OPERATING MANUAL

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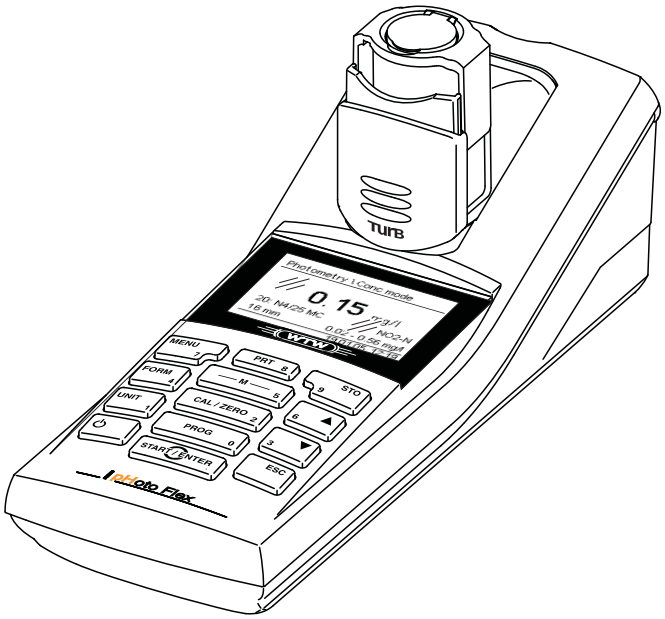


pHotoFlex® Turb

LED FILTER PHOTOMETER WITH INTEGRATED TURBIDITY MEASUREMENT AND pH FUNCTION

WTW

a xylem brand

pHotoFlex® Turb - Contents

1 Overview

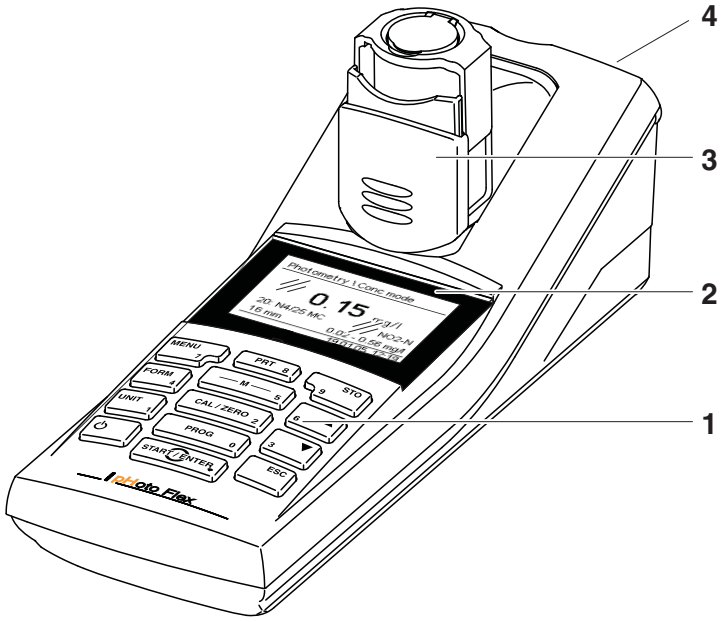
1.1 General features

The compact pHotoFlex® Turb handheld precision meter enables you to carry out the following measurements quickly and reliably:

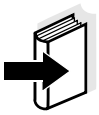
- Photometric measurements
  - Concentration measurements (colorimetric measurements)
  - Absorbance measurements
  - Transmission measurements
- pH measurements
- Turbidity measurements.

The pHotoFlex® Turb handheld meter provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

The proven MultiCal® calibration procedure supports you when calibrating for pH measurements and the AutoRead function enables precise pH measurements.



1	Keypad
2	Display
3	Cell shaft (folded out for a 16 mm cell to be inserted)
4	Socket field

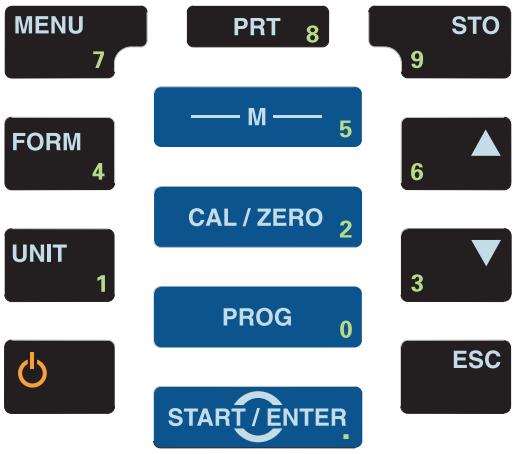


If you need further information or application notes, you can obtain the following material from WTW:

- Application reports
- Primers
- Safety datasheets.

You will find information on available literature in the WTW catalog or via the Internet.

1.2 Keypad



Key functions

M 5	Select the measuring mode **<M>** (long keystroke): – *Photometry* – *Turbidity* – *pH & ORP* Select the measured parameter within a measuring mode **<M>** (short keystroke): – *pH & ORP*: *pH*, *ORP* – *Photometry*: *Concentration*, *Absorbance*, *% Transmission* – *Turbidity*: no measured parameters selectable
CAL / ZERO 2	Start calibration (measuring modes, *pH & ORP*, *Turbidity*) Start zero adjustment or blank value measurement using the *Photometry* \ *Adjustment* menu (measuring mode, *Photometry*) **<CAL/ZERO>**

PROG 0	In the *Photometry* measuring mode: Select a program for concentration measurement **<PROG>**
START / ENTER	Open menus / confirm entries / start measurement **<START/ENTER>**
MENU 7	Call up the *Configuration* menu (all settings are made here) **<MENU>**
FORM 4	In the *Photometry* measuring mode, measured parameter, *Concentration*: switch over between available citation forms **<FORM>**
UNIT 1	In the *Photometry* measuring mode, measured parameter, *Concentration*: Switch over between available units **<UNIT>**
⏻	Switch the measuring instrument on/off **<ON/OFF>**
PRT 8	Output display contents to RS232 interface (e.g. print) **<PRT>**
STO 9	Open the *Store* menu **<STO>**, Quick storing **<STO> <STO>**
6 ▲ 3 ▼	Highlight menu items or selection Set values **<▲>, <▼>**
ESC	Switch to the next higher menu level / cancel input **<ESC>**

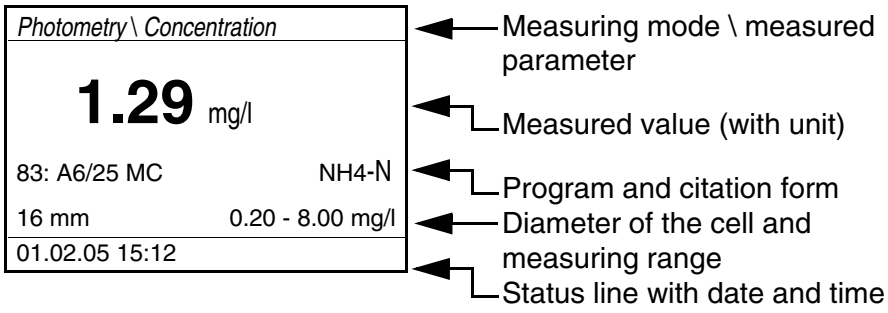
Keys with an additional number printed on are assigned doubly. This enables to directly enter numbers in special menus. Thus, you can, for example, conveniently enter the date and time via the number keys.

1.3 Display

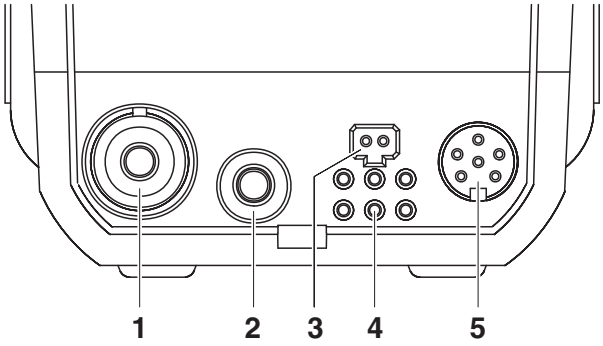
The graphic display shows all information of the current measurement in the measured value display. The illumination enables to read the dis-

play even in the darkness.

Example



1.4 Socket field



Identifying the connectors

1	pH electrode
2	pH temperature sensor
3	Power pack (9 V DC, see section 7.1)
4	Contacts for operation on the LabStation
5	RS232 serial interface

1.5 LabStation (optional)

The LabStation, which is available as an accessory, enables you to use the pHotoFlex® Turb conveniently in the laboratory (see LabStation operating manual).
Laboratory operation with the LabStation enables the following additional functions:

- With photometric measurements, the zero measurement is retained even after switching the pHotoFlex® Turb off and on again

- You can connect a bar code reader for the simplified calling up of programs
- The LSdata software included serves to easily enter user-defined programs
- Operation with power pack and rechargeable battery (included in the scope of delivery of the LabStation). The rechargeable battery in the pHotoFlex® Turb is automatically charged as soon as the meter is placed in the LabStation.

2 Safety

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the meter. Read this operating manual thoroughly and make yourself familiar with the meter before putting it into operation or working with it. The operating manual must be kept in the vicinity of the meter so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "Caution") indicates the level of danger:

CAUTION
indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

NOTE
indicates a possibly dangerous situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the meter

Note all labels, information signs and safety symbols on the meter and in the battery compartment. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

Observe the safety datasheets of the test reagents when working with photometric test sets.

2.2 Safe operation

CAUTION

Danger of eye damage by visible and invisible LED radiation. In the cell shaft there are light emitting diodes (LED) of the 1M class. Do not look at the radiation using optical instruments. With normal, authorized use there is no hazard.

2.2.1 Authorized use

This meter is authorized exclusively for the following measurements:

- Analysis of substances in water and aqueous solutions using round cells
- Concentration measurement
- Absorbance and transmission measurement

The fields of application are mobile use and use in the laboratory. Only the operation and running of the meter according to the instructions and technical specifications given in this operating manual is authorized (see chapter 7 TECHNICAL DATA). Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The meter may only be operated according to the authorized use specified above.
- The meter may only be supplied with power by the energy sources mentioned in this operating manual.
- The meter may only be operated under the environmental conditions mentioned in this operating manual.
- The meter may only be opened if this is explicitly described in this operating manual (example: Inserting the batteries).

2.2.3 Unauthorized use

The meter must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 7 TECHNICAL DATA).

3 Commissioning

3.1 Scope of delivery

- Handheld meter, pHotoFlex® Turb
- 4 batteries, 1.5 V type AA (in the battery compartment)
- 1 empty cell 16 mm
- 2 empty cells 28 mm
  with label to mark the cell for turbidity measurements
- AMCO®-Clear turbidity standard
- Microfiber cloth to clean the meter
- Compact operting manual
- Key overview / Program list
- CD-ROM with
  - detailed operating manual
  - photometry analysis manual with analysis specifications
  - software to program user-defined methods
- Optional: Rechargeable battery
- Optional: LabStation with LSdata PC software, rechargeable battery and universal power pack

The optional parts of the scope of delivery are available as accessories (see section 8.1).

3.2 Power supply

3.2.1 General information

You can operate the meter either with batteries, rechargeable batteries or a power pack. The power pack supplies the meter with low voltage (9 V DC). At the same time, the rechargeable battery is charged. The rechargeable battery is charged even while the meter is switched off.

The *LoBat* display indicator appears when the batteries or rechargeable batteries is nearly discharged.

Charging time of the rechargeable battery

approx. 36 hours.

CAUTION

Use original power packs only.
The line voltage at the operating site must lie within the input voltage range of the original power pack (see chapter 7 TECHNICAL DATA).

The rechargeable battery should not be completely discharged. If you

do not operate the instrument for a longer period of time you should charge the rechargeable battery every six months.

Automatic switchoff

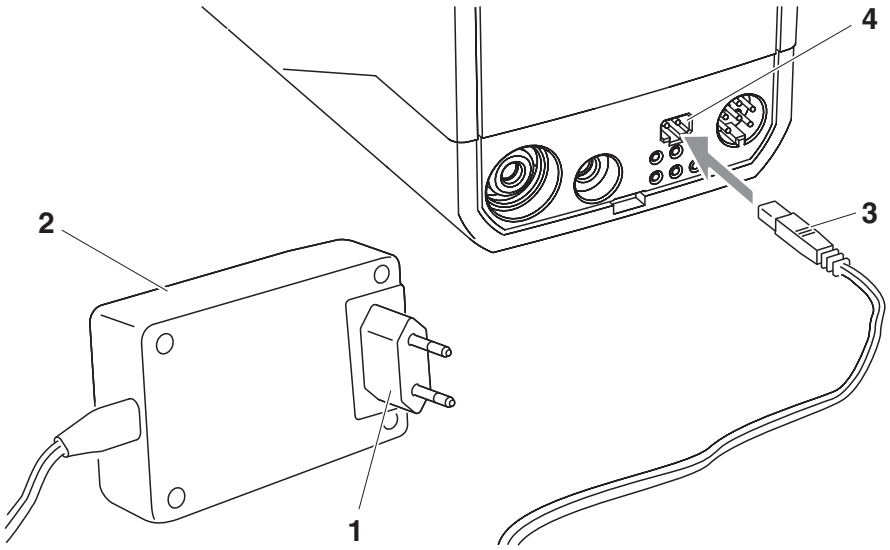
The meter has an automatic switch-off function in order to save the batteries or rechargeable battery (see section 4.4).

Display illumination

During operation with batteries or rechargeable battery the meter automatically switches off the display illumination if no key is pressed for 30 seconds. The illumination is switched on with the next keystroke again. The display illumination can also be switched off completely (see section 4.4.2).

Power pack and rechargeable battery are available as an accessory (see section 8.1).

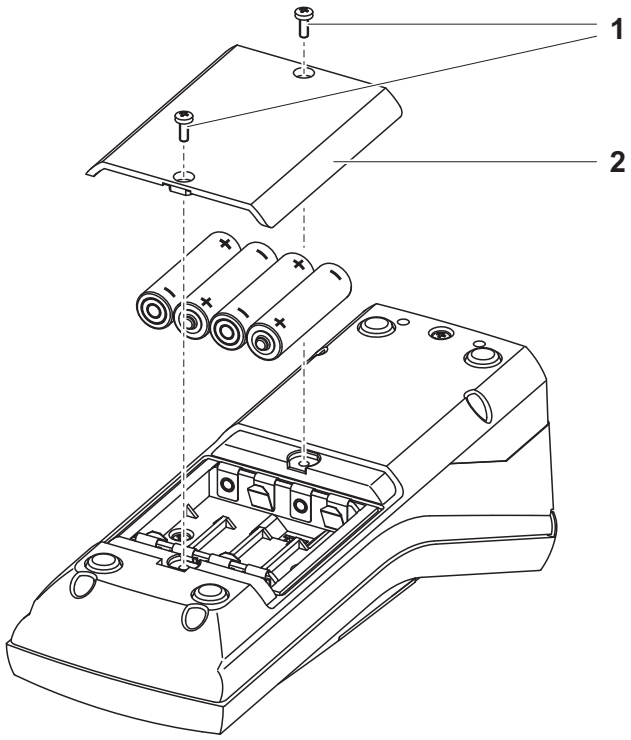
Connecting the power pack (optional)



1	If necessary, replace the Euro plug (1) on the power pack (2) by the country-specific plug suitable for your country.
2	Connect the plug (3) to the socket (4) of the meter.
3	Connect the power pack to an easily accessible power socket.

3.2.2 Inserting/exchanging the batteries

NOTE
Make sure that the poles of the batteries are positioned correctly.
The ± signs on the batteries must correspond to the ± signs in the battery compartment.



1	Open the battery compartment: – Unscrew the two screws (1) on the underside of the meter, – Remove the lid of the battery compartment (2).
2	If necessary, take four old batteries out of the battery compartment.
3	Insert four batteries (3) in the battery compartment.
4	Close the battery compartment and fix it with the screws.

3.3 Initial commissioning

Perform the following activities:

- For
  - Battery operation: Insert the batteries (see section 3.2.2)
  - Rechargeable battery operation: insert the rechargeable battery (see section 5.1.2)
  - line power operation and charging the rechargeable battery: connect the power pack (see section 3.2)
  - Operation with LabStation and rechargeable battery: Insert the rechargeable battery, connect the LabStation and insert the meter in the LabStation (see LabStation operating manual)
- Switch on the meter (see section 4.1)
- Set the language as necessary (see section 4.3.3)
- Set the date and time as necessary (see section 4.3.4)

When you set the language, date and time according to the mentioned sections of this operating manual you will quickly become familiar with the simple operation of the pHotoFlex® Turb.

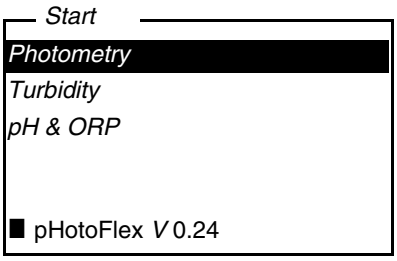
4 Operation

4.1 Switching on the meter

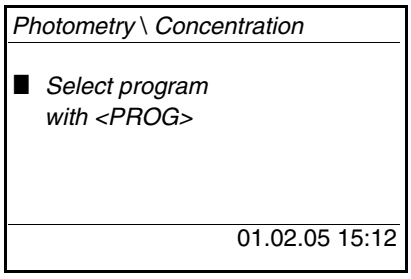
Switching on

Press the **<ON/OFF>** key.
For 30 seconds, *Start* menu appears with a selection of the measuring modes. The measuring mode last selected is highlighted.

The status line indicates the meter designation and the version number of the software.



After a few seconds, the meter automatically switches to the measuring mode and measured parameter used last.
The measured value display appears (here, e.g. measuring mode *Photometry*).



With **<M>** (long pressure) change the measuring mode.
With **<M>** (short pressure) toggle between the different measured parameters in the selected measuring mode.

Switching off

Press the **<ON/OFF>** key.

Automatic switchoff

The meter has an automatic switchoff function in order to save the batteries or rechargeable battery (see section 4.4). The automatic switchoff switches the meter off if no key is pressed for an adjustable period.

The automatic switchoff is not active

- if the power is supplied by the power pack (optional),
- if the power is supplied by the LabStation (optional),
- if the *Timer* or *Analysis timer* function is on.

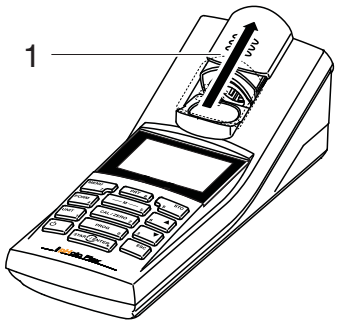
Display illumination with battery and rechargeable battery operation

During operation with batteries or rechargeable battery the meter automatically switches off the display illumination if no key is pressed for 30 seconds. The illumination is switched on again with the next keystroke.

4.2 Inserting a cell

To be able to insert cells in the pHotoFlex® Turb, the cell shaft has to be prepared to take in a cell.

1	Push the dust cover (1) upward. The cell shaft for 28 mm cells is open. ● Insert a 28 mm cell (see below) ● Insert a 16 mm cell (see page 19)



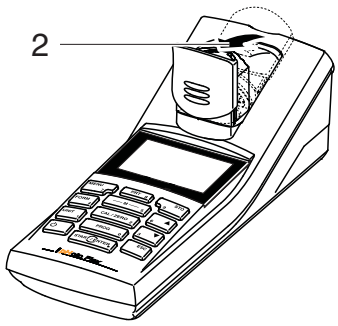
Inserting a 28 mm cell

2	Insert the cell so that it is positioned on the bottom of the cell shaft. The cell is ready to be measured.

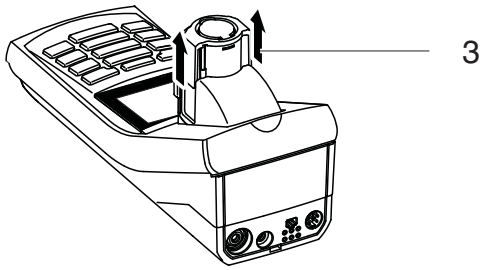
3	For turbidity measurement: Align the cell (see section 4.7.2).

Inserting a 16 mm cell

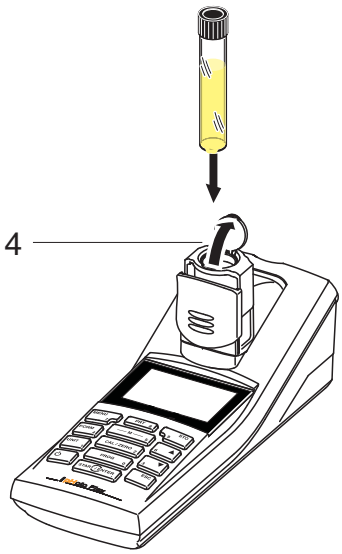
1	Put the fold-out cell shaft (2) in an upright position until it locks into place.



2	Pull up the height adapter (3). The cell shaft is extended.



3	Open the external light cover (4) of the cell shaft.



4	Insert the 16 mm cell (marking points forward) so that it is positioned on the bottom of the cell shaft.
5	Close the external light cover (4). The cell is ready to be measured.

For optimum measurement results, the cell must always be covered by the external light cover. Otherwise, external light can falsify the measurement result.

4.3 General operating principles

This section contains basic information on the operation of the pHotoFlex® Turb.

Operating elements, display

An overview of the operating elements and the display is given in section 1.2 and section 1.3.

Operating modes, navigation

An overview of the operating modes of the pHotoFlex® Turb and the navigation through menus and functions can be found in section 4.3.1 and section 4.3.2.

4.3.1 Operating modes

The instrument has the following operating modes:

- Measurement
  The display indicates measurement data in the measured value display
- Calibration
  The display indicates a calibration process with calibration information,
  or a process to carry out a zero adjustment
- Data transmission
  The meter transmits measuring datasets or calibration records to the serial interface
- Configuration
  The display indicates a menu with further menus, settings and functions

4.3.2 Navigation

Measured value display

In the measured value display, you can

- select a measuring mode with **<M>** (long pressure)
- select a measured parameter in the active measuring mode (e. g. pH <–> mV) with **<M>** (short pressure)
- open the menu with **<MENU>**
- switch to the superordinate *Start* menu with **<ESC>**.

Menus and dialogs

The menus for settings and dialogs in courses contain further submenus. The selection is made with the **<▲> <▼>** keys.
The current selection is highlighted as white text on a black background.

- Menus
  The name of the menu is displayed at the upper edge of the frame. Menus are opened by confirming with **<START/ENTER>**. Example:

Configuration

Photometry
Turbidity
pH & ORP
System
Info

- Settings
  Settings are indicated by a colon. The current setting is displayed on the right-hand side. With **<START/ENTER>**, the selection of the possible settings is opened. Subsequently, the setting can be changed with **<▲> <▼>** and **<START/ENTER>**.
  Example:

System

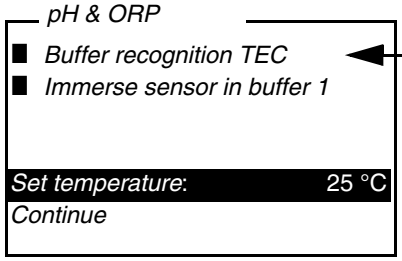
Language:	*English*
Beep:	*Off*
Illumination:	*On*
Contrast:	48 %
Temperature unit:	°C
Switchoff time:	30 min

- Functions
  Functions are designated by the name of the function. They are immediately carried out by confirming with **<START/ENTER>**.
  Example: display the *Calibration record* function
  (in the *pH & ORP* / *Calibration* menu).

pH & ORP

Calibration record	
Cal. type:	AutoCal
TEC	
Calibration interval:	007 d
Unit for slope:	mV/pH
■ 2.00 4.01 7.00 10.01	

- Messages
  Information or instructions are marked by the ■ symbol. They cannot be selected.
  Example:



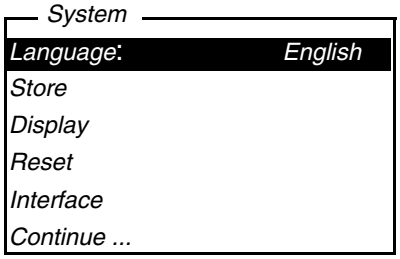
The principles of navigation are explained in the two following sections by reference of examples:

- Setting the language (section 4.3.3)
- Setting the date and time (section 4.3.4).

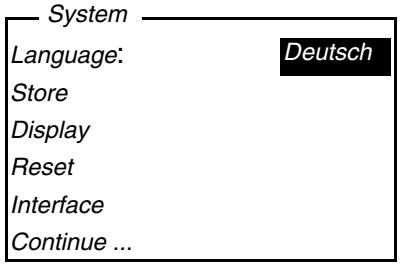
4.3.3 Navigation example 1: Setting the language

The following example describes in the language of the country how to set the language. On delivery, English is set as the language in the pHotoFlex® Turb. During initial commissioning, the language is set in the menu, *Configuration* / *System* / *Language.*

1	In the measured value display: Open the *Configuration* menu with **<MENU>**. The instrument is in the configuration mode.
2	Select the *System* menu with **<▲> <▼>**. The current selection is highlighted as white text on a black background.
3	Open the *System* menu with **<START/ENTER>.**



4	Select the *Language* menu with **<▲> <▼>**. The current selection is highlighted as white text on a black background.
5	Open the setting of the *Language* with **<START/ENTER>**.



6	Select the required language with **<▲> <▼>**.
7	Confirm the setting with **<START/ENTER>**. The setting is active. The menu is displayed in the selected language.
8	To make further settings, switch to the next higher menu level with **<ESC>**. or Switch to the measured value display with **<M>** (short pressure). The instrument is in the measurement mode.

4.3.4 Navigation example 2: Setting the date and time

The meter has a clock with a date function. The date and time are indicated in the status line of the measured value display. When storing measured values and calibrating, the current date and time are automatically stored as well.

Numerals are generally entered via the number keys.

The correct setting of the date and time and date format is important for the following functions and displays:

- Current date and time
- Calibration date
- Identification of stored measured values.

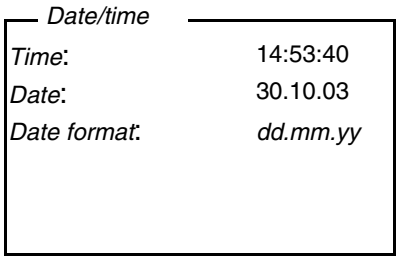
Therefore, check the time at regular intervals.

After a fall of the supply voltage (empty batteries or rechargeable battery), the date and time are reset to 01.01.2003, 00:00 hours.

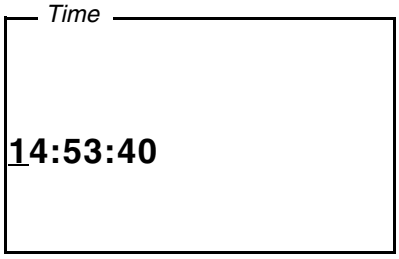
Setting the date, time and date format

The data format can be switched from the display of day, month, year (*dd.mm.yy*) to the display of month, day, year (*mm/dd/yy* or *mm.dd.yy*).

1	In the measured value display: Open the *Configuration* menu with **<MENU>**. The instrument is in the configuration mode.
2	Select and confirm the *System* / *Continue ...* / *Date/time* menu with **<▲> <▼>** and **<START/ENTER>**.



3	Select and confirm the *Time* menu with **<▲> <▼>** and **<START/ENTER>**. A display for the entry of numerals with the number keys opens up.



4	Enter the time using the number keys. The digit to be changed is displayed underlined.

In the case of wrong entries, you can cancel the procedure with <ESC>. After canceling with <ESC>, it is possible to enter all digits once again. The new digits are only taken over by confirming with <START/ENTER>.

5	Confirm the setting with **<START/ENTER>**. The time is set.

6	Set the current *Date* as necessary. The setting is made similarly to that of the time.
7	Change the date format as necessary.
8	To make further settings, switch to the next higher menu level with **<ESC>**. or Switch to the measured value display with **<M>** (short pressure). The instrument is in the measurement mode.

4.3.5 Menu overview

Photometry	*Measured parameter*	*Concentration* *% Transmission* *Absorbance*	
	Programs		
	Dilution		
	Analysis timer	*On* *Off*	
	Reset		
Turbidity	■ *No settings required.*		
pH & ORP	*Measured parameter*	*pH* *ORP*	
	Calibration	*Calibration record*	
		Cal. type	*TEC* *NIST/DIN*
		Calibration interval	1 ... 999 d
		Unit for slope	mV/pH %
	Man. temperature	-20 ... +130 °C	
	Temperature unit	°C, °F	
	Reset		
Timer			

(Continued next page)

System	*Language*	*Deutsch* *English* *Français* *Español*	
	Measured value memory	*Display*	
		RS232 download	
		Data filter	*Filter* *ID* *PROG* *Date*
		Delete	
		■ 4 *of* 1000 *occupied*	
		■ *Filter*: *No filter*	
	Display	*Illumination*	*Auto off* *On* *Off*
		Contrast	0 ... 100 %
		Brightness	0 ... 100 %
	Reset		
	Interface	*Baud rate*	1200, 2400, 4800, 9600, 19200
		Output format	*ASCII* *CSV*
	Continue ... / Date/time	*Time*	hh:mm:ss
		Date	
		Date format	*dd.mm.yy* *mm.dd.yy* *mm/dd/yy*
	Continue ... / Switchoff time	10, 20, 30, 40, 50 min, 1, 2, 3, 4, 5, 10, 15, 20, 24 h	
	Continue ... / Beep	*On* *Off*	
Info			

4.4 System settings (*System* menu)

The following instrument features and general functions can be found in the *Configuration* / *System* menu:

- Language selection (*Language*)
- Memory and database functions (*Store*)
- Display settings (*Display*)
- Restore basic settings (*Reset*)
- Configuration of the interface for PC/printer (*Interface*)
- Setting the date/time (*Date/time*)
- Setting the switch-off time (*Switchoff time*)
- Setting the keyboard sound (*Beep*)

Settings/functions

The settings can be found in the *Configuration* / *System* menu. To switch to the *Configuration* menu, press the **<MENU>** key.

Menu item	Setting	Description
Language	*Deutsch* *English* *Français* *Español*	Select the language (see section 4.3.3)
Store	*Display* *RS232 down-load* *Data filter* *Delete*	Memory and database functions (see section 4.8.2)
Display	*Illumination* *Contrast* *Brightness*	Switch on/off the display illumination (see section 4.4.2)
Reset	-	Resets all system settings to default (see section 4.10.1)
Interface	*Baud rate* *Output format*	Baud rate of the data interface (see section 4.4.3)
Continue ... / *Date/time*	*Time* *Date* *Date format*	Settings of time and date (see section 4.3.4)

Menu item	Setting	Description
Continue ... / *Switchoff time*	10, 20, 30, 40, 50 min, 1, 2, 3, 4, 5, 10, 15, 20, 24 h	The automatic switchoff switches the meter off if no entry is made for a specified period of time (*Switchoff time*). This saves the batteries or re-chargeable battery.
Continue ... / *Beep*	*On* *Off*	Switch on/off the beep on keystroke

4.4.1 *Measured value memory*

In the *Measured value memory* menu, you find functions to display and edit the stored measurement datasets:

- Display the measurement datsets on the screen (*Display*)
- Download the measurement datsets to the RS232 interface (*RS232 download*)
- Set up filter rules for the stored measurement datsets (*Data filter*)
- Erase all stored measurement datsets (*Delete*)
- Information on the number of occupied memory locations

The settings can be found in the *Configuration* / *System* / *Measured value memory* menu.
To switch to the *Configuration* menu, press the **<MENU>** key.

Settings/functions

Menu item	Setting/function	Description
Display	-	Displays in pages all measurement datasets that correspond to the filter settings. Further options: ● Scroll through the datasets with **<▲> <▼>**. ● Output the displayed dataset to the interface with **<PRT>**. ● Quit the display with **<ESC>**.
RS232 download	-	Downloads to the interface all measurement datasets that correspond to the filter settings. The download is ordered according to the date and time. The process can take several minutes. To terminate the process prematurely, press **<ESC>**.
Data filter	see section 4.8.2	Allows to set filter criteria in order to display and download datasets to the interface.
Delete	-	Erases the entire contents of the measuring data memory, independent of the filter settings. Note: All calibration data remains stored when performing this action.

All details on the subjects of memory and stored data is found in section 4.8.2.

4.4.2 *Display*

In the *Configuration* / *System* / *Display* menu, you set the display features:

- Switching on/off the display illumination (*Illumination*)
- Display contrast (*Contrast*)

The settings can be found in the *Configuration* / *System* / *Display* menu.
To switch to the *Configuration* menu, press the **<MENU>** key.

Settings

Menu item	Setting	Description
Illumination	*Auto off*	The display illumination is automatically switched off if no key has been pressed for 30 seconds.
	On *Off*	Switches the display illumination on or off permanently (see section 4.5.9)
Contrast	0 ... 100 %	Changes the display contrast
Brightness	0 ... 100 %	Changes the display brightness

4.4.3 *Interface*

In the *Interface* menu, you set the features of the interface:

- Transmission speed (*Baud rate*)
- Output format (*Output format*)

The settings can be found in the *Configuration* / *System* / *Interface* menu.
To switch to the *Configuration* menu, press the **<MENU>** key.

Settings

Menu item	Setting	Description
Baud rate	1200, 2400, 4800, 9600, 19200	Baud rate of the data interface
Output format	*ASCII* *CSV*	Output format for data transmission For details, see section 4.9

4.4.4 *Date/time*

In the *Configuration* / *System* / *Continue ...* / *Date/time* menu, you set the system clock:

- Current time (*Time*)
- Current date (*Date*)
- Format of the date display (*Date format*)

The settings can be found in the *Configuration* / *System* / *Continue ...* *Date/time* menu.
To switch to the *Configuration* menu, press the **<MENU>** key.

Settings

Menu item	Setting	Description
Time	hh:mm:ss	Enter the time with the number keys
Date		Enter the date with the number keys
Date format	*dd.mm.yy* *mm.dd.yy* *mm/dd/yy*	Settings of time and date.

4.5 Photometry

4.5.1 General information

Photometric measurements serve to determine chemical substances in liquid samples. For this determination, the substance to be determined has to be present in a form that is suitable for photometric measurement. At the same time, possible disturbing factors have to be excluded.

Before measurement, the sample has to be pretreated in order to bring the substance to be determined into the form that is suitable for measurement and at the same time exclude disturbing factors.
Pretreatment of the sample is described in the analysis specification.

In a simple case, pretreatment can be to dissolve a solid substance in water; it can, however, also include chemical conversions, e. g. a digestion.

The chemicals required in the analysis specification are available as test sets.

Suitable analysis specifications for test sets can be found in the photometry analysis manual (on CD-ROM).
There you will also find further instructions on handling chemicals and on how to proceed when applying the analysis specifications.

Methods and the corresponding method data for many test sets are stored as programs in the pHotoFlex® Turb. A program number is assigned to each program.

By entering the program number or by using a barcode reader the stored method data is loaded.

You can look up an overview of the available methods in the photometry analysis manual and display it on the screen of the pHotoFlex® Turb (see section 4.5.8).

You can measure the following parameters with the pHotoFlex® Turb:

- *Concentration* [mg/l]
- *% Transmission* []
- *Absorbance* []

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Clean the cells before filling them with sample and also before measuring as necessary (see section 5.2.2). The cells must be absolutely clean and free of scratches.
2	For measurement, place the pHotoFlex® Turb on a horizontal surface.

4.5.2 Settings for photometric measurements

For photometric measurements, the following settings are available in the *Configuration* / *Photometry* menu:

- Setting the measured parameter
- Displaying a list of all programs
- Setting the dilution factor
- Switching on or off the analysis timer
- Resetting the settings for photometric measurements

The settings can be found in the *Configuration* / *Photometry* menu. To switch to the *Configuration* menu, press the **<MENU>** key.

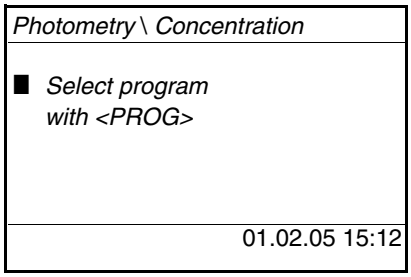
Settings

Menu item	Setting	Description
Measured parameter	*Concentration* *% Transmission* *Absorbance*	Measured parameters in the *Photometry* measuring mode
Programs		Display all programs with the corresponding program data (see section 4.5.8).
Dilution		Set the dilution factor (see section 4.5.11)
Analysis timer	*On* *Off*	Switch on/off the analysis timer (see section 4.5.9)
Reset		Reset all settings for the *Photometry* measuring mode (see section 4.10.3)

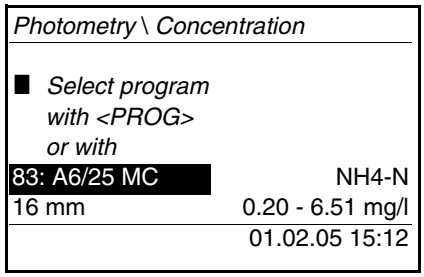
4.5.3 Measuring the concentration

1	Press the **<M>** key (long pressure) repeatedly until the *Photometry* measuring mode is selected.
2	Press the **<M>** key (short pressure) repeatedly until the measured variable, *Konzentration* is selected.

First concentration measurement with the pHotoFlex® Turb



Second and all further concentration measurements



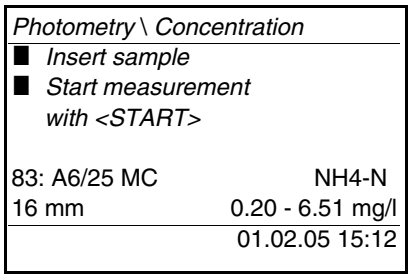
From the second concentration measurement, the data of the program last used is automatically displayed here.
With **<▲> <▼>** you can quickly switch between the ten programs last used.

To select a program, you can also read in the program number of an analysis specification with a barcode reader (see section 8.2). The following step 3 is then skipped. You can directly start measurement.

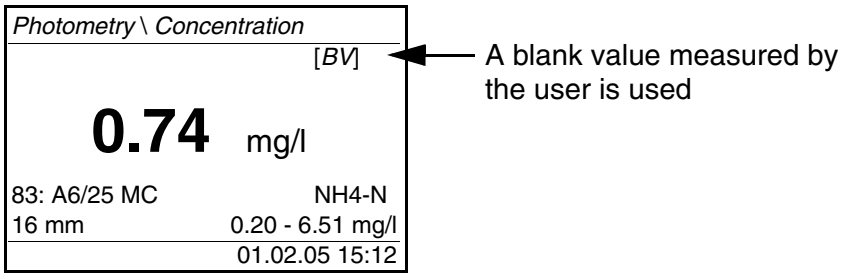
The program number of the test is given in the analysis specification, on the list of available programs and on the packing of some tests (under the barcode).

3	Open the *Program number* display with **<PROG>**, enter the required program number with the number keys and confirm with **<START/ENTER>**. or (from the second concentration measurement): Select a program out of the last ten programs with **<▲> <▼>**. The program data is displayed.

If a program number is selected that requires a measured blank value, the menu automatically guides to the blank value measurement.



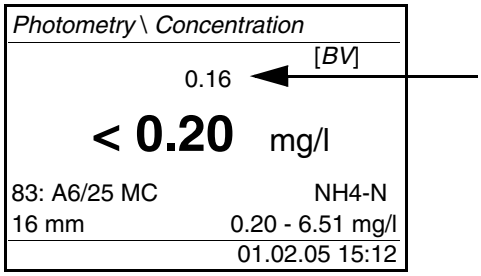
4	Insert the cell (see section 4.2).
5	Start the measurement with **<START/ENTER>**. Measurement is started. The result is displayed.



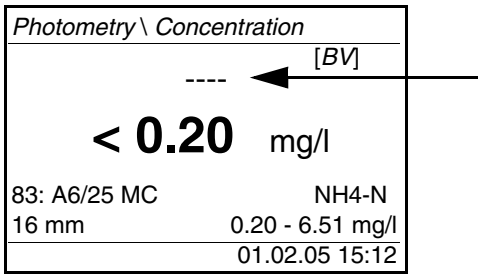
Display indication when the measuring range is undercut or exceeded

Display	Explanation
"< [Lower limit of measuring range]" instead of the measured value	Measuring range undercut. Remedy: Use a test with a lower measuring range
"> [Upper limit of measuring range]" instead of the measured value	Measuring range exceeded. Remedy: Use a test with a higher measuring range or dilute the sample
Orientation value	This value serves as a reference point for the selection of a suitable test or dilution ratio. If the measurement signal cannot be evaluated (intensity too high or too low), four bars appear ("----").

Examples:



Orientation value

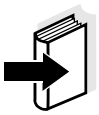


Measurement signal cannot be evaluated

The orientation value can be quite inaccurate and should not be used as a measure value!

4.5.4 Blank value (reagent blank value)

A blank value is required for every concentration measurement.
For some programs (methods) for concentration measurement, the blank values are already stored in the meter. They are used automatically. For all other programs, the blank value has to be determined separately before the first measurement.
Each stored reagent blank value can be replaced by a blank value determined by the user.



You will find more information on blank values in the photometry analysis manual.

A blank value is always stored for the program that has just been called up. It remains stored until it is erased (menu item, *Delete blank value*) or overwritten.
The *Reset* function erases all blank values measured by the user and restores the blank values stored in the factory.

If a blank value measured by the user is stored for a program, this blank value is used for measurement. The usage of the blank value measured by the user is documented and also indicated in the measured value display.

Measuring the blank value

1	Press the **<M>** key (long pressure) repeatedly until the *Photometry* measuring mode is selected.
2	Press the **<M>** key (short pressure) repeatedly until the measured variable, *Concentration* is selected.
3	Select a program with **<PROG>** as necessary.

The following measurement of the blank value applies only to the selected program. If no program is selected, the message ■ *No program selected.* appears on the display.

4	Open the adjustment menu with **<CAL/ZERO>**.

Photometry \ Adjustment

Zero adjust.
Measure blank value
Delete blank value

5	Using **<▲> <▼>** and **<START/ENTER>**, select and start the *Measure blank value* function. The menu-guided blank value measurement starts. Follow the instructions on the display.

Measure blank value
■ 83: A6/25 MC
■ *Cell* = 16 mm
■ *Insert blank sample*

Start measurement

6	Insert a cell with blank sample (see section 4.2).
7	Start the measurement of the blank value with **<START/ENTER>**. After measuring, the result of the blank value measurement is displayed and stored. The result is displayed as ■ *Blank value measurement successful!* or ■ *Blank value measurement erroneous!*

Measure blank value
■ 83: A6/25 MC
■ *Cell* = 16 mm
■ *Absorbance* = 0.301
■ *Blank value measurement successful!*

8	Confirm the result with **<START/ENTER>**. The blank value measurement is completed. The meter is ready to measure. or: Discard the result with **<ESC>**. Subsequently, carry out a new blank value measurement.

4.5.5 Standard adjustment (user calibration)

With some of the programs (methods) for concentration measurement, you can optimize the calibration curve stored in the meter with the aid of the *Standard adjustment* function.

A standard adjustment is only valid if the deviation compared to the original calibration is no more than 30%.

A standard adjustment is always stored for the program that is presently called up. A standard adjustment is only deleted if

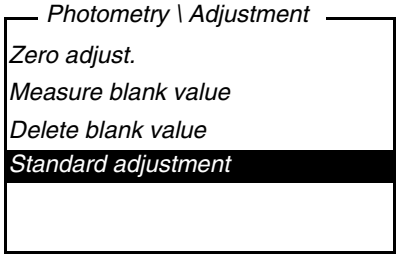
- a new standard adjustment is carried out
- the standard adjustment is erased manually
- the meter is reset to delivery status (*Reset* function)

Standard adjustment

1	If necessary, press the **<M>** key several times until the measured parameter *Concentration* is selected.
2	Select a program with **<PROG>** as necessary.

The following measurement of the standard applies only to the selected program.

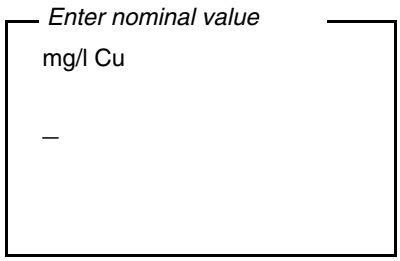
3	Using **<CAL/ZERO>**, open the *Photometry \ Adjustment* menu.



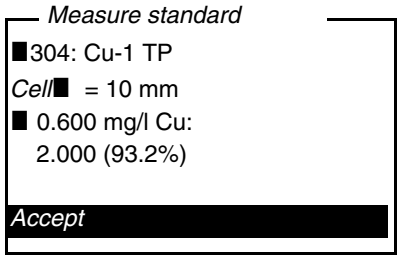
4	Open the *Standard adjustment* menu with **<▲> <▼>** and **<START/ENTER>**.

If data of a standard adjustment are already available, the data of the last standard adjustment are displayed. Here you can also erase the data of an active standard adjustment.

5	Using **<▲> <▼>** and **<START/ENTER>**, select and start the *Measure standard* function. The menu-guided standard measurement begins. Follow the instructions on the display.



6	Enter the nominal value of the standard. Note: Enter the decimal separator with **<START/ENTER>**.
7	Confirm the entered nominal value with **<START/ENTER>**.
8	Insert a cell with standard (see section 4.2).
9	Start the measurement of the standard with **<START/ENTER>**. After measuring, the result of the standard adjustment is displayed and stored. As the result, the measured value and the adjustment (in %) or *Error* is displayed.



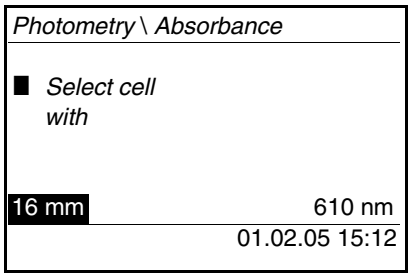
10	Confirm the result with **<START/ENTER>**. The standard adjustment is completed. The meter is ready to measure. or: Discard the result with **<ESC>**. Subsequently, carry out a new standard adjustment.

If a standard adjustment is stored for a program, the standard adjustment is automatically used for measurement. The usage of the standard adjustment is documented together with the measured value and indicated in the measured value display with [Cal].

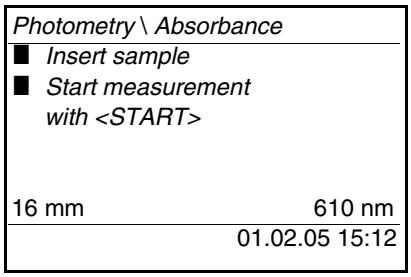
4.5.6 Measuring the absorbance/transmission

The transmission measurement is not described separately in the following example as it operates in exactly the same way as the absorbance measurement. The result of the measurement is displayed in *% Transmission*.

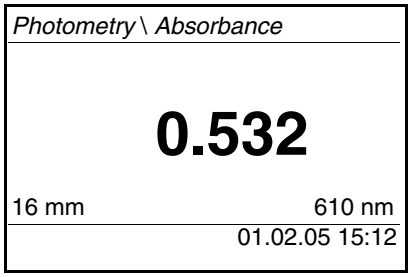
1	Press the **<M>** key (long pressure) repeatedly until the *Photometry* measuring mode is selected.
2	Press the **<M>** key (short pressure) repeatedly until the measured variable, *Absorbance* or *% Transmission* is selected.



3	Select the cell diameter with **<▲> <▼>** and confirm with **<START/ENTER>**.
4	Select the wavelength with **<▲> <▼>** and confirm with **<START/ENTER>**.



5	Clean the cell (see section 5.2.2).
6	Insert the cell (see section 4.2).
7	Start the measurement with **<START/ENTER>**. The measurement result is displayed when the measurement is finished.



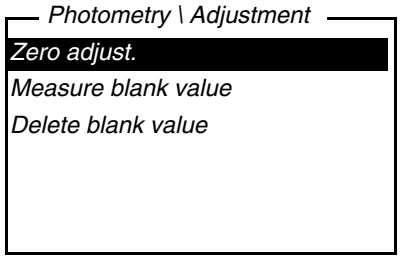
4.5.7 Zero adjustment

The zero adjustment, i. e. measuring and storing the absorbance of a cell filled with water, is necessary after the meter is switched on.

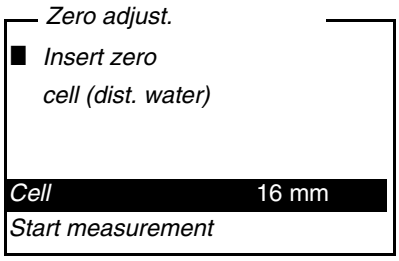
Additionally, we recommend to carry out a zero adjustment if the ambient temperature has changed.

Only perform the zero adjustment against distilled water in an optically perfect cell. The zero adjustment must be performed separately for each cell type.

1	Press the **<M>** key (long pressure) repeatedly until the *Photometry* measuring mode is selected.
2	Press the **<M>** key (short pressure) repeatedly until the measured variable, *Concentration* is selected.
3	Press the **<CAL/ZERO>** key. The menu for adjustment measurements opens up.



4	Using **<▲> <▼>** and **<START/ENTER>**, select and start the *Zero adjust.* function. The menu-guided zero adjustment starts. Follow the instructions on the display.



5	Insert the cell (see section 4.2)
6	Set another cell with **<▲> <▼>** and **<START/ENTER>** as necessary.
7	Start the measurement of the zero adjustment with **<START/ENTER>**. After measuring, the result of the zero adjustment is displayed and stored. ■ *Zero adjust. successful!* (successful zero adjustment) or ■ *Calibration error!* (zero adjustment not successful) is displayed as the result. The zero adjustment is completed.

If ■ *Calibration error!* was displayed as the calibration result, a note automatically reminds you of another zero adjustment before the next measurement.
Measuring is not possible without a valid zero adjustment.

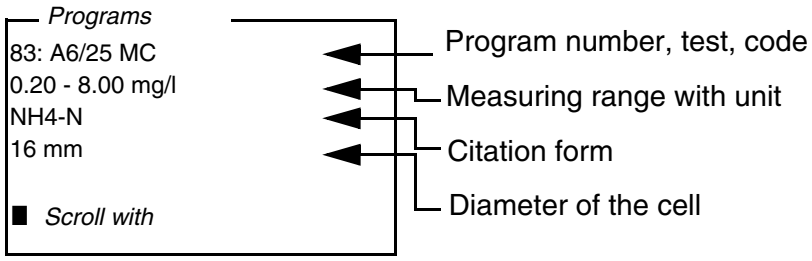
8	Confirm the result with **<START/ENTER>**. The zero adjustment is completed. The meter is ready to measure.

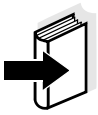
4.5.8 Programs

Displaying program data

You can view the most important data of all methods.
The method data is ordered according to the program number.

1 Open the *Configuration* / *Photometry* / *Programs* menu.
The display shows the most important data of the selected program.





This data is also to be found in the photometry analysis manual in the overview of the test sets and in the individual analysis specifications for the test sets.

Updating programs

Under www.WTW.com on the Internet, you can always find the latest software version with the newest programs and method data for your pHotoFlex® Turb (see FIRMWARE UPDATE).

User-defined programs

User-defined programs (methods) can be stored under program numbers between 900 and 999. You can store up to 100 user-defined programs (see section 4.13).

4.5.9 *Analysis timer*

Measuring according to analysis specifications often means there are waiting periods between the individual steps.
These waiting periods (time intervals) are stored in the instrument with the program data for each program. The active *Analysis timer* function automatically reminds you to observe these time intervals by means of the menu guidance.

If you want to manually enter time intervals, use the *Timer* function (see section 4.5.10).

The *Analysis timer* with the required time interval is automatically displayed at the due point.
Start the *Analysis timer* with the **<START/ENTER>** key.
It is not possible to shorten the time intervall.
An acoustic signal sounds when the adjusted time interval has expired.

The *Analysis timer* function is switched on or off in the *Configuration* / *Photometry*/*Analysis timer* menu.
This setting generally applies to all measurements with methods according to analysis specification.

4.5.10 *Timer*

When measuring according to analysis specifications, waiting periods often have to be kept between individual steps of the method.
With the *Timer* function you manually set a time interval.

If you want to be automatically reminded of the given time interval, use the *Analysis timer* function (see section 4.5.9).

The timer is displayed in the measured value display. It always displays the remaining time of the adjusted time interval.
When the adjusted time interval has expired, the timer indicates 00:00:00 and an acoustic signal sounds.

The *Timer* function is started in the *Configuration* / *Timer* menu by entering a time interval.

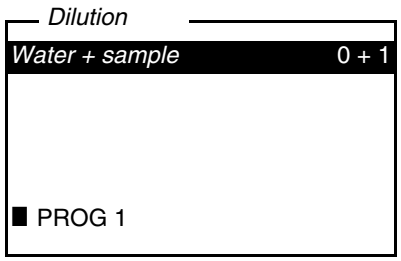
4.5.11 Measuring diluted samples

If the concentration of a test sample exceeds the measuring range of a method, you can dilute the sample by a factor 1 ... 99 so that the concentration of the diluted test sample is within the measuring range of the method (see photometry analysis manual). Thus a valid measurement is possible.

After entering the factor for the dilution the meter converts the concentration to that of the undiluted sample.
The display then indicates the measured value of the undiluted sample.

Entering the factor of the dilution

1	Select the program for which a dilution factor is to be entered.
2	Open the *Configuration* / *Photometry* / *Dilution* menu. The current factor of the dilution is displayed.



3	Open the display for the entry of numerals with **<START/ENTER>**.
4	Enter the factor of the dilution with the number keys. The factor has to be a whole number between 0 ... 99.
5	Confirm the factor with **<START/ENTER>**.
6	Exit the *Dilution* menu with **<ESC>**. For the following measurements with the selected program, the concentration of the undiluted sampled is displayed as the measurement result.

The entered dilution factor is only valid for the selected program. The dilution factor is erased if:

- the meter is switched off
- a different program number is selected
- the factor 0 is entered in the *Dilution* menu.

If a dilution factor is active, it is indicated on the display during measurement in the form [x + 1].

4.6 pH value / ORP voltage

4.6.1 General information

You can measure the following variables:

- pH value [ ]
- ORP [mV]

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

Temperature measurement

For reproducible pH measurements, it is essential to measure the temperature of the test sample.
You have the following possibilities for measuring the temperature:

- Automatic measurement of the temperature by a temperature sensor (NTC30 or Pt1000) integrated in electrode.
- Manual determination and input of the temperature.

The meter recognizes whether a suitable electrode is connected and automatically switches on the temperature measurement.

The display of the temperature indicates the active temperature measuring mode:

Temperature sensor	Resolution of the temp. display	Temperature of the test sample
yes	0.1 °C	automatic measurement
-	1 °C	manual measurement and entry

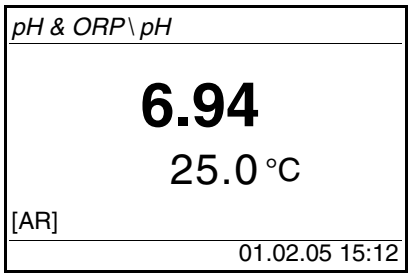
Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect a pH or ORP electrode to the meter.
2	Press the **<M>** key (long pressure) repeatedly until the *pH & ORP* measuring mode is selected.
3	Press the **<M>** key (short pressure) repeatedly until the measured parameter, *pH* or *ORP* is selected.
4	Adjust the temperature of the solutions and measure the current temperature if the measurement is made without a temperature sensor.
5	Calibrate or check the meter with the electrode.

4.6.2 Measuring the pH value

1	Perform the preparatory activities according to section 4.6.1.
2	Immerse the pH electrode in the test sample.



3	Press the **<M>** key (short pressure) repeatedly until the measured variable, *pH* is selected.

AutoRead (Drift control)

The AutoRead function (drift control) continually checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of measured values. The display of the measured parameter flashes until a stable measured value is available.

Criteria

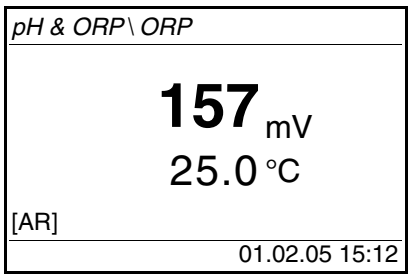
With identical measurement conditions, the following applies:

Measured parameter	Reproducibility	Response time
pH value	Better than 0.01	> 30 seconds

4.6.3 Measuring the ORP voltage

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

1	Perform the preparatory activities according to section 4.6.1.
2	Submerse the ORP electrode in the sample.



3	Press the **<M>** key (short pressure) repeatedly until the measured parameter, *ORP* is selected.

AutoRead (drift control)

The AutoRead function (drift control) continually checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of measured values. The display of the measured parameter flashes until a stable measured value is available.

Criteria

With identical measurement conditions, the following applies:

Measured parameter	Reproducibility	Response time
ORP voltage	better than 1 mV	> 30 seconds

4.6.4 Settings for pH and ORP measurements

Overview

For pH and ORP measurements, the following settings are available in the *Configuration* / *pH & ORP* menu:

- *Measured parameter*
- *Calibration record* (display, print)
- Selecting the calibration type
- Entering the *Calibration interval*
- Selecting the *Unit for slope*
- Selecting the *Temperature unit*
- *Reset*

Settings/functions

The settings can be found in the *Configuration* / *pH & ORP* menu. To switch to the *Configuration* menu, press the **<MENU>** key.

Menu item	Possible setting	Description
Measured parameter	*pH & ORP* mV	
Calibration / *Calibration record*	-	Displays the calibration record of the last calibration.
Calibration / *Cal. type*	*TEC* *NIST/DIN*	Buffer sets to be used for pH calibration. For details, see section 4.6.5.
Calibration / *Calibration interval*	1 ... 999 d	*Calibration interval* for the pH electrode (in days). The meter reminds you to calibrate regularly by the flashing sensor symbol in the measured value display.
Calibration / *Unit for slope*	mV/pH %	Unit of the slope. The % display refers to the Nernst slope of -59.16 mV/pH (100 x determined slope/Nernst slope).
Man. temperature	-20 ... +130 °C	Entry of the manually determined temperature. For measurements without temperature sensor only.
Temperature unit	°C, °F	Degrees Celsius Degrees Fahrenheit
Reset		Reset all settings for the *pH & ORP* measuring mode (see section 4.10.3)

4.6.5 Calibration

Why calibrate?

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

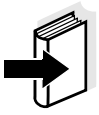
When to calibrate?

- After connecting another electrode
- When the sensor symbol flashes:
  - after the calibration interval has expired
  - after voltage interruption (e.g. empty batteries, empty rechargeable battery)

Buffer sets for calibration

You can use the buffer sets quoted in the table for an automatic calibration. The pH values are valid for the specified temperature values. The temperature dependence of the pH values is taken into account during calibration.

Buffer set	Name on the display	pH values at 25 °C
WTW technical buffer solutions	*TEC*	2.00 4.01 7.00 10.01
NIST/DIN buffer solutions	*NIST/DIN*	1.679 4.006 6.865 9.180 12.454



The buffers are selected in the *Configuration* / *pH & ORP* / *Cal. type* menu, see section 4.6.4).

Calibration points

Calibration can be performed using one, two or three buffer solutions in any order (single-point-, two-point or three-point calibration). The meter determines the following values and calculates the calibration line as follows:

	Determined values	Displayed calibration data
1-point	*Asy*	● Asymmetry = *Asy* ● Slope = Nernst slope (-59.16 mV/pH at 25 °C)
2-point	*Asy* *Slp.*	● Asymmetry = *Asy* ● Slope = *Slp.*
3-point	*Asy* *Slp.*	● Asymmetry = *Asy* ● Slope = *Slp.* The calibration line is calculated by linear regression.

You can display the slope in the unit, mV/pH or % (see section 4.6.4).

AutoRead

The calibration procedure automatically activates the AutoRead function.
The current AutoRead measurement can be terminated at any time (accepting the current value).

Calibration record

When finishing a calibration, the new calibration values are displayed as an informative message (■ symbol) first. Then you can decide whether you want to take over these values of the new calibration or whether you want to continue measuring with the old calibration data. After accepting the new calibration values the calibration record is displayed.

Displaying and downloading calibration data to interface

You can view the data of the last calibration on the display. Subsequently, you can download the displayed calibration data to the interface, e. g. to a printer or PC, with the **<PRT>** key.

The calibration record of the last calibration can be found under the *Configuration* / *pH & ORP* / *Calibration* / *Calibration record* menu item.

Sample of a record

```
31.10.03  16:13
pHotoFlex Ser. no. 12345678
Calibration pH & ORP
Calibration date 31.10.03  16:13:33
Calibration interval    7 d
AutoCal TEC
Buffer 1              4.01
Buffer 2              7.00
Buffer 3              10.01
Voltage 1           184.0 mV       24.0 °C
Voltage 2           3.0 mV         24.0 °C
Voltage 3           -177.0 mV      24.0 °C
Slope             -60.2 mV/pH
Asymmetry           4.0 mV
Sensor +++
```

Calibration evaluation

After calibrating, the meter automatically evaluates the calibration. The asymmetry and slope are evaluated separately. The worse evaluation of both is taken into account. The evaluation appears on the display and in the calibration record.

Sample display	Calibration record	Asymmetry [mV]	Slope [mV/pH]
	+++	-15 ... +15	-60.5 ... -58
	++	-20 ... +20	-58 ... -57
	+	-25 ... +25	-61 ... -60.5 or -57 ... -56
	-	-30 ... +30	-62 ... -61 or -56 ... -50
Clean the electrode according to the electrode operating manual			
----	----	< -30 or > 30	... -62 or ... -50
Eliminate the error according to chapter 6 WHAT TO DO IF...			

Preparatory activities

Perform the following preparatory activities when you want to calibrate:

1	Connect the pH electrode to the meter. The pH measured value display is displayed on the screen.
2	Keep the buffer solutions ready. Adjust the temperature of the buffer solutions, or measure the current temperature if you measure without a temperature sensor.

4.6.6 Carrying out the TEC and NIST/DIN calibration procedures

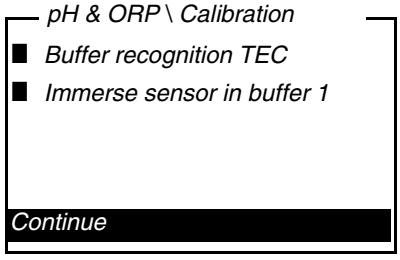
The two calibration procedures only differ in the usage of different buffer sets (see section 4.6.5). Make sure the *Cal. type* is correctly set in the *pH & ORP* / *Calibration* menu (see section 4.6.4).

For this procedure, use any one, two or three WTW technical buffer solutions in ascending or descending order.

The *TEC* calibration is described below. With the *NIST/DIN* calibration, the *NIST/DIN* buffer recognition and different nominal buffer values are displayed. Apart from that, the procedure is identical.

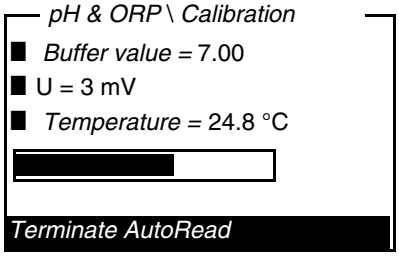
The TEC calibration for pH 10.01 is optimized for the WTW technical buffer solution TEP 10 Trace or TPL 10 Trace. Other buffer solutions can lead to an erroneous calibration. The correct buffer solutions are given in the WTW catalog or on the Internet.

1	Press the **<M>** key (short pressure) repeatedly until the measured parameter, *pH* or *ORP* is selected.
2	Start the calibration with **<CAL/ZERO>**. The calibration display appears.

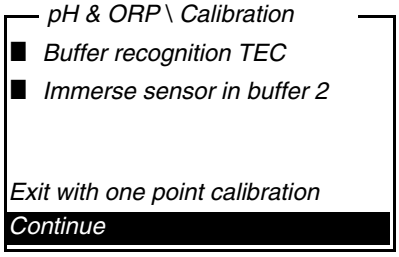


3	Immerse the electrode in buffer solution 1.
4	If the *Set temperature* menu item appears, measure and enter the temperature of the buffer manually (measurement without temperature sensor).

5	Using **<▲> <▼>**, select *Continue* and press **<START/ENTER>**. The buffer is measured. The measured value is checked for stability (AutoRead).



6	Wait for the end of the AutoRead measurement or accept the calibration value with **<START/ENTER>**. The calibration display for the next buffer appears.

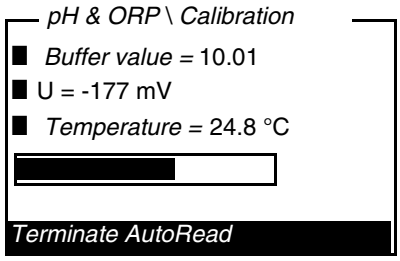


7	For single-point calibration, select *Exit with one point calibration* with **<▲> <▼>** and confirm with **<START/ENTER>**. The calibration is completed as a single-point calibration. The new calibration values are displayed as an informative message (■). You have the following options: ● Accept the new calibration values with **<START/ENTER>**. Subsequently, the calibration record is displayed and output to the interface at the same time. ● To switch to the measured value display without accepting the new calibration values, press **<M>** (short pressure) or **<ESC>**.

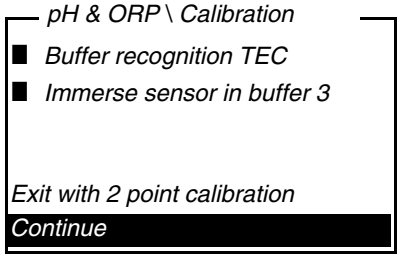
For **single-point calibration**, the instrument uses the Nernst slope (-59.16 mV/pH at 25 °C) and determines the asymmetry of the electrode.

Continuing for two-point calibration (*Cal. type TEC*)

8	Thoroughly rinse the electrode with distilled water.
9	Immerse the electrode in buffer solution 2.
10	If the *Set temperature* menu item appears, measure and enter the temperature of the buffer manually (measurement without temperature sensor).
11	Using **<▲> <▼>**, select *Continue* and press **<START/ENTER>**. The buffer is measured. The measured value is checked for stability (AutoRead).



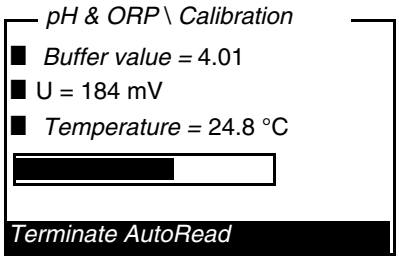
12	Wait for the end of the AutoRead measurement or *Terminate AutoRead* with **<START/ENTER>** and take over the calibration value. The calibration display for the next buffer appears.



13	For two-point calibration, select *Exit with 2 point calibration* with **<▲> <▼>** and confirm with **<START/ENTER>**. The calibration is completed as a two-point calibration. The new calibration values are displayed as an informative message (■). You have the following options: ● Accept the new calibration values with **<START/ENTER>**. Subsequently, the calibration record is displayed and output to the interface at the same time. ● To switch to the measured value display without accepting the new calibration values, press **<M>** (short pressure) or **<ESC>**.

Continuing for three-point calibration (*Cal. type TEC*)

14	Thoroughly rinse the electrode with distilled water.
15	Immerse the electrode in buffer solution 3.
16	If necessary, measure the temperature of buffer 3 manually, then enter and confirm it with **<▲> <▼>** and **<START/ENTER>** in the *Set temperature* setting.
17	Using **<▲> <▼>**, select *Continue* and press **<START/ENTER>**. The buffer is measured. The measured value is checked for stability (AutoRead).



18	Wait for the end of the AutoRead measurement or *Terminate AutoRead* with **<START/ENTER>** and take over the calibration value. The new calibration values are displayed as an informative message (■). You have the following options: ● Accept the new calibration values with **<START/ENTER>**. Subsequently, the calibration record is displayed and output to the interface at the same time. ● To switch to the measured value display without accepting the new calibration values, press **<M>** (short pressure) or **<ESC>**.

4.7 Turbidity

4.7.1 General information

Venting the sample

Air bubbles in the sample affect the measuring result to a massive extent because they have a large scattering effect on the incident light. Larger air bubbles cause sudden changes in the measured values whereas smaller air bubbles are recorded by the instrument as turbidity. Therefore, avoid or remove air bubbles:

Avoiding or removing air bubbles

- During sampling, ensure all movement is kept to a minimum
- If necessary, vent the sample (ultrasonic baths, heating or adding a surface-active substance to reduce the surface tension)

For the measurement of turbidity values under 1 FNU/NTU, please also note the Appendix 2 on page 105.

4.7.2 Aligning and marking a cell

Even completely clean quality cells exhibit tiny directional differences in their light transmittance. Therefore, if you want to achieve accurate and reproducible measurement results, it is necessary to always align the sample cells and cells for calibration standards in the same way (see section 2130 of the "Standard Methods for the Examination of Water and Wastewater", 19th edition).
To do so, the optimum alignment of the cell is determined.

Never apply oily liquids (or so-called "special silicone oils") in order to "smooth" possible scratches. They would unnecessarily soil the meter and your working environment. The measurement accuracy is ensured by aligning the cells. Scratched cells have to be replaced.

Aligning the cell

1	Press the **<M>** key (long pressure) repeatedly until the *Turbidity* measuring mode is selected.
2	Clean the cell (see section 5.2.2).
3	Insert the cell (see section 4.2).

4 Align the cell:
- Press and hold the **<START/ENTER>** key.
- Slowly and in small steps turn the cell by one complete rotation (by 360 °).
  After each step wait for a short time until the displayed measured value is stable.
- Turn the cell back to the position with the lowest measured value.

To keep the drift as low as possible, the time for aligning the cell while pressing and holding the **<START/ENTER>** key is limited to 30 seconds. After this time, the meter starts measuring automatically.

5 Release the **<START/ENTER>** key.
Measurement starts. The measured value is displayed.

Marking a cell

To be able to quickly bring a cell into the optimum position, it is helpful to mark the optimum position of the cell once it is determined. This shortens each measurement or calibration procedure with this cell considerably.

The marking can, e. g., be done on a label on the cap of the cell.

6 Mark the optimum position of the cell.
The cell is prepared for the shortened measuring and calibration procedures.

4.7.3 Measuring turbidity

CAUTION
Never pour any liquids directly into the cell shaft. Always use a cell for measurement. The meter only measures precisely if the cell is closed with the black light protection cap (WTW cells).

The outside of the cell always has to be clean, dry, and free of fingerprints and scratches. Clean the cell before starting to measure (see section 5.2.2). Only hold the cells by the top or by the black light protection cap.

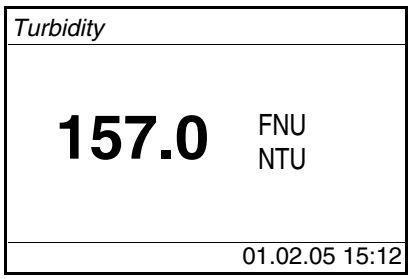
Measuring

1 Press the **<M>** key (long pressure) repeatedly until the *Turbidity* measuring mode is selected.

2	Rinse out a clean cell with the sample to be measured: Pour approximately 10 ml sample into the cell. Close the cell and rotate it several times before throwing the sample away.
3	Repeat the rinsing procedure twice more.
4	Fill the cell with the sample to be measured (approx. 15 ml). Close the cell with the black light protection cap.
5	Clean the cell (see section 5.2.2).
6	Insert the cell (see section 4.2).
7	Align the cell: ● Marked cell – Align the marking on the cell cap with the marking on the cell shaft. – Press and for a short time hold the **<START/ENTER>** key until the measured value is displayed. ● Unmarked cell (see page 60) – Press and hold the **<START/ENTER>** key. – Slowly and in small steps turn the cell by one complete rotation (by 360 °). After each step wait for a short time until the displayed measured value is stable. – Turn the cell back to the position with the lowest measured value.

To keep the drift as low as possible, the time for aligning the cell while pressing and holding the **<START/ENTER>** key is limited to 30 seconds. After this time, the meter automatically starts measuring or calibrating.

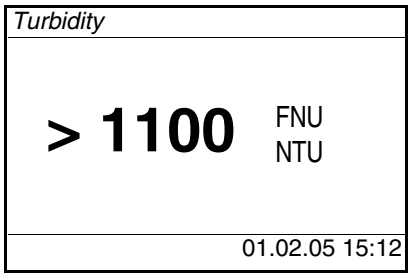
8	Release the **<START/ENTER>** key. Measurement starts. The measured value is displayed.



9	Repeat the steps 2 to 8 for further samples.

Display if the measuring range is exceeded

If the measured value is outside the measuring range of the pHotoFlex® Turb, it is indicated on the display:



4.7.4 Calibration

When to calibrate?

- Regularly every 90 days
- With a temperature change

Calibration procedures and calibration standards

For the menu-guided three-point calibration you need the following three calibration standards in the mentioned order:

Standard no.	NTU/FNU
1	1000
2	10,0
3	0,02

Preparing calibration

Perform the following preparatory activities when you want to calibrate:

1	Keep the cells with the required calibration standards ready and mark them as necessary (see page 60).
2	Clean the cell (see section 5.2.2).
3	Insert the cell (see section 4.2).

CAUTION
Never open the cells with the calibration standards.

Carrying out calibration

1	Press the **<M>** key (long pressure) repeatedly until the *Turbidity* measuring mode is selected.
2	Press the **<CAL/ZERO>** key. The menu-guided calibration begins. Follow the instructions on the display.

Turbidity \ Calibration

- *Insert standard*
  1000 FNU/NTU
- *Press and hold <START>*
- *Align sample*

3	Insert the cell with the displayed calibration standard (here e.g. 1000 NTU/FNU) in the cell shaft (see section 4.2).
4	Align the cell: ● Marked cell: – Align the marking on the cell cap with the marking on the cell shaft. – Press and time hold the **<START/ENTER>** key until the measured value is displayed. ● Unmarked cell (see page 60) – Press and hold the **<START/ENTER>** key. – Slowly and in small steps turn the cell by one complete rotation (by 360 °). – After each step wait for a short time until the displayed measured value is stable. – Turn the cell back to the position with the lowest measured value.

Turbidity \ Calibration

- *Turb.* = 1000 FNU/NTU
- *Start calibration*
  by releasing <START>

5	Release the **<START/ENTER>** key. Measurement of the calibration standard begins.

Before measuring the third calibration standard of 0.02 NTU/FNU you can exit the calibration with **<ESC>** at any time.

The new calibration data is discarded. The old calibration data is further used.

6	Repeat the steps 4 - 6 with the calibration standards, 10.0 NTU/FNU and 0.02 NTU/FNU. After measuring the 0.02 NTU/FNU calibration standard, the calibration result (■ *Calibration successful!* or ■ *Calibration error!*) is displayed and stored. Calibration is completed.
7	Confirm the calibration result with **<START/ENTER>**. The display shows instructions for the first measurement.

Turbidity

■ *Insert sample*
■ *Press and hold <START>*
■ *Align sample*

If ■ *Calibration error!* was displayed as the calibration result, a note appears on the display to recalibrate before measuring.
Should a valid calibration not be possible the meter also offers to continue measuring with the last valid calibration data.

4.8 Storing

The meter has 1000 storage locations for measurement datsets.

You can transmit measured values (datasets) to the data storage with the **<STO>** key.

Each storage process transmits the current dataset to the interface at the same time.

The number of storage locations that are still free is displayed in the *Store* menu. The number of storage locations that are occupied is displayed in the *System* \ *Measured value memory* menu.

Measurement dataset

A complete dataset consists of:

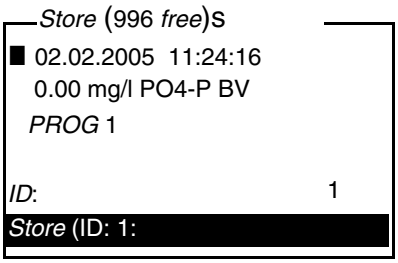
- Date/time
- ID number (ID)
- and the following measurement data depending on the selected measuring mode

Measuring mode	Measurement data
Photometry:	● Program number ● Measured value ● Citation form ● Use of a blank value (BV) ● Dilution (x +1)
Turbidity:	● Measured value
pH & ORP:	● Measured value (pH/mV) ● Measured temperature value (°C/°F) ● AutoRead info (*AR*) *AR* appears with the measured value if the AutoRead criterion was met while storing (stable measured value). Otherwise, the *AR* display is missing.

4.8.1 Storing measurement datsets

Proceed as follows to transmit to the data storage and simultaneously output to the interface a measurement dataset:

1	Press the **<STO>** key. The *Store* display appears.



2	Using **<▲> <▼>**, **<START/ENTER>** and the number keys, change and confirm the ID number (*ID*) as necessary (0 ... 999).
3	Using **<START/ENTER>** or **<STO>**, confirm *Store*. The dataset is stored. The instrument switches to the measured value display.

A measurement dataset is stored quickly by twice pressing **<STO>**. It is stored with the ID last set.

If the storage is full

You can erase the entire storage (see section 4.8.5), or overwrite the oldest dataset with the next storing procedure.
A security prompt appears before a dataset is overwritten.

4.8.2 Filtering measurement datsets

The functions to display and download stored measurement datsets (see section 4.4.1) refer to all stored measurement datsets that correspond to the adjusted filter criteria.

The settings can be found in the *Configuration* / *System* / *Measured value memory* /*Data filter* menu.
To switch to the *Configuration* menu, press the **<MENU>** key.

Data filter

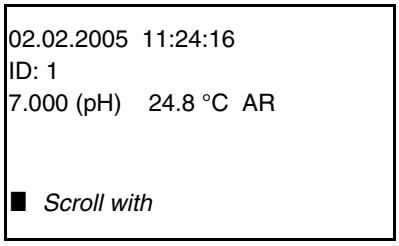
Menu item	Setting/function	Description
Filter		Filter criteria:
	No filter	Data filter switched off
	ID	Selection according to ID number
	PROG	Selection according to program
	Date	Selection according to period
	ID + PROG	Selection according to program and ID number
	ID + Date	Selection according to period and ID number
	PROG + Date	Selection according to program and date
	ID + PROG + Date	Selection according to ID, program and date
ID		Entry of filter criteria These menu items are made visible by selecting the filter criteria in the *Filter* menu.
PROG		
Date		

4.8.3 Displaying measurement datsets

You can read out stored datasets on the display. Only those datasets are displayed that correspond to the selected filter criteria (see section 4.8.2).

Start reading out the data on the display in the menu, *Configuration* / *System* / *Measured value memory* / *Display*.

Display of a dataset



Further datasets that correspond to the filter criteria are displayed with the **<▲> <▼>** keys.

Quitting the display

To quit the display of stored measurement datasets, you have the following options:

- Switch directly to the measured value display with **<M>** (short pressure).
- Leave the display and switch to the higher menu with **<ESC>** or **<START/ENTER>**.

4.8.4 Downloading the measurement datsets to the RS232 interface

You can download stored datasets to the RS232 interface. Only those datasets are downloaded that correspond to the selected filter criteria (see section 4.8.2).

The datasets are downloaded in the adjusted output format (see section 4.9.3).

The data download to the interface is started in the menu, *Configuration* / *System* / *Measured value memory* / *RS232 download*.

4.8.5 Erasing stored measurement datasets

You can erase the stored measurement datsets altogether if you do no longer need them.

Erasing all measurement datsets is done in the menu, *Configuration* / *System* / *Measured value memory* / *Delete*.

Erasing individual datasets is not possible. If all storage locations are occupied, however, it is possible to overwrite the oldest dataset at a time. A security prompt appears before a dataset is overwritten.

4.9 Transmitting data (RS 232 interface)

Via the RS 232 interface, you can transmit data to a PC or an external printer.

4.9.1 Connecting a PC/external printer

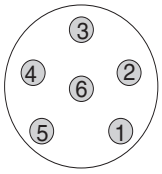
Connect the interface to the devices via the AK540/B (PC) or AK540/S (external printer) cable.

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

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

Baud rate	can be selected from: 1200, 2400, 4800, 9600, 19200 The baud rate must agree with the baud rate set on the PC/printer.
Handshake	RTS/CTS
PC only:	
Parity	none
Data bits	8
Stop bits	1s

Socket assignment



RS 232
REC

1 RTS
2 RxD
3 TxD
4 DTR
5 SG
6 CTS

4.9.2 Configuring the RS232 interface

For an error-free data transmission, the RS232 interface should be set to the same transmission speed (*Baud rate*) on the pHotoFlex® Turb and PC/printer.

You can set the following values for the baud rate on the pHotoFlex® Turb : 1200, 2400, 4800, 9600, 19200.

The baud rate is selected in the menu, *Configuration* / *System* / *Interface* / *Baud rate*.

4.9.3 Selecting the output format of datasets

For downloading data to the interface you can select the output format.

It is selected in the menu, *Configuration* / *System* / *Interface* / *Output format*.

The ASCII output format delivers formatted datasets.
The CSV output format delivers datasets separated by ";".

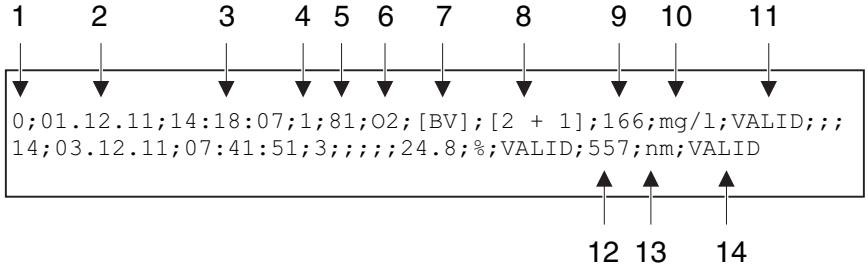
Output format, ASCII

```
pHotoFlex Ser. no. 12345678
31.10.04 09:56:20
ID: 1
10.01 (pH) AR
25 °C
_____________________________________

pHotoFlex Ser. no. 12345678
31.10.04 15:48:08
ID 1 / PROG 2
1.1 mg/l Pb [BV][9 + 1]
_____________________________________

etc...
```

Output format, CSV



	Data	Description
1	No.	Current number of the storage location (or "0" during output from measured value display)
2	Date	Date of storing
3	Time	Time of storing
4	ID	adjusted ID
5	Program number	Only for the measured parameter, *Concentration*
6	Citation form	Only for the measured parameter, *Concentration*
7	AR/ BV	● Measuring mode, *pH & ORP*: AutoRead ● Measured parameter, *Concentration*: Blank value
8	Dilution	Only for the measured parameter, *Concentration*
9	Measured value	● Measured value or ● Upper/lower measuring range limit (only with measured value status, OFL/UFL)
10	Unit of 9	● Unit of the measured value or ● Designation of dimensionless measured values, e.g. <pH>
11	Measured value status of 9	● VALID: Measured value valid ● INVALID: Measured value invalid ● UFL: Measured value below the lower measuring range limit ● OFL: Measured value above the upper measuring range limit
12	Secondary measured value	● Measuring mode, *pH & ORP*: Temperature ● Measured parameter, *Absorbance* / *% Transmission*: Wavelength
13	Unit of 12	● Measuring mode, *pH & ORP*: °C / °F ● Measured parameter, *Absorbance* / *% Transmission*: nm
14	Measured value status of 12	VALID, INVALID, UFL, OFL (see point 11)

4.9.4 Transmitting data

The following table shows which data are transmitted to the interface in which way:

Data	Operation / description
Current measured value	● Press **<PRT>**. ● Simultaneously with every manual storage process.
Stored measured values	● Display stored dataset and press **<PRT>**. ● All datasets according to the filter criteria via the *RS232 download* function (see section 4.8.2).
Calibration record (pH electrode)	● Calibration record of a pH electrode with **<PRT>** (after calling up from the storage or at the end of a calibration). ● Calibration record of a pH electrode at the end of a calibration procedure is transmitted automatically.

With the **<PRT>** key you output the data that is being shown on the display to the interface (displayed measured values, stored measurement datsets, calibration record).

4.10 Reset

You can reset (initialize) all system and measurement settings.

For turbidity measurement, there are no resettable settings.

4.10.1 Resetting the system settings

With the *System* / *Reset* function, all resettable settings are reset.

- Settings for *pH & ORP* (see section 4.10.3)
- Settings for *Photometry* (see section 4.10.2)
- System settings

System setting	Default settings
Baud rate	4800 Baud
Output format	ASCII
Illumination	*Auto off*
Contrast	50 %
Brightness	50 %
Switchoff time	30 min
Beep	*On*
Measuring mode	*Photometry*

4.10.2 Resetting the photometry settings

With the *Photometry* / *Reset* function, all photometry settings are reset.

Setting	Default settings
PROG	0
Cell size	16 mm
Measured parameter	*Concentration*
Wavelength	436 nm
Blank values	all erased

4.10.3 Resetting the pH settings

The calibration data are reset to the default settings together with the measuring parameters. Recalibrate after performing a reset.

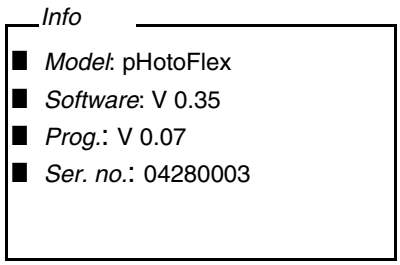
The following settings for pH measurements are reset to the default settings with the *Reset* function:

Setting	Default settings
Cal. type	*TEC*
Calibration interval	7 d
Measured parameter	*pH & ORP*
Asymmetry (*Asy*)	0 mV
Slope (*Slp.*)	-59.16 mV/pH
Temperature, manual	25 °C
Temperature	°C

4.11 Meter information

The following meter information is listed in the *Configuration* / *Info* menu:

- Model designation
- Software version
- Version number(s) of the stored program data
- Series number of the meter



4.12 Software update

With a software update you obtain the current software with all new programs and method data (see section 11).

A software update comprises

- new instrument software
- new programs (methods)
- revisions of existing methods

The current software version can be found on the Internet under www.WTW.com.

The proceeding for updating the software can be found in the appendix (see section 11).

4.13 Administrating user-defined methods

User-defined programs can be

- entered
- read out
- erased.

To store user-defined programs (methods) in the meter, determine a calibration line for your method yourself and transmit the data of this calibration line to the pHotoFlex® Turb.

Administration of the method data can be carried out in the LSdata software (see operating manual LSdata) or with the aid of a terminal program (section 4.13.1).

You need the following data in any case:

Data	Possible entries/examples
Program No:	900 ... 999
Model:	Any name (max. 5 characters)
Cuvette [mm]:	16 or 28
Wave length [nm]:	436, 517, 557, 594, 610 or 690
MRB: (measuring range beginning)	e.g. 0.05
MRE: (measuring range end)	e.g. 8.00
E0: (Offset)	e.g. 0.0
Slope:	e.g. 1.0
Resolution:	0.0001, 0.001, 0.01, 0.1, 1, 2, 5, 10 or 100
Formula: (citation form)	e.g. PO4-P (max. 9 characters)
Unit	e.g. mg/l (max. 7 characters)
Blank required: (No/Yes)	0 or 1

4.13.1 Administrating user-defined programs with a terminal program

Generally, a terminal program serves to establish a connection to a de-

vice on a data interface and to communicate with the device via a console on the display.
Thus, it is also possible to send command lines.

Terminal programs are available for different operating systems by different manufacturers. Windows (version 95 to XP) contains the "HyperTerminal" terminal program. It is in the program menu under *accessories*.

For more detailed information please refer to the user information of the terminal program.

The CD-ROM contains a configuration file for the HyperTerminal program. By double-clicking the configuration file (*.ht), the HyperTerminal with the required pre-settings for data exchange with the meter is opened.

The pHotoFlex® Turb can administrate the database of user-defined programs via command lines.

1	With the aid of the AK 540/B interface cable, connect the pHotoFlex® Turb 540 to the serial interface (COM port) of the PC (see section 8.1.1).
2	Make sure the pHotoFlex® Turb is switched on.
3	Start the terminal program on the PC.
4	Configure the connection settings for the COM interface as necessary.

Storing user-defined programs

Enter a command line according to the following scheme in the terminal program:

U.500#14,*Program No*,*Model*,*Cell [mm]*,*Wave length [nm]*,*MRB*, *MRE*,*E0*,*Slope*,*Resolution*,*Citation form*,*Unit*,*Blank required*,0,0

Example:

```
U.500#14,900,Test,16,436,0.0,2.0,0.0,1.0,0.01,test,
mg/l,0,0,0
```

The individual data sections of the command line are separated by commas. The dot "." has to be used as a decimal separator within a data section.

5	Enter the command line.
6	Finish the command line with Enter. The data is transmitted to the pHotoFlex® Turb.

If a program is already stored under the selected number, the programming procedure is canceled. To store the program under the selected number, first erase the program stored under the number.

After successful transmission, the terminal program writes "!>".
If the transmission failed, the terminal program writes "!>".

Erasing user-defined programs

To erase user-defined programs, enter a command line according to the following scheme in the terminal program:

	Erase all user-defined programs	**Erase one user-defined program**
Command line	U.520	U.521#1,*Program No*
Example	`U.520`	`U.521#1,900`

7	Enter the command line.
8	Finish the command line with Enter. The data is transmitted to the pHotoFlex® Turb. The requested data is displayed on the terminal as the result.

After successful transmission, the requested data is displayed on the terminal.
If the transmission failed, the terminal program writes "!>".

Reading out user-defined programs

To read out user-defined programs, enter a command line according to the following scheme in the terminal program:

	Read out all user-defined programs	Read out one user-defined program
Command line	U.510	U.511#1,*Program No*
Example	`U.510`	`U.511#1,900`

9	Enter the command line.
10	Finish the command line with Enter. The data is transmitted to the pHotoFlex® Turb. The requested data is displayed on the terminal as the result.

After successful transmission, the terminal program writes "!>".
If the transmission failed, the terminal program writes "!>".

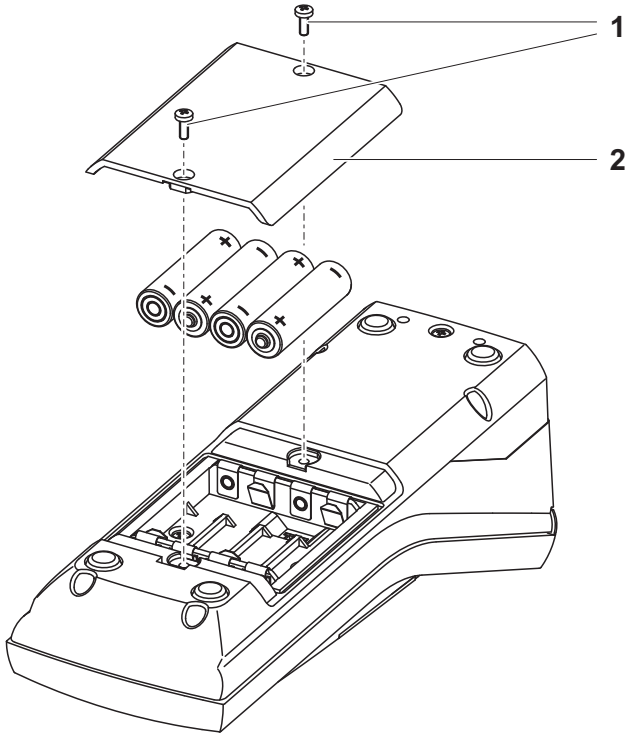
5 Maintenance, cleaning, disposal

5.1 Maintenance

The meter is almost maintenance-free.
The only maintenance task is replacing the batteries or rechargeable battery.

5.1.1 Inserting/exchanging the batteries

NOTE
Make sure that the poles of the batteries are positioned correctly.
The ± signs on the batteries must correspond to the ± signs in the battery compartment.



1	Open the battery compartment: – Unscrew the two screws (1) on the underside of the meter, – Remove the lid of the battery compartment (2).
2	If necessary, take four old batteries out of the battery compartment.
3	Insert four batteries (3) in the battery compartment.
4	Close the battery compartment and fix it with the screws.

Dispose of used batteries according to the local regulations of your country.

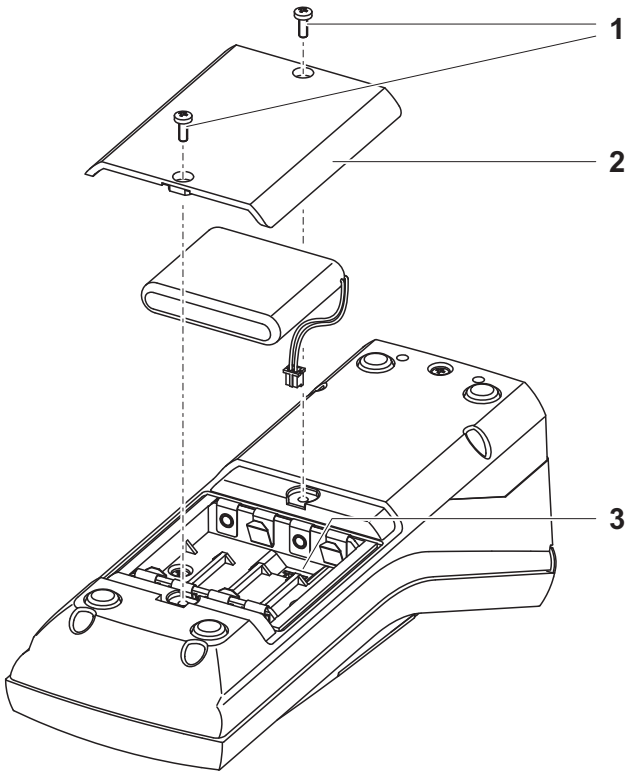
End users within the European Union are obligated to return used batteries (even ecologically compatible ones) to a collection point set up for recycling purposes.

Batteries are marked with the crossed-out waste container symbol. Therefore, they may not be disposed with the domestic waste.

5.1.2 Retrofitting the rechargeable battery

NOTE
Use original WTW rechargeable battery only.

Together with the power pack the rechargeable battery is available as an accessory (see section 8.1).



1	Open the battery compartment: – Unscrew the two screws (1) on the underside of the meter, – Remove the lid of the battery compartment (2).

2	If necessary, take four old batteries out of the battery compartment.
3	Connect the cable of the rechargeable battery with the socket (3) on the bottom of the battery compartment and insert the rechargeable battery in the battery compartment.
4	Close the battery compartment and fix it with the screws.

Dispose of used batteries according to the local regulations of your country.

End users within the European Union are obligated to return used batteries (even ecologically compatible ones) to a collection point set up for recycling purposes.

Batteries are marked with the crossed-out waste container symbol. Therefore, they may not be disposed with the domestic waste.

5.2 Cleaning

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

NOTE
The housing parts are made of plastic (polyurethane, ABS and PMMA) and are only conditionally resistant against organic solvents. Thus, avoid contact with acetone and similar detergents that contain solvents. Remove any splashes immediately.

5.2.1 Cleaning the cell shaft

If liquid is in the cell shaft (e.g. due to a spilled cell), clean the cell shaft as follows:

CAUTION
Cells can contain poisonous or corrosive substances. If the content is released follow the danger warnings on the cell. If necessary, take corresponding protective measures (protective goggles, protective gloves etc.).

1	Switch the pHotoFlex® Turb off and pull out the power plug.
2	Rinse the cell shaft with distilled water.

5.2.2 Cleaning the cells

Cells have to be clean, dry, and free of fingerprints. Therefore, clean them regularly:

1	Clean the cells inside and out with hydrochloric acid or laboratory soap.
2	Rinse out several times with distilled water.
3	Let them dry in the air.
4	Only hold the cells by the top or by the light protection cap so that the optical path is not impaired.
5	Before measuring, clean the cell with the enclosed cleaning cloth.

5.3 Packing

This meter is sent out in a protective transport packing.

We recommend: Keep the packing material. The original packing protects the meter against damage during transport.

5.4 Disposal

Batteries Dispose of used batteries according to the local regulations of your country (see section 5.1.1).

Meter At the end of its operational lifetime, the meter must be returned to the disposal or return system statutory in your country. If you have any questions, please contact your supplier.

6 What to do if...

6.1 General errors

Display, LoBat

Cause	Remedy
– The batteries or rechargeable battery are largely depleted	– Insert new batteries – Charge the rechargeable battery (see section 3.2)

Instrument does not react to keystroke

Cause	Remedy
– Software error – Operating condition undefined or EMC load unallowed	– Processor reset: Press the **<START/ENTER>** and **<PRT>** key simultaneously.

RS232 interface does not react

Cause	Remedy
– Software error – Operating condition undefined or EMC load unallowed	– Processor reset: Press the **<START/ENTER>** and **<PRT>** key simultaneously.

Error message, *Error 0, 8, 16, 16384*

Cause	Remedy
– Instrument error	– Repeat measurement – Meter defective, send meter to WTW for repair and quote the error number

6.2 Photometry

Measuring range undercut or exceeded

Cause	Remedy
– Program not suitable	– Select program with suitable measuring range – Dilute the sample

Obviously incorrect measured values

Cause	Remedy
– Measurement disturbed by external light	– Close the external light cover.
– Cell not correctly inserted	– Insert the cell so that it is positioned on the bottom of the cell shaft.
– Cell contaminated	– Clean the cell
– Cell shaft contaminated	– Clean the cell shaft
– Dilution set incorrectly	– Set the dilution
– Selected program unsuitable	– Select other program
– Zero measurement incorrect	– Perform zero measurement
– Blank value incorrect	– Remeasure the blank value

6.3 pH value / ORP voltage

Measuring range undercut or exceeded

Cause	Remedy
Electrode:	
– Air bubble in front of the diaphragm	– Remove air bubble
– Air in the diaphragm	– Extract air or moisten diaphragm
– Gel electrolyte dried out	– Replace electrode
Test sample	
– The pH value lies outside the measuring range	– not possible

Measured value display ----
(calibration error)

Cause	Remedy
Electrode:	
– Diaphragm contaminated	– Clean diaphragm
– Membrane contaminated	– Clean membrane
– Moisture in the plug	– Dry plug
– Not enough electrolyte	– Top up electrolyte
– Electrode obsolete	– Replace electrode
– Electrode broken	– Replace electrode
– Socket damp	– Dry socket
Calibration procedure:	
– Incorrect solution temperature (without temperature sensor)	– Set up correct temperature
– Incorrect buffer solutions	– Select buffer solutions suitable for the calibration procedure
– Buffer solutions too old	– Use only once. Note the shelf life

No stable measured value

Cause	Remedy
pH electrode:	
– Diaphragm contaminated	– Clean diaphragm
– Membrane contaminated	– Clean membrane
Test sample	
– pH value not stable	– Measure with air excluded if necessary
– Temperature not stable	– Temper if necessary
Electrode + test sample:	
– Conductivity too low (e.g. in ultrapure water)	– Use suitable electrode
– Temperature too high	– Use suitable electrode
– Organic liquids	– Use suitable electrode

Obviously incorrect measured values

Cause	Remedy
pH electrode:	
– Not connected	– Connect electrode
– Cable broken	– Replace cable or electrode
– pH electrode unsuitable	– Use suitable electrode
– Temperature difference between buffer and test sample too high	– Adjust temperature of buffer or sample solutions
– Measurement procedure not suitable	– Follow special procedure

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

6.4 Turbidity

Error message Measured values obviously incorrect

Cause	Remedy
– Cell not correctly inserted	– Lock cell into place
– Cell contaminated	– Clean the cell
– Calibration too old	– Carry out calibration

Measured value display *< 0.01 FNU*

Cause	Remedy
– Measured value outside the measuring range	– not possible

7 Technical data

7.1 General data

Dimensions	approx. 236 x 86 x 117 mm	
Weight	approx. 0.6 kg (without batteries)	
Mechanical structure	Type of protection	IP 67
Electrical safety	Protective class	III
Test certificates	CE, FCC	
Ambient conditions	Storage	- 25 °C ... + 65 °C
	Operation	0 °C ... + 50 °C
	Climatic class	2
Allowable relative humidity	Yearly mean: 30 days /year: other days:	75 % 95 % 85%
Power supply	Batteries	4 x 1.5 V, type AA
	Operating time with battery operation	approx. 5000 measurements
	Rechargeable battery (optional)	5 x 1.2 V nickel metal hydride (NiMH), type AAA
	Power pack Charging device (optional)	FRIWO FW7555M/09, 15.1432.500-00 Friwo Part. No. 1883259 ---------- RiHuiDa RHD20W090150 ---------- Input: 100 ... 240 V ~ / 50 ... 60 Hz / 400 mA Output: 9 V = / 1,5 A Connection max. overvoltage category II Primary plugs contained in the scope of delivery: Euro, US, UK and Australian.

Serial interface

Connection of the cable AK 540/B or AK 540/S

Baud rate	adjustable: 1200, 2400, 4800, 9600, 19200 Baud
Type	RS232
Data bits	8
Stop bits	2
Parity	None
Handshake	RTS/CTS
Cable length	max. 15 m

Guidelines and norms used

EMC	EC guideline 89/336/EEC EN 61326-1/A3:2003 FCC Class A
Instrument safety	EEC guideline 73/23/EEC EN 61010-1 :2001
Climatic class	VDI/VDE 3540
IP protection	EN 60529:1991

FCC Class A Equipment Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

7.2 Photometry

Optical measuring principle

LED photometer with filter

Interference filter

436 nm, 517 nm, 557 nm, 594 nm, 610 nm, 690 nm	
Accuracy:	± 2 nm

Photometric reproducibility	0.005 or better	
Photometric resolution	0.001	
Warm-up time	none	
Measuring time	approx. 2s	
Measured parameters	Concentration (method dependent, selectable display form), absorbance, transmission	
Measuring range	Absorbance:	-2,000 ... +2.000
	Transmission:	1 ... 150 %
User-defined programs	100	
Resolution Transmission	1.00 ... 9.99	0,01 %
	10.0 ... 150	± 0.1

7.3 pH value / ORP voltage

Measuring ranges, resolution

Variable	Measuring range	Resolution
pH	- 2.00 ... + 16.00	0.01
U [mV]	- 1000 ... + 1000	1
T [°C]	- 5.0 ... + 100.0	0.1
T [°F]	- 23.0 ... + 212.0	0.1

Manual temperature input

Variable	Range	Increment
T_{manual} [°C]	- 20 ... + 100	1

Accuracy (± 1 digit)

Variable	Accuracy	Temperature of the test sample
pH *	± 0.01	+ 15 °C ... + 35 °C
U [mV]	± 1	+ 15 °C ... + 35 °C
T [°C]	± 0.3	0 °C ... + 55 °C
T [°F]	± 0.54	0 °C ... + 55 °C

** when measuring in a range of ± 2 pH around a calibration point*

7.4 Turbidity

Measuring principle	Nephelometric measurement according to DIN EN ISO 7027
Light source	Infrared LED

Measuring range	0.01 ... 1100 NTU/FNU	
Resolution	in the range 0.01 ... 9.99	max 0.01 NTU/FNU
	in the range 10.0 ... 99.9	max 0.1 NTU/FNU
	in the range 100 ... 1100	max 1 NTU/FNU
Accuracy	in the range 0 ... 1000 NTU/FNU	± 2% of the measured value or ± 0.01 NTU/FNU
Measuring time	4 seconds	
Calibration	Automatic 3-point calibration	

8 Accessories, options

8.1 Accessories

Description	Model	Order no.
LabStation with LSdata PC software, rechargeable battery and universal power pack	LS Flex/430	251 301
Rechargeable battery for pHotoFlex	RB Flex/430	251 300
3 empty cuvettes, 28 x 60 mm	LKS28-Set	251 302
Calibration standard kit for Turb 430 IR/pHotoFlex Turb	Kal.Kit Turb 430 IR	600 560
Thermoprinter*	P3001	250 045
Needle printer*	LQ 300+	250 046
16 mm empty cell	RK 14/25	250 621

* a connection cable is required to connect the printer (see section 8.1.1)

8.1.1 Connection cable

PC You can connect a PC to the pHotoFlex® Turb in one of the following ways:

Description	Model	Order no.
● Connection PC - pHotoFlex® Turb		
– Cable	AK 540/B	902 842
+ USB adapter (for USB connection on PC)	Ada USB	902 881
● Connection PC - LabStation		
– Zero modem cable	AK Labor	902 758
+ USB adapter (for USB connection on PC)	Ada USB	902 881

Thermoprinter

You can connect the P3001 to the pHotoFlex® Turb in the following ways:

Description	Model	Order no.
● Connection P3001 - pHotoFlex® Turb		
– Cable	AK 540/S	902 843
● Connection P3001 - LabStation		
– Cable	AK 3000	250 745
in conjunction with an adapter (socket - socket) [GenderChanger]	Specialist shops	
or:		
– Cable, 2 x 9-pin (socket - plug)	Specialist shops	

Needle printer

You can connect an LQ300 needle printer to the pHotoFlex® Turb in one of the following ways:

Description	Model	Order no.
● Connection LQ300 - pHotoFlex® Turb		
– Cable	AK 540/B	902 842
with adapter 9-pin (plug) - 25-pin (plug)	Specialist shops	
● Connection LQ300 - LabStation		
– Cable	AK/LQ300	250 746
in conjunction with an adapter (socket - socket) [GenderChanger]	Specialist shops	
or:		
– Zero modem cable, 9-pin (socket) - 25-pin (plug)	Specialist shops	

8.2 Optional extensions of the pHotoFlex® Turb

The following optional extensions are available in specialist shops:

Device/cable	Model
Barcode reader*	● Handscanner Datalogic DLC6065-M1 ● Handscanner Datalogic Touch65
Connection cable Barcode reader - LabStation	Datalogic CAB-350

* In addition to the barcode reader, a suitable connection cable is required to operate the barcode reader

9 Lists

This chapter provides additional information and orientation aids.

Abbreviations

The list of abbreviations explains the indicators and the abbreviations that appear on the display and in the manual.

Specialist terms

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

Abbreviations

°C	Temperature unit, degrees Celsius
°F	Temperature unit, degrees Fahrenheit
Asy	Asymmetry
Cal	Calibration
d	Day
h	Hour
j	Year
K	Temperature unit, Kelvin
LoBat	Batteries almost empty (Low battery)
m	Month
mV	Voltage unit
mV/pH	Unit of the electrode slope (internat. mV)
NIST/DIN	Automatic pH calibration with buffer solutions prepared according to NIST or DIN 19 266
pH	pH value
s	Second
S	Slope (internat. k)
SELV	Safety Extra Low Voltage
Slp.	Slope determined with calibration
TEC	Automatic pH calibration with WTW technical buffer solutions according to DIN 19267
U	Voltage

Glossary

Adjusting To manipulate a measuring system so that the relevant value (e. g. the displayed value) differs as little as possible from the correct value or a value that is regarded as correct, or that the difference remains within the tolerance.

Asymmetry Designation for the offset potential of a pH electrode. It is the measurable potential of a symmetrical electrode, the membrane of which is immersed in a solution with the pH of the nominal electrode zero point (WTW electrodes: pH = 7).

AutoRange Name of the automatic selection of the measuring range.

AutoRead WTW name for a function to check the stability of the measured value.

Calibration Comparing the value from a measuring system (e. g. the displayed value) to the correct value or a value that is regarded as correct. Often, this expression is also used when the measuring system is adjusted at the same time (see adjusting).

Electrode zero point The zero point of a pH electrode is the pH value at which the electromotive force of the pH electrode at a specified temperature is zero. Normally, this is at 25 °C.

Electromotive force of an electrode The electromotive force U of the electrode is the measurable electromotive force of an electrode in a solution. It equals the sum of all the galvanic voltages of the electrode. Its dependency on the pH results in the electrode function which is characterized by the parameters, slope and zero point.

Junction The junction is a porous body in the housing wall of reference electrodes or electrolyte bridges. It forms the electrical contact between two solutions and makes electrolyte exchange more difficult. The expression, junction, is also used for ground or junction-less transitions.

Measured parameter The measured parameter is the physical dimension determined by measuring, e. g. pH, conductivity or DO concentration.

Measured value The measured value is the special value of a measured parameter to be determined. It is given as a combination of the numerical value and unit (e. g. 3 m; 0.5 s; 5.2 A; 373.15 K).

Measuring system The measuring system comprises all the devices used for measuring, e. g. meter and sensor. In addition, there is the cable and possibly an amplifier, terminal strip and armature.

Molality Molality is the quantity (in Mol) of a dissolved substance in 1000 g solvent.

MultiCal® WTW name stating that a meter provides several pH calibration procedures.

Offset potential	The measurable potential of a symmetrical electrode, the membrane of which is immersed in a solution with the pH of the nominal electrode zero point. The asymmetry is part of the offset potential.
ORP voltage	The ORP is caused by oxidizing or reducing substances dissolved in water if these substances become effective on an electrode surface (e. g. a gold or platinum surface).
pH value	The pH value is a measure of the acidic or basic effect of an aqueous solution. It corresponds to the negative decadic logarithm of the molal hydrogen ions activity divided by the unit of the molality. The practical pH value is the value of a pH measurement.
Potentiometry	Name of a measuring technique. The signal (depending on the measured parameter) of the electrode is the electrical potential. The electrical current remains constant.
Reset	Restoring the original condition of all settings of a measuring system.
Resolution	Smallest difference between two measured values that can be displayed by a meter.
Slope	The slope of a linear calibration function.
Standard solution	The standard solution is a solution where the measured value is known by definition. It is used to calibrate a measuring system.
Temperature function	Name of a mathematical function expressing the temperature behavior of a test sample, a sensor or part of a sensor.
Test sample	Designation of the test sample ready to be measured. Normally, a test sample is made by processing the original sample. The test sample and original sample are identical if the test sample was not processed.

Analysis specification
The exact proceeding to carry out the detection procedure is described in the analysis specification.

Blank value (reagent blank value)
The evaluation of the photometric measurement always refers to the comparison value of a sample without the substance to be determined (reagent blank value). Thus the influence of the basic absorbance of the reagents on photometric measurement is compensated for.

Cell
Vessel to take a liquid sample for photometric measurements.
The cell material (mostly glass) must have certain optical features to be suitable for photometry.

Citation forms
Different forms of representing a measured concentration value that can be derived from each other.
The method to determine phosphate, e.g. delivers a measured value for phosphorous P. This measured value can be alternatively quoted in the citation forms, PO4, PO4-P or P2O5.

Detection procedure
The detection procedure designates the general principle of how a sample is brought into a form suitable for measurement.
Different methods can be based on the same detection procedure.

LED
Light Emitting Diode
LEDs are used as the light source in the pHotoFlex® Turb.

Method
A method comprises a chemical detection procedure and special method data (calibration line) that is required to evaluate the measurement results.
How to carry out the method up to the photometric measurement is described in the analysis specification.
The pHotoFlex® Turb contains a database with methods (programs). Furthermore, user-defined methods can be entered in the database as well.

Program
In the pHotoFlex® Turb, methods with the relevant method data are stored as programs.
Programs are called up via the assigned program number.

Test set (test)
A test set contains all reagents that are required for the photometric determination of the sample according to the analysis specification.

Zero adjustment
Adjusting a photometer with a water-filled cell.
The zero adjustment applies to measuring all measured parameters (concentration, absorbance, transmission) of a photometer.

10 Index

11 Firmware update

General information

You can update the firmware of the pHotoFlex® Turb to the latest version with the aid of a Personal Computer.
You can find available firmware update files for your meter on the Internet.

The update program contains:
- the newest firmware (meter software)
- new or changed method data and programs.

A free serial interface (COM port) on your PC and the AK 540/B interface cable is required for this.

Connecting the meter to the PC

The following is required for connection to a PC:
- a free serial interface (COM or USB port) on your PC
- cable or LabStation with cable for connection to PC
  - for direct connection of the meter to the PC: the AK 540/B interface cable (accessory) or
  - for connection with the LabStation: an operable LabStation with null modem cable (accessory, see section 8.1)
- for connection to a USB interface on the PC: a USB adapter (accessory).

Prior to starting the update, make sure that the batteries are fully charged, or operate the pHotoFlex® Turb on the LabStation or with the power pack. Otherwise, there is a risk of the pHotoFlex® Turb crashing during the update.

Program installation

Install the firmware update program on your PC.

Program start

Start the program from the Windows start menu.
Via the language menu you can change the adjusted language.

For Microsoft Windows 7, administrator rights are required.

Firmware update

Proceed as follows:

1	Connect the pHotoFlex® Turb to an interface of the PC.
2	Make sure the pHotoFlex® Turb is switched on.
3	To start the updating process click the OK button.

4	Then follow the instructions of the program. The programming procedure takes approx. 5 minutes. A final message appears after the successful programming procedure. The firmware update is completed with this.
5	Disconnect the meter from the PC. The instrument is ready for operation.

After switching the meter off and on again you can check on the start display whether the meter has taken over the new software version.

12 Appendix: Turbidity values under 1 FNU/NTU

With turbidity values (under 1 FNU/NTU), the measured value is strongly influenced by the cell and its alignment.
In order to increase measuring accuracy with turbidity values under 1 FNU/NTU, calibration in the 0.02 FNU/NTU standard and later measurement should be carried out in the same cell. For calibration in the standards 10.0 and 1000 FNU/NTU follow the instructions on the display.
Proceed as follows to measure turbidity values under 1 FU/NTU:

Calibration procedure:

1	Press the **<CAL/ZERO>** key. The menu-guided calibration begins.
2	Carry out calibration of the standards 1000 FNU/NTU and 10.0 FNU/NTU in a clean and unscratched cell according to the menu guidance.
3	Fill the cleaned cell with the 0.02 FNU/NTU standard and calibrate.
4	Mark the alignment of the cell.

Calibrate

- after the calibration interval has expired
- with a temperature change

Measuring

5	Fill the marked and cleaned cell with test sample, align it with the marking and measure.
6	If necessary, fill the marked and cleaned cell once more with test sample and carry out further measurements.

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