SULFILOGGER™ USER MANUAL

SulfiLogger™ User Manual

Rev.2019-7-5, valid for serial numbers from S/N:1000000

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WARRANTY AND LIABILITY

This product is designed for industrial use. Not for use in human diagnostic or therapeutic procedures. This product must be handled with care and only by trained personnel. Unisense A/S recommends users to read the documentation very carefully.

WARRANTY

The SulfiLogger™ is covered by a limited warranty according to the product datasheet.

The warranty does not include repair or replacement necessitated by accident, neglect, misuse, unauthorized repair, or modification of the product. In no event will Unisense A/S be liable for any direct, indirect, consequential or incidental damages, including lost profits, or for any claim by any third party, arising out of the use, the results of use, or the inability to use this product.

Unisense assumes no liability for damages on instruments designed for indoor use due to unintended field use or exposure to dust, humidity or corrosive environments.

RECYCLING PROGRAM

Unisense a/s is committed to help our customers to recycle responsibly. More than 80 % of the product can be reused, so we ask you to request a pick-up label by writing to sulfilogger@unisense.com.

GENERAL INFORMATION

Thank you for choosing the Unisense SulfiLogger™ sensor - the only hydrogen sulfide (H_2S) sensor on the market enabling:

- Direct measurement of H_2S concentrations in either liquid or gas phase
- Easy plug'n'play installation
- Operation for measuring campaigns in harsh environments such as sewer networks
- Easy cleaning, maintenance and calibration

SAFETY

Please read this manual carefully before unpacking, installing or operating this equipment. Although the operation of the SulfiLogger™ sensor is straight forward, it is mandatory to be familiar with the content of this manual. Failure to do so may result in serious injury to operators or other persons, or damage to equipment. Do not use or install the SulfiLogger™ sensor and auxiliary equipment in any other way than specified in this manual. Special attention must be paid to all danger and caution statements.

Do not use the SulfiLogger™ sensor outside the specified electrical, mechanical and thermal parameters as specified in the data sheet. During the installation please wear personal protective equipment (PPE) according to the safety regulation of the installation site.

Hazard statement nomenclature

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

IMPORTANT NOTE
Information that requires special emphasis.

Hazardous areas - SulfiLogger™ sensor EX version

- Pay close attention to other EX equipment used in conjunction with the SulfiLogger™ sensor.
- Observe the specifications in the certificate as well as national and local regulations.
- Ensure that all personnel are suitably qualified.
- Always use approved EX barriers for installation.

Chemical and gas handling safety

DANGER
Handling hazardous gases such as hydrogen sulfide or chemical samples containing dissolved sulfides can be dangerous. Users of this product are advised to familiarize themselves with safety procedures, use of personal protective equipment

(PPE) and the correct use of gases and/or chemicals, and to carefully read all relevant Safety Data Sheets.

Installation and calibration of the SulfiLogger™ sensor may include the risk of contact with hazardous gases or liquids. It is especially important regarding the SulfiLogger™ sensor for hydrogen sulfide. Hydrogen sulfide is a highly toxic gas and special precautions are needed to avoid the risk of injury or death.

Furthermore, the installation of the SulfiLogger™ sensor in applications such as sewer networks or other facilities containing raw wastewater includes a risk of contact with a range of other chemical and biological threats, and any operator performing installation or service on the SulfiLogger™ sensor in such environments should therefore be trained in the environmental safety and need of PPE for the given application. This manual does not cover any such training. The use of the SulfiLogger™ sensor for specific applications may involve risks that are not mentioned here.

SUPPORT

SUPPORT, ORDERING, AND CONTACT INFORMATION

If you wish to order additional products or if you encounter any problems and need scientific/technical assistance, please do not hesitate to contact our sales and support team. We will respond to your inquiry within one working day.

E-mail: sulfilogger@unisense.com

Unisense A/S
Tueager 1
DK-8200 Aarhus N, Denmark
Tel: +45 8944 9500
Fax: +45 8944 9549

Further documentation and support is available at our website sulfilogger.com

OVERVIEW

The SulfiLogger™ sensor is available in a number of different configurations. Some of these are available in ATEX certified versions. Please pay close attention to your product type during the reading of this manual and the installation of the sensor. ATEX certified versions of the sensor are labeled SulfiLogger™ X1 and standard versions of the sensor are labeled SulfiLogger™ S1 sensor. If your product is an ATEX certified product (X1 series) it is very important that you carefully follow the instructions relating to ATEX specific installation requirements. Guidance for installation of the SulfiLogger™ sensor can be found in Appendix A. This guide is relevant for sensors with serialnumbers starting from 1000000. For older sensors please find the relevant guide on our homepage https://sulfilogger.com

MAINTENANCE

The SulfiLogger™ sensor has no active fouling handling, and the sensor head therefore needs periodic cleaning. The necessary cleaning frequency depends very much on the type of wastewater and on the turbulence around the sensor. Stagnant water gives ideal conditions for biofouling, and when choosing a mounting position it is therefore advisable to look for a position with relatively high flow / turbulence.

For new installations it is recommended to clean and calibrate the sensor one time per week to ensure stable operations. When more experience has been gained on the actual fouling rate at the installation site, this maintenance frequency may be changed.

Cleaning

The SulfiLogger™ sensor's durable design makes cleaning easy.

- Remove any accumulated rags/fibers and larger debris from the sensor.
- Wipe off the sensor head with a cloth. Take special care to ensure that the inlet slit(s) at the front of the sensor head is completely clean.
- If needed use water or a mild soap to clean the sensor head. This is especially important if a greasy layer has build up on the sensor or if a layer of biofilm can be directly seen. Ethanol can also be used.

Calibration

The SulfiLogger™ sensor comes factory calibrated and is as such ready to use immediately as received. However, calibration in

the field can be a good way to ensure that the sensor keeps the absolute accuracy after prolonged deployment. Initially it is recommended to calibrate the sensor before installation and subsequently once every month, but this can be subject to specific installation conditions.

The calibration procedure is simple and has no demand for access to SCADA values or connection of computer/laptop or other data viewing devices. The calibration routine relies on the SulfiLogger™ sensor's internal detection capability of the calibration gas and on the presence of a magnetic switch which is activated by the calibration cap. A number of different indicator light modes gives signal to the operator of what to do during the calibration, as described below. The position of the indicator light is shown in Figure 1.

Figure 1: Close-up view of the SulfiLogger™ sensor showing the position of the LED indicator light used for signaling during the calibration process (see below).

To calibrate the SulfiLogger™ sensor, a calibration gas with a concentration of 1000 ppm H_2S is needed. This can be ordered separately from Unisense together with a calibration kit that facilitates the activation of the calibration mode in the sensor and ensures a relevant flow of gas to the sensor during calibration. Refer to the

table on page 13 for more details on the ordering of calibration equipment. Figure 2 shows how the calibration kit and gas bottle is mounted on the SulfiLogger™ sensor. The reduction valve on the gas bottle ensures that the correct flow of gas is exposed to the sensor, and the valve should therefore be opened fully when a calibration is ongoing.

Figure 2: Mounting of the calibration cap and gas bottle

Overview of light indications on the SulfiLogger™ sensor

The indicator light on the SulfiLogger™ sensor is constantly giving a status of the sensor and can as such be used to check that the sensor is on. Before calibration is initiated it is important to be familiarized with the various status signals that the sensor uses as indications and calls for operator actions. These are summarized in the table below.

The calibration procedure of the SulfiLogger™ sensor consists of the following steps:

1. Initially, check that the sensor is on and is in normal operation mode showing Green flashes on the indicator light with one flash every 4 seconds. (slow blinking)

Light indication	Explanation
Green, 1 per 4 sec	Sensor is operating normally
Green, 1 per sec	Calibration cap mounted
Green, 3 per sec	Gas signal detected
Green and red, 1 per sec	Minimum calibration
Green and red, 2 per sec	Full calibration. Close and take off cap
Green, 15 times	Calibration succeeded
Red, 15 times	Calibration failed

2. Connect the gas bottle to the calibration cap with the supplied flow regulator and gas tube

3. Mount the calibration cap on the sensor and make sure to align the arrow of the calibration cap with the position of the indicator light (this activates the magnetic switch in the sensor). Thereby the calibration mode in the sensor is activated and the light indicator now switches to green flashes with one flash every second (medium blinking)

4. Open the flow regulator on the gas bottle to allow H_2S gas to reach the sensor. After a short time the light indicator should switch to green flashes at 3 flashes every second (fast blinking)

5. After approximately 3 minutes a minimum calibration has been achieved and the calibration procedure can be terminated. This is indicated by an alternating green and red light signal with one flash every second. If time allows we recommend to continue the calibration until a full calibration has been completed (see below)

6. A few minutes after the minimum calibration the flashing rate switches to faster alternations between red and green light at 2 flashes per second. This indicates that a full cali-

bration has been completed and it is time to terminate the calibration procedure

7. When either a minimum or a full calibration has been completed the regulator valve is closed on the gas bottle and the calibration cap should be removed. Pay close attention to the indicator light when removing the calibration cap since the result of the calibration is immediately shown on the indicator light when the magnetic switch is turned off. The indicator light shows 15 fast flashes (5 per second) of either green light or red light. If the flashes are green, the calibration has been completed and stored successfully. It the flashes are red, the calibration has failed during the process and the calibration procedure must be restarted.

CAUTION
If your sensor is installed using a flow cell, you must inspect the O-ring at the tip of the sensor when it is removed from the flow cell. If O-ring is worn or damaged it must be replaced by a new. Replacement O-rings and O-ring grease have been delivered together with the flow cell.

IMPORTANT NOTE
The fifteen short green flashes at the final stage of calibration is the only indication visible to the operator of a successful calibration. However, if in doubt, we recommend that the calibration validity is checked subsequent to calibration by exposing the SulfiLogger™ sensor to the calibration gas and checking the reading at the SCADA system or through the SulfiLogger App (The SulfiLogger™ sensor only). Please make sure to turn the calibration cap so that the arrow is NOT

aligned with the light indication signal when checking the calibration in order to avoid that a new calibration procedure is initiated.

ACCESSORIES

Here is a list of accessories available for the SulfiLogger™ sensor. Please contact Unisense to order these items.

LIST OF ACCESSORIES

Unisense item no.	Description
S00021	SulfiLogger™ X1/S1 extension pipe kit
S00022	RS-232 X1 barrier kit
S00023	Power / 4-20mA X1 barrier kit
C00005	H2S calibration gas, 1000ppm
C00004	Gas flow regulator
S00032	Calibration Cap
S00020	Calibration Cap/Flow cell, threaded. 10bar
C00055	30 mm pipe stud
C00002	10 meter RS-232 cable, single-ended
C00003	10 meter Power / 4-20mA cable, single-ended
C00056	Transport box (pelicase)
S00016	PowerCom Box S1 EU
S00017	PowerCom Box S1 US
S00049	PowerCom S1 cable, 10m
S00035	SulfiLogger™ X1/S1 Calibration kit (all incl.)

USING THE SULFILOGGER APP

Only relevant for sensor version

The SulfiLogger™ sensor comes with a free App which can be installed on Windows computers.

The SulfiLogger App can be downloaded and installed from the SulfiLogger™ website https://sulfilogger.com/products

The SulfiLogger App enables:

1. Verification of the sensor and battery status of the SulfiLogger™ sensor.
2. Easy access to the data stored in the SulfiLogger™ sensor device. The data can be exported in csv-file format.
3. Viewing of live data values from the SulfiLogger™ sensor.

To download data from the SulfiLogger™ sensor, simply connect the RS232 cable to a USB port on a laptop with the SulfiLogger App installed. Open the SulfiLogger App and press the "Download data" button. The data is stored as a csv-file in the folder "Unisense Data" in your local documents folder.

Using the PowerCom Box

The combined power and communication box (PowerCom Box) is a battery box used in connection with the SulfiLogger™ sensor. It enables the use of the SulfiLogger™ sensor in areas without a 4-20 mA connection. The PowerCom S1 cable is used to connect the SulfiLogger™ sensor to the PowerCom Box. The sensor cable is connected to the sensor connector (left side connector on figure 3) on the PowerCom Box.

Data stored on the SulfiLogger™ sensor is downloaded using a USB cable. Connect a USB cable to the USB port (right side connector on figure 3) and open the SulfiLogger App on your computer. For further information on how to download the sensor data, see the SulfiLogger App section in this manual.

The battery has a lifetime of about 2 months. When recharging the battery, use the power cable included with the PowerCom Box. The battery is recharged after about 6 hours. The SulfiLogger™ sensor cannot be connected to the PowerCom Box while charging.

Figure 3: Connections on the PowerCom Box. The sensor cable is connected to the PowerCom Box using the sensor connection to the left. Data are downloaded from the SulfiLogger™ sensor to a computer using the USB port on the right side.

SPECIFICATIONS

OPERATING PRINCIPLES OF THE SENSOR

Electrochemical measurements of hydrogen sulfide

The SulfiLogger™ sensor contains multiple individual sensing elements which are all based on Unisense core microsensor technology. For further information on the technology, visit: www.sulfilogger.com

The electrochemical microsensors in the SulfiLogger™ sensor measures dissolved H_2S which is one of the three forms of dissolved sulfide in equilibrium in the water phase, H_2S, HS^-, and S^{2-}. For all practical purposes in sewer applications, only the first two of these are of interest. The p_{Ka} value for deprotonation of H_2S is around $\mathrm{pH} = 7$, which is approximately the same as typical domestic wastewater. For this reason, wastewater will typically contain both H_2S and HS^-, and a separate measurement of the pH-value of the wastewater is necessary to calculate the total amount of dissolved sulfides in the wastewater. Please contact Unisense if you need guidance on how to find the concentration of total dissolved sulfide from the SulfiLogger™ sensor signal (only dissolved H_2S). For many purposes however, the dissolved H_2S measured by the SulfiLogger™ sensor is indeed the parameter of interest, since the concentration of dissolved H_2S is directly linked to the emission of gas phase H_2S which gives rise to the well-known odour and corrosion problems in the sewer. Measuring the concentration of H_2S in the liquid instead of in the gas phase gives a more reliable signal since the measurement is independent of the daily variations in ventilation conditions in the head space of the sewer, and it is independent of the exact mounting position of the sensor (in the liquid, the sulfide concentration is fairly homogeneous, whereas very large differences in gas phase concentration has

been seen from top to bottom of sewer head spaces).

Electrochemical sensors are sensitive to temperature changes, and for this reason each transducer in the sensor heads is compensated for temperature effects with reference to an internal temperature measurement in the SulfiLogger™ sensor's sensor head.

MEASURING IN DIFFERENT MEDIA - UNIT CONVERSIONS

The electrochemical microsensors in the SulfiLogger™ sensor' sensor head measures the partial pressure of H_2S. In the gas phase, this can be converted to a ppm-reading if the total barometric pressure is known, and in the liquid phase the measured value can be converted to a concentration measured in either µM or mg/L by using Henry's constant and the molar weight.

Each sensor is ordered with a specification of medium type, and the signal output from the SulfiLogger™ sensor is chosen as ppm for gas phase sensor heads and S−mg/L for liquid phase sensor heads, the "S" in front of mg/L meaning that only the sulfur fraction of the weight is counted in the specified measurement.

The ppm values for gas phase sensors is calculated by using a standard barometric pressure of 1atm = 101325Pa, and the mg/L values for liquid phase sensors is calculated by using a temperature corrected value of Henry's constant. Please note that other dissolved substances and high salinity values may also influence the conversion to mg/L units. For more information on this, please contact Unisense.

SULFILOGGER™ SENSORS

An overview of the SulfiLogger™ sensor types and their features can be found in the table below.

SulfiLogger™ sensor	S1-1010-5mgL	S1/X1-1020-5mgL	S1/X1-1120-5mgL or 1000ppm	X1-1220-1000ppm
Environment	Wastewater	Wastewater	Pressurized wastewater or gases	Pressurized gases
Range	0-5 mg/L	0-5 mg/L	0-5 mg/L	0-1000 ppm
Max pressure	10m	10m	3 barg	10 barg
Input power	Battery	20 to 30 V	20 to 30 V	20 to 30 V
Output data	Logged data	RS-232 or 4-20 mA	RS-232 or 4-20 mA	RS-232 or 4-20 mA
Mounting	Free hanging or Wall mounted	Free hanging or Wall mounted	In-line or Flow cell	In-line or Flow cell

Technical specifications common for all sensors:

Accuracy	+/- 5% of full range
Response time (t90)	<25 seconds
Detection limit	1% of full range
Operating humidity range	0-100%
Design temperature range	-20° C to +60° C (-4° F to +140° F)
Operating temperature range	0° C to +40° C (32° F to +104° F)

Mechanical specifications common for all sensors:

Length	240 mm
Diameter	Ø48.3mm / 1 ½" pipe
Weight	0.85 kg
Material	Stainless Steel - EN 1.4404 (316L)
Warranty	3 months

KNOWN INTERFERING SUBSTANCES

Below is a list of chemicals that has been tested against the sensor. The table shows where interference's has been found and to which extend they interfere. This list is also available online: www.sulfilogger.com/technology

Gas	Formula	Interference in gas (%)[1]	Interference in liquid (%)[2]
Methane	CH_4	0	0
Carbon dioxide	CO_2	0	0
Nitrogen	N_2	0	0
Oxygen	O_2	0	0
Air	O_2, N_2, Ar	0	0
Nitrous oxide	N_2O	0	0
Ammonia	NH_3	0	0
Hydrogen	H_2	0.8	96
Carbon monoxide	CO	0.6	77
Dimethyl sulfide	$(CH_3)_2S$	18	18
Methyl mercaptan	CH_3SH	174	44
Ethyl mercaptan	C_2H_6S	13	14
Sulfur dioxide	SO_2	40	1

[1] Given as signal for the interfering species in % of H_2S signal at equal partial pressures.

[2] Given as signal for the interfering species in % of H_2S signal at equal molar concentrations.

SULFILOGGER™ SENSOR SEWER INSTALLATIONS - TIPS AND TRICKS

When installing the SulfiLogger™ sensor for monitoring hydrogen sulfide in sewer networks the following notes may serve as guidelines for a monitoring campaign:

- Hydrogen Sulfide (H_2S) is created under oxygen free conditions in the sewer which typically occurs in Force Mains (pumped sewer lines). The concentration of dissolved H_2S increases when the residence time and/or temperature of the wastewater increase. H_2S is released at the end of the pipe, where the wastewater is again in contact with air (head space). This can be a simple overflow to gravitational sewer lines, a pump sump for a subsequent Force Mains pump line, a buffer tank or similar.
- The easiest and recommended way of deploying the SulfiLogger™ sensor for H_2S monitoring in sewer networks is to install the sensor with a connecting pipe protecting the cables. The pipe must be secured to either the sewer wall or at the top/inlet screen.
- The dissolved H_2S is released to gas phase during the first stretch of an aerated sewer. The exact distance of release depends on many different parameters such as turbulence and ventilation conditions, but in general it is advisable to measure as close to the end-of-pipe of the Force Main as possible to get a realistic measure of the initial H_2S concentration.
- The SulfiLogger™ S1/X1-1120-5mgLsensor can be mounted at access points directly on the Force Main. This can either

be done by attaching the sensors threaded fitting to the pressure pipe or through a dedicated load-lock system at the chosen position on the pipe. Note however, that liquid velocities are often high in pressurized pipes, and hence there is an increased risk of sensor damage associated with this type of measurements.

- In general it is recommended that the SulfiLogger™ sensor is mounted in a way where it is either always submerged or always out of the water (in the head space). Interpretation of data can be difficult if the SulfiLogger™ sensor is intermittently submerged. Furthermore, a mounting at a position where the SulfiLogger™ sensor gets in and out of the water often leads to an increased risk of biofouling and scaling, which significantly limits the time with reliable data in a field deployment.

TROUBLESHOOTING

Problem: The SulfiLogger App does not recognize the SulfiLogger™ sensor when it is connected (version 1010 only).
Solution: Try charging the battery of the PowerCom Box, or try disconnecting the wire from the PowerCom Box to the sensor and reconnect it subsequently.

Problem: The SulfiLogger™ sensor is showing values close to zero all the time even though grab sample analysis of the medium shows significant sulfide concentrations.
Solution: The inlet of the SulfiLogger™ sensor my be blocked by fouling. Try rinsing the sensor and gently wiping the front with a wet cloth, taking care not to apply force around the inlets of the sensing elements. If the measurements are performed in liquid phase (e.g. in wastewater), check the pH-value of the liquid. If the medium is alkaline (above pH-8) then the dissolved sulfide is primarily on the HS^--form, which is not detected by the SulfiLogger™ sensor. For slightly alkaline pH-values (pH-7-8), the pH-effect can be corrected for, but for higher pH-values, we recommend using the SulfiLogger™ sensor in a low-volume sidestream reactor, where the wastewater is acidified to ensure that all dissolved sulfide is on the H_2S-form.

Problem: The SulfiLogger™ sensor does not measure correct values according to our standard tests.
Solution: When judging the accuracy of the SulfiLogger™ sensor we always recommend to apply a gas phase measurement with gas from a pre-mixed gas bottle containing a known H_2S concentration. Please note that the accuracy (grade) of gas bottle

concentrations vary. The accuracy should be stated on the bottle or can be provided by the vendor. If judging the accuracy of the SulfiLogger™ sensor based on liquid phase measurements there are various ways to do this, all of which are prone to higher degrees of uncertainty than the gas phase testing: One option is to prepare a standard (stock solution) mixture with a known concentration of H_2S. Experience shows that this is not an easy task and that the concentration should continuously be checked with laboratory equipment such as spectrophotometric methods. For more information on this, please contact Unisense. Another option is to do grab sample analysis of wastewater and compare the results of a sulfide analysis (e.g. Clines' method) with the measurement values of the SulfiLogger™ sensor. Please be aware, though, that standard sulfide analyses of wastewater grab samples measures the *Total Sulfide* and not only the *Total Dissolved Sulfide*. For a comparison between the SulfiLogger™ sensor measurements and grab sample values it is thus needed to filter out any particulate sulfide of the samples, and it is necessary to do a pH-based calculation of the total dissolved sulfide from the SulfiLogger™ sensor signal. Furthermore, it should be noted that correct sampling techniques and sample preservation should be conducted with utmost care to avoid significant influences on the measured sulfide concentrations in the grab samples. For further information and guidance on procedures for liquid phase comparisons, please contact Unisense.

Problem: Even though the SulfiLogger™ sensor has just been calibrated, the measurements are showing incorrect values.
Solution: When calibrating the SulfiLogger™ sensor it is important that the procedure described in the Maintenance chapter above is followed. Please refer to the relevant chapter, and if

this is still giving problems, contact Unisense. Please also note that even though the signal of the SulfiLogger™ sensor is temperature compensated, the accuracy of the sensor is highest if the calibration is done at a temperature close to the temperature of subsequent measurements.

COMPLIANCE INFORMATION

FCC PART 15, CLASS A

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

F00001_FCC_Compliance Information _100.pdf

A: INSTALLATION GUIDE

SulfiLogger™

Installation manual

Revision 1.00 (Valid from May 2019)

Introduction

This guide covers the steps required to install the SulfiLogger™ sensor, including the electrical and mechanical installation procedures. For further information about the use and maintenance of the product, we kindly refer to the latest User Manual available at **www.SulfiLogger.com**. Warranty and legal information are described in the terms and conditions of your order confirmation and also available upon request.

Safety

Please read this manual carefully before unpacking, installing or operating the device. Although the operation of the SulfiLogger™ sensor is straightforward, it is mandatory to be familiar with the content of this manual. Failure to do so may result in serious injury to operators or other persons, or damage to equipment. Do not use or install the SulfiLogger™ sensor and auxiliary equipment in any other way than specified in this manual. Special attention must be paid to all danger and caution statements. Do not use the SulfiLogger™ sensor outside the specified electrical, mechanical and thermal parameters as specified in the data sheet. During the installation, please wear personal protective equipment (PPE) according to the safety regulation of the installation site.

Hazard statement nomenclature

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

IMPORTANT NOTE
Information that requires special emphasis.

Hazardous areas - SulfiLogger™ sensor EX version

- Pay close attention to other EX equipment used in conjunction with the SulfiLogger™ sensor.
- Observe the specifications in the certificate as well as national and local regulations.
- Ensure that all personnel are suitably qualified.
- Always use approved EX barriers for installation.

Chemical and gas handling safety

DANGER
Handling hazardous gases such as hydrogen sulfide or chemical samples containing dissolved sulfides can be dangerous. Users of this product are advised to familiarize themselves with safety procedures, use of personal protective equipment (PPE) and the correct use of gases and/or chemicals, and to carefully read all relevant Safety Data Sheets.

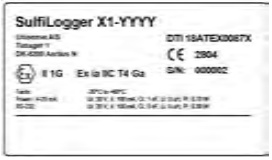
Installation and calibration of the SulfiLogger™ sensor may include the risk of contact with hazardous gases or liquids. Hydrogen sulfide is a highly toxic gas and special precautions are needed to avoid the risk of injury or death. Furthermore, the installation of the SulfiLogger™ sensor in applications such as sewer networks or other facilities containing raw wastewater includes a risk of contact with a range of other chemical and biological threats, and any operator performing installation or service on the SulfiLogger™ sensor in such environments should therefore be trained in the environmental safety and need of PPE for the given application. This manual does not cover any such training. The use of the SulfiLogger™ sensor for specific applications may involve risks that are not mentioned here.

Overview

The SulfiLogger™ sensor is available in different configurations in an ATEX certified version (X1 sensors) and a non-ATEX certified version (S1 sensors). If your product is an ATEX certified product, it is crucial that you carefully follow the instructions relating to ATEX specific installation requirements.

EU - ATEX certification

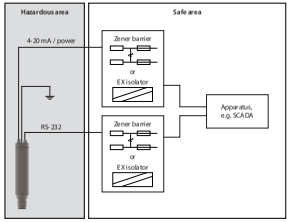
The SulfiLogger™ X1 sensor has the following marking:



Electrical installation

Barriers for SulfiLogger™ X1 installation

When using the SulfiLogger™ sensor, a Zener barrier or EX isolator MUST always be used. We recommend using barriers tested and approved by Unisense.



Connection

The SulfiLogger™ sensor has two connectors: A 4-20 mA power connector (5-pin M12 male) and an RS-232 connector (5-pin M12 female). We recommend using M12 plugs in stainless steel (EN 1.4404 / 316L). These cables can be provided by Unisense.

Please note that products powered by a battery box may require special attention. Please refer to the latest User Manual.

Port parameters

Please note that the colors listed here only apply for cables supplied by Unisense. The SulfiLogger™ is designed for 4-20 mA loop-power. However, this connector can also be used only for DC supply.

Power / 4-20 mA

Pin	Color	Connection
1	Brown	Positive (+12 to 24 v)
2	White	Not connected
3	Blue	Negative (-)
4	Black	Not connected
5	Gray	Not connected

Communication (RS-232)

Pin	Color	Connection
1	Brown	TXD
2	White	Not connected
3	Blue	RXD
4	Black	GND
5	Gray	Not connected

Grounding

The SulfiLogger™ sensor should always be grounded. However, national, regional or local regulation may apply. For use in ATEX-regulated areas, see EN/IEC 60079-14. Unisense recommends that the SulfiLogger™ sensor is always grounded using the M6 thread at the back of the device for a secure grounding connection.

DANGER
Using a SulfiLogger™ sensor from the X1-series without grounding will void the ATEX certificate.

Mechanical installation

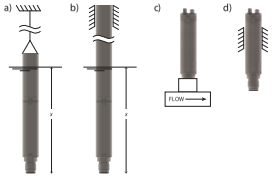
The SulfiLogger™ sensor can be installed in four different ways:

a) Free hanging (liquids)

b) Fixed (liquids)

c) Inline (gases)

d) Fixed (gases)



a) Free hanging (liquids)

This mounting option is ideal for low flow reservoirs and channels and generally suitable for short measurement campaigns. The SulfiLogger™ sensor is installed at the end of an extension pipe, attached to an anchor point using a steel wire and suspended down into the sewage. The extension pipe ensures that the cables and connectors are protected from fouling.

To perform this installation, you must ensure:

- That the circulation in the reservoir is sufficient to ensure good mixing.
- That the sensor tip can not touch the walls and bottom of the reservoir, especially during high flows. If there is a risk of the sensor hitting the walls, then you should perform the "fixed (liquids)" installation instead.
- That you have a suitable anchor point available to attach the steel wire to.
- That the length of the steel wire allows the sensor to remain in the liquid at all times while the back of the extension pipe at the same time remains out of the liquid.

b) Fixed (liquids)

This mounting option is ideal for permanent installations in low and high flow reservoirs and channels. It is similar to the "Free hanging (liquids)" installation in most regards but here, the extension pipe (and sensor) is fixated - not hanging in the steel wire. Unisense does not supply brackets or any other materials for this installation method.

c) Inline (gases)

Directly on the main pipe

The SulfiLogger™ sensor can be installed on a pipe stub allowing measurement in a closed system.

- Before installing the pipe stub a 30 mm hole must be drilled in the main pipe.
- The pipe stub is supplied by Unisense and must be welded onto the main pipe.
- Use a spanner (size 36) to screw the SulfiLogger™ sensor onto the pipe stub.
- Beware of the pressure rating of the SulfiLogger™ sensor and ensure that the pressure pipe system does not exceed the pressure limit.

Bypass flow using a flow cell

A portion of the flow can be directed/bypassed into a flow cell on which the SulfiLogger™ sensor is installed.

- Before the installation, please ensure that the pressure and temperature ratings of the bypassed flow are within the specifications of the SulfiLogger™ sensor.
- The flow cell is supplied by Unisense.
- Use a spanner (size 36) to screw the SulfiLogger™ sensor onto the flow cell.

d) Fixed (gases)

The SulfiLogger™ sensor can be mounted in pump wells, reservoirs etc. above water level for gas phase measurements. The outer diameter of the SulfiLogger™ sensor resembles a 1.5 " pipe and can thus be mounted using a standard 1.5 " pipe ring.

Extension pipe installation

For free hanging and fixed measurements in liquids, an extension pipe must be attached to the SulfiLogger™ sensor. This figure shows the steps needed to perform this installation:

- Unscrew the three hex screws on the back of the SulfiLogger™ sensor and remove the outer ring.
- Feed the cables through the extension pipe and attach them to the connectors on the sensor.
- Align the sensor with the screw holes of the extension pipe and screw in the three hex screws to secure the sensor to the extension pipe.

Temperature rating

The sensor is designed to withstand temperatures from -20°C to +60°C.

DANGER
Exposing a SulfiLogger™ sensor from the X1-series for ambient temperatures lower than -20°C or higher than +60°C will void the ATEX certificate.

The sensor, both S1 and X1 series, performs optimally between 0°C and +40°C.

Disassembly

We do not recommend you to disassemble the SulfiLogger™ sensor.

IMPORTANT NOTE
Disassembly of the sensor will void the warranty and render the sensor non-functional.

DANGER
Disassembly of a SulfiLogger™ sensor from the X1-series will void the ATEX certificate.

Support

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For further documentation, the latest User Manual and other resources, please visit the SulfiLogger™ sensor website:

www.SulfiLogger.com

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