CKD

Instruction Manual

Compressed Air FLOW SENSOR FLUEREX PFF series

PF500F

PF1000F

PF2000F

PF4000F

^{*} Thoroughly read this Instruction Manual before starting the sensor

^{*}Keep this Manual near the sensor where all concerned personnel have easy access to it.

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1. Safety instructions

This manual is intended for personnel who are familiar with basic knowledge about electricity, compressed air, fluid, piping, and refrigerant. CKD shall not be held responsible for troubles or accidents that result from installation, operation or repairs made by personnel who are not qualified or trained for the above subjects.

Improper handling may cause the machine not to be operated at its maximum performance level or lead to accidents or personal injury.

Always confirm the machine specification and operate the machine in the correct manner designated by CKD.

This machine is equipped with various safety and other protective devices.

However, improper handling of the machine may cause personal injury and/or damage to the machine. Read this operation manual carefully and fully comprehend its contents before operation.

Read the contents of the following warning labels, as well as cautions stated in the operation manual, and follow the instructions contented therein.

Keep this operation manual near the machine where all concerned personnel have easy access to it.

Safety precautions are classified into the following groups, DANGER, WARNING and CAUTION.



: This denotes hazards which WILL result in severe personal injury or death, if not avoided.



: This denotes hazards which COULD result in severe personal injury or death, if not avoided.



: This denotes hazards which COULD result in minor personal injury and/or product or property damage, if not avoided.

2. Cautions for operation

2-1 Cautions for design selection

♦Fluid used ♦



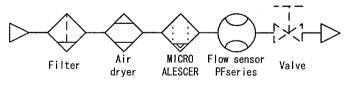
Never use any flammable fluid.



● This flow sensor cannot be used as a measuring instrument for business deals.

Do not use this flow sensor for business deals since this sensor does not conform to the measuring regulations. This sensor must always be used as an industrial sensor.

- The fluid applicable to this sensor is compressed air or nitrogen gas. Do not use any fluid other than those specified. Doing so may not guarantee the correct accuracy.
- The compressed air from the compressor may include drain (water, oxidized oil, or foreign matter, etc.). Therefore, a filter, an air dryer, and a MICRO ALESCER must be installed on the primary side (upstream side) of the sensor. The mesh (metallic screen) of the sensor is used to rectify the flow inside the piping. Since this mesh is not intended to remove foreign matter, always install an appropriate filter.



◆ Operating environment ◆



Explosion-proof environment

Never operate this sensor in an explosive gas atmosphere. Doing so may cause the sensor to explode or burn since it has no explosion-proof structure.

Applicable fluid

When the nitrogen gas is used for this sensor, oxygen shortage hazard may occur. Follow the cautions below to carefully operate the sensor.

- (1) Operate the sensor in a place where the fresh air can be introduced or the ventilation can be performed.
- (2) When using the nitrogen gas, always perform the ventilation.
- (3) Periodically check the nitrogen gas piping for leak.



Corrosive environment

Do not operate this sensor in a corrosive gas atmosphere, such as sulfur dioxide atmosphere.

Fluid temperature

Keep the fluid temperature in a range of 0 to 50°C. Additionally, even though the ambient temperature is in the specified range, do not operate the sensor in a place where the temperature is changed rapidly, causing dew condensation to occur.

Maximum operating pressure

If this sensor is operated at a pressure level exceeding its maximum working pressure, this may cause the sensor to malfunction. Always operate the sensor at its maximum working pressure or less.

● Drip-proof environment (In conformity with IP64) Since this sensor uses dust-proof and drip-proof structure, the sensor can be used safely even though the water is splashed onto it during maintenance and cleaning work.

However, do not use this sensor in a place where the water is always splashed onto it or where the water or oil scatters keenly.

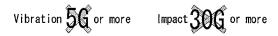


Ambient temperature

Always use this sensor in an ambient temperature range of 0 to 50°C.

Vibration and impact

Do not use this sensor in a place where a vibration of 5G or more and/or an impact of 30G or more may be applied to it.

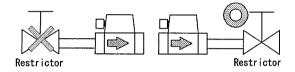


2-2 Cautions for mounting, piping, and wiring

◆ Piping ◆



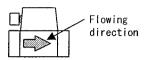
- This sensor is designed to install in the vertical, horizontal, or other posture.
- When adjusting the flow rate using a throttle valve (glove valve or ball valve, etc.), install such throttle valve on the secondary side (downstream side) of the sensor. If the throttle valve is installed on the primary side, this may cause a drift (flow disturbance) to occur, resulting in an error.



- When installing a stop valve on the primary side of the sensor for the repair and maintenance work, always use this sensor with such stop valve opened or closed fully.
- Do not install any pressure reducing valve (regulator) at a position immediately before the sensor (on the primary side).
- •When attaching the sensor to the piping, refer to the reference torque data listed below so that excessive screwing-in torque and/or loading torque are not applied to the connecting port.

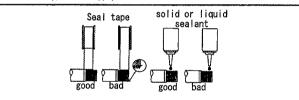
	PFS500D	PFS1000D	PFS2000D	PFS4000D	PFS8000D	PFS16000E
A.Maximum screwing-in torque N-	ո 29	29	29	48	72	80
B. Maximum loading torque N-m	14	14	14	38	48	60
Resin cover						

● Carry out the piping so that the fluid flowing direction is matched with the direction indicated on the body. If the sensor is connected in the reverse direction, a flow rate larger than the actual flow rate is indicated.



- Before starting the piping work, blow the air to remove foreign particles and cutting chips from the piping.
- Pay special attention so that no stress is applied to resin parts during piping work.
- Carefully carry out the piping work so that no seal tape dust and/or glue enter the piping.

To wind a fluoro resin seal tape on the screw thread part, wind the tape on the screw thread part once or twice so that the tape is not wound on 2-3 threads. Press the tape by fingernail to tightly contact the tape with the screw threads. When applying the liquid sealant, carefully apply it so that an excessive amount of sealant is not applied and sealant is not applied to 1-2 threads. Additionally, do not apply the sealant to the internal thread.



♦ Wiring ◆



●When operating the sensor, keep the power supply voltage and output at their specified levels. If a voltage exceeding the specified level is applied, tensile force to the wires. Doing so may cause faulty wiring.

2-3 Cautions for operation



● If the valve connected to the sensor is opened rapidly, the flow rate becomes several ten times larger than the flow rate rating. This may cause the platinum thin film sensor or rectifying unit to break, resulting in fluid flown out to the secondary side.

When opening the valve connected to the sensor, always open the valve gradually so that the monitor display does not exceed the flow rate rating.

CAUTION

- If a problem is found during operation, immediately shutdown the power supply to stop operation and contact the local sales representative. The display may become slightly hot (approximately 40°C), but this is not a problem.
- The internal setting, such as hardware check is made for 10 sec. After the power has been turned ON. The display and output do not function correctly during this period. Particularly, if the switch output is used to form an interlock circuit of the control system unit, erroneous stop may occur. In this case, mask the output during this internal setting period.
- Before changing the output set value, always stop the unit completely. Failure to do so may cause an unexpected operation of the control system unit.

2-4 Cautions for inspection and maintenance



- ●Always carry out the periodic inspection once a year or more frequently to make sure that the sensor functions correctly.
- Do not attempt to disassemble or modify the sensor. Doing so may cause the sensor to malfunction.

3. Product

3-1 Type indication method

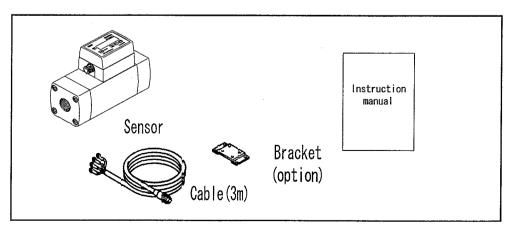
Item	Îtem Type		2nd hyphen (Option)	Specifica	itions .
Class	PF			Compressed air flow sensor	
Flow rate	500F	-10		25~500NL/min	Port size Rc3/8
/Port size		-15	-		Port size Rc1/2
	1000F	-10		50~1000NL/min	Port size Rc3/8
		-15			Port size Rc1/2
	2000F	-15		100~2000NL/min	Port size Rc1/2
		-20			Port size Rc3/4
	4000F	-20		200~4000NL/min	Port size Rc3/4
		-25			Port size Rc1
Analog output			-No symbol	DC0-5V	
			-A1	DC4-20mA	
			-A2	DC1-5V	
		***************************************	-A3	DC0-10V	
			-A6	DC0-5V + Integrated pulse out	put (Transistor output)

Notes

1)"F" of a **** end shows a version.

3-2 Component/Accessories

- Sensor
- Accessory cable
- Instruction manual
- Bracket (Option)

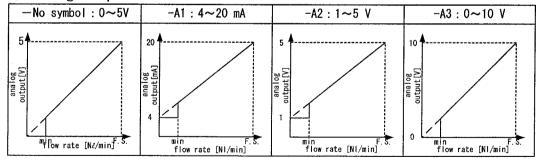


	Model	⊃F500F-10	PF500F-15	⊃F1000F-10	⊃F1000F−15	⊃F2000F-15	PF2000F-20	PF4000F-20	PF4000F-25	
Item	PF	Ŗ.	PF1	PFI	PF2	PF2	PF4	PF4		
Specifi	Flow rate range Nl/min	25~	-500	50~	1000	100~	-2000	200~	-4000	
-cations	Connecting port size	Rc3/8	Rc1/2	Rc3/8	Rc1/2	Rc3/8	Rc1/2	Rc1/2	Rc1	
	Applicable fluid			Con	npressed a	air • Nitro	gem	***************************************	***************************************	
	Quality of air used	Conden	sation for	ning point	t at atmos	pheric pr	essure, -1	7°C or lo	wer (*1)	
O	MAX. operating pressure			•••••	1.0	MPa	***************************************		***************************************	
Operating Conditions	MIN operating pressure				0.1	MPa				
Conditions	Allowable withstanding pressure									
	Ambient temperature and humidity			0-	~50°C(859	%RH or les	ss)			
	Fluid temperature	0~50°C								
	Linearity	±1.5 % F.S. (0.7MPa,20°C)								
Accuracy	Pressure characteristics		±1	.5 % F.S.	(0.1~1.5MPa, 0.7MPa Standard)					
	Temperature characteristics	±2.0 % F.S. (0~40°C, 20°C Standard)								
	Response time	Approx. 2.5sec								
	Marking	5-digit digital display								
	The minimum display flux NI/min	11	0	2	0	3	0	5	0	
	Integrated flow rate	The maximum number of digits for the integrated flowrate is 9								
	Analog output	Standard: DC0~5V Option: 4~20mA, 1~5V, 0~10V								
Output	Switch output	Transistor output max 35V 50mA								
	Pulse output	Option: Refer to 3-4. Integrated pulse output								
	Power source voltage	DC24V±10 % (MAX10W)								
	Accessory(3m with connector • Cire 0.5mm²)									
	To be held semi-permanently because of the use of EEPROM									
	Mounting direction	Vertically or horezontally								
Mounting	Lead-in straight tube	Not required								
	Protective structure	IP64(the sensor unit only, however)								
	Mass	1.5 kg 2.0 kg								

^{1*} If a foreign substance, moisture, and oil are contained in compressed air, detection of flux will become impossible and a sensor error will occur.

Please attach a filter, a refrigerating type drier, and an oil Myst filter before a flow sensor.

◆Analog output



Note1) By the flux below "min" of the following table, or more than "max", a flux display and an analog output are not outputted normally.

Note 2) A unit, to which the analog output is connected, must satisfy the following load conditions.

ltem	No symbol [0~5V]	-A1	-A2	-A3
Allowable	1MΩ	less than	1MΩ	1MΩ
load	or more	500Ω	or more	or more

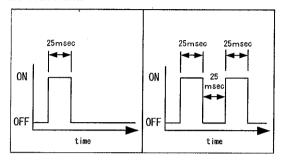
3-4 Integrated pulse output [Option:-A6]

· As for an Integrated pulse output, a pulse is outputted for every following addition value.

[Nℓ]

形番	PF500F	PF1000F	PF2000F	PF4000F
integrated flux per one pulse		1	0	

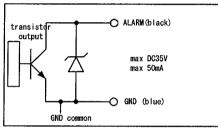
< exp. > Pulse Waveform



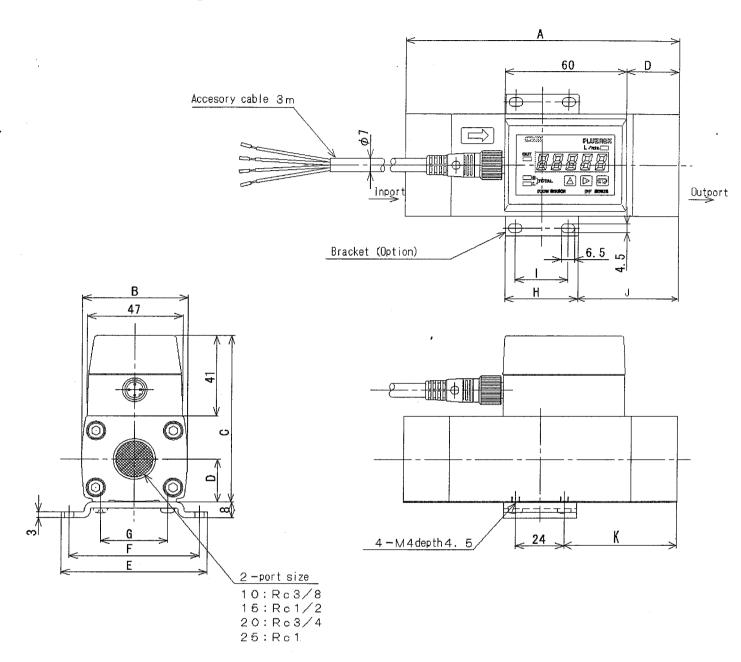
An addition display is updated at intervals of about 1 second.

· Electrical specification

◆Output circuit



3-5 Outline drawing



Model 1st hyphen	port size
-10	Rc3/8
-15	Rc1/2
-20	Rc3/4
-25	Rc 1

Model	Α	В	С	D	E	F	G	Н	I	J	K
PF500F, 1000F	135	52	85	26	72	64	33	36	26	49.5	55.5
PF2000F	135	55	96	26	72	64	33	36	26	49.5	55.5
PF4000F	176	65	109	46.5	84	74	42	40	28	70	78

4 Installation

4-1 Wiring method

· Note;2.Cautions for design selection

Connector

Type TM-4DSX3HG4

(Maker Correns Corporation)

Specification DC,4 wires, 0.5mm²

- Option(Analog output, Alarm output)

No symbol ;(0-5[V],NPN)

-P ;(0-5[V],PNP)

-A1 ;(4-20[mA])

-A2 ;(1-5[V],NPN) -PA2;(1-5[V],PNP)

-A3 ;(0-10[V],NPN)

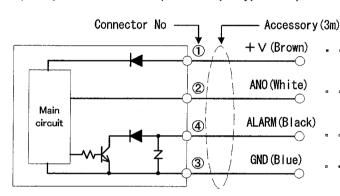
-PA3;(0-10[V],PNP)

;(Without analog output, NPN) ;(2-point alarm output,NPN) -A5

-PA4; (Without analog output, PNP) -PA5 :(2-point alarm output, PNP)

-A6 ; iIntegrated Pulse output, NPN, Aanalog output 0-5V)

1)No symbol,-A2,-A3,-A4(Alarm output type;NPN)



- - Connector should be connected to plus[+] side

of direct current source

· Analog output

: DC 15~24V±10%

Connector

pin No

Plug (Male)

: Voltage output in

propotion to flow

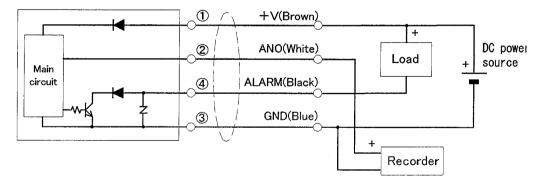
: MAX DC 30V-50mA

Alarm output (NPN)

- Connector should be connected to minus[-]side

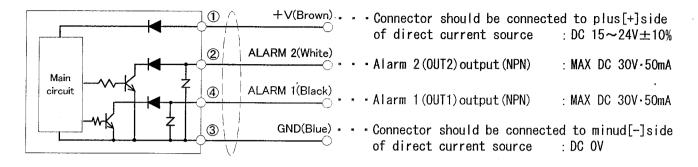
of direct durrent source : DC OV

Example of connection to relay/resistand load/recorder



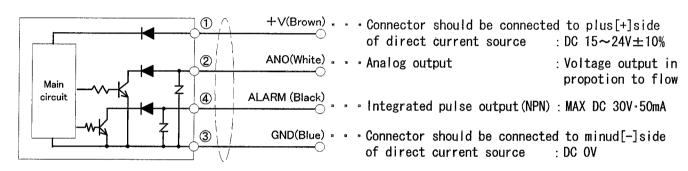
2)-A5(2-point alarm output:NPN)

When you select 2-point alarm output type, you can not use the analog output.



3)-A6(Integrated pulse output/Analog output 0-5V)

When you select Integrated pulse output type, you can not use the alarm output. An analog output can be used as standard.



5. Operation

5-1 Part names and functions

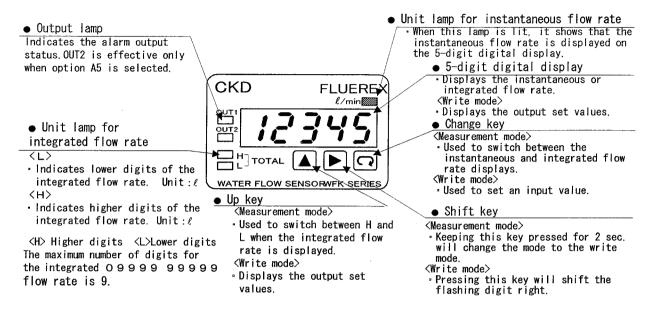


Fig. 5-1

5-2 Alarm parameters

Three kinds of settings are available depending on the application.

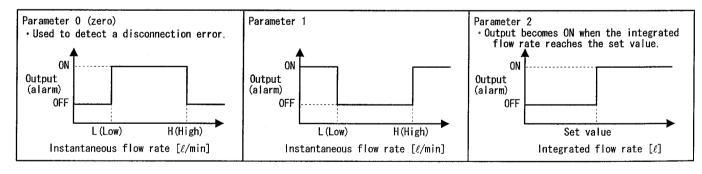


Fig. 5-2

Notes)

- 1) The output (alarm) ON status shows that the transistor is turned ON.
- 2) To ensure operational safety, always make the output settings after the upper units are stopped.
- 3) Set the parameters 0 and 1 so that the following conditions are met. If the conditions are not met completely, correct operation cannot be guaranteed.

$$0 < (L - h) <= L < (H - h)$$

However, note that the output is always OFF when L = H = h = 0 (at shipment from the factory).

5-3 Hysteresis

- · The hysteresis is set if the flow rate pulsates, causing the alarm to chatter.
- · When selecting 2-point alarm output (Option-A5), Hysteresis width of OUT1 is same as OUT2.

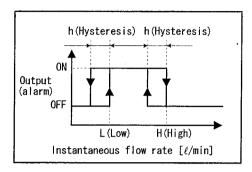


Fig. 5-3

5-4 Clearing of integrated value

- 1)Clear the integrated value using key operation in the write mode.
- 2)Clear the integrated value by turning OFF the power source.

5-5 Switching between instantaneous and integrated flow rate displays

• Every time the change key is pressed, the 5-digit display shows the instantaneous and integrated flow rate alternately. Additionally, it is also possible to temporarily switch the instantaneous flow rate display to the integrated flow rate display (for 10 sec.). Select a desired flow rate display as required.

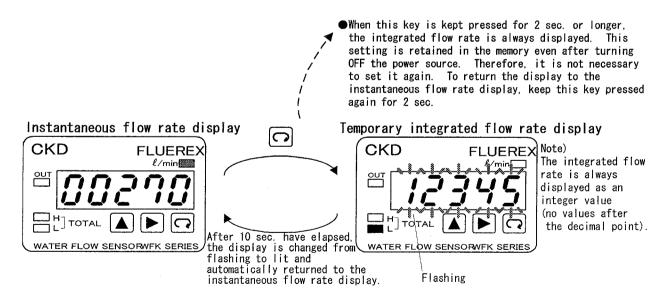


Fig. 5-4

5-6 Alarm setting procedure (instantaneous flow rate)

• The flow rate sensor enters the flow rate measurement state (measurement mode) as shown in Fig. 5-5 immediately after the power source is turned ON. The following describes procedures from the measurement mode with the values listed below.

P(Parameter) 0 L(Low) 100 H(High) 200 h(Hysteresis) 1

(To check the hardware of the flow rate sensor, all the LEDs are lit for 2 sec., and then the indication showing the flow rate range is lit for 1 sec. Immediately after the power source is turned ON.)

① Changing from measurement mode to write (setting) mode

· Keep the shift key pressed for 2 sec.

The OUT LED starts flashing, "P" is displayed at the first digit from the left end of the 7-segment LED display, and the LED at the fifth digit from the left end starts flashing.

2 Parameter setting

• Set a parameter using the up key .

- 3 Changing of mode to Low setting
- Press the change key . "L" is displayed at the first digit from the left end of the 7-segment LED display and the LED at the second digit from the left end starts flashing.

 (4) Low setting
 - ·Set a Low value using the shift \(\bigstar\) and up \(\bigstar\) keys.

 For example, to set "10" for Low, press the shift key once and the up key once. >
- (5) Changing of mode to High setting
- Press the change key . "H" is displayed at the first digit from the left end of the 7-segment LED display and the LED at the second digit from the left end starts flashing.

 (6) High setting

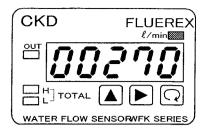
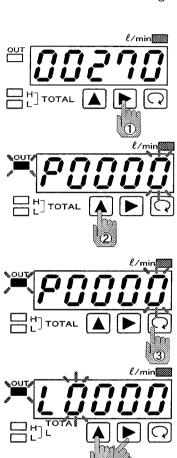
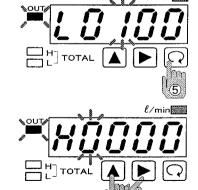


Fig.5-5





- 7 Changing of mode to hysteresis setting
 - Press the change key . "h" is displayed at the first digit from the left end of the 7-segment LED display and the LED at the second digit from the left end starts flashing.
- 8 Hysteresis setting
 - Set a hysteresis value using the shift \blacktriangleright and up \blacktriangleright

<For example, to set "1" for the hysteresis value, press the
shift key twice and the up key once. >

- 9 Changing of mode to integrated value clear mode
 - Press the change key (). The 7-segment LED display then shows the integrated flow rate and values at all digits start flashing. Additionally, the unit indication lamp "L-TOTAL" is lit.
- (11) Clearing of integrated value
 - To clear the integrated value, keep the shift | and up
 - keys pressed at the same time for 5 sec.

Note) If the integrated value does not need to clear, skip this step and jump to step (11), Completion.

- (11) Completion
 - Press the change key . The setting is completed and the display is returned to that appears immediately after the power source is turned ON. Fig. 5-5
- < 2-point alarm outputs>
- Parameter, Low, and High settings for OUT2 are added. After pressing the change key in above step (7), repeat operation steps (2) through (7). At this time, to show whether the OUT1 or OUT2 set value is indicated on the display, the OUT1 or OUT2 indication lamp is lit accordingly.

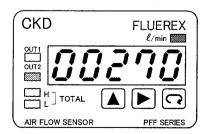
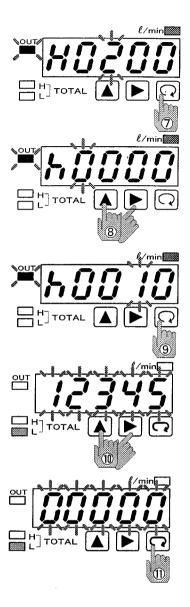


Fig. 5-6



5-7 Alarm setting procedure (integrated flow rate)

• The flow rate sensor enters the flow rate measurement state (measurement mode) as shown in Fig. 5-5 immediately after the power source is turned ON. The following describes procedures from the measurement mode with the values listed below.

(To check the hardware of the flow rate sensor, all the LEDs are lit for 2 sec., and then the indication showing the flow rate range is lit for 1 sec. Immediately after the power source is turned ON.)

- ① Changing from measurement mode to write (setting) mode
 - Keep the shift key pressed for 2 sec.

The OUT LED starts flashing, "P" is displayed at the first digit from the left end of the 7-segment LED display, and the LED at the fifth digit from the left end starts flashing.

- ②Parameter setting
 - Set a parameter using the up key .

<If the parameter is 2, press the up key twice.>

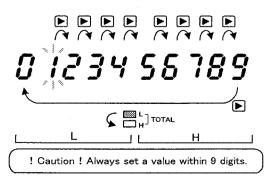
- (3) Changing of mode to integrated flow rate setting
 - Press the change key . The "H-TOTAL" indication lamp lights up and the LED at the second digit from the left end of the 7-segment LED display starts flashing. (At this time, the value indicated on the display is the previously set value. (Zero (0) is indicated at shipment from the factory.)
- 4 Integrated flow rate setting
 - Set an integrated flow rate set value using the shift 🕒

and up 🛕 keys.

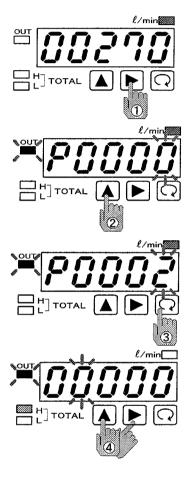
9-digit integrated flow rate set value is displayed by

changing H and L. Every time the shift key ▶ is pressed,

the digit is moved as shown below.



<For example, to set "200,000" for the integrated flow rate set value, press the shift key three times and the up key twice.>



- 5 Changing of mode to hysteresis setting
- Press the change key . "h" is displayed at the first digit from the left end of the 7-segment LED display and the LED at the second digit from the left end starts flashing.
- @Hysteresis setting
 - · Do not set any value.
- 7 Changing of mode to integrated value clear mode
 - Press the change key \(\superscript{\text{\text{\$\sigma}}} \). The 7-segment LED display then shows the integrated flow rate and values at all digits start flashing. Additionally, the unit indication lamp "L-TOTAL" is lit.
- ®Clearing of integrated value
 - ·To clear the integrated value, keep the shift 🕟 and up
 - keys pressed at the same time for 5 sec.

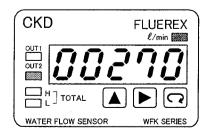
Note) If the integrated value does not need to clear, skip this step and jump to step (11), Completion.

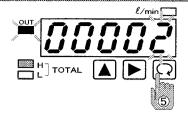
Completion

- Press the change key . The setting is completed and the display is returned to that appears immediately after the power source is turned ON. Fig. 5-5
- < 2-point alarm outputs>
- · Parameter, integrated flow rate settings for OUT2 are added.

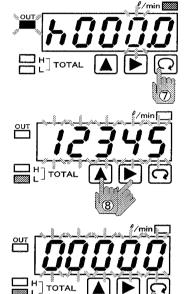
After pressing the change key \(\infty\) in above step (4), repeat operation steps (2) through (4). At this time, to show whether the OUT1 or OUT2 set value is indicated on the display, the OUT1 or OUT2 indication lamp is lit accordingly.

 It is also possible to individually set the instanta neous flow rate for OUT1 and integrated flow rate for OUT2.









6. Maintenance

6-1 If an error code is indicated

◆ If `Error' appears on the 5-digit display, check the error code and accordingly solve the problem.

Error code	Content	Corrective action
Err01	The abnormalities of a platinum thin film sensor	Contact the nearest sales agent.
Err02	Rated flow is exceeded or waterdrops have entered piping.	Rated flow is exceeded. Reduce flow below maximum limit. If the same error code is indicated after flow stops,waterdrops may have entered piping. (Inthis case, sensor performance cannot be guaranteed.) Remove moisture from piping. Sensor may be broken if continuously used without removing moisture. If sensor is broken, contact the nearest sales agent.
Err03	Low temperature	Temperature control is out of order.Accuracy cannot be guaranteed. Use at temperature within permissible
ErrOY	High temperature	limits.Sensor may be broken if continuously used at unacceptable temperatures.
Err 10	The abnormalities in writing of a memory	•Memory is out of order. Contact the nearest sales agent.
Errll	The abnormalities in reading of a memory	