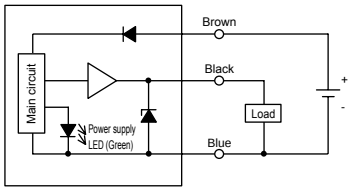
Example of internal circuit and load connection

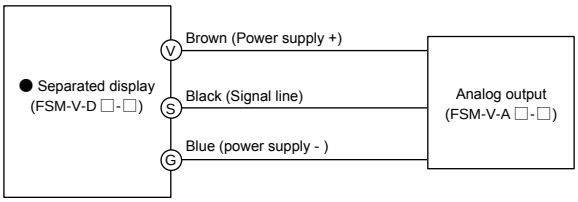
[FSM-V Series]

● FSM-V-A□ (Analog output)



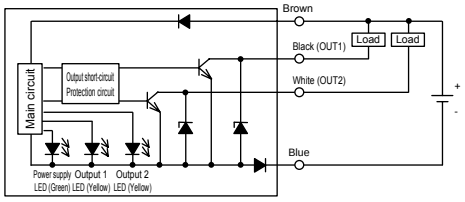
Line color	Description
Brown	Power supply 12 to 24 VDC
Blue	0 V(GND)
Black	Analog output (1 to 5 V)

● Connection method of separated display with analog output



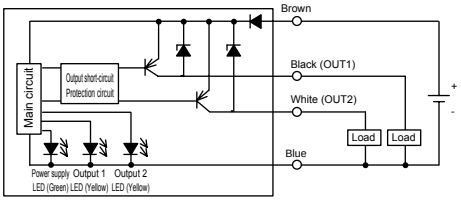
Note: The switch output cannot be combined with separated display.

● FSM-V-N□ (switch output NPN output)



Line color	Description
Brown	Power supply 12 to 24 VDC
Blue	0 V(GND)
Black	OUT1(max. 50 mA)
White	OUT2(max. 50 mA)

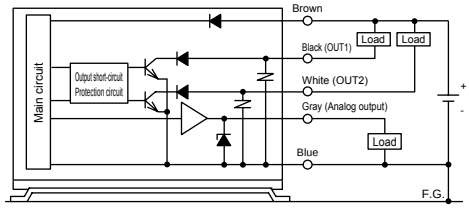
● FSM-V-P□ (switch output PNP output)



Line color	Description
Brown	Power supply 12 to 24 VDC
Blue	0 V(GND)
Black	OUT1(max. 50 mA)
White	OUT2(max. 50 mA)

[Separated display]

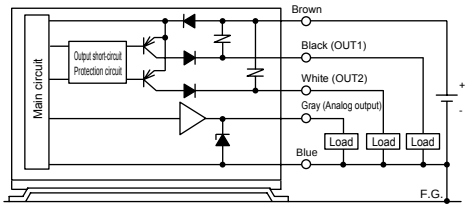
● FSM-V-DN-□ (separated display NPN output)



Line color	Description
Brown	Power supply 12 to 24 VDC
Blue	0 V(GND)
Gray	Analog output (1 to 5 V)
Black	OUT1(max. 50 mA)
White	OUT2(max. 50 mA)

· To reset short-circuit protection, turn OFF feed power supply, correct wiring mistakes, etc., then turn the power ON again.

● FSM-V-DP-□ (separated display PNP output)

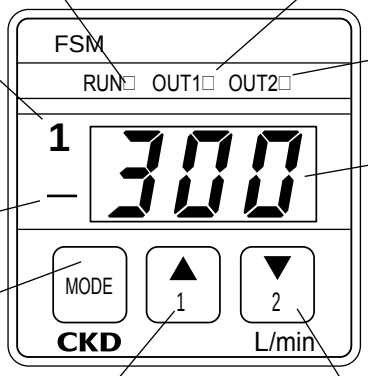


Line color	Description
Brown	Power supply 12 to 24 VDC
Blue	0 V(GND)
Gray	Analog output (1 to 5 V)
Black	OUT1(max. 50 mA)
White	OUT2(max. 50 mA)

· To reset short-circuit protection, turn OFF feed power supply, correct wiring mistakes, etc., then turn the power ON again

Names and functions of display/operation section

● Separated display (FSM-V-D)



RUN display
· Turns ON when flow rate is displayed.
· Blinks when peak hold operates.

Output (OUT1) display
· Lights when switch CH1 output is ON.
· Blinks when overcurrent is detected.

Overflow display (excluding FSM-V-D□)
· Turns ON when 3-digit display limit is exceeded, and indicates 1.
(at 10.00 L/min, this 1 turns ON and displays a 3-digit 0.00 LED.)

Output (OUT2) display
· Lights when switch CH2 output is ON.
· Blinks when overcurrent is detected.

3-digit LED display
· Displays flow rate, switch set values, and machine state
· In case of overflow, Hi is displayed. (Hi is displayed at approx. 10% F.S. or more.)
· In case of reverse direction overflow, Lo is displayed. (Lo is displayed at approx. -10% F.S. or below.)

Minus display
· Turns ON during reverse direction flow.

MODE key
· Used to enter each setting mode.
· Used to advance setting mode.
· Used to return to flow rate display.
· Used to cancel peak hold operation.

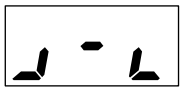
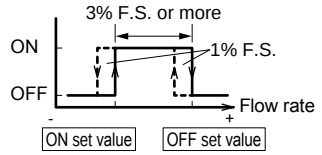
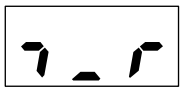
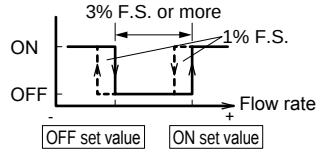
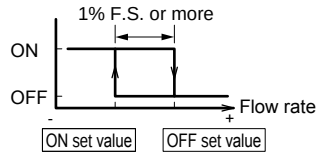
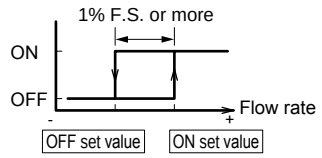
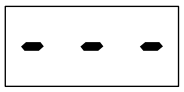
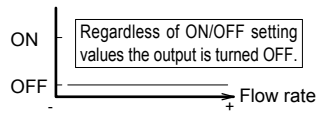
2 (DOWN) key
· During flow rate display, displays CH2 data sequentially.
· During peak hold operation, displays min. value.
· During mode selection, sets the mode.
· When setting each data, it is used to count down the values, etc.

1 (UP) key
· During flow rate display, displays CH1 data sequentially.
· During peak hold operation, displays max. value.
· During mode selection, sets the mode.
· When setting each data, it is used to count up the values, etc.

Operating method

Switch output function

Switch operation mode

Name of operation pattern	LED display	Operation waveform
Window operation 1 (ON when inside range)		
Window operation 2 (ON when outside range)		
Hysteresis operation 1 (ON at low flow rate side)		
Hysteresis operation 2 (ON at high flow rate side) (*6)		
Switch output OFF		

*1: In a window operation, provide an interval of 3% F.S. or more between the two setting values. A 1% F.S. hysteresis is automatically added to the ON and OFF sides.

*2: For hysteresis operation, provide an interval of 1% F.S. or more between the 2 set values.
If the two settings are the same, operation may not take place or may be unstable.

*3: If switches are operated when fluid is pulsating or flow rate is otherwise unstable, operation may be unstable.
In this case, provide sufficient margin between the two setting values, and confirm that switch operation is stable before use.

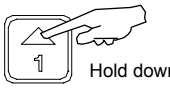
*4: The left side of the operation waveform indicates negative pressure and the right side positive pressure.

*5: Specifying the waveform pattern naturally determines the magnitude relationship of the ON and OFF setting values and precludes the reverse thereof.
With this product, however, operation of the designated operation pattern is the priority.
When two setting values are input, the device automatically judges their magnitude and assigns them setting values as ON and OFF accordingly.
Thus, even if ON and OFF setting values are input the other way by mistake, they will be corrected and the specified operation pattern will be performed.

*6: The output is held even during the Hi display.

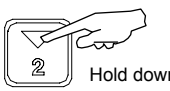
Confirmation of set value

CH1 data display



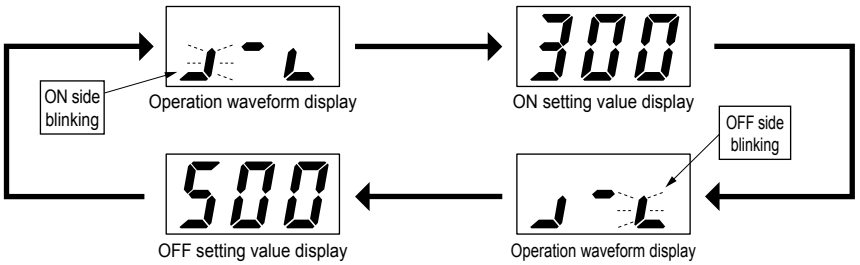
Hold down

CH2 data display

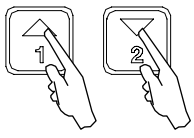


Hold down

By pressing each key during flow rate display, the switch data ON setting/OFF setting/ operation waveform, zero point adjustment value, and model No. can be confirmed.
Switch operation is not affected during this operation.



Zero point adjustment value/model No. display



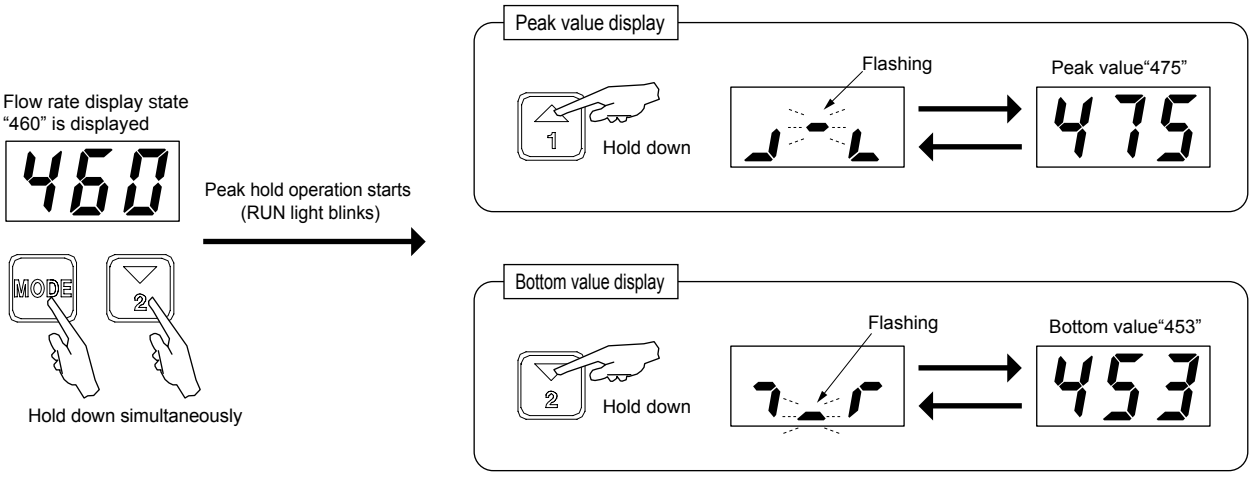
Hold down simultaneously

The zero point adjustment value and model No. are displayed alternately.
Switch operation is not affected even during this operation.

Operation method of each function

Peak hold function

Max. and min. values for the flow rate within a set interval are displayed.
Use this to check the instantaneous flow rate change, etc.
The peak hold operation does not affect this product's basic functions such as switch operations or flow rate display.



Switch output function

Refer to page 1474 for operation.

This product has 2-point switch output, and uses four operation modes and operation stop.
The switch function is started by setting the required operation pattern and by configuring two setting values, "ON/OFF", that specify the operation point.
Determine the required operation pattern and ON/OFF setting values before setting.
Select and set the following data to operate the switch.

CH1: Operation pattern	CH1: ON set value	CH1: OFF set value
CH2: Operation pattern	CH2: ON set value	CH2: OFF set value

Forced output function

Refer to page 1474 for operation.

Use this function to forcibly turn the switch output ON and confirm the wiring connection or initial operation of the input device.
(Note) Use this test function to check the wiring connection and input device operation. Avoid using this function instead of actual signals when executing the sequence program while the machinery and equipment are operating.

Zero point adjustment function

Refer to page 1474 for operation.

Deviation of the display from zero is compensated for in the no flow rate state.
If the setting was in error, readjust in a state with no fluid flowing.

(Note) The above settings and test significantly affect the output signal and display.
Before this operation, be sure to stop the machinery and equipment using this product and confirm that safety can be ensured in case of incorrect operation or display. Using this function while the machinery and equipment are operating is dangerous and may cause incorrect operation or display.

Return method

To return to the flow rate display during operation (when in settings mode), turn OFF the power supply, and then turn it ON again to return to the flow rate display.

Operation for switch output function/forced output function/zero point adjustment function

[Flow rate display]

For safety, if no key is operated for 2 seconds or more before the mode is confirmed, the flow rate display is redisplayed.

When the MODE key is held down longer, the flow rate is redisplayed.

MODE Hold down

Flashing

Flashing

MODE Release

Flashing

Set

Press 1 time

MODE Press 1 time

MODE Press 1 time

Flashing

Set

Press 1 time

MODE Press 1 time

Flashing

Set

Press 1 time

Basic key operation

These key operations are valid in the switch operation pattern setting, ON/OFF setting, and zero point adjustment mode.

- Data reset: MODE + 1 — Hold down simultaneously
- Count up: 1
- Count down: 2
- Data reading: 1 + 2 — Hold down simultaneously

Setting data for the switch output function

Switch CH1 Changing operation mode

Channel 1 display

Alternating display

Operation mode display

Changing operation mode with UP/DOWN keys

Switch CH1 Data setting ON/OFF

ON point waveform display

OFF point waveform display

Alternating display

Set value display: 500

Set value display: 700

Change the value with UP/DOWN keys

MODE Press 1 time

Switch CH2 Changing operation mode

Switch CH2 Data setting ON/OFF

Set this switch in the same way as switch CH1.

MODE Press 1 time

To flow rate display

MODE Press 1 time

Switch output forced ON mode

CH1 output ON — 1 Hold down

CH2 output ON — 2 Hold down

To flow rate display

MODE Press 1 time

Zero point adjustment mode

"AdJ" Display

Alternating display

Zero point adjustable value display

Adjustment value reading: 1 + 2 Hold down simultaneously

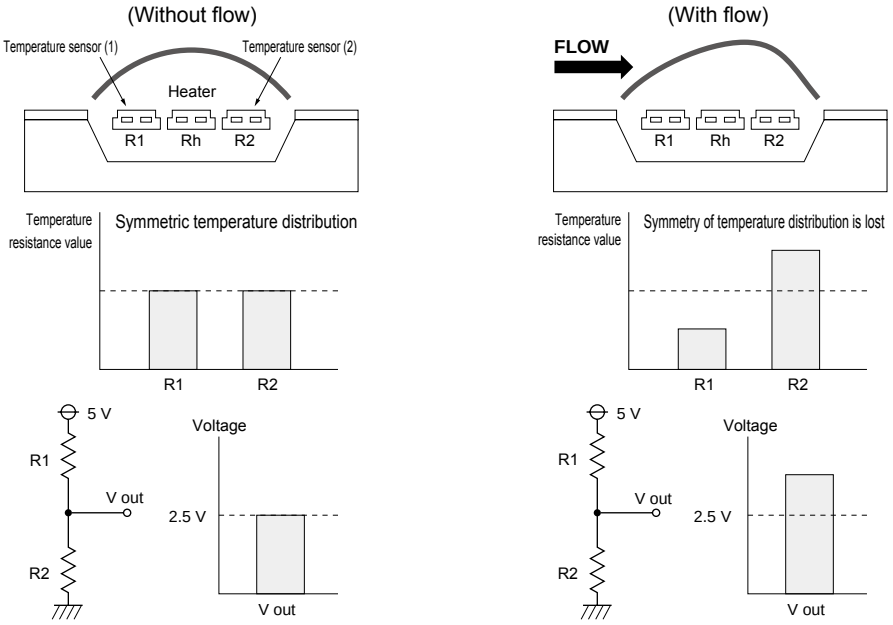
To flow rate display

MODE Press 1 time

CAUTION Make sure to perform zero point adjustment in a state with no fluid flowing.

Measurement principle of FSM-V Series

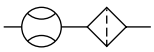
The FSM-V Series incorporates a platinum sensor chip (3 mm x 3.5 mm) machined with silicon micro-machining. The sensor is thermally insulated from the silicon substrate. The heating capacity is extremely low, enabling high sensitivity with a high-speed response.
At the sensor, two temperature sensors 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) will be inverted. By using this method, the bi-directional flow rate can be detected. This method is suitable for detecting a relatively small flow rate.



Customized products

Available as made to order. Contact CKD for details.

Type with filter



■ With filter ideal for suction confirmation
■ Compatible with FSM-V Series.

FSM-V Uni-direction detection

■ The standard is a bi-direction detection type, but a uni-direction detection is also supported. (Example: flow rate range ±10 L/min → 0 to 10 L/min)