TH-4000 Turbidimeter

Operation and Maintenance Manual

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TH-4000 Rev. 4/29/2022 v2

TH-4000
Turbidimeter
Operation Manual

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I. INTRODUCTION

The Hydro Instruments TH-4000 turbidimeter uses a pre-scaled inline sensor that measures turbidity in water using a white LED as the excitation light source and by measuring the scattered light at a 90-degree angle with respect to the excitation beam. The fluidic and optical arrangement of the sensor is designed to overcome many shortcomings associated with other inline turbidimeters. It can be easily inserted into the flow cell tee with a compression fitting designed to ensure correct positioning of the Series sensor in the water stream. The sensor has a short channel that can be easily cleaned and calibrated.

Specifications

Specifications	**TSH-10**	**TSH-100**	**TSH-1K**	**TSH-10K**
Turbidity Range:	0-10 NTU	0-100 NTU	0-1,000 NTU	0-10,000 NTU
Resolution:	0.05 NTU	0.10 NTU	1.00 NTU	10.0 NTU
Accuracy:	± 2% NTU			
Method:	Nephelometric, with white LED and IR LED (860 nm) light sources			
Calibration:	Two-point calibration against standard solution			
Sensor Body Material:	CPVC			
Temperature Limits:	40–120 °F (4–49 °C)			
Max. Pressure:	100 PSI (6.9 bar)			
Sample Flow	Min. = No minimum Max. = Maximum carrying capacity of the sample line.			

II. OPERATION OF THE TH-4000

A. Start Up and Installation

1. The TH-4000 will accept any single phase A/C power in the range of 110 to 240 VAC at 50 to 60 Hz. When connecting A/C power to the instrument, it is imperative that the A/C source be well grounded. Insufficient A/C grounding will disrupt proper operation of the instrument.
2. **Sensor Monitor Communication:** Each monitor can have up to two sensors connected. The sensor is 24VDC loop powered by the monitor and the sensor provides a 4-20mA signals to the monitor.
3. **Clean Lines:** Ensure that all sample lines are flushed out and clean before feeding sample water to the Turbidimeter.
4. **Sensor Protection:** The sensor should not be exposed directly to extreme temperatures or weather conditions.
5. **Sensor Start Up:** Ensure that the sensor head is clean and allow a few minutes for the reading to stabilize.
6. **Calibration:** The Model TH-4000 Turbidimeters can be calibrated with standard turbidity fluids. The standard can be poured directly into the flow cell for calibration.
7. **LED Indicators:** The red alarm indicator LED on the front panel will illuminate as long as an alarm condition is present.

B. Alarms and Output Signals

1. **Acknowledgement of Alarms:** If an alarm condition occurs, the alarm (red) LED will illuminate and the relay will be activated. To acknowledge an alarm (and thereby de-activate the relay contact output) press the ⊖ key.

   NOTE: Even after acknowledging the alarm the red LED will remain illuminated until the alarm condition has been removed.
2. **4-20 mA output channels:** The turbidity sensor has two dedicated 4-20 mA output channels. See Figure 4. AO1 is for channel 1 and AO2 is for channel 2.
3. **Alarm Relay:** The TH-4000 has two alarm relay outputs. These are SPDT, non-powered relays. See Figure 4. Relay 1 (NO1/CO1/NC1) is for channel 1 and relay 2 (NO2/CO2/NC2) is for channel 2.

C. Operation Screens

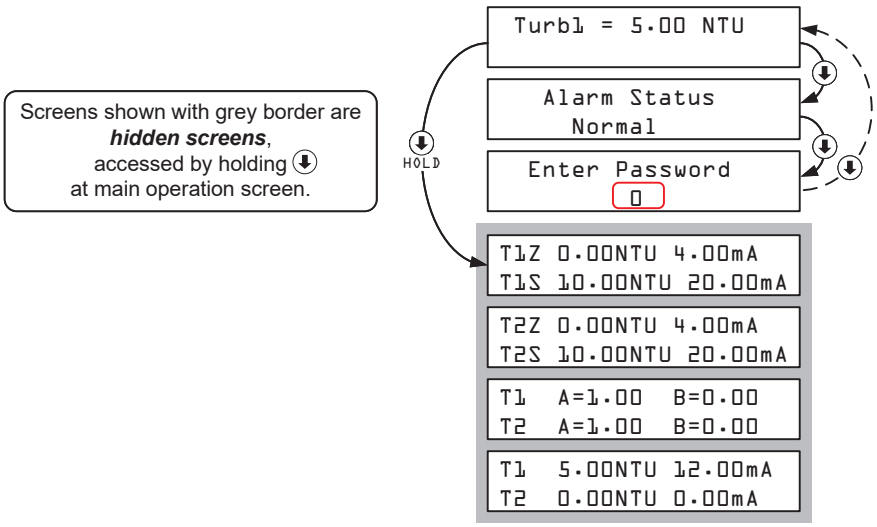
This section explains the features of the standard operating screens of the TH-4000.

NOTE: Navigate between the display screens below using the ⬆ and ⬇ keys.

1. **Home Screen:** This screen displays the gas type and reading of the sensor(s).
2. **Status Screen:** This screen shows all present alarm conditions.
3. **Password Screen:** See Section II.A for instructions on this screen and the configuration section.

FIGURE 1

TH-4000 Operation Mode Screens



Status messages

1. **Normal:** Indicates that the sensor reading is above 2 mA and below the high alarm set point.
2. **Alarm:** Indicates that the sensor reading exceeds the high alarm setting. (Meaning that if the alarm setting is at 10.0 NTU, then status will be “Alarm” if the reading is 10.0 NTU or higher.)
3. **Error:** Indicates that the sensor signal is below 2 mA and usually indicates that the sensor is
either damaged or not connected.

III. CONFIGURATION OF PARAMETERS

Configuration of Sensor Parameters & Calibration of Sensors

Each TH-4000 Turbidimeter will be set up from the factory as per the ordering instructions. However, settings and sensors can be changed using the following procedure.

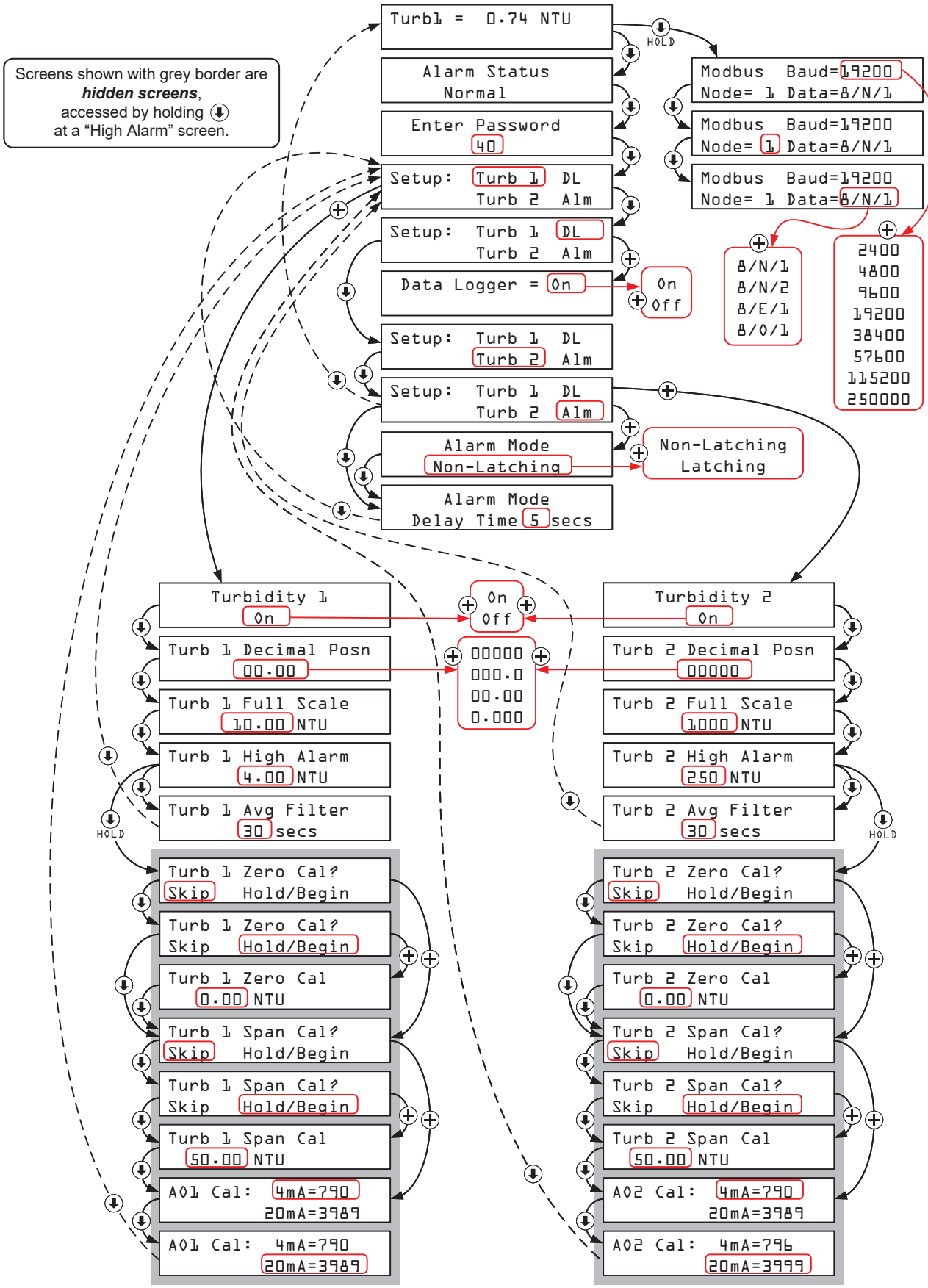
A. Entering Setup: All parameters are set in the password protected setup section.

1. Press the ⬇ key until the password screen is reached.
2. Use the ⊕ and ⊖ keys to set the password. The password is “40”.
3. Press the ⬇ key.

B. Configuring Each Channel

See Figure 2. The selected channel will flash. Move between the channels with the ⬆ and ⬇ keys. When the desired channel is flashing, press the ⊕ key to enter setup for that channel. Setup for each channel is identical.

FIGURE 2: TH-4000 All Screens



IV. MAINTENANCE

A. Sensor Maintenance

The turbidity sensor is designed to be easily removed, inspected, and cleaned when required. It is recommended that the turbidity sensor be checked for fouling and cleaned on a monthly basis. Heavily contaminated water may require more frequent cleanings. Cleaner water sources with less contamination may not require cleaning for several months.

B. Sensor Cleaning

Any equipment in contact with water treatment systems is subject to potential fouling and contaminants. Sensors can be cleaned using cleaning solutions. A small, soft bristle brush, Q-Tips cotton swab, or soft cloth may be used to safely clean the sensor housing and the optical sensor channel.

To clean the sensor, soak the lower half of the sensor in 100 mL sensor cleaning solution for 30 minutes. Rinse the sensor with distilled water and then check for the flashing blue light inside the optical sensor channel. If the surface is not entirely clean, continue to soak the sensor for an additional 30 minutes. Use a small, soft bristle brush and Q-Tips cotton swabs as necessary to remove any remaining buildup in the sensors optical sensor channel.

V. TROUBLESHOOTING

A. Installation Check – Review the following points first.

Sensor Installation: Check that the sensor head and flow cell are clean. Check that the sensor is properly installed in the flow cell and that water is flowing.

B. Symptoms, Likely Causes, and Suggested Responses

1. **Filter Time:** If the displayed reading is not stable, then the filter time can be increased to eliminate this oscillation.
2. **Span Calibration:** If the span calibration is performed incorrectly, then this will cause the readings to be inaccurate. Unless you intend to perform the span calibration, do not touch the
   ⊕ and ⊖ keys if you enter the span calibration screen.
3. **Sensor Wiring:** If the display is reading zero and giving an “Alarm Status: Error” message, then the sensor may not be connected to the monitor. Check the wiring at the circuit board in the monitor and inside the sensor enclosure.
4. **Sensor Replacement:** If the sensor is not putting out signals in the range of 4-20mA on channels 1 and 2, then it may be damaged and require replacement. Contact Hydro Instruments or your local sales representative.
5. **4-20 mA Output Calibration:** It is possible that somebody could enter the 4-20mA output calibration screens and change the values without understanding their meaning. This will cause the output 4-20mA signals to be inaccurate.

6. **Damaged Circuit Board:** The circuit boards can be damaged if high voltage is connected to the wrong terminals, by lightning, other power surges, or by corrosion. If you believe that the circuit board is damaged, then contact the factory and your local sales representative.
7. **Damaged Power Supply Board:** The power supply board accepts AC power (110-240 V at 50-60 Hz) and provides 24 VDC power to the main circuit board. If the main circuit board does not have power, then check the DC voltage on the output pins of the power supply board. If it has A/C power coming in, but is not putting out 24 VDC, then it either has a blown fuse or is damaged and requires replacement.
8. **Blown Fuse:** If the power supply board is not putting out 24 VDC, then always check to see if the fuse is blown and replace if necessary.

IV. OPTIONAL DATA LOGGER

1. **Description:** When enabled in the software, the data logger records the measured NTU of each attached turbidity sensor at a selectable frequency. This data is recorded on the Micro SDHC memory card and can be retrieved using any text-reading program. The Micro SDHC memory card is installed in the slot on the MB220 board as indicated on Figure 3 of this manual. To use the data logger the controller must be provided with the MJ500 Real-Time Clock board (which mounts directly on the MB220 board as shown on Figure 3).

2. **Operation:** To enable, enter the configuration menu on the monitor and select the option "DL". The first menu option that appears will be the On/Off menu. The menus which follow allow for adjustment of the data logger frequency and for changes to the clock (date and time). See figure 2.

   a. **Frequency**: The frequency is the time interval between data recordings. The frequency is adjustable in seconds, with a minimum setting of 5 seconds.

   b. **Data Logger Clock:** The clock is factory-set before shipment. However, because the clock is set on Eastern Standard time it may be necessary to change the date and time upon start-up.

3. **Stored Data Files:** The data will be written to text files on the Micro SDHC memory card. The formatting and handling of these files is as described below:

   a. **File Format:** The following is an example data file to illustrate the format used. As you can see, there is a three line header for each file. The fourth and fifth lines are headers for the data. You will see that each header and data entry is delimited by a comma.

   b. **File Name:** Each data file will be named according to the date on which it was created. For example if created on May 24, 2022, the file name would be May24_22.txt

   i. If the Micro SDHC memory card already has a file started earlier on the same day, then data will be written onto the existing file.

   ii. The text files are limited to 5 MB. Once this limit has been reached, a new file will automatically be created to allow data to continue to be written.

c. **Importing data into Excel:** The data files can be imported into Excel as follows:

NOTE: This assumes use of Excel 2007 version.

i. Select the “Data” tab.

ii. Among the “Get External Data” tabs on the toolbar, select “From Text”

iii. A pop up window will appear allowing you to search for and select the data file that you wish to import. After you have selected the file, click on “IMPORT”.

iv. Another pop up window “Text Import Wizard – Step 1 of 3” will then appear.

1. Here under “Original Data Type” you must select “Delimited”.

2. Lower down you are asked to select “Start import at row:___”. In order to eliminate the 3 line file header, you can select “4” here to start the data import on row 4 of the file.

3. Then click “Next”.

v. On the next pop up window “Text Import Wizard – Step 2 of 3” you need to select the type of delimiter being used in the data file. The data entries in these files are delimited by commas and so you must select “Comma”. After selecting Comma and only Comma, then click “Next”.

vi. On the next pop up window “Text Import Wizard – Step 3 of 3” you can accept the “Column data format” setting of “General” and then click “Finish”.

TABLE 1: TH-4000 Data Log File Example

Date	Time	Turb1	Turb2
MM/DD/YEAR	**HH:MM:SS**	**NTU**	**NTU**
05/24/2016	11:25:06	10.1	328.0
05/24/2016	11:26:06	10.1	328.0
05/24/2016	11:27:06	10.7	327.8
05/24/2016	11:28:06	11.3	327.6
05/24/2016	11:29:06	11.4	326.0

FIGURE 3: TH-4000 Controller Electronics

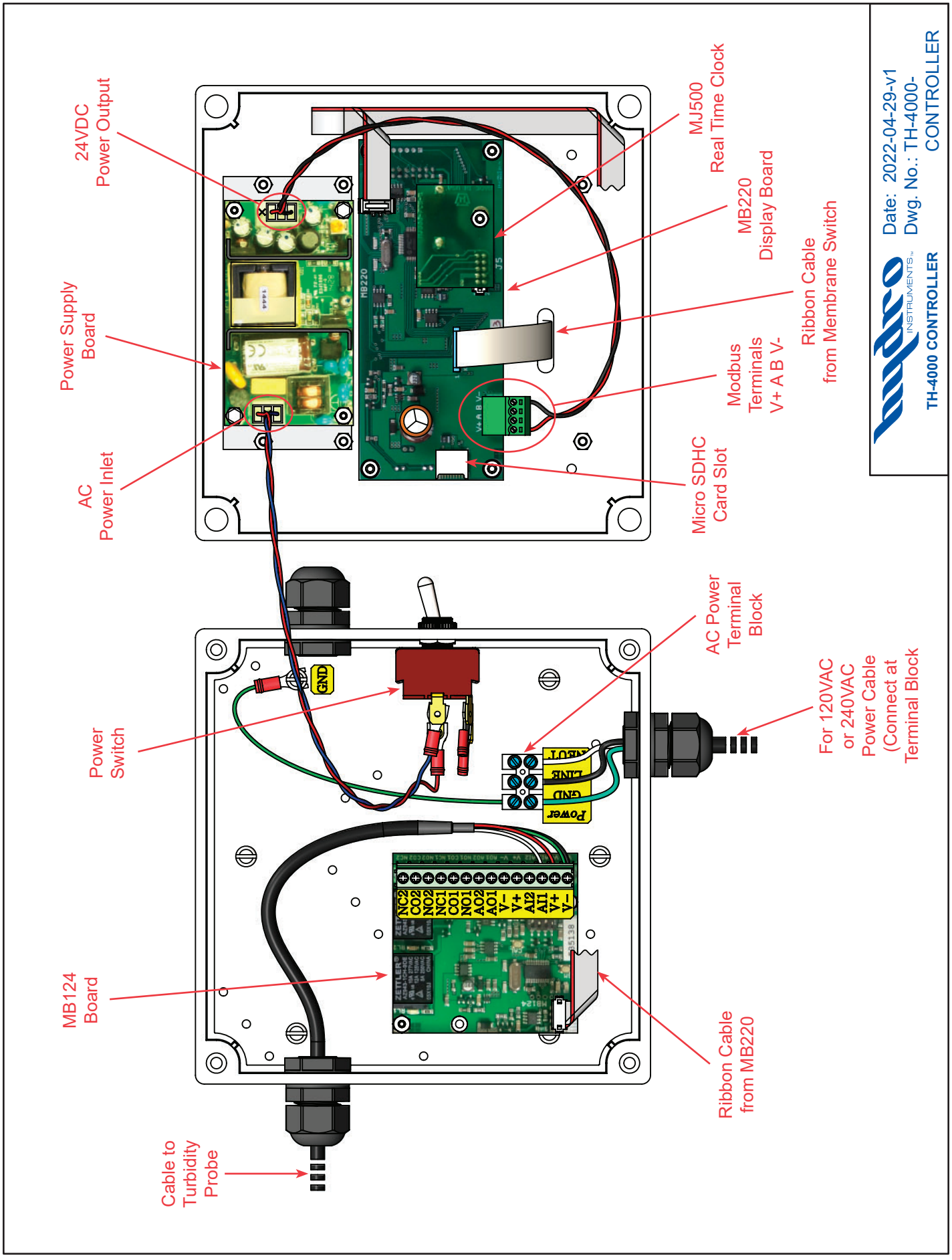
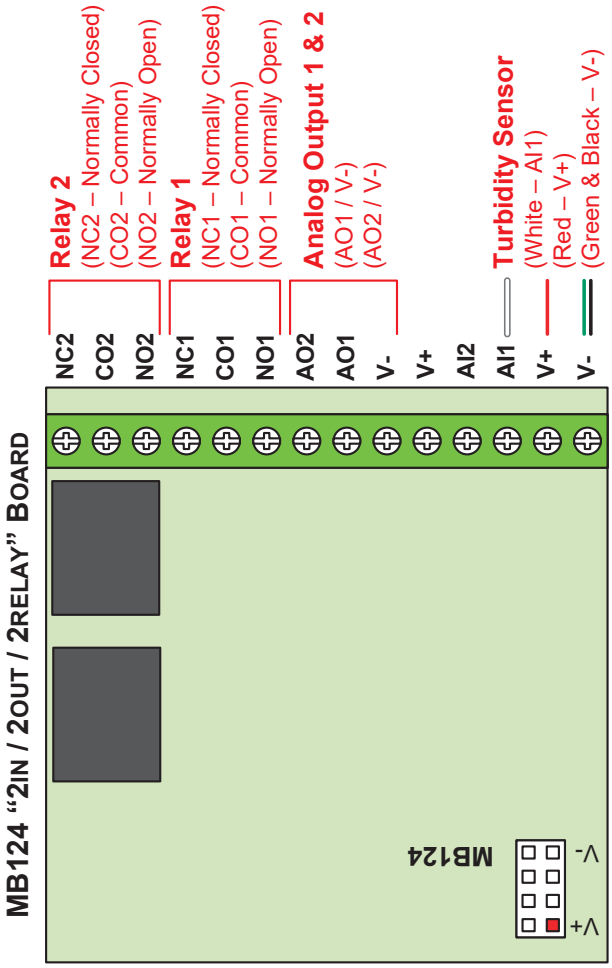
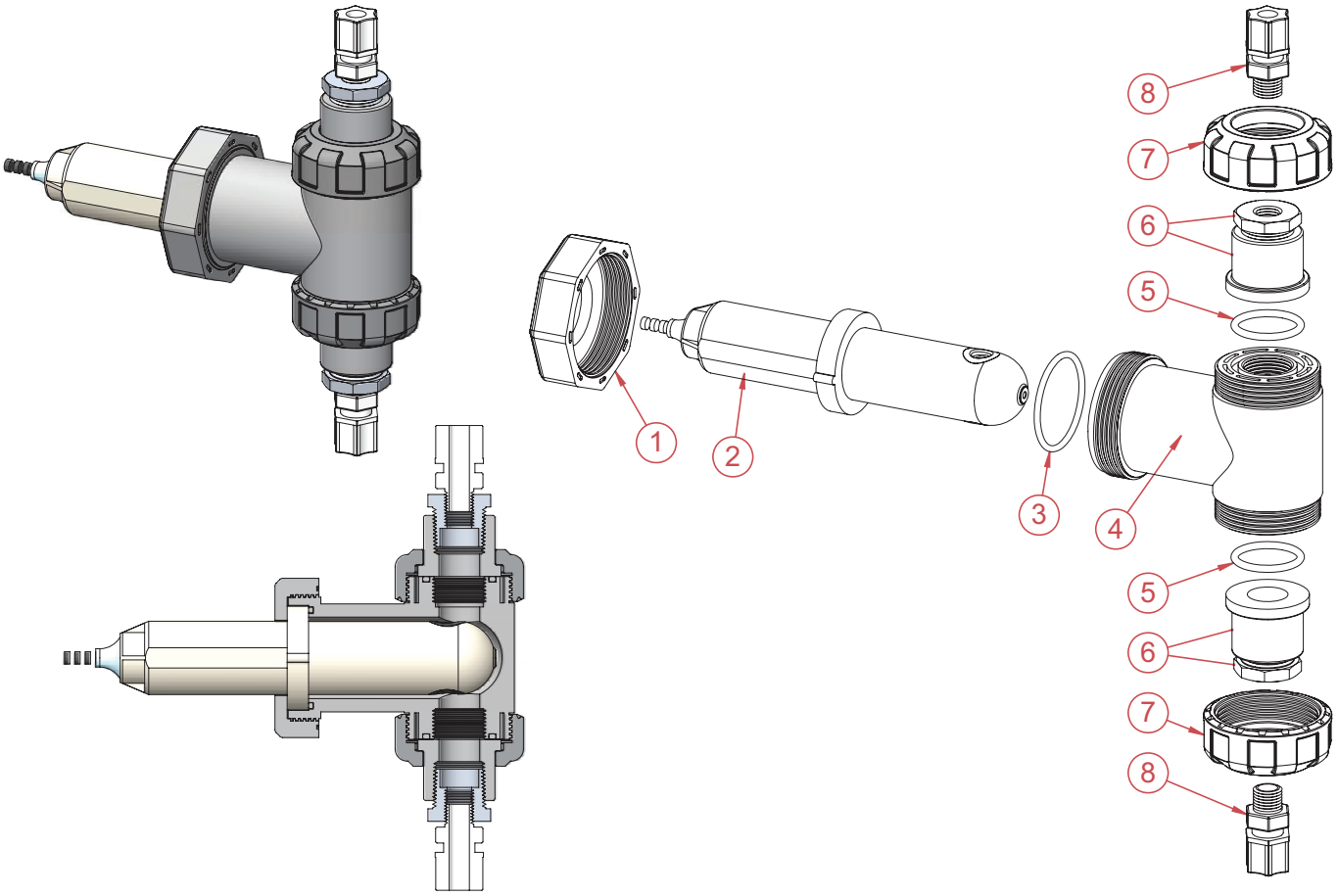


FIGURE 4: TH-4000 Circuit Board MB124



TH-4000 CIRCUIT BOARD MB124 Dwg. No.: TH-4000-PCB Date: 2022-04-20-v1



Item No.	Description	Quantity	Part No.
1	Probe Nut	1	TFC-PN-1
2	Turbidity Sensor	1	See Table
3	O-Ring	1	TFC-BOD-OR
4	Flow Tee Body, ¾"	1	TFC-BOD-1
5	O-Ring	2	TFC-UE-OR
6	Flow Tee Union End	2	TFC-UE
7	Flow Tee Union Nut	2	TFC-UN
8	Tubing Connector	2	10-6-4

Turbidity Sensor No.	Range
TSH-10	0-10 NTU
TSH-100	0-100 NTU
TSH-1K	0-1,000 NTU
TSH-10K	0-10,000 NTU

hydro INSTRUMENTS

TURBIDIMETER
FLOW TEE & SENSOR HOLDER

Date: 2022-04-18-v2
EXPLODED VIEW & BOM
Dwg. No. THC-4000-T