

pH-Meter 1140 and pH-Meter 1140-X

Instruction manual



60209

METTLER TOLEDO

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Warranty

Defects occurring within
3 years from delivery
date shall be remedied
free of charge at our
plant (carriage and insu-
rance paid by sender).
Accessories: 1 year

Safety Precautions

Be sure to read and observe the following requirements!



The pH-Meter 1140-X may only be opened to change the batteries outside hazardous areas. If repairs are necessary, the apparatus must be sent in to the factory.

Never operate the remote interface within hazardous areas.

When using the apparatus in hazardous areas, watch for electrostatic charges! For example, never wipe off the apparatus with a dry cloth. Observe the relevant regulations concerning ESD.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and secured against unintended operation.

The protection is likely to be impaired if, for example:

- the apparatus shows visible damage
- the apparatus fails to perform the intended measurements
- after prolonged storage at temperatures above 70 °C
- after severe transport stresses

Before recommissioning the apparatus, a professional routine test according to EN 61 010-1 shall be performed. This test should be carried out at our factory.

Information on this Instruction Manual

Italics are used for texts which appear in the pH-Meter 1140/1140-X display.

Bold print is used to represent keys, e.g. **cal**.



Display examples

or



keys whose functions are explained are frequently shown in the left-hand column.

Note



Notes provide important information that should be strictly followed when handling the instrument.

Warning



Warning means that the instructions given must always be followed for your own safety. Failure to follow these instructions may result in injuries.

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1 The pH-Meter 1140/1140-X

Package Contents

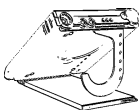


Please check the completeness of the shipment after unpacking.

The package should include:

- pH-Meter 1140/1140-X incl. batteries and electrode container
- carrying strap
- this instruction manual
- short instructions in German, English and French
- interface cable incl. coupler plug
- Paraly SW105 PC software

Short Instrument Description



The pH-Meter 1140/1140-X is used for pH and temperature measurement in industry, environment, food processing and waste-water treatment.

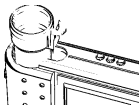
Operation of the pH-Meter 1140-X is also permitted in hazardous areas Zone 1.

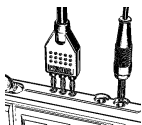
The instrument meets the European EMC regulations (89-336-EEC) and the recommendations of NAMUR NE 21.

The instrument is IP 66 protected to EN 60529 (jet water from all directions).

Temperature compensation is automatic with a Pt 1000 temperature probe, an NTC 30 k Ω (automatic recognition during power-on) or through manual temperature input.

Calibration can be carried out with buffer solutions from various, preselectable buffer sets. The buffer is then automatically recognized by the Calimatic[®].





- ❑ You can also calibrate manually by entering individual buffer values.
- ❑ The Sensoface[®] electrode monitoring system checks the connected electrode and provides information on its state.
- ❑ The datalogger records up to 100 measured pH or mV values together with temperature, date and time. Recording is either manually, interval or event-controlled.
- ❑ Only three AA batteries are required for uninterrupted operation for approx. 2,000 hours.
- ❑ Paraly SW 105 software allows complete remote control of the pH-Meter 1140/1140-X via PC. All measured values and parameters can be read out and easily processed further (e.g. using Microsoft Excel).
- ❑ Measured values and instrument record can also be output directly on a printer via the serial interface.
- ❑ Via the serial interface, the pH-Meter 1140/1140-X can be completely remote controlled by a PC. All measured values and parameters can be read out. Measured values and instrument record can be sent directly on a printer.

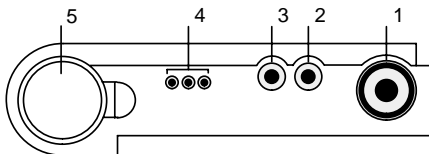
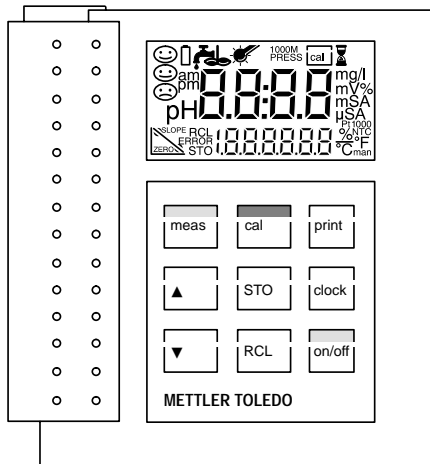
Warning



Never use the remote interface in hazardous areas!

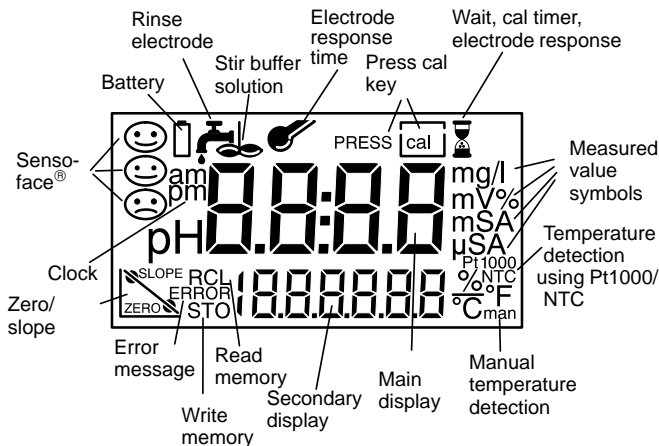
2 Operation

Instrument Design



- 1 Electrode connection
- 3 Reference electrode
- 2, 3 Temperature probe connection
- 4 Interface PC/printer
- 5 Electrode container

Display



Keypad



Pressing **on/off** switches the instrument on or off. When the instrument is switched off, one of the Sensoface® status indicators is visible in the display. After power-on, the instrument automatically performs a self test and checks which temperature probe is connected. After that, it automatically goes to pH measuring mode.

Note



You can also switch on the instrument using **meas**. However, in this case, only a short test is conducted and no determination of the temperature probe. The instrument assumes that the last temperature probe determined is used.



Pressing **meas** returns the instrument to measuring mode from any function. Pressing **meas** while in measuring mode selects the desired measured variable (pH or mV) for the main display.



Pressing **cal** starts calibration. With calibration the instrument is adjusted to the electrode. You can choose between one or two-point calibration either using Calimatic[®] automatic buffer recognition or with manual buffer entry.



For manual temperature specification (no temperature probe connected), the temperature is set using ▲ and ▼. In addition, these keys are also used to set the clock, to select the memory locations and to edit selected parameters.



Pressing **clock** switches the instrument into the clock mode. All measurement processes are cancelled and battery consumption is reduced to a minimum.



Pressing **STO** activates the data memory for writing measured values.



Pressing **RCL** activates the data memory for reading measured values.



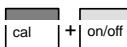
Pressing **print** outputs the currently measured value to a printer or PC.



Pressing **RCL** and **print** prints out the data memory.



Pressing **cal** and **print** prints out the instrument record.



Pressing **cal + on/off** when the instrument is switched off, activates the configuration menu.

Note



When pressing two keys at the same time, make sure that the key shown at the left is pressed first.

Sensoface[®] Electrode Monitoring



The Sensoface[®] automatic electrode monitoring system provides information on the electrode state. Zero point, slope, response time, impedance and drying out of the electrode are evaluated.

In addition, Sensoface[®] reminds you to regularly calibrate the instrument.

For more detailed information on the displayed electrode state and the individual evaluations of the parameters, please see chapter "Troubleshooting and Maintenance" (Pg. 23).

Connection and Start-up

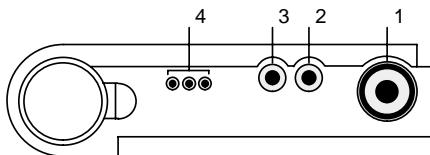
Electrode connection

Commercially available electrodes with a nominal electrode zero point of pH 7 and the following plugs can be connected:

- Coaxial standard plug to DIN 19 262 and/or
- 4 mm banana plug.

Connection assignment

Connection	Socket
Combination electrode	1
Single measuring electrode	1
Single reference electrode	3
Integrated temperature probe of combination electrodes	2
Separate temperature probe	2, 3
Remote interface	4



If no temperature probe has been connected, the instrument operates with the manually set temperature and *man* appears in the display.

Note



If the pH-Meter 1140/1140-X is connected to a PC and is used to take measurements in grounded liquid, measuring errors may result.

Note



Prior to first measurement, the buffer set to be used must be selected and the instrument calibrated. If required, the clock must be set.

Start-up

With the instrument switched-off, one of the Sensoface[®] status indicators is always visible.

Note



Even with the instrument switched off, the calibration data and the contents of the data memory remain permanently stored.



Pressing **on/off** switches the instrument into measuring mode.

After power-on, the instrument determines the connected temperature probe and performs a self test:

- Simultaneous appearance of all display segments, measured-value symbols and Sensoface[®] indicators
- Display of Model No. 1140/1140-X
- Display of software version
- Display of selected buffer set

Note



The temperature probe is only recognized during the power-on procedure after pressing **on/off**.

Note



The instrument can also be switched on with **meas**. However, in this case only a short test is performed and the temperature probe is not determined. The instrument assumes that the last temperature probe determined is used.

Configuration

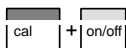
Note



If you calibrate using the Mettler-Toledo buffer set, generally you do not have to change the configuration.

The following basic settings can be changed in the configuration:

- Calibration timer interval
- Automatic calibration (Calimatic®)
on or off (manual), buffer set for automatic calibration
- Automatic instrument switch-off after
1 hour or 12 hours
- Remote interface
Printer output on/off, baud rate
- Temperature display
°C or °F
- Date and time format
24 hours and day, month, year or
12 hours (am/pm) and month, day, year



To activate the configuration, hold down **cal** with the instrument switched off and then press **on/off**.

Conf

The menu items of the configuration menu are worked through in sequence.



To change the setting of the respective menu item, press **▲** or **▼**.



Pressing **STO** switches to the next menu item and stores the displayed settings.



Pressing **meas** exits the configuration menu at any time. The value last displayed and possibly changed will then not be saved.

Calibration timer

0048
CAL h

With the calibration timer, the period of time can be specified within which calibration should take place. The interval may lie between 0 and 1,000 hours.

When approx. 80 % of the preset interval has passed, the calibration timer switches the Sensoface[®] indicator from ☺ to ☹. When the total interval has run out, the indicator is set to ☹.

The timer is reset with a calibration.

To switch off the calibration timer, enter 0 as the interval. (Factory setting: switched off).

Automatic or manual calibration

On
AutCAL

You can select whether you wish to calibrate with the Calimatic[®] automatic buffer recognition system or with manual specification of the individual buffer values.

When calibrating with Calimatic[®] automatic buffer recognition (AutCal on), you only have to enter the buffer set used once in the configuration menu. The temperature-corrected buffer values are stored. During calibration, the instrument then automatically recognizes the buffer used (factory setting: automatic calibration on, Mettler-Toledo technical buffer).

-00-
buffer

Select the buffer set with the buffers used in the buffer set selection. Various calibration buffer sets are stored in the pH-Meter 1140/1140-X.

The following buffer sets are permanently stored in the instrument:

<i>BUFFER -00-</i>	Knick technical buffers pH 2.00 4.01 7.00 9.21
<i>BUFFER -01-</i>	Mettler-Toledo technical buffers (former Ingold) pH 2.00 4.01 7.00 9.21
<i>BUFFER -02-</i>	Merck/Riedel pH 2.00 4.00 7.00 9.00 12.00
<i>BUFFER -03-</i>	DIN 19 267 pH 1.09 4.65 6.79 9.23 12.75
<i>BUFFER -04</i>	Ciba (94) pH 2.06 4.00 7.00 10.00

<i>BUFFER -05-</i>	Mettler-Toledo (USA)
	pH 4.00 7.00 10.01

<i>BUFFER -06-</i>	DIN 19 266 and NIST (NBS)
	pH 1.679 4.006 6.865 9.180

<i>BUFFER -07-</i>	HACH
	pH 4.00 7.00 10.18

Note



The instrument can only operate properly if the buffer solution used corresponds to the selected, activated buffer set.

Other buffer solutions, even those with the same nominal values, demonstrate a different temperature behavior. This leads to measurement errors.

OFF
AutCAL

For manual buffer specification (AutCal off), the pH value of the buffer solution must be entered for the correct temperature.

This allows to calibrate the instrument using any other buffer solution.

Automatic instrument switch-off

1 h
AutOFF

To protect the batteries, the instrument switches off automatically when not operated for a longer time.

You can select whether switch-off is to take place after one hour or after twelve hours (factory setting: 1 hour).

If the datalogger is active and during remote interface operation, the instrument is not switched off.

Interface

On
Print

If the pH-Meter 1140/1140-X is controlled by a PC and interface conflicts occur when the print key is pressed, you should deactivate the print function (factory setting: Print on, 4800 bauds).

4800
BAUD

The transmission speed can be set to 600, 1200, 2400, 4800 or 9600 bauds.

The transmission speed must correspond to that set in the printer or PC.

Data format and protocol are permanently set to 7 bits, one stop bit, even parity and XON/XOFF protocol (to NAMUR NE28).

Temperature display

A digital display showing the number '05' in the top row and the word 'TEMP' in the bottom row.

The temperature can be displayed either in °C or °F (factory setting: °C).

Time and date format

A digital display showing the time '24:00' in the top row and the word 'DATE' in the bottom row.

You can choose between the display format 24 hours and day.month.year and the format 12 hours am/pm and month.day.year).

Calibration

By calibration the pH meter is adjusted to zero point and slope of the electrode used.

Calimatic® automatic calibration

For calibration using Calimatic® automatic buffer recognition, you only have to enter the buffer set used once in the configuration menu. With the patented Calimatic® system, the instrument automatically recognizes the buffer solution, calculates the electrode zero point and slope (based on 25 °C) and carries out the corresponding adjustment. The sequence of the buffer solutions is unimportant.

Note



The instrument can only operate properly when the buffer solutions used correspond with the buffer set selected in the configuration menu.

Other buffer solutions even if with the same nominal values, may demonstrate a different temperature behavior, which leads to measurement errors.



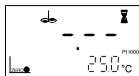
Pressing **cal** activates calibration.

Calibration can be exited again by pressing **meas**. In that case, zero, slope, time and date of the last calibration are displayed for a moment.

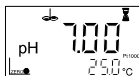
Immerse electrode and temperature probe in the first buffer solution. Either buffer solution can be used first.



Press **cal** to start calibration. If you do not want to calibrate, press **meas** to cancel the process.



During buffer recognition the lower line indicates the temperature. The hour glass flashes.



The nominal value of the recognized buffer solution is displayed for approx. 5 s. Electrode and temperature probe remain in the first buffer solution.

Note



The response times of electrode and temperature probe are considerably reduced if you first move the electrode in the buffer solution and then keep it still to read the values. This provides stable values more quickly.



The electrode stability is checked and the measured mV value displayed. Stability check can be cancelled with **cal**. However, this reduces calibration accuracy.



Calibration with the first buffer is completed. Remove electrode and temperature probe from the first buffer solution and rinse off both thoroughly.

- If you want to perform one-point calibration, press **meas** to terminate the calibration now. The instrument then shows the newly determined zero point in the main display and the old slope in the lower display and returns to pH measuring mode.
- For two-point calibration, immerse the electrode and temperature probe in the second buffer solution. Now start calibration again with **cal**. The calibration process runs again as for the first buffer.



At the end of the calibration, the zero point and slope (based on 25 °C) of the electrode are displayed. Then the instrument switches back to measuring mode.

Manual calibration

For calibration with manual buffer specification, you must enter the pH of the buffer solution used for the correct temperature.

This allows to calibrate with any buffer solution.



Pressing **cal** activates calibration.

Calibration can be exited again by pressing **meas**. In that case, zero, slope, time and date of the last calibration are displayed for a moment.



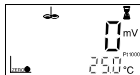
Enter the temperature-corrected pH of your buffer solution using **▲** and **▼**. Press **cal** to start calibration.

The buffer value set is stored so that you do not have to enter it for the next calibration at the same temperature.

Note



The response times of electrode and temperature probe are considerably reduced if you first move the electrode in the buffer solution and then keep it still to read the values. This provides stable values more quickly.



The electrode stability is checked and the measured mV value displayed. Stability check can be cancelled with **cal**. However, this reduces calibration accuracy.



Calibration with the first buffer is completed. Remove electrode and temperature probe from the first buffer solution and rinse off both thoroughly.

- If you want to perform one-point calibration, press **meas** to terminate the calibration now. The instrument then shows the newly determined zero point in the main display and the old slope in the lower display and returns to pH measuring mode.
- For two-point calibration, immerse the electrode and temperature probe in the second buffer solution. Enter the pH of the second buffer solution. Now start calibration again with **cal**. The calibration process runs again as for the first buffer.



At the end of the calibration the zero point and slope (based on 25 °C) of the electrode are displayed. Then the instrument switches back to measuring mode.

Converting slope % -> mV/pH			
%	mV/pH	%	mV/pH
78	46.2	91	53.9
79	46.8	92	54.5
80	47.4	93	55.1
81	48.0	94	55.6
82	48.5	95	56.2
83	49.1	96	56.8
84	49.7	97	57.4
85	50.3	98	58.0
86	50.9	99	58.6
87	51.5	100	59.2
88	52.1	101	59.8
89	52.7	102	60.4
90	53.3	103	61.0

Measurement

Measuring mode



Pressing **meas** accesses the measuring mode from all functions. In measuring mode the main display indicates the measured variable and the secondary display the temperature. The measured variable is selected with **meas**. You can choose between the following variables:

- pH
- Electrode potential [mV]

Note



The response times of electrode and temperature probe are considerably reduced if you first move the electrode in the buffer solution and then keep it still to read the values. This provides stable values more quickly.

Manual temperature specification

The *man* indicator signals that no temperature probe is connected. The instrument operates with the manually specified temperature. The specified temperature can be edited using ▲ and ▼.

Data Memory

Up to one hundred measured values can be stored in the data memory together with temperature, date and time. Storage is either manually or automatically using the datalogger. The currently set measured variable (pH or mV) is stored.

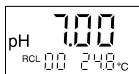
Write memory



At pressing **STO** the currently measured value is at first only shown in the display (HOLD).

Now you can select any memory location using ▲ and ▼. Press **STO** to store the measured value in the selected memory location. After storing the memory location number is automatically counted up and the instrument returns to measuring mode.

Read memory



Pressing **RCL** displays the last measured values stored.

Now you can select any memory location using ▲ and ▼. Pressing **RCL** switches between the measured value and time/date of storage. In this way, for example, you can search for a value that was stored at a certain time. Pressing **meas** returns you to measuring mode.

Clear memory



To clear the entire data memory, press **STO** to access memory mode and then **clock** to access datalogger mode. Here you select Clear (Clr) using ▲ or ▼.

By confirming this with **STO** the entire memory area is cleared.

If you do not want to clear, press **meas** to abort the procedure.

Datalogger

Datalogger

The datalogger records up to 100 measured values together with temperature, time and date in the data memory. Recording is either manually at the press of a key, interval or event-controlled. The datalogger always records the currently set measured variable (pH or mV).



Press **STO** to access memory mode and then **clock** to access datalogger mode. Here, you now choose between three different recording modes and the parameter setting of the datalogger using ▲ or ▼.



Pressing **STO** confirms the selected mode. In the Continue and Start mode this also starts the datalogger. The current memory location is shown in the display. If "Clear" has been selected, all memory locations are cleared and the instrument returns to measuring mode.



Pressing **meas** ends the datalogger mode.

Recording modes

A digital display showing the word 'Cont' in large characters above the word 'LOGGER' in smaller characters.

After pressing **STO**, recording is continued after the memory location in which the last measured value was stored (continue). Press **meas** to end logging.

A digital display showing the word 'Clr' in large characters above the word 'LOGGER' in smaller characters.

After pressing **STO**, the entire memory area is cleared without starting the datalogger (clear).

A digital display showing the word 'Start' in large characters above the word 'LOGGER' in smaller characters.

After pressing **STO**, the entire memory area is cleared. Recording begins from memory location "00" (start). Press **meas** to end logging.

Setting parameters of the datalogger

PAR
LOGGER

In the parameter setting mode you select whether recording is to be interval or event-controlled or manual at the press of a key.

Press **STO** to access the logging functions.

Int
LOGGER

To select interval-controlled recording of measured values, press **STO** and set the interval in which the recording is to take place using ▲ and ▼. The interval may lie between 5 seconds and 60 minutes. Default time (factory-set) is 2 minutes. After selecting your interval time, press **STO** to enter the value.

dIFF
LOGGER

With event-controlled measured-value recording, a measured value is not recorded until it deviates from the last memory value by the preset differential value. Using the time also recorded, you can determine when the value has changed. The differential value is entered in the subsequent parameter-setting step.

Note



The differential value is always based on the currently set measured variable (pH or mV). This means that if differential pH values are to be recorded, the instrument must be set to pH measurement prior to parameter setting and recording.

Shot
LOGGER

With manual recording, the measured values are saved with **STO**.



After selecting the above parameters, select "Continue" or "Start" using the ▲ and ▼ keys and then press **STO** to commence logging.

Note



The datalogger does not stop after reaching the last memory location (99). Recording is automatically continued with memory location number 00.

Clock Mode



Pressing **clock** activates the clock mode. The time and date are displayed.

In this operating mode the battery consumption of the pH-Meter 1140/1140-X is reduced to a minimum.

Setting clock

To set the clock or the date, the clock mode must be activated.



Press **clock** and **STO** simultaneously to set the clock.

A digital display showing the time "10:48".

The time display flashes. Now the time can be set using ▲ and ▼.

A digital display showing "date" and "25.06." below it.

Press **STO** again to store the displayed time. Now the date can be set.

A digital display showing "year" and "1996" below it.

Press **STO** again to store the date. Now the year can be set.

Press **STO** to confirm the year. The instrument returns to clock mode.

Serial Interface

Note



If the pH-Meter 1140/1140-X has been connected to a PC and measurement are taken in a grounded liquid, measurement errors may result.

With the remote interface, you can directly actuate a printer with serial port or set up a direct connection to a computer. Via the computer the instrument can be completely remote controlled and all data and parameters can be read out.

Interface parameters

The RS 232 interface can be defined for all common baud rates.

Setting is carried out in the configuration menu

- Baud rate:
 - 600 Bd
 - 1,200 Bd
 - 2,400 Bd
 - 4,800 Bd (default setting)
 - 9,600 Bd

Data format and protocol are permanently set to:

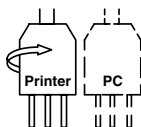
- 7 data bits
- even parity
- one stop bit
- XON/XOFF protocol

Note

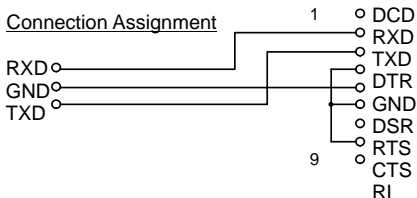


For the command set of the pH-Meter 1140/1140-X, refer to the online help of Paraly SW 105 transfer software.

Interface cable



Only one interface cable is required to operate a printer or PC. By simply turning around the plug on the pH-Meter 1140/1140-X the cable can be used to connect either a printer or a PC.



Printing Measured Values and Records

Note



Make sure that the print function is activated in the configuration (*Print on*) and the set baud rate corresponds to that of the printer.

Printing measured values



Press **print** while in measuring mode to print out the currently measured value. The measured value is printed out together with temperature, date and time and a three-digit identification number. The identification number is reset when the instrument is switched off.

Printing memory



Press **RCL** and then **print** to print out the data memory. All stored measured values are printed out with temperature, date and memory location number. If you only want to print individual memory locations, press **RCL** first. Then select the desired memory location using **▲** or **▼** and confirm with **print**.

Note



If Sensoface® was 😞 during measured-value recording, the memory location will be marked with *, and if the permissible measurement range (pH, mV, °C) was exceeded, with #.

Printing record



To print out the instrument record, press **cal** and then **print**. The record print-out contains:

- a calibration record with the exact data of the last calibration,
- the settings of the configuration menu,
- a record of the last instrument self-test and
- a list of the current Sensoface[®] criteria.

3 Troubleshooting and Maintenance

Sensoface® Electrode Monitoring



The automatic Sensoface® electrode monitoring system provides information on the electrode state. It evaluates zero point, slope and response time of the electrode. In addition, Sensoface® requests calibration at regular intervals.

Note



Sensoface® is specially designed for monitoring pH electrodes.

Note



The deterioration of the electrode condition is signified by 😊 or 😞 of the Sensoface® indicator ("smiley"). This evaluation is permanent. An improvement 😊 can only take place after a calibration.



This Sensoface® indicator provides information on the electrode response time, i.e. on the amount of time an electrode requires to supply a stable measured value. The value is determined during calibration.

Due to wear, aging and as the result of incorrect handling, e.g. drying out, the swelling layer of the glass membrane of an electrode may recede. This leads to a longer response time and the electrode becomes sluggish.




The electrode response is slow. You should consider to replace it. It may be possible to achieve an improvement by cleaning or, for an electrode returned to duty after dry storage, by rehydrating.




The electrode response is very slow. Correct measurement is no longer ensured. The electrode should be replaced.



This Sensoface[®] indicator provides information on the electrode zero point and the slope.

 Zero and slope of the electrode are still okay, however the electrode should be replaced soon.

 Zero and/or slope of the electrode have reached values which no longer ensure proper calibration. It is advisable to replace the electrode.

Note



The zero and slope values are determined during calibration. Therefore, the condition for accurate information is proper calibration. For this reason, always use fresh buffer solutions.

cal



Using the calibration timer, you can preset an interval within which calibration should take place.

The calibration timer also continues to run with the instrument switched off.

 Over 80 % of the calibration interval has already past.

 The calibration interval has been exceeded.

Error Messages

Sensor problems

If there are problems with a sensor, an error message appears and the measured-value display flashes.

ERROR 1

Problem with the electrode

Possible causes:

- Electrode defective
- Too little electrolyte in the electrode
- Electrode not connected
- Break in electrode cable
- Wrong electrode connected
- Measured pH less than -2 or greater than +16

ERROR 2 Problem with the electrode

Possible causes:

- Electrode defective
- Electrode not connected
- Break in electrode cable
- Measured electrode potential less than $-1,300$ mV or greater than $+1,300$ mV

ERROR 3 Problem with the temperature probe

Possible causes:

- Temperature probe defective
- Short circuit in temperature probe
- Wrong temperature probe connected
- Measured temperature less than -20 °C or greater than $+120$ °C

Note



When changing the temperature probe (also for electrodes with integrated temperature probe), note that the temperature probe type (Pt 1000/NTC 30 k Ω) is **only** recognized when the instrument is switched on with **on/off**.

Calibration error messages

If errors occur during calibration, or if the determined electrode data are outside the valid range, an error message appears (ERROR 4 ... ERROR 11).

ERROR 4

The electrode zero point determined during calibration is outside the permissible range. The zero point is less than pH 6 or greater than pH 8.

This message appears in measuring mode following a calibration. It can only be eliminated by recalibration.

Possible causes:

- Electrode "worn out"
- Buffer solutions unusable or falsified

-
- Buffer does not belong to configured buffer set
 - Temperature probe not immersed in buffer solution (for automatic temperature compensation)
 - Wrong buffer temperature set (for manual temperature specification)
 - Electrode has different nominal zero point

ERROR 5

The electrode slope determined during calibration lies outside the permissible range. The slope is less than 78 % or greater than 103 %. This message appears in measuring mode following a calibration. It can only be eliminated by recalibration.

Possible causes:

- Electrode "worn out"
- Buffer solutions unusable or falsified
- Buffer does not belong to configured buffer set
- Temperature probe not immersed in buffer solution (for automatic temperature compensation)
- Wrong buffer temperature set (for manual temperature specification)
- Electrode used has different nominal slope

ERROR 8

The instrument has recognized two identical buffer solutions.

This message is only displayed during calibration. Calibration must be repeated.

Possible causes:

- Same or similar buffer solution was used for both calibration steps
- Buffer solutions unusable or falsified
- Electrode defective or dirty

- Electrode not connected
- Break or short circuit in electrode cable

ERROR 9

The instrument cannot recognize the buffer solution used. This message is only displayed during calibration. Calibration must be repeated.

Possible causes:

- Buffer does not belong to configured buffer set
- Electrode defective or dirty
- Electrode not connected
- Break in electrode cable
- Wrong buffer temperature set (for manual temperature specification)

ERROR 10

During manual calibration, the buffer solutions were not used in the specified order. Calibration must be repeated.

ERROR 11

Calibration was cancelled after approx. 2 minutes because the electrode drift was too large. This message is only displayed during calibration.

Possible causes:

- Electrode defective or dirty
- No electrolyte in the electrode
- Electrode cable insufficiently shielded or defective
- Strong electric fields influence the measurement
- Major temperature fluctuation of the buffer solution
- No buffer solution or extremely diluted

ERROR 14

If the clock has not been set, e.g. after battery replacement, this error message is displayed. To clear the message, set the clock (see Pg. 19)

ERROR 15

If errors occur during transmission via the RS 232 interface, this error message appears.
This message is suppressed if "Printer on" is configured.

Possible causes:

- No valid message terminator transmitted (receiver overflow)
- Wrong transmission rate (baud rate) set (see Pg. 10)
- Error during transmission
- Wrong data format (see Pg. 20) e.g. parity bit

ERROR 18

If the instrument determines an error during the self-test, this error message appears: Configuration data defective

Possible causes:

- Configuration or calibration data are defective. Completely reconfigure and recalibrate the instrument.

ERROR 19**FAIL**

Error in the factory settings or system memory.
"FAIL" appears in the display.

Possible causes:

- EPROM or RAM defective
- Error in instrument factory settings

Note

This error message should normally not occur as the data are protected from loss by multiple safety functions. Should this error message nevertheless appear, no remedy is available. The instrument must be repaired and recalibrated at the factory.

Maintenance

Changing batteries



If the battery symbol appears in the display, the batteries need replacement. However, you can still use the instrument for a few days. When the battery voltage decreases further, the instrument switches off. (Since battery consumption is higher when the remote interface is used, the battery symbol is displayed earlier in that case.)



Never change the batteries within a hazardous area. Only use alkaline AA cells. Make sure the instrument is carefully closed again and the instrument protection cover with the rating plate is properly mounted on the instrument after changing the batteries.

To replace the batteries, you require 3 alkaline AA cells and a screwdriver (either straight-blade or Philips).

- Close the instrument protection cover and remove the electrode container.
- Unscrew the four screws on the back of the instrument and remove the cover.
- Remove the old batteries from the battery holder.
- Insert the new batteries in the specified direction.
- Make sure the instrument protection cover is in the notches provided and the rubber seal is correctly seated, especially near the pH socket.
- Remount the cover and secure it with the screws. Be sure to tighten the screws thoroughly.
- Remount the electrode container.

Note



When changing the batteries all calibration and configuration data are retained. The calibration timer runs out. Time and date must be reset. The instrument switches to pH measurement (as does the event-controlled datalogger). The current memory location is set to 00.

Warning

If you want to store the instrument for a longer time, the batteries must always be removed beforehand. Leaky batteries may damage the instrument.

Cleaning the instrument

To remove dust and dirt, the external surfaces of the instrument may be cleaned with water, and also with a mild household cleaner if necessary.

Warning

Watch electrostatic charging when using the instrument in hazardous areas!

Never wipe the instrument with a dry cloth, for example.

Appendix

Accessories

Designation	Order no
Puncture pH-electrode LoT406-M6-DXK-S7/25 *)	10 406 3123
Puncture knife	00 406 3000
Puncture kit (puncture electrode and knife)	00 406 3002
Electrode container, 5 pieces (for leak-proof storage of pH electrode)	52 120 695
Adapter 1 (for electrodes with S7, S7M screw cap and fixed cable of the InLab® series)	52 000 500
Adapter 2 (for puncture electrodes LoT406-M6-DXK-S7/25 and InLab® 427)	52 000 501
Coaxial cable AS7/1m/-15,30, DIN 19 262	1 003 0100
Temperature probe	52 120 350
Buffer pH 2.00 (colorless), 250 ml	20 9852 250
Buffer pH 4.01 (red), 250 ml	20 9863 250
Buffer pH 7.00 (green), 250 ml	20 9865 250
Buffer pH 9.21 (blue), 250 ml	20 9866 250
Single-use sealed buffer pouches pH 4.01, 30 pieces	51 302 069
Single-use sealed buffer pouches pH 7.00, 30 pieces	51 302 047
Single-use sealed buffer pouches pH 9.21, 30 pieces	51 302 070

*) For other types of sensors, please ask for the relative ordering information.

Specifications pH-Meter 1140/1140-X

Ranges	pH: -2.00 to +16.00 mV: -1,300 to +1,300 °C: -20.0 to +120.0
Display	LC display 35 x 67 mm, character height 15 mm
Measurement Cycle	approx. 1 s
Measurement Error (+ 1 count)	pH: < 0.01 mV: < 0.1 % meas. value + 0.3 mV °C: < 0.3 K
Input	DIN 19 262
Input Resistance	> 1 x 10 ¹² Ω
Input Current (20 °C)	< 1 x 10 ⁻¹² A
Electrode Standardization	Calimatic® automatic calibration with automatic buffer recognition (German patent 29 37 227) manual electrode standardization
Instrument and Electrode Monitoring	Sensoface®: evaluates the calibration interval, zero point, electrode slope, response time and glass impedance of the electrode, optical indication good/average/poor Calibration timer: monitors the calibration intervals, configurable from 1 to 1,000 hours, can be disabled Self test: during power-on
Temperature Compensation	Pt 1000 / NTC 30 kΩ (automatic recognition during power-on) or manual
Data Memory	100 memory locations: pH/mV, temp, time, date
Datalogger	manual, interval or event-controlled*)
Remote Interface	serial RS 232 interface, bidirectional, asynchronous, baud rate user-definable, can be used as either printer or computer interface
Data Retention	configuration/calibration data and factory settings >10 years
Auto Switch-off	after either 1 or 12 hours*)

*) configurable

RFI Suppression	to EN 50 081-1 and EN 50 081-2	
Immunity to Interference	to EN 50 082-1, EN 50 082-2 and NAMUR NE 21	
Explosion Protection (only 1140-X)	EEX ia IIC T6, PTB No. Ex-96.D.2139	
Environmental Temperature	Operation:	-10 to +55 °C
	Transport and storage:	-20 to +70 °C
Power Supply	3 alkaline AA cells	
Operating Time	approx. 2,000 h ¹⁾ , clock mode > 2 years	
Enclosure	Material: PA, IP 66 protected, with integrated electrode container	
Dimensions	133 x 160 x 30 mm (w x h x d)	
Weight	approx. 560 g including batteries	

1) Due to storage, the service life of the included battery may be shorter.

Certificate of Conformity

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin



CERTIFICATE OF CONFORMITY

PTB No. Ex-96.D.2140

(TRANSLATION)

- (1) This certificate is issued for the electrical apparatus
pH-Transmitter type 11.0X
- (2) manufactured by Mettler Toledo AG
CH-8902 Urdorf
- (3) This electrical apparatus and any acceptable variation thereto is specified in the Schedule to this Certificate of Conformity.
- (4) The Physikalisch-Technische Bundesanstalt, being an Approved Certification Body in accordance with article 14 of the Council Directive of the European Communities of December 18, 1975 (76/117/EEC), confirms that this electrical apparatus has been found to comply with the harmonized European Standards


Electrical apparatus for potentially explosive atmospheres

EN 50 014 1977 + A1...A5 (VDE 0170/0171 Part 1/1.87) General Requirements
EN 50 020 1977 + A1...A5 (VDE 0170/0171 Teil 7/4.92) Intrinsic Safety "i"

after the apparatus has been successfully subjected to pattern evaluation. The results of this pattern evaluation have been recorded in a confidential test report.

- (5) The apparatus marking shall include the code:
EEx ia IIC T6
- (6) The manufacturer shall be responsible for ensuring that any apparatus bearing the above marking conforms to the test documents specified in the Schedule to this certificate and that the routine verifications and tests prescribed have been carried out successfully.
- (7) The electrical apparatus may be marked with the Distinctive Community Mark according to Annex II to the Council Directive of February 6, 1979 (79/196/EEC). A facsimile of this mark is printed on this sheet of the certificate.

By order


Dr.-Ing. Johannsmeyer
Oberregierungsrat



Braunschweig, 26.11.1996

Test certificates without signature and official stamp shall not be valid.

The certificates may be circulated only without alteration.
Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt

SCHEDULE

to Certificate of Conformity PTB No. Ex-96.D.2140

The apparatus and the according pH- resp. Redox- and temperature measuring electrodes are used for measurement in the electrochemical and environmental range of application.

PT 1000- resp. NTC-sensors which are either separate or mounted inside the pH-electrode enable general, precise temperature measurements and an automatic temperature compensation during the pH-measurement.

The permissible ambient temperature range is $-10\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$.

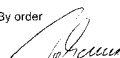
Electrical Data

Auxiliary supply	three mounted Alkaline-Manganese-cells, type AA
pH temperature measuring circuit (BU 2, 3, 4)	type of protection "Intrinsic Safety" EEx ia IIC maximum values: $U_o \leq 5\text{ V}$ $I_o \leq 11\text{ mA}$ $P_o \leq 13\text{ mW}$ $R_i > 487\ \Omega$ maximum permissible external capacitance $1\ \mu\text{F}$ maximum permissible external inductance 5 mH internal capacitance 30 nF internal inductance negligible small
Interface circuits RxD, TxD (BU 5, 6, 7)	$U_m = 250\text{ V}$ Operation outside hazardous areas only. The pH temperature measuring circuit may not lead into the hazardous area if the interface is connected to a non intrinsically safe circuit.

Test document

Certificate of Conformity PTB No. Ex-96.D.2139

By order


 Dr.-Ing. Johannsmeyer
 Oberregierungsrat



Braunschweig, 26.11.1996

Sheet 1/1

Physikalisch-Technische Bundesanstalt

Schedule to Certificate of Conformity PTB No.-Ex-96.D.2140

National Annex

to Certificate of Conformity PTB No. Ex-96.D.2140

In the area of application of the "Regulation concerning electrical equipment in potentially explosive atmospheres" (ElexV), the following is additionally applicable to the use of the equipment:

Use of the equipment in the zone 0 hazardous area

(a) Appraisal

Based on the documents submitted and the present state of knowledge, there will be no safety reservations about short time use of the pH/Pt-1000 sensors type ZU 6979 X0 in zone 0 of tanks for all flammable liquids of classes of hazard A1, AII and B, with the exception of carbon bisulphide, if the equipment is used inside tanks or pipings in which explosive vapour/air mixtures occur at pressures of 0,8 to 1,1 bar and at mixture temperatures of -20 °C to +60 °C (explosive atmospheres).

(b) Conditions

1. In portable application in hazardous area zone 0 the pH/Pt-1000 sensors type ZU 6979 X0 have to be connected to the tank via a ground terminal in advance.
2. The pH-Transmitter type 11 0X (portable apparatus) shall only be used in hazardous area Zone 1.
3. The pH temperature measuring circuit of the pH-Transmitter type 11.0X shall only be connected to the pH/Pt 1000 sensors type ZU 6979 X0.

By order

Dr.-Ing. Johannes
Oberregierungsrat



Braunschweig, 26.11.1996

4 General Information on Measurement

Note



The chapter "General Information on Measurement" provides a summary of the most important points to be observed during pH measurement. You can skip this chapter if you are sufficiently familiar with the practice of pH measurement.

Notes on pH Measurement

General information

Two electrodes, a glass electrode and a reference electrode, are required for electrometric pH measurement. They are usually offered combined in a glass or plastic body as a so-called combination electrode.

During pH measurement, simultaneous temperature detection is required. For a correct pH value you must always specify the respective measurement temperature, e.g. $\text{pH}_{25^{\circ}\text{C}} = 7.15$.

Using a temperature probe together with the electrode allows to optimally use the advantages of the microprocessor controlled pH meter.

Calibration and measurement

The measuring characteristics of pH electrodes are different for each electrode, are variable and temperature-dependent. Therefore, the meter must be adjusted to the respective current electrode characteristics. This process is called calibration.

For calibration, you take measurements in buffer solutions. These are solutions with exactly defined pH values. With the pH-Meter 1140 two calibration modes are available, i.e. automatic calibration using Calimatic[®] and manual calibration.

Calimatic[®] automatic calibration

In the pH-Meter 1140/1140-X the chart values of various buffer sets are stored for the correct temperatures. Simply select and enter the buffer set once when commissioning the instrument (see Pg. 9). Then the patented Calimatic[®] will calibrate the instrument at the press of a key.

Calibration is conducted with two different buffer solutions from the preset buffer set. The sequence of buffers is irrelevant. The pH meter measures the electrode voltages and the temperatures and compares then with the programmed pH temperature charts for the buffer solutions. From the measured values the instrument calculates the zero point and slope of the electrode. This type of calibration with two buffer solutions is a two-point or calibration.

For one-point calibration, only one buffer solution is used and the calibration process is discontinued after the first calibration step. Only zero point is adjusted in the process. The previous slope value is retained. As two-point calibration with modern microprocessor controlled meters is only slightly more complicated, it is always preferable.

Note



The buffer solutions used for calibration must always correspond to the buffer set selected in the instrument.

Manual calibration

If you want to work with special buffer solutions not included in the stored buffer sets, select manual calibration (see Pg. 9). Here, you enter your individual temperature-corrected buffer value (pH at calibration temperature). Values entered once remain stored. During the next calibration, the instrument will suggest these values again. That means you do not have to enter the values once more provided that the sequence of the last calibration is retained .

Note



Make sure that the buffer values are entered for the proper temperature. Do not enter the nominal buffer value but instead the pH of the buffer solution at the calibration temperature.

Calibration intervals

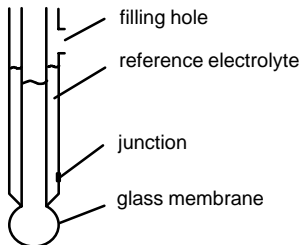
The calibration interval is highly dependent on the conditions under which measurements are taken. As a result, no generally valid interval can be given here. However, the calibration can be repeated frequently at the beginning. If the calibration values (electrode zero and slope) show only minor differences, the time between calibrations can be increased.

For measurements under constant conditions, weekly calibration may be sufficient. On the other hand, calibration may be necessary prior to each measurement when measuring in media with large temperature or pH differences. For monitoring the calibration interval, you should configure the calibration timer (see Pg. 9).

**Observe
the following:**

- For electrodes with liquid electrolyte, open the KCl filling hole for calibration, measurement and cleaning.
- Immerse the electrode in the buffer solution until the glass membrane and junction are completely immersed.
- Electrode response time is considerably reduced if you first move the electrode in the buffer solution and then keep it still to read the values.
- Always rinse the electrode with distilled water before immersing it in the buffer solution.
- Use two-point calibration whenever possible.
- If you calibrate without a temperature probe, make sure the manually set temperature matches the actual temperature of the buffer solutions and the substance to be measured.

Design of a combination electrode with liquid electrolyte



Buffer solutions

Two buffer solutions are required for a two-point calibration. The pH values of the buffer solutions should generally be at least two pH units apart and bracket the expected measured value.

Note



To ensure measurement accuracy, the buffer solutions must not be dirty.

- Therefore, never pour used buffer solution back into the storage container. Never use used buffer solution.
- Never immerse the electrode directly in the storage container.
- Always keep the storage container closed. The carbon dioxide from the air can lead to incorrect buffer solution values.

Note



The problems described above can be avoided by using buffer bags (see Accessories on Pg. 31).

Electrodes

Today, combination electrodes are commonly used due to the simpler handling involved.

When using combination electrodes, ensure a symmetric design when interconnecting:

- The dissipation systems of glass and reference electrodes have the same potential (e.g. both Ag/AgCl, KCl 3 mol/l, AgCl saturated or both "Kalomel", KCl saturated).
- Only combine Thalamide glass electrodes with Thalamide reference electrodes.

The nominal zero point of commercially available electrodes is pH 7.

Electrode care Proper cleaning and care increases electrode service life and measurement accuracy. Therefore, you should observe the following points:

- ❑ Store electrodes in KCl solution (reference electrolyte). Never store them dry. For a few hours the electrode can also remain in the electrode container, without liquid.
- ❑ Soak dry electrodes in KCl solution for up to 12 hours prior to initial use.
- ❑ For electrodes with liquid electrolyte, open the KCl filling hole for calibration, measurement and cleaning.
- ❑ Make sure the electrolyte in the electrode is always at least 2 cm higher than the medium to be measured. Top up the KCl solution if necessary. Use the KCl solution specified by the manufacturer.

Grease and oil deposits on the electrode can be removed with hot water and a household dishwashing liquid; for heavier dirt deposits, a household cleaner may also be used.

Protein contaminations can be removed by soaking the electrode in a pepsin – hydrochloric acid solution (electrode cleaner) for one hour.

- ❑ Do not rub the electrode dry with a cloth or fleece, as this will cause electric charging which may later result in incorrect measurements or even make them impossible.

Temperature compensation

The temperature compensation takes the temperature dependency of the electrode slope into account. Reference temperature for zero and slope of the instrument is 25°C. The pH of the medium to be measured is also temperature-dependent. This temperature dependence is unknown and depends on the composition of the measured medium. As a result, this temperature dependence cannot be compensated. Therefore, always indicate the measuring temperature together with the pH (observe when comparing measured pH values!).

Note

In the case of a major temperature difference between the calibration and measuring temperature, an additionally present temperature dependence of the electrode zero may disturb the electrode. This dependence is not subject to any general rules (in contrast to the temperature dependence of the slope). To achieve a particularly high degree of measurement accuracy, this error can be eliminated by calibrating at the measuring temperature (recommended by DIN 19268). The temperature dependence of the calibration buffer pH values is automatically taken into consideration during calibration with Calimatic®.

Technical Terms

Auto switch-off	To protect the batteries, the instrument switches off automatically when not operated for a longer period. Switch-off can take place after either one hour or twelve hours. When datalogger or remote interface are active, the instrument is not switched off.
Buffer set	Contains selected buffer solutions which can be used for automatic calibration with the Knick Calimatic [®] . The buffer set must be selected prior to initial calibration.
Buffer solution	Solution with an exactly defined pH for calibrating a pH measuring instrument.
cal	Key for activating calibration.
Calibration	Adjustment of the pH meter to the current electrode characteristics. The zero point and slope are adjusted. Either a one or two-point calibration can be carried out. With one-point calibration only the zero point is adjusted.
Calibration buffer set	See buffer set.
Calimatic[®]	Automatic buffer recognition. Before the first calibration, the buffer set used must be activated once. The patented Calimatic [®] then automatically recognizes the buffer solution used during calibration.
Combination electrode	Combination of glass and reference electrode in one body.
Datalogger	The datalogger records up to 100 measured values (pH or mV) together with the temperature, date and time in the data memory. Recording takes place either interval or event-controlled (measured-value difference) or manually at the press of a key.

Data memory	Up to 100 measured values (pH or mV) can be stored in the data memory together with temperature, time and date.
Electrode slope	Is indicated in % of the theoretical slope (59.2 mV/pH at 25 °C). The electrode slope is different for every electrode and changes with age and wear.
Electrode zero point	The voltage which a pH electrode gives off at a pH of 7. The electrode zero point is different for every electrode and changes with age and wear.
GLP	Good Laboratory Practice: Rules for conducting and documenting measurements in the laboratory.
meas	This key is used to return to measurement mode from all other levels. In measuring mode it switches between mV and pH.
NAMUR	German committee for measurement and control standards in the chemical industry
One-point calibration	Calibration with which only the electrode zero point is taken into consideration. The previous slope value is retained. Only one buffer solution is required for a one-point calibration.
pH electrode system	A pH electrode system consists of glass and reference electrode. If they are combined in one body, they are referred to as combination electrode.
Response time	Time from the start of a calibration step to the stabilization of the electrode potential.
Sensoface®	Automatic electrode monitoring. The Sensoface® indicators provide information on the status of the electrode and the instrument. Calibration interval, zero, slope and response time of the electrode are evaluated.
Slope	See electrode slope.
Two-point calibration	Calibration in which the electrode zero and slope are taken into consideration. Two buffer solutions are required for two-point calibration.
Zero point	See electrode zero point

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