

Compact Turbimeter

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INTRODUCTION

The Compact Turbimeter is the latest addition to the Palintest Compact Meter range which includes photometers for chlorine, ozone, chlorine dioxide and ammonia.

The Turbimeter operates according to the ISO 7027 method for measurement of turbidity, utilising two NIR light sources at 860nm as part of the QuadoptiX™ optical system.

The Turbimeter is provided in a hard case with accessories and standards to support effective use of the instrument.

For technical support or to report issues with this product please contact Palintest or your supplier.

KIT CONTENTS



Compact Turbimeter Instrument (CT12 Model)

4 x Sample Cuvettes

4 x SDVB Calibration Standards

1 x Silicone Oil (10 ml)

2 x Packs of cleaning and polishing cloths

1 x Sample/Dilution Tube

1 x Cleaning Brush

2 x WP48 Heat Pads

Instructions

QUADOPTIX™ TECHNOLOGY

The Palintest Compact Turbimeter utilizes QuadoptiX™ technology for turbidity measurement – a sophisticated optical approach designed to ensure turbidity measurements are as accurate and repeatable as possible in even the most challenging circumstances.

Turbidity measurements are carried out by analysis of light scattered at 90° to the incident light (nephelometric measurement) at levels below 40 NTU. Above 40 NTU the recommendation is to measure also at 180° to ‘compensate’ the 90° readings.

QuadoptiX technology uses two independent sources and two independent detectors to provide effectively four entirely autonomous measurement systems in the same instrument, allowing multiple validation of all results for greater accuracy.

START-UP AND START PAGE

To switch the unit on, press the POWER button and release. An audible beep will confirm the instrument is on. Switch off by holding the POWER button for 1 second.

The LCD screen is provided with a backlight option that can be set to on/off in the 'System' menu (see Page 9). The initial default setting is ON.

After initialization the Start page will appear and display, initially defaulted to Mode screen and showing three options:-

- 1 **Reading** – Select the mode to measure turbidity or suspended solids (see Page 12).
- 2 **Calibration** – Choose either SDVB, Total Suspended Solids or to Restore the factory calibration values (see Page 16).
- 3 **System** – view or set Log (result and calibration), Operator ID, Sample ID, Units, Language, Set Time, Set Date, Date Format, Software Version and switch the backlight on/off (see Page 9).

The option to change the Start page is available in the 'System' menu, allowing the user to choose to start in the default mode above, normal measurement mode or the last measurement mode used.

Navigation through Menus is carried out using the Up/Down buttons, using the OK button to select or the Back to return up a level.



Battery Life/Replacement

Your Compact Turbimeter is supplied with fresh batteries that will be suitable for at least 150 hours of use. Changing batteries is carried out through the compartment on the rear of the instrument. Two 'AA' 1.5V batteries are required. Current battery status is displayed on the screen to assist in power management.

The Turbimeter has an auto-off function to save power, automatically switching off the meter after five minutes of inactivity.

A back-up battery is located on the PCB to store all user data including the last mode used for reading. Replacing the AA batteries will not lead to settings or calibration data being lost.

If battery power is insufficient for effective analysis the Turbimeter screen will show **Error 110: Battery Low** and advise to change batteries. The battery icon will also show 'Empty' status.

If battery power is insufficient for any operation the Turbimeter screen will show **Error 111: Battery Critical** and automatically shut down.

SYSTEM MENU

The System menu allows the user to set the Compact Turbimeter preferences and review results and calibration data.

Log

Select 'Results' or 'Calibrations'.

Once the log has been chosen, select 'View' or 'Clear'.

The 'Readings' log holds up to 100 data points with date, time, Sample ID, Operator ID, Reading Mode and Result. The oldest result will automatically be overwritten when the log is full.

The 'Calibrations' log stores the date, time, method and Operator ID (if set) for the last 12 good calibrations.

To view data select 'View' and use the up/down buttons to scroll in either direction.

Use 'Clear' in either log to delete the entire log. Select 'Clear' then 'Yes' in the following screen to delete.

Operator ID

Optionally select or edit the username using alphanumeric characters.

To create a new Operator ID select a blank line and press 'OK'

Press 'New' to create the ID.

Use the Up/Down buttons to show/change characters.

When the correct character is shown, press and hold the [+] key for one second to move to the next character.

Correct mistakes by holding the [Del] key for one second.

Complete the process by pressing 'Done' briefly.

Select 'OK' to accept the entry or Edit to modify the entry.

To modify or delete an existing Operator ID, highlight the ID and select 'Edit' Choose either 'Edit' to modify the existing entry or 'Delete' to remove it from the list.

Deleting the Operator ID will not affect results stored in the log.

Up to 12 Operator IDs can be stored and recalled from memory as required.

To return to the System menu, either select the Operator ID required using 'OK' or highlight a blank entry (if one is available) and press 'Back'

Sample ID

Optionally set the Sample ID using the same method as Operator ID.

Up to 24 Sample IDs can be stored and recalled as required.

Both Operator ID and Sample ID are stored in the log with result and calibration data.

Units

Results can be displayed in NTU, FTU and FNU.

Language

Select English, French, German, Spanish or Italian and press 'OK' to switch to alternative languages.

Set Time

Increase/decrease the time by using the Up/Down buttons.

When the correct time is shown select 'OK'.

Set Date

Increase/decrease the date by using the Up/Down buttons.

When correct select 'OK'.

Date Format

Select DD/MM/YYYYY or MM/DD/YYYY as required.

Version

The serial number of the instrument and the software version will be displayed.

The instrument serial number is required for support and warranty claim.

Backlight

Select either 'Off' or 'On' as required.

The Compact Turbimeter will maintain the current status until changed.

Start Page

The 'Start Page' allows the user to define a choice of initial screens/modes on powering the Compact Turbimeter.

To change start page, highlight the favoured choice for initial screen – Mode Menu, Normal Reading Mode or Last Reading Mode. The new Start Page choice will appear when the instrument is next powered on.

LCD Contrast

The default setting is appropriate for all but the most challenging light conditions but, should it become necessary, the contrast setting for the LCD screen can be manually adjusted.

Use the up/down buttons to adjust the image on screen until the alternating shapes are clearly visible and press 'Back'

READING MENU

When taking readings ensure the cuvette is free from dirt, dust and condensation using the supplied lint-free cloths.

Ensure the light cap is in place to prevent stray light from adversely affecting readings. If no light cap is fitted or the sample cuvette is not correctly inserted Error 107: Blanking Error will be reported.

Microscopic scratches on the sample cuvette will refract light and can lead to higher than expected values. To prevent scratches having an impact apply a thin film of silicone oil (provided) to the sample cuvette.

Select the '**Reading**' menu and choose from:-

Normal – This mode reads the turbidity of the sample in approximately eight seconds with an audible beep at the start and finish of measurement.

Average – Selecting this mode prompts a further choice of Short Average (3 readings), Medium Average (6 readings) and Long Average (12 readings). Averaging readings is extremely useful for turbidity measurement where particles are in motion or where extremely high accuracy is required.

Continuous-Capture – This mode allows continuous reading of sample turbidity until measurement is manually interrupted. This mode will support cuvette indexing and settling studies on rapidly settling samples.

Total Suspended Solids – The relationship between turbidity and suspended solids can be approximated with correlated data. The QuadoptiX™ bench provides the performance required to produce reliable data for suspended solids, based on calculated factors (slope and offset) for turbidity versus suspended solids. Default factors are not possible due to the unique variety of size, shape and reflectivity of individual sample matrices.

Calculated factors will provide a rapid qualitative value for Total Suspended Solids that will be relevant until process conditions change. This reading mode will only become active upon a site-specific calibration being stored in the Compact Turbimeter.

Taking Readings

Normal Mode

Choose 'Reading' mode, select 'Normal' and press 'OK'.

Insert the sample with the orientation mark facing forward and press 'Read'.

A beep will sound at the start and end of measurement.

Result is displayed and stored in the results log with date, time, Operator ID and Sample ID.

(NOTE: See the 'System' section for details of the result log).

Average Mode

Choose 'Reading' mode, select 'Average' and press 'OK'.

Select the number of readings required for the averaging function :-

Short Average – 3 consecutive readings

Medium Average – 6 consecutive readings

Long Average – 12 consecutive readings

Insert the sample with the orientation mark facing forward and press 'Read'.

The instrument will beep at the start and end of measurement cycle.

Result is displayed on the screen and stored in the log with time, date, Operator ID and Sample ID.

Continuous-Capture Mode

Choose 'Reading' mode, select 'Continuous-Capture' and press 'OK'

Insert the sample with the orientation mark facing forward and press 'Read'.

A beep will occur at the start and end of each measurement cycle.

To store data in the log, press 'Capture' (repeat as required).

To cease measurement, press 'Back' at any time.

To index a cuvette, insert the sample cuvette with the orientation mark facing forward.

Systematically rotate the sample cuvette 45° at a time and record the position of the lowest value. This is the optimal cuvette alignment for low turbidity measurement.

Total Suspended Solids

This mode will only be active if a site calibration has been stored within the Turbimeter. Once a calibration has been created (via the 'Calibration' menu) the site ID can be used to recall the site specific relationship between turbidity and suspended solids.

Choose 'Reading' mode, select 'Total Suspended Solids' and press 'OK'.

Highlight the Site ID for the Site/Sample under investigation using the Up/Down arrows. The calibration data will be recalled automatically.

Insert the sample with the orientation mark facing forward and press 'Read'.

A beep will occur at the start and end of each measurement cycle.

Result is displayed on the screen in mg/l and stored in the log with time, date, Operator ID and Sample ID.

CALIBRATION MENU

The Compact Turbimeter is delivered with a stored calibration carried out on primary Formazin standards and validated as part of the production process. For field use, a set of calibration standards are provided as part of the kit.

Recalibration is only required if the standards provided show an unacceptable level of variation from the stated values on read-back.

Two different methods of calibration are available for the Turbimeter.

The calibration methods are :-

SDVB – The use of SDVB for field calibration of turbidity meters is preferable due to the improved stability and handling compared to Formazin. When calibrating turbidity instruments SDVB standards are assigned to a specific model and cannot be transferred. Using SDVB standards from another manufacturer may differ greatly when applied to the Turbimeter. This is normal behavior and should not cause concern.

Formazin – freshly prepared standards can also be used for calibration where available. Formazin is used as the primary calibration material for the Turbimeter and can also be used to align the calibration of different instruments when discrepancies occur. Preparation of Formazin standards from 4000 NTU stock solution is required to be within the stated limits detailed below.

Total Suspended Solids – When using the Turbimeter in Total Suspended Solids Reading mode, a calibration is required to set the relationship between the measured turbidity values and the ‘true’ suspended solids value, determined by gravimetric methods. This calibration can either be an assigned series of values from the results log or a simple algorithm with factors provided by the user. This relationship is typically a straight line and hence the factors consist of a slope and intercept.

The Compact Turbimeter has two methods of generating the data for relating the measurement of turbidity to total suspended solids (TSS):-

- 1 **Correlation** – Using the stored turbidity data from the instrument log and relating it to manually entered Total Suspended Solids data derived from elsewhere. The minimum number of correlation points required is one as the zero point can be used as a second point. A maximum number of 50 data points can be used.
- 2 **Factor** – Using data manipulated externally, a slope and intercept for the straight line relationship can be entered directly. Slope factors range from 0.1 – 50.0 and intercepts can be set from -50.0 - +50.0

Calibrating the Compact Turbimeter

SDVB

Select Calibration and press 'OK'.

Choose 'SDVB' and press 'OK'.

Select the lowest (0.05 – 0.15) NTU standard and insert into the sample chamber with the orientation mark facing forward.

Use the Up/Down buttons to adjust the value on screen to that on the standard and press 'Read'.

Repeat the process for the 20 NTU, 100 NTU and 800 NTU standards.

If standards have expired, are inserted in incorrect sequence or the 100 and 800 NTU standards are not inverted prior to use **Error 101: Incorrect Standard** may be shown.

After the final 800 NTU standard, the screen will show 'Calculating...Please wait' and a countdown will appear to show time remaining.

On completion of the process the Compact Turbimeter screen will show 'Successful'.

Press 'Back' to leave the calibration process and return to the Calibration menu.

To cease calibration during the data capture phase press 'Cancel'.

To cease the calibration process at any step, press 'Back' (calibration data will be discarded).

The time, date and Operator ID are stored in the calibration log for GLP compliance (see Page 9, System menu).

Formazin

Select Calibration and press 'OK'.

Choose 'Formazin' and press 'OK'.

Acceptable fresh Formazin standards should be prepared within the following ranges:

Low Standard 0.01 – 1.00 NTU

Second Standard 10.0 – 30.0 NTU

Third Standard 90.0 – 110.0 NTU

High Standard 720.0 – 880.0 NTU

Select the lowest (0.01 – 1.00) NTU standard and insert into the sample chamber with the orientation mark facing forward.

Use the Up/Down buttons to adjust the value on screen to that on the standard and press 'Read'.

Repeat the process for the second, third and high standards.

After the final standard, the screen will show 'Calculating...Please wait' and a countdown will appear to show time remaining.

On completion of the process the Compact Turbimeter screen will show 'Successful'.

Press 'Back' to leave the calibration process and return to the Calibration menu.

To cease calibration during the data capture phase press 'Cancel'.

To cease the calibration process at any step, press 'Back' (calibration data will be discarded).

The time, date and Operator ID are stored in the calibration log for GLP compliance (see Page 9, System menu).

Total Suspended Solids – Correlation

Select 'Calibration' and press 'OK'.

Select 'Total Suspended Solids' and press 'OK'.

If the Sample ID has already been created use the Up/Down arrows to highlight and press 'OK' to select.

If a new Sample ID is required, move the highlight to a blank area and press 'New'.

Create the new Sample ID using the Up/Down buttons to select characters as describe in the 'System' section.

Select 'Correlation' to enter the data entry screen.

The default (0, 0) point is always included. This can be deleted or edited if not required.

Select 'Add' to recall data points from memory for which a correlated suspended solids value has been measured.

Press 'Select' to enter the concentration of suspended solids determined externally using the Up/Down buttons.

When data entry is complete press 'Done' and the slope/intercept will be calculated and shown automatically.

Data points can be edited or deleted as required. Highlight the data point of interest and select 'Edit'

Choose either 'Edit' or 'Delete' as required. When complete select 'Done'

Press 'Back' to return to the 'Mode' menu.

Total Suspended Solids – Factor

Select 'Calibration' and press 'OK'

Select 'Total Suspended Solids' and press 'OK'.

If the Sample ID has already been created, use the Up/Down arrows to highlight and press 'OK' to select.

If a new Sample ID is required, move the highlight to a blank area and press 'New'.

Create the new Sample ID using the Up/Down buttons to select characters as describe in the System section.

Select 'Factor' to enter the data entry screen.

Highlight 'Slope' and press 'OK'.

Use the Up/Down buttons to enter the slope calculated externally. The value is limited between 0.1 and 50.0.

Press 'Done' to return to the 'Factor' screen.

Highlight 'Intercept' and press 'OK' (in many cases the intercept will be zero but for straight line fitting an offset will sometimes be required).

Use the Up/Down buttons to enter the intercept.

Select 'Add' to recall data points from memory for which a correlated suspended solids value has been measured.

To edit factors highlight the slope or intercept and press 'OK'

Use Up/Down buttons to adjust the value.

Press 'Back' to return to 'Calibration' menu.

Restore Factory Calibration

To restore the default calibration, select this option and press 'OK'.

Choose to continue – 'Yes'/'No'

The screen will show 'Successful'.

CARE AND MAINTENANCE

The Compact Turbimeter has been tested for IP67 compliance so accidental immersion will not damage the internal components.

Sample cuvette should be clean and dry prior to insertion into the sample holder. Lint free cloths are provided for this purpose.

Silicon oil is also present to use on scratched cuvette surfaces. Its use should not be necessary unless turbidity readings are consistently higher than expected. If required place two or three drops onto the vial and smear across the glass using the lint free cloth.

Indexing cells to find the optimal position for turbidity measurement is recommended, especially if measuring low values. The Continuous-Capture reading mode (see Page 14) contains more details on the suggested method.

User calibration is advised on a need-only basis, using the supplied SDVB standards. Calibration frequency is at the user discretion and can be deduced by reading the standards to determine any offset that may have occurred due to fouling.

Subjecting the standards to prolonged exposure to freezing temperatures will destroy the SDVB standards, seen by physical settling and a lowering of the NTU value. The use of a WP48 Heat Pad is recommended in these circumstances to prevent standard degradation.

Standards have a 12 month stability and should be replaced after this date. Replacement calibration sets are available, part number PTC 090, from your supplier or direct from Palintest Ltd.

No prescribed maintenance intervals are possible due to the high dependence on frequency of use, types of samples and conditions and user protocol. Service and maintenance is available via authorised service centres or direct from Palintest Ltd.

TROUBLESHOOTING

The Compact Turbimeter has internal diagnostics to advise on some issues as follows :-

Error 100 – Measurement Off-Scale

The reading is above 1050 NTU. Dilute using the provided PT 512 Dilution Tube and clean water and re-measure.

Error 101 – Incorrect Standard

The standard inserted is either the incorrect value or is no longer within an acceptable tolerance for calibration. Use the correct standard or replace the expired calibration set.

Error 107 – Blanking Error

The sample cuvette cap is not attached allowing ambient light into the QuadoptiX™ chamber or the sample cuvette is not fully inserted. Replace the cap and read again or fully insert the sample cuvette.

Error 110 – Battery Low

The available power is insufficient to support reliable analysis. Replace the batteries.

Error 111 – Battery Critical

Battery level is critically low and the instrument will automatically shut down immediately to ensure all data is written to the memory correctly.

Other more general issues that arise may be as follows:-

Readings are consistently higher than expected

Check the sample cuvette for dirt, scratches and marks. Turbidity is an optical measurement and will be adversely affected by unwanted items in the optical paths.

Index the cuvette using the 'Continuous-Capture' mode to ensure the most accurate reading position is selected.

Apply a thin film of silicone oil to the cuvette to 'fill in' any scratches.

Replace the cuvette with a new, unused cuvette.

Check the calibration using the supplied standards to ensure no offset has been inadvertently applied. Recalibrate if necessary.

Readings are consistently lower than expected

Fouling in the optical chamber may prevent the sources being transmitted with full intensity. The unique QuadoptiX™ system will prevent this issue arising in all but the most challenging circumstances.

Gently clean the optical chamber using a soft, damp cloth. Do not use abrasive materials.

Recalibrate the meter using the supplied standards to remove the offset.

Readings are unstable/variable

Turbidity is a measurement of scattered light with the source of scattering being microscopic and larger solids present in the sample. Solids can be mobile or settle during measurement leading to changes in readings over time.

Using the 'Continuous-Capture' mode will show the changes over time.

Using the 'Average' mode will remove/reduce the effects of settling or mobile solids.

The QuadoptiX™ system measures at four points and will also reduce the effects of solid distribution across the sample cuvette.

Total Suspended Solids (TSS) Results Inaccurate

The relationship between TSS and turbidity is a site/sample/season specific correlation and will require frequent validation. If results vary significantly from laboratory data a repeat calibration should be carried out.

TECHNICAL SUPPORT AND WARRANTY

For technical questions, reports of issues and any aspects related to this product, please contact your Palintest representative or service@palintest.com. Further contact details are found on the rear cover or on any of our websites.

When requesting technical or warranty support, please quote instrument serial number found on the underside of the Compact Turbimeter and in the System/Version area of the software.

The Compact Turbimeter has a two year warranty.

Calibration standards supplied have a 12 month stability. Replacement sets are available with part code PTC 090.

Other replacement items are also available via your authorised representative or direct from Palintest Ltd.