KROHNE

Operating Instructions

SU 501 Ex

Signal conditioning instrument

- Variable area flowmeters
- Vortex flowmeters
- Flow controllers
- Electromagnetic flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- **Level measuring instruments**
- Communications engineering
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature

Contents

27953-EN-050616

1 About this document

1.1 Function

This operating instructions manual has all the information you need for quick setup and safe operation of SU 501 Ex. Please read this manual before you start setup.

1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution, warning, danger
This symbol informs you of a dangerous situation that could occur. Ignoring this cautionary note can impair the person and/or the instrument.

Ex applications
This symbol indicates special instructions for Ex applications.

● **List**
The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence**
Numbers set in front indicate successive steps in a procedure.

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2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the operator. For safety and warranty reasons, any internal work on the instruments must be carried out only by personnel authorised by the manufacturer.

2.2 Appropriate use

SU 501 Ex is a universal signal conditioning instrument for connection of a level switch.

2.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

SU 501 Ex is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

2.5 CE conformity

SU 501 Ex is in CE conformity with EMC (89/336/EWG) and NSR (73/23/EWG).

Conformity has been judged acc. to the following standards:

- EMC:
  - Emission EN 50081-1: 1993
  - Susceptibility EN 50082-2: 1995
- NSR: EN 61010-1: 1993

2.6 Safety information for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- SU 501 Ex signal conditioning instrument
- Documentation
  - this operating instructions manual

Components

SU 501 Ex consists of the following components:

- SU 501 Ex signal conditioning instrument

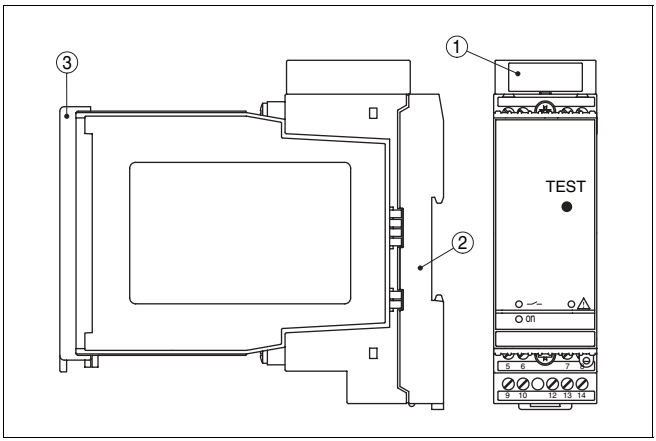

Fig. 1: SU 501 Ex
1 Ex separating chamber with Ex version
2 Socket
3 Transparent cover

3.2 Principle of operation

Area of application

SU 501 Ex is a single signal conditioning instrument for processing of vibrating level switches.

Physical principle

SU 501 Ex signal conditioning instrument can power connected instruments and process their measuring signals.

Power supply

You can find detailed information on the power supply in the "Technical data" in the "Supplement".

3.3 Adjustment

The integration time and the mode (A/B) can be preset on the signal conditioning instrument via a DIL switch block.

A test key is lowered on the front plate of SU 501 Ex. When pushing the key, the measuring system is checked on correct function.

3.4 Storage and transport

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test acc. to DIN EN 24180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Storage and transport temperature

- Storage and transport temperature see "*Supplement – Technical data – Ambient conditions*"
- Relative humidity 20 … 85 %

4 Mounting

4.1 General instructions

Installation location

SU 501 Ex signal conditioning instrument with plug-in socket for mounting on carrier rail acc. to EN 50022.

Transparent cover

The front plate of SU 501 Ex can be provided with a lockable transparent cover to protect the instrument against unauthorised adjustment. See the following figure for how to remove the transparent cover.

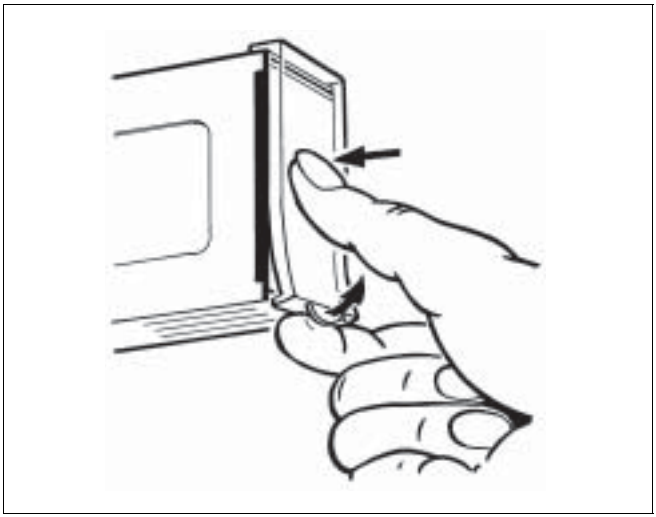

Fig. 2: Removing the transparent cover

4.2 Mounting information

Mounting

The plug-in socket is constructed for carrier rail mounting acc. to EN 50022. Power supply is connected to terminals 9 and 10. For neighbouring signal conditioning instruments, it is possible to continue connection L1 and N directly via the supplied bridges.

Danger:
The bridges must never be used with single instruments or at the end of a row of instruments. If this rule is not heeded, there is a danger of coming into contact with the operating voltage or causing a short circuit.

A SU 501 Ex in Ex version is an auxiliary, intrinsically safe instrument and must not be installed in hazardous areas.

Ex separating chamber

Before setup, the Ex separating chamber must be attached (as shown below) with Ex versions. Safe operation can be only ensured if the operating instructions manual and the EU type approval certificate are observed. SU 501 Ex must not be opened.

Close the upper terminals acc. to the following illustration.

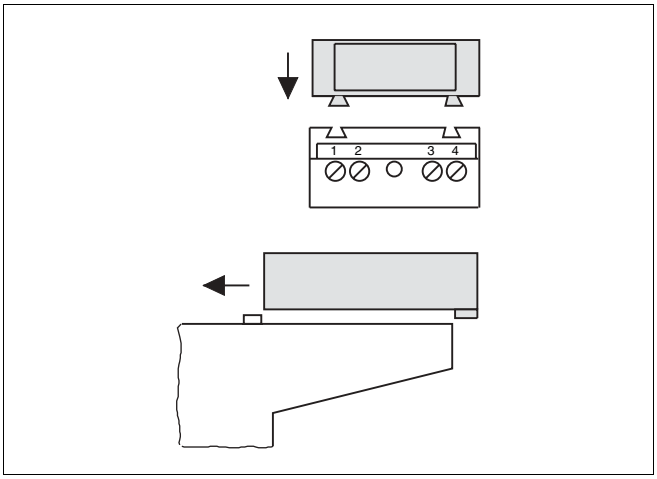

Fig. 3: Mounting the separating chamber

Instrument coding

All signal conditioning instruments are provided with different gaps dependent on type and version (mechanical coding).

The plug-in socket is provided with coded pins that can be inserted to prevent accidental interchanging of the various instrument types.

With a SU 501 Ex in Ex version, the supplied coded pins (type coded pin and Ex coded pin) must be inserted by the user acc. to the below chart.

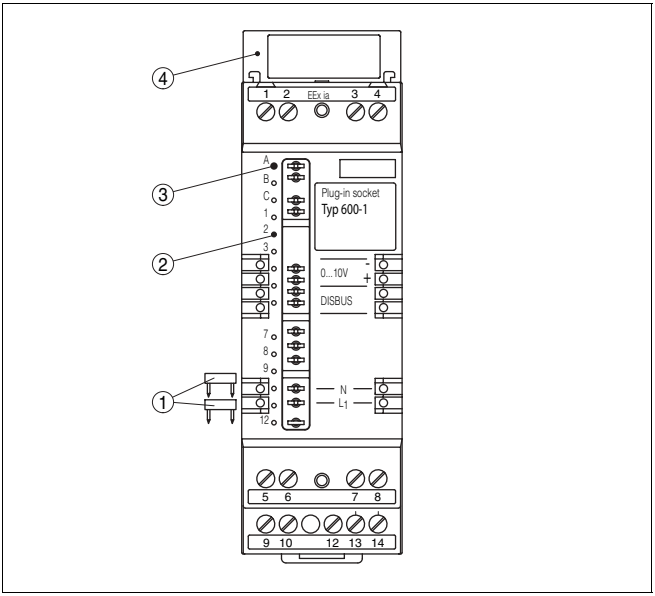

Fig. 4: Plug-in socket SU 501 Ex
1 Bridges for looping the power supply
2 Type coding for SU 501 Ex
3 Ex coding with Ex version
4 Ex separating chamber

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always observe the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltages are expected, overvoltage arresters should be installed.

Take note of safety instructions for Ex applications

In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units.

Select power supply

The power supply can be 20 … 250 V AC, 50/60 Hz or 20 … 72 V DC.

Select connection cable

Power supply of SU 501 Ex is connected with standard cable acc. to the national installation standards.

Standard two-wire cable without screening can be used to connect sensors. If electromagnetic interference is expected, screened cable must be used.

Cable screening and grounding

Connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal outside on the sensor housing must be connected to the potential equalisation.

If potential equalisation currents are expected, the screen connection on SU 501 Ex must be made via a ceramic capacitor (e.g. 1 nF, 1500 V). The low frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Select connection cable for Ex applications

Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

5.2 Connection procedure

Move to electrical connection and proceed as follows:

1 Snap the socket without SU 501 Ex onto the carrier rail

2 Connect sensor cable to terminal 1 and 2, and where applicable, connect the screen

3 Connect power supply (switched off) to terminal 9 and 10

4 Insert SU 501 Ex into the plug-in socket and screw it down tightly

The electrical connection is finished.

Before setting up Ex versions, make sure the Ex separating chamber is plugged (above the sensor terminals). The pins for type and Ex coding must also be inserted correctly.

5.3 Wiring plan

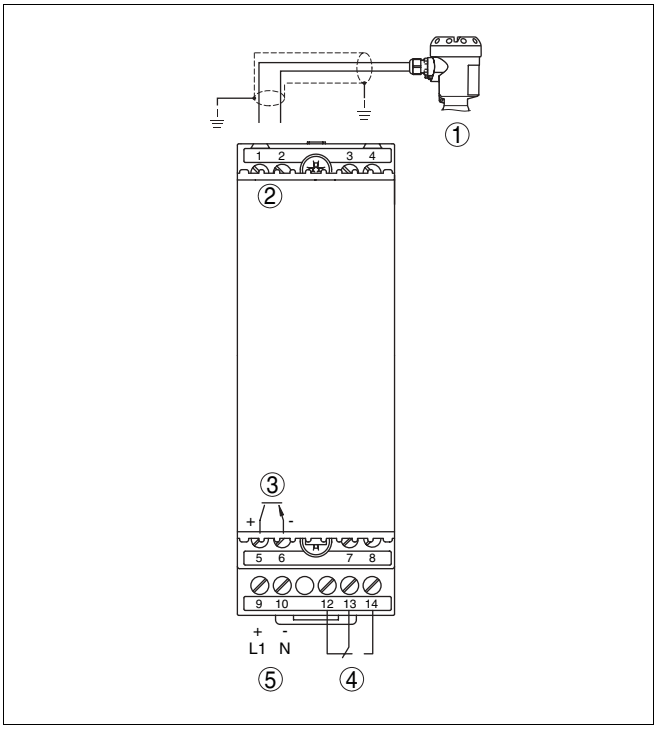

Fig. 5: Wiring plan SU 501 Ex
1 Sensor
2 Sensor input
3 Transistor output
4 Relay output
5 Power supply

6 Set up

6.1 Adjustment system

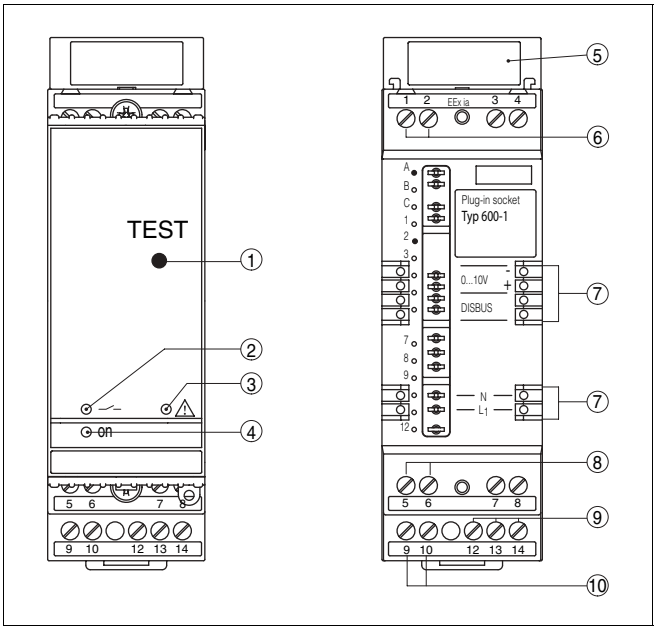

Fig. 6: Indicating and adjustment elements

1 *Test key*
2 *Control lamp level relay (LED)*
3 *Control lamp fail safe relay (LED)*
4 *Control lamp power supply (LED)*
5 *Ex separating chamber*
6 *Terminal for probe*
7 *Sockets for bridges*
8 *Transistor output*
9 *Relay output*
10 *Power supply*

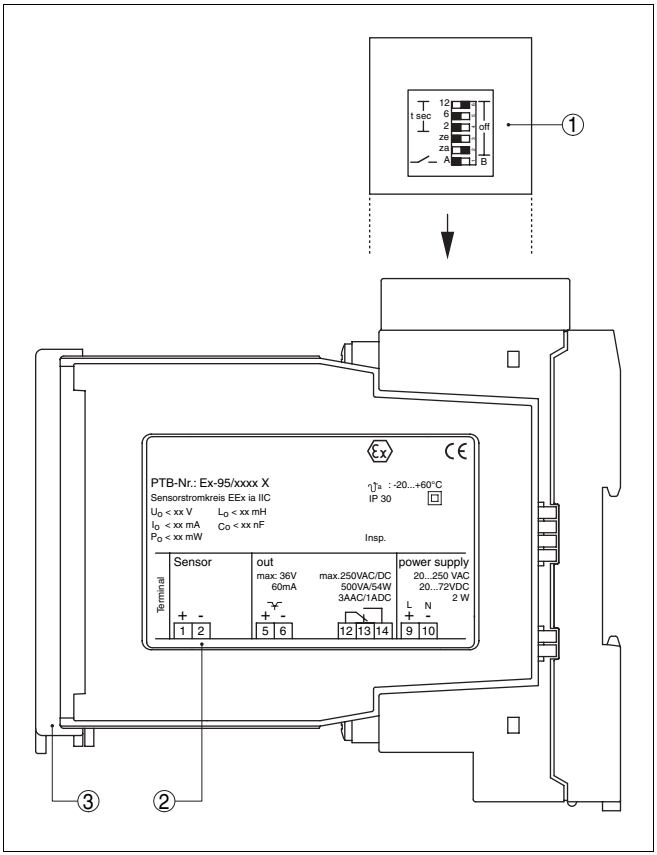

Fig. 7: Indicating and adjustment elements
1 DIL switch block
2 Type label
3 Transparent cover

6.2 Adjustment elements

Control lamps

Control lamps (LED) in the front plate indicate operation, switching status and fault signal.

- Green
  - Operation control lamp
  - Mains voltage on, instrument operates
- Red
  - Failure lamp
  - Fault on the sensor circuit by sensor failure or line break

  - If the fail safe relay is deenergized, the red failure lamp will light
- Yellow
  - Relay control lamp
  - The yellow relay control lamp reacts depending on the set mode (A/B)
  - In general, the relay control lamp indicates the activated (energised) condition of the relay
  - A dark relay control lamp means that the relay is deenergised (transistor blocks)

DIL switch block

Laterally on top (covered when mounted) there is a DIL switch block with six switches. The individual switches are assigned as follows:

- 1 – A/B mode
  - A – Max. detection or overfill protection
  - B – Min. detection or dry run detection
- 2 – Switch off delay (za)
- 3 – Switch on delay (ze)
- 4 – Integration time 2 s
- 5 – Integration time 6 s
- 6 – Integration time 12 s

With switch 1 you can adjust the mode (A – overfill protection or B – dry run protection).

With switch 2 and 3 you can adjust the switch off and/or switch on delay independently.

In the example (see previous illustration), mode A (max. detection of overfill protection) is selected (switch 1). The switch on delay is activated (switch 3) and the integration time is set to 8 seconds (switch 4, 5 and 6).

With switches 4, 5 and 6 you can adjust the integration time. The times of the activated time switches accumulate. If the switch on (ze) and switch off delay (za) are switched on together, the adjusted time applies to both delay modes.

Information:
Keep in mind that the integration time of the sensor and signal conditioning instrument accumulate.

Switch	1	2	3	4	5	6
Time		**za**	**ze**	**2 s**	**6 s**	**12 s**
0.2 s	A/B	off	off	off	off	off
0.5 s	A/B	[1]		off	off	off
2 s	A/B			on	off	off
6 s	A/B			off	on	off
8 s	A/B			on	on	off
12 s	A/B			off	off	on
14 s	A/B			on	off	on
18 s	A/B			off	on	on
20 s	A/B			on	on	on

Fault monitoring

The measuring system is continuously monitored. The following criteria are checked:

- Two-wire cable on line break and shortcircuit
- Interruption of the connection cable to the piezo elements
- Corrosion or damage of the tuning fork (vibrating rod)
- Break of the tuning fork (vibrating rod)
- no vibration
- Too low vibrating frequency
- Medium penetrating from the vessel side into the sensor

Test key

In systems with OPTISWITCH level switches in conjunction with a two-wire oscillator, a function test can be carried out. SU 501 Ex has an integrated test key. The test key is lowered in the front plate of the signal conditioning instrument. Push the test key with a suitable object (e.g. screwdriver, pen etc.).

By pushing the key, the system is checked on the following criteria:

- Switching function of the switching outputs
- Potential separation of the outputs
- The signal processing of the signal conditioning instrument

After pushing the test key, the complete measuring system is checked on correct function. The following operating conditions are simulated during the test:

- Fault signal
- Empty signal

[1] Set alternately switch 2 and/or 3 to "on". The times apply to the adjusted delay mode.

- Full signal

Check if all three switching conditions occur in the correct sequence and the stated duration. If not, there is a fault in the measuring system (see chapter "*Fault rectification*").

Note:
Keep in mind that the connected instruments are activated during the function test. By doing this, you can check the correct function of the measuring system.

Test procedure	**A-mode**	**B-mode**
1 Simulation of a fault signal (approx. 3 s) Level relay deenergised	Relay control lamp off	Relay control lamp off
1 Simulation of a fault signal Failure lamp	Failure lamp lights	Failure lamp lights
2 Simulation an empty signal (approx. 1.5 s) Level relay energised	Relay control lamp lights	Relay control lamp off
2 Simulation of an empty signal Failure lamp	Failure lamp off	Failure lamp off
3 Simulation of a full signal (approx. 1.5 s) Level relay deenergised	Relay control lamp off	Relay control lamp lights
3 Simulation of a full signal Failure lamp	Failure lamp off	Failure lamp off
4 Return to the current operating condition (covered/uncovered)		

7 Maintenance and fault rectification

7.1 Maintenance

When used as directed in normal operation, SU 501 Ex is completely maintenance-free.

7.2 Fault rectification

Causes of malfunction

SU 501 Ex offers maximum reliability. Nevertheless faults can occur during operation. These may be caused by the following, e.g.:

- Measured value of the sensor not correct
- Power supply
- Interference on the cables

Fault rectification

The first measures are checking the input and output signal. The procedure is described as follows. In many cases the causes can be determined and faults can be rectified.

Failure

? The red failure LED of the signal conditioning instrument lights

- Sensor not connected correctly

→ Measure the current value on the signal cable to the sensor

In Ex systems, make sure that the Ex protection is not influenced by the measuring instruments used.

→ Faults on the sensor causing a current change below 2 mA or above 23 mA, cause a fault signal on measuring instruments.

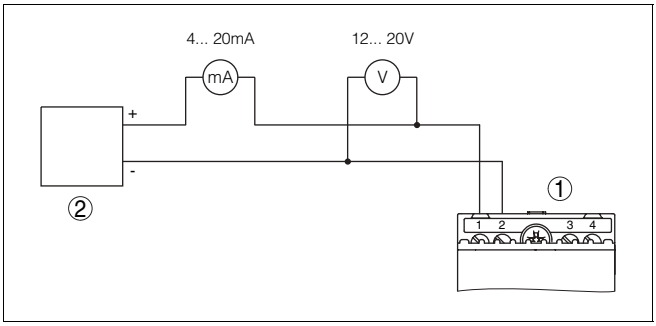

Fig. 8: Connection of a multimeter
1 SU 501 Ex signal conditioning instrument
2 Sensor

- Sensor not connected correctly

→ Measure the voltage on the connection cable

In Ex systems, make sure that the Ex protection is not influenced by the measuring instruments used.

→ The terminal voltage of the sensor is at least 12 V in normal condition

? The red failure LED of the signal conditioning instrument lights

- Current value <2 mA

→ Measure the current value on the signal cable to the sensor

1 Check all connections and connection cables to the sensor

The voltage should be approx. 17 … 20 V

If the value is below 17 V, probably the signal conditioning instrument is defective.

Exchange signal conditioning instrument or return it for repair

2 If the red failure lamp continues to light, separate the sensor from the connection cable and connect a resistor of 1 kOhm instead on the signal conditioning instrument

The signal conditioning instrument is defective if the failure lamp continues to light

Exchange signal conditioning instrument or return it for repair

3 Should the failure lamp extinguish, you can connect the sensor again. Separate the signal conditioning instrument from the connection cable and connect a resistor of 1 kOhm to the sensor input

4 If the failure lamp continues to light, the connection cable is probably interrupted

Check the connection cable to the sensor

5 Should the failure lamp extinguish, the sensor will be defective

Exchange sensor or return it for repair

? The red failure LED of the signal conditioning instrument lights

- Current value >22 mA

→ Measure the current value on the signal cable to the sensor

1 Check all connections and connection cables to the sensor

2 If the red failure lamp continues to light, separate the sensor from the connection cable and connect a resistor of 1 kOhm instead on the signal conditioning instrument

If the failure lamp extinguishes, the sensor is defective. Check the connected sensor

3 If the failure lamp continues to light, connect the sensor again. Separate signal conditioning instrument from the connection cable and connect a resistor of 1 kOhm to the sensor input.

4 If the failure lamp extinguishes, this is probably due to a shortcircuit in the connection cable

Check the connection cable to the sensor

5 If the failure lamp continues to light, the signal conditioning instrument is defective

Exchange signal conditioning instrument or return it for repair

? Malfunction during function test

- After pushing the test key, the switching conditions do not occur in the correct sequence or correct duration, e. g. no full signal is outputted.

→ Measure the line resistance

→ If the cable is highly resistive, bring it to a normal resistance, e.g. check terminals and cable connections on corrosion

7.3 Instrument repair

If a repair is necessary, please proceed as follows:

You can download a return form from our Internet homepage http://www.krohne-mar.com/fileadmin/media-lounge/PDF-Download/Specimen_e.pdf.

By doing this you help us carry out the repair quickly and without having to call back for needed information.

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument.

8 Dismounting

8.1 Dismounting procedure

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

8.2 Disposal

SU 501 Ex consists of materials which can be recycled by specialised recycling companies. We have purposely designed the electronic modules to be easily separable. Mark the instrument as scrap and dispose of it according to government regulations (electronic scrap ordinance, …).

Materials: see "*Technical data*"

If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

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9 Functional safety

9.1 General

Validity

This safety manual applies to the SU 501 Ex signal conditioning instrument. The instrument corresponds to a part system of type A.

Area of application

In combination with a vibrating level switch, the signal conditioning instrument can be used as measuring system for level detection meeting the special requirements of the safety technology, e.g.

- Mode "max." = A-mode for overfill protection
- Mode "min." = B-mode for dry run protection

The measuring system is qualified in both modes to meet the following requirement degree acc. to IEC 61508-2/IEC 61511:

- **SIL2** with architecture 1oo1D (single channel)
- **SIL3** with architecture 1oo2D (double-channel/redundant)

Safety function

The safety function of the signal conditioning instrument is the recognition of the meas. currents stated below and the conversion into a respective switching signal on the relay contact or the transistor output. The safe condition depends on the mode:

- In mode "max.": 16 ±1 mA for condition "covered"
- In mode "min.": 8 ±1 mA for condition "uncovered"

Relevant standards

- IEC 61508-1, -2, -4
  - Functional safety of electrical/electronic/programmable electronic systems
- IEC 61511-1
  - Functional safety – safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and software requirements

Safety requirements

The failure limit values for a safety function, depending on the SIL class (of IEC 61508-1, 7.6.2)

Safety integrity level	Low demand mode	High demand mode
SIL	**PFD_{avg}**	**PFH**
4	$>=10^{-5}$ up to $<10^{-4}$	$>=10^{-9}$ up to $<10^{-8}$
3	**$>=10^{-4}$ up to $<10^{-3}$**	**$>=10^{-8}$ up to $<10^{-7}$**
2	**$>=10^{-3}$ up to $<10^{-2}$**	**$>=10^{-7}$ up to $<10^{-6}$**
1	$>=10^{-2}$ up to $<10^{-1}$	$>=10^{-6}$ up to $<10^{-5}$

Safety integrity of the hardware for safety-relating subsystems of type A (IEC 61508-2, 7.4.3)

Safe failure fraction	Hardware fault tolerance		
SFF	**HFT = 0**	**HFT = 1**	**HFT = 2**
<60 %	SIL1	SIL1	SIL2
60 % up to <90 %	**SIL2**	**SIL3**	(SIL4)
90 % up to <99 %	SIL3	(SIL4)	(SIL4)
>=99 %	SIL3	(SIL4)	(SIL4)

9.2 Planning

General instructions and restrictions

- The measuring system must be used acc. to the application
- The application-specific limits must be maintained and the specifications must not be exceeded.
- Acc. to the specifications in the operating instructions manual, the current load of the output circuits must be within the limits.

Assumptions

For the implementation of FMEDA (Failure Mode, Effects and Diagnostics Analysis) the following assumptions form the basis:

- Failure rates are constant, wear of the mechanical parts is not taken into account
- Failure rates of external power supplies are not included
- Multiple errors are not taken into account
- The average ambient temperature during the operating time is +40°C (104°F)
- The environmental conditions correspond to an average industrial environment
- The lifetime of the components is around 8 to 12 years (IEC 61508-2, 7.4.7.4, remark 3)
- The condition of the output circuit is further processed acc. to the quiescent current principle
- The repair time (exchange of the meas. system) after a fail-safe error is eight hours (MTTR = 8 h)

Low demand mode

If the demand rate is only once a year, then the measuring system can be used as safety-relevant subsystem in "low demand mode" (IEC 61508-4, 3.5.12).

If the ratio of the internal diagnostics test rate of the measuring system to the demand rate exceeds the value 100, the measuring system can be treated in the way it is executing a safety function in the mode with low demand rate (IEC 61508-2, 7.4.3.2.5).

Corresponding characteristics is the value PFD_{avg} (average Probability of dangerous Failure on Demand). It is dependent on the test interval T_{Proof} between the function tests of the protective function.

Numbers see paragraph "Safety-technical characteristics".

High demand mode

If the "low demand mode" does not apply, the measuring system must be used as safety-relevant subsystem in "high demand" (IEC 61508-4, 3.5.12).

The fault tolerance time of the complete system must be higher than the sum of the reaction times or the diagnostics test periods of all components in the safety chain.

Corresponding characteristics is the value PFH (failure rate).

Numbers see paragraph "Safety-technical characteristics".

Safe condition and fault description

The safe condition of the measuring system is the switched off status (quiescent current principle):

- Relay output – relay deenergised
- Transistor output – transistor blocks

A fail-safe failure (safe failure) exists if the measuring system changes to the defined safe condition without demand of the process.

If the signal conditioning instrument detects currents <3.6 mA or >21.6 mA, the signal conditioning instrument takes on the safe condition.

A dangerous undetected failure exists if the measuring system does not go to the defined safe condition when required by the process.

Configuration of the processing unit

The processing unit must evaluate the output circuit of the measuring system by taking the quiescent current principle into account.

The processing unit must correspond to the SIL level of the measuring chain.

9.3 Setup

Mounting and installation

The prevailing plant conditions influence the safety of the measuring system. Therefore note the mounting and installation instructions of the appropriate operating instructions manual. Mainly important is the correct setting of the mode (min./max.).

9.4 Reaction during operation and in case of failure

- The adjustment elements must not be modified during operation.
- In case of modifications during operation, you have to take note of the safety functions.
- Occurring fault signals are described in the appropriate operating instructions manual.
- In case of detected failures or fault signals, the entire measuring system must be switched out of service and the process held in a safe condition by means of other measures.
- The manufacturer must be informed if due to a determined fault, the instrument will be exchanged (incl. a fault description)

9.5 Recurring function test

The recurring function test serves to reveal potential dangerous errors that are otherwise not discernible. The function of the measuring system must be checked at adequate intervals.

The operator is responsible for choosing the type of test and the intervals in the stated time frame. The time frame depends on the PFD_{avg} value acc. to the chart and diagram in section "Safety-related characteristics".

With high demand rate, a recurring function test is not requested in IEC 61508. The function of the measuring system is proven by the frequent use of the system. In double channel architectures it is useful to proof the redundancy by recurring function tests in appropriate intervals.

The test must be carried out in a way that verifies the flawless operation of the safety functions in conjunction with all system components.

The methods and procedures used during the tests must be stated and their suitability must be specified. The tests must be documented.

If the function test proves negative, the entire measuring system must be switched out of service and the process held in a safe condition by means of other measures.

In the double channel architecture 1oo2D this applies separately to both channels.

9.6 Safety-related characteristics

The failure rates of the electronics are determined by an FMEDA acc. to IEC 61508. These calculations are based on component failure rates acc. to SN 29500. All numerical values refer to an average ambient temperature during the operating time of +40°C (104°F). The calculations are also based on the specifications stated in chapter "Planning".

The data are also valid for overfill protection (A-mode) as well as dry run protection (B-mode).

λ_{sd}	0 FIT	safe detected failure (1 FIT = failure/10^9h)
λ_{su}	516 FIT	safe undetected failure
λ_{dd}	0 FIT	dangerous detected failure
λ_{du}	100 FIT	dangerous undetected failure
SFF	>84 %	Safe Failure Fraction

General data

$T_{Reaction}$ Failure reaction time	0.5 sec
MTBF = MTTF + MTTR	$1.52x10^6$ h
max. useful life of the measuring system for the safety function	approx. 10 years

Single channel architecture
The following characteristics are derived from the above mentioned data:

SIL2 (Safety Integrity Level)

HFT = 0 (Hardware Fault Tolerance)

Architecture 1oo1D

PFD_{avg} T_{Proof} = 1 year T_{Proof} = 5 years T_{Proof} = 10 years	 <0.044x10^{-2} <0.218x10^{-2} <0.436x10^{-2}
PFH	<0.1x10^{-6}/h

Double channel architecture

If the measuring instrument is used in a double channel architecture, the safety-relevant characteristics of the selected structure of the measuring chain must be calculated acc. to the above failure rates (especially for the selected application). A Common Cause Factor must be taken into account which is in the worst case 10 %.

The following is applicable:

SIL3 (Safety Integrity Level)

HFT = 1 (Hardware Fault Tolerance)

Time-dependent process of PFD_{avg}

The time-dependent process of PFD_{avg} reacts in the time period up to 10 years virtually linear to the operating time. The above values only apply to the T_{Proof} interval, after which a recurring function test must be carried out.

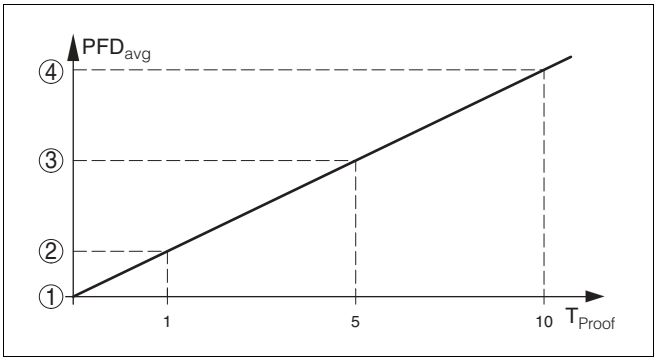

Fig. 9: Time-dependent process of PFD_{avg}[2)]
1 PFD_{avg} = 0
2 PFD_{avg} after 1 year
3 PFD_{avg} after 5 years
4 PFD_{avg} after 10 years

2) Numbers see in the above charts.

10 Supplement

10.1 Technical data

General data

Series	module unit with plug-in socket for mounting on carrier rail 35x7.5 or 35x5 acc. to EN 50022
Dimensions	W = 36 mm (1.42 in), H = 118.5 mm (4.66 in), D = 134 mm (5.28 in)
Weight	approx. 170 g (6 oz)
Housing material	Noryl SE100, Lexan 920A
Socket material	Noryl SE100, Noryl SE1 GFN3
Screw terminals	max. 1x1.5 mm^2

Power supply

Power supply	20 … 250 V AC, 50/60 Hz, 20 … 72 V DC
Power consumption	max. 3 W (3 … 18 VA)

Sensor input

Quantity	1
Data transmission	Analogue
Hysteresis	100 µA
Switching threshold	12 mA
Current limitation	24 mA (permanently short-circuit proof)
Sensor power supply	15 … 18 V DC
Detection line break	<=3.6 mA
Detection shortcircuit	>=21 mA
Connection cable	2-wire
Resistance per conductor	max. 35 Ohm

Relay output

Number, function	1x switching relay (spdt)
Integration time	0.2 … 20 s, directional switching
Mode	A/B switch (A - max. detection or overfill protection; B - min. detection or dry run protection)
Contact	1x spdt
Contact material	AgNi, hard gold-plated
Turn-on voltage	min. 10 mV DC, max. 250 V AC, 250 V DC
Switching current	min. 10 µA DC, max. 3 A AC, 1 A DC
Breaking capacitance	max. 500 VA, max. 54 W DC

Transistor output

Number, function	1 output, synchronously switching with the relay
Galvanic separation	floating
Max. values	
– U_B	max. 36 V DC
– I_B	max. 60 mA (short-circuit proof)
Transistor voltage loss	U_{CE} min. -1.5 V at I_B 60 mA
Blocking current	<10 µA

Adjustment elements

DIL switch block	for preadjustment of the integration time and mode
Test key	for function test
Control lamps in the front plate	
– status indication operating voltage	LED green
– Status indication fault signal	LED red
– Status indication switching point control	LED yellow

Ambient conditions

Ambient temperature	-20 … +60°C (-4 … +140°F), with an operating voltage of 60 … 72 V DC the permissible ambient temperature reduces linear from +60°C (+140°F) to +40°C (+104°F)
Storage and transport temperature	-40 … +70°C (-40 … +158°F)

Electrical protective measures

Protection	
– Signal conditioning instrument	IP 30
– Socket	IP 20
Overvoltage category	II
Protection class	II
Electrical separating measures	reliable separation (VDE 0106, part 1) between power supply, meas. data input, level relay and transistor output

Approvals[3)]

ATEX	ATEX II (1) GD [EEx ia] IIC
Others	WHG

[3)] Deviating data with Ex applications: see separate safety instructions.

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10.2 Dimensions

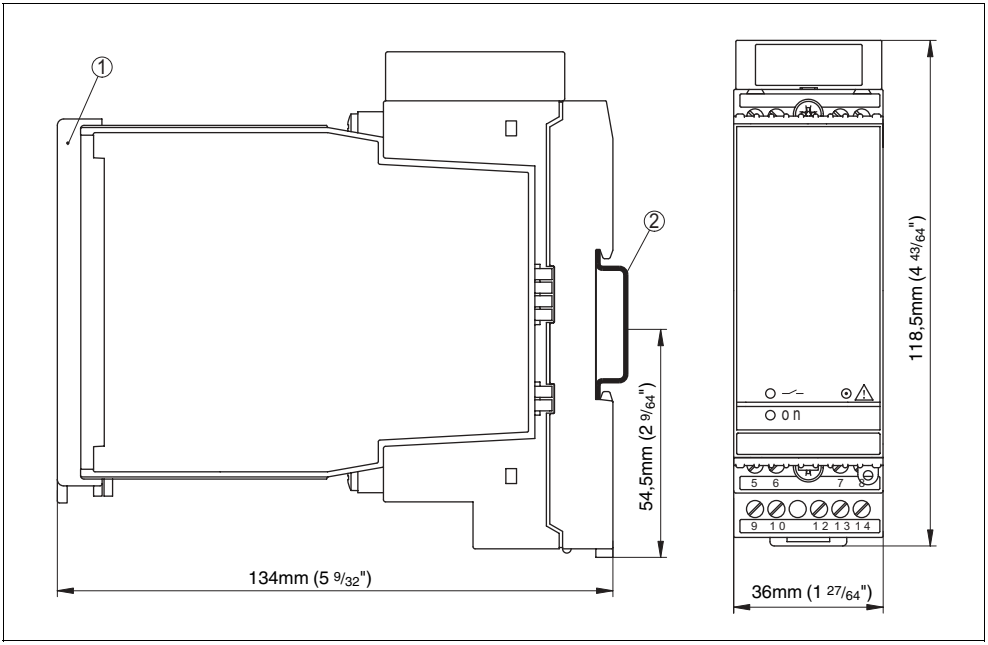

Fig. 10: Dimensions SU 501 Ex
1 Transparent cover
2 Carrier rail 35x7.5 or 35x15 acc. to EN 50022

10.3 Certificate

CE declaration of conformity

CE

Konformitätserklärung

Declaration of conformity
Déclaration de conformité

KROHNE

Krohne S.A.S.
Les Ors
F-26160 Romans Cedex

erklärt in alleiniger Verantwortung, daß das Produkt / declare under our sole responsibility that our product / déclare sous sa seule responsabilité que le produit

SU 501 (Ex)

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt / to which this declaration relates is in conformity with the following standards / auquel se réfère cette déclaration est conforme aux normes

Emission / Emission / Emission → EN 50 081 –1 : 1992
Immission / Susceptibility / Immission → EN 50 082 –2 : 1995
EN 61010 – 1 : 1993

gemäß den Bestimmungen der Richtlinien / following the provision of Directives / conformément aux dispositions des Directives

73/23 EWG
89/336 EWG

03.06.2005

i.V./p.p./P.O. Florian Stengele

Fig. 11: CE declaration of conformity

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Subject to change without notice