Intrinsically Safe Acoustic Emission Product Family:

Vallen ISAFE3

Operation Manual

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Purpose of this Document

This operation manual is to describe the features and the usage of ISAFE3 family products. Further the manual outlines specifications and requirements to obtain and maintain intrinsic safety.

Sections or sub-sections headed in ***italic font*** contain safety relevant information.

This manual does not describe the application of SISO3 in a zone 2 environment.

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1 Introduction

This user manual is part of the AE-sensor system ISAFE, consisting of AE-sensor ISAS3, signal isolator SISO3 and (optional) the HISO3 box to accommodate the signal isolator(s). Please read this document carefully before putting the AE-sensor system into operation. Make sure that an operation manual is always accessible to operators throughout the lifetime of the product.

Following symbols are used throughout the user manual:

Note:

Indicates a note or comment

CAUTION:

This symbol indicates processes or procedures which must be performed carefully in order to avoid problems.

DANGER:

This symbol indicates processes or procedures which must be performed carefully in order to avoid danger of life.

Following symbols can be found on the equipment

	IEC 60417-5017	Protective ground
	2014/34/EU	Explosion protection label
	2014/34/EU Appendix X	Sign of conformity

2 Safety Directions

The ISAFE sensor system, consisting of ISAS3, SISO3 and (optional) HISO3, has been produced and tested in compliance with standards and codes listed in section 14 of this User Manual. It has been shipped in safety related flawless condition. The user has to follow the notes and consider warning notes within this operation manual to ensure safe operation.

DANGER:

Make sure that ATEX zone rating of components complies with the ATEX zone rating of the area where components are installed.

DANGER:

Make sure that the AE-sensor ISAS3 is properly grounded to test object.

DANGER:

Make sure that the system is properly installed before it is taken into operation.

2.1 Intended Use

The AE-sensor system ISAFE3 is part of an Acoustic Emission measurement system, such as the AMSY-6. ISAFE3 consists of AE-sensor ISAS3 and signal isolator SISO3.

The AE-sensor ISAS3 picks up surface movements on a test object and converts them into AC voltage. ISAS3 can be installed in an explosion hazardous area that requires Equipment Protection Level (EPL) Ga, Gb or Gc only. For the relation between EPL and zones see EN 60079-14:2008/5.4.

SISO3 has to be located in a non-hazardous area and interfaces the intrinsically safe circuit with the AE system.

The sensor ISAS3 can be immersed into a liquid, usually water or oil, if the cable-to-case transition is properly sealed as described in chapter 8.3. The liquid shall have a chemical composition that does not degrade the wetted materials. These materials are specified in chapters 7.2.1 (case, O-ring) and 8.3.1 (heat shrink and clamps). The maximum peak pressure (12 bar) and ambient temperature range (-20 °C to +60 °C) must not be exceeded. ISAS3 must be safely and reliably fastened as outlined in chapter 8.1 and 8.2 ensuring good acoustic contact to the test object. For cabling and earthing see chapter 9. The cable from SISO3 to ISAS3 must comply with the environmental conditions or be properly protected. The cable must be installed and connected while the environment of ISAS3 is non-hazardous.

Signal isolator SISO3 must be installed in an environment of pollution degree 2 or 1; this could be inside a closed cabinet or an enclosure, see chapter 5.4 to 6.2. For pollution degree see glossary. Temperature inside the cabinet or enclosure must not exceed the temperature range of -20 °C to +60 °C.

For the additional requirements on EPL "Ga" see EN 60079-14:2008/12.3.

The individual application of ISAFE3 must ensure that the output of the sensor system is properly converted to digital data and properly processed. The sensor system allows for a computer controlled sensor coupling test by sending artificial AE with one sensor, to be picked up by one or more neighboring sensor(s). This feature helps to identify a loss of coupling quality or sensor sensitivity.

ISAFE3 shall be installed and operated by qualified personnel only. Correct operation of the AE-sensor system according to specification shall be verified in regular intervals by qualified personnel.

2.2 Foreseeable misuse

Do not install/operate the AE-sensor ISAS3 in mines.

Do not expose the AE-sensor ISAS3 to environment with temperature exceeding 60°C or on test objects with surface temperature higher than 60°C.

Do not expose the AE-sensor ISAS3 to ambient pressure higher than 12 bar.

Do not install/operate the signal isolator SISO3 in an explosion hazardous area.

Do not install/operate the signal isolator SISO3 in an environment with temperature exceeding 60°C.

Do not install/operate the signal isolator SISO3 in an environment of pollution degree 3 or larger. For pollution degree see glossary. Do not install/operate the AE-sensor system ISAFE3 if any of its components (ISAS3, SISO3, HISO3 or cables) show any visible defect.

2.3 Safe operation of the sensor system ISAFE

Set up

Please follow the mounting instructions of section 9. Make sure that you have the permission of the operator of the object under test to carry out the work as described in the mounting instructions.

Power supply connection

The signal isolator receives DC-power over the combined signal/power cable from the AE system. Use only Vallen-provided cables or cables that have been approved by Vallen Systeme to connect a signal isolator to a signal processor providing 28 V_{DC} power supply.

Install all cables in a safe way, avoiding stumbling and stepping on the cable. Please note the specified bending radius for each cable.

Ground connection

Make sure that each AE-sensor is grounded properly. Use a cable as short as possible with cross section of at least 4 mm². Make sure that each AE-sensor is grounded before it goes into operation.

Damage

Do not apply power to a signal isolator if it is obvious that a component of the AE-sensor system is damaged. In such a case make sure that it cannot be used by any other person.

Environmental conditions

Only use AE-sensor system ISAFE3 in environments that comply with environmental conditions specified in the given specification. Please make sure that dust or any fluid cannot enter the signal isolator. The HISO3 box was developed to protect the SISO3 (IP54).

Repairs

Only qualified personnel (see section 2.4) may open and repair equipment. Only replacement parts may be used that comply with the safety regulations of the equipment. Before removing cover parts make sure that no power is applied to the equipment.

Cleaning

Do not use abrasive or solvents for cleaning. Make sure that liquid cannot enter the equipment. For cleaning purposes a soft dry cloth is sufficient. In case of heavy stains use a moist cloth with a mild rinsing agent.

2.4 Qualified or certified personnel

Qualified personnel are characterized that they

- have an appropriate technical education
- know regulations concerning employment protection and on-the-job safety
- recognize safety of used equipment
- know operation manual of used equipment

Furthermore to qualification mentioned above certified personnel hold a valid certification according to ISO 9712, ASNT or any other comparable standard or standardization organization.

3 Sicherheitshinweise

Note:

This section contains the German translation of “Safety Directions”

Das AE-Sensor System, bestehend aus ISAS3, SISO3 und (optional) HISO3, ist gemäß den Standards und Richtlinien in Kapitel 14 des vorliegenden User Manuals gebaut und geprüft. Es hat das Werk in sicherheitstechnisch einwandfreiem Zustand verlassen. Um einen gefahrlosen Betrieb sicherzustellen, muss der Anwender die Hinweise und Warnvermerke beachten, die in dieser Gebrauchsanweisung enthalten sind.

GEFAHR:

Stellen Sie sicher, dass die ATEX Einstufung der Komponenten der ATEX Zoneneinstufung des Installationsortes entspricht.

GEFAHR:

Stellen Sie sicher, dass der Sensor ISAS3 ordnungsgemäß geerdet wurde bevor dieser betrieben wird.

GEFAHR:

Stellen Sie sicher, dass das AE-Sensor System ordnungsgemäß installiert wurde bevor es in Betrieb genommen wird.

3.1 Bestimmungsgemäßer Betrieb

Das AE-Sensor System ISAFE3 ist Teil eines Schallemissionsmessgeräts, wie zum Beispiel das AMSY-6. ISAFE3 besteht aus den Sensoren ISAS3 und dem Signalisolator SISO3.

ISAS3 nimmt Oberflächenbewegungen von Testobjekten auf und wandelt diese in AC-Spannung um. ISAS3 Sensoren können in explosionsgefährdeten Bereichen installiert werden, in denen das Geräteschutzniveau Ga, Gb oder Gc gefordert ist. Für die Zuordnung zwischen Geräteschutzniveau und Zonen beachten Sie bitte EN 60079-14:2008/5.4.

Der SISO3 wird außerhalb des Gefahrenbereichs installiert und verbindet den eigensicheren Schaltkreis mit dem AE System.

Der ISAS3 kann in Flüssigkeiten (normalerweise Wasser oder Öl) eingetaucht werden, wenn die Kabelverbindung ordnungsgemäß abgedichtet wurde (siehe Kapitel 8.3). Die Flüssigkeit darf das Material, mit dem es in Kontakt kommt, nicht angreifen oder verändern. Die relevanten Materialien sind in Kapital 7.2.1 (Gehäuse, O-Ring) und 8.3.1 (Schrumpfschlauch und Klammern) aufgeführt. Ein Maximaldruck von 12 bar und ein Umgebungstemperaturbereich von -20 °C bis +60 °C darf nicht überschritten werden. Der ISAS3 muss sicher befestigt werden, wie beschrieben in Kapitel 2.3 und 9.2, damit eine gute akustische Ankopplung gewährleistet ist. Bitte beachten Sie auch Kapitel 9 zum Thema Anschluss und Erdung des Systems. Die Kabel vom SISO3 zu dem ISAS3 Sensor müssen für die vorhandenen Umwelteinflüsse spezifiziert sein oder ausreichend geschützt werden. Die Kabel müssen mit dem ISAS3 verbunden werden, solange dieser sich noch nicht in einem Gefahrenbereich befindet.

Der Signalisolator SISO3 darf nur in einer Umgebung mit Verschmutzungsgrad 2 oder niedriger installiert werden. Dieses kann ein geschlossener Schrank oder ein Gehäuse sein (siehe Kapitel 6.1 bis 6.2). Die Innentemperatur des Schranks oder des Gehäuses darf nicht außerhalb eines Bereichs von -20 °C bis +60 °C liegen.

Weitere Angaben zum Geräteschutzniveau „Ga“ finden Sie in der Norm EN 60079-14:2008/12.3.

Bei der individuellen Anwendung des ISAFE3 muss sichergestellt werden, dass das Sensorsignal korrekt in digitale Daten umgewandelt wird und weiterverarbeitet werden kann. Das Sensorsystem ermöglicht eine automatische Ankopplungsüberprüfung, bei der ein Sensor ein künstliches AE Signal generiert, welches von den benachbarten Sensoren aufgenommen werden kann. Mit dieser Funktion können, mit Hilfe einer Software, Änderungen in der Ankopplung jedes Sensors an dem Prüfobjekt automatisch ermittelt werden.

Das AE-Sensor System darf nur durch qualifiziertes Personal (siehe Abschnitt 3.4) installiert und betrieben werden. Die korrekte Funktionsweise des AE-Sensor Systems muss in regelmäßigen Abständen durch qualifiziertes Personal geprüft werden.

3.2 Vorhersehbare Falschanwendungen

Installieren und betreiben Sie das AE-Sensor System ISAFE3 nicht in Bergwerken.

Installieren und betreiben Sie den AE-Sensor ISAS3 nicht in Umgebungen oder an Oberflächen deren Temperatur 60°C überschreiten.

Installieren und betreiben Sie den AE-Sensor ISAS3 nicht in Umgebungsdrücken über 12 bar.

Installieren und betreiben Sie den Signalisolator SISO3 nicht in explosionsgefährdeten Bereichen.

Installieren und betreiben Sie den Signalisolator SISO3 nicht in Umgebungen, deren Temperatur 60 °C überschreitet.

Installieren und betreiben Sie den Signalisolator SISO3 nicht in Umgebungen mit Verschmutzungsgrad über 2.

Betreiben Sie das AE-Sensor System nicht, wenn Komponenten davon (ISAS3, SISO3, HISO3 oder Kabel) offensichtliche Schäden aufweisen.

3.3 Sicherer Betrieb des AMSY-6

Aufstellen

Folgen Sie den Aufbauanweisungen des Kapitel 9. Stellen Sie sicher, dass Sie eine Bewilligung des Betreibers der zu prüfenden Anlage haben, um die Ausrüstung gemäß der Aufbauanweisung zu installieren.

Anschlussleitungen

Der Signalisolator wird über ein kombiniertes Signal/Spannungs-Kabel vom AE System mit Gleichspannung versorgt. Verwenden Sie nur Kabel von Vallen Systeme oder Kabel die von Vallen Systeme zur Verwendung freigegeben wurden, um den Signalisolator an die 28 V_{DC} Spannungsversorgung anzuschließen.

Verlegen Sie die Leitungen so, dass niemand darauf treten oder darüber stolpern kann. Beachten Sie den minimalen Biegeradius des jeweiligen Kabels.

Erdung

Stellen Sie vor der Inbetriebnahme sicher, dass jeder AE-Sensor fachgerecht geerdet ist. Der Sensor stellt dazu ein Erdungsgewinde samt Schraube zur Verfügung. Das verwendete Kabel muss einen Querschnitt von mindestens 4 mm² besitzen. Stellen Sie sicher, dass der Sensor geerdet ist bevor er in Betrieb genommen wird.

Beschädigungen

Stellen Sie sicher, dass der Signalisolator nicht mit Spannung versorgt wird, wenn eine Komponente des AE-Sensor Systems sichtbare Beschädigungen aufweist. Sichern Sie in einem solchen Fall das AE-Sensor System vor Inbetriebnahme durch Dritte ab.

Umgebungsbedingungen

Das AE-Sensor System darf nur unter solchen Umgebungsbedingungen eingesetzt werden, die im vorliegenden Operation Manual spezifiziert sind. Achten Sie darauf, dass keine Fremdmaterialien, wie Staub oder Flüssigkeit, in die Geräteöffnungen des Signalisolators SISO3 gelangen können. Für den Schutz der SISO3s wurde die HISO3 box entwickelt (IP54).

Reparaturen

Reparaturen dürfen nur von qualifiziertem Personal (siehe Abschnitt 3.4) ausgeführt werden. Es dürfen nur solche Ersatzteile verwendet werden, die die Sicherheitsbestimmungen des Gerätes nicht verändern. Vor dem Öffnen des Gerätes muss sichergestellt sein, dass keine Versorgungsspannung anliegt.

Reinigung

Verwenden Sie für die Reinigung kein Scheuerpulver und keine lack- oder kunststofflösende Reinigungsmittel. Lassen Sie keine Flüssigkeiten in das Gerät und den Anschlüssen eindringen. Zur Reinigung der Gehäuseoberfläche ist ein trockenes Tuch ausreichend. Bei starker Verschmutzung kann ein feuchtes Tuch verwendet werden, das in Wasser mit mildem Spülmittel getaucht und gut ausgewrungen wurde.

3.4 Qualifiziertes oder zertifiziertes Personal

Qualifiziertes Personal sind Personen die

- eine entsprechende technische Ausbildung haben
- die Regeln zu Arbeitsschutz und Arbeitssicherheit kennen
- die Sicherheit der Messausrüstung erkennen
- die Bedienungsanleitung der Messausrüstung kennen

Darüber hinaus sind zertifizierte Personen im Besitz einer gültigen Zertifizierung gemäß ISO 9712, ASNT oder vergleichbarer Standards oder Standardisierungseinrichtungen.

4 Description of AE sensor system ISAFE3

Acoustic Emission has been proven to be a powerful tool for integrity testing and leak detection especially for applications of the oil and gas industry. Working in the environment of gas and oil often requires special safety measures for the equipment to prevent accidental ignition of flammable gases or fluids. Especially AE sensors which are installed in close approximation or sometimes even within the explosive hazardous gas require some measures which make it impossible that any faults can cause sparks or any dangerous electrical discharge to the surrounding. For this reason Vallen Systeme developed the ISAFE3 product family.

ISAFE3 stands for **I**ntrinsically **SAFE** sensor system **3**. It consists of AE-sensor(s) ISAS3 and signal isolator(s) SISO3, interconnected over a 50 Ω coaxial cable. This cable transfers the DC supply voltage from the signal isolator to the sensor and the amplified AE signal from the sensor to the signal isolator.

The sensors and the cable are designed to be installed on a test object in an explosion hazardous area of zone 0, zone1 or zone 2 (e.g. tank of a ship, above ground storage tank in a refinery or pressure equipment on an oil rig). The signal isolator SISO3, the AE measuring system (e.g. AMSY-6) and the control PC have to be located in a non-hazardous area. Figure 4-1 shows the block diagram of an ISAFE3 sample installation. The cable between the AE-sensor ISAS3 and the signal isolator SISO3 can be several hundred meters long.

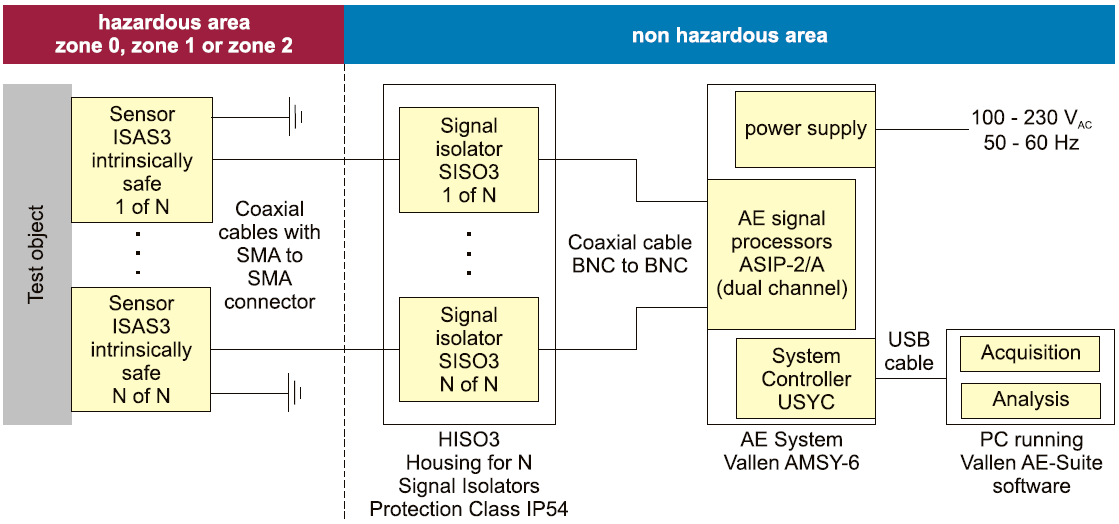


Figure 4-1 Block diagram of an ISAS3 sample setup

According to the ATEX directives the three different zones are defined as:

Zone 0 — An atmosphere where a mixture of air and flammable substances in the form of gas, vapor or mist is present frequently, continuously or for long periods.

Zone 1 — An atmosphere where a mixture of air and flammable substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally.

Zone 2 — An atmosphere where a mixture of air and flammable substances in the form of gas, vapor or mist is not likely to occur in normal operation but, if it does occur, will persist for only a short period.

SISO3 performs like a normal (not intrinsically safe) preamplifier with 28 V_{DC} supply voltage, 50 Ω output impedance, driving up to 10 V_{PP} into 50 Ω impedance of an AE signal processor.

Hence, SISO3 can be used with any AE signal processor providing a preamplifier supply voltage of 28 V_{DC} @ 90 mA over a coaxial cable of 50 Ω impedance.

ISAFE3 supports automatic sensor coupling verification: An AE signal processor sends an AST-control-pulse (short-cuts of 28 V supply voltage for some microseconds duration) to the signal isolator SISO3, which sends a similar pulse to the sensor ISAS3. The ISAS3 uses the pulse to generate an AE wave that propagates through or along the test object to be picked up by neighboring sensors. Changes of the received amplitudes of different pulsing tests are an indication for coupling problems with the sensors. The AST control pulse is supported by Vallen's AE signal processor ASIP-2/A.

For optimum performance and signal-to-noise ratio, the signal processing chain inside the AE system should comprise application specific frequency filters optimized for the application, e.g. as provided by Vallen ASIP-2/A.

4.1 Members of ISAFE3 family

ISAFE3 product family consists of the following variants of the intrinsically safe piezoelectric AE-sensor ISAS3-xxx, the signal isolator SISO3 and accessories.

Table 4-1 Members of ISAFE3 with ATEX type certification

Type	Description	Ex Protection
ISAS3-030	AE-Sensor for 25 to 80 kHz	<EX> II 1G Ex ia IIC T6 Ga
ISAS3-075	AE-Sensor for 50 to 300 kHz	<EX> II 1G Ex ia IIC T6 Ga
ISAS3-150	AE-Sensor for 150 to 450 kHz	<EX> II 1G Ex ia IIC T6 Ga
ISAS3-150-V01	AE-Sensor for 150 to 450 kHz	<EX> II 1G Ex ia IIC T6 Ga
ISAS3-375	AE-Sensor for 300 to 500 kHz	<EX> II 1G Ex ia IIC T6 Ga
ISAS3-900	AE-Sensor for 100 to 900 kHz	<EX> II 1G Ex ia IIC T6 Ga
SISO3	Signal Isolator (and barrier)	<EX> II (1) 3G Ex nA [ia Ga] IIC T4 Gc

ISAS3 variants differ only in the geometry of the piezoelectric element and piezo-cup, hence in the frequency response. Every ISAS3 contains a preamplifier with 20 dB gain.

SISO3 gain can be set to 14 dB, 20 dB or 26 dB by jumpers and can be changed by the user. Default gain is 14 dB for a total gain of 34 dB (including 20 dB of ISAS3).

Table 4-2 ISAFE3-Accessories, no certification required

Type	Description	Chapter
HISO3-08	Housing for up to 8 SISO3, IP54	6.1
HISO3-20	Housing for up to 20 SISO3, IP54	6.2
MAG4IS	Magnetic holder for all ISAS3 variants	8.1
SS-OIL-5MM	Sealing Set Hardware for ISAS3	8.3.1

5 Signal Isolator SISO3

SISO3 is a so-called associated apparatus. That means it is an electrical apparatus which contains both, intrinsically safe circuits and non-intrinsically safe circuits. It is constructed so that the non-intrinsically safe circuits cannot adversely affect the intrinsically safe circuits (EN 60079-0:2009 / 3.2). SISO3 is a module to be snapped on a DIN rail.

The purpose of signal isolator SISO3 is to

1.) electrically isolate the intrinsically safe sensor circuit from the AE system

2.) provide isolated DC-voltage for ISAS3 over the combined coaxial power/signal cable

3.) amplify the AE signal from the sensor and transfer it to the AE system

4.) transfer an AST control pulse from the AE system to the sensor

5.) limit the voltage, current, power and pulse energy on the intrinsically safe circuit in accordance with EN 60079-11:2007 for use in zone 0, even in the case of two worst case faults in SISO3 and two in ISAS3.

6.) ensure electro-static discharge of intrinsically safe cable over 220 kΩ to earth at DIN rail, when cable is interrupted.

Figure 5-1 SISO3 Module.

BNC: to AE system

SMA: Ex I to ISAS3 (Terminal screw 4: left most screw)

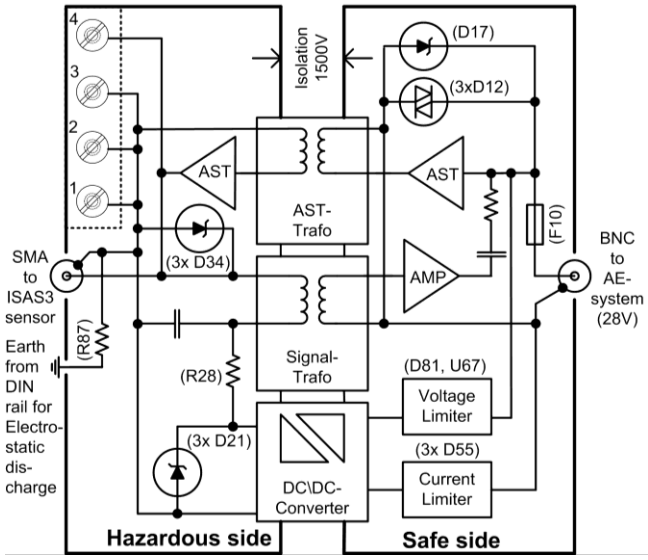


Figure 5-2 SISO3-Block Diagram

CAUTION:

- SISO3 must be installed within a dry and clean environment of pollution degree 2 or 1 (see EN 60079-11:2007 / F.2). For pollution degree see glossary. This needs usually an enclosure of protection class IP54. See chapter 6 Accessories for SISO3.
- SISO3 does not contain an overvoltage protection for atmospheric electricity. It is assumed that protection against atmospheric electricity is provided by other means.

5.1 SISO3 Labeling

5.1.1 Manufacturer and type:

Vallen Systeme GmbH, 82057 Icking, Germany

Signal Isolator SISO3	Type
SNo. yyyy-xxx	Serial number (yyyy = year, xxx number produced)
CE_{0123}	Notified body for EN 80079-34:2011 audit and surveillance: TÜV SÜD
TÜV-A 11ATEX0004X	Notified body for type examination: TÜV Austria, X: Does not contain overvoltage protection for atmospheric electricity.

5.1.2 ATEX / CENELEC label:

II (1) 3 G Ex nA [ia Ga] IIC T4 Gc

Tamb: -20 to +60 °C IP30

Meaning of the ATEX / CENELEC label elements:

	Indicates the following symbols as terms defining the area of use according to ATEX
II	Group of device which can be used in explosive areas but not in mines
(1)	This is an associated apparatus for a device of category 1 which is useable in zone 0
3	This apparatus is of category 3 from the group of device (II) useable in zone 2 (or in non-hazardous area). This operation manual does not deal with the use of SISO3 in a hazardous area
G	For use in explosion hazardous gas (not dust)
Ex	Label indicating the following symbols are terms defining the protection of devices according to CENELEC standards
nA	This is a non-sparking apparatus for use in zone 2
[ia Ga]	This is an associated apparatus of an intrinsically safe device "ia" in accordance with Equipment Protection Level (EPL) “Ga”. Equipment for explosive gas atmospheres, having a very high level of protection, which is not a source of ignition in normal operation, expected malfunction, or when subject to rare malfunction. Such equipment has a form of protection which will remain effective even in the presence of two potential faults or will have two independent means of protection (usable in zone 0) (EN60079-0 3.18.3)
IIC	Explosion group; for gases needing the lowest amount of energy to ignite an explosion, e.g. hydrogen
T4	Temperature class, defining that the maximum surface temperature a gas can reach in this apparatus (SISO3) stays always below 135 °C
Gc	Equipment for explosive gas atmospheres, having a normal level of protection, which is not a source of ignition in normal operation.

Tamb: -20 to +60 °C	This is the range of ambient temperature this apparatus can be operated in
IP30	Degree of protection against ingress of dust and liquid according to EN60529. First digit "3" means protected against objects larger than 2.5 mm diameter. Second digit "0" means no protection against ingress of water.

5.1.3 Front label

The front label of SISO3 is shown in Figure 5-3.

The string "to AE System" on top of the label belongs to the BNC connector above (see Figure 5-1). This connector is to be connected to an AE signal processor in the AE system.

The string "Ex i to ISAS3" at the bottom of the label belongs to the SMA connector below (Figure 5-1). This is the connector for the intrinsically safe circuit to the sensor ISAS3 in a hazardous area.

The user can put a cross in one of three gain setting boxes and write the channel number, the SISO3 belongs to, into the foreseen field.

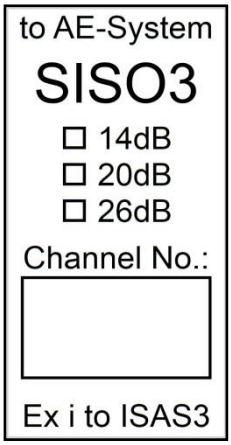


Figure 5-3 Front label

5.2 Specifications of SISO3

5.2.1 Specifications with relevance to intrinsic safety (IS)

The most important IS relevant specifications are shown by label and described in chapter 5.1.

5.2.2 Mechanical specifications

Protection class by module housing	IP30, means protected against particles larger than 2.5 mm diameter. No water protection.
Ambient temperature range, operational	-20 … +60 °C
Maximum surface temperatures (faulty)	T4: < 135°C
Module housing model	Phoenix ME, DIN rail clamp-on module
Case material	Polyamide
Case temperature range	-40 … +105 °C
Dimension	99 (H) x 114.5 (D) x 22.5 (W) mm
Weight	170 g

5.2.3 Safety relevant electrical parameters:

U_m = 250 V AC 50 - 60 Hz	Maximum voltage to maintain intrinsic safety
U_O = 13.8 V_{DC}	Maximum output voltage (open circuit)
I_O = 60 mA	Maximum output current (switches off at overload/short-cut)
P_O = 0.3 W	Maximum output power
C_O = 397 nF	Maximum external capacity
L_O = 22 mH	Maximum external inductivity

5.2.4 Electrical specifications of signal line at BNC connector (to/from AE-system):

Connector type at SISO3 module	Coaxial, BNC, female, 50 Ω, right-angled cable connector required due to limited height of HISO3.
Cable connector SISO3 side (recommended)	BNC 50 Ω, crimp, angled Telegärtner Art. No. J01000A1257 Assembly instruction: Figure 11-3
Cable connector ASIP-2 side (recommended)	BNC 50 Ω straight, Telegärtner J01000A1255 Assembly instruction: Figure 11-4
SISO3 input protection (fuse)	100 mA fuse
Maximum input DC voltage at which fuse will not blow	32 V
Minimum resistance of power supply (signal processor) to prevent blowing the fuse by in-rush current	50 Ω
SISO3 supply voltage, functional	(28 ± 1) V_{DC} 50 Ω AC impedance
Typical SISO3 supply current, functional	33 mA (standby) / 66 mA (full scale) / 88 mA (fourfold saturated, continuous)
AC output range	±5 V (full scale) into 50 Ω (of AE-system)
AC output impedance	50 Ω
Gain	Ex works: 14 dB; 14/20/26 dB jumper selectable (+20 dB of sensor)
AST-control pulse	Shortening 28 V_{DC} for 0.5 to 5 µs by AE system causing the sensor to generate an artificial AE-event for test purposes
Noise	See ISAS3 specification
Typical Frequency Response (-1 dB / -3 dB) without an ISAS3 connected	15 – 900 kHz / 10 – 1600 kHz
Maximum length of cable to AE system	100 m (4.2 Ω)

5.2.5 *Electrical specifications of external intrinsically safe circuit*

Connector type at SISO3 and ISAS3 side	Coaxial, SMA, female, 50 Ω
Connector type for cable end at SISO3 side (for use with HISO3 = right-angled, gold plated)	SMA male, 50 Ω, Telegärtner Art. No. J01150A0091 (Temp. and climate: IEC 60068 55/155/56) Assembly instruction: Figure 11-2
Connector type for cable end at ISAS3 side (straight, stainless steel)	SMA male, 50 Ω, Huber+Suhner Type 11_SMA-50-3-55/199_N (specified to -65°C to +165°C, IP68) Assembly instruction: Figure 11-1
Terminal block (test purposes only)	4 terminal screws, 4 = signal, 1 – 3 = shield (*Ex i* circuit),
Cable shield, ISAS3 side	Connected to metallic case of ISAS3
Cable shield, SISO3 side	Forms minus pole for voltage supply.
Output DC voltage, nominal	+12 V - 0.16 V/mA against cable shield
Output DC current, nominal,	13 mA (standby) / 20 mA (full scale) / 25 mA (fourfold saturated)
Output power (continuous, nominal)	300 mW (IS relevant)
AC input impedance of SISO3	50 Ω
AC output impedance of ISAS3	50 Ω
AC voltage range (full scale), at 14/20/26 dB SISO3 gain	2 V_{PP} @ 14 dB / 1 V_{PP} @ 20 dB / 0.5 V_{PP} @ 26 dB
AST-control pulse	Shortening intrinsically safe circuit for 0.5 – 5 µs by SISO3 activates an ISAS3 internal pulse generating an artificial AE event for test purposes. (See ISAS3 specs for details)
Isolation voltage test SMA-shield against BNC-shield	1500 V_{RMS} for 60 s, each unit individually tested. Module to be disconnected from DIN rail for this test
Resistance of shield to earth for electrostatic discharge on SISO3 side	220 kΩ, 0.25 W to earth at DIN-rail (0.125 W @ 60°C), (→165 V_{max}).
Parameters of cable type for SISO3-ISAS3-connection, not oil-proof	RG58C/U coaxial cable 50 Ω C_C < 100 pF/m, L_C < 0.34 µH/m R_C < 28 Ω/km (inner wire) + 14 Ω/km (shield) Diameter: 5 mm

Parameters for cable type for SISO3-ISAS3-connection, improved chemical resistance	E&E 29392-1 coaxial cable 50 Ω CC < 110 pF/m LC < 0.34 µH/m RC < 23 Ω/km (inner wire) + 12 Ω/km (shield) Diameter: 5 mm
Maximum cable length between SISO3 and ISAS3	Functional (85 Ω): 2.0 km By capacity (397 nF) > 3 km By inductivity (22 mH) > 3 km

5.3 Modifying SISO3-gain

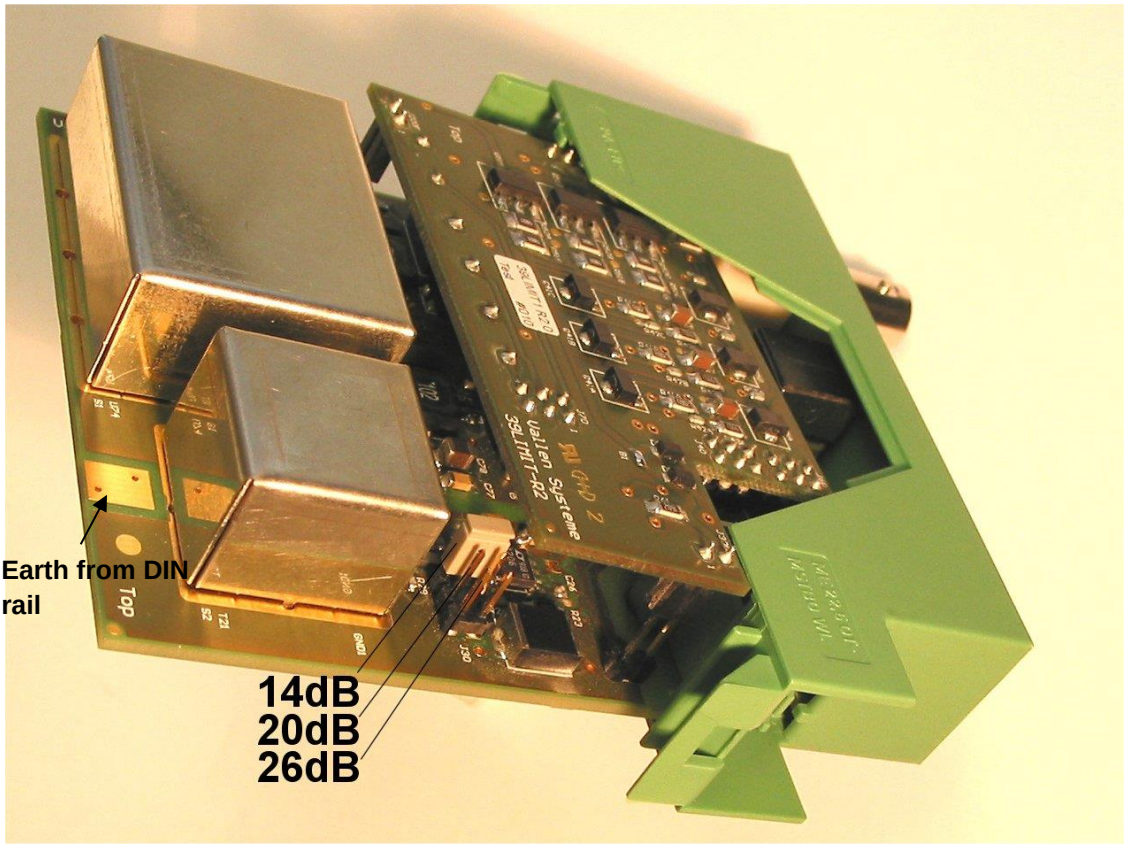


Figure 5-4 Position of the gain-jumpers on basic board, plug-on board lifted

SISO3 default gain setting is 14 dB and can be modified by jumpers to 20 or 26 dB. This reduces the input range at the piezo element from 200 mV_{PP} to 100 mV_{PP} or 50 mV_{PP}, respectively. For gain modification one must separate the lower part of the clip-on case. The upper part, where BNC and SMA connectors are mounted, can remain on the board.

For separation of the lower part of the green case use a small screwdriver and press slightly through a rectangle hole at the side, where the upper part of the green case overlaps the lower part and at same time pull the lower part few millimeters down. Do the same on the other side and then you can completely detach the lower part.

Figure 5-4 shows the position of the 3x2 pin jumper field for gain setting. One must shift up the plug-on-board (39LIMIT) a little to get access to the jumper. On default, the jumper shortens the

inner pair of pins, this defines 14 dB gain. For 20 dB gain move the jumper to the middle pair, for 26 dB move it to the outer pair of pins. Indicate the new gain on the front label by a cross. Place back the 39LIMIT plug-on board and shift the lower part of the green case back over the boards. Make sure the DIN-rail-connector inside the lower part of the green case will contact earth to the board; see the indication on the left of Figure 5-4**.**

5.4 Environmental conditions for SISO3

This chapter describes relevant information applicable for selection or construction of the housing of a number of SISO3 modules.

SISO3 modules must be installed into an outer case, where SISO3 modules can simply be clamped-on to a DIN rail.

The DIN rail must be connected to earth. SISO3 connects earth from DIN rail over 220 kΩ to the shield and minus of the intrinsically safe circuit to ensure electro static discharge when cable to ISAS3 is interrupted.

Depending on the environment of SISO3, different requirements apply.

Environment of SISO3	Pollution Degree	Requirement on outer case for SISO3
Non-hazardous	2 (or 1)	Dry environment. EN 60079-11:2007 / F.2 applies. Case shall be metallic and provide sufficient space and safe hold of SISO3 modules and cabling. Internal DIN rail needed for mounting and earth connection of SISO3 modules. Outer case shall be connected to earth potential. Ex-label not required for the case. Cable entry for intrinsically safe circuits to be labeled "Ex-i" Requirements are met by HISO3-xx products
Non hazardous	> 2	As before. The outer case must be of protection class IP54 (IEC60529) Requirements are met by HISO3-xx products.
Hazardous area of zone 2	2 (or 1)	As before. The outer case must undergo mechanical tests (7 Joule impact test, IP54 test) to be performed according to EN 60079-0:2009 / 6.2 and 26.4.2, 26.4.4, 26.4.5, if product is not an approved Ex-component. Ex-Label (same as SISO3) required.

Additional requirements on the outer case of SISO3, if installed in a hazardous area of zone 2:

EN 60079-14:2008 / 6 Protection against dangerous sparks

EN 60079-14:2008 / 9.3 Cabling

EN 60079-14:2008 / 12 Additional requirements for intrinsically safe installations

Depending on the application, other standards may need consideration.

6 Accessories for SISO3

6.1 HISO3-08

Box for up to 8 modules SISO3. It is for installation in a non-hazardous area.

Figure 6-1 Top view into opened HISO3-08

Figure 6-2 Front view on cable entry system

Figure 6-3 Side view on earth connection point

The HISO3-08 (Figure 6-1 to Figure 6-3) (manufacturer Rose 25.232018) offers a screw-terminal on the outside for earth connection (see Figure 6-3). The box dimension is 232 x 202 x 180 mm³. It is made of aluminum with polymer-coated surface. The SISO3 modules are clamped on a DIN rail. Cables enter over a so-called cable entry system, see Figure 6-2. A label nearby the cable entries identifies the *Ex i* cable positions as well as the output cables positions, see Figure 6-4. The label is not shown in Figure 6-2.

The cable entry system consists of a frame for up to 4 inserts, each insert (21 x 21 x 19 mm³, icotek KT4/5 #39908) allows accommodating up to 4 cables of 5 mm diameter each. Cables can be lead through the entry system with connectors already mounted. A top bar is screwed on the frame and holds the inserts in place. The stress relief is in accordance with EN 50262. If there are less cables to feed-in, the open holes must be closed with 5 mm diameter blind plugs. This, in combination with a sealing part bonded to the box of HISO3, ensures protection code IP54. The temperature range of the cable entry system is specified to -40°C to +140 °C.

As Figure 6-1 to Figure 6-3 show, all cables are connected to SISO3 over a right-angle plug.

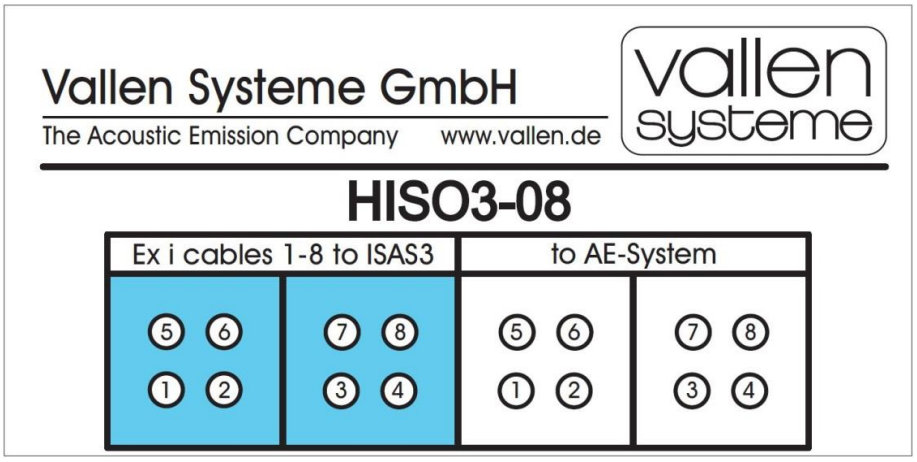


Figure 6-4 Label at cable entry of HISO3-08

6.1.1 Mechanical specifications of HISO3-08

Protection class	IP54 means protected against dust and splash water from all directions.
Temperature range	-20 … +60 °C (SISO3) -40 … +140 °C (cable entry system) -20 … +135 °C (outer case)
Dimensions and weight	232 x 202 x 181 mm³, 4.3 kg
Earth terminal	Two M6 threads on outer side of HISO3 (see Figure 6-3) Material of screws and washer: Stainless steel.
Ex-Label	HISO-08 is for installation in non-hazardous area and does not carry an Ex label. *Ex i* cable entries are clearly labeled.
Accessories:	HISO3-08 comes with 4 cable entries KT4/5, each for 4 cables, 5 mm thick. Blind plugs for unused cable holes.

6.2 HISO3-20

Box for up to 20 SISO3 modules. It is for installation in a non-hazardous area.

Figure 6-5 Top view into opened HISO3-20

Figure 6-6 Front view on cable entry system (non Ex i cables)

Figure 6-7 Front view on cable entry system (Ex i cables) and earth connection point

The outer box of HISO3-20 (Figure 6-5 to Figure 6-7) (manufacturer: Rolec; series: Alu-Kom; part number: AKH311) offers an outside screw-terminal for earth connection (see Figure 6-7). The box dimension is 402.5 x 310 x 180 mm³. It is made of aluminum with polymer-coated surface. The SISO3 modules are clamped on a DIN rail. Cables enter on two sides over two so-called cable entry systems (see Figure 6-6 and Figure 6-7). A label nearby the cable entries identifies the Ex i cable entries (Figure 6-7) and the non Ex i cable entries (Figure 6-6**)**.

The cable entry system consists of a frame for up to 5 inserts, each insert (21 x 21 x 19 mm³, icotek KT4/5 #39908) allowing inserting up to 4 cables of 5 mm diameter each. Internal cable channels are prepared to feed the AE system from one side, ending at the SISO3s' BNC plug, and the Ex i cables to the sensors from the other side, ending at the SISO3s' SMA plug.

Cables with connectors already mounted can be inserted. A top bar is screwed on the frame and holds the inserts in place. The stress relief is in accordance with EN 50262. If there are less cables to feed-in, the open holes must be closed with 5 mm diameter plugs (icotek st5, #42906). This, in combination with a sealing part bonded to the box of HISO3, ensures protection code IP54. The temperature range of the cable entry system is specified to -40 °C to +140 °C.

Connectors mounted to the cable ends inside HISO3-20 must be right angled because of the given enclosure dimension.

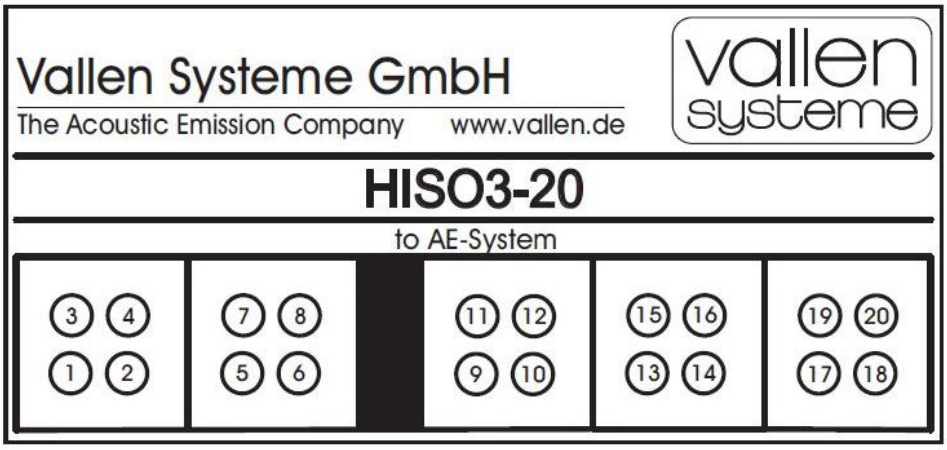


Figure 6-8 Label at cable entry of HISO3-20 (non Ex i cables).

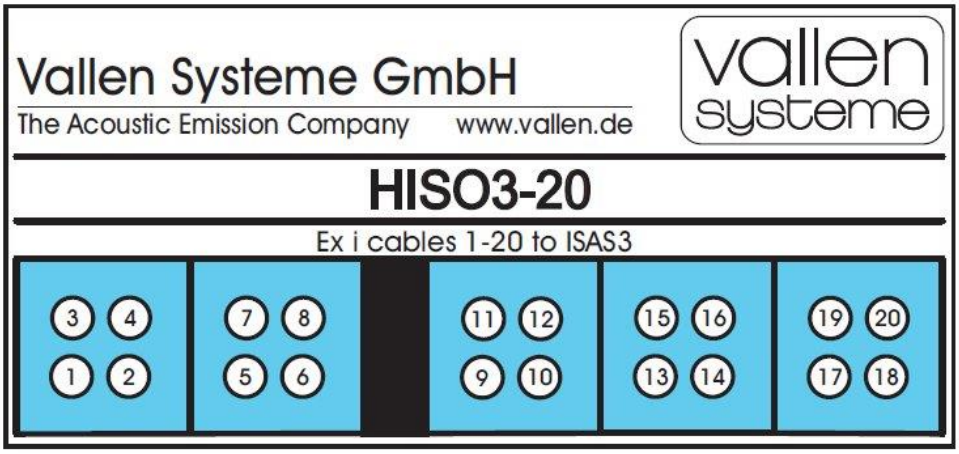


Figure 6-9 Label at cable entry of HISO3-20 (Ex i cables).

6.2.1 Mechanical specifications of HISO3-20

Protection class	IP54 means protected against dust and splash water from all directions.
Temperature range	-20 … +60 °C (SISO3) -40 … +140 °C (cable entry system) -20 … +135 °C (outer case)
Dimensions	402.5 x 310 x 180 mm³, 9.4 kg
Earth terminal	Two M6 threads on outer side of HISO3 (see Figure 6-7)

	Material of screws and washer: Stainless steel
Ex-Label	HISO-20 is for installation in non-hazardous area and does not carry an Ex label. *Ex i* cable entries are clearly labeled.
Accessories:	HISO3-20 comes with 10 cable entries KT4/5, each for 4 cables, 5 mm thick. Blind plugs for unused cable hole.

6.3 Cable entry instructions

Instructions given for HISO3-08 are similar for HISO3-20. Only difference is the recommended positions for the *ISxx* cable and the *Axx* cables.

HISO3-20 uses two cable entry systems each with 5 inserts, each insert holds up to 4 coaxial cables of 5 mm diameter. It is recommended to feed the cables to the AE system from left, ending at the SISO3s right angle BNC plug and the cable to the sensors from right, ending at the SISO3s right-angle SMA plug.

Figure 6-10 Insert cable

Figure 6-11 Space for cables on the right of right-most SISO3

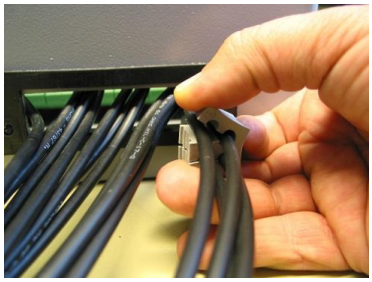


Figure 6-12 Clamp 4 cables into one insert

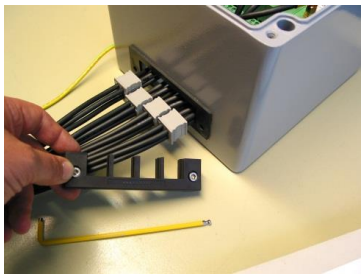


Figure 6-13 Lower part of frame

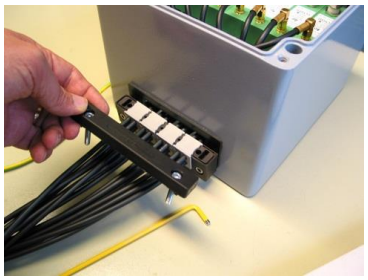


Figure 6-14 Top of frame

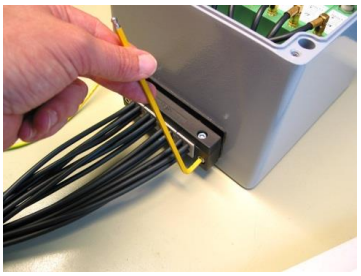


Figure 6-15 Fixing cable entry unit

For connecting SISO3s the following sequence is recommended:

(Needs a 3 mm and a 4 mm hexagon socket screw driver)

1. Before or while plugging on the connectors to SISO3, it is recommended to label the cables from AE-system with *Axx* (xx the channel number) and the intrinsically safe cables to the sensor with *ISxx*, for easy identification.
2. Fasten SISO3 at its final location, connect the earth terminal (see Figure 6-3) to ground using 4 mm^2 copper wire with end piece. Remove cable entry frame. Leave the sealing at the box. Remove the upper part of the frame.
3. Insert cables from AE system with right-angle BNC plug into the box (Figure 6-10)

4. Place all cables from AE-system around the right of right-most SISO3 (Figure 6-11) and connect them to SISO3
5. Lead all *Ex i* cables from ISAS3 sensors through the cable entry system and connect them to SISO3. *Ex i* cables require a right-angled SMA connector to connect to SISO3. **These cables shall be marked light blue** to identify their *Ex i* status, e.g. by using a piece of light blue heat shrink or light blue adhesive tape.
6. Clamp 4 cables into one insert (Figure 6-12), the cable to the AE system in the right two inserts, the *Ex i* cables from ISAS3 sensors into the left two inserts. See Figure 6-4.
7. Unused cable holes must be closed with 5 mm diameter closure plugs ST5 (See 6.1.1).
8. Shift the inserts into the lower frame (Figure 6-13) then mount the lower frame of the cable entry system loosely to the box.
9. Screw the upper part of the frame firmly onto the lower part (Figure 6-14)
10. Screw the lower part of the frame firmly to the box (Figure 6-15). This presses the lower and upper part of the frame against the sealing.
11. When all connections are made, mount the top cover of HISO3.

6.3.1 Dismounting a SISO3 from DIN rail

Figure 6-16 Opening the clip of SISO3 for removal from DIN rail

Figure 6-16 shows the position of the clip for the removal of a SISO3 from DIN rail. One must put a screw driver into the rectangle opening of the clip and move the clip 2 mm outwards, this will release the SISO3 from the DIN rail.

7 ISAS3 Overview

Purpose of ISAS3 is to

1.) pick up the surface movement of a test object caused by an AE-source, e.g. corrosion, crack growth or crack closure

2.) convert the surface movement into an electrical AE signal

3.) amplify the AE signal within a certain frequency range by 20 dB and send it over a coaxial cable to the signal isolator SISO3

4.) convert the AST control pulse from SISO3 into an artificial AE event for an automated sensor coupling verification.

Figure 7-1 View onto piezo-cup

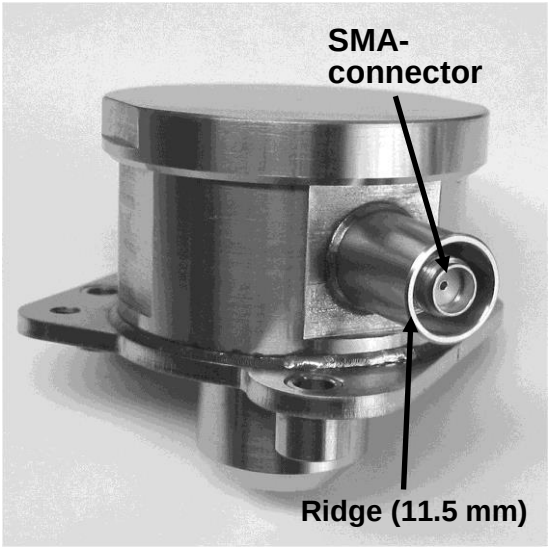


Figure 7-2 SMA-connector & sealing adapter

Figure 7-1 shows ISAS3 with its sensitive face pointing upwards. Within the piezo-cup is the piezoelectric element. The face of the cup must be pressed against the test object with a coupling agent in between. The coupling agent is for functional reasons (i.e. acoustic transmission), only. We recommend RTV162.

The two threads labeled "C" in Figure 7-1 are to screw-on earth connection wires for a safe earth connection of the metallic sensor case (see chapter 9 for details). For perfect high-pressure-sealing, the piezo-cup is laser-welded to the base plate of the sensor.

Figure 7-2 shows the sensor ISAS3 from side. The cylindrical part is laser-welded to the base plate and the SMA-protection adapter is laser welded to the cylindrical part. The SMA connector is for the intrinsically safe cable to SISO3. The SMA connector is embedded in a sealing adapter which allows for clamping on a flexible tube or a heat shrink. As Figure 7-2 shows, the outer diameter of the sealing adapter is 11.0 mm over a width of 14 mm, the ridge is 11.5 mm diameter over a width of 0.75 mm. This is for a durable sealing of the transition of either a cable to ISAS3, or the transition of a flexible tube to ISAS3. Such sealing is recommended in case of wet environment, e.g. on ship's deck or at tank cars. It is mandatory for installation inside a tank. See chapter ISAS3-SpecIP68 for details how to seal the cable-to-sensor transition against oil and 12 bar peak pressure.

CAUTION:

- According to EN 60079-14:2008/12.2.2.3 a) and b) (earthing of cable screens) the metallic case of ISAS3 must be safely connected to the metallic test structure by two wires of at least 1.5 mm^2 or one wire of at least 4 mm^2.
- If ISAS3 is to be installed inside a tank of liquid, sloshing forces and peak pressures up to 12 bar must be expected. Provisions have to be made to seal ISAS3 for 12 bar peak pressure as described in chapter 8.3 ISAS3-SpecIP68 and to protect the sensor case from sloshing forces, see chapter 8.2 ISAS3-SpecMount.

7.1 ISAS3 Labeling

ISAS3 is ATEX certified for use in explosion hazardous atmospheres of zone 0, 1 or 2 of lowest ignition energy (hydrogen).

7.1.1 Manufacturer and type:

Vallen Systeme GmbH, 82057 Icking, Germany (Manufacturer)

Type ISAS3-xxx	("xxx" can be 030, 075, 150, 150-V01, 375, 900, identifying the frequency range)
Serial no: yyyy xxx	(xxx = serial number, produced in year yyyy)
CE_{0123}	Notified body for EN 80079-34:2011 audit and surveillance: TÜV SÜD
TÜV-A 2011 ATEX0005X	Notified body for type examination: TÜV Austria, X: ISAS3 must be safely connected to metallic test structure by two wires of at least 1.5 mm^2 or one wire of at least 4 mm^2. If installed in liquid, ISAS3 to cable transition must be specially sealed. See Caution note on page 28.

7.1.2 *ATEX / CENELEC label*:

II 1G Ex ia IIC T6 Ga

IP68 Tamb: -20..+60°C

The meaning of this label is:

	Indicates the following symbols as terms defining the area of use according to ATEX
II	Group of device which can be used in explosive areas but not in mines
1	This is a device of category 1 from the group of device (II) useable in zone 0
G	For use in explosion hazardous gas (not dust)
Ex	Label indicating the following symbols are terms defining the protection of devices according to CENELEC standards
ia	This is an intrinsically safe device "ia" (useable in zone 0), safe at even two worst case faults

IIC	Explosion group; for gases needing the lowest amount of energy (< 60 µJ, hydrogen) to ignite an explosion. Group IIC specification covers also IIB and IIA, since these groups are for gases of higher ignition energy (60 to 180 µJ with IIB, e.g. for ethylene, and > 180 µJ with IIA, e.g. for propane)
T6	Temperature class, defining the maximum surface temperature a gas can reach in this apparatus stays always at least 5 K below 85 °C. T6 is the temperature class of lowest temperatures and covers the requirements of T1 - T5.
Ga	Equipment protection level (EPL) "Ga": Equipment for explosive gas atmospheres, having a very high level of protection, which is not a source of ignition in normal operation, expected malfunction, or when subject to rare malfunction. Such equipment will have a form of protection which will remain effective even in the presence of two potential faults or will have two independent means of protection.
IP68	Degree of protection against ingress of dust and liquid. First digit "6" means completely protected against ingress of dust. Second digit "8" means suitable for continuous immersion in water under conditions which shall be specified by the manufacturer.
Tamb: -20..+60°C	This is the range of ambient temperature this apparatus can be operated in. For maintaining intrinsic safety, the upper limit is essential. The lower limit has no influence on intrinsic safety and is a pure functional specification.

7.2 Specifications ISAS3-xxx

7.2.1 Mechanical specifications

Protection class (EN60529)	IP68 (cable connected) (for 12 bar peak pressure seal the cable-to-ISAS3-transition according to specification in chapter 8.3)
Ambient temperature	-20 °C … +60 °C
Case material	Stainless steel 1.4571 (German: V4A)
Case isolation	None, case connected to shield and minus pole of intrinsically safe circuit
Sealing	Three transitions (piezo-cup to base plate, base plate to cylinder, connector-adapter to cylinder) laser-welded, cover to cylinder sealed by threat and O-ring 1.78 mm thickness, made of FKM
Sealing adapter (for cable to ISAS3 sealing)	11.0 mm diameter, 14 mm width (for 11 mm wide clamp), plus ridge with 11.5 mm diameter, 0.75 mm width. (See Figure 7-2)
Earth connection	2 threads M4, see chapter 9.4 or 8.1
Maximum surface temperatures (worst case fault)	T6: < 85 °C at 60 °C T_{amb}

Internal molding	Completely molded
Dimension (for ISAS3-030 add 7.5 mm height)	53.5 (W) x 56 (L) x 47.5 (H) mm³, Cover diameter: 46.5 mm
Weight	0.25 kg (sensor) + 0.17 kg (magnetic holder)
Mounting aid	Magnetic holder MAG4IS, see chapter 8.1
Outside height of piezo-cup	18 mm (ISAS3-030: 25.5 mm)
Outer diameter of piezo-cup	22 mm
Diameter of acoustic most sensitive area (face)	14 mm
Diameter and height of bigger cylinder incl. thickness of cover & baseplate	Ø 45 x 29.5 (H) mm
Maximum safe impact energy (Type examination)	7 J (EN 60079-0:2009 Annex C)

7.2.2 Safety relevant electrical parameters:

U_i = 13.8 V	Maximum supply voltage
I_i = 60 mA	Maximum supply current
P_i = 0.3 W	Maximum input power
C_i = 65 nF	Maximum inner capacity
L_i = 1 µH	Maximum inner inductivity (due to threefold zener diodes)

7.2.3 Electrical specifications

Connector type ISAS3 side	SMA female 50 Ω, IP68 (connected), stainless steel
Connector type, cable side	SMA male, 50 Ω, Huber+Suhner Typ 11_SMA-50-3-55/199_N (specified to -65 °C to +165 °C, IP68)
Voltage supply, operational	12 ± 1 V over 160 Ω
Current consumption, operational	13 mA (standby) / 20 mA (full scale) / 25 mA (fourfold saturated)
Power Consumption, operational, versus current U_i = 12 V - 0.16 V/mA	129 mW (standby) / 176 mW (full scale) / 200 mW (fourfold saturated)
Input voltage range (from piezo)	±100 mV_P
Integral gain	20 dB
Output impedance	50 Ω

Output voltage range before saturation	2 V_{PP} into 50 Ω
Typical noise (referred to piezo) Peak / RMS, measured using ISAS3 -> SISO3 (26dB) -> post-amplifier (40dB) -> AMSY-6 at shown filter settings,	12.8 μV_P / 4.1 μV_{RMS} 25 - 45 kHz (ISAS3-030) 27.6 μV_P / 9.1 μV_{RMS} 25 - 100 kHz (ISAS3-075) 25.6 μV_P / 5.9 μV_{RMS} 95 - 300 kHz (ISAS3-150) 25.6 μV_P / 5.9 μV_{RMS} 95 - 300 kHz (ISAS3-150-V01) 24.0 μV_P / 4.4 μV_{RMS} 180 - 500 kHz (ISAS3-375) 33.1 μV_P / 5.5 μV_{RMS} 95 - 960 kHz (ISAS3-900)
AST-pulse for sensor coupling verification ISAS3 controlled by ASIP-2/A via SISO3, Pulse ISAS3-internally generated, in order to stimulate an AE event for test purposes. Amplitude can be controlled by AE system over the length of AST control pulse, to some extent.	Pulse width / Amplitude (typical) 0.5 us / 8.4 V 1 µs / 15 V 2 µs / 26 V 4 µs / 31 V

7.2.4 Acoustic specifications

Sensitivities are given referred to the piezo element (independent on gain), typical values

Model	Typical Peak sensitivity @ frequency	Typical Bandwidth (-10 dB) ISAS3+SISO3
ISAS3-030	-63 dB re 1 V/µbar @ 55 kHz	23 – 75 kHz
ISAS3-075	-61 dB re 1 V/µbar @ 78 kHz	25 – 120 kHz
ISAS3-150	-64 dB re 1 V/µbar @ 150 kHz	120 – 180 kHz
ISAS3-150-V01	-64 dB re 1 V/µbar @ 150 kHz	120 – 180 kHz
ISAS3-375	-63 dB re 1 V/µbar @ 370 kHz	220 – 780 kHz
ISAS3-900	-64 dB re 1 V/µbar @ 340 kHz	220 – 910 kHz

8 Accessories for ISAS3

8.1 Magnetic Holder MAG4IS

Figure 8-1 shows a magnetic holder MAG4IS. It consists of a mounting plate of stainless steel, which is pressed by three springs towards the test object. Three magnets have direct contact to the surface of the test object.

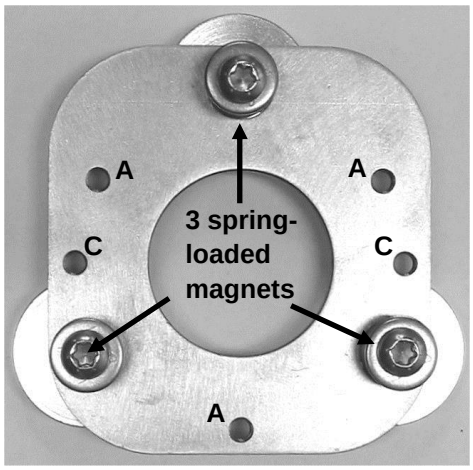


Figure 8-1 Magnetic holder MAG4IS

Three threads M4 (labeled A in Figure 8-1) are to fasten the base plate of sensor ISAS3. Two threads M4 (labeled C in Figure 8-1) are to mount e.g. a steel tape around a cylindrical tank for stronger fastening against vibration and acceleration when driving over bad roads.

Magnets are of material cobalt samarium. Each magnet provides a holding force of 200 N. Magnets are suitable for the full temperature range of ISAS3.

Each spring provides a holding force of 25 N. Springs are made of stainless steel.

MAG4IS is suited for all ISAS3 variants

Figure 8-2 shows the ISAS3 with the MAG4IS completely mounted. An earth connection must be made using one wire of at least 4 mm^2 copper (or two of at least 1.5 mm^2) fastened at the designated sensor thread M4 (see Figure 8-2, right) to an earth point nearby (EN 60079-14:2008, 12.2.4). Washers must be used and sufficient torque to ensure the earth connection is not twistable.

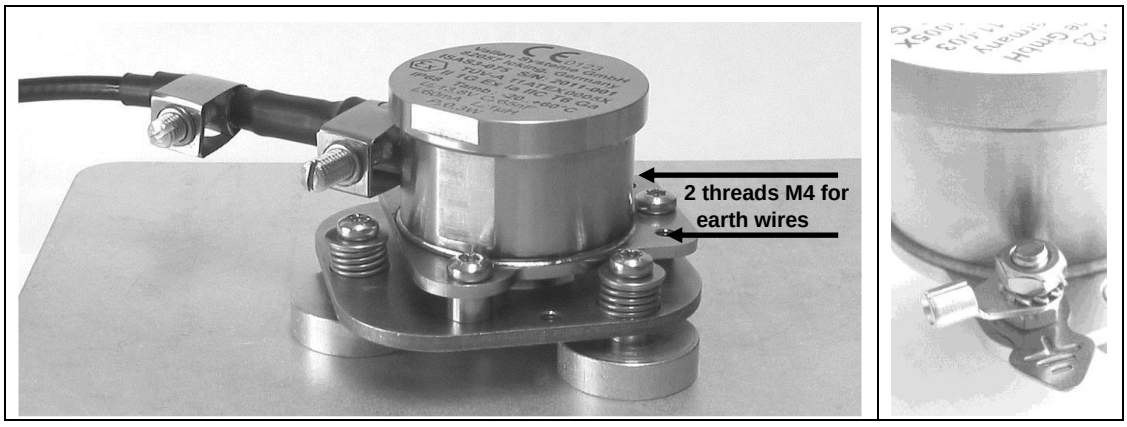


Figure 8-2 ISAS3 on magnetic holder MAG4IS (right: earth connection)

8.2 ISAS3-SpecMount

This describes an alternative mounting method of ISAS3 using welded screws instead of magnets.

The mounting plate shall be fastened by three M5x16 screws (instead of magnets), with hexagon screw-heads welded to the test object. The boreholes "B", 9 mm with MAG4IS, shall be 5.1 mm for the welded holder. Each screw holds the mounting plate using screw-nuts and washers on both sides. The mounting plate comes with the three screws already mounted and the distance between screw-heads and mounting plate adjusted to 10 mm.

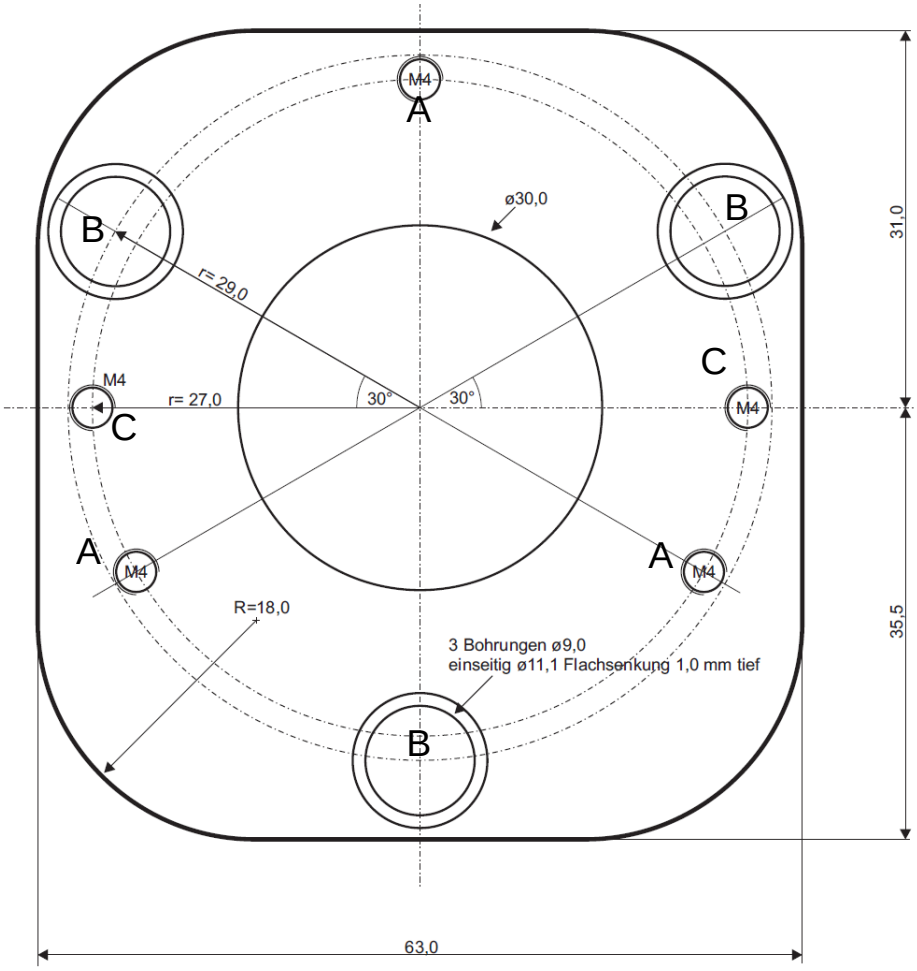


Figure 8-3 Mounting plate for magnetic holder, thickness 3 mm. *(39MMP1_R0.2 of 29.04.2011)*

A sensor position must be found, where the area between three welding points is perfectly flat and where the sensor's sensitive face will meet a clean surface. The three screw-heads holding the mounting plate shall be welded to the test object. Then the sensor ISAS3, with some coupling agent on the sensitive face, shall be mounted to the mounting plate using three screws M4, exactly as with MAG4IS (Figure 8-3), to threads "A" in Figure 8-1. If the test object's surface is not perfectly flat, the three pairs of screw-nuts must be loosened, the best position found and the screw-nuts re-fastened. The best position is found, when the sensor's sensitive area is exactly parallel and pressed onto the test object surface.

No spring is used with the welded holder, so motion or sloshing forces cannot influence the seat of the sensor. The cable leaving the sensor shall be fastened by an additional welded screw to avoid forces from cable to sensor from movements or sloshing.

Since all metallic parts are in direct contact to the test object, no extra earth wire is needed.

The distance of the mounting plate to the test object is nominal 10.0 mm with all ISAS3 variants, due to different distance pieces for the sensor. These are 12.5 mm long with ISAS3-030 and 5 mm with all other variants.

Two threads "C" in Figure 8-3 are symmetric to ISAS3 and foreseen to fasten the mounting plate by a steel tape around the circumference of a cylindrical tank (e.g. tank car monitoring).

8.3 ISAS3-SpecIP68 – oil resistant sealing of a cable-to-sensor transition against 12 bar peak pressure

8.3.1 Sealing Set Hardware: SS-OIL-5MM

This sealing set is needed to seal the transition of a 5 mm thick cable to ISAS3. It consists of:

1. 1 piece of heat shrink hose, oil resistant, Raychem RW-200-E-3/8-0, 9.5 mm inner diameter before shrinking, 50 mm length, -55 °C to +200 °C
2. 1 piece of heat shrink hose, oil resistant, Raychem RW-200-E-1/2-0, 12.7 mm inner diameter before shrinking, 60 mm length, -55 °C to +200 °C
3. 1 cable clamp for 7.4 to 10 mm diameter, oil resistant, 11 mm width
4. 1 cable clamp for 9.6 to 14 mm diameter, oil resistant, 11 mm width

The cable clamps are made of steels 1.4310, 1.4567 and 1.4305.

8.3.2 Usage of Sealing Set SS-OIL-5MM

For a temporary installation, cables don’t have to be installed in protective tubes, so for use for instance in a crude oil tank, oil proof coaxial cable must be used and inserted into the tank usually through a partly open man hole. Safety consideration must be provided by a safety expert on site. This chapter specifies only the recommended sealing of the cable-to-sensor transition against oil and 12 bar peak pressure. If sealing is needed for water, a less expensive heat shrink material than specified below may be used.

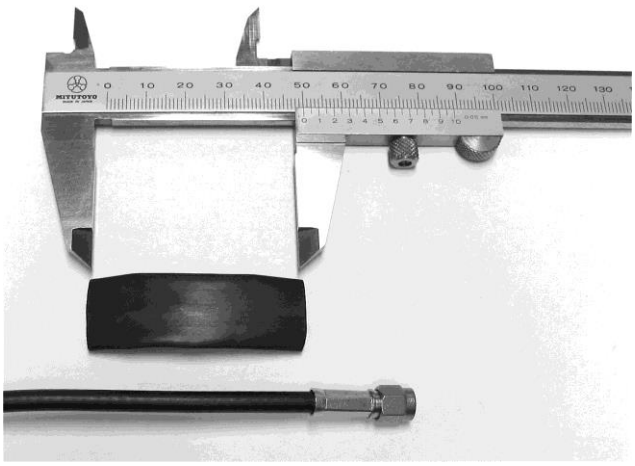


Figure 8-4

Figure 8-4 shows a 50 mm long section of a heat shrink of type RW200-E with 9.5 mm inner diameter before shrinking)

This type of heat shrink model can be shrinked at 150 °C to half of the diameter before shrinking. Thickness will be 0.9 mm after shrinking.

This part is used to make the cable thick enough for sealing by a thicker heat shrink.

Figure 8-5

Figure 8-5 shows the heat shrink of Figure 8-4 shrunk onto the cable and partly onto the SMA connector.

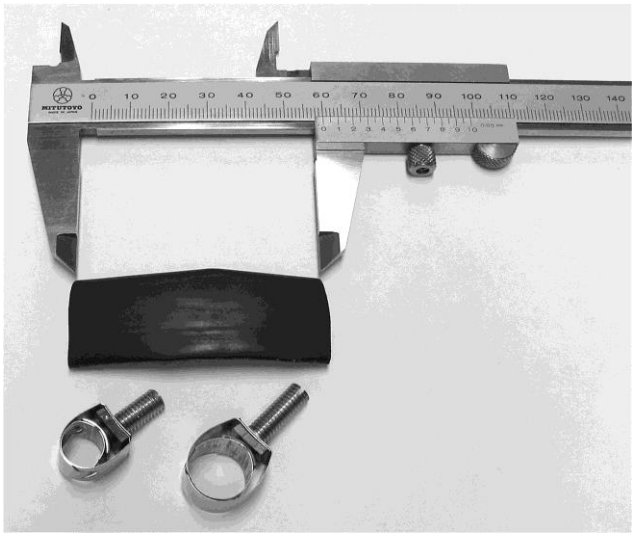


Figure 8-6

Figure 8-6 shows a 60 mm long section of heat shrink type RW200-E, 12.7 mm inner diameter before shrinking.

The shown stainless steel screwed-clamps are for sealing both heat shrinks on the coaxial cable.

The smaller one is to clamp both layers of heat shrink onto the cable, the bigger one is to clamp one heat shrink layer onto the connector adapter of ISAS3.

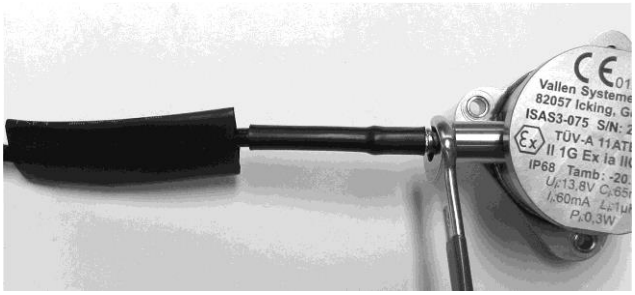


Figure 8-7

As seen in Figure 8-7, first the smaller clamp and then the larger clamp and then the heat shrink must be shifted over the cable end before the SMA connector is screwed on.

Figure 8-8

Figure 8-8 shows the heat shrink already shrunk over the connector-adapter on ISAS3 side.

Figure 8-9

Figure 8-9 shows the smaller stainless steel clamp being screwed onto the other end of the heat shrinks for safe tightening of heat shrink and cable.

The clamp is needed for durable sealing.

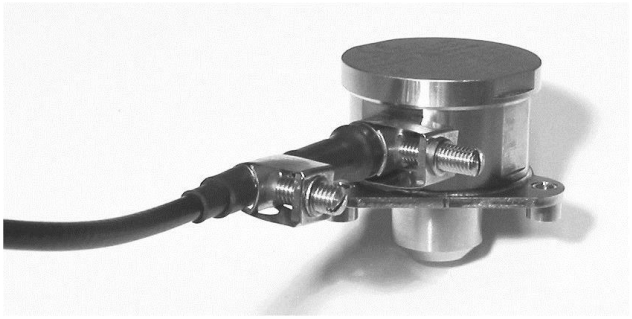


Figure 8-10

Figure 8-10 shows the completed cable to sensor transition. The sensitive face of the sensor is pointing downwards; no magnetic holder and earth connection wire is shown.

8.4 Sealing the transition of a cable-in-a-tube to sensor against 12 bar peak pressure

Within for instance a ship's tank it is assumed that for protection of permanently installed cables from mechanical damage and from oil, the coaxial cable run through a sealed tube to ISAS3. At ISAS3 side the tube must end in a flexible part which is sealed to ISAS3 with a heat shrink of appropriate diameter. RW200-E heat shrinks are available with inner diameters (before shrinking) of 15.9 mm, 19.1 mm, 22.2 mm and 25.4 mm.

If the inner diameter of the flexible tube is bigger than 11.0 to 11.5 mm (the outer diameter of the connector adapter), a heat shrink hose might be needed which is directly fitted onto the connector adapter.

For a long term sealing, clamps must be used as shown in the chapter before. These are available for the following diameter ranges: 12.2 to 17 mm, 14 to 19 mm, 15.5 to 21 mm, and 17.3 to 22 mm. Up to Ø 22 mm tubes and clamps (before clamping) are possible.

9 Installation

9.1 General hints

The applicable standards for intrinsic safety installations, especially EN 60079-14:2008 and EN 60079-25:2010 must be considered for intrinsically safe installations. Since SISO3 is an isolating barrier, severe requirements for non-isolating barriers do not apply. For example, it is not required to connect the intrinsically safe circuit at the signal isolator side to earth and it is also not required to use an isolating transformer before each mains powered device on the safe side of the installation (EN 60079-14:2008 / 12.3).

Beside of safety considerations, AE-experts have to provide AE-specific test procedures, e.g. to define sensor locations and maximum sensor distances. These considerations are not topic of this document.

Additional standards and rules may have to be considered for other aspects.

9.2 Sensor mounting – functional requirements

Sensor ISAS3 shall pick up very small surface movements in a pm range (1 pm = 10^{-12} m). The location for installing an AE sensor must be flat and clean. For best acoustic coupling a diameter of at least 25 mm shall be free from painting/coating for direct contact of the face of ISAS3 (14 mm diameter) to the test object. A coupling agent shall be used between face of ISAS3 and test object. For a permanent installation, a cold hardening silicon rubber, e.g. RTV162, is recommended as coupling agent. It also protects the area of removed coating against corrosion. RTV162 needs about 24 hours for curing. For temporary installations, silicon grease or other proven coupling materials can be used.

The sensitive face of ISAS3 must be pressed onto the surface of the test object with a constant force of at least 60 N. The magnetic holder MAG4IS is one example how this can be achieved for a temporary installation. Chapter 8.2 “ISAS3-SpecMount” shows details for a replacement of the 3 magnets by 3 bolts that can be welded to the test object for a permanent sensor installation.

9.3 Cabling between sensor ISAS3 and SISO3 (Ex i)

We recommend two types of 50 Ω coaxial cable:

- RG58C/U, if the cable will not come in contact with oil.
- E&E 29392-1, an ETFE cable that can come into contact with crude oil.

Cable parameters and maximal cable length (2 km) are listed under 5.2.5.

For mounting SMA connectors see the assembly instructions in Figure 11-1 (ISAS3 side) and Figure 11-2 (SISO3 side).

For sealing the cable-to-sensor transition against 12 bar peak pressure, see chapter 8.3 and 8.4.

For use on deck of a ship or at a tank car we recommend to protect the connector by using a normal heat shrink material that is less costly than RW200-E.

9.4 Sensor installation - safety relevant requirements for EPL “Gb” and “Gc” (Earth connection)

EN 60079-14:2008 / 12.2 defines the safety relevant requirements for the erection of intrinsically safe electrical installations of Equipment Protection Level (EPL) “Gb” (for hazardous areas of zone 1) and “Gc” (for hazardous areas of zone 2.)

The metallic case of sensor ISAS3 is in electric contact to the intrinsically safe circuit (shield & minus pole). It must be safely and reliably connected to potential equalization of the test object (EN 60079-14:2008 / 12.2.4). Most metallic test objects provide potential equalization at the point of sensor location due to their full metallic construction.

Pressing the contact face of an AE sensor to a test object, even if painting is removed, is not a safe electrical contact. Welded bolts used for holding the ISAS3 mounting plate are well suited contact points for potential equalization. Where ISAS3 cannot be directly screwed onto a metallic surface carrying potential equalization, ISAS3 provides two threads M4, one with a pre-mounted screw, earth symbol, nut, and a ring cable lug, chopper disk and another nut (see Figure 8-2). A wire of at least 4 mm^2 copper (or two wires of at least 1.5 mm^2 copper each) is to be used to connect the ISAS3 to the potential equalization. Sufficient torque to ensure the connection is not twistable at ISAS3 as well as at the welded bolts must be used.

For temporary installations, where magnet holders are used instead of welded bolts, safe access points for connecting ISAS3 case with the potential equalization must be found and used nearby.

Block diagram in Figure 9-1 applies.

9.5 Sensor installation - safety relevant requirements for EPL “Ga” (Earth connection)

EPL “Ga” is required for zone 0, the most hazardous environment.

The requirements for EPL “Ga” installations are summarized in EN 60079-14:2008 / 12.3. There it is urgently recommended to use isolating barriers, as given with SISO3. This eliminates additional requirements for safety transformers and allows that earth connection of the intrinsically safe sensor is only required at the sensor side and not at the side of the isolating barrier.

In addition, EN 60079-14:2008 / 12.3 requires a risk analysis that the installation is protected against atmospheric electricity (in worst case a lightning strike). If a risk of atmospheric electricity cannot be excluded, an appropriate overvoltage protection (10 kA 8/20µs) is required. ISAFE3 does not provide overvoltage protection against atmospheric electricity.

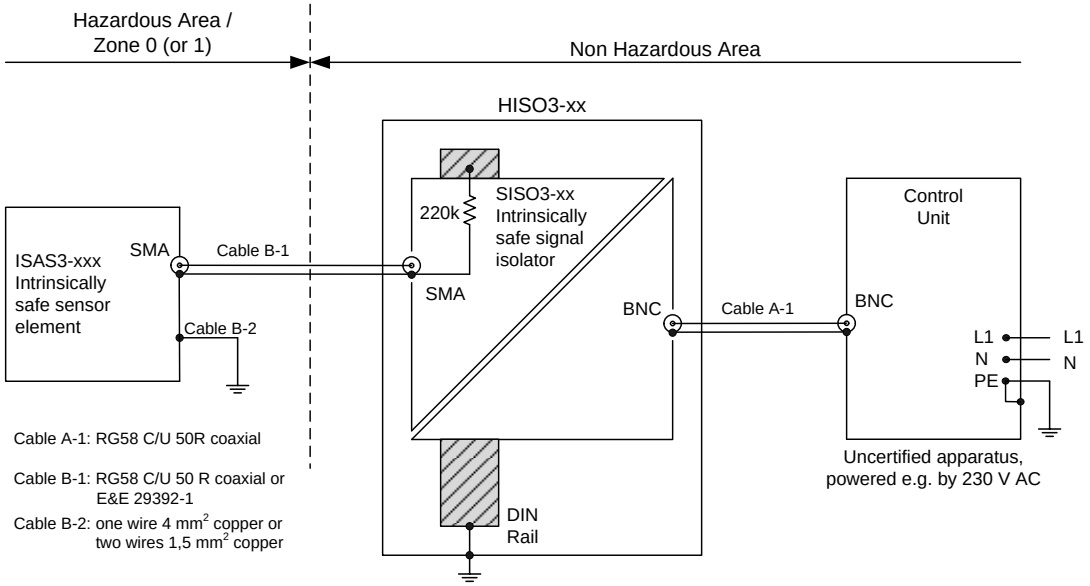


Figure 9-1 Block Diagram for use of ISAS3 in zone 0 (or 1, or 2) and SISO3 and Control Unit in non-hazardous area

9.6 Functional verification

Usage and functional verification of a set of ISAS3 & SISO3 shall be made as with any other AE sensor model, e.g. by verifying the response on a pencil lead break or the response on the artificial AE as generated by a pulsing sensor nearby. When used with a Vallen AE system, defining SISO3-xx dB (xx means the gain setting 14, 20 or 26 dB) as input device will automatically select the correct settings for pulsing method (AST), power supply (28 V) and gain (xx). Pulse amplitude can be modified by varying the pulse-width in the pulser setting dialogue in acquisition software.

With the first installation and during each periodical maintenance of the test object it is recommended to perform a functional verification of sensors, signal isolator and AE system as described in EN 13477-2:2010 (English).

9.7 Maintenance

There are no maintenance requirements other than described in EN 13477-2 which applies to all kind of AE equipment.

9.8 Adjustment

There are no adjustments needed or possible for the user with the exception of SISO3 gain setting to either 14, 20 or 26 dB.

10 Product code overview

Code	Product description
# ISAFE3, Intrinsically Safe sensor system	
ISAS3-030	AE sensor for EX Zone 0, 1 or 2; peak sensitivity at 30 kHz
ISAS3-075	AE sensor for EX Zone 0, 1 or 2; peak sensitivity at 75 kHz
ISAS3-150	AE sensor for EX Zone 0, 1 or 2; peak sensitivity at 150 kHz
ISAS3-150-V01	AE sensor for EX Zone 0, 1 or 2; peak sensitivity at 150 kHz; reinforced sensitive face plate
ISAS3-375	AE sensor for EX Zone 0, 1 or 2; peak sensitivity at 375 kHz
ISAS3-900	AE sensor for EX Zone 0, 1 or 2; with high sensitivity up to 900 kHz
MAG4-IS	Magnetic holder for ISAS3-xxx
SISO3	Signal isolator in clip-on box, must be mounted into an IP54 protected case
HISO3-08	Box for mounting up to 8 SISO3 in non-hazardous area, protection class IP54
HISO3-20	Box for mounting up to 20 SISO3 in non-hazardous area, protection class IP54
# BNC cables for connecting ASIP with SISO3	
CBL-1-2M-V26	Coaxial cable RG-58, one BNC-connector straight, one BNC-connector right-angled, 2m length
CBL-1-5M-V26	Coaxial cable RG-58, one BNC-connector straight, one BNC-connector right-angled, 5m length
# Coaxial cable (not oil resistant) with SMA-connector for connecting ISAS3 with SISO3	
CBL-1-5M-V4	Coaxial cable RG-58, one SMA-connector straight, one SMA-connector right-angled, 5m length
CBL-1-10M-V4	Coaxial cable RG-58, one SMA-connector straight, one SMA-connector right-angled, 10m length
CBL-1-25M-V4	Coaxial cable RG-58, one SMA-connector straight, one SMA-connector right-angled, 25m length
CBL-1-50M-V4	Coaxial cable RG-58, one SMA-connector straight, one SMA-connector right-angled, 50m length
CBL-1-100M-V4	Coaxial cable RG-58, one SMA-connector straight, one SMA-connector right-angled, 100m length
CBL-1-1M-V27	Coaxial cable RG-58 without connectors as bulk stock
# Coaxial cable (ETFE) with SMA-connector for connecting ISAS3 to SISO3	
CBL-1-5M-V32	Coaxial cable, ETFE, one SMA-connector straight, one SMA-connector right-angled, 5m length
CBL-1-10M-V32	Coaxial cable, ETFE, one SMA-connector straight, one SMA-connector right-angled, 10m length
CBL-1-25M-V32	Coaxial cable, ETFE, one SMA-connector straight, one SMA-connector right-angled, 25m length
CBL-1-50M-V32	Coaxial cable, ETFE, one SMA-connector straight, one SMA-connector right-angled, 50m length
CBL-1-100M-V32	Coaxial cable, ETFE, one SMA-connector straight, one SMA-connector right-angled, 100m length
CBL-1-1M-V33	Coaxial cable, ETFE, price per meter, without connectors
SMA-M-S	SMA-connector male, straight, not mounted to cable (add SMA-MNT)
SMA-M-R	SMA-connector male, right-angled, not mounted to cable (add SMA-MNT)
SMA-MNT	Mounting of SMA-connector (SMA-M-S or SMA-M-R) to cable (CBL-1-1M-V27 or CBL-1-1M-V33) on one side
# Sealing set for cable transition to ISAS3, oil resistant	
SS-OIL-5MM	Sealing Set for oil resistant sealing of 5mm cable to sensor transition ISAS3, without mounting
SS-MNT	Mounting of SS-OIL-5MM onto ISAS3
# Grounding cable for ISAS3 and HISO3, oil resistant	
CBL-1-1M-V29	Grounding Cable, 4 mm², oil resistant, price per meter, without mounting. For mounting to cable shoe included in ISAS3 sensor add GNDC-SHOE-MNT
GNDC-SHOE-MNT	Mounting grounding cable CBL-1-1M-V29 to cable shoe included in ISAS3 sensor

11 Assembly instructions for SMA and BNC connectors

C | 19.09.05 | 4186/MAP

Assembly instruction Series SMA No. 3069

Tools and materials required :

Soldering iron
Solder
Scissors, blade (74 Z-0-0-68)
Contact holder No. W 54
Locator tool No. W 14 "F" and "M"
Crimp tool : A insert for ...SMA-50-2-...
B insert for ...SMA-50-3-...

Straight connectors for flexible cables

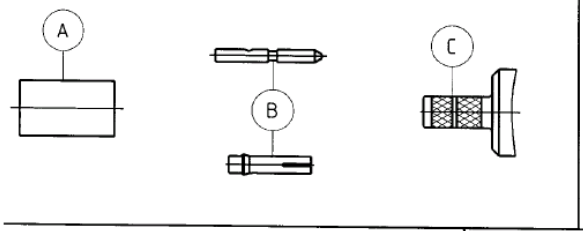
Cable entry : crimped

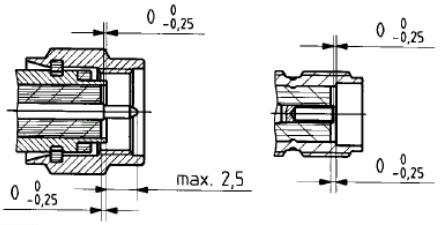
Connector types : (e.g.)		Cable : (e.g.)
	21 SMA 50 - 2 - 5	RG 188 A/U
	21 SMA 50 - 2 - 6	K 02252-d
11 SMA 50 - 3 - 5	21 SMA 50 - 3 - 5	RG 141 A/U
11 SMA 50 - 3 - 6	21 SMA 50 - 3 - 6	RG 142 A/U

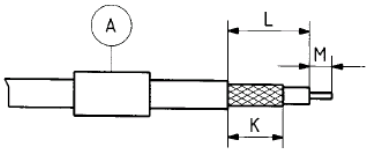
This connector is supplied in 3 parts

Centre contact : soldered

Braid : cavity A für ..SMA-50-2... / B für ...SMA-50-3...



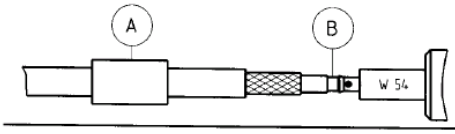




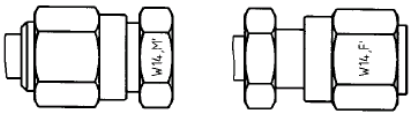
If required, slide taper sleeve or heat-shrink sleeve onto cable (not illustrated). Prepare cable acording to diagram.

Type :	K	L	M
11 SMA-50-2-...	5 mm	8,5 mm	2 mm
21 SMA-50-2-...	5 mm	7,5 mm	2 mm
. . SMA-50-3-...	8 mm	10,5 mm	2 mm
24 SMA-50-2-...	5 mm	12,5 mm	2 mm

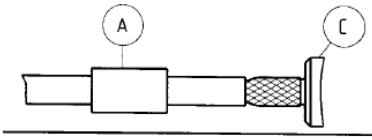
Slide ferrule A onto cable.



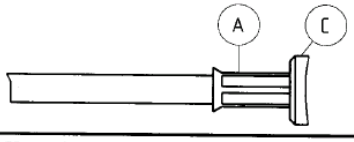
Push contact B onto contact holder W 54.
Heat contact B using a dry soldering iron.
Flow small amount of solder into bore hole of contact, insert inner conductor of cable and solder to contact.
Clean contact B and cable dielectric, remove excess solder.



Mount locator tool W 14 onto connector body C ("M" for male,"F" for female.)



Splay out braid and insert carefully prepared cable fully into connector body C.
Ensure that braid lies above the crimp neck.



Slide ferrule A over braid to about connector body C and crimp as close to connector body C as possible.
Remove locator tool and check interface dimensions.

SUHNER's skilled staff and specialised equipment are available to carry out complete R.F.lead-assembly on your behalf.We mount your connectors on cables at economic prices! Please contact our representative for further details of this service.

HUBER + SUHNER AG CH-9100 HERISAU

Deutscher Text siehe Rückseite

Figure 11-1 Assembly Instruction SMA, straight, ISAS3 side

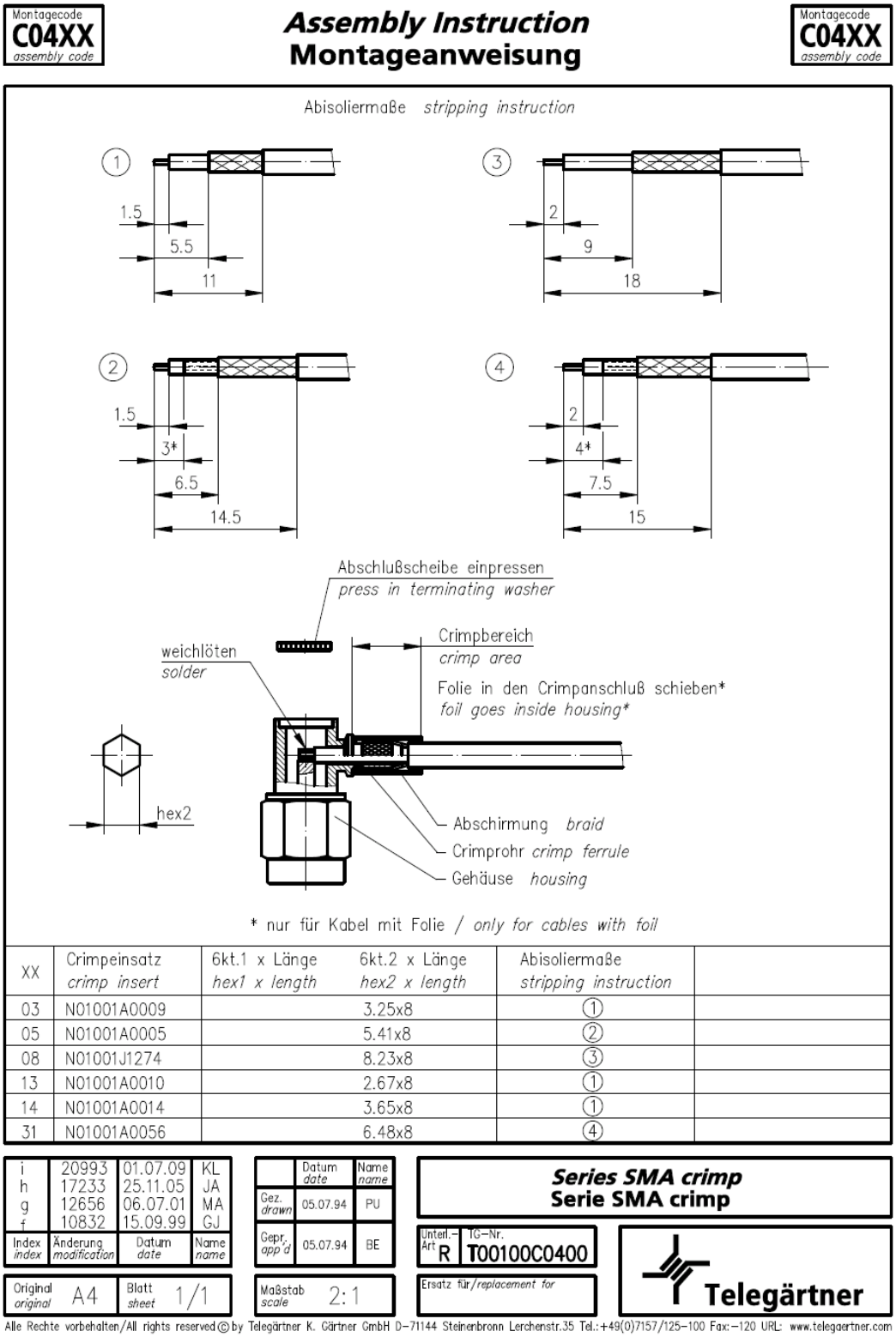


Figure 11-2 Assembly instruction SMA, angled, SISO3 side

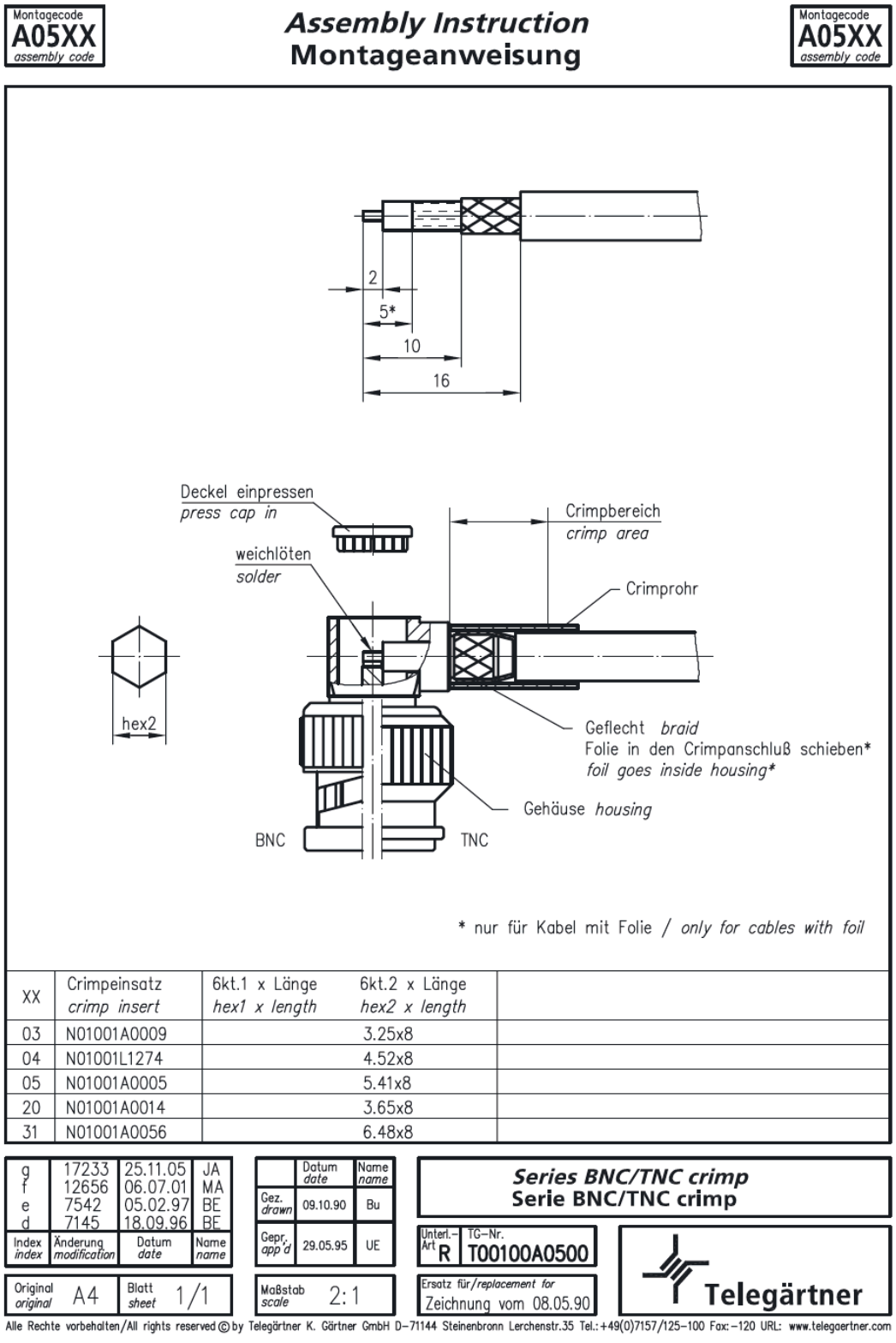


Figure 11-3 Assembly Instruction BNC, angled, SISO3 side

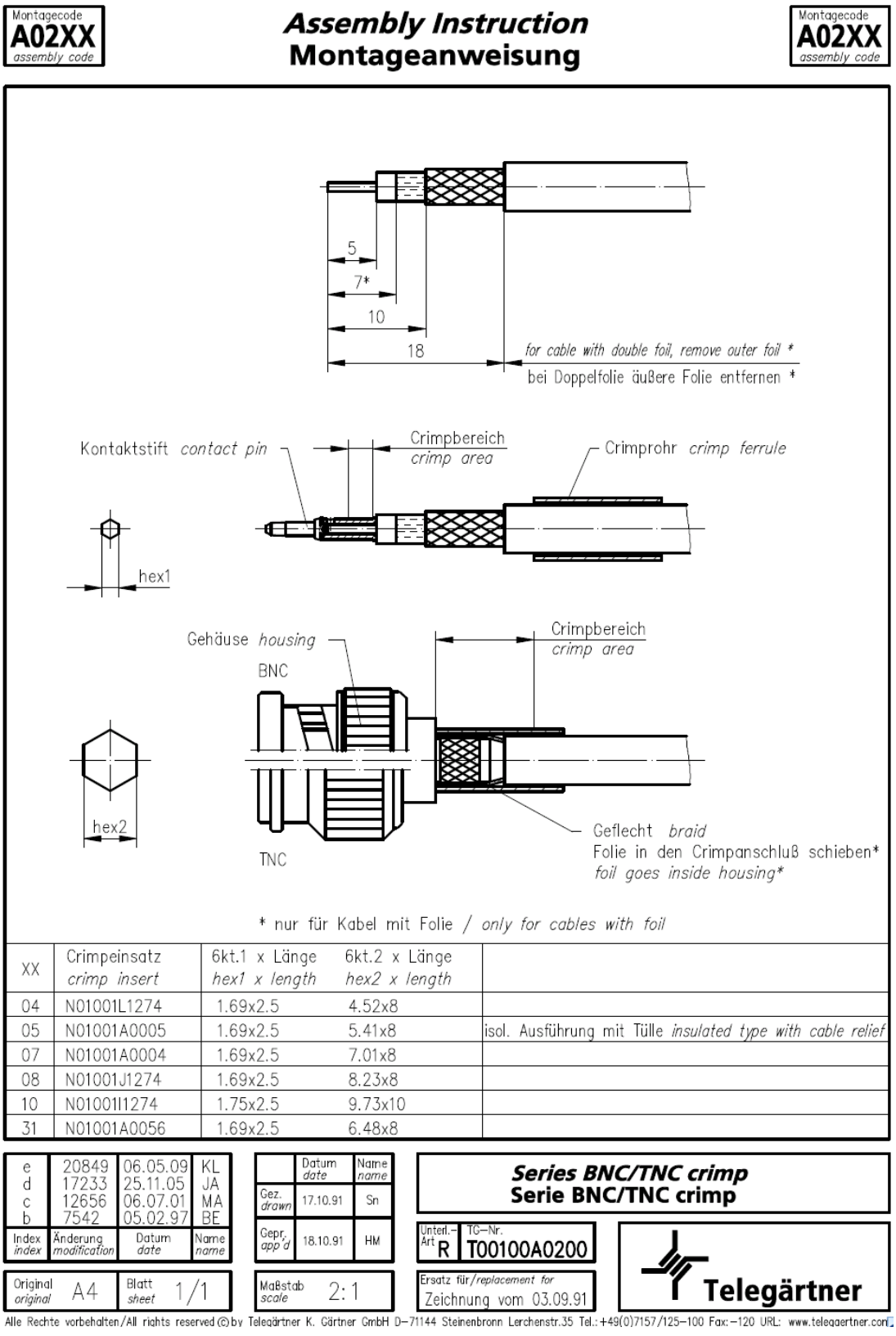


Figure 11-4 Assembly Instruction BNC, straight, ASIP-2 side

12 Abbreviations

AE	acoustic emission
AMSY-6	AE acquisition system from Vallen used for AT
ASIP-2	Signal processor from Vallen, part of AMSY-6, which processes the analogue signal from SISO3
AST	➔ Auto Sensor Test
AT	Acoustic emission testing
ATEX	"Appareils destinés à être utilisés en Atmosphères Explosibles" The ATEX directive, consisting of two directives, 2014/34/EU and 1999/92/EC, defines requirements for equipment and workplaces used in explosive atmosphere
BNC	Type of connector for coaxial cables
dB	decibel (dB), a logarithmic dimensionless unit of measurement expressing the magnitude of a physical quantity relative to a reference value
EN	European Norm
EPL	Equipment protection level
HISO3	Housing for AE-signal isolator and barrier for installation in non-hazardous area
IPxy	Housing protection according to IEC 60529 x: 3 = protected against solid objects (Ø 2.5 mm) 5 = dust protected 6 = dust-tight y: 0 = non protected 4 = protected against splashing water 8 = protected against the effects of continuous immersion in water
IS	intrinsically safe or intrinsic safety
ISAFE3	Family of intrinsically safe AE-products
ISAS3	Intrinsically Safe AE-Sensor, part of ISAFE3 family
MAG4IS	Magnetic holder for all ISAS3 variants
RG58C/U	standard coaxial cable type, 50 Ω impedance
RTV162	coupling agent type
RW200-E	oil resistant heat shrink type
SISO3	AE-signal isolator and barrier, part of ISAFE3 family
SMA	type of connector for coaxial cables
SS-OIL-5MM	oil resistant sealing set for the transition of cable (5mm diameter) to ISAS3.
T4, T6	Temperature class according, to EN 60079-0:2009, Table 2, defining a maximum surface temperature of 85 or 135 °C, respectively
Tamb	Ambient temperature range

USB	Universal serial bus
USYC	System interface of AMSY-6 to USB

13 Glossary

Automated sensor coupling verification:

A series of artificial burst AE, sequently sent by AE sensors, received by neighbored AE sensors, and a data presentation that lets an operator easily verify proper coupling quality of each sensor. Artificial burst AE is generated by ➔ Pulse-Through or ➔ AST

Auto Sensor Test (AST):

The capability of an AE sensor-preamplifier-combination to send an internally generated artificial AE burst for an ➔ automated sensor coupling verification

AST control pulse:

A short-cut of the power supply voltage of an AE preamplifier, variable in duration, for the ➔ Auto sensor test (AST)

DIN rail:

A metallic rail of a standard type widely used for mounting industrial control equipment inside an encapsulation. In this document the special form "Top hat rail according to EN 50022", 35 x 7.5 mm, is addressed

Equipment protection level:

Level of protection assigned to equipment, based on its likelihood of becoming a source of ignition and distinguishing the differences between explosive Gas atmospheres (Ga, Gb, Gc), explosive dust atmospheres (Da, Db, Dc) and explosive atmospheres in mines (Ma, Mb) (EN 60079-0:2009, 3.18)

Fourfold saturated:

Input voltage of an amplifier is 4 times above the linear range

Intrinsic safety:

Type of protection based on the restriction of electrical energy, within apparatus and interconnections exposed to a potentially explosive atmosphere, to a level below that which can cause ignition by either sparking or heating effects (EN 60079-11:2007)

Pulse Through:

The capability of a preamplifier to pass a pulse from the AE system to the sensor for an ➔ automated sensor coupling verification

Pollution Degree

Pollution degree is a classification according to the amount of dry pollution and condensation present in the environment. This classification is important since it affects creepage and clearance distances required to insure the safety of a product.

IEC-60664-1 has established four degrees of pollution severity:

Pollution Degree 1; No pollution or only dry, nonconductive pollution occurs. The pollution has no effect (on the electrical conductivity)

Pollution Degree 2: Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.
Office and laboratory areas are considered pollution degree 2 environments according to safety standards and certification bodies.

Pollution Degree 3: Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation occurs. To be found in industrial environment or construction sites (harsh environments).

Pollution Degree 4: The pollution generates persistent conductivity caused by conductive dust, rain, or snow.

14 Standard compliance

AE-sensor system complies with following standards and directives

	Directive	Applicable Standards
EMV	2014/30/EU	DIN EN 61326-1; Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen DIN EN 61326-2-2; Elektrische Mess-, Steuer-, Regel und Laborgeräte - EMV-Anforderungen - Teil 2-2: Besondere Anforderungen - Prüfanordnung, Betriebsbedingungen und Leistungsmerkmale für ortsveränderliche Prüf-, Mess- und Überwachungsgeräte für den Gebrauch in Niederspannungs-Stromversorgungsnetzen
ATEX	2014/34/EU	EN 60079-0; Explosive atmospheres - Part 0: Equipment - General requirements EN 60079-11; Explosive atmospheres - Part 11: Equipment protection by intrinsic safety “i” EN 60079-15; Explosive atmospheres - Part 15: Equipment protection by type of protection "n" EN 60079-26; Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga

15 Declaration of Conformity

SISO3:

The Acoustic Emission Company

EU Konformitätserklärung

EU Declaration of Conformity

Wir,

We,

Vallen Systeme GmbH
Schaeftlarner Weg 26a, 82057 Icking, Germany

erklären als Hersteller in alleiniger Verantwortung, dass das Produkt

declare as manufacturer under our sole responsibility that the product

Signalisolator

Signal isolator

Produktname / Type:

Product name / type:

SISO3

die einschlägigen Harmonisierungsvorschriften der Union erfüllen:

are in conformity with the relevant Union harmonization legislation:

Richtlinien

Directives

2014/30/EU - electromagnetic compatibility

2014/34/EU - ATEX

Die Übereinstimmung des bezeichneten Produkts mit den Vorschriften der angewandten Richtlinie(n) wird nachgewiesen durch die Einhaltung folgender Normen / Vorschriften:

The conformity of the product described above with the provisions of the applied Directive(s) is demonstrated by compliance with the following standards / regulation:

EN 61326-1:2013
EN 60079-0:2012
EN 61326-2-2:2013
EN 60079-11:2012
EN 60079-15:2011

Ex-Kennzeichnung

Ex-Marking

II (1) 3G Ex nA [ia Ga] IIC T4 Gc

EU - Baumusterprüfbescheinigung Nr.

EU - Type Examination Certificate No.

TÜV-A 11ATEX0004X

Notifizierte Stelle: Qualitätssicherung

Notified Body: Quality assurance

TÜV SÜD Product Service GmbH Zertifizierstellen / Kennnummer: 0123

Notifizierte Stelle: EU-Baumusterprüfung

Notified Body: EU-Type examination

TÜV AUSTRIA SERVICES GMBH / Kennnummer: 0408

Icking, 14. February 2017

Horst Trattnig
Technical Director

Thomas Duschl
Managing Director

Vallen Systeme GmbH
Schaeftlarner Weg 26a
82057 Icking, Germany

Phone: +49 8178 9674-400
info@vallen.de
www.vallen.de

ISAS3-xxx:

The Acoustic Emission Company

EU Konformitätserklärung

EU Declaration of Conformity

Wir,

We,

Vallen Systeme GmbH
Schaeftlarner Weg 26a, 82057 Icking, Germany

erklären als Hersteller in alleiniger Verantwortung, dass das Produkt

declare as manufacturer under our sole responsibility that the product

Schallemissionssensor

Acoustic Emission Sensor

Produktname / Type:

Product name / type:

ISAS3-xxx

die einschlägigen Harmonisierungsvorschriften der Union erfüllen:

are in conformity with the relevant Union harmonization legislation:

Richtlinien

Directives

2014/30/EU - electromagnetic compatibility

2014/34/EU - ATEX

Die Übereinstimmung des bezeichneten Produkts mit den Vorschriften der angewandten Richtlinie(n) wird nachgewiesen durch die Einhaltung folgender Normen / Vorschriften:

The conformity of the product described above with the provisions of the applied Directive(s) is demonstrated by compliance with the following standards / regulation:

EN 61326-1:2013
EN 60079-0:2012
EN 61326-2-3:2013
EN 60079-11:2012
EN 60079-26:2015

Ex-Kennzeichnung

Ex-Marking

II 1G Ex ia IIC T6 Ga

EU - Baumusterprüfbescheinigung Nr.

EU - Type Examination Certificate No.

TÜV-A 11ATEX0005X

Notifizierte Stelle: Qualitätssicherung

Notified Body: Quality assurance

TÜV SÜD Product Service GmbH Zertifizierstellen / Kennnummer: 0123

Notifizierte Stelle: EU-Baumusterprüfung

Notified Body: EU-Type examination

TÜV AUSTRIA SERVICES GMBH / Kennnummer: 0408

Icking, 14. February 2017

Horst Trattnig
Technical Director

Thomas Duschl
Managing Director

Vallen Systeme GmbH
Schaeftlarner Weg 26a
82057 Icking, Germany

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16 EC Type Examination Certification

SISO3 Page 1:

TÜV AUSTRIA SERVICES GMBH testing, inspection and certification body accredited by the Austrian Federal Ministry of Economy, Family and Youth

TÜV AUSTRIA

Certificate

(1) **EC Type Examination Certificate**

(2) Equipment or protective system intended for use in potentially explosive atmospheres – Directive 94/9/EC

(3) TÜV-A 11ATEX0004X

(4) Equipment: Signal Isolator SISO3

(5) Applicant: Vallen-Systeme GmbH

(6) Address: Schaeftlarner Weg 26a; 82057 Icking; Germany

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) TÜV AUSTRIA SERVICES GMBH, notified body number 0408 in accordance with article 9 of Directive 94/9/EC of the European Parliament and Council of 23 March 1994, certifies that this equipment or protective system has been found to comply with the design and construction of equipment and protective system intended for use in potentially explosive atmospheres, given in Annex II of the Directive.
The examination and test results are recorded in confidential report 2010-ET/PZW-EX-0-000003

(9) Compliance with the Essential Health and Safety Requirements been assured by compliance with:

EN 60079-0:2009	EN 60079-11:2007	EN 60079-15:2010

(10) If the sign X is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC Type examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance with the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

(12) The marking of the equipment or protective system shall include the following:

Ex II (1) 3G Ex nA [ia Ga] IIC T4 Gc

02.04.2012 — Date of issue

Dipl.-Ing. Kurt Mayerhofer — Certification representative

--- — End of validity

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TÜV AUSTRIA SERVICES GMBH
Electrical Engineering
1230 Vienna/Austria, Deutschstrasse 10

11ATEX0004Xe

Page 1/3

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Fax: +43 / 1 / 610 91-6405
e-mail: et@tuv.at
http://www.tuv.at

ZERTIFIKAT | CERTIFICATE | CERTIFICAT | CERTIFICADO | СЕРТИФИКАТ | شهادة | 证书 | 인증서

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(13) **SCHEDULE**

(14) EC Type Examination Certificate TÜV-A 11ATEX0004X

(15) **Description of Equipment**

The device is a signal-insulating unit with preamplifier basically designed to separate the unprotected circuits from the intrinsic safe circuits of the ISAFE3 measuring system, designed for non-destructive inspection of pressure vessels and pipe systems using AE-method. The device can also be used indenpently or together with other systems in explosion hazardous areas. Several SISO3-units can be mounted on a single DIN rail together.

Type code

Typ SISO3 ..

- basic type
- Optional: Add on of numerals or combination of letters without effect on explosion protection - reserved for future variants

Electrical Data

Non-intrinsically safe input parameters:

rated voltage:	U_N = 28 V_{DC}
max. supply voltage:	U_m = 250 V_{AC}
rated current:	I_N = 66 mA
rated power	P_N = 1,85 W

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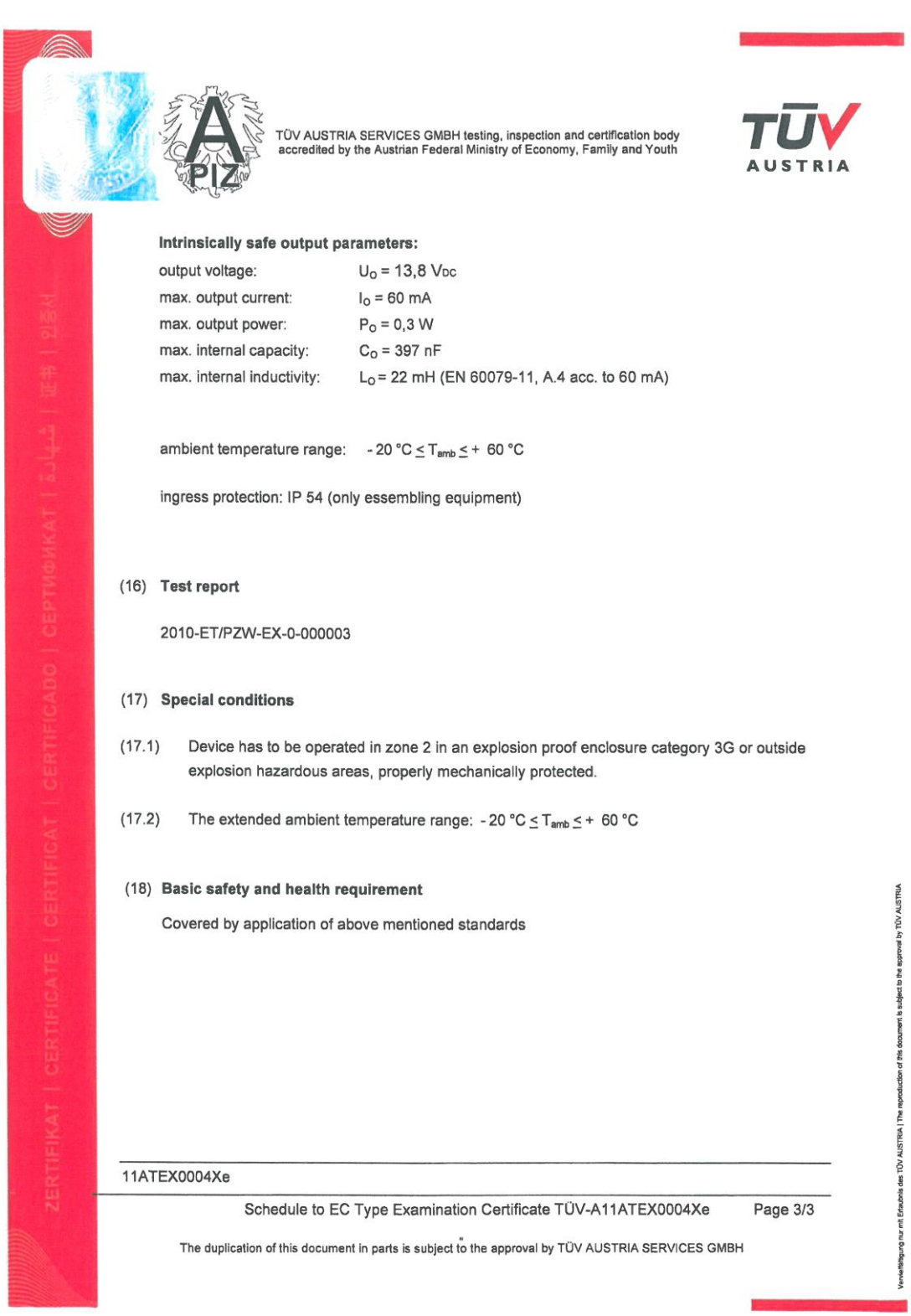

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Intrinsically safe output parameters:

output voltage:	U_O = 13,8 V_{DC}
max. output current:	I_O = 60 mA
max. output power:	P_O = 0,3 W
max. internal capacity:	C_O = 397 nF
max. internal inductivity:	L_O = 22 mH (EN 60079-11, A.4 acc. to 60 mA)

ambient temperature range: $-20\ °C \leq T_{amb} \leq +\ 60\ °C$

ingress protection: IP 54 (only essembling equipment)

(16) **Test report**

2010-ET/PZW-EX-0-000003

(17) **Special conditions**

(17.1) Device has to be operated in zone 2 in an explosion proof enclosure category 3G or outside explosion hazardous areas, properly mechanically protected.

(17.2) The extended ambient temperature range: $-20\ °C \leq T_{amb} \leq +\ 60\ °C$

(18) **Basic safety and health requirement**

Covered by application of above mentioned standards

11ATEX0004Xe

Schedule to EC Type Examination Certificate TÜV-A11ATEX0004Xe Page 3/3

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ISAS3 Page 1:

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TÜV AUSTRIA

Certificate

(1) **EC Type Examination Certificate**

(2) Equipment or protective system intended for use in potentially explosive atmospheres – Directive 94/9/EC

(3) TÜV-A 11ATEX0005X

(4) Equipment: Sensor System ISAS3

(5) Applicant: Vallen-Systeme GmbH

(6) Address: Schaeftlarner Weg 26a; 82057 Icking; Deutschland

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) TÜV AUSTRIA SERVICES GMBH, notified body number 0408 in accordance with article 9 of Directive 94/9/EC of the European Parliament and Council of 23 March 1994, certifies that this equipment or protective system has been found to comply with the design and construction of equipment and protective system intended for use in potentially explosive atmospheres, given in Annex II of the Directive.
The examination and test results are recorded in confidential report 2010-ET/PZW-EX-0-000004

(9) Compliance with the Essential Health and Safety Requirements been assured by compliance with:

EN 60079-0:2009	EN 60079-11:2007	EN 60079-26:2007

(10) If the sign X is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC Type examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance with the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

(12) The marking of the equipment or protective system shall include the following:

Ex II 1 G Ex ia IIC T6 Ga

02.04.2012
Date of issue

Dipl.-Ing. Kurt Mayerhofer
Certification representative

End of validity

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11ATEX0005Xe

Page 1/3

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(13) **SCHEDULE**

(14) EC Type Examination Certificate TÜV-A 11ATEX0005X

(15) **Description of Equipment**

ISAS3 is an ultrasound sensor consisting of two functional units: "amplifier" and "pulse decoder and driver". The enclosure consists of a base plate with piezo-cup and a chassis with a lid. The enclosure with piezoelectric element in the piezo-cup and all electronic components is inside completely molded.

Type Variations

Typ: ISAS3 - ....

- Basic type
- Optional: Add on of numerals or combination of letters without effect on explosion protection - reserved for future variants

Electrical Data

max. voltage:	$U_i = 13{,}8\ V_{DC}$
max. current:	$I_i = 60$ mA
max. power:	$P_i = 0{,}3$ W
max. internal capacity:	$C_i = 65$ nF
max. internal inductivity:	$L_i = 1$ µH

Technical data:

ambient temperature:	$-20\ °C \leq T_{amb} \leq +\ 60\ °C$
ingress protection:	IP 68

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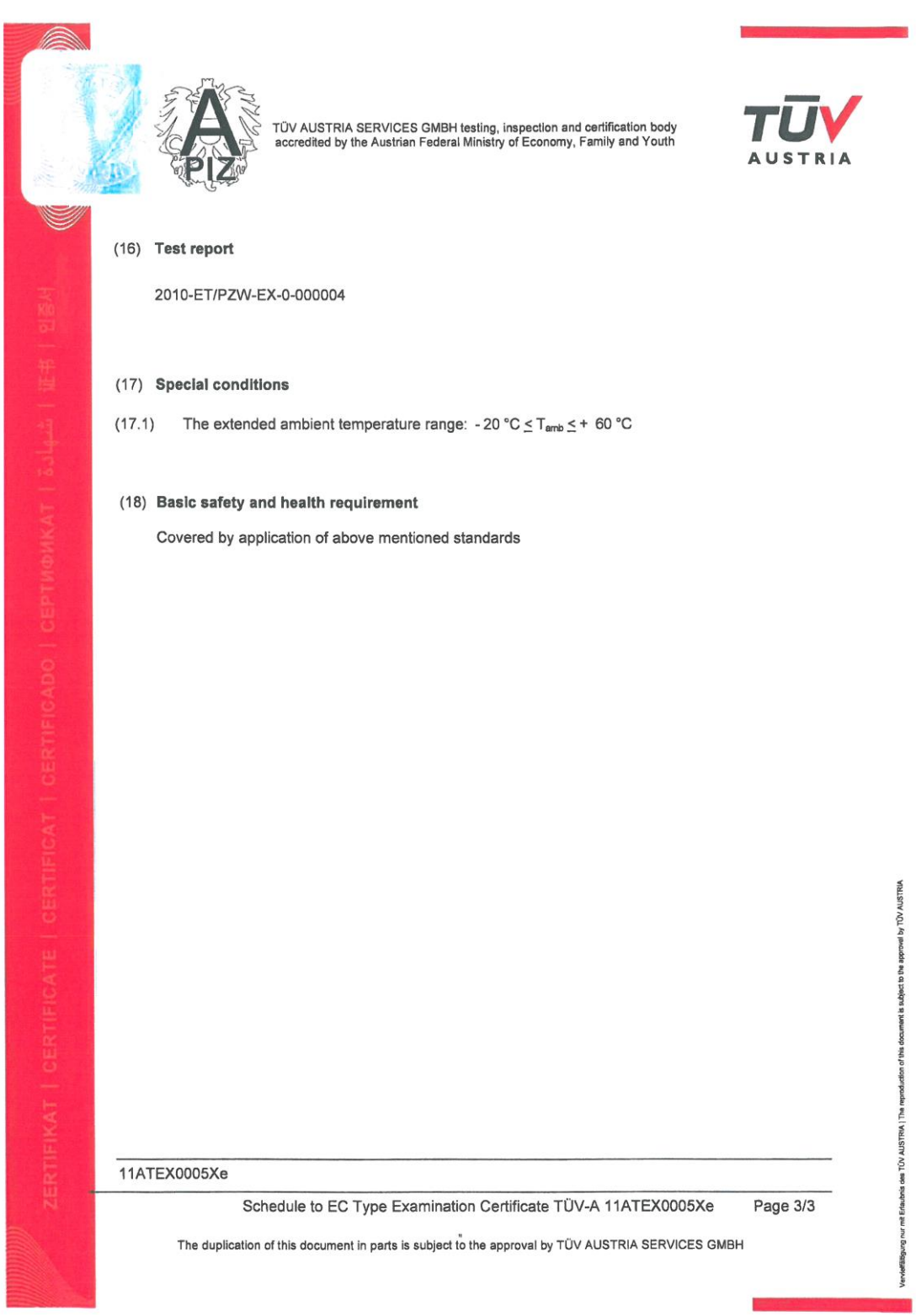
ISAS3 Page 3:



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TÜV AUSTRIA

(16) **Test report**

2010-ET/PZW-EX-0-000004

(17) **Special conditions**

(17.1) The extended ambient temperature range: - 20 °C ≤ T_{amb} ≤ + 60 °C

(18) **Basic safety and health requirement**

Covered by application of above mentioned standards

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11ATEX0005Xe

Schedule to EC Type Examination Certificate TÜV-A 11ATEX0005Xe Page 3/3

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17 2014/34/EU ATEX Certificate for Quality Assurance of Production

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

CERTIFICATE

(1) **about the acceptance of the production quality assurance**

(2) Equipment and components intended for use in potentially explosive atmospheres – **Directive 2014/34/EU**

(3) Certificate number: **TPS 17 ATEX Q 55515 006**

(4) Product Category: Equipment for Acoustic Emission Analysis, Group II, category 1, intrinsic safety,"Ex-i"

(5) Manufacturer: Vallen-Systeme GmbH

(6) Address: Schäftlarner Weg 26a
82057 Icking

(7) TÜV SÜD Product Service GmbH notified body No. 0123 in accordance with Article 18 of the Council Directive 2014/34/EU of February 26th 2016, certifies that the manufacturer maintains a quality assurance for the , which conforms with Annex IV of the Directive.

(8) This certificate is based upon the Audit Report No. 713100502, issued at 2017-03-29, and is valid until 2020-03-17.

The certificate can be withdrawn if the manufacturer does not longer satisfy the requirements of appendix IV.

The result of the quality assurance re-assessment is part of the certificate.

(9) According to article 16 (3) of the Directive 2014/34/EU, the CE-marking shall be followed by the identification number 0123 identifying the notified body, involved in the production control stage. See also notes overleaf.

Office of certification of explosion protection — München, 2017-03-29

Dipl.-Ing. U. Jacobs

642249

CE 0123

Quality Assurance Certificates without signature and official stamp are not valid. The certificate may be circulated only without alteration. Extracts or alterations are subject to approval by TÜV SÜD Product Service GmbH. In case of dispute, the German text shall prevail. The document is internally administrated under the following number: EX2A 17 03 55515 006

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

TÜV®

A1 / 04.11

Revision History:

Rev. Nr.	Date	Signed	Short description of changes
0	18.01.2013	DA, HV, TD	first external version
1	27.09.2013	TD	small editorial changes, modified dimensions of HISO3-20, implementation of chapter 10 “Product code overview”
2	25.07.2016	HT, MF	Added ISAS3-150-V01 New Directive 2014/34/EU New ATEX Certificate for Quality Assurance of Production (TÜV SÜD) English EC Type Examination Certificate SISO3 marking corrected typo errors Added related year to each EN reference Editorial changes Changed cable names Changed “oil proof” cable
3	21.04.2017	HT	Updated TÜV SÜD Certif. No. TPS 17 ATEX Q 55515 006 valid until 2020-03-17 Update, Declaration of Conformity – SISO3 and ISAS3
4	26.09.2018	HT	New Quality Assurance Certification: ISO 9001:2015

Freigabe:

Mit der Freigabe wird die Übereinstimmung aller Angaben in diesem Dokument mit den Angaben in den Zertifizierungsunterlagen der EG-BMP Nr.

„TÜV-A 11ATEX0004X“ und

„TÜV-A 11ATEX0005X“ bestätigt.

Unterschrift

Horst Trattnig

Entwicklungsleiter und ExSchB

Datum: 26.09.2018