



## Piezo Actuator Type Mass Flow Controllers

Purifying the process gas is an extremely important part of forming the thin films that are required in today's semiconductor manufacturing. Improving the purity of the gas involves increasing the effectiveness of purifiers and filters, as well as using ultra-clean gas flow systems. Conventional wisdom indicates that to make a gas supply system ultra clean, the areas that come in contact with the gas must be extremely well polished, and the entire system should be metal.

In the mass flow controller field, where the structure of gas supply systems is necessarily extremely complex, the above were considered difficult conditions to meet. Yet HORIBA STEC succeeded in developing a method for mass-producing metal diaphragm valves, and in 1984, the company released its SEC-4000 series of all-metal mass flow controllers, which came to be known as the ultra clean mass flow controllers. Research and development have continued, and now HORIBA STEC offers a variety of mass flow controllers that surpass the needs of the market—including the SEC-7300 series, which has become the de facto standard in compact mass flow controllers.

## SEC-7300 series

Compact mass flow controllers

The series that became the de facto standard in compact mass flow controllers

- ▶ Compact: With just 106 mm between surfaces, can perform flow rate control at up to 30 SLM (N<sub>2</sub>) (up to 50 SLM (N<sub>2</sub>) is available with this series).
- ▶ Flow rate control at extremely low flow rates: The SEC-7320 F.S. 1 SCCM model offers flow rate control for flow rates as low as 0.02 SCCM.
- ▶ Compatible with SDS (Safe Delivery Source Model): The SEC-734 OLD model offers differential pressure control from 1.33 kPa.  
Conforming gases: SDS cylinders packed with ASH<sub>3</sub>, BF<sub>3</sub>, SiF<sub>4</sub>, GeF<sub>4</sub>, etc.  
(SDS is a registered trademark of Matheson Tri-Gas, Semi-Gas, Semi-Gas Division, and ATMI, Inc.)
- ▶ Ultra clean: All metal construction (SEC-7300M type)
- ▶ Auto-close function is standard.



## SEC-4400 series

Mass flow controllers

The best-selling series that showed the world what ultra-clean means

- ▶ Ultra clean: All metal construction (SEC-4000M type)
- ▶ Compatible with a wide variety of flow rate control needs: Flow rate control between 0.1 SCCM and 100 SLM (N<sub>2</sub>) available in a single series.
- ▶ Models that prevent thermal siphoning: Mass flow controllers that are not affected by the installation orientation (SEC-4400MF/4500MF types). Feature a new sensor (patent pending) that prevents thermal siphoning through the very principles of its construction.
- ▶ Conforming gases: C<sub>2</sub>F<sub>6</sub>, C<sub>3</sub>F<sub>8</sub>, C<sub>4</sub>F<sub>8</sub>, SF<sub>6</sub>, SiF<sub>4</sub>, etc.
- ▶ Ultra clean: All metal construction (SEC-4000M type)
- ▶ Auto-close function is standard.
- ▶ Model with purge mode: SEC-4400SP type
- ▶ Wide range model: SEC-4400SR type



## SEC-4401/4501

Mass flow controllers

The ultimate in analog mass flow controllers

- ▶ High reliability: New sensor design, stable zero point: achieve  $\pm 20$  mV/y (typical)
- ▶ High precision:  $\pm 0.8$  F.S. (SEC-4401 type)
- ▶ Fast response: Feature an ultra-quick start function and offer response times under a second over the entire flow rate range.
- ▶ Models that prevent thermal siphoning: Mass flow controllers that are not affected by the installation orientation (SEC-4000MF type). Feature a new sensor (patent pending) that prevents thermal siphoning through the very principles of its construction.  
Conforming gases: C<sub>3</sub>F<sub>6</sub>, C<sub>3</sub>F<sub>8</sub>, C<sub>4</sub>F<sub>8</sub>, SF<sub>6</sub>, SiF<sub>4</sub>, etc.
- ▶ Ultra clean: All metal construction (SEC-4001M type)
- ▶ Auto-close function is standard.



# SEC-7300 series

| Model  | SEC- (mass flow controller) | 7320   | 7330   | 7340       | 7350   | 7355                   | 7340LD  | 7140   |  |
|--|-----------------------------|--|--|------------|--|------------------------|---|--|--|
|  | SEF- (mass flow meter)      |  | 7330   |            | 7350   | 7355                   |   |  |  |
| Materials used in gas contact area   |                             |  |  |            |  |                        |   |  |  |
| M: type, SUS316L, R: type, SUS316L, Viton®   |                             |  |  |            |  |                        |   |  |  |
| Valve type   |                             |  |  |            |  |                        |   |  |  |
| Open at power-off: 0 Close at power-off: C   |                             |  |  |            |  |                        |   |  |  |
| Standard flow rate range (N <sub>2</sub> equivalent F.S.)<br><small>(for SEC series)</small> |                             | 1/2/3 SCCM   | 5/10/20/50/100<br>200/500 SCCM<br>1/2 SLM        | 3/5/10 SLM | 20/30 SLM  | 50 SLM<br>(Hz:100 SLM) | 2/3/5/10 SCCM<br>20 SCCM 2kPa<br>30 SCCM 2.7kPa |  |  |
| Standard flow rate range (N <sub>2</sub> equivalent F.S.)<br><small>(for SEF series)</small> |                             |  | 5/10/20/50/100<br>200/500 SCCM<br>1/2/3/5/10 SLM |            | 20/30 SLM  | 50/100 SLM             |   | 5/10/20/50/100<br>200/500 SCCM<br>1/2/3/5/10 SLM   |  |
| Flow rate control range  |                             | 2 to 100% F.S.   |  |            |  |                        |   | 0 to 100% F.S.                                     |  |
| Response speed   |                             | Less than 1 sec (T98)  |  |            |  |                        |   |  |  |
| Accuracy   |                             | ± 1% F.S.  |  |            |  |                        |   |  |  |
| Linearity  |                             | ± 0.5% F.S.  |  |            |  |                        |   |  |  |
| Repeatability  |                             | ± 0.2% F.S.  |  |            |  |                        |   |  |  |
| Operating differential pressure<br><small>(for SEC series)</small>                           |                             | 1 SCCM to 5 SLM: 50 to 300 kPa (d)<br>10 SLM: 100 to 300 kPa (d)                                     |  |            | 20 SLM: 100 to 300 kPa (d)<br>30 SLM: 150 to 300 kPa (d) |                        | 150 to 300 kPa (d)                              | 1.33 to 101.3 kPa (d)                              |  |
| Maximum operating pressure   |                             | 300 kPa (G)  |  |            |  |                        |   |  |  |
| Pressure Resistance  |                             | 1 MPa (G)  |  |            |  |                        |   |  |  |
| Leak Integrity   |                             | M: 5 x 10 <sup>-12</sup> Pa·m <sup>3</sup> /s (He) R: 1 x 10 <sup>-9</sup> Pa·m <sup>3</sup> /s (He) |  |            |  |                        |   |  |  |
| Operating temperature  |                             | 5 to 50°C (accuracy guaranteed between 15 and 35°C)  |  |            |  |                        |   |  |  |
| Flow rate setting signal   |                             | 0.1 to 5VDC (Input impedance : more than 1MΩ)  |  |            |  |                        |   |  |  |
| Flow rate output signal  |                             | 0 to 5VDC (Minimum load resistance 2kΩ)  |  |            |  |                        |   |  |  |
| Drive power source   |                             | +15VDC ± 5%, 60 mA; -15 VDC ± 5%, 60 mA, 2.7 VA  |  |            |  |                        |   | +15 VDC ± 5%, 60 mA<br>-15 VDC ± 5%, 60 mA, 1.8 VA |  |
| Standard Fitting <sup>*1</sup>   |                             | 1/4 VCR type or IGS  |  |            | 3/8 VCR type   |                        | 1/4 VCR type or IGS                             |  |  |

\*1 Can be made compatible with an integrated unit flange. \* A model that has a signal cable connector on the side is available for use with integrated gas panels (for SEC-7340/7350/7355 series).

\* The standard flow rate range and operating differential pressure are different in the mass flow controllers (SEC series) versus the mass flow meters (SEF series).

\* SCCM and SLM are symbols indicating gas flow rate (mL/min, L/min at 0°C, 101.3 kPa).

\* Viton® is registered trademark of E. I. DuPont de Nemours.

# SEC-4400 series

| Model  | SEC- (mass flow controller) | 4400(MK3)  | 4500(MK3)         | 4550                            | 4600                            | 4400SP                          | 4400SR           | 4400MF   | 4500MF                     |                         |  |        |        |
|--|-----------------------------|--|-------------------|---------------------------------|---------------------------------|---------------------------------|------------------|--|----------------------------|-------------------------|--|--------|--------|
|  | SEF- (mass flow meter)      | 4400   | 4500              | 4550                            | 4600                            |                                 |                  |  |                            |                         |  |        |        |
| Materials used in gas contact area                                 |                             |  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| M: type, SUS316L, R: type, SUS316L, Viton®                         |                             |  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Valve type   |                             |  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Open at power-off: 0 Close at power-off: C                         |                             |  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Standard flow rate range (N <sub>2</sub> equivalent F.S.)          |                             | 5/10/20/30/50/100<br>200/300/500 SCCM<br>1/2/3/5 SLM   | 10 SLM            | 20 SLM                          | 30 SLM                          | 50 SLM                          | 50 SLM           | 100 SLM  | 5/10/20/50<br>100/200 SCCM | 500 SCCM<br>1/2/3/5 SLM | 5/10/20/30/50/100<br>200/300/500 SCCM<br>1/2/3/5 SLM | 10 SLM | 20 SLM |
| Flow rate control range  |                             | 2 to 100% F.S.   |                   |                                 |                                 |                                 |                  | 0.5 to 100% F.S.                                   |                            | 2 to 100% F.S.          |  |        |        |
| Response speed   |                             | Less than 1 sec (T98)  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Accuracy   |                             | ± 1% F.S. (MK3: ± 2% F.S.)   |                   |                                 |                                 |                                 | ± 1% F.S.        | ± 1% F.S. (10 to 100%)<br>± 0.2% F.S. (0.5 to 10%) |                            | ± 1% F.S.               |  |        |        |
| Linearity  |                             | ± 0.5% F.S. (MK3: ± 1% F.S.)   |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Repeatability  |                             | ± 0.2% F.S.  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Operating differential pressure<br><small>(for SEC series)</small> |                             | 50 to 300kPa (d)   | 100 to 300kPa (d) | 150 to 300kPa (d) <sup>*1</sup> | 100 to 300kPa (d) <sup>*1</sup> | 150 to 300kPa (d) <sup>*1</sup> | 50 to 300kPa (d) |  |                            | 100 to 300kPa (d)       |  |        |        |
| Maximum operating pressure   |                             | 300 kPa (G)  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Pressure Resistance  |                             | 1 MPa (G)  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Leak Integrity   |                             | M: 1 x 10 <sup>-11</sup> Pa·m <sup>3</sup> /s (He) R: 1 x 10 <sup>-9</sup> Pa·m <sup>3</sup> /s (He) |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Operating temperature  |                             | 5 to 50°C (accuracy guaranteed between 15 and 35°C)  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Flow rate setting signal   |                             | 0.1 to 5VDC (Input impedance : more than 1MΩ)  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Flow rate output signal  |                             | 0 to 5VDC (Minimum load resistance 2kΩ)  |                   |                                 |                                 |                                 |                  |  |                            |                         |  |        |        |
| Drive power source   |                             | +15VDC ± 5% 60mA -15VDC ± 5% 60mA 1.8VA  |                   |                                 |                                 |                                 |                  | +15VDC ± 5% 80mA -15VDC ± 5% 80mA 2.4VA            |                            |                         |  |        |        |
| Standard Fitting   |                             | 1/4 VCR type   |                   |                                 | 3/8 VCR type                    |                                 |                  | 1/4 VCR type                                       |                            |                         |  |        |        |

\*1 Operating pressure under atmospheric pressure conditions on the secondary side. \* SCCM and SLM are symbols indicating gas flow rate (mL/min, L/min at 0°C, 101.3 kPa).

\* Gases used by the SEC-400MK3: N<sub>2</sub>, H<sub>2</sub>, O<sub>2</sub>, He, Ar. Gases used by the SEC-4500MK3: N<sub>2</sub>, H<sub>2</sub>, O<sub>2</sub>.

\* Viton® is registered trademark of E. I. DuPont de Nemours.

# SEC-4001 series

| Model   | SEC- (mass flow controller) | 4401  | 4501              |
|---|-----------------------------|---|-------------------|
|   | SEF- (mass flow meter)      | 4401  | 4501              |
| Materials used in gas contact area                                      |                             |   |                   |
| M: type, SUS316L, R: type, SUS316L, Viton®                              |                             |   |                   |
| Valve type  |                             |   |                   |
| Open at power-off: 0 Close at power-off: C                              |                             |   |                   |
| Standard flow rate range (N <sub>2</sub> equivalent F.S.) <sup>*1</sup> |                             | 5/10/20/30/50/100/200/300/500 SCCM<br>1/2/3/5 SLM   | 10 SLM            |
| Flow rate control range   |                             | 2 to 100% F.S.  |                   |
| Response speed <sup>*2</sup>  |                             | Less than 1 sec across the entire flow rate control range (T98)                                       |                   |
| Accuracy  |                             | ± 0.8% F.S.   | ± 1% F.S.         |
| Linearity   |                             | ± 0.5% F.S.   |                   |
| Repeatability   |                             | ± 0.2% F.S.   |                   |
| Operating differential pressure<br><small>(for SEC series)</small>      |                             | 50 to 300kPa (d)  | 100 to 300kPa (d) |
| Maximum operating pressure  |                             | 300 kPa (G)   |                   |
| Pressure Resistance   |                             | 1MPa (G)  |                   |
| Leak Integrity  |                             | M: 5 x 10 <sup>-12</sup> Pa·m <sup>3</sup> /s (He), R: 1 x 10 <sup>-9</sup> Pa·m <sup>3</sup> /s (He) |                   |
| Operating temperature   |                             | 5 to 50°C (accuracy guaranteed between 15 and 45°C)   |                   |
| Flow rate setting signal  |                             | 0.1 to 5VDC (Input impedance : more than 1MΩ)   |                   |
| Flow rate output signal   |                             | 0 to 5VDC (Minimum load resistance 2kΩ)   |                   |
| Drive power source  |                             | +15 VDC ± 5%, 60 mA; -15 VDC ± 5%, 60 mA, 1.8 VA  |                   |
| Standard Fitting  |                             | 1/4 VCR type  |                   |
| Long-term zero point stability <sup>*3</sup>                            |                             | 20 mV/y typical   |                   |
| Standard functions  |                             | Auto-close (AC), ultra-quick start function standard  |                   |
| Options   |                             | Mount-free sensor (precision ± 1% F.S.) <sup>*4</sup>   |                   |

\*1 SCCM and SLM are symbols indicating gas flow rate (mL/min, L/min at 0°C). \*2 Responsiveness from 0% setting (fully closed setting) until entire flow range is reached.

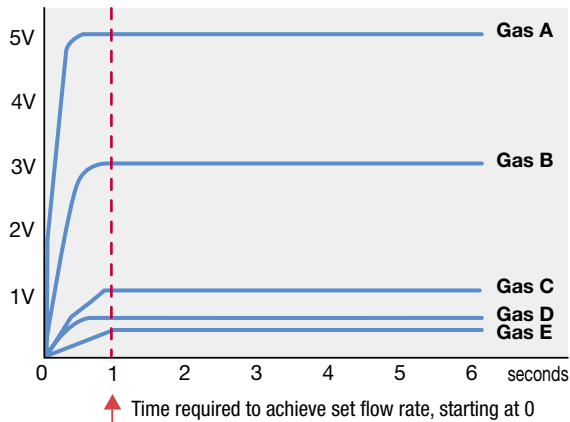
\*3 Value under set conditions (ambient temperature change within ± 2°C).

\*4 Models with mount-free sensor: Mass flow controllers: SEC-4401MF, SEC-4501MF; Mass flow meters: SEF-4401MF, SEF-4501MF

\* Viton® is registered trademark of E. I. DuPont de Nemours.

## High-speed response with ultra quick start (within one second for the entire flow control range)

### ▶ Ultra quick start function's responsiveness during startup of each line



### ▶ Remarkable improvement in responsiveness during startup

Mass flow controller valve control has traditionally been carried out through PID control, in which the sensor output signal is compared with the flow rate settings signal from the exterior of the unit. With this method, control is applied starting when the valve is still closed and continuing until an extremely low flow rate (2% F.S.) is achieved, so it takes time until the valve is able to begin controlling the gas flow rate effectively, and responsiveness within one second of start up is extremely difficult to achieve while meeting all the specified conditions. The ultra quick start function opens the valve for a brief moment, until the sensor output reaches a fixed value, after which the unit is transferred to PID control. This results in a dramatic improvement in the start-up response speed from the time when the valve is still closed until a low flow rate is achieved, and enables responsiveness across the entire flow rate control range within one second. The processes developed in recent years require low flow rate control and almost full scale flow rate control within a very short time, and since the mass flow range that a single unit can cover is quite large, a mass flow controller with ultra quick start can significantly increase both quality and throughput.

## Characteristics of the mount-free sensor (MF sensor)

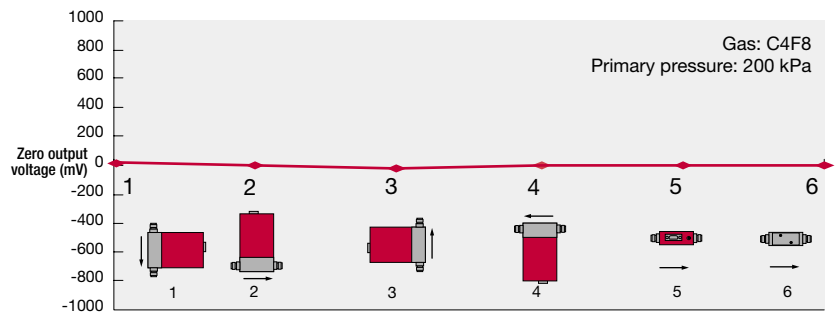
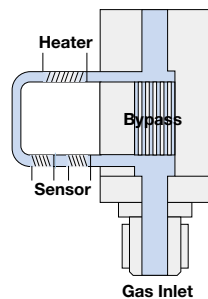
### ▶ What is thermal siphoning?

Thermal siphoning is a kind of convection that can occur within the flow rate sensor as the sensor is heated up. This convection can result in the output of a flow rate signal that resembles zero point drift, even when

the flow rate is not being controlled. Thermal siphoning is more likely to be affected if the mass flow controller is installed vertically. The effect created varies in proportion with the molecular weight and pressure.

### ▶ The design of the mount-free sensor (MF sensor)

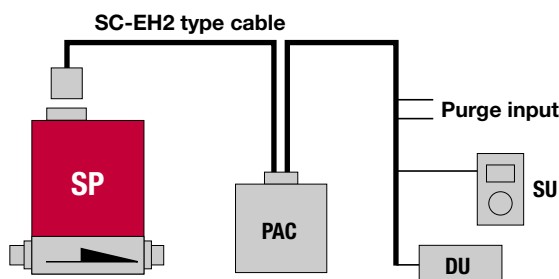
The mount-free sensor is a newly designed sensor (patent pending) that prevents the orientation of the unit from being a factor through the very principles of its construction. The equivalent heater is constructed to prevent convection. It is suitable for use with  $C_3F_8$ ,  $C_4F_8$ ,  $SF_6$ ,  $SiF_4$ , and other similar gases.



## Connecting the SEC-4400SP/SR

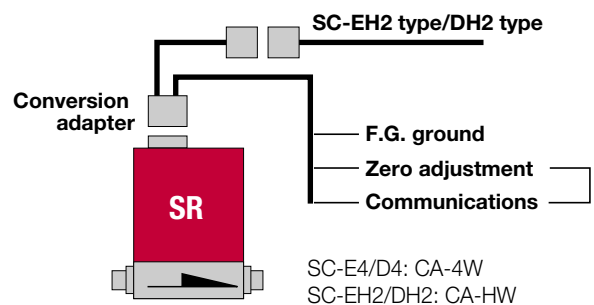
### ▶ SEC-4400SP

This model offers improved purge efficiency. Signal cable: When the valve open signal is input to the valve open/close signal input pin through an SC-EH2 type cable, it is possible to achieve a purge flow rate several times higher than that of ordinary models.



### ▶ SEC-4400SR

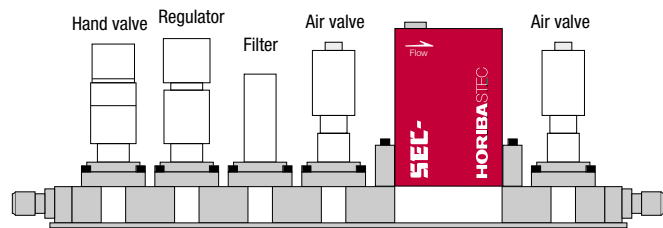
This model offers improved purge efficiency. Signal cable: When the valve open signal is input to the valve open/close signal input pin through an SC-EH2 type cable, it is possible to achieve a purge flow rate several times higher than that of ordinary models.



## Mass flow controllers for integrated gas panels

Integrated gas panels are made up of separate modules, including mass flow controllers, valves, regulators, filters, and so on, that perform the functions that were traditionally performed by parts in gas supply systems. Integrated gas panels can be manufactured without welding joints and piping since individual modules are used, and they are smaller and easier to maintain than traditional gas supply systems.

### ▶ Sample integrated gas panel design



### ▶ Advantages

- **Compatible with a wide variety of fittings**  
Compatible with every type of fitting, including C seals, CS seals, and W seals.
- **Easier to maintain**  
Unidirectional desorption makes it easier to desorb the mass flow controller.
- **Less dead volume**  
The amount of useless volume at the joint area is greatly reduced.

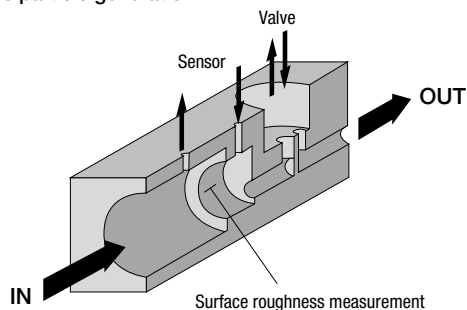
| Pitch size | Compatible model series   |
|------------|---|
| 1.125 inch | SEC-Z512 series   |
|            | SEC-Z10D series<br>(DeviceNet™ compatible mass flow controllers)  |
|            | SEC-7300 series   |
| 1.5 inch   | SEC-Z512/522 series   |
|            | SEC-Z10DW series<br>(DeviceNet™ compatible mass flow controllers) |
|            | SEC-F700 series   |
|            | SEC-F400 series   |
|            | SEC-V100D series  |
|            | SEC-7300 series   |

## SUC processing

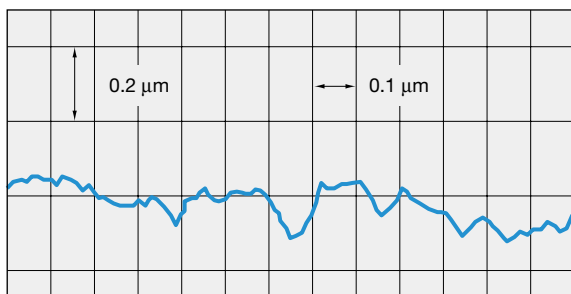
After machining, the surface of the stainless steel (SUS316L) that makes up the unit is polished until its roughness is at the sub-micron level.

### ▶ Advantages

- Improves gas emission characteristics.
- Controls particle generation.



### ▶ Results of surface roughness measurement



|             |                |
|-------------|----------------|
| Ra          | 0.035 μm       |
| RMS         | 0.035 μm       |
| Rt          | 0.120 μm       |
| Ro          | 0.06 μm        |
| Rv          | 0.06 μm        |
| Rz          | 0.090 μm       |
| Sm          | 0.113 μm       |
| SC          | 13 TL          |
| Slope       | 0.003          |
| <u>Rmax</u> | <u>0.31 μm</u> |

| Measurement conditions     | Results  |
|----------------------------|----------|
| Measurement scaling factor | 5000     |
| Drive speed                | 0.3 mm/s |
| Cutoff                     | 0.8 mm   |
| Measurement length         | 2.5 mm   |

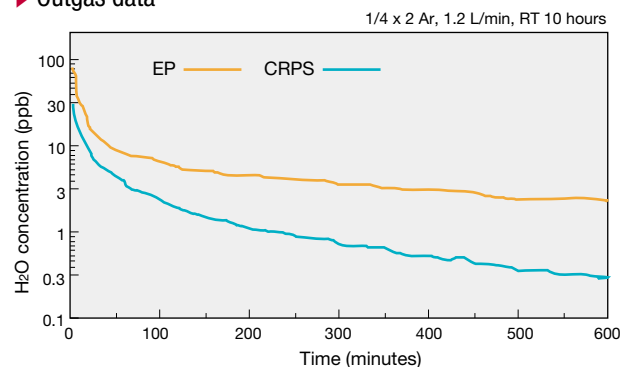
## CRP processing

After machining, the surface of the stainless steel (SUS316L) that makes up the unit is subjected to composite electrolytic polishing, and then a 100% Cr<sub>2</sub>O<sub>3</sub> oxidation film is formed on the surface.

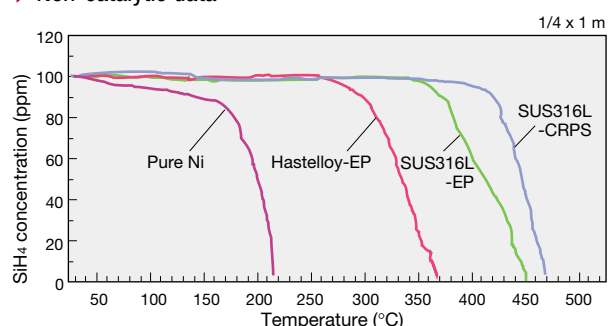
### ▶ Advantages

- Reduces outgassing of moisture and hydrocarbon gases.
- Increases resistance to corrosion by chlorine gases (highly corrosive gases).
- Has a non-catalytic effect on the spontaneous decomposition of SiH<sub>4</sub>/B<sub>2</sub>He and other similar chemicals.
- Suppresses contamination by particles from certain corrosive gases.

### ▶ Outgas data



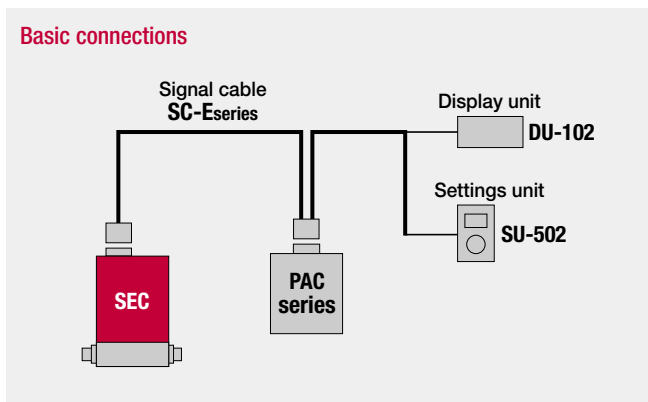
### ▶ Non-catalytic data



## Connecting analog mass flow controllers (examples)

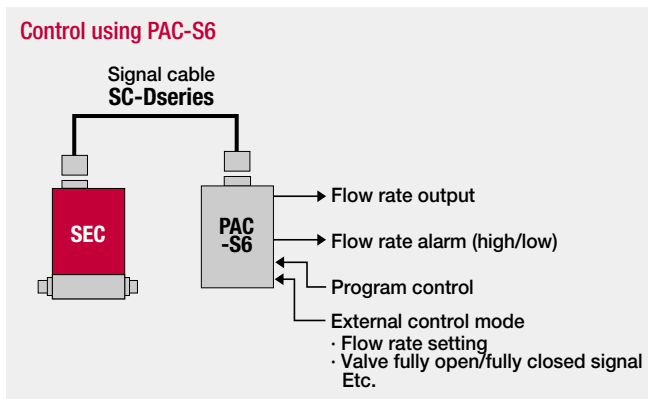
### ▶ Connecting to a digital power source, display unit, and settings unit

#### Basic connections

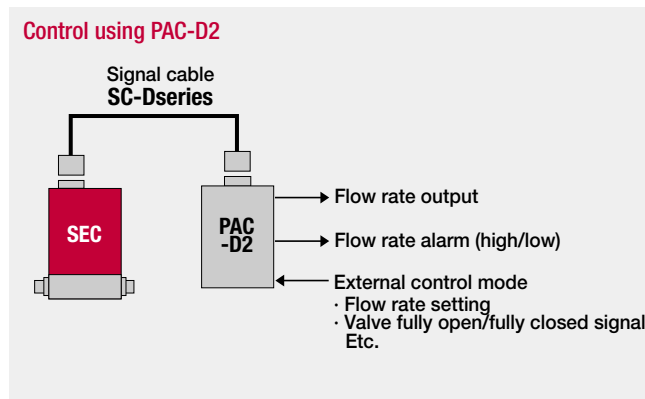


### ▶ Connecting to a dedicated controller

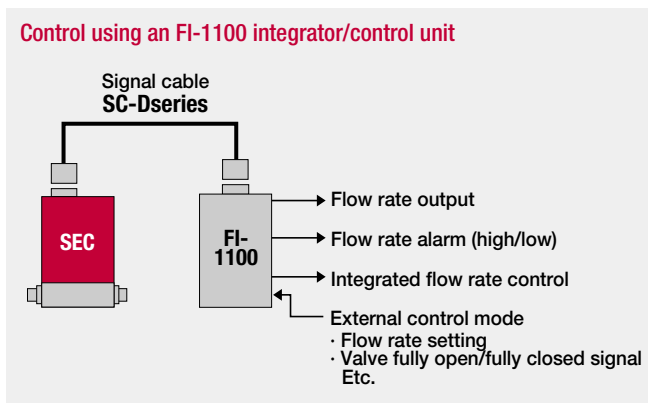
#### Control using PAC-S6



#### Control using PAC-D2

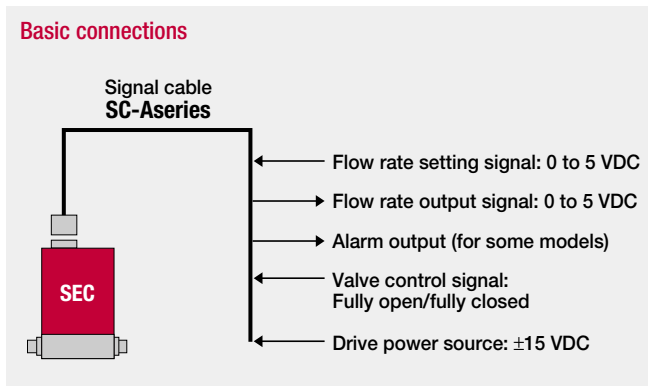


#### Control using an FI-1100 integrator/control unit



### ▶ Connecting to an external controller

#### Basic connections



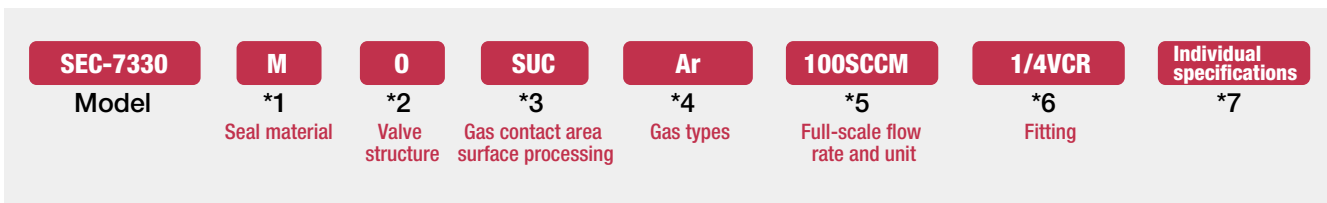
#### Connector connections

| Pin no. | Signal name                                  |
|---------|--|
| 1       | Valve forced open/close signal               |
| 2       | Analog flow rate output signal (0 to 5 VDC)  |
| 3       | Power source input (+15 VDC)                 |
| 4       | COMMON power source                          |
| 5       | Power source input (-15 VDC)                 |
| 6       | Analog flow rate setting signal (0 to 5 VDC) |
| 7       | COMMON signal                                |
| 8       | Alarm (option)                               |
| 9       | Valve voltage monitor (option)               |

Connector used: D-subminiature 9 contact pin connector (with M3 fitting screws)

## Choosing the appropriate mass flow controller model and specifications

### ► SEC series



- \*1** Select the seal material.  
M: Metal seal    R: Rubber seal  
If you are using poisonous or corrosive gases, we recommend using M (metal) as the seal material.  
(Examples: AsH<sub>3</sub>, B<sub>2</sub>H<sub>6</sub>, PH<sub>3</sub>, GeH<sub>4</sub>, H<sub>2</sub>Se, BCl<sub>3</sub>, BF<sub>3</sub>, Cl<sub>2</sub>, F<sub>2</sub>, HBr, HF, SiCl<sub>4</sub>, TiCl<sub>4</sub>, ClF<sub>3</sub>, HCl, WF<sub>6</sub>, etc.)
- \*2** Select the desired valve state for when there is no electricity. (Select the desired normal valve state.)  
O: Open    C: Closed    (This option is not available for flow meters.)
- \*3** Gas contact area surface processing  
The gas contact area can be processed to ultra clean levels (option).  
SUC: Surfaces are polished until the roughness is at the sub-micron level.  
CRP: A CRP film (passivation film) is formed on the gas contact surfaces (stainless steel).
- \*4** Select the types of gas you wish to use.
- \*5** Select the full scale flow rate and flow rate unit. The flow rate unit is usually noted at 0°C or 25°C (101.3 kPa). See Chart 1 for more information.
- \*6** Fitting  
A variety of contact joints other than 1/4 VCR type fitting can be used. Units can also be made compatible with integrated gas panels. Please contact HORIBA STEC for more information.
- \*7** Units can be adjusted to meet non-standard specifications. Please contact HORIBA STEC for more information.

Chart 1

| Flow rate unit | 0°C display | 25°C display |
|----------------|-------------|--------------|
| L/min          | SLM         | LM           |
| mL/min         | SCCM        | CCM          |

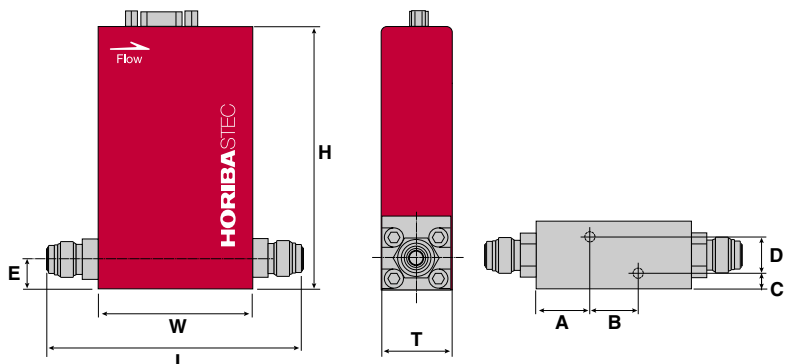
### ► Digital interface

- RS-485.F-Net protocol : SEC-Z512MG/Z522MG
- RS-422A.F-Net protocol : SEC-F700series SEC-V100Dseries
- DeviceNet™ : SEC-Z514MG/Z524MG  
SEC-Z10D/Z10DWseries

| Series      | Standard Flow Range (N <sub>2</sub> Equivalent F.S.) | Operating temperature |                 | Seal material |        | Internal surface polishing | Interface |                 |        | Fitting            |          |               |           |         |
|-------------|--|-----------------------|-----------------|---------------|--------|----------------------------|-----------|-----------------|--------|--------------------|----------|---------------|-----------|---------|
|             |  | Normal temp model     | High temp model | Metal         | Rubber |                            | Analog    | Digital (F-Net) |        | Digital DeviceNet™ | VCR Type | Swagelok type | IGS       |         |
|             |  |                       |                 |               |        |                            |           | RS-422A         | RS-485 |                    |          |               | 1.125inch | 1.5inch |
| SEC-Z500    | 5SCCM to 50SLM                                       | ○                     |                 | ○             |        | Standard                   | ○         |                 | ○      | ○                  |          | ○             | ○         |         |
| SEC-Z10D/DW | 5SCCM to 100SLM                                      | ○                     |                 | ○             |        | Standard                   |           |                 | ○      |                    |          | ○             | ○         |         |
| SEC-F700    | 5SCCM to 30SLM                                       | ○                     |                 | ○             |        | Option                     | ○         | ○               |        |                    |          | ○             | ○         |         |
| SEC-V100D   | 10SCCM to 50SLM                                      | ○                     |                 | ○             |        | Option                     | ○         | ○               |        |                    |          | ○             | ○         |         |
| SEC-7300    | 1SCCM to 100SLM                                      | ○                     |                 | ○             | ○      | Option                     | ○         |                 |        |                    | ○        | ○             | ○         |         |
| SEC-4400    | 5SCCM to 100SLM                                      | ○                     |                 | ○             | ○      | Option                     | ○         |                 |        |                    | ○        | ○             | ○         |         |
| SEC-4001    | 5SCCM to 20SLM                                       | ○                     |                 | ○             | ○      | Option                     | ○         |                 |        |                    | ○        | ○             |           |         |
| SEC-G100A   | 10SCCM to 5SLM                                       | ○                     |                 | ○             |        | Standard                   | ○         |                 |        |                    |          |               | ○         |         |
| SEC-E400J   | 10SCCM to 30SLM                                      | ○                     |                 | ○             |        | Option                     | ○         |                 |        |                    | ○        | ○             |           |         |
| SEC-E40     | 10SCCM to 500SLM                                     | ○                     |                 | ○             | ○      | —                          | ○         |                 |        |                    | ○        | ○             |           |         |
| SEC-8000    | 5SCCM to 100SLM                                      | ○                     | ○               | ○             |        | Option                     | ○         |                 |        |                    | ○        | ○             |           |         |
| SEC-2000    | 10SCCM to 100SLM                                     |                       | ○               | ○             | ○      | —                          | ○         |                 |        |                    | ○        | ○             |           |         |
| SEC-400     | 5SCCM to 200SLM                                      | ○                     |                 |               | ○      | —                          | ○         |                 |        |                    | ○        | ○             |           |         |

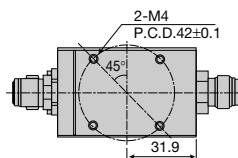
Mass flow meters: For the SEF series, please start by deciding without valve structure and then consider the other options.

# Dimensions

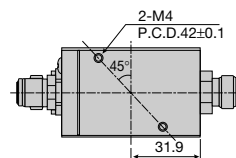


\*Please contact HORIBA STEC for information on details not shown here.

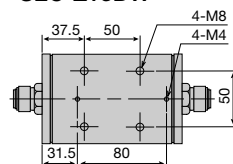
<1>  
SEC-Z522



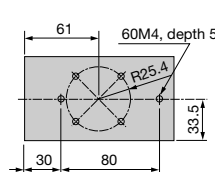
<2>  
SEC-V100 series  
SEC-Z10D series



<3>  
SEC-4600  
SEC-Z13DW



<4>  
SEC-600



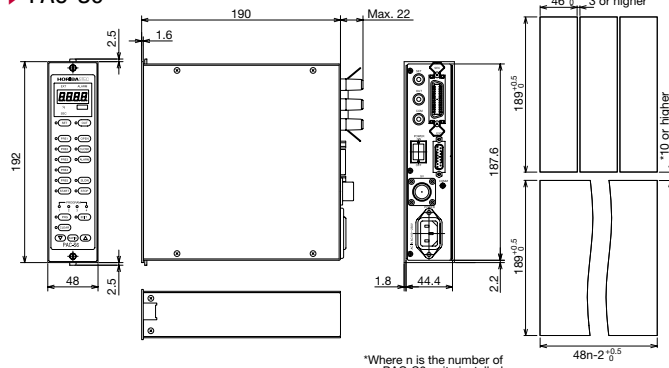
| Model            | H     | T    | W    | I     | (1/4 VCR) | (1/4 Swagelok) | (3/8 VCR) | (3/8 Swagelok) | A       | B     | C    | D    | E                    |
|------------------|-------|------|------|-------|-----------|----------------|-----------|----------------|---------|-------|------|------|----------------------|
| SEC-Z512         | 126   | 28   | 63.8 | 106   |           |                |           |                | 21.9    | 20    | 6.5  | 15   | 12.7                 |
| SEC-Z522         | 143   | 38.5 | 63.8 | 106   |           |                |           |                | See <1> |       |      |      | 12.7                 |
| SEC-Z11D         | 127   | 28.5 | 81.8 | 124   |           |                |           |                | See <2> |       |      |      | 12.7                 |
| SEC-Z12D         | 127   | 28.5 | 81.8 | 124   |           |                |           |                | See <2> |       |      |      | 12.7                 |
| SEC-Z13D         | 151.3 | 38.6 | 63.8 |       |           |                | 150.4     |                | 21.9    | 20    | 4.8  | 29   | 15.6                 |
| SEC-Z11DW        | 140   | 38.6 | 63.8 | 106   |           |                |           |                | See <2> |       |      |      | 12.7                 |
| SEC-Z12DW        | 140   | 38.6 | 63.8 | 106   |           |                |           |                | See <2> |       |      |      | 12.7                 |
| SEC-Z13DW        | 172   | 80   | 125  |       |           |                | 177       |                | See <3> |       |      |      | 20                   |
| SEC-F730         | 106   | 35   | 64.2 | 106 ² |           |                |           |                | 22.1    | 20    | 10   | 15   | 12.7                 |
| SEC-F740         | 126   | 35   | 64.2 | 106 ² |           |                |           |                | 22.1    | 20    | 10   | 15   | 12.7                 |
| SEC-F750         | 140   | 40   | 64.2 | 106 ² |           |                | 118       |                | 19.4    | 25    | 7.5  | 25   | 12.7                 |
| SEC-F440         | 112   | 38   | 76.2 | 124   | 127       |                |           |                | 19.1    | 38.1  | 9.75 | 18.5 | 12.7                 |
| SEC-F450         | 112   | 38   | 76.2 | 124   | 127       |                |           |                | 19.1    | 38.1  | 9.75 | 18.5 | 12.7                 |
| SEC/SEF-V110DM   | 116.5 | 37.6 | 63.8 | 106 ² |           |                |           |                | See <2> |       |      |      | 12.7                 |
| SEC/SEF-V120DM   | 116.5 | 37.6 | 63.8 | 106 ² |           |                |           |                | See <2> |       |      |      | 12.7                 |
| SEC-7320         | 106   | 28   | 63.8 | 106 ² | 110       |                |           |                | 21.9    | 20    | 6.5  | 15   | 12.7                 |
| SEC/SEF-7330     | 106   | 28   | 63.8 | 106 ² | 127       |                |           |                | 21.9    | 20    | 6.5  | 15   | 12.7                 |
| SEC-7340(LD)     | 126   | 28   | 63.8 | 106 ² | 127       |                |           |                | 21.9    | 20    | 6.5  | 15   | 12.7                 |
| SEC/SEF-7350     | 140   | 34   | 63.5 | 106 ² | 127       |                |           |                | 19.2    | 25    | 4.5  | 25   | 12.7                 |
| SEC/SEF-7355     | 145   | 49   | 80.8 | 124   |           |                | 132       | 135            | 20.4    | 40    | 12   | 25   | 20                   |
| SEF-7140         | 106   | 32   | 47   | 87    |           |                |           |                | 27.6    | 0     | 9    | 14   | 12.7                 |
| SEC/SEF-4400(MF) | 126   | 32   | 76   | 124   | 127       |                |           |                | 19      | 38.1  | 6.75 | 18.5 | 12.7                 |
| SEC/SEF-4500(MF) | 132   | 32   | 108  | 156   | 159       |                |           |                | 20.2    | 67.7  | 3.7  | 24.6 | 14.6 inner; 12 outer |
| SEC/SEF-4550     | 150   | 50   | 108  | 156   | 159       | 160            | 163       |                | 20.1    | 67.7  | 12.7 | 24.6 | 14.6 inner; 12 outer |
| SEC/SEF-4600     | 150   | 80   | 125  |       |           | 177            | 179       |                | See <3> |       |      |      | 20                   |
| SEC-4400SP/SR    | 126   | 32   | 76   | 124   |           |                |           |                | 19      | 38.1  | 6.75 | 18.5 | 12.7                 |
| SEC-4401(MF)     | 126   | 32   | 76   | 124   |           |                |           |                | 19      | 38.1  | 6.75 | 18.5 | 12.7                 |
| SEC-4501(MF)     | 132   | 32   | 108  | 156   |           |                | 164       |                | 20.2    | 67.7  | 3.7  | 24.6 | 14.6 inner; 12 outer |
| SEC-E440J        | 112   | 38   | 76.2 | 124   | 127       |                |           |                | 19.1    | 38.1  | 9.75 | 18.5 | 12.7                 |
| SEC-E450J        | 112   | 38   | 76.2 | 124   | 127       |                |           |                | 19.1    | 38.1  | 9.75 | 18.5 | 12.7                 |
| SEC-E40(MK3)     | 126   | 32   | 76   |       | 127       |                |           |                | 3.5     | 69    | 6.75 | 18.5 | 12.75                |
| SEC-E50(MK3)     | 126   | 32   | 76   |       | 127       |                |           |                | 3.5     | 69    | 6.75 | 18.5 | 12.75                |
| SEC-E60          | 159   | 44   | 95   |       |           |                | 150.8     |                | 3.5     | 50    | 8    | 28   | 22                   |
| SEC-E70          | 159   | 44   | 95   |       |           |                | 150.8     |                | 3.5     | 50    | 8    | 28   | 22                   |
| SEC/SEF-6470 ¹   | 147   | 40   | 150  |       |           |                |           |                | —       | 45    | —    | 20   | 35                   |
| SEC/SEF-6480 ¹   | 152.5 | 108  | 204  |       |           |                |           |                | —       | —     | —    | —    | 50                   |
| SEC-8340         | 130.5 | 48   | 76   | 124   | 127       |                |           |                | 19      | 38.1  | 6.75 | 18.5 | 22.7                 |
| SEC/SEF-8440     | 120.5 | 32   | 76   | 124   | 127       |                |           |                | 19      | 38.1  | 6.75 | 18.5 | 12.7                 |
| SEC/SEF-8450     | 127   | 32   | 108  | 156   | 159       |                |           |                | 20.2    | 67.7  | 3.7  | 24.6 | 14.6 inner; 12 outer |
| SEC/SEF-8455     | 150   | 50   | 108  | 156   | 159       | 160            | 163       |                | 20.1    | 67.7  | 12.7 | 24.6 | 14.6 inner; 12 outer |
| SEC/SEF-8460     | 150   | 80   | 125  | 172   | 172       | 177            | 179       |                | 31.5    | 80    | 15   | 50   | 20                   |
| SEC/SEF-2410     | 122   | 25.5 | 76   | 124   |           |                | 131       |                | 3.5     | 69    | 3.5  | 18.5 | 12.7                 |
| SEC/SEF-2510     | 131.5 | 32   | 108  | 156   |           |                | 163       |                | 17.2    | 101.6 | 9.3  | 25.4 | 14.6 inner; 12 outer |
| SEC/SEF-2551     | 137   | 44   | 136  | 184   |           |                | 191       |                | 30      | 80    | 33.5 | —    | 14.6 inner; 12 outer |
| SEC/SEF-310      | 80    | 20   | 60   | 106   | 110       |                |           |                | 20      | 20    | 10   | —    | 10                   |
| SEC/SEF-320      | 80    | 20   | 60   | 106   | 110       |                |           |                | 20      | 20    | 10   | —    | 10                   |
| SEC/SEF-400      | 122   | 25.5 | 76   | 124   | 127       | 131            | 131       |                | 3.5     | 69    | 3.5  | 18.5 | 12.7                 |
| SEC/SEF-500      | 131.5 | 32   | 108  | 156   | 160       | 163            | 163       |                | 9       | 80    | 3.7  | 24.6 | 14.6 inner; 12 outer |
| SEC/SEF-550      | 137   | 44   | 136  | 184   | 188       | 191            | 190       |                | 17.2    | 101.6 | 9.3  | 25.4 | 14.9                 |
| SEC/SEF-600 ¹    | 140   | 67   | 122  | 170   | 173       | 177            | 175       |                | See <4> |       |      |      | 20                   |
| SEC-400MK2-3     | 115.5 | 25.5 | 76   | 124   | 127       |                | 131       |                | 3.5     | 69    | 3.5  | 18.5 | 12.7                 |
| SEC-500MK2-3     | 125   | 32   | 108  | 156   | 160       | 163            | 163       |                | 9       | 90    | 3.7  | 24.6 | 14.6 inner; 12 outer |

¹ Please contact HORIBA STEC for details on the dimensions of the SEC/SEF-6470/6480.  
² Surface dimensions: 124 mm models can also be produced.

\* Please contact HORIBA STEC to request a copy of the dimension drawing.  
\* Equivalent products are sometimes used in place of the joints listed here.

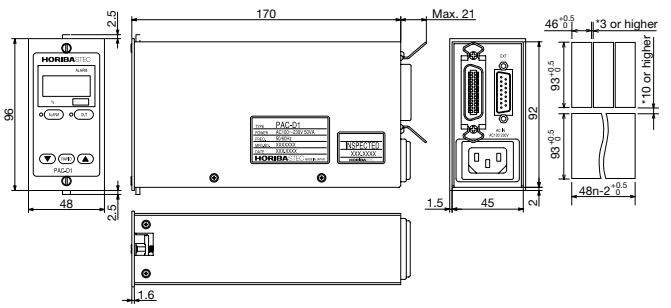
## Accessory dimensions

### ▶ PAC-S6



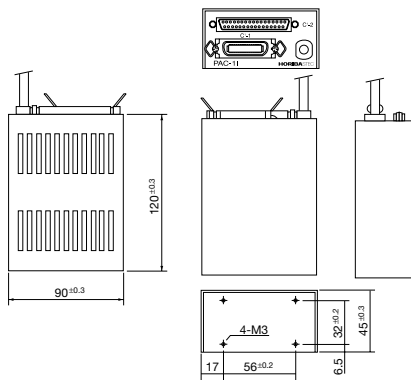
\*Where n is the number of PAC-S6 units installed.

### ▶ PAC-D1/D2

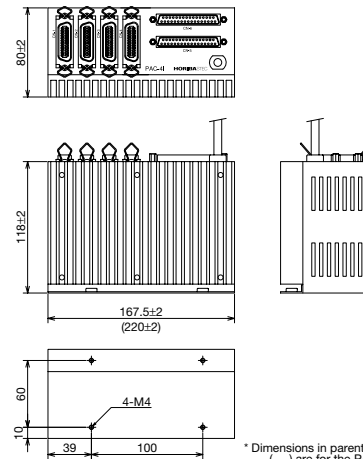


\*Where n is the number of PAC-D1/D2 units installed.

### ▶ PAC-11

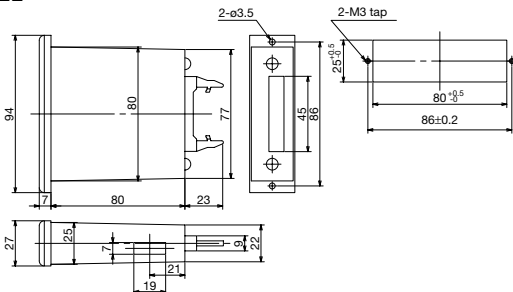


### ▶ PAC-41/61

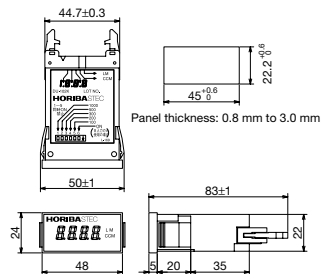


\* Dimensions in parentheses are for the PAC-61.

### ▶ DU-102E

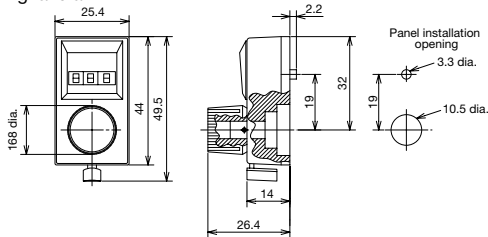


### ▶ DU-102K



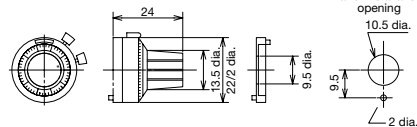
### ▶ SU-502ED

Digital dial

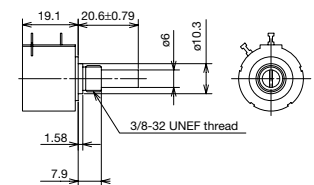


### ▶ SU-502EA

Analog dial



### ▶ Settings unit



### ▶ FI-1100

