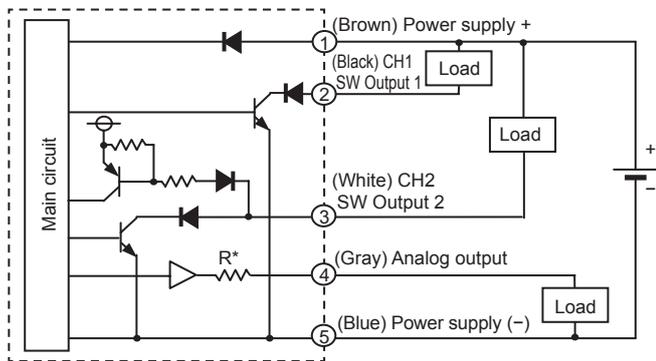


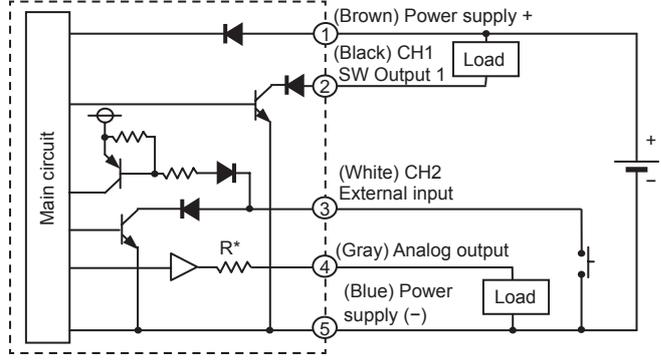
Example of internal circuit and load connection

● FSM3-L□□□□□B/F/□□ (LCD display NPN output)

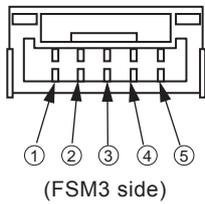
[CH2 is used as SW output]



[CH2 is used as external input]



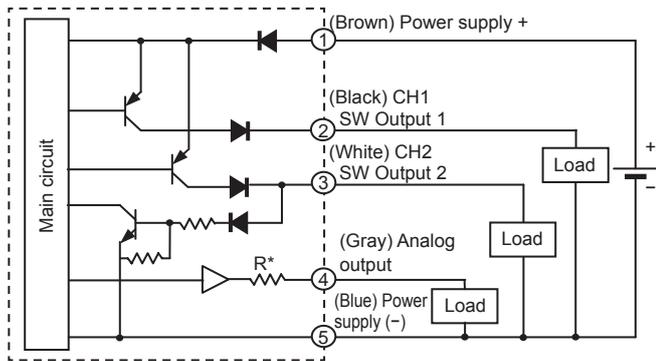
* Analog output voltage output R: approx. 1 kΩ
Current output R: approx. 100 Ω



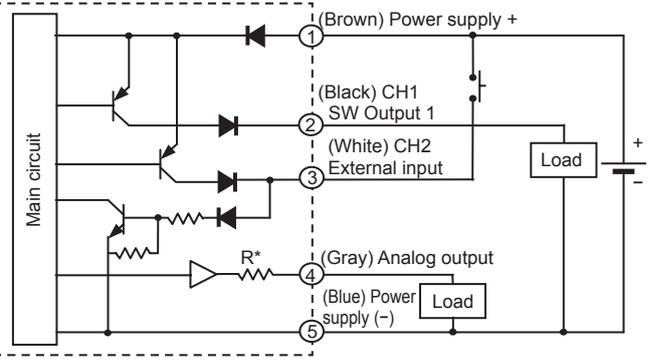
Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (switch output 2: max. 50 mA, or external input)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: 4 to 20 mA load impedance 300 Ω or less
⑤	Blue	Power supply - (GND)

● FSM3-L□□□□□D/H/□□ (LCD display PNP output)

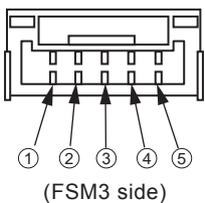
[CH2 is used as SW output]



[CH2 is used as external input]



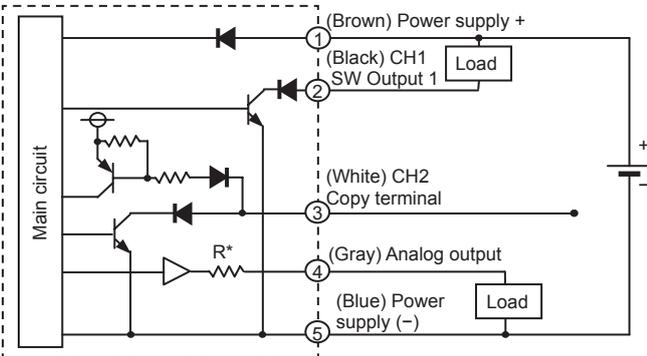
* Analog output voltage output R: approx. 1 kΩ
Current output R: approx. 100 Ω



Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (switch output 2: max. 50 mA, or external input)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: 4 to 20 mA load impedance 300 Ω or less
⑤	Blue	Power supply - (GND)

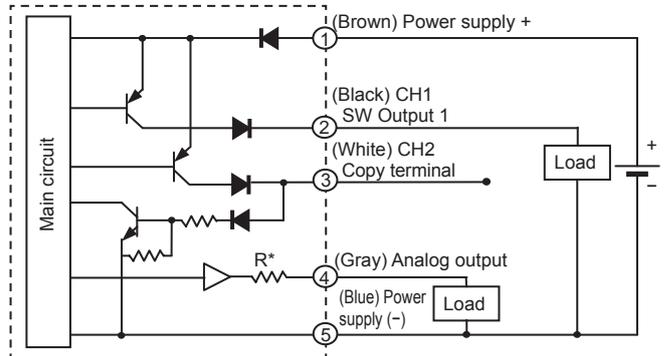
Example of internal circuit and load connection

● FSM3-L[][][][][][]A/E/[][]
(LCD display, NPN output, with setting copy function)

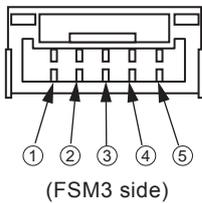


* Analog output voltage output R: approx. 1 kΩ
Current output R: approx. 100 Ω

● FSM3-L[][][][][][]C/G/[][]
(LCD display, PNP output, with setting copy function)



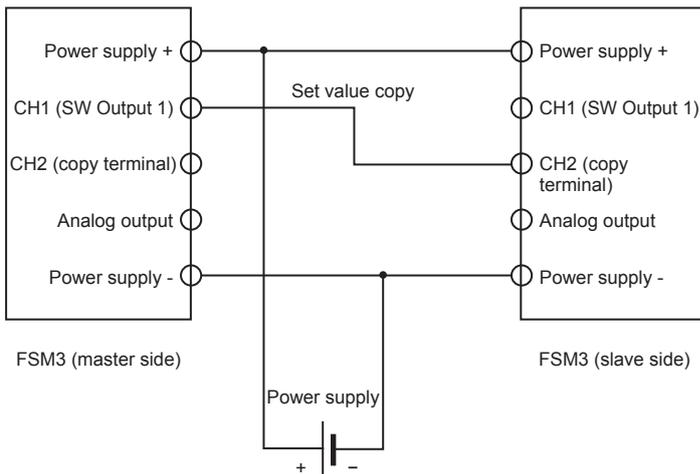
* Analog output voltage output R: approx. 1 kΩ
Current output R: approx. 100 Ω



Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (copy terminal)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: 4 to 20 mA load impedance 300 Ω or less
⑤	Blue	Power supply - (GND)

● FSM3-L[][][][][][]A/C/E/G/[][] (LCD display, with setting copy function)

[When using setting copy function]



Connect CH1 (SW output 1) on the master side to CH2 (copy terminal) on the slave side and power ON the sensor to use the setting copy function (F93).

Please be sure to make this connection only when using the setting copy function.

If copying is done while load is connected with the CH1, or switching is done while connected with the CH1 and CH2 as described in the load connection example above, there may be unexpected behavior on the equipment side or malfunctioning with the equipment and FSM3.

Please be sure to never use it when it is connected to a copy terminal.

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder Switch

MN3E
MN4E

4GA/B

M4GA/B

MN4GA/B

F.R.(module unit)

Clean F.R

Precision R

Press gauge
Diff. press gauge

Electro-pneumatic R

Speed controller

Auxiliary valve

Fitting/tube

Clean air unit

Pressure sensor

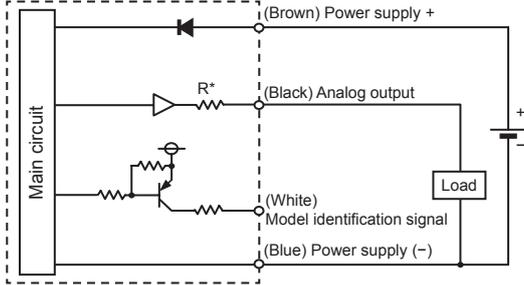
Flow rate sensor

Valve for air blow

Ending

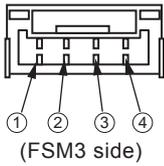
Example of internal circuit and load connection

● FSM3-B [] [] [] [] [] J/K [] [] (bar display)

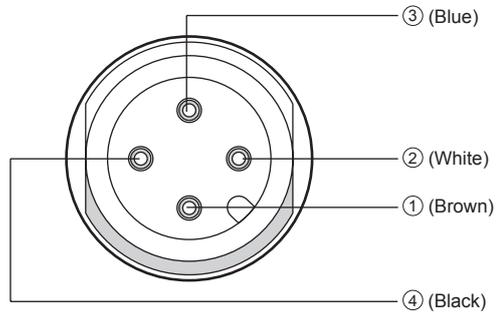


* Analog output voltage output R: approx. 1 kΩ
Analog output current output R: approx. 100 kΩ

Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	Analog output Voltage output: 1-5 V Load impedance 50 kΩ and over Current output: 4 to 20 mA Load impedance 300 Ω or less
③	White	Model identification signal It will not connect during use with a single unit.
④	Blue	Power supply - (GND)

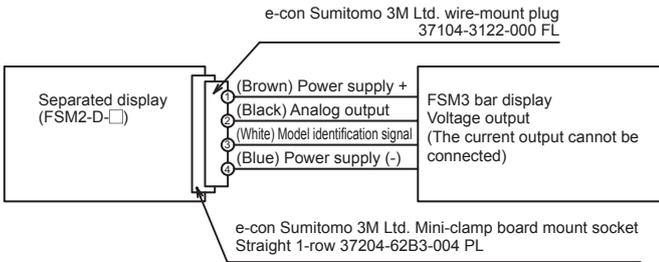


● FSM3-C [] [] [] [] [] L [] [] (IO-Link)

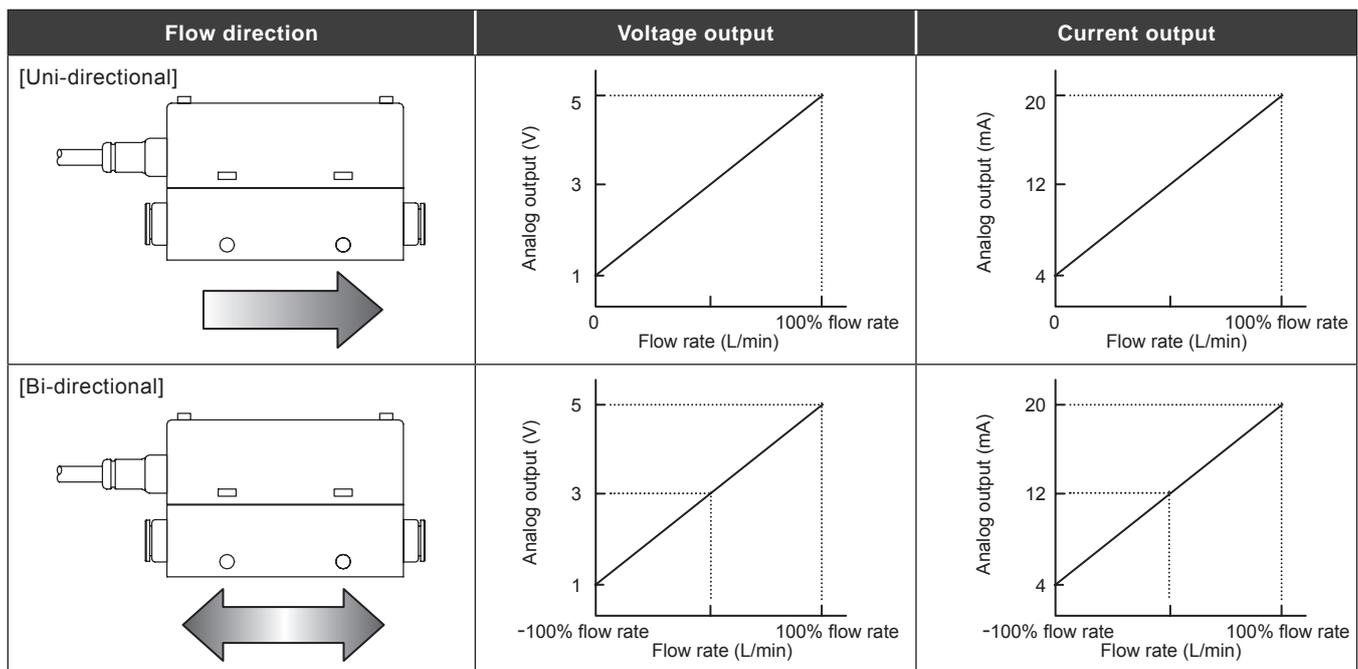


Terminal No.	Lead wire color	Name
①	Brown	Power supply + (18 to 30 V)
②	White	N.C.
③	Blue	Power supply - (GND)
④	Black	C/Q (IO-Link)

● Connecting the separated display and FSM3 bar display

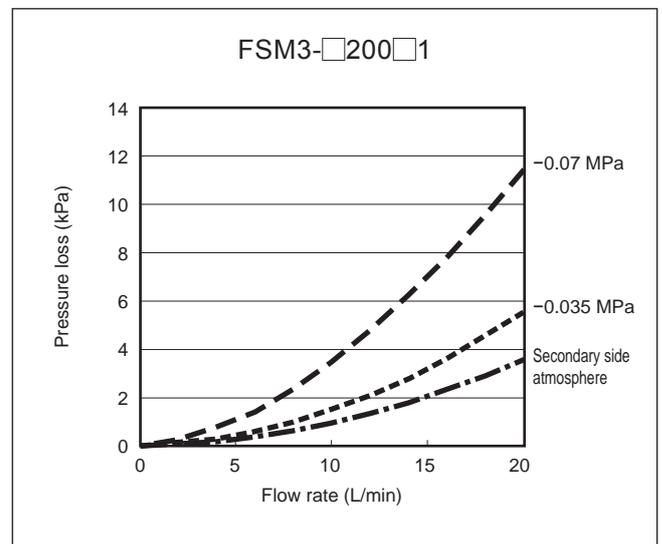
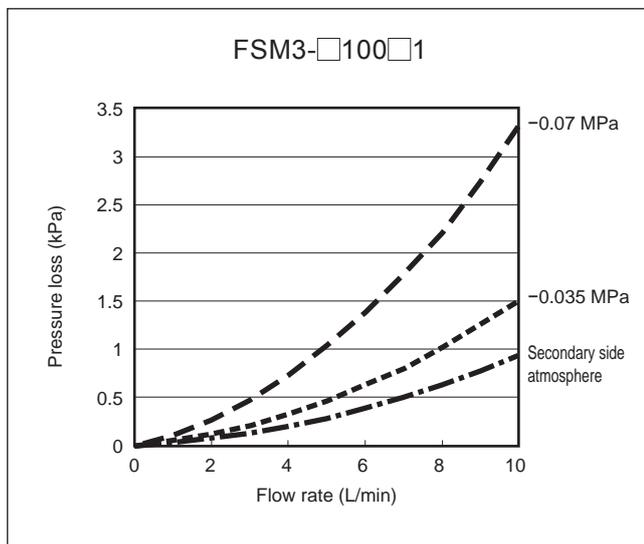
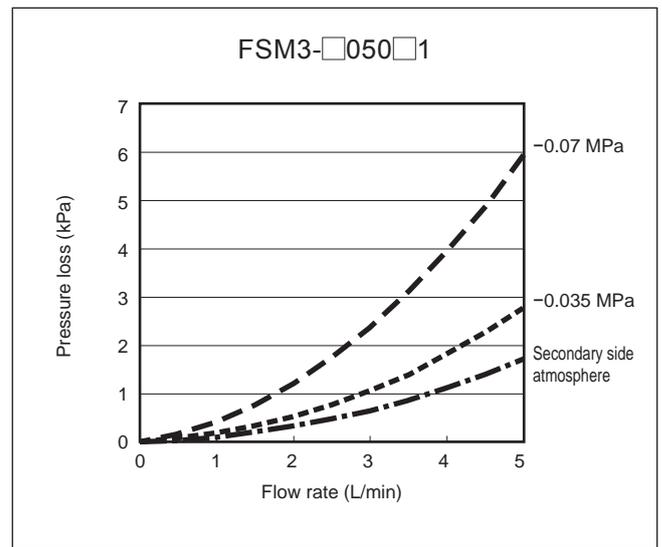
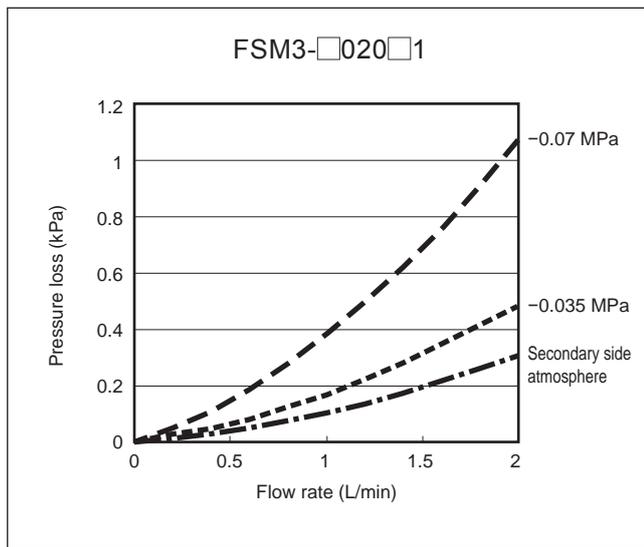
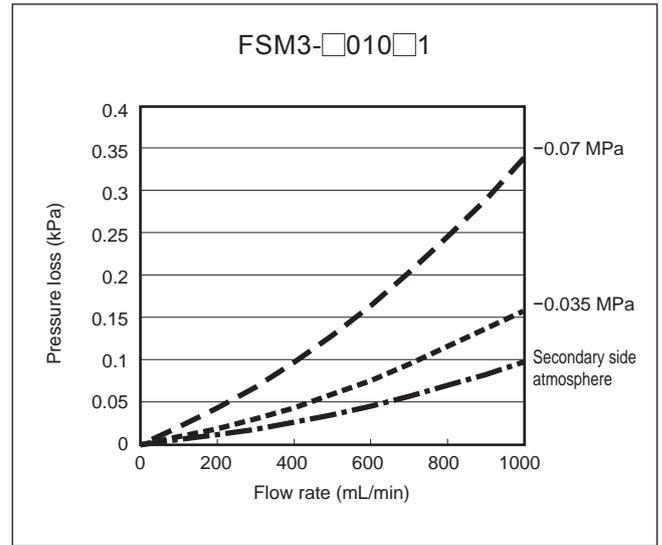
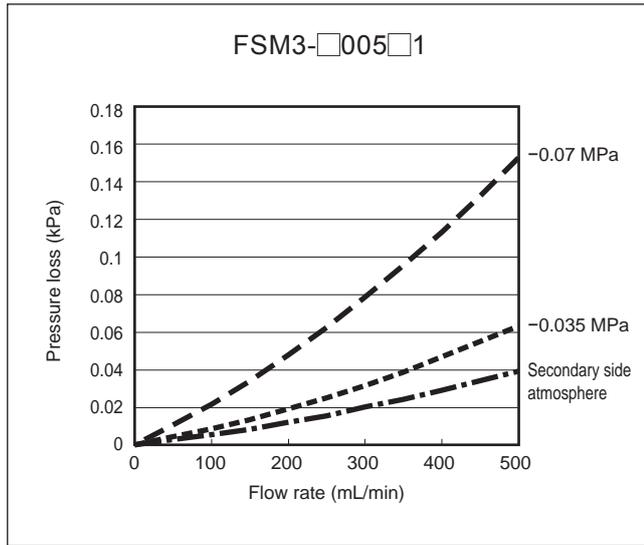


Analog output characteristics



- *1: The full scale of the uni-directional type is 0 to 100%, and full scale of the bi-directional type is -100% to 100%. With the display integrated bi-directional type, output can be switched to uni-directional with the button settings. The value after switching is a reference value. Refer to page 1087 for details.
- *2: Refer to page 1053 for details of analog output when carbon dioxide is switched to.
- *3: Outputs are made even outside the measurement flow range with analog outputs. Although accuracy is not guaranteed, outputs can be made with a voltage type with a minimum of about 0.6 V and a maximum of about 5.4 V, and with a current type with a minimum of about 2.4 mA and a maximum of about 21.6 mA.

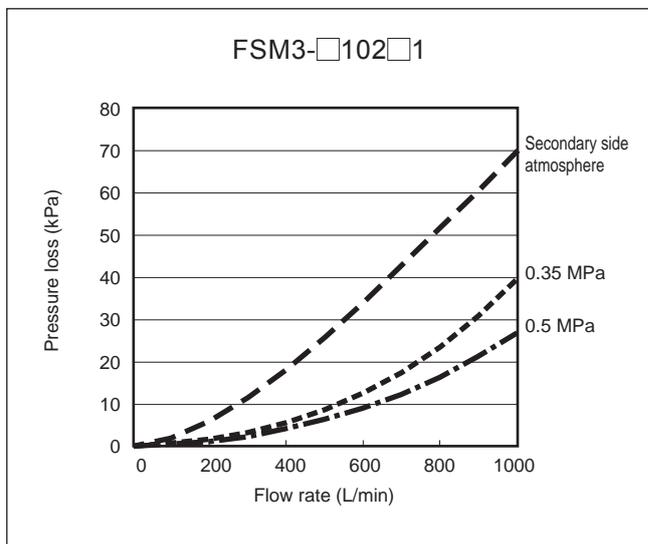
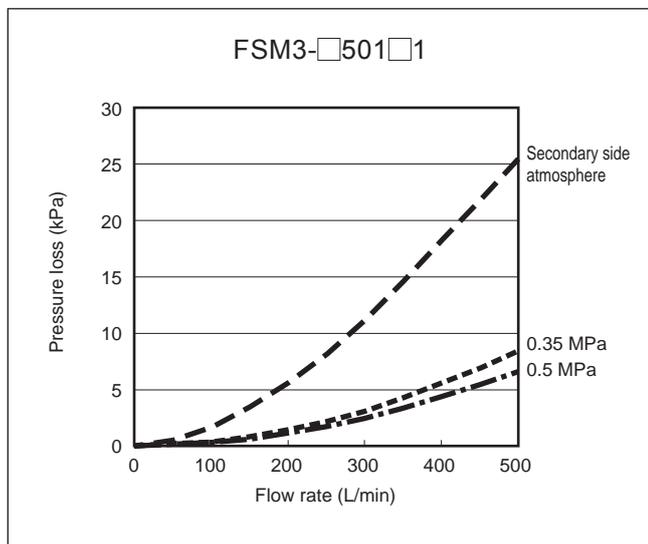
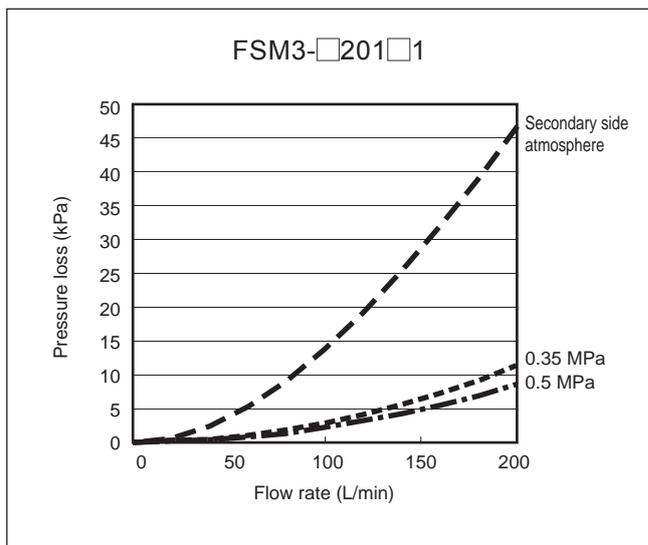
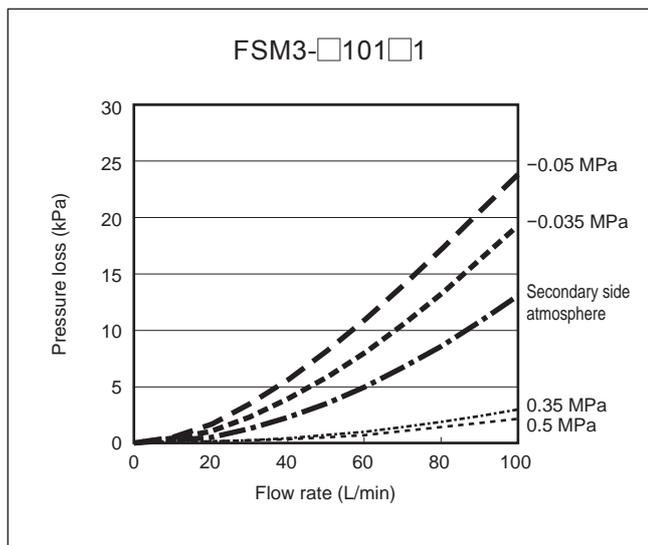
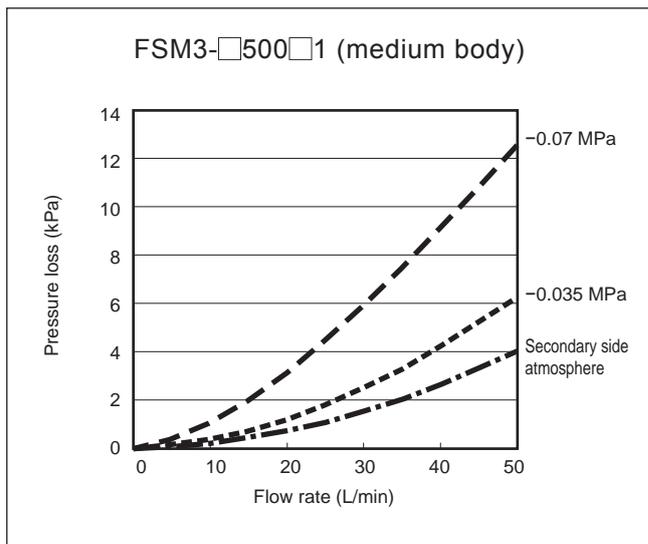
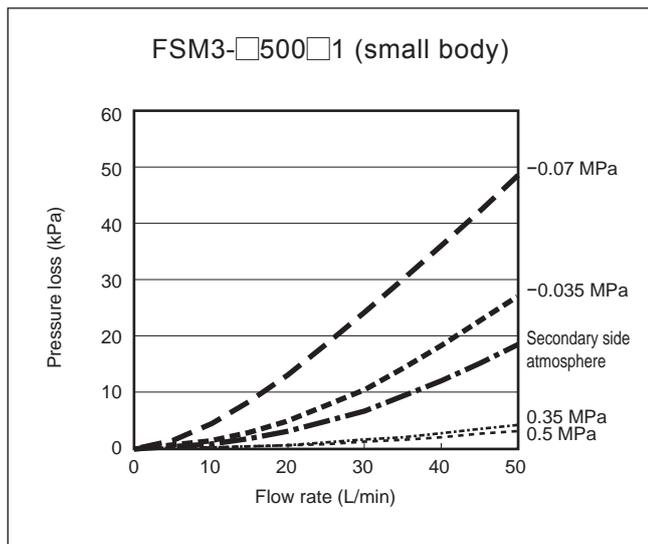
Pressure loss characteristics (resin body, air)



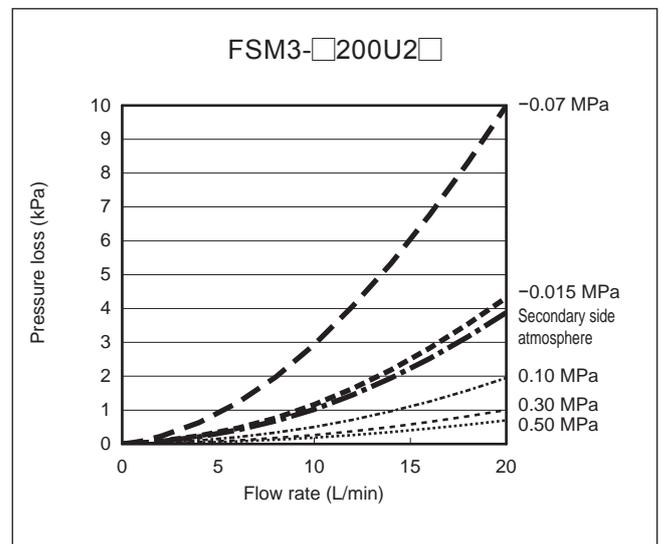
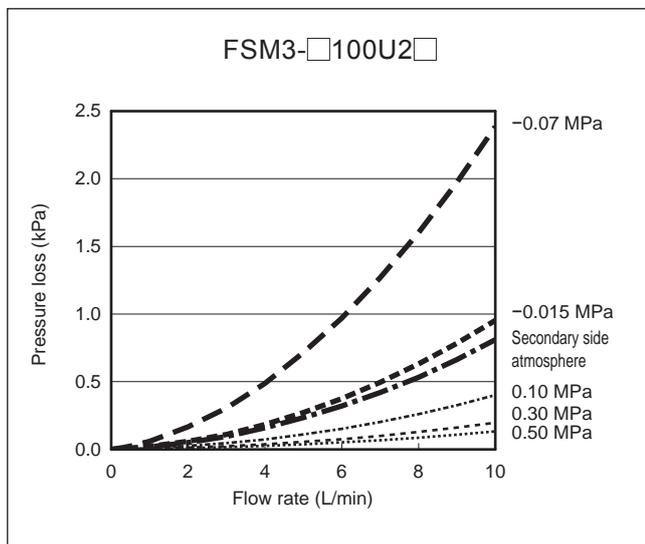
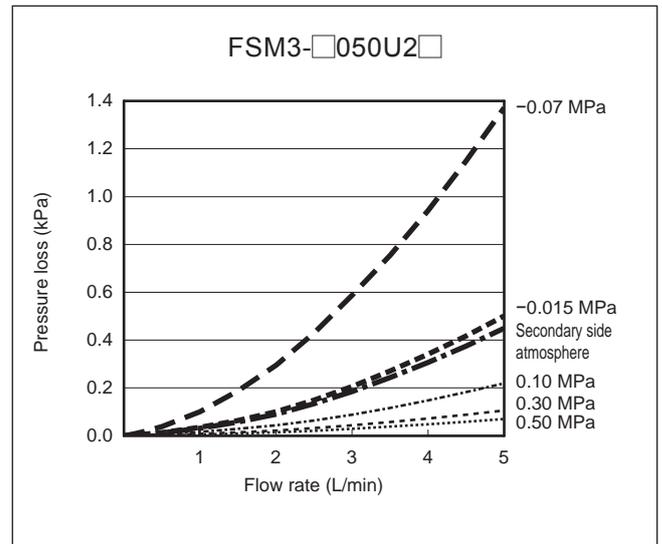
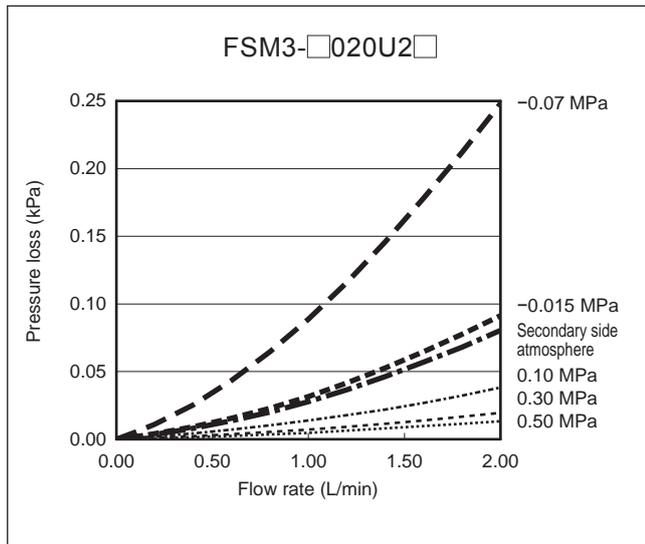
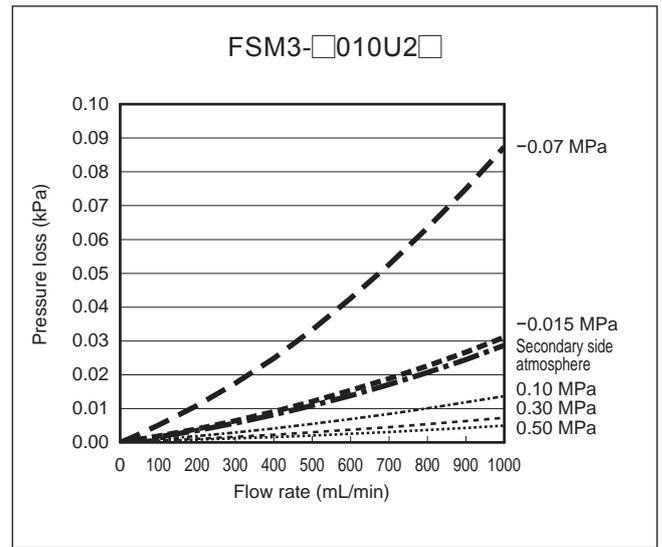
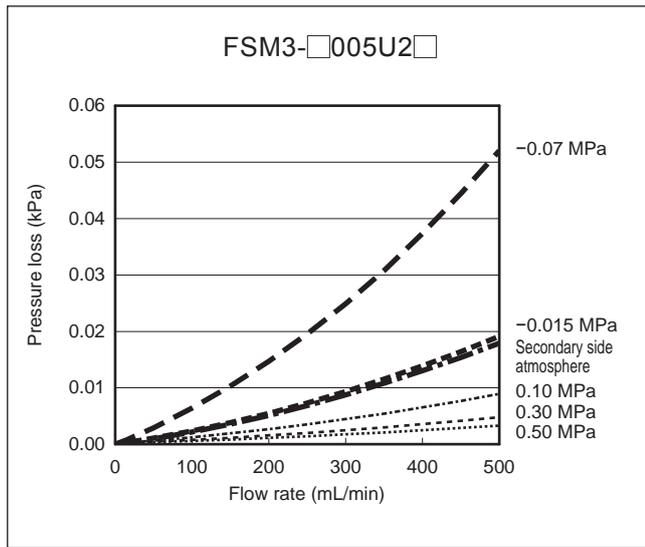
SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Pressure loss characteristics (resin body, air)

- SCPD3
- SCM
- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG
- STR2
- MRL2
- GRC
- Cylinder switch
- MN3E
MN4E
- 4GA/B
- M4GA/B
- MN4GA/B
- F.R (module unit)
- Clean F.R
- Precision R
- Press gauge
Diff. press gauge
- Electro-pneumatic R
- Speed controller
- Auxiliary valve
- Fitting/tube
- Clean air unit
- Pressure sensor
- Flow rate sensor**
- Valve for air blow
- Ending



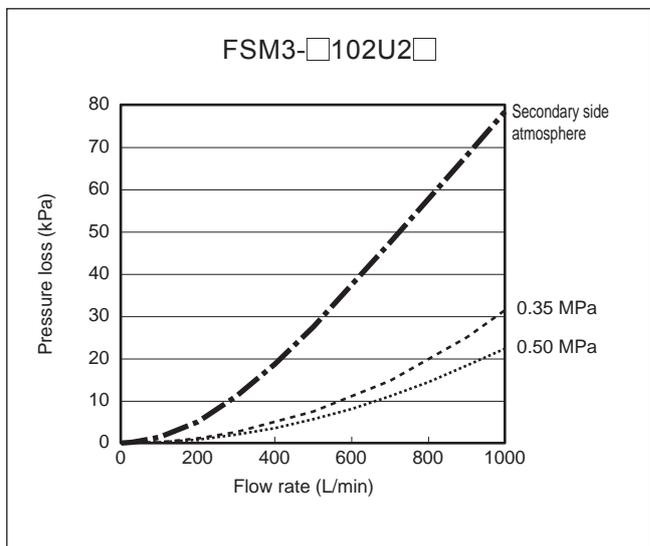
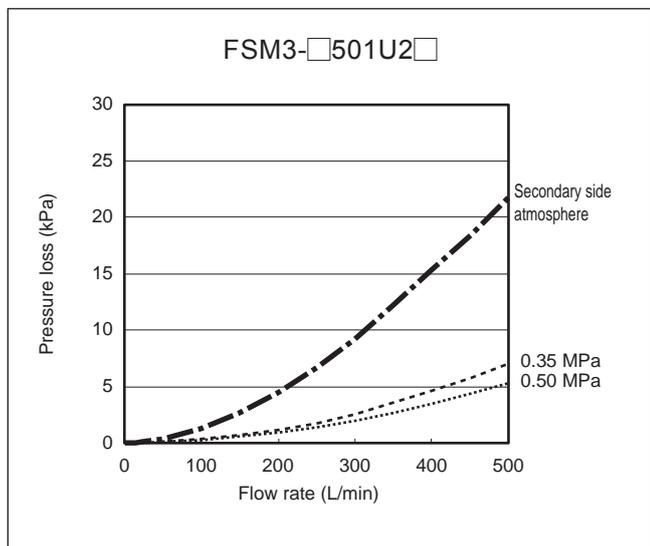
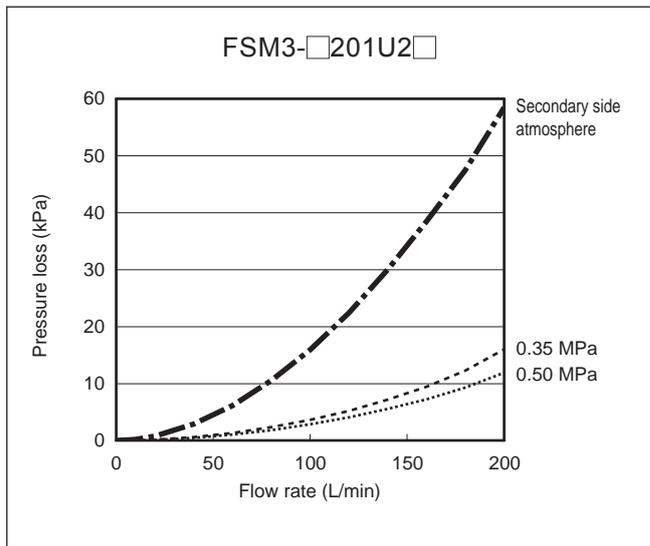
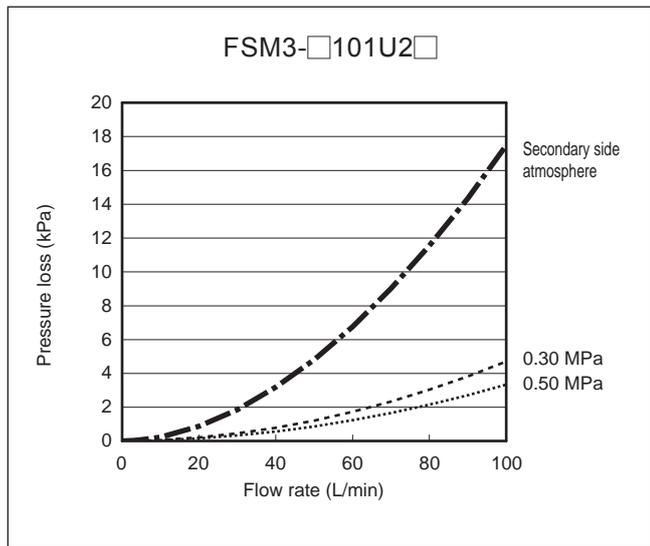
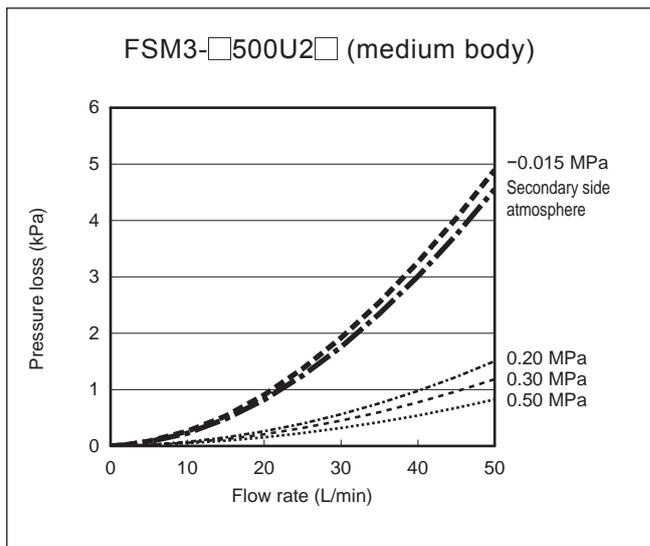
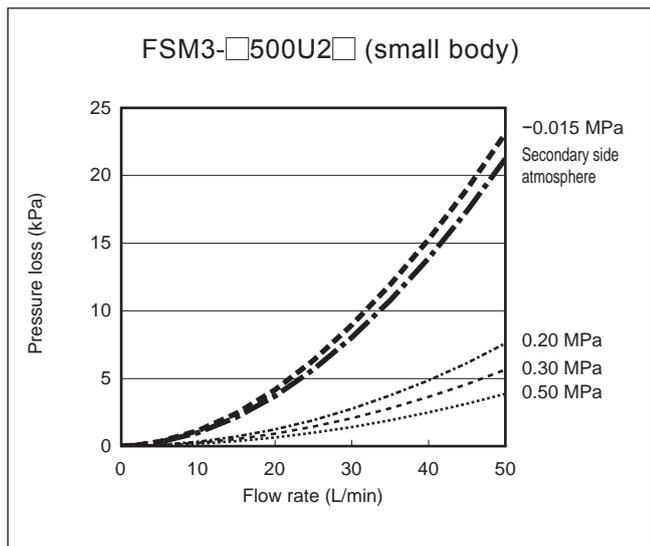
Pressure loss characteristics (stainless steel body, air)



SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Pressure loss characteristics (stainless steel body, air)

- SCPD3
- SCM
- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG
- STR2
- MRL2
- GRC
- Cylinder switch
- MN3E
MN4E
- 4GA/B
- M4GA/B
- MN4GA/B
- F.R (module unit)
- Clean F.R
- Precision R
- Press gauge
Diff. press gauge
- Electro-pneumatic R
- Speed controller
- Auxiliary valve
- Fitting/tube
- Clean air unit
- Pressure sensor
- Flow rate sensor**
- Valve for air blow
- Ending



Pressure loss characteristics

The graph shows the data obtained in air.

With gases other than air, as a guideline multiply specific gravity as follows.

Gas	Specific gravity
Argon	1.38
Carbon dioxide	1.53
Argon 80% Carbon dioxide 20%	1.41

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder
SwitchMN3E
MN4E

4GA/B

M4GA/B

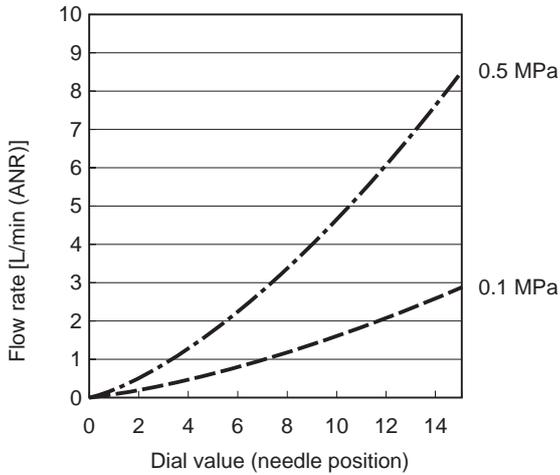
MN4GA/B

F.R.(module
unit)Clean
F.RPrecision
RPress gauge
Dif. press gaugeElectro-
pneumatic RSpeed
controllerAuxiliary
valveFitting/
tubeClean
air unitPressure
sensorFlow rate
sensorValve for
air blow

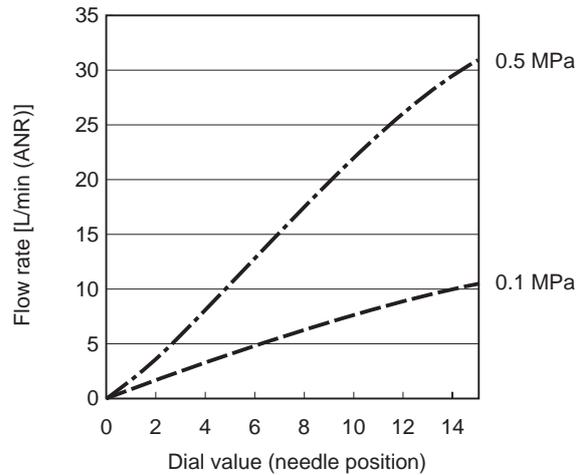
Ending

Needle valve flow characteristics (resin body) (for air, nitrogen gas)

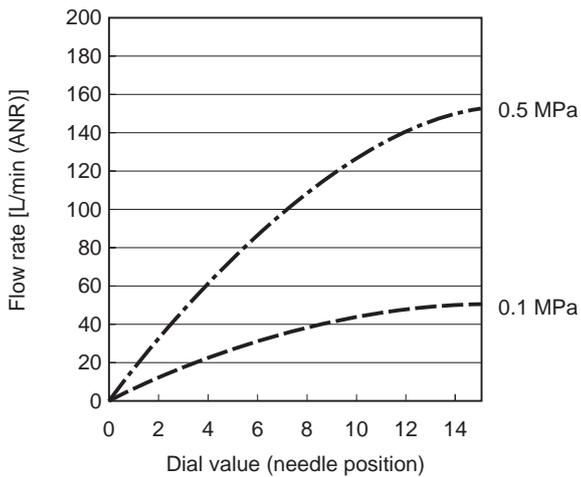
● FSM3-L005/010/020



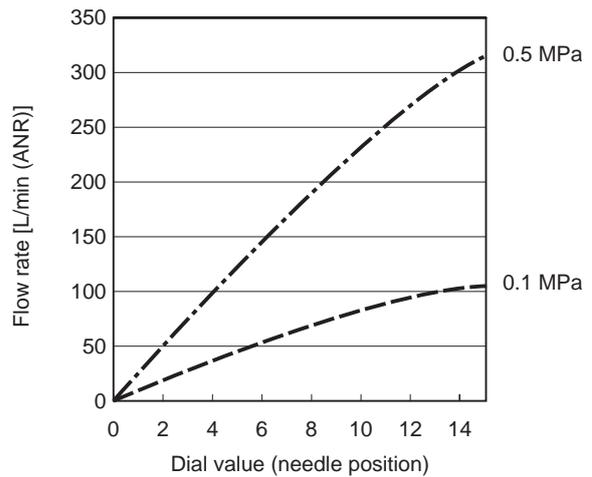
● FSM3-L050/100



● FSM3-L200/500-H04/H06



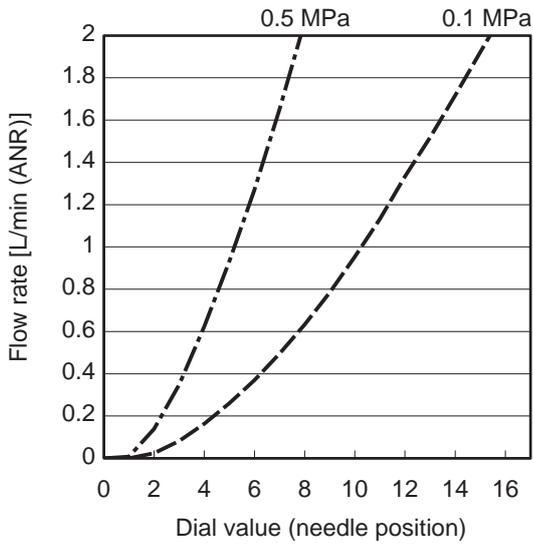
● FSM3-L500/101/201-H08/H10



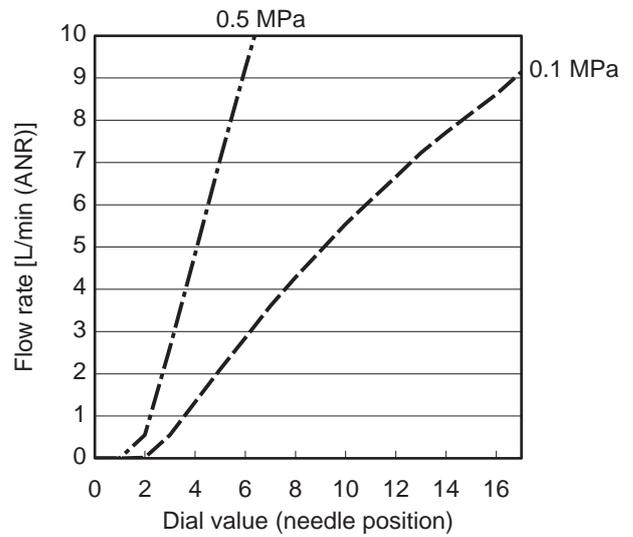
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- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG
- STR2
- MRL2
- GRC
- Cylinder switch
- MN3E
MN4E
- 4GA/B
- M4GA/B
- MN4GA/B
- F.R (module unit)
- Clean F.R
- Precision R
- Press gauge
Diff. press gauge
- Electro-pneumatic R
- Speed controller
- Auxiliary valve
- Fitting/tube
- Clean air unit
- Pressure sensor
- Flow rate sensor
- Valve for air blow
- Ending

Needle valve flow characteristics (stainless steel body) (for air, nitrogen gas)

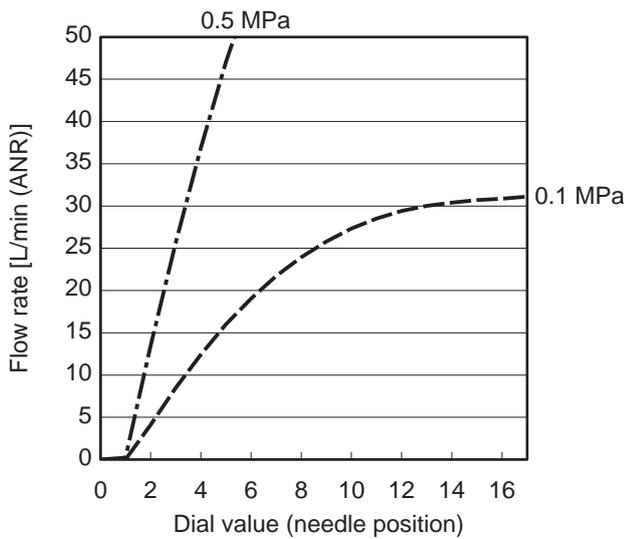
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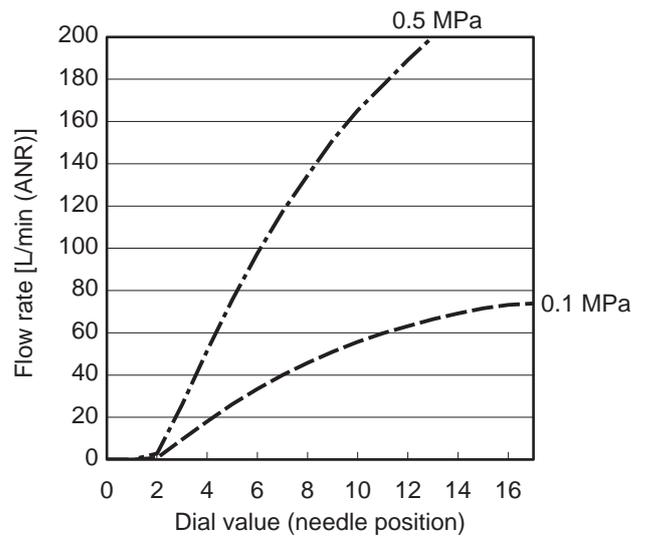
● FSM3-L050/100U2AA



● FSM3-L200/500U2AA



● FSM3-L500/101/201U2BA



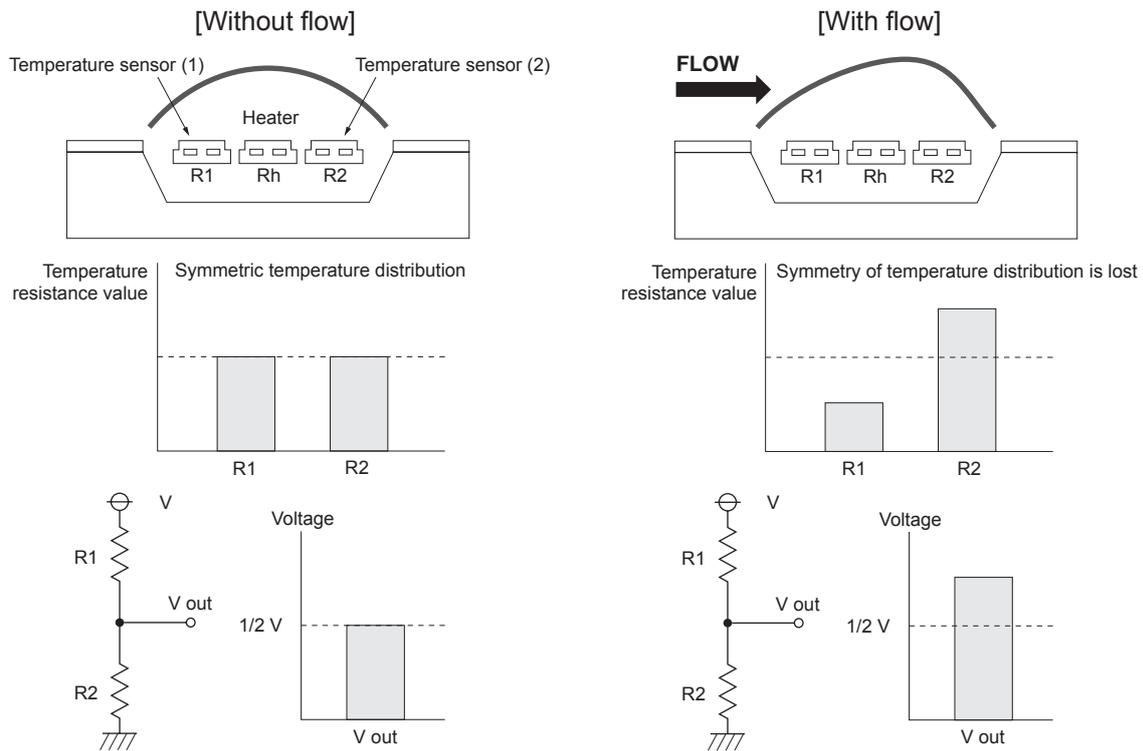
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SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
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MRL2
GRC
Cylinder Switch
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F.R.(module unit)
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Precision R
Press gauge Diff. press gauge
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Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Measurement principle of FSM3 Series

The FSM3 Series incorporates a platinum sensor chip machined with silicon micro-machining. The sensor is thermally insulated from the silicon substrate. The heating capacity is extremely low, enabling high sensitivity with a high-speed response.

At the sensor, two temperature sensors are arranged with a heater in between. Platinum, which has a resistance that changes based on temperature, is used for the temperature sensor. When the heater is turned ON and heating occurs, the temperature distribution is symmetrical to the center of the heater if there is no flow. When flow is received, the symmetrical property of the temperature distribution is lost, temperature upstream from the heater drops, and temperature downstream rises. This temperature difference appears as the difference in temperature sensor resistance, and varies with the flow rate. When the flow is reversed, the temperature difference (difference in resistance) is inverted. By using this method, the bi-directional flow rate can be detected. This method is suitable for detecting a relatively small flow rate.



1 Flow rate sensor selection method

Use as a guide for selection of the flow rate range when using the flow rate sensor for suction/unload confirmation or leakage inspection, etc., with the suction nozzle.

The flow rate can be calculated using the effective cross-sectional area of nozzle (pinhole) and the pressure difference inside and outside of nozzle.

- For $P_1 \geq 1.89P_2$ (acoustic velocity)

$$Q = 113.2 \times S \times P_1$$

- For $P_1 < 1.89P_2$ (subsonic velocity)

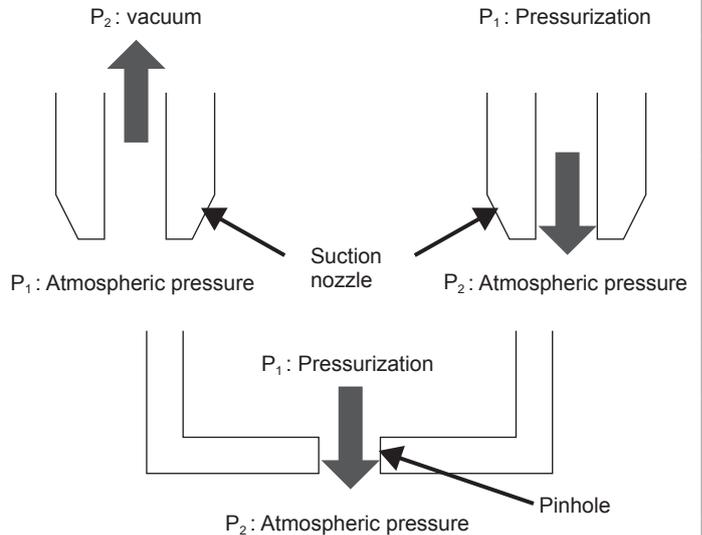
$$Q = 226.4 \times S \times \sqrt{P_2 (P_1 - P_2)}$$

Q : Flow rate L/min

P_1 : Primary side absolute pressure MPa

P_2 : Secondary side absolute pressure MPa

S : Effective cross-sectional area of nozzle (pinhole) mm²



- Example of calculation

The figure below shows the calculated value of flow rate when the nozzle diameter is $\phi 0.1$ to 2 and P_2 is varied.

	P_1 (MPa) Absolute pressure	P_1 (MPa) Gauge pressure	P_2 (MPa) Absolute pressure	P_2 (MPa) Gauge pressure	Acoustic velocity/subsonic velocity	Calculated flow rate value (L/min)									
						$\phi 0.1$	$\phi 0.2$	$\phi 0.3$	$\phi 0.4$	$\phi 0.5$	$\phi 0.7$	$\phi 1$	$\phi 1.5$	$\phi 2$	
Vacuum	0.1013	0	0.0313	-0.07	Acoustic velocity	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007	
	0.1013	0	0.0413	-0.06	Acoustic velocity	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007	
	0.1013	0	0.0513	-0.05	Acoustic velocity	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007	
	0.1013	0	0.0613	-0.04	Subsonic velocity	0.088	0.352	0.792	1.408	2.200	4.312	8.800	19.801	35.202	
	0.1013	0	0.0713	-0.03	Subsonic velocity	0.082	0.329	0.740	1.315	2.055	4.028	8.220	18.494	32.878	
	0.1013	0	0.0813	-0.02	Subsonic velocity	0.072	0.287	0.645	1.147	1.792	3.512	7.166	16.125	28.666	
Blow (leakage inspection)	0.1113	0.01	0.1013	0	Subsonic velocity	0.057	0.226	0.509	0.905	1.414	2.772	5.657	12.727	22.626	
	0.1213	0.02	0.1013	0	Subsonic velocity	0.080	0.320	0.720	1.280	2.000	3.920	8.000	17.999	31.998	
	0.1413	0.04	0.1013	0	Subsonic velocity	0.113	0.453	1.018	1.810	2.828	5.543	11.313	25.454	45.252	
	0.1613	0.06	0.1013	0	Subsonic velocity	0.139	0.554	1.247	2.217	3.464	6.789	13.856	31.175	55.423	
	0.1813	0.08	0.1013	0	Subsonic velocity	0.160	0.640	1.440	2.560	4.000	7.840	15.999	35.998	63.996	
	0.2013	0.1	0.1013	0	Acoustic velocity	0.179	0.716	1.610	2.862	4.472	8.765	17.888	40.248	71.552	
	0.3013	0.2	0.1013	0	Acoustic velocity	0.268	1.071	2.410	4.284	6.694	13.119	26.774	60.242	107.096	
	0.4013	0.3	0.1013	0	Acoustic velocity	0.357	1.426	3.209	5.706	8.915	17.474	35.660	80.236	142.641	
	0.5013	0.4	0.1013	0	Acoustic velocity	0.445	1.782	4.009	7.127	11.137	21.828	44.547	100.230	178.186	
	0.6013	0.5	0.1013	0	Acoustic velocity	0.534	2.137	4.809	8.549	13.358	26.182	53.433	120.224	213.731	

(CAUTION)

- When there is a leakage in the piping, etc., the actual flow rate becomes larger than the calculated value. When selecting the flow rate, consider the amount of leakage in the piping.
- When there is a portion narrower than the suction nozzle diameter in the middle of the piping, the flow rate may be reduced to lower than the calculated value. In addition, suction confirmation, etc., may become impossible.
- The effective cross-sectional area is just a guideline. When the nozzle is long and thin, the effective cross-sectional area becomes smaller than the opening area.
- The response time is determined by the inner volume of the piping from the flow rate sensor to suction nozzle (pinhole). For high-speed detection, reduce the inner volume of the piping as much as possible by installing a flow rate sensor near the suction nozzle, etc.

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder Switch

MN3E

MN4E

4GA/B

M4GA/B

MN4GA/B

F.R.(module unit)

Clean F.R

Precision R

Press gauge

Diff. press gauge

Electro-pneumatic R

Speed controller

Auxiliary valve

Fitting/tube

Clean air unit

Pressure sensor

Flow rate sensor

Valve for air blow

Ending

Product weight

■ Resin body

[Unit: g]

Model No.	Description	LCD display		Bar display	IO-Link
		Without needle valve	With needle valve		
Fitting					
BH1	Push-in (for ø4 mm straight)	60	90	50	50
CH1	Push-in (for ø6 mm straight)	50	80	40	50
DH1	Push-in (for ø8 mm straight)	80	120	70	80
EH1	Push-in (for ø10 mm straight)	80	120	70	80
HH1	Push-in (for ø1/4" straight)	60	90	50	50
JH1	Push-in (for ø3/8" straight)	80	120	70	80
AA1	Rc1/8 Straight	60	90	50	50
BA1	Rc1/4 Straight	60	100	50	60
CA1	Rc1/2 Straight	120	-	110	120
AF1	G1/8 Straight	70	100	60	70
BF1	G1/4 Straight	85	125	75	85
CF1	G1/2 Straight	120	-	110	120
AB1	G1/8 Straight	60	90	50	60
BB1	G1/4 Straight	70	110	60	70
CB1	G1/2 Straight	140	-	130	140
AC1	NPT1/8 Straight	50	80	50	50
BC1	NPT1/4 Straight	60	100	50	60
CC1	NPT1/2 Straight	120	-	110	120
Elbow					
BH2	Push-in (for ø4 mm elbow)	70	100	60	60
CH2	Push-in (for ø6 mm elbow)	60	90	50	60
DH2	Push-in (for ø8 mm elbow)	100	140	90	90
EH2	Push-in (for ø10 mm elbow)	100	140	90	100
HH2	Push-in (for ø1/4" elbow)	70	100	60	60
JH2	Push-in (for ø3/8" elbow)	100	140	90	100
AA2	Rc1/8 Elbow	70	100	60	60
BA2	Rc1/4 Elbow	80	120	70	80
AF2	G1/8 Elbow	80	110	70	80
BF2	G1/4 Elbow	105	145	95	105
AB2	G1/8 Elbow	70	100	60	70
BB2	G1/4 Elbow	90	130	80	90
AC2	NPT1/8 Elbow	70	100	60	60
BC2	NPT1/4 Elbow	80	120	70	80

■ Stainless steel body

[Unit: g]

Model No.	Description	LCD display		Bar display	IO-Link
		Without needle valve	With needle valve		
Fitting					
AA1	Rc1/8 Straight	100	165	90	95
BA1	Rc1/4 Straight	115	200	105	110
CA1	Rc1/2 Straight	420	-	410	420
AF1	G1/8 Straight	155	220	145	150
BF1	G1/4 Straight	190	275	180	185
CF1	G1/2 Straight	420	-	410	420
AB1	G1/8 Straight	100	165	90	95
BB1	G1/4 Straight	110	195	100	105
CB1	G1/2 Straight	440	-	430	440
AC1	NPT 1/8 Straight	100	165	90	95
BC1	NPT 1/4 Straight	115	200	105	110
CC1	NPT 1/2 Straight	420	-	410	420
AD1	1/4" double barbed fitting (500 mL/min to 50 L/min)	155	220	145	150
BD1	1/4" double barbed fitting (50 L/min to 200 L/min)	190	275	180	190
AE1	1/4" JXR male fitting (500 mL/min to 50 L/min)	155	220	145	150
BE1	1/4" JXR male fitting (50 L/min to 200 L/min)	190	275	180	190

MEMO

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder
Switch

MN3E
MN4E

4GA/B

M4GA/B

MN4GA/B

F.R.(module
unit)

Clean
F.R

Precision
R

Press gauge
Diff. press gauge

Electro-
pneumatic R

Speed
controller

Auxiliary
valve

Fitting/
tube

Clean
air unit

Pressure
sensor

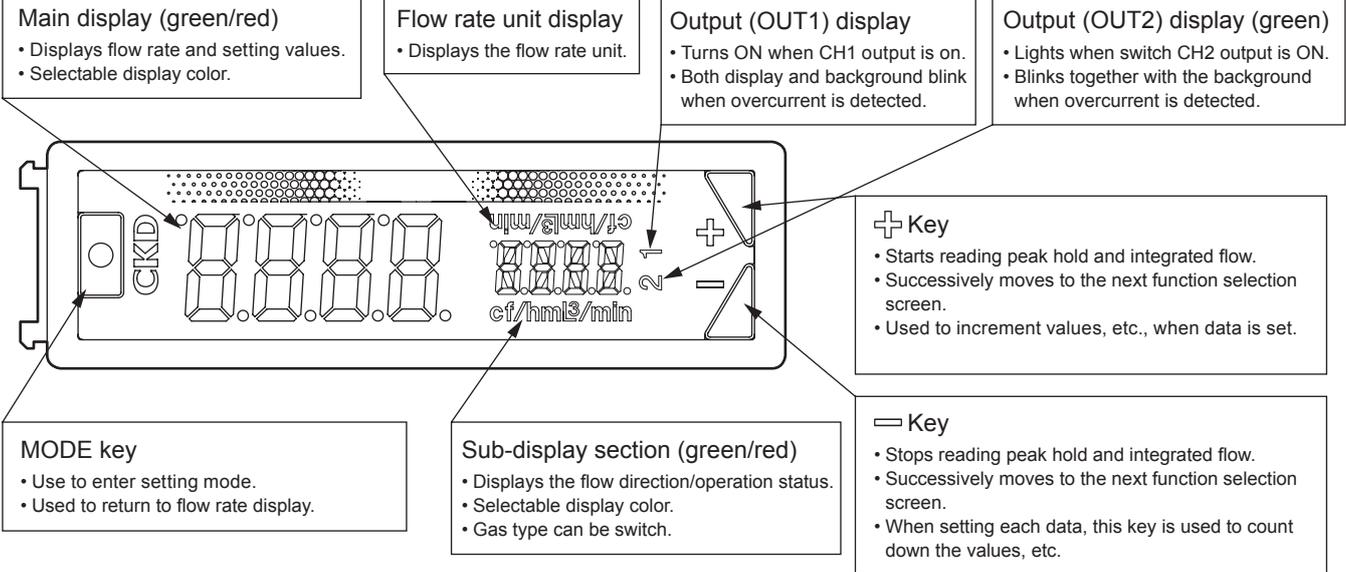
Flow rate
sensor

Valve for
air blow

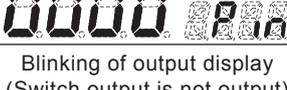
Ending

Names and functions of display/operation section (LCD display)

● Names of display parts



● Error code

Error code	Cause	Countermeasures
	The flow rate exceeds the flow rate display range.	Reduce the instantaneous flow rate value to within the flow rate range.
	Sensor has failed.	Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	The flow rate is below the lower limit of the flow rate display range.	Increase the instantaneous flow rate value to within the flow rate range.
	Sensor has failed.	Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	An error occurred during CPU processing.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	The zero adjustable range has been exceeded.	Make sure to set the flow rate to zero, and then perform the zero adjustment.
	An error occurred during EEPROM reading or writing operation.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	An error occurred during memory reading or writing.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	Sensor abnormality has occurred.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	Copying of settings failed.	Check connections and perform the operation again.
	Button operation is locked.	Release the lock before operating the buttons.
	A password is set.	Enter the set password. *Take care not to forget your password.
Blinking of output display (Switch output is not output)	The switch output's overcurrent protection circuit has operated.	Check whether load current exceeds the rating. Correctly connect, then turn the power ON again.

Names and functions of display/operation section (LCD display)

The functions and various settings are made during the normal flow rate display and during each mode. Each mode is divided into a maintenance mode, SET mode and setting monitor mode according to the frequency of use.

● Normal operation (RUN mode)

Item	Explanation	Default setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	Display (measuring)
Peak hold function	Max. and min. values for the flow rate within a set interval are displayed.	Non-display (stopped)
CO ₂ discharge display	By setting the power, discharge pressure, and flow rate of the compressor, as well as the power to CO ₂ conversion coefficient, you can learn how much CO ₂ is being discharged. (reference value obtained by calculation) This is available only when the gas type is set to air.	Non-display (stopped)
Integrating flow display	The integrated flow can be displayed. The switch output function includes a function to turn the switch ON/OFF at a level higher than the recommended cumulative value, and an integrated pulse function to output the pulse at a set cumulative value.	Non-display (measuring)

● SET Mode

No.	Item	Explanation	Default setting
F.01	Selection of CH1 operation	Select the CH1 setting. Switch output operation and integrated pulse can be set.	Without switch output
F.02	Selection of CH2 operation	Select the CH2 setting. Select whether to use CH2 as a switch output, or to use as an external input (integrated value reset/auto reference).	Without switch output
F.03	Integrating function settings	Whether to continuously acquire integrated flow values or set a time can be selected. Whether or not to hold that data also can be selected.	Continuous acquisition: Data hold OFF
F.04	Sub-screen display setting	Set the sub-display section's display method. The display can be switched to "flow direction", "reference state", "gas type", or "numbering display".	Flow direction
F.05	Display color setting	Set the display color. (red, green) The color for a normal display and for switch output ON can be set.	At normal: Green At switch ON: Red
F.06	Setting of flow rate direction (Bi-directional type)	Setting the flow rate direction. Setting available for bi-directional, one-side forward direction or one-side reverse direction.	Bi-direction
F.07	Display inversion function	The LCD display can be flipped vertically.	Standard display
F.08	Reference state setting	Whether to set standard state or reference state can be selected. Standard state (ANR): Converted into volumetric flow rate at 20°C, 1 barometric pressure, 65%RH (For gas types other than air: 20°C, 1 barometric pressure, 0% RH) Reference state (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure, 0%RH	ANR
F.09	Unit setting (overseas models only)	The unit can be set. Can be selected from L/min and cf/h (cf/min).	Domestic model: L/min Overseas model: L/min
F.10	Display cycle setting	The digital display refresh cycle can be set in three stages from 0.25 sec to 1 sec. If the display flickers, it may be improved by setting a longer display refresh cycle.	0.25 sec
F.11	Analog output Setting response time	Set the response time. Analog output can be set in seven steps from 0.05 sec to approx. 1.50 sec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	0.5 sec
F.12	Numbering setting	Numbering can be set.	0000
F.13	Gas type switch	The measured gas can be switched. (Model with full scale flow rate of 200 L/min or below) (The gas type cannot be switched on an oxygen type.)	Air
F.14	Setting ECO mode	ECO mode can be set. If the buttons are not operated for approx. one minute, the ECO mode will activate and turn OFF the display's backlight. Current consumption can be reduced with this mode.	OFF
F.15	CO ₂ discharge calculation setting	The CO ₂ discharge calculation can be set. Set you compressor power, discharge pressure, flow rate, and CO ₂ conversion coefficient.	• Power: 0.20 KW • Pressure : 0.10 MPa • Flow rate: 100 L/min • Conversion factor: 0.000 kg (CO ₂) /kwh
F.16	Lock setting	The key lock and password methods can be set. Use these selectively depending on the working environment.	OFF
F.17	Peak hold setting	Whether to continuously acquire peak hold values or set a time can be selected. Whether or not to hold that data also can be selected.	Continuous acquisition: Data hold OFF

● Maintenance mode

No.	Item	Explanation	Default setting
F.91	Forced output function	Use this function to forcibly turn the switch output ON and confirm the wiring connection or initial operation of the input device.	-
F.92	Zero adjustment	The zero point deviation is corrected.	Adjust value: 000
F.93	Setting copy function	Set values can be copied if the model supports copying between two FSM3's. (Copying is possible only between products with the same model No.)	-
F.99	Reset function	Returns settings to their default states.	-

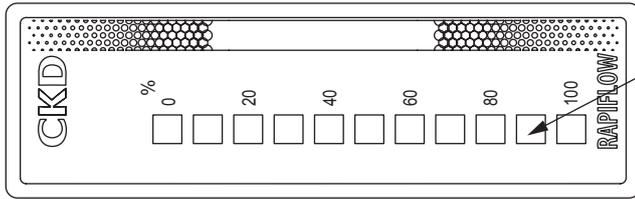
● Setting monitor mode

Item	Explanation	Default setting
Setting monitor function	Details set in the SET mode can be confirmed. (Setting details cannot be edited.)	-

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E
MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge
Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Names and functions of display/operation section (bar display type)

● Names of display parts



Flow bar display

- Lights according to flow rate.
- Blinks at overflow.

[Example] Display in the case of FSM3-B101

Flow rate	Uni-direction	Bi-directional
0%		
+60% (Forward direction)		
+110% (Forward direction) Blinks at overflow. * Blinks at +110% F.S. or more.		
-10% (Reverse direction)		
-110% (Reverse direction)		

● Error code

Error code	Cause	Countermeasures
The third from left blinks 	An abnormality occurred during memory reading or writing.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
[Uni-direction] All blink 	The flow rate exceeds the flow rate display range.	Reduce the instantaneous flow rate value to within the flow rate range.
[Bi-directional] The right half blinks 	Sensor failure	Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
[Uni-direction] The leftmost blinks 	The flow rate is below the lower limit of the flow rate display range.	Increase the instantaneous flow rate value to within the flow rate range.
[Bi-directional] The left half blinks 	Sensor failure	Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.

MEMO

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder
Switch

MN3E
MN4E

4GA/B

M4GA/B

MN4GA/B

F.R.(module
unit)

Clean
F.R

Precision
R

Press gauge
Diff. press gauge

Electro-
pneumatic R

Speed
controller

Auxiliary
valve

Fitting/
tube

Clean
air unit

Pressure
sensor

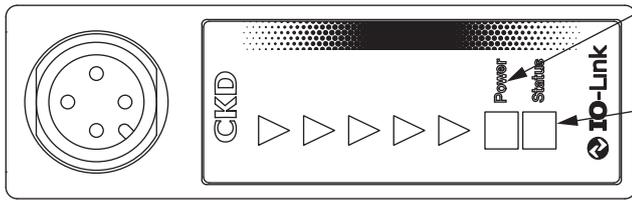
Flow rate
sensor

Valve for
air blow

Ending

Names and functions of display/operation section (IO-Link)

● IO-Link



Power lamp (green)

- Lights when power supply is ON.
- Blinks during IO-Link communication.

Status lamp (green, orange, red)

- Green Lights when the flow rate is within the specified range.
- Orange On when the flow rate exceeds 100% F.S. and is 110% F.S. or below.
- Red On when the flow rate exceeds 110% F.S.
- Lights when an error occurs.

* The lamp turns off when the flow rate is under $\pm 3\%$ F.S.

● Communication specifications

Item	Details
Communication protocol	IO-Link
Communication protocol version	V1.1
Transmission bit rate	COM2 (38.4 kbps)
Port	Class A
Process data length (input)	4 bytes
Process data length (output)	0 byte
Min. cycle time	5 ms
Data storage	1 kbyte
SIO mode support	None

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Data name	MSB															LSB
Data range	Instantaneous flow rate															
Format	Refer to Table 1															
	Integer 16															

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data name	Error	WARNING	-	-	-	-	Switch output		Vacant							
							2	1								
Data range	True/False															
Format	Boolean															

Data range (Table 1)

		005	010	020	050	100	200	500	101	201	501	102
Data range (□/min)	U	-50 to 550 mL	-100 to 1100 mL	-0.20 to 2.20 L	-0.50 to 5.50 L	-1.00 to 11.00 L	-2.0 to 22.0 L	-5.0 to 55.0 L	-10.0 to 110.0 L	-20 to 220 L	-50 to 550 L	-100 to 1100 L
	B	-550 to 550 mL	-1100 to 1100 mL	-2.20 to 2.20 L	-5.50 to 5.50 L	-11.00 to 11.00 L	-22.0 to 22.0 L	-55.0 to 55.0 L	-110.0 to 110.0 L	-220 to 220 L	-550 to 550 L	-1100 to 1100 L

* The data range changes when CO₂ is set as the gas type. Refer to page 1087.
 * Download the IO-Link configuration files (IODD) from the CKD website (<https://www.ckd.co.jp/en/>).

● Explanation of functions (IO-Link)

Item	Explanation	Default setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	-
Integrating flow display	Displays the integrating flow counted after indicating to start logging.	Stop
Instantaneous flow rate peak value display (Peak hold function)	Displays the maximum and minimum instantaneous flow rate values during the period between indicating to start logging and stop logging.	Stop
Error display	Displays the error details.	-
Warning display (WARNING)	Displays the warning details.	-
Power ON time display	Displays the total power ON time from the start of use. This time is not reset even if the power turns OFF. (Also not reset when using the reset setting)	-
Operation for switch output function	The switch output operation function can be set. This function can be used to monitor whether the flow rate is within the set range or monitor whether it exceeds the set flow rate.	Not set
Flow rate standard setting	The flow rate standard can be selected. Standard condition (ANR): Converted into volumetric flow rate at 20°C, 1 barometric pressure, 65% RH (For gas types other than air: 20°C, 1 barometric pressure, 0% RH) Standard condition (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure, 0% RH	ANR
Gas type switch	The measured gas can be switched. (Model with full scale flow rate of 200 L/min or below. The gas type cannot be switched on an oxygen type)	Air
Change travel average (Setting response time)	The travel average when measuring can be set. The average can be set in seven steps from 50 msec to 1500 msec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	50msec
Lock setting	Parameter Lock can be set, which disables changing the parameters of the unit. Data Storage Lock can be set, which prohibits uploading and downloading set values to the master. (Parameter Lock and Data Storage Lock and be set simultaneously)	Not set
Zero adjustment	The zero point deviation is compensated. (within ±10% F.S.)	Not set
Data storage function	Uploading set values to the master and downloading set values from the master are possible. (Can be copied by the same model No.)	-
Reset function	Returns the settings to the factory settings. (Cannot reset while Parameter Lock is enabled)	-
Unit identification function	The model No., serial No. or other unit-unique information can be confirmed on the network.	-

SCPD3
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MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending