EAGLE EYE
POWER SOLUTIONS

Instruction Manual

SG-Ultra Max

Portable Density Meter

While every precaution has been taken in the preparation of this document, Eagle Eye Power Soltuions (EEPS) 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. EEPS does not make a commitment to update the information in this manual. Specifications are subject to change without notice.

Contact: Eagle Eye Power Solutions
6306 Eastwood Ct.
Mequon, WI 53092
Tel: 1-877-805-3377
Fax: 414-962-3660
E-mail: info@eepowersolutions.com
Web: eepowersolution.com

Contents

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.

The instruction manual is a part of the product. Keep this instruction manual for the complete working life of the product and ensure that it is easily accessible for all people involved with the product. If you receive any additions to or revisions of this instruction manual from Eagle Eye, these must be treated as part of the instruction manual.

Conventions for safety messages

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

Convention	Description
<key>	The names of keys and buttons are written between angle brackets.
menu level 1 > menu level 2	Menu paths are written in italics. Menu levels are connected by a closing angle bracket.

2 Safety Instructions

- Read this instruction manual before using the instrument.
- Make this instruction manual easily accessible to all persons working with the instrument.
- Follow all hints and instructions in this instruction manual to ensure the correct use and safe functioning of the instrument.

2.1 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 to determine the applicability of regulatory limitations.
- We warrant the proper functioning of the instrument only if no modifications are made to mechanics, electronics, module firmware, or instrument software.
- Use the instrument only for the purpose described in the instruction manual. Eagle Eye is not liable for damages caused by incorrect use of the instrument.
- The results delivered by the instrument depend not only on the correct functioning of the instrument but also on various other factors. We therefore recommend that you have the results checked (e.g. plausibility tested) by skilled personnel before consequential actions are taken based on the measured data.

2.2 Installation and Use

- The installation procedure shall be carried out only by authorized personnel who are familiar with the installation instructions.
- Use only accessories and consumables supplied or approved by Eagle Eye
- Ensure that all operators have been trained beforehand to use the instrument safely and correctly.
- Ensure that the instrument is sufficiently supervised during operation.
- In case of damage or malfunction, do not continue operating the instrument. Do not operate the instrument under conditions which could result in damage to goods or injuries or loss of life.
- Do not expose the instrument to temperatures below 0 °C (32 °F) when the measuring cell contains water. Freezing water will cause rupture of the measuring cell.
- The instrument is not insulated against high voltages. Measuring samples under high voltage (e.g. in energized battery banks) bears the risk of an electric shock. Define appropriate testing procedures and safety measures to protect yourself from any electric shock.

Operation in areas with risk of explosion

- The instrument is **not** explosion-proof and therefore must not be operated in areas with risk of explosion.

General precautions

- Observe and adhere to your national safety regulations regarding the handling of all substances associated with your measurements (e.g. use safety goggles, gloves, respiratory protection, etc.).
- Before a measurement, check the wetted parts of the instrument for chemical resistance to the samples and cleaning agents used.

Precautions for flammable samples and cleaning agents

- Keep potential sources of ignition, like sparks or open flames, at a safe distance from the instrument.
- Store only the minimum required amount of sample, cleaning agents, and other flammable materials near the instrument.
- Do not spill sample/cleaning agents or leave their containers uncovered. Immediately remove spilled sample/cleaning agents.
- Ensure that the setup location is sufficiently ventilated. The environment of the instrument must be kept free of flammable gases and vapors.
- Provide fire-extinguishing equipment.

Battery Handling

- Never open the battery compartment in hazardous areas. Exchange the batteries only outside of hazardous areas.

2.3 Maintenance, Service, Repairs

- Service and repair procedures may be carried out only by authorized personnel or Eagle Eye.
- For repairs, contact Eagle Eye Power Solutions. The instrument must not be returned without the filled out "Safety Declaration for Instrument Repairs" and must be cleaned before return.
- You must not return instruments which are contaminated by radioactive materials, infectious agents, or other harmful substances that cause health hazards.

2.4 Disposal

- Concerning the disposal of the instrument, observe the legal requirements in your country.

3 SG-Ultra Max – Overview

The portable density meter SG-Ultra Max measures the density of liquids in g/cm^3 or kg/m^3 by the oscillating U-tube method. Apart from density you can select various further measuring units (relative density, density at reference temperature, concentrations). A temperature sensor measures the sample temperature directly 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 compact design it is easy to perform measurements on samples which are difficult to access. A TFT display ensures clear visibility of results, even in dark surroundings. The backlight of the oscillator at the same time enables you 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.

SG-Ultra Max is operated via keys on the front side. Up to 1024 measured data can be stored in the memory of the SG-Ultra Max density meter and can be recalled, exported to a PC, or printed later. The transfer of the stored measured data to a printer or PC is done wirelessly using the integrated Bluetooth interface.

SG-Ultra Max is additionally equipped with an RFID interface. Via this interface, sample IDs and methods can be uniquely linked to an RFID tag. Later on, by reading the RFID tag, you can switch quickly and easily between different sample IDs and methods which further increases the efficiency of your measuring process.

3.1 Measuring Principle

Definition of density

The density (ρ) of a sample is defined as its mass (m) divided by its volume (V):

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

As the volume changes with temperature, density is a temperature-dependent measuring unit.

The oscillating U-tube method

The sample is introduced into a U-shaped borosilicate glass tube that is being electronically excited to vibrate at its characteristic frequency. The characteristic frequency changes depending on the density of the sample. With the 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, with the aid of density/concentration tables, the density value of a binary mixture can be used to calculate its composition.

This procedure is also applicable for so-called quasi-binary mixtures. These mixtures contain two major components and some additional ones 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 and water because the concentrations of flavors and acids are very small compared to those of sugar and water. Hence, the sugar concentration can be determined with a density meter.

The same holds for the determination of the alcohol concentration in distillates that can be considered to be quasi-binary mixtures of ethanol and water.

4 Checking the Supplied Parts

SG-Ultra Max has been tested and packed carefully before shipment. However, damage may occur during transportation.

1. Keep the packaging material (box, foam pieces, transport protection) for possible returns or for questions from the transportation or the insurance company.
2. To check the delivery for completeness, compare the supplied parts to those listed in table 4-1.
3. If a part is missing, contact your local Eagle Eye representative.
4. If a part is damaged, contact the transportation company and your local Eagle Eye representative.

Table 4-1: Supplied parts

Symbol	Pcs.	Article description
	1	SG-Ultra Max Portable Density Meter
	1	Pump lever with lock function PP

Table 4-1: Supplied parts (cont.)

Symbol	Pcs.	Article description
	1	Rubber housing SG-Ultra Max measuring cell
	1	Instruction manual
	1	Filling tube 180 mm
	1	Adapter Luer ¼" UNF
	10	Syringes 2 mL Luer
	1	Allen key 3 mm DIN 911

Table 4-2: Options

Article description
Screw plug ¼" UNF
Filling tube 600 mm
Spare wristband for portable instruments
Set carrying strap SG-Ultra Max
Bluetooth USB adapter
ABS disc tag 30 mm, 5 mm hole R/W
White PVC sticker disc tag 30 mm R/W
Black laundry tag 30 mm R/W
Printer CMP-20BT Bluetooth/RS232C
Carrying case
ISO 17025 calibration density G1
ISO 17025 re-calibration density G1
ISO 17025 extra calibration point
New custom parameter
Installation custom parameter

5 View

5.1 Front View

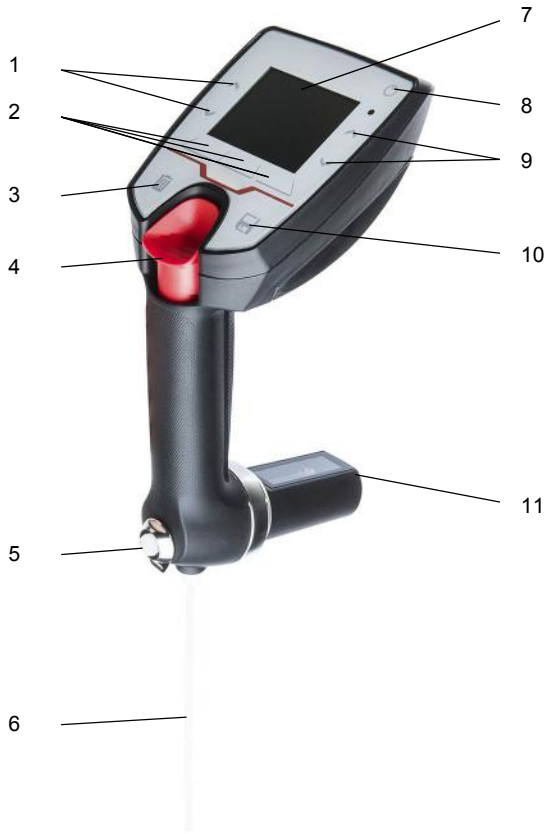

Fig. 5-1: Front view of the instrument

1 Arrow keys	*7 LCD display*
2 Function keys	*8 Power ON/OFF key*
3 Delete key	*9 Arrow keys*
4 Filling pump	*10 Data storage key*
5 Screw plug	*11 Measuring cell*
6 Filling tube	

5.2 Keys on the Front

	Power ON/OFF key	to switch the instrument on and off
	Data storage key	to start a measurement When the measurement is finished, the result is stored automatically in the internal memory.
	Delete key	to delete the data of the last measurement
	Arrow keys	to navigate in the quick access area, in menus or in selection/character lists
	Function keys	to activate a key function displayed directly above

5.3 Rear View

Fig. 5-2: Rear view of the instrument

1 RFID interface and type plate with serial number
2 Screw of battery compartment

6 Putting the unit into Operation

6.1 Connecting the Filling Tube

Screw in the filling tube by hand until some resistance against further turning can be felt. Tighten with your fingers only, do not use any tools.

Fig. 6-1: Connecting the filling tube

6.2 Mounting the Syringe Adapter

For some applications, e.g. filling samples of higher viscosity, filling via syringe may be more convenient. To do so, mount the syringe adapter.

Mounting the syringe adapter

1. Remove the screw plug (see fig. 5-1).
2. Screw in the adapter Luer ¼" UNF by hand until some resistance against further turning can be felt. Tighten with your fingers only, do not use any tools.

6.3 Switching the Instrument On/Off

- To switch the unit on, press the ⏻ key until the display lights up.
- To switch the unit off, press the ⏻ key until the instrument is switched off.

7 Operating SG-Ultra Max

7.1 Main Screen

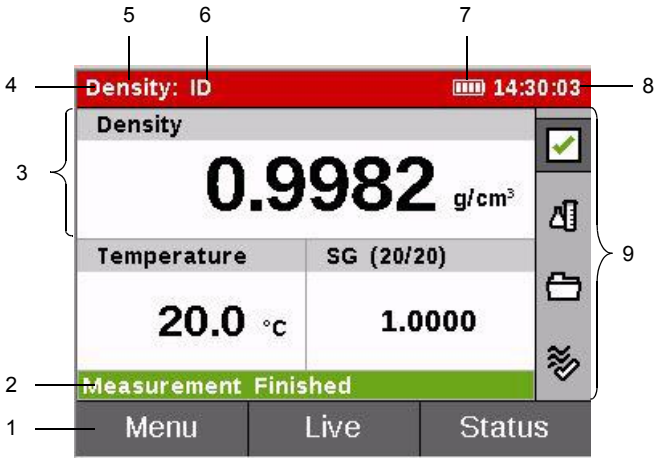

Fig. 7-1: Example main screen

1 Key functions
2 Status bar
3 Output field
4 Header
5 Method
6 Sample ID
7 Battery charge status symbol
8 Current time
9 Quick access area

Header

On the left side of the header, you find information on the currently used method, the sample ID, the number of stored data sets, or the index of the currently shown data set, depending on the active mode and function.

On the right side of the header, the battery charge status and the current time are displayed. When activated, the symbol for Bluetooth may also show at the left of the battery symbol.

Symbols in the header

Symbol	Description
	The battery charge status symbol informs you about the battery charge status. See section 15.1.1 for details.
	The RFID symbol shows in the header of the main screen when an RFID tag is read.
	The Bluetooth symbol shows in the header of the main screen when data is sent via Bluetooth.

Output Fields

You can select 2 or 3 sample parameters to be simultaneously displayed on the main screen. Each parameter is shown in a separate output field.

Status Bar

The status bar shows the status of the instrument or a measurement. If applicable, a progress bar will show the progress of activities.

7.2 Key Functions

The key functions correspond to the function keys below/above the display (the assignment of keys adapts to the active selection). The following key functions are available:

Function	Description
Back	Leaves the menu and goes to the next higher menu level.
Cancel	Aborts an operation.
Delete	Initiates deleting a value, or deletes the next character to the left.
Done	Finishes an entry.
Edit	Switches into editing mode allowing you to enter values or change the current selection.
Enter	Enters a character.
Menu	Opens the menu.
New	Initiates entering a new value.
Next	Continues with a procedure, or selects the next item to the right.
No	Rejects a proposition.
OK	Confirms a selection, or finishes a procedure.
Prev	Selects the next item to the left.
Print	Prints the selected data.
RFID	Reads an RFID tag.
Start	Starts a procedure.
Yes	Accepts a proposition.

On the main screen, the right function key can assume the following functions according to the icon selected in the quick access area:

Function	Description
Check	Quick access to the checks.
Data	Quick access to the measurement data.
Sample	Quick access to the method list and sample ID list for making a selection.
Status	Quick access to the measurement status and any associated warning or error message.

7.3 Quick Access Area

Use the arrow keys to select a quick access function. Activate the function with the right function key.

The following quick access functions are available:

Icon	Function
  	"Status" function Use it to check the measurement status. The status indicator can assume 3 states: • green check mark: status OK • yellow symbol with exclamation mark: there is a warning message • red symbol with lightning: there is an error message
	"Sample" / "Sample ID" function Use it to select a measuring method and a sample ID for the next measurement.
	"Data" function Use it to view measurement and check data stored in the data memory.
	"Check" function Use it to initiate a check.

7.4 Menu Navigation

- Use the **function keys** to switch menus and to trigger selection-specific activities.
- Use the **arrow keys** to navigate within menus and to select an item.

  With longer screen content, a black scroll bar will show on the right side of the scrollable area. Use the arrow keys to scroll through the content.

7.5 Entering Text or Numbers

After you have switched into editing mode, you see a selection bar on the right side of the screen:

1. Use the arrow keys to select the next character/digit to enter.

TIP: *Keep the arrow keys pressed to scroll through the selection bar quickly.*

   Select the red left arrow ◂, if available, to edit the previous position (one character to the left).

   Select the red left arrow with shaft ←, if available, to delete the last character.

2. Tap <Enter> to enter the selected character at the current position.

   Tap <Prev>, if available, to move the current position one character to the left.

   The editing line will show the whole current text/ number.

3. Tap <Done> to finish character entry and to confirm the entered text/number.

   Tap <Cancel> at any time to abort character entry and to discard the entered text/number.

7.6 Selecting from a List

After you have switched into editing mode, you see a selection list folded out:

1. Use the arrow keys to select your choice.
2. Tap <OK> to confirm the selected value.

   Tap <Cancel> to abort selection.

8 Instrument Settings

8.1 Setting the Language

1. Tap <Menu> and select *Setup* > *Language*.
2. Tap <Edit>.
3. Select the preferred language:
   - English
   - Deutsch
4. Tap <Back> repeatedly to return to the main screen.

8.2 Setting Date and Time

Date and time are automatically saved with measurement and check data. During operation, the current time is displayed on the right side of the header.

Setting the date or time

1. Tap <Menu> and select *Setup* > *Date and Time* > *Set Date and Time*.
2. Select "Date" or "Time" and tap <Edit>.
3. Enter the current date or time, respectively.
4. Tap <Back> repeatedly to return to the main screen.

Setting the date or time format

1. Tap <Menu> and select *Setup* > *Date and Time* > *Set Date and Time Format*.
2. Select "Set Date Format" or "Set Time Format" and tap <Edit>.
3. Select one of three date formats (DD=day, MM=month, YYYY=year):
   - DD.MM.YYYY
   - YYYY-MM-DD
   - MM/DD/YYYY

   Select one of two time formats (24 hour clock or 12 hour clock):
   - 24h
   - AM/PM
4. Tap <Back> repeatedly to return to the main screen.

8.3 Setting PIN Protection

You can protect access to the menu by a PIN (personal identification number). After you have set PIN protection, you can still use all functions of the quick access area (performing measurements, selecting methods and sample IDs, etc.) without the need for entering a PIN.

Activating PIN protection

1. Tap <Menu> and select *Setup* > *PIN Settings*.
2. Select "Set PIN protection" and tap <Edit>.
3. Select "On" from the selection list.
4. Select "New PIN" and tap <Edit>.
5. Enter your 4-digit PIN.
6. Select "Confirm new PIN" and tap <Edit>.
7. Repeat the PIN that you have entered before.
8. Tap <Back> repeatedly to return to the main screen.

Every time you tap <Menu> while PIN protection is activated, you will have to enter the active PIN and confirm it with "OK" to be able to continue.

NOTICE
Be sure to remember the set PIN as you will not be able to deactivate PIN protection without it.

Deactivating PIN protection

1. Tap <Menu> and enter the active PIN.
2. Select *Setup* > *PIN Settings*.
3. "Active PIN" is preselected.

   Tap <Edit> and enter the active PIN.
4. Select "Set PIN protection" and tap <Edit>.
5. Select "Off" from the selection list.
6. Tap <Back> repeatedly to return to the main screen.

Changing the active PIN

1. Tap <Menu> and enter the currently active PIN.
2. Select *Setup* > *PIN Settings*.
3. "Active PIN" is preselected.

   Tap <Edit> and enter the currently active PIN.
4. Select "New PIN" and tap <Edit>.
5. Enter the new PIN.
6. Select "Confirm new PIN" and tap <Edit>.
7. Repeat the PIN that you have entered before.
8. Tap <Back> repeatedly to return to the main screen.

8.4 Display Settings

In this menu, you can activate/deactivate the automatic display rotation. Furthermore, you can set the display brightness as well as the time, after which the illumination of the display and the measuring cell will be automatically dimmed.

Activating/deactivating the automatic display rotation

1. Tap <Menu> and select *Setup* > *Display Settings*.
2. Select "Display Rotation" and tap <Edit>.
3. Select "On" or "Off" from the selection list.
4. Tap <Back> repeatedly to return to the main screen.

Setting the display brightness

1. Tap <Menu> and select *Setup* > *Display Settings*.
2. Select "Display Brightness" and tap <Edit>.
3. Select one of three brightness options:
   - High
   - Mid
   - Low
4. Tap <Back> repeatedly to return to the main screen.

Setting the display dimming

1. Tap <Menu> and select *Setup* > *Display Settings*.
2. Select "Display Dimming" and tap <Edit>.
3. Select one of three dimming options:
   - 30 Seconds
   - 60 Seconds
   - Off (no dimming)
4. Tap <Back> repeatedly to return to the main screen.

8.5 Sound Settings

When sound is enabled, the instrument beeps whenever a key is tapped.

1. Tap <Menu> and select *Setup* > *Sound*.
2. Tap <Edit>.
3. Select the preferred option (on/off).
4. Tap <Back> repeatedly to return to the main screen.

8.6 Units

In this menu, you can set the units for density and temperature.

Setting units

1. Tap <Menu> and select *Setup* > *Units*.
2. Select "Density Unit" or "Temperature Unit" and tap <Edit>.
3. Select one of three density units:
   - g/cm^3
   - kg/m^3
   - lb/gal

   Select one of two temperature units:
   - °C
   - °F
4. Tap <Back> repeatedly to return to the main screen.

8.7 Setting up Bluetooth Connections

Setting up the connection to a printer

1. Switch on the Bluetooth printer.
2. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *Configure Printer*.
3. Tap <Edit> and select "Bluetooth Printer".
4. Tap <Back>.
5. Select "Configure Printer Target".
6. Tap <Start> to search for available Bluetooth devices.
7. Tap <Edit> and select the desired device.
8. Tap <Next> and then <OK> to save your selection.
9. Tap <Back> repeatedly to return to the main screen.

IMPORTANT: *You can only save one Bluetooth device. If you establish a new Bluetooth connection as described above, the latest connection will be deleted.*

Setting up the connection to a PC

1. Switch on the PC and check whether it offers an integrated Bluetooth interface.
   If not, use an external Bluetooth adapter.
2. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *Configure Export Target*.
3. Tap <Start> to search for available Bluetooth devices.
4. Tap <Edit> and select the desired device.
5. Tap <Next> and then <OK> to save your selection.
6. Tap <Back> repeatedly to return to the main screen.

IMPORTANT: *You can only save one Bluetooth device. If you establish a new Bluetooth connection as described above, the latest connection will be deleted.*

8.8 Reset to Factory Settings

1. Tap <Menu> and select *Setup* > *Reset to Factory Settings*.
   The following settings will be reset:

Setting	**Factory setting**
Language	English
Methods	Defined standard methods
Active method	Density
Sample IDs	ID
Date format	DD.MM.YYYY
Time format	24h
Measurement mode	Precise
Display rotation	On
Printer	None
Export data format	csv
Export data delimiter	Semicolon
Export data decimal point	Comma
Temperature unit	°C
Density unit	g/cm^3
PIN protection	Off
Custom	Factory preset custom parameters

TIP: *Ensure that you export or print the content of the data memory before resetting to factory settings, as this function will delete the data memory (and therefore all measured data).*

2. Tap <Yes> to reset to factory settings.
   Tap <No> to cancel the reset operation.
3. Tap <Back> repeatedly to return to the main screen.

9 Measuring Settings

9.1 Setting the Measurement Mode

SG-Ultra Max features three measurement modes, "Precise", "Fast" and "Manual".

For each measurement mode, different stability criteria have to be fulfilled before the measuring result is stored. The stability criterion is always related to the temperature:

- Measurement mode "Precise":
  The result is stored as soon as the measured temperature value stays within 0.2 K for 10 seconds. This measurement mode delivers the most accurate results, but may take a longer time in case the sample temperature differs greatly from the ambient temperature.
- Measurement mode "Fast":
  The result is stored as soon as the measured temperature value stays within 0.4 K for 10 seconds. This measurement mode delivers quicker results than the "Precise" mode, but as the density is highly temperature-dependent, the measured result is not as accurate.
- Measurement mode "Manual":
  You decide yourself when to store your measurement result. The result is stored immediately after tapping the key.

Setting the measurement mode

1. Tap <Menu> and select *Setup* > *Measurement Mode*.
2. Tap <Edit>.
3. Select one of three measurement modes:
   - Precise
   - Fast
   - Manual
4. Tap <Back> repeatedly to return to the main screen.

9.2 Defining an Offset

You can define an offset for your measurement which is automatically added to parameter 1 of your measurement. You can define an offset for each method separately.

Defining an offset

1. Tap <Menu> and select *Methods* > *Edit Method*.
2. Select a method from the list and tap <Edit>.
3. Select "Offset" and tap <Edit>.
4. Enter the desired value and tap <Done>.
5. Tap <Back> repeatedly to return to the main screen.

9.3 Defining Limits

The function will give a warning when measurement results of parameter 1 lie outside of the margins of your internal quality specification.

Define limits in the method settings. Measurement results outside the thereby defined margins will be highlighted by a yellow background color and marked in the data memory accordingly.

Defining limits

1. Tap <Menu> and select *Methods* > *Edit Method*.
2. Select a method from the list and tap <Edit>.
3. Select "Limit" and tap <Yes> to activate the limit function.

   Two more input fields for entering the limit values come up in the parameter list.
4. Enter the respective values for "Upper Limit" and "Lower Limit".

IMPORTANT: *The limits apply only to parameter 1.*

5. Tap <Back> repeatedly to return to the main screen.

9.4 Output Fields on the Main Screen

The arrangement of output fields on the main screen depends on your choice of parameters to be displayed (which you have made with the method settings, see section 11.1.1).

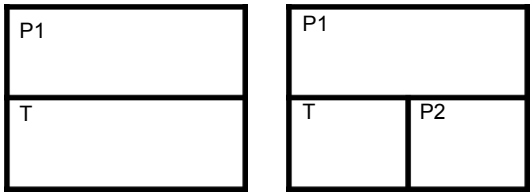

Fig. 9-2: Possible arrangements of output fields

P1/P2 ...freely configurable parameters
T.....measuring temperature

10 Checks and Adjustments

Perform a water check every day before you start the measurements to verify that the instrument is measuring with adequate accuracy.

Perform a water adjustment if the water check advises you to do so.

10.1 Performing a Water Check

Use freshly degassed ultra-pure (bi-distilled or deionized) water.

Performing a water check

1. Clean the measuring cell as described in section 14.
2. Rinse the measuring cell until no more cleaning agent residues are present.
3. In the quick access area, activate ("Check" function).
4. Select "Water Check" and tap <OK>.
5. Follow the instructions on the screen.
6. After the procedure has finished, the check results are displayed.

   If the deviations from the target values exceed defined limits, you will see a recommendation to perform a water adjustment.

   Tap <OK>.
7. Tap <Back> to return to the main screen.

10.2 Performing a Water Adjustment

Use freshly degassed ultra-pure (bi-distilled or deionized) water.

Performing a water adjustment

1. Clean the measuring cell as described in section 14.
2. Rinse the measuring cell until no more cleaning agent residues are present.
3. Tap <Menu> and select *Adjustments* > *Water Adjustment.*
4. Fill ultra-pure water (15 °C to 25 °C) into the instrument.
5. Tap <Start>.

6. After the procedure has finished, the density deviation to the previous adjustment is displayed.
7. To save the adjustment, tap <Save>.

   To refuse the adjustment, tap <Cancel>.

10.3 Performing a Custom Adjustment

You can use any other reference liquid with a known density at 20 °C and known temperature coefficient Alpha for a custom adjustment.

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

Performing a custom adjustment

1. Clean the measuring cell as described in section 14.
2. Rinse the measuring cell until no more cleaning agent residues are present.
3. Tap <Menu> and select *Adjustments* > *Custom Adjustment*.
4. Fill reference liquid (15 °C to 25 °C) into the instrument.
5. Tap <Start>.
6. Tap <Edit> and enter the density of the reference liquid at the stated reference temperature.
7. Tap <Next>.
8. Tap <Edit> and enter the temperature coefficient Alpha of the reference liquid.
9. Tap <Next>.
10. After the procedure has finished, the density deviation to the previous adjustment is displayed.
11. To save the adjustment, tap <Save>.

    To refuse the adjustment, tap <Cancel>.

10.4 Reset to Factory Adjustment

If you want to undo all your adjustments, reset the instrument to factory adjustment.

Resetting the instrument to factory adjustment

1. Tap <Menu> and select *Adjustments* > *Factory Adjustment*.
2. Tap <Yes> to reset to factory adjustment.

   The factory adjustment is restored.

11 Methods and Sample IDs

11.1 Methods

Methods are preset measurement settings which you can simply assign to a measurement by the method name.

A method of SG-Ultra Max comprises the following method settings:

- Method Name
  Choose as required.
- Parameter 1–2
  Select the parameters to be displayed on the measuring screen. See the parameter overview in appendix C for possible choices.
  If you select "None", the parameter will not be displayed.
- Offset
  This value is added to parameter 1.
- Limit
  Define the upper and lower limit for the measurement results. The limits are only applied to parameter 1.
- Temperature coefficient Alpha
  If applicable for the selected parameter. See section 11.1.3 for details on the temperature coefficient.

SG-Ultra Max comes with 8 predefined methods covering the most common applications.

All calculated parameters of the methods derive from the sample density at the measured temperature.

Table 11-1: Predefined methods

Method	**Parameter 1**	**Parameter 2**
Density	Density	SG (20/20)
Sugar	Brix	Density
Extract	Extract	Density
Ethanol	Alcohol@20°C	Density
Crude Oil	API A@15°C	API SG A@15°C
Fuel Oil	API B@15°C	API SG B@15°C
Lubricants	API D@15°C	API SG D@15°C
H2SO4	H2SO4 %w/w	Density

11.1.1 Managing Methods

You can edit the predefined methods as well as newly created ones to meet your requirements.

- Method names can be up to 11 characters long.
- You may use the letters "A" to "Z", digits "0" to "9", points ".", underlines "_" and blanks "␣" for the composition of a method name.

Defining your own methods

You can create new methods in addition to the preset ones:

1. Tap <Menu> and select *Methods* > *New Method*.
2. Edit the method settings as described below.
3. Tap <Back> repeatedly to return to the main screen.

Editing methods

1. Tap <Menu> and select *Methods* > *Edit Method*.
2. Select a method that you want to edit and tap <Edit>.
3. Select a method setting that you want to edit and tap <Edit>.
4. Enter a value or select it from a list as appropriate.
5. Repeat steps 3–4 for all method settings that you want to edit.
6. Tap <Back> repeatedly to return to the main screen.

Importing methods

1. Save the file on a PC (e.g. on the desktop), see appendix D for an example file.
2. On the PC, right-click the file and select "Send it to Bluetooth".
3. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *File Transfer* > *Import Methods*.
4. Tap <Start> to start the automatic import procedure.

Deleting methods

1. Tap <Menu> and select *Methods* > *Edit Method*.
2. Select a method that you want to delete and tap <Delete>.
3. Tap <Yes> to confirm deletion.
   Tap <No> to abort deletion.
4. Tap <Back> repeatedly to return to the main screen.

11.1.2 Assigning a Method to a Measurement

1. In the quick access area, activate  ("Sample" function).
2. Select "Method" and tap <Edit>.
3. Select the appropriate method from the list.
4. Tap <Back> to return to the main screen.

The assigned method is shown in the header.

11.1.3 Calculating the Temperature Coefficient Alpha

The temperature coefficient Alpha (g/cm^3/K) is needed for the calculation of the following measuring units:

- Density@
- Specific Gravity SG
- Baumé

The temperature coefficient Alpha can be calculated as follows:

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

ρ_1....density at temperature T_1
ρ_2....density at temperature T_2

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

11.2 Custom Parameters

11.2.1 Using Predefined Custom Parameters

In addition to the standard parameters, your SG-Ultra Max offers 10 predefined custom parameters.

Parameter	Concentration Range	Temperature Range
CaCl2 (calcium chloride)	0 to 45 % w/w	0 to 50 °C
HCl (hydrochloric acid)	0 to 40 % w/w	0 to 50 °C
H2O2 (hydrogen peroxide)	0 to 100 % w/w	0 to 30 °C
C3H7OH (isopropanol)	0 to 30 % w/w	0 to 40 °C
C3H7OH (isopropanol)	30 to 100 % w/w	0 to 40 °C
CH3OH (methanol)	0 to 100 % w/w	10 to 40 °C
HNO3 (nitric acid)	0 to 70 % w/w	0 to 40 °C
NaOH (sodium hydroxide)	0 to 53 % w/w	0 to 40 °C
Öchsle	-100 to 600 °Öchsle	5 to 40 °C
KMW (Klosterneuburger Grade)	0 to 30 °KMW	0 to 50 °C

To use these custom parameters, select parameter type "Custom" (see section 11.1.1).

11.2.2 Importing New Custom Parameters

If you need one or more additional measuring parameters, you can import them into your instrument. Contact your local Eagle Eye representative to receive a custom parameter from Eagle Eye.

You will receive a file with the custom parameter(s) in the correct format from Eagle Eye.

Importing custom parameters

1. Save the file on a PC (e.g. on the desktop).
2. On the PC, right-click the file and select "Send it to Bluetooth".
3. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *File Transfer* > *Import Custom Parameters*.
4. Tap <Start> to start the automatic import procedure.

11.3 Defining and Using Sample IDs

Sample IDs serve to tag your measurement results, e.g. with a designation from your product varieties, thus facilitating full traceability of your measurement results.

Up to 250 different sample IDs can be manually defined or imported.

- Sample IDs can be up to 11 characters long.
- You may use the letters "A" to "Z", digits "0" to "9", points ".", underlines "_" and blanks "␣" for the composition of a sample ID.

Defining a sample ID

1. Tap <Menu> and select *Sample IDs*.
2. Tap <New>.
3. Tap <Edit> and enter a sample ID.

   Confirm with <Done>.
4. Tap <Back> repeatedly to return to the main screen.

Importing sample IDs

1. Save the file on a PC (e.g. on the desktop), see appendix D for an example file.
2. On the PC, right-click the file and select "Send it to Bluetooth".
3. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *File Transfer* > *Import Sample IDs*.
4. Tap <Start> to start the automatic import procedure.

Deleting a sample ID

1. Tap <Menu> and select *Sample IDs*.
2. Select a sample ID that you want to delete and tap <Delete>.
3. Tap <Yes> to confirm deletion.

   Tap <No> to abort deletion.
4. Tap <Back> repeatedly to return to the main screen.

TIP: *You cannot delete the currently used sample ID.*

Assigning a Sample ID to a Measurement

1. In the quick access area, activate ("Sample ID" function).
2. Select "Sample ID" and tap <Edit>.
3. Select the appropriate sample ID from the list.
4. Tap <Back> to return to the main screen.

All subsequent measurements will use the selected sample ID until you assign a new one.

The assigned sample ID is shown in the header.

11.4 Using the RFID Function

Using RFID enables you to write sample IDs and methods to RFID tags, and to use the programmed RFID tags for a quicker assignment of sample ID and method.

Qualifications for using RFID

The reading distance of the RFID receiver integrated in the instrument is about 2 cm (0.8 in). The RFID tag must be within this distance for the instrument to be able to successfully read it.

TIP: *The larger the diameter of a tag, the larger is the reading distance.*

For an optimum reading, hold the RFID tag about 0.5 cm (0.2 in) below the RFID interface mark on the top of the instrument (near the instrument's RFID antenna, see fig. 5-2).

The instrument supports the use of passive read/write RFID tags.

Reading RFID tags

Reading the RFID tag information might be helpful to identify an RFID tag in case your tags have got mixed up, or you may want to check that the tag has been programmed correctly.

The RFID tag information comprises:

- the sample ID stored on the tag,
- the method stored on the tag.

1. Tap <Menu> and select *Setup* > *RFID* > *Read Tag*.
2. Hold the RFID tag to the RFID interface of the instrument until the RFID tag information is displayed.
3. To read another RFID tag, tap <Back>, then select "Read Tag", and continue with step 2.
4. Tap <Back> repeatedly to return to the main screen.

Programming RFID tags

1. Tap <Menu> and select *Setup* > *RFID* > *Write Tag*.
2. Select "Method" and tap <Edit>.
3. Select the method to be written to the RFID tag from the list.
4. Select "Sample ID" and tap <Edit>.
5. Select the sample ID to be written to the RFID tag from the list.
6. Hold the RFID tag to the RFID interface of the instrument.
7. Select "Write Tag" and tap <OK>.

   The selected sample ID and method will be written to the RFID tag.
8. Repeat this procedure to program further RFID tags with sample IDs and methods.
9. Tap <Back> repeatedly to return to the main screen.

Erasing RFID tags

You can erase the information on an RFID tag, e.g. to correct a writing mistake or to reuse an RFID tag for a new sample ID and method.

1. Tap <Menu> and select *Setup* > *RFID* > *Erase Tag*.
2. Hold the RFID tag to the RFID interface of the instrument.
3. Tap <OK>.
4. To erase another RFID tag, select "Erase Tag" and repeat steps 2 to 3.
5. Tap <Back> repeatedly to return to the main screen.

Assigning sample ID and method to a measurement via RFID

This procedure works only if the sample ID and method on the RFID tag are also stored on the instrument.

1. Tap <RFID>.
2. Hold the programmed RFID tag to the RFID interface of the instrument.

   After reading the RFID tag information, the instrument returns to the main screen. The sample ID and method from the RFID tag are shown in the header.

TIP: *If the RFID tag contains only its UID, the message "Tag empty" pops up as there are no method and sample ID saved.*

12 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.

WARNING

SG-Ultra Max is not insulated against high voltages. Measuring samples under high voltage (e.g. in energized battery banks) bears the risk of an electric shock.

- Define appropriate testing procedures and safety measures to protect yourself from any electric shock.

NOTICE

Before performing a measurement, make sure that the wetted parts are resistant to the sample (see appendix A.3).

NOTICE

Samples containing dissolved CO_2 create bubbles in the measuring cell rendering the measurement results invalid. Degas the sample properly before measurement by:

- boiling it for several minutes,
- stirring it vigorously for 5 to 15 minutes until bubbling ceases or
- putting it for approximately 5 to 10 minutes into an ultrasonic bath until bubbling ceases.

12.1 Filling the Sample

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

12.1.1 Filling with the Filling Tube

1. Press down the pump lever as far as it will go (see fig. 12-1).
2. Submerge the filling tube in the sample.
3. Slowly release the pump lever.

Fig. 12-1: Filling sample using the filling tube

12.1.2 Filling with a Syringe

WARNING

If you remove the pump when filling with a syringe, or remove the syringe after filling, the system becomes leaky. Harmful liquids leaking from the instrument may cause injuries.

- Do not remove the pump.
- Do not remove the syringe during measurement.

IMPORTANT: *When delivered, the instrument is equipped with the pump lever without lock function. Replace this pump lever by the pump lever with lock function (supplied with the instrument) as described in appendix 15.*

1. Mount the syringe adapter (see section 6.2).
2. Lock the pump lever.

   Push the pump lever down and forward simultaneously to minimize the dead volume in the syringe plunger.
3. Place the filling tube in a suitable waste vessel.
4. Fill the syringe with the sample.
5. Attach the syringe to the syringe adapter and fill the measuring cell (see fig. 12-2).

Fig. 12-2: Filling sample using a syringe

12.2 Measuring

1. Before you start a measurement, check that
   - you have selected the proper measuring mode (see section 9.1).
   - you have assigned the proper method (see section 11.1.2).
   - you have assigned the proper sample ID, if needed (see section 11.3).
   - the sample's temperature is between 0 °C and 100 °C (32 °F and 212 °F).
   - suitable solvents for cleaning are available.
2. Fill the sample (see section 12.1.1 for filling with the filling tube or section 12.1.2 for filling with a syringe).

   The instrument shows a continuous reading of the current measuring values.
3. Check for bubble-free filling and that the measuring cell is fully filled.

   Possible reasons for bubbles in the measuring cell are:
   - gas bubbles in the sample
   - leaky connection of the filling tube, the pump or the screw plug/ syringe adapter
4. Tap the key to start a measurement.

   The result is displayed and stored in the internal data memory.
5. **Filled with filling tube**: Place the filling tube in a suitable waste vessel and press the pump lever to empty the measuring cell.

   Filled with syringe: Unplug the syringe to let the sample drain off via the filling tube.

13 Measurement/Check Data in the Data Memory

Measured data as well as check data are stored automatically in the data memory.
All stored data sets include date and time of the measurement or check.
The data memory can hold a total of 1024 data sets. Further measurements will overwrite the oldest saved data sets.

13.1 Viewing Data

1. In the quick access area, activate 🗀 ("Data" function).

   The last data set will be displayed
2. Use the arrow keys to browse through the data sets in the data memory.

   The index of the currently displayed data set is shown in the header.

   Measurement data are shown with gray background, check data with blue background.
3. Tap <Back> to return to the main screen.

13.2 Printing Data

You can send the measured data to a printer via Bluetooth. For details about setting up a Bluetooth connection, see section 8.7.

Be sure to connect and switch on your printer.

Printing a single data set

1. In the quick access area, activate 🗀 ("Data" function).
2. Use the arrow keys to select the data set to be printed.
3. Tap <Print>.
4. Tap <Back> to return to the main screen.

Printing all data sets

1. Tap <Menu> and select *Measurement Data* > *Print All*.
2. Tap <Yes> to confirm printing.
   Tap <No> to abort printing.
3. Tap <Back> repeatedly to return to the main screen.

13.3 Exporting Data to a PC

You can export the data stored in the data memory to a PC. You can select between a *.csv or *.txt file. For details about setting up a Bluetooth connection, see section 8.7.

Setting the export file format

1. Tap <Menu> and select *Setup* > *Data Transfer* > *Configure Data Format*.
2. Select "File Format" and tap <Edit>.
3. Select one of two export file formats:
   - CSV
   - TXT
4. Tap <OK>.

   If you have selected TXT, tap <Back> repeatedly to return to the main screen.
5. If you have selected CSV, select "Table Delimiter" and tap <Edit>.
6. Select one of four table delimiters:
   - ; (semicolon)
   - / (slash)
   - , (comma)
   - TAB
7. Tap <OK>.
8. Select "Decimal Separator" and tap <Edit>.
9. Select one of two decimal separators:
   - . (point)
   - , (comma)
10. Tap <Back> repeatedly to return to the main screen.

Saving data

1. On the PC, right-click the Bluetooth icon and select "Receive a File" (see section 8.7 for details about setting up a Bluetooth connection).
2. For saving methods, sample IDs or custom parameters, proceed as follows:
   a. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *File Transfer*.
   b. Select the data to be exported (methods, sample IDs, custom parameters).

c. Tap <Yes> to export the selected data.

The file is now transferred to your PC and stored on the desktop.

3. For saving measurement data, proceed as follows:

a. On SG-Ultra Max tap <Menu> and select *Measurement Data* > *Export Measurement Data*.

b. Tap <Yes>.

The file is now transferred to your PC and stored on the desktop.

Sending data to a terminal program on a PC

1. Set up a connection to a printer with the PC as printer (see section 8.7).
2. Open a terminal program and set it up as follows:
   - Baud rate: 115200
   - Data bits: 8
   - Parity: none
   - Stop bits: 1
   - Handshake: none
3. Send data by printing it as described in section 13.2.

13.4 Deleting Data

Deleting the last stored data set

Version A

1. Tap the key.

   The last stored data set is deleted. There will be no confirmation request.

Version B

1. Tap <Menu> and select *Measurement Data* > *Delete Last*.
2. Tap <Yes> to confirm deleting.

   Tap <No> to abort deleting.
3. Tap <Back> repeatedly to return to the main screen.

Deleting all data

1. Tap <Menu> and select *Measurement Data* > *Delete All*.
2. Tap <Yes> to confirm deleting.

   Tap <No> to abort deleting.
3. Tap <Back> repeatedly to return to the main screen.

14 Cleaning and Storing

NOTICE
- Make sure the solvent you use for cleaning is suitable. For details on recommended cleaning agents see section 14.2.3.
- Do not use any mechanical action for cleaning the measuring cell.

14.1 Cleaning the Measuring Cell

1. Empty the measuring cell:
   a. Place the filling tube in a suitable waste vessel.
   b. **Filled with filling tube**: Press the pump lever to empty the measuring cell.
      Filled with syringe: Unplug the syringe to let the sample drain off via the filling tube.
2. Fill the measuring cell with a suitable solvent.
3. Pump the solvent through the whole measuring system several times.
4. Empty the measuring cell.

TIP: *If the cleaning is done with a syringe, move the plunger of the syringe back and forth vigorously several times so that air bubbles add to the cleaning action.*

14.2 Cleaning Interval

The cleaning interval strongly depends on the application. For some samples, a displacement of the previous sample by the next one suffices. For other applications, a cleaning after each measurement might be necessary.

Displacing the sample	For samples which are very similar to each other (e.g. one type of fermenting wine after the other). To displace the sample, empty the measuring cell after the measurement and rinse it with the next sample before measuring that one. Clean your SG-Ultra Max thoroughly at the end of your measurement cycle.
Cleaning after each measurement	For samples with different chemical properties which are immiscible and/or difficult to remove from the measuring cell.

14.2.1 Cleaning at the End of a Measurement Cycle

At the end of your measuring cycle clean your SG-Ultra Max thoroughly before you store it. You do not need to dry the measuring cell (assuming that you make sure the cleaning liquid does not freeze in the measuring cell). You can leave deionized water in the measuring cell when storing the instrument for a day.

NOTICE

If you want to dry the measuring cell with compressed air, do not apply an overpressure of more than 1 bar.

14.2.2 Cleaning Visible Residues in the Measuring Cell

Some samples like wort or grape juice may cause residues in the measuring cell after longer measurement periods. In this case use an enzymatic lab cleaner to remove the residues from the cell (see recommendations below).

14.2.3 Recommended Cleaning Agents

WARNING

The mixture of concentrated sulfuric acid with water will cause a very strong exothermic reaction which may destroy the measuring cell and/or cause serious injuries.

- Never flush out concentrated sulfuric acid with water.
- Ensure that samples of very different concentrations do not come into contact with each other. Therefore remove 98 % H_2SO_4 only with 70 % H_2SO_4, and remove 70 % H_2SO_4 with 40 % H_2SO_4. Then water may be used to rinse the measuring cell.
- Always use separate waste containers for sulfuric acid waste and ethanol (or other solvent) waste. Label the waste containers properly to avoid mix-ups.
- Never flush sulfuric acid waste and ethanol (or other solvent) waste down the sink.
- Always dispose of the waste according to regional laws and regulations.
- Place the waste containers behind a safety shield and in a catch basin.

For cleaning the instrument, use two cleaning liquids:

- Cleaning liquid 1 dissolves and removes sample residues in the measuring cell. It has to be a good solvent for all sample components.

- Cleaning liquid 2 removes cleaning liquid 1 (has to be a good solvent for cleaning liquid 1) and evaporates easily in order to accelerate drying of the cell. It must not attack the U-tube or leave any deposits, as drops of cleaning liquid 2 will remain in the U-tube.

TIP: *To prevent limestone deposits, never use tap water as cleaning liquid 2, but use purified (e.g. deionized water) instead.*

Sample	**Cleaning liquid 1**	**Cleaning liquid 2**
Petroleum products	Toluene, petroleum naphtha, petroleum ether, n-nonane, cyclohexane, …	Ethanol
Battery acid	Tap water	Ultra-pure (bi-distilled or deionized) water
Liquid soap & detergent, shampoo	Tap water	Ultra-pure (bi-distilled or deionized) water
Salad dressing, mayonnaise	Petroleum naphtha, dish washing agent in water	Ethanol
Sun tan lotion	Petroleum naphtha	Ethanol
Soft Drinks	Tap water	Ultra-pure (bi-distilled or deionized) water
Beer & Spirits	Tap water	Ultra-pure (bi-distilled or deionized) water
Beer wort, grape juice, syrup	Warm tap water	Ultra-pure (bi-distilled or deionized) water
Milk	Tap water, enzymatic lab cleaner	Ultra-pure (bi-distilled or deionized) water
98 % H_2SO_4	70 % H_2SO_4	40 % H_2SO_4 followed by ultra-pure (bi-distilled or deionized) water

Before filling samples with unknown cleaning properties into the measuring cell, always perform some preliminary cleaning experiments on a glass plate (e.g. microscopic slide). A sample should only be introduced into the density measuring cell if it can be removed completely by rinsing (not wiping!) with a suitable solvent.

Aqueous (polar) samples are best rinsed with polar liquids like water, alcohol or acetone.

Organic samples (oils, fuels, lubricants, etc.) are best rinsed with organic liquids (e.g. petroleum naphtha, petroleum ether, toluene, n-nonane).

Samples containing organic and aqueous components (like mayonnaise, which contains oil and water) may have to be rinsed alternately with organic and aqueous rinsing agents several times.

Samples containing protein (e.g. beer, milk) should never be brought into contact with alcohol, because this can cause denaturation of the protein and precipitation on the glass wall. Protein residues can build up when samples like beer wort or grape juice are measured over a long time. Enzymatic lab cleaners are usually best suited for removing these contaminants. Recommended cleaning agents: "Winepress Cleaner PM Membrane Presses", Cat. No. 409004, from Wigol®; "TM Desana" from Thonhauser. Refer to the instructions of the manufacturer concerning the concentration of the cleaning agent.

Strong alkaline lab cleaners (pH above 10.5) should only be applied briefly and at temperatures below 25 °C because strong alkalis attack the glass surface upon prolonged exposure and at high temperatures.

14.3 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.

Dismounting the pump

1. Push the pump lever upwards with both thumbs.
2. Release the pump by a ¼ turn counterclockwise (see fig. 14-1).
3. Remove the pump.

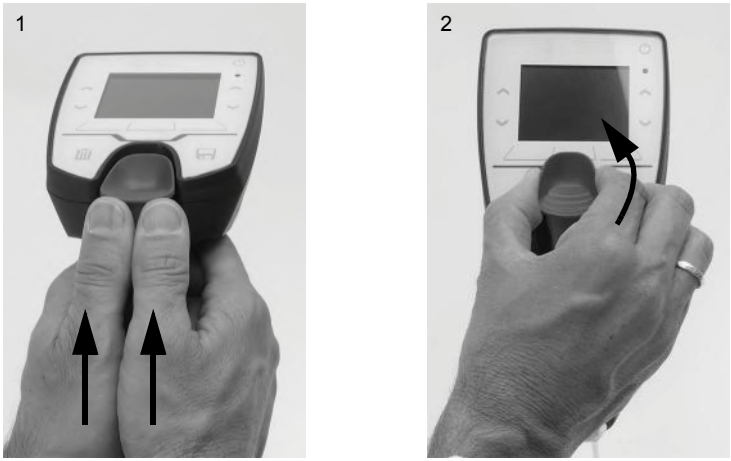

Fig. 14-1: Dismounting the pump

Cleaning the pump

1. Rinse the pump with running tap water.
2. Dry the pump with a lint-free cloth.

Remounting the pump

1. If the pump shaft has been locked, release the lock (see fig. 14-2):
   a. Press the marks on the front and rear of the pump shaft.
   b. Pull on the end of the pump shaft.

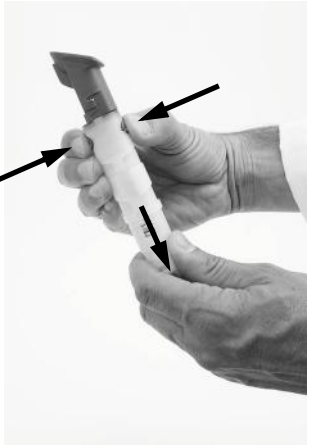

Fig. 14-2: Releasing a locked pump

2. Insert the pump with the pump lever's top pointing to the left (see fig. 14-3).
3. Turn the pump clockwise until it engages.

   The pump lever's top points to the instrument's display.
4. Push the pump lever down to fix the pump.

Fig. 14-3: Remounting the pump

14.4 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 (pH < 10).

Remove the rubber housing of the measuring cell periodically to ensure that no liquid is located between the measuring cell and the rubber housing

Cleaning the rubber housing of the measuring cell

1. Remove the rubber housing by pulling it off the cell cartridge.
2. Clean and dry the outside of the measuring cell and the complete rubber housing.

   Ensure that all parts are completely dry.
3. Shift the rubber housing back onto the measuring cell.

14.5 Storing the Instrument

Before storing the instrument for a longer period of time, clean the measuring cell as described in section 14.1. 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 ultra-pure (bi-distilled or deionized) water or solvent. If you have filled the liquid via the plastic syringe, leave the syringe in the adapter to stop the liquid running out.

15 Maintenance and Repair

15.1 Maintenance

Eagle Eye recommends a preventive maintenance interval of at least once a year by an authorized service technician.

15.1.1 Exchanging the Batteries

Battery charge status

An icon in the right corner of the header indicates the battery charge status. When the batteries are almost empty, the icon starts to flash and after a short time, the instrument switches itself off.

Exchanging the batteries

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.

1. With the supplied Allen key, unscrew the screw fixing the battery compartment to the rear of the instrument's display and lift the battery compartment off (see fig. 15-1).

   The screw is loosely attached to the battery compartment, so it can't get lost.

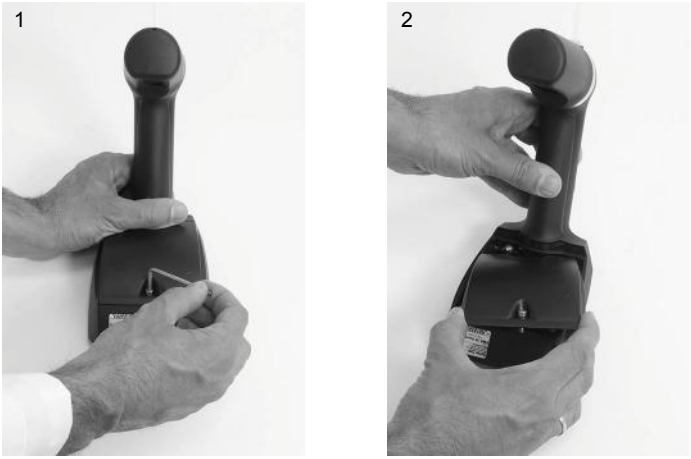

Fig. 15-1: Removing the battery compartment

2. Remove the cover of the battery compartment by pressing down and sliding it forward simultaneously (see fig. 15-2).

Fig. 15-2: Removing the battery compartment

3. Exchange the batteries for new ones.

NOTICE

- Observe the correct polarity when you insert the batteries, see the engraving in the battery compartment.
- Only use batteries of the same type and with the same level of battery charge.
- Ensure that the instrument's inside is absolutely dry. Any kind of liquid will cause damage to the electronic parts of the instrument.

4. Reassemble all parts in reverse order.

15.1.2 Exchanging the Pump Lever

1. Dismount the pump as described in section 14.3.
2. The pump lever is fixed with 2 pins and can be dismounted carefully by hand. Do not use any tools.
3. Mount the new pump lever by shifting it in place.

15.2 Firmware Update

Your Eagle Eye representative will inform you when a new firmware update for your SG-Ultra Max is available. After receiving the update file, you can import it into the instrument via Bluetooth. For details about setting up a Bluetooth connection, see section 8.7.

1. Save the update file (extension *.afp) on a PC (e.g. on the desktop).
2. On the PC, right-click the update file and select "Send it to Bluetooth".
3. On SG-Ultra Max tap <Menu> and select *Setup* > *Data Transfer* > *Firmware Update*.
4. Tap <Start> to start the automatic update procedure.

15.3 System Information

The instrument holds system information comprising:

- Instrument type
- Serial number of the instrument
- Firmware version
- Hardware version
- Serial number of the density measuring cell
- Deviation density adjustment
- Printer name
- Printer address
- PC name
- PC address
- Number of performed boot ups
- Operating time

Accessing system information

1. Tap <Menu> and select *Service* > *System Information*.
2. Tap <Back> repeatedly to return to the main screen.

15.4 Warranty Exclusions

The warranty does not cover the replacement of parts subject to natural wear and tear. Consumables, such as syringes, hoses, cables, adapters, pump diaphragms, filling and protection accessories, etc. as well as glass parts are excluded from the warranty.

15.5 Returning the Device for Repair

In case your instrument needs repair, contact your local Eagle Eye representative who will take care of the necessary steps. The instrument must not be returned without the filled out "Safety Declaration for Instrument Repairs" and must be cleaned before return.

TIP: *Find the contact data for Eagle Eye Power Solutions on their website: www.eepowersolutions.com*

Appendix A: Technical Data

A.1: Specifications

Measuring range	
Density Temperature Viscosity	0–3 g/cm^3 0–40 °C (32–104 °F)[a] 0–1000 mPa·s
Accuracy[b]	
Density Temperature	0.001 g/cm^3 0.2 °C (0.4 °F)
Repeatability s.d.	
Density Temperature	0.0005 g/cm^3 0.1 °C (0.2 °F)
Resolution	
Density Temperature	0.0001 g/cm^3 0.1 °C (0.1 °F)
Sample volume	2 mL
Sample temperature	max. 100 °C (212 °F)

a Filling at higher temperatures possible
b Viscosity < 100 mPa·s, density < 2 g/cm^3

A.2: Instrument Data and Operating Conditions

Dimensions (L x W x H)	245 mm x 103 mm x 126 mm (96.5 in x 40.6 in x 49.6 in)
Weight	660 g (23.3 oz)
Power supply	
Battery type Battery life	3# Alkaline battery 1.5V, type EN91 (LR06, AA) > 100 hours
Ambient temperature[a]	-10 °C to +50 °C (14 °C to 122 °F)
Air humidity	5–90 % rel. humidity, non-condensing
Protection class	IP X4
Data memory	• 1024 measured data sets • 250 sample IDs • 30 measuring methods
Interfaces	• Bluetooth • RFID

a The sample must not freeze in the measuring cell.

A.3: Wetted Parts

The following materials are in contact with the samples and cleaning agents:

Material	**Part**
Borosilicate glass	measuring cell, filling pump
PP (polypropylene)	housing
PTFE (polytetrafluoroethylene)	filling tube
PVDF (polyvinylidene fluoride)	connection block, screw plug, adapter Luer, pump lever
Kalrez	flat seal between connection block and measuring cell
Viton Extreme	sealing of the filling pump

Appendix B: Density [g/cm^3] of Water[1]

(0 °C to 40 °C / 32 °F to 104 °F)

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

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

Appendix C: Parameter Overview

Parameters marked with * require additional settings, see table C-2 for an overview of the additional settings and section 11.1.1 for more details. The parameters number is used when importing methods.

Table C-1: Parameter Overview

Param. type	Parameter	No.	Description
Density	Density	1	Density at the displayed measuring temperature in g/cm^3, kg/m^3 or lb/gal
	*Density@	2	Density at the selected reference temperature in g/cm^3, kg/m^3 or lb/gal. The temperature influence is compensated by the temperature coefficient Alpha (g/cm^3/K).
	*Specific Gravity SG	3	Specific gravity is the density of the sample at the selected reference temperature divided by the density of water at the selected reference temperature. The temperature influence is compensated by the temperature coefficient Alpha (g/cm^3/K).
Alcohol	Alcohol % v/v @ 20°C	4	Concentration of an ethanol/water mixture in % by volume at 20 °C
	Alcohol % w/w	5	Concentration of an ethanol/water mixture in % by weight
	Alcohol US @ 60°F	6	Degree Proof at 60 °F

Table C-1: Parameter Overview (cont.)

Param. type	Parameter	No.	Description
API	API Gravity A @ 15°C @ 20°C @ 29.5°C @ 60°F	 7 10 13 16	API number for the product group A (crude oil), referred to the respective reference temperature
	API Gravity B @ 15°C @ 20°C @ 29.5°C @ 60°F	 8 11 14 17	API number for the product group B (fuels), referred to the respective reference temperature
	API Gravity D @ 15°C @ 20°C @ 29.5°C @ 60°F	 9 12 15 18	API number for the product group D (lubricants), referred to the respective reference temperature
	API SG A @ 15°C @ 20°C @ 29.5°C @ 60°F	 20 22 25 28	Specific gravity for the product group A (crude oil), referred to the respective reference temperature
	API SG B @ 15°C @ 20°C @ 29.5°C @ 60°F	 19 23 26 29	Specific gravity for the product group B (fuels), referred to the respective reference temperature
	API SG D @ 15°C @ 20°C @ 29.5°C @ 60°F	 21 24 27 30	Specific gravity for the product group D (lubricants), referred to the respective reference temperature
	API Density A @ 15°C @ 20°C @ 29.5°C @ 60°F	 31 34 37 40	Density of the product group A (crude oil), referred to the respective reference temperature

Table C-1: Parameter Overview (cont.)

Param. type	Parameter	No.	Description
API	API Density B @ 15°C @ 20°C @ 29.5°C @ 60°F	 32 35 38 41	Density of the product group B (fuels), referred to the respective reference temperature
	API Density D @ 15°C @ 20°C @ 29.5°C @ 60°F	 33 36 39 42	Density of the product group D (lubricants), referred to the respective reference temperature
Baumé	*Baumé	43	Degree Baumé at 60 °F. The temperature influence is compensated by the set temperature coefficient Alpha (g/cm^3/K). 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, the instrument automatically switches between the two calculation methods.
H2SO4	H2SO4 % v/v @ 20°C	45	Concentration of sulfuric acid or battery acid in % v/v at 20 °C
	H2SO4 % w/w	44	Concentration of sulfuric acid or battery acid in % w/w
Sugar	Brix	46	Concentration of sugar in °Brix
	Extract	47	Concentration of sugar in °Plato

Table C-1: Parameter Overview (cont.)

Param. type	Parameter	No.	Description
Custom	KMW	-	Klosterneuburger Mostwaage Austrian-specific unit for the sugar content in must
	Öchsle	-	Measuring unit calculated from the density of grape must.
	NaOH	-	Concentration of sodium hydroxide in % w/w
	HNO3	-	Concentration of nitric acid in % w/w
	Methanol	-	Concentration of methanol in % w/w
	Isopr30-100	-	Concentration of isopropanol in % w/w
	Isopr0-30	-	Concentration of isopropanol in % w/w
	H2O2	-	Concentration of hydrogen peroxide in % w/w
	HCl	-	Concentration of hydrochloric acid in % w/w
	CaCl2	-	Concentration of calcium chloride in % w/w
Raw Data	Period	48	Period value in µs of the oscillator at the measuring temperature
	Resistance	-	Resistance in Ω of the temperature sensor (only for service purposes)

Table C-2: Additional settings

Parameter	Additional settings	Description
Density@	Temperature 1	Reference temperature at which the density is displayed
	Alpha ($g/cm^3/K$)	Temperature coefficient (see section 11.1.3)
Specific Gravity SG	Temperature 1	Reference temperature for the density of the sample
	Temperature 2	Reference temperature for the density of water
	Alpha ($g/cm^3/K$)	Temperature coefficient (see section 11.1.3)
Baumé	Alpha ($g/cm^3/K$)	Temperature coefficient (see section 11.1.3)

Appendix D: Example Files

methods.txt

```
Method:
Name=H2SO4
Parameter1=44[a]
Offset=0.000000
Parameter2=1
Method:
Name=Density
Parameter1=1
Offset=0.000000
Parameter2=3
Temp1=20
Temp2=20
Alpha=0.000300
```

a see table C-1 for the number of the desired parameter

sampleID.txt

```
ID 1
ID 2
ID 3
```

Appendix E: Firmware Versions

Firmware version	Date of release	Document number	Remarks
1.000	10.05.2017	E28IB002ML-A	First software version released

Appendix F: Menu Tree

Measurement Data	Export Measurement Data		
	Print All		
	Delete Last		
	Delete All		
Sample IDs			
Methods	New Method		
	Edit Method		
Setup	Data Transfer	Configure Export Target	
		Configure Printer Target	
		Configure Printer	
		Configure Data Format	
		File Transfer	Export Sample IDs
			Export Methods
			Export Custom Parameters
			Import Sample IDs
			Import Methods
			Import Custom Parameters
		Firmware Update	
	RFID	Write Tag	
		Read Tag	
		Erase Tag	
	Measurement Mode		
	PIN Settings		
	Date and Time	Set Date and Time	
		Set Date and Time Format	
	Language		

Setup	Display Settings
	Sound
	Units
	Reset to Factory Settings
Adjustments	Water Adjustment
	Custom Adjustment
	Factory Adjustment
Service	System Information
	Live Raw Data
	Calibration Mode[a]

a for service purposes only