

High Performance Mass Flow Controller

# SEC-Z500X





Introducing the remarkable *X*,  
a break-through in mass flow control technology

The mass flow controller, is a key piece of semiconductor manufacturing equipment. Its quality and efficiency play a major role in the success or failure of the semiconductor manufacturing process. HORIBA STEC, a company that has consistently introduced high-quality, highly functional products to the demanding semiconductor manufacturing market, and thereby grown its worldwide market share to over 30%\*1, has recently developed a new mass flow controller, one that breaks the mold completely and will change the future of mass flow control technology.

That new mass flow controller is the SEC-Z500X.

It provides all the mass flow functions customers need, including the flexibility to handle different gas types and flow volumes.

The customer him or herself can alter its specifications to suit changing needs\*2.

The unit is also RoHS compliant, which makes it the perfect environmentally friendly tool for improving corporate value.

The highly functional, high added value 'X' is brimming with previously unknown charm.

The world is witnessing the birth of a mass flow controller that will change the future of the semiconductor industry.

**SEC-Z500X, revealed for the first time**

\*1 From VLSI's 2005 Research Report.  
\*2 Multi-gas, multi-range function

-  **Quality and dependability**  
**The superior dependability you expect from HORIBA STEC. Industry leader**  
HORIBA STEC, is a brand hailed by equipment manufacturers throughout the world, one of many indications that HORIBA STEC consistently supplies high-quality, highly dependable products that meet the toughest standards.
-  **Reliable supply**  
HORIBA STEC quickly and reliably supplies equipment to its customers through its three main bases: Kyoto, which acts as HORIBA STEC's headquarters; Aso, the HORIBA Group's mass production factory, which features the latest in production equipment; and two bases in the United States (CA, TX), which act as ultra-quick suppliers.  
\* The new Aso factory was completed in October 2005.
-  **Global Support**  
**A reliable support system with an international network**  
Using a network that has branches throughout the world, HORIBA STEC's highly skilled engineers offer complete support for all HORIBA STEC products.
-  **RoHS compliant**  
**Complying with all RoHS regulations**  
The Corporate Social Responsibility (CSR) of companies involves, among other things, working to protect the environment. As a company within the HORIBA Group, a leader in environmental analysis equipment, HORIBA STEC is always striving to develop and manufacture environmentally sound products.

**RoHS regulations:**  
RoHS stands for "Restriction of Hazardous Substances", and is a set of regulations enforced in the EU to limit the use of six hazardous substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyls (PBDEs)), in electric and electronic components.



*We never compromise on performance.*

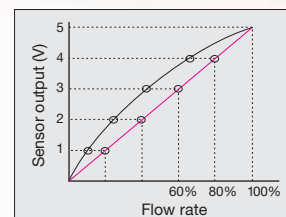


## High Accuracy

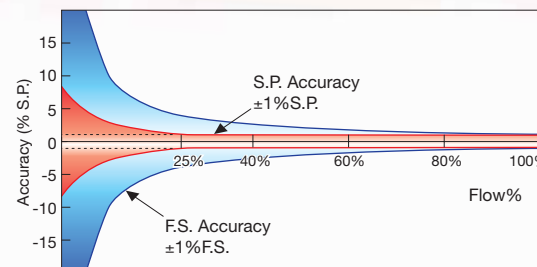
### High Accuracy $\pm 1.0\%$ S.P.

MFC's linearity is compensated by polynomial approximated curve. This achieves high accuracy for all flow control ranges. For the purpose of advancement of actual gas accuracy, the calibration data of various process gases are measured by HORIBA STEC standard gas measurement system.

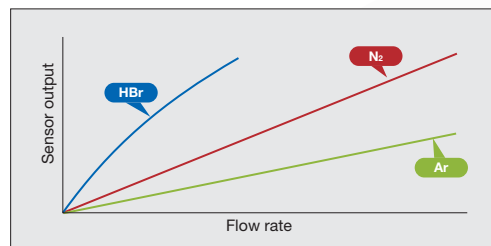
Accuracy	$\pm 1.0\%$ S.P.	: 25–100% F.S.
	$\pm 0.25\%$ F.S.	: $\leq 25\%$ F.S.



$$y = ax^5 + bx^4 + cx^3 + dx^2 + ex + f$$



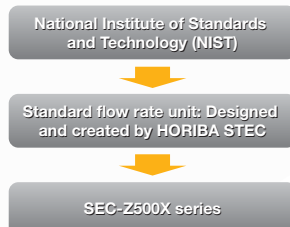
### Gas flow rate characteristic curve



Gases used in semiconductor processes have a variety of different properties. The flow rate calibration function used in the SEC-Z500X series uses detailed measurement data about the flow rate characteristics of each type of process gas, across different flow rate ranges, as a basis for calibration. This huge store of measurement data paired with highly reliable sensors and the latest in calibration technology ensures extremely precise process gas flow rate control.

### Traceability

The National Institute of Standards and Technology (NIST, a U.S. organization) certifies the traceability of the flow rate calibration used by the SEC-Z500X series. These units use a flow rate calibration unit that meets NIST calibration standards.



### High-precision standard flow rate system

The latest high-precision standard flow rate system is installed at HORIBA STEC's bases in the United States and Japan. This system, which uses a build-up method, can measure the flow rate of process gases, including those containing a high level of toxic substances, and volatile gases. The measured data is centrally managed through a database maintained at headquarters, which allows HORIBA STEC to continually improve process gas flow rate control precision.

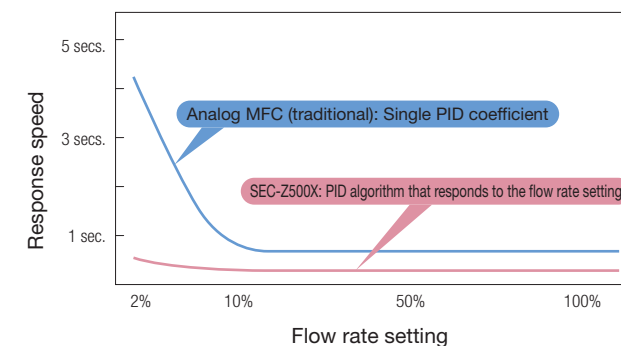


## High-speed response throughout the flow rate range

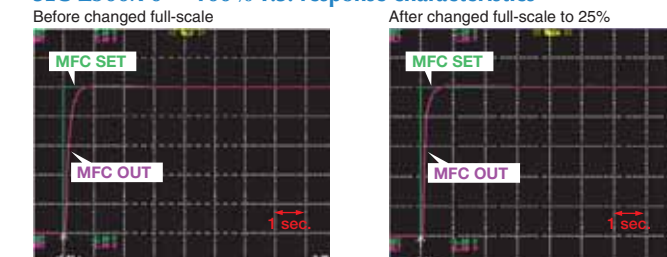
### High Speed Response

SEC-Z500X is installed with a newly developed "Variable PID system", which can achieve 1 second response to all setting points. Variable PID is continuously changing depending on setting flow points. This allows the PID factor to be optimized when you changed full scale flow and gases.

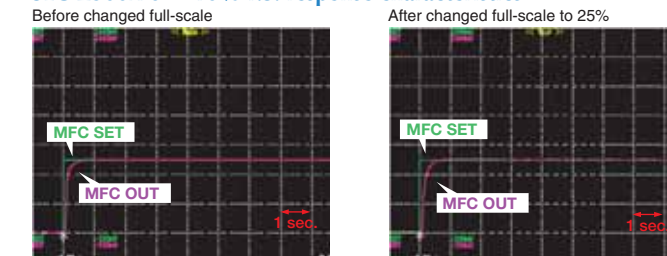
### Response speed comparison, with and without the PID algorithm



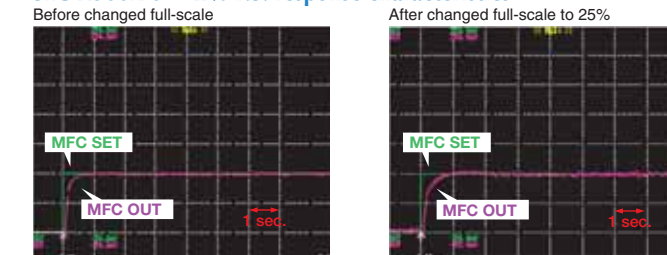
### SEC-Z500X 0 → 100% F.S. response characteristics



### SEC-Z500X 0 → 10% F.S. response characteristics



### SEC-Z500X 0 → 2% F.S. response characteristics





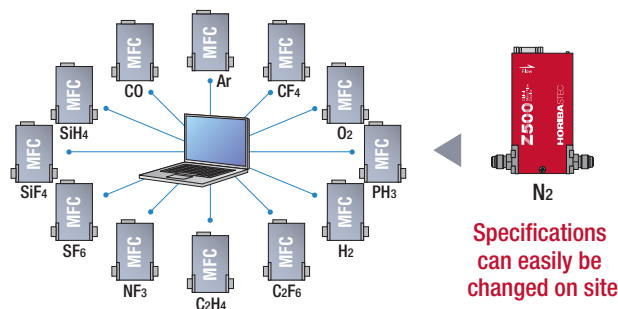


The best in quality for you



Multi-gas, multi-range solution

HORIBA STEC has made it possible for the user to change the type of gas or full-scale flow rate on site. Our special Z500 configuration software makes it possible to change these specifications at will. Best of all, the changes can be made without removing the mass flow controller from the gas panel or piping. This reduces the number of spare mass flow controllers users need to store, and helps save both time and money.



Suitable for multiple types of gas  
Freely change types of gas

Example:  
SEC-Z500X MR-MG02

N<sub>2</sub> 100 SCCM

Ar 110 SCCM

B<sub>2</sub>H<sub>6</sub>55 SCCM

Suitable for multiple ranges  
Freely change the full scale

Example:  
SEC-Z500X MR-MG04

N<sub>2</sub> 1000 SCCM

N<sub>2</sub> 250 SCCM

Flow rate control range  
20 to 1000 SCCM

Flow rate control range  
5 to 250 SCCM

Changing the full-scale flow rate

Even when the same full-scale values are used, the MR/MG numbers associated with the full-scale flow rate values for the calibration gas may vary, due to variations in the thermal conductivity of the different process gases. To increase flow rate calibration precision, HORIBA STEC offers the following lineup of MR/MG numbers.

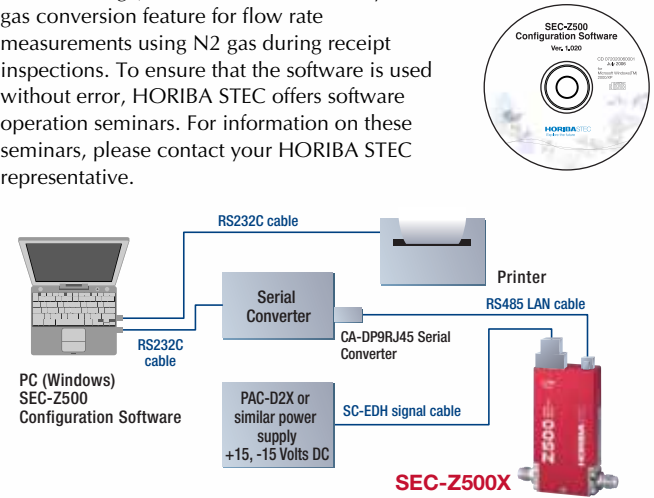
List of full-scale flow rates for different gases

Gas type MR/MG number	N <sub>2</sub>	Ar	H <sub>2</sub>	SF <sub>6</sub>	HBr	WF <sub>6</sub>
SEC-Z51 series						
R01	3 – 10	—	—	—	—	—
R1.5	—	—	—	—	—	—
01	8 – 30	12 – 35	8 – 30	5 – 11	5 – 9	—
1.5	—	—	—	—	9 – 17	—
02	25 – 100	35 – 110	25 – 100	9 – 36	16 – 31	5 – 6
2.5	—	—	—	—	25 – 50	6 – 11
03	75 – 300	110 – 350	75 – 300	28 – 100	44 – 86	10 – 20
3.5	—	—	—	—	79 – 150	19 – 37
04	250 – 1000	350 – 1100	250 – 1000	90 – 350	150 – 280	34 – 67
4.5	—	—	—	—	280 – 540	60 – 110
05	750 – 3000	1100 – 3500	750 – 3000	260 – 1000	470 – 930	110 – 200
5.5	—	—	—	—	860 – 1700	190 – 370
06	2500 – 10000	3500 – 11000	2500 – 10000	780 – 3100	1600 – 3100	360 – 700
SEC-Z52 series						
6.5	—	—	—	—	—	—
07	10000 – 30000	10000 – 30000	10000 – 30000	—	—	—
08	30000 – 50000	30000 – 50000	30000 – 50000	—	—	—

Minimum flow rate — maximum flow rate

Configuration software that allows the user to alter specifications on-site

The SEC-Z500X offers multi-gas, multi-range functionality, thanks to its configuration software. This software makes it possible to select MR/MG numbers simply by entering the type of gas being used and the flow rate range, and also features a handy N2 gas conversion feature for flow rate measurements using N2 gas during receipt inspections. To ensure that the software is used without error, HORIBA STEC offers software operation seminars. For information on these seminars, please contact your HORIBA STEC representative.



Name	Notes
Computer	OS: Japanese or English, Windows® 2000 / XP / Vista
Software	Configuration software
	HORIBA STEC offers seminars detailing the use of the software.
Communications converter (serial)	RS-485
Conversion adapter (CA-DP9RJ45)	Communications converter to LAN cable
RS232C cable	PC to communications converter
LAN cable	LAN cable for SEC-Z500X communications
USB serial converter	Required for computers that do not have a serial port
Label printer	Please consult your HORIBA STEC representative for further information

The customer can supply all the system components listed above, if desired, except for the software, which must be provided by HORIBA STEC. Please consult your HORIBA STEC representative for more detailed specifications.



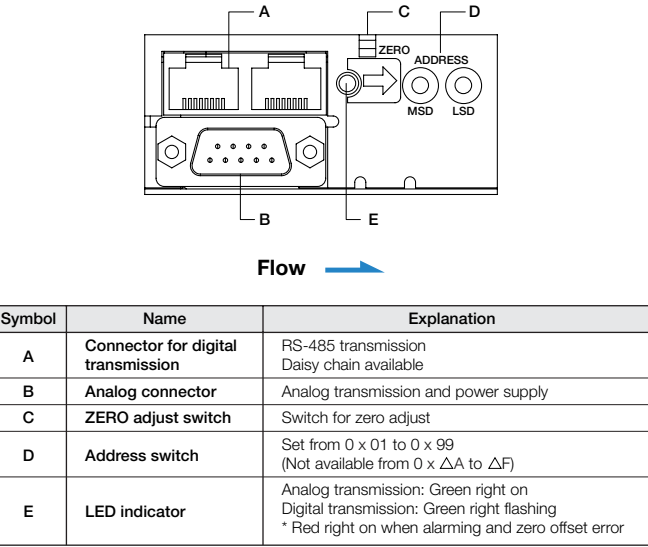
Product specifications

Digital/Analog transmission models

Mass flow controller model	*1	SEC-Z512KX	SEC-Z512MGX	SEC-Z522MGXN	SEC-Z522MGX	SEC-Z532KVX	SEC-Z542KVX
Mass flow meter model	*1	SEF-Z512KX	SEF-Z512MGX	SEF-Z522MGXN	SEF-Z522MGX	SEF-Z532KVX	SEF-Z542KVX
Full-scale flow rate (N <sub>2</sub> conversion flow rate)	1/2 SCCM	MR/MG number #R01: 10 SCCM #R1.5: 17.5 SCCM #01: 30 SCCM #1.5: 55 SCCM #02: 100 SCCM #2.5: 175 SCCM #03: 300 SCCM #3.5: 550 SCCM #04: 1 SLM #4.5: 1.75 SLM #05: 3 SLM #5.5: 5.5 SLM #06: 10 SLM	MR/MG number #6.5: 22 SLM #07: 30 SLM #08: 50 SLM	100 SLM	200 SLM		
Valve Type	O: Normally open. C: Normally closed					C: Normally closed	
Flow rate at fully closed control valve	≤ 2% F.S.					≤ 5% F.S.	
Flow rate control range	2-100% of F.S.					5-100% of F.S.	
Flow rate measuring range (SEF)	0-100% of F.S.					0-100% of F.S.	
Accuracy	*2	±1.0% F.S.	±1.0% S.P. (Flow rate > 25% F.S.) ±0.25% F.S. (Flow rate ≤ 25% F.S.)			±1.0% S.P. (flow rate > 35% F.S.) ±0.35% F.S. (flow rate ≤ 35% F.S.)	
Operating temperature	5 to 50°C (recommended temperature range: 15 to 45°C)					5 to 50°C (recommended temperature range: 15 to 45°C)	
Response	≤ 1 second: Over full flow rate range					≤ 1.5 second: Over full flow rate range (typically 1 second)	
Linearity	≤ ±0.5% F.S.					≤ ±0.5% F.S.	
Repeatability	≤ ±0.2% F.S.					≤ ±0.2% F.S.	
Operating differential pressure	50 to 300 kPa (d)	50 to 300 kPa (d) #5.5, #06: 100 to 300 kPa (d)	200 to 300 kPa (d)			200 to 300 kPa (d)	
Operating differential pressure (SEF)	≤ 300 kPa (d)					≤ 300 kPa (d)	
MAX. Operating pressure	450 kPa (g)					300 kPa (g)	
Pressure resistance	1000 kPa (g)					1000 kPa (g)	
Leak Integrity	≤ 5 x 10 <sup>-12</sup> Pa•m <sup>3</sup> /s (He)					≤ 5 x 10 <sup>-12</sup> Pa•m <sup>3</sup> /s (He)	
Flow rate setting signal	0.1 to 5 V DC (2% to F.S.); Input impedance 1 MΩ or higher					0.25 to 5 V DC (5% to F.S.); Input impedance 1 MΩ or higher	
Flow rate output signal	0 to 5 V DC (0% to F.S.); Minimum load resistance 2 kΩ or higher					0 to 5 V DC (0% to F.S.); Minimum load resistance 2 kΩ or higher	
Digital interface	With address function: RS-485 (transmission speed 38,400 bps) F-Net Protocol					With address function: RS-485 (transmission speed 38,400 bps) F-Net Protocol	
Wetted materials	316L Stainless Steel (polished surface)					316L Stainless Steel (polished surface), PTFE, magnetic stainless steel	
Power supply	+15V ±5%, 150 mA -15V ±5%, 150 mA					+15V ±5%, 150 mA -15V ±5%, 250 mA	+15V ±5%, 150 mA -15V ±5%, 250 mA
Signal response	Analog: D-Sub 9-pin (TOP) Digital: 2 LAN jacks (TOP)					Analog: D-Sub 9-pin (TOP) Digital: 2 LAN jacks (TOP)	
Standard Fitting	*3	1/4 inch VCR equivalent Option: 1.125 inch IGS, 1.5 inch IGS	1/4 inch VCR equivalent Option: 1.125 inch IGS	1.5 inch IGS	3/8 inch VCR equivalent Option: 1. 5 inch IGS	1/2 inch VCR equivalent	
Mounting orientation	Free					Free	

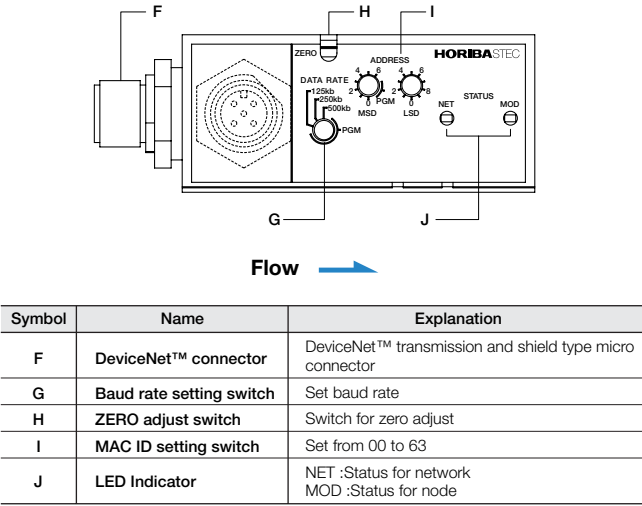
\*1 The gas type and full scale settings for the SEC(SEF)-Z512MGX, Z522MGX, and Z522MGXN can be changed by the operator, using special software.  
\*2 The flow rate precision guaranteed temperatures conform to SEMI E56-1296 standards. The precision is that associated with the full-scale MR and MG number values.  
\*3 IGS: Integrated Gas System  
\* SCCM and SLM are notations indicating the gas flow rate (mL/min, L/min, at 0°C and 101.3 kPa).

Digital/Analog transmission models



Symbol	Name	Explanation
A	Connector for digital transmission	RS-485 transmission Daisy chain available
B	Analog connector	Analog transmission and power supply
C	ZERO adjust switch	Switch for zero adjust
D	Address switch	Set from 0 x 01 to 0 x 99 (Not available from 0 x ΔA to ΔF)
E	LED indicator	Analog transmission: Green right on Digital transmission: Green right flashing * Red right on when alarming and zero offset error

DeviceNet™ transmission models



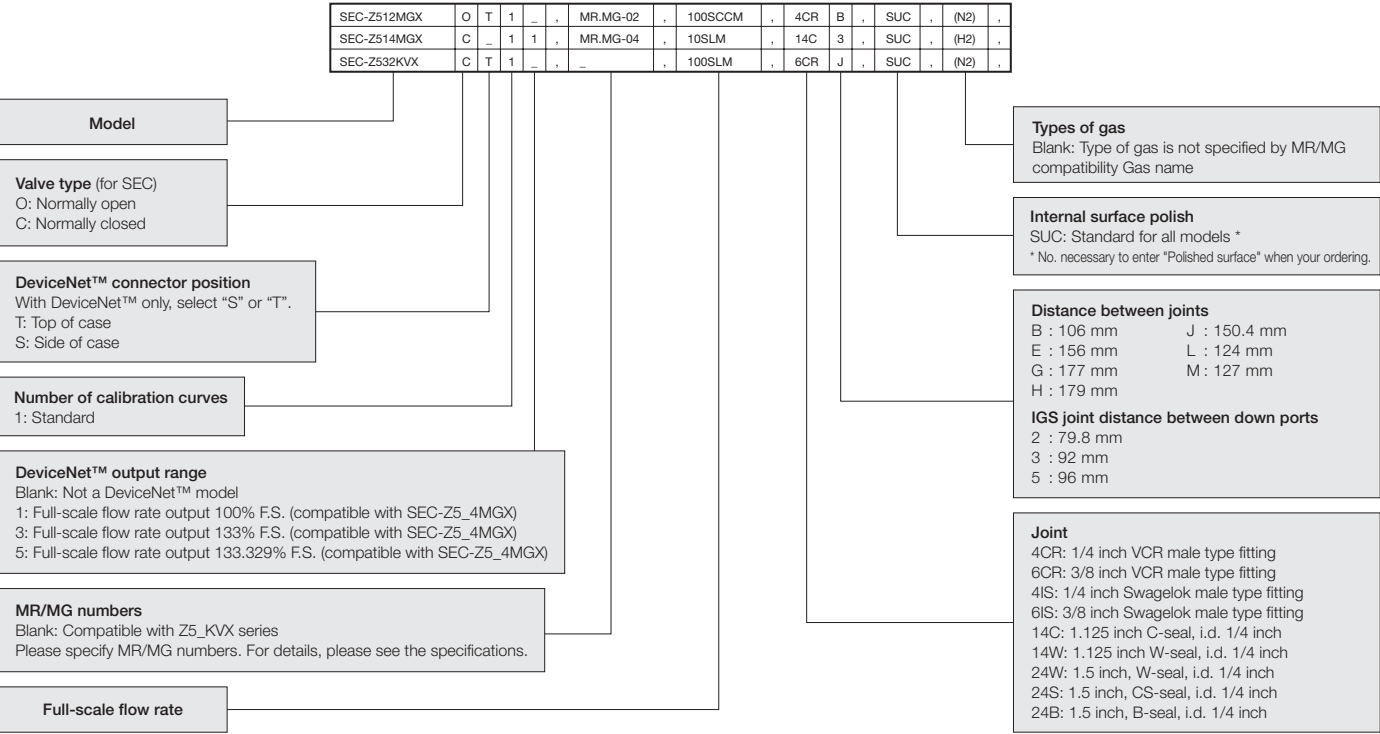
Symbol	Name	Explanation
F	DeviceNet™ connector	DeviceNet™ transmission and shield type micro connector
G	Baud rate setting switch	Set baud rate
H	ZERO adjust switch	Switch for zero adjust
I	MAC ID setting switch	Set from 00 to 63
J	LED Indicator	NET :Status for network MOD :Status for node

DeviceNet™ transmission models

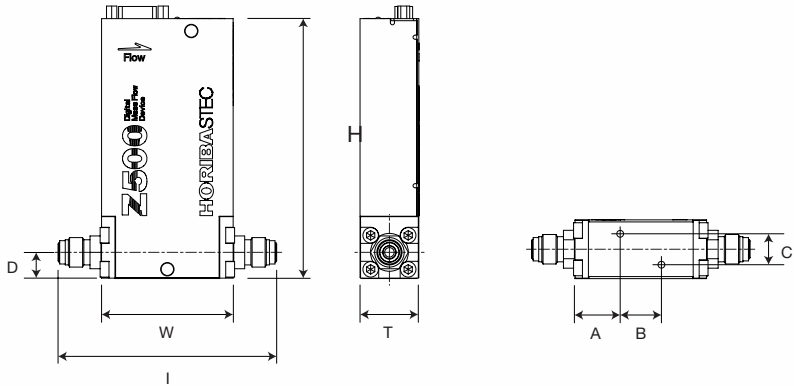
Mass flow controller model	*1	SEC-Z514KX	SEC-Z514MGX	SEC-Z524MGXN	SEC-Z524MGX	SEC-Z534KVX	SEC-Z544KVX
Mass flow meter model	*1	SEF-Z514KX	SEF-Z514MGX	SEF-Z524MGXN	SEF-Z524MGX	SEF-Z534KVX	SEF-Z544KVX
Full-scale flow rate (N <sub>2</sub> conversion flow rate)		1/2 SCCM	MR/MG number #R01: 10 SCCM #R1.5: 17.5 SCCM #01: 30 SCCM #1.5: 55 SCCM #02: 100 SCCM #2.5: 175 SCCM #03: 300 SCCM #3.5: 550 SCCM #04: 1 SLM #4.5: 1.75 SLM #05: 3 SLM #5.5: 5.5 SLM #06: 10 SLM		MR/MG number #6.5: 22 SLM #07: 30 SLM #08: 50 SLM	100 SLM	200 SLM
Valve Type		O: Normally open C: Normally closed				C: Normally closed	
Flow rate at fully closed control valve		≤ 2% F.S.				≤ 5% F.S.	
Flow rate control range		2-100% of F.S.				5-100% of F.S.	
Flow rate measuring range (SEF)		0-100% of F.S.				0-100% of F.S.	
Accuracy	*2	±1.0% F.S.	±1.0% S.P. (Flow rate > 25% F.S.) ±0.25% F.S. (Flow rate ≤ 25% F.S.)			±1.0% S.P. (flow rate > 35% F.S.) ±0.35% F.S. (flow rate ≤ 35% F.S.)	
Operating temperature		5 to 50°C (recommended temperature range: 15 to 45°C)				5 to 50°C (recommended temperature range: 15 to 45°C)	
Response		≤ 1 second: Over full flow rate range				≤ 1.5 second: Over full flow rate range (typically 1 second)	
Linearity		≤ ±0.5% F.S.				≤ ±0.5% F.S.	
Repeatability		≤ ±0.2% F.S.				≤ ±0.2% F.S.	≤ ±0.5% F.S.
Operating differential pressure		50 to 300 kPa (d)	50 to 300 kPa (d) #5.5, #06: 100 to 300 kPa (d)	200 to 300 kPa (d)		200 to 300 kPa (d)	
Operating differential pressure (SEF)		≤ 300 kPa (d)				≤ 300 kPa (d)	
MAX. Operating pressure		450 kPa (g)				300 kPa (g)	
Pressure resistance		1000 kPa (g)				1000 kPa (g)	
Leak Integrity		≤ 5 x 10 <sup>-12</sup> Pa•m <sup>3</sup> /s (He)				≤ 5 x 10 <sup>-12</sup> Pa•m <sup>3</sup> /s (He)	
Digital interface		DeviceNet™ Protocol				DeviceNet™ Protocol	
Wetted materials		316L Stainless Steel (polished surface)				316L Stainless Steel (polished surface), PTFE, magnetic stainless steel	
Power supply		Conforming to ODVA standards, DC 24 V, 4.0 VA				Conforming to ODVA standards DC 24 V, 7.5 VA	Conforming to ODVA standards DC 24 V, 7.0 VA
Standard Fitting	*3	1/4 inch VCR equivalent Option: 1.125 inch IGS, 1.5 inch IGS	1/4 inch VCR equivalent Option: 1.125 inch IGS	1.5 inch IGS		3/8 inch VCR equivalent Option: 1. 5 inch IGS	1/2 inch VCR equivalent
Mounting orientation		Free				Free	

\*1 The gas type and full scale settings for the SEC(SEF)-Z514MGX, Z524MGX, and Z524MGXN can be changed by the operator, using special software.  
\*2 The flow rate precision guaranteed temperatures conform to SEMI E56-1296 standards. The precision is that associated with the full-scale MR and MG number values.  
\*3 IGS: Integrated Gas System  
\* SCCM and SLM are notations indicating the gas flow rate (mL/min, L/min, at 0°C and 101.3 kPa).

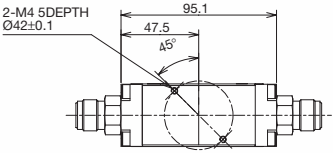
Selecting a model



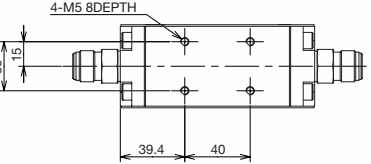
External dimensions



SEC-Z53\_X series



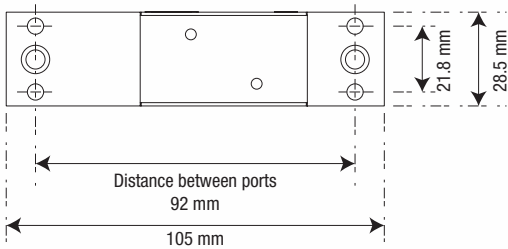
SEC-Z54\_X series



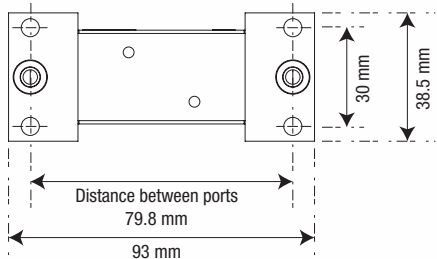
Model	H	T	W	I VCR type				A	B	C	D
				1/4 B	1/4 L	3/8 G	1/2 G				
Digital/Analog transmission models											
SEC-Z512KX	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z512MGX	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z522MGXN	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z522XN	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z522MGX	143±1	38.5±0.5	63.8	Compatible with 1.5 inch IGS							
SEC-Z522X	143±1	38.5±0.5	63.8	Compatible with 1.5 inch IGS							
SEC-Z532KVX	145±1	38±0.5	80.8	—	—	150.4±1	—	See above diagram.			18.5
SEC-Z542KVX	159±1	50.8±0.5	118.9	—	—	—	177±1	See above diagram.			22
DeviceNet™ transmission models											
SEC-Z514KX	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z514MGX	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z524MGXN	126±1	28.5±0.5	63.8	106±1	124±1	—	—	21.9	20±0.1	15±0.1	12.7
SEC-Z524MGX	143±1	38.5±0.5	63.8	Compatible with 1.5 inch IGS							
SEC-Z534KVX	145±1	38±0.5	80.8	—	—	150.4±1	—	See above diagram.			18.5
SEC-Z544KVX	159±1	50.8±0.5	118.9	—	—	—	177±1	See above diagram.			22

Accumulated joint mounting dimensions

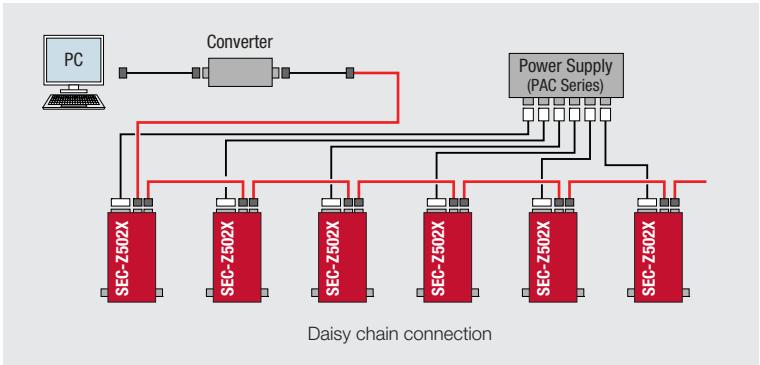
1.125-inch compatible models



1.5-inch compatible models

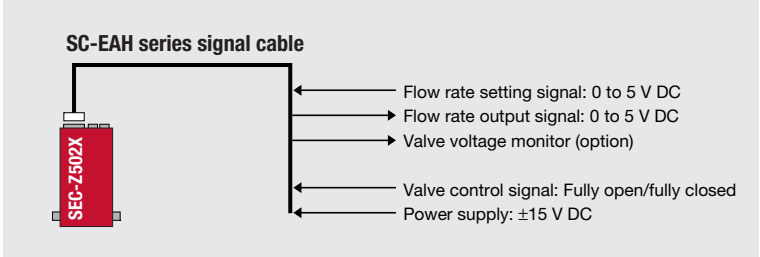


Digital transmission

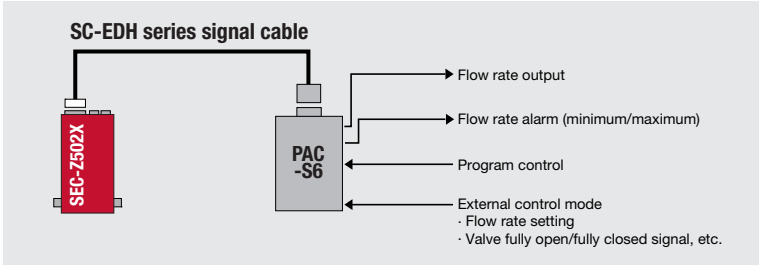


Analog transmission

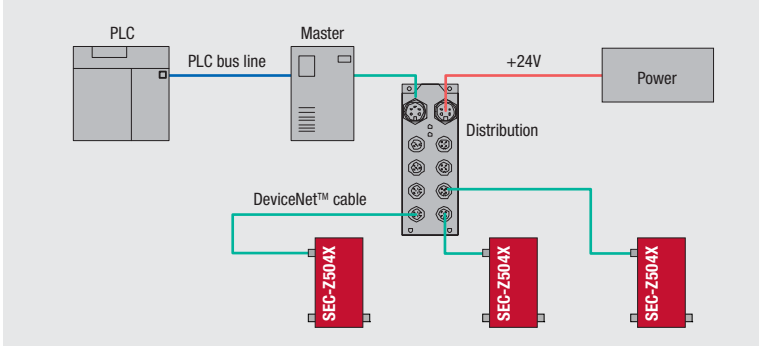
Using an external power source and control signal



Using PAC-S6 control unit



DeviceNet™ transmission



DeviceNet™ communications

DeviceNet™ is an open and global field network that was developed by the ODVA (Open DeviceNet™ Vendor Association, Inc.) as a unique means for supporting standardization worldwide. The ODVA offers EDS (Electronic Data Sheet) specifications, which are designed to allow shared operability and programming in a multi-vendor environment. The ODVA also carries out conformance testing. Devices that have passed the ODVA's conformance testing can display the logo.

RS485 digital transmission connector

Pin No.	Signal name
1	Signal ground [D. COM]
2	Signal ground [D. COM]
3	N.C.
4	Serial output/input (-)
5	Serial output/input (+)
6	N.C.
7	N.C.
8	N.C.

Connector used: RJ-45

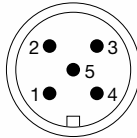
Analog connectors

Pin No.	Signal name
1	Valve open/closed input *1
2	Flow rate output signal: 0 to 5 V DC
3	Power source: +15V DC
4	Power source: Common *2
5	Power source: -15V DC
6	Flow rate setting signal: 0 to 5 V DC
7	Signal: Common *2
8	Signal: Common *2
9	NC

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

\*1 SEF series is N.C.  
\*2 The pin No. 4 Common power source and pin No. 7 Common signal are not connected within the mass flow controller. The pin No. 7 and No. 8 Common signals are connected within the mass flow controller.

DeviceNet™ transmission connectors



Pin No.	Signal name
1	Drain
2	V+
3	V-
4	CAN_H
5	CAN_L

Advantages

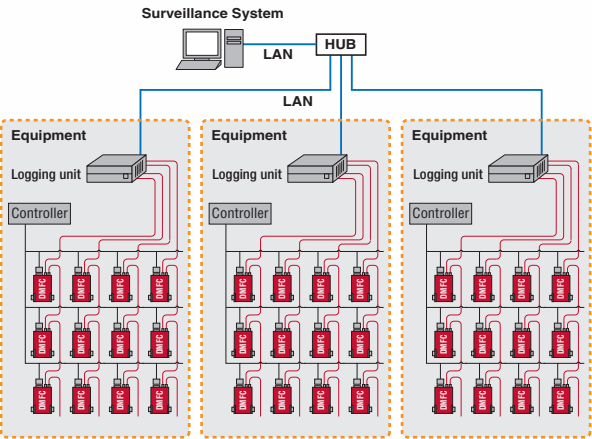
- Reduces costs, since AD/DA converters and I/O boards are not required.
- The user simply connects the devices through network cables and makes address settings. This reduces both the number of processes required and the time involved.
- No special accessories are necessary for the devices. Users can simply choose DeviceNet™ conforming products, which reduces costs.



▶ eDiagnostic digital mass flow controller monitoring system

The importance of preventative maintenance for production equipment in semiconductor device manufacturing plants is widely acknowledged. In fact, preventative maintenance is considered a critical factor for increasing productivity. HORIBA STEC offers a preventative maintenance system for its mass flow controllers, which are considered key devices in the semiconductor manufacturing process. The mass flow controller's preventative maintenance system monitors the flow rate control conditions and the position of the valve, and determines the status of overall flow rate control in the mass flow controller. The system informs the user of what sort of maintenance is required before the mass flow controller becomes unable to control the flow rate. It is considered difficult to predict the maintenance required for a mass flow controller's functioning by monitoring its flow control status alone. HORIBA STEC's mass flow controller monitoring system collects information on the control status of the digital mass flow controllers (analog control) in semiconductor manufacturing equipment using digital communications, and monitors whether or not there is a need for any preventative maintenance. This system is compatible with LAN (TCP/IP) networks, and a single superior Surveillance Server can be used to monitor the mass flow controllers in each semiconductor manufacturing system. It's also relatively easy to create a wide area network for this monitoring system. The logging unit can be used to log the flow rate control status of digital mass flow controller in each semiconductor manufacturing system. The Surveillance Server is connected to the logging unit through a LAN. The logging unit monitors the flow rate control conditions and the position of the flow control valve, and determines whether any preventative maintenance is necessary. This data can be used to investigate the reasons for problems or to review changes in the gas pressure, in addition to determining whether or not preventative maintenance is required.

▶ Sample system setup



▶ Digital mass flow controller monitoring software; compatible with RS-485 and DeviceNet™ transmission

HORIBA STEC also offers monitoring software that is compatible with HORIBA STEC's digital mass flow controller protocol (F-Net protocol) and is able to monitor all mass flow controller related transmissions. This software makes it easy to check the status of transmissions between control units such as the PLC or PC and the SEC-Z500X series units. In addition to checking if the digital transmission cable and signal converter are installed correctly, it can use the digital mass flow controller's address transmissions to monitor and control installation information and valve operating status. When DeviceNet™ transmission is used, the software operates using digital transmission information only. In fact, with DeviceNet™, it is possible to monitor the control status of the digital mass flow controller using just this software, a PC, and the DeviceNet™ transmission unit; there is no need for a special, additional control unit mounted on the equipment.

▶ Easy-to-use digital mass flow controller monitoring software

The digital mass flow controller monitoring system uses eDiagnostic monitoring software. The mass flow controller's control status is monitored through digital transmissions, and then logged and saved in a PC. The eDiagnostic software also features a function that outputs alarms as necessary based on the monitored flow rate control status and valve aperture information. Real-time monitoring makes it possible to go back and review the circumstances surrounding changes in the control status and gas supply conditions. The monitoring information is also extremely useful in investigating the causes of any malfunctions that arise.

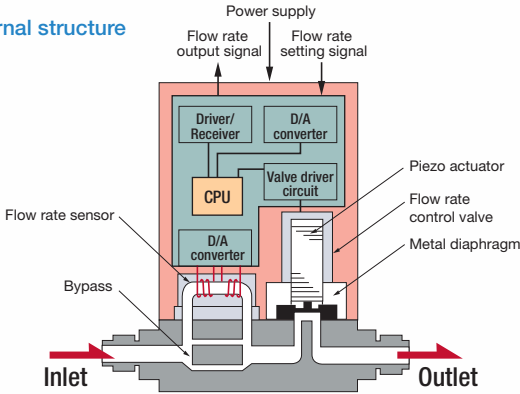
▶ Digital mass flow controller control software

HORIBA STEC also offers control software that is compatible with HORIBA STEC's digital mass flow controller protocol (F-Net protocol). In addition to offering digital mass flow controller flow rate control (step control, loop control functions, etc.), it is also designed to output the aperture control signal for valves mounted on the same gas line. Thanks to these features, this software offers optimal small-scale gas supply system control.

▶ Structure and operating principles

The general structure of the SEC-Z500X series of mass flow controllers is shown in the diagram to the right. These mass flow controllers have a flow rate measurement section that includes a sensor, bypass, flow rate control valve, and special circuitry. A CPU is part of the circuitry, which makes it both multi-functional and highly efficient. The gas is input from an Intel joint, and is divided so that it flows over both the flow rate sensor and a bypass. The sensor measures the mass flow rate of the gas, and the flow rate control valve modifies the flow rate so that the difference between the measured flow rate and the flow rate received from the external flow rate setting signal is 0 (zero). The units feature a loop circuit, so even if there is a secondary pressure change or ambient temperature change that could affect the supply pressure of the introduced gas, the flow rate is instantaneously corrected, which ensures stable flow rate control.

▶ Internal structure



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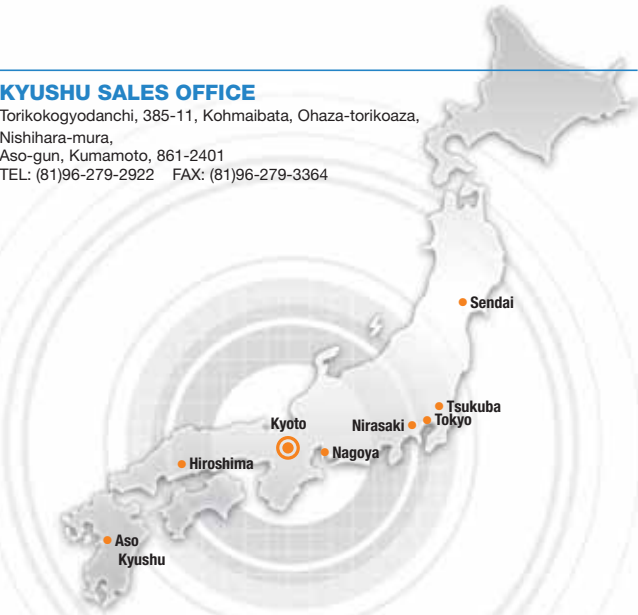
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# DRY PROCESS

Optimal process gas control, as well as vacuum measurement and thin film control

## Source Gas Control



Mass flow controllers  
**SEC-Z500X** series

### New RoHS standard compliant models

High-precision, fast-response user-friendly models offering multi-gas and multi-range functionality.



Auto-pressure regulators  
**UR-7300** series

### Electronic regulators with a piezo valve

Control gas line pressure using electric signals, and make it possible to create simpler, lighter-weight gas panels than can be produced with mechanical regulators.

Process Gas Control

Exhaust Control Valve

## Vaporized Liquid Source Control

Liquid miniature digital mass flow controllers  
**LF-F/LV-F** series



### Featuring the world's first flow rate sensor with cooled measurement

Miniature digital mass flow controllers featuring the world's first flow rate sensors with cooled measurement. The use of digital control circuits increases precision and response speed.

Liquid vaporization systems  
**MI/MV** series



### Gas liquid mixture vaporization provides highly efficient vaporization of liquids

Liquid vaporization systems that instantly vaporize liquids such as TEOS and supply them to the chamber. The combination of a miniature mass flow meter that measures the flow rate of the liquid and a mass flow controller that controls the flow of the carrier gas are the basis for these optimized vaporization systems, which were designed using know-how acquired through years of vaporization system research and development.

Automatic liquid supply systems  
**LU-A1000** series

### Providing liquid to vaporization systems safely and without waste

Provide a safe, automatic supply of liquids from the liquid storage tank to the vaporization system, and prevent material waste. These new RoHS-compliant models are designed to alleviate environmental concerns. They also feature an automatic tank exchange sequence, and all maintenance can be performed from the same side of the unit, which makes them extremely easy to use.



## Pressure Monitoring in Process Chamber



Residual gas analyzer  
**Micropole™** System

### The world's smallest quadrupole mass analyzer

The world's smallest residual gas analyzer. Uses quadrupoles for measurement. A design utilizing 16 unique cylindrical electrodes made it possible to create this world's smallest residual gas analyzer, which features 9 detecting elements.



Plasma Diagnosis Endpoint Monitor  
**CPM-100**

### A compact endpoint monitor that easily installs on existing equipment

HORIBA STEC offers a variety of plasma diagnosis endpoint monitors for use in dry etching process endpoint monitoring.

## Process Chamber Exhaust Gas Monitoring



FTIR gas analyzers  
**FG-100A** series

### Compact gas analyzers that increase processing efficiency

FTIR gas analyzers that feature all of HORIBA's gas analysis technology (FTIR, gas sampling, fixed sample calculation, software). Easy to transport, these gas analyzers are suitable not only for FPD manufacturing, but also for a wide variety of analysis functions.



High Performance Mass Flow Controller

**SEC-Z500X**

<http://www.secz500.com>



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