

## Conductivity Measuring Instrument (pure water)

as of version 1.7

### Operating Manual

# GLF 100 RW



WEEE-Reg.-Nr. DE 93889386

# CONTENTS

<b>1</b>	<b>Intended use</b> .....	<b>3</b>
<b>2</b>	<b>General advice</b> .....	<b>3</b>
<b>3</b>	<b>Safety instructions</b> .....	<b>3</b>
<b>4</b>	<b>Operating and maintenance:</b> .....	<b>3</b>
<b>5</b>	<b>Disposal notes</b> .....	<b>4</b>
<b>6</b>	<b>Display elements</b> .....	<b>4</b>
<b>7</b>	<b>Pushbuttons</b> .....	<b>4</b>
7.1	Min-/max value memory .....	4
7.2	Hold – function.....	4
<b>8</b>	<b>Configuration of the instrument</b> .....	<b>5</b>
<b>9</b>	<b>Adjusting of the instrument</b> .....	<b>6</b>
<b>10</b>	<b>System messages</b> .....	<b>6</b>
<b>11</b>	<b>Inspection of the accuracy / Adjustment Services</b> .....	<b>6</b>
<b>12</b>	<b>General information about low conductivity measuring</b> .....	<b>7</b>
12.1	Measuring hints.....	7
12.2	Measuring procedure: .....	7
12.3	Temperature compensations .....	7
<b>13</b>	<b>Specification</b> .....	<b>8</b>

## 1 Intended use

**Precise measurements of conductivity in pure water applications with conductivities below 100 $\mu$ S/cm. Attention: Tap water is no pure water (several 100 $\mu$ S/cm)!**

### Applications:

- Monitoring of boiler water
  - Functional checking of ion exchangers
  - Checking of distilled / deionised / demineralised water
- etc.

## 2 General advice

Read through this document attentively and make yourself familiar to the operation of the device before you use it. Keep this document in a ready-to-hand way in order to be able to look up in the case of doubt.

## 3 Safety instructions

This device has been designed and tested in accordance to the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using it.

1. Trouble-free operation and reliability of the device can only be guaranteed if it is not subjected to any other climatic conditions than those stated under "Specification".
2. Transporting the device from a cold to a warm environment condensation may result in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.
3. The circuitry has to be designed most carefully if the device should be connected to other devices. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.
4. Whenever there may be a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting. Operator safety may be a risk if:
  - there is visible damage to the device or the device is not working as specified
  - the device has been stored under unsuitable conditions for a longer timeIn case of doubt, please return device to manufacturer for repair or maintenance.
5. **Warning:** Do not use this product as safety or emergency stop device or in any other application where failure of the product could result in personal injury or material damage. Failure to comply with these instructions could result in death or serious injury and material damage

## 4 Operating and maintenance:

- If the symbol "**BAT**" is displayed at the left side of display, the battery is weak, measuring can be continued for a short period. If "**bAt**" is displayed in the main display the battery is used up and needs to be replaced. Measuring is no more possible.
- The battery has to be removed, when storing device above 50 °C.

**Hint: We recommend removing the battery if device is not used for a longer period of time!**

### **Risk of Leakage**

- Treat device and probes carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect from soiling.
- After switching on the instrument a segment test (all segments) is displayed, followed by P.off, if auto power off function is activated (please refer to configuration).

## 5 Disposal notes



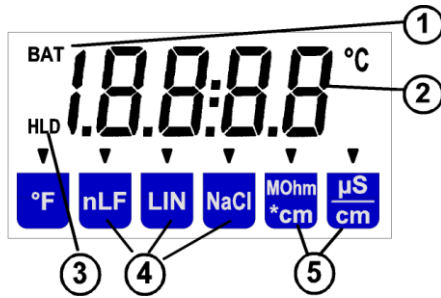
Dispense exhausted batteries at destined gathering places.

This device must not be disposed as “residual waste”.

To dispose this device, please send it directly to us (adequately stamped).

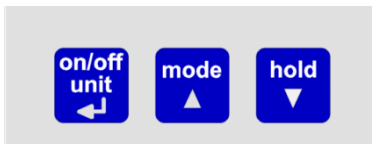
We will dispose it appropriately and environmentally friendly.

## 6 Display elements



<b>1. BAT</b>	Indicates low battery
<b>2. measurement display</b>	Consider additional arrows and symbols in display!
<b>3. HLD</b>	Measure value is “frozen”
<b>4. temperature compensation</b>	Arrows indicating the active temperature compensation
<b>nLF</b>	Non linear temperature compensation
<b>LIN</b>	linear temperature compensation
<b>NaCl</b>	compensation of weak NaCl solutions
<b>5. Unit-arrows</b>	Indicating unit of measured value

## 7 Pushbuttons



### on/off

Press long: off;

Press short: Show temperature

### mode

Choose between measuring value / Min value / Max value  
press 2s: reset Min and Max value

### hold:

Hold current measuring value (“HLD” in display)

### 7.1 Min-/max value memory


The lowest and highest measured value since the turning-on of the device will be stored.

Watch Min value (Lo): press shortly key **mode** once display changes between “Lo” and Min value

Watch Max value (Hi): press shortly **mode** once again display changes between “Hi” and Max value

Restore current value: press shortly **mode** once again current value of the chosen unit is displayed

Delete Min / Max value: press **mode** for 2 sec. Min and Max values will be deleted; the display shows shortly “CLr” (clear)

The min-/max value memory stores the lowest / highest conductivity (resistivity) value plus the related temperature. Pressing shortly () changes between the min-/max measuring value and the min-/max temperature.


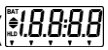




**After switching-off and turning-on again all Min- / Max- values will be deleted.**




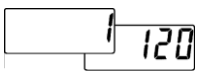
### 7.2 Hold – function


When the hold – key is pressed, the current measured value will be “frozen” (display symbol: HLD) until the key is pressed again. Then the device will measure in its normal way again.

## 8 Configuration of the instrument

To configure the instruments according to Your needs proceed like follows:

- Switch off the instrument.
- Switch on the instrument and press mode-key (  ) during the segment test (  ) until the display shows the first parameter "P\_oF"
- If a parameter should be edited, press key up or down (   ), the setting of the parameter will be shown.  
You can be changed via up/down keys and receipt the changed parameter with .
- Jump to the next parameter with .

parameter	value	meaning
<b>key</b> 	<b>keys</b>  	
<b>P_oF</b>	<b>Auto Power-Off</b> <i>factory setting: Auto</i>	
		<b>Auto Power-Off</b> in minutes. If there won't be pressed, the device will be switched off automatically to save battery power (adjustable range 1 to 120 min)
	<b>oFF</b>	automatic power-off is deactivated (continuous operating)
<b>Unit</b>	<b>Unit of display</b> <i>factory setting: cond <math>\mu</math>S/cm</i>	
	<b>cond <math>\mu</math>S/cm</b>	Measuring of conductivity in unit $\mu$ S/cm
	<b>rESi MOhm*cm</b>	Measuring of resistivity in unit MOhm*cm
<b>rAnG</b>	<b>Range of display</b> <i>factory setting: Auto</i>	
	<b>Auto</b>	Measuring with auto-range
	<b>100.0 <math>\mu</math>S/cm</b>	If Unit = cond $\mu$ S/cm: conductivity range 0.0 ... 100.0 $\mu$ S/cm
	<b>20.00 <math>\mu</math>S/cm</b>	" : conductivity range 0.00 ... 20.00 $\mu$ S/cm
	<b>2.000 <math>\mu</math>S/cm</b>	" : conductivity range 0.000 ... 2.000 $\mu$ S/cm (no auto-range)
	<b>.2000 MOhm*cm</b>	If Unit = rESi MOhm*cm: resistivity range 0.0100 ... 0.2000 MOhm*cm
	<b>2.000 MOhm*cm</b>	" : resistivity range 0.010 ... 2.000 MOhm*cm
<b>20.00 MOhm*cm</b>	" : resistivity range 0.01 ... 20.00 MOhm*cm	
<b>tUnit</b>	<b>Unit of temperature display</b> <i>factory setting: °C</i>	
	<b>°C</b>	temperature is displayed in °C
	<b>°F</b>	temperature is displayed in °F
<b>tCor</b>	<b>temperature compensation</b> (only for $\mu$ S/cm and mS/cm) <i>factory setting: nLF</i>	
	<b>OFF</b>	No temperature compensation of conductivity measuring
	<b>nLF</b>	non-linear temperature compensation for natural water acc. to EN 27888 (ISO 7888) to measure ground water, surface water, drinking water and purest water
	<b>Lin</b>	Linear temperature compensation with adjustable coefficient (t.Lin)
<b>nA.CL</b>	Temperature compensation of weak NaCl-solutions acc. to DIN EN 60746-3	
<b>tREF</b>	<b>Reference temperature of temp. compensation</b> (only for t.Cor <> oFF) <i>factory setting: 25 °C</i>	
	<b>25 °C / 77 °F</b>	Reference temperature 25 °C / 77 °F
	<b>20 °C / 68 °F</b>	Reference temperature 20 °C / 68 °F
<b>tLin</b>	<b>Compensation coefficient</b> (only for t.Cor = Lin) <i>factory setting: 1.000</i>	
	<b>0.300 .. 5.000</b>	Temperature compensations coefficient in % / K. The factor has to be evaluated by experiment or resolved from literature.
<b>Int</b>	<b>Restore to factory settings</b>	
	<b>no</b>	Settings are kept
	<b>YES</b>	Restoring device to factory settings

Pressing  again stores the settings, the instruments restarts (segment test)







**Please note:** If there is no key pressed within the menu mode within 2 minutes, the configuration will be cancelled, the entered settings are lost!




## 9 Adjusting of the instrument


The cell correction may change due to natural ageing or deposits at the measuring cell. In case you have an accurate reference liquid, you may adjust the instrument by changing the cells scale adjustment accordingly.

The temperature measuring is very stable and has to be adjusted in very seldom cases only.

To adjust the instruments according to Your needs proceed like follows::

- Switch off instrument.
- Switch on the instrument and press hold-key (  ) during the segment test (  ) until the display shows the first parameter "P\_oF"
- If a parameter should be edited, press key up or down (   ), the setting of the parameter will be shown.  
You can be changed via up/down keys and receipt the changed parameter with .
- Jump to the next parameter with key 

Parameter key 	Value keys  	Meaning
<b>SCL</b>	<b>Scale correction of measuring cell</b>	
	<b>0.800..1.200</b>	Adjustment of the measuring cells scale
<b>OFSt</b>	<b>Offset of temperature</b>	
	<b>-2.0...2.0 °C</b> <b>-3.6...3.6 °F</b>	Offset setting of temperature measurement (see below)
<b>SCLt</b>	<b>Scale correction of temperature</b>	
	<b>-5.00...5.00 %</b>	Scale adjustment of temperature measurement <i>Display = (measured value - offset) * ( 1 + scale adjustment / 100)</i>

Pressing  again stores the settings, the instruments restarts (segment test)

**Please note: If there is no key pressed within the menu mode within 2 minutes, the adjusting will be cancelled, the entered settings are lost!**

## 10 System messages

Er. 1 = Measuring range has been exceeded

-- = Sensor Error

Er. 7 = System fault - the device has detected a system fault (defective or far outside allowable ambient temperature range)

Er. 9 = Cable break - please return the device to the manufacturer

If „**BAT**” is displayed at the left side of display, the battery is weak; measuring can be continued for a short period.

If “**bAt**” is displayed in the main display the battery is used up and needs to be replaced. Measuring is no more possible.

## 11 Inspection of the accuracy / Adjustment Services

Accuracy can be inspected with test-solutions (extra equipment).

If the precision is not more within the admissible range, we suggest to send the device to the manufacturer for a new adjustment.

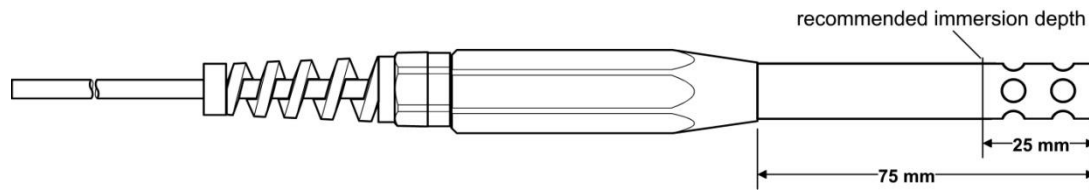
<It is also possible to order a factory calibration certificate.



## 12 General information about low conductivity measuring

### The Conductivity Measuring Cell

During the measurement, the conductivity measuring cell must be dipped at least in so far, that at least 25 mm beginning from the top of the measuring cell, is located in the medium. The measuring chamber between the inner electrode and the outer electrode must not contain air bubbles during the measuring, a sufficient flow through the measuring chamber is necessary for precise results.



The measuring cell can either be stored dry or in water. If changing over from one liquid to another with conductivities varying widely make sure to properly rinse and shake dry measuring cell.

**Attention: The measuring cell must never come into contact with water-repellent materials such as oil or silicone. Any soiling of the inner part of the measuring cell has to be avoided! Clear only with de-ionized/de mineralized water or alcohol.**

### 12.1 Measuring hints

According to the high influence of even smallest contaminations special care has to be taken when handling the measuring cell.

The precision of the instrument is very constant if it is used as intended. Depending on the necessary accuracy the instruments can be used up to several years without recalibration of the cell, if treated carefully.

If the accuracy should be controlled or improved, this is done by means of suitable reference solutions, e.g. 84 µS/cm and the adjusting of the cells scale adjustment.

Attention! Wrong handling of reference solution can make them useless very fast.

General: Tap water is no pure water and commonly has a conductivity of several 100 µS/cm. The upper range of the GLF 100 RW is 100µS/cm, therefore it is not suitable to measure tap-water.

### 12.2 Measuring procedure:

Before immersion to the measuring solution, rinse the electrode with deionised water, dry with a paper towel and shake remaining water out.

The measuring is speeded up considerably, if the electrode is immersed and pulled out the solution several times. Be aware that no air bubbles are in the electrode, if so; repel them by knocking at the electrode.

During the measuring the electrode needs sufficient flow, e.g. via stirring the solution.

When temperature compensation is activated, the electrode needs enough time to adjust to the actual temperature of the measuring solution to work accurate.

When analysing pure water in piping's we suggest the usage of a suitable flow armature.

Attention! Pure water solves the carbon dioxide of the ambient air, the resulting carbonic acid increases the conductivity, if an open storage of the solution is used (Value may rise up to several µS/cm)

### 12.3 Temperature compensations

The conductivity of aqueous solution is temperature dependent. The dependency itself is strongly dependent on the kind of solution. For different applications therefore different means of temperature compensations are applicable:

#### nLF: natural water

For many applications in the higher measuring range of the instrument the non linear temperature compensation of natural waters is precise ("nLF" according to EN 27888). The most common reference temperature is 25 °C.

#### Lin: Linear temperature compensation

If it is only measured in a narrow conductivity range, the temperature compensation factor of this range can be determined. The exact temperature coefficient can be entered via instruments configuration.

$$LF \text{ reference temperature} = \frac{LF \text{ current temperature}}{1 + \frac{t \cdot Lin}{100} * (\text{current temperature} - \text{reference temperature})}$$

#### NaCl: weak NaCl solutions

Especially at pure water analysis the kind of contamination is determined by the application itself and well known. Often NaCl contamination is the main source of conductivity. In such cases the temperature compensation of weak NaCl-solutions acc. to DIN EN 60746-3 is a precise compensation method.

## 13 Specification

### Measuring

<b>Principle</b>	Conductivity measuring via 2 pole stainless steel electrode	
<b>Meas. Ranges</b>	Range	Resolution
Conductivity	0.000 ... 2.000 $\mu\text{S}/\text{cm}$	001 $\mu\text{S}/\text{cm}$
	0.00 ... 20.00 $\mu\text{S}/\text{cm}$	0,01 $\mu\text{S}/\text{cm}$
	0.0 ... 100.0 $\mu\text{S}/\text{cm}$	0.1 $\mu\text{S}/\text{cm}$
Resistivity	0.0100...0.2000 $\text{M}\Omega\cdot\text{cm}$	
	0.010...2.000 $\text{M}\Omega\cdot\text{cm}$	
	0.01...20.00 $\text{M}\Omega\cdot\text{cm}$	
Temperature	-5.0 ... 100.0 $^{\circ}\text{C}$	
<b>Electrode</b>	Concentric 2 pole stainless steel electrode (1.4404, 1.4435), integrated temperature sensor, outer diameter 12 mm, minimum immersion depth 25 mm Cable length 1.2 m.	
Guarantee	12 month (assuming appropriate usage)	
<b>Accuracy</b>	$\pm 1$ Digit (at nominal-temperature)	
Conductivity:	typ. better than $\pm (1,0 \%$ of measured value + 0,5 % FS)	
Temperature	$\pm 0.3$ K	
<b>T.-compensation:</b>	linear temperature compensation with adjustable coefficient non-linear temperature compensation according to EN 27888 temperature compensation of weak NaCl solutions acc. to EN 60746-3 reference temperatures 20 $^{\circ}\text{C}$ and 25 $^{\circ}\text{C}$	
<b>Nominal temperature</b>	25 $^{\circ}\text{C}$	
<b>Ambient</b>	Temperature instrument -25 ... +50 $^{\circ}\text{C}$ Temperature cell -5 ... +80 $^{\circ}\text{C}$ (short time 100 $^{\circ}\text{C}$ ) Relative humidity instrument 0 ... 95 %RH (non condensing)	
<b>Storage temperature</b>	-5 ... +50 $^{\circ}\text{C}$	
<b>Housing</b>	Dimension: 110 x 67 x 30 mm (H x W x D) impact resistant ABS, membrane keyboard, transparent panel. Front side IP65	
<b>Weight</b>	approx. 155 g	
<b>Power Supply</b>	9V-Battery, type 6F22 (zinc-carbon battery included) Operating time with zinc-carbon battery >200 hours	
<b>Power Consumption</b>	<1.5 mA	
<b>Display</b>	ca. 11 mm high, 4½-digit LCD-display with additional segments	
<b>Pushbuttons</b>	3 membrane keys for on/off switch, menu operation, min/max/ hold-function etc.	
<b>Hold Function</b>	Press key to store current value.	
<b>Automatic-Off-Function</b>	Device will be automatically switched off if not operated for longer time (adjustable from 1...120 min)	

### EMC:

The device corresponds to the essential protection ratings established in the Directives of the European Parliament and of the council on the approximation of the laws of the memberstates relating to the electromagnetic compatibility (2004/108/EC).  
EN 61326-1 : 2013 (table 3, class B), additional error: < 1 % FS.