

### Operating Instructions

English translation

Errors and technical changes reserved

#### Correct Use



REGULATORY  
APPROVAL  
PENDING

The TETHYS IP65 KR is an all-purpose safe coupling relay with three safe relay-contacts. It ensures the quick and safe deactivation of the moving parts of a machine in case of danger.

The Device is water and dust proof according to IP65 and therefore intended for usage outside of control cabinets e.g. directly at the machine.

The TETHYS IP65 KR couples safe signals of e.g. pulsed PLC's to the periphery for galvanic isolation and power adjustment. It can also be used as contact extension for a basic device of the TETHYS family or SR-series.

The TETHYS IP65 KR is specially designed and certified for the use in furnaces and ancillary equipment in continuously mode according to EN 50156-1 and EN 746-2.

- 3 safe, redundant, diverse relay contacts
- 1 auxiliary contact (signaling contact)
- 1 auxiliary semiconductor output (signaling output)
- Coupling of safe signals for galvanic isolation and power adjustment
- Indication of the switching state via LED
- Internal overcurrent and overvoltage protection
- Water and dust proof according to IP65
- Reinforced isolation (6kV, OVC III, EN 60664-1)
- Up to PL e, SIL 3, category 4



#### Function

The safe coupling relay TETHYS IP65 KR is designed for safe isolation of safety circuits according to EN 60204-1 and can be used up to safety category 4, PL e according to EN ISO 13849-1 and SIL 3 according to IEC 61508. The internal logical system closes the safety contacts when the control line is switched on.

If the control line is switched off, the positively driven safety contacts are opened and safely switch the machine off. It is ensured that a single fault does not lead to a loss of the safety function and that every fault is detected by cyclical self-monitoring no later than when the system is switched off and switched on again.

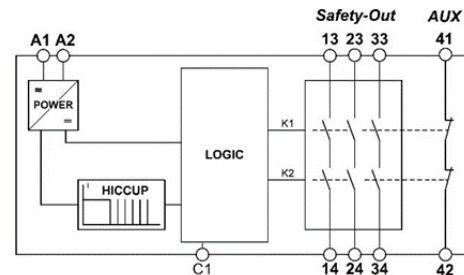


Fig. 1 Block diagram TETHYS IP65 KR

#### Installation

The device can operate outside of control cabinets due to its IP65 degree of protection.

There are two mounting variants, installation via screws or lashing. A maximum of three screws per side ensured maximum durability against induced shocks.

The shock ratings are reached by using two screws per side.

The following should be noted:

- Ensure the mounting variant (screws or lashing) and the mounting surface is strong enough to support the device, including cabling, and inducted loads while machine operation.
- Use at least one screw or strap on each side.
- Ensure sufficient heat dissipation around the device

#### Safety Precautions



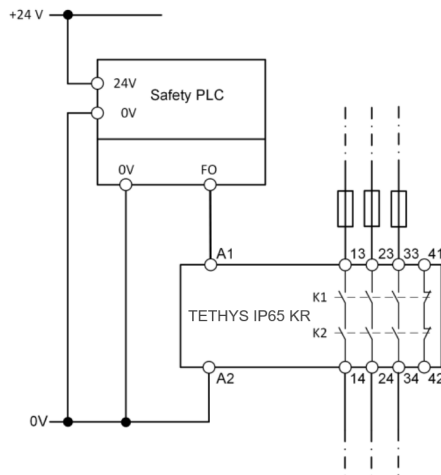
- Installation and commissioning of the device must be performed **only by authorized personnel**.
- Observe the country-specific regulations when installing the device.
- The electrical connection of the device is only allowed to be made with the device isolated.
- The wiring of the device must comply with the instructions in this user information, otherwise there is a risk that the safety function will be lost.
- It is not allowed to open the device, tamper with the device or bypass the safety devices.
- All relevant safety regulations and standards are to be observed.

- The overall concept of the control system in which the device is incorporated must be validated by the user.
- Failure to observe the safety regulations can result in death, serious injury and serious damage.
- Note down the version of the product (see label "Ver. X") and check it prior to every commissioning of a new device. If the version has changed, the overall concept of the control system in which the device is incorporated must be validated again by the user.
- The year of manufacture can be found on the type label on the device. It is located at the end of the line of the voltage specification, below the ID number.

#### Applications

The device has to be wired as shown in Fig. 2 to Fig. 5

#### TETHYS IP65 KR as Coupling Relay for safe PLC Output



**Fig. 2:**

Single channel control with safe PLC output.  
(Category 4, up to PL e / SIL 3, if the safety output meets PL e / SIL 3 and short circuits in line between the safety output and A1 of the TETHYS IP65 KR can be ruled out - see Advice)

**Caution:**

Safety contacts will be activated immediately by switching on the control line.  
Make sure that A2 is the correct reference potential to the switching voltage A1.

**Advice:**

For example EN ISO 13849-2, table D4 - Cables within an electrical installation space in accordance with EN 60204-1.

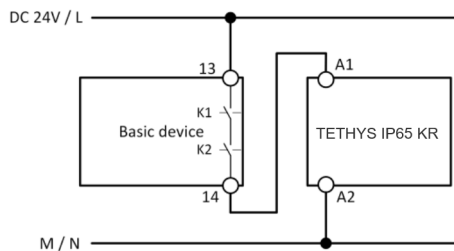
A feedback loop for monitoring the TETHYS IP65 KR is **not** necessary. The TETHYS IP65 KR monitors itself.  
However, if a feedback loop is necessary for the application, this can be achieved by wiring the feedback to the auxiliary contact 41-42. (see Fig.4 or Fig. 5).



**Attention:**

- Make sure that the reference potential of the signal generator and the TETHYS IP65 KR is the same
- It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated

#### TETHYS IP65 KR as Expansion Module - Control with safe relay



**Fig. 3:**

Wiring as contact extension of a basic device (for example from Zander TETHYS Family)  
(Category 4, up to PL e / SIL 3, if the safety output meets PL e / SIL 3 and short circuits in line between the safety output and A1 of the TETHYS IP65 KR can be ruled out - see Advice)

**Caution:**

Safety contacts will be activated immediately by switching on the basic device.

**Advice:**

For example EN ISO 13849-2, table D4 - Cables within an electrical installation space in accordance with EN 60204-1.

A feedback loop for monitoring the TETHYS IP65 KR is **not** necessary. The TETHYS IP65 KR monitors itself.

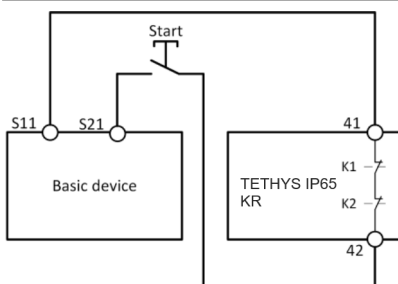
However, if a feedback loop is necessary for the application, this can be achieved by wiring the feedback to the auxiliary contact 41-42 (see Fig.4 or Fig. 5).



**Notice:**

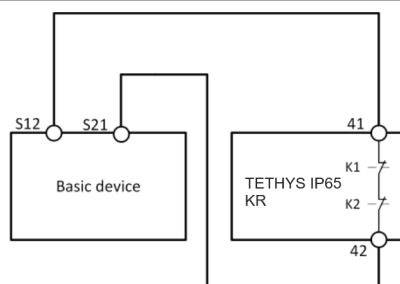
- The earth connection of the power supply unit must be on the secondary side
- It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated
- For the applications according Fig. 8 and 9, make sure that the refer-

#### TETHYS IP65 KR as Expansion Module - Feedback Loop



**Fig. 4:**

Wiring of the feedback loop for using a manual, monitored start.



**Fig. 5:**

Wiring of the feedback loop for using an automatic start.

#### Commissioning Procedure



**Note:** The items listed under "Electrical connection" must be observed during commissioning.

##### 1. Feedback loop:

If a feedback loop is necessary for the application, it has to be wired as shown in Fig.4 or Fig.5.

##### 2. Control line:

Connect the control line to the contact A1 and M/N or 0V to A2. (e.g. Fig. 2).

**Caution:** Power may not be activated yet.

##### 3. Starting the device:

Turning on the TETHYS IP65 KR via A1.

##### Caution:

The safety contacts will close immediately by turning on the control line. All LED are lit.

##### 4. Triggering safety function:

Turning off the TETHYS IP65 KR via A1.

All LED turn off.

##### 5. Reactivation:

Turning on the TETHYS IP65 KR via A1. All LED are lit.

#### Check and Maintenance

No maintenance is required for the device itself.

But the following checks are regularly required to ensure proper and continuous functioning:

- Check the switch function
- Check for signs of manipulation and safety function bypassing
- Check if the device is mounted and connected securely
- Check for soiling

Check if the safety device is working properly, in particular:

- Every time after initial commissioning
- Every time after replacing a component
- After every fault in the safety circuit

Irrespective of this, the safe function of the protective device should be checked at suitable intervals, e.g. as part of the system's maintenance program. Maintenance work on the device itself is not required.

#### What to Do in Case of a Fault?

##### Device does not switch on:

- Check the wiring by comparing it to the wiring diagrams.
- Check the control line at A1.
- If the feedback loop is used, is it closed?
- Check reference potential.

If the fault still exists, perform the steps listed under "Commissioning Procedure".

If these steps do not remedy the fault either, return the device to the manufacturer for examination.

**Opening the device is impermissible and will void the warranty.**

#### Technical Data

Corresponds to the standards	EN 60204-1; EN ISO 13849-1; EN 62061; EN 50156-1; EN 746-2; IEC 61508 Parts 1-2, 4-7; IEC 61511-1
Operating voltage	DC 24 V
Permissible deviation	+10%/-15%
Power consumption	<b>DC 24 V</b> typ. 2.4 W
Control voltage at A1	DC 24 V +10%/-15%
Control current A1	typ. 100 mA
Start logic	Automatic start: static high level on A1
Auxiliary output	1 semiconductor output
Auxiliary output logic	Inverted to safety contacts, active low
Auxiliary output voltage	DC 24 V +10%/-20%
Auxiliary output current	DC 100 mA max
Safety contacts	3 NO contacts
Auxiliary contacts	1 NC contact
Max. switching voltage NO contacts	AC 250 V
Max. switching voltage NC contacts	AC 25 V DC 60V
Safety contact breaking capacity (13-14, 23-24, 33-34) (6 switching cycles/ min)	AC: 250 V, 2000 VA, 8 A for ohmic load 250 V, 3 A for AC-15 DC: 40 V, 320 W, 8A for ohmic load 24 V, 3 A, for DC-13  Max. total current through all 3 contacts: 15 A (13-14, 23-24, 33-34)
Auxiliary contact breaking capacity (41-12)	AC: 250 V, 500 VA, 2 A for ohmic load DC: 40 V, 80 W, 2 A for ohmic load
Minimum contact load	5 V, 10 mA
Contact fuses	10 A gG 6 A gG for applications acc. to EN 50156-1 (See Chapter 10.5.5.3.4)
Contact material	AgSnO <sub>2</sub>
Contact service life	mech. approx. 1 x 10 <sup>7</sup>
Max. line cross section	0.14 - 2.5 mm <sup>2</sup>
Tightening moment X1 ... X5 (Min. / Max.)	0,8 Nm / 1,3 Nm
Typ. switch-on delay / switch-off delay for NO contacts requested via A1	< 50ms / < 30ms
Max. length of control line	1000m with 0.75 mm <sup>2</sup>
Rated insulation voltage	AC 250 V
Degree of contamination	2 (EN 60664-1)
Overvoltage category	3 (EN 60664-1)
Max. altitude	≤ 2000 m (above sea level)
Rated impulse withstand voltage / air- and creepage distance, in between NO contacts	6 kV / 5.5 mm (EN 60664-1)
Rated impulse withstand voltage / air- and creepage distance, between NO contacts and SELV signals	6 kV / 5.5 mm (EN 60664-1)
Rated impulse withstand voltage / air- and creepage distance, between NC contacts and SELV signals	330 V / 0.2 mm (EN 60664-1)
Degree of protection	IP65
Temperature range	-25 °C bis +55 °C
Weight	320 g
Mounting	Fixed screw connection or lashing

#### Electrical Connection

- Consider the information in the section "Technical data"
- A safety transformer according to EN 61558-2-6 or a power supply unit with electrical isolation from the mains must be connected. (SELV)
- External fusing of the safety contacts must be provided
- If the device does not function after commissioning, it must be returned to the manufacturer unopened. Opening the device will void the warranty
- Use adequate protective circuit for inductive loads (e.g. free-wheeling diode)

A1: Control line  
A2: Control line  
13-14: Safety contact 1  
23-24: Safety contact 2  
33-34: Safety contact 3  
41-42: Auxiliary contact  
C1: Auxiliary Output

Fig. 16 Connections

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#### Disclaimer and warranty

If the above mentioned conditions for appropriate use are not complied with or if the safety instructions are not followed or if any maintenance operations are not carried out as required, this shall lead to an exclusion of liability and loss of warranty.

#### ATTENTION!

We would like to point out that it is the full responsibility of the operator to ensure a plant availability. Using the TETHYS IP65 KR, a safe coupling relay according to

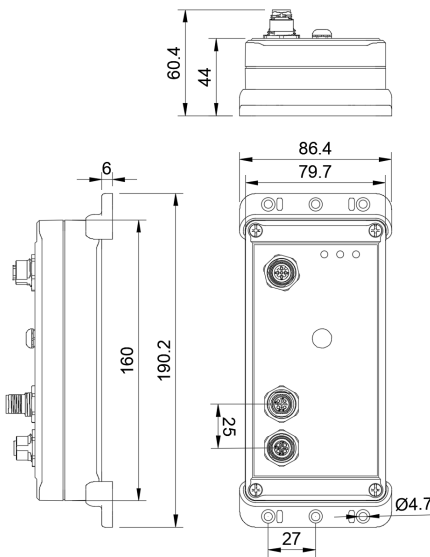
- EN ISO 13849-1
- EN IEC 62061
- IEC 61508
- EN 50156-1
- EN 746-2
- IEC 61511-1

is used, which will be brought into the safe state when the safety function is requested.

This means that the connected load is switched off as soon as a request from connected sensor elements or diagnostic measures detects a dangerous state, e.g. caused by a component fault.

Since process-related applications in particular have high demands on availability, limited availability can also have significant consequences. It is therefore recommended to stock a second unit to avoid long downtimes in such a case. These are recommendations of the manufacturer, the evaluation of the importance of the plant availability is the sole responsibility of the operator.

#### Dimension Drawing



#### Pinout

Standard M12 connector configuration

X1 - Power		
M12 A-coded, 5 Pin, Female		
1	A1	Power supply +
2	41	Auxiliary contact NC +
3	A2	Power supply -
4	42	Auxiliary contact NC -
5	C1	Auxiliary semiconductor output

Pin-out is IO-Link compatible.

X4 - Safety Contacts High-Side		
M12 S-coded, 3+1 Pin, Male		
1	13	Safety Contact 1 + (High-Side)
2	23	Safety Contact 2 + (High-Side)
3	33	Safety Contact 3 + (High-Side)
4	n.c.	not used

X5 - Safety Contacts Low-Side		
M12 S-coded, 3+1 Pin, Female		
1	14	Safety Cotact 1 - (Low-Side)
2	24	Safety Contact 2 - (Low-Side)
3	34	Safety Contact 3 - (Low-Side)
4	n.c.	not used

**Note:** Customer-specific pinout and connector types according to customer requirements are possible. Please contact our team for further information.

#### Variants

Order no. 476110	TETHYS IP65 KR	Standard M12 connector configuration
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#### Safety Characteristics

##### Safety characteristics according to EN ISO 13849-1

Load - DC-13	≤ 0.1 A	≤ 1 A	≤ 2 A
Max. duration of use [Years]	20	20	20
Category	4	4	4
PL	e	e	e
PFHd [1/h]	Pending	Pending	Pending
nop [Cycles / year]	Pending	Pending	Pending

##### Safety characteristics according to IEC 61508 - High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13

Max. duration of use [Years]	20
Proof-Test-Intervall [Years]	20
PFH [1/h]	Pending
SIL	3

##### Safety characteristics for alternate 1oo1 structure for process industry - High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13

Device type	A
HFT	1
SIL	3
SFF [%]	Pending
$\lambda_{SD}$ [FIT]	Pending
$\lambda_{SU}$ [FIT]	Pending
$\lambda_{DD}$ [FIT]	Pending
$\lambda_{DU}$ [FIT]	Pending
PFH [1/h]	Pending

##### Safety characteristics according to IEC 61508 - Low Demand

Conditions: Maximum load AC-15 / DC-13

Max. duration of use [Years]	20
Proof-Test-Intervall [Years]	Pending
PFD <sub>AVG</sub>	Pending
SIL	Pending

##### Safety characteristics for alternate 1oo1 structure for process industry - Low Demand

Conditions: Maximum load AC-15 / DC-13

Device type	Pending
HFT	Pending
SIL	Pending
SFF [%]	Pending
$\lambda_{SD}$ [FIT]	Pending
$\lambda_{SU}$ [FIT]	Pending
$\lambda_{DD}$ [FIT]	Pending
$\lambda_{DU}$ [FIT]	Pending
PFD <sub>avg</sub> (e.g. for T = 1 year)	Pending

*CE  
Declaration*

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