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 measurment 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

- The flow range is for N_2 gas, and depending upon the kind of gases, the range may sometimes vary.
- The calibration criterion is 0 °C and 1013hPa.
- 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 HM5182B (NO)	HM5173B	HM5141B HM5151B (NO)	HM5142B HM5152B (NO)	HM5143B
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	$1x10^{-9}$ 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, Viton	SUS316, Teflon, Viton
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 1013hPa. (Calibration can be made in other temperatures.)
The standard flow range is for N_2 gas. The range may vary depending on the kind of gas.
"NO" in parenthesis stands for NORMAL OPEN type and others mean NORMAL CLOSE type.
500L/min(nor) is possible in flow range. (N_2 Conversion)
Neoprene is available for the sealing material.

EXAMPLE OF MODEL SELECTION

Flow range indicates the flow rate on the basis of N_2 gas.
When measuring other gases than N_2, the flow rate converted to N_2 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 N_2 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 N_2 gas shall be made as well as the single component.

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

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_2H_4	0.64	Nitrogen monoxide	NO	0.99
Air	Air	1.00	Propylene	C_3H_6	0.44	Nitrogen dioxide	NO_2	0.75
Diborane	B_2H_6	0.46	Carbon-dioxide gas	CO_2	0.74	Nitrogen oxide	N_2O	0.74
Methane	CH_4	0.74	Carbon monoxide	CO	1.00	Nitrogen	N_2	1.00
Ethane	C_2H_6	0.51	Hydrogen	H_2	1.00	Oxygen	O_2	0.99
Propane	C_3H_8	0.34	Helium	He	1.40	Phosphine	PH_3	0.78
Butane	C_4H_{10}	0.32	Anmonia	NH_3	0.78	Silane	SiH_4	0.66
Acetylene	C_2H_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 : CH_4
Flow rate : 5L/min(nor)
Pressure : 0.5MPa
Temperature : 20°C
Fitting : 1/4" SWL
Flowmeter alone : Desired accuracy : ±1% F.S.

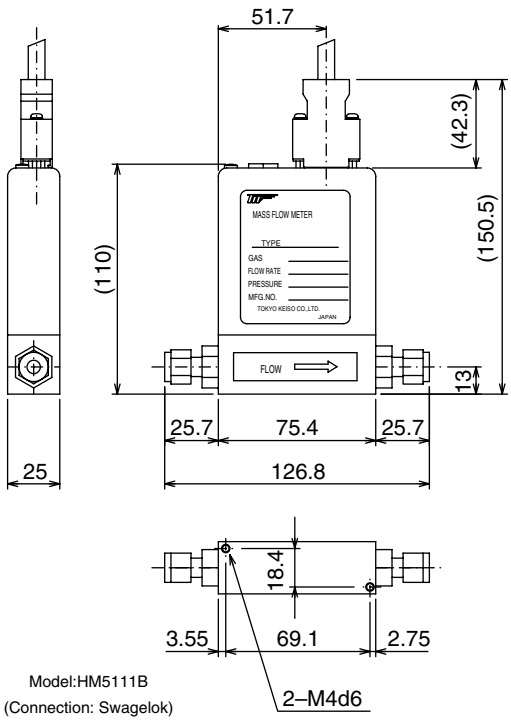
$$\text{Flow rate conversed to } N_2 \text{ gas} = \frac{5\text{L/min (nor)}}{0.74\ (\text{CF})}$$

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

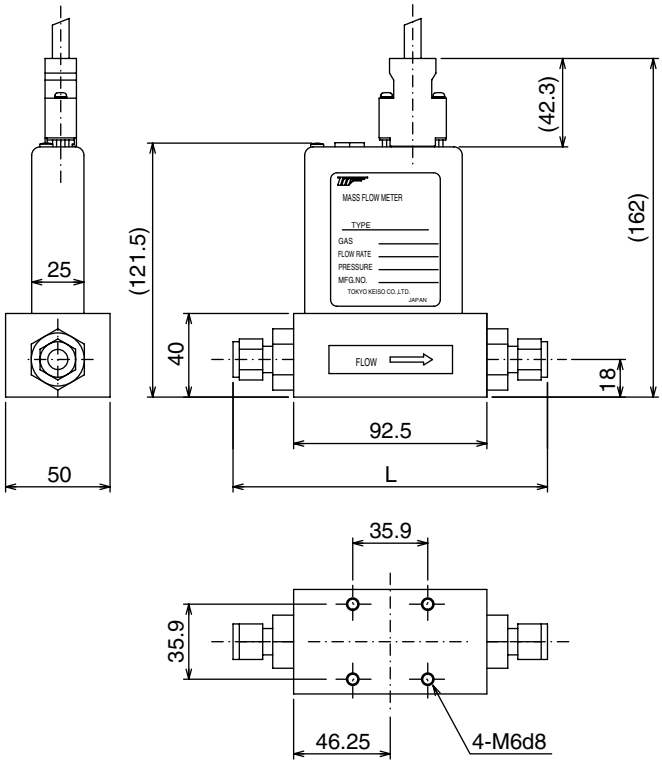
Model covering this flow rate is **HM5111B13ZS.**

DIMENSION

Mass Flowmeter

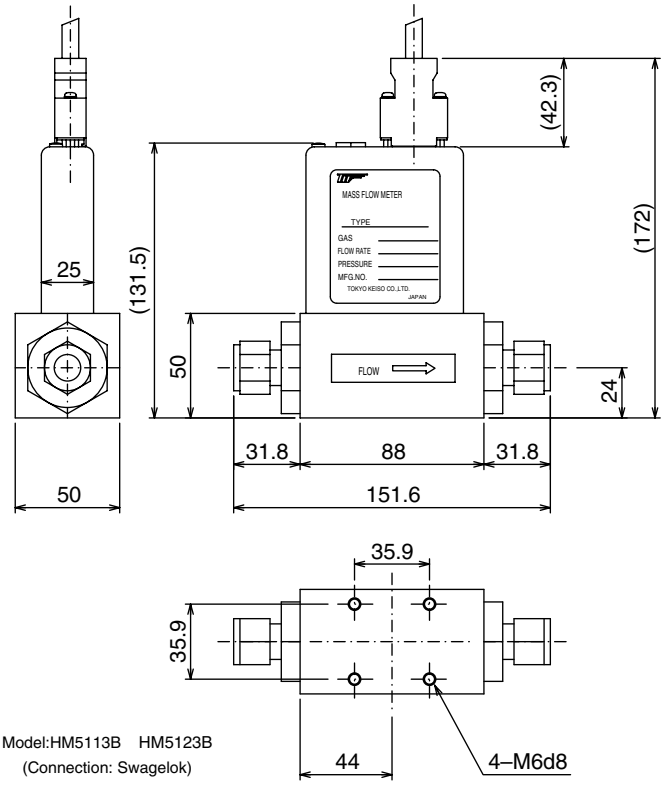


Model:HM5111B
(Connection: Swagelok)



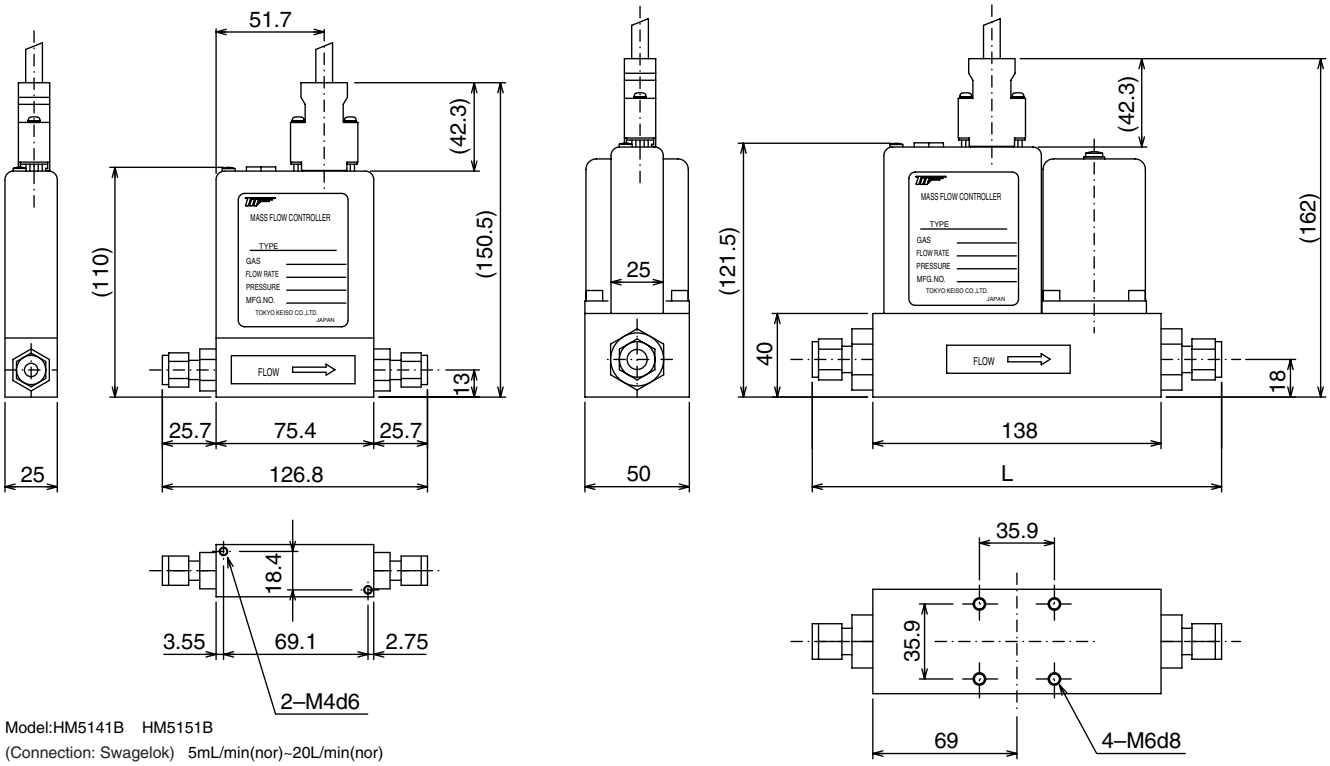
Model	Size	L
HM5112B	3/8"	150.5
HM5122B	1/2"	151

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



Model:HM5113B HM5123B
(Connection: Swagelok)

Mass Flow Controller

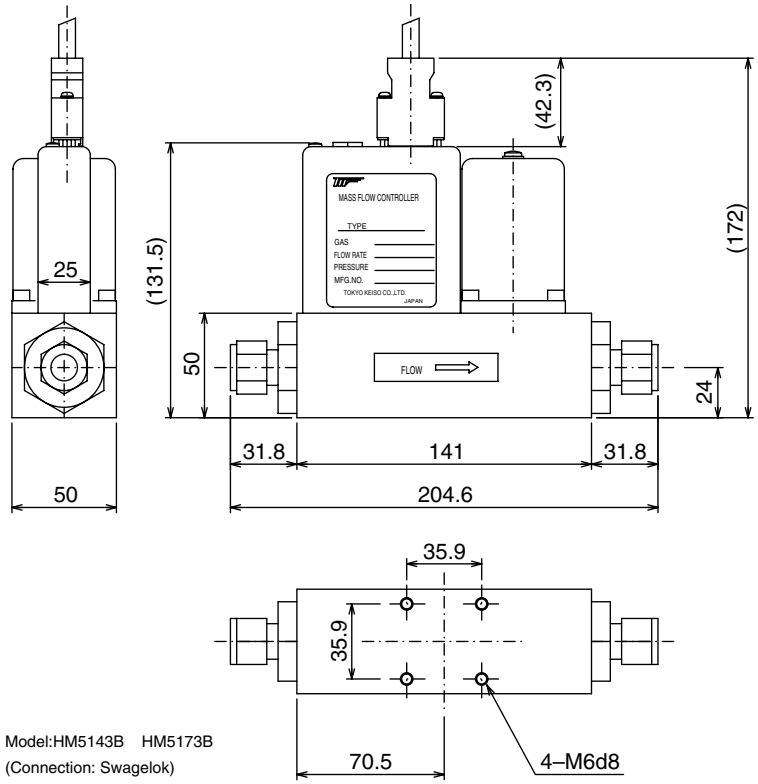


Model:HM5141B HM5151B
(Connection: Swagelok) 5mL/min(nor)~20L/min(nor)

Model
HM5142B
HM5152B
HM5172B
HM5182B

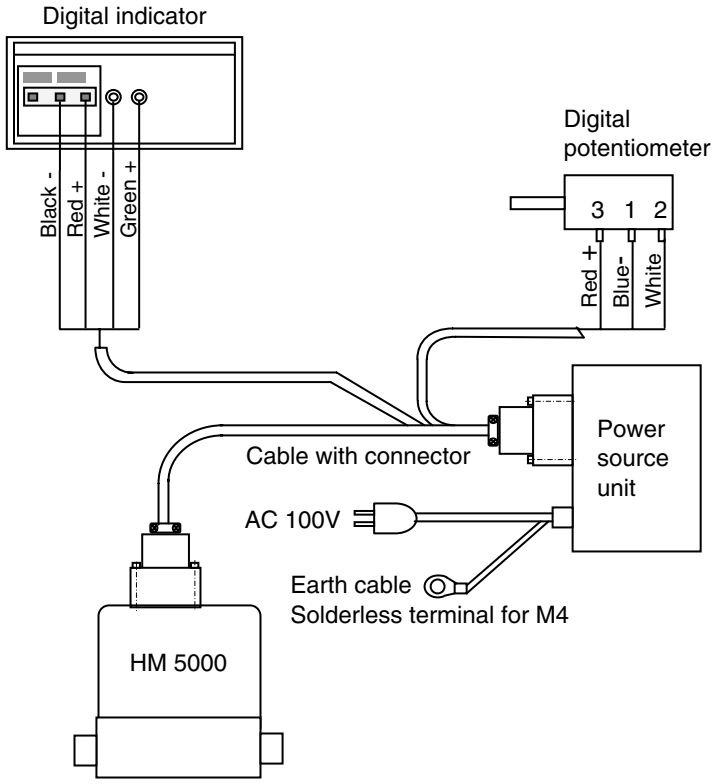
Size	L
3/8"	196
1/2"	196.5

(Connection: Swagelok)



Model:HM5143B HM5173B
(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

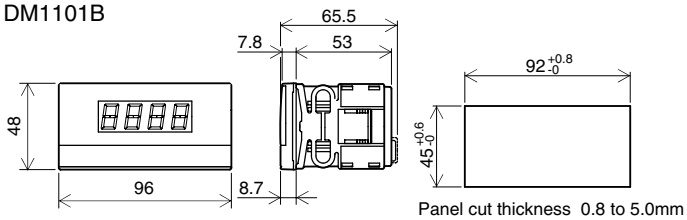
[Specification]

Type	DM1101B□□	DM1501B□□
Indication	LED7 segments (Red indication)	
Over indication	1999 blinks	000 or -000 blinks
Power source	DC5V ±10%	DC5V ±5%
Power consumption	220mA / DC5V	0.3W
Mass	85g	40g

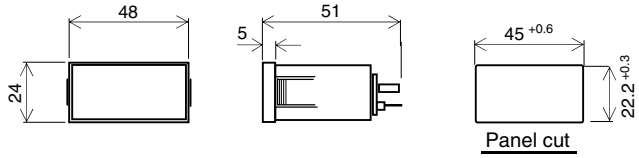
Code	Indication	Code	Indication	Code	Indication
01	0~5.00 mL/min (nor)	08	0~300 mL/min (nor)	15	0~20.0 L/min (nor)
02	0~10.00 mL/min (nor)	09	0~500 mL/min (nor)	16	0~30.0 L/min (nor)
03	0~20.00 mL/min (nor)	10	0~1000 mL/min (nor)	17	0~50.0 L/min (nor)
04	0~30.00 mL/min (nor)	11	0~2.00 L/min (nor)	18	0~100.0 L/min (nor)
05	0~50.00 mL/min (nor)	12	0~3.00 L/min (nor)	19	0~200 L/min (nor)
06	0~100.00 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]

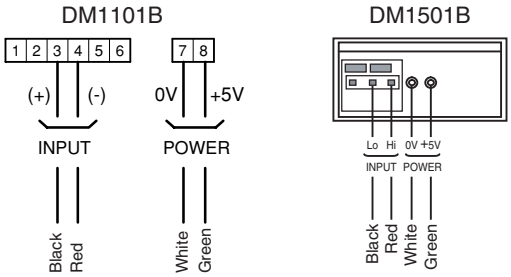
DM1101B



DM1501B



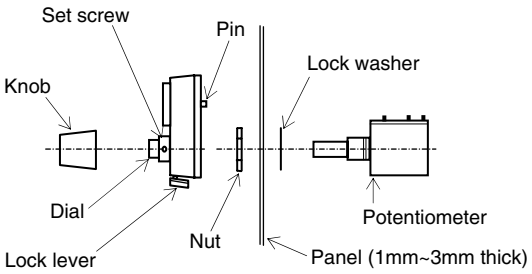
[Connection]

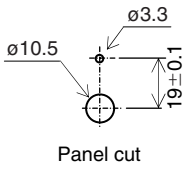


INDICATOR AND DIGITAL POTENTIOMETER FOR MASS FLOWMETER AND MASS FLOW CONTROLLER

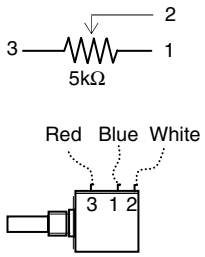
Digital potentiometer (DP1001B)

[Installation]

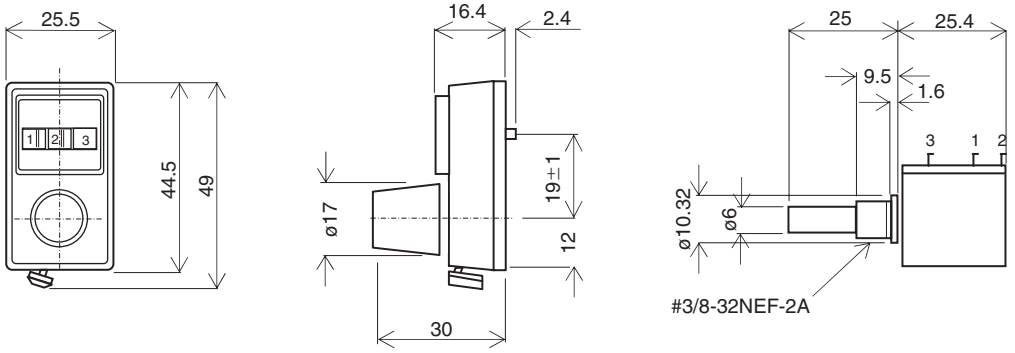




[Connection]



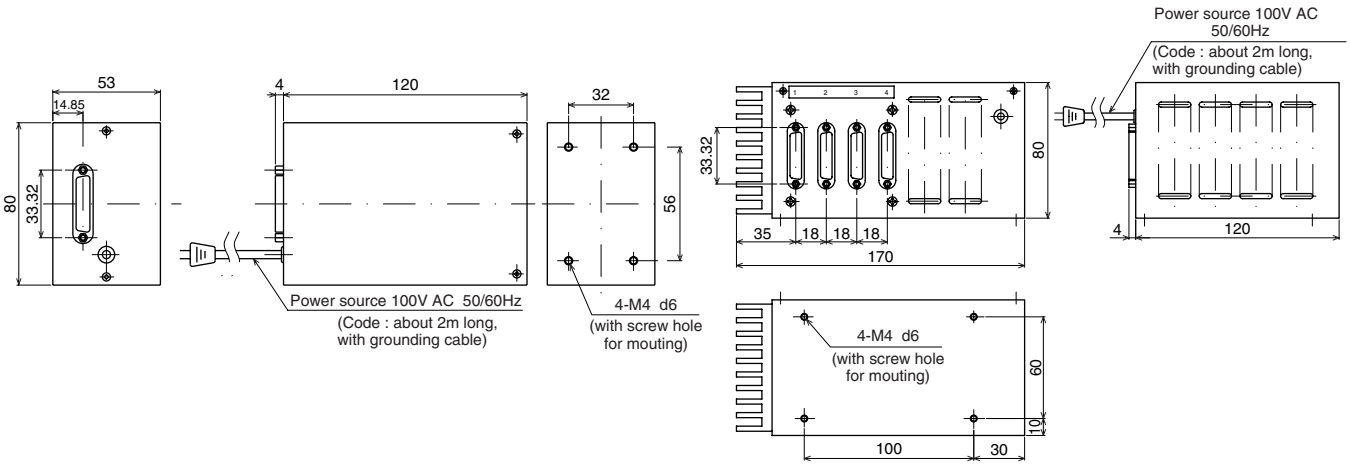
[Dimension]



Power supply unit

Power source for one unit PU1001B, PU1501B

Power source for four units PU1004B



Rear View

* Specification is subject to change without notice.

TOKYO KEISO CO., LTD.

Head Office : Shiba Toho Building, 1-7-24 Shibakoen, Minato-ku, Tokyo 105-8558
Tel : +81-3-3431-1625 (KEY) ; Fax : +81-3-3433-4922
e-mail : overseas.sales@tokyokeiso.co.jp ; URL : http://www.tokyokeiso.co.jp