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TSS Portable handheld measurement instrument for turbidity/solids

User Manual

06/2021, Edition 7

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Section 1 Specifications

These are subject to change without notice.

Performance specifications		
Wavelength	860 nm	
Parameter	**Turbidity**	**Solids (dry matter)**
Measurement method	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	0.001–9999 FNU (NTU)	0.001–400 g/L (upper limit depends on matrix)
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
Precision	Measuring range: 0.001–9999 FNU Accuracy of the measurement value: < 3 % or +/- 0.02 FNU (whichever is greater)	Measuring range: 0.001–400 g/L Accuracy of the 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
Sample temperature	0–60 °C (32–140 °F), up to 80 °C (176 °F) briefly	
Pressure range	Max. 10 bar	
Display	LCD, alphanumeric, 4 rows of 16 characters	
Input	6 membrane keys, menu with quick access to important functions	
Power supply (rechargeable batteries)	6 rechargeable NiMH batteries, type AA HR6 (recommended: 1.2 V/min. 1800 mAH)[1]	
Power consumption	Approx. 60 mA	
Data log	Up to 290 measurement values	
Interface	RS 485	
Probe material	Stainless steel, sapphire	
Cable	10 m (33 ft), PUR, ∅ 8.3 mm (0.33 in.); S-2000 connector, 6-pin	
Protection class	Probe: IP68 Control unit: IP 55	
Size	Probe: ∅ 40 mm (1.57 in.), length = 29 cm (11.42 in.) Control unit: 11 × 23 × 4 cm (4.33 × 9 × 1.57 in.)	
Weight	Probe: 1600 g (3.53 lb) Control unit: 560 g (1.23 lb)	
Warranty	2 years	

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment.

Section 2 General Information

2.1 Safety information

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

To prevent damage to or impairment of the device's protection equipment, the device may only be used or installed as described in this manual.

2.1.1 Hazard notices in this manual

⚠DANGER

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

⚠WARNING

Indicates a potentially or imminently dangerous situation that, if it is not avoided, can lead to death or to serious injuries.

⚠CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury if it is not avoided.

NOTICE

Indicates a situation that, if it is not avoided, can lead to damage to the device. 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.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol may be found on an enclosure or barrier within the product and indicates a risk of electric shock and/or death by electrocution.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems after 12 August 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 manufacturer for disposal at no charge to the user. ***Note:*** *Please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment, manufacturer-supplied electrical accessories, and all auxiliary items for recycling or proper disposal.*

2.2 Overview of product

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

2.3 Measurement instrument

The instrument stores the recorded data under the corresponding calibration curve. Four calibration curves for solids (C-DS1, C-DS2, C-DS3, C-DS4) and one calibration curve for turbidity (C-TU) are available for selection.

For solids measurements, a specific calibration must be assigned to each measurement point (section 5.1, page 23).

All measurement values are saved with details of the selected calibration curve, the measurement value, the homogeneity, the date and the time.

Various individual parameters for input, signal processing and output can be set in the menu (Section 4, page 15).

2.4 Measuring principle

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 is 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. Care must therefore be taken to ensure 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.

⚠ WARNING

Risk of falling. Measurements are taken directly on site with this instrument. In order to avoid falling into the basin, all 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 may catch unintentionally on a slide or stirrer and the connected probe cable may put the user at risk.

3.1 Product contents

After taking the instrument out of the case, check each part for damage. All the components on the enclosed list must be present. If any parts are missing or damaged, please contact the manufacturer or the distributor.

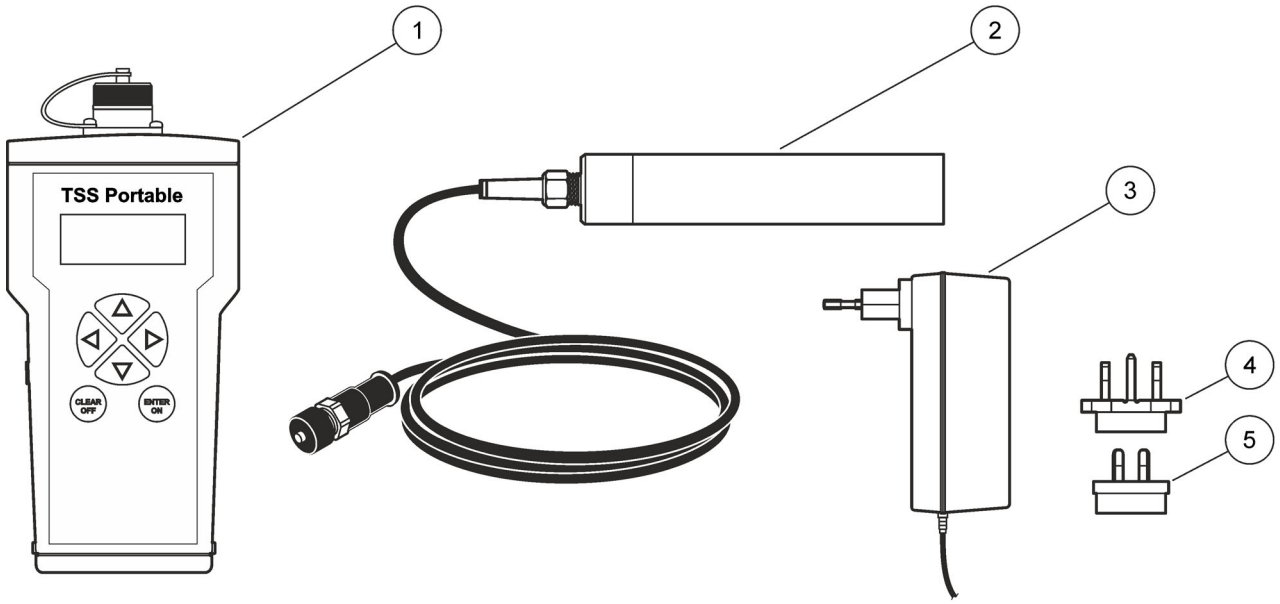


Figure 1 Product contents

1	TSS Portable handheld instrument	**4**	UK adapter plug[1]
2	Probe with 10 m (32.8 ft) cable	**5**	AUS adapter plug[1]
3	Charger with EU adapter plug installed[1]		

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment. If the charger is not part of the shipment, charge the batteries with a charger available in your country. Make sure that the charger agrees the battery specifications.

3.2 Powered via rechargeable batteries

⚠WARNING

Risk of fire and explosion. Only use rechargeable NiMH batteries and ensure that the rechargeable NiMH batteries are inserted correctly in the battery compartment. Incorrect insertion of the rechargeable NiMH batteries may damage the instrument or lead to fire or explosions.

⚠WARNING

Risk of fire and explosion. When using not rechargeable AA batteries, the not rechargeable batteries could explode if the instrument is connected to the charger. Only use rechargeable NiMH batteries from the manufacturer of the instrument.

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

NOTICE

Remove the rechargeable NiMH batteries if the instrument is not to be used for a period of time.
Only use rechargeable NiMH batteries from the manufacturer of the instrument.

3.2.1 Inserting the rechargeable 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 the delivered six rechargeable NiMH batteries into the battery holder. Take note of the markings for the polarity.

Note: *Make sure that the rechargeable 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 engages in the catches.

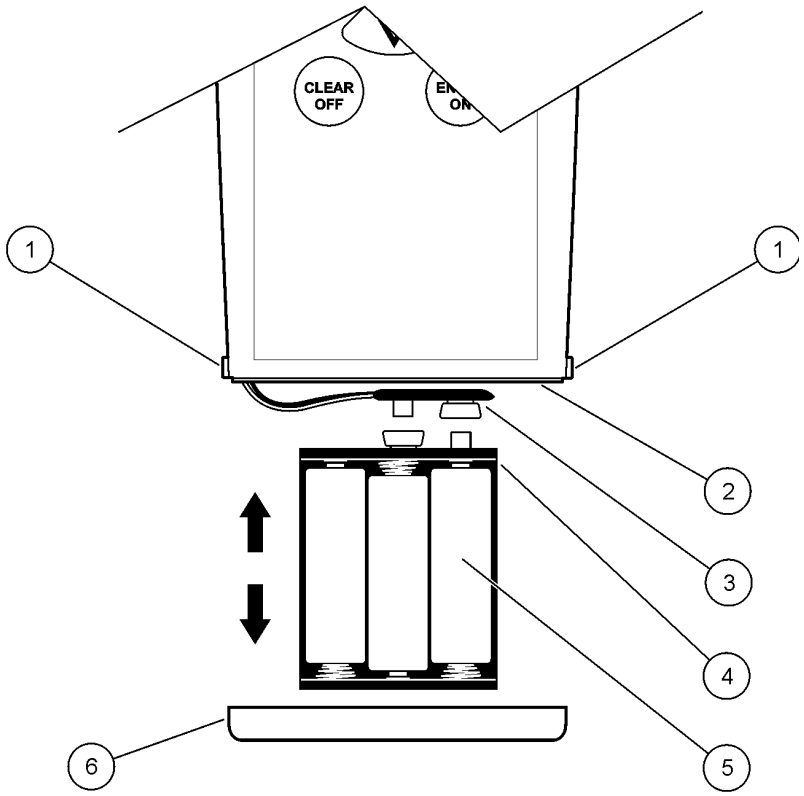


Figure 2 Inserting the rechargeable batteries

1	Catch	**4**	Battery holder
2	Battery compartment	**5**	rechargeable Batteries
3	Battery clip	**6**	Cap

3.2.2 Install the charger[1]

⚠WARNING

Risk of fire and explosion.

Only use the battery charger to charge the rechargeable NiMH batteries, while batteries inside the instrument.

1. Fix the required adapter to the charger, until it audibly locks into place.
2. Insert the charging plug (item 2, Figure 4) into the charging socket (item 3, Figure 4) of the instrument.
3. Connect the power (100–240 V~/50–60 Hz).

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment. If the charger is not part of the shipment, charge the batteries with a charger available in your country. Make sure that the charger agrees the battery specifications.

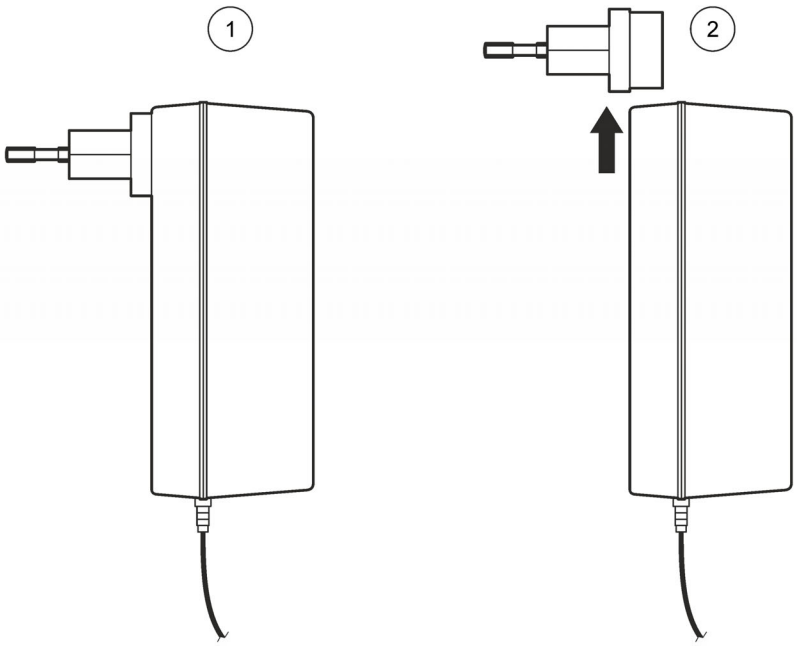


Figure 3 Replacing the adapter

1	Charger[1]	**2**	Removing the adapter

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment. If the charger is not part of the shipment, charge the batteries with a charger available in your country. Make sure that the charger agrees the battery specifications.

3.2.3 Charging the rechargeable batteries

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

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

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

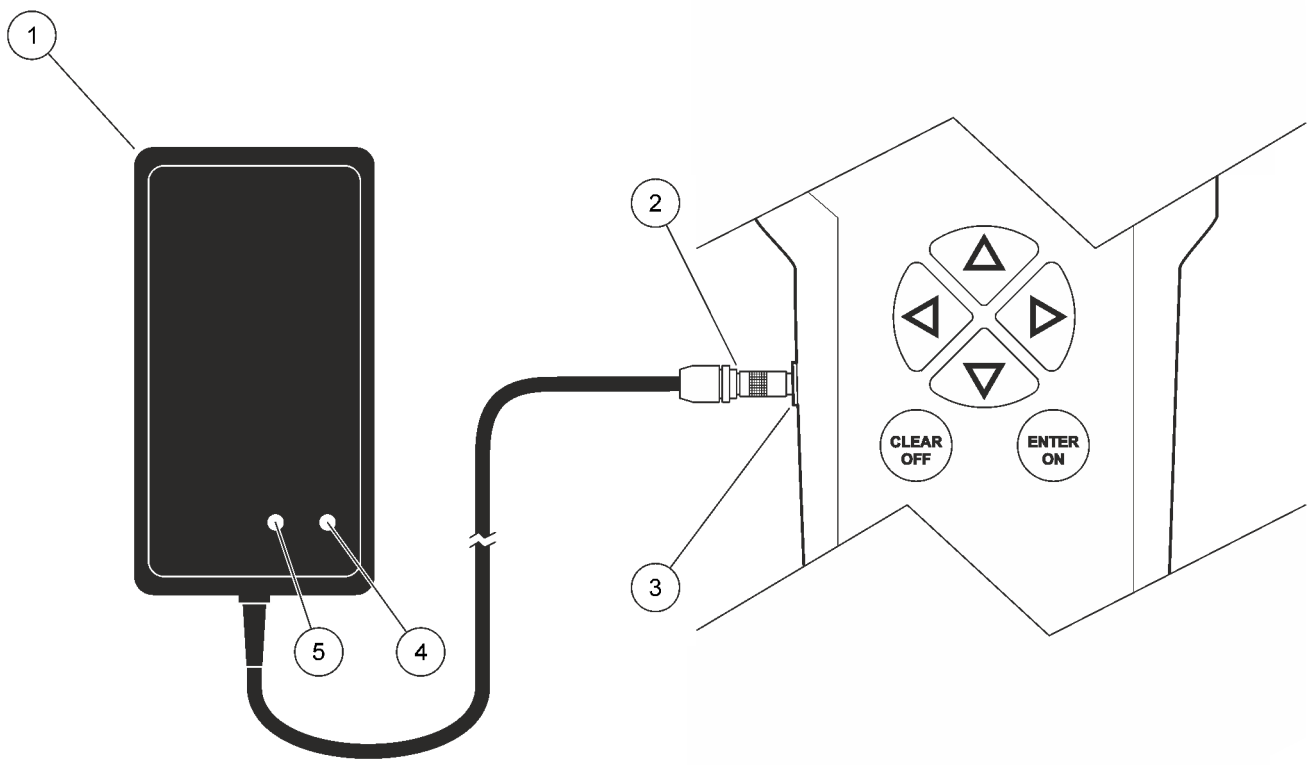


Figure 4 Charging the rechargeable batteries

1	Charger[1]	**4**	Red/yellow LED flashes: Fault state
2	Charging plug	**5**	Green LED flashes: rechargeable batteries currently charching Green LED is on: rechargeable batteries fully charged
3	Charging socket		

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment. If the charger is not part of the shipment, charge the batteries with a charger available in your country. Make sure that the charger agrees the battery specifications.

3.3 Connecting the probe

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

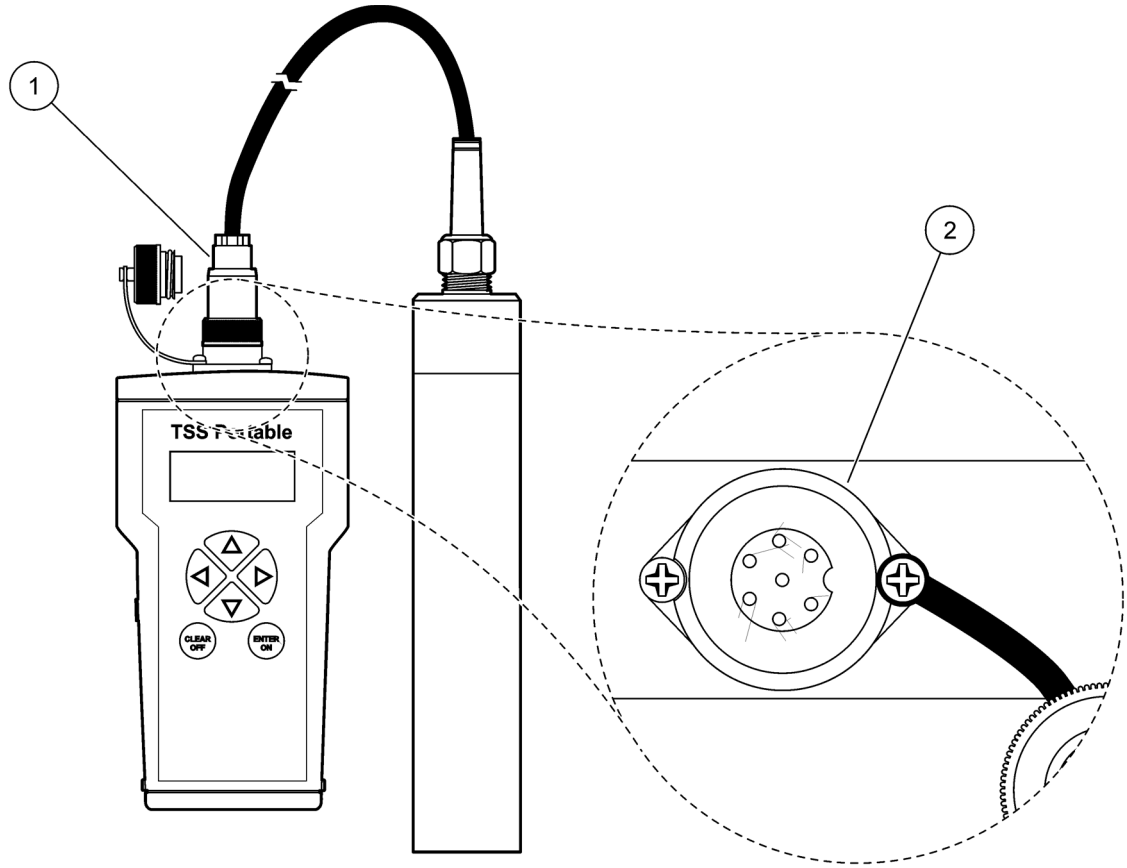


Figure 5 Connecting the probe plug to the instrument

1	Probe plug	**2**	Probe connection

3.4 Switching the instrument on and off

1. Fully charge the rechargeable batteries (see section 3.2.3).

   Note: *The rechargeable 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 rechargeable batteries.*

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

3.4.1 Register a new probe

If a new probe is connected during initial installation, the error message "Incorrect probe" is displayed.

1. Select **MENU** and confirm with **ENTER/ON**.
2. Select **SYSTEM** and confirm with **ENTER/ON**.
3. Enter code **390** using the navigation keys (see section 4.2, page 15) and confirm with **ENTER/ON**.
4. Select **CLEAR/OFF** twice to return to the main menu.

   Note: *The probe is now registered and the TS curves can be calibrated (see section 5.1, page 23).*

Section 4 Start Up

4.1 System start overview

1. Switch on the measurement instrument (section 3.4, page 14).
2. Connect the probe to the measurement instrument (section 3.3, page 13).
3. Edit the time/date, display, units, language and integration time (section 4.3, page 17).
4. Calibration of the solids calibration curve in line with calibration instructions (section 4.7, page 19).
5. Select desired calibration curve (section 4.8, page 19).
6. Show the data in the display (section 5.3, page 27).

4.2 User interface and navigation

4.2.1 Keypad

Figure 6 shows the navigation keys on the instrument.

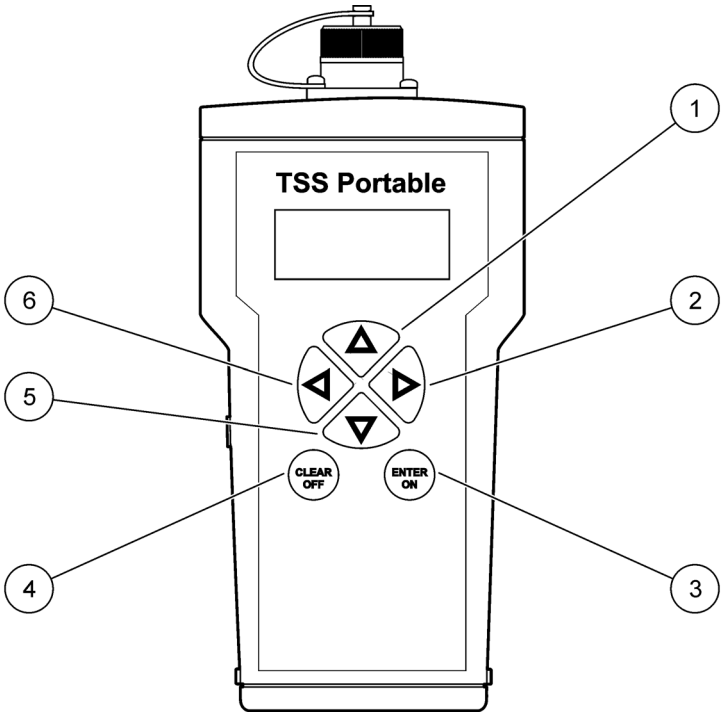


Figure 6 Description of the keypad

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

In its basic setting, the display shows the main measurement variables and the date/time (Figure 7). It can be set in a user-defined manner, see section 4.5, page 18.

Table 1 Navigating 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**. – Switch 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 entries. – Switch 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

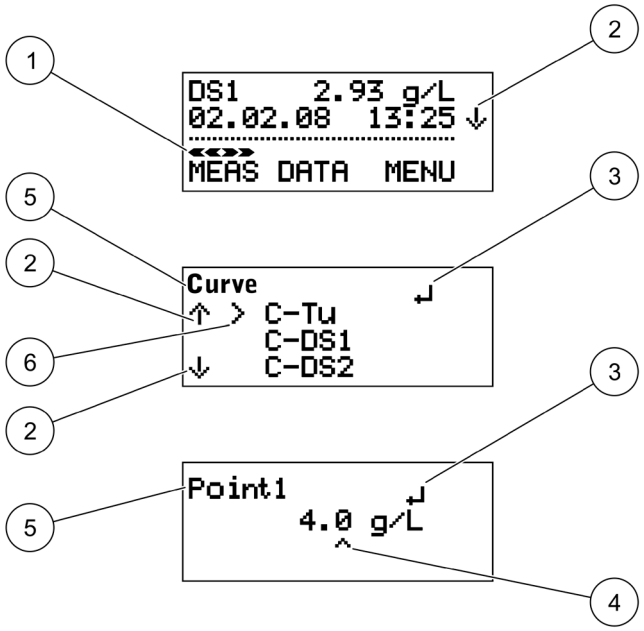


Figure 7 Display of results from the instrument with connected probe

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

4.2.2.1 Querying internal information

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

The following information is displayed:

a. Measurement value (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
- Serial no. XXXXX (instrument designation)
- Software version XXXXX (instrument designation)

4.3 Select language

The instrument supports the 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** and confirm with **ENTER/ON**.
3. Select **DEUT./GERMAN.** for German or **ENGL./ENGLISH** for English and confirm with **ENTER/ON**.
4. Press **CLEAR/OFF** to return to the main menu.

4.4 Setting the date and time

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. Change the displayed values with the navigation keys.
5. Confirm each setting with **ENTER/ON**.
6. Press **CLEAR/OFF** to return to the **MENU**.

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

4.5 Setting the display

It is possible to custom-define the first two rows of the display. In the standard setting, the first line shows the main measured variable and the second line shows the date/time.

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **DISPLAY**, confirm with **ENTER/ON**.
3. Select **ROW 1**, confirm with **ENTER/ON**.
4. Select option for **ROW 1**, confirm with **ENTER/ON**.
   - Measurement value
   - Homogeneous
   - Battery
   - Time
5. Select **ROW 2**, confirm with **ENTER/ON**.
6. Select option for **ROW 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 Setting the units

The following measurement units are available for turbidity and solids:

Turbidity units (TU): FNU, NTU, EBC

Solids units (DS1 to DS4): ppm, mg/L, g/L, %

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **UNITS**, confirm with **ENTER/ON**.
3. Select the desired calibration curve (C-TU, C-DS1, C-DS2, C-DS3 or C-DS4) and confirm with**ENTER/ON**.
4. Select the desired measurement unit and 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

To determine the sludge blanket level, set the units to mg/L, g/L or %. Select an integration time of 0 seconds (refer to section 4.9, page 21) to increase the response time. Calibrate the measurement system and slowly lower the sensor into the clarifier. Once the sludge blanket level is reached, the solids concentration will increase significantly. The distance of the sludge blanket from the surface of the water can then be read off from the meter markings on the probe cable.

4.7 Calibration

For turbidity measurement, a standard curve C-TU is already stored in the probe. Calibration is not required.

However, for solids measurement, calibration is required in order to set the rough measurement signals to a calibrated display (refer to section 5.1, page 23). A precise solids measurement is not possible without 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 Defining the measurement points

4.8.1 Overview of calibration curves

- C-TU = Turbidity curve (standard curve)
- C-DS1 = solids curve 1 (calibration curve)
- C-DS2 = solids curve 2 (calibration curve)
- C-DS3 = solids curve 3 (calibration curve)
- C-DS4 = solids curve 4 (calibration curve)

4.8.2 Measurements

4.8.2.1 Practical example for 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.*

For the solids measurement, calibration is required. There are four curves available: C-DS1, C-DS2, C-DS3, C-DS4. Each curve can be assigned to any measurement point. In the example, curve C-DS1 is selected.

1. Connect the probe to the instrument.
2. To switch on the instrument, press **ENTER/ON** for 2 seconds.

Select calibration curve

3. Select **MENU**, confirm with **ENTER/ON**.
4. Select **CALIBRATE**, confirm with **ENTER/ON**.
5. Select **CURVE C-TU** and confirm with**ENTER/ON**.

   Note: *Curve C-TU is the default setting.*

6. Select calibration curve **C-DS1** with the navigation keys **UP/DOWN** and confirm with**ENTER/ON**.

   The instrument reads the probe data and info text appears on the display.

Calibrate curve C-DS1:

7. Select **MEMORY** and confirm with **ENTER/ON**.
8. Lower the probe into a container that contains a homogeneous sample.
9. Select **POINT 1** and confirm with **ENTER/ON** while stirring 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 (2.76 in.).
   It takes 5 to 20 seconds to record the calibration point; then the selection menu for calibration appears. While recording, the display shows the note "Memory".
10. Take the probe out of the container and clean it.
11. Determine the solids content of the sample in the laboratory.
12. Select ***POINT 1** and confirm with**ENTER/ON**.
13. Enter the laboratory value with the navigation keys and confirm with **ENTER/ON**.
    - Navigation key **LEFT/RIGHT**: Jump to next/previous decimal place
    - Navigation key **UP/DOWN**: Change number

    The laboratory value is saved. The main menu is shown.

Measure:

14. Select **MEASURE**, confirm with **ENTER/ON**.
15. Select **START** and confirm with **ENTER/ON**.

    Note: *Data is automatically saved every minute, max. 290 measurement points.*

Stop measurement:

16. Select **MEASURE**, confirm with **ENTER/ON**.
17. Select **STOP**, confirm with **ENTER/ON**.

Delete the saved measurement points:

18. Select **DATA**, confirm with **ENTER/ON**.
19. Select **DELETE MEP** and confirm with**ENTER/ON**.
20. Select **YES** and confirm with**ENTER/ON**.

4.8.2.2 Practical example for turbidity measurement

A standard curve C-TU is stored for the turbidity measurement.

1. Connect probe to instrument.
2. To switch the instrument on, press **ENTER/ON** for 2 seconds.
3. Select **READ** and confirm with**ENTER/ON**.
4. Place probe in measuring medium.
5. Select **START** and confirm with **ENTER/ON**.

   Note: *The data is automatically saved every minute, max. 290 measurement points.*

6. To stop the measurement, select **READ** and confirm with **ENTER/ON**.
7. Select **STOP**, confirm with **ENTER/ON**.

Delete the saved measurement points:

8. Select **DATA** and confirm with **ENTER/ON**.
9. Select **DELETE MEP** and confirm with**ENTER/ON**.
10. Select **YES** and confirm with **ENTER/ON**.

4.9 Setting the integration time

Note: *The measurement values are averaged out over the integration time, which results in a smooth measurement signal. For the sludge blanket level measurement (refer to section 4.6.1, page 18), select the integration time 0 seconds.*

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** and confirm with **ENTER/ON**.
2. Select **EXTRAS** and confirm with **ENTER/ON**.
3. Select **INTEGRATION** and confirm with**ENTER/ON**.
4. Change the displayed value with the navigation keys.
5. Confirm each entry with **ENTER/ON**.
6. Press **CLEAR/OFF** to return to the **MENU**.

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

Section 5 Operation

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.

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

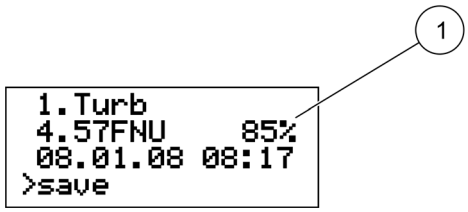


Figure 8 Homogeneity in %

1	Homogeneity

Replacing 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 you have changed the probe, the error message "Incorrect probe" is displayed. Register the new probe under* ***MENU > SYSTEM*** *with the code* ***390*** *(see section 3.4.1, page 14). This releases all the calibration curves for the solid matter measurement. The instrument then needs to be recalibrated.*

5.1.2 Calibrating

The instrument can save one turbidity curve and up to four solids calibration curves. This makes measurements in media with different qualities possible. Each measurement point can have one of the saved calibration curves assigned to it individually.

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 below or above 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 broad measuring ranges, 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 sample is diluted or sedimented. Recorded calibration points are indicated by a star (e.g. ⋆point 1) and remain saved even if the device is switched off in the meantime.

1. Fill a black container with a representative sample of the measuring medium. Ensure that it is mixed evenly.
2. Use a part of the sample for the solids analysis in the laboratory.
3. Clean the probe.
4. Dip the probe into the container.
5. Select **MENU**, confirm with **ENTER/ON**.
6. Select **CALIBRATE**, confirm with **ENTER/ON**.

   The instrument reads the probe data and info text appears on the display.
7. Select the curve shown and confirm with **ENTER/ON**.
8. Select the desired curve and confirm with **ENTER/ON**.
9. Select **MEMORY** and confirm with **ENTER/ON**.
10. Select **POINT…** (Point 1, 2 or 3), confirm with **ENTER/ON.** In doing so, 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 (2.76 in.) (Figure 9).
    It takes 5 to 20 seconds to record the calibration point; then the selection menu for calibration appears. While recording, "Memory" is indicated on the display.
11. Take the probe out of the container and clean it. If necessary, record more calibration points with diluted or settled samples. Remove part of these samples for the solids analysis in the laboratory.
12. Determine the solids content of the sample(s) in the laboratory.
13. Select ***POINT…** (*Point 1, 2 or 3) and confirm with **ENTER/ON**.

14. Enter the laboratory values using the navigation keys and confirm with **ENTER/ON**.

- Navigation key **LEFT/RIGHT**: Jump to the next/previous decimal place
- Navigation key **UP/DOWN**: Change number

The laboratory value is saved. The main menu is shown.

Repeat steps 1 to 14 to record additional calibration points.

The instrument automatically sorts the saved calibration points according to the size of the calibration values. The sequence in which the calibration points were recorded is not considered.
Point 1 is always allocated the lowest calibration value.
Point 2 is allocated the next larger calibration value.
Point 3 is allocated the largest calibration value.

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

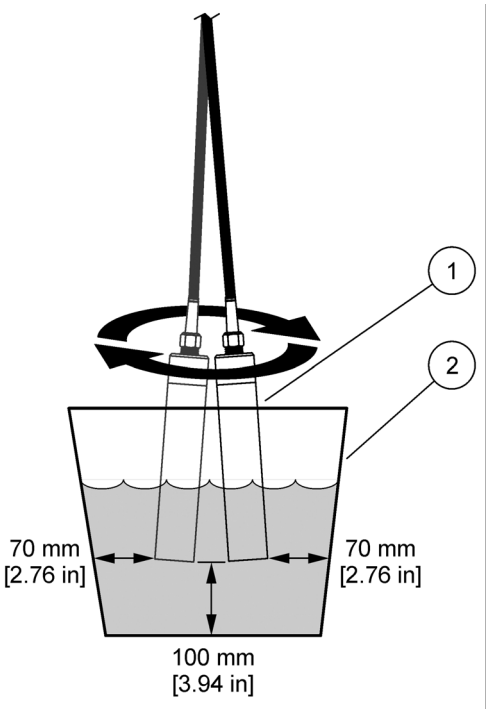


Figure 9 Minimum distances of the probe head in the container

1	Probe	**2**	Container

5.1.3 Manual calibration value correction

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **CALIBRATE**, confirm with **ENTER/ON**.

   The instrument reads the probe data.
3. Select the curve shown and confirm with **ENTER/ON**.
4. Select the desired curve and confirm with**ENTER/ON**.
5. Select the desired point and confirm with **ENTER/ON**.
6. Overwrite the existing calibration point.
7. Enter the value for the calibration point using the navigation keys and confirm with **ENTER/ON**.
   - Navigation key **LEFT/RIGHT**: Jump to next/previous decimal place
   - 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 and 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 **CALIBRATE**, confirm with **ENTER/ON**.

   The instrument reads the probe data.
3. Select turbidity curve **C-Tu** and 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 curves is shown. Select curve **C-Tu** and confirm with **ENTER/ON**. Curve C-TU is activated.*
   *Open the selection menu for curve C-TU with **ENTER/ON**, select **RESET** and confirm with **ENTER/ON**.*

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

The DS curves can also be reset to the default calibration (1-point calibration at 4 g/L). However, a precise determination of the solids concentration can only be obtained through calibration (refer to section 5.1, page 23).

5.2 Measure

Note: *In order to obtain precise solids measurement results, you must calibrate the instrument before the first measurement is taken.*
Without any calibration of the DS curves, the instrument returns to 1-point default calibration at 4 g/L. Deviations from the actual measurement value may occur.

5.2.1 Selecting the calibration curve

Before starting the measurement, the calibration curve that corresponds to the measurement point must be selected.

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **CALIBRATE**, confirm with **ENTER/ON**.
3. Selectthe curve shown and confirm with **ENTER/ON**.
4. Select the desired curve with the navigation key **UP/DOWN** and confirm with **ENTER/ON**.
5. Select **CLEAR/OFF** twice to return to the main menu.

5.2.2 Start the measurement

When starting the measurement, the measurement is carried out continuously and the current measurement value is saved at intervals.

1. Select **MEASURE**, confirm with **ENTER/ON**.
2. Select **START** and confirm with **ENTER/ON**.

5.2.3 Interrupt and resume the measurement

1. Press **CLEAR/OFF** for 2 seconds.

   The instrument is switched off and the measurement is interrupted.
2. Press **ENTER/ON** for 2 seconds.

   The instrument switches on and the measurement continues with the same settings as before the instrument was switched off.

5.2.4 Stop measurement

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

5.3 Show the data in the display

The display shows the stored data for the corresponding calibration curves.

1. Select the desired calibration curve (refer to section 5.2.1, page 27).
2. Select **DATA**, confirm with **ENTER/ON**.
3. Select **DISPLAY DATA** and confirm with **ENTER/ON**.

   Only the stored data for the selected calibration curve is displayed.

5.4 Delete data for a calibration curve

1. Select the desired calibration curve (refer to section 5.2.1, page 27).
2. Select **DATA**, confirm with **ENTER/ON**.
3. Select **DELETE MEP** and confirm with **ENTER/ON**.

   Only the stored data for the selected calibration curve is deleted.
4. Select **YES**, confirm with **ENTER/ON**.

   ***Note: NO** aborts the erasing procedure.*

5.5 Delete stored data for all calibration curves

1. Select **MENU**, confirm with **ENTER/ON**.
2. Select **SYSTEM**, confirm with **ENTER/ON**.
3. Enter the value **379** using the navigation keys and confirm with **ENTER/ON**.

⚠ CAUTION

Potential chemical and biological eye and skin hazards.

Only qualified personnel should perform the tasks described in this section of the operating manual.

The cleanliness of the measurement windows in the sensor head is critical to the accuracy of the measurement results!

Cleaning the instrument

Clean the instrument with a damp, lint-free cloth.

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 very stubborn deposits, clean with a soft cloth soaked in 5% hydrochloric acid.

Observe the 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 – It may be necessary to recalibrate
Clean the probe	Probe is dirty	– Clean the probe – May be triggered by inhomogeneous 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. (1-point default calibration of DS curves not sufficiently precise for measuring medium)
Calibration insufficient –	Further calibration point with lower concentration is missing	Further calibration point with lower concentration is required
Calibration insufficient +	Further calibration point with greater concentration is missing	Further calibration point with greater concentration 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
Battery is empty	Battery not charged	Charge the battery fully[1]
Incorrect probe	Probe has been replaced but not re-registered or correctly registered on instrument	– Connect the correct probe – Use code 390 to release DS curve for new probe 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 batteries[2]

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment. If the charger is not part of the shipment, charge the batteries with a charger available in your country. Make sure that the charger agrees the battery specifications.

[2] If the message is repeated, send the instrument for repair

7.2 Informative messages

Display	Caused by	Measure/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)

Section 8 Replacement parts and accessories

8.1 Replacement Parts

Description	Order-No.
TSS Portable handheld instrument (TSS Portable handheld measurement instrument includes meter, TSS probe (10 m (32.8 ft) cable, plug), charger[1] with four adapters (EU, USA, GB and AUS/China), rechargeable batteries, manual and carry case	LXV322.99.00001
TSS Portable handheld instrument	LXV320.99.00001
TSS probe (10 m (32.8 ft) cable, plug)	LXV321.99.00001
6× rechargeable NiMH batteries, type AA HR6, 1800 mAh	LZY604
Charger for rechargeable batteries with four adapters[1]	LZY607
Battery holder	LZY606
Standard case	LZY605

[1] The battery charger must agree with local and national safety regulations and may not be part of the shipment. If the charger is not part of the shipment, charge the batteries with a charger available in your country. Make sure that the charger agrees the battery specifications.

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