



## Thermal Mass Flowmeter/ Controller for Gas

# MASFLO-OVAL II



Mass Flowmeter  
(FHA)



Mass Flow Controller  
(FHB)

Non-explosionproof

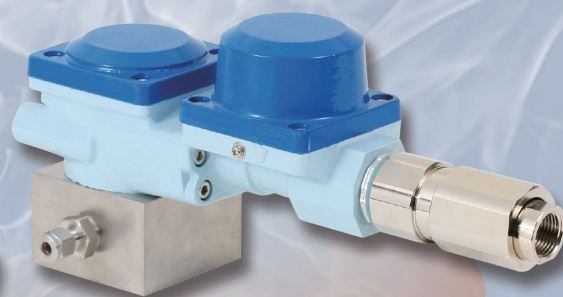
Supply system/Mixing process

Semiconductor production/Pilot plan

Measurement of Hydrogen/Ammonia



Mass Flowmeter  
(FHC)



Control Valve for FHC  
(FHD)

Explosionproof

### [Measurement principle]

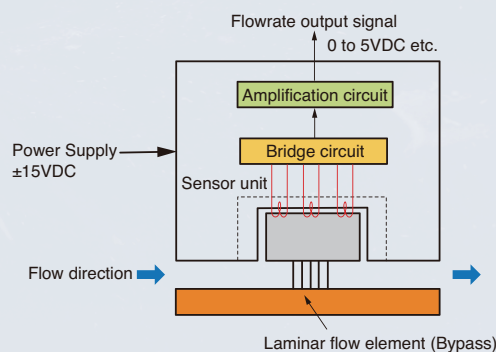
The gas introduced into the meter is divided into the sensor unit at a constant proportion by laminar flow element.

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.



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

**FHA**

**FHB**


**FHA is a high accuracy, compact gas flow meter**

**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%/°C of FS	
Pressure effect	0.1%/0.1MPa of RD (N <sub>2</sub> ), 0.01%/0.1MPa of RD (H <sub>2</sub> )	
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.

## FLOW RANGE/MAX OPERATING PRESSURE

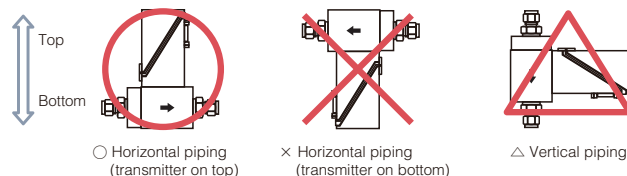
### FHA

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				

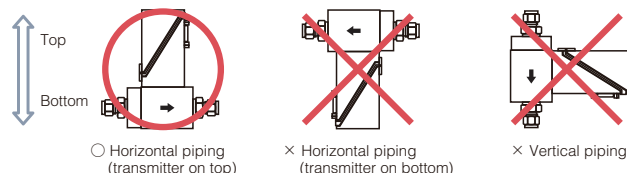
\*1: Maximum operating pressure may be lower depending on connection specification.

## PHYSICAL ORIENTATION

- If the pressure is less than 1MPa



- If the pressure is 1MPa or more



### FHB

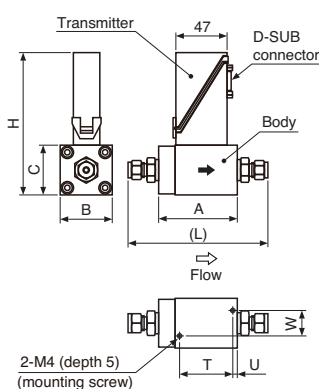
Full scale flow range NL/min (at Air)	Model code		Kv value
	Maximum operating pressure		
	9.8MPa	19.6MPa	
Minimum 0.00015 to 0.0075	FHB11S	FHB21S	1.1×10 <sup>-5</sup> to 6.6×10 <sup>-2</sup>
Maximum 0.3 to 15			
Minimum 0.3 to 15	FHB12S		
Maximum 1.4 to 70 Up to 100NL/min available with H <sub>2</sub> and Helium			

\*1: Maximum operating pressure may be lower depending on connection specification and Kv value of valve.

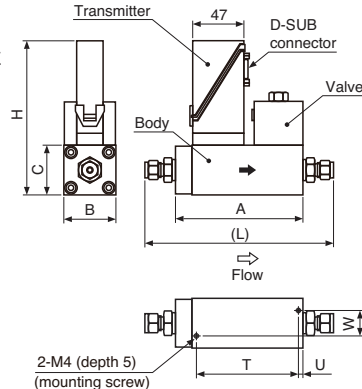
\*2: If Kv value is 4.3 × 10<sup>-3</sup> or more, maximum operating pressure is restricted at 10MPa.

## 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
FHB	FHA22S/32S	91	65	65	151	148	50	5	23	G1/4	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	G1/2	9.1
	FHB11S/21S	102	45	45	142	159	92	5	21	G1/4	2.0
	FHB12S	117	46	46	143	174	92	5	21	G1/4	2.1

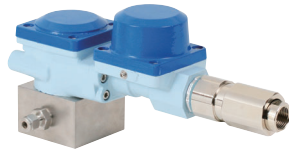
NOTE: Dimension L varies with joint size.

# Explosionproof structure which can be used for hydrogen gas

FHC



FHD



FHC is the hydrogen gas explosionproof model of FHA, the general-purpose mass flowmeter for gas. It can be supplied as the certified product for the high pressure gas.

FHD is based on FHB with the control valve in the hydrogen explosionproof structure. In combination with FHC, it makes up of the explosionproof 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

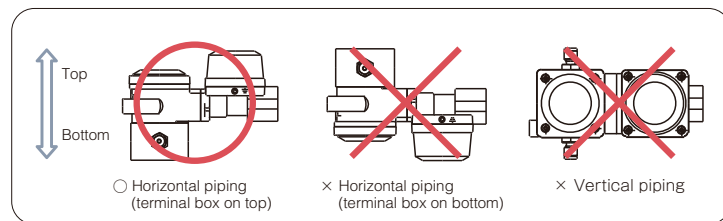
## STANDARD SPECIFICATIONS

	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 <sub>2</sub> ), 0.01%/0.1MPa of RD (H <sub>2</sub> )	
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.

## PHYSICAL ORIENTATION



## DIMENSIONS [Unit: mm]

● FHC

Technical drawings of FHC series instruments. The main drawing shows the front view with dimensions: E : 245, 168, G, H, I, T, U, W, h, A, B, C, F. Labels include: Body, Terminal part, Pressure-tight packing gland, TIIS: G3/4 KCs: M25x1.5, and Flow. A detail drawing shows the mounting screw with 4-M5 (depth 7) and dimensions H, W, D.

● FHD

Technical drawings of FHD series instruments. The main drawing shows the front view with dimensions: E : 222, 144, G, H, I, T, U, W, h, A, B, C, F. Labels include: Body, Terminal part, Pressure-tight packing gland, TIIS: G3/4 KCs: M25x1.5, and Flow. A detail drawing shows the mounting screw with 4-M5 (depth 7) and dimensions H, W, D.

	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	119	82	67	190	176	105	60	11	60	32	G1/2	8.4
	FHC32S	138	100	100	223	209	138	70	9	90	50	G1/2	13.3
	FHC33S	70	70	45	109	132	68	50	50	22.5	G1/4	3.8	
FHD	FHD30S	70	70	45	109	132	68	50	50	22.5	G1/4	3.8	
	FHD31S	70	70	45	109	132	68	50	50	22.5	G1/4	3.8	
	FHD32S	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.

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.



## Receiving Instrument for MASFLO-OVAL II



- DIN-sized (except for ROU06A) compact and lightweight receiving instruments. Provided with all the basic capabilities required for measurement and control
- Equipped with 0 to 5VDC external output as the standard specifications. ROU00C, the high-end model, has a built-in analog converter and is applicable to 1 to 5VDC, 0 to 20mADC and 4 to 20mADC
- Combined with MASFLO-OVAL II series, flow measurement/ control system can configure easily in laboratories, experimental equipment, etc.
- Quick delivery and affordable price

## MODEL/ CONFIGURATION

Function  Model	±15V DC Power output	Display	Totalizer	Set-point adjuster	Conversion factor setter (※1)	External control input compatibility	Signal converter (※2)	Connecting instruments		Description of the model
								MASFLO-OVALII		
								Sensor	Controller	
								FHA FHC	FHB FHC+FHD	
ROU01A	○	—	—	—	—	○	—	○	○	Supplies power to MASFLO-OVAL II. Equipped with flow input/output.
ROU02A	○	○	—	—	—	—	—	○	—	Equipped with flow display.
ROU03A	○	○	—	○	—	—	—	—	○	Equipped with flow display and set-point adjuster.
ROU04A	○	○	—	—	○	—	—	○	—	Conversion factor setter added to ROU02A.
ROU05A	○	○	—	○	○	—	—	—	○	Conversion factor setter added to ROU03A.
ROU06A	○	—	—	—	—	○	—	○	○	Provides power to up to 4 MASFLO-OVAL II. Capable of flow input/output.
ROU07A	○	○	○	—	—	—	—	○	—	Totalizer and pulse output added to ROU02A.
ROU08A	○	○	○	○	—	—	—	—	○	Totalizer and pulse output added to ROU03A.
ROU01C	○	—	—	—	—	○	○	○	○	Analog signal converter added to ROU01A.
ROU02C	○	○	—	—	—	—	○	○	—	Analog signal converter added to ROU02A.
ROU03C	○	○	—	○	—	○	○	—	○	Analog signal converter and remote control (external setting input) added to ROU03A.
ROU07C	○	○	○	—	—	—	○	○	—	Analog signal converter added to ROU07A.
ROU08C	○	○	○	○	—	○	○	—	○	Analog signal converter and remote control (external setting input) added to ROU08A.
ROU03S	○	○	—	○	—	○	—	—	○	Equipped with flow display, set-point adjuster, and external setting input.
ROU05S	○	○	—	○	○	○	—	—	○	Conversion factor setter added to ROU03S.

Each MASFLO-OVAL II requires an ROU series with the exception of ROU06A. Up to 4 instruments can be connected to ROU06A.

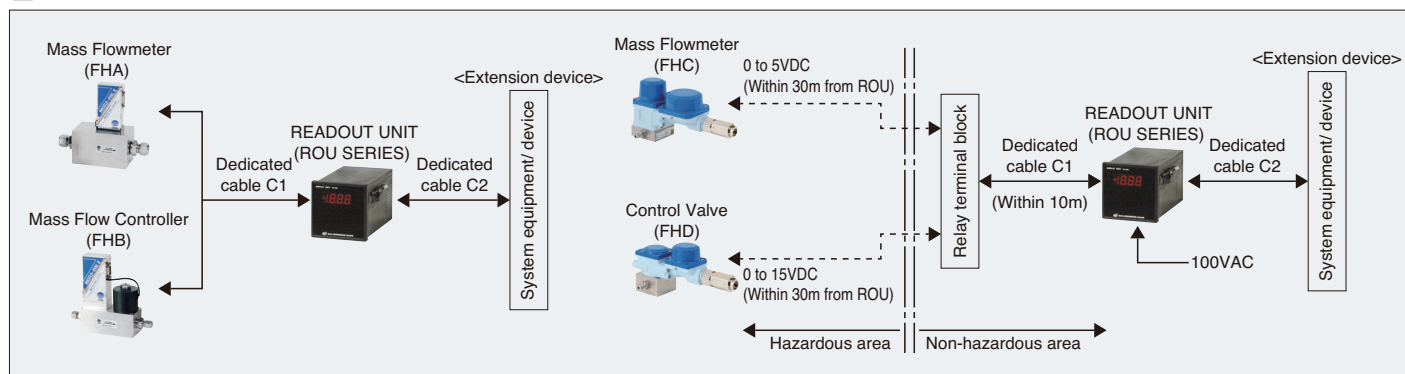
Analog input/output circuit and pulse output circuit of the ROU series are not isolated. For use of external input/output, connection should be made through an analog isolator as necessary.

(※1): If conversion factor needs to be set arbitrarily, models with conversion factor setter should be selected.

(Refer to the general specification sheet of MASFLO-OVAL II for the details of conversion factor.)

(※2): Signal converter is capable of converting between 4 types of analog signal: 0 to 5VDC, 1 to 5VDC, 0 to 20mADC, and 4 to 20mADC.

## ■ CONNECTION WITH A READOUT UNIT



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