Laboratory pH Meter
CG 843

Accuracy when going to press

All details contained in this operating manual are valid data at the time of going to press. However, SCHOTT may add details for both technical and commercial reasons, or in order to fulfil legal requirements of different countries. This does not affect the characteristics described.

Warranty declaration

The designated instrument is covered by a warranty of three years from the date of purchase.
The instrument warranty extends to manufacturing faults that are determined within the period of warranty.
The warranty excludes components that are replaced during maintenance such as batteries, etc.

The warranty claim extends to restoring the instrument to readiness for use but not, however, to any further claim for damages. Improper handling or unauthorized opening of the instrument invalidates any warranty claim.

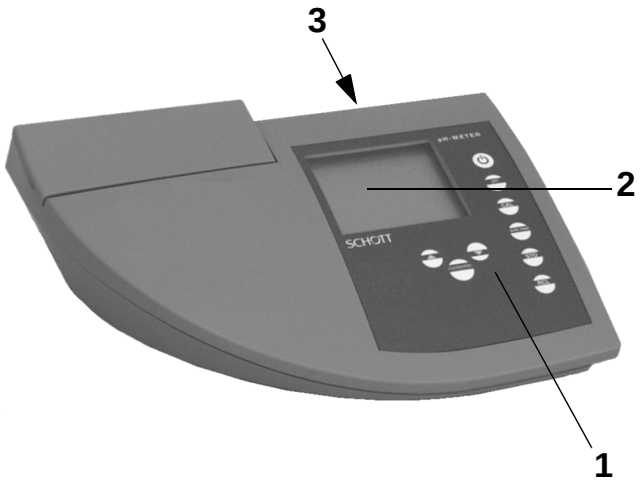
To ascertain the warranty liability, return the instrument and proof of purchase together with the date of purchase freight paid or prepaid.

Copyright

1 Overview

The compact *CG 843* precision pH meter lets you perform pH measurements rapidly and reliably. The *CG 843* provides the highest degree of operating comfort, reliability and measuring safety for all applications.

The proven calibration procedures and special *AutoRead* function support your work with the pH meter.



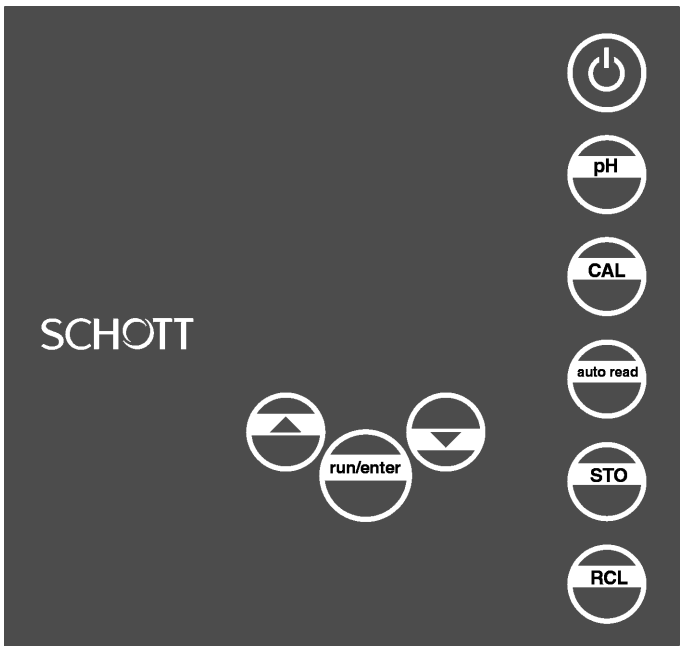
1 Keypad

2 Display

3 Sockets

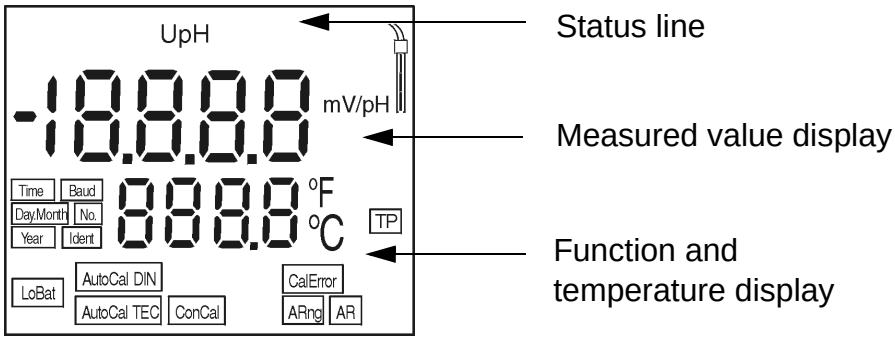
Note
The measuring instrument can also be delivered as part of a set.
Information on this and other accessories is available in the SCHOTT general catalog.

1.1 Keypad

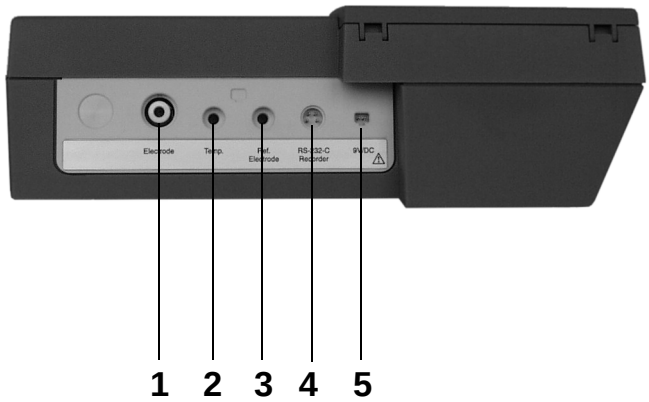


	Switch measuring instrument on or off **<on/off>**
pH	Select measuring mode **<pH>**
CAL	Call up calibration procedure **<CAL>**
auto read	Activate/deactivate AutoRead **<auto read>**
STO	Store measured value **<STO>**
RCL	Display/transmit measured values **<RCL>**
	Reduce values, scroll **<▼>**
run/enter	Confirm inputs, start AutoRead **<run/enter>**
	Increase values, scroll **<▲>**

1.2 Display



1.3 Sockets



1 Socket according to DIN 19262/BNC

2 PT 1000/NTC30 connection for pH combined electrode with temperature probe

3 Reference electrode connection

4 RS 232 interface/analog output

5 Connection for plug-in power supply (optional)

Caution
Only connect probes to the instrument that cannot feed excessive voltages or currents (> SELV and > circuit with current limiter).
Nearly all commercial electrodes – especially SCHOTT electrodes – meet these requirements.

1.4 Declaration of conformity

SCHOTT

KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ

Wir erklären in alleiniger Verantwortung, daß die Produkte

pH-Meter
CG 843

auf die sich diese Erklärung bezieht, übereinstimmen mit dem normativen Dokument

We declare under our sole responsibility that the products

pH-Meter
CG 843

to which this declaration relates are in conformity with the normative document

Nous déclarons notre seule resbonsabilité que les produits

pH-Meter
CG 843

aux quels se réfère cette déclaration est conforme au document normatif

Technische Daten
pH-Meter CG 843
29.03.99

SCHOTT Geräte GmbH
Im Langgewann 5
D 65719 Hofheim am Taunus
Deutschland, Germany, Allemagne

29. März, March 29rd, 29, Mars, 1999

AGQSF0000-A058-00/990329

1.5 Technical data

Ambient temperature

Storage temperature	- 25 °C ... + 65 °C
Operating temp.	0 °C ... + 55 °C
Allowable relative humidity	Annual mean: < 75 % 30 days/year: 95 % Other days: 85 %

Measuring ranges and resolution

pH	- 2.000 ... + 16.000 - 2.00 ... + 16.00	resolution selectable
U [mV]	- 999.9 ... + 999.9 - 1999 ... + 1999	
T [°C]	- 5.0 ... + 100.0	
T [°F]	+ 23.0 ... + 212.0	

Measuring accuracy (± 1 digit)

Given as measuring uncertainty at a confidence level of 95%. All accuracies additionally depend on the accuracies of the measuring probes.

pH (± 2 pH units around the calibration point)	± 0.005 at + 15 °C ... + 35 °C ± 0.01
U [mV]	± 0.4 at + 15 °C ... + 35 °C ± 1
T [°C]	NTC 30: ± 0.1 PT 1000: ± 0.5 at 0 °C ... 15 °C ± 0.1 at 15 °C ... 35 °C ± 1 at 35 °C ... 55 °C
T [°F]	NTC 30: ± 0.2 PT 1000: ± 0.9 at 32 °F ... 59 °F ± 0.2 at 59 °F ... 95 °F ± 1.8 at 95 °F ... 131 °F

Housing

Length [mm]	230
Width [mm]	210
Height [mm]	70
Weight [kg]	Approx. 1.3 (without plug-in power supply unit)
Material	ABS

EMC and VDE norms

Interference emission (generic standard)	EN 50081-1 FCC class A
Interference immunity (generic standard)	EN 50082-1
Protective class	3, EN61010-1
Climatic class	2, VDI/VDE 3540

Test marks TÜV GS, UL/CUL, CE

Display Multifunctional LCD

Keypad Foil keypad (Polyester)

Power supply	Batteries	4 x 1.5 V AA type alkaline manganese batteries
	Runtime	Approx. 3000 operating hours
	Mains power supply (option)	Plug-in power supply unit: Connection max. overvoltage category II Plug-in power supply (Euro plug): Type no.: Z851 Order no.: 28 520 4897 FRIWO FW3288, 11.8134 Friwo Part No. 1816492 Input: 230V ~ / 50 Hz / 23 VA Output: 6 V = / 1,8 A /10,8 VA Plug-in power supply (US plug): Type no.: Z852 Order no.: 28 520 4901 FRIWO FW3288, 11.8451 Friwo Part No. 1816493 Input: 120V ~ / 60 Hz / 21,5 VA Output: 6 V = / 1,8 A Plug-in power supply (UK plug): Type no.: Z849 Order no.: 28 520 4975 FRIWO FW3288, 11.8453 Friwo Part No. 1770896 Input: 230V ~ / 50 Hz / 23 VA Output: 6 V = / 1,8 A
Data storage	Ring store for 200 value pairs, pH/mV, temperature	
Temperature compensation	Automatic with Pt 1000/NTC (30 kΩ)	-5 ... 99.9 °C
	Manual input	-20 ... 130 °C resolution 1K

Connectors	Electrodes	Socket acc. to DIN 19 262 or BNC 4-mm socket for reference electode
	Temp. probe	4-mm socket for temperature probe
	Interface/ analog output	Bidirectional RS 232 interface or analog output with autom. recognition of the PC, printer, or recorder connected
	Plug-in power supply (option)	2 pole special Friwo
Input amplifier	Input impedance	$\geq 10^{12}\ \Omega$
	Offset current	$\leq 10^{-12}$ A
Calibration modes	AutoCal TEC	With Technical buffers, pH values 2.00; 4.00; 7.00; 10.00 at 25 °C; buffers are temperature compensated in the range 0 ... 90 °C
	AutoCal DIN	With standard buffers according to DIN 19 266/NIST, pH values: 1.68; 4.01; 6.87; 9.18 at 25 °C; buffers are temperature compensated in the range 0 ... 90 °C
	ConCal	With any buffers; one and two-point calibration, manual acceptance of measured values and temp. input

2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the pH meter. Consequently, all responsible personnel must read this operating manual before working with the instrument.
The operating manual must always be available within the vicinity of the instrument.

Target group

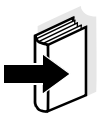
This measuring instrument was developed for use in the laboratory.
Thus, we assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

Symbols used

Caution
indicates instructions that have to be followed to prevent damage to your instrument.

Warning
indicates instructions that have to be followed to protect yourself and the instrument from dangerous electrical voltage.

Note
Indicates notes that draw your attention to special features.



Note
Indicates cross-references to other documents, e.g. application reports, operating manuals of electrodes, etc.

2.1 Authorized use

This instrument is authorized exclusively for pH and Redox measurements in the laboratory.
The technical specifications as given in the section 1.5 TECHNICAL DATA must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized.
Any other use is considered **unauthorized**.

2.2 General safety instructions

This instrument is constructed and tested in compliance with the EN 61010-1 safety regulations for electronic measuring instruments.
It left the factory in a safe and secure technical condition.

Function and operational safety

The smooth functioning and operational safety of the instrument can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed.

The smooth functioning and operational safety of the instrument can only be guaranteed under the climatic conditions specified in the section 1.5 TECHNICAL DATA.

If the instrument was transported from a cold environment to a warm environment, the formation of condensate can lead to the faulty functioning of the instrument. In this event, wait until the temperature of the instrument reaches room temperature before putting the instrument back into operation.

Caution
The instrument is only allowed to be opened by personnel authorized by SCHOTT.

Safe operation

If safe operation is no longer possible, the instrument must be taken out of service and secured against inadvertent operation.
Safe operation is no longer possible if:

- the instrument has been damaged in transport
- the instrument has been stored under adverse conditions for a lengthy period of time
- the instrument is visibly damaged
- the instrument no longer operates as described in this manual

If you are in doubt contact the supplier of the instrument.

Obligations of the operator

The operator of this measuring instrument must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety datasheets of the chemical manufacturer.

3 Commissioning

Perform the following activities for the initial commissioning:

- Set the date and time
- Connect the plug-in power supply.

Setting the date and time

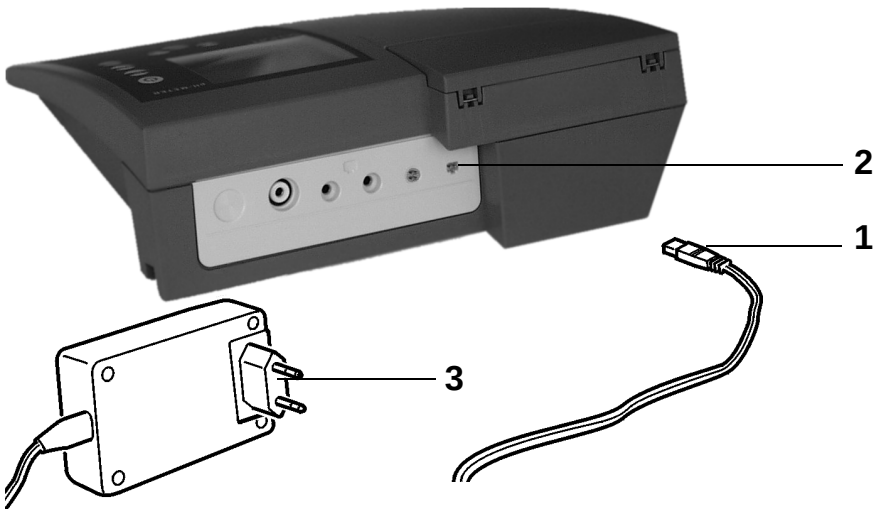
1	Press and hold down the **<pH>** key.
2	Press the **<on/off>** key. The *display test* appears briefly on the display. The measuring instrument then switches automatically to the setting of the baud rate.
3	Press the **<run/enter>** key repeatedly until the date flashes on the display.
4	Set today's date by pressing **<▲> <▼>**.
5	Confirm with **<run/enter>**. The date (month) flashes on the display.
6	Set the current month by pressing **<▲> <▼>.**
7	Confirm with **<run/enter>**. The year appears on the display.
8	Set the current year by pressing **<▲> <▼>.**
9	Confirm with **<run/enter>**. The hour field flashes on the display.
10	Set the current time by pressing **<▲> <▼>**
11	Confirm with **<run/enter>**. The minutes field flashes on the display.
12	Set the current time by pressing **<▲> <▼>**
13	Confirm with **<run/enter>**. The measuring instrument then switches to the pH measuring mode automatically.

Connecting the plug-in power supply (optional)

The measuring instrument works battery-powered. It can, however, also be supplied by the plug-in power supply which is available as an accessory.

Warning
The line voltage on site must lie within the input voltage range of the original plug-in power supply unit (see section 1.5 TECHNICAL DATA).

Caution
Use original plug-in power supplies only (see section 1.5 TECHNICAL DATA).



1	Insert the plug (1) into the socket (2) of the pH meter.
2	Connect the original plug-in power supply (3) to an easily accessible mains socket.

Note
You can also perform measurements without a plug-in power supply.

4 Operation

4.1 Switch on the instrument

1	Place the instrument on a flat surface and protect it against intense light and heat.
2	Press the **<on/off>** key. The *display test* appears briefly on the display. The instrument then switches automatically to the previously selected measuring mode.

Note

The instrument has an energy saving feature to avoid unnecessary battery depletion.
The energy saving feature switches the instrument off if no key has been pressed for an hour.
The energy saving feature is not active:

- if the power is supplied by the plug-in power supply
- if the *AutoStore* function is active
- if the communication cable is connected
- if the recorder cable is connected
- if the printer cable is connected
  (for external printers)

4.2 Measuring

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect the electrode to the instrument.
2	Adjust the temperature of the buffer or test solutions or measure the current temperature if the measurement is made without a temperature probe.
3	Calibrate or check the instrument with the electrode according to section 4.3 CALIBRATING.
4	Select the measuring mode by pressing **<pH>**.

Note
Incorrect calibration of the pH electrode will result in incorrect measured values. Therefore, regularly perform calibration before measuring.

Caution
When connecting an earthed PC/printer, measurements cannot be performed in earthed media as incorrect values would result.
The RS232 interface is not galvanically isolated.

Temperature probe

Measurements can be performed with and without a temperature probe. A connected temperature probe is indicated by TP on the display.

Note
The pH meter automatically recognizes the type of the temperature probe used. As a result, you can connect electrodes with the NTC30 or Pt1000.

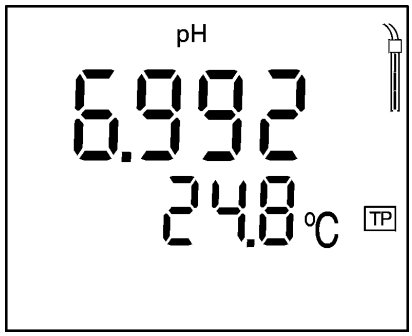
The temperature measurement is absolutely essential for a reproducible pH measurement. If the measurement is made without a temperature probe, proceed as follows:

1	Determine the current temperature using an external thermometer.
2	Set up the temperature by pressing **<▲> <▼>.**

Note
When calibrating without a temperature probe, set up the current temperature of the respective buffer solution manually by pressing the **<▲> <▼>** keys.

4.2.1 Measuring the pH value

1	Perform the preparatory activities according to section 4.2.
2	Immerse the pH electrode into the test sample.
3	Press the **<pH>** key until *pH* appears in the status display. The pH value appears on the display.



AutoRead AR (Drift control)

The *AutoRead* function (drift control) checks the stability of the measurement signal. The stability has a considerable effect on the reproducibility of the measured values.
For identical measurement conditions, the following criteria apply:

- pH value: better than 0.02 (response time: > 30 s)

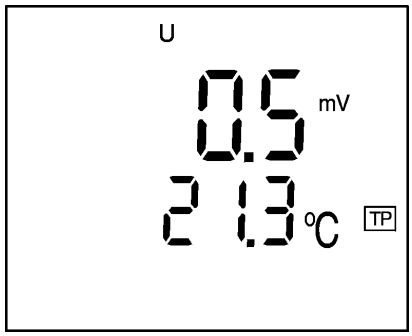
1	Call up the pH measuring mode by pressing **<pH>**.
2	Activate the AutoRead function by pressing **<auto read>**. The current measured value is frozen (Hold function).
3	Start the AutoRead function by pressing **<run/enter>**. AR flashes on the display until a stable measured value is reached. This measured value is transmitted to the RS interface.
4	If necessary, start the next AutoRead measurement by pressing **<run/enter>**.
5	To cancel the AutoRead function: Press the **<auto read>** key.

Note
The current AutoRead measurement (with acceptance of the current value) can be terminated at any time by pressing **<run/enter>**.

4.2.2 Measuring the Redox voltage

The pH meter can measure the Redox voltage (mV) of a solution when connected with a Redox electrode, e.g. BlueLine 31 Rx.

1	Perform the preparatory activities according to section 4.2.
2	Immerse the Redox electrode into the test sample.
3	Press the **<pH>** key repeatedly until U appears in the status line. The Redox voltage (mV) of the sample appears on the display.
4	Wait for a stable measured value.



Note
Redox electrodes are not calibrated. However, you can check Redox electrodes using a test solution.

4.2.3 Transmitting measured values

You can transmit measured values (data records) in 3 ways:

- Switch on the data transmission (Int 2) (see 114)
  - After expiry of the selected interval, the current data record is sent to the RS interface.
- Switch on AutoStore (Int 1) (see section 4.4.2 SWITCHING ON AUTOSTORE (INT 1) 108)
  - After expiry of the selected interval, the current data record is sent to the RS interface and in addition is stored in the data store of the instrument
  - AutoStore (Int 1) covers the *data transmission* interval (Int 2).
- Press the **<run/enter>** key
  This manually triggers a transmitting of the current measured values at any time - independently of the selected intervals.

Note
If you connect a recorder (analog output), both the output to the digital output are switched off.

4.3 Calibrating

Why calibrate?

pH electrodes age. This changes the asymmetry (zero point) and slope of the pH electrode. As a result, an inexact measured value is displayed. Calibration determines the current values of the asymmetry and slope of the electrode and they are stored in the instrument.
Thus, you should calibrate at regular intervals.

When to calibrate?

- After connecting another electrode
- When the sensor symbol flashes:
  - after expiry of the calibration interval
  - after a voltage interruption, e.g. battery change

You can choose between 3 calibration procedures:

AutoCal TEC

is specially adapted to the Technical buffer solutions as a fully automatic two or three-point calibration. The buffer solutions are automatically recognized by the instrument.
The following pH values are available:
2.00, 4.00, 7.00, 10.00.

AutoCal DIN

is specially adapted to permanently programmed buffer solutions according to DIN 19266 as a fully automatic two or three-point calibration. The buffer solutions are automatically recognized by the instrument.
The following pH values are available:
1.68, 4.01, 6.87, 9.18.

ConCal

is the conventional two-point calibration with 2 freely selectable buffer solutions or single-point calibration as the rapid method.

AutoRead

In calibration using AutoCal TEC and AutoCal DIN, the *AutoRead* function is automatically activated.
The current AutoRead measurement (with acceptance of the current value) can be terminated at any time by pressing **<run/enter>**.

Calibration protocol

The calibration protocol contains the calibration data of the current calibration. You can call up the calibration protocol by outputting the data storage (section 4.4.3).

Note
You can automatically print out a calibration protocol after the calibration. To do so, connect a printer according to section section 4.5.3 before the calibration. After a valid calibration, the protocol is printed.

Sample printout:

```
CALIBRATION PROTOCOL
 02.03.99     14:19
Device No.: 12345678
CALIBRATION pH
Cal Time: 01.03.99 / 15:20
Cal Interval:   7d
AutoCal DIN   Tauto
Buffer 1   1.679
Buffer 2   4.008 *
Buffer 3   6.865
Buffer 4   9.180 *
C1      174.1mV  25.0°C
C2     -133.3mV  25.0°C
S1     -59.4 mV/pH
ASY1   -   4 mV
Probe:     +++
```

Calibration evaluation

After the calibration, the instrument automatically evaluates the current status. The asymmetry and slope are separately evaluated. The worst evaluation appears on the display.

Display	Asymmetry [mV]	Slope [mV/pH]
	-15 ... +15	58 ... 60.5
	-20 ... +20	57 ... 58
	-25 ... +25	56 ... 57 or 60.5 ... 61
 Clean the electrode according to the electrode operating manual	-30 ... +30	56 ... 50 or 61 ... 62
E3 Clear the fault according to chapter 6 WHAT TO DO IF...	< -30 or > 30	< 50 or > 62

Preparatory activities

1	Switch on the instrument by pressing **<on/off>**.
2	Connect the pH electrode to the instrument.
3	Keep the buffer solutions ready.
4	Adjust the temperature of the solutions and measure the current temperature if the measurement is performed without a temperature probe.

4.3.1 Calibration interval (Int 3)

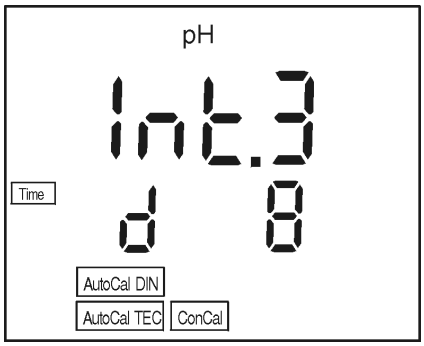
The flashing sensor symbol reminds you to calibrate regularly. After the selected calibration interval (Int 3) expires, the sensor symbol flashes. Measurements can continue.

Note
To ensure the high measuring precision of the measuring system, perform a calibration after the calibration interval expires.

Setting the calibration interval

The calibration interval (Int 3) is set to 7 days in the factory. The interval can be changed (1 ... 999 days):

1	Switch off the instrument.
2	Press **<pH>** and hold down the key.
3	Press the **<on/off>** key. The *display test* appears briefly on the display. The instrument then switches automatically to the configuration level.
4	Press the **<run/enter>** key until *Int 3* appears on the display.



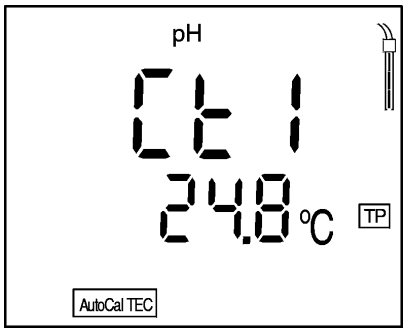
5	Press **<▲> <▼>** to set the required time interval until the next calibration.
6	Confirm with **<run/enter>**.
7	Change to the measuring mode by pressing **<pH>**.

4.3.2 AutoCal TEC

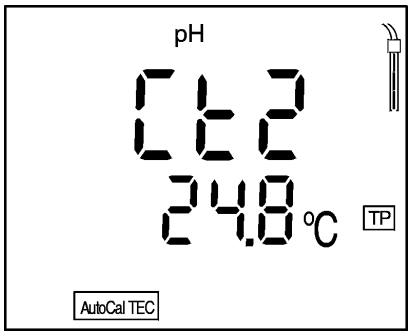
Use any two or three of the Technical buffer solutions for this procedure in increasing or decreasing order.

Note
Steps 2, 6 and 13 are not required if you use a temperature probe.

1	Press the **<CAL>** key repeatedly until *Ct1* and the *AutoCal TEC* function display appears.



2	If necessary, set the temperature of the buffer solution by pressing **<▲> <▼>**.
3	Submerse the pH electrode in the first buffer solution.
4	Press the **<run/enter>** key. AR flashes on the display. The electrode voltage (mV) appears on the display. As soon as a stable value is recognized, *Ct2* appears.



5	Thoroughly rinse the electrode with distilled water.

6	If necessary, set the temperature of the second buffer solution by pressing **<▲> <▼>**.
7	Submerse the electrode in the second buffer solution.
8	Press the **<run/enter>** key. AR flashes on the display. The electrode voltage (mV) appears on the display. As soon as a stable value is recognized, *AR* disappears. The sensor symbol shows the electrode evaluation after the two-point calibration. The value of the slope (mV/pH) appears on the display.
9	Press the **<run/enter>** key. The value of the asymmetry (mV) appears on the display.
10	To return to the measuring mode: Press the **<pH>** key or continue with three-point calibration.

Three-point calibration

11	Press the **<run/enter>** key. *Ct3* appears on the display.
12	Thoroughly rinse the electrode with distilled water.
13	If necessary, set the temperature of the third buffer solution by pressing **<▲> <▼>**.
14	Submerse the electrode in the third buffer solution.
15	Press the **<run/enter>** key. AR flashes on the display. The electrode voltage (mV) appears on the display. As soon as a stable value is recognized, *AR* disappears. The sensor symbol shows the electrode evaluation after the three-point calibration. The value of the slope (mV/pH) appears on the display.
16	Press the **<run/enter>** key. The value of the asymmetry (mV) appears on the display.
17	To return to the measuring mode: Press the **<pH>** key.

Note
You can also prematurely terminate the three-point calibration by pressing **<pH>**. The values of the two-point calibration for the slope and asymmetry are then stored.

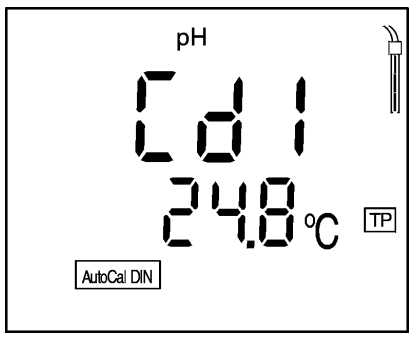
4.3.3 AutoCal DIN

Use two or three different DIN buffer solutions for this procedure in increasing or decreasing order.

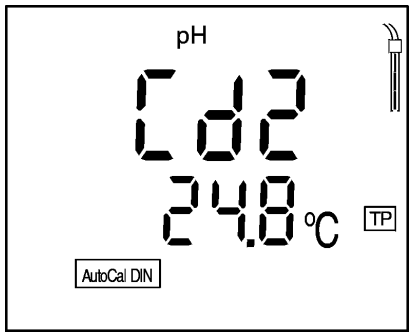
DIN buffer solution	pH
A	1.68
C	4.01
D	6.87
F	9.18

Note
Steps 2, 6 and 13 are not required if you use a temperature probe.

1	Press the **<CAL>** key repeatedly until *Cd1* and the *AutoCal DIN* function display appear.



2	If necessary, set the temperature of the buffer solution by pressing **<▲> <▼>**.
3	Submerse the pH electrode in the first buffer solution.
4	Press the **<run/enter>** key. *AR* flashes on the display. The electrode voltage (mV) appears on the display. As soon as a stable value is recognized, *Cd2* appears.



5	Thoroughly rinse the electrode with distilled water.
6	If necessary, set the temperature of the second buffer solution by pressing **<▲> <▼>**.
7	Submerse the electrode in the second buffer solution.
8	Press the **<run/enter>** key. AR flashes on the display. The electrode voltage (mV) appears on the display. As soon as a stable value is recognized, *AR* disappears. The sensor symbol shows the electrode evaluation after the two-point calibration. The value of the slope (mV/pH) appears on the display.
9	Press the **<run/enter>** key. The value of the asymmetry (mV) appears on the display.
10	To return to the measuring mode: Press the **<pH>** key or continue with the three-point calibration.

Three-point calibration

11	Press the **<run/enter>** key. *Cd3* appears on the display.
12	Thoroughly rinse the electrode with distilled water.
13	If necessary, set the temperature of the third buffer solution by pressing **<▲> <▼>**.
14	Submerse the electrode in the third buffer solution.
15	Press the **<run/enter>** key. *AR* flashes on the display. The electrode voltage (mV) appears on the display. As soon as a stable value is recognized, *AR* disappears. The sensor symbol shows the electrode evaluation after the three-point calibration. The value of the slope (mV/pH) appears on the display.
16	Press the **<run/enter>** key. The value of the asymmetry appears on the display (mV).
17	To return to the measuring mode: Press the **<pH>** key.

Note
You can also prematurely terminate the three-point calibration by pressing **<pH>**. The values of the two-point calibration for slope and asymmetry are then retained.

4.3.4 ConCal

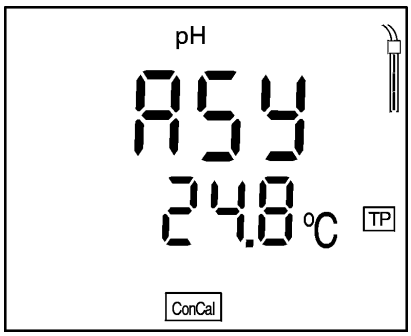
Two-point calibration

Use two buffer solutions for this procedure:

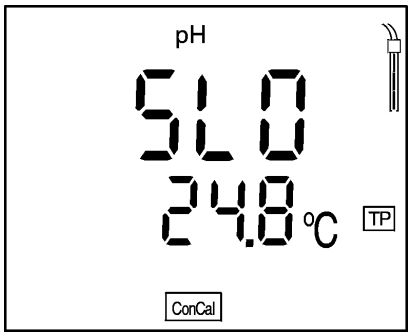
- pH 7.0 ± 0.5
- any other buffer solution

Note
Steps 2 and 9 are not required if you use a temperature probe.

1	Press the **<CAL>** key repeatedly until *ASY* and the *ConCal* function display appear.



2	If necessary, set the temperature of the buffer solution by pressing **<▲> <▼>**.
3	Submerse the pH electrode in the first buffer solution pH 7.0 ± 0.5.
4	Press the **<run/enter>** key. The measured pH value appears on the display.
5	Set the nominal pH value of the buffer solution (at the current temperature) by pressing the **<▲> <▼>** keys.
6	Press the **<run/enter>** key. The value of the asymmetry (mV) and the sensor symbol appear on the display.
7	Press the **<run/enter>** key. *SLO*(pe) appears on the display.



8	Thoroughly rinse the electrode with distilled water.
9	If necessary, set the temperature of the second buffer solution by pressing **<▲> <▼>**.
10	Submerse the electrode in the second buffer solution.
11	Press the **<run/enter>** key. The second measured pH value appears on the display.
12	Set the nominal pH value of the second buffer solution (at the current temperature).
13	Press the **<run/enter>** key. The value of the slope (mV/pH) appears on the display. The sensor symbol shows the evaluation of the electrode after the two-point calibration.
14	Press the **<run/enter>** key. The value of the asymmetry (mV) appears on the display again.
15	To return to the measuring mode: Press the **<pH>** key.

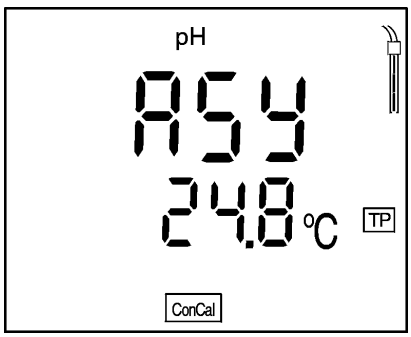
Single-point calibration

Use a buffer solution in the range pH = 7.0 ± 0.5 for this procedure.

Note
Only the electrode asymmetry is determined in single-point calibration. The slope of the last two-point calibration is retained.

Note
Step 2 is not required if you use a temperature probe. The TP message indicates an active temperature measurement.

1	Press the **<CAL>** key repeatedly until *ASY* and the *ConCal* function display appear.



2	Set the temperature of the buffer solution by pressing **<▲> <▼>**.
3	Submerse the pH electrode in the buffer solution.
4	Press the **<run/enter>** key. The measured pH value appears on the display.
5	Set the nominal pH value of the buffer solution (at the current temperature) by pressing the **<▲> <▼>** keys.
6	Press the **<run/enter>** key. The value of the asymmetry (mV) and the sensor symbol for the evaluation of the electrode appears on the display.
7	To return to the measuring mode: Press the **<pH>** key.

4.4 Storing

The pH meter has an internal data storage device. Up to 200 data records can be stored in it.
A complete data record consists of:

- Memory location
- Date
- Time
- Measured value
- Temperature
- Temperature measurement procedure
- I.D. number

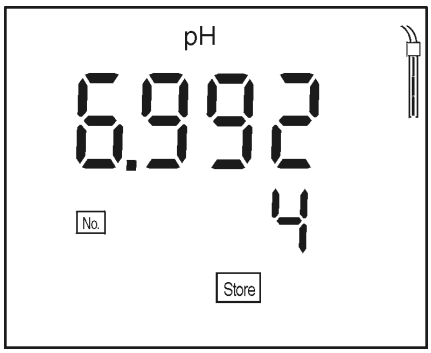
You can transmit measured values (data records) to the data storage in 2 ways:

- Manual storage
- Switching on the AutoStore function (Int 1).

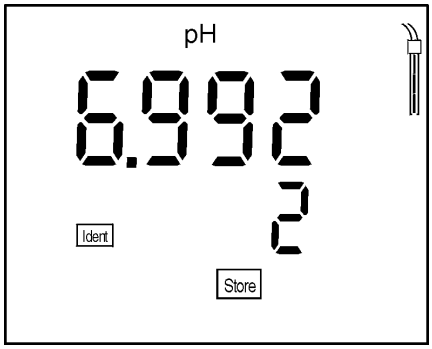
4.4.1 Manual storage

You can transmit a measured value to the data storage as follows:

1	Press the **<STO>** key. The current number of the next free memory location appears on the display.



2	Confirm with **<run/enter>**. The display changes to the input of the I.D. number.



3	Enter the required I.D. number (1 ... 999) by pressing **<▲> <▼>**.
4	Confirm with **<run/enter>**. The instrument changes to the measuring mode.

StoFull message

This message appears if all 200 memory locations are full.

You have the following options:

Store the current measured value. The oldest measured value (memory location 1) is overwritten by this	Press **<run/enter>**
Return to the measuring mode without storing	Press any key
Output the data storage	See section 4.4.3
Delete the data storage	See section 4.4.4

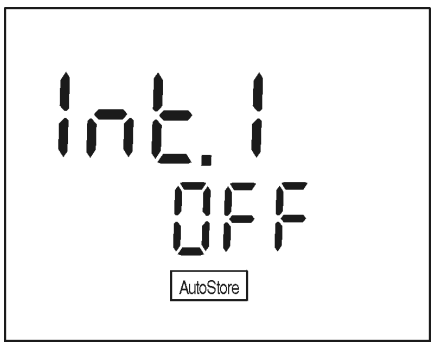
4.4.2 Switching on AutoStore (Int 1)

The storage interval (Int 1) determines the time interval between automatic storage processes.
After the time interval expires, the current data record is transmitted to the data storage and to the RS interface.

Setting the storage interval

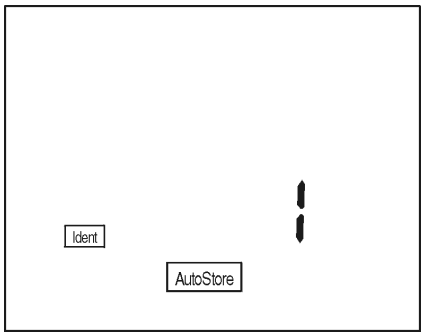
The storage interval (Int 1) is set to OFF in the factory. Thus, the *AutoStore* function is switched off.
To switch the function on, set up a time interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

1	Press and hold down the **<run/enter>** key.
2	Press the **<STO>** key. *Int.1* appears on the display.



3	Press the **<▲> <▼>** keys to set up the required time interval between storage processes.
4	Confirm with **<run/enter>**. The number of free memory locations appears on the display.

5	As soon as all 200 memory locations are full, the AutoStore function is terminated (Int 1 = OFF). If too few storage locations are available for your measurements: – backup the data storage (see 110) and – clear the data stored (see 113).
6	Confirm with **<run/enter>**. The prompt for the I.D. number appears on the display.



7	Press **<▲> <▼>** to set the required I.D. number.
8	Confirm with **<run/enter>**. The instrument changes to the pH measuring mode and starts the measuring and storage procedure. *AutoStore* flashes on the display.

Note

The *AutoStore* function is interrupted if you perform other functions, e.g. output data storage.
After completing the other function, the *AutoStore* function continues. However, as a result, gaps can occur in the recording of the measured values.

Switching off the AutoStore

Switch off the *AutoStore* function by:

- Setting the storage interval (Int 1) to OFF or
- Switch the pH meter off and on again.

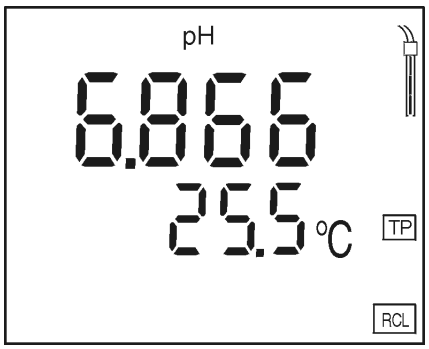
4.4.3 Outputting the data storage

The contents of the data storage can be output to the:

- display
- RS interface

Outputting to the display

1	Press the **<RCL>** key repeatedly until *Sto disp* appears on the display.
2	Press the **<run/enter>** key. A measured value appears on the display. The memory location of the data store appears for approx. 2 s. This is followed by the corresponding temperature.



You can perform the following activities:

Display further parameters of the data record (I.D. no., date, time, memory location)	Press **<run/enter>**
Advance one data record (memory location)	Press **<▲>**
Go back one data record (memory location)	Press **<▼>**

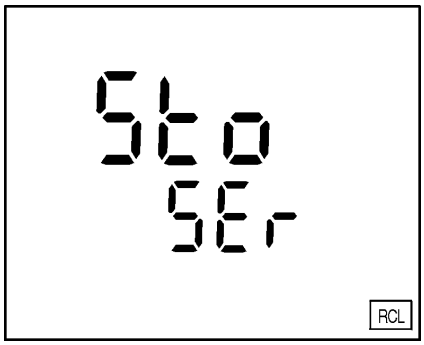
Note

If you want to find a specific parameter (e.g. date), proceed as follows:

1	Select the parameter (e.g. date) by pressing **<run/enter>**.
2	Press **<▲>** or **<▼>** repeatedly until the required date appears on the display. After approx. 2 s, the temperature of the displayed measured value appears.

Outputting to RS interface

1	Press the **<RCL>** key repeatedly until *Sto SEr* appears on the display.



2	Press the **<run/enter>** key. *Sto CAL* appears on the display. The calibration protocol is transmitted to the RS interface. Following the calibration protocol, the complete contents of the storage is transmitted to the RS interface.

Note
You can the cancel the transmission by pressing **<pH>** or **<run/enter>**.

Sample printout:

```
CALIBRATION PROTOCOL
 02.03.99     14:19
Device No.: 12345678
CALIBRATION pH
Cal Time: 01.03.99 / 15:20
Cal Interval:   7d
AutoCal DIN   Tauto
Buffer 1   1.679
Buffer 2   4.008 *
Buffer 3   6.865
Buffer 4   9.180 *
C1      174.1mV  25.0°C
C2     -133.3mV  25.0°C
S1     -59.4 mV/pH
ASY1   -   4 mV
Probe:     +++

No.    1:
 09.03.99       17:10
pH 10.01        25    °C
Tman         AR
Ident :  1

No.    2:
 09.03.99       17:11
pH 10.01        24,7  °C
Tauto         AR
Ident :  1

No.    3:
 09.03.99       17:12
  305 mV
Tauto
Ident :  13
```

The printout contains:

- calibration protocol
- storage contents

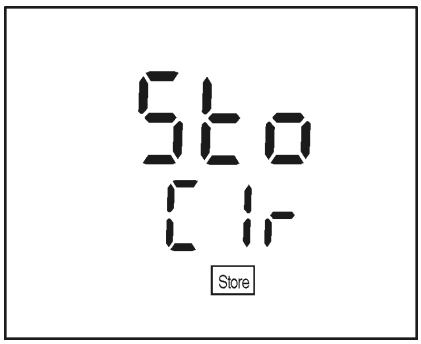
4.4.4 Clearing the storage

This function can erase the stored data records. 200 memory locations will then become available again.

Note
The *Clear store* function only appears if data records have already been stored in the storage. Otherwise, the pH meter automatically changes to the measuring mode.

In order to delete all the data records, proceed as follows:

1	Switch off the instrument.
2	Press and hold down the **<STO>** key.
3	Press the **<on/off>** key. The *display test* appears briefly on the display.



4	Confirm the clearing process by pressing **<run/ enter>**. Pressing any other key stops the clearing process and the data records remain in the storage.

Note
The calibration data remain in the storage and can be called up via the calibration protocol.

4.5 Data transmission

You can use the following options to transmit data:

- One of the following options:
  - The *AutoStore* function (108) is used to periodically (*Int 1* storage interval) save measured values internally and output them on the RS interface.
  - The *data transmission interval (Int 2)* function is used to periodically output measured values to a RS interface (see below).
- The *Output data store* function (110) is used to output calibration data and stored measured values to the RS interface.
- The analog recorder output (116) is used to output measured values as voltages.

4.5.1 Data transmission interval (Int 2)

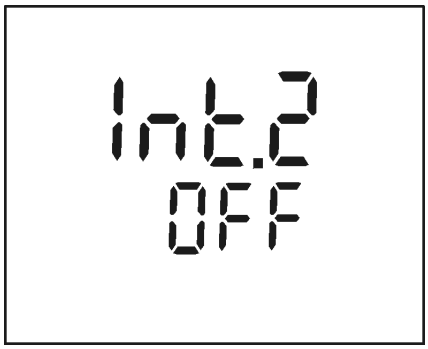
The interval for the data transmission (Int 2) is determined by the time interval between automatic data transmissions. After the time interval expires, the current data record is transmitted to the RS interface.

Note
The setting of the interval (Int 2) only has an effect when the storage interval (*AutoStore* function) is switched off.

Setting the *data transmission* interval

The interval is set to OFF in the factory.
To start the data transmission, set up an interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

1	Press and hold down the **<run/enter>** key.
2	Press the **<auto read>** key. *Int 2* appears on the display.



3	Press **<▲> <▼>** to set up the required time interval between storage processes.
4	Confirm with **<run/enter>**. The instrument changes automatically to the pH measuring mode.

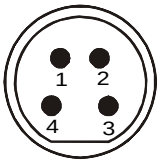
Note
If the *AutoStore* function is active, the data transmission is performed according to the setting of the storage interval (Int1). Set the storage interval (Int 1) to OFF to activate the *data transmission* interval (Int 2).

Note
You can also set the *data transmission* interval (Int 2) in the *Configuration* menu (see 118).

4.5.2 Recorder (analog output)

You can transmit the data to a recorder via the analog output. Connect the analog output to the recorder via the Z394 RS interface cable.
The data output switches automatically to *recorder output*.

Socket assignment



RS 232
REC

1 Free
2 Plug coding
3 Ground
4 Analog output
low impedance electrode signal
corresponds to 50 ... 62 mV/pH
(internal resistance < 5 Ohm)

Note
Activate the analog output by connecting 2 and 3.

4.5.3 PC/external printer (RS232 interface)

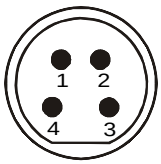
You can transmit data to a PC or an external printer via the RS232 interface.
Connect the RS interface to the instrument via the Z395 cable (PC) or Z391 cable (external printer).
The data output switches automatically to *RS232*.

Note
The RS232 interface is not galvanically isolated.
If it is connected to an earthed PC/printer, measurements cannot be made in earthed media as this would give incorrect results!

Set up the following transmission data on the PC/printer:

Baud rate	Selectable between: 1200, 2400, 4800, 9600
Handshake	RTS/CTS + Xon/Xoff
PC only:	
Parity	None
Data bits	8
Stop bits	1

Socket assignment



RS 232
REC

1 CTS
2 RxD
3 Ground
4 TxD

4.6 Configuration

You can adapt the pH meter to your individual requirements. To do this, the following parameters can be changed (the status on delivery is marked in bold):

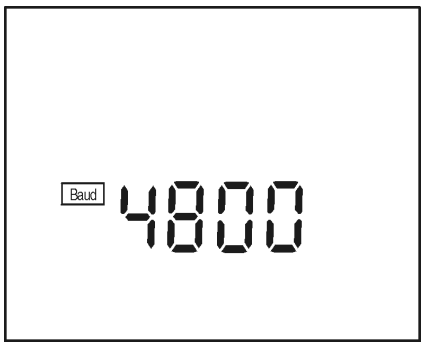
Baud rate	1200, 2400, **4800**, 9600
Data transmission interval (Int 2)	**OFF**, 5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min
Calibration interval (Int 3)	1 ... **7** ... 999 d
Temperature unit	**°C**, °F
Date/time	As required
Resolution of pH display	**0.01**, 0.001

Note

You can leave the configuration menu at any time. Parameters that have already been changed are stored.
To do this, press the **<pH>** key.

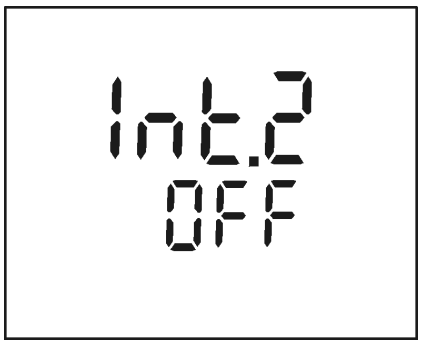
1	Switch off the instrument.
2	Press and hold down the **<pH>** key.
3	Press the **<on/off>** key. *The display test* appears briefly on the display. The instrument then switches automatically to the setting of the baud rate.

Baud rate



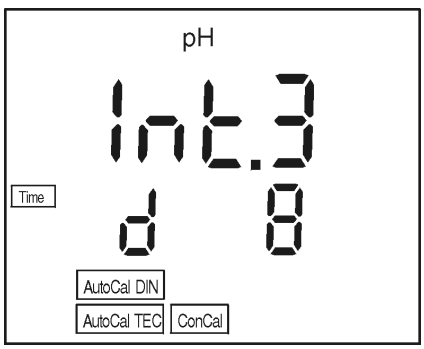
4	Set up the required baud rate by pressing **<▲> <▼>**.
5	Confirm with **<run/enter>**. *Int 2* appears on the display.

Data transmission interval



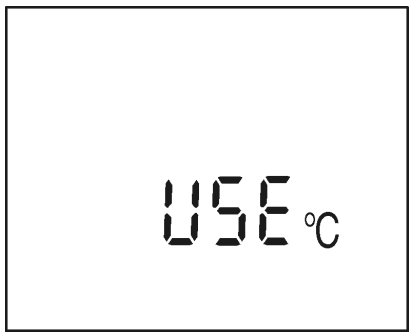
6	Set up the required time interval by pressing **<▲> <▼>**.
7	Confirm with **<run/enter>**. *Int 3* appears on the display.

Calibration interval



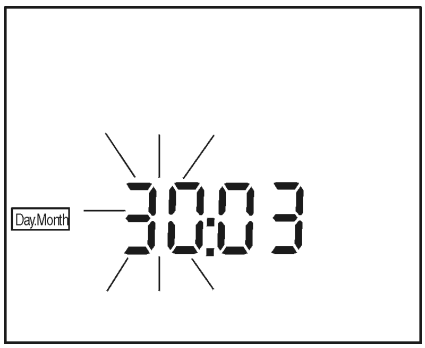
8	Set up the required time interval by pressing **<▲> <▼>**.
9	Confirm with **<run/enter>**. *USE °C* appears on the display.

Temperature unit



10	Change between °C and °F by pressing **<▲> <▼>**.
11	Confirm with **<run/enter>**. The date flashes on the display.

Date and time



12	Set today's date by pressing **<▲> <▼>**.
13	Confirm with **<run/enter>**. The date (month) flashes on the display.
14	Set the current month by pressing **<▲> <▼>**.
15	Confirm with **<run/enter>**. The year appears on the display.

16	Set the current year by pressing **<▲> <▼>**.
17	Confirm with **<run/enter>**. The hours flash on the display.
18	Set the current time by pressing **<▲> <▼>**.
19	Confirm with **<run/enter>**. The minutes flash on the screen.
20	Set the current time by pressing **<▲> <▼>**.
21	Confirm with **<run/enter>**. The instrument changes automatically to the pH measuring mode.

Adjusting the resolution

1	Press and hold down the **<run/enter>** key.
2	Press the **<pH>** key. The measured values appear with the higher resolution on the display, e.g. pH = 4.012.
3	Press the **<run/enter>** key and **<pH>** key again. The measured values with the lower resolution appear on the display, e.g. pH = 4.01.

4.7 Reset

You can reset (initialize) measuring and configuration parameters separately from one another.

Measuring parameters

The following measuring parameters (pH InI) are reset to the values they had on delivery:

Measuring mode	pH
Asymmetry	0 mV
Slope	-59.16 mV/pH
Calibration procedure	AutoCal TEC
Temperature, manual	25 °C
Resolution of pH display	0.01

Note
When the measuring parameters are reset, the calibration data are lost. After the parameters have been reset, calibrate!

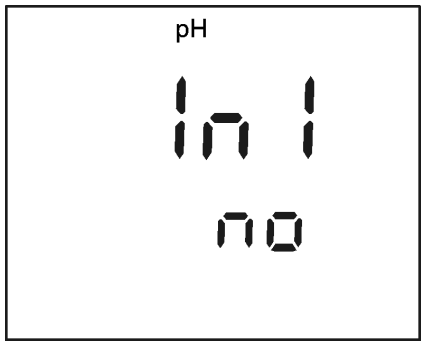
Configuration parameters

The following configuration parameters (InI) are reset to the values they had on delivery:

Baud rate	4800
Interval 1 (automatic storing)	OFF
Interval 2 (for data transmission)	OFF

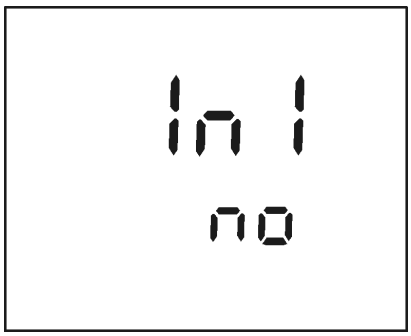
Resetting measuring parameters

1	Press and hold down the **<run/enter>** key.
2	Press the **<CAL>** key.



3	Use **<▲> <▼>** to toggle between no and yes. yes: reset measuring parameters. no: retain settings.
4	Confirm with **<run/enter>**. The instrument changes to the configuration parameters.

Resetting configuration parameters



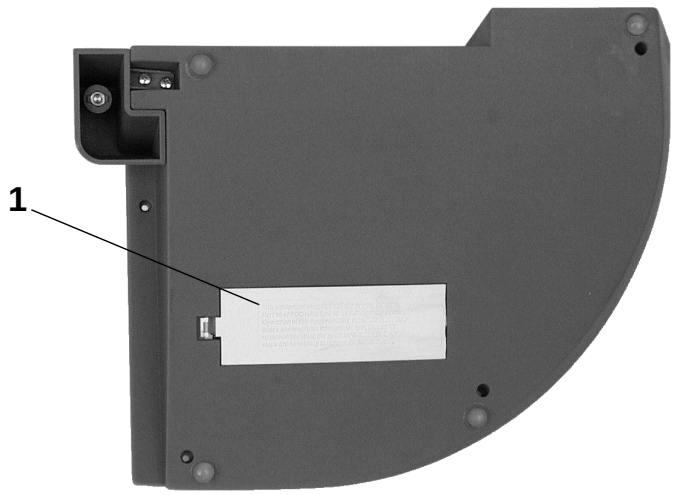
5	Toggle between no and yes by pressing **<▲> <▼>**. yes: reset configuration parameters. no: retain settings.
6	Confirm with **<run/enter>**. The instrument changes automatically to the pH measuring mode.

5 Maintenance, cleaning, disposal

5.1 Maintenance

The measuring instrument is almost maintenance-free. The only maintenance task is replacing the batteries:

1	Open the battery compartment (1) on the underside of the instrument.
2	Remove the batteries from the battery compartment.
3	Insert four new batteries (Type Mignon AA) into the battery compartment.
4	Close the battery compartment (1). The date (day) flashes on the display.
5	Set up date/time according chapter 3 COMMISSIONING.



Caution

Make sure that the poles of the batteries are the right way round. The ± signs in the battery compartment must correspond to the ± signs on the batteries.
Only use leakproof alkaline manganese batteries.

Note

See the relevant operating manual of the electrode for instructions on maintenance.

5.2 Cleaning

Occasionally wipe the outside of the measuring instrument with a damp, lint-free cloth. Disinfect the housing with isopropanol as required.

Caution

The housing is made of synthetic material (ABS). Thus, avoid contact with acetone or similar detergents that contain solvents. Remove any splashes immediately.

5.3 Disposal

Packing

The measuring instrument is sent out in a protective transport packing.
We recommend: Keep the packing material. It protects the instrument against damage during transport.

Batteries

This note refers to the battery regulation that applies in the Federal Republic of Germany. We would ask end-consumers in other countries to follow their local statutory provisions.

Note

In compliance with §14 of the BATTERY REGULATION, we would like to point out that this instrument contains batteries. Batteries that have been removed must only be disposed of at the recycling facility set up for this purpose or via the retail outlet.
It is illegal to dispose of them in household refuse.

Measuring instrument

Dispose of the measuring instrument as electronic waste at an appropriate collection point. It is illegal to dispose of them in household refuse.

6 What to do if...

Error message, OFL

Cause	Remedy
pH electrode:	
– Not connected	– Connect electrode
– Air bubbles in front of the diaphragm	– Remove air bubbles
– Air in the diaphragm	– Extract air or moisten diaphragm
– Cable broken	– Replace electrode
– Gel electrolyte dried out	– Replace electrode

Error message, E3

Cause	Remedy
pH electrode:	
– Diaphragm contaminated	– Clean diaphragm
– Membrane contaminated	– Clean membrane
– Moisture in the plug	– Dry plug
– Electrolyte obsolete	– Replace electrode
– Electrode obsolete	– Replace electrode
– Electrode broken	– Replace electrode
Measuring instrument:	
– Incorrect calibration procedure	– Select correct procedure
– Incorrect solution temperature (without temperature probe)	– Set up correct temperature
– Socket damp	– Dry socket

Buffer solutions:	
– Incorrect buffer solutions	– Change calibration procedure
– Buffer solutions too old	– Only use once. Note the shelf life
– Buffer solutions depleted	– Change solutions

No stable measured value

Cause	**Remedy**
pH electrode:	
– Diaphragm contaminated	– Clean diaphragm
– Membrane contaminated	– Clean membrane

Sample:	
– pH value not stable	– Measure with air excluded if necessary
– Temperature not stable	– Adjust temperature if necessary

Electrode + sample:	
– Conductivity too low	– Use suitable electrode
– Temperature too high	– Use suitable electrode
– Organic liquids	– Use suitable electrode

Sensor symbol flashes

Cause	**Remedy**
– Calibrating interval expired	– Newly calibrate measuring system

LoBat display

Cause	Remedy
– Batteries almost depleted	– Replace batteries (see section 5.1 MAINTENANCE)

to display

Cause	Remedy
– Timeout of the interface	– Checkout connected instrument

Obviously incorrect measured values

Cause	Remedy
– pH electrode unsuitable	– Use suitable electrode
– Temperature difference between buffer and sample too large	– Adjust temperature of buffers or samples
– Measuring procedure not suitable	– Follow special procedure

Instrument does not react to keystroke

Cause	Remedy
– Operating state undefined or EMC electric stress unallowed	– Processor reset: Press the **<auto read>** key and switch on instrument

StoFul message

Cause	Remedy
– All 200 memory locations are full	– Output data store and clear data store

7 Lists

This chapter provides additional information and orientation aids.

Abbreviations The list of abbreviations explains abbreviations that appear on the display or when dealing with the instrument.

Specialist terms The glossary briefly explains the meaning of the specialist terms. However, terms that should already be familiar to the target group are not described here.

Index The index helps you find the topics that you are looking for.

Abbreviations

AR	AutoRead (drift control)
ARng	Automatic range switching Measuring instrument measures with highest resolution
ASY	Asymmetry
AutoCal DIN	Automatic calibration with DIN buffer solutions
AutoCal TEC	Automatic calibration with Technical buffer solutions
Cal	Calibration
Cd...	Calibration with DIN buffer solutions (acc. to DIN 19 266)
ConCal	Conventional one/two point calibration
Ct...	Calibration with Technical buffer solutions
disp	Display Displays the data storage on the screen
E3	Error message (see chapter 6 WHAT TO DO IF...)
InI	Initialization Resets individual basic functions to the status they had on delivery
LoBat	Low Battery Batteries are almost empty
mV	Voltage unit
mV/pH	Unit of the electrode slope
OFL	Overflow Display range exceeded
pH	pH value

RCL	Recall memory dump
S	Slope
SELV	Safety Extra Low Voltage
SEr	Serial interface Output of the data storage on the RS 232 or on the internal printer
SLO	Slope Slope setting on calibration
Sto	Store Memory
TP	Temperature probe Temperature measurement active
U_{ASY}	Asymmetry potential
°C	Temperature unit, °Celsius
°F	Temperature unit, Fahrenheit

Glossary

Asymmetry Zero point of a pH electrode.

Resolution Number of decimal places that appear for a measured value.

AutoRead Monitors the electrode drift and releases the measured value only after the stability criterion has been reached. In this way, this procedure ensures the highest degree of precision and reproducibility.

Baud rate Transmission rate in bits/s.

Diaphragm Contact point between the reference electrolytic solution and the sample.

Drift control See AUTOREAD.

Test sample Sample to be measured (can be liquid or solid).

Test solution Stable solution with a precisely known Redox voltage.

Buffer solution Stable solution with a precisely known pH value.

Redox voltage Potentiometric quantity.

Slope Specifies the voltage change per pH unit.

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