

Manual

Version 10.09.2024

Transmitter Model C1

Turbidity Measuring Probe Model ProScat-12

12° Forward Scattered Turbidity Meter

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Some countries do not allow the limitation of liability, so that this exclusion is possibly not valid for you.

Warranty conditions

The warranty for this product takes place according to the legal provisions. As place of warranty we explicitly name Chemtronic Waltemode GmbH, Monheim am Rhein, Germany. Chemtronic will charge the additional expenses e.g. travel expenses, overnight cost, etc., in case of warranty service at the customer site.

Consumable parts as well as wearing parts e.g. lamps, gaskets, etc. are not covered by warranty.

Improper use, gross negligence, use of the system outside of the technical specifications, missing or improper maintenance will cause a loss of the warranty claim. Please pay attention to our general terms of contract.

Storage

Please inspect the instrument immediately after receiving for potential shipping damages.

If the instrument has already been unpacked for inspection or testing, or if the instrument has been removed from the process and it is not to be installed or reinstalled for more than 1 day, the following procedure should be observed:

1. If the instrument has been in service, the wetted portion should be thoroughly cleaned (typically with clean water) and then thoroughly dried.
2. In case the original packing material is not available, place the instrument in a sealed heavy plastic bag with a desiccant added to assure clean dry storage.
3. The instrument should then be stored in a protected area until time of installation.

Safety instructions

Take notice to the following general safety instructions during use and operation of the system. Ignoring these instructions or special warnings inside of this manual can damage the sensor, cause inaccurate measurements, and possibly result in unsafe installations. Chemtronic Waltemode GmbH will not take any responsibility for consequences arising from ignoring the safety instructions and warnings.

For ALL chemical liquids

Reagents, standards or the measured product may be toxic or otherwise harmful to human health. Observe appropriate precautions when handling and disposing the reagents. Review the appropriate published material safety data sheets regarding the safe handling and disposal of all these products.

Electrical installation

Qualified technical personnel must perform the electrical installation of the system.

Hazardous area

DO NOT INSTALL the system in hazardous.



Do not install the system in hazardous areas (Ex Zone 0, Ex Zone I, Ex Zone II) without the optional explosion proof approvals and certifications.



Maintenance

Always disconnect the instrument from power during maintenance, replacement of components, installation of additional components or any other operations at the open instrument.

Only qualified technical personnel must perform this work.

Operating the instrument with open enclosure

Only qualified technical personnel should operate the instrument when the enclosure is open (e.g. during repair or calibration procedure). Be careful that no moisture enters the enclosure.



Some components inside the instrument are energized with voltages, which can cause lethal shocks in case of contact. Be careful during installation, handling and operation of the instrument.



Improper installation / operation of the system

Warranty is void if the system is / was installed improperly, handled improperly, used outside of the technical specifications or damaged by gross negligence.

Package Content

- 1.) Transmitter model C1with turbidity probe model ProScat-12 according to user's specification.
- 2.) USB Stick with C1_Config- Software and Documentation
- 3.) USB cable.
- 4.) Printed Manual and Documentation



Please contact us immediately in case of an incomplete delivery or in case of an damage off one of the components.



Installation Guidelines



The measuring system is typically delivered with a factory calibration according to user's specification. The device is ready for use without further calibration / configuration.



Make sure that Instrument is disconnected from the mains, during wiring procedure.

Danger, take notice!



Make sure that your pipe is not pressurized or at low pressure before you insert or retract your probe to process. Before beginning any work the sensor must be cleaned and flushed thoroughly. Depending on customers' application product residues can be very dangerous (aggressive, poisonous).

Wear protective equipment if necessary (masks, safety glasses, protective gloves, etc.).

Transmitter Model C1

- Transmitter and Sensor are sensitive components, do not drop and handle with care.
- Please do not use the system in case of any visible mechanical damages!
- Do not operate with open enclosure. Exposed electronics will promote the risk of electrical shock and might cause damage to the unit.
- The enclosures of sensor and transmitter fit IP65 / Nema 4x protection class.
- Follow the wiring diagram in this manual.
- Supply voltage: 24VDC $\pm$ 10% (optional 100-240VAC, 50-60Hz), observe type plate!
- Proper instrument grounding: The instrument must be grounded to avoid electrical shock hazards to personnel and damages to the unit.
- The power consumption of the Instrument is less than 15W.
- Relay ratings for alarms and control of external devices are 1 A at 24VDC.
- Analog output: 0/4-20mA, max. 500Ohm (isolated)
- The ambient temperature for the Transmitter must be in a range of -10°C to 60°C (use dry purge air above 40°C approx. 10 l/h).

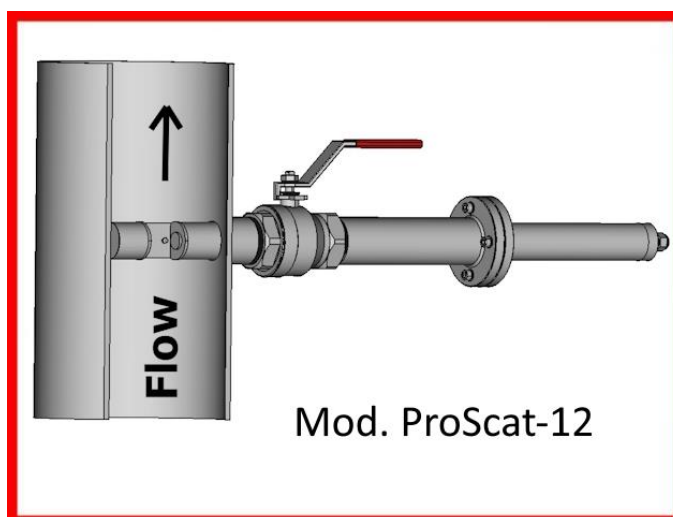
Sensor Model ProScat-12

- The sensor is configured according to the application and typically factory calibrated. Before installing the sensor, check that the device is calibrated to the desired measuring range.
- Since in many cases calibration is performed with liquid standards inside the measuring cell, do not install sensors in the pipeline before calibration.
- Keep sensor cables as short as possible (At least 0.5m away from power lines to avoid interferences).
- We recommend leaving the cables on the sensor 2m longer, so that the sensor can be placed on the ground floor for calibration and maintenance.
- Check lamp voltage in case of shortening the sensor cables, set voltage to a value of 5V DC (excessive lamp voltage reduces the service life of the measuring lamp).
- Avoid air and gas bubbles in the measuring cell of the sensor, they cause noise and drift of the measured values. (Degassing is not to be expected at pressures above 2 bar, in aqueous solutions).
- Ideally, install the sensor in a vertical riser line to make sure that gas bubbles can escape with the product flow.
- Purge sensor with dry, oil-free instrument air (approx. 10 l/h), when measuring cold media below the dew point. Measuring results will be impaired by condensation water at the windows. Condensation water inside the sensor may lead to the destruction of the optic's and detector system.
- Purge the sensor with dry, oil-free instrument air (approx. 10 l/h) in case hot media above 110°C.
- Use original parts only.
- When using the optional cleaning nozzles (measuring cell cleaning), ensure that the pressure of the cleaning liquid is at least 50% above the process pressure. The installation of a check valve is strongly recommended.



Exceeding the specified maximum pressure and/or the specified maximum temperature represents a high safety risk.

Installation example probe model ProScat-12 (Process insertion via ball valve)



Principle of Operation

What does turbidity mean?

Turbidity is an optical impression, which describes the characteristic of a transparent product, to scatter light. A focused light beam will be attenuated and scattered in hazy products, so that this product can become practically opaque in bigger layers.

What causes turbidity?

Turbidity is caused by particles in transparent products. A particle is defined as something with a different refractive index as the carrier product. Some examples of particles are minerals, yeast cells, metals, oil drops in water, milk in water, gas bubbles and aerosols.

Measurement of turbidity

Turbidity is not a clearly defined magnitude like e.g. temperature or pressure.

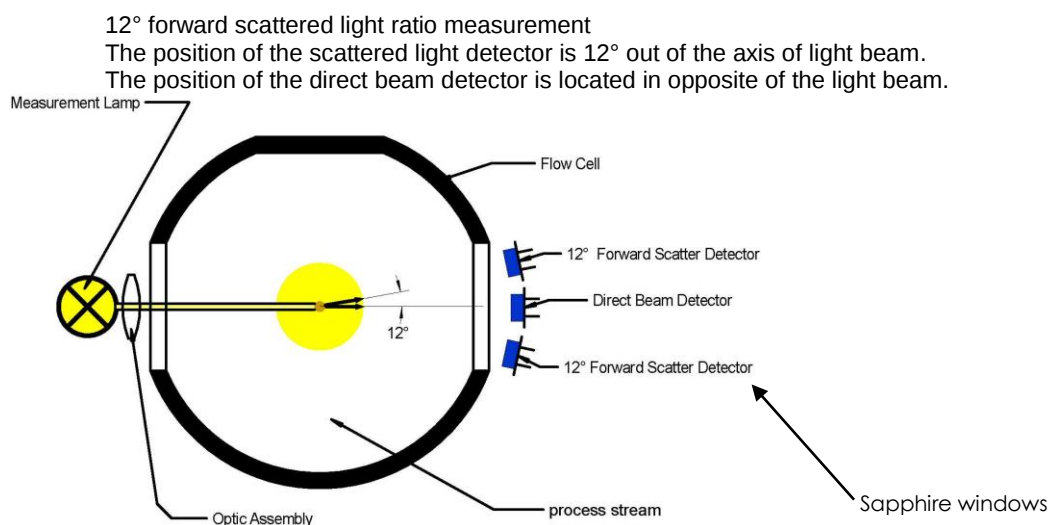
Turbidity is a subjective impression. For this reason, turbidity measurement systems will be typically calibrated by using a comparison's standard such as Formazin and Diatomaceous Earth.

Principle of measurement

The 12° forward scatter ratio method:

The forward scatter method is typically used at low turbidities and produces nearly mass related measurement results. This means that a small particle causes a low scattered light intensity and a large particle causes a high scattered light intensity. This allows a calibration in mg/l in case the specific weight of the particles is at about 1kg/dm³.

Main applications are quality control, filtration control, oil in water, etc.



An intense collimated beam of light is projected through a sample inside of the flow cell.

The intensity of the light beam is measured by the direct beam detector, located opposite to the light source.
The intensity of the scattered light, is measured by the scatter light detector.

The ratio of scattered and direct light signals, compensate for changes in product color, lamp ageing and window coatings. The signals will be processed as followed:

$$\frac{\text{Scattered light signal}}{\text{Direct light signal}} = \text{Turbidity value}$$

The particles inside the liquid flow decrease the intensity of direct light, and increase the intensity of the scattered light, that means the turbidity rises.

Product color, lamp ageing and window coatings decrease the intensity of direct **and** scattered light in same ratio that means the turbidity value stays constant.

Typical Measuring units

ppm:	Parts per million	FNU ¹ :	Formazin Nephelometric Unit
FTU:	Formazin Turbidity Unit	mg/l:	Milligram per liter
TEF:	Trübungseinheiten Formazin (German for FTU)	gr/l:	Gram per liter
EBC:	European Brewery Convention	% TS:	Percent total solids
NTU ¹ :	Nephelometric Turbidity Unit		

The dependencies on the different measuring units

1 FTU = 1 TEF = 1 NTU¹ = 1 FNU¹ = 0,25 EBC

¹ Nephelometry describes the method of side scatter turbidity measurements, these units are used at 90° side scatter turbidity meters only.

Based on comparisons measurements, by using a 12° forward measurement system we have found the following dependencies.

1 FTU = 1 TEF = 0,25 EBC = 2,05ppm = 2,05 mg/l = 0,00205 g/l = 0,00000205 % TS

* At a specific particle weight of 1 kg/dm, 1mg/l particles in 1 kg of water will correspond to 1ppm.

Typical ranges

The original design of scatter light turbidimeter was used for the detection of low turbidities. The resolution of these instruments is suited easily in ranges lower as 0.1ppm (approx. 0.05 TEF / FTU / FNU / NTU or approx. 0.01EBC) and better. The maximum range is in ideal case lower than 200ppm, but there are as well systems available with a range of more than 8000ppm.

Please take notice:

There are turbidity meters with several different methods of measurement available!

Make sure that your turbidity meters operate according to the same principle of measurement, if you compare measurement results.

For example:

you can compare 90° vs. 90° scattered light turbidity meters, or 12° vs. 12° scattered light turbidity meters.

Never compare turbidity meters with different methods of measurement!

Software Installation (C1-Config Software)

System Requirements

Supported Operating Systems	Microsoft Windows 7, 8, 10
Requirements	Microsoft.NET Framework 4.72 (x86 & x64)
RAM	2GB
Hard Disk Space	< 1MB

Installation Procedure C1-Config Software

- I. Close any open programs that are running on your computer before starting the installation.
- II. Double click on setup.exe.
- III. Software installs automatically

Connect C1 Transmitter to a PC- or Laptop

Connect the device according to the connection diagram and switch on the device. Then connect the PC/laptop to the C1 measuring amplifier using the USB cable (not vice versa).

To perform a restart, always disconnect the USB plug as well.



Take Notice:

The USB- connector of the C1 is located under the cover cap at the outside of transmitter enclosure.

C1-Config Software

Start Software per click/double click on the C1-Config icon.

Select Language

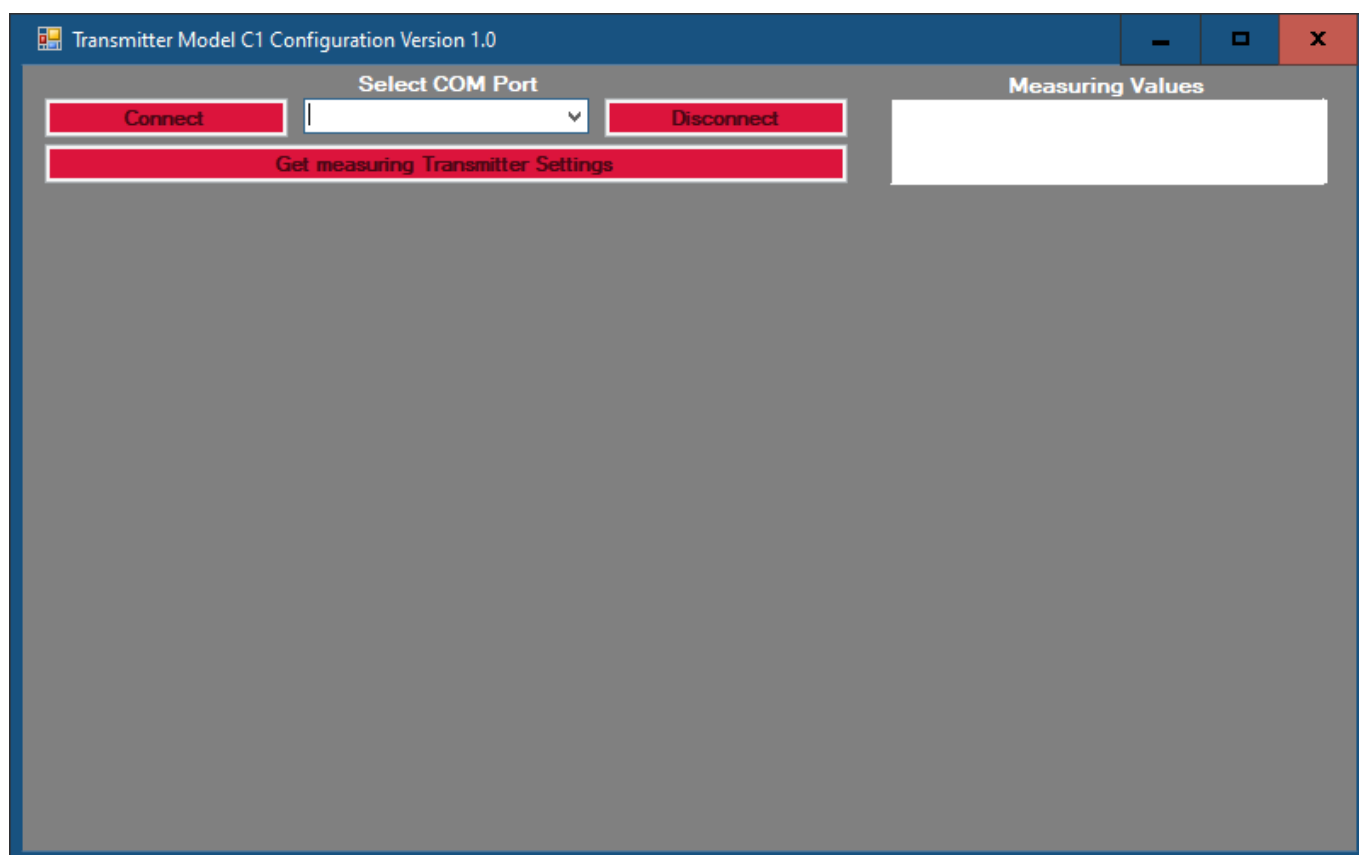


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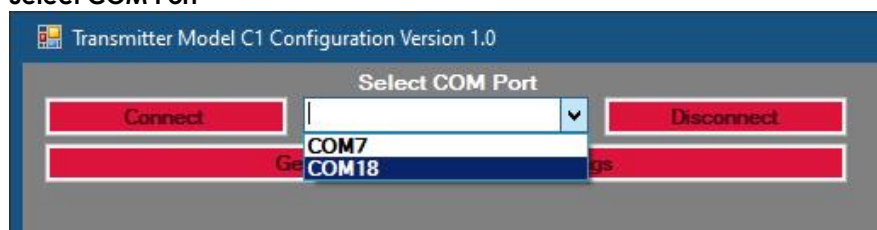
C1- Configuration Software



Select your language and proceed!



Select COM Port



Select the COM port of your turbidity meter, click “connect” button and then the “Get Settings” button.



Finding the correct COM Port:

Shut down C1-Config software. Disconnect USB cable.

Restart software, go to “Select COM Port”, look to the list of active Ports.

Shut down C1-Config software again. Reconnect USB cable.

Restart software; go to “Select COM Port”, Com Port list shows now the additional Port of the instrument. Select these COM port and click “Connect Button”.

A click to the “Get measuring Transmitter Settings” button will transfer the current transmitter settings and measuring values to the screen.

Set measuring Range

Adjust or enter your measuring range.

Enter measuring Unit

Allows entering an application specific measuring unit like ppm, mg/l, EBC, FTU, ...
The measuring unit is limited to four characters (ASC II).

Set Damping

The Damping function averages the last measuring results of the instrument.
The instrument displays always the average of the last 6 results, in case the Damping is set to "6",
This makes readings more stable and protects for measuring outliers.
Damping can be set between "1" and "25".

Adjust Zero Offset

Adjust Zero Offset allows to set the instrument readings to "0".
Zero offset procedure requires clear almost turbidity free liquid inside of sensors flow cell.



Take Notice:

Use ultra pure liquids without bubbles / particles only in case you like to shift "0" reading of the instrument.

Adjust Gain

Adjust Gain allows a correction of the instrument reading at a known turbidity.

Example:

Instrument reading: "0.95"

Turbidity: "1.00"

Gain must be set to "1.05" to result a reading of "1.00" ($0.95 \times 1.05 = 1$)

Set Relay Setpoint

The "Relay Setpoint" defines the switching point of the alarm relay.

Set Relay Hysteresis

The hysteresis affects the relay setpoint.

Following settings: setpoint "2.00" and hysteresis "0.1"

Alarm will be switched at "2.1" and reset will be switched at "1.9"

So alarm switching point will be (setpoint + hysteresis)

and reset will be (setpoint – hysteresis).



Take Notice:

All Settings you change (Range, Damping, Zero, Gain, etc.) will be immediately transferred via USB to instrument's measuring electronic! But they are not in the permanent memory. So a reset or power on off will restore the old settings.

Apply Settings to Transmitter

Stores new settings (Range, Damping, Zero, Gain , etc.) to the permanent memory of the measuring electronic!

Save Settings to File

Store a backup of your instrument settings onto the hard disc of your computer / laptop. The backup files are in txt format and located at C:/Chemtronic_C1.



Take Notice:

We strictly recommend to backup the factory settings of the instrument before you do any changes at the instrument settings.

Read Settings from File

Read a backup file from the hard disc of your computer (data recovery).

Calibration



Danger, take notice!

Make sure that your pipe is not pressurized or at low pressure before you retract your probe from process. Before beginning any work the sensor must be cleaned and flushed thoroughly. Depending on customers' application product residues can be very dangerous (aggressive, poisonous).

Wear protective equipment if necessary (masks, safety glasses, protective gloves, etc.).

Notice:

- Qualified technical personnel must perform repair and maintenance.
- Avoid pulling and twisting of the probe cable.
- Avoid applying excessive force during installation and reinstallation of the probe.
- Please be sure that no dust or other particles penetrates into the optical assembly.
- In case of any dirty components please clean carefully by using fresh water and a cloth (lint-free), dry all components by using instrument air.
- Use suitable tools only.

Benötigtes Werkzeug:

- PC/Laptop with installed C1_Config Software
- USB- Cable
- Plugs or blind flanges to seal / fill the flow cell

Example calibration (Range 0-1000ppm)

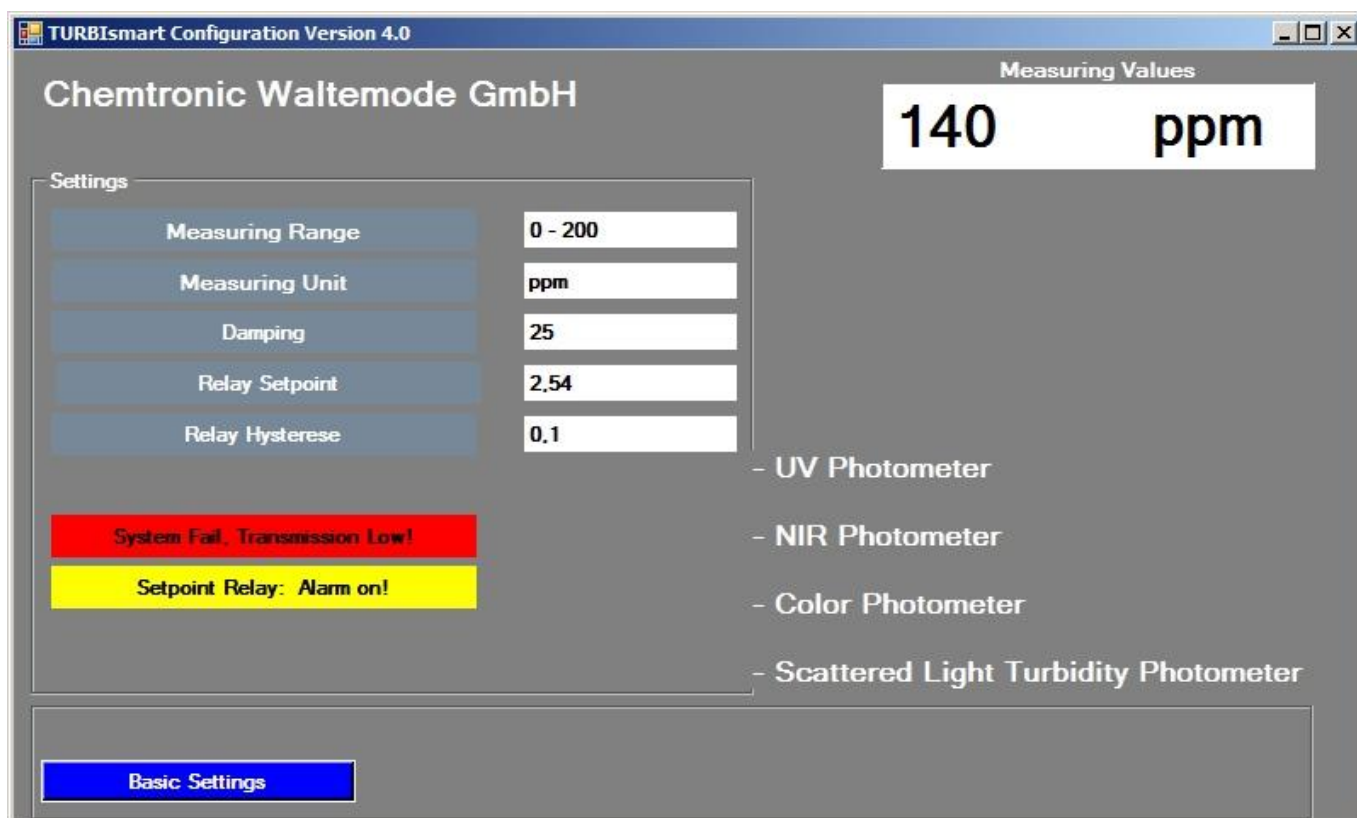
- 1.) Uninstall sensor from pipe.
- 2.) Fill sensor's flow cell with low concentration calibration standard (zero liquid).
Typically distilled- or demineralized- water.
Take notice that distilled- / demineralized water does not have an absolute zero concentration.
The turbidity of laboratory grade distillate shows typically a turbidity value of 0.1 - 0.3ppm
- 3.) Make sure that the optical path of the sensor is completely submerged.
Make sure that there are no bubbles in the optical path.
Protect flow cell against ambient light.
- 4.) Connect your PC/Laptop via USB to the C1 Transmitter and start the C1-Config software.
- 5.) Use "Adjust Zero Offset" to set the instrument reading to a reading of "0.2ppm".
- 6.) Empty your flow cell
- 7.) Fill sensor's flow cell with a 900ppm calibration standard.
Take notice, the calibration standard should have a concentration of about 75% to 100% of calibrated range (90% of 1000ppm = 900ppm in our example)
- 8.) Make sure that the optical path of the sensor is completely submerged.
Make sure that there are no bubbles in the optical path.
Protect flow cell against ambient light.
- 9.) Use "Adjust Gain" to set the instrument reading to a reading of "900ppm".
- 10.) Empty the flow cell and reinstall the sensor to the pipe



Take Notice:

Push button "Transfer Settings to Transmitter" in menu "Basic Settings" to finalize your calibration otherwise you will get the previous calibration after reset or power on/off. Transfer Settings to Transmitter will store the new calibration into the permanent memory of the instrument!

Measuring Screen



The measuring screen is the standard menu if the system is used with a PC / Panel PC. The menu displays the some general settings, system health information and measuring values.

Maintenance Work

The measuring transmitter model C1 is free of maintenance!

The turbidity probe model ProScat-12 has a low maintenance requirement, which is limited to the replacement of the wearing parts (measuring lamp / seals) and the cleaning of the measuring windows.

The measuring lamp has an indicated service life of approximately one year.

The optional IR-LED has an indicated service life of approximately eight years.

However, the service life of the lamp varies considerably depending by process / ambient conditions.

Depending by application, coatings may form on the windows.

This may make it necessary to clean the measuring windows at fixed intervals.

Optionally, in some applications, windows can be cleaned automatically via cleaning jets.

The service life of the seals depends by material, product, process temperature and process pressure. Service life varies between 6 months and 10 years. The interval of cleaning and seal replacement is determined by the operator depending on the application. Contact us in case of questions about the service life of the respective seals.



Please take notice:

A factory inspection is recommended after 5 years of operation.



Please take notice:

In case of measuring hazardous substances (corrosive / toxic substances).

Appropriate protective measures must be taken before cleaning.

(Protective clothing, safety goggles, gloves, if necessary breathing mask).

Make absolutely sure that the measuring cell is emptied and depressurized before starting the cleaning procedure.

Trouble Shooting

Complete failure: - Display and LEDs completely without function.

Remedy:

Check whether the supply voltage is present.

Use the wiring diagram to check whether the supply voltage is connected correctly.

For 24V DC operation, check polarity.

Check fuse F1 and replace it if necessary.

Contact Service.

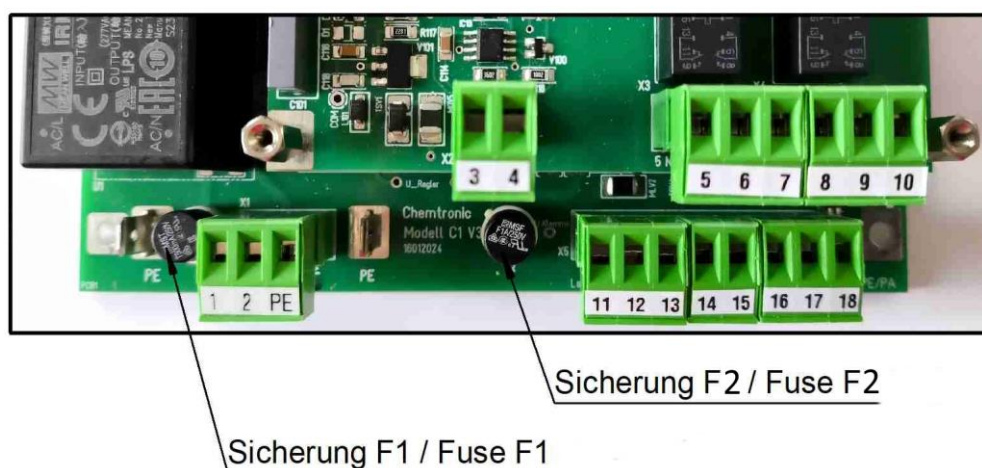
Error: Check fuse - Fuse F2 for the measuring lamp defective.

Remedy:

Check that there is no short circuit in the lamp or the supply line to the lamp.

Check fuse F2 and replace it if necessary.

Contact service.



Error: Sensor LED - LED in the connected sensor is defective.

Error: Sensor lamp - Measuring lamp in the connected sensor is defective.

Remedy:

Use the wiring diagram to check whether the LED/measuring lamp is connected correctly.

Pay attention to polarity in case a LED- light source is connected.

Replace the LED/Lamp. (If necessary, follow the instructions in the relevant manual).

Contact service.

Error: Transmission Low - Sensor outside the physical measuring range, the light from the Led / measuring lamp in the sensor is completely absorbed.

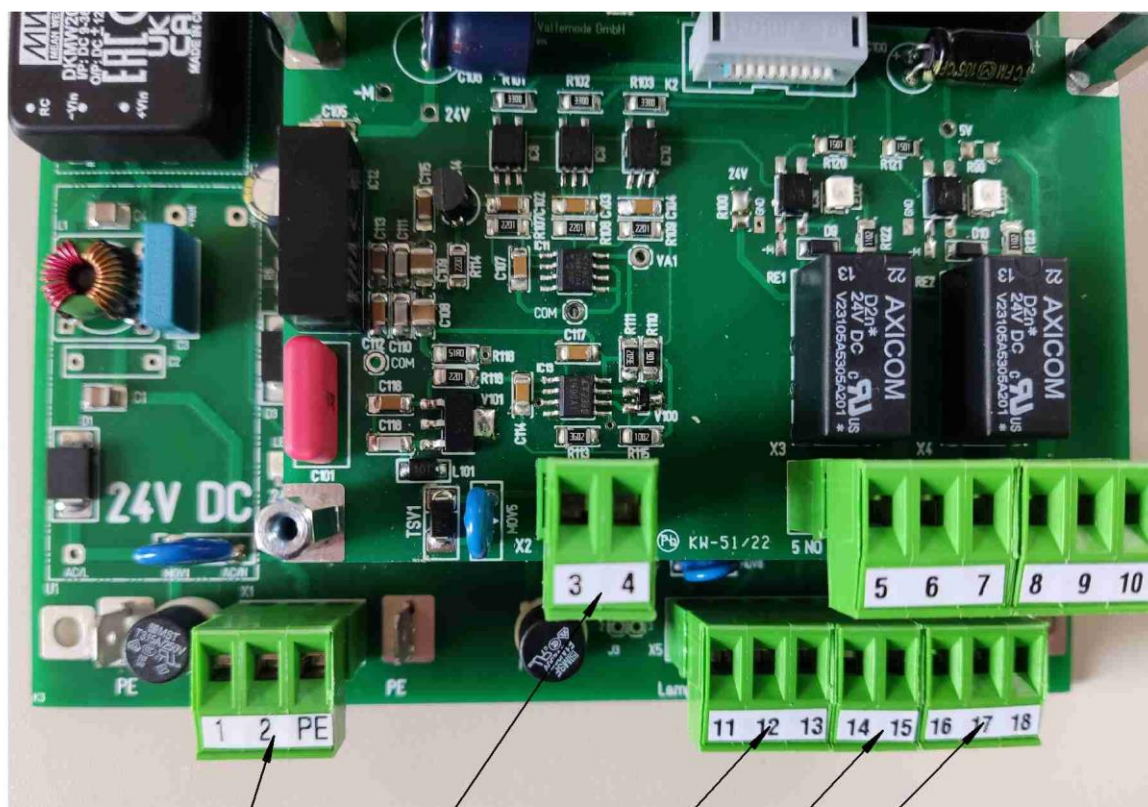
Remedy: Abnormal process condition, solid concentration in the measured product extremely high.

Critical Absorption - Light absorption exceeds application-specific limit value.

Remedy:

Abnormal process condition, extremely high color/solids concentration in the sensor.

Terminal PC-Board Model C1



Supply Voltage
Versorgungsspannung

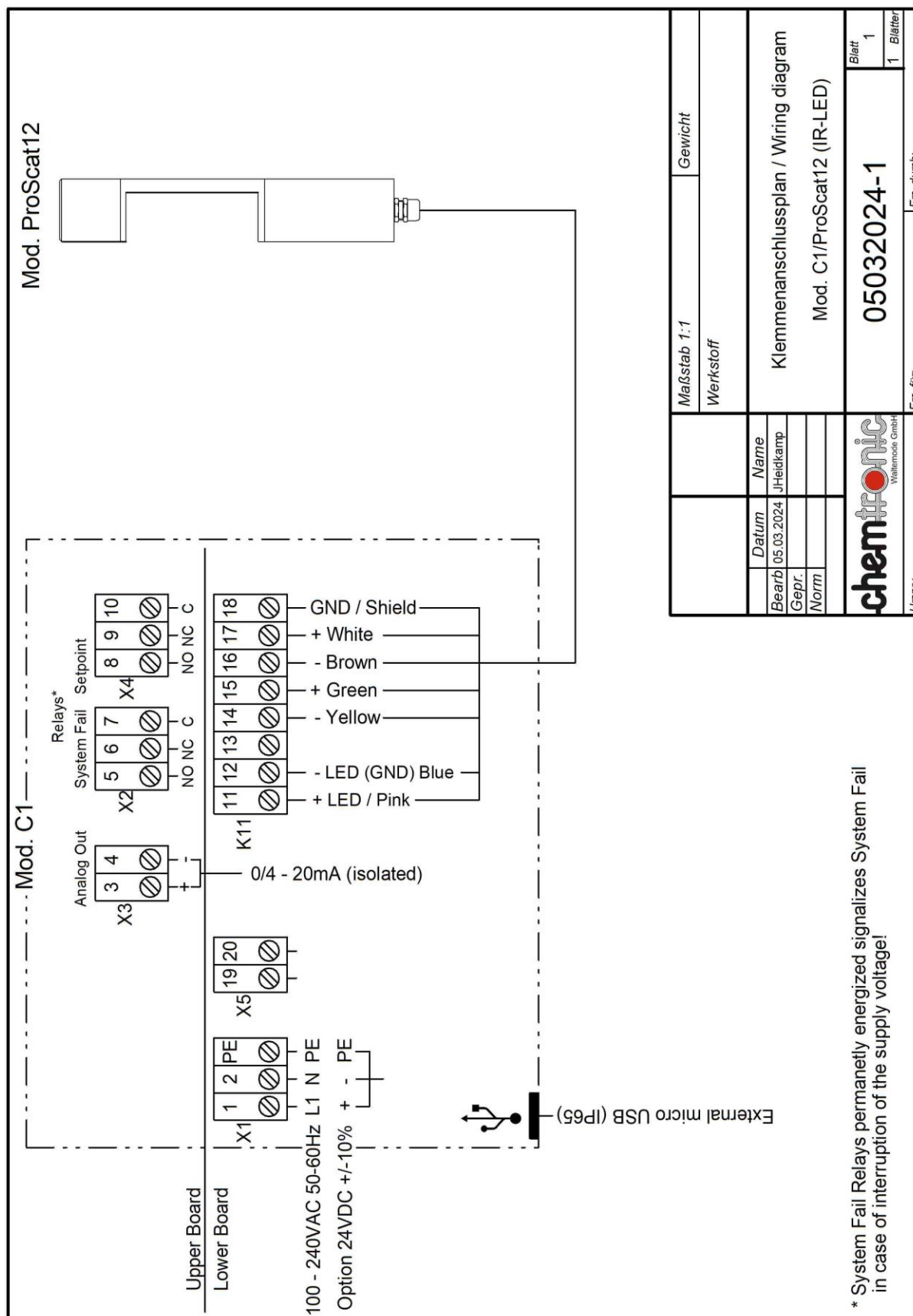
Analog out (0/4-20mA)
Analogausg. (0/4-20mA)

Lamp / LED
Lampe / LED

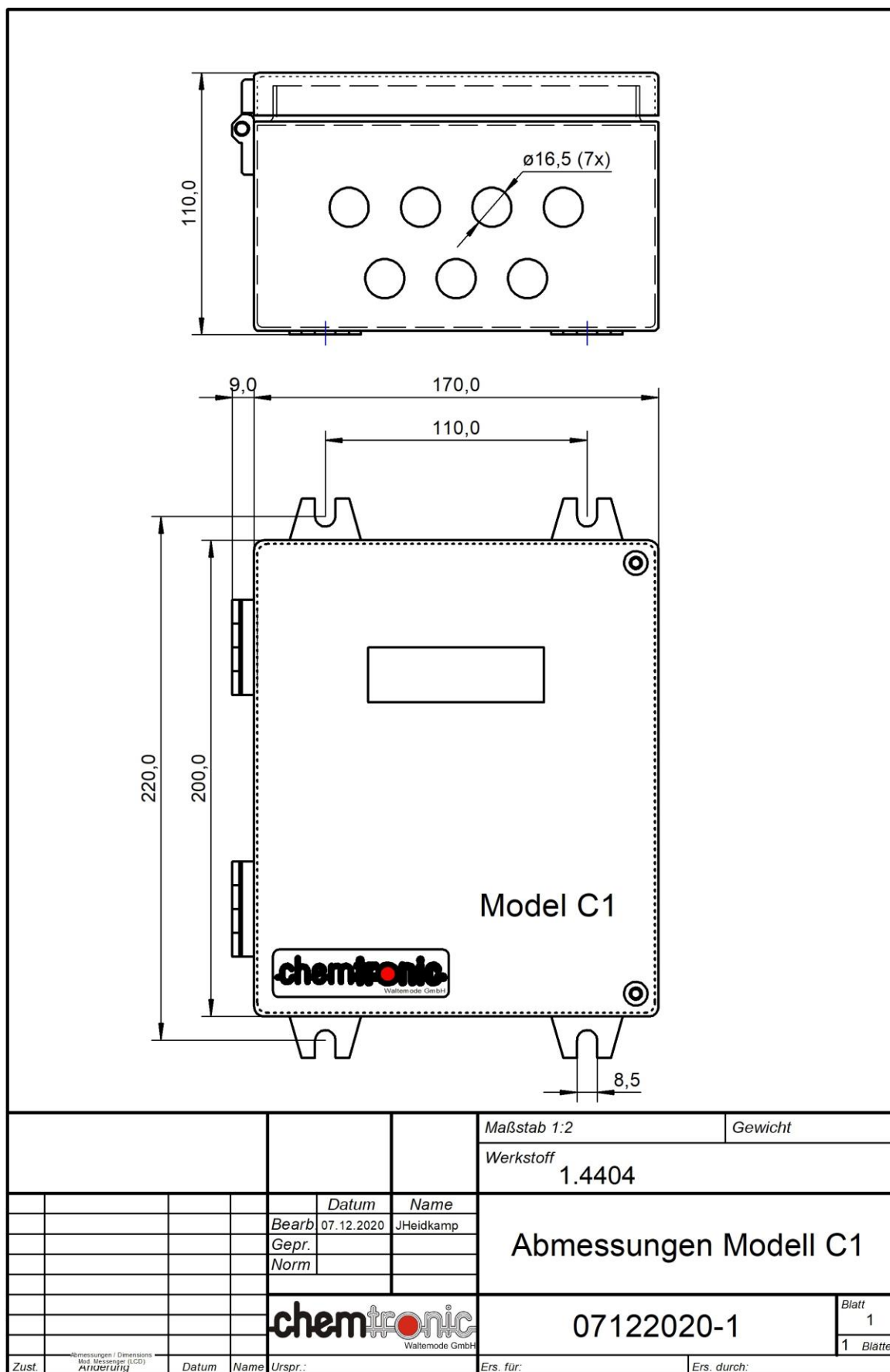
Signal 1 In

Signal 2 In

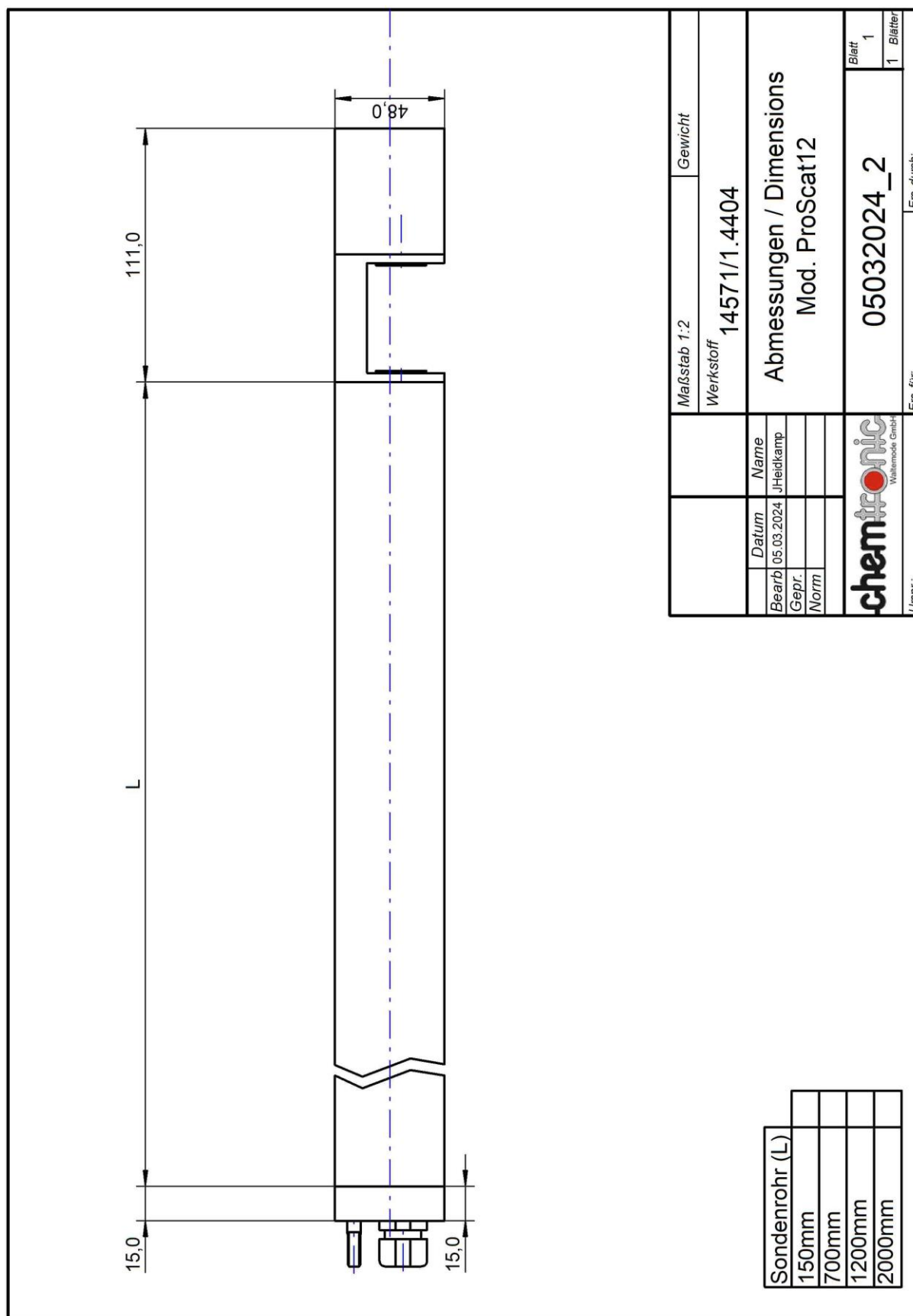
Wiring Diagram Model ProScat-12 / C1



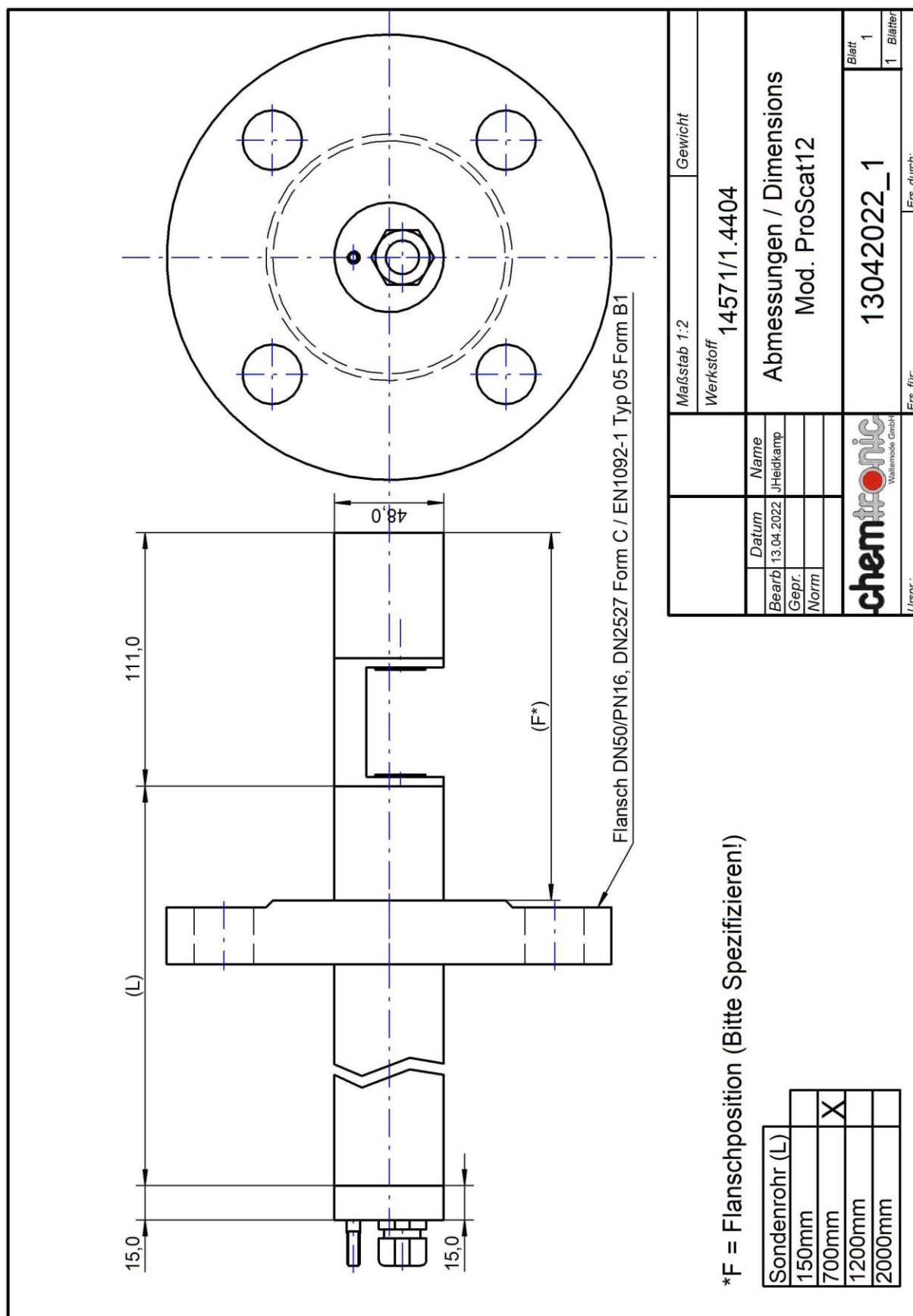
Dimensional Drawing Model C1



Dimensional Drawing Model ProScat-12

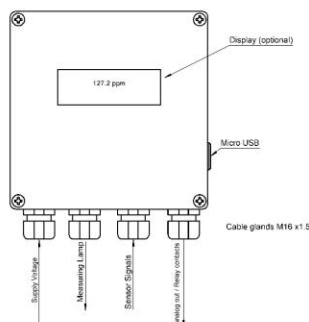


Dimensional Drawing Model ProScat-12 (with installation flange)



Data Sheet Transmitter Model C1

Transmitter Model C1



- Configuration via PC, Laptop
- Menu - based, intuitive User Interface
- Serial Interface: USB
- Optional backlit LCD
- Outputs: 4-20mA, Setpoint Relay, System fail Relay
- Multiple sample curve-fit
- Programmable Measuring Units: EBC, FTU, TEF, ppm
- Full backup of Configuration & Calibration

- Stainless Steel Enclosure (304SS / 1.4301)
- Optional Hazardous area Zone II (Ex nA IIA T3 Gc)*
- Optional Hazardous area Zone I alu enclosure (Ex d IIC T5/6)
- Protection class Enclosures: Nema 4x / IP65
- Stable and reliable excellent process control
- Suitable for all potable, waste and process waters

* Transmitter for hazardous area Zone II without Relays and external USB (non sparking device).

Description:

The transmitter model C1 can be used with all optical sensors of the Monitek / Chemtronic series. The programming/calibration of the system is done via a PC or notebook using the menu-driven software. Calibration is done with multiple samples. All settings and calibration values can be backed up, extern, at your PC's hard disc.

Applications:

- Scatter light turbidity measurement
- Absorption turbidity measurement
- Single channel color measurement
- Dual channel color measurement

Operational areas:

- Chemical industry
- Petrochemical industry
- Pulp & Paper
- Beer and beverages

Technical Data:

Temperature range: maximal 45°C

Enclosure material: 1.4301

Measuring range: Sensor specific (programmable)

Interface: USB

Software: Configuration/Calibration via Windows PC

Reproducibility: $\pm 1 \%$

Protection class: IP65 / NEMA 4X

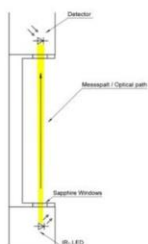
Supply: 18-27 VDC optional 90-260VAC / 50/60Hz

Analog output: 4-20mA, 500 Ohm (isolated)

Relay outputs: Contact ratings 24VDC/1A

Data Sheet Probe Model ProScat-12

Model ProScat12 (PS12)



- 12° scattered light turbidity measurement
- Low in Maintenance
- Probe 0,7m (Pipe installation via 2" Ball Valve)
- Alternative with DIN/EN- or ANSI Flanges
- Optical Path length 48mm
- Calibration interval typically 36 Month
- Material measuring Windows: Sapphire
- Compensation of light up to medium window coatings
- Compensation of Product Colours
- Cleanig Jets (optional)

Description:

The turbidity probe Model ProScat12 uses the principle of 12° forward scattered light to detect suspended particles in liquids. The transmitter model C or C1 is required to use this sensor. The system has been designed for continuous operation with long life time. A ratio measurement of direct- / scatter light assures highly reliable and repeatable measurement results. Inaccuracies caused by product color, lamp ageing or window coating will be compensated. The forward scatter measuring results are nearly independent of particle size and will correlate to product concentration. Calibration can be done in multiple ranges and measurement units like EBC, ppm, mg/l, etc.

Optional cleaning jets will allow a cleaning of the sapphire windows in determined intervals. The installation of the sensor can be done in almost any pipe > DN125, whereby process connections and sealing materials are specified according to the application.

Applications:

- Product Turbidity
- Sedimentation
- Flotation
- Oil in Water

Einsatzgebiete:

- Chemical Industry
- Petrochemical Industry
- Pulp and Paper
- Power Stations

Technical Data:

Line size:	>DN150	Measuring range:	typical 0 -5 -10 -500ppm
Process pressure:	PN16 / ANSI class 150	Reproducibility:	± 1 %
Process temperature:	maximum 60°C	Detector system:	Silicium diodes
Sensor material:	1.4471 (other on request)	Meas. wavelength:	typical 880nm
Window material:	Sapphire	Protection class:	IP65 / NEMA 4x
Gasket material:	Application specific		

EU Declaration of Conformity (CE)**EU-Konformitätserklärung
EU Declaration of Conformity**

Der Hersteller:
The Manufacturer:
Chemtronic Waltemode GmbH
Niederstraße 14
40789 Monheim am Rhein



erklärt hiermit das das Prozess Fotometer
herewith declares that the process photometer:

Messverstärker / Transmitter Mod.:	C1 in Verbindung mit / with
Sensoren Modelle / Sensors & Probes Mod.:	AP2, CSW, LAS, MTC., MSC., TBM,

folgenden europäischen Richtlinien entspricht:
complies with the following European directives:

2014/30/EU	Richtlinie über die elektromagnetische Verträglichkeit Electromagnetic compatibility
2014/35/EU	Niederspannungsrichtlinie Electrical equipment designed for use within certain voltage limits

Angewandte harmonisierte Normen:
Applied harmonized standards:

EN61010-1 /2020	Sicherheitsbestimmungen für Mess-, Steuer-, Regel- und Laborgeräte Safety requirements for equipment for measurement, control, & laboratory use
EN61000-6,2 /2019	Störfestigkeit für Industriebereiche Immunity standard for industrial environments
EN61000-6,4 /2011	Elektromagnetische Verträglichkeit (Störaussendung) Emission standard for industrial environments

Monheim den 16.06. 2020

Gunnar Waltemode
Geschäftsführer / General Manager