



SBS-3500

Portable Density Meter

From Firmware Version V1.54

Instruction Manual

While every precaution has been taken in the preparation of this document, Storage Battery Systems, Inc. (SBS) assumes no responsibility for technical or printing errors or omissions. Nor is any liability assumed for damages resulting from the use of the information contained in this instruction manual. SBS does not make a commitment to update the information in this manual. Specifications are subject to change without notice.

All rights reserved. No part of this document may be translated, reproduced, or distributed in any form (print, photocopy, microfilm or any other process) without the prior written permission of SBS. Trademarks may be used in this instruction manual without being marked as such. These are the property of their respective owners and are legally protected.

Contact: Storage Battery Systems, Inc.
 N56 W16665 Ridgewood Drive
 Menomonee Falls, WI 53051
 Phone: (800) 554-2243
 Fax: (262) 703-3073

Date: August 11, 2009

Contents

1	About the Instruction Manual	6
2	Safety Instructions	7
3	Measuring Principle	9
4	SBS-3500 – An Overview	10
5	Checking the Supplied Parts	11
6	Description of the Instrument	13
6.1	Front View.....	13
6.2	Rear View	15
6.3	Display.....	16
7	Operating the SBS-3500.....	18
7.1	Connecting the Filling Tube	18
7.2	Attaching the Syringe Adapter	18
7.3	Switching the Instrument On	19
7.4	Switching the Instrument Off.....	19
8	Defining the Basic Settings.....	20
8.1	Language Settings	20
8.2	Units	20
8.3	Sound Settings	20
8.4	Energy Saving Mode.....	20
8.5	Backlight.....	21
8.6	Contrast Settings.....	21
8.7	Allocation of the Softkey Function.....	21
8.8	Password Protection	22
8.9	Date and Time Settings	23
8.10	Exporting the System Settings to a PC.....	24
9	Performing a Measurement.....	25
9.1	Selecting the Measuring Unit.....	26
9.1.1	Categories of Measuring Units.....	26

9.1.2	Calculating a Temperature Coefficient	28
9.1.3	Importing Custom Functions.....	28
9.2	Selecting Measuring Methods	29
Application of the method selection		29
9.2.1	Entering a New Method.....	29
9.2.2	Entering Method Lists	30
9.2.3	Editing a Method.....	32
9.2.4	Deleting a Method	32
9.2.5	Deleting All Methods	32
9.2.6	Selecting a Method	32
9.3	Assigning a Sample ID	33
9.3.1	Entering the Sample ID	33
9.3.2	Entering Sample ID Lists.....	33
9.3.3	Changing the Sample ID	34
9.3.4	Deleting a Sample ID.....	34
9.3.5	Deleting all Sample IDs.....	34
9.3.6	Selecting a Sample ID.....	35
9.4	Using the RFID Function.....	35
9.4.1	Preconditions for using RFID.....	35
9.4.2	Allocating RFID Tags.....	35
9.4.3	Selecting a Method and/or Sample ID via RFID	36
9.4.4	Application Examples of RFID	36
9.5	Filling Sample	36
9.5.2	Filling with the Plastic Syringe.....	37
9.6	Performing a Measurement.....	38
9.6.1	Deleting the Measured Value	38
9.6.2	Printing the Measured Value	38
9.6.3	Emptying the Measuring Cell.....	38
9.7	Accessing Saved Measuring Data.....	39
9.8	Exporting Measuring Data to a PC.....	39
9.9	Printing the Saved Measuring Data	41
9.10	Deleting the Saved Measuring Data	41

10	Cleaning and Storing the Instrument.....	42
10.1	Cleaning the Measuring Cell	42
10.2	Cleaning the Filling Pump.....	42
10.3	Cleaning the Pump Housing.....	42
10.4	Cleaning the Housing and Display.....	43
10.5	Storing the Instrument.....	43
11	Maintenance	44
11.1	Changing the Batteries.....	44
11.2	Carrying out a Firmware Update	46
11.3	Device Information	47
11.3.1	Accessing Device Information	47
11.3.2	Exporting Device Information	47
11.4	Exporting Adjustment Date.....	48
12	Readjustment.....	49
12.1	Check Measurement	49
12.2	Water Adjustment	49
12.3	Custom Adjustment	50
12.4	Defining an Offset	50
12.5	Restoring to Factory Adjustment.....	50
13	Error Messages and Warnings	51
14	Technical Data.....	52
15	Wetted Parts	53
	Appendix A: Density of Water (0°C to 40°C).....	54
	Appendix B: Measuring Unit Details	55
	Appendix C: Menu Tree	58




1 About the Instruction Manual

This instruction manual informs you about the installation and the safe handling and use of the product. Pay special attention to the safety instructions and warnings in the manual and on the product.

This instruction manual is a part of the product. Keep this instruction manual for the complete working life of the product and make sure it is easily accessible to all people involved with the product.

Conventions for Safety Messages

The following conventions for safety messages are used in this instruction manual:

	DANGER Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE Notice indicates a situation which, if not avoided, could result in damage to property.

TIP Tip gives extra information about the situation at hand.

Typographical Conventions

The following typographical conventions are used in this instruction manual:

Convention	Description
<key>	The names of keys and buttons are written inside angle brackets
“Menu Level 1 > Menu Level 2”	Menu paths are written in bold, inside straight quotation marks. The menu levels are connected using a closing angle bracket

2 Safety Instructions

- Read this instruction manual before using the portable density meter SBS-3500.
- Follow all hints and instructions contained in this instruction manual to ensure the correct use and safe functioning of the SBS-3500.

Liability

- This instruction manual does not claim to address all safety issues associated with the use of the instrument and samples. It is your responsibility to establish health and safety practices and determine the applicability of regulatory limitations.
- SBS only warrants the proper functioning of the SBS-3500 if no adjustments have been made to the mechanics, electronics, and firmware.
- Only use the SBS-3500 for the purpose described in this instruction manual. SBS is not liable for damages caused by incorrect use of the SBS-3500.

Installation and Use

- The SBS-3500 is **not** an explosion-proof instrument and therefore must not be operated in areas with risk of explosion.
- Never remove the pump lock and battery cover in hazardous areas. Only exchange the batteries outside of hazardous areas.
- The installation procedure shall only be carried out by authorized personnel who are familiar with installation instructions.
- Do not use any accessories or wearing parts other than those supplied or approved by SBS.
- Make sure all operators are trained to use the instrument safely and correctly before starting any applicable operations.
- In case of damage or malfunction, do not continue operating the SBS-3500. Do not operate the instrument under conditions which could result in damage to goods and/or injuries and loss of life.
- Check the SBS-3500 for chemical resistance to the samples and cleaning liquids.
- Do not expose the instrument to temperatures below 0°C (32°F) if water is contained in the measuring cell or pump (freezing water will cause rupture of the measuring cell).

Maintenance and Service

- The results delivered by the SBS-3500 not only depend on the correct functioning of the instrument, but also on various other factors. We therefore recommend you have the results checked (e.g. plausibility tested) by skilled personnel before consequential actions are taken based on the results.
- Service and repair procedures may only be carried out by authorized personnel or by SBS.

- If your instruments need repair, contact your local SBS representative.

Disposal

- Concerning the disposal of the SBS-3500 observe the legal requirements in your country.

Precautions for Highly Flammable Samples and Cleaning Liquids

- Observe and adhere to your national safety regulations for handling the measured samples (e.g. use of safety goggles, gloves, respiratory protection, etc.)
- Only store the minimum required amount of sample, cleaning liquids and other inflammable materials near the SBS-3500.
- Do not leave sample/rinsing containers uncovered. Clean all spillages immediately.
- Make sure that the setup location is sufficiently ventilated. The environment of the SBS-3500 must be kept free of flammable gases and vapors.
- Supply a fire extinguisher.

3 Measuring Principle

Definition of Density

The density ρ of a sample is defined as its mass divided by its volume:

$$\rho = \frac{m}{V}$$

Density is a temperature-dependant measuring unit.

The Oscillating U-Tube Principle

The sample is introduced into a U-shaped borosilicate glass tube that is being excited to vibrate at its characteristic frequency electronically. The characteristic frequency changes depending on the density of the sample. Through determination of the characteristic frequency the density of the sample can be calculated. Due to the temperature dependency of the density value, the temperature of the sample has to be determined precisely.

Concentration Measurement

In binary mixtures, the density of the mixture is a function of its composition. Thus, by using density/concentration tables, the density value of a binary mixture can be used to calculate its composition.

This is also possible with so-called quasi binary mixtures. These are mixtures containing two major components and some additional ones which are present in very small concentrations compared to the two main components. Many decarbonated soft drinks, for example, can be considered to be quasi binary mixtures of sugar in water because the concentration of flavors and acids are very small compared to sugar and water. Thus, the sugar concentration can be measured with a density meter.

4 SBS-3500 – An Overview

The portable density meter SBS-3500 measures the density of liquids in g/cm^3 or kg/m^3 according to the oscillating U-tube principle. Apart from density you can select various further measuring units (relative density, density at reference temperature, concentrations). A temperature sensor measures the sample temperature right at the measuring cell. The temperature is displayed and can be used internally for automatic temperature compensation of the density reading if required.

Owing to the lightweight and compact design one can easily perform measurements of usually difficult accessible samples. The backlight of the display ensures clear visibility of results, even in dark surroundings. The backlight of the oscillator at the same time enables to observe the filling process in detail.

Samples are filled into the measuring cell using the built-in pipette-style pump or a syringe. You can allocate sample IDs to your samples for easier identification. You can also define and store different measuring methods allowing acceleration of repeatedly performed standard measurements.

The SBS-3500 is operated via seven keys. 1024 measuring data including date, time and sample ID can be stored in the memory of the SBS-3500 density meter and can be recalled, exported to a PC or printed later. The transfer of the stored measuring data to a printer or PC is done wireless using an infrared interface (IrDA).

The produce version SBS-3500 Tag&Log is additionally equipped with an RFID interface. Via this interface data can be read in from an RFID tag and allocated to a sample ID and/or method. Later on, by reading the RFID tag, you can switch fast and easily between different sample IDs and methods which further increases the efficiency of your measuring process.

5 Checking the Supplied Parts

The SBS-3500 was tested and packed carefully before shipment. However, damage may occur during transport.

1. Keep the packaging material (box, foam piece) for possible returns and further questions from the transport company or insurance company.
2. Check the delivery for completion by comparing the supplied parts to those given in Table 5.1
3. If a part is missing, contact your SBS representative.
4. If a part is damaged, contact the transport company and your SBS representative.

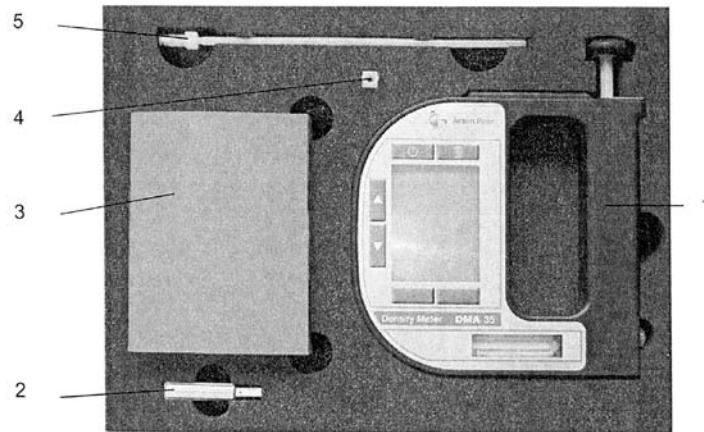


Fig. 5-1 Supplied Items

- 1 – SBS-3500 Density Meter
- 2 – IrDA USB Adapter (Optional)
- 3 – Plastic Syringes – 2 mL
- 4 – Luer Adapter $\frac{1}{4}$ " UNF (for syringe filling)
- 5 – Filling Tube (standard 180 mm)

Table 5.1 – Supplied Parts


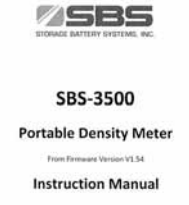
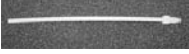


Symbol	Pcs.	Article Description	Mat. No.
	1	SBS-3500 portable density meter SBS-3500 Tag&Log portable density meter	84138 87448
	1	Instruction Manual English	88155
	1	Filling tube (standard 180 mm)	68527
	1	Luer adapter 1/4" UNF (for syringe filling)	64792
	10	Plastic syringes 2 mL	58802

Table 5.2 – Optional Parts

Article Description	Mat. No.
Custom function for SBS-3500	88974
DKD Calibration SBS-3500	88153
Filling Tube PTFE, length 600 mm	78503
IrDA USB Adapter LCS-8141	88085
Printer CMP-10-ES RS232C/IrDA	87817
RFID ABS Disc Tag 30 x 5 x 2 mm	88443
RFID Laundry Tag 30 mm	88444
RFID PVC Disc Tag 30 mm	88445

6 Description of the Instrument

6.1 Front View

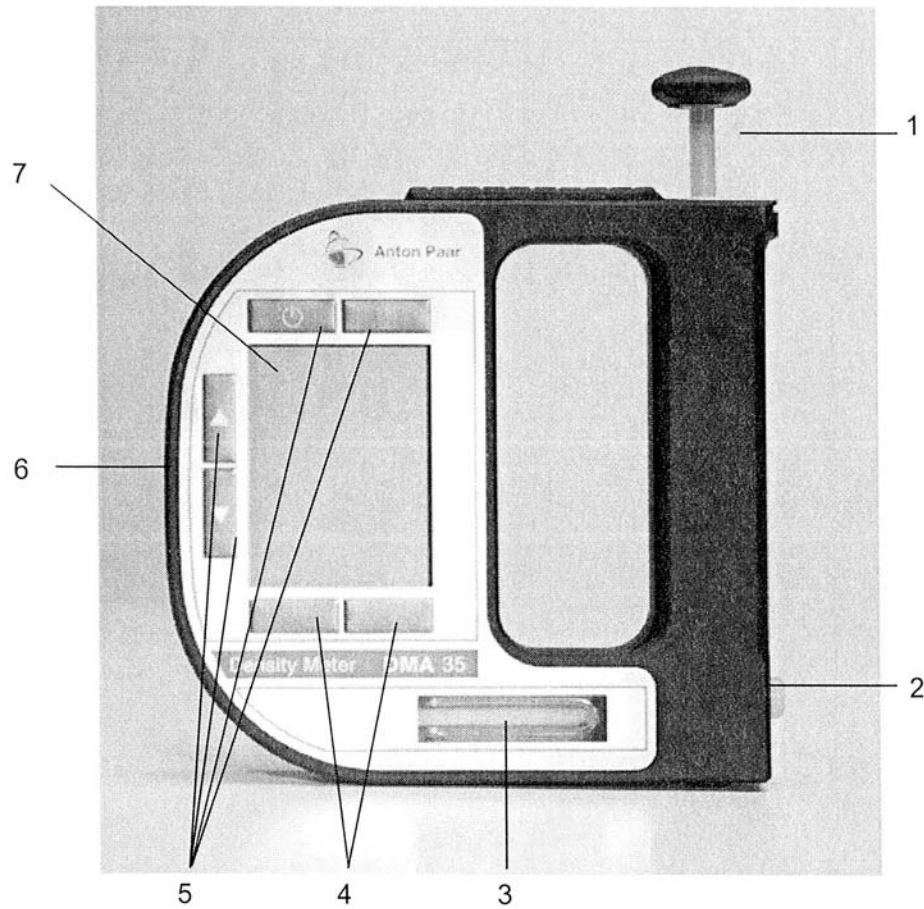


Fig. 6-1 Front View of SBS-3500

- 1 – Built-In Pump
- 2 – Screw Plug
- 3 – Measuring Cell
- 4 – Softkeys
- 5 – Operating Keys
- 6 – RFID Interface (only for SBS-3500 versions with RFID Interface)
- 7 – Graphical, Monochrome LC Display

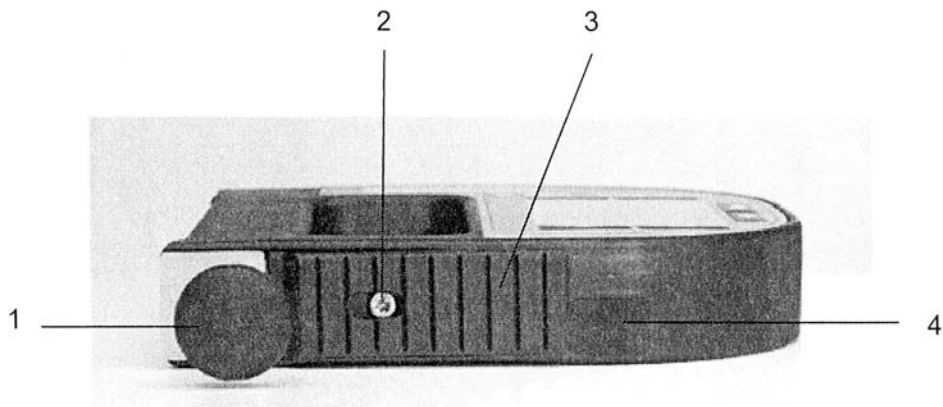


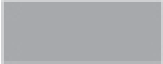



Fig. 6-2 Top View of SBS-3500

- 1 – Built-In Pump
- 2 – Fixing Screw of the Pump Lock
- 3 – Pump Lock
- 4 – Infrared Interface (IrDA)

Keys at the Front Side

	<p>For switching the instrument on and off.</p>
	<p>For deleting measuring data, entries and characters during an entry.</p>
	<p>Softkeys for selecting menu items and for navigation. The function of the right softkey can be configured.</p>
	<p>Arrow keys for navigation within the menu and for the entry of characters.</p>

TIP For faster up and down navigation, keep the arrow keys pressed.

6.2 Rear View

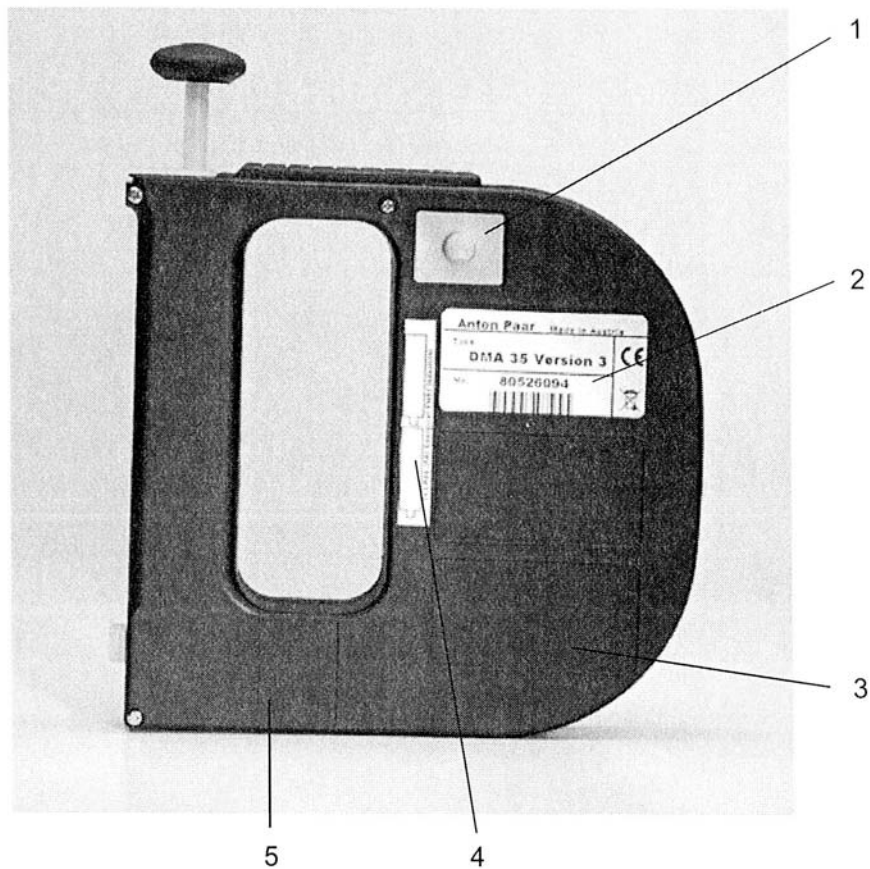



Fig. 6-3 Rear view of SBS-3500

- 1 – Data Storage Key
- 2 – Type Plate
- 3 – Custom Functions (Optional)
- 4 – Mark for the correct battery insertion
- 5 – Calibration Number (Optional)

Key at the Rear Side

	For starting a measurement and storing results in the memory.
---	---

6.3 Display

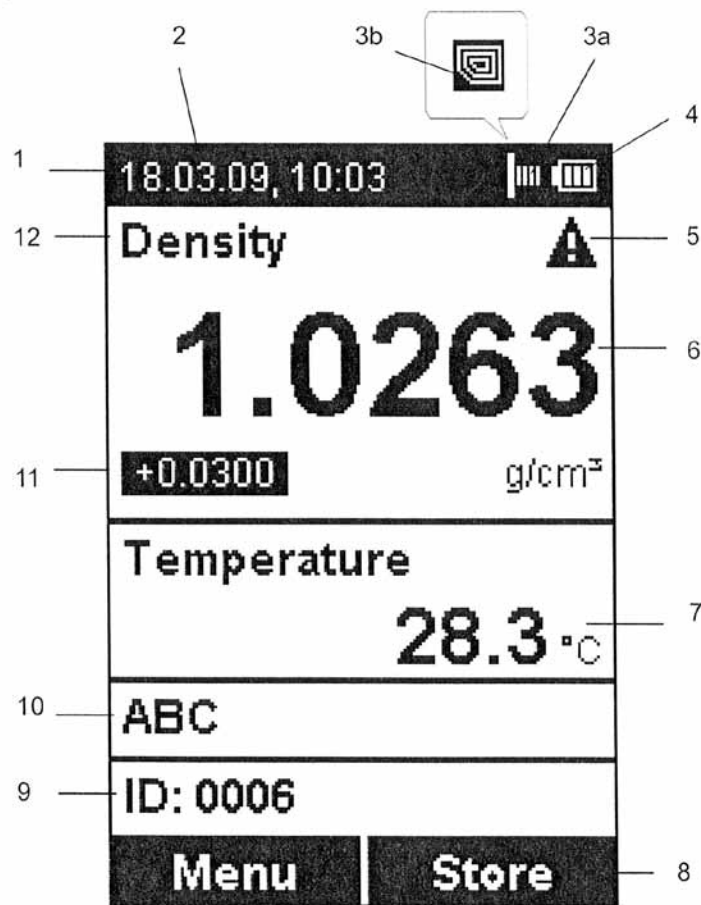






Fig. 6-4 Display of SBS-3500

- 1 – Information Header
- 2 – Date and Time
- 3 – Symbol for infrared data transfer (3a) or RFID symbol¹ (3b)
- 4 – Symbol for battery charge status
- 5 – Warning Sign
- 6 – Measuring Value
- 7 – Sample Temperature °C/°F
- 8 – Softkey Configuration
- 9 – Sample ID
- 10 – Method
- 11 – Custom Offset
- 12 – Measuring Unit

¹ Only for SBS-3500 versions with RFID interface

Symbols on the Display

	The infrared data transfer symbol is shown on the information header when data is imported or exported via the IrDA interface.
	The RFID symbol is shown on the information header when it is possible to allocate an RFID tag to a method or sample ID and when an RFID tag is read while the instrument displays the main screen. Furthermore, methods and/or sample IDs with an allocated RFID tag are marked with this symbol when listed.
	The battery charge status symbol informs you about the battery charge status of your instrument. For further information on different charge status symbols and their meanings, see Chapter 11.1.
	The warning sign indicates that a measured value is outside range specifications. The warning sign is always shown together with an information (press the right softkey) stating the warning type (for details about warning types, see Chapter 13).

7 Operating the SBS-3500

7.1 Connecting the Filling Tube

- Screw in the filling tube by hand until you feel some resistance against turning. Do not use any tools for screwing in the filling tube.




Fig. 7-1 Connecting the filling tube

7.2 Attaching the Syringe Adapter

1. Remove the screw plug at the side of the instrument
2. Screw in the Luer adapter (see Chapter 5) by hand until you feel some resistance against turning. Do not use any tools for screwing in the Luer adapter.

7.3 Switching the Instrument On

- To switch the instrument on, press the  key

After showing the welcome screen, the SBS-3500 immediately switches to the main screen (measuring mode). Now you can start the measuring process.

7.4 Switching the Instrument Off

- To switch the instrument off, press the  key until “Power Off” is displayed.

If the instrument is in the energy saving mode (see Chapter 8.4), the SBS-3500 switches automatically off after 3, 5, or 10 minutes inactivity (depending on the setting).

8 Defining the Basic Settings

8.1 Language Settings

You can choose between two different menu languages:

1. Press <Menu> and select **“Setup > Language”**.
2. Select the preferred language and press <OK>.

8.2 Units

1. Press <Menu> and select **“Setup > Units”**.
2. Select **g/cm³** or **kg/m³** as the density unit and press <OK>.
3. Select **°C** or **°F** as the temperature unit and press <Save>.

Your settings are saved and the measuring results are shown in the selected units.

8.3 Sound Settings

When sound is enabled, the SBS-3500 beeps when it is switched on and off and when a key is pressed. When sound is disabled, the instrument only beeps when it is switched on and off.

1. Press <Menu> and select **“Setup > Beep”**.
2. Select the preferred setting (Beep on/off) and press <Save>.

8.4 Energy Saving Mode

Enabling the energy saving mode lowers the power consumption of the instrument and thus extends battery life. When the energy saving mode is enabled, the instrument will automatically switch itself off after 3, 5, or 10 minutes of inactivity.

When the energy saving mode is disabled, the instrument will remain switched on until it is turned off

using the  key.

1. Press <Menu> and select **“Setup > Energy Saving”**.
2. Select the preferred setting (Off, 3, 5 or 10 minutes) and press <Save>.

8.5 Backlight

The LC display and the oscillator are equipped with a backlight. The backlight ensures that even under bad lighting conditions the measuring results and menu options are easily readable. The backlight of the oscillator enables you to observe the filling process.

You can choose between “Auto”, “Off”, and “On”:

Auto	The backlight automatically turns on when a key is pressed. The backlight also turns on automatically if the instrument recognizes that a new sample is being filled into the measuring cell. To activate the backlight without accessing the menu, press an arrow key. The backlight switches off automatically after 30 seconds
Off	The backlight is permanently off.
On	The backlight is permanently on.

TIP Having the backlight turned on permanently will shorten battery life.

1. Press <Menu> and select **“Setup > Backlight”**.
2. Select the preferred setting (Auto, Off, On) and press <Save>.

8.6 Contrast Settings

The display contrast can be freely adjusted to suit your preference.


1. Press <Menu> and select **“Setup > Display Contrast”**.
2. Select the preferred setting (-8 to +8) and press <Save>.

8.7 Allocation of the Softkey Function

On the front side of the SBS-3500 are two softkeys. When the instrument displays the main screen, the left softkey always takes you to the main menu. The right softkey can be allocated with one out of three predefined functions. The allocated function is only available in the main menu.

The functions available are “RFID²”, “Store” and “Print”.

² Only for SBS-3500 versions with RFID interface

RFID	Enables importing RFID tags that are allocated to a method or sample ID. The method or sample ID allocated will automatically be used for the following measurements.
Store	Provides the same functionality as the  key on the back of the instrument and starts and stores a measurement.
Print	Enable immediate print-out of the measured value using the IrDA interface.

1. Press <Menu> and select **“Setup > Softkey”**.
2. Select the preferred setting (RFID, Store, Print) and press <Save>.

8.8 Password Protection

You can protect your instrument with a password according to your demands. If the password protection is enabled, the password needs to be entered before changing the settings, before performing an adjustment and before selecting a measuring unit.

For performing measurements as well as entering, changing, or deleting measuring methods or sample IDs no password is required.

You can change the password anytime or disable password protection entirely.

To set a password

1. Press <Menu> and select **“Setup > Set Password”**.
2. Enter the first number of your password using the arrow keys and press <OK>.
3. Repeat this procedure to set the other numbers of the password and press <Continue>.
4. Enter the password again and press <Save>.
The password has now been saved.
5. Keep your password information safe.

To change or delete the password

1. Press <Menu> and select **“Setup”**.
2. Enter your password.
3. Select **“Set Password”**.
4. Enter the current password and press <OK>.
5. If you want to change the password, enter the new password.
Your settings are now protected with the new password.
6. If you want to disable the password protection entirely, enter <0000> as the new password and press <Save>.
The password protection is now disabled.

8.9 Date and Time Settings

During operation the information header always displays the current date and time. Date and time have to be set once during initial startup of the instrument.

To set date and time

1. Press <Menu> and select **“Setup > Date and Time > Set Date and Time”**.
2. Enter the current day, month and year using the arrow keys and confirm each of your selections by pressing <OK>. The cursor moves to the next value to be set.
3. Press <Save>. Now the time settings are displayed on the screen.
4. Repeat the procedure to enter the current time and press <Save>. Date and time are now displayed in the information header.

To set the date format

1. Press <Menu> and elect **“Setup > Date and Time > Date Format”**.
2. Select the preferred date format and press <OK>.

To set the time format

1. Press <Menu> and select **“Setup > Date and Time > Time Format”**.
2. Select the preferred time format and press <OK>.

8.10 Exporting the System Settings to a PC

For service purposes and for multiplying the system settings to several instruments, you can export the selected settings to a PC. The file containing the settings is then available for archiving as a backup copy or for multiplying the settings.

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Hold the IrDA interface of SBS-3500 to the IrDA interface of your PC to establish communication between the two instruments.
3. Press <Menu> and select **"Setup > Import / Export > Send to PC > System Settings"**.
4. Click <Yes>.
The system settings are transferred and filed on the desktop.

Example:

```
<DMA35>
<SYSTEM_SETTINGS>
  <DATE_FORMAT>0</DATE_FORMAT>
  <TIME_FORMAT>0</TIME_FORMAT>
  <SOFTKEY>0</SOFTKEY>
  <BACKLIGHT>1</BACKLIGHT>
  <ENERGY_SAVING>0</ENERGY_SAVING>
  <BEEP>1</BEEP>
  <DENS_UNIT>0</DENS_UNIT>
  <TEMP_UNIT>0</TEMP_UNIT>
  <LANGUAGE>1</LANGUAGE>
  <DATA_FORMAT>0</DATA_FORMAT>
  <DATA_DELIMITER>0</DATA_DELIMITER>
  <DATA_DECIMALPOINT>0</DATA_DECIMALPOINT>
</SYSTEM_SETTINGS>
</DMA35>
```


9 Performing a Measurement

General Instructions for measuring



WARNING

Handling samples with temperatures of more than 70°C bears the danger of heavy burns. Make sure you wear protective clothes or ensure alternative protection from burns when handling high temperature samples.

NOTICE Before performing a measurement, make sure that the wetted parts are resistant to the sample (see Chapter 15).

- Make sure that the measuring cell is filled free from gas bubbles. Possible reasons for gas bubble in the measuring cell are:
 - Gas bubbles in the sample
 - Leaky connection of the filling tube, the pump or the screw plug
- Make sure that the measuring cell is fully filled.
- Make sure that the sample temperature does not deviate too strongly from the ambient temperature.

When measuring samples with a temperature which greatly differs from the ambient temperature, the measurement takes longer because the sample temperature first has to adjust to the ambient temperature.

If the sample measured is outside the temperature specifications (0 to +40°C), the display shows the warning sign until the sample has reached a measurable temperature. If the measured value is nevertheless saved, it is shown with an exclamation mark.

- Make sure to carefully clean the instrument after each measurement series to avoid deposits in the measuring cell.
- Make sure that suitable solvents for cleaning are available.

TIP Your filled sample is continuously measured and the measuring result is displayed. By storing the measuring result, you can print it or export it to a PC later.

9.1 Selecting the Measuring Unit

For measuring your samples you can choose between a number of predefined measuring units or you can import custom functions into the instrument and select one of them as the measuring unit. Contact your SBS representative to obtain a custom function from SBS.

All measuring units are derived from the density of the sample at the measured temperature.

1. Press <Menu> and select **“Measuring Units”**.
The list of the predefined measuring units is displayed.
2. Select the preferred measuring unit and press <OK>.
Some measuring units contain sub items with options to be selected.
3. Select the preferred option and press <OK>.
The measuring unit has now been changed.

9.1.1 Categories of Measuring Units

Meas. Units	Options	Description
Density	Density	Density at the displayed measuring temperature in g/cm^3 or kg/m^3 .
	Density @ xx °C	Density at the chosen reference temperature in g/cm^3 or kg/m^3 .
	Specific Gravity SG: SG Temp (°C or °F) α ($\text{g/cm}^3/\text{K}$).	Specific gravity is the density of the sample (at the chosen reference temperature) divided by the density of water (at the chosen reference temperature). Temperature influence is compensated by the set temperature coefficient α ($\text{g/cm}^3/\text{K}$).
Alcohol	Alcohol % v/v @ 20°C	Concentration of an ethanol/water mixture in % by volume at 20°C. The measuring range is 0 to 100% v/v.
	Alcohol % w/w	Concentration of a mixture of alcohol and water in % by weight at 20°C. The measuring range is 0 to 100% w/w.
	Alcohol US @ 60°F (°Proof)	Degrees Proof at 60°F. The measuring range is 0 to 200 °Proof.
API ³	API Gravity A API Gravity B API Gravity D	API number for the product group referred to the reference temperature of 15°C or 60°F. Product Group A: Crude Oil

³ Depending on the set temperature unit (°C or °F), the API values are automatically displayed @ 15°C or @ 60°F.

Meas. Units	Options	Description
		Product Group B: Fuels Product Group D: Lubricants
	API SG A API SG B API SG D	Specific gravity for the product group referred to the reference temperature of 15°C or 60°F.
	API Density A API Density G API Density D	Density of the product group in g/cm ³ with regard to the reference temperature of 15°C or 60°F.
Baumé	A (g/cm ³ /K)	Degrees Baumé at 60°F. The measuring range is 0 to 100 ° Baumé. Temperature influence is compensated by the set temperature coefficient α . For determining degree Baumé there are two different calculation methods depending on whether the density is above or below the density of water. Depending on the density of the measured liquid, SBS-3500 automatically switches between the two calculation methods.
H2SO4	H2SO4 % w/w	Concentration of sulfuric acid or battery acid in % by weight. The measuring range is 0 to 70% w/w.
	H2SO4 20°C	Density of sulfuric acid or battery acid at 20°C. The measuring range is 0.8 to 2 g/cm ³ .
Sugar	Brix	Degrees Brix (sucrose concentration in % by weight) at 20°C. The measuring range is -10 to 85 °Brix.
	Extract (°Plato)	Degrees Plato at 20°C. The measuring range is -10 to 85 °Plato.
Custom Functions	--	Optional custom functions. Contact your SBS representative to obtain a custom function.
Period	--	Period value of the oscillator at the measuring temperature.
Raw Data	--	Period value and resistance of the temperature sensor (only for service purposes).

9.1.2 Calculating a Temperature Coefficient

A temperature coefficient α (g/cm³/K) is needed for the calculation of some measuring units at certain reference temperatures.

The temperature coefficient can be calculated as follows:

$$\text{Temperature coefficient} = \left| \frac{\rho_1 - \rho_2}{T_1 - T_2} \right|$$

ρ_1 ... Density at temperature T_1

ρ_2 ... Density at temperature T_2

Typical temperature coefficients:

Numerous aqueous solutions from 0 to approx. 20%	0.0003
Numerous aqueous solutions from 10 to approx. 50%	0.0005
Numerous organic solutions	0.001

9.1.3 Importing Custom Functions

In addition to the predefined measuring units, you can import up to five custom functions to the instrument and select one of these as the measuring unit.

To do this, the coefficients for the calculation of your measuring unit need to be transferred to the instrument in the correct format. Contact your SBS representative if you want to import one or more additional measuring units to your instrument. You will receive a file with the custom functions in the correct format from SBS.

To Import Custom functions

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Press <Menu> and select **“Setup > Import / Export> Receive from PC”**.
3. Hold the IrDA interface of the SBS-3500 to the IrDA interface of your PC to establish communication between the two instruments.
4. On your PC, right click on the file you want to transmit and choose **“Send to > Infrared Recipient”**.

The custom function list is sent to the SBS-3500 and the custom functions are then available as measuring units.

9.2 Selecting Measuring Methods

Application of the method selection

You can define and store measuring methods in your SBS-3500, providing a great contribution to a more efficient organization of your measuring processes, especially if you want to measure many different substances according to different measuring units.

A stored measuring method may contain the following kinds of information:

- Measuring unit
- Offset value
- Temperature coefficient
- Number of the RFID Tag⁴

You can define and name up to 20 different measuring methods. To see how many of the 20 storage places are still available, go to the menu **“Device Information”** (see Chapter 11.3).

If you own several SBS-3500 instruments, you can import the same method list to all instruments.

9.2.1 Entering a New Method

1. Select the preferred measuring parameter (see Chapter 9.1) and, if necessary, the customer offset (see Chapter 12.4).
2. Press <Menu> and select **“Methods > Enter new Method”**.
3. Enter the first character of the measuring method’s name using the arrow keys and press <OK>.
4. Repeat this procedure for the other characters.

TIP If you choose the tick symbol without first choosing the characters, the method will be saved as <empty>. In this case, while being in the main screen only an empty bar indicates that a method has been selected.

5. Navigate to the tick symbol using the arrow keys and press <Save>.

TIP If you keep an arrow key pressed, the cursor automatically stops at the tick symbol.

⁴ Only for SBS-3500 versions with RFID interface

9.2.2 Entering Method Lists

If you plan to set up or edit large method lists, you can do so conveniently on the PC and then import the list to the SBS-3500. If you own several SBS-3500 instruments, you can import the same method list to all instruments to get several identical instruments.

To gain insight into the format to be used, first define one or two methods on the instrument (see Chapter 9.2.1) and then transfer these to the PC. After doing that you can conveniently enter further methods in the same format and import these into the instrument.

TIP Importing a new method list automatically deletes the existing method list.

Entering the data on the PC also allows for using additional characters. The instrument supports the space character and the following characters.

!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^
_	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{	|	}
~	°	²	³	µ	Ä	Ö	Ü	ß	ä	é	ö	ü																		

Method List Template

The following table explains the lines of a method list:

<DMA35>	
<METHODLIST>	
<METHOD>	
<NAME>DENSITY</NAME>	Name of the first method: Density
<RFID></RFID>	No RFID tag allocated
<UNIT>1</UNIT>	Measuring unit: Density
</METHOD>	
<METHOD>	
<NAME>ALCOHOL</NAME>	Name of the second method: Alcohol
<RFID>0100.7916.3A16</RFID>	RFID tag 0100.7916.3A16 allocated
<UNIT>11</UNIT>	Measuring unit: Alcohol % v/v
</METHOD>	
<METHOD>	
<NAME>SG</NAME>	Name of the third method: SG
<RFID></RFID>	No RFID tag allocated
<UNIT>3</UNIT>	Measuring unit: Specific Gravity SG
<ALPHA>0.00124</ALPHA>	Temperature coefficient: 0.00124
<TEMP1>20</TEMP1>	Temperature 1: 20
<TEMP2>4</TEMP2>	Temperature 2: 4
</METHOD>	
</METHODLIST>	
</DMA35>	

To Enter Method Lists


1. If your PC has no IrDA interface, install the IrDA USB adapter to your PC.
2. Hold the IrDA interface of the SBS-3500 to the IrDA interface of your PC to establish communication between the two instruments.
3. After having set up one or two methods as explained above, press <Menu> and choose **“Settings > Import / Export > Send to PC > Methods”**.
A dialog window appears on your PC asking if you want to accept the file.
4. Click <Yes>.
The method list will be transferred and filed on the desktop.

5. Open the method list on your PC using a text editor and enter additional methods in the same format at will.
6. Save your changes.
7. Press <Menu> and select **“Setup > Import / Export > Receive from PC”**.
8. Hold the IrDA interface of the SBS-3500 to the IrDA interface of your PC to again establish communication between the two instruments.
9. On your PC, right click on the file you want to transmit and select **“Send to > Infrared Recipient”**.
The method list is sent to the SBS-3500 and automatically accepted.


9.2.3 Editing a Method

1. Press <Menu> and choose **“Methods > Edit Method”**.
2. Select the method you want to edit and press <OK>.
3. For changing a method name, see Chapter 9.2.1 and for allocating an RFID tag, see Chapter 9.4.2.

9.2.4 Deleting a Method

1. Press <Menu> and select “Methods > Edit Method”.
2. Select the method to be deleted and press 
3. Select <Delete Selected>.
4. Press <Delete> when asked if you really want to delete the method.
The selected method is deleted from the method list.

9.2.5 Deleting All Methods

1. Press <Menu> and choose “Methods > Edit Method”.
2. Select a method and press 
3. Select <Delete all>.
4. Press <Delete> when asked if you really want to delete all methods.
All methods are deleted.

9.2.6 Selecting a Method

1. Press <Menu> and choose “Methods > Select Method”.
All stored methods are displayed.
2. Select the preferred method and press <OK>.
The name of the measuring method is displayed on the main screen and the following measurements are performed according to the selected method.

9.3 Assigning a Sample ID

You can assign different sample IDs to samples. This function helps to uniquely assign measuring data to

- Samples (sample identification)
- Users who performed the measurement (user identification)
- The measuring point where the sample was taken, etc.

You can save up to 100 different sample IDs to samples. To see how many of the 100 storage places are still available, go to the menu “**Device information**” (see Chapter 11.3).

9.3.1 Entering the Sample ID

1. Press <Menu> and select “**Sample-ID> Enter new ID**”.
2. Use the arrow keys to enter the first letter of the ID and press <OK>.
3. Repeat this procedure for the other letters in the ID.
4. Browse with the arrow keys to the tick symbol and press <Save>.

TIP If you keep an arrow key pressed, the cursor automatically stops at the tick symbol.

TIP If you enter a new sample ID and only select the tick symbol without entering letters for the ID, the sample ID is automatically given the name <empty>. The 4-digit consecutive number of the measuring data is then used as the ID.

9.3.2 Entering Sample ID Lists

The following table explains each line of a sample ID list:

<DMA>	
<IDLIST>	
<ID>	
<NAME></NAME>	Name of the first ID: <empty>
<RFID></RFID>	No RFID tag has been allocated
</ID>	
<ID>	
<NAME>ETHANOL</NAME>	Name of the second ID: <Ethanol>
<RFID>0100.7916.3A16</RFID>	RFID Tag 0100.7916.3A16 allocated
</ID>	
<ID>	
<NAME>WATER</NAME>	Name of the third ID: <Water>
<RFID></RFID>	No RFID tag has been allocated
</ID>	
</IDLIST>	
</DMA35>	


To enter a sample ID list

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.
3. First define one or two sample IDs on the instrument, as described above. Then press <Menu> and select **“Setup > Import / Export> Send to PC > Sample-ID List”**.
A dialog window appears on the PC asking if you want to accept the file.
4. Click <Yes>.
The sample ID list is transferred and filed on the desktop.
5. Open the sample ID list on your PC in a text editor and enter further sample IDs using the same format at will.
6. Save your changes.
7. Press <Menu> and select **“Setup > Import / Export > Receive from PC”**.
8. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC again to establish communication between the two instruments.
9. On the PC right mouse-click on the file you want to send and select **“Send to > Infrared Recipient”**.
The sample ID list is sent to the SBS-3500 and automatically accepted.


9.3.3 Changing the Sample ID

1. Press <Menu> and select **“Sample-ID > Edit ID”**.
2. Select the ID you want to change and press <OK>.
3. For changing the sample ID, see Chapter 9.3.3, and for allocating an RFID tag, see Chapter 9.4.2.

9.3.4 Deleting a Sample ID

1. Press <Menu> and select **“Sample-ID > Edit ID”**.
2. Select the sample ID you want to delete and press 
3. Select <Delete selected ID>.
4. Press <Delete> when asked if you really want to delete the selected ID.
The selected ID is deleted.

9.3.5 Deleting all Sample IDs

1. Press <Menu> and select **“Sample-ID > Edit ID”**.
2. Select any ample ID and press 

3. Select <Delete all IDs>.
4. Press <Delete> when asked if you really want to delete all IDs.
All IDs are deleted.

9.3.6 Selecting a Sample ID

1. Press <Menu> and select “Sample-ID > Select ID”.
All saved sample IDs are displayed
2. Select the required sample ID and press <OK>.
The sample ID is now selected and all measurements are given this ID. The sample ID is shown on the main screen.

9.4 Using the RFID Function

The product version SBS-3500 Tag&Log is additionally equipped with an RFID interface, enabling to uniquely allocate an RFID tag to a method and/or sample ID. By reading the tag that has been uniquely allocated to a method and/or sample ID when the instrument displays the main screen, this method and/or sample ID is automatically used for the following measurements.

9.4.1 Preconditions for using RFID

Only with product version SBS-3500 Tag&Log is it possible to use the RFID function, as only this version is equipped with an RFID interface. The functionality of the RFID communication is only guaranteed for RFID tags that support data exchange on a frequency of 125 kHz and are equipped with chip type “Hitag S2048”.

The communication range of the RFID receiver integrated in the SBS-3500 is about 2 cm. The tag has to be situation within this area to enable data exchange with the SBS-3500.

9.4.2 Allocating RFID Tags

Allocation of an RFID tag is done by reading the unique identification number of the tag via the RFID interface of the SBS-3500 and by allocating this identification number to a method and/or sample ID on the instrument. Allocation is done exclusively on the instrument and no programming of the tag is done.

You can allocate an RFID tag during entering a new method (see Chapter 9.2.1) or sample ID (see Chapter 9.3.1) as well as during editing a method (see Chapter 9.2.3) or sample ID (see Chapter 9.3.3).


1. Go to the corresponding menu as described in the appropriate chapter.
2. Hold the RFID tag to the RFID interface of the SBS-3500 until the RFID tag number is displayed.
3. You can now enter further characters, if required.

4. Navigate to the tick symbol using the arrow keys and press <Save>.

An RFID tag may only be allocated to one method and/or sample ID. If you try to allocate an RFID tag to more than one method and/or sample ID. If you try to allocate an RFID tag to more than one method and/or sample ID, the message “RFID in use” is displayed. In this case, choose another RFID tag for this method or sample ID.

To check whether an RFID tag has already been allocated to a certain method or sample ID, go to the menu “**Methods > Edit Method**” or “**Sample-ID > Edit ID**”, select the respective method or sample ID, and hold the RFID tag to the RFID interface. If the RFID tag has already been allocated to this method or sample ID, the RFID tag number and the message “RFID matches” is displayed.

9.4.3 Selecting a Method and/or Sample ID via RFID

This way of selection is only available if one or more methods and/or sample IDs have been allocated to an RFID tag (see Chapter 9.4.2). Measuring methods and sample IDs that have an allocated RFID tag are marked with the RFID symbol  .

1. Allocate the RFID function to the softkey (see Chapter 8.7)
2. When the instrument displays the main screen, press the <RFID> softkey.
The message “Reading RFID” is displayed.
3. Hold the allocated RFID tag to the RFID interface of the instrument.
The method and/or sample ID allocated will automatically be used for the following measurements.

9.4.4 Application Examples of RFID

RFID tags can be attached on the outside of tank farms, for example. Before an employee takes a sample from the tank to measure it, the measuring method and sample ID to be used can be changed accordingly by reading the RFID tag.

The RFID function also proves to be useful when inspecting incoming goods: For each incoming good you can allocate an RFID tag to the measuring method and sample ID to be used and catalog the tags. By doing this, the allocated RFID tag can easily be scanned from the catalog when the substance is coming in, a sample can be taken and measured and traced back via the sample ID later.

9.5 Filling Sample

Depending on the viscosity of the sample, you can fill the measuring cell using the filling tube or the plastic syringe. When filling highly viscous samples, we recommend using the plastic syringe.

9.5.1 Filling Using the Filling Tube

1. Press down the pump lever as far as it will go (see Fig. 9 – 1).
2. Submerge the filling tube in the sample.
3. Slowly release the pump lever.

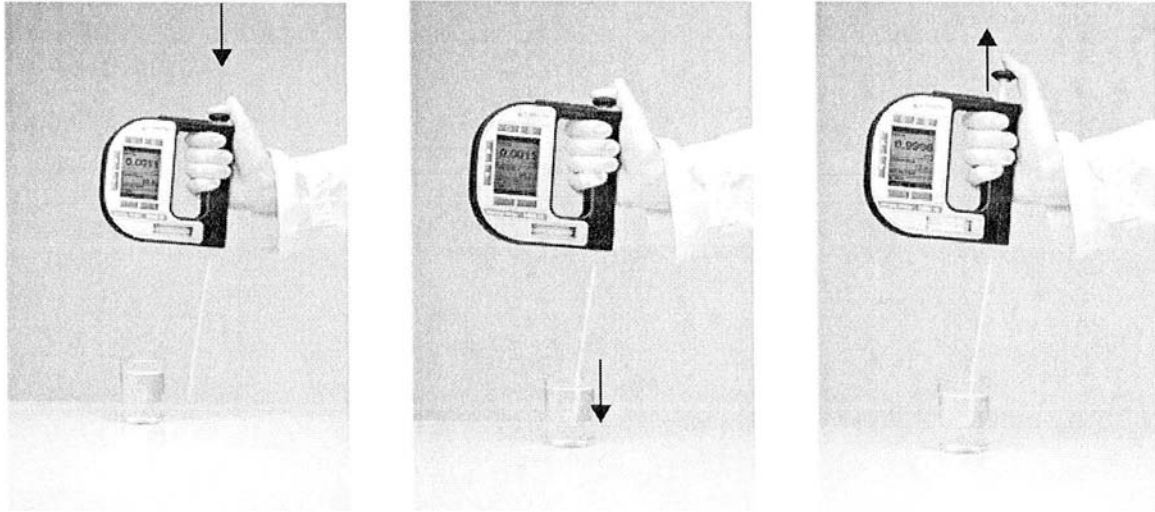


Fig. 9 – 1 Filling sample using the filling tube

9.5.2 Filling with the Plastic Syringe

NOTICE Do not remove the pump when filling with the plastic syringe.
Otherwise, the system is leaky

1. Fill the plastic syringe with the sample.
2. Fill the measuring cell through the Luer adapter using the plastic syringe.

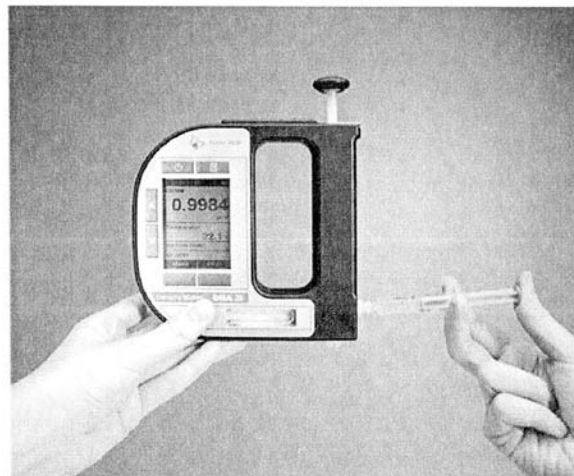



Fig. 9-2 Filling sample using the plastic syringe


9.6 Performing a Measurement

1. Select the measuring unit (see Chapter 9.1) or measuring method (see Chapter 9.2).
2. Define a sample ID if you want to assign the measurement results to a specific sample (see Chapter 9.3).
3. Fill the measuring cell with the sample.
4. Press the  key on the back of the SBS-3500.

The measured value is displayed as soon as the result has stabilized. The measured value with all corresponding data is now saved in the results list.

5. Press <OK> to return to the measuring mode.

9.6.1 Deleting the Measured Value

- Press the  instead of <OK> when the measured value appears on the display. The measured value is deleted and the instrument returns to the measuring mode.

9.6.2 Printing the Measured Value

You can transfer the measured value to a printer via the IrDA interface. For a compatible printer, contact your SBS representative.

1. Allocate the softkey the command <Print> (see Chapter 8.7).
2. Switch on the printer with the IrDA interface.
3. Press the <Print> key when the measured value appears on the display.
4. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the printer to establish communication between the printer and density meter.
The measured value is printed.

You can also print out all or only the last measuring data (see Chapter 9.9).

9.6.3 Emptying the Measuring Cell

1. Place the filling tube in a vessel which is suitable for sample disposal.
2. Empty the measuring cell by pressing the pump lever.

9.7 Accessing Saved Measuring Data

You can save up to 1024 measuring data directly in the instrument's memory. If the memory contains 1024 saved values, further values will overwrite the oldest saved values. Each saved value is given a consecutive 4-digit number. Using this number you can see whether the instrument has overwritten old entries. This is the case if the consecutive number is larger than 1024. If you delete all measuring data, the counter starts again at 0001.

To see how many values are saved you can select **"Device Information"** (see Chapter 11.3).

1. Press <Menu> and select **"Measuring Data"**.
The list of results is displayed (see Fig. 9-3).

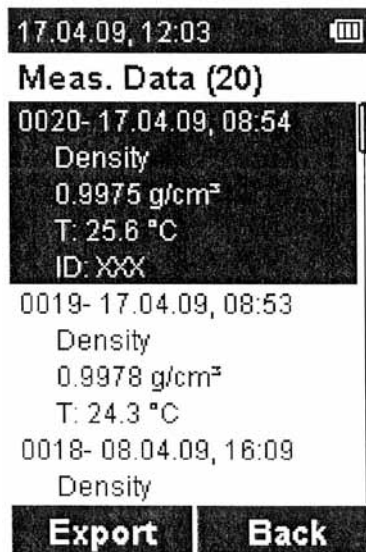


Fig. 9-3 Measuring Data

9.8 Exporting Measuring Data to a PC

Exporting measuring data to a PC does not require a special program. You just need a PC with an infrared interface or a PC with an IrDA USB adapter installed and connected. Contact your SBS representative if you need an IrDA USB adapter for your PC.

To set the data export format

1. Press <Menu> and select **"Setup > Import / Export > Data Format"**.
You can choose between different format options.
2. Choose the data format, <CSV> or <TXT>, and press <OK>.

3. Choose the delimiter, <,> [comma], <;> [semi-colon] or </> [slash], and press <OK>. Your changes are accepted and used for the following data export.

To export a measured value

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Press <Menu> and elect **“Measuring Data”**.
3. Select the measured value required for export using the arrow keys.
4. Press <Export>.
5. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.
6. Select <Export Selected> to export the selected measured value to the PC. A dialog window appears on the PC asking if you want to accept the file.
7. Click <Yes>. The measured value is transferred on the desktop.

To export all measuring data

You have two options for exporting all measuring data to a PC.

Option 1:

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Press <Menu> and select **“Measuring Data”**.
3. Press <Export>.
4. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.
5. Select <Export All> to export the whole list of measuring data to the PC. A dialog window appears on the PC asking if you want to accept the file.
6. Click <Yes>. The measuring data are transferred and filed on the desktop.

Option 2:

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.
3. Press <Menu> and select **“Setup > Import / Export > Send to PC > Measuring Data”** and press <OK>.
4. Click <Yes>. The measuring data are transferred and filed on the desktop.

9.9 Printing the Saved Measuring Data

You can transfer the saved measuring data to a printer via the IrDA interface. For a compatible printer, contact your SBS representative.

To print a selected measured value


1. Switch on the printer with the IrDA interface.
2. Press <Menu> and select **“Measuring Data”**.
3. Select the measured value required for printing using the arrow keys.
4. Press <Export>.
5. Select <Print Selected> to print the selected measured value.
6. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the printer to allow communication between the printer and density meter.
The measured value is printed.

To print all saved measuring data


1. Switch on the printer with the IrDA interface.
2. Press <Menu> and select **“Measuring Data”**.
3. Press <Export>.
4. Select <Print All> to print the whole list of measuring data.
5. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the printer to allow communication between the printer and density meter.
All measuring data are printed.

9.10 Deleting the Saved Measuring Data

To delete the last measured value

1. Press <Menu> and select **“Measuring Data”**.
2. Select a measured value and press 
3. Select <Delete Last> and press <OK>.
4. Press <Delete> when asked if you really want to delete the last measured value.
The last measured value is removed from the list.

To delete all measuring data

1. Press <Menu> and select **“Measuring Data”**.
2. Select a measured value and press 
3. Select <Delete All> and press <OK>.
4. Press <Delete> when asked if you really want to delete all measuring data.
All measuring data are deleted.

10 Cleaning and Storing the Instrument

10.1 Cleaning the Measuring Cell

Clean the measuring cell regularly before and after each measurement series with a suitable solvent to ensure the long-term accuracy of your results. If the measuring cell is not sufficiently cleaned, residue may form in the measuring cell and lead to inaccurate measurements results. Depending on the application, also cleaning between measurements may be required.

NOTICE Make sure the solvent you use for cleaning is suitable.

1. Place the filling tube in a vessel which is suitable for sample disposal.
2. Empty the measuring cell by pressing the pump lever.
3. Fill the measuring cell with a suitable solvent.
4. Pump the solvent through the whole measuring system several times.

10.2 Cleaning the Filling Pump

Clean the filling pump regularly, depending on your application. If you measure aggressive samples, e.g. battery acid, clean the filling pump more often.

1. Place the filling tube in a vessel which is suitable for sample disposal.
2. Empty the measuring cell by pressing the pump lever.
3. Open the pump lock and remove the pump.
4. Rinse the pump under running tap water while moving the pump piston up and down.
5. Dry the pump with a lint-free cloth.
6. Insert the pump and close the pump lock.

10.3 Cleaning the Pump Housing

The SBS-3500 is completely sealed against the outside and the pump. Therefore, you can rinse the pump housing with running tap water if the housing is dirty.

1. Place the filling tube in a vessel which is suitable for sample disposal.
2. Empty the measuring cell by pressing the pump lever.
3. Open the pump lock and remove the pump.
4. Hold the pump housing under running water and rinse it thoroughly.
5. Insert the pump and close the pump lock.

10.4 Cleaning the Housing and Display

To clean the housing and display, use a soft cloth dipped in ethanol or warm water. If necessary, you can use a mild solvent ($\text{pH} < 10$).

10.5 Storing the Instrument

Before storing the instrument for a longer period of time, clean the measuring cell as described in Chapter 10.1. This prevents any liquid residues freezing or drying in the measuring cell, which could destroy the cell or lead to measuring inaccuracies.





For storage lasting less than one day, fill the measuring cell with deionized water or solvent. If you have filled the liquid via the plastic syringe, leave the syringe in the adapter to stop the liquid from running out.

11 Maintenance

11.1 Changing the Batteries

You can see the status of the battery by looking at the battery symbol in the top right-hand corner of the display.

The following statuses are possible:

Battery is full	
Battery is a little low	
Battery is low	
Battery is empty	

When the batteries are almost empty, the warning “Low Battery” is displayed. After the second warning “Battery Empty”, the instrument switches itself off.

If the batteries are flat, you can easily replace them.



WARNING

When opening the battery compartment or exchanging batteries, sparks may be generated which can cause an explosion or fire in hazardous areas. Serious injuries are possible.

- Never open the battery cover in hazardous areas.
- Only replace the batteries outside hazardous areas.

NOTICE

- Always observe the correct polarity when replacing the batteries
 - Only use batteries of the same type and with the same level of battery charge.
1. Place the filling tube in a vessel which is suitable for sample disposal.
 2. Empty the measuring cell by pressing the pump lever.
 3. Open the pump lock and remove the pump.

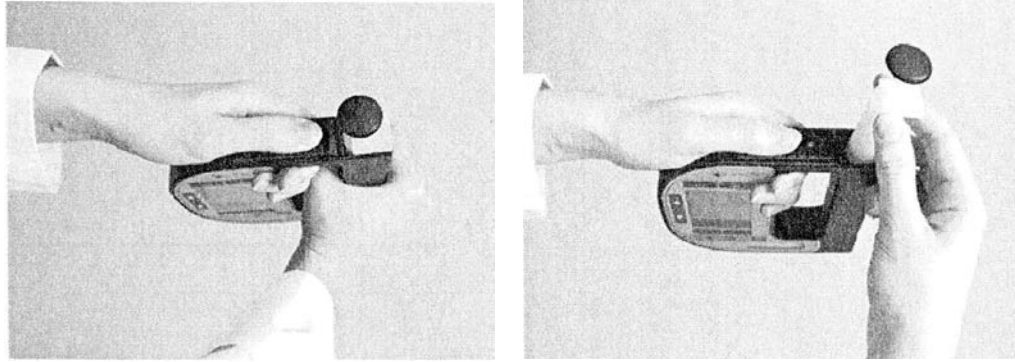


Fig. 11-1 Removing the pump

4. Screw out the screw of the pump lock using an Allen key size 2.5 and remove the screw.

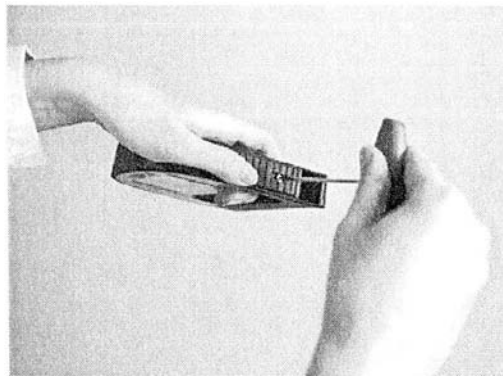


Fig. 11-2 Removing the pump lock screw

5. Remove the pump lock by sliding it outwards.



Fig. 11-3 Removing the pump lock

6. Use a coin to open the battery cover by turning.



Fig. 11-4 Opening the battery cover

7. Remove the flat batteries by turning the instrument upside down.
8. Insert the new batteries. The picture on the back of the instrument shows the correct positioning of the batteries.
9. Close the battery cover using a coin.
10. Insert the pump lock again and slide it back to the original position. Make sure you slide the pump lock in the correct direction.
12. Insert the pump again.
13. Close the pump lock.
The instrument is ready for operation.
14. Check that the instrument is working properly by switching it on and checking the display.

11.2 Carrying out a Firmware Update

Your SBS representative will inform you when a new firmware update for your SBS-3500 is available. After receiving the update file, you can import it into the instrument.

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.
3. Press <Menu> and select **“Setup > Import / Export > Receive from PC”**.
4. On the PC right mouse-click on the file you want to send and select **“Send to > Infrared Recipient”**.

The firmware update is sent to the SBS-3500.

The SBS-3500 switches itself off during the update procedure. The update procedure takes around one minute. Then the instrument switches itself back on. The new firmware is now installed.

11.3 Device Information

Information about the instrument is saved in the instrument and can be accessed or exported at any time. This information includes the following:

- Manufacturer
- Instrument name
- Serial number
- Instrument status
 - Measuring data: xxxx/1024
 - IDs: xxx/100
 - Methods: xx/20
- Firmware version
- Date of the firmware version
- Bootloader version
- Date of the bootloader version
- Hardware status

11.3.1 Accessing Device Information

- Press <Menu> and select “Setup > Device Information”.
The device information is displayed.

11.3.2 Exporting Device Information

You can export the instrument information onto a PC.

1. If your PC has no IrDA interface, install the IrDA USB adapter on your PC.
2. Press <Menu> and select “**Setup > Import / Export > Send to PC > Device Information.**”
3. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.
A dialog window appears on the PC asking if you want to accept the file.
4. Click <Yes>.
The instrument information is transferred and filed on the desktop as a text file.

Example:

```
<DMA35>
<DEVICE>
  <DIST>Anton Paar</DIST>
  <NAME>DMA 35 Version 3</NAME>
  <SERIAL>98765432</SERIAL>
  <MEASURING_DATA>5/1024<MEASURING_DATA>
  <SAMPLE_IDS>1/100</SAMPLE_IDS>
  <METHODS>2/20</METHODS>
  <SOFTWARE>v1.54</SOFTWARE>
  <DATE>06.04.2009</DATE>
  <BL_SOFTWARE>v0.23</BL_SOFTWARE>
  <BL_DATE>18.03.2009</BL_DATE>
  <HARDWARE>5435.3</HARDWARE>
</DEVICE>
</DMA35>
```

11.4 Exporting Adjustment Date

The currently valid adjustment data are stored on your instrument. You can transfer these to your PC.

1. If your PC has no IrDA interface, install the IrDA USB adapter of your PC.
2. Press <Menu> and select "Setup > Import / Export > Send to PC > Adjustment."
3. Hold the IrDA interface of the SBS-3500 to the IrDA interface of the PC to establish communication between the two instruments.

A dialog window appears on the PC asking you to accept the file transfer.

4. Click <Yes>.

The adjustment data are transferred and filed on the desktop as a text file.

Example:

```
<DMA35>
<ADJUSTMENTDATA>
  <KA>1.518872E-06</KA>
  <KB>1.843933E+00</KB>
  <KC>1.352293E-04</KC>
  <KD>-2.457641E-07</KD>
  <TKA>7.068061E-04</TKA>
  <TKB>2.739587E-04</TKB>
  <TKC>5.822781E-08</TKC>
</ADJUSTMENTDATA>
</DMA35>
```


12 Readjustment

To ensure accurate results it is necessary to clean the measuring cell before and after each measurement series. If the measuring cell is not sufficiently cleaned, residue can form in the measuring cell. This can be noticed if the density values for deionized water begin to deviate. Therefore, perform regularly check measurements with deionized water.

If the density values for water deviate by more than $\pm 0.001 \text{ g/cm}^3$ at the given temperature from the table values (see Appendix A), then a readjustment is required. A readjustment is only possible if the calculated difference between the measured and the theoretical value is smaller than 0.01 g/cm^3 and the temperature of the water is between 15 and 25°C .

12.1 Check Measurement

1. Clean the measuring cell as described in Chapter 10.1 and rinse the measuring cell until no more solvent residues are present.
2. Select the measuring unit "Density" (see Chapter 9.1).
3. Fill the measuring cell with deionized water and perform a measurement (see Chapter 9.5 and 9.6).
4. Compare the measured density value with the table values (see Appendix A).
5. If the measured density value deviates more than 0.001 g/cm^3 from the table value, perform a readjustment.

12.2 Water Adjustment

One option is to readjust using deionized water.

1. Clean the measuring cell as described in Chapter 10.1 and rinse the measuring cell until no more solvent residues are present.
2. Press <Menu> and select "**Adjustment > Water Adjustment**".
3. Fill the measuring cell with deionized water at approximately 20°C (15 to 25°C) without bubbles.
4. Confirm with <OK> that the measuring cell is filled with deionized water.
The density value of the filled deionized water is now measured and compared with the adjustment data. The display shows the calculated deviation (Delta) in g/cm^3 .
5. Press <OK> to activate the new adjustment.

12.3 Custom Adjustment

You can also use any other reference liquid with a known density at 20°C and known temperature coefficient for your readjustment.

We recommend using the customer adjustment e.g. if you measure only liquids in a specific density range (e.g. high density) and want to yield more accurate results in this range.

1. Clean the measuring cell as described in Chapter 10.1 and rinse the measuring cell until no more solvent residues are present.
2. Press <Menu> and select **“Adjustment > Custom Adjustment”**.
3. Fill the measuring cell with reference liquid at approx. 20°C (15 to 25°C) without bubbles.
4. Confirm with <OK> that the measuring cell is filled with reference liquid.
You are asked to enter the density of your reference liquid at 20°C.
5. Using the arrow keys, select the first number and press <OK>.
6. Repeat the procedure for the other numbers and press <Save>.
7. Enter the temperature coefficient of your reference liquid and press <Save>.
The density of the filled reference liquid is now measured and compared with the entered density for the reference liquid at 20°C. The display shows the calculated deviation (Delta) in g/cm³.
8. Press <OK> to activate the new adjustment.

12.4 Defining an Offset

You can define an offset for your measurement. This is automatically added to each measured value. The offset value always refers to the current measuring unit and is deleted when you change to another measuring unit. If you have selected a method, the set offset is saved with the method.

1. Press <Menu> and select **“Adjustment > Custom Offset”**.
2. Using the arrow keys, select the first number of your offset value and press <OK>.
3. Repeat the procedure for all other numbers and press <Save>.
The set offset is now shown in the main screen.

12.5 Restoring to Factory Adjustment

If you want to undo all your adjustments you can restore the factory adjustment.

1. Press <Menu> and select **“Adjustment > Factory Adjustment”**.
The display shows: **“Are you sure that you want to reset to factory adjustment?”**
2. Press <OK> to restore the factory adjustment.
The factory adjustment is restored.

13 Error Messages and Warnings

Error Message	Cause
Out of Specification	The measured sample temperature is outside the specifications.
Out of Range	The measured value is outside the specified range. Possible reasons: <ul style="list-style-type: none"> • The temperature is too high or too low • The density is too high or too low • The measured value is invalid
Temperature Range	The temperature of the reference liquid for readjustment is outside the temperature specifications (+15 to +25°C).
Density Range	The density of deionized water at 20°C measured during readjustment is outside the allowed limits (tolerance 0.01 g/cm ³).
Criterion	The density of deionized water at 20°C measured during readjustment deviates from factory adjustment by more than 0.01 g/cm ³ .
Low Battery	The battery is almost empty.
Battery Empty	The battery is empty.
Error 01	The temperature is invalid.
Error 02	The period is invalid.
Error 03	SBS-3500 has no adjustment data

NOTICE If the error messages “Error 01” to “Error 04” occur, send in your instrument for service.

14 Technical Data

Measuring range:	
Density:	0 to 3 g/cm ³
Temperature:	0 to 40°C (32 to 104°F)
Viscosity:	0 to approx. 1000 mPa's
Accuracy:	
Density ^a :	0.001 g/cm ³
Temperature:	0.2°C
Repeatability, s.d.:	
Density:	0.0005 g/cm ³
Temperature:	0.1°C
Resolution:	
Density:	0.0001 g/cm ³
Temperature:	0.1°C
Sample volume:	Approx. 2 mL
Sample temperature:	0 to 100°C
Ambient temperature^b:	-10 to +50°C (14 to 122°F)
Storage temperature^c:	-20 to +70°C (-4 to 158°F)
Humidity:	5 to 90% relative air humidity, non-condensing
Protection class:	IP54 (use in light rain or snow possible)
Display:	LCD monochrome, graphical, 41 x 55mm, 160 x 240 pixels
Data memory:	1024 measuring data
Interfaces:	Infrared: IrDA 1.4 Low Power Compliant Protocol: IrOBEX / IrLPT
Power supply:	
Battery type:	Alkaline battery 1.5V LR06 MIGNON, AA
Battery life:	> 100 hours
Dimensions^d:	150 x 138 x 27 mm (5.5 x 5.4 x 1.1 inches)
Weight (including batteries):	368g (13 ounces)

^a Viscosity < 100 mPa's, density range 0 to 2 g/cm³

^b The sample must not freeze in the oscillator

^c Empty the measuring cell before storing the instrument

^d Without pump and filling tube

15 Wetted Parts

The following materials are in contact with samples and the cleaning liquids.

Material	Part
Borosilicate glass	Measuring cell
PTFE (Polytetrafluoroethylene)	Filling tube, piston for hand pump
PVDF (Polyvinylidene fluoride)	Connection block, bolt
Kalez	Oscillator sealing
PP (Polypropylene) GF	Housing for SBS-3500

Appendix A: Density of Water⁵ (0°C to 40°C)

T °C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	.99984	.99985	.99985	.99986	.99987	.99987	.99988	.99988	.99989	.99989
1	.99990	.99990	.99991	.99991	.99992	.99992	.99993	.99993	.99993	.99994
2	.99994	.99994	.99995	.99995	.99995	.99995	.99996	.99996	.99996	.99996
3	.99996	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997
4	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997
5	.99996	.99996	.99996	.99996	.99996	.99995	.99995	.99995	.99995	.99994
6	.99994	.99994	.99993	.99993	.99993	.99992	.99992	.99991	.99991	.99991
7	.99990	.99990	.99989	.99989	.99988	.99988	.99987	.99987	.99986	.99985
8	.99985	.99984	.99984	.99983	.99982	.99982	.99981	.99980	.99980	.99979
9	.99978	.99977	.99977	.99976	.99975	.99974	.99973	.99973	.99972	.99971
10	.99970	.99969	.99968	.99967	.99966	.99965	.99964	.99963	.99962	.99961
11	.99960	.99959	.99958	.99957	.99956	.99955	.99954	.99953	.99952	.99951
12	.99950	.99949	.99947	.99946	.99945	.99944	.99943	.99941	.99940	.99939
13	.99938	.99936	.99935	.99934	.99933	.99931	.99930	.99929	.99927	.99926
14	.99924	.99923	.99922	.99920	.99919	.99917	.99916	.99914	.99913	.99911
15	.99910	.99908	.99907	.99905	.99904	.99902	.99901	.99899	.99897	.99896
16	.99894	.99893	.99891	.99889	.99888	.99886	.99884	.99883	.99881	.99879
17	.99877	.99876	.99874	.99872	.99870	.99869	.99867	.99865	.99863	.99861
18	.99859	.99858	.99856	.99854	.99852	.99850	.99848	.99846	.99844	.99842
19	.99840	.99838	.99836	.99835	.99833	.99831	.99828	.99826	.99824	.99822
20	.99820	.99818	.99816	.99814	.99812	.99810	.99808	.99806	.99803	.99801
21	.99799	.99797	.99795	.99793	.99790	.99788	.99786	.99784	.99781	.99779
22	.99777	.99775	.99772	.99770	.99768	.99765	.99763	.99761	.99758	.99756
23	.99754	.99751	.99749	.99747	.99744	.99742	.99739	.99737	.99734	.99732
24	.99730	.99727	.99725	.99722	.99720	.99717	.99715	.99712	.99709	.99707
25	.99704	.99702	.99699	.99697	.99694	.99691	.99689	.99686	.99683	.99681
26	.99678	.99676	.99673	.99670	.99667	.99665	.99662	.99659	.99657	.99654
27	.99651	.99648	.99646	.99643	.99640	.99637	.99634	.99632	.99629	.99626
28	.99623	.99620	.99617	.99615	.99612	.99609	.99606	.99603	.99600	.99597
29	.99594	.99591	.99588	.99585	.99582	.99579	.99577	.99574	.99571	.99568
30	.99564	.99561	.99558	.99555	.99552	.99549	.99546	.99543	.99540	.99537
31	.99534	.99531	.99528	.99524	.99521	.99518	.99515	.99512	.99509	.99506
32	.99502	.99499	.99496	.99493	.99490	.99486	.99483	.99480	.99477	.99473
33	.99470	.99467	.99463	.99460	.99457	.99454	.99450	.99447	.99444	.99440
34	.99437	.99433	.99430	.99427	.99423	.99420	.99417	.99413	.99410	.99406
35	.99403	.99399	.99396	.99393	.99389	.99386	.99382	.99379	.99375	.99372
36	.99368	.99365	.99361	.99358	.99354	.99350	.99347	.99343	.99340	.99336
37	.99333	.99329	.99325	.99322	.99318	.99314	.99311	.99307	.99304	.99300
38	.99296	.99292	.99289	.99285	.99281	.99278	.99274	.99270	.99267	.99263
39	.99259	.99255	.99252	.99248	.99244	.99240	.99236	.99233	.99229	.99225
40	.99221	.99217	.99214	.99210	.99206	.99202	.99198	.99194	.99190	.99186

⁵ Excerpt from: Spieweck, F. & Bettin, H.: Review: Solid and liquid density determination. Technisches Messen 59 (1992) pp. 285-292

Appendix B: Measuring Unit Details

ID	Measuring unit		Minimum	Maximum	Unit	Format	Offset format
1	Density		0.0000	3.0000	g/cm ³	n.nnnn	0.0nnn
			0000.0	3000.0	kg/m ³	nnnn.n	00nn.n
2	Density @ xx °C		0.0000	3.0000	g/cm ³	n.nnnn	0.0nnn
			0000.0	3000.0	kg/m ³	nnnn.n	00nn.n
3	Specific Gravity SG		0.0000	3.0000	--	n.nnnn	0.0nnn
4	Period		0000.00	9999.99	µs	nnnn.nn	No Offset
5	Raw Data	Period	0000.00	9999.99	µs	nnnn.nn	No Offset
		Resistance	1000	200000	Ohm	nnnnn	No Offset
6	Baumé		000.00	100.00	°Baumé	nnn.nn	00n.nn
7	Brix		-10.00	85.00	°Brix	nnn.nn	00n.nn
8	Extract		-10.00	85.00	°Plato	nnn.nn	00n.nn
9	H2SO4 % w/w		000.00	070.00	% w/w	nnn.nn	00n.nn
10	H2SO4 @ 20 °C		0.8000	2.0000	g/cm ³	n.nnnn	0.0nnn
			0800.0	2000.0	kg/m ³	nnnn.n	00nn.n
11	Alcohol % v/v @ 20 °C		000.00	100.00	% v/v	nnn.nn	00n.nn
12	Alcohol % w/w		000.00	100.00	% w/w	nnn.nn	00n.nn
13	Alcohol US @ 60 °F		000.00	200.00	Proof	nnn.nn	00n.nn
14	API Gravity A ^a		-50.00	100.00	°API	nnn.nn	00n.nn
15	API Gravity B						
16	API Gravity D						
17	API SG A		0.5000	1.5000	--	n.nnnn	0.0nnn
18	API SG B						
19	API SG D						

ID	Measuring unit	Minimum	Maximum	Unit	Format	Offset format
20	API Density A	0.5000	1.5000	g/cm ³	nnnn.n	0.0nnn
		0500.0	1500.0	kg/m ³	n.nnnn	00nn.n
21	API Density B	0.5000	1.5000	g/cm ³	nnnn.n	0.0nnn
		0500.0	1500.0	kg/m ³	n.nnnn	00nn.n
22	API Density D	0.5000	1.5000	g/cm ³	nnnn.n	0.0nnn
		0500.0	1500.0	kg/m ³	n.nnnn	00nn.n
23 30 31 32 33	Custom Functions	--	--	--	--	--

- a Depending on the set temperature unit (°C or °F), the API values are automatically displayed @ 15 °C or @ 60 °F.

ID	Measuring unit		ρ_{\min} [g/cm ³]	ρ_{\max} [g/cm ³]	T_{\min} [°C]	T_{\max} [°C]	T_{\min} valid [°C]	T_{\max} valid [°C]
1	Density		0	3	-20	80	0	40
2	Density @ xx °C		0	3	-20	80	0	40
3	Specific Gravity SG		0	3	-20	80	0	40
4	Period		--	--	--	--	--	--
5	Raw Data	Period	--	--	--	--	--	--
		Resistance	--	--	--	--	--	--
6	Baumé		0.5	2	-20	80	0	40
7	Brix		0.8	2	-20	80	0	40
8	Extract		0.8	2	-20	80	0	40
9	H2SO4 % w/w		0.8	2	0	75	10	40
10	H2SO4 @ 20 °C		0.8	2	0	75	10	40

ID	Measuring unit	ρ_{\min} [g/cm ³]	ρ_{\max} [g/cm ³]	T _{min} [°C]	T _{max} [°C]	T _{min} valid [°C]	T _{max} valid [°C]
11	Alcohol % v/v @ 20 °C	0.5	1.0	-10	40	0	40
12	Alcohol % w/w						
13	Alcohol US @ 60 °F						
14	API Gravity A ^a	0.5	1.5	-20	80	0	40
15	API Gravity B						
16	API Gravity D						
17	API SG A	0.5	1.5	-20	80	0	40
18	API SG B						
19	API SG D						
20	API Density A	0.5	1.5	-20	80	0	40
21	API Density B						
22	API Density D						
23 30 31 32 33	Custom Functions	--	--	--	--	--	--

Appendix C: Menu Tree

Adjustment	Water Adjustment				
	Custom Adjustment				
	Custom Offset				
	Factory Adjustment				
Setup	Import / Export	Send to PC	Custom Functions		
			Adjustment		
			Device Information		
			Sample-ID List		
			Methods		
			System Settings		
			Measuring Data		
		Receive from PC			
		Data Format	Format: CSV; TXT		
			Delimiter: . ; /		
			Decimalpoint: . ,		
		Set Password			
		Date and Time	Set Date and Time		
				Date Format	dd.mm.yy
					dd.mm.yyyy
					yy-mm-dd
					yyyy-mm-dd
					mm/dd/yy
					mm/dd/yyyy
			Time Format	24 hours	
				am/pm	
		Softkey	Store; Print; RFID ^a		
		Display Contrast	-8, ..., +8		
		Backlight	On; Auto; Off		
		Energy Saving	Off; 3 min; 5 min; 10 min		
		Beep	On; Off		
		Units	Density: g/cm ³ ; kg/m ³		
	Temperature: °C; °F				
	Language	English			
		Deutsch			
	Device Information				

Adjustment	Water Adjustment			
	Custom Adjustment			
	Custom Offset			
	Factory Adjustment			
Setup	Import / Export	Send to PC	Custom Functions	
			Adjustment	
			Device Information	
			Sample-ID List	
			Methods	
			System Settings	
			Measuring Data	
		Receive from PC		
		Data Format	Format: CSV; TXT	
			Delimiter: . ; /	
			Decimalpoint: . ,	
		Set Password		
		Date and Time	Set Date and Time	
			Date Format	dd.mm.yy
				dd.mm.yyyy
				yy-mm-dd
				yyyy-mm-dd
				mm/dd/yy
				mm/dd/yyyy
		Time Format	24 hours	
			am/pm	
		Softkey	Store; Print; RFID ^a	
		Display Contrast	-8, ..., +8	
	Backlight	On; Auto; Off		
	Energy Saving	Off; 3 min; 5 min; 10 min		
	Beep	On; Off		
	Units	Density: g/cm ³ ; kg/m ³		
		Temperature: °C; °F		
	Language	English		
		Deutsch		
	Device Information			

