



# Turbidity Standards

© Copyright by Bioanalytic GmbH (1/4)

## General Information

Turbidity is an optical impairment of the transparency in clear liquids, gases or solids. They are caused by small particles with a refractive index that deviates from the carrier or the ability of light absorption or light scattering.

## Standardization

In order to measure the strength of turbidity in liquids in a comparable way, the liquid turbidity standard formazin was created as a reference/comparison. All turbidity units refer to dilutions of this formazin standard solution.

## Definitions

The units of measurement for turbidity are as defined below, but are also often found mixed. For ratio measurements, the unit of measurement must be marked (e.g. NTU-RATIO).

### NTU (DIN EN 27027 and ISO 7027)

Nephelometric Turbidity Unit.

Light source: Infrared 860 nm  
Measuring angle: 90° (non-Ratio)  
Regulations: DIN EN 27027 and ISO 7027.

### NTU (US EPA)

Nephelometric Turbidity Unit.

Light source: White light  
Measuring angle: 90° (non-Ratio)  
Regulations: US EPA (US Environmental Protection Agency) Standard Methods 180.1, 2130 B

### NTU-RATIO

Nephelometric Turbidity Unit Ratio.

Light source: White light  
Measuring angle: see instrument description  
Regulations: none = instrument-specific

### FAU

Formazine Attenuation Units.

Light source: Infrared 860 nm.  
Measuring angle: 0°/180°  
Regulations: DIN EN 27027 and ISO 7027.

### FNU

Formazine Nephelometric Units.

Light source: Infrared 860 nm.  
Measuring angle: 90°  
Regulations: DIN EN 27027 and ISO 7027.

### FTU

Formazine Turbidity Unit.

Light source: White light.  
Measuring angle: 90°  
Regulations: US EPA (US Environmental Protection Agency) Standard Methods 180.1, 2130 B.

### TE/F

Turbidity unit/formazin

German unit used in water treatment. Less common.

### EBC

European/international turbidity unit used for beer brewing.

FAU = FNU = FTU = NTU = TE/F

Only applies to formazine.

All other liquids provide different values for the different measuring methods (measuring angles). Conversions between the units are not possible.

## Metrological Methods

Currently, 2 metrological methods are standardised and recognised:

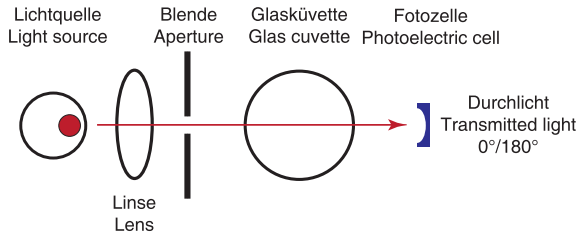
- Measurement with infrared light 860 nm according to DIN EN 27027 and ISO 7027
- White light measurement according to US EPA (US Environmental Protection Agency) Standard Methods 2130 B

## Principle

The results of the following methods can only be compared to a limited extent with each other.

### Transmitted Light Measurement

The transmitted light, which hits the photocell in a straight line (0°/180°), is measured. This measurement can be carried out on suitable photometers. Such systems are particularly suitable for measuring medium and high turbidity. With low turbidity values, the resolution between irradiated and continuous radiation is too low to obtain acceptable results.



Photometric principle

Product Information Turbidity Standards

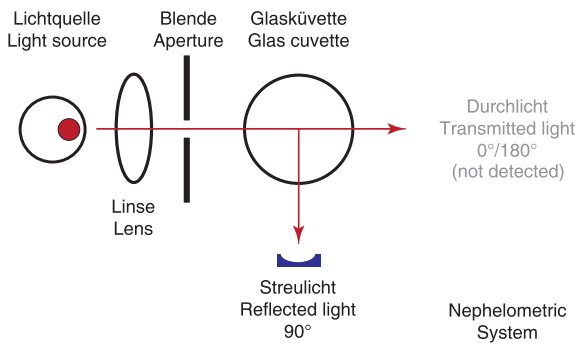
2023-10-30

(en)

030000-PR01

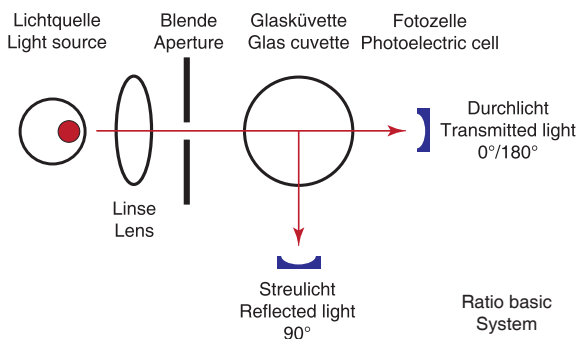
### Nephelometric = Reflected Light Measurement 90°

The reflected light is measured at an angle of 90°. The measurement method is particularly suitable for low turbidity values.



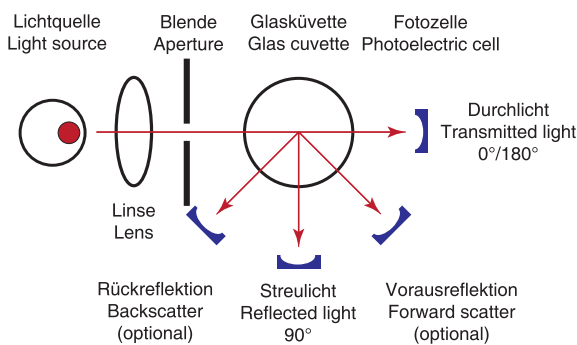
### Ratio Basic

"Ratio" is the simultaneous or proportional measurement with several detectors. The simplest version is the simultaneous measurement of scattered light at 90° and transmitted light 0°/180°.



### Ratio Plus

There are further instrument versions with additional (optional) detectors. These can be detectors for reflection and forward reflection.



### Formazin Turbidity Standards

Formazin turbidity standards are per se the definition of the turbidity level (golden standard). Turbidity standards must produce identical readings on the different instrument types. If they do not, the instrument is out of specification for turbidity.

Formazin turbidity standards are aqueous suspensions of formazin and are the reference suspension for all turbidity measurement methods. Bioanalytic's turbidity standards are stabilized by a special process and can be used for calibration, control, validation or qualification of almost all brands and models of turbidimeters.

#### Advantages:

- Formazin turbidity standards are the reference suspension for all turbidity measurement methods.
- The turbidity standards can be used for almost all brands and models of turbidimeters.
- Formazin is the calibration reference and all measurement units give the same turbidity measurement result.
- Formazin turbidity standards are essential for instrument development.

#### Risks and Safety

Please observe the necessary precautions for use of laboratory reagents. Applications should be performed by expert personnel only.



[www.sds-id.com](http://www.sds-id.com)

For additional safety information please refer to the information on the label and the corresponding Safety Data Sheet (SDS).

Download via QR code or link: [www.sds-id.com/100192-1](http://www.sds-id.com/100192-1)

### Polymer Bead Turbidity Standards

Polymer Bead Turbidity Standards are aqueous suspensions of extremely monodispersed polymer microparticles ( $\pm 1\%$ ) in a specially prepared aqueous solution.

Polymer Bead turbidity standards are available for both measurement methods in accordance with DIN EN 7027 / ISO 7027 and US EPA.

#### Advantages:

- No toxic ingredients.
- Stabilized against germ growth.
- Contains additives for better wetting of the cell surface and easier rising of air bubbles. This improves the precision of the measurement.
- No special requirements for handling and disposal.

#### Disadvantages:

- Values depend on the turbidimeter / measurement method (ratio / non-ratio). Indication of the results of different measurement methods in the certificate of analysis.

#### Risks and Safety

Please observe the necessary precautions for use of laboratory reagents. Applications should be performed by expert personnel only.



[www.sds-id.com](http://www.sds-id.com)

For additional safety information please refer to the information on the label and the corresponding Safety Data Sheet (SDS).

Download via QR code or link: [www.sds-id.com/100190-3](http://www.sds-id.com/100190-3)

## Application

### **Ratio vs. non-Ratio**

The measuring methods non-Ratio / Ratio are a sole characteristic of the respective measuring instruments. This only describes the measuring method. Devices with "Ratio" also consider transmitted light and/or other reflection angles in addition to 90° radiation.

An algorithm can be used to partially compensate for disturbing effects of scattered light and sample coloration.

### **ATTENTION!**

The ratio methods do not correspond to the metrological regulations according to the two currently standardized metrological procedures!

The advantages of the ratio methods are more noticeable at high values.

Please refer to the instrument's instructions for use to find out whether your instrument can also measure "ratio" and whether it has an automatic and/or manual switchover for this purpose.

### **Example for automatic or manual switchover**

< 40 NTU = non-ratio

≥ 40 NTU = Ratio

For a normative related measurement switch Ratio to OFF.

### **Which standard type is the right one for me?**

First and foremost, make sure that you choose the measurement method (DIN ISO or US EPA) you require.

For measurement values < 40 NTU, non-ratio measurement is usually recommended. Further information can be found in the instruction manual of your measuring instrument.

## Notes

The above information refers exclusively to our products and cannot be taken for products of other manufacturers.

### **Shelf Life**

In the original sealed condition, the turbidity standards can be kept under the storage conditions specified on the label until the printed expiry date. Keep bottles well closed and protected from direct light.

### **Support / Information service**

For methodological and technical support, please contact us by E-Mail at [support@bioanalytic.de](mailto:support@bioanalytic.de) (German, English).

Periodically check for updates of this product information on our website.

### **Feedback**

Information from users can be reported to [support@bioanalytic.de](mailto:support@bioanalytic.de) (German, English).

Suggestions for further developments will be considered.

### **Waste Management**

Please observe your national laws and regulations.

Used and expired solutions must be disposed of in accordance with your local regulations.

Inside the EU, national regulations apply that are based on the current, amended version of Council Directive 67/548/EEG on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

Decontaminated packaging can be disposed of as household waste or recycled, unless otherwise specified.

## Literature & Footnotes

- Graphical symbols and labels used are available according to the standard or on our website.
- EN ISO 7027 ([www.beuth.de](http://www.beuth.de), [www.iso.org](http://www.iso.org))
- US EPA ([www.epa.gov](http://www.epa.gov)).

\*\* Turbidity value in accordance with the stated measuring method.

# Appendix

## Formazin

<b>Formazin</b>				
FTU/NTU	System	REF	Gebinde	
0.0	FTU/NTU	-	030200-1010	1000 ml
1.0	FTU/NTU	-	030205-0250	250 ml
2.0	FTU/NTU	-	030206-0250	250 ml
4.0	FTU/NTU	-	030207-0250	250 ml
5.0	FTU/NTU	-	030208-0250	250 ml
10.0	FTU/NTU	-	030209-0250	250 ml
20.0	FTU/NTU	-	030210-0250	250 ml
40.0	FTU/NTU	-	030211-0250	250 ml
50.0	FTU/NTU	-	030212-0250	250 ml
100	FTU/NTU	-	030214-0250	250 ml
200	FTU/NTU	-	030215-0250	250 ml
400	FTU/NTU	-	030216-0250	250 ml
500	FTU/NTU	-	030217-0250	250 ml
1000	FTU/NTU	-	030218-0250	250 ml
2000	FTU/NTU	-	030219-0250	250 ml
4000	FTU/NTU	-	030220-0250	250 ml

Size: 250 ml = Brown glass bottle with pouring ring.  
Other package sizes and other (any) values are available on request.

<b>Formazin Dilution Sheet for 1000ml Turbidity Standard</b>			
FTU/NTU	Verdünnung	4000 FTU/NTU REF 030220-	
0.0	FTU/NTU	—, —	
0.1	FTU/NTU	1:40000	25.0 µl
0.2	FTU/NTU	1:20000	50.0 µl
0.5	FTU/NTU	1:8000	125.0 µl
1.0	FTU/NTU	1:4000	250.0 µl
2.0	FTU/NTU	1:2000	500.0 µl
5.0	FTU/NTU	1:800	1.25 ml
10.0	FTU/NTU	1:400	2.50 ml
20.0	FTU/NTU	1:200	5.00 ml
50.0	FTU/NTU	1:80	12.5 ml
100	FTU/NTU	1:40	25.0 ml
200	FTU/NTU	1:20	50.0 ml
500	FTU/NTU	1:8	125 ml
1000	FTU/NTU	1:4	250 ml
2000	FTU/NTU	1:2	500 ml
4000	FTU/NTU	—	1000 ml

The indicated volumes are filled with Formazin Diluent (REF 030200) at 20 °C ±0.5 °C to 1000ml. The preparation vessels must be pre-rinsed beforehand with dilution solution (REF 030200) without particles. Instead of Formazin Diluent, freshly distilled water 0.1 µm filtered can also be used.

Prepare this dilution fresh daily.

Observe the laboratory guidelines and the safety data sheet during processing!  
Make sure that the dilutions produced are labelled correctly.  
Certificates and documents from Bioanalytic are invalid for the self-produced dilutions or can only be used within the scope of their own self-documented traceability.

## Polymer Bead

<b>Polymer Bead non Ratio</b>				
NTU		REF	Gebinde	
0.00	NTU	non-Ratio	030100-...	100/500 ml
1.0	NTU	non-Ratio	030105-...	100/500 ml
2.0	NTU	non-Ratio	030106-...	100/500 ml
4.0	NTU	non-Ratio	030107-...	100/500 ml
5.0	NTU	non-Ratio	030108-...	100/500 ml
10.0	NTU	non-Ratio	030109-...	100/500 ml
20.0	NTU	non-Ratio	030110-...	100/500 ml
40.0	NTU	non-Ratio	030111-...	100/500 ml
50.0	NTU	non-Ratio	030112-...	100/500 ml
100	NTU	non-Ratio	030114-...	100/500 ml
200	NTU	non-Ratio	030115-...	100/500 ml
400	NTU	non-Ratio	030116-...	100/500 ml
500	NTU	non-Ratio	030117-...	100/500 ml
1000	NTU	non-Ratio	030118-...	100/500 ml
2000	NTU	non-Ratio	030119-...	100/500 ml

Gebinde: REF ...0100 = 100ml  
REF ...0500 = 500ml  
Andere Gebindegrößen und andere (beliebige) Werte sind auf Anfrage lieferbar.

<b>Polymer Bead Ratio</b>				
NTU		REF	Gebinde	
0.00	NTU	Ratio	030400-...	100/500 ml
1.0	NTU	Ratio	030405-...	100/500 ml
2.0	NTU	Ratio	030406-...	100/500 ml
4.0	NTU	Ratio	030407-...	100/500 ml
5.0	NTU	Ratio	030408-...	100/500 ml
10.0	NTU	Ratio	030409-...	100/500 ml
20.0	NTU	Ratio	030410-...	100/500 ml
40.0	NTU	Ratio	030411-...	100/500 ml
50.0	NTU	Ratio	030412-...	100/500 ml
100	NTU	Ratio	030414-...	100/500 ml
200	NTU	Ratio	030415-...	100/500 ml
400	NTU	Ratio	030416-...	100/500 ml
500	NTU	Ratio	030417-...	100/500 ml
1000	NTU	Ratio	030418-...	100/500 ml
2000	NTU	Ratio	030419-...	100/500 ml

Size: REF ...0100 = 100ml  
REF ...0500 = 500ml  
Other package sizes and other (any) values are available on request.