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INSTRUCTION MANUAL

Thermal Dispersion Type Level Transmitter

HTML-TM

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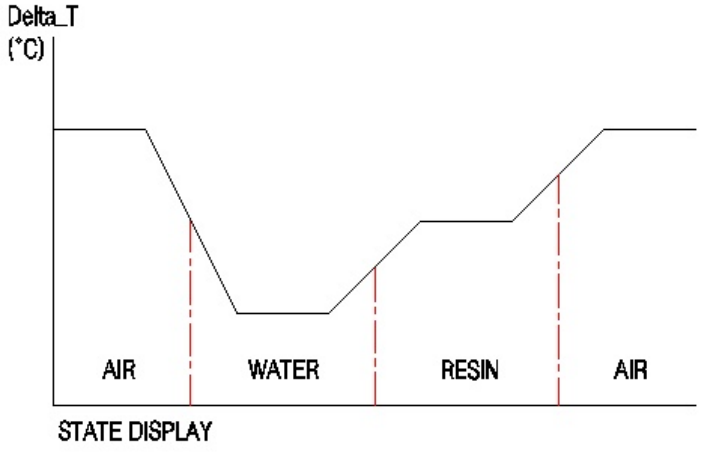
1. Overview

HTML-TM is a thermal dispersion–type multipoint level meter that measures the level of liquid or suspension with a level element. It is designed to have a microprocessor in the level transmitter for high accuracy and a self-diagnosis function. It is also designed to have an LCD text interface such that it can identify problems rapidly and respond thereto adequately with an error LED or HHT-2000 (loader) when some of the multipoint sensors of the level element become abnormal.

1.1 Operating Principles

The level element of this level meter comprises a reference sensor and an active sensor, and utilizes RTDs and a heater. The reference sensor measures the fluid temperature, while the active sensor having a heater measures temperatures higher than the fluid temperature. Because thermal dispersion varies depending on the different densities of two media, which are the measurement subjects, the temperature between the reference sensor and the sensor, △T, varies as shown in Figure 1.1. △T is converted by the RTD into △R (resistance difference) and sent to the level transmitter. The level transmitter calculates the relationship between the densities of the media based on △R, and determines the measurement subjects.



1.2 Specifications

1.2.1 Measurement range: User specifiable

1.2.2 Input power voltage: 90–240 VAC, 50–60 Hz, ±10%, 10 W maximum.

1.2.3 Number of sensor lines: 1–7

1.2.4 Measurable substances: Gas, liquid, and suspension

1.2.5 Output signal level: 4–20 mA, contact alarm (1 DPDT and 3 SPDTs)

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

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

1.2.8 Accuracy: ±1.0% FS

1.2.9 Response time: As low as 5.0 Seconds (1″/min decrease)

1.3 Terms and Definitions

1.3.1 Level Meter (L/M)

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

1.3.2 Level Element (L/E)

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

1.3.3 Level Transmitter (L/T)

The L/T calculates level with embedded software from the values collected by the L/E and transmits output signals.

1.3.4 Sensors

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

1.3.5 Sa and Sr

Sa and Sr refer to active sensor and reference sensor, respectively. They are sensors for measuring temperature of the measurement subjects and the thermal dispersed temperature by the heater, respectively.

1.3.6 Ra and Rr

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

1.3.7 ΔR

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

1.3.8 Loader (model: HHT-2000)

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

1.3.9 Simulator

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

1.4 Composition

This instrument, L/M, which comprises an L/E and an L/T, measures level based on output signals. 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 data collected by the L/E is calculated and converted by the software embedded in the L/T for transmitting output signals.

The F/T has an average life of no shorter than 7 years, and has electronic components that are easily available in the market.

Among the life of the electronic parts, the life of capacitors is limited to 7 years.

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

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, a main, an input, 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 alarm signals for set points, as well as digital data of level to the output board.

5.2.5 Output Board: This board receives digital data from the main board, converts them to analog data (4–20 mA) for transmitting them outside the L/T, and sends out contact points for the outputs.

2. Test Preparations

2.1 HTML-TM, 1 set

2.2 Multimeter, 1 EA: for checking output and relay contact points

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

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

3. Wiring for Functional Test

3.1 For wiring, refer to the attached wiring diagram.

3.2 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.

3.3 For the cable connecting to the L/E, use a 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 L/T for measuring DC of 4–20 mA.

3.5 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.

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

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

3.7.1 Connect the power to terminals AC1−AC2 of the terminal block.

3.7.2 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 H1 to the terminals H1-1 and H1-2 of the terminal block.

4) Connect Srn to the terminals An-1, An-2, and An-C of the terminal block.

5) Connect San to the terminals An-1, An-2, and An-C of the terminal block.

6) Connect Hn to the terminals Hn-1 and Hn-2 of the terminal block.
(n = number of points, maximum 7)

4. Checkpoints 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 L/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.

1) Apply power to the L/T. (warm-up: 20 minutes)

2) Connect the heater to the terminals Hn-1 and Hn-2 of the terminal block.

3) Connect the ammeter between the power supply terminal and the heater in a serial manner.

4) Check that the current is 75 mA ± 1%. If not, adjust the current with the loader.

4.4 Adjust and check the L/T.

By using the loader, check and adjust the input/output and factor values of the L/M.

4.4.1 Input calibration

In the ***Sensor01 R Check*** menu, check that the input resistance is within the tolerance of ± 2.5 Ω.

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 1500 Ω, wait for approximately 10 seconds in the ***Sensor01 Span Cali*** menu of the loader, and press ***ENT***.

c. Press ***ENT***, and in the ***Sens 01 Check*** menu, check if the same resistance values of 1,000Ω, 1,250Ω, and 1,500Ω of the simulator are indicated.

d. If the error is beyond ± 2.5 Ω, repeat the above processes "a" through "c."

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 Set the factor.

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

2) In the ***Input Sensor No*** menu, enter the number of sensors corresponding to the level points used by the L/E. (e.g., 7 points = 7)

3) In the ***Level Detail in Input Sensor No*** menu, enter the ***Setting Value*** of the performance test report on the water and resin data, which were calculated in accordance with the L/E test procedures.

4) In the ***Level Setting*** menu, enter the values of the alarm points for the sludge (resin) and water. # Enter the water HH (HI, HI) values in the air value column.

(e.g., In case of resin 43%, water 83%, and water HH 90%, enter sludge 43%, water 83%, and air 90%.)

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 L/M.

5.3 After the wiring is completed, enter the value of the performance test report for all the level points by using the decade resistance box or the simulator.

5.3.1 Initial resistance of the REF: 1,000.00 Ω

5.3.2 Initial resistance of the ACT: 1,000.00 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 For the resistance values of the points depending on the media, enter the resistance values of Ref.R and Act.R by checking the performance test report.

5.7.2 Check and record that output is acquired according to the sensing status of the input condition.

5.7.3 In the case of alarm points, check that contact alarm sounds, and record the result in the ***Alarm*** column of the performance test report.

6. Procedures for Verification Test

6.1 Carry out wiring for the verification test of HTML-TM.

6.1.1 Carry out wiring between the L/T and the L/E.

6.2 Check that the wiring is proper, apply power of 120 VAC 60 Hz, and allow warm-up for no shorter than 20 minutes before the verification test.

6.3 Check the condition of the main board.

6.3.1 Check that the Run LED of the main board remains on.

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

6.4 Check the condition of the input board.

6.4.1 Check that the Active Error LED of the input board remains off.

6.4.2 Check that the Reference Error LED of the input board remains off.

6.5 Check that the test subject exists, and feed it.

6.6 Drain the test subject, and check the operation of HTML-TM.

6.6.1 Check that the proper output is acquired for the measurement points of the L/E in case of existence/inexistence of the test subject.

6.6.1 Check that the proper contact points are made for the alarm points of the L/E in case of existence/inexistence of the test subject.

7. Precautions

7.1 Precautions for handling and storage.

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

7.1.2 Do not bend the sensor part.

7.1.3 Items that may cause harmful corrosion during storage

7.2 Precautions for wiring

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

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

7.2.3 Check the wired cables at regular intervals.

7.2.4 Wiring should be carried out by a qualified person.

7.2.5 Use the terminal lugs supplied by HITROL.

7.3 Precautions for installation.

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

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

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

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

7.4 Error display

7.4.1 Error LED

Lighting of the Error LED on the transmitter indicates disconnection, short, or delta R anomalies of the relevant points. For more details, check them with the loader.

7.4.2 Open error

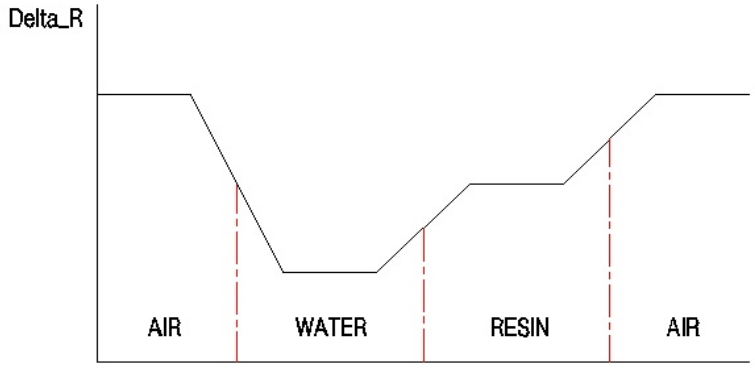
When Open Error is indicated on the display of the loader, recheck wiring for disconnections.

7.4.3 Short error

When Short Error is indicated on the display of the loader, recheck wiring for shorts.

7.4.4 Delta R error

When Delta R error is indicated on the display of the loader, check that the Delta R value is proper, by checking the Act.R and Ref.R resistance values of the L/E.



STATE DISPLAY

7.5 Because the boards are vulnerable to static electricity, make sure to use the attached plate in handling them.

7.6 The life of the transmitter components is no shorter than 7 years. However, for maintaining their performance, the PCB boards shall be replaced at the interval of 7 years.

8. Installation method

8.1 Installation method of HTML-TM

8.1.1 Remove the bolts and the cover of the flexible joint.

8.1.2 After removal, insert the product into the nozzle.

8.1.3 When inserting, insert it after bending it properly so that it does not touch the ceiling.

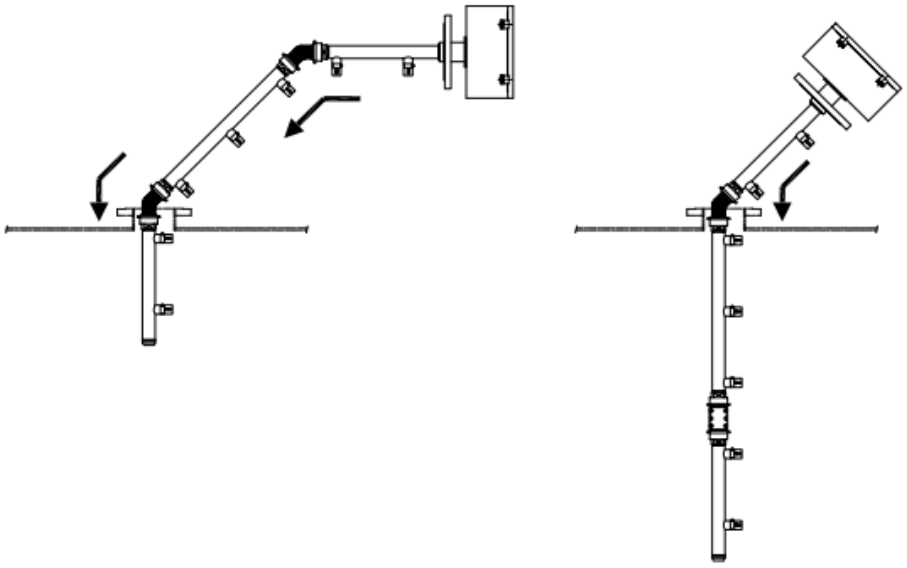
8.1.4 After inserting the first flexible joint, assemble the cover and bolts.

8.1.5 Proceed the remaining flexible joints in the same manner as in 8.1.4.

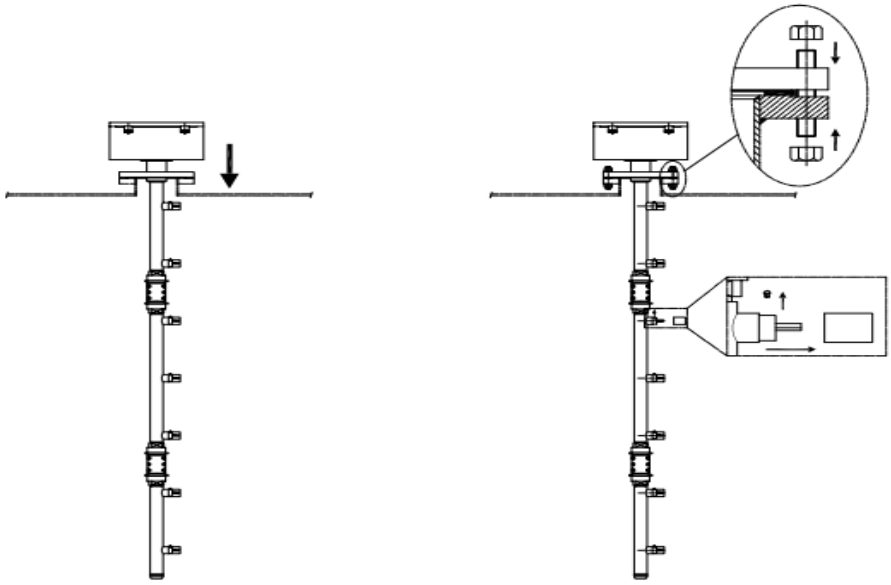
8.1.6 When the product is fully inserted, fasten it with bolts and nuts.

8.1.7 When the product installation is completed, remove the cap of the sensor part.

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



<Figure 1>



<Figure 2>

9. HHT-2000 Manual

9.1 Overview

HHT-2000 Loader is used for the checking and management of the thermal dispersion–type level meter. It is used as connected to the serial communications port of the transmitter, and it does not require a separate power supply because it receives power through the communications port.

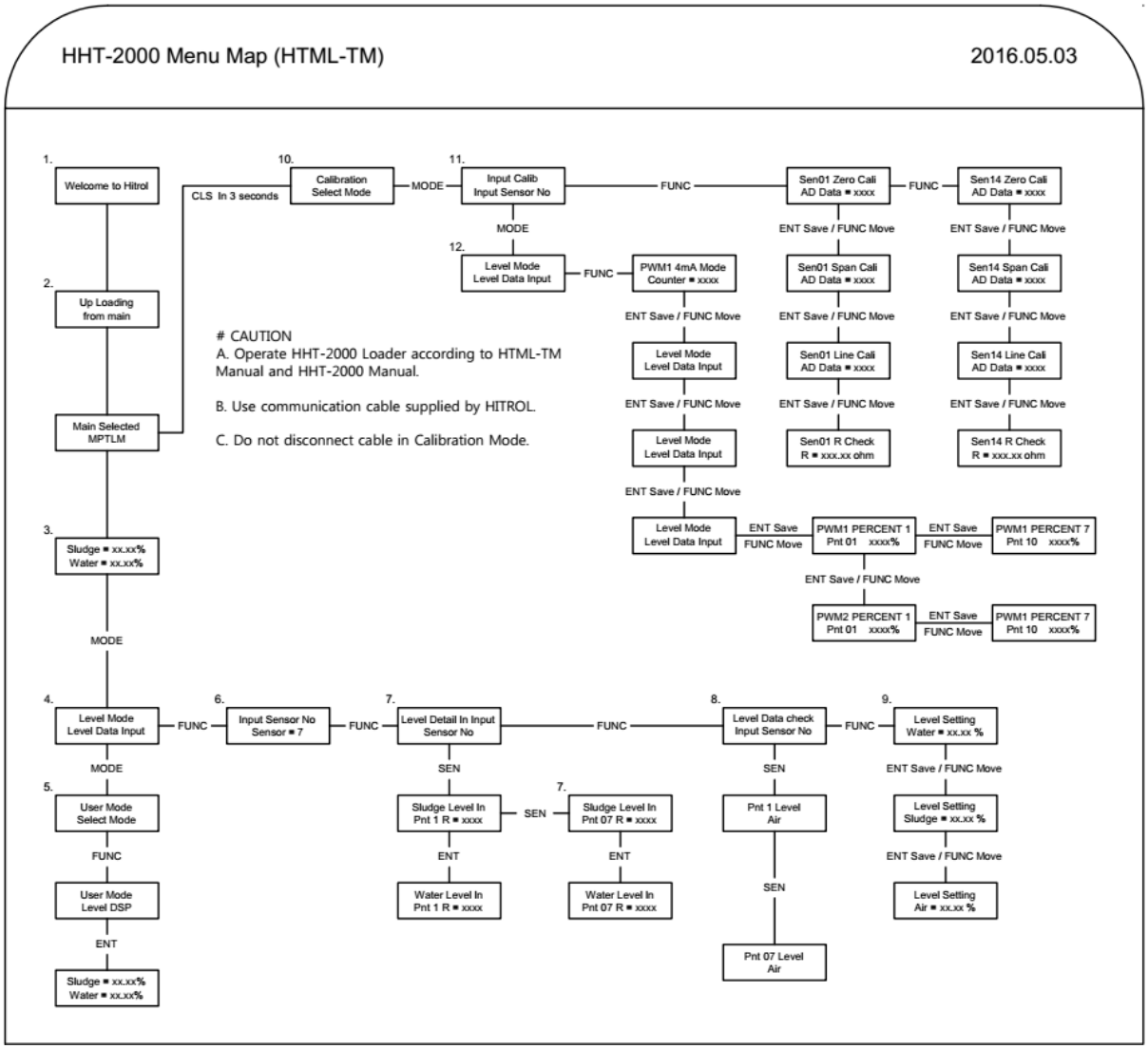
It is designed such that it can be compatible with the multipoint thermal mass flow meter, the multipoint thermal level meter, and the continuous level meter.

9.1.1 Equipment

9.1.1.1 HHT-2000 (Loader), 1 EA

9.1.1.2 Serial communications cable, 1 EA

9.2 HHT-2000 menu map



9.3 HHT-2000 menu description

9.3.1 Connect the loader to the serial communications port of the transmitter.

9.3.2 Then, the data of the transmitter is loaded onto the loader, and setting is done by automatic identification of the model.

9.3.3 Current level status is displayed.

9.3.4 The normal mode is possible in the user mode and the level mode, which can be switched by pressing the ***Mode*** key.

9.3.5 In the user mode, pressing of the ***FUNC*** key will display the level of both the sludge (resin) and water in the % unit.

9.3.6 Enter the number of sensor points in use, and press the ***ENT*** key for setting.

9.3.7 Enter the resistance setting values, which are specified in the performance test report, for the media of each sensor point.

9.3.8 Pressing of the ***SEN*** key will display the measurement status of each sensor point. The status types are divided into air, water, and resin, and ERROR will be displayed in case of errors.

9.3.9 The Level Setting menu is for setting the contact alarm outputs. Enter the setting values for the sludge (resin), and water. Enter the water HH (HI, HI) values in the air value column. (e.g., In case of resin 43%, water 83%, and water HH 90%, enter sludge 43%, water 83%, and air 90%.)

9.3.10 At any position of the menu, pressing of the ***CLS*** key for 3 seconds will switch between the normal mode and the calibration mode.

9.3.11 The input calibration mode if for calibrating sensor resistance range (1,000–1,500 Ω). Press the ***SEN*** key for switching among the sensors to be calibrated.

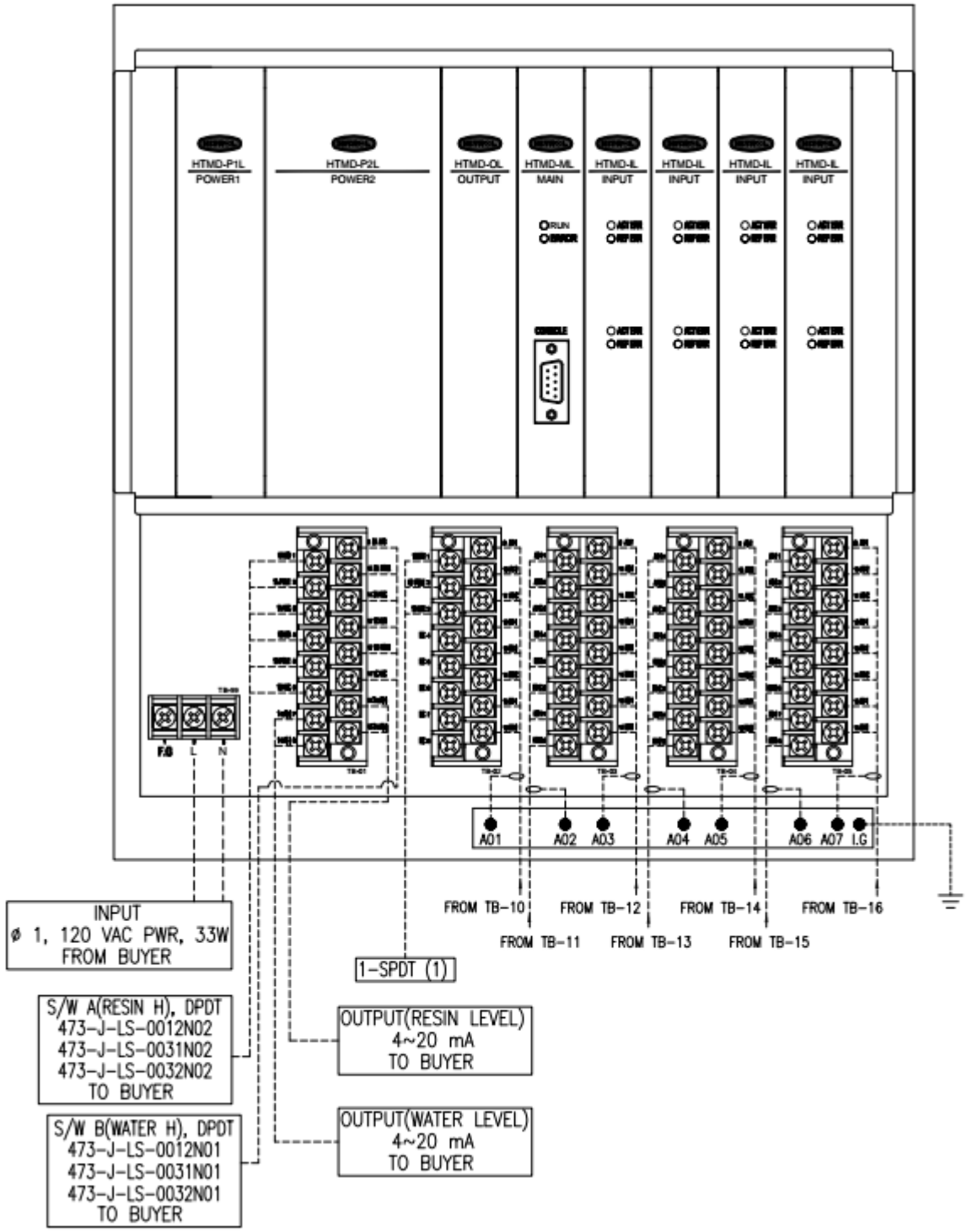
9.3.12 The output calibration mode is for calibrating output current range (4–20 mA). Press the ***FUNC*** key for switching between the 4 mA and 20 mA modes to be calibrated.

9.3.13 Set the output of each point.

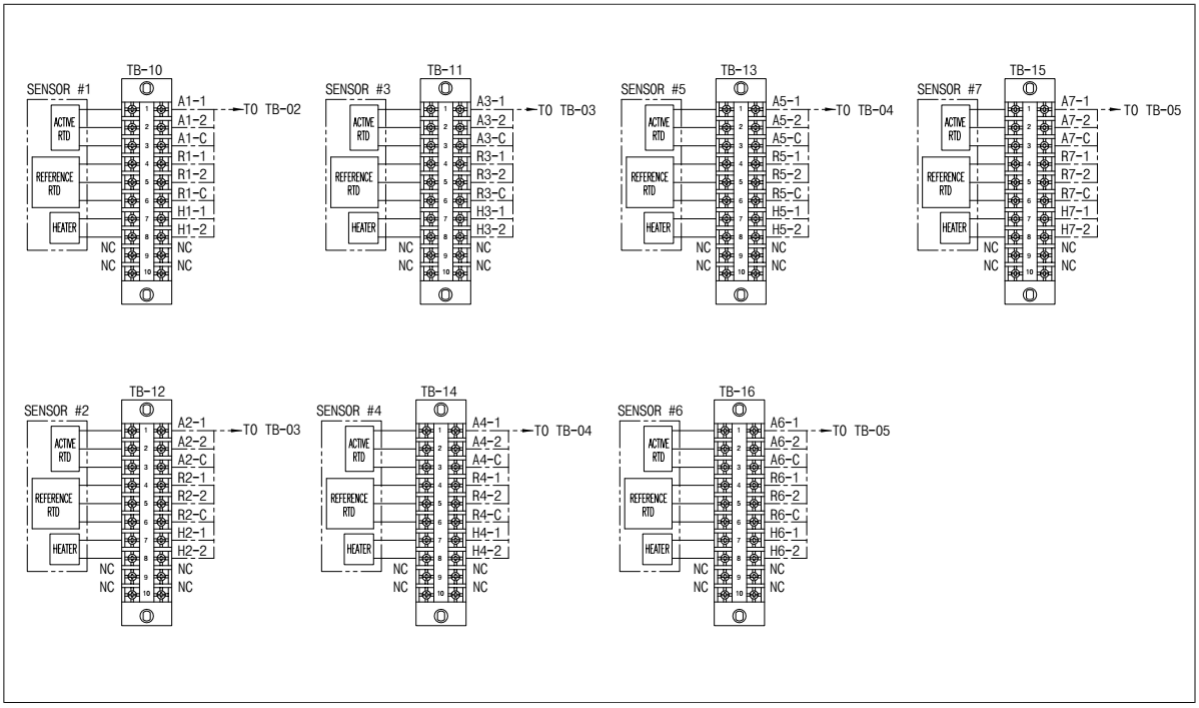
For example, enter the percentage values for the outputs of water and resin.

10. Appendix

10.1 Transmitter



10.2 Sensor


SENSOR #1
TB-10
ACTIVE RTD
REFERENCE RTD
HEATER
A1-1
A1-2
A1-C
R1-1
R1-2
R1-C
H1-1
H1-2
NC
NC
NC
NC
TO TB-02
SENSOR #3
TB-11
A3-1
A3-2
A3-C
R3-1
R3-2
R3-C
H3-1
H3-2
TO TB-03
SENSOR #5
TB-13
A5-1
A5-2
A5-C
R5-1
R5-2
R5-C
H5-1
H5-2
TO TB-04
SENSOR #7
TB-15
A7-1
A7-2
A7-C
R7-1
R7-2
R7-C
H7-1
H7-2
TO TB-05
SENSOR #2
TB-12
A2-1
A2-2
A2-C
R2-1
R2-2
R2-C
H2-1
H2-2
TO TB-03
SENSOR #4
TB-14
A4-1
A4-2
A4-C
R4-1
R4-2
R4-C
H4-1
H4-2
TO TB-04
SENSOR #6
TB-16
A6-1
A6-2
A6-C
R6-1
R6-2
R6-C
H6-1
H6-2
TO TB-05