

Turbidity measurement



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Application areas and meters overview

The turbidity of a sample is a subjective perception and in shows variable effects in contrast to electrochemical or physical parameters. It is based on particles that are dispersed in a solution, of different sizes, differently shaped and movable. Turbidity measurement serves as a quality and indicator parameter in many applications.

- yes
- ✓ yes
- not recommended/not present

Applications	Turb® 430 IR	Turb® 430 T	Turb® 355 IR
Turbidity in drinking water as per EN ISO 7027	●		●
Turbidity in drinking water as per US EPA 180.1		●	
Official monitoring	●	●	●
Environmental monitoring	●	●	●
Industry, quality control with IR 860 nm	●		●
Industry, quality control with halogen 560 nm		●	
Service laboratories, mixed applications	●	●	●
Field applications and mobile QC	●	●	
Properties			
Standard measurement < 1 NTU	✓	✓	–
AMCO Clear® calibration standards	✓	✓	✓
AQA with documentation/protocol	✓	✓	–
Calibration interval	✓	✓	–
Data management PC software LSdata (on request)	✓	✓	–
LIMS connection via LSdata	✓	✓	–
PC port	✓	✓	–
Battery/battery packs	✓/✓	✓/✓	✓/–
Data memory	✓	✓	–
Software methods update	✓	✓	–
Standalone instrument / LabStation (as laboratory solution, optional)	✓/✓	✓/✓	–/–
Carrying case kits	✓	✓	✓
	Turb® 430 IR	Turb® 430 T	Turb® 355 IR
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Turbidity measurement: A parameter for quality control

In quality monitoring, the measured value "turbidity" is a meaningful indicator parameter. This applies e.g. for drinking water treatment, where the number of particles must be less than 1 NTU as a possible base for bacteria. In beverage production, in the chemical industry, in the production of vaccines or even fuels for engine development, turbidity is a quality control with "in-house" limit value definitions.

Undissolved solids in liquid, as e.g. algae, sludge, microbes or other particles, absorb and scatter light passing through. As the number of particles increases, the turbidity degree also increases noticeably for our eyes. The shape, size and composition of the particles influence the degree of turbidity. The measurement of the scattered light at a 90 ° angle has proven to be superior, especially in the low measuring ranges, and is therefore standard for measuring in drinking water control.



Various standard specifications for drinking water monitoring

There are different types of measuring instruments that differ with respect to the light source: For standard-compliant measurements in accordance with ISO 7027 / DIN EN 27027 (EN ISO 7027), an IR LED (infrared) with a wavelength of 860 nm is required. The Standard Methods for the Examination of Water and Waste water / US EPA require a tungsten broadband light source ("white light").

Infrared or white light depending on the application

For applications without standard specifications, the optimum solution is sought. As the turbidity measurement is often used for quality control, the measurement should be carried out in a previously internally defined measured value window.

- Infrared (IR) light sources minimize or eliminate the influence of coloring in a solution, as at the wavelength of 860 nm virtually no absorption takes place. It is therefore particularly advantageous for colored solutions. The detection sensitivity for small particles is somewhat lower at this wavelength due to the generally lower scattering of small particles.
- White light has a higher sensitivity for small particles, on the other hand an intrinsic coloring of the solution has a reinforced disturbing factor.

Various measuring methods

Especially in the field of industrial quality control, different methods are used: In addition to the nephelometric measurement with 90 ° scattered light for low turbidity values, the transmitted light method at 180 ° is advantageous for medium and higher turbidity, as the scattered light and the shadow effect between the particles increases with increasing turbidity and the decrease of the light intensity provides a more accurate result.

Depending on the manufacturer or industry, the ratio method measures at different angles and calculates the results. There is no single standard for this.



Turbidity measuring cuvette and standard cuvette

AMCO Clear® turbidity standards

- **±1% Production accuracy**
- **High precision and long-term stability**
- **Does not pose a health hazard**
- **Easy to dispose of**

The calibration of turbidity meters is based on the reproduction of differently sized and shaped particles in the real world. The turbidity standards AMCO Clear® for Turb® instruments are polymeric calibration standards with a defined particle composition and are distinguished from formazine by significantly higher result accuracy and stability without drift behavior. The conventional formazine standards with a tolerance of 5-10% are compared with the production accuracy with regard to the particle composition of 1%. They are batch-certified and N.I.S.T. traceable to formazine.

The standards are optimally matched in the particle composition to the respective instrument optics and are particularly well suited for applications in the lowest measuring range such as drinking water.



AMCO Clear turbidity standards

Mobile turbidity meter with laboratory quality Turb® 430 IR/Turb® 430 T

The Turb® 430 series turbidity meters are equally well suitable for portable and laboratory use due to their accuracy and laboratory comfort. They cover the measuring range of 0.02-1100 NTU / FNU for nephelometric measurements with 90° scattered light.

Turb® 430 IR fulfils the requirements of DIN 27027/ISO 7027, Turb® 430 T those of US EPA 180.1. The turbidity meters are characterised by many extras:

- Intuitive operation with menu navigation
- Automatic measuring range switching
- Simple and high precision calibration
- AQA by means of calibration protocol and calibration interval adjustment
- 1000 data sets can be stored
- Sample identification number (ID)
- Scattered light behaviour as per Pharmacopoeia 9
- Data output
- Optional PC software LSdata for convenient data management (see page 175)

Turb® 430 turbidity meter with AMCO Clear® turbidity standards

- **Highest precision from 0.02 NTU**
- **Accoring to DIN/EN ISO and US EPA**
- **AQA with GLP-complying documentation**



Portable turbidity measurement with the Turb® 430 Series

- **Mobile Laboratory quality**
- **Safe working on site**
- **GLP-compliant documentation**

For the mobile monitoring of the drinking water quality of wellheads, cisterns and springs or for environmental monitoring and measurement at various production sites, there is the practical carrying case kit with a small "laboratory table", battery pack and the PC software LSData for data management.



The mobile turbidity laboratory - the carrying case kits for Turb® 430 IR/T

Turbidity measurement in the laboratory with the Turb® 430 Series




- **Highest precision**
- **Data memory and sample ID**
- **Documentation via PC software LSdata (see page 175)**
- **Optional LabStation**

The precision optics together with the long-term stable calibration through the AMCO Clear® turbidity standards and GLP-compliant documentation make the Turb® 430 series the ideal partner for service laboratories, health authorities and manufacturing industry, wherever mobile as well as laboratory use is required.



Turb® 430 turbidity meter with LabStation in mineral water industry

Turb® 355 T / Turb® 355 IR

-  **0 - 1100 NTU/FNU**
-  **Simple operation**
-  **Quality control > 1 NTU**



Turb® 355 IR/T field case set



Small, portable turbidity meters

Battery-powered turbidity meter with Infrared LED (860 nm) for nephelometric measurements in accordance with ISO 7027/DIN EN 27027 (EN ISO 7027) or as white light model with tungsten lamp in accordance with US EPA.

It is handy, light and very easy to use.

The Turb® 355 IR/T is supplied as a kit in a small carrying case, which contains all necessary accessories (calibration standards 0.02 - 10.0 and 1000 NTU, empty cuvettes and batteries). The instrument operates with 4 MICRO (AAA) Alkali manganese batteries.

Technical specifications: Turbidity meters

	Turb® 430 IR / Turb® 430 T	Turb® 355 IR / 355 T
Measurement principles	Nephelometric (90° scattered light)	Nephelometric (90° scattered light)
Light source	IR LED / Tungsten lamp	IR-LED/Tungsten lamp
Measuring ranges	NTU 0,02 - 1100 / 0 - 1100 FNU 0.02 - 1100	0 - 1100 0 - 1100
Resolution	0.01 for the range 0.00 - 9,99 0.1 for the range 10 - 99,90 1 for the range 100 - 1100	0.01 NTU in the range 1 - 9.99 0.1 NTU in the range 10.0 - 99.9 1 NTU in the range 100 - 1000
Accuracy	0.01 NTU or ±2 % of the measured value	±2 % of the measured value or ±0.1 NTU last decimal point in the range 1 ... 500 NTU ±3% of the measured value in the range 500 ... 1100 NTU
Repeatability	<0.5 % of the measured value or 0.01 NTU/FNU	±1% of the measured value or ±0.05 NTU/FNU
Calibration	Automatic 3 point calibration	Automatic 1...3 point calibration
Response time	Approx. 3 seconds (IR) / approx 7 seconds (T)	14 seconds
Cuvette	28 x 60 mm, 20 ml sample volume	25 x 45 mm, 15 ml sample volume
Interface	RS 232, USB via adapter	
Particular calibration protocol	Yes	-
Functions Measured value memory	1000	-
RS 232	Yes	-
Date/time:	Yes	-
Data evaluation	Yes	-
Battery	optional	-
Operating temperature	0 - +50 °C	0 - +50 °C
Power Supply	4 Mignon (AA) for approx. 3000 measurements	4 MICRO (AAA) Alkaline batteries sufficient for more than 1,500 measurements

Order information: Turbidity meters

Model	Description	Order no.
Turb® 355 IR	Portable meters a carrying case as per ISO 7027 / DIN EN 27027 (EN ISO 7027), with 3 calibration standards 0.02 - 10.0 - 1000 NTU	600311
Turb® 355 T	as Turb® 355 IR, but with tungsten light source as per US EPA 180.1	600312
Turb® 430 IR	Portable turbidity meter for nephelometric measurements (90 °) according to DIN EN 27027, incl. calibration kit 0.02 - 10 - 1000 NTU, suitable for drinking water	600320
Turb® 430 T	as Turb® 430 IR, but with tungsten light source as per US EPA 180.1	600325
Turb® 430 IR/SET	Portable turbidity meter (90 °) with infrared light source as per DIN EN 27027 in a field carrying case with table insert, calibration set 0.02 - 10.0 - 1000 NTU and accessories	600321
Turb® 430 T/SET	as Turb® 430 IR/SET, but with tungsten light source as per US EPA 180.1	600326
For additional products, sets, and accessories, see price list or www.WTW.com		



Multi parameter

pH

ORP

ISE

Dissolved Oxygen

Conductivity

BOD/Respiration

Photometry

Turbidity

Software, Documentation