Operating Manual

pH / Redox Monitors

pH 170
pH 296

EcoLine
pH 170

QuadroLine
pH 296

Accuracy when going to press

The use of advanced technology and the high quality standard of our instruments are the result of continuous development. This may result in differences between this operating manual and your meter. We cannot guarantee that there are absolutely no errors in this manual. We are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions. The information in this manual is subject to change without any notice.

Warranty

The designated meter is covered by a warranty of 2 years from the date of purchase.
The meter warranty extends to manufacturing faults that are determined within the period of warranty. The warranty excludes components that are replaced during maintenance.

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

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

Copyright

Please read these safety instructions carefully before installing the instrument!

This instrument is built according to the safety rules for electronic measuring instruments and left the factory in a safe and secure condition from a safety engineering aspect (IEC 1010).

The smooth functioning and operational safety of the equipment can only be guaranteed by following the general safety precautions applicable and the special safety instructions given in this operating manual.

- Before switching on the instrument, ensure that the operational voltage specified for the instrument correspond to the power supply. (specification of the ranges of the voltage supply).
- This instrument may only be operated using accessories that comply with the specifications in the chapter "Technical Data" in this operating manual. The manufacturer accepts no liability for damage resulting from the use of unsuitable accessories.
- The trouble-free function and operational safety of the instrument can only be guaranteed by following the climate conditions specified in the chapter "Technical data" in this operating manual.
- Opening of the instrument as well as adjustment and maintenance or repair work must only be performed by personnel authorized by WTW. Depending on the severity, contravention can lead to loss of warranty.
- If safe operation is no longer possible, the equipment must be taken out of service and secured against inadvertent operation by labeling with warning signs.

- The safety of the user can be affected by the instrument if, for example,
  - ❍ the instrument is visibly damaged,
  - ❍ the instrument no longer operates as prescribed,
  - ❍ the instrument has been stored under adverse conditions for a lengthy period of time,
  - ❍ the instrument was exposed to adverse transport conditions.

Basically, if you are in any doubt, please return the instrument for repair or maintenance to the manufacturer of the equipment, "Wissenschaftlich-Technische-Werkstätten GmbH".

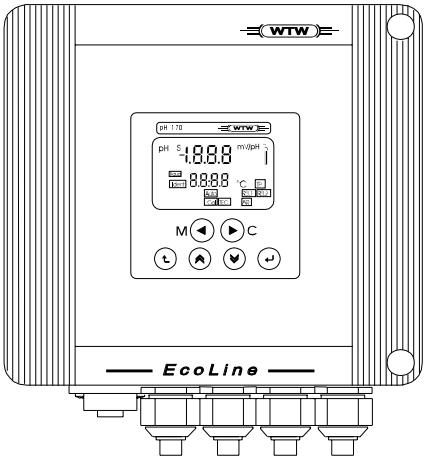
Contents

Contents

Front views

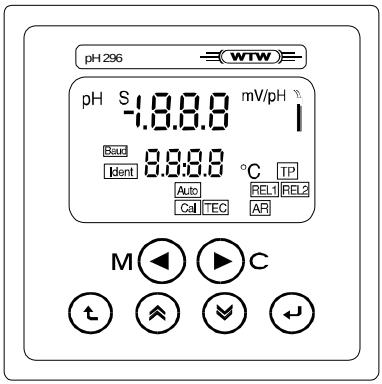
EcoLine

pH 170

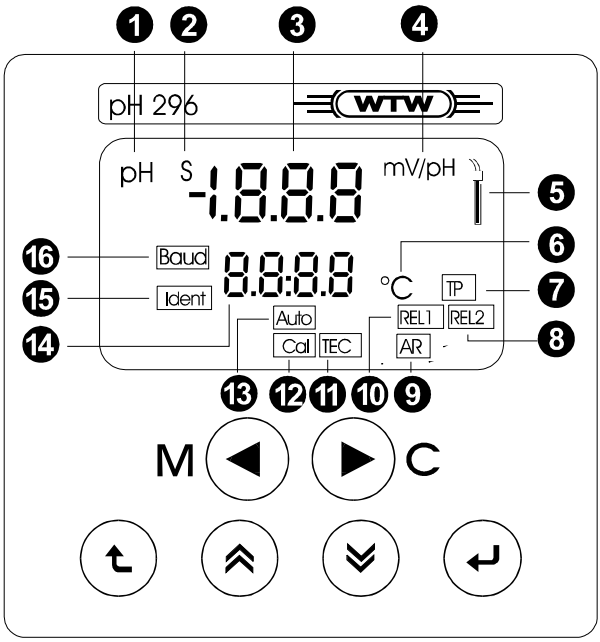


QuadroLine

pH 296



Control panel



Display

1. pH measuring mode
2. Slope/ Measuring chain
3. Alphanumeric display: measured value, slope, asymmetry, user interface
4. Dimensions: mV (Redox), mV/pH (slope)
5. Alarm display if sensor is defective
6. Dimension: °C
7. Configuration of temperature compensation
8. Relay 2 is active (flashes if check (PrPF) is active)
9. Calibration: AutoRead “Active “
10. Relay 1 is active (flashes if check (PrPF) is active)
11. Calibration procedure with technical buffers selected
12. Calibration mode
13. Automatic calibration selected
14. Alphanumeric display: temperature, configuration parameters
15. IDENT no./RS 485 operation
16. BAUD rate/RS 485 interface

Display messages

Note:
The first letter of a display message is used for allocation.
Configuration displays have a “C” as the first letter and a "P" identifies displays of the parameterization.

Configuration:

CO	**CO**nfiguration
CFU	**C**onfiguration **FU**nction
CCL	**C**onfiguration **C**a**L**ibration
Ctc	**C**onfiguration **t**emperature **c**ompensation
C In	**C**onfiguration **In**put
Cr1	**C**onfiguration **r**ecorder **1**
Cr2	**C**onfiguration **r**ecorder **2**
Crc	**C**onfiguration **r**elay **c**onfiguration
CrF	**C**onfiguration **r**elay **F**unction

Parameterization:

PA	**PA**rametration
Pr1	**P**arametration **r**ecorder **1**
Pr2	**P**arametration **r**ecorder **2**
PL	**P**arametration **L**imits
PIF	**P**arametration **I**nter**F**ace
Prd	**P**arametration **r**e**d**ox
Ptc	**P**arametration **t**emperature **c**ompensation
PCd	**P**arametration **C**o**d**e
Pt	**P**arametration **t**emperature

Viewing Mode:

So	**So**ftwareversion

General:

690	SensoLyt® **690**
700	SensoLyt® **700**
oth	**oth**er Probes
100	Pt**100**
1000	Pt**1000**
ntc	**ntc**
nF	**n**o **F**unction
PS	**P**ower **S**upply
FrC	**Fr**eeze **C**ontact
UL	**U**pper **L**imit
LL	**L**ower **L**imit
PI	**P**roportional **I**mpulse
PF	**P**roportional **F**requency
C	**C**lose
O	**O**pen
Pro	**Pro**portional band
tI	**t**ime **I**ntervall
tF	**t**ime **F**requency
HS	**H**y**S**teresis
td	**t**ime **d**elay
Prn	**Pr**i**n**tmodus
SI	**SI**avemodus

Checking Mode:

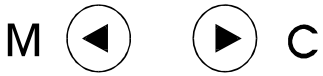
Cod	**Cod**enumber
tStrEC1	te**St rEC**order **1**
tStrEC2	te**St rEC**order **2**
tStrEL	te**St rEL**ay
tSt485	te**St** Interface RS**485**

Digital interface option RS

Display messages see separate opering manual RA 485

Keyboard

- **Operating keys** to switch between Measurement (M) and Calibration (C)



- **Function keys** to switch between the operating levels and changing of setting values in configuration and parameterization.

ESCAPE
to leave a menu

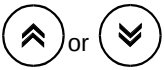
UP
to increase a value or to scroll upwards in scrolling mode

DOWN
to decrease a value or to scroll downwards in scrolling mode

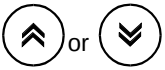
ENTER
to confirm the input

Operating instructions

The user interface is partly implemented via a "compelled guidance", i.e. all menus with direct dependence must be passed through. A *Code* enables access to the submenus, PA (Parameterization) and CO (Configuration) (see section "Configuration" and "Parameterization").

Select between CO and PA using the keys 

Change to the next submenu: 

Select the required setting: 

Accept the setting: 

Return to the program start:
(except under compelled guidance) 

or to the last submenu: 

Return to the "Measure/Calibrate" function - if no compelled guidance is present: 

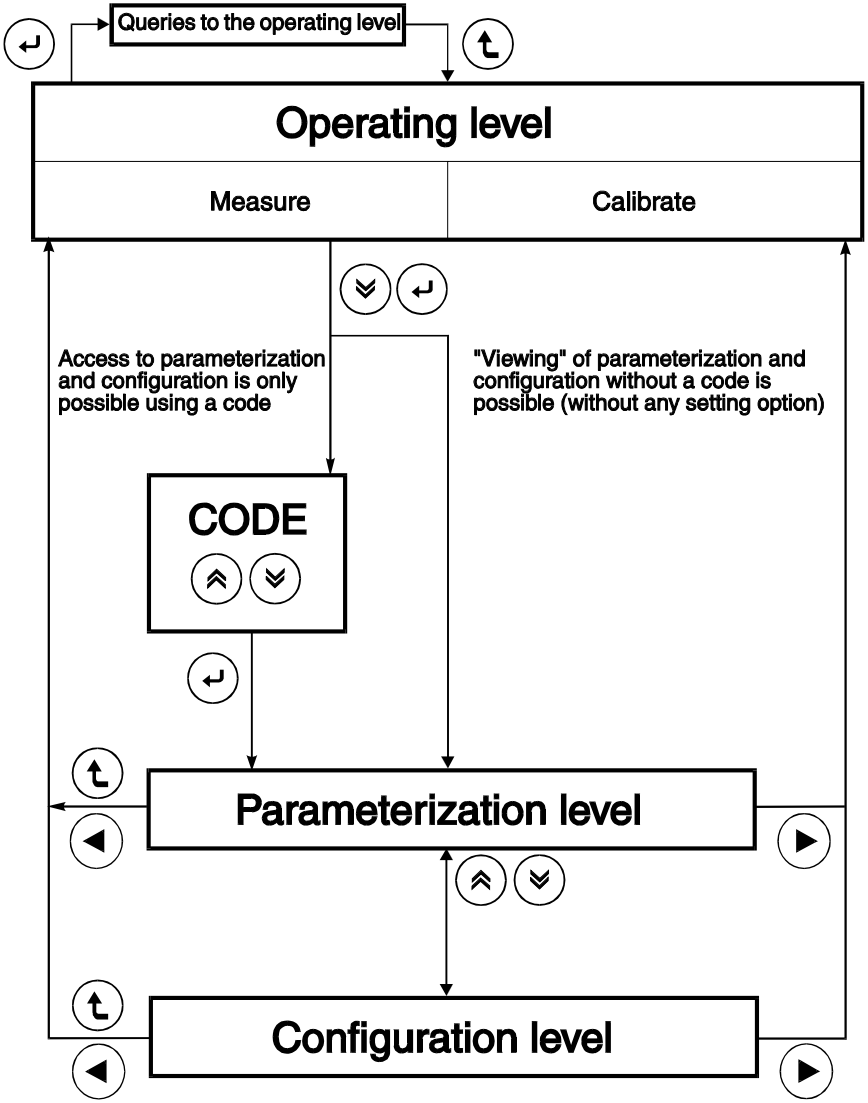
Operating levels

The instrument functions are incorporated in three levels consecutively structured to ensure a clear and transparent structure.
This structure ensures that the user is provided with an instrument that, although it has universal options, can still be set so that unauthorized actions do not interfere with the reliable measuring mode.

Operating level:
The configuration and parameterization can be interrogated in the operating level without having to enter a code while the measuring mode continues to run. However, the settings cannot be changed. The *Measure* and *Calibrate* operating modes can be selected without any access restrictions.

Parameterization level:
The measuring ranges, limiting values, etc. are entered here. Access is protected by a code.

Configuration level:
The functions of the monitor are allocated in this level.
The configuration is performed after the installation of the instrument, mainly on the initial commissioning. Access is also protected by a code.



Note:
After a power fail, the instrument returns to the previous operating mode.
All settings are preserved.

General instructions

- Instruments to be installed in the field (pH 170) must be equipped with a protective cover (see WTW accessories).
- After installing the pH 170, close the cover to ensure compliance with the IP66 standard.
- Inputs/outputs require no additional lightning protection.
  The measures required for lightning protection are already incorporated in the monitor and any existing lightning protection measures can be used in addition.
- The PG screws of the pH 170 are designed for cable diameters of 10 to 14 mm.
  Unused cable feed-throughs (PG screws) are equipped with a sealing plug to ensure compliance with the IP66 standard.

Power supply

Only allow qualified electricians to perform the installation as it involves a line voltage that could endanger life.

A bipolar disconnection option between instrument and mains is provided (e.g. a fuse)!

Depending on the version, the instruments are designed for **230 VAC, 115 VAC**, **24 VAC or 24 VDC**. The line voltage is printed on the nameplate. Always check that the correct line voltage is applied before commissioning the instrument.

An incorrect line voltage can result in damage to the instrument!

In instruments with a 24 VDC module, observe the following:
Only operate instruments with a voltage source that fulfills the requirements for SELV (Safety Extra Low Voltage with enhanced insulation against dangerous voltages) in accordance with EN 60950.
Without an interface, the requirements should fulfill EN 61010-1.

All instruments of the "170/296" series are constructed in accordance with safety class II, i.e. no protective earth conductor is required.

Do not feed the protective earth conductor into the instrument or connect it to an instrument terminal or to a supply line!
Only authorized WTW technicians are allowed to change the instrument fuse.

"SENS-CHECK" connection

The "SENS-CHECK" relay is designed as a closing contact that is electrically isolated from the instrument; it is then always active (= closed) if a sensor error occurs.
This message is also output on the display.
Sensor errors in the switching station are displayed using the relay.

Note:
The relay contact should only be loaded with a maximum of 250 VAC / 5A up to a maximum of 150 W.

REC 1 / REC 2 connections

The REC 1 (pH/mV) and REC 2 (temperature) current outputs can be configured as follows:

- 0 to 20 mA
- 4 to 20 mA

If terminals with a common earth are used, ensure the exact polarity of the direction of the current flow (+ / –). It involves active current sources that require no external current source!

Do not use an external current source as this can lead to malfunction of the current outputs!

Maximum load of 600 Ohm.

K1 / K2 (relay contacts)

The K1 and K2 relay contacts are designed as potential-free closers (make contacts).
These contacts can also be configured as openers (break contacts) via the configuration level. The assignment of the relay to the corresponding functions is undertaken by the software configuration.

Note:
The contacts are designed for 250 VAC / 5A with, however, a maximum of 150 W.

RS 485 digital interface (RS option)

The RS 485 interface operates with differential levels that are not susceptible to interference. In this way, cable lengths of up to 1 km long can be implemented. The instruments are connected via a 2-wire line. A twisted 3-wire line is recommended for greater lengths or a larger number of instruments; the third line is used as a reference potential (GND), to compensate for any possible differences in potential that occur.

Terminate every bus with a resistor using the software (see Parameterizing).

The last device on the bus must provide the terminating resistor, i.e. in parameterizing in the menu item PIF, the last device must have the termination connected additionally within the bus connection (tr = **t**e**r**mination) and disconnected (notr = **no t**e**r**mination) in all other devices.

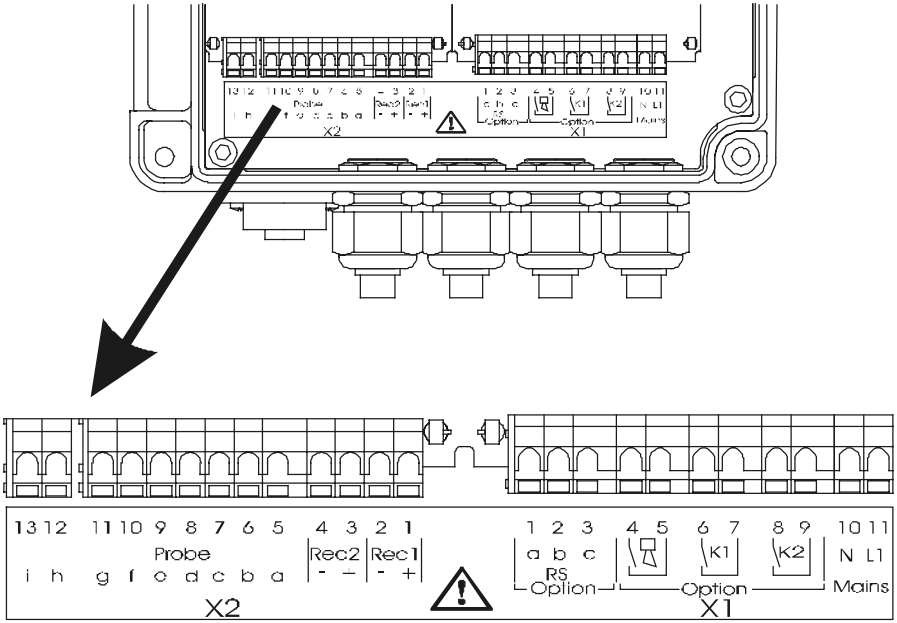
If only one device is used, this is also effectively the last device and the terminating resistor must be connected (tr).

All other technical data and operating instructions are given in *RS 485 Operating Manual*.

USA and Canada:
Use the *MCB 17x conduit box* for the power supply and relay/alarm contacts. Follow the installation instructions.

Installation instructions for the pH 170

Terminal assignment



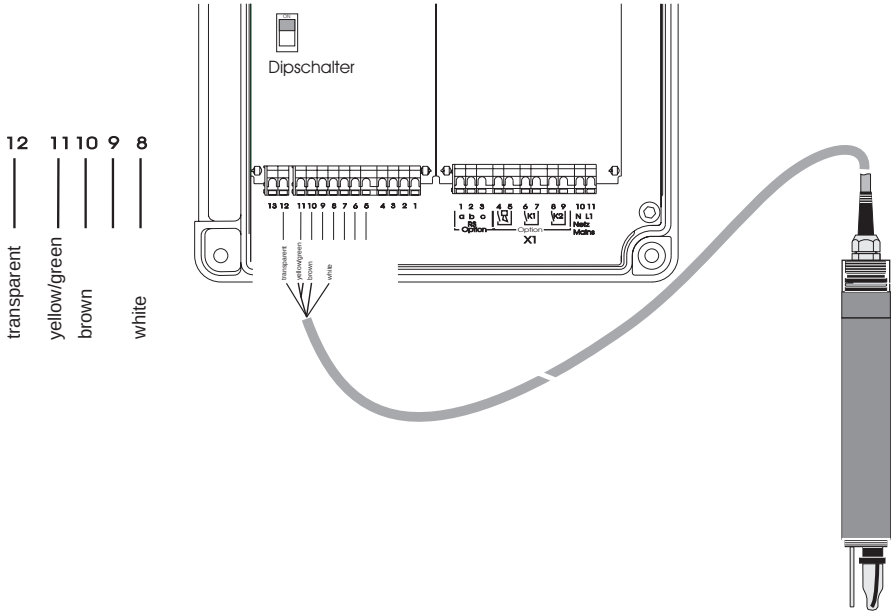
Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485 option)	REC 1 +
2	B (RS 485 option)	REC 1 –
3	GND (RS 485 option)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	a (sensor)
6	K1 (R option)	b (sensor)
7	K1 (R option)	c (sensor)
8	K2 (R option)	d (sensor)
9	K2 (R option)	e (sensor)
10	N (mains)	f (sensor)
11	L1 (mains)	g (sensor)
12	–	h (sensor)
13	–	i (sensor)

Note:
For power supplies above 24 VDC, use the following wiring:
L_1 + 24 V
N GND

Connecting the SensoLyt 650

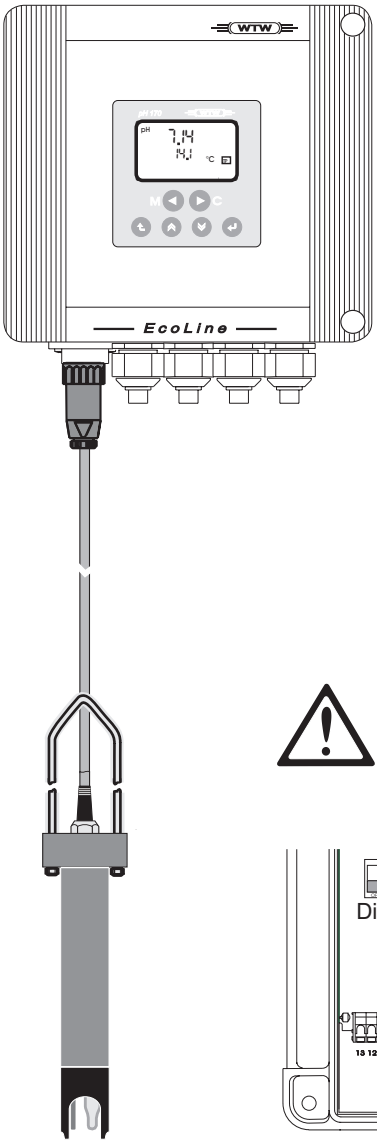
If a SensoLyt 650 is used, the Dip switch on the circuit board of the 170 must be in the “ON“ position.



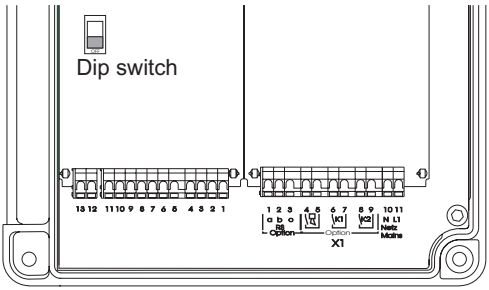
Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485 option)	REC 1 +
2	B (RS 485 option)	REC 1 –
3	GND (RS 485 option)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	–
6	K1 (R option)	–
7	K1 (R option)	–
8	K2 (R option)	white
9	K2 (R option)	–
10	N (mains)	brown
11	L1 (mains)	yellow + green
12	–	transparent
13	–	–

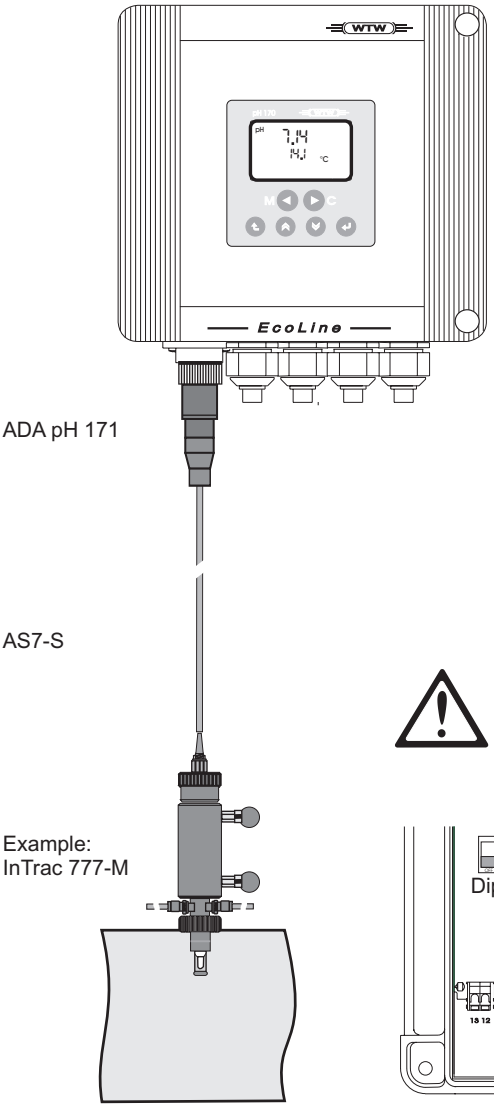
Connecting the SensoLyt 690 or SensoLyt 700



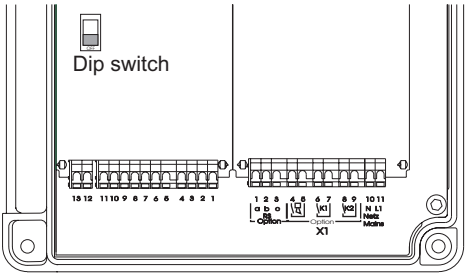
The dip switch on the circuit board of the 170 must be in the "OFF" position.



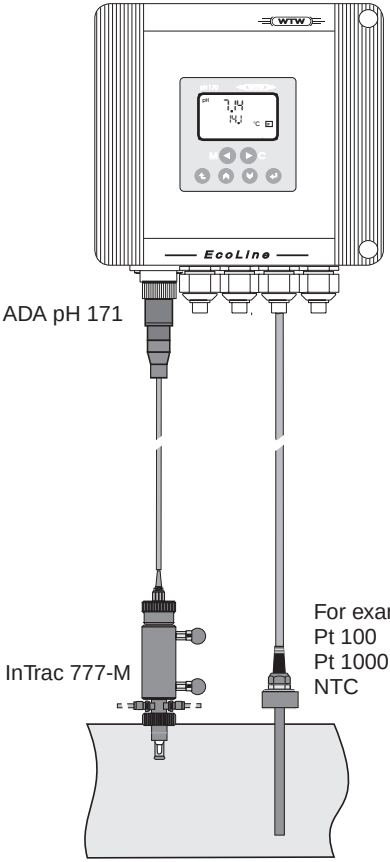
Connecting other sensors



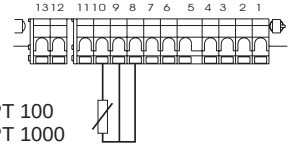
The dip switch on the circuit board of the 170 must be in the "OFF" position.



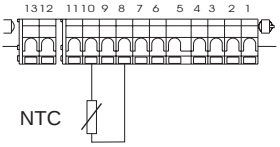
Connecting other sensors with an external temperature sensor



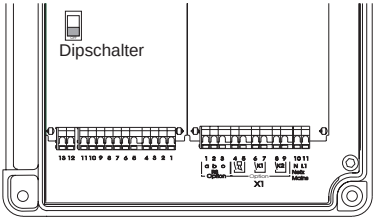
3-wire connection:



2-wire connection:

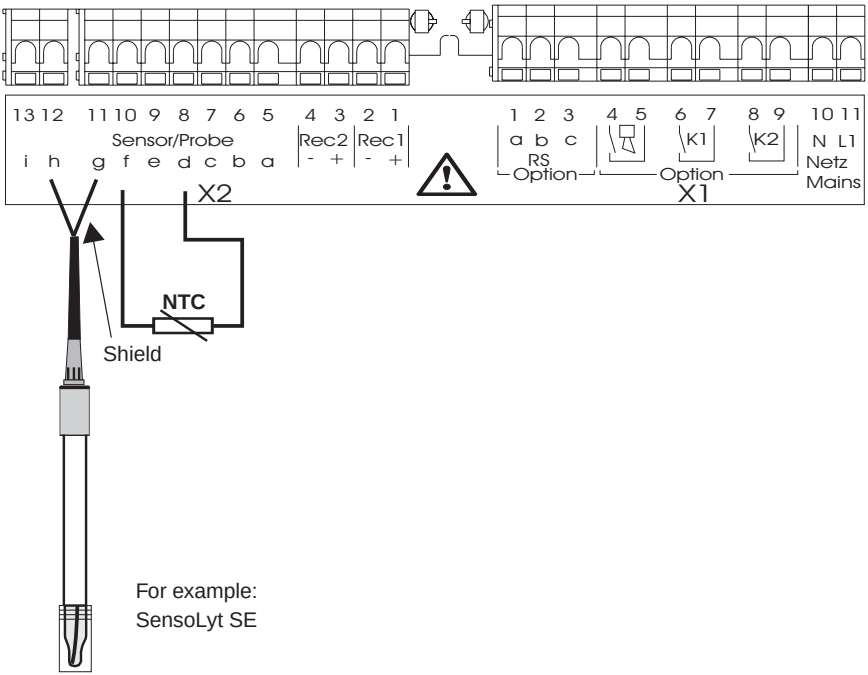


The Dip switch on the circuit board of the 170 must be in the "OFF" postion.



Connecting a high-resistance probe with external temperature probe (Example: NTC)

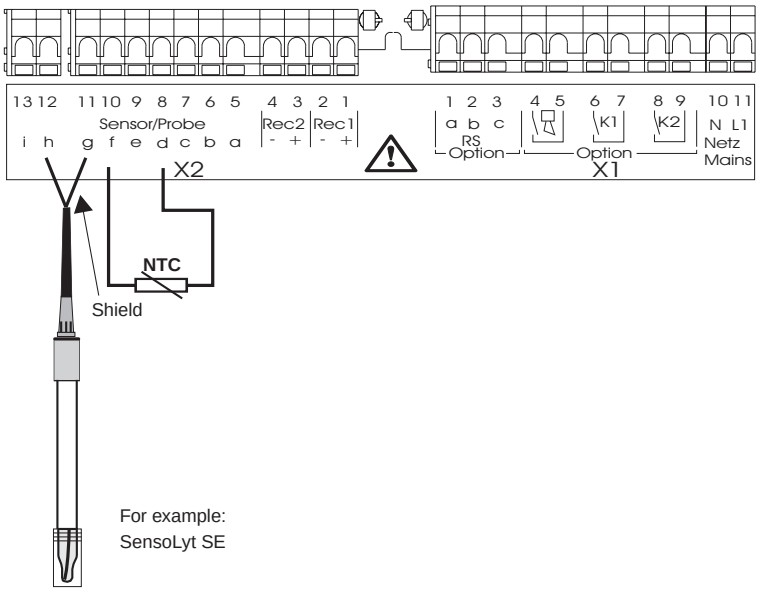
The Dip switch must be in the “ON“ position.



When installing a high-resistance probe, ensure that no cable makes contact with the terminal strips between the plugs 11 and 12!

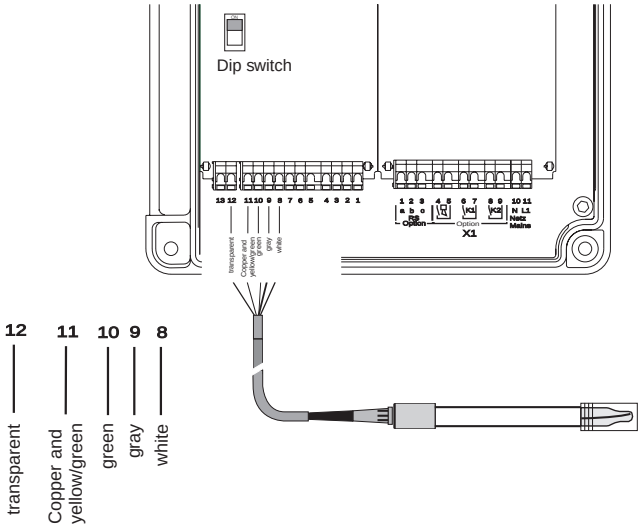
Connecting a high-resistance probe with external temperature probe (Example: PT 100 / PT 1000)

The Dip switch must be in the “ON“ position.



When installing a high-resistance probe, ensure that no cable makes contact with the terminal strips between the plugs 11 and 12!

Connecting a InPro® 4200

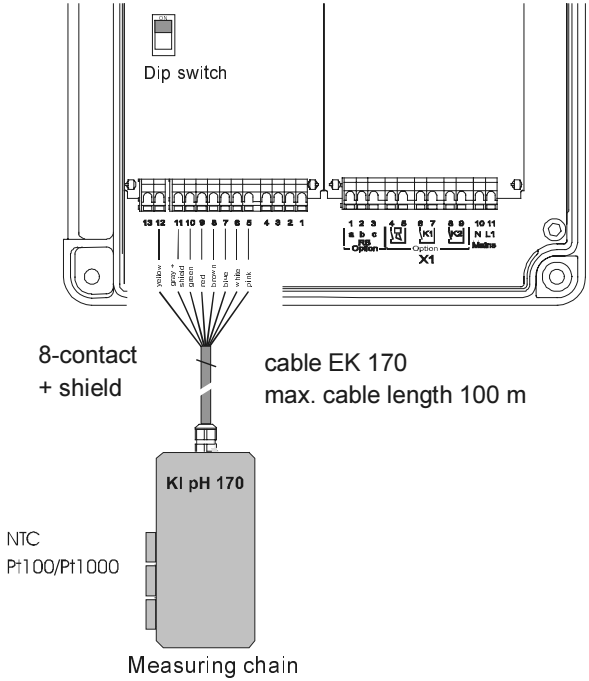


Terminal	Terminal assignment	
	X1	X2
1	*A (RS 485)*	*REC 1 +*
2	*B (RS 485)*	*REC 1 –*
3	*GND (RS 485)*	*REC 2 +*
4	*Sens-Check*	*REC 2 –*
5	*Sens-Check*	–
6	*Relay 1*	–
7	*Relay 1*	–
8	*Relay 2*	*white*
9	*Relay 2*	*gray*
10	*N (mains)*	*green*
11	*L1 (mains)*	*copper and yellow/green*
12	–	*transparent*
13	–	–

Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Connecting the KI/pH 170 terminal box

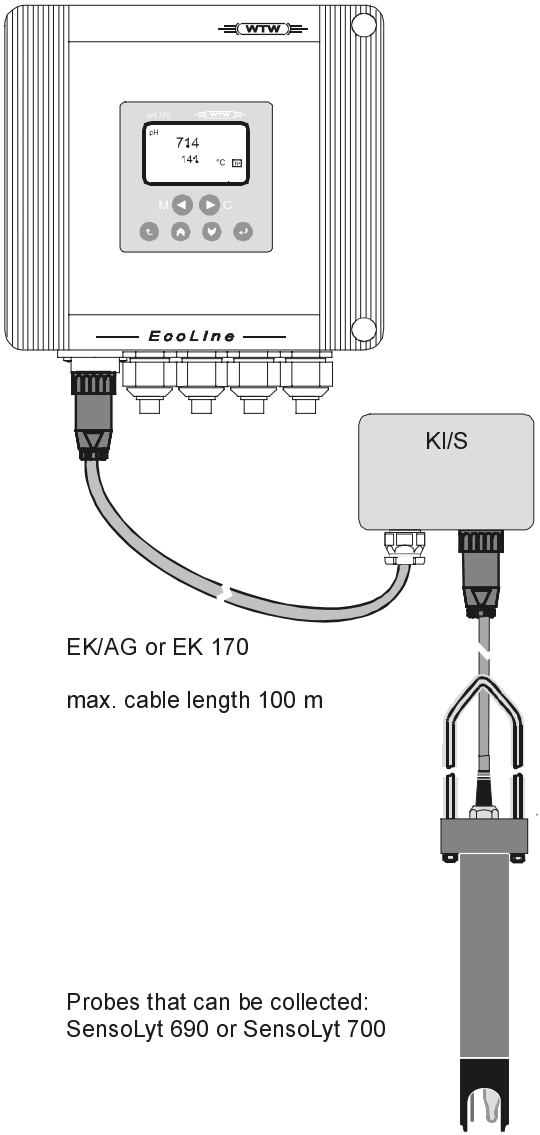
When using a KI/pH 170, the dip switch of the 170 on the PCB must be set to the “ON“ setting.



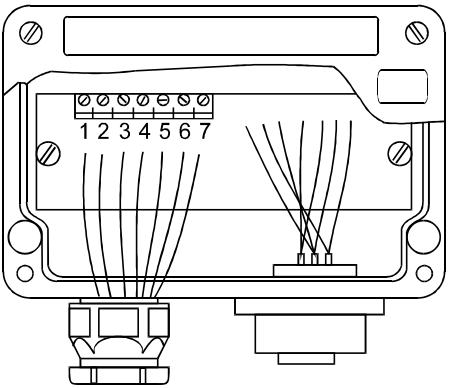
Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485 option)	REC 1 +
2	B (RS 485 option)	REC 1 –
3	GND (RS 485 option)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	pink
6	K1 (R option)	white
7	K1 (R option)	blue
8	K2 (R option)	brown
9	K2 (R option)	red
10	N (mains)	green
11	L1 (mains)	gray + screen
12	–	yellow
13	–	–

Connecting the KI/S terminal box



Wiring of KI/S



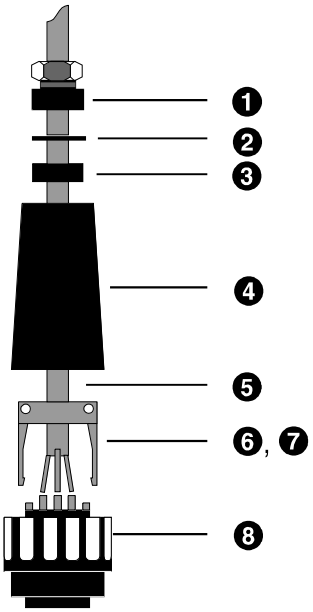
Strip terminal	Colour of wires
1	yellow
2	gray+ shield
3	pink
4	blue
5	brown
6	green
7	white

Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Note:
After connection of the 8-wire EK 170 cable, the 8th wire remains unused.
The unused wire should be fixed in position or pinched off.

Connecting the KI/S connection box to the LF 170 using the K 160 plug and EK/AG cable

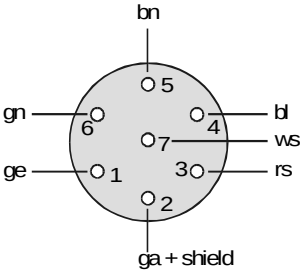
The sensor cable can be extended to a max. length of 100 m cable.
To do this, connect the K 160 plug of the EK/AG cable to the KI/S connection box.



– Slide the screw-type cable gland ❶, washer ❷, seal ❸ and sleeve ❹ onto the cable ❺.

– Solder the plug ❽ to the cable ❺.

Wiring side of the instrument plug:



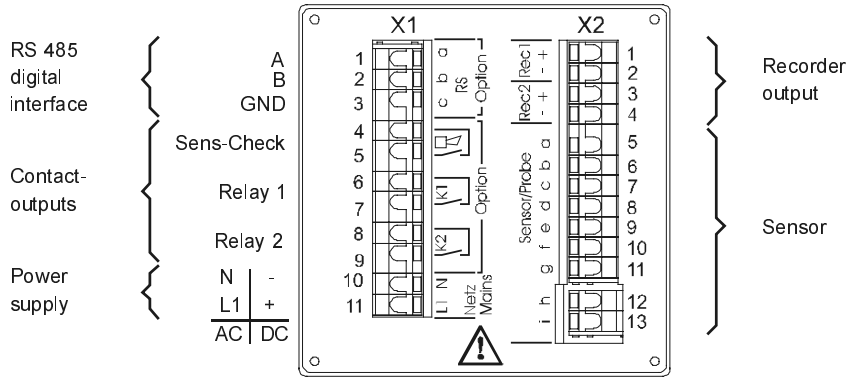
– Latch the strain relief ❻ into the plug ❽ and screw the cable clamp ❼ to the strain relief ❻. The cable clamp ❼ must lie on the cable sheath to relieve the strands.

  Screw the plug ❽ to the sleeve ❹.
  Pay attention to the vertical alignment of the sleeve ❹!

– Screw the rubber seal ❸ to the cable ❶ and screw the washer ❷ into the sleeve ❹.

Installation instructions for the pH 296

Terminal assignment

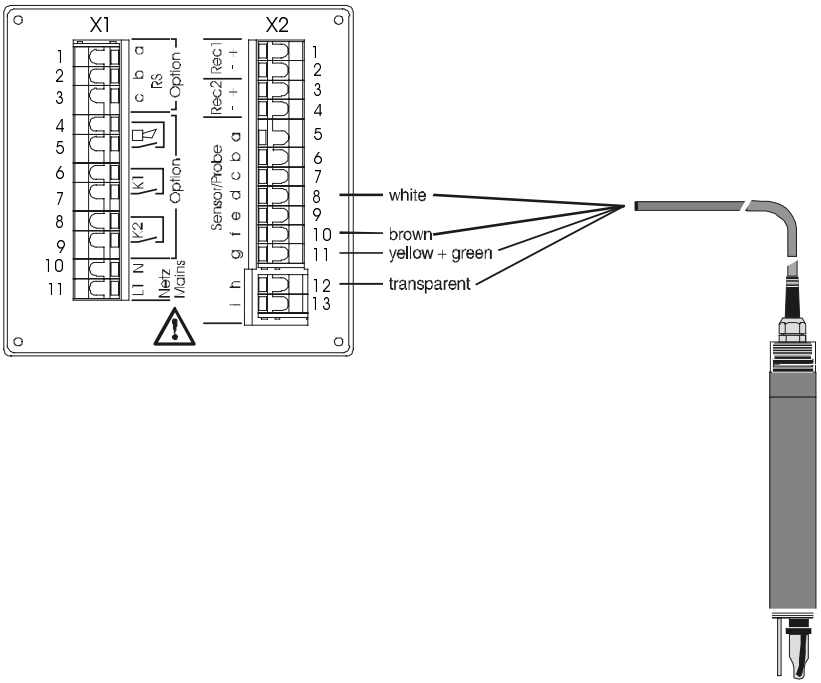


Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485)	REC 1 +
2	B (RS 485)	REC 1 –
3	GND (RS 485)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	a (sensor)
6	Relay 1	b (sensor)
7	Relay 1	c (sensor)
8	Relay 2	d (sensor)
9	Relay 2	e (sensor)
10	N (mains)	f (sensor)
11	L1 (mains)	g (sensor)
12	–	h (sensor)
13	–	i (sensor)

Note:
For power supplies above 24 VDC, use the following wiring:
L_1 + 24 V
N GND

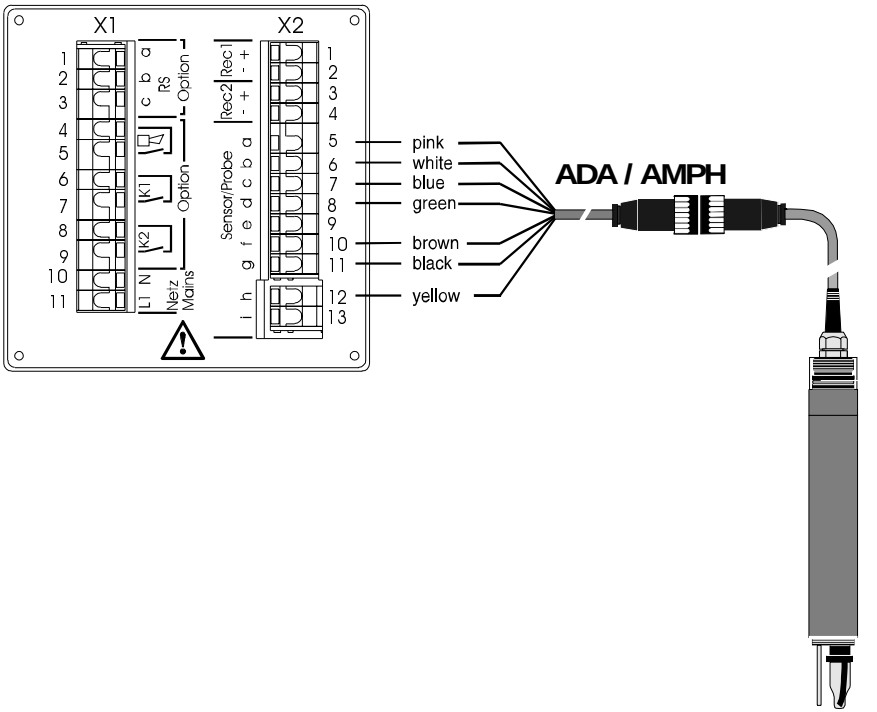
Connecting the SensoLyt 650



Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485)	REC 1 +
2	B (RS 485)	REC 1 –
3	GND (RS 485)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	–
6	Relay 1	–
7	Relay 1	–
8	Relay 2	white
9	Relay 2	–
10	N (mains)	brown
11	L1 (mains)	yellow + green
12	–	transparent
13	–	–

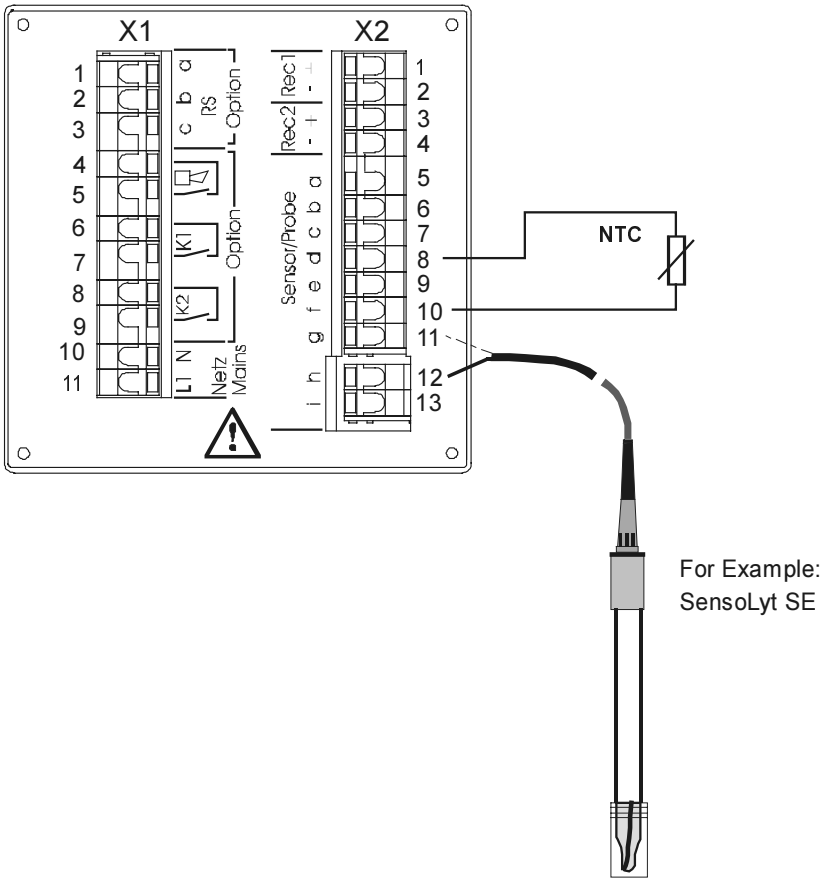
Connecting the SensoLyt 690 or SensoLyt 700



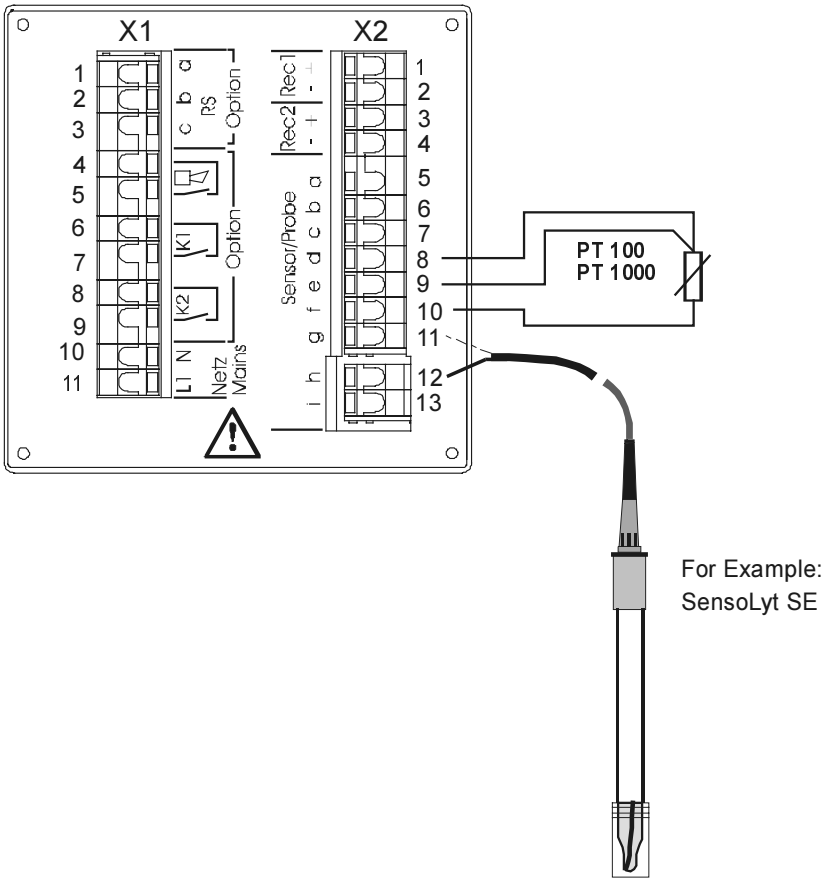
Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485)	REC 1 +
2	B (RS 485)	REC 1 –
3	GND (RS 485)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	pink
6	Relay 1	white
7	Relay 1	blue
8	Relay 2	green
9	Relay 2	–
10	N (mains)	brown
11	L1 (mains)	black
12	–	yellow
13	–	–

Connecting measuring chains with an external temperature sensor

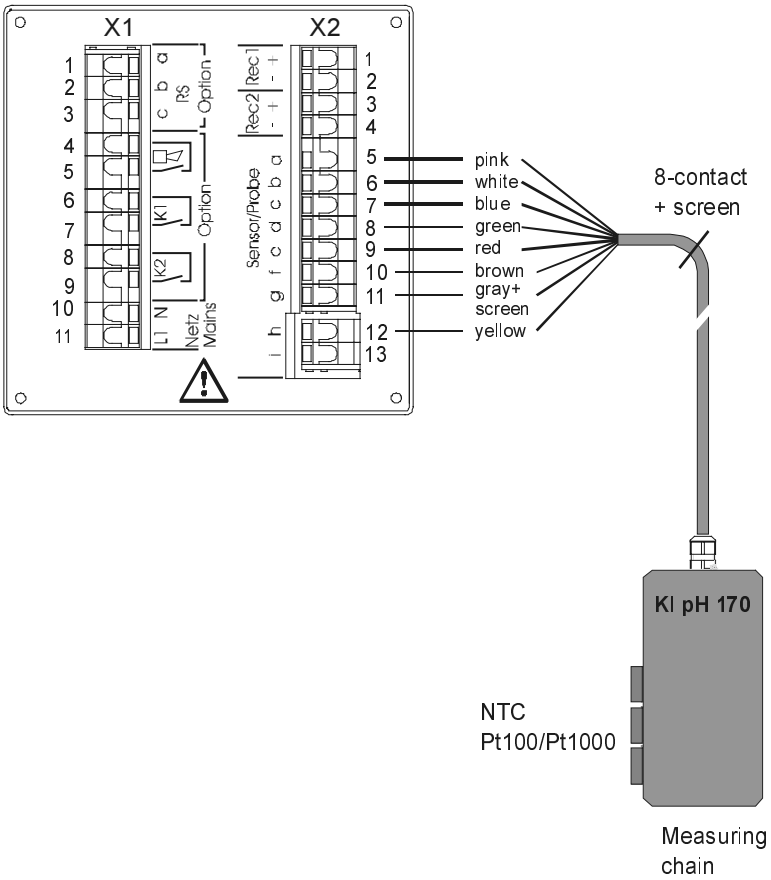


Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.



Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

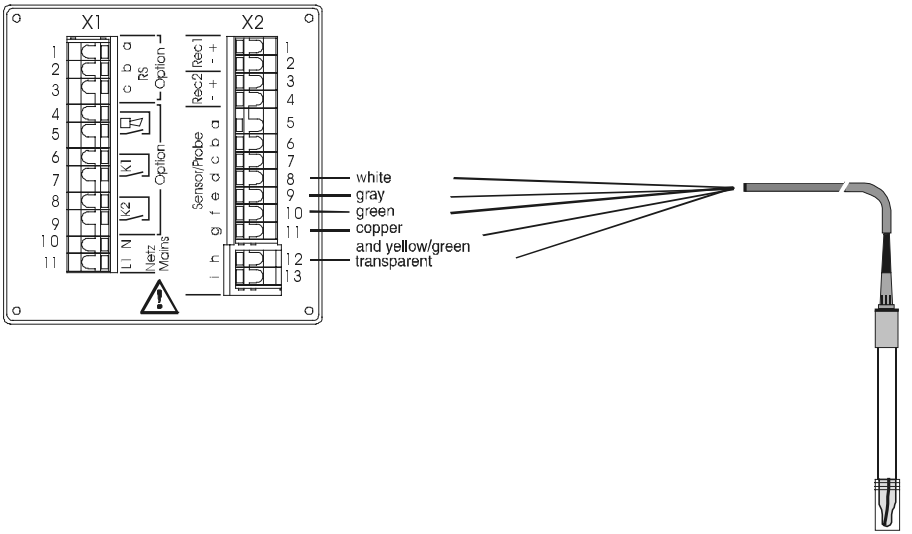
Connecting the terminal box KI/pH 170



Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485)	REC 1 +
2	B (RS 485)	REC 1 –
3	GND (RS 485)	REC 2 +
4	Sens-Check	REC 2 –
5	Sens-Check	pink
6	Relay 1	white
7	Relay 1	blue
8	Relay 2	green
9	Relay 2	red
10	N (mains)	brown
11	L1 (mains)	gray + screen
12	–	yellow
13	–	–

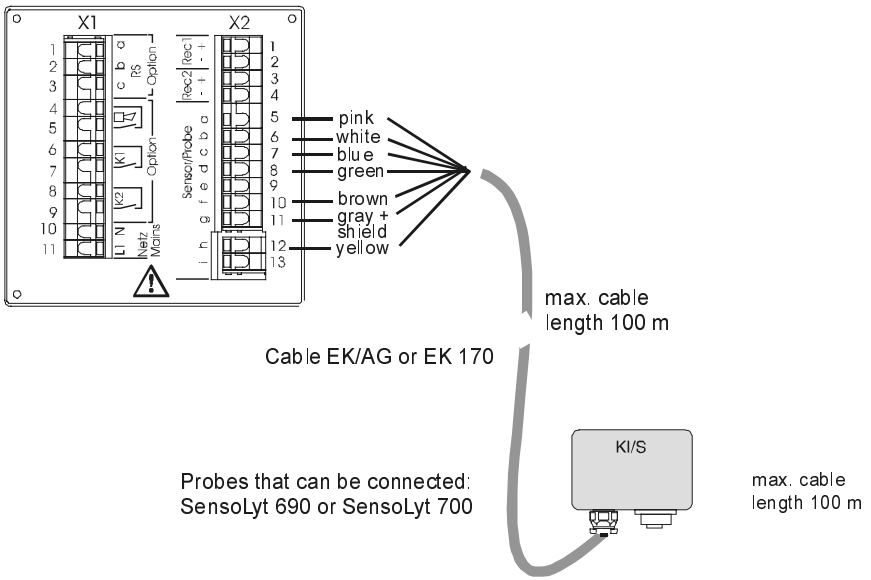
Connecting a InPro® 4200



Terminal	Terminal assignment	
	X1	X2
1	*A (RS 485)*	*REC 1 +*
2	*B (RS 485)*	*REC 1 –*
3	*GND (RS 485)*	*REC 2 +*
4	*Sens-Check*	*REC 2 –*
5	*Sens-Check*	–
6	*Relay 1*	–
7	*Relay 1*	–
8	*Relay 2*	*white*
9	*Relay 2*	*gray*
10	*N (mains)*	*green*
11	*L1 (mains)*	*copper and yellow/green*
12	–	*transparent*
13	–	–

Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

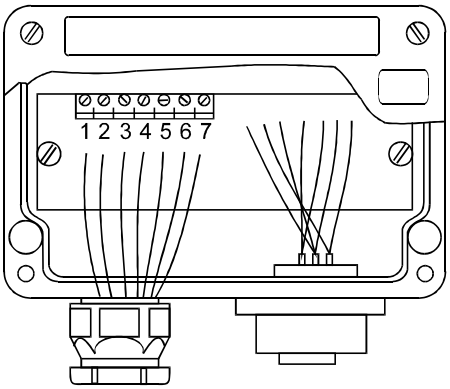
Connecting the KI/S terminal box



Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Terminal	Terminal assignment	
	X1	X2
1	A (RS 485)	REC 1 +
2	B (RS 485)	REC 1 –
3	GND (RS 485)	REC 2 +
4	–	REC 2 –
5	–	pink
6	Relay 1	white
7	Relay 1	blue
8	Relay 2	green
9	Relay 2	–
10	N (mains)	brown
11	L1 (mains)	gray + shield
12	–	yellow
13	–	–

Wiring of KI/S



Strip terminal	Colour of wires
1	yellow
2	gray + shield
3	pink
4	blue
5	brown
6	green
7	white

Unused wires must not jut into the housing. Otherwise, malfunctions can occur. This especially applies to the ground wire of the mains cable.
Cut off unused wires in the housing as close to the armored thread joint as possible.

Note:
After connection of the 8-wire EK 170 cable, the 8th wire remains unused.
The unused wire should be fixed in position or pinched off.

The configuration defines the operating mode of the instrument. To do this, the configuration level is split into submenus (see the flow diagram).

The submenus only offer those setting options that have not yet been established on the basis of the previous configuration of the program.

Access to the configuration level can be protected via a code.

Perform the configuration with the instrument in a ready-to-operate condition, i.e.: the monitor is connected to the supply voltage and the measuring probe is connected.

Factory settings

Adjustable function	Setting	Menu item
pH/mV	pH	CFu
Calibration procedure	Auto Cal TEC	CAL
Temperature compensation	TP (automatic)	tEc
Sensor type	690	S In
Measuring range of recorder output 1	2.00 to 12.00 pH	cr1
Temperature range of recorder output 2 [1)]	0 to 50 °C	cr2
Relay function [2)]	nF REL1 (no function for rel. 1)	rFC
	nF REL2 (no function for rel. 2)	

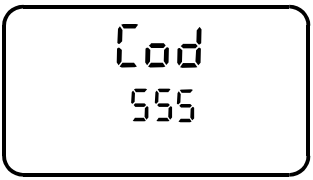
1) only in the T option

2) only in the Relay option

Calling up the configuration level

- Press the DOWN key.
- Press the ENTER key.

The display shows the following:

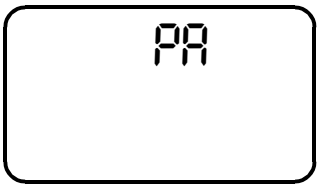


The first numeral flashes.

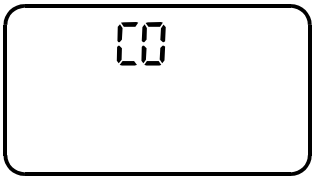
No code number is set in the delivery state.
To access the configuration level
- press the ENTER key 3 times.

If a code number was already set in an earlier parameterization, proceed as follows:
- Set the first numeral using the UP / DOWN keys.
- Press ENTER to confirm the input.
- Set the other two numerals in the same way.

The following display appears:



- Use the UP / DOWN keys to change between PA and CO.
- To reach the configuration level, select CO.



- Press ENTER to confirm the input.

If an incorrect code is entered or the ESCAPE key pressed, access to the configuration is made in the viewing mode. That is to say, settings can be inspected but not changed.

Overview table of the submenus

Display	Description	Basic instrument	Option	
			Relay	T option
CFU	Select the measuring mode	+		
CAL	Select the calibrating procedure	+		
tEc	Select the temperature compensation	+		
S In	Select the sensor type	+		
r1	Select recorder 1	+		
r2	Select recorder 2			+
rC	Assignment of the pilot relay		+	
rF	Operating mode of the pilot relay		+	

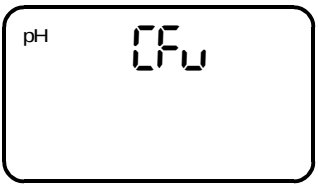
+ Menu appears in the corresponding model of the instrument.

Selecting the measuring mode

Two measuring modes can be selected in the CFU submenu:

- pH measuring mode
- mV (Redox) measuring mode

Note:
In the operating mode, *pH with SensoLyt 700 Sensor*, glassbreak monitoring is permanently switched on.
In the *mV* operating mode and the *pH with SensoLyt 690* operating mode or in *External sensors,* glassbreak monitoring is permanently switched off.
.



– Use the UP / DOWN keys to select between pH and mV (Redox).
– Press the ENTER key to go to CAL.

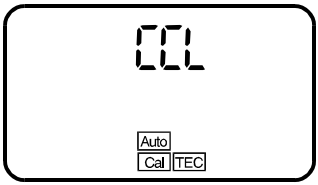
Selecting the calibrating procedure

The instrument can perform three calibration procedures (see also the section, *Calibration*):

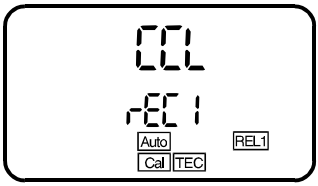
- Auto Cal TEC
- Auto Cal TEC rEC 1 REL1
- Cal

– Use the UP / DOWN keys to select a calibration procedure.
– Press the ENTER key to confirm it.

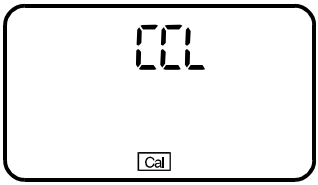
AutoCal TEC:



AutoCal TEC with buffer value output:



ConCal:



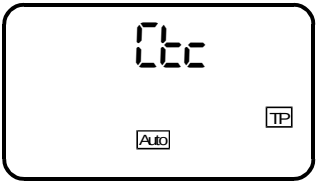
Selecting the temperature compensation

In the Ctc submenu, the following setting options can be selected:

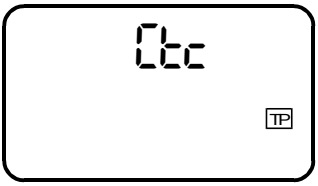
- Auto TP (automatic temperature compensation)
- TP (manual temperature compensation)

– Select a compensation procedure by pressing the UP / DOWN keys.
– Press the ENTER key to confirm it.

Auto TP:



TP:

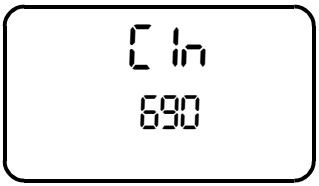


Selecting the sensor

The following setting options can be selected:

Display	Sensor
690	SensoLyt® 690 temperature measurement with NTC
700	SensoLyt® 700 temperature measurement with NTC and Sens-Check
oth	SensoLyt® 650 with NTC or external sensor with NTC; Pt 100 or Pt 1000 without Sens-Check

- Press the UP / DOWN keys to select a sensor.
- Press the ENTER key to confirm the selection.

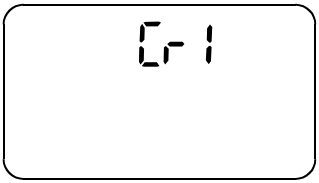


Example:
SensoLyt® 690

Note:
The instrument in conjunction with a SensoLyt® 700 is equipped with glassbreak monitoring (Sensor-Check) that monitors the measuring chain for glass breakage. The Sensor-Check is not in operation during calibration.
When the temperature entry is manual, no Sensor-Check is possible.

Selecting the REC 1 recorder output

The display shows:



If the recorder range is exceeded (OFL), the recorder outputs issue a constant signal of 20.5 mA.
A return to the preset recorder range is performed automatically after eliminating the exceeding of the recorder range.

Delivery state:

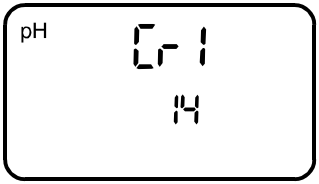
pH recorder range	pH 2 to pH 12	corresponds to 4 to 20 mA
Redox recorder range	– 1000 mV to + 1000 mV Display: – 999 mV to + 999 mV	corresponds to 4 to 20 mA

Admissible recorder ranges (depending on the measured variables):

Measurement variables	**pH**	**mV**
Recorder ranges	variable	variable
Maximum (recorder range end)	pH 4.00 to pH 14.00	– 500 up to + 1000 mV
Minimum (recorder range start)	pH 0.00 to pH 10.00	– 1000 up to + 500 mV
Extent of the recorder range	min. of 4 pH units max. of 14 pH units	min. 500 mV max. 2000 mV
D/span (setting steps)	1.00 pH units	100 mV

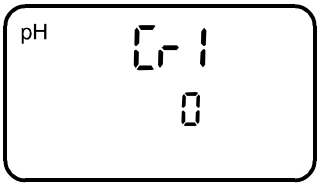
Setting for CFu = pH:

– Press the ENTER key when the following display appears:



– Press the UP / DOWN keys to change the upper value.
– Press ENTER to confirm the input.

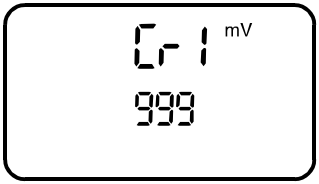
The preset lower value appears:



– Press the UP / DOWN keys to change the lower value.
– Press ENTER to confirm the input.

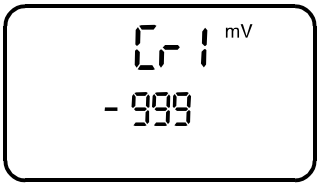
Selection when CFu = mV (Redox measurement)

– Press the ENTER key when the following display appears:



– Press the UP / DOWN keys to change the upper value.
– Press ENTER to confirm the input.

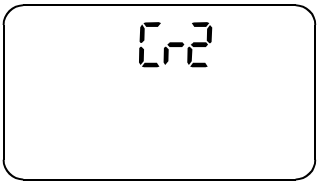
The preset lower value appears:



– Press the UP / DOWN keys to change the lower value.
– Press ENTER to confirm the input.

Selecting the REC 2 recorder output

The display shows:



If the recorder range is exceeded (OFL), the recorder outputs issue a constant signal of 20.5 mA.
A return to the preset recorder range is performed automatically after eliminating the exceeding of the recorder range.

Delivery state:

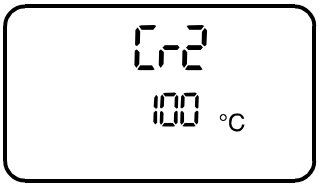
Temperature recorder range 0 °C to + 50 °C corresponds to 4 to 20 mA

Admissible recorder ranges (depending on the temperature sensor):

Temperature sensor	**NTC**	**PT100 / PT1000**
Recorder ranges	variable	variable
Maximum (recorder range end)	+25 °C to +100 °C	+25 °C to +130 °C
Minimum (recorder range start)	-5 °C to +5 °C	-20 °C to +5 °C
D/span (setting step size)	1 °C	1 °C

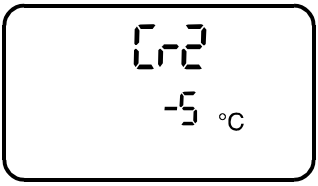
Setting:

– Press the ENTER key when the following display appears:



– Press the UP / DOWN keys to change the upper value.
– Press ENTER to confirm the input.

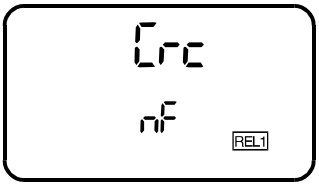
The lower set value appears:



– Press the UP / DOWN keys to change the lower value.
– Press ENTER to confirm the input.

Relay 1 / Relay 2 (R option)

The display shows:



Selecting the relay functions

A function can be assigned to each relay:

Function	Description
nF (no function)	Relay without any function
PS (power supply)	Contact is closed when power is applied and opens if there is a power fail
FrC (freeze)	Is active if the measured value is frozen - e.g. during calibration
LiLL (limits)	Operates as an upper/ lower limit indicator and is active on exceeding/untercutting the rated value
PI	Pulse regulation (only for pH)
PF	Frequency regulation (only for pH)

Limit indicator (UL.LL)

The following functions can be selected:

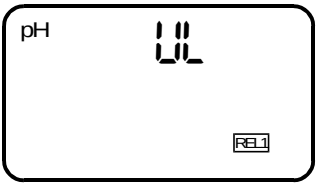
UL **U**pper **L**imit

LL **L**ower **L**imit

Function		Description
pH	mV	
UL pH	UL mV	upper limit – main parameter
LL pH	LL mV	lower limit – main parameter
UL °C	UL °C	upper limit – temperature
LL °C	LL °C	lower limit – temperature

Setting:

- Press the UP / DOWN keys to select the UL.LL relay function, e.g. for **Relay 1**.
- Press ENTER to confirm the input.



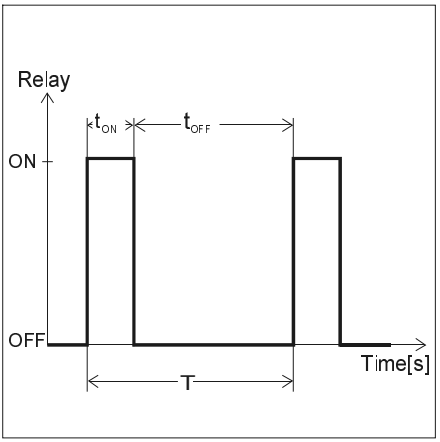
- Press the UP / DOWN keys to select the required limit function, e.g. UL pH for **Relay 1**.
- Press ENTER to confirm the input.
- Adjust the setting for relay 2 in the same way.

Pulse regulator (PI)

In impulse regulation, the output relay - within a preselected proportional band - is clocked and the switch contact is closed for a longer or shorter time according to the deviation from the limit.

- In larger deviations of the measured value from the limit, the contact is closed longer and the pause is short.
- If the value is close to the limit, the contact is closed only briefly and the pause is correspondingly longer.

The total time (switch-on and switch-off time) is designated as the switching period, T.
While the switching times vary depending on the control deviation, the time intervall, T, remains constant (see adjacent figure).
Pulse duration regulators are used for, e.g. the control of valves.
Within the set up proportional band, Xp, the relative duration of operation of the relay lies between 10 and 90%.

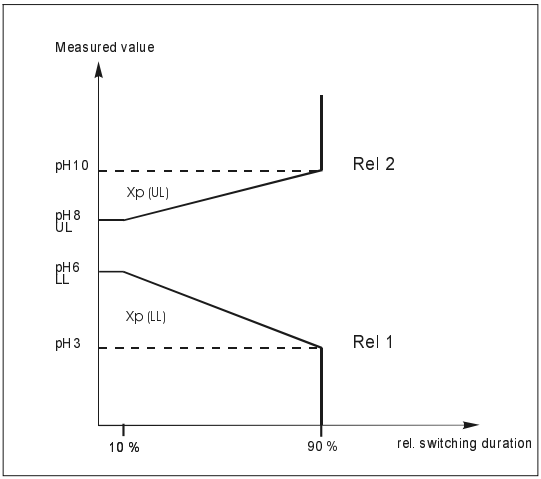


Relative switching duration= $\frac{t_{ON}}{T} \cdot 100\,\%$

Setting parameter:

Setting range T:	5 to 100 sec. (interval)
Proportional band, Xp:	Set in steps of 0.1 pH over the whole measuring range.
Basic setting:	10 sec, proportional band of 1 pH

Example:



The following default limits are given:
Rel1: LL = pH 6 Xp (LL) = 3 pH
Rel2: UL = pH 8 Xp (UL) = 2 pH

pH value = 6 to 8
If the value lies between pH 6 and pH 8 (nominal range), it is not regulated.

pH value = 3 to 6
If the value sinks below pH 6, it is regulated between 10 and 90% by Rel 1.

pH value < 3
If the value sinks below pH 3 (except for Xp/LL), it is further regulated by 90% using Rel 1.

pH value = 8 to 10
If the value rises above pH 8, it is regulated between 10 and 90% using Rel 2.

pH value > 10
If the value rises above pH 10 (except for Xp/UL), it is further regulated by 90% using Rel 2.

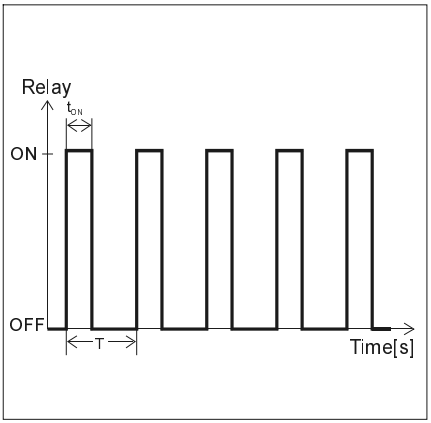
Frequency regulator (PF)

In frequency regulation - within a preselected proportional band - the output relay is clocked where the clock frequency is higher or lower depending on the deviation from the limit.

- In larger deviations of the measured value from the limit, the switching rate is higher.
- If the value is close to the limit, the relay is actuated less often.

While the frequency varies depending on the deviation from the limit, the pulse duration t_{ON} (0.3 sec.) remains constant.

Pulse frequency regulators are used for, e.g. the control of magnetic dosing pumps.
Outside the proportional band set up, Xp, the maximum frequency is output and, thus, the maximum possible performance of the pump achieved.
The maximum possible frequency is entered via the software.

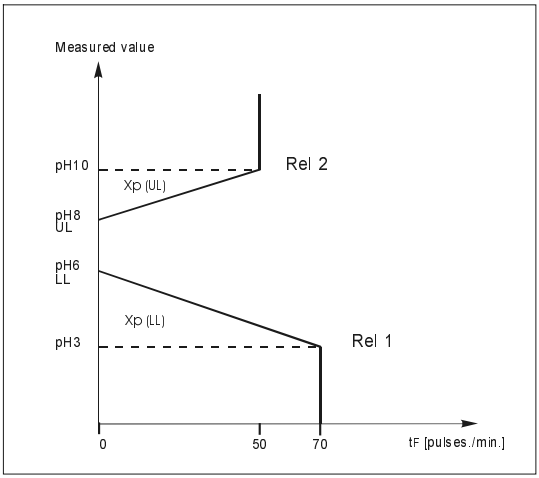


$$\text{Pulse frequency} = \frac{\text{Number of pulses}}{\text{S}}$$

Setting parameter:

Setting range:	50 to 120 pulses/min
Proportional band, Xp:	Set in steps of 0.1 pH over the whole measuring range
Basic setting:	70 pulses/min, proportional band of 1 pH

Example:



The following default limits are given:
Rel1: LL = pH 6 Xp (LL) = 3 pH tF = 70 Imp./Min.
Rel2: UL = pH 8 Xp (UL) = 2 pH tF = 50 Imp./Min.

pH value = 6 to 8
If the value lies between pH 6 and pH 8 (set range), it is not regulated.

pH value = 3 to 6
If the value sinks below pH 6, Rel 1 is regulated between 0 and 70 pulses/min

pH value < 3
If the value sinks below pH 3 (except for Xp/LL), it is further regulated using Rel 1 by 70 pulses/min.

pH value = 8 to 10
If the value rises above pH 8, it is regulated using Rel 2 between 0 and 50 pulses/min.

pH value > 10
If the value rises above pH 10 (except for Xp/UL), it is further regulated using Rel 2 by 50 pulses/min.

Proportional band, Xp

The proportional band Xp lies above or below the limiting value.
When entering a PL UL (Upper Limit) limiting value, Xp begins above the respective limit whereas , when entering a PL LL (Lower Limit) limiting value, it begins below the respective limit.

Thus, this results in a limit range for PL UL of:

- pH 0.0 to pH 13.9 (0.1 pH minimum proportional band)

and for PL LL, a limit of:

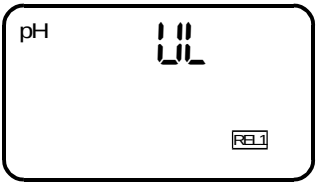
- pH 0.1 to pH 14 (0.1 pH minimum proportional band).

Note:
Thus, the Xp proportional band can have a minimum value of 0.1 pH and a maximum value of 13.9 pH.

Setting procedure for pulse or frequency regulation

Example P1:

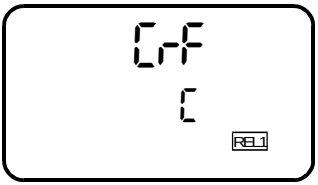
- Press the UP / DOWN keys to select the P1 relay function, e.g. for *Relay 1*.
- Press ENTER to confirm the selection.



- Use UP / DOWN to select between UL (Upper Limit) and LL (Lower Limit) to set up the functions required.
- Press ENTER to confirm the selection.

Selecting the switching direction (opener / closer) for FrC, UL.LL

The CnF submenu is used to determine whether a relay operates as an opener (break) or a closer (make).



- Press the ENTER key to enter into the CnF submenu.
- Use the UP / DOWN keys to select between:
  CLOSER (C = Close)
  OPENER (O = Open)
- Press the ENTER key to confirm the selection.
- Conduct the setting for relay 2 in the same way.

The parameterization creates the numeric values of the functions for which the instrument is configured.

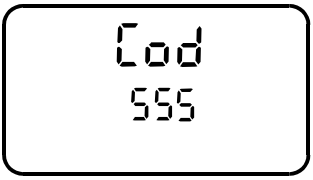
Factory settings

Adjustable function	Setting	Menu item
Recorder output 1: Current range Attenuation	 4 to 20 mA 20 mA/s	Pr 1
Recorder output 2: Current range Attenuation	 4 to 20 mA 20 mA/s	Pr2
Settings of the RS 485 digital interface (only in the RS option)	SLAVE 9600 Bd 8 no (8 bit, no parity) Ident 01 notr (no closing resistor)	P IF
Code	000	Pcd
Temperature zero shift	ΔT 0 °C	Pt
manual temperature compensation	15 °C	Ptc

Calling up the parameterization level

Calling up the parameterization level from the measuring mode

- Press the DOWN key.
- Press the ENTER key.



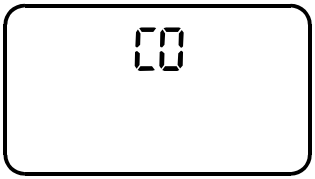
The first numeral flashes.

No code number is set in the delivery state.
To access the configuration level
- press the ENTER key 3 times.

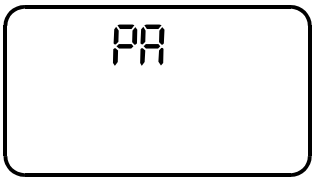
If a code number was already set in an earlier parameterization, proceed as follows:
- Set the first numeral using the UP / DOWN keys.
- Press ENTER to confirm the input.
- Set the other two numerals in the same way.
- The display shows PA.

Calling up the parameterization level from the configuration mode

Press ENTER when the configuration is finished.
The following display appears.



- Use the UP / DOWN keys to change to the parameterization level.



- Press the ENTER key to confirm the input.

If an incorrect code is entered or the ESCAPE key pressed, access to the parameterization is made in view mode. That is to say, settings can be checked but not changed.

Overview table of the submenus

Display	Description	Basic instrument	Option		
			Relay	T	RS-485
Pr 1	Recorder output 1	+			
Pr2	Recorder output 2			+	
PL	Limiting value indicator		+		
P IF	RS 485 interface				+
PtC	Manual temperature setting [1)]	+			
PCd	Set up the code number	+			
Pt	Temperature compensation	+			

+ Menu appears in the corresponding model of the instrument.

[1)] Only appears in the manual setting of the temperature compensation (tCt)

REC 1 and REC 2 recorder outputs (REC 2 only in T option)

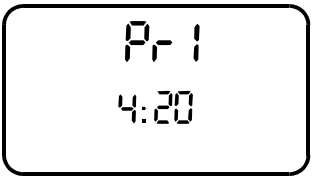
This submenu enables the setting of:

- Current range
  - 0 to 20 mA
  - 4 to 20 mA
- Attenuation [dI/dt] (dI = current change; dt = time change)
  - 0.1 mA/s
  - 1.0 mA/s
  - 5.0 mA/s
  - 20.0 mA/s (= delivery state)

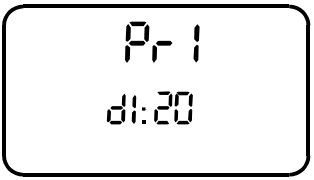
Note:
Attenuation = changing speed of the recorder flow [mA/sec]
on a sudden change of the input signal.

Setting:

- Press the ENTER key when the Pr 1 submenu appears:

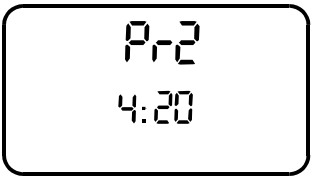


- Use the UP / DOWN keys to select the current range.
- Press the ENTER key to confirm the input.



- Use the UP / DOWN keys to select the attenuation.
- Press the ENTER key to confirm the input.

- Press the ENTER key when the Pr2 submenu appears:



- Set recorder output 2 in the same way as recorder output 1.
- Press the ENTER key to confirm the input.

Relay 1 / Relay 2 (R option)

Limit indicator (UL.LL)

The PL submenu enables the allocation of the following values for the relay occupied by a limit function (UL.LL) in the configuration level:

1. Limiting value L (Limit)
2. Hysteresis HS (Hysteresis)
3. Time delay Td (Time delay)

The PL submenu displays only the limit functions (UL or LL) that were selected in the configuration of the instrument (configuration level ⇒ CnF submenu).

Overview table:

Nominal	Minimum: Maximum: Setting accuracy: Default:	lower measurement range final value (UBE) upper measurement range final value (OBE) depends on the meas. value display for the upper limits, the maximum, otherwise the minimum
Hysteresis	Minimum: Maximum: Setting accuracy: Default:	0 10% of the measurement range (OBE - UBE) depends on the meas. value display 0
Time delay	Minimum: Maximum: Setting step: Default:	0 sec 59 min 59 sec 1 sec 0 sec

Nominal: Upper or lower limiting value (nominal value) that is set up. Exceeding or undercutting the measuring signal of this value causes switching of the relevant relay programmed as a limit contact.

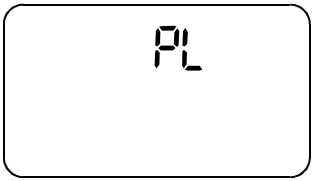
Hysteresis: Range above and below the nominal value set up that shifts the switching point of the relay. In this way, oscillation of the regulation is prevented.

Time delay: Time in seconds for which the value must be applied before a release is performed (by which the switching of the relay can be delayed).

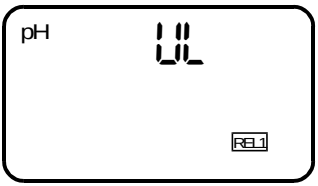
The input of these 3 values is subject to a compelled guidance. Even if no setting of hysteresis and time delay is planned (value = 0), you must pass through these submenus!

Setting the parameters for limit indicators

Example: Set up the upper limit for “pH“ on relay 1.



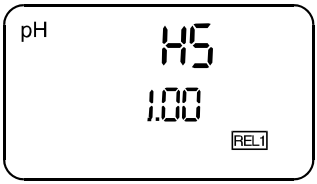
– Press the ENTER key to enter the PL submenu.



– Press the ENTER key again to set this limiting value.

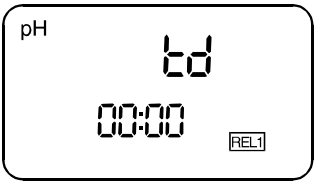
The first/second/third or fourth numeral flashes.

– Use the UP / DOWN keys to set the numeral (flashing) of the limiting value and confirm it by pressing the ENTER key.
– Set the other numerals in the same way.
– Confirm the last numeral using the ENTER key and the HS submenu appears.



– Use the UP / DOWN keys to set the first numeral (flashing) of the hysteresis.
– Press the ENTER key to confirm the input.
– Set the both other numerals in the same way.

  Setting range: 0 to 10 % from the measuring range.
– Confirm the last numeral using the ENTER key and the Ed submenu appears.

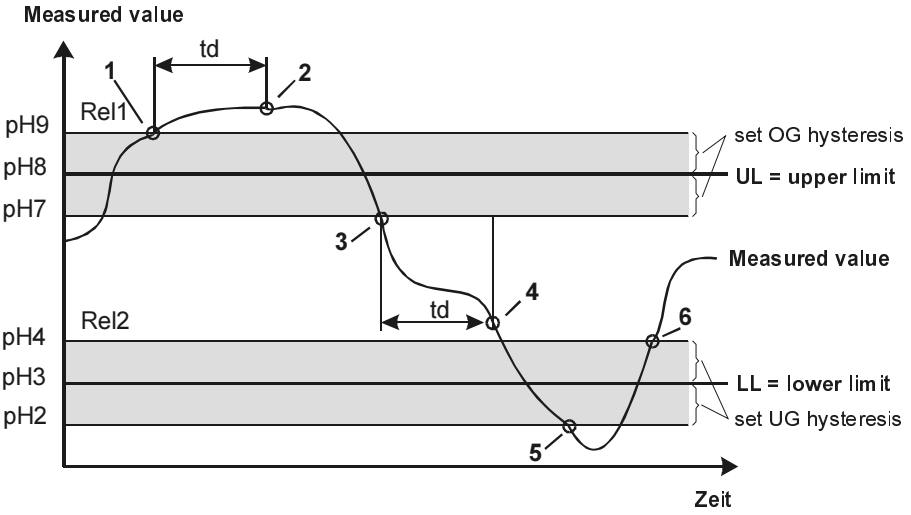


– Use the UP / DOWN keys to set the **seconds** (**right-hand flashing digits**) of the time delay.
– Press the ENTER key to confirm the input.
– Set the **minutes** (**two numerals on the left**) in the same way.

  Setting range: 0 to 59 min 59 sec.
– Press the ENTER key. Conduct the setting for relay 2 in the same way.

Example:

Rel 1:	UL = pH 8	HS = 1 pH	td = 0
Rel 2:	LL = pH 3	HS = 1 pH	td = 0



1 Upper limit passed
2 Upper limit indicator switches
3 Upper limit falls below
4 Upper limit indicator switches back
5 Lower limit indicator switches
6 Lower limit indicator switches back

Pulse regulator / Frequency regulator

The PL submenu enables the allocation of the following values to the relay occupied with a control function (PI / PF) in the configuration level:

1. Limiting value L (Limit)
2. Proportional band Pro
3. PI : time interval tI
   PF: pulses/minute tF

The PL submenu displays only the limit functions (UL or LL) that were selected in the configuration of the instrument (configuration level ⇒ CnF submenu).

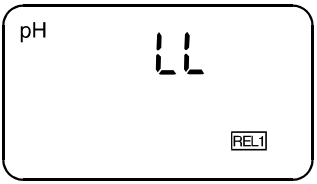
Overview table:

Nominal	Minimum: Maximum: Setting accuracy: Default:	UL : pH 0.0 LL : pH 0.1 UL : pH 13.9 LL : pH 14.0 depends on the meas. value display UL : pH 9.0 LL : pH 5.0
Proportional band	Minimum: Maximum: Setting accuracy: Default:	0.1 pH UL: band end - UL LL: LL – band start depends on the meas. value display 0.1 pH
Time interval (PI)	Minimum: Maximum: Setting step: Default:	5 sec 100 sec 1 sec 10 sec
Pulses / min. (PF)	Minimum: Maximum: Setting step: Default:	50 pulses/min 120 pulses/min 1 pulses/min 70 pulses/min

Note:
Further information on this is given in the chapter *Configuration*, section *Pulse regulator/Frequency regulator*.

Parameters for the pulse regulator / frequency regulator

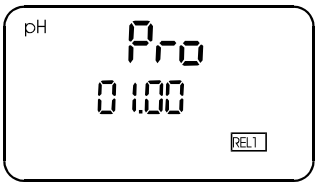
– Press the ENTER key to enter the submenu:



– Press the ENTER key again to set this limiting value.

The first/second/third or fourth numeral is flashing.

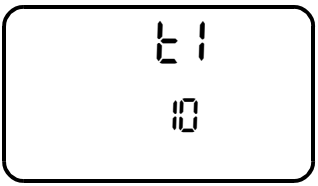
– Use the UP / DOWN keys to set the numeral (flashing) of the limiting value and confirm it by pressing the ENTER key.
– Set the other numerals in the same way.
– Confirm the last numeral using the ENTER key when the Pro submenu appears.



The first/second/third or fourth numeral is flashing.

– Use the UP / DOWN keys to set the numeral (flashing) of the limiting value and confirm it by pressing the ENTER key.
– Set the other numerals in the same way.
– Confirm the last numeral using ENTER and go on to the submenu, t I (PI controller) or dF (PF controller).

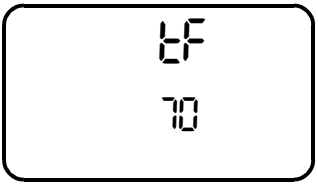
Setting the pulse regulator:



t1 submenu:

- Use the UP / DOWN keys to set the time interval to between 5 and 100 sec.
- Press the ENTER key to confirm the input.

Setting the frequency regulator:

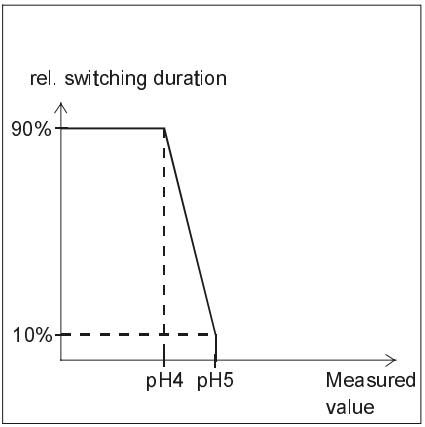


tF submenu:

- Use the UP / DOWN keys to set the max. number of pulses/min to between 50 and 120 pulses/min.
- Press the ENTER key to confirm the input.
- Adjust the setting for relay 2 in the same way.

Example 1:

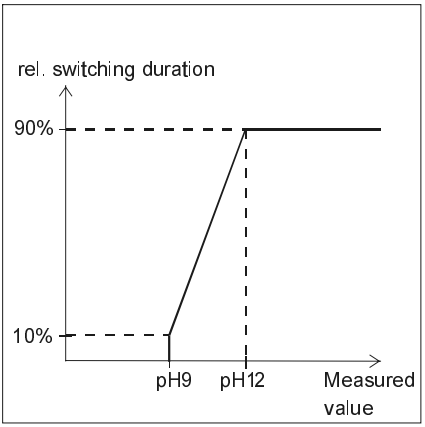
Rel 1 was configured as a PI controller with the function of LL. A value of LL = pH 5.0 results in the possible proportional band of 0.1 pH to 5.00 pH.



In a proportional band of 1.0 pH, the PI controller controls a range of pH 4.0 to pH 5.0 in proportion to the measured value.

Example 2:

Rel 2 was configured as a PI controller with the function of UL. A value of UL = pH 9.0 results in the possible proportional band of 0.1 pH to 5.00 pH.



In a proportional band of 3.0 pH, the PI controller controls a band of pH 9.0 to pH 12.0 in proportion to the measured value.

RS 485 interface (RS option)

- Call up the P IF submenu using ENTER:

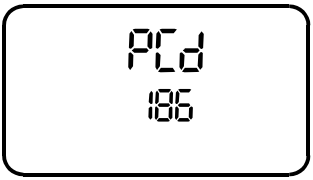
The parameterization of the RS 485 interface is described in a separate manual that is included within the scope of delivery of instruments with a RS 485 interface (RS instrument version).

Setting up the code

The setting of a code prevents changes to the configuration and parameterization of the instrument by the unintentional or erroneous pressing of an input key.
On entering the configuration / parameterization, the code number must be entered by the user (see *Calling up the configuration level / Calling up the parameterization level*).
No code is set in the delivery state.
Thus, the configuration and parameterization of the instrument is not protected. The input of a code number firstly protects the instrument against unintended or unauthorized changes.

Setting:

– Call up the PCd submenu using ENTER:



– The current code number appears on the display (delivery state: 000).
The first numeral flashes.
– Set the first numeral using the UP / DOWN keys.
– Press the ENTER key to confirm the input.

Note:
(The code number 555 is not permitted!)

– Set the other two numerals in the same way.

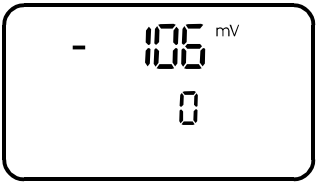
Note:
After the entry of a code number, the instrument can only be configured or parameterized using this new code!

Lifting the code number lock
The code number lock can only be entered by removing the reset in the delivery state again. To do this, enter the code number **000.**

Redox shift

This submenu enables the Redox potential to be shifted by ± 100 mV.
The menu is only provided when the instrument is in the *Redox* measuring mode. If a correction of the measured value is undertaken, the correction value appears in the display (normal measuring mode).

– Press the ENTER key to call up the Prd submenu:



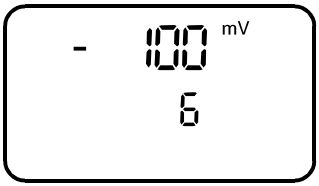
The momentary Redox value is displayed in the upper field and the correction value in the lower field.
The correcting value of "0" is used initially.

– Use the UP / DOWN keys to compensate in the range of ± 300 mV.
Step size: 1 mV.

The indicating range limits with the maximum correction lie at ± 1100 mV.
The correction value is further counted and the Redox measuring value simultaneously changed by the same amount.

The recorder output tracks the display value!

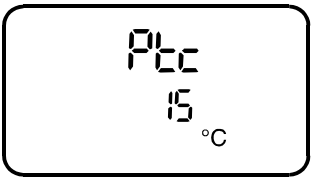
Display in the normal measuring mode in the Redox shift, e.g.:



The Redox measurement value displayed (- 100 mV) is corrected by + 6 mV, i.e. the uncorrected measurement value lay at - 106 mV.

Temperature input in manual temperature compensation

The following submenu appears only in the manual temperature compensation in the *pH* measuring mode:



- Call up the submenu using the ENTER key when the first numeral flashes.
- Set the first numeral using the UP / DOWN keys.
- Press the ENTER key to confirm the input.
- Set the other two numerals in the same way.

Temperature range	Sensor [1])
– 5 to + 100 °C	ntC
– 20 to + 130 °C	Pt 100 Pt 1000

See the technical data of the sensors (allowable temperature ranges).

Temperature compensation

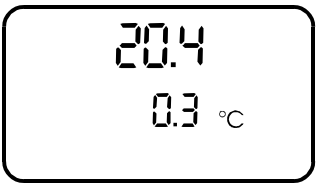
The Pt submenu enables compensation of the temperature measuring sensor tolerances in the test probe (shifting of the zero point by a maximum of 0.5 °C) and appears only if, in the configuration of tEc, the automatic temperature compensation was set.

Place the measuring probe in a vessel containing at least 2 liters of water due to its thermal capacity.

Leave the measuring probe and reference thermometer in the water for at least 15 minutes, or with temperature differences between the water and test probe > 10 °C for at least 1 hour, and stir the water occasionally until the comparison can be made.

Setting:

– Use ENTER to call up the Pt submenu:



– Use the UP / DOWN keys to set the value (± 0,5 °C). At the same time, the corrected measured value (upper line) and the correction value (lower line) are displayed.
– Press the ENTER key to confirm the input.
– Press the M key to return to the measuring mode.

Displaying the parameterization and configuration data

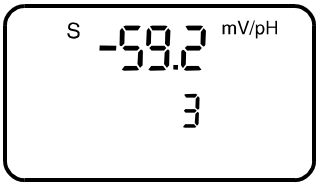
In the viewing mode, settings can be queried without having to input a code. However, the settings cannot be modified.

To leave the measuring mode and go into the viewing mode, perform the following steps:

- Press the DOWN key.
- Press the ENTER key when the first numeral flashes.
- Press the ESCAPE key.
- Use the UP / DOWN keys to change between the parameterization PA and configuration CO.
- Press the ENTER key to run through the submenus.

Displaying the calibration data and software version

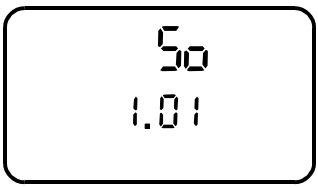
- By pressing the ENTER key in the measuring mode, the following display appears:



Note:
No calibration data is displayed in the mV measuring mode.

If a calibrating error (CAL Err) is present, the cause of the calibrating error is displayed instead of the calibration data
(see chapter “Calibration“).

- Use the UP / DOWN keys to call up the So submenu:



Press the M key to return to the measuring mode.

Measuring Mode

The pH 170 and pH 296 instruments are automatically located in the measuring mode following the first commissioning.
Otherwise, the measuring mode - except in compelled guidance - can be called up from any operating level by pressing the *M* key (see also section, *Operating instructions*).

The calibration of the pH measuring is made according to the selected calibrating procedure. The following calibrating procedures are available:

- **Auto Cal TEC:**
  Automatic calibration using the WTW technical buffer solutions for pH 2.00, 4.01, 7.00 or 10.00.
- **Auto Cal TEC rEC 1 REL1:**
  with additional buffer output on the REC 1 output
- **Cal:**
  conventional calibration using any buffer solutions.

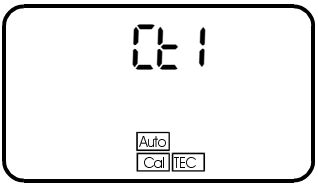
During the calibration procedure, the recorder output is frozen to the current value and the switching relays retain the current operating status.

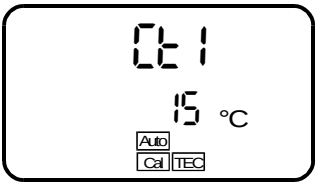
Calling up the calibrating mode

AutoCal TEC and AutoCal TEC calibrating procedures with buffer output

Calibrating process:

– Use the C (calibration) key to select the *Calibration operating mode*.
  The recorder outputs are frozen on the current value, the switching relays keep the current operating condition. The following display appears:



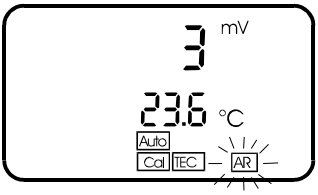


Note:
In manual temperature compensation, set the temperature of the buffer solution using the UP / DOWN keys.

If the temperature varies, the manual temperature input is still valid in the measuring operation!

Note:
The calibration can be terminated by pressing the ESCAPE key.

- Rinse the measuring chain and immerse it in the 1st buffer solution.
- Use the ENTER key to start the calibration.

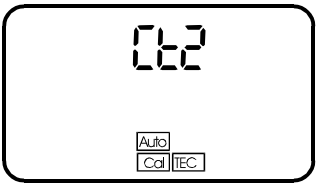


The measurement runs until a stable measuring value is reached (AR flashes / display in mV).

Note:
In manual temperature compensation, the buffer temperature set up, otherwise the current buffer temperature, is displayed.

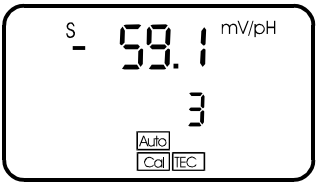
Duration of the calibrating process:
Min. 30 sec to max. 10 min

Note:
If no stable measured value is achieved after 10 minutes, the "CAL Err" error message appears, see also parameterization reports.



- Rinse the measuring chain again and immerse it in the 2nd buffer solution.
- Start the calibration again.

Note:
The temperature set up in manual temperature compensation with "Cb 1" continues to be valid.



After successful calibration, the display appears showing the slope and offset voltage ("Asymmetry"),
e.g. – 59.1 mV/pH,
ASY 3 mV.

Admissible ranges:

Slope	- 62.0	to	- 50.0 mV/pH
ASY	- 45	to	+ 45 mV

- Use the ENTER or M key to go back to the measuring mode. At the same time, the "freezing" of the recorder output and the switching relay lifted.

In "AutoCal TEC" with buffer output, the buffer values are output via relay 1 and recorder 1 (see AutoCal TEC with buffer output)

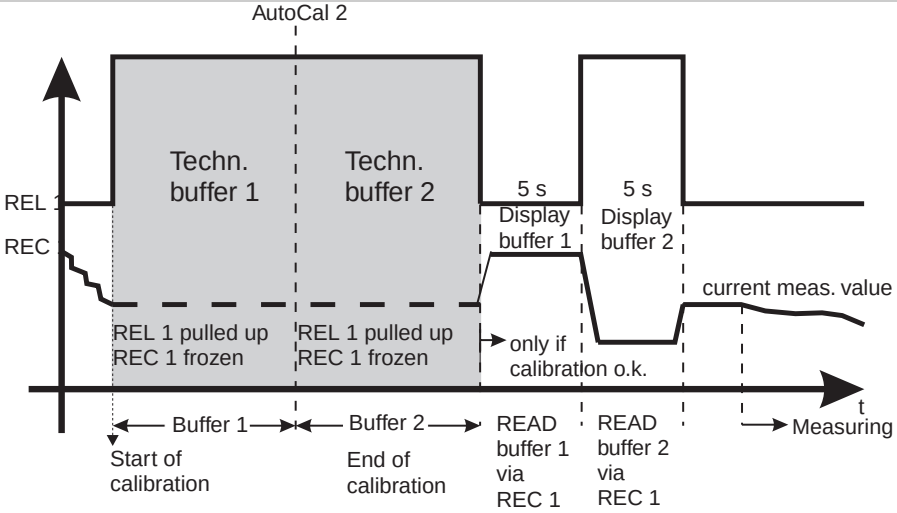
Calibration error, CAL Err

The CAL Err error message appears if

- no stable measured value was reached or
- non-admissible values were measured for slope and offset voltage.

– Use the ENTER key after the error has been eliminated to redo the calibration.

AutoCal TEC with buffer value



If the calibration is not o.k., REL 1 remains pulled up and REC 1 frozen and a return is made to the start: "Start calibration".

After terminating the calibrating process, the relevant buffer value for every **5s** is output at the recorder REC 1.
REL 1 is used for synchronization.

Note:
For the buffer value output, the range of Rec1 is always pH 0 to pH 14 (not dependent on the set recorder range).

Formulas for conversion of pH to current:

1. Setting of 0 to 20 mA

$$I = \frac{20}{14}\left[\frac{mA}{pH}\right] \cdot \text{buffer value [pH]}$$

$$\text{buffer value} = \frac{14}{20}\left[\frac{pH}{mA}\right] \cdot I\,[mA]$$

2. Setting of 4 to 20 mA

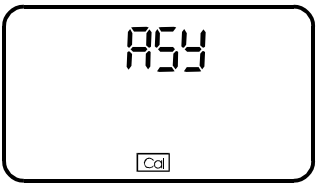
$$I = 4\,[mA] + \frac{16}{14}\left[\frac{mA}{pH}\right] \cdot \text{buffer value [pH]}$$

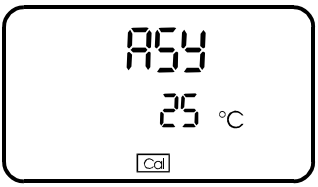
$$\text{buffer value} = \frac{14}{16}\left[\frac{pH}{mA}\right] \cdot (I[mA] - 4[mA])$$

Calibration using any buffer solutions: "ConCal"

Calibrating process:

– Use the C (calibration) key to select the *Calibration operating mode*.
  The recorder outputs are frozen on the current value, the switching relays keep the current operating condition. The following display appears:





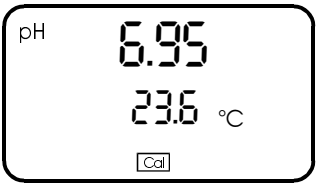
Note:
In manual temperature compensation, set the temperature of the buffer solution using the UP / DOWN keys.

If the temperature varies, the manual temperature input is still valid in the measuring operation.

Note:
The calibration can be terminated by pressing the ESCAPE key.

– Rinse the measuring chain and immerse it in the 1st buffer solution (**pH 7**).
– Use the ENTER key to start the calibration.

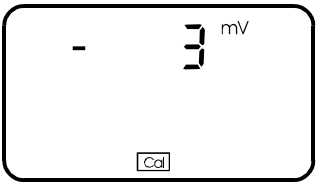
Setting up the offset voltage ("Asymmetry" ASY)



– Use the UP / DOWN keys to set the pH value of the first buffer solution according to the temperature.

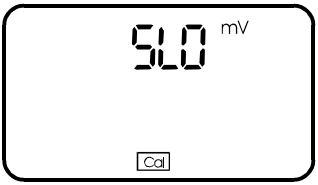
Note:
In manual temperature compensation, the buffer temperature set up, otherwise the current buffer temperature, is displayed.

– Press the ENTER key to confirm it.



Display of the offset voltage ("Asymmetry"), e.g. ASY 3 mV.

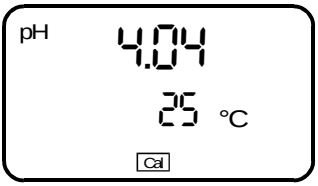
– Press the ENTER key to confirm it.



Note:
In manual temperature compensation, the temperature set up for the first buffer in *ASY* is also displayed. This continues to be valid for the second buffer.

– Rinse the measuring chain again and immerse it in the 2nd buffer solution.
– Continue the calibration with the ENTER key.

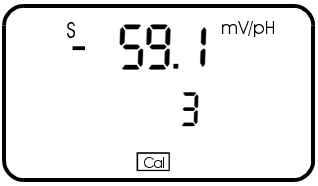
Setting up the measuring chain slope



– Use the UP / DOWN keys to set the pH value of the second buffer solution 2 according to the temperature.

Note:
In manual temperature compensation, the buffer temperature set up, otherwise the current buffer temperature, is displayed.

– Use the ENTER key to confirm it



After successful calibration, the display appears showing the slope and offset voltage ("Asymmetry"),

e.g. – 59.1 mV/pH,
ASY 3 mV.

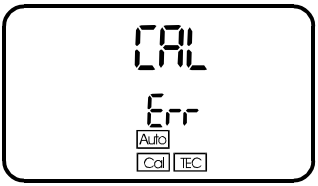
Admissible ranges:

Slope	- 62.0	to	- 50.0 mV/pH
ASY	- 45	to	+ 45 mV

– Use the ENTER or M key to go back to the measuring mode. At the same time, the "freezing" of the recorder output and the switching relay is lifted.

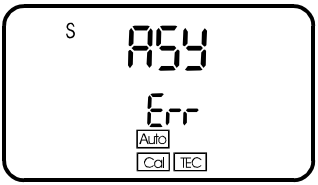
Calibrating errors

If the calibration routine is left after an invalid calibration, an error is output. Instead of the measured value, three lines appear on the display. The last measured value remains frozen.



– Press ENTER:
The cause of the error is displayed.

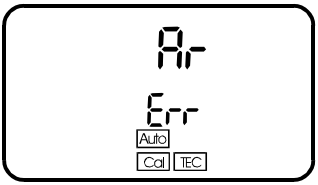
Slope or offset error:



Measure:

In the mV mode, check the Redox potential of the buffer and the sensor or replace the measuring chain.

Autoread error (measured value unstable):



Measure:

Repeat the calibration and, if the error is reoccurs, check the sensor.

The checking mode may only be used by trained specialist personal as special knowledge is required.

The interfaces of the pH 170 or pH 296 and connected peripheral devices (e.g. recorder, PLC, PC, printer) can be checked in the checking mode.

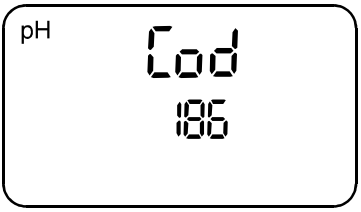
Furthermore, the user can display the code number.

Calling up the checking mode

- Hold the ESCAPE key down and briefly press the UP key to call up the checking mode.
- Leave the checking mode again by pressing the M or C key.

Displaying the code number

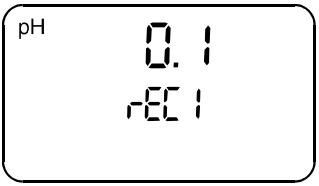
The code number is displayed in the Cod submenu after pressing the ENTER key:



- Press the ENTER key again to continue with recorder output 1

Recorder output 1

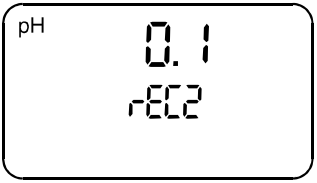
A current of 0.1 mA is set in the tSt rEC1 submenu after pressing the ENTER key:



- Press C to set the current to 20.0 mA
- Press M to set the current to 0.1 mA
- Press UP to increase the current (max. 20.5 mA)
- Press DOWN to decrease the current (min. 0.0 mA)
- Press the ENTER key again to continue with recorder output 2

Recorder output 2

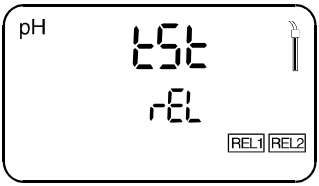
A current of 0.1 mA is set in the tSt rEC2 submenu after pressing the ENTER key:



- Press C to set the current to 20.0 mA
- Press M to set the current to 0.1 mA
- Press UP to increase the current (max. 20.5 mA)
- Press DOWN to decrease the current (min. 0.0 mA)
- Press the ENTER key again to continue with relay test.

Relay test

After pressing the ENTER key, the tSt message flashes in the tSt rEL submenu:



Note:
Rel 1 and Rel 2 are only addressed if the control option is present.

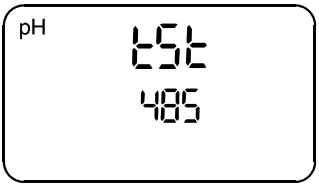
If a relay is switched on, the relevant symbol appears on the display.

- Press the ESCAPE key:
  Relay 1 on/off REL1
- Press the UP key:
  Relay 2 on/off REL2
- Press the DOWN key:

  Sens-Check E/A 
- Press the ENTER key to continue with RS485

RS 485

After pressing the ENTER key, the tSt message flashes in the tSt 485 submenu:

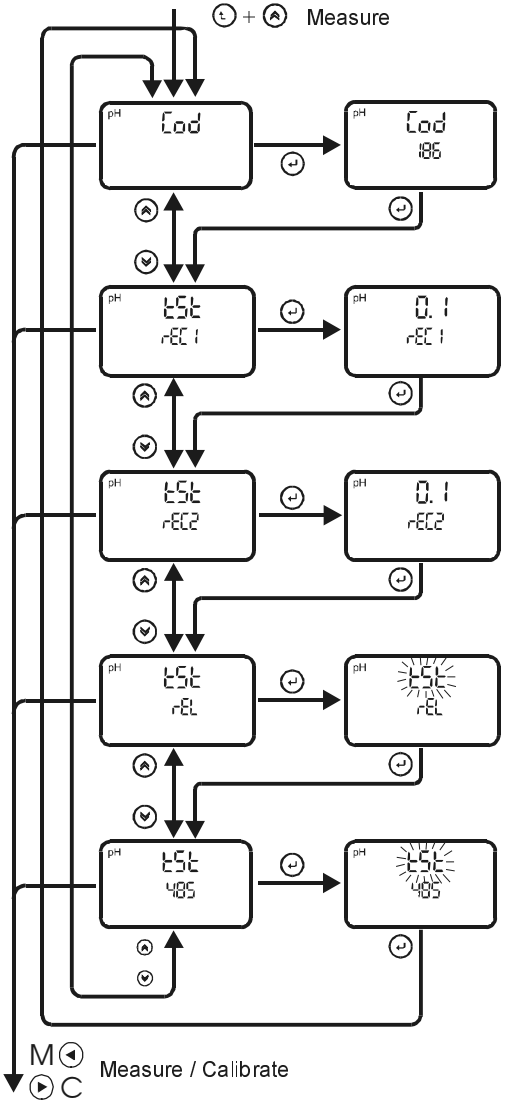


Note:
The menu item only appears if the RS 485 interface is present.

The RS 485 operates in the test mode as a repeater, i.e. all the blocks received are sent back again.

- Press the ESCAPE key:
  Sends the instrument identification according to the "RSID" RS command (with RS 485 protocol)
- Press the UP key:
  Sends the instrument identification according to the "RSID" RS command (without RS 485 protocol; for printer output)
- Press the ENTER key:
  Terminates the RS 485 test to continue with *Displaying the code number*

Flowchart


+
Measure
pH
Cod
pH
Cod
186
pH
tSt
rEC1
pH
0.1
rEC1
pH
tSt
rEC2
pH
0.1
rEC2
pH
tSt
rEL
pH
tSt
rEL
pH
tSt
485
pH
tSt
485
M
C
Measure / Calibrate

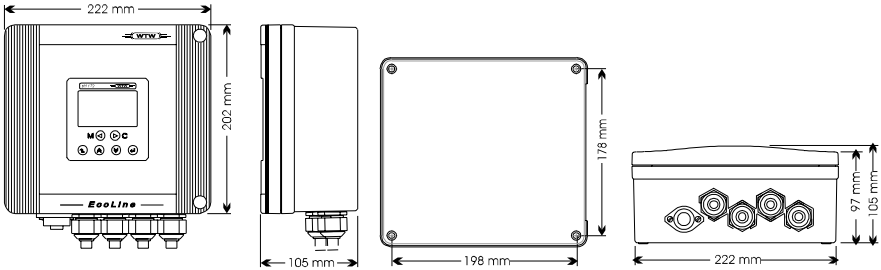
The *ph 170* and *pH 296* instruments are largely maintenance-free.
Some instructions are given here on taking care of the instruments:

- Keep the instruments free from dust and dirt as far as possible.
- Do not use a high-pressure cleaner to clean the housing.
- Do not any cleaning agent that contains solvent.
- Follow the details given in the sensor operating manual on cleaning and maintenance of the sensors!
- Check the instruments regularly for mechanical damage and, if necessary, take them out of service.
- Follow the safety instructions even when carrying out cleaning activities!

The following messages could occur (shown in order of priority):

Message	Reason	Measure
Err	Serious error that does not permit any further measuring	– Send the instrument to WTW
CAL Err	No valid calibration exists	– Calibrate the instrument again (see also the chapter, *Calibration*)
OFL	The pH/temperature value lies outside the measuring range (Overflow)	– Check the sensor and sensor connection
Measured value flashes	An overflow is present on the corresponding recorder output	– Adapt the recorder range
	Sensor possibly defective (only in the SensoLyt 700 and automatic temperature compensation)	– For help, see the sensor operating manual
Err AdPt	Hardware error	– Send the instrument to WTW

Technical data for pH 170



Display

Measured value	LCD 7 segment	
	• pH / Redox	3-digit
	• Temperature	4-digit
Units, settings	Symbols	

pH measurement

Signal input	Low impedance or high impedance	
Display and measuring range	0.00 to 14.00 pH	
Measured value resolution	0.01 pH	
Accuracy	± 0.01 pH ± 1 digit	
Automatic temperature compensation	• NTC	– 5 to + 100 °C
	• PT100/PT1000	– 20 to + 130 °C
Reference temperature	+ 25 °C	
Calibration	• AutoCal TEC	Automatic calibration with technical buffers
	• AutoCal TEC rEC1 REL1	Automatic calibration with technical buffers and subsequent output of the buffer used in the calibration
	• ConCal	Manual calibration with arbitrary buffer solutions
Calibrating range	• Slope range	– 62 mV/pH to – 50 mV/pH
	• Asymmetry potential	– 45 mV to + 45 mV

Redox measurement

Redox signal input	Low impedance or high impedance
Display and measuring range	– 1000 mV to + 1000 mV
Measured value resolution	1 mV
Accuracy	± 2 mV ± 1 digit

Temperature measurement

Temperature sensor	• NTC (integrated in SensoLyt or external armatures) • PT 100 (3-line technology, direct via terminals) • PT 1000 (3-line technology, direct via terminals)
Accuracy	• NTC ± 0.2 K ± 1 digit • PT100/PT 1000 ± 0.1 K ± 1 digit Additional fine adjustment of ± 0.5 K
Resolution	0.1 K

Inputs / outputs

Sensor input	7-contact round plugconnector with screw fixing
Contact outputs	SENS-CHECK relay Closes on sensor defect Relay 1/ Relay 2 Functions, limit controller • Max. switching voltage 250 VAC • Max. switching current 5 A • Max. switching capacity 150 W (ohmic load)
Signal outputs	0/4 to 20 mA; electrically isolated from the input; recorder ranges and recorder attenuation can be set via software • Basic accuracy 0.1% • Load max. 600 Ohm • Load effect < 0.1 %
Connector terminals	Accessible after opening the instrument; Cable inlet by 4 PG screws Connector cross section 0.5 to 2.5 mm² • Power supply 2-contact • Relay 1/2 each 2-contact • SENS Check 2-contact • Recorder connections each 2-contact • Sensor 9-contact

Protection type

Lightning protector (inputs and outputs)	• Coarse protection 90 V / 1.5 KA (8/20µs) • Fine protection 600 Watt
Electrical instrument protection	Safety class 2 according to IEC 1010
Housing	IP 66

Electrical connection data

Voltage supply (depending on the instrument version)	• 230 VAC (– 15% + 10%) • 115 VAC (– 15% + 10%) • 24 VAC (– 15% + 10%) • 24 VDC (– 30% + 20%)
Frequency	48 to 62 Hz
Power consumption	Max. 18 Watt
Test certificates	GS, CE (for all supply voltages)
Interference suppression	According to EN 50081-1
Interference immunity	According to EN 50082-2, Namur recommendations

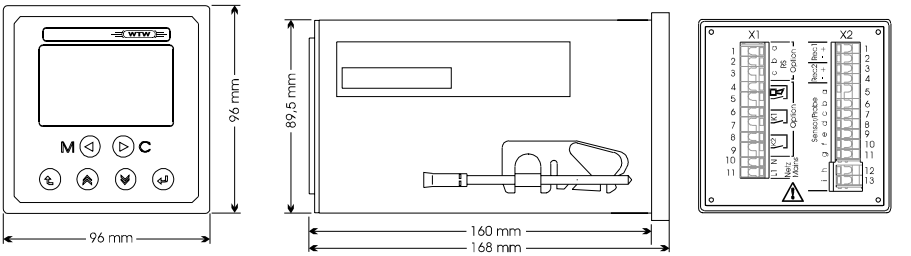
Ambient temperature

Limits of operating range	– 25 °C to + 55 °C
Storage and transport temperature	– 25 °C to + 65 °C
Climate class	Climate class 4, VDI / VDE 3540 Bl.2

Mechanical data

Dimensions	222 x 238 (202) x 105 mm (B x H x T) (height in parentheses without PG screws)
Weight	Approx. 2.2 kg
Keypad (material)	Polyester
Housing (material)	Polycarbonate

Technical data for pH 296



Display

Measured value	LCD 7 segment	
	• pH / Redox	3-digit
	• Temperature	4-digit
Units, settings	Symbols	

pH measurement

Signal input	High resistance	
Display and measuring range	0.00 to 14.00 pH	
Measured value resolution	0.01 pH	
Accuracy:	± 0.01 pH ± 1 digit	
Automatic temperature compensation	• NTC	– 5 to + 100 °C
	• PT100/PT1000	– 20 to + 130 °C
Reference temperature	+ 25 °C	
Calibration	• AutoCal TEC	Automatic calibration with technical buffers
	• AutoCal TEC rEC1 REL1	Automatic calibration with technical buffers and subsequent output of the buffer used in the calibration
	• ConCal	Manual calibration with arbitrary buffers
Calibration range	• Slope range	– 62 mV/pH to – 50 mV/pH
	• Asymmetry potential	– 45 mV to + 45 mV

Redox measurement

Redox signal input	High impedance
Display and measuring range	– 1000 mV to + 1000 mV
Measured value resolution	1 mV
Accuracy	± 2 mV ± 1 digit

Temperature measurement

Temperature sensor	• NTC (integrated in SensoLyt or external armatures) • PT 100 (3-line technology, direct via terminals) • PT 1000 (3-line technology, direct via terminals)
Accuracy	• NTC ± 0.2 K ± 1 digit • PT100/PT 1000 ± 0.1 K ± 1 digit Additional fine adjustment of ± 0.5 K
Resolution	0.1 K

Inputs / outputs

Digital interface	RS-485; 2(3)-wire connection Bus operation is possible with up to 31 units
Contact outputs	SENS-CHECK relay Closes on sensor defect Relay 1/ Relay 2 Functions, limit controller • Max. switching voltage 250 VAC • Max. switching current 5 A • Max. switching capacity 150 W (ohmic load)
Signal outputs	0/4 to 20 mA; electrically isolated from the input; recorder ranges and recorder attenuation can be set via software • Basic accuracy 0.1% • Load max. 600 Ohm • Load effect < 0.1 %
Connection terminals	Accessible on the instrument backplate Connector cross section 0.5 to 2.5 mm² • Power supply 2-contact • Relay 1/2 each 2-contact • SENS Check 2-contact • RS-485 3-contact • Recorder connections each 2-contact • Sensor 9-contact

Protection type

Lightning protector (inputs and outputs)	• Coarse protection 90 V / 1.5 KA (8/20µs) • Fine protection 600 Watt
Electrical instrument protection	Safety class 2 according to IEC 1010
Housing	IP 54

Electrical connection data

Voltage supply (depending on the instrument version)	• 230 VAC (– 15% + 10%) • 115 VAC (– 15% + 10%) • 24 VAC (– 15% + 10%) • 24 VDC (– 30% + 20%)
Frequency	48 to 62 Hz
Power consumption	Max. 18 Watt
Test certificates	GS, CE (for all supply voltages)
Interference suppression	According to EN 50081-1
Interference immunity	According to EN 50082-2, Namur recommendations

Ambient temperature

Limits of operating range	– 25 °C to + 55 °C
Storage and transport temperature	– 25 °C to + 65 °C

Mechanical data

Dimensions	96 x 96 x 168 mm (B x H x T)
Weight	Approx. 1.1 kg
Keypad (material)	Polyester
Housing (material)	Fiber-reinforced Noryl