

# TSS Portable Troubleshooting Guide



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## Scope and Principle

1. Scope: The TSS Portable is a handheld measurement instrument for the analytical determination of turbidity, suspended solids, and sludge blanket level in aqueous media.
2. 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°. Sludge blanket level is assessed by lowering the calibrated sensor into the sample and monitoring the depth when the suspended solids concentration significantly increases. The cable is marked every meter to assist with the actual depth from the water surface.
3. Application: The Hach TSS Portable handheld instrument is ideal for remote monitoring of turbidity and suspended solids/blanket level in municipal and industrial wastewater, drinking water and river monitoring. (same as SOLITAX sc)
4. Specific applications
  - a. Municipal Wastewater: Control of waste water intake, Biology, Sludge Treatment, Control of discharge
  - b. Industrial Wastewater: Pulp & Paper, Dairy, Beverages, Filtration, flocculation, Industrial waste water, Aluminum oxide production
  - c. Drinking water: Spring Water, Drinking Water Reservoir, Filtering Station, Ground Water Pumping

## Presale Information

1. Only TSS portable instrument on the market that can measure all three parameters: suspended solids, sludge blanket level, and turbidity.
2. Ability to store 1 turbidity calibration curve and 4 calibration curves for suspended solids
  - a. The meters comes with a default turbidity curve
  - b. The meter comes with a default suspended solids curve but it is recommended to create a user curve.
3. Probe is manufactured with polished stainless steel and sapphire windows for long life and reliability.
4. See specifications contained in manual for concentration ranges.
5. Air bubble compensation is built into the software for better accuracy and lower measuring range.

## Accessories/Replacement Parts

1. Standard Case -LZY605



2. Probe Only - LZV321.99.00001



3. Meter Only - LXV320.99.00001



4. Rechargeable NiMH Batteries - LZY604



5. Battery Holder - LZY606



6. Charger - LZY607



7. Protective Beaker - LZI-66.11487



## Product Contents

1. Complete kit: LXV322.99.00002
2. TSS portable handheld instrument
3. Probe with 10m cable
4. Adapter plugs:
  - a. Charger with EU adapter plug installed, USA adapter plug, UK adapter plug, AUS/China adapter plug
5. Carrying Case
6. Quick Start guide (DOC013.53.90141)
7. User manual (DOC023.53.90050)

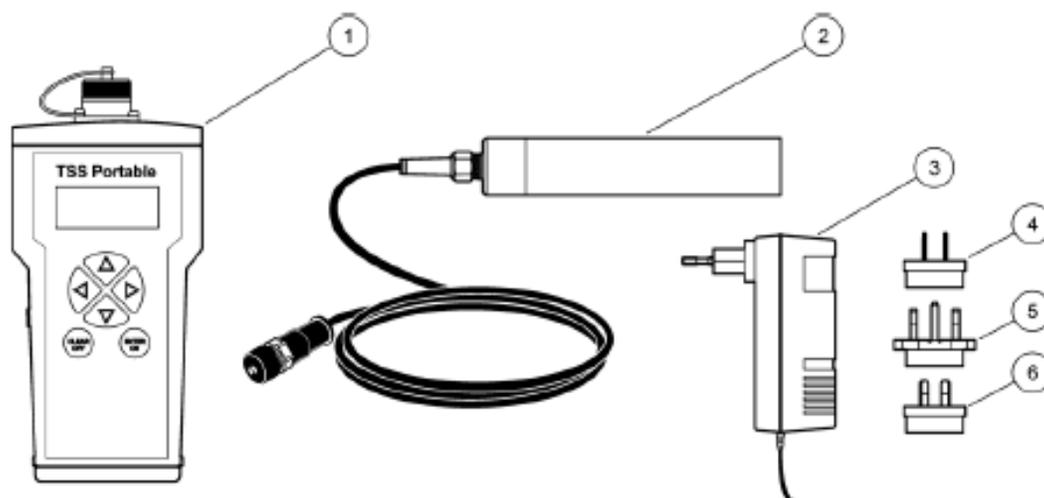
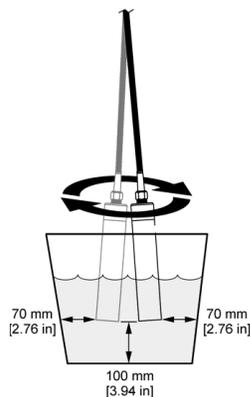


Figure 1 Product contents

1	TSS Portable handheld instrument	4	USA adapter plug
2	Probe with 10 m (32.8 ft) cable	5	UK adapter plug
3	Charger with EU adapter plug installed	6	AUS/China adapter plug

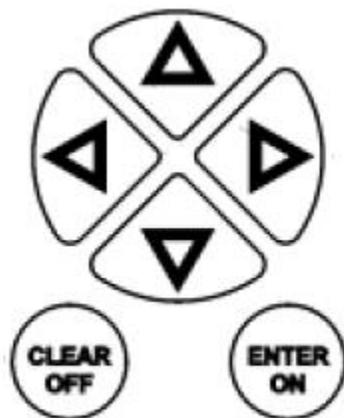
## RECOMMENDED CALIBRATION EQUIPMENT

1. Black container (dark bucket) To avoid reflections of the measurement beam on the base and walls during calibration.
2. Container should hold at least 1L of sample
3. The probe must swirl inside the bucket and have a clearance of 2 inches from the side walls and 3 inches from the bottom of the container.



4. Gravimetric measurement of sample

## KEYPAD FUNCTION:



1. Turning on the meter: Press and hold the ENTER ON key
2. Turning off the meter: Press and hold the CLEAR OFF key
3. To select desired function: Press the ENTER ON key



4. To go back one screen: Press the CLEAR OFF key
5. Entering multi-digit numbers: Use left or right key navigation keys to move cursor to the correct place (1,10,100,1000nds). Then use the up or down navigation keys to select the desired number.

**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

### SYSTEM START (Recommendation)

1. Install rechargeable batteries and fully charge using the battery charger
2. Switch on the meter
3. Set the Date/Time, Display, Units, Language, and Integration time under MENU
4. Connect the probe to the meter
5. Select the desired curve (turbidity or suspended solids) under MENU
6. Calibrate the suspended solids curve following calibration instructions

### Software

1. New software was released March 5<sup>th</sup> 2012 from serial number 1426375
  - a. Changes in the software included a simplified 3 sub-menu format: MEAS, DATA, MENU. The MEP menu was removed.

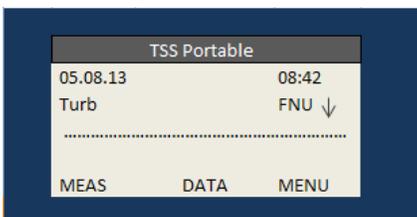
- b. The measurement is continuous

## SOFTWARE MENU

### 1. Main Menu structure overview

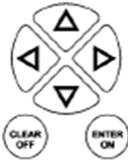
MENU	SUB FOLDER	SUBFOLDER	PURPOSE
<b>MEAS</b>			
	Start. Stop		Starting and Stopping the continuous measurement.
<b>DATA</b>			
	Display Data. Delete Data		Displays and deletes the stored data for the corresponding calibration curves.
<b>MENU</b>			
	Calibration		Calibration of Turbidity and solids curves.
		Curve. Memory	
	Time / Date		Set the time and date display.
		Year.Month.Day. Hour.Minute. Second	
	Display		Custom define the first two rows of the display.
	Units		Measurement units available for turbidity and solids.
		FNU.NTU.EBC. PPM.mg/L.g/L.%	
	Extras		Measurement values are averaged over the integration time.
		Integration. Log-Interval	
	Language		Languages supported.
	System		

### 2. Display Menu



3. Menu Structure “MEAS” with function

- a. Use up and down Navigation key to move through the “MEAS” menu



MEAS Menu						
05.08.13		09:17	Date / Time			
DS1	-----	mg/L	Curve / Units			
.....						
MEAS	DATA	MENU				
.....						
Homogen.		100%	Measurement value (homogeneity in %)			
Battery			Battery charge level			
.....						
MEAS	DATA	MENU				
.....						
Probe Serial No			Probe serial number			
		458652				
.....						
MEAS	DATA	MENU				
.....						
Probe SW-Vers.			Probe software version			
		631059				
.....						
MEAS	DATA	MENU				
.....						
Probe Starts			Probe number start (probe diagnosis data)			
		0				
.....						
MEAS	DATA	MENU				



DATA-Cap. Rem.	183 Points		Remaining capacity of the measurement points (up to 290 points)
MEAS	DATA	MENU	
Error no.	0		Fault no. XX
MEAS	DATA	MENU	
Serial no.	453414		Meter Serial number
MEAS	DATA	MENU	
SW-Vers.	631025		Meter Software version
MEAS	DATA	MENU	

4. Menu structure "DATA" with function
  - a. Display Data

1.DS1			Data Point / Curve
8mg/L		100%	Result / Homogeneity %
06.12.12		19.59	Date / Time
next point			Allows to scroll data points

- b. Delete Data: \*YES will delete all data points for that curve



5. Menu structure “MENU” with function

MENU	SUB FOLDER	SUBFOLDER	PURPOSE
MENU			
	Calibration		Calibration of Turbidity and solids curves.
		Curve. Memory	
	Time / Date		Set the time and date display.
		Year.Month.Day. Hour.Minute. Second	
	Display		Custom define the first two rows of the display.
	Units		Measurement units available for turbidity and solids.
		FNU.NTU.EBC. PPM.mg/L.g/L.%	
	Extras		Measurement values are averaged over the integration time.
		Integration. Log-Interval	
	Language		Languages supported.
	System		

a. “Calibration” menu with function

MENU	SUB FOLDER	SUB FOLDER	SUB FOLDER	PURPOSE
MENU				
	Calibration			
		Curve		
			C-TU	Turbidity Curve
			C-DS1	Suspended solids curves
			C-DS2	
			C-DS3	
			C-DS4	
			Reset	
		Memory		Defines which calibration point will be saved in the chosen curve
			Point 1	Selection for single or multiple calibration points for a chosen curve
			Point 2	
			Point 3	
			Delete	Will delete the memory point but not the calibration point
		Point 1		Stored calibration points with gravimetric concentration entered
		Point 2		
		Point 3		



b. "Time/Date" menu with function

MENU	SUB FOLDER	SUB FOLDER	PURPOSE
MENU			
	Time / Date		
		Year	Four digit year
		Month	1 or 2 digit month
		Day	1 or 2 digit day
		Hour	1 or 2 digit hour
		Minute	1 or 2 digit minute
		Second	1 or 2 digit second

c. "Display" menu with function

MENU	SUB FOLDER	SUB FOLDER	SUB FOLDER	PURPOSE
MENU				
	Display			Customer defines the first two rows of the display.
		Line 1		
			Meas. Value	Curve and unit
			Homogen.	Homogeneity %
			Battery.	Battery charge level
			Time	Time
		Line 2		
			Meas. Value	Curve and unit
			Homogen.	Homogeneity %
			Battery.	Battery charge level
			Time	Time



d. "Units" menu with function

MENU	SUB FOLDER	SUB FOLDER	SUB FOLDER	PURPOSE
MENU				
	Units			Measurement units available for turbidity and solids.
		C-TU		Turbidity Curve
			FNU	Units of turbidity
			NTU	
			EBC	
		C-DS1		Suspended solids curves DS1
			PPM	Units of solids
			mg/L	
			g/L	
			%	
		C-DS2		Suspended solids curves DS2
			PPM	Units of solids
			mg/L	
			g/L	
			%	
		C-DS3		Suspended solids curves DS3
			PPM	Units of solids
			mg/L	
			g/L	
			%	
		C-DS4		Suspended solids curves DS4
			PPM	Units of solids
			mg/L	
			g/L	
			%	

e. "Extras" menu with function

MENU	SUB FOLDER	SUB FOLDER	SUB FOLDER	PURPOSE
MENU				
	Extras			Set integration and interval of measurements
		Integration		Sets the timeframe for measurement values to be averaged during continuous measurement.
			"x" seconds	time: 0 to 999 seconds
		Log-Interval		Measurements occur continuously and saved to the log in timed intervals.
			"x" min	time: 0 to 60 min

f. “Language” and “System” menu with function

MENU	SUB FOLDER	SUB FOLDER	PURPOSE
MENU			
	Language		Selects software language
		German	
		English	
	System		Enter code to register probe and perform system reset

## SOFTWARE ERROR MESSAGES

1. Error Messages: As taken from the manual 3<sup>rd</sup> edition section 7

### 7.1 Error messages

	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
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 <sup>1)</sup>

- a. MEAS OVERRANGE: Concentration too high Action: Medium cannot be measured
- b. ZERO: Calibration pint too close to zero Action: Delete calibration and start again



- c. LED FAILURE: Faulty LED Action: Send the probe for repair
  - d. EE RSRVD ERR/EE SETUP ERR: Meter fault Action: Send the meter for repair
  - e. ACCU FLAT: old software version for a low battery
2. Informative Messages:

## 7.2 Informative messages

	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)

## Calibration

### (Turbidity and Suspended Solids)

1. Instrument can save one turbidity curve and up to four solids calibration curves
2. Turbidity is factory calibrated but a user calibration can be saved
3. Single-point calibration draws a straight line to zero. Recommended to select a sample that is in the upper third of the expected measuring range.
4. Multiple-point calibration
  - a. First calibration point is recommended to be a low concentration.
  - b. Second calibration point is recommended to be as high a concentration as possible.
  - c. Multiple calibration points can be created from a single sample by creating dilutions.
5. Deleting calibration points: Set the concentration of the calibration point to the value 0.0 and then **ENTER**.
6. Steps for multipoint calibration (overview)
  1. Fill a black container with a representative sample of the measuring medium. ☑ Ensure that it is mixed evenly. It is best to try to achieve 100 % homogeneous. The distance between the probe head and the walls and base of the container must always be more than 70 mm (2.76 in.)
  2. Use a part of the sample for the solids analysis in the laboratory using a gravimetric method.
  3. Clean the probe.
  4. Place the probe into the container.
  5. Select **MENU**, **ENTER**, and **CALIBRATION**, **ENTER**. In the calibration menu select desired **CURVE**, **ENTER**.



6. Select **MEMORY**, **ENTER**, and the desired **POINT**. Once the point is selected and **ENTER** is pressed the probe will start to measure the sample.
7. Stir the probe in the sample at a steady rate. **“Wait”** is visible with **MEMORY** on the display.
8. After the measurement the software will return to the **CALIBRATION** menu.
9. The **POINT** will now have an asterisk (\*) **\*POINT** in display.
10. The probe can be rinsed and placed in other samples and other calibration points can be saved following steps 6-9.
11. Enter the laboratory result for each of the saved **\*POINTS** by selecting the **\*POINT**, **ENTER**. The keypad can be used to enter the laboratory measurement value.
12. After entering the laboratory select **ENTER**. **“POINT SAVE”** will be displayed briefly.
13. The instrument can automatically sort the saved calibration points. 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.
14. The laboratory measurement can be corrected at any time by overwriting the saved **POINT**.

## Measurement

1. Turbidity measurements can utilize the factory set default calibration
2. Precise solids measurement will need a user calibration.
3. Setting the curve for measurement.
  - a. Recommended to **STOP** measurement under **MEAS**
  - b. Then select **MENU**, confirm with **ENTER**.
  - c. Select **CALIBRATE**, confirm with **ENTER**.
  - d. Select the curve shown and confirm with **ENTER**.
  - e. Select the desired curve with the navigation key **UP/DOWN** and confirm with **ENTER**.
  - f. Select **CLEAR/OFF** twice to return to the main menu.
4. Retrieving / Deleting Data
  - a. Select the desired curve under **MENU, CALIBRATE, CURVE, ENTER**
  - b. Select **CLEAR/OFF** twice to return to the main menu

- c. Select **DATA, ENTER, DISPLAY DATA, ENTER**
- d. Use the navigation key **UP/DOWN** to select the desired point
- e. Selecting **DATA, ENTER, DELETE DATA, YES** will delete all data for that curve.

### SLUDGE BLANKET LEVEL

1. Select appropriate suspended solids curve
2. Select appropriate units
3. Select integration time to zero.
4. Insert probe in sample and start measurement. 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 determined by reading the depth markings on the probe cable.

### Maintenance

1. Cleaning the measurement windows on the probe depends on the application. If required, they can be cleaned with any conventional cleaning agent and a soft cloth. In the case of stubborn deposits on the window, it can be wiped with a soft cloth soaked in the 5% hydrochloric acid.
2. Replacement of the batteries

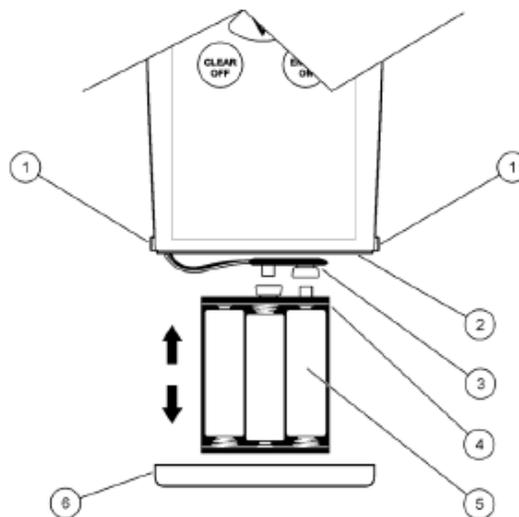


Figure 2 Inserting the rechargeable batteries

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



## FAQ

**Q: What is the system code to register a new probe?**

**A:** The code is 390. Navigate from Menu to System to enter code.

**Q: What is the system reset code?**

**A:** The code is 4711. Navigate from Menu to System to enter code.

**Q: How can all the stored calibration curves be deleted?**

**A:** The code is 379. Navigate from Menu to System to enter code.

**Q: Does the TSS portable probe come in longer lengths?**

**A:** No, the probe currently only comes in 10meter cable lengths.

**Q: Is the TSS portable system EPA approved?**

**A:** No, the EPA has not approved either the turbidity or suspended solids measurement using this device.

**Q: What is the expected battery life expectancy?**

**A:** Using new rechargeable (6 NiMH) batteries, the expected life of the charge is 4 hours continuous use. This expected life will shorten as the batteries age.

**Q: Is there a power cord available for the TSS portable system?**

**A:** No, the TSS portable system will only come with a battery charger. It is recommended to turn the meter off while charging the batteries.



**Q: What is the product warranty?**

**A:** The warranty is 2 years for both meter and probe.

**Q: What is the meter's water resistance rating?**

**A:** The meter is rated IP55 and cannot be immersed.

**Q: Can the meter be connected to a computer for downloading data?**

**A:** No, the meter does not have a way to connect to a storage device or a computer.

**Q: What do I do if Hach changes the software version of the meter?**

**A:** The meter will have to be sent to the appropriate service center for the software update.

**Q: Is there any precaution to switching curves while still taking a continuous measurement?**

**A:** When switching curves during a measurement, the next measurement is done with the new calibration curve. The respective data set is stored respectively. Data sets consist of Calibration curve name/Meas. Value/date and time. If an individual measurement site at the plant is assigned to one calibration curve, data may easily be identified. If you have two measurement points using the same calibration curve, you may distinguish the measurement sites only by the time the measurement was taken. In the field this should work fine since measurements are done in a predefined order.

**Q: How does the DELETE function work under MEMORY?**

**A:** This function deletes memorized measurement data that were performed within the course of a calibration. In case you have not assigned concentrations or turbidity values (points marked with \*), the calibration measurement can be deleted and retaken.

**Q: Is setting a calibration point to zero, the only way to remove the point from a calibration curve?**



**A:** For DS calibration curves, setting the point to zero is the only way of removing it from the calibration curve. If you intent to delete stored data for all calibration curves please enter code 379 in the system menu.

**Q: How does the RESET function work under CALIBRATION?**

**A:** The RESET function is used to reset changes in the C-TU curve. To return the C-TU curve to default the calibration points will also need to be set to zero.

**Q: What are the default calibration points for turbidity entered into the meter?**

**A:** Default calibration is factory set after an individual calibration of the probe. There are no fixed FNU values as the calibration standards may vary slightly depending on the stock solution used in manufacturing. They are in the range of : < 0.1 FNU; 400 FNU; 2000 FNU

**Q: Is there a factory default calibration for suspended solid DS curves?**

**A:** The factory DS calibration is based on the probe response of a single point at 4 g/L, obtained from a comprehensive analysis of many different sludge types. It is a kind of mean value that fits many types of sludge. A user calibration is recommended for accuracy.

**Q: What could be the cause of the error messages: Calibration insufficient - or Calibration insufficient +?**

**A:** errors “calibration insufficient -” means: Further calibration point with lower concentration is missing in order to receive good results.  
error “Calibration insufficient +” means: Further calibration point with greater concentration is missing in order to receive good results.

**Q: How do the errors “calibration insufficient +” and “overflow area” differ in how they are generated?**

**A:** Error: “overflow area” designates that a probe is measuring in an unsuitable medium – It may be necessary to recalibrate. This error accure when the sludge concentration is at the upper end of the measurement range and almost no light is reflected back to the sensors detector. Setting up a new calibration curve is recommended. If the problem continues, the sludge concentration is too high to be measured with the TSS portable probe; the value is beyond the probes measurement range.



**Q: Is there general guidance for creating the most accurate calibration curve for suspended solids?**

**A:** Hach recommends selecting a calibration point with a value in the upper third of the range expected. Start with a single point calibration in that range. In case a single point calibration is not sufficient, the error “message Calibration insufficient –” or “Calibration insufficient +” will guide you to set up an appropriate curve, thus will provide a more accurate measurement.

**Q: Does Hach have a general statement that explains how the solids calibration correlates to measured value?**

**A:** Yes, A single point calibration draws a straight line from the probes zero point to the point of calibration; however the mathematical transformation of the different signals of the different detectors is nonlinear. When a calibration curve consists of 3 points the curve is created by connecting the straight lines. The course may not hit the zero e.g. because the medium itself is colored and absorbs light. \

**Q: Is there any difference how the probe is operating when selecting between the turbidity units FNU, NTU, and EBC?**

**A:** FNU and NTU are equal and are just a different name for the unit of turbidity. EBC is the unit for turbidity defined by the European Brewery Convention. It is meant to be used by breweries:  
 $1 \text{ FNU} = 0.25 \text{ ECB}$

**Q: Does the specification of 290 measurement values only include what is stored in the DATA menu?**

**A:** The 290 measurement values are the summed values that can be stored in the calibration and data menus.

**Q: Does the air bubble compensation apply to both the turbidity and suspended solids measurement?**

**A:** Yes, the software applies air bubble compensation to both types of measurements.

**Q: How should the homogeneity % be interpreted?**

**A:** The % homogeneity is an indicator for the quality of your sludge measurement. Between 80% and 100% the result of your measurement is authentic. Homogeneity has nothing to do with the



calibration, but instead relates to the structure of the sludge. If you have a good / constant sludge structure the % of homogeneity is high. The ratio between water and sludge and the structure of the sludge is responsible for a high homogeneity value.

**Q: Will the TSS portable system work correctly on low or not fully charged batteries?**

**A:** Customers have reported issues with taking measurements, frozen menus, meters powering off unexpectedly, and calibration issues when the batteries were low or not fully charged.

**Q: Can the software be updated by the customer?**

**A:** No – this must be sent to Service.

**Q: The specifications on the meter and probe state that the acceptable low-end temperature limit is 0 degrees C. Can it be used at slightly lower temperatures?**

**A:** We would not recommend this as it has not been tested this low and some components may not operate correctly at this lower temperature.