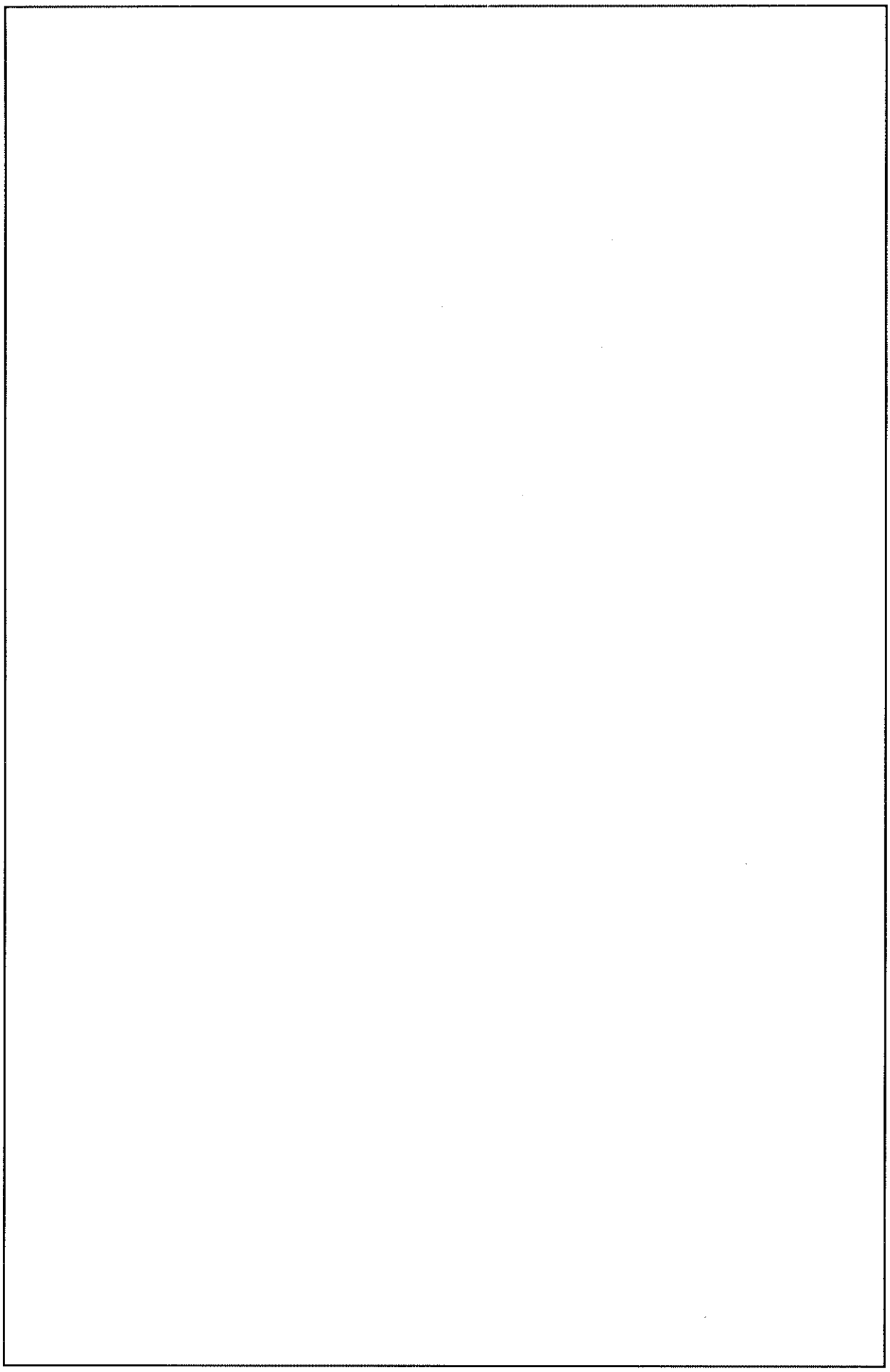
USER'S MANUAL

Microprocessor controlled high performance pH and mV meter

pH 3000

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BA pH 3000



Important hints for the user

These notes must be read before the instrument is put into service!

This instrument has been built and tested according to the German safety regulations for electronic test instruments as detailed in DIN 0411, part 1, and left the factory in a technically and operationally perfect condition.
In order to maintain this condition and guarantee safe operation the user must observe the references and warning statements contained in this manual.

1. The instrument is constructed according to safety class II

2. The instrument is designed for use within an enclosed space. Over and above this it can be subjected to temperatures between -10° C and +5° C without impairing its performance.

3. Before switching on the instrument, check that the mains voltage selected matches the mains supply volts.

4. Caution: Opening any covers or the removal of any parts, except where removable by hand, expose live parts when the instrument is connected to the mains supply! Connection points can also be live!

   Remove the mains before any adjustment, maintenance, repair or exchange of parts is carried out.

   Adjustment, maintenance or repair of live parts should be avoided wherever possible. If such work is unavoidable then it must be carried out by qualified specialists who are aware of the dangers involved!

5. Some capacitors in the instrument keep their charge, even after the instrument is switched off.

6. Only fuses of the designated type and nominal amperage should be used as replacements. Short circuiting or patching the fuse holder is forbidden.

7. If it is obvious that the instrument no longer conforms to the safety regulations then it must be put out of operation and secured against inadvertent use.

The instrument no longer confirms to the safety regulations when

- The instrument has been visually damaged
- The instrument no longer functions
- The instrument was stored for a long period under unsuitable conditions
- The instrument was subjected to bad transport conditions

In case of doubt send the instrument back to the manufacturer (WTW) for repair or maintenance.

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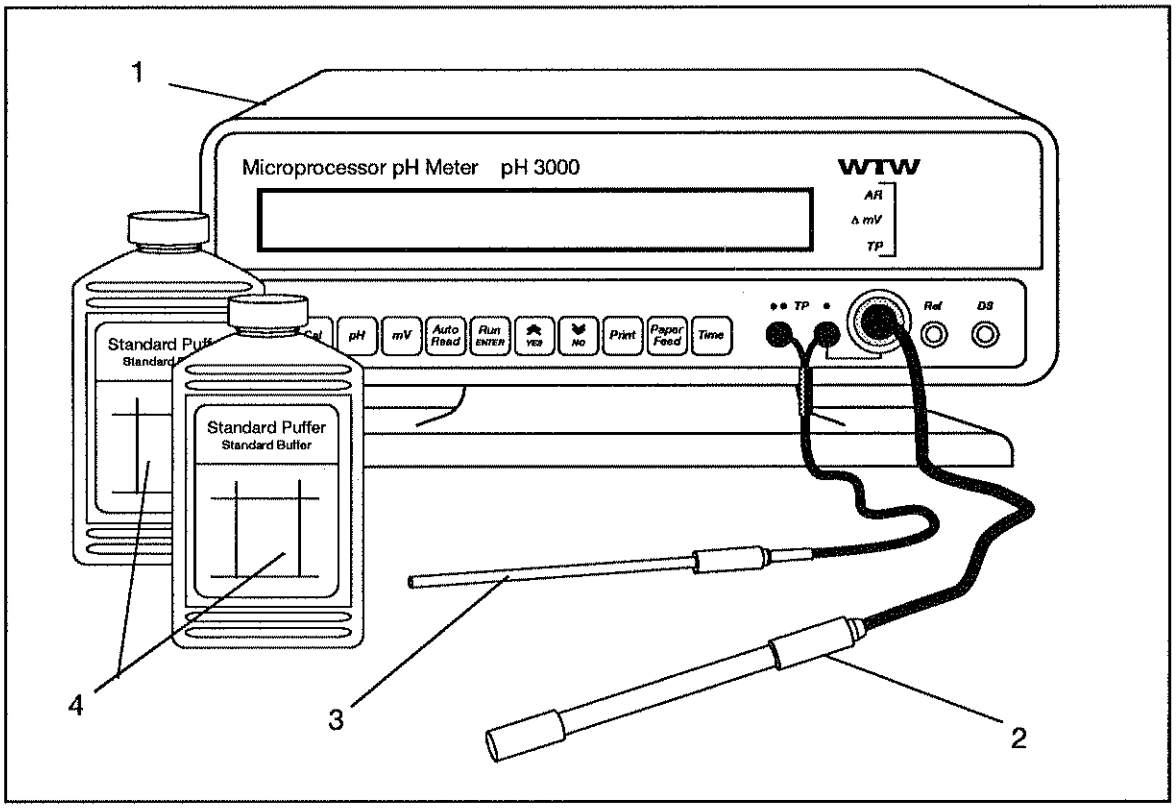
User's instructions for the pH combined electrode E 56 55

Technical specifications of the temperature probe TFK 150 57

User's Manual for the pH 3000

Thank you for choosing the pH 3000; a highly developed microprocessor-controlled pH meter that will satisfy all your requirements. This manual provides an overview of the many functions of the instrument and supports the user with detailed information. The many diagrams and illustrations describe the stages of operation clearly but the setting up and measured values shown are obviously only examples. Our technical customer advisory service is available for general questions about pH measuring techniques and the calibration process described. We will gladly send the application reports described and our pH primer on request.

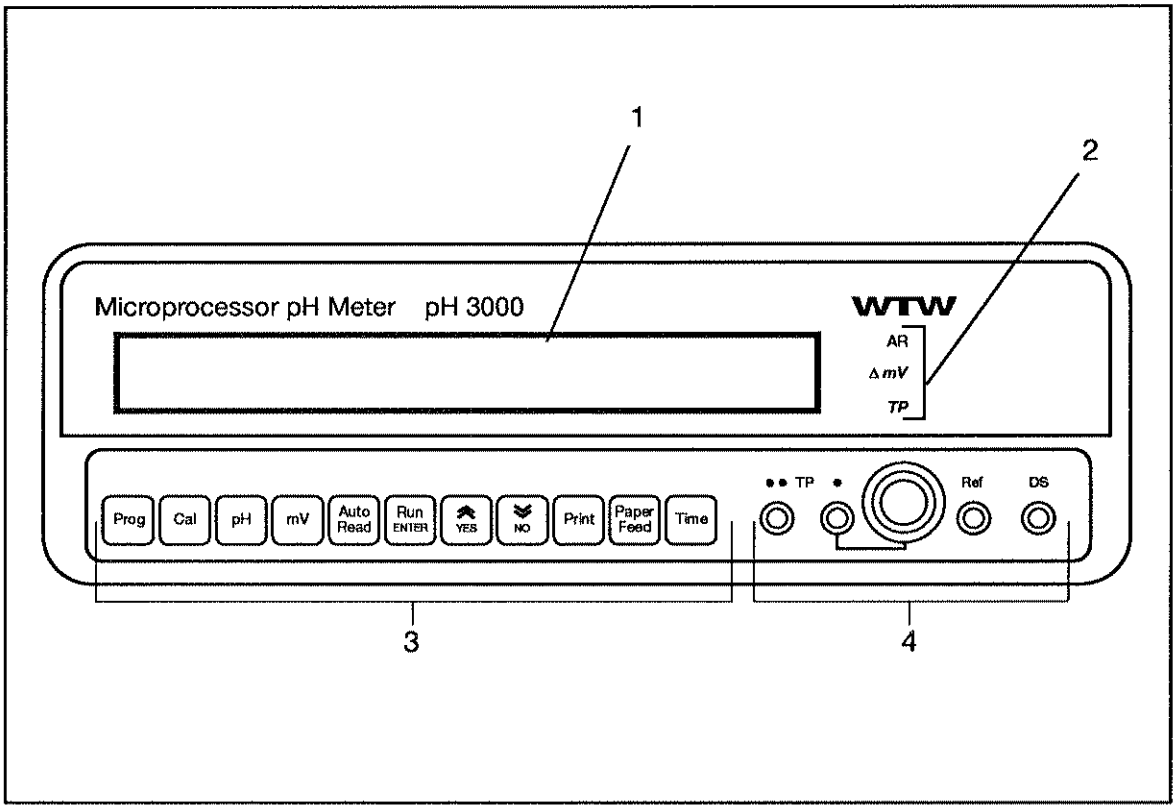
Recommended basic equipment for pH measurement



1 pH meter pH 3000
2 pH laboratory electrode
3 Temperature probe
4 At least two standard buffer solutions

Displays, keys and connections

Front view



1 Multiple display: displays values, user instructions, data (e.g. time)

2 Status display

AR	(Auto Read):	auto read
ΔmV		mV measurement against a shift potential
TP		ID of the temperature probe connected

3 Foil keys

Scroll mode: Depress the key so long until the required function is set.

Keys with red lettering are multifunctional keys

Prog : second function of the keys *Cal* *pH* *mV* *Print* *Time*

Keys with gold lettering are calibrating and measurement keys

Cal : select calibration procedure (scroll mode)

Prog Cal	:	compile the buffer set
pH	:	measure the pH value
Prog pH	:	query the electrode data
mV	:	measure the electrode voltage e.g. redox voltage
Prog mV	:	set up the shift potential
Auto Read	:	switch auto read on or off

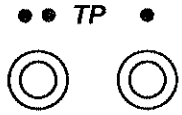
Keys with beige lettering are adjusting and acknowledge keys

Run ENTER	:	start measurement, acknowledge inputs
^^ YES	:	set the higher numerical values (scroll mode) switch on the printer functions
vv NO	:	set the lower numerical values (scroll mode) switch off the printer functions

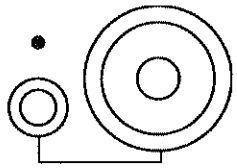
Keys with green lettering are printer and time keys

Print	:	print the measured values
Prog Print	:	set the printer functions
Paper Feed	:	initiate a line feed
Time	:	display date, time and print interval (scroll mode)
Prog Time	:	set the date, time and print interval (scroll mode)

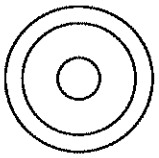
4. Connections



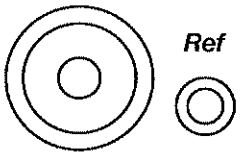
: temperature probe with two banana plugs
(TFK 150 or Pt 1000)
plug in banana plugs as required



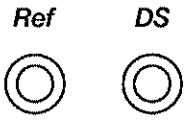
: combined electrode with integrated temperature probe
with banana plug and DIN plug



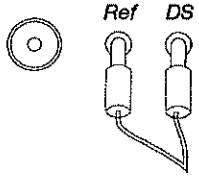
: combined electrode, e.g. pH or redox electrode
DIN plug



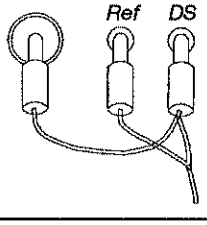
: double electrode, e.g. ion selective electrode
DIN plug: measuring electrode
banana plug: reference electrode



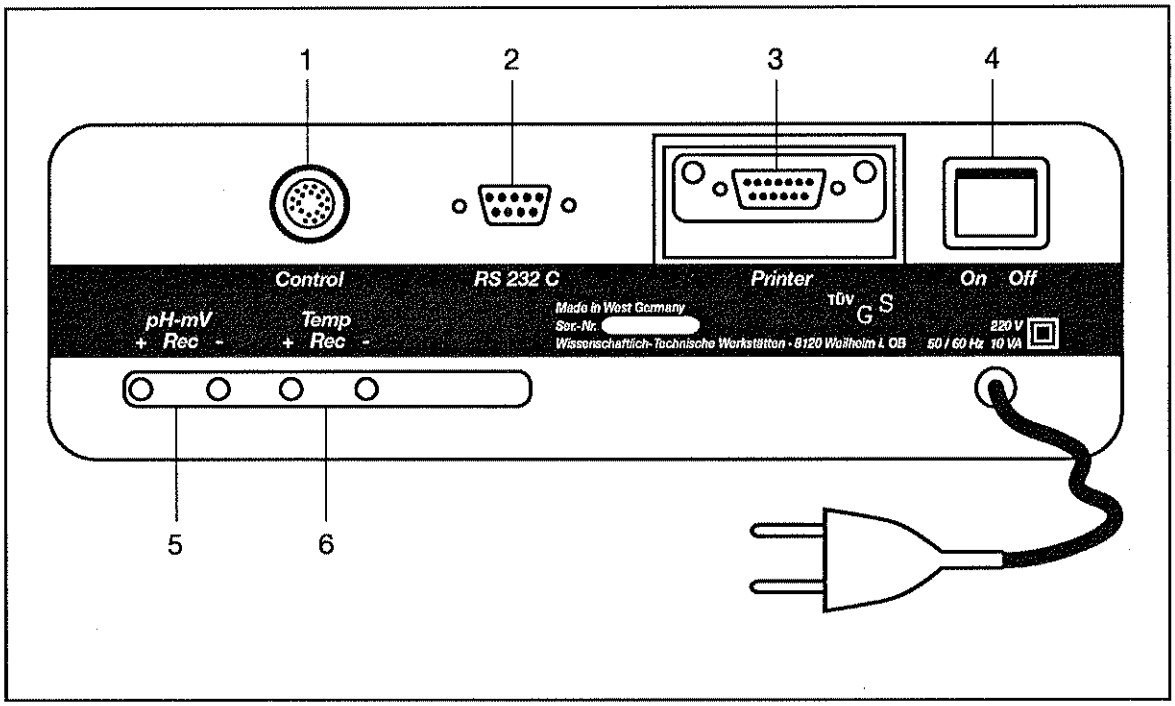
: double platinum electrode for Dead Stop Titrations
plug in the banana plugs in the Ref. or DS sockets as required



short circuit the DS socket with the DIN socket (inner)

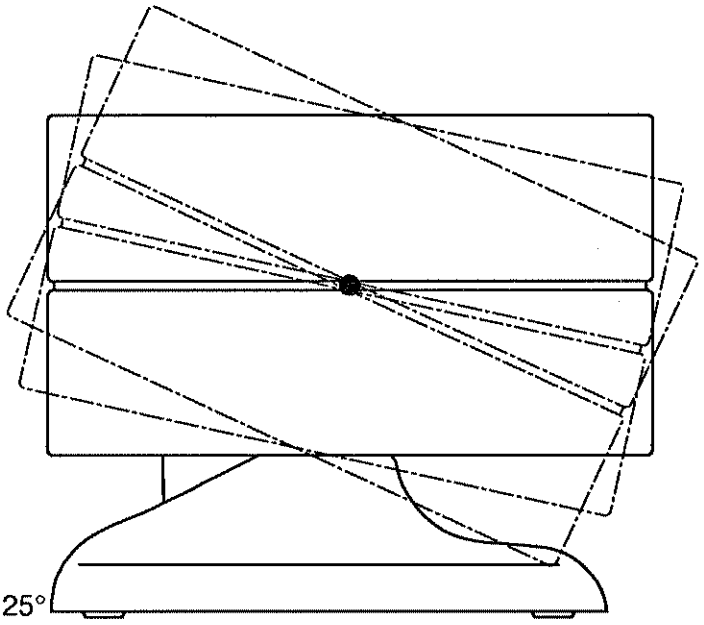


Rear connections



1 Control port for the Multiplex 3000/pMX
2 RS 232 serial interface for a computer or printer
3 Printer interface for the P 500
4 Mains switch
5 pH/mV voltage output, ±2V, for a pen recorder
6 Temp voltage output, ±2V, for a pen recorder

Adjustable viewing angle



Adjustable in steps of 0°, 12.5° and 25°

Putting into operation

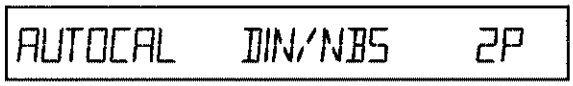
- Connect the instrument to the mains supply.
- Connect the electrode and the temperature probe.
- Switch on the instrument with the ON/OFF switch.

Proposals for the familiarisation with the instrument

Initial set-up: Depress [Prog] key and switch on simultaneously.

Release the [Prog] key at the display test.

- Wait for the display test until an acoustic signal sounds.
- The pH 3000 is now ready for operation and is set to the last mode used or is set to the initial set-up mode.



Calibration and pH measurement

Calibration with two standard buffer solutions

Depress **Cal** bis `AUTOCAL DIN/NBS 2P` appears — AR / ΔmV / TP

Use two buffer solutions which conform to DIN 19266, e.g. pH = 6.865 (25°C) and pH = 4.006 (25°C).
The data of five standard buffer solutions are stored in the instrument; pH = 1.679 (25°C), pH = 4.006 (25°C), pH = 6.865 (25°C), pH = 9.180 (25°C) and pH = 12.454 (25°C).

Run ENTER — `TEMP 1 24.5 °C` — AR / ΔmV / TP

immerse the pH electrode and temperature probe in a buffer solution

Run ENTER — `BUFFER 1 DIN/NBS`

Acknowledge temp. value

Run ENTER — `2 mV 24.5 °C` — AR / ΔmV / TP

Start measurement — electrode potential — temperature — „AR" flashes; wait for signal

`TEMP 2 24.5 °C` — AR / ΔmV / TP

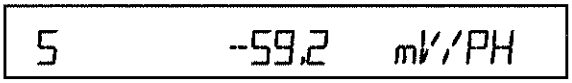
rinse the pH electrode and immerse in the second buffer solution

Run ENTER — `BUFFER 2 DIN/NBS`

Acknowledge temp. value

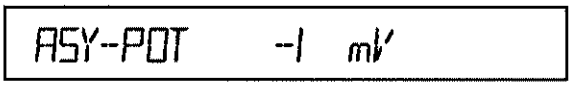
Run ENTER — `170 mV 24.5 °C` — AR / ΔmV / TP

Start measurement — electrode potential — temperature — AR flashes; wait for signal



slope at 25°C

Run ENTER



asymmetry voltage

The calibration is now ended and the respective pH electrode data are stored.

Measurement

---

pH



Rinse the pH electrode and immerse in the sample

wait until the value stabilises

High resolution pH measurement

pH

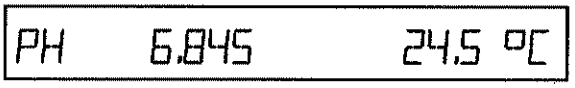


pH 0.01 resolution

pH

change over

pH



pH 0.001 resolution

Auto Read

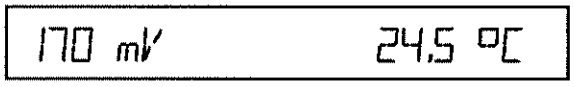
The stability of the electrode signal is judged by the pH 3000 during calibration and optionally during measurement.

Auto Read during calibration

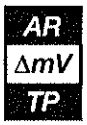
The instrument activates the auto read



Start calibration



measured value released



AR flashes, the auto read is working



end measurement manually

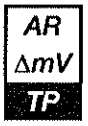
or



await the acoustic signal (drift < 0,1 mV/30sec)



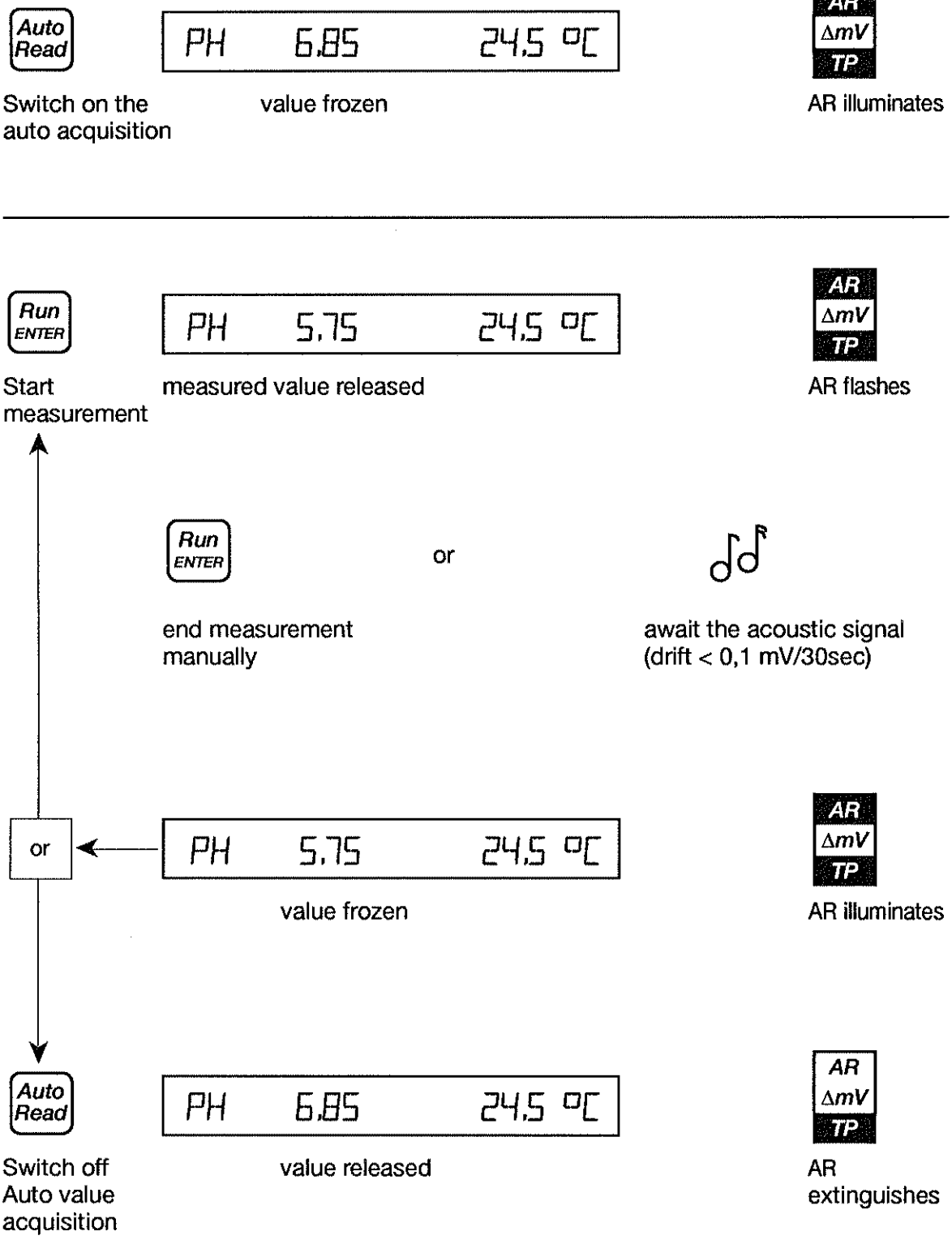
result stored, continue with the calibration



AR extinguishes

---

pH measurement with automatic acquisition

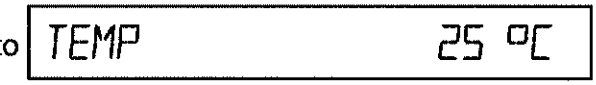


Measurement period: min. 30 seconds,max. 10 minutes
Max. drift: 0.1 mV/30 sec.
Error message E2: Abort during unstable values

Working without a temperature probe

Calibration without a temperature probe

Calibration up to



manual temp. setting,
resolution 1°C



determine the
temperature of
buffer solution

AR
ΔmV
TP

YES

NO

set temperature
manually

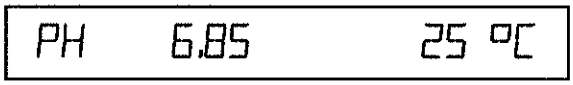
Run
ENTER

continue with the
calibration procedure

---

pH measurement without a temperature probe

pH



pH value and manual
temp. setting,
resolution 1°C



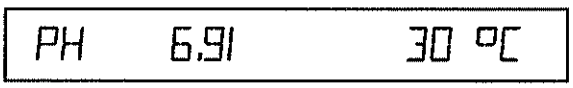
determine the
temperature of
buffer solution

AR
ΔmV
TP

YES

NO

set temperature manually



Temperature compensation

The slope of the pH measuring electrode and the pH value of the measuring and buffer solutions are temperature dependent.

The temperature compensation allows for the influence of the temperature on the slope of the pH electrode.

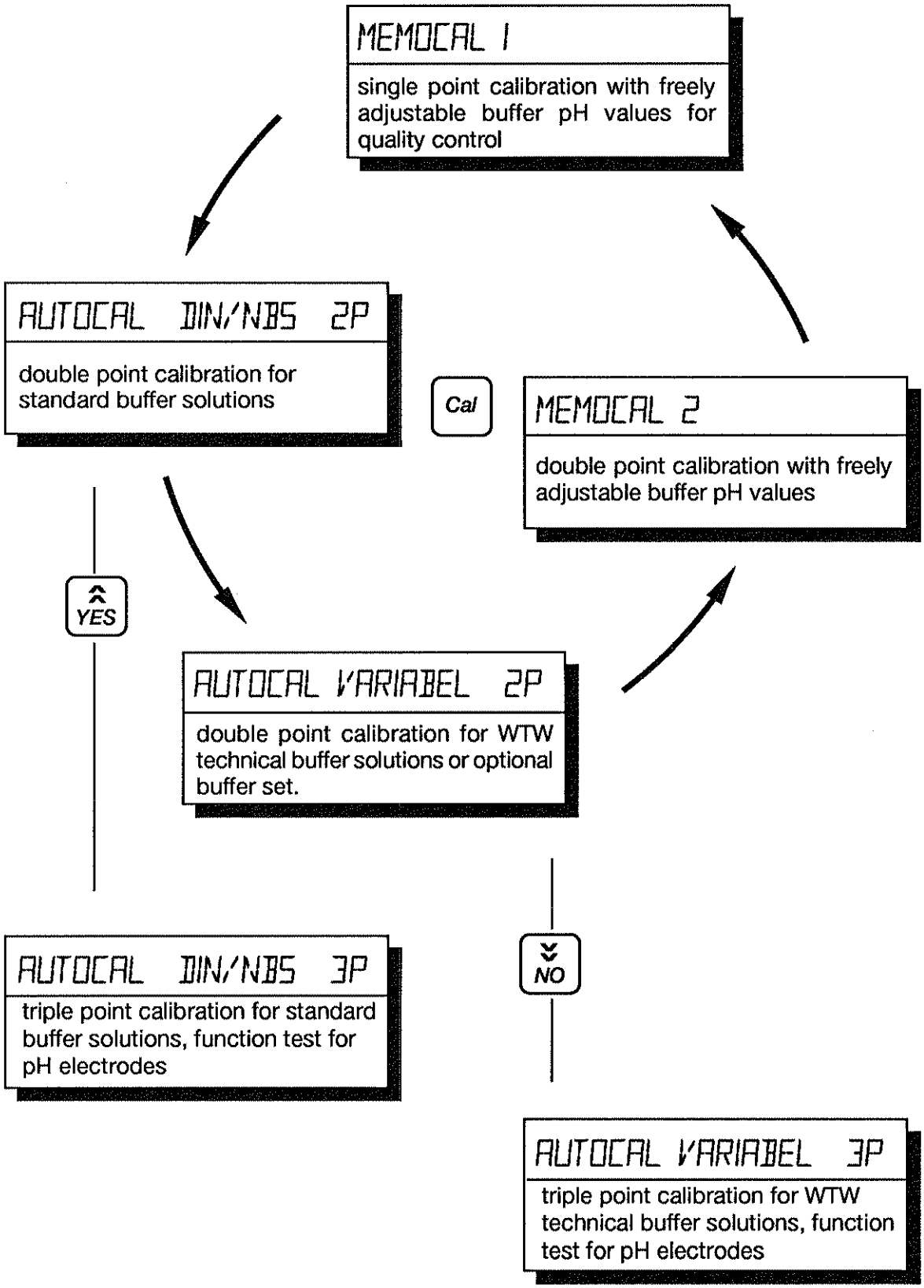
The pH value of measuring samples is displayed at the temperature of measuring solution in conformity with DIN 38404.

The temperature dependent pH values of the 27 usable buffer solutions are stored for use with the AUTOCal procedure.

The instrument requires the temperature of the buffer solution and the sample solution when calibrating or measuring the pH. The temperature should be entered manually or acquired with a temperature probe.

Further calibration functions

Overwiew of the calibration functions



Calibration and pH electrode test with three standard solutions (CalControl)

Cal to

AUTOCAL DIN/NBS 2P

YES

AUTOCAL DIN/NBS 3P

Use three buffer solutions; pH 4.006 (25°), pH 6.865 (25°) and pH 9.180 (25°)

Run ENTER

TEMP 1 24.5 °C

AR ΔmV TP

immerse the pH electrode and the temperature probe in the buffer solution

Run ENTER

BUFFER 1 DIN/NBS

Acknowledge temp. value

Run ENTER

2 mV 24.5 °C

AR ΔmV TP

Start measurement

electrode potential

temperature

AR flashes wait for the signal

TEMP 2 24.5 °C

AR ΔmV TP

rinse the pH electrode and temperature probe and immerse in the second buffer solution

Run ENTER

BUFFER 2 DIN/NBS

Acknowledge temp. value

170 mV 24.5 °C

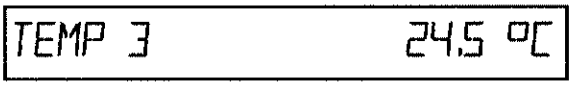
AR ΔmV TP

Start

electrode potential

temperature

AR flashes, wait for the signal



AR
ΔmV
TP

rinse the pH electrode and the temperature probe and immerse in the third buffer solution

Run ENTER



Acknowledge temp. value

Run ENTER



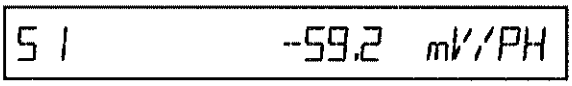
AR
ΔmV
TP

Start

electrode potential

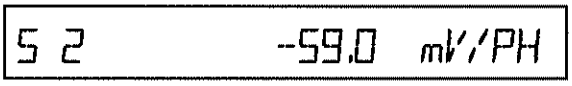
temperature

AR flashes, wait for the signal



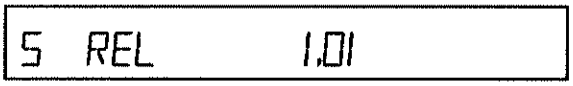
slope between the pH 4.006 and pH 6.865 buffer solutions at 25°C

Run ENTER



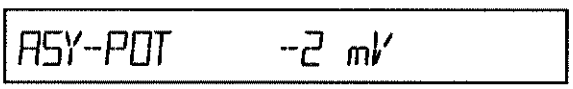
slope between the pH 6.685 and pH 9.180 buffer solutions at 25°C

Run ENTER



relative slope display

Run ENTER



asymmetry potential

The calibration is now finished and the corresponding data are stored.
For general hints about the procedure see Application Report, No. 63023/pH

Calibration with two freely selected trade buffer solutions (Variable AutoCal)

Cal to AUTOCAL VARIABEL 2P

Use two WTW technical buffer solutions,e.g. pH 7.00 (25°C) and pH 4.01 (25°C)

In the initial set-up the data from four WTW technical buffer solutions are stored in the instrument; pH 2.00 (25°C), pH 4.01 (25°C), pH 7.00 (25°C) and pH 10.00 (25°C). Buffer sets can also be compiled additionally using this calibration procedure (see page 28, Compilation of a Set of Buffers).

Run ENTER — TEMP 1 24,5 °C — AR ΔmV TP

immerse the pH electrode and temperature probe in a buffer solution

Run ENTER — BUFFER 1 VARIABEL

Acknowledge temp. value

Run ENTER — 2 mV 24,5 °C — AR ΔmV TP

Start measurement — electrode potential — temperature — AR flashes, wait for the signal

TEMP 2 24,5 °C — AR ΔmV TP

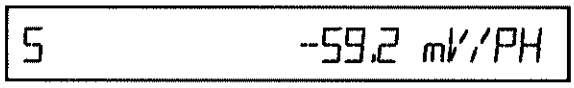
rinse the pH electrode and the temperature probe and immerse in the second buffer solution

Run ENTER — BUFFER 2 VARIABEL

Acknowledge temp. value

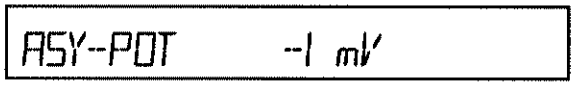
Run ENTER — 170 mV 24,5 °C — AR ΔmV TP

Start measurement — electrode potential — temperature — AR flashes, wait for the signal



slope at 25°C

Run ENTER



asymmetry potential

The calibration is ended and the corresponding data are stored.

Calibration and pH electrode test with three WTW technical buffer solutions (CalControl)

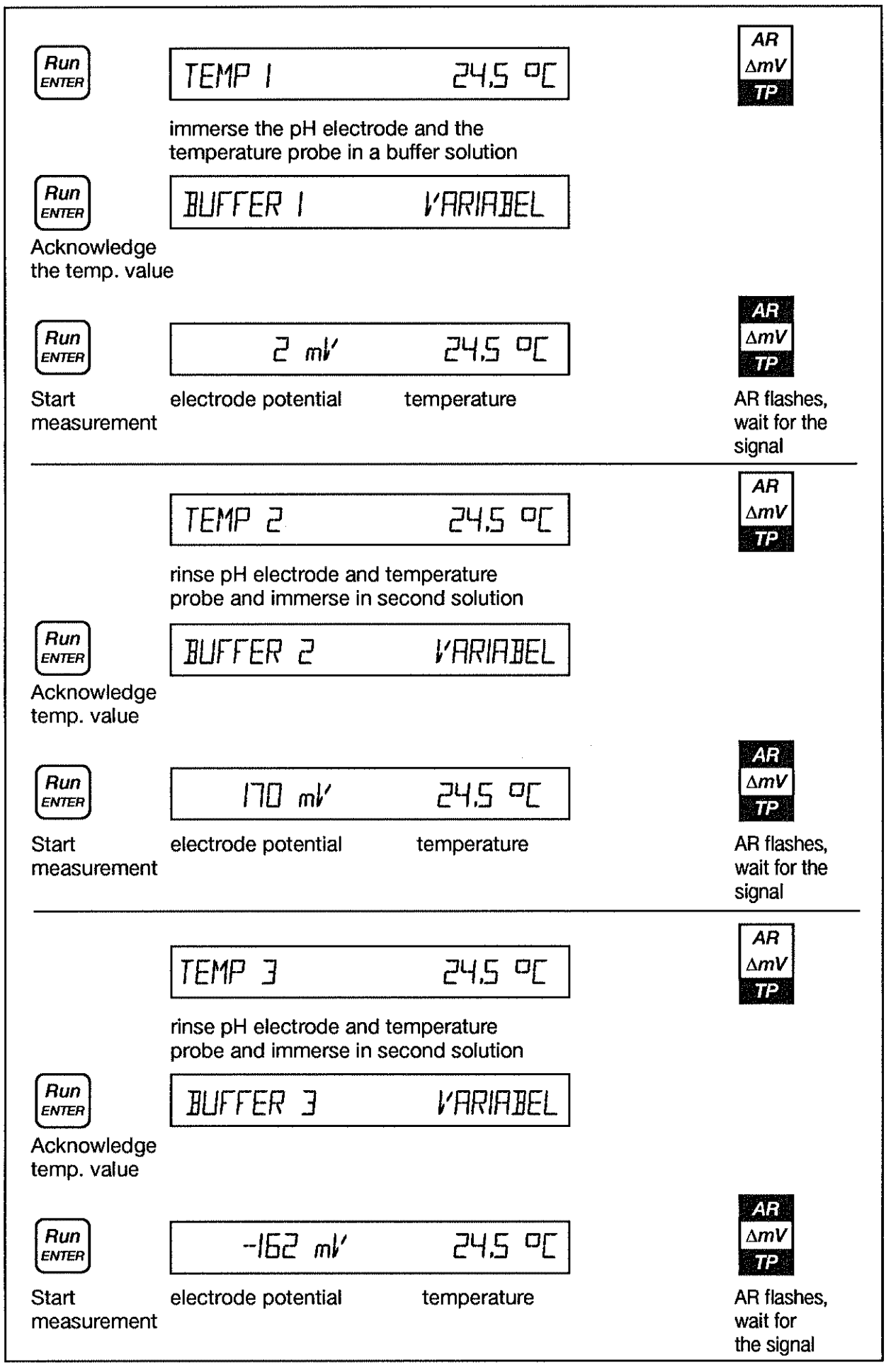
Cal

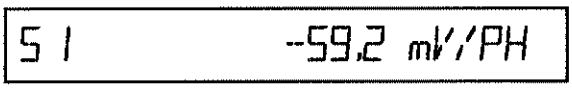


YES



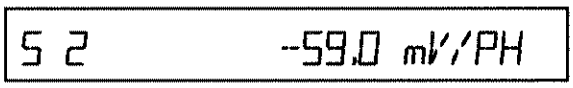
Use three WTW technical buffer solutions;
pH 4.01 (25°C), pH 7.00 (25°C) and pH 10.00 (25°C).


Run ENTER
TEMP 1 24.5 °C
AR
ΔmV
TP
immerse the pH electrode and the temperature probe in a buffer solution
Run ENTER
BUFFER 1 VARIABEL
Acknowledge the temp. value
Run ENTER
2 mV 24.5 °C
AR
ΔmV
TP
Start measurement
electrode potential
temperature
AR flashes, wait for the signal
TEMP 2 24.5 °C
AR
ΔmV
TP
rinse pH electrode and temperature probe and immerse in second solution
Run ENTER
BUFFER 2 VARIABEL
Acknowledge temp. value
Run ENTER
170 mV 24.5 °C
AR
ΔmV
TP
Start measurement
electrode potential
temperature
AR flashes, wait for the signal
TEMP 3 24.5 °C
AR
ΔmV
TP
rinse pH electrode and temperature probe and immerse in second solution
Run ENTER
BUFFER 3 VARIABEL
Acknowledge temp. value
Run ENTER
-162 mV 24.5 °C
AR
ΔmV
TP
Start measurement
electrode potential
temperature
AR flashes, wait for the signal



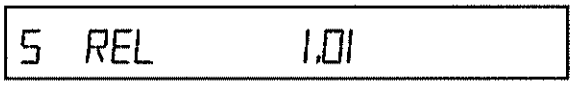
Slope between buffer solutions
pH 4.01 and pH 7.00 at 25°C

Run ENTER



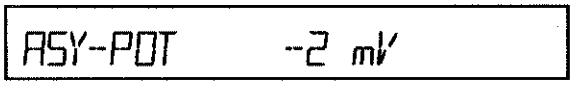
Slope between buffer solutions
pH 7.00 and pH 10.00 at 25°C

Run ENTER



display of the relative slope

Run ENTER



asymmetry potential

The calibration is ended and the corresponding data are stored.

Calibration with two freely set buffer pH values (MemoCal 2 point)

Cal



In the initial set-up the instrument proposes the values pH 7.00 (25°C) and pH 4.01 (25°C). The values can be set with the „UP" and „DOWN" keys to the pH values of any optional buffer solutions.

Run ENTER



immerse the pH electrode and temperature probe in the first buffer solution, wait for a stable display and the read off

Run ENTER



YES NO

set the pH value of the buffer solution according to the temperature measured

Run ENTER



AR ΔmV TP

Start measurement | electrode potential | temperature | AR flashes, wait for the signal

---



rinse the pH electrode and the temperature probe and immerse in the second buffer solution, wait for a stable display and read off.

Run ENTER



YES NO

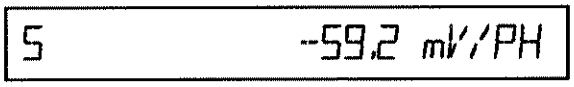
set the pH value of the buffer solution according to the temperature measured

Run ENTER



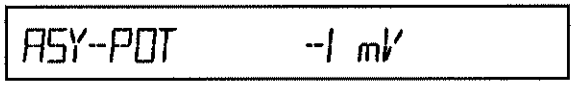
AR ΔmV TP

Startrt measurement | electrode potential | temperature | AR flashes, wait for the signal



Slope at 25°C

Run ENTER



asymmetry potential

The calibration is finished and the corresponding data are stored.

Calibration with one freely set buffer pH value (MemoCal 1 point)

Cal bis MEMOCAL 1

In the initial set-up the instrument proposes the value pH 7.00 (25°C). The value can be set with the "UP" and "DOWN" keys to the pH values of any optional buffer solutions.

Run ENTER

TEMP 24.5 °C

immerse the pH electrode and temperature probe in the first buffer solution

Run ENTER

BUFFER PH 7.02 YES NO

set the pH value of the buffer solution according to the temperature measured

Run ENTER

-1 mV 24.5 °C

AR ΔmV TP

Start measurement | electrode potential | temperature | AR flashes, wait for the signal

S -59.2 mV/PH

ideal slope at 25°C (theoretical value)

Run ENTER

ASY-POT -1 mV

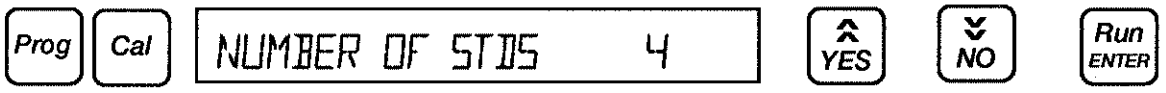
Asymmetry potential

The calibration is now finished and the corresponding data are stored.

For general hints about the procedure see Application Report, No. 63024/pH

Compilation of a set of buffers

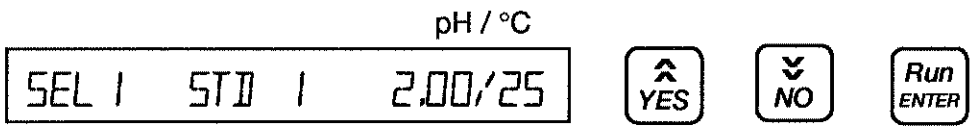
A total of 27 commercially available buffer solutions can be used for the "AUTOCAL VARIABLE 2P" procedure. The instrument is provided with a special memory in which at least two and up to five different data records for buffer solutions are stored. In the initial set-up the data of four WTW technical buffer solutions are stored; pH 2.00 (25°C), pH 4.01(25°C), pH 7.00 (25°C) and pH 10.00 (25°C). These data can be swapped in the secondary function of the "CAL"key.
A selection of buffers is given on pages 30 - 32.



proposed number of data records

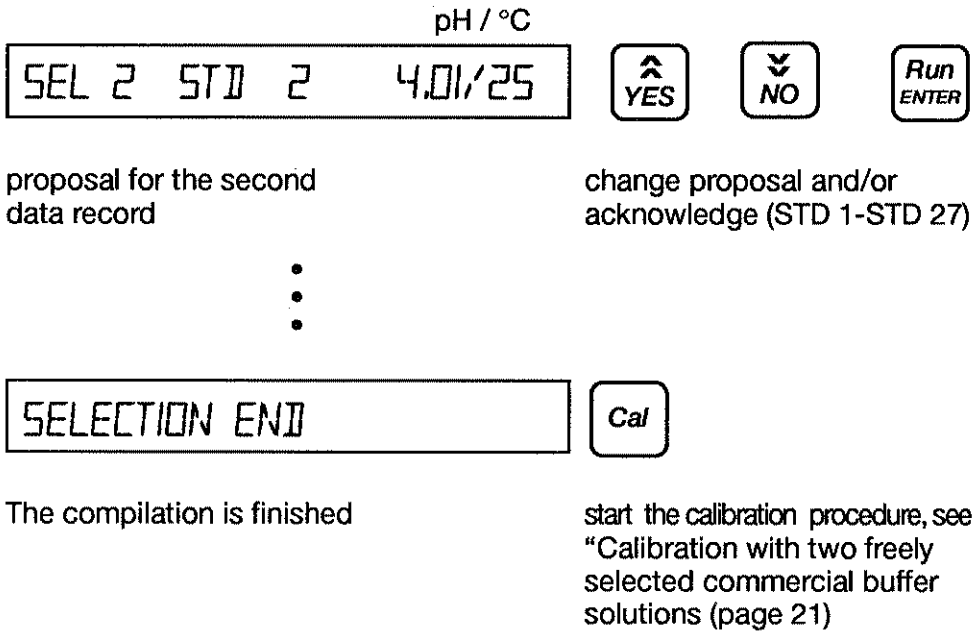
change proposal and/or acknowledge (min 2, max 5)

The selected buffer pH values must differ by at least two units.
Inadmissible values only appear shortly in the display. The pH 3000 then searches independently for the nearest possible pH value.



proposal for the first data record (compare tables on pages 30-32)

change proposal and/or acknowledge (STD 1-STD 27)



If the display is not changed with the "Yes" or "No" keys, the setting up mode can be exited by depressing any other function key.

If the display is changed with the "Yes" or "No" keys the setting-up mode can only be exited when "SELECTION END" has been reached.

Tables: Data records for the buffer solutions

WTW technical buffer solutions

°C	pH values STD 1	STD 2	STD 3	STD 4	STD 5
0	2.03	4.01	7.12	9.52	10.65
5	2.02	4.01	7.09	9.45	10.52
10	2.01	4.00	7.06	9.38	10.39
15	2.00	4.00	7.04	9.32	10.26
20	2.00	4.00	7.02	9.26	10.13
25	**2.00**	**4.01**	**7.00**	**9.21**	**10.00**
30	1.99	4.01	6.99	9.16	9.87
35	1.99	4.02	6.98	9.11	9.74
40	1.98	4.03	6.97	9.06	9.61
45	1.98	4.04	6.97	9.03	9.48
50	1.98	4.06	6.97	8.99	9.35
55	1.98	4.08	6.98	8.96	
60	1.99	4.10	6.98	8.93	
65	1.99	4.13	6.99	8.90	
70	2.00	4.16	7.00	8.88	
75	2.00	4.19	7.02	8.85	
80	2.00	4.22	7.04	8.83	
85	2.00	4.26	7.06	8.81	
90	2.00	4.30	7.09	8.79	
95	2.00	4.35	7.12	8.77	

Technical buffer solutions conforming to DIN 19267

°C	pH values STD 6	STD 7	STD 8	STD 9	STD 10	STD 11
0	1.08	3.14	4.67	6.89	9.48	13.95
5	1.08	3.12	4.67	6.87	9.43	13.63
10	1.09	3.10	4.66	6.84	9.37	13.37
15	1.09	3.08	4.66	6.82	9.32	13.16
20	1.09	3.07	4.65	6.80	9.27	12.96
25	**1.09**	**3.06**	**4.65**	**6.79**	**9.23**	**12.75**
30	1.10	3.05	4.65	6.78	9.18	12.61
35	1.10	3.05	4.65	6.77	9.13	12.45
40	1.10	3.04	4.66	6.76	9.09	12.29
45	1.10	3.04	4.67	6.76	9.04	12.09
50	1.11	3.04	4.68	6.76	9.00	11.89
55	1.11	3.04	4.69	6.76	8.96	11.79
60	1.11	3.04	4.70	6.76	8.92	11.69
65	1.11	3.04	4.71	6.76	8.90	11.56
70	1.11	3.04	4.72	6.76	8.88	11.43
75	1.11	3.04	4.73	6.77	8.86	11.31
80	1.12	3.05	4.75	6.78	8.85	11.19
85	1.12	3.06	4.77	6.79	8.83	11.09
90	1.13	3.07	4.79	6.80	8.82	10.99
95	1.13	3.08	4.82	6.81	8.81	10.89

Merck buffer titrisole and buffer solutions
Riedel de Haen buffer fixanale and buffer solutions

°C	pH values STD 12	STD 13	STD 14	STD 15	STD 16
0	2.01	4.05	7.13	9.24	12.58
5	2.01	4.04	7.07	9.16	12.41
10	2.01	4.02	7.05	9.11	12.26
15	2.00	4.01	7.02	9.05	12.10
20	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
25	2.00	4.01	6.98	8.95	11.88
30	2.00	4.01	6.98	8.91	11.72
35	2.00	4.01	6.96	8.88	11.67
40	2.00	4.01	6.95	8.85	11.54
45	2.00	4.01	6.95	8.82	11.44
50	2.00	4.00	6.95	8.79	11.33
55	2.00	4.00	6.95	8.76	11.19
60	2.00	4.00	6.96	8.73	11.04
65	2.00	4.00	6.96	8.72	10.97
70	2.01	4.00	6.96	8.70	10.90
75	2.01	4.00	6.96	8.68	10.80
80	2.01	4.00	6.97	8.66	10.70
85	2.01	4.00	6.98	8.65	10.59
90	2.01	4.00	7.00	8.64	10.48
95	2.01	4.00	7.02	8.64	10.37

Merck buffer titrisole and buffer solutions
Riedel de Haen buffer fixanale and buffer solutions

°C	pH values STD 17	STD 18	STD 19	STD 20	STD 21	STD 22
0	0.96	3.05	6.04	8.15	10.26	13.80
5	0.99	3.05	6.02	8.10	10.17	13.59
10	0.99	3.03	6.01	8.07	10.11	13.37
15	0.99	3.01	6.00	8.04	10.05	13.18
20	**1.00**	**3.00**	**6.00**	**8.00**	**10.00**	**13.00**
25	1.01	3.00	6.02	7.96	9.94	12.83
30	1.01	3.00	6.03	7.94	9.89	12.67
35	1.01	3.00	6.03	7.92	9.84	12.59
40	1.01	2.98	6.04	7.90	9.82	12.41
45	1.01	2.98	6.05	7.88	9.78	12.28
50	1.01	2.97	6.06	7.85	9.74	12.15
55	1.02	2.97	6.08	7.84	9.71	11.95
60	1.02	2.97	6.10	7.83	9.67	11.75
65	1.02	2.97	6.11	7.82	9.65	11.68
70	1.02	2.97	6.12	7.80	9.62	11.61
75	1.02	2.97	6.14	7.79	9.59	11.50
80	1.02	2.97	6.17	7.78	9.55	11.39
85	1.02	2.97	6.20	7.77	9.52	11.27
90	1.02	2.96	6.24	7.75	9.49	11.15
95	1.02	2.96	6.28	7.74	9.46	11.03

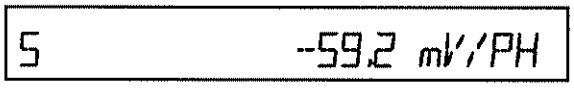
Standard buffer solutions according to DIN 19266

°C	pH values STD 23	STD 24	STD 25	STD 26	STD 27
0		4.010	6.984	9.464	13.423
5	1.668	4.004	6.951	9.395	13.207
10	1.670	4.000	6.923	9.332	13.003
15	1.672	3.999	6.900	9.276	12.810
20	1.675	4.001	6.881	9.225	12.627
25	**1.679**	**4.006**	**6.865**	**9.180**	**12.454**
30	1.683	4.012	6.853	9.139	12.289
35	1.688	4.021	6.844	9.102	12.133
38	1.691	4.027	6.840	9.081	12.043
40	1.694	4.031	6.838	9.068	11.984
45	1.700	4.043	6.834	9.038	11.410
50	1.707	4.057	6.833	9.011	11.705
55	1.715	4.071	6.834	8.985	11.574
60	1.723	4.087	6.836	8.962	11.449
70	1.743	4.126	6.845	8.921	
80	1.766	4.164	6.859	8.885	
90	1.792	4.205	6.877	8.850	
95	1.806	4.227	6.886	8.833	

Querying electrode data

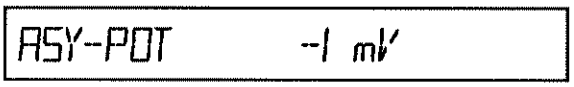
Calibrating with two buffer solutions

Prog pH



slope at 25°C

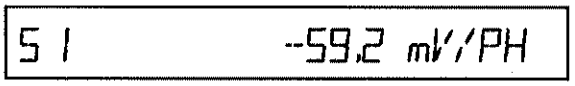
Run ENTER



asymmetry potential

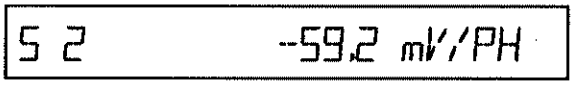
Calibrating with three buffer solutions

Prog pH



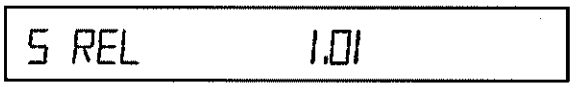
slope at 25°C between the buffer solutions pH6.685 and pH 4.006 or buffer solutions pH 7.00 and pH 4.01

Run ENTER



slope at 25°C between the buffer solutions pH 6.685 and pH 9.180 or buffer solutions pH 7.00 and pH 10.00

Run ENTER



display of relative slope
(gauge of efficiency of the electrode)

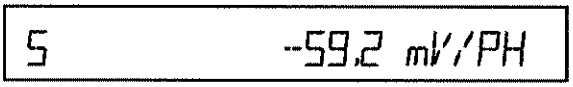
Run ENTER



asymmetry potential

Calibration with one buffer solution

Prog pH



ideal slope at 25°C
(theoretical value)

Run ENTER



asymmetry potential

Measurement of mV

Relative mV measurement against shift potential
(e.g. measurement of Redox potential with the Redox combined electrode)

Prog mV



shift potential in initial set-up = 0 mV

AR
ΔmV
TP

status display not illuminated

Effect of the shift potential

	measured value	minus	shift potential	=	displayed value
Example 1:	400 mV	–	– 210 mV	=	610 mV
Example 2:	400 mV	–	210 mV	=	190 mV

YES NO



Enter shift potential

e.g.: potential given in the manual for a Redox electrode

AR
ΔmV
TP

status display not illuminated

---

mV



Immerse the electrode in sample solution

relative mV measured value

AR
ΔmV
TP

status display illuminates

Absolute mV measurement

Prog mV

0 mV STORED

set shift potential to 0 mV

AR
ΔmV
TP

status display
not illuminated

---

mV

400 mV 24.5 °C

immerse the electrode in sample solution

absolute mV measured value

AR
ΔmV
TP

status display
not illuminated

High resolution mV measurement

mV

-173 mV 24.5 °C

1 mV resolution

mV

changeover

mV

-172.6 mV 24.5 °C

0.1 mV resolution

---

mV measurement without a temperature probe

mV

-173 mV

AR
ΔmV
TP

no temperature display

Time, date and print period time

Read time and date

Time



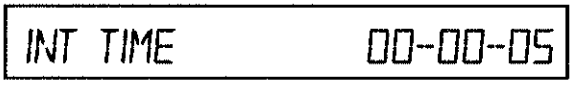
time: hours - minutes - seconds

Time



date: day - month - year

Time



display of the print interval time
(see printer functions, page 39)
interval time: hours-minutes-seconds

Set time and date

Prog Time



YES NO Run ENTER

time: set the flashing digits



YES NO Run ENTER

date: set the flashing digits

Set the print period time

INT TIME	00-00-05	YES	NO	Run ENTER

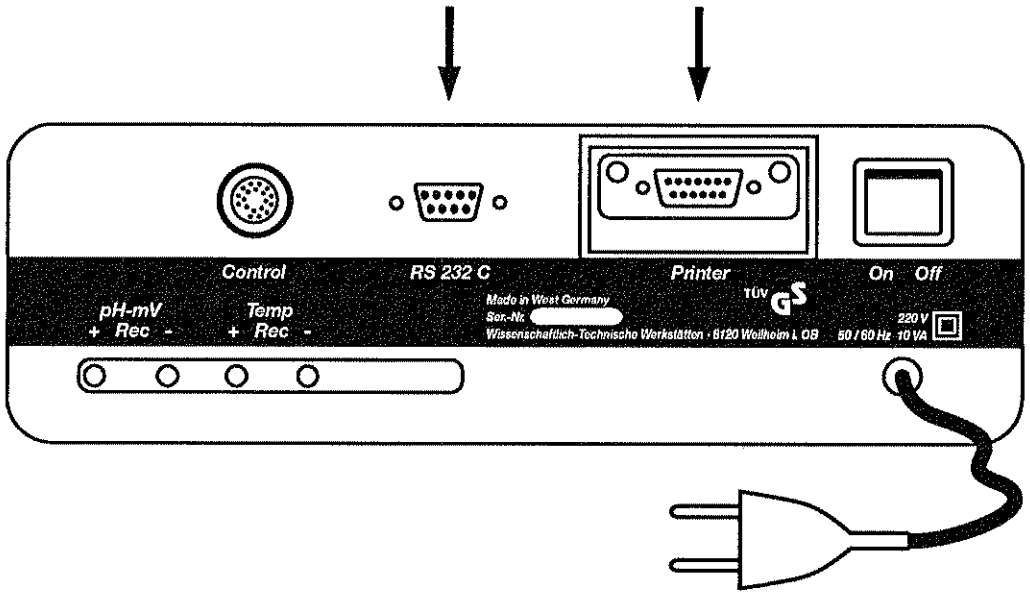
print period: set the flashing digits (5 sec ... 24 h)

Time — exit the set mode

Printer operation

printer with V24/RS 232 C serial interface and IBM character set

WTW printer P500



Functions

Single printout: [Print]

printout of the pH or mV value

Line feed: [Paper Feed]

one line feed:	depress key once
several line feeds:	hold key depressed

Printer functions: [Prog] [Print]

[YES] functions ON

[NO] functions OFF

Event controlled printout



log printout after e.g. calibration
or auto-read measurements

Time controlled printout



continuous printout of values.
set the time interval as in
"Set the print period" page 38

Printout of date and time

logs of time or event controlled
printouts always start with date and time



for single printouts

Line numbering reset



the line number is reset to 1 at:

- time controlled printout abort
- single printout, keys Prog and Print



line numbering is continuous up to 999,
resets to 1 if power is removed

Activation of time controlled printout

Prog Print



Run ENTER to



YES

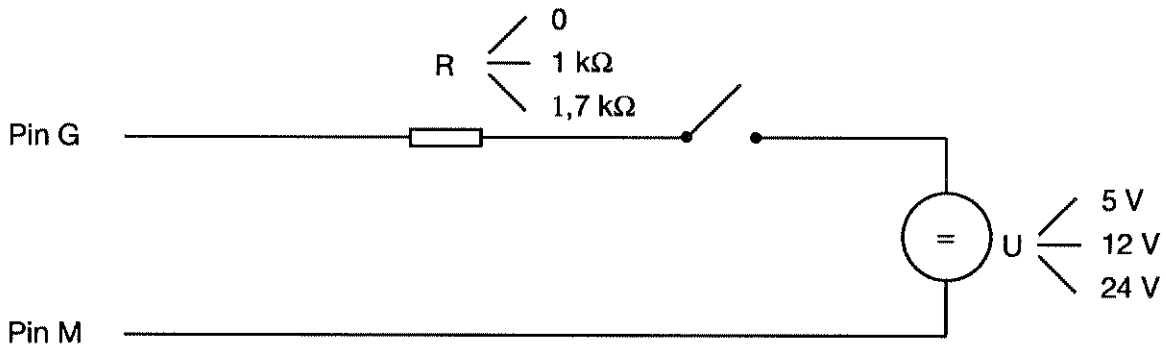


Start: Print

Stop: Print Prog Cal pH mV Time

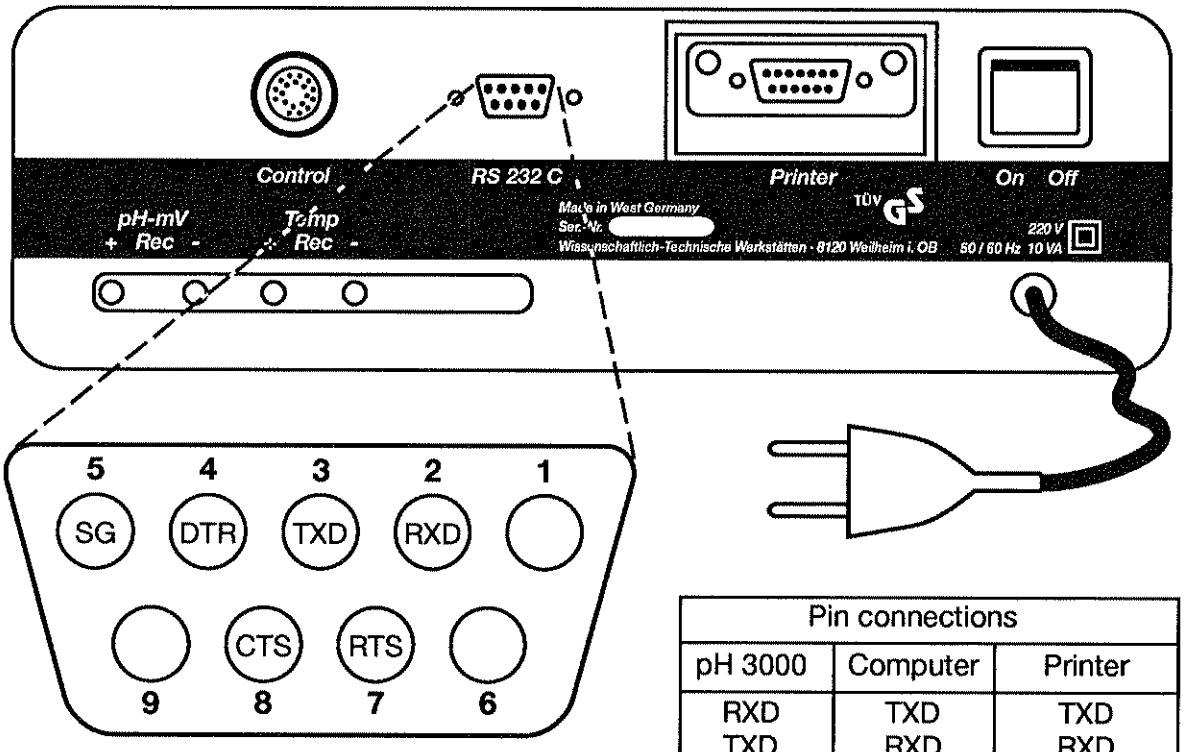
External triggering of the printout

Triggering a single printout at the control port
Switch pin G for 250 mS with+5, +12 or +24V according to the series resistor R.



See "Connection of external equipment" page 45, for the pin connections.

Computer connection



V24/RS 232.C interface

Pin connections		
pH 3000	Computer	Printer
RXD	TXD	TXD
TXD	RXD	RXD
DTR	DSR	–
SG	SG	SG
RTS	CTS	–
CTS	RTS	DTR or short circiut CTS and RTS

Commands

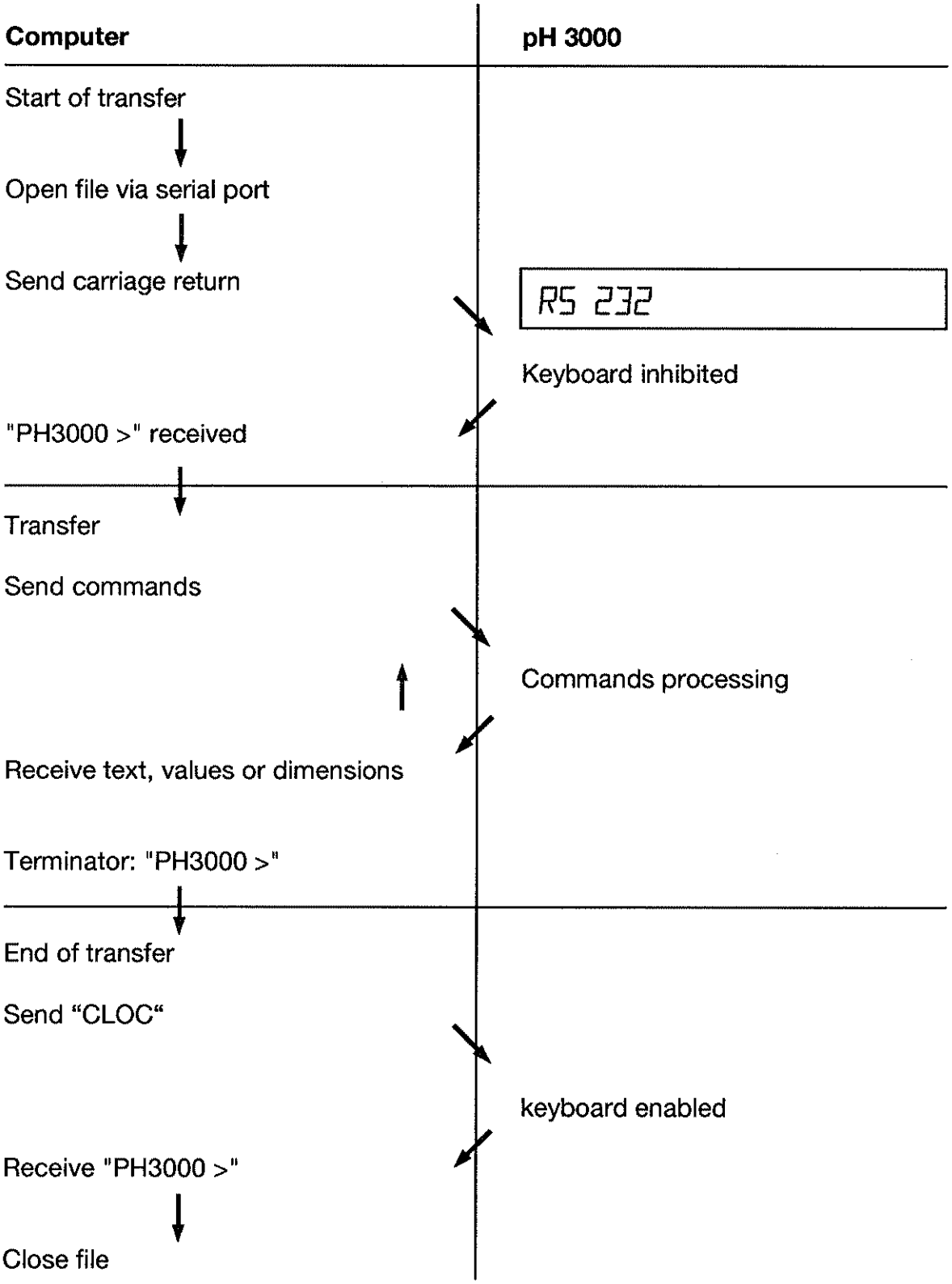
Command	
""	– Start of communication with each first carriage return (CHR$13)
"CLOC"	– Switches the pH 3000 back to normal operation

Command	See Calibration functions, pages 12 & 18
"CACS"	– Calibration with two standard buffer solutions
"CAS3"	– Calibration and pH electrode test with three standard buffer solutions (CalControl)
"CACV"	– Calibration with two freely selected commercial buffer solutions
"CAV3"	– Calibration and pH electrode test with three WTW technical buffer solutions (CalControl)
"CMC2"	– Calibration with two freely adjustable buffer pH values
"CMC1"	– Calibration with one freely adjustable buffer pH value

Command	See Key functions, page 8
"CPHC"	– pH
"CMVC"	– mV
"CARD"	– Auto Read
"CRUN"	– Run ENTER

Commands for external equipment connected to the control port

"WSCPn"	– Bitmap output; n = 0 – 7
"CRCP"	– Receive ASCII characters 0 - 7
"WCHAnnnn"	– Multiplexer channel selection, nnnn = BASE, AB, C, D, E, F



Software for IBM compatible computers:
TELEMATE V2.11 Terminal program for the simple operation of the pH-instrument, available from:
Microserve, Postfach 1368, W-2804 Lilienthal.
PRINT DAT V.1 Sample program for the data transfer triggered by the test instrument, available from:
Wissenschaftlich-Technische Werkstätten GmbH, Trifthofstraße 57a, W-8120 Weilheim

Sample program in GWBASIC
for IBM compatible computers

```
10      OPEN "com1:1200,n,8,1" AS #1
100     REM ----------------------Enter command and send
110     PRINT:INPUT "Command :",BE$
120     IF BE$= "e" THEN CLOSE#1:END
130     PRINT#1, BE$: GOSUB 1000
140     GOTO 110
1000    REM ----------------------Receive data and output
1010    Y$=""
1020    INPUT#1,X$
1030    Y$=Y$+X$+", "
1040    IF X$="PH3000 >" THEN PRINT "Received data ";Y$:RETURN
1050    GOTO 1020
```

Line10 : opens the interface

Lines110 ... 140 : The instrument can receive after the first "carriage return" has been transferred. Any previous characters have no effect.
haben keine Wirkung.
The "e" and "return" keys end the program.

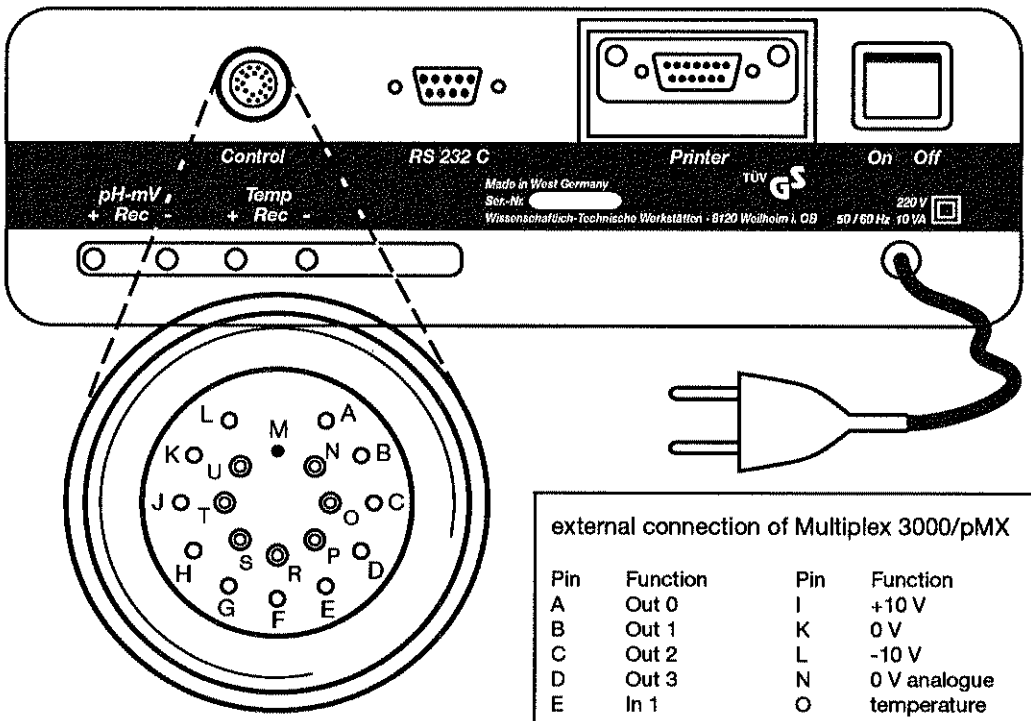
Lines1010 ... 1050: Reads the data sent from the instrument and displays them on the screen.

Output format:

- ASCII characters (IBM character code)
- Character strings consist of one or more fields
- Fields are separated with with a comma
- Text, values or dimensions are shown in one field
- A dimension is always given with a value

Connection of external equipment

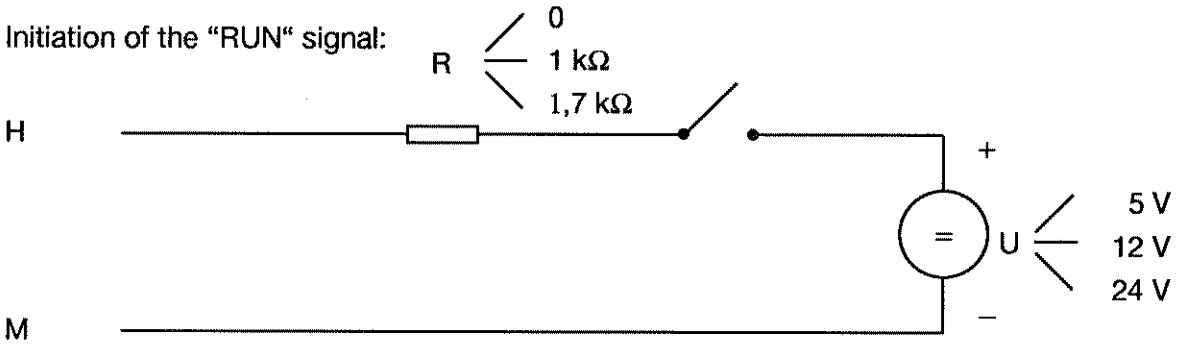
e.g.: Sample changer



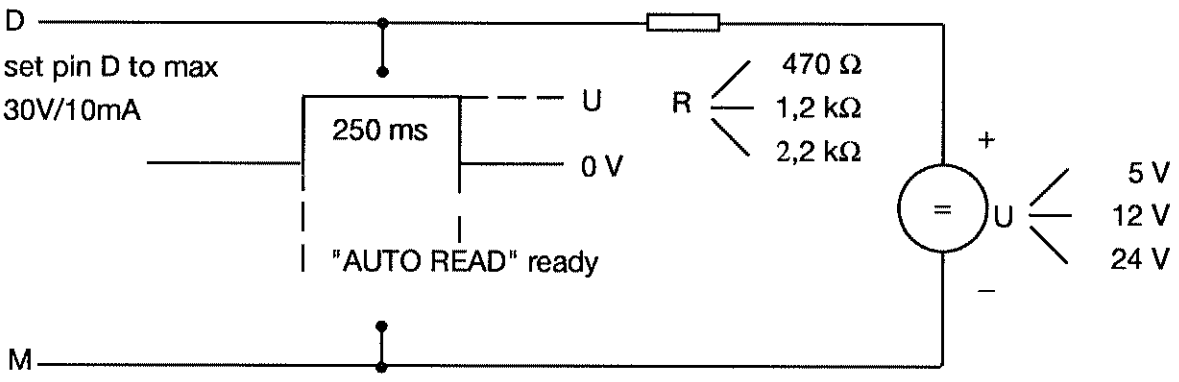
external connection of Multiplex 3000/pMX

Pin	Function	Pin	Function
A	Out 0	I	+10 V
B	Out 1	K	0 V
C	Out 2	L	-10 V
D	Out 3	N	0 V analogue
E	In 1	O	temperature
F	In 2	P	pH
G	In 3	R	setting
H	In 4	S	N.C.
M	Common	T	N.C.
		U	mux recognition

Initiation of the "RUN" signal:



Answerback for activated "AUTO READ" function



Error messages

General: **Please check the following:**

- is the electrode connected?
- is the electrode immersed in sufficient solution?
- is the protective cap or the soak cap removed?
- is the electrode damaged (e.g. glass broken or cable open circuit)
- is there any visible contamination (e.g. calcareous deposits)?

NO STAT VALUE E2

Unstable values

Cause	**Remedy**
Changing pH value of the solution, e.g. gassing carbon dioxide	measure in a sealed off beaker
Special measuring solution: – Low ionic solution – Contaminated solution	use a special electrode: – electrode with polished diaphragm – electrode with polished diaphragm
Aged or falsely stored electrode	change or soak the electrode: see user's manual for the electrode; page 55
Contaminated electrode	purify the electrode: see user's manual for the electrode; page 55
Solution temperature outside the limits	see technical specifications: "range/accuracy", "°C"; page 49

CAL ERROR E3

unreliable calibration

Cause	**Remedy**
Wrong buffer solution	Use the preset or selected solution for the calibration procedure concerned
Aged buffer solution	Use a new solution. Buffer solutions are given a stable life of six months. Never store solutions in an opened bottle. Never calibrate in the buffer bottle, always use a beaker. Never refill the bottle with used buffer solutions.

Asymmetry potential <-30 mV oder >+30 mV	Purify the diaphragm (see user's manual for the electrode). In the case of electrodes with a refill opening, change the reference electrolyte solution change the electrode
Slope <-62 mV/pH oder >-50 mV/pH	purify the glass membrane; see user's manual for the electrode change the electrode
Relative slope < 0.95 oder > 1.05 The response of the electrode is too slow for auto read measurements	contaminated electrode clean. Change aged electrodes or electrodes otherwise unsuitable for precision measurement

DATA LOST

Cause	**Remedy**
Defective electronic part or loss of internal setting and calibration data	Reset the instrument to the initial set-up condition; see commissioning, page 11. If the DATA LOST display reappears the instrument must be sent to the WTW factory for repair .

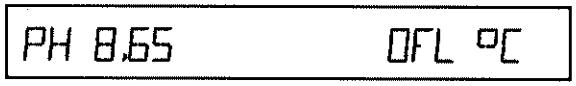
Flashing display when the admissible range is exceeded

S -48.5 mV/pH	
S 1 -63.2 mV/pH	
S 2 -35.0 mV/pH	Flashing outside the admissible range <-62 mV/pH, >-50 mV/pH, see „CAL ERROR E3“ - „slope“
S REL 1.25	Flashing outside the admissible range <0.95, >1.05, see „CAL ERROR E3“ - „relative slope“
ASY-POT -34 mV	Flashing outside the admisible range, <-30 mV, >+30 mV, see „CAL ERROR E3“ „asymmetry potential“

Overflow display when the measuring range is exceeded



pH value < -2 or > 16



Temperature < -5°C or > +110°C



mV measurement value
< -2000 mV or > +2000 mV



< -800 mV or > +800 mV
in the calibration procedure

Overflow display when the range is exceeded







overflow when the slope is
< -99 mV/pH or > +99 mV/pH
see "CAL ERROR E3" – „slope"



overflow when the relative slope is
< -9.99 or > 9.99
see "CAL ERROR E3" – "relative slope"



overflow when the asymmetry potential
is < -99 mV or > +99 mV
see "CAL ERROR E3" – "slope"

Technical specifications of the pH 3000

Readings
Range/Accuracy

: pH -2.00 ...16.00 / pH ± 0.01
-2.000...16.000 / pH ± 0.003

: mV -2000 ... 2000
-2000.0 ... 2000.0

± 0.2 mV within the range -1000 mV...+1000 mV
± 1 mV within the range -1000 mV...-2000 mV
± 1 mV within the range +1000 mV...+2000 mV

: °C -5...110 / ± 0.2 K

temperature probe interchange error:
TFK 150: < 0.2 K in -5°C ... +60°C
< 0.4 K in +60°C ... +110°C
Pt 1000: according to DIN tolerances

Setting range

pH buffer value -2.00 ... +16.00
shift potential -1400mV ... +1400mV
temperature -20°C ... +130°C

Admissible range

electrode slope -62 mV/pH ... -50 mV/pH
relative slope 0.95 ... 1.05
asymmetry potential -30 mV ... +30 mV

Number of memories for the electrodes

1 memory for measuring point pH 3000
5 memories for measuring points on Multiplex 3000/pMX

Displays

multiple displays:
fluorescent display, green, 20 characters
14 segment, 10 mm high
status displays:
LED red illumination

Inputs/Outputs

measurement electrode: DIN 19262 socket
input impedance > $5 * 10^{12}$ Ω
temperature probe: 4 mm socket
reference electrode: 4 mm socket
dead stop measuring cell: 4 mm socket,
short cct. current 10 µA
open cct. voltage 600 mV

Printer Output

	Range	Slope
pH:	-200 mV ... 1600 mV	100 mV/pH
mV:	-2000 mV ... +2000 mV	1 mV/mV
°C:	-50 mV ... +1100 mV	10 mV/K

resolution/accuracy:
1 mV = 0.01 pH = 0.1 K / 0.5% from mean

internal resistance:
1 kΩ

Digital interfaces

V 24/ RS 232 C, 9 pole, for computer
or printer, galvanically isolated

baud rate:	1200
data bits:	8
stop bits:	1
parity:	none
max. cable length:	15 m
handshake:	hardware
display format:	ASCII character string IBM character code list separator = comma

printer , 15 pole
for plug-in mini printer P 500

control port, galvanically isolated 19 pole flange socket for multiplex 3000/pMX

Clock and calendar

battery:
lithium 1.7 Ah

life:
10 years minimum

accuracy:
1 x 10^{-4} %

Power supply

mains:
230 V ~ (-15%/+6%); 50-60 Hz

optional:
115 V ~/ 60 Hz

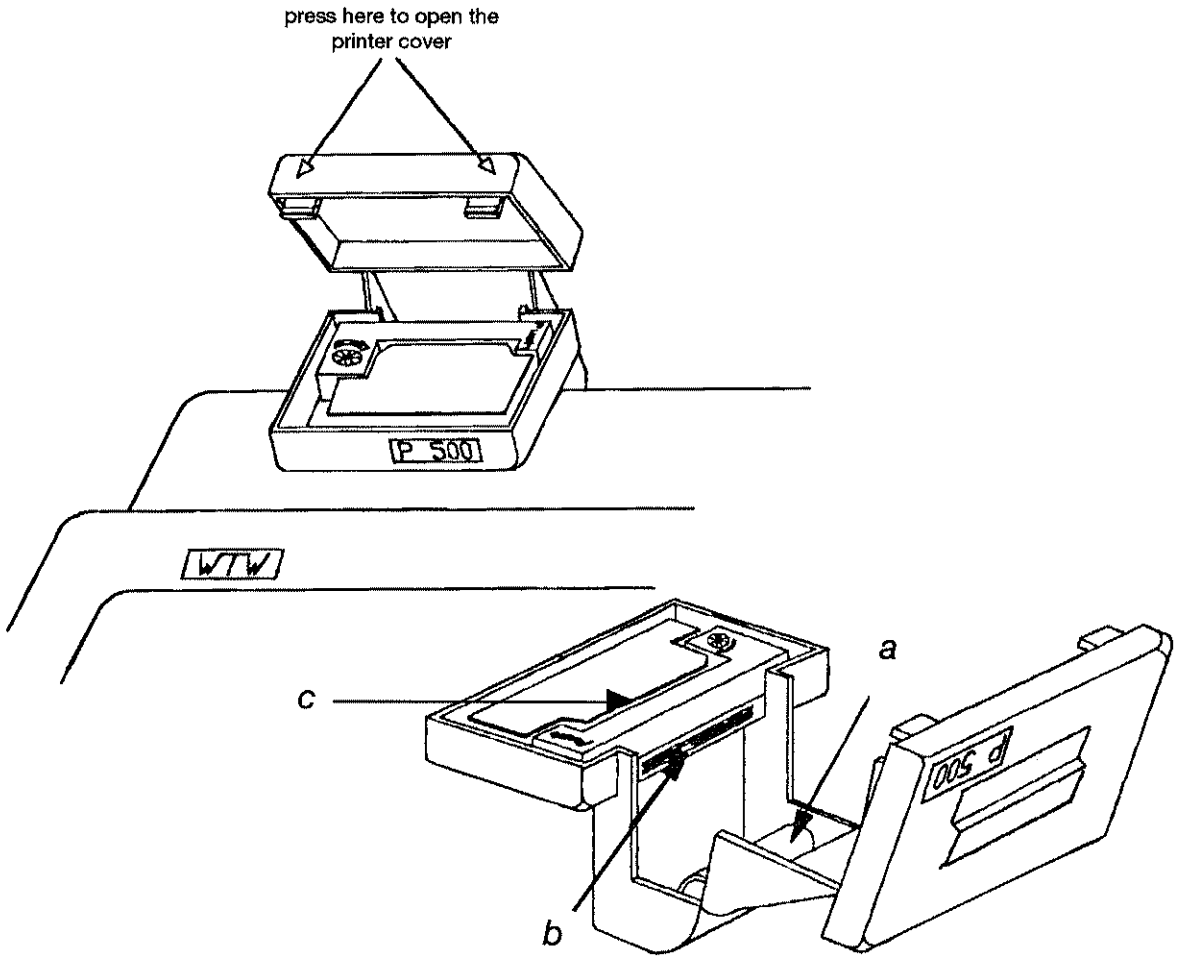
power consumption
10 VA

Fuses	1 x 0.1 AMT 3 x 0.4 AMT
Data protection	all manual settings and calibrating data are stored for an unlimited period when the instrument is switched off or at a power supply failure
Housing	protection: IP 41, according to DIN 40050 protective classes: housing: class II, according to DIN VDE 0411 inputs/outputs:: class III, according to DIN VDE 0411 isolation group: B, according to DIN VDE 0110 climate class: 2, according to VDI/VDE 3540 ambient temperature: storage: -25°C bis +65°C operation: +5°C bis +40°C relative humidity: yearly mean: ≤ 75 % 30 days/year: 95 % remaining days: 85 % light dew: yes radio interference transmission: suppressed according to FCC part 15, subpart J limit class A
Measurements/Weight	300 x 140 x 180 mm/ approx. 2,8 kg

User's instructions for the needle printer P 500

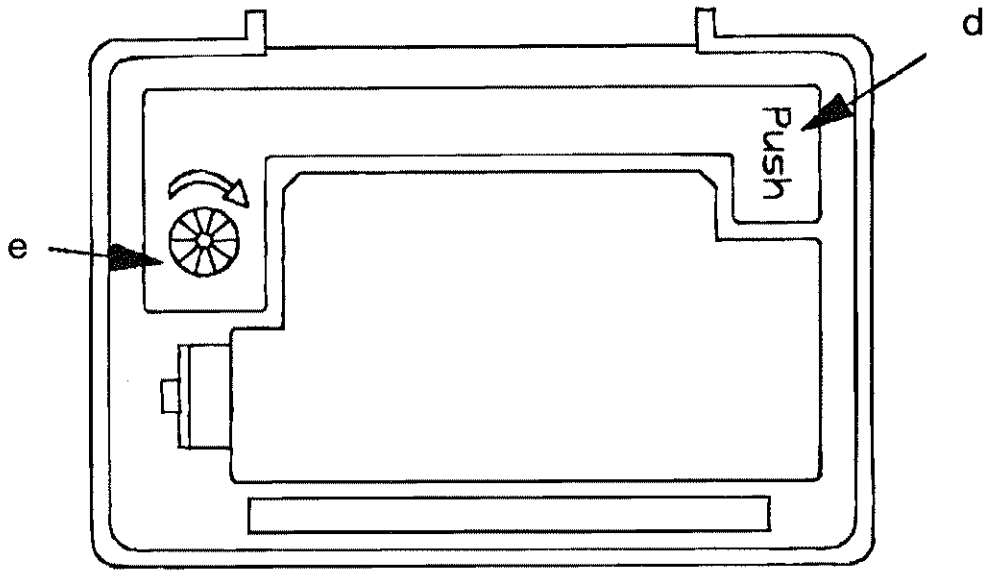
The P 500 is a mini printer used with the WTW measuring instruments via a special printer interface. The printer can only be used in conjunction with the instrument. The printer functions are dependent upon and can be controlled from the instrument (see the measuring instrument instructions)

Attention: The printer should be plugged into the interface only when the instrument is switched off



Fitting a new paper roll

- Open the printer (fig. 1)
- Remove the empty cardboard roller (a)
- Open the new roll of paper and fit
- Insert the start of the roll in the slot (b)
- Depress the "Paper Feed" key on the instrument until approx. 5 cm. of paper is showing
- Feed the paper through the slit in the cover when closing



Changing the print ribbon

- Open the printer
- Depress PUSH (d) and remove the ribbon
- Tension the new ribbon with the knob (e)
- Insert the paper between the ribbon and the cassette housing
- Insert the printer ribbon
- Pull in the ribbon by turning the knob (e)
- Feed the paper through the slit in the cover when closing

Technical Specification of the P 500

Printing method	7 dot needle printer	
Print format	dots per line: 144 characters per line: 24	
Printing speed	approx. 150 ms/1-dot line approx. ca. 0.7 lines/sec	
Character format	character size 1.7 mm (B) x 2.4 mm (H) distance between dots horizontal : 0.33 mm vertical: 0.33 mm	
Ribbon	type FBK 500	order No.: 102 470
Paper	type RP 500	order No.: 102 460
	wood-free paper	
	width: 58 mm	
	roll diameter:	max. 30 mm
Dimensions	100 x 70 x 100 mm	
Weight	approx.. 0.25 kg	

User's instructions for the combined electrode E 56

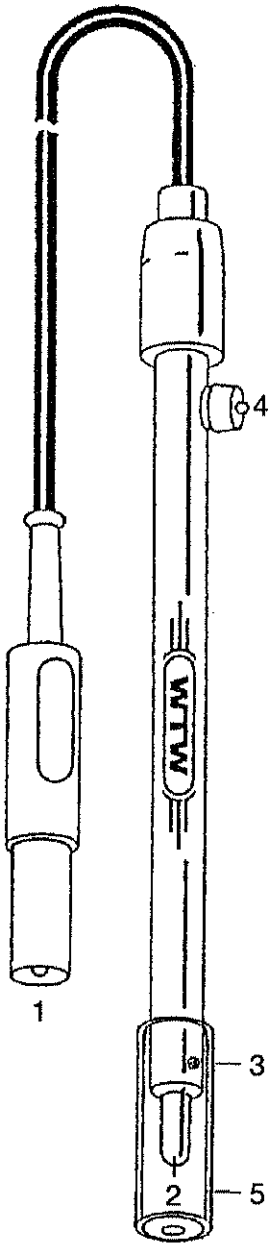
1 standard DIN 19262 plug

2 pH electrode membrane

3 reference electrode diaphragm

4 reference electrolyte solution refill opening

5 soak cap



Technical specifications

pH range	0 ... +12
Temperature range	0 ... +80°C
Reference electrolyte solution	silver chloride saturated potassium chloride solution
Max. immersion depth	120 mm
Min. immersion depth	25 mm
Shaft diameter	12 mm
Cable length	1 m
Shaft material	Glass

Putting into operation

- Remove the soak cap
- Soak for 10 minutes in neutral buffer
- Remove the rubber cap on the refill opening (4) if using solutions with different temperatures (>5K)
- Calibrate according to the user's manual of the instrument

Storage

Always keep the electrode membrane wet. During breaks in measuring procedures apply the soak cap, filled with a solution of three-molar potassium chloride (WTW 3/pH KCl solution). Never use distilled water when storing. If the membrane is dried out soak the electrode in a neutral buffer or a solution of three-molar potasisum chloride (WTW 3/pH KCl solution).

Maintenance of the reference system

Change the reference electrolyte solution every six months.

Cleaning the contaminated E 56 pH combined electrode

Water soluble impurities can be rinsed off with distilled water. For other impurities proceed as follows:

Impurity	Cleaning solution	Reaction time
Grease and oil	Warm water and household washing up liquid	Arbitrary
Lime and hydroxide coatings	Hydrochloride acid (10%)	Arbitrary
Sulphide impurities (black diaphragm)	Diaphragm cleaner	1 hour
Albuminous components	Pepsin cleaning solution	1 hour

Change the reference solution after cleaning and rinse the electrode carefully with distilled water.

Ageing of the E 56 electrode

Every pH electrode is subject to a natural ageing process which continuously slows down the response, causing the electrode slope to diminish gradually. Improper storage of the electrode, special measuring solutions such as sulphide, high alkaline, albuminous solutions or high temperatures, large pH and temperature changes can reduce the life considerably. Mechanical damage or damage caused by measuring solutions are not covered by the guarantee.

Technical specifications of the temperature probe TFK 150

Temperature probe	: precision NTC (30 kΩ at 25 °C)
Temperature range	: 0 ... 100 °C
Normal tolerance and linearity drift	: better than 0.25 K (at 25 °C)
Setting time	: t_{99} < 35 sec.
Material	: V4A steel, ECTFE coated
Immersion depth	: min. 25 mm max. 110 mm
Shaft diameter	: 6.5 mm
Cable length	: 1 m
Connection	: 2 banana plugs with horizontal holes

