MANUAL

SEN-TRAN - HART

SMART pressure transmitter with HART communication

Type number: **4 0 □ - 0 - □ □ □ - □**

Serial number:

Production date:

June 2013

Serial number on the manual and on the product must be identical!

Dear Customer,

Please study this manual before you install the transmitter. In order of personal and property safety and the optimal performance of the product become thoroughly acquainted with the content of the manual before installing, operating or maintenance of the product.

TABLE OF CONTENT

1. DESIGNATION AND APPLICATION

The SEN-TRAN – HART pressure and absolute pressure transmitters are applicable for high accuracy measurement of gauge pressure and absolute pressure of liquids, gases or steams and for transmitting a proportional current signal.
The application of this transmitter is recommended, where the accuracy of the measurement is important (e.g. custody transfer, finely controlled technologies), even in case of extreme climate environment. The enclosure's protection grade is IP65.
The 4...20 mA transmitters with HART function have the main advantage, that they can be programmed and read out in hazardous area with a HART communicator.

If the transmitter has an LCD, the measured value can be read locally without any other device. The basic settings of the transmitter can be modified with the buttons next to the display in non-hazardous area. In hazardous area the flame proof type (Ex d IIB) transmitter can be applied directly, and the intrinsic safe type can be used only with auxiliary devices (e.g. Zener barrier, 24 V power supply).

The material of the metal parts in contact with the measured medium is stainless steel (AISI 316). In case of measurement of aggressive substances, the limitations becoming from the quality of the applied material is a guide. In case the aggressivity or temperature of the medium is over the limits given by the used materials or the specified values, application of a pressure transmission unit is necessary.

2. TECHNICAL DATA

2.1. TYPE TABLE

Type number: **4 0 □ - 0 - □ □ □ - □** /A or G, S, K, U

Class of Accuracy	
0	0.10
1	0.16

Safety	
0	Standard
1*	Intrinsic safe
2	Flameproof

Display	
0	with
1	without

Measurement range (bar)		
1	0…1	A,G
2	0…3.5	A,G
3	0…10	A,G
4	0…35	A,G
5	0…100	A
6	0…350	A

Output signal (mA)	
0	4 … 20
1	4…20+HART

A – Absolute pressure transmitter
G – Gauge pressure transmitter
S – Version suitable to be used in nuclear power stations
K, U – Special version
* – Under development

2.2. SPECIFICATION

Measurement ranges:	from 1 bar to 350 bar
Maximum over pressure	150% of measurement range
Class of accuracy:	0.1 0.16
Output signal:	4…20 mA DC with HART modulation
Input vs. output signal characteristic:	linear or square root
Power supply:	10 ... 45 V DC without HART
	12 …45 V DC with HART
Load resistance:	$R_L[\Omega]=(U_T - 10\ [V]) / I_{max}\ [A]$
	where U_T = power supply, I_{max} = upper value of the output current range
Ambient temperature range:	-20…+60°C, without display –40 … +80°C
Process temperature range:	-40°C…+80°C
Ex-protection:	Ⓔx II2G Ex d IIB T5 Gb
Ingress protection:	IP65 MSZ EN 60529:2001
Vibration resistance:	0 ... 500 Hz, 0.5 g
Electrical strength:	500 Veff, 50 Hz
Insulation resistance:	min. 10 MΩ
Cable gland:	M20x1.5 EEx d II.
Wire diameter:	0.5 ... 1.5 mm^2
Mounting position:	vertical or horizontal with side or bottom outlet
Process connection:	M20x1.5
Weight:	~ 1700 g

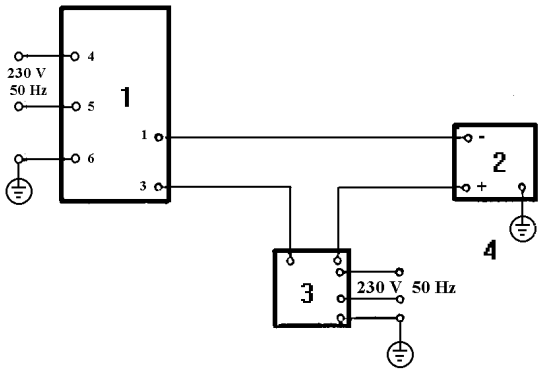
Additional errors

For temperature change %/10 °C:	less than ±0.1; ±0.16 (according to class of accuracy)
Stability:	class of accuracy / 12 month

Reference conditions

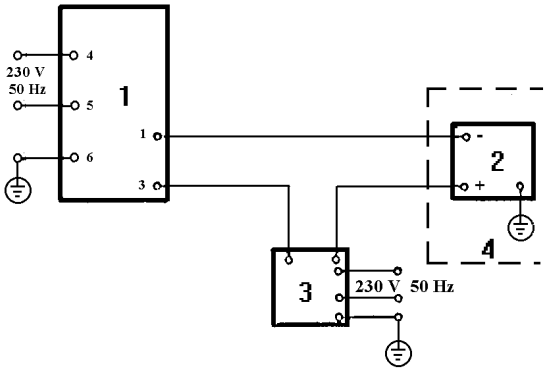
Power supply:	24 V ±1%
Load resistance:	100 Ω
Ambient temperature:	23 ±2 °C

2.3. ARRANGEMENT OF THE POSSIBLE MEASUREMENT LOOP



1. Power supply
2. Transmitter
3. Signal processing
4. Non-hazardous area

Figure 1.a. - Standard loop



1. Power supply
2. Transmitter with II2G Ex d IIB T5 Gb flame-proof enclosure
3. Signal processing
4. Hazardous area

Figure 1.b. – Flame proof Ⓔx II2G Ex d IIB T5 Gb loop

3. TECHNICAL DESCRIPTION

3.1. OPERATION

The SEN-TRAN – HART transmitter consists of the following main parts regarding the operation.

3.1.1. The piezoresistive sensor

The applied pressure sensor is manufactured with semiconductor technology and contains four diffused 3.5 kΩ resistor on the surface of a mono crystal wafer. These resistors form a Wheatstone-bridge. The sensor was mounted on a glass holder eliminating any mechanical stress effect. The holder with the sensor chip was assembled into a stainless steel case. The pressure sensing side of the case was closed with a 0.02 or 0.05 mm thick stainless steel diaphragm. Finally the pressure sensor was filled with AK20 type silicone- oil. Such way pressure acts without any attenuation to the sensing element.

Output signal of the resistive bridge is proportional to the deformation of the silicon sensing element caused by the applied pressure. This signal will be transformed to a proportional 4…20 mA current signal by an electronic circuit.

At the holder of the gauge pressure sensor there is a ventilating opening that connects the reference side of the sensor with the open air. It makes the equalization of the sensor for changes in the atmospheric pressure possible. In case of the absolute pressure sensor the reference side is closed in vacuum at manufacturing, so the sensor measures the atmospheric pressure too.

3.1.2. Electronic

The task of the electronic part:

- to provide inner supply and reference voltage with the proper safety termination
- to supply the sensor and to condition the signal of the sensor for the digital module
- to convert the signal of the sensor to 4...20 mA current signal
- HART communication
- to calculate the compensated pressure based on the measured (p,T) and on the stored calibration data
- to provide output current signal based on the selected measurement range
- to display measured value on the LCD

The electronic circuit can be only changed with the sensor, because the electronic stores the sensor's calibration data in an EEPROM.

The measurement range can be changed inside the nominal measurement range by changing the upper and the lower limit. The proper range is set in the factory according to the given order.

The customer or the user can ask the manufacturer to change the measurement range, however it can be changed using a HART communicator or by the buttons next to the LCD.

The following changes can be done:

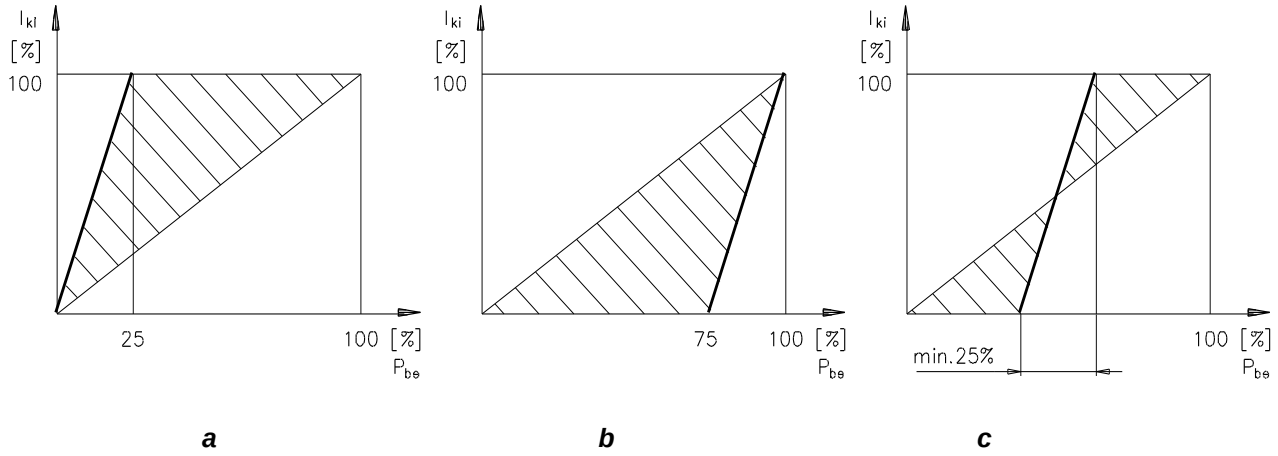


Figure 2. Change the measurement range

a. Decreasing the range by changing the upper limit
b. Decreasing the range by changing the lower limit
c. Decreasing the range by changing the lower and the upper limit

3.2. STRUCTURE

Construction of the enclosure is according to standards MSZ EN 60079-0:2013, MSZ EN 60079-1:2008, MSZ EN 60529:2011.
The enclosure consists of two parts:

- Assembled enclosures satisfying the requirements of flameproof enclosure and the cover to be screwed on, fixing element, earthing stud and electric inlet.
- Cable inlet according to the requirements of Ex d standard.

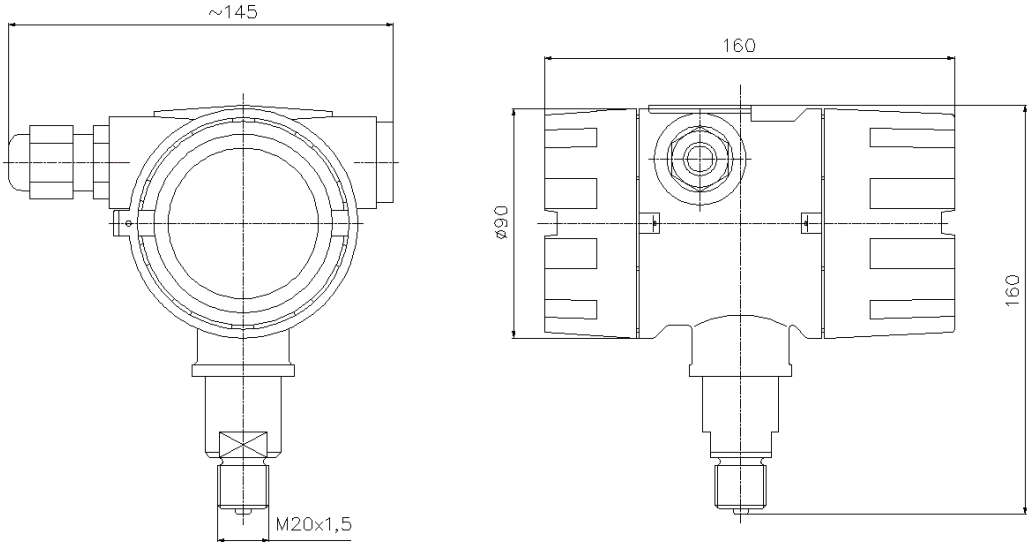


Figure 3. Outline drawing of the transmitter

The cover screwed into the enclosure is protected against unscrewing by inner keyhole screw. This screw is also used for sealing. Under the cable inlet there is a standard earthing stud with fixing, spring washer and nut.

Data table and setting table are on the outer side of the enclosure. Protection mode and grade are shown on the data plate.

3.3. KEEPING THE EXPLOSION PROTECTION MODE OF FLAME PROOF TRANSMITTER (EX d II)

The flame proof enclosure is protected against explosion by the way that the electric parts have an enclosure that can bear the pressure of an explosion within, without permanent damage and are cooling the explosion flame that is no more able to flame the explosive area.

The tightness of the enclosure made of heat-treated alloy of the transmitter is tested for one minute with 10 bar water pressure by checking dimensions, too.

The intersection of threaded and flat parts ensuring flameproofness of the enclosures, the gap sizes and surface quality are according to related standards, therefore the flame proof enclosure transmitter can only be applied in case the critical surfaces of it's enclosure is complete, unhurt.

Only approved Ex d II cable gland can be used in hazardous area.

Open the enclosure only without presence of power voltage in hazardous area!

d

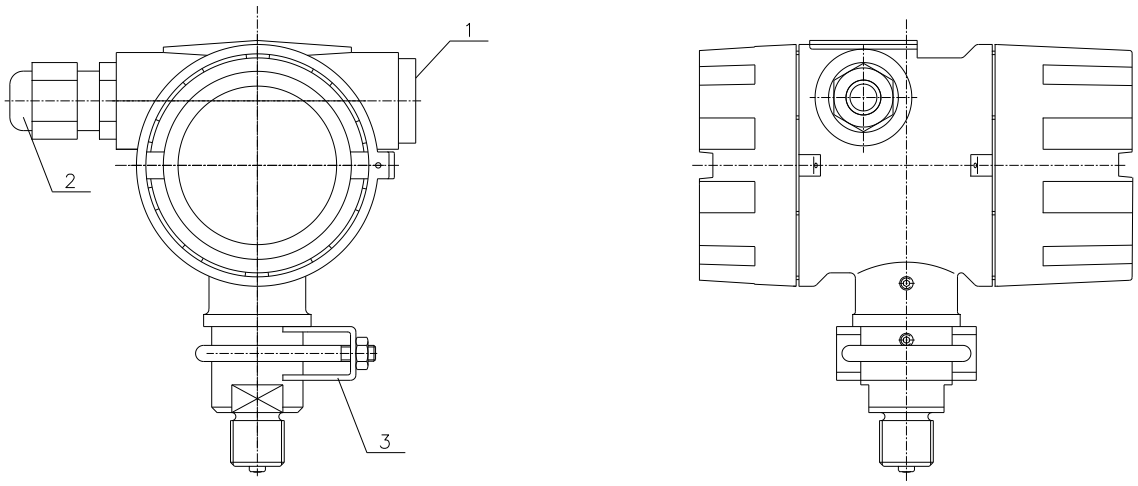
4. TRANSPORT AND STORAGE

Transport of the transmitter is done in a package filled with a material defending against shock and beating. During transportation the ambient temperature must not exceed the specified value.

5. MOUNTING

Before mounting, the instrument must be surveyed. Make sure that:

- the type and other parameters of the transmitter are fit to the given measurement loop.
- the enclosure is intact.
- the following parts are present: cable sealing, cover fixing and lead seal, earthing screw.



Optionally supplied parts:

1. terminal screw (can be replaced by a surge protector)
2. cable gland (only Ex cable gland can be used)
3. shackle (ordering option)

Figure 4. - Accessories

5.1. Mounting and position

The transmitter can be mounted several ways: directly on impulse line, on panel, on wall or on 2” pipe with the recommended shackle and accessory. Figure 4 shows the recommended and optionally supplied mounting. Figure 3 shows the main dimensions of the transmitter.

5.2. Mounting requirements

Accuracy of pressure measurement is highly depending on the proper mounting of the transmitter and the impulse line. The piping between the process and the transmitter must transfer the pressure accurately to the transmitter. In order to achieve accurate results install the transmitter near the process and use minimal length of piping.

Nevertheless easy access to the transmitter, personal safety, field test possibility and proper surrounding for the transmitter must also be considered.

Generally the transmitter should be installed to a place where vibration, shock and temperature fluctuation is minimal and must not be exposed to corrosive effects.

The best position of the instrument depends on the given application. The transmitter can be connected to the process different ways. To ensure leakageless connection use thread sealing approved by the local plant.

WARNING

Do not expose torque directly on the enclosure of the electronic unit because in case it turns versus the pressure inlet the electronic unit might be damaged. To avoid injury **only the formed part of the pressure connection must be fixed with wrench.**

5.3. Aspects for forming the pressure transmitting piping

For different measuring circumstances different arrangement of signal piping (impulse line) is needed.

- In the pipe filled with liquid no high points, in case the pipe filled with gas no low points must occur.
- Cross-section of the pipeline must be large enough to avoid the effect of attenuation and clogging.
- The pipe section filled with liquid must be well bled.
- Avoid formation of sediment in the piping.

Liquids:

The slope of the piping from the pipeline to the transmitter must be max. 8 cm per meter. Connection of the signal pipe must be on the measurement side of the pipeline to avoid clogging of the transmitter or the piping. The transmitter should be mounted on the same level or under the tapping of the pipeline in order the gases can leave to the pipeline.

Gases:

The slope of the piping must be max. 8 cm per meter. The direction of the slope must be from the transmitter to the pipeline. Connection of the signal pipe must be on the side or on the top of the pipeline. The transmitter should be positioned at the same level or above the tapping of the pipeline in order the liquids can leave to the pipeline.

Steams:

Connection of the signal pipe must be on the side of the pipeline. Besides this the transmitter should be positioned under the level of the pipeline tapping in order the condensed liquid can fill the signal piping.

The insertion of a “T” connector might be necessary between the transmitter and the cutoff valve of the measured substance. In case a valve mounted on this “T” connector the transmitter can be connected to free air and calibration can be checked without dismounting.

NOTE

In case of steam measurement or high temperature process the temperature must not exceed the specified limit value at the signal connection. Use of condensate vessel can be eliminated, because the volume change of the transmitter is negligible.

5.4. Connection of electric cable

Electric cable must be connected through the cable gland on the side of electronic unit. The cable gland ensures cable inlet and fixation. Screw out the inner keyhole screw of the cover and remove the cover. Equip the cable gland on the instrument and pull the proper cable through the gland. Connect the wires to the terminal block and then screw the gland for proper sealing. Figure 5 shows wire connection.

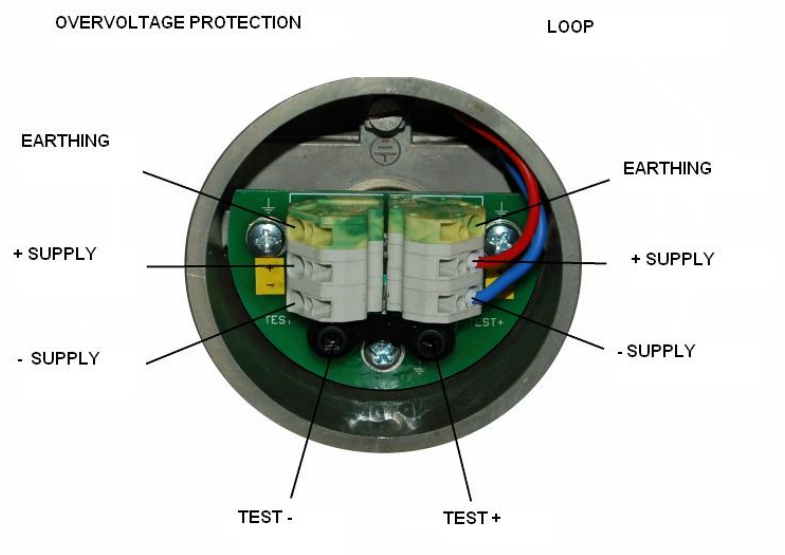
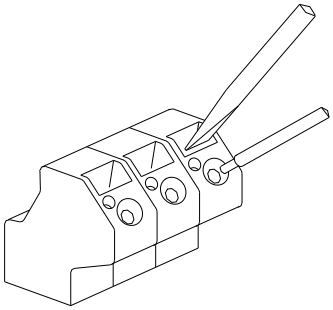
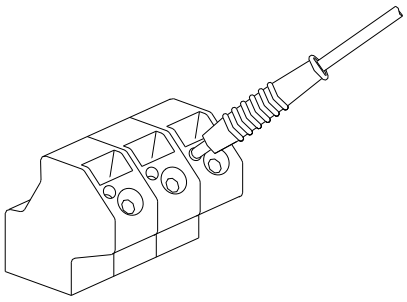


Figure 5. – Terminal block

Positive supply must be connected to the + terminal, the negative supply must be connected to the – terminal, earthing must be connected to the EARTH terminal.



Connecting the wire with 3.5 mm screw driver.



Test measurement using Ø2 mm banana plug.

Figure 6. Connecting the wire to the terminal block

WARNING

Do not connect any live wire to the TEST terminals, the voltage can damage the test diode. Do not connect any test meter between the TEST and the housing. **High current of the power supply can blow out the fuse of the test meter.** It is not necessary to shield electronic wires. Electronic immunity can be increased by using twisted pairs. Do not place cable in opened cable channel containing high current cable or next to high power electronic equipments. The loop can be earthed at one point or earthing can be omitted. The recommended earthing point is the negative supply. The earthing must be done to fit to the given measurement loop.

6. INSTALLATION

After the transmitter is mounted and supplied with impulse line and cut-off valve, put it under pressure slightly. Check the sealing for leakage. Power can be switched on following this.

Power supply

The power supply must provide DC voltage with ripple less than 100 mV peak-to-peak. The complete loop resistance is the sum of the resistance of the wires and the resistance of the devices in the loop (e.g. controller, meter). The maximum load can be calculated using the formula in Chapter 2.2.

Change the measurement range

The measurement range can be changed using the buttons next to the display.

Figure 7. – The display

The following parameters and modes can be set using the buttons or with HART communicator without breaking the loop: the lower and the higher limit of the range, the damping, the displayed unit, fix output current.

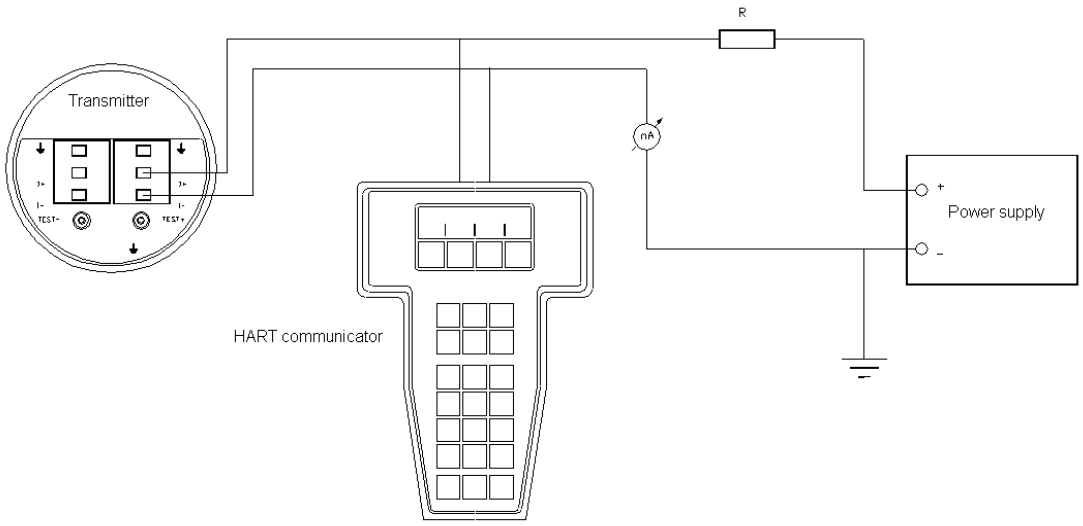


Figure 8. – Connecting the HART communicator

Manual of the Three Keys

ZERO(Z), SPAN(S), MODE(M)

OPEN THE LOCK

Press<Z>and <S> for 5 seconds then can open the lock. (LCD screen showing :OPEN)

4mA Rerange With Pressure

Set the present input to zero reference level, press <Z>for 2 seconds, the transmitter will output 4.000mA.(LCD screen showing: LSET)

20mA Rerange With Pressure

Set the present input to span reference level, press<S>key for 2 seconds, the transmitter will output 20.000mA .(LCD screen showing: HEST)

PV=0

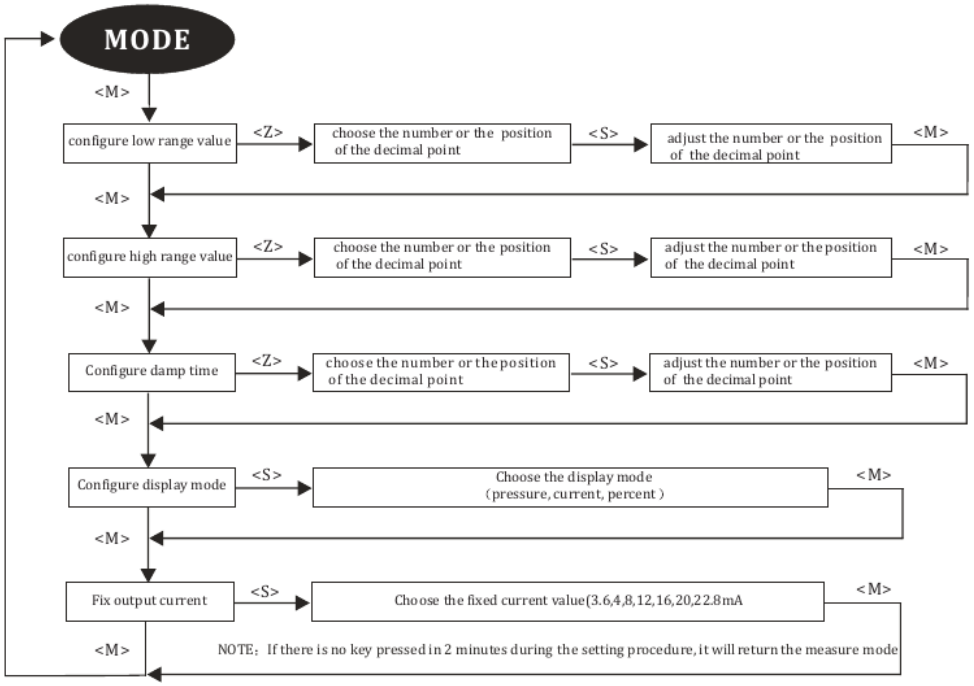
Set the transmitter under the atmosphere, press <Z>and <S> keys for 2 seconds. it can get PV=0. (LCD screen showing :PV=0)

NOTE: If the PV/RANGE>0.5, it can not get PV=0. （LCD screen showing ：PVER）

RESET

Turn off the power, Press <Z>, then turn on the power to the transmitter, continue to press<Z> for 5 seconds, if LCD screen shows OK, the transmitter get reset.

NOTE: If LCD screen shows FAIL, the transmitter can not get reset (Maybe because the data has not been backup to the transmitter in factory).



7. MAINTENANCE

This chapter describes the maintenance of SEN-TRAN – HART pressure transmitter. It helps to solve some generally occurring operational problems and to keep the specified operational parameters of the transmitter.

WARNING

Apply only those procedures and parts that are definitely referred in this manual. Applying not referred procedures or parts has an effect on the operation of the transmitter and its output signal that is used for controlling some process. It can cause risk to the system and to the explosion safety. With questions concerning these procedures and parts contact to WESZTA-T Ltd.

8. MALFUNCTION AND TROUBLESHOOTING

8.1. MECHANICAL MALFUNCTION

Impulse line:

- Check if the impulse line is not clogged.
- Check if the cutoff valve is completely open.
- Check if the density of the liquid did not change in the impulse line.
- Check if the liquid is not congealed in the pressure connector.
- Check if there is no clogging in the pressure connector of the transmitter. If there is, wash the connector with clean water or proper solvent.

WARNING

Do not try to remove clogging from the sensor by scratching, because the thin separate membrane might get hurt and the transmitter can be damaged.

8.2. ELECTRICAL MALFUNCTION

Power supply:

- Measure the input voltage at the transmitter. This must be 10...45 V DC, if there is no load on the terminals. In case of 250 Ohm load it must be at least 15 V.
- Check if the power capacity of the supply unit is suitable for the current consumption of all the connected transmitter.

Transmitter wiring

- Check the loop impedance.
- Check the insulation of the wires to detect the possible earth shorting.
- Check the proper polarity at the terminal block.
- Check there is no intermittent shorting, break or multiple earthing.

If the output signal does not change and less than 4 mA or greater than 20 mA in case there is no pressure, then the sensor is damaged.

8.3. MALFUNCTION: OUTPUT SIGNAL IS LESS THAN LOW LIMIT

If the output signal is about 2.5 mA (less than the low limit), try to restart the instrument by switching off/on the power supply. If this does not solve the problem, switch off the power supply, then press button Z and switch on the power supply, while hold the button Z pressed for five seconds. This will restore factory settings. If this does not solve the problem, contact to WESZTA-T service department.

9. SAFETY PRESCRIPTION

National standards prescribe keeping and ensuring safety. For your own sake, from point of view of life and property safety, obey these regulations.

10. WARRANTY

WESZTA-T Ltd. takes warranty for each transmitter for 18 month from delivery and 12 month from installation. Warranty ceases in case the user opens the sealed instrument, performs unskilled operation or maintenance.