



**Thermal Digital Mass Flow
Meter / Controller**

EX-550 SERIES

Instruction Manual

KOFLOC Corp.

Please read this manual thoroughly prior to installing and using the product. This way it is possible to ensure the performance and safety of the product and prevent possible accidents and damage to the product due to incorrect use.

When the product has failed or is considered to require readjustment, please contact our sales office or the dealer which you purchased the product from. Our experienced technical staff will give you appropriate advice. Please follow the instructions given.

Please note that if you repair/modify the product yourself, not only serious accidents may occur, but our warranty will become void.

The contents of the manual are subject to change without notice for improvement. Prior to shipment, every care has been taken in preparing this manual not to mention the product itself, but if you notice any imperfections, errors or omission, please contact our sales office or the dealer.

<< Prior to use >> and << Precautions for use >>

Various alert symbols and signal words are used in this manual and attached to the product to ensure correct use of the product and to prevent possible personal injury or loss of life and property damage. The symbols and meanings of the signal words are as follows:



WARNING

Ignoring this symbol and handling the product incorrectly may result in loss of life or serious injury.



CAUTION

Ignoring this symbol and handling the product incorrectly may result in personal injury or damage to property.



The symbol \triangle is shown to warn or to draw attention to hazards that may be caused by apparent misoperation or misuse.



The symbol \bigcirc is shown to prohibit certain actions to prevent the occurrence of hazards.



The symbol \bullet is shown to require (instruct) certain actions to prevent the occurrence of hazards.

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1. Foreword

Thank you for your selection of the Digital mass Flow Meter / Controller EX-550 Series. Prior to using your new equipment, please read this manual thoroughly to ensure it is used in a safe and correct manner.

Please keep in mind that this instruction manual may be revised without notice.

2. Precautions for Use

◆ Prior to use

All the products have been assembled and adjusted one by one in accordance with the specifications. The type of gas to use, flow rate and other data are shown on the ID plate attached to the back of the case. Check the ID plate and make sure these specifications meet your order.

① Model - Power supply - Input - Output

• Model	[EX-550C] : Mass flow controller [EX-550M] : Mass flow meter
• Power supply	[15] : $\pm 15\text{VDC}$ [24] : 24VDC
• Input/Output	[V] : Voltage [I] : Current

② Applicable gas

③ Flow rate

SCCM※ = ml / min at 0°C : 1 atm (101.325 kPa)

SLM※ = l / min at 0°C : 1 atm (101.325 kPa)

NCCM = ml / min at 20°C : 1 atm (101.325 kPa)

NLM = l / min at 20°C : 1 atm (101.325 kPa)

※Calibration temperature is different from the above in some industries and therefore, KOFLOC states the calibration temperature at the same time.




④ Calibration gas

⑤ Operating differential pressure

⑥ Serial No.

◆ Handling

- (1) Use the equipment within the pressure range shown in the specification.
- (2) Use the equipment at the ambient temperature and humidity shown in the specification.
- (3) This is precision equipment. Keep it protected against strong shock.

 CAUTION	
	Do not apply a pressure exceeding the allowable level. Otherwise, the product may be damaged
	This product is precision equipment. Exercise caution to protect it from shocks by, for example, falling and hitting. Otherwise, the product may be damaged.

◆ Transportation

Wherever possible, transport the product in the condition in which it has been received from KOFLOC to the installation site in order to prevent damage due to accidents during transportation.

◆ Installation and piping

(1) Installation place

- ① This equipment is designed for indoor use.

Never install the equipment in a place where it is likely to be wetted by water or rain.

The equipment may fail. Install the equipment in a place where sufficient ventilation is provided and changes in humidity are minimal.

- ② Install the equipment in a place free of vibration and impact.
- ③ Do not use the equipment under direct sunlight or at high temperature/humidity.
- ④ Install the equipment in a place free of dust.
- ⑤ Install the product in a place free of corrosive gases.
- ⑥ Install the product in a place free of a strong electric/magnetic field.

The frame to fix the block shall be connected to an electrically stable point (e.g. being grounded).

- ⑦ Install the product in a place where ambient temperature is 15 to 35°C.

(2) Lay piping so that the flow direction matches the arrow (►) shown on the body.

(3) Install the product horizontally.

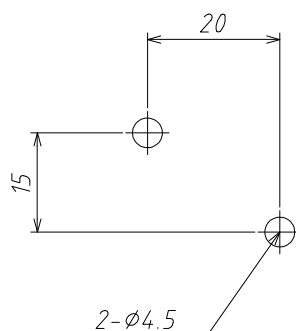
Install the product in such a way that the LED/switches do not face downward.

- (4) Be sure to install a line filter (100 μm or finer) on the inlet side of gas.
- (5) Where complete shutoff is required, provide a shutoff valve.
- (6) To use a highly reactive gas, be sure to conduct complete purge with inert gas before and after use.

■ Installation method

Install the product with two M4 screws from the back using threaded holes on the bottom.

※Unit: mm



WARNING



Never let gas exceeding the explosion limit flow to the product. Otherwise, it may cause explosion accidents



Never use the product the gas contact part of which has not been degreased (oil-free treatment) for oxygen. Otherwise, a fire may break out.
Even when the product has been degreased, if it has been used for a gas other than oxygen, never use it for oxygen.



CAUTION



Ensure that no foreign matter will flow into the product. If piping rust, water droplets, oil mist, dust, etc. flow into the product, they may cause measurement/control errors and damage to the product.
If there is a possibility that foreign matter will flow into the product, install a suitable device such as a filter, strainer and mist trap having a capacity to remove foreign matter larger than 100μm in the upstream and inspect or replace it periodically.



The mass flow controller valve control is intended for precise control and has not been designed for complete shutoff. Where complete shutoff is required, install a shutoff valve on the inlet or outlet side.

◆ Wiring

Connect wires referring to 7.Connectors and Pin Assignment.

◆ Storage of the product

If the product is not put in use for a long time after it was received, unexpected troubles may occur. When it is expected that the product will be kept in storage for a long time, take the following precautions:

- (1) Store the product in the package in which it was received from KOFLOC, wherever possible.
- (2) Store the product in a place described below:
 - ① A place free of rain and water.
 - ② A place free of vibration and impact.
 - ③ A place of normal temperature and normal humidity (around 25°C, 65%).
 - ④ A place free of dust.
 - ⑤ A place free of corrosive gases.
 - ⑥ A place free of a strong electric/magnetic field.
- (3) To store the product that has been used, purge it with clean air or N₂ so that measuring gas will not remain in the flow meter. Cover the inlet and outlet sides (joints) of measuring gas with caps to prevent intrusion of dust and dirt.



CAUTION

When installing the mass flow controller, noise generating sources in the vicinity of installation, environment filled with moisture and dust and very hot/cold, corrosive gas ambient must be avoided. Such conditions are causes of serious failure.



CAUTION

Never wash the piping system after the mass flow controller has been installed. Such a practice may cause serious failure. The product has not been designed for baking after piping, and therefore high-temperature baking (above 80°C) may cause serious failure.

3. Overview of the Product

The digital mass flow meter is mass flow sensor developed based on the principle of the thermal mass flow sensor. The digital mass flow controller is a high-performance gas flow controller incorporating a flow sensor and a flow control valve.

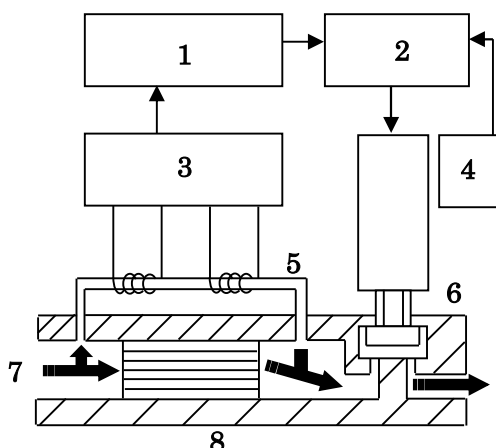
EX-550 Series has the following functions and features:

- (1) The control valve is of normally closed type.
(Closed when not energized. However, shut allowed as desired)
- (2) High accuracy ($\pm 1\%$ F.S.)
- (3) High speed response (Motion set flow rate region 1 second or less)
- (4) Same size lined up for 10 SCCM to 5 SLM.
- (5) The flow rate setting input/output signal is a voltage signal of 0 to 5.0 VDC
or a current signal of 4 to 20 mA (according to the specification).
- (6) Operable on ± 15 V power supply or 24 V single power supply (according to the specification).

4. Product Configuration

The digital mass flow controller is configured with sensors, bypass, valve and electric circuit as shown below. The valve is operated by feedback control so as to make the flow rate output signal from the sensor match the set input signal.

1. Operation circuit
2. Proportional control circuit
3. Bridge circuit
4. Flow rate setting signal
5. Flow sensor
6. Solenoid valve
7. Gas
8. Bypass



CAUTION

- (1) The mass flow controller valve control is intended for precise control and has not been designed for complete shutoff. Where complete shutoff is required, install a shutoff valve on the inlet or outlet side.
- (2) When a shutoff valve is installed on the inlet or outlet side of the mass flow controller, a small amount of gas may be trapped between the downstream of the mass flow controller and the shutoff valve. As a result, flow surge will occur when the mass flow controller is started. The flow surge can be mitigated by shortening the distance between the controller and the shutoff valve or locating the shutoff valve in the upstream of the mass flow controller.

5. Standard Specifications

Item		Specifications	
Model		Mass flow controller EX-550C	Mass flow meter EX-550M
Flow range (in N ₂)		Full scale flow rate (F.S.) 10SCCM~5SLM	
Valve system		Normally closed, proportional solenoid valve	—
Applicable gas		N ₂ (Other gas products are produced by nitrogen conversion)	
Control range (Flow range)		2~100% F.S.	
Response		All region response 1sec. (within±2%F.S., typical)	
Accuracy※1		$\leq 25\% \text{F.S.} : \pm 0.25\% \text{F.S.}$ $25\% \text{F.S.} < : \pm 1.0\% \text{S.P.}$	
Repeatability※1		±0.2%F.S.以内	
Pressure	Operating differential pressure※2	50~300kPa	—
	Inlet max. pressure	300kPa(G)	
	Proof pressure	980kPa(G)	
Temperature	Working temperature	5~50°C	
	Accuracy guarantee temperature	15~35°C	
	Storage temperature	-10~60°C	
Humidity		10~90%RH(No condensation)	
Installation posture		Free	
Leak rate (He)		$1 \times 10^{-11} \text{ Pa} \cdot \text{m}^3/\text{sec.}$ 以下	
Materials in contact with gas		SUS316L, magnetic stainless steel,※3, PTFE	
Electrical connection		D-sub 9-pin male type	
Flow rate setting input signal		0 to 5VDC (Input impedance about. 1MΩ) or 4 to 20mA (Input impedance about. 250Ω)	—
Flow rate output signal※4		0 to 5VDC (Load resistance 10kΩ or higher) or 4 to 20mA (Load resistance 500Ω or lower)	
Power supply		+15VDC(±5%) 150mA or lower, -15VDC(±5%) 150mA or lower or +24VDC(±10%) 180mA or lower	
Weight※5		About. 500 g	About440 g

※1 The precision and repeatability are guaranteed for proofreading gas and full-scale flow rate

※2 The operating differential pressure may vary depending on specifications.

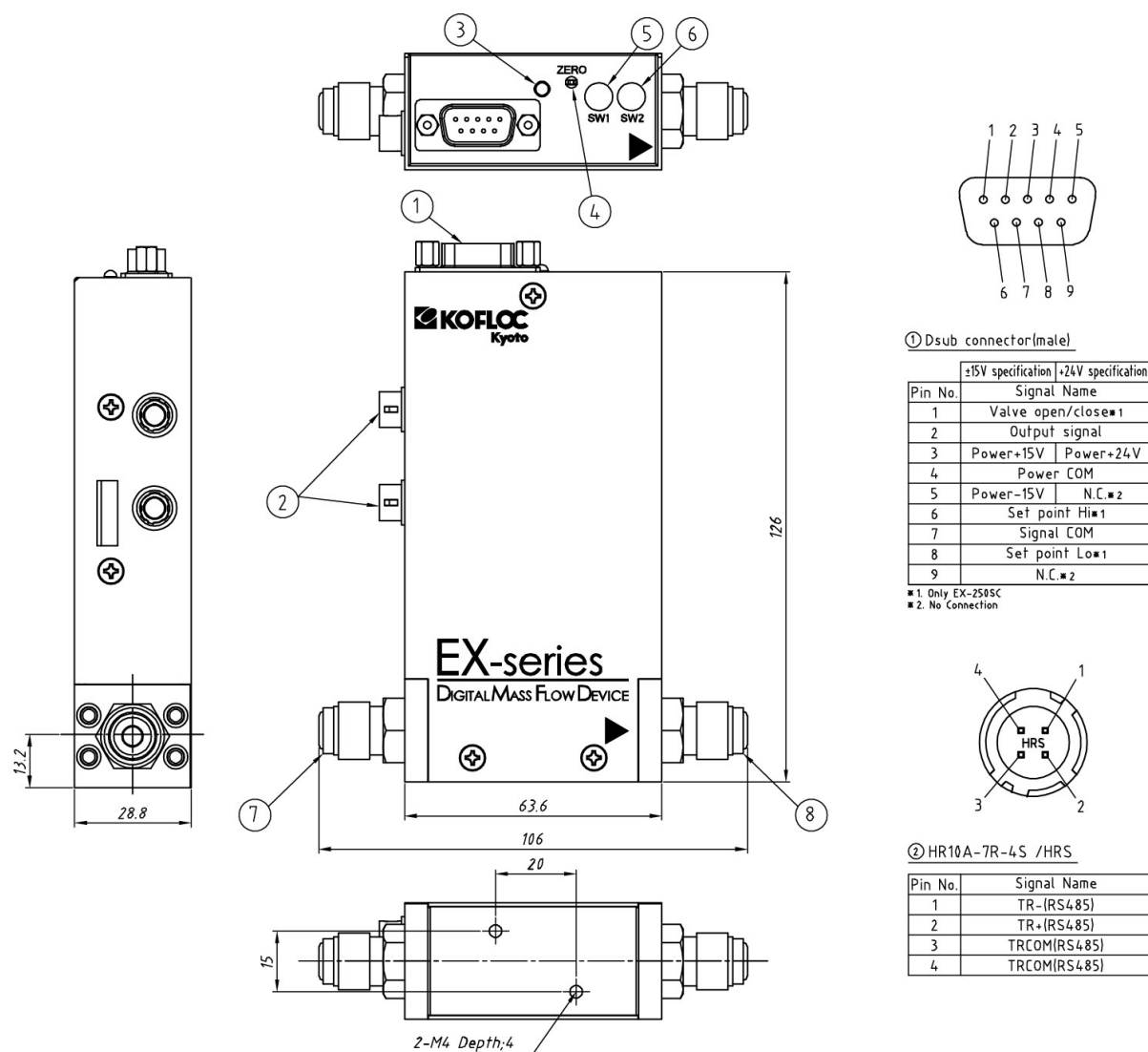
※3 The mass flow meter does not use magnetic stainless steel.

※4 For the output voltage, see "CAUTION" in 7. Connectors and Pin Assignment.

※5 The weight does not include joints.

6. External View

※Unit:mm



※Never remove the protective seals of the body right side.

The product warranty will become void.

Table1: Nomenclature and function

Symbol	Name	Function
①	D-sub 9-pin (male)	Connect the power supply and input/output signals using the dedicated cable with connector.
②	Communication connector	Connect the communication cable.
③	LED	When the product is operating normally, the LED lights green (orange in the digital flow rate setting mode). When it fails, the LED lights red.
④	Zero adjust switch	Used for zero adjustment. To conduct zero adjustment, set the differential pressure applied to the product to zero.
⑤	C.F. switch	Used to set a C.F. value of the product.
⑥	Address switch	Used to set the address No. of this product. Set the address No. prior to starting communications. It has been set to [1] in the factory.

Table2: Switch Number of C.F.(Conversion factor) switch and function

Switch No.	Function
0※1, 2	Applicable gas
1	N ₂ (Nitrogen)
2	AIR
3	H ₂ (Hydrogen)
4	He(Helium)
5	Ar(Argon)
6	O ₂ (Oxygen)
7	CO ₂ (Carbon dioxide)
8	Unusable
9	User custom C.F. mode (Changeable by the user)

※1 The C.F. conversion value specified when the order was placed has been set.

※2 Position when the product is shipped.

※3 The full scale of the selected gas is the same as the full scale of the gas when the order.

7. Connectors and Pin Assignment

(1) D-subminiature 9-pin connector

Product side connector : Part No. DE-9PF-N (made by JAE)

Example of applicable connector : Part No. DE-9SF-N (made by JAE)

1) Power supply ±15 V pin assignment

Pin No.	Signal Name
1	Valve open-close input※1
2	Flow rate output (0 to 5VDC or 4 to 20mA) ※2
3	Power supply +15V
4	Power supply COM※3
5	Power supply -15V
6	Flow rate setting input Hi (0 to 5VDC or 4 to 20mA)※4
7	Flow rate output COM※3
8	Flow rate setting input Lo※5
9	N.C.

2) Power supply +24 V pin assignment

Pin No.	Signal Name
1	Valve open-close input※ ¹
2	Flow rate output (0 to 5VDC or 4 to 20mA)※ ²
3	Power supply +24V
4	Power supply COM※ ³
5	N.C.
6	Flow rate setting input Hi (0 to 5VDC or 4 to 20mA)※ ⁴
7	Flow rate output COM※ ³
8	Flow rate setting input Lo※ ⁵
9	N.C.

※¹ N.C. on the meter.

N.C.: Non-connection (Connect nothing.)

※² Load resistance 0 to 5VDC:10kΩ or higher 4 to 20mA:500Ω or lower

※³ The power supply COM (No. 4) and the flow rate voltage output COM (No. 7) are connected internally.

※⁴ Input impedance 0 to 5VDC:About.1MΩ 4 to 20mA:About.250Ω

N.C. on the meter.

※⁵ The flow rate setting input of this product is of differential type. For single-end flow rate setting signals, connect the flow rate setting voltage input Lo (No. 8) to the power supply COM (No. 4) or Flow rate voltage output COM (No. 7).



CAUTION

(1) The flow rate setting input signal must be within 0 to 5 V or 4 to 20 mA.

(The withstand voltage of this product is ± 15 V.)

(2) The range of flow rate output signals of this product is -1 to 7 V or -4 to 28 mA.

Take the above into consideration for the tolerance of product to be connected and software processing of signals acquired.

(3) The pin assignment of product complies with the SEMI Standard.

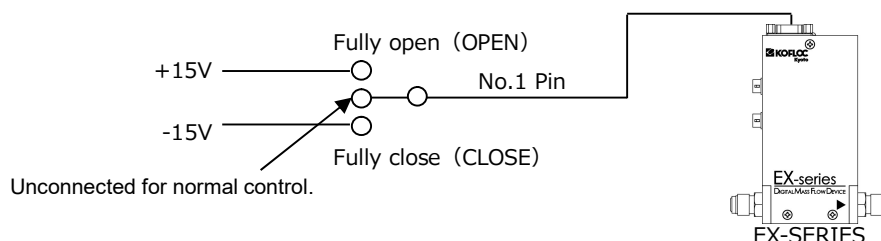
Please note that there are products that have a connector of the same D-sub 9-pin spec., but do not comply with the SEMI Standard (including product made by other companies). Carefully check the pin assignment of product to connect. Incorrect connection may cause serious failure.

① Internal valve control input (Mass flow controller only)

No. 1 pin of the connector is the signal input pin for opening/closing the internal valve. By using this input, it is possible to force the internal valve to be switched over between fully open (OPEN) and fully close (CLOSE) regardless of values of flow rate setting signals. In the case of digital flow rate setting also, priority is given to the internal valve open/close input. The input impedance of the valve open-close input is 100 k Ω .

•Power supply $\pm 15\text{V}$

Inputting $+15\text{ V}$ to No. 1 pin opens the valve fully and inputting -15V closes the valve fully.

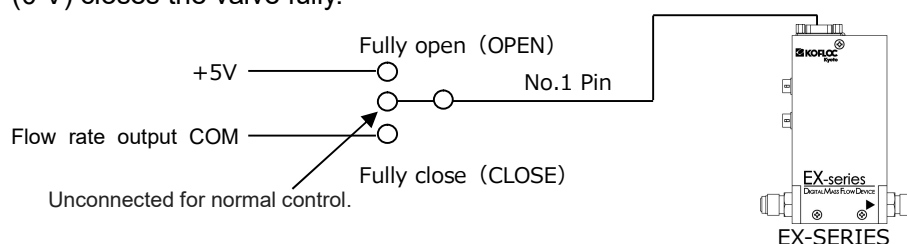


Example of the use of the valve open-close input

Pin input / Function	OPEN	-15V	+15V
Internal valve operation	CONTROL	Fully close (CLOSE)	Fully open (OPEN)

•Power supply $+24\text{V}$

Inputting $+15\text{ V}$ to $+24\text{ V}$ to No. 1 pin opens the valve fully and inputting the flow rate output COM (0 V) closes the valve fully.



Example of the use of the valve open-close input

Pin input / Function	OPEN	Flow rate output COM (0V)	+5V to +24V
Internal valve operation	CONTROL	Fully close (CLOSE)	Fully open (OPEN)

② Analog input and output signals

Pin 6 of the connector is used when performing a flow control by the analog signal from the outside (the mass flow Controller only). Pin 6 of the connector is output to an analog signal proportional to the flow rate.

When you change the analog / digital flow rate setting, Please refer to the "WFSM" command of the separate "Digital Mass Flow Meters / Controllers EX-250S manual (communication)"

The default setting is "analog".

Kind of input and output signals are respectively a selection from voltage (0-5V) / current (4-20mA). Select at the time of ordering, you will not be able to change the type of signal.

(2) Communication connector

Product side connector : Part No. HR10A-7R-4S

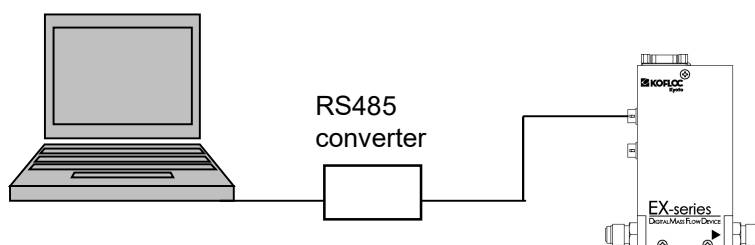
(made by HIROSE ELECTRIC)

Applicable connector : Part No. HR10A-7P-4P

(made by HIROSE ELECTRIC)

Pin No.	Signal Name
1	TR-(RS485)
2	TR+(RS485)
3	TR_COM(RS485)
4	TR_COM(RS485)

※ For communication commands, see the separate "Thermal Digital Mass Flow Controller EX-250S Series RS-485 Communications Instruction Manual".



※The cables to use must be the dedicated cables specified by KOFLOC.

8. Operating Procedure

(1) Operating Procedure

- 1) Make sure that the gas flow direction matches the arrow shown on the side of the product.
- 2) Make sure that the joints do not leak with a He leak detector.
- 3) Connect the connector in accordance with 7. Connectors and Pin Assignment.
Provide a sufficient margin for the electric capacity.
- 4) When the power is turned on, the LED flashes red, orange. After about 5 seconds, it changes to green (orange in the digital flow rate setting mode) automatically. Turn on the power and perform a warm-up run for 15 minutes or longer.
- 5) Supply gas at the specified pressure. When the set voltage signal is input, the gas control based on the flow rate proportional to the set voltage signal will be started. The input/output signal at the full-scale flow rate is 5.0 VDC or 20 mA.
- 6) Calculate flow rate setting voltage·current signal value as follows:
flow rate setting voltage signal value

$$= [(Desired\ flow\ rate\ value) \div (Full-scale\ flow\ rate\ value)] \times 5.0VDC$$
flow rate setting current signal value

$$= [(Desired\ flow\ rate\ value) \div (Full-scale\ flow\ rate\ value)] \times 16mA + 4mA$$
- 7) Calculate instantaneous flow rate value as follows:
Instantaneous flow rate value = (Flow rate output voltage) \div (5.0V DC) \times (Full-scale flow rate value)
Instantaneous flow rate value = {(Flow rate output current) $-$ (4mA)} \div (16mA) \times (Full-scale flow rate value)

(2) Main function

- 1) Zero adjust switch
Press the zero adjust switch to do zero correction. When performing zero adjustment, set a differential pressure applied to the product to zero. When the zero adjust switch is pressed, the LED flashes red/orange for about 2 seconds. Then the LED lights green (orange in the digital flow rate setting mode).
- 2) Auto zero function
Zero correction can be done automatically. The default is "valid".
For details, see the separate "Thermal Digital Mass Flow Controller EX-250S Series RS-485 Communications Instruction Manual".
- 3) 1% cut function
A value within $\pm 1\%$ F.S. may be shown as 0. The default is "invalid".
For details, see the separate "Thermal Digital Mass Flow Controller EX-250S Series RS-485 Communications Instruction Manual".
- 4) Differential pressure setting function (Mass flow controller only)
The product is shipped after it has been set to the specified pressure. The user may change the specified pressure by setting a (guide) differential pressure below 150 kPa as "low differential pressure" and a pressure above it as "standard differential pressure".
For details, see the separate "Thermal Digital Mass Flow Controller EX-250S Series RS-485 Communications Instruction Manual".
- 5) Control valve overheat preventing function (Mass flow controller only)
The valve overheat preventing function operates when the mass flow controller is in the setting of "CONTROL" or "OPEN" and the detected flow rate less than 1% F.S. continues for 5 minutes. When this happens, the LED on the product flashes red. Check to see if gas is being introduced to the product.



CAUTION

- (1) Prior to starting wiring, check pin numbers.
Incorrect wiring may result in breakage, failure or malfunction of the product. Be sure wires are connected correctly.
- (2) When a joint needs to be tightened strongly, be sure to use the torque recommended by the joint manufacturer. An excessive torque may break the connecting port.
- (3) Ensure that seal tape and adhesive will not come out to the inside from the piping threads.
- (4) Lay piping so that the flow direction matches the arrow shown on the body.
- (5) Install the product main unit horizontally.
- (6) Be sure to install a line filter (100 μm or finer) on the gas inlet side.

((3) Status of the LED of mass flow meter (MFM)/mass flow controller (MFC)

State of the product			State of the LED
Powered on		(MFM/MFC)	Red/orange flashing (about 5 seconds after power on)
Normal		(MFM)	Green lit
Normal		(MFC analog flow rate setting mode)	
Normal		(MFC digital flow rate setting mode)	Orange lit
Zero adjust switch pressed (zero adjustment executed)		(MFM/MFC)	Green/orange flashing (About 2 seconds)
Auto-zero adjustment※1	Starting	(MFC)	Green/orange flashing
	Continuous	(MFC analog flow rate setting mode)	Green flashing
	Continuous	(MFC digital flow rate setting mode)	Orange flashing

※1 The default of auto zero adjustment is "invalid".

During auto zero adjustment, the status of the LED is as shown above.

9. Troubleshooting Q & A and Precautions for Maintenance

(1) Troubleshooting and corrective action

Symptom	Possible Cause	Check and Action
1. No flow rate is output.	a. The power is not on.	Check to see if the LED has lit.
	b. Connection with the indicator is not correct.	Reconnect. Check wire colors to see if wires have been connected correctly.
	c. Gas is not being supplied.	1. Check to see if the source pressure of the cylinder is sufficient and the valve is open. 2. Check to see if the solenoid valve, 3-way valve, etc. in the line are working properly. 3. Check the line filter for clog.
	d. The outlet side piping of the mass flow controller is blocked.	Check the solenoid valve, 3-way valve, air valve, etc.
	e. The forced close signal has been input to the mass flow controller.	Check to see if the valve forced close signal (-15 VDC) has not been input to Pin No. 1.
	f. The power supply is faulty.	Disconnect the cable and check the power supply voltage ± 15 VDC ($\pm 5\%$ max.) (24 V spec.: +24 VDC (within $\pm 10\%$)) with a tester. If no voltage is present, replace the power supply.
	g. The orifice is clogged.	The orifice needs to be overhauled and cleaned or replaced. Please request the dealer for repair.
	h. The sensor tube is clogged.	If the tube is clogged, gas keeps flowing. Check it. The sensor needs to be replaced. Please request the dealer for repair.
2. The output will not become zero. (power on 15 minutes or longer)	a. The control valve is leaking internally or externally.	Disconnect the piping before the mass flow controller to remove gas and check to see if the output will become zero.
	b. The command and external setter are not connected correctly.	Check wiring of the command and external setter.
	c. If the above wiring has no problem, the sensor is faulty or the electronic circuit is faulty.	The electronic circuit is faulty. Please request the dealer for repair.
	d. The sensor is faulty or the electronic circuit is faulty.	The zero point may be adjusted for reuse, but the flow accuracy will be impaired. The same measure as c above is required. Please request the dealer for repair.
3. When gas is flowing, the indicated flow rate is not stable.	a. The supply pressure on the inlet side of the mass flow controller is unstable constantly.	Install a pressure regulator on the inlet side to make the pressure constant.
	b. The control valve is faulty.	Please request the dealer for repair.
	c. The indicator is faulty.	Replace the indicator.
	d. The connector is not connected correctly.	Check to see if the connector has been fitted firmly.
4. The set indication cannot be obtained.	a. The pressure on the inlet side of the mass flow controller is too high or the controller is faulty. Or, a pressure difference between the inlet side and the outlet side is not adequate.	Adjust the pressure to the adequate level as shown in the brochure or set an adequate differential pressure.
	b. The pressure loss of piping is large. Or the pressure loss has increased as the filter, check valve, etc. has become nearly clogged.	Place a pressure gauge immediately before and after the mass flow controller and check to see if the pressure difference is adequate. Make adjustment to get an adequate differential pressure.
	c. The orifice in the control valve is nearly clogged.	If the problem is solved by increasing the pressure, it is most likely that the orifice is clogged. To replace the orifice, please request the dealer.
5. The flow rate is clearly less than the indicated flow rate.	a. The piping line is leaking.	Using the evacuation method, leak detect fluid, etc., investigate causes of leak such as failure to tighten piping line nuts, insufficient tightening of such nuts or others and retighten the nuts of leaking places or take other corrective actions to stop leak.
	b. The mass flow main unit is leaking.	Same as above. When checking leak using leak detect fluid, apply such fluid only to the joints before and after the unit, but do not apply it to the inside of the main unit cover. After checking, wipe off leak detect fluid completely so that it will not remain at all.

	c. The bypass is clogged.	Please request the dealer for repair.
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Troubleshooting and corrective action (Continued)

Symptom	Possible Cause	Check and Action
6. The flow rate is clearly larger than the indicated flow rate.	a. The sensor tube is nearly clogged.	Request the dealer for repair.
7. Even if the external set input is set to zero, gas keeps flowing.	a. The set voltage by external setting is not zero. Or, the printed board is faulty. Or, the wiring of the command soldered part is broken.	Input the valve forced close signal (-15 VDC) to Pin No. 1 and see if gas stops. If gas does not stop, the valve needs to be adjusted. Please request the dealer for repair. If gas stops, a possible cause is a faulty electronic circuit. Please request the dealer for repair.
	b. Internal leak due to adhesion of dust, etc. to the sealing area of the control valve.	The control valve needs to be overhauled and cleaned. Please request the dealer for repair.
	c. The zero point voltage has moved to the negative side.	The zero point voltage is abnormal. See Symptom 2 The output will not become zero.
8. The LED is flashing red/orange.	a. Immediately after power on.	The LED flashes red/orange for about 5 seconds after power on. Then the LED lights green (orange in the digital flow rate setting mode).
9. The LED has lit red.	a. The sensor is faulty.	The sensor is faulty. Request the dealer for repair.
10. The LED is flashing red.	a. In the state of "CONTROL" or "OPEN", gas has been forced to be closed for 5 minutes externally.	1. Check to see if the source pressure of the cylinder is sufficient and the valve is open. 2. Check to see if the solenoid valve, 3-way valve, etc. in the line are working properly. 3. Check the line filter for clog.
11. The LED does not light up.	a. No power is being supplied.	Check the power supply and wiring.
	b. The power supply circuit is faulty.	Request the dealer for repair.

(2) Precautions for maintenance

Cleaning the inlet and outlet joints

When removing the joints for cleaning, conduct the work in clean environment so that no dust and dirt will enter the product. However, never disassemble or overhaul the product nor remove the protective seals.

If the product has been disassembled or overhauled or the protective seals have been removed, it is considered that the user has waived his/her right to warranty even within the warranty period.

10. After-sale Service

This product has been subjected to strict inspection prior to shipment. Should it fail, however, please contact the dealer or sales agent.

Please note that the product that is serviced by us will have the user-set parameters reset to the initial settings before shipment from KOFLOC.

11. Warranty

Contents of warranty

(1) Warranty period

The warranty period is one (1) year after ex-factory date of KOFLOC.

(2) Scope of warranty

If the KOFLOC product fails during the warranty period due to a cause attributable to KOFLOC, KOFLOC will, at its option and expense, provide a replacement product or repair the failed product at the KOFLOC factory. The scope of warranty is limited to the product itself and KOFLOC shall not be held liable whatsoever for damages suffered by the customer due to a failure of the KOFLOC product regardless of significance and kind of such damages.

(3) Out of warranty

The warranty shall not apply to the following failures even if they occur during the warranty period:

- a) Failure due to misuse or improper repair or modification. (Failure resulting from use under conditions different from the manufacturing specifications is included.)
- b) Failure due to dropping of the product after purchase.
- c) Failure due to fire, earthquake, flood, lightning or other natural disaster, or riot, war or the like.
- d) Failure due to intrusion of foreign matter from piping.
- e) Failure caused by a problem specific to a combination with other incorporated product.
- f) Other failures which are considered not attributable to KOFLOC.
- g) When the product is used on your equipment (machinery), this warranty shall not apply to damages that are considered avoidable should your equipment be equipped with functions, structure and safety measures that are commonly employed according to the industry practice.

KOFLOC Corp.

URL : <http://www.kofloc.co.jp>

