OWNERS MANUAL

Micro TPI Field Portable Turbidimeter

HF scientific, inc.
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Manual Part No. 22666 (12/04)
Rev. 1.4

DECLARATION OF CONFORMITY

Application of Council Directive

Standard to which Conformity is Declared:

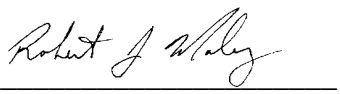
Product Safety - Tested and passed CE EN61010-1:1990 + A1:1992 (73/32 EEC)

Immunity and Emissions – Tested and passed EN61326:1997 + A1:1998

Manufacturer's Name:	HF scientific, inc.
Manufacturer's Address:	3170 Metro Parkway, Fort Myers, Florida 33916-7597
Type of Equipment:	Field Portable Turbidimeter
Model No:	MicroTPI

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standard

Place: Fort Myers, Florida USA



(Signature)

Robert J. Maley, President

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Specifications

Measurement Range	0.01 –1100 NTU/FTU
Accuracy	±2% of reading or 0.01 NTU (0-500 NTU) ±3% of reading (500-1100 NTU)
Resolution	0.01 NTU on low readings
Regulatory Compliance	Compliant to ISO 7027: Water Quality – Determination of Turbidity (Nephelometric Method)
Response Time	6 - 16 seconds
Display	7 Segment Liquid Crystal Display
Operating Temperature Range	0°C – 50°C (32°F – 122°F)
Sample Temperature Range	0°C – 50°C (32°F – 122°F)
Relative Humidity	0-90% Non Condensing
Power Supply	4 – AAA Batteries (life is approximately 1000 readings using standard alkaline batteries)
Certification	CE
Insulation Rating	Pollution Degree 2
Approximate Dimensions	Instrument: 7 cm x 16.5 cm x 4.8 cm (2 ¾" x 6 ½" x 1 7/8") Instrument in Minilab Case: 25 cm x 21.6 cm x 6.3 cm (10" x 8 1/2" x 2 1/2")
Enclosure Rating:	NEMA 4X Designed to meet the specifications of IP67
Shipping Weight:	1.22 kg (2.70 lbs)
Shipping Dimensions:	28 cm x 30.5 cm x 7.6 cm (11" x 12" x 3")
Warranty	1 Year from date of shipment

1.0 Overview

The MicroTPI (the instrument hereafter) allows you to measure turbidity in the field. This instrument was designed to meet the design criteria specified in ISO 7027 and DIN 27027 for the measurement of the turbidity of a sample.

1.1 Unpacking and Inspection of the Instrument and Accessories

The table below indicates the items that you should find in your turbidimeter shipment.

Item	Quantity
Field Portable Turbidimeter with 4 AAA batteries installed	1
Instruction Card	1
Instrument Carrying Case	1
PRIMELIME Calibration Set (0.02, 10.0 , 1000 NTU Standards)	1
Empty Cuvettes & Kimwipes®	2

Remove the instrument from the packing carton. Carefully inspect all items to ensure that no visible damage has occurred during shipment. If the items you received do not match your order, please immediately contact your local distributor or the HF scientific, inc. Customer Service department.

Warning: Extra care should be taken when unpacking, opening, and handling the calibration standards and sample cuvettes in the Accessory Kit; surface scratches or finger smudges on the cuvette surface may cause measurement errors. Handle these items by the cap of the cuvette only.

Note: The instrument is shipped with the batteries installed.

Figure 1 is a depiction of the top of the instrument. The three main components of the instrument are the sample well, the display, and the touch pad. The following sections will describe the functionality of the display and the touch pad. The proper use of the instrument and the sample well will be discussed in later sections.

Figure 1: Top view of the instrument.

1.2 The Display

All of the items that can appear on the display are shown in Figure 2. The display is used for reporting the turbidity levels and to provide user guidance in the customer setting routine. In addition, the display also has several other blocks that are used to communicate error messages and provide user guidance.

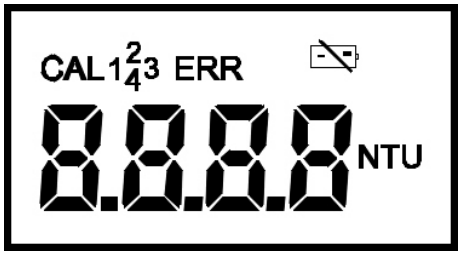


Figure 2 – Display used in the instrument.

1.3 The Instrument and Touch Pad

The touch pad has five buttons: **ON/OFF, CAL, ↵, ▲**, and **▼**. The **ON/OFF** button is used to turn the instrument on and off. The **CAL** button, when pressed, initiates the calibration mode of the instrument. The ↵ button, when pressed, indicates to the instrument that it should take a reading. The ▲ and ▼ buttons are used to change the calibration points.

2.0 Safety

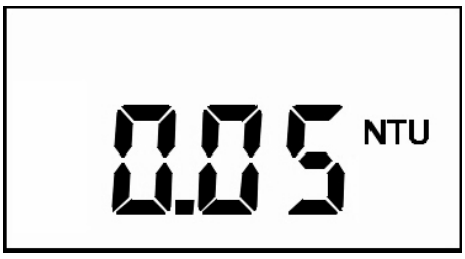
This manual contains basic instructions that you must follow during the operation, care and maintenance of the instrument. The safety protection provided by this equipment may be impaired if it is used in a manner not described in this manual. It is recommended that all operators should read this manual prior to working with this instrument.

In certain instances **NOTES**, or helpful hints, have been highlighted to give further clarification to the instructions. Refer to the *Table of Contents* to easily find specific topics and to learn about unfamiliar terms.

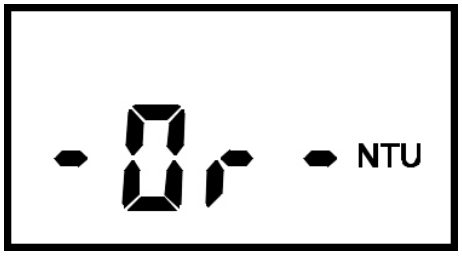
3.0 Normal Operation

This instrument allows you to measure the turbidity of a grab sample. The turbidity is reported in **N**ephelometric **T**urbidity **U**nits (NTU). Readings above 1100 NTU are outside the range of this instrument.

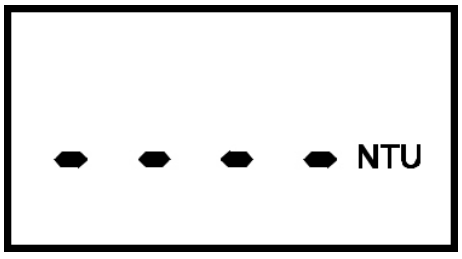
During normal operation, the instrument will have the last valid turbidity reading indicated on the display (see illustration below).



If the sample that you are measuring has a turbidity that is higher than that which the instrument can measure, the instrument will indicate this as an over-range condition:



In certain instances, during normal operation, the instrument will briefly display a row of dashes across the display



This indicates that either the instrument is performing an auto-ranging function, or the sample has a substantial amount of bubbles. If the dashes remain for an extended period of time please ensure that the sample does not have a large amount of bubbles present; if there are not bubbles present, please contact the Technical Services Department for further assistance and guidance (refer to section 5.3).

3.1 Routine Measurement

The instrument measures and reports the turbidity of a sample in nephelometric turbidity units (NTU's).

Note: Nephelometric turbidity units (NTU's) are numerically equivalent to Formazin turbidity units (FTU's) (See Glossary).

Turn on the instrument by pressing the ON/OFF button continuously for 1 second. Allow 75-second warm-up period while preparing for the turbidity measurement as described in the following steps:

1. Sample approximately 100 ml of your process, as you would normally do for turbidity measurement.
2. Obtain a clean and dry sample cuvette.
3. Rinse the cuvette with approximately 10 ml of the sample water (2/3 of cuvette volume), capping the cuvette with the black light shield (cuvette top) and inverting several times. Discard the used sample and repeat the rinsing procedure two more times.
4. Completely fill the rinsed cuvette (from step 3) with the remaining portion (approximately 15 ml) of the grab sample and then cap the cuvette with the supplied cap. Ensure that the outside of the cuvette is dry, clean and free from smudges[1]
5. Place the cuvette into the instrument and press it down until it snaps fully into the sample well. Index the cuvette by pressing and holding down the ↵ button while rotating the cuvette to identify the lowest reading (the displayed turbidity is continuously updated on the display). Once the cuvette is indexed, release the ↵ button to display the measured turbidity (see Glossary for more information on indexing a cuvette).
6. Repeat steps 1 through 5 for all of your samples.

Warning: *NEVER* pour liquid directly into the sample well of the instrument always use a cuvette. The instrument will only accurately measure the turbidity of a sample when cuvettes sealed with the black cap are used. The black cap serves as both seal and a light shield.

Note: The instrument will turn off after approximately 5 minutes if no buttons are pressed.

[1] Any typical glass cleaner can be used along with a lint free cloth, or tissue (Kimwipes®), to clean the outside of the cuvette.

4.0 Instrument Calibration

The instrument was calibrated and tested prior to leaving the factory. Therefore, it is possible to use the instrument directly out of the box. However, re-calibration of the instrument is recommended to help you become familiar with the operation of the instrument and the calibration procedures. In addition, re-calibration is recommended at least once every three months.

The instrument requires four (4) standards to be fully calibrated.

During calibration, the instrument performs several system self-diagnostics. As such, several warning messages may be displayed. If the instrument detects an irregularity (detectors or lamp) a warning message will be displayed upon exiting the calibration mode. If this occurs please attempt to rectify the problem yourself, or contact the authorized technical services department (see section 5.2). In any event, the instrument will continue to read the turbidity with a decreased accuracy until the error is rectified.

4.1 Calibration Standards

We recommend that you use the following materials[2] during calibration to achieve the accuracy stated in this manual:

1. **CAL 1**: 1000 NTU PRIMELIME Calibration Standard available from HF scientific inc. [3]
2. **CAL 2**: 100 NTU PRIMELIME Calibration Standard available from HF scientific inc. [3]
3. **CAL 3**: 10.0 NTU PRIMELIME Calibration Standard available from HF scientific inc. [3]
4. **CAL 4**: 0.02 NTU PRIMELIME Calibration Standard available from HF scientific inc. [3]

It is well known that diluted Formazin is unstable. If you choose to use Formazin to calibrate the instrument, ensure that you are using a fresh stock suspension of Formazin to achieve the accuracy quoted for the instrument. A Formazin Stock Solution Kit is available. PRIMELIME calibration standards are more stable than Formazin and have a limited shelf life of 1 year. If you use the PRIMELIME calibration standards to calibrate the instrument, review the expiration date to ensure that the standards have not expired. PRIMELIME calibration standards are a US EPA approved alternative standard to Formazin.

4.2 Indexing the Calibration Standards

The United States Environmental Protection Agency (US EPA) recommends that cuvettes used for instrument calibration or sample measurement be indexed. To comply with this recommendation, each calibration standard is supplied with an indexing ring and each instrument has a reference point for quick and repeatable indexing of the calibration standard. To index a calibration standard perform the following steps:

1. While holding down the ↵ button, slowly rotate the calibration standard one complete revolution (360°) pausing between increments to allow the display to update.

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[2] User prepared formazin may be used as an alternative to sealed calibration standards for calibration of this instrument.

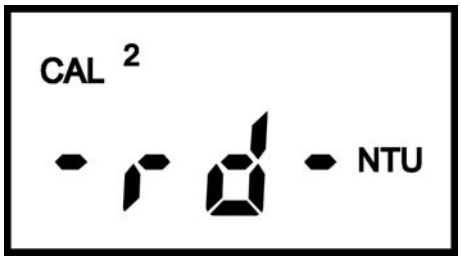
[3] See section 7.0 for Accessories & Replacement Parts List.

2. While rotating the standard, observe the turbidity reading and locate the cuvette position with the lowest turbidity reading.
3. With the calibration standard positioned at the location having the lowest turbidity reading, install the Indexing Ring over the black light shield on the standard so that the pointer of the Ring aligns with the reference arrow on the instrument.

4.3 Calibration Procedures

1. Select the calibration function of the instrument by pressing the **CAL** button once. The "**CAL"** block will be illuminated on the display with "**1**" indicating the standard required for this step of the calibration. This is the first standard that should be used in a full calibration.

2. Insert the 1000 NTU standard (**CAL 1** in the figure above) into the sample well and press down until the cuvette snaps fully into the instrument. Align the indexing ring with the arrow on the instrument (see section 4.2 if you have not already indexed the Standard).
3. Wait for the reading to stabilize. Once the reading has stabilized press the ↵ button to indicate to the instrument that it should calibrate on this point. You will see something similar to the display shown below.



4. When the instrument has completed calibration on this point, it prompts you to insert the next calibration standard into the sample well (**CAL 2**).

5. Repeat steps 2-4 for each calibration standard. When you calibrate on **CAL 4** (turbidity free water), the instrument will automatically exit out of calibration returning back to the normal operating mode.

Notes :

1. During calibration, the screen actively displays the current turbidity value. After the CAL value changes, it is common for the display to not report the exact turbidity of the standard as it either is expecting a new standard or has not yet calibrated the new standard.

2. If you wish to exit the calibration mode you may do so at the end of any step by pressing the CAL button. The instrument will accept only the values calibrated prior to exiting.

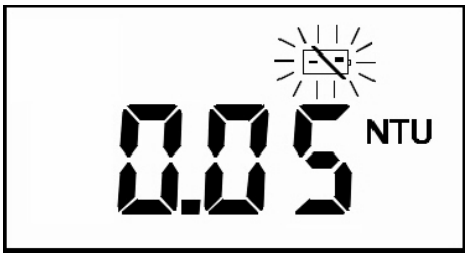
5.0 Troubleshooting

The instrument routinely performs self-diagnostics, and will automatically generate messages to provide you with specific diagnostic information.

5.1 System Warning Messages

Automatic warning messages are generated to provide you with specific diagnostic information about the instrument. These messages are for your use and do not indicate a reduction in the performance of the instrument or a failure of any component in the instrument.

Flashing Battery Symbol: A flashing battery on the display indicates that the batteries need to be replaced. Under this condition, you should replace the batteries as soon as possible to ensure that the instrument will continue to function properly. If the batteries get too low to accurately measure, the instrument will turn off. The instrument might not turn back on until the batteries have been replaced. See section 6.2 for more information



5.2 System Error Messages

Normally, the cause of an error message is external to the instrument. If an error is identified the instrument will flash the error block (ERR) along with the error number.

The following table lists the error messages and their associated meanings:

Error	ASSOCIATED MEANING	TYPICAL CAUSE
1	Lamp failure	Lamp has too low an output for proper turbidity measurement.
2	General Calibration failure: There is not sufficient signal between the 0.02 NTU and 10.0 NTU standards used for calibration	Either the wrong standards were used in calibration or there is an internal sensor failure.
3	General Calibration failure: There is not sufficient signal between the 10.0 NTU and 100.0 NTU standards used for calibration	Either the wrong standards were used in calibration or there is an internal sensor failure.
4	General Calibration failure: There is not sufficient signal between the 100.0 NTU and 1000.0 NTU standards used for calibration	Either the wrong standards were used in calibration or there is an internal sensor failure.
Err	Multiple error conditions are met	

5.3 Technical and Customer Assistance

If you need assistance regarding this instrument please contact the HF scientific, inc. Technical Service Department.

HF scientific, inc.
3170 Metro Parkway
Fort Myers, Florida 33916-7597
Phone: (239) 337-2116
Fax: (239) 332-7643
Email: info@hfscientific.com

6.0 Routine Maintenance

If you do not plan on leaving the instrument in the supplied carrying case, when not in use, ensure that the instrument has been turned off and that a clean sample cuvette fitted with a black cap has been placed in the sample well. This will ensure that a minimal amount of dust and/or debris will be able to settle on the optics of the instrument.

6.1 Cuvette Cleaning and Care

Proper measurement of the turbidity of a sample requires the use of a cuvette that is free of marks, smudges, scratches and any bacterial growth. Cleaning the cuvette is accomplished by washing the interior and exterior of the cuvette in a detergent solution. Once cleaned, the cuvette should be rinsed thoroughly 8 to 10 times with clean distilled water to eliminate the possibility of detergent buildup and streaking. Cleaned and dried cuvettes should be stored with the black caps on. The cuvettes can be stored in a cuvette rack (see accessories and replacement parts list). During normal operation you may use any typical glass cleaner along with a lint free cloth or tissue (Kimwipes®), to clean the outside of the cuvettes.

Condensation may appear on the cuvette when your sample is very cold and the relative humidity is high. When this happens, the turbidity that you read may be higher than the actual turbidity due to the light scattered by the condensate on the cuvette. If you find yourself in this circumstance you can alleviate the problem by either coating the cuvette with an anti-fogging agent, or by running warm water over the cuvette for a short period of time to warm the sample prior to measurement.

6.2 Battery Replacement

The instrument will periodically require new batteries to function properly. This will be indicated with a flashing battery indicator on the display. To replace the batteries:

1. Turn the instrument off and place it upside down on a soft surface.
2. Remove the two screws (A) securing the battery cover (B). Lift cover off.
3. Remove the old batteries. Place four new AAA batteries (C) into the battery compartment (ensuring the correct polarity).
4. Replace the battery cover and fasten the two screws carefully to ensure a watertight seal.
5. Dispose of used batteries in accordance with all federal, state and local regulations.

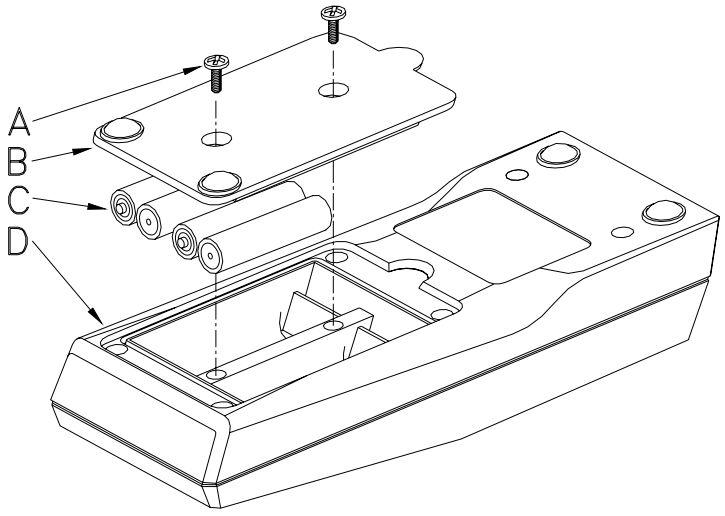


Figure 3: Detailed view of the battery compartment

7.0 Accessories and Replacement Parts List

The items shown below are recommended accessories and replacement parts for the instrument.

Accessory	Catalog Number
PRIME Calibration Set for normal operation (includes 0.02 NTU, 10.0 NTU, 100.0 NTU and 1000 NTU Standards).	29855
Turbidity Free Water, 4 Liters (1gal.)	70908
Formazin Stock Solution, 4000 NTU, 500 mL	70914
Operators Manual	22666
Formazin Stock Solution Kit	50040
Sample Cuvettes – 3 pack	19856
Rechargeable Battery Kit	19859

To order any accessory or replacement part, please contact the HF scientific, inc. Customer Service Department. See section 5.3 for contact information.

8.0 Warranty

The manufacturer 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. The manufacturer'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 lamps including fluorescent backlight, 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 the manufacturer's factory. This includes all freight charges incurred in shipping to and from the manufacturer's factory.

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

The manufacturer 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. The manufacturer 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 the manufacturer any liability except as set forth above.

8.1 Waterproof Seal

Opening the main instrument enclosure (excluding the battery compartment) may void the warranty.

Glossary

Formazin Nephelometric Units (FNU): *see Nephelometric Turbidity Units*

Formazin Turbidity Units (FTU): *see Nephelometric Turbidity Units*

Indexing a Cuvette: The United States Environmental Protection Agency (US EPA) recommends that cuvettes used for turbidimeter calibration or sample measurement be indexed. To index a cuvette with a sample in it, slowly rotate the cuvette throughout one complete revolution (360°). While rotating the sample cuvette, observe the display and locate the position that the cuvette is in which provides the lowest turbidity reading. This position is the indexed position of the cuvette. Refer to section 4.2 of this manual to learn how to index a cuvette in this instrument.

Nephelometric Turbidity Units (NTU): Unit of measure used when relating the light scattered by a liquid media to the light scattered by a known concentration of Formazin Polymer. This unit of measure is recognized as a measure of the optical clarity of an aqueous sample. NTU is the accepted unit of measurement for turbidity.

Turbidity: 1) A measure of the attenuation of a radiant flux as it passes through a liquid media. 2) Optical clarity of a liquid, 3) A phenomena caused by the presence of undissolved matter in a liquid media.