

INSTRUCTION MANUAL

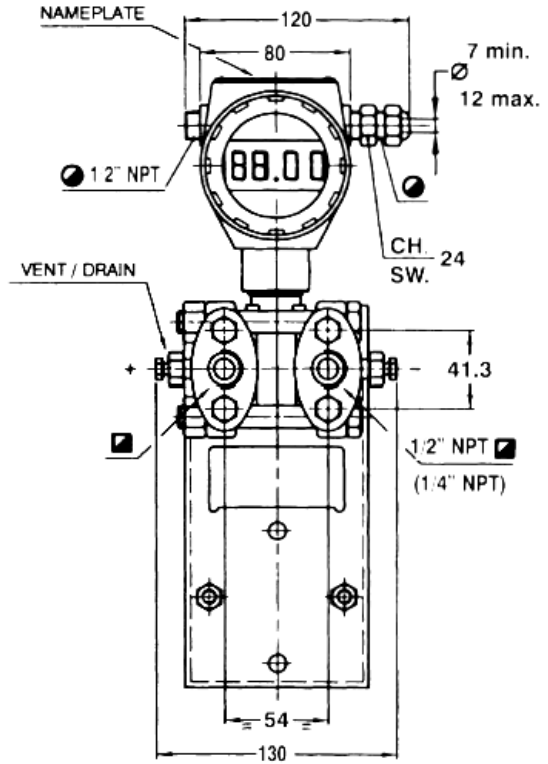
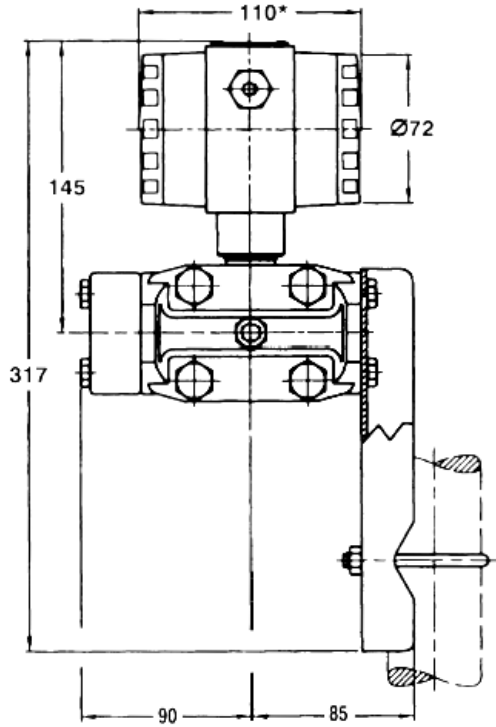


SET 47B

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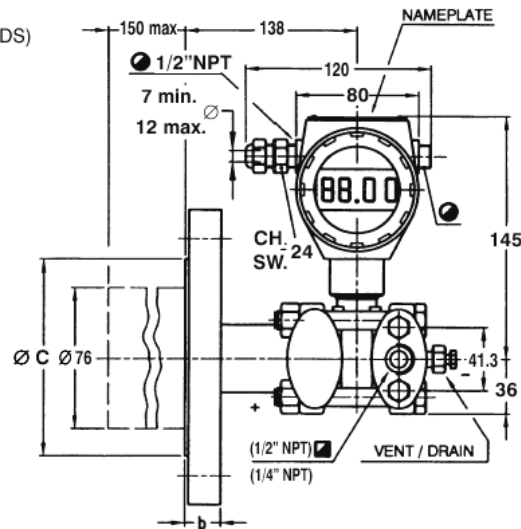
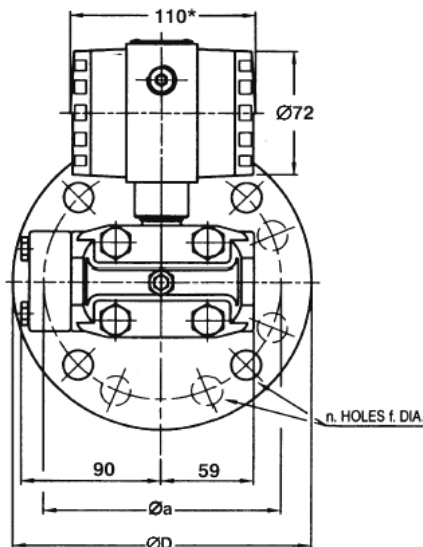
MAIN DATA: DIMENSIONS (mm) AND SENSOR'S RANGES

* 100 mm CLEARANCE TO REMOVE COVER (BOTH ENDS)



RIF.	NOM. RANGE mbar	SPAN min (mbar) max	RANGE LIMITS min. (mbar) max
D	0/250	25/525	-262,5/+262,5
E	0/600	60/1260	-630/+630
F	0/1600	160/3360	-1680/+1680
G	0/4000	400/8400	-4200/+4200
C	0/50	5/105	-52,5/+52,5
B	0/18	1,8/37,8	-18,9/+18,9

* 100 mm CLEARANCE TO REMOVE COVER (BOTH ENDS)



MOUNTING FLANGE	D	a	C	b	n	f
DN80 PN6 2223/29 3" ANSI 150 RF	190	151	128	27	4	19
DN80 PN16 UNI 2223/29	200	160	138	27	8	18
3" ANSI 300 RF	210	168	128	28	8	22

1 - PRODUCT SHEET
GENERAL

The SET 47B transmitter is a series of two-wire microprocessor-based, 4-20 mA, instruments with ceramic sensor. This transmitter measures and locally displays gauge differential and level from 1,8 to 8400 mbar. Temperature, compensation, software linearization and displays the sensor temperature. Parameters can be adjusted digitally. The 4 digits LCD indicator displays the measured reading either in engineering units or percentage.

1.1- FUNCTIONAL DATA

With reference to the following, please note these definitions:

Nominal range: (referred to the sensor mounted on the instrument) the pressure range (included between a minimum and a maximum values) to measure which the sensor has been designed.

Nominal span: the pressure interval between the minimum and maximum values of the sensor nominal range. The span is a number.

Measuring range: the pressure range between minimum and maximum for which the transmitter has been calibrated.

Measuring span: the pressure interval between minimum and maximum values of the measuring range.

Input scale initial value or zero input: minimum pressure value included in the measuring range.

Input full scale value: maximum pressure value included in the measuring range.

PHYSICAL CHARACTERISTICS

Power supply: 11,1 - 30 V d.c. with no load.

Relation between supply voltage and permissible load with I_{max} 22,4 mA:

0/250 ohm for 16,7 V d.c.

0/576 ohm for 24 V d.c.

0/844 ohm for 30 V d.c.

Output signal: 4/20 mA - 2 wire system.

LCD display reading: $-10 \div +65^{\circ}\text{C}$.

4 digits LCD display, 5 symbols (bar, mbar, psi, %, sec).

Settling time: 150 ms (at 27°C).

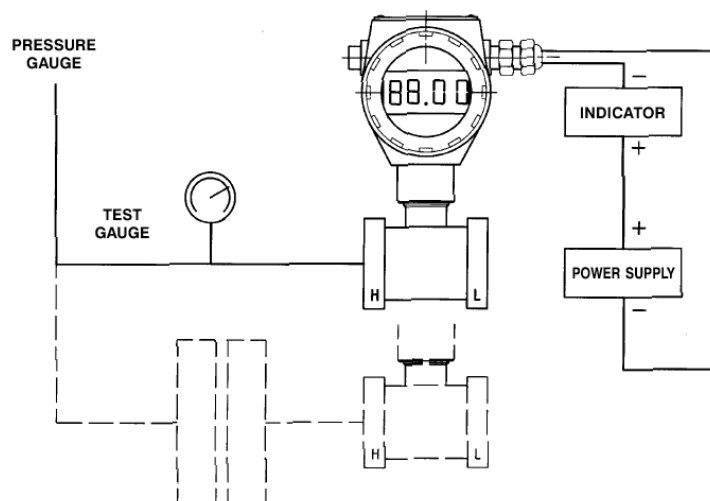
For differential cells: Sensing element static pressure and unilateral overpressure nominal limits: medium range 100 bar, low 50 bar.

Working pressure for mod. BL: see flange rating.

Process chambers volume: 6 and 16 cm³ approx.

Displacement: 0,2 and 0,3 cm³ at span max.

Fig. 1 - Bench calibration setup



1.2 - ENVIRONMENT AND CONDITIONS

Temperature

Process fluid: $-20 \div +100^{\circ}\text{C}$.

Housing: $-20 \div +80^{\circ}\text{C}$.

Handling and storage: $-20 \div +90^{\circ}\text{C}$.

Relative humidity: $0 \div 100\%$ R.H. No condensing.

LCD display reading: $-10 \div +65^{\circ}\text{C}$.

Performance

Unless otherwise stated, performance specifications are referred at atmospheric pressure, nominal span, silicon oil filling and are given as a percent of span.

Accuracy rating: it is assured within the following limits:

Non linearity: $\pm 0,10\%$.

Repeatability: $\pm 0,10\%$.

Hysteresis: $\pm 0,10\%$.

1.3 - OPERATING INFLUENCES

Thermal drift: it is referred to $-10 \div +65^{\circ}\text{C}$ range.

Zero: $\pm 0,1\%/10^{\circ}\text{K}$. Span: $\pm 0,1\%/+10^{\circ}\text{K}$ at nominal range.

Power supply effect: negligible between 11,1 and 30 V d.c.

1.4 - PHYSICAL SPECIFICATIONS

Process wetted parts: diaphragm AISI 316 L/hastelloy C - drain and vent plugs AISI 316 - extension AISI 316 – gaskets PTFE + Viton.

Mounting flange: process wetted locking ring AISI 316 rotatable mounting collar: carbon steel / AISI 316.

Housing: die cast aluminium alloy AL UNI 4514 finished with epoxy resin (RAL 5014), Buna N gaskets.

Covers: reinforced technopolymer.

Covers O-ring: Buna N.

Filling fluid: silicon oil.

Nameplate: stainless steel, fixed on housing.

Calibration

Standard: at nominal range, linear.

Optional: at the conditions specified with the order.

Environmental protection: the transmitter is dust and sand tight and protected against sea waves effects as defined by IEC IP 66. Suitable for tropical climate operation as defined in DIN 50.015.

Process connections: flanges as per codification, 1/2 NPT f on adaptors and 1/4 NPT f on process chamber.

Bolts: AISI 304.

Electrical connections: two cable entries on electronic housing, 1/2 NPT and cable gland PG 13,5 for 7 to 12 mm diameter cable.

Terminal board: 2 terminals for signal wiring up to 1,5 mm (14 AWG). Connection for ground and cable shield.

Mounting position: any position.

Net weight:

SET47B: 5,1 kg.

1.5 - EXPLOSION PROTECTION

Classification

Type: intrinsic safety EEx ia IIB T6, T5, T4 to EN 50.014 and EN 50.020 suitable for zone 0 groups IIA, IIB.

Certificate: certification pending.

Supply condition

Condition A

U_o = No-load voltage: <= 30 V d.c.

I_o = Short circuit current: <= 120 mA

P_o = Max transferred power: 0,75 W.

Condition B

U_o = No-load voltage: <= 25,2 V d.c.

I_o = Short circuit current: <= 152 mA.

P_o = Max transferred power: 0,95 W.

1.6 - ELECTROMAGNETIC COMPATABILITY

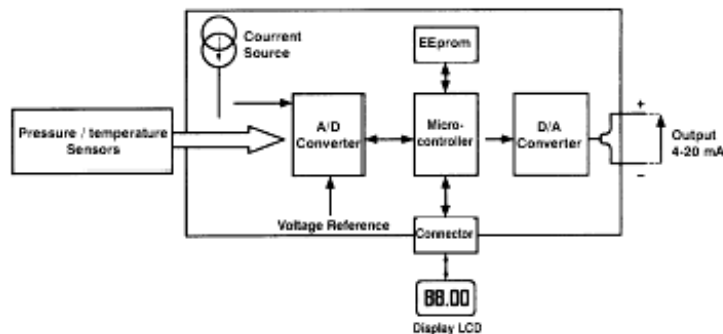
Conforms to the standards EM 50081-2 in accordance with EM 50082-2 89/336/EEC and following modifications.

2 - THEORY OF OPERATION

2.1 - BASIC OPERATION

The functional block diagram of the transmitter is shown in the figure below:

Fig. 2



Inputs are sampled and digitized by the "analog to digital" converter (ADC). The sensor signal integrity is checked by a diagnostic routine. Digital data is linearised and converted to the selected engineering units e.g. bar. The measurement is then ranged to the lower and upper range values. This value is finally converted to a 4-20 mA analogue output signal. The configuration is held in a non volatile memory (not lost in case of power failure).

The transmitter configuration can be changed by using several functions through the push buttons on the LCD display.

The transmitter continuously performs internal diagnostics to give maximum reliability and help the user to identify any problems. Any critical condition will drive the output to the selected failsafe direction (Hi/Lo).

2.2 - TRANSMITTER OUTPUT LEVELS

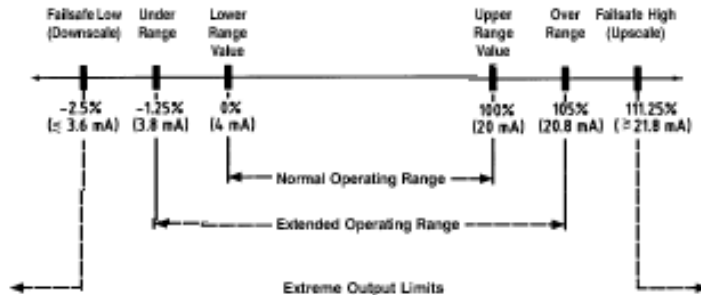


Fig. 3 Output levels

3 – INSTALLATION

3.1 - INSTRUMENT IDENTIFICATION

Instrument data can be found on the nameplate fixed to the top of transmitter housing. The Serial Number that must be quoted at the occurrence of specific requests to the manufacturer.

Fig. 4 shows both sides of the housing with covers removed.

Between the two buttons there is a three pin connector for the serial communications. The serial port is used for factory calibration.

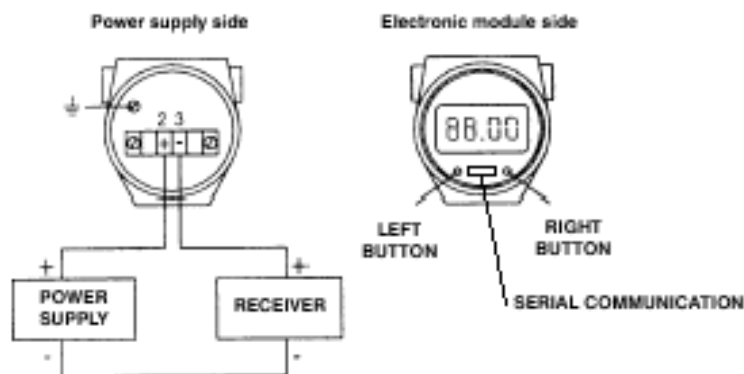


Fig. 4

3.2 - TRANSMITTER MOUNTING

A mounting bracket is supplied for series SET 47B to fix the instrument horizontally or vertically to a DN 50 (2 inch) pipe. SET47BL level transmitter has no bracket because it is mounted directly using its flanged connection. Refer to dimensional drawing for details. The position of the housing has no effect on the instrument operation.

3.3 - TRANSMITTER WIRING

Remove the cover of terminal compartment for access to terminals "+", "-", and ground (earth). Insert the power supply cable through one of the two 1/2" NPT openings. As shown in Fig. 4 connect terminal "+" to "-" power supply, "+" to "+" power supply, "-" to "+" receiver.

In the case of reversed polarity, the instrument will not operate; however in this case the instrument will not be damaged.

See Fig. 5 for a typical connection.

A 2-core cable (section 0,5 mm² or greater) may be used for connection.

Twisted wires are better protected from electrical noise. Some applications may require shielded cables; earth the shield at the power supply ground only.

Avoid locating cables near a.c. power cables such as mains supply.

Connect the earth screw to a ground, preferably the same ground used in the measuring circuit.

Cabling may be up to 3 km long. Reinstall the removed cover.

3.4 - POWER SUPPLY

To guarantee a 4 to 22,4 mA output signal, the minimum supply voltage must be calculated. It is a function of the total resistive load (output load).

This value is the sum of the resistances of each component in the circuit, excluding the transmitter. The graph shown in Fig. 6 gives the minimum supply voltage required. The value can also be obtained from the following formula:

$$V_{cc} = 0,0224 \times R + 11,1$$

where:

$$R = \text{output load.}$$

See example on Fig. 6. For a total circuit resistance of 576 Ohm, the minimum supply voltage must be 24 V c.c. The power unit must be able to supply a minimum 25 mA for standard operation of the current loop.

3.5 - INTRINSIC SAFETY WIRING

For use in hazardous area we guarantee that the construction of transmitters series SET47B are in accordance with CESI Certification EX intrinsic safety, as for EEx ia IIB T6, T5, T4. The associated apparatus must have it's own protection. Safety barriers are required on power supplies between safe and hazardous locations.

The following operating conditions assure conformance to the intrinsic safety Certification:

Definitions (referred to the EN 50.020)

for the field device:

U_i = maximum input voltage.

I_i = maximum input current.

P_i = maximum input power.

for the associated apparatus:

U_o = open circuit voltage

I_o = short circuit current.

P_o = maximum output power.

Condition A

$U_i = 30 \text{ V d.c.}; I_i = 120 \text{ mA}; P_i = 0,75 \text{ W}$

Condition B

$U_i = 25.2 \text{ V d.c.}; I_i = 152 \text{ mA}; P_i = 0,95 \text{ W}$

Thus the SAFETY BARRIER to use must comply with:

$U_o < U_i$.

$I_o < I_i$

$P_o < P_i$

Naturally the three values together U_o, I_o, P_o must correspondent to one of the above operating conditions. Maximum

ambient temperature: 40°C for T6, 55°C for T5, 80°C for T4.

Fig. 5

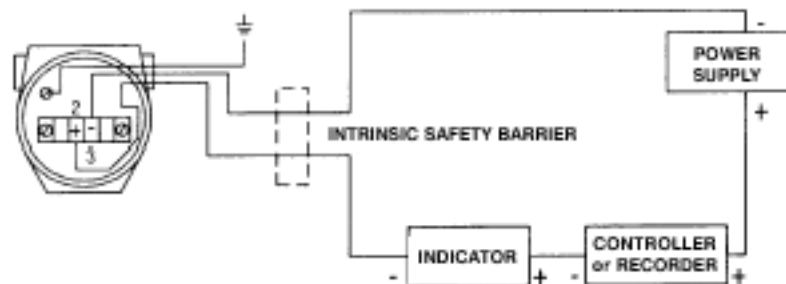
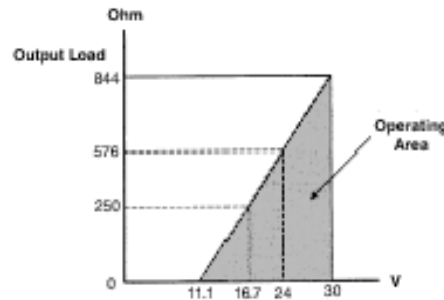


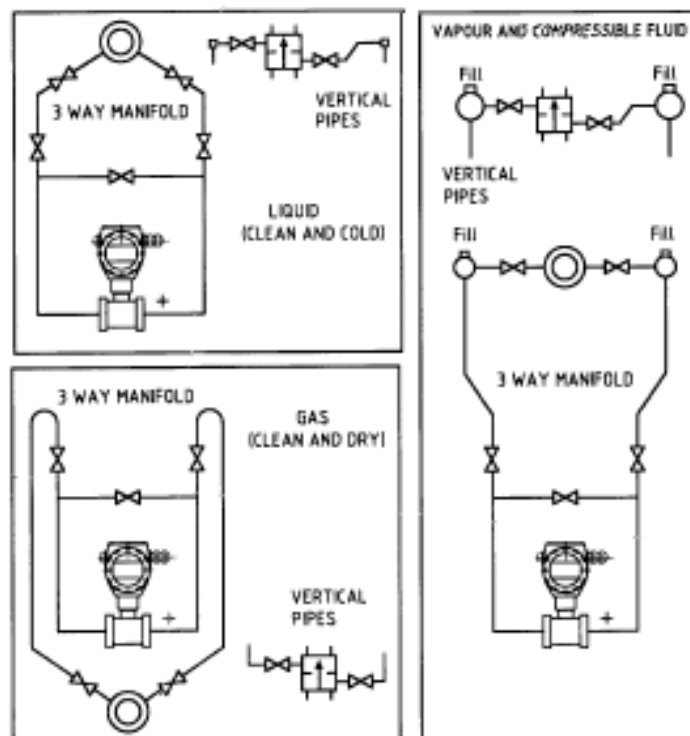
Fig. 6



3.6 - PIPING FOR FLOW MEASUREMENTS

- 1 - Fig. 7 shows some of the installations recommended by ISO 2186 Standards. Refer to this Standard for more information.
- 2 - Normal mounting position for the transmitter is below the pressure connections. Filling connectors should be mounted as close as possible to the transmitter and equidistant from it (diameter not less than 10 mm), at the same level, to have equal heads on the transmitter.
- 3 - The descending pipes can be filled with condensate vapours of the process fluid or with suitable inert liquid to prevent direct contact with the transmitter.
- 4 - When the lines are not liquid filled drain plugs should be mounted in the lowest possible position.
- 5 - The transmitter should be mounted above the process connections only when in service with dry and clean gas flow without seal liquid.
- 6 - When the connections are located on a vertical process line, the flow should be upward.
- 7 - Transmitters with a very small displacement, like the ones here described, can be mounted without condensing pots.
- 8 - Pressure connections on model SET47B are marked with " H " (" + ") and " L " (" - "); the higher pressure will be applied to " + " side.
- 9 - Always check carefully all manifolds, reducers if any, vents and drain plugs for leaks.

Fig. 7 - Piping for flow meters



3.7 - PRESSURE AND LEVEL MEASUREMENTS

The transmitters SET47B may be used for pressure and, in the lower ranges, also for level measurements in tanks. In Fig. 8 the simplest mounting, direct on piping, is illustrated. For the applications of level measurements in reservoirs at atmospheric pressure, a correct calibration, always within the SPAN max. must be calculated taking into consideration the values A,B,C. and the liquid's specific gravity (see Fig. 9).

Warning: the diaphragm seal must be always covered by the liquid.

Examples:

- 1 - (see Fig. 9).

The minimum head of water is $W_{min} = C \times G_c + B \times G_a$; the maximum head of water is $W_{max} = C \times G_c + B \times G_a + A \times G_a$

where:

G_a = specific gravity of the liquid into the tank (kg/dm^3).

G_c = spec. gravity of seal liquid, if any, (kg/dm^3).

Note that often $C = 0$.

Span value is:

$SPAN = W_{max} - W_{min} = A \times G_a$.

Supposing that:

$A = 3000 \text{ mm}$, $B = 500 \text{ mm}$, $C = 600 \text{ mm}$.

$G_a = 0.9 \text{ kg/dm}^3$, $G_c = 1.0 \text{ kg/dm}^3$.

we obtain:

$W_{min} = 600 \times 1.0 - 500 \times 0.9 = 1050 \text{ mm H}_2\text{O}$ (zero suppression).

$W_{max} = 600 \times 1.0 - 500 \times 0.9 + 3000 \times 0.9 = 3750 \text{ mm H}_2\text{O}$

$SPAN = 3000 \times 0.9 = 2700 \text{ mm H}_2\text{O}$ (span).

The calibration will result:

from 1050 to 3750 mm H₂O.

The dashed part of Fig. 9 completes a sketch for closed tank with empty equalizing piping (dry leg). In this case the calculation in the above example remains valid. Calibration steps for his example are also discussed in chapter configuration.

Fig. 8

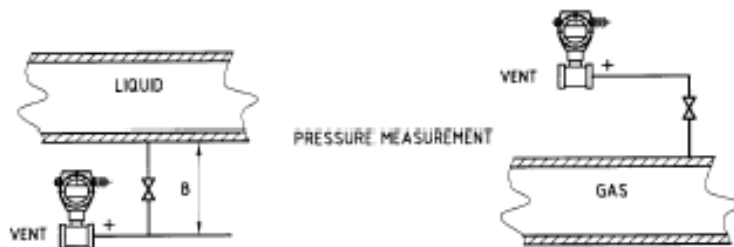
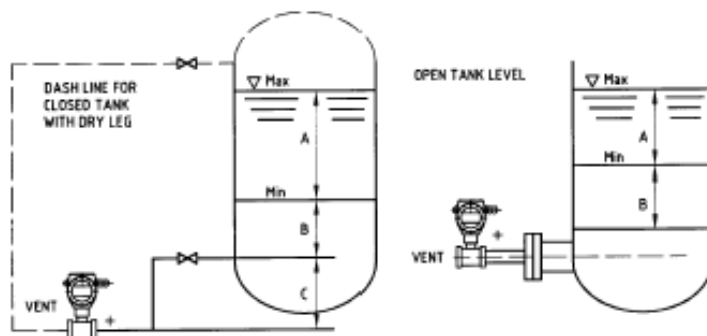


Fig. 9



- 2 - (closed tank with wet leg and fluid filled piping) See Fig. 10

With the symbol values of example – 1 :

$$W_{min} = B \times G_a - F \times G_c$$

$$W_{max} = B \times G_a - A \times G_a - F \times G_c$$

$$\text{Span} = A \times G_a = 3000 \times 0.9 = 2700 \text{ mm H}_2\text{O}.$$

Let $F = 4000 \text{ mm}$, so:

$$W_{min} = 500 \times 0.9 - 4000 \times 1 = -3550 \text{ mm H}_2\text{O}.$$

$$W_{max} = 500 \times 0.9 + 3000 \times 0.9 - 4000 \times 1 = -850 \text{ mm H}_2\text{O}.$$

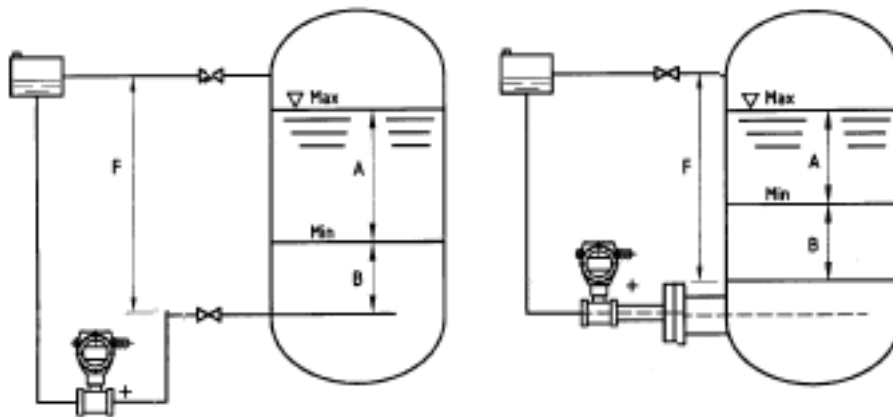
Calibration range: from -3550 to $-850 \text{ mm H}_2\text{O}$.

It'll be operated a zero elevation of $3550 \text{ mm H}_2\text{O}$.

Note:

When sealing liquid is used, its specific gravity must be greater than that of the process liquid.

Fig. 10 - Closed tank level with leg



4. CONFIGURATION

4.1 - DEFINITIONS

Nominal range	Referred to the instrument's sensor, it is the pressures range to measure which the instrument has been designed.
Nominal Span	The difference between the two points of the Nominal Range. E.g. SET47B Nominal Range 0/250 mbar (Ref. D) Nominal Span = 250 mbar
USL (Upper Sensor Limit)	Maximum Range limit of measurable pressure
LSL (Lower Sensor Limit)	Minimum Range limit of measurable pressure
Calibration Range	A Pressure Range included between maximum limit (USL) and minimum limit (LSL)
URV (Upper Range Value)	High value of calibrated range (corresponds to 20 mA)
LRV (Lower Range Value)	Low value of calibrated range (corresponds to 4 mA)
Span	Difference between Upper and Lower points of the calibrated range (Span = URV-LRV)

4.2 - DISPLAY AND PUSH BUTTONS

- ✓ When you power up the instrument, it will show a pre-established sequence for about 6 seconds. This procedure allows the display of the software revision, test of the LCD segments, internal diagnostics, etc.
- ✓ After initialization, the display shows the primary variable (pressure).
- ✓ The push buttons combinations are referenced as follows:

LB	⇒	Left Button
RB	⇒	Right Button
LB+RB	⇒	Both buttons are pushed at the same time
LB or RB	⇒	One of the two buttons
LB&RB	⇒	First press LB , while LB is pressed, press RB
RB&LB	⇒	First press RB , while RB is pressed, press LB

4.3 - CONFIGURATION OF THE DISPLAY

The display parameters that can be configured are:

GROUP 1: Pressure unit configuration

- ✓ bar / mbar depending on sensors™ range or
 - ✓ PSI depending on the selected engineering unit (see function F9)
 - ✓ % relative to the span set by the user (LRV/URV).
- You can also configure the display to alternate between two measurements units:
- ✓ Automatic switching between [bar or PSI] and %
 - ✓ Automatic switching between [bar or PSI] and °C (where °C is the sensor temperature)

GROUP 2: Temperature or pressure

- ✓ Temperature of the sensor expressed in °C
- ✓ Pressure expressed as % of the sensor normal measuring range (LRL/URL)
- ✓ Numerical value of the analog to digital converter.

To select the desired configuration:

- ✓ First rotate by pressing LB as many times as you reach the desired unit, then release LB.
- ✓ To change from one group to the other one, push LB followed by RB (LB&RB).
- ✓ To activate/inactivate the alternate display of [bar <-> %] or [PSI <-> %], enter in Group 1, push LB for about 2 seconds.
- ✓ To activate/inactivate the alternate display of [bar <-> °C] or [PSI <-> °C], enter in Group 1, push RB for about 2 seconds.

Example

- ✓ If you want to read the pressure as a % of the sensor nominal range (LRL/URL):
 1. Select group 2 by LB&RB.
 2. Press LB as many times as you read the pressure as a % of the sensor nominal range, then release.

- ✓ If you want to read the pressure in bar:
 1. Go back to group 1 by LB&RB.
 2. Press LB as many times as you read the pressure value with the symbol "bar", then release.

4.4 - CONFIGURATION OF THE DEVICE - USE OF FUNCTIONS

The device configuration functions are:

F1	⇒	Save configuration in Non Volatile Memory
F2	⇒	Display of LRV and URV
F3	⇒	Low Range Value
F4	⇒	Upper Range Value
F5	⇒	Damping
F6	⇒	Configure and calibrate LRV/URV from input pressures (span unchanged)
F7	⇒	Configure and calibrate LRV/URV from input pressures (span modified)
F8	⇒	Calibrate zero pressure reference
F9	⇒	Engineering unit (bar/PSI)
F10	⇒	Failsafe direction
F11	⇒	Transfer Function Selection (Linear/SQR)

- ✓ To scroll functions, keep the LB+RB pushed until you reach the desired function.
- ✓ When the required function appears on the display, the buttons have to be released to remain in that state.
- ✓ Functions can be executed according to the procedure described in the following paragraphs.
- ✓ A time out is implemented and therefore, if no action is taken after 3 seconds, the device returns to the normal display.

FUNCTION 1: Allows the storage of the configuration in the Non Volatile Memory

Press **LB+RB** ⇒ to select F1, then release

Press **LB** ⇒ A short message will appear (Ld) to confirm that your configuration has been loaded in the Non Volatile Memory.

After this message, the system returns to the normal display and your configuration has been saved.

NOTE:

This function saves the following parameter inside the Non Volatile Memory:

- 1) Zero calibration of the instrument (zero pressure reference).
- 2) Visualization mode.
- 3) URV and LRV.
- 4) Damping filter valve.
- 5) Fail mode selection.
- 6) Transfer function selection.

FUNCTION 2: Low Range Value (LRV) and Upper Range Value (URV) display only

With this function you can read LRV and URV but you cannot change them. (See functions 3 and 4 for any change.)

Press **LB+RB** ⇒ until you reach F2, then release

Press **LB** ⇒ Display LRV

Press **LB&RB** ⇒ Display LRV as % of the sensor nominal range

Press **RB** ⇒ Display URV

Press **RB&LB** ⇒ Display URV as % of the sensor nominal range

FUNCTION 3: Allows to change the LRV without changing URV (span will be modified)

Press **LB+RB** ⇒ until you reach F3, then release

Press **LB or RB** ⇒ Display LRV

Press **RB** ⇒ Increase until you reach the desired value

Press **LB** ⇒ Decrease until you reach the desired value

Press **RB+LB** ⇒ Store the value in Volatile Memory

After the confirmation LB+RB, the message "Ld" will appear to confirm that your modification has been loaded in the Volatile Memory. After this message, the system returns to the normal display.

NOTE: The minimum span you are allowed to set without changing URV is 10 % of the sensor nominal range.

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 4: Allows to change the URV without changing LRV (span will be modified)

Press **LB+RB** ⇒ until you reach F4, then release

Press **LB or RB** ⇒ Display URV

Press **RB** ⇒ Increase until you reach the desired value

Press **LB** ⇒ Decrease until you reach the desired value

Press **RB+LB** ⇒ Store the value in Volatile Memory

After the confirmation LB+RB, the message "Ld" will appear to confirm that your modification has been loaded in the Volatile Memory. After this message, the system returns to the normal display.

NOTE: The minimum span you are allowed to set without changing LRV is 10 % of the sensor nominal range.

FUNCTION 5: Allows to display and modify the damping filter

Press **LB+RB** ⇒ until you reach F5, then release

Press **LB or RB** ⇒ Display the filter value

Press **RB** ⇒ Increase until you reach the desired filter value

Press **LB** ⇒ Decrease until you reach the desired filter value

Press **RB+LB** ⇒ Store the value in Volatile Memory

After the confirmation LB+RB, the message "Ld" will appear to confirm that your modification has been loaded in the Volatile Memory. After this message, the system returns to the normal display.

NOTE:

- ✓ The filter value you are allowed to set is between 1 second and 31 seconds.
- ✓ If the filter value is not equal to zero, the "sec", symbol will appear in normal display.
- ✓ The filter is a digital 1st order Low Pass Filter

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 6: Allows to configure and calibrate URV or LRV using the input pressures (span unchanged)

- Press **LB+RB** ⇒ until you reach F6, then release
⇒ Apply LRV pressure
- Press **LB** ⇒ Display the applied pressure value
- Press **LB&RB** ⇒ Set LRV (4 mA) to the displayed pressure value
⇒ Apply URV pressure
- Press **RB** ⇒ Display the applied pressure value
- Press **RB&LB** ⇒ Set URV (20 mA) to the displayed pressure value

The new LRV is accepted only if:

- ✓ Pressure value + span < 105 % of sensor nominal range

The new URV is accepted only if:

- ✓ Pressure value < 105 % of the sensor nominal range
- ✓ Pressure value - span > -105% of the sensor nominal range

When the above mentioned conditions are met, the message "Ld" will appear to confirm that your modification has been loaded in the Volatile Memory. After this message, the system returns to the normal display. If the message "Ld" does not appear, the first step of F6 is displayed again.

NOTE: The minimum span you are allowed to set is equal to 10 % of the sensor nominal range.

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 7: Allows to configure and calibrate URV or LRV using the input pressures (span modified)

- Press **LB+RB** ⇒ until you reach F7, then release
⇒ Apply LRV pressure
- Press **LB** ⇒ Display the applied pressure value
- Press **LB&RB** ⇒ Set LRV (4 mA) to the displayed pressure value
⇒ Apply URV pressure
- Press **RB** ⇒ Display the applied pressure value
- Press **RB&LB** ⇒ Set URV (20 mA) to the displayed pressure value

The new LRV is accepted only if:

- ✓ Pressure value < 95 % of the sensor nominal range

The new URV is accepted only if:

- ✓ Pressure value < 105 % of the sensor nominal range
- ✓ Pressure value > - 105% of sensor nominal range + minimum span

When the above mentioned conditions are met, the message "Ld" will appear to confirm that your modification has been loaded in the Volatile Memory. After this message, the system returns to the normal display. If the message "Ld" does not appear, the first step of F7 is displayed again.

If the new LRV (URV) decreases **the span under 10% of the sensor nominal range**, URV (LRV) will be changed to have a span value equal to minimum.

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 8: Allows to calibrate the zero pressure value of the instrument

Press **LB+RB** ⇒ until you reach F8, then release

⇒ Ensure zero pressure applied

Press **LB** ⇒ Display the applied pressure value

Press **LB&RB** ⇒ Set the primary value to zero

The display will show "0000" value

Release **LB** while **RB** is ⇒ "Ld" is displayed: loaded in the volatile memory still pressed

After the "Ld" message, the system returns to the normal display

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 9: Allows to choose the engineering units PSI or bar

Press **LB+RB** ⇒ until you reach F9, then release

Press **LB** ⇒ Display the actual engineering unit

Press **LB** ⇒ Change the unit (bar <-> PSI)

Press **LB&RB** ⇒ Store the engineering unit in volatile memory, then system returns to the normal display

WARNING:

- ✓ The time out will confirm the last unit you have selected (same effect as press **LB&RB**).
- ✓ If the bar engineering unit has been selected, the symbol "bar" (or mbar) will appear on the display.
- ✓ If the PSI engineering unit has been selected, the symbol PSI will not appear with the primary value, but will be displayed alone every ten seconds.

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 10: Failsafe direction Selection

The transmitter will go to a failsafe direction when it detects a failure. (In that case, the measurement in % on the display goes to 555.5 %.)

LO: low alarm with a fixed current < 3.6 mA

HI: high alarm with a fixed current > 21.8 mA

Press **LB+RB** ⇒ until you reach F10, then release

Press **LB** ⇒ Display the actual failsafe direction

Press **LB** ⇒ Change the direction (Hi <-> Lo)

Press **LB&RB** ⇒ The choice becomes effective, the system returns to the normal display.

WARNING: The time out will confirm the last direction you have selected. (same effect as **LB&RB** pressed)

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

FUNCTION 11: Transfer Function Selection

The transmitter has an output signal (4 - 20 mA) following a

LF (Linear Function): $\text{Out}\% = X \cdot 100$

SF (SQR Function) : for $X > 0$ $\text{Out}\% = \text{SQR}(X) \cdot 100.$

with $X = [\text{Input}/(\text{URV}-\text{LRV})]$

Press LB+RB \Rightarrow until you reach F11, then release

Press LB \Rightarrow Display the actual Transfer Function

Press LB \Rightarrow Change the Transfer Function (SF \leftrightarrow LF)

Press LB&RB \Rightarrow The choice becomes effective, the system returns to the normal display.

WARNING: The time out will confirm the last direction you have selected. (same effect as LB&RB pressed)

Remember to store the new values in the Non Volatile Memory though the F1 function otherwise the data will get lost after switching off the instrument.

5. CALIBRATION

The instrument allows the access to a procedure for periodic calibration of current output and of pressure measurement

- ✓ When the device is powered it will show a pre-established sequence for about 6 seconds.
- ✓ If during this sequence both buttons are pushed (**LB+RB**) the instrument enters in to the calibration procedure.
- ✓ Using this procedure it is possible to calibrate the current output 4 — 20 mA and the pressure measurement using accurate reference instruments.

Remember that the following calibration procedures change the factory trims.
WARNING: Do not calibrate if the instrument is operative on the process.
Follow with care the instruction.

5.1 - OUTPUT CURRENT CALIBRATION

- ✓ Using this calibration you can verify and adjust the output signal 4 — 20 mA.
- ✓ For the calibration are required:
- ✓ A precision multimeter for current measurement
- ✓ Insert the multimeter in series in the current loop (range mA)

After power the display will show the first step of the current calibration sequence : **1c04**

The calibration starts at 4 mA and ends at 20 mA with steps of 2 mA.

The **1c** characters identify the present procedure

The **xx (04 — 06 — 08 - - 20)** characters identify the current value (mA) to be calibrated.

Press **LB** ⇒ To decrease the current until the reading on the multimeter reaches the value to be calibrated
(e.g. **1c04** ⇒ I=4.00 mA, **1c06** ⇒ I= 6.00 mA). On the display the Digital to Analogue Converter value is shown.

Press **RB** ⇒ To increase the current until the reading on the multimeter reaches the value to be calibrated (e.g. **1c04** ⇒ I=4.00 mA, **1c06** ⇒ I= 6.00 mA). On the display the Digital to Analogue Converter value is shown.

Press **LB&RB** ⇒ To confirm the value and pass to the following step (e.g. **1c04** ⇒ **1c06**).
Proceed the calibration until **1c20**.

NOTE: The last step **1c20** calibrate the 20 mA output, saves the data in to non volatile memory and pass to the pressure calibration sequence.

To exit from the procedure without any changes on the current calibration turn off the power before the end of 1c20 step.

Do non turn off the power during the 1c20 step otherwise the data in the non volatile memory could get lost.

5.2 – SENSOR'S NON-LINEARITY ADJUSTMENT

- ✓ Using this procedure it is possible to adjust the pressure measurement on one side (positive or negative) of the transmitter referring it to an external pressure generator/indicator.
- ✓ For the calibration are required:
- ✓ An accurate pressure generator/indicator.
- ✓ Connect the pressure generator at the positive (or negative: see following note) pressure connection of the transmitter.

At the end of the current calibration procedure on the display will appear the first step of the pressure calibration sequence : **3c00**

To skip this calibration turn off the power.

The calibration proceed from 0% to 100% of the nominal range with steps of 20%.

The **3c** characters identify the present procedure

The **xx (00 — 20 — 40 - - 80)** characters identify the value (% of the nominal range) to be calibrated.

Display **3c00** Set of zero pressure reference. Leave both the pressure connections at the atmospheric pressure.

Push **LB** ⇒ On display will be shown the actual value of the Analogue to Digital Converter

Push **RB** ⇒ On display will be shown the actual value of the measurement as % of the Nominal Range.

Push **LB&RB** ⇒ To set the value and go to the following step (e.g. **3c00** ⇒ **3c20**).

NOTE: The new value is accepted only if it differs maximum +/- 5% respect to the ideal calibration (perfect linear sensor).

Display **3c20** ⇒ 3c80 Pressure Calibration. Apply a pressure equal to the xx% of the Nominal Full Scale of the Sensor.

E.g. Display = **3c40**, Full Scale = **4 bar**

Apply **P = 1,6 bar** (equal to 40% of 4 bar)

Push **LB** ⇒ On display will be shown the actual value of the Analogue to Digital Converter

Push **RB** ⇒ On display will be shown the actual value of the measurement as % of the Nominal Range.

Push **LB&RB** ⇒ To set the value and go to the following step (e.g. **3c20** ⇒ **3c40**).

NOTE: The new value is accepted only if it differs maximum +/- 5% respect to the ideal calibration (perfect linear sensor).

Display **3cFS** Full Scale Calibration. Apply a pressure equal to the FS

Push **LB** ⇒ On display will be shown the actual value of the Analogue to Digital Converter

Push **RB** ⇒ On display will be shown the actual value of the measurement as % of the Nominal Range.

Push **LB&RB** ⇒ To set the value and save the pressure calibration data in to non volatile memory.

The instrument automatically resets and returns to the normal display

NOTE:

- ✓ The new value is accepted only if it differs maximum +/- 5% respect to the ideal calibration (perfect linear sensor).
- ✓ Calibration always refers to the Nominal Range of the sensor and is independent from the LRV and URV.
- ✓ The last step **3cFS** calibrates the Full Scale and saves the data in to the non volatile memory.

NOTE:

In place of calibrate the positive side of the measuring cell it is possible to calibrate the negative side. In this case connect the negative pressure connection of the transmitter to the pressure generator. During calibration the measure (%) of the pressure will be negative.

**To exit from the procedure without any changes on the current calibration turn off the power before the end of 3cFS step.
Do not turn off the power during the 3cFS step otherwise the data in the non volatile memory could get lost.**

6 - MAINTENANCE

6.1 - PERIODIC SERVICE

The transmitters of this series have no moving components and therefore the maintenance operations are related only to the environment conditions. It is suggested a periodic control of the internal parts in the top housing to ensure that no moisture infiltration is present and that the terminals are clean so as to assure a good electric continuity.

Do not use solvents for cleaning. The main electronic components, the housing with encapsulated sensor and electronic module are mounted; if the necessary equipment is not available it is very difficult to replace one of these components and retain good accuracy; it is necessary to send the instrument to out factory or to the nearest Service Center.

6.2 – TROUBLESHOOTING

Verification of correct operation of the transmitter should be based on the instruction discussed in the present manual. In absence of output signal or an output value not corresponding to the real value, the following tests are suggested:

6.2.1 Connections. The process piping must be installed correctly, unwanted gas or liquid pockets can affect the measured value and accumulation of dirt and pipe incrustation may cause blocks. The interception must be in the open position.

Check that wiring is correct (polarity) and in good condition, both for mains supply and shielding.

6.2.2 - External load: supply voltage value is a function of the resistive load, verify this value.

6.2.3 - Power supply: the D.C. voltage must have the correct value and polarity.

6.2.4 - Calibration tests.

Follow the instruction in chapter 4 and 5.

With the adjustment of LB and SPAN RB buttons it should be possible to set lower and upper scale values 4 and 20 to mA.

If this operation is not successful, the failure should be repaired by a Authorized Center.

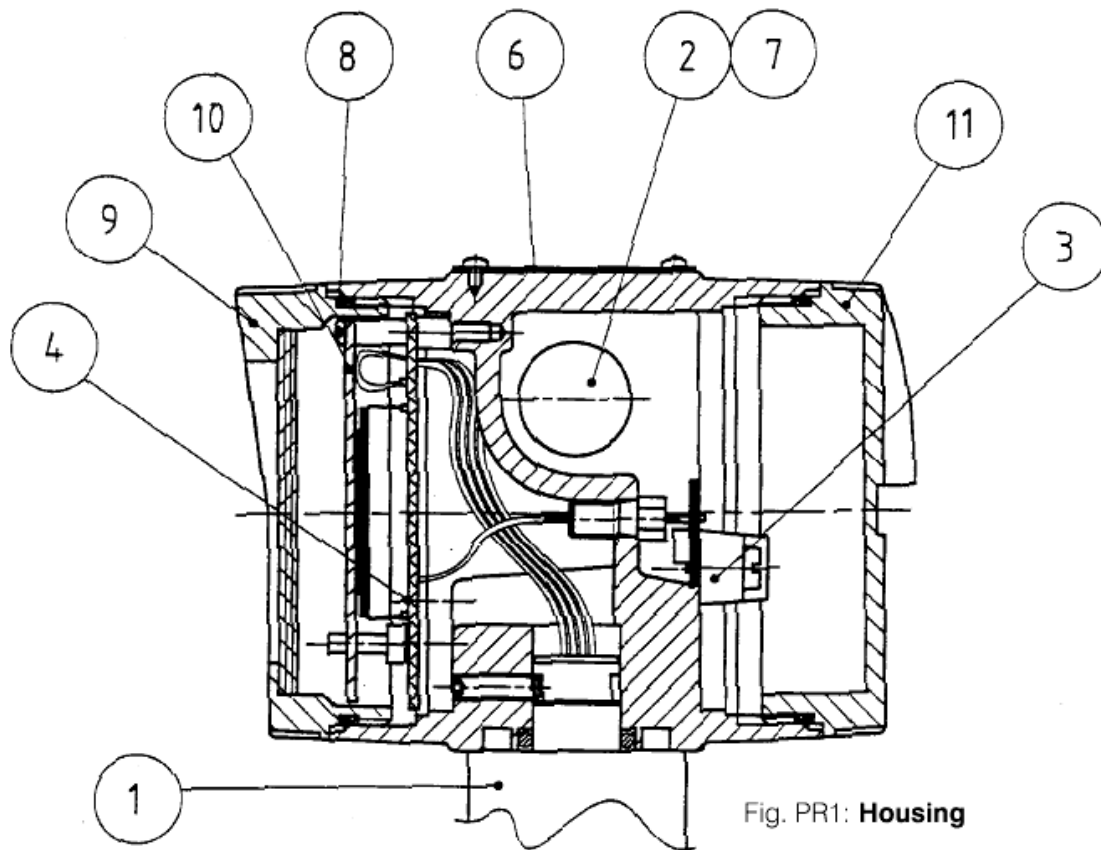


Fig. PR1: Housing

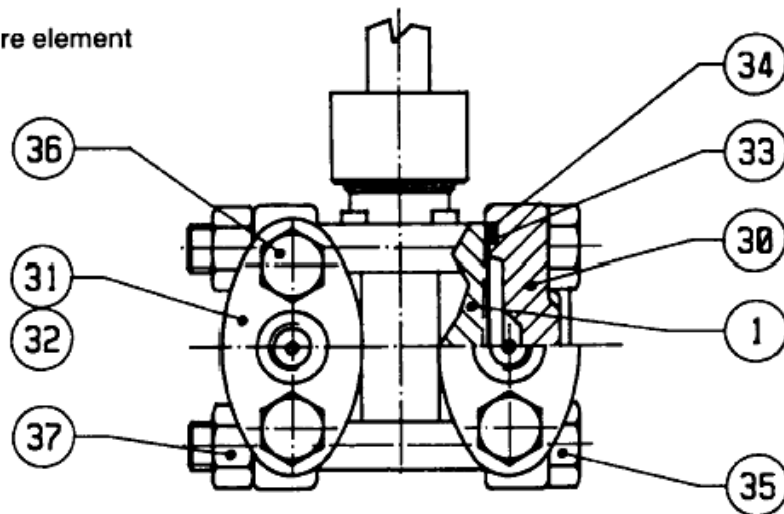
E.1 - SPARE PARTS

With the request of spare parts it is required to indicate the Serial Number of the instrument to control that the correct component will be delivered. Available spare parts are (with its own code and mounting quantity in parenthesis).

HOUSING (Fig. PR1)

- 1 - Measuring element (see next figures).
- 2 - Plug 1/2 NPT for housing: 71/82.
- 3 - Terminal board: 49-6B/16+49-5/53.
- 4 - Electronic module: 49-7/93.
- 5 - Microcontroller: 49/131.....
- 6 - Nameplate: 40/.....
- 7 - Cable gland: 36/77.
- 8 - Cover gaskets:3-3/54 (2 pz).
- 9 - Forward cover with window: 17/90.
- 10- Display frontal protection: 37/55.
- 11- Rear cover: 17/61.

Fig. EM1: Differential pressure element



PRIMARY ELEMENT

Model SET47B and SET47BL (Fig. EM1):

- 1 - Measuring element
Low range: 85/110
Medium range: 85/109/range
- 30 - Body
low range: 80-9/63.
high range: 80-9/60.
- 31 - Flanged connection: 85/39/material (2 pcs).
- 32 - Gasket: 21/53 (2 pcs).
- 33 - Gasket (2 pz).
low range: 21/124.
medium range: 21/122.
- 34 - Ring "OR" (2 pcs).
low range: 3-3/68/VI
medium range: 3-3/67
- 35 - Screw M12X100 (4 pcs)
low range: 42/231/material.
medium range: 42/177/material.
- 36 - Screw 7/16X20: 42/124/Ac (4 pcs).
- 37 - Nut M12: 18/1/material (4 pcs).