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INSTRUCTION MANUAL

Thermal Dispersion Type Flow Transmitter

HTMF

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1. Overview

HTMF-MF is a multipoint thermal dispersion–type gas flow meter. It enables measuring of gas flow even at an installation location where flow distribution is not even based on multipoint gas flow measurements. It is designed to have a microprocessor in the flow transmitter for high accuracy and a self-diagnosis function. It is also designed such that it can measure flow continuously by excluding abnormal sensors when some of the multipoint sensors of the flow element become abnormal.

1.1 Operating Principles

Each flow element of this flow meter comprises a reference sensor and an active sensor, which utilize a reference RTD and an active RTD, respectively. The reference sensor measures the fluid temperature, while the active sensor having a heater measures temperatures higher than the fluid temperature. When flow occurs in the fluid, the temperature measured by the active sensor drops, which generates temperature difference, △T, between the reference sensor and the active sensor. The flow element converts △T into resistance element △R from the reference RTD and the active RTD, and sends △R to the flow transmitter. The flow transmitter calculates mass flow and volume flow from △R and its relationship with gas mass.

1.2 Specifications

1.2.1 Flow measurement range: 0.1–100,000 SCFM (user specifiable).

1.2.2 Input power voltage: 110–130 VAC, 50–60 Hz, ±10%, 20 W maximum.

1.2.3 Number of sensor lines: 1–8 (user specifiable).

1.2.4 Measurable fluid: Gas (air, nitrogen, oxygen, carbon dioxide, methane, etc.).

1.2.5 Output signal level: 4–20 mA.

1.2.6 Operating pressure: Max 10 bar (higher pressure available upon user's request).

1.2.7 Operating temperature: Flow element (−5℃ to 150 ℃), transmitter (0 to 60℃).

1.2.8 Accuracy: ±1.0% FS.

1.2.9 Repeatability: ±0.5% FS.

1.2.10 Response time: Max 1.0 sec.

1.2.11 Straight pipe size: Front end 15 D, rear end 10 D.
(minimum front end 5 D, minimum rear end 3 D)

1.3 Terms and definitions

1.3.1 HTMF-MF

This generally refers to a multipoint thermal dispersion–type flow meter.

1.3.2 Flow Meter (F/M)

The F/M comprises a flow element and a flow transmitter.

1.3.3 Flow Element (F/E)

The F/E, which measures actual flow, comprises a sensor element that has sensors, and a duct flange that can be attached to a duct.

1.3.4 Flow Transmitter (F/T)

The F/T calculates flow with embedded software from the values collected by the F/E, and transmits the calculated values promptly.

1.3.5 Sensors

Sensors are core parts of the F/E, and are categorized into active sensors (Sa) and reference sensors (Sr).

1.3.6 Sa and Sr

Sa and Sr refer to active sensor and reference sensor, respectively. They are sensors for measuring temperature of heaters and air, respectively.

1.3.7 Ra and Rr

They refer to resistance values of Sa and Sr, respectively.

1.3.8 ΔR

This refers to the difference between Ra and Rr (Ra−Rr = ΔR)

1.3.9 PWM

PWM stands for pulse width modulation.

1.3.10 Loader (HHT-2000)

This is an external terminal device that displays the values of the F/T and enables configuration thereof.

1.3.11 Simulator

This refers to the decade resistance box that is used for replacement of input signals of the F/E, and for calibration or functional checking of the F/T.

1.4 Composition

This instrument, F/M, comprises an F/E and an F/T.

The F/E, which measures actual flow, comprises a sensor element that has sensors, and a duct flange that can be attached to a duct. The flow data collected by the F/E is calculated and converted by the software embedded in the F/T. The F/T has an average life of no shorter than

7 years, and has electronic components that are easily available in the market.

1.4.1 The F/E comprises an Sr and Sas of which the number depends on the number of lines.

1.4.1.1 The Sr, which comprises an RTD, measures temperature of the fluid.

1.4.1.2 Each Sa, which comprises an RTD and a heater, measures temperatures higher than the fluid temperature.

1.4.2 The F/T comprises a base, a power, an input, a main, and an output board.

1.4.2.1 Base Board: This board has connectors for the other boards and a terminal block for connecting external cables.

1.4.2.2 Power Board: This board supplies DC power to the components at constant voltages and at constant currents.

1.4.2.3 Input Board: This board receives data from the F/E, carries our A/D conversion, and transmits the converted data to the main board for facilitating calculation by the microprocessor.

1.4.2.4 Main Board: This board receives data from the input boards, calculates the data, and sends them to the output board.

1.4.2.5 Output Board: This board receives digital data from the main board, and converts them to analog data (4–20 mA) for transmitting them outside the F/T.

2. Test preparations

2.1 HTMF-MF, 1 set

2.2 Multimeter, 1 EA: for checking output (4–20 mA)

2.3 Simulator, 2 EA: decade resistance box (1,000–1,500 Ω)

2.4 Performance test report: on test data of the F/E

3. Wiring for Functional Test

3.1 For wiring, refer to the attached wiring diagram.

3.2 For wiring of the F/E and the F/T of the thermal dispersion–type F/M, use cables that conform to product specifications of our company. For wiring, it is preferable to use single-strand cables between the F/E and the F/T. In addition, special care should be taken in case cables are joined midway.

3.3 For the cable connecting to the F/E, use core conforming to the specifications of our company to minimize noise of the signal line by mitigating EMI, etc.

3.4 Connect a multimeter to the output end of the F/T for measuring DC of 4–20 mA.

3.5 The wiring of the power voltage cable shall be installed separately from the signal cable that extends from the F/E. When it is inevitable to use a same conduit or duct, take care to ensure a complete electronic shield.

3.6 In a functional test, it is allowable to utilize a decade resistance box and a detection sensor simulator that conforms to the specifications values same with those of the sensor, replacing the actual F/E.

3.7 For the heater part of the detection sensor, it is allowable to use dummy load which conforms to the same specifications.

3.8 For the functional test, the detailed wiring shall be as follows:

3.8.1 Connect the power to terminals AC1–AC2 of the terminal block.

3.8.2 Connect the sensors:

1) Connect Sr1 to the terminals R1-1, R1-2, and R1-C of the terminal block.
2) Connect Sa1 to the terminals A1-1, A1-2, and A1-C of the terminal block.
3) Connect San to the terminals An-1, An-2, and An-C of the terminal block.

3.8.3 Connect the digital multimeter to the terminals O1-1 (+), and O1-2 (−) of the terminal block.

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4. Checkpoint for Functional Test

4.1 Check the testing instruments.

4.2 Check the calibration period of the testing instruments.

4.2.1 Simulator

Check that it satisfies the resistance range, and that its calibration period has not expired.

4.2.2 Multimeter

Check that its calibration period has not expired.

4.3 Check the F/E

Check the resistance values of the sensors and the heater.

4.3.1 Resistance range of the sensors and the heater

1) R_A: 1,000 Ω = 0℃, ∴ △3.76 Ω/℃ (e.g., 20℃ = 1,075.2 Ω ± 1%)

2) R_R: 1,000 Ω = 0℃, ∴ △3.76 Ω/℃ (e.g., 20℃ = 1,075.2 Ω ± 1%)

3) Heater : 220 Ω ± 1%

4.3.2 Check the output current of the heater.

Apply power to the F/T (warm-up: 20 minutes), connect the multimeter to the output terminals, and measure the output current for checking that it is 75 mA ± 1%.

The range can be adjusted with the HHT-2000 (loader) menu.

4.4 Adjust and check the F/T

Connect the loader to the main board, and set the input/output and the factor value of the F/M.

4.4.1 Input calibration

1) Zero and span calibration

a. Set the resistance value of the simulator to 1000 Ω, wait for approximately 10 seconds in the ***Sensor01 Zero Cali*** menu of the loader, and press ***ENT***.

b. Set the resistance value of the simulator to 1500 Ω, wait for approximately 10 seconds in the ***Sensor01 Span Cali*** menu of the loader, and press ***ENT***.

c. After pressing ***ENT***, in the ***Sens 01 R Check*** menu, check if the same resistance values of 1000Ω, 1250Ω, and 1500Ω of the simulator are indicated.

d. If a large difference is observed, adjust the resistance values of the simulator, and repeat the above processes.

4.4.2 Line calibration

1) In the ***Sens 01 Line Cali*** menu of the loader, measure the line resistance, and press ***ENT***.

4.4.3 Output calibration

Check that proper output is measured by the multimeter connected to the output terminals.

1) PWM1 04 mA

Check that the indicated value at the multimeter connected to the output terminals of the terminal block is 4 mA ± 0.1%. When the value is beyond the range, adjust the counter value of the ***PWM1 04 mA Mode*** that is indicated in the loader, press ***ENT***, and check the indicated value.

2) PWM1 20mA

Check that the indicated value at the multimeter connected to the output terminals of the terminal block is 20 mA ± 0.1%. When the value is beyond the range, adjust the counter value of the ***PWM1 20 mA Mode*** that is indicated in the loader, press ***ENT***, and check the indicated value.

4.4.4 Set the factor.

1) Enter the △R and the factor value, which are calculated in accordance with the L/E test procedures, into the F/T by using the loader (HHT-2000).

a. Enter the ***PWM R Data***.

Enter the △R of the performance test report that is calculated in accordance with the F/E test procedures.

b. ***ALPHA***: This is the temperature compensation coefficient. The input effective range is 0–60, and the default value is 30.

c. ***CUTOFF***: This is for the function that enables the user to set a certain cutoff range, such that zero can be output below the set range of the output. The input effective range is 0%–20%, and the default value is 10%.

d. ***Psia***: This is for inputting the inside pressure of the duct in use. The input effective range is 0–500 Psia, and the default value is 14.7 Psia. (It is used for measuring mass flow of the gas.)

e. ***AREA***: This is for inputting the area of the duct in use. The input effective range is 0.001–9.999 ㎡, and the default value is 1.000 ㎡.

5. Procedures for Functional Test

5.1 Prepare a performance test report for the instrument subjected to the functional test.

5.2 Carry out wiring for the functional test of the thermal dispersion–type F/M.

5.3 After the wiring is completed, enter the value of the performance test report by using the decade resistance box.

5.3.1 Initial resistance of the Sr: 1,000.00 Ω

5.3.2 Initial resistance of the Sa: 1,150.00 Ω

5.4 Apply power of 120 VAC 60 Hz, and allow warm-up for no shorter than 20 minutes before the functional test.

5.5 Check the condition of the main board.

5.5.1 Check that the Run LED of the main board blinks at the intervals of approximately 1 second.

5.5.2 Check that the Error LED of the main board remains off.

5.6 Check the condition of the input board.

5.6.1 Check that the Active1 Error LED of the input board remains off.

5.6.2 Check that the Reference1 Error LED of the input board remains off.

5.7 Check the output.

5.7.1 Enter the resistance value of the Sa that corresponds to the output current to be checked.

5.7.2 Check that the proper output current is measured for the Sa.

6. Precautions

6.1 Precautions for handling and storage.

6.1.1 Do not knock down the product or give a strong impact.

6.1.2 Do not bend the sensor part.

6.1.3 Items that may cause harmful corrosion during storage

6.2 Precautions for wiring

6.2.1 Wire the cables to the terminal block by referring to the attached wiring diagram.

6.2.2 Take care in wiring, because miss-wiring may lead to malfunction of the instrument.

6.2.3 Check the wired cables at regular intervals.

6.2.4 Wiring should be carried out by a qualified person.

6.2.5 Use the terminal lugs supplied by HITROL.

6.3 Precautions for installation.

6.3.1 When flanges or screws are used for fastening, the size should be the same.

6.3.2 The user should place a washer between each bolt and nut to prevent loosening

6.3.3 When fastening flanges to each other, gaskets should be used.

6.3.4 The power should be supplied when the installation has been completed and the cover has been fastened.

6.4 Error lamp

6.4.1 Open error

When Open Error is indicated on the DSP, recheck wiring for disconnections.

6.4.2 Short error

When Short Error is indicated on the DSP, recheck wiring for shorts.

6.4.3 Delta R error

When Delta R error is indicated on the DSP, check that the Delta R value on the loader is proper.

6.5 The life of the transmitter components is no shorter than 5 years. However, the basic checking interval and the replacement interval of the PCB boards are 5 years and 7 years respectively.

Among the life of the electronic parts, the life of capacitors is no longer than 7 years. Therefore, their replacement interval is regarded to be 7 years in accordance with the service life management procedures.

7. Installation method

7.1 Installation method of HTMF-Round Type

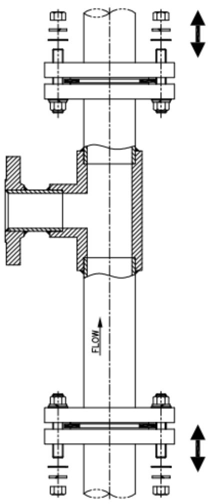
7.1.1 Insert the sensor bracket into the user piping line.

7.1.2 Check flow direction and fasten it with bolts and nuts.

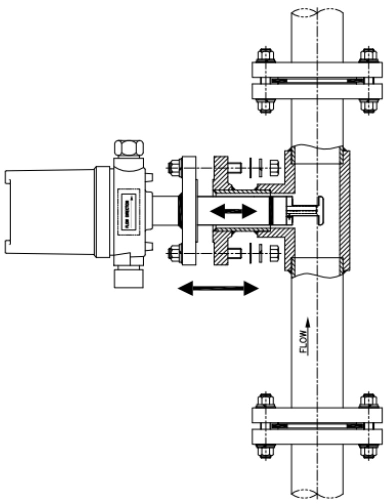
7.1.3 Check flow direction of the sensor as shown below and insert it into the bracket.

7.1.4 Fasten the sensor with bolts and nuts same as bracket.

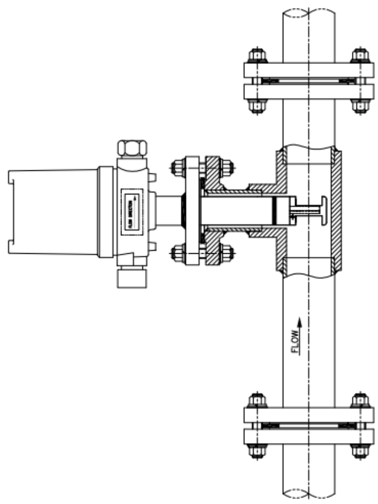
7.1.5 In case of separation, perform the above method in reverse order.



<Figure1>



<Figure2>



<Figure3>

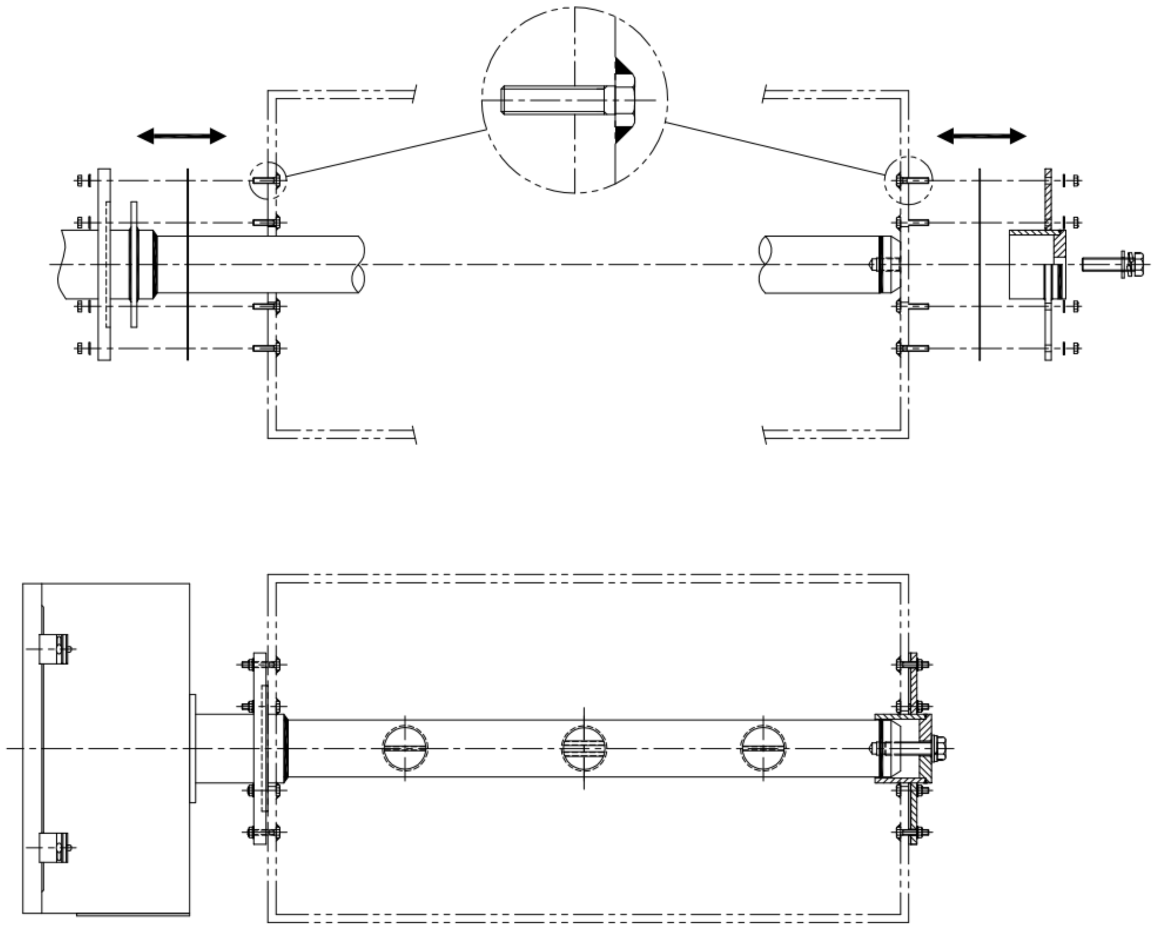
7.2 Installation method of HTMF-Duct Type

7.2.1 Weld the bolt to the duct before inserting the product. (See Figure 4 below)

7.2.2 After inserting the product, fasten it with bolts and nuts.

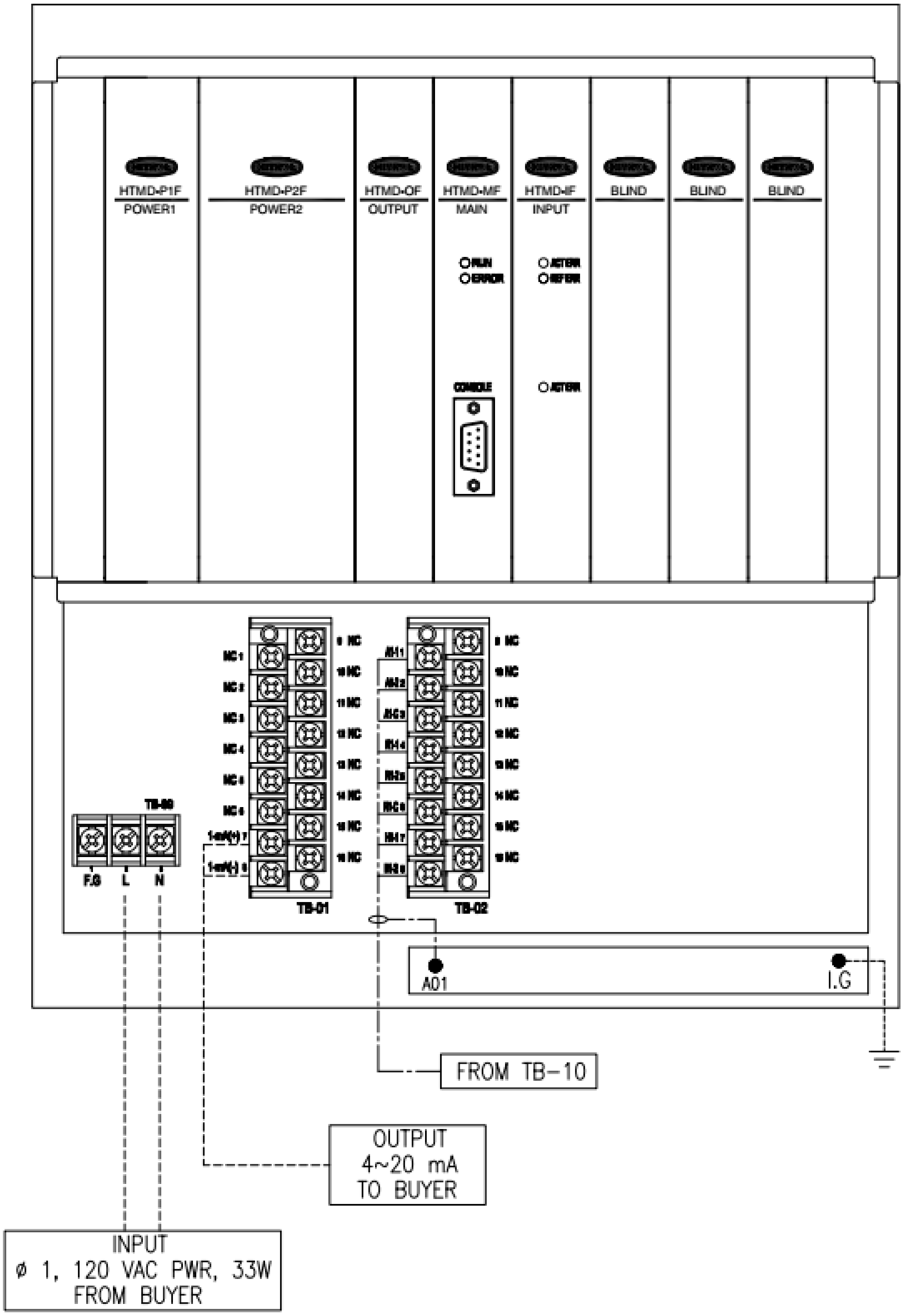
7.2.3 Insert the product into the lower part with mounting hardware and fasten the bolts and nuts to the duct.

7.2.4 In case of separation, perform the above method in reverse order.



<Figure 4>

8. Appendix



HTMD-P1F
POWER1
HTMD-P2F
POWER2
HTMD-OF
OUTPUT
HTMD-MF
MAIN
HTMD-IF
INPUT
BLIND
BLIND
BLIND
F.G
L
N
TB-01
TB-02
A01
I.G
FROM TB-10
OUTPUT
4~20 mA
TO BUYER
INPUT
ø 1, 120 VAC PWR, 33W
FROM BUYER