allowed for "external Autozero" version.		

3) TOTAL RESET OF THE CALIBRATION VALUES

Application mode	Limits	Result
The Autozero fuction can be activated in the following ways: 1) Magnet has to be maintained on the Autozero position for a time of 20 to 25 seconds. 2) Short-circuiting the correct pins (e.g. pins E-F for the 6 pin connector) for a time of 20 to 25 seconds, for the external Autozero version.		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 IE/IX transmitter series, can increase up to 7 mA.		

4b - NE21 and NE43 compatibility specifications (for series IX - IE - I7)

The IX - IE and I7 series are fully compatible with the NE21 Namur recommendation.
The same compatibility is valid for the NE43 Namur recommendation with the following sensor behaviour in case of breakdown:

·   Cut cable: breakdown information as the signal is ≤ 3,6 mA
·   Device not connected: breakdown information as the signal is ≤ 3,6 mA
·   Broken power-supply: breakdown information as the signal is ≤ 3,6 mA or in case of performance problems
·   Most common failures on primary sensors: the signal goes to 23 mA (e.g. due to overpressure)

NOTE: in all the remaining situations, the output signal is always included between 3,6 and 21 mA.

Recommendation: the error level set by the customer (e.g. maximum pressure value) has to be inside the sensor nominal range.

5. AUTOCOMPENSATION EFFECT ON IMPACT SERIES

Impact series sensors work on a piezoresistive principle by a silicon chip. All the components need about an accurate thermal compensation either of the zero signal or of the span signal.
This compensation eliminates the sensor drift effects and is realized by the temperature signal digital reading through the silicon chip.
The components thermal inertia can generate signal over/under elongations (<15% FSO) during fast thermal gradients.
In steady state the signal is correctly compensated.

6. SENSOR TECHNICAL SPECIFICATION

6a - IN Series - Technical data

Accuracy (1)	**H** <±0.25%FSO **M** <±0.5%FSO
Resolution	16 bit
Measurement range	0..100 to 0..1000bar 0..1500 to 0..15000psi
Maximum overpressure (without degrading)	1,5 x FS (maximum pressure 1200bar/17400psi)
Measurement principle	Piezoresistive
Power supply	15...30Vdc N, C
Maximum current absorption	15mA
Insulation resistance (at 50Vdc)	>1000 MOhm
Output signal Full Scale FSO	5Vdc (M) - 10Vdc (N) 5.1Vdc (B) - 10.1Vdc (C)
Zero balance (tollerance ± 0.25% FSO)	0Vdc (M,N) 0.1Vdc (B,C)
Zero signals adjustment (tollerance ± 0.25% FSO)	"Autozero" function
Maximum allowed load	1mA
Response time (10...90% FSO)	8ms (option 1ms)
Output noise (RMS 10-400Hz)	< 0.025% FSO
Calibration signal	80% FSO
Output short circuit ingress and reverse polarity protection	YES
Voltage spike protection	> 2KV burst test, secondo EN61000-4-4
Compensed temperature range housing	0...+85°C
Operating temperature range housing	-30...+85°C
Storage temperature range housing	-40...+125°C
Maximum diaphragm temperature	350°C / 660°F
Zero signal variation due to process temperature variation in range (20-350°C)	< ± 1,2%FSO
Span signal variation due to process temperature variation in range (20-350°C)	< ± 1%FSO
Std contact diaphragm with process	15-5 PH GTP
Thermocouple (Model IN2)	STD: type "J" (isolated junction) type "K" (on request)
Protection degree (with 6-pole female connector)	IP65
Electrical connection	Conn. 6-pin VPT07RA10-6PT(PT02A-10-6P)

FSO = Full scale output.

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

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

6b - I3 Series - Technical data

Accuracy (1)	**H** <±0.25%FSO **M** <±0.5%FSO
Resolution	16 bit
Measurement range	0..100 to 0..1000bar 0..1500 to 0..15000psi
Maximum overpressure (without degrading)	1,5 x FS 1,5 x FS (maximum pressure 1200bar/17400psi)
Measurement principle	Piezoresistive
Power supply	8...12Vdc (10Vdc tipico)
Input impedance	350 Ohm ± 10%
Insulation resistance (at 50Vdc)	>1000 MOhm
Output signal Full Scale FSO	2,5mV/V (option 2) 3,33mV/V (option 3)
Zero signals adjustment (tollerance ± 0.5% FSO)	"Autozero" function
Output impedance	350 Ohm ± 10%
Response time (10...90% FSO)	8ms (option 1ms)
Output noise (RMS 10-400Hz)	< 0.025% FSO
Calibration signal	80% FSO
Output short circuit ingress and reverse polarity protection	YES
Voltage spike protection	> 2KV burst test, to EN61000-4-4
Compensed temperature range housing	0...+85°C
Operating temperature range housing	-30...+85°C
Storage temperature range housing	-40...+125°C
Maximum diaphragm temperature	350°C
Zero signal variation due to process temperature variation in range (20-350°C)	< ± 1,2%FSO
Span signal variation due to process temperature variation in range (20-350°C)	< ± 1%FSO
Std contact diaphragm with process	15-5 PH GTP
Thermocouple (Model I32)	STD: type "J" (isolated junction) type "K" (on request)
Protection degree (with 6-pole female connector)	IP65
Electrical connection	Conn. 6-pin VPT07RA10-6PT (PT02A-10-6P)

FSO = Full scale output.
(1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability.

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

6c - IX Series - Technical data	
Accuracy (1)	**H** <±0.25%FSO **M** <±0.5%FSO
Resolution	16 bit
Measurement range	0..100 to 0..1000bar 0..1500 to 0..15000psi
Maximum overpressure (without degrading)	1,5 x FS 1,5 x FS (maximum pressure 1200bar/17400psi)
Measurement principle	Piezoresistive
Power supply	10...30Vdc
Maximum current absorption	23mA
Insulation resistance (at 50Vdc)	>1000 MOhm
Output signal Full Scale FSO	20mA
Zero balance (tollerance ± 0.25% FSO)	4mA
Zero signals adjustment (tollerance ± 0.25% FSO)	"Autozero" function
Maximum allowed load	see diagram
Response time (10...90% FSO)	8ms
Output noise (RMS 10-400Hz)	< 0.025% FSO
Calibration signal	80% FSO
Output short circuit ingress and reverse polarity protection	YES
Voltage spike protection	> 2KV burst test, to EN61000-4-4
Compensed temperature range housing	0...+85°C
Operating temperature range housing	-20...+35°C
Storage temperature range housin	-40...+125°C
Maximum diaphragm temperature	350°C / 660°F
Zero signal variation due to process temperature variation in range (20-350°C)	< ± 1,2%FSO
Span signal variation due to process temperature variation in range (20-350°C)	< ± 1%FSO
Std contact diaphragm with process	15-5 PH GTP
Thermocouple (model IX2)	STD: type "J" (isolated junction) type "K" (on request)
Protection degree (with 6-pole female connector)	IP65
Electrical connection	Conn. 6-pin VPT07RA10-6PT (PT02A-10-6P) Conn. 8-pin PC02E-12-8P Cable output

FSO = Full scale output.
(1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability.

Sensors are manufactured in compliance with:
- EMC 2004/108/CE compatibility directive
- RoHS 2002/95/CE directive
- ATEX 94/9/CE

Sensors are also tested according to NAMUR NE21 and NE43 recommendations

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

6d - IE series - IE Performance Level "c" Series - Technical data

Accuracy (1)	**H** <±0.25%FSO **M** <±0.5%FSO
Resolution	16 bit
Measurement range	0..100 to 0..1000bar 0..1500 to 0..15000psi
Maximum overpressure (without degrading)	1,5 x FS 1,5 x FS (maximum pressure 1200bar/17400psi)
Measurement principle	Piezoresistive
Power supply	13...30Vdc
Maximum current absorption	23 mA (40 mA with optional relay)
Output signal Full Scale FSO	20mA
Zero balance (tollerance ± 0.25% FSO)	4mA
Zero signals adjustment (tollerance ± 0.25% FSO)	"Autozero" function
Response time (10...90% FSO)	8ms
Output noise (RMS 10-400Hz)	< 0.025% FSO
Calibration signal	80% FSO
Reverse polarity protection	YES
Compensated temperature range housing	0...+85°C
Operating temperature range housing	-30...+85°C
Storage temperature range housing	-40...+125°C
Maximum diaphragm temperature	350°C / 660°F
Zero signal variation due to process temperature variation in range (20-350°C)	< ± 1,2%FSO
Span signal variation due to process temperature variation in range (20-350°C)	< ± 1%FSO
Std contact diaphragm with process	15-5 PH GTP
Thermocouple (model IE2)	STD: type "J" (isolated junction) type "K" (on request)
Protection degree (with 6-pole female connector)	IP65
Electrical connection	Conn. 6-pin VPT07RA10-6PT (PT02A-10-6P) Conn. 8-pin (Binder) M16 DIN/EN45326 (09-0173-00-08)

FSO = Full scale output.

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

Sensors are manufactured in compliance with:
- EMC 2004/108/CE compatibility directive
- RoHS 2002/95/CE directive
- 2006/42/CE machine directive

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

6e - I7 Performance Level "c" Series - Technical data

Accuracy (1)	**H** <±0.25%FSO **M** <±0.5%FSO
Resolution	16 bit
Measurement range	0..100 to 0..1000bar 0..1500 to 0..15000psi
Maximum overpressure (without degrading)	1,5 x FS 1,5 x FS (maximum pressure 1200bar/17400psi)
Measurement principle	Piezoresistive
Power supply	18...30Vdc
Maximum current absorption	15 mA (30 mA with optional relay)
Output signal Full Scale FSO	10,5 Vdc
Zero balance (tollerance ± 0.25% FSO)	0,5 Vdc
Zero signals adjustment (tollerance ± 0.25% FSO)	"Autozero" function
Response time (10...90% FSO)	8ms
Output noise (RMS 10-400Hz)	< 0.025% FSO
Calibration signal	80% FSO
Output short circuit	YES
Supply reverse polarity protection	YES
Compensated temperature range housing	0...+85°C
Operating temperature range housing	-30...+85°C
Storage temperature range housing	-40...+125°C
Maximum diaphragm temperature	350°C / 660°F
Zero signal variation due to process temperature variation in range (20-350°C)	< ± 1,2%FSO
Span signal variation due to process temperature variation in range (20-350°C)	< ± 1%FSO
Std contact diaphragm with process	15-5 PH GTP
Thermocouple (model I72)	STD: type "J" (isolated junction) type "K" (on request)
Protection degree (with 6-pole female connector)	IP65
Electrical connection	Conn. 6-pin VPT07RA10-6PT (PT02A-10-6P) Conn. 8-pin (Binder) M16 DIN/EN45326 (09-0173-00-08)
Supply from output protection	YES

FSO = Full scale output.
(1) BFSL method (Best Fit Straight Line): includes combined effects of Non-Linearity, Hysteresis and Repeatability.

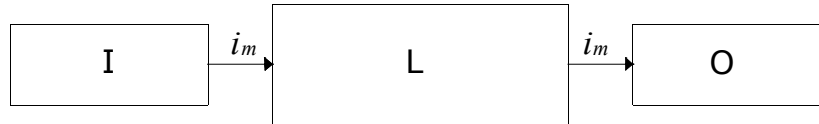Sensors are manufactured in compliance with:
- EMC 2004/108/CE compatibility directive
- RoHS 2002/95/CE directive
- 2006/42/CE machine directive

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

Designated category and fail exclusions

The designated category to which are limited the use of safety related parts is Category 1.

```
┌───────────┐   i_m   ┌───────────┐   i_m   ┌───────────┐
│     I     │────────▶│     L     │────────▶│     O     │
└───────────┘         └───────────┘         └───────────┘
```

Legend:

I   Input device (transducer)
L   Logic solver
O   Output device (actuator)
i$_m$ Connections

The safety function of the transducer is the correct transduction of the pressure in the extrusion chamber in order to detect overpressures and the overcoming of a fixed safety pressure threshold. The transduction is correct when it's within the specifications written in the *datasheet* and in the operation manual.

In the evaluation three different failures have been excluded:

• Wearing/corrosion of the mechanical parts at the process front end [13849-2:2005 prospect A.4]
• Break of the mechanical parts at the process front end [13849-2:2005 prospect A.4]
• Plastic deformation due to excessive loads of the mechanical parts at the process front end [13849-2:2005 prospect A.4]

Limitations and maintenance

To maintain the device in the designated category it must be used only by skilled people and strictly following the present safety instructions and the operating manual regarding the mechanical installation, the electrical connection, the maximum rated and environmental conditions.

The periodical maintenance activities to be done in order to preserve the device in the designated category are:

• Visual inspection of the process front end membrane and of the pitch of the thread, in order to evaluate abnormal abrasion or wearing due to incorrect mounting lasting in time.
  Every 2 years.

• Installation hole inspection: correct profile and dimension and absence of material residuals or occlusions of the pressure channel. Every 2 years.

• At any new installation or re-installation use anti-seize compound paste in order to avoid grip of the thread.

Effect on the safety function of the performance variations

The limit of performance degradation in order to avoid the loss of the security function is ± 5 % of the span at room temperature.
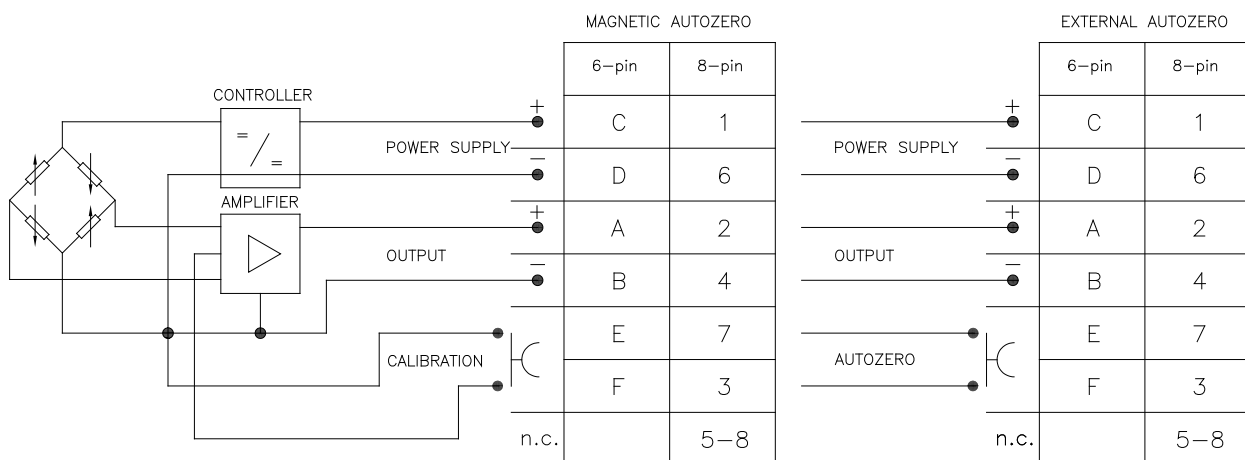
SRP/CS interface and protection devices

The SRP/CS interface is the multi-polar connector type 6 poles VEAM VP07RA10-6PT2 or the multi-polar connector type BINDER 8 poles M18 DIN/EN 45326, as illustrated in fig. 1, where are also pointed out the connections in case of voltage amplified output (4 wires: 2 for supply and 2 for signal) or current amplified (2 wires connection).

In the case of relay output with retransmitted output in current (2 wires) or voltage (4 wires) the connections are shown in fig. 2.
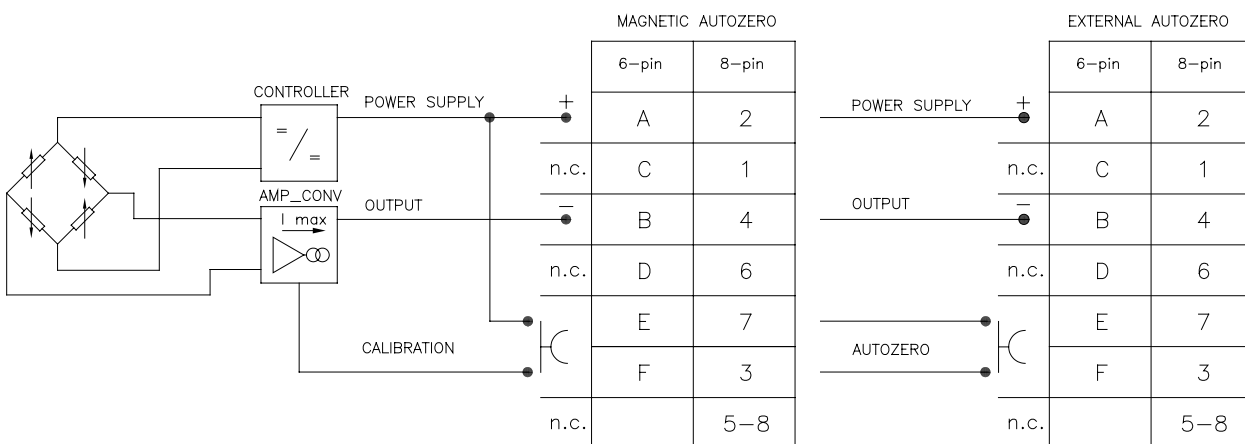

ELECTRICAL CONNECTIONS

VOLTAGE OUTPUT

	MAGNETIC AUTOZERO			EXTERNAL AUTOZERO	
	6−pin	8−pin		6−pin	8−pin
POWER SUPPLY +	C	1	POWER SUPPLY +	C	1
POWER SUPPLY −	D	6	POWER SUPPLY −	D	6
OUTPUT +	A	2	OUTPUT +	A	2
OUTPUT −	B	4	OUTPUT −	B	4
CALIBRATION	E	7	AUTOZERO	E	7
	F	3		F	3
n.c.		5−8	n.c.		5−8

The cable shield is tied to connector via cable clamp

CURRENT OUTPUT

	MAGNETIC AUTOZERO			EXTERNAL AUTOZERO	
	6−pin	8−pin		6−pin	8−pin
POWER SUPPLY +	A	2	POWER SUPPLY +	A	2
n.c.	C	1	n.c.	C	1
OUTPUT −	B	4	OUTPUT −	B	4
n.c.	D	6	n.c.	D	6
CALIBRATION	E	7	AUTOZERO	E	7
	F	3		F	3
n.c.		5−8	n.c.		5−8

The cable shield is tied to connector via cable clamp

6 pin connector VPT07RA10-6PT2
(PT02A-10-6P)
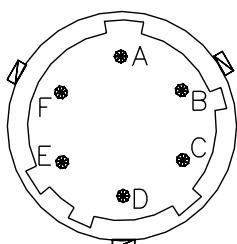
8 pin connector (Binder)
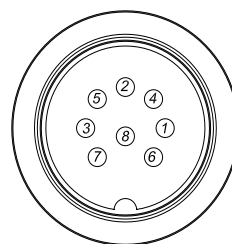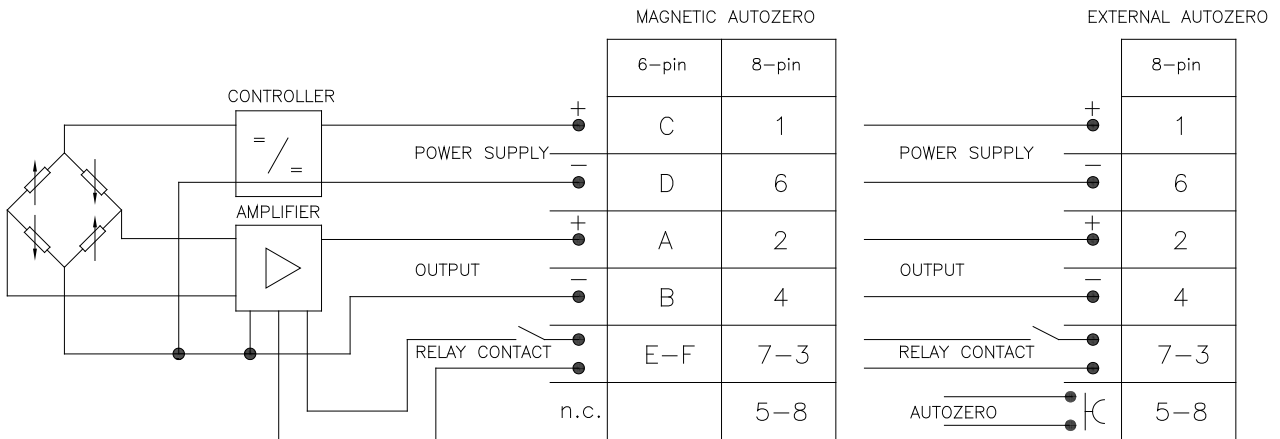M16 DIN/EN45326 (09-0173-00-08)
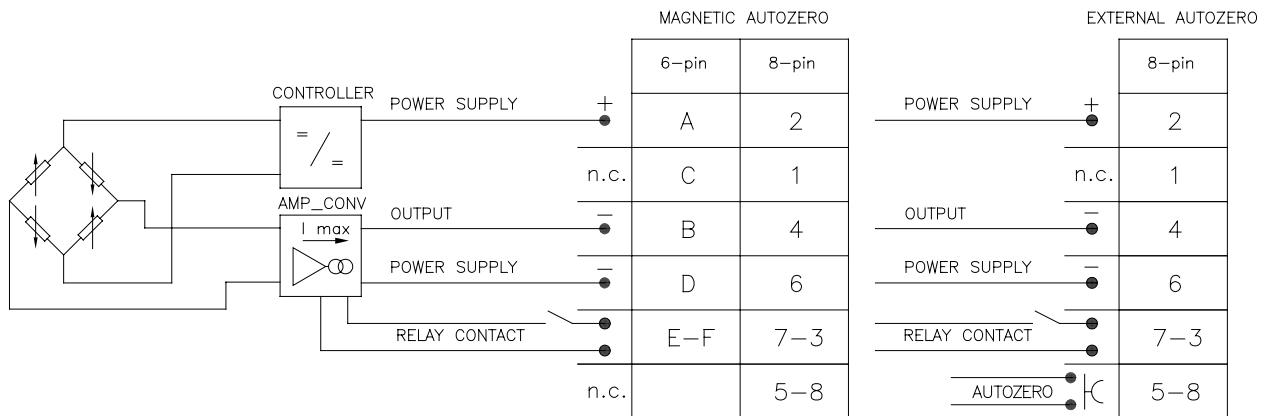

Fig. 1 - SRP/CS interface

VOLTAGE OUTPUT

Relay output (6-8 pin connector)

	MAGNETIC AUTOZERO		EXTERNAL AUTOZERO
	6-pin	8-pin	8-pin
POWER SUPPLY +	C	1	1
POWER SUPPLY −	D	6	6
OUTPUT +	A	2	2
OUTPUT −	B	4	4
RELAY CONTACT	E−F	7−3	7−3
n.c. / AUTOZERO		5−8	5−8

The cable shield is tied to connector via cable clamp

CURRENT OUTPUT

Relay output (6-8 pin connector)

	MAGNETIC AUTOZERO		EXTERNAL AUTOZERO
	6-pin	8-pin	8-pin
POWER SUPPLY +	A	2	2
n.c.	C	1	1
OUTPUT −	B	4	4
POWER SUPPLY −	D	6	6
RELAY CONTACT	E−F	7−3	7−3
n.c. / AUTOZERO		5−8	5−8

The cable shield is tied to connector via cable clamp

Fig. 2 - SRP/CS Interface

Response time

The response time at dangerous event is 8 ms.
The response time at a fail condition is 400 ms.

Environmental and operational limits

In order to maintain the device in the designated category it must work within the following limits (Tab.1):

Limit	Voltage output	Current output
Overpressure without degradation	1,5 x FS (maximum pressure 1200bar/17400psi)	1,5 x FS (maximum pressure 1200bar/17400psi)
Supply	15..30 Vdc	Load diagram
Process fluid temperature	23..350 °C	23..350 °C
Operating electronic temperature	-30..+85 °C	-30..+85 °C
Storage temperature range	-40..+125 °C	-40..+125 °C
Dust protection	IP 6X (EN 60529)	IP 6X (EN 60529)
Water protection	IP X5 (EN 60529)	IP X5 (EN 60529)
Vibrational levels	EN 60068-2-6 (5g, 10..500 Hz)	EN 60068-2-6 (5g, 10..500 Hz)
EMC– Emissions	EN 61326-1 EN 61326-2-3	EN 61326-1 EN 61326-2-3
EMC – Immunity	EN 61326-1 EN 61326-2-3	EN 61326-1 EN 61326-2-3

Tab.1 - Environmental and operational limits

Suspension of the safety function

In IMPACT transducer it's not allowed any suspension or bypass of the safety function.

Indications and alarms

    The IMPACT transducers can have two different electrical output: analog amplified (0,5..10,5 V o 4..20 mA) and/or a relay output.

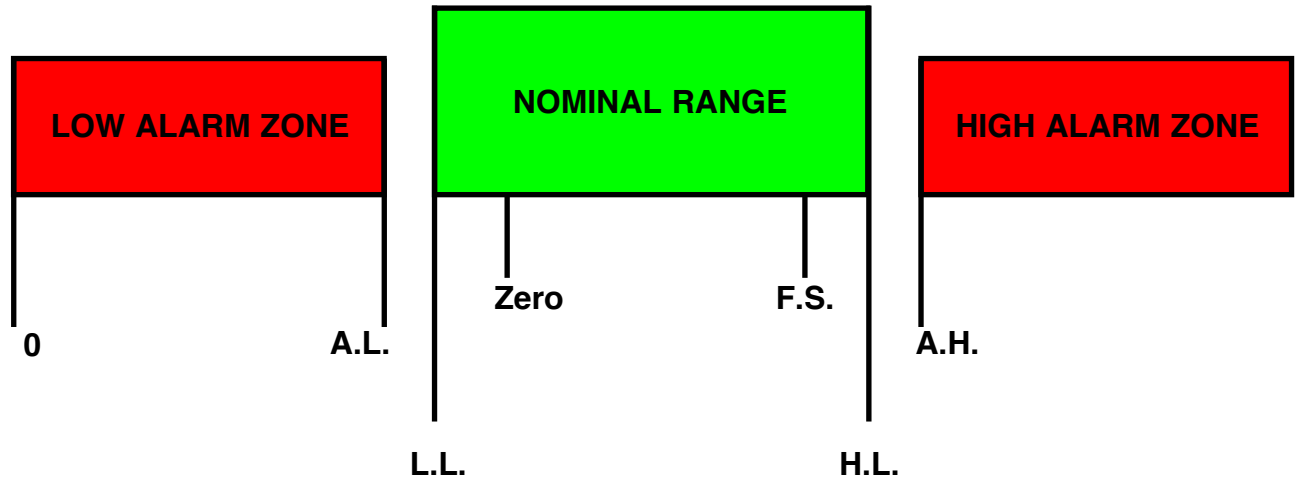In fig. 3 are shown the significant value of the outputs in case of analog signal:

Fig.3 - Outputs levels

Tabella valori Uscite:	OUTPUT 4-20 mA	OUTPUT 0,5-10,5 V	GENERIC OUTPUT
L.L . = Low Limit	= 3,640 mA	= 0,275 V	= Zero -2,25% Span
A.L. = Alarm Low	< 3,600 mA	< 0,250 V	< Zero -2,50% Span
H.L. = High Limit	= 20,960 mA	= 11,100 V	= F.S. + 6,00% Span
A.H. = Alarm High	> 21,000 mA	> 11,125 V	> F.S. + 6,25% Span

In case of relay output, the relay is normally closed except when:

· there is an alarm

· the % of F.S. set as the alarm threshold has been exceeded

In table 3 are pointed out the failures, their effects on the output signal, on the relay output and how to reset them:

Failure	Analog output	Relay output	How to reset
Supply wire broken	<3,6 mA < 0,25 V	OPEN	Remove problem
Sensor unconnected	<3,6 mA < 0,25 V	OPEN	Remove problem
Supply system broken	<3,6 mA < 0,25 V	OPEN	Remove problem
Broken chip	>21 mA > 11,125 V	OPEN	Send sensor to factory for repair
Pin detachment	>21 mA > 11,125 V	OPEN	Send sensor to factory for repair
Pressure over 150% of the span vs factory zero @ RT	<3,6 mA < 0,25 V	OPEN	Switch off and on
Preload loss exceeds -30 % of span vs factory zero @ RT	<3,6 mA < 0,25 V	OPEN	Send sensor to factory for repair
Overvoltage	<3,6 mA < 0,25 V	OPEN	Switch off and on
Undervoltage	<3,6 mA < 0,25 V	OPEN	Switch off and on
Voltage variations	<3,6 mA < 0,25 V	OPEN	Switch off and on
Program sequence error	<3,6 mA < 0,25 V	OPEN	Switch off and on
Overtemperature on electronics	<3,6 mA < 0,25 V	OPEN	Switch off and on
Primary or front end stage error	<3,6 mA < 0,25 V	OPEN	Switch off and on

Tab. 3 - Failures, effect on electrical outputs and reset

The analog output levels shown refer to sensors with 4-20 mA output and 0.5-10.5V.
For other electrical output levels, in case of alarm the output level is calculated as follows:

Out Alarm Low(mA,V)< Zero value (mA,V) – 2.50 % span (mA,V)

Out Alarm High (mA,V)> F.S. value (mA,V) + 6.25 % span (mA,V)

In the Impact sensors, no hardware feedback have been implemented.

Command modes

The command modes must be used by the user only to make periodical recalibrations of the system in the process, and are made through:

- √ Pin CAL
- √ Magnetic sensor

The event combinations give the following functions:
1. Autozero
2. Calibration (CAL)
3. Reset autozero

1) AUTOZERO

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 correct pins (e.g. pins E-F for the 6 pin connector) for the external Autozero version. The magnet has to be maintained on the Autozero position for a time within 2 to 5 seconds.	± 40% F.S.	The Autozero effect will be visible after waiting 2 seconds after the start of the seconds. The precision of the zero value will be defined by the accuracy class of the sensor.
NOTES: During the Autozero phase, the current output for the IE/IX transmitter series, can increase up to 7 mA. That's a short variation only visible during the Autozero phase; it won't have any effects on the final signal.		
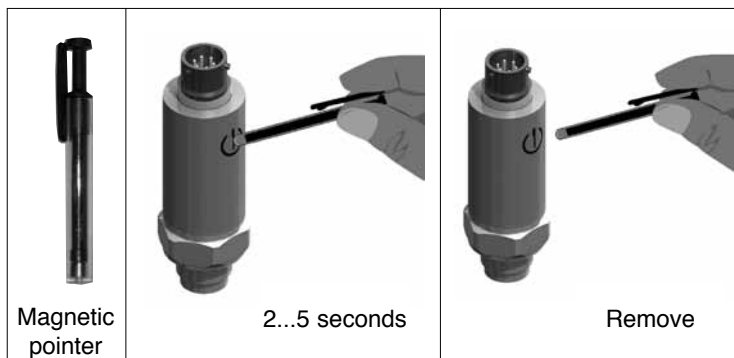
1) Machine pressure = 0 bar and transducer powered.
2) Put magnetic pointer on marked spot (2...5 seconds).
3) Remove magnetic pointer.
4) Ready !

= marked spot
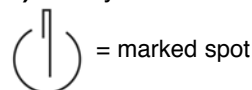
Warning: the periodical zero ricalibration through the Autozero function must be done at stable temperature and no pressure in the extrusion chamber.

2) CALIBRATION (CAL)

Application mode	Limits	Result
Start CAL: The Calibration function is activated by short-circuiting the pin E – F for a minimum time of 1 second. Stop CAL: Release the E - F short-circuit.	The whole Zero unbalancement in comparison to the zero done by the manufacturer, has to be ± 20%FS.	During the Calibration phase the signal will be unbalanced to the 80% FS. The calibration effect is visible 2 seconds after short-circuiting E - F. The Calibration function doesn't work outside the defined limits.
NOTES: The Calibration function is not allowed for "external Autozero" version.		

3) TOTAL RESET OF THE CALIBRATION VALUES

Application mode	Limits	Result
The Autozero fuction can be activated in the following ways: 1) Magnet has to be maintained on the Autozero position for a time of 20 to 25 seconds. 2) Short-circuiting the correct pins (e.g. pins E-F for the 6 pin connector) for a time of 20 to 25 seconds, for the external Autozero version.		The Zero and Span of the transmitter will be recalibrated to the factory settings.
NOTES: During the total reset phase, the current output for the IE/IX transmitter series, can increase up to 7 mA.		

Mainteinance and troubleshooting

In order to assure the correct execution of the safety function, it's necessary to make the following maintenance activities:

<u>Visual inspection of the process front end membrane and of the pitch of the thread</u>

The activity evaluates abnormal abrasion or wearing due to uncorrect mounting or by aggresive process materials.

The thread pitch inspection must assure the sensor integrity to avoid fluid outcoming from the extrusion chamber or poor sealing of the sensor mounted in its side.

Periodicity: every 2 years.

<u>Installation hole check</u>

The activity evaluates the hole profile and dimensions in order to avoid failures or sensor bad functioning.

Periodicity: every 2 years.

Sensor calibration check

The activity evaluates the sensor transduction characteristic curve. This is implemented by applying known pressure and checking the output detected values.

Periodicity: every 4 years.

Pressure channel occlusion check

The activity evaluates the presence of eventual occlusions of the pressure channel which will lead to improper functioning.

Periodicity: every year.

Command modes check

The activity evaluates the proper functioning of the command modes and their effects on the sensor. This is implemented by feeding the sensor out of the line and performing the following operations: RESET AUTOZERO, AUTOZERO, CALIBRATION.

Periodicity: every 2 years.

In the tab. 4 the most common failures and troubleshooting are pointed out:

Failure	Possible causes	Troubleshooting
The sensor doesn't signal pressure and no alarm signal is activated	• Pressure channel occlusion • Output stage failure • Preload loss from -2,25% to -30% of span • Over Pressure from 106% to 150% of span	1 - Sensor power-off and disassembly 2 - Double check possible pressure channel occlusion and clean it from residuals or material 3 - Do the AUTOZERO function. If the problem persists, send the sensor to factory for repair 4 - Reduce the process pressure under the F.S. value
The sensor alarm signal is "HIGH"	• Brochen Chip • Broken primary element • Pin detachement	1 - Sensor power-off and disassembly 2 - If the problem persists, send the sensor to factory for repair 3 - If the sensor works fine, mount the sensor in the seat following instruction manual
The sensor alarm signal is "LOW"	• Cut cable / broken connector • Device not connected • Broken supply • Overvoltage • Undervoltage • Floating power supply • Pressure above threshold (1,5 x FS) • Preload loss exceeds < - 30% of span • Program sequence error • Overtemperature on electron ics • Error on primary element/ input stage error	1 - Sensor power-off and disassembly 2 - Check the correct connection of power supply 3 - Check the electrical continuity between the female plug and the power supply 4 - Check if the power supply level is within specifications 5 - Check voltage supply stability 6 - If the sensor works fine, mount the sensor in the seat following instruction manual

The CAL function doesnìt work	• Broken electronics
	• Zero signal threshold out of range
	• Broken connector/cut cable
		1 - Stop the machine and make sure the pressure is zero
		2 - Check the cable and connector and replace if necessary
		3 - Do the following in sequence:
		  • RESET PARAMETER
		  • AUTOZERO
		  • CALIBRATION
		4 - If the problem persists, send the sensor to factory for repair

The AUTOZERO function doesn't work	• Broken electronics • Zero signal outside activation range • Broken connector/cable (only external autozero version) • Wrong magnetic pen positioning	1 - Stop the machine and make sure the pressure is zero 2 - Make sure you are doing the operation with pen and autozero mark correctly aligned. 3 - Run RESET PARAMETERS; if the difference in absolute value between the read and theoretical zero signal is greater than 40% FS, remove the sensor, check and clean its seat, reinsert the sensor and rerun AUTOZERO. 4 - If the difference in absolute value between the read and theoretical zero signal is less than 40% FS, check the cable and connector and replace if necessary 5 - If the problem persists, send the sensor to factory for repair

Tab. 4 - Troubleshooting

Application for use relevant to the designated category

The IMPACT transducer can be used in a pressure sensing chain in order to stop any pressure gene rating system if a pressure threshold is overcome.
The threshold is only set in factory and can't be changed by the user.

In diagram "A" (Fig. 4) is shown a possible application: the sensor detects the pressure and gives in output an analog electrical value proportional to the pressure itself; SRP/CS compares the signal with its internal alarm threshold: if the threshold is exceeded the SRP/CS will stop the pressure generation elements.
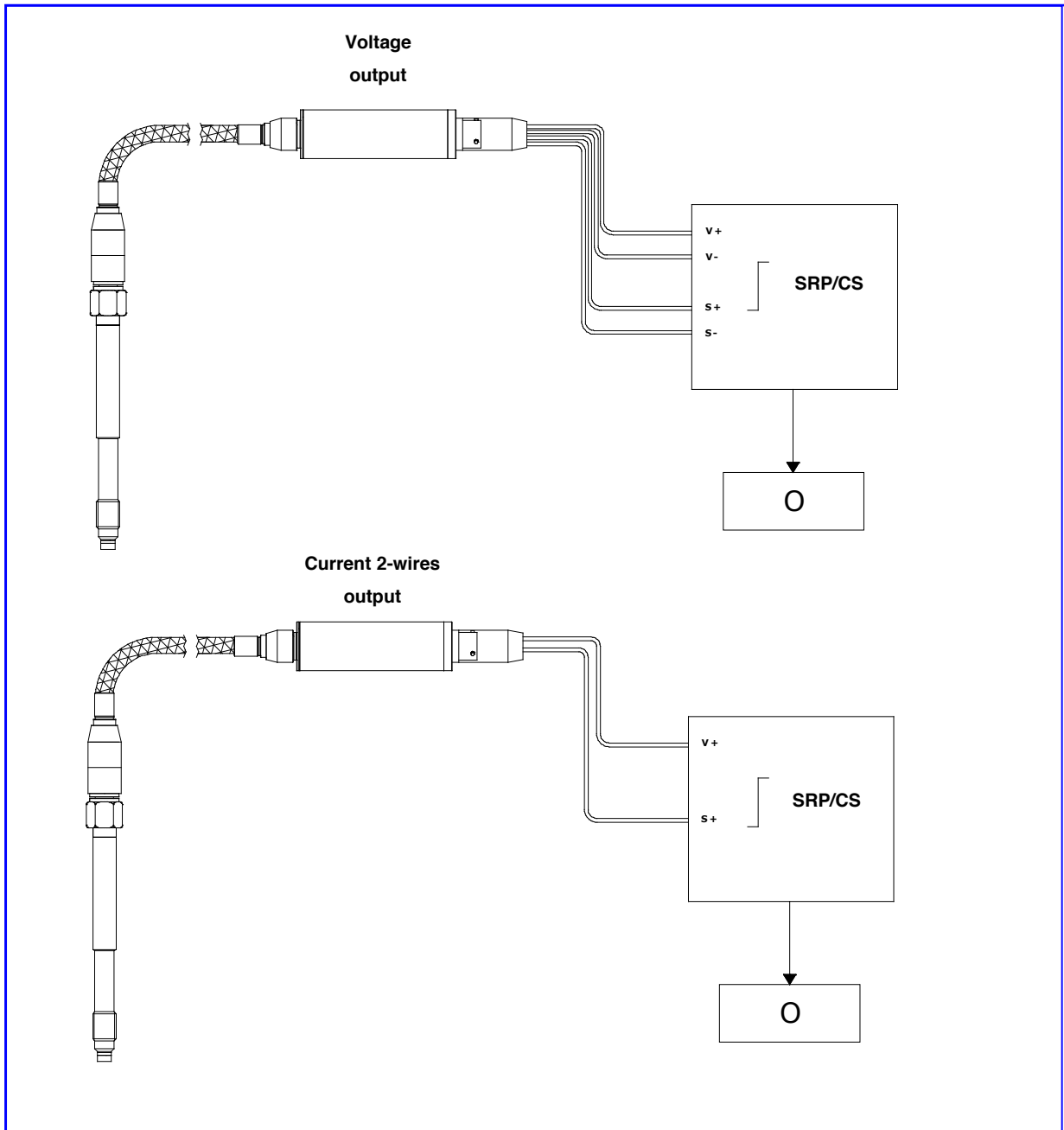

Fig. 4 - Application diagram A

In diagram "B" (Fig. 5) is shown a second possible configuration with the relay output: the sensor detects the pressure and compares it with a fixed threshold set in the factory and not changeable by the user; if the threshold is exceeded, the relay will change to normally open; the relay output is interfaced with an enable input of the pressure generating elements motor drive; when the threshold is exceeded, the open state of the relay stops the pressure generating elements.
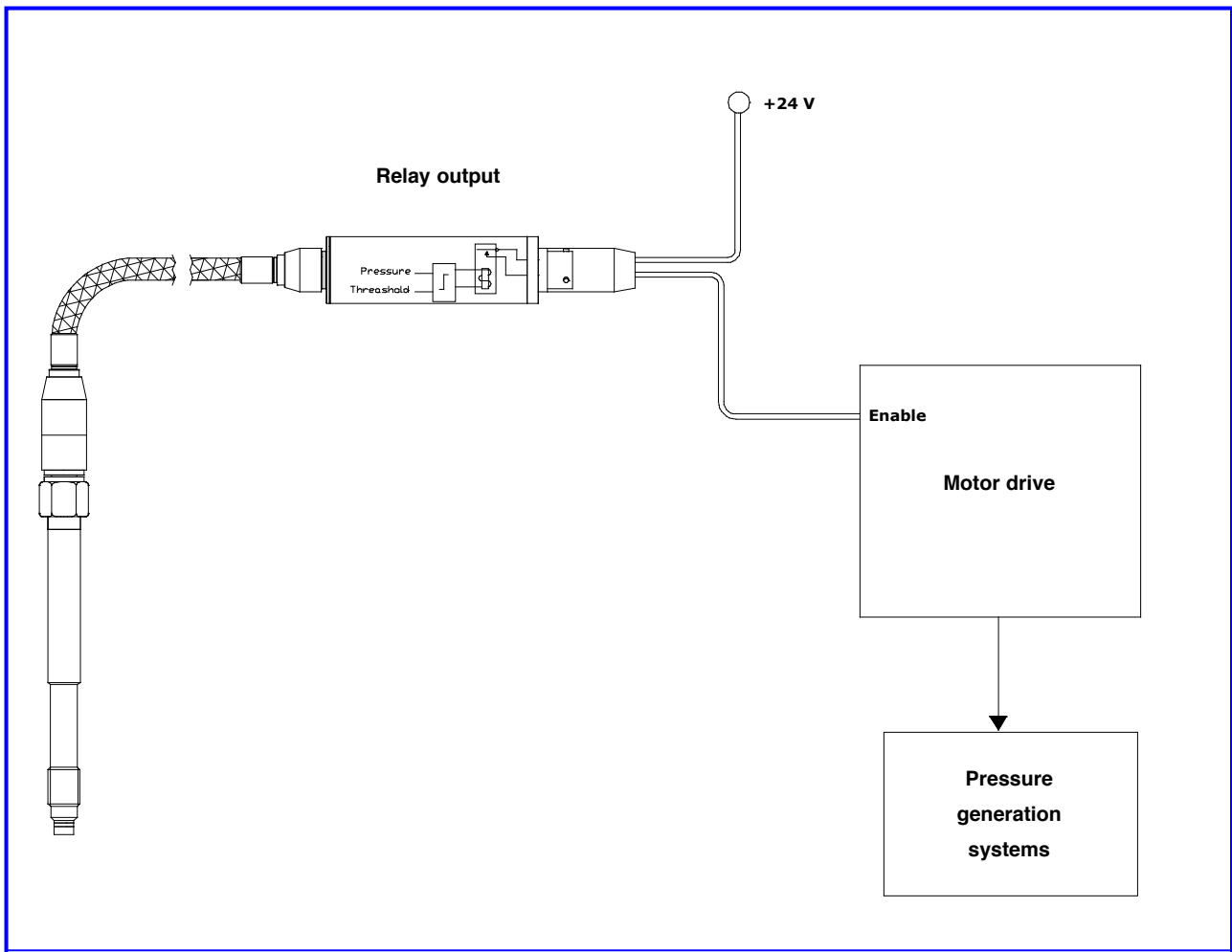

Fig. 5 - Application diagram B

Category and performance level

The device installed, used, operated and kept following the prescription of the present safety manual and in the operating manual are compliant with:

EN ISO 13849-1: 2006 Category 1 PL c

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