

INSTRUCTION MANUAL FOR FLOW MONITOR TYPE MWFM-AN-01

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%An operator should read carefully this instruction manual and conduct correct handing.

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Safety Precautions

- Be sure to thoroughly read the instruction manual before using the products.
- Keep the instruction manual in a safe, convenient location for future reference.
- All or part of the contents described in this manual may be changed without any notice.
- Due to our constant striving for further improvement of products, parts or products that differ from those described in this manual may be substituted.

WARNING (Failure to observe this WARNING may cause a fatal or serious injury.) Be sure to confirm that any peripheral equipment does not move before installation work.

- In addition, observe safety requirements for installation work where high-place work is expected.
- Be sure to turn off the power source before wiring, mounting and transportation work. (Failure to observe this WARNING may result in an electric shock/ injury or equipment damage due to short-circuit.)
- Carry out wiring work correctly with reference to a proper drawing.
- Never disassemble the equipment. (Failure to observe this WARNING may result in an electric shock.)
- Do not open the cover under an explosive environmental condition when power is entered. (Failure to observe this WARNING may result in an injury or equipment damage.)
- Do not place or store the equipment in any hostile environmental place where it will be subjected to direct sunlight, rain, water droplet, hazardous gas/water, etc..

CAUTION (Failure to observe this CAUTION may cause a moderate injury or equipment damage.)

- Do not use the equipment for any purpose other than the original purpose of use.
- Be sure to confirm the specification of equipment and use the equipment within the range of specification. (Mounting conditions such as temperature, power source, frequency, etc.)
- Make sure a correct wiring before applying power source.
- Do not have a shock or strong impact to the equipment.
- (Failure to observe this CAUTION may result in equipment damage.)
- Be sure to connect necessary terminals (grounding, etc.).
- Remove all wiring to the equipment before doing electrical welding work near the equipment.
- Do not forcedly bend or pull the lead wire also do not use unnecessarily long wire.
- Tighten the cover, lead outlet, etc. properly so that dust, rainwater, etc. do not enter inside the equipment.
- Do not use the equipment under a corrosive condition (NH₃, SO₂, Cl₂, etc.).
- Be sure to tighten the cable grand so that outer air does not enter inside the equipment.
- When applying piping connection such as conduit, etc. instead of cable grand, apply putty or equivalents on the cable entry so that outer air does not enter inside the equipment.

∑ IMPORTANT (indicates notes or information to help customers.)

Limitations of Warranty:

- Warranty period shall be one year from the date of delivery (ex-factory).
- Any damage of any other products that have occurred for use of the equipment is not covered by this warranty. Also any loss induced by failure or malfunction of the equipment is not covered by this warranty.
- Failure or malfunction caused by following are not covered by this warranty:
- a. Modification or repair by a party other than MATSUSHIMA's authorized personnel, or replacement of parts not recommended by MATSUSHIMA.
- b. Inadequate storage, installation, use, inspection or maintenance that does not comply with specifications.
- c. Cause for any peripheral equipment or device.
- d. Accident beyond control and force majeure (fire, earthquake, flood, riots, etc.).

Lack of instructions to MATSUSHIMA for information or safety requirements that can be predicted only by customers' side.

This warranty conditions do not limit customers' legal right.

Price for the equipment does not include any charge for services such as commissioning, supervising, etc..

1. Overview

The flow monitor detects the powder flow by using the Doppler effect, which is induced by continuously transmitting microwaves.

This device outputs an electrical signal of the flow rate measured relative to the given measuring span, which can be freely set.

2. Specifications

	2-1. Model	MWFM-AN-01
	2-2. Supply voltage	80 VAC to 240 VAC at 50/60 Hz
	2-3. Frequency	24.15 GHz
	2-4. Oscillation power	6.6 mW typ.
	2-5. Current output	4 mA to 20 mA DC Max. load resistance: 600 Ω
	2-6. Fault alarm output	Current output at device failure 0 mA
	2-7. Moving average	1 to 90 times (adjustable)
	2-8. Power consumption	Max. 10 VA
	2-9. Ambient temperature	–10 °C to 55 °C
2-10. Allowable temperature –20 °C to 80 °C (measuring object)		
	2-11. Allowable pressure	Max. ± 0.5 MPa (± 5 kgf/cm ²)
	2-12. Materials	Housing: ADC Mounting boss: SUS304 Transmitting surface: PTFE
	2-13. Mounting	G1 screw (with mounting locknut and packing)
	2-14. Protection	IP65
	2-16. Mass	Approx. 1.8 kg

3. Part Names and Functions

Fig. 1 shows the panel surface as it looks when the housing cover is removed.



No.	Name	Function	
1	7 segment LEDs	Display the measurement results (as a percentage of the set value). Also display the set value for each parameter.	
2	MOD button	Switches the parameter setting window. Note: When the button is held down for three seconds or longer, the mode will change to simulation mode.	
3	STO button	Stores the data that was changed when setting parameters. Also, when pressed while the window is being used for measurement display, shows the level of the reflected signal.	
4	\rightarrow button	Moves the cursor during parameter setting operations.	
5	↑ button	Changes the numeric value during parameter setting operations.	
6	POWER lamp (green)	Lights up when the power supply is turned on.	
7	PARAMETER lamp (yellow)	Lights up when a parameter setting is changed.	
8	ALARM lamp	Lights up upon failure of the device.	
9	Terminal block	For lead-cable connections, use pin-type crimp terminals. The terminal layout is shown in Fig. 8.	
10	Lead outlet	M 20 \times 1.5 screw	

Table 1 Part Names and Functions

4. Installation

The mounting part of the Flow Monitor is a G1 screw. Install the Flow Monitor either horizontally or vertically with the use of the G1 locknut and packing provided with the device.

If there is any concern about the screw loosening, apply liquid gasket.

If the Flow Monitor is to be used outdoors, attach a rain cover or similar protective cover to minimize the entry of rain water. Do not install the Flow Monitor at a location where light may shine on the transmitting surface at the G1 screw end, as this may cause a malfunction.



Fig. 2 Installation Example



Fig. 3 Mounting Section Detail

<How to install so that adhesion and accumulation of transported materials is minimized> Install as shown in Fig. 4, so that the transmitting and receiving surface is flush with the container wall (tube, pipeline, etc.).

If installation shown above is not possible, install a shield made of a material such as low-permittivity Teflon or ceramics to allow microwave transmission.

 Important: : Do not use a shield made of an electroconductive material.
It may cause a false detection, especially when the measured material contains some moisture.



Fig.4 Installation to Minimize Adhesion and Accumulation of Transported Material

5. Flow Monitor Installation Conditions

5-1. Free-Fall Applications



Fig.5 Installation on Free-Fall Equipment



5-3. Earth Connection

Be sure to connect the earth terminal provided on the side of the housing case. (100 Ω or less earth resistance)



Fig. 7 Earth Terminal Connection

6. Wiring

- Use a cable of 1.25 mm² to 2 mm² diameter, and suitable for the environmental conditions in which it is to be used.
- Connect wires only to the AC (power supply) and to 4 mA to 20 mA (current output) terminals.

Caution: Do not connect unused terminals, as this may result in a Flow Monitor failure.

Caution: Be sure to confirm that the power supply has been turned off before connecting the wiring. Failure to observe this precaution may result in an electric shock, electric leakage, fire or other accident.



Fig. 8 Terminal Block

/! IMPORTANT: If the Flow Monitor is used in an environment where electrical noise is generated, use a protective metal conduit tube for the cable to prevent malfunction caused by electrical interference.

7. Operation

The display window on the Flow Monitor panel functions as a measurement display window (for checking measured values) and a setting window (for entry of parameters), and must be operated in accordance with each situation.

The window operation procedures and indications on display are described below.



<Measurement Display Window>



Displays measurement results. (Flow rate in % is shown.)

Displays the current zero setting. (Enter a value to be set for 0%.) Input value range: 0 - 9999Default: 0

Displays the current span setting. **(Enter a value to be set for 100%** Input value range: 10 – 57000 Default: 57000

Displays the current moving-average setting. (Enter a value for the number of times the moving average is taken.) Input value range: 1 – 90 times Default: 5 times

Displays the current sampling time setting for automatic entry and setting operation. (Enter a value for the sampling time.) Input value range: 1 - 60 minutes Default: 1 minute 7-1. Setting Zero and Span

There are two methods, automatic and manual, to enter and set the zero and span values: Use either method according to the situation.

- 7-1-1. Manual Entry and Setting Method
 - (a) Setting Zero

Check and record the value of the arithmetic processing result indicated under no-load conditions (nothing is flowing inside). Then, enter that value into the zero setting in the parameter setting window.



Displays measurement results. (Flow rate in % is shown.)

Displays arithmetic processing results. (The product of vibration amplitude V \times frequency Hz is shown). Checks and records the value.

With the zero setting on display, enter the value checked in the previous step.

The numeric character which is flickering can be changed. Use $[\rightarrow]$ to change the flickering position, $[\uparrow]$ to change the number, and [STO] to store the entered value.

(b) Setting Span

Check and record the current value of the arithmetic processing result indicated under real-load conditions (the subject material is flowing at the maximum flow rate). Then, enter that value into the span setting in the parameter setting window.



7-1-2. Automatic Entry and Setting Method

With the automatic entry and setting method, data measured within the sampling time (which has been set to any desirable value within the setting range) is calculated. The zero and span settings are automatically entered and stored to reflect the calculation results.

Note: The default setting for the sampling time is one minute.



(b) Setting Span



7-2. Setting the Moving Average (Number of Times the Moving Average is Taken)



Displays measurement results. (Flow rate in % is shown.)

With the moving average setting on display, enter a value to be set. The numeric character which is flickering can be changed. Use $[\rightarrow]$ to change the flickering position, $[\uparrow]$ to change the numeric character, and [STO] to store the entered value.

Displays measurement results. (Flow rate in % is shown.)

Note: The number of times that can be set for the moving average is from 1 to 90 (times). If a number between 91 and 99 is input and [STO] is pressed, 90 will be set automatically.

7-3. Setting Sampling Time for Automatic Entry and Setting Operation



Displays measurement results. (Flow rate in % is shown.)

With the sampling time setting for automatic entry and setting operation on display, enter a value to be set. The numeric character which is flickering can be changed. Use $[\rightarrow]$ to change the flickering position, $[\uparrow]$ to change the numeric character, and [STO] to store the entered value.

Displays measurement results. (Flow rate in % is shown.)

Note: The sampling time can be set from 1 to 60 (minutes). If a value between 61 and 69 is input and [STO] is pressed, 60 will be set automatically.

7-4. Simulation

The sensor is equipped with simulation function that enables operation checks of externally connected devices.



Displays measurement results. (Flow rate in % is shown.)

With the simulation mode on display, enter a value to be set. The numeric character which is flickering can be changed.

When the value is changed, the electric current of the new value will be output.

Use $[\rightarrow]$ to change the flickering position, $[\uparrow]$ to change the numeric character, and [STO] to end simulation and display the measurement result.

Displays measurement results. (Flow rate in % is shown.)

8. Sensitivity adjustment

Flow Monitor has a sensitivity selector function. When the signal does not change in proportion to the increase/decrease of flow amount in the initial setting, change the selector switch as shown below and make a measurement again.

/ Caution:

"The signal does not change" means such situation that the indication (%) of Flow Monitor never changes though the flow amount changes.

But it excludes the situation that the indication(%) does not change from 0%.



Fig. 9 Sensitivity Selector Switch

- ① Remove Cover of Flow Monitor.
- (2) Sensitivity Selector Switch is in red circle. Change Selector Switch from "Low" to "Hi" (downward) with a thin flathead screwdriver.
- ③ Restart the flow conveyance and check whether the indication of Flow Monitor properly changes.

9. Maintenance

Any material or substance that adheres to the transmitting surface may cause any malfunction. Regularly clean the transmitting surface with a dry cloth.

Warning: Be sure to turn off the power supply before starting maintenance work of the sensor. Keep the inside of pipes free of conveyed material during the maintenance work.

10. Troubleshooting

Problem	Probable Cause	Corrective Action			
"-Hi-" is indicated on the	The measurement result is 999.9% or	Set the zero and span			
LED display.	higher.	parameters.			
	With automatic entry and setting:	Reset the zero and span			
"Err" is indicated on the	• The value set for span is smaller than	parameters.			
LED display.	the value set for zero.				
	• The difference between the zero and				
	span set values is 10 or less.				
	Power is not being supplied.	Supply power.			
The sensor does not	Cable disconnection	Repair the disconnected			
operate.		section.			
	Device failure	Contact Matsushima.			
	Proper adjustment has not been	Set the zero and span			
Sensor malfunction	completed.	parameters.			
(erroneous indication)	Material is adhering to the transmitting	Clean the transmitting surface.			
	surface of the sensor				
	Wear or damage to the transmitting	Contact Matsushima.			
	surface of the sensor				
	Supply voltage has dropped.	Increase the voltage to within			
		the specifications.			
Do not disassemble or modify the product. Doing so will invalidate the manufacturer's warranty.					

Table 2 Troubleshooting

Note: Specifications and design, etc. are subject to change for product improvement without prior notice.