

# Sentron

## SI line pH METER MANUAL

*For products:*

SI400      7400-0xx

SI600      7600-0xx

**Warning!** The only user replaceable parts in this meter are the batteries. These can be accessed by opening the battery compartment. Do not open the meter casing. Opening the meter may cause damage and will void the guarantee. Also, do not remove the SD memory card from the meter unless instructed to do so by a Sentron service engineer.

All information provided in this manual is applicable at the moment of publication. Sentron holds the right to change components, functions and procedures without notice.

Manual SI line pH meter

Ref. number E7500330.03



In the event your Sentron pH meter has this symbol on its label, you are requested to return this meter to Sentron after use. Sentron will ensure the meter is disposed of in an environmentally friendly way.

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# 1 General

The Sentron SI line meter allows you to perform accurate pH measurements together with Sentron SI line probes. We advise you to read the 'Quick Start' guide before use and keep this guide for future reference. We also advise you to read this manual to learn about the meter's many built in features.

The Sentron pH meters and probes are designed for pH measurements. Do not use the meters or probes for other applications as this may cause damage.

## 1.1 Declaration of compliance

Sentron Europe B.V. located in Leek, the Netherlands, declares that the Sentron SI line pH meters are designed and produced in accordance with EMC-standards EN 61326-1: 2006.

As a result of this and adherence to other standards this meter is permitted to carry the CE-mark.

## 1.2 Guarantee

All Sentron meters are produced, packaged and transported with the utmost care and Sentron provides a 12 month guarantee for material or manufacturing defects.

All Sentron probes have a guarantee of 6 months. You can find information on the guarantee provided on probes in the probe manual.

Sentron will, according to its own judgment, either replace or repair a defect meter within 12 months of shipment, provided the cause is a defect in material of manufacturing and the defect appeared during correct use of the meter. The guarantee explicitly excludes normal wear and tear and misuse of the meter.

The decision whether or not the guarantee is applicable is subject to Sentron's assessment of the defect cause. Sentron holds the right, at wholly its own discretion, to refuse guarantee claims in the event it suspects the meter has been used incorrectly. In cases of incorrect use Sentron may, but is not obliged to, offer to repair the meter at regular repair fees.

Any representations and guarantees made by any person, including distributors, representatives and employees of Sentron that are contradictory to the abovementioned guarantee conditions are void unless these are made in writing and signed by an authorized person.

Sentron holds the right to request proof of purchase in the event guarantee claims are made.

Sentron is not liable to users for any damages, either direct or indirect, relating to the use or intended use of Sentron meters or accessories.

## 1.3 Specifications

	SI400 7400-0xx	SI600 7600-0xx
<b>pH</b>		
Accuracy*	+/- 0.01	+/- 0.005
Resolution*	0.01	0.005
Range*	pH 0.00...16.00	pH 0.000...16.000
Calibration	Smart calibration wizard	
1-point	✓	✓
2-point	✓	✓
3-point		✓
5-point		✓
Buffer types		
Sentron	✓	✓
DIN, NIST, JIS		✓
Calibration reminder (user definable time)	✓	✓
Calibration Reports		
Display report	✓	✓
Save report file		max. 7
Send calibration report(s) to PC through USB		✓
Automatic Temperature Correction (ATC)	✓	✓
<b>Temperature</b>		
Accuracy*	+/- 0.5 °C (0.9 °F)	
Resolution*	0.1 °C (0.1 °F)	
Range*	-20...120 °C (0...248 °F)	
Display °C/°F	✓	✓
<b>Options</b>		
Languages	English, French, German, Dutch, Spanish	
Bias setting (user definable fixed offset value)		pH -9.99...9.99
Powersave		
Display on/off button	✓	✓
Display auto off (user definable time)	✓	✓
Meter auto off (user definable time)	✓	✓
Button sound (on/off)	✓	✓
Data handling		
Store current measurement value(s) manually	max. 10	max. 500
Log measurement value(s) automatically at user definable interval 1-60 sec		max. 65000
Send logged data file to PC through USB		✓
Remote readout from PC through USB (max. 1 readout per sec.)		✓
Alarm setpoints and warnings (user definable min-max settings)		
pH		0...14 pH
Temperature		0...80 °C (32...176 °F)
Stability check (change in pH per unit time)		0.01...0.10 pH/30sec
<b>Physical properties</b>		
Dimensions (W x H x D)	80mm x 160mm x 36mm (3.13" x 6.30" x 1.14")	
Weight (incl. batteries)	379 gram (13.4 oz)	
Power consumption		
Display on	220mA	
Display off	85mA	
Display	3.2" 240x320 LCD color display	
Operation	7h continuous / 26h with power save enabled	
Temperature	0...45 °C (4...115 °F) max. 90% rel.humidity	
Humidity	max. 75% relative humidity	
Storage	Batteries must be removed when long-time stored	
Temperature	0...60 °C (4...140 °F) max. 90% rel.humidity	
Humidity	max. 80% relative humidity	
Protection rating	IP65 (splash water resistant)	
Memory	2GB µSD-Card (Do not use µSDHC cards)	
Materials	According RoHS Directive 2011/65/EU Annex II	
Casing	PC/ABS	
Buttons, boot and caps	Silicone	
Connectors		
Probe connection	5-pin socket, push-pull	
Power adapter / PC-connection	USB Mini-B socket	
Galvanic isolation	4kV between meter and probe	
Protective rubber boot	White (7x05-005) or Grey (7x05-010)	
Batteries	3 x AA NiMH 2400mAh (15A-ANSI or IEC-LR6)	
Replacable	✓	✓
Rechargeable via USB (5VDC - minimum 500mA to start charging)	✓	✓
Recharge time (empty-full, with Sentron charger, @ 1000mA)	7 hours	
Realtime clock with date	✓	✓

\* dependent of used probe type

Specifications subject to change

## 2 Installation

To start using your Sentron SI pH meter for the first time you will need to connect a probe to the meter and remove the battery isolator. In the sections below you will find instructions on how to do this. In the Batteries section you will also find instructions for charging and replacing batteries.

### 2.1 Batteries

#### 2.1.1 First time use

The SI meter is delivered with three pre-installed pre-charged AA rechargeable batteries. To activate the meter for the first time, pull the plastic strip (battery isolator) out of the battery compartment and press the power button.

#### 2.1.2 Recharging batteries

When fully charged, the three AA rechargeable batteries with which the Sentron SI meter was shipped provide 7 hours of operating under normal use.

To recharge the batteries, connect the meter to the power adapter using the supplied USB cable and place the power adaptor in a power outlet. The meter will recharge in approximately 7 hours.

In case the meter batteries are empty and will not be recharged soon, remove the batteries.

#### 2.1.3 Replacing batteries

The three AA batteries required for operation of the meter are replaceable. The rechargeable batteries may lose capacity over their lifetime and replacement may be necessary when operating time on a battery charge becomes too short. When replacing the rechargeable batteries, only batteries supplied by Sentron should be installed. To replace the batteries, open the battery compartment cover by turning the half turn screw counter clockwise and pulling the bottom of the battery cover outwards. When inserting the batteries ensure the orientation of the batteries have the correct + and - alignment as indicated in the figure below.



It is possible to temporarily install non-rechargeable batteries when the rechargeable batteries have run out and there are no other fully charged rechargeable batteries available (i.e. when using the meter in a remote location). This should be done with care as the non—rechargeable batteries should be removed immediately after use, before the meter is connected to a power adaptor or USB port.

**Warning!** Do not connect the meter to the power adaptor or to a USB when non-rechargeable batteries are installed. This may damage the batteries and/or meter.

#### 2.1.4 Batteries and storage

In the event the meter is not used for a longer time period the batteries should be fully recharged and removed from the meter.

### 2.2 *Connection of probe to meter*

The probe is designed to work in combination with a Sentron SI line pH meter. Push the probe's connector into the socket on the upper side of the meter. The (white) notch on the probe connector needs to be aligned with the meter, having the notch facing towards the front side of the meter. The connector is pushed down until it clicks into the meter's socket.

The probe can be disconnected from the meter by simply pulling the probe connector.



**Connect the probe to the meter**

**Note:** Do not turn the probe connector once inserted into the meter's socket. Also, make sure both meter and probe connector are clean and free from debris before connection.

Do not pull the probe's cable, always pull the connector.

### 2.3 SD memory card

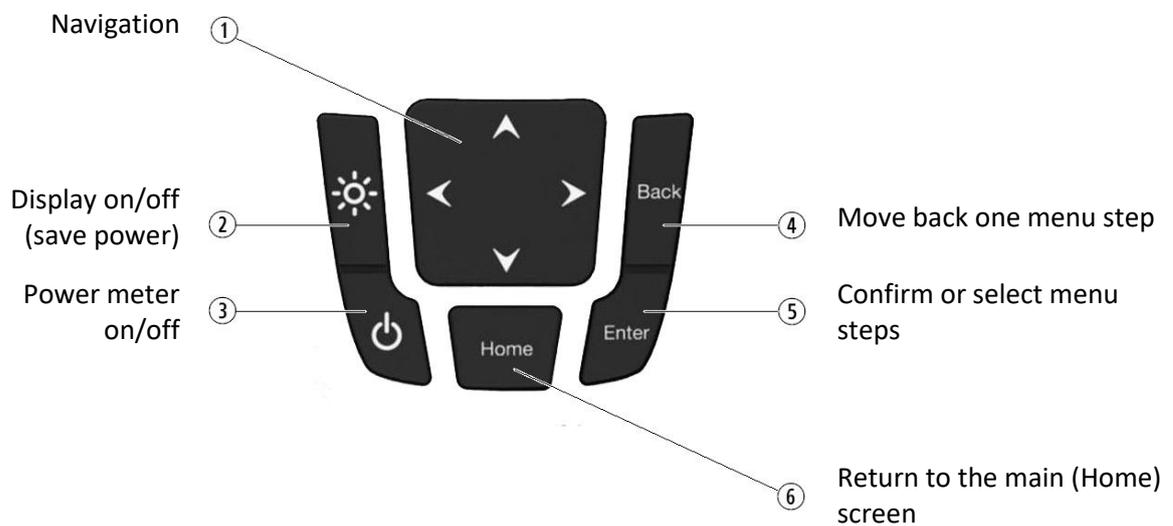
The battery compartment contains a SD card slot holder with a pre-installed SD card. This SD card is required for the meter's operation and should not be removed unless instructed by a Sentron service engineer.

## 3 Operation

Operation of the SI meter is done via the 6 keys below the screen.

### 3.1 Keypad

The SI meter contains a keypad with six keys

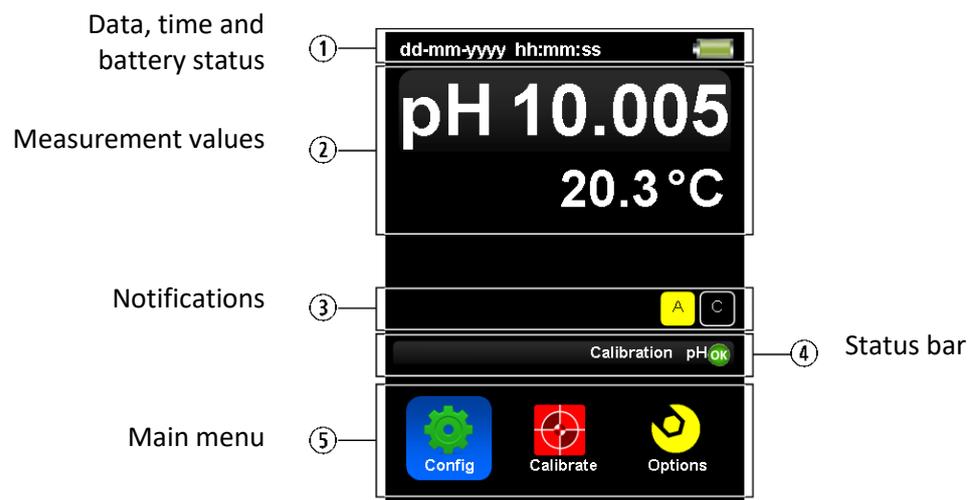


### 3.2 Home screen

The home screen displays all the key information required when making pH measurements. It contains five sections:

- Date, time and battery status
- Measurement values
- Notifications
- Status bar
- Main menu

The SI meter's home screen



#### 3.2.1

#### 3.2.2 Date, time and battery status

The top of the screen contains the actual date (DD-MM-YYY) and the time (user settable as 12 or 24 hour notation).

In the right hand corner the status of the battery is displayed:

Indicator	Battery status
	Charging
	100% capacity
	75% capacity
	50% capacity
	25% capacity
	Almost empty

#### 3.2.3 Measurement values

The measurement values section on the home screen contains the pH and temperature recorded by the probe. When a probe is connected the pH value should be between 1 and 14. When no probe is connected the pH value will be 16.00(0) and the temperature will read -20°C (or -4°F).

### 3.2.4 Notifications

Only when the main screen is displayed, some additional notifications regarding certain settings are can being displayed on top of the status bar.

#### Alarm (SI600 only):

An alarm can be set when pH and / or temperature values go beyond user definable upper and lower limits. See chapters 6.1.1 and 6.1.2 for setting or changing the pH and temperature alarm settings.



Notification  
of a *set* Alarm



Notification of  
an *activated* Alarm

#### Calibration reminder:

A calibration reminder can be set to perform calibrations within a specific time interval. The time interval is user definable. See chapter 5.5 for setting or changing the calibration reminder function.



Notification of a *set*  
calibration reminder



Notification of an  
*activated* calibration  
reminder

#### Stability check:

The stability check can be set to provide a warning when the rate of change of pH exceeds a certain threshold. See chapter 6.1.3 for setting or changing the stability check.



Notification of a *set*  
stability check



Notification of an  
*activated* stability check

#### Bias:

A user definable bias value can be set to adjust the displayed pH measurement value. See chapter 6.3 for setting or changing the bias.



Notification of a *set*  
bias

#### Range:

A range notification is a default alarm (not user definable) and provides a warning when pH and / or temperature conditions exceed the specification limits of the equipment.



Notification of a  
range alarm

### 3.2.5 Status bar

The status bar displays additional information about the meter status. What is displayed depends on whether the meter is on the home screen, in a sub menu or a function is being selected.

On the home screen, the status bar will display information regarding the probe, e.g. *Probe disconnected* or *Calibration OK*. When sub menu's are selected, it will show the menu name. When a function is being selected the status bar will provide useful instructions or status information such as *Place probe in next buffer, Take sample, Send data* etc.

### 3.2.6 Main menu

The meter's main menu has three icons: Config, Calibrate and Options. Selecting one of these main menu icons will display the subsequent menu.

- The Config submenu contains the general configuration options of the meter, such as display, language and time settings.
- The Calibrate submenu contains all the functions and options related to the calibration of the probe. For instance, performing a calibration, setting buffer type and recalling calibration report(s).
- The Options submenu allows the user to set parameters and perform actions related to measurements and measurement values. In this submenu functions such as alarm thresholds, data acquisition and bias settings can be accessed.

## 4 Configuration

In the Config submenu a wide range of features such as energy saving, time and display language settings can be selected. All features in this menu relate to the operation of the meter itself, options and settings related to the measurements can be found in the *Options* menu (Page 27).

### 4.1 Power save

The Sentron SI meter has two options to save power and extend battery operation time: Display-off and Meter-off. Set either one, or both, of the options to maximize use of the battery capacity:

**Display-off:** switch off the display after a user definable inactive time.

When the display-off option is activated, the screen will switch off after the selected time has expired since the last key has been pressed. Pressing any key will turn the screen back on.

While the screen is turned off, the meter will still fully function and perform such actions as logging and measuring the signals from the connected probe. Pressing a key during the display-off mode will not evoke any action other than reactivating the display.

To set or change the Display-off setting:

Go to the *Config* menu, and choose *Power save*.

Now select *Display-off*.

Toggle the *on/off* button and select the display-off time between 1 and 60 minutes.

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

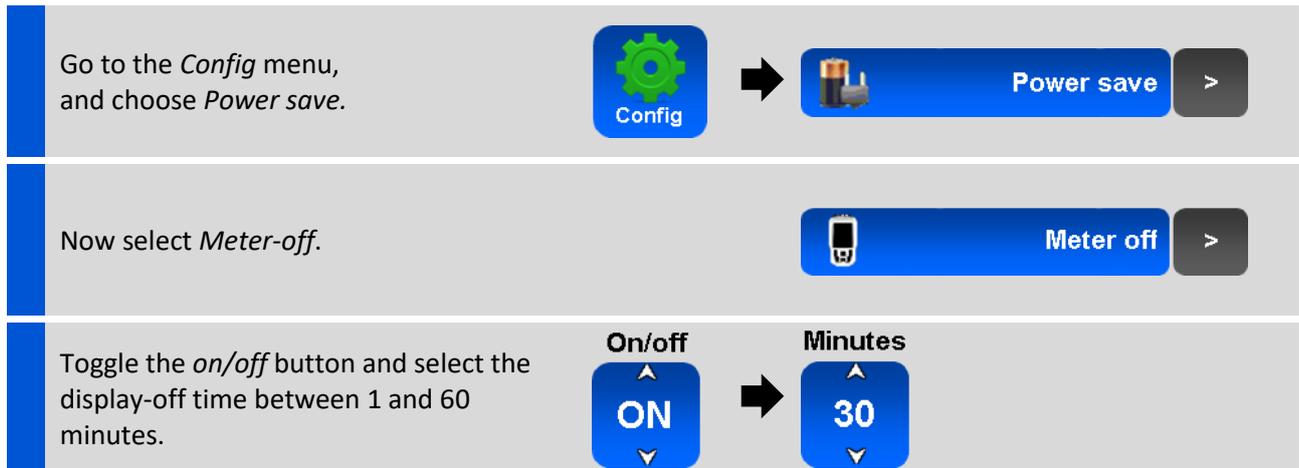
**Meter-off:** switch off the meter after a user definable inactive time.

With the meter-off function activated, the meter will power down entirely after the selected time has expired since the last key action. The meter has to be turned back on in the same way as a “normal” power-up; by pressing the *ON* button on the keypad.

When the meter is switched off using this function, the meter is entirely powered down. This means the ISFET pH sensor circuit will be powered down as well. Since a new calibration is recommended after a startup, it is therefore recommended to perform a new calibration after an automatic *Meter-off* as well.

The meter will not power-down when the AC-adaptor is connected.

To set or change the Meter-off setting:



Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

**Note:** For meters with logging capabilities (SI600), the *meter-off* function will be automatically disabled for the period of active logging. Hence, setting this function will not affect measurements during continuous logging.

## 4.2 Time

The Sentron SI meter is equipped with a highly accurate internal clock. The date and time are factory set to Central European Time (CET), which is 1 hour ahead of Coordinated Universal Time (UTC +01:00).

The meter's time setting can be adjusted to the local time and either 12 or 24 hour display can be selected.

To set the meter to your local time the time can be adjusted 24 hours forwards or backwards with respect to the factory preset time. The date will adjust accordingly when the 0:00 time is crossed. Time zones west of UTC should adjust time backwards and time zones east of UTC should adjust time forwards.

Daylight savings time is not set automatically and, if required, should be set manually.

To change the time and/or set the 12- or 24-hour clock:

Go to the <i>Config</i> menu, and select Time.	 → 
Toggle the <i>12/24</i> button to set the display into either a 12- or 24-hour clock notation.	
Toggle the <i>Hours</i> and <i>Minutes</i> buttons to change the meter's current setting.	

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

## 4.3 Button sound

When operating the Sentron SI meter, audible sounds can be generated to provide feedback on button operation. Sound can be set to on or off, the volume of the sound cannot be altered.

The button sound setting has no influence on the audible notifications for set alarms.

To set or disable the button sound:

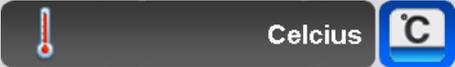
Go to the <i>Config</i> menu, now select and enter the <i>Button sound</i> option.	 → 
Toggle and choose the button sound to <i>on</i> or <i>off</i> .	

Confirm and apply with the *Enter* key, or exit with the *Back* key to discard any changes.

## 4.4 Temperature

The Sentron SI meter can display temperature in either Celsius or Fahrenheit. The resolution is not influenced by the chosen unit setting.

To change the temperature unit:

Go to the <i>Config</i> menu, now select and enter the <i>Temperature</i> option.	 → 
Toggle and choose the desired unit setting.	

Confirm and apply with the *Enter* key, or exit with the *Back* key to discard any changes.

## 4.5 Language

The language in which the Sentron SI meter displays menus and options can be changed into one of the five pre-installed languages; Dutch, English, French, German, and Spanish.

To change the language:

Go to the <i>Config</i> menu, now select and enter the <i>Language</i> option.	 → 
Toggle and choose one of the available languages.	

Confirm and apply with the *Enter* key, or exit with the *Back* key to discard any changes.

## 5 Calibration

In order to perform accurate pH measurement with a Sentron SI meter, it must be calibrated before use. Generally, a calibration should be performed each time the meter is switched on or when a different probe is attached. In practice this means calibration should be performed at least daily.

The calibration process consists of placing a probe attached to the Sentron pH meter in one, or a series of, buffer solutions with a predetermined pH. The type of calibration, and the number of calibration points depend on several factors. In general, the more buffers that are used, the more accurate the calibration will be. A detailed explanation of the calibration process, and the considerations for choosing the number of calibration points, can be found in section 5.1.

The Sentron SI meter displays a calibration results at the end of each calibration and stores the calibration results in a report. This report is available for review at a later time. Please review section 5.4 for detailed information on accessing and interpreting calibration reports.

The Sentron SI meter can provide a warning as a reminder to perform a calibration. The warning will be activated after a user definable time period since the last calibration. It is recommended to set this calibration reminder time at an appropriate setting for the intended application. This function is explained in section 5.5

The Sentron SI 400 meter can only be calibrated using Sentron buffer sets. The SI 600 meter can be calibrated using Sentron, DIN, NIST and JIS buffer sets. The process for changing the buffer set configuration is explained in section 5.6 below.

## 5.1 Determining the calibration type

When starting a new pH measurement, the first step is to determine what calibration process is most appropriate for this application. Choosing the wrong calibration process may result in inaccurate measurements and possibly require the measurements to be repeated.

Calibrations can be either single or multiple point. The SI400 meter allows 1 and 2 point calibration, whilst the SI600 allows 1, 2, 3 and 5 point calibration. In general, increasing the number of points used for calibration will increase the measurement accuracy. However, the calibration range should be as close as possible to the range over which measurements are expected to take place and extend to above and below the minimum and maximum expected measurement values.

**1 point calibration**, an option for quick pH measurements spanning 1 – 2 pH.

*Example:*

A single point calibration would be an option for measurements where the objective is to quickly detect a difference from one single point e.g. pH 7, and the variation is always lesser than 1 pH in either direction. For a 1 point calibration a buffer should be available with a pH close to the point from which the deviations are to be measured

**2 point calibration**, recommended for accurate pH measurements spanning < 3 pH and quick measurements spanning 3 – 6 pH.

*Examples:*

If, for instance, measurement values are expected to lie between pH 7 and pH 10, a 2 point calibration would be appropriate. A 2 point calibration would be performed with buffers with pH 7 and pH 10.

If, on the other hand, measurement values are expected lie between pH 6 and pH 10, a 2 point calibration performed with a pH 4 and pH 10 buffer would be acceptable. For most accurate measurements, however, a 3 point calibration with pH 4, pH 7 and pH 10 buffers should be considered.

**3 point calibration**, recommended for accurate pH measurements spanning 3 – 6 pH and quick measurements spanning >6 pH.

*Examples:*

A series of measurements that are expected, for example, to take place between 4 and 10 pH would most accurately be performed when preceded by a 3 point calibration with pH 4 and pH 7 and pH 10 buffers.

Measurements expected to take place over a wider range of 7 pH, for example, between pH 2 and pH 11 could also be performed using a 3 point calibration with pH 2, pH 7 and pH 12 buffers, but would more accurately be measured using a 5 point calibration.

**5 point calibration**, recommended for accurate pH measurements spanning > 6 pH.

*Examples:*

Measurements expected to take place between pH 3 and pH 11 would require a full 5 point with pH 2, pH 4, pH 7, pH 10 and pH 12 buffers to achieve the most accurate measurements.

A number of experiments conducted sequentially that each have a relatively narrow range of expected values, but whose values overall are spread over a wide range, for which pH will be taken without interim calibrations between the experiments will require a 5 point calibration

- Experiment 1 values are expected between pH 2 and pH 3
- Experiment 2 values are expected between pH 7 and pH 9
- Experiment 3 values are expected between pH 9 and pH 12

## **5.2 Before calibration**

To ensure the best possible calibration results, always observe the following guidelines:

- Only use the buffer set with which your meter is configured
- Only use fresh buffers for a calibration
- Make sure your buffer sets are at the same temperature range as your sample to be measured
- Before, during and after calibration, always clean and flush your probe. Please see the probe manual for instructions on how to clean the probe.
- Make use of the calibration reminder function to ensure calibrations are made at appropriate time intervals (see chapter 5.5)
- Make use of Sentron twin-neck calibration fluid bottles as they minimize contamination of the buffer and allow convenient storage and calibration using a single bottle.

When a new probe is attached to a meter, or when a probe has not been used for a while, the probe may react slow or has low slope readings after calibration. In this case the probe will need to be “soaked” (revitalized). This will reactivate an inactive probe and ensures it will produce stable readings. For more information on revitalization and treatment of the probe, please review the probe manual.

### 5.3 Performing a calibration

The calibration sequence is set up in such a way that it is easy to perform and minimal input is required. To rule out erroneous multi-point calibrations, the calibration can only take place for an increasing or decreasing pH sequence. Hence, a multi-point calibration must be started with either the highest or lowest pH value in the intended range.

To perform a calibration, first chose the number of calibration points for which the calibration is to be performed. Next, select the pH value of first buffer with which the calibration with be started.

In most cases, the first selected buffer type combined with the chosen number of calibration points, is sufficient to determine the calibration path. In some multiple point calibrations cases, however, a second buffer solution has to be selected in order for the meter to understand the desired calibration path.

The screen will continuously provide information about the status of the calibration and which step is to be taken next. After the calibration is completed, a report is shown with details of the performed calibration such as time, date, temperature, slope and buffer type used.

To perform a calibration:

Go to the <i>Calibrate</i> menu, and choose <i>Calibrate</i> .	 →  Calibrate 
Now toggle and select <i>number of calibration points</i> .	
Toggle and select the first calibration value to start with. ( <i>some cases require a second calibration value to be entered</i> )	

Follow the instructions provided by the meter and when done, a calibration report is displayed. Exit the calibration report with the *Close* button.

Successful calibrations result in the display of the message *calibration OK* on the home screen status bar. If, for any reason the calibration process has not been successful a message will be displayed on the screen. Also, a calibration process may be aborted. In both cases the meter will automatically revert back to the last successful calibration results. Be aware that this last calibration may have exceeded the recommended or user defined calibration interval.

#### 5.3.1 Aborting a calibration

Aborting a calibration by pressing the “back” or “home” button during the calibration process will evoke the message “probe disconnected” for a maximum of 120 seconds at the status bar on the main screen. As well, the measurement values will be out of range in this time period. Hereafter, the probe will return to the same calibration state as it was before.

**Recommendation:** disconnect the probe from the meter to prevent the above described waiting time. The calibration procedure has to be repeated completely.

## 5.4 Calibration reports

After each calibration a report is generated and stored in the meter's memory. The date of calibration, the buffers used, measured temperature and, in the case of a multi-point calibration, the calculated slopes are summarized in this report. Calibration reports are shown after each calibration and are stored by the meter.

### 5.4.1 Review calibration reports

A calibration report can be viewed to review how the last calibration process was performed. To see the report and results again at a later time, it can be opened from the *calibration reports* menu.

The SI400 stores only the latest calibration report and only this last report can be reviewed:

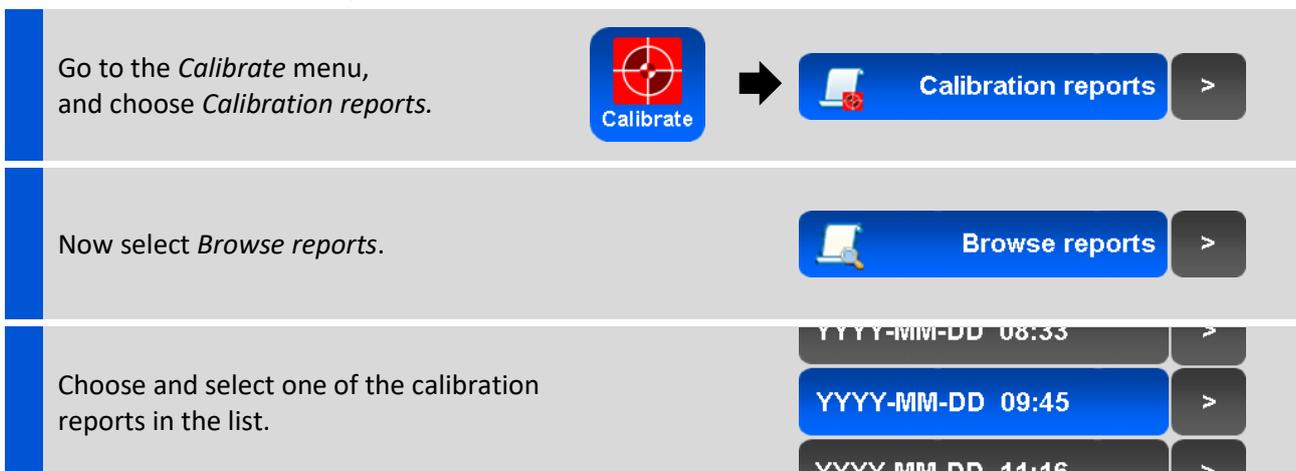
To review a calibration report (SI400):



Exit the report with the *Close* button, or remove the report with the *Delete* button.

The SI600 has the possibility to save, review and send the last seven calibration reports to a PC:

To review a calibration report (SI600):



Exit the report with the *Close* button, or remove the report with the *Delete* button.

### 5.4.2 Interpreting the displayed slope percentage

The slope percentage displayed in the calibration report is an indication of the calibration's success and the state of the probe.

Normal slopes should be between 105% – 95%.

Slopes outside these values, indicate polluted or aging probes. Although calibrations and measurements can be performed the measured values may be less accurate. In this case, be sure to replace the probe.

### 5.4.3 Send reports (SI600 only)

The calibration reports in the meter's memory can be sent to a PC via the USB port. All available reports will be sent sequentially. It is not possible to send individual reports.

To send the calibration reports via the USB port:

Go to the <i>Calibrate</i> menu, and choose <i>Calibration reports</i> .	 →  >
Now select <i>Send reports</i> .	 >

The message *SENDING REPORTS* will appear in the status bar during data transfer.

### 5.4.4 Delete reports

Reports can be deleted via the *calibration reports* menu.

The SI400 contains only the latest report. Deleting this report will only delete the overview, not the actual calibration values.

To delete an individual calibration report (SI400):

Go to the <i>Calibrate</i> menu, and choose <i>Calibration report</i> .	 →  >
At the opened report, select <i>Delete</i> .	 

Confirm the deletion with the *Yes* button, or cancel and return with the *No* button.

The SI600 can hold up to ten calibration reports, these can be deleted individually as well as together at once. Deleting a report will only delete the overview, not the actual calibration values.

To delete an individual calibration report (SI600):

Go to the *Calibrate* menu, and choose *Calibration reports*.

 → 

Now select *Browse reports*.



Choose and select one of the calibration reports in the list.



YYYY-MM-DD 08:33	>
YYYY-MM-DD 09:45	>
YYYY-MM-DD 11:16	>

At the opened report, select *Delete*.

Confirm the deletion with the *Yes* button, or cancel and return with the *No* button.

To delete all calibration reports (SI600):

Go to the *Calibrate* menu, and choose *Calibration reports*.

 → 

Now select *Delete all reports*.



Confirm the deletion with the *Yes* button, or cancel and return with the *No* button.

## 5.5 Calibration reminder

In order to perform accurate measurements, it is necessary to periodically repeat the calibration process. How often this is necessary will depend on the application and the chemical composition of the samples measured.

To ensure that periodic calibrations take place on time for any specific application, it is possible to set a user defined calibration reminder time after which a notification is displayed on the main screen.

It is always advisable, after a series of measurements have been performed, to place the probe in a relevant pH buffer solution to check that the calibration is still accurate. The deviation of the displayed value from the buffer solution value will provide an indication if, and how much, drift occurred during the measurements. If this drift is too large, it may be necessary to repeat the measurements with intermediate calibrations.

To set or change the calibration reminder:

The image shows two parts of the user interface. The top part shows a 'Calibrate' button with a red target icon, which leads to a 'Calibration reminder' button with a red triangle icon and a right arrow. The bottom part shows an 'On/off' toggle set to 'ON', which leads to a time selection screen with 'Hours' set to 8 and 'Minutes' set to 00.

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

The *Calibration reminder* setting appears as a notification on the Home screen.

Notification of a <i>set</i> calibration reminder	Notification of an <i>activated</i> calibration reminder

After a new power-up or after (re-)connecting a probe, there will be an automated calibration reminder always, despite the manual calibration reminder setting.

## 5.6 Buffer selection (SI600 only)

There are a number of standard buffer set types that are commonly used for calibration of pH meters. The buffer sets consist of a range of predefined pH values for which buffers are prepared in a standard and reproducible way.

All Sentron SI line meters are compatible with the Sentron buffer set. Selected meters, such as the SI600, have the option of changing the buffer set. The SI600 supports, besides the standard Sentron buffer set, also DIN, NIST and JIS buffer sets. It is not possible to create a user defined buffer set.

To change the buffer set:

Go to the <i>Calibrate</i> menu, now select and enter the <i>Buffer selection</i> option.		→	 Buffer selection	
Toggle and choose one of the available buffer sets.			 Sentron buffers	

Confirm and apply with the *Enter* key, or exit with the *Back* key to discard any changes.

Please see below for tables of temperature versus pH value for the various buffers.

### 5.6.1 SENTRON buffer set

The default buffer set for which the meter is configured is the SENTRON buffer set.

The Sentron buffer set consists of a set of five NIST-traceable buffers with a pH of 2.00, 4.00, 7.00, 10.00 and 12.00 at 25°C. The table containing the temperature dependence of the buffer set is presented in Table 1 below.

°C	°F	#1	#2	#3	#4	#5
5	41	2.01	4.00	7.10	10.22	12.70
15	59	2.01	4.00	7.04	10.14	12.38
<b>25</b>	<b>77</b>	<b>2.00</b>	<b>4.00</b>	<b>7.00</b>	<b>10.00</b>	<b>12.00</b>
35	95	2.00	4.02	6.98	9.91	11.63
45	113	2.00	4.04	6.96	9.81	11.38
55	131	2.00	4.07	6.96	9.76	11.12
65	149	2.00	4.10	6.95	9.71	10.86
75	167	2.00	4.12	6.94	9.66	10.60
85	185	2.00	4.15	6.93	9.61	10.34
95	203	2.00	4.17	6.92	9.56	10.08

Table 1: SENTRON Buffer set

Note that since the SENTRON buffer set is based on the NIST standard, they are available from other manufacturers as well.

### 5.6.2 DIN buffer set

The table containing the temperature dependence of the DIN buffer set as it is used in the SI meter is presented in Table 2 below.

°C	°F	#1	#2	#3	#4	#5
5	41	3.12	4.67	6.87	9.43	13.57
15	59	3.08	4.65	6.82	9.32	13.17
<b>25</b>	<b>77</b>	<b>3.06</b>	<b>4.65</b>	<b>6.79</b>	<b>9.23</b>	<b>12.75</b>
35	95	3.04	4.65	6.77	9.14	12.45
45	113	3.04	4.67	6.76	9.05	12.14
55	131	3.04	4.69	6.76	8.96	11.83
65	149	3.03	4.71	6.75	8.87	11.52
75	167	3.02	4.73	6.75	8.78	11.21
85	185	3.01	4.75	6.74	8.69	10.90
95	203	3.00	4.77	6.74	8.60	10.59

Table 2: DIN Buffer set

### 5.6.3 NIST buffer set

The table containing the temperature dependence of the NIST buffer set as it is used in the SI meter is presented in Table 3 below.

°C	°F	#1	#2	#3	#4	#5
5	41	1.67	4.00	6.95	9.40	13.21
15	59	1.67	4.00	6.90	9.28	12.81
<b>25</b>	<b>77</b>	<b>1.68</b>	<b>4.01</b>	<b>6.87</b>	<b>9.18</b>	<b>12.45</b>
35	95	1.69	4.02	6.84	9.10	12.13
45	113	1.70	4.05	6.83	9.04	11.84
55	131	1.72	4.08	6.83	8.99	11.57
65	149	1.73	4.11	6.84	8.94	11.33
75	167	1.75	4.15	6.85	8.90	11.11
85	185	1.78	4.18	6.87	8.88	10.91
95	203	1.81	4.23	6.89	8.83	10.73

Table 3: NIST Buffer set

### 5.6.4 JIS buffer set

The table containing the temperature dependence of the JIS buffer set as it is used in the SI meter is presented in Table 4 below.

°C	°F	#1	#2	#3	#4	#5
5	41	1.67	4.01	6.95	9.39	13.21
15	59	1.67	4.00	6.90	9.27	12.81
<b>25</b>	<b>77</b>	<b>1.68</b>	<b>4.01</b>	<b>6.86</b>	<b>9.18</b>	<b>12.45</b>
35	95	1.69	4.02	6.84	9.10	12.14
45	113	1.70	4.04	6.83	9.04	11.84
55	131	1.72	4.08	6.84	8.99	11.58
65	149	1.73	4.11	6.84	8.94	11.33
75	167	1.75	4.14	6.85	8.91	11.11
85	185	1.78	4.18	6.87	8.87	10.91
95	203	1.81	4.23	6.89	8.83	10.73

Table 4: JIS Buffer set

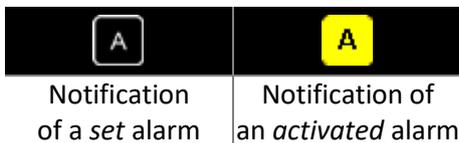
## 6 Options

The options menu contains various features such as alarms and data acquisition options (note that options may only be available in Sentron's advanced meters such as the SI600). All features in this menu relate to the actual measurement and/or measurement values. Operation and settings regarding the meter itself, like energy, time and display features are placed in the *Config* menu (Page 12).

### 6.1 Alarms (SI600 only)

Alarms can be set to notify when measured values respectively surpass or fall below defined maximum and minimum thresholds. Alarm thresholds can be set for *pH*, *temperature* and/or *stability* (the rate of change of pH over time).

When an alarm is set, a notification will display on the main screen. A transparent indicator with the letter *A* indicates that an alarm is set. When an alarm is activated, an audible sound can be heard and the alarm notification turns on bright yellow on the main screen.



#### 6.1.1 pH alarm

The pH alarm can be set for a minimum and maximum value. When the pH value exceeds the maximum value or falls below the minimum value of the set limits, the alarm is triggered and the meter will start beeping and the alarm notification is displayed on the main screen. The pH alarm can be set between *minimum* 0.00 and *maximum* 14.00.

To set or change the pH alarm:

Go to the <i>Options</i> menu, and choose <i>Alarms</i> .	
Now select <i>pH</i> .	
Toggle the <i>on/off</i> button and select the <i>minimum</i> and <i>maximum</i> desired thresholds to trigger the alarm.	

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

### 6.1.2 Temperature alarm

The temperature alarm can be set for a minimum and maximum value. When the temperature exceeds the maximum value or falls below the minimum value of the set limits, the alarm is triggered and the meter will start beeping and the alarm notification is displayed on the main screen. The temperature alarm can be set between *minimum* 0.0 and *maximum* 80.0 degrees Celsius (32.0 and 176.0 degrees Fahrenheit).

To set or change the temperature alarm:

Go to the *Options* menu, and choose *Alarms*.

Now select *Temperature*.

Toggle the *on/off* button and select the *minimum* and *maximum* desired thresholds to trigger the alarm.

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

### 6.1.3 Stability check

The stability check can be used to give a warning when a measurement has become unstable and rapid changes in the measured pH occur. The definition of “stable” may vary between applications and industries, therefore the SI meter has a user definable stability criterion.

When set, the stability check displays a notification (SC) on the main screen when the measured pH value changes faster than the specified maximum rate of change. When the alarm is triggered the meter will also start beeping.

Notification of a <i>set</i> SC	Notification of an <i>activated</i> SC

The stability is expressed in a certain pH change per time unit (30 seconds). The default is set to 0,02pH/30 sec. The stability criteria can be set between 0.01 and 0.10 pH per 30 seconds. The time frame of 30 seconds cannot be changed. Thanks to a smart algorithm, the meter is able to determine the set stability criterion within 8 seconds. This means, the stability check indication can be provided within around 8 seconds as well.

To set or change the stability check:

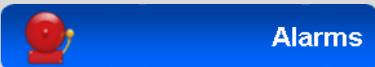
Go to the <i>Options</i> menu, and choose <i>Alarms</i> .	 →  Alarms >
Now select <i>Stability check</i> .	 Stability check >
Toggle the <i>on/off</i> button and select the desired minimum stability value.	On/off ON ↑ ↓ → pH/30 sec 0.02 ↑ ↓

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

#### 6.1.4 Disable all alarms

When multiple alarms have been set and are no longer required, they can be deactivated by a single *Disable all alarms* action.

To disable all alarms at once:

Go to the <i>Options</i> menu, and choose <i>Alarms</i> .	 →  Alarms >
Now select <i>Disable all alarms</i> .	 Disable all alarms >

Confirm and apply with the *Yes* button, or discard and exit with the *No* button.

## 6.2 Storing measurements

Sentron SI series meters have several options, depending on the model, for storing measurement data. These options, and how data can be transferred to a PC are described below.

The meter distinguishes between manual recording of an individual measurement value and automated recording of a series of measurements. Storing a single measurement is referred to as a “sample” where automated measurements are referred to as “logging”. The logging function is available for SI600 meters only.

### 6.2.1 Sampling

Sampling is storing the current pH and temperature measurement values to the meter’s memory. Sampled values can be looked up at a later time and/or sent to a PC. The sample will remain in the meter’s memory, even when batteries are replaced, until it is erased.

The maximum number of samples which can be stored to the meter’s memory is dependent on the meter type. The SI400 can store up to 10 samples, the SI600 can store up to 300 samples.

To take a sample:

Go to the <i>Options</i> menu, and choose <i>Data acquisition</i> .	 →  <b>Data acquisition</b> >
Now select <i>Sample</i> .	 <b>Sample</b> >
Press <i>Take sample</i> to record the momentary measurement values.	 <b>Take sample</b> >

-“**TAKING SAMPLE**” - will appear in the status bar during sampling.

In case the meter’s memory is full, a message will appear saying “**MEMORY FULL**”. One or more samples should be transferred to a PC (SI600 only) or deleted from the meter’s memory to proceed with sampling.

## 6.2.2 Changing the sample name prefix

Samples are given a default four character prefix “SAMP” follow by an automated sequential numbering of three digits starting with 000. Hence, the first samples taken with this prefix have names SAMP000, SAMP001, SAMP002 etc.

In order to better identify samples that have been taken it is possible to adjust the standard prefix into a custom one. The (default) name can be altered by four toggle buttons which can be set to the letters A-Z, the numbers 0-9 and the \_ (underscore sign).

When changing the sample prefix name, the names of all existing samples names remain unchanged. It is not possible to change the name of an existing sample on the meter, therefore, if a different sample prefix is desired, it is necessary to set the desired sample name prefix before the sample is taken.

The follow-up number is raised automatically for every unique name existing in the meter’s memory, starting with 000. Once a number is deleted, or the memory has been emptied, counting will start over with the lowest possible number.

To change the sample prefix:

Go to the <i>Options</i> menu, and choose <i>Data acquisition</i> .	 →  <b>Data acquisition</b> >
Now select <i>Sample</i> .	 <b>Sample</b> >
Press <i>Name sample</i> .	 <b>Name sample</b> >
Change the characters by toggling the displayed buttons to the desired prefix name.	

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

### 6.2.3 Review/delete a single sample

Stored and saved samples can be looked up and viewed individually on the meter. All stored samples can be viewed using the *Browse sample* menu. When a sample is viewed it can either be closed to be viewed again at a later time or deleted.

To review and/or delete a sample:

Go to the <i>Options</i> menu, and choose <i>Data acquisition</i> .	 →  <b>Data acquisition</b> ▾						
Now select <i>Sample</i> .	 <b>Sample</b> ▾						
Press <i>Browse samples</i> .	 <b>Browse samples</b> ▾						
Choose and select one of the stored samples in the list.	<table border="1"><tr><td>SAMP000</td><td>▾</td></tr><tr><td><b>SAMP001</b></td><td>▾</td></tr><tr><td>SAMP002</td><td>▾</td></tr></table>	SAMP000	▾	<b>SAMP001</b>	▾	SAMP002	▾
SAMP000	▾						
<b>SAMP001</b>	▾						
SAMP002	▾						

Exit the sample overview with the *Close* button, or to remove the sample by choosing the delete button:

At the opened sample overview, select <i>Delete</i> .	 <b>Close</b>  <b>Delete</b>
---	---

Confirm the deletion with the *Yes* button, or cancel and return with the *No* button.

## 6.2.4 Logging (SI600 only)

Sentron's SI 600 pH meters are capable of logging data automatically at a predetermined time interval to the internal memory. This option can be used to analyze or monitor pH over a time period without having to be present at the meter to record the data.

The log file will remain in the meter's memory until it is erased. This data will remain in the meter's memory when batteries are replaced. How to send a log file to a PC for analysis is described in section 6.2.7.

To start a log:

Go to the <i>Options</i> menu, and choose <i>Data acquisition</i> .	 →  <b>Data acquisition</b> >
Now select <i>Log</i> .	 <b>Log</b> >
Press <i>Set log</i> .	 <b>Set log</b> >
Toggle the <i>on/off</i> button and select the desired interval time.	<b>On/off</b>  → <b>Minutes</b> 

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

Once the logging is setup and set, a recording icon will appear on the main screen.



Notification  
of an *activated log*

The maximum number of measurements per log file is 65000. In case a log file exceeds this amount of data points a new file will be generated automatically. In case the meter's memory is full, a message will appear saying "*MEMORY FULL*". No more new data points are recorded when the meter memory is full, existing data will not be overwritten.

## 6.2.5 Changing the log name prefix

Log files are given a default four character prefix “LOG\_” follow by an automated sequential numbering of three digits starting with 000. Hence, the first log files taken with this prefix have names LOG\_000, LOG\_001, LOG\_002 etc.

In order to better identify logs that have been recorded it is possible to adjust the standard prefix into a custom one. The (default) name can be altered by four toggle buttons which can be set to the letters A-Z, the numbers 0-9 and the \_ (underscore sign).

When changing the log file prefix, the names of all existing samples names remain unchanged. It is not possible to change the name of an existing log file on the meter, therefore, if a different sample prefix is desired, it is necessary to set the desired sample name prefix before starting logging data.

The follow-up number is raised automatically for every unique name existing in the meter’s memory, starting with 000. Once a number is deleted, or the memory has been emptied, counting will start over with the lowest possible number.

To change the log name prefix:

Go to the <i>Options</i> menu, and choose <i>Data acquisition</i> .	 →  <b>Data acquisition</b> ▾
Now select <i>Log</i> .	 <b>Log</b> ▾
Press <i>Name log</i> .	 <b>Name log</b> ▾
Change the characters by toggling the displayed buttons to the desired prefix name.	

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

When the maximum number of data points for one log file is 65000 is reached, a new file will be automatically created with the same name but with a higher follow up number.

## 6.2.6 Review/delete a log file

It is possible to review information on the log file such as start date / time, end date / time and the number of recorded data points on the meter. The actual measurement values within log files cannot be viewed on the meter as the number of recorded data points is usually large and not very meaningful in tabular form on a small screen. Log files can be transferred to a PC for further analysis, see chapter 6.2.7 for details on sending data to a PC.

All stored log files can be viewed from the *Browse logs* menu. When a log is viewed it can either be closed to be viewed again at a later time or deleted.

To review / delete a sample:

Go to the *Options* menu, and choose *Data acquisition*.

Now select *Log*.

Press *Browse logs*.

Choose and select one of the stored logs in the list.

Exit the log overview with the *Close* button, or press *Delete* to remove the log file:

At the opened log overview, select *Delete*.

Confirm the deletion with the *Yes* button, or cancel and return with the *No* button.

### 6.2.7 Send data to a PC (SI 600 only)

To move a stored data point or data log to a PC, first connect the meter to the PC using the USB cable supplied with the meter. Second, open a “listening” program (like e.g. HyperTerminal or Putty) and set baud rate to 9600 8 N 1 for receiving the data from the USB port. Then send the data to the PC.

To send data to a PC (SI600):

Go to the *Options* menu, and choose *Data acquisition*.

Now select the *Send data* menu.

Choose and select either to *send all logs*, *send all samples* or *send all data*.

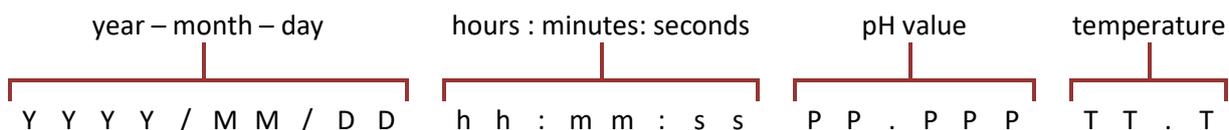
- *SENDING DATA* - will appear in the status bar during the data transfer.

The received data can be copied e.g. in a spreadsheet program, or a custom program, for further analysis.

### 6.2.8 Query meter values

The meter’s momentary measurement values can be queried from a connected PC as well (SI600 only). This allows integration of pH measurements into a software application running on a PC. The meter must be connected to the PC using a USB cable and suitable software needs to be running to read / write to a USB port.

To query the meter the string “ACT” needs to be sent to the USB port to which the meter is connected. The meter will return a string that contains date, time and the momentary pH and temperature values separated with a “space”. The string format is:



The received data can be copied e.g. in a spreadsheet program, or a custom program, for further analysis.

## 6.2.9 Erasing data / emptying the SD-card

The Sentron meter will not overwrite stored samples and logs. To free up memory, it may be necessary to erase samples and/or logs. All data can be deleted at once, or all samples and/or all logs can be deleted at once.

Deletion of individual samples or logs can be done via the browse feature. The overview of a single sample or log contains a *Delete* button to remove the displayed data, see previous chapters *Sampling* and/or *Logging* for deleting individual data.

To delete all stored data (SI600):

Go to the <i>Options</i> menu, and choose <i>Data acquisition</i> .	 → 
Now select the <i>Delete data</i> menu.	
Choose and select either to <i>delete all logs</i> , <i>delete all samples</i> or <i>delete all data</i> .	  

Confirm the deletion with the *Yes* button, or cancel and return with the *No* button.

### 6.3 Bias setting

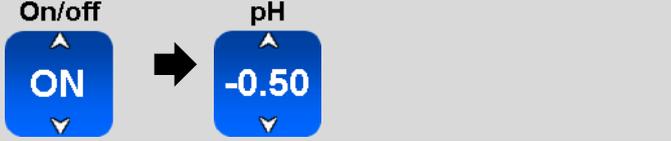
In certain exceptional cases it may happen that the pH measured by the Sentron ISFET pH sensor differs from a glass pH electrode by a constant pH value. This difference occurs under certain circumstances and is an inherent physical property of the two different ways pH is measured by a glass or solid state electrode.

The offset is often seen in comparison measurements between Glass and ISFET, particularly in lactose products. Although both probes are calibrated at the same buffer fluid (simultaneously), the readout in the sample material may differ slightly.

To compensate this difference, an offset (bias) can be set so that the measurement values are the same. This setting can be done at either the glass electrode side or, when the glass measurement equipment has only limited functions, at the SI meter.

Note that with a fixed offset, the displayed pH value is changed with respect to the calibrated values. Therefore measurement in a buffer fluid will contain the very offset in the readout.

To set or change the Bias:

Go to the <i>Options</i> menu, and select <i>Bias</i> .	
Toggle the <i>on/off</i> button and select the bias offset between -9.99 and 9.99 pH.	

Confirm and apply with the *Set* button, or exit with the *Back* button to discard any changes.

The Bias setting appears as a notification on the Home screen.



## **7 Maintenance**

A Sentron SI series meter requires very little maintenance. In the event the meter becomes dirty, it can be cleaned using a damp cloth.

To avoid having the USB connector become clogged by dirt, keep the dust cover closed except when recharging or data transferring.

## 8 Troubleshooting guide

Screen message	Possible cause	Solution
uSDcard message	uSDcard could be damaged, is not present or has a bad connection.	Make sure the uSDcard is properly installed or replace with new one.
Probe disconnected	Probe not connected properly.	Re-connect the probe.
	Probe damaged.	Align connector on white mark. See chapter 2.2 of meter manual.
	Probe cable damaged.	Contact distributor for possibilities on repair or replacement.
Probe error	General probe error, unable to achieve high performance measurement values. Most likely due to wear and/or aging.	Contact distributor for advice and/or sales of replacement items.
Replace probe soon	ISFET and/or reference are showing signs of wear and/or ageing due to use. High performance is in jeopardy.	Be advised to replace probe soon.
Probe degrading	ISFET and/or reference are affected by wear and/or ageing due to use.	Soak/clean the probe. See chapter 3 of probe manual. Also, be advised to plan for probe replacement.

Operating symptoms	Possible cause	Solution				
Fixed pH and/or temperature value e.g.: <table border="1"> <tr> <td>pH</td> <td>Temp.</td> </tr> <tr> <td>16.00(0)</td> <td>-20.0 °C</td> </tr> </table>	pH	Temp.	16.00(0)	-20.0 °C	Probe in general, and/or ISFET /reference is not responding properly.	Re-connect the probe. Align connector on white mark. See chapter 2.2 of meter manual.  Contact distributor for possibilities on repair or replacement.
pH	Temp.					
16.00(0)	-20.0 °C					
Slow calibration	Contaminated ISFET and/or reference.	Soak/clean the probe. See chapter 3 of probe manual. Brush the ISFET gently.				
Fluctuating pH value		Contact distributor for possibilities on repair or replacement.				
Slope to high/low	Calibration flaw.	Recalibrate, make sure to always use fresh pH buffers and buffers of the correct (selected) types: SENTRON/DIN/NIST/JIS.				
	Contaminated ISFET and/or reference.	Soak/clean the probe. See chapter 3 of probe manual. Brush the ISFET gently.				
Short working time of pH meter	Meter is not charged properly.	Re-connect and check the connection between charger and meter.				
	Defect/degraded batteries.	See chapter 2.1.2 of meter manual.				
	Defect charger and/or cable.	Replace <u>all</u> batteries.				

USB data connection issue	USB cable connection fail	Re-connect the USB cable to meter and master (computer i.e.).
	Baud rate mismatch	Set master to right baud rate 9600 8 N 1

## 9 Contact information

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