



TECHNICAL GUIDANCE

High accuracy & High Performance

HM5000 Series

MASS FLOWMETER / CONTROLLER

OUTLINE

HM5000 series is Thermal Mass Flowmeter and Controller, which measure various kinds of gas.

The flow rate of gas from 5mL/min(nor) to 400L/min(nor) can be measured and controlled without being influenced by the change in temperature and pressure.

There are two types available: Mass Flowmeter to measure flow rate and Mass Flow Controller with control valve built in, and also available in high performance and wide use types. Selection can be made depending upon the applications.

FEATURES

- ❑ Flow rate measurement in wide range
Available for wide range from 0 to 5mL/min(nor) to 0 to 400 L/min (nor).
- ❑ High accuracy
±1%F.S. (High performance type)
- ❑ Miniaturization and improvement of reliability
- ❑ The following functions possible to add optionally.
Slow start function (Normal close type)
Output signal : 1 to 5VDC

APPLICATIONS

- ❑ Utility gas supply lines in industries
- ❑ Various instruments for analysis
- ❑ Semiconductor gas supply lines
- ❑ Gas constant flow control and mixture control
- ❑ Embedded devices



MODEL CODE

H M 5 1 4 1 B 0 6 A S

Model

Flow range

Code	Flow span	Code	Flow span
01	5mL/min (nor)	11	2L/min (nor)
02	10mL/min (nor)	12	3L/min (nor)
03	20mL/min (nor)	13	5L/min (nor)
04	30mL/min (nor)	14	10L/min (nor)
05	50mL/min (nor)	15	20L/min (nor)
06	100mL/min (nor)	16	30L/min (nor)
07	200mL/min (nor)	17	50L/min (nor)
08	300mL/min (nor)	18	100L/min (nor)
09	500mL/min (nor)	19	200L/min (nor)
10	1000mL/min (nor)	20	400L/min (nor)
		99	Special

Name of Gas

Symbol	Name of Gas
A	N ₂
B	Air
C	O ₂
D	H ₂
E	He
F	Ar
Z	Others

Joint

Symbol	Fitting	Remarks
S	Swagelok	Standard
R	VCR	Option
O	VCO	Option
Z	Others	Option

- Consult factory for special specification.
- If required optionally, append the contents above "MODEL CODE".

SPECIFICATIONS

Classification	Wide use type		High performance type		
Model (Mass Flowmeter)	HM5122B	HM5123B	HM5111B	HM5112B	HM5113B
Model (Mass Flow Controller)	HM5172B (NC) HM5182B (NO)	HM5173B (NC)	HM5141B (NC) HM5151B (NO)	HM5142B (NC) HM5152B (NO)	HM5143B (NC)
Scale range (N ₂ conversion)	30/50/100/200 L/min(nor)	400L/min(nor)	5/10/20/30/50/100/ 200/300/500/1000 mL/min(nor) 2/3/5/10/20 L/min(nor)	30/50/100/200 L/min(nor)	400L/min(nor)

Classification	Mass Flowmeter	Mass Flow Controller
Accuracy	High performance type : ±1% F.S. (HM5113B, HM5143B ±2% F.S.) Wide use type : ±2% F.S. (HM5123B, HM5173B ±4% F.S.)	
Linearity	High performance type : ±0.5% F.S.	Wide use type : ±1% F.S.
Reproducibility	High performance type : ±0.2% F.S.	Wide use type : ±0.4% F.S.
Response	Within 3 seconds (98% of Span)	Within 3 seconds up to ±2% of set value
Max. operating pressure	970kPa	
Test pressure	1470kPa	
Pressure loss	4.9kPa : 5mL/min (nor)~20L/min (nor) 9.8kPa : 30L/min (nor)~200L/min (nor) 15.7kPa : 400L/min (nor)	
Operating differential pressure		34.3~274.4kPa : 5mL/min (nor)~5L/min (nor) 68.6~274.4kPa : 10L/min (nor)~200L/min (nor) 107.8~274.4kPa : 400L/min (nor)
Operating temperature	5~45°C (Gas temperature is same as operating temperature)	
Leak standard	1×10 ⁻⁹ Pa • m ³ /s (He) or below	
Set signal		0.1~5VDC
Output signal	Output voltage 0~5VDC Output voltage 1~5VDC(Option)	
Position of installation	Free (±0.5% of Span)	
Contact gas material	SUS316, FKM	SUS316, Teflon, FKM
Fitting	1/4" Swagelok (Option VCR, VOC) : 5mL/min (nor)~20L/min (nor) 3/8" Swagelok (Option VCR, VOC) : 30L/min (nor)~100L/min (nor) 1/2" Swagelok (Option VCR, VOC) : 200L/min (nor)~400L/min (nor)	
Mass	600g (Except Power supply and Cable) : 5mL/min (nor)~20L/min (nor) 1.6kg (Except Power supply and Cable) : 30L/min (nor)~200L/min (nor) 2kg (Except Power supply and Cable) : 400L/min (nor)	750g (Except Power supply and Cable) : 5mL/min (nor)~20L/min (nor) 3kg (Except Power supply and Cable) : 30L/min (nor)~200L/min (nor) 3.7kg (Except Power supply and Cable) : 400L/min (nor)
Control range	2 to 100% of Span	
Cable	2m with connector (Std.), 3m, 5m (Option)	
Power consumption	Within 1W	Within 3W : 5mL/min (nor)~20L/min (nor) Within 5W : 30L/min (nor)~200L/min (nor) Within 5W : 400L/min (nor)
Slow start circuit		Built-in (Option) Only NC is applied.

The calibration criterion is 0 °C and 1 atm. (Calibration can be made in other temperatures.)

The standard flow range is for N₂ gas. The range may vary depending on the kind of gas.

NC and NO stands for "Normal close type" and "Normal open type" respectively.

500L/min(nor) is possible in flow range. (N₂ Conversion)

Chloroprene rubber is available for the sealing material.

EXAMPLE OF MODEL SELECTION

Flow range indicates the flow rate on the basis of N₂ gas.

When measuring other gases than N₂, the flow rate converted to N₂ gas shall be obtained by the below-mentioned Conversion Factor (CF), and then confirm if it is in the desired model.

The flow rate converted to N₂ gas can be obtained by the following formula.

In case of single component:

$$\text{Flow rate converted to N}_2 \text{ gas} = \frac{\text{Flow rate of gas to be used}}{\text{CF}}$$

In case of mixed gas:

CF of mixed gas shall be obtained, and then the conversion to N₂ gas shall be made as well as the single component.

$$\text{CF of mixed gas} = \frac{1}{\frac{X1}{CF1} + \frac{X2}{CF2} + \dots + \frac{Xn}{CFn}}$$

X1 : Density of Component 1 (VOL%/100)

X2 : Density of Component 2 (VOL%/100)

⋮ ⋮

Xn: Density of Component n (VOL%/100)

CF1 : CF of Component 1

CF2 : CF of Component 2

⋮ ⋮

CFn : CF of Component n

$$\text{Flow rate converted to N}_2 \text{ gas} = \frac{\text{Flow rate of mixed gas}}{\text{CF of mixed gas}}$$

Conversion Factor (CF)

Gas	Chemical Formula	Conversion Factor (CF)	Gas	Chemical Formula	Conversion Factor (CF)	Gas	Chemical Formula	Conversion Factor (CF)
Argon	Ar	1.40	Ethylene	C ₂ H ₄	0.64	Nitrogen monoxide	NO	0.99
Air	Air	1.00	Propylene	C ₃ H ₆	0.44	Nitrogen dioxide	NO ₂	0.75
Diborane	B ₂ H ₆	0.46	Carbon-dioxide gas	CO ₂	0.74	Nitrogen oxide	N ₂ O	0.74
Methane	CH ₄	0.74	Carbon monoxide	CO	1.00	Nitrogen	N ₂	1.00
Ethane	C ₂ H ₆	0.51	Hydrogen	H ₂	1.00	Oxygen	O ₂	0.99
Propane	C ₃ H ₈	0.34	Helium	He	1.40	Phosphine	PH ₃	0.78
Butane	C ₄ H ₁₀	0.32	Anmonia	NH ₃	0.78	Silane	SiH ₄	0.66
Acetylene	C ₂ H ₂	0.66	Neon	Ne	1.39	Sulfur dioxide	SO ₂	0.70

*Other gases besides the above mentioned ones can be measured, too. Contact Tokyo Keiso if any.

Example

Fluid : CH₄

Flow rate : 5L/min(nor)

Pressure : 0.5MPa

Temperature : 20°C

Fitting : 1/4" SWL

Flowmeter alone : Desired accuracy : ±1% F.S.

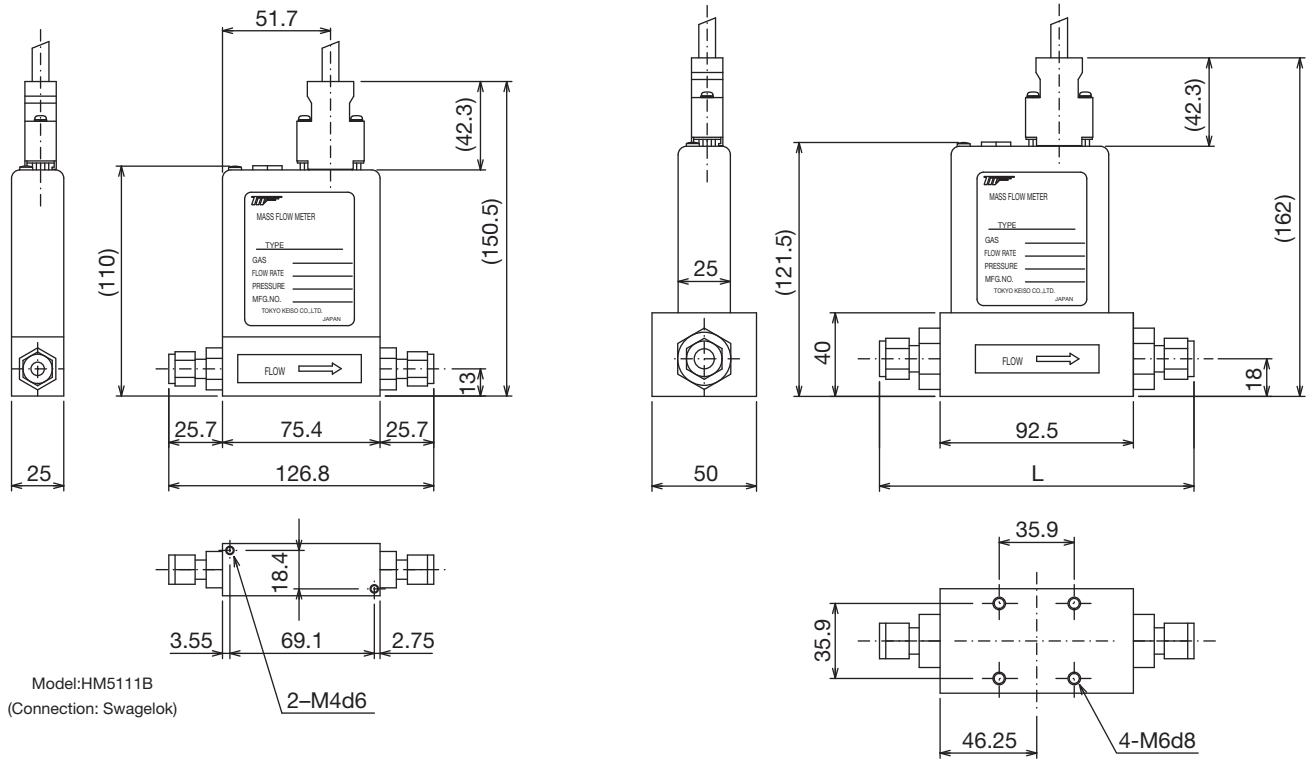
$$\text{Flow rate converted to N}_2 \text{ gas} = \frac{5\text{L/min (nor)}}{0.74 \text{ (CF)}}$$

$$= 6.76\text{L/min (nor)}$$

Model covering this flow rate is **HM5111B13ZS**.

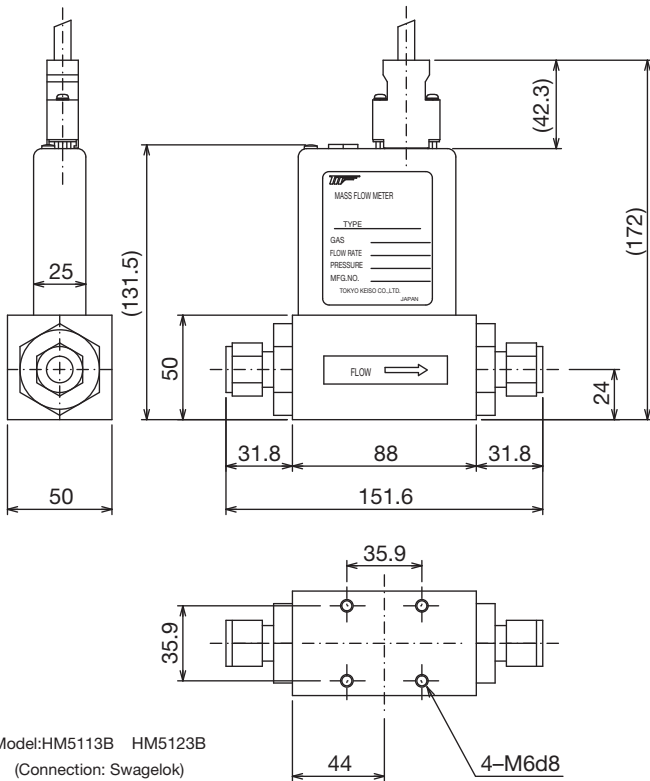
DIMENSION

Mass Flowmeter

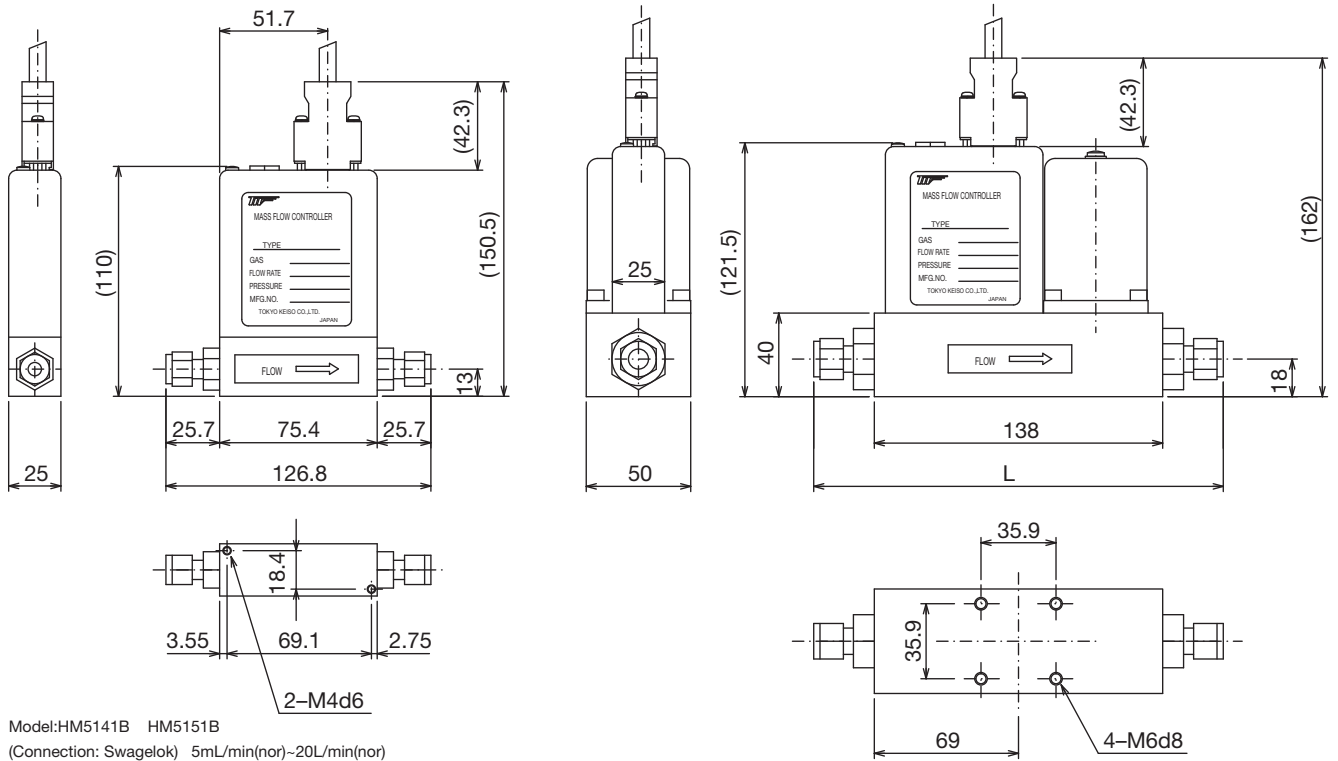


Model	Size	L
HM5112B	3/8"	150.5
HM5122B	1/2"	151

(Connection: Swagelok) 30L/min(nor)~200L/min(nor)

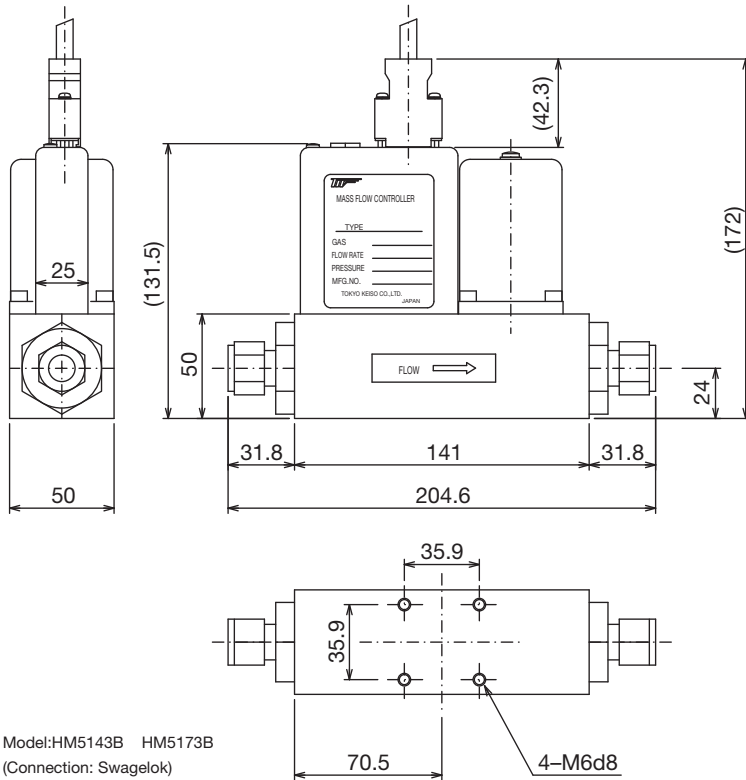


Mass Flow Controller

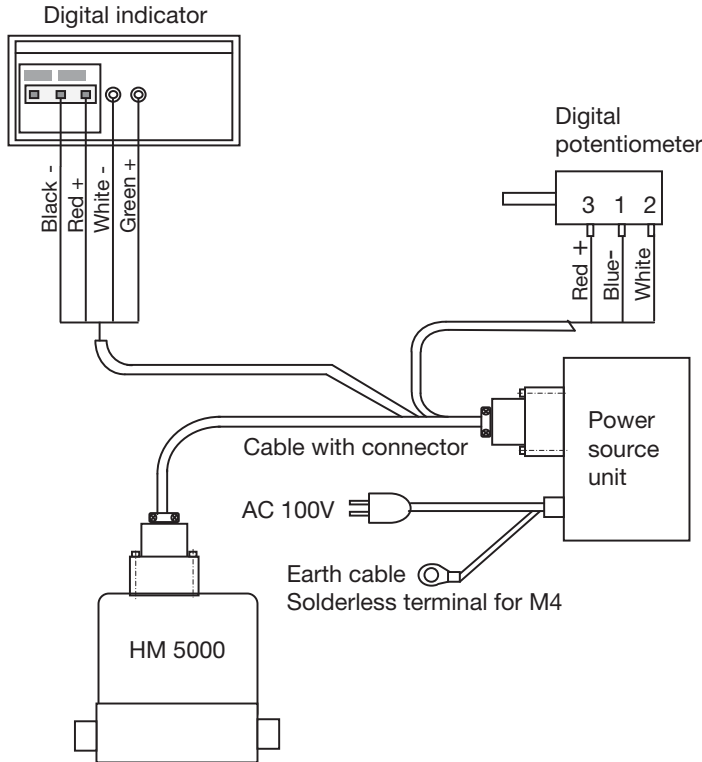


Model	Size	L
HM5142B	3/8"	196
HM5152B	1/2"	196.5

(Connection: Swagelok)



GENERAL CONSTRUCTION



General composition is shown in the left figure.

Mass flowmeter	HM5000
Digital indicator	DM1501B
Digital potentiometer	DP1001B
Power source unit	PU1001B
Cable with connector (Std. 2m)	
Mass flowmeter	CA1252B
Mass flow controller	CA1152B

* Potentiometer is not available with Mass flowmeter.

INDICATOR AND DIGITAL POTENTIOMETER FOR MASS FLOWMETER AND MASS FLOW CONTROLLER

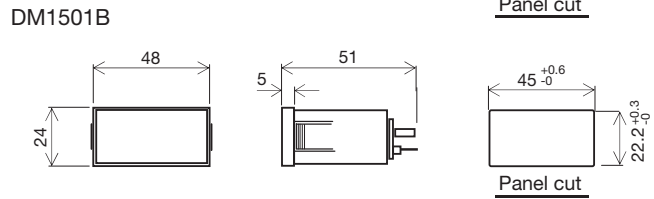
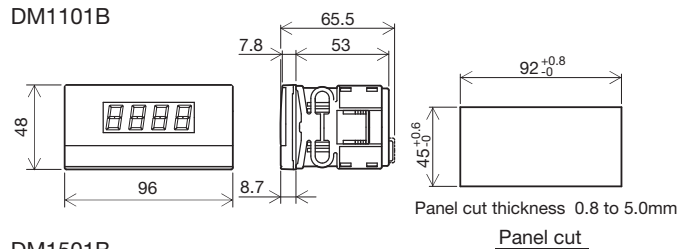
Indicator

[Specification]

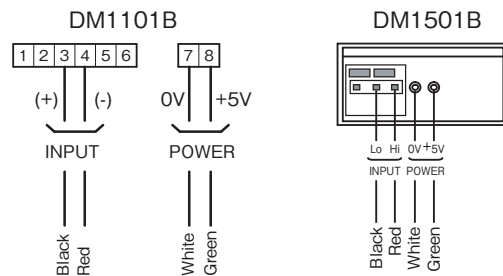
Type	DM1101B□□	DM1501B□□
Indication	LED7 segments (Red indication)	
Over indication	1999 blinks	000 or -000 blinks
Power source	+DC5V ±5%	
Power consumption	1.2W	0.3W
Mass	85g	40g

Code	Indication	Code	Indication	Code	Indication
01	0~5.00 mL/min (nor)	08	0~300 mL/min (nor)	15	0~20.0 L/min (nor)
02	0~10.00 mL/min (nor)	09	0~500 mL/min (nor)	16	0~30.0 L/min (nor)
03	0~20.0 mL/min (nor)	10	0~1000 mL/min (nor)	17	0~50.0 L/min (nor)
04	0~30.0 mL/min (nor)	11	0~2.00 L/min (nor)	18	0~100.0 L/min (nor)
05	0~50.0 mL/min (nor)	12	0~3.00 L/min (nor)	19	0~200 L/min (nor)
06	0~100.0 mL/min (nor)	13	0~5.00 L/min (nor)	20	0~400 L/min (nor)
07	0~200 mL/min (nor)	14	0~10.00 L/min (nor)	99	Special

[Dimension]



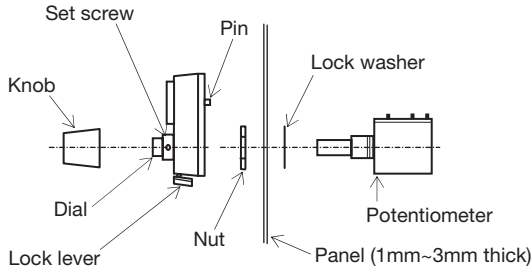
[Connection]



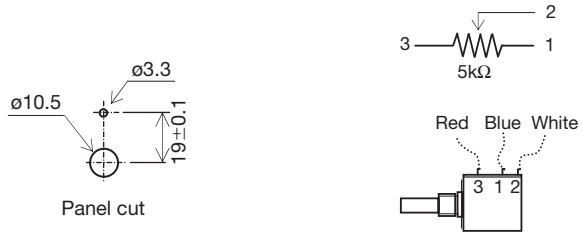
INDICATOR AND DIGITAL POTENTIOMETER FOR MASS FLOWMETER AND MASS FLOW CONTROLLER

Digital potentiometer (DP1001B)

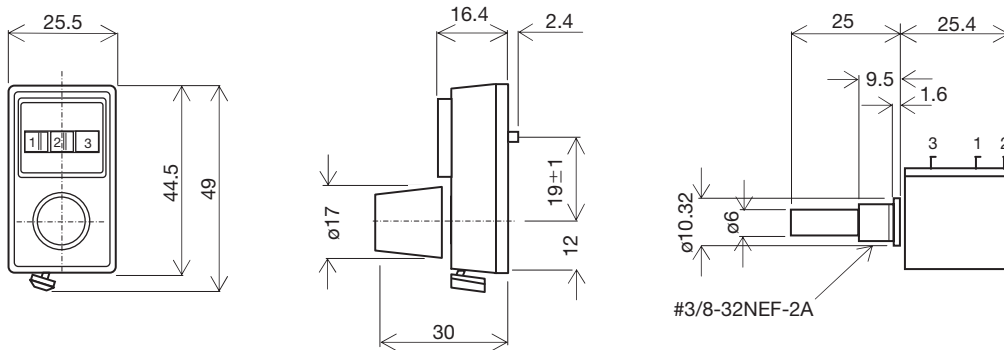
[Installation]



[Connection]



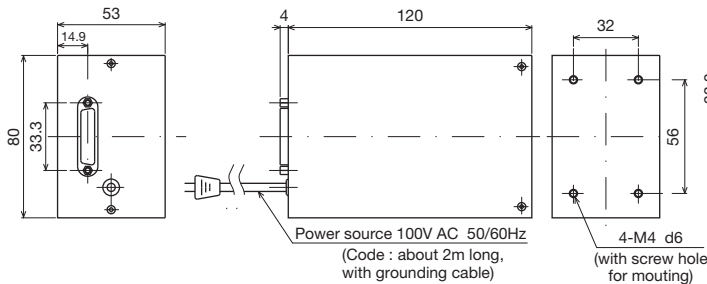
[Dimension]



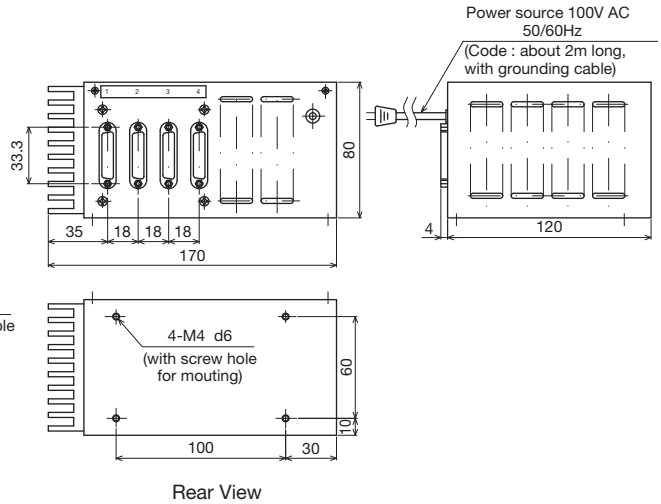
Power supply unit

[Dimension]

Power source for one unit PU1001B



Power source for four units PU1004B



[Specifications]

MODEL	One Unit PU1001B	Fourth Unit PU1004B
METHOD	Dropper	Dropper
OBJECTIVE	Whole HM series	Whole HM series
OUTPUT	+15V 50mA -15V 350mA +5V 250mA	+15V 0.2A -15V 1.4A +5V 1.0A
POWER SUPPLY	100VAC±10%	50/60Hz
TEMPERATURE	5 to 45°C	
COATING COLOR	Metallic Silver	
MASS	1kg	2kg

* Specification is subject to change without notice.

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