OVAL

Thermal Mass Flowmeter/ Controller for Gas

MASFLO-OVAL II

Supply system/Mixing process

Semiconductor production/Pilot plant

Measurement of Hydrogen/Ammonia



Mass Flowmeter (FHA)

Mass Flow Controller (FHB)

Non-explosionproof



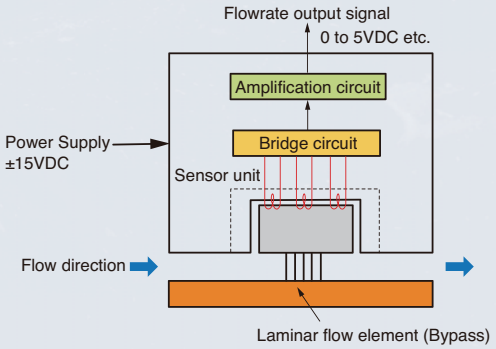
Mass Flowmeter (FHC)

Control Valve for FHC (FHD)

Explosionproof

[Measurement principle]

The gas introduced into the meter is divided into the sensor unit at a constant proportion by laminar flow element.
Inside the sensor unit, a heater coil and temperature sensors loop around the capillary in the center and both ends, respectively. These temperature sensors constitute the bridge circuit.
When the gas that flows through the sensor unit remains still, heat supplied from the heater is transferred to the temperature sensors on both sides equally and the balance of the bridge circuit is maintained.
However, once the gas starts to flow, the difference occurs in the heat transferred to the temperature sensors, and an output proportional to the mass flowrate is obtained from the bridge circuit.
By changing the branch-off proportion in the laminar flow element, the desired flowrate range can be obtained.



MASFLO-OVAL II MODEL: FHA/FHB Non-explosionproof

Measure/Control accurately the flowrate of gas on a mass basis

FHA



FHB



FHA is a high accuracy, compact gas flowmeter

FHB is a flowrate controller that FHA is integrated with a control valve (electromagnetic type)

- Applicable to a wide range of flowrate, from 5NCCM (mL/min [normal]) to 500NLM (L/min [normal])
- Optimal full-scale adjustment is available with the laminar flow element
- Applicable to the most types of gas, except for high corrosive gas
- Fast response
- The control valve is of a normal close, electromagnetic type that ensures fast response and safe to use
- Compatible with a variety of applications by combining with the readout unit

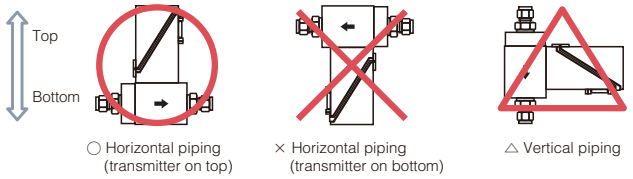
STANDARD SPECIFICATIONS

		FHA	FHB
Construction		Non-explosionproof, for indoor use	
Connecting tube outer diameter		1/8″, 1/4″, 3/8″, 6mm, 12mm, 1/2″	1/8″, 1/4″, 3/8″, 6mm
Accuracy (※1) (including linearity)		± 1% of FS (at actual gas calibration)	
Reproducibility		± 0.2% of FS	
Response		1 to 3sec (time constant)	1 to 2sec (within ±2% of setting, except for during zero startup)
Operating temperature range		−10 to +70°C (no condensation)	
Temperature effect		± 0.1%/℃ of FS	
Pressure effect		0.1%/0.1MPa of RD (N_2), 0.01%/0.1MPa of RD (H_2)	
Pressure loss (Air) (※2)		3.5 to 10.5 kPa	
Zero stability		Long-term error: Max. 1%/year, Temperature drift: 0.05%/°C	
Materials	Body	Major parts: SUS316 or equivalent	
	Seal	Fluoro-rubber (FKM): standard, Chloroprene rubber (CR), Perfluoroelastomer (FFKM)	
Power supply		±15VDC	

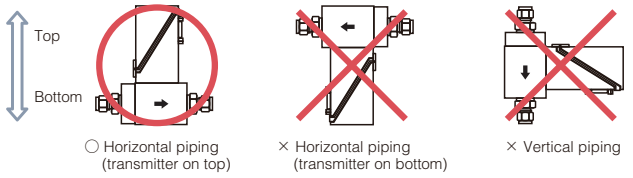
※1: Under normal circumstances, calibration is conducted using air or nitrogen gas with conversion factor compensation.
※2: Only for the body of the mass flowmeter; pressure loss for joint is excluded.

PHYSICAL ORIENTATION

●If the pressure is less than 1MPa



●If the pressure is 1MPa or more



FLOW RANGE/MAX OPERATING PRESSURE

● FHA

Full scale flow range NL/min (at Air)	Model code: Maximum operating pressure (※1) 0.99MPa	9.8MPa	19.6MPa	39.2MPa
Minimum 0.0001 to 0.005	FHA00S	FHA10S	FHA20S	FHA30S
Maximum 0.00015 to 0.0075				
Minimum 0.00015 to 0.0075	FHA01S	FHA11S	FHA21S	FHA31S
Maximum 0.3 to 15				
Minimum 0.3 to 15		FHA12S	FHA22S	FHA32S
Maximum 2 to 100				
Minimum 2 to 100		FHA13S	FHA23S	FHA33S
Maximum 10 to 500				

※1: Maximum operating pressure may be lower depending on connection specification.

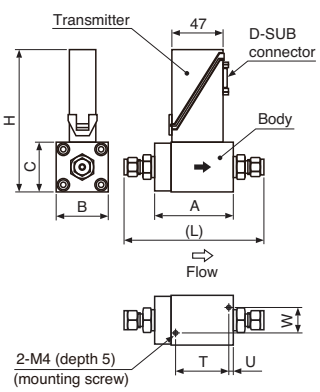
● FHB

Full scale flow range NL/min (at Air)	Model code: Maximum operating pressure 9.8MPa	19.6MPa	Kv value
Minimum 0.00015 to 0.0075	FHB11S/11H	FHB21S/21H	1.1×10^{-5} to 6.6×10^{-2}
Maximum 0.3 to 15			
Minimum 0.3 to 15	FHB12S/12H		
Maximum 1.4 to 70 Up to 100NL/min available with H_2 and Helium			

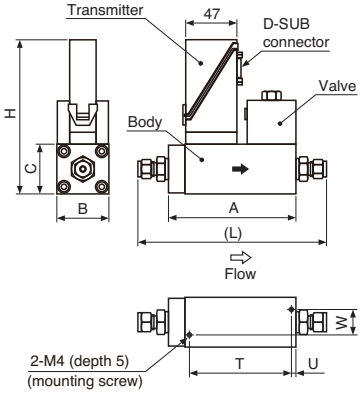
※1: Maximum operating pressure may be lower depending on connection specification and Kv value of valve.
※2: If Kv value is 4.3×10^{-3} or more, maximum operating pressure is restricted at 10MPa.

DIMENSIONS [Unit: mm]

● FHA



● FHB



	MODEL	A	B	C	H	(L)	T	U	W	Body internal thread	Weight (kg)
FHA	FHA00S/10S	47	25	25	111	98	37	5	16	IN: G1/4 OUT: G1/8	0.3
	FHA20S/30S										
	FHA01S/11S					103					
	FHA21S/31S										
	FHA12S	72	46	46	132	129	47	5	21	G1/4	1.2
	FHA22S/32S	91	65	65	151	148	50	5	23		2.9
	FHA13S	108	66	66	152	176	75	5	28	G1/2	3.1
	FHA23S/33S	135	101	101	187	202	75	5	40		9.1
FHB	FHB11S/21S	102	45	45	142	159	92	5	21	G1/4	2.0
	FHB11H/21H										
	FHB12S	117	46	46	143	174	92	5	21		2.1
	FHB12H										

NOTE: Dimension L varies with joint size.

MASFLO-OVAL II MODEL: FHC/FHD Explosionproof

Explosionproof structure which can be used for hydrogen gas

FHC



FHD



FHC is a hydrogen explosion-proof model of the general-purpose gas mass flow meter FHA, and is available as a high-pressure gas certified product.

FHD is based on FHB with the control valve in the hydrogen explosionproof structure. In combination with FHC, it makes up of the explosionproof thermal mass flowrate controller for gas.

- JIS explosionproof construction model "d3aG4", that is applicable to hydrogen gas
- Applicable to a wide range of operating pressure, from vacuum to 36.2MPa at the maximum
- Applicable to a wide range of flowrate, from 5NCCM (mL/min [normal]) to 500NLM (L/min [normal])
- Optimal full scale adjustment is available with laminar flow element
- Applicable to the most types of gas, except for high corrosive gas
- The control valve is of a normal close, electromagnetic type that ensures fast response and safe to use
- Compatible with a variety of applications by combining with the readout unit

■ STANDARD SPECIFICATIONS

		FHC	FHD
Construction		Explosionproof configuration (TIIS、KCs)	
Connecting tube outer diameter		1/8″, 1/4″, 3/8″, 3/4″, 6mm, 12mm, 1/2″	1/8″, 1/4″, 3/8″, 6mm, 12mm, 1/2″
Accuracy (※1) (including linearity)		± 1% of FS (at actual gas calibration)	
Reproducibility		± 0.2% of FS	
Response		1 to 3sec (time constant)	1 to 2sec (within ±2% of setting, except for during zero startup)
Operating temperature range		−10 to +50°C (due to explosionproof configuration) (no condensation)	
Temperature effect		± 0.1%/°C of FS	
Pressure effect		0.1%/0.1MPa of RD (N_2), 0.01%/0.1MPa of RD (H_2)	
Pressure loss (Air) (※2)		3.5 to 10.5 kPa	
Zero stability		Long-term error: Maximum 1%/year, Temperature drift: 0.05%/°C	
Materials	Body	Major parts: SUS316	
	Housing	AC4C-T6	
	Seal	Fluoro-rubber (FKM): standard, Chloroprene rubber (CR), Perfluoroelastomer (FFKM)	
Power supply		±15VDC	

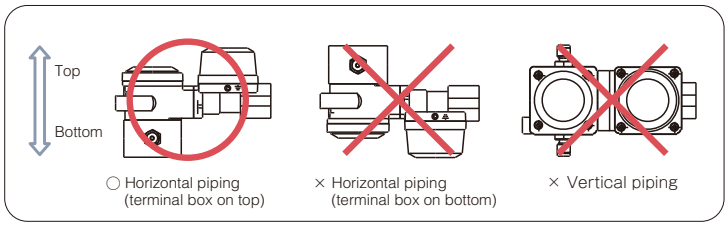
※1: Under normal circumstances, calibration is conducted using air or nitrogen gas with conversion factor compensation.
※2: Only for the body of the mass flowmeter; pressure loss for joint is excluded.

■ FLOW RANGE/MAX OPERATING PRESSURE

Full scale flow range NL/min (at Air)	Model code		Kv value
	Maximum operating pressure 39.2MPa		
	MFM model code	Combination as MFC	
Minimum 0.0001 to 0.005	FHC30S	FHC30S + FHD30S	1.1×10^{-5} to 6.6×10^{-2}
Maximum 0.00015 to 0.0075			
Minimum 0.00015 to 0.0075	FHC31S	FHC31S + FHD31S/31H	
Maximum 0.3 to 15			
Minimum 0.3 to 15	FHC32S	FHC32S + FHD32S/32H	
Maximum 2 to 100			
Minimum 2 to 100	FHC33S		
Maximum 10 to 500			

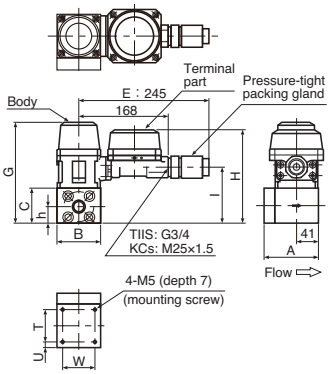
※1: Maximum operating pressure may be lower depending on connection specification and Kv value of valve.
※2: FHC series can be supplied as the certified product for the high pressure gas. (Approved range is the body only. Detachable parts, such as double ferrule bite-type fitting, are not included.)
※3: FHD series functions as control valve by combining with FHC series. FHD cannot be used by itself.
※4: FHD series is available only if both full scale flow range and Kv value of valve are satisfied.
※5: If Kv value is between 4.3×10^{-3} and 6.6×10^{-2}, maximum operating pressure is restricted at 10MPa.

■ PHYSICAL ORIENTATION

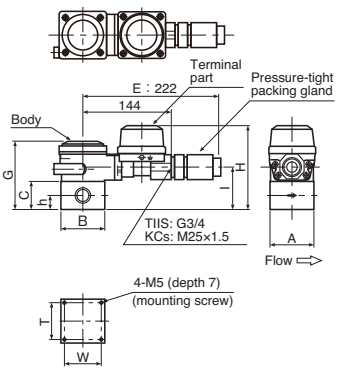


■ DIMENSIONS [Unit: mm]

● FHC



● FHD



	MODEL	A	B	C	G	H	I	T	U	W	h	Body internal thread	Weight (kg)
FHC	FHC30S	82	82	30	153	139	68	60	11	60	15	G1/4	5.0
	FHC31S												
	FHC32S	119	82	67	190	176	105	60	11	60	32	G1/2	8.4
	FHC33S	138	100	100	223	209	138	70	9	90	50	G1/2	13.3
FHD	FHD30S	70	70	45	109	132	68	50		50	22.5	G1/4	3.8
	FHD31S/31H												
	FHD32S/32H	70	70	45	109	132	68	50		50	22.5	G1/2	3.8

NOTE: 1. Dimension E is the approximate dimension based on HPN series pressure-tight packing.
2. Dimension A is the face-to-face dimension of the instrument. Actual dimension may differ based on the joint to be used.
3. The height of pipe axis (dimension h) differs between mass flowmeter and control valve.

READOUT UNIT MODEL: ROU28S, ROU28C

Receiving Instrument for MASFLO-OVAL II



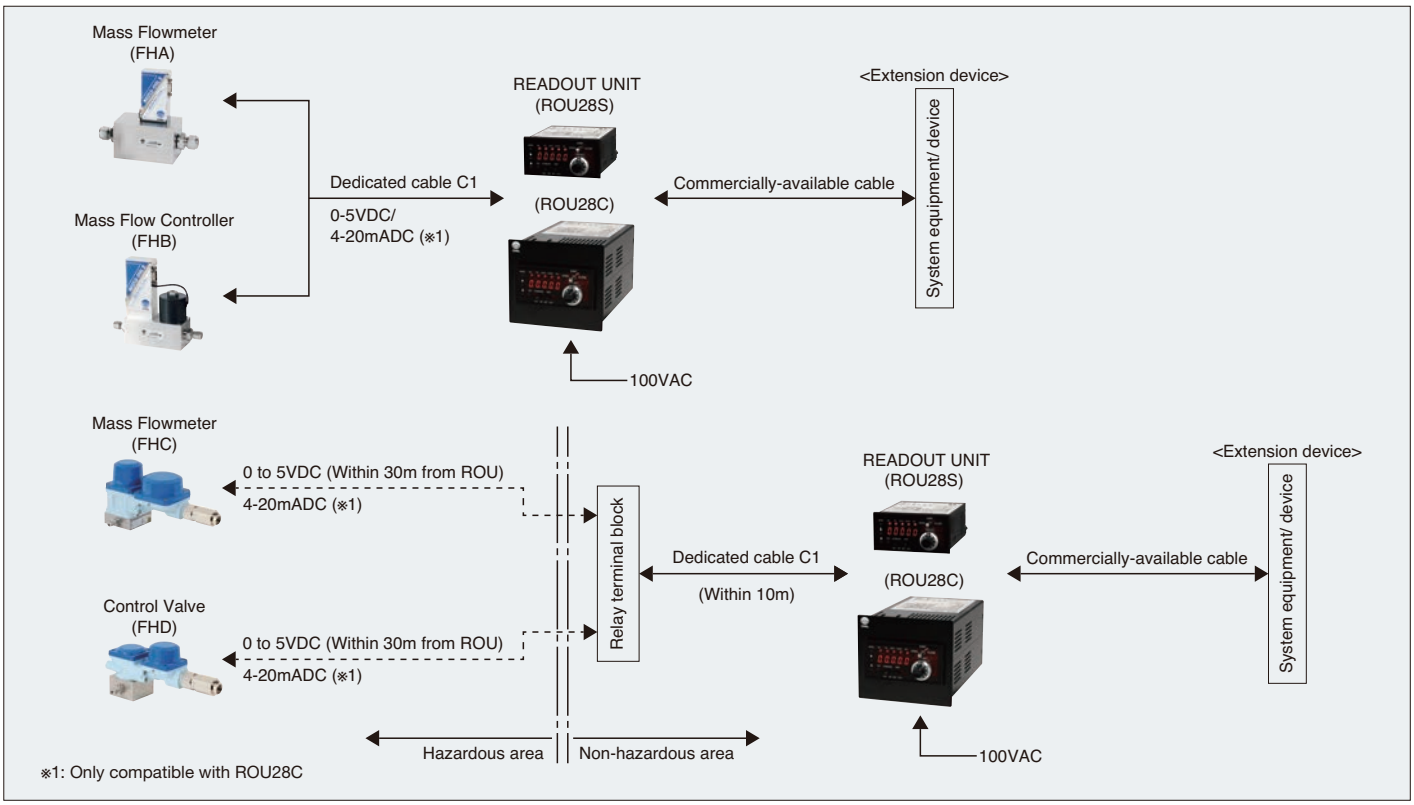
MODEL: ROU28S
(0 to 5VDC only)



MODEL: ROU28C
(4 to 20mADC/0 to 5VDC supported)

- A small, lightweight receiving instrument with the basic functions required for measurement and control.
- Flowrate value, accumulated flowrate value and flowrate set-point can be switched to the display.
- A flowrate adjustment device and an external input switch are placed on the front, realizing an easy-to-use layout.
- As standard specifications, it includes external output (analog and pulse) and external control input functions. Therefore, flexibility of system design can be improved.
- By combining the readout unit with the MASFLO-OVAL II series, a flow measurement system can be easily configured.

■ CONNECTION WITH A READOUT UNIT



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