



# TECHNICAL GUIDANCE

Flameproof Construction  
Covering Hydrogen Atmosphere

**EP-TF-5300 Series EP-TC-1000 Series**  
**H-EP-TF-5300 Series EP-TC-2000V Series**  
Thermal Mass Flowmeter/Mass Flow Controller

## OUTLINE

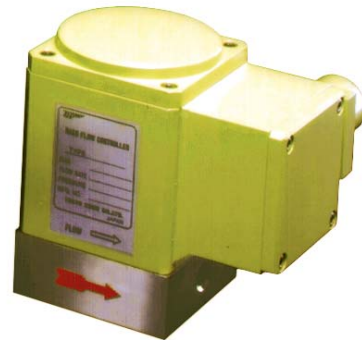
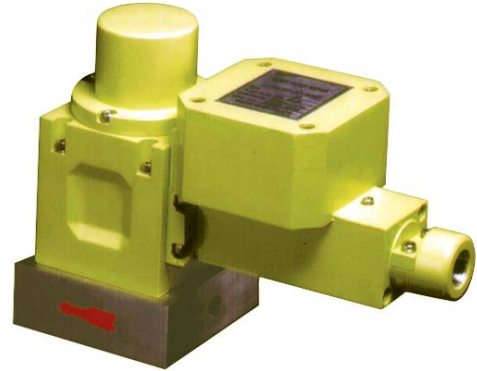
EP-TF-5300 Series are Thermal Mass Flowmeter for the gases with a flameproof construction. The mass flow rate of various kinds of gases can be measured, regardless of such process conditions as pressure, temperature etc.

The minimum full scale is 5mL/min (nor), and the maximum full scale is 500L/min (nor). Maximum Operating Pressure is 4.9MPa which covers the various applications.

Meantime, H-EP-TF-5300 Series (for the high pressure) can cover the max. operating pressure up to 14.7MPa.

Thermal Mass Flow Controller (EP-TC-1000 Series) is the flameproof control valve, and this can be used together with EP-TF-5300 Series. The mass flow rate of the various kinds of gasses can be automatically controlled.

EP-TC-2000V Series is for the high pressure and used together with H-EP-TF-5300 Series, covering the maximum operating pressure of 9.8MPa.



## FEATURES

### □ FLAMEPROOF CONSTRUCTION

Both Mass Flowmeter and Mass Flow Controller cover the hydrogen atmosphere(JIS Class "1" area).

The application has become much wider than before.

### □ HIGH ACCURACY ( $\pm 1\%$ F.S.)

The gas mass flow rate can be measured in high accuracy because of our theory and the know-how for many years.

### □ EXTENSIVE FLOW RANGE

These instruments can be used for the applications from the pilot plant to the actual industrial applications.

### □ SUPPORTING INSTRUMENT READY

The indication, integration and controlling can be conducted, assembled with TM-1400/2000 Mini Convertor unit.

(H-) EP-TF-5300 Flameproof Mass Flowmeter for High Pressure

STANDARD SPECIFICATIONS

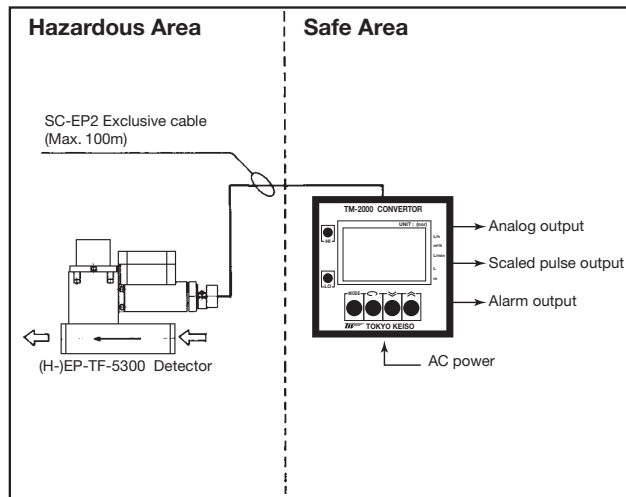
Model	(H-)EP-TF-5310	(H-)EP-TF-5320	(H-)EP-TF-5330	(H-)EP-TF-5340
Flow Range (Full Scale)	5mL/min. (nor) to 20L/min. (nor)	20 to 80L/min. (nor)	80 to 300L/min. (nor)	300 to 500L/min. (nor)
Flow output signal	0 to 5 V DC			
Accuracy	±1.0% F.S. (25°C Standard)			
Response Time	Within 3 seconds for 90%			
Max. operating pressure	4.9 MPa (H-EP-TF-5300 is up to 14.7 MPa.)			
Ambient and gas temp.	5 to 50°C			
Temperature effect	Span ± 0.1%F.S./°C max. Zero point ±0.05%F.S./°C max.			
Pressure effect	±0.1% F.S. / (0.1MPa) max. (on N <sub>2</sub> )*			
Enclosure	Flameproof construction JIS d3aG4			
Cable entry	G1/2 (=PF1/2) Female screw			
Power source	+15 V DC 25mA max. Model TM-2000 -15 V DC 5mA max. (Use Converter unit)			
Gas contact material	SUS 316, FKM or CR			
Connection size (OD)	1/4"	1/4", 3/8"	3/8", 1/2"	3/8", 1/2", 3/4"
Type of connection	Swagelok, VCR, VCO, Rc (=PT), NPT, Flange			

\*The pressure effect varies with the operating pressure and kind of fluid when the pressure exceeds 1 MPa.

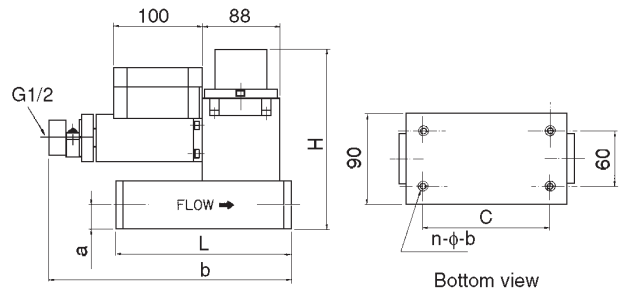
MODEL CODE

Model	Flow Rate	Gas Connection	Fluid
EP-TF-53	0- A-B-C		
H			For high pressure
1			5mL/min(nor) to 20L/min(nor)
2			20L/min(nor) to 80L/min(nor)
3			80L/min(nor) to 300L/min(nor)
4			300L/min(nor) to 500L/min(nor)
	(A×10+B)10° Unit mL/min (nor)		1L/min (nor)=1000mL/min (nor) L/min (nor) : Normal Liters per minute
		S	Swagelok
		R	VCR (EP-TF-5300)
		O	VCO (EP-TF-5300)
		P	Rc (=PT)
		N	NPT
		F	Flange
		0 4	1/4"
		0 6	3/8"
		0 8	1/2"
		1 2	3/4"

FLOW MEASUREMENT ONLY (WITH TM-2000 Mini convertor unit)



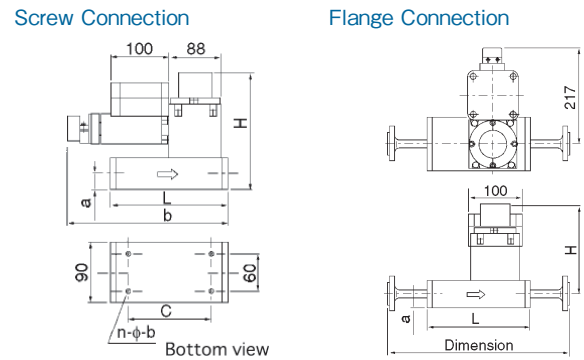
EXTERNAL DIMENSION (EP-TF-5300)



Model	H	L*	a	b	c	n-φ-d	Estimated Mass
EP-TF-5310	177	107	16	268	60	4-M5-10	6.0kg
EP-TF-5320	183	116	19	261	60	4-M5-10	7.0kg
EP-TF-5330	203	182	29	281	104	4-M10-15	10.5kg
EP-TF-5340	203	222	29	281	144	4-M10-15	12.0kg

(1) Flow direction can be changed by 90 degrees.

EXTERNAL DIMENSION (H-EP-TF-5300)



SCREW OR SWAGELOK CONNECTION

Model	H	L	a	b	c	n-φ-d	Estimated Mass
H-EP-TF-5310	183	124	19	276	60	4-M5-10	7.0kg
H-EP-TF-5320	193	150	24	282	60	4-M5-10	8.5kg
H-EP-TF-5330	205	223	30	313	110	4-M10-15	12.5kg
H-EP-TF-5340	205	263	30	313	150	4-M10-15	14.0kg

- (1) In case of Swagelok, the fitting is regarded as the accessory, and it is not screwed in the body.
- (2) Cable entry can be changed by 90 degrees against the flow direction.

FLANGE CONNECTION

List for dimension between surfaces. (mm)

In case the cable entry is the right angle against the flow direction.

Connection size: 15mm (1/2") or 20mm (3/4")

Model	Standard		ANSI · JPI			
	10K	20K	150Lb	300Lb	800Lb	1500Lb
H-EP-TF-5310	250	270	250	270	300	320
H-EP-TF-5320	270	290	270	290	320	340
H-EP-TF-5330	340	360	340	360	390	410
H-EP-TF-5340	380	400	380	400	430	450

ESTIMATED MASS (kg)

Connection size: 20mm (3/4")

Model	Standard		ANSI · JPI			
	10K	20K	150Lb	300Lb	800Lb	1500Lb
H-EP-TF-5310	8.5	8.7	8.7	9.2	10.0	12.5
H-EP-TF-5320	10.0	10.2	10.2	10.7	11.5	14.0
H-EP-TF-5330	14.0	14.2	14.2	14.7	15.5	18.0
H-EP-TF-5340	15.5	15.7	15.7	16.2	17.0	19.5

## EP-TC-1000/2000V MASS FLOW CONTROLLER

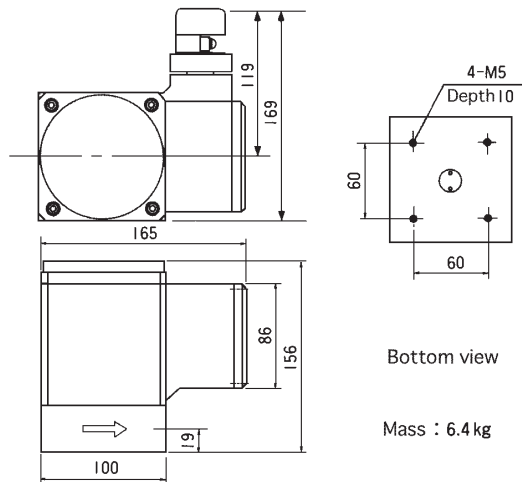
EP-TC Series Mass Flow Controller is the flameproof control valve and is used together with(H-) EP-TF-5300 Mass Flowmeter.

### Standard Specification for EP-TC-1000

Model	EP-TC-1000	
Scale Range*1	Min. 0 to 5mL/min. (nor)	Max. 0 to 100L/min. (nor)
Flow Control Range	2 to 100% of full scale	
Response Time	3 sec. for 98% of setting value	
Input Setting Signal	0 to 5 V DC	
Primary Side Max. Pressure	2.9MPa	
Controllable Differential Pressure	0.07 to 0.3MPa	
Ambient and Gas Temperature	5 to 50°C	
Enclosure	Flameproof, JIS d3aG4	
Power Source	+15V DC 25mA max. ( Use TM-1400 Type Converter unit. ) -15V DC 320mA max.	
Gas Contact Material	SUS316, SHOMAC®*2,FKM or CR	
Connection	Caliber	OD1/4", 3/8"
	Standard	Swagelok, VCR, VCO, Rc(=PT), NPT

\*1 : Flow rate based on N<sub>2</sub>. Min. flow range of H<sub>2</sub> is 250mL/min. (nor).  
\*2 : Specially high purity Ferrite system Stainless steel (High corrosion resistant and strong magnetic material)

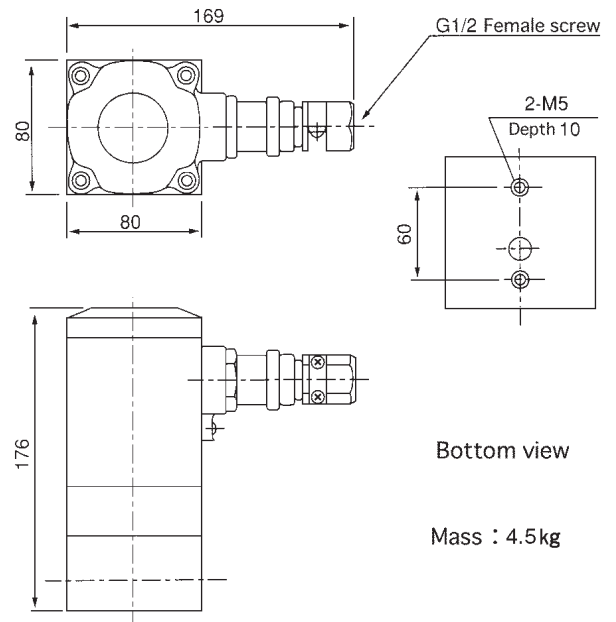
### EXTERNAL DIMENSION (EP-TC-1000)



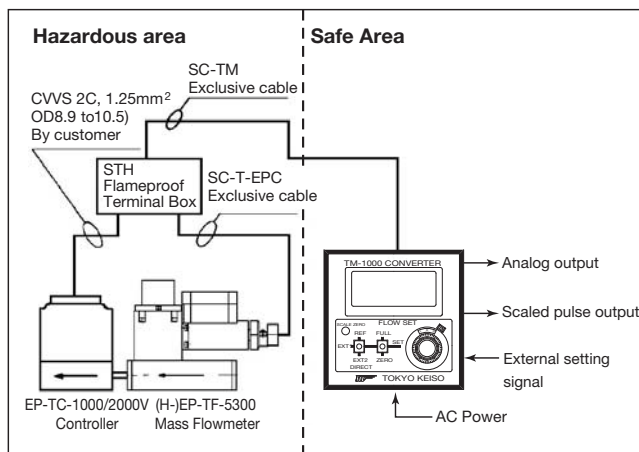
### Standard Specification for EP-TC-2000V

Model	EP-TC-2000V	
Scale Range*1	Min. 0 to 200mL/min. (nor)	Max. 0 to 100L/min. (nor)
Flow Control Range	2 to 100% of full scale	
Response Time	Within 3 sec. for 98% of setting value	
Input Setting Signal	0 to 5 V DC	
Primary Side Max. Pressure	9.8 MPa	
Controllable Differential Pressure	Less than F.S. 20L/min. (nor) 20% to 80% of Primary pressure More than F.S. 20L/min (nor) 20% to 40%	
Enclosure	Flameproof, Exd II CT6	
Ambient and Gas Temperature	5 to 48°C	
Power Source	+15V DC 25mA max. ( Use TM-1400 Type Converter unit. ) -15V DC 320mA max.	
Gas Contact Material	SUS316, SHOMAC®*2,FKM or CR	
Connection	Caliber	OD 3/8"
	Standard	Swagelok (OD1/4", 3/8"), Rc (=PT)

### EXTERNAL DIMENSION (EP-TC-2000V)



### FLOW METER/CONTROLLER (WITH TM-1400 Mini convertor unit)



## EXAMPLE OF MODEL SELECTION

The flow range is indicated as that of N<sub>2</sub> gas.

When measuring other gases, use the conversion factors (CF) shown below to convert the flow rate of the desired gas to that of N<sub>2</sub> and confirm that the selected model is appropriate for that measurement.

### Formula for single-component gas

$$\text{Flow rate converted to that of N}_2 = \frac{\text{Flow rate of the gas specified by customers}}{\text{CF of the gas}}$$

### Formula for mixed gas (gas with two or more components)

First, identify each CF of the component gases, calculate the CF of the mixed gas, and then convert its flow rate to that of N<sub>2</sub>.

$$\text{CF of the mixed gas} = \frac{1}{\frac{X1}{CF1} + \frac{X2}{CF2} + \dots + \frac{X6}{CF6}}$$

X1 : Composition ratio of Component 1 (vol%/100)

X2 : Composition ratio of Component 2 (vol%/100)

⋮

X6 : Composition ratio of Component 6 (vol%/100)

CF1 : CF of Component 1

CF2 : CF of Component 2

⋮

CF6 : CF of Component 6

$$\text{Flow rate converted to that of N}_2 = \frac{\text{Flow rate of the mixed gas specified by customers}}{\text{CF of the mixed gas}}$$

CF of main gases

Fluid	Molecular formula	CF	Fluid	Molecular formula	CF
Nitrogen	N <sub>2</sub>	1.000	Nitrogen dioxide	NO <sub>2</sub>	0.740
Air	AIR	1.001	Nitrogen monoxide	N <sub>2</sub> O	0.714
Argon	Ar	1.2 <sup>*a</sup>	Oxygen	O <sub>2</sub>	0.984
Carbon monoxide	CO	0.998	Methane	CH <sub>4</sub>	0.782
Carbon dioxide <sup>*b</sup>	CO <sub>2</sub>	0.745	Ethylene	C <sub>2</sub> H <sub>4</sub>	0.623
Helium	He	1.404	Ethane	C <sub>2</sub> H <sub>6</sub>	0.505
Hydrogen	H <sub>2</sub>	1.007	Propylene	C <sub>3</sub> H <sub>6</sub>	0.407
Neon	Ne	1.403	Propane	C <sub>3</sub> H <sub>8</sub>	0.351
Ammonia	NH <sub>3</sub>	0.769	n-butane	n-C <sub>4</sub> H <sub>10</sub>	0.266
Nitric monoxide	NO	0.976			

\*a : Use 1.4, not 1.2, for CF to convert the flow rate of Ar to that of N<sub>2</sub>.

\*b : Operating pressure is limited to 3 MPa at 30°C or more for CO<sub>2</sub> (H-EP-TF-5300Series).

Example: When the fluid is helium, the flow rate is 25 L/min (nor), pressure is 0.1 MPa, temperature is 20°C, and fitting is 1/4"SWL:

$$\text{Flow rate converted to that of N}_2 = \frac{25\text{L/min (nor)}}{1.404 \text{ (CF)}} = 17.8 \text{ L/min.(nor)}$$

Thus, TF-5310-253-S04 should be selected.

## Cautions on use

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- The mass flowmeter outputs flow rate signals from 0% to 100%. If the value in the lowest digit fluctuates too much at the zero point, set the low-cut at the converter. TM-2000 (a dedicated converter) cuts off values of 2% or less as standard.
- When fluid flows in the opposite direction, the mass flowmeter outputs negative signals. To prevent this, install a check valve in the down stream of the flowmeter.
- The flow rate output characteristic of the mass flowmeter has been set to 5.000 [V] at the full-scale flow rate. If the flow rate exceeds the upper limit, the output of the flowmeter rises linearly at first but then declines gradually. To prevent this, use the flowmeter within the rated flow rates.
- Stop the flow of gas completely before adjusting the zero point. For details, see the Instruction Manual.
- Never allow gases that corrode SUS316 to flow through the flowmeter because the sensor capillary is made of SUS316TP.
- Install the unit horizontally.
- The primary pressure of mass flow controller should be the same as the operating pressure as specified in the inquiry.
- Install the unit at the place where rainwater does not splash directly.
- Read Instruction Manual carefully.

## Cautions on installation

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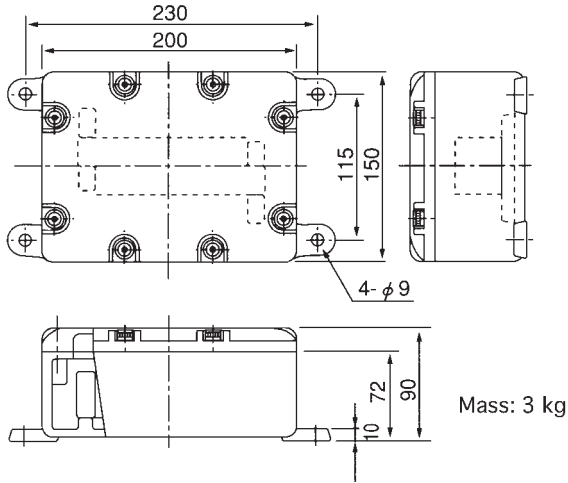
- Since the sensor capillary has a small bore of  $\phi 0.3$ , it is easily blocked by dust and other foreign matter. Flush the piping thoroughly to remove foreign matter and moisture before mounting the flowmeter.
- For ammonia, DME, and other liqescent gases, install a filter in the upstream of the flowmeter.
- To avoid electrical noise, use shielded lines. Do not place them alongside other power lines.
- The arrow on the main body shows the correct direction of the flow for measurement. Install the flowmeter so that the measuring gas flows in this direction.
- The (H-) EP-TF-5300 series (high-pressure type) must be installed horizontally.
- The flowmeter and its piping may be cooled at the high pressure service. To prevent measuring gases from liquefying, add insulation material or a tape heater on the piping or the flowmeter.

PERIPHERAL EQUIPMENT / ACCESSORY Mass Flowmeter / Controller

FLAMEPROOF TERMINAL BOX

When using EP-TC-1000/2000V with Mass Flow Controller, this is used for connection at the hazardous area.

Model	STH-1S-A
Construction	Flameproof, JIS d2G4
Material	AC7A-F
Cable Entry	3×G1/2 (Cable gland attached)
Paint Color	Mansel 7.5BG6/1.5



EXCLUSIVE CABLE

SC-EP2	(H-)EP-TF-5300 to TM-2000	Max. 100m
SC-TM	STH Flameproof Terminal Box to TM-1400	Max. 100m in total
SC-T-EPC	(H-)EP-TF-5300 to STH Flameproof Terminal Box	

TM-1400/2000 Mini converter unit

TM-1400/2000 is a compact converter unit based on DIN 72, and not only Indication, but the ratio setting can be made with the mass flow controller.



TM-1400  
(For mass flow controller)



TM-2000  
(For mass flowmeter)

Technical Guidance for TM-1400/2000 Mini Converter Unit is separately available. Contact us if needed.

ORDERING /INQUIRY FORM

Model	(H-)EP-TF-53□□/EP-TC-1000/2000V				
Gas					
Primary Side Pressure	Max.	MPa	Normal	MPa	Min. Mpa
Variation Range of Secondary Pressure	to				Mpa
Temperature	°C				
Full Scale	<input type="checkbox"/> mL/min. (nor)		<input type="checkbox"/> L/min. (nor)		
Connection Size	<input type="checkbox"/> 1/4"	<input type="checkbox"/> 3/8"	<input type="checkbox"/> 1/2"	<input type="checkbox"/> 3/4"	
Connection Standard	<input type="checkbox"/> Swagelok		<input type="checkbox"/> Rc (=PT)		<input type="checkbox"/> Others

Converter	<input type="checkbox"/> TM-22□□-□ (Indication/Integration/Alarm)	For mass flowmeter
	<input type="checkbox"/> TM-14□□-□□ (Indication/setting)	For mass flow controller
Exclusive cable	SC-TM	<input type="checkbox"/> m (Max. 100m in total)
	SC-T-EPC	<input type="checkbox"/> m
	SC-EP2	<input type="checkbox"/> m (Max.100m)

\* Specification is subject to change without notice.



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