

Manual

Version 16.07.2014

Absorption Probe (UV / VIS / NIR)

Model UVS-1

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There are no further reaching warranty claims to take because of the content of existing document.

The UV- absorption probe model UVS-1 is a product of Chemtronic Waltemode GmbH

The Transmitter model Messenger is a product of Galvanic Applied Sciences Inc.

Non -warranty

Chemtronic Waltemode GmbH takes no responsibility or warranty for any technical or editorial mistakes or omissions in this document. The information in this publication will be provided without warranty for its correctness. Chemtronic Waltemode GmbH reserves all rights to make changes to this document without further notice.

Chemtronic Waltemode GmbH is by no means liable for any consequential damages or miscellaneous damages, which occur during the use or storage of the system.

Some countries do not permit the limitation of liability and hence this exclusion may not be applicable.

Warranty conditions

The warranty for this product takes place according to the legal provisions. As places of warranty we explicitly name Chemtronic Waltemode GmbH, Monheim am Rhein, Germany or Galvanic Applied Sciences Inc., Bedford MA, USA. In case of warranty service at the client's site, an additional charge for eg. travel expenses, overnight cost, etc may be made. 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 void any warranty claim. Please pay attention to our general terms of contract.

Safety instructions

Special attention is advised to the following general safety instructions during use and operation of the system. Ignoring these instructions or special warnings within this manual may damage the system, cause inaccurate measurements, and possibly result in an unsafe installation. Chemtronic Waltemode GmbH will not accept any responsibility for consequences arising from ignoring the safety instructions and warnings.

For ALL chemical liquids

The reagents or standards 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 reagents or standards.

Electrical installation

Only qualified electrical technicians should make any electrical connections to the unit.

Hazardous area

DO NOT INSTALL the system in hazardous area without the optional Ex-proof equipment. Operation of non Ex-proof systems in hazardous area could be a big risk!



Using the system in hazardous areas (Ex Zone I / Ex Zone II) will only be safe with the installation of the optional special Ex-proof designs including all required 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 calibration procedure). Be careful that no moisture enters the enclosure.



Some components inside the instrument are energized with voltages, which may 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 installed incorrectly, handled improperly, used outside of the technical specifications (of the instrument), or damaged by gross negligence.

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. The instrument should be placed in the original packing material.
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.

Transport damage

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

For any insurance claims being submitted to the transportation company it is absolutely necessary to notify the transportation company immediately upon receipt of the instrument. In case of obvious damage to the outer packing a receipt stating that the box is damaged must be obtained from the courier in order to make any claim on the insurance.

Any delay in making a claim for damage may result in the claim being rejected and in addition Chemtronic Waltemode will not assume any liability for these damages.

Shipment of the instrument

Please clean the instrument carefully before shipment (e.g. for revision / repair). Please use fixed packaging to protect the instrument against any shipping damages.

If at all possible the original packaging should be used.

System Inspection

Check to ensure that all components of the instrument have arrived safely. The complete system includes:

The Messenger transmitter, the UVS-1 probe, the cable set and the manual.

The Messenger versions without display or with LCD typically include an additional CD-Rom with Messenger Graph Software and an interface adapter Model USB- Nano.

If there is any damage to the equipment or if anything is missing please contact us immediately. Save the packing material for future system storage or shipping!

Before installation and start up!

Please note. The following points are important to avoid damages of the Sensors at high temperature applications:

- Please connect purge air (cooling) before process insertion (dry, oil- & dust free instrument air)
- Leave air output open
- Do not interrupt the air cooling
- Remove the probe immediately from the process in case air purge fails!

General Installation guidelines



WARNING: To avoid the possibility of electrical shock make sure the AC power mains are switched off or otherwise disconnected, before you begin wiring the system. It is a good practice to install a main power cutoff switch with external main fuses near the system.



1. Transmitter and probe are sensitive components, do not drop and handle with care.
2. Please do not install or use the system in case of any visible mechanical damages!
3. Refer to the wiring diagram in this manual and that of the transmitter manual while installing the system.

Transmitter:

1. The Messenger enclosure fits IP65 / NEMA-4X protection standards but mounting the Messenger in a dry/dust free area is recommended.
2. The ambient temperature for the transmitter must be in a range of -10°C to 50°C (use dry purge air above 40°C)
3. AC power consumption of the Messenger Transmitter is less than 50 watt
4. Transmitter relay ratings for alarms and external devices are 2 A at 250V~ maximum
5. Do not operate with open enclosure. Exposed electronics both increases the risk of an electrical shock and may result in damage of the unit.
6. Do not alter cable length. The instrument has been calibrated with a specified cable length. Altering the length of the cable may cause unstable & noisy signals and void instrument calibration.
7. Only use the original cables supplied with the unit. Under no circumstances must the cables be extended or replaced by longer lengths.
8. Ship the instrument in the original packing material to avoid damage to the sensor or transmitter.
9. Mishandling of the system is not covered under warranty. Do not disconnect the interior wiring of the sensor.
10. Proper instrument grounding: The instrument must be grounded to avoid electrical shock hazards to personnel, damage to the unit and erroneous operation.

Probe:

1. The model USS-1 is manufactured in accordance with the client's application (variable optical path length (OPL), gasket material, wavelength, etc.).
2. The process temperature and pressure must not exceed the specification of the probe. Temperatures of more than 55°C inside the probe handle will shut down the UV source to avoid any damage caused by overheating.



Danger: Exceeding the specified maximum pressure and / or the specified maximum temperature could result in a potential safety risk.



3. It is recommended that the calibration be checked again prior to the system before installation of the probe (flow cell).
4. Avoid any air or gas bubble in the product stream as these could cause erratic readings. Noisy and unstable readings will result from the presence of bubbles (bubbles are not expected at pressures above 2 barg in aqueous solutions).
5. In ideal case the location / installation of the probe should be in a vertical standpipe.
6. Align the optical path (measuring gap) in direction of the flow.
7. In case the process temperature should fall under the dew point or rise above 55 °C, purge the probe enclosure with dry instrument air (approx. 10 l/h). Temperatures above 55°C will possibly damage the UV- LED. To avoid this occurring the probe is powered down when the inner enclosure temperatures above 55°C.
Condensed water may damage the complete probe at temperature under the dew point.

General (Model UVS-1)

The UV- photometer model UVS-1 / Messenger measures UV- absorbing compounds in liquid products. Optionally the probe may be upgraded to additionally detect the IR-absorbing compounds. This second IR- absorption signal is used to compensate for the turbidity caused by particles.

Operating principle of model UVS-1

UV- Absorption:

The emitted light from a pulsed UV-LED (measuring wavelength typically 254nm or 280nm) passes the process stream when the resulting light is sensed by the measurement detector. Other wavelengths in a spectral range of 240nm to 880nm are available as an option. Please pay attention to the specification of your probe. The decrease in UV- energy is caused by the absorbance of the light by organic species and other substances with UV- absorption e.g. turbidity, caused by particles. A second, reference detector, controls the output of the UV-LED and thus corrects for any changes in the intensity of the UV output.

IR- Absorption: (optional)

As with the UV- absorption the light from a pulsed IR-LED (alternates with the UV- LED) passes through the same path as described above. The decrease in IR- energy (typical wavelength 850nm) is caused by the IR-absorbance of particles (turbidity) only and will be displayed as a second measuring result. Now the reference detector corrects alternating eventual intensity changes of the IR- LED and the UV- LED.

Dual Beam / Dual Wavelength: (optional)

Alternating measurement of UV- and IR- absorption is used to compensate for turbidity caused by particles.

The absorption at measuring wavelength detects the UV- absorption caused by UV- absorbing compounds and total solids.

The absorption at reference wavelength detects the absorption caused by total solids only.

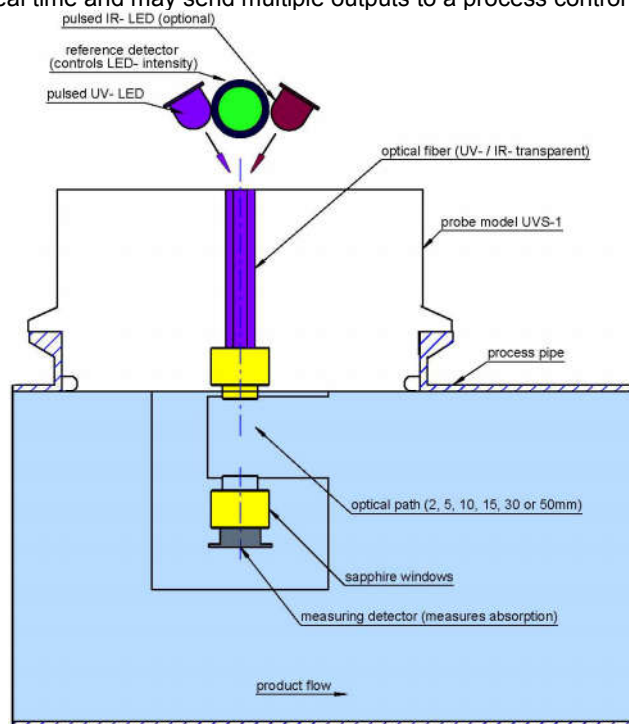
The difference between the two signals gives the concentration of UV- absorbing substances only (e.g. organics, proteins, etc) this method compensates for the absorption of turbidity / particles and provides a measurement of the substances which absorb in the UV- spectrum only. If the probe is specified to measure the absorption in the visible spectrum (colour measurement) the result will be calculated as follow: $[\text{colour absorption} + \text{turbidity absorption}] - \text{turbidity absorption} = \text{colour absorption}$. The dual wavelength measurement compensates for turbidity and results UV- / colour- absorption only without being affected by turbidity.

Temperature:

The model UVS-1 is equipped with two built-in temperature sensors.

Sensor 1 is located in the measuring tip and provides the product temperature and may be displayed as an additional measuring signal. Sensor 2 measures the temperature of the UV- LED and is used to shut down the probe in case the upper temperature limit is reached or exceeded.

All probe signals are converted and processed by the Messenger transmitter. The Messenger transmitter provides the calculated measuring results in real time and may send multiple outputs to a process control system.



* The reference detector controls the intensity of the pulsed UV- / IR- LED

** The measuring detector receives the alternating UV- / IR- absorption signals (IR- absorption is optional)

Take notice: The figure shows the probe 90° turned in the process, this is just for better view.
The typical positioning of the probe makes sure that the process stream flows thru the optical path.

The sensitivity of an UV- measurement system is mainly dependent upon three parameters.

1. The intensity of the UV- / IR- sources.
2. The optical path length (OPL¹).

The **Intensity of the UV- source** is measured by using a reference detector. The reference detector compensates changes of the UV- intensity caused by lamp aging.

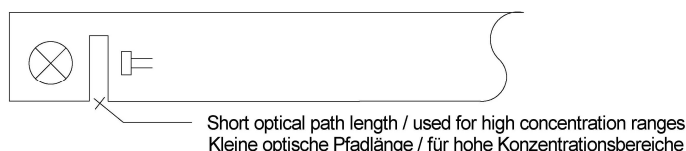
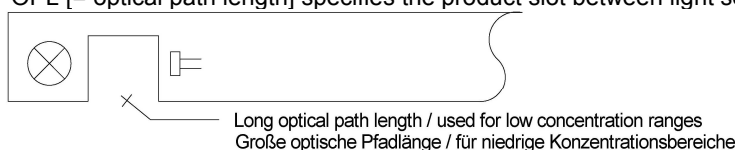
The **optical path length** is variable and has to be selected to meet the requirements of specific applications. A long OPL is required for low concentration measurements otherwise there is not enough change in UV- intensity to obtain a reliable measurement result. A short OPL is required for high concentration measurements, or with substances exhibiting a high absorption coefficient, otherwise there is insufficient energy, passing through the solution, to be measured by the measurement detector. Otherwise there is not enough light intensity to pass the product.

A third parameter is the molecular extinction coefficient (absorptivity) of the compound being measured. This factor must be considered in the selection of the optical path length and is the most important consideration while specifying the hardware.

Long OPL = Low concentrations / high sensitivity

Short OPL = High concentrations / low sensitivity

¹OPL [= optical path length] specifies the product slot between light source and detector



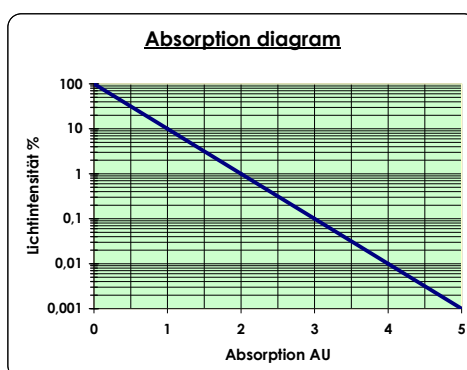
Definition of Absorption Units (AU)

The common measurement unit of an absorption photometer is called AU (Absorption - Unit). Absorption Units are as well known as Extinction Units (Ext) or Concentration Units (CU).

- 1 AU = 90 % loss of UV- intensity
- 2 AU = 99 % loss of UV- intensity
- 3 AU = 99,9 % loss of UV- intensity

The absolute range of model UVS-1 absorption probe:

- 0 to 0.1 AU (lowest range)
- 0 to 4 AU (highest range).



Typical measurement Units

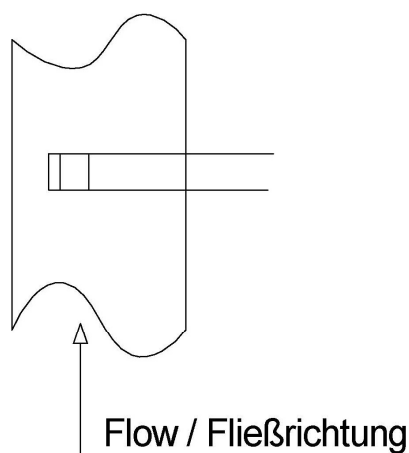
The Messenger transmitter converts the raw absorption (AU- values) to application specific units.

SAC₂₅₄: **S**pectral **A**bsorption **C**oefficient
 TOC: **T**otal **O**rganic **C**arbon
 COD: **C**hemical **O**xygen **D**emand
 PPM: **P**arts **P**er **M**illion
 AU: **A**bsorption **U**nit

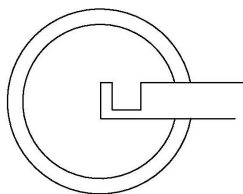
Probe Installation

- Align the optical path (measuring gap) in direction of the flow.
- The process pressure should never exceed the specification of the delivered probe.
- The process temperature should never exceed the specification of the probe.
- Avoid air /gas bubbles inside the optical path of the sensor as these cause interference with the light path resulting in a noisy measurement signal. (The air bubbles.... At pressures above 2 barg in aqueous solutions).
- Purge the probe enclosure with dry instrument air (approx. 10 l/h) in case the process temperature should fall under the dew point or rise above 55 °C. Temperatures above 55°C will possibly damage the UV- LED. To avoid this occurring the probe is powered down when the inner enclosure temperature rise above 55°C.
Condensation of water inside the probe (temperatures under the dew point) may damage the complete probe.

Einbau in eine vertikale Rohrleitung Installation in a vertical pipe



Einbau in eine horizontale Rohrleitung Installation in a horizontal pipe



Luft- / Gasblasen können problemlos und schnell aus dem Messspalt entweichen.

Air or gas bubbles can easily escape from the measurement gap.

Maintenance



We strongly recommend returning the probe for revision to Chemtronic Waltemode GmbH after a maximum 5 years of operation.



Typically, the probe does not require maintenance or a replacement of wearing parts within the normal operating period specified.



An increased revision interval of 2 years is recommended in case of permanent process temperatures above 100°C or in case of aggressive products (e.g. strong acids / alkalis). Please contact Chemtronic Waltemode GmbH for support if you are not sure.



Cleaning of the probe

Use water and mild cleaning agents only to clean the probe.

Don't use abrasive detergents for cleaning!

Don't use mechanical utilities for cleaning which can scratch the surfaces (metal brushes, etc.)

Use lint-free cloth or a soft brush only!

Trouble Shooting

The probe model UVS-1 may show two different error messages.

1. Sensor fail
this error message is typically reported by **relay no. 4** of the Messenger transmitter (factory preset).
The analogue out (4/0 – 20mA) will be set to 20mA output.
The Error occurs in case of a defective UV- / IR- source inside the probe (please contact Chemtronic for support)
The UV- light of the probe is generated by an LED with an extreme long life time (approx. 5 years) and will typically be replaced during the 5 year revision work.
2. Temperature shut down
this error message is typically reported by **relay no. 3** of the Messenger transmitter (factory preset).
The analogue out (4/0 – 20mA) will be set to 20mA output.
The Error occurs in case of temperatures above 55°C inside the probe handle. UV- source has been switched off for safety reasons to avoid a damage caused by overheating.

Remove the Probe immediately from the process.

Wait until the probe temperature falls below 55°C.

Use purge air (dry instrument air) for cooling in case of permanent high process temperatures above 75°C.



The temperature shut down resets automatically if the LED- temperature drops under 55°C. The Messenger transmitter displays "optic fault" in case of "temperature shut down" (factory preset). This error message can be switched off in the menu „set analog outputs“, just set "Overrange" to "not assigned" to switch this message off.



Relay No. 3 switches off to signalize this error.



The Messenger transmitter displays the "optic fault" message in case of "temperature shut down" (factory preset). This error message can be switched off in the menu „set analog outputs“, just set "Overrange" to "not assigned" to switch this message off.



Relay No. 4 switches off to signalize this error.

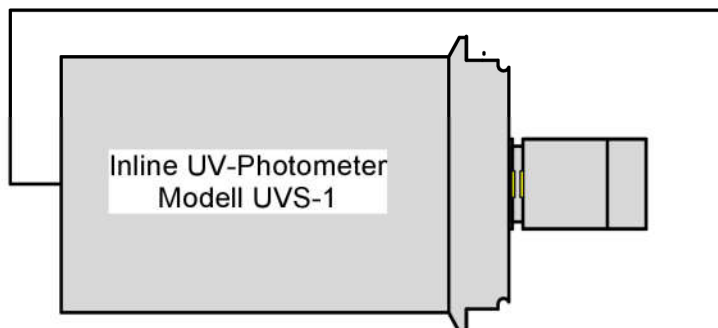
Relay No. 3 and Relay No. 4 are permanently energized (factory preset).

Both relays signalize temperature shut down and Sensor Fail even if the LCD error message has been switched off.

Wiring Diagram (Probe model UVS-1 / Messenger)

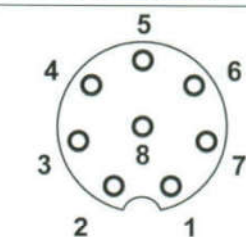
UVS-1 Anschlussklemmen / UVS-1 terminal block

GND	(1) weiß / white
UB +	(2) braun / brown
I - UV	(3) grün / green
I - IR	(4) gelb / yellow
I - T	(5) grau / grey
SF	(6) rosa / pink
SD	(7) blau / blue
GND	(8) rot / red



Belegung Anschlussbuchse (Pin 1 bis 8)

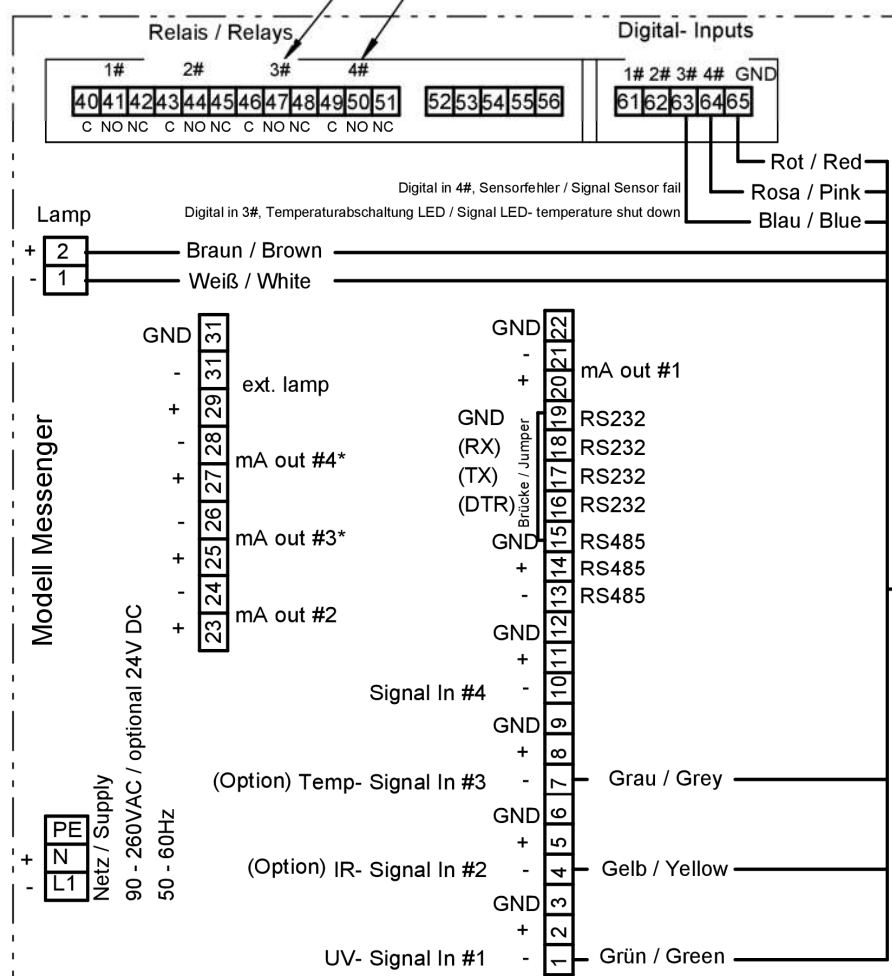
SACC-M12FS-8CON-PG 9-SH



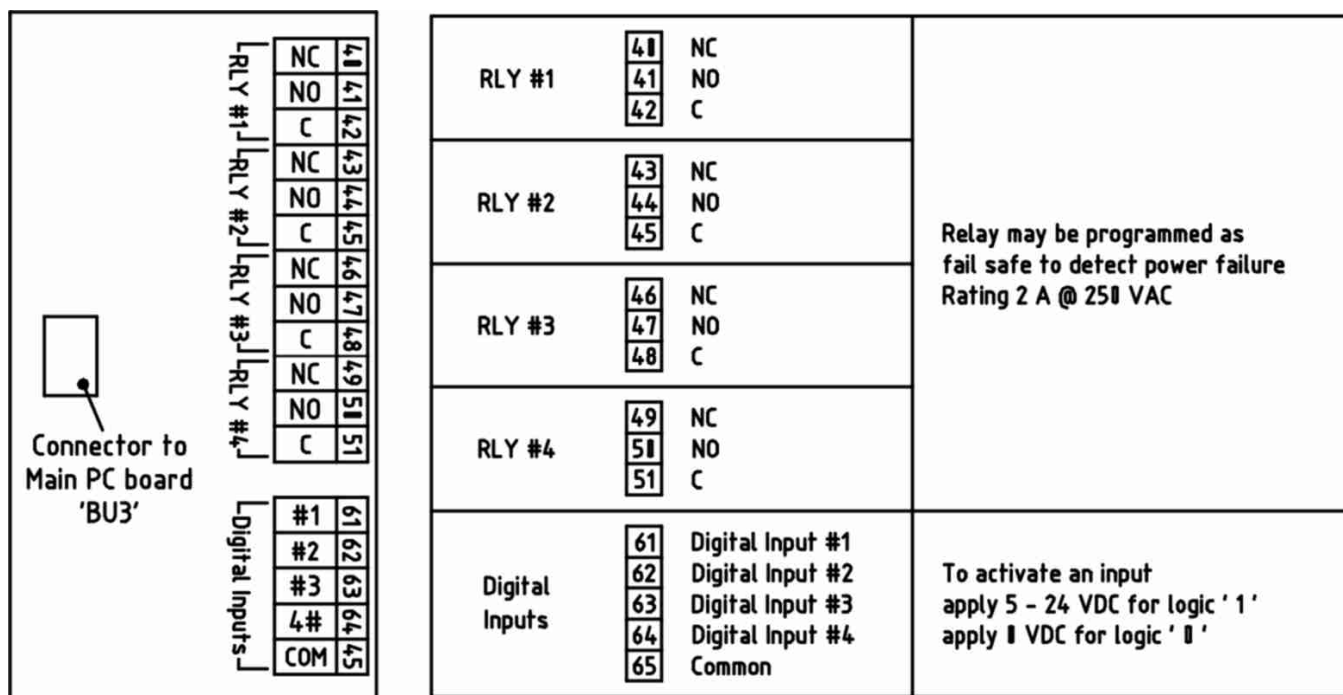
Buchse M12, 8-polig

Relais #3, Temperaurabschaltung / Relay 3#, temperature shut down

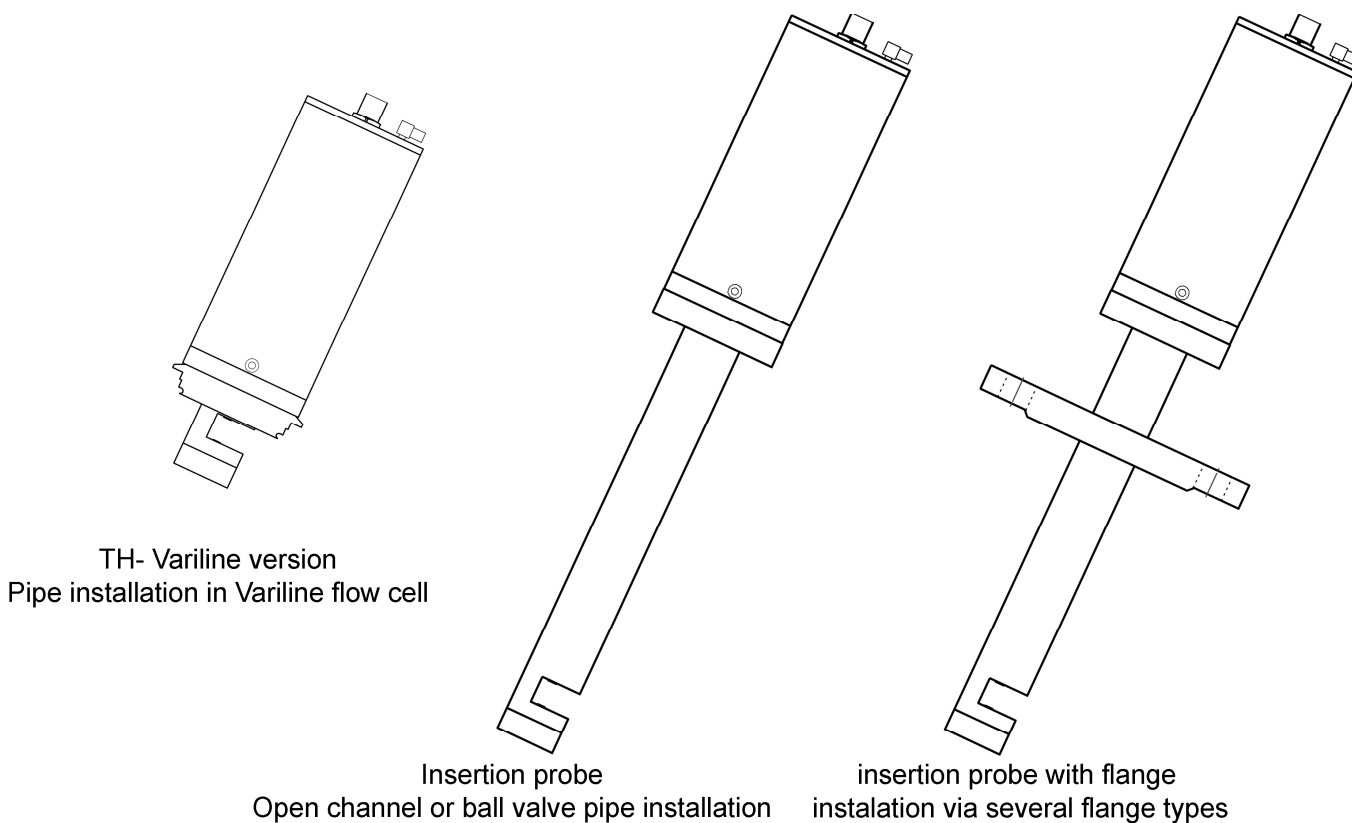
Relais 4#, Sensorfehler / Relay 4', sensor fail



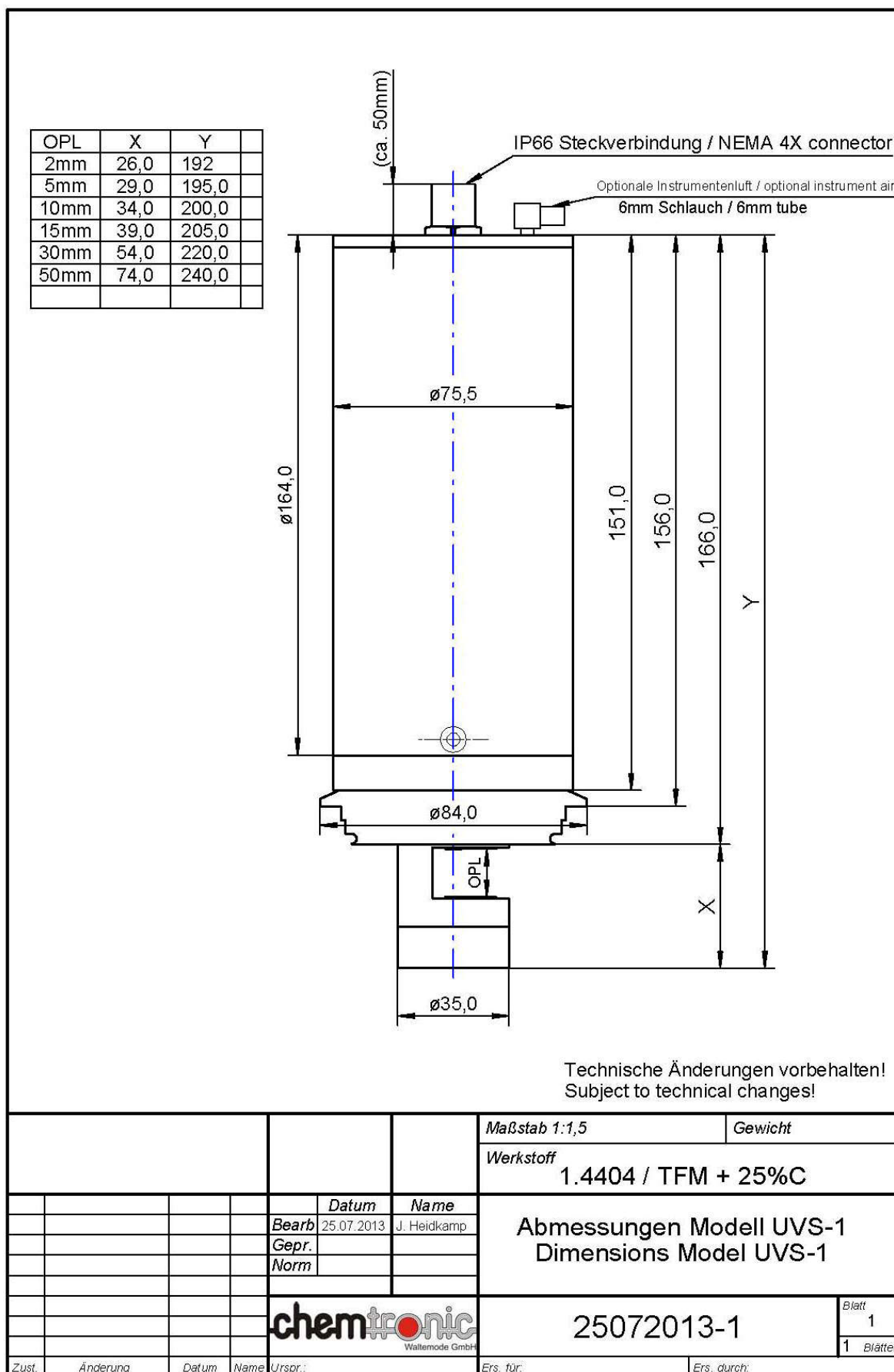
Wiring Diagram (Relays / Digital inputs)



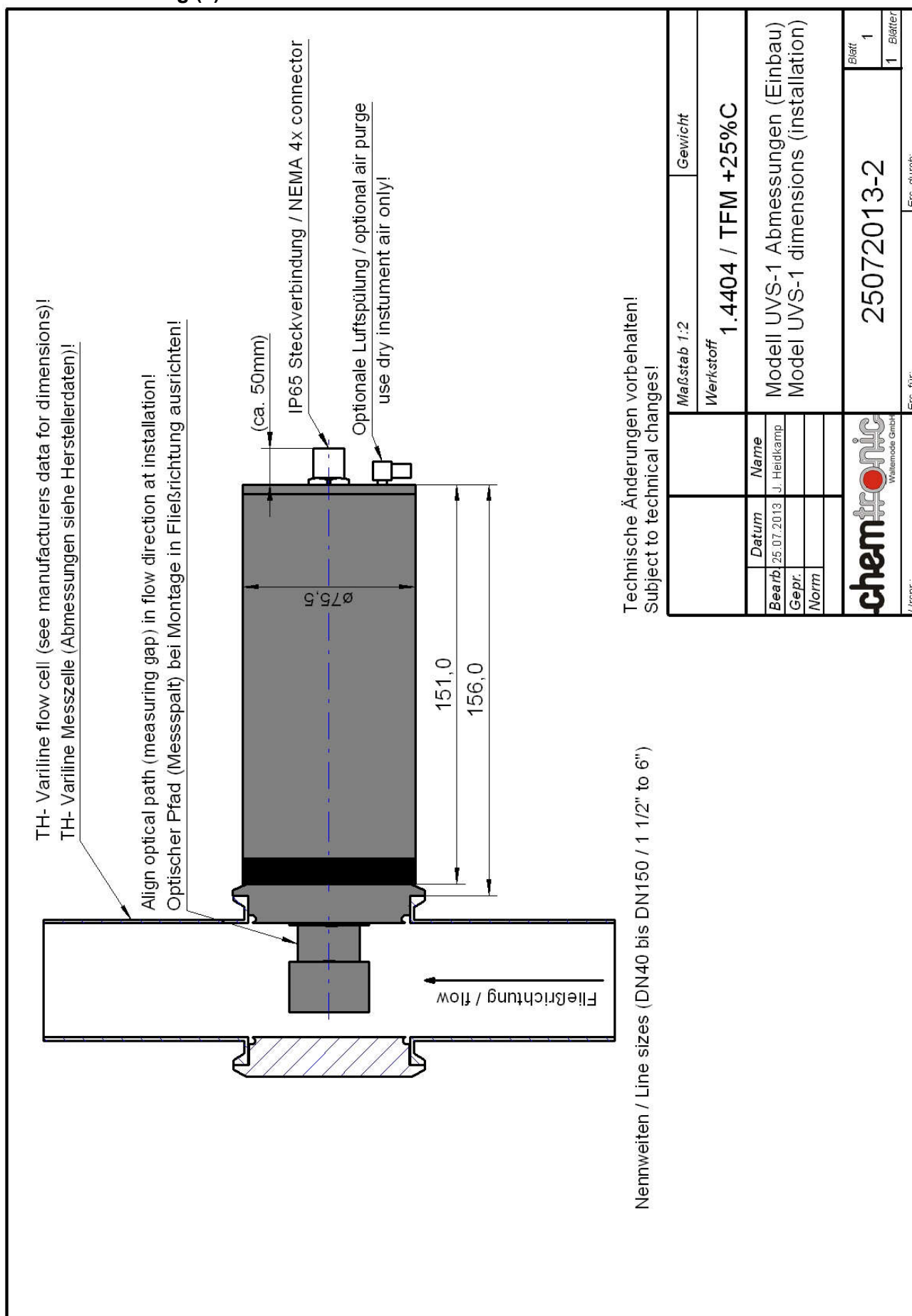
Versions Model UVS-1



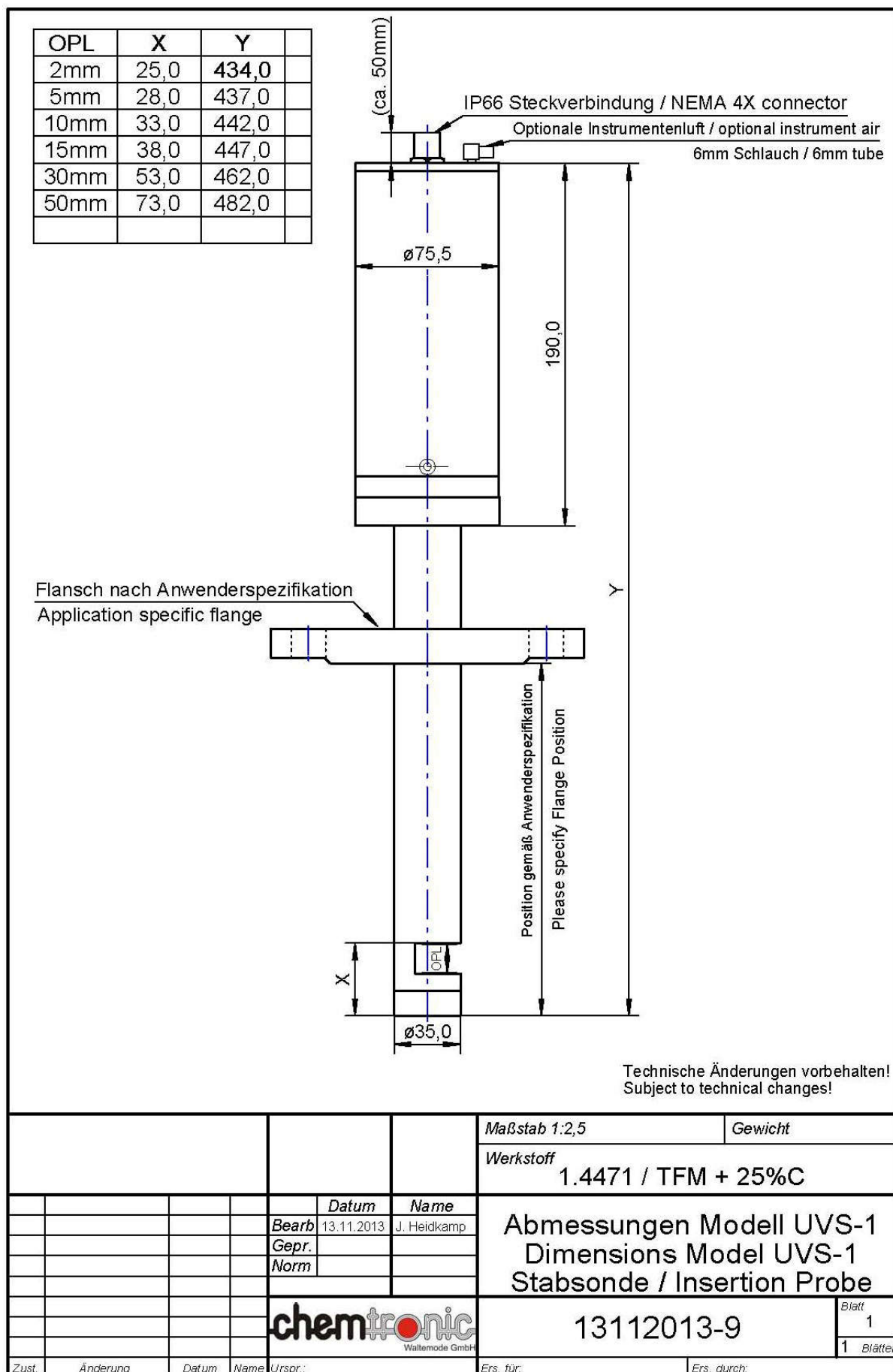
Dimensional Drawing (1) TH- Varvient Version



Dimensional Drawing (2) Varivent Version



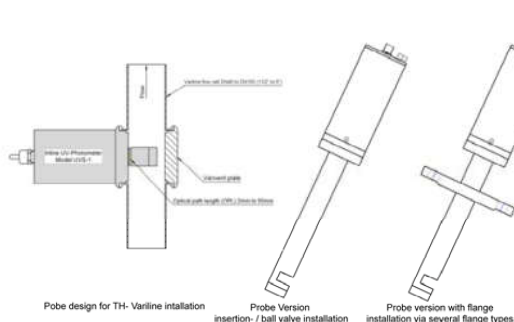
Dimensional Drawing (4) Insertion Probe with Flange



Technical Data / Data Sheet

Model UVS-1

Process UV/VIS/NIR- Absorption Photometer



- **Low Maintenance**
- **Typical calibration interval 12 Month**
- **Material measuring windows: Sapphire**
- **Typical measuring wavelength: 254nm or 280nm**
- **Other wavelength in UV/VIS- spectrum available on request**
- **Optional dual wavelength measurement**
- **Optional process temperature measurement**
- **Installation via TH- Varivent plate (TH- Variline flow cell)**
- **Variline flow cell sizes: DN40 to DN150 (1 1/2" to 6")**
- **Optional extended probe length (insertion length 215 mm)**
- **Optional flanges: DIN, ANSI, Tri clover, APV, TH, ...**
- **Optional Air purge**
- **Cleaning: CIP / SIP**

Description:

The sensor model UVS-1 is used to detect UV- absorbing substances in liquids at wavelength of 254nm or 280nm. Other wavelengths are available on request (240 – 880nm). The lifetime of the LED- light sources is between 2 and 5 years (depending by wave length and application).

The probe detects all UV- absorbing substances at the specified wavelength. This means the probe is sensitive against substances which absorb only UV- light (e.g. benzene) and substances which absorb in the whole UV/VIS/NIR spectrum (e.g. solids). Therefore the dual wavelength option offers a second reference measurement, typical in the NIR- spectrum at 850nm. The UV- absorption is affected by UV- absorbing substances and turbidity (solids).

The NIR- absorption is primary affected by particles (turbidity).

The difference of the both absorption signals ([UV- absorption + turbidity absorption] - turbidity absorption) allows to detect all substances which absorb in the specified UV- range only.

If the probe is specified to measure the absorption in the visible spectrum (colour measurement) the result will be calculated as follow: ([colour absorption + turbidity absorption] - turbidity absorption) = colour absorption. The dual wavelength measurement compensates for turbidity and results UV / colour absorption the influences of the turbidity will be compensated.

A temperature sensor provides a shut down of the probe in case of too high product temperature.

This temperature signal can be displayed as an additional option (accuracy approx. +/- 1°C).

The transmitter model Messenger is required to process the sensor signal of the UV- absorption, respectively the optional signals of dual wavelength absorption and temperature.

Calibration can be done in multiple ranges and measurement units by using up to 8 calibration samples. The UVS-1 covers a wide span measuring ranges, due to the availability of multiple optical path lengths (2mm up to 50mm).

Applications:

- UV254 (optional with reference wavelength 850nm)
- UV280 (optional with reference wavelength 850nm)
- Spectral Absorption Coefficient (SAC)
- TOC / COD / PAC
- Toluene, Benzene,
- Colour measurements in the visible spectrum

Operational areas :

- Potable water / Waste water treatment
- Food and drinking industry
- Bio technology
- Pharmaceutical
- ...

Technical Data:

Line sizes:	DN40 – DN150 / 1½" to 6"	Measuring range absorption:	typical: 0–4AU
Process pressure:	PN25 at DN40 & DN50 PN16 at DN65 & DN80 PN10 at DN100 to DN150	Measuring range temp.:	typical 0-140°C (optional)
Temperature range:	maximal 75° (110°C w. purge air) short time 140°C	Optical path length:	2mm, 5mm, 10mm, 15mm, 30mm or 50mm
Flow cell material:	1.4404 (316L)	Reproducibility:	± 1 %
Window material:	Sapphire	Measuring wavelength:	254nm or 280nm (other on request)
Gasket material:	EPDM (other on request)	Reference wavelength:	850nm
		Protection class:	IP65 / NEMA 4X
		Cleaning:	CIP / SIP