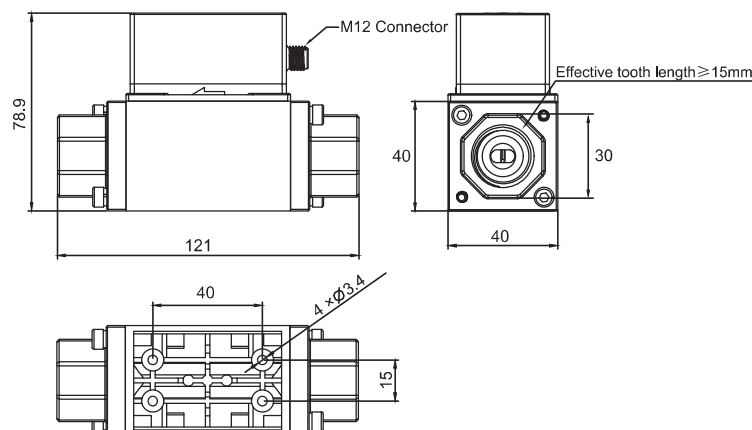


Vortex Flow Sensor

FMV-016-IOL-XXX Dual switching signal output (Flow,temperature) XXX:Select by interface

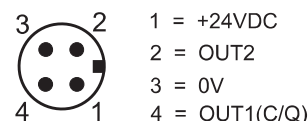
SENTINEL
INDUSTRIAL AUTOMATION



- Von Karman vortex principle vortex flow sensor
- Flow, Temperature dual switching signal output, Dual Display
- Switching signal normally open/normally closed, NPN/PNP/push-pull optional
- High-resolution IPS display
- M12 A-code 4-pin IO-Link Class A interface
- Cumulative flow recording function
- Various thread specifications and model selections
- Units can be selected, simple button menu operation
- Four viewing directions can be switched
- The product is small in size and occupies little space

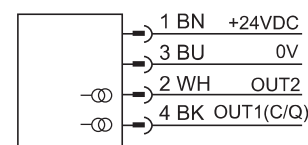
Model	FMV-016-IOL-G12 FMV-016-IOL-RC12 FMV-016-IOL-NPT12	FMV-016-IOL-G38 FMV-016-IOL-RC38 FMV-016-IOL-NPT38
Operating voltage	24VDC ± 10%	
Operating current	<100mA	
Flow parameters	water	
Measuring medium	2 - 16 L/min (0.12 - 0.96 m³/h)	
Measuring range	< 3.0%F.S	
Flow accuracy	99999L or 99999m³ Note: Power off reset, For reference only	
Cumulative flow range	PPS/SUS304(Stainless steel)	
Contact liquid material	Thread G or RC or NPT Model selection	
Process connection	10bar, greatest pressure 16bar	
Pressure Level	L/min m³/h button optional	
Real-time flow unit	NPN/PNP/Push-Pull, NO/NC, Hysteresis/Window programmable	
Switching signal output type	250mA	
Switching signal output current	2.2 L/min - 16 L/min	
Switch point SP setting range	2 L/min - 15.8 L/min	
Release point rP setting range	0.2L/min	
Minimum interval between SP and rP points	0.1 L/min	
Switching signal output resolution		
Temperature parameters	0-100°C	
Measuring range	1°C	
Temperature accuracy	°C or °F Button optional	
Display units	NPN/PNP/Push-Pull, NO/NC, Hysteresis/Window programmable	
Switching signal output type	250mA	
Switching signal output current	1 °C - 100 °C	
Switch point SP setting range	0 °C - 99°C	
Release point rP setting range	1°C(1%F.S)	
Minimum interval between SP and rP points	0.1 °C	
Switching signal output resolution		
IO-Link		
Vendor ID	1317 (0x0525)	
Device ID	198162(0x030612)	
Number of interfaces	1	
IO-Link protocol version	V1.1	
IO-Link interface type	Class A	
Frame type	TYPE_2_V	
Transmission rate	COM2 38.4 kbit/s	
Minimum cycle time	3000us	
ISDU(Indexing Service)	Support	
Block parameter operations	Not support	
Data storage(DS)	Support	
Data storage lock	Support Note: To maintain compatibility, this feature is supported, but the device will not perform this operation	
Ambient temperature	-10 - 65°C	
Protection level	IP65	

M12 connection



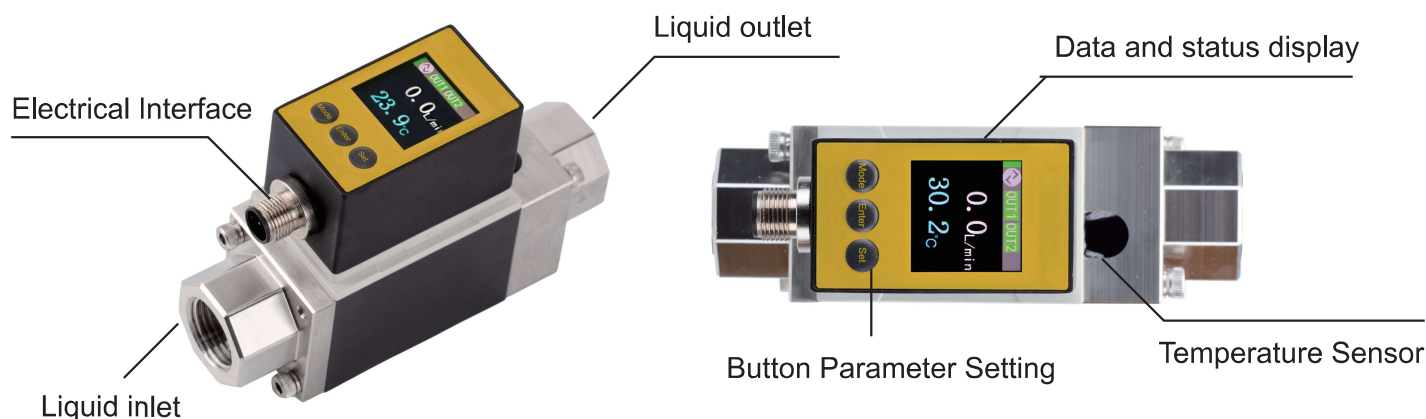
Note: OUT1: switching signal (flow) or IO-Link
OUT2: switching signal (Flow, temperature optional)

Wiring Diagram

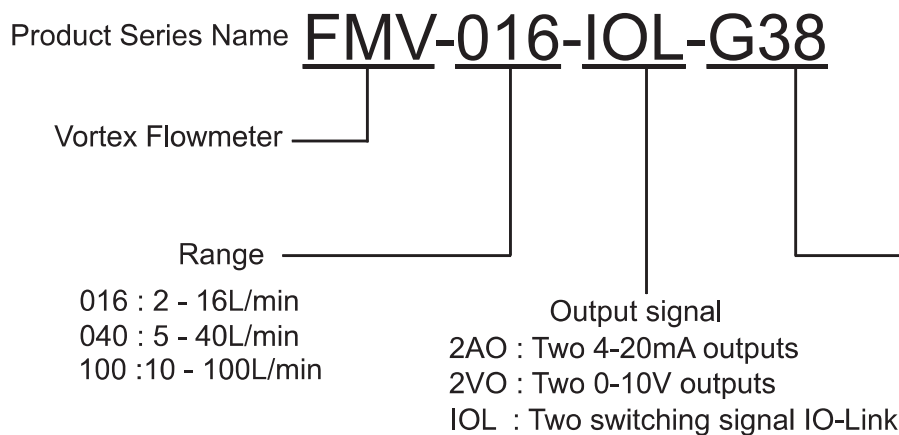


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Product structure



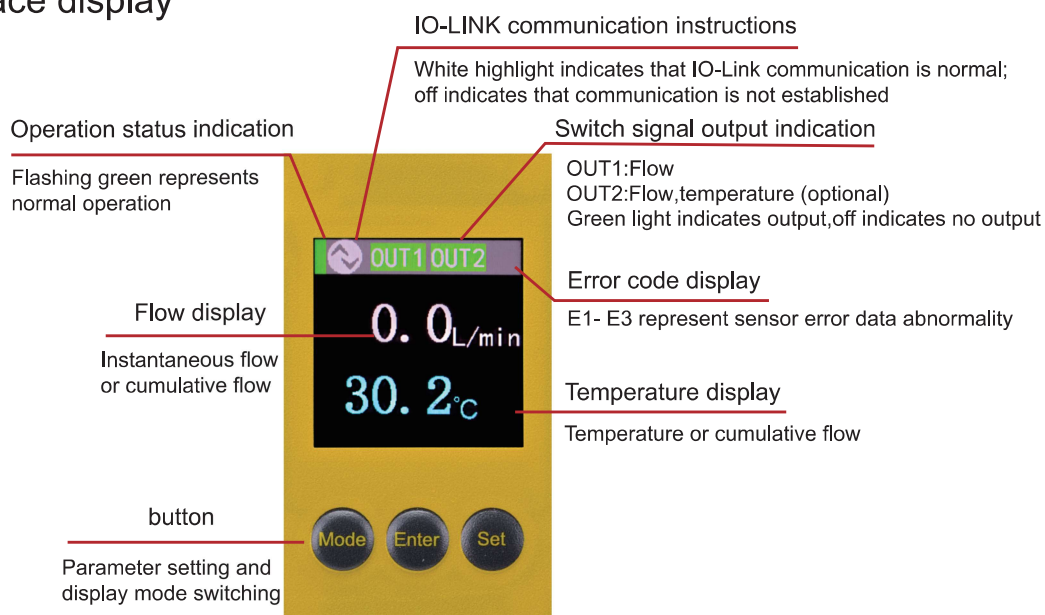
Product model naming rules



Interface thread specifications

Model code	Corresponding specifications	Adaptable range
G38	G3/8	016
RC38	RC3/8	016
NPT38	NPT3/8	016
G12	G1/2	016 040
RC12	RC1/2	016 040
NPT12	NPT1/2	016 040
G34	G3/4	100 040
RC34	RC3/4	100 040
NPT34	NPT3/4	100 040
G1	G1	100
RC1	RC1	100
NPT1	NPT1	100

Main interface display

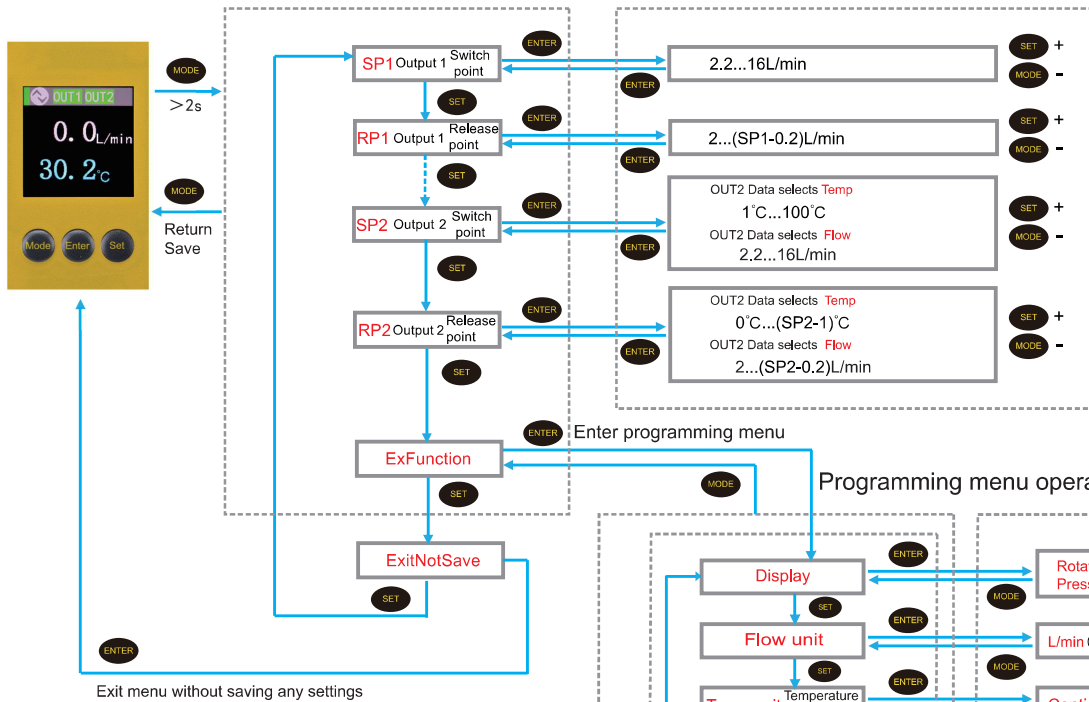


User Manual

parameter settings

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Simple menu operation

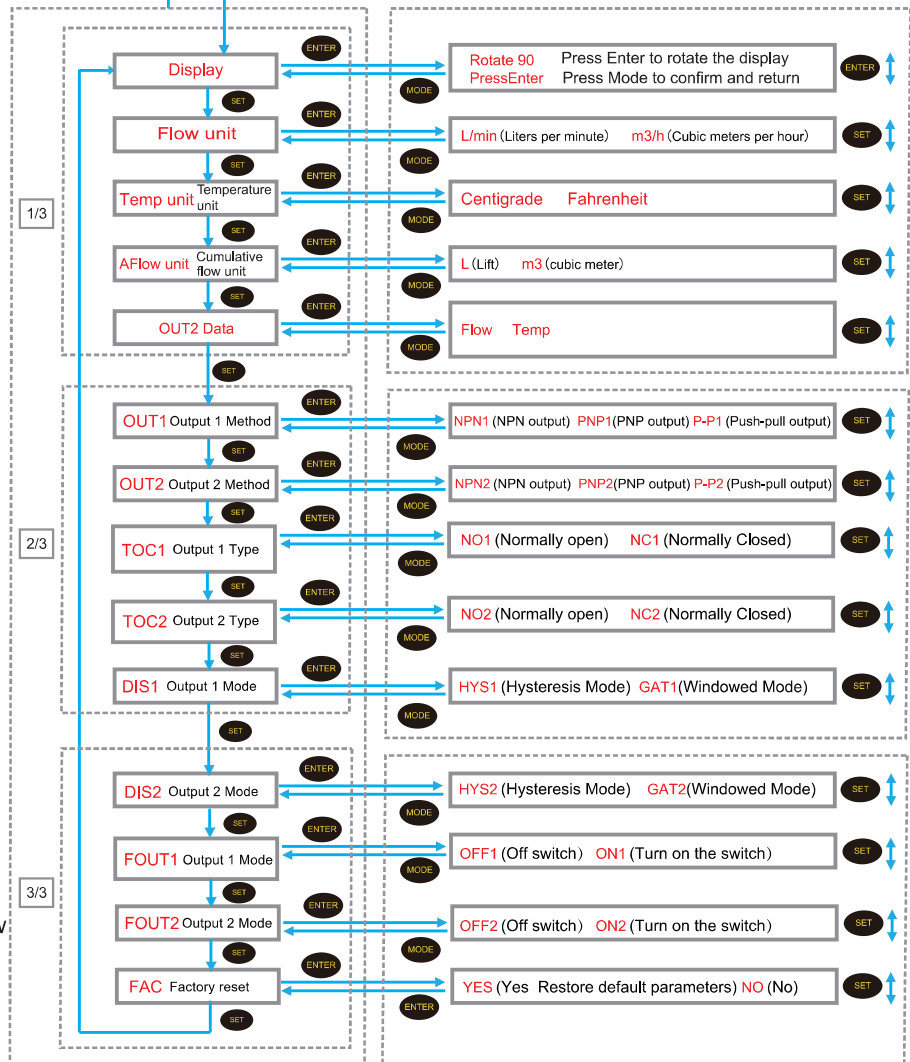


- ✘ Press Enter for 4 seconds to switch between instantaneous flow and cumulative flow display in the flow display bar
- ✘ Press the Set key for 4 seconds to switch between temperature and cumulative flow display in the temperature display bar
- ✘ When the cumulative flow is displayed, press Enter and Set for 4 seconds to clear the cumulative flow.

Notice:

1. The cumulative flow will be cleared when the power is turned on; there is an error in the cumulative flow, which is for reference only;
2. When both the flow display bar and the temperature display bar show the cumulative flow, the two display units automatically switch to different units;
3. After entering the menu without performing any operation, the system will automatically exit the menu and return to the main interface within 3 minutes without saving the settings;
4. When the flow rate exceeds the detection range, the flow display characters will turn red and flash at a frequency of about 1HZ;
5. When the error code display area shows E1 to E3, the displayed data is abnormal and the sensor is abnormal. Please contact the manufacturer;
6. In the main interface, if the green bar in the operation status display area flashes, it is running normally. If it does not flash, the sensor is running abnormally. Please power on again;

Programming menu operation

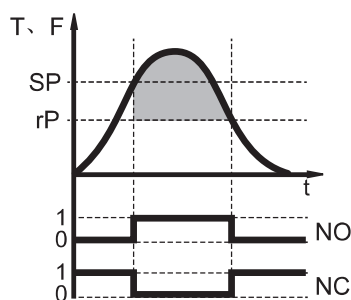


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FAC Default Parameters

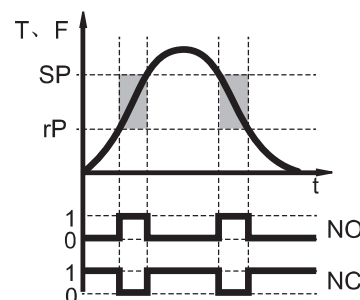
Parameter list	FAC Default Value
SP1	25%F.S L/min
RP1	23%F.S L/min
SP2	50.0℃
RP2	45.0℃
Display	UP
Flow unit	L/min
Temp unit	Centigrade(℃)
AFlow unit	L
OUT2 Data	Temp
OUT1	PNP1
OUT2	PNP2
TOC1	NO1
TOC2	NO2
DIS1	HYS1
DIS2	HYS2
FOUT1	OFF1
FOUT2	OFF2

Description of switching signal data output



Hysteresis Mode

This ensures a stable switching state, independent of temperature or flow fluctuations affecting the set point. The switching range can be set by the user via the switch point (SP) and release point (rP)



Windowed Mode

Determine whether the temperature or flow is within a specific range (window), and trigger the output switch under the corresponding conditions to generate an alarm signal. The switch range can be set by the user through the upper window limit (SP) and the lower window limit (rP)

Note: When setting SP, it must be greater than rP. You can set the SP value first and then rP. If the set SP is less than rP, rP will drop to the maximum value allowed.

Process data input data

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 data is an unsigned number in L/min, ranging from 20 to 160, which means the actual flow is magnified 10 times.

Tbit represents 14-bit temperature data. The temperature data is an unsigned number in ℃, ranging from 0 to 1000, which means the actual temperature is magnified 10 times.

OUT1 and OUT2 represent the switching signal output status;

Use the right shift instruction to remove OUT1 and OUT2 to obtain 14-bit temperature data.

IO-Link parameters

Parameter data/ Request data/Indexing Service(ISDU indexed service data unit)

Index	Subindex	Parameter name	length	Permissions	Describe
0x02 2	0	System Commands	1Byte	Write	0x80 128 Device reset 0x82 130 Factory reset
0x10 16	0	Manufacturer's name	8Byte	Read	Sentinel
0x11 17	0	Manufacturer Description	41Byte	Read	Sentinel Industrial Ethernet manufacturer
0x12 18	0	Product name	11Byte	Read	FMV-xxx-IOL
0x13 19	0	Product ID	8Byte	Read	19816201
0x14 20	0	Product Description	25Byte	Read	Vortexflow sensor io-link
0x15 21	0	Serial-Number	10Byte	Read	1981620101
0x16 22	0	Hardware version	8Byte	Read	HW-V0.01
0x17 23	0	Software version	8Byte	Read	FW-V0.01
0x18 24	0	Apply Tags	maximum 32Byte	Read Write	ApplicationSpecificTag is used to mark the device in the application This item is defined in the IODD file and is included in DataStorage(DS)
0x19 25	0	Function Label	maximum 32Byte	Read Write	FunctionTag is a special tag for device functions, including This item is not defined in the IODD file and can be set directly through Index
0x1A 26	0	Local Tags	maximum 32Byte	Read Write	LocationTag is a special tag used for local devices, including DS This item is not defined in the IODD file and can be set directly through Index
0x24 36	0	Device status	1Byte	Read	0:The device is operating normally; 1:Maintenance is required; 2:Incorrect operating environment or parameters; 3:The device is temporarily invalid; 4:The device fails to operate;

Index	Subindex	Parameter name	length	Permissions	Ranges
0x1F4 500	0	Flow unit	1Byte	Read Write	0: L/min 1: m3/h
0x1F5 501	0	TOC1 Output 1 Type	1Byte	Read Write	0: NO Normally open 1: NC Normally Closed
0x1F6 502	0	TOC2 Output 2 Type	1Byte	Read Write	0: NO Normally open 1: NC Normally Closed
0x1F7 503	0	OUT1 Output 1 method	1Byte	Read Write	0: NPN output 1: PNP output 2: P-P push-pull output
0x1F8 504	0	OUT2 Output 2 method	1Byte	Read Write	0: NPN output 1: PNP output 2: P-P push-pull output
0x1F9 505	0	DIS1 Output 1 Mode	1Byte	Read Write	0: HYS hysteresis mode 1: GAT window mode
0x1FA 506	0	DIS2 Output 2 Mode	1Byte	Read Write	0: HYS hysteresis mode 1: GAT window mode
0x1FB 507	0	Display Mode	1Byte	Read Write	0: UP positive display 1: Display when rotated 90° clockwise 2: Display when rotated 180° clockwise 3: Display when rotated 270° clockwise
0x1FD 509	0	FoUT1 When a fault occurs, output 1	1Byte	Read Write	0: OFF1(Off switch) 1: ON1(Turn on the switch)
0x1FE 510	0	FoUT2 When a fault occurs, output 2	1Byte	Read Write	0: OFF2(Off switch) 1: ON2(Turn on the switch)
0x200 512	0	Temp unit Temperature Units	1Byte	Read Write	0: Centigrade 1: Fahrenheit
0x201 513	0	Aflow unit Cumulative flow unit	1Byte	Read Write	0: L 1: m3
0x202 514	0	OUT2 Data Output 2 data	1Byte	Read Write	0: Flow 1: Temp
0x258 600	0	SP1 Output 1 Switch point	2Byte	Read Write	22 to 160 Note: Unit: L/min SP1 should be greater than RP1 otherwise it will be rejected
0x259 601	0	RP1 Output 1 Release point	2Byte	Read Write	20 to 158 Note: Unit: L/min RP1 should be less than SP1 otherwise it will be rejected
0x25A 602	0	SP2 Output 2 Switch point	2Byte	Read Write	When OUT2 Data selects Temp: 10 to 1000 Note: Unit: °C SP2 should be greater than RP2 otherwise it will be rejected When OUT2 Data selects Flow: 22 to 160 Note: Unit: L/min SP2 should be greater than RP2 otherwise it will be rejected
0x25B 603	0	RP2 Output 2 Release point	2Byte	Read Write	When OUT2 Data selects Temp: 0 to 990 Note: Unit: °C RP2 should be less than SP2 otherwise it will be rejected When OUT2 Data selects Flow: 20 to 158 Note: Unit: L/min SP2 should be greater than RP2 otherwise it will be rejected

Error code

32785 / 0x8011: Invalid index 32819 / 0x8033: The length of the written parameter exceeds the defined length 32816 / 0x8030: The written parameter exceeds the settable range
 32786 / 0x8012: Invalid subindex 32820 / 0x8034: The length of the written parameter is less than the defined length

Piping precautions

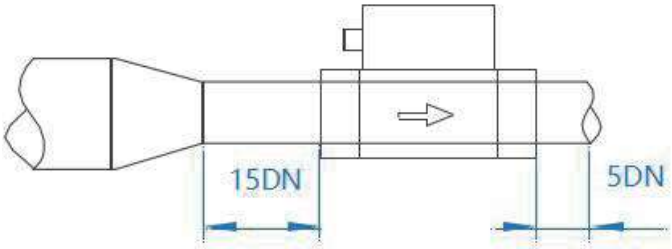
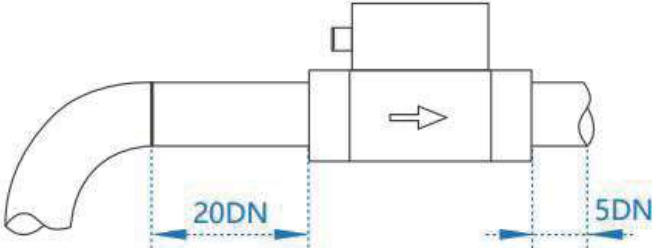
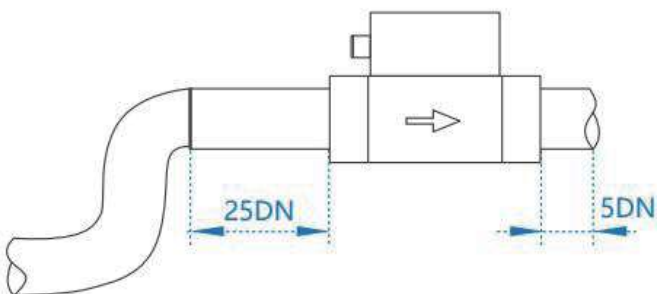
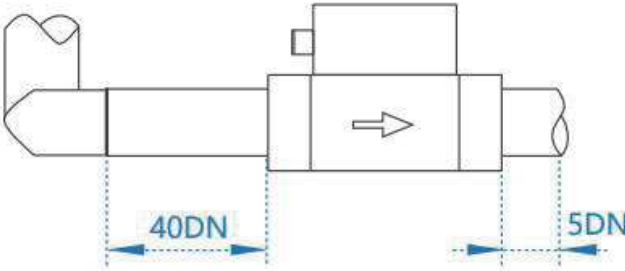
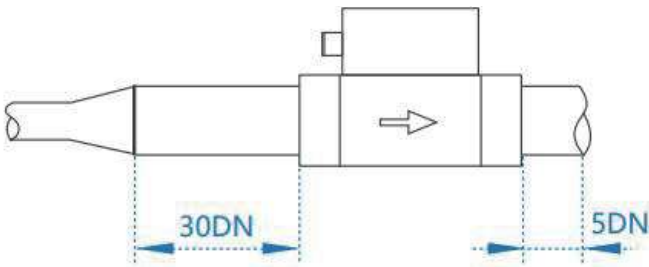
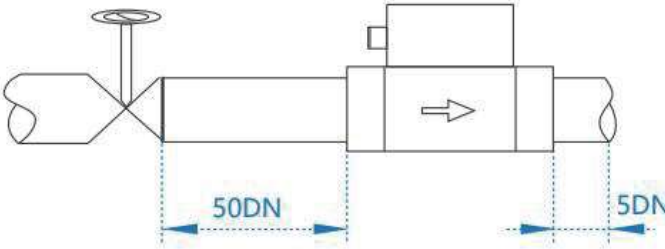
When piping the product, use a wrench to connect the metal parts (pipe fittings) that are integrated with the piping.
 If a wrench is used on other parts, the flow sensor may be damaged. The safe torque for piping is shown in the table below.

Thread (G/RC/NPT)	3/8	1/2	3/4	1
Applicable torque range	22~24 N·m	28~30 N·m	28~30 N·m	36~38 N·m
Torque safety range	<200N·m	<200N·m	<200N·m	<200N·m

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Pipeline installation precautions

Sensor upstream pipeline type and straight pipe length before and after

Pipe type upstream of sensor	Length of front and rear straight pipe sections
Concentric contraction fully open valve	
One 90 degree elbow	
Two 90 degree elbows on the same plane	
Two 90 degree elbows in different planes	
Concentric expansion	
Regulating valve half open valve (not recommended)	

Note: DN represents the nominal diameter or diameter of the pipe.

For the sensor to work properly, the following instructions must be followed:

1. Avoid multiple bends that are not on the same level before approaching the inlet.
2. The inner diameter of the pipe cannot be smaller than the inner diameter of the measuring pipe.

The table on the right shows the pipe installation requirements for different situations.