

SIRIUS industrial controls

Safety relays 3TK2810-1 safety-related speed monitor

Equipment Manual

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

1.1 Purpose of this manual

Note**Original Equipment Manual**

The Equipment Manual of the safety-related 3TK2810-1 speed monitor described below is the original Equipment Manual.

This manual contains a detailed description of the 3TK2810-1 safety-related speed monitor and its components. The manual provides you with the information you require for configuring, commissioning and using the 3TK2810-1 safety-related speed monitor. Typical application examples provide you with a clear and practice-oriented introduction.

Furthermore, the manual contains technical specifications of the relay to facilitate configuration.

1.2 Required basic knowledge

A general knowledge of the following areas is needed in order to understand this manual:

- Low-voltage switchgear
- Digital circuit logic
- Automation systems
- Safety systems

1.3 Validity range

The manual is valid for the present 3TK2810-1 safety-related speed monitor. It contains a description of the components valid at the time of publication.

SIEMENS reserves the right of including a Product Information for each new component, and for each component of a later version.

1.4 Siemens Industry Online Support

Information and service

At Siemens Industry Online Support you can obtain up-to-date information from our global support database:

- Product support
- Application examples
- Forum
- mySupport

Link: Siemens Industry Online Support (<https://support.industry.siemens.com/cs/de/en>)

Product support

You can find information and comprehensive know-how covering all aspects of your product here:

- **FAQs**
Answers to frequently asked questions
- **Manuals/operating instructions**
Read online or download, available as PDF or individually configurable.
- **Certificates**
Clearly sorted according to approving authority, type and country.
- **Characteristics**
For support in planning and configuring your system.
- **Product announcements**
The latest information and news concerning our products.
- **Downloads**
Here you will find updates, service packs, HSPs and much more for your product.
- **Application examples**
Function blocks, background and system descriptions, performance statements, demonstration systems, and application examples, clearly explained and represented.
- **Technical data**
Technical product data for support in planning and implementing your project

Link: Product support (<https://support.industry.siemens.com/cs/ww/en/ps>)

mySupport

The following functions are available in your personal work area "mySupport":

- **Support Request**
Search for request number, product or subject
- **My filters**
With filters, you limit the content of the online support to different focal points.

- **My favorites**
With favorites you bookmark articles and products that you need frequently.
- **My notifications**
Your personal mailbox for exchanging information and managing your contacts. You can compile your own individual newsletter in the "Notifications" section.
- **My products**
With product lists you can virtually map your control cabinet, your system or your entire automation project.
- **My documentation**
Configure your individual documentation from different manuals.
- **CAX data**
Easy access to CAX data, e.g. 3D models, 2D dimension drawings, EPLAN macros, device circuit diagrams
- **My IBase registrations**
Register your Siemens products, systems and software.

1.5 Siemens Industry Online Support app

Siemens Industry Online Support app

The Siemens Industry Online Support app provides you access to all the device-specific information available on the Siemens Industry Online Support portal for a particular article number, such as operating instructions, manuals, data sheets, FAQs etc.

The Siemens Industry Online Support app is available for Android and iOS:



Android



iOS

1.6 User responsibility for system design and function

The products described here were developed to perform safety-related functions as part of an overall installation or machine. A complete, safety-related system is generally equipped with sensors, evaluation units, and signaling units, and uses reliable shutdown concepts. It is the responsibility of the manufacturer of a system or machine to ensure that the product functions properly.

Siemens AG, its regional offices, and associated companies (hereinafter referred to as "Siemens") cannot guarantee all the properties of an entire plant, system or machine that has not been designed by Siemens.

Nor can Siemens assume liability for recommendations that appear or are implied in the following description. No new guarantee, warranty, or liability claims beyond the scope of the Siemens general terms of supply are to be derived or inferred from the following description.

1.7 Recycling and disposal

For environmentally-friendly recycling and disposal of your old device, contact a company certified for the disposal of used electrical and electronic equipment, and dispose of the device as specified in the regulations for your particular country.

Safety instructions

2.1 General safety notes

Note

SIL 3 according to IEC 62061

PL e / Cat. 4 according to ISO 13849-1

The 3TK2810-1 safety relays are designed so that applications up to SIL 3 according to IEC 62061 / PL e according to ISO 13849-1 can be implemented.

WARNING

Hazardous Voltage.

Can Cause Death, Serious Injury, or Property Damage.

Hazardous electrical voltage can cause electric shock, burns and damage to property.

- Before starting work, disconnect the system and the device from the power supply.

WARNING

Loss of the safety functions due to missing function test.

Can Cause Death, Serious Injury, or Property Damage.

In accordance with RFU CNB/M/11.050, when using actuators such as 3SK1 output expansions, contactors or relays in continuous operation in factory automation applications, a function test interval (shutdown test) ≤ 1 year for SIL 2 according to IEC 62061 or PL d with Cat. 3 according to ISO 13849 is required. ≤ 1 month for SIL 3 according to IEC 62061 or PL e with Cat. 3 or Cat. 4 according to ISO 13849 applies. Only then do the safety characteristic values apply.

Exception: A function test interval ≤ 1 year is also permissible for SIL3 applications in the process industry (in accordance with IEC 61511), exclusively for low-demand use, due to a significantly lower failure rate probability of the electromechanical components. This does not apply to safety-related applications in accordance with the Machinery Directive 2006/42/EC.

Function test procedure for actuators with contacts:

- Actuate the connected sensors.
- Check their effect on the safety relay and the downstream actuators*.
- Activate the safety relay via the connected sensors.
- Check their effect on the safety relay and the downstream actuators*.
- Defective devices must be replaced.

*Since the read-back time of the delayable output functions is retriggerable, the actuation duration for switching on and off for the regular function test must be longer than the time set in the "Switching time" parameter. Only in this way can it be ensured that the expected switching status has also been set on the connected actuator.

 WARNING

Risk due to conductive contamination.

Can Cause Death, Serious Injury, or Property Damage.

The devices must be protected against conductive contamination, taking the ambient conditions into account. One way to achieve this is to install the devices in a control cabinet with the appropriate degree of protection.

You can find more information in the IEC 60529 standard "*Degrees of protection provided by enclosures (IP code)*".

2.2 Product-specific information

Safety instructions

NOTICE**Observe the ESD guidelines**

When handling and installing the devices, observe the ESD guidelines.
Connection is only permitted when the power adapters have been deactivated.

ESD guidelines

ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

NOTICE**Damage to the speed monitor from electrostatic charging!**

The speed monitor contains electrostatically sensitive devices. These modules will be destroyed or damaged by improper handling.

- You must discharge your body electrostatically immediately before touching an electronic component. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe.
- Always hold the component by the plastic enclosure.
- Electronic modules should not be brought into contact with electrically insulating materials such as plastic film, plastic parts, insulating table supports or clothing made of synthetic fibers.
- Always place electrostatic sensitive devices on conductive bases.
- Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metallized plastic or metal containers. Leave the component in its packaging until installation.

Note

In the case of capacitive or inductive load at the output contacts, sufficient suppressor circuits must be provided to protect against contact overload. A fuse must also be connected in series to protect against welding of the safety contacts (see Chapter "Technical data (Page 85)").

Note

Routing of the sensor cables

If electromagnetic interferences are to be expected, all initiator/encoder cables must be shielded when laid. The shielding must be connected to PE at both ends.

Dormant error detection

Note

In case of longer standstill times ($t \geq 24$ h), a start-up test (function test of the application) is absolutely necessary before restarting the system.

Exception:

Such a startup test is not necessary when using NAMUR sensors.

Note

Change of diagnosis time to 30 s for devices with product version E04

When using two-channel initiators and encoders, the diagnosis time for signal discrepancy [1] is 30 s. This means that errors on initiators and encoders are only detected after this time and the device reacts accordingly. If the time from the start of a motion to the next standstill is shorter than the diagnosis time, the failure of a single channel (signal discrepancy) is not detected during this time.

For applications whose motion time is always less than the diagnosis time, it must be checked at least every 24 hours whether the signals of the initiators and encoders are properly present on both channels. The check is performed based on the rated speeds on the device display. This behavior applies to devices with product version E04. For devices with product version E03 or lower, the diagnosis time is 5 s.

[1] Signal discrepancy means that an initiator or encoder on a channel provides no signals, or an encoder provides different frequencies between track A, /A and track B, /B.

Note

Diagnosis time settable in the range between 1 s and 250 s as of product version E05

For devices with product version E05 or higher, the diagnosis time can be set in the range between 1 s and 250 s. This means that the time response can be adapted to the application accordingly. In principle, the diagnosis time should be as short as possible. In addition, it must be ensured that the diagnosis time is shorter than the motion time (starting a motion until the next standstill), otherwise it must be checked at least every 24 hours whether the signals of the initiators and encoders are properly present on both channels. The check is performed based on the rated speeds on the device display.

Connection of the initiators

Note

If common sensor potentials are directly connected to the initiators and a common return wire is connected to the 3TK2810-1 device, the first error that occurs will result in a loss of the safety function. Thus the maximum achievable SIL = 1 and the PL = c.

A series connection of proximity switches is not permitted.

Encoder

NOTICE

Use of encoders

In order to achieve the highest possible SIL/PL when using encoders, 2-channel encoders (4 tracks: A, A/, B, B/) with defined failure behavior (high-impedance outputs that have $R_a \geq 50$ kOhm as high-impedance outputs in the event of a fault) must be used.

If such information cannot be found on the encoder manufacturer's data sheet, the response in case of encoder failure must be requested from the manufacturer.

No specific safety encoders have to be used on the 3TK2810-1 safety-related speed monitor. If an encoder is used, the encoder's **FIT** (Failure in Time) value must be incorporated into the calculation of the safety chain.

Encoders that are operated on a 3TK2810-1 safety-related speed monitor must have the following properties:

- TTL/HTL encoders that provide two signal tracks with the respectively inverted signals.
- All sin/cos encoders that supply both the sine and the cosine tracks with the respectively inverted signals (sin, /sin and cos, /cos).
- The phase offset of the two signals A (or sin) and B (or cos) must be 90 °, between A and /A or B and /B it must be 180 ° in each case.
- The encoder's signals must have a high resistance in the event of failure.

The 3TK2810-1 speed monitor detects a disrupting offset of the signal track or mutual overtaking of the signals in the case of sin/cos encoders. Detection of the fault is independent of the set frequency. The 3TK2810-1 safety-related speed monitor assumes the safe state and issues a fault message.

It is the responsibility of the user to check whether a specific encoder and its pin assignments match the 3TK2810-1 safety-related speed monitor.

Actuator wiring up to PL e / Cat. 4 according to ISO 13849-1, or SIL 3 according to IEC 62061

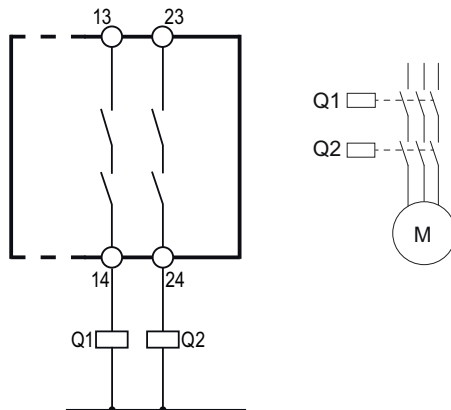


Figure 2-1 Dual-channel actuator wiring via two terminals

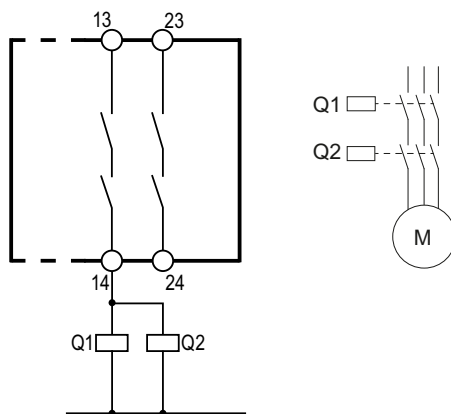


Figure 2-2 Dual-channel actuator wiring via one terminal

Note

To achieve SIL 2/3 according to IEC 62061 or PL d/e according to ISO 13849-1, a fault exclusion such as a short-circuit to a power cable or ground is required. This can, for example, be implemented within a control cabinet or by installing the connection cables in such a way that they are protected. If this is not possible, the actuators must be wired via two safety-related outputs, see image "Dual-channel actuator wiring via **two** terminals". For this purpose, separate cables must be laid to actuators / contactors.

See also

Application (Page 29)

Basic versions (Page 30)

Configuring (Page 64)

2.3 Intended use

WARNING

Intended use

Can Cause Death, Serious Injury, or Property Damage.

The devices may only be used for the applications described in the catalog and the technical description (see Chapter "Application (Page 29)"), and only in conjunction with equipment or components from other manufacturers which have been approved or recommended by Siemens. You must also ensure that suitable and reliable encoders are used (see Chapter "Basic versions (Page 30)" and "Configuring (Page 64)").

This product can function correctly and reliably only if it is transported, stored, assembled and mounted correctly, and operated and maintained as recommended.

Before you run any sample programs or programs you have written yourself, make sure that running the plant cannot cause injury to anyone else or damage to the machine itself.

EU notice: Commissioning is absolutely prohibited until it has been ensured that the machine in which the component described here is to be installed complies with the stipulations of the Directive 2006/42/EC.

WARNING

Hazardous condition of the plant.

Can Cause Death, Serious Injury, or Property Damage.

The basis of the safety concept is that a safe state exists for all process variables. With the 3TK2810-1 safety relay, this is the value "0". This applies to sensors and actuators.

WARNING

Loss of the safety functions due to changes to the system.

Can Cause Death, Serious Injury, or Property Damage.

To ensure the safety of the system, any changes to it or any replacement of defective components must be followed by a thorough and successfully completed function test of the system.

2.4 Safety information for hazardous areas

WARNING
Hazardous Voltage. Can Cause Death, Serious Injury, or Property Damage. Installation of the 3TK28 safety relays in hazardous areas The components of the 3TK28 are not suitable for installation in hazardous areas. Please contact your ATEX specialist.

2.5 Current information about operational safety

Important note for maintaining operational safety of your system

**WARNING****Hazardous voltage**

Can cause death, serious injury, or property damage.

Please take note of our latest information

Systems with safety-related characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with special product monitoring measures. For this reason, we publish a special newsletter containing information on product developments and features that are (or could be) relevant to operation of safety-related systems. So that you are always up to date in this respect as well. You can find more information here:

SIEMENS newsletter (<http://www.siemens.com/sirius-newsletter>)

2.6 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that can be implemented, please visit:

<https://www.siemens.com/industrialsecurity>

2.7 Declaration of conformity

The manufacturer declares that the safety components of the SIRIUS 3TK series in the designs marketed by us comply with the applicable basic safety and health requirements of the EC Directives* stated (including amendments) and that the stated standards* were applied in their design and construction.

* You can download the complete EC Declaration of Conformity as a PDF.

2.7 Declaration of conformity

Product description

3.1 Overview

All key product features at a glance

General information:

- TÜV approval / UL approval
 - Acc. to IEC 61800-5-2
 - Suitable for use in applications up to Level (SIL) 3 according to IEC 61508
 - Max. SIL 3 according to IEC 62061
 - Performance Level (PL) e according to ISO 13849-1
- Width 45 mm
- Frequencies from 1 Hz to 400 kHz can be monitored depending on the sensor used.

Sensors:

- 1-channel or 2-channel protective door monitor
- Monitoring of a release magnet (spring-locked tumbler)
- PNP or NPN initiators adjustable
- Connection of different encoders possible (sin/cos, TTL, HTL)
Please note the signal shape in Chapter "Technical data (Page 85)".
- Connection of NAMUR initiators possible (note device versions)

Outputs:

- 2 enabling circuits with positively-driven contacts (2-channel configuration)
- 2 semiconductor signaling outputs

Times:

- Adjustable start override (0 to 999 s)
- Adjustable release delay time (0 to 999 s)
- Adjustable switch-off monitoring (0.5 to 999 s)
- Adjustable discrepancy time (1.0 s to 250.0 s)

Adjustment/diagnostics:

- Device settings via menu-driven display or RJ45 (FCC Western Modular 8P8C) with connecting cable (copy function)
- Selectable modes:
 - Automatic mode: Monitoring of automatic speed window and standstill speed.
 - Setup mode: Monitoring of setup speed window. Standstill permanently enabled.

3.1 Overview

- Autostart/monitored start
- LED displays for status diagnostics
- Display for status diagnostics and device parameterization

Installation conditions:

- The devices must be installed in control cabinets with degree of protection IP54 or higher, taking account of the ambient conditions.

3.2 Application

The device is designed for use on machines and plants whose motions or moving parts can constitute a hazard to personnel or machinery.

The device continuously carries out standstill monitoring (output circuit 13/14) and speed monitoring (output circuit 23/24). For speed monitoring, there is a choice between automatic and setup mode.

With the corresponding circuitry and suitable additional components (such as drives, sensors and tripping elements), the 3TK2810-1 can be used to implement the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), and SSM (Safe Speed Monitor) from the IEC 61800-5-2 standard.

Note

Routing of the sensor cables

If electromagnetic interferences are to be expected, all initiator/encoder cables must be shielded when laid. The shielding must be connected to PE at both ends.

3.3 Basic versions

3TK2810-1 speed monitor

The speed monitor is the main component of safety-related speed monitoring and is necessary in every application. The terminals and the RJ45 interface are used for the outputs, and for supplying the device with power and signals. The device is parameterized using the keys and the display. The LEDs and the display show operating statuses, error messages and diagnostics data.

The device can be configured using the display and the keys on the front panel or via the RJ45 connection and appropriate connecting cable (see section "Accessories (Page 36)") using the copy function.

The speed can be detected by the following measuring sensors:

- Two NPN or PNP proximity switches connected to inputs E1 and E2. The proximity switches are supplied with 24 V DC from the speed monitor, via terminals U and GND. For device variants with NAMUR sensors, these are connected to terminals U1 and U2. The supply of 8.2 V DC is provided via terminals U1 and U2.
- Encoders (sin/cos, TTL, HTL) connected via cable adapters (available as accessories) to the RJ45 interface. The encoder is not supplied with power by the speed monitor. Absence of feedback must be observed. When selecting the encoders it must be ensured that the signal tracks A, B and their inverted tracks are present.
- A combination of encoder and proximity switch (or in the case of NAMUR sensor version).

Functional principle of the 3TK2810-1 speed monitor

The 3TK2810-1 speed monitor is used for safety-related detection or monitoring of a standstill (output 13/14), and additionally for monitoring a set speed window (lower and upper speed limit) in setup or automatic mode (output 23/24).

To detect the standstill or the speed of the motor, the speed (frequency) is measured using two NPN or PNP proximity switches (design version with NAMUR sensors) or using encoders (sin/cos, TTL, HTL) with two signal tracks and their inverted tracks. (See Fig. "Example of HTL level signal characteristics")

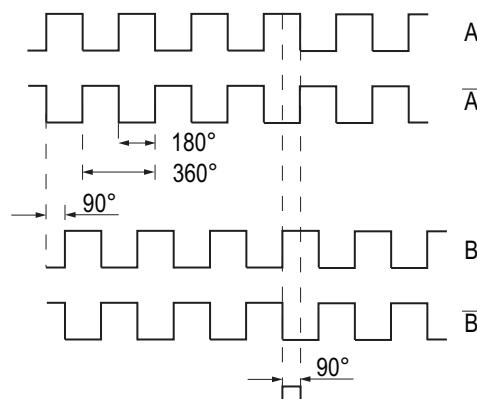


Figure 3-1 Example of TTL/HTL level signal characteristics

A combination of encoder and NPN or PNP proximity switch / Namur sensor is also possible.

Evaluation is carried out in two diversely redundant microcontrollers using the applied pulse trains. The measured frequency is compared here with the specified speed limit for standstill, and with the limits for setup or automatic mode (depending on the operating mode). The speed limits for the individual operating modes can be adjusted by the user to optimally adapt the speed monitor to the most diverse applications and motor types. If a motor standstill is detected, NO contact paths 13/14 are connected. If the speed is within the specified limits of setup or automatic mode, NO contact paths 23/24 are connected.

Requirements for the encoder

Implementation: exclusively with 2 signal tracks and the inverted signal track in each case (A, /A, B, /B)

A: 0 degrees

B: 90 degrees (relative to A)

/A: 180 degrees (relative to A, corresponds to: inverted with respect to A)

/B: 270 degrees (relative to A, corresponds to: inverted with respect to B)

Output:

TTL (LOW level ≤ 2 V, HIGH level ≥ 3 V)

HTL (LOW level ≤ 2 V, HIGH level ≥ 3 V)

sin/cos ($U_A = 1$ V_{pp} [$\pm 10\%$] (differential signal between A and /A or B and /B), $U_{\text{Offset}} = 2.5$ V [$\pm 10\%$])

NOTICE

Malfunction due to excessive offset

With an offset greater than 4 V, no more LOW levels can be detected on the device and thus also no pulses or frequency. The device reacts as if frequency = 0 Hz.

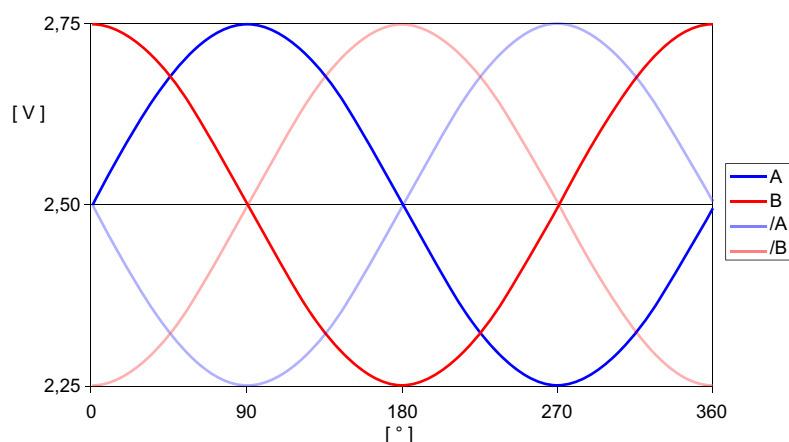


Figure 3-2 Example of signal characteristics for sin/cos encoders

If "RJ45: Encoder" is selected in Item 1.3 of the parameter assignment (encoder selection), a defined failure response (high-impedance outputs) must be ensured in the case of faulty supply voltage or internal encoder faults.

Whether or not the encoder has a high-impedance failure response must be clarified with the manufacturer.

Due to the higher safety category (SIL3/PL e) of the 3TK2810-1 speed monitor, the connected encoder is evaluated in a safety-related manner. This means that encoder faults (e.g. incorrect phase offset, incorrect pulse-to-pause ratio, wire breaks, defective output signals, parasitic oscillations, etc.) are detected by the 3TK2810-1 speed monitor. As a result, the application can achieve up to PL e according to ISO 13849 and SIL 3 according to IEC 62061.

No synthetically generated signals may be used as input signals.

Use of encoders

NOTICE
Use of encoders
In order to achieve the highest possible SIL/PL when using encoders, 2-channel encoders (4 tracks: A, A/, B, B/) with defined failure behavior (high-impedance outputs that have $R_a \geq 50$ kOhm as high-impedance outputs in the event of a fault) must be used.
If such information cannot be found on the encoder manufacturer's data sheet, the response in case of encoder failure must be requested from the manufacturer.

Note

Vibrations and shocks can influence the output signals of encoders and proximity switches. For this reason, it must be ensured that valid input signals are always present at the 3TK2810-1 speed monitor irrespective of any influences. When encoders are used, if vibrations and shocks cannot be eliminated, it should be ensured through design measures that the output signals of the encoder are not influenced. When proximity switches are used, it should be ensured that the signal change takes place simultaneously on both channels. Failure to observe the above-indicated information may result in error messages due to invalid signals.

Power-up/self-test

Once the power supply has been applied, the device performs a self-test. During the self-test phase, all LEDs briefly light up (lamp test) and all the pixels on the display are energized for approximately 2 seconds.

After power-up, the LEDs light up according to the device status.

Functional principle in setup mode

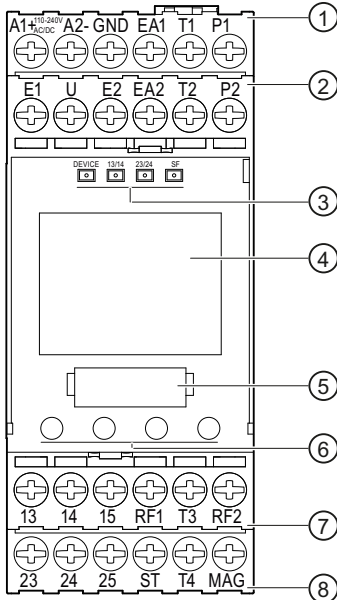
If the 3TK2810-1 safety-related speed monitor is switched to the setup mode (control of terminal EA1), the output contact 13/14 closes immediately. If the machine speed is also within the parameterized speed window, the output contact 23/24 closes.

If setup mode (control of terminal EA1) is selected, monitoring of the protective door contacts is deactivated (sensor circuits T1/P1 and T2/P2). The protective door can now be opened by an enabling command to the interlock magnets.

Versions and order numbers of the 3TK2810-1 speed monitor

MLFB	Designation
3TK2810-1BA41	Speed monitor 24 V DC screw-type terminal
3TK2810-1BA42	Speed monitor 24 V DC spring-loaded terminal
3TK2810-1KA41	Speed monitor 110 to 240 V AC/DC screw-type terminal
3TK2810-1KA42	Speed monitor 110 to 240 V AC/DC spring-loaded terminal
3TK2810-1BA41-0AA0	Speed monitor 24 V DC screw-type terminal; for use with Namur sensors
3TK2810-1BA42-0AA0	Speed monitor 24 V DC spring-loaded terminal; for use with Namur sensors
3TK2810-1KA41-0AA0	Speed monitor 110 to 240 V AC/DC screw-type terminal; for use with Namur sensors
3TK2810-1KA42-0AA0	Speed monitor 110 to 240 V AC/DC spring-loaded terminal; for use with Namur sensors

Design of the 3TK2810-1 speed monitor

Front view	No.	Meaning
 The diagram shows the front view of the speed monitor. It features two rows of terminal blocks at the top and bottom. The top row includes terminals A1, A2, GND, EA1, T1, and P1. The bottom row includes terminals 13, 14, 15, RF1, T3, and RF2. Below the top row are terminals E1, U, E2, EA2, T2, and P2. Below the bottom row are terminals 23, 24, 25, ST, T4, and MAG. In the center is a large rectangular display area. Above the display are four small square buttons for menu navigation. Below the display are four circular indicator lights. The entire unit is labeled with 'DEVICE 1314 2324 SF'.	①	Removable terminal block D
	②	Removable terminal block C
	③	Display LEDs
	④	Display
	⑤	Label
	⑥	Buttons for menu navigation
	⑦	Removable terminal block A
	⑧	Removable terminal block B

Terminal designations of the 3TK2810-1 speed monitor

Terminal	Function
A1	24 V DC or 110 - 240 V AC/DC power supply
A2	Chassis ground/N
23/24	Safety-related output. Closed if speed is within permissible window or power-up override time is running
13/14	Safety-related output. Closed if speed < speed limit or setup mode has been selected (via EA1 and EA2)
15	Standstill signaling output
25	Speed signaling output
T1	Test signal channel 1
T2	Test signal channel 2
T3	Test signal channel 3
T4	Test signal channel 4
ST	Start of the drive
RF1	Feedback circuit 1 input
RF2	Feedback circuit 2 input
P1	Input for position switch channel 1
P2	Input for position switch channel 2
MAG	Input for solenoid monitoring (contact closed/open when magnet attracted/repelled)
EA1	Setup speed /automatic speed channel 1 switchover
EA2	Setup speed/ automatic speed channel 2 switchover
U 3TK2810-1.A4.-0AA0 only: U1	Connection of proximity switch channel 1+2
GND 3TK2810-1.A4.-0AA0 only: U2	Connection of proximity switch channel 1+2
E1	Proximity switch 1 signal input
E2	Proximity switch 2 signal input

Interfaces of the 3TK2810-1 speed monitor

Interface	Meaning
RJ45	Interface for connecting the encoder and for the copy function

Operator control elements of the 3TK2810-1 speed monitor

Element	Meaning
Keys	Navigation in the operator control menu / error acknowledgement

Display elements of the 3TK2810-1 speed monitor

Element	Display	Meaning
DEVICE	Green	Device OK
	Flashing green	Parameterizing mode
	Flashing red	Parameterization error
	Red	Device defective
13/14	Green	Output contact 13/14 closed
	Flashing green	Switch-off monitoring feedback circuit 2 failed
23/24	Green	Output contact 23/24 closed
	Flashing green	Switch-off monitoring feedback circuit 1 failed
SF	Off	No error
	Red	(External) error
Display		Diagnostics
		Error messages
		Status indicator, possibly parameterization

3.4 Accessories

The following accessories are available in addition to the main devices:

MLFB	Designation
3TK2810-0A	Cable for connecting with encoder/for copy function
3TK2810-1A	Adapter for connecting with Siemens/Heidenhain encoder 15-pin
3TK2810-1B	Adapter for connecting with Siemens/Heidenhain encoder 25-pin

The adapters (15-pin or 25-pin) are used as the connection between the encoder, the controller and the standstill/speed monitor. They are designed for Siemens/Heidenhain controllers with the following PIN assignments:

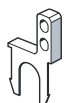
Signal	SUB D15/SUB D25	RJ45
VCC	1	2*
GND	2	1
A	3	3
$\bar{A}$	4	4
B	6	6
$\bar{B}$	7	8

* Connection not absolutely necessary (not evaluated by device)

Further accessories:

Fixing lugs for mounting the device on a level surface. Per device 2 units are required.

Order No.: 3RP1903



Functions

4.1 Terminals and their functions

Supply voltage A1, A2

Connection for device supply (see Chapter "Technical data (Page 85)").

Measuring inputs U, GND, (or U1, U2), E1, E2 and RJ45

The connections E1 and E2 are provided for NPN and PNP proximity switches (device version with NAMUR sensors). The switches are supplied by terminals U with 24 V DC (device version NAMUR $U1 = U2 = 8.2 \text{ V DC}$) and GND. The encoder type (NPN or PNP) must be selected in the menu.

The RJ45 interface is suitable for connecting encoders with sin/cos, TTL and HTL signals.

Output circuits (contacts) 13/14, 23/24

The device has two output circuits each implemented with two safety relays (standstill 13/14: K1, K2; setup or automatic speed monitoring 23/24: K3, K4) with positively-driven contacts switched in series.

- Automatic mode: Monitoring of automatic speed window and standstill speed.
 - Contact 13/14 connects if the speed drops below the set standstill speed ($n < n_{\text{still}}$), in other words, if standstill is detected.
 - Contact 23/24 connects if the speed is within the set speed limits of automatic mode ($n_{\text{min}} < n < n_{\text{max}}$).
- Setup mode: Monitoring of setup speed window. Standstill permanently enabled.
 - Contact 13/14 is permanently closed.
 - Contact 23/24 connects if the speed is within the set speed limits of setup mode ($n_{\text{min}} < n < n_{\text{max}}$).

Signaling outputs 15 and 25

The semiconductor signal outputs 15 and 25 are designed, for example, for connection to a PLC and not for use in safety-related functions.

They function as follows:

- The internal supply potential (U_{Rel} approx. 24 V) is output via terminal 15 when the speed drops below the set standstill speed ($n < n_{\text{still}}$), in other words, if standstill is detected.
- The internal supply potential (U_{Rel} approx. 24 V) is output via terminal 25 if the speed is within the set speed limits of setup and automatic mode ($n_{\text{min}} < n < n_{\text{max}}$).

Test signals T1, T2, T3, T4

To detect errors in the input circuit or in processing of the safety-related inputs ST, RF1, RF2, EA1, EA2, P1, P2 and MAG, a dynamic output signal is routed via the contact blocks, and via the start and feedback circuits. The output signals at the individual outputs T1, T2, T3 and T4 vary here so that cross-circuits between the output signals can thus also be detected.

Signal input ST (start circuit)

The start signal is applied at this input. ST is supplied by test signal T4. To start the motion connected at 23/24 as well as the monitoring function, the START pushbutton must be pressed in the case of manual start. The pushbutton is monitored for cross-circuit or short-circuit by scanning the falling edge (opening of the START pushbutton) at switch-on. For this reason, it must not be pressed for longer than 3 s. If a cross-circuit or short-circuit is detected, the device switches to the safe state and a diagnostics message is displayed.

After correction of the fault, it is necessary to perform a reset (see Chapter "Troubleshooting (Page 72)") or a restart by switching the supply voltage off and on.

At autostart, the test signal T4 must be applied at ST to start the device using a jumper.

Signal input MAG (interlock for protective door)

MAG is supplied by test signal T4. When the hazardous motion is started (output 23/24), the protective door must be interlocked. The interlock magnet is equipped with a contact that is read into the device via the MAG terminal. If the contact is closed, the device cannot be started or it goes immediately to a safe state (output contact 23/24 drops out). However, as soon as the contact is closed again, the device can be restarted. Acknowledgment of the error is not necessary.

The contact is permanently monitored. If this is not used, terminals T4 and MAG must be jumpered.

Signal input RF1 (feedback circuit for setup or automatic mode)

RF1 is supplied by test signal T3. The NC contacts of the external contactors connected at terminal 24 are read in via terminal RF1. Connection of output contact 23/24 is only possible if the feedback contacts are closed.

If contact extension or reinforcement is not used, terminals T3 and RF1 must be jumpered.

Signal input RF2 (feedback circuit for standstill)

RF2 is supplied by test signal T3. The NC contacts of the external contactors connected at terminal 14 are read in via terminal RF2. Connection of output contact 13/14 is only possible if the feedback contacts are closed. If output contact 13/14 is switched off, the feedback contacts must be closed 1 second afterwards, otherwise the relevant diagnostics message appears. After correction of the fault, it is necessary to perform a reset (see Chapter "Troubleshooting (Page 72)") or a restart by switching the supply voltage off and on.

If contact extension or reinforcement is not used, terminals T3 and RF2 must be jumpered.

Signal input P1 and P2 (position switches for protective door)

P1 is supplied by test signal T1, and P2 by test signal T2. These terminals are used to connect the position switches for the protective door with a tumbler. To achieve maximum fail-safety (Performance Level e according to ISO 13849-1 and SIL3 according to IEC 61508), the position switches are connected with two channels.

The position switches are monitored for simultaneity. When the position switches are opened, contacts P1 and P2 must be opened within $t < 1.0$ s. If simultaneity is not satisfied, a diagnostics message appears on the display. After correction of the fault, it is necessary to perform a reset (see Chapter "Troubleshooting (Page 72)") or a restart by switching the supply voltage off and on.

Both position switches must be closed to start output contact 23/24. When connecting a single-channel position switch or two individual single-channel position switches for a lower category, detection of simultaneity must be disabled in the menu. Terminals T2 and P2 must be jumpered when using a single-channel position switch.

If no position switches are used, terminals T1 must be jumpered with P1, and terminals T2 with P2.

If setup mode (control of terminal EA1) is selected, monitoring of the protective door contacts is deactivated (sensor circuits T1/P1 and T2/P2). The protective door can now be opened by an enabling command to the interlock magnets.

Signal input EA1 and EA2 (operating mode selection)

The speed monitor is suitable for monitoring 2 operating modes (setup and automatic mode). The relevant speed limits for both operating modes are set in the menu using the pushbuttons. Safety-related selection of the operating mode, and thus the speed to be monitored, is carried out with an antivalent switch connected in a two-channel configuration to connections EA1 and EA2.

Monitoring of the setup speed is selected if EA1 is connected with T1 via the antivalent selector switch, and EA2 is disconnected from T2 by the antivalent switch. To monitor automatic speed, EA1 must be disconnected from T1 by the antivalent switch, and EA2 must be connected to T2 via the antivalent selector switch. The two channels of the switch are monitored for simultaneity ($t_{\text{diff}} < 1.0$ s). If simultaneity is not satisfied, or a cross-circuit exists between EA1 and EA2, the device goes to a safe fault state. After correction of the fault, it is necessary to perform a reset (see Chapter "Troubleshooting (Page 72)") or a restart by switching the supply voltage off and on.

If the 3TK2810-1 safety-related speed monitor is switched to the setup mode (control of terminal EA1), the output contact 13/14 closes immediately. If the machine speed is also within the parameterized speed window, the output contact 23/24 closes.

4.2 Function diagram for setup and automatic mode

Requirements

- Start type: Automatic start
- Protective door closed and signal present at P1 and P2
- Magnet of the tumbler provides positive checkback signal (signal to MAG)

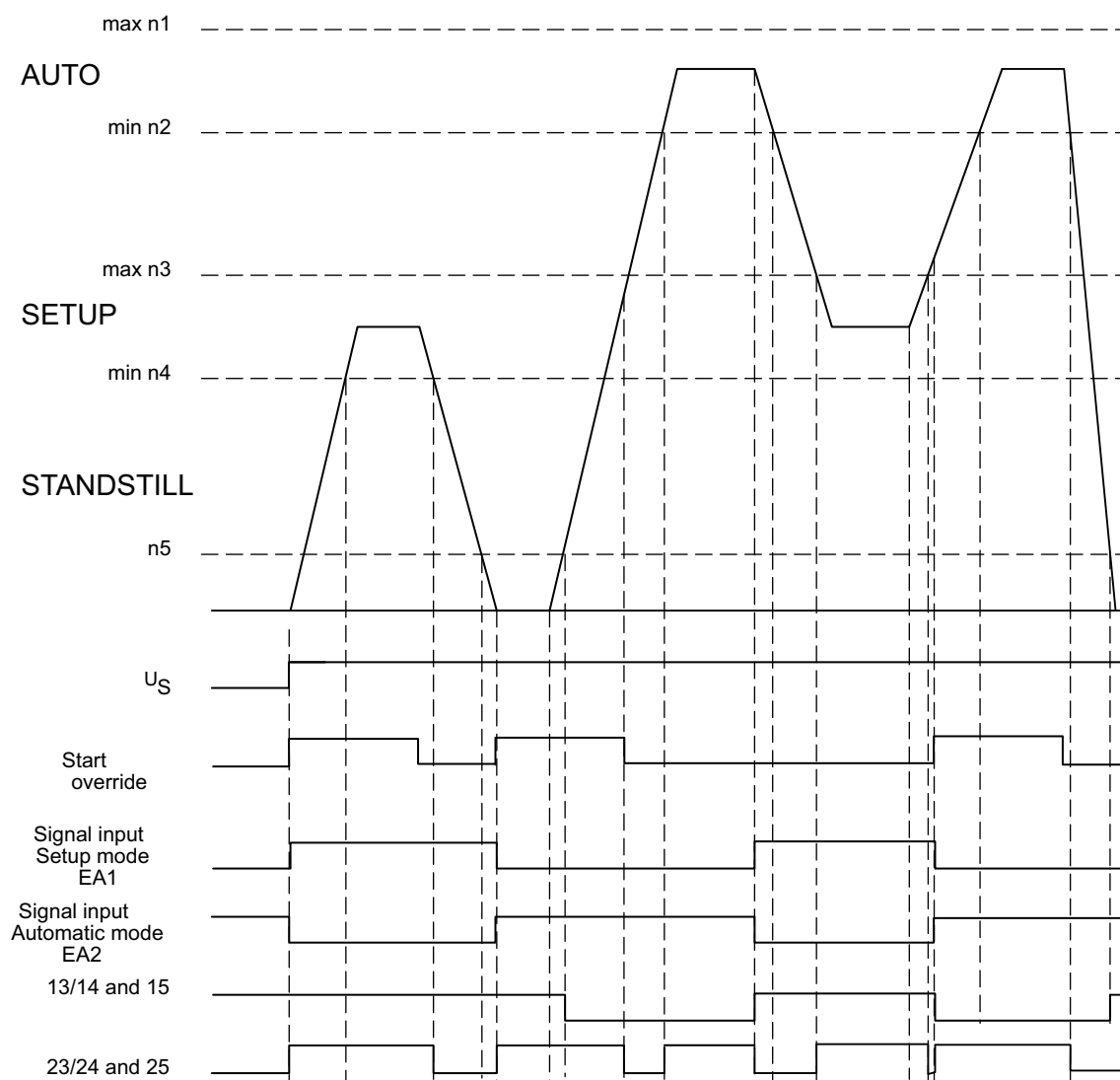
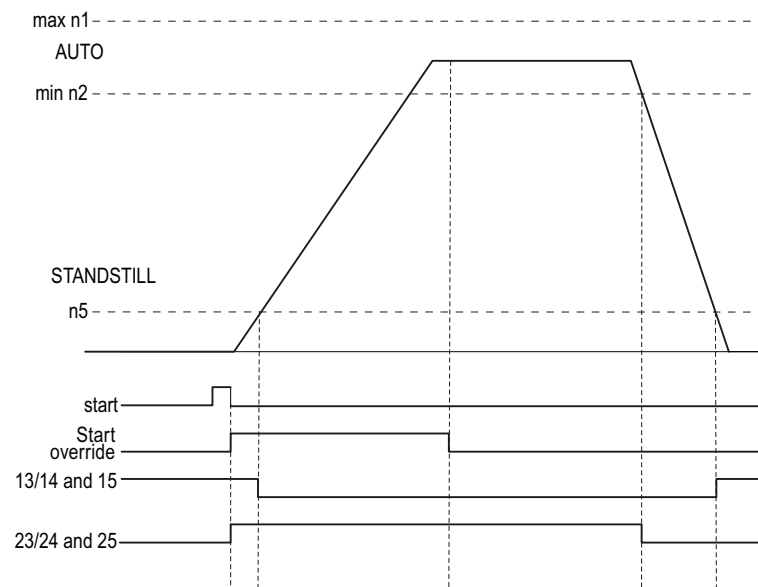


Figure 4-1 Function diagram for setup and automatic mode

4.3 Function diagram for automatic mode

Requirements

- Start type: Manual start
- Protective door closed and signal present at P1 and P2
- Magnet of the tumbler provides positive checkback signal (signal to MAG)
- "AUTOMATIC MODE" is selected (no signal at EA1 and signal at EA2)



4.3 Function diagram for automatic mode

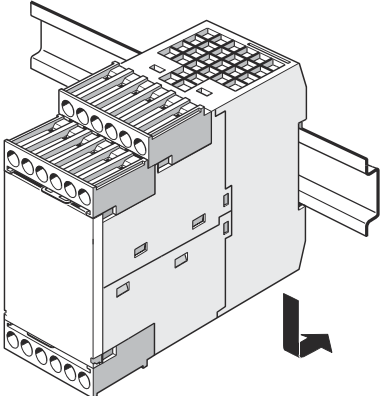
Assembling

5.1 Mounting the device on a DIN rail

Requirements

- At the installation location, a horizontal 35 mm mounting rail in accordance with DIN EN 60715 is properly secured
- Please observe the information about the mounting position in Chapter "Technical data (Page 85)"

DIN rail mounting procedure

Step	Operating instruction	Figure
1	Hang the back of the device onto the upper edge of the DIN rail	
2	Press the lower half of the device against the DIN rail until the device engages	

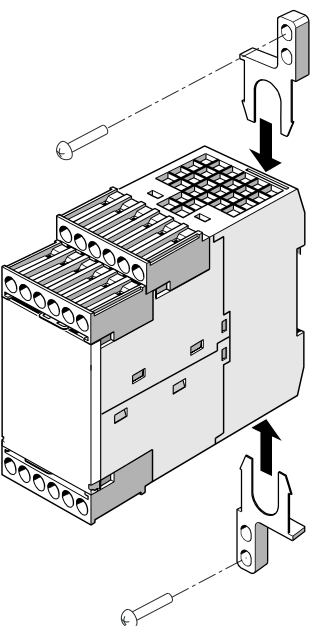
5.2 Mounting the device on a level surface

Requirements

Please note the following requirements for mounting on a level surface:

- Please observe the information about the mounting position in Chapter "Technical data (Page 85)".
- Two properly executed drill holes with thread or plug on the level surface
For details of the distances between the drilled holes, refer to the relevant drilling diagram in Chapter "Drilling pattern (Page 87)".
- Two head screws to fit the drilled holes with a maximum thread diameter of 5 mm
- Two plastic securing brackets
Please refer to the accessories list for the relevant order number in Chapter "Accessories (Page 36)".

Procedure for mounting on a level surface

Step	Operating instruction	Figure
1	Insert the securing brackets into the openings provided on the device until they engage.	
2	Hold the device up to the surface prepared for screw fastening.	
3	Insert the screws through the oblong holes in the securing brackets.	
4	Screw the device onto the level surface so that it is secure.	

5.3 Disassembling the device

WARNING

Hazardous Voltage.

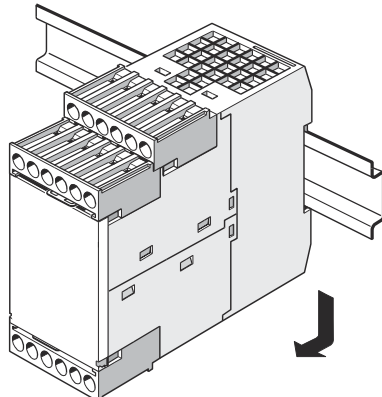
Can Cause Death, Serious Injury, or Property Damage.

Before starting work, therefore, disconnect the system and devices from the power supply.

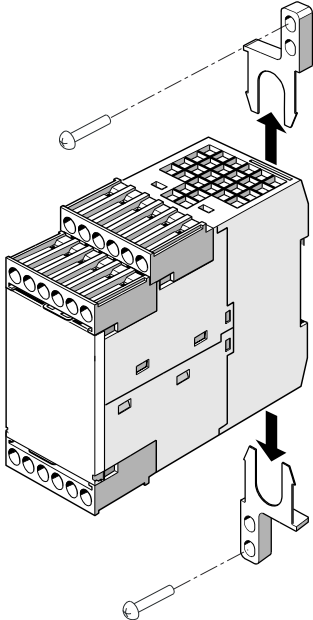
Requirements

- All system interface connections are terminated.
- The terminal blocks have been removed or disconnected.

Disassembling the device from a DIN rail

Step	Operating instruction	Figure
1	Pull the device down until the lower half can be pulled away from the DIN rail.	
2	Pull the lower half of the device away from the DIN rail.	
3	Lift the device from the upper edge of the DIN rail.	

Disassembling the device from a level surface

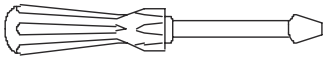
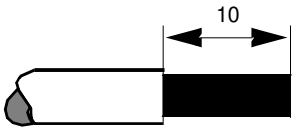
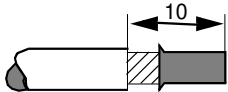
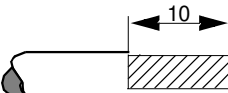
Step	Operating instruction	Figure
1	Hold the device firmly.	
2	Unscrew the cap screws.	
3	Lift the device from the level surface.	
4	Remove the securing brackets from the device.	

Connecting

6

6.1 Connection data for terminal blocks

The following connection data apply dependent on the removable terminal block:

	Specification and value in the case of removable terminal blocks with screw-type terminals	Specification and value in the case of removable terminal blocks with spring-loaded terminals
Screwdriver 	Cross-tip screwdriver Size: PZ 2 (ø 5 ... 6 mm) Torque: 0.8 ... 1.2 Nm Order No.: 8WA2803	Screwdriver Size: 0 or 1 (width to 3 mm) for raising the terminal springs Order No.: 8WH9200-0AA0
Rigid cable 	Maximum number of cables x cable cross-section: 1 x 0.5 ... 4.0 mm ² or 2 x 0.5 ... 2.5 mm ²	Maximum number of cables x cable cross-section: 2 x 0.25 ... 1.5 mm ²
Flexible cable with end sleeve/ cable lug 	Maximum number of cables x cable cross-section: 1 x 0.5 ... 2.5 mm ² or 2 x 0.5 ... 1.5 mm ²	Maximum number of cables x cable cross-section: 2 x 0.25 ... 1.5 mm ²
Flexible cable 	Not allowed	Maximum number of cables x cable cross-section: 2 x 0.25 ... 1.5 mm ²

6.2 Connecting terminal blocks

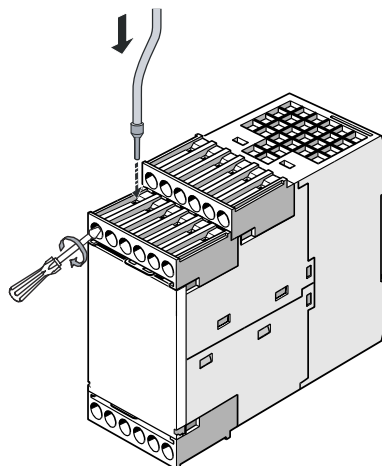
WARNING

Hazardous Voltage.

Can Cause Death, Serious Injury, or Property Damage.

Before starting work, therefore, disconnect the system and devices from the power supply.

Procedure for screw-type terminal blocks

Step	Operating instruction	Figure
1	Insert the relevant cable into square on the screw-type terminal until it engages.	
2	Hold the cable in the screw-type terminal.	
3	Tighten the screw of the terminal in which the cable is inserted.	
4	Pull on the cable to ensure it is screwed tight.	

Procedure for spring-loaded terminal blocks

Step	Operating instruction	Figure
1	To release the terminal spring, insert the 3-mm flat-head screwdriver into the square opening of the spring-loaded terminal until it engages. Please observe a 10° horizontal angular deviation of the screwdriver to the oval opening.	
2	Insert the cable into the oval opening as far as it will go.	
3	Hold the cable in the spring-loaded terminal.	
4	Remove the screwdriver.	
5	Pull on the cable to ensure it is tight.	

6.3 Disconnecting



WARNING

Hazardous Voltage.
Can Cause Death, Serious Injury, or Property Damage.

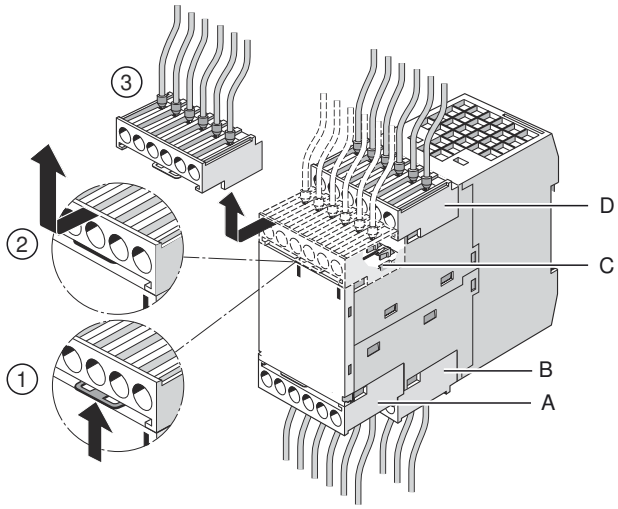
Before starting work, therefore, disconnect the system and devices from the power supply.

Removing terminal blocks from the device

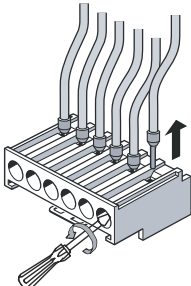
Note

Order of removal

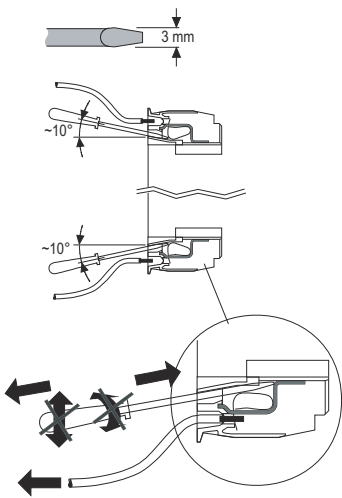
Remove terminal block A before terminal block B, and C before D.

Step	Operating instruction	Figure
1	Insert a flat-head screwdriver between the clip of the terminal block and the front panel ①.	
2	Pull the terminal block out to the front ②.	
3	Lift the terminal block out of the mechanically coded guiderail of the device ③.	

Disconnecting screw-type terminals

Step	Operating instruction	Figure
1	Unscrew the screw of the screw-type terminal.	
2	Remove the cable from the unscrewed screw-type terminal.	

Disconnecting spring-loaded terminals

Step	Operating instruction	Figure
1	Insert the flat-head screwdriver into the square opening of the spring-loaded terminal until it engages. Please observe a 10° horizontal angular deviation of the screwdriver to the oval opening.	
2	Remove the cable from the oval opening.	
3	Remove the screwdriver.	

6.4 Plugging in terminal blocks

 **WARNING**

Hazardous Voltage.
Can Cause Death, Serious Injury, or Property Damage.
Before starting work, therefore, disconnect the system and devices from the power supply.

Requirement

You must have removed the terminal blocks, for the purpose of replacing a device, for example.

Procedure when plugging in the terminal blocks

Note

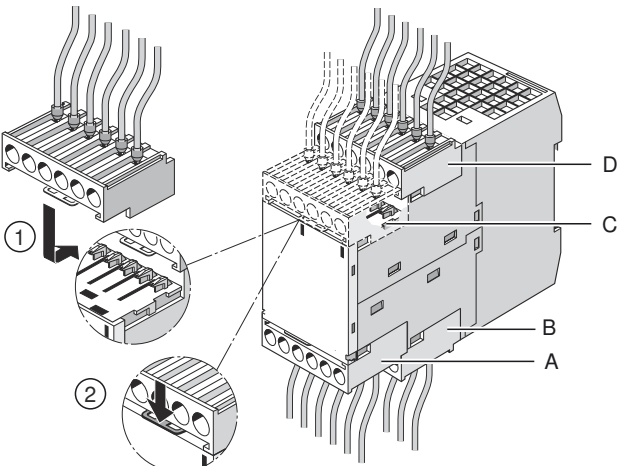
Removable terminal blocks are mechanically coded to prevent polarity reversal

The removable terminal blocks are mechanically coded to prevent polarity reversal and are labeled with A, B, C or D on the inside. Only use the slots shown in the diagram below.

Note

Plug-in sequence

Connect terminal block B before terminal block A, and D before C.

Step	Operating instruction	Figure
1	Insert the removable terminal block into the mechanically coded guiderail of the device ①.	
2	Slide the removable terminal block back until it audibly engages.	
3	Check that the clip of the removable terminal block closes flush with the front panel ②.	

Operation

7.1 Times

Start override time t_a

The start override time is used, for example, to bridge the start time of a motor until it has reached a specific speed. If the parameterized min. setup or automatic speed is not reached within the parameterized start override time t_a , the device switches immediately to the safe state. Contacts 23/24 are opened and signaling output 25 switches off.

The startup override executes at restart of the device, when changing from setup to automatic mode in autostart mode, and in manual start mode every time the START pushbutton is pressed. However, the requirement for this is always that before starting the start override time, all safety requirements (position switch, magnet switch, feedback circuit) must be satisfied, with the exception of the speed. During start override, output contact 23/24 is permanently connected provided the safety requirements such as position switch and magnet switch continue to be satisfied.

See also Chapter "Terminals and their functions (Page 37)" in this regard.

Release delay time t_v

The release delay time is the time that elapses until output contacts 13/14 and signaling contact 15 are switched through following a detected standstill.

See also Chapter "Terminals and their functions (Page 37)" in this regard.

Switch-off monitoring time t_f

The switch-off monitoring time is used to check the contactors connected to output contacts 23/24. If the feedback at RF1 is not available within the parameterized switch-off monitoring time t_f after switching off output 23/24, a blink code in the ratio 50/50 is output at signaling output 25. An error message is also displayed.

After eliminating the error, it is necessary to perform a reset (see Chapter "Troubleshooting (Page 72)") or a restart by switching the supply voltage off and on.

Discrepancy time

The discrepancy time is the time span in which a discrepancy, i.e. different signal states, of the detection signals is permissible. Only after the discrepancy time has elapsed does a signal discrepancy lead to an error.

Verification of response times in the case of safety circuits

When safety equipment is commissioned, steps must be taken to verify that a safety-related output will switch off within a maximum permissible response time if the input signal changes at the relevant input.

To provide this verification, you must calculate the total response time of the application you have configured.

Note

Note that the results of calculating the response time affect the level of safety and affect the overall design of the system.

Response time up to the switch-off procedure after expiry of the set start override time

The maximum response time up to detection of a violation of the upper/lower limit depends on the selected parameters. The lower the set values, the longer the device requires to detect the pending fault.

To achieve a faster response time, encoders or gear wheels that supply several pulses per revolution can be used (e.g. encoders with 32 pulses). This reduces the time $1 / f_{\text{threshold}}$ by the factor of the number of pulses of the encoder or the number of teeth on the gear wheel.

The following applies in general: $t_{\text{Switch-off_max}} = 1 : f + t_{\text{Response}}$

e.g. under-speed in setup mode to be checked 120 rpm = 2 Hz

with initiators (1 pulse/rev.): $t_{\text{Switch-off_max}} = 1 : 2 \text{ Hz} + 150 \text{ ms} = 650 \text{ ms}$

with encoder with number of pulses = 32: $t_{\text{Switch-off_max}} = 1 : (2 \text{ Hz} \times 32) + 150 \text{ ms} = 166 \text{ ms}$

f = set frequency threshold or frequency of the applied measuring signal (e.g. under-frequency in setup mode)

t_{Response} = internal response time following detection of the switch-off frequency (max. 150 ms)

Indication on the display

In the normal operating mode, all set values can be checked at any time by pressing the "Up" or "Down" key.

In addition, the current speed is indicated by initiator 1 or by the encoder. However, this speed does not correspond to the accuracy of the device and is used exclusively for diagnostics purposes!

7.2 Parameterizing/configuring

7.2.1 Commissioning

Note

Since the commissioning and parameterization of the speed monitor are important safety-related steps, they must be carried out by qualified personnel.

Requirements

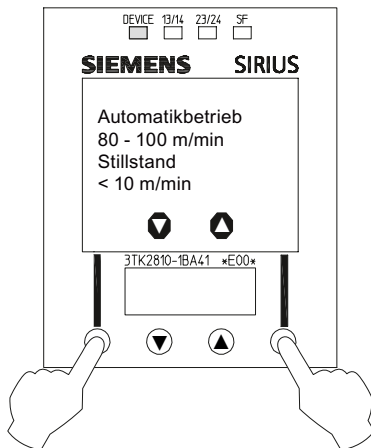
The following requirements must be met for commissioning:

- The device has been installed
For more information see: Chapter "Assembling (Page 43)"
- Check all the latches to ensure that they are properly engaged.
- The device has been wired
For more information see: Chapter "Connecting (Page 47)"
- The parameterization is available and consistent.
- The power supply for the device is connected.

7.2.2 Parameterization using the display

To enter the parameterization mode of the device, press the following button combinations:

- Press the right button and keep it pressed.
- Also press the left button (see below).
A display test follows
- After correct execution of the display test, confirm with the OK button (right button)
- The parameterization can then be modified.
- Before the device accepts the modified parameters, you must confirm the parameters again for security.



! WARNING

Hazardous Voltage.

Can Cause Death, Serious Injury, or Property Damage.

Carry out functional test of the system

To guarantee the safety of the system, a full functional test must be carried out and successfully concluded following parameterization.

Note

You must document the set parameters with the printed form (see Chapter "Appendix (Page 97)").

7.2.3 Lock changes

By activating the menu item "Lock changes", no more changes to the parameters can be made. It is not possible to cancel this parameter. It is only possible to reset to factory settings and to re-enter all parameters.

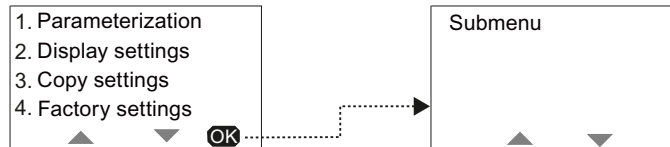
Change tracking is also automatically activated when "Lock changes" is activated.

7.2.4 Change tracking of parameterization

The menu item "Change tracking" is available in order to be able to recognize any changes that have been made subsequently to the parameterization. In this menu a counter can be activated once. It is then incremented with every future change. Once the counter has been activated, it is no longer possible for the user to reset or deactivate the counter.

7.2.5 Parameterization menu

You can navigate through menu using the keys. Each menu option may have additional sub-menus. The menu structure and menu representation are in part directly dependent on the device parameterization and the hardware configuration.



1.	Parameter assignment		
1.1	Motion monitoring ¹⁾		
		Translatory	
		Rotational	
			OK
1.2	Encoder type ¹⁾		
		Lin. encoder	
		Rot. encoder	
			OK
1.3	Encoder selection		
		RJ45: Encoder + E2	
		RJ45: Encoder	
		E1+ E2	
			OK
1.4	Lead/transformation		
		Transformation	
		1 : 1	
		Lead	
		10.000 [mm]	
			OK
1.5	Encoder settings		
		Signal form	
		sin/cos or TTL	
		HTL	
		Resolution	
		1024 [pulses/rev or mm]	
			OK
1.6	Initiator settings		
		Initiator type	
		pnp	
		nnp	
		Resolution E1	
		10 [pulses/rev or mm]	
		Resolution E2	
		10 [pulses/rev or mm]	
			OK
1.7	Speed limits		
		Automatic max.	
		100 [r/min or m/min]	

			Automatic min.	
			80 [r/min or m/min]	
			Setting max.	
			60 [r/min or m/min]	
			Setting min.	
			40 [r/min or m/min]	
			Standstill	
			10 [r/min or m/min]	
				OK
	1.8	Times		
			Start override	
			5.0 [s]	
			Release delay	
			5.0 [s]	
			Switch-off monitoring	
			5.0 [s]	
			Discrepancy time	
			5.0 [s]	
				OK
	1.9	Start type		
			Manual start	
			Automatic start	
				OK
	1.10	Protective door monitoring		
			Simultaneity on	
			Simultaneity off	
				OK

¹⁾ If this setting is changed, points 1.4, 1.5 and 1.7 are reset to the default values.

*) **Bold values are default values.**

2.	Display setting		
	2.1	Languages	
			English
			Deutsch
			Francais
			Espanol
			Italiano
			OK
	2.2	Contrast	
			50 [%]
			OK
	2.3	Lighting	
			OFF
			3 s
			10 s
			1 min
			5 min
			ON
			OK
	2.4	Diagnostics	
			Do not show
			Show
			OK
	2.5	Error messages	
			Do not show
			Show
			OK
	2.6	Operation display	
			Manual
			3 s
			10 s
			1 min
			5 min
			OK

*) Bold values are default values.

3.	Copy settings		
	Parameters		
	Display settings		
	Parameters + display settings		
			OK

4.	Factory settings		
	Parameters		
	Display settings		
	Parameters + display settings		
			OK

5.	Changes		
	5.1	Lock changes	
		Activate	
			OK
	5.2	Change tracking	
		Activate	
			OK

6.	About 3TK2810-1		
			OK

7.2.6 Parameterization and pin assignments of the RJ45 interface

The RJ45 interface is used for connecting an encoder to the device with the relevant configuration of the 3TK2810-1. With the appropriate transfer cable (see accessories), the interface can also be used to parameterize another device using the copy function. This is important if the speed monitor is to be used in a standard application, or if it has to be replaced in the event of a fault.

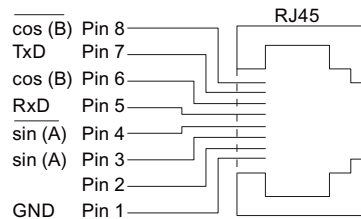


Figure 7-1 Pin assignments of the RJ45 interface

7.2.7 Copying parameters

The parameters can be copied by linking two speed monitors using the transfer cable.

Procedure:

1. Connect both speed monitors with the transfer cable
2. Connect both speed monitors to power supply
3. Select "Copy parameters" in the menu of the "Sending device".
4. Start the copy operation with "Send parameters"
5. The prompt "Receive parameters?" appears on the display of the "Receive device" As soon as this is acknowledged with "OK" (right softkey), transfer begins.
6. When transfer has been completed, the basic screens appear again on both devices.
7. Disconnect the cable (remove transfer cable).



WARNING

Hazardous voltage

Can cause death, serious injury, or property damage.

Performing a function test of the system

To guarantee the safety of the system, a complete function test must be carried out and successfully concluded after copying the parameters.

Copying the parameters to other devices

- E03 or older to E03 or older is possible.
- E03 or older to E04 is possible, provided the parameterization lock in the device with E04 is deactivated.
- E04 to E04 is possible, provided that the parameterization lock in the receiving device with E04 is deactivated. The parameterization lock in the sending device with E04 can be activated.

E04 to E03 or older is not possible.

If copying is not possible, a corresponding message is displayed:

- "Receiving device not compatible": This message is displayed on the sending device if it detects that the receiving device is incompatible.
- In case of system errors, a corresponding message is displayed.

7.3 Configuring

7.3.1 Configuration information

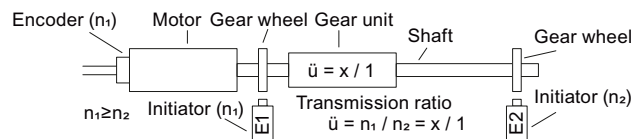
Mounting measuring sensors

Cross-circuits between the measuring sensors must be avoided by means of suitable cable installation.

Transmission ratio or shaft fracture monitoring

In certain applications, it can be necessary to set a transmission ratio. The following arrangement of the initiators or the encoder is necessary here:

- The speed to be monitored on the encoder or on initiator 1 (E1) must always be greater than or equal to the speed to be monitored on initiator 2 (E2).
- The set speed limits on the display always refer to the encoder or to initiator 1 (E1) when a transmission ratio is set.
- If the gear unit switched between E1 and E2 does not have an integer ratio, it can be adjusted appropriately by modifying the resolution settings E1/E2 (pulses/rev. or mm).



z.B.: $n = 1500 \text{ U/min}$; $n = 300 \text{ U/min}$

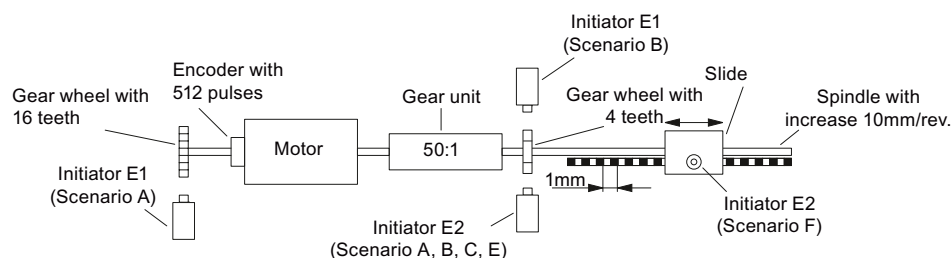
$$\ddot{u} = \frac{n_1}{n_2} = \frac{1500 \text{ U/min}}{300 \text{ U/min}}$$

➡ Input on display ratio = 5:1

This arrangement is also used to detect a shaft fracture. If the measuring signals of the measuring sensor do not agree with the measuring sensor on the shaft in accordance with the ratio, the device switches immediately to a safe fault state.

7.3.2 Configuration examples

7.3.2.1 Rotational motion, rotary encoder



Settings on the display using the example above:

Scenario A:

1. Parameterization:
 - 1.1 Monitored motion: Rotational
 - 1.2 Encoder type: Rot. encoder
 - 1.3 Encoder selection: E1+E2
 - 1.6 Initiator settings:

Resolution E1	16 pulses/rev.
Resolution E2	4 pulses/rev.
 - 1.4 Lead//transmission:

Transmission:	50:1
---------------	------

The speed limits (rpm) to be set refer to the speed at initiator E1.

Scenario B:

1. Parameterization:
 - 1.1 Monitored motion: Rotational
 - 1.2 Encoder type: Rot. encoder
 - 1.3 Encoder selection: E1+E2
 - 1.6 Initiator settings:

Resolution E1	4 pulses/rev.
Resolution E2	4 pulses/rev.
 - 1.4 Lead//transmission:

Transmission:	1:1 (since the measurement is made at the same point)
---------------	---

The speed limits (rpm) to be set refer to the speed at initiator E1.

Scenario C:

1. Parameterization:
 - 1.1 Monitored motion: Rotational
 - 1.2 Encoder type: Rot. encoder
 - 1.3 Encoder selection: Encoder+E2
 - 1.5 Encoder resolution: 512 pulses/rev.
 - 1.6 Initiator settings:
 - Resolution E2 4 pulses/rev.
 - 1.4 Lead//transmission:
 - Transmission: 50:1
- The speed limits (rpm) to be set refer to the speed at the encoder.

Scenario D:

1. Parameterization:
 - 1.1 Monitored motion: Rotational
 - 1.2 Encoder type: Rot. encoder
 - 1.3 Encoder selection: Encoder
 - 1.5 Encoder resolution: 512 pulses/rev.
 - 1.4 Lead//transmission:
 - Transmission: not relevant since only one encoder has been selected.
- The speed limits (rpm) to be set refer to the speed at the encoder.

Scenario E: Monitoring the slide to, e.g. 3 m/min.

1. Parameterization:
 - 1.1 Monitored motion: Rotational
 - 1.2 Encoder type: Rot. encoder
 - 1.3 Encoder selection: Encoder+E2
 - 1.5 Encoder resolution: 512 pulses/rev.
 - 1.6 Initiator settings:
 - Resolution E2 4 pulses/rev.
 - 1.4 Lead//transmission:
 - Transmission: 50:1
- $$\begin{aligned}
 \text{Rotational monitoring threshold} &= \frac{\text{Translational monitoring threshold} \times \text{transmission ratio}}{\text{Lead}} \\
 &= \frac{3 \text{ m/min} \times 50}{10 \text{ mm/rev.}} = 15000 \text{ rpm}
 \end{aligned}$$

Scenario F: Monitoring the slide to, e.g. 3 m/min.

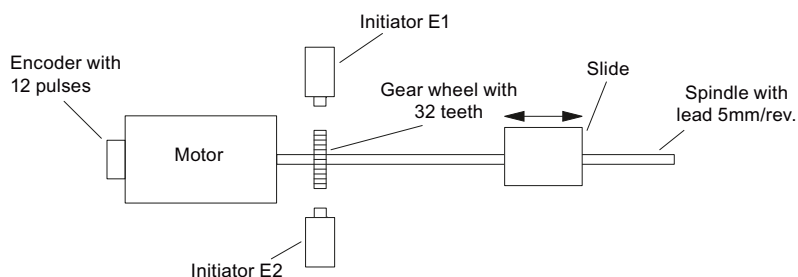
1. Parameterization:

1.1 Monitored motion:	Rotational
1.2 Encoder type:	Rot. encoder
1.3 Encoder selection:	Encoder+E2
1.5 Encoder resolution:	512 pulses/rev.
1.6 Initiator settings:	
Resolution E2	10 pulses/rev. (1 mm/pulse)
1.4 Lead//transmission:	
Transmission:	50:1

The speed limits (rpm) to be set refer to the speed at the encoder, so to monitor the slide as shown, the translational motion must first be converted to the corresponding rotational motion. The resolution of initiator E2 must also be calculated. This is done as follows:

$$\begin{aligned}
 \text{Rotational initiator resolution E2} &= \frac{\text{Lead}}{\text{Translational initiator resolution E2}} \\
 &= \frac{10 \text{ mm/rev.}}{1 \text{ mm/pulse}} = 10 \text{ pulses/rev.} \\
 \\
 \text{Rotational monitoring threshold} &= \frac{\text{Translational monitoring threshold x transmission ratio}}{\text{Lead}} \\
 &= \frac{3 \text{ m/min} \times 50}{10 \text{ mm/rev.}} = 15000 \text{ rpm}
 \end{aligned}$$

7.3.2.2 Translational motion, rotary encoder



Settings on the display using the example above:

Scenario A:

1. Parameterization:

1.1 Monitored motion:	Translational
1.2 Encoder type:	Rot. encoder
1.3 Encoder selection:	E1+E2
1.6 Initiator settings:	

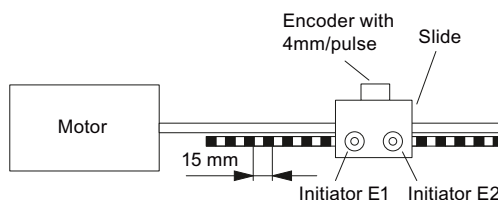
Resolution E1	32 pulses/rev.
Resolution E2	32 pulses/rev.
1.4 Lead//transmission:	
Lead:	5 mm/rev.
The speed limits (rpm) to be set refer to the speed at initiator E1.	

Scenario B:

1. Parameterization:	
1.1 Monitored motion:	Translational
1.2 Encoder type:	Rot. encoder
1.3 Encoder selection:	Encoder+E2
1.5 Encoder resolution:	12 pulses/rev.
1.6 Initiator settings:	
Resolution E2	32 pulses/rev.
1.4 Lead//transmission:	
Lead:	5 mm/rev.
The speed limits (rpm) to be set refer to the speed at the encoder.	

Scenario C:

1. Parameterization:	
1.1 Monitored motion:	Translational
1.2 Encoder type:	Rot. encoder
1.3 Encoder selection:	Encoder+E2
1.5 Encoder resolution:	12 pulses/rev.
1.6 Initiator settings:	
Resolution E2	32 pulses/rev.
1.4 Lead//transmission:	
Lead:	5 mm/rev.
The speed limits (rpm) to be set refer to the speed at the encoder.	

7.3.2.3 Translational motion, linear encoder

Settings on the display using the example above:

Scenario A:

- 1. Parameterization:
 - 1.1 Monitored motion: Translational
 - 1.2 Encoder type: Lin. encoder
 - 1.3 Encoder selection: E1+E2
 - 1.6 Initiator settings:
 - Resolution E1 15 pulses/rev.
 - Resolution E2 15 pulses/rev.
- The speed limits (rpm) to be set refer to the frequency at initiator E1.

Scenario B:

- 1. Parameterization:
 - 1.1 Monitored motion: Translational
 - 1.2 Encoder type: Lin. encoder
 - 1.3 Encoder selection: Encoder+E2
 - 1.5 Encoder resolution: 4 mm/pulse
 - 1.6 Initiator settings:
 - Resolution E2 15 pulses/rev.
- The speed limits (rpm) to be set refer to the frequency at the encoder.

Scenario C:

- 1. Parameterization:
 - 1.1 Monitored motion: Translational
 - 1.2 Encoder type: Lin. encoder
 - 1.3 Encoder selection: Encoder
 - 1.5 Encoder resolution: 4 mm/pulse
- The speed limits (rpm) to be set refer to the frequency at the encoder.

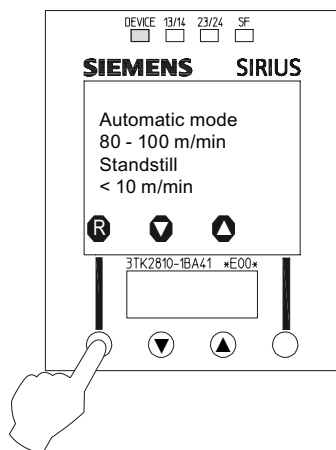
Diagnostics/troubleshooting

8.1 Reading the setting values during operation

The parameters set on the device during normal operation can be read using the "up/down" arrow keys.

8.2 Troubleshooting

If faults are detected on or in the device, these are indicated by the LEDs and on the display with the appropriate message. If the fault necessitates a reset of the device, the pending fault must first be corrected and the error/diagnostics message on the device must be acknowledged. The left button must then be pressed for approximately 3 seconds to trigger a reset of the device.



In the case of system faults, the device must be briefly switched off. If a system fault is detected again on switching on, the device must be returned to the manufacturer.

8.3 Errors / error messages

Error message	SF LED	Error
System error: System error 0x11 occurred! (Page 74)	Red	A signal discrepancy occurred in the encoder or initiator signals.
System error: System error 0xXX occurred! (Page 74)	Red	An internal error occurred
Error: The stored parameters are incorrect! (Page 74)	Red	The stored parameters are incorrect!
Error: The measured signal is outside the measuring range! (Page 74)	Red	The measured signals change faster than the device can detect.
Error: No encoder is connected! (Page 74)	Red	No correct signal sequence of the encoder was detected.
Error: The encoder is defective! (Page 74)	Red	No correct signal sequence of the encoder was detected.
Error: The encoder no longer supplies any signals! (Page 74)	Red	No signals of the encoder were detected.
Error: Initiator E1 no longer supplies any signals! (Page 74)	Red	No signals of the initiator were detected.
Error: Initiator E2 no longer supplies any signals! (Page 74)	Red	No signals of the initiator were detected.
Shaft breakage: Different rotational speeds at E1 and E2! (Page 74)	Red	The ratio of the speeds at inputs E1 and E2 differs.
Shaft breakage: Different rotational speeds at the encoder and at E2! (Page 74)	Red	The ratio of the speeds at the encoder and at E2 differs.
Error: Supply voltage above the defined range! (Page 74)	Red	The supply voltage is too high.
Error: Supply voltage below the defined range! (Page 74)	Red	The supply voltage is too low.
Error: Wiring at RF1 is faulty! (Page 74)	Red	The wiring of the feedback circuit RF1 is faulty.
Error: Wiring at RF2 is faulty! (Page 74)	Red	The wiring of the feedback circuit RF2 is faulty.
Error: RF1 does not close in time! (Page 74)	Red	The contactor on RF1 does not close in time!
Error: RF2 does not close in time! (Page 74)	Red	The contactor on RF2 does not close in time!
Error: Wiring at MAG is faulty! (Page 74)	Red	The wiring of the MAG interlock monitor is faulty.
Error: Wiring at ST is faulty! (Page 74)	Red	Wiring of the START pushbutton ST is faulty.
Error: Line fault at the START pushbutton! (Page 74)	Red	A cross-circuit or short-circuit was detected at input ST.
Error: Wiring at P1 or P2 is faulty! (Page 74)	Red	Wiring at the inputs P1 or P2 is faulty.
Error: Simultaneity error of the position switches! (Page 74)	Red	The two contacts of the position switches do not open simultaneously.
Error: Wiring at EA1 or EA2 is faulty! (Page 74)	Red	Wiring at the inputs EA1 or EA2 is faulty.
Error: Mode selector switch defective! (Page 74)	Red	The contact transfer time or the antivalence condition was not observed.

8.4 Remedial measures

System error: System error 0x11 occurred!

Diagnostics:

A signal discrepancy has been detected between the encoder tracks.

For devices up to product version E03, a signal discrepancy of 5 s is accepted before the device changes to the error state.

Devices with product version E04 accept a discrepancy of 30 s.

For devices with product version E05 or higher, the user can set the discrepancy time in the range between 1 s and 250 s.

A signal discrepancy exists if the frequency of the signals deviates by at least 6.25%.

Remedy:

Check cabling to the encoder, including EMC-compliant cable installation, or check shielding of encoder and signals:

- Defective or EMC-disturbed encoder (encoder only supplies signals A and /A or B and /B)

The encoder used has only tracks A and B (/A and /B are missing).

Adapt discrepancy time (as of product version E05).

If the error still occurs, restart the device or replace the device.

System error: System error 0xXX occurred!

Diagnostics:

An internal component defect or EMC interference occurred that exceeds the standard values. Restart device. If the error still occurs, the device must be replaced.

Remedy:

Restart the device or replace the device.

Error: The stored parameters are incorrect!

Diagnostics:

The parameters stored in the device are incorrect or inconsistent.

Remedy:

Check all parameter settings in the menu and correct if necessary.

If the error still occurs, restart the device or replace the device.

Error: The measured signal is outside the measuring range!**Diagnostics:**

The frequency of the measured signals is greater than the permissible measuring range.
The maximum frequency for encoders is 600 kHz and for initiators 6 kHz.

Remedy:

Use encoders with lower resolution or fewer trip cams for the initiator.

Error: No encoder is connected!**Diagnostics:**

At least one phase of the encoder (e.g. A, /A, B, /B) is not connected.

Remedy:

Check wiring of the encoder.
Replace the encoder.

Error: The encoder is defective!**Diagnostics:**

The phase offset between signals A, /A, B, /B deviates more than $\pm 23^\circ$ from the required 90° , the pulse-pause ratio deviates more than 35% from the required 50/50 ratio, or the offset for sin/cos encoders is greater than 3 V.

Remedy

Check connection of GND between encoder and device.
Check EMC-compliant installation including shielding.
Check encoder signals.

Error: The encoder no longer supplies any signals!**Diagnostics:**

The encoder no longer supplies signals, although signals from the initiator are still present at E2 or a signal discrepancy has been detected between the encoder tracks.
For devices up to product version E03, a signal discrepancy of 5 s is accepted before the device changes to the error state.

Devices with product version E04 accept a discrepancy of 30 s.

For devices with product version E05 or higher, the user can set the discrepancy time in the range between 1 s and 250 s.

A signal discrepancy exists if the frequency of the signals deviates by at least 6.25%.

Remedy:

Check connection of GND between encoder and device.

Check EMC-compliant installation including shielding.

Check encoder signals.

Adapt discrepancy time (as of product version E05).

Error: Initiator E1 no longer supplies any signals!

Diagnostics:

Initiator E1 suddenly no longer supplies signals, although a frequency is still present at E2.

For devices up to product version E03, a signal discrepancy of 5 s is accepted before the device changes to the error state.

Devices with product version E04 accept a discrepancy of 30 s.

For devices with product version E05 or higher, the user can set the discrepancy time in the range between 1 s and 250 s.

A signal discrepancy exists if the frequency of the signals deviates by at least 6.25%.

Remedy:

Check connection of GND between encoder and device.

Check EMC-compliant installation including shielding.

Check whether there are micromovements of the motor which already cause the encoder signals to change, but the signal of the initiator still remains stable.

Adjust discrepancy time (as of product version E05)

Error: Initiator E2 no longer supplies any signals!

Diagnostics:

The initiator at E2 no longer supplies signals although signals of the encoder are still present, or the initiator E2 suddenly no longer supplies signals although a frequency is still present at E1.

For devices up to product version E03, a signal discrepancy of 5 s is accepted before the device changes to the error state.

Devices with product version E04 accept a discrepancy of 30 s.

For devices with product version E05 and higher, the discrepancy time can be set by the user in the range between 1 s and 250 s.

A signal discrepancy exists if the frequency of the signals deviates by at least 6.25%.

Remedy:

Check connection of GND between encoder and device.

Check EMC-compliant installation including shielding.

Check whether there are micromovements of the motor which already cause the encoder

signals to change, but the signal of the initiator still remains stable.
Adjust discrepancy time (as of product version E05).

Shaft breakage: Different rotational speeds at E1 and E2!

Diagnostics:

The ratio of the speed of E1 to E2 does not match the set values.

For devices up to product version E03, a signal discrepancy of 5 s is accepted before the device changes to the error state.

Devices with product version E04 accept a discrepancy of 30 s.

For devices with product version E05 and higher, the discrepancy time can be set by the user in the range between 1 s and 250 s.

A signal discrepancy exists if the frequency of the signals deviates by at least 6.25%.

Remedy:

Check the parameter settings.

Check or correct wiring.

Replace initiators.

If the error still occurs, restart the device or replace the device.

Shaft breakage: Different rotational speeds at the encoder and at E2!

Diagnostics:

The ratio of the speed of the encoder to E2 does not match the set values.

For devices up to product version E03, a signal discrepancy of 5 s is accepted before the device changes to the error state.

Devices with product version E04 accept a discrepancy of 30 s.

For devices with product version E05 and higher, the discrepancy time can be set by the user in the range between 1 s and 250 s.

A signal discrepancy exists if the frequency of the signals deviates by at least 6.25%.

Remedy:

Check the parameter settings.

Check or correct wiring.

Check or replace encoder or initiator.

Error: Supply voltage above the defined range!

Diagnostics:

- 24 V DC devices: connected supply voltage too high
- 110-240 V AC/DC devices: external voltage at terminals U1, 15 or 25

Remedy:

Check or correct the supply voltage.

For 110-240 V AC/DC devices, also check the wiring of terminals U1, 15 and 25.

If the error still occurs, restart the device or replace the device.

Error: Supply voltage below the defined range!

Diagnostics:

The connected supply voltage is too low.

Remedy:

Check or correct the supply voltage.

If the error still occurs, restart the device or replace the device.

Error: Wiring at RF1 is faulty!

Diagnostics:

Output T3 is to be used as the supply for input RF1. Use of the outputs T1, T2, T4 or 24 V DC is not permitted.

Remedy:

Check or correct wiring.

Error: Wiring at RF2 is faulty!

Diagnostics:

Output T3 is to be used as the supply for input RF1. Use of the outputs T1, T2, T4 or 24 V DC is not permitted.

Remedy:

Check or correct wiring.

Error: RF1 does not close in time!

Diagnostics:

The feedback contact does not close within the set switch-off monitoring time, or if a feedback contact is not used, the bridge to T3 is missing.

The RF1 terminal is not connected to T3.

Remedy:

Check or correct wiring.

Replace contactor.

Error: RF2 does not close in time!**Diagnostics:**

The feedback contact does not close within the set switch-off monitoring time, or if a feedback contact is not used, the bridge to T3 is missing.
The RF2 terminal is not connected to T3.

Remedy:

Check or correct wiring.
Replace contactor.

Error: Wiring at MAG is faulty!**Diagnostics:**

Output T4 is to be used as the supply for input MAG. Use of the outputs T1, T2, T3 or 24 V DC is not permitted.

Remedy:

Check or correct wiring.
Replace position switch.

Error: Wiring at ST is faulty!**Diagnostics:**

Output T4 is to be used as the supply for input ST. Use of the outputs T1, T2, T3 or 24 V DC is not permitted.

Remedy:

Check or correct wiring.
Replace START pushbutton.

Error: Line fault at the START pushbutton!**Diagnostics:**

The START pushbutton was pressed for longer than 3.0 s, ST and T4 are bridged, or manual start is set instead of automatic start. There is a cross-circuit or short-circuit or the pushbutton is jammed.
Check wiring, START pushbutton, and parameter settings.

Remedy:

Observe actuation time.
Check parameter settings.
Check or correct wiring and pushbutton.

Error: Wiring at P1 or P2 is faulty!

Diagnostics:

Output T1 is to be used as the supply for input P1. Use of the outputs T2, T3, T4 or 24 V DC is not permitted.

Output T2 must be used for input P2. Use of the outputs T1, T3, T4 or 24 V DC is not permitted.

Remedy:

Check or correct wiring.

Replace position switch.

Error: Simultaneity error of the position switches!

Diagnostics:

The two contacts of the position switches at P1 and P2 do not open within 1.0 s.

Remedy:

Check or correct wiring.

Check or replace position switch.

Error: Wiring at EA1 or EA2 is faulty!

Diagnostics:

Output T1 is to be used as the supply for input EA1. Use of the outputs T2, T3, T4 or 24 V DC is not permitted.

Output T2 must be used for input EA2. Use of the outputs T1, T3, T4 or 24 V DC is not permitted.

Remedy:

Check or correct wiring.

Error: Mode selector switch defective!

Diagnostics:

The antivalent mode selector switch at inputs EA1 and EA2 does not change its states within 1.0 s.

Remedy:

Check or correct wiring.

Check or replace mode selector switch.

8.5 Behavior in the event of a fault

8.5.1 Power failure

After failure of the supply voltage, the device is switched off. When the supply returns, the device is ready for operation again. For more information on power-up please refer to Chapter "Basic versions (Page 30)", section "Power-up/self-test".

8.5.2 Internal error

The device LED shows a red light in the case of an internal fault in the device. The device must be replaced and repair is not possible.

Note

The device LED on the 3TK2810-1 devices can also show a continuous red light if a discrepancy is found between the two internal processors that monitor each other. Apart from an actual device defect, extreme EMC influences may cause this discrepancy. If this is the case, however, the display will indicate an error code at the same time. Please notify us of this error code if the problem occurs again. With a cold start, i.e. after the control supply voltage has been interrupted, the 3TK2810-1 device forgets this error again.

8.5.3 Sensor fault

8.5.3.1 Position switch protective door

When the position switches are opened, contacts P1 and P2 must be opened within $t < 1.0$ s. If simultaneity is not satisfied, a diagnostics message appears on the display. After correction of the fault, it is necessary to perform a reset (see Troubleshooting) or a restart by switching the supply voltage off and on.

Both position switches must be closed to start output contact 23/24.

If only single-channel or two individual single-channel position switches are to be connected for a lower category, detection of simultaneity must be disabled in the menu. Terminals T2 and P2 must be jumpered when using a single-channel position switch. If no position switches are used, terminals T1 must be jumpered with P1, and terminals T2 with P2.

8.5.3.2 Speed sensor

If the speed encoder fails (encoder or initiators defective), the device immediately switches to the safe state (outputs are switched off).

The time until the error is reported can be set via the discrepancy time. This message must be acknowledged.

8.5.4 Fault in the feedback circuit

8.5.4.1 Contacts of the feedback circuit are not closed on starting

Connection of output contact 13/14 or 23/24 is only possible if the relevant feedback contact is closed.

A fault message is not displayed.

8.5.4.2 Contacts of the feedback circuit do not close after stopping

If the contacts of the feedback circuit do not close after the device is stopped, the contactors are still energized or defective. A message is displayed.

A restart or reset is necessary following correction of the fault.

8.5.5 Cross-circuit/short-circuit

If a cross-circuit or short-circuit is detected, the device switches to the safe state. An error message is generated and the diagnostics provides information on the location of the fault.

A restart or reset is necessary following correction of the fault.

8.5.6 Fault in the connection to the adapter

If an adapter module has been parameterized and the connection to the adapter is interrupted, or the adapter signals a fault, the device switches to the safe state. An error message is generated and the diagnostics provides information on the location of the fault.

A restart or reset is necessary following correction of the fault.

8.5.7 Violation of upper/lower parameterized speed limits

8.5.7.1 Automatic speed exceeded

If the parameterized maximum automatic speed is exceeded, the device switches immediately to the safe state. Contacts 23/24 are opened. The corresponding signaling outputs are switched.

8.5.7.2 Automatic speed undershot

If the parameterized minimum automatic speed is undershot, the device switches immediately to the safe state. Contacts 23/24 are opened and when the lower parameterized standstill speed limit is violated, contacts 13/14 are closed. The corresponding signaling outputs are switched.

8.5.7.3 Setup speed exceeded

If the parameterized maximum setup speed is exceeded, the device switches immediately to the safe state. Contacts 23/24 are opened. The corresponding signaling outputs are switched.

8.5.7.4 Setup speed undershot

If the parameterized minimum setup speed is undershot, the device switches immediately to the safe state. Contacts 23/24 are opened. The corresponding signaling outputs are switched.

8.5.7.5 Standstill speed exceeded

If the parameterized maximum standstill speed is exceeded, the device switches immediately to the safe state. Contacts 13/14 are opened. The corresponding signaling outputs are switched. Applies only in automatic mode, in setup mode contacts 13/14 are permanently closed.

8.5.7.6 Start override time exceeded

If the parameterized minimum setup or automatic speed (depending on the switch position) is not reached within the parameterized start override time t_a , the device switches immediately to the safe state. Contacts 23/24 are opened and when the lower parameterized standstill speed limit is violated, contacts 13/14 are closed. The corresponding signaling outputs are switched.

See also Chapter "Times (Page 53)"

8.5.8 Parameterized monitoring times exceeded/undershot**8.5.8.1 Release delay time undershot**

If "unlocked" is indicated at the MAG input before expiry of the release delay time t_v , the device switches immediately to the safe state. The corresponding signaling outputs are switched.

See also Chapter "Times (Page 53)"

8.6 Device replacement

** WARNING****Hazardous Voltage.****Can Cause Death, Serious Injury, or Property Damage.**

Before starting work, therefore, disconnect the system and devices from the power supply.

Note

When replacing a device, you do not need to re-wire it. The terminal blocks can be disconnected from the defective device and then connected to the new device.

Replace device

1. Disconnect the defective device.
See also Chapter "Disconnecting (Page 50)".
2. De-install the defective device.
See also Chapter "Disassembling the device (Page 45)".
3. Install the new device.
See also Chapter "Mounting the device on a DIN rail (Page 43)" or Chapter "Mounting the device on a level surface (Page 44)".
4. Connect the device.
See also Chapter "Connecting terminal blocks (Page 48)".

The device is powered up after the supply voltage has been applied.

For more information on power-up please refer to Chapter "Basic versions (Page 30), section "Power-up/self-test".

Parameterization following device replacement

After the device has been replaced, transfer the parameterization from the existing speed monitor.

See also Chapter "Copying parameters (Page 62)"

or

parameterize your speed monitor using the data sheet you have completed.

See also Chapter "Parameterization using the display (Page 55)" and Chapter "Parameterization menu (Page 57)"; or "Printed form for documenting the setting parameters (Page 97)".

** WARNING****Hazardous Voltage.****Can Cause Death, Serious Injury, or Property Damage.****Carry out functional test of the system**

To guarantee the safety of the system, a full functional test must be carried out and successfully concluded following parameterization.

Technical data

9.1 Technical data in Siemens Industry Online Support

Technical data sheet

You can also find the technical data of the product at Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/>).

1. Enter the full article number of the desired device in the "Product" field, and confirm with the Enter key.
2. Click the "Technical data" link.

The screenshot shows the Siemens Industry Online Support search interface. At the top, there is a "Product tree" dropdown set to "All" and a search bar labeled "Enter keyword...". Below this, the search results are displayed. The "Product" field contains the article number "3RV2015-4BA10", which is highlighted with a red box. The "Entry type" dropdown is set to "Technical data (1)", also highlighted with a red box. The "Date" field has "From" and "To" input boxes. Below the search filters, there is a "Search product" button. The search results section shows a product image placeholder and the product name "3RV2015-4BA10" in red. Below the name, the product description is listed: "CIRCUIT BREAKER, SCREW TYPE, 20 A CIRCUIT BREAKER SIZE S2 FOR MOTOR PROTECTION, CLASS 10, A-RELEASE 14...20A, N-RELEASE 20DA, SCREW TERMINAL, STANDARD BREAKING CAPACITY". At the bottom of the results, there are navigation links: "> Product details", "> Technical data" (highlighted with a red box), and "> CAx data".

9.2 Overview tables

Overview tables technical data

You will find overview tables with technical data in the "Product information" tab in our online ordering system.

See also

Overview tables (<https://mall.industry.siemens.com/mall/en/WW/Catalog/Products/10027588?tree=CatalogTree>)

9.3 Drilling pattern

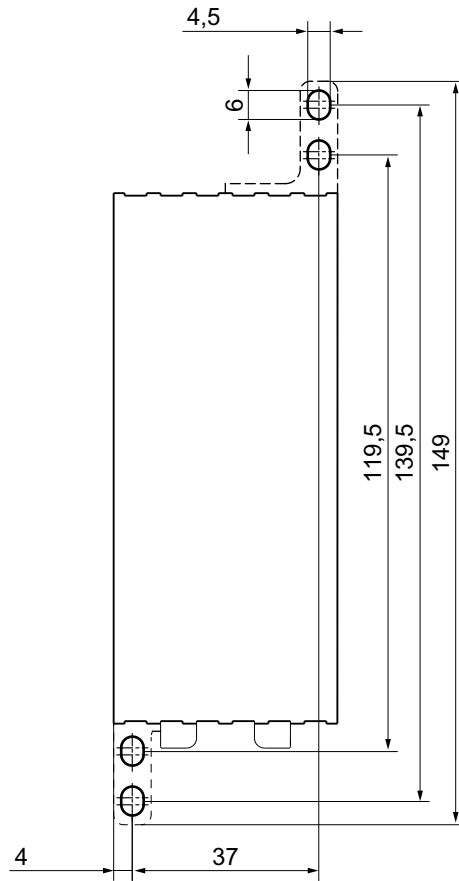


Figure 9-1 Drilling diagram Enclosure 45 mm

9.4 Derating

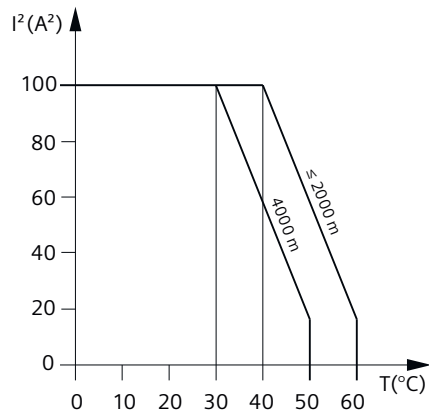


Figure 9-2 Derating table

Max. permissible current at 60 °C (≤ 2000 m) or 50 °C (4000 m) over 4 contact rows =
 $2 \text{ A} \triangleq 4 \times 2^2 \text{ A}^2 = 16 \text{ A}^2$

$$I^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$$

I_1, I_2, I_3, I_4 - Current in the contact paths

Total current limit curve

At an operating altitude > 2000 m, corresponding adjustment of the curve by -0.5 °C / 100 m.

Note

There are no changes to the safety characteristics specified in the data sheet for use between 2000 m and 4000 m.

9.5 Electrical endurance

Table 9-1 Electrical endurance of the relay outputs of the speed monitor

Utilization category	U_e (V)	I_e (A)	B10 _d value (operating cycles)
AC-15	230	0.5	8000000
		1	500000
		2	90000
DC-13	24	1	1500000
		2	190000
		3	85000
		4	20000

Valid for AC-15:cos (phi)on = 0.7; cos(phi)off = 0.4 inductive

DC-13 (tau) 0 ... 100 ms inductive

9.5 Electrical endurance

CAX data

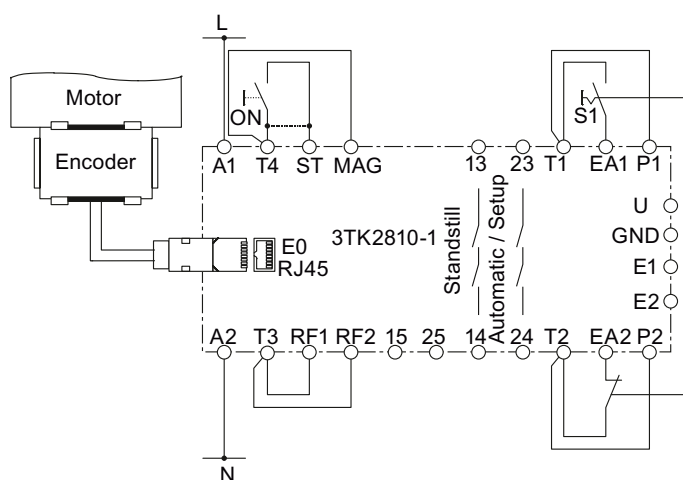
10.1 CAX data

You can find the CAX data in the Siemens Industry Online Support.

1. Enter the full article number of the desired device in the "Product" field, and confirm with the Enter key.
2. Click the "CAX data" link.

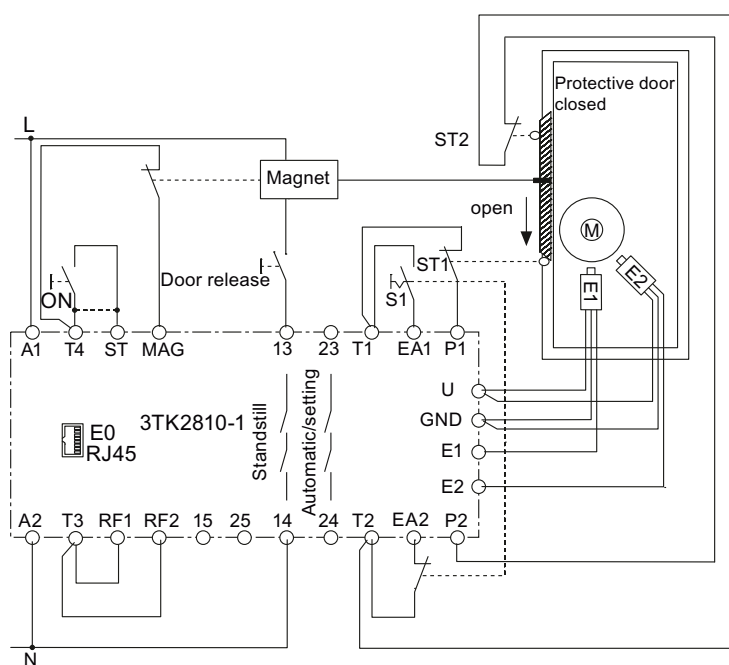
The screenshot shows the Siemens Industry Online Support search interface. At the top, there is a "Product tree" dropdown set to "All" and a search bar labeled "Enter keyword...". Below this, the search results are displayed. The "Product" field contains the article number "3RV2015-4BA10", which is highlighted with a red box. The "Entry type" dropdown is set to "Technical data (1)", also highlighted with a red box. The "Date" field has "From" and "To" input boxes. Below the search filters, the search results are listed. The first result is for the product "3RV2015-4BA10", which is highlighted with a red box. The product description is: "CIRCUIT BREAKER, SCREW TYPE, 20 A CIRCUIT BREAKER SIZE S2 FOR MOTOR PROTECTION, CLASS 10, A-RELEASE 14...20A, N-RELEASE 20DA, SCREW TERMINAL, STANDARD BREAKING CAPACITY". Below the product description, there are navigation links: "> Product details", "> Technical data", and "> CAX data". The "CAX data" link is highlighted with a red box.

Application examples



Speed and standstill monitoring using suitable encoder, automatic mode; for manual start, START pushbutton at T4 / ST; for automatic start, bridge at T4 / ST; suitable up to SIL 3, PL e.

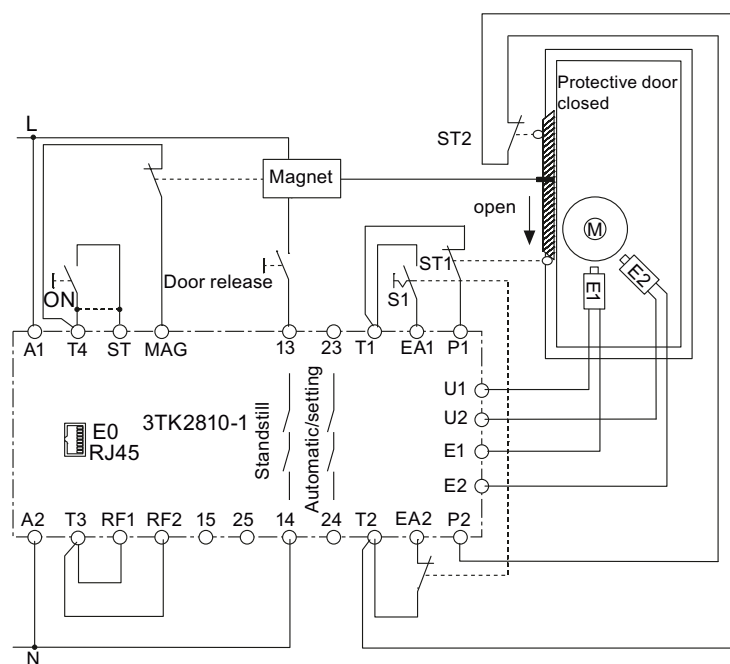
A prerequisite for PL e is that start-up testing must be performed for longer standstill times (standstill time > 24 h) and that the motion time (starting a motion until the next standstill) is regularly longer than the discrepancy time.



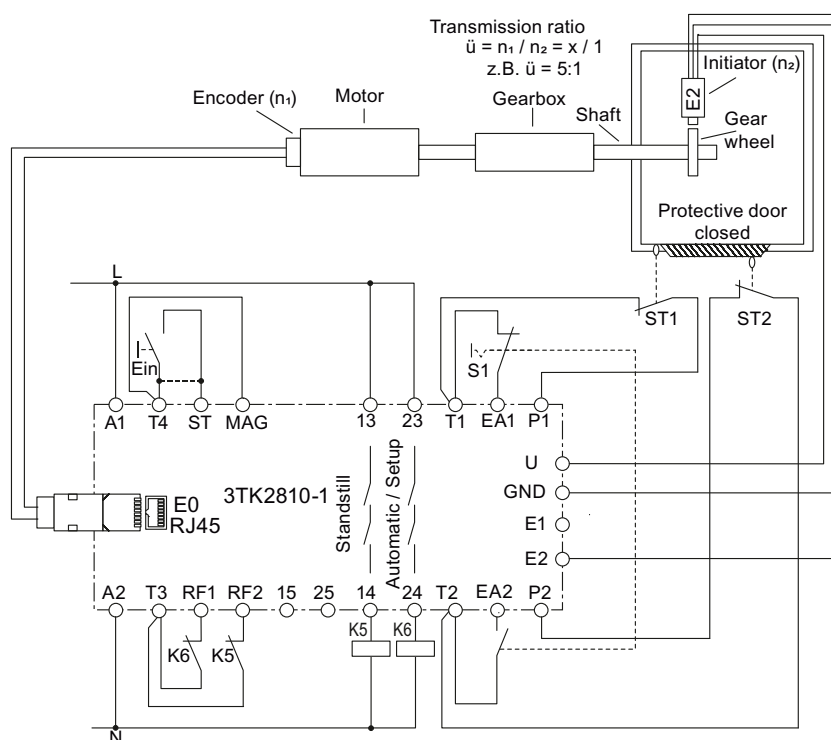
Two-channel speed and standstill monitoring using two NPN or PNP proximity switches; automatic mode; protective door monitoring active; for manual start, START pushbutton at T4 / ST; for automatic start, bridge at T4 / ST; suitable up to SIL 3, PL e.

A prerequisite for PL e is that start-up testing must be performed for longer standstill times (standstill time > 24 h) and that the motion time (starting a motion until the next standstill) is regularly longer than the discrepancy time.

Please read the note "Connecting the initiators" in Chapter "Product-specific information (Page 17)".



Speed and standstill monitoring using two NAMUR sensors; automatic mode; protective door monitoring active; for manual start, START pushbutton at T4 / ST; for automatic start, bridge at T4 / ST; suitable up to SIL 3, PL e.



Speed and standstill monitoring using encoder and one NPN or PNP proximity switch; setup mode; transmission ratio set; protective door monitoring active; for manual start, START button at T4 / ST; for automatic start, bridge at T4 / ST; suitable up to SIL 3, PL e.

A prerequisite for PL e is that start-up testing must be performed for longer standstill times (standstill time > 24 h) and that the motion time (starting a motion until the next standstill) is regularly longer than the discrepancy time.

Appendix

A.1 Printed form for documenting the setting parameters

Device:	3TK2810-1
Device number:	
Configuration carried out by:	
Date:	

1.	Parameter assignment	
1.1	Monitored motion	
		Translational
		Rotational
1.2	Encoder type	
		Lin. encoder
		Rot. encoder
1.3	Encoder selection	
		RJ45: Encoder + E2
		RJ45: Encoder
		E1+ E2
1.4	Lead/transformation	
		Transformation
		Lead
1.5	Encoder settings	
		Signal form
		sin/cos or TTL
		HTL
		Resolution
1.6	Initiator settings	
		Initiator type
		pnp
		nnp
		Resolution E1
		Resolution E2
1.7	Speed limits	
		Automatic max.
		Automatic min.
		Setting max.
		Setting min.
		Standstill
1.8	Times	
		Start override

A.1 Printed form for documenting the setting parameters

			Release delay
			Switch-off monitoring
			Discrepancy time
	1.9	Start type	
			Manual start
			Automatic start
	1.10	Protective door monitoring	
			Simultaneity on
			Simultaneity off

Note

Please complete the printed form and keep it in a safe place!

