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# The system for photometric water analysis

## NANOCOLOR® Photometer

For universal use in water and waste water analysis

### Save time

- Fast measurements by NANOCOLOR® barcode technology
- Pre-programmed tests and photometric basic functions
- Simple measurements without cuvette slot cover
- Clear display of all significant data and functions on the user-friendly touch-screen



### Experience precision

- Highly accurate measurements by high-quality optical components
- Self-explanatory user guidance
- Safe test procedures with test instructions presented as pictograms

### Meet specifications

- Internal quality control in accordance to ISO 9001
- Documentation of results in accordance to GLP
- Clear memory management
- Convenient export of data and professional data and spectrum processing with NANOCOLOR® PC software

Data export  
 software  
 included!



### Enjoy flexibility

- Flexible measurements of different cuvettes without adapter
- Free programming of user defined applications
- Fast photometer update - free of charge

## NANOCOLOR® Heating blocks

For fast and safe sample digestions

### Experienced and flexible

- Pre-programmed standard programmes for all routine digestions
- Easy to programme for user-defined methods
- Performance of all required digestions with only one instrument

### Simple and fast

- Very short warm-up times
- Procedure of all routine digestions in only 30 minutes
- Simple operation via symbol keys



### Controlled and safe

- Electronic temperature control and fully automatic calibration with the NANOCOLOR® T-Set
- Extra thick safety covers on the surface of the heating blocks as protection against contact
- Electronic protection against excess temperature

### Reliable and versatile

- Constant digestion conditions with high temperature stability
- Suitable for all NANOCOLOR® digestion methods



# The system for photometric water analysis

## NANOCOLOR® tests

### User-friendly and precise analysis

#### Approved

- Reliable and comparable results - The reaction basis of NANOCOLOR® tests is based on internationally approved standard methods like DIN-, EN-, ISO-, EPA- und APHA.

#### Precise

- Easy handling and highest accuracy - All NANOCOLOR® tests contain accurately predosed ready-to-use reagents and calibrated accessories.

#### Versatile

- The perfect test for every request - For all important parameters in water and waste water analysis, a large number of tests with different ranges is available.

#### Unique

- No confusion of different tests – Every NANOCOLOR® test box is equipped with a clearly identifiable colour coded label.

## Tube tests

### Easy and fast measurements

- Using NANOCOLOR® bar coded test tubes, the measurement is automatically performed after inserting the cuvette into the cuvette slot.

### Maximum safety for the user

- The contact with any dangerous chemicals is avoided because the measurement is performed directly in the test tube.

## Standard tests

### Highest sensitivity

- The use of rectangular cuvettes with 50 mm optical path allows the detection of minimum amounts of the detectable substance.

### Highest accuracy

- The use of a large sample volume guarantees safe and reproducible results.

## Accessories and service

### The complete analysis from one source

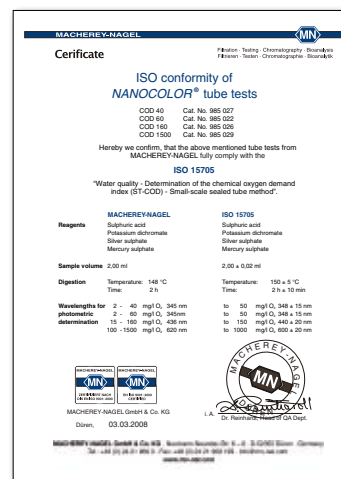
- Wide range of analytical accessories and special chemicals
- Excellent service and technical support

## The NANOCONTROL system

### Analytical quality control for the complete analytical system

### Coverage towards authorities and supervisors

- Single and multistandards incl. 100+ addition solutions
- NANOCHECK
- NANOCOLOR® T-Set



# The system for photometric water analysis

## NANOCOLOR® spectrophotometer

### Spectrophotometer NANOCOLOR® UV/VIS

- High-resolution scans
- Fast measurements
- Self-explanatory user guidance
- Safe processing of data and spectra
- Highest accuracy

**NEW!**



### UV/VIS Spectrophotometer with reference detector technology (RDT)

The NANOCOLOR® UV/VIS from MACHEREY-NAGEL is a powerful UV/VIS spectrophotometer with monochromator (190 – 1100 nm) for universal use in all areas of water and waste water analysis. This includes municipal and industrial waste water, drinking water, process water, surface water, ground water as well as cooling and boiler feed water. The NANOCOLOR® UV/VIS is also the ideal test unit for quality control in various fields of industry, such as food and beverage industries.

### Save time and make your lab work easier

#### Fast measurements by NANOCOLOR® barcode technology



- Fully automatic, instant cuvette detection by the built-in laser scanner allows simple and fast routine analysis.
- Selection of the test method and suitable wavelength, the actual measurement and storage of the measurement results are carried out automatically without having to use any other key.

#### Measurement without cuvette slot cover

- The state-of-the-art optical system is insensitive to external light and allows straightforward measurements

#### User-friendly touchscreen

- All significant data and functions are clearly shown on the coloured, backlit touchscreen display.

#### Pre-programmed tests and photometric basic functions

- More than 100 pre-programmed tests with over 200 analysis programmes.
- Straightforward call of all photometric basic functions, such as absorbance, transmission, factor, standard and multi-wavelength measurements, as well as kinetics and scan.

### Experience precision and increase accuracy

#### Self-explanatory user guidance

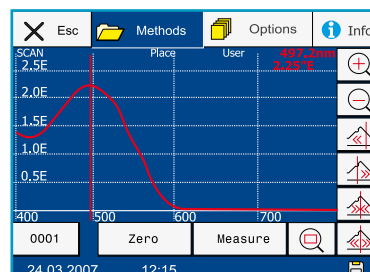
- All tests and menu items can be activated quickly and easily. The photometer can be operated without complex and time-consuming training.

#### Manual with test instructions, presented as pictograms



- Safe test procedures without complex instructions.

#### Highly accurate measurements by high-quality optical components



- Precision optics and reference detector technology (RDT) ensure accurate results.
- High resolution scans are recorded and shown on the display within seconds.

# The system for photometric water analysis

## NANOCOLOR® spectrophotometer

### Assure results and meet specifications

#### IQC according to ISO 9001 with NANOCONTROL NANOCHECK

- Conformance to requirements of internal quality control (IQC) and protection towards supervisors and authorities.
- Fast and easy control of photometric accuracy of the NANOCOLOR®  $UV/VIS$  with NANOCONTROL NANOCHECK (REF 925 701) by the user himself.

#### Documentation of results according to GLP



- Individual entries of sample number, sample location, user and dilution.
- Graphic display of the results, relating to the measurement range and the 20 – 80% range.

#### Clear memory management

- GLP-conform storage of the measured results with all supplementary information such as date, time, sample number, sample location, user and dilution.
- Fast and easy access to stored results and data sets.

#### Convenient export of data



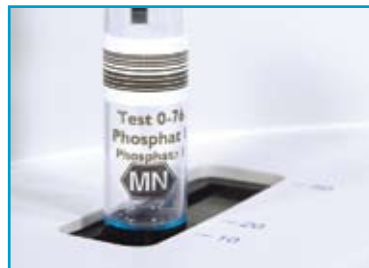
- Easy transfer of measured results and spectra to various common PC formats (e.g. MS Excel).
- Direct print-out of measured data with the NANOCOLOR® thermal printer (REF 919 16).

#### Professional software for data and spectrum processing included

- Easy processing of transferred data either with the NANOCOLOR®  $UV/VIS$  PC software or with standard software.

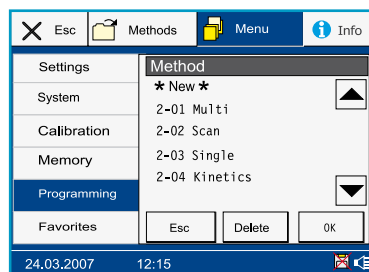
### Enjoy flexibility and be prepared for the future

#### No cuvette adapter required



- Round tubes (16 mm OD) and rectangular cuvettes (2, 10, 20, 50 mm) can be used in the universal cuvette slot without any adapter.
- Small accessories are not required

#### Programmable for user defined applications



- Free programming of up to 100 user-defined methods
- Wavelength range: 190 – 1100 nm

#### Additional turbidity measurements with 90° scattered light

- Performance of nephelometric turbidity measurements with 90° scattered light for low turbidity values in addition to the 180° transmittance method for high turbidity values.

#### Fast photometer update - free of charge


- At any time, stay up-to-date with easy software updating via Internet/PC
- For the current software update please visit [www.mn-net.com](http://www.mn-net.com)



# The system for photometric water analysis

## NANOCOLOR<sup>®</sup> spectrophotometer

### Technical data

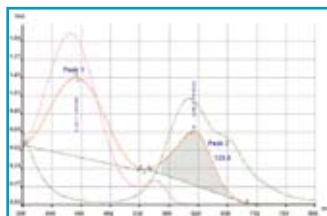
NANOCOLOR <sup>®</sup> <sup>UV/VIS</sup>	
Type	UV/VIS Spectrophotometer with reference detector technology (RDT)
Light sources	Halogen lamp (visible range) and deuterium lamp (UV range)
Optical system	Monochromator
Wavelength range	190 – 1100 nm
Wavelength accuracy	± 1 nm
Wavelength resolution	0.3 nm (190 – 1100 nm)
Wavelength calibration	Automatic
Wavelength selection	Automatic, barcode, manual
Scan speed	900 nm or 1 complete scan in less than 1 min
Spectral bandwidth	< 4 nm
Photometric range	± 3.0 E in wavelength range 200 – 900 nm
Photometric accuracy	0.005 E at 0.0-0.5 E; 1% at 0.5-2.0 E
Photometric linearity	< 0.5% at 2 E; < 1% at > 2 E
Stray light	< 0.05%
Measuring modes	More than 100 pre-programmed tests, 100 optionally programmable methods, absorbance, transmission, factor, kinetics, 2-point calibration, scan, nephelometric turbidity measurement
Cuvette holder	Test tubes 14 mm ID, rectangular cuvettes 2, 10, 20, 50 mm
Data memory	500 measured data sets, GLP conform
Display	Coloured LCD touchscreen with background lighting
Operation	Barcode technology, display user guidance, touchscreen
External light	Insensitive, open cuvette slot
Interfaces	USB and bi-directional serial RS 232
Update	Via Internet / PC
Operating range	10 – 40 °C , max. 80% relative humidity (without condensation)
Power supply	110 – 240 V, ~50/60 Hz, 60 VA
Dimensions L / W / H	390 / 285 / 155 mm
Weight	6.5 kg
Warranty	2 years
Declaration of conformity:	
 This device complies with the following directives: <ul style="list-style-type: none"> <li>- 2006/95/EC - Low-Voltage Directive</li> <li>- 2004/108/EC - EMC Directive</li> </ul>	

### NANOCOLOR<sup>®</sup> <sup>UV/VIS</sup> PC Software • More power for your photometer

- Convenient data export
- Automatic IQC functions
- Clear memory management
- Comprehensive facilities for spectrum analysis
- Data and spectra documentation in accordance to GLP

#### Save time and make your lab work easier

##### Comprehensive spectrum analysis



- Automatic and manual peak analysis/integration requiring just a few mouse clicks, and an optional smoothing function
- Easy-to-view spectra using grid lines, zero line correction, and multi-colour captions
- Detailed display using software-generated or manual scaling and zoom function
- Visual prioritizing of scans that are overlaid

##### Convenient export of data

- Quick and easy export of measuring data into standard formats such as MS Excel, OpenOffice, XML, and semicolon-separated text
- Data allocation into separate tables according to sampling site, test number, date and user
- Convenient transfer of measuring data to database systems using the XML format





# The system for photometric water analysis

## NANOCOLOR® photometers

### NANOCOLOR® 500 D

The digital photometer for universal use in water and waste water analysis



- Backlit graphic display
- USB interface for data transfer
- Additional measuring programme: **Transmission**
- Data memory for up to 500 values

### NANOCOLOR® 400 D

The economical photometer for routine analysis



- 2-line LC display
- Data memory for up to 999 values

### NANOCOLOR® 500 D and 400 D

#### Flexible applications for every requirement

##### Uniquely versatile

The digital photometer **NANOCOLOR® 500 D** is the logical development of our very successful photometer **NANOCOLOR® 400 D**. Adapted to our customers' current and future requirements, it is suitable for universal use in water and wastewater analysis. This includes municipal and industrial wastewater, drinking water, surface water, ground water as well as cooling and boiler water.

##### NANOCOLOR® Bar Code Technology (NBT)



Fully automatic, instant cuvette detection by the built-in laser scanner allows simple and fast routine analysis. Selection of the test method and suitable wavelength, the actual measurement and storage of the measurement result are carried out automatically without having to use any other key.

##### Simple and clear user guidance

The newly designed user guidance allows safe operation and facilitates your daily work. In the configuration menu, you can select up to 12 languages (de, en, fr, es, it, nl, hu, pl; **NANOCOLOR® 500 D** additionally: pt, cz, id, si).

##### Convenient memory management

Automatic storage can be switched on and off in the configuration menu. Moreover, individual measurement values can be stored manually via the keypad at all times. Stored measurement values and data records can be accessed by method, sample location, date and time.

##### Comfortable updating and data processing



- State-of-the-art interfaces
- Fast photometer update via Internet/PC
- GLP compliant measurement documentation on PC or printer
- User-friendly data export software
  - ✓ data transfer in MS Excel / OpenOffice Calc etc.
  - ✓ recording of calibration curves for programming of user defined methods
- Direct print-out on the **NANOCOLOR®** thermal printer (REF 919 16)

##### In the field and in the lab

The standard built-in, robust high-performance battery with charge regulator allows continuous operation at 220 V (110 V) and up to 3000 on-site mains-independent measurements. The battery charge status is shown in the graphic display. In the power saving mode, the photometer switches itself off after 10, 20... 120 min.

# The system for photometric water analysis

## NANOCOLOR® photometers

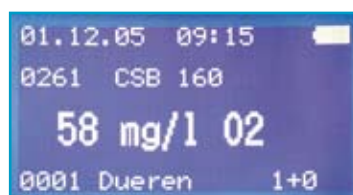
### Universal cuvette holder

Round tubes (16 mm OD) and rectangular cuvettes (10, 20 and 50 mm) can be used without adapter.

### Versatile – Flexible – Safe

- Over 100 preprogrammed tests with over 200 analysis programmes of MACHEREY-NAGEL
- Programmable for 100 user defined applications, linear and non-linear methods
- Automatic functional test and auto-calibration
- Professional photometric basic functions (extinction, transmission, measurement with factor, kinetics, twopoint calibration)


### NANOCOLOR® 500 D – Everything at a glance



The modern, illuminated graphic display of the NANOCOLOR® 500 D with user guidance shows all important data at a glance.

- Measurement result, displayed directly in the required measuring unit
- Date / time
- Battery charge status
- Sample number (4 characters)
- Sample location (alphanumeric, 12 characters)
- Dilution
- Memory on / off

### Technical data

	NANOCOLOR® 500 D		NANOCOLOR® 400 D	
Type	Single beam filter photometer with microprocessor control, self-test and auto-calibration, wavelength range 340 – 860 nm			
Optics	automatic filter wheel with 10 interference filters			
Wavelengths	345 / 365 / 436 / 470 / 520 / 540 / 585 / 620 / 690 / 800 nm plus 2 compartments for additional filters			
Wavelength accuracy	± 2 nm bandwidth at half transmission 10 – 12 nm			
Light source	Tungsten lamp			
Detector	silicon photodiode			
Blank value	automatic and prestored			
Measuring modes	over 100 preprogrammed tests, 100 freely programmable methods, extinction, transmission, factor, kinetics, two-point calibration		over 100 preprogrammed tests, 100 freely programmable methods extinction, factor, kinetics, two-point calibration	
Measuring range	about 3 E without sign			
Photometric accuracy	± 1%			
Stability	< 0.002 E/h			
Cuvette holder	round tubes 16 mm OD rectangular cuvettes 10, 20, 50 mm			
Data memory	500 measurement data records, GLP compatible		999 measurement data records, GLP compatible	
Display	illuminated graphic display with user guidance, 64 x 128 pixels, 12 languages		2-line LC display, 8 languages	
Operation	bar code technology, display user guidance, foilcovered push-buttons			
Interfaces	USB and bidirectional serial RS 232		bidirectional serial RS 232 and parallel Centronics	
Update	via Internet / PC			
Operating range	0 – 50 °C, up to 90 % relative humidity			
Power supply	100 – 240 V~, 50/60 Hz / 6 V, 3.2 Ah via built-in battery with charge regulator and mains power supply			
Dimensions:	227 x 282 x 105 mm			
Weight	2.4 kg			
Marking	CE			
Warranty	2 years			
Declaration of conformity:				
<div><div></div><div><p>This device complies with the following directives:</p><ul style="list-style-type: none"><li>- 2006/95/EC - Low-Voltage Directive</li><li>- 2004/108/EC - EMC Directive</li></ul></div></div>				

# The system for photometric water analysis

## NANOCOLOR® photometers

### Up-to-date data processing

Data processing options of the photometers *NANOCOLOR*® 500 D and 400 D offer:

- large data memory for up to 999 measurement values (500 for the *NANOCOLOR*® 500 D)
  - ✓ automatic storage of all values or user-defined storage of specific values via keypad
  - ✓ memory storage optional (e. g. for repeated measurements)
- traceability of measured values
  - ✓ built-in timer with date for data processing
  - ✓ automatic assignment of date and time for every stored value
  - ✓ optional assignment of sample location and sample number for every stored value
  - ✓ clear identification of values above or below the measuring range for stored values
- Free selection of individual values by method, sample location, sample number, date and time

### Interfaces



- Both photometers are equipped with a serial RS 232 interface for data transfer to a PC or a direct print-out on the *NANOCOLOR*® thermal printer (REF 919 16).
- The photometer *NANOCOLOR*® 500 D is additionally equipped with a USB 1.1 interface for data transfer to a PC.
  - ✓ measured values can be transferred to a computer automatically after every measurement or from the data memory
  - ✓ data management is compatible with Windows® systems
  - ✓ data transfer to the PC can be performed with programs from the Windows® accessories
- The photometer *NANOCOLOR*® 400 D is additionally equipped with a Centronics interface

### Data transfer to standard software:

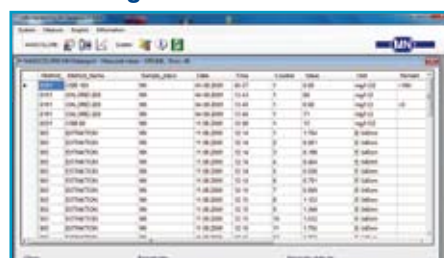
#### NANOCOLOR® Photometer Data Export

##### Data Export

The fast availability and safe storage of analytical data with standard software is an important aspect in almost all laboratories. The software *NANOCOLOR*® Photometer data export offers for the Photometer *NANOCOLOR*® 500 D, 400 D, Linus, 350 D, 300 D, 250 D a direct ("online") storage of the measurement results.

For the photometers specified above, the PF-12 as well as for the Luminometer BioFix® *Lumi-10* a read out of the instrument memory ("offline") with the software *NANOCOLOR*® Photometer data export is possible.

##### Data storage



The software offers the possibility to store the measured data in different formats in order to work on or archive them in other software products.

As formats XLS (Microsoft Excel), XML (data base format), TXT (text file ASCII) and ODS (OpenOfficeCalc) are available.

##### Recording of calibration curves



The program allows automatic construction of calibration curves up to 4th degree and the calculation of all relevant statistical parameters such as coefficient of variation, standard deviation etc. and the preparation of calibration protocols.

##### Minimum system requirements:

The software *NANOCOLOR*® Photometer data export requires at least a Pentium 4 / Athlon XP processor, 100 MB free space on the hard disk, 512 MB RAM (1024 MB or more is recommended) running under Windows XP or higher. The Microsoft .NET Framework V 2.0 program must be installed on the system. The VGA resolution should be at least 1024 \* 768 pixels. One free serial RS-232 port or one free USB port is required on the computer

##### Ordering information:

**NANOCOLOR® Photometer Data Export**  
**Zero modem cable**

**REF 919 02**  
**REF 919 680**

# The system for photometric water analysis

## NANOCOLOR® photometers

### Photometer and accessories · Ordering information

Description	Pack of	REF
<b>Photometers</b>		
Universal photometer <b>NANOCOLOR®</b> 500 D incl. software DVD, manual, protective covering, mains adapter, data cable, USB cable and calibration cuvette in stable transport case	1	<b>919 500</b>
Universal photometer <b>NANOCOLOR®</b> 400 D incl. software DVD, manual, protective covering, mains adapter, data cable and calibration cuvette in stable transport case	1	<b>919 70</b>
<b>Analytical quality control</b>		
<b>NANOCONTROL</b> NANOCHECK, test solutions for the determination of photometric accuracy	1	<b>925 701</b>
<b>Special filters for photometers <b>NANOCOLOR®</b> 500 D / 400 D / 350 D / 300 D / 250 D</b>		
Special filters incl. ex factory installation (wavelengths on request)	1	<b>919 850.2</b>
<b>Manuals</b>		
Manual for <b>NANOCOLOR®</b> 500 D	1	<b>919 501</b>
Manual for <b>NANOCOLOR®</b> 400 D	1	<b>919 09</b>
<b>Cuvettes</b>		
Calibration cuvette for <b>NANOCOLOR®</b> photometers	1	<b>916 908</b>
Glass cuvettes, 5 mm optical path	2	<b>919 32</b>
Glass cuvettes, 10 mm optical path	2	<b>919 33</b>
Glass cuvettes, 20 mm optical path	2	<b>919 34</b>
Glass cuvette, 50 mm optical path	1	<b>919 35</b>
Semi-micro cuvette, 50 mm optical path	1	<b>919 50</b>
Lids for glass cuvettes 10 mm	2	<b>919 41</b>
Lids for glass cuvettes 50 mm	2	<b>919 40</b>
Disposable plastic cuvettes, 10 mm optical path	100	<b>919 37</b>
<b>Lamps</b>		
Tungsten lamp for <b>NANOCOLOR®</b> 500 D / 400 D / 350 D / 300 D / 250 D	1	<b>919 787</b>
<b>Protective coverings</b>		
Protective covering for <b>NANOCOLOR®</b> 500 D / 400 D	1	<b>919 18</b>
<b>Printer</b>		
<b>NANOCOLOR®</b> thermal printer for <b>NANOCOLOR®</b> <sup>UV</sup> / <sub>VIS</sub> / 500 D / 400 D / 350 D / 300 D / 250 D and PF-11	1	<b>919 16</b>
Cable for <b>NANOCOLOR®</b> thermal printer for <b>NANOCOLOR®</b> <sup>UV</sup> / <sub>VIS</sub>	1	<b>919 133</b>
Paper for <b>NANOCOLOR®</b> thermal printer rolls of 58 mm width, core 12 mm, outer diameter 30 mm	5 rolls	<b>930 65</b>
Paper for <b>NANOCOLOR®</b> thermal printer rolls of 58 mm width, core 12 mm, outer diameter 45 mm	5 rolls	<b>930 71</b>
<b>Software</b>		
Data transfer software for photometers <b>NANOCOLOR®</b> 500 D / 400 D / 350 D / 300 D / 250 D and luminometer BioFix® <i>Lumi-10</i>	1 DVD	<b>919 02</b>
for data transfer		
Zero modem cable, serial, 2x9 pin SUB-D socket, for <b>NANOCOLOR®</b> 500 D / 400 D / 350 D / 300 D / 250 D and photometer PF-10 / PF-11	1	<b>919 680</b>
Adapter, 9 pin SUB-D plug to 25 pin SUB-D socket	1	<b>919 681</b>
<b>Power supply</b>		
Mains adapter for <b>NANOCOLOR®</b> 500 D / 400 D / 350 D / 300 D / 250 D / PF-11 / PF-10; prim. 100 – 240 V ~; sec. 9 V = / 1500 mA	1	<b>919 06</b>
Rechargeable battery for photometers <b>NANOCOLOR®</b> 500 D / 400 D / 350 D	1	<b>919 914</b>

\*Additional cable (REF 919 133) is required



# The system for photometric water analysis

## NANOCOLOR® heating blocks

### NANOCOLOR® VARIO 3 and VARIO compact

Programmable heating blocks for chemical-analytical digestions

- High-speed COD in 30 minutes
- Easy to operate by symbol keys
- Preset standard programmes for all routine digestions
- Programmable for user-defined digestion methods
- High temperature stability and short warm-up times
- External temperature control and calibration with NANOCOLOR® T-Set (REF 919 917)

Suitable for all NANOCOLOR® digestion methods

Application	Temperature	Time
COD in accordance with ISO 15705	148 °C	120 min
High-speed COD	160 °C	30 min
TOC	120 °C	120 min
total nitrogen	120 °C	30 min
total phosphorous	120 °C	30 min
Organic acids	100 °C	10 min
Metals	120 °C	30 min
AOX	120 °C	30 min
Programmable, user-defined programmes	30 – 160 °C	0:01 – 99:59 h

### NANOCOLOR® VARIO 3



- Simultaneous digestion of 24 samples
- 2 independently usable heating units
- 2 separate protective coverings

### NANOCOLOR® VARIO compact



- Simultaneous digestion of 12 samples

### Ordering information


Description	Pack of	REF
<b>Heating blocks</b>		
Heating block NANOCOLOR® VARIO 3, incl. power cable, 2 separate protective coverings and manual	1	919 36
Heating block NANOCOLOR® VARIO compact, incl. power cable, protective covering and manual	1	919 13
<b>Accessories for digestion in a heating block</b>		
NANOCOLOR® T-Set for electronic temperature control and calibration of heating blocks NANOCOLOR® VARIO 3 and VARIO compact	1	919 917
Protective covering for heating blocks NANOCOLOR® VARIO 3 and NANOCOLOR® VARIO compact, transparent	1	916 593
Exchangeable safety cover for heating blocks NANOCOLOR® VARIO 3 and NANOCOLOR® VARIO compact	1	916 598
Reducing adapters 22 → 16 mm for NANOCOLOR® heating blocks	2	919 916
<b>Accessories for electronic temperature control of heating blocks</b>		
Adaptor T-Set 16 mm	1	919 924
Adaptor T-Set 11 mm	1	919 925
USB-serial-Adaptor for heating blocks NANOCOLOR® VARIO 3 and NANOCOLOR® VARIO compact and NANOCOLOR® T-Set	1	919 926



# The system for photometric water analysis

## NANOCOLOR® heating blocks


### Technical data

	NANOCOLOR® VARIO 3	NANOCOLOR® VARIO compact
Type	programmable heating block for chemical-analytical digestions with 24 holes for test tubes with 16 mm OD (outer diameter)	programmable heating block for chemical-analytical digestions with 12 holes for test tubes with 16 mm OD (outer diameter)
Display	4 LED displays, 6 mm character height, display shows temperature and remaining heating time	2 LED displays, 6 mm character height, display shows temperature and remaining heating time
Operation	foil-covered symbol keys	
Temperature range	30 – 160 °C (1 °C increments)	
Temperatures	5 preprogrammed temperatures (70 / 100 / 120 / 148 / 160 °C); 4 free memory locations for individual temperature settings	
Warm-up time	from 20 °C to 160 °C within 10 minutes	
Heating times	4 preprogrammed heating times (0:30 h, 1:00 h, 2:00 h, cont.) 5 free memory locations for individual time settings	
Time range	0:01 – 99:59 h (0:01 h increments)	
Safety devices	2 integrated protective coverings as protection against excess temperature exchangeable safety covers as protection against contact	integrated protective covering as protection against excess temperature exchangeable safety cover as protection against contact
Interface	bidirectional serial RS 232 allows connection with NANOCOLOR® T-Set (REF 919 917) (Possibility for fully-automated calibration and generation of a test certificate for the inspection equipment monitoring according to DWA – A 704) Update via PC	
Power supply	110 – 230 V ~, 50/60 Hz	
Power consumption	250 / 500 VA	125 / 250 VA
Dimensions	255 x 250 x 140 mm	155 x 250 x 140 mm
Weight	ca. 3.85 kg	ca. 1.8 kg
Marking	CE	CE
Warranty	2 years	2 years
Declaration of conformity:		
 This device complies with the following directives: - 2006/95/EC - Low-Voltage Directive - 2004/108/EC - EMC Directive		

### NANOCOLOR® T-Set

Calibrated temperature sensor with electronic for external temperature control, fully automatic calibration and preparation of a test certificate for instrument control and monitoring

### Technical data

Detector	PT 1000 (95 x 4 mm)
Accuracy	± 0.1 °C
Display	via LED-displays of the heating block and the NANOCOLOR® T-Set software
Operation	via foil-covered symbol keys of the heating block and the NANOCOLOR® T-Set software
Temperature range	0 – 200 °C
Temperature stability	± 0.2 °C
Long term stability	± 0.1 °C
Interfaces	bidirectional serial RS 232
Operating range	0 – 50 °C, up to 90 % relative humidity
Power supply	via RS 232
Power consumption	max. 20 mW
Dimensions	112 mm (length)
Weight	ca. 60 g
Marking	CE
Certificate	calibrated against adjusted thermometers
Warranty	2 years
Declaration of conformity:	
 This device complies with the following directives: - 2004/108/EC - EMC Directive	



# The system for photometric water analysis





## NANOCOLOR® tube tests

### The perfect tool for routine analysis in sewage plants and industry

- Precisely predosed reagents in 16 mm tubes
- Accurate reagent dosage with NANOFIX capsules
- Measurement directly in the test tube
- Minimal exposure to chemicals
- Reduced reagent consumption
- Less disposal problems
- Bar-code cuvette identification
- No preparation of blank values necessary
- Time saving and easy-to-follow procedures
- Fast and reliable results



### Product information for photometers NANOCOLOR® <sup>uv/vis</sup>, 500 D, 400 D, Linus, 350 D, 300 D, 250 D

Test	Measuring ranges <i>NANOCOLOR</i> ® photometers		Wave-lengths	No. of tests	REF
Alcohol, see Ethanol and Methanol					
Aluminium 07	0.02 – 0.70 mg/l Al <sup>3+</sup>		540 nm	19	985 098
Ammonium 3	0.04 – 2.30 mg/l NH <sub>4</sub> -N	0.05 – 3.00 mg/l NH <sub>4</sub> <sup>+</sup>	690 nm	20	985 003
Ammonium 10	0.2 – 8.0 mg/l NH <sub>4</sub> -N	0.2 – 10.0 mg/l NH <sub>4</sub> <sup>+</sup>	690 nm	20	985 004
Ammonium 50	1 – 40 mg/l NH <sub>4</sub> -N	1 – 50 mg/l NH <sub>4</sub> <sup>+</sup>	690 nm	20	985 005
Ammonium 100	4 – 80 mg/l NH <sub>4</sub> -N	5 – 100 mg/l NH <sub>4</sub> <sup>+</sup>	585 nm	20	985 008
Ammonium 200	30 – 160 mg/l NH <sub>4</sub> -N	40 – 200 mg/l NH <sub>4</sub> <sup>+</sup>	585 nm	20	985 006
Anionic surfactants see Surfactants			<i>NEW!</i>		
AOX 3	0.1 – 3.0 mg/l AOX	0.01 – 0.30 mg/l AOX	470 nm	20	985 007
BOD <sub>5</sub> (in Winkler bottles according to DIN EN 1899-1-H51)	2 – 3000 mg/l O <sub>2</sub>		436 nm	25 – 50	985 822
BOD <sub>5</sub> -TT	0.5 – 3000 mg/l O <sub>2</sub>		436 nm	22	985 825
Cadmium 2 <sup>1)</sup>	0.05 – 2.00 mg/l Cd <sup>2+</sup>		520 nm	10 – 19	985 014
Carbonate hardness 15	1.0 – 15.0 °d	0.4 – 5.4 mmol/l H <sup>+</sup>	436/585 nm	20	985 015
Cationic surfactants see Surfactants			<i>NEW!</i>		
Chloride 200	5 – 200 mg/l Cl <sup>–</sup>		470 nm	20	985 019
Chloride 50	0.5 – 50.0 mg/l Cl <sup>–</sup>		470 nm	20	985 021
Chlorine/Ozone 2	0.05 – 2.50 mg/l Cl <sub>2</sub>	0.05 – 2.00 mg/l O <sub>3</sub>	540 nm	20	985 017
Chlorine dioxide 5	0.15 – 5.00 mg/l ClO <sub>2</sub>		540 nm	20	985 018
Chromate 5	0.05 – 2.00 mg/l Cr(VI) 0.005 – 0.500 mg/l Cr(VI)  <sup>2)</sup>	0.1 – 4.0 mg/l CrO <sub>4</sub> <sup>2–</sup> 0.01 – 1.00 mg/l CrO <sub>4</sub> <sup>2–</sup>  <sup>2)</sup>	540 nm	20	985 024
COD 40	2 – 40 mg/l O <sub>2</sub>		345 nm	20	985 027
COD 60	5 – 60 mg/l O <sub>2</sub>		345 nm	20	985 022
COD 160	15 – 160 mg/l O <sub>2</sub>		436 nm	20	985 026
COD 160 Hg-free	15 – 160 mg/l O <sub>2</sub>		436 nm	20	963 026
COD 300	50 – 300 mg/l O <sub>2</sub>		436 nm	20	985 033
COD 1500	100 – 1500 mg/l O <sub>2</sub>		620 nm	20	985 029
COD 10000	1.00 – 10.00 g/l O <sub>2</sub>		620 nm	20	985 023
COD 15000	1.0 – 15.0 g/l O <sub>2</sub>		620 nm	20	985 028
COD 60000	5.0 – 60.0 g/l O <sub>2</sub>		620 nm	20	985 012
org. Complexing agents 10 (screening test)	0.5 – 10.0 mg/l I <sub>Bik</sub>		540 nm	10 – 19	985 052
Copper 7	0.10 – 7.00 mg/l Cu <sup>2+</sup>		585 nm	20	985 054
Cyanide 08	0.02 – 0.80 mg/l CN <sup>–</sup>	0.005 – 0.100 mg/l CN <sup>–</sup>  <sup>2)</sup>	585/605 nm	20	985 031
DEHA 1 (Diethylhydroxylamine)	0.05 – 1.00 mg/l DEHA		540 nm	20	985 035
Ethanol 1000	0.10 – 1.00 g/l EtOH	0.013 – 0.130 Vol.% EtOH	620 nm	23	985 838
<sup>1)</sup> This test cannot be evaluated with the <i>NANOCOLOR</i> ® 250 D <sup>3)</sup> without bar code <sup>4)</sup> special filter necessary  <sup>2)</sup> a more sensitive measuring range is possible by using 50 mm semi-micro cuvettes (REF 919 50)					

<sup>1)</sup> This test cannot be evaluated with the NANOCOLOR® 250 D

<sup>3)</sup> without bar code

<sup>4)</sup> special filter necessary

<sup>2)</sup> a more sensitive measuring range is possible by using 50 mm semi-micro cuvettes (REF 919 50)

# The system for photometric water analysis

## NANOCOLOR® tube tests

Test	Measuring ranges <b>NANOCOLOR®</b> photometers		Wave-lengths	No. of tests	REF
Fatty acids see Organic acids					
Fluoride 2	0.1 – 2.0 mg/l F <sup>-</sup>		620 nm	20	985 040
Formaldehyde 8	0.1 – 8.0 mg/l HCHO		585 nm	20	985 041
Formaldehyde 10	0.20 – 10.00 mg/l HCHO	0.02 – 1.00 mg/l HCHO <sup>1) 2)</sup>	412 nm <sup>4)</sup>	20	985 046
Hardness 20	1.0 – 20.0 °d 0.2 – 3.6 mmol/l	5 – 50 mg/l Mg <sup>2+</sup> 10 – 100 mg/l Ca <sup>2+</sup>	540 nm	20	985 043
residual Hardness 1	0.02 – 1.00 °d	0.004 – 0.180 mmol/l	540 nm	20	985 084
HC 300 (hydrocarbons)	0.5 – 5.6 mg/l HC	30 – 300 mg/kg HC	436 nm	20	985 057
Iron 3	0.10 – 3.00 mg/l Fe	0.02 – 1.00 mg/l Fe <sup>1) 2)</sup>	540 nm	20	985 037
Lead 5 <sup>1)</sup>	0.10 – 5.00 mg/l Pb <sup>2+</sup>		520 nm	20	985 009
Manganese 10	0.1 – 10.0 mg/l Mn	0.02 – 2.00 mg/l Mn <sup>1) 2)</sup>	470 nm	20	985 058
Methanol 15	0.2 – 15.0 mg/l MeOH		620 nm	23	985 859
Molybdenum 40	1.0 – 40.0 mg/l Mo(VI)	1.6 – 65.0 mg/l MoO <sub>4</sub> <sup>2-</sup>	345/365 nm	20	985 056
Nickel 7	0.10 – 7.00 mg/l Ni <sup>2+</sup>	0.02 – 1.00 mg/l Ni <sup>2+</sup> <sup>1) 2)</sup>	470 nm	20	985 061
Nitrate 8 <b>NEW!</b>	0.30 – 8.00 mg/l NO <sub>3</sub> -N	1.3 – 35.0 mg/l NO <sub>3</sub> <sup>-</sup>	365 nm	20	985 065
Nitrate 50	0.3 – 22.0 mg/l NO <sub>3</sub> -N	2 – 100 mg/l NO <sub>3</sub> <sup>-</sup>	365/385 nm	20	985 064
Nitrate 250	4 – 60 mg/l NO <sub>3</sub> -N	20 – 250 mg/l NO <sub>3</sub> <sup>-</sup>	365/385 nm	20	985 066
Nitrite 2	0.003 – 0.460 mg/l NO <sub>2</sub> -N	0.02 – 1.50 mg/l NO <sub>2</sub> <sup>-</sup>	540 nm	20	985 068
Nitrite 4	0.1 – 4.0 mg/l NO <sub>2</sub> -N	0.3 – 13.0 mg/l NO <sub>2</sub> <sup>-</sup>	540 nm	20	985 069
total Nitrogen TN <sub>b</sub> 22	0.5 – 22.0 mg/l N		365/385 nm	20	985 083
total Nitrogen TN <sub>b</sub> 220	5 – 220 mg/l N		365/385 nm	20	985 088
nonionic Surfactants, see Surfactants					
Organic acids 3000	30 – 3000 mg/l CH <sub>3</sub> COOH	0.5 – 50.0 mmol/l CH <sub>3</sub> COOH	470 nm	20	985 050
Oxygen 12	0.5 – 12.0 mg/l O <sub>2</sub>		436 nm	22	985 082
Ozone, see Chlorine/Ozone 2					
Peroxide 2	0.03 – 2.00 mg/l H <sub>2</sub> O <sub>2</sub>		620 nm	10 – 19	985 871
pH 6.5 – 8.2 <sup>3)</sup>	pH 6.5 – 8.2		436/540 nm	100	918 72
Phenolic index 5 <sup>1)</sup>	0.2 – 5.0 mg/l phenol		520 nm	20	985 074
ortho- and total-Phosphate 1	0.05 – 1.50 mg/l P 0.010 – 0.800 mg/l P <sup>1) 2)</sup>	0.2 – 5.0 mg/l PO <sub>4</sub> <sup>3-</sup> 0.03 – 2.50 mg/l PO <sub>4</sub> <sup>3-</sup> <sup>1) 2)</sup>	690 nm	19	985 076
ortho- and total-Phosphate 5	0.20 – 5.00 mg/l P	0.5 – 15.0 mg/l PO <sub>4</sub> <sup>3-</sup>	690 nm	19	985 081
ortho- and total-Phosphate 15	0.30 – 15.00 mg/l P	1.0 – 45.0 mg/l PO <sub>4</sub> <sup>3-</sup>	690 nm	19	985 080
ortho- and total-Phosphate 45	5.0 – 50.0 mg/l P	15 – 150 mg/l PO <sub>4</sub> <sup>3-</sup>	690 nm	19	985 055
ortho- and total-Phosphate 50	10.0 – 50.0 mg/l P	30 – 150 mg/l PO <sub>4</sub> <sup>3-</sup>	436 nm	19	985 079
POC 200	20 – 200 mg/l POC	2 – 40 mg/l KWI	436 nm	20	985 070
Potassium 50	2 – 50 mg/l K <sup>+</sup>		690 nm	20	985 045
Silver 3	0.20 – 3.00 mg/l Ag <sup>+</sup>		620 nm	20	985 049
Starch 100	5 – 100 mg/l Starch		540 nm	19	985 085
Sulphate 200	10 – 200 mg/l SO <sub>4</sub> <sup>2-</sup>		436 nm	20	985 086
Sulphate 1000	200 – 1000 mg/l SO <sub>4</sub> <sup>2-</sup>		436 nm	20	985 087
Sulphide 3	0.05 – 3.00 mg/l S <sup>2-</sup>		620 nm	20	985 073
Sulphite 10	0.2 – 10.0 mg/l SO <sub>3</sub> <sup>2-</sup>	0.05 – 2.40 mg/l SO <sub>3</sub> <sup>2-</sup> <sup>1) 2)</sup>	436 nm	20	985 089
Sulphite 100	5 – 100 mg/l SO <sub>3</sub> <sup>2-</sup>		470 nm	19	985 090
Anionic Surfactants 4 <b>NEW!</b>	0.20 – 4.00 mg/l MBAS		620 nm	20	985 032
Cationic Surfactants 4 <b>NEW!</b>	0.20 – 4.00 mg/l CTAB		620 nm	20	985 034
Nonionic Surfactants 15	0.3 – 15.0 mg/l Triton® X-100		610/620 nm	20	985 047
Thiocyanate 50	0.5 – 50.0 mg/l SCN <sup>-</sup>		470 nm	20	985 091
Tin 3 <sup>1)</sup>	0.10 – 3.00 mg/l Sn		520 nm	18	985 097
TOC 25 <b>NEW!</b>	2.0 – 25.0 mg/l C		585 nm	10	985 093
TOC 60 <b>NEW!</b>	10 – 60 mg/l C		585 nm	10	985 094
TOC 600 <b>NEW!</b>	40 – 600 mg/l C		585 nm	10	985 099
TTC / Sludge activity 150	5 – 150 µg TPF	0.050 – 2.300 E	470 nm	20	985 890
Zinc 4	0.10 – 4.00 mg/l Zn <sup>2+</sup>		620 nm	20	985 096

<sup>1)</sup> This test cannot be evaluated with the **NANOCOLOR®** 250 D

<sup>3)</sup> without bar code

<sup>4)</sup> special filter necessary

<sup>1) 2)</sup> a more sensitive measuring range is possible by using 50 mm semi-micro cuvettes (REF 919 50)

<sup>1)</sup> This test cannot be evaluated with the NANOCOLOR® 250 D <sup>3)</sup> without bar code <sup>4)</sup> special filter necessary  
<sup>2)</sup> a more sensitive measuring range is possible by using 50 mm semi-micro cuvettes (REF 919 50)

# The system for photometric water analysis

## NANOCOLOR® standard tests

These test kits contain the necessary chemicals cost-efficiently prepared in individual bottles. To conduct a test, just fill 20 ml test solution into a 25 ml volumetric flask and add the reagents according to the included instructions.

After adding water up to the 25 ml mark, the solution is transferred to a rectangular cuvette for photometric measurement.

### Advantages of this application:

- safe observation of the reaction in the volumetric flask
- highest precision and high sensitivity due to use of precision cuvettes with 50 mm thickness
- higher measuring range due to use of different size cuvettes (10 – 50 mm)
- measuring range can be enhanced easily by dilution in measuring flask
- high number of tests with one test set, especially with diluted test solutions



### Product information for photometers NANOCOLOR® UV/VIS, 500 D, 400 D, Linus and 300 D

These tests cannot be evaluated with the photometer NANOCOLOR® 350 D and 250 D. However, they can still be used with the photometers NANOCOLOR® SM-1, 200 D, 100 D, 50 D, 25, PT-2 and PT-3.

Test	Measuring range NANOCOLOR® photometers	Wavelength	No. of tests <sup>2)</sup>	REF
Aluminium	0.01 – 1.00 mg/l Al <sup>3+</sup>	540 nm	200	918 02
Ammonium	0.01 – 2.0 mg/l NH <sub>4</sub> -N	690 nm	100	918 05
Chloride	0.2 – 125 mg/l Cl <sup>-</sup>	470 nm	220	918 20
Chlorine	0.02 – 10.0 mg/l Cl <sub>2</sub>	540 nm	250	918 16
Chlorine dioxide	0.04 – 4.00 mg/l ClO <sub>2</sub>	540 nm	50	918 163
Chromate	0.01 – 3.0 mg/l Cr(VI)	540 nm	250	918 25
Cobalt	0.002 – 0.70 mg/l Co <sup>2+</sup>	540 nm	220	918 51
Colour (Hazen/DIN) <sup>1)</sup>	5 – 500 mg/l Pt (Hazen)	436 nm	–	Test 1-39
Copper <sup>4)</sup>	0.01 – 10.0 mg/l Cu <sup>2+</sup>	585 nm	250	918 53
Cyanide	0.001 – 0.50 mg/l CN <sup>-</sup>	585 nm	250	918 30
Fluoride	0.05 – 2.00 mg/l F <sup>-</sup>	585 nm	200	918 142
Hydrazine	0.002 – 1.50 mg/l N <sub>2</sub> H <sub>4</sub>	436 nm	220	918 44
Iron <sup>4)</sup>	0.01 – 15.0 mg/l Fe	470 nm	250	918 36
Manganese <sup>4)</sup>	0.01 – 10.0 mg/l Mn	470 nm	250	918 60
Nickel <sup>4)</sup>	0.01 – 10.0 mg/l Ni <sup>2+</sup>	436 nm	250	918 62
Nitrate	0.9 – 30.0 mg/l NO <sub>3</sub> -N	365/385 nm	100	918 65
Nitrate Z	0.02 – 1.0 mg/l NO <sub>3</sub> -N	520 nm	440	918 63
Nitrite <sup>4)</sup>	0.002 – 0.30 mg/l NO <sub>2</sub> -N	520 nm	220	918 67
Phenol	0.01 – 7.0 mg/l Phenol	470 nm	440	918 75
ortho-Phosphate	0.04 – 6.5 mg/l PO <sub>4</sub> -P	690 nm	440	918 77
ortho-Phosphate <sup>4)</sup>	0.2 – 17 mg/l PO <sub>4</sub> -P	436 nm	440	918 78
Silica <sup>4)</sup>	0.01 – 5.00 mg/l Si	690 nm	250	918 48
	0.002 – 0.100 mg/l Si <sup>3)</sup>	800 nm		
Sulphide	0.01 – 3.0 mg/l S <sup>2-</sup>	620/660 nm	250	918 88
Turbidity (formazine/DIN) <sup>1)</sup>	1 – 100 TE/F (= FAU)	620/860 nm	–	Test 1-92
Turbidity <sup>1) 5)</sup>	1 – 1000 NTU	–	–	Test 9-06
Zinc	0.02 – 3.0 mg/l Zn <sup>2+</sup>	620 nm	250	918 95

<sup>1)</sup> A NANOCOLOR® standard test is not required. The original sample has to be measured without additional reagents.

<sup>2)</sup> Maximum number, the actual number of tests depends on the sample volume.

<sup>3)</sup> High sensitivity measurement

<sup>4)</sup> Simplified procedure in a beaker is possible. Please ask for special instructions!

<sup>5)</sup> evaluation only possible with NANOCOLOR® UV/VIS

Special chemicals for NANOCOLOR® standard tests are described with the individual parameters and tests from page 96.



# The system for photometric water analysis

## NANOCOLOR® standard tests

Extraction methods are a special type of standard tests:

Some analytical procedures require application of two immiscible phases. By shaking in a separation funnel the colour complex is transferred into the organic phase.

### This method is used:

- to increase sensitivity when the colour intensity is higher in the organic solvent
- to increase selectivity, i. e. only the colour complex of the substance in question is soluble in the organic phase while interfering compounds remain in the aqueous phase
- when the colour complex formed in the reaction is not soluble in water

The NANOCOLOR® analytical system mainly uses chlorinated hydrocarbons as organic phase which form the lower layer during extraction. Some analytical instructions prescribe two consecutive extractions to increase selectivity and eliminate interferences.



### NANOCOLOR® standard tests with extraction methods

These tests cannot be evaluated with the photometer NANOCOLOR® 350 D and 250 D. The reagent sets 918 10, 918 13, 918 32 and 918 34 contain chlorinated hydrocarbons. If national or international legal limitations for the use, storage or shipment of tetrachloromethane must be observed, the reagent sets 918 10 and 918 13 are also available without tetrachloromethane.

### Ordering information

Test	Measuring range NANOCOLOR® photometers 500 D, 400 D, Linus, 300 D	Wave- length	No. of tests	REF
Cadmium	0.002 – 0.50 mg/l Cd <sup>2+</sup>	520 nm	25	918 13
Cadmium (without tetrachloromethane)*	0.002 – 0.50 mg/l Cd <sup>2+</sup>	520 nm	25	918 131
Detergents anionic	0.02 – 5.0 mg/l MBAS	620 nm	40	918 32
Detergents cationic	0.05 – 5.0 mg/l CTAB	436 nm	40	918 34
Lead	0.005 – 1.00 mg/l Pb <sup>2+</sup>	520 nm	25	918 10
Lead (without tetrachloromethane)*	0.005 – 1.00 mg/l Pb <sup>2+</sup>	520 nm	25	918 101

\* The tetrachloromethane required for these tests has to be purchased from a local laboratory shop.

Special chemicals for these NANOCOLOR® tests are described with the individual parameters and tests from page 96.

### Accessories for NANOCOLOR® standard tests

### Ordering information

Description	Pack of	REF
<b>Accessories</b>		
Glass cuvettes, 10 mm optical path	2	919 33
Glass cuvettes, 50 mm optical path	1	919 35
Semi-micro cuvette 50 mm for reduced analytical preparations and sensitive measurements	1	919 50
Lids for glass cuvettes 10 mm	2	919 41
Lids for glass cuvettes 50 mm	2	919 40
Disposable cuvettes, plastic, 10 mm optical path	100	919 37
Separation funnel 100 ml, glass, with NS glass tap and polyethylene stopper	2	916 64
Stand with clamps and bosses for 4 separation funnels, height 70 cm	1	916 95



# The system for photometric water analysis

## Description of individual parameters and tests

### Alcohol

see Ethanol, page 103, and Methanol, page 106

### Aluminium

Al

#### Reaction basis:

In weakly acidic solution aluminium ions react with eriochrome cyanine R to form a red-violet coloured complex.

Strongly acidic and buffered samples have to be adjusted to pH 6. Turbid solutions have to be filtered (membrane filters 0.45 µm, REF 916 50).

#### NANOCOLOR® Aluminium 07

REF 985 098

Type: tube test 0-98  
Measuring range: 0.02 – 0.70 mg/l Al<sup>3+</sup>  
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

#### NANOCOLOR® Aluminium

REF 918 02

Type: standard test 1-02  
Measuring range: 0.01 – 1.00 mg/l Al<sup>3+</sup>  
Sufficient for: 200 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

### Ammonium

NH<sub>4</sub>

#### Reaction basis:

DIN method: At a pH value of about 12.6 ammonium ions react with hypochlorite and salicylate in the presence of sodium nitroprussiate as catalyst to form a blue indophenol.

Good reproducibility is obtained for weakly polluted waters. Heavy pollution causes errors, unless a distillation precedes the analysis. Strongly acidic and buffered samples have to be adjusted to pH 9 – 10 for the test using sodium hydroxide solution.

#### NANOCOLOR® Ammonium 3

REF 985 003

Type: tube test 0-03  
Measuring range: 0.04 – 2.30 mg/l NH<sub>4</sub>-N  
0.05 – 3.00 mg/l NH<sub>4</sub><sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+1)

#### NANOCOLOR® Ammonium 10

REF 985 004

Type: tube test 0-04  
Measuring range: 0.2 – 8.0 mg/l NH<sub>4</sub>-N  
0.2 – 10.0 mg/l NH<sub>4</sub><sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

#### NANOCOLOR® Ammonium 50

REF 985 005

Type: tube test 0-05  
Measuring range: 1 – 40 mg/l NH<sub>4</sub>-N  
1 – 50 mg/l NH<sub>4</sub><sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

#### NANOCOLOR® Ammonium 100

REF 985 008

Type: tube test 0-08  
Measuring range: 4 – 80 mg/l NH<sub>4</sub>-N  
5 – 100 mg/l NH<sub>4</sub><sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

#### NANOCOLOR® Ammonium 200

REF 985 006

Type: tube test 0-06  
Measuring range: 30 – 160 mg/l NH<sub>4</sub>-N  
40 – 200 mg/l NH<sub>4</sub><sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

#### NANOCOLOR® Ammonium

REF 918 05

Type: standard test 1-05  
Measuring range: 0.01 – 2.0 mg/l NH<sub>4</sub>-N  
0.01 – 2.5 mg/l NH<sub>4</sub><sup>+</sup>  
Sufficient for: 100 tests  
Shelf life: at least 1 year  
Sea water suitability: no

### Anionic Surfactants

see Surfactants, page 113

### AOX

AOX

#### Reaction basis:

DIN method: Adsorbable organically bound halogens (AOX) is an important sum parameter for the control of water quality. The AOX content represents the sum of organically bound halogens (chlorine, bromine, iodine) which are adsorbable to a suitable adsorbent (Reaction basis similar to DIN 38409-H22).

The pH-value of the sample must be between 3 and 5.

#### NANOCOLOR® AOX 3

REF 985 007

Type: tube test 0-07  
Measuring range: 0.1 – 3.0 mg/l AOX  
0.01 – 0.30 mg/l AOX  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, with 200 ml of rinsing solution  
For further information about AOX see page 120.



# The system for photometric water analysis

## Description of individual parameters and tests

### BOD<sub>5</sub> (Biochemical Oxygen Demand)

**BOD**

Simple determination of the biochemical oxygen demand after 5 days (BOD<sub>5</sub>) of undiluted samples without using a control in accordance with DIN EN 1899-2-H52! The oxygen enriched, undiluted sample is incubated in test tubes for 5 days at 20 ± 1°C in the dark. Determination of the dissolved oxygen after 5 days is based on the Winkler procedure, DIN EN 25813-G21

#### Reaction basis:

**DIN method:** the determination of the BOD<sub>5</sub> is carried out with the so-called dilution principle. The oxygen concentration is determined immediately after preparation of the sample and again after a five-day incubation in Winkler-flasks.

**Simplified method:** Incubation of the sample and oxygen determination after five days are conducted in the same cuvette.

Reaction basis for both method analog DIN EN 1899-1-H51 and DIN EN 25813-G21.

### NANOCOLOR® BOD<sub>5</sub> REF 985 822

Type: in Winkler bottles, test 8-22  
Measuring range: 2 – 3000 mg/l O<sub>2</sub>  
Sufficient for: 25 – 50 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

### NANOCOLOR® BOD<sub>5</sub>-TT REF 985 825

Type: tube test 8-25  
Measuring range: 0.5 – 3000 mg/l O<sub>2</sub>  
Sufficient for: 22 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

For further information about BOD<sub>5</sub>, please see page 121.



### Bromine

**Br<sub>2</sub>**

Bromine and bromating reagents such as 1,3-dibromo-5,5-dimethylhydantoin (DBH) are used – like chlorine – for disinfecting swimming pool water.

For the determination of bromine you may use all NANOCOLOR® Chlorine tests (see page 98). A factor for conversion is given in the instructions.

### Cadmium

**Cd**

#### Reaction bases:

**(a) Cadion method:** in alkaline solution cadmium ions react with cadion [1-(4-nitrophenyl)-3-(4-phenylazophenyl)-triazene] to form a red colour complex, which is evaluated photometrically.

**(b) Dithizone method:** at a pH > 6 cadmium ions react with dithizone to form primary cadmium dithizonate, which is stable in strongly alkaline medium and dissolves in carbon tetrachloride (tetrachloromethane) highly sensitive with pink colour. Interfering heavy metals are removed with dithizone in acidic medium.

### NANOCOLOR® Cadmium 2

REF 985 014

Type: tube test 0-14  
Reaction basis: (a) Cadion method  
Measuring range: 0.05 – 2.00 mg/l Cd<sup>2+</sup>  
Sufficient for: 10 – 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes



### NANOCOLOR® Cadmium

#### with tetrachloromethane

REF 918 13

#### without tetrachloromethane

REF 918 131

Type: standard test 1-13  
Reaction basis: (b) dithizone method  
Measuring range: 0.002 – 0.50 mg/l Cd<sup>2+</sup>  
Sufficient for: 25 tests  
Shelf life: at least 1.5 years  
Sea water suitability: no

*Reagent set 918 13 contains tetrachloromethane. Observe local regulations concerning halogenated hydrocarbons.*

*Reagent set 918 131 does not contain the required tetrachloromethane which has to be purchased separately from a local laboratory store.*

# The system for photometric water analysis

## Description of individual parameters and tests

### Carbonate hardness (Alkalinity)



#### Reaction basis:

Photometric determination is performed with bromophenol blue.

#### **NANOCOLOR® Carbonate hardness 15**

REF 985 015

Type: tube test 0-15  
Measuring range: 1.0 – 15.0 °d  
0.4 – 5.4 mmol/l H<sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes



### Cationic Surfactants

see Surfactants, page 113



### Chloride



#### Reaction basis:

Chloride ions react with mercury(II) thiocyanate to form undissociated mercury(II) chloride. The liberated thiocyanate shows a blood-red colouration with iron(III) ions. (Reaction basis according to DIN EN ISO 15682-D31).

#### **NANOCOLOR® Chloride 50**

REF 985 021

Type: tube test 0-21  
Measuring range: 0.5 – 50.0 mg/l Cl<sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

#### **NANOCOLOR® Chloride 200**

REF 985 019

Type: tube test 0-19  
Measuring range: 5 – 200 mg/l Cl<sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1:200)

#### **NANOCOLOR® Chloride**

REF 918 20

Type: standard test 1-20  
Measuring range: 0.2 – 125 mg/l Cl<sup>-</sup>  
Sufficient for: 220 tests  
Shelf life: at least 1 year  
Sea water suitability: no

### Chlorine / Chlorine dioxide / Ozone



#### Reaction basis:

DIN EN ISO method: Free chlorine, total chlorine and ozone react with DPD (N,N-diethyl-1,4-phenylene diamine) to form a red-violet dye. By defined addition of iodide ions one can distinguish between the individual components (Reaction basis test 0-17 and test 1-16 according to DIN EN ISO 7393-G4-2; test 0-18 and test 1-16<sub>3</sub> according to DIN 38408-G5).

#### **NANOCOLOR® Chlorine / Ozone 2**

REF 985 017

Type: tube test 0-17  
Measuring range: 0.05 – 2.50 mg/l Cl<sub>2</sub>  
0.05 – 2.00 mg/l O<sub>3</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

#### **NANOCOLOR® Chlorine**

REF 918 16

Type: standard tests 1-16  
Measuring range: 0.02 – 10.0 mg/l Cl<sub>2</sub>  
Sufficient for: 250 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### **NANOCOLOR® Chlorine dioxide 5**

REF 985 018

Type: tube tests 0-18  
Measuring range: 0.15 – 5.00 mg/l ClO<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

*Chlorine dioxide, like chlorine, reacts with DPD to form a redviolet dye. By using a special supplementary reagent, chlorine dioxide is determined selectively.*

#### **NANOCOLOR® Chlorine dioxide**

REF 918 163

Type: standard test 1-16<sub>3</sub>  
Measuring range: 0.04 – 4.00 mg/l ClO<sub>2</sub>  
Sufficient for: 50 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

*Chlorine dioxide, like chlorine, reacts with DPD to form a red violet dye. For a simultaneous determination of chlorine, chlorine dioxide and chlorite we recommend the procedure Test 1-16<sub>4</sub>. For an evaluation in accordance with drinking water specifications only the 50-mm rectangular cuvette can be applied.*

# The system for photometric water analysis

## Description of individual parameters and tests

### Chromium / Chromate

Cr

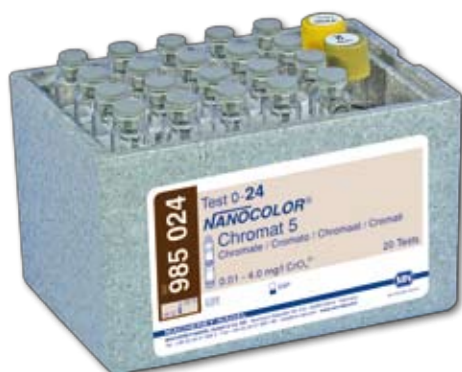
#### Reaction basis:

In acidic medium, chromate ions react with diphenylcarbazide (lyophilised in the tube test) to form a red-violet coloured complex. Chromium(III) ions are not determined unless they are converted to Cr(VI) by silver-catalysed oxidation with ammonium peroxodisulphate/sulphuric acid. (Reaction basis according to DIN 38 405-D24).

#### NANOCOLOR® Chromate 5

REF 985 024

Type: tube test 0-24  
 Measuring range: 0.1 – 4.0 mg/l  $\text{CrO}_4^{2-}$   
 0.05 – 2.00 mg/l Cr(VI)  
 when using semi-micro cuvettes  
 (REF 919 50):  
 0.01 – 1.00 mg/l  $\text{CrO}_4^{2-}$   
 0.005 – 0.500 mg/l Cr(VI)  
 Sufficient for: 20 tests  
 Shelf life: at least 2 years  
 Sea water suitability: yes



### Cobalt

Co

#### Reaction basis:

At a pH > 5 cobalt(II) ions react with 4-[5-chloropyridyl-(2)-azo]-m-phenylene diamine (5-Cl-PADAB) to form a pink coloured complex which, contrary to other heavy metal complexes, is also stable below pH 5.

#### NANOCOLOR® Cobalt

REF 918 51

Type: standard test 1-51  
 Measuring range: 0.002 – 0.70 mg/l  $\text{Co}^{2+}$   
 No. of tests: 220 tests  
 Shelf life: at least 2 years  
 Sea water suitability: yes



#### NANOCOLOR® Chromate

REF 918 25

Type: standard test 1-25  
 Measuring range: 0.01 – 6.0 mg/l  $\text{CrO}_4^{2-}$   
 0.01 – 3.0 mg/l Cr(VI)  
 Sufficient for: 250 tests  
 Shelf life: at least 2 years  
 Sea water suitability: yes

If you need to determine total chromium with the above reagent sets chromate, you require:

#### NANOCOLOR® NanOx Metal

REF 918 978

Sufficient for: approx. 150 tests  
 Shelf life: at least 1 year

#### + empty reaction tubes 14 mm ID

REF 916 80

or

#### NANOCOLOR® total Chromium

REF 918 253

Pre-Oxidation  
 for tube test 0-24 0.05 – 4.0 mg/l Cr  
 for standard test 1-25 0.05 – 30.0 mg/l Cr  
 Sufficient for: 50 digestions  
 Shelf life: at least 3 years



# The system for photometric water analysis

## Description of individual parameters and tests

### COD (chemical oxygen demand)

COD

#### Reaction basis:

ISO method:

The chemical oxygen demand of water is determined by silver-catalyzed oxidation with potassium dichromate/sulphuric acid at 148 °C during a two hour period.

Using different chromate concentrations, one can cover different measuring ranges. For COD 40/60/160/300 the colour decrease of the yellow dichromate ions is measured.

For COD 1500/10000/15000/60000 the colour increase of the green chromium(III) ions formed is evaluated.

If the chloride content is above 1500 mg/l the sample has to be diluted with COD-free water, or you may use the chloride complexing agent. Lower chloride concentrations are masked by the mercury(II) sulphate present in the test tubes.

The tests 0-27, 0-22, 0-26 and 0-29 are in accordance with ISO 15705:2002

#### NANOCOLOR® COD 60

REF 985 022

Type: tube tests 0-22  
Measuring range: 5 – 60 mg/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year at 2 – 8 °C  
Sea water suitability: no

DIN ISO

*The high COD sensitivity of these tests requires a reduced amount of potassium dichromate. This also means that a reduced oxidizing power is present, possibly leading to a low result for the residual COD, which are often the hardest components to be digested.*

#### NANOCOLOR® COD 160

REF 985 026

Type: tube test 0-26  
Measuring range: 15 – 160 mg/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

DIN ISO

#### NANOCOLOR® COD 160 Hg-free

REF 963 026

without use of toxic mercury salts

Type: tube test 0-26  
Measuring range: 15 – 160 mg/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year at 2 – 8 °C  
Sea water suitability: no

*Chloride contents below 2000 mg/l are eliminated by a simple filtration pretreatment step using a special cartridge and do not interfere.*

*The reliable dichromate chemistry leads to reproducible and comparable results.*

#### NANOCOLOR® COD 300

REF 985 033

Type: tube test 0-33  
Measuring range: 50 – 300 mg/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

#### NANOCOLOR® COD 1500

REF 985 029

Type: tube test 0-29  
Measuring range: 100 – 1500 mg/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

DIN ISO



### Benefits of NANOCOLOR® tube tests in comparison to ISO 6060:

The new ISO 15705 is based on the same chemical reaction as the established ISO 6060. The water contents are oxidized by sulphuric acid and potassium dichromate in the presence of silver sulphate and mercury(II) sulphate. Compared with the ISO 6060, the new method, described in the ISO 15705 has significant advantages:

- five times less mercury
- comparably less other toxic and hazardous reagents
- all reagents are predosed in round tubes
- reduced risks for the user
- reproducible results because of photometric determination

#### NANOCOLOR® COD 40

REF 985 027

Type: test tubes 0-27  
Measuring range: 2 – 40 mg/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year at 2 – 8 °C  
Sea water suitability: no

DIN ISO





# The system for photometric water analysis

## Description of individual parameters and tests

### NANOCOLOR® COD 10000

REF 985 023

Type: tube test 0-23  
Measuring range: 1.00 – 10.00 g/l O<sub>2</sub>  
Sufficient for: 20 test  
Shelf life: at least 1 year  
Sea water suitability: no

### NANOCOLOR® COD 15000

REF 985 028

Type: tube test 0-28  
Measuring range: 1.0 – 15.0 g/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

### NANOCOLOR® COD 60000

REF 985 012

Type: tube test 0-12  
Measuring range: 5.0 – 60.0 g/l O<sub>2</sub>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no



### Chloride complexing agent

REF 918 911

for COD determinations with chloride concentrations from 1000 – 7000 mg/l Cl<sup>-</sup>

Sufficient for: 100 – 200 tests  
Shelf life: at least 1.5 years

### Cartridges for chloride elimination

REF 963 911

for removal of up to 2000 mg/l Cl<sup>-</sup> per cartridge

Pack of: 10 cartridges  
Shelf life: at least 1 year at 2 – 8 °C

### COD-free water

REF 918 993

for control of measurements and dilution of water samples

## Colour / Colouration

1/m

Colours occurring in natural waters are usually in the yellow to brown range. Other colours (e. g. in waste water) are not completely covered.

### Reaction basis:

For determination of the colour intensity one uses the HAZEN scale, which is calibrated with platinum-cobalt chloride standards.

In accordance with DIN EN ISO 7887-C1-3 the colouration is measured as spectral absorption coefficient at 3 wavelengths: 436 nm, ~525 nm, ~620 nm. The colour of the pure sample is measured without any reagents. **NANOCOLOR®** photometers are programmed with all necessary calibration data for the above determinations.

Turbidities have to be filtered (membrane filtration kit, REF 916 50). If you also need the turbidity value of your sample, you may calculate it from the difference of a measurement before and another after filtration.

### NANOCOLOR® Colour

Type: no reagents required; test 1-39  
Measuring range: 5 – 500 mg/l Pt  
0.2 – 20.0 1/m  
Sea water suitability: yes

## Complexing agents (organic)

I<sub>BIC</sub>

### Reaction basis:

DIN method: Photometric determination of the decolouration of the bismuth-xylenol orange complex

The complexing agents are determined relative to the bismuth complexing index I<sub>BIC</sub>. The following conversion factors apply:

1 mg/l I<sub>BIC</sub>  $\triangleq$  1.4 mg/l EDTA (M = 292 g/mol)  $\triangleq$  1.0 mg/l NTA

This method is a screening test which covers strong complexing agents. If the result is positive, metals present in the sample may be partially or completely withdrawn from the photometric determination. In this case a digestion for the analysis of metals (e. g. with Crack set REF 918 08 or **NANOCOLOR®** NanOx Metal, REF 918 978) has to precede the photometric measurement (Reaction basis according to DIN 38409-H26).

### NANOCOLOR® org. Complexing agents 10 (screening test)

REF 985 052

Type: tube test 0-52  
Measuring range: 0.5 – 10.0 mg/l I<sub>BIC</sub>  
Sufficient for: 10 – 19 determinations  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1:20)



# The system for photometric water analysis

## Description of individual parameters and tests

### Copper

Cu

#### Reaction basis:

In weakly alkaline solution copper(II) ions react with cuprizone [oxalic acid bis(cyclohexylidene hydrazide)] to form a blue complex.

#### NANOCOLOR® Copper 7

REF 985 054

Type: tube test 0-54  
Measuring range: 0.10 – 7.00 mg/l Cu<sup>2+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes



#### NANOCOLOR® Copper

REF 918 53

Type: standard test 1-53  
Measuring range: 0.01 – 10.0 mg/l Cu<sup>2+</sup>  
Sufficient for: 250 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

#### Reagents for lime precipitation

REF 918 939

Reagent for eliminating interfering calcium (up to 20 g/l Ca<sup>2+</sup>) for copper, nickel and zinc determinations.  
Sufficient for: 20 tests  
Shelf life: at least 2 years

### Cyanide

CN<sup>-</sup>

#### Reaction basis:

Cyanide ions react with chloroamine T to form cyanogen chloride which forms a polymethine dye with a pyridine derivative and barbituric acid. The test measures free cyanide and cyanide complexes which can be destroyed with chlorine. (Reaction basis test 0-31 analog DIN EN ISO 14403-D6; test 1-30 analog DIN 38405-D13 + D14).

For determination of cyanide which can be easily liberated and for determination of *total* cyanide please ask for a special instruction from MACHEREY-NAGEL.

#### NANOCOLOR® Cyanide 08

REF 985 031

Type: standard test 0-31  
Measuring range: 0.02 – 0.80 mg/l CN<sup>-</sup>  
when using semi-micro cuvettes  
50 mm (REF 919 50)  
0.005 – 0.100 mg/l CN<sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+3)

#### NANOCOLOR® Cyanide

REF 918 30

Type: standard test 1-30  
Measuring range: 0.001 – 0.50 mg/l CN<sup>-</sup>  
Sufficient for: 250 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

### DEHA (diethylhydroxylamine)

DEHA

In boiler houses the carcinogenic hydrazine is more and more replaced by diethylhydroxylamine (DEHA) to remove oxygen.

#### Reaction basis:

Measurement of the reduction properties of DEHA for iron(III) ions and photometric determination of the iron(II) ions formed after 15 min heating to 100 °C.

#### NANOCOLOR® DEHA 1

REF 985 035

Type: standard test 0-35  
Measuring range: 0.05 – 1.00 mg/l DEHA  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes



### Detergents

see Surfactants, page 113



# The system for photometric water analysis

## Description of individual parameters and tests

### Ethanol

**EtOH**

#### Reaction basis:

The enzyme alcoholoxidase splits ethanol to form acetaldehyde and hydrogen peroxide. The peroxide formed reacts by catalytic oxidation of a chromogen with peroxidase to form a blue dye.

Applicable for spirits, beer and fruit juices. Strong oxidising agents can cause high results.

#### **NANOCOLOR® Ethanol 1000**

**REF 985 838**

Type: tube test 8-38  
Measuring range: 0.10 – 1.00 g/l EtOH  
0.013 – 0.130 Vol.% EtOH  
Sufficient for: 23 tests  
Shelf life: at least 2 years at < 0 °C  
Sea water suitability: no



### Fatty acids

see Organic acids, page 108

**HOAc**

### Fluoride

**F<sup>-</sup>**

#### Reaction bases:

(a) Fluoride shifts the colour of the lanthanum-alizarin complex to violet. In a buffered solution the colour shift can be measured photometrically.

(b) Photometric determination of fluoride ions with 1,8-dihydroxy-2-(4-sulfophenylazo)naphthalene-3,6-disulphonic acid (SPADNS)

#### **NANOCOLOR® Fluoride 2**

**REF 985 040**

Type: tube test 0-40  
Reaction basis: (a) method with lanthanum-alizarin complex  
Measuring range: 0.1 – 2.0 mg/l F<sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1+9)

#### **NANOCOLOR® Fluoride**

**REF 918 142**

Type: standard test 1-42  
Reaction basis: (b) SPADNS-method  
Measuring range: 0.05 – 2.00 mg/l F<sup>-</sup>  
Sufficient for: 200 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after distillation

### Formaldehyde

**HCHO**

Formaldehyde has technically been produced for approx. 100 years and is used as raw material for resins, as binding material for wood-based panels (chipboards), for textile treatment, for disinfection and conservation and as raw material for medicinal products and explosives. Particularly in wood and chipboard industry the content of formaldehyde must be determined and threshold values must be observed. Chipboards are the main source for formaldehyde in living spaces.

Chipboards and other wood-based panels, like plywood or blockboards are often glued with binding materials based on formaldehyde which are easy and cheap to produce. To produce these binding materials, formaldehyde is spiked with urea, whereby water is formed, which dries afterwards. This process is reversible, so that during the life-time of such wood-based panels the influence of air humidity leads to a digestion of the binding material to formaldehyde and urea. The resulting formaldehyde gases out from the wood-based panel. This process takes place during the whole service life of the panel, as long as there is binding material in the panel.

The classification of wood-based panels is done with the standardised perforator method (DIN EN 120 – Wood-based panels – Determination of formaldehyde content, Extraction method called the perforator method).

#### Reaction bases:

(a) **Chromotropic acid method:** Formaldehyde reacts with chromotropic acid in sulphuric acid solution to form a violet dye.

(b) **Acetylacetone method:** Formaldehyde reacts with ammonium ions and acetylacetone to a yellow dye.

#### **NANOCOLOR® Formaldehyde 8**

**REF 985 041**

Type: tube test 0-41  
Reaction basis: (a) Chromotropic acid method  
Measuring range: 0.1 – 8.0 mg/l HCHO  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: no

#### **NANOCOLOR® Formaldehyde 10**

**REF 985 046**

Type: tube test 0-46  
Reaction basis: (b) Acetylacetone method  
Measuring range: 0.20 – 10.00 mg/l HCHO  
when using semi-micro cuvettes  
50 mm (REF 919 50):  
0.02 – 1.00 mg/l HCHO  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

The comparability of the results obtained with the tube test **NANOCOLOR® Formaldehyde 10** with the results measured with the standardised perforator method according to DIN EN 120 was checked and certified by the eph (Development- and test laboratory for wood technology) in Dresden, Germany.

# The system for photometric water analysis

## Description of individual parameters and tests

### total Hardness

°d

#### Reaction basis:

Photometric determination of total hardness with phthalein purple.

#### NANOCOLOR® Hardness 20

REF 985 043

Type: tube test 0-43

Measuring range: 1.0 – 20.0 °d  
5 – 50 mg/l Mg<sup>2+</sup>  
10 – 100 mg/l Ca<sup>2+</sup>

Sufficient for: 20 tests

Shelf life: at least 1.5 years

Sea water suitability: yes, after dilution (1:30)

*With the aid of a selective masking agent differentiation between calcium and magnesium is possible.*



#### NANOCOLOR® residual Hardness 1

REF 985 084

Type: tube test 0-84

Measuring range: 0.02 – 1.00 °d  
0.004 – 0.180 mmol/l

Sufficient for: 20 tests

Shelf life: at least 1 year

Sea water suitability: no

### Hydrocarbons

HC

#### Reaction basis:

The determination of hydrocarbons is based on an MN-patented method without halogenated solvents. The extracting agent is n-pentane. After removal of polar substances, the extracting agent is evaporated and the test tube with the evaporation residue is connected with a COD test tube via a screwed joint. Finally, the hydrocarbons are oxidised as COD and determined photometrically.

#### NANOCOLOR® HC 300

REF 985 057

Type: tube test 0-57

Measuring range: 0.5 – 5.6 mg/l HC  
30 – 300 mg/kg HC  
after extraction from water or soil samples

Sufficient for: 20 tests

Shelf life: at least 1 year

Sea water suitability: yes

#### NANOCOLOR® HC 300

REF 918 571

Type: Extraktion kit for water samples  
Test 0-57<sub>1</sub>

Sufficient for: 20 tests

Shelf life: at least 1.5 years

#### NANOCOLOR® HC 300

REF 918 572

Type: Extraktion kit for soil samples  
Test 0-57<sub>2</sub>

Sufficient for: 20 tests

Shelf life: at least 1.5 years

For a detailed description see page 122.

### Hydrazine

N<sub>2</sub>H<sub>4</sub>

#### Reaction basis:

DIN method: In acidic solution hydrazine reacts with 4-dimethylaminobenzaldehyde to form a yellow-orange compound.

#### NANOCOLOR® Hydrazine

REF 918 44

Type: standard test 1-44

Measuring range: 0.002 – 1.50 mg/l N<sub>2</sub>H<sub>4</sub>

Sufficient for: 220 tests

Shelf life: at least 1 year

Sea water suitability: yes



# The system for photometric water analysis

## Description of individual parameters and tests

### Iron

#### Fe

##### Reaction bases:

(a) **Triazine method:** iron(II) ions react with a triazine derivative to form a violet coloured complex.

(b) **DIN method:** iron(II) ions react with 1,10-phenanthroline to form an orange coloured complex. This method determines dissolved and easily soluble iron compounds. (Reaction basis according to DIN 38406-E1).

For differentiation between *total* iron and dissolved iron we recommend the following methods:

A: determination of the dissolved iron after filtration with the membrane filtration kit 0.45 µm (REF 916 50)

B: determination of total iron after digestion with **NANOCOLOR® NanOx Metal** (REF 918 978) or with **NANOCOLOR® Crack Set** (REF 918 08)

##### **NANOCOLOR® Iron 3**

REF 985 037

Type: tube test 0-37  
 Reaction basis: (a) Triazine method  
 Measuring range: 0.10 – 3.00 mg/l Fe  
 when using semi-micro cuvettes  
 50 mm (REF 919 50):  
 0.02 – 1.00 mg/l Fe  
 Sufficient for: 20 tests  
 Shelf life: at least 1 year  
 Sea water suitability: yes

##### **NANOCOLOR® Iron**

REF 918 36

Type: standard test 1-36  
 Reaction basis: (b) DIN method  
 Measuring range: 0.01 – 15.0 mg/l Fe  
 Sufficient for: 250 tests  
 Shelf life: at least 3 years  
 Sea water suitability: yes



### Lead

#### Pb

##### Reaction bases:

(a) **PAR method:** in the presence of cyanide lead(II) ions react with 4-[pyridyl-(2)-azo]-resorcinol (PAR) to form a red dye. If interfering heavy metals are present, only the red lead complex is destroyed and the colour decrease is measured photometrically.

(b) **Dithizone method:** at pH 7 to 9 in the presence of cyanide lead(II) ions react with dithizone to form primary lead dithizonate, which is soluble in carbon tetrachloride with high selectivity yielding a pink solution (extraction method).

##### **NANOCOLOR® Lead 5**

REF 985 009

Type: tube test 0-09  
 Reaction basis: (a) PAR method  
 Measuring range: 0.10 – 5.00 mg/l Pb<sup>2+</sup>  
 Sufficient for: 20 tests  
 Shelf life: at least 1 year  
 Sea water suitability: no



##### **NANOCOLOR® Lead with tetrachloromethane without tetrachloromethane**

REF 918 10

REF 918 101

Type: standard test 1-10  
 Reaction basis: (b) Dithizone method  
 Measuring range: 0.005 – 1.00 mg/l Pb<sup>2+</sup>  
 Sufficient for: 25 tests  
 Shelf life: at least 1.5 years  
 Sea water suitability: no

*Reagent set 918 10 contains tetrachloromethane. Observe local regulations concerning halogenated hydrocarbons.*

*Reagent set 918 101 does not contain the required tetrachloromethane which has to be purchased separately from a local laboratory store.*

### Lipophilic substances

#### HC

see Hydrocarbons, page 108 and 122



# The system for photometric water analysis

## Description of individual parameters and tests

### Manganese

Mn

#### Reaction basis:

In alkaline solution manganese ions react with formaldoxime to form an orange-red complex (according to DIN 38406-E2).

#### **NANOCOLOR® Manganese 10**

REF 985 058

Type: tube test 0-58  
Measuring range: 0.1 – 10.0 mg/l Mn  
when using semi-micro cuvettes  
50 mm (REF 919 50):  
0.02 – 2.00 mg/l Mn

Sufficient for: 20 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### **NANOCOLOR® Manganese**

REF 918 60

Type: standard tests 1-60  
Measuring range: 0.01 – 10.0 mg/l Mn  
Sufficient for: 250 tests  
Shelf life: at least 3 years  
Sea water suitability: no

### Methanol

MeOH

#### Reaction basis:

The enzyme alcoholoxidase splits methanol to form formaldehyde and hydrogen peroxide. The peroxide reacts by catalytic oxidation of a chromogen with peroxidase to form a blue colour dye.

Suitable for the analysis of waste water, surface water and drinking water.

#### **NANOCOLOR® Methanol 15**

REF 985 859

Type: tube test 8-59  
Measuring range: 0.2 – 15.0 mg/l MeOH  
Sufficient for: 23 tests  
Shelf life: at least 1 year at < 0 °C  
Sea water suitability: no

### Molybdenum

Mo

#### Reaction basis:

Molybdate ions react with thioglycolic acid to form a yellow colour complex. Nitrite interferes with the determination and has to be destroyed with amidosulphuric acid (REF 918 973) prior to the analysis.

#### **NANOCOLOR® Molybdenum 40**

REF 985 056

Type: tube test 0-56  
Measuring range: 1.0 – 40.0 mg/l Mo(VI)  
1.6 – 65.0 mg/l MoO<sub>4</sub><sup>2-</sup>

Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: no

### nonionic Surfactants

see Surfactants, page 113



### Nickel

Ni

#### Reaction basis:

In alkaline solution nickel ions react with diacetyldioxime after oxidation to form a red-brown dye. Nickel cyanide and nickel cyanocomplexes are not determined. To remove interfering calcium, use the reagents for lime precipitation.

Nickel in complexes will not be detected. For the determination of total Nickel, a digestion with **NANOCOLOR® NanOx Metal** (REF 918 978) or with the digestion kit (REF 918 08) has to be carried out before.

#### **NANOCOLOR® Nickel 7**

REF 985 061

Type: tube test 0-61  
Measuring range: 0.10 – 7.00 mg/l Ni<sup>2+</sup>  
when using semi-micro cuvettes  
50 mm (REF 919 50):  
0.02 – 1.00 mg/l Ni<sup>2+</sup>

Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1+9)



#### **NANOCOLOR® Nickel**

REF 918 62

Type: standard test 1-62  
Measuring range: 0.01 – 10.0 mg/l Ni<sup>2+</sup>  
Sufficient for: 250 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

#### **Reagents for precipitation**

REF 918 939

Reagents for elimination of interfering calcium (up to 20 g/l Ca<sup>2+</sup>) for copper, nickel and zinc determinations.

Sufficient for: 20 tests  
Shelf life: at least 2 years

# The system for photometric water analysis

## Description of individual parameters and tests

### Nitrate

NO<sub>3</sub>

#### Reaction bases:

**(a) ISO method:** in acidic solution nitrate ions react with 2,6-dimethylphenol to form 4-nitro-2,6-dimethylphenol, which can be evaluated photometrically.

Applicable for drinking, ground and weakly polluted surface water (Reaction basis according to DIN 38405-D9-2).

**(b) Reduction method:** first nitrate ions are reduced to form nitrite ions. In acidic solution these nitrite ions react with sulphanilic acid and 1-naphthylamine to form a red azo dye. Nitrite interferes (elimination with amidosulphuric acid).

#### NANOCOLOR® Nitrate 8

REF 985 065

Type: tube test 0-65  
Reaction basis: (a) ISO method  
Measuring range: 0.30 – 8.00 mg/l NO<sub>3</sub>-N  
1.3 – 35.0 mg/l NO<sub>3</sub><sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: no

**NEW!**

#### NANOCOLOR® Nitrate 50

REF 985 064

Type: tube test 0-64  
Reaction basis: (a) ISO method  
Measuring range: 0.3 – 22.0 mg/l NO<sub>3</sub>-N  
2 – 100 mg/l NO<sub>3</sub><sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: no

#### NANOCOLOR® Nitrate 250

REF 985 066

Type: tube test 0-66  
Reaction basis: (a) ISO method  
Measuring range: 4 – 60 mg/l NO<sub>3</sub>-N  
20 – 250 mg/l NO<sub>3</sub><sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: no

#### NANOCOLOR® Nitrate

REF 918 65

Type: standard test 1-65  
Reaction basis: (a) ISO method  
Measuring range: 0.9 – 30.0 mg/l NO<sub>3</sub>-N  
2 – 140 mg/l NO<sub>3</sub><sup>-</sup>  
Sufficient for: 100 tests  
Shelf life: at least 2 years  
Sea water suitability: no

#### NANOCOLOR® Nitrate Z

REF 918 63

Type: standard test 1-63  
Reaction basis: (b) Reduction method  
Measuring range: 0.02 – 1.0 mg/l NO<sub>3</sub>-N  
0.1 – 5.0 mg/l NO<sub>3</sub><sup>-</sup>  
Sufficient for: 440 tests  
Shelf life: at least 1.5 years  
Sea water suitability: no

#### Amidosulphuric acid

REF 918 973

for elimination of interfering nitrite

#### Cartridges for chlorine elimination

REF 963 911

One cartridge is sufficient for removal of up to 2000 mg/l Cl<sup>-</sup>  
Pack of: 10 cartridges  
Shelf life: at least 1 year at 2 – 8 °C

### Nitrite

NO<sub>2</sub>

#### Reaction basis:

**(a) DIN EN method:** nitrite reacts with sulphanilamide and N-(1-naphthyl)-ethylene diamine (lyophilised) to form a red-violet azo dye (Reaction basis according to DIN EN 26777-D10).

**(b) Sulphanilic acid method:** in acidic solution sulphanilic acid is diazotised with nitrite. The diazonium salt is coupled with 1-naphthylamine to form a red dye.

#### NANOCOLOR® Nitrite 2

REF 985 068

Type: tube test 0-68  
Reaction basis: (a) DIN EN method  
Measuring range: 0.003 – 0.460 mg/l NO<sub>2</sub>-N  
0.02 – 1.50 mg/l NO<sub>2</sub><sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes



#### NANOCOLOR® Nitrite 4

REF 985 069

Type: tube test 0-69  
Reaction basis: (a) DIN EN method  
Measuring range: 0.1 – 4.0 mg/l NO<sub>2</sub>-N  
0.3 – 13.0 mg/l NO<sub>2</sub><sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

#### NANOCOLOR® Nitrite

REF 918 67

Type: standard test 1-67  
Reaction basis: (b) sulphanilic acid method  
Measuring range: 0.002 – 0.30 mg/l NO<sub>2</sub>-N  
0.005 – 1.00 mg/l NO<sub>2</sub><sup>-</sup>  
Sufficient for: 220 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

# The system for photometric water analysis

## Description of individual parameters and tests

### Nitrite in cooling lubricants

The reagents for sample preparation allow to prepare nitrite-containing samples for photometric measurement using a clarification precipitation (Carrez solutions 1+2).

#### Reagents for sample preparation by clarification precipitation

REF 918 937

Reagents for removal of emulsions, turbidities and colour prior to the test, e. g. for nitrite in cooling lubricants, seepage water from waste deposits etc.

Sufficient for: 30 tests  
Shelf life: at least 2 years

### Nitrogen (total)

TN<sub>b</sub>

#### Reaction basis:

DIN EN ISO method: all organic and inorganic nitrogen containing substances are oxidised to nitrate in acidic solution. In acidic solution nitrate ions react with 2,6-dimethylphenol to form 4-nitro-2,6-dimethylphenol, which can be evaluated photometrically. (Reaction basis according to DIN 38405-D9).

A more detailed description of the digestion in a heating block can be found on page 116.

#### NANOCOLOR® total-Nitrogen TN<sub>b</sub> 22

REF 985 083

Type: tube test 0-83  
Measuring range: 0.5 – 22.0 mg/l N  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

#### NANOCOLOR® total-Nitrogen TN<sub>b</sub> 220

REF 985 088

Type: tube test 0-88  
Measuring range: 5 – 220 mg/l N  
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: no

*The complete tests 0-83 and 0-88 contain NANOCOLOR® NanOx N digestion and compensation reagent and the corresponding nitrate tube tests.*

### Organic acids

HOAc

#### Reaction basis:

The determination of organic acids is carried out in two steps:

1. Esterification of organic acids with ethylene glycol
2. Conversion of the esters to hydroxamic acids, which subsequently react with iron (III) ions to form red coloured complexes, which are determined photometrically.

The concentration of organic acids in waters is affected by biochemical processes. Therefore, the samples have to be determined rapidly after sampling. (Reaction basis according to DIN EN 38414-S19).

Turbid solutions have to be filtered before the determination. Digested sludge must be filtered (e.g. with folded filter MN 617 we, REF 535 018 or membrane filter 0.45 µm, REF 916 50) or centrifuged.

#### NANOCOLOR® Organic acids

REF 985 050

Type: tube test 0-50  
Measuring range: 30 – 3000 mg/l CH<sub>3</sub>COOH  
0.5 – 50.0 mmol/l CH<sub>3</sub>COOH  
Sufficient for: 20 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes



### Oxygen

O<sub>2</sub>

#### Reaction basis:

Oxygen reacts with manganese(II) ions and potassium iodide to form an equivalent amount of iodine, which is measured photometrically. (Reaction basis according to DIN EN 25813-G21).

Good reproducibility is obtained when the tube test is filled to the brim (without air bubbles) at the sampling location in order to immediately bind the oxygen by chemical reaction. The photometric method thus provides a true alternative to the measurement with electrometric oxygen electrodes.

#### NANOCOLOR® Oxygen 12

REF 985 082

Type: tube tests 0-82  
Measuring range: 0.5 – 12.0 mg/l O<sub>2</sub>  
Sufficient for: 22 tests  
Shelf life: at least 2 years  
Sea water suitability: yes

# The system for photometric water analysis

## Description of individual parameters and tests

### Ozone

see Chlorine, page 98



### Peroxide

#### Reaction basis:

Peroxides react by catalytic oxidation of a chromogen in the presence of peroxidase to form a blue dye.

#### NANOCOLOR® Peroxide 2

REF 985 871

Type: tube test 8-71  
Measuring range: 0.03 – 2.00 mg/l  $H_2O_2$   
Sufficient for: 10 – 19 tests  
Shelf life: at least 1 year at 2 – 8 °C  
Sea water suitability: yes



### pH value

#### Reaction basis:

Photometric determination of the pH value in water with phenol red as indicator

#### NANOCOLOR® pH 6.5 – 8.2

REF 918 72

Type: tube test 0-72  
Measuring range: pH 6.5 – 8.2  
Sufficient for: 100 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes

pH

### Phenol / Phenolic index



#### Reaction bases:

(a) **DIN method:** photometric determination of phenols and other compounds capable of oxidative coupling, which form antipyrine dyes with 4-aminoantipyrine (Reaction basis according to DIN 38409-H16-3).

Oxidising substances, reducing substances and cyanides interfere. For turbid waters and sea water analysis an additional extraction with isobutyl methyl ketone (MIBK) is necessary.

(b) **Nitroaniline method:** phenol reacts with diazotised 4-nitroaniline to form a red dye. The colour can fluctuate between yellow, brown and red with other phenols. In addition to phenol most phenol derivatives are determined, too. For heavily polluted waters the phenols should first be separated by steam distillation.

#### NANOCOLOR® Phenolic index 5

REF 985 074

Type: tube test 0-74  
Reaction basis: (a) DIN method  
Measuring range: 0.2 – 5.0 mg/l phenolic index  
Sufficient for: 20 test  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after extraction with Isobutyl methyl ketone



#### Isobutyl methyl ketone

REF 918 929

for colour extraction, for the tube test, for difficult sample matrices

Sufficient for: 12 – 24 tests

#### NANOCOLOR® Phenol

REF 918 75

Type: standard test 1-75  
Reaction basis: (b) nitroaniline method  
Measuring range: 0.01 – 7.0 mg/l phenol  
Sufficient for: 440 tests  
Shelf life: at least 3 years  
Sea water suitability: yes, after dilution (1+9)



# The system for photometric water analysis

## Description of individual parameters and tests

### Phosphate

PO<sub>4</sub>

#### Reaction basis:

(a) **DIN method:** ammonium molybdate reacts with ortho-phosphate ions to form phosphomolybdic acid. This is reduced to molybdenum blue. For the determination of total phosphate, an acidic oxidation at 100 – 120 °C must precede to detect poly- and organic phosphates. (Reaction basis according to DIN EN ISO 6878-D11).

Occasional precipitations after the digestion can be filtered off with membrane filters. In case of a high content of organic matter and/or organically bound phosphorus, we recommend digestion with **NANOCOLOR® NanOx Metal** (REF 918 978).

(b) **Vanadate method:** ortho-phosphate ions react with molybdate/vanadate to form a yellow phosphate-molybdate-vanadate complex.

For the determination of total phosphate, an acidic oxidation at 100 – 120 °C must precede to detect poly- and organic phosphates. Phosphorus compounds which are hard to oxidize can be digested with **NANOCOLOR® NanOx Metal** (REF 918 978).

Turbid solutions have to be filtered prior to the analysis of ortho phosphate. Strongly alkaline or strongly acidic sample solutions have to be adjusted to pH 3 – 10 for the test.

#### **NANOCOLOR® ortho- and total Phosphate 1**

REF 985 076

Type: tube test 0-76  
Reaction basis: (a) DIN method  
Measuring range: 0.05 – 1.50 mg/l P (PO<sub>4</sub>-P)  
0.2 – 5.0 mg/l PO<sub>4</sub><sup>3-</sup>  
when using semi-micro cuvettes  
50 mm (REF 919 50):  
0.010 – 0.800 mg/l P (PO<sub>4</sub>-P)  
0.03 – 2.50 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes (ortho-P)

#### **NANOCOLOR® ortho- and total Phosphate 5**

REF 985 081

Type: tube test 0-81  
Reaction basis: (a) DIN method  
Measuring range: 0.20 – 5.00 mg/l P (PO<sub>4</sub>-P)  
0.5 – 15.0 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes (ortho-P)

#### **NANOCOLOR® ortho- and total Phosphate 15**

REF 985 080

Type: tube test 0-80  
Reaction basis: (a) DIN method  
Measuring range: 0.30 – 15.00 mg/l P (PO<sub>4</sub>-P)  
1.0 – 45.0 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes (ortho-P)



#### **NANOCOLOR® ortho- and total Phosphate 45**

REF 985 055

Type: tube test 0-55  
Reaction basis: (a) DIN method  
Measuring range: 5.0 – 50.0 mg/l P (PO<sub>4</sub>-P)  
15 – 150 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes (ortho-P)

#### **NANOCOLOR® ortho- and total Phosphate 50**

REF 985 079

Type: tube test 0-79  
Reaction basis: (b) Vanadate method  
Measuring range: 10.0 – 50.0 mg/l P (PO<sub>4</sub>-P)  
30 – 150 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 19 tests  
Shelf life: at least 3 years  
Sea water suitability: yes (ortho-P)

#### **NANOCOLOR® ortho-Phosphate**

REF 918 77

Type: standard test 1-77  
Reaction basis: (a) DIN method  
Measuring range: 0.04 – 6.5 mg/l PO<sub>4</sub><sup>3-</sup>  
0.1 – 20.0 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 440 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### **NANOCOLOR® ortho-Phosphate**

REF 918 78

Type: standard test 1-78  
Reaction basis: (b) Vanadate method  
Measuring range: 0.2 – 17 mg/l PO<sub>4</sub><sup>3-</sup>  
0.5 – 50 mg/l PO<sub>4</sub><sup>3-</sup>  
Sufficient for: 440 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### **Determination of total phosphorus with NANOCOLOR® NanOx Metal**

For phosphorus compounds which are difficult to oxidize, we recommend digestion with **NANOCOLOR® NanOx Metal** (REF 918 978).

For details concerning the digestion with **NANOCOLOR® NanOx Metal** in a heating block please see page 113.

This digestion is also used, when total phosphorus is to be determined with standard tests 1-77 or 1-78.

# The system for photometric water analysis

## Description of individual parameters and tests

### POC

Polyoxycarboxylic acids (POC) are copolymers (e.g. from acrolein, acrylic acid, hydroxy- acrylic acid or maleic acid) with the general empirical formula  $-\text{[CH}_2\text{-CO]}_n\text{-OR}$ .

Polyacrylates are polymers based on the esters of acrylic acid with the general empirical formula  $-\text{[CH}_2\text{-CH-COOR]}_n\text{-}$ .

Polyoxycarboxylic acids and Polyacrylates are substances with outstanding dispersing properties. Therefore, they are used in boiler feed and cooling water as reagents for hardness stabilization, to prevent coating generated by calcium carbonate.

#### Reaction basis:

Photometric turbidity measurement with Hyamine® 1622

#### NANOCOLOR® POC 200

REF 985 070

Type: tube test 0-70  
Measuring range: 20 – 200 mg/l POC AS 2020  
20 – 200 mg/l POC HS 2020  
20 – 200 mg/l Polystabil® DK  
2 – 40 mg/l Polystabil® KWI

Sufficient for: 20 tests  
Shelf life: at least 1.5 years  
Sea water suitability: yes, after dilution (1+3)

### Potassium

K

#### Reaction basis:

Potassium reacts with sodium tetraphenylborate to form an insoluble compound which can be measured as turbidity.

#### NANOCOLOR® Potassium 50

REF 985 045

Type: tube test 0-45  
Measuring range: 2 – 50 mg/l K<sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1+9)



#### Ammonium compensation reagent

REF 918 045

Supplementary reagent for the test NANOCOLOR® potassium 50 for removal of interfering ammonium (up to 5 mg/l NH<sub>4</sub>-N)

### POC

### Residual Hardness

see total Hardness, page 104

### Sludge

see TTC, page 114

### Silica / Silicon

#### Reaction basis:

DIN method: in acidic solution dissolved silica and silicates react with ammonium molybdate to form yellow silicomolybdic acid. This is reduced to a blue compound by addition of a reducing agent (reaction basis according to DIN EN ISO 16264-H57).

It is important that the distilled water used for filling up or dilution is free of silica.

#### NANOCOLOR® Silica

REF 918 48

Type: standard test 1-48  
Measuring range: 0.005 – 10.0 mg/l SiO<sub>2</sub>  
Sufficient for: 250 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

#### Silica-free water

REF 918 912

for the analytical preparation, especially for minute concentrations of silicon, and for dilution of water samples  
purity: < 0.005 mg/l SiO<sub>2</sub>

### Silver

Ag<sup>+</sup>

#### Reaction basis:

Silver ions react with an indicator to form a blue dye.

Insoluble silver compounds like silver bromide, silver chloride, silver iodide, silver cyanide or silverthiocyanate are not detected with this test.

These compounds can be determined after pretreatment with NANOCOLOR® NanOx Metal (REF 918 978).

#### NANOCOLOR® Silver 3

REF 985 049

Type: tube test 0-49  
Measuring range: 0.20 – 3.00 mg/l Ag<sup>+</sup>  
Sufficient for: 20 tests  
Shelf life: at least 1.5 years  
Sea water suitability: no



# The system for photometric water analysis

## Description of individual parameters and tests

### Starch



#### Reaction basis:

Starch reacts with iodine in sulfuric acid solution to form a blue inclusion complex.

Oxidising and reducing substances interfere.

#### NANOCOLOR® Starch 100

REF 985 085

Type: tube test 0-85  
Measuring range: 5 – 100 mg/l starch  
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+1)

### Sulphate



#### Reaction basis:

turbidity measurement as barium sulphate (Reaction basis according to DIN 38405-D5-2).

Turbidities interfere and have to be filtered prior to the test. Good reproducibility is obtained for drinking, surface and ground water. Polluted waste waters cause low results.

#### NANOCOLOR® Sulphate 200

REF 985 086

Type: tube test 0-86  
Measuring range: 10 – 200 mg/l  $\text{SO}_4^{2-}$   
Sufficient for: 20 tests  
Shelf life: at least 3 years  
Sea water suitability: no

#### NANOCOLOR® Sulphate 1000

REF 985 087

Type: tube test 0-87  
Measuring range: 200 – 1000 mg/l  $\text{SO}_4^{2-}$   
Sufficient for: 20 tests  
Shelf life: at least 3 years  
Sea water suitability: no

### Sulphide / Hydrogen sulphide



#### Reaction basis:

DIN method: N,N-Dimethyl-1,4-phenylene diamine reacts with hydrogen sulphide to form a compound which changes to leucomethylene blue. This compound is oxidised to methylene blue using iron(III) ions (Reaction basis according to DIN 38405-D26/27).

Sulphide is measured in an acidic medium; vigorous mixing can cause evaporation of gaseous hydrogen sulphide which escapes analysis.

#### NANOCOLOR® Sulphide 3

REF 985 073

Type: tube test 0-73  
Measuring range: 0.05 – 3.00 mg/l  $\text{S}^{2-}$   
Sufficient for: 20 tests  
Shelf life: at least 3 years  
Sea water suitability: yes, after dilution (1+3)

**NEW!**



#### NANOCOLOR® Sulphide

REF 918 88

Type: standard test 1-88  
Measuring range: 0.01 – 3.0 mg/l  $\text{S}^{2-}$   
Sufficient for: 250 tests  
Shelf life: at least 3 years  
Sea water suitability: yes

### Sulphite



#### Reaction basis:

(a) **Thiodibenzoic acid method:** Sulphite reacts with a derivative of thiodibenzoic acid to form a yellow colour complex, which is evaluated photometrically. Contrary to the reduction method (b), which also covers other reducing agents, this procedure is selective for sulphite.

(b) **Reduction method:** sulphite ions bleach iodine solutions. The excess iodine is measured photometrically. Oxidising and reducing substances interfere.

#### NANOCOLOR® Sulphite 10

REF 985 089

Type: standard test 0-89  
Reaction basis: (a) Thiodibenzoic acid method  
Measuring range: 0.2 – 10.0 mg/l  $\text{SO}_3^{2-}$   
when using semi-micro cuvettes  
50 mm (REF 919 50):  
0.05 – 2.40 mg/l  $\text{SO}_3^{2-}$   
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1:20)

#### NANOCOLOR® Sulphite 100

REF 985 090

Type: standard test 0-90  
Reaction basis: (b) Reduction method  
Measuring range: 5 – 100 mg/l  $\text{SO}_3^{2-}$   
Sufficient for: 19 tests  
Shelf life: at least 1 year  
Sea water suitability: yes

# The system for photometric water analysis

## Description of individual parameters and tests

### Surfactants (detergents)



Detergents are surface-active substances, which are classified into anionic, cationic and nonionic surfactants. They can be found in municipal and industrial waste waters.

#### Reaction bases:

**(a) Methylene blue method:** Under suitable conditions anionic detergents react with methylene blue to form a coloured complex, which is extracted with an organic phase according to DIN 38 409-H23. Reference substance is methyl dodecylbenzene sulphonate (MBAS: 342 g/mol) (Reaction basis according to DIN 38409-H23-1).

**(b) Bromophenol blue method:** Cationic detergents react with bromophenol blue to form a coloured complex, which is extracted with an organic phase. Reference substance is N-cetyl-N,N,N-trimethylammonium bromide (CTAB: 364.5 g/mol).

**(c) Disulfine blue method:** Cationic surfactants react with disulfine blue to form a coloured complex, which is extracted with chloroform.

**(d) TBPE method:** Nonionic surfactants react with an indicator (TBPE = Tetrabromphenolphthaleinethylester) to form a complex, which is extracted with dichloromethane.

If a water contains cationic and anionic detergents, equivalent quantities are combined and escape analysis. Normally detergents are determined as a sum. For the analysis of specific detergents a correction factor has to be determined

#### NANOCOLOR® Anionic surfactants 4

REF 985 032

Type: tube test 0-32  
Reaction basis: (a) methylene blue method **NEW!**  
Measuring range: 0.20 – 4.00 mg/l MBAS  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1+19)

#### NANOCOLOR® Detergents anionic

REF 918 32

Type: standard test 1-32  
Reaction basis: (a) methylene blue method  
Measuring range: 0.02 – 5.0 mg/l MBAS  
Sufficient for: 40 tests  
Shelf life: at least 3 years  
Sea water suitability: no

*The test kit contains chlorinated hydrocarbons; observe local regulations.*

#### NANOCOLOR® Cationic surfactants 4

REF 985 034

Type: tube test 0-34  
Reaction basis: (c) Disulfine blue method **NEW!**  
Measuring range: 0.20 – 4.00 mg/l CTAB  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1+19)

#### NANOCOLOR® Detergents cationic

REF 918 34

Type: standard test 1-34  
Reaction basis: (b) bromophenol blue method  
Measuring range: 0.05 – 5.0 mg/l CTAB  
Sufficient for: 40 tests  
Shelf life: at least 3 years  
Sea water suitability: no

*The test kit contains chlorinated hydrocarbons; observe local regulations.*

#### NANOCOLOR® Nonionic surfactants 15

REF 985 047

Type: Tube test 0-47  
Reaction basis: (d) TBPE method  
Measuring range: 0.3 – 15.0 mg/l Triton® X-100  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: no



### Thiocyanate

SCN

#### Reaction basis:

Thiocyanate reacts with iron(III) ions to form blood-red iron(III) thiocyanate.

The described method can also be used for detecting a thiocyanate interference during cyanide determination (test 1-30 and test 0-31).

#### NANOCOLOR® Thiocyanate 50

REF 985 091

Type: tube test 0-91  
Measuring range: 0.5 – 50.0 mg/l SCN<sup>-</sup>  
Sufficient for: 20 tests  
Shelf life: at least 2 years  
Sea water suitability: yes, after dilution (1+1)

### Tin

Sn

#### Reaction basis:

Photometric determination of dissolved tin(II) and tin(IV) with 9-phenyl-3-fluorone.

#### NANOCOLOR® Tin 3

REF 985 097

Type: tube test 0-97  
Measuring range: 0.10 – 3.00 mg/l Sn  
Sufficient for: 18 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+9)



# The system for photometric water analysis

## Description of individual parameters and tests

### TOC

#### Total organic carbon

##### Reaction basis:

clear and simple two-step procedure:

1. removal of inorganic carbon (TIC)
2. digestion of organic carbon (TOC) and determination of the CO<sub>2</sub> formed as colour decrease of an indicator (Reaction basis according to DIN EN 1484)

#### NANOCOLOR® TOC 25

Type: tube test 0-93  
Measuring range: 2.0 – 25.0 mg/l TOC  
Sufficient for: 10 tests  
Shelf life: at least 1 year  
Sea water suitability: no

REF 985 093

**NEW!**

#### NANOCOLOR® TOC 60

Type: tube test 0-94  
Measuring range: 2 – 60 mg/l TOC  
Sufficient for: 10 tests  
Shelf life: at least 1 year  
Sea water suitability: no

REF 985 094

**NEW!**



#### NANOCOLOR® TOC 600

Type: tube test 0-99  
Measuring range: 40 – 600 mg/l TOC  
Sufficient for: 10 tests  
Shelf life: at least 1 year  
Sea water suitability: no

REF 985 099

**NEW!**

#### NANOCOLOR® Thermo caps

for the determination of TOC

Content: 3 pcs

REF 916 116

### TOC

### TTC / Sludge activity

### TPF

##### Reaction basis:

Determination of the biochemical activity of sludge (activated sludge, digested sludge etc.) by means of the dehydrogenase activity using 2,3,5-triphenyltetrazoliumchloride (TTC). Colourless TTC is converted into red triphenylformazane (TPF) by dehydrogenases. The formed, water-insoluble TPF is dissolved in ethanol and is determined photometrically.

This method allows the determination of the biochemical activity of sludge samples, the characterisation of the action of waste waters and waste water constituents towards sludge and a rapid visual evaluation of the degree of stabilisation of a sludge.

#### NANOCOLOR® TTC / Sludge activity 150

REF 985 890

Type: tube test 8-90  
Measuring range: 5 – 150 µg TPF  
Sufficient for: 20 tests  
Shelf life: at least 2 years at 2 – 8 °C  
Sea water suitability: no



# The system for photometric water analysis

## Description of individual parameters and tests

### Turbidity

FAU / NTU

#### Reaction basis:

The turbidity is measured by comparison with formazine-standard suspensions. The result can be given as spectral attenuation coefficient in  $1/m$  according to German and international standard methods (Reaction basis according to DIN EN ISO 7027-C2)

(a) turbidity measurement with 180° transmitted light

(b) Turbidity measurement with 90° scattered light

#### NANOCOLOR® Turbidity

Test 1-92

Type: no reagents required  
test 1-92  
Reaction basis: (a) turbidity measurement with 180°  
transmitted light  
Measuring range: 1 – 100 FAU  
0.2 – 40.0  $1/m$   
Sea water suitability: yes

#### NANOCOLOR® Turbidity

Test 9-06

Type: no reagents required  
test 9-06  
Reaction basis: (b) turbidity measurement with 90°  
scattered light  
Measuring range: 1 – 1000 NTU  
Sea water suitability: yes

The nephelometric turbidity measurement is only possible with the spectrophotometer NANOCOLOR®  $UV/VIS$ .

### Zinc

Zn

#### Reaction basis:

At pH 8.5 – 9.5 zinc ions react with zincon to form a blue colour complex.

#### NANOCOLOR® Zinc 4

REF 985 096

Type: Tube test 0-96  
Measuring range: 0.10 – 4.00 mg/l  $Zn^{2+}$   
Sufficient for: 20 tests  
Shelf life: at least 1 year  
Sea water suitability: yes, after dilution (1+1)



#### NANOCOLOR® Zinc

REF 918 95

Type: Standard test 1-95  
Measuring range: 0.02 – 3.0 mg/l  $Zn^{2+}$   
Sufficient for: 250 tests  
Shelf life: 3 years  
Sea water suitability: yes, after dilution (1+9)

#### Reagents for lime precipitation

REF 918 939

Reagents for elimination of interfering calcium (up to 20 g/l  $Ca^{2+}$ ) for copper, nickel and zinc determinations.

Sufficient for: 20 tests  
Shelf life: at least 2 years

## Chemicals for special NANOCOLOR® procedures

### Ordering information

Description	Pack of	REF
Distilled water for dilutions	1 l	918 932
Silica-free water for the preparation of a blank value for the determination of silica	1 l	918 912
COD-free water for dilutions of samples prior to COD analysis	50 ml	918 993
Isobutyl methyl ketone (MIBK) for tube test phenolic index 5 (method 1-742)	100 ml	918 929
Chloride complexing agent for COD analysis	100 ml	918 911
Amidosulphuric acid for elimination of nitrite interferences	25 g	918 973
Reagents for sample preparation by clarification precipitation, for the determination of nitrite in cooling lubricants etc.	2 x 30 ml	918 937
Reagents for lime precipitation, for removal of interfering calcium for determinations of copper, nickel and zinc	100 g	918 939
Ammonium compensation reagent	30 ml	918 045

# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · Determination of *total* TN<sub>b</sub>

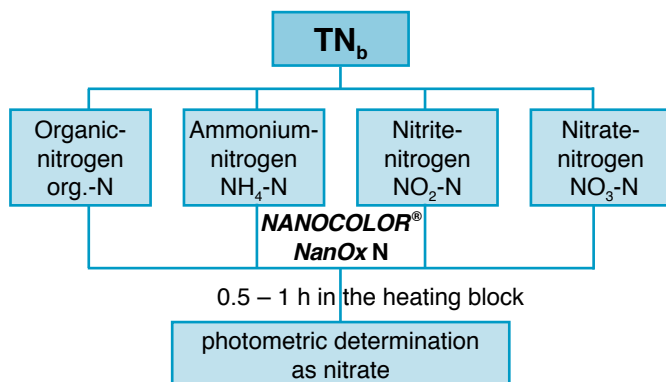
In some countries government regulations require a complete nitrogen balance for effluents. Besides ammonium, nitrite and nitrate, organic nitrogen compounds have to be determined – the sum of all these nitrogen compounds is called total nitrogen.

The Standard Method DIN EN ISO 11 905-1 describes the procedure for the determination of total N. After formation of nitrate by oxidative digestion of all inorganic and organic nitrogen-containing substances, a subsequent nitrate determination gives the total nitrogen content in mg N per litre. In samples with low nitrate and nitrite concentrations this method directly gives similar results to the determination of Total Kjeldahl Nitrogen TKN (including only ammonium and organic nitrogen compounds). In the presence of detectable amounts of nitrate/nitrite, the TKN can be determined by subtracting nitrate/nitrite nitrogen from total nitrogen.

### **NANOCOLOR® NanOx N**

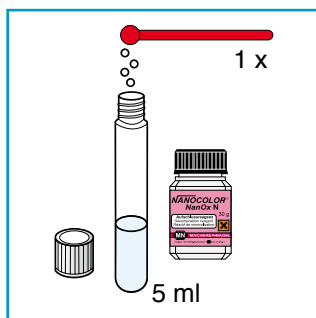
#### solid reagents for oxidative digestion of samples containing nitrogen compounds

*NanOx N* consists of convenient solid oxidative digestion reagents (potassium peroxodisulphate) and solid compensation reagents for elimination of interfering substances. After digestion with *NanOx N*, the samples can be analysed with **NANOCOLOR® Nitrate** tube or standard tests.

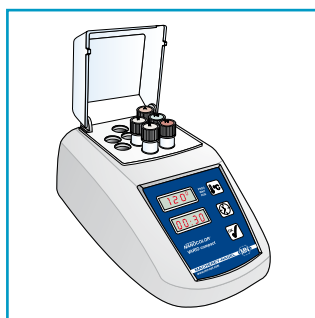


#### Digestion in a heating block

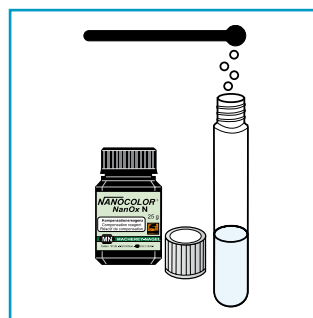
- easy handling
- choice for everyday routine analyses



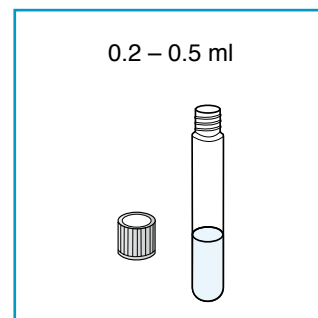
Mix sample with **NANOCOLOR® NanOx N** digestion reagent.



Boil: 30 minutes at 120 °C  
or 1 hour at 100 °C.



Add compensation reagent.



Decomposed sample for the test procedure.

For this digestion the following reagents and accessories are required:

**NANOCOLOR® total Nitrogen TN<sub>b</sub> 22**  
Type: tube test 0-88  
Measuring range: 0.5 – 22.0 mg/l N  
Shelf life: at least 1 year

REF 985 083

or

**NANOCOLOR® total Nitrogen TN<sub>b</sub> 220**  
Type: tube test 0-88  
Measuring range: 5 – 220 mg/l N  
Shelf life: at least 1 year

REF 985 088

The above mentioned tests are convenient combinations of **NANOCOLOR® NanOx N** reagents, predosed tube tests for determination of total N and digestion tubes.

or

**NANOCOLOR® NanOx N solid reagents**  
empty reaction tubes 14 mm ID

REF 918 979

REF 916 80

**NANOCOLOR® Nitrate 50**  
Type: tube test 0-64  
Measuring range: 0.3 – 22.0 mg/l N  
Shelf life: at least 2 years

REF 985 064

or

**NANOCOLOR® NanOx N solid reagents**  
empty reaction tubes 14 mm ID

REF 918 979

REF 916 80

**NANOCOLOR® Nitrate**  
Type: tube test 1-65  
Measuring range: 0.9 – 30.0 mg/l N  
Shelf life: at least 2 years

REF 918 65

Dilution of the sample can considerably increase the measuring ranges.

# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · Determination of *total* phosphorus

The element phosphorus occurs in many different circulations on earth. In waters, phosphorus containing substances are unwanted, whereas in soil phosphorus is an important fertilizer for the growth of plants. Phosphates occur in many different waters, mainly as *ortho*- and poly-phosphates. Most phosphates reach the waters via the municipal and industrial waste water. They derive from detergents, residues of human and animal excrements and from soluble contents of fertilizers. The discharge of phosphates to rivers and lakes leads to eutrophication, an increased growth of algae and water plants.

In many countries governmental regulations require a complete phosphorus balance for effluents. Besides *ortho*-phosphates, also phosphonates and organic phosphorus compounds have to be determined – the sum of all these compounds is called *total* phosphorus. After formation of phosphate by oxidative digestion of all inorganic and organic phosphorus-containing substances, a subsequent determination of phosphate gives the total phosphorus content in mg P per litre.

The **NANOCOLOR®** system offers several rapid and convenient methods for sample preparation and determination of total phosphorus.

### a) **NANOCOLOR®** tube tests for digestion in a heating block

- solid reagent capsules for digestion
- predosed tube tests for determination of *total* P
- digestion and photometric evaluation in one and the same test tube
- the choice for everyday routine analyses

For a correct determination of *total* P with **NANOCOLOR®** tube tests, the following reagents are available:

#### **NANOCOLOR® ortho- and total Phosphate 1** REF 985 076

Type: tube test 0-76  
Measuring range: 0.05 – 1.50 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 1 year

#### **NANOCOLOR® ortho- and total Phosphate 5** REF 985 081

Type: tube test 0-81  
Measuring range: 0.20 – 5.00 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 1 year

#### **NANOCOLOR® ortho- and total Phosphate 15** REF 985 080

Type: tube test 0-80  
Measuring range: 0.30 – 15.00 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 1 year



#### **NANOCOLOR® ortho- and total Phosphate 45** REF 985 055

Type: tube test 0-55  
Measuring range: 5.0 – 50.0 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 1 year

#### **NANOCOLOR® ortho- and total Phosphate 50** REF 985 079

Type: tube test 0-79  
Measuring range: 10.0 – 50.0 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 3 years

### b) **NANOCOLOR®** standard tests and solid reagents **NanOx Metal** for digestion in a heating block

For frequent analyses of large numbers of samples, **NANOCOLOR®** standard tests are the choice for determination of *total* P. For a correct determination of *total* P the following reagents and accessories are required:

#### **NANOCOLOR® NanOx Metal solid reagents** REF 918 978

empty reaction tubes 14 mm ID REF 916 80

#### **NANOCOLOR® ortho-Phosphate** REF 918 77

Type: standard test 1-77  
Measuring range: 0.04 – 6.5 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 3 years

or

#### **NANOCOLOR® NanOx Metal solid reagents** REF 918 978

empty reaction tubes 14 mm ID REF 916 80

#### **NANOCOLOR® ortho-Phosphate** REF 918 78

Type: standard test 1-78  
Measuring range: 0.2 – 17 mg/l P ( $\text{PO}_4\text{-P}$ )  
Shelf life: at least 3 years



# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · Oxidation of samples containing heavy metals

In practice an analysis often recovers only the quantity of metals which is present in the sample as dissolved ions. If the total content of a metal has to be determined (particularly samples of highly contaminated water or industrial waste water), it must be digested to avoid falsely negative or falsely low results. Usually, by applying acid and heat, undissolved metal oxides are dissolved, metal ions are released from complexes and adsorptive compounds or interfering organic substances are eliminated. Thus, maximum recovery rates can be achieved for the analysis of heavy metals.

The **NANOCOLOR®** system offers various rapid and convenient methods for sample preparation with solid reagents for regular digestion and liquid reagents for vigorous digestion.

### **NANOCOLOR® NanOx Metal**

#### solid reagents for oxidative digestion of samples containing heavy metals

**NANOCOLOR® NanOx Metal** consists of convenient solid oxidative digestion reagents (potassium peroxodisulphate) and solid neutralisation reagents for pH adjustment prior to the subsequent determination of metals.

#### Digestion in a heating block

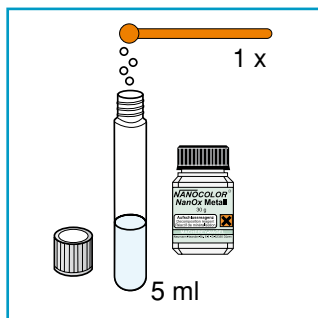
- easy handling
- choice for everyday routine analysis

#### **NANOCOLOR® NanOx Metal**

**REF 918 978**

empty reaction tubes 14 mm ID

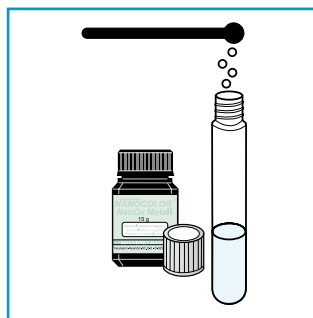
**REF 916 80**



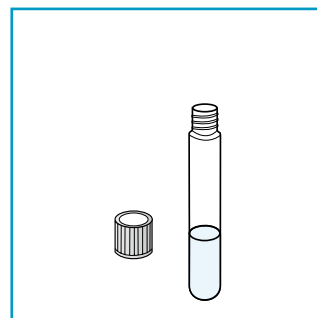
Mix sample with *NanOx Metal* digestion reagent.



Boil: 30 minutes at 120 °C or 1 hour at 100 °C.



Add neutralisation reagent.



Decomposed sample for test procedure.

After digestion with *NanOx Metal*, the samples can be analysed with the following **NANOCOLOR®** tests:

Test 0-98 Aluminium 07 *	Test 0-54 Copper 7
Test 1-02 Aluminium *	Test 0-37 Iron
Test 1-13 Cadmium	Test 1-36 Iron
Test 0-14 Cadmium 2	Test 0-61 Nickel 7
Test 0-24 Chromate 5 (Chromium)	Test 1-62 Nickel
Test 1-25 Chromate (Chromium)	Test 0-49 Silver
Test 1-51 Cobalt	Test 1-95 Zinc
Test 1-53 Copper	Test 0-96 Zinc 4

\*only with microwave digestion

# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · Oxidation of samples containing heavy metals

### **NANOCOLOR®** Crack set

#### Liquid reagents for oxidative digestion of samples containing heavy metals

The crack set is used for oxidative sample preparation in acidic medium (sulphuric acid / potassium peroxodisulphate) under normal pressure at 100 °C in a heating block. The crack set is recommended

- for complete and vigorous digestion of very resistant samples
- when microwave digestion with NanOx has failed
- when microwave digestion can not be applied because of high organic contamination of the sample

After digestion, the samples can be analysed in accordance with the instructions for the respective **NANOCOLOR®** tests. For this digestion the following reagents and accessories are required:

#### **NANOCOLOR®** Crack set

**REF 918 08**

Type: Reagent set for sample preparation  
Shelf life: at least 3 years

#### Reaction basis:

Digestion with sulphuric acid/potassium peroxodisulphate at 100 – 120 °C. Some stable heavy metal cyanide complexes are not completely destructible.

The **NANOCOLOR®** reagent set Crack set contains all reagents required for the oxidative digestion and subsequent neutralisation. Additionally, a heating block with 22 mm bores and reagent sets for determination of the individual metals are required



#### Accessories for crack set · Ordering information

Description	Pack of	REF
Tube for sample digestion 22 mm diameter, NS 19/26, with glass stopper	2	<b>916 66</b>
Condenser 200 mm, type KS, NS 19/26 bottom and NS 29/32 top, with 3 m polyethylene tubing	1	<b>916 67</b>
Absorption attachment for condenser, NS 29/32	1	<b>916 68</b>

After digestion the sample can be analysed with the following <b>NANOCOLOR®</b> tests:	
Test 0-09 Lead	Test 1-36 Iron
Test 0-14 Cadmium 2	Test 1-51 Cobalt
Test 0-37 Iron 3	Test 1-53 Copper
Test 0-54 Copper 7	Test 1-62 Nickel
Test 0-61 Nickel 7	Test 1-95 Zinc
Test 0-96 Zinc 4	

### **NANOCOLOR®** reagent set Sludge 50

#### Liquid reagents for oxidative digestion of sludge containing heavy metals

In Germany, the use of sludge for soil improvement in farming and forestry and in gardening is regulated by government regulations which define the maximum contents of 7 heavy metals (Cd, Cr, Cu, Hg, Ni, Pb, Zn) allowable in sludge for the above applications. The **NANOCOLOR®** reagent set sludge 50 allows even non-chemists to determine these contents with high accuracy. It is, however, recommended that you arrange for the supplier of the kit to provide instructions to those members of your team likely to be involved in its use.

With the exception of mercury and lead all of the above metals can be determined with the **NANOCOLOR®** analytical system. The photometers **NANOCOLOR®** 250 D and 350 D cannot be used for this sludge analysis. When using the photometers **NANOCOLOR®** <sup>UV/VIS</sup>, 500 D, 400 D or 300 D, you can directly read results as mg/kg dried residue of sludge (S). For a digestion of sludge we recommend the following reagents and accessories:

#### **NANOCOLOR®** Sludge

**REF 918 50**

#### **NANOCOLOR®** Sludge

**REF 918 501**

Type: Reagent sets for digestion with aqua regia  
Shelf life: at least 3 years

Reagent set 918 501 does not contain the nitric acid 65 % and hydrochloric acid 37 % required for the digestion and is thus suited for airfreight. The acids have to be purchased separately from a local laboratory supply store.

#### Reaction basis:

Mineralisation of sludge and soil samples with aqua regia at 100 °C and preparation of a solution for metal analysis according to DIN 38-414-S7. Additionally, reagent sets for determination of the individual metals are required.

#### Accessories for sludge analysis · Ordering information

Description	REF
Combination of all equipment required for sludge analysis (without reagents, photometer and heating block): 1 mortar with pestle, 2 tubes for sample digestion with stoppers, 1 condenser with connecting tubing, 1 absorption attachment, 100 filter circles MN 1670, 11 cm diameter, 100 filter circles MN 640 d, 15 cm diameter, 1 plastic wash bottle 500 ml, 1 holder for round glass tubes and tubes for sample digestion, 2 volumetric flasks 100 ml, 1 Erlenmeyer flask 200 ml, 1 measuring cylinder 50 ml, 1 pipette 50 ml, 1 glass funnel each with 60 mm and 80 mm diameter, 100 test strips pH-Fix 0 – 14, 1 double spatula 180 mm, safety glasses, bulb for filling 20 ml pipettes, instructions for use	<b>916 10</b>

After digestion the sample can be analysed with the following **NANOCOLOR®** tests:

Test 1-13 <sub>2</sub> Cadmium	1 – 100 *
Test 1-25 <sub>3</sub> + 1-25 Chromium	20 – 1800 *
Test 1-53 Copper	20 – 4000 *
Test 1-62 Nickel	2 – 400 *
Test 1-95 Zinc	80 – 6000 *

\* ranges in mg/kg for **NANOCOLOR®** <sup>UV/VIS</sup>, 500 D, 400 D, Linus and 300 D

# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · AOX (adsorbable organically bound halogens)

### AOX analysis has never been so easy and reliable before!

The AOX content represents the sum of organically bound halogens (chlorine, bromine, iodine) which are adsorbable to a suitable adsorbent; their concentration is expressed as chloride.

The rapid test **NANOCOLOR®** AOX 3 allows the determination of AOX in natural waters, industrial or municipal waste waters and sea water. The test is based on an easy three-step procedure:

1. Solid phase extraction with the **NANOSORB** adsorbent for AOX according to DIN 38 409-22
2. Oxidative digestion of the enriched adsorbent in a heating block at 120 °C or in a microwave oven
3. Photometric determination of AOX as chloride

### Advantages of **NANOCOLOR®** AOX 3

- The complete test procedure takes less than 60 minutes – when using a microwave oven for the digestion, first results are obtained in even less than 30 minutes.
- No expensive instrumentation is required; the test can be performed and evaluated with the usual equipment for photometric water analysis.
- In contrast to carbon-based adsorbents, the use of **NANOSORB** for AOX, a polymeric adsorbent pad, avoids interferences by inorganic halides, which can be removed entirely from the adsorbent. Even in sea water, with chloride contents of up to 20 g/l (!), reproducible results are obtained.
- For convenient handling, **NANOSORB** for AOX pads come individually prepackaged in plastic cartridges, protecting the adsorbent during adsorption.
- The use of predosed reagents shortens the procedure and reduces the analyst's exposure to chemicals to a minimum.
- Outstanding recovery rates can be achieved, even in undiluted samples with high COD contents.
- Application of the automatic pump set increases the sensitivity of the test kit and facilitates the use of **NANOSORB** for AOX.

For a correct determination of AOX you need the following reagents and accessories:

### **NANOCOLOR®** AOX 3

REF 985 007

Type: tube test 0-07  
Measuring range: 0.1 – 3.0 mg/l AOX  
0.01 – 0.3 mg/l AOX  
Shelf life: at least 1 year

### **NANOCOLOR®** starter set for AOX 3

REF 916 111

Includes useful accessories for the determination of AOX with reagent set AOX 3; recommended to be ordered with the first order of reagent set AOX 3



### Supplement kit for AOX 3

REF 918 072

Contains additional oxidising reagents for the sensitive AOX range (0.01 – 0.3 mg/l AOX) as well as for COD-contaminated samples between 50 and 1000 mg/l COD

Shelf life: at least 1 year

### Pump set for AOX 3

REF 916 115

Required to increase the sensitivity of reagent set AOX 3 or simply a useful auxiliary for convenient solid phase extraction with **NANOSORB** for AOX





# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · BOD<sub>5</sub> (biochemical oxygen demand)

Together with the chemical oxygen demand (COD) the biochemical oxygen demand (BOD) is the most important sum parameter for an estimation of the pollution of waste water. The BOD is defined as the amount of oxygen per volume, which is used by the microorganisms at 20 °C for oxidative degradation of the organic substances present in the water. Normally, the BOD is determined over a period of 5 days, and is then called BOD<sub>5</sub>. MACHEREY-NAGEL offers two tests for the determination of the BOD<sub>5</sub>: a method with sample incubation in Winkler bottles, in accordance with DIN EN 1899-1-H51, and a quick, simplified tube test.

### Benefits of **NANOCOLOR®** BOD<sub>5</sub>

- recovery rates within the tolerances stated in DIN EN 1899-1-H51
- oxygen measurement similar to DIN EN 25813-621, no manometers required
- use of a nitrification inhibitor avoids oxygen consumption caused by oxidation of ammonium and nitrite (nitrification)
- sample incubation in Winkler flasks in accordance with DIN EN 1899-1-H51 or
- simplified incubation and oxygen measurement in one and the same test tube
- photometric evaluation with all types of **NANOCOLOR®** photometers – no additional instrumentation necessary
- clear evaluation form for hand-written step-by-step calculation of the BOD<sub>5</sub>

For a correct determination of the BOD<sub>5</sub> you need the following reagents and accessories:

### a) BOD<sub>5</sub> determination in Winkler bottles according to DIN EN 1899-1-H51

#### **NANOCOLOR®** BOD<sub>5</sub>

REF 985 822

Type: in Winkler bottles, according to DIN EN 1899-1-H51, test 8-22  
 Measuring range: 0.5 – 3000 mg/l O<sub>2</sub>  
 Shelf life: at least 2 years



#### BOD<sub>5</sub>-accessories set

REF 916 918

Includes useful accessories for sample preparation prior to the determination of BOD<sub>5</sub>, recommended to be ordered with the first order of the tube test BOD<sub>5</sub>.

The accessories set consists of an electric air pump, 2 aerating bricks, tubing, a 10 l PE container, a 1 l laboratory bottle and 4 Winkler bottles.

#### BOD<sub>5</sub> nutrient mixture

REF 918 994

Without nitrification inhibitor *N*-allylthiourea (ATU).

Ready-to-use supplementary reagents for preparation of the inoculating water for BOD<sub>5</sub> test 8-22.

#### BOD<sub>5</sub> nutrient mixture Plus

REF 918 995

With nitrification inhibitor *N*-allylthiourea (ATU).

ready-to-use supplementary reagents for preparation of the inoculating water for BOD<sub>5</sub> test 8-22.

### b) BOD<sub>5</sub> determination as simplified tube test

Simple determination of the biochemical oxygen demand after 5 days (BOD<sub>5</sub>) of undiluted samples without using a control in accordance with DIN EN 1899-2-H52! The oxygen enriched, undiluted sample is incubated in test tubes for 5 days at 20 ± 1°C in the dark. Determination of the dissolved oxygen after 5 days is based on the Winkler procedure, DIN EN 25813-G21.

#### **NANOCOLOR®** BOD<sub>5</sub>-TT

REF 985 825

Type: tube test 8-25  
 Measuring range: 0.5 – 3000 mg/l O<sub>2</sub>  
 Shelf life: at least 2 years

Includes nitrification inhibitor *N*-allylthiourea (ATU) to prevent falsely high BOD<sub>5</sub> results due to high ammonium concentrations.



#### BOD<sub>5</sub> accessories set

REF 916 925

Includes useful accessories for sample preparation prior to the determination of BOD<sub>5</sub>-TT, recommended to be ordered with the first order of the tube test BOD<sub>5</sub>-TT.

The accessories set consists of an electric air pump, 2 aerating bricks, tubing, a 1000 ml PE container and two 40 ml reaction vessels.

### Spare parts · Ordering information

Description	Pack of	REF
Oxygen bottles according to Winkler	4	916 919
4 aerating bricks	4	916 920
10 reaction vessels for BOD <sub>5</sub> -TT	10	916 926

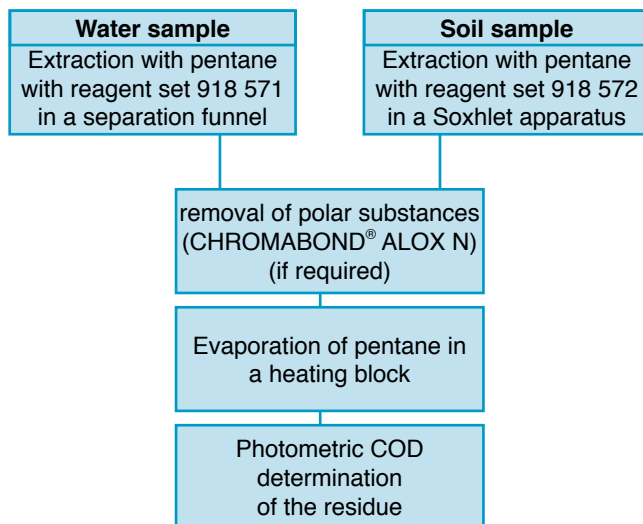


# The system for photometric water analysis

## Special **NANOCOLOR®** procedures · Hydrocarbons / lipophilic substances

The rapid test **NANOCOLOR®** HC 300 (Hydrocarbons) is based on a MN-patented method. Hydrocarbons with a boiling temperature above 120 °C can be detected in a clear fivestep procedure:

1. extraction of hydrocarbons from the sample
2. removal of polar substances
3. evaporation of the extraction solvent
4. oxidative digestion in a heating block
5. photometric determination of hydrocarbons



### Benefits of **NANOCOLOR®** HC 300

- applicable for water and soil
- extraction without halogenated solvents
- mercury-free reagents
- outstanding selectivity
- complete removal of polar substances by solid phase extraction with CHROMABOND® ALOX N columns
- can be adapted to the determination of lipophilic substances
- evaluation with all types of **NANOCOLOR®** photometers – no expensive analytical instrumentation required

For a correct determination of hydrocarbons you need the following reagents and accessories:

### **NANOCOLOR®** HC 300 REF 985 057 after extraction from water or soil samples

Type:	tube test 0-57	
Measuring range:	0.5 – 5.6 mg/l HC	
	30 – 300 mg/kg HC	
Shelf life:	at least 1 year at 15 – 25 °C	
Reaction tubes (empty, pack of 20)		REF 916 80
Threaded couplings (pack of 2)		REF 916 04
Stop valves for piston pipettes (pack of 100)		REF 916 21

### For determination of hydrocarbons in water

#### Extraction kit HC from water REF 918 571

Shelf life:	1.5 years	
Separation funnel 500 ml (pack of 2)		REF 916 08
Volumetric flask 25 ml (pack of 2)		REF 916 61

### For determination of hydrocarbons in soil

#### Extraction kit HC from soil REF 918 572

Shelf life:	1.5 years	
Soxhlet apparatus 30 ml (additionally a heater is required)		REF 916 05
Extraction thimbles (pack of 25)		REF 645 008
Volumetric flask 50 ml (pack of 2)		REF 916 06

### For removal of fatty acids, fat or other polar compounds

CHROMABOND® SPE columns		REF 730 250
ALOX N (pack of 20)		REF 916 09
Plastic syringes 50 ml (pack of 10)		REF 916 03
Syringe adapters (pack of 2)		



# The system for photometric water analysis

## NANOCOLOR® accessories

A comprehensive analytical system should include all accessories required for the analytical procedure, such as equipment for sampling, sample preparation and conservation, for digestion reactions, extraction and filtration – from analytical preparations to protective accessories for safe operation. All these components improve analytical procedures and thus help to obtain optimum results.

### NANOCOLOR® membrane filters

Removal of turbidities (fine filtration) is recommended for two reasons:

- Turbidities interfere with photometric determinations, intense turbidities must be removed prior to the analysis.
- When both soluble and total amounts of a substance (e.g. iron, manganese, COD etc.) have to be determined, part of the sample has to be filtered to remove undissolved particles. The German Standard Methods use a pore size of 0.45 µm as standard for differentiation between dissolved and undissolved particles.

Additionally we offer a pore size of 1.2 µm.



#### Ordering information

Description	Pack of	REF
Membrane filtration kit 0.45 µm: 2 syringes 20 ml and 25 CHROMAFIL® membrane filters 0.45 µm	1 kit	916 50
CHROMAFIL® membrane filters 0.45 µm	50	916 52
Membrane filtration kit 1.2 µm: 2 syringes 20 ml and 25 CHROMAFIL® membrane filters 1.2 µm	1 kit	916 511
CHROMAFIL® membrane filters 1.2 µm	50	916 513
Membrane filtration kit: 2 syringes 20 ml and 25 CHROMAFIL® membrane filters GF/PES	1 kit	916 01
CHROMAFIL® membrane filters GF/PES	50	916 02

### Piston pipettes and pipette stand

Exact dosage of water sample and reagents is prerequisite for analytical accuracy. We offer a complete line of piston pipettes – with fixed or adjustable volume.

- convenient operation – exact dosage
- guarantees clean analytical work through use of disposable tips
- high security when working with toxic or corrosive substances, because direct contact is avoided
- clean and safe storage of the valuable pipettes in a pipette stand
- all pipettes are supplied with tip ejector



#### Ordering information

Description	Pack of	REF
200 µl piston pipette (without tips)	1	916 72
Plastic tips for 50 – 200 µl piston pipettes	100	916 915
500 µl piston pipette (without tips)	1	916 53
Plastic tips for 200 – 1000 µl piston pipettes	100	916 76
1.0 ml piston pipette (without tips)	1	916 71
Plastic tips for 200 – 1000 µl piston pipettes	100	916 76
2.0 ml piston pipette (without tips)	1	916 917
Plastic tips for 1.0 – 5.0 ml piston pipettes	100	916 916
5 – 50 µl digital piston pipette, adjustable	1	916 58
50 – 200 µl digital piston pipette, adjustable	1	916 914
Plastic tips for 5 – 50 and 50 – 200 µl piston pipettes	100	916 915
200 – 1000 µl digital piston pipette, adjustable	1	916 77
Plastic tips for 200 – 1000 µl piston pipettes	100	916 76
1.0 – 5.0 ml digital piston pipette, adjustable	1	916 909
Plastic tips for 1.0 – 5.0 ml piston pipettes	100	916 916
Pipette stand for 6 piston pipettes	1	916 79

# The system for photometric water analysis

## NANOCOLOR® accessories

### General analytical accessories

#### Ordering information

Description	Pack of	REF
Reaction tube 14 mm ID	20	916 80
Volumetric flask 10 ml for reduced analytical preparations	2	916 42
Volumetric flask 25 ml with NS 10/19 and polyethylene stopper for analytical preparations	2	916 61
Volumetric flask 100 ml with NS 12/21 and polyethylene stopper	2	916 83
Erlenmeyer flask 50 ml	1	916 212
Erlenmeyer flask 100 ml	1	916 38
Measuring cylinder 50 ml	1	916 84
Pipette 20 ml, short version	1	916 62
Bulb for filling pipettes	1	916 65
Glass funnel 60 mm diameter	1	916 81
Glass funnel 80 mm diameter	1	916 82
Filter circles MN 1670, 11 cm diameter	100	470 011
Filter circles MN 640 d, 15 cm diameter	100	205 015
Plastic wash bottle 500 ml	1	916 89
Magnetic stirring unit without heater	1	970 115
Mini-magnets for stirring	1	916 211
Timer with digital display and acoustic signal (up to 99:59 min)	1	916 96
Electric air pump with delivery tube	1	916 55
Double spatula, 18/8 steel, 180 mm long	1	916 94
Porcelain mortar 90 mm diameter with pestle	1	916 88
Holder for 15 round glass tubes and 2 tubes for sample digestion	1	916 36
Safety bottle for shaking COD test tubes	1	916 37
Safety kit, consist of safety glasses, gloves and rubber apron	1	916 90

## Quality control for photometric water analysis

### The NANOCONTROL system for analytical quality control

Reagents, measuring equipment and personal handling are already subject to validation, or frequent internal control in many labs.

The NANOCONTROL system offers a complete range of products for analytical quality control of analyses carried out with the NANOCOLOR® system.

- NANOCONTROL standards
- NANOCONTROL 100+ addition (spike solution)
- NANOCONTROL NANOCHECK

Corresponding to the overall concept of NANOCOLOR® water analysis system, no additional equipment or specific training is needed for the use of NANOCONTROL.

**NANOCONTROL standards** allow the user to check all components of the analytical system:

- personal handling
- NANOCOLOR® measuring equipment, especially the photometers and reagents; evaluation forms can be provided.

**NANOCONTROL 100+** is used for the detection of proportional interferences, caused by ingredients which disturb or enhance the reaction and thereby may adulterate the results.

The application of NANOCONTROL quality assurance requires a little additional effort, but it gives you the necessary backup to confirm the measured values in your lab.

#### NANOCONTROL NANOCHECK

Test solutions for the determination of photometric accuracy

NANOCONTROL NANOCHECK is a secondary standard for the control of inspection, measuring and test equipment in accordance to ISO 9001 and ISO 14001. The test solutions have been checked in a reference photometer monitored with primary standards (NIST-Standards). The results are documented. With only 2 stable colour solutions the wavelength accuracy and the linearity of the absorbance measurement can be checked. NANOCONTROL NANOCHECK fulfils the requirements of analytical quality control mentioned in the DWA-advisory leaflet A 704 (Operational Methods for the Self-Monitoring of Wastewater Systems).

#### NANOCONTROL NANOCHECK

Shelf life: at least 1 year

REF 925 701



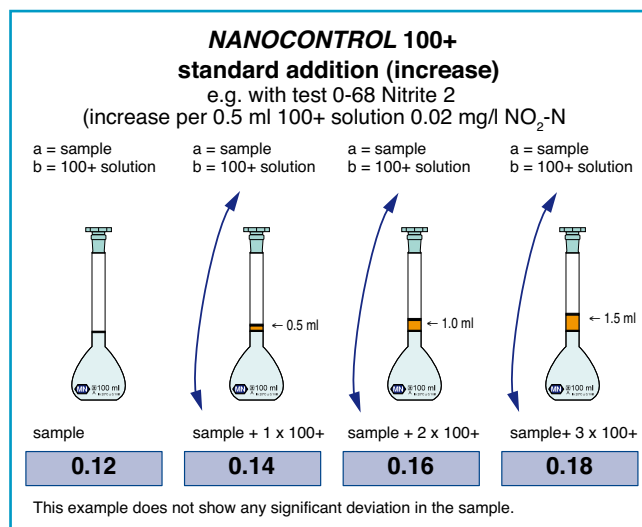
# Quality control for photometric water analysis

## The *NANOCOLOR* system for analytical quality control

### *NANOCOLOR* Standards

*NANOCOLOR* standards are solutions of a defined concentration of the parameter in question. The concentration lies in the middle of the corresponding measurement range and has a very narrow confidence interval which is given for each standard.

The application principle is simple: Instead of the water sample, you conduct the test as usual with the provided standard solution. If the determined value lies within the confidence interval, all single components of the analytical workspace are OK and yield reliable results. In the case of discrepancies, the manual gives helpful hints for a systematic error search.



### *NANOCOLOR* single standards for analytical quality control · Ordering information

<i>NANOCOLOR</i> ® test	Dimension	Concentration of the standard solution	Addition per 0.5 ml 100 + spiking solution	Number of tests	REF
AOX 3 (test 0-07)	mg/l AOX	1.0	1.0	20	925 07
BOD <sub>5</sub> (test 8-22 und 8-25)	mg/l O <sub>2</sub>	210	—	10	925 82
Chlorine (test 1-16)	mg/l Cl <sub>2</sub>	1.00	—	30	925 17
Chlorine 2 (test 0-17)	mg/l Cl <sub>2</sub>	0.80	—	—	—
Chromate 5 (test 0-24)	mg/l CrO <sub>4</sub> <sup>2-</sup>	2.0	0.5	15	925 24
Chromate (test 1-25)	mg/l CrO <sub>4</sub> <sup>2-</sup>	0.40	0.5	—	—
COD 60 (test 0-22, 0-27)	mg/l O <sub>2</sub>	30	—	15	925 22
COD 160 (test 0-26, 0-33; test 0-94)	mg/l O <sub>2</sub> mg/l C	100 40	— —	15 15	925 26
COD 15000 (test 0-23, 0-28)	g/l O <sub>2</sub>	4.0	—	30 – 150	925 28
COD 1500 (test 0-29)	mg/l O <sub>2</sub>	400	—	15	925 29
Nitrite (test 1-67)	mg/l NO <sub>2</sub> -N	0.060	0.02	15	925 68
Nitrite 2 (test 0-68)	mg/l NO <sub>2</sub> -N	0.30	0.02	—	—
Nitrite 4 (test 0-69)	mg/l NO <sub>2</sub> -N	2.1	—	—	—
ortho-Phosphate 1 (test 0-76)	mg/l PO <sub>4</sub> -P	1.00	0.10	15	925 76
ortho-Phosphate (test 1-77)	mg/l PO <sub>4</sub> -P	0.20	0.10	—	—
Sulphite 100 (test 0-90)	mg/l SO <sub>3</sub> <sup>2-</sup>	50	—	15	925 90
TOC see COD 160					
Note: For chlorine (tests 1-16 and 0-17) and sulphite (test 0-90), as standards simulation substances are used, which react in the same way as the original parameter.					



# Quality control for photometric water analysis

## The **NANOCONTROL** system for analytical quality control

### **NANOCONTROL** Multistandards

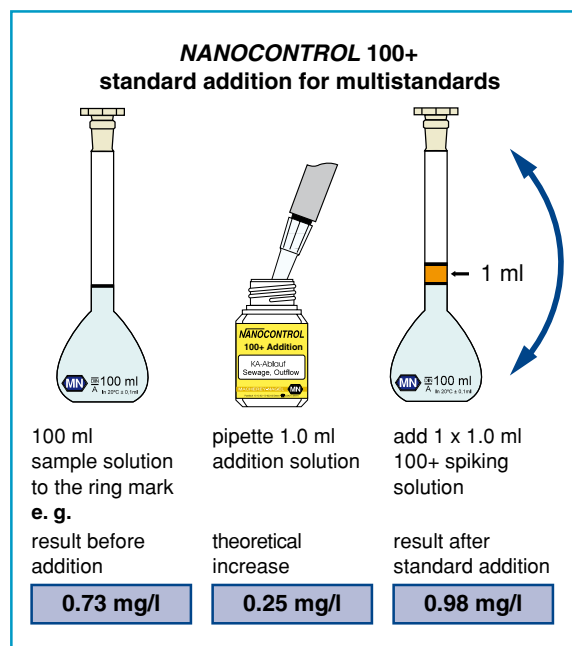
Similar to the single standard solutions, there are standard mixtures of substances which were developed for special application fields e. g. sewage treatment plants, or waterworks. With the help of these standards several characteristic parameters can be determined and documented.

#### **NANOCONTROL 100+ addition (spike solution)**



Spike solutions (**NANOCONTROL 100+** solution) allow tracing of interferences, which may be present in the sample. Using spike solutions is recommended whenever:

- you start a new analytical series with an unknown sample matrix
- you know that your sample contains interfering substances, e. g. proteins, larger amounts of salts etc.
- you find continuous major deviations from other analytical procedures
- you question the accuracy of your own analytical results

The principle of standard addition is, to increase the concentration of a sample in defined steps. The recovery rate is then an indication of possible interferences. When constant, proportional deviations occur, which can be counterbalanced; thus, the result can be corrected. For the multistandard solution, a spike solution **NANOCONTROL 100+** is also available. Because of the complexity of the sample composition, we recommend a simplified procedure with a one-off addition of 1.0 ml of **NANOCONTROL 100+** solution.



### **NANOCONTROL** multistandards for analytical quality control · Ordering information

Parameter	NANOCOLOR® test		Concentration of the standard solution	Confidence interval	Number of tests	REF
NANOCONTROL multistandard Sewage1 outflow incl. NANOCONTROL 100+ standard addition					12 – 120	925 011
Ammonium	0-03 0-04	Ammonium 3 Ammonium 10	0.75 mg/l NH <sub>4</sub> -N 3.0 mg/l NH <sub>4</sub> -N	0.67 – 0.83 mg/l 2.7 – 3.3 mg/l		
COD	0-26 0-33	COD 160 COD 300	114 mg/l COD 114 mg/l COD	103 – 125 mg/l 103 – 125 mg/l		
Nitrate	0-64	Nitrate 50	6.0 mg/l NO <sub>3</sub> -N	5.2 – 6.8 mg/l		
total N	0-83	total Nitrogen TN <sub>b</sub> 22	12.0 mg/l N	10.0 – 14.0 mg/l		
total P	0-76 0-81	total Phosphate 1 total Phosphate 5	0.63 mg/l P 2.50 mg/l P	0.56 – 0.70 mg/l 2.25 – 2.75 mg/l		
NANOCONTROL multistandard Sewage1 outflow 2 incl. NANOCONTROL 100+ standard addition					12 – 120	925 010
Ammonium	0-03	Ammonium 3	1.80 mg/l NH <sub>4</sub> -N	1.60 – 2.00 mg/l		
COD	0-27 0-22	COD 40 COD 60	30 mg/l O <sub>2</sub> 30 mg/l O <sub>2</sub>	26 – 34 mg/l 26 – 34 mg/l		
Nitrate	0-64 1-65	Nitrate 50 Nitrate	3.0 mg/l NO <sub>3</sub> -N 3.0 mg/l NO <sub>3</sub> -N	2.6 – 3.4 mg/l 2.6 – 3.4 mg/l		
total P	0-76 0-81	total Phosphate 1 total Phosphate 5	1.00 mg/l P 1.00 mg/l P	0.90 – 1.10 mg/l 0.90 – 1.10 mg/l		
total N	0-83	total Nitrogen TN <sub>b</sub> 22	5.8 mg/l N	5.2 – 6.4 mg/l		






Multistandards can also be used for checking reagents and photometers from other manufacturers.

The contents of one package of each multistandard are sufficient for at least 1 repeated test of each parameter indicated. If you only check one or a few parameters, then the number of individual determinations is increased.

Shelf life: 1 year, 6 weeks after opened

# Quality control for photometric water analysis

## The *NANOCONTROL* system for analytical quality control

Parameter	<i>NANOCOLOR</i> ® test	Concentration of the standard solution	Confidence interval	Number of tests	REF
<b><i>NANOCONTROL</i> multistandard Sewage inflow</b> incl. <i>NANOCONTROL</i> 100+ standard addition				30 – 300	925 012
Ammonium	0-05	Ammonium 50	25 mg/l NH <sub>4</sub> -N	22 – 28 mg/l	
COD	0-29	COD 1500	400 mg/l COD	360 – 440 mg/l	
Nitrate	0-64 0-66	Nitrate 50 Nitrate 250	15.0 mg/l NO <sub>3</sub> -N 15 mg/l NO <sub>3</sub> -N	13.5 – 16.5 mg/l 13 – 17 mg/l	
total-P	0-80 0-81	total Phosphate 15 total Phosphate 5	8.00 mg/l P 3.20 mg/l P	7.20 – 8.80 mg/l 2.90 – 3.50 mg/l	
total-N	0-88	total Nitrogen TN <sub>p</sub> 220	75 mg/l N	67 – 83 mg/l	
<b><i>NANOCONTROL</i> multistandard Seepage</b> incl. <i>NANOCONTROL</i> 100+ standard addition				15 – 300	925 013
Ammonium	0-06 0-08	Ammonium 200 Ammonium 100	80 mg/l NH <sub>4</sub> -N 40 mg/l NH <sub>4</sub> -N	72 – 88 mg/l 36 – 44 mg/l	
COD	0-23 0-28	COD 10000 COD 15000	4.00 g/l COD 4.0 g/l COD	3.60 – 4.40 g/l 3.6 – 4.4 g/l	
Nitrate	0-66	Nitrate 250	30 mg/l NO <sub>3</sub> -N	27 – 33 mg/l	
total P	0-55	total Phosphate 45	25.0 mg/l P	22.0 – 28.0 mg/l	
ortho-P	0-79	ortho-Phosphate 50	25.0 mg/l PO <sub>4</sub> -P	22.0 – 28.0 mg/l	
<b><i>NANOCONTROL</i> multistandard Metals 1</b> incl. <i>NANOCONTROL</i> 100+ standard addition				15 – 60	925 015
Cadmium	1-13 0-14	Cadmium Cadmium 2	0.10 mg/l Cd <sup>2+</sup> 1.00 mg/l Cd <sup>2+</sup>	0.08 – 0.12 mg/l 0.80 – 1.20 mg/l	
Chloride	0-19 0-21	Chloride 200 Chloride 50	80 mg/l Cl <sup>-</sup> 20 mg/l Cl <sup>-</sup>	70 – 90 mg/l 17 – 23 mg/l	
Chromium	0-24 <sub>3</sub> 0-24 <sub>4</sub> 1-25 <sub>3</sub>	Chromate 5 + total Chromium Chromate 5 + NanOx Metal Chromate + total Chromium	1.0 mg/l Cr 1.0 mg/l Cr 1.0 mg/l Cr	0.8 – 1.2 mg/l 0.8 – 1.2 mg/l 0.8 – 1.2 mg/l	
Iron	1-36 0-37	Iron Iron 3	0.10 mg/l Fe <sup>3+</sup> 1.00 mg/l Fe <sup>3+</sup>	0.08 – 0.12 mg/l 0.80 – 1.20 mg/l	
Fluoride	0-40 1-42	Fluoride 2 Fluoride	1.0 mg/l F <sup>-</sup> 1.00 mg/l F <sup>-</sup>	0.8 – 1.2 mg/l 0.80 – 1.20 mg/l	
Sulphate	0-86	Sulphate 200	80 mg/l SO <sub>4</sub> <sup>2-</sup>	70 – 90 mg/l	
Zinc	1-95 0-96	Zinc Zinc 4	0.10 mg/l Zn <sup>2+</sup> 1.00 mg/l Zn <sup>2+</sup>	0.08 – 0.12 mg/l 0.80 – 1.20 mg/l	
<b><i>NANOCONTROL</i> multistandard Metals 2</b> incl. <i>NANOCONTROL</i> 100+ standard addition				15	925 016
Copper	1-53 0-54	Copper Copper 7	0.60 mg/l Cu <sup>2+</sup> 2.00 mg/l Cu <sup>2+</sup>	0.50 – 0.70 mg/l 1.80 – 2.20 mg/l	
Lead	0-09 1-10	Lead 5 Lead	2.50 mg/l Pb <sup>2+</sup> 0.25 mg/l Pb <sup>2+</sup>	2.25 – 2.75 mg/l 0.22 – 0.28 mg/l	
Nickel	0-61 1-62	Nickel 7 Nickel	2.00 mg/l Ni <sup>2+</sup> 0.60 mg/l Ni <sup>2+</sup>	1.80 – 2.20 mg/l 0.50 – 0.70 mg/l	
Potassium	0-45	Potassium 50	20 mg/l K <sup>+</sup>	18 – 22 mg/l	
<b><i>NANOCONTROL</i> multistandard Drinking water</b> incl. <i>NANOCONTROL</i> 100+ standard addition				15 – 30	925 018
Aluminium	1-02 0-98	Aluminium Aluminium 07	0.50 mg/l Al <sup>3+</sup> 0.50 mg/l Al <sup>3+</sup>	0.44 – 0.56 mg/l 0.44 – 0.56 mg/l	
Ammonium	1-05	Ammonium	0.20 mg/l NH <sub>4</sub> -N	0.17 – 0.23 mg/l	
Chloride	1-20 0-21	Chloride Chloride 50	20 mg/l Cl <sup>-</sup> 20 mg/l Cl <sup>-</sup>	17 – 23 mg/l 17 – 23 mg/l	
Iron	1-36 0-37	Iron Iron 3	1.50 mg/l Fe <sup>3+</sup> 1.50 mg/l Fe <sup>3+</sup>	1.30 – 1.70 mg/l 1.30 – 1.70 mg/l	
Manganese	1-60 0-58	Manganese Manganese 10	1.50 mg/l Mn <sup>2+</sup> 1.5 mg/l Mn <sup>2+</sup>	1.30 – 1.70 mg/l 1.3 – 1.7 mg/l	
Sulphate	0-86	Sulphate 200	120 mg/l SO <sub>4</sub> <sup>2-</sup>	102 – 138 mg/l	

Multistandards can also be used for checking reagents and photometers from other manufacturers.

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Shelf life: 1 year, 6 weeks after opened