MCW400A100
Multi-Channel Indicator
User's Manual

Thank you for purchasing the MCW400A100 Multi-Channel Indicator.

This manual contains information for ensuring correct use of the Multi-Channel Indicator. It also provides necessary information for installation, maintenance, and troubleshooting.

This manual should be read by those who design and maintain devices that use the Multi-Channel Indicator. Be sure to keep this manual nearby for handy reference.

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.
Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

NOTICE

Be sure that the user receives this manual before the product is used.

Copying or duplicating this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

Safety precautions are intended to ensure the safe and correct use of this product, and to prevent damage to property. Be sure to observe these safety precautions, and be sure to read and understand the contents of this user's manual.

⚠ CAUTION

Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

⚠ CAUTION

- Use Yamatake's SurgeNon if there is a risk of power surge due to lightning. Failure to use adequate protection might cause fire or faulty operation.
- Use the MCW400A100 within the operating ranges recommended in the specifications for power supply and I/O voltage. Failure to do so might cause fire or faulty operation.
- When discarding the MCW400A100, dispose of it as industrial waste, following local regulations.

! Handling Precautions

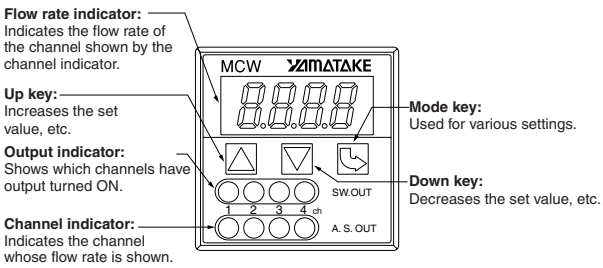
- Do not disassemble the MCW400A100. Doing so might cause faulty operation.
- Do not use the MCW400A100 during the transitional period (0.5s) immediately after the power has been turned ON.

OVERVIEW

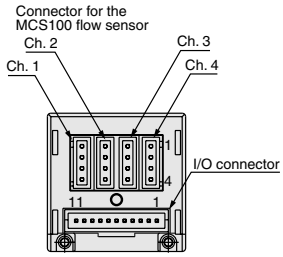
The MCW400A100 is a multi-channel display designed to remotely display the instantaneous flow rate of up to four MCS-series flow sensors. It also produces open collector output for any flow that is within the specified limits. Additionally, by means of RS-232C communications, a personal computer can be used to change settings or to view and save flow-rate indications and outputs.

PARTS NAMES AND FUNCTIONS

■ Display and console



■ Connector



MOUNTING

■ Location

⚠ CAUTION

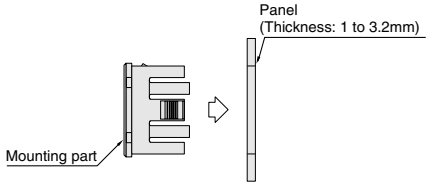
- Use the MCW400A100 within the operating ranges given in the specifications for temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc. Failure to do so might cause fire or malfunction.
- Do not allow lead clippings, chips or water to enter the controller case. They might cause fire or faulty operation.

Install the MCW400A100 where:

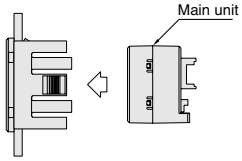
- There are no ignitable or flammable materials.
- It is not exposed to direct sunlight (ultraviolet rays).
- There are no salt particles or iron particles, and no excessive dust.
- Humidity is not excessive.
- There are no organic solvents, phosphate ester hydraulic fluid, sulfur dioxide, chlorine gas, and/or acids.
- It is far from high voltage sources, welding machines, and other sources of electrical noise.

■ Panel mounting procedure

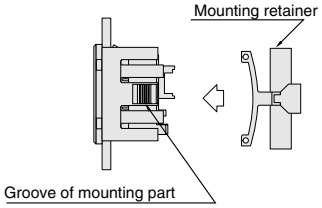
(1) Insert the mounting part into the panel hole to firmly fix it to the panel.



(2) Insert the main unit into the back of the mounting part.



(3) After completing step (2), insert the mounting retainer from the back so that it engages the groove of the mounting part.



Note

- To take the MCW400A100 off the panel, first remove the mounting retainer with a screwdriver, and then disassemble in the reverse order of assembly.

WIRING

■ Connector and wiring

Handling Precautions

- Do not apply excessive force, vibration, or impact to the connectors or cables. Doing so might cause equipment failure.
- When using a switching regulator for the power supply, be sure to ground the frame ground.
- When using any device (switching regulator, inverter motor, etc.) that produces electrical noise near the flow sensor, be sure to ground the frame ground of the device.

● Flow sensor connector and wires

Pin No.	Function	Color of lead wire
1	Supply voltage (+V)	Brown
2	Sensor output	Black
3	Supply voltage (GND)	Blue
4	Trigger signal for memorizing reference flow value	(See note)

Note

- Lead wire for trigger signal for memorizing reference flow value must be supplied by the customer. Wire size is 0.14 to 0.3mm^2 and outside diameter of the insulator is 0.8 to 1.0mm.

● I/O connector and wires

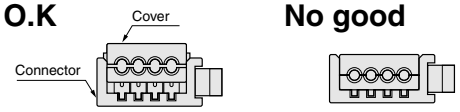
Pin No.	Function	Color of lead wire
1	Power supply + (24Vdc)	Red
2	Power supply - (GND)	Black
3	Output 1 (SW1)	White
4	Output 2 (SW2)	Green
5	Output 3 (SW3)	Yellow
6	Output 4 (SW4)	Brown
7	RS-232C (SG)	Blue
8	RS-232C (RXD)	Brown
9	RS-232C (TXD)	Black
10	N.C.	-
11	N.C.	-

● Connecting the cable of the flow sensor

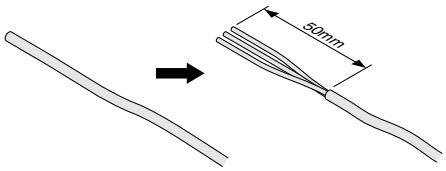
The cable of the flow sensor is not yet connected to the connector (pin contacts). Follow the steps below to connect the cable and connector.

Handling Precautions

- Make sure that the connector cover (lead wire insertion part) stands above the connector main body as shown in the figure below. If the connector cover is not lifted off the connector main body, it cannot be used.



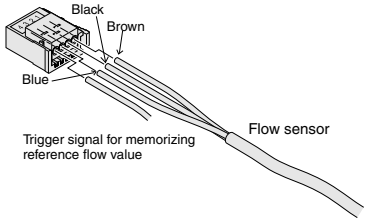
(1) Cut the cable to the required length. Remove the sheath approx. 50mm from the end to free the lead wires. However, do not remove the insulation from the lead wires.



Handling Precautions

- The insulation at the end of the flow sensor wire is incised at the factory. Cut off this portion of the wire before inserting the leads into the connector.

(2) Insert the lead wires into the holes in the connector cover so that the lead wire colors and pin Nos. match those indicated on the connector. Check through the top of the semitransparent cover that the lead wires are fully inserted to the end. (The insertion length is approx. 9mm.)

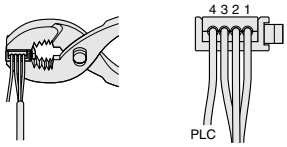


! Handling Precautions

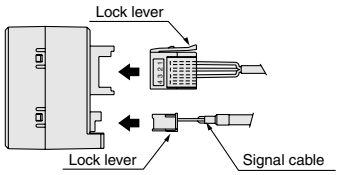
- If reference flow value is desired, be sure to insert that lead wire into the connector cover before crimping.

(3) Carefully squeeze the cover and connector main body together with an appropriate hand tool, such as pliers so that no lead wires are disconnected from the connector.

The crimping force must be 980.7N or less.
When the connector and cover top surfaces are level, the connection work is complete.



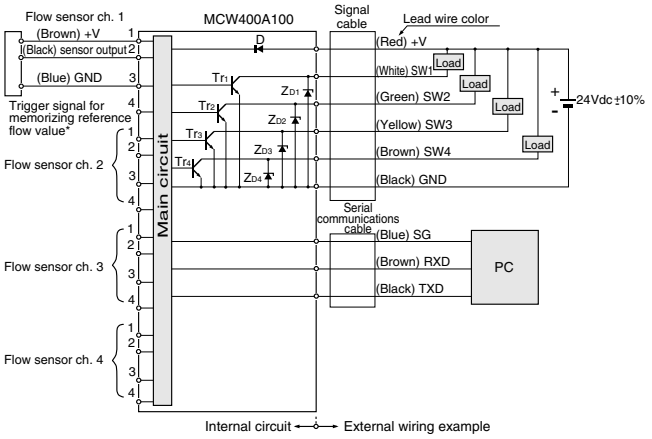
● Connecting and disconnecting the cable



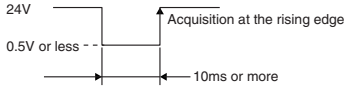
(1) To connect the flow sensor cable and signal cable, position the lock levers as shown in the figure above, and insert the cable connectors until the locks are engaged.

(2) To disconnect the cable, push down the lock lever sufficiently, hold the connector, and pull the cable out. Be especially careful that no excessive force is applied to the lead wires.

■ Internal circuit and external wiring example



*Trigger signal for memorizing reference flow value acquisition level and timing



OPERATION

■ Operating

When the power is turned ON, this unit automatically enters indication mode. In indication mode, the flow rate of channel 1 is shown on the flow rate indicator and channel indicator 1 is lit. The indicated channel can be changed with the △ or ▽ key.

SETTING

! Handling Precautions

- Do not press the keys with a mechanical pencil or other sharp-tipped object. Doing so might cause damage.

When the mode key is pressed after the power has been turned ON, the mode enters the setting mode. To change the settings from the factory defaults, follow the steps below.

Power on → Indication mode →

Indication settings	• Auto-scan flow rate display • Manual flow display on/off • Peak hold and bottom hold
Basic settings	• Flow sensor selection • Operation mode selection • Threshold value settings • Hysteresis settings
Advanced settings	• Trigger signal for memorizing reference flow value • Zero reset • Output mode inverting

● Factory settings (all 4 channels)

Flow range type: SE1 (MCS100A100)
Operation mode: CO1 (window comparator mode 1)
Hysteresis: 0.02L/min
L1 level: 2.00L/min
L2 level: 1.00L/min

1. Indication settings

1-1 Auto-scanning indication

Auto-scanning indication at all channels is available.

Steps	Key operation	7-seg. LED	Remarks
1		SEF1	
2	△	SEF2	
3		SEF	
4	△ ▽ (At same time)		Auto-scanning starts
5	△ ▽ (At same time)		Auto-scanning stops

! Handling Precautions

- Since the auto-scanning mode is also used for the key lock function, key operations other than auto-scanning cancellation are not possible.
- When the power is turned OFF, the auto-scanning mode is cancelled.

1-2 Manual flow display on/off

The flow rate indication can be turned on and off.

Steps	Key operation	7-seg. LED	Remark
1		SEF1	
2	△	SEF2	
3		SEF	
4	(At same time) ▽		7-segment LED turns off
5	(At same time) ▽	＊＊＊	7-segment LED turns on again

1-3 Peak hold and bottom hold

The peak or bottom flow rate can be displayed.

Steps	Peak hold	7-seg. LED	Bottom hold	7-seg. LED	Remark
1		SEF1		SEF1	
2	△	SEF2	△	SEF2	
3	△	SEF3	△	SEF3	
4	△	SEF4	△	SEF4	
5		SEF		SEF	
6	△ (At same time)	PHL	(At same time) ▽	bHL	Hold start
7	△ (At same time)		(At same time) ▽		Cancelled

! Handling Precautions

- The displayed channel can be changed during hold.
- If the power is turned OFF, the peak hold or bottom hold is cancelled.
- Peak hold and bottom hold cannot be done at the same time.
- When the indication hold function is activated, the output hold function is also activated at the same time.

2 Basic settings

2-1 Flow sensor selection

The desired flow sensor can be set for each channel.

Steps	Key operation	7-seg. LED	Remarks
1		SEF1	
2		SEF	
3	△ ▽ (At same time)	CH1	△ or ▽ selects channel
4		SE1	△ or ▽ selects flow sensor
5			Flow sensor is set.

Flow sensor settings

SE1 : MCS100A100 (-3 to +3L/min)
SE2: MCS100A104 (0 to 3L/min)
SE3: MCS100A108 (-500 to +500mL/min)
SE4: MCS100A112 (0 to 500mL/min)
SE5: MCS100A120 (0 to 10L/min)

2-2 Operation mode selection

The desired operation mode can be set for each channel.

Steps	Key operation	7-seg. LED	Remarks
1		SEF1	
2		SEF	
3	(At same time) ▽	CH1	△ or ▽ selects channel
4		C01	△ or ▽ selects output mode
5			Output mode is set.

Operation mode settings

C01 : Window comparator mode 1
C02: Window comparator mode 2
C03: Window comparator mode 3
C04: Window comparator mode 4

2-3 Threshold settings (L1 (ΔL)/L2)

The desired threshold flow rate can be set for each channel.

Steps	Key operation	7-seg. LED	Remarks
1		SEF1	
2		SEF	
3		11	△ or ▽ selects channel
4		***	△ or ▽ sets threshold rate
5			Threshold flow rate is set.

Threshold flow rate settings

11 : 1ch_L1/ΔL
12 : 1ch_L2
21: 2ch_L1/ΔL
22: 2ch_L2
31: 3ch_L1/ΔL
32: 3ch_L2
41: 4ch_L1/ΔL
42: 4ch_L2

2-4 Hysteresis settings

The desired hysteresis can be set for each channel.

Steps	Key operation	7-seg. LED	Remarks
1		SEF1	
2	△	SEF2	
3		SEF	
4	△ (At same time)	HYS1	△ or ▽ selects channel
		0.02	△ or ▽ sets hysteresis
5			Hysteresis is set

Hysteresis settings

HYS1: Ch. 1
HYS2: Ch. 2
HYS3: Ch. 3
HYS4: Ch. 4

! Handling Precautions

- To prevent chattering, set the hysteresis value to 2 or more.

3 Advanced settings

3-1 Trigger signal for memorizing reference flow value enable (window comparator mode 2 or 3)

When using window comparator mode 2 or 3, the trigger signal for memorizing reference flow value can be performed.

Steps	Key operation	7-seg. LED	Remarks
1		SEF1	
2		SEF	
3	△ (At same time)	REF1	△ or ▽ selects channel
4			The reference flow value is available.

Enabled channel settings

REF1: Ch. 1
REF2: Ch. 2
REF3: Ch. 3
REF4: Ch. 4

3-2 Zero point adjustment (zero reset)

The zero point can be adjusted for each channel.

Steps	Key operation	7-seg. LED	Remark
1		SEF1	
2	△	SEF2	
3	△	SEF3	
4		SEF	
5	△ ▽ (At same time)	b-1	△ or ▽ selects channel.
6			Zero point is adjusted.

Zero point adjustment settings

b-1: Ch. 1
b-2: Ch. 2
b-3: Ch. 3
b-4: Ch. 4

! Handling Precautions

- If the power is turned OFF, the zero point adjustment is cancelled.

3-3 Output mode inverting (window comparator mode 4 only)

The output of any channel can be inverted.

Steps	Key operation	7-seg. LED	Remarks
1	[S]	SEF1	
2	[△]	SEF2	
3	[△]	SEF3	
	[S]	SEF	
4	[△] (At same time) [S]	CH1	[△] or [▽] selects channel
	[S]	S-0	[△] or [▽] sets mode
5	[S]		Output mode is inverted.

Output mode inverting

S-0: Non-inverted (normally open)
S-1: Inverted (normally closed)

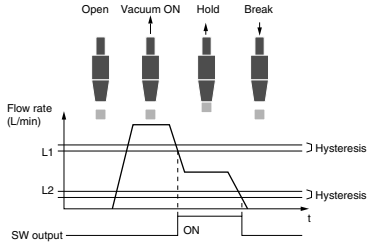
! Handling Precautions

- This function is disabled in any mode other than window comparator mode 4.

4 Operation mode

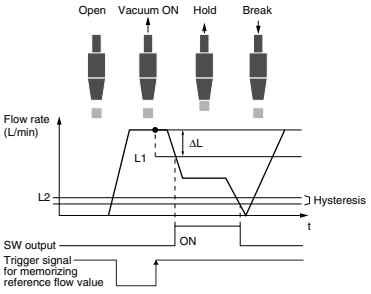
4-1 Window comparator mode 1

L1 and L2 can be set to desired levels. If the flow rate is increasing, SW output is not turned ON.



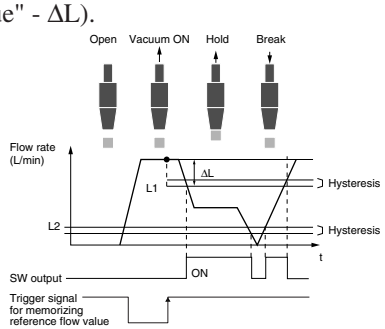
4-2 Window comparator mode 2

L1 is automatically set according to the ΔL setting and reference flow value (L1 = "reference flow value" - ΔL). If the flow value is increasing, output is not turned ON.



4-3 Window comparator mode 3

L1 is automatically set according to the ΔL setting and reference flow value (L1 = "reference flow value" - ΔL).

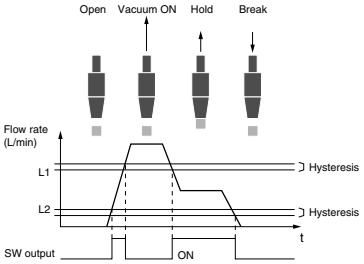


! Handling Precautions

- Do not input a trigger signal for memorizing reference flow value frequently in window comparator mode 2 or 3. Doing so might cause the number of EEPROM erase-write cycles to exceed the guaranteed amount.

4-4 Window comparator mode 4

L1 and L2 can be set to desired levels.



RS-232C Communications

● Hardware requirement

PC: PC-98 series or equivalent DOS/V machine
OS: Windows 95 or later

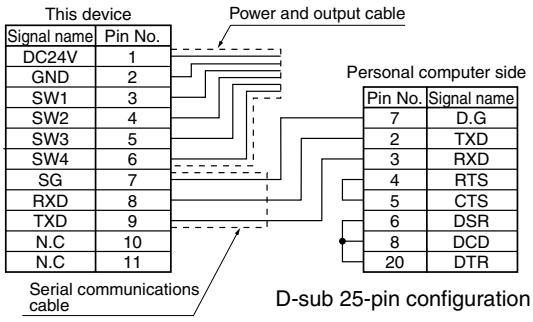
● Software requirement

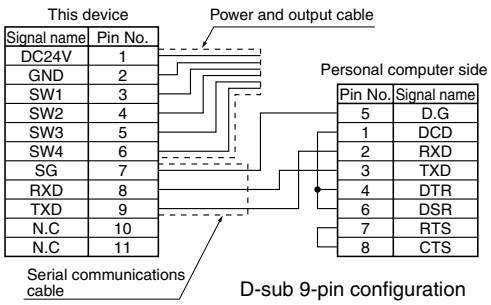
HyperTerminal, a standard accessory of Windows 95 or later, is used. For details about how to set up HyperTerminal, see page 7.

● Communications parameters

Item	Contents
Transmission speed	9600bps
Stop bits	1bit
Parity	Odd
Parity check	Yes
Data bit length	8 bits
Communications method	Full duplex
Return key send procedure	CR/LF codes

● Communications cable specification and connection





■ Function list

Function	Key operation	RS-232C command
Instantaneous flow rate indication	Yes	@A
L1 (ΔL) / (L2) settings	Yes	@PRE
Hysteresis settings	Yes	@HYS
Trigger signal for memorizing reference flow value	Yes	@P
Operation mode selection	Yes	@MODE
Flow sensor selection	Yes	@TYPE
Zero reset setting	Yes	@B
Auto-scanning indication	Yes	@AS
Output mode setting (only for comparator mode 4)	Yes	@INV
Peak hold setting	Yes	@PHL
Bottom hold setting	Yes	@BHL
Indication on/off	Yes	@DIS
Operation mode confirmation	No	@MD
Flow sensor type confirmation	No	@TP
L1 / L2 confirmation	No	@C
Threshold flow value confirmation (only for modes 2 and 3)	No	@E
Output status confirmation	No	@SW
Version indication	No	@VER

● Error indication and correction

Error indication	Error details	Correction method
oFF	Flow sensor of the selected channel is not connected or wiring is faulty.	Replace the flow sensor after turn OFF the power or the cable.
E-1	Threshold flow value beyond the measurement range is set in window comparator mode 2 or 3.	After correcting the error, keep the mode key pressed for 1 second or longer.
E-2n ("n" shows relevant channel.)	Excessive voltage (5V or more) is input to the sensor (channels 1-4).	
E-3n ("n" shows relevant channel.)	Output current is excessive.	

● Communications commands

! Handling Precautions

- Underscores (␣) in the send examples stand for spaces.
- The following example shows a response if an error occurs.

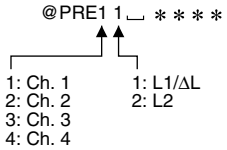
NG (CR/LF)
21:illegal type

@A

Function: Reads out the current flow rate (channels 1-4).
Command example: @A (CR/LF)
Response example: 1=-3.00 (CR/LF)
2=3.00 (CR/LF)
(CR/LF)←This shows that no sensor is connected to ch. 3.
4=0.00 (CR/LF)
(CR/LF)

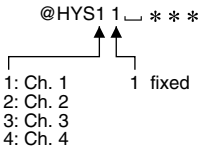
@PRE

Function: Sets the ON/OFF point for any channel.
Command example: @PRE11 ␣ -3.00 (CR/LF)
Response example: OK (CR/LF)
@PRE11: Channel 1, L1/ΔL setting
@PRE12: Channel 1, L2 setting
@PRE21: Channel 2, L1/ΔL setting
@PRE22: Channel 2, L2 setting
@PRE31: Channel 3, L1/ΔL setting
@PRE32: Channel 3, L2 setting
@PRE41: Channel 4, L1/ΔL setting
@PRE42: Channel 4, L2 setting



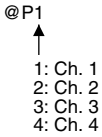
@HYS

Function: Sets the hysteresis width for any channel.
Command example: @HYS11 ␣ 0.02 (CR/LF)
Response example: OK (CR/LF)
@HYS11: Channel 1, hysteresis width setting
@HYS21: Channel 2, hysteresis width setting
@HYS31: Channel 3, hysteresis width setting
@HYS41: Channel 4, hysteresis width setting



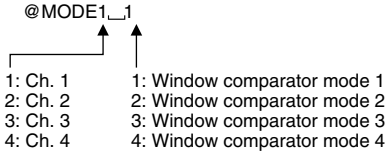
@P

Function: Sets trigger signal for memorizing reference flow value is enabled or not, when window comparator mode 2 or 3 is selected as the operation mode.
Command example: @P1 (CR/LF)
Response example: OK (CR/LF)
@P1: Trigger signal for memorizing reference flow value is enabled at channel 1
@P2: Trigger signal for memorizing reference flow value is enabled at channel 2
@P3: Trigger signal for memorizing reference flow value is enabled at channel 3
@P4: Trigger signal for memorizing reference flow value is enabled at channel 4



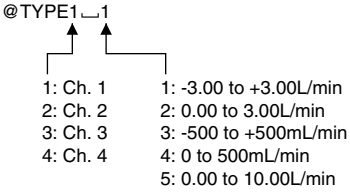
@MODE

Function: Sets the operation mode for any channel.
Command example: @MODE1 ␣ 1 (CR/LF)
Response example: OK (CR/LF)



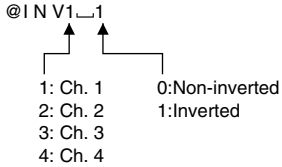
@TYPE

Function: Sets the flow sensor type for any channel.
Command example: @TYPE1 ␣ 1 (CR/LF)
Response example: OK (CR/LF)



@INV (only for window comparator mode 4)

Function: Sets the output of any channel to be inverted or non-inverted.
Command example: @INV1 ␣ 0 (CR/LF)
Response example: OK (CR/LF)



@B

Function: Adjusts the zero point for any channel
Command example: @B1 (CR/LF)
Response example: OK (CR/LF)

@B1
↑
1: Ch.1
2: Ch.2
3: Ch.3
4: Ch.4

@SW

Function: Indicates the output status of each channel
Command example: @SW (CR/LF)
Response example: 1010 (CR/LF)

1 0 1 0
↑ ↑ ↑ ↑
Ch.1 Ch.2 Ch.3 Ch.4

1: SW output ON
0: SW output OFF

@MD

Function: Indicates the operation mode for each channel
Command example: @MD (CR/LF)
Response example: 1231 (CR/LF)

1 2 3 1
↑ ↑ ↑ ↑
Ch.1 Ch.2 Ch.3 Ch.4

1: Window comparator mode 1
2: Window comparator mode 2
3: Window comparator mode 3
4: Window comparator mode 4

@TP

Function: Indicates the flow sensor type for each channel
Command example: @TP (CR/LF)
Response example: 1135 (CR/LF)

1 1 3 5
↑ ↑ ↑ ↑
Ch.1 Ch.2 Ch.3 Ch.4

1: -3.00 to +3.00L/min
2: 0 to 3.00L/min
3: -500 to +500mL/min
4: 0 to 500mL/min
5: 0.00 to 10.00L/min

@C

Function: Indicates L1 (ΔL) and L2 for any channel
Command example: @C1 (CR/LF)
Response example: 1.00 (CR/LF) ←L1(ΔL)
0.50 (CR/LF) ←L2
(CR/LF)

@C1
↑
1: Ch. 1
2: Ch. 2
3: Ch. 3
4: Ch. 4

@E

Function: Indicates L1 = ("reference flow rate"-ΔL) and L2 for any channel
Command example: @E1 (CR/LF)
Response example: 1.00 (CR/LF) ←L1 (="reference flow value" -ΔL)
0.50 (CR/LF) ←L2
(CR/LF)

@E1
↑
1: Ch. 1
2: Ch. 2
3: Ch. 3
4: Ch. 4

@DIS

Function: Turns off the flow rate indication
Command example: @DIS ␣ 1 (CR/LF)
Response example: OK (CR/LF)

@DIS␣1
↑
1: OFF
0: ON

@AS

Function: Sets the auto-scanning function turn ON or OFF
Command example: @AS ␣ 1 (CR/LF)
Response example: OK (CR/LF)

@AS␣1
↑
1: ON
0: OFF

@PHL

Function: Sets the peak hold function ON or OFF
Command example: @PHL ␣ 1 (CR/LF)
Response example: OK (CR/LF)

@PHL␣1
↑
1: ON
0: OFF

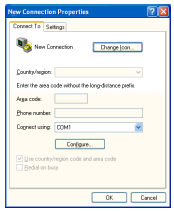
@BHL

Function: Sets the bottom hold function ON or OFF
Command example: @BHL ␣ 1 (CR/LF)
Response example: OK (CR/LF)

@BHL␣1
↑
1: ON
0: OFF

● HyperTerminal setup

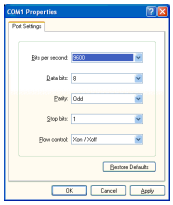
(1) From the [File] menu, select [Properties] to open the screen shown in the figure below. Set [Connection Method]. Click the [Modem Setting] button.



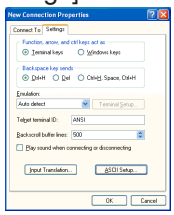
(2) Set the communications settings as shown:

Transmission speed (B): 9600
Date length (D): 8
Parity (P): Odd
Stop bit (S): 1
Flow control (F): Xon/Xoff

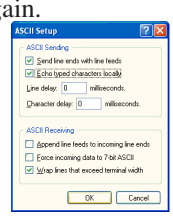
Then, click the [OK] button.



(3) Click the [Settings] tab seen in step (1), and the screen shown in the figure below will appear. Click the [ASCII Settings] button.



(4) Configure the settings as shown below and click [OK]. The screen returns to that shown in step (3). Click [OK] again.

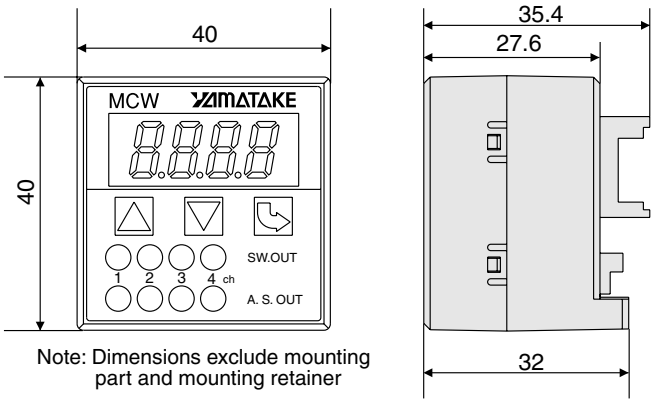


■ Specifications

Item	Specification
Power	24Vdc +/- 10%
Supply voltage for flow sensor	24Vdc +/- 10%
Current consumption	100mA max (not including flow sensor current)
Applicable sensor type	MCS100A100 (-3 to 3 L/min) MCS100A104 (0 to 3L/min)) MCS100A108 (-500 to 500mL/min) MCS100A112 (0 to 500mL/min) MCS100A120 (0 to 10L/min)
Number of connected sensors	1 to 4
Input voltage range	1 to 5Vdc
Maximum applied voltage	5.3Vdc
Number of outputs	4
Output type	NPN open collector
Response time	3ms or less
Load voltage	30Vdc or less
Load current	50mA or less
Internal voltage drop	0.3V max. (with 5mA load current)
Operation mode	Window comparator modes 1 to 4
Output mode (inverted / direct)	Effective only in window comparator mode 4
Hysteresis	Variable (set to "2" or more)
Flow rate display	7 segment LED, 3 digit display
Output indication (SW.OUT)	Red LED lights up when output is ON
Auto scan channel display	Green LED for the displayed channel lights up
Console keys	△: up, ▽: down, ⏎: mode
Communications	RS-232C communications
Operating temperature	-10 to +50℃ (no condensation or freezing)
Storage temperature	-20 to +80℃ (no condensation or freezing)
Dielectric strength	500Vac 1min
Insulation resistance	100MΩ or more (500Vdc megger)
Vibration resistance	88.3 m/s² (total amplitude 1.5mm 10 to 55Hz)
Shock resistance	294.2 m/s² (non-repeated shock)
Case material	PBT
Mass	Approx. 45g

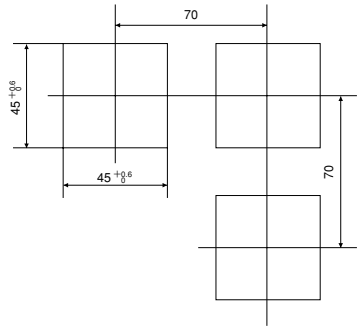
■ External dimensions

Unit: mm



Note: Dimensions exclude mounting part and mounting retainer

■ Panel cutout dimensions



YAMATAKE *Specifications are subject to change without notice.*

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