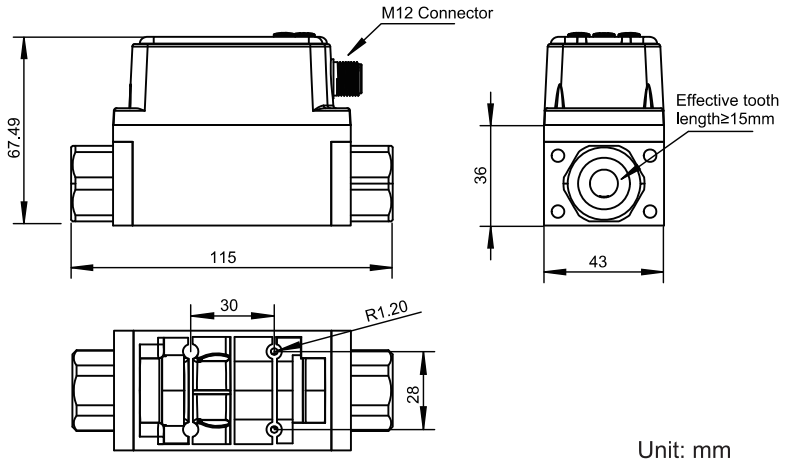
# Vortex Flow Sensor

## FMVH-040-IOL-G12 Dual switching outputs and IO-Link




Unit: mm

- Based on the von Karman vortex-street principle
- Dual outputs and dual-display for flow and temperature
- Digital output: NO / NC, NPN / PNP / Push-Pull selectable
- TFT colour display
- M12 A-coded, 4-pin connector
- IO-Link Class A interface
- Totalised flow recording function
- Selectable units, simple operation via push-button menu
- Four freely-adjustable viewing directions
- Compact dimensions, low space requirement

| Model | FMVH-040-IOL-G12 |
|---|---|
| Operating voltage | 24VDC ± 10% |
| Operating current | <100mA |
| **Flow parameters** | |
| Measured medium | water |
| Measuring range | 2 - 40 L/min (0.12 - 2.4 $m^3$/h) |
| Flow accuracy | < 3.0%F.S |
| Totalised flow range | 99999 L or 99999 $m^3$.<br>Note: Reset on power-cycle, for reference only |
| Wetted materials | ETFE/PA6T/SUS 304 stainless steel |
| Process connection | G1/2 female thread |
| Pressure rating | 12 bar; maximum pressure: 18 bar |
| Instantaneous flow unit | L/min or $m^3$/h, selectable via button |
| Output signal | switching signal; IO-Link; (configurable)<br>NPN/PNP/Push-Pull; NO/NC;<br>Hysteresis/Window(parameterisable) |
| Digital output current | 250mA |
| Set point SP | 2.4 L/min - 40 L/min |
| Reset point rP | 2 L/min - 39.6 L/min |
| Minimum SP-rP separation | 0.4 L/min |
| Resolution | 0.1 L/min |
| **Temperature parameters** | |
| Measuring range | 0-100℃ |
| Temperature accuracy | 1℃ |
| Display unit | °C or °F, selectable via button |
| Output signal | NPN/PNP/Push-Pull; NO/NC; Hysteresis/Window, (parameterisable) |
| Digital output current | 250mA |
| Set point SP | 1°C - 100°C |
| Reset point rP | 0 ℃- 99℃ |
| Minimum SP-rP separation | 1°C (1% F.S.) |
| Resolution | 0.1°C |
| **IO-Link** | |
| Vendor ID | 1317 (0x0525) |
| Device ID | 198162(0x030612) |
| Number of interfaces | 1 |
| IO-Link revision | V1.1 |
| Required master port type | Class A |
| Frame type | TYPE_2_V |
| Transmission type | COM2 38.4 kbit/s |
| Minimum cycle time | 3000us |
| ISDU (indexed service) | supported |
| Block parameter operation | not supported |
| Data storage (DS) | supported |
| Data storage lock | supported.<br>Note: This function is enabled for compatibility, but no operation will be executed by the device. |
| Ambient temperature | -10...+65°C |
| Protection | IP65 |

### M12 interface

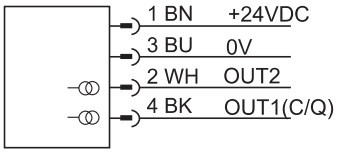



1 = +24VDC
2 = OUT2
3 = 0V
4 = OUT1(C/Q)

Note:
OUT1: Flow monitoring switching output IO-Link

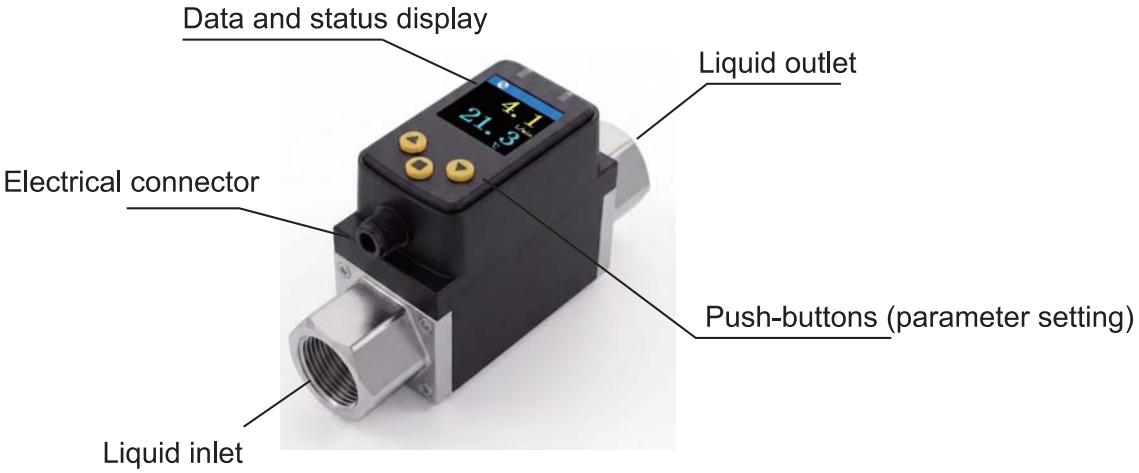
OUT2: Flow or temperature monitoring switching output

### Wiring Diagram



# User Manual

## Product Structure




## Model designation

**FMVH-100-2AO-G34**

Series

Vortex flow sensors with display

Measuring range

016 : 1 - 16 L/min
040 : 2 - 40 L/min
070 : 3.5 - 70 L/min
100 : 5 - 100 L/min
150 : 9 - 150 L/min

Output signal

2AO : 2-channel 4-20 mA analogue outputs
IOL : 2-channel switching outputs,IO-Link

Port Thread Specifications

| Model Code | Thread Specifications | Measuring Range |
|---|---|---|
| G12 | G1/2 | 016 |
| G12 | G1/2 | 040 |
| G12 | G1/2 | 070 |
| G34 | G3/4 | 100 |
| G1 | G1 | 150 |

## Main screen display




Operating status indicator

Green flashing:
normal operation

IO-Link status indicator

White LED steady-on: IO-Link communication normal
LED off: No communication established

Switching output indicator

OUT1: flow
OUT2: flow, temperature (selectable)
Green LED steady-on: Output active
LED off: No output

Flow display

Instantaneous flow or totalised flow

Error code display

FE: Abnormal flow data
TE: Abnormal temperature data

Push-buttons

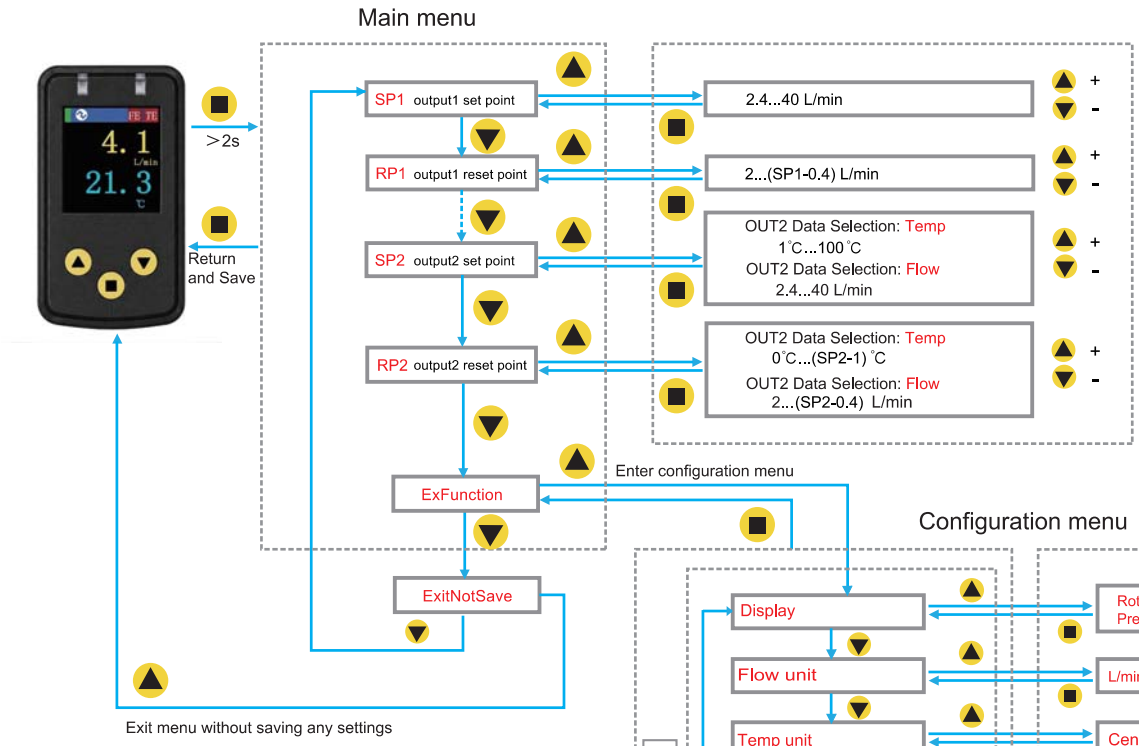
Parameter setting & display
mode switching

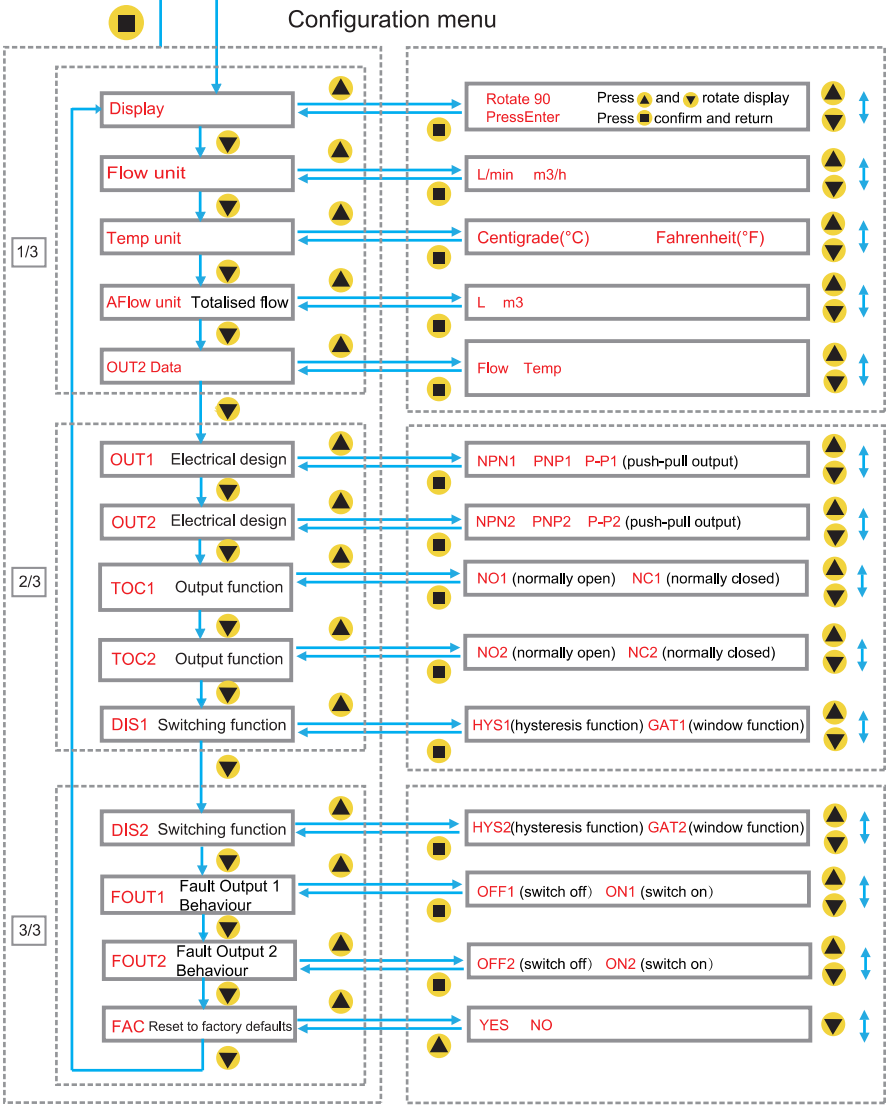
Temperature display

Temperature or totalised flow

# User Manual

## Parameter Configuration




※ Press and hold ▲ for 8 s to toggle between instantaneous flow and totalised flow on the flow display field.

※ Press and hold ▼ for 8 s to toggle between temperature and totalised flow on the temperature display field.

※ While totalised flow is shown, press and hold both ▲ and ▼ keys for 8 s to reset the totalised flow.

Note:

1. The totalised flow will be reset on power-on. The totalised flow contains errors and is for reference only.

2. When totalised flow is displayed on both the flow display field and temperature display field, the two display units will automatically switch to different units.

3. If no operation is performed after entering the menu, the unit will automatically exit the menu and return to the main screen after 3 minutes without saving settings.

4. When flow exceeds the detection range, the flow display characters turn red and flash at approximately 1 Hz.

5. If FE or TE appears in the error-code display area, the displayed data is abnormal indicating a sensor fault. Please contact the manufacturer.

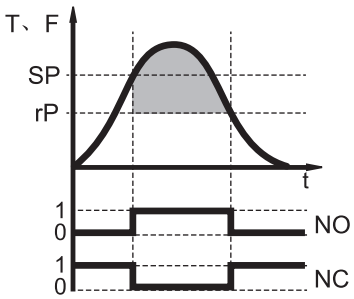
6. On the main screen, a flashing green frame in the operating-status display area indicates normal operation. A non-flashing frame signifies abnormal sensor operation; please power-cycle the device.

# User Manual

## FAC Default Parameter

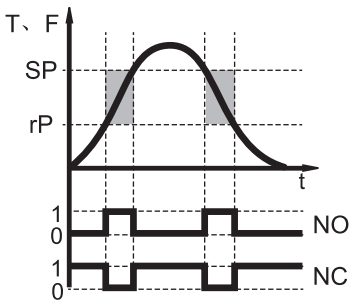
| Parameters | FAC default value |
|---|---|
| SP1 | 25%F.S L/min |
| RP1 | 23%F.S L/min |
| SP2 | 50.0℃ |
| RP2 | 45.0℃ |
| Display | UP |
| Flow unit | L/min |
| Temp unit | Centigrade(℃) |
| AFlow unit | L |
| OUT2 Data | Temp |
| OUT1 | PNP1 |
| OUT2 | PNP2 |
| TOC1 | NO1 |
| TOC2 | NO2 |
| DIS1 | HYS1 |
| DIS2 | HYS2 |
| FOUT1 | OFF1 |
| FOUT2 | OFF2 |

## Switching Function




Hysteresis function

The hysteresis function stabilises the switching output against minor measured-value fluctuations. It is configured via a set point (SP) and reset point (rP).




Window function

The window function defines a valid monitoring range by upper-limit and lower-limit values. The switching output becomes active when the measured value lies within this range.It is configured via a set point (SP) and reset point (rP).

Note:
SP must be greater than rP. Configure SP first, then set rP.
If a value for SP lower than rP is entered, rP will automatically be reduced to the maximum permissible value.

## Process Data Input

| *BYTE* | BYTE0 | | | | | | | | BYTE1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *BIT* | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
| *DATA* | Fbit15 | Fbit14 | Fbit13 | Fbit12 | Fbit11 | Fbit10 | Fbit9 | Fbit8 | Fbit7 | Fbit6 | Fbit5 | Fbit4 | Fbit3 | Fbit2 | Fbit1 | Fbit0 |

| *BYTE* | BYTE2 | | | | | | | | BYTE3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *BIT* | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| *DATA* | Tbit13 | Tbit12 | Tbit11 | Tbit10 | Tbit9 | Tbit8 | Tbit7 | Tbit6 | Tbit5 | Tbit4 | Tbit3 | Tbit2 | Tbit1 | Tbit0 | OUT2 | OUT1 |

Note:
Fbit represents 16-bit flow data. The flow value is an unsigned integer in units of L/min, ranging from 20 to 400. The value is scaled up by a factor of 10 relative to the actual flow.
Tbit represents 14-bit temperature data. The temperature value is an unsigned integer in units of °C, ranging from 0 to 1000. The value is scaled up by a factor of 10 relative to the actual temperature.
OUT1 and OUT2 denote the switching-output status bits.
Use a right-shift instruction to mask out OUT1 and OUT2 to retrieve the 14-bit temperature data.

## IO-Link Parameters

### Parameter data / request data / indexed service data unit (ISDU)

| Index | Subindex | Parameter name | Length | Access | Description |
|---|---|---|---|---|---|
| 0x02<br>2 | 0 | System command | 1Byte | Write | 0x80(128):Device reset 0x82(130): Restore factory settings |
| 0x10<br>16 | 0 | Vendor name | 8Byte | Read | Sentinel |
| 0x11<br>17 | 0 | Vendor description | 41Byte | Read | Sentinel Industrial Ethernet manufacturer |
| 0x12<br>18 | 0 | Product name | 12Byte | Read | FMVH-xxx-IOL |
| 0x13<br>19 | 0 | Product ID | 8Byte | Read | 19816201 |
| 0x14<br>20 | 0 | Product description | 25Byte | Read | Vortexflow sensor io-link |
| 0x15<br>21 | 0 | Serial number | 10Byte | Read | 1981620101 |
| 0x16<br>22 | 0 | Hardware version | 8Byte | Read | HW-V0.01 |
| 0x17<br>23 | 0 | Firmware version | 8Byte | Read | FW-V0.01 |
| 0x18<br>24 | 0 | Application tag | Max.<br>32Byte | Read<br>Write | ApplicationSpecificTag: special identifier for device application usage.<br>Defined in IODD file, stored within DataStorage (DS). |
| 0x19<br>25 | 0 | Function tag | Max.<br>32Byte | Read<br>Write | FunctionTag: special identifier for device functions,stored within DataStorage (DS).<br>Not defined in IODD file; setting is available directly via Index access. |
| 0x1A<br>26 | 0 | Location tag | Max.<br>32Byte | Read<br>Write | LocationTag: special local identifier for the device,stored within DataStorage (DS).<br>Not defined in IODD file; setting is available directly via Index access. |
| 0x24<br>36 | 0 | Device status | 1Byte | Read | 0: Device operating normally; 1: Maintenance required; 2: Incorrect operating environment or parameters;<br>3: Device temporarily inactive; 4: Device operation failure |

| Index | Subindex | Parameter name | Length | Access | Value range |
|---|---|---|---|---|---|
| 0x1F4 500 | 0 | Flow unit | 1Byte | Read Write | 0: L/min 1: m3/h |
| 0x1F5 501 | 0 | TOC1 output1 function | 1Byte | Read Write | 0: NO normally open; 1: NC normally closed |
| 0x1F6 502 | 0 | TOC2 output2 function | 1Byte | Read Write | 0: NO normally open; 1: NC normally closed |
| 0x1F7 503 | 0 | OUT1 electrical design | 1Byte | Read Write | 0: NPN output; 1: PNP output; 2: P-P push-pull output |
| 0x1F8 504 | 0 | OUT2 electrical design | 1Byte | Read Write | 0: NPN output; 1: PNP output; 2: P-P push-pull output |
| 0x1F9 505 | 0 | DIS1 switching function | 1Byte | Read Write | 0: HYS hysteresis function; 1: GAT window function |
| 0x1FA 506 | 0 | DIS2 switching function | 1Byte | Read Write | 0: HYS hysteresis function; 1: GAT window function |
| 0x1FB 507 | 0 | Display mode | 1Byte | Read Write | 2: Upright display 3: Rotated 90° clockwise; 0: Rotated 180° clockwise 1: Rotated 270° clockwise |
| 0x1FD 509 | 0 | FOUT1 Fault Output 1 Behaviour | 1Byte | Read Write | 0: OFF1 (switch off); 1: ON1 (switch on) |
| 0x1FE 510 | 0 | FOUT2 Fault Output 2 Behaviour | 1Byte | Read Write | 0: OFF2 (switch off); 1: ON2 (switch on) |
| 0x200 512 | 0 | Temp unit | 1Byte | Read Write | 0: Centigrade (°C); 1: Fahrenheit (°F) |
| 0x201 513 | 0 | Aflow unit Totalised flow unit | 1Byte | Read Write | 0: L 1: $m^3$ |
| 0x202 514 | 0 | OUT2 Data | 1Byte | Read Write | 0: Flow 1: Temp |
| 0x258 600 | 0 | SP1 Output 1 Set-point | 2Byte | Read Write | 24 to 400<br>Note: unit L/min; Value will be rejected if SP1 is not greater than rP1. |
| 0x259 601 | 0 | rP1 Output 2 Reset-point | 2Byte | Read Write | 20 to 396<br>Note: unit L/min; Value will be rejected if rP1 is not less than SP1. |
| 0x25A 602 | 0 | SP2 Output 1 Set-point | 2Byte | Read Write | When OUT2 Data Source = Temp: 10 to 1000, Note: Unit °C. Value will be rejected if SP2 is not greater than rP2.<br>When OUT2 Data Source = Flow: 24 to 400, Note: Unit L/min. Value will be rejected if SP2 is not greater than rP2. |
| 0x25B 603 | 0 | rP2 Output 2 Reset-point | 2Byte | Read Write | When OUT2 Data Source = Temp: 0 to 990, Note: Unit °C. Value will be rejected if rP2 is not less than SP2.<br>When OUT2 Data Source = Flow: 20 to 396, Note: Unit L/min. Value will be rejected if rP2 is not less than SP2. |

## Error codes

32785 / 0x8011: Index not available

32786 / 0x8012: Sub-index not available

32816 / 0x8030: Written parameter out of configurable range

32819 / 0x8033: Written parameter length exceeds defined length

32820 / 0x8034: Written parameter length is shorter than defined length

## Piping Precautions

When piping the unit, apply wrench force only on the integrated metal section of the piping port (pipe fitting). Using a wrench on other areas may damage the flow-sensor. Safe tightening torque values are listed in the table below.

| Thread (G/RC/NPT) | 3/8 | 1/2 | 3/4 | 1 |
|---|---|---|---|---|
| Recommended Torque Range | 22 – 24 N·m | 28 – 30 N·m | 28 – 30 N·m | 36 – 38 N·m |
| Maximum Safe Torque | <200N·m | <200N·m | <200N·m | <200N·m |

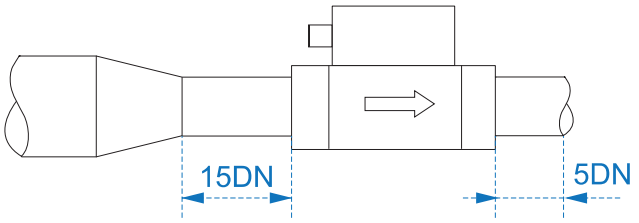
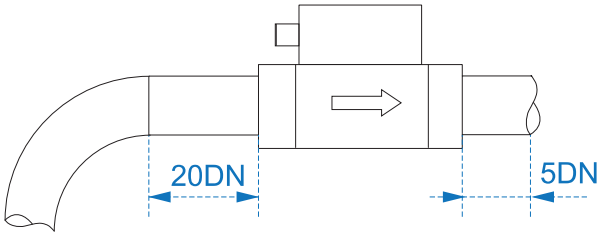
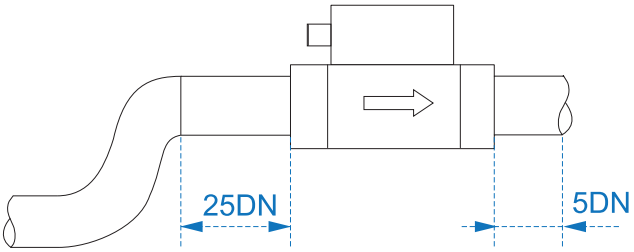
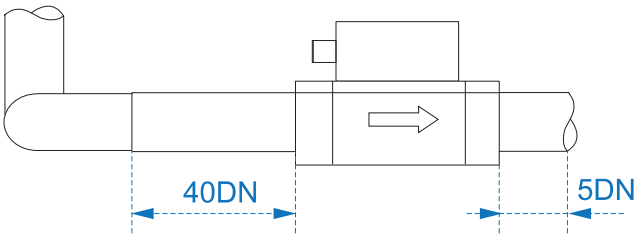
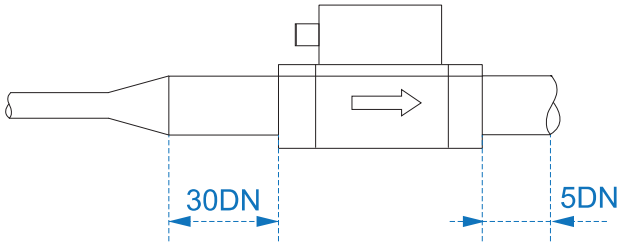
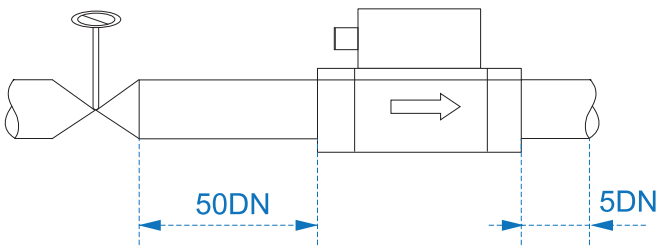
## Piping Installation Precautions

To ensure proper sensor operation, the following instructions must be observed:

1.Avoid multiple out-of-plane bends close to the inlet.

2.The internal diameter of the pipe shall not be smaller than the internal diameter of the measuring pipe.

3.The table on the right lists piping installation requirements for different conditions.

| Upstream Pipe Configuration | Required Upstream & Downstream |
|---|---|
| Concentric reducer with fully-open valve |  |
| Single 90° elbow |  |
| Two 90° elbows in the same plane |  |
| Two 90° elbows out-of-plane |  |
| Concentric expander |  |
| Partially-open control valve (Not Recommended) |  |

Note: DN stands for nominal pipe diameter.