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TSS Portable Handheld Instrument for Turbidity/Suspended Solids

User Manual

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Section 1 Specifications

Specifications are subject to change without notice.

Performance specifications		
Wavelength	860 nm	
Parameter	Turbidity	Suspended Solids
Measurement technique	Combined multiple-beam alternating light technique with IR diode system and beam focus 2-channel 90° scattered light measurement in accordance with DIN EN 27027 / ISO 7027; additional measurement value verification through six-channel multiple-angle measurement	Modified absorption measurement Six-channel multiple-angle measurement
Measuring range	0.001–4.000 FNU (NTU)	0.001–400 g/L (upper limit depends on sample characteristics)
Resolution	0.001 at 0–0.999 FNU 0.01 at 1–9.99 FNU 0.1 at 10–99.9 FNU 1 at >100 FNU	0.001 at 0–0.999 g/L 0.01 at 1–9.99 g/L 0.1 at 10–99.9 g/L 1 at >100 g/L
Accuracy	Measuring range: 0.001–4000 FNU Accuracy of measurement value: <3% or +/- 0.02 FNU (whichever is greater)	Measuring range: 0.001–400 g/L Accuracy of measurement value: <4% or +/- 0.001 g/L (whichever is greater)
Reproducibility	<4 % of measurement value	<5 % of measurement value
Units	FNU, NTU, EBC	ppm, mg/L, g/L, %
Calibration	1 calibration curve (factory calibration)	4 calibration curves
Mode of operation	Single, single with data storage, interval measurement and continuous measurement	
Air-bubble compensation	Via software	
Temperature of sample	0–60 °C (32–140 °F), up to 80 °C (176 °F) briefly	
Pressure range	Max. 10 bar (145.04 psi)	
Display	LCD, alphanumeric, 4 rows of 16 characters, 0.95 inch (24 mm) high, UV treated	
Input	6 membrane key buttons, menu with fast access to the major functions	
Power supply (batteries)	6 rechargeable NiMH batteries (recommended: 1.2 V/min. 1800 mAh) or 6 AA alkali batteries	
Power consumption	Approx. 60 mA	
Data storage	Up to 290 measurement values	
Interface (probe to meter)	RS485	
Probe material	Stainless steel, sensor window: sapphire	
Cable	10 m (32.8 ft), PUR, ø 8.3 mm (0.33 in.); S-2000 connector, 6-pin	
Protection class	Probe: IP68 Meter: IP 55	
Size	Probe: Ø 40 mm (1.57 in.), length = 29 cm (11.42 in.) Meter: 11x23x4 cm (4.33x9.06x1.57 in.)	
Weight	Probe: 1600 g (56.44 oz, 3.53 lbs) Meter: 560 g (19.75 oz, 1.23 lbs)	
Warranty	2 years	

Section 2 General Information

2.1 Safety information

Read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger, warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this instrument is not impaired, do not use or install this instrument in any manner other than that specified in this user manual.

2.1.1 Use of hazard information



DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. Note: <i>For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.</i>
	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.

2.2 Product overview

The TSS Portable is a handheld instrument for the analytical determination of turbidity and suspended solids in aqueous media.

2.3 Measurement instrument

The instrument stores the recorded data under the corresponding measurement points. Standard designations, for example PST1 for primary sedimentation tank 1 or AT1 for aeration tank 1, are available for selection.

For the turbidity/suspended solids measurements, a measurement-type-specific calibration must be assigned to each measurement point. ([Section 5.1 on page 21](#)).

For the single measurement with "saving," the continuous measurement and the interval measurement are saved with details of measurement type, measurement value, date and time.

Various individual parameters for entering, signal processing and output can be set in the menu ([Section 4 on page 13](#)).

2.4 Theory of operation

The measuring principle is based on a combined infrared absorption stray light process, which determines the lowest turbidity value according to DIN EN 27027 just as precisely and continuously as the high sludge content. In so doing, the light scattered sideways by the turbidity particles are measured at an angle of 90°. In the case of solid material, the measurement occurs at an angle of 90° and 120°.

2.5 Probe

The probe contains sensitive optical and electronic components. Make sure that it is not subjected to any hard mechanical impacts. The inside of the probe, and of the display unit, does not contain any components that can be serviced by the user.

Section 3 Installation



CAUTION
Risk of falling. Measurements are taken directly on site with this instrument. In order to avoid falling into the tank, all the local safety regulations with respect to roping up and wearing appropriate protective clothing and shoes must be observed.
Risk of injury. Do not secure the instrument to your body. The measuring probe could be caught unintentionally on a slide or stirrer and the user may be put at risk by the connected probe cable.



WARNING
Electrical and fire hazards. Only qualified personnel should conduct the tasks described in this section of the manual.

3.1 Unpack the instrument

Remove the instrument from the shipping container and inspect each part for damage. Verify that all items listed in [Figure 1](#) are included. If any items are missing or damaged, contact the manufacturer or distributor.

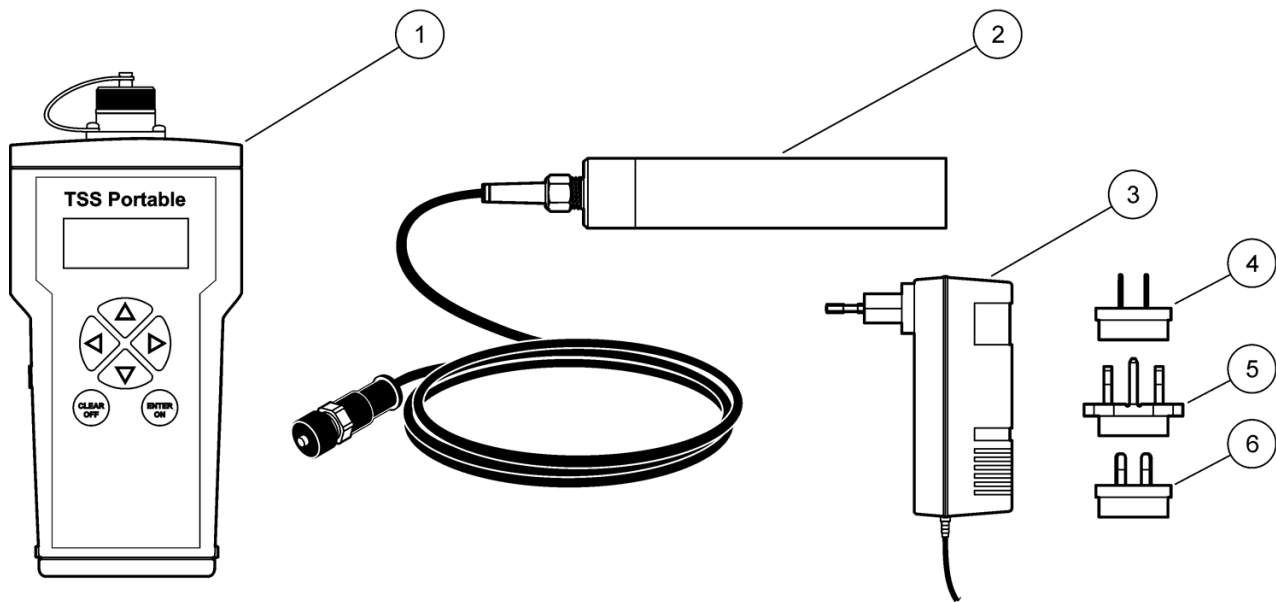


Figure 1 Items supplied

1	TSS Portable handheld instrument	4	USA adapter plug
2	Probe with 10 m cable	5	UK adapter plug
3	Charger with EU adapter plug installed	6	AUS/China adapter plug

3.2 Battery power (rechargeable batteries/standard batteries)



DANGER
Risk of fire and explosion. Only use NiMH rechargeable batteries or AA alkali batteries and make sure that the batteries are inserted correctly in the battery compartment. Incorrect insertion of the batteries could lead to damage on the instrument, to fire or explosions.



DANGER
Risk of fire and explosion. When using AA batteries, the instrument must never be connected to the power supply.

The instrument is operated by six rechargeable or standard batteries (NiMH or alkali) (Figure 2).

Important Note: Never use different rechargeable or standard battery types at the same time.

Important Note: If the instrument is not to be used for a period of time, remove the batteries.

3.2.1 Insert the batteries

- 1. Press in both catches at the same time and release the cover.
 - 2. Take the battery holder out of the battery compartment (Figure 2).
 - 3. Insert six rechargeable or standard batteries (NiMH or alkali) into the battery holder. Take note of the markings for the polarity.
- Important Note:** Make sure that the batteries have been inserted into the battery compartment correctly.
- 4. Connect the battery holder to the battery clip.
 - 5. Push the battery holder into the battery compartment.
 - 6. Push the cover onto the battery compartment, until it audibly locks into place.

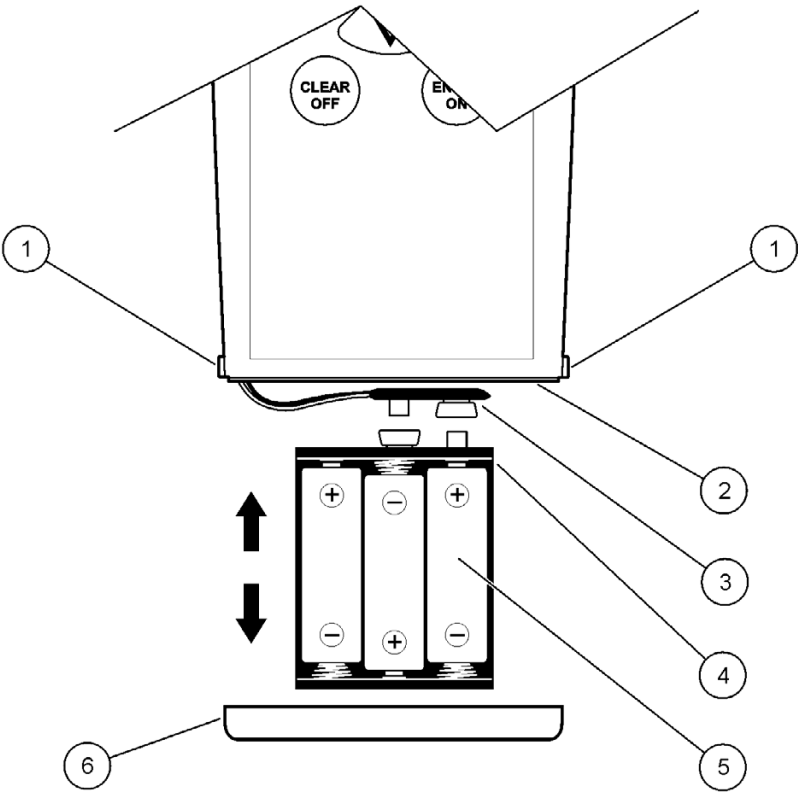


Figure 2 Insert the batteries

1	Catch	4	Battery holder
2	Battery compartment	5	Batteries
3	Battery clip	6	Cover

3.2.2 Charger for the rechargeable batteries

1. Push the slide switch (item 2, Figure 3) on the back of the charger up and remove the adapter (item 3, Figure 3).
2. Install the required adapter to the charger, until it audibly locks into place.
3. Insert the charging plug (item 3, Figure 4) into the charging socket (item 4, Figure 4) of the instrument.
4. Connect the power (100–240 V~/50–60 Hz).

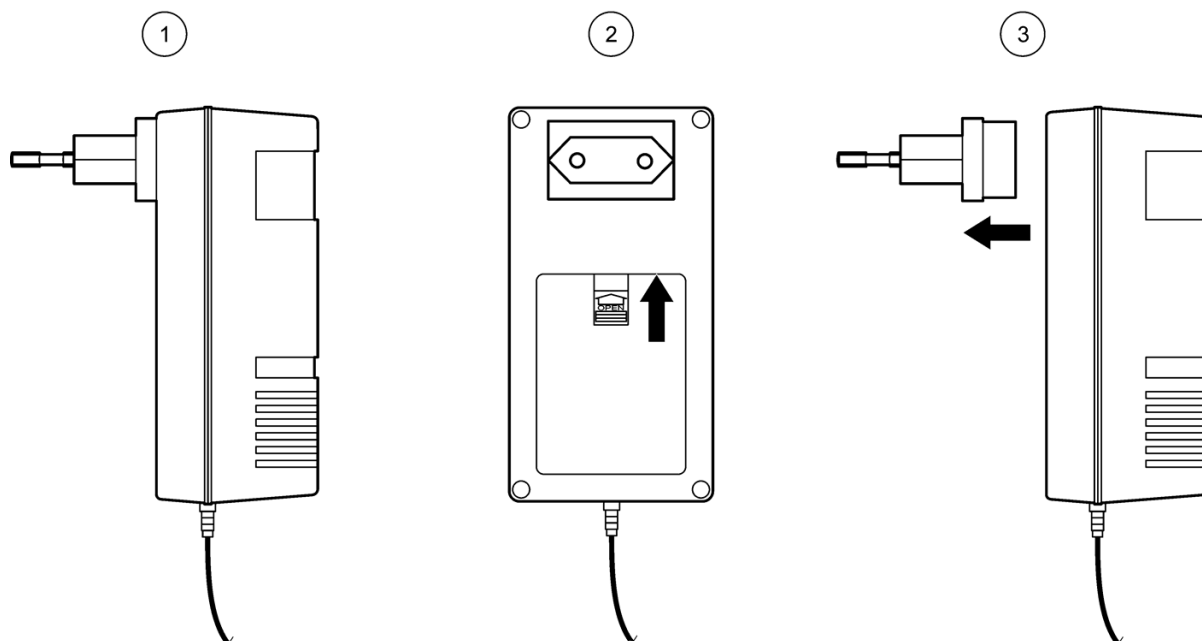


Figure 3 Replace the adapter

1	Charger	3	Remove the adapter
2	Slide switch		

3.2.3 Charge the batteries

Important Note: The instrument must be switched off while charging so that the batteries can be charged.

Important Note: When using the instrument for the first time, charge for at least three hours. The batteries are fully charged when the LED on the charger is green.

1. When using NiMH rechargeable batteries, connect the charger to the power supply and then connect to the instrument (Figure 4). The batteries are charged.
2. Once the batteries are fully charged, disconnect the instrument from the charger.

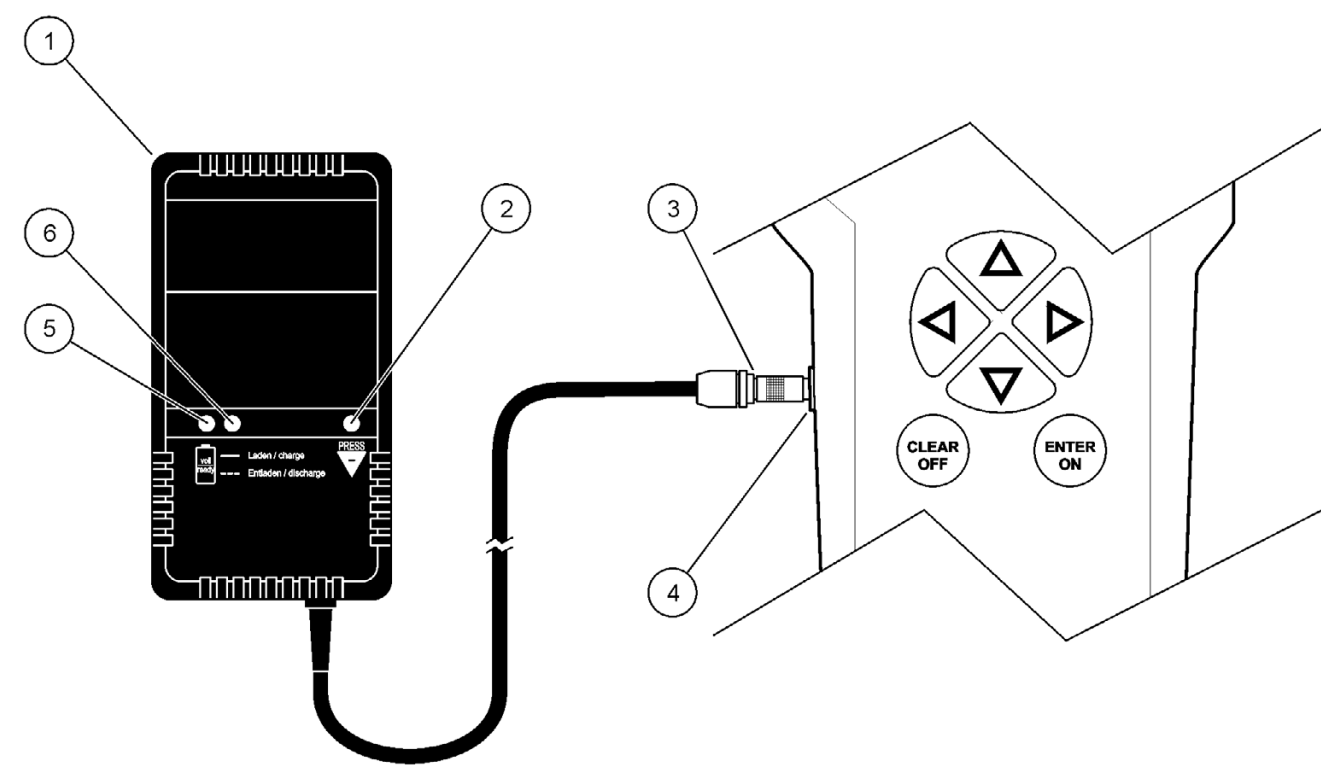


Figure 4 Charge the batteries

1	Charger	4	Charging socket
2	Discharge button (yellow)	5	LED lamp (green => batteries fully charged)
3	Charging plug	6	LED lamp (red => batteries currently charging)

3.3 Probe connection

Remove the protective cap and connect the probe plug to the instrument ([Figure 5](#)).

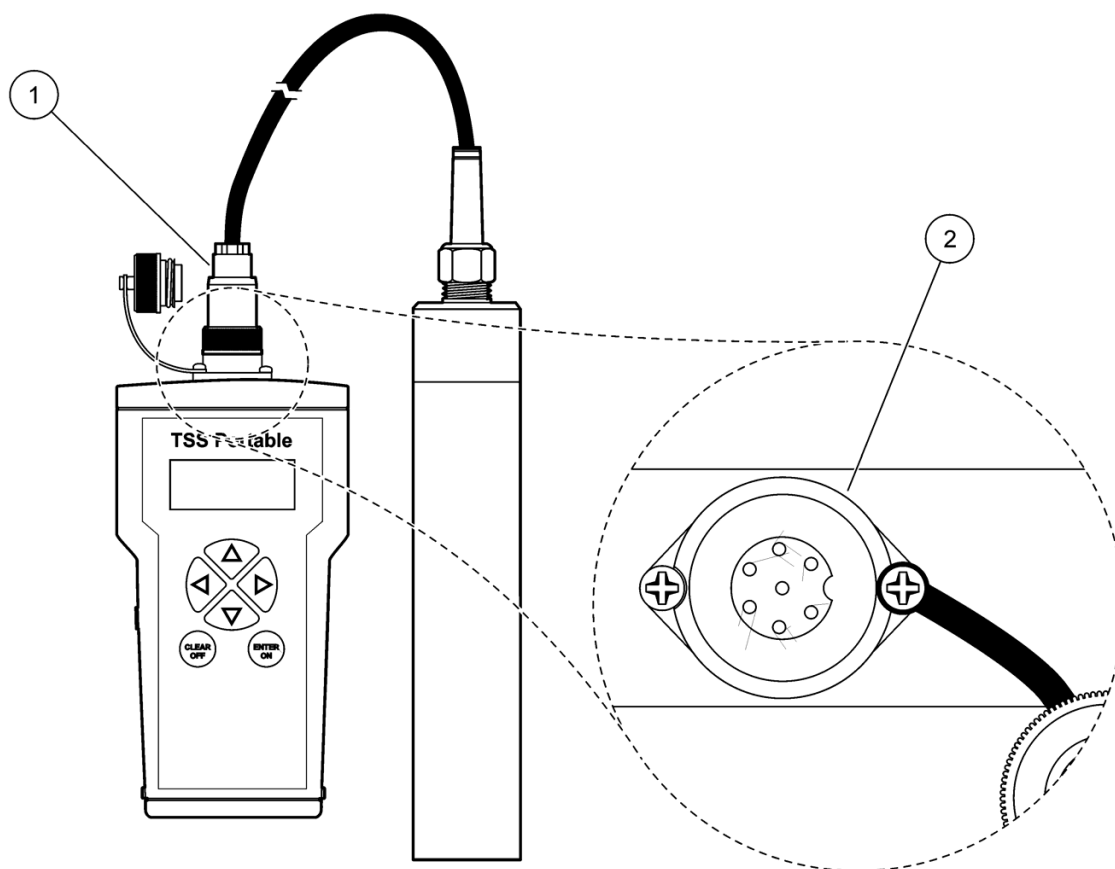


Figure 5 Connect the probe plug to the instrument

1 Probe plug	2 Probe connection
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3.4 Turn the instrument on and off

1. Fully charge the instrument ([Section 3.2.3](#)).

Note: The batteries are fully charged when the LED on the charger is green.

2. Press **ENTER/ON** for two seconds to turn on the instrument.

Note: If the instrument does not turn on, check the position of the batteries.

3. Press **CLEAR/OFF** for two seconds to turn the instrument off again.

Note: The instrument shuts down automatically if it is not used for approximately four minutes (exception: continuous measurement).

Section 4 Start Up

4.1 System start overview

1. Turn on the measurement instrument ([Section 3.4 on page 11](#)).
2. Connect the probe to the measurement instrument ([Section 3.3 on page 11](#)).
3. Edit the time/date, display, units, language and integration time ([Section 4.3 on page 15](#)).
4. Calibration of the suspended solids in line with calibration instructions ([Section 4.7 on page 16](#)).
5. Define the measurement points in line with the instructions ([Section 4.8 on page 17](#)) and allocate calibration curves.
6. Show the data in the display ([Section 5.3 on page 26](#)).

4.2 User interface and navigation

4.2.1 Keypad description

[Figure 6](#) shows the navigation keys on the instrument.

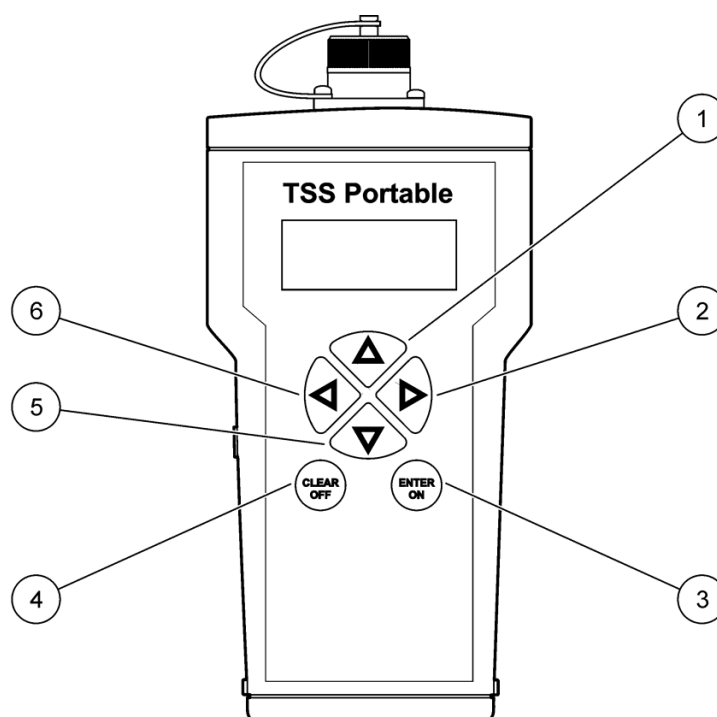


Figure 6 Description of the keypad

1	Navigation key UP	4	CLEAR/OFF
2	Navigation key RIGHT	5	Navigation key DOWN
3	ENTER/ON	6	Navigation key LEFT

4.2.2 Display description

In the default setting, the display shows the main measurement variables and the date/time (Figure 7). The display settings are user-selectable, see Section 4.5 on page 16.

Table 1 Navigation in the menu

Navigation key	Description
Navigation key RIGHT/LEFT	Navigation occurs with the RIGHT/LEFT navigation keys.
Navigation key UP/DOWN	Navigation occurs with the UP/DOWN navigation keys.
ENTER/ON	- Confirm selection and entry with ENTER/ON . - Turn the instrument on with ENTER/ON .
CLEAR/OFF	- Abort actions with CLEAR/OFF . - Press CLEAR/OFF to return to the previous menu option or abort an entry. - Turn the instrument off with CLEAR/OFF .
Vertical arrows	The vertical arrows in the display show that there are additional menu options or measurement values above or below.
Cursor	- The cursor points to the selected main menu option. Navigation occurs with the RIGHT/LEFT navigation keys. - The active decimal place is displayed.
> (arrow)	The current selection is displayed

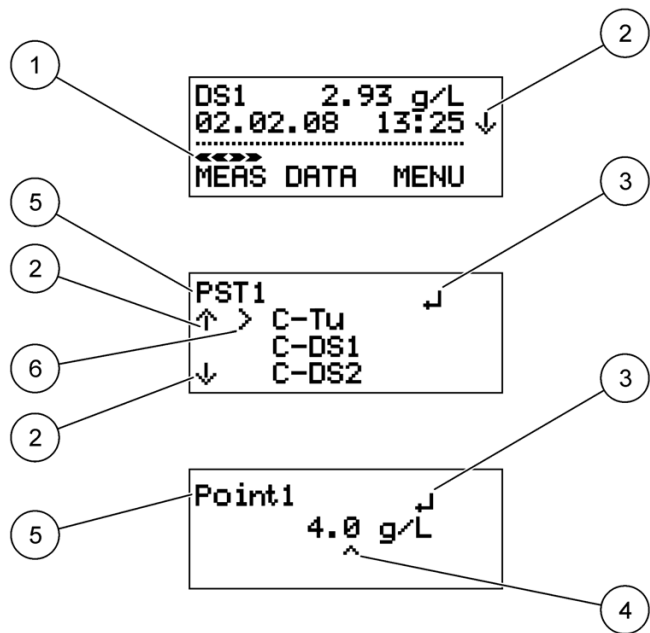


Figure 7 Display of results from the instrument with probe connected

1	Cursor	4	Current decimal place
2	Vertical arrows	5	Menu option
3	Input mode	6	Active selection

4.2.2.1 Internal probe information

Information about the probe and instrument can be recalled directly from the main menu using the navigation keys **UP/DOWN**.

The following information is displayed:

- a. Measured variable (homogeneity in %)
- b. Battery charge level
- c. Diagnosis parameters, such as:
 - Probe serial number (instrument information)
 - Probe software version (instrument information)
 - Probe number Start XX (probe diagnosis data)
 - DATA rem. cap. XXX (Remaining capacity of the measurement points)
 - Fault no. XX
 - Activated measurement type
 - Serial no. XXXXX (instrument designation)
 - Software version XXXXX (instrument designation)

4.3 Language selection

The instrument supports the following languages, German and English. The instrument functions in the selected language until the option is changed.

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **SPRACHE/LANGUAGE**, confirm with **ENTER/ON**.
3. Select **DEUT./GERMAN** for German or **ENGL./ENGLISH** for English, confirm with **ENTER/ON**.
4. Press **CLEAR/OFF**, to return to the main menu.

4.4 Date and time setup

Set the time and date display:

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **TIME/DATE**, confirm with **ENTER/ON**.
3. Select **YEAR**, **MONTH**, **DAY**, **HOUR**, **MINUTE** or **SECOND**, confirm with **ENTER/ON**.
4. Select decimal places with the **RIGHT/LEFT** navigation keys.
5. Change the displayed value with the **UP/DOWN** navigation keys.
6. Confirm each setting with **ENTER/ON**.
7. Press **CLEAR/OFF**, to return to the **MENU**.

Note: Press **CLEAR/OFF** again to return to the main menu.

4.5 Display setup

The first two lines of the display are user-selectable. In the default setting, the first row shows the main measurement variable and the second row shows the date/time.

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **DISPLAY**, confirm with **ENTER/ON**.
3. Select **LINE 1**, confirm with **ENTER/ON**.
4. Select option for **LINE 1**, confirm with **ENTER/ON**.
 - Measurement value
 - Homogeneity
 - Battery
 - Time
5. Select **LINE 2**, confirm with **ENTER/ON**.
6. Select option for **LINE 2**, confirm with **ENTER/ON**.
7. Press **CLEAR/OFF**, to return to the **MENU**.

*Note: Press **CLEAR/OFF** again to return to the main menu.*

4.6 Units setup

The following measurement units are available for turbidity and suspended solids:

Turbidity units (TR): FNU, NTU, EBC

Suspended solids units (TS1 to TS4): ppm, mg/L, g/L, %

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **UNITS**, confirm with **ENTER/ON**.
3. Select Measurement type, confirm with **ENTER/ON**.
4. Select Measurement unit, confirm with **ENTER/ON**.
5. Press **CLEAR/OFF**, to return to the **MENU**.

*Note: Press **CLEAR/OFF** again to return to the main menu.*

4.6.1 Sludge blanket level

Sludge blanket level can be measured by setting the units to mg/L, g/L or %.

Calibrate your system, and then slowly lower the sensor into the clarifier. The suspended solids concentration will significantly increase as it reaches the sludge blanket level. Once the blanket level is reached, look at the the sensor cable which is marked every meter to determine the sludge blanket level depth from the water surface.

4.7 Calibration

For turbidity measurement, a standard curve C-TU is already stored in the probe. Calibration is not required, but this curve must be allocated to the desired measurement point.

For suspended solids measurement, calibration is essential in order to set the rough measurement signals to a calibrated display (refer to [Section 5.1 on page 21](#)). TSS measurement is not possible without a valid measurement point definition or calibration. There are four calibration curves available: C-DS1, C-DS2, C-DS3, C-DS4. These curves can be allocated to the individual measurement points.

4.8 Definition of the measurement points

4.8.1 Overview of measurement points and curves

Abbreviations available on the instrument for measuring points	Abbreviations available on the instrument for calibration curves
• PST1 = Primary sedimentation tank 1 • PST2 = Primary sedimentation tank 2 • AT1 = Aeration tank 1 • AT2 = Aeration tank 2 • SST1 = Secondary sedimentation tank 1 • SST2 = Secondary sedimentation tank 2 • OutTu = Outlet turbidity • OutDS = Outlet dry substance • Dig-S = Digested sludge • Activ = Activated sludge • Turb = Turbidity • DS1 = Dry substance 1 • DS2 = Dry substance 2 • DS3 = Dry substance 3 • DS4 = Dry substance 4	• C-Tu = Turbidity curve (standard curve) • C-DS1 = Suspended solids curve (calibration curve) • C-DS2 = Suspended solids curve (calibration curve) • C-DS3 = Suspended solids curve (calibration curve) • C-DS4 = Suspended solids curve (calibration curve)

4.8.2 Allocation to measurement points

A calibration curve must be assigned to each measurement point. It is possible to assign one curve to several measurement points.

Example: If a measurement is to be taken in aeration tank 1 and aeration tank 2, it is a good idea to use the same curve if the media in the tanks are shown to have the same qualities. Measurement points that are not required can be deactivated so that the selection is smaller and the display is clearer. The measuring points are reactivated upon reallocation.

1. Select **MENU**, confirm with **ENTER/ON**.
2. **SELECT MEP-DEF.**, confirm with **ENTER/ON**.
3. Select measurement point ([Section 4.8.3](#)), confirm with **ENTER/ON**.
4. Select calibration curve (C-TU, C-DS1, C-DS2, C-DS3, C-DS4 or OFF), confirm with **ENTER/ON**.
5. Press **CLEAR/OFF**, to return to the **MENU**.

Note: Press **CLEAR/OFF** again to return to the main menu.

4.8.3 Measurements

4.8.3.1 Practical example for suspended solids measurement

Note: The type and composition of the solid particles of a medium can differ greatly. For this reason, it is not possible to define a general standard, and different measurement media must be calibrated specifically in each case.

Assumption: The measurement data of the measurements from two primary sedimentation tanks and two secondary clarifiers should be saved for later evaluation. It is assumed that the measurement medium in the two primary sedimentation tanks and in the two secondary clarifiers have the same quality, and that only one calibration per stage is required accordingly: Calibration curve 1 for the two primary sedimentation tanks and calibration curve 2 for the two secondary clarifiers.

1. Define four measurement points on the instrument (refer to section [4.8.2 on page 17](#))
2. For example, activate measurement points PST1, PST2, SST1 and SST2:
Allocate calibration curve 1 (e.g. C-DS1) to PST1 and PST2, and calibration curve 2 (e.g. C-DS2) to SST1 and SST2.
3. Calibrate curves 1 and 2 (refer to section [5.1.2 on page 21](#))
4. Select the appropriate measurement points in the tanks and start the measurements. The data will be automatically measured with the allocated calibration and saved at the correct position. (refer to section [5.1.1 on page 21](#))
5. The data will be displayed under the measurement point with date and time (refer to section [5.2 on page 24](#)).

4.8.3.2 Practical example for turbidity measurement

A standardized turbidity curve is stored in the probe for turbidity measurement; calibration is not necessary. Turbidity curve C-Tu must simply be allocated to the selected measurement points.

4.9 Integration time setup

Important Note: The integration time is only effective in the case of continuous measurement. The values are averaged out during this time, which results in a smooth measurement signal.

Upon delivery, the default value is set to 30 seconds. The integration time can be set to between 0 and 1000 seconds.

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **EXTRAS**, confirm with **ENTER/ON**.
3. Select **INTEGRATION**, confirm with **ENTER/ON**.
4. Select decimal places with the **RIGHT/LEFT** navigation keys.
5. Change the displayed value with the **UP/DOWN** navigation keys.
6. Confirm each setting with **ENTER/ON**.
7. Press **CLEAR/OFF**, to return to the **MENU**.

Note: Press **CLEAR/OFF** again to return to the main menu.

4.10 On time setup

The on time allows the probe to reach a stable operating condition once a measurement has been initiated. The measurement value is only generated toward the end of the set time. The default setting of the on time is 5 seconds. Certain applications may require more response time for more stability. The on time of 5–40 seconds is effective for the following measurement modes:

- Single measurement
 - Single measurement with data storage
 - Interval measurement (with automatic shut down)
1. Select **MENU**, confirm with **ENTER/ON**.
 2. Select **EXTRAS**, confirm with **ENTER/ON**.
 3. Select **ON-TIME**, confirm with **ENTER/ON**.
 4. Select decimal places with the **RIGHT/LEFT** navigation keys.
 5. Change the displayed value with the **UP/DOWN** navigation keys.
 6. Confirm each setting with **ENTER/ON**.
 7. Press **CLEAR/OFF**, to return to the **MENU**.

Note: Press **CLEAR/OFF** again to return to the main menu.

5.1 Calibration

Turbidity measurements do not need to be calibrated, as a standardized calibration curve according to ISO 7027 is stored in the instrument. It is possible to create a customer-specific calibration of the turbidity curve. If the standard curve has been altered, a star (*) appears before the measurement point.

Suspended solids measurements must be calibrated on site. It is not possible to define a general standard for this as the type and composition of the solid particles can differ greatly.

5.1.1 Special notes for calibration

Calibration containers

In order to avoid reflections of the measurement beam on the base and walls of the container, a black—or at the very least dark-colored—container should be used for calibration.

The probe may also remain in the tank, so long as a representative laboratory sample can be taken at this point.

Measured variable (homogeneity)

100% represents a homogeneous sample. After approximately 10 seconds, this measured variable provides a representative statement about the homogeneity of the measuring medium. The homogeneity is displayed as a percentage value after an individual measurement (Figure 8).

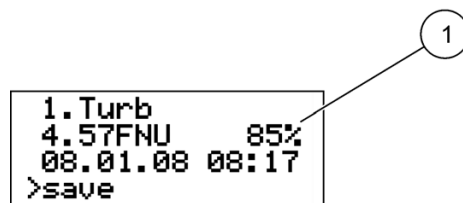


Figure 8 Homogeneity in %

1 Homogeneity

Replace the probe

As the calibration is carried out for the measuring system (meter and probe), only the probe supplied may be used for the measurements. If a different probe is used, the equipment must be recalibrated.

Note: If the probe is replaced, the instrument reports "incorrect probe." Enter **390** in menu option "**System**" using the navigation keys. This releases all the calibration curves for the suspended solids measurement. Then the instrument needs to be recalibrated.

5.1.2 Calibration procedure

The instrument can save one turbidity curve and up to four suspended solids calibration curves. This reduces the need for constant re-calibration for different locations or and/or types of sludge. Each measurement location can have one of the saved calibration curves assigned to it individually.

Note: During calibration, the automatic shut-down of the handheld instrument is deactivated.

1-point calibration

In order to define a calibration curve, it is generally sufficient to use a single calibration point in the probe's measuring range. This should lie in the upper third of the expected measuring range.

Note: If the measurement value is above or below the range defined by a point, the instrument displays an error message: Calibration insufficient +/- . This means an additional calibration point is required.

Multiple-point calibration

For a broad measuring range, a second calibration point must be recorded:

First calibration point (lower value) at as low a concentration as possible.

Second calibration point (upper value) at as high a concentration as possible.

Up to three calibration points per curve can be recorded. To record several calibration points, the test sample is diluted or sedimented. Recorded calibration points are indicated by a star (e.g. *point 1) and remain saved, even if the instrument is switched off in the meantime.

1. Put a representative sample of the measuring medium into a black container. Make sure that it is mixed evenly.
2. Use a part of this sample for the suspended solids analysis in the laboratory.
3. Clean the probe.
4. Insert the probe into the container.
5. Select **MENU**, confirm with **ENTER/ON**.
6. Select **CALIBRATION**, confirm with **ENTER/ON**. The instrument reads the probe data and an informative text appears in the display.
7. Select the curve shown, confirm with **ENTER/ON**.
8. Select the desired curve, confirm with **ENTER/ON**.
9. Select **MEMORY**, confirm with **ENTER/ON**.
10. Select **POINT...** (Point 1, 2 or 3), confirm with **ENTER/ON**. In so doing, stir the measuring medium with the probe. The distance between the probe head and the walls and base of the container must always be more than 70 mm (Figure 9). It takes 10 to 20 seconds to record the calibration point; then the selection menu for calibration appears. While recording, the display shows the note "Memory."
11. Remove the probe from the container and clean it. If necessary, record more calibration points with diluted or settled samples. Remove part of these samples for the suspended solids analysis in the laboratory.
12. Determine the suspended solids of the sample(s) in the laboratory.
13. Select *Point... (*Point 1, 2 or 3), confirm with **ENTER/ON**.
14. Enter the laboratory value using the navigation keys, press **ENTER/ON** to confirm.
 - Navigation key **LEFT/RIGHT**: Jump to the next/previous decimal figure
 - Navigation key **UP/DOWN**: Change number
15. The laboratory value is saved. The main menu is shown.

Repeat steps 1 to 15 to record additional calibration points.

The instrument automatically sorts the saved calibration points according to the size of the calibration values, irrespective of the sequence in which the calibration points were recorded.

Point 1 is always allocated the lowest calibration value.

Point 2 is allocated the next higher calibration value.
Point 3 is allocated the highest calibration value.

The value determined in the laboratory can be corrected at anytime by overwriting (refer to 5.1.3).

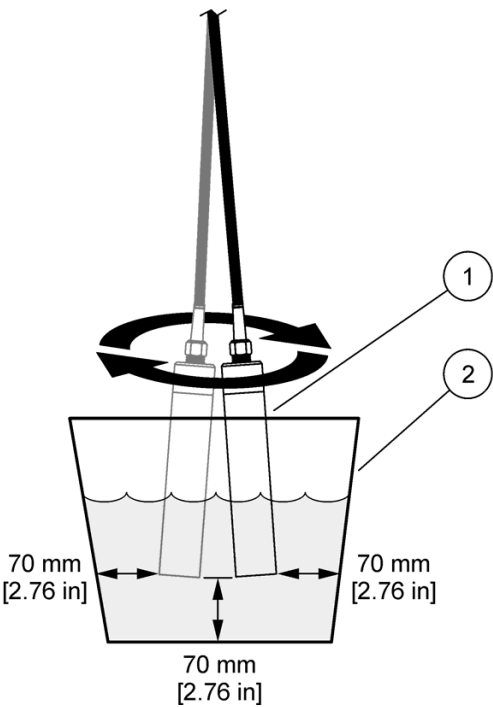


Figure 9 Minimum distances of the probe head in the container

1	Probe	2	Container
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5.1.3 Manual calibration value correction

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **CALIBRATION**, confirm with **ENTER/ON**. The instrument reads the probe data.
3. Select the curve shown, confirm with **ENTER/ON**.
4. Select the desired curve, confirm with **ENTER/ON**.
5. Select the desired point, confirm with **ENTER/ON**.
6. Overwrite the existing calibration point.
7. Enter the value for the calibration point using the navigation keys, confirm with **ENTER/ON**.
 - Navigation key **LEFT/RIGHT**: Jump to the next/previous decimal figure
 - Navigation key **UP/DOWN**: Change number

5.1.4 Delete calibration point

Same procedure as in [section 5.1.3](#). Set the concentration of the calibration point to the value 0.000, confirm with **ENTER/ON**. The calibration point is deleted.

5.1.5 Reset to default calibration

If the turbidity calibration was changed, it can be reset to the default calibration in accordance with ISO 7027.

Note: Stop the current measurement before the default calibration is reset.

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **CALIBRATION**, confirm with **ENTER/ON**. The instrument reads the probe data.
3. Select turbidity curve **C-TU**, confirm with **ENTER/ON**.

Note: If turbidity curve **C-TU** is not shown in the menu, select the curve shown and confirm with **ENTER/ON**. The selection menu for the curve is shown. Select curve **C-TU**, confirm with **ENTER/ON**. Curve **C-TU** is activated. Open the selection menu for curve **C-TU** with **ENTER/ON**, select **RESET**, confirm with **ENTER/ON**.

4. Press navigation key **UP/DOWN**, select **RESET**, confirm with **ENTER/ON**.

The reset function is not to be used to reset the suspended solids curves. Suspended solids curves are reset when all calibration points are deleted. Refer to [section 5.1.4](#) for details.

5.2 Measurement

Note: In order to obtain suspended solids measurement results, the instrument must be calibrated before the first measurement is taken.

The following measurement types are possible:

- Single measurement
- Single measurement with data storage
- Interval measurement
- Continuous measurement

5.2.1 Single measurement

No data is stored for the single measurement. The values are shown on the display.

1. Select **MEAS**, confirm with **ENTER/ON**.
2. Select **SINGLE**, confirm with **ENTER/ON**.
3. Select desired measurement point **MEP:...**, confirm with **ENTER/ON**. The measurement points available for selection are those that are activated in the measurement point definition (menu option **MEP-DEF.**).
4. Select **MEASURE NOW**, confirm with **ENTER/ON**.
5. Read off the measurement value from the display.

5.2.2 Single measurement with data storage

With selecting single measurement with data storage, the displayed results can be stored if required.

1. Select **MEAS**, confirm with **ENTER/ON**.
2. Select **SINGLE+SAVE**, confirm with **ENTER/ON**.
3. Select desired measurement point **MEP:...**, confirm with **ENTER/ON**. The measurement points available for selection are those that are activated in the measurement point definition (menu option **MEP-DEF.**).
4. Select **MEASURE NOW**, confirm with **ENTER/ON**.
5. Select **YES** or **NO**, confirm with **ENTER/ON**.
6. After the measurement is taken, **save** and confirm with **ENTER/ON**.

*Note: Selecting **NO** will abort the saving procedure.*

5.2.3 Interval measurement

On interval measurement, the data is measured at certain intervals. As soon as the interval period has been reached, the instrument starts automatically, saves the current measurement value and switches back to standby (power save) mode. This means that the display also goes out.

1. Select **MEAS**, confirm with **ENTER/ON**.
2. Select **INTERVAL**, confirm with **ENTER/ON**.
3. Select desired measurement point **MEP:...**, confirm with **ENTER/ON**. The measurement points available for selection are those that are activated in the measurement point definition (menu option **MEP-DEF.**).
4. Select **INTERVAL** and set the time interval (1/2/3/4/5/6/10/12/15/20/30/60 minutes) for the measurements.
5. Enter the interval using the navigation keys, confirm with **ENTER/ON**.
 - Navigation key **LEFT/RIGHT**: Jump to the next/previous decimal figure
 - Navigation key **UP/DOWN**: Change number
6. Select **MEASURE NOW**, confirm with **ENTER/ON**. After measuring, the instrument switches into standby mode.

Suspend standby mode/interval measurement

1. Turn on the instrument with **ENTER/ON**. Scrolling text on the display shows that an interval measurement is taking place.
2. Select **MEAS**, confirm with **ENTER/ON**.
3. Select **STOP**, confirm with **ENTER/ON**.

5.2.4 Continuous measurement

On continuous measurement, measurements are taken continuously, and the current measurement value is saved at intervals.

1. Select **MEAS**, confirm with **ENTER/ON**.
2. Select **CONTINUOUS**, confirm with **ENTER/ON**.
3. Select desired measurement point **MEP:...**, confirm with **ENTER/ON**. The measurement points available for selection are those that are activated in the measurement point definition (menu option **MEP-DEF**.).
4. Select **INTERVAL**, confirm with **ENTER/ON**.
5. Enter the interval using the navigation keys, confirm with **ENTER/ON**.
 - Navigation key **LEFT/RIGHT**: Jump to the next/previous decimal figure
 - Navigation key **UP/DOWN**: Change number
6. Select **MEASURE NOW**, confirm with **ENTER/ON**.
7. Read off the measurement value from the display.

5.2.4.1 Interrupt and restart the continuous measurement

1. Press **CLEAR/OFF** for two seconds. The instrument switches off and the continuous measurement is suspended.
2. Press **ENTER/ON** for two seconds. The instrument switches on and the continuous measurement continues with the same settings as before the instrument was switched off.

5.2.4.2 Stop the continuous measurement

1. Select **MEAS**, confirm with **ENTER/ON**.
2. Select **STOP**, confirm with **ENTER/ON**.

5.3 Display the data

The display shows the stored data for the measurement points.

1. Select **DATA**, confirm with **ENTER/ON**.
2. Select desired measurement point **MEP:...**, confirm with **ENTER/ON**. Only those measurement points are displayed, which contain saved data.
3. Select **DISPLAY MEP**, confirm with **ENTER/ON**. The data is shown in the display.
4. Display additional data with **ENTER/ON**.

5.4 Delete data from a measurement point

1. Select **DATA**, confirm with **ENTER/ON**.
2. Select desired measurement point **MEP:...**, confirm with **ENTER/ON**. Only those measurement points are displayed, which contain saved data.
3. Select **DELETE MEP**, confirm with **ENTER/ON**.
4. Select **YES**, confirm with **ENTER/ON**.

Note: NO aborts the erasing procedure.

5.5 Delete saved data from all measurement points

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **SYSTEM**, confirm with **ENTER/ON**.
3. Set the value in the **System** menu to **379** using the navigation keys, confirm with **ENTER/ON**.

Section 6 Maintenance

The cleanliness of the measurement windows in probe is important to maintain accurate readings!

Cleaning the measurement windows

The windows are made of sapphire glass. If required, they can be cleaned with any conventional cleaning agent and a soft cloth. In the case of stubborn deposits, wipe it with a soft cloth soaked in the 5% hydrochloric acid.

WARNING: Observe safety conditions and wear protective clothing!

- Safety glasses
- Gloves
- Overalls

Section 7 Troubleshooting

7.1 Error messages

Problem/display screen	Caused by	Action
Communication with probe	The probe is not connected to the instrument	- Plug in the probe - Check the connection to the probe - Correct probe number
EEPROM error	Values cannot be saved	Switch the instrument off and then back on again
Overflow area	Concentration too high	- Probe is measuring in an unsuitable medium - Recalibration may be required
Clean the probe	Probe is dirty	- Clean the probe - May be triggered by non-homogeneous measuring medium
Offset error	Calibration point set incorrectly (calibration point too close to the zero point)	Recalibration required
Calibration error	No calibration available, calibration points set incorrectly (upper and lower calibration points transposed)	Recalibration required. (There is no suspended solids curve in the probe when shipped from the factory)
Calibration insufficient ->-	Additional calibration point with lower concentration is missing	Additional calibration point with lower concentration is required
Calibration insufficient ->+	Additional calibration point with higher concentration is missing	Additional calibration point with greater concentration is required
Probe error	Technical error in the probe	- Switch the instrument off and then back on again - If the message is repeated, send the probe for repair
First MEASUREMENT=Stop	Continuous or interval measurement was not stopped before performing a calibration	Stop the continuous or interval measurement before calibration
Battery is empty	Battery not charged	Charge the battery fully
Incorrect probe	Probe has been replaced but not correctly registered to the handheld instrument	- Connect the correct probe - If necessary, release the suspended solids curve for the new probe with Code 390 and recalibrate
Error time/date	Time/date implausible	- Switch the instrument off and then back on again - Check the time/date set - If required, change the clock batteries¹⁾

¹ If the message is repeated, send the instrument for repair

7.2 Informative messages

Display screen	Caused by	Action/Note
Wait	Calibration is being recorded	Wait (probe in calibration medium)
Manufacturer standard	Measurement value is outside the standard (only for turbidity)	Value is above the DIN standard of 4000 FNU (NTU)
Interval measurement...	The instrument is carrying out an interval measurement	Ongoing interval measurement

Section 8 Replacement Parts

Description – Replacement Parts for Amrica and Asia	Catalog number
TSS Portable hand-held system (TSS Portable hand-held system includes meter, TSS probe (10m cable, plug), charger with four adapters (ES, USA, GB and AUS/China) batteries, manual and carry case	LXV322.99.00002
TSS Portable handheld meter only	LXV320.99.00002
TSS probe only (10m cable, plug)	LXV321.99.00002
6 x rechargeable NiMH batteries, AA min. 1.8 Ah	LZY604
Charger for rechargeable batteries with 4 plug adapters	LZY607
Battery holder	LZY606
Empty, hard-sided instrument case with handle	LZY605
Description – Replacement Parts for Europe and North Africa	Catalog number
TSS Portable hand-held system (TSS Portable handheld system includes meter, TSS probe (10m cable, plug), charger with four adapters (ES, USA, GB and AUS/China) batteries, manual and carry case	LXV322.99.00001
TSS Portable handheld meter only	LXV320.99.00001
TSS probe only (10m cable, plug)	LXV321.99.00001
6 x rechargeable NiMH batteries, AA min. 1.8 Ah	LZY604
Charger for rechargeable batteries with 4 plug adapters	LZY607
Battery holder	LZY606
Empty, hard-sided instrument case with handle	LZY605

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Section 10 Limited warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

