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INSTRUCTION MANUAL

Thermal Dispersion Type Level Trnamsmitter

HTML-TC

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Table of Contents

1. Introduction

This document describes the operating principles of the HTML-TC level meter, which is a continuous level transmitter; the procedures for its installation, operation, and maintenance; and the procedures for troubleshooting.

This level meter is designed to measure and output fluid levels. Its outputs can be made in analog signals, and the liquid crystal display (LCD) of the HHT-2000 Loader.

2. Operating Principles

This level meter utilizes two types of RTD sensors, namely reference RTD and active RTD, for measuring fluid levels. The reference RTD sensor measures the fluid temperature, while the active RTD sensor having a heater measures temperatures higher than the fluid temperature. When the level of the measured fluid changes, the temperature of the active RTD changes by the area where the level element contacts the measured fluid. At this time, △T, the difference in the measured temperatures between the reference RTD and the active RTD, is formed. The level element measures △R for △T, and sends the measured △R to the level transmitter. The level transmitter calculates the level from the received △R, and converts it the level as the output signal. 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 anomalies of the level sensor and the boards inside the transmitter can be checked with the LED display of the level transmitter and the HHT-2000 loader.

3. Specifications

3.1 Level measurement range: 10–300 cm (user specifiable)

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

3.3 Measurable fluid: Liquid

3.4 Output signal level: 4–20 mA

3.5 Depth of the level measuring sensor insertion: Variable depending on the pipe size (user specifiable)

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

3.7 Operating temperature:

3.7.1 Level Element: −20℃ to 230℃

3.7.2 Transmitter: 0℃ to 60℃

3.8 Accuracy: ±1.0% FS

3.9 Repeatability: ±0.5% FS

3.10 Unit of level: Percentage of the total range (%)

4. Terms and Definitions

4.1 Level Meter (L/M)

The L/M comprises a level element and a level transmitter.

4.2 Level Element (L/E)

The L/E, which measures actual level, comprises a sensor element to which sensors are mounted, and a flange that can be mounted to a sump.

4.3 Level Transmitter (L/T)

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

4.4 Sensors

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

4.5 Sa and Sr

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

4.6 Ra and Rr

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

4.7 ΔR

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

4.8 PWM

PWM stands for pulse width modulation.

4.9 Loader

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

4.10 Simulator

This refers to the Decade Resistance Box that is used for inputting certain resistance values to the L/T.

5. Composition

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

The L/E, which measures actual level, comprises a sensor element to which sensors are mounted, and a flange that can be mounted to a sump.

The level data collected by the L/E is calculated and converted by the software embedded in the L/T.

5.1 The L/E comprises an Sr and an Sa.

5.1.1 Sr: The Sr, which comprises an RTD, measures fluid temperature.

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

5.2 The L/T comprises a base, a power, an input, a main, and an output board.

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

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

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

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

5.2.5 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 L/T.

6. Testing Instruments

6.1 MTML-TC 1 Set

6.2 Multimeter 1 EA – Output (4~20mA)

6.3 Decade box 2 EA – Decade Resistance Box (1000~1500 Ω)

7. Wiring for Functional Test

7.1 For wiring, refer to the attached wiring diagram.

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

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

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

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

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

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

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

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

7.8.2 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.

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

8. Checkpoints for Functional Test

8.1 Check the testing instruments.

8.2 Check the calibration period of the testing instruments.

8.2.1 Simulator

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

8.2.2 Multimeter

Check that its calibration period has not expired.

8.3 Check the L/E.

Check the resistance values of the sensors

8.3.1 Resistance range of the sensors

1) R_A: 1,000 Ω – 1,500 Ω

2) R_R: 1,000 Ω – 1,500 Ω

8.4 Adjust and check the L/T.

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

8.4.1 Input calibration

1) Zero and span calibration

a. Set the resistance value of the simulator to 1,000 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 1,500 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 1,000 Ω, 1,200 Ω, and 1,500 Ω of the simulator are indicated.

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

8.4.2 Line calibration

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

8.4.3 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 4.0 mA ± 0.1%. When the value is beyond the range, adjust the counter value of the ***PWM1 4.0 mA Mode*** that is indicated in the loader, press ***ENT***, and check the indicated value.

2) PWM1 20 mA

Check that the indicated value at the multimeter connected to the output terminals of the terminal block is 20.0 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.

8.4.4 Set the factor.

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

a. ***Level Detail In*** input

Enter the △R that is calculated in accordance with the L/E test procedures.

b.***Level Average No***: Adjust the average number of the data read from the L/E. The input effective range is 1–9, and the default value is 1.

9. Functional Test Procedures

9.1 Carry out wiring for the functional test of the thermal dispersion-type L/M.

9.2 After the wiring is completed, set the signals of the F/E at the default values as the following by using the decade resistance box:

9.2.1 Resistance of the Sr: 1,000.00 Ω

9.2.2 Resistance of the Sa: 1,100.00 Ω

9.2.3 The L/E resistance difference (△R) at the initial setting: 100.00 Ω

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

9.4 Check the condition of the main board.

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

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

9.5 Check the condition of the input board.

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

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

9.6 Carry out the test with the resistance of the Sr fixed.

Change the resistance values of the decade resistance box corresponding to the resistance values of the Sa to the △R values given in Table 1-1, and check the output mA values.

	Level(%)	0%	25%	50%	75%	100%
Input	Ref RTD 01(ohm)	1000.00	1000.00	1000.00	1000.00	1000.00
	Act RTD 01(ohm)	1100.00	1080.00	1060.00	1040.00	1020.00
Output	Level(mA)	4.0mA	8.0mA	12.0mA	16.0mA	20.0mA

<Table 1-1>

10. Precautions

10.1 Precautions for handling and storage.

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

10.1.2 Do not bend the sensor part.

10.1.3 Items that may cause harmful corrosion during storage

10.2 Precautions for wiring

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

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

10.2.3 Check the wired cables at regular intervals.

10.2.4 Wiring should be carried out by a qualified person.

10.2.5 Use the terminal lugs supplied by HITROL.

10.3 Precautions for installation.

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

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

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

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

11. Installation method

11.1 Installation method of HTML-TC

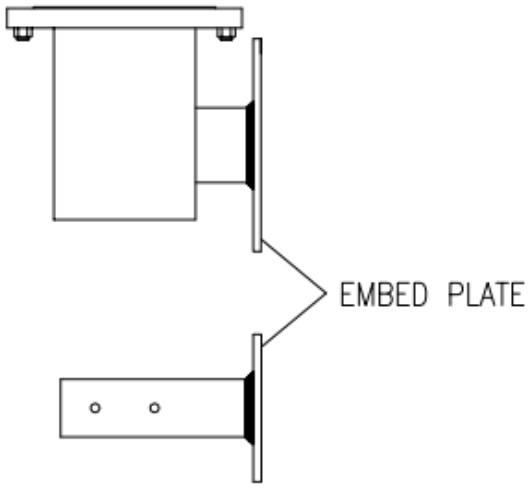
11.1.1 Weld bracket supplied by HITROL to embed plate.

11.1.2 Insert the product after welding

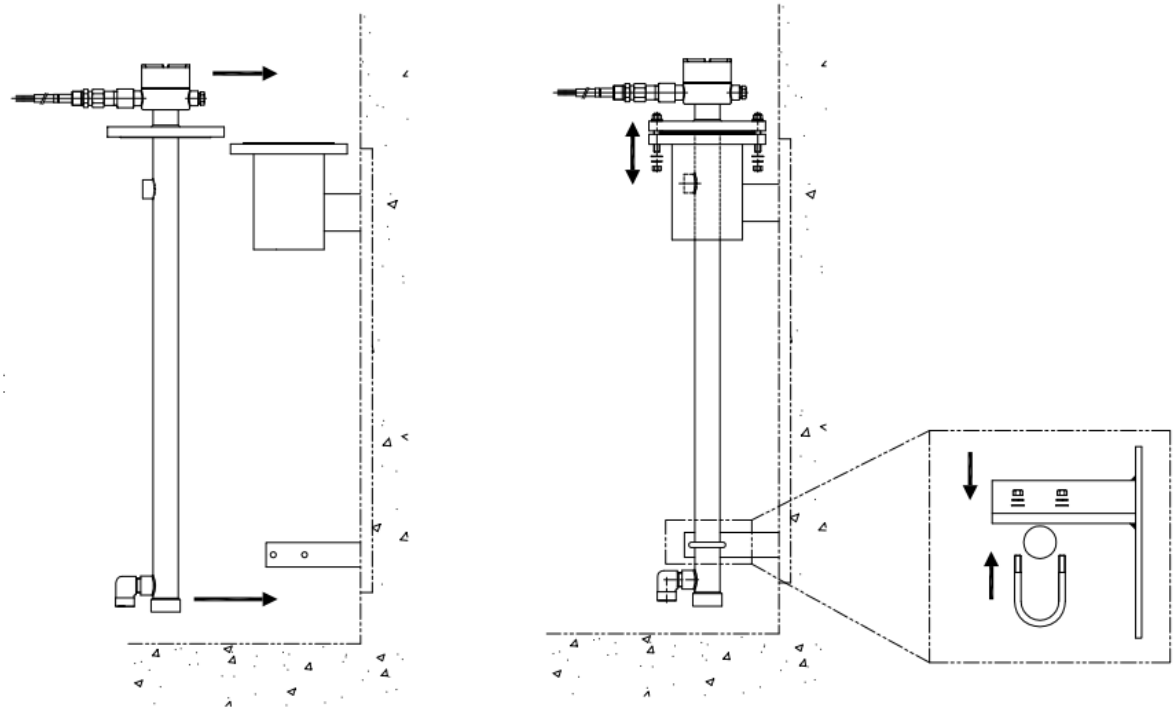
11.1.3 After inserting the product, fasten it with bolts and nuts.

11.1.4 Fasten U-bolt with nuts as shown in the figure below.

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

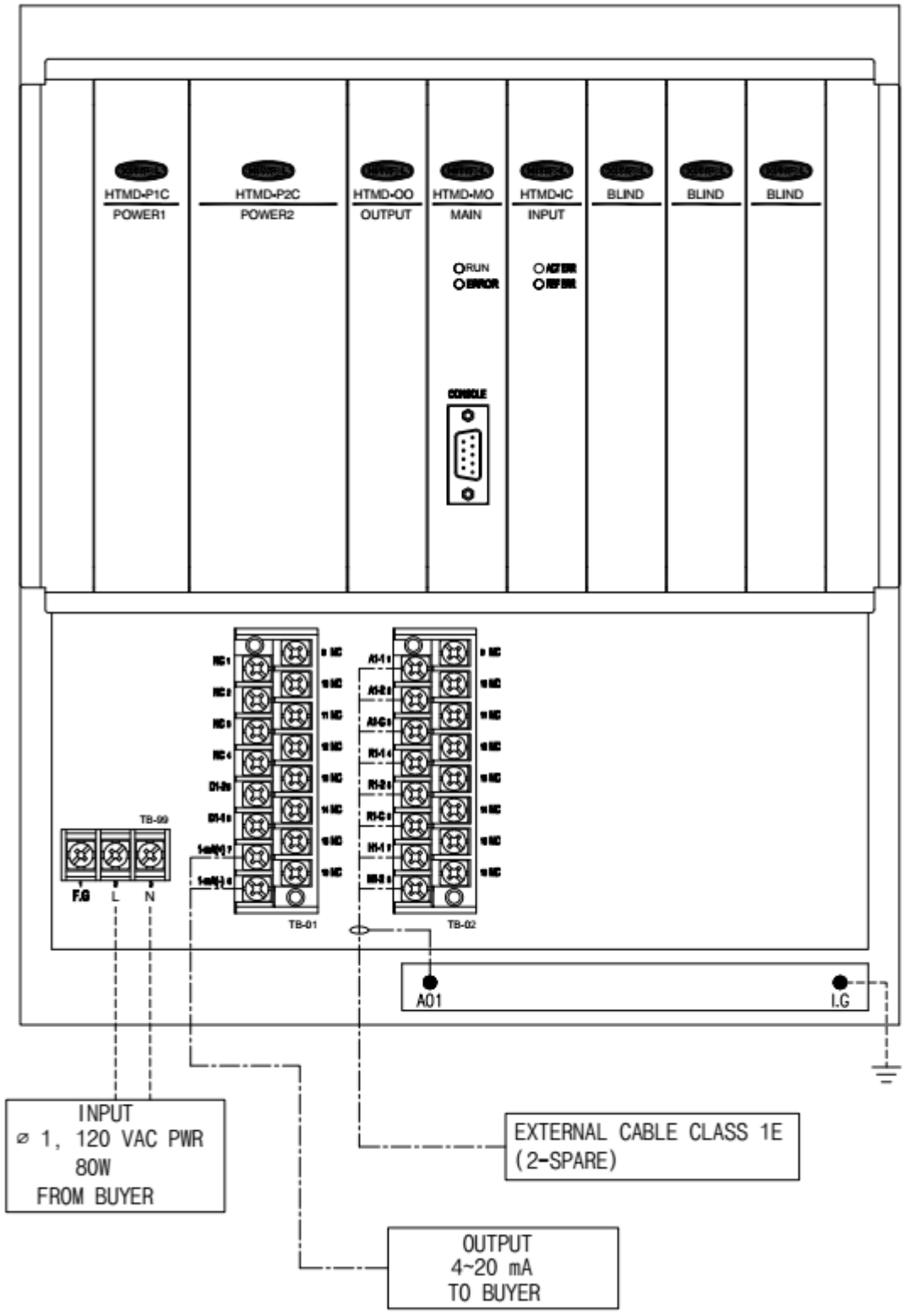


<Figure 1>



<Figure 2>

11. Appendix


HTMD-P1C
POWER1
HTMD-P2C
POWER2
HTMD-OO
OUTPUT
HTMD-MO
MAIN
HTMD-IC
INPUT
BLIND
BLIND
BLIND
RUN
ERROR
CONSOLE
TB-99
F.G
L
N
TB-01
TB-02
A01
I.G
INPUT
⌀ 1, 120 VAC PWR
80W
FROM BUYER
EXTERNAL CABLE CLASS 1E
(2-SPARE)
OUTPUT
4~20 mA
TO BUYER