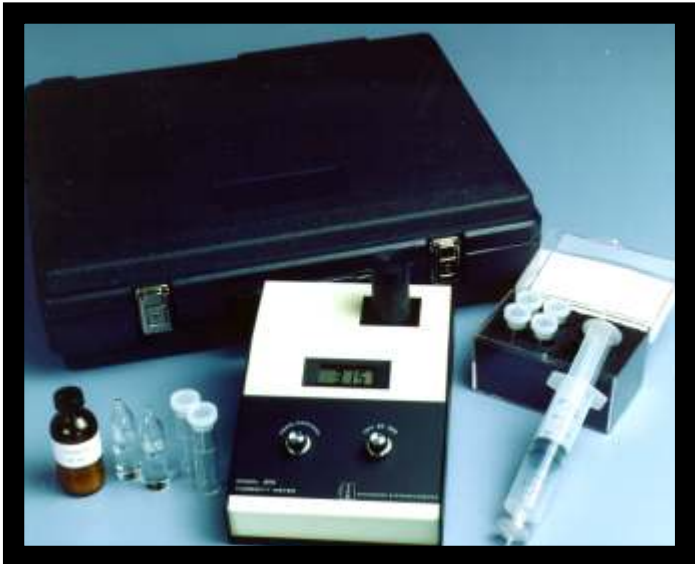


Engineered Systems & Designs

TURBIDITY METER

Operator's Manual for Model 800 Turbidimeter



Model 800 with Optional
Battery Pack and Carrying Case

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Specifications for Turbidimeters Models 800 and 800-P

Meter:

Range: 0-19.99 and 0-199.9 NTU

Accuracy: +/- 2% or 0.05 NTU

Display: 0.5" LCD

Photometric Data:

Photodetector: 2 photo voltaic cells, centered at 90 degrees to the incident light path, spectral peak response between 400 and 600 nm.

Lamp: Tungsten, lens-end 3.5 volt, operating at a color temperature of 2230 degrees K. Distance traversed by incident light and scattered light within the sample tube is 2.5 cm.

Control Panel:

Range Selector: 3 Positions: OFF/0-20 NTU/0-200 NTU

Zero Control: For calibration to 0 NTU

Power Requirements:

Line Operated: 120 volts, 50/60 Hz

Battery: 12-volt sealed battery with battery pack

Meter Housing:

Material: Aluminum

Dimensions: 9.25L x 6.66W x 3.20 H"

Weight: 3 lbs, Model 800; 9 lbs, Model 800-P

Introduction

Models 800 and 800-P meet EPA specifications for measurement of turbidity in drinking water. Their drift-free, accurate readings make these instruments suitable for testing municipal water, food and beverage processing, and any aqueous solutions in which control of clarity is critical.

Models 800 and 800-P are true nephelometers, measuring the amount of light scattered at a right angle from a beam of light passing through the test sample. Test results are read directly in NTUs on a LCD digital readout. The turbidimeters are pre-calibrated and a simple "zero adjustment" is the only steps required prior to testing.

Cover the sample vial and chamber when a reading is taken. To prevent dust accumulation, leave the light shield in place on the instrument when it is not in use. Do not store sample vials in the chamber.

A function control switch turns the instrument ON and also serves as the range selector for the two ranges: 0-20

and 0-200 NTU. These meters are designed to remain on permanently. However, during long periods of non-use, it is recommended the units be switched off to prolong lamp life. If switched off, they will require approximately 30 minutes for warm-up.

Handle the sample vials with extreme care. Discard any vials with scratches. It is important that the vial, especially the bottom, be wiped clean with lint-free tissues before inserting into the reading chamber. To avoid smudges, handle all vials by the top of the vial only. The vials measure 20 X 70 mm.

On the side of each sample vial is a vertical white index line. Make sure this index line faces the exact same position every time you insert the sample vial into the test chamber. If the index line is not in the same position, the reading on the meter will change; not because of the change in the test solution, but because of the varying optical characteristics of the sample vial. You can verify this glassware effect by rotating the sample vial in the test chamber. You will notice the meter readings change.

Caps for the sample vials are provided. These caps should be placed on the sample vials before the vials are put into the reading chamber to prevent any accidental spilling of the contents into the chamber. The chamber should be kept dry and clean at all times to insure accurate readings.

Turbidity samples and standards should be thoroughly mixed before inserting either into the reading chamber. All bubbles should be removed, either by allowing the vial to stand for a few minutes or by gently tapping and swirling the contents.

Particulate matter, such as dust or lint in the sample, will cause considerable fluctuation in the meter's readings as the particles come into the path of the light beam. In most cases, the meter's readings will waver between a steady reading and a higher reading. The reading will eventually fluctuate back down to a lower reading as the particles settle. When this type of reading is evident, it is best to remove the light shield and examine the sample.

Preparation of Turbidity-Free Water Reference Standards

The filter holder and syringe must be conditioned, by forcing at least two syringe loads of deionized water through the filtering mechanism to remove foreign matter from the filtering apparatus. The first and second rinses are discarded.

Turbidity-free water, as prepared below, may be stored in the dark, at room temperature, in a clear glass bottle with a screw cap, or in a turbidity vial and used as required.

The storage vessels should be rinsed thoroughly with filtered-deionized water. Periodically inspect the water for foreign matter in a bright light.

Procedures for Making Triple Filtered Distilled Water

1. Remove the plunger from the syringe and attach the filter holder to the bottom of the syringe.
2. Pour approximately 50 ml of deionized water into the barrel of the syringe, replace the plunger into barrel and exert pressure on the plunger to slowly force the water through the filter. Collect the water in a suitably clean container.
3. Remove filter holder from syringe then remove plunger from barrel of the syringe. This procedure is required to prevent rupturing the membrane filter by the vacuum created as the plunger is removed from the barrel.
4. Replace filter holder and repeat Steps 3 and 4 until the desired amount of turbidity-free water is collected. Periodically examine the membrane filter to insure no holes or cracks are evident.
5. Repeat Steps 1 through 4 using the 1X filtered water obtained in Step 4. This will give you 2X filter water.
6. Repeat Steps 1 through 4 using the 2X filtered water of Step 5. This will give you 3X or triple-filtered water.
7. Depending up on the nature of the unfiltered water, it is possible to prepare a liter or more of turbidity-free water using a single filter. The membrane filter may be stored in the holder for an indefinite period of time and used as required.

Preparation of Amco Clear Standards

Calibration of the Models 800 and 800-P are based upon Amco Clear, a suspension which is more reproducible in its light-scattering properties than any other suspension.

These meters have been calibrated to Amco Clear solutions by the factory and the calibration should not change with time. However, should the instruments indicate a need for calibration, it may be accomplished in the laboratory by using carefully prepared Amco Clear solution as noted:

The standard Amco Clear solution has a value of 400 NTU. This solution is used as the stock solution and is stable for one year. Dilutions of the stock solution are made with turbidity-free water as prepared in the instructions following.

A working standard is prepared by pipetting exactly X mL of the stock solution into a clean, volumetric flask and diluting to 100 mL. The working standard has an NTU value of X NTU and is stable for one year. See table below.

The following table gives the relationship between dilutions of the 400 NTU solution and the resulting values as NTU. When diluting the suspension, use only turbidity-free, triple-filtered, deionized water.

NTU	mL of 400 NTU Solution (diluted to 100 mL with turbidity-free water)	
	Stock mL	DI Water mL
400		
200	50.0	50.0
50	12.5	87.5
20	5.0	95.0
10	2.5	97.5
1	0.25	99.75

Dilution of Sample

If the sample has a turbidity reading greater than 200 NTUs, it is necessary to dilute the sample with turbidity-free, deionized water to bring the reading within range of the instrument. Turbidity-free, deionized water may be prepared as described above. The following calculation is required if the sample is diluted.

$$\frac{A \times (B+C)}{C} = D$$

Where A = NTU found in diluted sample
 B = Volume of deionized water used, mL
 C = Sample volume taken for dilution, mL
 D = NTU of original, undiluted sample

For example, if 10 mL of sample water is diluted with 90 mL of turbidity-free water to a total volume of 100 mL and the resulting solution measures 40 NTU, the turbidity of the original undiluted sample is:

$$\frac{40 (90 + 10)}{10} = 400 \text{ NTU}$$

General Operating Instructions

1. First, attach the AC wall adapter's 3.5 mm plug into the instrument's jack located on the rear panel of the instrument. The AC wall adapter converts 120 volts AC to 12 volts DC, 500 milliamps. Allow Model 800 or 800-P to warm-up for 30 minutes.
 2. Insert a sample vial (20x70mm) containing a turbidity-free zero (0) reference of either triple filtered water or a 0 NTU primary standard into the chamber and replace the light shield. Ensure cap is on vial. Permanently sealed secondary standards of 0 NTU and 10 NTU values are available for purchase from the manufacturer. Please refer to the replacement parts section on the last page.
 3. Rotate the range switch to the "20" position, and with the zero adjustment knob adjust meter to read "0.0". For multiple samples, it is not necessary to reset the zero for each sample.
 4. Remove the zero standard from the chamber and insert the test sample. Ensure cap is on the vial.
 5. Replace light shield.
 6. Rotate switch until appropriate range is selected for reading the sample. If the meter shows a 1____, it is over-ranged. Change the range switch to the 200 range. If the reading is greater than 200 NTU, dilute the sample by 1/2 to obtain reading and multiple results by 2, or see page 2 for dilution instructions.
 7. Remove sample from chamber and replace light shield. Samples should never be allowed to remain in the chamber for extended periods of time.
- 1B. Set the panel "Zero Control" knob at mid-range, so the arrow on the knob points at the letter "o" on the word "Control". Locate the coarse zero potentiometer. It can be found on the right side of the instrument and is marked "0". With a small screwdriver, set the coarse zero pot so that the meter reads as closely to zero (o) as possible. An exact zero can now be set with the "Zero Control" knob.
 2. Insert a 10 NTU primary standard solution into the chamber and cover. Set the range switch to "20". If the meter does not read 10.00, adjust the potentiometer marked "20", found on the right side of the instrument, with a screwdriver until the meter reads 10.00. The digit "1" will appear in the display when the instrument is over-range, that is over 19.99.
 3. With the 10 NTU primary standard solution in the chamber and covered, set the range switch to "200". If the meter does not read 10.00, adjust the potentiometer marked "200", found on the right side of the instrument, with a screwdriver until the meter reads 10.00. The digit, "1____" will appear in the display when the instrument is over-range, that is over 199.9.
 4. Repeat Steps 1-4 if necessary. The instrument is now calibrated in both ranges.

Calibration Procedure Using Primary Standardized Solutions

Although each instrument is pre-calibrated before it leaves the factory, it may be necessary to check the calibration to determine if the instrument is responding according to the specifications. The instrument should be allowed to warm-up for 30 minutes. Please read the instructions thoroughly before starting.

Procedure:

- 1A. Insert a sample vial with turbidity-free, triple filtered, deionized water standard in the chamber and cover. Set the range switch to "20" NTU. Set the "Zero Control" potentiometer on the instrument panel so that the meter reads "0.0". If the meter cannot be made to read zero (0), then go to Step 1B; if the meter does read zero, then go to Step 2.
- 1B. Set the panel "Zero Control" knob at mid-range, so the arrow on the knob points at the letter "o" on the word "Control". Locate the coarse zero potentiometer. It can be found on the right side of the instrument and is marked "0". With a small screwdriver, set the coarse zero pot so that the meter reads as closely to zero (o) as possible. An exact zero can now be set with the "Zero Control" knob.
2. Insert a 10 NTU primary standard solution into the chamber and cover. Set the range switch to "20". If the meter does not read 10.00, adjust the potentiometer marked "20", found on the right side of the instrument, with a screwdriver until the meter reads 10.00. The digit "1" will appear in the display when the instrument is over-range, that is over 19.99.
3. With the 10 NTU primary standard solution in the chamber and covered, set the range switch to "200". If the meter does not read 10.00, adjust the potentiometer marked "200", found on the right side of the instrument, with a screwdriver until the meter reads 10.00. The digit, "1____" will appear in the display when the instrument is over-range, that is over 199.9.
4. Repeat Steps 1-4 if necessary. The instrument is now calibrated in both ranges.

Secondary Standards

Secondary standards are an easy way to calibrate your instrument on a daily basis. The secondary standards are sealed and permanent. The secondary standards need to be calibrated when first used and then every six months thereafter. Once the values of the sealed secondary standards have been determined, you use these values for six months. After six months, you must perform a primary calibration on the instrument using primary standards and then re-establish the secondary standard's value for the next six months.

Procedure:

1. Calibrate the instrument using primary standards.
2. Do Not make any changes to the instrument.
3. Insert the 0 NTU secondary standard. It will not read "0.00". The value will be close to zero but most likely it will not read zero. For example, the 0 NTU could read as -0.1 or +0.2 NTU. WRITE DOWN the displayed value of the 0 NTU. This value will be what you calibrate the meter to for the next six months using the 0 NTU sealed secondary standard.
4. Insert the 10 NTU secondary standard. It will not read "10.00". The value will be close to ten but most likely it will not read ten. For example, the 10 NTU could read as 9.8 or 10.2 NTU. WRITE DOWN the displayed value of the 10 NTU. This value will be what you calibrate the meter to for the next six months using the 10 NTU sealed secondary standard.

Model 800-P Battery Operation

CAUTION - CAUTION - CAUTION - CAUTION

The enclosed battery pack stores a large amount of energy.

Do not allow anything to short out the battery's plug.

Treat this battery with the same respect and caution given to a car battery. Failure to do so may result in damage or injury to you or the instrument.

Model 800-P turbidity meter has a battery pack. The battery pack is a sealed, gel-filled, 12-volt DC, 1.9 amp hour battery. The battery is permanently mounted in a luggage-type carrying case and is connected to the turbidity meter via a six-inch long double-ended plug. Either model can be used in the laboratory with the AC wall adapter supplied with the meter or in the field with the battery pack.

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Battery Pack Operation:

To use the battery pack, insert the double-ended plug between the battery jack and the 3.5 mm AC adapter jack found on the back of the meter. A fully-charged battery should provide 90 minutes of continuous operation or approximately 180 random samples. To conserve battery power, we recommend the meter be turned on for a test and then turned off immediately afterwards.

Charging the Battery:

To charge the battery, take the plug of the AC wall adapter and insert it into the battery jack. It will take 24 hours to fully charge the battery. The battery is fully charged at the factory before shipping.

Maintenance

Replacing Light Bulb:

Unplug instrument from receptacle. Remove the four screws from the bottom of the turbidity meter and one on the left and right side. Lift the instrument housing from the base. The top part of the instrument housing contains the light box from which the bulb and lead wires can be removed. Unscrew (counter-clockwise) the black barrel which holds the lamp.

Carefully disconnect the wire leads going to the lamp from the printed circuit board by unscrewing the wire nuts. Attach the new bulb leads using the wire nuts, and place the bulb back into position in the light box. Place the instrument housing over the base and replace the six screws.

Plug the instrument into a receptacle. The optical characteristics of each bulb are carefully controlled, but to insure accurate results it may be necessary to calibrate the instrument according to the instructions on page 3.

Cleaning the Light Box:

Periodically clean the light box chamber with a lint-free cloth or tissue to remove foreign matter which may

interfere with turbidity readings. If any solution is spilled into the chamber, remove the spilled fluid immediately with an absorbent towel. Wipe clean with a lint-free cloth or tissue.

Replacement Parts

The following is a list of replacement parts available for Models 800 and 800-P:

01-TUR-CAP	Turbidity cap (light shield)
01-TUR-FILTER	Filter, 0.2 micron disposable
01-TUR-400NTU	400 NTU primary Amco standard
01-TUR-SYRINGE.....	50cc syringe
01-TUR-VIAL	20x70 mm, flat bottom, with cap
01-TUR-0NTU	0 NTU secondary sealed Amco standard
01-TUR-10NTU	10 NTU secondary sealed Amco standard
01-LMP-L1006	Lamp, 3.5 volt
01-ADAPTER-500 MA	AC Adapter 12 volts DC 500 ma
01-TUR-BATT	Rechargeable battery pack with carrying case and secondary standards : 0 & 10 NTU

Service

In the event you need factory service, please call for a Return Goods Authorization number. Included with the returned items should be information concerning its serial number, specific reason for return, name of a contact person, telephone number and return address (no P. O. Box numbers). Returns should be made to the following address:

Engineered Systems & Designs, Inc.

119 A Sandy Drive
Newark, DE 19713-1148 U.S.A.
phone: 302-456-0446
fax: 302-456-0441
email: esd@esdinc.com
web: www.esdinc.com

Any instrument received for repair, with serial numbers indicating manufacture and sale outside the stated warranty periods, will be repaired at cost or returned "as is".

Any instrument requiring repair, within the warranty period, must be returned to Engineered Systems & Designs for appropriate inspection and necessary repair. Out-of-warranty repairs and non-warranty repairs will be invoiced based on cost of parts and labor.

All products being returned shall be repaired at reasonable cost or replaced at the discretion of Engineered Systems & Designs and will not, under any terms, be accepted for credit. Allow a 5-7 day window for repairs.

Our policy is to return warranty repairs via UPS Ground. If you need the instrument in a rush, you will have to agree to pay for the freight service you choose.

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