Flow Sensor For Nitrogen Gas Extraction Unit

NS-QFS Series

INSTRUCTION MANUAL

SM-A30482-A

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's "NS-QFS Series" Flow Sensor For Nitrogen Gas Extraction Unit.
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the pneumatic or water control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

ISO 4414, JIS B 8370, JFPS 2008 (the latest edition of each standard), the High Pressure Gas Safety Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations.

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

The product is intended for use in devices or parts for general industrial machinery.

It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Precautions on Working Fluid

⚠ DANGER

Do not use this product for flammable fluids.

There is a risk of explosion.

⚠ WARNING

This product cannot be used as a business mater.

Do not use this product for commercial transactions as it is not compliant with the Measurement act.

Do not seal the fluid in the pipe for long periods of time.

Depending on the fluid, retaining the fluid for long periods could adversely affect the performance.

Use this product only within the specified range.

Applications exceeding the max. working pressure and specified flow rate range may result in faults.

When using a valve on the primary side of the sensor, use only valves with oil-prohibited specifications.

This sensor could malfunction or fail if exposed to splattering grease, oil, etc. As friction powder may be generated depending on the valve, mount a filter to prevent the powder from entering the sensor.

Use ambient/fluid temperatures from 5 to 50°C within the specified range.

Even if the temperature is within the specified range, do not use this product if the ambient temperature and fluid temperature could suddenly change and cause dew to condense.

⚠ CAUTION

Do not overflow.

The sensor can handle an overflow double the measured range. If dynamic pressure is applied near the maximum working pressure (when a pressure difference exceeding the max. working pressure is applied between primary and secondary sides), the sensor may operate abnormally.

Precautions on Maintenance

⚠CAUTION

Do not use solvent, alcohol or detergent in cleaning, since the resin could absorb it.
Wipe off dirt with a rag soaked in a diluted neutral detergent solution and wrung out well.

Check the flow rate accuracy periodically.
It is recommended to check the flow rate accuracy periodically. The accuracy may change from the initial state depending on the condition of use and the environment. Also, when the product is used for a long period, the accuracy may change due to a deterioration of the sensor chip.

This product's flow rate is measured at a mass flow rate unaffected by temperature or pressure.The unit is L/min, but this is the display when the mass flow rate is converted to volumetric flow rate at 20°C 1 atmosphere (101 kPa) relative humidity 65%RH.

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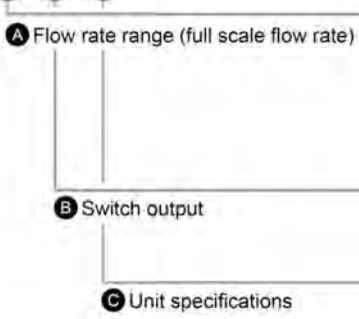
1. PRODUCT OVERVIEW

1.1 Model Number Indication

NS-QFS - (A)(N)(1)



Code	Description
Ⓐ Flow rate range (full scale flow rate)	
A	Flow rate range 20 L/min
B	Flow rate range 50 L/min
C	Flow rate range 100 L/min
D	Flow rate range 200 L/min
E	Flow rate range 500 L/min
Ⓑ Switch output	
N	NPN transistor open collector output 1 point
P	PNP transistor open collector output 1 point
Ⓒ Unit specifications	
1	SI units only
2	With unit switching function (overseas models only) *1

⚠ Precautions for model No. selection

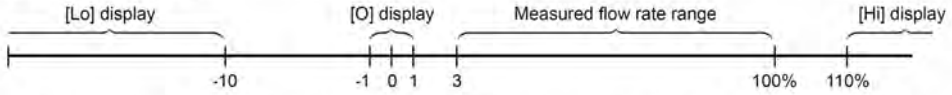
*1: Models with the unit switching function are not sold in Japan.

1.2 Specifications

Item				NS-QFS-A	NS-QFS-B	NS-QFS-C	NS-QFS-D	NS-QFS-E
Flow direction				Uni-direction				
Measurement flow rate range *1			(L/min)	0.6 to 20	1.5 to 50	3 to 100	6 to 200	15 to 500
Display				4 digit + +4 digit 2 color LCD				
Flow rate display range *2			(L/min)	-1.9 to 21.9	-4.9 to 54.9	-9.9 to 109.9	-19 to 219	-49 to 549
Integration display *3	Display range		L	0.0 to ± 999999.9 L			0 to ± 9999999 L	
	Pulse output rate		L	0.2	0.5	1	2	5
Working conditions	Applicable fluids			Nitrogen gas				
	Temperature range		°C	5 to 50 (no condensation)				
	Pressure range		MPa	0 to 1.0				0 to 0.75
	Proof pressure		MPa	1.5				
Operating ambient temperature/humidity				5 to 50 °C, 90% RH or less				
Storage temperature			°C	-10 to 60				
Accuracy *4 (Fluid: in dry air)	Accuracy		*5	Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")				
	Repeatability		*6	Within ±1% F.S. (Secondary side released to atmosphere)				
	Temperature characteristics			Within ±0.2% F.S./°C (15 to 35 °C, base temperature 25 °C)				
	Pressure characteristics			Within ±5% F.S. (0.35 MPa reference)				
Response time			*7	50 msec or less (setting response time OFF)				
Switch output	[B]	N		NPN open collector 1 point output (50 mA or less, voltage drop 2.4 V or less)				
		P		PNP open collector 1 point output (50 mA or less, voltage drop 2.4 V or less)				
Analog output				4 to 20 mA current output (connecting load impedance 0 to 300 Ω)				
Power supply voltage				24 VDC (21.6 to 26.4 V) ripple rate 1% or less				
Current consumption			*8	45 mA or less				
Lead wire				ø3.7, AWG26 or equivalent x 5-conductor, insulator O.D. ø1.0, length 2.5 m				
Functions				(1) setting copy function, (2) flow rate integration, (3) peak hold, etc.				
Degree of protection				IP40 or equivalent (IEC standard)				
Protection circuit			*9	Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection				
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8				
Weight			kg	0.8				

*1:The value converted to volumetric flow rate at standard condition (20 °C 1 barometric pressure (101 kPa) relative humidity 65%).

*2: Display at each flow rate is as follows.



*3: The accumulated flow is a calculated (reference) value. When using the integrated save function, take care to prevent the number of saves from exceeding the access count limit of the storage device (1 million times). (Changes to various settings also are counted in the access count.)
Number of saves = Usage time / 5 minutes < 1 million times
When instantaneous flow rate is below 1% it is not counted as integrating flow.

*4: Compressed air is used for adjusting and inspecting this product.

*5: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy. Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ± 3% F.S.

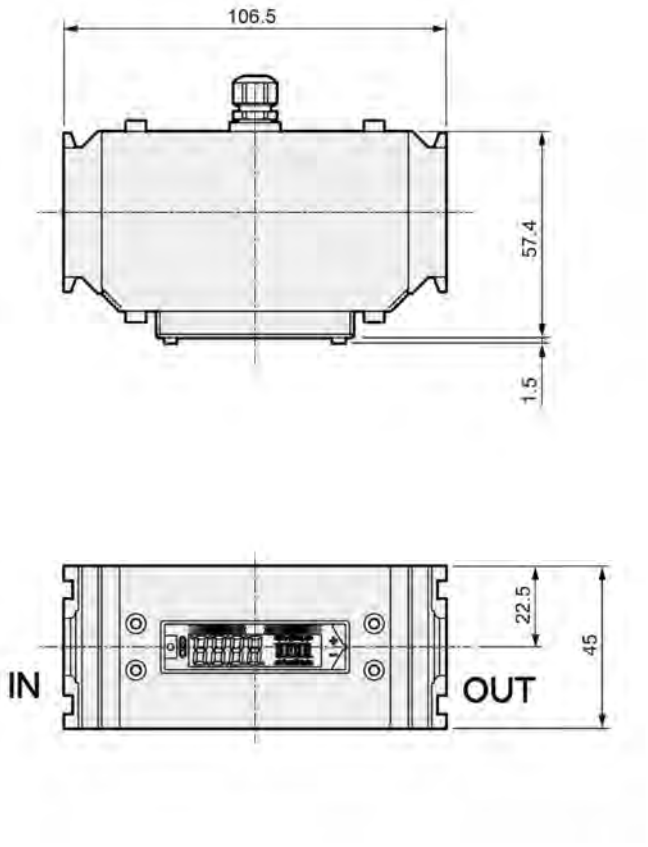
*6: Repeatability calculated during a short time. Change over time is not included.

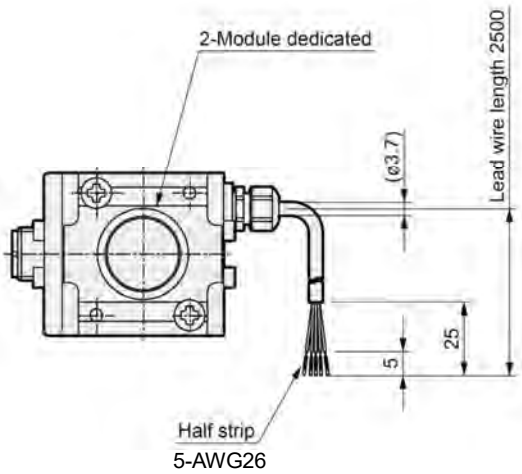
*7: The actual response time changes depending on the piping conditions. As a guideline, the response time can be set within the range of 50 msec to 1.5 sec.

*8: Current for when no load is applied. Please note that the current consumption changes depending on the load connection status.

*9: This product's protection function is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.

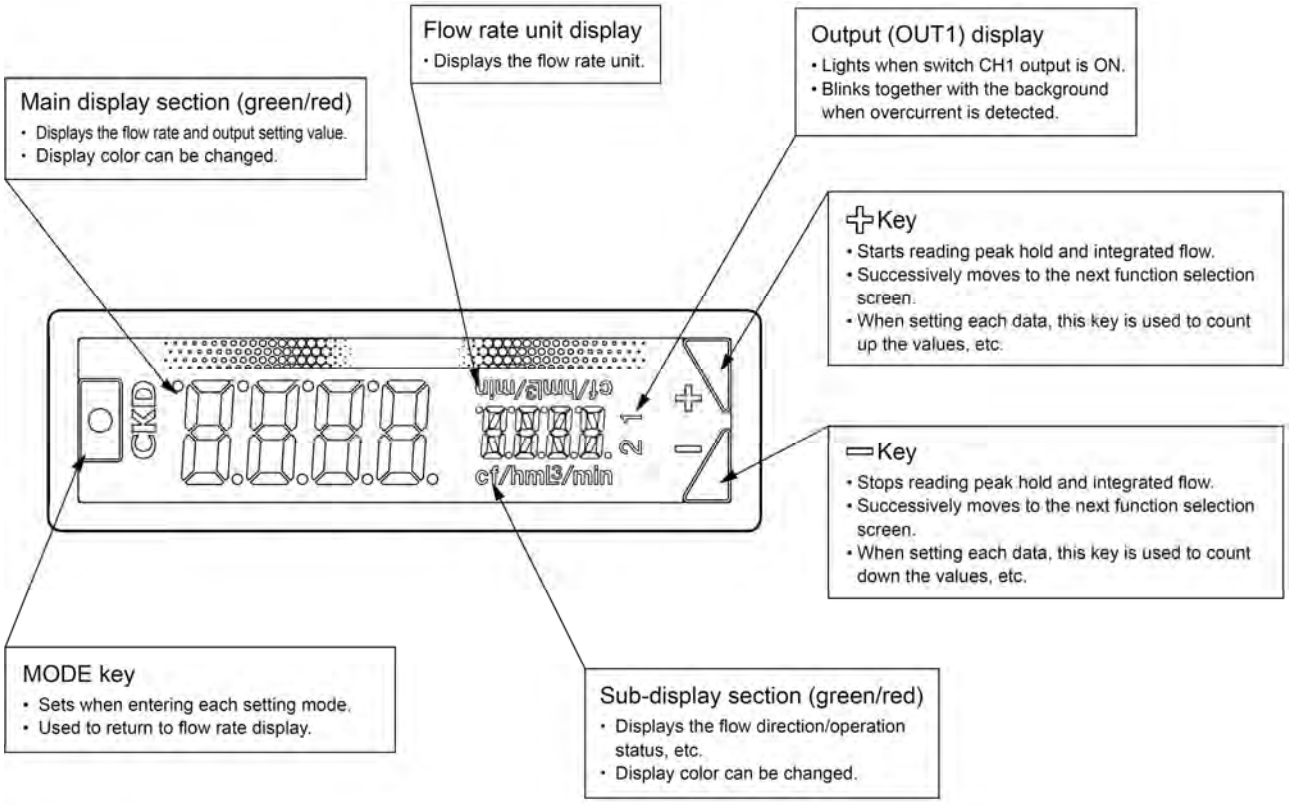
1.3 Dimensions





1.4 Functions

1.4.1 Names and Functions of Display and Operation Panel



1.4.2 Function descriptio

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

■ **Normal operation (RUN mode)** (Refer to Page 7 for the operation.)

Item	Explanation	Default setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	Instantaneous flow rate display
Peak hold function	Max. and min. values for the flow rate within a set interval are displayed.	
Integrating flow display	The integrated flow can be displayed. The switch output 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.	

■ **SET mode** (Refer to Page 8 for the operation.)

No.	Item	Explanation	Default setting
F.01	Selection of CH1 operation	Select the function of CH1. Switch output operation and integrated pulse settings can be set.	No switch output
F.03	Integrating function settings	You can choose to acquire integrating flow values consecutively or at set times. You can also choose to keep the data or not.	Consecutive acquisition: Data hold OFF
F.04	Sub-screen display Setting	Set the sub-display section's display method. Can be switched to flow direction, reference state, or number display.	Flow direction
F.05	Display color setting	Set the display color. (Red, Green) The color for normal display and for switch output ON can be set.	At normal: Green At switch ON: Red
F.07	Display inversion Function	The LCD display can be vertically inverted.	Standard display
F.08	Reference state setting	Select from the standard state or reference state. Standard state (ANR): Converted into volumetric flow rate at 20 °C, 1 barometric pressure, relative 65% Reference state (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure, 0% RH	Standard state (ANR)
F.09	Unit setting (For overseas only)	The units can be set. Can be selected from L/min and cf/h.	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.	0.5 sec
F.11	Analog output setting response time	Set the response time.Response can be set in seven stages from 0.05 sec to approx.. 1.5 sec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	0.05 sec
F.12	Numbering setting	You can set the numbering.	0000
F.14	Setting ECO mode	An 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.16	Lock setting	Key lock method and PIN number method can be set. Change use according to the working environment. If you have forgotten your PIN code, please contact your nearest CKD branch.	OFF
F.17	Peak hold setting	You can choose to acquire peak bottom values consecutively or at set times. You can also choose to keep the data or not.	Consecutive acquisition: Data hold OFF

Note1: Data is saved every 5 minutes. Please be careful that the number of times maintained does not exceed the number of access times of the storage element (the limit is 1 million times).
（Changes to various settings are also counted in the number of accesses.）
Times maintained = Usage time / 5min（＜1 million）

■ **Maintenance mode** (Refer to Page 15 for the operation.)

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 compensated.	Adjust value : 0
F.93	Setting copy function	Operation and setting values can be easily copied between NS-QFS of the same model No.	—
F.99	Reset function	Returns the settings to the default settings.	—

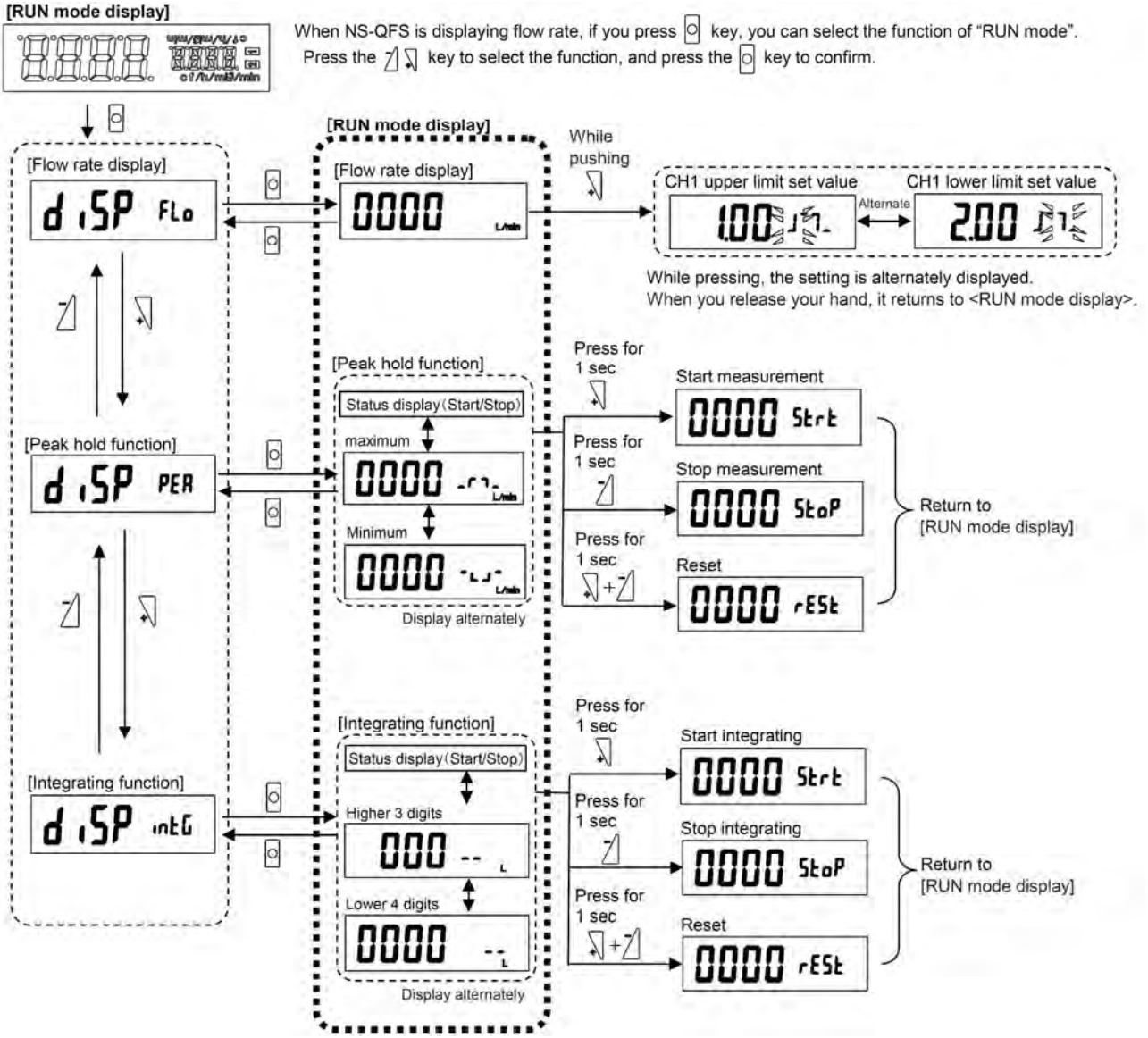
■ **Setting monitor mode** (Refer to Page 16 for the operation.)

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

1.5 How to operate

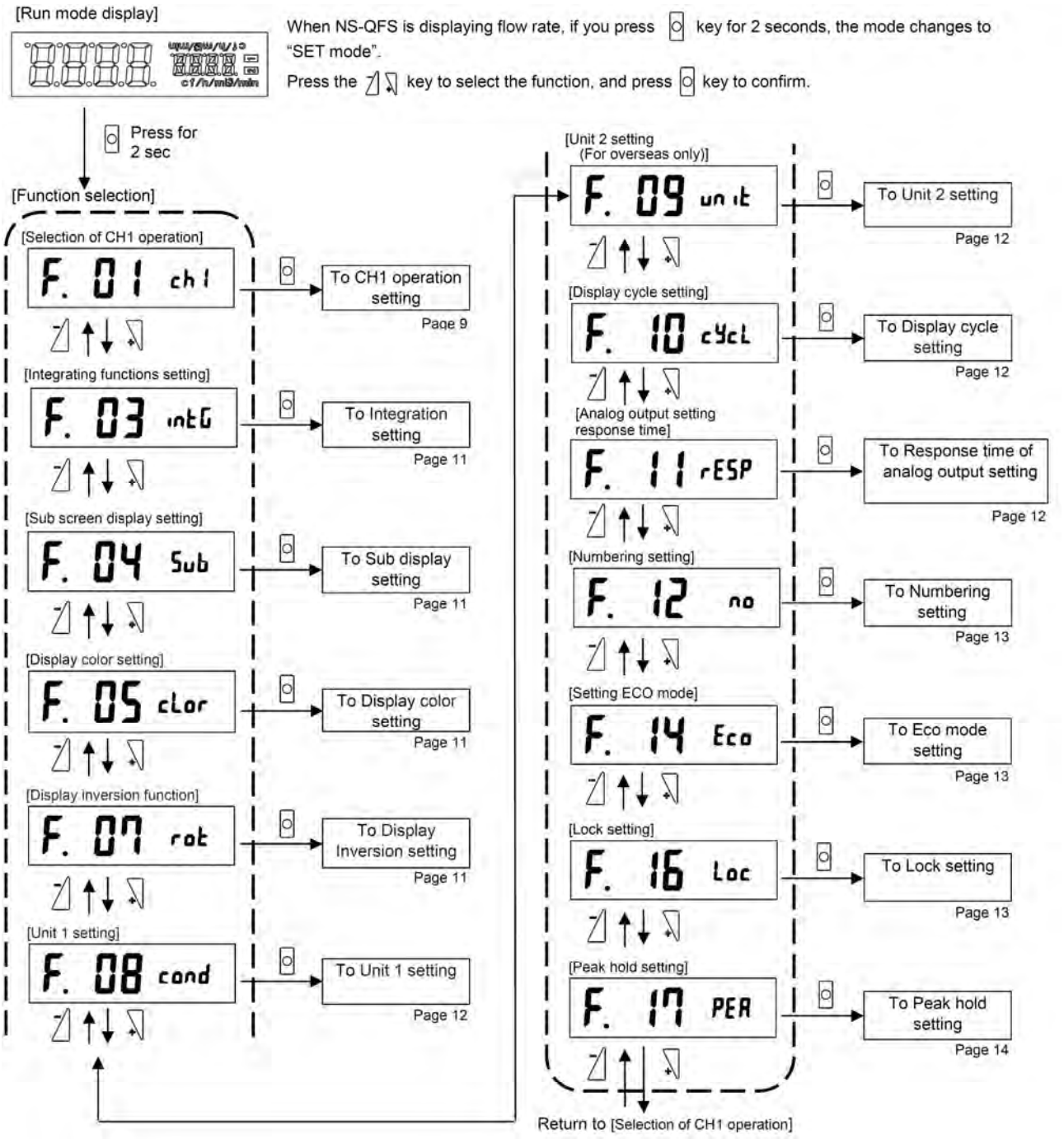
1.5.1 RUN mode

*The figure of the key without comments means “Press one time”.



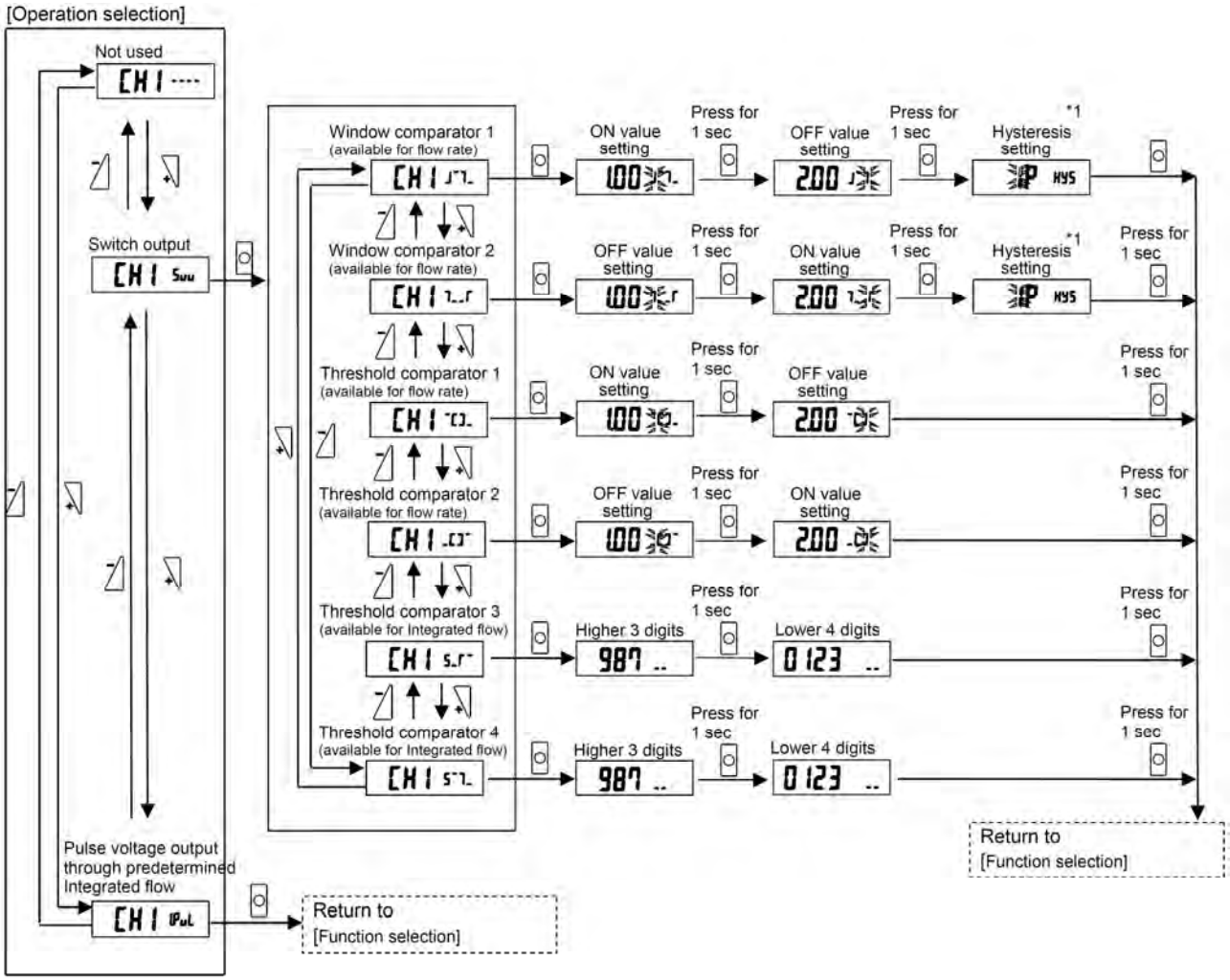
1.5.2 SET mode

*The figure of the key without comments means “Press one time”.



■ F.01_Selection of CH1 operation

Select the CH1 setting.
Switch output operation and integrated pulse settings can be set.

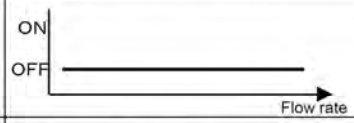
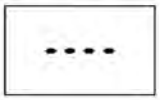
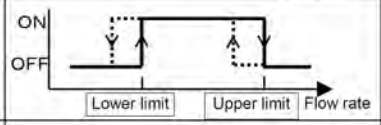
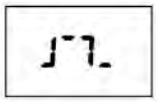
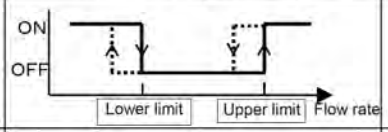
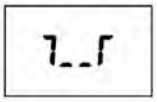
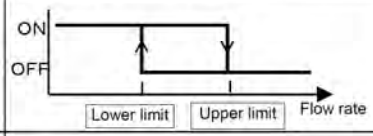
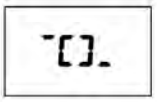
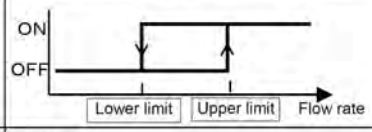
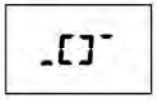
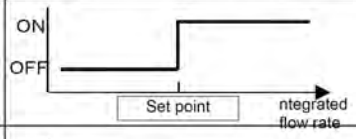
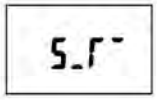
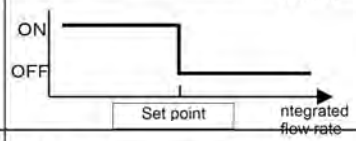
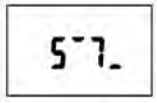
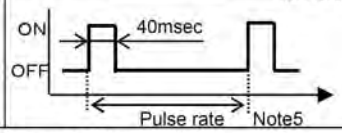
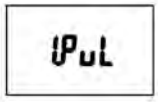


*1 Set the hysteresis value satisfies the relationship below, so as to work correctly.
(Higher value - lower value) > 2 × Hysteresis
The default setting of hysteresis is "1 P" = (1%).

[Note] Press ○ + ⊿ , or in 30 seconds without operation, so NS-QFS returns "RUN mode".

Supplement [1] : Switch output function

Depending on the application, you can choose from 8 types of switch operation.

No.	Operation pattern	Description	Operation waveform	LCD display (Sub display)
1	Switch output OFF	Switch output OFF		
2	Window operation [1] (Range inside ON) Note1, 2	The switch turns ON when the level is within the designated flow rate range.		
3	Window operation [2] (Range out ON) Note1, 2	The switch turns ON when the level is not within the designated flow rate range.		
4	Hysteresis operation [1] (Flow rate small side ON) Note1, 3	ON when lower than set point. Hysteresis can be arbitrarily set.		
5	Hysteresis operation [2] (Flow rate large side ON) Note1, 3	ON when higher than set point. Hysteresis can be arbitrarily set.		
6	Integrated output [1] (On when higher than set integration) Note4	The switch turns ON at the set integrated flow.		
7	Integrated output [2] (Off when higher than set integration) Note4	The switch turns OFF at the set integrated flow.		
8	Integrated pulse Note5,6	The integrated pulse is output during integration. See specifications for details on the pulse output rate.		

Note1: The range of 0 to 100% of the full scale flow rate is the settable range.

Note2: Hysteresis can be set for the upper and lower limits of Window operation [1] or [2] . Hysteresis can be set from 1 to 8% FS.

Note3: Switch output is kept ON even if it exceeds measurement flow range when switch output is ON. (ON also when Hi or Lo is displayed)

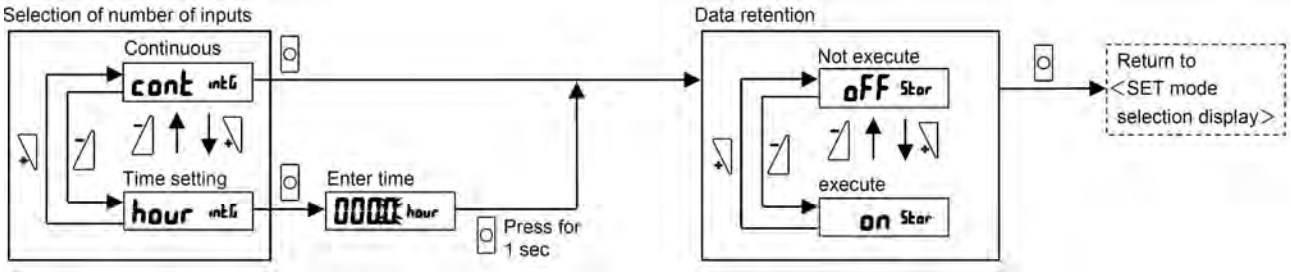
Note4: The displayable range of integrated flow rate is the settable range.

Note5: Refer to [Pulse output rate] in <1.2. Specifications>.

Note6: When the integrated pulse output is set, the output (OUT 1) display also flashes.

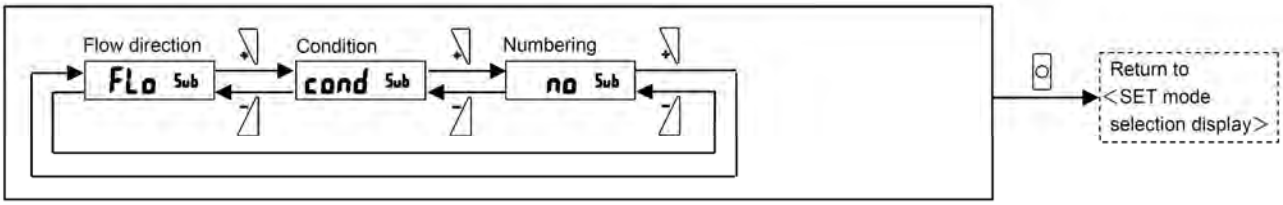
■ F.03_Integrating function settings

You can choose to acquire integrating flow values consecutively or at set times.
You can also choose to keep the data or not.



■ F.04_Sub-screen display setting

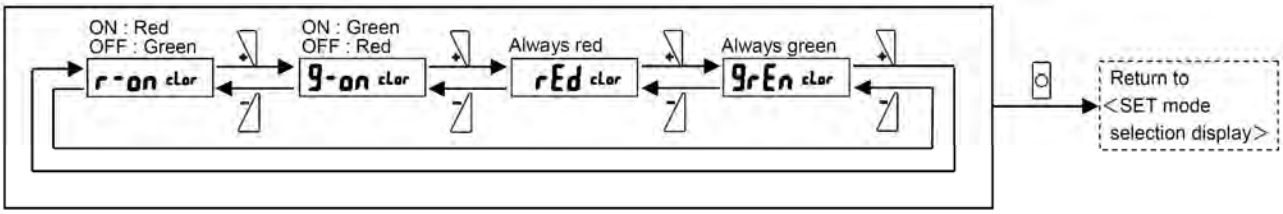
Set the sub-display section's display method.
Can be switched to flow direction, reference state, or numbering display.



■ F.05_Display color setting

Set display color. (red, green)

The color for a normal display and for switch output ON can be set.



■ F.07_Display inversion function

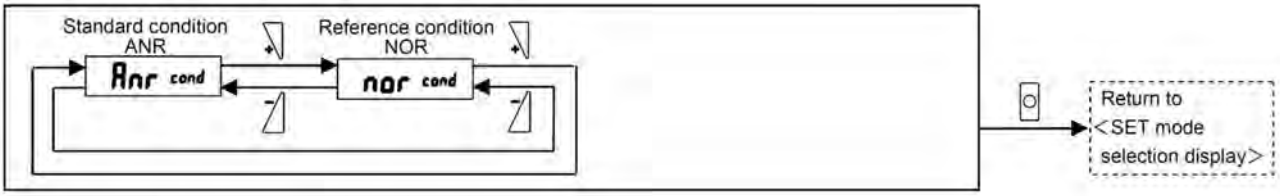
The LCD display can be vertically inverted.

■ F.08_Reference state

Select from the standard state or reference state.

Standard state (ANR): Converted into volumetric flow rate at 20 °C, 1 barometric pressure, relative 65%

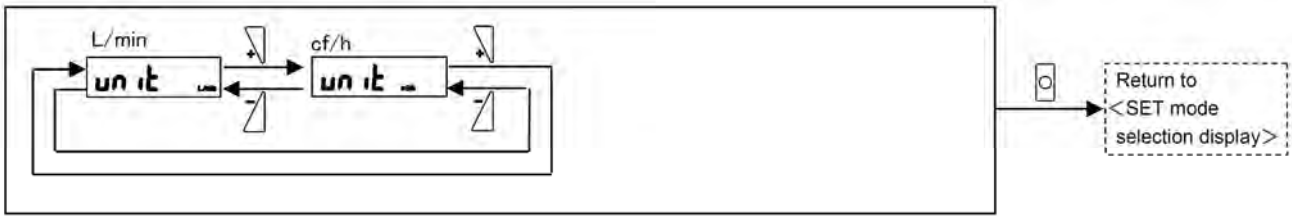
Reference state (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure, 0% RH



■ F.09_Unit setting

(For overseas only)

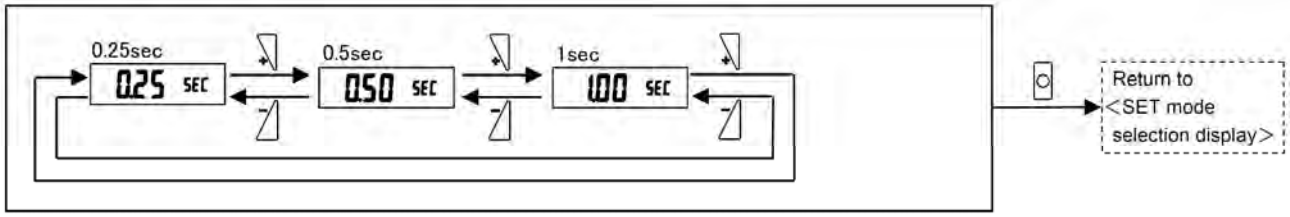
The units can be set.Can be selected from L/min and cf/h.



■ F.10_Display cycle setting

The digital display refresh cycle can be set in three stages from 0.25 sec to 1 sec.

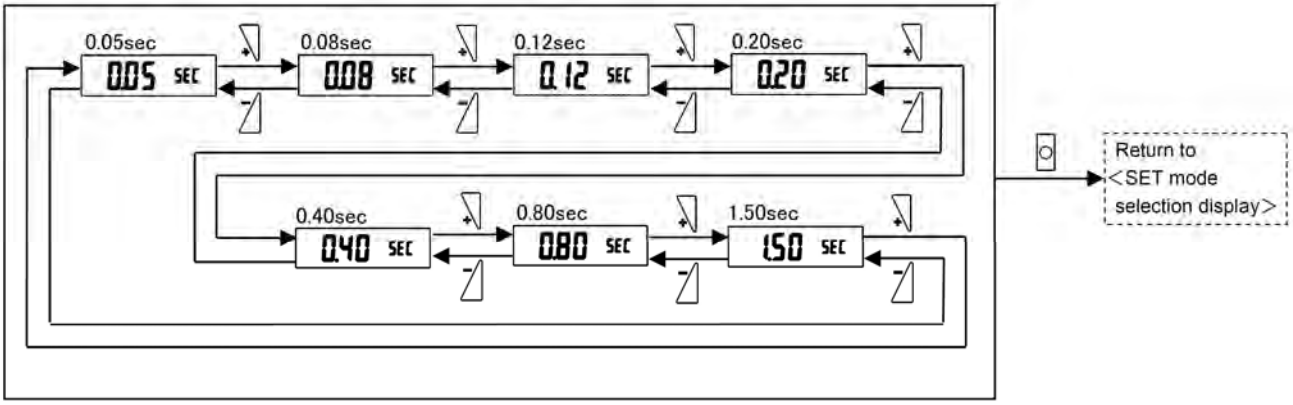
If the display flickers, it may be improved by setting a longer display refresh cycle.



■ F.11_Analog output setting response time

Set the response time.Response can be set in seven stages from 0.05 sec to approx. 1.50 sec.

Chattering and mis-operation caused by sudden flow rate changes or noise ar e prevented.

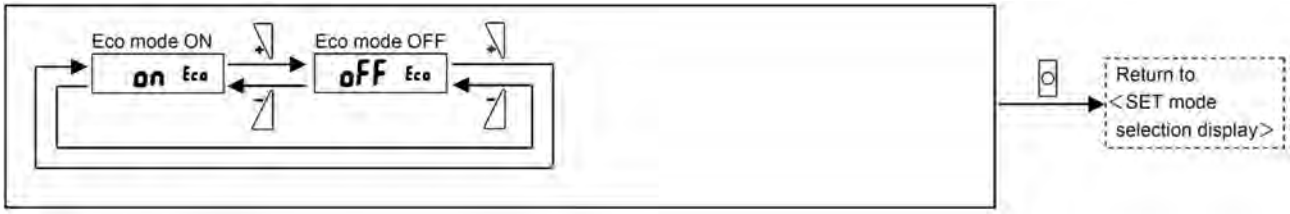


■ F.12_Numbering setting

Any unique number can be assigned to each product.

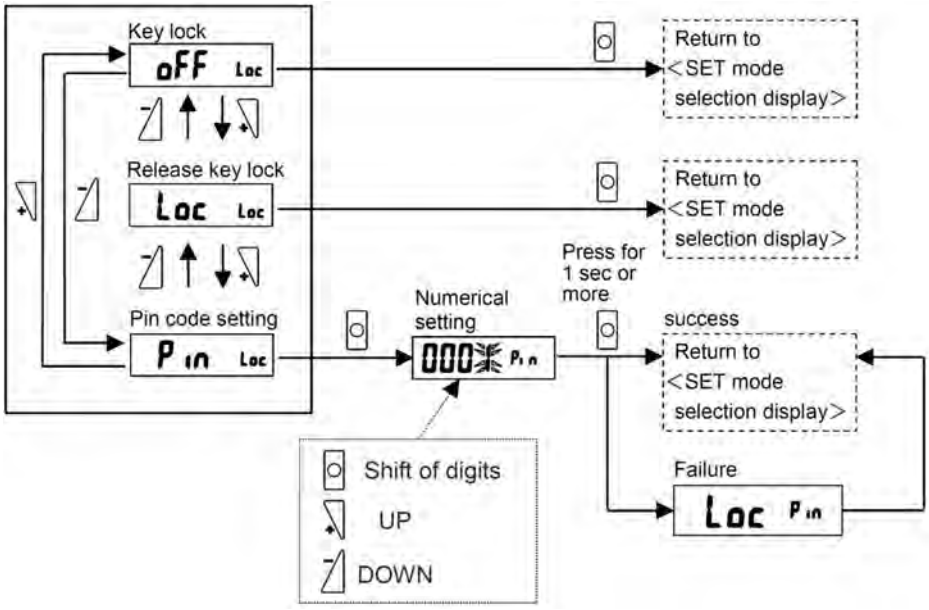
■ F.14_Setting ECO mode

An 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.



■ F.16_Lock setting

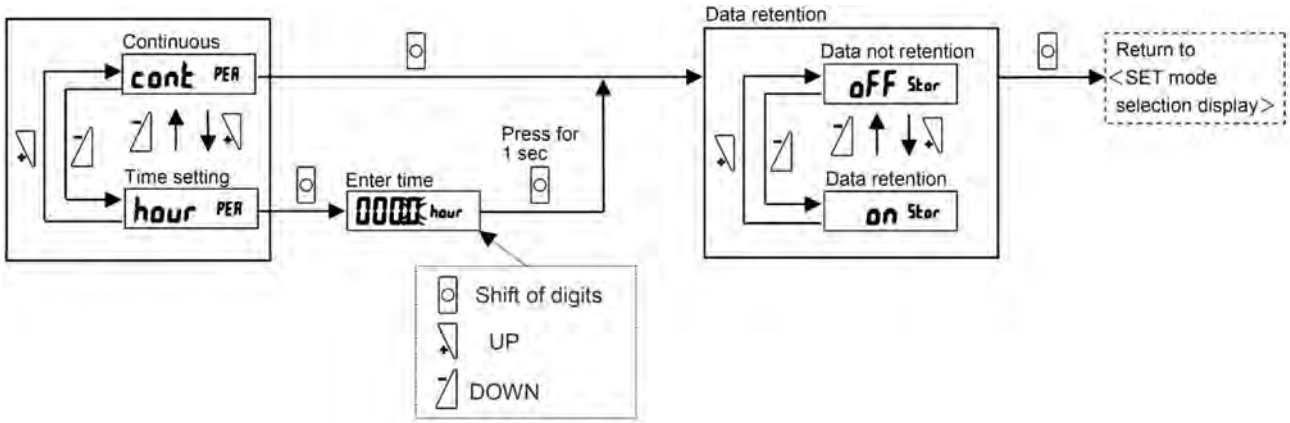
Set key locking method.
Set whether to enable key lock (to prevent operation) or reset by pin code.
In the case of secret code setting, the lock function works and it becomes the pin code input screen.



* If you have forgotten your PIN code, please contact your CKD branch.

■ F.17_Peak hold setting

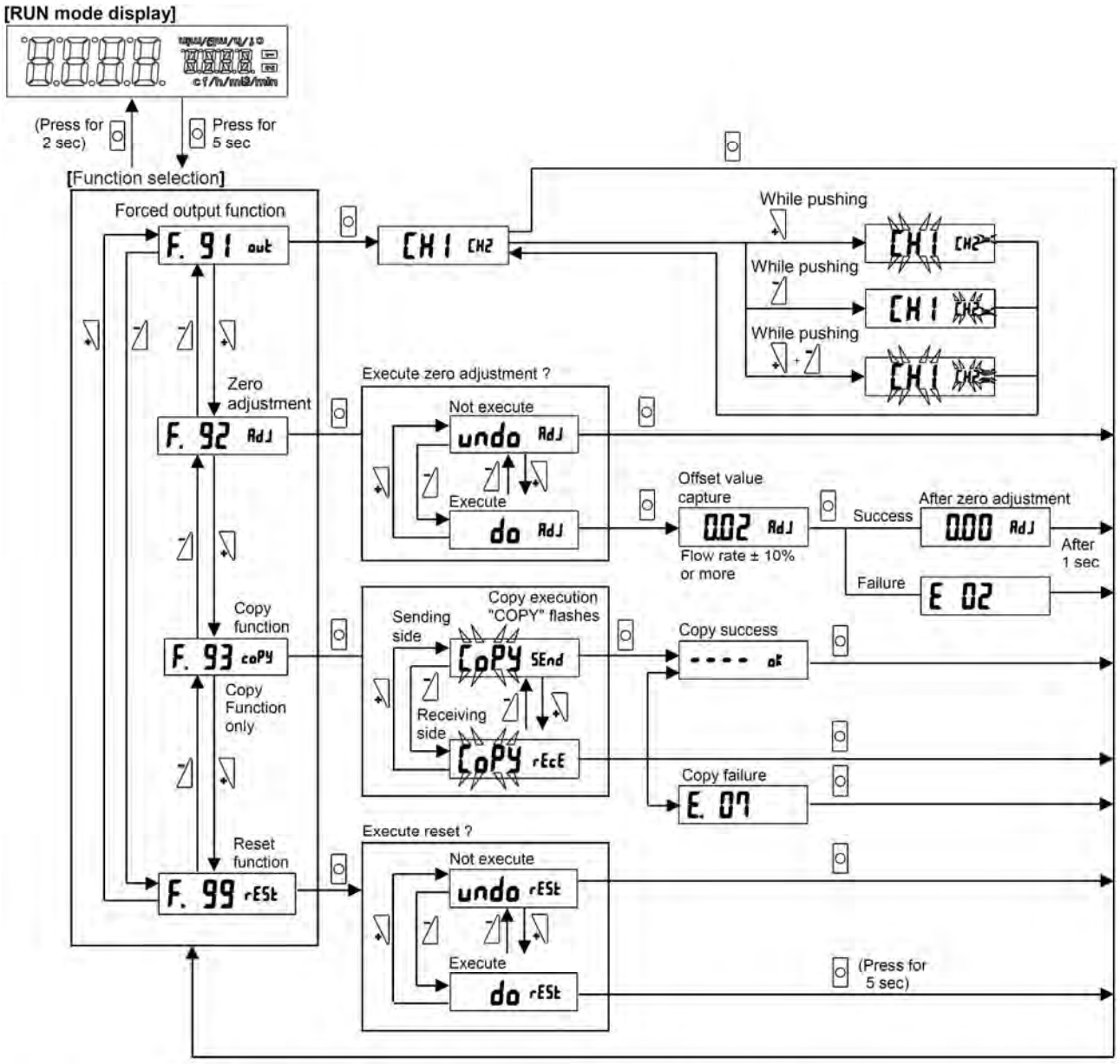
You can choose to acquire peak bottom values consecutively or at set times.
You can also choose to keep the data or not.
Data retention is saved periodically (every 5 minutes) in EEPROM.



*If you perform "F.08" (unit 1 setting), "F.09" (unit 2 setting),
F.01 (Operation setting), Integrated flow value, peak hold value are reset.

1.5.3 Maintenance mode

*The figure of the key without comments means “Press one time”.



※1 Pressing + on all screens except <Function selection screen> returns to <Function selection screen>.
(However, this operation is not accepted during copying)

※2 Pressing + on the full screen of <Function selection screen> returns to <RUN mode display>.

※3 Copy function copies F.01 to F.17 setting in SET mode.
However, F.12(Numbering function) · F.16(Pin code) is not copied.

※4 Resetting will restore the factory default settings.

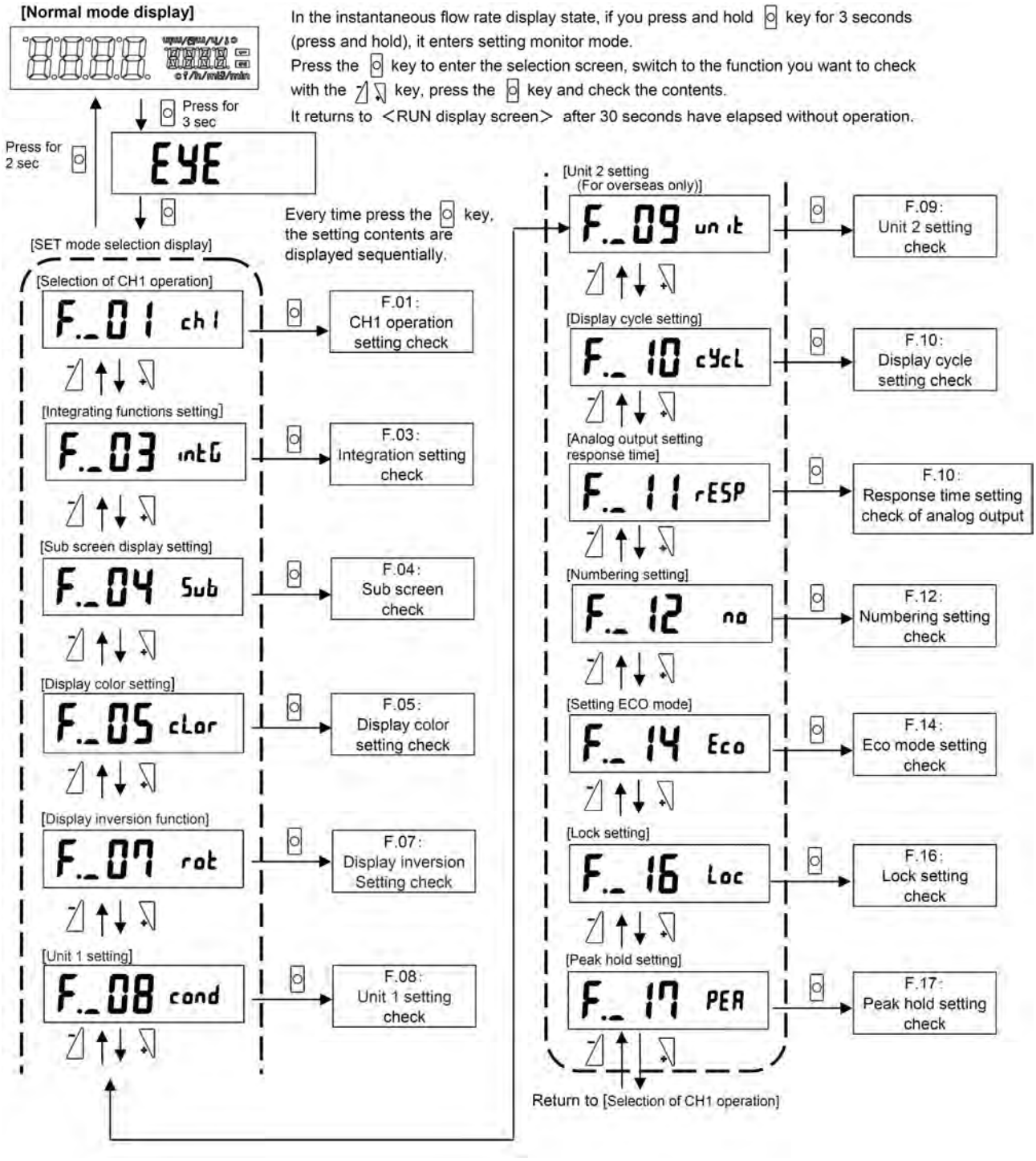
※5 When one second has elapsed by pressing the or in the <function selection screen>, you can accelerate the count up or count down.

※6 It returns to <RUN display screen> after 30 seconds have elapsed without operation.

※7 In the integrated output setting [1], [2], when setting a negative value, the negative display is " 123 " instead of " -123 ".

1.5.4 Setting monitor mode

*The figure of the key without comments means “Press one time”.



2. INSTALLATION

2.1 Environment

⚠ DANGER

Never use this product in an explosive gas atmosphere.
The structure is not explosion-proof, and explosions or fires could occur.

⚠ WARNING

If the failure of this product leads to a serious accident, be sure to provide a fail-safe mechanism.

Do not use this product in an atmosphere containing corrosive gases such as sulfur dioxide.

Use ambient/fluid temperatures from 5 to 50°C within the specified range.
Even if the temperature is within the specified range, do not use this product if the ambient temperature and fluid temperature could suddenly change and cause dew to condense.

Do not install this product where water, salt, dust, or swarf is present or in a pressurized or depressurized environment.
Drip-proof environments: The degree of protection of this product is equivalent to IP40.
The product cannot be used with large temperature variations or high temperature/humidity since condensation may occur inside the body.

Do not install the product to a movable section or in places subject to vibrations.
Vibrations and shocks may cause a malfunction.

⚠ CAUTION

A final clean filter should be used in circuits where dust generation could be a problem.
The flow path is not completely free of dust generation.

Always attach the pipes before starting wiring.

Align the fluid flow direction to the direction indicated on the product when connecting the pipes.

Before installing piping, clean out the pipes using air blower to remove all foreign matter and cutting chips from the pipes.
The rectifier or sensor chip could be damaged if a large amount of foreign matter, cutting chips, etc., enters.

Do not install the regulator/solenoid valve, etc., immediately before the product.
Generated drift may cause errors.

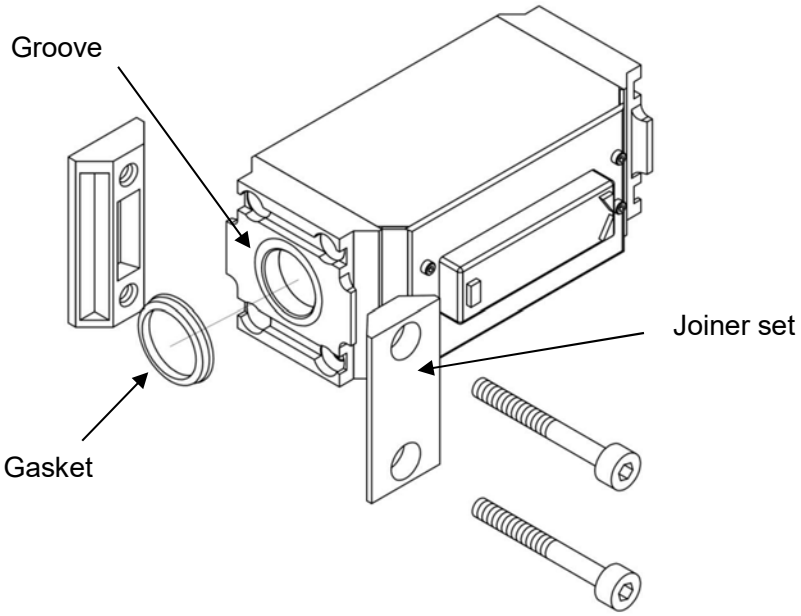
Do not subjected to torsion, tension or moment load to the product.

The LCD display type flow rate meter uses a liquid crystal display.This may be difficult to read depending on the angle.

2.2 Mounting

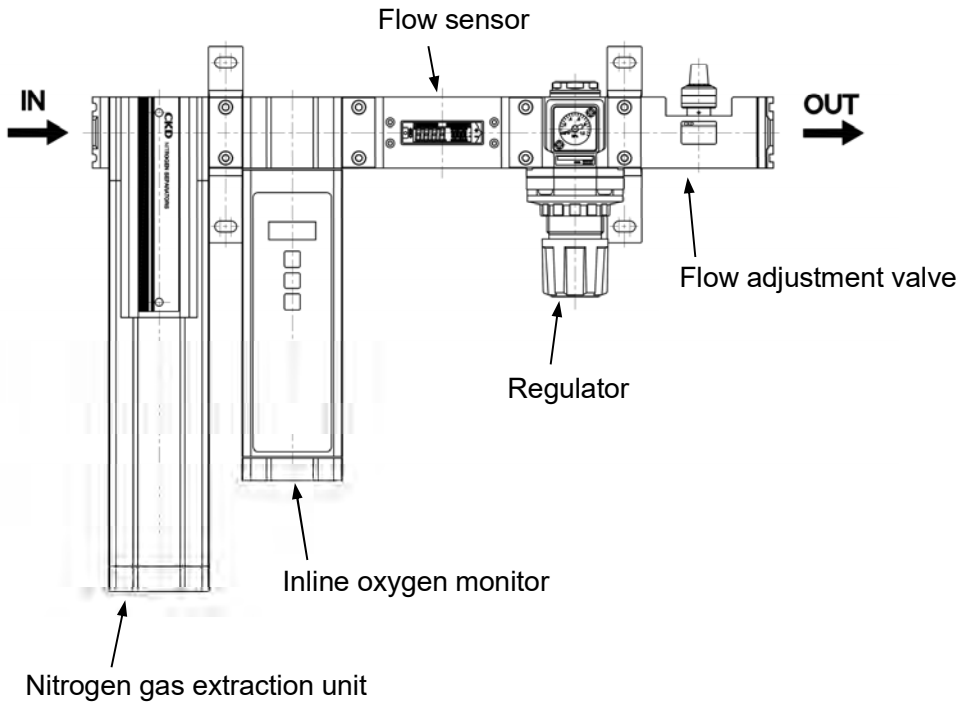
■ Module mounting

Attach to the secondary side of our nitrogen gas extraction unit using the attached joiner set.
When mounting, make sure to insert the gasket into the groove of the product.
Tightening torque of joiner screw：6.9±0.7N



■ Module mounting example

Install on the secondary side of the nitrogen gas extraction unit.
The equipment that causes the drift (regulator, flow adjustment valve, solenoid valve, controller, tc.) install it on the secondary side.



2.3 Wiring

⚠ DANGER

Use power supply voltage and output within the specified voltage.
If voltage exceeding the specified voltage is applied, the sensor could malfunction or be damaged, or electrical shock or fire could occur. Do not use any load that exceeds the rated output. Otherwise, output damage or fire may result.

Stop the control device and equipment and turn power OFF before wiring.
Starting operation suddenly could cause unpredictable and dangerous operation.
Conduct an energized test with controls and machine devices stopped, and set target switch data.
Be sure to discharge any accumulated electrostatic charge among personnel, tools, or equipment before and during work.

⚠ WARNING

Install the product and wiring away from sources of noise, such as power distribution wires.
Provide separate countermeasures for surge applied to the power cable.
The display or output could fluctuate.

Do not short-circuit the load.
Failure to observe this could result in rupture or burning.

Ensure that wires are properly insulated.
Check that wires do not come into contact with other circuits, that no ground faults occur, and that the insulator between terminals is not defective.
Overcurrent could flow in and damage the sensor.

Check line color when wiring.
As incorrect wiring could result in sensor damage and malfunctions, check wire color against the instruction manual before wiring.

Use a stabilized DC power supply within the specified rating that has been insulated from the AC power supply.

A non-insulated power supply could result in electrical shock. If power is not stabilized, the peak value could be exceeded. This could damage the product or impair accuracy.

Do not use at levels exceeding the power supply voltage range.
If voltage exceeding this range is applied or if AC power (AC100V) is applied, the product could rupture or burn.

Check that stress (7 N and over) is not directly applied to the sensor cable.

The power supply is a DC stabilized power supply completely isolated from the AC primary side. Connect either the + side or - side of the power to the F.G.
Between the internal power circuit and the product`s housing, a varistor (limit voltage approx. 40 V) is connected to prevent dielectric breakdown of the sensor. Do not conduct a withstand voltage test or insulation resistance test between the internal power circuit and product housing. Disconnect wiring first if this testing is required. An excessive potential difference between the power supply and product housing will burn internal parts. After installing, connecting and wiring the unit, electrical welding of the device/frame, short-circuit accidents, etc., could cause welding current, excessively high voltage caused by welding, or surge voltage, etc., to run through the wiring, ground wire, or fluid path connected between the above devices, damaging wires or devices. Conduct any work such as electrical welding after removing this device and disconnecting all electric wires connected to the F.G.

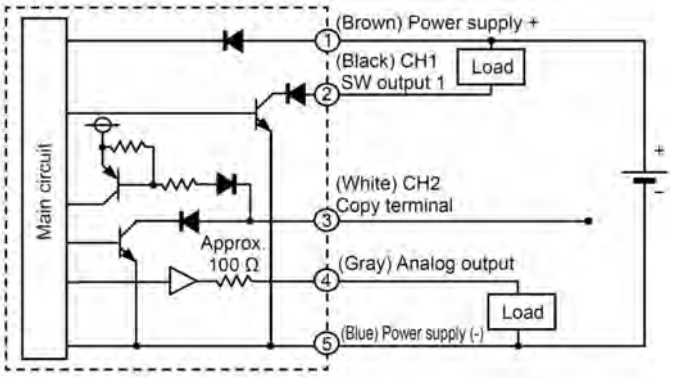
⚠ CAUTION

Confirm that switch operation is stable before use.

If switches are operated when fluid is pulsating or flow rate is otherwise unstable, operation may be unstable. Avoid setting switches in an unstable area.

2.3.1 Example of internal circuit and load connection

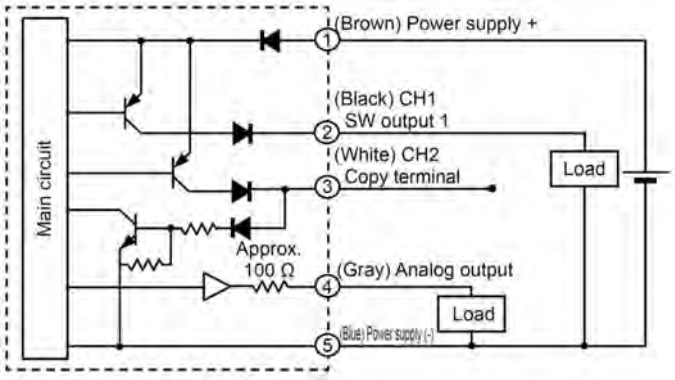
■ NPN output



*When using the copy function, please refer to "2.3.1 When copying setting values"

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 Current output: 4 to 20 mA load impedance 300 Ω or less
(5)	Blue	Power supply - (GND)

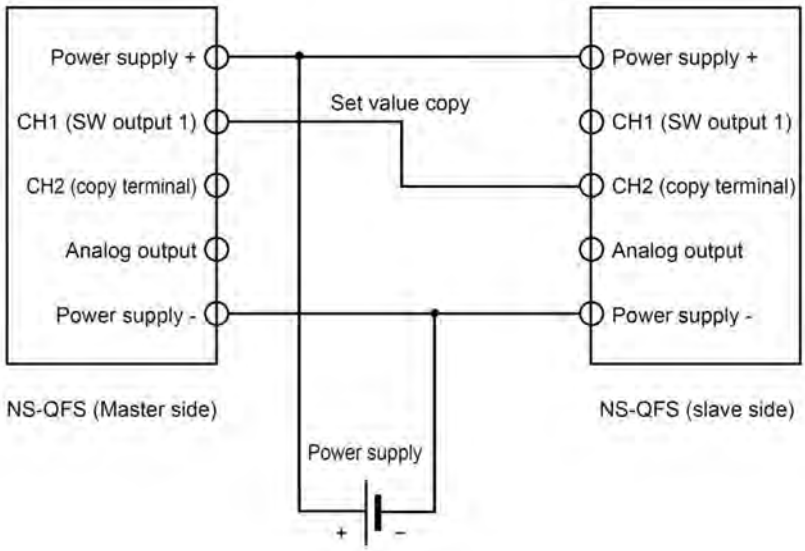
■ PNP output



*When using the copy function, please refer to "2.3.1 When copying setting values"

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 Current output: 4 to 20 mA load impedance 300 Ω or less
(5)	Blue	Power supply - (GND)

■ When copying setting values



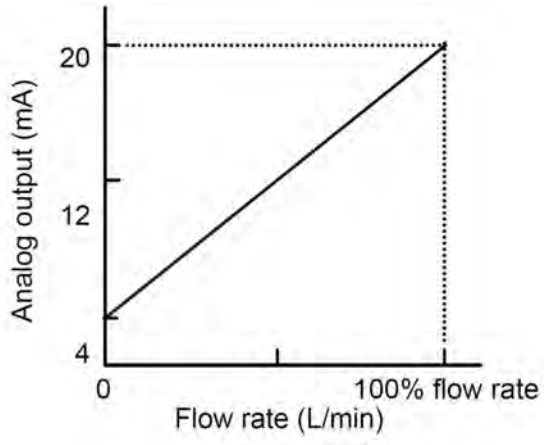
Connect CH1 (SW output 1) on the master side to CH2 (copy terminal) on the slave side and power ON the sensor to use the setting copy function (F93).

Use this connection only when using the setting copy function.

As with the load connection example above, if copying is performed with the load connected to CH1, or the switch is operated while CH1 and CH2 are connected the device may operate unexpectedly or the device and NS-QFS may malfunction.

Never use the unit with the copy terminal connected.

2.4 Analog output characteristics



3. USAGE

⚠ WARNING

Observe the conditions of use for conforming to the CE standard.

This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:

[Conditions]

- The evaluation of this product is performed by using a lead wire that has a power supply line and a signal line paired to assess the product's performance.
- This product is not equipped with surge protection. Implement surge protection measures on the system side.

Do not disassemble or modify.

This may cause malfunction.

Provide a standby time (5 minutes or more) after turning the power ON for use.

Output accuracy is affected by temperature characteristics and heat generated when energized.

Provide a control circuit/program that ignores signals for at approximately five seconds after power is turned ON.

Immediately after power is turned ON, this product does not start flow rate detection switch operation for approx. 5 seconds to complete self-diagnosis.

⚠ CAUTION

If a problem occurs during operation, immediately turn the power OFF, stop use, and contact your dealer.

This product uses a micro-sensor chip, and must be installed where it will not be subject to dropping, impact or vibration.

Handle this product as a precision component during installation and transportation.

Keep this product's flow rate within the rated flow range.

Use this product within the working pressure.

When changing the output set value, turn OFF the equipment first in order to prevent unexpected operation in the control system equipment.

Analog output continues even if the flow rate range is exceeded.

"Hi" or "Lo" will be displayed. Note that this is outside the guaranteed precision.

It is recommended to check the operation of the product periodically.

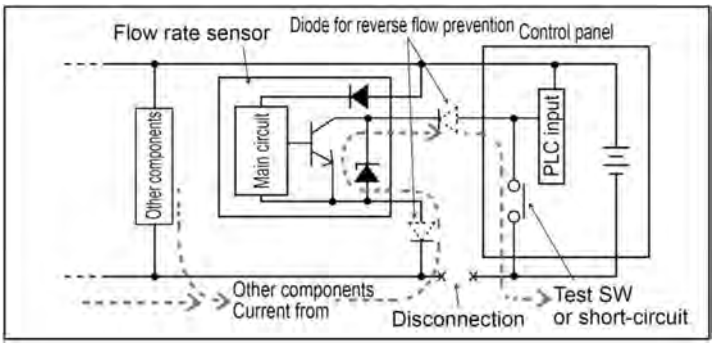
The accuracy may vary from the initial status depending on the working environment or working conditions.

Periodically inspect the sensor chip.

The sensor chip will degrade when used for long periods and cause the detected flow rate to fluctuate.

Pay attention to the reverse current caused by disconnected wires/wiring resistance.

If other devices, including a flow rate sensor, are connected to the same power supply as the flow rate sensor, and the switch output wire and power cable negative (-) side are short-circuited to check the operation of the control panel input unit, or if the power cable negative (-) side is disconnected, reverse current could flow to the flow rate sensor's switch output circuit and cause damage.



⚠CAUTION

Take the following measures to prevent damage caused by reverse current.

(1) Avoid centralizing current at the power cable, especially the minus side power cable, and use as thick a cable as possible.

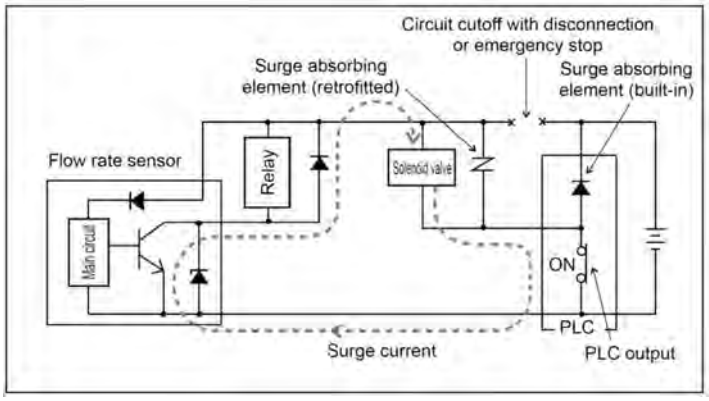
(2) Limit the number of devices connected to the same power supply as the flow rate sensor.

(3) Insert a diode parallel to the flow rate sensor's output line to prevent reverse current.

(4) Insert a diode parallel to the flow rate sensor power wire's negative (-) side to prevent reverse current.

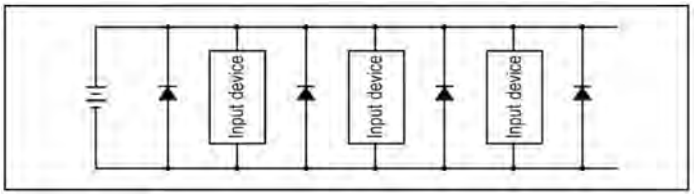
Pay attention to surge current flow-around.

When flow rate sensor power is shared with an inductive load that generates surges, such as a solenoid valve or relay, if the circuit is cut off while the inductive load is functioning, surge current could enter the switch output circuit and cause damage depending on where the surge absorbing element is installed.



Take the measures below to prevent damage from sneak surge current.

- Separate the power supply for output including the inductive load, such as the solenoid valve and relay, and input, such as the flow rate sensor.
- If a separate power supply cannot be used, directly install a surge absorption element for all inductive loads. Consider that the surge absorption element connected to the PLC, etc., protects only the individual device.
- Connect a surge absorption element to places on the power wiring shown in the figure below, as a measure against disconnections in unspecified areas.



When the devices are connected to a connector, turn off the power before disconnecting or connecting the connector. If the connector is disconnected while the product is energized, the output circuit may become damaged due to loop surge currents.

Do not rotate the cover.

This may lead to failure.

Do not use solvent, alcohol or detergent in cleaning.

Wipe off dirt with a rag soaked in a diluted neutral detergent solution and wrung out well.

4. TROUBLESHOOTING

4.1 Problems, Causes, and Solutions

If the product does not operate as intended, check the table below for a possible solution.

Trouble	Cause	Corrective action
No flow display	Wrong connection of power source.	Connect the rated power supply correctly.
	It is in eco mode.	Please press either the MODE key or the + key - or - key to confirm that it will light again. (Do not push the button for a long time) During Eco mode, the backlight of the display turns off unless the button is operated for about 1 minute.
	Malfunction caused by noise.	Keep NS-QFS main unit and cable away from noise source.
	The external wiring is disconnected	Please reconfirm / repair the external wiring.
	Output circuit is broken.	Replace NS-QFS.
No analog output	Wrong connection of power source.	Connect the rated power supply correctly.
	Mistake the connecting line	Please reconfirm the external wiring and rewire.
	Analog GND line is not connected	Check the wiring of the connected device. [Example] The connected device and the analog output are connected, but GND is not connected. Or, the connected device and analog output GND were not in common GND.
	Malfunction caused by noise.	Keep NS-QFS main unit and cable away from noise source.
	The external wiring is disconnected	Please reconfirm / repair the external wiring.
	Output circuit is broken.	Replace NS-QFS.
No switch output	Wrong connection of power source.	Connect the rated power supply correctly.
	Mistake the connecting line.	Please use the forcible output function of F.91 and check the I/O with the connected device. As a result of the I/O check, if there is no conduction, check the cable color and correctly re-wiring.
	Output specification does not match. (NPN or PNP)	Make sure that it matches the specifications of the connected device. (As an example, it does not operate normally if NS-QFS is NPN specification and the input unit of PLC to be connected is PNP specification.)
	Malfunction caused by noise.	Keep NS-QFS main unit and cable away from noise source.
	The external wiring is disconnected.	Please use the forcible output function of F.91 and check the I/O with the connected device. As a result of the I/O check, if there is no conduction, replace the rewiring or wiring.
	Output circuit is broken.	Please use the forcible output function of F.91 and check the I/O with the connected device. As a result of the I/O check, if there is no problem with wiring and there is no conduction, replace NS-QFS.

Trouble	Cause	Corrective action
Flow display does not reach 0.	Leakage	Check and correct piping.
	Foreign matter is mixed inside the main body. (Foreign matter sticking to sensor chip.)	Replace NS-QFS. When installing the main body, make sure that there is no foreign matter in the piping or the port of the main unit, and use a filter so that foreign matter does not get mixed in the main body.
	Malfunction caused by noise.	Keep NS-QFS main unit and cable away from noise source.
	Sensor chip is broken.	Replace NS-QFS.
	Fluid outside the specification is flowing.	Please use with the fluid that this product supports.
	The zero point is shifted.	Please adjust the zero point and correct the zero point. (Bar display type has no zero adjustment function)
	NS-QFS warm-up shortage.	Please use it after energizing (= warm up) for more than 5 minutes when using. If there is no energization (= warming up) for more than 5 minutes, the zero point may be shifted.
The flow rate indication does not change from 0.	Foreign matter is mixed inside the main body and it is clogged.	Foreign matter is mixed inside the main body and it is not possible to measure the correct flow rate. Please replace the main unit. When installing the main body, make sure that there is no foreign matter in the piping or the port of the main body, and use a filter so that foreign matter does not get mixed in the main body.
Flow indicator is wrong, Feel bad in accuracy.	Foreign matter is mixed inside the main body. (Foreign matter sticking to sensor chip.)	Foreign matter is mixed inside the main body and it is not possible to measure the correct flow rate. Please replace the main unit. When installing the main body, make sure that there is no foreign matter in the piping or the port of the main body, and use a filter so that foreign matter does not get mixed in the main body.
	Malfunction caused by noise.	Keep NS-QFS main unit and cable away from noise source.
	Sensor chip is broken.	Replace NS-QFS.
	The flow rate range type being used is large.	This product accuracy is ± 3% of flow rate range (full scale flow rate). Measuring small flows with high flow rate range type will result in poor accuracy. Please reselect to the flow range type corresponding to the measured flow rate and replace it.
	The flow is disturbed, the uneven flow is occurring.	It is considered that the equipment causing the uneven flow is installed on the primary side of this product. If there is the uneven flow, it may cause errors, Install the target equipment on the secondary side of this product. [Examples of equipment that causing the uneven flow] Regulator, solenoid valve, flow control valve, etc.
	Difference between ANR and NOR	Flow rate standard of NS-QFS remains at ANR setting, and there is a difference in measurement when flow rate is set with flow meter based on NOR. Change the flow standard of NS-QFS to NOR.
	NS-QFS warm-up shortage	Please use it after energizing (= warm up) for more than 5 minutes when using. If there is no energization (= warming up) for more than 5 minutes, the zero point may be shifted.
	Fluid outside the specification is flowing	Please use with the fluid that this product supports. It cannot be used correctly with fluids outside specifications.
It doesn't move at power supply on by abnormal display.	It turned on power with the button had been pushed.	The power supply is put again without pushing the button.

If you have any other questions or concerns, contact your CKD branch or dealer.

4.2 Error Code

Basically, errors are reset automatically. If an error is not reset automatically, perform auto OFF or turn off the power, confirm the cause and correct the errors according to the table below. Then, turn off the auto OFF function or turn on the power again.

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.

Error code	Cause	Countermeasures
	Button operations is locked.	Release the lock before operating the buttons.
	A password is set.	Enter the set password. * Be careful not to forget your password. If you have forgotten your PIN code, please contact your CKD branch or dealer.
Blinking of output display (Switch output is not output)	The switch output's over current protection circuit has operated.	Check whether load current exceeds the rating. Correctly connect, then turn the power ON again.

5. WARRANTY PROVISIONS

5.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

5.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.