Vortex Type Flow Sensor

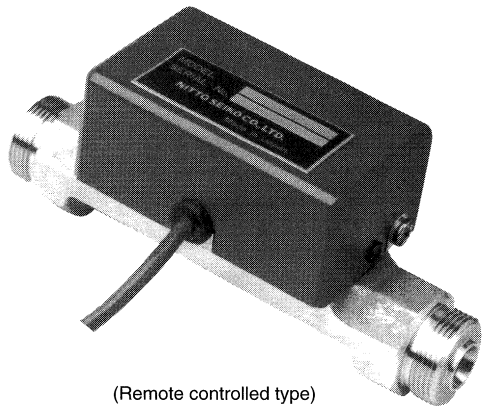
FLOP™

Specifications

SSW10251 97.02

■General

Vortex type flow sensor FLOP is a flow sensor based on the principle of Karman's vortex. A vortex generating body is installed in a pipeline, and the generating frequency of the Karman's vortex (proportional to the flow velocity) produced in the downstream of the vortex generating body is measured by means of a special detector.



(Remote controlled type)

■Features

- Simple construction without moving part and excellent reliability and durability.
- Low-pressure loss structure with little contraction of area of the flow channel.
- A linear PPS resin structure type is provided, which is usable also in extrapure water piping.
- Field display type with easy modification of direction of indication.
- Abundant variations including field display type, remote controlled type and field display + remote controlled type, with process connection selectable according to the piping from among screwed joint, union joint and wafer joint.

■Uses

- Liquid crystal & semiconductor cleaning system, semiconductor manufacturing system.
- Super computer cooling system.
- Water purifying apparatus
- Food processing system.
- Measurement & monitoring of flow rate of other various kinds of liquid.

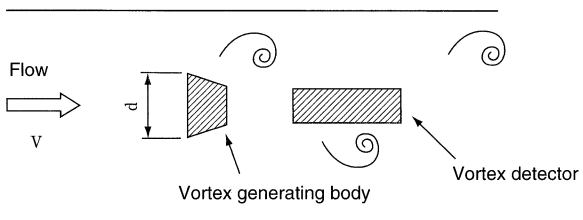
■Working principle

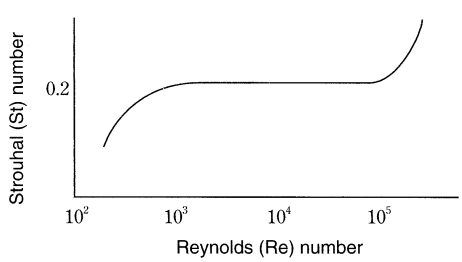
If you put an obstacle perpendicularly to a flow, vortex is produced on the downstream side alternately from both left and right, forming vortex lined in 2 rows (Karman's vortex). A proportional relation of the following formula is established for this regular generation of vortex and the flow, and flow velocity and flow rate can be determined with measurement of this eddy current:

$$f = St \cdot \frac{V}{d}$$

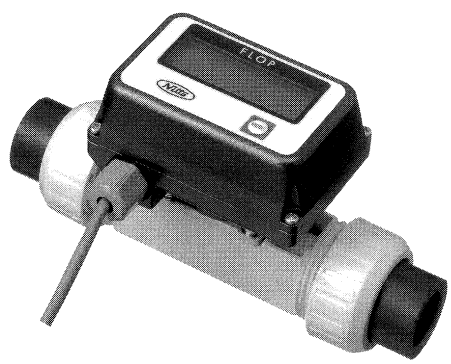
f = Karman's vortex generating frequency
St = Strouhal number (= 0.2)
V = Flow velocity
d = Constant

St (Strouhal number) takes a fixed value (St = 0.2) in a certain range ($3 \times 10^3 \sim 10^5$) of Reynolds number (Re). Since St is a dimensionless constant, the Karman's vortex generating frequency f is not influenced by temperature, pressure, density, etc.





(Field display)



(Field display type, with output)

■Specifications

● **Detecting unit**

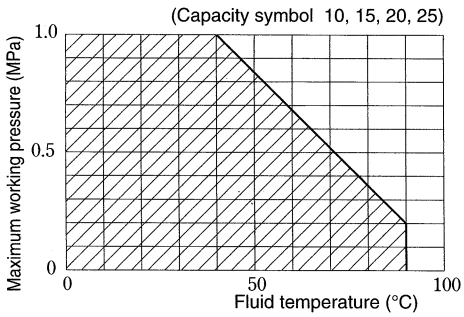
Range of flow rate, kinematic viscosity of fluid

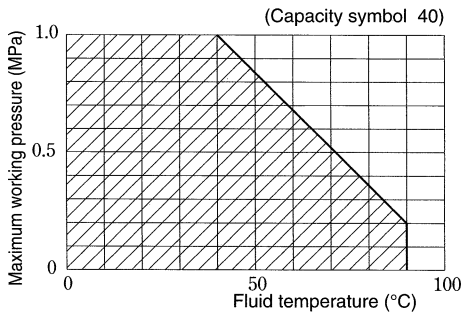
Capacity symbol	Range of flow rate (L/min)	Kinematic viscosity of fluid (mm^2/s)
10	4 ~ 25	2 or under
15	8 ~ 50	3 or under
20	12 ~ 80	4 or under
25	20 ~ 130	5.5 or under
40	60 ~ 350	9 or under

Fluid temperature: 0 ~ 90˚C

Fluid pressure: 1MPa or under

* In the case of a body made of linear PPS, use in the range shaded part in the drawing below.





Measuring accuracy: Within ±2% FS

Mounting posture: Horizontal (converting unit not to face the ground) & vertical mounting.

Material of liquid end portion:

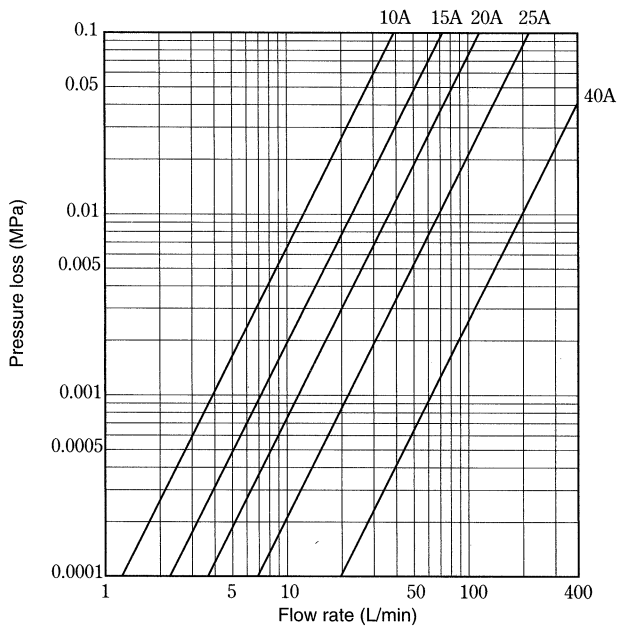
(field display type, field display type with output)

Body	Vortex generating body	Vortex detector	Sealing O ring
Linear PPS	Linear PPS	Linear PPS	FPM
SUS316	PEEK (10, 15A)	PEEK	FPM
SUS316	SUS316 (20, 25A)	PEEK	FPM

(Remote controlled type)

Body	Vortex generating body	Vortex detector	Sealing O ring
SUS316	PEEK (10, 15A)	PEEK	EPDM
SCS14	SCS14 (25A)	PEEK	EPDM
SUS304	SUS304 (40A)	PEEK	FPM

Pressure loss (Viscosity of liquid: 1mPa·s)



● **Converter unit**

Power supply

Type	Supply voltage
Field display	Built-in 3VDC UM3 lithium battery (service life: Approx. 2 years)
Field display (with output)	12 ~ 24V DC
Remote controlled	17 ~ 26.4V DC

Ambient temperature: 0 ~ 50˚C

Ambient humidity: 95%RH or under

Signal output: Maximum load resistance

Remote controlled type:

50Ω (at 17V) ~ 400Ω (at 24V)

Field display type with output:

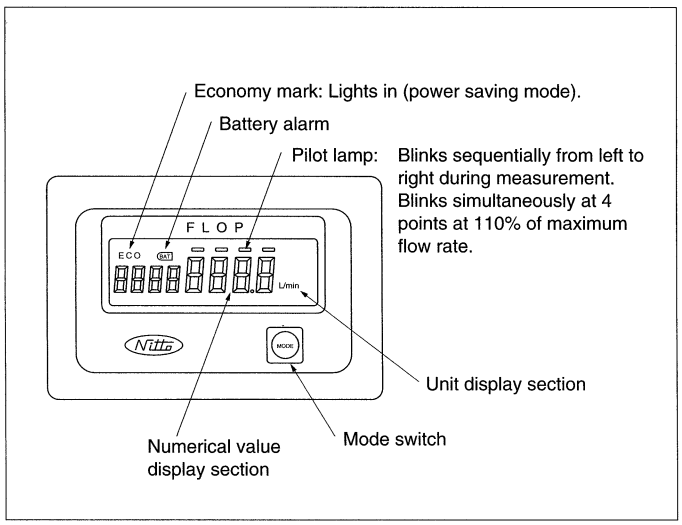
120Ω (at 12V) ~ 600Ω (at 24V)

Capacity symbol	Output
10	4 ~ 20mA / 0 ~ 25 L/min
15	4 ~ 20mA / 0 ~ 50 L/min
20	4 ~ 20mA / 0 ~ 80 L/min
25	4 ~ 20mA / 0 ~ 130 L/min
40	4 ~ 20mA / 0 ~ 350 L/min

Display: 7-segment LCD 8-digit (7H 4-digit, 10H 4-digit)
Displayed items: Instantaneous flow rate, integrated flow rate (selectable with MODE switch)

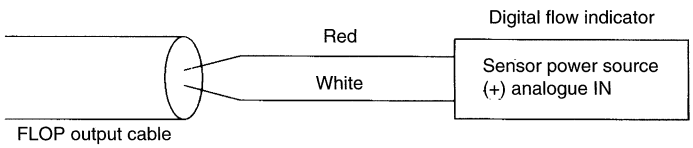
Capacity symbol	Instantaneous flow rate unit (3-digit)	Integrated flow rate unit (8-digit)
10	0.1 L/min, 0.01m³/h	1L, 0.01m³, 0.1m³
15	0.1 L/min, 0.01m³/h	1L, 0.01m³, 0.1m³
20	0.1 L/min, 0.01m³/h	1L, 0.01m³, 0.1m³
25	1 L/min, 0.01m³/h	1L, 0.01m³, 0.1m³
40	1 L/min, 0.1m³/h	0.01m³, 0.1m³

Alarm
Excessive flow rate alarm: 110% of maximum flow rate
Battery alarm

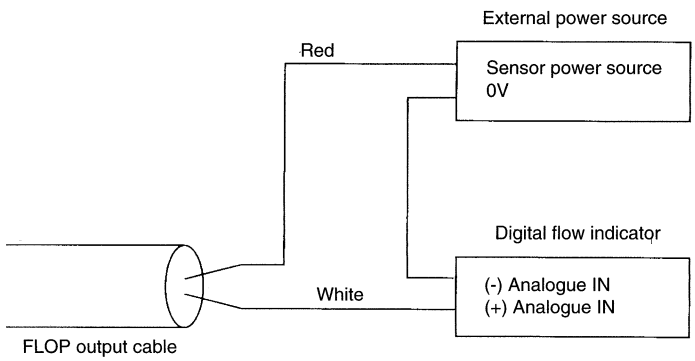


■Connections

● Case of connection to a digital flow indicator with built-in sensor power source



● Case of connection to a digital flow indicator without built-in sensor power source



■Handling precautions

● Installation

(1) Provide a straight pipe portion of 7D or over (10D for bore 40) on the upstream side of FLOP and of 5D (D: bore) on the downstream side, to secure the accuracy.
(2) In the case where there is an elbow on the upstream side, provide a straight pipe portion of 10D or over between the elbow and FLOP.
(3) Any piping equipment which may cause disturbance to the flow such as control valve, etc. shall be installed on the downstream side of FLOP.
(4) In the case of a horizontal piping, avoid installing with the converter section looking downward, as it causes deterioration of electronic parts due to accumulation of condensed water in the converter section.
(5) In the case of a vertical piping, install in such a way that the fluid flows from bottom to top, to avoid double-layer current.
(6) Install in such a way that the arrow mark indicating the direction of flow given on FLOP agrees with the direction of flow of the fluid.
(7) Flush the inside the piping before installing FLOP, because penetration of foreign matters may cause operating error. In case of mixing of foreign matters in the liquid, install a strainer on the upstream side.
(8) Avoid splash of water on the converter section because it is not of dripproof structure.

● Wire connection

(1) The shielded wire of the shielded cable coming out from the converter section of the remote controlled type is connected to the grounding terminal of the body. Cut off the shielded wire when you connect the cable to the equipment within the current cable length.
When extending the cable with a relay terminal, etc., cut off the shielded wire on the terminal side (side connected to the equipment) of the extension cable. Moreover, connect the shielded wire of the shielded cable coming out from the converter section of the field display type with output to GND.
(2) Take care to avoid placing the cable close to or in parallel with any power line or high-tension line.

■Model

Type	Specification code								Description
QS									Field display type
VS									Remote controlled type
Capacity symbol	10								10A
	15								15A
	20								20A
	25								25A
	40								40A
Body material		2							Linear PPS
		5							SUS304 (VS40 only)
		6							SUS316
		7							SCS14 (VS25 only)
External output			0						4 ~ 20mA without output
			2						4 ~ 20mA with output
Process connection				R					Screw joint
				U					Union joint
				W					JIS 10K wafer
Nominal diameter of union joint					16				16mm
					20				20mm
					25				25mm
					–				Other than union joint

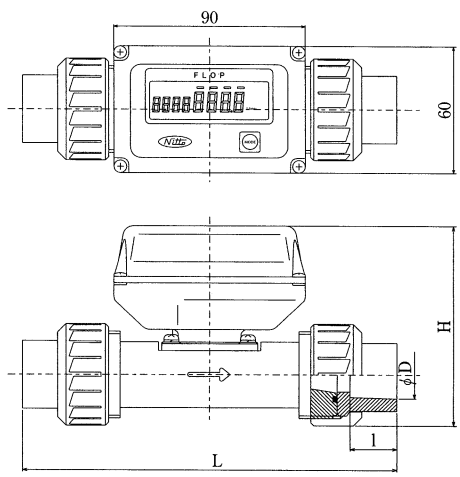
* For manufacturable models, refer to the table below.

Type	Body material	Capacity symbol	Wafer connection	Union joint (nominal diameter)	Screw joint (nominal dia.)
Field display type	Linear PPS	10	–	○ (16)	○ (R1/2)
		15	–	○ (16, 20)	———
		20	–	○ (20, 25)	———
		25	–	○ (25)	———
		40	○	———	———
	Stainless steel	10	–	———	○ (R3/8)
		15	–	———	○ (R1/2)
		20	–	———	○ (R3/4)
		25	–	———	○ (R1)
Field display type (with output)	Linear PPS	10	–	○ (16)	○ (R1/2)
		15	–	○ (16, 20)	———
		20	–	○ (20, 25)	———
		25	–	○ (25)	———
		40	○	———	———
	Stainless steel	10	–	———	○ (R3/8)
		15	–	———	○ (R1/2)
		20	–	———	○ (R3/4)
		25	–	———	○ (R1)
Remote controlled type	Stainless steel	10	–	———	○ (M26)
		15	–	———	○ (M32)
		25	–	———	○ (M40)
		40	○	———	———

○ : Specification available
– : Specification unavailable

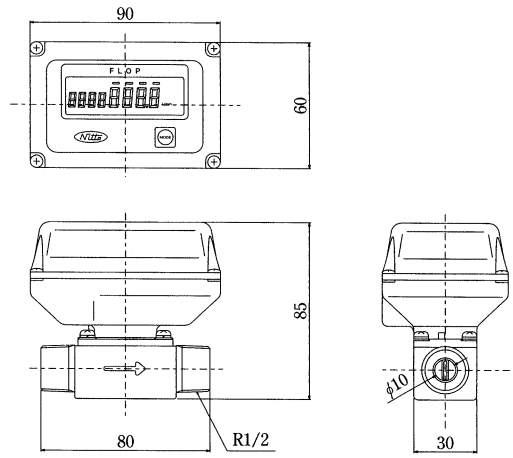
■Shape and dimensions

Field display type (Union joint)



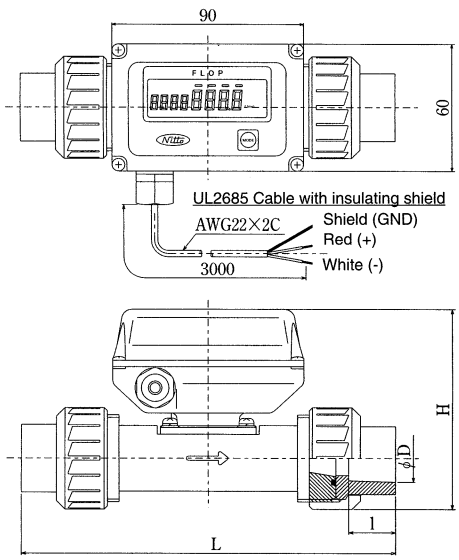
Model	Main dimensions (mm)				
	L	l	H	øD	ød
QS1020U16	176	22	94	22.3	10
QS1520U16	176	22	96	22.3	14
QS1520U20	190	25	100	26.3	14
QS2020U20	190	25	110	26.3	18
QS2020U25	192	29	113	32.3	18
QS2520U25	192	29	115	32.3	23

Field display type (Screw joint)



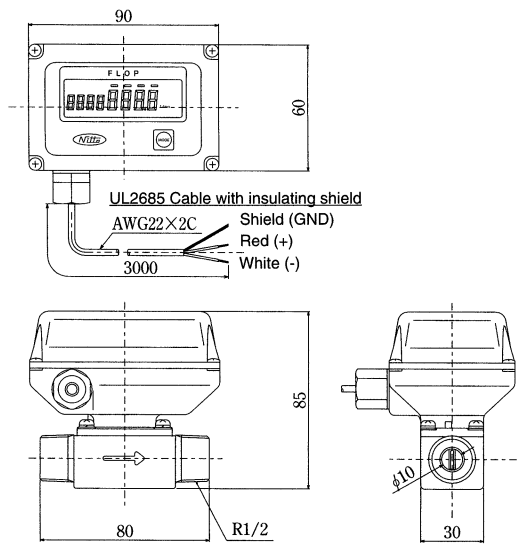
<Model: QS1020R>

Field display type with output (Union joint)



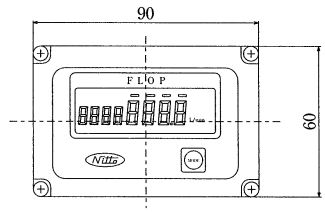
Model	Main dimensions (mm)				
	L	l	H	øD	ød
QS1022U16	176	22	94	22.3	10
QS1522U16	176	22	96	22.3	14
QS1522U20	190	25	100	26.3	14
QS2022U20	190	25	110	26.3	18
QS2022U25	192	29	113	32.3	18
QS2522U25	192	29	115	32.3	23

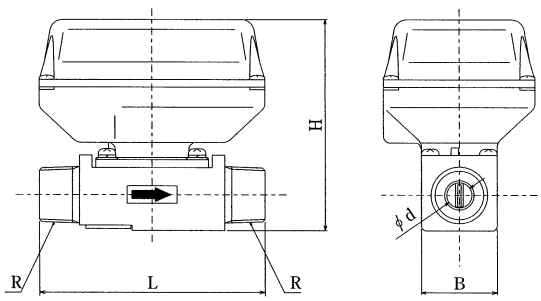
Field display type with output (Screw joint)



<Model: QS1022R>

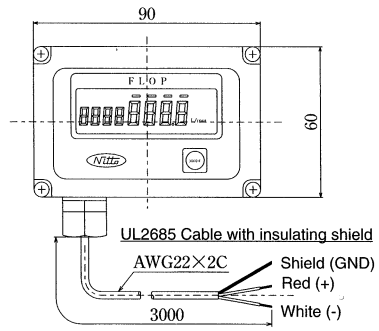
Field display type (Screw joint)

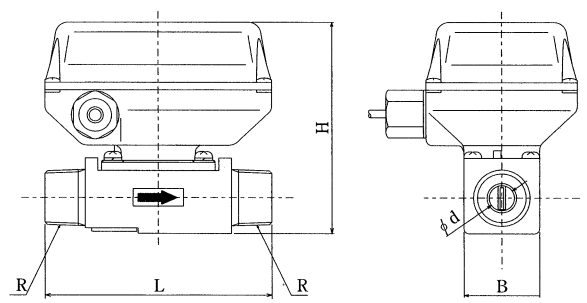




Model	Main dimensions (mm)				
	L	H	B	ød	R
QS1060R	80	85	30	10	R3/8
QS1560R	90	89	30	14	R1/2
QS2060R	120	98	40	18	R3/4
QS2560R	130	103	40	23	R1

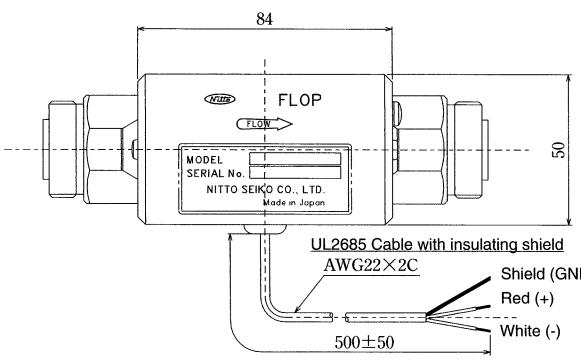
Field display type with output (Screw joint)



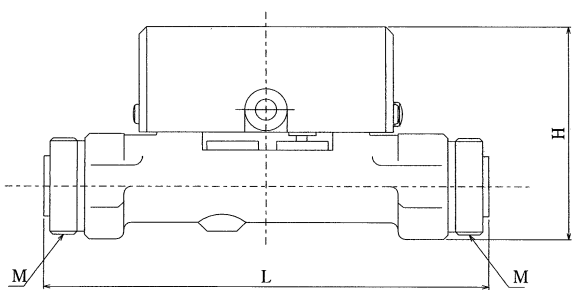


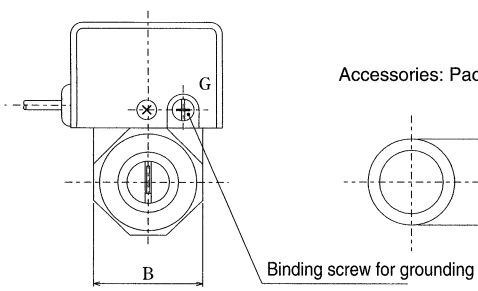
Model	Main dimensions (mm)				
	L	H	B	ød	R
QS1062R	80	85	30	10	R3/8
QS1562R	90	89	30	14	R1/2
QS2062R	120	98	40	18	R3/4
QS2562R	130	103	40	23	R1

Remote controlled type (Screw joint)

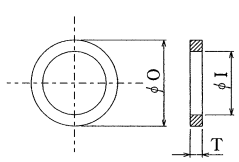


Model	Main dimensions (mm)						
	L	H	B	M	T	øI	øO
VS1062R	150	65	30	M26x1.5	4	15	22.5
VS1562R	150	71	36	M32x1.5	4	21	28.5
VS2572R	154	80	45	M40x1.5	4	27.5	37



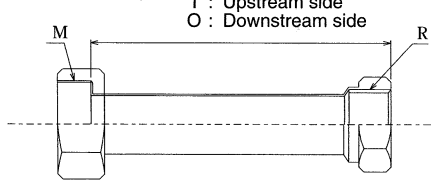


Accessories: Packing x 2 pcs.



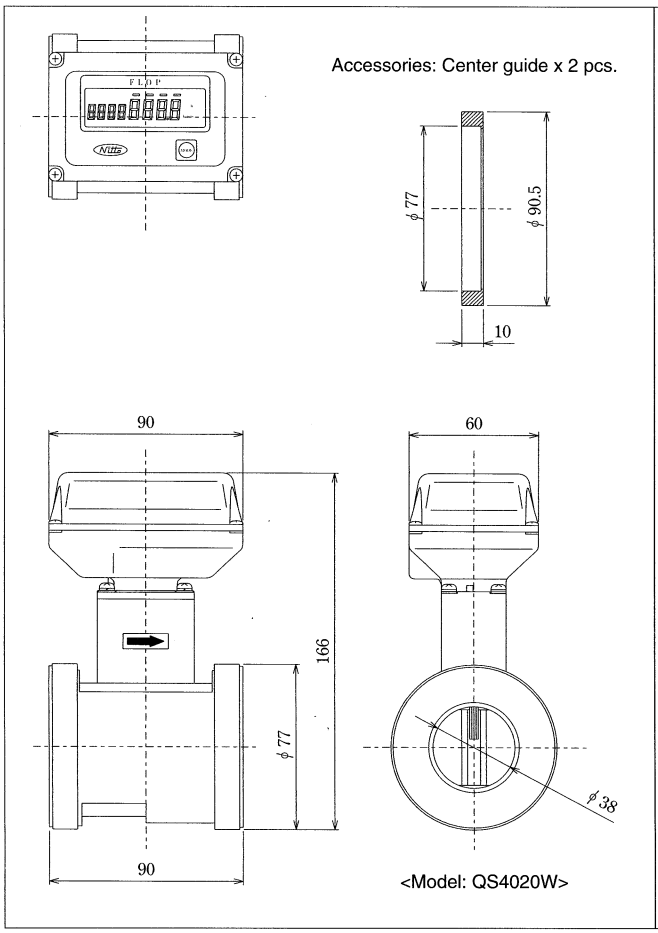
Accessories: Joint piping

I : Upstream side
O : Downstream side



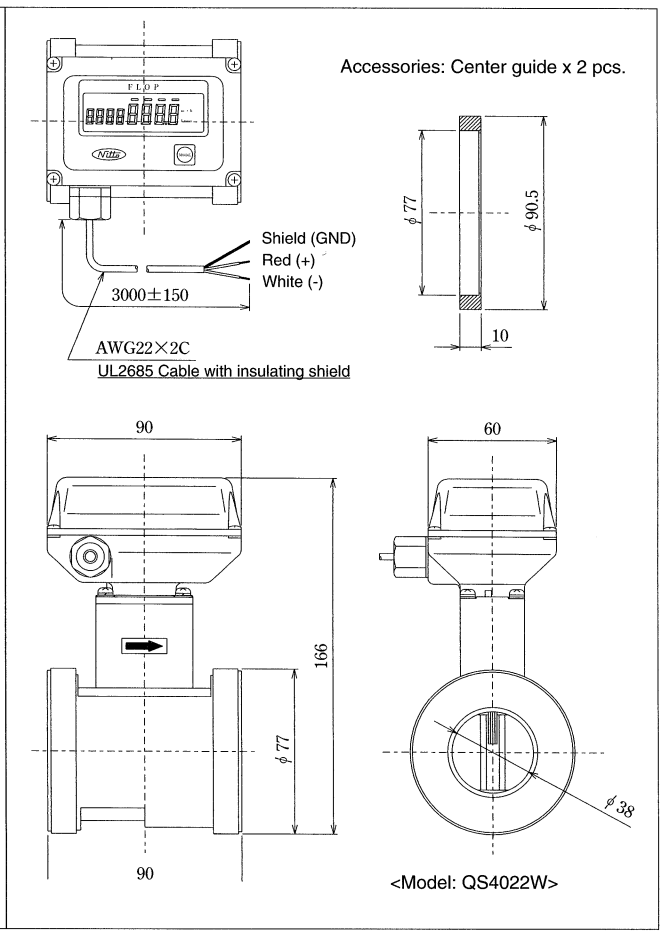
Model (Upstream side / Down side)	Main dimensions (mm)			
	I	O	R	M
VS10-401 / VS10-402	70	50	Rp1/2	M26x1.5
VS15-401 / VS15-402	110	80	Rp3/4	M32x1.5
VS25-401 / VS25-402	180	130	Rp 1	M40x1.5

Field display type (Wafer)



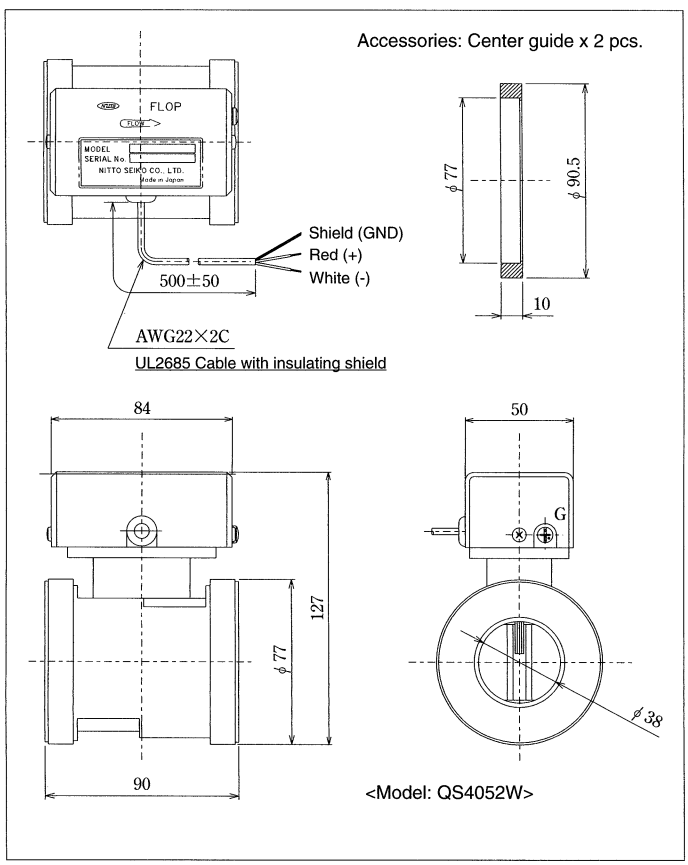
<Model: QS4020W>

Field display type with output (Wafer)



<Model: QS4022W>

Remote controlled type (Wafer)



<Model: QS4052W>

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