

ST 2000 Pressure Transmitter

Operator Manual

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About This Document

Revision Notes

The following list provides notes concerning all revisions of this document.

| <u>Doc ID</u> | <u>Rel ID</u> | <u>Date</u> | <u>Notes</u> |
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| 34-ST-11-21 | Issue 1 | 04/03 | 1 st issue of document. |
| | Issue 2 | 03/04 | Corrections under Intrinsic Safety Approval, Electromagnetic compatibility, and Intrinsic safety Barriers ; Includes Addendum 34-ST-99-33 , regarding applicability of ATEX Directive 94/6/EC. |
| 34-ST-11-30 | Issue 3 | 07/05 | Software release 3.0 Corrections: Functions F8 – F9 – F10 Introduces new Functions: F11 - Output action selection Transmitter calibration Functions: c000 – c0FS – c004 – c020 |
| | Issue 4 | 02/07 | Updated revision dates, formatting. |

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Symbol definitions

The following table lists those symbols used in this document to denote certain conditions.

| <u>Symbol</u> | <u>Definition</u> |
|---|---|
|  | This CAUTION symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual. |
|  | This WARNING symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual. |
|  | WARNING: risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible. |
|  | ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices |
|  | Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor. |
|  | Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements. |
|  | Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements. |
|  | Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements. |

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Addenda

Addendum 34-ST-99-33 - ATEX Directive 94/6/EC (8 pages)

1. Overview

1.1..General

- ✓ The Series ST 2000 Pressure Transmitter is a microprocessor-based unit. This instrument is 2-wire loop-powered and gives a 4-20 mA output linearized to pressure.
- ✓ This transmitter measures and locally displays gauge pressure from 0.2 to 460 bar (3 to 6700 psi) or absolute pressure from 0.2 to 11.5 bar (3 to 165 psi). For greater absolute pressure measurements than 11.5 bar (165 psi) use the appropriate gauge pressure model. The effects of process temperature are compensated and software linearization is included.
- ✓ Parameters can be adjusted digitally. The 4 digits LCD indicator displays the measured reading either in engineering units or percentage.

1.2 Models

Table 1 Transmitter Models

| GAUGE ↻ | | | | |
|-------------------|--------------------------|---|-----------------------------------|------------------------------------|
| Model # | NOMINAL Bar/(psi) | RANGE LIMITS (min./max.) bar/(psi) | SPAN (min./max.) bar/(psi) | OVERPRESSURE Max. bar/(psi) |
| STG20F | 0-2/(0-30) | -1 to 2.3/(-14.5 to 33) | 0.2 to 3.3/(3 to 47) | 7/(100) |
| STG20G | 0-5/(0-70) | -1 to 5.75/(-14.5 to 83) | 0.5 to 6.75/(7 to 98) | 12/(174) |
| STG20H | 0-10/(0-145) | -1 to 11.5/(-14.5 to 166) | 1 to 12.5/(14.5 to 181) | 25/(362) |
| STG20K | 0-20/(0-300) | -1 to 23/(-14.5 to 333) | 2 to 24/(30 to 348) | 50/(725) |
| STG20L | 0-50/(0-725) | -1 to 57.5/(-14.5 to 833) | 5 to 58.5/(72.5 to 848) | 120/(1740) |
| STG20M | 0-100/(0-1450) | -1 to 115/(-14.5 to 1667) | 10 to 116/(145 to 1682) | 250/(3620) |
| STG20N | 0-200/(0-2900) | -1 to 230/(-14.5 to 3335) | 20 to 231/(290 to 3350) | 500/(7250) |
| STG20P | 0-400/(0-5800) | -1 to 460/(-14.5 to 6671) | 40 to 461/(580 to 6686) | 600/(8700) |
| ABSOLUTE ↻ | | | | |
| Model # | NOMINAL Bar/(psi) | RANGE LIMITS (min./max.) bar/(psi) | SPAN (min./max.) bar/(psi) | OVERPRESSURE Max. bar/(psi) |
| STA201 | 0-2/(0-30) | 0 to 2.3/(0 to 33) | 0.2 to 2.3/(3 to 33) | 7/(100) |
| STA202 | 0-5/(0-70) | 0 to 5.75/(0 to 83) | 0.5 to 5.75/(7 to 83) | 12/(174) |
| STA203 | 0-10/(0-145) | 0 to 11.5/(0 to 165) | 1 to 11.5/(14.5 to 165) | 25/(362) |

EXAMPLE: STG20H

- ✓ This transmitter displays gauge pressure.
- ✓ Its nominal sensor range is 0-10 bar (0-145 psi).
- ✓ The minimum LRV value is -1 bar (-14.5 psi).
- ✓ The maximum URV value is 11.5 bar (165 psi).
- ✓ The minimum span value is 1 bar (14.5 psi).
- ✓ The maximum span value is 12.5 bar (181 psi).
- ✓ The maximum permitted overpressure is 25 bar (362 psi).

2. Technical Specifications

2.1 Environmental Conditions

Table 2 Environmental Conditions

| | Reference | Operating limits | Process fluid standard connections | Process fluid connections with flush diaphragm seals | Storage |
|--------------------------|----------------|-------------------------|------------------------------------|--|------------------------|
| Temperature | 23°C 73.4°F | -20/+80°C -4/+176 °F | -20/+80°C -4/+176°F | -20/+130°C -4/+266°F | -20/+90°C -4/+194°F |
| Humidity (%RH) | | 0/100 | | | |
| Supply Voltage (VDC) | 24 | 11.1/30 | | | |
| (Resistive load = 576 Ω) | | | | | |

2.2 Performance In Operating Range

- ✓ Performance specifications are given at ambient temperature (23°C/73.4°F) and nominal range. All errors are given as percentages of nominal range.
- ✓ Output accuracy: ± 0.2 % of calibrated span or URL, whichever is greater. (Including non linearity, repeatability, hysteresis)
- ✓ Thermal drift: referred to 0/60°C (32°F/140°F) range as percentage of the nominal range
Zero: ± 0.2 %/10°C (50°F)
Span: ± 0.2 %/10°C (50°F) at nominal range
- ✓ LCD display reading: operating between -10 and +65°C (14°F and 149°F)
- ✓ 4 digits LCD display, 5 symbols (bar, mbar, PSI, %, sec)
- ✓ Power supply effect: negligible between 11.1 and 30 VDC

2.3 Functional Specifications

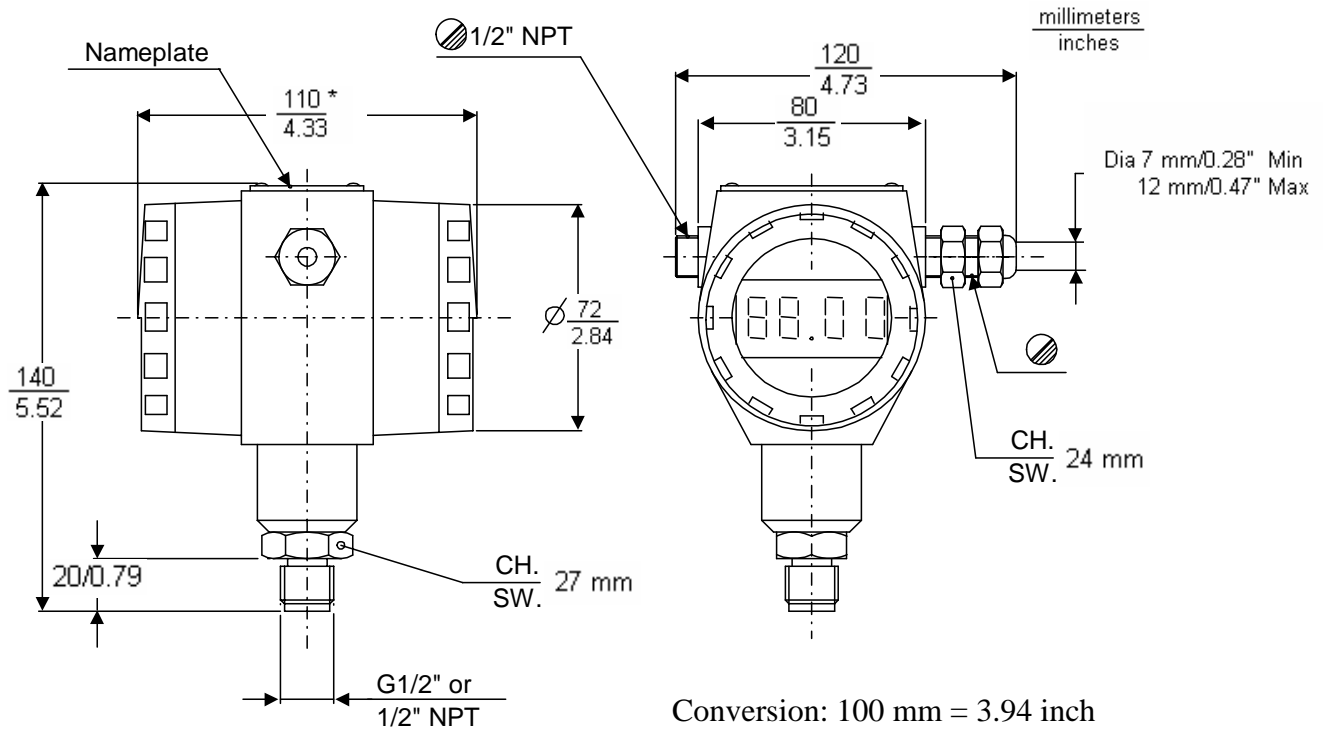
- ✓ Output: 2 wire 4–20 mA
- ✓ Extended working range: 3.8–20.8 mA
- ✓ Extreme output limits: <3.6 mA and > 21.8 mA
- ✓ Load Resistance Limits: 0 to 844 ohms as shown in Figure 14 Operating Area.

2.4 Physical Specifications

| | | | |
|---------------------------------|--|-----------|---------------------------------|
| Material | Housing: Die cast aluminum alloy AL UNI 4514 finished with epoxy resin powder (light beige). | | |
| | Covers: Aluminum | | |
| | Covers O-ring: Buna N | | |
| | Identification tags: SS permanently mounted on the instrument. | | |
| | Wetted parts: alumina (aluminum oxide), AISI 316, Viton/kalrez. | | |
| Environmental protection | The transmitter is dust and sand tight and protected against water penetration as defined by IEC IP 66 – Suitable for tropical climate operation as defined in DIN 50.015. | | |
| Process connections | 1/2 ANSI B2.1 (NPT-F) | Alum. Ox. | (Figure 5) |
| | 1/2" ANSI B2.1 (NPT-F) | AISI 316 | (Figure 6) |
| | 1/2" ANSI B2.1 (NPT-M) | AISI 316 | (Figure 7) |
| | G1/2 UNI/ISO 228/1 | Alum. Ox. | (Figure 1) |
| | 1/2 ANSI B2.1 (NPT-M) | Alum. Ox. | (Figure 1) |
| | G1/2 UNI/ISO 228/1 | AISI 316 | (Figure 2 Flush connections) |
| | G1 UNI/ISO 228/1 | AISI 316 | (Figure 2 Flush connections) |
| | Union nut (65×1/6) | AISI 316 | (Figure 4 Sanitary connection) |
| | Union nut (78×1/6) | AISI 316 | (Figure 4 Sanitary connection) |
| | Clamp (1 1/2") | AISI 316 | (Figure 3 Tri-clamp connection) |
| | Clamp (2") | AISI 316 | (Figure 3 Tri-clamp connection) |
| 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
Mounting
Net weight

Standard: two terminals for signal wiring up to 1.5 mm² – 14 AWG. Earth connection for shield of cable.
 Direct on pressure connection or with optional mounting bracket
 0.85 Kg (1.87 lbs)



* 100 mm Clearance to remove cover (both ends)

Figure 1

DIMENSIONS:

Conversion: 100 mm = 3.94 inch

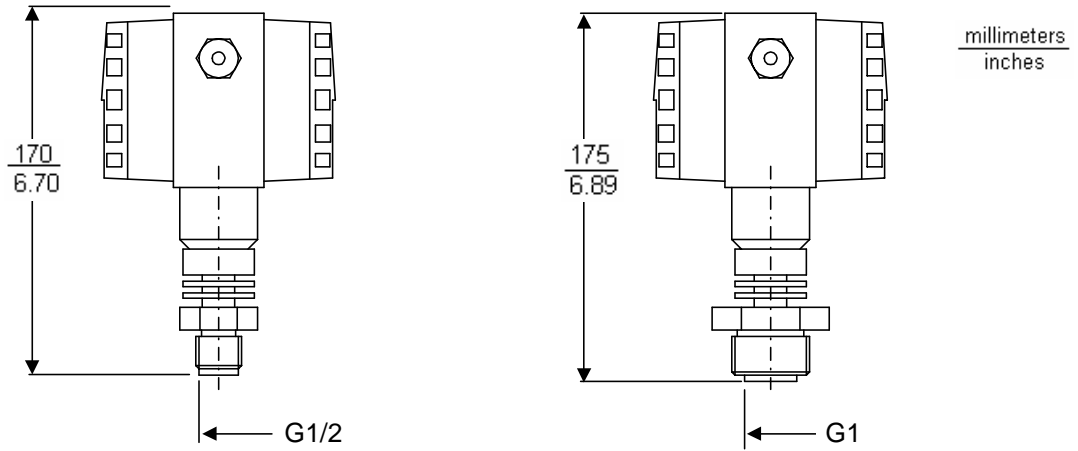


Figure 2 Flush connections

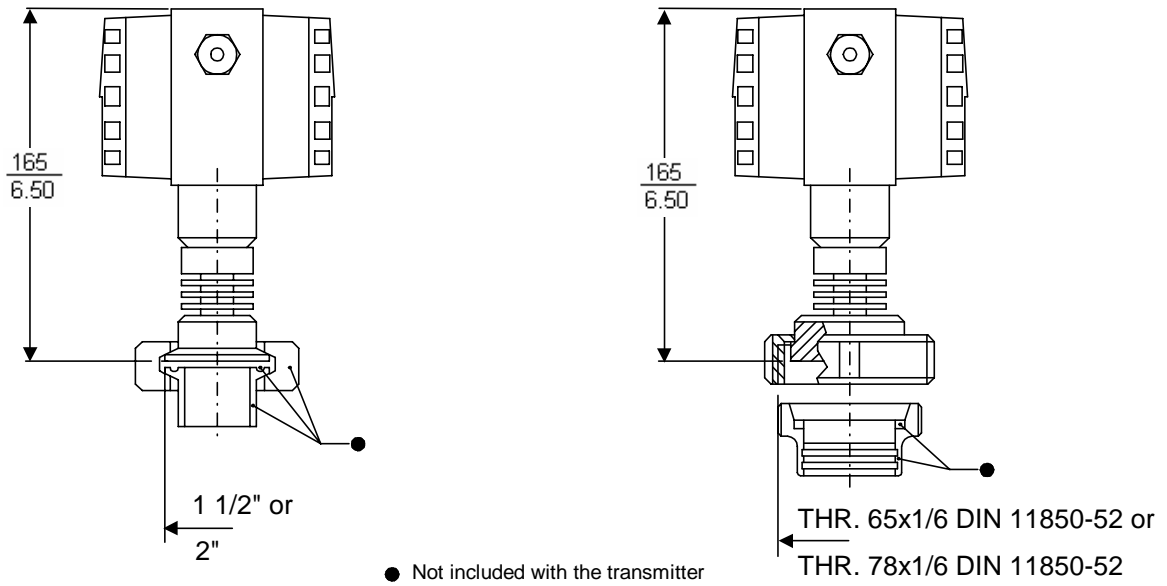


Figure 3 Tri-clamp connection

Figure 4 Sanitary connection

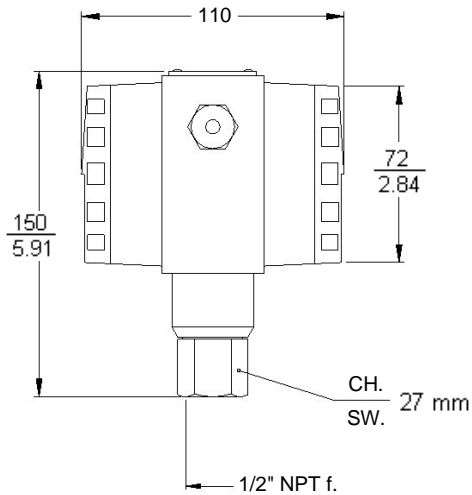


Figure 5

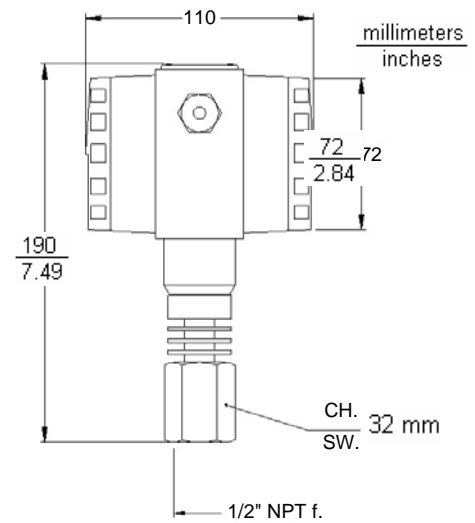


Figure 6

Conversion: 100 mm = 3.94 inch

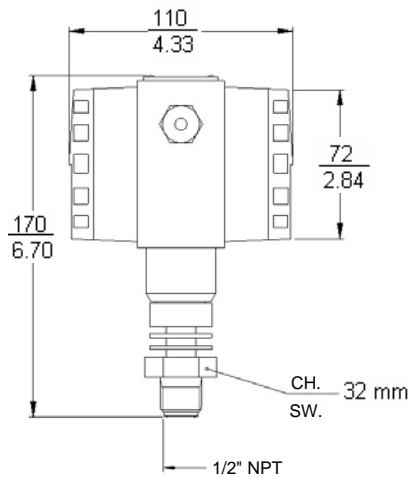


Figure 7

2.5 Intrinsic Safety Approval

Classification

- ✓ Type: intrinsic safety CESI 04 ATEX 039 Ex II 1G, EEx ia IIB T6, T5, T4 to EN 50.014 and EN 50.020 suitable for Zone 0 Groups IIA, IIB.
- ✓ Certification: Refer to Addendum 34-ST-99-33 at the end of this Operator Manual.
- ✓ Ambient temperature ranges
 - T6: -20 to 40°C (-4°F to 104°F)
 - T5: -20 to 55°C (-4°F to 131°F)
 - T4: -20 to 80°C (-4°F to 176°F)

2.6 Electromagnetic Compatibility

In conformity with the EMC Directive 89/336/EEC according to EN 61326-1-1997.

3. Theory of Operation

3.1 Basic Operation

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

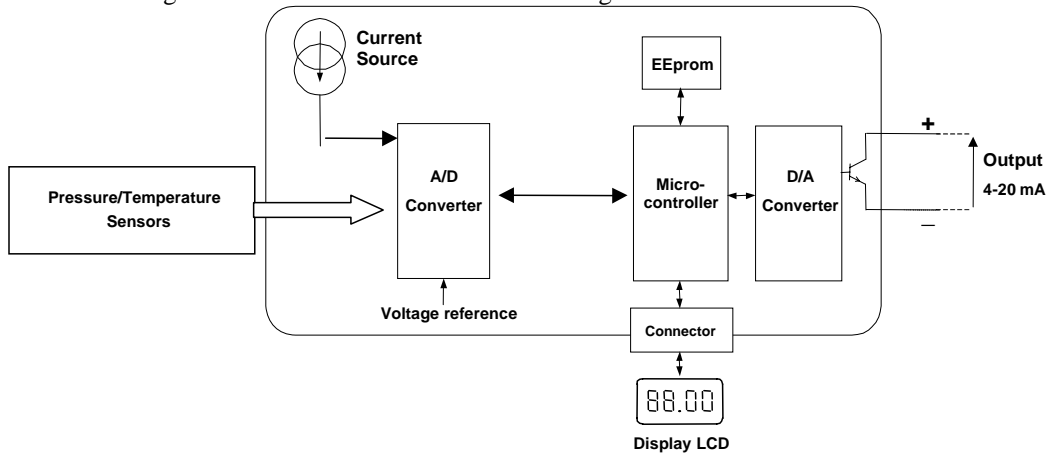


Figure 8 Functional Block Diagram

- ✓
- ✓ 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 analog 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).

3.2 Transmitter Output Levels

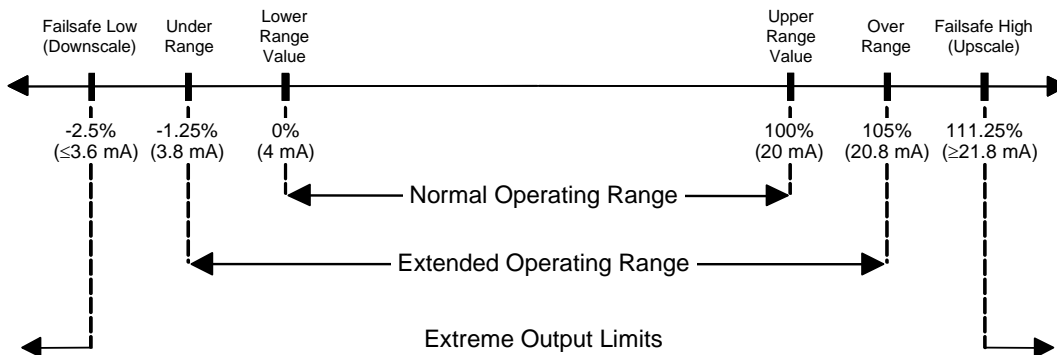


Figure 9 Output levels

3.3 Intrinsic Safety Barriers

- ✓ For use in hazardous area, the construction of transmitters series ST 2000 are in accordance with the Certificate listed in Addendum 34-ST-99-33 (near the back of this manual), intrinsically safe, EEx ia IIB T6, T5, T4.
- ✓ Safety barriers are required on power supplies between the safe location and the hazardous location.
- ✓ The transmitter intrinsic safety entity parameters are 30 V and 152 mA. Suitable safety barriers should limit the available energy to lower values than these (e.g. 28 V/93 mA), and are available from all suppliers of safety barriers (e.g. MTL, PEPPERL+FUCHS, STAHL, ABB, etc).
- ✓ Full details of the transmitter certified parameters are: $V_i = 30 \text{ V}$; $I_i = 152 \text{ mA}$; $P_i = 0.95 \text{ W}$; $C_i = 10 \text{ nF}$; $L_i = 135 \text{ } \mu\text{H}$

4. Bench Check Installation And Commissioning

4.1 Unpacking

Unpack the unit and verify the contents are as ordered:

- ✓ the ST2000 transmitter,
- ✓ one plug ½'' NPT and one ½'' NPT cable gland,
- ✓ one Allen wrench (used to adjust the orientation of the head of the transmitter if needed)



During the delivery, the transmitter head is not locked in order to allow an optimum positioning for the mounting.

4.2 Instrument Identification

- ✓ Instrument data can be found on the nameplate fixed to the top of the transmitter housing. (Model, Serial number, Tag, Calibration, Nominal Range, ...). A facsimile of this nameplate is included in Addendum 34-ST-99-33.
- ✓ The Figure 10 shows both sides of the housing with covers removed.

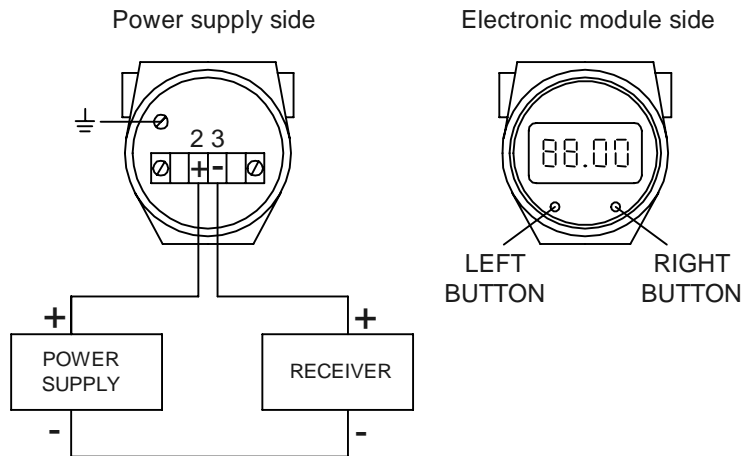


Figure 10 Housing, Covers removed

4.3 INSTALLATION

Transmitter Mounting

- ✓ The transmitter is supplied for direct mounting or with a mounting bracket when it is equipped with remote seal and capillary tubing.
- ✓ The bracket may be used in any case (supplied on request) for fixing to a DN50 pipe, horizontal or vertical or used for surface mounting. Refer to dimensional drawing for details and clearances.
- ✓ The housing position does not affect the instrument operation. Figure 11 and Figure 12 show the simplest mounting, direct on piping.



When you have finished the mounting, do not forget to lock the transmitter head positioning screw.

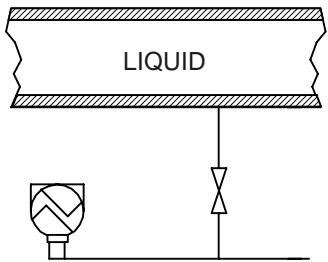


Figure 11 Pressure measurement for liquid

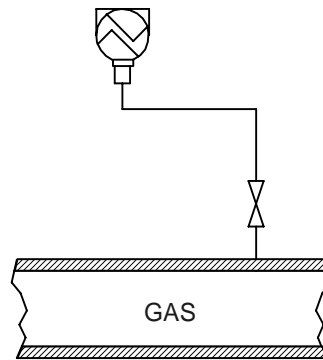


Figure 12 Pressure measurement for gas

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. In the case of reversed polarity the instrument will not be damaged. See Figure 13 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 AC power cables such as main supplies.
- ✓ 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.

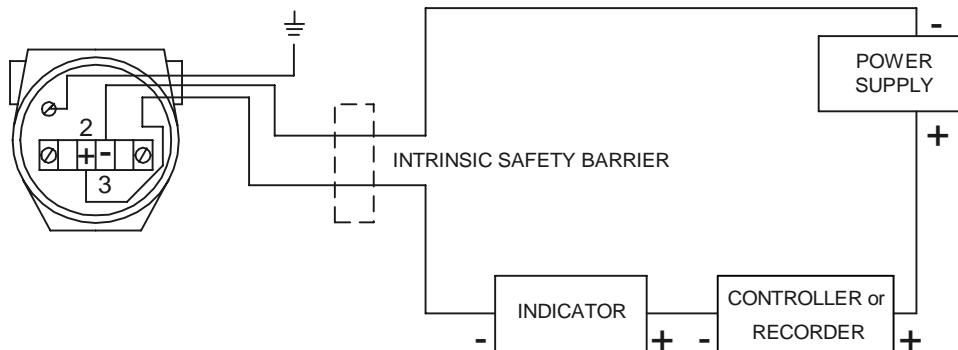


Figure 13 Typical Wiring Connections

Power supply

- ✓ To guarantee a 4 to 22.4 mA output signal, the minimum supply voltage must be checked. It is a function of the total resistive load (output load). This value is the sum of the resistance of each component in the circuit, excluding the transmitter. See Figure 14 for minimum supply voltage required.
- ✓ The value can also be obtained from the following formula:
$$V = 0.0224 \times R + 11.1$$
 where R = output load
- ✓ For a total circuit resistance of 576 Ohms, the minimum supply voltage must be 24 VDC.
- ✓ The power unit must be able to provide a minimum current of 25 mA for standard operation of the current loop.

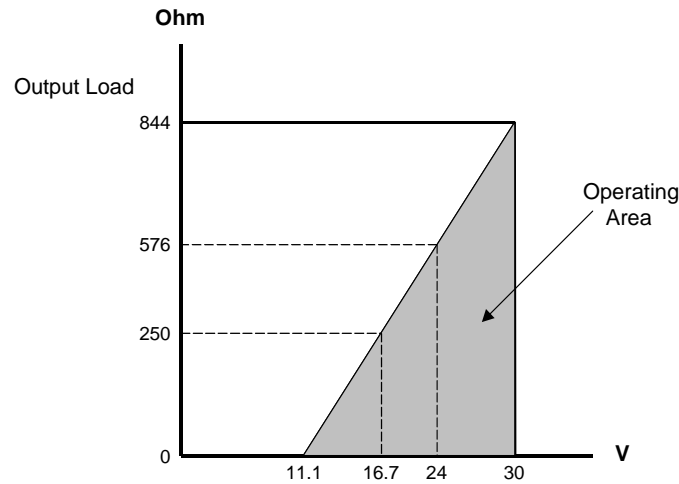


Figure 14 Operating Area

5. Configuration

5.1 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, then press RB |
| RB&LB | ⇒ | First press RB , while RB is pressed, then press LB |

5.2 Configuration Of The Display

The display parameters that can be configured are:

GROUP 1: Pressure unit configuration

- ✓ bar (automatically to mbar if value low) 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 necessary to reach the desired unit, then release **LB**.
- ✓ To change from Group 1 to Group 2, push **LB** followed by **RB** (**LB&RB**).
- ✓ To activate/inactivate the alternate display of [bar <-> %] or [PSI <-> %], enter in Group 1, hold **LB** for about 2 seconds.
- ✓ To activate/inactivate the alternate display of [bar <-> °C] or [PSI <-> °C], enter in Group 1, hold **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 necessary to 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 necessary to read the pressure value with the symbol “bar”, then release.

5.3 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 | ⇒ | Output action |

- ✓ 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.

There are 4 more Functions available for Transmitter Calibration. These functions are indicated here below for reference and are described in par.5.4.

| | | |
|-------------|---|--------------------------|
| c000 | ⇒ | LRV calibration |
| c0FS | ⇒ | SPAN calibration |
| c004 | ⇒ | 4 mA output calibration |
| c020 | ⇒ | 20 mA output calibration |

- ✓ To reach the Calibration Functions push **RB** followed by **LB (RB&LB)** while on the display are shown Group 1 or Group 2 parameters.

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. | | |

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 **LB+RB** ⇨ 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 through 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 **LB+RB** ⇨ 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.



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

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 **LB+RB** ⇨ 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 51 seconds.
- ✓ If the filter value is not equal to zero, the "sec." symbol will appear in normal display.



Remember to store the new values in the Non Volatile Memory through 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 < 105 % of the sensor nominal range
- ✓ Pressure value + span < 115 % of sensor nominal range

The new URV is accepted only if:

- ✓ Pressure value < 115 % of the sensor nominal range
 - ✓ Pressure value – span > -1 bar
-

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.

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 < 105 % of the sensor nominal range
 - ✓ Pressure value > -1 bar
-

The new URV is accepted only if:

- ✓ Pressure value < 115 % of the sensor nominal range
 - ✓ Pressure value > -1 bar + 10 % of 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 F7 is displayed again.

Only when the condition **Pressure value > -1 bar** is not met, the transmitter will change the span to have a span value 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.

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 (P= atmospheric pressure for gauge tx or P= vacuum for absolute pressure tx)

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

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

and hold both The display will show “0000” value

pushed After about 3 sec “Ld” is displayed: new zero is loaded in the volatile memory

Release **RB** ⇒ The display returns to show the applied pressure value

while **LB** is 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 (first time)

Press **LB** ⇒ Change the unit (bar <-> PSI) and store the new selection in volatile memory

Press **LB+RB** ⇒ Go to next Function (F10)

WARNING:

- ✓ The time out will confirm the last unit you have selected.

- ✓ 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 through 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 (first time)

Press **LB** ⇒ Change the direction (Hi <-> Lo) and store the new selection in volatile memory

Press **LB+RB** ⇒ Go to next Function (F11)

WARNING:

The time out will confirm the last direction you have selected.



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

New

FUNCTION 11: Output Action Selection

The current output signal (4-20 mA) is related to the input signal (pressure) depending on the action selection:

dO (direct Output) : Direct linear action

Input=LRV – Output= 0%=4 mA

Input=URV – Output=100%=20 mA

cO (complementary Output): Reverse linear Action

Input=LRV – Output= 100%=20 mA

Input=URV – Output=0%=4 mA

Press **LB+RB** ⇒ until you reach F11, then release

Press **LB** ⇒ Display the actual Output action (first time)

Press **LB** ⇒ Change the action (dO <-> cO) and store the new selection in volatile memory

Press **LB+RB** ⇒ Go to next Function (F12)

WARNING:

The time out will confirm the last direction you have selected.



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

New

5.4 Transmitter Calibration

The transmitter calibration functions are:

- c000** ⇒ LRV calibration
- c0FS** ⇒ SPAN calibration
- c004** ⇒ 4 mA output calibration
- c020** ⇒ 20 mA output calibration

- ✓ To reach the Calibration Functions push **RB** followed by **LB (RB&LB)** while on the display are shown Group 1 or Group 2 parameters. On the display will appear **c000**.
- ✓ 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 c000: LRV calibration

- ✓ For this calibration it is required an accurate pressure source (Accuracy better than 0.05 % of sensor span) connected to the pressure connection of the Tx.
- ✓ Apply a pressure equal to LRV and read the measure as % of the span set by user (URV-LRV)
- ✓ If there is an error in the measure, using **c000** it is possible to adjust the measure to LRV (0.0 %) with a resolution of 0.1% of the span set by the user.
- ✓ Correction limits are +/- 5% of the span set by the user

While **c000** is displayed ⇒ Display the actual correction (- 5.0 / +5.0 %)

Press **LB** or **RB**

Press **RB** ⇒ Introduce a positive correction (Zero adjust) to the pressure measure. Each count corresponds to an increase of the 0.1% of the span set by user (URV-LRV)

Press **LB** ⇒ Introduce a negative correction (Zero adjust) to the pressure measure. Each count corresponds to a decrease of the 0.1% of the span set by user (URV-LRV)

Press **LB+RB** ⇒ 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.

Example:

Sensor nominal Range: 5 bar. User calibration: LRV= 1 bar URV=3 bar (span=2 bar)

Pressure applied by precision pressure source 1 bar: Tx measure= 0.3 % (1.006 bar) ⇒ Error= +0.3%

Introduce a Correction of - 0.3% of the span (- 0.006 bar)

New measure after calibration will be 0.0 %

Note: LRV calibration does not affect Span calibration



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

FUNCTION c0FS: SPAN calibration

- ✓ For this calibration it is required an accurate (better than 0.05 % of sensor span) pressure source connected to the pressure connection of the Tx.
- ✓ Apply a pressure equal to URV and read the measure as % of the span set by user (URV-LRV)
- ✓ If there is an error in the measure, using **c0FS** it is possible to adjust the measure to UVR (100.0 %) with a resolution of 0.1% of the span set by the user.
- ✓ Correction limits are +/- 9.9% of the span set by the user

Press **LB+RB** ⇒ until you reach **c0FS**, then release

| | | |
|------------------------------|---|--|
| Press LB or RB | ⇒ | Display the actual correction (- 9.9 / + 9.9 %) |
| Press RB | ⇒ | Introduce a positive correction (Span adjust) to the pressure measure. Each count corresponds to an increase of the 0.1% of the span set by user (URV-LRV) |
| Press LB | ⇒ | Introduce a negative correction (Span adjust) to the pressure measure. Each count corresponds to a decrease of the 0.1% of the span set by user (URV-LRV) |
| Press LB+RB | ⇒ | 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.

Example:

Sensor nominal Range: 5 bar. User calibration: LRV= 1 bar URV=3 bar (span=2 bar)
 Pressure applied by precision pressure source 3 bar: Tx measure= 99.6 % (2.992 bar) ⇒ Error= -0.4%
 Introduce a Correction of + 0.4% of the span (+ 0.008 bar)
 New measure after calibration will be 100.0 %

Note: SPAN calibration does not affect LRV calibration



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

FUNCTION c004: 4 mA Output calibration

- ✓ Using this function it is possible to verify and adjust the 4 mA output signal.
- ✓ For the calibration it is required a precision multimeter (resolution min. 0.01 mA) for current measurement
- ✓ Insert the multimeter in series in the current loop
- ✓ Correction limits are +/- 0.5 mA around the 4 mA generated by the Tx

NOTE: this calibration adjust the D/A output of the transmitter and doesn't affect the pressure calibration.

| | | |
|------------------------------|---|--|
| Press LB+RB | ⇒ | until you reach c004, then release |
| Press LB or RB | ⇒ | Force the Output to 4 mA and display actual 4mA correction (- 50 / +50 counts) |
| Press RB | ⇒ | Increase current output. Each count correspond to 10 µA increase of the output |
| Press LB | ⇒ | Decrease current output. Each count correspond to 10 µA decrease of the output |
| Press LB+RB | ⇒ | Store the value in Volatile Memory and release the Output current |

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 goes automatically to the **c020 Function**.

WARNING: The Output calibration forces the current output to values not related to the process variable measure. Never perform calibration while the process is running.



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

FUNCTION c020: 20 mA Output calibration

- ✓ Using this function it is possible to verify and adjust the 20 mA output signal.
- ✓ For the calibration it is required a precision multimeter (resolution min. 0.01 mA) for current measurement
- ✓ Insert the multimeter in series in the current loop
- ✓ Correction limits are +/- 1 mA around the 20 mA generated by the Tx

NOTE: this calibration adjust the D/A output of the transmitter and doesn't affect the pressure calibration.

| | | |
|------------------------------|---|---|
| Press LB+RB | ⇒ | until you reach c020, then release |
| Press LB or RB | ⇒ | Force the Output to 20 mA and display actual 20 mA correction (- 99 / +99 counts) |
| Press RB | ⇒ | Increase current output. Each count correspond to 10 µA increase of the output |
| Press LB | ⇒ | Decrease current output. Each count correspond to 10 µA decrease of the output |
| Press LB+RB | ⇒ | Store the value in Volatile Memory and release the Output current |

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.

WARNING: The Output calibration forces the current output to values not related to the process variable measure. Never perform calibration while the process is running.



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

5.4.1 Transmitter Calibration Procedures

- ✓ ST2000 transmitters are factory calibrated for the nominal range of the sensor or for the selected LRV and URV. A periodical calibration can be performed by the user using the described Functions and following the procedure indicated in this paragraph.
- ✓ Calibration frequency can vary greatly depending on the application, performance requirements.
Generally a new calibration is necessary after a reranging (change of LRV and URV) of the transmitter



It is possible to degrade the performance of the Tx if the calibration is done improperly or using equipments that does not satisfy the accuracy requirements.

1. Using Function **F8** the user can adjust the transmitter Zero reference (P= atmospheric pressure for gauge tx or P= vacuum for absolute pressure tx), trimming the initial position of the factory calibration curve.
 - Ensure zero pressure applied (P= atmospheric pressure for gauge tx or P= vacuum for absolute pressure tx)
 - Follow the indication provided in the Function **F8** description
2. Using Functions **c000** and **c0FS** the user can calibrate the Tx at the selected LRV and URV:
 - Set the Output action to Direct using Function F11 to avoid inconsistency in the measurements.
 - Set damping to 0 sec using Function F5 to avoid errors due to Tx response delay.
 - These calibrations should not be performed while the device is connected to the process.
 - **Note: Perform LRV calibration first and then SPAN calibration.**
 - Follow the indication provided in the Functions **c000** and **c0FS** descriptions
3. Using Functions **c004** and **c020** the user can calibrate the current output. These Functions adjust the digital to analog signal conversion and does not influence the pressure measure of the sensor:
 - These calibrations should not be performed while the device is connected to the process.
 - **Note: Perform c004 calibration first and then c020 calibration.**
 - Follow the indication provided in the Functions c004 and c020 descriptions

6. Maintenance/Troubleshooting

6.1 Maintenance

- ✓ The transmitter has no moving components and therefore the maintenance operations are related only to the environmental conditions.
- ✓ It is suggested to plan a periodic check of the internal parts in the top housing to ensure that no moisture penetration is present and that the terminals are clean to assure a good electrical continuity (do not use solvents for cleaning).

6.2 Troubleshooting

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

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 process isolation valve must be in the open position. Check that wiring is correct (polarity) and in good condition, both for main supply and shielding.

External load

Supply voltage value is a function of the resistive load; verify this value. (See Figure 14.)

Power supply

- ✓ The DC voltage must have the correct value and polarity (11.1 – 30 VDC).
- ✓ Calibration tests: Follow the instruction in chapter 5.

ST 2000 Pressure Transmitter

34-ST-99-33

3/04

Addendum (to Operator's Manual 34-ST-11-21)

Overview

ATEX Directive 94/6/EC

The ATEX Directive 94/6/EC is a European CE Mark directive concerning products that are designed for use in potentially explosive environments. This "New Approach" directive is based on, and is an expansion of, European Norms (EN, CENELEC standards).

On June 30, 2003, the ATEX (ATmospheres EXplosibles) directive will replace directives currently in effect, and from that time, only products with the ATEX certification and with ATEX labeling will be approved for free movement in the 19 EU (European Union) and EFTA (European Free Trade Association) countries. As defined in the directive, "free movement" refers to:

- placing a product on the market, and/or
- placing a product into service.

The ATEX Directive 94/6/EC is a living (set of) document(s), subject to further change and refinement, whose details are beyond the scope of this addendum. Further information can be obtained in the Official Journal of the European Communities No L100/1, and in related publications such as Guidelines on the Application of Directive 94/9/EC. Both of these items are available at:

<http://europa.eu.int/comm/enterprise/atex/index.htm>

Products that have been previously certified under the EN and CENELEC European Norms, and which comply fully with all standards in the New Approach directive have, by application, received certification under ATEX Directive 94/6/EC.

The Honeywell ST 2000 Pressure Transmitter is now ATEX certified, and all units manufactured currently and in the future will include labeling that includes all markings required under the ATEX directive.

Inclusions

To ensure that all required information will be available to the user, the following items are include with this Addendum for reference:

1. Declaration of Conformity – ATEX CE 0344 (Honeywell document number 51453504 Revision A).

Purpose and Content of this Addendum

This Addendum includes information required under the ATEX Directive regarding:

1. The appearance and meaning of each certification mark (CE Mark) that appears on the label(s) affixed to the product.
2. Instructions for installation and use of the product is given in:
34-ST-11-21 – ST 2000 Pressure Transmitter Release Operator’s Manual, of which this Addendum is a part.

Details regarding certification marks that appear in labeling for this product are given in this addendum.

Attention

The publications cited above and the functioning and construction (except for labeling) of the devices described therein are essentially unchanged. The purpose of this addendum is to provide details on the purpose and appearance of the labels attached to each device under ATEX Directive 94/6/EC.

Attention

Before installing the equipment in a potentially explosive atmosphere, please read the information provided in this Addendum, which supports the ATEX certifications for this product.

CE Conformity

The ST 2000 Pressure Transmitter is in conformity with the protection requirements of the following European Council Directives: 94/9/EC, the Explosive Atmospheres (ATEX) Directive, 89/336/EEC, and the Electromagnetic Compatibility (EMC) Directive.

In conformity with the ATEX directive, the CE mark on the certification nameplate includes the Notified Body identification number 0344, (KEMA) adjacent to the EC Type Examination Certificate number.

Deviation from the installation conditions in this manual may invalidate this product’s conformity with the Explosive Atmospheres, and EMC Directives.

Conformity of this product with any other “CE Mark” Directive(s) shall not be assumed.

Marking, ATEX Directive

Honeywell’s Model ST 2000 Pressure Transmitter, with the following nameplate attached, has been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19-April-1994.

Special conditions for safe use,

The ST 2000 Pressure Transmitter is an intrinsically safe apparatus that may be installed in a Group IIB (Ethylene) potentially explosive atmosphere.

Intrinsic Safety

The power terminals (+, -) must be connected only to a certified associated intrinsically safe apparatus.

The electrical parameters (U, I, and P) of the associated apparatus connected to the power terminals (+, -) must not exceed the following values:

$$U_i \leq 30V \quad I_i \leq 152 \text{ mA} \quad P_i \leq 0.95 \text{ W}$$

Ambient temperature: -20°C to 80°C

Temperature classifications: T6 Ta = -20 to +40°C

T5 Ta = -20 to +55°C

T4 Ta = -20 to +80°C

Enclosure classification: IP 66

Installation

Fitness of the transmitter for the installation area

In case of use in areas with danger of explosion, it must be verified that the identified type of transmitter is suitable for the classification of the zone and for the presence of flammable substances in the plant.


The safety essential requisite against the risk of explosion in the classified areas are fixed from the European Directives 94/9/CE of March 23 rd 1994 (as far as it concerns the apparatus) and 1999/92/CE of December 16th 1999 (as far as it concerns the plant).

The classification of the areas with risk of explosion is specified in standard EN60079-10, Electrical Apparatus for Explosive Gas Atmospheres – Part 10, Classification of hazardous areas.

The technical requirements for electric fittings in the classified areas are given in standard EN60079-14, Electrical Apparatus for Explosive Gas Atmospheres – Part 14, Electrical installations in hazardous areas (other than mines).

The plate shows the functional data and the references of the notified body for the certification.

Safety data definitions

| | |
|---|---|
| II 1 G | Transmitter for surface plants with presence of gas or vapours, Group II, category 1, suitable for zone 0 and with redundancy for zone 1 and 2. |
| EEx ia | Intrinsically Safe transmitter, category ia. |
| II B | Group IIB apparatus, suitable for substances (gas) of group IIB. |
| T6, T5, T4 | Temperature Class of the transmitter (maximum temperature) |
| CE | Conformity mark to European Directives applicable to the apparatus |
|  | Conformity marking to 94/9/CE Directive and technical rules |
| Ta | Ambient temperature |
| Ui, Ii, Pi, Ci, Li | Maximum Input parameters of the apparatus (related to intrinsic safety) |

Notes:

- a) Transmitters suitable for the group IIB are also suitable for gas group IIA;
- b) Transmitters with temperature class of T6 are also suitable for all substances with higher temperature classifications (T5, T4, T3, T2, T1);
- c) Transmitters with temperature class of T5 are also suitable for all substances with higher class of temperature (T4, T3, T2, T1);
- d) Transmitters with temperature class of T4 are also suitable for all substances with higher class of temperature (T3, T2, T1);
- e) Associated apparatus must be chosen based on the maximum input parameters of the transmitter.

Additional Warnings for Installation

Refer to the Operator's Manual for correct installation.

Process pressure and temperature must not exceed the marked Maximum Allowable Working Pressure (MAWP) or maximum specified process temperature.

When the transmitter is connected to the process it can be subjected to high pressures and temperatures. To avoid accidents from the sudden discharge of pressure and/or contact with dangerous or flammable fluids, pay special attention when the transmitter is taken out of service, heated or repaired. Verify that the transmitter is isolated from the process and is not affected by pressure and/or temperature before servicing.

Electrical Connections

Follow the instructions in the Operator Manual for the electrical connections. For installation in hazardous areas, the transmitter must be connected to associated apparatus (e.g. safety barriers), certified according to the standard EN 50020, with output electrical characteristics compatible with the maximum input parameters (on the nameplate) of the certified transmitter.

The evaluation of the system connected with the associated apparatus, the transmitter, and the interconnecting cables must be done only by experienced personnel, and must match the requirements of EN 50039, Electrical Apparatus for Explosive Gas Atmospheres – Intrinsically Safe Electrical Systems ‘i’.

For correct installation, it is necessary to follow the safety instructions of the selected associated apparatus.

Inspection and Maintenance

Inspection and maintenance of the transmitters shall be in accordance with IEC 60079-17, Electrical Apparatus for Explosive Gas Atmospheres – Part 17: Inspection and Maintenance of Electrical Installations in Hazardous Areas (Other than Mines).

Instrument Service

There are no user repairable components in the ST 2000 transmitter. Contact your nearest Honeywell representative for service.

EC DECLARATION OF CONFORMITY

 **ATEX** **CE 0344**

We declare under our sole responsibility that the following products,

ST 2000 Pressure Transmitters (per attached list)

to which this declaration relates, are in conformity with the protection requirements of Council Directive: 94/9/EC (ATEX Directive) on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres, and 89/336/EEC (EMC Directive) as amended by 92/31/EEC and 93/68/EEC on the approximation of the laws of the Member States relating to Electromagnetic Compatibility.

The models covered by this Declaration are specified in Technical File 51453500, and shown on the attached list.

Conformity to EMC Directive is in accordance with the following European Standard:

EN 61326-1997 Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements


Conformity to the ATEX Directive is in accordance with the following European standards.

EN 50014-1997 Electrical Apparatus for Potentially Explosive Atmospheres - General Requirements

EN 50020-2002 Electrical Apparatus for Potentially Explosive Atmospheres - Intrinsic Safety "i"

EN 50284-1999 Special Requirements for Construction, Test and Marking of Electrical Apparatus of Equipment Group II, Category 1 G

| Notified Bodies: | EC Type Examination Certificates | Production Quality Assurance Notification |
|-------------------------|---|--|
| | CESI – Elettrotecnico Sperimentale Italiano Giacinto Motta SpA – 0722 Via R. Rubattino 54 20134 Milano, Italia | KEMA Quality B. V. – 0344 Utrechtseweg 310 6812 AR Arnhem The Netherlands |

| Certificate | Protection |
|-------------------------|---|
| CESI 04 ATEX 039 |  II 1 G EEx ia IIB T6, Tamb –20 to +40°C T5, Tamb –20 to +55°C T4, Tamb –20 to +80°C |

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person is identified below.

Honeywell International Inc.
Industrial Measurement & Control
1100 Virginia Drive
Fort Washington, PA 19034 USA



Frederick M. Kent
Standards & Approvals Engineer

Issue 1 March 2004
Date:

ST 2000 Pressure Transmitters

| Model | Description |
|--------------|-------------------------------|
| STA201 | Absolute Pressure Transmitter |
| STA202 | Absolute Pressure Transmitter |
| STA203 | Absolute Pressure Transmitter |
| STG20F | Gauge Pressure Transmitter |
| STG20G | Gauge Pressure Transmitter |
| STG20H | Gauge Pressure Transmitter |
| STG20K | Gauge Pressure Transmitter |
| STG20L | Gauge Pressure Transmitter |
| STG20M | Gauge Pressure Transmitter |
| STG20N | Gauge Pressure Transmitter |
| STG20P | Gauge Pressure Transmitter |



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