

# Functional Safety

SMART Transmitter Power  
Supply  
HiC2027\*\*,  
KCD2-STC-(Ex)1.20.\*\*

Manual

# SIL

IEC 61508/61511



*SIL2*  
/  
*SIL3*



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# 1 Introduction

## 1.1 Content of this Document

This document contains information for usage of the device in functional safety-related applications. You need this information to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



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**Note**

This document does not substitute the instruction manual.

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**Note**

For full information on the product, refer to the instruction manual and further documentation on the Internet at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

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The documentation consists of the following parts:

- Present document
- Instruction manual
- Manual
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- FMEDA report
- Assessment report
- Additional documents

For more information about Pepperl+Fuchs products with functional safety, see [www.pepperl-fuchs.com/sil](http://www.pepperl-fuchs.com/sil).

## 1.2 Safety Information

### Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismantling of the product. The personnel must have read and understood the instruction manual and the further documentation.

### Intended Use

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

The device is developed, manufactured and tested according to the relevant safety standards.

Use the device only

- for the application described
- with specified environmental conditions
- with devices that are suitable for this safety application

### Improper Use

Protection of the personnel and the plant is not ensured if the device is not used according to its intended use.

## 1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

### Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



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#### **Danger!**

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

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#### **Warning!**

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

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#### **Caution!**

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

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### Informative Symbols



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#### **Note**

This symbol brings important information to your attention.

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#### **Action**

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

## 2 Product Description

### 2.1 Function

#### General

The device supplies 2-wire transmitters in the hazardous area, and can also be used with current sources.

It transfers the analog input signal to the safe area as two isolated output signals.

Bi-directional communication is supported for SMART transmitters that use current modulation and voltage modulation for the information transfer.

The output is selected as a current source, current sink, or voltage source via switches.

#### HiC2027\*\*

This isolated barrier is used for intrinsic safety applications.

This device mounts on a HiC termination board.

#### KCD2-STC-1.2O

This signal conditioner provides the galvanic isolation between field circuits and control circuits.

Test sockets for the connection of HART communicators are integrated into the terminals of the device.

The device is mounted on a 35 mm DIN mounting rail according to EN 60715.

#### KCD2-STC-Ex1.2O.\*\*

This isolated barrier is used for intrinsic safety applications.

Test sockets for the connection of HART communicators are integrated into the terminals of the device.

The device is mounted on a 35 mm DIN mounting rail according to EN 60715.

### 2.2 Interfaces

The device has the following interfaces.

- Safety relevant interfaces: input I, output I, output II
- Non-safety relevant interfaces: none  
The HART communication is not relevant for functional safety.

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#### Note

For corresponding connections see datasheet.

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## 2.3 Marking

|  |             |
|--|-------------|
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| Internet: <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> |             |
| HiC2027, HiC2027DE,<br>KCD2-STC-1.2O, KCD2-STC-Ex1.2O, KCD2-STC-Ex1.2O.DE  | Up to SIL 2 |
| HiC2027ES, KCD2-STC-Ex1.2O.ES  | Up to SIL 3 |

## 2.4 Standards and Directives for Functional Safety

### Device specific standards and directives

|                   |  |
|-------------------|--|
| Functional safety | IEC/EN 61508, part 1 – 7, edition 2010:<br>Functional safety of electrical/electronic/programmable<br>electronic safety-related systems (manufacturer) |
|-------------------|--|

### System-specific standards and directives

|                   |  |
|-------------------|--|
| Functional safety | IEC 61511-1:2016+COR1:2016+A1:2017<br>EN 61511-1:2017+A1:2017<br>Functional safety – Safety instrumented systems<br>for the process industry sector (user) |
|-------------------|--|

## 3 Planning

### 3.1 System Structure

#### 3.1.1 Low Demand Mode of Operation

If there are two control loops, one for the standard operation and another one for the functional safety, then usually the demand rate for the safety loop is assumed to be less than once per year.

The relevant safety parameters to be verified are:

- the  $PFD_{avg}$  value (average **P**robability of dangerous **F**ailure on **D**emand) and the  $T_1$  value (proof test interval that has a direct impact on the  $PFD_{avg}$  value)
- the SFF value (**S**afe **F**ailure **F**raction)
- the HFT architecture (**H**ardware **F**ault **T**olerance)

#### 3.1.2 High Demand or Continuous Mode of Operation

If there is only one safety loop, which combines the standard operation and safety-related operation, then usually the demand rate for this safety loop is assumed to be higher than once per year.

The relevant safety parameters to be verified are:

- the PFH value (**P**robability of dangerous **F**ailure per **H**our)
- Fault reaction time of the safety system
- the SFF value (**S**afe **F**ailure **F**raction)
- the HFT architecture (**H**ardware **F**ault **T**olerance)

#### 3.1.3 Safe Failure Fraction

The safe failure fraction describes the ratio of all safe failures and dangerous detected failures to the total failure rate.

$$SFF = (\lambda_s + \lambda_{dd}) / (\lambda_s + \lambda_{dd} + \lambda_{du})$$

A safe failure fraction as defined in IEC/EN 61508 is only relevant for elements or (sub)systems in a complete safety loop. The device under consideration is always part of a safety loop but is not regarded as a complete element or subsystem.

For calculating the SIL of a safety loop it is necessary to evaluate the safe failure fraction of the elements and subsystems, but not of a single device.

Nevertheless the SFF of the device is given in this document for reference.

## 3.2 Assumptions

The following assumptions have been made during the FMEDA:

- Failure rate based on the Siemens standard SN 29500.
- Failure rates are constant, wear is not considered.
- External power supply failure rates are not included.
- The safety-related device is considered to be of type **A** device with a hardware fault tolerance of **0**.
- The device will be used under average industrial ambient conditions comparable to the classification "stationary mounted" according to MIL-HDBK-217F.  
Alternatively, operating stress conditions typical of an industrial field environment similar to IEC/EN 60654-1 Class C with an average temperature over a long period of time of 40 °C may be assumed. For a higher average temperature of 60 °C, the failure rates must be multiplied by a factor of 2.5 based on experience. A similar factor must be used if frequent temperature fluctuations are expected.
- Any safe failures that occur (e. g. output in safe state) will be corrected within 24 hours (e. g. remove sensor fault).
- While the device is being repaired, measures must be taken to maintain the safety function (e. g. substitution by a replacement device).
- If you using the HART function, observe that the HART signal superimposes an analog signal on the signal line. This is negligible for slow acquisition system (typically < 25 acquisition/s). If in doubt, use HART filters at the analog input of the receiving device.
- The application program in the programmable logic controller (PLC) is configured to detect underrange and overrange failures.

### SIL 2 application

- To build a SIL safety loop for the defined SIL, it is assumed as an example that this device uses 10 % of the available budget for  $PFD_{avg}/PFH$ .
- For a SIL 2 application operating in low demand mode the total  $PFD_{avg}$  value of the SIF (**S**afety **I**nstrumented **F**unction) should be smaller than  $10^{-2}$ , hence the maximum allowable  $PFD_{avg}$  value would then be  $10^{-3}$ .
- For a SIL 2 application operating in high demand mode the total PFH value of the SIF should be smaller than  $10^{-6}$  per hour, hence the maximum allowable PFH value would then be  $10^{-7}$  per hour.
- Since the safety loop has a hardware fault tolerance of **0** and it is a type **A** device, the SFF must be > 60 % according to table 2 of IEC/EN 61508-2 for a SIL 2 (sub) system.

### SIL 3 application

- To build a SIL safety loop for the defined SIL, it is assumed as an example that this device uses 10 % of the available budget for  $PFD_{avg}/PFH$ .
- For a SIL 3 application operating in low demand mode the total  $PFD_{avg}$  value of the SIF (**S**afety **I**nstrumented **F**unction) should be smaller than  $10^{-3}$ , hence the maximum allowable  $PFD_{avg}$  value would then be  $10^{-4}$ .
- For a SIL 3 application operating in high demand mode the total PFH value of the SIF should be smaller than  $10^{-7}$  per hour, hence the maximum allowable PFH value would then be  $10^{-8}$  per hour.
- Since the safety loop has a hardware fault tolerance of **0** and it is a type **A** device, the SFF must be > 90 % according to table 2 of IEC/EN 61508-2 for a SIL 3 (sub) system.

### 3.3 Safety Function and Safe State

#### Safe State

The safe state depends on the limit value in the respective application.

#### Safety Function

The device transfers analog signals from the input to the output with a deviation of less than 2 %.

Values below 4 mA or above 20 mA (below 1 V or above 5 V) indicate a fault in the periphery or within the device and a dangerous detected failure.



#### Note

All operating modes that can be set on the device are permitted in the safety function.

| Operating mode of the output | Input signals   | Output signals  |
|------------------------------|-----------------|-----------------|
| Current sink, current source | 0/4 mA to 20 mA | 0/4 mA to 20 mA |
| Voltage source               | 0/4 mA to 20 mA | 0/1 V to 5 V    |

Table 3.1

The outputs of the device must be configured by DIP switches. All valid configurations are allowed for use within safety functions.

#### KCD2-STC-(Ex)1.20.\*\* devices

| Operating mode        | Switch S1 | Switch S2 |
|-----------------------|-----------|-----------|
| Current source output | I         | II        |
| Current sink output   | II        | II        |
| Voltage source output | I         | I         |
| Not valid             | II        | I         |

Table 3.2 Switch settings output I

| Operating mode        | Switch S3 | Switch S4 |
|-----------------------|-----------|-----------|
| Current source output | II        | I         |
| Current sink output   | II        | II        |
| Voltage source output | I         | I         |
| Not valid             | I         | II        |

Table 3.3 Switch settings output II

**HiC2027(ES) devices**

| Operating mode        | Switch S1 | Switch S2 |
|-----------------------|-----------|-----------|
| Current source output | I         | I         |
| Current sink output   | I         | II        |
| Voltage source output | II        | I         |
| Not valid             | II        | II        |

Table 3.4 Switch settings output I

| Operating mode        | Switch S3 | Switch S4 |
|-----------------------|-----------|-----------|
| Current source output | I         | I         |
| Current sink output   | I         | II        |
| Voltage source output | II        | I         |
| Not valid             | II        | II        |

Table 3.5 Switch settings output II

**HiC2027DE device**

| Operating mode        | Switch S3 | Switch S4 |
|-----------------------|-----------|-----------|
| Current source output | I         | I         |
| Current sink output   | I         | II        |
| Voltage source output | II        | I         |
| Not valid             | II        | II        |

Table 3.6 Switch settings output I

| Operating mode        | Switch S5 | Switch S6 |
|-----------------------|-----------|-----------|
| Current source output | I         | I         |
| Current sink output   | I         | II        |
| Voltage source output | II        | I         |
| Not valid             | II        | II        |

Table 3.7 Switch settings output II

**Reaction Time**

The reaction time for all safety functions is < 50 ms.

**Note**

See corresponding datasheets for further information.

### 3.4 Characteristic Safety Values

#### SIL 2 Versions: HiC2027(DE), KCD2-STC-(Ex)1.20(.DE)

| Parameters acc. to IEC 61508           | Characteristic values               |
|--|-------------------------------------|
| Assessment type and documentation      | Full assessment                     |
| Device type                            | A                                   |
| Operating mode                         | Low Demand Mode or High Demand Mode |
| HFT                                    | 0                                   |
| SIL                                    | 2                                   |
| SC                                     | 3                                   |
| Safety function                        | Transfer of analog signals          |
| $\lambda_s^1$                          | 0 FIT                               |
| $\lambda_{dd}$                         | 222 FIT                             |
| $\lambda_{du}$                         | 55 FIT                              |
| $\lambda_{annunciation}$               | 0 FIT                               |
| $\lambda_{total}$ (safety function)    | 277 FIT                             |
| $\lambda_{total}$ (one channel)        | 920 FIT                             |
| SFF <sup>1</sup>                       | 80 %                                |
| PTC                                    | 100 %                               |
| MTBF <sup>2</sup>                      | 124 years                           |
| PFH                                    | $5.49 \times 10^{-8}$ 1/h           |
| PFD <sub>avg</sub> for $T_1 = 1$ year  | $2.40 \times 10^{-4}$               |
| PFD <sub>avg</sub> for $T_1 = 2$ years | $4.81 \times 10^{-4}$               |
| PFD <sub>avg</sub> for $T_1 = 5$ years | $1.20 \times 10^{-3}$               |
| Reaction time                          | < 50 ms                             |

Table 3.8

<sup>1</sup> "No effect failures" and "Annunciation failures" are not influencing the safety function and are therefore not included in SFF and in the failure rates of the safety function.

<sup>2</sup> acc. to SN29500. This value includes failures which are not part of the safety function/MTTR = 24 h. The value is valid for one channel only.

## SIL 3 Versions: HiC2027ES, KCD2-STC-Ex1.20.ES

| Parameters acc. to IEC 61508           | Characteristic values               |                           |
|--|-------------------------------------|---------------------------|
| Assessment type and documentation      | Full assessment                     |                           |
| Device type                            | A                                   |                           |
| Operating mode                         | Low Demand Mode or High Demand Mode |                           |
| HFT                                    | 0                                   |                           |
| SIL                                    | 3                                   |                           |
| SC                                     | 3                                   |                           |
| Safety function                        | Transfer of analog signals          |                           |
| Input and output function              | Channel 1                           | Channel 2                 |
| $\lambda_s^1$                          | 0 FIT                               | 0 FIT                     |
| $\lambda_{dd}$                         | 229 FIT                             | 243 FIT                   |
| $\lambda_{du}$                         | 7.0 FIT                             | 8.4 FIT                   |
| $\lambda_{annunciation}$               | 26.2 FIT                            | 26.2 FIT                  |
| $\lambda_{total}$ (safety function)    | 236 FIT                             | 251 FIT                   |
| $\lambda_{total}$ (one channel)        | 953 FIT                             | 951 FIT                   |
| SFF <sup>1</sup>                       | 97.0 %                              | 96.6 %                    |
| PTC                                    | 100 %                               | 100 %                     |
| MTBF <sup>2</sup>                      | 120 years                           | 120 years                 |
| PFH                                    | $7.00 \times 10^{-9}$ 1/h           | $8.37 \times 10^{-9}$ 1/h |
| PFD <sub>avg</sub> for $T_1 = 1$ year  | $3.06 \times 10^{-5}$               | $3.67 \times 10^{-5}$     |
| PFD <sub>avg</sub> for $T_1 = 2$ years | $6.13 \times 10^{-5}$               | $7.33 \times 10^{-5}$     |
| PFD <sub>avg</sub> for $T_1 = 5$ years | $1.53 \times 10^{-4}$               | $1.83 \times 10^{-4}$     |
| Reaction time                          | < 50 ms                             | < 50 ms                   |

Table 3.9

<sup>1</sup> "No effect failures" and "Annunciation failures" are not influencing the safety function and are therefore not included in SFF and in the failure rates of the safety function.

<sup>2</sup> acc. to SN29500. This value includes failures which are not part of the safety function/MTTR = 24 h. The value is valid for one channel only.

The characteristic safety values like PFD, SFF, HFT and  $T_1$  are taken from the SIL report/FMEDA report. Observe that PFD and  $T_1$  are related to each other.

The function of the devices has to be checked within the proof test interval ( $T_1$ ).

### 3.5 Useful Lifetime

Although a constant failure rate is assumed by the probabilistic estimation this only applies provided that the useful lifetime of components is not exceeded. Beyond this useful lifetime, the result of the probabilistic estimation is meaningless as the probability of failure significantly increases with time. The useful lifetime is highly dependent on the component itself and its operating conditions – temperature in particular. For example, electrolytic capacitors can be very sensitive to the operating temperature.

This assumption of a constant failure rate is based on the bathtub curve, which shows the typical behavior for electronic components.

Therefore it is obvious that failure calculation is only valid for components that have this constant domain and that the validity of the calculation is limited to the useful lifetime of each component.

It is assumed that early failures are detected to a huge percentage during the installation and therefore the assumption of a constant failure rate during the useful lifetime is valid.

However, according to IEC/EN 61508-2, a useful lifetime, based on general experience, should be assumed. Experience has shown that the useful lifetime often lies within a range period of about 8 to 12 years.

As noted in DIN EN 61508-2:2011 note N3, appropriate measures taken by the manufacturer and plant operator can extend the useful lifetime.

Our experience has shown that the useful lifetime of a Pepperl+Fuchs product can be higher if the ambient conditions support a long life time, for example if the ambient temperature is significantly below 60 °C.

Please note that the useful lifetime refers to the (constant) failure rate of the device. The effective life time can be higher.

The estimated useful lifetime is greater than the warranty period prescribed by law or the manufacturer's guarantee period. However, this does not result in an extension of the warranty or guarantee services. Failure to reach the estimated useful lifetime is not a material defect.

## 4 Mounting and Installation



### Mounting and Installing the Device

1. Observe the safety instructions in the instruction manual.
2. Observe the information in the manual.
3. Observe the requirements for the safety loop.
4. Connect the device only to devices that are suitable for this safety application.
5. Check the safety function to ensure the expected output behavior.

### 4.1 Configuration



#### Configuring the Devices with DIP Switches on the Device Side

The device is configured via DIP switches. The DIP switches for setting the safety functions are on the side of the device.

1. De-energize the device before configuring the device.
2. Remove the device.
3. Configure the device for the required safety function via the DIP switches, see chapter 3.3.
4. Secure the DIP switches to prevent unintentional adjustments.
5. Mount the device.
6. Connect the device again.



#### Configuring the Devices with DIP Switches on the Front Side

The device is configured via DIP switches. The DIP switches for setting the safety functions are on the front of the device.

1. De-energize the device before configuring the device.
2. Open the cover.
3. Configure the device for the required safety function via the DIP switches, see chapter 3.3.
4. Close the cover.
5. Secure the DIP switches to prevent unintentional adjustments.
6. Connect the device again.



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**Note**

See corresponding datasheets for further information.

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## 5 Operation



### Danger!

Danger to life from missing safety function

If the safety loop is put out of service, the safety function is no longer guaranteed.

- Do not deactivate the device.
- Do not bypass the safety function.
- Do not repair, modify, or manipulate the device.



### Operating the device

1. Observe the safety instruction in the instruction manual.
2. Observe the information in the manual.
3. Use the device only with devices that are suitable for this safety application.
4. Correct any occurring safe failures within 24 hours. Take measures to maintain the safety function while the device is being repaired.

### 5.1 Proof Test

This section describes a possible proof test procedure. The user is not obliged to use this proposal. The user may consider different concepts with an individual determination of the respective effectiveness, e. g. concepts according to NA106:2018.

According to IEC/EN 61508-2 a recurring proof test shall be undertaken to reveal potential dangerous failures that are not detected otherwise.

Check the function of the subsystem at periodic intervals depending on the applied  $PFD_{avg}$  in accordance with the characteristic safety values. See chapter 3.4.

It is under the responsibility of the plant operator to define the type of proof test and the interval time period.

Equipment required:

- Digital multimeter with an accuracy better than 0.1 %  
Use for the proof test of the intrinsic safety side of the device a special digital multimeter for intrinsically safe circuits.  
If intrinsically safe circuits are operated with non-intrinsically safe circuits, they must no longer be used as intrinsically safe circuits.
- Power supply set to nominal voltage of 24 V DC
- Process calibrator with current source and current sink function with an accuracy better than 20  $\mu$ A



**Proof Test Procedure**

1. Put out of service the entire safety loop. Protect the application by means of other measures.
2. Prepare a test set-up, see figures below.
3. Test the devices. Verify the current values as given in table below.
4. Set back the device to the original settings for the application after the test.

| Step No. | Input value (mA) | Configuration                    |                    |
|----------|------------------|----------------------------------|--------------------|
|          |                  | Current source/current sink (mA) | Voltage source (V) |
| 1        | 20.0             | 20.0 ± 0.4                       | 5.0 ± 0.1          |
| 2        | 12.0             | 12.0 ± 0.4                       | 3.0 ± 0.1          |
| 3        | 4.0              | 4.0 ± 0.4                        | 1.0 ± 0.1          |
| 4        | 23.0             | 23.0 ± 0.4                       | 5.75 ± 0.1         |
| 5        | 0                | < 0.2                            | < 0.1              |

Table 5.1 Steps to be performed for the proof test

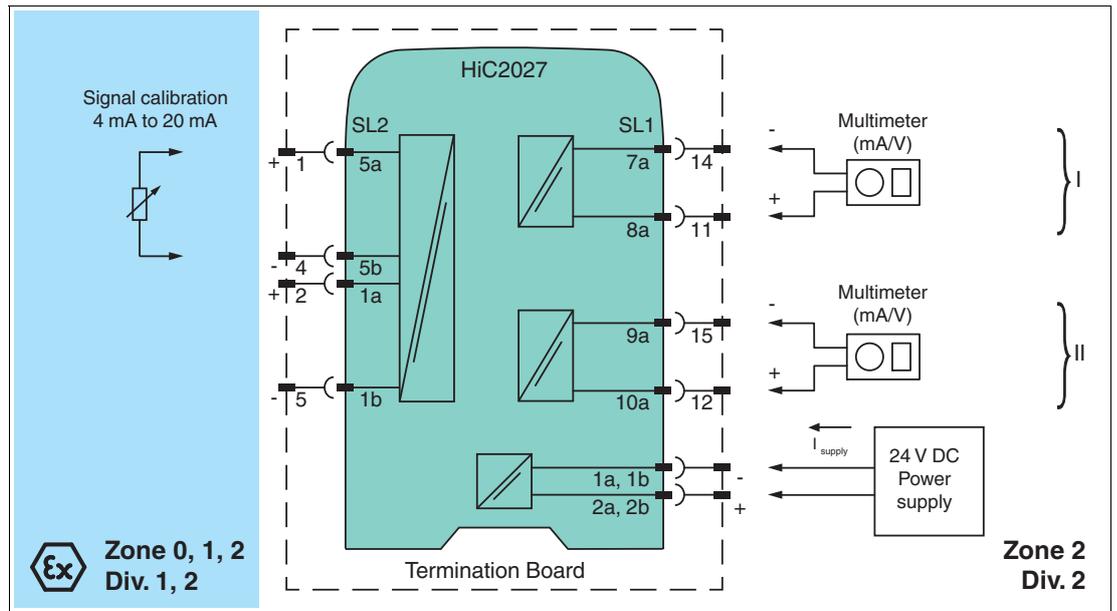


Figure 5.1 Proof test set-up for HiC2027\*\*



**Tip**

The easiest way to test HiC devices is by using a stand-alone HiCTB\*\*-SCT-\*\*\*-\*\*-\*\*\* termination board. In this test, it is not necessary to disconnect the wiring of the existing application. Faults in a subsequent wiring can be avoided.

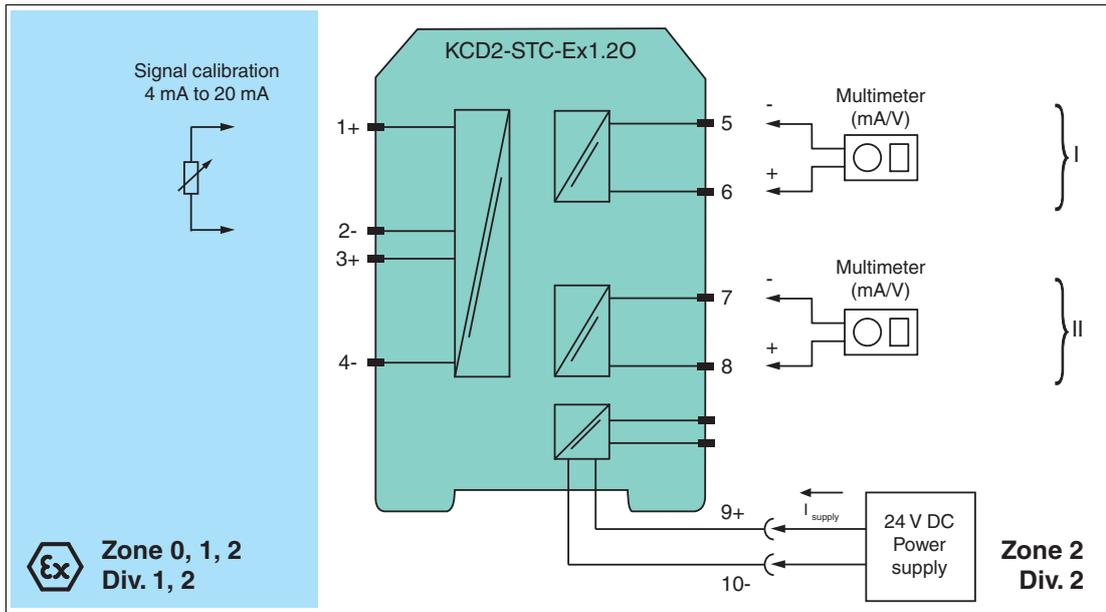


Figure 5.2 Proof test set-up for KCD2-STC-(Ex)1.2O.\*\*

Usage in Zone 0, 1, 2/Div. 1, 2 only for KCD2-STC-Ex1.2O, KCD2-STC-Ex1.2O.DE, KCD2-STC-Ex1.2O.ES

## 6 Maintenance and Repair

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### **Danger!**

Danger to life from missing safety function

Changes to the device or a defect of the device can lead to device malfunction.  
The function of the device and the safety function is no longer guaranteed.

Do not repair, modify, or manipulate the device.

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### **Maintaining, Repairing or Replacing the Device**

In case of maintenance, repair or replacement of the device, proceed as follows:

1. Implement appropriate maintenance procedures for regular maintenance of the safety loop.
2. While the device is maintained, repaired or replaced, the safety function does not work.  
Take appropriate measures to protect personnel and equipment while the safety function is not available.  
Secure the application against accidental restart.
3. Do not repair a defective device. A defective device must only be repaired by the manufacturer.
4. If there is a defect, always replace the device with an original device.

## 7 List of Abbreviations

|  |  |
|--|--|
| <b>ESD</b>                                 | <b>Emergency Shutdown</b>  |
| <b>FIT</b>                                 | <b>Failure In Time</b> in $10^{-9}$ 1/h  |
| <b>FMEDA</b>                               | <b>Failure Mode, Effects, and Diagnostics Analysis</b>   |
| $\lambda_s$                                | Probability of safe failure  |
| $\lambda_{dd}$                             | Probability of dangerous detected failure  |
| $\lambda_{du}$                             | Probability of dangerous undetected failure  |
| $\lambda_{\text{no effect}}$               | Probability of failures of components in the safety loop that have no effect on the safety function. |
| $\lambda_{\text{not part}}$                | Probability of failure of components that are not in the safety loop                                 |
| $\lambda_{\text{total (safety function)}}$ | Probability of failure of components that are in the safety loop                                     |
| <b>HFT</b>                                 | <b>Hardware Fault Tolerance</b>  |
| <b>MTBF</b>                                | <b>Mean Time Between Failures</b>  |
| <b>MTTR</b>                                | <b>Mean Time To Restoration</b>  |
| <b>PCS</b>                                 | <b>Process Control System</b>  |
| <b>PF<sub>avg</sub></b>                    | Average <b>Probability of dangerous Failure on Demand</b>  |
| <b>PFH</b>                                 | Average frequency of dangerous failure per hour  |
| <b>PLC</b>                                 | <b>Programmable Logic Controller</b>   |
| <b>PTC</b>                                 | <b>Proof Test Coverage</b>   |
| <b>SC</b>                                  | <b>Systematic Capability</b>   |
| <b>SFF</b>                                 | <b>Safe Failure Fraction</b>   |
| <b>SIF</b>                                 | <b>Safety Instrumented Function</b>  |
| <b>SIL</b>                                 | <b>Safety Integrity Level</b>  |
| <b>SIS</b>                                 | <b>Safety Instrumented System</b>  |
| <b>T<sub>1</sub></b>                       | Proof Test Interval  |



# Your automation, our passion.

## Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

## Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
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