Operating Instructions

SenseLine Plus
pH / ORP/ Ion meter F470

Contents

1. Introduction

Thank you for purchasing this high quality QiS portable meter. SenseLine Plus is much more than just a series of portable meters with an excellent price/performance ratio. It is an ingenious concept that includes many exciting new features:

- IP67 rating: this applies to the instrument itself as well as to the sensors and the connections;
- optimum ease of use, making the operating instructions primarily a source of reference;
- excellent ergonomics, as if the instrument were part of you;
- option for regular equipment qualification, giving you full confidence that your measurement results are always accurate;

2. Safety measures

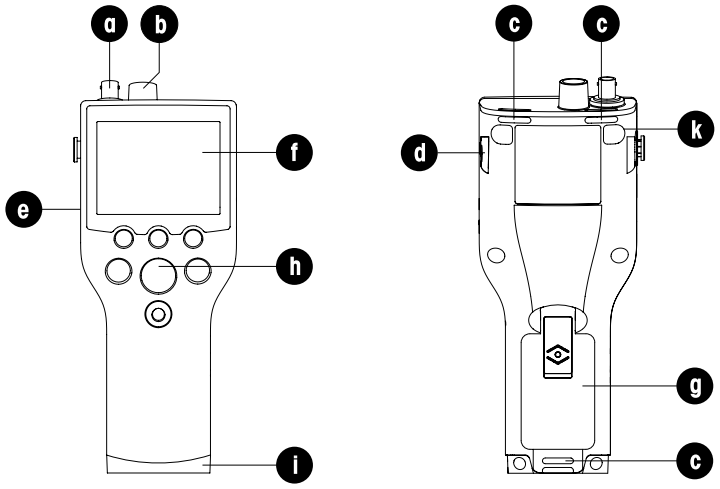
Measures for your protection

- Never work in an environment subject to explosion hazards! The housing of the instrument is not gas tight (explosion hazard due to spark formation, corrosion caused by the ingress of gases).

- When using chemicals and solvents, comply with the instructions of the producer and the general lab safety rules!

Measures for your operational safety

- Do not unscrew the two halves of the housing.
- Have the instrument serviced only by QiS Service!
- Dry off any liquids sprayed immediately! The instrument is not watertight.
- Exclude the following environmental influences:
  - powerful vibrations,
  - direct sunlight,
  - atmospheric humidity greater than 80%,
  - corrosive gas atmosphere,
  - temperatures below 5 °C and above 40 °C,
  - powerful electric or magnetic fields!

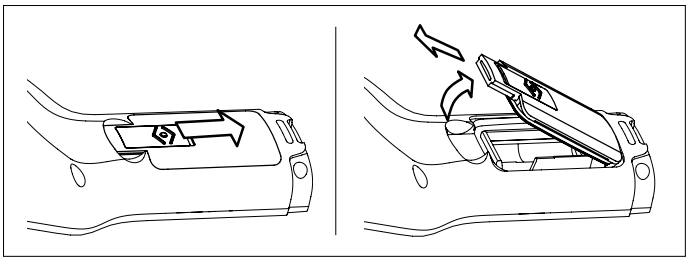


a	**BNC socket** for mV/pH signal input
b	**Cinch socket** for temperature signal input
c	**Slots** for attaching the wrist strap
d	**Fixing points**
e	**Infrared (IrDA) window**
f	**Display**
g	**Battery cover**
h	**Rubber key pad**
i	**Bottom cap**
k	**Rubber feet** fixing points

3. Installation

Carefully unpack the meter. Keep the calibration certificate in a safe place.

3.1 Installing the batteries

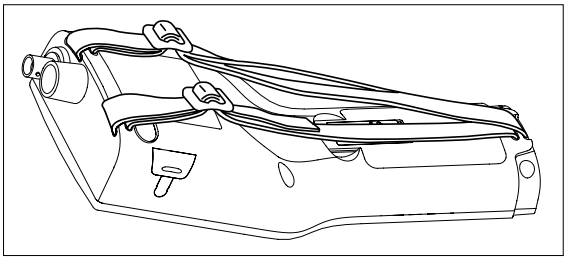


1. Push the button on the Battery cover in the direction of the arrow, hold the lid with two fingers and remove it;
2. Insert the batteries in the battery compartment, as shown;
3. Replace the Battery cover, and push back the button to fix the lid in place.

Note

The IP67 rating requires the battery compartment to be perfectly sealed. The sealing ring around the Battery cover must be replaced if it is damaged in any way (SenseLine Sealing Kit, QA8110X).

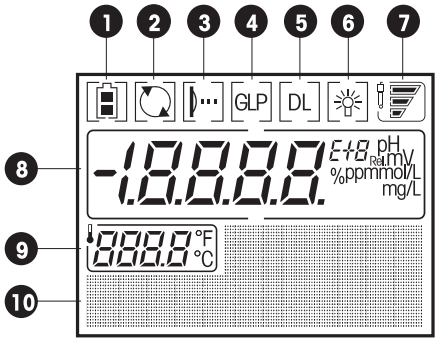
3.2 Fitting the wrist strap



Fit the wrist strap as shown in the diagram.

4. Operating the F470 pH meter

4.1 The display



1	Battery status shows the condition of the batteries – fully charged, half-charged or fully discharged. (To replace batteries see Section 3.1)
2	Auto-off override, in default operation, the meter switches itself off after 15 minutes to prolong battery life. After switching off/on the auto-off is active again
3	IrDA infrared interface for data transfer to printer or PC (See Section 4.7)
4	GLP print-out is acitvated (See end of Section 4.6)
5	Data Logging, timed interval reading is active, data is transferred to memory at a user-defined interval
6	Backlighting, meter switches on backlighting when any key is pressed
7	Electrode condition (for electrode maintenance, see Section 5.2)

Slope: 80-125%
Offset: ±(0-15) mV
Electrode is in good condition

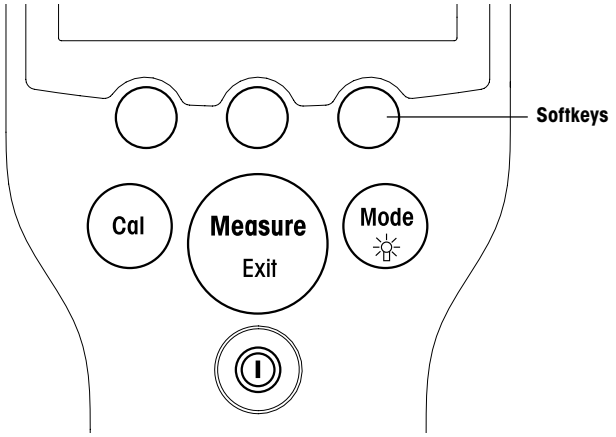
Slope: 70-80%
Offset: ±(15-35) mV
Electrode needs cleaning

Slope: 60-70%
Offset: ±(>35) mV
Electrode is faulty

The frame blinks when the calibration reminder is on and a calibration is due.

8	pH/mV/concentration reading
9	Temperature
10	Dot matrix area

4.2 Key controls



	Press and release	Press and hold for 2 seconds
I	- Meter on/off	- Switch on/off auto-off override (switches off the meter after 15 minutes)
Measure Exit	- Start or endpoint measurement - Back to measurement mode (ignore the input)	
Cal	- Start calibration	
Mode	- Switch between pH, mV, rel. mV and ion concentration modes	- Backlighting: on/off (when backlighting is on, the meter switches on backlighting at the stroke of any key for a user defined period of 10, 15 or 30 seconds.)

4.3 Operation with softkeys

The SenseLine Plus F470 pH meter has three softkeys. The functions assigned to them change during operation depending on the application. The assignment is shown on the bottom line of the screen.

Example: In the a measurement screen, the three softkeys are assigned as follows:

Menu	Store	Data
Activate menu setting	Store an endpointed measurement	Activate "Data" menu

The other soft key functions are as follows:

→	Move one digit to the right	+	Increase value by one
Enter	Enter the highlighted menu Accept the entered value	Exit	One level up in the menu tree
Select	Select the highlighted function	↓	Scroll through the menu
Edit	Change the settings	Back	One step back in the procedure
End	Store and quit menu	Next	One step forward in the procedure
Save	Save the calibration data	Trans	Transfer data to printer or PC
Delete	Delete the selected data	Yes	Confirm deletion

4.4 Calibration

The SenseLine Plus F470 pH/ORP/ION Meter allows you to perform calibrations with up to five points.

4.4.1 pH settings

If you select your calibration buffer group from one of the six predefined buffer groups in the meter, the buffers are automatically recognized and displayed during calibration (auto buffer recognition).
The six predefined buffer groups are:

1	1.68	4.00	7.00	10.01		(at 25 °C)
2	2.00	4.01	7.00	9.21	11.00	(at 25 °C)
3	2.00	4.00	7.00	9.00	12.00	(at 20 °C)
4	1.679	4.008	6.865	9.180		(at 25 °C)
5	1.679	4.006	6.865	9.180	12.454	(at 25 °C)
6	1.09	4.65	6.79	9.23	12.75	(at 25 °C)

Tables (B1...B6) for automatic temperature compensation are programmed in the meter for each buffer (see also Appendix).
You can also follow the buffer setting procedure described below to define your own buffer group , but in this case auto buffer recognition does not work during calibration.

4.4.2 Setting a customized buffer group

- In the pH menu enter "4. Set Cal", enter "1. Buffer" and select "7. Customized".
- Edit the temperature of the pH buffers.
- Press **Enter** to save the value.
- Enter the pH value of your first buffer. Press **Enter** to save the value.
- Press **Next** to enter the next buffer, press **Back** to re-enter the current buffer value or press **End** to finish setting.
- After you have made the settings, the temperature and buffers entered are shown on the display. Quit the menu and start the calibration.

4.4.3 Setting ion concentration standards

SenseLine Plus F470 pH/ORP/ION Meter allows you to calibrate using one of the following concentration units:

1. mmol/L
2. mol/L
3. ppm
4. mg/L
5. %

- In the ion menu enter "4. Set Cal", enter "1. Standard" and press **Edit** to start setting.
- Select the concentration unit in which you have prepared the standards.
- Enter the temperature of the standards.
- Press **Enter** to save the value.
- Enter the concentration of the standards.
- Press **Enter** to save the value
- Press **Next** to enter the next standard, press **Back** to re-enter the current standard or press **End** to finish setting.
- After you have made the settings, the temperature and buffers entered are shown on the display. Quit the menu and start the calibration.

4.4.4 Performing a calibration

- Place the electrode in a calibration buffer and press **Cal**.
- The meter endpoints according to the preselected endpoint format or after pressing **Measure**.
- Rinse the electrode with deionized water.
- Place the electrode in the second calibration buffer and press **Cal**.
- Repeat the procedure for all of your calibration buffers.
- End the calibration by pressing the **End** softkey. The calibration data is shown on the display.
- To use the calibration data for later measurements, press **Save**. To discard the calibration data, press **Cancel**.

Note

- To ensure accurate pH or ion concentration readings, you should perform a calibration regularly.
- We recommend the use of a temperature sensor or an electrode with a built-in temperature probe.
- For ion measurements, or some cases in pH measurements, you can use the MTC mode. You should then keep all buffers or standard solutions and sample solutions at the same set temperature.

4.5 Sample measurement

4.5.1 Performing a pH measurement

Place the electrode in the sample and press **Measure** to start the measurement: the decimal point blinks. The display shows the pH of the sample. The automatic endpoint **A** is the default setting of the meter.

Select the automatic, manual or timed endpointing method in the menu under "2. Set meas." in "1. EP Format".
To manually endpoint a measurement press **Measure**, the display freezes and $\overline{M}$ appears.
If the timed endpointing method is selected, the display freezes automatically after the set time has elapsed and $\overline{T}$ appears.

Note

For stability criterion of automatic endpoint algorithm (**A**) see Section 4.6.

4.5.2 Performing a mV/rel. mV measurement

To change to mV mode press **Mode** repeatedly until the mV or rel. mV unit is shown.
To perform a mV measurement, follow the same procedure as for pH measurement.

4.5.3 Performing an ion measurement

To change to ion measurement mode press **Mode** repeatedly until the preset unit for ion measurement is shown.
To perform an ion measurement, follow the same procedure as for pH measurement.

4.6 Menus for pH/mV/Rel. mV/Ion measurement

The SenseLine Plus F470 pH meter allows you to perform four different types of measurement: pH, mV, Rel. mV and Ion. To switch to the measurement mode required, press **Mode**.

Menu structure

pH	mV	Rel. mV	Ion
1. Set temp.	**1. Set temp.**	**1. Set temp.**	**1. Set temp.**
1. MTC temp. 2. Temp. unit 1. °C 2. °F	1. MTC temp 2. Temp. unit 1. °C 1. °F	1. MTC temp 2. Temp. unit 1. °C 1. °F	1. MTC temp 2. Temp. unit 1. °C 1. °F
2. Set. meas.	**2. Set. meas.**	**2. Set. meas.**	**2. Set. meas.**
1. EP format 1. Auto 2. Manual 3. Timed 2. Resolution 1. X.X 2. X.XX 3. X.XXX	1. EP format 1. Auto 2. Manual 3. Timed 2. Resolution 1. X 2. X.X	1. EP format 1. Auto 2. Manual 3. Timed 2. Resolution 1. X 2. X.X 3. R. mV offset	1. EP format 1. Auto 2. Manual 3. Timed 2. Ion type 1. Na^+ 2. K^+ 3. $NO3^-$ 4. Cl^- 5. F^- 6. $NH4^+$ 7. Ion^+ 8. Ion^- 9. $Ion2^+$ 10. $Ion2^-$
3. Sensor ID	**3. Sensor ID**	**3. Sensor ID**	**3. Sensor ID**
4. Set cal.			**4. Set cal.**
1. Buffer 1. MT US 2. MT Europe 3. Merck 4. JIS Z 8802 5. DIN / NIST 6. DIN 19267 7. Customized 2. Cal. Remind 1. Off 2. On 3. Cal. Mode 1. Segment 2. Linear			1. Standard 2. Cal. Remind 1. Off 2. On 3. Cal. Mode 1. Segment 2. Linear
5. Data log	**4. Data log**	**4. Data log**	**5. Data log**
1. Auto save 1. Off 2. On 2. T- int. read 1. Off 2. On	1. Auto save 1. Off 2. On 2. T- int. read 1. Off 2. On	1. Auto save 1. Off 2. On 2. T- int. read 1. Off 2. On	1. Auto save 1. Off 2. On 2. T- int. read 1. Off 2. On

6. Data output	5. Data output	5. Data output	6. Data output
1. To printer	1. To printer	1. To printer	1. To printer
2. To PC	2. To PC	2. To PC	2. To PC
7. GLP	**6. GLP**	**6. GLP**	**7. GLP**
1. On	1. On	1. On	1. On
2. Off	2. Off	2. Off	2. Off
8. System	**7. System**	**7. System**	**8. System**
1. Time	1. Time	1. Time	1. Time
2. Date	2. Date	2. Date	2. Date
3. Light off	3. Light off	3. Light off	3. Light off
4. Self test	4. Self test	4. Self test	4. Self test

Set temp.

Set MTC temperature

If the meter does not detect a temperature probe, it automatically switches to the manual temperature compensation mode and MTC appears. In this case the temperature of the sample has to be entered in the Set MTC menu (-30 °C to 130 °C). The meter calculates the temperature-adjusted electrode slope using this temperature and shows the temperature-compensated value in the measurement display.

Note

For better accuracy, we recommend the use of either a built-in or a separate temperature probe. If a temperature probe is used, **ATC** and the sample temperature are displayed.

Set meas.

EP format

With this menu you can choose between one of three different types of endpoint formats:

"Auto"
Automatic endpoint /A is a special algorithm that determines the end of an individual reading, depending on the behavior of the sensor used.

Stability criterion for resolution of 0.1 pH units
The signal of the sensor input must not change by more than 0.6 mV in 4 seconds.

Stability criterion for resolution of 0.01 pH units
The signal of the sensor input must not change by more than 0.1 mV in 6 seconds.

Stability criterion for resolution of 0.001 pH units and ion measurement
The signal of the sensor input must not change by more than 0.03 mV in 6 seconds.

Stability criterion for resolution of 1 mV, rel. mV units
The signal of the sensor input must not change by more than 0.5 mV in 4 seconds.

Stability criterion for resolution of 0.1 mV, rel. mV units
The signal of the sensor input must not change by more than 0.05 mV in 4 seconds.

"Manual"
Manual endpoint /M means the meter never endpoints the reading unless the user manually presses **Measure**.

"Timed"
With the timed endpoint /T, the reading is ended automatically when the set time period has elapsed.

Note

Every measurement can be endpointed manually by pressing **Measure**. The meter then displays .

The table below shows how the endpoint format is displayed in the course of the measurement.

Preselected format	Start of measurement	Signal stability	Endpointed measurement [1]
Auto endpoint	A	A	A
	A	Measure ⟹	M
Manual endpoint	M	Measure ⇨	M
	M	Measure ⟹	M
Timed endpoint	T	⇨	T
	T	Measure ⟹	M

[1] The endpoint format actually used (last column) and not that preselected is stored with the data.

Sensor ID

You can set an 8-digit, numerical sensor ID. In the GLP mode, the sensor ID will be assigned to each calibration and measurement value. This allows you to trace back data.

Set cal.

Buffer

In pH mode you can choose one of 6 different predefined buffer groups. You can also define your own buffer group (up to 5 buffers).
In the ion mode, you can define temperature, units and concentrations for up to 5 ion standards. For more details, see Section 4.4.

Note

When using a user-defined buffer group in the calibration, the screen will display the buffer value you set. Make sure that you use the correct buffer. You should also keep the buffer temperature at the set value. When using a temperature probe, if the temperature measured differs by more than 0.5 °C from the set value, an error message is shown.

Calibration Reminder

If you choose calibration reminder "ON", you are reminded to perform a new calibration after a certain user defined interval (maximum 9999 h) has elapsed. In this case blinks.

Calibration mode

If high pH accuracy is required, the segment method is recommended. The calibration curve is made up of linear segments joining the individual calibration points.
With the linear method, the calibration curve is determined using linear regression. This method is recommended for samples with widely varying pH values.

Data log

The F470 is designed to store up to 200 sets of measurement data in the memory.

Auto Save

"Auto Save" logs automatically every endpointed reading $\overline{A}$, $\overline{M}$ and $\overline{T}$ to the memory.
If "Auto Save" is set to **Off**, the **Store** softkey appears in the measuring screen. You can then manually store endpointed data by pressing this softkey.

T-int. read (Timed-interval reading)

With timed-interval reading, a reading is stored to memory every time after a certain interval (3 – 9999 s) defined in the menu has elapsed. You may stop the reading by pressing **Measure**. When timed-interval reading is "on", DL is shown on the display.

For readings lasting longer than 15 minutes, switch off the auto-off function by pressing and holding down ⏻ for two seconds.
When working in the timed-interval reading mode, you can define the length of the measurement period by selecting the appropriate endpoint mode ($\overline{A}$, $\overline{M}$ and $\overline{T}$) in the menu "2. Set. meas." under the item "1. EP format".

Data output

Data stored in the instrument's memory can be transferred to the QiS printer or PC via the infrared interface.

GLP

You can choose between two different data formats when outputting the data from memory: GLP ON or GLP OFF:

Examples

GLP format

GLP	On
Date	01-JAN-07 / JAN-01-07
Time	09:31:03
Sample_ID	040914
Result	pH 6.986
mV	5.3 mV
Temperature	25.3 °C
ATC/MTC	ATC
Endpoint	Auto
Sensor_ID	04091401
Last_cal.	09-13-06
Signature	_____

Non-GLP format

GLP	Off
Result	pH 6.986
Temperature	25.3 °C
ATC/MTC	ATC
Endpoint	Auto

System

Light off

You can define the time (10 s, 15 s, 30 s) after which backlighting automatically switches off.

Note

The light function can be turned on/off by pressing and holding down ☼.

Self test

This menu item starts the self-diagnosis routine. The meter displays the full screen first, then each icon blinks one after the other. This allows you to check whether all the icons are correctly diplayed. The final step is to check that the function keys are working properly. This requires user interaction.
You are now requested to press the seven function keys on the keypad one by one in any order. Each time you press a key, an icon disappears from the display. Continue to press the other keys until all the icons have disappeared.

When self-diagnosis has been successfully completed, the meter returns to the system menu. If error messages appear, contact QiS Service.

Note

You have to finish pressing all the seven keys within two minutes, otherwise "Self test failed!" appears, and you will have to repeat the procedure.

4.7 Handling your stored data

4.7.1 Menu structure

To access the memory, press the **Data** softkey.

1. Meas. Data	**(Enter measurement database)**
1. Review	(Review data)
2. Transfer	(Transfer data)
1. Partial	(Set parameter to transfer part of data from memory)
2. All	(Transfer all data from memory)
3. Delete	(Delete data)
1. Partial	(Set parameter to delete part of data from memory)
2. All	(Delete all data from memory)
2. Cal. Data	**(Enter calibration database)**
1. pH	
1. Current	(Review/transfer current calibration data)
2. 5 latest	(Review/transfer 5 latest calibration data)
2. Ion	
1. Current	(Review/transfer current calibration data)
2. 5 latest	(Review/transfer 5 latest calibration data)

4.7.2 Infrared interface

With SenseLine Plus it is possible to transfer either all data or a user defined set of data from the memory to a QiS printer or to a PC. The data is transferred via the IR interface on the left side of the meter.
The following descrpitions describes how to proceed with the different configurations:

- Data transfer from SenseLine Plus to a printer is done using an IR-RS232 adapter (QA8580X). To prepare for data transfer connect the RS232 plug to the corresponding interface on the backside of the printer. Point the instrument's IR window toward the IR receiver on the other end of the adapter cable. Start data transfer in the data menu.
- For data transfer from SenseLine Plus to a PC, there are two different possibilities:
  - direct transfer via an IrDA interface on your PC
  - transfer via IR-RS232 adapter (QA8580X)

Open Hyperterminal or BalanceLink. Adjust the settings for data transfer as follows:

Baud rate:	1200 IR-USB / 9600 IR-RS232
Data bits:	8
Parity:	none
Stop bits:	1
Handshake:	none

Connect the adapter to the PC and/or point the IR window of the meter to the IR receiver. Start the data transfer by selecting the transfer item in the data menu.

4.8 Working in the routine mode

The SenseLine Plus meter has two working modes:

Expert mode	The default setting enables all functions of the meter
Routine mode	All system and calibration settings are fixed according to what was defined in the expert mode.

In the routine mode the meter only allows the following functions:

- Calibrating and measuring
- Editing the MTC temperature
- Storing, viewing and printing data

Activation of the routine mode

To change to the routine mode, switch off the meter. Press **Measure**, **Mode** and the **right** softkey simultaneously. The meter now allows you to select the working mode.
Select "1. Routine" and confirm by pressing **Select**. The meter switches itself off automatically. Switch on the meter by pressing **On/Off**. From now on you can work safely without the risk of unintentionally changing settings or deleting data.

Activation of expert mode

To enable all functions, switch off the meter and press **Measure**, **Mode** and the **right** softkey simultaneously.
Select "2. Expert" and confirm by pressing **Select**. The meter switches itself off automatically.
Switch on the meter by pressing **On/Off**. You now have access to all menu functions again.

Note

The concept of the two working modes is a GLP feature that ensures that important settings or stored data cannot be unintentionally changed under routine working conditions.

4.9 Error messages

Self test failed!		Repeat the self-diagnosis procedure and make sure that you finish pressing all seven keys within two minutes. If "Self test failed!" still appears, call QiS Service.
Meas. out of range!	Measured value out of range	Make sure the electrode wetting cap has been removed and that the electrode is properly connected and placed in the sample solution. If no electrode is connected, put the shorting clip in the socket.
Full!	Data memory is full	Go to "Data" to delete data, otherwise you will not be able to store new measurement data.
Invalid value!	The value you entered is invalid	Reenter a value.
Offset out of range!		Make sure you have the correct buffer and that it is fresh. Clean or replace the electrode.

Slope out of range!		Make sure you have the correct buffer and that it is fresh. Clean or replace the electrode.
Wrong buffer!	Meter cannot recognize the buffer or standard	Make sure you have the correct buffer and that it is fresh. Make sure that the buffer has not been used more than once during the calibration.
T differs from setting!	ATC measured temperature differs by more than 0.5 °C from the user-defined value	Keep the buffer or sample at the set temperature or change the temperature setting.
Temp. out of range!	ATC measured temperature is out of pH calibration buffer range: 5 °C…50 °C	Keep the buffer temperature within the range.

5. Maintenance

5.1 Meter maintenance

Never unscrew the two halves of the housing.
The SenseLine Plus series instruments do not require any maintenance other than an occasional wipe with a damp cloth and the replacement of dead batteries.
The housing is made of acrylonitrile butadiene styrene/polycarbonate (ABS/PC). This material is attacked by some organic solvents, such as toluene, xylene and methyl ethyl ketone (MEK). Any spillage should be immediately wiped off.

5.2 Electrode maintenance

Make sure the electrode is always stored in an appropriate storage solution.
For maximum accuracy, any filling solution that may have "crept" and encrusted the outside of the electrode should be removed with deionized water.
Always store the electrode according to the manufacturer's instructions and do not allow it to dry out.
If the electrode slope falls rapidly, or if the response becomes sluggish, the following procedures may help. Try one of the following, depending on your sample.

1. For fat or oil build-up, degrease the membrane with cotton wool soaked in either acetone or a soap solution.
2. If the sensor membrane has dried out, soak the tip of the electrode in 0.1 M HCl overnight.
3. If protein build-up has occurred in the diaphragm, remove deposits by soaking the electrode in an HCl /pepsin solution (QS941X).
4. If silver sulfide contamination has occurred, remove the deposits by soaking the electrode in a solution of thiourea (QS901X).

After treatment a new calibration should be performed.

Note

Cleaning and filling solutions should be handled with the same care as that given to toxic or corrosive substances.

5.3 Disposal

In conformance with the European Directive 2002/96/ EC on Waste Electrical and Electronic Equipment (WEEE) this device may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements.
Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment.
If you have any questions, please contact the responsible authority or the distributor from which you purchased this device.
Should this device be passed on to other parties (for private or professional use), the content of this regulation must also be related.
Thank you for your contribution to environmental protection.

6. Accessories

	Order no.
SenseLine pH meter F410	
SenseLine Conducitivity meter F430	
SenseLine Plus Dissolved oxygen meter F450	
Swing arm electrode holder	QA854X
Sealing kit	QA8110X
AA batteries, pk/4	QA8120X
Carrying case	QA8130X
Printer	QA8140X
Printer paper, pk/5	QA8150X
RS232 infrared adapter	QA8580X
pH buffer 4 (red), 500ml	QS910X
pH buffer 7 (yellow), 500ml	QS912X
pH buffer 9 (green), 500ml	QS914X
pH buffer 10 (blue), 500ml	QS916X
pH storage solution 3M KCl, 500ml	QS942X
pH Filling solution 3M KCl, 500ml	QS937X
pH Filling solution 3M KCl/ AgCl, 100ml	QS938X
Redox standard 258 mV, 500ml	QS960X
Redox standard 468 mV, 500ml	QS961X
Storage bottle, pk/4	QA839X
pH electrode; temperature sensor; gel-filled, epoxy, 1m cable, IP67	QP4111T
pH electrode; temperature sensor; gel-filled, epoxy, 10m cable, IP67	QP4111T10
Redox electrode with Platinum pin, glass	QR402X
Redox electrode with Platinum pin, epoxy	QR400X

7. Specifications

	SenseLine Plus pH/ORP/Ion meter F470	
Measurement range	pH:	-2.000…19.999
		-1999.9…1999.9 mV
	ATC:	-5…130 °C
	MTC:	-30…130 °C
	Ion:	0.000…999.9%
		0.000…9999 ppm
		1.00E-9…9.99E+9 mg/L
		1.00E-9…9.99E+9 mmol/L
		1.00E-9…9.99E+9 mol/L
Resolution	0.1/0.01/0.001 pH	
	0.1 mV	
	0.1 °C	
	Ion 3 or 4 digits	
Limits of error pH	± 0.002 pH	
	± 0.2 mV	
	± 0.2 °C	
Limits of error Ion	± 0.5% (this limit only applies for meter)	
pH calibration	up to 5 points	
Isopotential point	pH 7.00	
Calibration buffer	6 predefined groups	
	1 user-defined group of 5 buffers	
Output	IrDA	
Power requirements	Ratings:	6 V DC, 70 mA
	Batteries:	4 x AA/LR6 1.5 V or NiMH 1.2 V rechargeable
Size/Weight	220 x 90 x 45 mm / 0.33 kg	
Display	Liquid crystal	
pH input	BNC (IP67), impedance $>10^{12}$ Ω	
T input	Cinch (IP67), NTC 30KΩ	
IP rating	IP67 with and without electrode	
Battery life	> 500 working hours (with no backlighting)	
Ambient conditions	Temperature:	5…40 °C
	Relative humidity:	5%…80% (non-condensing)
	Installation category:	II
	Pollution degree:	2
Materials	Housing:	ABS/PC reinforced
	Window:	polymethylmethacrylate (PMMA)
	Keypad:	silicone rubber

8. Appendix

8.1 Buffer tables

SenseLine Plus pH Meters automatically correct for the temperature dependence of the buffer pH using the values given in the tables:

Buffer Set 1 (ref. 25 °C)

5	7.09	4.00	10.25	1.67	
10	7.06	4.00	10.18	1.67	
15	7.04	4.00	10.12	1.67	
20	7.02	4.00	10.06	1.68	
25	7.00	4.00	10.01	1.68	
30	6.99	4.01	9.97	1.68	
35	6.98	4.02	9.93	1.69	
40	6.97	4.03	9.89	1.69	
45	6.97	4.04	9.86	1.70	
50	6.97	4.06	9.83	1.71	

Buffer Set 2 (ref. 25 °C)

5	7.09	4.01	9.45	2.02	11.72
10	7.06	4.00	9.38	2.01	11.54
15	7.04	4.00	9.32	2.00	11.36
20	7.02	4.00	9.26	2.00	11.18
25	7.00	4.01	9.21	2.00	11.00
30	6.99	4.01	9.16	1.99	10.82
35	6.98	4.02	9.11	1.99	10.64
40	6.97	4.03	9.06	1.98	10.46
45	6.97	4.04	9.03	1.98	10.28
50	6.97	4.06	8.99	1.98	10.10

Buffer Set 3 (ref. 20 °C)

5	7.07	4.04	9.16	2.01	12.41
10	7.05	4.02	9.11	2.01	12.26
15	7.02	4.01	9.05	2.00	12.10
20	7.00	4.00	9.00	2.00	12.00
25	6.98	4.01	8.95	2.00	11.88
30	6.98	4.01	8.91	2.00	11.72
35	6.96	4.01	8.88	2.00	11.67
40	6.95	4.01	8.85	2.00	11.54
45	6.95	4.01	8.82	2.00	11.44
50	6.95	4.00	8.79	2.00	11.33

Buffer Set 4 (ref. 25 °C)

5	1.668	3.999	6.951	9.395
10	1.670	3.998	6.923	9.332
15	1.672	3.999	6.900	9.276
20	1.675	4.002	6.881	9.225
25	1.679	4.008	6.865	9.180
30	1.683	4.015	6.853	9.139
35	1.688	4.024	6.844	9.102
40	1.694	4.035	6.838	9.068
45	1.700	4.047	6.834	9.038
50	1.707	4.060	6.833	9.011

Buffer Set 5 (ref. 25 °C)

5	1.668	4.004	6.950	9.392	13.207
10	1.670	4.001	6.922	9.331	13.003
15	1.672	4.001	6.900	9.277	12.810
20	1.676	4.003	6.880	9.228	12.627
25	1.680	4.008	6.865	9.184	12.454
30	1.685	4.015	6.853	9.144	12.289
35	1.691	4.026	6.845	9.110	12.133
40	1.697	4.036	6.837	9.076	11.984
45	1.704	4.049	6.834	9.046	11.841
50	1.712	4.064	6.833	9.018	11.705

Buffer Set 6 (ref. 25 °C)

5	1.08	4.67	6.87	9.43	13.63
10	1.09	4.66	6.84	9.37	13.37
15	1.09	4.66	6.82	9.32	13.16
20	1.09	4.65	6.80	9.27	12.96
25	1.09	4.65	6.79	9.23	12.75
30	1.10	4.65	6.78	9.18	12.61
35	1.10	4.65	6.77	9.13	12.45
40	1.10	4.66	6.76	9.09	12.29
45	1.10	4.67	6.76	9.04	12.09
50	1.11	4.68	6.76	9.00	11.98

8.2 Error Limits

Message / Description	Range not accepted	
Meas. out of range (Measuring value out of range)	pH: mV: Ion: Ion: Ion:	< -2.000 or > 19.999 < -1999 or > 1999 < 1.00E-9 or >9.99E+9 [mmol/L], [mol/L], [mg/L] < 0.000 or 999.9 % < 0.000 or 999.9 ppm
Temperature out of range	T [°C]:	< 5 or > 50
Offset out of range (first cal. point)	I Eref1-Eb I	> 60 mV
Slope out of range (cal.points 2, 3...)	I Eref1-Eb I	> 60 mV
Wrong buffer	I ΔEref1 I I ΔEref1 I	< 10 mV for pH < 1 mV for Ion
T differs from setting!	I t_{ATC}-t_{buffer} I	> 0.5 °C

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Subject to technical changes and to the availability of the accessories supplied with the instruments.
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