

# Mass Flow Controller Instruction Manual

## MC-700 Series

### Safety Precautions

#### **WARNING** Incorrect handling may cause death or injury

- Before connecting the fittings, check that no damage or defects are found on the fittings. Make connections properly and make sure that a leak test is conducted before actual operation to prevent fluid from leaking into the atmosphere (Hereafter, the measured fluid is called "gas" or "fluid").
- DO NOT apply any fluids corrosive to materials exposed to gas. Corrosion may cause fluid to leak into the atmosphere. Check the gas type to be used in advance.
- This device is not designed as an explosion proof structure. DO NOT use this device in a place where explosion-proof structures are required. Doing so may cause fire or explosion.

#### **CAUTION** Incorrect handling may lead to medium or slight injury or may cause damage to, or loss of, facilities or equipment

- Observe the precautions listed in the WARNING (above)
- Strictly observe the electrical specifications. Not doing so may cause fire, damage to sensors or malfunction.
- This device is not designed to be waterproof. DO NOT locate this device outdoors or in a place where it may be splashed with water. Doing so may cause fire, trouble, or malfunction of the device.
- DO NOT modify this device. It may cause fire or other problems.
- This device is not designed to handle hot swap. Please avoid attaching and removing the power supply connector and interface connector with the power switched on. Attachment and/or removal with the power on may result in failure of the device.
- While a power supply is applied to MFC,  $\pm 15\text{VDC}$  must be applied simultaneously. If only  $+15\text{VDC}$  or  $-15\text{VDC}$  is applied, electronic circuits will become unstable and it may cause a malfunction of MFC.
- This device is a precious device, please handle it carefully. Dropping down or handling it carelessly will cause damage. Please use assist instrument while moving or setting the device.
- Regular maintenance is recommended for steady use of this device (Recommended proofreading frequency is once a year).

### 1. Introduction

This manual explains basic operation of the MC-700 series (Hereafter, it is called "MFC"). Please read through this manual and other separate volumes (Digital Interface Manual, Special Function Manual, Command Chart) carefully to familiarize yourself with the features of this device.

### 2. Summary

This device is the mass flow controller with the function of switching different kinds of gas and flow rate (Hereafter called "variable function" or "VR"). By using the 3 rotary switches on the MFC, the gas type and flow rate can be changed. The rotary switches are placed conveniently on top of the MFC unit so that adjustments can be made accordingly even after the unit is set in position. For old models, stocking MFC for each of gas and flowrate was necessary because only one spec is available to one MFC, and MC-700 can reduce your stocking because it can be used for more than one spec with one MFC.

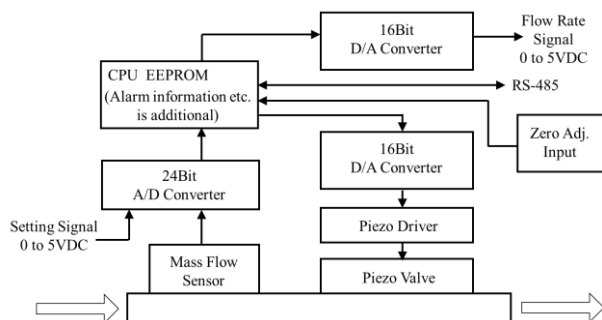
### 3. Features

The MFC has the following features.

- LINTEC's proprietary ambient temperature compensation type flow sensor.
  - The influence of ambient temperature is small due to the sensor temperature control following the ambient temperature.
  - Since the temperature distribution of the sensor is constant, high-speed response is possible.
- Gas type and flow rate setting can be changed by using the 3 switches on the mass flow controller unit.
- Digital interface (RS-485) is standard equipment and the maximum of 32 MFCs could be connected together with daisy chain.
  - (Option: Digital interface RS-232C is possible)
- Small structure of dead volume using diaphragm valve.
- Stainless steel 316L is used because of good corrosion resistance and seal ability.
- Particulate-free structure
- RoHS compliant, CE conformity

### 4. Structure

The MFC consists of sensors, bypass, valves, and a microcomputer for signal processing. A digital PID feedback control system controls the valve action so that flow rate output from the sensor agrees with flow rate setting value.



### 5. Specification / Dimensions

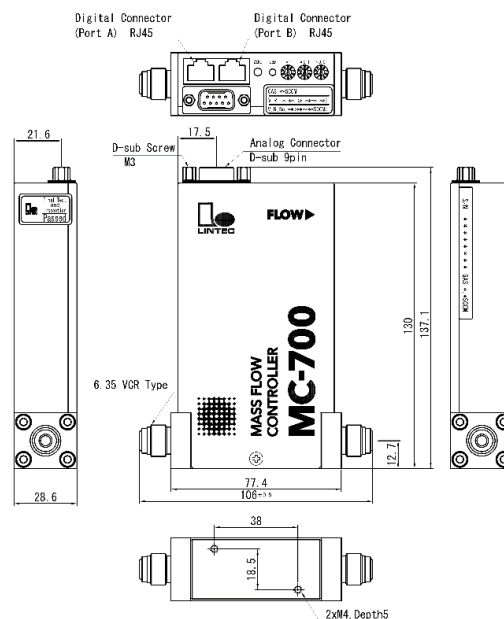
#### (1) Specification

Mass Flow Controller			
Name	MC-710 MC-720 MC-730		
Model	MC-710	MC-720	MC-730
Standard flow rate in nitrogen VR number	10SCCM to 3SLM (VR number 02 to 06)	3.1 to 10SLM (VR number 07)	11 to 50SLM (VR number 08 and 09)
Valve operation mode	Normally closed / Normally open		
Internal surface treatment	No treatment / Precision polishing		
Flow rate control range	2% of full scale		
Analog flow rate setting signal	Proportional to flow rate: 0 to 5VDC		
Analog flow rate output signal	Proportional to flow rate: 0 to 5VDC		
Variable function (VR)	Changeable by using rotary switches (0.50 to 2.00) Range is limited by original flow rate range of unit		
Accuracy (Note1)	$\pm 1.0\%$ F.S.		
Repeatability (Note1)	$\pm 0.2\%$ F.S.		
Response time	1sec (Typical)		
Operating differential pressure (Note2)	50 to 300kPa	100 to 300kPa	150 to 300kPa
Maximum operating pressure	300kPa(G)		
Withstanding pressure	1MPa(G)		
Operational temp/ Humidity range	5 to 50°C / 0 to 80%RH (with no condensation) (Accuracy insurance 15 to 35°C)		
Storage temp/ Humidity range	0 to 60°C / 0 to 80%RH (with no condensation)		
Leak integrity	Less than $1 \times 10^{-11} \text{Pa} \cdot \text{m}^3/\text{sec}$ (He)		
Mounting direction	Free		
Materials exposed to gas	Stainless steel 316L, PCTFE, PTFE		
Seal materials	Stainless steel 316L		
Actuator	Piezo electric actuator		
Fitting	6.35VCR Type: 124mm 6.35VCR Type: 106mm (option) 6.35SWL Type: 127mm (option)		
Power supply	$+15\text{VDC} \pm 3\%$ : 120mA $-15\text{VDC} \pm 3\%$ : 50mA		
Analog interface	D-sub 9pin (male), Fixed size of screw: M3		
Digital interface	RS-485 (RJ45 Jack) 2-wire Maximum connection 32 units RS-232C (RJ45 Jack) Maximum connection 100units (R0/R1 Option)		
Weight	Approx. 1 kg		

Note 1) The value at the time of shipping. This may change with usage of VR function.

Note 2) The value at the time of shipping. This may change with gas type and flow rate setting.  
• Connect the MFC to the ground.

#### (2) Dimensions



### 6. Ordering information

MC-710 MC- 4VR2 A0A0A0 - 06 - N2 - 1.5SLM

[1] [2] [3] [4] [5] [6] [7]

[1] Model: MC: Mass Flow Controller Series MC-710 MC-720 MC-730

[2] Valve operation mode · Internal surface treatment  
NO: Normally opened valve / No treatment  
NC: Normally closed valve / No treatment  
MO: Normally opened valve / Precision polishing  
MC: Normally closed valve / Precision polishing

[3] Fitting  
4VR2: 6.35VCR Type 124mm  
4VR1: 6.35VCR Type 106mm (option)  
4SWL: 6.35SWL Type 127mm (option)  
※ Please consult us for other fitting types.

[4] Other options  
Default settings is labeled "A0A0A0", please consult for more information.

[5] VR Number

[6] Gas type

[7] Full scale flow rate and unit: SCCM(0°C standard), SLM(0°C standard)

7. Connection

(1) Analog interface connector

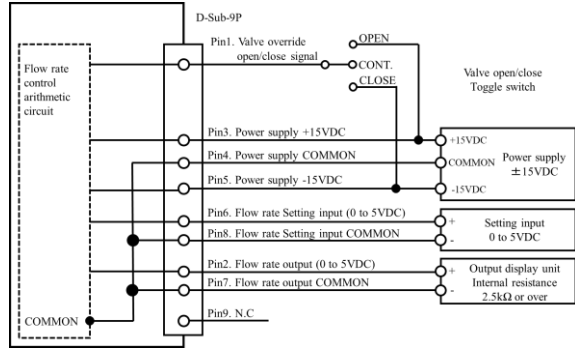
Mounted connector : D-Sub 9 pin(male)

Pair connector : D-Sub 9 pin(female) (Fixed size of screw : M3)

Pin No.	Signal name	Function
1	Valve override open/close signal (Note3)	+15VDC: OPEN, -15VDC: CLOSE
2	Flow rate output signal 0 to 5VDC	Flow rate output voltage plus side 0 to 5VDC
3	Power supply input +15VDC±3%	Power supply (plus) 120mA
4	Power supply COMMON (Note4)	COMMON ±15VDC±3%
5	Power supply input -15VDC±3%	Power supply (minus) 50mA
6	Flow rate setting signal 0 to 5VDC	Flow rate setting voltage 0 to 5VDC (plus)
7	Flow rate output COMMON (Note4)	Flow rate output signal COMMON
8	Flow rate setting COMMON (Note4)	Flow rate setting signal COMMON

Note3) Impedance for flow rate setting signal is 10MΩ, valve override signal resistance is 100kΩ. Note4) Pin No.[4],[7]and No.[8] are connected internally in MFC.

Wirings should be done as shown below in order to remove the effect of potential difference among the COMMON.



Do not connect. Flow rate setting signal COMMON[8], Flow rate output signal[7], and Power supply COMMON[4] in the power supply unit.

(2) Digital interface connector

Mounted connector : RJ-45 Modular jack

Pair connector : RJ-45 Modular plug

·Digital Interface (Port A)

Pin No.	Signal Name		Function
	RS-485	RS-232C(Note5)	
1	Signal COMMON		RS-485/RS-232C Signal COMMON
2	Signal COMMON		RS-485/RS-232C Signal COMMON
3	N.C.		-
4	Signal [-Txd/Rxd]	Signal [Rxd]	RS-485 2-wire system transmitter / receiver minus signal RS-232C receiver signal
5	Signal [+Txd/Rxd]	Signal [Txd]	RS-485 2-wire system transmitter / receiver plus signal RS-232C transmitter signal
6	N.C.		-
7	N.C.		-
8	N.C.	Power OUT (Note6)	RS-485 Unconnected RS-232C Power Output 5VDC

·Digital Interface (Port B)

Pin No.	Signal Name		Function
	RS-485	RS-232C(Note5)	
1	Signal COMMON		RS-485/RS-232C Signal COMMON
2	Signal COMMON		RS-485/RS-232C Signal COMMON
3	N.C.		-
4	Signal [-Txd/Rxd]	Signal [Txd]	RS-485 2-wire system transmitter / receiver minus signal RS-232C transmitter signal
5	Signal [+Txd/Rxd]	Signal [Rxd]	RS-485 2-wire system transmitter / receiver plus signal RS-232C receiver signal
6	N.C.		-
7	N.C.		-
8	N.C.		-

Note5) Digital interface is RS-232C specification if the factory default option is specified as R0 or R1. Refer to the attached sheet of digital interface instruction manual for connection.

Note6) [Power OUT] means the power output of RS-1 interface and it is not applicable for connections to other machines without R1 option.

·RS-1 is a discontinued product. Therefore, MC-3000E series / MC-2000 series can be replaced with MC-700 series including option.

8. Alarm functions

The MFC has two types of alarm functions built in. In addition, alarm status can be confirmed using both digital communication (alarm output from the digital connector) and an LED located on top of the body of the MFC. As alarm settings can only be changed using digital communication, please carry out necessary changes using this method. For details, please refer to the Interface Instruction Manual.

Alarm	Set off	LED indicator
A	Setting value ≠flow rate output	Continuous Red
	Flow totalizer Alarm level 2	
	Rotary switch setting error (Note 7)	Continuous Red (only analog mode)
	Power supply voltage (+15VDC) drop	Off
B	Voltage of valve control change	Red (every 0.5sec flashing)
	Abnormal zero offset (Note 7)	
	Flow totalizer Alarm level 1	
Other	Command error	Continuous Red (every 0.5sec flashing)
Normal	-	Green (every 1sec flashing)

9. Software switch (factory shipped value)

This MFC is provided with a software switch for operation mode setting. Before operation, input the necessary data for various functions by using the digital interface. Details of the functions are described in the special function manual.

Software switch	Available values	Function	Default
Device number	00 to 99	Device No. Registration	00
Alarm A range	0 to 99 [%]	Setting Alarm A range	5%
Alarm B range	0 to 99 [%]	Setting of Alarm B range	20%
Alarm timer	0 to 99 [seconds]	Setting of Alarm timer	5 seconds
Alarm cancel timer	0 to 99 [seconds]	Setting of time of alarm sound after error is cleared	2 seconds
Alarm A output	Enable / Disable	Setting of Alarm A output	Enable
Alarm B output	Enable / Disable	Setting of Alarm B output	Disable (Note 7)
Operation mode	Analog / Digital	Switching of Analog/digital	Analog
Power on mode	Analog / Digital	Switching of Operation mode in power turning on	Analog
Valve control	C / O / H / S	Close / Open / Hold / Servo	Servo
Control mode	2%Close/2%Hold/Nor mal	Control mode setting at flow rate setting <2% 2%Close: Valve Close 2%Hold: 2% Control Normal: Normal Control	2%Close
Variable range	0.50 to 2.00(Analog) 5000 to 20000(Digital) Both Analog and Digital have limits according to the specification	<Variable range setting> Analog mode (Priority to rotary switch) Digital mode (Priority to digital setting) However, in the case that rotary switch is 0.00, priority will be given to the digital setting even in Analog mode.	Dependent on full scale flow rate
Communication protocol (RS-485/RS-232C) (Note7)	9600 to 38400bps 8bit / 7bit Odd / Even / None 1bit / 2bit	Baud rate Character length Parity Stop bit	9600bps 7bit None 2bit

Note7) Zero adjustment error alarms regardless of the “Enable” / “Disable” of the alarm.

·If the zero adjust button on the top of the MFC is pressed and held for over 5 seconds, the communication protocol is reset to default.

10. Operation

(1) Procedure

- 1) This product is packed in a clean room before shipment. Please break the seals in a clean room after taking it out of its box.
- 2) Check the gas type and flow rate and check the direction of the gas flow and the MFC before installation.
- 3) Check for gas leaks from the tubing with a helium (He) leak detector.
- 4) Connect the interface connectors according to the Connector table.
- 5) Power requirements are +15VDC:120mA and -15VDC: 50mA. Check the voltage, polarity, and capacitance of the power supply voltage.
- 6) Turn on power supply and let the equipment warm up for at least 5 minutes (Recommended time: 30min).
- 7) Adjust the zero point by pressing the zero adjustment, switch located on the top of the MFC. Before zero-point adjustment, check that gas is not being supplied and the device was warmed up for 30 minutes or more in order to ensure sensor stability.
- 8) Input the flow rate setting signal and supply gas with required differential pressure to the MFC. The MFC will begin to control the gas flow in proportion to the preset voltage. Full-scale voltage is 5VDC. Maximum input voltage is ±15.5VDC.
- 9) When the output flow rate signal is used, the tolerance voltage of the external device should be more than ±15.5VDC. When it's connected the output valve may be within the range of the maximum voltage ±15.5VDC.
- 10) Complete shut-off cannot be achieved with the mass flow controller. If complete shut-off is desired, a shut-off valve should be installed.
- 11) When a highly reactive gas is used, thoroughly purge all foreign matter from the tubing and the MFC before operation.
- 12) When contaminated gas is used, install a filter at the equipment inlet.
- 13) Use the MFC within the range of the operating temperature (15 to 35°C), and keep it at the same temperature with the gas. If used in any environment that does not meet the above-mentioned requirements, the flow rate cannot be measured accurately and the device may fail.
- 14) Do not switch the power supply on and off within one second. It may cause failure.

(2) Valve control signal

The MFC features a forced valve open/close input function.

The connector pin No.1 is used to input the internal valve open/close signal. By inputting this signal, a forced opening/closing of the internal valve can be performed without depending on the value of the flow rate preset signal.

When +15VDC is input: fully open

When -15VDC is input: fully closed

### (3) Variable Range function

By using one device of MFC, it is possible to modify multiple flow rate ranges and gas types. To modify the flow rate or the gas type, refer to the following VR corresponding chart or the calculation formula, and modify the variable range by the rotary switches (for analog control) or digital communications (for digital control).

Flow range and gas type

Model	VR number	Flow rate range in Nitrogen	VR value applicable	Standard flow rate
MC-710	02	10 to 30 SCCM	0.50 to 1.50	15 SCCM
	03	25 to 100 SCCM	0.50 to 2.00	50 SCCM
	04	75 to 300 SCCM	0.50 to 2.00	150 SCCM
	05	0.25 to 1 SLM	0.50 to 2.00	500 SCCM
	06	0.75 to 3 SLM	0.50 to 2.00	1.5SLM
MC-720	07	2.5 to 10 SLM	0.50 to 2.00	5 SLM
MC-730	08	10 to 30 SLM	0.50 to 1.50	15 SLM
	09	30 to 50 SLM	0.60 to 1.00	30 SLM

[Formula]

(standard flow rate) ÷ (desired flow rate) × (conversion factor)

By using this function, the flow rate and gas type may be changed, however if a different gas is to be used, please consider the properties of the gas and confirm the responsiveness before usage. Also, in the case that the gas may cause debris or particle, please refrain from using it. If you have any questions of conversion factor, please contact us.

### (4) Digital interface

The MFC features the RS-485 or RS-232C (Note 5) digital interfaces. Many special functions can be employed using the digital interfaces.

Please refer to other manuals (Digital Interface Manual, Special Function Manual Command Chart).

## 11. Product warranty

#### (1) Period

This product is guaranteed for a period of 1 year from date of shipment. Defects are repaired according to the following regulations.

#### (2) Scope

Warranty coverage is restricted to this product only. Any other damage caused by an is not covered.

#### (3) Disclaimer facts

The following repairs are not covered by the warranty:

- 1) Failure caused by by-product of fluid used
- 2) Failure caused by misuse (including careless operation) or incorrect repair or modification
- 3) Failure caused by dropping after purchasing
- 4) Failure caused by a natural disasters

Even if the warranty period is still in effect, the following items may not be repaired.

- 1) In case of the product is returned with fluid remaining inside
- 2) In case of what kind of fluid was not informed used on the product

The MFC is a precision instrument. Control may become unstable if electric noise, temperature change of fluid, pulsation of fluid pressure etc. occurs. Please be forewarned.

This instruction manual is subject to revision without notice

# LINTEC CO., LTD.

<http://www.lintec-mfc.co.jp>

#### Corporate Headquarters

4-1-23 Sekinotsu, Otsu City, Shiga Pref. 520-2277, Japan  
TEL. +81-(0)77-536-2210 FAX. +81-(0)77-536-2215

#### Tokyo Branch Office

3F Hattori Build., 4-30-14 Yotsuya Shinjyuku-ku Tokyo 160-0004, Japan  
TEL. +81-(0)3-5366-2801 FAX. +81-(0)3-3341-3513