



# Water Testing

## Turbidity Analysis

from leading experts



## Competence in turbidity

Turbidity is one of the most important parameters for measuring water quality – especially for drinking water. But it also causes the biggest difficulties. Lovibond® has the solution you need for reliable, fast & trouble-free processes in your daily monitoring routine.

### Our turbidity measurement systems

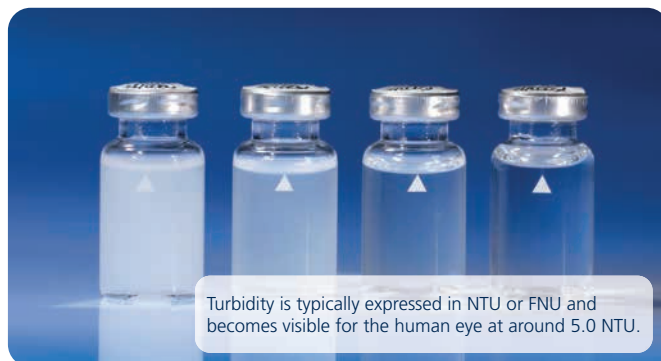
- are designed by world-renowned experts
- set new technical standards
- offer cost-effective system solutions
- simplify your measuring routine
- provide you with everything from a single source
  - from the measuring instrument to the standards & accessories

# Turbidity basics

## What is turbidity?

Turbidity is a measure of the degree to which water loses clarity due to the presence of suspended particles that scatter or absorb transmitted light. The more suspended solids are in the water, the murkier it seems and the higher is the turbidity. Turbidity also depends on the size of particles that affect the scattering or absorption of light.

It is considered as an indicator parameter that provides valuable information about the quality of water quickly, reliably and relatively low-cost. As a sum parameter, turbidity data correlate strongly with the sample composition, so that all types of suspended matter such as sediments, minerals or microorganisms can be detected. Turbidity can be measured using on-line instruments, benchtop and portable meters or even turbidity tubes.



## Why does turbidity matter?

Sources of turbidity in water are for instance clay, silt, organic and inorganic matter, algae, plankton and other microscopic organisms. They can include anything from decaying plant material, sediments or even shedding from the weathering of rocks.

The level of turbidity can also vary due to seasonal weather changes, an increase in rainfall, or natural disasters such as landslides. Human activity can also contribute to the turbidity levels of a water source. Pollution from construction sites is one major cause, but even running a boat in a body of water can add turbidity.

The early detection of a sudden increase in turbidity in previously clear waters can help to avoid hazards to aquatic organisms and humans, impairment of navigation and flood risks.

Turbidity is a well recognised parameter for evaluating water quality. Even though it does not always represent a direct risk to public health, it can indicate the presence of pathogenic microorganisms and be an effective indicator of hazardous events throughout the water supply system, from catchment to point of use.

National authorities therefore have a legitimate interest in monitoring turbidity with state-of-the-art instruments, as the human eye cannot reliably detect turbidity below 20 NTU. Water with this low turbidity may be aesthetically pleasing, but it can still be a health concern because pathogens can hide even in small particles. Turbidity is a helpful parameter to improve drinking water treatment plants as well as disinfection times. The World Health Organization (WHO) has published guidelines for quality aspects of drinking water, recommending turbidity values < 1 NTU for safe drinking water.



## The measurement of turbidity

**Turbidity** is nowadays mainly measured using optoelectronic meters. An artificial light source emits a known intensity of light through a sample. Suspended particles inside the sample scatter or absorb the light. The intensity of the scattered or absorbed light is subsequently detected by a photodetector, which correlates with the turbidity.

In former days, the so-called Jackson Candle was used to determine turbidity, but this method is no longer applied because of the inaccuracy of readings. However, it is still common to test turbid water based on the immersion depth method. A so-called Secchi Disc is lowered into water until it can no longer be seen due to the turbidity.

### The nature of turbidity

A turbidity signal is relative and not absolute as e.g. pH.

The intensity of scattered light depends on:

- Type of particle (absorbance)
- Concentration (number of particles)
- Size & shape of particles (absorbance – reflection)
- Wavelength of the light
- Angle between light source and detector
- Geometry / dimensions of test tube & optical pathway

## Methods of turbidity measurement

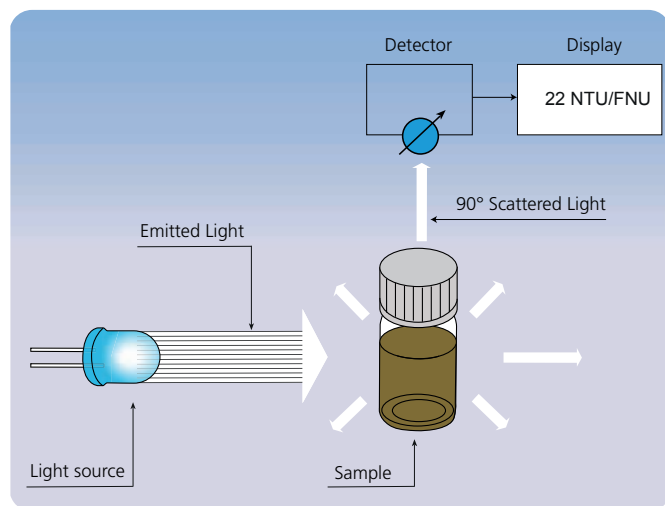


### The darker the better

Our experts solved two fundamental problems in turbidity measuring in a patented and unprecedented way. The sophisticated arrangement of the two detectors allows the analysis of low and high turbidity samples with unsurpassed accuracy over the complete measuring range up to 4,000 NTU. The angle of detection stays at 90° over the entire range, so this method remains purely nephelometric.

This ensures consistent results at any time, regardless of the size and shape of the turbidity-causing particles. The light-absorbing trap (BLAC®) eliminates stray light perfectly and provides extremely accurate results for low turbidity down to 0.01 NTU.

The new **BLAC®** technology stands for:  
**B**ackscattered **L**ight **A**bsorbing **C**avity.



### Nephelometric turbidity measurement

A nephelometer, often referred to as a turbidimeter, consists of a light source and a detector arranged at right angles to the incident light beam. The incident light beam passes through the sample and scatters the light in all directions.

In nephelometers, only the light scattered at 90° is measured to determine the turbidity of a water sample. The 90° arrangement is recommended for low turbidity (< 400 NTU) according to ISO 7027 and US EPA regulatory standards.

Turbidity readings are typically expressed in NTU (nephelometric turbidity units) or FNU (nephelometric formazin units, more common in Europe) and refer to the method as well as the standard used for the instrument.

The primary standard for calibration and adjustment of turbidimeters is based on formazin.

### Attenuation method

A turbidimeter that uses light attenuation to detect turbidity consists of a light source and a detector arranged in line to the incident light beam. The incident light beam passes through the sample, whereby part of the light is absorbed by the sample. The intensity of absorbed light at 180° is measured to determine turbidity.

ISO 7027 recommends this method only for high turbidity (> 40 FAU). The unit is expressed as FAU (Formazin Attenuation Unit) and refers to the method as well as the standard being used.

## Key applications & industries

### Drinking water

Turbidity is an important parameter for drinking water treatment and hygiene measures, especially in municipal drinking water treatment plants.

Pathogenic microorganisms can hide in solutions with high turbidity. The suspended solids prevent oxidising agents, e.g. free chlorine, from developing its disinfecting effect. Accurate turbidity monitoring ensures that drinking water can be properly disinfected and remains germ-free. A change in turbidity may also indicate defective filtration systems or main breaks in water distribution systems. Chlorine was being added to water systems in Europe since 1835 for the purpose of odor removal. Since 1890, it has been recognised that chlorine is an effective tool for disinfection. It still remains the most common disinfectant agent used around the world.

In water treatment plants turbidity must be controlled at various points from catchment to point of use. Measurement limits to be complied with depend on the regulations applicable in each country. There are also regulations for the monitoring of turbidity in drinking water distribution with routine tests along the distribution line. Regulatory compliance with standards such as ISO in Europe or the EPA in the USA is mandatory.

### Waste water monitoring

Waste water treatment is unique as it relies on maintaining ideal conditions for microbiological processes to be efficient. However, pathogenic microorganisms still need to be disposed before the water is discharged. Chlorine is added finally to kill the pathogens, but will be consumed so that there will be no residual chlorine, which could have a negative impact on ecosystems. Here turbidity can provide information about whether suspended solids have been effectively removed by filtration during clarification and how much time is required for chlorine disinfection.

### Environmental analysis

Natural events such as floods or earthquakes can cause high turbidity in rivers, dams or surface water and thus harm the environment. Living organisms in water bodies can be threatened existentially as turbidity impacts by dispersing sunlight and reducing the oxygen concentration. The respiration and reproduction of fish as well as photosynthesis is affected. Other events that can cause higher turbidity include seasonal algae growth or anthropogenic pollution from agriculture, forestry, or construction sites. Here, turbidity is an important indicator to detect harmful environmental influences in time.

### Guidelines & regulations for drinking water

WHO published guidelines for quality aspects of drinkable water recommend max limit at < 1.0 NTU

#### Max limits are decided by national governments:

|  |   |
|--|---|
| USA EPA Environmental Protection Administration          | 1.0 / 0.3 NTU   |
| German Drinking Water Ordinance (TrinkwV)                | 1.0 NTU   |
| China Ministry of Environmental Protection (former SEPA) | 1,000 mg/L dissolved solids (TDS) & turbidity < 1.0 NTU |
| Ministry of Environment Japan Tokyo                      | < 2 Degrees<br>0.1 Degrees                              |



### Laboratory analysis

In laboratories, samples from the food industry, environmental monitoring, sewage treatment and drinking water plants are part of the routine. Regular analysis of samples is mandatory for many different applications, and therefore a wide range of different turbidities are analysed in laboratories. Here, turbidity can be used as an indicator to validate the efficiency of processes, for functional control of on-line instruments and for quality control of products.

### Industrial water control

Suspended particles can cause many problems in cooling towers and related downstream equipment. Bacterial slime can form more rapidly on towers where the circulating water has high level of particles and sediments. Those can require silt removal and more frequent cleaning and can cause clogging of the water distribution system and silt-up in water basins.

Poor boiler feedwater quality increases energy consumption, reduces steam quality and purity and can reduce both production rates and product quality. Reversed Osmosis (RO) is used to produce highly purified water for drinking water systems, boilers, food and beverage processes. The quality of the feedwater determines the performance of the RO system. The maximum turbidity levels for RO is 1.0 NTU. Ultra Filtration (UF), 100 nm -1,000 nm, removes suspended solids, viruses and bacteria from feedwater, providing clean UF permeate turbidity of < 0.1 NTU.



# ISO EPA

## Regulatory compliance

ISO and the US EPA are the two main organisations that govern the design criteria of a turbidimeter and set specifications or even regulations for turbidity measurement. Compliance to one of these standards is regionally based. For example, the United States of America along with many other countries in Central and South America, Australia and parts of Asia follow the US EPA regulations.

Europe, Africa as well as some Asian countries follow ISO 7027 regulations.

It should be noted that having regulatory compliant turbidity readings is only necessary when you are testing for regulatory reporting purposes. In these cases, a local authority can advise the user of their reporting requirements.

Essentially every turbidimeter available has been designed to comply with the guidelines set by one of these organisations. There are many process control applications for turbidity outside the scope of regulatory reporting.

## Choosing a light source

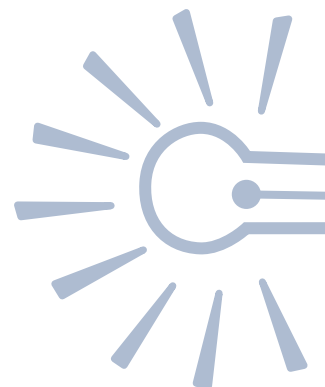
ISO 7027 requires the use of an infrared light source; while US EPA requires the use of a tungsten or "white light" source. Upon evaluation and approval, the US EPA also allows the use of other light sources, such as red LEDs and lasers, on a case-by-case basis.

Lovibond® offers a variety of different light sources for turbidity measurement. They meet different regulatory requirements. Although these light sources are regulatory approved, they are expected to deliver slightly different results. Depending on your goals you can find the best turbidimeter for your application. Choose the instrument with the light source that works best for your application.

**ISO compliant  
& US EPA (pending)**

**Selection guide for the different versions of light sources from Lovibond®**  
(WL = White Light; IR = Infrared; RED = Red Light; L = Laser)

| Suitability                   | Good | Better  | Best       |
|-------------------------------|------|---------|------------|
| EPA compliance                | -    | -       | WL, RED, L |
| ISO compliance                | -    | -       | IR         |
| Colour removal                | WL   | RED, L  | IR         |
| Lowest stray light            | WL   | RED, IR | L          |
| Detection of dissolved solids | IR   | RED, L  | WL         |
| Filtration optimisation       | WL   | IR, RED | L          |



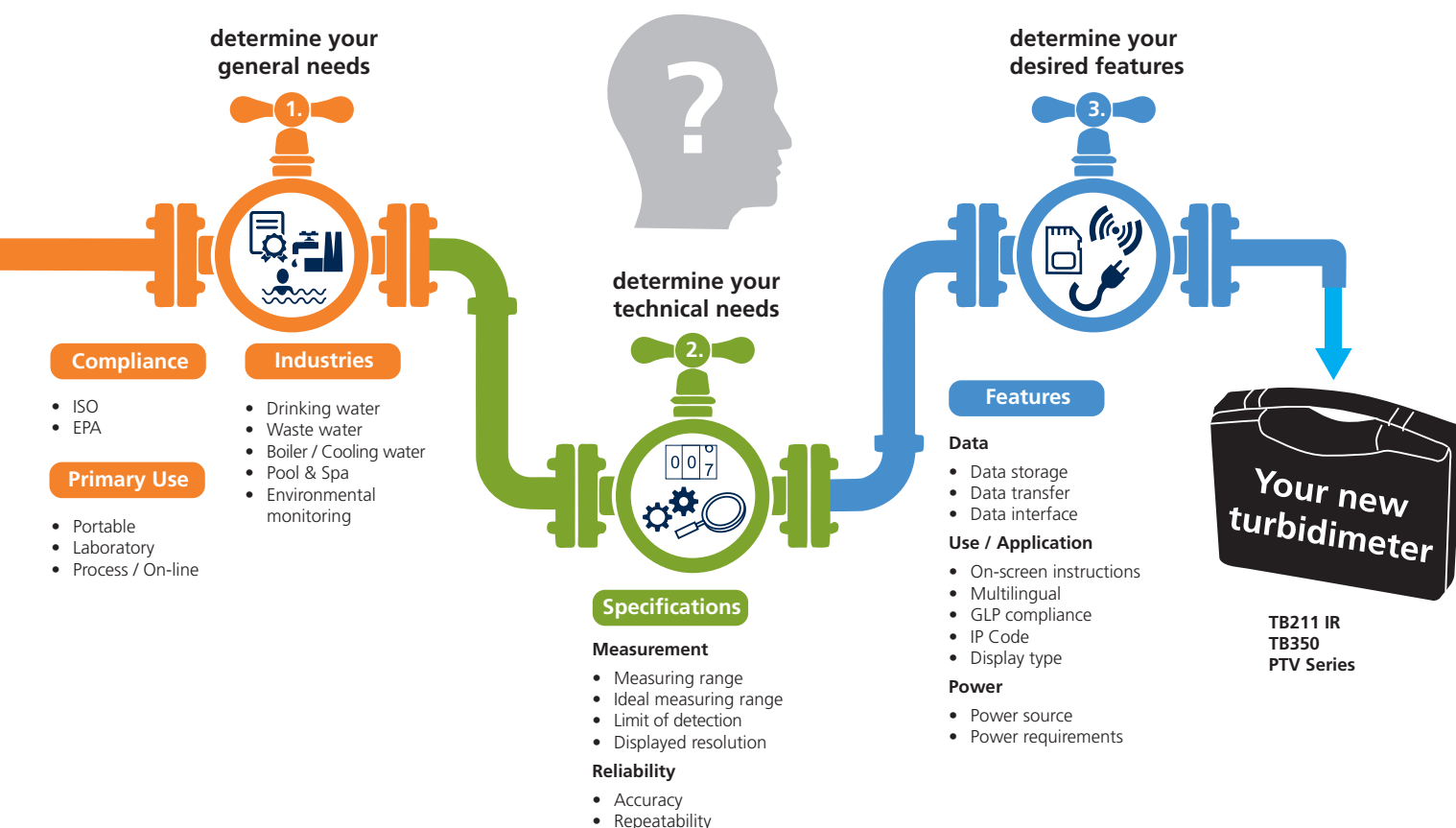
# Our solutions for you

## Follow your needs to your perfect turbidimeter

With so many options, selecting the best turbidimeter for your needs is a difficult choice. Some key things to keep in mind when considering your options are:

- Am I measuring for compliance reporting?  
If so, make sure the turbidimeter selected comply with the regulation (ISO or US EPA).
- Where am I performing my turbidity measurements?  
We have instruments designed for use in the lab, plant, field, or in-process.  
Make sure the instrument you choose is designed to operate the way you will use it.
- How is the nature of your sample?  
Is it coloured, do you have an expected value, are there fast-settling particles?
- Prioritise technical requirements and features. Some features and capabilities will matter more to you than others. Know what's most important and focus on those needs.

## Just 3 steps – choose the best turbidity solution for you



## Step one: determine your general needs

| Instrument | Compliance |     | Primary use |            |                   | Industries     |             |                  |            |                          |
|------------|------------|-----|-------------|------------|-------------------|----------------|-------------|------------------|------------|--------------------------|
|            | ISO        | EPA | Portable    | Laboratory | Process / On-line | Drinking water | Waste water | Industrial Water | Pool & Spa | Environmental monitoring |
| TB211 IR   | ✓          |     | ✓           |            |                   | ✓              | ✓           |                  | ✓          |                          |
| TB350      | ✓          | ✓*  | ✓           | ✓          |                   | ✓              | ✓           | ✓                |            | ✓                        |
| PTV Series | ✓          | ✓   |             |            | ✓                 | ✓              |             |                  |            |                          |

\* EPA approval pending

## Step two: determine your technical needs

| Key specifications | TB211 IR  | TB350   | PTV Series   |
|--------------------|---|---|--|
| Light source       | IR  | IR, WL  | PTV1000: IR, WL<br>PTV2000: Red LED<br>PTV6000: Laser        |
| Method             | Nephelometric   | Nephelometric (Multipath 90° BLAC®)                                     | Nephelometric  |
| Display units      | NTU   | NTU, FNU, Degrees, mg/L Kaolin, mg/l PSL                                | NTU, FNU, mNTU, TE/F, mg/L PSL, mg/L Kaolin, Degrees, Custom |
| Measuring range    | 0-1,100 NTU   | 0-4,000 NTU   | PTV1000 / 2000: 0-100 NTU<br>PTV6000: 0-20 NTU               |
| Resolution         | 0.01-9.99 NTU: 0.01 NTU<br>10-99.9 NTU: 0.1 NTU<br>100-1,100 NTU: 1 NTU | 0.01-9.99 NTU: 0.01 NTU<br>10-99.9 NTU: 0.1 NTU<br>100-4,000 NTU: 1 NTU | 0.0001 NTU (range depending)                                 |
| Accuracy           | 0.01-500 NTU: ± 2.5 % MV or ± 0.01 NTU<br>500-1,100 NTU: ± 5 % MV       | < ± 1.8 % MV + stray light  | 0-10 NTU: ± 2 MV<br>10-100 NTU: ± 4 % MV                     |
| Repeatability      | ± 1 % MV or ± 0.01 NTU  | < ± 1 % MV or ± 0.01 NTU  | < ± 1 % of reading   |

## Step three: determine your desired features

| Key feature           | TB211 IR      | TB350  | PTV Series   |
|-----------------------|---------------|--|--|
| Display               | Backlit LCD   | Full Colour Touchscreen  | Full Colour Touchscreen  |
| Data storage          | 125 data sets | 250 measurements, all calibration/verification data and events | user selectable data log rate of 15-sec, 30-sec, 1-min, 2-min, 5-min, 10-min, 15-min (default), 1-hour, 4-hour |
| Interface             | Micro-USB     | UBS-C, USB-A   | Micro-USB, optional Bluetooth®   |
| Data format           | CSV           | CSV  | CSV  |
| On-screen instruction | -             | ✓  | ✓  |
| Multilingual GUI      | -             | ✓  | ✓  |
| Measurement mode      | Single        | Single<br>Signal Averaging<br>Fast-Settling                    | Continuous   |
| Power saving options  | Auto-Off      | Auto-Off<br>Auto Backlit-Off<br>Sleeping Mode                  | N/A  |
| Power supply          | 9 V battery   | 4 x AA batteries<br>NiMH battery pack<br>Mains adapter         | 100-240 V / 50-60 Hz   |



## Understanding interferences

As simple as turbidity appears on first sight, it is important to understand possible influences and interferences to receive most reliable results. Turbidity readings are not always stable and may fluctuate. In most cases, the cause for that is not a defective instrument. Most suspended particles are not ideally spherical. Different orientations of an asymmetric particle can cause minor fluctuating readings as the incident light may hit particles at different positions. Signal averaging and repetitive measurements are helpful to obtain reliable readings. Strong turbidity fluctuations may result from interferences based on physical effects or material contamination and damage.

Below is a list of the most common interferences users should be aware of when measuring turbidity. Our instruments are designed to mitigate these interferences as much as possible.

| Interference          | What is it / Why it happens  | Impact on readings  | How to eliminate  |
|-----------------------|--|---|---|
| Bubbles               | Bubbles are mainly caused by adding air to a sample, e.g. by shaking the sample vial.  | Bubbles reflect light and can be a significant error that causes higher readings if not addressed.  | <ul style="list-style-type: none"><li>Let the sample sit after mixing.</li><li>Degas the sample.</li></ul>  |
| Colour                | Colour is mostly an "aesthetic parameter" and is often caused by decaying organic matter such as plants. Most common in surface water, but can be present in ground water.                               | Colour in the sample absorbs incident light and causes false low readings. Please note, instruments with an IR lightsource are not subject to this interference.  | <ul style="list-style-type: none"><li>Use a light source that is not affected by colour, e.g. infrared.</li></ul>   |
| Settling of particles | Some particles are too large and heavy to stay in suspension and sink to the bottom. Most common in samples with a turbidity value above 20 NTU.   | Can cause the stratification of a sample and can cause false low or high turbidity readings.  | <ul style="list-style-type: none"><li>Use Fast-Settling mode with TB350 or perform multiple measurements.</li></ul>   |
| Scaling & Fouling     | Scaling is generally calcium-based and forms a mineral coating on a surface. Fouling is the accumulation of biological material on a surface, often perceived as "slime".                                | These are generally more of a concern in process monitoring. Materials resulting from scaling or fouling can detach from the surfaces and cause spikes in turbidity readings that are not representative of the sample. | <ul style="list-style-type: none"><li>Check your water pipe systems.</li></ul>  |
| Condensation          | Water that collects on the outside of the sample vial. Occurs when humidity in the air comes into contact with a surface colder than the air.  | Condensation can reflect light and can be a significant error that causes higher readings.  | <ul style="list-style-type: none"><li>Let the sample adjust to RT.</li><li>Wipe condensates away using lint-free cloths.</li></ul>  |
| Stray Light           | Any light that reaches the detector that does not come from the sample is defined as stray light. Examples are internal reflections or reflections from glass and light leakage into the sample chamber. | Can cause a positive error in turbidity measurement.  | <ul style="list-style-type: none"><li>Avoid any damage, dirt and scratches on glass.</li><li>Index your vial.</li><li>Use silicon oil for low turb to remove micro scratches.</li><li>Use turbidimeters with light traps (e.g. BLAC® technology).</li></ul> |



# Evolution of instruments

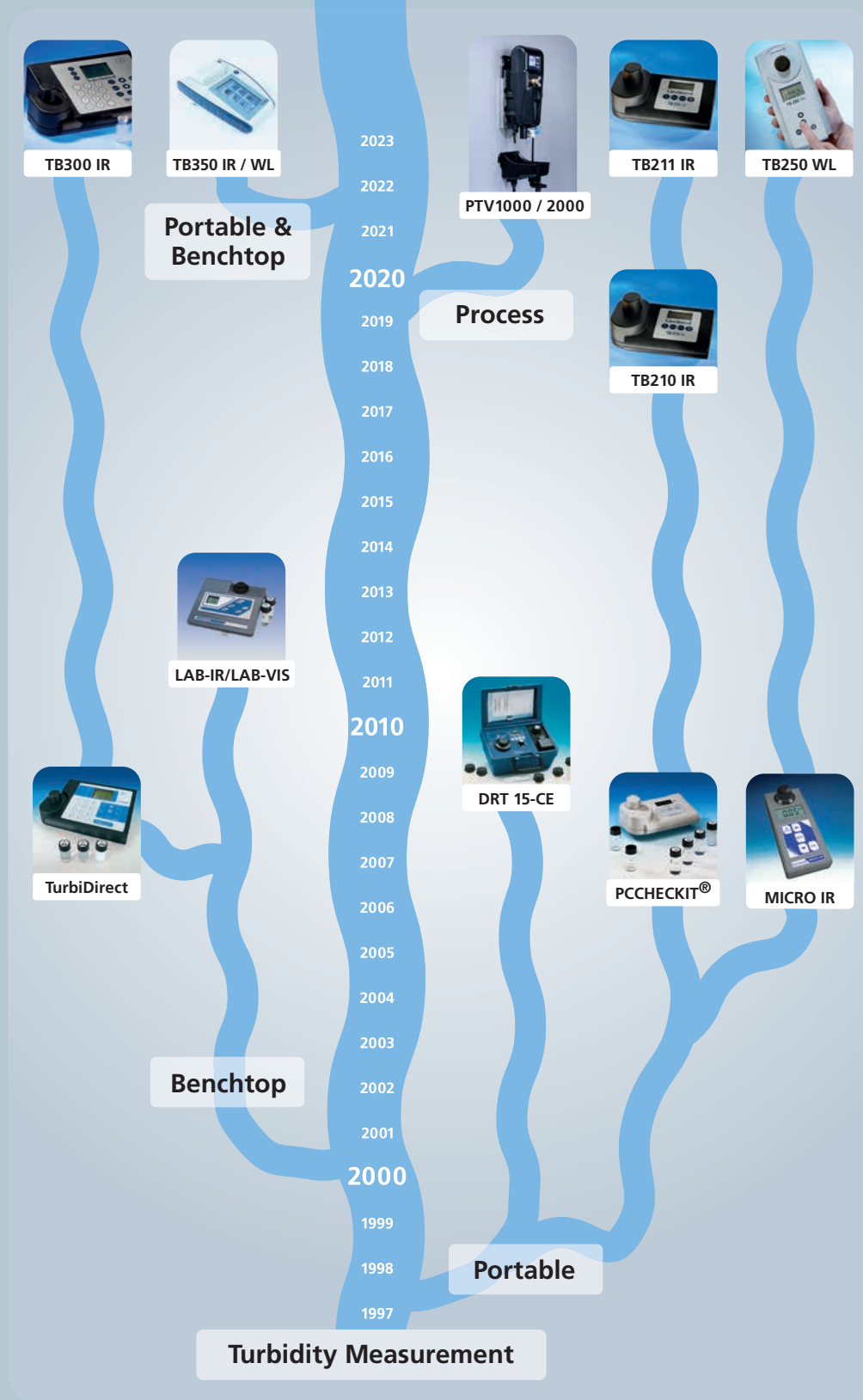
More than **25 years**  
experience in turbidity

**Lovibond® has been setting standards in water & colour analysis for around 140 years**

We developed analytical standards and instruments that have significant value in the field of water and colour analysis. Customer loyalty is particularly important to us. That's why our customers' needs are incorporated into all our technologies, which contributes significantly to the success of our brand.

We have the world's most renowned experts for the parameter of turbidity in our research and development team. Together we work on innovative solutions for the most pressing challenges in turbidity measurement.

Just discover the world of Lovibond® products and find the right instrument and standards for your purpose.



# Portable turbidimeters



## TB211 IR for fast & easy measurements

- Meets ISO 7027 testing requirements
- Lightweight & completely portable – ideal for the field
- Simple data transfer via USB interface
- Quick and easy calibration with prepared standards

### Why buy

- Low maintenance, up to 600 tests possible with one set of batteries on a single battery life
- Ready to use formazin based T-CAL® primary standards & simple operation
- Backlit display makes it easy to see the results, even in dark environments
- Ideal instrument for routine measurements  $\geq 1$  NTU

Order-Code: 266030

### i

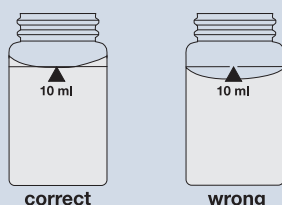
## Practical tips for turbidity measurement

### Comparison of results from different instruments

Turbidity readings from the following instruments cannot be compared:

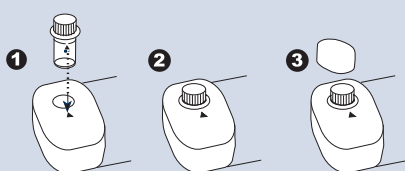
- Instruments using different light sources: IR  $\neq$  WL
- Instruments that use different methods: nephelometric  $\neq$  attenuation
- Instruments calibrated with different calibration standards
- Instruments that use the ratio method and those without this method

### Correct use of sample cuvettes



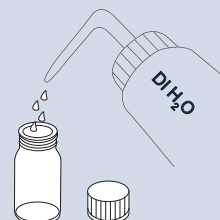
**Fill** the sample water up to the mark on the cuvette. The water usually does not fill the cuvette with a flat water surface, but with a curved one. The lowest point of the water sample should be at the level of the mark.

### Positioning of cuvettes



**Hold** the cuvettes by the cap to avoid dirt and fingerprints on the glass. Contamination on the glass can be removed with a lint-free cloth. Indexing the cuvette can help to obtain the best position for accurate measurements.

### Cleaning of cuvettes



**Rinse** cuvettes thoroughly with deionised water after each measurement. Clean with laboratory detergent and rinse with deionised water. Clean heavy contamination with 1:1 HCl followed by multiple rinses.

*elimination of stray light  
by light absorbing traps  
(BLAC®)*

*multipath  
nephelometric  
detection*

*patented  
state-of-the-art  
optical system*

## TB350 IR & TB350 WL

for lab accuracy as portable solution

- Available with infrared & white light LED
- Easy, full-colour touchscreen, user interface that provides animated & guided procedures and straightforward data management
- Multi-lingual graphical interface
- Delivers superior accuracy at low & high turbidities

### Why buy

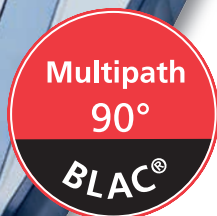
- Combines a state-of-the-art optical system with ease of use & flexibility
- 90° nephelometric detection over the complete measuring range from 0.01 up to 4,000 NTU
- Visual alert if the reading is out of tolerance
- High performance optics to ensure accuracy
- Supplied ready-to-use with sample cells, silicone oil and T-CAL® calibration standards
- 3 different modes: Single, Signal Averaging, Fast-Settling

Code TB350 IR: 194300

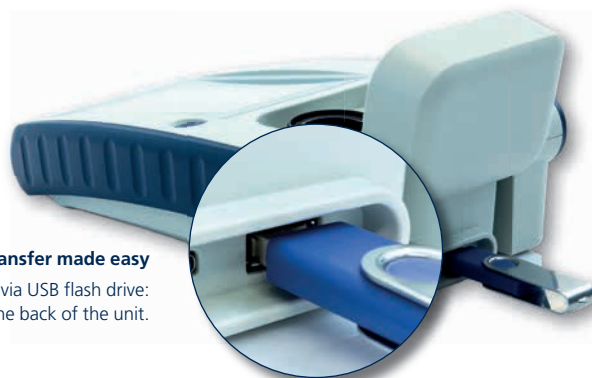
Code TB350 WL: 194310

*guided  
& animated  
procedure*

*full-colour  
touchscreen display*



Here you can  
learn even  
more about  
the TB350



### Data transfer made easy

Plug & play: Share your measurement results via USB flash drive: simply connect the stick to the USB-A port on the back of the unit.

## All you need in one case



Take it or leave it: The TB350 turbidity meter is ideal for portable use in field applications such as water distribution systems monitoring and laboratories that test a wide range of samples.

- Set of ready-to-use T-CAL® calibration & verification standards
- Silicone oil
- Cleaning cloth
- Brush for sample vials
- Sample cells with black lids
- Screwdriver
- AA batteries
- Plastic inlay usable as a tray
- Instrument dimension: 225 x 155 x 83 mm (L x W x H)

# Turbidity Standards

## T-CAL®-Standards

formazin based for turbidimeters

T-CAL® turbidity standards from Lovibond® are a stabilised formazin formulation. They are primary based standards and are US EPA and ISO compliant. T-CAL®-Standards can be used to verify and/or calibrate any turbidimeter (including Hach® instruments).



Because T-CAL®-Standards, at any turbidity level, are long time stable, they are available in a wide variety of ready-to-use bottles and sizes. This saves the user a significant amount of time preparing the standards and eliminates the chance of an improper calibration due to dilution errors. T-CAL® turbidity standards have a long shelf life and there are no concerns about degradation in climatically challenging environments.

### Single Standards for all turbidimeters

Get the whole range of formazin based turbidity primary standards for turbidimeters of any manufacturer with our T-CAL® series. Ready-to-use, prepared in a wide variety of packaging sizes.

- Stabilised solution with long shelf life
- Prevention of preparation measurement errors due to accurate mixing
- Conform to US EPA and ISO 7027 norms
- Cover a wide measurement range from < 0.1 to 4,000 NTU

| Single Standard           | Quantity | Code     | Quantity | Code     | Quantity | Code     |
|---------------------------|----------|----------|----------|----------|----------|----------|
| T-CAL®-Standard <0.1 NTU  | 125 mL   | 48012012 | 500 mL   | 48012050 | 1,000 mL | 48012099 |
| T-CAL®-Standard 0.3 NTU   |          |          | 500 mL   | 48011050 |          |          |
| T-CAL®-Standard 1.0 NTU   | 125 mL   | 48011112 | 500 mL   | 48011150 | 1,000 mL | 48011199 |
| T-CAL®-Standard 5.0 NTU   |          |          | 500 mL   | 48012250 |          |          |
| T-CAL®-Standard 10 NTU    | 125 mL   | 48011212 | 500 mL   | 48011250 |          |          |
| T-CAL®-Standard 20 NTU    | 125 mL   | 48012312 | 500 mL   | 48012350 | 1,000 mL | 48012399 |
| T-CAL®-Standard 100 NTU   | 125 mL   | 48011512 | 500 mL   | 48011550 |          |          |
| T-CAL®-Standard 200 NTU   | 125 mL   | 48011612 | 500 mL   | 48011650 |          |          |
| T-CAL®-Standard 800 NTU   | 125 mL   | 48011712 | 500 mL   | 48011750 |          |          |
| T-CAL®-Standard 1,000 NTU | 125 mL   | 48011812 | 500 mL   | 48011850 |          |          |
| T-CAL®-Standard 4,000 NTU | 125 mL   | 48012912 | 500 mL   | 48012950 |          |          |





| Standards in set           | Set quantity                                     | Code     |
|----------------------------|--|----------|
| <b>T-CAL®-Standard Set</b> | <0.1 / 20 NTU, each 2x1,000 mL                   | 48019399 |
| <b>T-CAL®-Standard Set</b> | <0.1 / 20 / 200 / 1,000 / 4,000 NTU, each 125 mL | 48019712 |
| <b>T-CAL®-Standard Set</b> | <0.1 / 20 / 200 / 1,000 / 4,000 NTU, each 500 mL | 48019750 |
| <b>T-CAL®-Standard Set</b> | <0.1 / 20 / 100 / 800 NTU, each 125 mL           | 48019412 |
| <b>T-CAL®-Standard Set</b> | <0.1 / 20 / 100 / 800 NTU, each 500 mL           | 48019450 |
| <b>T-CAL®-Standard Set</b> | 10 / 20 / 100 / 800 NTU, each 125 mL             | 48019512 |
| <b>T-CAL®-Standard Set</b> | 10 / 20 / 100 / 800 NTU, each 500 mL             | 48019550 |

HACH® is a registered trademark of Hach Company, Loveland, Colorado. The use of the HACH® trademark does not imply any affiliation with or approval by Hach Company regarding the formulation, testing or compatibility of these products for use in HACH® brand spectrophotometers or other instruments or systems.

## Standards in sets for Hach® instruments

Get the perfect set for your Hach® instrument. Choose the appropriate composition to meet your requirements.

- Stabilised, ready-to-use & long shelf life
- In compliance with ISO & US EPA
- No contact with strongly hazardous ingredients
- In precise concentrations for specific instruments

## T-CAL®-Standards in user prepared sets for Lovibond® turbidimeters

Set of stable primary-based formazin turbidity standards in sealed vials, prepared in ready-to-use concentrations to ensure quick and safe instrument verification and/or calibration. All concentrations are verified under tight quality control specifications and are compliant to US EPA and ISO standards. This set delivers all of the concentrations needed to calibrate and verify the TB350, TB211 IR and TB300 IR turbidimeter. The standards are supplied in sealed vials, eliminating any need for preparation and avoiding contact to hazardous chemicals.

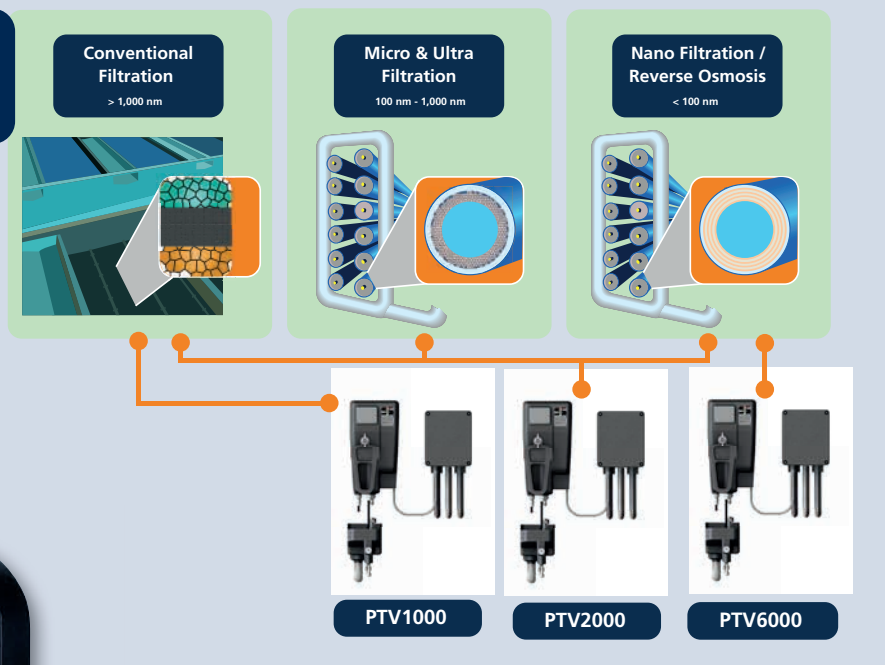
- Save time and eliminate errors – no need for dilution
- US EPA and ISO approved primary-based formazin standards
- Offered in specific concentrations for Lovibond® instruments
- Long shelf-life of more than 1 year at 5-25 °C



| Standard for instrument                           | Code   |
|---|--------|
| <0.1 / 20 / 200 / 800 NTU for TB211 IR & TB300 IR | 194150 |
| 5.0 / 20 / 800 / 2,000 / 4,000 NTU for TB350 WL   | 194152 |
| 5.0 / 20 / 800 / 4,000 NTU for TB350 IR           | 194154 |



# Process turbidimeters



*big & backlit - touchscreen  
is designed to be viewed  
from up to 15 feet away*



## PTV Series

for on-line turbidity measurement

- Protected system eliminates common errors
- Simple construction & installation
- Easy calibration & verification
- Unrivalled low flow rates of 30 to 150 mL/min (70 % less than other devices)
- Immersed detector & heated optics prevent disturbing condensation on the optics

## Why buy

- Primary based T-CALplus® formazin standards to simplify the calibration & verification
- No more complicated setup actions & endless installation attempts
- Eliminate interfering bubbles & complicated handling
- Stable, drift-free & durable LED light sources
- Primary measuring range in drinking water is 0,0001 to 100 NTU

| Instrument  | Code      |
|---|-----------|
| PTV1000 IR basic  | 6125683   |
| PTV1000 IR with flow indicator and Bluetooth                    | 6124684   |
| PTV1000 EPA / WL basic  | 5135683   |
| PTV2000 EPA / WL with flow indicator and Bluetooth              | 6134684   |
| PTV2000 EPA / Red basic   | 6145683   |
| PTV2000 EPA / Red with flow indicator and Bluetooth             | 6144684   |
| PTV6000 EPA / Laser basic                                       | 6155683   |
| PTV6000 EPA / Laser with flow indicator and Bluetooth           | 6154684   |
| <b>optional for all PTV series models</b>                       |           |
| Installation panel mounting system, a place for everything      | 19806-088 |
| Fluidics manager, sample management simplified                  | 19806-056 |
| Anybus digital interfaces (Profibus DP, Modbus or Ethernet TCP) |           |

Here you can  
learn even  
more about  
the PTV



The **stability** of formazin standards for verification and calibration of turbidimeters has been a long term issue for users. Depending on the desired concentration, dilutions of a formazin suspension may need to be discarded in as little as 24 hours. Lovibond®'s turbidity standards overcome stability issues due to a formazin stabilised formula available in different sizes and containers.

## PTV standards

### T-CAL<sup>plus</sup>®-Standards for PTV Series



Process turbidity measurement has never been easier: **T-CAL<sup>plus</sup>®** Standards are unique primary standards, based on a stabilised formazin formulation.

- Compliant with ISO standards & US EPA
- Come ready-to-use:  
5.0 NTU & 20 NTU standards for calibration  
0.3 NTU & 1.0 NTU standards for verifying
- Special cleaning kit & solution for ensuring correct results

| Standard                | Code     |
|-------------------------|----------|
| 0.30 NTU, 350 mL in bag | 48010035 |
| 1.00 NTU, 350 mL in bag | 48010135 |
| 5.00 NTU, 350 mL in bag | 48010235 |



for more details  
please download  
our leaflet "T-CAL<sup>®</sup>  
Standards"

### Calibration of PTV instruments

Easier and safer than ever: Simply connect the T-CAL<sup>plus</sup>® standard to the instrument, press the calibration button and start calibration:

- Empty the measuring chamber with the drain valve.
- Prepare the Lovibond® T-CAL<sup>plus</sup>® calibrant: Mix it simply by pressing.
- Connect the Lovibond® T-CAL<sup>plus</sup>® calibrant via the calibration tube with the service point of the instrument.
- Hang up the standard.
- The solution is now filling the flow body completely.
- At the completion a retrievable record is added to the calibration log.
- The slope or gain of the calibration is required to be within a factor of 0.5 and 2.0.
- The calibration solution bag can be used to collect the calibration solution for disposal.
- During the whole procedure there will be no direct contact with the calibration solution.



# Find out more



## Accessories

| Instrument  | Item                                       | Code      |
|-------------|--|-----------|
| Basic       | Sample cuvettes with black lid, set of 12  | 197655    |
|             | Cleaning cloth                             | 197635    |
|             | Cuvette stand for 6 round cuvettes ø 24 mm | 418951    |
|             | Cleaning brush, 11 cm length               | 380230    |
|             | Silicon oil                                | 194295    |
| TB211 IR    | Sample chamber lid                         | 19801100  |
|             | Battery 9 V                                | 1950012   |
|             | USB cable 1.5 m                            | 19802509  |
|             | Factory calibration certificate ISO 9001   | 999765    |
| TB350 IR/WL | Power supply TB series                     | 19820-170 |
|             | Batteries (AA), set of 4                   | 1950025   |
|             | USB-C cable 1 m, USB-C to A                | 19820-081 |



## Lovibond® website



Discover the product portfolio of Lovibond® and much more with one click.

## Video tutorial



The easiest way to see how it works. Just watch the videos and find out how to use our instruments.

### Tintometer GmbH

Tel: +49 (0) 231/94510-0  
sales@lovibond.com  
Germany

### Tintometer China

Tel: +86 10 85251111 ext. 330  
Customer Care China: 4009021628  
Fax: +86 10 85251001  
chinaoffice@tintometer.com  
China

### The Tintometer Limited

Tel: +44 1980 664800  
water.sales@lovibond.uk  
UK

### Tintometer South East Asia

Tel: +60 (0)3 3325 2285/6  
lovibond.asia@tintometer.com  
Malaysia

### Tintometer Inc.

Tel: +1 941 756 6410  
sales@lovibond.us  
U.S.A.

### Tintometer India Pvt. Ltd.

Tel: 1800 102 3891  
indiaoffice@lovibond.in  
India

### Tintometer Spain

Tel: +34 661 606 770  
sales@tintometer.es  
Spain

### Tintometer Brazil

Tel: +55 11 3230 6410  
sales@tintometer.com.br  
Brazil

Technical changes without notice.

Lovibond® and Tintometer® are Trademarks of the Tintometer Group of Companies

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc.

## Lovibond® Water Testing

ES France - Département Bio-Tests & Industries - 127 rue de Buzenval BP 26 - 92380 Garches  
Tél. 01 47 95 99 90 - Fax. 01 47 01 16 22 - e-mail: bio@es-france.com - Site Web: www.es-france.com