Manual

Version 08.02.2023

Inline Color Photometer

Model COLORsmart-AD

Single Beam dual Wavelength Absorption

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Content

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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)

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.

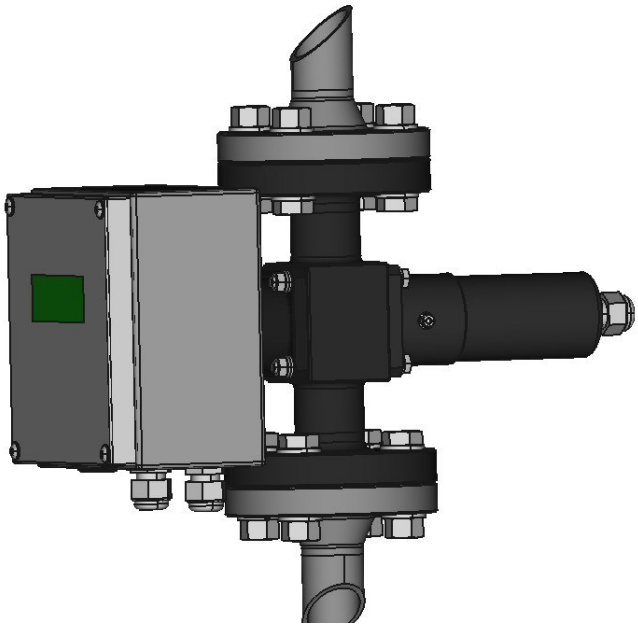
Installation Guidelines

Danger!
Exceeding the specified maximum pressure and / or the specified maximum temperature will cause a very high safety risk. Please read the additional safety instructions before installation and start-up.

- The instrument is factory pre- calibrated according to customers specification.
- The location / installation of the sensor should be in a vertical standpipe.
- If installation occurs in a horizontal pipe, make sure that eventual gas bubbles will escape with the product flow.
- Avoid air and gas bubbles inside the sensor, they cause disturbances. Air and gas bubbles will cause noise and drift of the measurement signal. (The air bubbles are not expected at pressures upwards of 2bar in aqueous solutions).
- The process pressure should never exceed the specification of the sensor.
- The process temperature should never exceed the specification of the sensor.
- In case the process temperature should fall under the dew point, purge the sensor optic housings with dry instrument air (approx. 10 l/h). Condensed water and excessive temperatures can damage the sensor and cause inaccurate measurements.
- Transmitter and optics are sensitive components, do not drop and handle with care.
- Follow the wiring diagram in this manual.
- Please do not use the system in case of any visible mechanical damages!
- The enclosure fits IP65 / Nema 4x protection class.
- The ambient temperature for the system must be in a range of -10°C to 55°C (use dry purge air above 40°C approx. 10 l/h).
- The power consumption of the Instrument is less than 10W.
- Instruments relay ratings for alarms and external devices are 1 A at 24VDC.
- Do not operate with open enclosure. Exposed electronics will promote the risk of electrical shock and might cause damage to the unit.
- Proper instrument grounding: The instrument must be grounded to avoid electrical shock hazards to personnel and damages to the unit.

Installation and align of the System

Model COLORsmart-AD



Vertical pipe, avoid bubbles,
pressure and temperature in specified range.

Direction of flow!

Principle of Operation

The single beam, dual wavelength photometer model COLORsmart-AD is used to measure the colour of liquid products. The light absorption is measured at two different wavelengths. The difference between these both absorbance values is used to calculate the colour concentration.

What does Colour mean?

Colour is defined as a light released sense impression mediated by eye.
The physical science considers light as electromagnetic waves. Colour is not a clear defined magnitude like e.g. temperature or pressure, colour is a subjective impression.

How arises a Colour Impression?

A colour impression will be caused, in case electromagnetic waves of the visible spectrum (wavelengths of about 380nm up to 750nm) will fall on the eye.

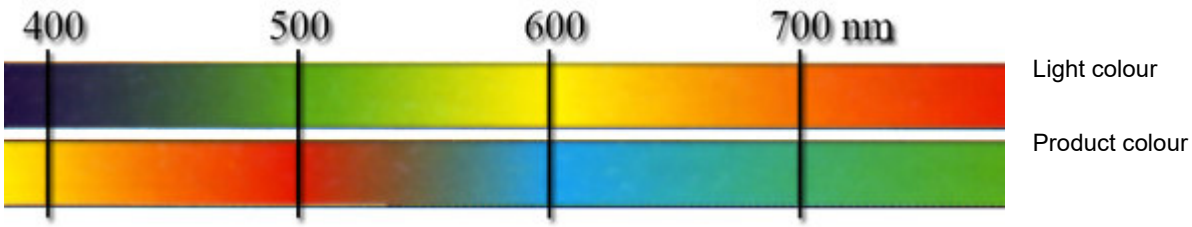
How accrues Colour?

White light (colourless) consists from the summation of all colours of the visible spectrum. A colour impression accrues for the eye, in case a specific range of wavelengths within the visible spectrum will be absorbed.

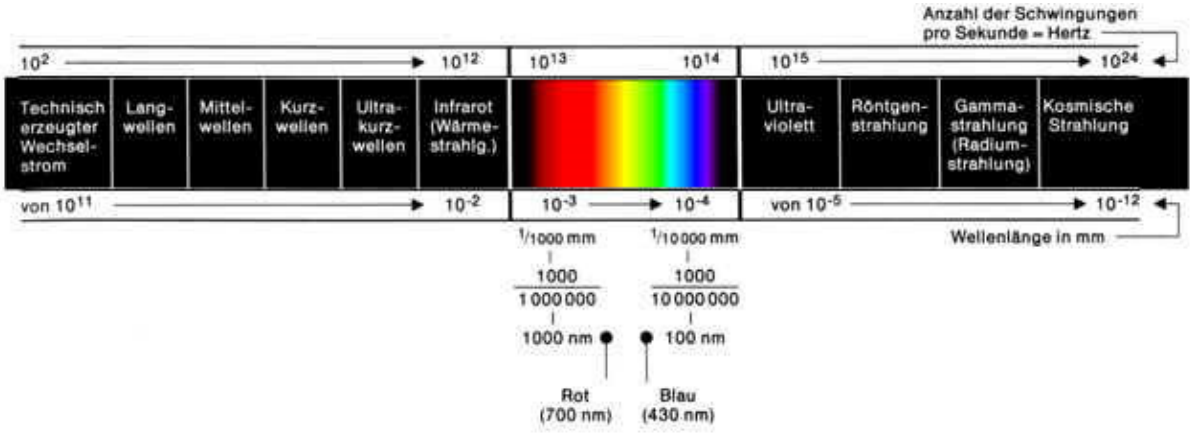
Context between Wavelength and Colour

Absorbed Wavelength λ [nm]	Colour of absorbed Light	Visual impression human eye
380 – 435	violet	yellow-green
435 – 480	blue	yellow
480 – 490	greenish-blue	orange
490 – 500	bluish-green	red
500 – 560	green	magenta
560 – 580	yellow-green	violet
580 – 595	yellow	blue
595 – 650	orange	greenish-blue
650 – 780	red	bluish-green

Comparison absorbed light colour / product colour



Total Spectrum



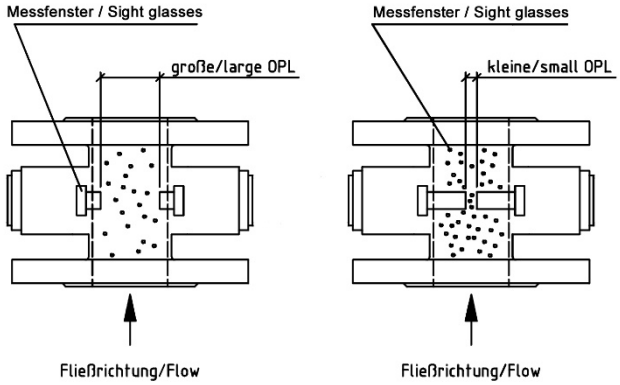
The following methods are used for the measurement of a “colour concentration” in a liquid; both methods are based on the principle of light absorption at specific wavelengths.

Example single wavelength absorption:
Measurement of blue colour in a liquid.
The light absorption in a spectral range of approximately 600nm will be detected and evaluated; this is the range of wavelengths where the blue colour generates light absorption.

Mainly two parameters will affect the sensitivity of the measurement.

1. The initial intensity of the white light source, which is a constant value of the respective sensor.
2. The optical path length (OPL) which is a variable magnitude of the sensor.

The sensor requires a large optical path length (OPL) to generate enough light attenuation at low colour concentration.
The sensor requires a small optical path length (OPL), to ensure enough light intensity penetrates the product at high colour concentration.



Large optical path length/OPL = measurement of low concentrations/high sensitivity
Small optical path length/OPL = measurement of high concentrations/low sensitivity

Single Beam dual Wavelength Measurement

Single Beam dual Wavelength Measurement
The previously described method of single wavelength absorption operates with filtrated liquids with low particle content only, because the particles in the liquid absorb the light as well as colour. Therefore, particles affect the measurement results. Particles absorb the light at the complete spectral range and not at specific wavelengths only. Colour absorbs the light at specific wavelengths in the visible spectrum. Therefore, colour is typically measured at two different wavelengths ranges. The measurement channel detects in a spectral range where colour and particles absorb. The reference channel detects in a spectral range where only colour absorbs. This method is called, single beam dual wavelength measurement.

The measurement channel detects the absorption caused by colour and particles.
The reference channel detects the absorption caused by particles only.

The difference of both signals will result the absorption caused by colour only.

The difference measurement compensates for cross interference’s caused by particles, window coatings and lamp ageing

Example dual wavelength absorption:
Measurement of blue colour in liquid.
The measurement channel detects the light absorption in a range of approx. 600nm (colour and particles).
The reference channel detects the particle absorption at 850 nm (invisible NIR light, unaffected by colour).

Measurement Ch. (blue colour + particles) – **Reference Ch.** (particles only) = **Colour Concentration**

Software Installation (COLORsmart-AD Configuration / Calibration)

System Requirements

Supported Operating Systems	Microsoft Windows 7, 8, 10, 11
Requirements	Microsoft.NET Framework 4.5 (x86 & x64)
RAM	2GB
Hard Disk Space	< 1MB

Installation Procedere COLORsmart config Software

I. Close any open programs that are running on your computer before starting the installation.
II. Plug the supplied USB stick into the USB port of your computer
III. Use the Windows file explorer to access the root directory of the USB stick.
IV. Double click on the file “setup.exe”.
V. Software installs automatically, follow instructions at your monitor.

Connect COLORsmart-AD to a PC- or Laptop

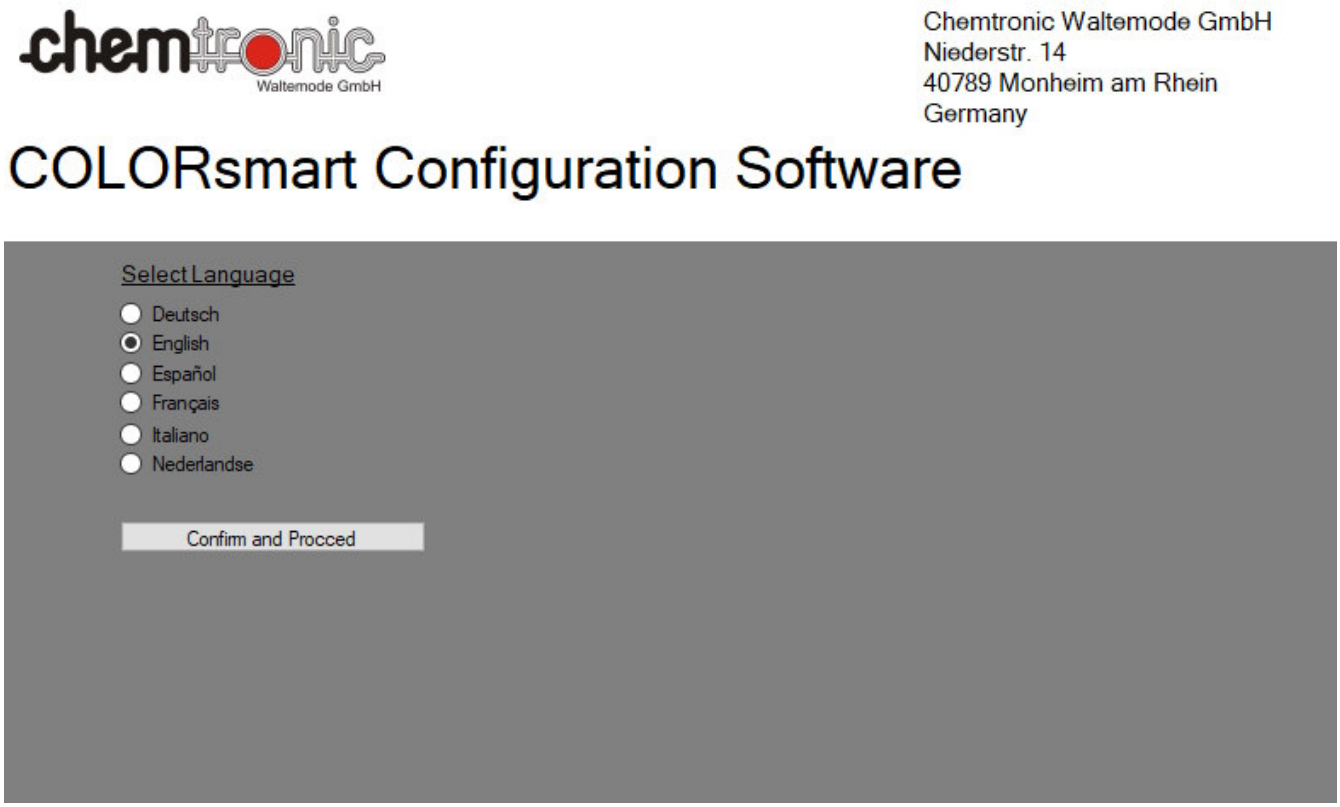
Connect instrument to the mains (see wiring Diagram)
Connect your PC/Laptop to COLORsmart-AD using USB Cable Type A Male to Micro Type B Male.

Take Notice:
The USB- connector of the COLORsmart-AD-P is located under the cover cap at the outside of transmitter enclosure.

COLORsmart-AD Software

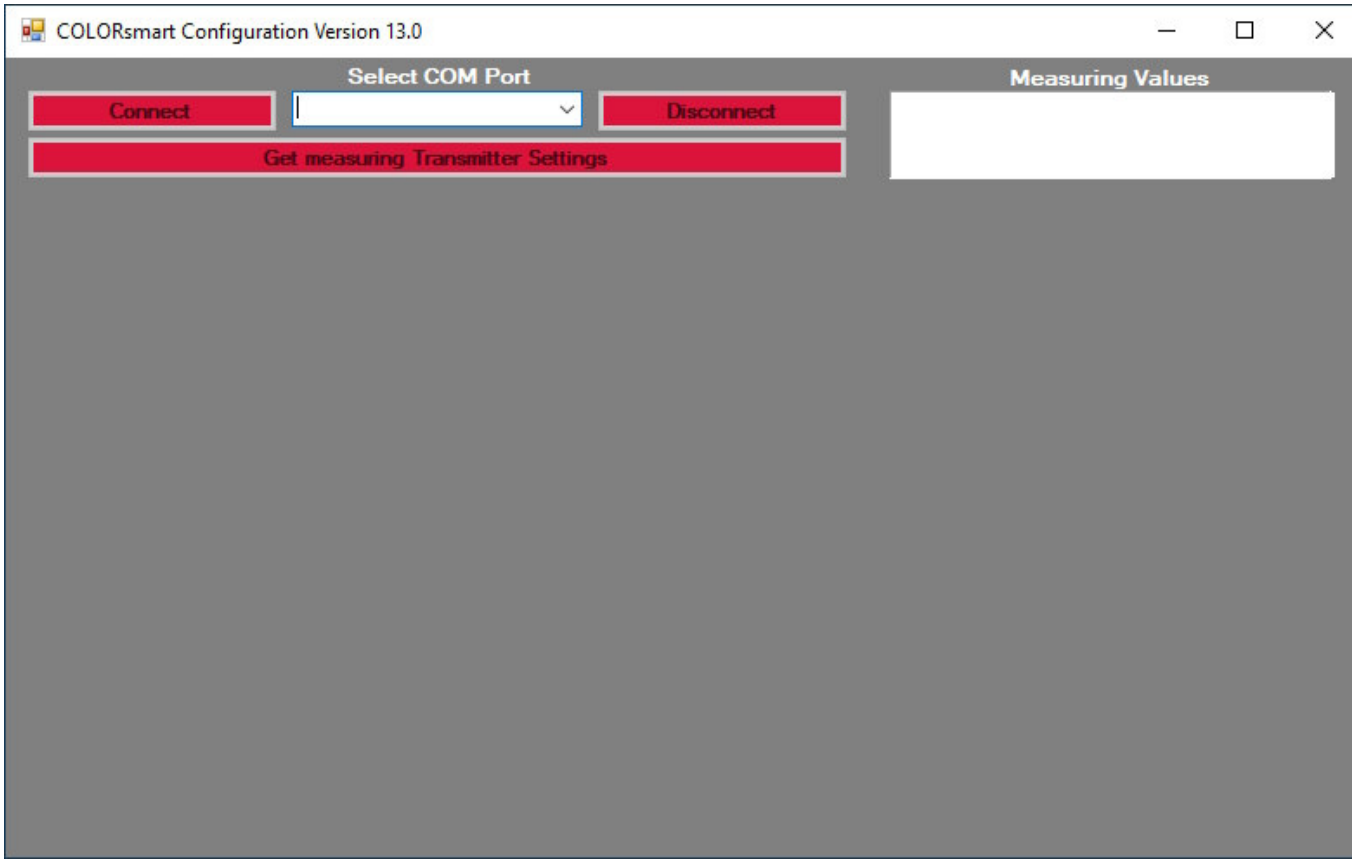
Start Software per click/double click on the COLORsmart-AD icon.

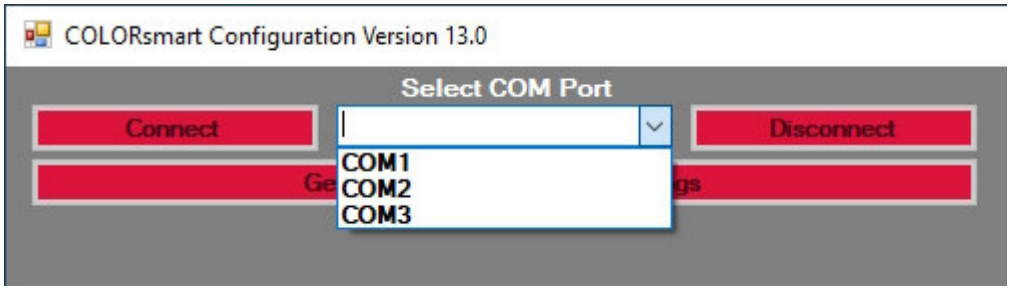
Select Language



Select your language and proceed!

Select COM Port

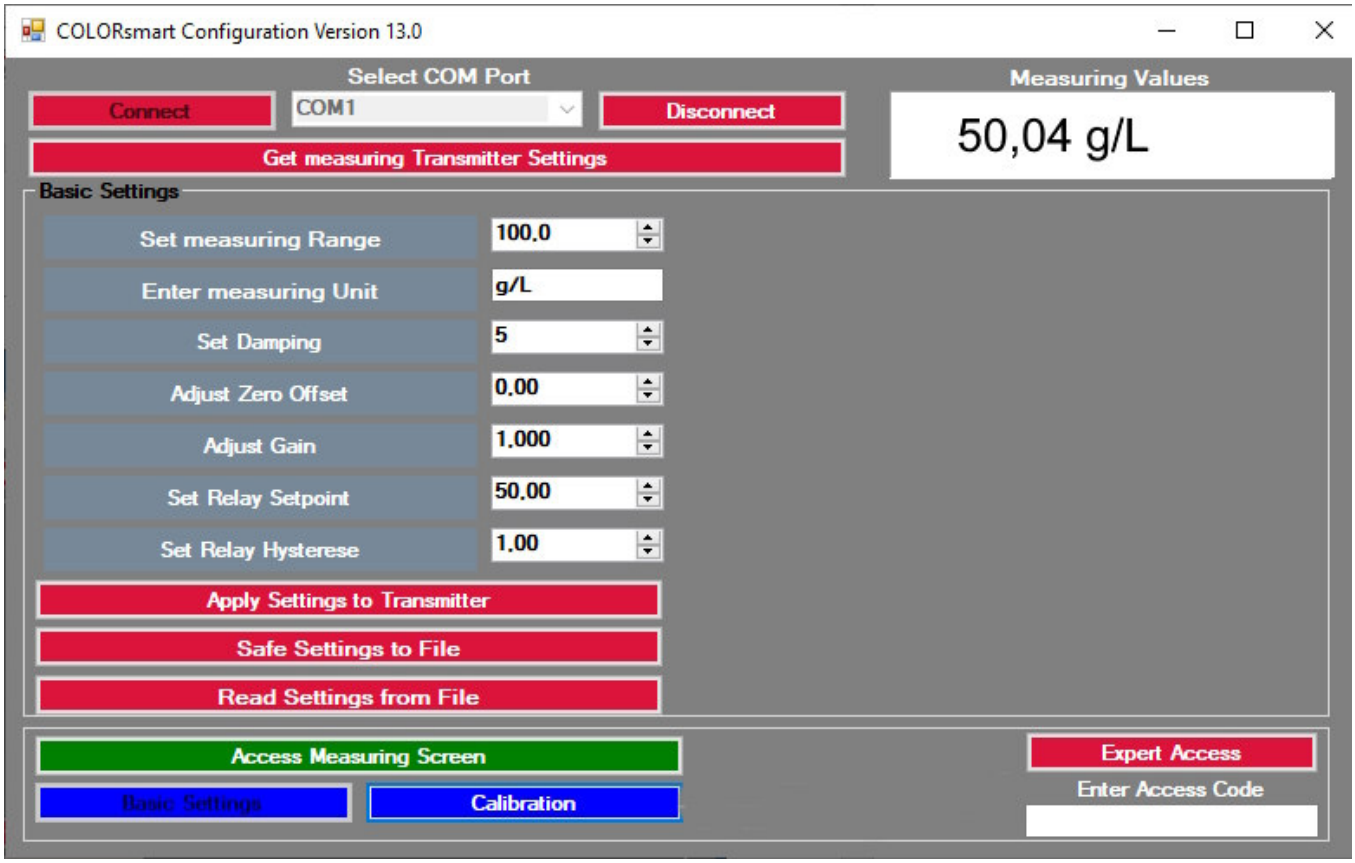




Select the COM port of your turbidity meter, click “connect” button and then the “Get Settings” button.

Finding the correct COM Port:
Shut down COLORsmart-AD software. Disconnect USB cable.
Restart software, go to “Select COM Port”, look to the list of active Ports.
Shut down COLORsmart-AD 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.

Take Notice:
The maximum possible measuring range depends by the settings in calibration menu!

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 shift low measuring results to “0”.

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 inside the flow cell : "1.00"
Gain must be set to "1.05" to result a reading of "1.00" (0.95 x 1.05 = 1)

Set Relay Setpoint

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

Set Relay Hysterese

The hysterese affects the relay setpoint.
Following settings: setpoint "2.00" and hysterese "0.1"
Alarm will be switched at "2.1" and reset will be switched at "1.9"
So alarm switching point will be (setpoint + hysterese)
and reset will be (setpoint – hysterese).

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. 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!

Safe Settings to File

Stores 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_TURBIsmart.

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).

Enter Access Code

The Access code for expert level: "1212"
Enter Access code: 1212
Click to Button "Expert Access" to access calibration menu

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.*

Required tools:

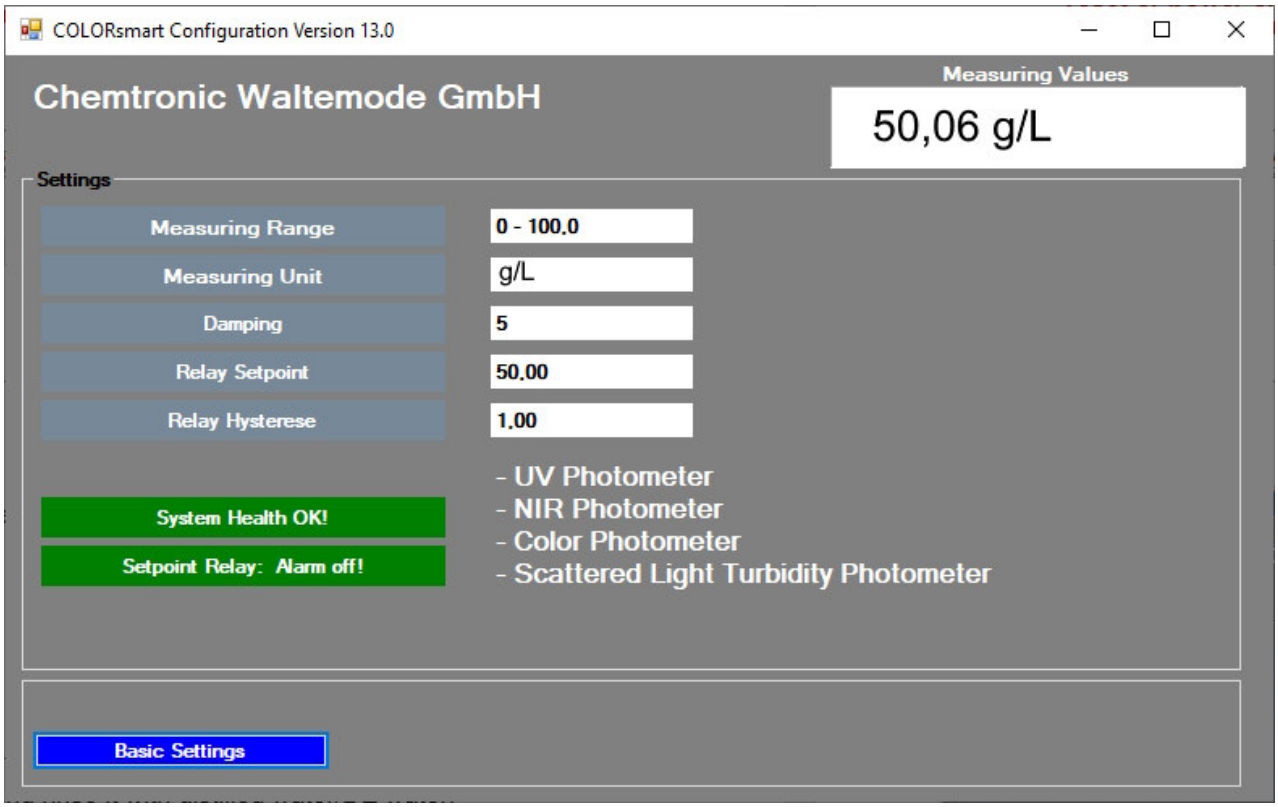
- PC/Laptop with installed COLORsmart_Config Software
- USB- Cable
- Plugs or blind flanges to seal / fill the flow cell

Example calibration (Range 0-100 g (Copper Sulphate)

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 in every application. An inline correction of zero offset may be necessary depending by measured product.
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 COLORsmart and start the Config software.*
5.) *Use "Adjust Zero Offset" to set the instrument reading to a reading of "0 g/L".*
6.) *Empty your flow cell*
7.) *Fill sensor's flow cell with an 80g/L copper sulphate calibration standard.*
Take notice, the calibration standard should have a concentration of about 75% to 100% of calibrated range (80% of 100g/L = 80g/L 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 "450APHA".*
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 some general settings, system health information and measuring values.

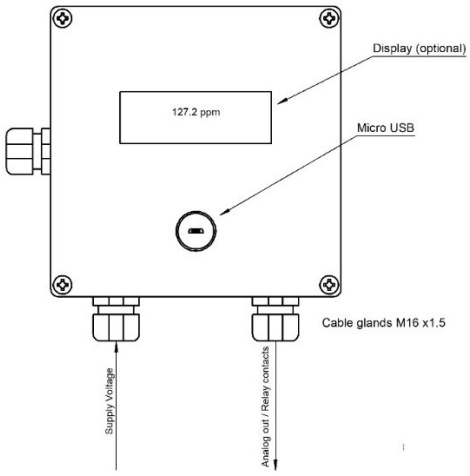
Maintenance Work

Qualified technical personnel must perform repair and maintenance!

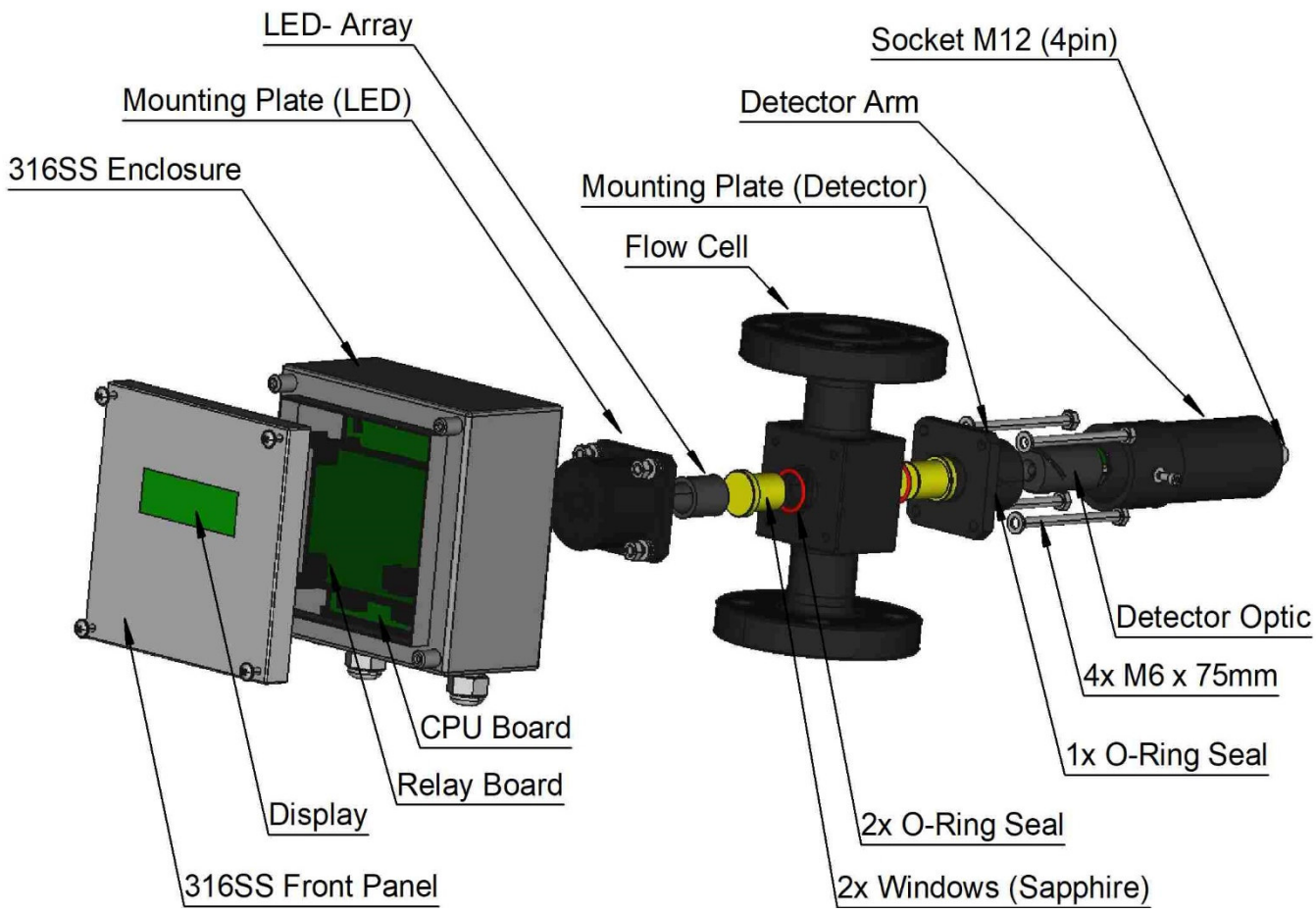
The model COLORsmart-AD is almost free of maintenance.
It is recommended to check calibration every 24 months.
Depending by application, coatings may form on the sapphire windows.
A slight coating formation or clouding of the windows is compensated by the equation of measurement- and reference wave length.
In case of extremely strong coating formation, it may be necessary to clean the measuring windows at fixed intervals. The cleaning interval is determined by the operator depending on the application.
The product pipe must be unpressurized and empty before starting the cleaning.
Clean the windows with a suitable cleaning agent, a cloth or a soft brush.
In case of mineral / lime coatings, we recommend placing the windows in diluted acetic acid for a few minutes.

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.

Front View showing Display and USB



Exploded view



Parts List

Pos.	Qty required	Article-No.	Article-Description
001	1	S-0000-0116-00	Stückliste COLORsmart
001.1	2	C208-6000-VI	O-Ring (MTC/MSC • FKM • 21x2,5)
001.2	2	C208-6000-KA	O-Ring (MTC/MSC • FFKM • 21x2,5)
001.3	1	C208-5010-00	O-Ring (FKM • 36x2,5)
001.4	2	2200-1100-SA	Messfenster / measuring window (Saphir 11mm) - (22 , MTC, MSC)
001.5	2	2200-1400-SA	Messfenster / measuring window (Saphir 15mm) - (22 , MTC, MSC)
001.6	2	2200-1900-SA	Messfenster / measuring window (Saphir 20.0mm) - (22 , MTC, MSC)
001.7	2	2200-2400-SA	Messfenster / measuring window (Saphir 25,0mm) - (22 , MTC, MSC)
001.8	1	CS00-0001-00	COLORsmart Messzelle / Flowcell (DN25 flanges, Material POM, 6Bar)
001.9	1	CS00-0002-00	COLORsmart Mounting Plate LED (Material POM)
001.10	1	CS00-0003-00	COLORsmart Mounting Plate Detector (Material POM)
001.11	1	CS00-0004-00	COLORsmart LED Array (450nm/600nm Copper Sulphate)
001.12	1	CS00-0005-00	COLORsmart Detector optic (450nm / 600nm Copper Sulphate)
001.13	1	TS00-0001-00	TURBIsmart / COLORsmart Main Board (CPU)
001.14	1	TS00-0002-00	TURBIsmart / COLORsmart Relay Roard
001.15	1	TS00-0003-00	TURBIsmart / COLORsmart LCD (Dislpay)

Wiring Terminals (Circuit Boards)

Connector for optional LC- Display

Reset Button

Setpoint relay

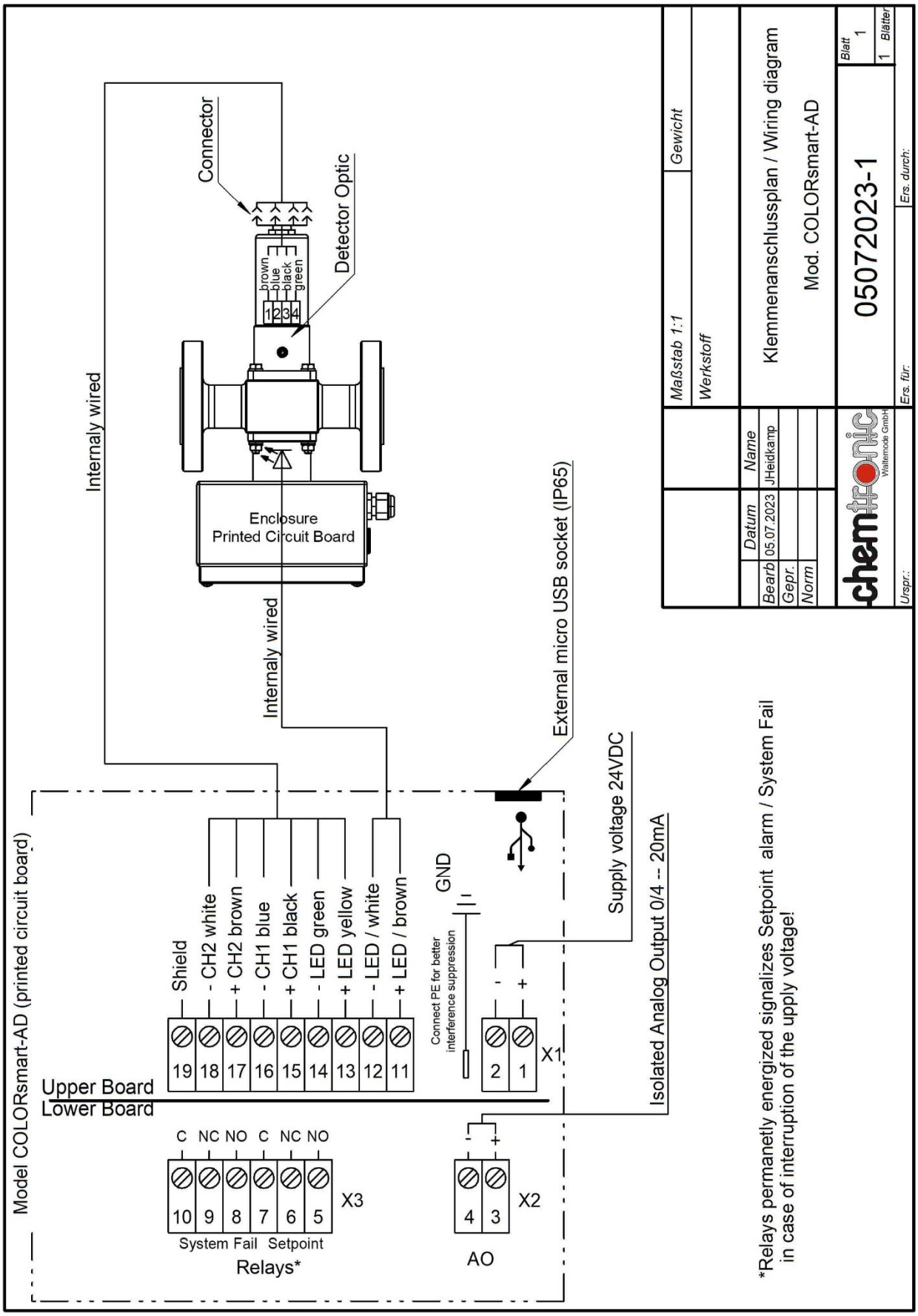
System fail relay (alternative control of sensor cleaning cycle)

Connect PE (Earth Ground) for better interference supression!

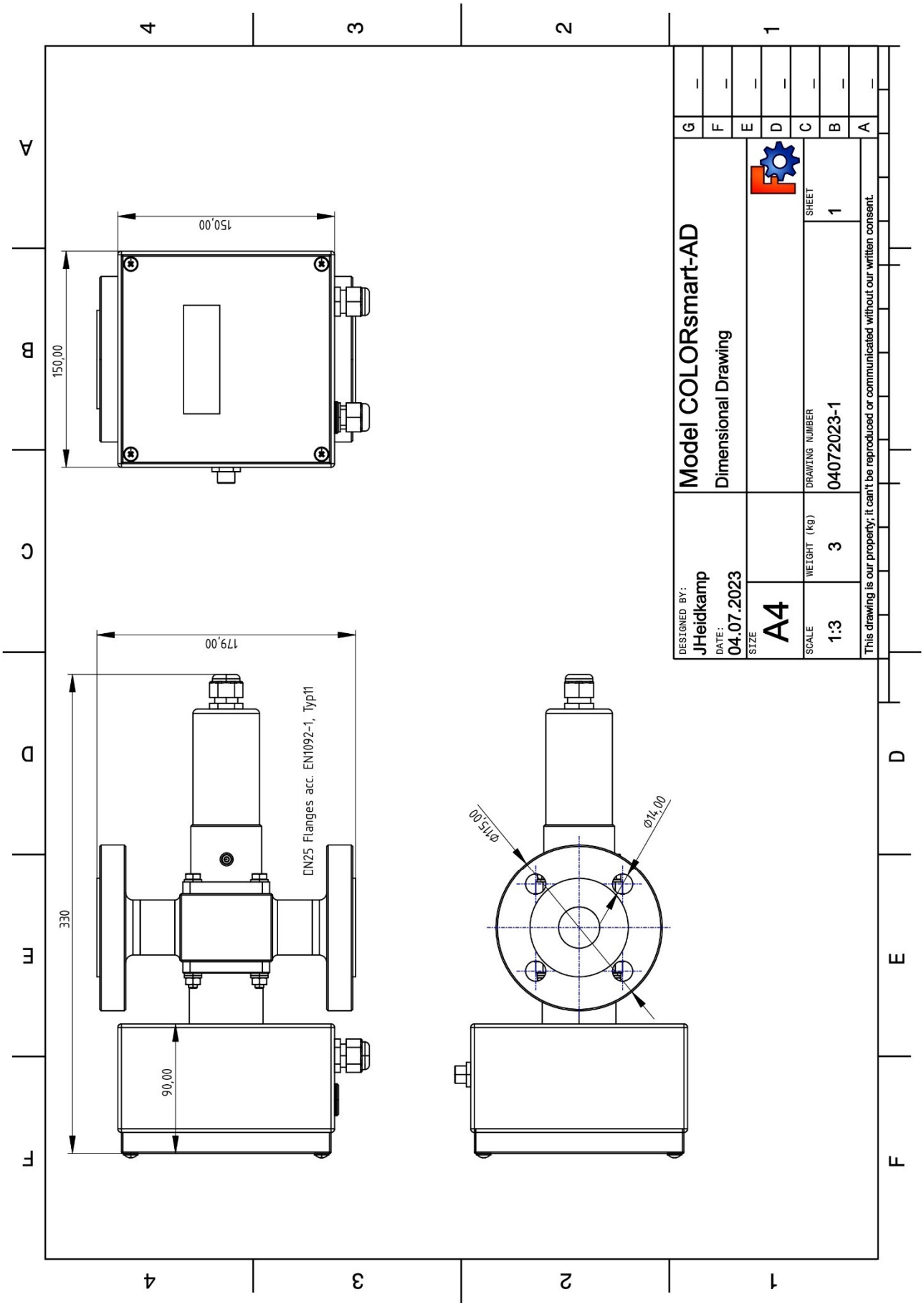
Analog outut (0/4 - 20mA)

24CDC Supply voltage

Wiring Diagram COLORsmart-AD

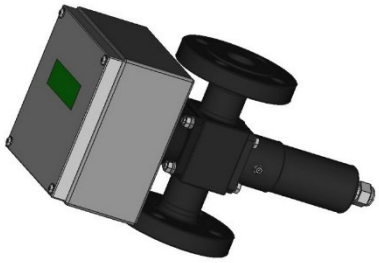


Dimensional Drawings COLORsmart-AD Series



Technical Data / Data Sheet COLORsmart-AD

Model COLORsmart-AD



- **Single beam dual wavelength color photometer**
- **Low maintenance / long service life**
- **Extended calibration interval: Typical 18 month**
- **Configuration via PC, Laptop**
- **Menu - based, intuitive User Interface**
- **Serial Interface: USB**
- **Optional backlit LCD**
- **Outputs: 4-20mA, Relay Setpoint, Relay system fail**
- **Fitting of measuring Curve**
- **Measuring Ranges: Progammable**
- **Measuring Units: Programmable (g/l, ppm, ...)**
- **Protection Class: IP65 / Nema 4x**
- **Light Sources: LED**
- **Measuring windows : Sapphire**

Description:

The inline photometer Model COLORsmart-AD uses the principle of single beam dual wavelength absorption to detect a color concentration in liquids. The system has been designed for continuous operation with long life time. The equation of measuring wavelength and reference wavelength assure highly reliable and repeatable measurement results. Inaccuracies caused by turbidity, ageing of light source or window coating will be compensated to a high degree. The integrated transmitter allows an easy setup and calibration.

Applications:

- Copper concentration
- Nickel concentration
- Cobalt concentration
- ...

Operational areas:

- Galvanic
- Plating
- Recycling
- ...

Technical Data:

Line sizes:	DN 25
Process pressure:	PN 6
Temperature range:	maximal 55°C / 75°C short time
Sensor material:	POM (other on request)
Window material:	Sapphire
Gasket material:	FKM other on request)
Measuring range:	typical 0-2,5AU

Reproducibility:	± 1 %
Protection class:	IP65 / NEMA 4X
Supply:	24VDC ± 10 %
Analog output:	4-20mA, 500 Ohm (isolated)
Relay outputs:	Contact ratings 24VDC/1A
Interface:	USB

EU Certificate of conformity (CE)

chemtronic Waltemode GmbH

EU-Konformitätserklärung

EU Declaration of Conformity

CE

Der Hersteller:
The Manufacturer:
Chemtronic Waltemode GmbH
Niederstr. 14
40789 Monheim am Rhein / Germany

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

Model COLORsmart-AD
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

Störfestigkeit / Immunity standard (EN61326-1)
EN61000-4-2 /2009 & EN61000-4-3 /2020 & EN61000-4-4 /2012 & EN61000-4-5 /2014[1)] +A1
EN61000-4-6 /2014[1)] +AC & EN61000-4-8 /2010 & EN61000-4-11 /2020[1)] +AC

Störaussendung / Emission
EN55011/2016 + A1, A11 & EN61000-3-2/2014[1)] & EN61000-3-3/2013[1)]

Bemerkungen / Comments
[1)] Verwendung der aktuellen Ausgabe / Use of the current edition
[2)] Prüfling enthält gemäß Herstellerangaben keine magnetisch sensitiven Elemente
[3)] Prüfling mit Gleichspannung versorgt / Test object supplied with DC- voltage

Monheim den 16.10. 2022

Gunnar Waltemode
Geschäftsführer / General Manager