HM-PS Pressure Transmitter

User Manual

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Symbols

The symbols that may be found in this document are defined as follows.

Symbol	Description
Danger	Indicates a hazardous situation which, if not avoided, will or could result in serious injury.
Caution	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results.
Note	Provides additional information to emphasize or supplement important points of the main text.

Safety Instruction

These instructions are intended to ensure that user can use the product correctly to avoid danger or property loss. The device can only be operated by trained personnel in accordance with these instructions and local safety regulations.

Mounting and Maintenance

Danger

- Caution! Removal of the transmitter is only permitted under normal pressure!
- When using pressure transmitters in hazardous situations, installation, use and maintenance shall be in accordance with the operating instructions in user manual and local safety regulations.
- The pressure transmitter is powered by an external power supply, the supply circuit shall comply with the energy limit circuit specified in the relevant standard and be aware of the high voltage that may be present in the circuit.
- Process leaks can cause injury or death. To avoid process leakage, always use only O-rings that are sealed in conjunction with the corresponding flange joint.

Caution

- The pressure transmitter shall be installed, tested and maintained by professional engineers or technicians. Read the manual carefully before installation.
- The maximum static pressure overload of the pressure transmitter is noted on the label of the Product, and the maximum pressure in process should not exceed the range of the pressure transmitter.

Storage

Storage of transmitters do not require any special handling. There is no limit on the storage period, but the warranty is the same as the period set by the company.

Transportation

After verification, the transmitter is packed in a carton to protect it from damage.

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1. Product description

The HM-PS Series pressure transmitters use high-precision silicon sensor, based on electronic components with a microprocessor, to enable communication with field equipment.

The product measures the density and pressure of gases or vapors, and level of liquid, and converts the measured data to 4 to 20 mA DC HART output or Modbus-RTU/RS-485 signal output.

This series of products provides a variety of measuring accuracy, range, liquid sealing for selection, adapting to different application scenarios and environment. Read the specifications for the product you choose to learn about the complete product performance and features.

1.1 Product sepcification

- Power supply: 24 VDC
- Protection level: IP66/IP67
- Ambient temperature: -40 to 70°C (-40 to 158°F)

2. Appearance and installation

Caution

- For operator and plant safety, it is essential that the installation is carried out by trained personnel according to the technical data of the model. Refer to the data sheet of the model for technical data.
- For transmitters with a remote seal and a capillary style connection, avoid using capillaries to lift the flange directly during handling, avoid repeated bending at the same position of the capillary, and the capillary bend radius is recommended ≥ 10cm.

2.1 Pressure transmitter installation

- Gauge and absolute transmitters: Mount directly to impulse line without an additional bracket, or mount directly to a wall, panel, or 2-inch pipe with optional mounting bracket.
- Differential pressure transmitter (also, gauge and absolute transmitter in this style): Mount directly to a wall, panel, or 2-inch pipe with an additional mounting bracket.

2.1.1 Gauge pressure and absolute transmitter installation

Mount to impulse line

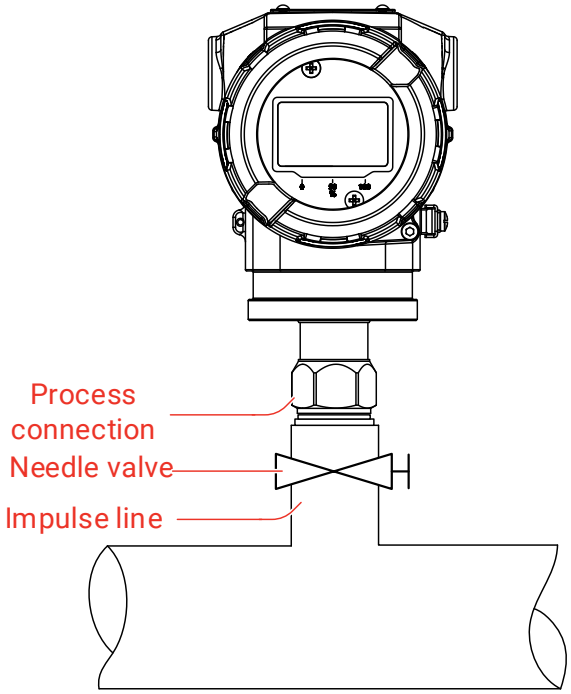


Figure 2-1 Mount to impulse line

The standard process connection is: 1/2 NPT female threaded, which can be connected to the following connectors (optional):

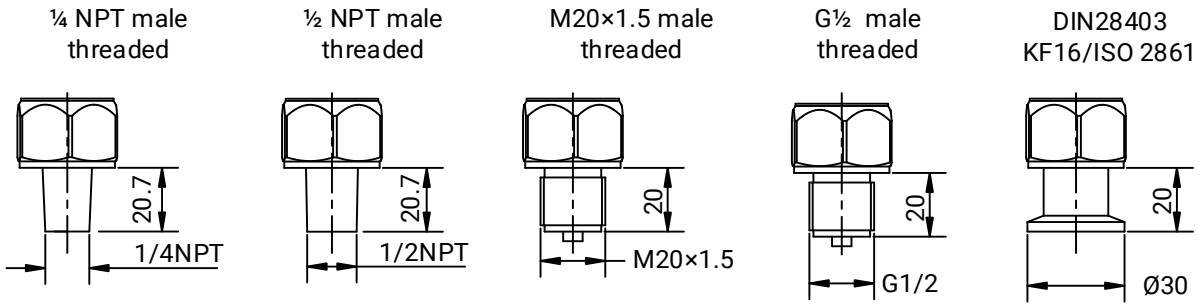


Figure 2-2 Optional process connection

Mounting with bracket

Mount the transmitter to wall or pipe using the optional bracket.

The clamp is used when the bracket is mounted on a pipe and is not required for wall mounting. The holder is used to secure the transmitter body to the bracket.

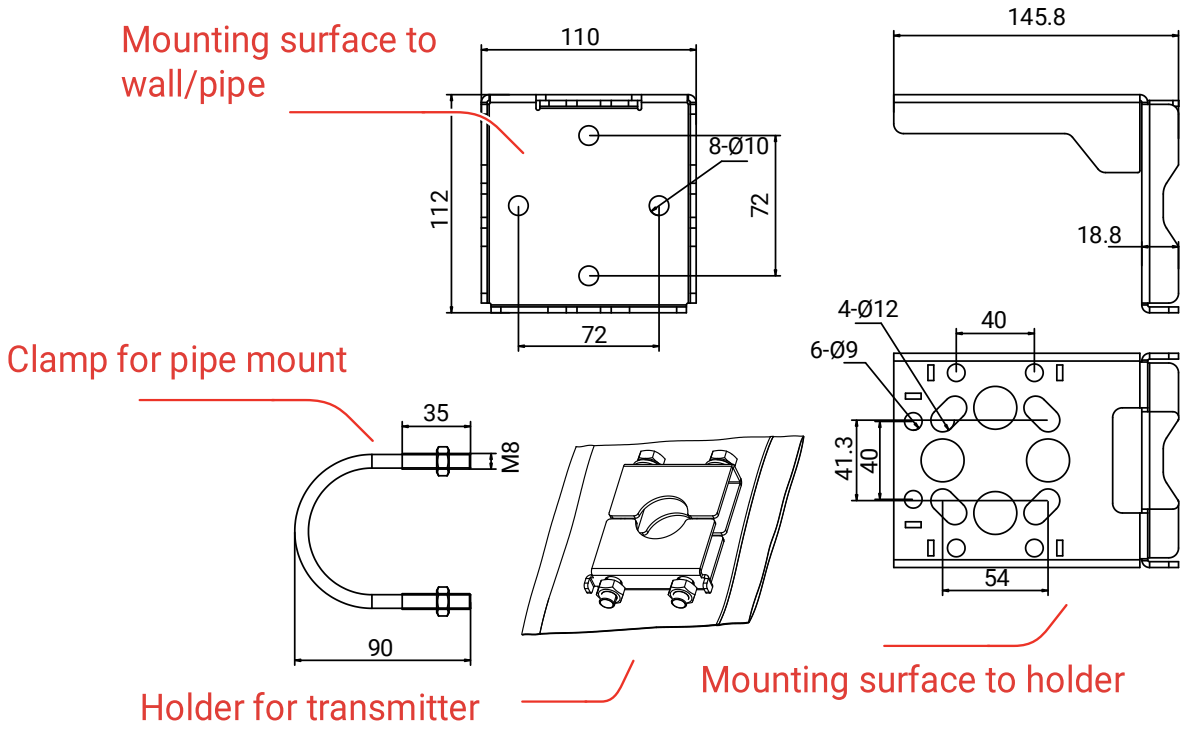
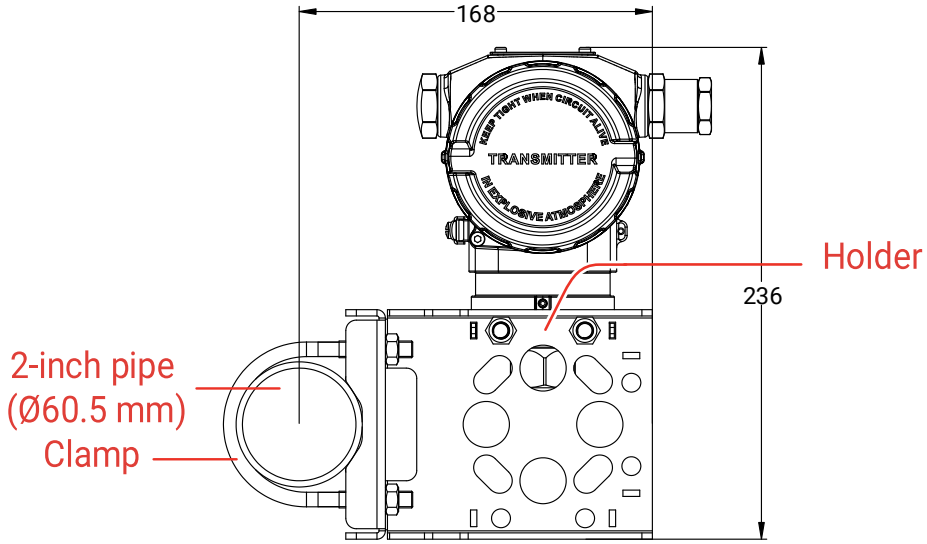


Figure 2-3 Bracket parts and size for gauge and absolute transmitter (unit: mm)



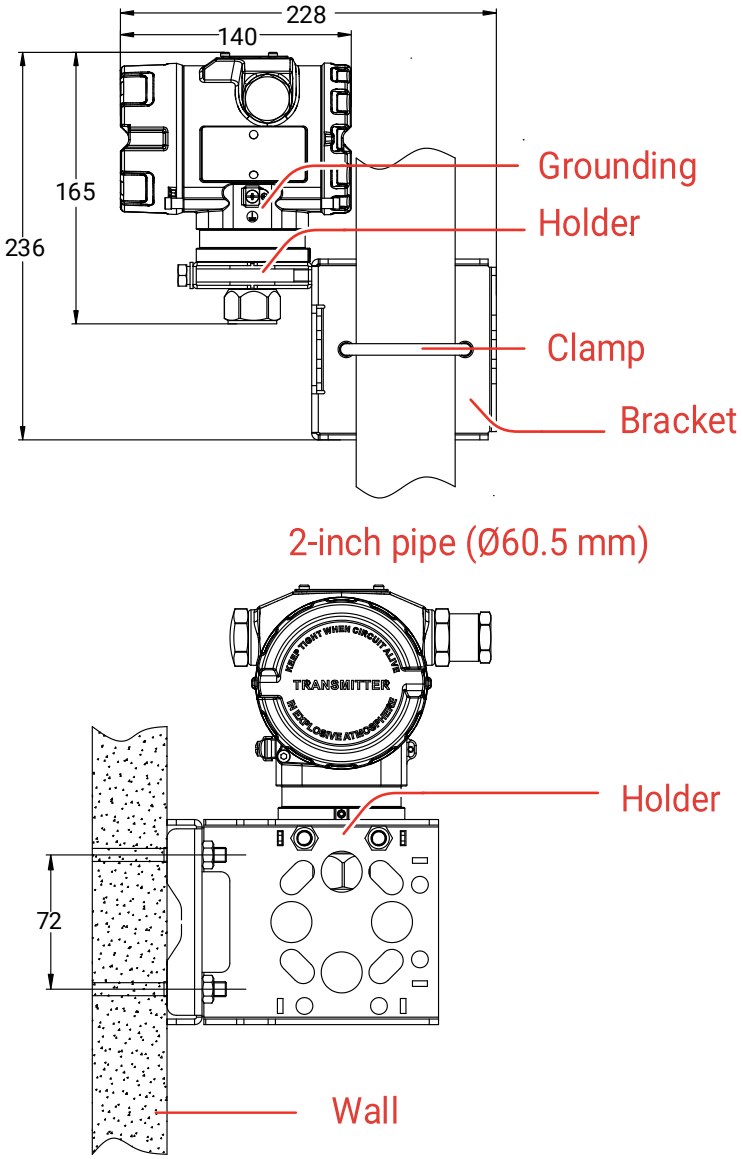


Figure 2-4 Bracket mounting of gauge and absolute pressure transmitter

2.1.2 **Differential and differential style pressure transmitter installation**

Mount the transmitter to wall or pipe using the optional bracket.

The clamp is used when the bracket is mounted on a pipe and is not required for wall mounting.

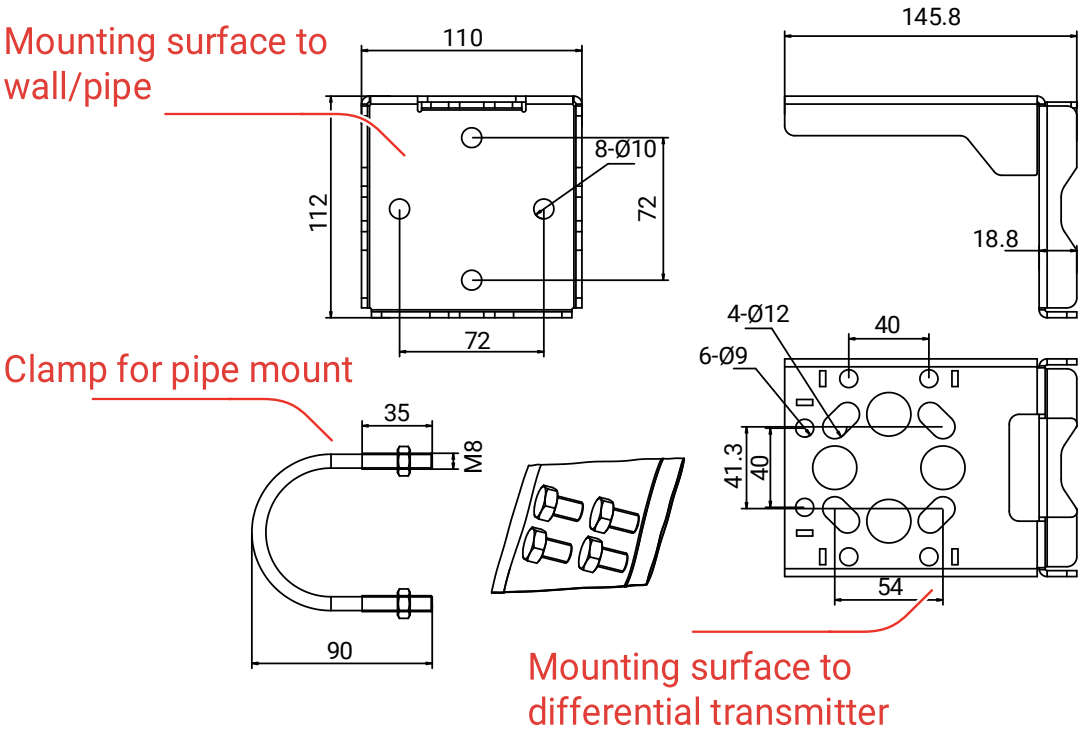
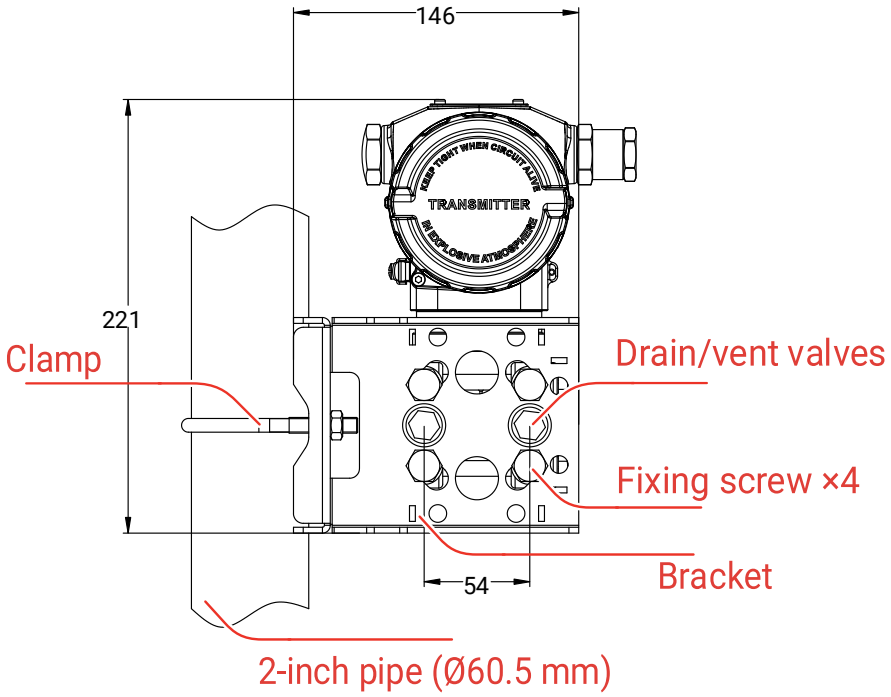


Figure 2-5 Bracket for differential pressure transmitter



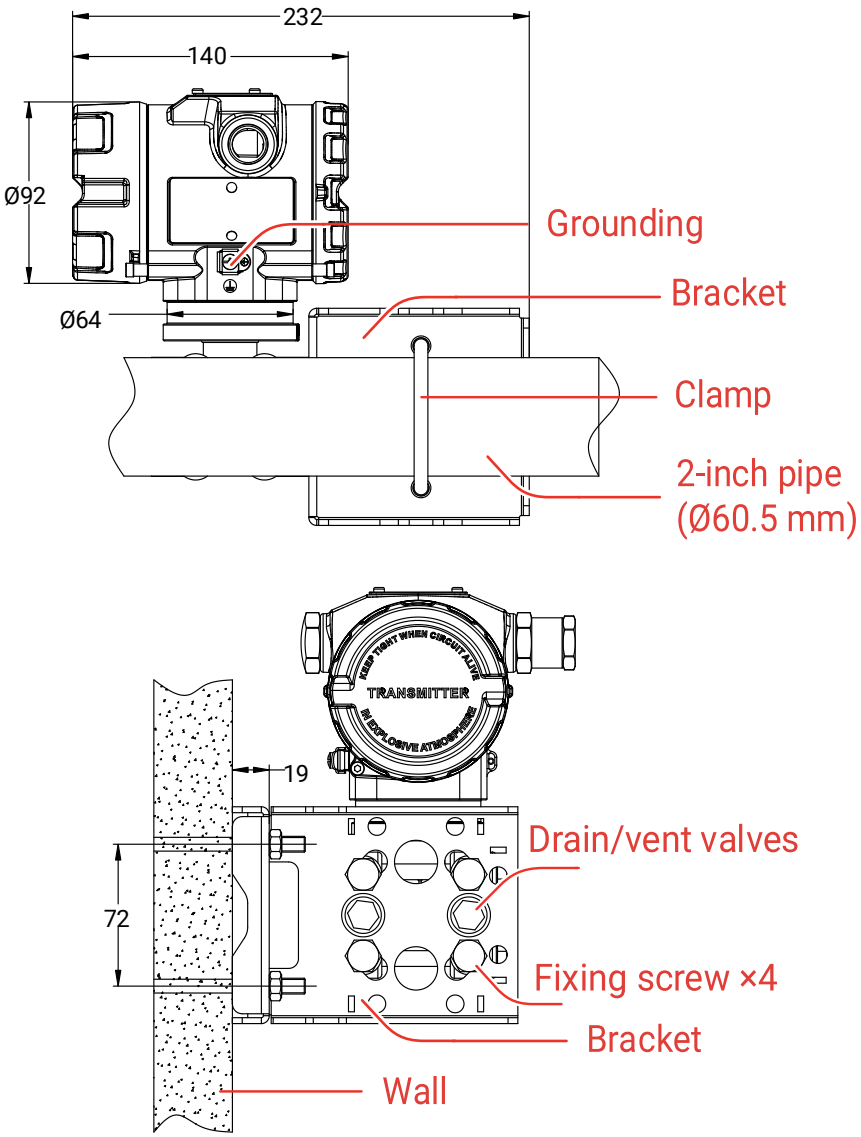


Figure 2-6 Bracket mounting of differential and differential style pressure transmitter

2.1.3 **Precautions for installation of the impulse line**

For proper installation, the following points must be observed:

- The impulse line shall be as short as possible and avoid sharp bends.
- The installation slope of the impulse line shall not be less than 1:12 to avoid precipitation.
- The impulse line must be blown with compressed air and flushed with the medium measured before connecting to the transmitter.
- If the medium is liquid, drain the impulse line completely.

- The impulse line shall be so arranged that air bubbles in the liquid and deposits in the gas under measurement can be returned to the process piping.
- There must be no leakage after process pipe installation.
- When installing the differential pressure transmitter to impulse lines, note that the negative cavity is connected to the low pressure side and the positive cavity is connected to the high side.

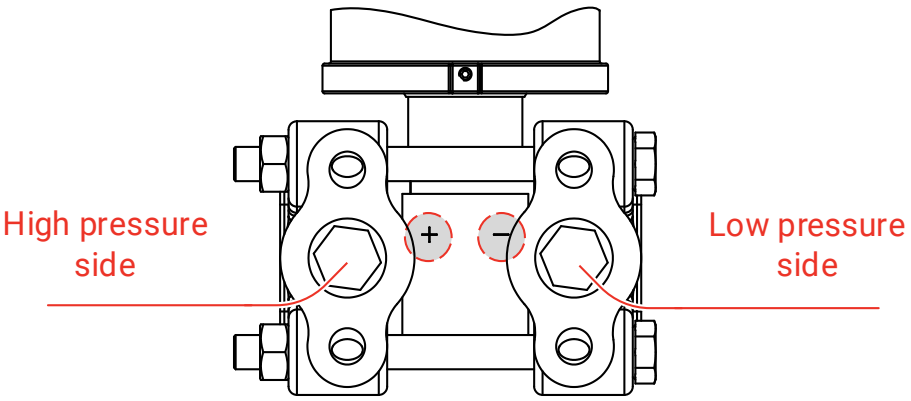


Figure 2-7 Differential pressure transmitter high and low pressure connection

2.1.1 **Housing rotation**

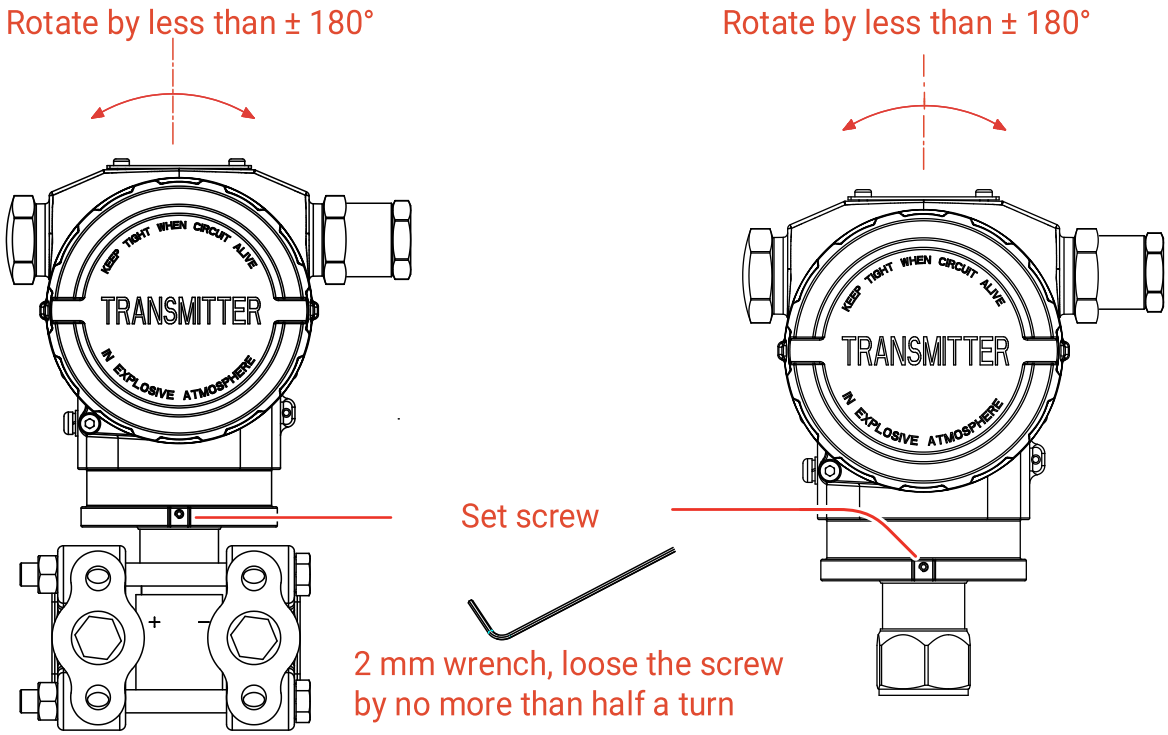


Figure 2-8 Housing rotation

The transmitter housing can rotate approximately ± 180 degrees relative to the sensor without affecting performance and internal wiring. Do not force the sensor to rotate, loosen or lock the set screw with a 2 mm hex wrench. This minimizes the impact on electronic connections and output displays.

2.2 **Wire connection**

2.2.1 **4~20mA output and RS-485 output**

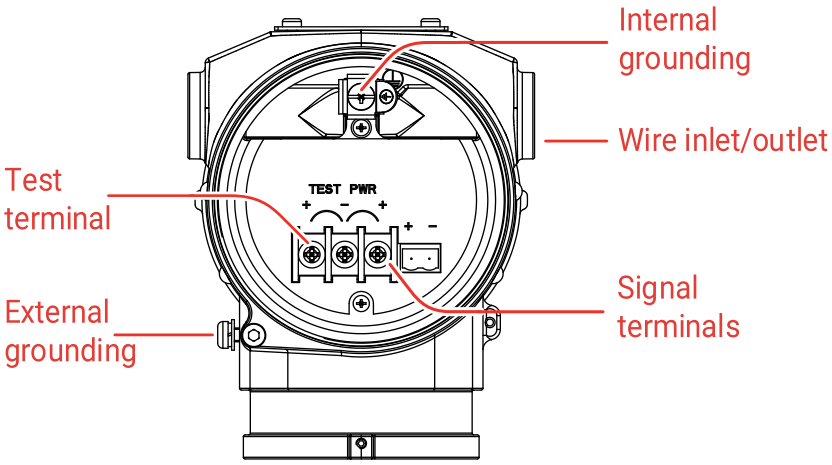


Figure 2-9 4-20 mA output

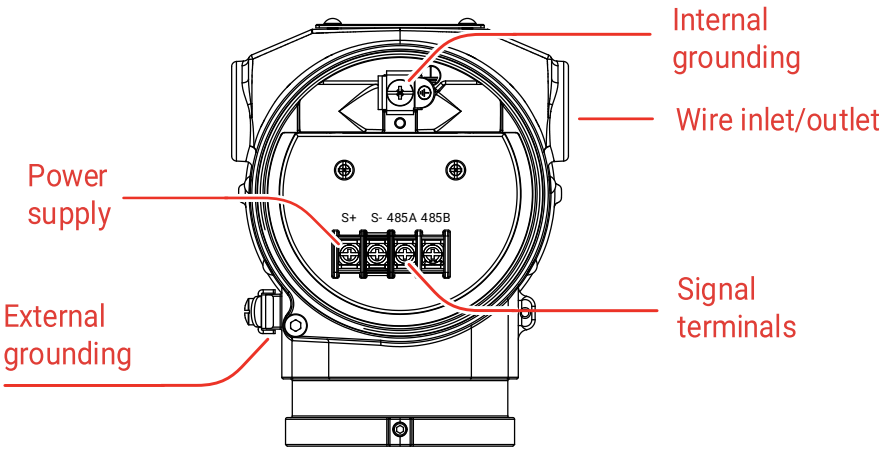


Figure 2-10 RS-485 signal output

- Power and signal wires can be connected to terminals via M20x1.5 wire inlet/outlet at two sides. Use wire with cross section area no more than 2.5 mm2 (14 AWG).
- (Non-explosive type) The optional cable entry for M20×1.5 ensures IP67 protection for 6~12mm outer diameter shielded cables.
- For RS-485 connection, connect the 485A terminal to the A-end of the host and the 485B terminal to the B-end of the host.

2.2.2 **Grounding**

- Use a shielded twisted pair signal cable for optimal performance.
- Ground the enclosure to meet local grounding regulations.
- To ensure proper grounding, cable shielding shall meet the following requirements:
  - The shielding should be trimmed flat and avoid contact to enclosure of the electronic parts.
  - If the wire is routed through the junction box, it should be connected to the next section of the shield.
  - The power supply should be properly grounded.

The earth crimping clip and terminal should be prepared by users.

2.2.3 **Voltage input**

Caution

- Relevant instructions noted in your local regulations must be followed during wiring.
- Since the transmitter does not have a power switch, the system must have overcurrent protection or a power cut-off device.

The power input shall meet the following requirements:

- Transmitter with backlight LCD display: 24 VDC
- Check that the working voltage is consistent with that specified on the nameplate.

2.2.4 **Handheld field communicator wiring (4~20mA output only)**

Parameters of the transmitter can be read and set via a handheld field communicator that supports HART protocol.

The handheld field communicator is not an included accessory and need to be purchased by the user.

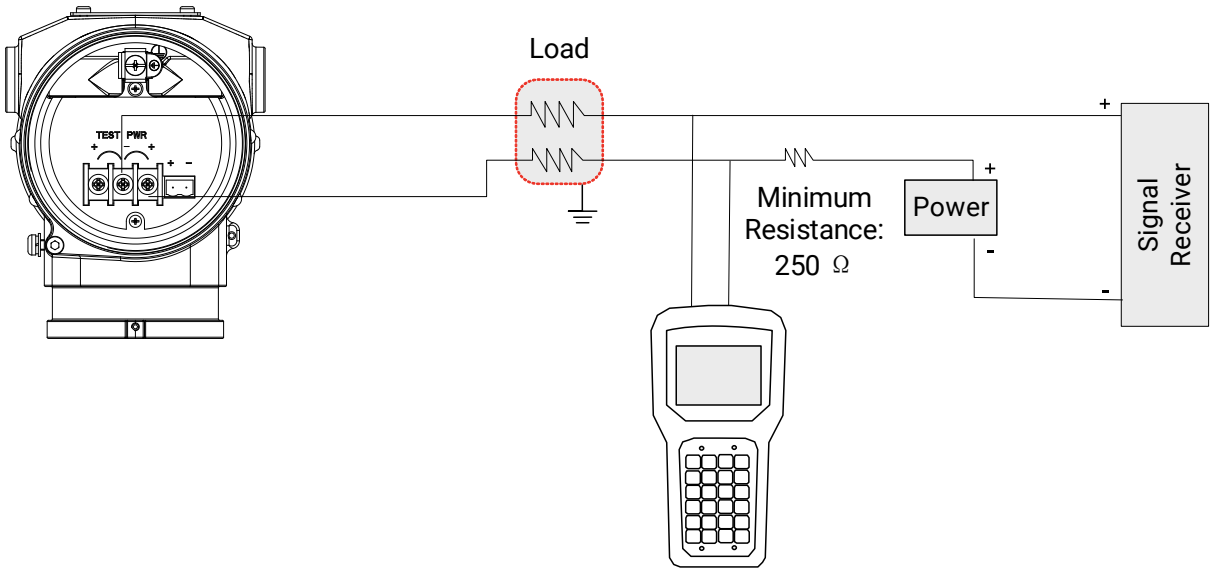


Figure 2-11 Transmitter and handheld field communicator wiring

Wire up the transmitter and a handheld field communicator as shown. The communicator can read and set parameters on the transmitter.

The communicator communicates through AC signals superimposed on 4~20mA output signals. This modulation does not change the mean value and therefore does not affect the measured signal. The resistance between the communicator and the power supply must be at least 250 Ω. If standard installation does not achieve this value, an additional resistor is required.

2.3 **Seal for housing**

After wiring and setting up, tighten the housing cover until there is no gap between the cover and the housing to achieve waterproof sealing.

For M20 wire inlet/outlet, install a conduit plug with the threads fully engaged or until mechanical resistance occurs.



M20 conduit plugs or cable entry with Ø 18 (ID) × 1.8 sealing ring are recommended.

2.4 **Cable protection**

To prevent liquid from flowing along the cable causing a liquid build-up at the waterproof connector or entering the junction box, set the cable between the wiring box and the transmitter in a U-loop with the bottom of the U-shape lower the pressure transmitter.

Please reserve a sufficient length of cable for service replacement.

3. **Quick set-up**

Once the installation is complete, the power supply is switched on and the transmitter is ready for use.

Refer to 3.1 for the power-up procedure. After power-up, perform zero trim and measurement span adjustment of the transmitter.

3.1 **Power-up procedure**

Before you start

The following must be checked before power is applied:

- Process connection and electrical connections are properly done.
- The impulse line and measuring chamber of the transmitter are filled with medium.

Steps

Follow the procedure to operate the valves before putting the transmitter into operation.

1. If a shut-off valve is present, open the shut-off valve.

2. Open the equalizing valve on the three-valve block (only for differential pressure transmitters, not for absolute or gauge pressure transmitters).

3. Open the isolate valve to positive chamber.

4. Shut the equalizing valve (only for differential pressure transmitters, not for absolute or gauge pressure transmitters).

5. Open the isolation valve to negative chamber (only for differential pressure transmitters, not for absolute or gauge pressure transmitters).

To exit operation of a transmitter, reverse the steps.



The three valve block is not included and requires the user purchasing.

3.2 **Zero trim and measurement range adjustment**

Zero offset may occur when mounting the transmitter, for example, tilted mounting position, uneven horizontal position of 2 chambers of differential pressure transmitter. The zero offset must be trimmed at this point.

The transmitter factory-set range may be different from the measurement range of the user's actual demand. Adjusting the transmitter to the actual desired range helps achieve a more accurate reading.

Zero trim and range adjustment can be achieved in the following ways:

- Use local control buttons of the transmitter.
- For the transmitter supports HART protocol, connect a field communicator to the transmitter (refer to 2.2.4) and perform zero trim. Refer to guide of your field communicator for instructions.
- For the transmitter supports MODBUS-RTU/RS-485 protocol, refer to Appendix A for more information on how to set the device via the protocol.

3.3 **Notes for 4-20 mA output**

If the measured pressure is within the range of the nameplate, the output current signal is 4~20mA. If the pressure is below the calibrated measurement range, the output signal is between 3.9 and 4mA, and if the pressure is above the calibrated measurement range, the output signal is between 20 and 20.5mA.

Output signal limit: I_{min}= 3.9mA, I_{max}= 20.5mA.

Alarm type can be set. Low mode (low) is 3.6 mA, high mode (high) is 21 mA, and no-alarm mode (keep) is the current value that was valid until the fault was occurred. The default setting is high mode.

4. Transmitter configuration (local buttons)

This chapter describes how to configure the transmitter with its operation menu and buttons.

The control buttons are located under the top nameplate. Unscrew the nameplate to reveal both the Z and S control buttons.

Secure the nameplate after configuration.

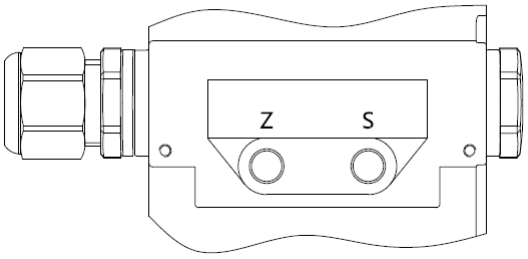


Figure 4-1 Local control buttons

4.2 Screen information and menu tree

4.2.1 Screen display

Use the (Z) (S) button on the top of the transmitter to adjust the screen display and transmitter parameters.

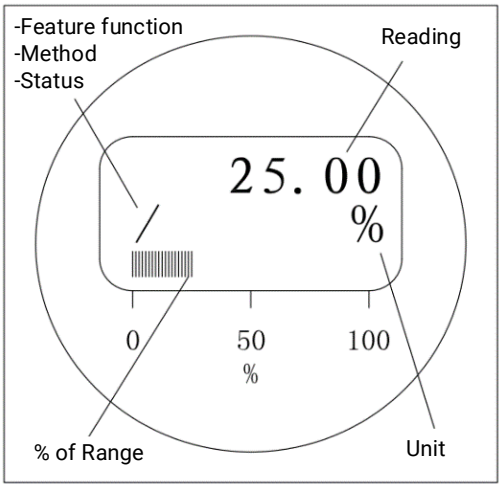


Figure 4-2 Screen display information

4.2.2 **Menu tree (4~20mA output)**

When the transmitter is powered up, with the menu not activated, enter the key "OK" (press the Z and S keys simultaneously) once to start the main menu. Navigate through the main menu with the Z and S keys and press the Z and S keys simultaneously again to access the sub-menu.

Table 4-1 Menu function (4~20mA output)

Number	Function	Menu Name	[Z] and/or [S] Operation
1	Preview	VIEW	View measured pressure and settings by press [Z] or [S]. 1. basic pressure value 2. % of range 3. static pressure value 4. PT100 temperature 5. electronic board temperature 6. lower range value (LRV) 7. upper range value (URV) 8. static pressure sensor lower limit 9. static pressure sensor upper limit

2	Get LRV	GET 0%	Press the 2 keys simultaneously to set the current pressure to the lower range value.
3	Get URV	GET 100%	Press the 2 keys simultaneously to set the current pressure to the upper range value.
4	Set LRV	SET 0%	Use the [Z] and [S] key to adjust to the desired value, and press them simultaneously to save the set value as the lower range value.
5	Set URV	SET 100%	Use the [Z] and [S] key to adjust to the desired value, and press them simultaneously to save the set value as the upper range value.
6	Zero trim	SHIFT ZERO	Press the 2 keys simultaneously to perform transmitter zero trim.
7	Analog reading shift	OFFSET SHIFT	Use the [Z][S] keys to adjust to an appropriate percentage value, press the 2 keys simultaneously to shift the analog reading to the actual pressure value.
8	Damping value	DAMPING	Use the [Z][S] key to adjust to the desired damping value, and press the 2 keys simultaneously to save the value (the damping value ranges from 0.1s to 60.0s).
9	Display mode	DISPLAY	Use the [Z][S] key to select the desired display type and press the 2 keys simultaneously to confirm the selection (pressure value, percentage, current, analog output).
10	Display accuracy	DIGITS	Use the [Z][S] key to select the screen display precision. Press the 2 keys simultaneously to save the settings. 0-4 indicates 0-4 decimal places retained.
11	Pressure Unit	UNIT	Use the [Z][S] key to select the desired pressure unit, and press the 2 keys simultaneously to confirm the selection.

12	Linear function	FUNCTION	Use the [Z][S] key to select the desired measurement linear function, and press the 2 keys simultaneously to confirm the selection (linear, square root, range flip).
13	Alarm mode	ALARM type	Use the [Z][S] key to select the desired alarm type, and press the 2 keys simultaneously to confirm the selection (high mode, low and, keep mode).
14	Analog output of LRV	OUT 0%	Use the [Z][S] key to set a value, and press the 2 keys simultaneously to save the analog output value as the lower range pressure.
15	Analog output of URV	OUT 100%	Use the [Z][S] key to set a value, and press the 2 keys simultaneously to save the analog output value as the upper range pressure.
16	Scaled variable	Out unit	Use the [Z][S] key to select the desired custom unit for readings, and press the 2 keys simultaneously to confirm the selection (flow, volume, length, density).
17	Loop test	LOOP TEST	An ammeter test is required. Use the [Z][S] key to select a fixed current value (3.6mA, 4.00mA, 8.00mA, 20.00mA, and 21mA are optional), and the transmitter outputs the set current. Press the 2 keys simultaneously to exit fixed current mode.
18	Small signal cut	CUT OFF	Use the [Z][S] key to adjust to the desired percentage value, and press the 2 keys simultaneously to confirm the setting (recommended value from 0.01% to 10%).
19	Lock/unlock button control	LOCK	Use the [Z][S] key to select the Unlocked (unLo) and Locked (Lo) states, and press the 2 keys simultaneously to confirm the selection. When locked, hold [Z] for 20 seconds to unlock.

20	Version number	SOFT VER	Display the current software version.

4.2.3 **Menu tree (RS-485 output)**

When the transmitter is powered up, with the menu not activated, enter the key "OK" (press the Z and S keys simultaneously) once to start the main menu. Navigate through the main menu with the Z and S keys and press the Z and S keys simultaneously again to access the sub-menu.

Table 4-2 Menu function (RS-485)

Number	Function	Menu Name	[Z] and/or [S] Operation
1	Preview	View	View measured pressure and settings by press [Z] or [S]. 1. basic pressure value 2. % of range 3. static pressure value 4. PT100 temperature (T1) 5. ambient temperature (T2) 6. lower range value (LRV) 7. upper range value (URV)
2	Zero trim	SHIFT ZERO	Press the 2 keys simultaneously to perform transmitter zero trim.
3	Damping value	DAMPING	Use the [Z][S] key to adjust to the desired damping value, and press the 2 keys simultaneously to save the value (the damping value ranges from 0.1s to 60.0s).

4	Display mode	DISPLAY CYCLE	Use the [Z][S] key to select the desired display type and press the 2 keys simultaneously to confirm the selection. P: pressure P%: % of range SP: static pressure (gauge transmitter shows as 0 NONE) PT100: PT100 temperature T: sensor temperature (ambient temperature)
5	Display accuracy	DISPLAY ACCUR	Use the [Z][S] key to select the screen display precision. Press the 2 keys simultaneously to save the settings. 0-4 indicates 0-4 decimal places retained.
6	Pressure unit	UNIT	Use the [Z][S] key to select the desired pressure unit, and press the 2 keys simultaneously to confirm the selection.
7	Small signal cut	SIGNAL CUT	Use the [Z][S] key to adjust to the desired percentage value, and press the 2 keys simultaneously to confirm the setting (recommended value from 0.01% to 10%).
8	Lock/unlock button control	LOCK	Use the [Z][S] key to select the Unlocked (unLo) and Locked (Lo) states, and press the 2 keys simultaneously to confirm the selection. When locked, hold [Z] for 20 seconds to unlock.
9	Temperature calibration	TEMP CAL	This feature is not available to users.
10	Address settings	ADDR	Set subordinate address. Use the [Z][S] key to adjust to the desired address value, and press the 2 keys simultaneously to confirm the setting.
11	Baud rate settings	BAUD	Set baud rate. 1200, 2400, 4800, 9600, 19200, and 38400 optional.

12	Set parity bit	PARITY	Select the parity bit. No parity, Odd, and Even, are selectable.
13	Communication Preview	COMM VIEW	Display order: 1. Address; 2. Baud rate; 3. Data bits; 4. Parity bit; 5. Stop bits
14	Software version	SOFT VER	Display the current software version.

4.3 **Operating instructions**

4.3.1 **Buttons**

Function of local control buttons [Z] and [S] are as follows:

Table 4-3 Button functions

Function	Button Operation
Confirm key	Press the [Z] and [S] buttons simultaneously, hold for 0.2-10 seconds and release them simultaneously.
Left key	Press the [Z] button, hold for 0.2-10 seconds and release.
Right key	Press the [S] key, hold for 0.2-10 seconds and release.

4.3.2 **Enter and exit menu**

When the menu is not activated, enter the Confirm key once to enter the menu.

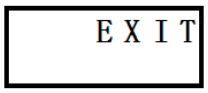


Figure 4-3 Main menu

Enter the Confirm key once when it displays as Figure 4-3 to exit the menu.

4.3.3 **Browse the menu**

Once the menu is activated, browse the menu by entering the left key [Z] and the right key [S].

- The left key [Z]: press to cycle the menu items from down to top.

- The right key [S]: press to cycle the menu items from top to down.
- The confirm key [Z] and [S]: confirm the selection or enter the sub-menu.

4.3.4 **Input data**

Select an option

Navigate through the options by entering the left (Z) key and the right (S) key, and confirm selection by entering the confirm key once.

The display shows OK to indicate successful setup.

Enter the Confirm key again to clearly prompt and return to the menu browsing state. If you need to exit the menu, see 4.3.2 Enter and exit menu.



Figure 4-4 Prompt for successful setup

Edit data

Some settings require the user to enter specific values. The following takes damping value setting as an example to illustrate the data editing.

Assuming the current damping value is 0.1s and the menu is not active. Now we need to change the damping value to 1.0s, and proceed is:

1. Enter the Confirm key once to launch the menu.

2. Enter the left (Z) key or the right (S) key several times to go DAMPING.



Figure 4-5 Menu Options - Damping Settings

3. Enter the Confirm key once to enter the damping setting (DAMPING). The display shows as in Figure 4-6.

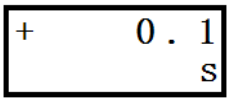


Figure 4-6 Damping setting

4. Enter the left (Z) key or right (S) key once to enter the editing state. The editable digit displays a blinking cursor.

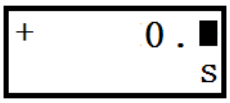


Figure 4-7 Data editing

Table 4-4 Data Editing Method

Function	Press the key
Move the cursor	Move the cursor with the Left key [Z]. Each time the Left key is entered, the cursor moves one digit to the left (decimal point skipped). If it is already the most left position, the cursor moves to the most right position.
Change number or sign of each digit	Pass the right key [S] to change the number or the sign. Each time the Right key is entered, the number at the cursor is added by 1, that is, 0 becomes 1, 1 becomes 2, and so on. Special variations include "9" to "0", "space" to "1", "+" to "-", "-" to "+".

5. When the data editing is completed (+1.000), enter the Confirm key once. A message OK appears on the display to indicate that the setup was successful.

If the input data exceeds the range, the transmitter prompts an error message as in Figure 4-8. Enter the Confirm key once to clear the prompt. Repeat the above steps to re-enter the data.



Figure 4-8 Error message

6. Enter the Confirm key once to return to menu.

4.4 View viariables and parameters

Go to VIEW menu to check the measured data for the current operating condition, including current pressure/differential pressure, % of Range, etc.

1. When the menu is not active, enter the Confirm key once to launch the menu.

2. Browse the menu via the left (Z) key and the right (S) key and select VIEW. Enter the confirm key once. The first variable "Pressure" is displayed.

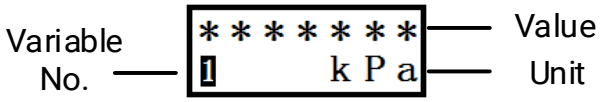


Figure 4-9 View variables

3. Enter the right (S) key once to switch to the next variable. See the menu tree for the supported variables and parameters in Table 4-1 and Table 4-6. Enter the left key [Z] to switch the items reversely.

4. When finished, enter the Confirm key once to return to the menu browsing.

4.5 Zero trim and measurement range adjustment

Before put into normal use, the transmitter should be zero trimmed and re-ranged to obtain more accurate measurement result. The following introduces several common conditions and corresponding adjustment suggestions.

4.5.1 Get analog lower range (4~20mA output only)

Condition

There is a differential pressure transmitter installed in site whose upper sensor limit is 40 kPa and measurement range is 0 to 20 kPa. In normal use, when pipe differential pressure is 0 to 20 kPa, it displays 0.1 to 20.1 kPa and outputs current from 4.08 to 20.08 mA.

Adjustment

The output current value changes to 4~20mA while the pressure reading display remains unchanged.

Procedure

1. Set the pipe differential pressure to 0 kPa and the transmitter displays +0.1 kPa.
2. Launch the menu, and navigate to **GET 0%**.
3. Enter the Confirm key once, the program changes the measurement range to 0.1 to 20.1 kPa and displays the message OK;
4. Enter the Confirm key once to clear the prompt and return to the menu browsing.
5. Navigate to VIEW menu, and you can see the first variable is 0.1 kPa and the third variable is 4 mA.
6. Make the pipe differential pressure 20 kPa.
7. Navigate to VIEW menu, and you can see that the first variable is 20.1 kPa and the third variable is 20 mA.
8. Exit the menu.

4.5.2 Get analog upper range (4~20mA output only)

Conditions

There is a differential pressure transmitter installed in site whose upper sensor range is 40 kPa and measurement range is 0 ~ 40 kPa. In normal use, the differential pressure in pipe is 0 to 20 kPa, and it displays 0 to 20 kPa and outputs current from 4 to 12 mA.

Adjustment

The output current value changes to 4 to 20mA while the pressure reading display remains unchanged.

Procedure

1. Set the pipe differential pressure to 20kPa. The transmitter displays +20 kPa.
2. Launch the menu, and navigate to **GET100%**.
3. Enter the Confirm key once, program changes the measurement range to 0 to 20kPa and displays the message OK.
4. Enter the Confirm key once to clear the prompt and return to the menu browsing.
5. Navigate to VIEW menu, and you can see the first variable is 20kPa and the third variable is 20mA.
6. Make the pipe differential pressure 0 kPa.
7. Navigate to VIEW menu, and you can see that the first variable is 0kPa and the third variable is 4mA;
8. Exit the menu.

4.5.3 Set analog lower range value (4~20mA output only)

Conditions

There is a differential pressure transmitter installed in site whose upper sensor range is 40 kPa, and the measurement range is 0 ~ 20 kPa. In normal use, when pipe differential pressure is -4 to 20 kPa, it displays -4 to 20k Pa and output current from 3.9 to 20mA.

Adjustment

The output current value changes to 4 to 20mA while the pressure reading display remains unchanged.

Procedure

1. Launch the menu, and navigate to SET 0%.
2. Enter the Confirm key once, and it displays 0 kPa as the lower range.

3. Enter the left (Z) or right (S) key once to enter data editing, and a blinking cursor appears on the display.

4. Change the value to -4 kPa. Refer to 4.3.4 Input data.

5. Enter the Confirm key once. The program changes the lower range to -4 kPa and displays OK.

6. Enter the Confirm key once to clear the prompt and return to menu browsing.

7. Adjust the pipe differential pressure to -4 kPa.

8. Navigate to VIEW menu, and you can see the first variable is -4 kPa and the third variable is 4 mA.

9. Adjust the pipe differential pressure to 20 kPa.

10. Navigate to VIEW menu, and you can see the first variable is 20kPa and the third variable is 20mA.

11. Exit the menu.

4.5.4 **Set analog upper range value (4~20mA output only)**

Conditions

There is a differential pressure transmitter installed in site whose upper sensor range is 40 kPa, and the measurement range is 0 to 40 kPa. In normal use, when pipe differential pressure is 0 to 20 kPa, it displays 0 to 20kPa and outputs current from 4 to 12 mA.

Adjustment

The output current value changes to 4 to 20mA while the pressure reading display remains unchanged.

Procedure

1. Launch the menu, and navigate to SET 100%.

2. Enter the Confirm key once, it displays 40 kPa as the upper range.
3. Enter the left (Z) or right (S) key once to enter data editing, and a blinking cursor appears on the display.
4. Change the value to 20 kPa. Refer to 4.3.4 Input data.
5. Enter the Confirm key once. The program changes the upper range to 20 kPa and displays OK.
6. Enter the Confirm key once to clear the prompt and return to the menu browsing.
7. Make the pipe differential pressure 0 kPa.
8. Navigate to VIEW menu, and you can see the first variable is 0kPa and the third variable is 4 mA;
9. Make the pipe differential pressure 20 kPa;
10. Navigate to VIEW menu, and you can see the first variable is 20 kPa and the third variable is 20 mA;
11. Exit the menu.

4.5.5 **Shift digital zero**

Conditions

There is a differential pressure transmitter installed in site whose upper sensor range is 40 kPa, and the measurement range is 0 to 20 kPa. In normal use, when the pipe differential pressure is 0 to 20 kPa, it display 0.1 to 20.1 kPa.

Adjustment

Change the display reading to 0 to 20 kPa.

Procedure

1. Set the pipe differential pressure to 0 kPa, and the transmitter displays +0.1 kPa.

2. Launch the menu, navigate to **SHIFT ZERO**.

3. Enter the Confirm key once, and the program modifies the digital zero value and displays OK.

4. Enter the Confirm key once to clear the prompt and return to menu browsing.

5. Navigate to VIEW menu, and you can see the first variable is now 0kPa.

6. Make the pipe differential pressure 20 kPa.

7. Navigate to VIEW menu, and you can see the first variable is now 20 kPa.

8. Exit the menu.

4.5.6 **Shift analog range (4~20mA output only)**

Conditions

There is a differential pressure transmitter installed in site whose upper sensor range is 40 kPa, and the measurement range is 0 to 40 kPa. In normal use, when pipe differential pressure is -20 to 20 kPa, it displays -20 to 20 kPa and outputs current from 3.9 to 12 mA.

Adjustment

The output current value changes to 4 to 20mA while the pressure reading display remains unchanged.

Procedure

1. Set the pipe differential pressure to 0 kPa, and the transmitter displays 0kPa.

2. Launch the menu, and navigate to **OFFSET SHIFT**.

3. Enter the Confirm key once, and it displays the current pressure/differential pressure in percent of range +0.00%.

4. Enter the left (Z) or right (S) key once to enter data editing, and a blinking cursor appears on the display.

5. Change the value to +50%. Refer to 4.3.4 Input data for the way of editing, and refer to next step for the calculation of % of modified quantity.

6. Enter the Confirm key once and the program will shift the analog range, i.e. the upper and lower ranges will be modified the same way and quantity. The modifications are made in accordance with the following formula:

   1) Span = upper range – lower range = 40 – 0 = 40 kPa

   2) % of modified quantity = % after shift – % before shift = 50.00% - 0.00% = 50.00%

   3) Modified quantity = span × % of modified quantity = 40 × 50.00% = 20 kPa

   4) Upper range after shift = original upper range – modified quantity = 40 – 20 = 20 kPa

   5) Lower range after shift = original lower range – modified quantity = 0 – 20 = -20 kPa

7. Enter the Confirm key once to clear the prompt and return to menu browsing.

8. Navigate to VIEW menu, and you can see the first variable is 0kPa and the third variable is 12 mA.

9. Make the pipe differential pressure 20 kPa.

10. Navigate to VIEW menu, and you can see the first variable is 20 kPa and the third variable is 20 mA.

11. Make the pipe differential pressure -20 kPa.

12. Navigate to VIEW menu, and you can see the first variable is, and you can see the first variable is -20kPa and the third variable is 4mA.

13. Navigate to SET 0% menu, and you can see the lower range is now –20 kPa.

14. Navigate to SET 100% menu, and you to see the upper range is now +20 kPa.

15. Exit the menu.

4.6 **Set pressure unit**

Sets the unit for pressure/differential pressure (the first variable). Available units are as follows.

Table 4-5 Unit of pressure

Number	Name	Display	Number	Name	Display
1	Pa	Pa	11	inches of mercury	inHg
2	KPa	kPa	12	feet of water at 20°C/68°F	ftH2O
3	Torr	torr	13	millimeters of water at 20°C/68°F	mmH2O
4	ATM	atm	14	millimeters of mercury	mmHg
5	MPa	MPa	15	Psi	psi
6	meters of water at 20°C/68°F	mH2O	16	bar	bar
7	meters of water at 4°C/39°F	mH4O	17	mbar	mbar
8	inches of water at 4°C/39°F	inH4O	18	g/cm2	g/cm2
9	millimeters of water at 4°C/39°F	mmH4O	19	Kg/cm2	kg/c2
10	inches of water at 20°C/68°F	InH2O			

Procedure

1. Launch the menu, and navigate to UNIT.

2. Enter the Confirm key once to enter the pressure unit setting.

3. Enter the left (Z) or right (S) key to browse the units, and confirm the selection.

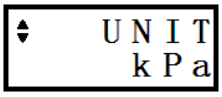


Figure 4-10 Pressure unit setting

4. The transmitter prompts OK.

5. Enter the Confirm key once to clear the prompt and return to the menu browsing.

6. Exit the menu, and check on the first variable to see if the unit changes to the set one.

4.7 **Set damping value**

User-selected damping will affect the transmitter's ability to respond to changes in the applied process. A higher value can smooth variations in output readings caused by rapid input changes.

For applications where pressure changes frequently, increase the damping time appropriately can stabilize the reading. Do not increase the damping time arbitrarily, which may block some sudden abnormal pressures from being measured.

In most conditions, use the factory settings. If adjustment is required, refer to the setting described in 4.3.4 .

Valid damping values range from 0.1s to 60s. If the input parameter exceeds the range, the transmitter prompts an error message.

4.8 **Adjust default variable display when menu is inactive**

When the menu is not activated, the transmitter displays the first variable in the VIEW menu. The default display can be adjusted via **DISPLAY/DISPLAY CYCLE** menu.

Assume that the second variable % of Range is the default variable for display. The procedure of changing it to the first variable Pressure/Differential Pressure is as follows:

Procedure

1. Launch the menu, and navigate to **DISPLAY/DISPLAY CYCLE** menu.
2. Enter the Confirm key once and it displays the second variable (%).
3. Enter the left (Z) or right (S) key to navigate to the first variable (Pressure/Differential Pressure, displayed in its unit).
4. Enter the Confirm key once, and it displays OK.
5. Enter the Confirm key once to clear the prompt and return to the menu browsing.
6. Exit the menu, and check the default display.

4.9 **Set decimal places of reading**

Sets the decimal places for the data displayed on the screen. Go to the DIGITS menu, and the option 0 to 4 stands for 0 to 4-digits retained after the decimal point.

1. Launch the menu, and navigate to **DIGITS**.
2. Enter the Confirm key once.
3. Switch between 0 and 4 with the left (Z) or right (S) key. 0 means no decimal places, and 4 means 4 decimal places.
4. Enter the Confirm key once, and it prompts OK.
5. Enter the Confirm key once to clear the prompt and return to the menu browsing.
6. Exit the menu, and check the change of reading.

4.10 **Set scaled variable of analog output (4~20mA output only)**

Set the unit for the scaled variable of the analog output (fourth variable in the VIEW menu). Available options are units of flow, volume, length, density units, etc. See the table below.

Table 4-6 Table of functional units of analog output

No.	Name	Display	No.	Name	Display
Volumeric flow rate					
1	cubic meters per second	m3/s	8	cubic feet per second	ft3/s
2	cubic meters per minute	m3/m	9	cubic feet per minute	ft3/m
3	cubic meters per hour	m3/h	10	cubic feet per hour	ft3/h
4	cubic meters per day	m3/d	11	gallons per second	gal/s
5	litres per second	L/s	12	gallons per minute	gal/m
6	litres per minute	L/m	13	gallons per hour	gal/h
7	litres per hour	L/h			
Volume					
14	cubic meters	m3	17	cubic feet	ft3
15	litres	L	18	cubic inches	in3
16	US gallons	gal			
Length					
19	meters	m	21	feet	ft
20	milimeters	mm	22	inches	in
Mass					
23	kilograms	kg	25	pounds	lb
24	tons	t			
Mass flow rate					
26	kilograms per second	kg/s	31	tons per day	t/d.
27	kilograms per minute	kg/m	32	pounds per second	lb/s
28	kilograms per hour	kg/h	33	pounds per minute	lb/m
29	tons per minute	t/m	34	pounds per hour	lb/h
30	tons per hour	t/h			
Mass volume (density)					

No.	Name	Display	No.	Name	Display
35	kilograms per cubic meter	kg/m3	37	grams per liter	g/L
36	kilograms per liter	kg/L			

Procedure

1. Launch the menu, and navigate to **OUT UNIT**.
2. Enter the Confirm key once.
3. Switch output units with the left (Z) or right (S) key.
4. Enter the Confirm key once and it prompts OK.
5. Enter the Confirm key once to clear the prompt and return to the menu browsing.
6. Exit the menu, and check the fourth variable display via the VIEW menu.

4.11 Set alarm current type (4~20mA output only)

Set the type of alarm current from high, low, and no alarm (keep) modes. The current value is 3.6 mA for low mode, 21 mA for high mode, and the current value valid until the fault occurs for keep mode. The factory setting is high mode.

1. Launch the menu, navigate to the **ALARM TYPE**.
2. Enter the Confirm key once and it displays the current alarm type.
3. Switch the alarm current type with the left (Z) or right (S) key.
4. Enter the Confirm key once and it displays the current value for the alarm type.
5. Enter the Confirm key once and it prompts OK.
6. Enter the Confirm key once to clear the prompt and return to the menu browsing.

4.12 **Feature function selection (4~20mA output only)**

Three options are ctable in FUNCTION menu, linear, square root, and range flip.

Range Flip: it flips the linear relationship between pressure and current. For example, if 4 mA represents 0 kPa and 20 mA represents 40 kPa before range flip, 4 ma represents 40 kPa and 20 mA for 0 kPa after flip.

Procedure

1. Launch the menu and navigate to **FUNCTION** menu.

2. Enter the Confirm key once and it displays the current function.

3. Switch the function with the left (Z) or right (S) key.

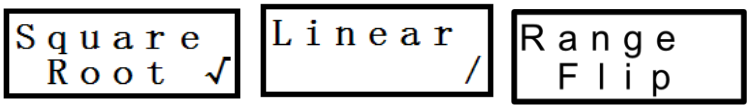


Figure 4-11 Options: Square Root (Left) Linear (Mid) Range Flip (Right)

4. Enter the Confirm key once and it displays OK.

5. Enter the Confirm key once to clear the prompt and return to the menu browsing.

6. Exit the menu. The function icon is displayed besides the reading.

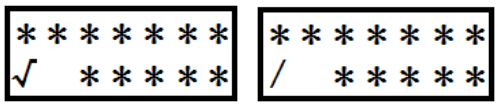


Figure 4-12 Square root (left) linear (right)

"*" indicates an indeterminate display.

4.13 **Communication settings (RS-485 models only)**

The communication follows the MODBUS-RTU communication protocol (RS-485) and the transmitter is the subordinate. The transmitter subordinate communication address, baud rate, and parity digit need to be set.

The communication parameters can be viewed through the COMM VIEW menu.

For more information on the MODBUS-RTU protocol, see Appendix A MODBUS-RTU Protocol.

4.13.1 **Set communication address**

Transmitter is the subordinate. The permitted address ranges from 1 to 255.

1. Launch the menu, and navigate to **ADDR** menu;
2. Enter the Confirm key once.
3. Enter values. Refer to 4.3.4 .
4. Enter the Confirm key once and it displays OK.
5. Enter the Confirm key once to clear the prompt and return to the menu browsing.

4.13.2 **Set baud rate**

The setting shall be consistent with the host baud rate setting.

1. Launch the menu and navigate to **BAUD** menu.
2. Enter the Confirm key once.
3. Switch the options with the left (Z) or right (S) key.
4. Enter the Confirm key once to confirm the modification. And it displays OK.
5. Enter the Confirm key once to clear the prompt and return to the menu browsing.

4.13.3 **Set parity bit**

The setting shall be consistent with the host parity bit setting.

1. Launch the menu, and navigate to **PARITY** menu.
2. Enter the Confirm key once.

3. Switch the options with the left (Z) or right (S) key.

4. Enter the Confirm key once to confirm the modification. And it displays OK.

5. Enter the Confirm key once to clear the prompt and return to the menu browsing.

4.13.4 **Preview communication parameters**

Display order: 1. subordinate address; 2. baud rate; 3. data bits; 4. parity; 5. stop bits.

1. Launch the menu, and navigate to **COMM VIEW** menu.

2. Enter the Confirm key once.

3. Enter the left (Z) or right (S) key to browse the parameters.

4. Enter the Confirm key once to return to the menu browsing.

5. Maintenance and repair

5.1 Maintenance

5.1.1 Varify output signal regularly

Regularly verify the output signals according to the operating instructions in the 4 Transmitter configuration (local buttons) .

5.1.2 Clean transmitter

There may be deposits on transmitter even in normal use. Thus, the transmitter should be cleaned regularly according to the field application conditions. The cleaning is recommended to be done indoors. The procedure is as follows.

1. Loosen the hex nut of the process flange.
2. Carefully remove the flange. Avoid scratching, puncturing, or depressing the isolating diaphragms.
3. Clean isolating diaphragms and flange with a soft brush and a mild cleaning solution and rinse with clear water.
4. Replace the O-ring of the process flange.
5. Reassemble the process flange. Avoid scratching, puncturing, or depressing the isolating diaphragms. (The cross-sections of both process flanges must be kept in the same plane and at the correct angle to the housing.)
6. Tighten the nuts with a torque wrench, and check for leaks.

5.2 Repair

Safety regulations must be following throughout the entire process of use. Disassemble is allowed only during cleaning, inspection, and repair.

The sensor should only be repaired by the manufacturer. Malfunctioned transmitters should be returned to the manufacturer for repair providing of fault description and possible causes.

Appendix A. MODBUS-RTU Protocol

A.1 Data format

A.1.1 Communication protocol

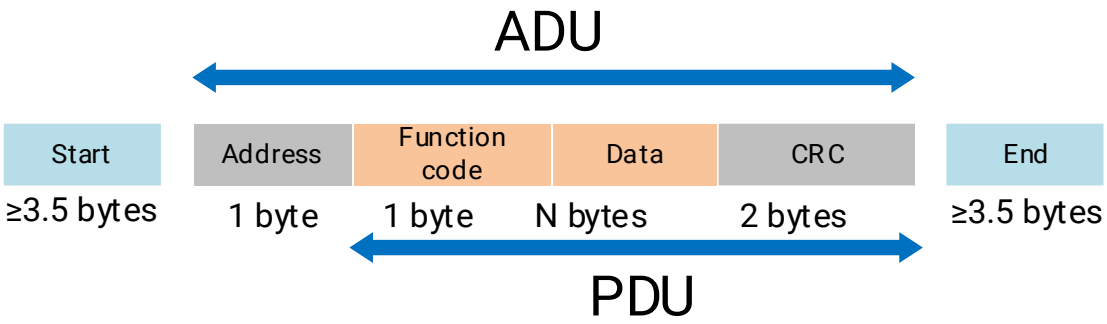
The communication with the transmitter adopts the master and subordinate query mode in MODBUS RTU protocol.

A.1.2 Communication data format

The subordinate address specified in the protocol is 0-255. As 0 is used for broadcasting which is not supported in this protocol version, 1 to 255 are usable.

The default data format is (9600, 8, E, 1), in which 9600 is the baud rate, 8 is data bits, E is even parity, and 1 is the stop bit.

The start and end of the data frame require idle time of more than 3.5 bytes.



A.2 Commands

The transmitter uses command 0x03, 0x04, 0x06, and 0x10 in the MODBUS protocol.

A.2.1 **Modbus registers**

Type	Size	Permission	Content
Input register	2 Bytes	Read-only	I/O systems provide this type of data
Holding register	2 Bytes	Read-write	Change this type of data through the application

A.2.2 **Data format**

The integers involved in the command are represented as 16-bit unsigned integers. Floating point numbers are in the 4-byte (32-bit) IEEE754 format, and the 4-byte order is 1032.

When converted to the 0123 order, the highest to lowest bits are 31-0 bits.

31	30-23	22-0
Sign (S)	Exponent	Mantissa

For the sign bit, 1 means that the float is negative and 0 is positive.

A.3 **Registers and commands in use**

A.3.1 **Holding register**

The holding register saves the device and configuration information.

Register address	Holding register number	Function	Description	Function code
0001	40001	Pressure unit	See the unit code in A.3.4 .	0x03, 0x06
0002	40002	Static pressure unit	Same with the pressure unit or common unit MPa (kPa, psi)	0x03, 0x06
0003	40003	Instrument type (read-only)	0: Pressure 1: Temperature 2: Flow - orifice plate 3: Flow - venturi	0x03

Register address	Holding register number	Function	Description	Function code
0004	40004	Sensor type (read-only)	0: Differential pressure 3: Gauge pressure 6: Absolute pressure	0x03
0005	40005	Sensor range code (read-only)	Code — Meaning 0 — 1 kPa 1 — 6 kPa 2 — 40 kPa 3 — 250 kPa 4 — 1000 kPa 5 — 3000 kPa 6 — 10 MPa 7 — 21 MPa 8 — 40 MPa 9 — 60 MPa 10 — 70 MPa 11 — 4000 kPa 12 — 10 kPa 13 — 100 kPa	0x03
0006	40006	Subordinate address	Range: 1-255	0x03, 0x06

Register address	Holding register number	Function	Description	Function code
0007	40007	Baud rate	Default 9600 bps Code Baud rate (bps) 0 1200 1 2400 2 4800 3 9600 4 19200 5 38400 NOTE: Reboot is NOT requried for the modification taking effect. Adjust the upper machine baud rate value to match the instrument before communication.	0x03, 0x06
0008	40008	Parity	Default parity: Even Code Parity mode 0 No parity 1 Odd parity 2 Even parity NOTE: Reboot is NOT requried for the modification taking effect. Adjust the upper machine baud rate value to match the instrument before communication.	0x03, 0x06
0009	40009	Data bits (read-only)	Default 8 bits	0x03
0010	40010	Stop bits (read-only)	Default 1 bit	0x03

Register address	Holding register number	Function	Description	Function code
0011	40011	4-byte data format	Default: 1032 Code Data format 0 1032 order 1 3210 order 2 0123 order 3 2301 order Note: 1) This data format is for floating point reading and writing; 2) modifications are not recommended.	0x03, 0x06
0012	40012	Display	0: Pressure; 1: Percentage; 2: Static pressure; 3: Temperature	0x03, 0x06
0013-14	40013-14	Measurement lower range	User set lower range, which affects % of range calculation.	0x03, 0x10
0015-16	40015-16	Measurement upper range	User set upper range, which affects % of range calculation.	0x03, 0x10
0017-18	40017-18	Damping	Unit: seconds (s).	0x03, 0x10
0019-20	40019-20	Small signal cut	Unit: % of range	0x03, 0x10
0021-22	40021-22	Lower sensor limit (read-only)		0x03
0023-24	40023-24	Upper sensor limit (read-only)		0x03
Reserved				
0031	40031	Zero shift (operaiton only)	0: not perform 1: perform once	0x03, 0x06

Register address	Holding register number	Function	Description	Function code
0032	40032	Device reboot (operaiton only)	0: not perform 1: perform	0x03, 0x06
Reserved				
0051	40051	Factory number - year (2 digits, read only)	Example: 19 (year 2019)	0x03
0052	40052	Factory number – month (2 digits, read only)	Example: 08 (August)	0x03
0053	40053	Factory number - sensor type (1 digit, read only)	Example: 2 (pressure sensor)	0x03
0054	40054	Factory number – serial number high (2 digits, read only)	Example: 02 (meaning 20000)	0x03
0055	40055	Factory number – serial number low (2 digits, read only)	Example: 5885 (meaning 5885)	0x03
0056	40056	Software version (read only)	Example: 30 (R30, R30T01)	0x03
0057	40057	Software revision (read only)	Example: 1 (T01, R30T01)	0x03

Register address	Holding register number	Function	Description	Function code
Reserved				
0061	40061	Bit No.1	2-byte integer data, read and write. Data saved when powered off.	0x03, 0x06
0062	40062	Bit No.2	2-byte integer data, read and write. Data saved when powered off.	0x03, 0x06
0063	40063	Bit No.3	2-byte integer data, read and write. Data saved when powered off.	0x03, 0x06
0064	40064	Display cycle: 1st display	0: pressure; 1: % of range; 2: static pressure; 3: PT100 temperature; 4: PCB temperature NOTE: Duplicates amoung 3 display items are counted as one option.	0x03, 0x06
0065	40065	Display cycle: 2nd display	0: pressure; 1: % of range; 2: static pressure; 3: PT100 temperature; 4: PCB temperature NOTE: Duplicates amoung 3 display items are counted as one option.	0x03, 0x06
0066	40066	Display cycle: 3rd display	0: pressure; 1: % of range; 2: static pressure; 3: PT100 temperature; 4: PCB temperature NOTE: Duplicates amoung 3 display items are counted as one option.	0x03, 0x06

Function code 03: read holding register

- Function code: 0x03
- Register address: 0001-0024 and 0051~0063
- Data length: 24 bytes or less (12 holding registers total)

Read the value of the holding register. Read 16-bit integers (accounting for two bytes) from registers 0001 to 0012 and registers 0051 to 0057. Read floating-point number (4 bytes for each) from registers 0013 to 0024.

MODBUS request

Function code	1 byte	0x03
Start address	2 byte	0x0000 to 0x0017 or 0x0032 to 0x003E
Number of reads	2 bytes	0x0001 to 0x000C

MODBUS response

Function code	1 byte	0x03
Byte count	1 byte	N*2
Input status	N*2 byte	

Error response

Function code	1 byte	0x03 + 0x80
Error code	1 byte	0x01, 0x02, 0x03, 0x04. See A.3.3 for code explaination.

Examples

Request	Addr 03 00 00 00 03 CRC0 CRC1
Response	Addr 03 06 00 00 00 01 00 02 CRC2 CRC3



Addr is the subordinate address, and CRCn is the CRC checksum value.

Function code 06: write one holding register

- Function code: 0x06
- Register address: 0001-0012, 0031~0034, and 0061~0063
- Data length: 2 bytes



Writing holding register (address ranges from 0001 to 0012, 0031 to 0034, and 0061 to 0063) individually is supported.

MODBUS request

Function code	1 byte	0x06
Start address	2 byte	0x0000~0x000B, 0x001E~0x0021, or 0x003C~0x003E

Content	2 byte	

MODBUS response

Function code	1 byte	0x06
Start address	2 byte	0x0000~0x000B, 0x001E~0x0021, or 0x003C~0x003E
Content	2 byte	

Error response

Function code	1 byte	0x06 + 0x80
Error code	1 byte	0x01, 0x02, 0x03, 0x04. See A.3.3 Error code for code explaination.

Examples

Request	Addr 06 00 01 00 01 CRC0 CRC1
Response	Addr 06 00 01 00 01 CRC2 CRC3

Addr is the subordinate address, and CRCn is the CRC checksum value.

Function code 16: write multiple holding registers

- Function code: 0x10
- Register address: 0013~0024
- Data length: 4 bytes

Because the 6# command writes only one register, 16# commands can be used for floating-point numbers that take up two registers. Only one float can be written at a time.

MODBUS request

Function code	1 byte	0x10
Start address	2 byte	0x000C to 0x0017
Set the length	2 byte	0x0002
Byte count	1 byte	0x04

Content	4 byte	

MODBUS response

Function code	1 byte	0x10
Start address	2 byte	0x000C to 0x0017
Data length	2 byte	0x0002

Error response

Function code	1 byte	0x10 + 0x80
Error code	1 byte	0x01, 0x02, 0x03, 0x04. See A.3.3 Error code for code explaination.

Examples

Set holding register 17~18 to set damping to 1s.

Request	Addr 10 00 10 00 02 04 00 00 00 3F 80 CRC0 CRC1
Response	Addr 10 00 10 00 02 CRC2 CRCRC3



Addr is the subordinate address, and CRCn is the CRC checksum value.

A.3.2 **Input registers**

Read variables.

Register address	Register number	Function	Description	Function code
0001-02	30001-02	Pressure		0x04
0003-04	30003-04	Pressure in %	Unit: % of range	0x04
0005-06	30005-06	Static pressure		0x04
0007-08	30007-08	Temperature - PT100		0x04
Reserved				

Register address	Register number	Function	Description	Function code
0021	30021	Lower alarm register	Lower alarm status 0001 Operating flow 0004 Standard flow 0010 Pressure 0040 Temperature Note: 1) There is no upper or lower limit setting for the multiple variable instrument now. Alarm function is available for sensor overrange notification; 2) The register keeps the alarm notification that measured value exceeds the lower sensor range.	0x04
0022	30022	Upper alarm register	Upper alarm status 0001 Operating Flow 0004 Standard Flow 0010 Pressure 0040 Temperature NOTE: The register keeps the alarm notification that measured value exceeds the upper sensor range.	0x04

Register address	Register number	Function	Description	Function code
0023	30023	Fault location register	Example: 2 (02, indicating a problem during pressure collection) (ERROR 02 12, pressure chip damaged or overloaded) Note: It prompts an error code when abnormal operating condition is present. Provide this code to service personnel if an unresolvable error code occurs.	0x04
0024	30024	Fault type register	Example: 12 (12 indicates that chip damage or overload is present during pressure collection) (ERROR 02 12, pressure chip damaged or overloaded)	0x04



In the protocol, the register address begins with 1. In command sending, the actual use of the register address starts at 0. For example, for the holding register number 40002 (static pressure unit), the register address is 2, and the actual register address in command is 1. 30000~39999 is the input register number in actual use.

Function Code 04: read input register

- Function code: 0x04
- Register number: 0001-0008 and 0021~0024
- Data length: 24 bytes or less



Read input data. 32-bit floating point number for register number from 0001 to 0008, and hexadecimal data or integer for register from 0021 to 0024.

MODBUS request

Function code	1 byte	0x04
Start address	2 byte	0x0000 to 0x0007, or 0x0014 to 0x0017
Input quantity	2 byte	0x0001 to 0x000C

MODBUS response

Function code	1 byte	0x04
Byte count	1 byte	N*2
Input status	N*2 byte	

Error response

Function code	1 byte	0x04 + 0x80
Error code	1 byte	0x01, 0x02, 0x03, 0x04. See A.3.3 Error code for code explaination.

Examples

Request	Addr 04 00 00 00 08 CRC0 CRC1
Response	Addr 04 10 72 EF 3D FF 85 12 3E AB 00 00 00 00 00 FF 00 47 7F CRC2 CRC3

Addr is the subordinate address, and CRCn is the CRC checksum value.

A.3.3 **Error code**

This error code is an error prompt that is answered when the command requirements are not met.

Error code	Meaning
0x01	Funciton code exception
0x02	For read operations: wrong starting address or number of registers For write operation (function code 6): start address exception For write operations (function code 16): wrong start address, or wrong start address and number of registers

0x03	For read operations: wrongt number of registers For write operation (function code 6): abnormal data input For write operations (function code 16): wrongt number of registers or bytes (bytes = number of registers×2)
0x04	The set data exceeds the range or sensor damaged

A.3.4 **Pressure unit code**

No.	Name	Code	Display
1	inches of water at 20 °C / 68 °F	1	inH2O
2	inches of mercury	2	inHg
3	feet of water at 20°C / 68°F	3	ftH2O
4	millimeters of water at 20 °C / 68 °F	4	mmH2O
5	millimeters of mercury	5	mmHg
6	Psi	6	psi
7	bar	7	bar
8	mbar	8	mbar
9	g/cm2	9	g/cm2
10	Kg/cm2	10	kg/c2
11	Pa	11	Pa
12	KPa	12	kPa
13	Torr	13	torr
14	ATM	14	atm
15	meters of water at 4 °C / 39 °F	171	mH4O
16	MPa	237	MPa
17	inches of water at 4 °C / 39 °F	238	inH4O
18	milimeters of water at 4 °C / 39 °F	239	mmH4O
19	meters of water at 20 °C / 68 °F	240	mH2O