

SERVICE MANUAL

Micro TPI/TPW Laboratory Turbidimeter

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1.0 Overview

This manual is designed to assist in the identification, upgrade and testing of the Micro TPI/TPW turbidimeter. Although some basic replacement procedures are covered, this manual is not designed to assist in component level repair.

It is recommended that the Operators Manual is on hand before servicing these instruments. The latest copy of this manual is available online at:

www.hfscientific.com/register.htm or contact HF scientific Customer Service.

Additional assistance is available at HF scientific instrument service dept.:

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2.0 Theory of Operation

The Micro TPI/TPW was designed to be a field turbidimeter. While it is easy to operate and calibrate, it can read from 0.02 – 1000 NTU. Operators will be able to get over 5000 readings on a single set of four AAA batteries. The instrument is also waterproof and if dropped into water it will float.

The instrument is designed around the Texas Instruments MSP430P148 flash based CPU. Calibration variables are held in flash.

The battery condition is monitored whenever the instrument is on. A battery icon will flash when the batteries needs replacement, but the readings can still be trusted. When the icon is solid the reading may be out of specification. If the batteries get too low, the instrument will not turn on.

There are two possible light sources. The White Light uses a tungsten filament lamp and meets the USEPA standard 180.1. The IR model uses a long life LED and meets the requirements of ISO 7027. The PCB's are selectively populated to drive these light sources, so changing between lamp types is not possible.

The detector is a single photodiode. The signal is amplified and sent to an A/D which is then read by the CPU. The CPU linearizes the signal and based on the calibration variables, displays the reading on an LCD.

Calibration consists of placing three known standards in the optical well in a specific order and pressing the ← button when the standard has been indexed (rotated to read the lowest value). The CPU reads the resulting signal from these known standards and stores them as a variable. These variables provide a reference to the built-in linearization curve.

3.0 Lamp Replacements

The white light is a tungsten filament lamp which although has a low life, in the Micro TPW it is only turned on for about one second during readings, but is kept on during indexing. The effective life of the white light lamps should easily be 5-10 years. The IR lamps are LED's which are rated for 10 years if run continuously, considering the actual usage the life is not an issue.

The IR lamp is soldered to the PCB and can easily be changed orientation is not important, but electrical polarity is. Note that the lead connected to the case is on the left side.

The white light lamp can be replaced if needed. Make sure the filament is installed vertically. Tighten the lamp set screw just enough to hold it in place. Over tightening will cause a lamp failure.

4.0 Battery Change

The Micro TPI/TPW operates on four AAA batteries. While a very long operating life (5000 readings) can be achieved on standard alkaline batteries, rechargeable batteries may be used with a shorter operating life.

To change the batteries simply remove the two large screws retaining the battery cover. The battery orientation is clearly marked. While reversing the batteries will not damage the instrument, it will not operate in this manner.

5.0 Opening the Micro TPI/TPW Enclosure

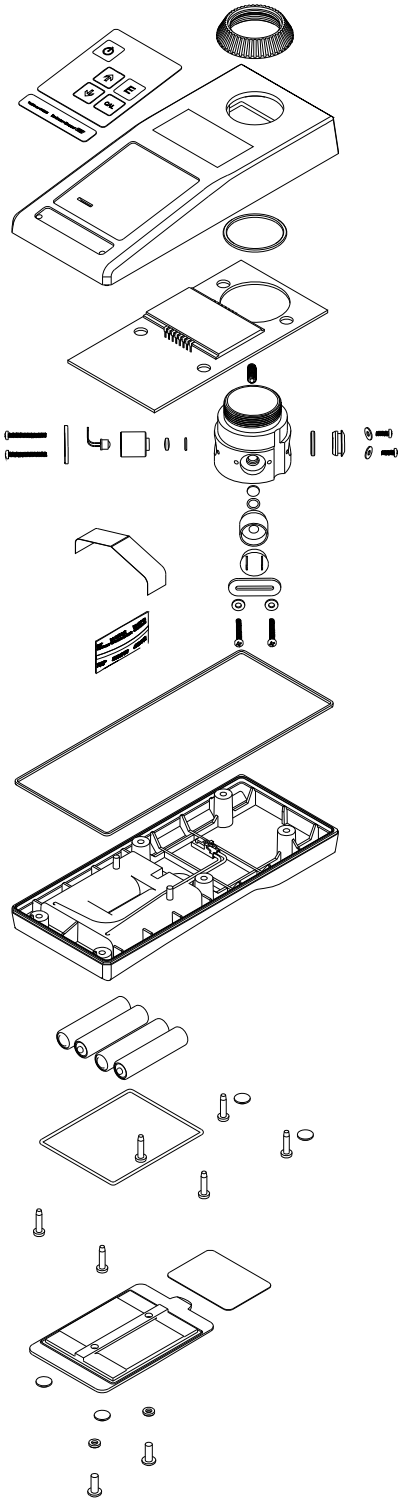
If the repair requires opening the Micro TPI/TPW module, use the procedure shown below. Refer to the diagram on the previous page.

Steps:

1. Turn the unit off.
2. Remove two screws retaining the battery cover.
3. Remove the battery cover.
4. Remove the six screws and pull the bottom half of the instrument case away from the top portion of the instrument case. Note that one screw hole has hot melt glue in it as a tamper deterrent. This can easily be removed with a sharp pair of tweezers or similar tool.

To ensure a dry environment for the electronics and optics, a desiccant pillow is inserted inside the instrument. This pillow should be replaced with fresh one prior to reassembly.

6.0 Micro TPI/TPW –Exploded Diagram



7.0 Restoring Factory Calibration

The Micro TPI/TPW stores calibration values in two different places in the flash memory of the CPU. The first location is the area where operator calibrations are stored and the second is where factory calibrations are stored. When the instruments are shipped these areas contain identical numbers. If an operator has a problem calibrating he can restore the factory calibration, using the following procedure:

- Press and hold the ▲ button
- Press the ← button
- The instrument will turn off
- Release the buttons
- When the instrument is turned on again it will have the factory calibration restored

8.0 Technical Mode

This operational mode is **not** recommended for the average operator and should **not** be used outside of a service facility. Calibrations performed under service should always be performed in technical mode. This stores calibration values in a separate section of flash memory that can always be recalled by the operator should he have problems with calibration.

To enter Technical Mode Press and hold the ← key, press the **CAL** key, then release both keys. The flashing NTU & FTU will indicate that you are in technical mode. In this operational mode there are only two differences:

1. Calibrations will be stored to both memory locations; the Factory and Operator locations.
2. The normal 5 minute time out is over ridden. The instrument will only turn off when either the **ON/OFF** key is pressed or the batteries get too low to operate the instrument. Be careful to turn the instrument off or it will eventually drain them.

To exit technical mode, simply turn the instrument off. When the instrument is next operated it will be in normal operational mode

9.0 Error Codes

POST stands for **Power On Status Test**. This feature will test various internal functions of the instrument each time power is applied. Pushing and releasing the ▲ & ▼ buttons at the same time, from either operating mode, will result in some information being displayed on the screen:

1. The first number displayed is probably something like 1.1.19. This is the software version number
2. The next number is usually four zero's.
3. The third number should start with a P. this is the POST test number. P 08 is normal for other values see below.
4. The last number is also usually four zero's.

The instrument will now display the last reading taken and is ready for normally operation.

9.1 POST Codes

The following POST codes are used.:

P 01	SPI Failure
P 02	Microprocessor ADC Failure
P 03	Measurement ADC Vref Failure
P 04	Vlcd Failure
P 05 – P 07	Not Used
P 08	Normal Operation
P 09	LCD Error
P 10	Not Used
P 11	Lamp Failure
P 12	Measurement ADC Failure.

9.2 Other Error Indications

Over Range:

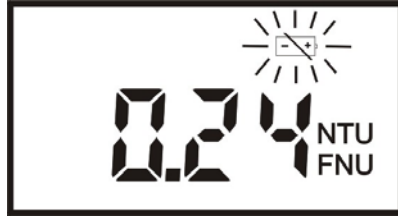


The standard inserted is over the readable range of the instrument.

Calibration Error:



Batteries Low:



The batteries are in need of replacement, but will not affect operation of instrument.

Batteries Too Low:



The batteries are too low for the instrument to operate properly.

NOTE: If the batteries are determined to be too low to operate the instrument, the instrument will fail to turn on, or will turn off if already on.

10.0 Optics

Failures in optoelectronic devices such as the LED and photodiode are extremely rare. Since the Micro TPI & TPW are optical based instruments, problems can exist with cleanliness of apertures and lenses. These components can be given a cursory check with a dental inspection mirror; however a complete disassembly may be required to determine proper cleanliness.

Before disassembly, ensure that enough clean table space and tools are available to perform this type of service.

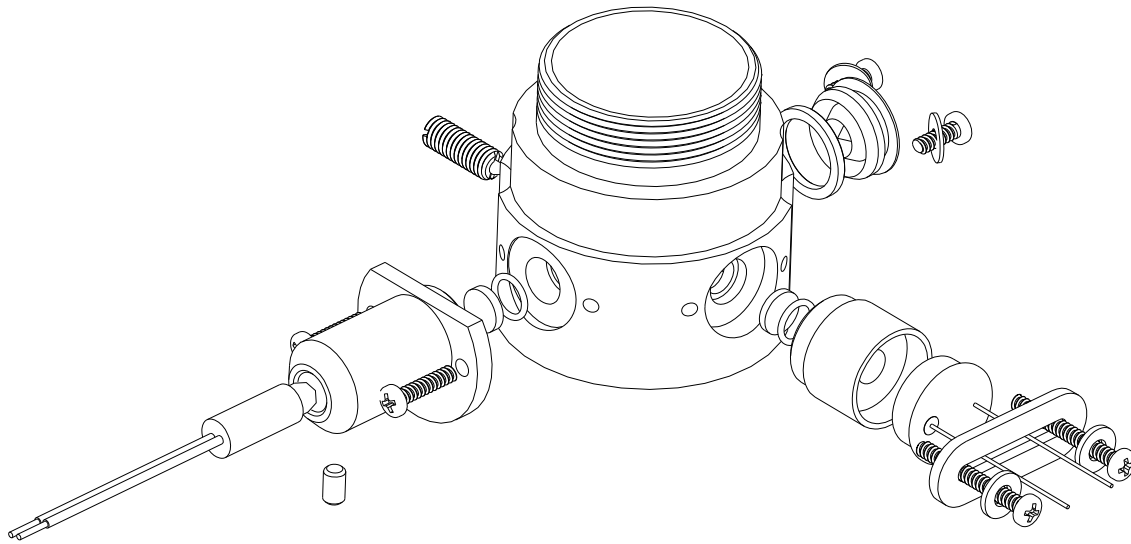
If disassembling the optics, first remove the battery connector and place the lower case aside. Pull down the keypad connector lock and remove the ribbon cable. Undo the threaded collar ring. The entire optics and PCB can now be removed.

It is recommended that the optics be removed from the PCB for disassembly to reduce stress on the optoelectronic components.

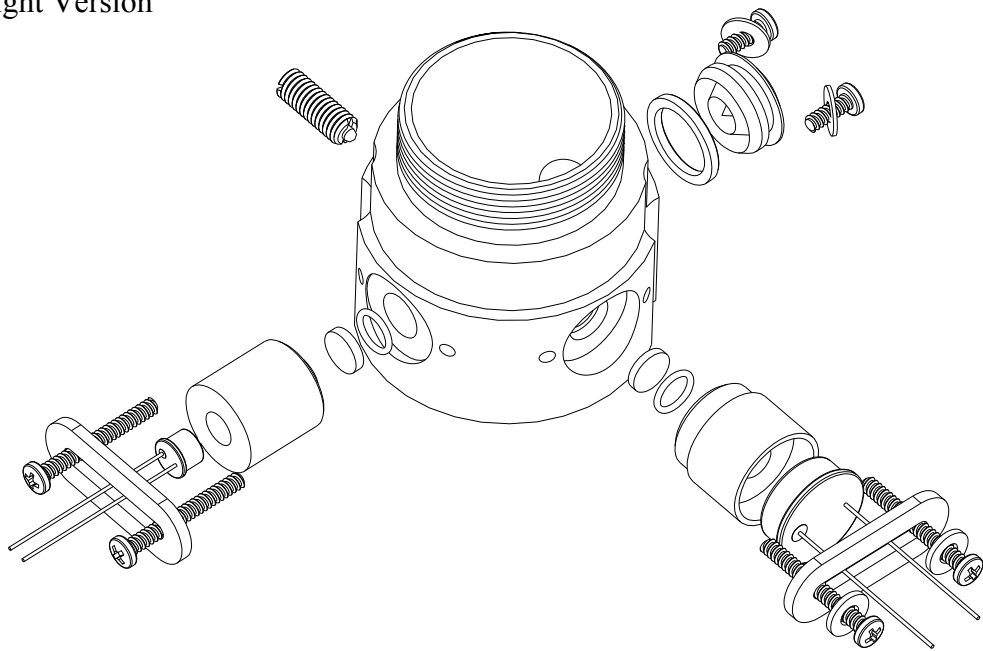
Two types of lenses are used. A single convex is used in front of the photodiode, and a double convex is used in front of the white light lamp. Ensure when reassembling that the lenses are placed in the correct place and that the flat side of the single convex lens faces the optical block. The lenses are made of uncoated glass and can be cleaned using a common glass cleaner and laboratory wipes such as KIMWIPES.

Exploded views of the two types of optical arrangements are shown on the following page.

White Light Version



IR Light Version



11.0 Software Upgrade

Software on the Micro TPI and Micro TPW can be changed as upgrades become available. These will require a software upgrade kit available from HF scientific inc. Since the software upgrade completely wipes the flash memory clear, the instrument will need to be calibrated in TECH mode to restore proper operation. Please ensure that good standards are available prior performing a software upgrade. Contact the HF service dept. for more information on the software upgrade kit.

12.0 Accessories and Replacement Parts List

The items shown below are recommended accessories and replacement parts. Common parts, such as lamps, batteries, calibration kits and cuvettes should be kept on hand.

Accessory	Catalog Number	
	White Light	Infrared
Replacement Lamp Module	24362	21385
Replacement PCB Without Optics Assembly	24361	
Sample Cuvette – 3 pack	19856	
PRIME _{TIME} Calibration Kit, Full Range, .02, 10 & 1000 NTU	29845	
PRIME _{TIME} Calibration Standard 10 NTU	24381S	
Turbidity Free Water, 4 liters (1 gal.)	70908	
Formazin Stock Kit	50040	
Formazin Stock Solution, 4000 NTU, 500 ml	70914	
Rechargeable battery kit	19859	
Case Screw	26014	
Keypad	22655	
Photodiode	20850	

13.0 Technical and Customer Assistance

If assistance is needed regarding this instrument please do not hesitate to contact the HF scientific, inc. Technical Service Department to order parts contact Customer service:

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14.0 Warranty

HF scientific, inc., as vendor, warrants to the original purchaser of this instrument that it will be free of defects in material and workmanship, in normal use and service, for a period of one year from date of delivery to the original purchaser. HF scientific, inc.'s, obligation under this warranty is limited to replacing, at its factory, the instrument or any part thereof. Parts, which by their nature are normally required to be replaced periodically, consistent with normal maintenance, specifically reagent, desiccant, sensors, electrodes and fuses are excluded. Also excluded are accessories and supply type items.

Original purchaser is responsible for return of the instruments, or parts thereof, to HF scientific, inc.'s factory. This includes all freight charges incurred in shipping to and from HF scientific, inc.'s factory.

HF scientific, inc. is not responsible for damage to the instrument, or parts thereof, resulting from misuse, environmental corrosion, negligence or accident, or defects resulting from repairs, alterations or installation made by any person or company not authorized by HF scientific, inc.

HF scientific, inc. assumes no liability for consequential damage of any kind, and the original purchaser, by placement of any order for the instrument, or parts thereof, shall be deemed liable for any and all damages incurred by the use or misuse of the instruments, or parts thereof, by the purchaser, its employees, or others, following receipt thereof.

Carefully inspect this product for shipping damage, if damaged, immediately notify the shipping company and arrange an on-site inspection. HF scientific, inc. cannot be responsible for damage in shipment and cannot assist with claims without an on-site inspection of the damage.

This warranty is given expressly and in lieu of all other warranties, expressed or implied. Purchaser agrees that there is no warranty on merchantability and that there are no other warranties, expressed or implied. No agent is authorized to assume for HF scientific, inc. any liability except as set forth above.

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