Analog/DIgital Mass Flow Controller

NM-1500 Series

Instruction manual

TOKYO KEISO TAIWAN CO., LTD.

Contents

1. Preface

We are appreciated for your company to choose our analog mass flow controller. Please read the instruction manual carefully before operating the controller. This manual will instruct you how to operate the controller properly.

2. Notices before operation

Check following items before operating the controller.

(1) Is the flow direction correct?

(2) The unit of flow rate is at 0℃ 1 atm(normal condition) or 20℃ 1 atm(standard condition).

(3) Does a pipeline have any leak?

(4) Is the air pressure within a specified range?

(5) Is the controller used in the ambient temperature from 15℃ to 35℃?

(6) Are the power voltage、polarity and output correct?

(7) Install a line filter before the gas inlet.

(8) Are the pipelines purged completely for the gas with high reaction characteristics such as toxicity or corrosion?

(9) Add a stop valve for complete shutoff is necessary.

3. Abstract

The mass flow controller is developed under the theorem of thermal mass flow detection. The controller is a high-efficiency gas flow controller consisting of a flow sensor and a solenoid valve.

4. Specifications

Analog Type

Function		Meter				Controller				
Standard Model		NM-1510AM	NM-1520AM		NM-1530AM	NM-1510AC	NM-1520AC		NM-1530AC	
Range(full scale)	mL/min(nor)	10,20,50 100,200, 500				10,20,50 100,200, 500				
	L/min(nor)	1,2,5	10,20	50	100,150	1,2,5	10,20	50	100	150
Valve operation mode						Normally Closed				
Minimum controllable flow rate(%F.S.)						2.0				
Response time(sec)(2-98% F.S.)		1.5				3.0	2.0			
Accuracy(%F.S.)		±2.0			±2.5	±2.0			±3.0	
Linearity(%F.S.)		±1.0			±1.5	±1.0			±1.5	
Repeatability(% F.S.)		±0.5				±0.5			±1.0	
Required differential pressure	kpa					49-294	98-294	147-294	294-392	392-490
Maximum operation pressure	kpa					294			392	490
Withstand pressure	kpa	980								
Operation temperature	℃	15-35								
Temperature coefficient (% F.S.)/ ℃	Zero Span	0.1 0.1								
Leak rate	pa·m3/sec	$<1\cdot10^{-11}$			$1\cdot10^{-9}$	$<1\cdot10^{-11}$			$1\cdot10^{-9}$	
Control valve						Solenoid				
Materials exposed by gas	Body	SUS-316L								
	Control valve					PTFE				
	Seals	Gold			Viton	Gold			Viton	
	Blazing at sensor	Nickel(Ni)								
Fitting	Standard	1/4" VCR,SWL			3/8"SWL	1/4" VCR,SWL			3/8"SWL	
	Optional	1/4" VCO, 3/8"SWL, 3/8"VCR			3/8"VCR	1/4" VCO, 3/8"SWL, 3/8"VCR			3/8"VCR	
Flow rate output signal		DC 0~5V (DC 1~5V, DC 4~20mA)								
Flow rate setting signal						DC 0-5V (DC 1~5V, DC 4~20mA)				
Zero adjustment		Zero VR								
Cable connector		D-Sub 9 Pin connector								
Power supply requirement		DC +15V 60mA / DC -15V 200mA DC 24V 250mA								

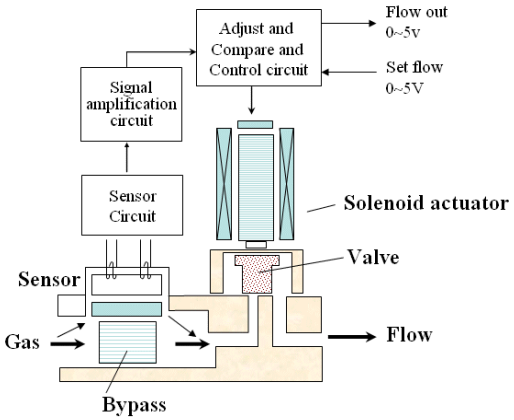
Digital Type

Function		Meter				Controller				
Standard Model (Digital Type)		NM-1510DM	NM-1520DM		NM-1530DM	NM-1510DC	NM-1520DC		NM-1530DC	
Range(full scale)	mL/min(nor)	10,20,50 100,200, 500				10,20,50 100,200, 500				
	L/min(nor)	1,2,5	10,20	50	100,150	1,2,5	10,20	50	100	150
Valve operation mode						Normally Closed				
Minimum controllable flow rate(% F.S.)						2.0				
Response time(sec)(2-98% F.S.)		1.0				1.5	1.0			
Accuracy(%F.S.)		±1.5				±1.5				
Linearity(%F.S.)		±0.7				±0.7				
Repeatability(% F.S.)		±0.5				±0.5				
Required differential pressure	kpa					49-294	98-294	147-294	294-392	392-490
Maximum operation pressure	kpa					294			392	490
Withstand pressure	kpa	980								
Operation temperature	℃	15-35								
Temperature coefficient (% F.S.)/ ℃	Zero Span	0.1 0.1								
Leak rate	pa·m3/sec	$1\cdot10^{-11}$			$1\cdot10^{-9}$	$1\cdot10^{-11}$			$1\cdot10^{-9}$	
Control valve						Solenoid				
Materials exposed by gas	Body	SUS-316L								
	Control valve					PTFE				
	Seals	Gold			Viton	Gold			Viton	
	Blazing at sensor	Nickel(Ni)								
Fitting	Standard	1/4" VCR,SWL			3/8" SWL	1/4" VCR,SWL			3/8" SWL	
	Optional	1/4" VCO, 3/8"SWL, 3/8"VCR			3/8"VCR	1/4" VCO, 3/8"SWL, 3/8"VCR			3/8"VCR	
Flow rate output signal		DC 0~5V (DC 1~5V, DC 4~20mA)								
Flow rate setting signal						DC 0-5V (DC 1~5V, DC 4~20mA)				
Zero adjustment		Set Zero (Switch & Command)								
Digital communication		RS485								
Electrical connection		D-Sub 9 pin connector								
Communication connection		RJ45 connector								
Power supply requirement		DC +15V 150mA / DC -15V 200mA DC 24V 300mA								

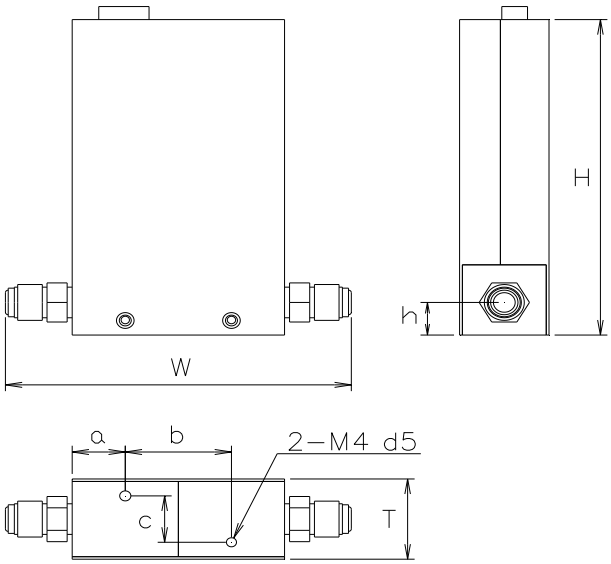
*option: ±1.0%F.S.

5. Structure

As shown in the figure, the mass flow controller consists of a sensor bypass, valves and circuit. Through loop control, the flow rate will coincide with set point.



6. Dimension and appearance



Dim.:mm

Model	Seal	W(Install)				T	H	h	Bottom		
		1/4" VCR	1/4" SWL	3/8" VCR	3/8" SWL				a	b	c
NM-1500	Viton (≧100NL/min)	123.8	127.4	130.0	130.0	32	126	13	19	38	18.5
	Gold (<100NL/min)	123.8	127.4								

7. Wiring

1) Analog Type Interface Connector：NM Connector(D-Sub 9 pin male)

Pin No	Signals Name (24V type)	Description	Signals Name (± 15V type)	Description	Wire Color
1	**(NM-1500AC) Valve Control**	DC+15V: valve fully open DC-15V: valve fully close			Grey
	(NM-1500DC) Valve Control	DC+24V: valve fully open GND: valve fully close	**Valve Control**	DC+15V: valve fully open DC-15V: valve fully close	
2	**Flow**	output signal 0~5 DCV (1-5DCV/4-20mA)			Yellow
3	**24 V**	Power Supply：DC+24V	**+15 V**	power supply **+15 V**	Red
4	**COM**	Power COM	**COM**	± 15V power COM	Green
5	**NC**	NC	**-15 V**	power supply **-15 V**	Blue
6	**Set**	flow rate setting signal DC0~5 V (DC1-5V/4-20mA)			Orange
7	**Out COM**	output signal COM			Purple
8	**Set COM**	setting signal COM			Black
9	**(NM-1500AC) VTP**	Solenoid valve voltage test point DC 0~ -13.5V (Pin 5 for COM)			White
	(NM-1500DC) PULSE	Open Collector Output(NPN), Pulse/High Alarm/Low Alarm			
		Cable Shielding			Dark Black

Note: Pin 7., pin 8. are connected to the same COM, pin 4. is connected to isolated Power COM.

1) Power supply
   24V type：D-sub Pin 3. (24V), and pin 4.(power COM) should be connected to power supply.
   ± 15V type：D-sub Pin 3. (+15V), pin 5.(-15V) and pin 4.(power COM) should be connected to dual power supply.
2) Flow rate Setting
   Pin 6 .(Set) and pin 8.(Set COM) are for flow rate setting by external DC1~5V(DC0~5V), this voltage must be very stable and high accuracy to 0.1% F.S. (5000 mV).
3) Output signal
   Pin 2 .(Out) and pin 7.(Out COM) are for output signal, this signal is the same as the setting voltage under normal controlling.
4) Valve control
   Pin 1.(valve control) is for forcing the control valve to be fully opened or fully closed
   NM-1500AC：DC+15V：valve fully open
   DC-15V：valve fully close
   NM-1500DC(24V Type)：DC+24V：valve fully open
   GND：fully close
   NM-1500DC(±15V Type)：DC+15V：valve fully open
   DC-15V：fully close
   The valve is controlled by setting signal as Pin 1 is not connected to any voltage

input normally.
The input impedance is 1 MΩ.

5) NM-1500AC VTP
Pin 9.(VTP) is for checking the solenoid valve voltage, pin 5.(-15V) is for COM when measuring.

6) NM-1500DM/DC Open Collector Output
Pin 9. of NM-1500DC supplies open collector output for Volume Pulse, High Alarm or Low Alarm selected by communication command.

2) Digital Interface Connector： RJ45 Connector

Pin No.	Signal Name	Description
1	Signal COM	RS485 Signal COM
2	Signal COM	RS485 Signal COM
3	NC	NC
4	RS485 D-	RS485 D- Signal
5	RS485 D+	RS485 D+ Signal
6	NC	NC
7	NC	NC
8	NC	NC

Instruction for terminals:

1) RS485 D-, RS485 D+
This is RS485 standard Serial Transmission Interface, which can send/receive signals to/from MFC according to the command of software.

2) NC
Not Connected.

8. Communication

NM- 1500D series transmits the messages by Modbus RTU modes through RS485 interface.

1) RS485 protocol：
- Baud rate：1200,2400, 4800, 9600, 19200, 38400 bps
- Data bit：8
- Stop bit：1.2
- Parity：none, odd, even

2) Functioin Codes

Master commands	Slave Echo (Normal/ Unnormal)	Function
03H	03H/83H	Read holding registers
04H	04H/84H	Read input registers
06H	06H/86H	Preset single holding register
10H	10H/90H	Preset multiple holding registers

3) Address table 0f input register

Address	Function	Read/ Write (R/W)	Data Type	Unit	Content
0000H	Flow Rate	R	signed long	mL/min ,L/min	
0001H					
0002H	Flow Rate Percent	R	signed int	%	0.00~100.00
0003H	Setting value	R	signed long	mL/min ,L/min	
0004H					
0005H	Setting value percentage	R	signed int	%	0.00~100.00
0006H	Analog setting value	R	signed int	V,mA	
0007H	Analog flow rate value	R	signed int	V,mA	

Address table 0f holding register

Address	Function	Read/ Write (R/W)	Data Type	Unit	Content
0000H	Setting value percentage	R/W	signed int	%	0.00~100.00
0001H	Control mode selection	R/W	unsigned int		[Low Byte] & 0FH： 0H：Analog control 1H：Digital control 2H：Valve full close 3H：Valve full open
0002H	Scale Range	R/W	unsigned long		Decimal point is decided by address 0004H
0003H					
0004H	Flow rate decimal point	R/W	unsigned int		0~3
0005H	Low cut-off Mode	R/W	unsigned int		0H：Low cut-off set 0 1H：Low cut-off Hold 2H：Low cut-off NC
0006H	Low cut-off percentage	R/W	unsigned int	%	0.00~10.00%
0007H	Moving average times	R/W	unsigned int		1~30
0008H	Gain	R/W	unsigned int		
0009H	Offset	R/W	signed int		
000AH	Zero adjust	R/W	signed int		DA count
000BH	Span adjust	R/W	signed int		DA count
0012H	Modbus ID	R/W	unsigned		01H~F7H
0013H	RS485 Protocal	R/W	unsigned		[Low Byte] & 0FH： 0H:1200

					1H:2400, 2H:4800, 3H:9600, 4H:19200 5H:38400 [Low Byte] & F0H： 00H:” e,8,1” 10H:” e,8,2” 20H:” n,8,1” 30H:” n,8,2” 40H:” o,8,1” 50H:” o,8,2”
0015H	Open Collector output mode	R/W	unsigned int		0：None 1：High & Low Alarm 2：High Alarm 3：Low Alarm 4：Volume Pulse
0018H	Flow rate unit	R/W	unsigned int		mL/min,L/min
0019H	High Alarm setting percentage	R/W	unsigned int		0.00~100.00
001AH	Low Alarm setting percentage	R/W	unsigned int		0.00~100.00
0074H	Parameter writing allowed	W	unsigned int		Password: 0001H

9. Pulse output

The pulse output of NM-1500DC includes the functions of high alarm and low alarm selected by the value of register 0015H,

0：None
1：High & Low Alarm
2：High Alarm
3：Low Alarm
4：Volume Pulse

The setting value of high alarm is decided by the value of register 0019H, and the setting value of low alarm is decided by the value of register 001AH。

10. LED light

	LED	Range	duration
Normal	Green:On/Off 0.5 sec Red: Off		
High/Low alarm	Green:Off Red: On/Off 0.5 sec	±2% F.S.	2 sec
Out of valve control	Green: Off Red: On	±5% F.S.	5 sec
Loading default settings	Green & Red glittering 0.1sec alternately，5 times		

11. Operation methods

1) Install the connections of MFC by following the gas flow direction.
2) Test the leakage by helium leakage detector.
3) Connect the signal connectors to power supply.
4) After the controller is turned on, MFC should warm up at least 30 minutes.
5) Gas pressure should be following the specifications.
6) The conversion of voltage and flow

   Setting voltage = (Flow/Full scale) x 5V

12. Service

Our products have passed a series of strict quality examination before delivery.
Please inform us as soon as possible if any problem happened.

13. Warranty

(1) A year guaranty
(2) If the product has malfunction caused by following reasons during guaranty period, we will not provide free service.
- The product has damages or malfunction caused by improper operation, modification, repair, handling and dropping.
- Operate the controller without following the instruction manual.
- The damage caused by a natural disaster.

(3)We will charge material fee and management fee if the guaranty period expires.