

Steam Flow Meter *STEAMcube*

Model MVC30A (Integral Type)

Model MVC31A (Integral Type for large flow)

OVERVIEW

The steam flow meter *STEAMcube* is designed exclusively to measure saturated steam. Because steam conditions change greatly according to the effects of pressure and temperature, steam flow measurement involves a number of difficulties.

STEAMcube measures differential pressure, which is used to measure flow rates, and steam pressure, to calculate steam density from a built-in steam table, and generates a mass flow rate of steam based on these measurements and calculations. This measurement scheme enables *STEAMcube* to make accurate steam flow rate measurements under the changing conditions.

China RoHS

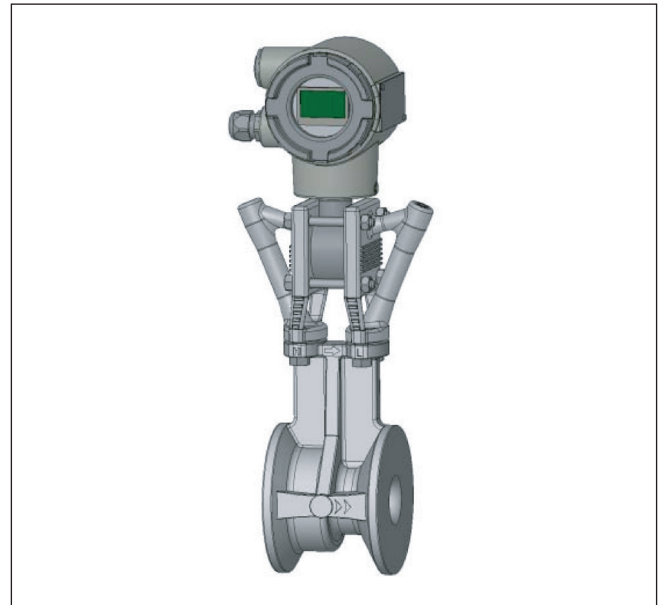
This device is used in the Oil & Gas, Petrochemical, Chemical, Pulp & Paper, Food & Beverage, Machinery, Steel/Metal & Mining, and Automobile industries and therefore does not fall under the China RoHS Legislation.

If this device is used in semiconductor manufacturing equipment, labeling on the device and documents for the China RoHS may be required. If such documents are required, consult an Azbil Corp. representative.

FEATURES

Dealing with changing steam flow conditions by measuring mass flow rates

- Because steam conditions change greatly due to the effects of pressure and temperature, it is very difficult to make accurate steam flow rate measurements. If a flow rate is measured based on the volume of steam passing through a flow meter, a considerable measurement error occurs due to the effects of changing steam conditions (expansion and contraction occur frequently). To measure a fluid such as steam, a flow rate should be measured based on a mass flow rate instead of the volume of steam passing through a flow meter because a mass flow rate remains unchanged even under changing pressure and temperature conditions.



- *STEAMcube*, equipped with dual sensors, measures pressure and differential pressure simultaneously and separately. By collating these measured pressure values with data in a built-in steam table, *STEAMcube* is able to calculate the temperature and density of saturated steam. It is also able to calculate a mass flow rate based on the temperature and density values.

Generating analog and pulse outputs simultaneously

STEAMcube can generate both analog and pulse outputs simultaneously. Using the pulse output, totalized flow rates can be counted with a level of accuracy higher than that of analog integration executed by DCS. Therefore, the pulse output is suitable for custody transfer applications. On the other hand, the analog output can be configured to output instantaneous flow rates or to selectively output either pressure or temperature measurements. By leveraging this feature of *STEAMcube*, it is possible to decrease the number of pressure transmitters by one.

Covering low-velocity regions by producing an uninterrupted output

- A vortex flow meter measures steam flow rates by counting the number of vortexes occurring downstream of a vortex shedder bar in a measurement pipe. Vortexes do not occur stably in a low-velocity state, and this leads to a loss of output, which is acknowledged as a problem to be solved.
- Because *STEAMcube* operates on the same principles as a differential pressure type flow meter, it can produce stable outputs over the entire velocity range even to ultra-low velocities. Therefore, *STEAMcube* can be used effectively, for example, to measure low flow rates of steam running through of equipment that is kept warm (hot).

Self water-sealed structure that enhances maintainability

- If a differential pressure transmitter is used to measure steam flow rates, the temperature of the transmitter itself increases as it is exposed to steam. To prevent this temperature increase, a water seal pot (drain pot) is used. However, a number of problems occur when using the water seal pot: the connecting pipe may become clogged by sludge, there is difficulty in controlling the liquid level, there is work needed to keep the pot warm to prevent freezing, etc.
- Because *STEAMcube* employs a self water-sealed structure, steam is cooled and turns into a water-sealed liquid which pools in a water pocket set inside a cover flange; this makes it possible to prevent the temperature of the transmitter from increasing. In addition, because sludge returns under its own weight to a steam pipe, it does not pool in the water pocket and, therefore, the connecting pipe does not need to be purged. Because *STEAMcube* is a differential pressure type flow meter, it provides the advantage that it can be removed from a point of measurement during operation and maintenance can be done for it if the three-way valve (optional part) is used. A vortex flow meter does not provide this advantage.

eTube that contributes to a decrease in pressure losses

To generate differential pressure, *STEAMcube* uses the eTube originally developed by Azbil Corporation as a flow element, instead of the conventionally used orifice. Because the eTube has a throttle structure shaped along the line of flow of fluid passing through it, energy losses occurring in the throttle can be minimized. Pressure losses of eTube are about 50% of those of an orifice of the same throttle diameter; so a substantial reduction in pressure losses has been achieved.

APPLICATIONS

- Measuring flow rates of utility steam used in various types of plants
- Measuring flow rates of steam being traded in an industrial complex
- Measuring flow rates of steam used in a sterilization process in the food market
- Measuring flow rates of steam used for heating in the machinery and equipment industry
- Measuring flow rates of steam used in district heating and cooling systems

STEAMcube can also be used for various other applications using steam.

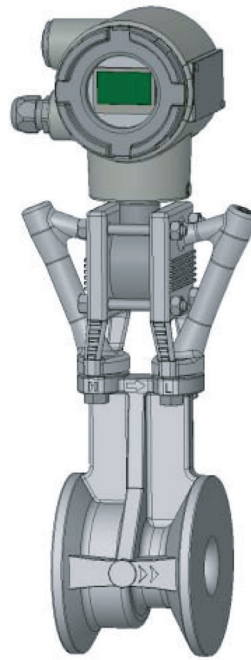
STRUCTURE

Converter

Measuring pressure and differential pressure simultaneously and separately with dual sensors
 Outputting mass flow rates based on density compensation calculations
 Output: Simultaneous analog and pulse outputs
 Display: Flow rates, pressure and temperature are output to be displayed on the LCD.

Differential pressure generating part in the oval throat type

Stable flow-rate output can be obtained thanks to the flow rectification effect.
 Low loss, minimum length of upstream and downstream straight pipes
 Size: 25mm to 150mm
 Rated pressure: JIS 10K, 20K, etc.
 Temperature: Up to 215°C
 Straight pipe lengths: 0.5 D minimum



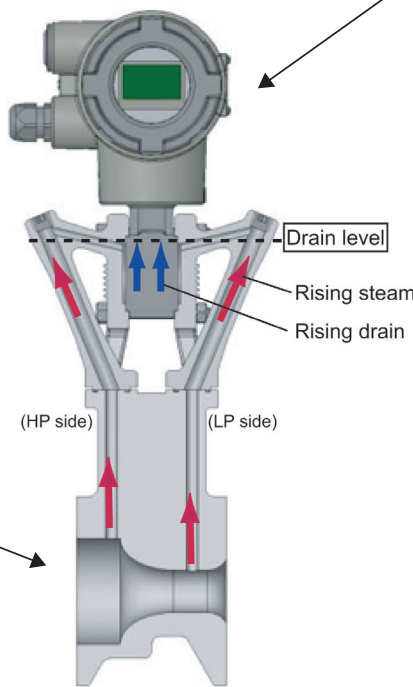
Self water-sealed body cover

Figure 1. Configuration

Differential pressure generating part in the eTube

The eTube has a differential pressure generating mechanism with a structure shown in Figure 2. Because the throttle has a streamlined shape, the flow separation, pressure losses and vortices occurring in the throttle can be minimized. This means that the differential pressure generated by the differential pressure generating mechanism can be extracted with minimal losses and turned into differential pressure signals to be used for flow rate measurement. Therefore, eTube's S/N ratio is very high, making it possible to extract stable differential pressure signals even if differential pressure is very low. In addition, the eTube produces a favorable side effect: a flow conditioning effect. This flow conditioning effect further produces the following advantages:

- The length of straight pipes used in the upstream and downstream portions can be shortened considerably.
- Flow meters can be installed to existing pipe lines without restrictions on locations in which to install them.



Self water-sealed structure

A diaphragm at the double-sided remote seal receives the differential pressure generated by the detecting part. This differential pressure is converted to flow rate signals output.
 If the diaphragm, which is made of stainless steel is heated to high temperature, the flowmeter may malfunction. To prevent this increase in the temperature of the diaphragm, the diaphragm is designed as a watersealed structure; the diaphragm is protected in water from overheating.
 This structure is called a self watersealed structure (SWS hereinafter). In a space enclosed by the diaphragm and the SWS cover flange, steam (fluid to be measured) is cooled, condenses and turns into water which cools the diaphragm to protect it from heat. Avoid applying heat to the SWS cover flange at the top of the detecting part. **The SWS cover flange must be exposed to outside air to make it radiate heat.** The approach to flow control and measurement so far described is basically identical to that for the conventional steam flow measurement mechanism using a differential pressure transmitter and an orifice. However, one difference should be noted with respect to the structure: in the case of the SWS structure, the seal pot used in the conventional instrumentation with a lead pipe is contained inside the differential pressure generating mechanism.

Figure 2. Structure

SPECIFICATIONS

Basic specifications

Process fluid

Steam only (saturated steam)

Measurement range and accuracy

[Flow rate]

Measurable range

See Table 1 through 4 on Page 11.

Accuracy

Standard specification: ±3% rdg

High-accuracy specification: ±2% rdg

Range of guaranteed accuracy

Process pressure PP MPaG	Range of guaranteed accuracy
0.3 < PP ≤ 2.0	Up to one tenth of maximum flow limit
0.1 < PP ≤ 0.3	Up to one eighth of maximum flow limit
0 ≤ PP ≤ 0.1	Up to one fifth of maximum flow limit

[Pressure (static pressure)]

Measurable range

0.101 to 3.5 MPa abs*

* This is output range of analog output

* This is not an operating pressure limit.

Accuracy

Shown below

Process pressure PP MPaG	Accuracy
0.35 < PP ≤ 2.0	±0.3%FS
0.17 ≤ PP ≤ 0.35	± (0.025 + 0.275 × $\frac{0.35}{PP}$)%FS

* Since the absolute pressure sensor is used for the process pressure measurement, the gauge pressure is set as 0.101 MPa abs.

[Temperature]

Measurable range

0 to 300 °C *

* This is output range of analog output

* This is not an operating temperature limit.

Accuracy

Accuracy is not specified because the temperature output is calculated from the steam table.

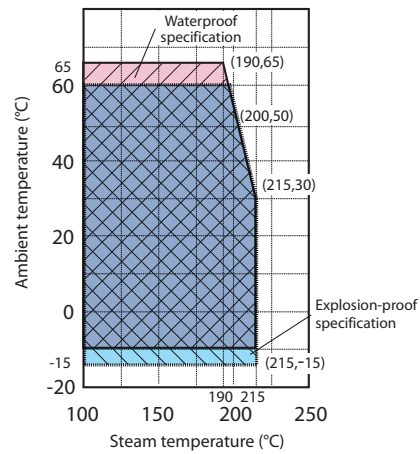
Repeatability

±0.5% rdg of flow rate output

Fluid pressure

Rated pressure of a selected process connection

Ambient temperature and steam temperature:



Ambient humidity

10 to 90% RH (no condensation)

Power source voltage

24 VDC (16.7 to 45 VDC)

Pressure loss

$$\text{MVC30A: } P_{\text{loss}} = 50 \times \left(\frac{Q}{Q_{\text{max}}} \right)^2$$

$$\text{MVC31A: } P_{\text{loss}} = 40 \times \left(\frac{Q}{Q_{\text{max}}} \right)^2$$

P_{loss} : Pressure loss when the flow rate is Q (kg/h or m³/h)

Q: Flow rate (kg/h or m³/h)

Q_{max} : Maximum flow rate in the range of guaranteed accuracy. (kg/h or m³/h) (see table 1 through 4)

Grounding

Grounding resistance to be less than 100 Ω

Installation

Integral type

Structure specifications

Material

[Measuring pipe section]

Measuring pipe body

SCS14A, SUS304 (for 150mm only)

Support bridge

SUS304 (for 150mm only)

Packing

Graphite

Connection

Wafer type

Flange bore diameter

25mm, 40mm, 50mm, 80mm, 100mm, 150mm

Flange specifications

JIS 10K and 20K, ANSI 150 and 300, JPI 150 and 300

Flange surface

RF (not serrated)

[Transmitter body]**Meter body**

SUS316

Diaphragm

SUS316L

Body cover

SCS14

Packing

PTFE (polytetrafluoroethylene) and SUS316

Transmitter case

Aluminum alloy

Transmitter O-ring

Chloroprene rubber

Fastening bolts and nuts

SNB7 or SUS304

Paint

Standard (acrylic baked finish)

Paint color**(Transmitter case)**

Light beige (Munsell 4Y7.2/1.3)

(Transmitter cover)

Dark beige (Munsell 10YR4.7/0.5)

Protection levelJIS C0920 watertight type
IEC IP67, NEMA3 and 4X**Flameproof structure**TIIS Ex d IIB+H₂ T4-X**Electrical conduit**

G1/2 (female) × 2 positions

Specifications of the signal conversion section**Output signal**

Analog *1 output, pulse *1 output, (analog and pulse outputs can be used simultaneously)

Selection of flow rate output*

One flow rate output must be selected from the following three outputs.

F specification:

Open collector pulse (totalized flow rate) +
analog (instantaneous flow rate)

P specification:

Open collector pulse (totalized flow rate) +
analog (saturation pressure)

T specification:

Open collector pulse (totalized flow rate) +
analog (saturation temperature)

* Flow rate output is dummy mass flow rate output. It is used to calculate the steam density and the steam saturation temperature measured based on pipe pressure values by referring to the steam table built into STEAMcube and to correct steam density values, on the assumption that the fluid to be measured is saturated steam.

[Analog output]**Output format**

Selected flow rate output is output using 4 to 20 mA DC.

Damping time constant (63% response)

To be selected from 0, 2, 4, 8, 16 and 32 seconds

To be selected from instantaneous flow rate, saturation pressure and saturation temperature

Dead time

0.4 seconds

[Pulse output]**Output format**

Open collector pulse

Contact capacity

30 VDC, 50 mA (maximum)

Residual voltage at output ON 2.6V max.

Leakage current at output OFF 0.19mA max.

Frequency

0.006 to 200 Hz

Pulse width

Frequency range	Pulse width
50 Hz < maximum pulse frequency ≤ 200 Hz	1 ms
5 Hz < maximum pulse frequency ≤ 50 Hz	10 ms
Maximum pulse frequency ≤ 5 Hz	100 ms

Pulse duty

Duty ratio fixed to 50%

[LCD display output]

Display	Displayed information	Number of digits	Character height
Main display	Instantaneous flow rate	4.5 digits One digit below the decimal point	About 6 mm
	Totalized flow rate	6 digits	
Sub display	Pressure and temperature	4.5 digits One digit below the decimal point	About 4 mm
	Instantaneous flow rate	4.5 digits One digit below the decimal point	
	Totalized flow rate	6 digits	

[LCD display unit]

Totalized flow rate	Instantaneous flow rate			Temperature	Process pressure
t	t/day	t/h	t/min	°C	MPa
kg	kg/day	kg/h	kg/min		
m ³	m ³ /day	m ³ /h	m ³ /min		

Output in case of abnormality**Analog output**

The burnout function is provided; output is moves to Hi or Lo limit. Otherwise, output can be selected without burnout processing.

Burnout current

Hi/Lo=20.8 mA to 3.8 mA DC

Pulse output

If burnout occurs, pulse output stops (not counted). Otherwise, pulse output can be selected from hold (from the counts that are held before the occurrence of abnormality).

If power failure occurs**Data retention**

Totalized flow rate values are recorded and retained in EEPROM in power OFF.

Communication functions**Communicator**

Field communication software CommStaff Model CFS100

Communication conditions

See Figure 10 "Supply voltage and load resistance values".

Self-diagnosis:

Self-diagnosis functions are provided to detect malfunctioning of EEPROM, CPU or temperature sensors, as well as equipment temperature abnormality.

Other specifications**Test report***

A test report in our company's format is issued.

* *STEAMcube is a piece of equipment comprising two components: the eTube for generating differential pressure and the multivariable differential pressure transmitter. For differential pressure type flow meters, test data obtained by placing them in the flow of liquid or fluid are usually available. For STEAMcube, however, such test data is not available.*

Cable gland (one or two)

Cable gland required for the Flameproof structure is packaged with the flow meter shipment.

Waterproof gland (one or two)

Waterproof gland (not explosion-proof) is packaged with the flow meter shipment.

Signal cables to be used**Signal cables***

CVV, CEV, CEE, CVVS, CEVS, CEES

* *Use a cable with the specific heatproof temperature rating suited for the location where it is used.*

INSTALLATION PRECAUTIONS

Verify the flow direction mark

Verify the flow direction mark on the flow meter matches the process fluid flow direction. Wrong installation causes the inaccurate measurement.

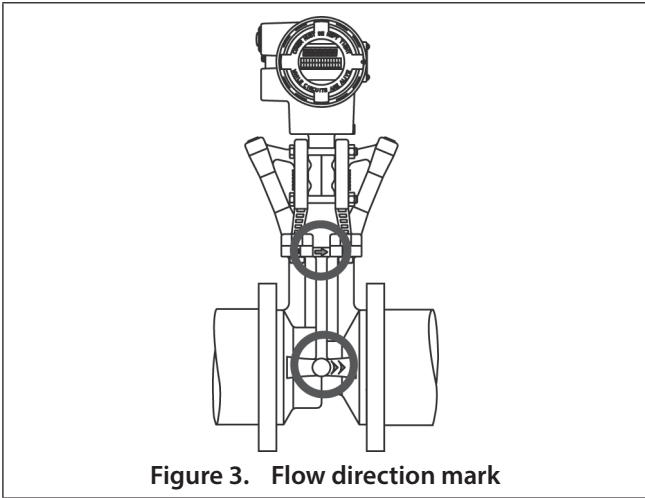


Figure 3. Flow direction mark

Over range flow

In case that the steam is released from the downstream of the flow meter to the atmosphere, the steam expands rapidly and its velocity becomes transonic speed.

If this happens, the steam exceeds the measurable flow rate range and the steam is not saturated and thus it causes inaccurate measurement.

It is strongly recommended to install the valve or restriction at the downstream side of the flowmeter.

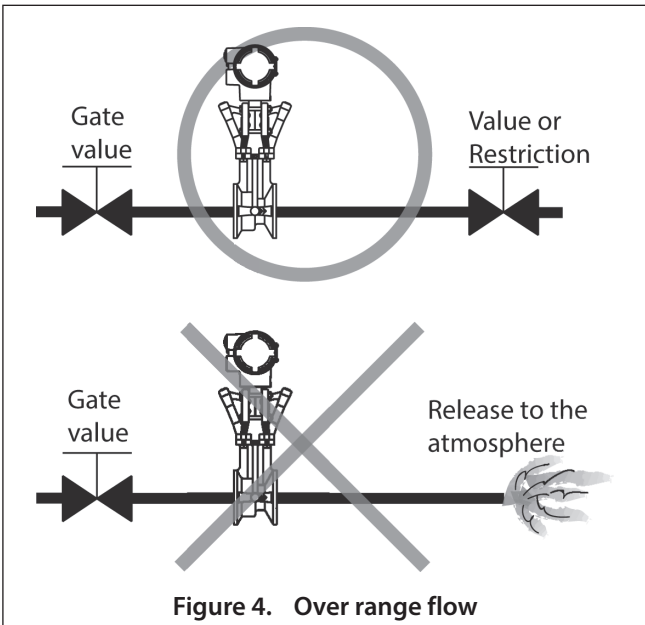


Figure 4. Over range flow

Lengths of straight pipes on the upstream and downstream sides of STEAMcube

To generate stable differential pressure, STEAMcube requires that straight pipes on the upstream and downstream sides have at least the lengths shown in Figure 5. D is the bore diameter (line size). For example, 0.5D shows that the length of a straight tube is 0.5 times as long as the bore diameter (line size).

Figure 5 shows the specified lengths of straight pipes on the upstream and downstream sides of STEAMcube. If a straight pipe has a length shorter than that specified in Figure 5, output errors may occur.

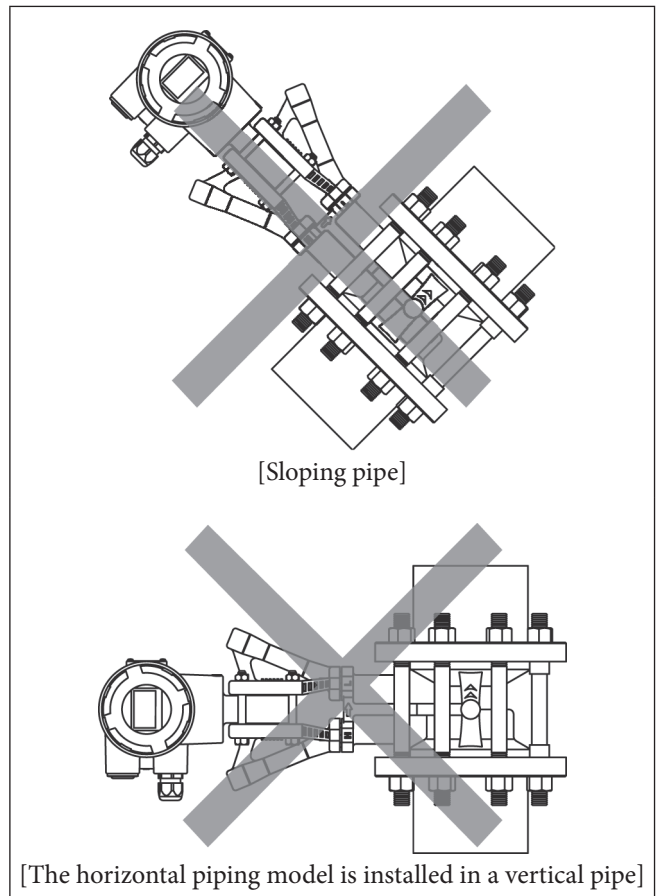
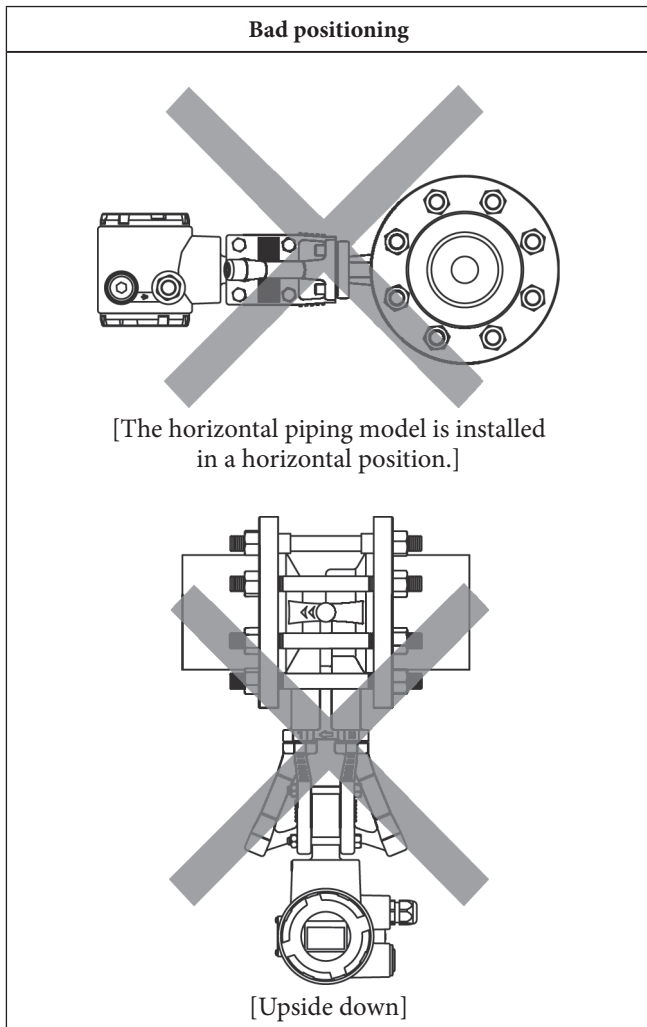
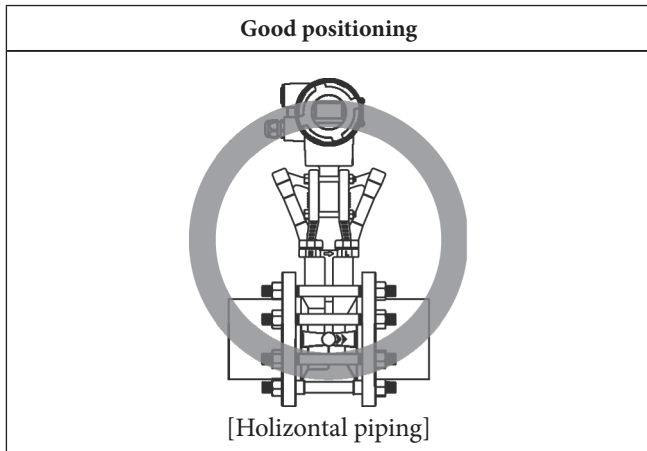
Upstream side L1		
<p>One right-angle bend</p>	<p>Two or more right-angle bends set on the same plane</p>	<p>Shrinkage pipe</p>
0.5	1.5	2.5
Upstream side L1	Downstream side L2	
<p>Expanding pipe</p>	<p>Gate valve (fully open)*</p>	<p>All joints shown at left</p>
1.5	2.5	0.6

Figure 5. Lengths of straight pipes on the upstream and downstream sides

* Valves in this figure are the gate valve, ball valve but not globe valve.

Precautions concerning positioning of STEAMcube

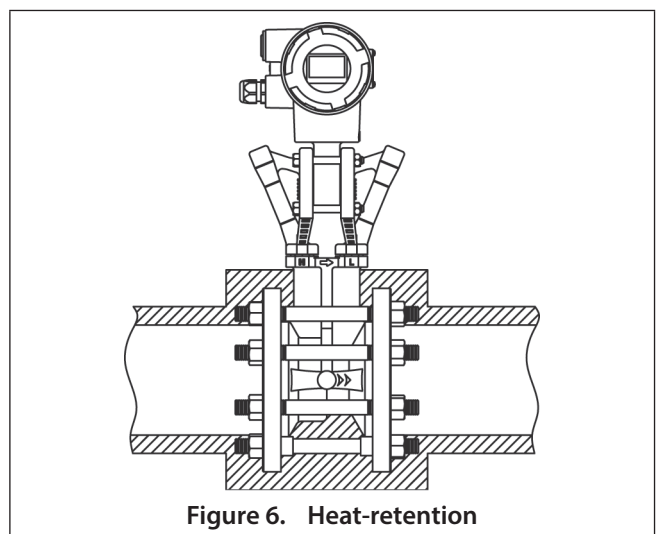
Steam cools inside the SWS flange of STEAMcube. Cooled steam turns into condensate which covers a diaphragm at the pressure receiving part to prevent the diaphragm from overheating. In this mechanism, condensate must always remain pooled inside the SWS flange.



Precautions for the heat-retention

This device adopts the self water-sealed structure which condenses the steam and condensed water protects the device from the steam.

CAUTION
<ul style="list-style-type: none"> Do not keep the self water-seal flange, meterbody and converter warm. It may cause the damage on the device.



Condensate must not pool or stagnate in a pipe!

Do not install *STEAMcube* in a position where condensate may pool or stagnate inside a pipe. Before starting the installation work, check the position where *STEAMcube* is to be installed to make sure that condensate does not pool or stagnate inside a pipe.

⚠ CAUTION

- Prevent condensate from pooling in the pipes. A large amount of condensate in a pipe can cause a water hammer that may affect not only the flowmeter but also the downstream devices.

Note that pooled water may also produce differential pressure not due to flow. In such a case, output is generated when there is no steam flow.

When installing the flowmeter, be sure to install a steam trap nearby to discharge condensate.

Caution for the noise of steam

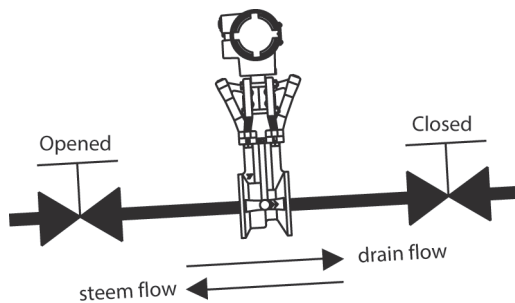
In some piping, the flowmeter may generate noise or vibration.

In order to avoid the noise/vibration, it is suggested not to install the flow meter close to the tee pipes, valves, bent pipes and filters.

If condensed water flows in the flowmeter and flasehs, significant noise may be generated. Install the flowmeter the place where the condensed water flows.

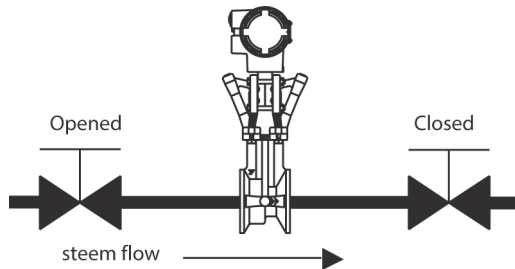
⚠ CAUTION

- Impact to transmitter can damage sensor module.
- Use a power supply with overcurrent protection for this instrument.



If the direction of steam flow is reverse to that of drain flow in sloping piping:

Two-phase counter flows occur, and condensate may pool inside a pipe.



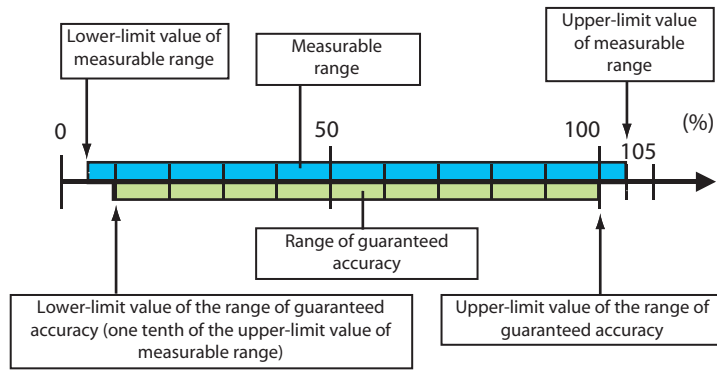
If a valve on the primary is opened and that on the secondary is closed in horizontal piping:

Because steam continues flowing from the primary, it is cooled before it reaches the valve on the secondary, causing the pipe to be filled up with condensate.

Figure 7. Cases of installation that may result in pooling of condensate

MEASUREMENT RANGE SETTING

(Unit:mm)



Example: In the case of 50mm and 1 MPa

Check the range of guaranteed accuracy in Table 1. The range of guaranteed accuracy is from 1,196 kg/h (upper-limit value) to 120 kg/h (lower-limit value). The range can be expanded to 1,255 kg/h which is 1.05 times as large as the upper-limit value of the range of guaranteed accuracy. It is recommended that you make an easy-to-use setting* by omitting fractions, for example, 0 to 1,200 kg/h.

If the lower-limit value is less than 69 kg/h, output will be cut. Use caution in this regard.

* A special communicator is needed to change the internal setting.

Figure 8. Measurement range and the range of guaranteed accuracy

Factory Default Setting

ITEM	Factory Default Setting	other
Flow rate range	Customer instruction	Order decisions
Process Pressure range	0.101 to 3.5 MPa_abs	
Temperature range	0 to 300 °C	
Pulse Weigh	Customer instruction	
Damping	Customer instruction	When there is not a designation this makes 2 seconds.
Burnout	Customer instruction	Order decisions
Low flow cut	3% of Flow rate range	This converts Low flow cut, SP cut and DP cut to the flow rate and the biggest one is choose in it.
SP cut value	0.035 MPa	
DP cut value	0.3 kPa	
Density compensation	Customer instruction	Flow rate output : C only
Height	Customer instruction	When there is not a designation this makes 0.0m.(MVC32/33A only)

Table 1. MVC30A Measurable range of saturated steam (in the case of mass flow rate output)

(kg/h)

Static pressure (MPa_G)	25mm				40mm				50mm			
	Measurable range				Measurable range				Measurable range			
	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit
		Upper limit	Lower limit			Upper limit	Lower limit			Upper limit	Lower limit	
0.1	90	86	17	8	215	205	41	19	355	338	68	31
0.2	133	127	16	10	318	303	38	23	525	500	62	38
0.3	176	167	21	11	420	400	50	26	693	660	82	43
0.4	203	193	19	12	484	461	46	29	799	761	76	48
0.5	227	216	22	13	541	515	51	31	892	850	85	52
0.6	248	236	24	14	592	564	56	34	976	930	93	56
0.7	268	255	25	15	639	608	61	36	1054	1004	100	60
0.8	286	272	27	16	682	649	65	38	1125	1072	107	63
0.9	303	288	29	17	722	688	69	40	1192	1135	114	66
1.0	319	304	30	18	761	724	72	42	1255	1196	120	69
1.1	334	318	32	18	797	759	76	44	1315	1253	125	72
1.2	349	332	33	19	832	792	79	46	1373	1307	131	75
1.3	363	345	35	20	865	824	82	47	1428	1360	136	78
1.4	376	358	36	20	897	855	85	49	1481	1410	141	81
1.5	389	370	37	21	928	884	88	50	1532	1459	146	83
1.6	402	382	38	22	958	913	91	52	1581	1506	151	86
1.7	414	394	39	22	987	940	94	53	1629	1552	155	88
1.8	426	405	41	23	1016	967	97	55	1676	1596	160	90
1.9	437	416	42	24	1043	993	99	56	1722	1640	164	93
2.0	448	427	43	24	1070	1019	102	57	1766	1682	168	95

(kg/h)

Static pressure (MPa_G)	80mm				100mm				150mm			
	Measurable range				Measurable range				Measurable range			
	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit
		Upper limit	Lower limit			Upper limit	Lower limit			Upper limit	Lower limit	
0.1	689	656	131	60	1202	1145	229	105	2689	2561	512	235
0.2	1017	969	121	73	1775	1691	211	127	3972	3782	473	284
0.3	1342	1278	160	83	2343	2231	279	145	5241	4992	624	325
0.4	1549	1475	148	92	2703	2575	257	161	6048	5760	576	361
0.5	1729	1647	165	101	3018	2874	287	176	6752	6431	643	393
0.6	1893	1802	180	108	3303	3146	315	189	7390	7038	704	423
0.7	2043	1946	195	115	3565	3396	340	202	7977	7597	760	451
0.8	2181	2077	208	122	3806	3625	363	213	8516	8110	811	477
0.9	2311	2201	220	128	4033	3841	384	224	9023	8593	859	501
1.0	2433	2317	232	134	4246	4044	404	235	9500	9048	905	525
1.1	2549	2428	243	140	4449	4237	424	245	9954	9480	948	547
1.2	2660	2534	253	146	4643	4422	442	254	10388	9894	989	569
1.3	2767	2635	264	151	4830	4600	460	263	10805	10291	1029	589
1.4	2870	2733	273	156	5009	4771	477	272	11206	10673	1067	609
1.5	2969	2828	283	161	5182	4935	494	281	11594	11042	1104	629
1.6	3065	2919	292	166	5350	5095	509	289	11969	11399	1140	648
1.7	3158	3008	301	171	5512	5250	525	298	12332	11745	1174	666
1.8	3249	3094	309	175	5670	5400	540	306	12685	12081	1208	684
1.9	3336	3178	318	180	5823	5546	555	313	13028	12408	1241	701
2.0	3422	3259	326	184	5973	5688	569	321	13363	12726	1273	718

Table 2. MVC30A Measurable range of saturated steam (in the case of volume flow rate output)

(m³/h)

Static pressure (MPa_G)	25mm				40mm				50mm			
	Measurable range				Measurable range				Measurable range			
	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit
		Upper limit	Lower limit			Upper limit	Lower limit			Upper limit	Lower limit	
0.1	79	76	15	7	190	181	36	16	314	299	60	27
0.2	81	77	10	6	193	184	23	14	318	303	38	22
0.3	81	77	10	5	194	185	23	12	321	306	38	20
0.4	76	73	7	4	182	174	17	11	301	287	29	18
0.5	72	68	7	4	171	163	16	10	283	269	27	16
0.6	68	65	6	4	162	154	15	9	267	255	25	15
0.7	64	61	6	4	154	147	15	9	254	242	24	14
0.8	62	59	6	3	147	140	14	8	243	231	23	13
0.9	59	56	6	3	141	134	13	8	233	221	22	13
1.0	57	54	5	3	135	129	13	7	223	213	21	12
1.1	55	52	5	3	130	124	12	7	215	205	21	12
1.2	53	50	5	3	126	120	12	7	208	198	20	11
1.3	51	49	5	3	122	116	12	7	202	192	19	11
1.4	50	47	5	3	118	113	11	6	196	186	19	11
1.5	48	46	5	3	115	110	11	6	190	181	18	10
1.6	47	45	4	2	112	107	11	6	185	176	18	10
1.7	46	44	4	2	109	104	10	6	180	172	17	10
1.8	45	42	4	2	107	101	10	6	176	167	17	9
1.9	44	41	4	2	104	99	10	6	172	164	16	9
2.0	43	41	4	2	102	97	10	5	168	160	16	9

(m³/h)

Static pressure (MPa_G)	80mm				100mm				150mm			
	Measurable range				Measurable range				Measurable range			
	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit	Upper limit	Range of guaranteed accuracy		Lower limit
		Upper limit	Lower limit			Upper limit	Lower limit			Upper limit	Lower limit	
0.1	609	580	116	53	1063	1013	203	92	2381	2268	454	206
0.2	617	588	74	44	1078	1027	128	76	2415	2300	287	171
0.3	622	593	74	38	1087	1035	129	67	2433	2317	290	150
0.4	584	556	56	34	1019	971	97	60	2282	2173	217	135
0.5	549	523	52	32	958	913	91	55	2145	2043	204	124
0.6	519	494	49	29	906	863	86	51	2028	1931	193	115
0.7	493	469	47	28	860	819	82	48	1926	1834	183	108
0.8	471	448	45	26	822	783	78	46	1839	1752	175	102
0.9	451	429	43	25	787	750	75	43	1763	1679	168	97
1.0	433	413	41	24	757	721	72	41	1694	1613	161	93
1.1	418	398	40	23	729	695	69	40	1633	1555	156	89
1.2	404	384	38	22	705	671	67	38	1578	1503	150	86
1.3	391	372	37	21	682	650	65	37	1528	1455	145	83
1.4	379	361	36	20	662	631	63	36	1482	1411	141	80
1.5	368	351	35	20	643	613	61	35	1440	1372	137	78
1.6	359	342	34	19	626	596	60	34	1402	1335	133	75
1.7	350	333	33	19	610	581	58	33	1366	1301	130	73
1.8	341	325	32	18	596	567	57	32	1333	1270	127	71
1.9	333	317	32	18	582	554	55	31	1302	1240	124	70
2.0	326	310	31	17	569	542	54	30	1274	1213	121	68

Table 3. MVC31A for large flow Measurable range of saturated steam (in the case of mass flow rate output)

(kg/h)

Static pressure (MPa_G)	25mm				40mm				50mm			
	Measurable range				Measurable range				Measurable range			
	Range of guaranteed accuracy				Range of guaranteed accuracy				Range of guaranteed accuracy			
	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit
0.1	211	201	40	19	515	491	98	45	832	793	159	74
0.2	312	297	37	22	761	725	91	55	1230	1171	146	89
0.3	412	392	49	26	1005	957	120	63	1624	1547	193	102
0.4	477	454	45	29	1164	1109	111	70	1880	1791	179	113
0.5	534	509	51	31	1303	1241	124	76	2105	2005	201	123
0.6	585	558	56	34	1429	1361	136	82	2309	2199	220	133
0.7	633	603	60	36	1545	1471	147	87	2496	2377	238	142
0.8	676	644	64	38	1651	1573	157	92	2667	2540	254	150
0.9	717	683	68	40	1751	1667	167	97	2828	2694	269	157
1.0	756	720	72	42	1845	1757	176	102	2981	2839	284	165
1.1	793	755	75	43	1935	1843	184	106	3125	2977	298	172
1.2	828	788	79	45	2020	1924	192	110	3264	3108	311	179
1.3	861	820	82	47	2102	2002	200	114	3396	3235	323	185
1.4	894	851	85	48	2182	2078	208	118	3524	3356	336	191
1.5	925	881	88	50	2258	2150	215	122	3647	3474	347	198
1.6	955	910	91	51	2332	2220	222	126	3767	3587	359	203
1.7	984	938	94	53	2403	2289	229	129	3882	3697	370	209
1.8	1013	965	96	54	2473	2355	235	133	3994	3804	380	215
1.9	1041	991	99	56	2540	2419	242	136	4103	3908	391	220
2.0	1068	1017	102	57	2606	2482	248	140	4210	4009	401	226

(kg/h)

Static pressure (MPa_G)	80mm				100mm				150mm			
	Measurable range				Measurable range				Measurable range			
	Range of guaranteed accuracy				Range of guaranteed accuracy				Range of guaranteed accuracy			
	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit
0.1	1614	1537	307	143	2734	2604	521	242	6310	6009	1202	560
0.2	2385	2271	284	173	4040	3847	481	293	9322	8878	1110	676
0.3	3149	2999	375	198	5333	5079	635	335	12307	11721	1465	775
0.4	3646	3473	347	220	6176	5882	588	372	14250	13572	1357	860
0.5	4083	3888	389	239	6914	6585	659	406	15955	15195	1520	937
0.6	4477	4264	426	258	7582	7221	722	437	17496	16663	1666	1009
0.7	4840	4609	461	275	8196	7806	781	466	18913	18013	1801	1076
0.8	5172	4926	493	291	8760	8343	834	492	20214	19251	1925	1138
0.9	5485	5224	522	306	9289	8847	885	518	21435	20414	2041	1196
1.0	5780	5505	550	320	9789	9323	932	542	22588	21512	2151	1252
1.1	6061	5772	577	334	10264	9776	978	565	23685	22557	2256	1306
1.2	6329	6027	603	347	10719	10208	1021	588	24733	23555	2356	1357
1.3	6586	6273	627	359	11155	10623	1062	609	25739	24513	2451	1407
1.4	6834	6508	651	372	11574	11023	1102	630	26706	25435	2543	1455
1.5	7073	6736	674	383	11978	11408	1141	650	27640	26324	2632	1501
1.6	7304	6956	696	395	12370	11781	1178	669	28543	27184	2718	1546
1.7	7528	7169	717	406	12749	12142	1214	688	29418	28018	2802	1590
1.8	7745	7376	738	417	13118	12493	1249	707	30269	28827	2883	1632
1.9	7957	7578	758	428	13476	12834	1283	725	31095	29615	2961	1674
2.0	8163	7774	777	438	13825	13167	1317	742	31901	30382	3038	1714

When doing the range setting of more than 20000 kg/h, the entry to change a unit into ton/h is necessary.

Table 4. MVC31A for large flow Measurable range of saturated steam (in the case of volume flow rate output)

(m³/h)

Static pressure (MPa_G)	25mm				40mm				50mm			
	Measurable range				Measurable range				Measurable range			
	Range of guaranteed accuracy				Range of guaranteed accuracy				Range of guaranteed accuracy			
	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit
0.1	186	177	35	16	454	432	86	40	733	698	140	65
0.2	189	180	22	14	460	438	55	33	744	708	89	54
0.3	190	181	23	12	464	442	55	29	750	714	89	47
0.4	179	170	17	11	436	416	42	26	705	672	67	42
0.5	169	161	16	10	412	392	39	24	665	633	63	39
0.6	160	152	15	9	390	371	37	22	630	600	60	36
0.7	152	145	14	9	371	353	35	21	599	570	57	34
0.8	145	138	14	8	354	337	34	20	572	545	55	32
0.9	139	133	13	8	340	324	32	19	549	523	52	31
1.0	134	128	13	7	327	311	31	18	528	503	50	29
1.1	129	123	12	7	315	300	30	17	509	485	49	28
1.2	125	119	12	7	305	290	29	17	492	469	47	27
1.3	121	115	12	7	295	281	28	16	477	454	45	26
1.4	117	112	11	6	287	273	27	16	463	441	44	25
1.5	114	109	11	6	279	265	27	15	450	429	43	24
1.6	111	106	11	6	271	258	26	15	438	417	42	24
1.7	108	103	10	6	264	252	25	14	427	407	41	23
1.8	106	101	10	6	258	246	25	14	417	397	40	22
1.9	103	98	10	6	252	240	24	14	407	388	39	22
2.0	101	96	10	5	247	235	23	13	399	380	38	21

(m³/h)

Static pressure (MPa_G)	25mm				40mm				50mm			
	Measurable range				Measurable range				Measurable range			
	Range of guaranteed accuracy				Range of guaranteed accuracy				Range of guaranteed accuracy			
	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit	Upper limit	Upper limit	Lower limit	Lower limit
0.1	1422	1355	271	126	2409	2295	459	213	5560	5295	1059	493
0.2	1442	1374	172	104	2443	2327	291	177	5637	5369	671	409
0.3	1453	1384	173	91	2462	2344	293	155	5680	5410	676	358
0.4	1367	1302	130	82	2316	2205	221	140	5343	5089	509	322
0.5	1289	1228	123	76	2183	2079	208	128	5038	4798	480	296
0.6	1221	1163	116	70	2068	1969	197	119	4771	4544	454	275
0.7	1161	1106	111	66	1967	1873	187	112	4538	4322	432	258
0.8	1110	1057	106	62	1880	1791	179	106	4338	4132	413	244
0.9	1065	1014	101	59	1803	1717	172	101	4161	3963	396	232
1.0	1024	975	98	57	1735	1652	165	96	4003	3812	381	222
1.1	988	941	94	54	1673	1593	159	92	3860	3677	368	213
1.2	955	909	91	52	1617	1540	154	89	3732	3554	355	205
1.3	925	881	88	50	1567	1492	149	85	3615	3443	344	198
1.4	898	855	86	49	1521	1448	145	83	3509	3342	334	191
1.5	873	831	83	47	1478	1408	141	80	3411	3249	325	185
1.6	850	809	81	46	1439	1371	137	78	3321	3163	316	180
1.7	828	789	79	45	1403	1336	134	76	3237	3083	308	175
1.8	809	770	77	44	1369	1304	130	74	3160	3009	301	170
1.9	790	752	75	42	1338	1274	127	72	3088	2941	294	166
2.0	773	736	74	41	1309	1246	125	70	3020	2876	288	162

MODEL SELECTION

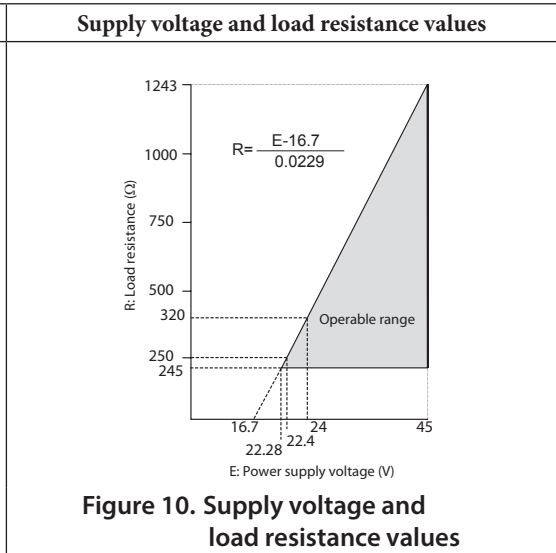
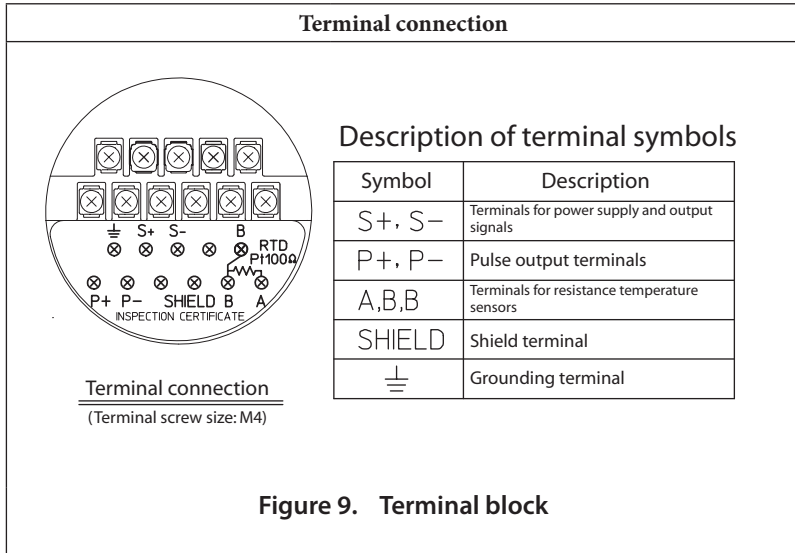
Steam Flow Meter *STEAMcube*

Model MVC30A - I II III IV - V VI VII VIII - / Options (Some options can be selected per each model.)

Model MVC31A - I II III IV - V VI VII VIII - / Options (Some options can be selected per each model.)

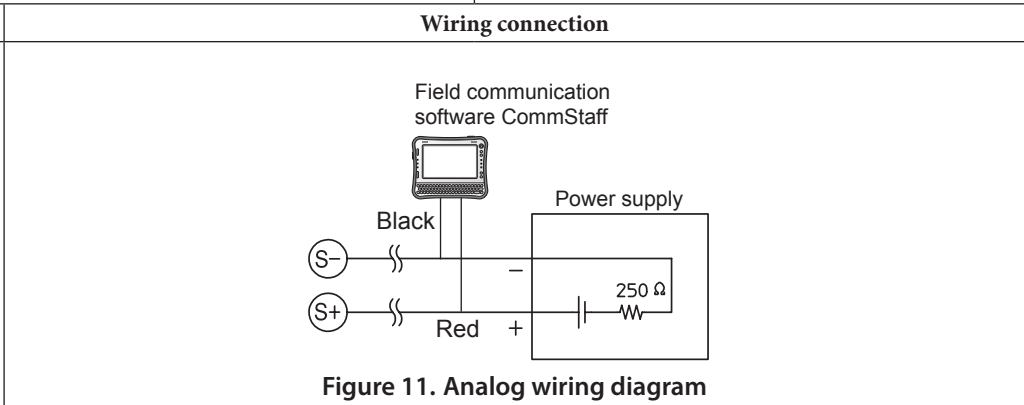
Basic model no.	MVC30A		Selections				Additional selections				Options
	MVC31A										
Selections (detector specification)	Line size	25mm	3								
		40mm	4								
		50mm	5								
		80mm	8								
		100mm	A								
		150mm	C								
	Process connection	JIS10K wafer type		V							
		JIS20K wafer type		W							
		JPI/ANSI class 150 wafer type		S							
		JPI/ANSI class 300 wafer type		T							
Sealing liquid	None (in the case of the integral-type model)		X								
Capillary length	None								X		
Additional selections (converter specification)	Output allocation (analog output)	Open collector pulse (totalized flow rate) + analog (instantaneous flow rate)	F								
		Open collector pulse (totalized flow rate) + analog (saturation pressure)	P								
		Open collector pulse (totalized flow rate) + analog (saturation temperature)	T								
	Burnout direction	None					X				
		Burnout upper limit					U				
		Burnout lower limit					D				
	Flow rate output	Volume					V				
		Standard (pressure)					P				
		Density to be substituted (fixed value)					C				
	Indicators and display allocation	None						X			
		Main display for totalized flow rate, and sub display for instantaneous flow rate						1			
		Main display for totalized flow rate, and sub display for pressure and temperature						2			
		Main display for instantaneous flow rate, and sub display for totalized flow rate						A			
		Main display for instantaneous flow rate, and sub display for pressure and temperature						B			
	Electrical conduit and explosion-proof construction	G1/2, no flameproof construction, one plastic cable gland							1		
		G1/2, no flameproof construction, two plastic cable glands							2		
G1/2, TIIIS Flameproof, one pressure-resistant packing-cable gland								J			
G1/2, TIIIS Flameproof, two pressure-resistant packing-cable glands								T			
Mounting/direction of flow	Horizontal piping from left to right								1		
	Horizontal piping from right to left								2		
Options	Options	None								XX	
		High-accuracy specification								C1	
		Bolt and nut assembly (carbon steel) * For wafer type only								N1	
		Bolt and nut assembly (SUS304) * For wafer type only								N2	
		Material of bolts and nuts used on the cover flange - SUS304								H7	
		Test report								T1	

ELECTRICAL WIRING

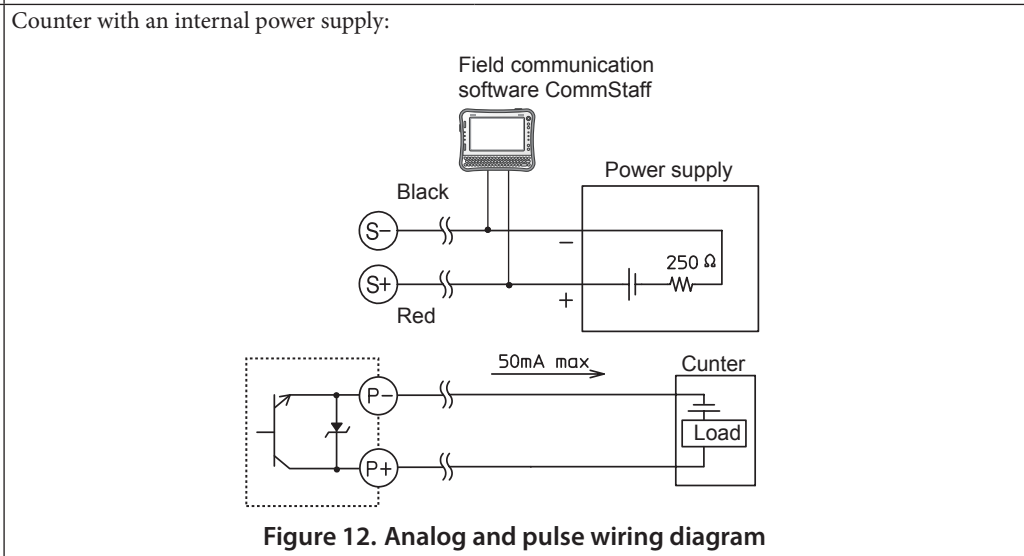


Connection

If analog output only is used



If pulse output only is used or if pulse output is used with analog output

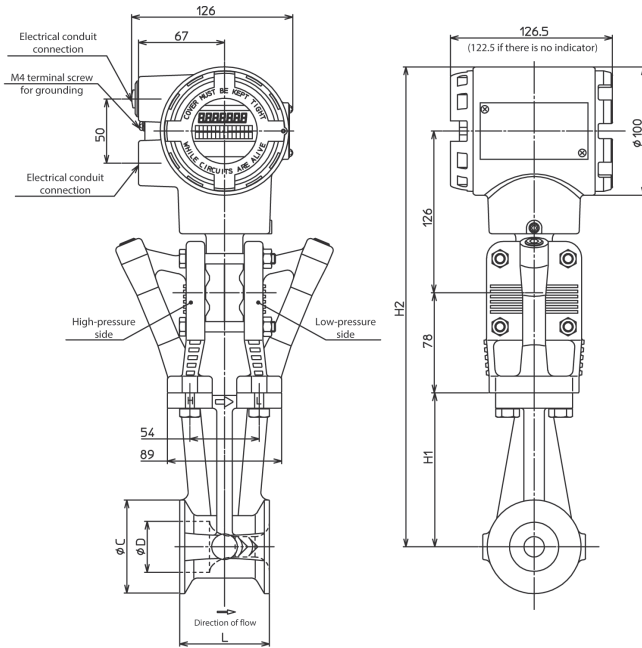


DIMENSIONS

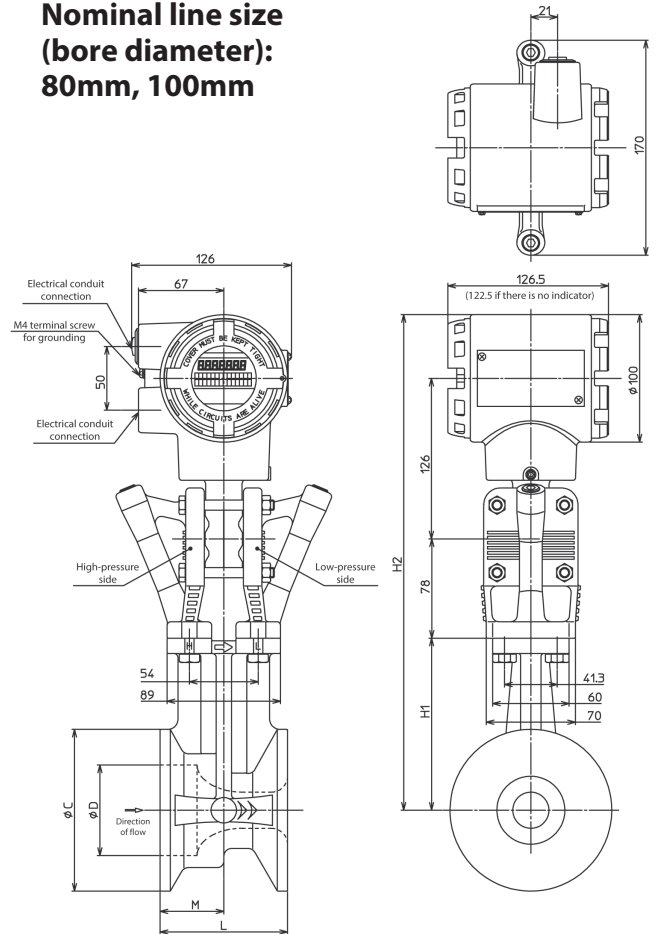
Horizontal piping from left to right (specification 1)

(Unit: mm)

**Nominal line size
(bore diameter):
25mm, 40mm, 50mm**



**Nominal line size
(bore diameter):
80mm, 100mm**



Nominal line size (bore diameter): 150mm

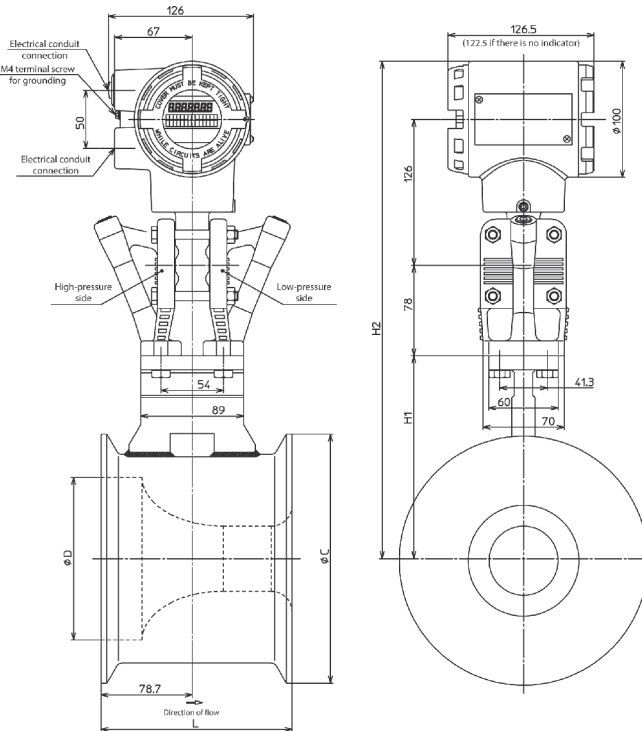


Table of dimensions

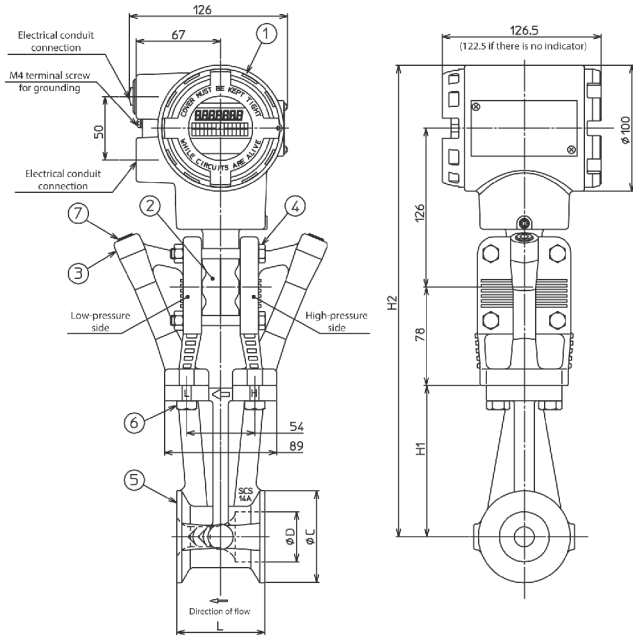
Horizontal connection

Size	L	M	φC	φD	H1	H2	Weight
25mm	70	-	50.8	25.7	110	364	About 6.4 kg
40mm	70	-	73	39.7	120	374	About 7.1 kg
50mm	75	-	92	51	125	379	About 7.8 kg
80mm	100	50	127	71	135	389	About 9.3 kg
100mm	120	55.85	157.2	93.8	150	404	About 13.2 kg
150mm	165	-	214.9	140.3	175	429	About 42.5 kg

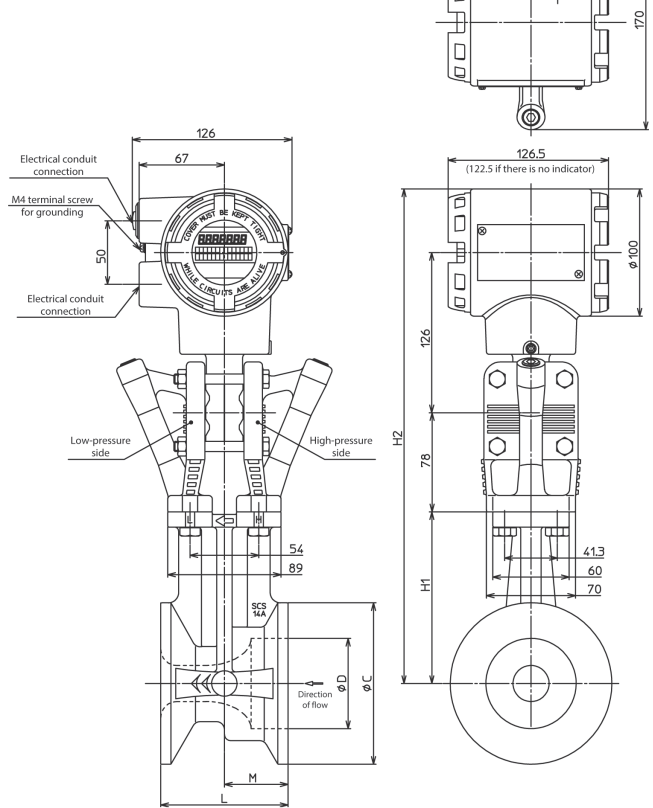
Horizontal piping from right to left (specification 2)

(Unit: mm)

Nominal line size
(bore diameter):
25mm, 40mm, 50mm



Nominal line size
(bore diameter):
80mm, 100mm



Nominal line size (bore diameter): 150mm

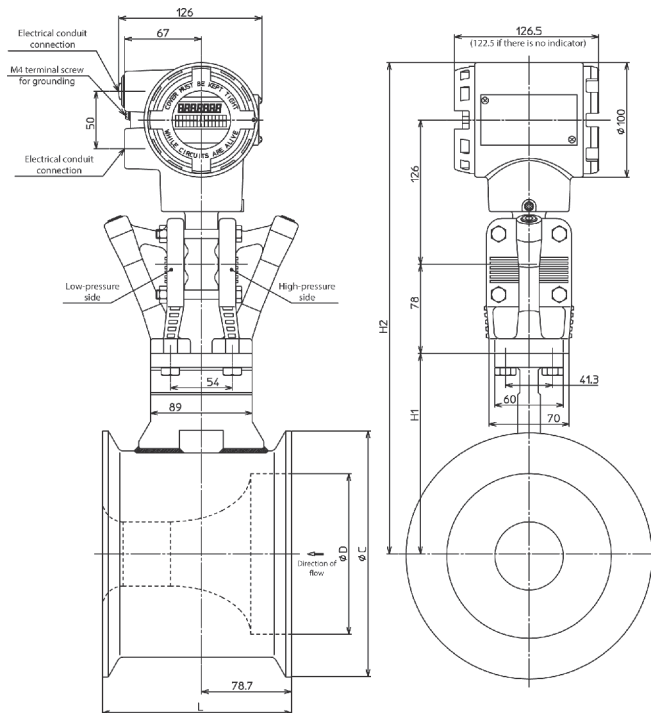


Table of dimensions

Horizontal connection

Size	L	M	φC	φD	H1	H2	Weight
25mm	70	-	50.8	25.7	110	364	About 6.4 kg
40mm	70	-	73	39.7	120	374	About 7.1 kg
50mm	75	-	92	51	125	379	About 7.8 kg
80mm	100	50	127	71	135	389	About 9.3 kg
100mm	120	55.85	157.2	93.8	150	404	About 13.2 kg
150mm	165	-	214.9	140.3	175	429	About 42.5 kg

Desired delivery time		Sales representative of your company	
-----------------------	--	--------------------------------------	--

The following information is required to select an appropriate STEAMcube model:

Instrument control number

Tag No.	_____ (Use up to eight alphanumeric characters.)
---------	--

Fluid conditions

Item	Operating conditions	STEAMcube allowable range
Fluid description	Saturated steam	Saturated steam only (STEAMcube cannot be used with superheated steam.)
Steam pressure	(MPa_G)	Less than the rating of the connecting flange
Steam temperature	(°C)	100 to 215 °C
Ambient temperature	(°C)	-10 to 65 °C (-15 to 60 °C for the explosion-proof type STEAMcube)
Flow rate	(kg/h) or (m³/h)	See the attached table.

Specifications of the detecting part

Piping connection	Structure	<input type="checkbox"/> Wafer type				
	Standard	<input type="checkbox"/> JIS	<input type="checkbox"/> ANSI	<input type="checkbox"/> JPI		
	Rate	<input type="checkbox"/> 10 k	<input type="checkbox"/> 20 k	<input type="checkbox"/> #150	<input type="checkbox"/> #300	
Line size	<input type="checkbox"/> 25 mm	<input type="checkbox"/> 40 mm	<input type="checkbox"/> 50 mm	<input type="checkbox"/> 80 mm	<input type="checkbox"/> 100 mm	<input type="checkbox"/> 150 mm
Installation	Horizontal piping (<input type="checkbox"/> Left-to-right flow with respect to the display <input type="checkbox"/> Right-to-left flow with respect to the display)					
Straight pipe lengths	Upstream side (_____ mm) = D, downstream side (_____ mm) = D					
Installation height	<input type="checkbox"/> (. _ _ _) m Enter a difference in the height between the detecting and converter parts in meters.					

Specifications of the converter part

Structure	<input type="checkbox"/> Flameproof construction (TIIS Ex d IIB+H ₂ T4-X) <input type="checkbox"/> Waterproof construction	
Wiring connection	Pressure-resistant packing-cable gland (<input type="checkbox"/> 1 piece attached <input type="checkbox"/> 2 pieces attached)	
	Waterproof gland (<input type="checkbox"/> 1 piece attached <input type="checkbox"/> 2 pieces attached)	
Power supply	<input type="checkbox"/> 24 VDC (17.9 to 45 VDC/To use the communication function, a power supply of 22.4 V or more and a load resistance of 250 Ω or more are required.)	
Unit	<input type="checkbox"/> kg/h <input type="checkbox"/> t/h <input type="checkbox"/> m³/h (for the volume flow rate output)	
Flow rate range	_____ to _____ in units shown above	
Low flow cut	<input type="checkbox"/> Required (_____ in units shown above) (A flow rate larger than the specified minimum flow rate is required to use the low flow cut function.) <input type="checkbox"/> Not required	
Damping	<input type="checkbox"/> (seconds) (Select one from 0, 2, 4, 8, 16 and 32 seconds.)	
Pulse output	<input type="checkbox"/> Pulse weight: (_____ in units shown above/pulse)	
Display	Main display	<input type="checkbox"/> Totalized flow rate or <input type="checkbox"/> Instantaneous flow rate
	Display	<input type="checkbox"/> Totalized flow rate or <input type="checkbox"/> Instantaneous flow rate or <input type="checkbox"/> Steam temperature and pressure in piping
Paint	<input type="checkbox"/> Standard paint	

Option

<input type="checkbox"/> High accuracy (2% RD)
<input type="checkbox"/> Bolts & Nuts for installation (<input type="checkbox"/> Carbon steel, <input type="checkbox"/> SUS304) wafer style only
<input type="checkbox"/> Cover flange bolt material (SUS304)
<input type="checkbox"/> With Test Report

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<http://www.azbil.com/products/factory/order.html>

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Specifications are subject to change without notice.

Azbil Corporation

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