



Mass Flow Controller
ST-500/550 (EtherCAT®)
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 the dealer or our sales office and convey your request.

Please note that if you repair/modify the product by 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 KOFLOC.

<< 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:



DANGER

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



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.

1. Foreword

Thank you for your selection of the Mass Flow Controller ST-500/550. Prior to using your new equipment, please read this manual thoroughly to ensure it is used in a safe and correct manner.

2. Precautions for Use

(1) Checking the product

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 : **ST-500/550**

② GAS: Name of fluid

③ FLOW RATE: Flow rate, calibration temperature SCCM = mL/min, SLM = L/min
※"SCCM" is an abbreviation of Standard Cubic Centimeter per Minute and is usually indicated at 0°C.

However, 20°C is used in many industries and therefore the product has been adjusted and data are indicated at the unit of flow rate and temperature specified by the customers when they placed an order. If the calibration temperature is different, the actual flow rate (mass flow rate) varies largely. Be sure to check these data.

④ CALIB.: Calibration gas

⑤ SERIAL No. : Serial No.

(3) Transportation of the product

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 and injury due to accidents during transportation.

This is precision equipment. If it fails due to a shock applied by, for example, dropping it, the warranty may become void.

(4) 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:

- Store the product in the package in which it was received from KOFLOC, wherever possible.
- 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%RH).

④ A place free of dust.

⑤ A place free of corrosive gases.

⑥ A place free of a strong electric/magnetic field.

※ 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. (If highly reactive gas has been used, be sure to use inert gas instead of air.) Cover the inlet and outlet sides (joints) of measuring gas with caps to prevent intrusion of dust and dirt.



CAUTION

To dispose of the product, be sure to follow the local ordinances.

3. Specifications

(1) Specifications

Name	Mass Flow Controller	
Model	ST-500/550	
Flow rate (N2 converted)	10SCCM, 50SCCM, 100SCCM, 300SCCM, 500SCCM, 1SLM, 3SLM, 5SLM, 10SLM	30SLM
Valve system	Normally closed	
Min. control flow rate	2%F.S.	
Flow rate accuracy ※1	$\leq \pm 1.0\% \text{S.P. (10\% - 100\%)}$ $\leq \pm 0.1\% \text{F.S. (2\% - 10\%)}$	
Repeatability	$\leq \pm 0.2\% \text{F.S.}$	
Response time	$\leq 1 \text{sec.}$	
Required differential pressure	50 - 300kPa	200 - 300kPa
Max. primary working pressure	300kPa(G)	
Proof primary pressure	1MPa(G)	
Flow rate accuracy guarantee temperature	15 - 40°C	
Working temperature / humidity	5°C - 50°C / 0 - 80%RH (No condensation)	
Storage temperature / humidity	0°C - 60°C / 0 - 80%RH (No condensation)	
External leak rate	$\leq 1 \times 10^{-11} \text{ Pa} \cdot \text{m}^3/\text{sec (He)}$	
PI function ※2	For pressure change of $\pm 3 \text{psi}$ at SV: 5-100%: Overshoot: $\leq \pm 2\% \text{F.S.}$, Settling Time ($\leq 2\% \text{S.P.}$): $\leq 1 \text{sec.}$	
Installation posture	Not specified (Free)	
Materials in contact with gas	SUS316L, PTFE, Au, Co-Ni alloy	
Seal material	SUS316L, Au	
Actuator system	Solenoid actuator	
Standard joint / Fac-to-face dimension	1.125 W-Seal 92mm 6.35 VCR 124mm	
Drive power supply ※3	24VDC	
Digital interface	EtherCAT® ※4	
Product weight	Approx. 1 kg	

※1: Accuracy measured with calibration gas (N2) and KOFLOC standard equipment.

※2: Only ST-500

※3: Connect the controller to the frame ground (grounding).

※4: EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

4. Installation

(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. Or, the equipment may fail. Install the equipment in a place where sufficient ventilation is provided and change in humidity is 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 equipment in a place free of corrosive gases.
 ⑥ Install the equipment in a place free of a strong electric/magnetic field.

Install the equipment in a place where ambient temperature is 15 to 35°C.

* The product has been packaged in our clean room prior to shipment. After taking the product out of the packing box, open the package in your clean room.

* Please note that the use of the product under conditions deviating from the specifications is a cause of failure. Be sure to abide by the specified conditions.



CAUTION

When installing the mass flow unit, be sure to avoid such conditions as the existence of noise sources around the installation place, water droplets/dust filled environment and high temperature/corrosive gas atmosphere. They may become causes of serious accidents and failure.

(2) Installation method

For installation, use the threaded holes (M4) on the bottom of the main unit block.

For the installation dimensions, see 6. External View on page 6.

(3) Installation posture

As a rule, install the controller horizontally. If it needs to be installed vertically, warm it up fully and then adjust the zero point.

Lay piping so that the directions of the gas inlet and outlet match the arrows shown on the ID plate.

(4) Piping and filter

Make sure that commercially available pipes and joints to use for the piping system are those that are clean or have been washed completely.

Install a line filter on the gas inlet. In particular, when air from a compressor or blower fan is used, a large amount of oil mist or water droplets may be contained.

Install an oil filter/moisture-removal filter in the upstream.



CAUTION

Never wash the piping system after the mass flow unit has been installed. Such a practice is a cause of serious failure.



WARNING

Check the gas piping connections for leak. If unsafe gas is used without this check, serious accidents may occur.



CAUTION

Carefully lay piping in the downstream also so that condensed water droplets will not enter the main unit due to backflow.



CAUTION

Make sure that the installation direction (gas flow direction) is correct. Due to the characteristics of the mass flow controller, if it is installed in a wrong direction, the control command to the valve may not work, and the valve may become fully opened.



CAUTION

The ST-500/550 valve is intended for precise control and has not been designed for complete shutoff.

Where complete shutoff is required, install a shutoff-dedicated valve in the upstream or downstream.

Then, a small amount of gas will be trapped between the solenoid valve of the mass flow controller and the shutoff valve. As a result, surge will occur when the mass flow controller is started. The influence of surge can be varied 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) Wiring

For wiring, use the cable dedicated to EtherCAT or suitable for EtherCAT.

5. Operating Procedure

(1) Warning up

Turn on the power with no gas pressure being applied to the inlet side of the main unit (pressure difference between the inlet side and the outlet side being completely zero). When the motion mode is “Full Open” or “Control”, conduct warming up for about 15 minutes (30 minutes recommended) with “Full Close” or “Control” and “set flow rate being zero”. If the controller is used without warming up, the flow rate accuracy will deteriorate.

※The controller has been set to the Full Close mode prior to shipment.

(2) Zero point adjustment

This controller is equipped with the “zero adjust function”.

Pressing the [Zero] switch on the side of the main unit corrects zero point deviation.

(3) Introducing gas

Make sure that the type of gas to use and the supply source pressure are correct and then supply gas.

※Check to see if the supply gas pressure is within the working pressure range. (See 3. Specifications on page 3.)

※When highly reactive gas is to be used, purge the inside of piping with inert gas such as N₂ before introducing gas.

(4) Filling gas

To use gas other than air, it is necessary to conduct purging until the inside of the controller and piping are filled with gas.

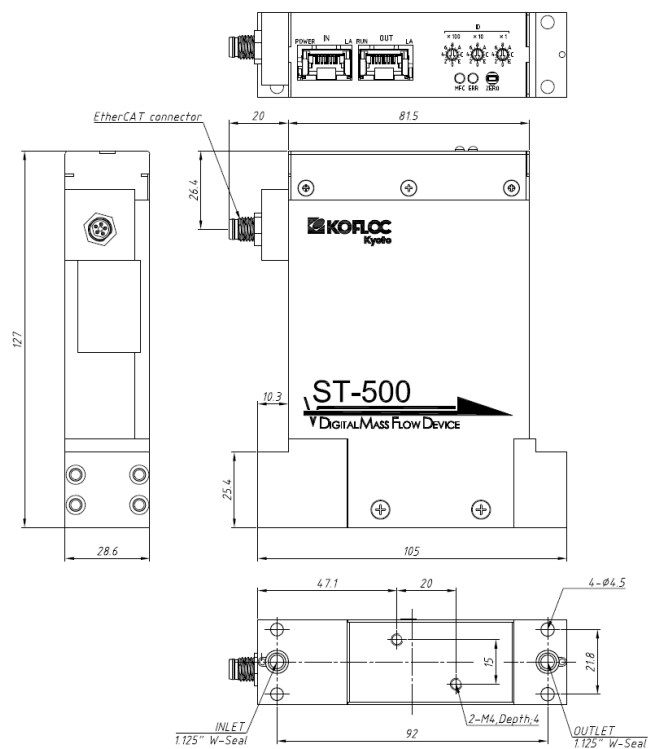
※Take such action as setting the motion mode to “Full Open”.

(5) Control

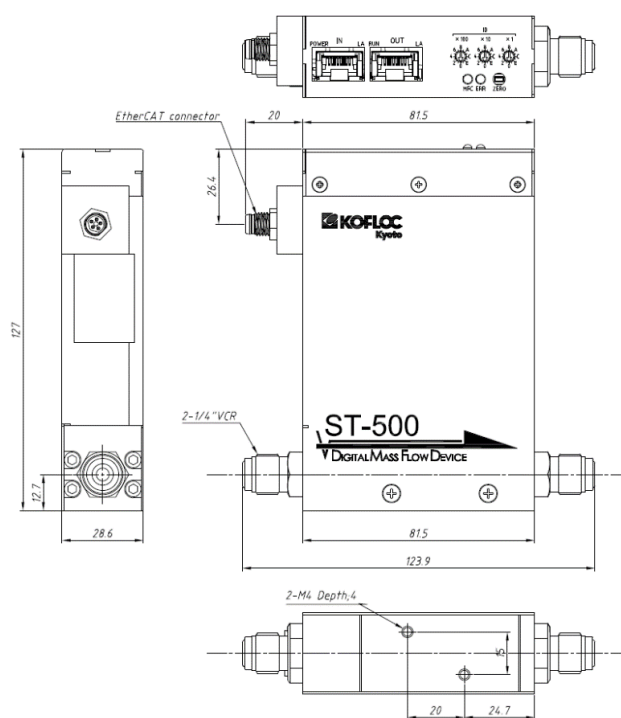
Make necessary settings via the network and enter values to set. Then the gas control is started.

6. External View

1.125 W-Seal

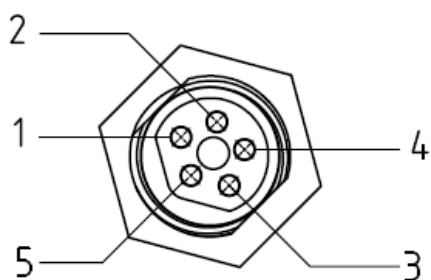


6.35 VCR



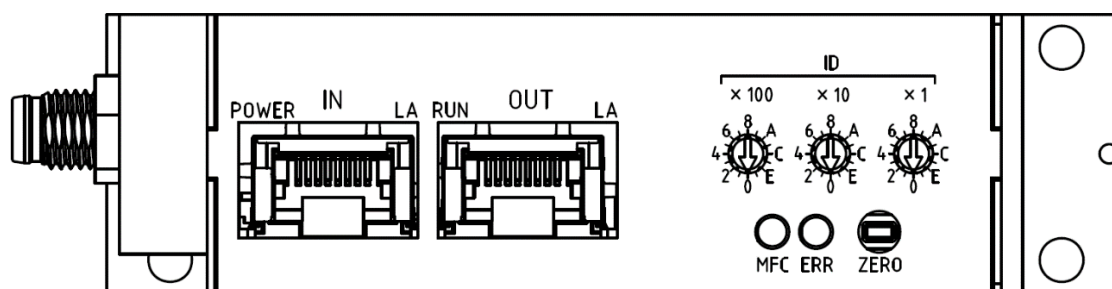
7. Connector Connection and Terminals

(1) M8 round screw type 5-pin male (side of main unit): Power connector



Pin No.	Signal Name
1	Power +24VDC
2	N.C.
3	Power Common
4	N.C.
5	N.C.

(2) Communication connector, switches, LEDs (top of main unit)



•RJ45 modular jack: EtherCAT communication IN/OUT

Pin No.	Signal Name	Function
1	TX+	Send data +
2	TX-	Send data -
3	RX+	Receive data +
4	N.C.	
5	N.C.	
6	RX-	Receive data -
7	N.C.	
8	N.C.	

•Rotary switch: ID (x100/x10/x1) Communication device No.

•Switch: ZERO Zero point adjustment. To adjust the zero point, close the valve.

•LED

Name	Function
POWER	Off: Power off On: Power on
LA	Off: No link Blinking: Link (Active) On: Link (Non-active)
RUN	Off: INITIALISATION Blinking: PRE-OPERATIONAL Single Flash: SAFE-OPERATIONAL On: OPERATIONAL
MFC	Red and orange alternately on: Turning on power Green on: Normal operation Green and orange alternately on: Performing or starting zero point adjustment. Green blinking: Performing auto zero adjustment
ERR	Off: No error Blinking: Invalid Configuration Single Flash: Local Error Double Flash: Watchdog Timeout

8. After-sale Service

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

9. Product Warranty

Warranty

① Warranty period

The warranty period is one (1) year after shipment from 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 KOFLOC warranty shall not cover damages caused by reasons not attributable to KOFLOC and opportunity loss, lost profits, secondary disaster, accident compensation, damage to products other than KOFLOC products and other compensation suffered by customers due to malfunction or failure of KOFLOC products.

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 or water droplets from piping.
- e) Failure caused by a problem specific to a combination with other incorporated equipment.
- f) Other failures which are considered not attributable to KOFLOC.

KOFLOC shall not be held liable for your or your customer's opportunity loss, damage to products other than KOFLOC products and other damages due to malfunction or failure of KOFLOC products.

KOFLOC Corp.

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