PCE-TUM 50 Turbidity Meter

Instruction Manual

Introduction

Thank you for selecting the PCE-TUM 50 benchtop turbidity meter. This meter operates on the nephelometric principle of turbidity measurement and is designed to meet the criteria specified in ISO 7027. This manual provides a step-by-step guide to help you operate the meter, please carefully read the following instructions before use.

Unpacking

Before unpacking, ensure that the current work environment meet following conditions.

- Relative humidity is less than 80 %.

- Ambient temperature is greater than 0°C and less than 60°C.

- No potential electromagnetic and ambient light interference.

The following list describes the standard components of the meter. After the unpacking, please check all components are complete. If any are damaged or missing, please contact nearest distributor.

1 x Turbidity meter PCE-TUM 50
1 x Cuvette with lid
4 x Calibration cuvettes turbidity
1 x AC Power adapter
1 x Cleaning cloth
1 x User manual

Keypad

The PCE-TUM 50 turbidity meter is designed with a 6 key, names and symbols describe each function key controls.

KEY	FUNCTION
⏻ ESC	• Switches the meter ON/OFF. • Exits the calibration or setting and returns to measurement.
📄 CAL	• Starts calibration. • Enters the setup menu (Press and hold the key for 3 seconds).
◄ MI	• Stores current reading to memory. • Increase value or scroll up through the menu item.
► MR	• Views the stored data. • Decrease value or scroll down through the menu item.
ENTER	• Confirms the calibration, settings or displayed options.
🔒 MEAS	• Starts measurement. • Locks the measured value.

Connecting the Power Adapter

• Before plugging in the power adapter, ensure that its voltage matches the local main voltage.

• Insert the connector of power adapter into the power socket on the rear panel of the meter. The meter is now ready for use.

Switching the Meter On and Off

• Press the ⏻ key to switch on the meter, the display shows the measured value.

• Press and hold the ⏻ key for 3 seconds, the meter will switch off.
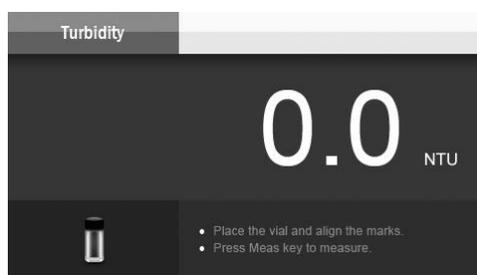
Prior to Use

Switch on the meter and allow the meter to warm up for at least 15 minutes.

Setup Menu

The PCE-TUM 50 turbidity meter contains an integrated setup menu that is used to customize the displayed option to meet measurement requirements.

The following table describes the functions of the menu items.
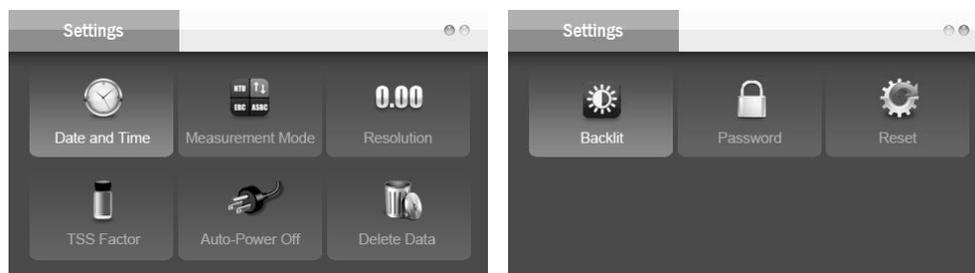
| MENU	OPTIONS	DESCRIPTION	DEFAULT
Date and Time	Year-month-day, hour-minutes	Set the current date and time.	---
Measurement Mode	NTU	Nephelometric Turbidity Unit	NTU
	FNU	Formazin Nephelometric Unit	
	EBC	Turbidity scale of the European Brewery Commission	
	ASBC	Turbidity scale of the American Society of Brewing Chemists	
	mg/L	Total Suspended Solids Unit	
Resolution	0.1	Set the resolution of the turbidity measurement.	0.1
	0.01		
TSS Factor	---	Set the conversion factor for measurement of the Total Suspended Solids.	0.13
Auto Power-Off	2 hours	When the option is enabled, the meter will automatically turn off if no key is pressed within 2 hours.	Disable
	Disable		
Delete Data	Delete all stored data	Delete all stored readings in the memory.	Cancel
	Cancel		
Backlit	---	Set the brightness level of the backlight.	---
Password	Enable	Set the password protection for calibration and settings.	Disable
	Disable		
Reset	Enable	Reset the meter to factory default settings.	Disable
	Disable		

Setting the date and time

1.1   Press and hold the 🗒 key for 3 seconds to enter the setup menu, press the **Enter** key to confirm.

1.2   Press the ◄ or ► key to set the year, press the **Enter** key to move the cursor to "Month".

1.3   Repert the steps above to set the year, month, day, hour and minutes until the meter returns to the measurement mode. Setting is completed.
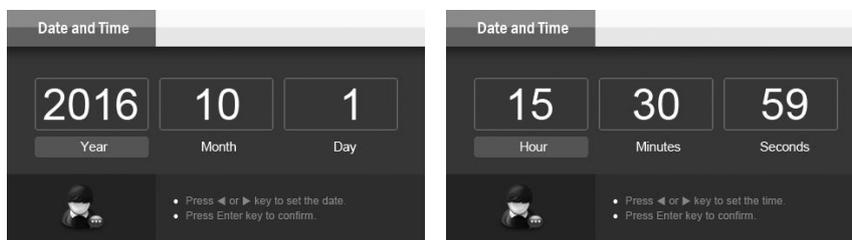
Setting the measurement mode and unit

The PCE-TUM 50 turbidity meter is capable of selecting the 4 turbidity units, including the NTU, FNU, EBC and ASBC. If the Total Suspended Solids mode is selected, the measurement unit will switch to mg/L.

2.1   Press and hold the 🗒 key for 3 seconds to enter the setup menu.

2.2   Press the ◄ or ► key to select the "Measurement Mode", press the **Enter** key to confirm.

2.3   Press the ◄ or ► key to select the measurement unit, press the **Enter** key, the meter enters to the selected measurement mode.

Resolution

The meter provides two resolution options. For the high-accuracy measurements, 0.01 is recommended. The default option is 0.1.
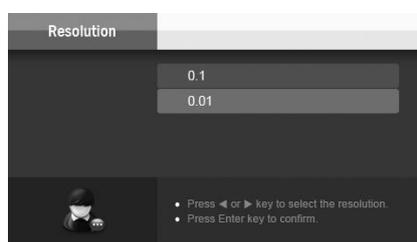
3.1   Press and hold the 🗒 key for 3 seconds to enter the setup menu.

3.2   Press the ◄ or ► key to select the "Resolution", press the **Enter** key to confirm.

3.3   Press the ◄ or ► key to select the desired resolution, press the **Enter** key to return to the measurement mode.

TSS factor

Please refer to page 10 "Total Suspended Solids Measurement".

Auto-power off

The PCE-TUM 50 turbidity meter provides an Auto-Power Off function that can be set to 2 hours or Disable. When the option is enabled, if you do not press any key within the specified time period, the meter will automatically turn off.
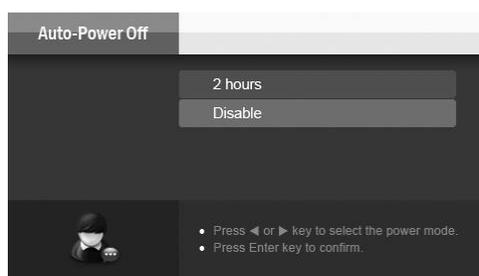
4.1   Press and hold the 🗎 key for 3 seconds to enter the setup menu.

4.2   Press the ◄ or ► key to select the "Auto-Power Off", press the **Enter** key to confirm.

4.3   Press the ◄ or ► key to select the "2 hours" or "Disable", press the **Enter** key to return to the measurement mode.

Clear the stored data

Please refer to page 13 "Clearing the Memory".

Password

The password protection is used to prevent the unauthorized calibration and settings. If enabled, the user must enter the 4-digit password to access the

calibration or setup menu.

5.1   Press and hold the 🗎 key for 3 seconds to enter the setup menu.

5.2   Press the ◄ or ► key to select the "Password", press the **Enter** key to confirm.

5.3   Press the ◄ or ► key to select the "Enable", press the **Enter** key, the display shows 4 digits and the cursor appears below the first digit.

5.4   Press the ◄ or ► key to set the password, press the **Enter** key to confirm and move to the next digit.

5.5   Repeat the steps above until the meter returns to the measurement mode. Setting is completed.
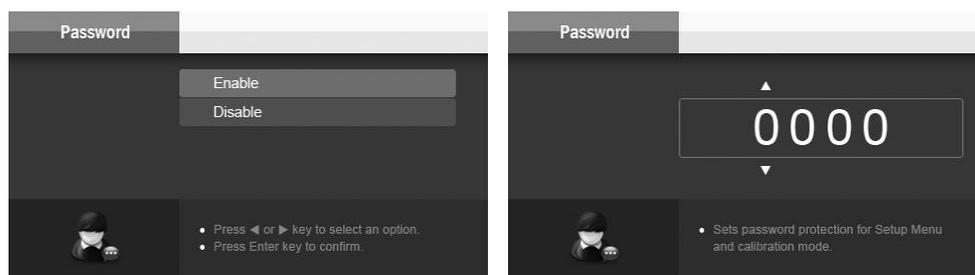
Unlock or reset the password

6.1   Press and hold the 📄 key for 3 seconds, the meter shows the "Password Protection" and waits for entering the correct digits.

6.2   Press the ◄ or ► key to enter the password, press the **Enter** key to confirm. Once you have successfully entered the setup menu, selecting the "Password" option and "Disable". The password will be removed.
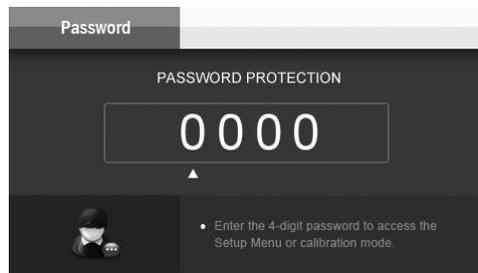
Restore factory settings

The Factory Reset is used to restore the meter back to factory default settings. If enabled, all of the calibration data and selected options/parameters will be lost or reset, the meter must be recalibrated.
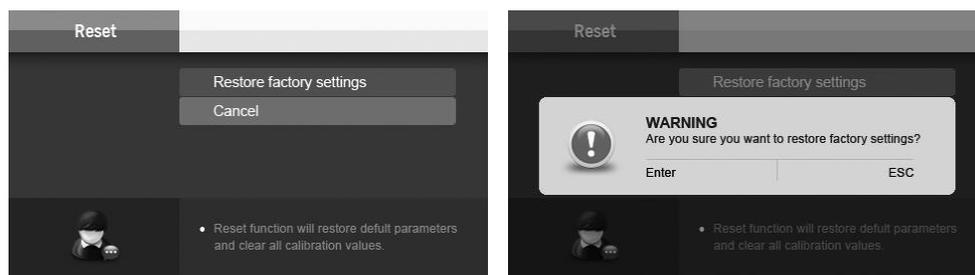

7.1   Press and hold the 📄 key for 3 seconds to enter the setup menu.

7.2   Press the ◄ or ► key to select the "Reset", press the **Enter** key to confirm.

7.3   Press the ◄ or ► key to select "Restore factory settings", press the **Enter** key. The meter shows "Are you sure you want to restore factory settings ?".

7.4   Press the **Enter** key, the meter immediately restores the factory settings, press the **ESC** key to cancel.

ⓘ   During the setting process, press the **ESC** key, the meter will exit the setting and return to the measurement mode.

Important Notes for Measurement and Calibration

- To avoid errors from ambient light interference, DO NOT use the meter in bright sunlight. Always close the light shield lid during the measurement and calibration.

- Glass vials and caps must be cleaned thoroughly with deionised water after each measurement. Minor residuals can cause errors.

- The outside of the vial must be clean and dry, before starting the test. Wipe the vial with a lint-free cloth to remove fingerprints or waterdrops.

- If the vial has minor scratches or scuffs, add a few drops of silicone oil to outside of the vial. Wipe with lint-free cloth.

- In order to get accurate readings, we recommend using the same vial to perform the measurement or calibration.

- Ensure that the vial is positioned in the sample chamber, the mark on the vial must be aligned with the arrow on the meter.
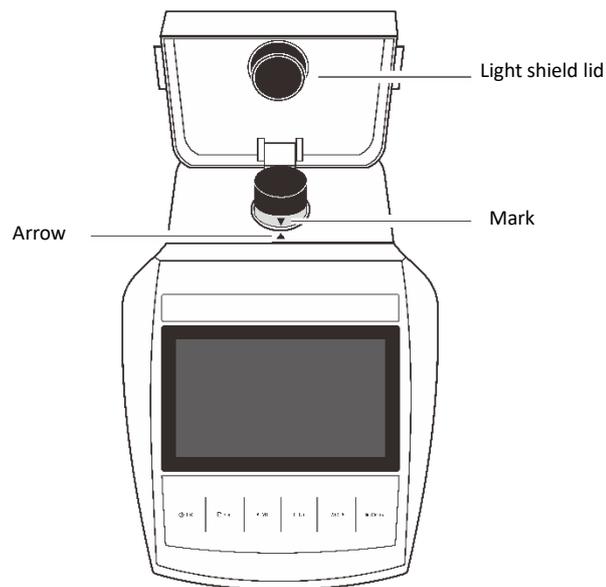
Turbidity Calibration

- The PCE-TUM 50 turbidity meter is calibrated with Formazin Standards at the factory and does not require user calibration prior to use.

- During the calibration process, do not shake or agitate the calibration standard violently to prevent air bubbles.

- In order to get accurate measuring results, we recommend calibrating the meter at least once a month.

- The meter allows turbidity calibration up to 7 points with minimum of 2 points, the default calibration points include the 0.02, 10.00, 200, 500, 1000, 1500 and 2000 NTU. You are able to select the calibration point during the calibration.

Calibrate the meter
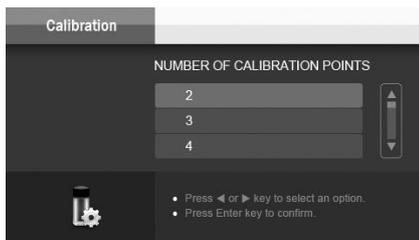
1. Press the **Cal** key to enter the calibration mode, the meter prompts to select the "Number of Calibration Points".
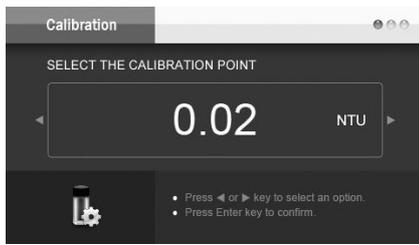
2. Press the ◄ or ► key to select an applicable option (2 to 7 points), press the **Enter** key, the display shows 0.02 NTU.
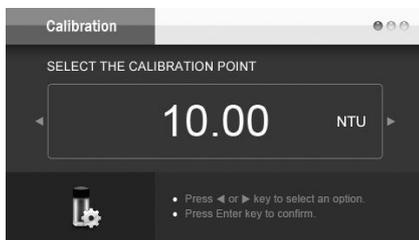
3. If necessary, press the ◄ or ► key to select desired calibration point (e.g., 10.00 NTU).
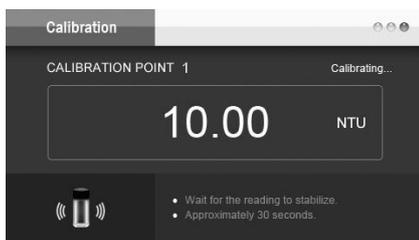
4. Insert the corresponding standard into the sample chamber, ensure that the mark on the vial cap always aligns with the arrow on the meter. Close the light shield lid.

5. Press the **Enter** key, the meter begins the calibration. The Calibrating..icon shows in the upper right corner of screen.
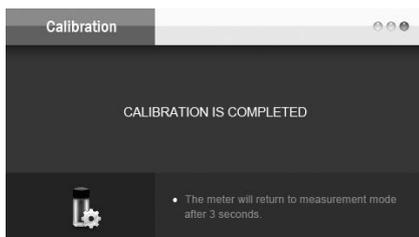
6. Wait for the measured value to stabilize, the display automatically show the next calibration point (e,g., 200 NTU).

7. Repeat steps 3 to 5 above until the display shows "Calibration is Completed". The meter returns to the measurement mode. Calibration is completed.

ⓘ During the calibration process, press the **ESC** key, the meter will exit the calibration and return to the measurement mode.

Turbidity Measurement

An accurate turbidity measurement depends on good measurement techniques. Factors such as clean sample vials, positioning of vial in the sample chamber, covering the vial with the light shield lid, meter calibration, removal of bubbles, etc. For more information, please refer to page 7 "Important Notes for

Measurement and Calibration".

Measurement - low turbidity samples

For the low turbidity samples, we recommend using the same vial to perform the measurement and calibration.

1.1.   Rinse the vial with approximately 10ml of the sample, capping the vial with the screw cap and gently inverting it several times. Discard the used sample and repeat the rinsing procedure two more times.

1.2.   Fill the vial with the sample. Cap the vial.

1.3   Allow the vial to stand undisturbed for 1 minute so that bubbles can disappear.

1.4   Wipe the vial with the lint-free cloth to remove waterdrops and fingerprints. Ensure that the outside of the vial is dry and clean.

1.5   Place the vial in the sample chamber. Align the mark on the vial with the arrow on the meter.

1.6   Close the light shield lid. Press the **Meas** key to start the measurement.

1.7   During the measurement process, press the 🔒 key. The measured value will be locked. Press the key again, the meter resumes measuring.

Measurement - high turbidity samples

The high turbidity samples (>2000 NTU) must be diluted prior to measurement. The dilution water can be obtained by filtering deionized water through a

< 0.45 μm filter membrane.

2.1   Repeat steps 1.1 to 1.6 above and record the measured value.

2.2   Calculate the true turbidity of the original sample use the formula below:

$$T = \frac{T_d (V_s + V_d)}{V_s}$$

Where:

T = Ture turbidity of the original sample

T_d = Measured value

V_s = Volume of the original sample (mL)

V_d = Volume of the dilution water (mL)

Total Suspended Solids Measurement

The PCE-TUM 50 turbidity meter contains the Total Suspended Solids measurement mode that need to enter the correct conversion factor prior to measurement.

Calculating the TSS factor

3.1   Rinse the filter disk with distilled water to remove any solids that may remain.

3.2   Put the filter disk in a watch glass and dry them in a 104°C drying oven for 1 hour.

3.3   Remove the filter disk and watch glass and put in a desiccator. Immediately cover the desiccator. Wait for them decrease to room temperature.

3.4   Weigh the filter disk and watch glass and record the mg value as B.

3.5   Filter the 100ml of sample through pre-weighed filter disk.

3.6   Put the filter disk and watch glass in a 104°C drying oven for 1 hour.

3.7   Remove the filter disk and watch glass and put in a desiccator. Immediately cover the desiccator. Wait for them decrease to room temperature.

3.8   Weigh the filter disk and watch glass and record the mg value as A.

3.9   Calculate the TSS value use the formula below:

$$TSS \ (mg/L) = \frac{(A - B)}{0.1}$$

4.0   Fill the vial with the sample.

4.1   Repeat the turbidity measurement steps 1.1 to 1.6 and record the NTU value.

4.2   Calculate the TSS conversion factor use the formula below:

$$Factor = \frac{NTU}{TSS \ (mg/L)}$$

Setting the TSS factor

5.1   Press and hold the 🗒 key for 3 seconds to enter the setup menu.

5.2   Press the ◄ or ► key to select the "TSS Factor", press the **Enter** key to confirm.

5.3   Press the ◄ or ► key to set the conversion factor, press the **Enter** key to return to the measurement mode.
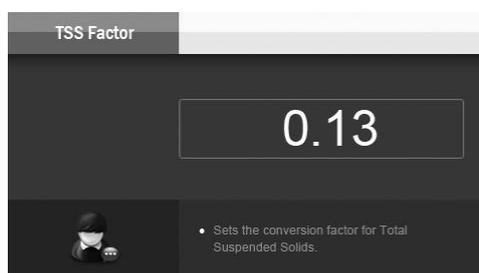
Selecting the TSS measurement mode

6.1   Press and hold the 🗎 key for 3 seconds to enter the setup menu.

6.2   Press the ◄ or ► key to select the "Measurement Mode", press the **Enter** key to confirm.

6.3   Press the ◄ or ► key to select "mg/L (TSS)", press the **Enter** key. The meter enters the Total Suspended Solids measurement mode.
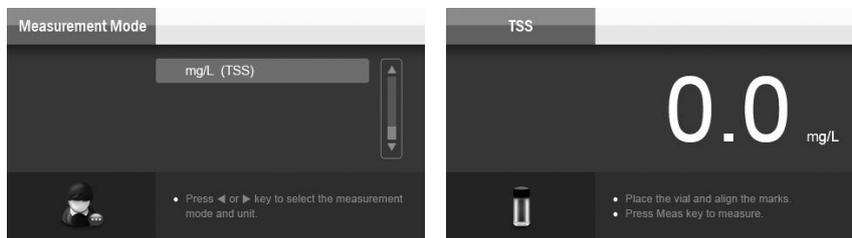
TSS measurement

The measurement method is the same as the turbidity. Please refer to page 10 "Turbidity Measurement".

Storing and Recalling Data

The PCE-TUM 50 turbidity meter is capable of storing and recalling up to 200 data sets.

Storing readings into memory

During the measurement process, press the **MI** key to store the reading into the memory. The display will show "Data is stored in memory".
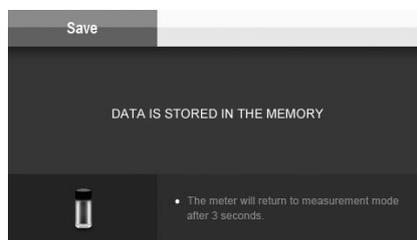
Viewing stored readings

1.   Press the **MR** key in the measurement mode, the meter shows the stored data.

2.   If necessary, press the ◄ or ► key to view the data log.

3.   Press the **ESC** key, the meter returns to the measurement mode.

Clearing the memory

When the memory is full, the meter will automatically show a reminder if the **MI** key is pressed. To delete all stored data, please follow the steps below.

1. Press and hold the 🖹 key for 3 seconds to enter the setup menu.

2. Press the ◄ or ► key to select the "Delete Data", press the **Enter** key to confirm.

3. Press the ◄ or ► key to select the "Delete all stored data".
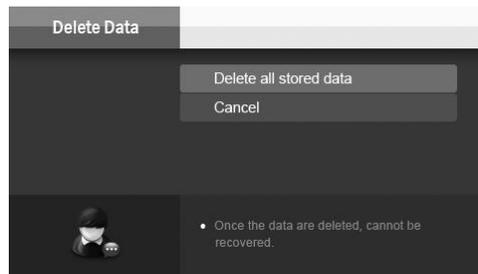
4. Press the **Enter** key, the meter shows a warning "Are you sure you want to delete all stored data ?"
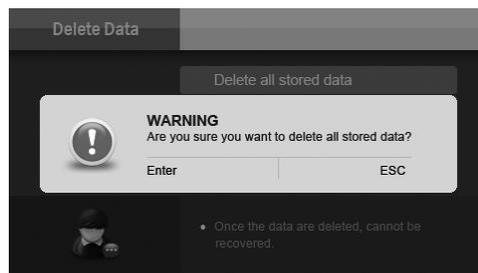

5. Press the **Enter** key to confirm or the **ESC** key to cancel. The meter returns to the measurement mode.

Communication

PCE Instruments provides a Data Acquisition System that can be used to transfer data, receive the measuring values or import the data to Excel. You are able to download this software from our official website at https://www.pce-instruments.com/english/download-win_4.htm   Before installation, ensure that Windows 7/8/10 operating system has been installed on your computer.

Receiving data

• Connect the USB cable to meter and computer. Click the DAS icon, the system will automatically scan an available communication port and show the message box "Found a port on your computer".

• Click the **OK** button, the application starts.
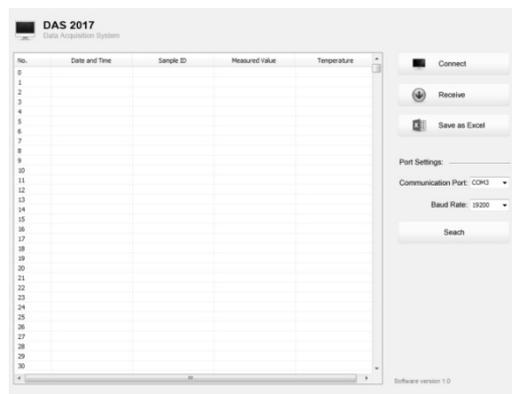
• Click the **Connect** button, the screen shows "Port is connected" indicate that communication between the meter and the computer has been established.

• Click the **OK** button to confirm.

• Click the **Receive** button, the stored data in meter will automatically send to computer.

Create the excel file

When the transfer is completed, click the **Save as Excel** button, the measured values in the data sheet will automatically convert to Excel file.

ⓘ   Once the software is closed, all received data will be lost and cannot be recovered.

Specifications

Model	PCE-TUM 50
Measurement Method	ISO 7027 nephelometric method (90°)
Measurement Range	0~2000 NTU/FNU, 0~500 EBC, 0~9999 ASBC, TSS range depends on conversion factor
Resolution	0.01 (0~100 NTU), 0.1 (100~999 NTU), 1 (999~2000 NTU)
Accuracy	±2% (0~500 NTU), ±3% (501~2000 NTU)
Default Calibration Standards	0.02, 10.00, 200, 500, 1000, 1500, 2000 NTU or User-Defined
Light Source	Infrared-emitting diode (850 nm wavelength)
Detector	Silicon Photodiode
Stray Light	< 0.02 NTU
Sample Vials	60 (H) × 25 (Dia)mm
Memory	Stores up to 200 data sets
Output	USB Communication Interface
Operating Temperature	0~60°C
Power Requirements	DC12V/2A, using AC adapters, 220VAC/50Hz
Dimensions	250 (L) × 177 (W) × 96 (H)mm
Weight	1.2kg

Addendum 1. Indexing and Matching Sample Vials

The United States Environmental Protection Agency (U.S. EPA) recommends that vials used for turbidity calibration or sample measurement be indexed. Its purpose is obtain a position which provides the lowest turbidity reading. The indexing methods are as follows.

1.1   Fill the vial using the distilled water (< 0.5 NTU). Cap the vial.

1.2   Wipe the vial with the lint-free cloth to remove waterdrops and fingerprints.

1.3   Let the vial stand undisturbed for 5 minutes.

1.4   Place the vial in the sample chamber. Align the mark on the vial with the arrow on the meter.

1.5   Press the **Meas** key to begin the measurement.

1.6   Slowly rotate the vial approximately 45 degrees. Close the light shield lid and record the measured value.

1.7   Repeat step 6 until the lowest turbidity reading is shown.

1.8   Mark this position on the vial.

Match sample vials

For the best accuracy and repeatability of turbidity measurement, using one indexed vial is best choice. If you need to use a few vials, match these vials are necessary.

2.1   Repeat the steps above for each vial and record the measured values.

2.2   Find the closest position of these vials measuring value and mark it.

Addendum 2. Preparation of Standard Formazin Solutions

Preparation of turbidity-free water

Turbidity-free water is used for preparation of turbidity standards and is prepared by filtering deionized water through a 0.45µm or smaller pore-sized membrane.

Preparation of turbidity standards

*   4000 NTU:

(1)   Dissolve 1 gram hydrazine sulfate [$(NH_2)_2 \cdot H_2SO_4$] in filtered water and dilute to 100ml in a volumetric flask.

(2)   Dissolve 10 grams hexamethylenetetramine [$(CH_2)_6N_4$] in filtered water and dilute to 100ml in a volumetric flask.

(3)   Mix 5.0ml of hydrazine sulfate and 5.0ml of hexamethylenetetramine solutions in a 100ml volumetric flask and let stand 24 hours at 25(±3°C).

*   1000 NTU: mix 25ml of 4000 NTU standard in a 100ml flask, dilute to the mark.

*   500 NTU: mix 12.5ml of 4000 NTU standard in a 100ml flask, dilute to the mark.

*   200 NTU: mix 10.0ml of 4000 NTU standard in a 100ml flask, dilute to the mark. Mix 50.0ml of above standard in a 100ml flask, dilute to the mark.

*   10 NTU: mix 10.0ml of 4000 NTU standard in a 100ml flask, dilute to the mark. Mix 2.5ml of above standard in a 100ml flask, dilute to the mark.

Warranty

The warranty period for meter is one year from the date of shipment. Above warranty does not cover the sensor and calibration solutions. Out of warranty products will be repaired on a charged basis. The warranty on your meter shall not apply to defects resulting from:

*   Improper or inadequate maintenance by customer.

*   Unauthorized modification or misuse.

*   Operation outside of the environment specifications of the products.

For more information, please contact the nearest authorized distributor.