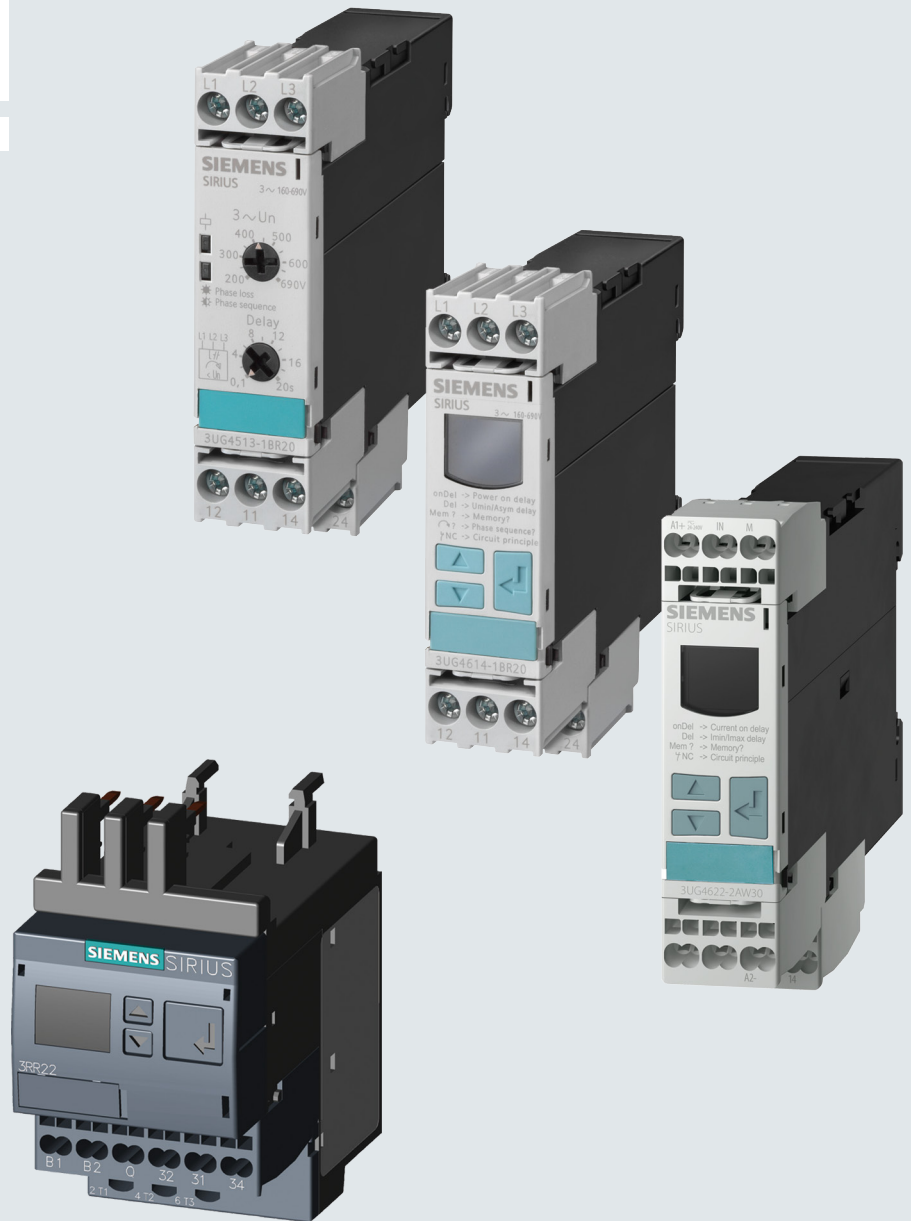


SIEMENS



# Industrial Controls

## Monitoring and Control Devices

### 3UG4 / 3RR2 Monitoring Relays

Manual

Edition

05/2016

siemens.com



## Industrial Controls

### Monitoring and control devices 3UG4 / 3RR2 monitoring relays




#### Manual

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## Legal information

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 <b>DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.
 <b>WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
 <b>CAUTION</b>
indicates that minor personal injury can result if proper precautions are not taken.
<b>NOTICE</b>
indicates that property damage can result if proper precautions are not taken.


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### 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.

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 <b>WARNING</b>
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.

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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

## Purpose of the manual

This manual describes the 3UG4 monitoring relays for stand-alone assembly and the 3RR2 current monitoring relays for mounting on 3RT2 contactors

The manual provides overview information for integrating the monitoring relays into the system environment, and it describes the hardware and software components of the devices.

The information in this manual enables you to commission the monitoring relays.

## Required basic knowledge

To understand these operating instructions you should have a general knowledge of automation engineering and low-voltage switchgear.

## Scope of the manual

The manual is valid for these monitoring relays. It contains a description of the devices that is valid at the time of publication.

## 1.1 Service&Support

### Online Support

The Online Support in the Service&Support portal is an extensive information system for all questions relating to Siemens products and solutions. This service enables direct and central access to in-depth information concerning the products, systems and applications for industry and to a large number of programming, configuration and application examples. Its content is available via a mobile app.

The Technical Forum of the Online Support provides the opportunity for users to swap information. Support Request allows contact to be established with Siemens experts in Technical Support.

Siemens Industry Online Support ensures that users in industry are always kept up-to-date with news, software updates and announcements by means of newsletters and Twitter.

**Links:** Service&Support Portal (<http://support.automation.siemens.com>), Online Support (<http://support.automation.siemens.com/WW/view/en/16605022>)

## Product Support

Are you looking for product information such as technical data, updates or FAQs? Here, the "Product Support" section of the Service & Support Portal offers an extensive collection of all information about the Siemens Industry Automation and Drive Technologies products and solutions:

- Answers to frequently asked questions (FAQs)
- Updates/upgrades, service packs and support tools for downloading
- Manuals and operating instructions
- Technical data/CAx data
- Approvals and certificates
- Test certificates and characteristic curves

All Product Support information is at your disposal free of charge and around the clock, and you always get the current version.

**Link:** Product Support (<http://support.automation.siemens.com/WW/view/en/4000024>)

## CAx data

The CAx Download Manager provides you with a simple means of gaining access to up-to-date product data for your CAx or CAe system.

You configure your own download package with just a few clicks. You can choose from the following information for products

- Product images
- 2D dimensional drawings
- 3D models
- Internal circuit diagrams
- EPLAN macro files
- Manuals
- Characteristics
- Operating instructions
- Certificates
- Product master data

**Link:** CAx Download Manager (<http://support.automation.siemens.com/WW/view/en/42455541>)

## Applications & Tools

Applications & Tools supports you with various tools and examples when it comes to solving your automation tasks. Solutions are presented in interaction with several components in the system, without focusing on individual products.

- Application examples
- Function blocks & tools
- Background and system descriptions
- Performance statements
- Demonstration systems/videos

**Link:** Applications & Tools (<http://support.automation.siemens.com/WW/view/en/20208582>)

## My Documentation Manager

My Documentation Manager enables you to compile your own documentation from our standard documents (manuals), which are located in the Product Support section. Under mySupport, you have the opportunity to create and manage you own compilations in a structure of their own.

**Link:**

MyDocumentationManager (<http://support.automation.siemens.com/WW/view/en/38715968>)

## Reference

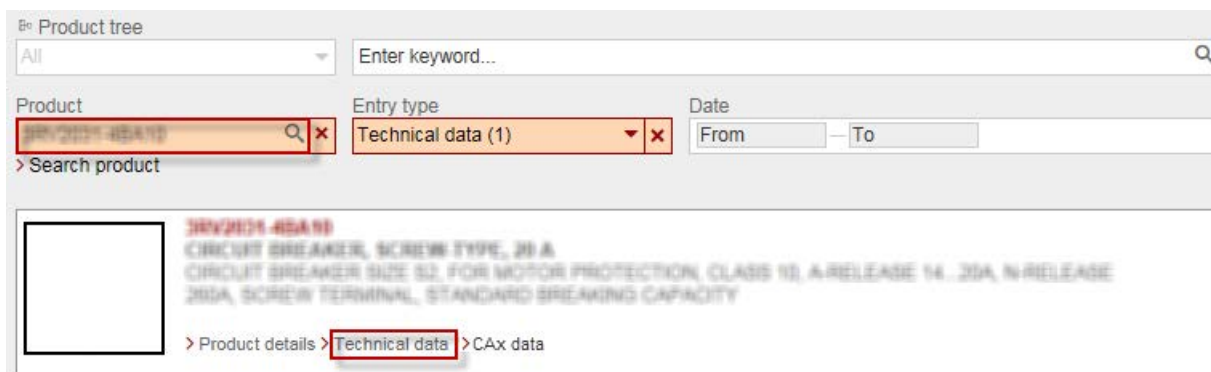
You can find further information on structure and navigation in Online Support here (<http://support.automation.siemens.com/WW/view/en/11774658>).

## 1.2 Technical data in Siemens Industry Online Support

### Technical data sheet

You can find all the technical data of the product in the Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/16364/td>).

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.



### Compare products

You can compare the technical data of the products in Siemens Industry Online Support.

1. Select the products you want to compare.
2. Click the "Compare technical data" button.

### Further documentation

To install and connect the monitoring relays, you require the operating instructions of the monitoring relays used.

The Appendix "References (Page 361)" has a list of the operating instructions.

## 1.3 DataMatrix code

A DataMatrix code is lasered onto all 3UG4/3RR2 monitoring relay devices underneath the label.

The DataMatrix codes are standardized in ISO/IEC 16022. The DataMatrix codes on Siemens devices use ECC200 coding for powerful error correction.

The following device information is encoded in the DataMatrix codes as a bit stream:

- Article number
- Serial number
- If applicable, MAC address

This information is stored in the following format in the DataMatrix code:

1P	Article number	+	S	Location	/	Date	Serial number
Data identifier	User content	Separator	User content	Separator	User content	User content	

---

### Note

The information content is displayed without spaces.

---

This machine-readable information simplifies and accelerates handling of the respective devices.

As well as fast access to the serial numbers of the respective devices for unique identification, the DataMatrix codes simplify communication with Siemens Technical Support.

## SIEMENS Industry Support App

DataMatrix codes primarily enable extremely fast and convenient access to all device-specific information relating to an article number in the SIEMENS Service&Support Portal, such as operating instructions, manuals, data sheets, FAQs, etc.

We provide the SIEMENS Industry Support app free for this purpose and it can be used on most commercially available smartphones and tablets.

The SIEMENS Industry Support app is available for iOS and Android-based devices and can be accessed via the following links:



Link for Android



Link for iOS

## Recycling and disposal

These devices can be recycled thanks to their low pollutant content. For environmentally-friendly recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

## Up-to-the-minute information

You can obtain further assistance by calling the following numbers:

### Technical Assistance:

Telephone: +49 (911) 895-5900 (8 a.m. to 5 p.m. CET)

Fax: +49 (911) 895-5907

### or on the Internet at:

E-mail: (<mailto:technical-assistance@siemens.com>)

Internet: ([www.siemens.com/industrial-controls/technical-assistance](http://www.siemens.com/industrial-controls/technical-assistance))



## Safety information

### 2.1 Standards

#### Applicable standards

The monitoring relays comply with the following standards:

Table 2- 1 Standards - monitoring relays

Device standards	<ul style="list-style-type: none"> <li>• IEC / EN 60947-1 "Low-voltage switchgear and controlgear: General rules"</li> <li>• IEC / EN 60947-4-1 "Contactors and motor-starters: Electromechanical contactors and motor-starters"</li> <li>• IEC / EN 60947-5-1 "Control circuit devices and switching elements: Electromechanical control circuit devices"; VDE 0660 "Low-voltage switchgear"</li> <li>• IEC / EN 61557-8 "Equipment for testing, measuring or monitoring of protective measures - Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC, Part 8: Insulation monitoring devices for IT systems".</li> <li>• DIN EN 50042 "Terminal marking"</li> <li>• DIN EN 61869-2 "Instrument transformers - Part 2: Additional requirements for current transformers"</li> </ul>
EMC standard <sup>1)</sup>	<ul style="list-style-type: none"> <li>• IEC / EN 61000-6-2 "Generic standards - Immunity for industrial environments"</li> <li>• IEC / EN 61000-6-4 "Generic standards - Emission standard for industrial environments"</li> </ul>
Resistance to extreme climates	<ul style="list-style-type: none"> <li>• IEC 60721-3-3 "Classification of environmental conditions"</li> </ul> <p>The monitoring relays are climate-proof according to IEC 60721-3.</p>
Touch protection	<ul style="list-style-type: none"> <li>• IEC / EN 60529 "Degrees of protection provided by enclosures"</li> </ul> <p>Monitoring relays are safe to touch in accordance with IEC / EN 60529.</p>


<sup>1)</sup> This is a device of Class A. When used in domestic areas, the device can cause radio interference. Users may have to take suitable measures.

#### Reference


SIRIUS components have been approved by a whole range of bodies for various sectors (shipbuilding, etc.). An up-to-date list of approvals appears in Chapter 10 of the Catalog IC 10 - SIRIUS "Industrial Controls" ([www.siemens.com/industrial-controls/catalogs](http://www.siemens.com/industrial-controls/catalogs)), and more information, as well as an option to download certificates, can be obtained on the Internet ([www.siemens.com/automation/csi\\_en](http://www.siemens.com/automation/csi_en)).

## 2.2 Product-specific safety information

### Intended use

 <b>WARNING</b>
<b>Intended use</b> <b>Can Cause Death, Serious Injury, or Property Damage.</b> The devices may only be used for the applications described in the catalog and the technical description, and only in conjunction with equipment or components from other manufacturers which have been approved or recommended by Siemens. This product can function correctly and reliably only if it is transported, stored, assembled, and installed correctly, and operated and maintained as recommended. Before you run any sample programs or programs that you have written yourself, make sure that running the plant cannot cause injury to anyone else or damage to the machine itself.

### Hazardous Voltage

 <b>WARNING</b>
<b>Hazardous Voltage.</b> Will cause death or serious injury. Turn off and lock out all power supplying this device before working on this device.

### Radio interference

---

**Note**

The devices have been built as Class A devices.  
Use of these devices in domestic areas can result in radio interference!

---

## 2.3 Approvals, test certificates, characteristics

### Approvals, test certificates, characteristics

You can find an overview of the certifications available for low-voltage controls and distribution products and other technical documentation, updated daily, on the Internet ([www.siemens.com/industrial-controls/support](http://www.siemens.com/industrial-controls/support)).

You will find further information in the Catalog IC 10 - SIRIUS "Industrial Controls," Chapter 10 ([www.siemens.com/industrial-controls/catalogs](http://www.siemens.com/industrial-controls/catalogs)).

# System overview

## 3.1 Product description

### Product description

The tried and tested SIRIUS monitoring relays for electrical and mechanical quantities enable constant monitoring of all important characteristic quantities that provide information about the reliability performance of the plant. Sudden disturbances and gradual changes, which may reveal a maintenance requirement, for example, are both indicated. By means of relay outputs, the monitoring relays enable direct shutdown of the affected sections of the plant as well as issuing an alarm (e.g. by switching on a warning lamp). To respond flexibly to short-term disturbances such as voltage dips or load variation, the monitoring relays have settable delay times. This avoids unnecessary alarming and shutdowns while enhancing plant availability.

The individual 3UG4 monitoring relays offer the following functions in various combinations:

- Undershoot and/or overshoot of liquid levels
- Phase sequence
- Phase failure, neutral failure
- Phase asymmetry
- Undershoot and/or overshoot of voltage thresholds
- Undershoot and/or overshoot of current thresholds
- Undershoot and/or overshoot of power factor thresholds
- Monitoring of the active current or apparent current
- Monitoring of the fault current
- Monitoring the insulation resistance
- Undershoot and/or overshoot of speed thresholds

The 3RT2 contactors for mounting on 3RR2 current monitoring relays offer:

- Phase sequence
- Phase failure
- Undershoot and/or overshoot of current thresholds
- Monitoring of the active current or apparent current
- Monitoring of the fault current

## 3.2 Application planning

The following information must be taken into account when planning applications involving the SIRIUS monitoring relays.

### Installation altitude

The monitoring relays are approved for installation altitudes up to 2,000 m. The reduced air density at altitudes higher than 2,000 meters affects the electrical characteristics of the monitoring relays. The reduction factors which have to be taken into account when using monitoring relays at altitudes higher than 2,000 m can be obtained on request on the Internet ([www.siemens.com/automation/csi\\_en](http://www.siemens.com/automation/csi_en)).

### Operating conditions and resistance to extreme climates

The monitoring relays are climate-proof. They are intended for use in enclosed spaces in which no severe operating conditions prevail (e.g. dust, caustic vapors, hazardous gases). Appropriate measures must be taken when installing in areas subject to dust and humidity. Condensation on the devices is not permissible.

### Special application environments

The SIRIUS devices have been approved by a whole range of bodies for various sectors (shipbuilding, etc.). An up-to-date list of approvals is provided in Chapter 10 of the Catalog IC 10 - SIRIUS "Industrial Controls." You will find more information and an option to download certificates on the Internet ([www.siemens.com/automation/csi\\_en](http://www.siemens.com/automation/csi_en)).

## 3.3 Connection methods

### 3.3.1 Screw-type connection


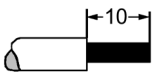
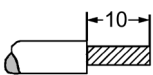
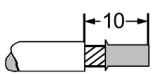
#### Screw-type connection

Use the following tool to establish the connection: All SIRIUS monitoring relays feature size PZ 2 screws for Pozidriv screwdrivers.

The devices have screw terminals with captive screws and washers. The screw terminals also allow for the connection of 2 conductors with different cross-sections.

#### Connection cross-sections of the removable terminal blocks with screw-type connections


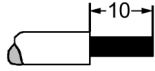
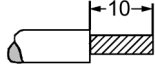
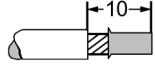
Table 3- 1 Removable terminal block with screw-type connections - monitoring relays

		Removable terminal
Tool		Pozidriv size PZ 2, Ø 5 to 6 mm
Tightening torque		0.8 to 1.2 Nm
Solid and stranded		1 x (0.5 to 4) mm <sup>2</sup>
		2 x (0.5 to 2.5) mm <sup>2</sup>
Finely stranded without end sleeve		---
Finely stranded with end sleeve		1 x (0.5 to 2.5) mm <sup>2</sup>
		2 x (0.5 to 1.5) mm <sup>2</sup>
AWG		2 x (20 to 14)

**Connection cross-sections of the permanently connected terminal blocks with screw-type connections**

The following table lists the permissible conductor cross-sections for the main conductor connections of 3RR2 current monitoring relays with analog and digital setting (size S00, S0 and S2) with screw-type connections.

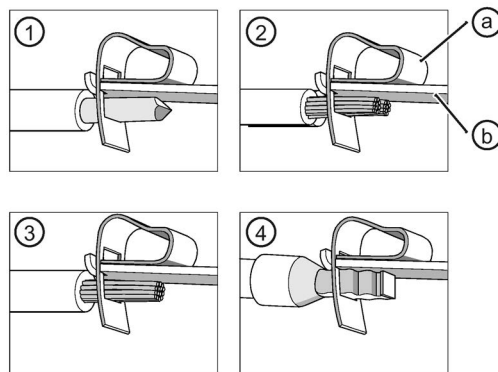
Table 3-2 Permanently connected terminal block with screw-type connection - Main conductor terminals of the 3RR2 current monitoring relays

		Permanently connected terminal		
		Size S00	Size S0	Size S2
Tool		Pozidriv size PZ 2, Ø 5 to 6 mm	Pozidriv size PZ 2, Ø 5 to 6 mm	Pozidriv size PZ 2 Ø 5 to 6 mm
Tightening torque		0.8 to 1.2 Nm	2 - 2.5 Nm	3 to 4.5 Nm (27 to 40 lb.in)
Solid and stranded		2 x (0.5 to 1.5) mm <sup>2</sup>	2 x (1 to 2.5) mm <sup>2</sup>	2 x (1.0 to 35 mm <sup>2</sup> )
		2 x (0.75 to 2.5) mm <sup>2</sup>	2 x (2.5 to 10) mm <sup>2</sup>	1 x (1.0 to 50 mm <sup>2</sup> )
		max. 2 x (1 ... 4) mm <sup>2</sup>		
Finely stranded without end sleeve		---	---	---
Finely stranded with end sleeve		2 x (0.5 to 1.5) mm <sup>2</sup>	2 x (1 to 2.5) mm <sup>2</sup>	2 x (1.0 to 25 mm <sup>2</sup> )
		2 x (0.75 to 2.5) mm <sup>2</sup>	2 x (2.5 to 6) mm <sup>2</sup>	1 x (1.0 to 35 mm <sup>2</sup> )
			max. 1 x 10 mm <sup>2</sup>	
AWG		2 x (20 to 14)	2 x (16 to 12)	2 x (18 to 2)
		1 x 12	2 x (14 to 8)	1 x (18 to 1)

### 3.3.2 Spring-loaded connection

#### Spring-loaded connection

All SIRIUS monitoring relays have spring-loaded connections. They make wiring quick and maintenance-free, while also meeting high demands in terms of vibration and shock resistance. If the cross-section of a connectable wire is greater than 6 mm<sup>2</sup>, the forces required for operation of the tension spring are so high that the spring-loaded connection can no longer be used in a problem-free manner. For this reason, size S2 current monitoring relays are only offered with screw-type or spring-loaded terminals in the control circuit. The terminals of the main current paths are always screw-type terminals.



- ① Solid
- ② Finely stranded
- ③ Stranded
- ④ Finely stranded with end sleeve
- a Spring-loaded terminal
- b Busbar

Image 3-1 Spring-loaded terminal

The conductors can be clamped directly or you can pre-treat them to add a form of splice protection. This could involve attaching end sleeves or pin cable lugs to the ends of the conductors; the tidiest solution is to use conductors whose ends have been sealed by means of ultrasound.

### 3.3 Connection methods

The devices are equipped with a two-wire terminal, i.e. two independent connections for each current path (exception: in the case of 3RR2, terminals of the main current paths have one clamping point). Just one conductor is connected to each clamping point. The spring-loaded terminal presses the conductor against the busbar, which curves around inside the terminal. The high contact pressure per unit area achieved in this way is gas-tight. The spring-loaded terminal presses flat against the conductor, but does not damage it. The spring force of the spring-loaded terminal has been dimensioned such that the clamping force adjusts to the conductor diameter automatically. This ensures that any conductor deformation caused by settling, creepage, or yielding is compensated for. The clamping point cannot become loose of its own accord. This connection is vibration- and shock-proof. Vibrations or shocks will not damage the conductor, nor will they cause contact separation. These terminals are particularly well suited for use with machines and systems which are subject to stresses such as these, e.g. vibrators, rail vehicles, and elevators.

The contact pressure between the conductor and the busbar is set to an optimum level, so this clamp connection is appropriate for high-voltage applications, as well as for transferring voltages and currents in the mV or mA range within instrumentation and electronic components.

A standardized screwdriver (3 mm slot; 3RA2908-1A) is offered in the Catalog IC10 "Industrial Controls" ([www.siemens.com/industrial-controls/catalogs](http://www.siemens.com/industrial-controls/catalogs)) as an actuation tool for opening the spring-loaded terminals.



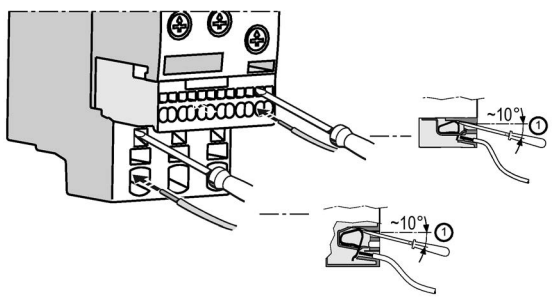
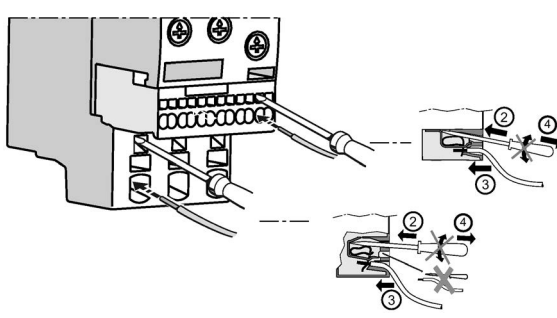
### Spring-loaded connection for mountable 3RR2 current monitoring relays

The table below describes the procedure for creating a spring-loaded connection:



<b>! DANGER</b>	
<b>Hazardous Voltage.</b>	
Will cause death or serious injury.	
Turn off and lock out all power supplying this device before working on this device.	

Table 3- 3 Connecting the 3RR2 current monitoring relay spring-loaded terminal

Step	Instructions	Figure
1	Insert the screwdriver into the respective operating slot.	
2	Press the screwdriver down, then push it into the operating slot as far as it will go. The screwdriver blade keeps the spring-loaded terminal open automatically.	
3	Insert the conductor into the oval connection slot.	
4	Remove the screwdriver. The terminal closes and the conductor is now securely clamped.	

#### Note

#### Damage to spring-loaded terminal on the 3RR2 current monitoring relay!

If you insert the screwdriver into the central opening (main circuit S00 and S0 only) on the spring-loaded terminal, this could damage the terminal.

Do not insert the screwdriver into the central opening on the spring-loaded terminal.

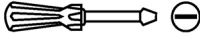
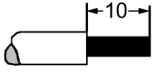
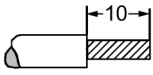
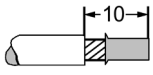
Spring-loaded terminal for 3UG4 monitoring relay

Table 3- 4 Connecting the monitoring relay spring-loaded terminal

Step	Operating instruction	Figure
1	Insert the screwdriver into the topmost (A) or bottommost (B) operating slot on the right-hand side.	
2	Press the screwdriver up (A) or down (B), then push it into the operating slot as far as it will go. The screwdriver blade keeps the spring-loaded terminal open automatically.	
3	Insert the conductor into the oval connection slot.	
4	Remove the screwdriver. The terminal closes and the conductor is now securely clamped.	

### Connection cross-sections of the removable terminal blocks with a spring-loaded connection (3RR and 3UG)

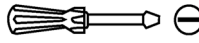
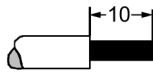
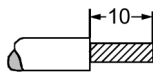
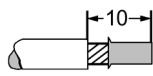
Table 3- 5 Removable terminal block with spring-loaded connections - monitoring relays

		Removable terminal
Tool		Ø 3.0 x 0.5 (3RA2908-1A)
Solid and stranded		2 x (0.25 to 1.5) mm <sup>2</sup>
Finely stranded without end sleeve		2 x (0.25 to 1.5) mm <sup>2</sup>
Finely stranded with end sleeve		2 x (0.25 to 1.5) mm <sup>2</sup>
AWG		2 x (24 to 16)

### Connection cross-sections of the permanently connected terminal blocks with a spring-loaded connection

The following table lists the permissible conductor cross-sections for the main conductor terminals of the 3RR2 current monitoring relays for analog and digital setting (size S00 and S0) with a spring-loaded connection.

Table 3- 6 Permanently connected terminal block with spring-loaded connection - main conductor terminals of 3RR2 current monitoring relays

		Permanently connected terminal	
		Size S00	Size S0
Tool		Ø3.0 x 0.5 (3RA2908-1A)	Ø3.0 x 0.5 (3RA2908-1A)
Solid		1 x (0.5 to 4) mm <sup>2</sup>	1 x (1 to 10) mm <sup>2</sup>
Finely stranded without end sleeve		1 x (0.5 to 2.5) mm <sup>2</sup>	1 x (1 to 6) mm <sup>2</sup>
Finely stranded with end sleeve		1 x (0.5 to 2.5) mm <sup>2</sup>	1 x (1 to 6) mm <sup>2</sup>
AWG		1 x (20 to 12)	1 x (18 to 8)

### 3.3.3 Device replacement by means of removable terminals



**! DANGER**  
**Hazardous Voltage**  
 Will cause death or serious injury.  
 Turn off and lock out power before working on this equipment.

The removable terminals of 3UG4 monitoring relays facilitate device replacement when necessary. The mechanical coding on the terminals prevents mix-ups.

**Note**

The terminals can only be dismantled in the following order due to their arrangement on the monitoring relay:

1. Lower, front terminal (A)
2. Lower, rear terminal (B)
3. Upper, front terminal (C)
4. Upper, rear terminal (D)

Step	Instructions	Figure
1	Press the interlock in the direction of the removable terminal.	
2	Remove the terminal to the front.	
3 / 4	Attach the new terminal and press the terminal into the device until the interlock audibly engages.	

**Note**

The procedure is similar on devices with fewer connection terminals.

## **3.4 Mounting / removal**

### **3.4.1 Mounting 3RR2 current monitoring relay**

#### **Mounting options**

3RR2 current monitoring relays are matched to 3RT2 contactors and 3RF34 (size S0) solid-state contactors in terms of their electrical and mechanical features. As a result, direct mounting can be achieved easily.

Alternatively, the devices can also be installed individually in the case of stand-alone assembly or if a 3RU2 / 3RB3 overload relay is being used at the same time. The accessories required for separate mounting are described in Chapter "Terminal support for stand-alone assembly (Page 324)."

#### **Minimum clearance**

The following minimum clearances from grounded and live parts must be complied with when installing the 3RR2 monitoring relay:

- At the side: 6 mm
- Forward (on front): 6 mm

#### **Mounting position**

It can be mounted in any position.

**Direct mounting on 3RT2 contactor / 3RF34 (size S0) solid-state contactor**

The diagram below shows an example mounting scenario based on mounting the 3RR21 analog setting current monitoring relay, size S0, on the 3RT2 contactor.

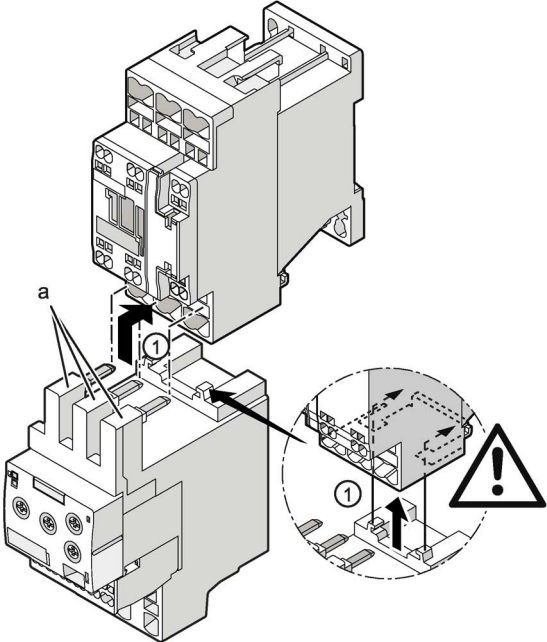
Table 3- 7 Mounting of 3RR2 current monitoring relay, screw-type connection system (size S0)

Step	Instructions	Figure
1	Push the current monitoring relay into the contactor from below. Attach the two hooks on the current monitoring relay to the two openings on the rear of the contactor. This pushes the main current contacts into the corresponding terminals on the contactor.	
2	Tighten the screws on the contactor with a Pozidriv size 2 (S00) or Pozidriv size 3 (S0) screwdriver (tightening torque 0.8 ... 1.2 Nm). Check that the cable is clamped tight.	

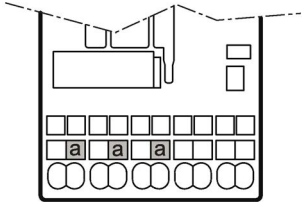
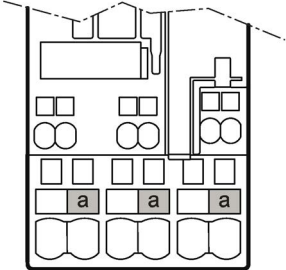
**Note**

The connection cross-sections of the removable and permanently connected terminal blocks with screw-type connections are described in the Chapter "Screw-type connection (Page 21)".

Table 3- 8 Mounting of 3RR2 current monitoring relay, spring-loaded connection system (size S0)

Step	Instructions	Figure
1	<p>Insert the contacts (a) into the central opening of the spring-loaded terminals on the contactor (see below, a), with the contacts flush to the right. Make sure that the guide tabs (zoom view) are inserted into the designated slots on the contactor.</p> <p>The current monitoring relay will sit correctly flush with the contactor on the left- and right-hand sides.</p>	

The figures below show the openings of the main conductor terminals on the contactor (S00 and S0) into which the contacts on the current monitoring relay have to be inserted.

Main conductor terminal on the contactor (a) (S00):	Main conductor terminal on the contactor (a) (S0):
	

**Note**

**Adapter for direct mounting on 3RF34 solid-state contactor**

For direct mounting on a 3RF34 solid-state contactor, an additional 3RF3900-0QA88 adapter is required, which is attached to the solid-state contactor. Information is provided in the "SIRIUS solid state contactors / solid state reversing contactors" (<http://support.automation.siemens.com/WW/view/en/44362244>) operating instructions.

**Disassembly**

To disassemble the S00/S0/S2 assemblies from the DIN rail, press the contactor down and pull it toward you.

Table 3- 9 Removing the 3RR2 current monitoring relay, screw-type connection system (size S0)

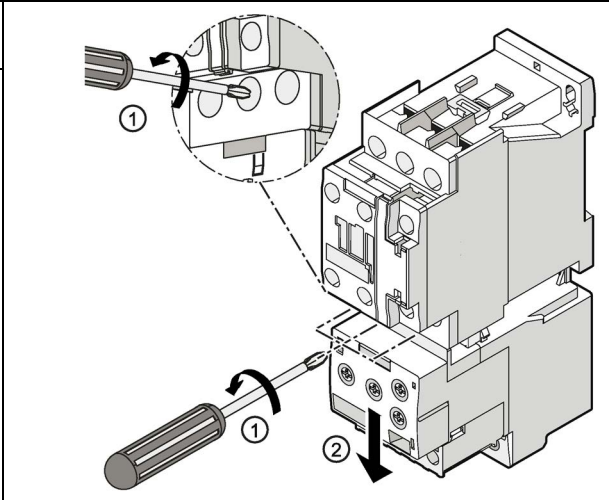
Step	Instructions	Figure
1	Undo the screws on the main conductor terminals.	
2	Pull the current monitoring relay down and away from the contactor.	

Table 3- 10 Removing the 3RR2 current monitoring relay, spring-loaded connection system (size S00)

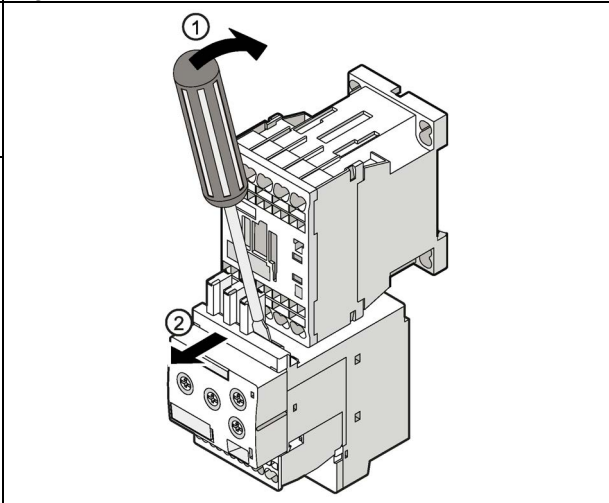
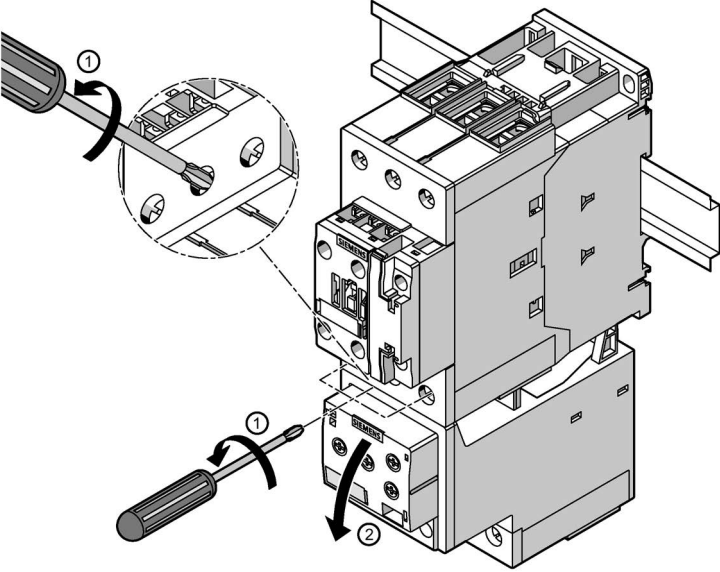
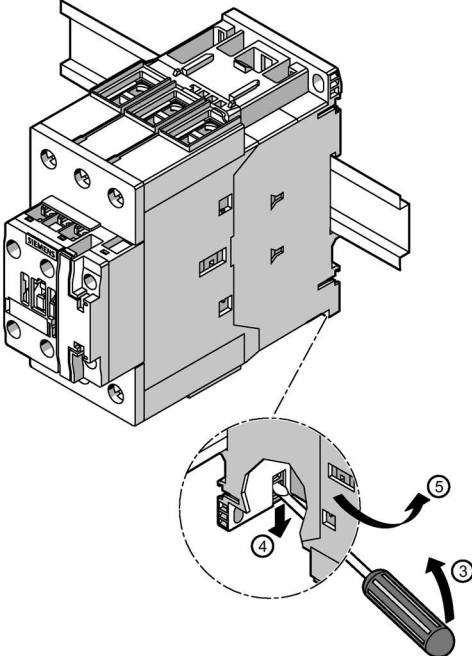
Step	Instructions	Figure
1	Position the screwdriver on the current monitoring relay as shown in the figure. Carefully dislodge the current monitoring relay from the contactor.	
2	Pull the current monitoring relay toward you and away from the contactor.	



Table 3- 11 Removing the 3RR2 current monitoring relay (size S2)

Step	Instructions	Figure
1	Undo the screws on the main conductor terminals.	
2	Pull the current monitoring relay down and away from the contactor	
3	Push the release slide down with a screwdriver	
4	Swing the contactor upwards to remove it	
5		

### Separately mounted

#### Note

The accessories required for separate mounting are described in the Chapter "Terminal support for stand-alone assembly (Page 324)".

### 3.4.2 Mounting the 3UG4 monitoring relay

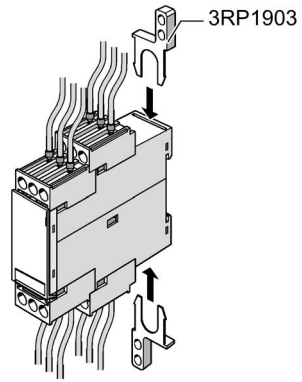
#### Mounting position

It can be mounted in any position.

#### Screw mounting

The illustration below shows how to screw-mount the 3UG4 monitoring relay.

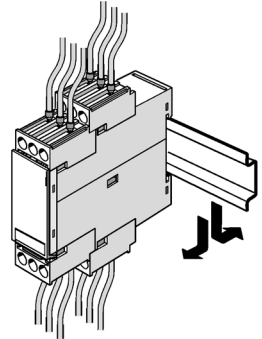
Table 3- 12 Mounting the monitoring relay (screw mounting)

Step	Operating instruction	Image
1	Slide the push-in lugs into the openings on the monitoring relay at the top and bottom, and use the screwdriver to secure the device by screwing suitable screws through the holes in the push-in lugs.	 <p>The diagram illustrates the screw-mounting process. A 3UG4 monitoring relay is shown with several wires connected to its top and bottom terminals. Two U-shaped push-in lugs, labeled '3RP1903', are being inserted into the top and bottom of the relay. Arrows indicate the direction of insertion. A screwdriver is shown at the bottom right, positioned to tighten a screw through the hole in the bottom lug to secure the relay to the rail.</p>

#### Standard-rail mounting

The illustration below shows how to mount the 3UG4 monitoring relay onto a standard rail.

Table 3- 13 Mounting the monitoring relay (mounting on and removing from standard rail)

Step	Operating instruction	Image
1	Position the device on the top edge of the mounting rail and press it down until it snaps onto the bottom edge of the rail.  To remove the device, press it down, pushing against the mounting springs, and swivel the device to remove it.	 <p>The diagram illustrates the standard-rail mounting process. A 3UG4 monitoring relay is shown with wires connected to its terminals. It is being positioned on top of a standard DIN rail. An arrow points downwards, indicating the direction to press the relay onto the rail. A small inset diagram shows the bottom edge of the rail with a spring mechanism that allows the relay to snap onto it.</p>

### 3.4.3 Installing the 3UG458. monitoring relay.

#### Rail mounting

The figure below shows how to install the 3UG458. insulation monitoring relay on a standard rail.

Table 3- 14 Installing the 3UG458. insulation monitoring relay (mounting onto standard rail)

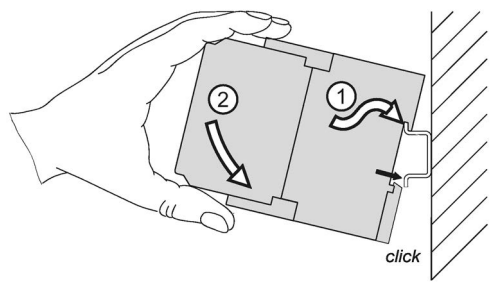
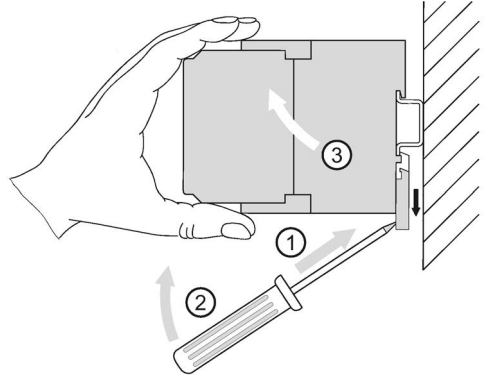
Step	Instructions	Figure
1 / 2	Position the device on the top edge of the DIN rail and press down until it snaps onto the bottom edge of the DIN rail.	

Table 3- 15 Removing the 3UG458. insulation monitoring relay. (Removing from standard rail)

Step	Instructions	Figure
1 / 2	To remove, apply the screwdriver to the device and push it up with a twisting motion against the tension of the fixing spring.	
3	Swing the device upwards to remove it.	

## 3.5 Overview of the functions

### 3.5.1 3RR2 current monitoring relays

Table 3- 16 Functions of the 3RR21 / 3RR22 current monitoring relays for analog and digital setting

Function	Current monitoring relay	
	3RR21	3RR22
<b>Current monitoring</b>		
Monitoring for undercurrent	2p	3p
Monitoring for overcurrent	2p	3p
Apparent current monitoring	✓	✓
Active current monitoring	—	✓
Range monitoring	2p	3p
Monitoring for phase failure, wire break	2p	3p
Monitoring for phase sequence	—	✓
Internal ground-fault detection (fault current monitoring)	—	✓
Blocking current monitoring	—	✓
<b>Supply voltage</b>		
Self-powered, without auxiliary voltage	—	—
Externally powered, with auxiliary voltage	✓	✓

✓: Function available

2p: Monitoring is 2-phase

3p: Monitoring is 3-phase

— : Function not available

### 3.5.2 3UG45 / 3UG46 monitoring relays

Table 3- 17 Functions of the 3UG45/3UG46 monitoring relays for analog and digital setting

Function	Monitoring relays																	
	3UG45							3UG46										
	01	11	12	13	8	14	15	16	17	18	31	32	33	21	22	41	25	51
<b>Line monitoring and voltage monitoring</b>																		
Monitoring for phase sequence	—	✓	✓	✓	—	✓	✓	✓	✓	✓	—	—	—	—	—	—	—	—
Monitoring for phase failure	—	o <sup>1)</sup>	✓	✓	—	✓	✓	✓	✓	✓	—	—	—	—	—	—	—	—
Monitoring for asymmetry	—	—	10 %	20 %	—	✓	o <sup>2)</sup>	o <sup>2)</sup>	✓	✓	—	—	—	—	—	—	—	—
Monitoring for undervoltage	—	—	—	3p	—	3p	3p	3p	3p	3p	1p	1p	1p	—	—	—	—	—
Monitoring for overvoltage	—	—	—	—	—	—	3p	3p	3p	3p	1p	1p	1p	—	—	—	—	—
Monitoring for N conductor failure	—	—	—	—	—	—	—	✓	—	✓	—	—	—	—	—	—	—	—
Automatic direction of rotation correction in the case of incorrect phase sequence	—	—	—	—	—	—	—	—	✓	✓	—	—	—	—	—	—	—	—
<b>Power factor monitoring and current monitoring</b>																		
Monitoring for undercurrent	—	—	—	—	—	—	—	—	—	—	—	—	—	1p	1p	1p	—	—
Monitoring for overcurrent	—	—	—	—	—	—	—	—	—	—	—	—	—	1p	1p	1p	—	—
Active current monitoring	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	—	—
Apparent current monitoring	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	✓	—	—	—
Power factor monitoring	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	—	—
<b>Fault current monitoring/insulation monitoring</b>																		
Monitoring for fault current/ground fault	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓	—
Insulation monitoring	—	—	—	—	✓	—	—	—	—	—	—	—	—	—	—	—	—	—
<b>Filling level monitoring</b>																		
Monitoring for filling level overshoot / resistance overshoot	✓	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Monitoring for filling level undershoot / resistance undershoot	✓	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Function	Monitoring relays																	
	3UG45								3UG46									
	01	11	12	13	8	14	15	16	17	18	31	32	33	21	22	41	25	51
<b>Speed monitoring</b>																		
Monitoring for speed overshoot	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓
Monitoring for speed undershoot	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✓
<b>Rated control supply voltage</b>																		
Self-powered, without auxiliary voltage	—	✓	✓	✓	—	✓	✓	✓	✓	✓	—	—	✓	—	—	✓	—	—
Externally powered, with auxiliary voltage	✓	—	—	—	✓	—	—	—	—	—	✓	✓	—	✓	✓	—	✓	✓

✓: Function available

1p: Monitoring is 1-phase

3p: Monitoring is 3-phase

— : Function not available

○: Function available with limitations

- 1) Detection causes problems with regenerative power recovery.
- 2) By monitoring the voltage thresholds.

**True root mean square measurement (tRMS) / use with frequency converters:**

The monitoring relays work with an electronic measuring method which calculates the actual (effective) value of a measured value (tRMS), regardless of whether the measured variable's waveform is purely sinusoidal or distorted.

The measured signal must only meet the following requirements:



- Periodic waveform (sinusoidal) within the specified frequency range
- Continuous zero crossings

As long as the line on the primary or the secondary side in the environment of a frequency converter fulfills these requirements, the monitoring relays can also be operated upstream or downstream of frequency converters. The required line quality can be ensured by using line filters/sine-wave filters where applicable. Of course, the suitability of the relevant monitoring relay for the monitored line frequencies must also be considered.


## 3.6 Menu-based operation

### Operator controls

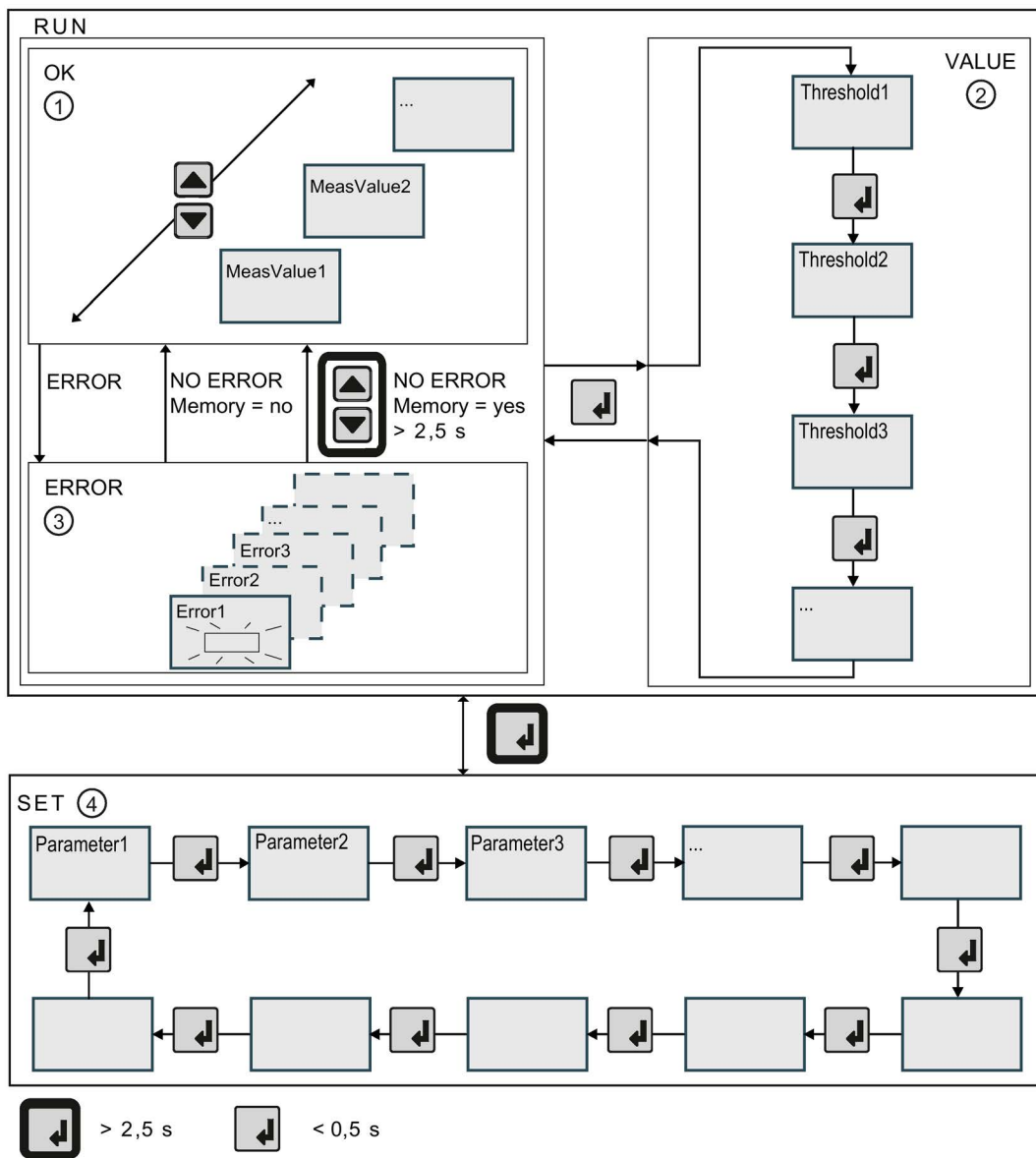
The digitally adjustable monitoring relays have three keys for navigating on the menu levels:

- SET key  for navigating to the menu levels and for switching between the menu levels
- 2 arrow keys  for setting parameters

Navigation through the menu system of the monitoring relays is explained below in a schematic diagram.

Depending on the device version and as long as no faults have occurred, one or  more different measuring values ① can be displayed with the help of the arrow keys. In the event of a fault, the display indicates the type of fault ③ by means of flashing symbols. By repeatedly pressing the SET key briefly, it is possible to set the desired type of monitoring (overshoot, undershoot, or range monitoring) and parameterize the lower and/or upper threshold ② in accordance with the device-specific setting ranges. After pressing the SET key for at least 2.5 s, in a further step, the basic device parameters ④, such as the switching behavior of the output relays, the reset response in the event of a fault, and/or the tripping delay times can be set.

Menu-based operation



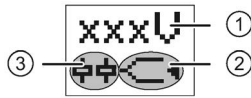
- ① RUN - OK Status display in the correct range, see below
  - Measured value1 / Measured value2 / ...
- ② RUN - VALUE Settings of the monitored thresholds, see below
- ③ RUN - ERROR Status display in the event of a fault


If a threshold is overshoot or undershot, the outputs of the monitoring relays switch over after the set delay time. The display indicates the type of error.

  - Error1 /Error2 / ... Error detected
- ④ SET Settings for basic device parameters, see below



## Menu levels "RUN" and "SET"



The RUN menu shows the up-to-date current measured value ①. You can use the arrow keys  to change between the individual measuring values on devices with multiple outputs. In this case, the display automatically switches between the name of the measured value and the actual measured value.


② represents the selected type of monitoring (overshoot, undershoot, or range monitoring). An arrow symbol indicates whether the measuring value is within, above or below the set thresholds.

Next to this, one or two symbols ③ represent the type (changeover contact or semiconductor output) and the switching status of the outputs.

### Navigation in the menu

There are basically two ways of navigating on both menu levels:

- Brief pressing the SET key  ( $\leq 0.5$  s)


You can jump from one parameter to the next within one menu level by briefly pressing the SET key . The order is not variable.


Entry	Display at the RUN menu level	Display at the SET menu level
1.	Current measuring value (MeasValue1 / MeasValue2 / ...) or error symbol (Error1 / Error2 / Error3 / ...), switching contact symbols and monitoring methods for diagnostics	Parameter1
2.	Threshold1	Parameter2
3.	Threshold2	Parameter3
4.	Threshold3	...
5.	...	

#### Note


The setting options a device actually offers depends on the type and can be looked up in the relevant chapters on operation in this manual.

You can find full details of menu-based operation for the individual devices in Appendix D "Menu-based operation" (Page 389).

- Pressing and holding the SET key  ( $> 2.5$  s)

By pressing and holding the SET key , the menu changes from RUN to SET and vice versa.



#### – RUN → SET

Menu level change can be started from any display. While the SET key is pressed,  appears on the display.

After a successful change, you always arrive at the first menu item (parameter1) of the "SET" menu level.

In the event of an error, changing to the "SET" menu level is only possible from "RUN-VALUE" ②. If an error is indicated, the SET key must be pressed first briefly ( $< 0.5$  s).

#### – SET → RUN




You can switch menus from any of the menu commands. While the SET key  is pressed,  appears on the display.

After a successful change, you arrive at current measuring value (measuringvalue1) or the current error of the RUN menu level.

---

**Note**



**Aborting the menu switchover**

The switchover process will be interrupted if the SET key  is released while  or  is displayed. The menu will revert to the menu command you were working with when the switch was initiated.

---

**Note**

**Reset in the event of an error**

To reset the device, it is necessary to press both arrow keys  simultaneously for more than 2.5 s after removal of the cause of error and with Hand-RESET active. While the keys are pressed,  appears on the display.

The possible settings for resetting the devices via the "Reset response" parameter can be found in the "Operation" chapters of the relevant monitoring relays.

---

**Note**

3UG4625 residual current monitoring relays automatically return to showing the actual measured value 30 seconds after the last limit value change.

---

**Note**

Quitting the SET menu level will trigger an internal reset in 3UG4621/3UG4622/3UG4625 and 3UG4641 device variants and restart the startup delay.

---



## 3RR2 current monitoring relays

### 4.1 Product description

#### Overview

SIRIUS 3RR2 current monitoring relays are suitable for current monitoring of motors or other loads. They are capable of two-phase or three-phase monitoring of the rms value of AC currents, checking that the values do not overshoot or undershoot set thresholds.

SIRIUS 3RR2 current monitoring relays are available in the following variants:

- Basic version (3RR21): with analog setting using rotary buttons, two-phase monitoring and CO contact.
- Basic version (3RR22): digital setting via a display, 3-phase monitoring, CO contact, and semiconductor output; also monitors phase sequence, phase failure, ground fault and blocking current
- Version for IO-Link (3RR24): same as standard version, but additionally with IO-Link interface for direct interfacing to a PLC for remote parameterization, remote diagnostics, cyclic transfer of measured values, support of the parameter server functionality of IO-Link (with master as from specification V1.1), with integrated runtime and switching cycle counter

You can find further information in the Manual "3UG48/3RR24 Monitoring Relays for IO-Link".

Whereas apparent current monitoring is primarily used in the rated torque range or for overload, active current monitoring can be used to observe and evaluate the degree of loading across a motor's entire torque range.

Apparent current monitoring and active current monitoring are described in more detail in the Chapter "Parameters (Page 363)".

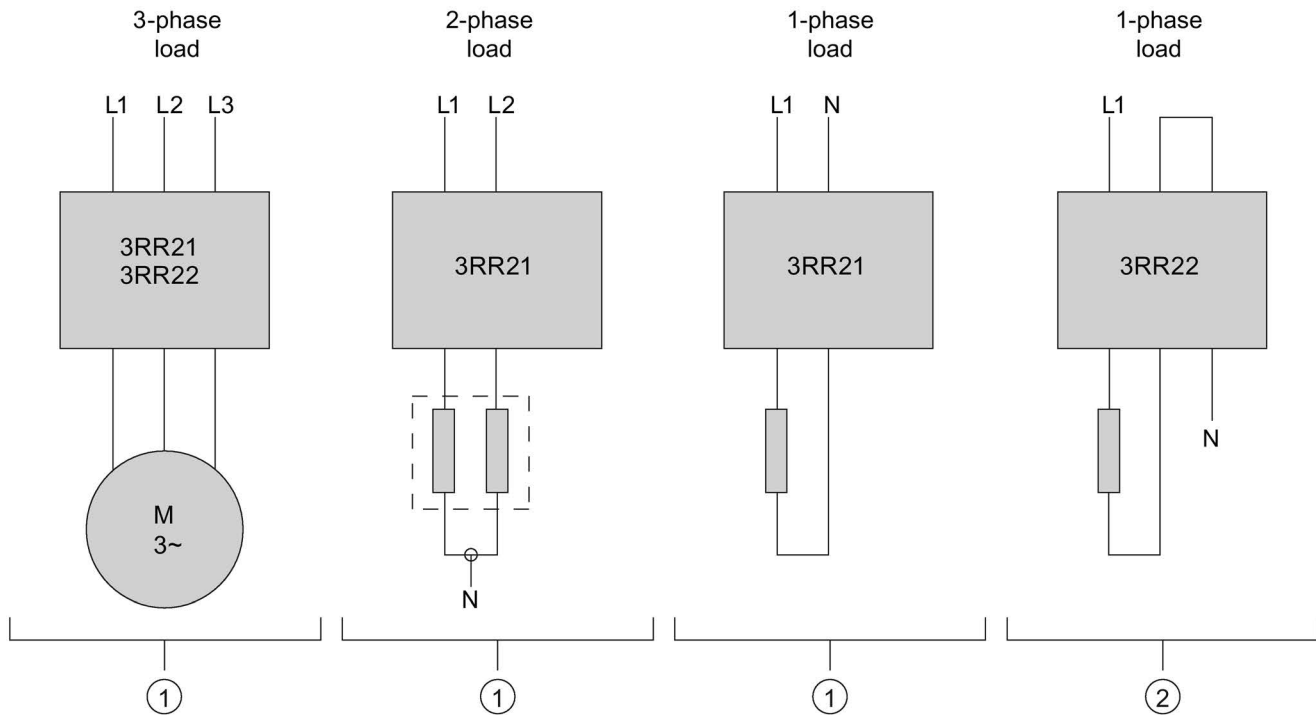
**System integration**

3RR2 current monitoring relays are available in three sizes, S00, S0 and S2. 3RR2 current monitoring relays are matched to 3RT2 contactors and 3RF34 (size S0) solid-state contactors in terms of their electrical and mechanical features. They can be integrated in the feeder by means of direct mounting. This eliminates the need for the main circuit to be wired separately and no additional transformers are required.

For a stand-alone assembly or if an overload relay is being used at the same time, terminal supports for stand-alone assembly are available for separate DIN rail mounting.

3RR2 current monitoring relays were conceived for monitoring 3-phase systems.

Depending on the device version used, monitoring of 1- or 2-phase AC systems is possible with the following wiring variants:



- ① Complete device functionality possible
- ② Device functionality only possible with limitations:
  - Residual current monitoring not possible (→ switch off)
  - Phase sequence monitoring not possible (→ switch off)
  - Active current monitoring not possible (→ switch off)

**Note**

The monitoring functions of the 2 phases (3RR21) or the 3 phases (3RR22) are ORed to the output relay(s), i.e. a fault in one monitored phase (e.g. current violation L1) already affects the output relay(s).

**Accessories**

The accessories have been tailored to the current monitoring relays; they can be mounted easily and without the need for tools. The accessories are described in the Chapter "Accessories for 3RR2 current monitoring relays (Page 323)".

## 4.2 Application areas

The 3RR2 current monitoring relays are used, for example, in the following applications:

- Monitoring for current overshoot and current undershoot
- Monitoring for cable breaks
- Monitoring for no-load operation and load shedding (as might be the case, for example, in the event of a torn V belt)
- Underload monitoring in the lower performance range (if a pump was running in no-load operation, for example)
- Monitoring for overload (as might affect pumps with a soiled filter system, for example)
- Monitoring the performance of electrical loads such as heaters
- Monitoring for incorrect phase sequences on mobile equipment such as compressors or cranes
- Monitoring for high-impedance faults to ground (caused by damaged insulation or moisture, for example)

Table 4- 1 Application areas of the 3RR2 current monitoring relays

Function	Application
<ul style="list-style-type: none"> <li>• Undercurrent</li> <li>• Overcurrent</li> <li>• Apparent current</li> <li>• Active current (3RR22 only)</li> <li>• Phase failure / wire break</li> <li>• Phase sequence (3RR22 only)</li> <li>• Internal ground fault detection (fault current) (3RR22 only)</li> <li>• Block current (3RR22 only)</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency lighting</li> <li>• Heating systems (electroplating plants, plastic injection machines, paintshops)</li> <li>• Lamps (tunnels, OR lighting, traffic lights, signal systems, UV lamps, infrared radiators, laser lamps)</li> <li>• Fan</li> <li>• Pumps</li> <li>• Sawing system</li> <li>• Conveyor belt</li> <li>• Surface grinding machine</li> <li>• Breaking mill</li> <li>• Milling machine</li> <li>• Car wash</li> <li>• Lifting platform</li> <li>• Screw conveyor</li> <li>• Crane</li> <li>• Turning machine</li> <li>• Woodworking</li> <li>• Grain mills</li> <li>• Steel industry</li> </ul>

## 4.3 Performance features of current monitoring relays

Table 4- 2 Performance features of 3RR2 current monitoring relays with analog setting

Functions/Parameters	Current monitoring relays with analog setting		
	3RR2141-.A.30	3RR2142-.A.30	3RR2143-.A.30
Rated current	1.6 to 16 A	4 to 40 A	8 to 80 A
Frequency range	50/60 Hz AC	50/60 Hz AC	50/60 Hz AC
Supply voltage $U_s$	<ul style="list-style-type: none"> <li>• -.AA30: 24 V AC/DC</li> <li>• -.AW30: 24 to 240 V AC/DC</li> </ul>		
Monitoring for current overshoots and/or undershoots	2-phase	2-phase	2-phase
Contacts	1 CO contact	1 CO contact	1 CO contact

Table 4- 3 Performance features of 3RR2 current monitoring relays with digital setting

Functions/Parameters	Current monitoring relays with digital setting		
	3RR2241-.F.30	3RR2242-.F.30	3RR2243-.F.30
Rated current	1.6 to 16 A	4 to 40 A	8 to 80 A
Frequency range	20 to 400 Hz AC	20 to 400 Hz AC	20 to 400 Hz AC
Supply voltage $U_s$	<ul style="list-style-type: none"> <li>• -.FA30: 24 V AC/DC</li> <li>• -.FW30: 24 to 240 V AC/DC</li> </ul>		
Monitoring for current overshoots and/or undershoots	3-phase	3-phase	3-phase
Contacts	1 CO contact/ 1 semiconductor output	1 CO contact/ 1 semiconductor output	1 CO contact/ 1 semiconductor output



### 4.3.1 General data

Table 4- 4 General data for 3RR2 current monitoring relays

Feature	Benefit	3RR21 Basic, analog setting	3RR22 Standard, digital setting
Sizes	<ul style="list-style-type: none"> <li>The devices are matched to the dimensions, connections and technical features of the other devices in the SIRIUS modular system.</li> <li>The devices permit mounting of slim-line and compact load feeders in widths of 45 mm (S00 and S0) or 55 mm (S2).</li> <li>The devices make configuration easier.</li> </ul>	S00, S0, S2	S00, S0, S2
Current range	<ul style="list-style-type: none"> <li>The devices are matched to the other devices in the SIRIUS modular system</li> <li>Just 1 option per size with a wide setting range makes configuration easy.</li> </ul>	S00: 1.6 to 16 A S0: 4.0 to 40 A S2: 8.0 to 80 A	S00: 1.6 to 16 A S0: 4.0 to 40 A S2: 8.0 to 80 A

You can find further technical information on 3RR24 in the Manual "3UG48/3RR24 monitoring relays for IO-Link (<http://support.automation.siemens.com/WW/view/en/54375430>)" on the internet.

### 4.3.2 Properties

Table 4- 5 Equipment of 3RR2 current monitoring relays

Feature	Benefit	3RR21 Basic, analog setting	3RR22 Standard, digital setting
Reset function	<ul style="list-style-type: none"> <li>Enables manual or automatic resetting of the monitoring relay</li> <li>Resetting directly on the device or by disconnecting and reconnecting the supply voltage (remote reset)</li> </ul>	✓	✓
ON-delay time	<ul style="list-style-type: none"> <li>Enables motor starting without evaluation of the starting current</li> <li>Can be used to monitor motors with lengthy startup</li> </ul>	0 s to 60 s	0 to 99 s
Tripping delay time	<ul style="list-style-type: none"> <li>Prevents frequent warnings and disconnection in response to currents in the vicinity of the thresholds</li> <li>Permits brief violations of thresholds during operation</li> </ul>	0 s to 30 s	0 s to 30 s
Operating and indicating elements	<ul style="list-style-type: none"> <li>For setting thresholds and delay times</li> <li>For selectable functions</li> <li>For fast and selective diagnostics</li> <li>Display for permanent indication of measured values</li> </ul>	LEDs and rotary buttons	Display and buttons
Integrated contacts	<ul style="list-style-type: none"> <li>Allow the system or process to be shut down in the event of an irregularity</li> <li>Can be used to output signals</li> </ul>	1 CO contact	1 CO contact 1 semiconductor output

### 4.3.3 Configuration of load feeders

Table 4- 6 Load feeders with 3RR2 current monitoring relays

Feature	Benefit	3RR21 Basic, analog setting	3RR22 Standard, digital setting
Short-circuit-proof up to 100 kA at 690 V (in conjunction with the appropriate fuses or the appropriate motor starter protector)	<ul style="list-style-type: none"> <li>Provides optimum protection of the loads and operating personnel in the event of short circuits due to insulation faults or faulty switching operations</li> </ul>	✓	✓
Electrical and mechanical matching to 3RT2 contactors	<ul style="list-style-type: none"> <li>Simplifies configuration</li> <li>Reduces connection outlay and costs</li> <li>Enables stand-alone assembly as well as space-saving direct mounting</li> </ul>	✓	✓
Spring-loaded connection system for main circuit (option) and auxiliary circuit (option)	<ul style="list-style-type: none"> <li>Enables fast connections</li> <li>Ensures that connections are vibration-resistant</li> <li>Enables maintenance-free connections</li> </ul>	✓	✓

### 4.3.4 Combinations with 3RT20 contactor

Monitoring relay type	Current range	3RT20 1 S00 contactors 3/4/5.5/7.5 kW	3RT20 2 S0 contactors 5.5/7.5/11/15/18.5 kW	3RT20 3 S2 contactors 18.5/22/30/37 kW
3RR2141	1.6 to 16 A	✓	X	X
3RR2241	1.6 to 16 A	✓	X	X
3RR2142	4.0 to 40 A	X	✓	X
3RR2242	4.0 to 40 A	X	✓	X
3RR2143	8.0 to 80 A	X	X	✓
3RR2243	8.0 to 80 A	X	X	✓

X = with stand-alone assembly support

You can find further technical information on 3RR24 in the Manual "3UG48/3RR24 monitoring relays for IO-Link

(<http://support.automation.siemens.com/WW/view/en/54375430>)" on the internet.

## 4.4 3RR21 current monitoring relays

### 4.4.1 Operator controls and connection terminals

#### Front view / terminal labeling (basic version)

Front view	Description	
	<b>Position digits</b>	
	①	Connection for contactor mounting or for stand-alone assembly
	②	Rotary button for setting the threshold for overshoot "I▲"
	③	Rotary button for setting the threshold for undershoot "I▼"
	④	Sliding switch "Memory" for selecting the reset response parameter (manual/autoreset):
	⑤	Control circuit terminal (removable): The control circuit can be connected using either the screw-type or the spring-loaded connection system.
	⑥	Main circuit terminal (permanently connected) : The main circuit can be connected using either the screw-type or the spring-loaded connection system.
	⑦	Label (below which there is a DATAMatrix code)
	⑧	Device article number
	⑨	Rotary button for startup delay time "onDel (s)"
	⑩	Rotary button for tripping delay time "Del (s)"
⑪	Status display via "Ready" LEDs (green) for auxiliary voltage and "Fault" (red) for switching state	
<b>Terminal labels</b>		
B1	Supply voltage ~ / +	
B2	Supply voltage ~ / -	
32	Output relay K1 changeover contact NC contact	
31	Output relay K1 changeover contact root	
34	Output relay K1 changeover contact NO contact	
2/T1, 4/T2, 6/T3	Main circuit terminals	
14 / 22	Feed-through contactor auxiliary switch (S00)	
A2	Feed-through contactor coil terminal (S00)	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 59)".

## 4.4.2 Function

### General functionality

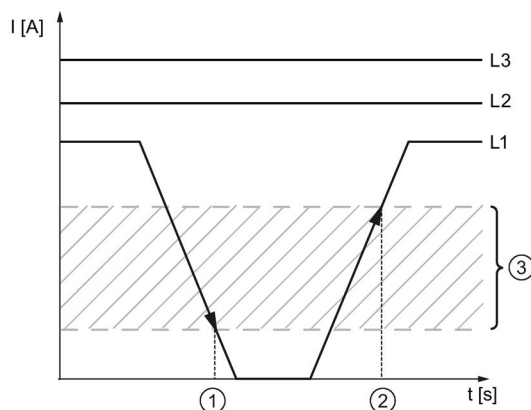
Depending on the setting, the current monitoring relays monitor an AC load current that flows through terminals 1/L1 - 2/T1 and 3/L2 - 4/T2 of the device for **overshoot** ( $I\blacktriangle$ ) or **undershoot** ( $I\blacktriangledown$ ) or in **range monitoring** ( $I\blacktriangle$  and  $I\blacktriangledown \neq \text{OFF}$ ).

Depending on their design, the current monitoring relays are powered with a 24 V AC/DC or 24 to 240 V AC/DC supply voltage through terminals B1/B2.

With two-phase apparent current monitoring, one changeover output, and analog adjustment, the 3RR214.-A.30 (basic-version) current monitoring relays provide a high level of monitoring reliability particularly in the rated and overload ranges.

The switching states of the output relay are given below in the section entitled "Function diagrams."

### Cable break detected



- ① Cable break detected
- ② No cable break
- ③ Hysteresis cable break:
  - S00: 1.2 A to 1.6 A
  - S0: 3.0 A to 4.0 A
  - S2: 6.0 A to 8.0 A

Image 4-1 Diagram of cable break

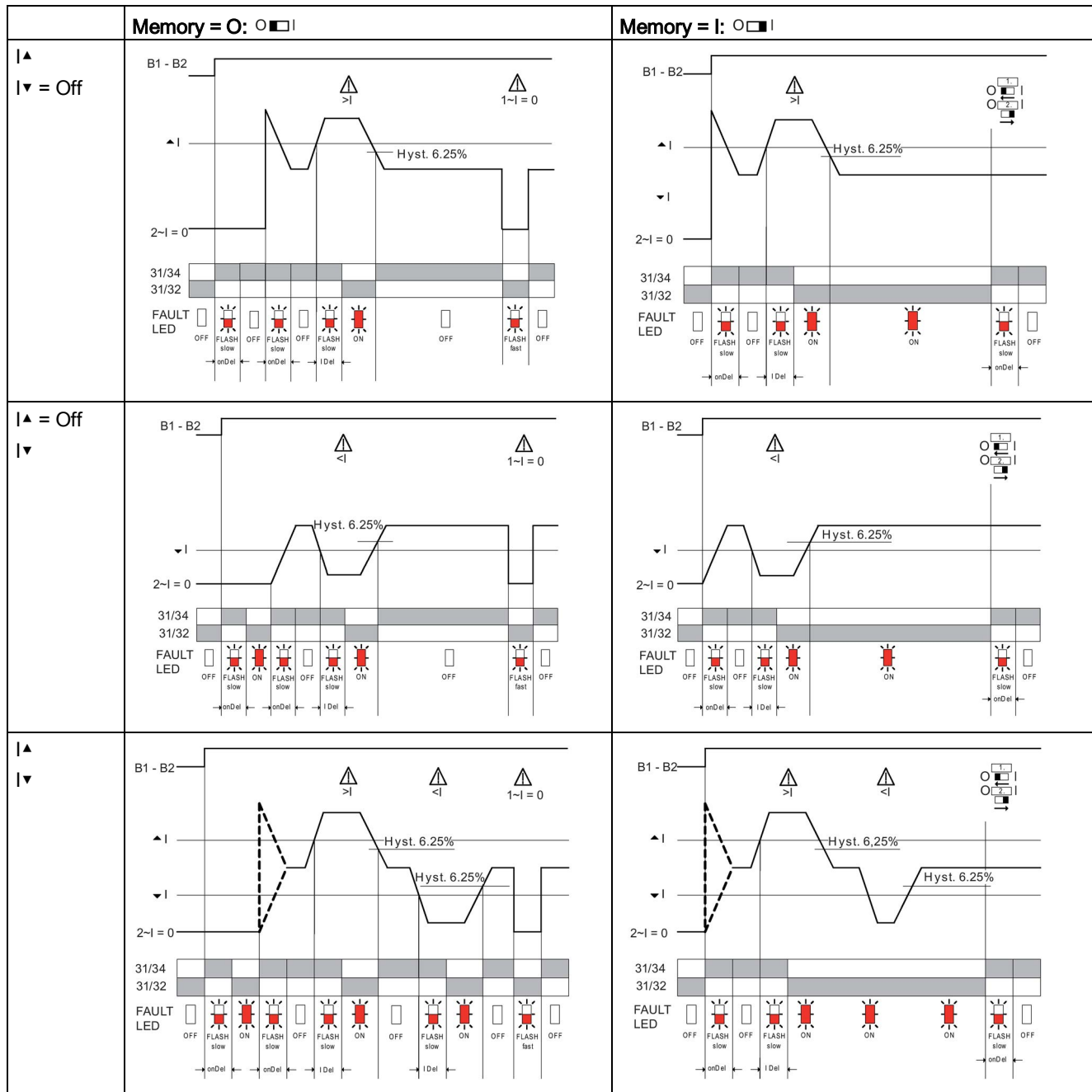
If a cable break (zero current in branch circuit 1/L1 - 2/T1 or 3/L2 - 4/T2) is detected (time ①), all running delay times are aborted, the red FAULT LED flashes rapidly and the CO contact immediately changes its switching state.

When a defined current flow returns to both branch circuits (1/L1 - 2/T1, 3/L2 - 4/T2) (time ②), the CO contact responds according to the defined settings.

If Memory = I, the tripping state is saved.

If the unmonitored phase 5/L3 - 6/T3 fails, this can be detected if a motor is connected by an increase in current in both phases 1/L1 - 2/T1 and 3/L2 - 4/T2.

Function diagrams



### 4.4.3 Operation

#### Parameters

The following parameters can be set on the relevant rotary button using a screwdriver:

Table 4- 7 Parameter information, 3RR21 current monitoring relays with analog setting

Parameters	Control element <sup>5)</sup>	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
ON-delay time (onDel)	9	0 s	60 s	Continuous	0 s
Tripping delay time (Del)	10	0 s	30 s	Continuous	0 s
Threshold for current overshoot (I <sub>▲</sub> )	2	1.6 A or OFF <sup>1)</sup> 4 A or OFF <sup>2)</sup> 8 A or OFF <sup>3)</sup>	16 A <sup>1)</sup> 40 A <sup>2)</sup> 80 A <sup>3)</sup>	Continuous	8 A <sup>1)</sup> 20 A <sup>2)</sup> 40 A <sup>3)</sup>
Threshold for current undershoot (I <sub>▼</sub> )	3	1.6 A or OFF <sup>1)</sup> 4 A or OFF <sup>2)</sup> 8 A or OFF <sup>3)</sup>	16 A <sup>1)</sup> 40 A <sup>2)</sup> 80 A <sup>3)</sup>	Continuous	Disabled
Reset response (Memory)	4	0 = automatic rest	1 = manual reset <sup>4)</sup>	--	Automatic reset

1) current monitoring relay 3RR2141-.A.30

2) current monitoring relay 3RR2142-.A.30

3) current monitoring relay 3RR2143-.A.30

4) a stored fault condition can be reset by briefly switching to Memory = 0 or by switching off the supply voltage.

5) The position digits refer to the front view in the Chapter "Operator controls and connection terminals (Page 53)."

#### Hysteresis

The hysteresis is set to a fixed value of 6.25% of the set threshold.



## Changes to settings of threshold for current overshoot (I▲) and threshold for current undershoot (I▼)

---

### **Note**

#### **Deactivating monitoring**

If both threshold values are deactivated (OFF), the following will no longer be monitored:

- Current overshoot
- Current undershoot

The following parameters continue to be monitored:

- Phase failure
- 

The parameters are described in the Chapter "Parameters (Page 363)".

### **Required tools**

The same screwdriver can be used to set the parameters as for mounting the current monitoring relays.

### 4.4.4 Diagnostics

#### Status display

On the current monitoring relay with analog setting, two status LEDs indicate the operating state:

- FAULT (red)
- READY (green)

Display	Meaning
FAULT off	Measured value is within range limits
FAULT steady on	Device has tripped
FAULT flashes at 1 Hz	Delay time is running
FAULT flashes at 4 Hz	Cable break/phase failure detected
READY off	Voltage is not applied at B1 - B2
READY on	Voltage is applied at B1 - B2

You can find more information about the LED display response in the Chapter "Function (Page 54)."

## 4.4.5 Circuit diagrams

### Internal circuit diagrams 3RR21

#### 3RR2141-1A.30 current monitoring relay

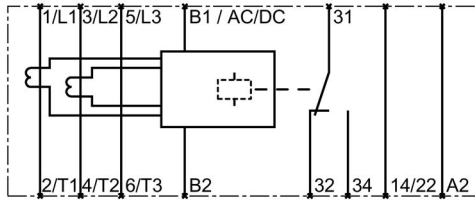


Image 4-2 1 CO contact, 2-phase

#### 3RR2141-2A.30, 3RR2142-.A.30, 3RR2143-.A.30 current monitoring relays

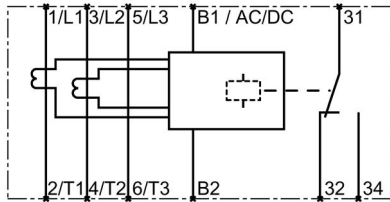


Image 4-3 1 CO contact, 2-phase

## 4.4.6 Technical data

### General technical specifications

		3RR2141-.....	3RR2142-.....	3RR2143-.....
product brand name		SIRIUS		
Product designation		multi-phase current monitoring		
Design of the product		multi-phase current monitoring		
Size of the contactor can be combined company-specific		S00	S0	S2
Protection class IP				
• on the front		IP20		
• of the terminal		IP20		IP00
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690		
Installation altitude at a height over sea level maximum	m	2 000		
Ambient temperature				
• during storage	°C	-40 ... +80		
• during operating		-25 ... +60		
Electromagnetic compatibility		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4		
EMC immunity to interference according to IEC 60947-1		ambience A (industrial sector)		
EMC emitted interference according to IEC 60947-1		ambience A (industrial sector)		
Resistance against shock		15g / 11 ms		10g / 11 ms
Resistance against vibration		10 ... 55 Hz / 0.35 mm		
Impulse voltage resistance rated value	kV	6		
Operating apparent output rated value	V·A	4		
Rating Rated value	W	2.5		

	3RR2141-.....	3RR2142-.....	3RR2143-.....
<b>Reference code</b>			
<ul style="list-style-type: none"> <li>according to DIN 40719 extended according to IEC 204-2 according to IEC 750</li> </ul>	K		
<ul style="list-style-type: none"> <li>according to DIN EN 61346-2</li> </ul>	K		
<b>Mechanical operating cycles as operating time typical</b>	10 000 000		
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>	100 000		
<b>Adjustable response delay time</b>			
<ul style="list-style-type: none"> <li>when starting</li> </ul>	s	0 ... 60	
<ul style="list-style-type: none"> <li>with lower or upper limit violation</li> </ul>	s	0 ... 30	
<b>Standby time for restart after fault</b>	s	0.3	
<b>Phase number</b>	3		
<b>Number of monitored phases</b>	2		
<b>Product function</b>			
<ul style="list-style-type: none"> <li>overcurrent monitoring</li> </ul>	Yes		
<ul style="list-style-type: none"> <li>undercurrent monitoring</li> </ul>	Yes		
<ul style="list-style-type: none"> <li>overcurrent and undercurrent monitoring</li> </ul>	Yes		
<ul style="list-style-type: none"> <li>apparent current monitoring</li> </ul>	Yes		
<ul style="list-style-type: none"> <li>active current monitoring</li> </ul>	No		
<ul style="list-style-type: none"> <li>undercurrent recognition of 3 phases</li> </ul>	No		
<ul style="list-style-type: none"> <li>phase sequence recognition</li> </ul>	No		
<ul style="list-style-type: none"> <li>can be activated or deactivated phase sequence recognition</li> </ul>	No		
<ul style="list-style-type: none"> <li>self-reset</li> </ul>	Yes		
<ul style="list-style-type: none"> <li>reset external</li> </ul>	No		
<ul style="list-style-type: none"> <li>manual RESET</li> </ul>	Yes		

3RR2 current monitoring relays

4.4 3RR21 current monitoring relays

		3RR2141-.....	3RR2142-.....	3RR2143-.....
<b>Adjustable response current</b>				
• 1	A	1.6 ... 16	4 ... 40	8 ... 80
• 2	A	1.6 ... 16	4 ... 40	8 ... 80
<b>Factor as multiple of the current monitoring upper limit</b>				
• for the adjustable value of a blocking current		—		—
<b>Response value residual current detection at 50/60 Hz typical</b>	A	—		
<b>Type of current for monitoring</b>		AC		
<b>Measurable current</b>				
• for AC	A	1.6 ... 16	4 ... 40	8 ... 80
<b>Adjustable switching hysteresis for measured current value</b>	A	—		—
<b>Relative switching hysteresis for measured current value</b>	%	6.25		
<b>Response time maximum</b>	s	0.3		
<b>Relative repeat accuracy</b>	%	2		
<b>Relative metering precision with regard to measuring range limit</b>	%	10		
<b>Temperature drift per °C</b>	%/°C	0.1		
<b>Current-carrying capacity</b>				
• for permanent overcurrent maximum permissible	A	16	40	80 <sup>1)</sup>
• for overcurrent duration < 1 s maximum permissible	A	320	800	1 600

1) Class 10 = 80 A  
 Class 20 = 60 A  
 Class 30 = 50 A

### Connections 3RR2141 (size S00)

	3RR2141-1....	3RR2141-2....
<b>Design of the electrical connection</b>		
• for main current circuit	screw-type terminals	spring-loaded terminals
• for auxiliary and control current circuit	screw-type terminals	spring-loaded terminals
<b>Product function</b>		
• removable terminal for main circuit	No	
• removable terminal for auxiliary and control circuit	Yes	
<b>Type of the connectable conductor cross-section</b>		
• for main contacts		
– solid	2x (0.5 ... 1.5 mm <sup>2</sup> ), 2x (0.75 ... 2.5 mm <sup>2</sup> ), 2x (1 ... 4 mm <sup>2</sup> )	1x (0.5 ... 4 mm <sup>2</sup> )
– stranded	—	
– finely stranded		
– with conductor end processing	2x (0.5 ... 1.5 mm <sup>2</sup> ), 2x (0.75 ... 2.5 mm <sup>2</sup> )	1x (0.5 ... 2.5 mm <sup>2</sup> )
– without conductor final cutting	—	1x (0.5 ... 2.5 mm <sup>2</sup> )
• for AWG conductors for main contacts	1x 12, 2x (20 ... 14)	1x (20 ... 12)
• for auxiliary contacts		
– solid	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	
– finely stranded		
– with conductor end processing	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
– without conductor final cutting	—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors for auxiliary contacts	2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.8 ... 1.2
<b>Verification of suitability</b>	CE / UL / CSA	

**Connections 3RR2142 (size S0)**

	3RR2142-1....	3RR2142-2....
<b>Design of the electrical connection</b>		
<ul style="list-style-type: none"> <li>for main current circuit</li> <li>for auxiliary and control current circuit</li> </ul>	screw-type terminals screw-type terminals	spring-loaded terminals spring-loaded terminals
<b>Product function</b>		
<ul style="list-style-type: none"> <li>removable terminal for main circuit</li> <li>removable terminal for auxiliary and control circuit</li> </ul>	No Yes	
<b>Type of the connectable conductor cross-section</b>		
<ul style="list-style-type: none"> <li>for main contacts                             <ul style="list-style-type: none"> <li>solid</li> <li>stranded</li> <li>finely stranded</li> <li>with conductor end processing</li> <li>without conductor final cutting</li> </ul> </li> <li>for AWG conductors for main contacts</li> <li>for auxiliary contacts                             <ul style="list-style-type: none"> <li>solid</li> <li>finely stranded</li> <li>with conductor end processing</li> <li>without conductor final cutting</li> </ul> </li> <li>for AWG conductors for auxiliary contacts</li> </ul>	2x (1 ... 2.5 mm <sup>2</sup> ), 2x (2.5 ... 10 mm <sup>2</sup> ) — 2x (1 ... 2.5 mm <sup>2</sup> ), 2x (2.5 ... 6 mm <sup>2</sup> ), 1x 10 mm <sup>2</sup> — 2 x (16 ... 14), 2x (14 ... 8) 1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> ) 1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> ) — 2x (20 ... 14)	1x (1 ... 10 mm <sup>2</sup> ) 1x (1 ... 6 mm <sup>2</sup> ) 1x (1 ... 6 mm <sup>2</sup> ) 1x (18 ... 8) 2x (0.25 ... 1.5 mm <sup>2</sup> ) 2x (0.25 ... 1.5 mm <sup>2</sup> ) 2x (24 ... 16)
<b>Tightening torque</b>		
<ul style="list-style-type: none"> <li>with screw-type terminals</li> </ul>	N·m	0.8 ... 1.2
<b>Verification of suitability</b>	CE / UL / CSA	



### Connections 3RR2143 (size S2)

		3RR2143-1....	3RR2143-3....
<b>Design of the electrical connection</b>			
• for main current circuit		screw-type terminals	
• for auxiliary and control current circuit		screw-type terminals	spring-loaded terminals
<b>Product function</b>			
• removable terminal for main circuit		No	
• removable terminal for auxiliary and control circuit		Yes	
<b>Type of the connectable conductor cross-section</b>			
• for main contacts			
– solid		2x (1 ... 35 mm <sup>2</sup> ), 1x (1 ... 50 mm <sup>2</sup> )	
– stranded		2x (1 ... 35 mm <sup>2</sup> ), 1x (1 ... 50 mm <sup>2</sup> )	
– finely stranded			
– with conductor end processing		2x (1 ... 25 mm <sup>2</sup> ), 1x (1 ... 35 mm <sup>2</sup> )	
– without conductor final cutting		—	
• for AWG conductors for main contacts		2x (18 ... 2), 1x (18 ... 1)	
• for auxiliary contacts			
– solid		1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	
– finely stranded			
– with conductor end processing		1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
– without conductor final cutting		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors for auxiliary contacts		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	0.8 1.2	
<b>Verification of suitability</b>		CE / UL / CSA	

**Mounting, fixing, dimensions**

Frame size: (S0, S00)

		3RR2141-1....	3RR2142-1....	3RR2141-2....	3RR2142-2....
<b>Built in orientation</b>		any			
<b>Type of mounting</b>		direct mounting			
<b>Width</b>	mm	45			
<b>Height</b>	mm	79	88	91	109
<b>Depth</b>	mm	81	93	81	93
<b>Distance, to be maintained, to the ranks assembly</b>					
• forwards	mm	0			
• backwards	mm	0			
• upwards	mm	0			
• downwards	mm	0			
• sideways	mm	0			
<b>Distance, to be maintained, to earthed part</b>					
• forwards	mm	0	6		
• backwards	mm	0			
• upwards	mm	0	6	0	6
• downwards	mm	0	6	0	6
• sideways	mm	6			
<b>Distance, to be maintained, conductive elements</b>					
• forwards	mm	0	6		
• backwards	mm	0			
• upwards	mm	0	6	0	6
• downwards	mm	0	6	0	6
• sideways	mm	6			

**Frame size: (S2)**

		3RR2143-1....	3RR2143-3....
<b>mounting position</b>		any	
<b>Mounting type</b>		direct mounting	
<b>Width</b>	mm	55	
<b>Height</b>	mm	99	
<b>Depth</b>	mm	112	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• upwards	mm	0	
• downwards	mm	10	
• sideways	mm	0	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	10	
• backwards	mm	0	
• upwards	mm	10	
• downwards	mm	10	
• sideways	mm	10	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	10	
• backwards	mm	0	
• upwards	mm	10	
• downwards	mm	10	
• sideways	mm	10	

Auxiliary circuit

	3RR2141-.....	3RR2142-.....
<b>Design of the contact element of the output relay</b>	closed-circuit current	
<b>Operating current at 17 V minimum</b>	mA	5
<b>Number of outputs as contact-less semiconductor switching element for reporting function non-delayed</b>	—	
<b>Current-carrying capacity of the semiconductor output</b>		
• at DC-13 at 240 V	A	—
• at AC-14 at 240 V at 50/60 Hz	A	—
<b>Residual current of the semiconductor output maximum</b>	A	—
<b>Number of NC contacts for auxiliary contacts</b>	—	
<b>Number of NO contacts for auxiliary contacts</b>	—	
<b>Number of change-over switches</b>		
• for auxiliary contacts		1
• delayed switching		—
<b>Operating current of the auxiliary contacts</b>		
• at AC-15		
– at 24 V	A	3
– at 230 V	A	3
– at 400 V	A	3
• at DC-13 at 24 V	A	1
• at DC-13 at 125 V	A	0.2
• at DC-13 at 250 V	A	0.1

## Supply voltage

		3RR214.-.A..	3RR214.-.W..
<b>Type of supply voltage</b>		AC/DC	
<b>Supply voltage frequency</b>			
• 1	Hz	50 ... 60	
<b>Supply voltage 1</b>			
• for DC			
– rated value	V	24	—
– initial rated value	V	—	24
– final rated value	V	—	240
• at 50 Hz for AC			
– rated value	V	24	—
– initial rated value	V	—	24
– final rated value	V	—	240
• at 60 Hz for AC			
– rated value	V	24	—
– initial rated value	V	—	24
– final rated value	V	—	240
<b>Insulation voltage of the auxiliary and control circuit for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>		V	300
<b>Impulse voltage resistance of the auxiliary and control current circuit rated value</b>		V	4 000
<b>Stored energy time supply voltage failure minimum</b>		ms	10

## 4.5 3RR22 current monitoring relays

### 4.5.1 Operator controls and connection terminals

#### Front view / terminal labeling (standard version)

Front view	Description	
	<b>Position digits</b>	
	①	Connection for contactor mounting or for stand-alone assembly
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Legend for menu
	⑤	Control circuit terminal (removable): The control circuit can be connected using either the screw-type or the spring-loaded connection system.
	⑥	Main circuit terminal (permanently connected): The main circuit can be connected using either the screw-type or the spring-loaded connection system.
	⑦	Label
	⑧	Device article number
	⑨	Display for parameterization, actual-value indication, and diagnostics
<b>Terminal labels</b>		
B1	Supply voltage ~ / +	
B2	Supply voltage ~ / -	
Q	Semiconductor output, e.g. for pre-warning threshold	
32	Output relay K1 CO contact NC contact, e.g. for alarm threshold	
31	Output relay K1 CO contact root, e.g. for alarm threshold	
34	Output relay K1 CO contact NO contact, e.g. for alarm threshold	
2/T1, 4/T2, 6/T3	Main circuit terminals	
14/22	Feed-through contactor auxiliary switch (S00)	
A2	Feed-through contactor coil terminal (S00)	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 78)".

## 4.5.2 Function

### General functionality

Depending on its setting, the plant is monitored for **overshoot** (I▲ CO contact, !!▲ semiconductor output) or **undershoot** (I▼ CO contact, !!▼ semiconductor output) or for a **range** (I▲ , !!▲ and I▼ , !!▼ ≠ OFF).

Depending on their design, the current monitoring relays are powered with a 24 V AC/DC or 24 to 240 V AC/DC supply voltage through terminals B1/B2.

If the power supply is switched on, the CO contact and the semiconductor output responds after expiry of the set ON-delay time (onDel) on the set circuit principle (closed-circuit principle NC or open-circuit principle NO).

The 3RR224.-F.30 current monitoring relays with digital setting (standard variations) monitor the AC load current (apparent current  $I_s$  or active current  $I_p$ ) that flows through the 1/L1 - 2/T1, 3/L2 - 4/T2 and 5/L3 - 6/T3 device terminals. The monitoring relay has two separate outputs, which respond to separately settable thresholds.

The devices support further diagnostic options such as **residual current monitoring** and **phase sequence monitoring**, and are also be used to monitor motors even below the rated torque. The monitoring relays have an additional separate semiconductor output, an actual-value display, and support digital adjustment.

The 3RR22 current monitoring relays have a display and are parameterized with three keys.

You can find the setting ranges and factory settings of the available parameters in the Chapter "Operation (Page 75)."

You can find a description of the individual parameters in the Chapter "Parameters (Page 363)".

You will find the switching states of the output relay below in the Section "Function diagrams" and in the Chapter "Diagnostics (Page 77)."

## Reset response

If the device is set to automatic reset, the CO contact and the semiconductor output will respond once a previously occurring error has been dealt with and the reclosing delay time has elapsed. A previously occurring error is, therefore, not saved.

If manual RESET is selected, the CO contact remains in the current switching state even if a previously occurring error has been dealt with.

This saved fault condition can be reset by pressing both arrow keys at the same time for longer than 2.5 s or by disconnecting and reconnecting the auxiliary voltage.

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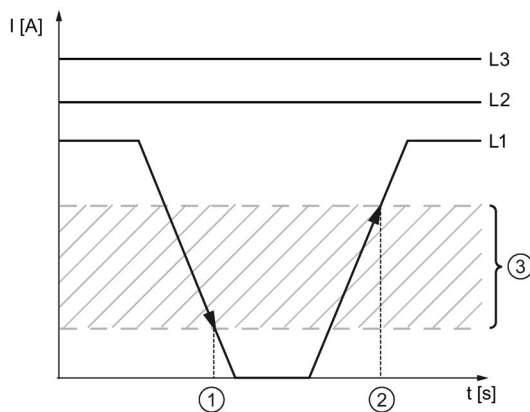
### Note

#### Semiconductor output

The semiconductor output always responds in automatic reset.

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## Cable break detected



- ① Cable break detected
- ② No cable break
- ③ Hysteresis cable break:
  - S00: 1.2 A to 1.6 A
  - S0: 3.0 A to 4.0 A
  - S2: 6.0 A to 8.0 A

Image 4-4 Cable break

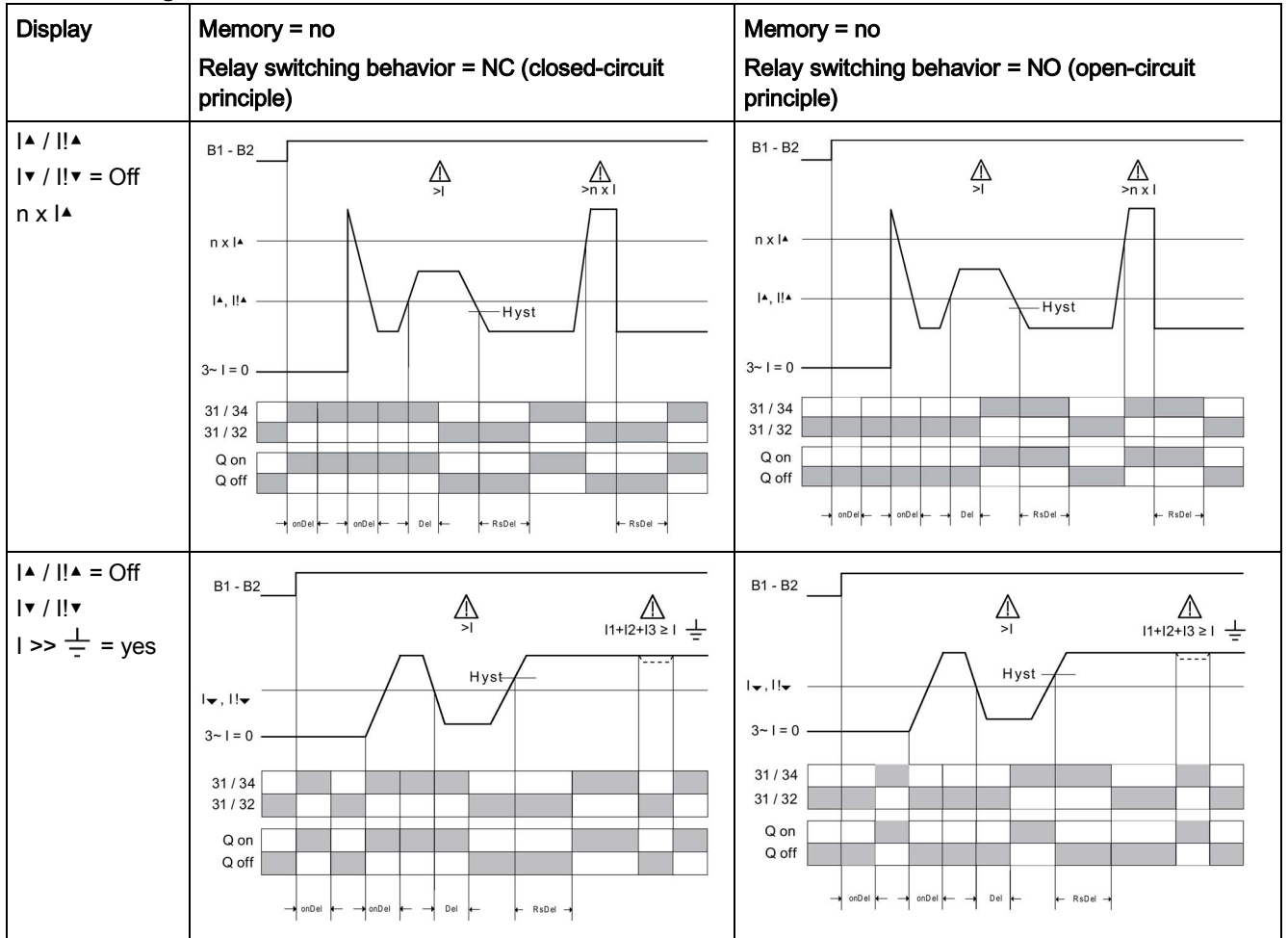
If a cable break is detected in a branch circuit (time ①), all delay times which are running (onDel, RsDel, Del) are aborted and both the CO contact and the semiconductor output change their switching state immediately ( $\leq 200$  ms).

When a defined current flow returns to all branch circuits (1/L1 - 2/T1, 3/L2 - 4/T2 und 5/L3 - 6/T3) (time ②), the CO contact and the semiconductor output respond again according to the defined settings.

If manual RESET (Mem = yes) is selected, the tripping state is saved.



Function diagrams



Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
<p><math>I_{\Delta} / I!_{\Delta} = \text{Off}</math>  <math>I_{\nabla} / I!_{\nabla}</math></p>		
<p><math>\curvearrowright = \text{yes}</math></p>		

### 4.5.3 Operation

#### Parameters

Parameterization of the devices is possible locally using the display and the three keys.




#### Parameter information

The table below shows the settable parameter information of the 3RR22 current monitoring relay with digital setting:

Table 4- 8 Parameter information, 3RR22 current monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for current undershoot(I▼)	1.6 A or OFF <sup>1)</sup> 4 A or OFF <sup>2)</sup> 8 A or OFF <sup>3)</sup>	16 A <sup>1)</sup> 40 A <sup>2)</sup> 80 A <sup>3)</sup>	0.1 A <sup>1)</sup> 0.1 A <sup>2)</sup> 0.2 A <sup>3)</sup>	1.6 A <sup>1)</sup> 4 A <sup>2)</sup> 8 A <sup>3)</sup>
"RUN"	Threshold for current overshoot (I▲)	1.6 A <sup>1)</sup> 4 A <sup>2)</sup> 8 A <sup>3)</sup>	16 A or OFF <sup>1)</sup> 40 A or OFF <sup>2)</sup> 80 A or OFF <sup>3)</sup>	0.1 A <sup>1)</sup> 0.1 A <sup>2)</sup> 0.2 A <sup>3)</sup>	3 A <sup>1)</sup> 8 A <sup>2)</sup> 16 A <sup>3)</sup>
"RUN"	Warning threshold for current undershoot (I!▼)	1.6 A or OFF <sup>1)</sup> 4 A or OFF <sup>2)</sup> 8 A or OFF <sup>3)</sup>	16 A <sup>1)</sup> 40 A <sup>2)</sup> 80 A <sup>3)</sup>	0.1 A <sup>1)</sup> 0.1 A <sup>2)</sup> 0.2 A <sup>3)</sup>	1.6 A <sup>1)</sup> 4 A <sup>2)</sup> 8 A <sup>3)</sup>
"RUN"	Warning threshold for current overshoot (I!▲)	1.6 A <sup>1)</sup> 4 A <sup>2)</sup> 8 A <sup>3)</sup>	16 A or OFF <sup>1)</sup> 40 A or OFF <sup>2)</sup> 80 A or OFF <sup>3)</sup>	0.1 A <sup>1)</sup> 0.1 A <sup>2)</sup> 0.2 A <sup>3)</sup>	3 A <sup>1)</sup> 8 A <sup>2)</sup> 16 A <sup>3)</sup>
"SET"	Hysteresis (Hyst)	0.1 A <sup>1)</sup> 0.1 A <sup>2)</sup> 0.2 A <sup>3)</sup>	3.0 A <sup>1)</sup> 8.0 A <sup>2)</sup> 16.0 A <sup>3)</sup>	0.1 A 0.1 A <sup>2)</sup> 0.2 A <sup>3)</sup>	0.5 A <sup>1)</sup> 0.8 A <sup>2)</sup> 1.6 A <sup>3)</sup>
"SET"	ON-delay time (onDel)	0 s	99 s	1 s	0 s
"SET"	Tripping delay time (Del)	0 s	30 s	1 s	0 s
"SET"	Reclosing delay time (RsDel)	0 min.	300 min.	1 min.	0 min.
"SET"	Blocking current monitoring (n x I▲)	no x I▲	5 x I▲	1 x I▲	no x I▲
"SET"	Residual current monitoring (I >> $\frac{1}{n}$ )	no or yes		--	no

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Phase sequence monitoring (  )	no or yes		--	no
"SET"	Load current monitoring (apparent current $I_s$ /active current $I_p$ )	$I_s$ or $I_p$		--	$I_s$
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC or NO		--	NC

- 1) 3RR2241 current monitoring relay
- 2) 3RR2242 current monitoring relay
- 3) 3RR2243 current monitoring relay

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**Note**

The "current overshoot" or "current undershoot" monitoring mode is defined with the setting OFF for the upper and lower threshold.

---

**Note**

**Deactivating monitoring**

If the upper and lower threshold values are deactivated (OFF), monitoring will cease for:

- Current overshoot
- Current undershoot
- Blocking current

The following parameters continue to be monitored:

- Fault current (if activated)
- Incorrect phase sequence (if activated)
- Phase failure

The up-to-date measured value is displayed permanently.

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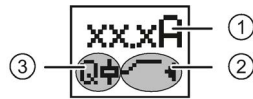
The parameters are described in the Chapter "Parameters (Page 363)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 39)".

## 4.5.4 Diagnostics

### Display information

The display is divided into three different areas.



- ① Current measured value or fault symbol
- ② Type of monitoring
- ③ Symbols for the semiconductor contact (left) and the CO contact (right)

### Meaning of the information on the display

#### Note

#### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and faults are indicated on the display as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	12.5A	Displays the measured current
①	$n \times I^{\Delta}$	Flashing: Current is above the set blocking current
①	$I >> \frac{I}{n}$	Flashing: Fault current detected
①	$L \rightarrow$	Flashing: Cable break/phase failure detected
①	$\curvearrowright !$	Flashing: Incorrect phase sequence detected
②		Monitoring for current overshoot
②		Monitoring for current undershoot
②		Range monitoring (monitoring for current overshoot and current undershoot)
②	◀	Current is in correct range
②	▲	A current overshoot has occurred
②	▼	A current undershoot has occurred
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 31/32 open, relay contact 31/34 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 31/32 closed, relay contact 31/34 open</li> </ul>
③	Q	<ul style="list-style-type: none"> <li>• Not flashing: Semiconductor output closed, supply voltage connected</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Semiconductor output open, supply voltage not switched through</li> </ul>

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 71)".

### 4.5.5 Circuit diagrams

#### Internal circuit diagrams 3RR22

##### 3RR2241-1F.30 current monitoring relay

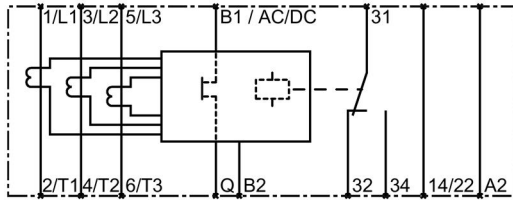


Image 4-5 1 CO contact, 3-phase

##### 3RR2241-2F.30, 3RR2242-.F.30, 3RR2243-.F.30 current monitoring relays

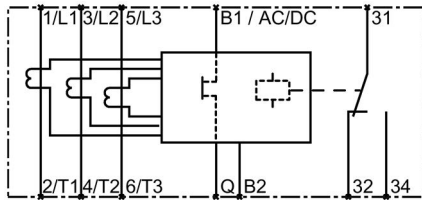


Image 4-6 1 CO contact, 3-phase

## 4.5.6 Technical data

### General technical specifications

	3RR2241-.....	3RR2242-.....	3RR2243-.....
<b>product brand name</b>	SIRIUS		
<b>Product designation</b>	multi-phase current monitoring		
<b>Design of the product</b>	multi-phase current monitoring		
<b>Size of the contactor can be combined company-specific</b>	S00	S0	S2
<b>Protection class IP</b>			
• on the front	IP20		
• of the terminal	IP20		IP00
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	690	
<b>Installation altitude at a height over sea level maximum</b>	m	2 000	
<b>Ambient temperature</b>			
• during storage	°C	-40 ... +80	
• during operating	°C	-25 ... +60	
<b>Electromagnetic compatibility</b>	IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4		
<b>EMC immunity to interference according to IEC 60947-1</b>	ambience A (industrial sector)		
<b>EMC emitted interference according to IEC 60947-1</b>	ambience A (industrial sector)		
<b>Resistance against shock</b>	15g / 11 ms		
<b>Resistance against vibration</b>	10 ... 55 Hz / 0.35 mm		10 ... 55 Hz / 0,35 mm
<b>Impulse voltage resistance rated value</b>	kV	6	
<b>Operating apparent output rated value</b>	V·A	4	
<b>Rating Rated value</b>	W	2.5	
<b>Reference code</b>			
• according to DIN 40719 extended according to IEC 204-2 according to IEC 750	K		
• according to DIN EN 61346-2	K		

4.5 3RR22 current monitoring relays

	3RR2241-.....	3RR2242-.....	3RR2243-.....
<b>Mechanical operating cycles as operating time typical</b>	10 000 000		
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>	100 000		
<b>Precision of digital display</b>	+/-1 digit		
<b>Adjustable response delay time</b>			
• when starting                      s	0 ... 99		
• with lower or upper limit violation                      s	0 ... 30		
<b>Standby time for restart after fault</b> s	0.2		
<b>Phase number</b>	3		
<b>Number of monitored phases</b>	3		
<b>Product function</b>			
• overcurrent monitoring	Yes		
• undercurrent monitoring	Yes		
• overcurrent and undercurrent monitoring	Yes		
• apparent current monitoring	Yes		
• active current monitoring	Yes		
• undercurrent recognition of 3 phases	Yes		
• phase sequence recognition	Yes		
• can be activated or deactivated phase sequence recognition	Yes		
• self-reset	Yes		
• reset external	No		
• manual RESET	Yes		



		3RR2241-.....	3RR2242-.....	3RR2243-.....
<b>Adjustable response current</b>				
• 1	A	1.6 ... 16	4 ... 40	8 ... 80
• 2	A	1.6 ... 16	4 ... 40	8 ... 80
<b>Factor as multiple of the current monitoring upper limit</b>				
• for the adjustable value of a blocking current		2 ... 5		
<b>Response value residual current detection at 50/60 Hz typical</b>	A	1.5	4	8
<b>Relative metering precision with regard to measured value</b>	%	5		
<b>Type of current for monitoring</b>		AC		
<b>Measurable current</b>				
• for AC	A	1.6 ... 16	4 ... 40	8 ... 80
<b>Adjustable switching hysteresis for measured current value</b>	A	0.1 ... 3	0.1 ... 8	0.2 ... 16
<b>Relative switching hysteresis for measured current value</b>	%	—		
<b>Response time maximum</b>	s	0.2		
<b>Relative repeat accuracy</b>	%	2		
<b>Temperature drift per °C</b>	%/°C	0.1		
<b>Current-carrying capacity</b>				
• for permanent overcurrent maximum permissible	A	16	40	80 <sup>1)</sup>
• for overcurrent duration < 1 s maximum permissible	A	320	800	1 600

1) Class 10 = 80 A  
Class 20 = 60 A  
Class 30 = 50 A

**Connections 3RR2241 (size S00)**

	3RR2241-1....	3RR2241-2....
<b>Design of the electrical connection</b>		
• for main current circuit	screw-type terminals	spring-loaded terminals
• for auxiliary and control current circuit	screw-type terminals	spring-loaded terminals
<b>Product function</b>		
• removable terminal for main circuit	No	
• removable terminal for auxiliary and control circuit	Yes	
<b>Type of the connectable conductor cross-section</b>		
• for main contacts		
– solid	2x (0.5 ... 1.5 mm <sup>2</sup> ), 2x (0.75 ... 2.5 mm <sup>2</sup> ), 2x (1 ... 4 mm <sup>2</sup> )	1x (0.5 ... 4 mm <sup>2</sup> )
– stranded	—	
– finely stranded		
– with conductor end processing	2x (0.5 ... 1.5 mm <sup>2</sup> ), 2x (0.75 ... 2.5 mm <sup>2</sup> )	1x (0.5 ... 2.5 mm <sup>2</sup> )
– without conductor final cutting	—	1x (0.5 ... 2.5 mm <sup>2</sup> )
• for AWG conductors for main contacts	1x 12, 2x (20 ... 14)	1x (20 ... 12)
• for auxiliary contacts		
– solid	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	
– finely stranded		
– with conductor end processing	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
– without conductor final cutting	—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors for auxiliary contacts	2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.8 ... 1.2
<b>Verification of suitability</b>		CE / UL / CSA

### Connections 3RR2242 (size S0)

	3RR2242-1....	3RR2242-2....
<b>Design of the electrical connection</b>		
• for main current circuit	screw-type terminals	spring-loaded terminals
• for auxiliary and control current circuit	screw-type terminals	spring-loaded terminals
<b>Product function</b>		
• removable terminal for main circuit	No	
• removable terminal for auxiliary and control circuit	Yes	
<b>Type of the connectable conductor cross-section</b>		
• for main contacts		
– solid	2x (1 ... 2.5 mm <sup>2</sup> ), 2x (2.5 ... 10 mm <sup>2</sup> )	1x (1 ... 10 mm <sup>2</sup> )
– stranded	—	
– finely stranded		
– with conductor end processing	2x (1 ... 2.5 mm <sup>2</sup> ), 2x (2.5 ... 6 mm <sup>2</sup> ), 1x 10 mm <sup>2</sup>	1x (1 ... 6 mm <sup>2</sup> )
– without conductor final cutting	—	1x (1 ... 6 mm <sup>2</sup> )
• for AWG conductors for main contacts	2 x (16 ... 14), 2x (14 ... 8)	1x (18 ... 8)
• for auxiliary contacts		
– solid	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	
– finely stranded		
– with conductor end processing	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
– without conductor final cutting	—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors for auxiliary contacts	2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.8 ... 1.2
<b>Verification of suitability</b>	CE / UL / CSA	

**3RR2243 connections (size S2)**

		3RR2243-1....	3RR2243-3....
<b>Design of the electrical connection</b>			
• for main current circuit		screw-type terminals	
• for auxiliary and control current circuit		screw-type terminals	spring-loaded terminals
<b>Product function</b>			
• removable terminal for main circuit		No	
• removable terminal for auxiliary and control circuit		Yes	
<b>Type of the connectable conductor cross-section</b>			
• for main contacts			
– solid		2x (1 ... 35 mm <sup>2</sup> ), 1x (1 ... 50 mm <sup>2</sup> )	
– stranded		2x (1 ... 35 mm <sup>2</sup> ), 1x (1 ... 50 mm <sup>2</sup> )	
– finely stranded			
– with conductor end processing		2x (1 ... 25 mm <sup>2</sup> ), 1x (1 ... 35 mm <sup>2</sup> )	
– without conductor final cutting		—	
• for AWG conductors for main contacts		2x (18 ... 2), 1x (18 ... 1)	
• for auxiliary contacts			
– solid		1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	
– finely stranded			
– with conductor end processing		1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
– without conductor final cutting		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors for auxiliary contacts		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	0.8 1.2	
<b>Verification of suitability</b>		CE / UL / CSA	

**Mounting, fixing, dimensions**

Frame size: (S0, S00)

		3RR2241-1....	3RR2242-1....	3RR2 241-2....	3RR2 242-2....
<b>Built in orientation</b>		any			
<b>Type of mounting</b>		direct mounting			
<b>Width</b>	mm	45			
<b>Height</b>	mm	79	88	91	109
<b>Depth</b>	mm	81	93	81	93
<b>Distance, to be maintained, to the ranks assembly</b>					
• forwards	mm	0			
• backwards	mm	0			
• upwards	mm	0			
• downwards	mm	0			
• sideways	mm	0			
<b>Distance, to be maintained, to earthed part</b>					
• forwards	mm	0	6		
• backwards	mm	0			
• upwards	mm	0	6	0	6
• downwards	mm	0	6	0	6
• sideways	mm	6			
<b>Distance, to be maintained, conductive elements</b>					
• forwards	mm	0	6		
• backwards	mm	0			
• upwards	mm	0	6	0	6
• downwards	mm	0	6	0	6
• sideways	mm	6			

Frame size: (S2)

		3RR2243-1....	3RR2243-3....
<b>mounting position</b>		any	
<b>Mounting type</b>		direct mounting	
<b>Width</b>	mm	55	
<b>Height</b>	mm	99	
<b>Depth</b>	mm	112	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• upwards	mm	0	
• downwards	mm	10	
• sideways	mm	0	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	10	
• backwards	mm	0	
• upwards	mm	10	
• downwards	mm	10	
• sideways	mm	10	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	10	
• backwards	mm	0	
• upwards	mm	10	
• downwards	mm	10	
• sideways	mm	10	

## Auxiliary circuit

		3RR2241-.....	3RR2242-.....	3RR2243-.....
<b>Design of the contact element of the output relay</b>		closed-circuit current / open-circuit current		
<b>Operating current at 17 V minimum</b>	mA	5		
<b>Number of outputs as contact-less semiconductor switching element for reporting function non-delayed</b>		1		
<b>Current-carrying capacity of the semiconductor output</b>				
• at DC-13 at 240 V	mA	20		
• at AC-14 at 240 V at 50/60 Hz	mA	20		
<b>Residual current of the semiconductor output maximum</b>	mA	0.035		
<b>Number of NC contacts for auxiliary contacts</b>		—		
<b>Number of NO contacts for auxiliary contacts</b>		—		
<b>Number of changeover contacts for auxiliary contacts</b>		1		
<b>Operating current of the auxiliary contacts</b>				
• at AC-15				
– at 24 V	A	3		
– at 230 V	A	3		
– at 400 V	A	3		
• at DC-13 at 24 V	A	1		
• at DC-13 at 125 V	A	0.2		
• at DC-13 at 250 V	A	0.1		

Supply voltage

		3RR224.-.A..	3RR224.-.W..
<b>Type of supply voltage</b>		AC/DC	
<b>Supply voltage frequency</b>			
• 1	Hz	50 ... 60	
<b>Supply voltage 1</b>			
• for DC			
– rated value	V	24	—
– initial rated value	V	—	24
– final rated value	V	—	240
• at 50 Hz for AC			
– rated value	V	24	—
– initial rated value	V	—	24
– final rated value	V	—	240
• at 60 Hz for AC			
– rated value	V	24	—
– initial rated value	V	—	24
– final rated value	V	—	240
<b>Insulation voltage of the auxiliary and control circuit for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	300	
<b>Impulse voltage resistance of the auxiliary and control current circuit rated value</b>	V	4 000	
<b>Stored energy time supply voltage failure minimum</b>	ms	10	



## 3UG4501 filling level monitoring relay

### 5.1 Application areas

#### Application areas

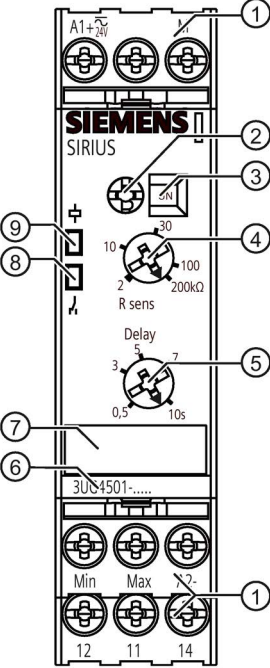
The 3UG4501 filling level monitoring relays are used, for example, in the following applications:

Table 5- 1 Application areas of the 3UG4501 filling level monitoring relay

Function	Application
<ul style="list-style-type: none"> <li>• One-point filling level monitoring and two-point filling level monitoring</li> <li>• Overflow protection</li> <li>• Dry-run protection</li> <li>• Leakage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Open-loop control of a bilge pump, e.g. on ships or construction sites</li> <li>• Filling level monitoring of lubricants</li> <li>• Filling level monitoring of dosing containers</li> <li>• Filling level monitoring of oil sumps</li> <li>• Filling level monitoring of rainwater catchment basins</li> <li>• Water supply</li> <li>• Waste water treatment plant</li> </ul>

## 5.2 Operator controls and connection terminals

### Front view / terminal labeling

Front view	Description
	<b>Position digits</b>
	① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	② Rotary button for setting the monitoring mode.
	③ Display field: drainage control (OV) or inflow control (UN)
	④ Rotary button for setting the sensor sensitivity (R sens)
	⑤ Rotary button for setting the tripping delay (Delay)
	⑥ Device article number
	⑦ Label
	⑧ Status display: LED contact symbol (yellow)
	⑨ Status display: LED coil symbol (green)
	<b>Terminal labels</b>
	A1+ Rated control supply voltage ~ / +
	A2- Rated control supply voltage ~ / -
	M (GND) Reference point
Min Minimum level	
Max Maximum level	
12 Output relay K1 CO contact NC contact	
11 Output relay K1 CO contact root	
14 Output relay K1 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 95)".

## 5.3 Functions

### General functionality

The 3UG4501 filling level monitoring relays and the connectable 2-pole or 3-pole 3UG3207-.. probes are used to monitor the filling levels of electrically conductive liquids.

### Monitoring

The working principle of the 3UG4501 filling level monitoring relay is based on measurement of the electrical resistance of the liquid between the probes (minimum and maximum level) or the reference potential (conductive measurement principle). The output relay changes its switching state if the measured value is below the sensitivity set on the front. The probes (e.g. 3UG3207-..) are powered with alternating current (AC measured current) to exclude electrolysis phenomena in the liquid.

---

#### Note

The filling level monitoring relays do not have active monitoring of probe defects or probe conductor defects. Therefore when selecting the probes and routing the cable, make sure that this source of error is precluded. For example, use stable bow probes if wire electrodes are in danger of being broken.

---

Depending on their design, the 3UG4501 filling level monitoring relays are powered with a 24 V AC/DC or 24 to 240 V AC/DC rated control supply voltage through terminals A1+ / A2-. When the rated control supply voltage is applied, the green LED next to the coil symbol on the device cover lights up.

---

#### Note

On the 3UG4501-.AA30 devices with 24 V AC / DC versions, as a common reference for the AC probe voltage at terminals Min and Max, terminal M must not be connected to terminals A1 / A2 of the device or grounded!

On the 3UG4501-.AW30 24 to 240 V AC / DC versions, terminals M, Min, and Max are electrically isolated from terminals A1 and A2 of the rated control supply voltage!

---

#### Note

The specified voltages represent the absolute thresholds.

---

#### Tripping delay

Tripping can be delayed by 0.5 to 10 s to avoid tripping the switching function too early when the level has not quite been reached (e.g. wave motion or foaming of the liquid).

The switching states of the output relay are given below in the section entitled "Function diagrams."

### Probes for filling level monitoring

To monitor filling levels of electrically conductive liquids, the following probes can be mounted on the 3UG4501 filling level relays.

- Three-pole wire electrode
- Two-pole wire electrode
- Two-pole bow electrode
- Single-pole bow electrode for side mounting
- Single-pole rod electrode for side mounting

These necessary accessories are described in Chapter "Probes for the 3UG4501 monitoring relay (Page 329)."

---

#### Note

At the terminals, other resistance sensors in the range 2 to 200 k $\Omega$  (e.g. photoresistor, temperature sensors, resistor-based position encoders, etc.) can also be connected. The monitoring relays are therefore also suitable as resistance triggers.

---

### Two-point monitoring

If the liquid level reaches the maximum probe while the minimum probe and reference probe are immersed, the output relay changes its switching state. The output relay reverts to its original switching state as soon as the minimum probe is no longer in contact with the liquid.

### One-point monitoring

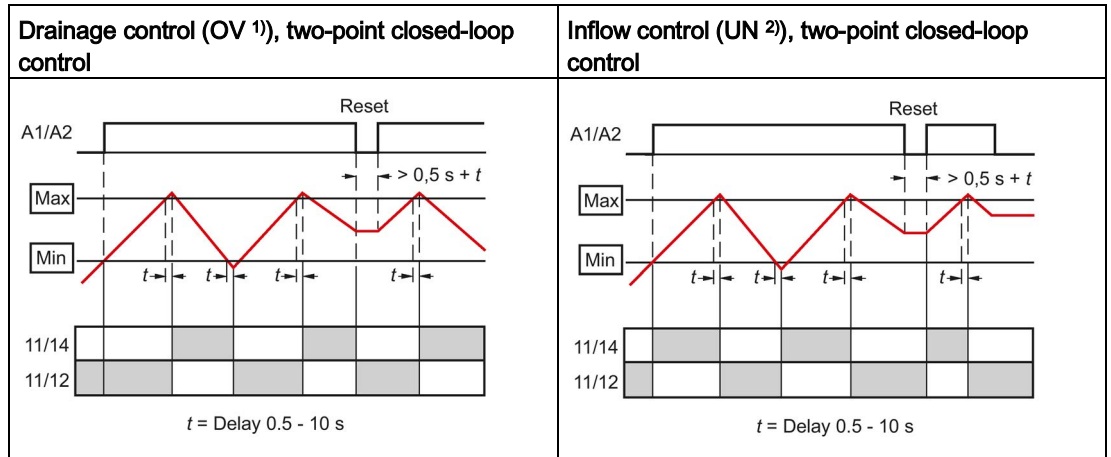
For closed loop control of only one level, the terminals for Min and Max are bridged on the filling level monitoring relay. The output relay changes its switching state as soon as the liquid level has been reached. The output relay reverts to its original switching state as soon as the probe is no longer in contact with the liquid.

### Reset response

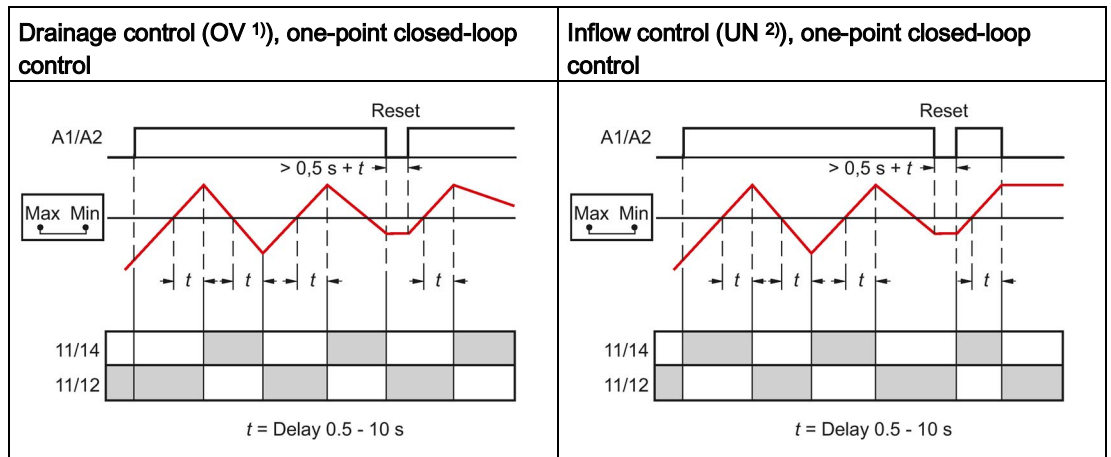
For reliable resetting, the rated control supply voltage must be interrupted at least for the set delay time of +0.5 s.

When the rated control supply voltage is interrupted, the output relay returns to the quiescent state when the power failure backup time has expired (contact 11-12 is closed, contact 11-14 is open). If the rated control supply voltage is switched on again after  $> 0.5 \text{ s} + \text{Delay} (t)$  (device reset), the output relay switches depending on the set relay switching behavior.

Function diagrams 3UG4501



- 1) OV = overshoot
- 2) UN = undershoot



- 1) OV = overshoot
- 2) UN = undershoot

## 5.4 Operation

### Parameters

The following parameters can be set on the relevant rotary button using a screwdriver:

Table 5-2 Parameter information, 3UG4501 filling level monitoring relay

Parameters	Operating elements <sup>2)</sup>	Setting range		Increment
		Minimum value	Maximum value	
Monitoring mode <sup>1)</sup> : drainage control (OV) or inflow control (UN)	3	--	--	--
Sensor sensitivity (R sens)	4	2 kΩ	200 kΩ	Continuous
Tripping delay time (Delay)	5	0.5 s	10 s	Continuous

<sup>1)</sup> By operating the rotary button, it is possible to choose between drainage control (OV) and inflow control (UN) depending on the application (one-point control or two-point control).

<sup>2)</sup> The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 90)."

Chapter "Circuit diagrams (Page 95)" shows the wiring examples for the different monitoring modes.

The parameters are defined in Chapter "Parameters (Page 363)."

### Required tools

The same screwdriver can be used to set the parameters as for mounting the filling level monitoring relays.

## 5.5 Diagnostics

### 5.5.1 Diagnostics with LED

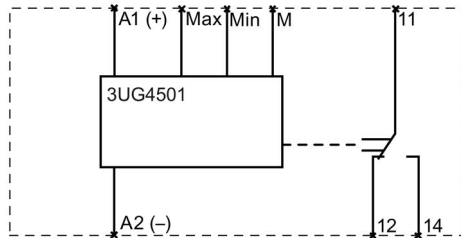
Depending on the liquid level, the output relay switches in accordance with its set relay switching behavior (drainage control OV, inflow control UN). If the output relay responds (contact 11-12 open, contact 11-14 closed), the yellow LED next to the contact symbol on the device cover lights up.

The switching behavior of the output relay is shown in Chapter "Functions (Page 91)."

## 5.6 Circuit diagrams

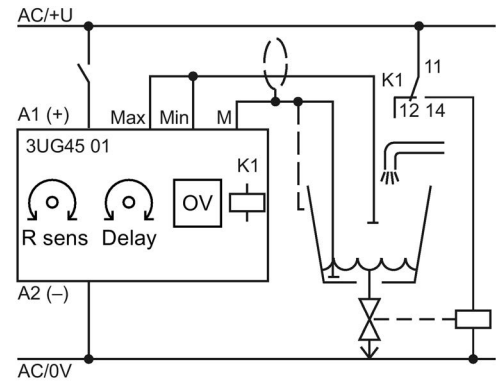
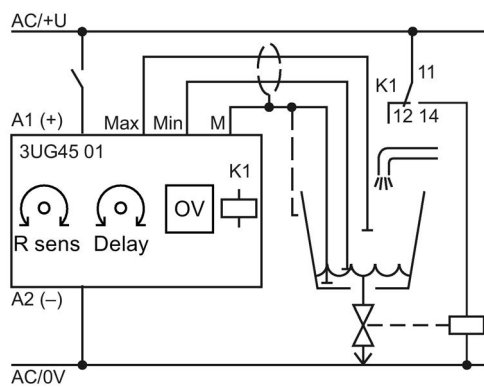
### Internal circuit diagram

3UG4501-.A.30 level monitoring relays



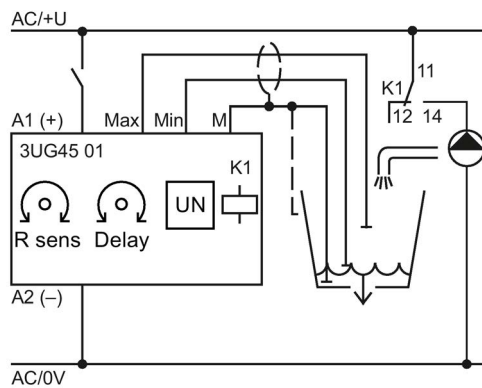
### Wiring examples

#### Drainage control



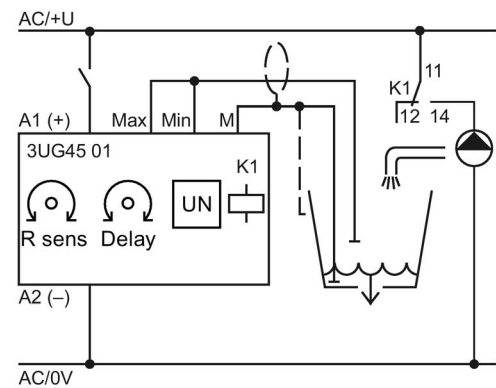
#### Two-step control

##### Inflow control



#### Two-step control

#### One-point closed-loop control



#### One-point closed-loop control

## 5.7 Technical data

### General technical details

		3UG4501-..A..	3UG4501-..W..
<b>Product function</b>		Monitoring relay for level monitoring	
<b>Response time maximum</b>	s	0.3	
<b>Relative metering precision</b>	%	20	
<b>Temperature drift per °C</b>	%/°C	1	
<b>Relative repeat accuracy</b>	%	1	
<b>Manufacturer article number of the optional sensor</b>		2-pole and 3-pole sensors 3UG3207	
<b>Cable length of the sensor maximum</b>	m	100	
<b>Type of display LED</b>		Yes	
<b>Product function</b>			
• response sensitivity adjustable		Yes	
• outlet monitoring adjustable		Yes	
• inlet monitoring adjustable		Yes	
• reset external		Yes	
<b>Starting time after the control supply voltage has been applied</b>	ms	500	
<b>Voltage type of control feed voltage</b>		AC/DC	
<b>Control supply voltage</b>			
• at 50 Hz at AC			
– rated value	V	24	24 ... 240
• at 60 Hz at AC			
– rated value	V	24	24 ... 240
• for DC			
– rated value	V	24	24 ... 240
<b>Operating range factor control supply voltage rated value</b>			
• at 50 Hz			
– for AC		0.85 ... 1.1	
• at 60 Hz			
– for AC		0.85 ... 1.1	
• for DC		0.85 ... 1.1	
<b>Impulse voltage resistance rated value</b>	kV	4	
<b>Recorded real power</b>	W	2	
<b>Protection class IP</b>		IP20	



		3UG4501-..A..	3UG4501-..W..
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4	
<b>Operating current at 17 V minimum</b>	mA	5	
<b>Continuous current of the DIAZED fuse link of the output relay</b>	A	4	
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g	
<b>Shock resistance according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms	
<b>Installation altitude at a height over sea level maximum</b>	m	2 000	
<b>Current carrying capacity of output relay</b>			
• at AC-15			
– at 250 V at 50/60 Hz	A	3	
– at 400 V at 50/60 Hz	A	3	
• at DC-13			
– at 24 V	A	1	
– at 125 V	A	0.2	
– at 250 V	A	0.1	
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV	
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV	
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV	
<b>Electrostatic discharge according to IEC 61000-4-2</b>		6 kV contact discharge / 8 kV air discharge	
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m	
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	300	
<b>Degree of pollution</b>		3	
<b>Apparent power consumed</b>			
• at 24 V for AC maximum	V·A	2	
• at 240 V for AC maximum	V·A	—	4
<b>Ambient temperature</b>			
• during operating	°C	-25 ... +60	
• during storage	°C	-40 ... +80	
• during transport	°C	-40 ... +80	

5.7 Technical data

	3UG4501-..A..	3UG4501-..W..
Galvanic isolation between entrance and outlet	Yes	
Galvanic isolation between the outputs	No	
Mechanical operating cycles as operating time typical	10 000 000	
Electrical operating cycles as operating time at AC-15 at 230 V typical	100 000	
Operating cycles with 3RT2 contactor maximum	1/h	5 000

## Mechanical design

		3UG4501-1....	3UG4501-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	92	94
<b>Depth</b>	mm	91	
<b>mounting position</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Mounting type</b>		screw and snap-on mounting	
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes	

5.7 Technical data

	3UG4501-1....	3UG4501-2....
<b>Design of the electrical connection</b>	screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-sections</b>		
• solid	1x (0.5 ... 4.0 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
• finely stranded		
– with wire end processing	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2 x (0.25 ... 1.5 mm <sup>2</sup> )
– without wire end processing	—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors		
– solid	2x (20 ... 14)	2x (24 ... 16)
– stranded	2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.8 ... 1.2
<b>Number of change-over switches delayed switching</b>		1

Measuring circuit

		3UG4501-.....
<b>Adjustable response delay time</b>		
• when starting	s	0.3 ... 10
• with lower or upper limit violation	s	0.3 ... 10
<b>Adjustable response value impedance</b>	kΩ	2 ... 200
<b>Measuring electrode current maximum</b>	mA	1
<b>Measuring electrode voltage maximum</b>	V	15
<b>Number of measuring circuits</b>		1
<b>Stored energy time at mains power cut minimum</b>	s	0.2

## 3UG4.1 line monitoring relay

### Overview

The electronic line monitoring relays permit maximum protection for mobile machines and plants or in unstable power systems. Using the monitoring relays, line and voltage errors can be detected early and minimized.

Depending on the version, the electronic line monitoring relays monitor the following:

- Phase sequence
- Phase failure with and without neutral conductor monitoring
- Phase asymmetry
- Undervoltage and/or overvoltage

## 6.1 Application areas

### Application areas

The various line monitoring relays are used, for example, in non-stationary systems such as refrigeration containers, construction site compressors, and cranes. The devices are used in the following application areas:

Table 6- 1 Application areas of the line monitoring relays

Function	Application
Phase sequence	<ul style="list-style-type: none"> <li>• Direction of rotation of the drive</li> <li>• Refrigeration trucks</li> <li>• Refrigerators</li> <li>• Saws</li> <li>• Pumps</li> <li>• Rollers</li> <li>• Transport of persons (elevators, moving staircases and walkways)</li> </ul>
Phase failure	<ul style="list-style-type: none"> <li>• A fuse has tripped</li> <li>• Control supply voltage failure</li> <li>• Cable break</li> <li>• Crane systems</li> <li>• Electrical welding</li> <li>• Emergency generating sets (banks, hospitals, alarm systems, power plants)</li> <li>• Transport of persons (elevators, moving staircases and walkways)</li> </ul>
Phase asymmetry	<ul style="list-style-type: none"> <li>• Motor protection (overheating of the motor through asymmetric voltage)</li> <li>• Detection of asymmetric systems</li> </ul>
Undervoltage	<ul style="list-style-type: none"> <li>• Increased current on a motor with corresponding overheating</li> <li>• Unintended device reset</li> <li>• Mains failure – particularly with battery supply</li> <li>• Heating systems</li> <li>• Cranes</li> <li>• Elevators</li> <li>• Protection on unstable systems (switchover to emergency current, monitoring of the generator)</li> </ul>
Overvoltage	<ul style="list-style-type: none"> <li>• System protection against destruction caused by supply overvoltages</li> <li>• Energy supply to the line</li> <li>• Lamps (UV lamps, laser lamps, OP lighting, tunnels, traffic lights)</li> </ul>

## 6.2 3UG4511 line monitoring relay

### 6.2.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4511

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable) Connection is possible using screw-type terminals or spring-loaded terminals.
	②	Circuit diagram
	③	Device article number
	④	Label
	⑤	Status display: LED contact symbol (green)
		<b>Terminal labels</b>
	L1, L2, L3	Rated control supply voltage
	12	Output relay K1 CO contact NC contact
	11	Output relay K1 CO contact root
	14	Output relay K1 CO contact NO contact
	22	Output relay K2 CO contact NC contact (on the 3UG4511-.B only)
	21	Output relay K2 CO contact root (on the 3UG4511-.B only)
	24	Output relay K2 CO contact NC contact (on the 3UG4511-.B only)

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 106)".

## 6.2.2 Function

### General functionality

The 3UG4511 line monitoring relays monitor the **phase sequence** in a three-phase system.

The devices are **self-powered** (measuring voltage = rated control supply voltage) and work on the closed-circuit principle. Depending on the version, the line monitoring relays are powered with a rated control supply voltage of 160 V to 260 V (3UG4511-..N20), 320 to 500 V (3UG4511-..P20) and 420 to 690 V (3UG4511-..Q20) through terminals L1 / L2 / L3.

All 3UG4511 line monitoring relays feature at least one output relay (output relay K1 CO contact). The 3UG4511-.B line monitoring relays have an additional relay (output relay K2 CO contact). Output relay K2 switches synchronously with output relay K1.

No settings are required for operation.

---

#### Note

The specified voltages represent the absolute thresholds.

---

### Monitoring

If the correct phase sequences are applied to terminals L1-L2-L3, the output relay picks up after the response time and the "contact symbol" LED lights up green. If the phase sequence is incorrect, the output relay remains in its quiescent position. After the power system has been disconnected, the output relays drop out after the response time has expired.

---

#### Note

After failure of one phase, motors generate a reverse voltage at the terminal of the failed phase due to the regenerative power recovery. This can be up to 90 % of the line voltage in magnitude. Because the 3UG4511 line monitoring relays are not protected against reverse voltage, such a phase failure is not reliably detected.

If this type of monitoring is required, the 3UG4512 line monitoring relay should be used, for example!

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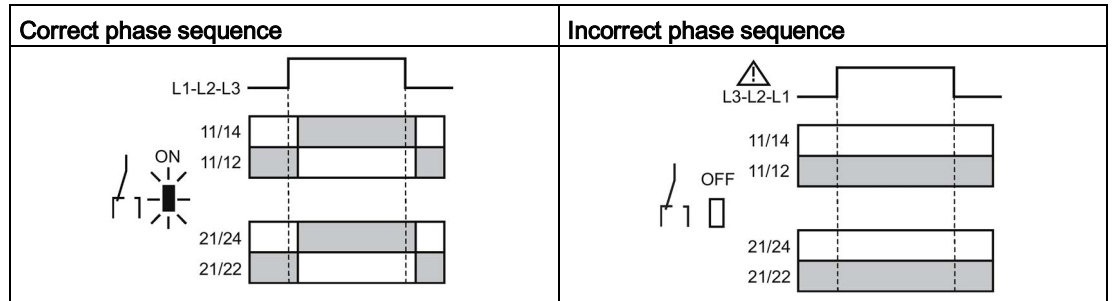
You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 105)."

### Reset response

The device features an autoreset that resets the output relay to its original state after an error message and rectification of the fault that has occurred.



## Function diagrams 3UG4511



### 6.2.3 Diagnostics

#### 6.2.3.1 Diagnostics with LED

#### Status display

The following information about the operating state is displayed on the 3UG4511 line monitoring relay:

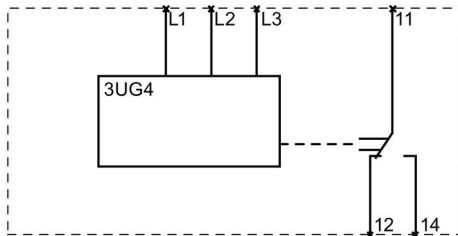
Operating status	LED contact symbol (green)	State of the output relay
		12/ 11/ 14 22/ 21/ 24
Correct phase sequence	On	
Incorrect phase sequence	Off	

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 104)."

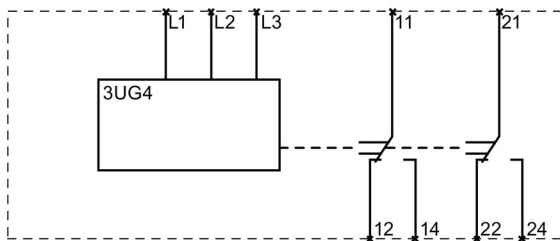
### 6.2.4 Circuit diagrams

#### Internal circuit diagrams 3UG4511

##### 3UG4511-.A.. line monitoring relays



##### 3UG4511-.B.. line monitoring relays



---

**Note**

It is not necessary to fuse the measuring circuit to protect the device. Fusing for line protection depends on the cross-section used.

---

**Note**

The 3UG4511 line monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

---

## 6.2.5 Technical data

### Measuring circuit

		3UG4511-..N	3UG4511-..P	3UG4511-..Q
<b>Type of voltage for monitoring</b>		AC		
<b>Number of poles for main current circuit</b>		3		
<b>Measurable voltage</b>				
<ul style="list-style-type: none"> <li>for AC</li> </ul>	V	160 ... 260	320 ... 500	420 ... 690

### General technical details

		3UG4511-..N	3UG4511-..P	3UG4511-..Q
<b>Product function</b>		Phase monitoring relay		
<b>Type of display LED</b>		Yes		
<b>Product function</b>				
<ul style="list-style-type: none"> <li>undervoltage recognition</li> </ul>		No		
<ul style="list-style-type: none"> <li>overvoltage recognition</li> </ul>		No		
<ul style="list-style-type: none"> <li>phase sequence recognition</li> </ul>		Yes		
<ul style="list-style-type: none"> <li>phase disturbance recognition</li> </ul>		No		
<ul style="list-style-type: none"> <li>asymmetry recognition</li> </ul>		No		
<ul style="list-style-type: none"> <li>overvoltage recognition of 3 phases</li> </ul>		No		
<ul style="list-style-type: none"> <li>undervoltage recognition of 3 phases</li> </ul>		No		
<ul style="list-style-type: none"> <li>tension window recognition of 3 phases</li> </ul>		No		
<ul style="list-style-type: none"> <li>reset external</li> </ul>		—		
<ul style="list-style-type: none"> <li>self-reset</li> </ul>		Yes		
<ul style="list-style-type: none"> <li>open-circuit or closed-circuit current principle</li> </ul>		No		
<b>Starting time after the control supply voltage has been applied</b>	s	0.2		
<b>Response time maximum</b>	s	0.45		
<b>Temperature drift per °C</b>	%/°C	—		
<b>Relative repeat accuracy</b>	%	—		
<b>Voltage type of control feed voltage</b>		AC		
<b>Control supply voltage</b>				
<ul style="list-style-type: none"> <li>at 50 Hz at AC rated value</li> </ul>	V	160 ... 260	320 ... 500	420 ... 690
<ul style="list-style-type: none"> <li>at 60 Hz at AC rated value</li> </ul>	V	160 ... 260	320 ... 500	420 ... 690
<b>Operating range factor control supply voltage rated value</b>				
<ul style="list-style-type: none"> <li>at 50 Hz for AC</li> </ul>		1		1
<ul style="list-style-type: none"> <li>at 60 Hz for AC</li> </ul>		1		1

3UG4.1 line monitoring relay

6.2 3UG4511 line monitoring relay

		3UG4511-..N	3UG4511-..P	3UG4511-..Q
Impulse voltage resistance rated value	kV	6		
Recorded real power	W	2		
Protection class IP		IP20		
Electromagnetic compatibility		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4		
Operating current at 17 V minimum	mA	5		
Continuous current of the DIAZED fuse link of the output relay	A	4		
Resistance against vibration according to IEC 60068-2-6		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g		
Shock resistance according to IEC 60068-2-27		sinusoidal half-wave 15g / 11 ms		
Current carrying capacity of output relay				
• at AC-15				
– at 250 V at 50/60 Hz	A	3		
– at 400 V at 50/60 Hz	A	3		
• at DC-13				
– at 24 V	A	1		
– at 125 V	A	0.2		
– at 250 V	A	0.1		
Installation altitude at a height over sea level maximum	m	2 000		
Conductor-bound parasitic coupling BURST according to IEC 61000-4-4		2 kV		
Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5		2 kV		
Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5		1 kV		
Electrostatic discharge according to IEC 61000-4-2		6 kV contact discharge / 8 kV air discharge		
Field-bound parasitic coupling according to IEC 61000-4-3		10 V/m		
Thermal current of the contact-affected switching element maximum	A	5		
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690		
Degree of pollution		3		
Ambient temperature				
• during operating	°C	-25 ... +60		
• during storage	°C	-40 ... +85		
• during transport	°C	-40 ... +85		

	3UG4511-..N	3UG4511-..P	3UG4511-..Q
<b>Galvanic isolation</b>			
• between entrance and outlet	Yes		
• between the outputs	Yes		
• between the voltage supply and other circuits	Yes		
<b>Mechanical operating cycles as operating time typical</b>	10 000 000		
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>	100 000		
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000	

## Mechanical design

	3UG4511-1A...	3UG4511-1B...	3UG4511-2A...	3UG4511-2B...
<b>Width</b>	mm	22.5		
<b>Height</b>	mm	83	92	84
<b>Depth</b>	mm	91		
<b>mounting position</b>		any		
<b>Distance, to be maintained, to earthed part</b>				
• forwards	mm	0		
• backwards	mm	0		
• sideways	mm	0		
• upwards	mm	0		
• downwards	mm	0		
<b>Distance, to be maintained, to the ranks assembly</b>				
• forwards	mm	0		
• backwards	mm	0		
• sideways	mm	0		
• upwards	mm	0		
• downwards	mm	0		

	3UG4511-1A...	3UG4511-1B...	3UG4511-2A...	3UG4511-2B...
<b>Distance, to be maintained, conductive elements</b>				
• forwards mm	0			
• backwards mm	0			
• sideways mm	0			
• upwards mm	0			
• downwards mm	0			
<b>Mounting type</b>	snap-on mounting			
<b>Product function removable terminal for auxiliary and control circuit</b>	Yes			
<b>Design of the electrical connection</b>	screw-type terminals		spring-loaded terminals	
<b>Type of the connectable conductor cross-sections</b>				
• solid	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )		2x (0.25 ... 1.5 mm <sup>2</sup> )	
• finely stranded				
– with wire end processing	1x (0,5 ... 2,5 mm <sup>2</sup> ), 2x (0,5 ... 1,5 mm <sup>2</sup> )		2 x (0.25 ... 1.5 mm <sup>2</sup> )	
– without wire end processing	—		2x (0.25 ... 1.5 mm <sup>2</sup> )	
• for AWG conductors				
– solid	2x (20 ... 14)		2x (24 ... 16)	
– stranded	2x (20 ... 14)		2x (24 ... 16)	
<b>Tightening torque</b>				
• with screw-type terminals N·m	0.8 ... 1.2		—	
<b>Number of change-over switches delayed switching</b>	1	2	1	2

## 6.3 3UG4512 line monitoring relay

### 6.3.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4512

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable) Connection is possible using screw-type terminals or spring-loaded terminals.
	②	Circuit diagram
	③	Device article number
	④	Label
	⑤	Status display: LED phase failure / phase sequence (red)
	⑥	Status display: LED coil symbol (green)
		<b>Terminal labels</b>
	L1, L2, L3	Rated control supply voltage
	12	Output relay K1 CO contact NC contact
	11	Output relay K1 CO contact root
	14	Output relay K1 CO contact NO contact
	22	Output relay K2 CO contact NC contact (on the 3UG4512-.B only)
	21	Output relay K2 CO contact root (on the 3UG4512-.B only)
24	Output relay K2 CO contact NC contact (on the 3UG4512-.B only)	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 115)".

## 6.3.2 Function

### General functionality

The 3UG4512 line monitoring relays monitor the **phase sequence** and the **phase failure** of one of the three phases in a three-phase system. The asymmetry threshold is 10 %.

The devices are **self-powered** (measuring voltage = rated control supply voltage) and work on the closed-circuit principle. The 3UG4512 line monitoring relays monitor all phases of three-phase AC networks from 160 to 690 V through terminals L1 / L2 / L3 and also draw power from all three phases simultaneously.

All 3UG4512 line monitoring relays feature at least one output relay (output relay K1 CO contact). The 3UG4512-.B line monitoring relays have an additional relay (output relay K2 CO contact). Output relay K2 switches synchronously with output relay K1.

No settings are required for operation.

---

### Note

The specified voltages represent the absolute thresholds.

---

### Monitoring

Thanks to a special measuring method, a phase failure is detected with certainty despite wide-range voltage from 160 to 690 V AC and reverse power of up to 90 % from the load in the case of regenerative power recovery.

If the line voltage is switched on, the LED "coil symbol" will light up green. If the correct phase sequence is applied to terminals L1-L2-L3, the output relays pick up. If the phase sequence is incorrect, the "phase failure / phase sequence" LED flashes red and the output relays remain in their quiescent position. On a phase failure, the "phase failure / phase sequence" LED lights up red continuously and the output relays drop out to protect the application from any damage that may result.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 114)."



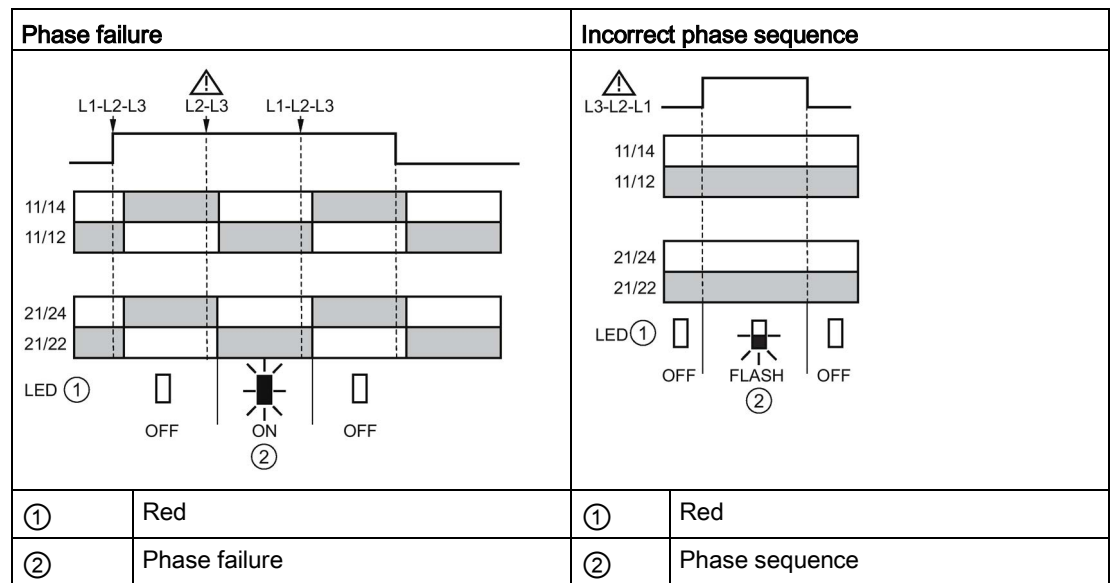
## Reset response

The device features an autoreset function. The autoreset function resets the output relay to its original state after an error message and rectification of the fault that has occurred.

### Note

The red "phase failure / phase sequence" LED is a fault diagnostics display and does not indicate the current state of the relay!

## Function diagrams 3UG4512

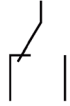
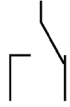
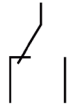
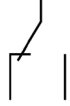


### 6.3.3 Diagnostics

#### 6.3.3.1 Diagnostics with LED

##### Status display

The following information about the operating state is displayed on the 3UG4512 line monitoring relay:

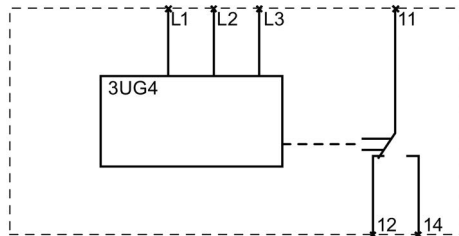
Operating state	LED		State of the output relays 12/ 11/ 14 22/ 21/ 24
	Coil symbol (green)	Phase failure / phase sequence (red)	
<ul style="list-style-type: none"> <li>Supply voltage not present</li> </ul>	Off	Off	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Correct phase sequence</li> <li>All phases available</li> </ul>	On	Off	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Incorrect phase sequence</li> </ul>	On	flashing	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Phase failure</li> </ul>	On	On	

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 112)".

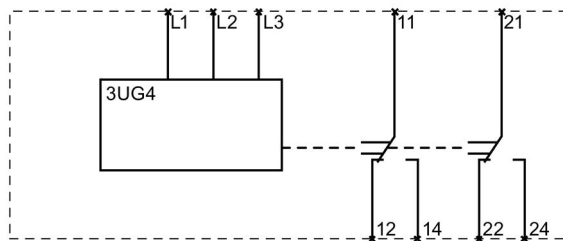
## 6.3.4 Circuit diagrams

### Internal circuit diagrams 3UG4512

#### 3UG4512-.A.. line monitoring relays



#### 3UG4512-.B.. line monitoring relays



---

#### Note

It is not necessary to fuse the measuring circuit to protect the device. Fusing for line protection depends on the cross-section used.

---

#### Note

The 3UG4512 line monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

---

### 6.3.5 Technical data

#### Measuring circuit

			3UG4512-.....
Type of voltage for monitoring			AC
Number of poles for main current circuit			3
Measurable voltage			
• for AC	V		160 ... 690
Adjustable voltage range	V		— ...

#### General technical details

			3UG4512-.....
Product function			Phase monitoring relay
Design of the display			—
Type of display LED			Yes
Product function			
• undervoltage recognition			No
• overvoltage recognition			No
• phase sequence recognition			Yes
• phase disturbance recognition			Yes
• asymmetry recognition			No
• overvoltage recognition of 3 phases			No
• undervoltage recognition of 3 phases			No
• tension window recognition of 3 phases			No
• reset external			—
• self-reset			Yes
• open-circuit or closed-circuit current principle			No
Starting time after the control supply voltage has been applied	s		1
Response time maximum	s		0.45
Temperature drift per °C	%/°C		—

		3UG4512-.....
<b>Voltage type of control feed voltage</b>		AC
<b>Control supply voltage</b>		
• at 50 Hz at AC rated value	V	160 ... 690
• at 60 Hz at AC rated value	V	160 ... 690
<b>Operating range factor control supply voltage rated value</b>		
• at 50 Hz for AC		1
• at 60 Hz for AC		1
<b>Impulse voltage resistance rated value</b>	kV	6
<b>Recorded real power</b>	W	2
<b>Protection class IP</b>		IP20
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
<b>Operating current at 17 V minimum</b>	mA	5
<b>Continuous current of the DIAZED fuse link of the output relay</b>		A
		4
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
<b>Shock resistance according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms
<b>Current carrying capacity of output relay</b>		
• at AC-15		
– at 250 V at 50/60 Hz	A	3
– at 400 V at 50/60 Hz	A	3
• at DC-13		
– at 24 V	A	1
– at 125 V	A	0.2
– at 250 V	A	0.1
<b>Installation altitude at a height over sea level maximum</b>	m	2 000
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV
<b>Electrostatic discharge according to IEC 61000-4-2</b>		6 kV contact discharge / 8 kV air discharge
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m
<b>Thermal current of the contact-affected switching element maximum</b>		A
		5
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>		V
		690

		3UG4512-.....
<b>Degree of pollution</b>		3
<b>Ambient temperature</b>		
• during operating	°C	-25 ... +60
• during storage	°C	-40 ... +85
• during transport	°C	-40 ... +85
<b>Galvanic isolation</b>		
• between entrance and outlet		Yes
• between the outputs		Yes
• between the voltage supply and other circuits		Yes
<b>Mechanical operating cycles as operating time typical</b>		10 000 000
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000

## Mechanical design

		3UG4512-1A...	3UG4512-1B...	3UG4512-2A...	3UG4512-2B...
<b>Width</b>	mm	22.5			
<b>Height</b>	mm	83	92	84	94
<b>Depth</b>	mm	91			
<b>Built in orientation</b>		any			
<b>Distance, to be maintained, to earthed part</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, to the ranks assembly</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, conductive elements</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Type of mounting</b>		snap-on mounting			
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes			

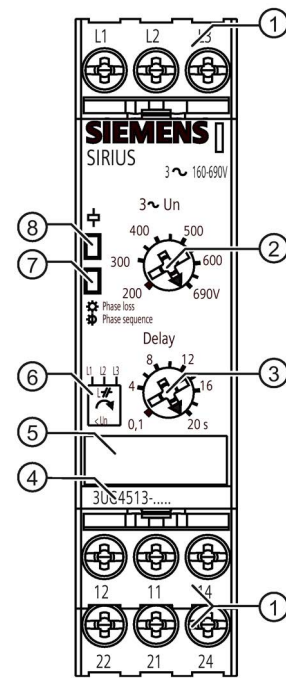
	3UG4512-1A...	3UG4512-1B...	3UG4512-2A...	3UG4512-2B...
<b>Design of the electrical connection</b>	screw-type terminals		spring-loaded terminals	
<b>Type of the connectable conductor cross-section</b>				
<ul style="list-style-type: none"> <li>• solid</li> </ul>	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )		2x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>• finely stranded                             <ul style="list-style-type: none"> <li>– with wire end processing</li> <li>– without wire end processing</li> </ul> </li> </ul>	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )		2 x (0.25 ... 1.5 mm <sup>2</sup> )	
	—		2x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>• for AWG conductors                             <ul style="list-style-type: none"> <li>– solid</li> <li>– stranded</li> </ul> </li> </ul>	2x (20 ... 14)		2x (24 ... 16)	
	2x (20 ... 14)		2x (24 ... 16)	
<b>Tightening torque</b>				
<ul style="list-style-type: none"> <li>• with screw-type terminals</li> </ul>	N·m	0.8 ... 1.2	— ...	
<b>Number of change-over switches delayed switching</b>	1	2	1	2



## 6.4 3UG4513 line monitoring relay

### 6.4.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4513

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable) Connection is possible using screw-type terminals or spring-loaded terminals.
	②	Rotary button for setting the nominal line voltage (3~U <sub>n</sub> )
	③	Rotary button for setting the tripping delay (Delay)
	④	Device article number
	⑤	Label
	⑥	Function symbol
	⑦	Status display: LED phase failure / phase sequence (red)
	⑧	Status display: LED coil symbol (green)
	<b>Terminal labels</b>	
	L1, L2, L3	Rated control supply voltage
	12	Output relay K1 CO contact NC contact
	11	Output relay K1 CO contact root
	14	Output relay K1 CO contact NO contact
22	Output relay K2 CO contact NC contact	
21	Output relay K2 CO contact root	
24	Output relay K2 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 126)".

## 6.4.2 Function

### General functionality

The 3UG4513 line monitoring relays monitor for **phase sequence**, **phase failure** of one of the three phases, and **undershoot** of at least one line-to-line voltage of the set nominal line voltage by 20 % in a three-phase system.

The devices are **self-powered** (measuring voltage = rated control supply voltage) and work on the closed-circuit principle. The 3UG4513 line monitoring relays monitor all phases of three-phase AC networks from 160 to 690 V through terminals L1 / L2 / L3 and also draw power from all three phases simultaneously.

The 3UG4513 line monitoring relay features two rotary buttons for setting the trip delay (Delay) and the nominal line voltage ( $U_n$  3AC).

The hysteresis is 5 % of the set value of the nominal line voltage.

The 3UG4513 line monitoring relays feature 2 output relays (output relay K1 and output relay K2). The relays work synchronously.

---

### Note

The specified voltages represent the absolute thresholds.

---

### Monitoring

If the line voltage is switched on, the LED "coil symbol" will light up green. If the correct phase sequence is applied to terminals L1-L2-L3 and if the monitored line-to-line voltage is in the permissible range of the set nominal line voltage ( $U_n$  3AC), the output relays pick up.

If the phase sequence is incorrect, the "phase failure / phase sequence" LED flashes red and the output relays remain in their quiescent position.

If the monitored line-to-line voltage falls symmetrically (all three phase voltages at the same time) or asymmetrically (only one phase voltage) to more than 20 % below the value for the nominal line voltage set on the front of the device, after the time set on the front has elapsed (Delay), the output relays will drop out and the "phase failure / phase sequence" LED will light up red continuously. On a phase failure, the "phase failure / phase sequence" LED lights up red continuously and the output relays drop out to protect the application from any damage that may result. The set delay time has no effect on the phase failure monitoring.

Thanks to a special measuring method, a phase failure is detected with certainty despite wide-range voltage from 160 to 690 V AC and reverse power of up to 80 % from the load in the case of regenerative power recovery.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 125)."

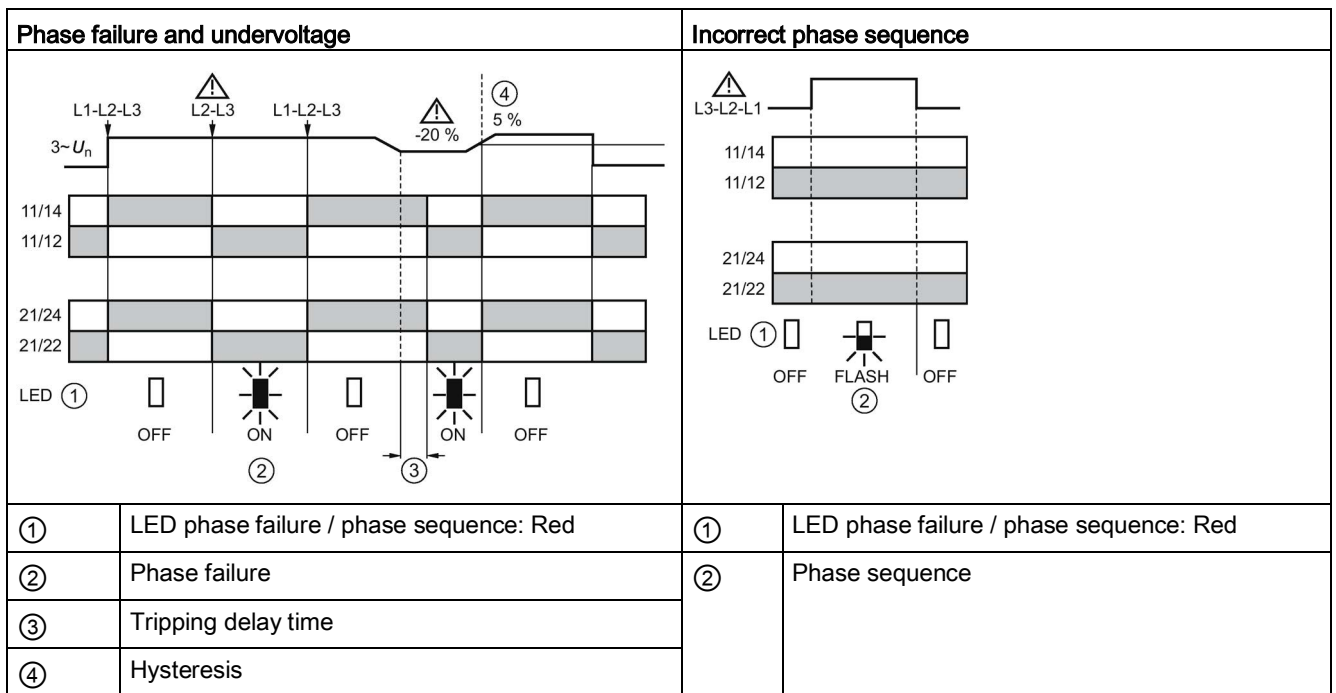
## Reset response

The device features an autoreset that resets the output relays to their original state after an error message and rectification of the fault that has occurred.

### Note

The red LED is a fault diagnostics display and does not indicate the current state of the relay!

## Function diagrams 3UG4513



### 6.4.3 Operation

#### Parameters

The following parameters can be set on the relevant rotary button using a screwdriver:

Table 6- 2 Parameter information, 3UG4513 line monitoring relay

Parameters	Control element <sup>1)</sup>	Setting range		Increment
		Minimum value	Maximum value	
Tripping delay time (Delay)	3	0.1 s	20 s	Continuous
Nominal line voltage (3~U <sub>n</sub> )	2	200 V	690 V <sup>2)</sup>	Continuous

<sup>1)</sup> The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 121)."

<sup>2)</sup> absolute threshold

The parameters are described in Chapter "Parameters (Page 363)."

#### Required tools

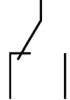
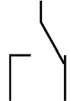
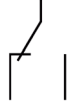
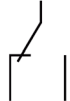
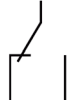
The same screwdriver can be used to set the parameters as for mounting the line monitoring relays.

## 6.4.4 Diagnostics

### 6.4.4.1 Diagnostics with LED

#### Status display

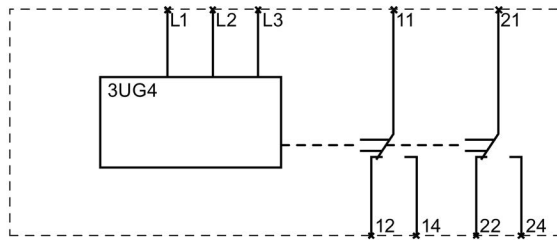
The following information about the operating state is displayed on the 3UG4513 line monitoring relays:

Operating status	LED		State of the output relays
	Coil symbol (green)	Phase failure / phase sequence (red)	12/ 11/ 14 22/ 21/ 24
<ul style="list-style-type: none"> <li>Supply voltage not present</li> </ul>	Off	Off	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Correct phase sequence</li> <li>All phases available</li> <li>Line-to-line voltage OK</li> </ul>	On	Off	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Incorrect phase sequence</li> </ul>	On	flashing	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Phase failure</li> </ul>	On	On	
<ul style="list-style-type: none"> <li>Supply voltage present</li> <li>Line-to-line voltage undershot</li> </ul>	On	On	

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 122)."

### 6.4.5 Circuit diagrams

#### Internal circuit diagrams 3UG4513 line monitoring relay



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**Note**

It is not necessary to fuse the measuring circuit to protect the device. Fusing for line protection depends on the cross-section used.

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**Note**

The 3UG4513 line monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

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## 6.4.6 Technical data

### Measuring circuit

3UG4513-.....		
Type of voltage for monitoring		AC
Number of poles for main current circuit		3
Measurable voltage		
• for AC	V	160 ... 690
Adjustable voltage range	V	200 ... 690

### General technical details

3UG4513-.....		
Product function		Phase monitoring relay
Type of display LED		Yes
Product function		
• undervoltage recognition		Yes
• overvoltage recognition		No
• phase sequence recognition		Yes
• phase disturbance recognition		Yes
• asymmetry recognition		Yes
• overvoltage recognition of 3 phases		No
• undervoltage recognition of 3 phases		Yes
• tension window recognition of 3 phases		No
• reset external		—
• self-reset		Yes
• open-circuit or closed-circuit current principle		No
Starting time after the control supply voltage has been applied	s	1
Response time maximum	s	0.45
Relative adjustment accuracy	%	—
Relative repeat accuracy	%	1

		3UG4513-.....
<b>Type of voltage of the controlled supply voltage</b>		AC
<b>Control supply voltage</b>		
• at 50 Hz at AC rated value	V	160 ... 690
• at 60 Hz at AC rated value	V	160 ... 690
<b>Working range factor supply voltage rated value</b>		
• at 50 Hz for AC		1
• at 60 Hz for AC		1
<b>Impulse voltage resistance rated value</b>	kV	6
<b>Recorded real power</b>	W	2
<b>Protection class IP</b>		IP20
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
<b>Operating current at 17 V minimum</b>	mA	5
<b>Continuous current of the DIAZED fuse link of the output relay</b>		4
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
<b>Resistance against shock according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms
<b>Current carrying capacity of output relay</b>		
• at AC-15		
– at 250 V at 50/60 Hz	A	3
– at 400 V at 50/60 Hz	A	3
• at DC-13		
– at 24 V	A	1
– at 125 V	A	0.2
– at 250 V	A	0.1
<b>Installation altitude at a height over sea level maximum</b>	m	2 000
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV
<b>Electrostatic discharge according to IEC 61000-4-2</b>		6 kV contact discharge / 8 kV air discharge
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m



		3UG4513-.....
<b>Thermal current of the contact-affected switching element maximum</b>	A	5
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	690
<b>Degree of pollution</b>		3
<b>Ambient temperature</b>		
• during operating	°C	-25 ... +60
• during storage	°C	-40 ... +85
• during transport	°C	-40 ... +85
<b>Galvanic isolation</b>		
• between entrance and outlet		Yes
• between the outputs		Yes
• between the voltage supply and other circuits		Yes
<b>Mechanical operating cycles as operating time typical</b>		10 000 000
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000

**Mechanical design**

		3UG4513-1....	3UG4513-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	92	94
<b>Depth</b>	mm	91	
<b>Built in orientation</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Type of mounting</b>		snap-on mounting	
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes	
<b>Design of the electrical connection</b>		screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-section</b>			
• solid		1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
• finely stranded			
– with wire end processing		1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2 x (0.25 ... 1.5 mm <sup>2</sup> )
– without wire end processing		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors			
– solid		2x (20 ... 14)	2x (24 ... 16)
– stranded		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	0.8 ... 1.2	— ...
<b>Number of change-over switches delayed switching</b>		2	

## 6.5 3UG4614 line monitoring relay

### 6.5.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4614

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Device article number
	⑤	Label
	⑥	Legend for menu
	⑦	Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>	
	L1, L2, L3	Rated control supply voltage
	12	Output relay K1 CO contact NC contact
	11	Output relay K1 CO contact root
	14	Output relay K1 CO contact NO contact
	22	Output relay K2 CO contact NC contact
21	Output relay K2 CO contact root	
24	Output relay K2 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 137)".

## 6.5.2 Functions

### General functionality

The 3UG4614 line monitoring relays monitor a three-phase system for **phase asymmetry, undervoltage, phase failure, and phase sequence**.

The devices feature a wide-range voltage input and are **self-powered** (measuring voltage = rated control supply voltage). The 3UG4614 line monitoring relays monitor all phases of three-phase AC networks from 160 to 690 V through terminals L1 / L2 / L3 and also draw power from all three phases simultaneously.

The 3UG4614 line monitoring relays feature 2 output relays (output relay K1 and output relay K2). The relays work synchronously.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 135)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

---

### Note

The specified voltages represent the absolute thresholds.

---

## Monitoring

The output relays respond in accordance with the set relay switching behavior (closed-circuit principle NC or open-circuit principle NO) if the following conditions are met:

- Correct phase sequence at terminals L1-L2-L3
- The monitored voltage ( $U_{x-y}$ ) is larger than the set value
- The voltage symmetry ( $A_{sy}$ ) is smaller than the set value

If a fault occurs (phase failure, incorrect phase sequence, or phase asymmetry), the output relays switch in accordance with the relay switching behavior.

In the case of incorrect direction of rotation, the 3UG4614 line monitoring relays immediately shut down. Thanks to a special measuring method, a phase failure is detected with certainty despite wide-range voltage from 160 to 690 V AC and reverse power of up to 80 % from the load in the case of regenerative power recovery.

On failure of one of the phases, the output relays drop out immediately to protect the application from any damage that may result. Set delay times have no effect on the phase failure monitoring.

---

### Note

The 3UG4614 line monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

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### Startup delay


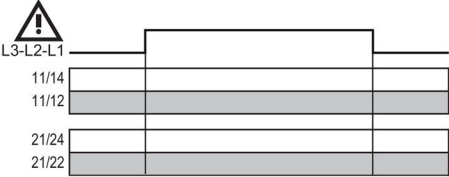
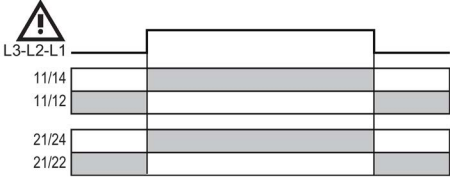
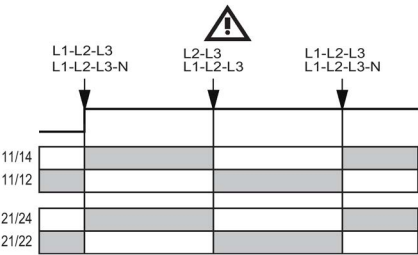
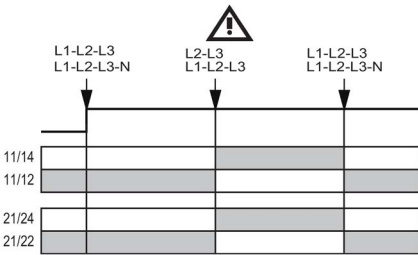
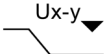
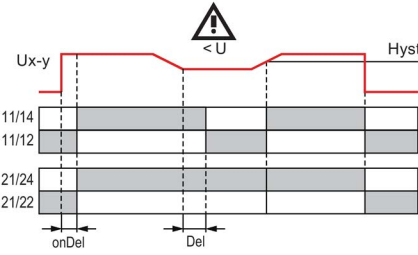
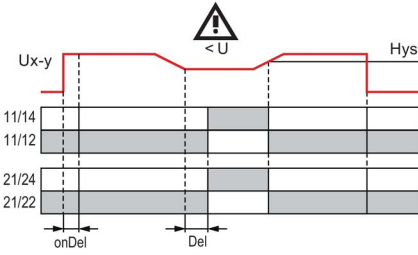
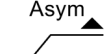
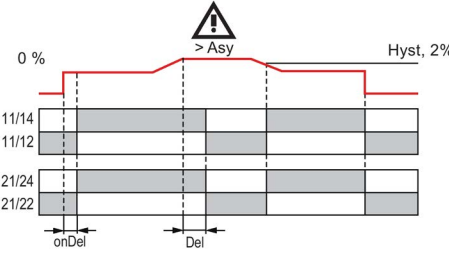
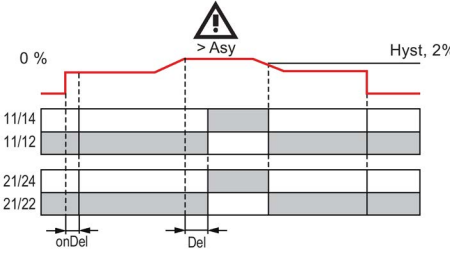
After applying the supply voltage or resetting the monitoring relays, the set ON-delay begins (onDel). During this time, undershooting or overshooting of the set threshold values will not cause the CO contact to respond but instead will result in a restart of the ON-delay.

### Tripping delay

If the measured value overshoots or undershoots the set threshold after expiry of the ON-delay time (onDel), the set tripping delay time (Del) and the relay symbol will flash. After expiry of this time, the output relays change the switching state. On the display, the current measuring value and the symbol for undershoot or overshoot flash.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 136)."

Function diagrams 3UG4614

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
		
<p>L <math>\neq</math></p>		
<p>Ux-y <math>\nabla</math></p> 		
<p>Asym <math>\blacktriangle</math></p> 		

## 6.5.3 Operation

### Parameters


Parameterization of the devices is possible locally using the display and the three keys.



### Parameter information

The table below shows the settable parameter information of the 3UG4614 line monitoring relays:

Table 6-3 Parameter information, 3UG4614 line monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for undershoot (U $\nabla$ )	160 V	690 V	1 V	375 V
"RUN"	Threshold for voltage asymmetry (Asy)	5 % or OFF	20 %	1 %	5 %
"SET"	Hysteresis (Hyst)	1 V	20 V	1 V	5 V
"SET"	Stabilization delay (onDel)	0.1 s	20 s	0.1 s	0.1 s
"SET"	Tripping delay time (Del) (on undervoltage or overshoot of the asymmetry value)	0.1 s	20 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = HandRESET	--	no = Autoreset
"SET"	Phase sequence monitoring 	no	yes	--	yes
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC	NO	--	NC

The parameters are described in Chapter "Parameters (Page 363)."

Menu-based operation is described in Chapter "Menu-based operation (Page 39)."

## 6.5.4 Diagnostics

### 6.5.4.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Voltage measured value or fault symbol
- ② Type of monitoring
- ③ Symbols of the changeover contacts

#### Meaning of the information on the display

##### Note

##### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and line faults are indicated as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	200V	Measured line-to-line voltage (L1 - L2) is displayed
①	L ⚡	Flashing: Phase failure detected
①	↷ !	Flashing: Incorrect phase sequence detected
①	Asym	Flashing: Voltage asymmetry detected
②		Monitoring for overshoot of the voltage asymmetry
②		Monitoring for voltage undershoot
②	◀	Voltage is in correct range
②	▲	A voltage overshoot has occurred
②	▼	A voltage undershoot has occurred
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 21/22 open, relay contact 21/24 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open</li> </ul>

You will find more information about the switching behavior of the output relays in Chapter "Functions (Page 132)".



## 6.5.4.2 Reset

### RESET



How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

- Manual RESET (Memory = 1 / Mem = yes)

To reset the devices with digital setting, it is necessary to press both arrow keys   simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

## 6.5.5 Circuit diagrams

### Internal circuit diagrams 3UG4614 line monitoring relay

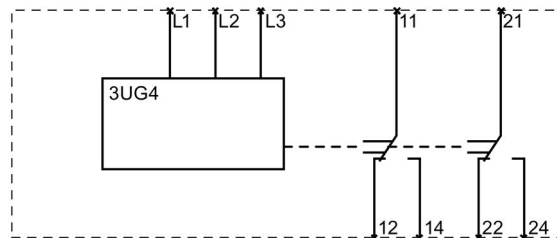


Image 6-1 3UG4614

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#### Note

It is not necessary to fuse the measuring circuit to protect the device. Fusing for line protection depends on the cross-section used.

---

### 6.5.6 Technical data

#### Measuring circuit

		3UG4614-.....
<b>Type of voltage for monitoring</b>		AC
<b>Number of poles for main current circuit</b>		3
<b>Measurable voltage</b>		
• for AC	V	160 ... 690
<b>Adjustable voltage range</b>		V 120 ... 690
<b>Adjustable response delay time</b>		
• when starting	s	0.1 ... 20
• with lower or upper limit violation	s	0.1 ... 20

#### General technical details

		3UG4614-.....
<b>Product function</b>		Phase monitoring relay
<b>Type of display LED</b>		No
<b>Product function</b>		
• undervoltage recognition		Yes
• overvoltage recognition		No
• phase sequence recognition		Yes
• phase disturbance recognition		Yes
• asymmetry recognition		Yes
• overvoltage recognition of 3 phases		No
• undervoltage recognition of 3 phases		Yes
• tension window recognition of 3 phases		No
• reset external		—
• self-reset		Yes
• open-circuit or closed-circuit current principle		Yes
<b>Starting time after the control supply voltage has been applied</b>	s	1
<b>Response time maximum</b>	ms	450
<b>Precision of digital display</b>		+/-1 Digit
<b>Relative metering precision</b>	%	5
<b>Relative adjustment accuracy</b>	%	0.2
<b>Relative repeat accuracy</b>	%	1

		3UG4614-.....
<b>Voltage type of control feed voltage</b>		AC
<b>Control supply voltage</b>		
• at 50 Hz at AC rated value	V	160 ... 690
• at 60 Hz at AC rated value	V	160 ... 690
<b>Operating range factor control supply voltage rated value</b>		
• at 50 Hz for AC		1
• at 60 Hz for AC		1
<b>Impulse voltage resistance rated value</b>	kV	6
<b>Recorded real power</b>	W	2
<b>Protection class IP</b>		IP20
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
<b>Operating current at 17 V minimum</b>	mA	5
<b>Continuous current of the DIAZED fuse link of the output relay</b>	A	4
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
<b>Shock resistance according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms
<b>Current carrying capacity of output relay</b>		
• at AC-15		
– at 250 V at 50/60 Hz	A	3
– at 400 V at 50/60 Hz	A	3
• at DC-13		
– at 24 V	A	1
– at 125 V	A	0.2
– at 250 V	A	0.1
<b>Installation altitude at a height over sea level maximum</b>	m	2 000
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV
<b>Electrostatic discharge according to IEC 61000-4-2</b>		6 kV contact discharge / 8 kV air discharge
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m
<b>Thermal current of the contact-affected switching element maximum</b>	A	5
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	690

		3UG4614-.....
<b>Degree of pollution</b>		3
<b>Ambient temperature</b>		
• during operating	°C	-25 ... +60
• during storage	°C	-40 ... +85
• during transport	°C	-40 ... +85
<b>Galvanic isolation between entrance and outlet</b>		Yes
<b>Galvanic isolation between the outputs</b>		Yes
<b>Mechanical operating cycles as operating time typical</b>		10 000 000
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000

## Mechanical design

		3UG4614-1....	3UG4614-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	92	94
<b>Depth</b>	mm	91	
<b>Built in orientation</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Type of mounting</b>		snap-on mounting	
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes	
<b>Design of the electrical connection</b>		screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-section</b>			
• solid		1x (0,5 ... 4 mm <sup>2</sup> ), 2x (0,5 ... 2,5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
• finely stranded			
– with wire end processing		1x (0,5 ... 2,5 mm <sup>2</sup> ), 2x (0,5 ... 1,5 mm <sup>2</sup> )	2 x (0.25 ... 1.5 mm <sup>2</sup> )
– without wire end processing		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors			
– solid		2x (20 ... 14)	2x (24 ... 16)
– stranded		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	0.8 ... 1.2	— ...
<b>Number of change-over switches delayed switching</b>		2	

## 6.6 3UG4615 / 3UG4616 line monitoring relays

### 6.6.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4615/ 3UG4616

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable) Connection is possible using screw-type terminals or spring-loaded terminals.
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Device article number
	⑤	Label
	⑥	Legend for menu
	⑦	Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>	
	L1, L2, L3	Rated control supply voltage
	N	Neutral conductor (only on 3UG4616)
	12	Output relay K1 CO contact NC contact
	11	Output relay K1 CO contact root
	14	Output relay K1 CO contact NO contact
	22	Output relay K2 CO contact NC contact
21	Output relay K2 CO contact root	
24	Output relay K2 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 150)".

## 6.6.2 Functions

### General functionality

The 3UG4615 line monitoring relays monitor a three-phase system for **phase failure**, **undervoltage**, **overvoltage**, and **phase sequence**.

---

#### Note

The 3UG4616 line monitoring relays have the same functions as the 3UG4615 monitoring relays and also monitor the **neutral conductor for failure**.

---

The devices feature a wide-range voltage input and are **self-powered** (measuring voltage = rated control supply voltage). Depending on the version, the line monitoring relays are powered with a line-to-line voltage of 160 to 690 V (3UG4615) or with a line-to-neutral voltage of 90 to 400 V (3UG4616) through terminals L1 / L2 / L3.

The 3UG4615 / 3UG4616 line monitoring relays feature 2 output relays (output relay K1 and output relay K2).

The 3UG4615 / 3UG4616 line monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 146)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

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#### Note

The specified voltages represent the absolute thresholds.

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## Monitoring

The 3UG4615 / 3UG4616 line monitoring relays have two output relays. With output relay K1, a three-phase system is monitored for undervoltage. With output relay K2, a three-phase system is monitored for overvoltage.

The output relays respond in accordance with the set relay switching behavior (closed-circuit principle NC or open-circuit principle NO).

If a fault occurs (phase failure, incorrect phase sequence, voltage undershoot or voltage overshoot), the output relays switch in accordance with the relay switching behavior. In the case of voltage undershoot or voltage overshoot, the output relays do not respond until expiry of the set tripping delay time ( $U_{\Delta Del}$  and  $U_{\nabla Del}$ ).

In the case of incorrect direction of rotation, the devices immediately shut down.

The display indicates the following voltages in the case of the line monitoring relays:

- 3UG4615: Line-to-line voltage between L1 and L2, L1 and L3, L2 and L3
- 3UG4616: Line-to-neutral voltage between L1 and N, L2 and N, L3 and N

Thanks to a special measuring method, a phase failure is detected with certainty despite wide-range voltage from 160 to 690 V AC and reverse power of up to 80 % from the load in the case of regenerative power recovery.

On failure of one of the phases (or neutral conductor failure for the 3UG4616 line monitoring relays), the output relays drop out immediately to protect the application from any damage that may result. Set delay times have no effect on the phase failure monitoring.

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### Note


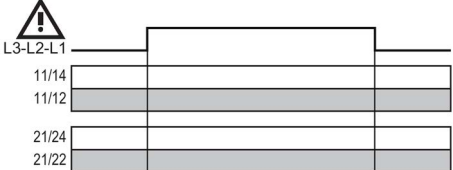
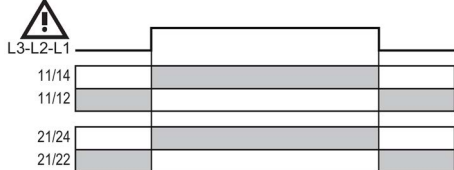

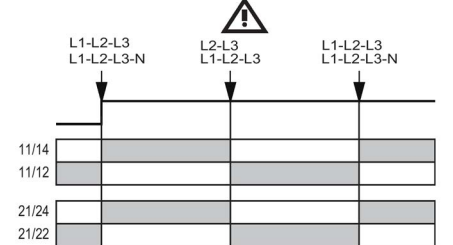
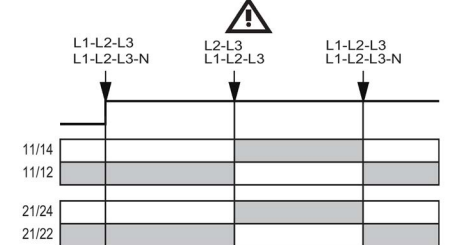

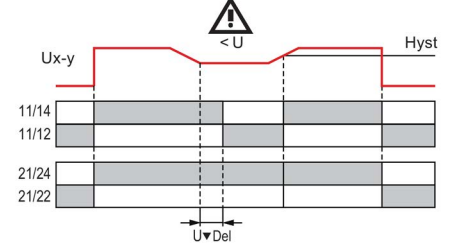
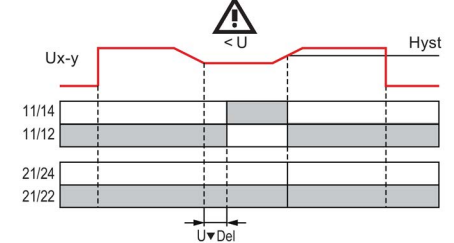

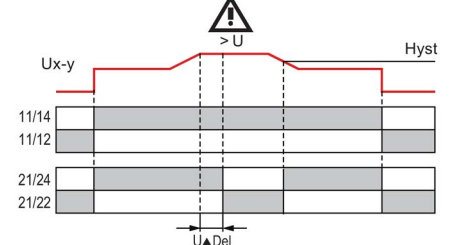
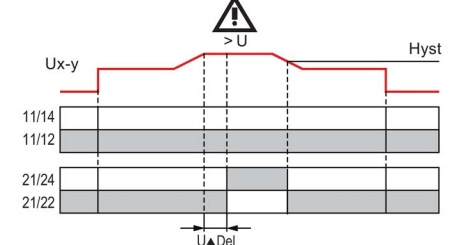
The 3UG4615 and 3UG4616 line monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

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You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 147)."



Function diagrams 3UG4615 / 3UG4616

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
		
		
		
		

### 6.6.3 Operation

#### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



#### Parameter information

The table below shows the settable parameter information of the 3UG4615 and 3UG4616 line monitoring relays:

Table 6-4 Parameter information, 3UG4615 and 3UG4616 line monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for undershoot (U▼)	160 V <sup>1)</sup> 90 V <sup>2)</sup>	690 V <sup>1)</sup> 400 V <sup>2)</sup>	1 V	375 V <sup>1)</sup> 215 V <sup>2)</sup>
"RUN"	Threshold for overshoot (U▲)	160 V <sup>1)</sup> 90 V <sup>2)</sup>	690 V <sup>1)</sup> 400 V <sup>2)</sup>	1 V	425 V <sup>1)</sup> 245 V <sup>2)</sup>
"SET"	Hysteresis (Hyst)	1.0 V	20.0 V	1 V	5.0 V
"SET"	Tripping delay time (U▼Del)	0.1 s	20.0 s	0.1 s	0.1 s
"SET"	Tripping delay time (U▲Del)	0.1 s	20.0 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Phase sequence monitoring (↻)	no	yes	--	no
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC	NO	--	NC

1) 3UG4615 line monitoring relay

2) 3UG4616 line monitoring relay

The parameters are described in the Chapter "Parameters (Page 363)".

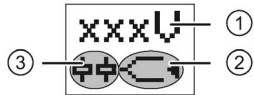
Menu-based operation is described in the Chapter "Menu-based operation (Page 39)".

## 6.6.4 Diagnostics

### 6.6.4.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Voltage measured value or fault symbol
- ② Type of monitoring
- ③ Symbols of the changeover contacts







**Meaning of the information on the display**

**Note**

**Indications in the event of a fault**

The symbols on the display flash to indicate an error.

The following statuses and line faults are indicated as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	200V	Measured voltage is displayed
①	Lx	Flashing: Phase failure detected
①		Flashing: Incorrect phase sequence detected
②		Monitoring for voltage overshoot
②		Monitoring for voltage undershoot
②		Range monitoring (monitoring for voltage overshoot and undershoot)
②	◀	Voltage is in correct range
②	▲	A voltage overshoot has occurred
②	▼	A voltage undershoot has occurred
③	 U▼	<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>• Flashing: Delay time (tripping delay) is running</li> <li>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>
③	 U▲	<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 21/22 open, relay contact 21/24 closed</li> <li>• Flashing: Delay time (tripping delay) is running</li> <li>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open</li> </ul>

**Note**

On phase failure or phase sequence error, both CO contacts respond.

**Note**

If the monitoring relays are used downstream of a frequency converter, it is necessary to obtain a waveform without additional zero crossings of the voltage. This can be achieved with the help of a sine-wave filter.

You will find more information about the switching behavior of the output relays in Chapter "Functions (Page 143)".

## 6.6.4.2 Reset

### RESET



How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

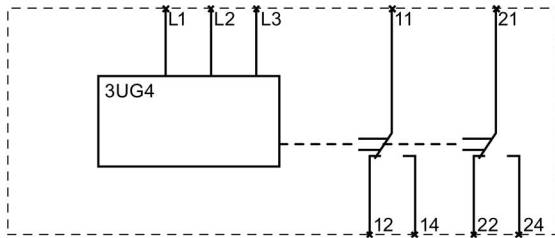
- Manual RESET (Memory = 1 / Mem = yes)

To reset the devices with digital setting, it is necessary to press both arrow keys   simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

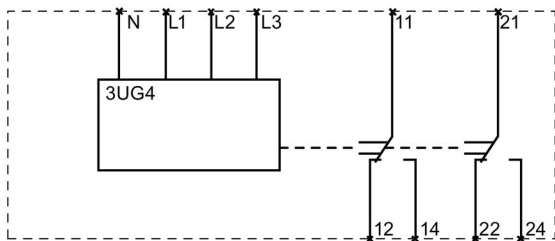
### 6.6.5 Circuit diagrams

#### Internal circuit diagrams 3UG4615 / 3UG4616

3UG4615 line monitoring relay



3UG4616 line monitoring relay



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#### Note

It is not necessary to fuse the measuring circuit to protect the device. Fusing for line protection depends on the cross-section used.

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## 6.6.6 Technical data

### Measuring circuit

	3UG4615-.....	3UG4616-.....
Type of voltage for monitoring	AC	
Number of poles for main current circuit	3	
Measurable voltage		
• for AC	V	160 ... 690
Adjustable voltage range	V	160 ... 690
Adjustable response delay time with lower or upper limit violation	s	0.1 ... 20

### General technical details

	3UG4615-.....	3UG4616-.....
Product function	Phase monitoring relay	
Design of the display	LCD	
Type of display LED	No	
Product function		
• undervoltage recognition	Yes	
• overvoltage recognition	Yes	
• phase sequence recognition	Yes	
• phase disturbance recognition	Yes	
• asymmetry recognition	Yes	
• overvoltage recognition of 3 phases	Yes	
• undervoltage recognition of 3 phases	Yes	
• tension window recognition of 3 phases	Yes	
• reset external	—	
• self-reset	Yes	
• open-circuit or closed-circuit current principle	Yes	
Starting time after the control supply voltage has been applied	s	1
Response time maximum	s	0.45
Relative adjustment accuracy	%	0.2
Relative metering precision	%	5
Precision of digital display	+/-1 digit	
Relative repeat accuracy	%	1

		3UG4615-....	3UG4616-....
Type of voltage of the controlled supply voltage		AC	
Control supply voltage			
• at 50 Hz at AC rated value	V	160 ... 690	
• at 60 Hz at AC rated value	V	160 ... 690	
Working range factor supply voltage rated value			
• at 50 Hz for AC		1	
• at 60 Hz for AC		1	
Impulse voltage resistance rated value	kV	6	
Recorded real power	W	2	
Protection class IP		IP20	
Electromagnetic compatibility		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4	
Operating current at 17 V minimum	mA	5	
Continuous current of the DIAZED fuse link of the output relay	A	4	
Resistance against vibration according to IEC 60068-2-6		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g	
Resistance against shock according to IEC 60068-2-27		sinusoidal half-wave 15g / 11 ms	
Current carrying capacity of output relay			
• at AC-15			
– at 250 V at 50/60 Hz	A	3	
– at 400 V at 50/60 Hz	A	3	
• at DC-13			
– at 24 V	A	1	
– at 125 V	A	0.2	
– at 250 V	A	0.1	
Installation altitude at a height over sea level maximum	m	2 000	
Conductor-bound parasitic coupling BURST according to IEC 61000-4-4		2 kV	
Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5		2 kV	
Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5		1 kV	
Electrostatic discharge according to IEC 61000-4-2		6 kV contact discharge / 8 kV air discharge	
Field-bound parasitic coupling according to IEC 61000-4-3		10 V/m	
Thermal current of the contact-affected switching element maximum	A	5	



		3UG4615-.....	3UG4616-.....
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690	
Degree of pollution		3	
<b>Ambient temperature</b>			
• during operating	°C	-25 ... +60	
• during storage	°C	-40 ... +85	
• during transport	°C	-40 ... +85	
<b>Galvanic isolation</b>			
• between entrance and outlet		Yes	
• between the outputs		Yes	
• between the voltage supply and other circuits		Yes	
<b>Mechanical operating cycles as operating time typical</b>		10 000 000	
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000	
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000	

**Mechanical design**

		3UG4615-1....	3UG4616-1....	3UG4615-2....	3UG4616-2....
<b>Width</b>	mm	22.5			
<b>Height</b>	mm	92	102	94	103
<b>Depth</b>	mm	91			
<b>Built in orientation</b>		any			
<b>Distance, to be maintained, to earthed part</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, to the ranks assembly</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, conductive elements</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			

	3UG4615-1....	3UG4616-1....	3UG4615-2....	3UG4616-2....
<b>Type of mounting</b>	snap-on mounting			
<b>Product function removable terminal for auxiliary and control circuit</b>	Yes			
<b>Design of the electrical connection</b>	screw-type terminals		spring-loaded terminals	
<b>Type of the connectable conductor cross-section</b>				
• solid	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )		2x (0.25 ... 1.5 mm <sup>2</sup> )	
• finely stranded				
– with wire end processing	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )		2 x (0.25 ... 1.5 mm <sup>2</sup> )	
– without wire end processing	—		2x (0.25 ... 1.5 mm <sup>2</sup> )	
• for AWG conductors				
– solid	2x (20 ... 14)		2x (24 ... 16)	
– stranded	2x (20 ... 14)		2x (24 ... 16)	
<b>Tightening torque</b>				
• with screw-type terminals N·m	0.8 ... 1.2		— ...	
<b>Number of change-over switches delayed switching</b>	2			

## 6.7 3UG4617 / 3UG4618 line monitoring relays

### 6.7.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4617 / 3UG4618

Front view	Description																
	<b>Position digits</b>																
	<table border="1"> <tr> <td>①</td> <td>Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.</td> </tr> <tr> <td>②</td> <td>Arrow keys for menu navigation</td> </tr> <tr> <td>③</td> <td>SET key for menu navigation</td> </tr> <tr> <td>④</td> <td>Device article number</td> </tr> <tr> <td>⑤</td> <td>Label</td> </tr> <tr> <td>⑥</td> <td>Legend for menu</td> </tr> <tr> <td>⑦</td> <td>Display for parameterization, actual-value indication, and diagnostics</td> </tr> </table>	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.	②	Arrow keys for menu navigation	③	SET key for menu navigation	④	Device article number	⑤	Label	⑥	Legend for menu	⑦	Display for parameterization, actual-value indication, and diagnostics		
	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.															
	②	Arrow keys for menu navigation															
	③	SET key for menu navigation															
	④	Device article number															
	⑤	Label															
	⑥	Legend for menu															
	⑦	Display for parameterization, actual-value indication, and diagnostics															
	<b>Terminal labels</b>																
	<table border="1"> <tr> <td>L1, L2, L3</td> <td>Rated control supply voltage</td> </tr> <tr> <td>N</td> <td>Neutral conductor (on 3UG4618 only)</td> </tr> <tr> <td>12</td> <td>Output relay K1 CO contact NC contact</td> </tr> <tr> <td>11</td> <td>Output relay K1 CO contact root</td> </tr> <tr> <td>14</td> <td>Output relay K1 CO contact NO contact</td> </tr> <tr> <td>22</td> <td>Output relay K2 CO contact NC contact</td> </tr> <tr> <td>21</td> <td>Output relay K2 CO contact root</td> </tr> <tr> <td>24</td> <td>Output relay K2 CO contact NO contact</td> </tr> </table>	L1, L2, L3	Rated control supply voltage	N	Neutral conductor (on 3UG4618 only)	12	Output relay K1 CO contact NC contact	11	Output relay K1 CO contact root	14	Output relay K1 CO contact NO contact	22	Output relay K2 CO contact NC contact	21	Output relay K2 CO contact root	24	Output relay K2 CO contact NO contact
	L1, L2, L3	Rated control supply voltage															
	N	Neutral conductor (on 3UG4618 only)															
12	Output relay K1 CO contact NC contact																
11	Output relay K1 CO contact root																
14	Output relay K1 CO contact NO contact																
22	Output relay K2 CO contact NC contact																
21	Output relay K2 CO contact root																
24	Output relay K2 CO contact NO contact																

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 165)".

## 6.7.2 Functions

### General functionality

The 3UG4617 line monitoring relays monitor a three-phase system for **phase sequence**, **phase failure**, **phase asymmetry**, **undervoltage**, and **overvoltage**.

---

#### Note

The 3UG4618 line monitoring relays have the same functions as the 3UG4617 monitoring relays and also monitor the **neutral conductor for failure**.

---

The devices feature a wide-range voltage input and are **self-powered** (measuring voltage = rated control supply voltage) and work on the closed-circuit principle. Depending on the version, the line monitoring relays are powered with a line-to-line voltage of 160 to 690 V (3UG4617) and with a line-to-neutral voltage of 90 to 400 V (3UG4618) through terminals L1 / L2 / L3.

The 3UG4617 / 3UG4618 line monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 161)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

---

#### Note

The specified voltages represent the absolute thresholds.

---

## Monitoring

Output relay K1 is for warning or shutdown on faults in the power system (voltage, asymmetry). Output relay K2 responds differently depending on the phase sequence.

### Phase sequence

If the correct phase sequence is applied to terminals L1-L2-L3, output relay K2 (relay contact 21-22-24) picks up. This is represented by a relay symbol on the display. If the phase sequence is incorrect, output relay K2 will not pick up. An error is not indicated on the display; only the relay symbol remains in the disconnected state.

### Undervoltage or overvoltage

If the monitored voltages ( $U_{x-y}$ ) are larger than the set lower voltage value ( $U_{\nabla}$ ) and smaller than the set upper voltage value ( $U_{\blacktriangle}$ ), i.e. they are within the voltage limits and the line voltage asymmetry ( $A_{sy}$ ) is less than the set value, the output relay K1 (relay contact 11-12-14) picks up approx. 50 ms after the response of output relay K2 (relay contact 21-22-24).

The display indicates the following voltages in the case of the line monitoring relays:

- 3UG4617: Line-to-line voltage between L1 and L2, L1 and L3, L2 and L3
- 3UG4618: Line-to-neutral voltage between L1 and N, L2 and N, L3 and N

### Phase failure

In the case of a phase failure (or neutral conductor failure for the 3UG4618 line monitoring relays), output relay K1 (relay contact 11-12-14) drops out without delay to protect the application from any damage that may result. Set delay times have no effect on phase failure monitoring.

In the case of voltage undershoot, voltage overshoot, or asymmetry overshoot faults, output relay K1 drops out after the set tripping delay time ( $Del$ ).

Thanks to a special measuring method, a phase failure is detected with certainty despite wide-range voltage from 160 to 690 V AC and reverse power of up to 80 % from the load in the case of regenerative power recovery.

### **Incorrect direction of rotation**

With the CO contact 21-22-24 of the output relay K2, for example, an incorrectly fed phase sequence for a load connected downstream can be automatically corrected using an external reversing combination. The Chapter "Circuit diagrams (Page 165)" provides an example of wiring for automatic phase correction.

---

### **Note**

The 3UG4617 and 3UG4618 line monitoring relays only evaluate the phase sequence while all 3 phases are present. For safety reasons, the phase sequence is not reevaluated after 2-phase operation or a phase failure after which the third phase has appeared. In this case, the output relay for the phase rotation remains in its last switching state. The phase sequence is not reevaluated until after the device has been reset or all 3 phases have been simultaneously switched off and on again.

---


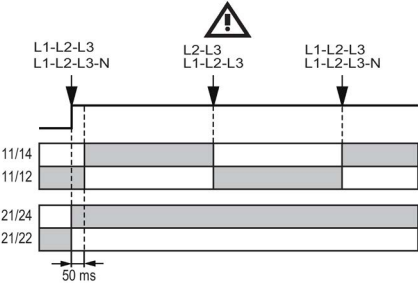
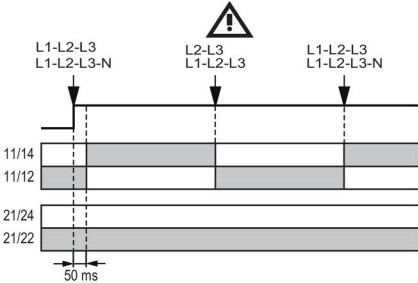
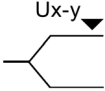
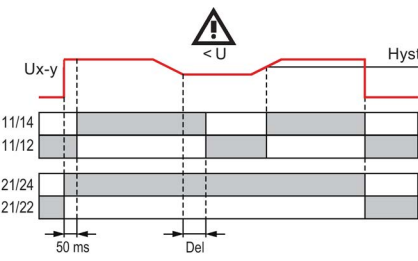
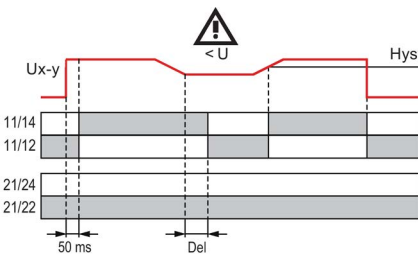
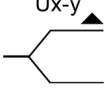
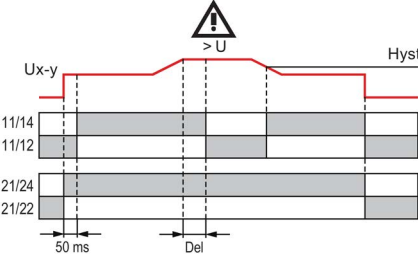
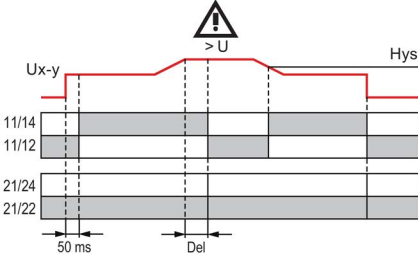
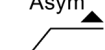
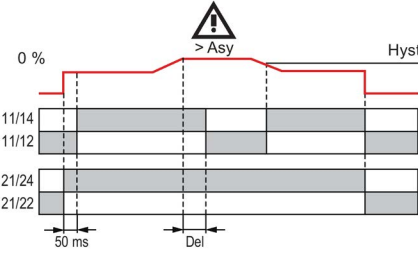
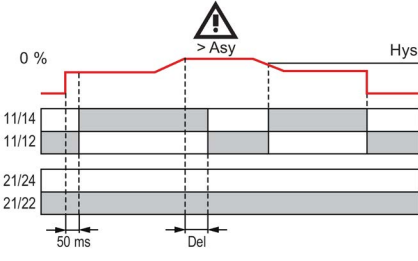
### **Note**

The 3UG4617 and 3UG4618 line monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

---

You will find the switching states of the output relays below in the Section "Function diagrams" and in the Chapter "Diagnostics (Page 162)."

Function diagrams 3UG4617 / 3UG4618

Display	Correct phase sequence L1-L2-L3 Memory = no	Incorrect phase sequence L3-L2-L1 Memory = no
		
		
		
		



### 6.7.3 Operation

#### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



#### Parameter information

The table below shows the settable parameter information of the 3UG4617 and 3UG4618 line monitoring relays:

Table 6- 5 Parameter information, 3UG4617 and 3UG4618 line monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for voltage undershoot (U▼)	160 V <sup>1)</sup> 90 V <sup>2)</sup>	690 V <sup>1)</sup> 400 V <sup>2)</sup>	1 V	375 V <sup>1)</sup> 215 V <sup>2)</sup>
"RUN"	Threshold for voltage overshoot (U▲)	160 V <sup>1)</sup> 90 V <sup>2)</sup>	690 V <sup>1)</sup> 400 V <sup>2)</sup>	1 V	425 V <sup>1)</sup> 245 V <sup>2)</sup>
"RUN"	Voltage asymmetry (Asy)	5 % or OFF	20 %	1 %	OFF
"SET"	Hysteresis (Hyst)	1 V	20.0 V	1 V	5 V
"SET"	Tripping delay time (Del)	0.1 s	20.0 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset

1) 3UG4617 line monitoring relay

2) 3UG4618 line monitoring relay

The parameters are described in the Chapter "Parameters (Page 363)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 39)".

## 6.7.4 Diagnostics

### 6.7.4.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Voltage measured value or fault symbol
- ② Type of monitoring
- ③ Symbols of the changeover contacts




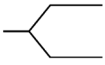




## Meaning of the information on the display

### Note

#### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and line faults are indicated as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	200V	Measured voltage is displayed
①	L 	Flashing: Phase failure detected
①	Asym	Flashing: Line voltage asymmetry detected
②		Monitoring for voltage overshoot
②		Monitoring for voltage undershoot
②		Range monitoring (monitoring for voltage overshoot and undershoot)
②	◀	Voltage is in correct range
②	▲	A voltage overshoot has occurred
②	▼	A voltage undershoot has occurred
③		Error <ul style="list-style-type: none"> <li>Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>Flashing: Delay time (tripping delay) is running</li> <li>Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>
③		  <ul style="list-style-type: none"> <li>Not flashing: Relay contact 21/22 open, relay contact 21/24 closed</li> <li>Masked out: Relay contact 21/22 closed, relay contact 21/24 open</li> </ul>

### Note

CO contact 1 switches on all types of error.

CO contact 2 is for operating a reversing combination.

You will find more information about the switching behavior of the output relays in Chapter "Functions (Page 157)".

### 6.7.4.2 Reset

#### RESET



How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

- Manual RESET (Memory = 1 / Mem = yes)

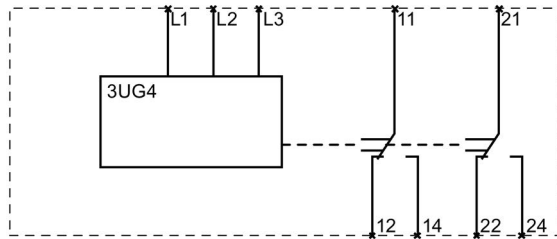
To reset the devices with digital setting, it is necessary to press both arrow keys   simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

## 6.7.5 Circuit diagrams

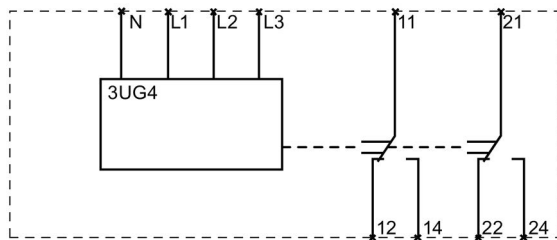
### 6.7.5.1 Internal circuit diagrams

#### Internal circuit diagram 3UG4617 / 3UG4618

##### 3UG4617 line monitoring relay



##### 3UG4618 line monitoring relay



#### Note

It is not necessary to fuse the measuring circuit to protect the device. Fusing for line protection depends on the cross-section used.

### 6.7.5.2 Wiring examples

#### Automatic phase correction

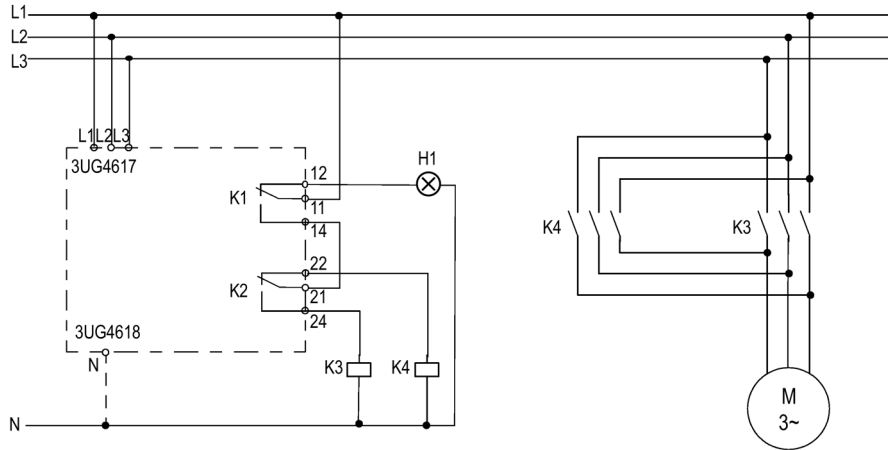


Image 6-2 3UG4617 / 3UG4618 automatic phase correction

## 6.7.6 Technical data

### Measuring circuit

	3UG4617-.....	3UG4618-.....
Type of voltage for monitoring	AC	
Number of poles for main current circuit	3	
Measurable voltage		
• for AC	V	160 ... 690
Adjustable voltage range	V	160 ... 690
Adjustable response delay time with lower or upper limit violation	s	0.1 ... 20

### General technical details

	3UG4617-.....	3UG4618-.....
Product function	Phase monitoring relay	
Design of the display	LCD	
Type of display LED	No	
Product function		
• undervoltage recognition	Yes	
• overvoltage recognition	Yes	
• phase sequence recognition	Yes	
• phase disturbance recognition	Yes	
• asymmetry recognition	Yes	
• overvoltage recognition of 3 phases	Yes	
• undervoltage recognition of 3 phases	Yes	
• tension window recognition of 3 phases	Yes	
• reset external	—	
• self-reset	Yes	
• open-circuit or closed-circuit current principle	No	

	3UG4617-.....	3UG4618-.....
Starting time after the control supply voltage has been applied	s	1
Response time maximum	s	0.45
Relative adjustment accuracy	%	0.2
Relative metering precision	%	5
Precision of digital display		+/-1 digit
Relative repeat accuracy	%	1
Type of voltage of the controlled supply voltage		AC
Control supply voltage		
• at 50 Hz at AC rated value	V	160 ... 690
• at 60 Hz at AC rated value	V	160 ... 690
Working range factor supply voltage rated value		
• at 50 Hz for AC		1
• at 60 Hz for AC		1
Impulse voltage resistance rated value	kV	6
Recorded real power	W	2
Protection class IP		IP20
Electromagnetic compatibility		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
Operating current at 17 V minimum	mA	5
Continuous current of the DIAZED fuse link of the output relay	A	4
Resistance against vibration according to IEC 60068-2-6		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
Resistance against shock according to IEC 60068-2-27		sinusoidal half-wave 15g / 11 ms
Current carrying capacity of output relay		
• at AC-15		
– at 250 V at 50/60 Hz	A	3
– at 400 V at 50/60 Hz	A	3
• at DC-13		
– at 24 V	A	1
– at 125 V	A	0.2
– at 250 V	A	0.1



		3UG4617-.....	3UG4618-.....
Installation altitude at a height over sea level maximum	m	2 000	
Conductor-bound parasitic coupling BURST according to IEC 61000-4-4		2 kV	
Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5		2 kV	
Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5		1 kV	
Electrostatic discharge according to IEC 61000-4-2		6 kV contact discharge / 8 kV air discharge	
Field-bound parasitic coupling according to IEC 61000-4-3		10 V/m	
Thermal current of the contact-affected switching element maximum	A	5	
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690	
Degree of pollution		3	
<b>Ambient temperature</b>			
• during operating	°C	-25 ... +60	
• during storage	°C	-40 ... +85	
• during transport	°C	-40 ... +85	
<b>Galvanic isolation</b>			
• between entrance and outlet		Yes	
• between the outputs		Yes	
• between the voltage supply and other circuits		Yes	
<b>Mechanical operating cycles as operating time typical</b>		10 000 000	
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000	
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000	

**Mechanical design**

		3UG4617-1....	3UG4618-1....	3UG4617-2....	3UG4618-2....
<b>Width</b>	mm	22.5			
<b>Height</b>	mm	92	102	94	103
<b>Depth</b>	mm	91			
<b>Built in orientation</b>		any			
<b>Distance, to be maintained, to earthed part</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, to the ranks assembly</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, conductive elements</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			

	3UG4617-1....	3UG4618-1....	3UG4617-2....	3UG4618-2....
<b>Type of mounting</b>	snap-on mounting			
<b>Product function removable terminal for auxiliary and control circuit</b>	Yes			
<b>Design of the electrical connection</b>	screw-type terminals		spring-loaded terminals	
<b>Type of the connectable conductor cross-section</b>				
<ul style="list-style-type: none"> <li>• solid</li> </ul>	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )		2x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>• finely stranded <ul style="list-style-type: none"> <li>– with wire end processing</li> <li>– without wire end processing</li> </ul> </li> </ul>	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )		2 x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>– without wire end processing</li> </ul>	—		2x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>• for AWG conductors <ul style="list-style-type: none"> <li>– solid</li> <li>– stranded</li> </ul> </li> </ul>	2x (20 ... 14)		2x (24 ... 16)	
<ul style="list-style-type: none"> <li>– stranded</li> </ul>	2x (20 ... 14)		2x (24 ... 16)	
<b>Tightening torque</b>				
<ul style="list-style-type: none"> <li>• with screw-type terminals</li> </ul>	N·m	0.8 ... 1.2	— ...	
<b>Number of change-over switches delayed switching</b>	2			



## 3UG4621/3UG4622 current monitoring relays

### 7.1 Application areas

#### Application areas

The current monitoring relays are used, for example, in the following applications:

Table 7- 1 Application areas of the current monitoring relays

Function	Application
<ul style="list-style-type: none"> <li>• Undercurrent monitoring and overcurrent monitoring</li> <li>• Monitoring the functionality of electrical loads</li> <li>• Wire-break monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Threshold switch for analog signals from 4 to 20 mA</li> <li>• Emergency lighting (failure of a lamp → drop in current strength in the system)</li> <li>• Heating systems (electroplating plants, plastic injection machines, paintshops)</li> <li>• Lamps (tunnels, OP lighting, traffic lights, signal systems, UV lamps, infrared radiators, laser lamps)</li> </ul>

## 7.2 Operator controls and connection terminals

### Front view / terminal labeling 3UG4621 / 3UG4622

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Device article number
	⑤	Label
	⑥	Legend for menu
	⑦	Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>	
	A1+	Rated control supply voltage ~ / +
A2-	Rated control supply voltage ~ / -	
M (GND)	Measuring signal input -	
IN	Measuring signal input +	
12	Output relay K1 CO contact NC contact	
11	Output relay K1 CO contact root	
14	Output relay K1 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 182)".

## 7.3 Functions

### General functionality

Depending on the set threshold, the 3UG4621 / 3UG4622 current monitoring relays monitor a single-phase AC load current (RMS value) or DC load current flowing over terminals IN and M of the device for **overshoot** ( $I^{\blacktriangle}$ ) or **undershoot** ( $I^{\blacktriangledown}$ ) or in **range monitoring** ( $I^{\blacktriangle}$  and  $I^{\blacktriangledown}$ ). The devices differ by their measuring ranges and versions with different rated control supply voltages. The true root mean square value (tRMS) of the current is measured. Depending on their design, the current monitoring relays are powered with a rated control supply voltage of 24 V AC/DC or 24 to 240 V AC/DC supply voltage through terminals A1/A2.

The 3UG4621 / 3UG4622 current monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 179)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

### Monitoring

If the rated control supply voltage is switched on and no load current is as yet flowing, the display indicates 0.0 mA (on the 3UG4621) or 0.00 A (on the 3UG4622) and shows a symbol for current overshoot monitoring, current undershoot monitoring, or range monitoring.

#### ON-delay time

If the load current overshoots the lower measuring range limit 3 mA (3UG4621) or 50 mA (3UG4622), the set ON-delay time begins (onDel). During this time, undershooting or overshooting of the set threshold values will not result in a relay response of the CO contact.

#### Tripping delay

If a threshold is reached, the output relay K1 responds after expiry of the tripping delay time ( $I^{\blacktriangledown Del}$ ) depending on the set relay switching behavior. An output change-over contact is available as a signaling contact.

---

#### Note

For AC currents  $I > 10$  A, commercially available current transformers, e.g. 4NC, can be used as accessories. You will find more information in Catalog LV10 ([www.siemens.com/lowvoltage/infomaterial](http://www.siemens.com/lowvoltage/infomaterial)).

---

### Relay switching behavior

The relay switching behavior can be defined in order to adapt the current monitoring relay to different external circuit connections and applications.

If the closed-circuit principle (NC) is set, active switching of the relay when no fault is pending also ensures that a power failure is detected as a fault. If the open-circuit principle (NO) is set, active switching of the relay only when a fault occurs means that a power failure is not detected as a fault.

With the setting  $U_S = \text{on}$ , the relay switches to the correct state when the supply voltage is applied but waits to detect the current flow before actually monitoring. The monitoring relay is thus switched on without generating an error message because, for example, the motor is not yet running and no current is flowing.

With parameterization NC /  $U_S = \text{on}$ , a motor can also be switched directly by closing the monitoring relay if the output relay K1 switches the contactor coil voltage. However, a defect that prevents current from flowing is not signaled with this setting. In this case, setting the relay switching behavior to NC /  $I > 3 \text{ mA}$  (3UG4621) or NC /  $I > 50 \text{ mA}$  (3UG4622) is appropriate. When the supply voltage is applied, the output relay K1 is switched to the operate condition and the ON-delay time (onDel) is started. If current is not yet flowing normally after this time has elapsed, the output relay will switch back to the fault condition.

If a motor is not to be started directly using the monitoring relay, but in parallel using a pushbutton, with the monitoring relay ensuring the contactor holding, the switching behavior can be set accordingly.

With the setting  $I > 3 \text{ mA}$  (3UG4621) or  $I > 50 \text{ mA}$  (3UG4622) in combination with a set ON-delay time  $\text{onDel} = 0$ , output relay K1 will only switch to the OK condition if a current is actually measured. In this case, the monitoring relay will hold the contactor until a fault occurs or the current flow is interrupted by a further button or switch. If an ON-delay time is necessary, initial switching of the output relay on application of the supply voltage or on starting the ON-delay time must be suppressed by means of external logic.

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### Note

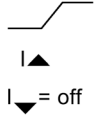
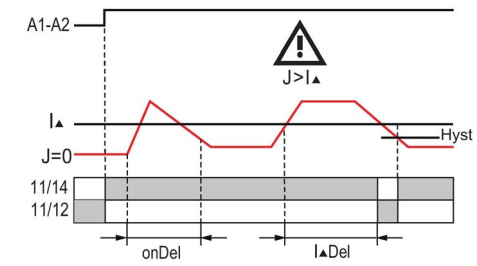
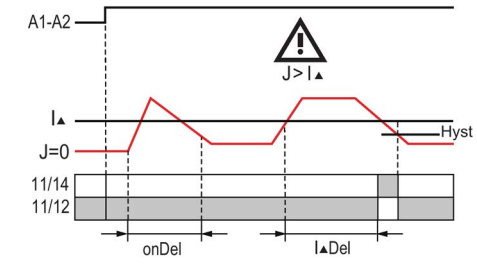
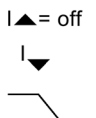
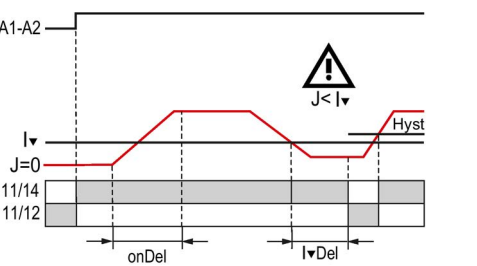
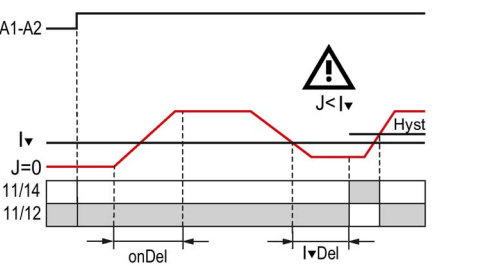
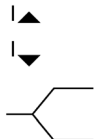
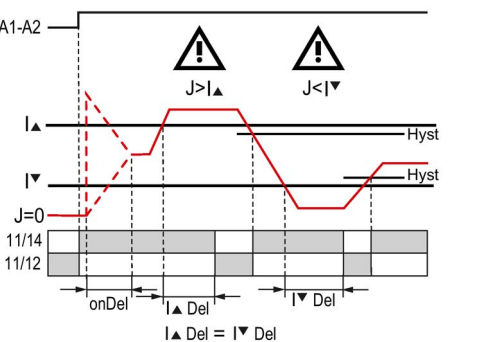
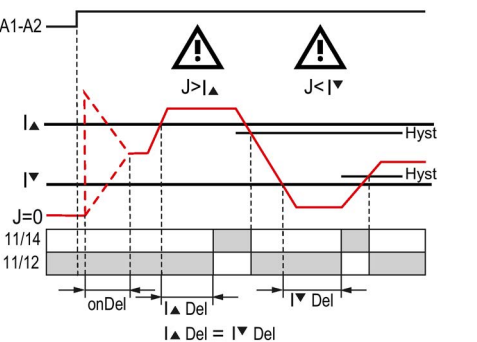
The name of the parameter values is based on the assumption that the ON-delay time  $\text{onDel} = 0$  is set. The output relay K1 then responds either immediately when the supply voltage  $U_S$  is applied or after measurement of a current flow on the set NC or NO working principle.

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You will find the switching states of the output relay below in the section entitled "Function diagrams" and in Chapter "Diagnostics (Page 180)."



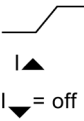
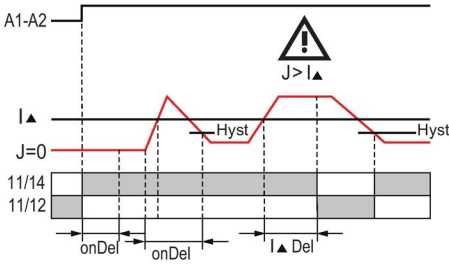
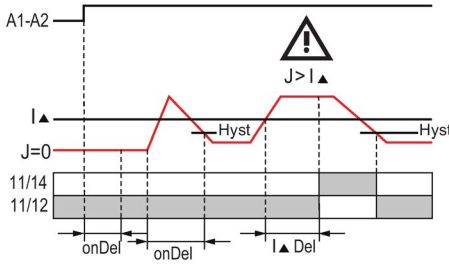
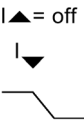
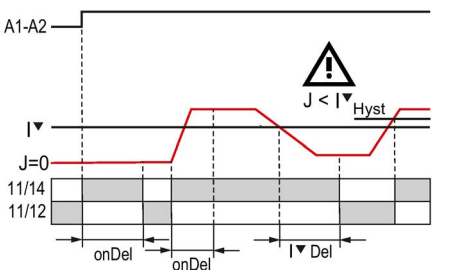
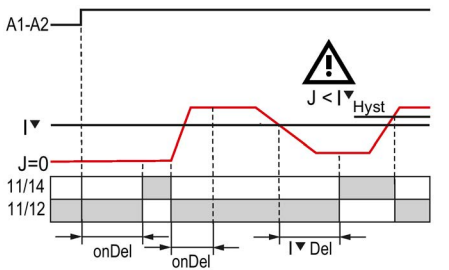
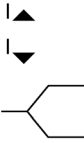
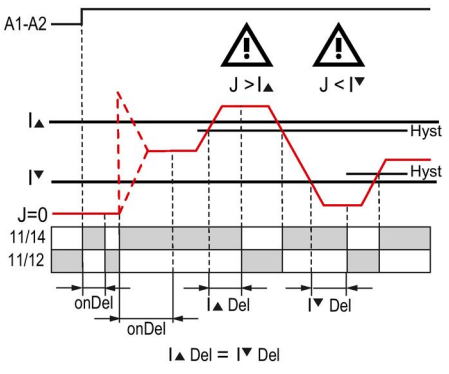
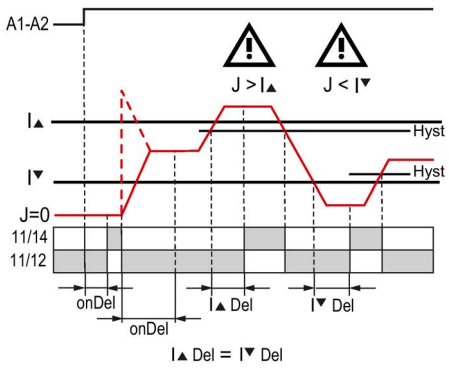
Function diagrams (from application of the rated control supply voltage  $U_s = \text{on}$ )

Display	Memory = no Relay switching behavior = NC (closed-circuit principle) $U_s = \text{on}$	Memory = no Relay switching behavior = NO (open-circuit principle) $U_s = \text{on}$
		
		
		

J = Currently measured current value

I = set threshold value for the current

Function diagrams (on reaching the lower measuring range limit of the measuring current  $I > 3 \text{ mA} / 50 \text{ mA}$ )

Display	Memory = no Relay switching behavior = NC (closed-circuit principle) $I > 3 \text{ mA} / 50 \text{ mA}$	Memory = no Relay switching behavior = NO (open-circuit principle) $I > 3 \text{ mA} / 50 \text{ mA}$
		
		
		

J = Currently measured current value

I = set threshold value for the current

## 7.4 Operation

### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



### Parameter information

The table below shows the settable parameter information of the 3UG4621 and 3UG4622 current monitoring relays:

Table 7- 2 Parameter information, 3UG4621 and 3UG4622 current monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for undershoot (I▼)	3.0 mA or OFF <sup>1)</sup> 0.05 A or OFF <sup>2)</sup>	500 mA <sup>1)</sup> 10.0 A <sup>2)</sup>	0.1 mA <sup>1)</sup> 0.01 A <sup>2)</sup>	50 mA <sup>1)</sup> 1.5 A <sup>2)</sup>
"RUN"	Threshold for overshoot (I▲)	3.0 mA <sup>1)</sup> 0.05 A <sup>2)</sup>	500 mA or OFF <sup>1)</sup> 10.0 A or OFF <sup>2)</sup>	0.1 mA <sup>1)</sup> 0.01 A <sup>2)</sup>	150 mA <sup>1)</sup> 2.5 A <sup>2)</sup>
"SET"	Hysteresis (Hyst)	0.1 mA <sup>1)</sup> 0.01 A <sup>2)</sup>	250.0 mA <sup>1)</sup> 5.0 A <sup>2)</sup>	0.1 mA <sup>1)</sup> 0.01 A <sup>2)</sup>	10.0 mA <sup>1)</sup> 0.5 A <sup>2)</sup>
"SET"	ON-delay time (onDel)	0.1 s	20 s	0.1 s	0.1 s
"SET"	Tripping delay time (I♦Del)	0.1 s	20 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC / U <sub>s</sub> = on or NO / I > 3 mA <sup>1)</sup> NC / U <sub>s</sub> = on or NO / I > 50 mA <sup>2)</sup>		--	NC / U <sub>s</sub> = on

1) 3UG4621 current monitoring relay

2) 3UG4622 current monitoring relay

#### Note

"Overshoot" monitoring mode is activated when the undershoot threshold is set to OFF.

"Undershoot" monitoring mode is activated when the overshoot threshold is set to OFF.

#### Note

##### Deactivating monitoring

If the upper and lower threshold values are deactivated (OFF), monitoring will cease for:

- Current overshoot
- Current undershoot

The up-to-date measured value is displayed permanently.

The parameters are described in the Chapter "Parameters (Page 363)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 39)".

## 7.5 Diagnostics

### 7.5.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Current measured value or fault symbol
- ② Type of monitoring
- ③ Symbol of the changeover contact

#### Meaning of the information on the display

##### Note

##### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and faults are indicated on the display as a diagnostics message with flashing symbols:

Display areas	Symbol	Meaning
①	5.0A	Displays the measured current
②		Monitoring for current overshoot
②		Monitoring for current undershoot
②		Range monitoring (monitoring for current overshoot and current undershoot)
②	◀	Current is in correct range
②	▲	A current overshoot has occurred
②	▼	A current undershoot has occurred
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 175)."

## 7.5.2 Reset

### RESET



How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

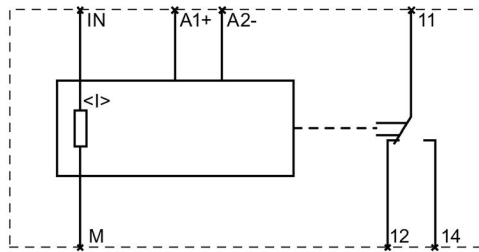
- Manual RESET (Memory = 1 / Mem = yes)

To reset the devices with digital setting, it is necessary to press both arrow keys   simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

## 7.6 Circuit diagrams

### 7.6.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4621 / 3UG4622 current monitoring relays



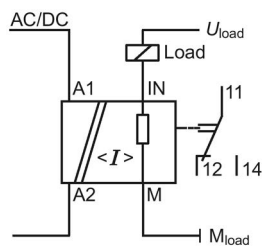
#### Note

On the 24 V AC / DC version of the 3UG4621/22-.AA30, terminals A2 and M (GND) are electrically connected in the device! The load current must flow through terminal M (GND).

On the 24 to 240 V AC/DC versions of the 3UG4621/22-.AW30, terminals A2 and M (GND) are electrically separated!

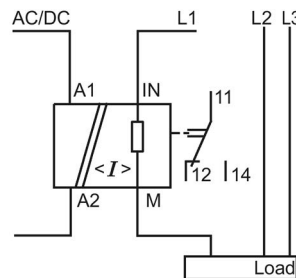
### 7.6.2 Wiring examples (3UG46...AW30)

#### Single-phase operation



3UG462...AW30 single-phase operation

#### Three-phase operation



3UG462...AW30 three-phase operation

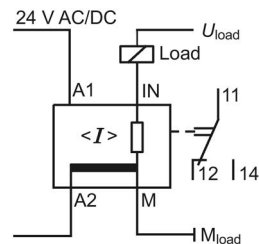
### 7.6.3 Wiring examples (3UG462.-.AA30)

#### Note

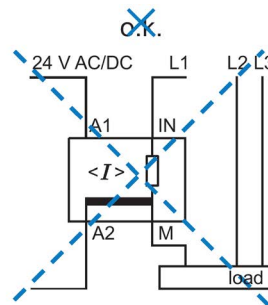
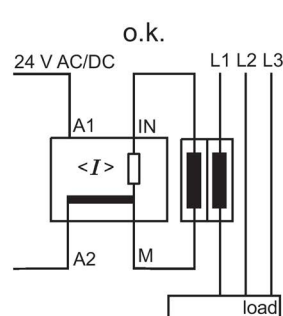
If this arrangement is not complied with, the monitoring relay may be destroyed and the short-circuit current may damage the plant!

Operation with a **separate** control circuit and load current circuit

- single-phase

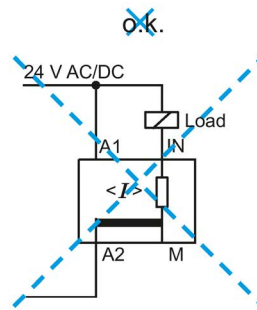
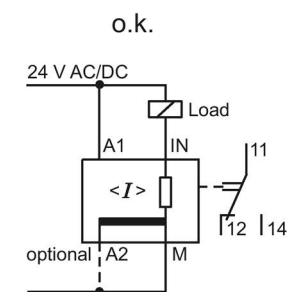


- three-phase



Operation with a **common** control circuit and load current circuit

- single-phase



#### Note

##### Configuration

In the case of 3UG462.-.AA30, A2 and M (GND) are internally electrically connected!

If the load to be monitored and the current monitoring relay are powered from the same system, terminal A2 is not required!

The load current must always flow away through M (GND), otherwise the current monitoring relay may be destroyed!

## 7.7 Technical data

### Measuring circuit

		3UG4621-..A	3UG4621-..W	3UG4622-..A	3UG4622-..W
<b>Number of poles for main current circuit</b>		1			
<b>Type of current for monitoring</b>		AC/DC			
<b>Measurable current</b>	A	0.003 ... 0.6		0.05 ... 15	
<b>Measurable current for AC</b>	A	0.003 ... 0.6		0.05 ... 15	
<b>Measurable line frequency</b>	Hz	40 ... 500			
<b>Internal resistance of the measuring circuit</b>	Ω	0.5		0.005	
<b>Adjustable response current</b>					
• 1	A	0.003 ... 0.5		0.5 ... 10	
• 2	A	0.003 ... 0.5		0.5 ... 10	
<b>Adjustable response delay time</b>					
• when starting	s	0.1 ... 20			
• with lower or upper limit violation	s	0.1 ... 20			
<b>Adjustable switching hysteresis for measured current value</b>	mA	0.1 ... 250		10 ... 5 000	
<b>Stored energy time at mains power cut minimum</b>	ms	10			
<b>Operating voltage</b>					
• rated value	V	24	24 ... 240	24	24 ... 240



## General technical details

		3UG4621-..A..	3UG4622-..A..	3UG4621-..W..	3UG4622-..W..
<b>Product function</b>		Current monitoring relay			
<b>Design of the display</b>		LCD			
<b>Product function</b>					
• overcurrent recognition of 1 phase		Yes			
• overcurrent recognition of 3 phases		No			
• undercurrent recognition of 1 phase		Yes			
• undercurrent recognition of 3 phases		No			
• overcurrent recognition DC		Yes			
• undercurrent recognition DC		Yes			
• current window recognition DC		Yes			
• tension window recognition of 1 phase		No			
• tension window recognition of 3 phases		No			
• reset external		Yes			
• self-reset		Yes			
• open-circuit or closed-circuit current principle		Yes			
<b>Starting time after the control supply voltage has been applied</b>	s	1			
<b>Response time maximum</b>	ms	450			
<b>Relative metering precision</b>	%	5			
<b>Precision of digital display</b>		+/-1 digit			
<b>Relative temperature-related measurement deviation</b>	%	5			
<b>Temperature drift per °C</b>	%/°C	0.1			
<b>Relative repeat accuracy</b>	%	1			

7.7 Technical data

		3UG4621-..A..	3UG4622-..A..	3UG4621-..W..	3UG4622-..W..
<b>Type of voltage of supply voltage</b>		AC/DC			
<b>Supply voltage 1</b>					
• at 50 Hz for AC					
– rated value	V	24		—	
– initial rated value	V	—		24	
– final rated value	V	—		240	
• at 60 Hz for AC					
– rated value	V	24		—	
– initial rated value	V	—		240	24
– final rated value	V	—		24	240
• for DC					
– rated value	V	24		—	
– initial rated value	V	—		24	
– final rated value	V	—		240	
<b>Impulse voltage resistance rated value</b>	kV	4			
<b>Recorded real power</b>	W	2			
<b>Protection class IP</b>		IP20			
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4			
<b>Operating current at 17 V minimum</b>	mA	5			
<b>Continuous current of the DIAZED fuse link of the output relay</b>	A	4			
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g			
<b>Resistance against shock according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms			
<b>Current carrying capacity</b>					
• of output relay					
– at AC-15					
– at 250 V at 50/60 Hz	A	3			
– at 400 V at 50/60 Hz	A	3			
– at DC-13					
– at 24 V	A	1			
– at 125 V	A	0.2			
– at 250 V	A	0.1			
• for permanent overcurrent maximum permissible	A	0.6	15	0.6	15
• for overcurrent duration < 1 s maximum permissible	A	5	50	5	50

		3UG4621-..A..	3UG4622-..A..	3UG4621-..W..	3UG4622-..W..
Installation altitude at a height over sea level maximum		2 000			
Conductor-bound parasitic coupling BURST according to IEC 61000-4-4		2 kV			
Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5		2 kV			
Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5		1 kV			
Electrostatic discharge according to IEC 61000-4-2		6 kV contact discharge / 8 kV air discharge			
Field-bound parasitic coupling according to IEC 61000-4-3		10 V/m			
Thermal current of the contact-affected switching element maximum	A	5			
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690			
Maximum permissible voltage for safe disconnection					
• between control and auxiliary circuit	V	300			
• between auxiliary circuit and auxiliary circuit	V	300			
Degree of pollution		3			
Ambient temperature					
• during operating	°C	-25 ... +60			
• during storage	°C	-40 ... +85			
• during transport	°C	-40 ... +85			
Galvanic isolation					
• between entrance and outlet		Yes			
• between the outputs		Yes			
• between the voltage supply and other circuits		No		Yes	
Mechanical operating cycles as operating time typical		10 000 000			
Electrical operating cycles as operating time at AC-15 at 230 V typical		100 000			
Operating cycles with 3RT2 contactor maximum	1/h	5 000			

7.7 Technical data

**Mechanical design**

		3UG4621-1....	3UG4622-1....	3UG4621-2....	3UG4622-2....
<b>Width</b>	mm	22.5			
<b>Height</b>	mm	92		94	
<b>Depth</b>	mm	91			
<b>Built in orientation</b>		any			
<b>Distance, to be maintained, to earthed part</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, to the ranks assembly</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			
<b>Distance, to be maintained, conductive elements</b>					
• forwards	mm	0			
• backwards	mm	0			
• sideways	mm	0			
• upwards	mm	0			
• downwards	mm	0			

	3UG4621-1....	3UG4622-1....	3UG4621-2....	3UG4622-2....
<b>Type of mounting</b>	snap-on mounting			
<b>Design of the electrical connection</b>				
<ul style="list-style-type: none"> <li>for auxiliary and control current circuit</li> </ul>	screw-type terminals		spring-loaded terminals	
<ul style="list-style-type: none"> <li>for main current circuit</li> </ul>	screw-type terminals		spring-loaded terminals	
<b>Product function</b>				
<ul style="list-style-type: none"> <li>removable terminal for auxiliary and control circuit</li> </ul>	Yes			
<ul style="list-style-type: none"> <li>removable terminal for main circuit</li> </ul>	Yes			
<b>Type of the connectable conductor cross-section</b>				
<ul style="list-style-type: none"> <li>solid</li> </ul>	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )		2x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>finely stranded <ul style="list-style-type: none"> <li>– with wire end processing</li> <li>– without wire end processing</li> </ul> </li> </ul>	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )		2 x (0.25 ... 1.5 mm <sup>2</sup> )	
<ul style="list-style-type: none"> <li>for AWG conductors <ul style="list-style-type: none"> <li>– solid</li> <li>– stranded</li> </ul> </li> </ul>	—		2x (0.25 ... 1.5 mm <sup>2</sup> )	
	2x (20 ... 14)		2x (24 ... 16)	
	2x (20 ... 14)		2x (24 ... 16)	
<b>Tightening torque</b>				
<ul style="list-style-type: none"> <li>with screw-type terminals</li> </ul>	N·m	0.8 ... 1.2		— ...
<b>Number of change-over switches delayed switching</b>	1			



# 3UG4625 residual current monitoring relay with 3UL23 transformer

# 8

## 8.1 Application areas

### Application areas

Residual current monitoring relays are used in industry to:

- Protect systems from damage caused by fault currents
- Prevent production losses caused by unplanned downtime
- Perform maintenance to meet all demands

3UG4625 residual current monitoring relays are used in conjunction with 3UL23 residual current transformers to monitor systems where environmental conditions increase the chance of higher fault currents. The devices are used for applications including in the following areas:

Table 8- 1 Application areas of 3UG4625 residual current monitoring relays

Cause of fault	Application
<ul style="list-style-type: none"><li>• Dust deposits on terminals</li></ul>	<ul style="list-style-type: none"><li>• Woodworking, grain mills</li></ul>
<ul style="list-style-type: none"><li>• Increased levels of humidity</li></ul>	<ul style="list-style-type: none"><li>• Mining, power supply containers</li></ul>
<ul style="list-style-type: none"><li>• Capacitive fault currents as "basic fault load"</li></ul>	<ul style="list-style-type: none"><li>• For large systems (line length)</li></ul>
<ul style="list-style-type: none"><li>• Porous cables and lines</li></ul>	<ul style="list-style-type: none"><li>• Motor winding insulation</li></ul>
<ul style="list-style-type: none"><li>• Diminishing insulation caused by material wear</li></ul>	<ul style="list-style-type: none"><li>• Furnaces</li></ul>

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### Note

3UG4625 residual current monitoring relays monitor devices and systems for their correct function.

They are **not** suitable for personal protection or protection from fires.

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## 8.2 Operator controls and connection terminals

### 3UG4625 front view/terminal labeling

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Device article number
	⑤	Label
	⑥	Legend for menu
	⑦	Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>	
	A1+	Rated control supply voltage ~ / +
	A2-	Rated control supply voltage ~ / -
	C1	Connection for 3UL23 residual current transformer
	C2	
	12	Output relay K1 CO contact NC contact (alarm output)
11	Output relay K1 CO contact root	
14	Output relay K1 CO contact NO contact	
22	Output relay K2 CO contact NC contact (warning output)	
21	Output relay K2 CO contact root	
24	Output relay K2 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 206)".



## 8.3 Functions

### General functionality

3UG4625 residual current monitoring relays are supplied with a rated control supply voltage of 24 to 240 V AC/DC (rms value), 50/60 Hz via terminals A1+ and A2-.

3UG4625 residual current monitoring relays are equipped with a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 202)".

You will find a description of the individual parameters in Chapter "Parameters (Page 363)".

The main conductors and, if present, the neutral conductor to which the load is connected, are routed through the opening of the ring core of a 3UL23 residual current transformer. There is a secondary winding around this ring core to which the 3UG4625 residual current monitoring relay is connected.

In fault-free operation of a system, the sum of inflowing and outflowing currents equals zero. No current is then induced in the secondary winding of the residual current transformer.

When an insulation error occurs, for example, the sum of the inflowing currents is greater than the sum of the outflowing currents.

The residual current induces a secondary current in the secondary winding of the transformer. This current is evaluated in the monitoring relay and used to display the current residual current and to switch the output relays when the set warning threshold or the tripping threshold is overshoot.

To ensure a maximum plant availability 3UG4625 residual current monitoring relays focus on the following features:

- **High degree of measuring accuracy**  
3UG4625 residual current monitoring relays in combination with 3UL23 residual current transformers operate with a measuring accuracy of  $-7.5\%/+7.5\%$ . This enables set limit values to be monitored very precisely. False tripping caused by measuring errors is minimized.
- **Adjustable delay times**  
The ON-delay time of 3UG4625 residual current monitoring relays can be configured freely, enabling fading out of fault currents due to high input currents that are measured during motor start-up only. Short-term fault currents or emitted interference can be easily faded out using the adjustable tripping delay time. For more information please see the Chapter "Measuring accuracy (Page 193)".
- **Wide-range supply voltage**  
3UG4625 residual current monitoring relays can be operated at an input voltage of between 24 and 240 V AC/DC. This not only ensures that devices can be used worldwide, but that temporary supply voltage dips do not cause a failure of the monitoring function, that is, plant stoppage.  
The switching response of the relay outputs can be set to open-circuit principle (NO) if you intend to continue plant operation even if the monitoring function fails. This means only actively determined fault currents are reported via the relay outputs.
- **Permanent self-monitoring**  
The permanent self-monitoring feature of 3UG4625 ensures reliable system monitoring. The connected 3UL23 residual current transformer is also permanently monitored for open-circuit or short-circuit. As a result, cyclic manual tests to ensure its function are obsolete. Regardless of this, it is possible at any time to test the output relays for switching capability. Pressing the Set button for longer than 2.5 s will call up parameter assignment mode. This will cause the output relays to switch to the fault state as a safety precaution. Proceed as described above to quit parameter assignment mode. The output relay will once again switch back to its normal operating state.

### Measuring accuracy

The combination of 3UG4625 residual current monitoring relay and 3UL23 residual current transformer is designed so that a warning or alarm is triggered at the latest upon exceeding the set limit values. To safeguard this function, slightly higher fault currents than those actually measured are displayed and compared with the set limit values.

The measuring accuracy is  $-7.5\%/+7.5\%$  of the value displayed. This takes into account the measuring accuracy of monitoring relay and residual current transformer.

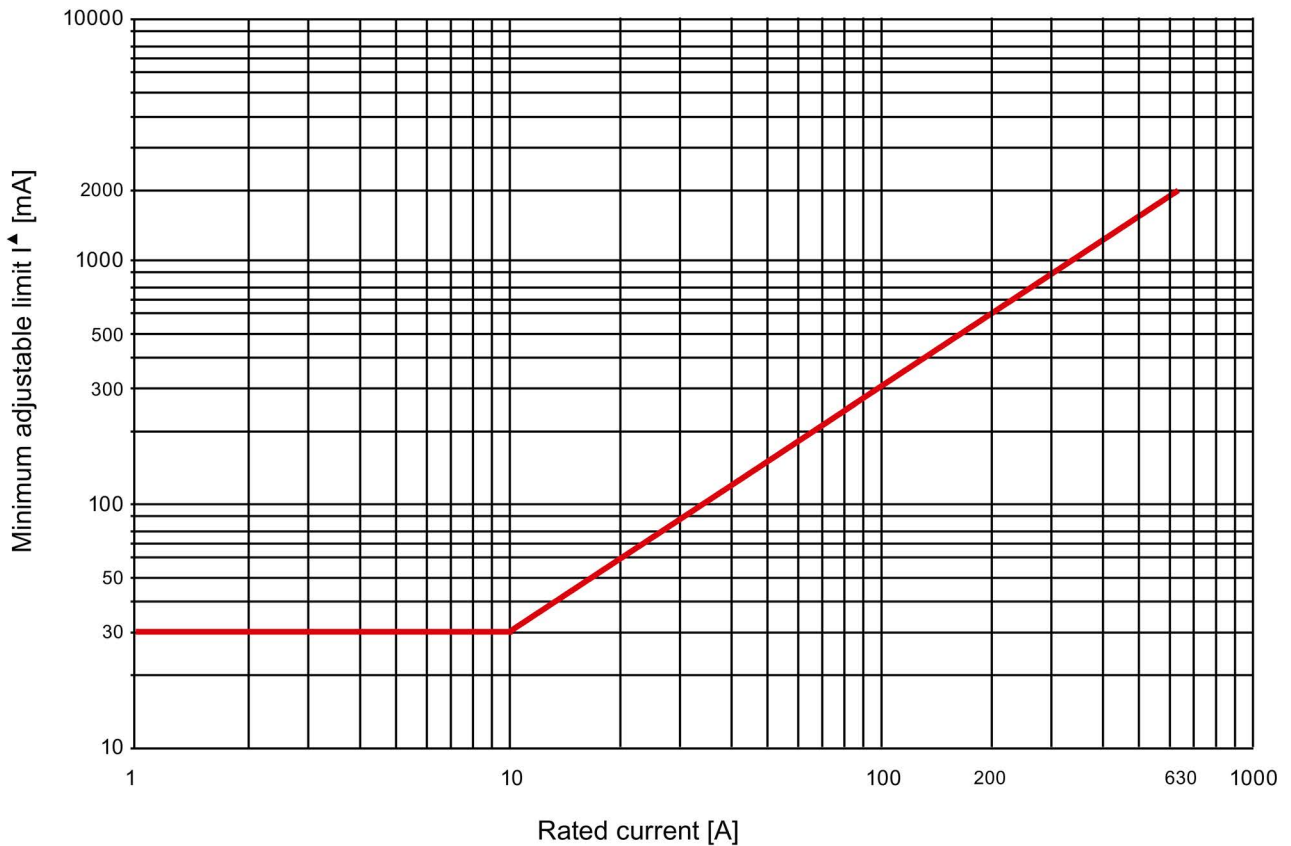
### Limits of fault current measurement

In the event of increasing primary currents, transformer production tolerances, imbalances in the cable routing and current loads in individual cables increasingly cause what appear to be fault currents that are detected by the evaluation units.

An increased false tripping may occur if excessively low monitoring limit values have been set at high primary currents. Such tolerances also mean that the measuring accuracy no longer corresponds to the range of between  $-7.5\%/+7.5\%$ .

To avoid these types of measuring errors and false tripping, we recommend to set the limit values to the minimum values listed in the following graphic, depending on the applicable primary current.

Minimum adjustable parameters  $I^{\Delta}$  for all transformer sizes at 50/60 Hz



### 8.3 Functions

If monitoring is required within limit values that are lower than those recommended, we recommend the use of delay times, particularly if false tripping occurs exclusively during motor start-up.

If delay times do not lead to the desired result, the use of shield sleeves may considerably lower the minimum possible monitoring limit.

For more information see Chapters "Installation specifications (Page 335)" and "Potential for optimization (Page 339)".

The monitored current waveforms also have a strong influence on the measuring accuracy. In the case of loads with generalized phase control, deviations from the measuring accuracy can occur when monitoring for high residual current limits. The cause of this is the extreme difference between the monitored rms values and the peak values of the residual current. The more extreme the generalized phase control, the shorter the time during which current flows, and the lower the resulting rms value. To achieve and monitor a high rms value in such a case, an extremely high peak value of the residual current is necessary. In the case of high currents, current transformers tend towards saturation in which a further increase in current on the primary side does not result in an equivalent increase on the secondary side. In the case of extreme peak values of the residual current, the measuring accuracy suffers as a result of this principle. Due to the great difference between the peak value and the rms value, monitoring for lower limits is useful.

## Monitoring

### Initialization

When the monitoring relay is connected to the supply voltage, the initialization phase starts and internal functional tests are performed. During the initialization phase that lasts approximately 1.6 s, the connection to the 3UL23 residual-current transformer is one of the things that is checked. During this time, no measurement or monitoring of the fault current takes place. -- A is shown on the display. The relay switching behavior during the initialization phase can be determined with the help of the "Init" parameter. In the factory setting ("Init" parameter = **ERR**), the output relays switch to the fault state until completion of the initialization phase because there is no valid measuring result of the fault current.

If the parameter is set to "OK", it is assumed that there is no internal fault and the fault current will be within the set limits. For this reason, the output relays are switched to the work position when the supply voltage is present.

This parameter setting is useful if the residual current monitoring relays are not permanently connected to the supply voltage and instead are to be started immediately when the monitored application is started, and output relays in the alarm position result in immediate shutdown of the application again, e.g. when connecting a contactor with interruption of the self-locking by the output relay contacts.

After completion of the initialization phase, a permanent self-test takes place without interrupting the monitoring function.

### Normal operation

If the measured fault current exceeds the set warning threshold (!), the associated CO contact 21-22-24 changes the switching state without delay. On the display, the arrows for "threshold overshoot" and "measured value within the set limits" (↔) flash alternately as an indication.

On the display, the currently displayed measuring value and the symbol for overshoot flash.

---

### Note

Currents with line frequencies of between 16 and 400 Hz can be monitored by 3UG4625 residual current monitoring relays in conjunction with 3UL23 residual current transformers!

### Startup delay

The set ON-delay time is triggered if the fault current overshoots the lower measuring range limit of 20 mA (onDel). During this time, exceeding the set limit values will not trigger a relay response of the CO contacts.

To start a drive, the output relay switches to the correct state during the ON-delay time (onDel), depending on the selected open-circuit principle or closed-circuit principle, even if the measured value remains above the set value.

### Tripping delay

If the measured value exceeds the set threshold (I\*) after expiry of the ON-delay time (onDel), the set tripping delay time (I\*Del) starts and the relay symbol flashes. After expiry of this time, the output relay K1 changes the switching state. Exceeding the set warning threshold will cause output relay K2 to switch immediately without taking into account the tripping delay time. On the display, the actual measured value and the symbol for overshoot flash.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 203)."

8.3 Functions

**Tripping conditions**

The combination of 3UG4625 residual current monitoring relay and 3UL23 residual current transformer responds according to the following tripping conditions:

<b>Residual current monitoring relays</b>	<b>Fault current</b>
No tripping	0 to 85 % of the set threshold
Tripping not defined	85 to 100 % of the set threshold
Tripping	$\geq$ 100 % of the set threshold

**3UL23 residual current transformer**

3UL23 residual current transformers can be used in conjunction with 3UG4625 residual current monitoring relays to detect fault currents in machines and systems.

3UL23 residual current transformers are suitable for detecting pure AC fault currents and AC fault currents with a pulsating direct-current component.

These necessary accessories are described in Chapter "3UL23 residual current transformers for 3UG4625 monitoring relays (Page 333)."

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**Note**

Do not ground the neutral conductor downstream of the residual current transformer as otherwise fault current monitoring functions can no longer be ensured.

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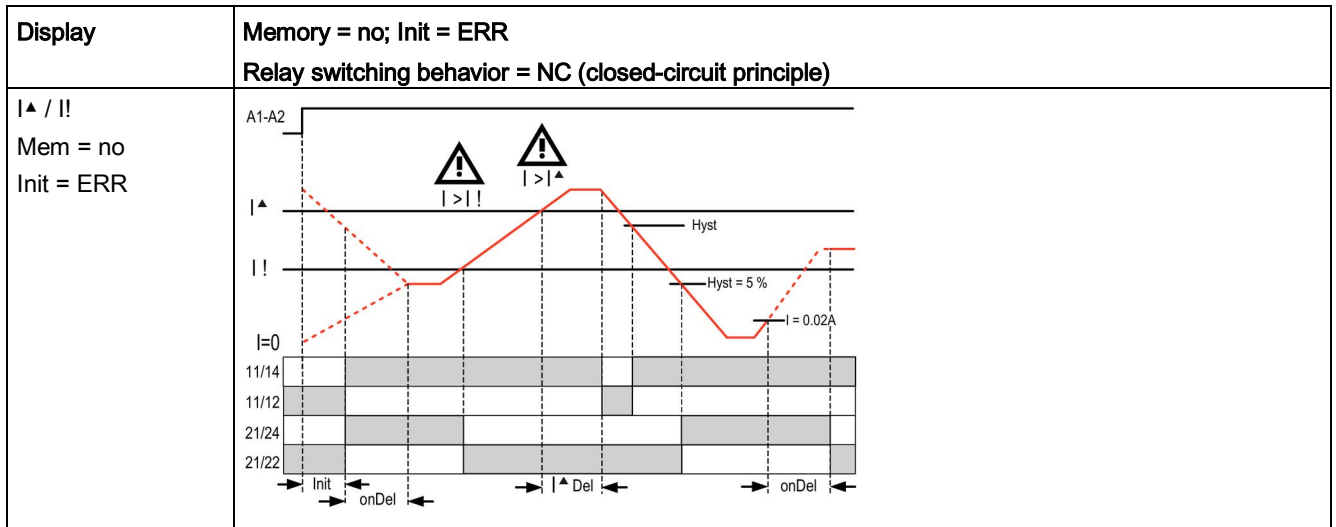
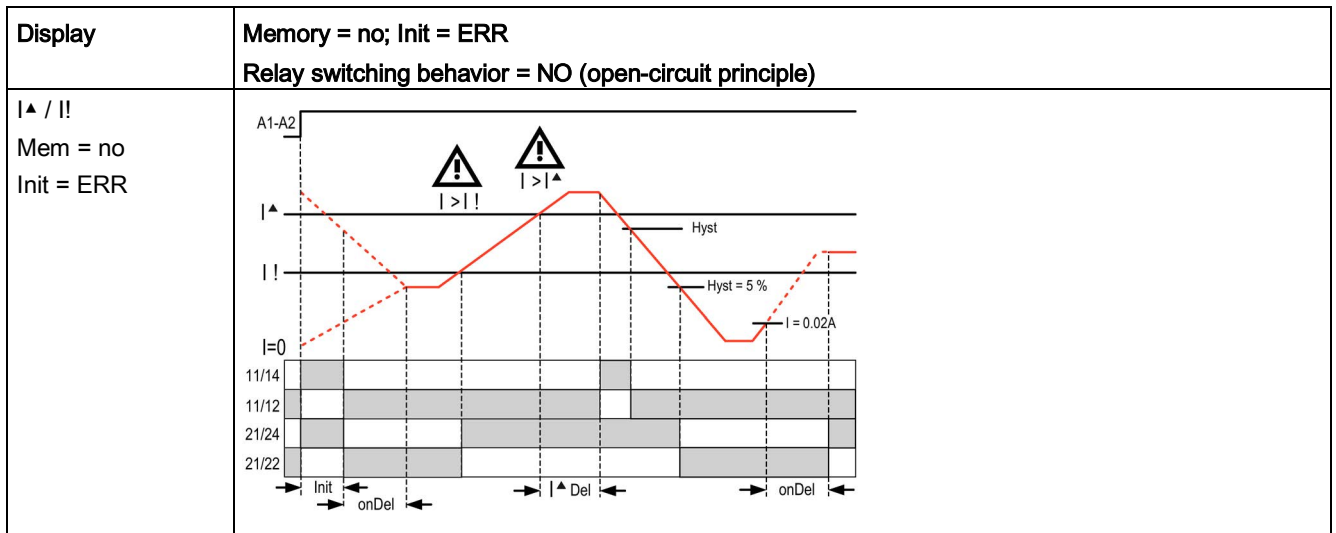
Function diagrams for 3UG4625

Note

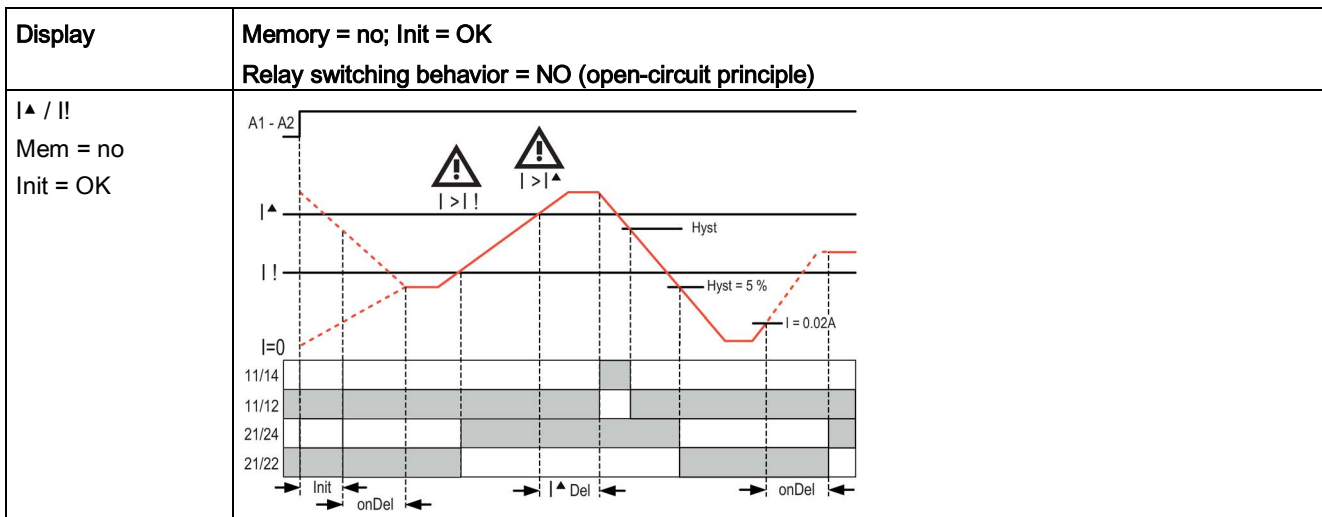
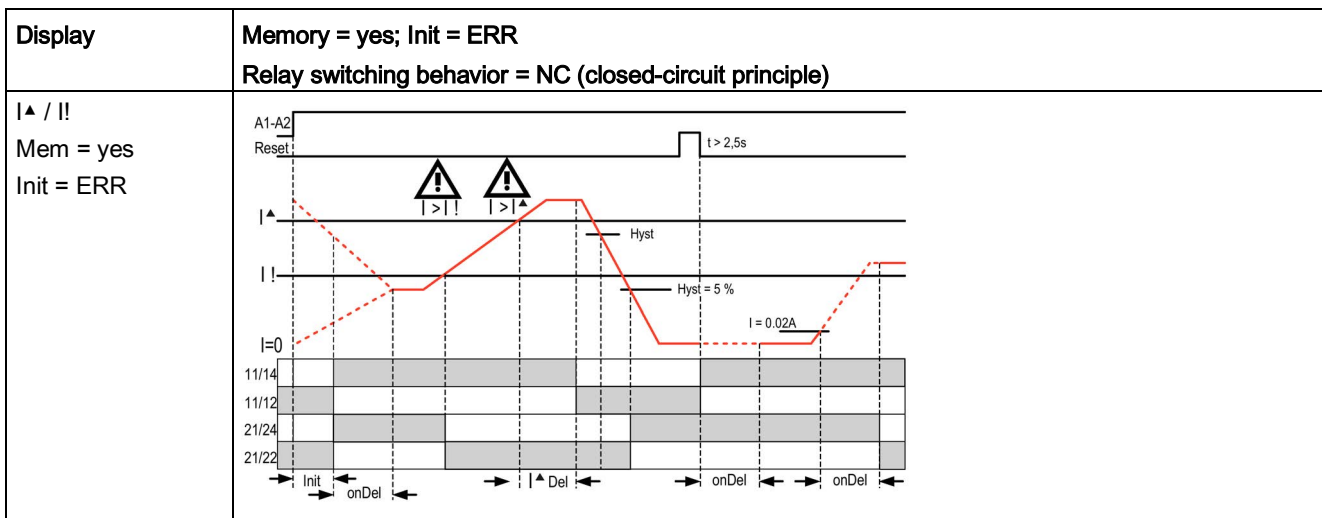
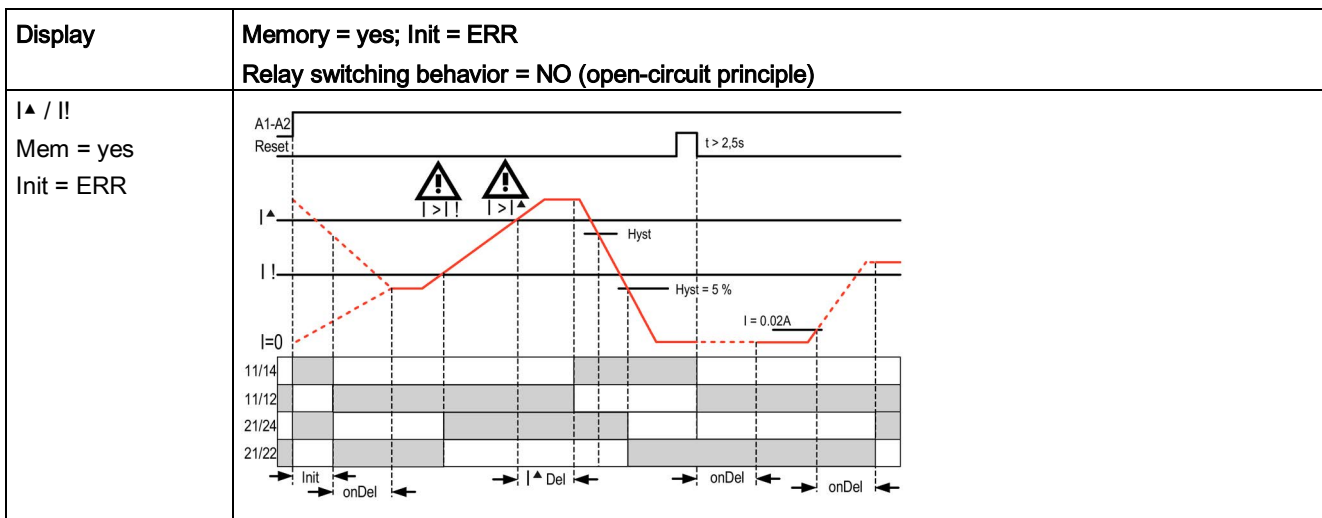
Difference between Hyst and Hysteresis

In the following diagrams, the term "Hyst" refers to the "Hysteresis" parameter. The "Hysteresis" parameter refers to the monitored limit values ( $I^\Delta$ ) and can be set in the SET menu.

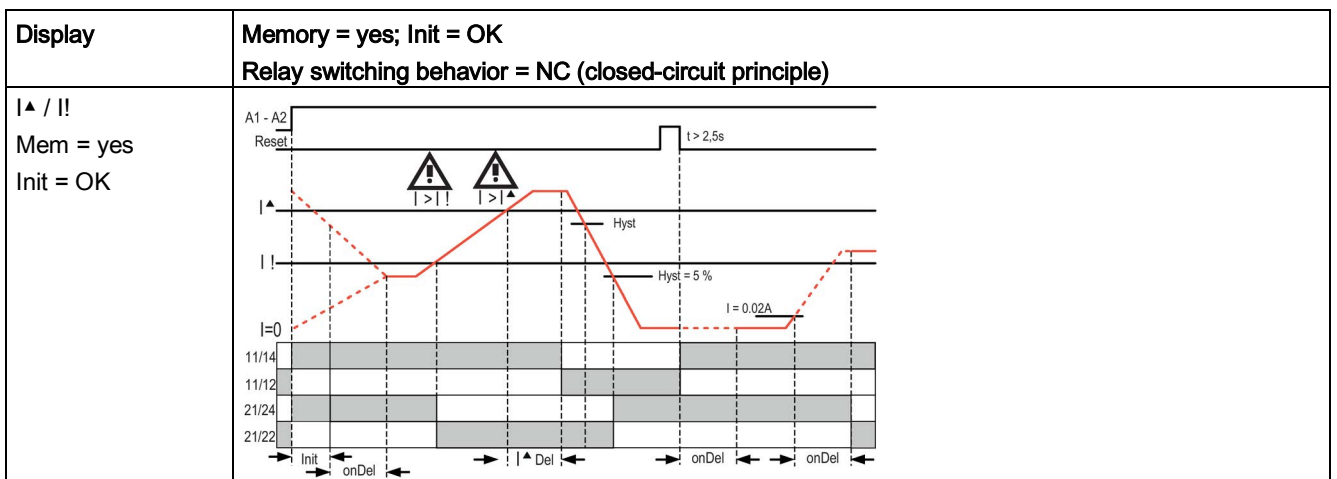
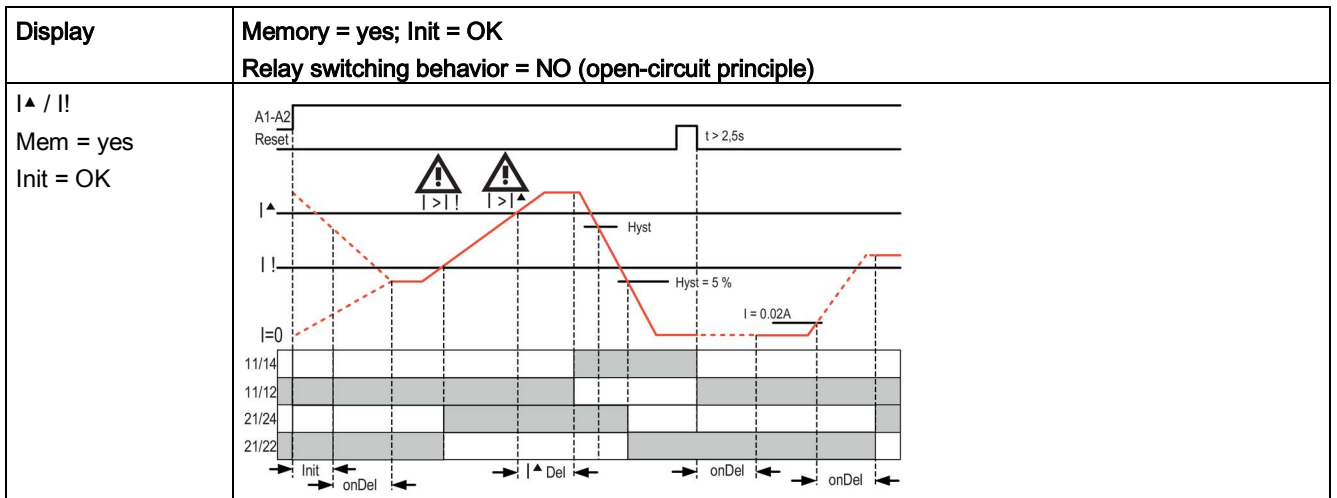
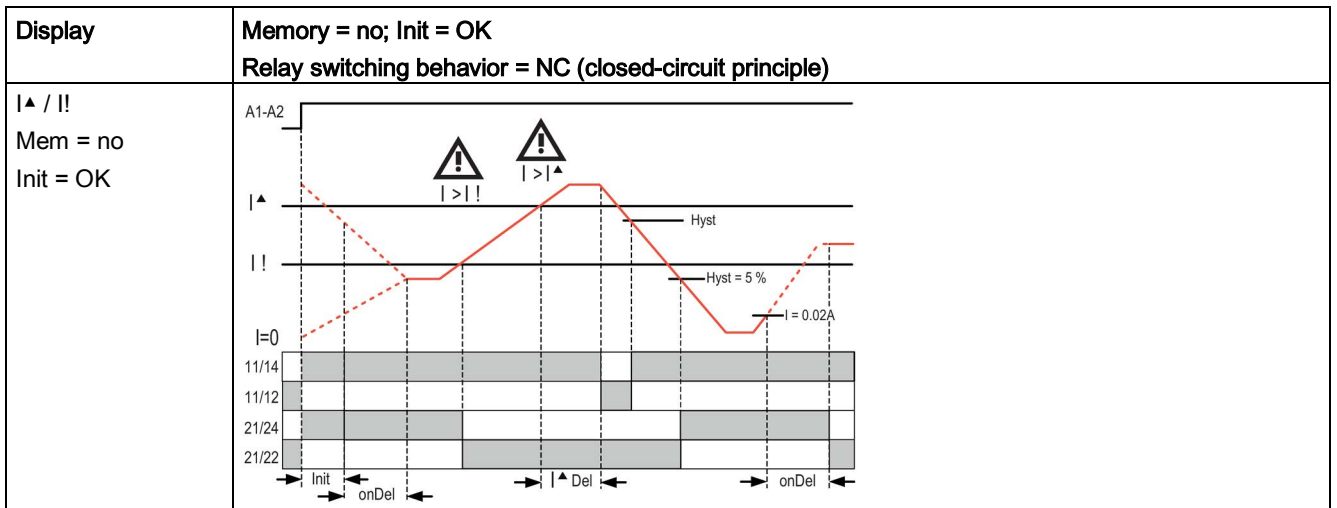
However, "Hyst = 5 %" refers to the warning thresholds ( $I!$ ) and is permanently set to 5 %.



8.3 Functions







**Note**

The system is immediately switched off in the event of an open-circuit or short-circuit in the transformer connection cables.

## 8.4 Operation

### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



### Parameter information

The following table lists the adjustable parameter information for the 3UG4625 residual current monitoring relay:

Table 8-2 Parameter information, 3UG4625 residual current monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for overshoot (I▲)	0.03 A	40.0 A	Depending on the value, 0.01 A or 0.1 A	1.0 A
"RUN"	Warning threshold for overshoot (I!)	0.03 A or OFF	40.0 A	Depending on the value, 0.01 A or 0.1 A	0.5 A
"SET"	Hysteresis (Hyst)	OFF (0 %)	50 %	5 %	5 %
"SET"	Initialization (Init)	ERR	OK	--	ERR
"SET"	ON-delay time (onDel)	0.1 s or OFF	20.0 s	0.1 s	OFF
"SET"	Tripping delay time (I▲Del)	0.1 s or OFF	20.0 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC or NO		--	NC

#### Note

Various parameters are deactivated by setting OFF.

The parameters are described in the Chapter "Parameters (Page 363)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 39)".

The 3UL23 residual current transformers used cover the entire fault current range from 0.03 to 40 A in all sizes.

For more information on the technical data of 3UL23 residual current transformers see Chapter "Technical data (Page 346)".

## 8.5 Diagnostics

### 8.5.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Current measured value or fault symbol
- ② Type of monitoring
- ③ Symbols of the changeover contacts










### Meaning of the information on the display

**Note**

**Indications in the event of a fault**

The symbols on the display flash to indicate an error.

The following statuses and faults are indicated on the display as a diagnostics message with the following symbols:

Display area	Symbol	Meaning
①	5.00A	<ul style="list-style-type: none"> <li>Not flashing: the currently measured current is displayed</li> <li>Flashing: A current overshoot has occurred (the currently measured current flashes on the display)</li> </ul>
②		Monitoring for current overshoot
②		Current is in correct range
②		Flashing alternately. The warning threshold has been exceeded
②		Flashing: A current overshoot has occurred
③	 I*	<ul style="list-style-type: none"> <li>Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>Flashing: Delay time (ON-delay or tripping delay) running</li> <li>Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>
③	 !!	<ul style="list-style-type: none"> <li>Not flashing: Relay contact 21/22 open, relay contact 21/24 closed</li> <li>Flashing: Delay time (ON-delay) running</li> <li>Masked out: Relay contact 21/22 closed, relay contact 21/24 open</li> </ul>
①	---A	Self-test active, no measurements
①		Measurement range exceeded (> 40 A)
①	0.00A	Fallen below measurement range
①		Open circuit (flashing)
①		Short-circuit (flashing)

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 193)."

## 8.5.2 Reset

### RESET


How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

- Manual RESET (Memory = 1 / Mem = yes)

To reset the devices with digital setting, it is necessary to press both arrow keys  simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

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#### Note

The warning threshold is always reset by autoreset.

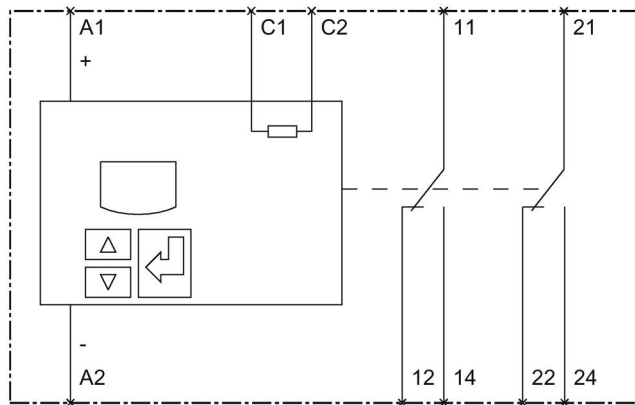
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## 8.6 Circuit diagrams

### 8.6.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4625

3UG4625-.CW30 residual current monitoring relay, 24 to 240 V



#### Note

3UG4625 residual current monitoring relays are suitable for operation with 3UL23 residual current transformers for external ground-fault monitoring. The output signal of the 3UL23 residual current transformer is connected to terminals C1 and C2 of the monitoring relay. To avoid interference injection, which could result in incorrect measurements, these connecting lines must be routed as parallel as possible and twisted, or shielded cables must be used.

### 8.6.2 Wiring examples

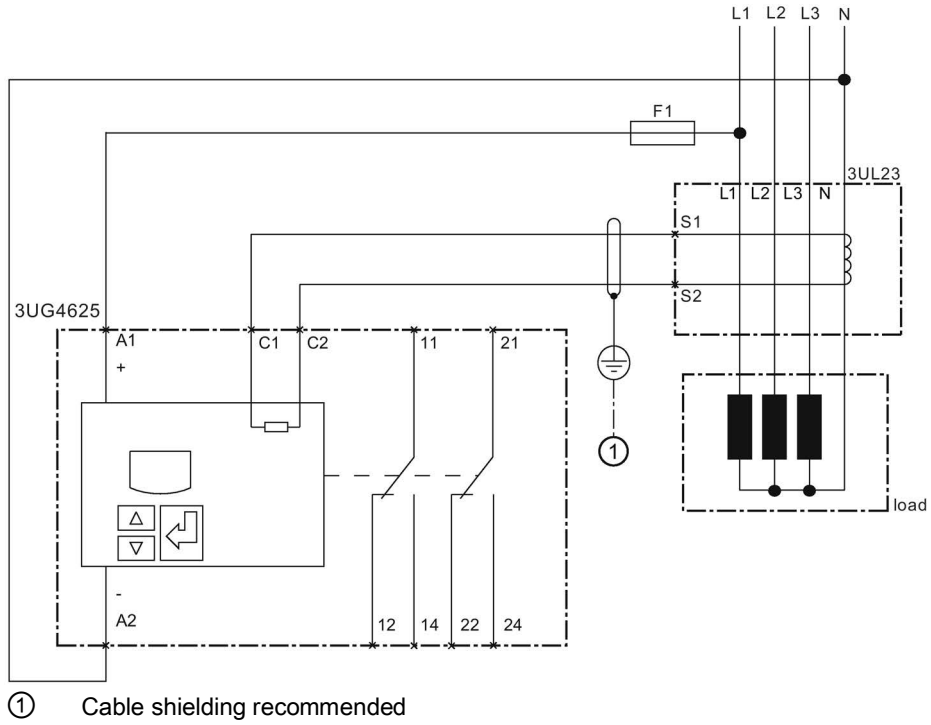


Image 8-1 Wiring diagram of 3UG4625 with 3UL23

## 8.7 Technical data

### Measuring circuit

			3UG4625-.....
Type of current for monitoring			AC
Measurable line frequency	Hz		16 400
Adjustable response current			
• 1	A		0.03 ... 40
• 2	A		0.03 ... 40
Adjustable response delay time when starting	s		0.1 ... 20
Adjustable response delay time	s		0.1 ... 20
Switching hysteresis	%		0 ... 50
Stored energy time at mains power cut minimum	ms		10
Operating voltage			
• rated value	V		24 ... 240

### General technical details

			3UG4625-.....
Product function			for three-phase supplies
Design of the display			LCD
Product function			
• difference current indication			Yes
• defect storage			Yes
• overcurrent recognition of 1 phase			Yes
• undercurrent recognition of 1 phase			No
• reset external			Yes
• open-circuit or closed-circuit current principle			Yes
Starting time after the control supply voltage has been applied	ms		1 600
Response time maximum	ms		150
Relative metering precision	%		5
Precision of digital display			+/-1 digit
Temperature drift per °C	%/°C		0.1
Relative repeat accuracy	%		1



		3UG4625-.....
<b>Type of voltage of the controlled supply voltage</b>		AC/DC
<b>Control supply voltage</b>		
• at 50 Hz at AC		
– rated value	V	24 ... 240
• at 60 Hz at AC		
– rated value	V	24 ... 240
• for DC		
– rated value	V	24 ... 240
<b>Working range factor supply voltage rated value</b>		
• at 50 Hz		
– for AC		0.85 ... 1.1
• at 60 Hz		
– for AC		0.85 ... 1.1
• for DC		0.85 ... 1.1
<b>Impulse voltage resistance rated value</b>	kV	4
<b>Recorded real power</b>	W	2
<b>Protection class IP</b>		IP20
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
<b>Operating current at 17 V minimum</b>	mA	5
<b>Continuous current of the DIAZED fuse link of the output relay</b>	A	4
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
<b>Resistance against shock according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms
<b>Installation altitude at a height over sea level maximum</b>	m	2 000
<b>Current carrying capacity of output relay at AC-15</b>		
• at 250 V at 50/60 Hz	A	3
• at 400 V at 50/60 Hz	A	3
<b>Current carrying capacity of output relay at DC-13</b>		
• at 24 V	A	1
• at 125 V	A	0.2
• at 250 V	A	0.1
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV

8.7 Technical data

		3UG4625-.....
<b>Electrostatic discharge according to IEC 61000-4-2</b>		4 kV contact discharge / 8 kV air discharge
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m
<b>Thermal current of the contact-affected switching element maximum</b>	A	5
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	300
<b>Degree of pollution</b>		3
<b>Ambient temperature</b>		
• during operating	°C	-25 ... +60
• during storage	°C	-40 ... +85
• during transport	°C	-40 ... +85
<b>Design of the electrical isolation</b>		galvanic
<b>Galvanic isolation</b>		
• between entrance and outlet		Yes
• between the outputs		Yes
• between the voltage supply and other circuits		No
<b>Mechanical operating cycles as operating time typical</b>		10 000 000
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000

## Mechanical design

		3UG4625-1....	3UG4625-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	102	103
<b>Depth</b>	mm	91	
<b>mounting position</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Type of mounting</b>		screw and snap-on mounting onto 35 mm standard mounting rail	
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes	
<b>Design of the electrical connection</b>		screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-section</b>			
• solid		1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
• finely stranded			
– with wire end processing		1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2 x (0.25 ... 1.5 mm <sup>2</sup> )
– without wire end processing		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors			
– solid		2x (20 ... 14)	2x (24 ... 16)
– stranded		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	0.8 ... 1.2	—
<b>Number of change-over switches delayed switching</b>		2	



## 3UG458. insulation monitoring relay

### Overview

The 3UG458. insulation monitoring relays are used for monitoring the insulation resistance (in accordance with IEC 61557-8) between ungrounded single-phase or three-phase AC systems and a protective conductor.

The family comprises the following devices:

- Insulation monitoring relays for ungrounded AC systems with a rated system voltage of up to  $U_n = 400$  V AC.
- Insulation monitoring relays for ungrounded AC systems, DC systems, and mixed AC/DC systems with a rated system voltage of up to  $U_n = 250$  V AC and  $U_n = 300$  V DC.
- Insulation monitoring relays for ungrounded AC systems, DC systems, and mixed AC/DC systems with a rated system voltage of up to  $U_n = 400$  V AC and  $U_n = 600$  V DC. The measuring range can be extended up to  $U_n = 690$  V AC and  $U_n = 1000$  V DC by using an upstream module.

Ungrounded, insulated systems (IT networks) are always used when high requirements are placed on the reliability of the power supply, e.g. emergency lighting. IT systems are supplied via an isolation transformer or voltage sources such as batteries or a generator. An insulation fault that occurs between an external conductor and ground represents a grounding of this conductor. This does not result in the closing of a circuit and operation can continue without hazard (single fault security). Before a second insulation fault occurs, the first fault must be corrected (e.g. in accordance with DIN VDE 0100-410). Insulation monitoring relays are used to implement this requirement. The insulation monitoring relays measure the resistance of the external conductor and the neutral conductor against ground, and immediately report a fault if the set insulation resistance is undershot. This procedure enables controlled shutdown, or correction of the fault without interrupting the power supply.

The insulation monitoring relays monitor the following fault types, depending on the version:

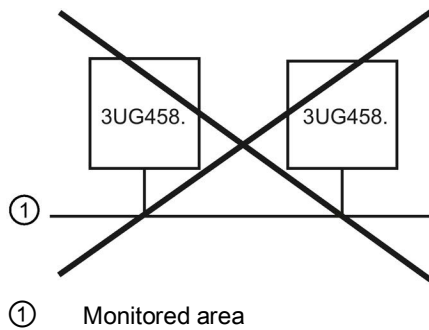
- Open circuit
- Incorrect settings
- Ungrounded, strictly AC systems for insulation faults
- Ungrounded, strictly DC systems for insulation faults
- Ungrounded, mixed DC systems and AC systems for insulation faults (e.g. AC systems with rectifiers or switched-mode power supplies)

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**Note**

The use of two 3UG458 devices in a galvanically connected area (monitored area) is not permissible.

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## 9.1 Application areas

### Application areas

The 3UG458. insulation monitoring relays are used in the following applications, for example:

Table 9- 1 Application areas of the insulation monitoring relays

Function	Application
<ul style="list-style-type: none"> <li>Insulation monitor for ungrounded systems</li> </ul>	<ul style="list-style-type: none"> <li>Emergency power supplies</li> <li>Safety lighting</li> <li>Industrial production plants with high availability requirements (chemical industry, automobile manufacture, printing)</li> <li>Shipbuilding and railways</li> <li>Mobile power generators (aircraft)</li> <li>Renewable energies (wind energy and photovoltaic plants)</li> <li>Mining industry</li> </ul>

#### Note

The 3UG4582 and 3UG4583 insulation monitors are only suitable for use in systems with frequency converters (primary or secondary side) if operation with generated frequencies < 15Hz and > 400Hz is ruled out.

The 3UG4581 version is not suitable for operation with a frequency converter.

Table 9- 2 Functions of the 3UG4581/3UG4582/3UG4583 insulation monitoring relays

Function	Insulation monitoring relays		
	3UG4581	3UG4582	3UG4583
<b>Insulation monitoring</b>			
Monitoring for open circuit	—	✓	✓ <sup>1)</sup>
Monitoring for incorrect settings	—	—	✓
Control circuit monitoring	1p	1p	1p
Main circuit monitoring	1p, 3p, 3p + N	1p, 2p, 2p + N, 3p, 3p + N	1p, 2p, 2p + N, 3p, 3p + N

✓: Function available

1p: Monitoring is 1-phase

2p: Monitoring is 2-phase

2p + N: Monitoring is 2-phase + N conductor

3p: Monitoring is 3-phase

3p + N: Monitoring is 3-phase + N conductor

— : Function not available

<sup>1)</sup> Configurable

## 9.2 Performance features of the insulation monitoring relays

### General data

Table 9-3 General data of the 3UG4581/3UG4582/3UG4583 insulation monitoring relays

General data	Insulation monitoring relays		
	3UG4581	3UG4582	3UG4583
<b>Setting range of the target pick-up values</b>			
• 1 to 100 k $\Omega$	✓	✓	✓
• 2 to 200 k $\Omega$	—	—	✓
<b>Rated voltage of the system to be monitored</b>			
• 0 ... 250 V AC	—	✓	—
• 0 ... 400 V AC	✓	—	✓
• 0 ... 600 V AC	—	—	✓ <sup>(1)</sup>
• 0 to 300 V DC	—	✓	—
• 0 to 600 V DC	—	—	✓
• 0 to 1000 V DC	—	—	✓ <sup>(1)</sup>
<b>Maximum discharge capacity of the system</b>			
• 10 $\mu$ F	✓	✓	—
• 20 $\mu$ F	—	—	✓
<b>Output contacts</b>			
• 1 changeover contact	✓	✓	—
• 2 changeover contacts or 1 changeover contact + 1 changeover contact, adjustable	—	—	✓
<b>Number of thresholds</b>			
• 1	✓	✓	—
• 1 or 2, adjustable	—	—	✓
<b>Functional principle</b>	Closed-circuit principle	Closed-circuit principle	Open-circuit principle or closed-circuit principle, configurable



General data	Insulation monitoring relays		
	3UG4581	3UG4582	3UG4583
<b>Rated control and supply voltage</b>			
• 24 ... 240 V AC / DC	✓	✓	✓
<b>Rated frequency</b>			
• 15 ... 400 Hz	—	✓	✓
• 50 ... 60 Hz	✓	—	—
<b>Autoreset or manual RESET</b>	✓ <sup>2)</sup>	✓ <sup>2)</sup>	✓ <sup>2)</sup>
<b>Remote RESET</b>	✓ via control input	✓ via control input	✓ via control input
<b>Retentive fault memory</b>	—	—	✓ <sup>2)</sup>
<b>Open-circuit detection</b>	—	—	✓ <sup>2)</sup>

✓: Function available

—: Function not available

1) With 3UG4983-1A upstream module

2) Configurable

## 9.3 3UG4581 insulation monitoring relay

### 9.3.1 Operator controls and connection terminals

#### Front view/terminal labeling 3UG4581

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block: Screw-type connections are possible.
	②	Test/RESET button <sup>1)</sup>
	③	Status display: LED for device status $\oplus$ (green)
	④	Status display: LED for monitoring status F (red)
	⑤	Status display: LED output contact status $\neq$ (yellow)
	⑥	Label
	⑦	Rotary button for adjusting the insulation resistance (R.2 for the units position of R)
	⑧	Rotary button for adjusting the insulation resistance (R.1 for the tens position of R) Setting value "0" is colored yellow. <sup>2)</sup>
	⑨	Device article number
<b>Terminal labels</b>		
A1+	Rated control supply voltage ~ / +	
A2-	Rated control supply voltage ~ / -	
Y1	Control inputs; isolation control	
Y2	Y1-Y3: Remote test	
Y3	Y2-Y3: Remote reset/autoreset	
L	Measuring signal input, connection to phase or N conductor	
	Measuring signal input, ground connection	
12	Output relay K1 CO contact NC contact	
11	Output relay K1 CO contact root	
14	Output relay K1 CO contact NO contact	

1) A test is only possible if there is no fault. A reset is only possible if the measured value is greater than the set threshold including the hysteresis.

2) Information on setting accuracy

- at setting value "0", a setting accuracy of >15 % applies for R
- at setting value ">1", a setting accuracy of 6 % applies for R

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Technical data (Page 233)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 227)".

## 9.3.2 Functions

### General functionality

The 3UG4581 insulation monitoring relays are supplied with a rated control and supply voltage of 24 V to 240 V AC/DC, and they monitor the insulation resistance in ungrounded AC systems in accordance with IEC 61557-8.

The devices can monitor control circuits (1-phase) and main circuits (3-phase). For this purpose, the insulation resistance between the system cables (terminal L) and system ground (terminal  $\perp$ ) is measured. Systems with rated system voltages  $U_n = 0$  to 400 V AC (50 to 60 Hz) can be connected directly to the measuring inputs, and their insulation resistance can be monitored.

The 3UG4581 insulation monitoring relays have two rotary buttons for adjusting the insulation resistance R and a test/RESET button for performing an internal test on the device, or for resetting the device.

If the measured value drops below the set threshold, the output relays are set to fault status.

For systems with voltages over 400 V AC, the 3UG4583 insulation monitoring relays with 3UG4983 upstream module can be used for system voltages to 690 V AC.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operator control (Page 224)".


You will find a description of the individual parameters in the Chapter "Parameters (Page 363)".

### Measuring procedure of the 3UG4581 insulation monitoring relay

An overlaid DC measuring signal is used on the 3UG4581 insulation monitoring relay for measuring. The insulation resistance of the system is calculated with the help of the overlaid DC measuring voltage and the resulting current.

The 3UG4581 insulation monitoring relays can be configured to the relevant application conditions and are therefore versatile in use.

## Monitoring

The system to be monitored is connected to terminal L (connection to phase or N conductor). The ground potential is connected to terminal .

The devices work according to the closed-circuit principle NC.

After applying the rated control and supply voltage, the insulation monitoring relay goes through an internal test that checks the proper functioning of the operational device. The test encompasses an internal test of the device at hardware and firmware level, as well as system diagnostics with calculation of the first measured value of the insulation resistance. If there are no internal device faults or external faults on completion of this test, output relay K1 picks up. This test can take several seconds depending on individual system properties.

If the measured value undershoots the set threshold, output relay K1 drops out. If the measured value overshoots the threshold including hysteresis, output relay K1 picks up (if autoreset is active). All operating statuses of the insulation monitoring relay are displayed via three LEDs.

---

### Note

If the continuously present rated system voltage is greater than 240 V, a minimum gap of 10 mm must be maintained to the next device.




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You will find the switching states of the output relay below in the section "Functions (Page 219)" and in Chapter "Diagnostics (Page 226)".

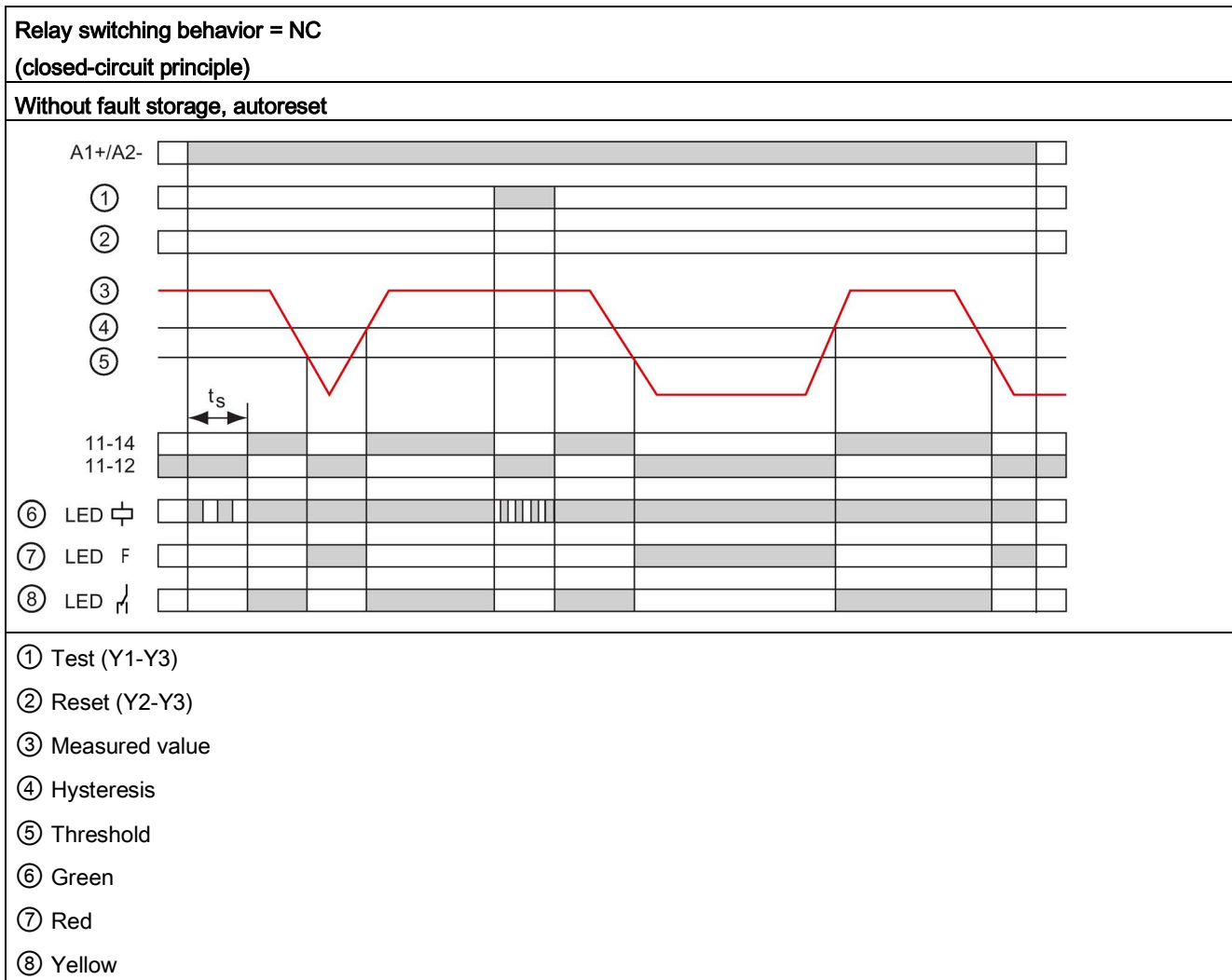
### Reset response and memory function

The device features an autoreset that resets output relay K1 to its original state after an fault message and rectification of the fault that has occurred. As well as autoreset, the devices can also be set to manual RESET by means of external switching.

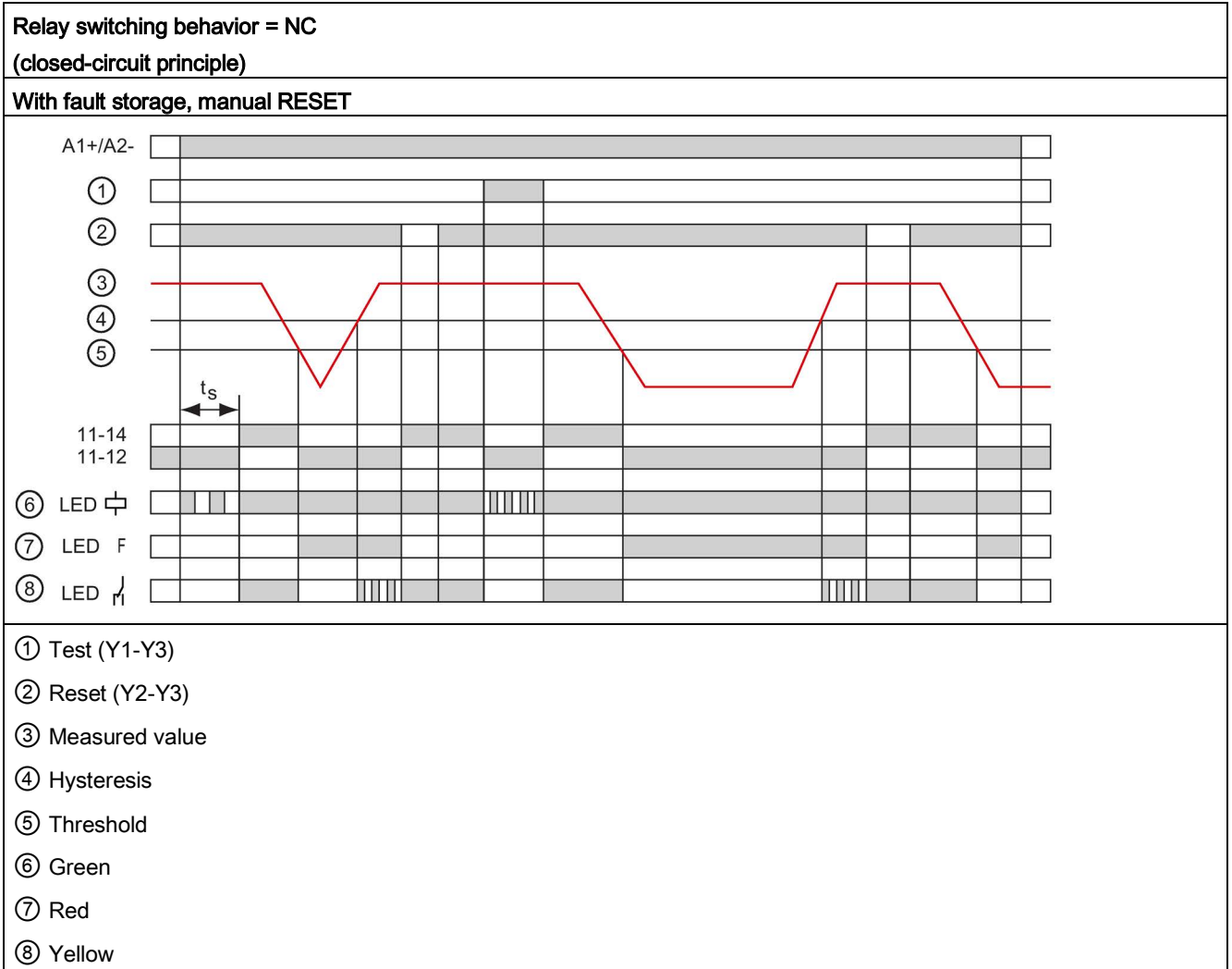
The output relay (on 3UG4583: both output relays) remains dropped out if manual RESET is active, and it only picks up again after actuation of the combined test/reset button, or following activation of remote reset (terminals Y2-Y3) if the insulation resistance is greater than the set threshold including hysteresis. Another method of resetting the device is by switching the supply voltage off and on again, provided the fault is not stored in retentive (non-volatile) memory.

Connection Y2-Y3	Reset options
	1) On the front (Test/Reset button) 2) Remote reset (remote button with NC function) 3) A1+ / A2- (switching the supply voltage off/on)
	1) On the front (Test/Reset button) 2) A1+ / A2- (switching the supply voltage off/on)
	1) Autoreset (factory setting)

### Function diagrams 3UG4581



$t_s$  = Time for internal device test after applying the supply voltage



$t_s$  = Time for internal device test after applying the supply voltage

### 9.3.3 Operator control

#### Parameters

The following parameters can be set on the two ten-level rotary buttons (absolute scale) with the help of a screwdriver:

Table 9- 4 Parameter information, 3UG4581 insulation monitoring relay

Parameters	Control elements <sup>1)</sup>	Setting range		Increment
		Minimum value	Maximum value	
Threshold for undershoot (tens position of R) (R.1-value) <sup>2)</sup>	8	0 kΩ	90 kΩ	10 kΩ increments
Threshold for undershoot (R.2-value) <sup>3)</sup>	7	1 kΩ	10 kΩ	1 kΩ increments
Reset response	2	Deactivated	Activated	--

<sup>1)</sup> The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 218)".

<sup>2)</sup> By operating the rotary button, the tens position of the threshold for undershoot can be selected.

<sup>3)</sup> By operating the rotary button, the units position of the threshold for undershoot can be selected

The threshold is derived from the sum of the two set values. If, for example, threshold R.1-value is set to 70 and threshold R.2-value is set to 8, threshold R1 corresponds to 78 kΩ.

Chapter "Internal circuit diagrams (Page 227)" shows examples for the different monitoring modes.

The parameters are defined in the Chapter "Parameters (Page 363)".

#### Tools required

The same screwdriver can be used to set the parameters as for wiring the insulation monitoring relays.



## Carrying out the self-test

The test function is only possible if there is no fault.

By operating the combined test/reset button, the insulation monitoring relay goes through an internal test that checks the proper functioning of the operational device.

The output relays do not pick up or they switch to the fault status while the Test/Reset button is pressed, while control contact Y1-Y3 is closed, or while the test functions execute after application of the supply voltage. The test function can be started again at any time via the Test/Reset button on the front or via a remote test button. The graphic below shows the connection of the button for the remote test.








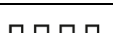
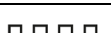
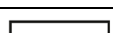
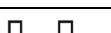
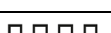
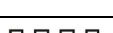
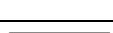
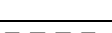
Image 9-1 Remote test button

### 9.3.4 Diagnostics

#### 9.3.4.1 Diagnostics with LEDs

##### Status display

The following information indicates the operating state on the 3UG4581 insulation monitoring relays:

Operating state	LED $\Phi$ (green)	LED F (red)	LED $\Delta$ (yellow)
Self-test (after $U_s = on$ )		Off	Off
No fault		Off	
Insulation fault (threshold undershot)			Off
System leakage capacitance too high at device startup			Off
Measuring result invalid			Off
Internal fault	Off		Off
Test function active		Off	Off
Manual RESET possible <sup>1)</sup>		<sup>2)</sup>	

1) The device has tripped following an insulation fault. The fault has been stored and the insulation resistance has reverted to a value above the set threshold including hysteresis.

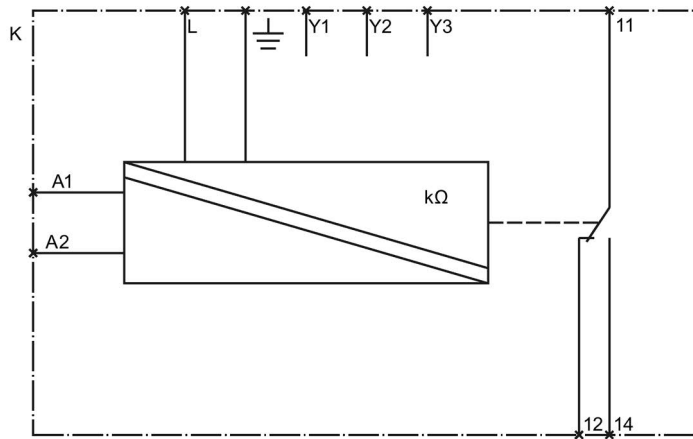
2) Dependent on the fault.

The switching behavior of the output relay is shown in Chapter "Functions (Page 219)".

### 9.3.5 Circuit diagrams

#### 9.3.5.1 Internal circuit diagrams

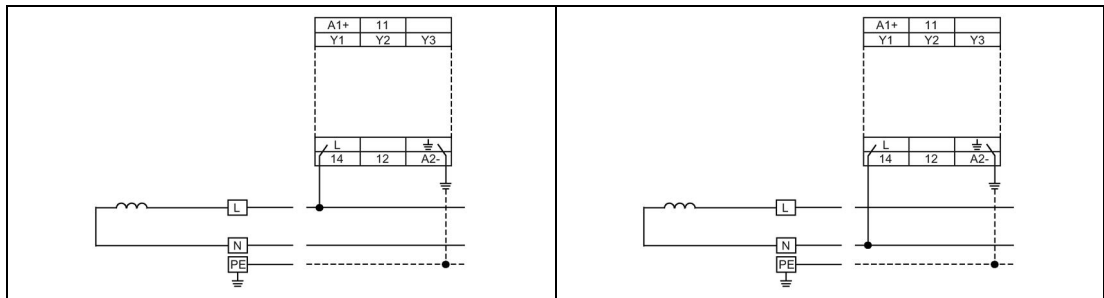
##### Internal circuit diagram 3UG4581-1AW30 insulation monitoring relay



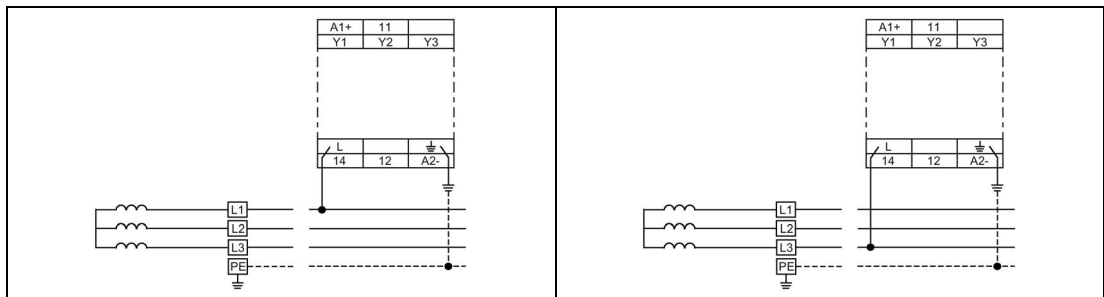
**Wiring examples 3UG4581 insulation monitoring relays**

Measuring input L can be connected to any conductor (phase or N conductor). The rated system voltage must be  $U_n \leq 400$  V AC (50 to 60 Hz).

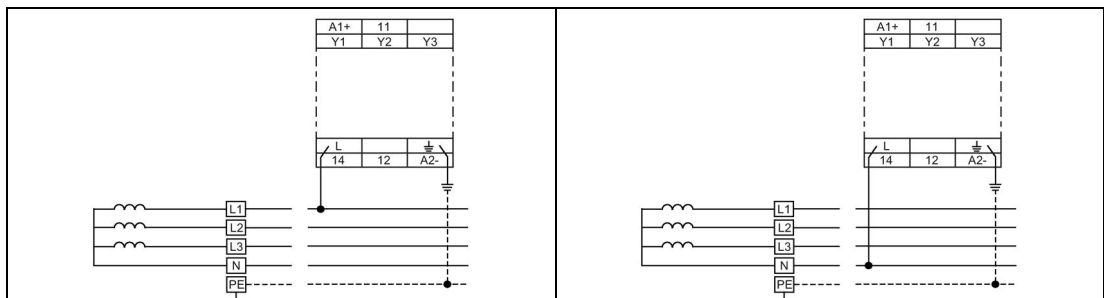
**2-wire AC system**



**3-wire AC system**

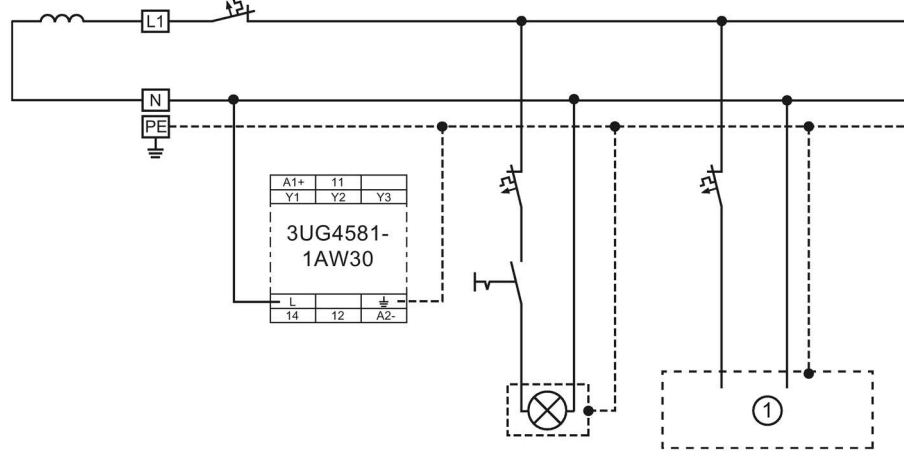


**4-wire AC system**



### Application examples

The figure below shows monitoring for ground fault/insulation fault in the case of an ungrounded 2-wire IT AC system. The voltage source is the secondary side of an isolating transformer that galvanically isolates the system and the downstream circuit.



① Loads

Image 9-2 Monitoring for ground fault/insulation fault in the case of an ungrounded 2-wire IT AC system

### Note

The maximum cable length of the control cables is 50 m or 100 pF/m.

The figure below shows monitoring for ground fault/insulation fault in the case of an ungrounded 4-wire IT AC system. The voltage source is the secondary side of an isolating transformer that galvanically isolates the system and the downstream circuit.

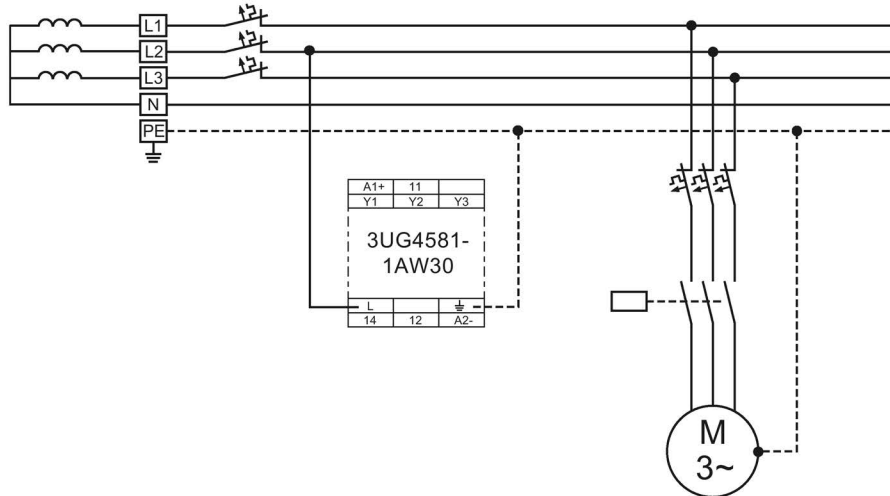


Image 9-3 Monitoring for ground fault/insulation fault in the case of an ungrounded 4-wire IT AC system

**Note**

The maximum cable length of the control cables is 50 m or 100 pF/m.

### 9.3.6 Characteristics

#### Characteristic curves of the 3UG4581 insulation monitoring relays

The characteristics below show the load limit curves of the 3UG4581 insulation monitoring relays.

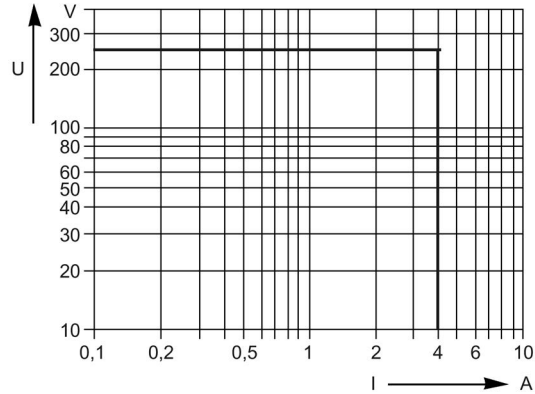


Image 9-4 AC load (resistive)

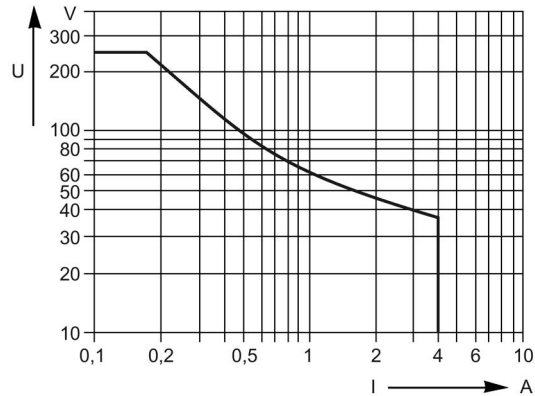


Image 9-5 DC load (resistive)

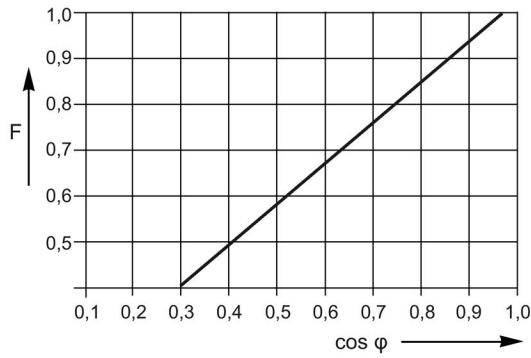
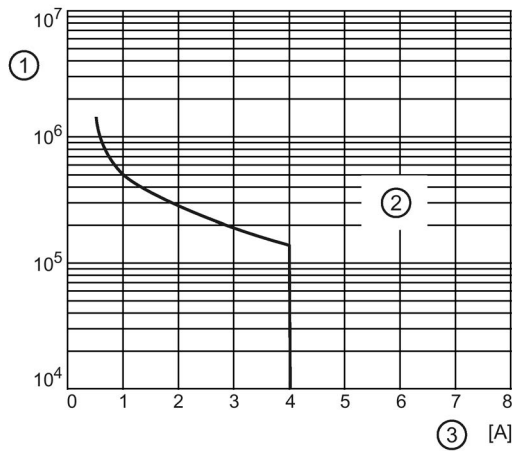


Image 9-6 Reduction factor F in the case of inductive AC load



- ① Operating cycles
- ② 250 V, resistive load
- ③ Switching current

Image 9-7 Contact service life



### 9.3.7 Technical data

#### Measuring circuit

			3UG4581-1AW30
Type of voltage for monitoring			AC
Measurable line frequency	Hz		50 ... 60
Network leakage resistance	μF		10
Adjustable response value impedance			
• 1	kΩ		1 ... 100

#### General technical details

			3UG4581-1AW30
Product function			insulation monitor
Product function isolation control			Yes
Product function defect storage			Yes
Type of voltage of the controlled supply voltage			AC/DC
Operating frequency rated value	Hz		15 ... 400
Control supply voltage			
• for DC rated value	V		24 ... 240
• at 50 Hz at AC rated value	V		24 ... 240
• at 60 Hz at AC – rated value	V		24 ... 240
Operating range factor control supply voltage rated value			
• for DC			0.85 ... 1.1
Working range factor supply voltage rated value at 50 Hz			
• for AC			0.85 ... 1.1
Working range factor supply voltage rated value at 60 Hz			
• for AC			0.85 ... 1.1
Impulse voltage resistance rated value	V		6 000
Thermal current of the contact-affected switching element maximum	A		4
Protection class IP			IP20
Ambient temperature			
• during operating	°C		-25 ... +60
Item designation according to DIN EN 61346-2			K
Item designation according to DIN 40719 extendable after IEC 204-2 according to IEC 750			K

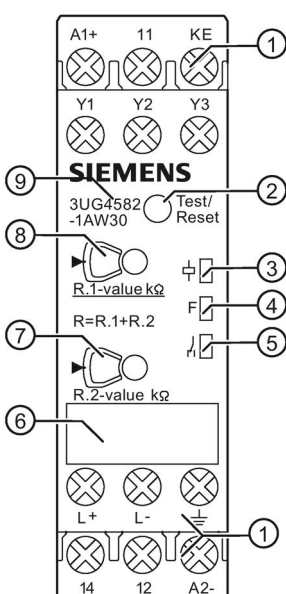

## Mechanical design

		3UG4581-1AW30
<b>Width</b>	mm	22.5
<b>Height</b>	mm	78
<b>Depth</b>	mm	100
<b>Built in orientation</b>		any
<b>Distance, to be maintained, to the ranks assembly</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, conductive elements</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, to earthed part</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Type of mounting</b>		snap-on fastening on 35 mm standard rail
<b>Product function removable terminal for auxiliary and control circuit</b>		No
<b>Design of the electrical connection</b>		screw-type terminals
<b>Conductor cross-section that can be connected</b>		
• solid	mm <sup>2</sup>	0.75 ... 2.5
<b>Conductor cross-section that can be connected finely stranded</b>		
• with wire end processing	mm <sup>2</sup>	0.75 ... 2.5
<b>AWG number as coded connectable conductor cross section</b>		
• solid		20 ... 12
<b>AWG number as coded connectable conductor cross section</b>		
• stranded		18 ... 14
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.6 ... 0.8
<b>Number of change-over switches delayed switching</b>		1

## 9.4 3UG4582/3UG4583 insulation monitoring relays

### 9.4.1 Operator controls and connection terminals

#### Front view/terminal labeling 3UG4582

Front view	Description
	<b>Position digits</b>
	① Terminal block: Screw-type connections are possible.
	② Test/RESET button
	③ Status display: LED for device status $\oplus$ (green)
	④ Status display: LED for monitoring status F (red)
	⑤ Status display: LED output contact status $\neq$ (yellow)
	⑥ Label
	⑦ Rotary button for adjusting the insulation resistance (R.2 for the units position of R)
	⑧ Rotary button for adjusting the insulation resistance (R.1 for the tens position of R) Setting value "0" is colored yellow. <sup>1)</sup>
	⑨ Device article number
	<b>Terminal labels</b>
A1+	Rated control supply voltage ~ / +
A2-	Rated control supply voltage ~ / -
Y1	Control inputs; isolation control
Y2	Y1-Y3: Remote test
Y3	Y2-Y3: Remote reset/autoreset
L+	Measuring signal input, connection to phase or L+
L-	Measuring signal input, connection to phase, N conductor or L-
KE	Measuring signal input, control ground connection for open-circuit monitoring
	Measuring signal input, ground connection
12	Output relay K1 CO contact NC contact
11	Output relay K1 CO contact root
14	Output relay K1 CO contact NO contact

<sup>1)</sup> Information on setting accuracy

- at setting value "0", a setting accuracy of >15 % applies for R
- at setting value ">1", a setting accuracy of 8 % applies for R

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Technical data (Page 265)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 255)".

Front view/terminal labeling 3UG4583

Front view	Description
	<p><b>Position digits</b></p>
	<p>① Terminal block: Screw-type connections are possible.</p>
	<p>② Device order number</p>
	<p>③ Rotary button for adjusting the insulation resistance (R2.1 for the tens position of R2) Setting value "0" is colored yellow.<sup>1)</sup></p>
	<p>④ Status display: LED for device status <math>\oplus</math> (green)</p>
	<p>⑤ Status display: LED for monitoring status F (red)</p>
	<p>⑥ Status display: LED output contact status <math>\neq</math> (yellow)</p>
	<p>⑦ Rotary button for adjusting the insulation resistance (R2.2 for the units position of R2)</p>
	<p>⑧ Label</p>
	<p>⑨ Rotary button for adjusting the insulation resistance (R1.2 for the units position of R1)</p>
	<p>⑩ Test/RESET button</p>
<p>⑪ Rotary button for adjusting the insulation resistance (R1.1 for the tens position of R1) Setting value "0" is colored yellow.<sup>1)</sup></p>	
<p><b>Terminal labels</b></p>	
<p>A1+ Rated control supply voltage ~ / +</p>	
<p>A2- Rated control supply voltage ~ / -</p>	
<p>Y1 Control inputs; isolation control</p>	
<p>Y2 Y1-Y3: Remote test</p>	
<p>Y3 Y2-Y3: Remote reset/autoreset</p>	
<p>VS Connection terminals for the upstream module</p>	
<p>V1+</p>	
<p>V1-</p>	
<p>L+ Measuring signal input, connection to phase or L+</p>	
<p>L- Measuring signal input, connection to phase, N conductor or L-</p>	
<p>KE Measuring signal input, control ground connection for open-circuit monitoring</p>	
<p><math>\perp</math> Measuring signal input, ground connection</p>	
<p>12 Output relay K1 CO contact NC contact</p>	
<p>11 Output relay K1 CO contact root</p>	
<p>14 Output relay K1 CO contact NO contact</p>	
<p>22 Output relay K2 CO contact NC contact</p>	
<p>21 Output relay K2 CO contact root</p>	
<p>24 Output relay K2 CO contact NO contact</p>	

1) Information on setting accuracy

- at setting value "0", a setting accuracy of >15 % applies for R
- at setting value ">1", a setting accuracy of 6 % applies for R

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Technical data (Page 265)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 255)".

## 9.4.2 Functions

### General functionality

The 3UG4582/3UG4583 insulation monitoring relays are supplied with a rated control and supply voltage of 24 V to 240 V AC/DC, and they monitor the insulation resistance in accordance with IEC 61557-8 in ungrounded IT-AC systems, IT-AC systems with galvanically connected DC circuits, or IT-DC systems.

The devices can monitor control circuits (1-phase) and main circuits (3-phase). For this purpose, the insulation resistance between the system cables (terminal L+ and L-) and system ground (terminal  $\perp$  and KE) is measured. Systems with rated system voltages  $U_n = 0$  to 250 V AC (15 to 400 Hz) /  $U_n = 0$  to 300 V DC (3UG4582) or  $U_n = 0$  to 400 V AC (15 to 400 Hz) /  $U_n = 0$  to 600 V DC (3UG4583) can be connected direct to the measuring inputs, and their insulation resistance can be monitored.

The insulation monitoring relays have two rotary buttons (3UG4582)/four rotary buttons (3UG4583) for adjusting the insulation resistance R and a Test/RESET button, to perform an internal test on the device or to reset the device.

If the measured value drops below the set threshold, the output relays are set to fault status.

For systems with voltages over 400 V AC and 600 V DC, the 3UG4583 insulation monitoring relays with 3UG4983 upstream module can be used for extending the voltage range.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operator control (Page 249)".

You will find a description of the individual parameters in the Chapter "Parameters (Page 363)".

### Measuring method

The 3UG4582/3UG4583 insulation monitoring relays use a new predictive measuring method for high-speed measurements and fast pick-up times. The devices can be configured to the relevant application conditions and are therefore versatile in use.

A pulsing measuring signal is fed into the system to be monitored and the insulation resistance is calculated from this.

The received signal is different in form to the injected measuring signal. This change depends on the insulation resistance and the system discharge capacity. The change to the insulation resistance is predicted from this deviating form. If the predicted insulation resistance corresponds to the insulation resistance calculated in the next measuring cycle and is lower than the set threshold, output relay K1 responds depending on the device configuration.

This adaptive measuring principle is suitable for detecting symmetrical insulation faults.

## Monitoring

The system to be monitored is connected to the measuring signal inputs L+, L-. The terminals can be connected to any conductor (phase, +/- potential, or N conductor). The measuring signal inputs must be connected to different conductors.

The ground potential is connected to the terminals  $\perp$  and KE.

KE stands for control ground and is used for monitoring the fault-free ground connection of the insulation monitoring relay.

The 3UG4582 insulation monitoring relays work according to the closed-circuit principle NC. The 3UG4583 insulation monitoring relays work in accordance with the set relay switching behavior (closed-circuit principle NC or open-circuit principle NO).

After applying the rated control supply voltage, the insulation monitoring relay goes through an internal test that checks the proper functioning of the operational device. The test encompasses an internal test of the device at hardware and firmware level (on the 3UG4583, a settings check is also carried out), as well as system diagnostics with calculation of the system discharge capacity of the first measured value of the insulation resistance. If there are no internal device faults or external faults on completion of this test, the output relays change their switching state (if closed-circuit principle is set). The time for this test can be 10 s - 15 s with purely AC systems. The circuit is opened instantaneously after detection of a fault. In AC systems with DC components, as is the case when rectifiers are used, up to 15 s can be needed.

---

### Note

If the 3UG4583 insulation monitoring relay is used for monitoring the winding insulation of a motor, the function test first results in a fault message if the closed-circuit principle is selected, since the device is not applied to the supply voltage until a measurement is possible on the switched-off motor. Either this fault must be hidden by downstream logic, or the open-circuit principle must be set. The output relays would only pick up if an insulation fault or internal device faults are detected. However, the fault "Missing supply voltage" can then no longer be detected.

---

If the measured value undershoots the set threshold in the case of the 3UG4582 insulation monitoring relays, output relay K1 drops out. If the measured value overshoots the threshold including hysteresis, output relay K1 picks up.

The principle of operation of the 3UG4583 insulation monitoring relays can be configured via DIP switch 4:

In the functional principle **1 x 2 changeover contacts**, both output relays K1 and K2 respond to threshold R1 (warning). The settings of threshold R2 have no influence on the principle of operation. If the measured value undershoots the set threshold, the output relays switch to the fault status. If the measured value overshoots the set threshold including hysteresis, the output relays revert to the original state.

In the functional principle **2 x 1 changeover contacts**, output relay K1 responds to threshold R1 (shutdown) and output relay K2 responds to threshold R2 (warning). If the measured value undershoots the set threshold R2 (warning), output relay K2 switches. If the measured value undershoots the set threshold R1 (shutdown), output relay K1 switches. If the measured value overshoots the set threshold R1 (shutdown) including hysteresis, output relay K1 reverts to the original state. If the measured value overshoots the set threshold R2 (warning) including hysteresis, output relay K2 reverts to the original state.

All operating states of the 3UG4582/3UG4583 insulation monitoring relays are displayed via three LEDs.

### Additional monitoring functions

The 3UG4582/3UG4583 insulation monitoring relays also have two further functions.

The devices monitor the terminals  $\underline{\underline{\perp}}$  and KE cyclically for **open circuit**. If an open circuit is detected on one of the connected conductors, output relay K1 switches to the fault state (on the 3UG4583, both output relays K1 and K2). The 3UG4583 also has an open-circuit detection function that can be shut down and automatically tests the measuring signal inputs L+ and L- at system start. This open-circuit test can be repeated at any time during operation by activating the test function (Test/RESET button). On the 3UG4583, open-circuit detection can be switched on (ON) and off (OFF) using DIP switch 3.

The 3UG4582/3UG4583 insulation monitoring relays monitor the ungrounded AC system, DC system, or AC/DC system for impermissibly high **system discharge capacity**. If the system discharge capacity is too high, output relay K1 switches to the fault state (on the 3UG4583, both output relays K1 and K2 switch to the fault state). If incorrect settings that could result in a malfunction are made on the 3UG4583, the output relays switch to the fault state. If, for example, an insulation warning value is set that is lower than the selected shutdown threshold, this results in a parameterization error.

You will find the switching states of the output relays below in the Section "Function diagrams (Page 243)" and in the Chapter "Diagnostics (Page 253)".




You will find the setting ranges and factory settings of the available parameters, and the definitions of the DIP switch positions in the Chapter "Operator control (Page 249)".



## Reset response and memory function

The device features an autoreset that resets output relay K1 to its original state after a fault message and rectification of the fault that has occurred. As well as autoreset, the devices can also be set to manual RESET by means of external switching.

The output relay (on 3UG4583: both output relays) remains dropped out if manual RESET is active, and it only picks up again after actuation of the combined test/reset button, or following activation of remote reset (terminals Y2-Y3) if the insulation resistance is greater than the set threshold including hysteresis. Another method of resetting the device is by switching the supply voltage off and on again, provided the fault is not stored in retentive (non-volatile) memory.




Connection Y2-Y3	Reset options
	<ol style="list-style-type: none"> <li>1) On the front (Test/Reset button)</li> <li>2) Remote reset (remote button with NC function)</li> <li>3) A1+ / A2- (switching the supply voltage off/on)</li> </ol>
	<ol style="list-style-type: none"> <li>1) On the front (Test/Reset button)</li> <li>2) A1+ / A2- (switching the supply voltage off/on)</li> </ol>
	<ol style="list-style-type: none"> <li>1) Autoreset (factory setting)</li> </ol>

### Non-volatile memory function on the 3UG4583

The 3UG4583 insulation monitoring relays also have a configurable non-volatile (retentive) fault storage function. After shutting down and restoring the rated control and supply voltage, the device is in the state it was in prior to shutdown, until it is reset.

If fault storage is activated using DIP switch 2 (ON), output relays K1 and K2 remain in the fault state and do not switch back to their original position until actuation of the combined Test/Reset button, or until activation of the remote reset (jumping of terminals Y2/Y3) if the measured insulation resistance is greater than the set threshold(s) including hysteresis. Fault storage is non-volatile.

The table below shows the different options for resetting the device depending on the setting of DIP switch 2.

DIP switch 2	OFF	ON
	1) On the front (Test/Reset button) 2) Remote reset (remote button with NC function) 3) A1+ / A2- (switching the supply voltage off/on)	1) On the front (Test/Reset button) 2) Remote reset (remote button with NC function)
	1) On the front (Test/Reset button) 2) A1+ / A2- (switching the supply voltage off/on)	1) On the front (Test/Reset button)
	1) Autoreset (factory setting)	— 1)

1) If there is no external connection between terminals Y2 and Y3 while retentive fault storage is set, internal device monitoring detects a parameterization error.

You will find the setting ranges and factory settings of the available parameters, and the definitions of the DIP switch positions in Chapter "Operator control (Page 249)".

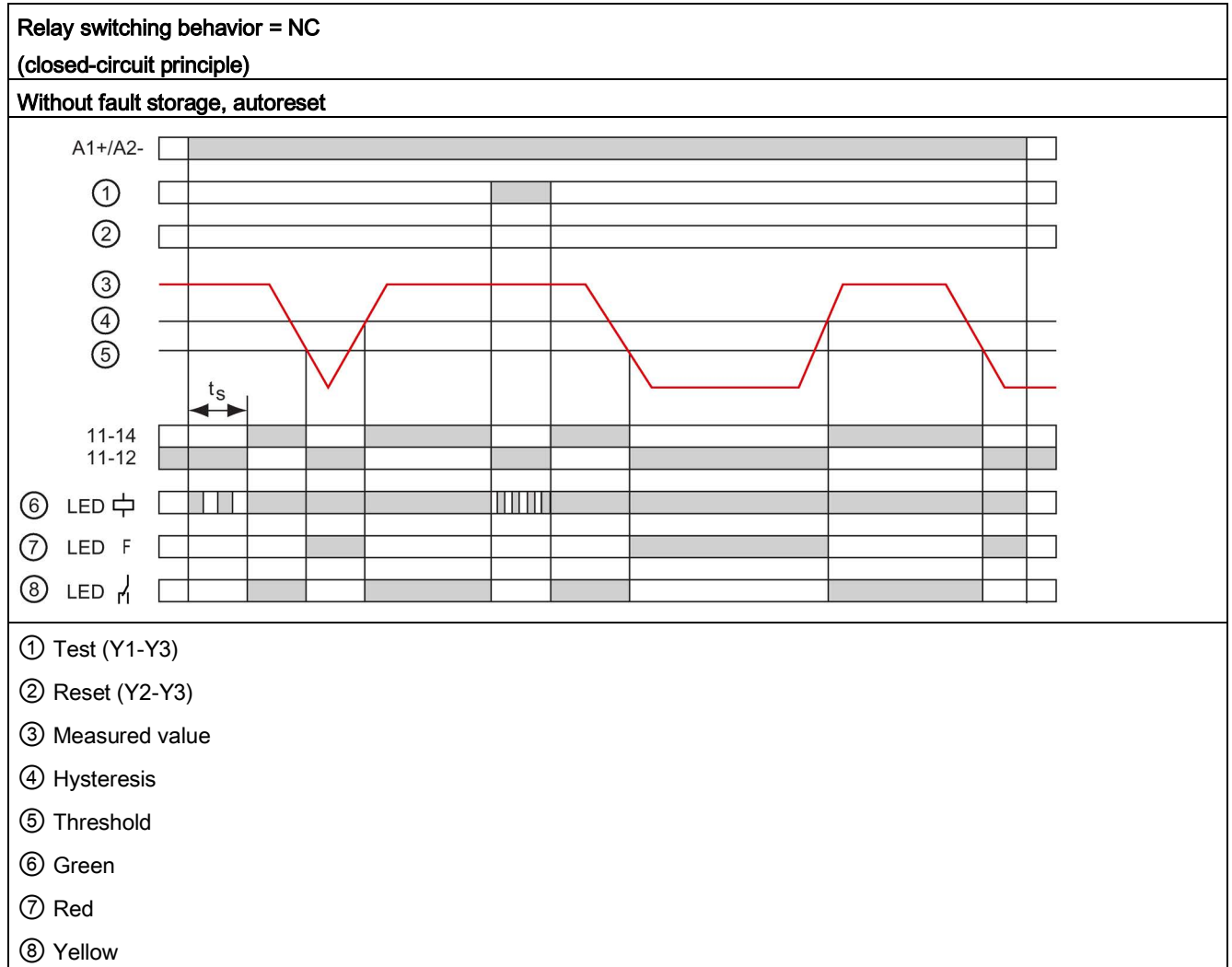
### 3UG4983-1A upstream module for extending the voltage range

The 3UG4983-1A upstream module can be used to extend the measuring range of the rated system voltage  $U_n$  to be monitored. The upstream module is used to connect the 3UG4583 insulation monitoring relay to systems with up to 690 V AC and 1000 V DC. The upstream module is connected to terminals VS, V1+ and V1- of the insulation monitoring relay.

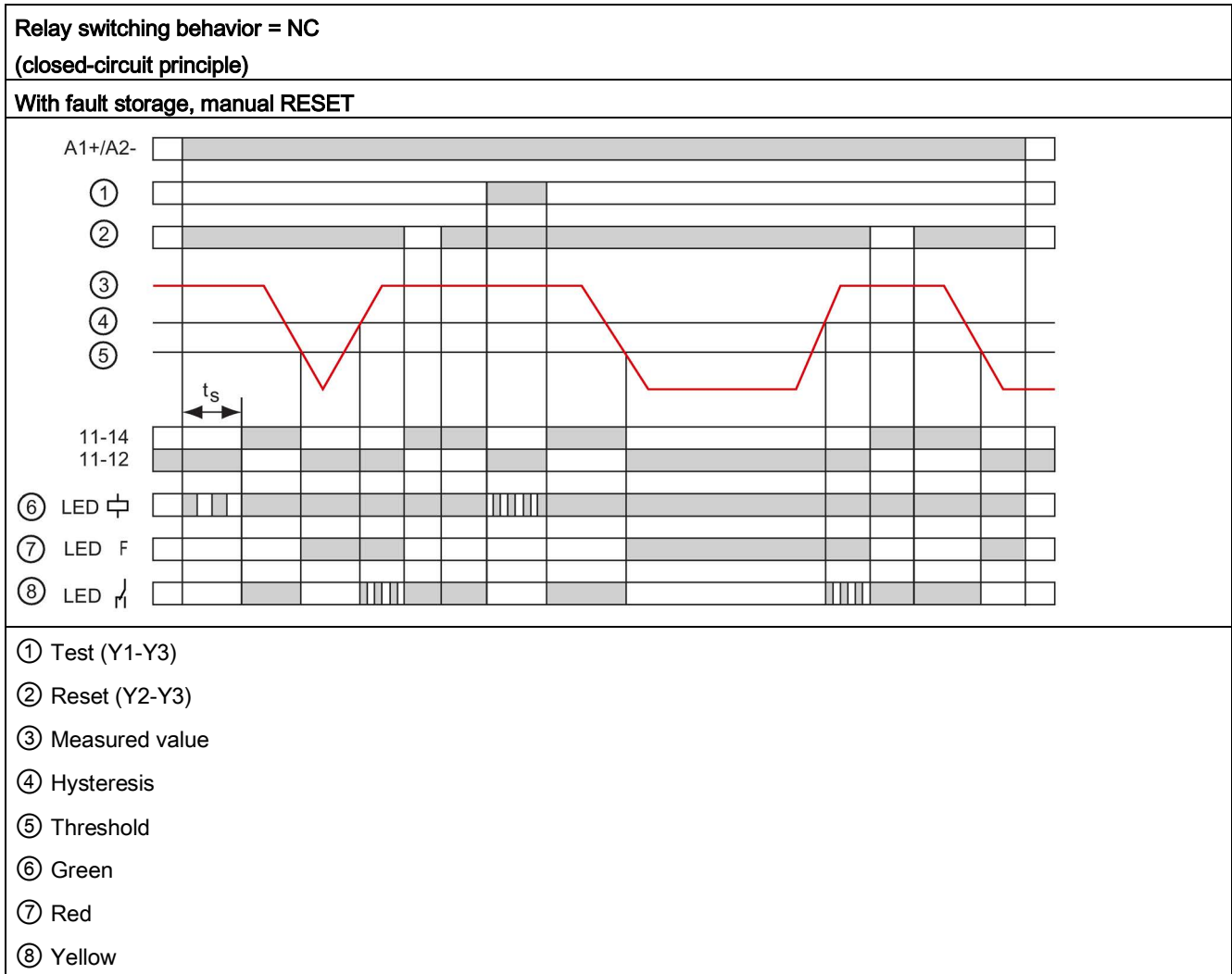
These accessories are described in Chapter "3UG4983 upstream module for the 3UG4583 monitoring relay (Page 353)".

9.4.2.1 Function diagrams

3UG4582 function diagrams

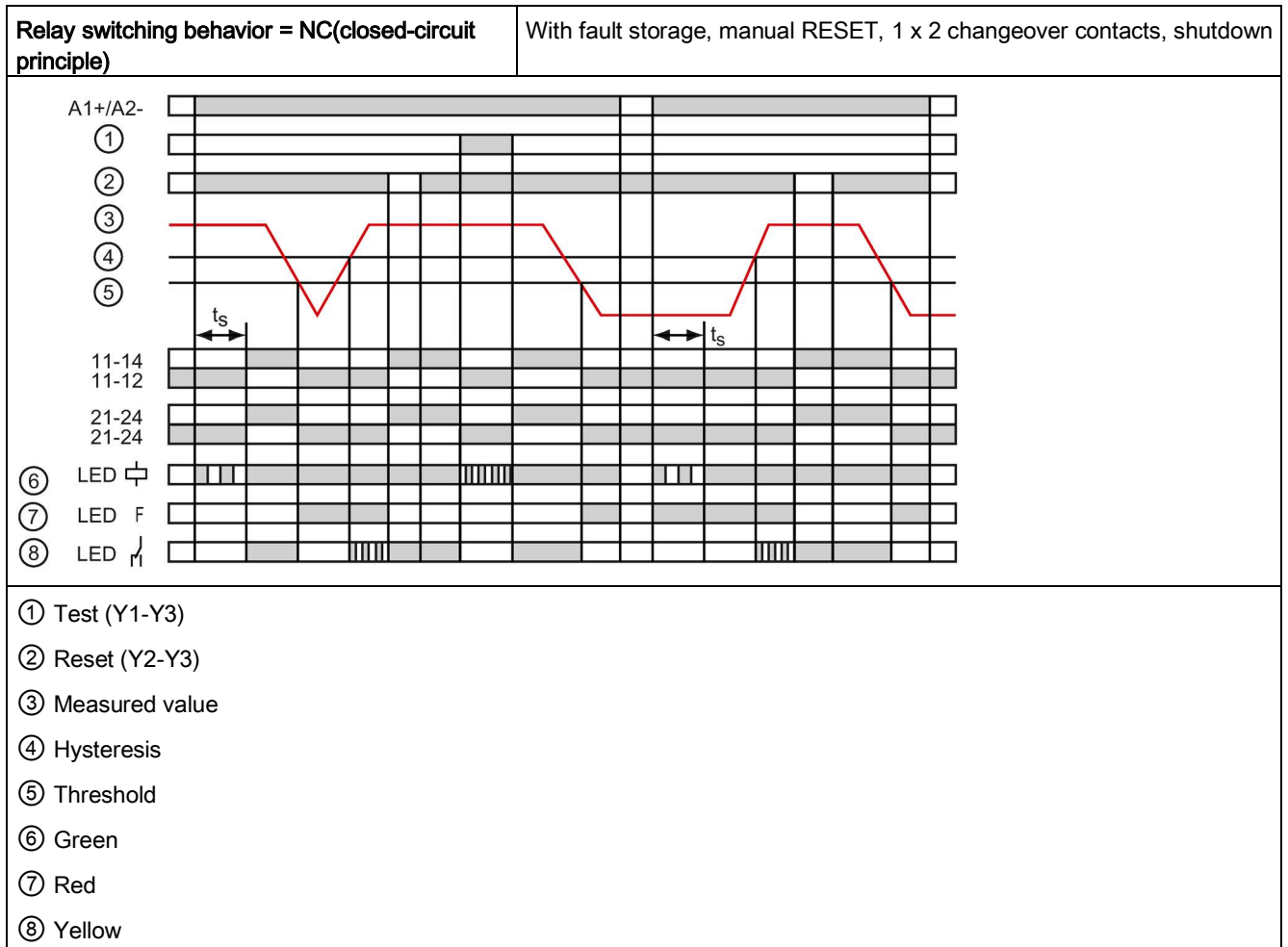


$t_s$  = Time for internal device test after applying the supply voltage

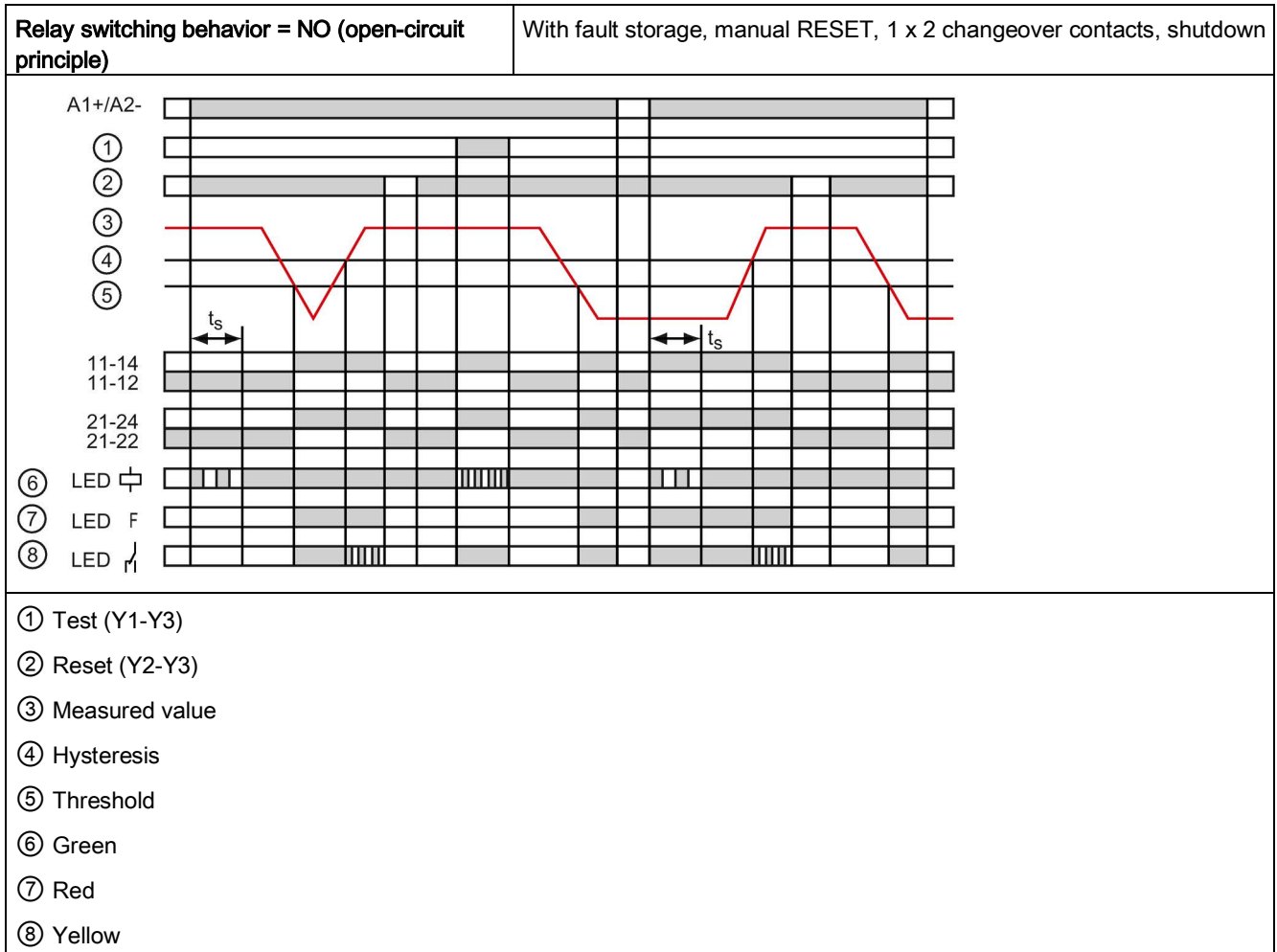


$t_s$  = Time for internal device test after applying the supply voltage

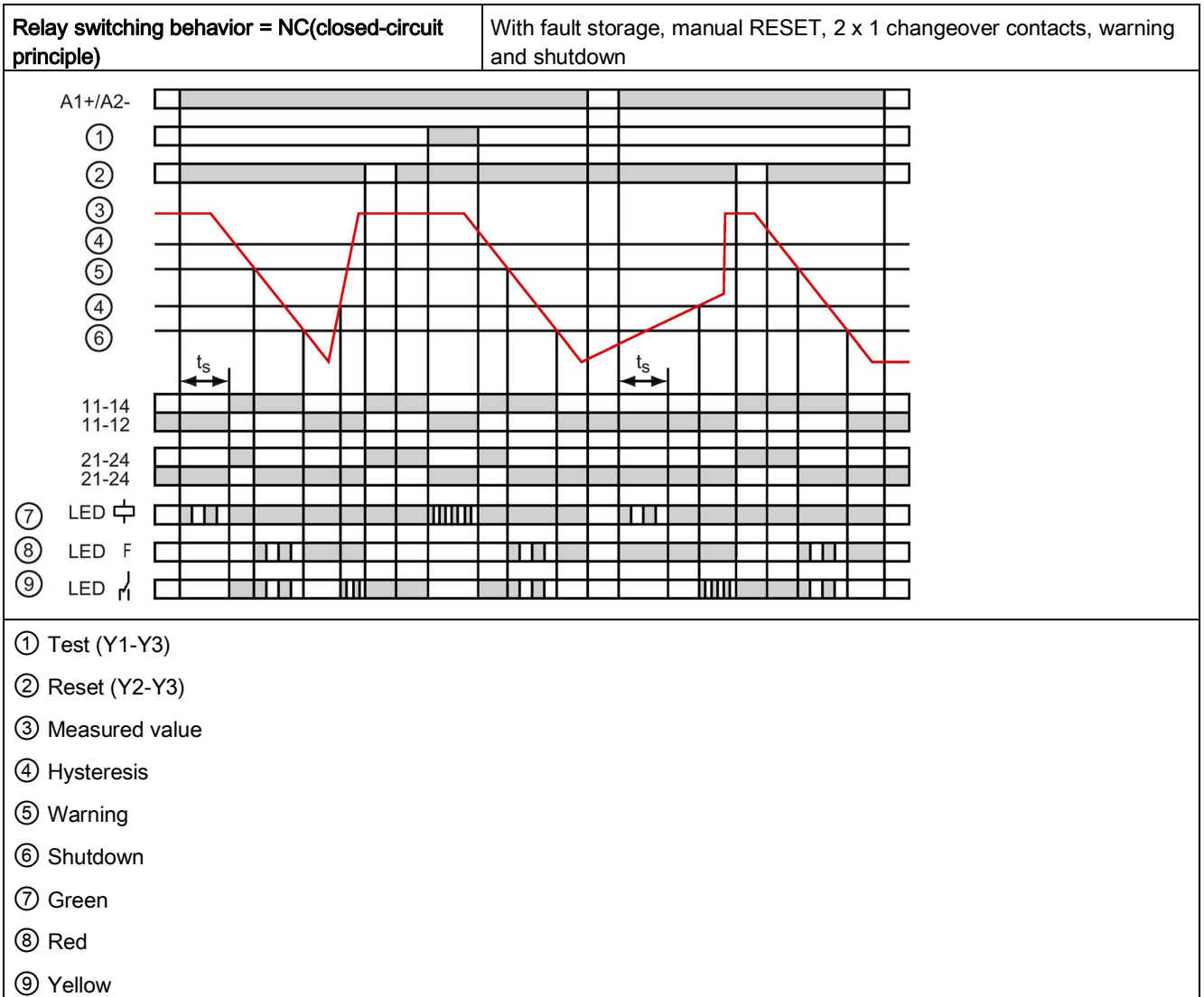
3UG4583 function diagrams



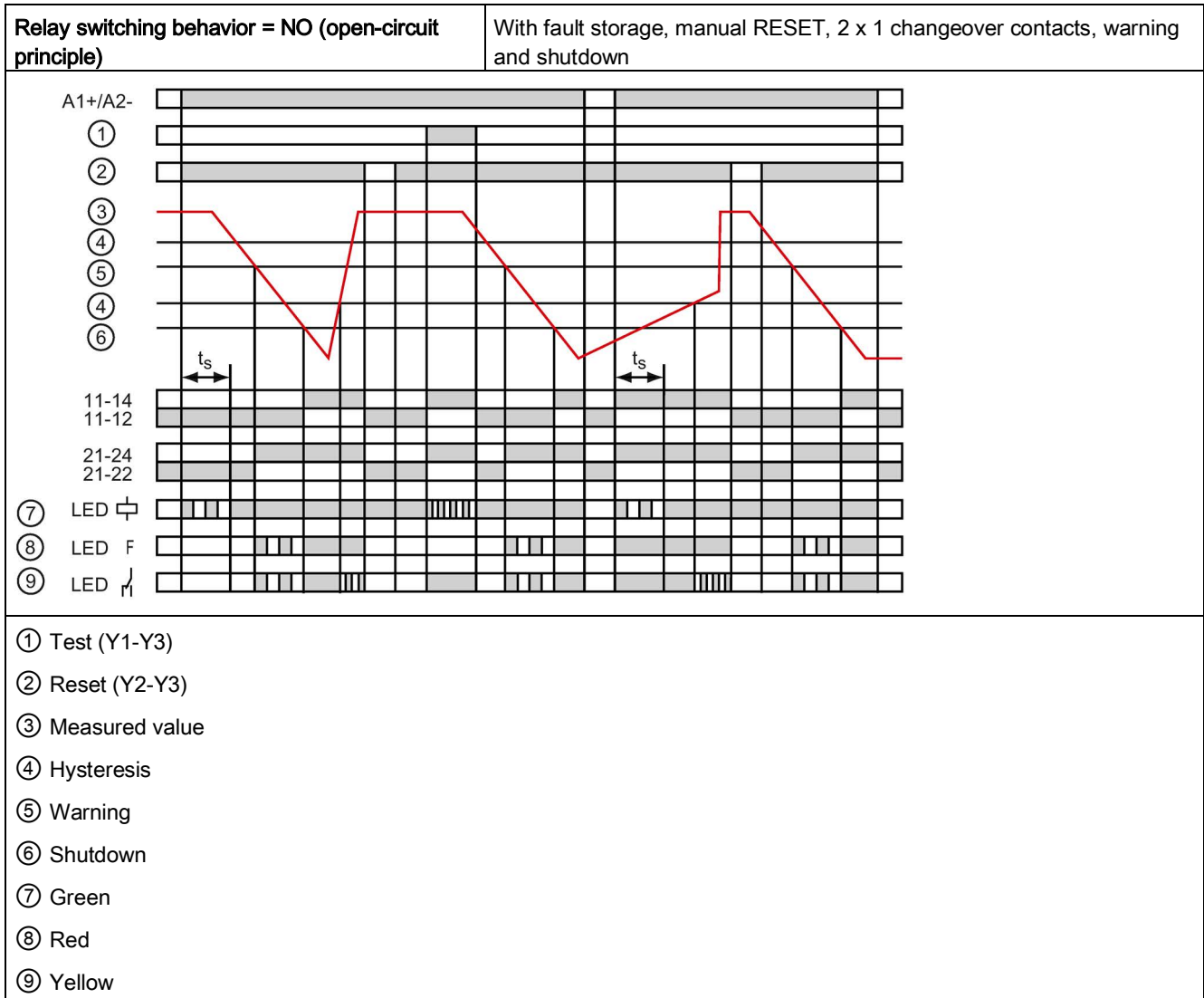
$t_s$  = Time for internal device test after applying the supply voltage



$t_s$  = Time for internal device test after applying the supply voltage



$t_s$  = Time for internal device test after applying the supply voltage



$t_s$  = Time for internal device test after applying the supply voltage



### 9.4.3 Operator control

#### Parameters

The following parameters can be set on the two (3UG4582) or four (3UG4583) ten-level rotary buttons (absolute scale) with the help of a screwdriver:

Table 9- 5 Parameter information, 3UG4582/3UG4583 insulation monitoring relays

Parameters	Control elements <sup>1)</sup>	Setting range		Increment
		Minimum value	Maximum value	
Threshold for undershoot (R.1-value) <sup>2)</sup>	8	0 k $\Omega$	90 k $\Omega$	10 k $\Omega$ increments
Threshold for undershoot (R.2-value) <sup>3)</sup>	7	1 k $\Omega$	10 k $\Omega$	1 k $\Omega$ increments
Threshold for undershoot (R1.1-value) <sup>4)</sup>	11	0 k $\Omega$	90 k $\Omega$	10 k $\Omega$ increments
Threshold for undershoot (R1.2-value) <sup>5)</sup>	9	1 k $\Omega$	10 k $\Omega$	1 k $\Omega$ increments
Threshold for undershoot (R2.1-value) <sup>6)</sup>	3	0 k $\Omega$	90 k $\Omega$	10 k $\Omega$ increments
Threshold for undershoot (R2.2-value) <sup>7)</sup>	7	1 k $\Omega$	10 k $\Omega$	1 k $\Omega$ increments
Test / Reset	2 (3UG4582) 10 (3UG4583)	Deactivated	Activated	--

<sup>1)</sup> The position digits refer to the front view of the respective 3UG4582 / 3UG4583 devices in Chapter "Operator controls and connection terminals (Page 235)".

<sup>2)</sup> 3UG4582: By operating the rotary button, the tens position of the threshold for undershoot (R.1) can be selected.

<sup>3)</sup> 3UG4582: By operating the rotary button, the units position of the threshold for undershoot (R.2) can be selected

<sup>4)</sup> 3UG4583: By operating the rotary button, the tens position of the threshold for undershoot (R1.1) can be selected.

<sup>5)</sup> 3UG4583: By operating the rotary button, the units position of the threshold for undershoot (R1.2) can be selected

<sup>6)</sup> 3UG4583: By operating the rotary button, the tens position of the threshold for undershoot (R2.1) can be selected.

<sup>7)</sup> 3UG4583: By operating the rotary button, the units position of the threshold for the insulation resistance R2.2 can be selected

The threshold is derived from the sum of the two set values. If, for example, threshold R.1-value is set to 70 and threshold R.2-value is set to 8 on the 3UG4582, threshold R corresponds to 78 k $\Omega$ .

### DIP switch


The DIP switches are located behind the label on the front of the 3UG4583 insulation monitoring relays. Four settings can be parameterized with the DIP switch.

The tables below contain the setting options on the device and the explanations for the relevant switch positions. When the device is delivered, the switch is in the position OFF.

Table 9- 6 DIP switch - 3UG4583

Position	4 Functional principle	3 Open-circuit detection	2 Non-volatile (retentive) fault storage	1 Functional principle of output relays K1 and K2
ON ↑	2 x 1 changeover contacts	Activated	Activated	Closed-circuit principle NC
OFF	1 x 2 changeover contacts	Deactivated	Deactivated	Open-circuit principle NO

Table 9- 7 Definitions of the DIP switch positions - 3UG4583

DIP switch	ON	OFF
Position 4 <b>Functional principle</b> <b>2 x 1 changeover contacts /</b> <b>1 x 2 changeover contacts</b>	<b>2 x 1 changeover contacts</b> If functional principle 2 x 1 changeover contacts is set, output relay K1 responds to threshold R1 (shutdown) and output relay K2 responds to threshold R2 (warning).	<b>1 x 2 changeover contacts</b> If functional principle 1 x 2 changeover contacts is set, both output relays K1 and K2 respond to threshold R1 (warning). The settings of threshold R2 have no influence on the principle of operation.
Position 3 <b>Open-circuit detection</b>	<b>Open-circuit detection activated</b> If open-circuit monitoring is activated, the insulation monitoring relay monitors cables connected to terminals L+, L-,  and KE for interruption.	<b>Open-circuit detection deactivated</b> This setting deactivates open-circuit detection.
Position 2 <b>Non-volatile (retentive) fault storage</b>	<b>Non-volatile fault storage activated</b> If retentive fault storage is activated, output relays K1 and K2 remain in the fault state even after a failure or active shutdown of the supply voltage, until the device is reset using the Test/Reset button or a remote reset is carried out (jumping of terminals Y2 / Y3).	<b>Non-volatile fault storage deactivated</b> If the function is deactivated, output relays K1 and K2 switch back to the good state following failure or active shutdown of the supply voltage if there is no longer an insulation fault after the supply voltage has been restored. A remote reset can also be carried out by switching the supply voltage. However, a voltage failure results in the loss of a saved warning message or alarm message.
Position 1 <b>Functional principle of output relays K1 and K2</b>	<b>Closed-circuit principle NC</b> Output relays K1 and K2 pick up after application of the supply voltage and successful self-test and system diagnostics. If a fault occurs, the output relays drop out. As long as there is no fault, the output relays remain in the active state.	<b>Open-circuit principle NO</b> If a fault occurs, output relays K1 and K2 pick up. As long as there is no fault, the output relays remain in the dropped-out state.

Chapter "Wiring examples (Page 256)" shows the examples for the different monitoring modes.

The parameters are defined in the Chapter "Parameters (Page 363)".

### Tools required

The same screwdriver can be used to set the parameters as for wiring the insulation monitoring relays.

### Carrying out the self-test

The test function is only possible if there is no fault.

By operating the combined test/reset button, the insulation monitoring relay goes through an internal test that checks the proper functioning of the operational device.

The output relays do not pick up or they switch to the fault status while the Test/Reset button is pressed, while control contact Y1-Y3 is closed, or while the test functions execute after application of the supply voltage. The test function can be started again at any time via the Test/Reset button on the front or via a remote test button. The graphic below shows the connection of the button for the remote test.






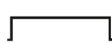




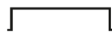





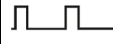

Image 9-8 Remote test button







## 9.4.4 Diagnostics

### 9.4.4.1 Diagnostics with LEDs

#### Status display

The following information indicates the operating state on the 3UG4582/3UG4583 insulation monitoring relays:

Operating state	LED $\Phi$ (green)	LED F (red)	LED $\Delta$ (yellow)
Startup		Off	Off
No fault		Off	<ul style="list-style-type: none"> <li>On the 3UG4582: </li> <li>On the 3UG4583: Dependent on the configuration</li> </ul>
Pre-warning <sup>1)</sup>			
Insulation fault (threshold undershot)			<ul style="list-style-type: none"> <li>On the 3UG4582: Off</li> <li>On the 3UG4583: Dependent on the configuration</li> </ul>
PE/KE open circuit			<ul style="list-style-type: none"> <li>On the 3UG4582: Off</li> <li>On the 3UG4583: Dependent on the configuration</li> </ul>
L+/L- open circuit at system start <sup>1)</sup> / Test function <sup>1)</sup>	 / 		Dependent on the configuration
System discharge capacity too high/measured result invalid			<ul style="list-style-type: none"> <li>On the 3UG4582: Off</li> <li>On the 3UG4583: Dependent on the configuration</li> </ul>
Internal fault	<ul style="list-style-type: none"> <li>On the 3UG4582: Off</li> <li>On the 3UG4583: Dependent on the configuration</li> </ul>		<ul style="list-style-type: none"> <li>On the 3UG4582: Off</li> <li>On the 3UG4583: Dependent on the configuration</li> </ul>

Operating state	LED $\Phi$ (green)	LED F (red)	LED $\Delta$ (yellow)
Setting error <sup>1), 2)</sup>			
Test function		Off	<ul style="list-style-type: none"> <li>• On the 3UG4582: Off</li> <li>• On the 3UG4583: Dependent on the configuration</li> </ul>
Manual RESET possible <sup>3)</sup>		<sup>4)</sup>	

- 1) Only on the 3UG4583-1CW30.
- 2) Possible setting error: The threshold for shutdown is set to a higher value than the warning threshold, and non-volatile (retentive) fault storage is set simultaneously with autoreset.
- 3) The device has tripped following an insulation fault. The fault has been stored and the insulation resistance has reverted to a value above the set threshold including hysteresis.
- 4) Dependent on the fault.

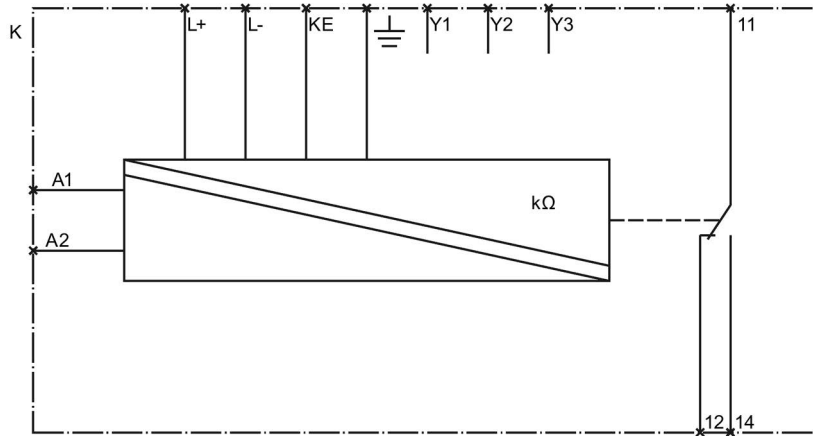
The switching behavior of the output relay is shown in Chapter "Functions (Page 238)".

## 9.4.5 Circuit diagrams

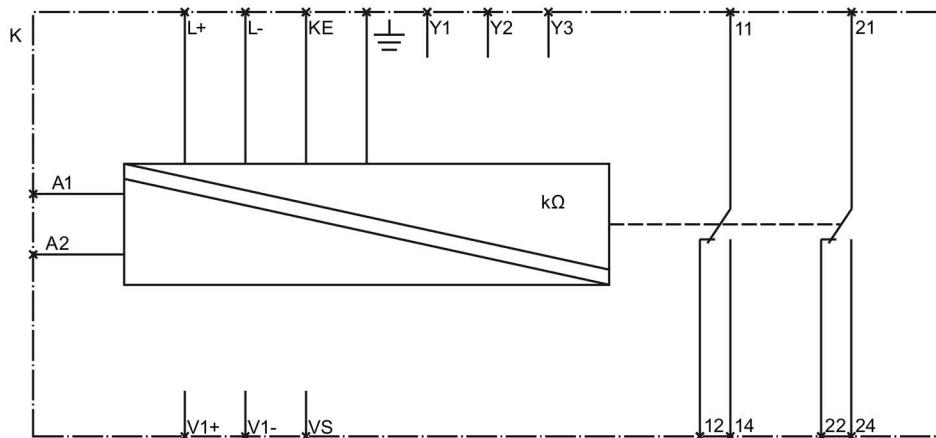
### 9.4.5.1 Internal circuit diagrams

Internal circuit diagrams 3UG4582-1AW30 / 3UG4583-1CW30

#### 3UG4582-1AW30 insulation monitoring relay



#### 3UG4583-1CW30 insulation monitoring relay



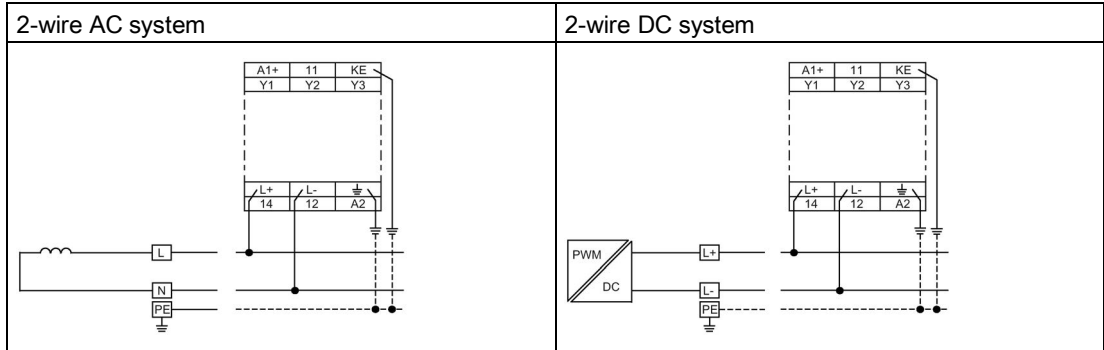
9.4.5.2 Wiring examples

Wiring examples 3UG4582 insulation monitoring relays

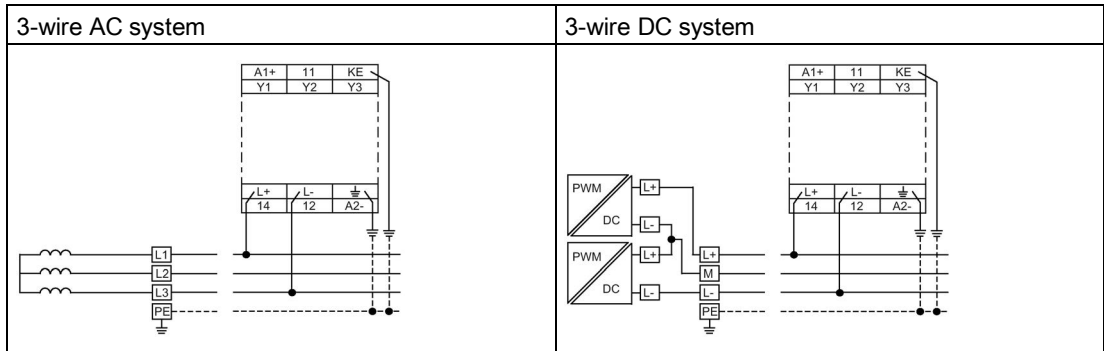
Measuring inputs L+ and L- can be connected to any conductor (phase or N conductor).  
 Measuring inputs L+ and L- must always be connected to different conductors.

The rated system voltage is  $U_n \leq 250$  V AC (15 to 400 Hz) or  $U_n \leq 300$  V DC.

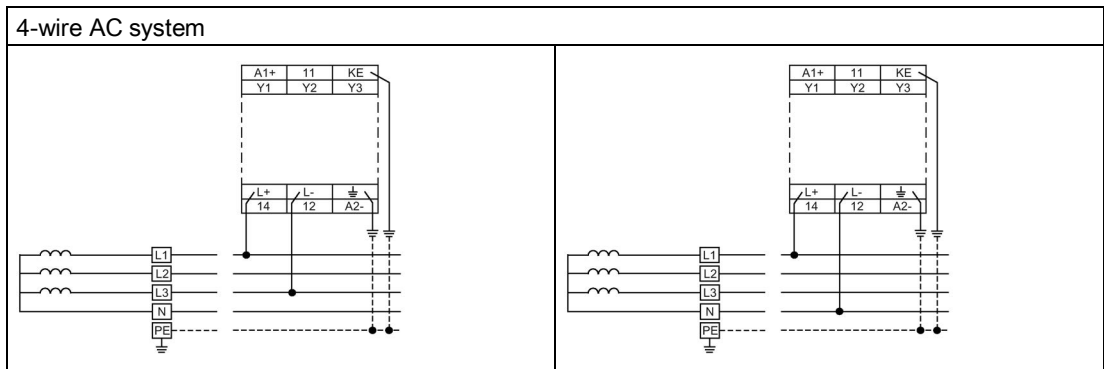
2-wire AC system / 2-wire DC system



3-wire AC system / 3-wire DC system



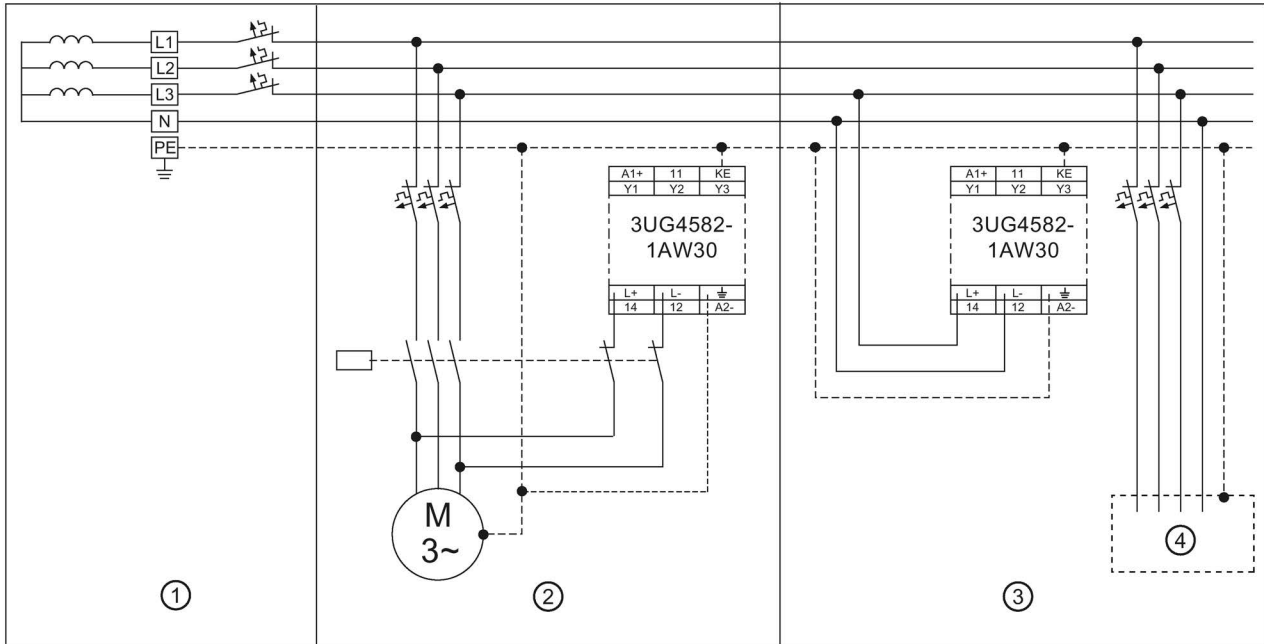
4-wire AC system





## Application examples

The figure below shows monitoring for ground fault/insulation fault in the different load circuits.



- ① The voltage source is the secondary side of an isolating transformer that galvanically isolates the system and the downstream circuit.
- ② The insulation resistance of this motor feeder is always monitored when the motor is switched off. If the motor contactor drops out, the two NC contacts connect the measuring circuit with the motor cables.
- ③ The 3UG4582-1AW30 insulation monitoring relay permanently monitors the insulation resistance of the remaining system with all connected loads.
- ④ Loads

Image 9-9 Monitoring for ground fault/insulation fault with different load circuits

### Note

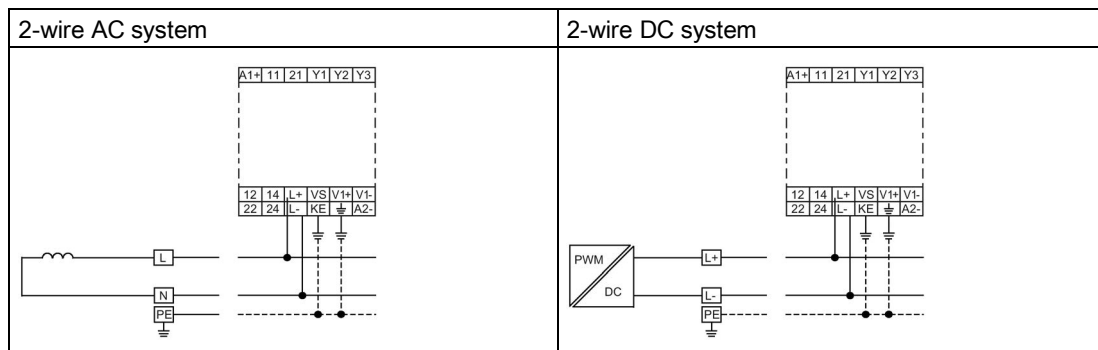
The maximum cable length of the control cables is 50 m or 100 pF/m.

### Wiring examples 3UG4583 insulation monitoring relays

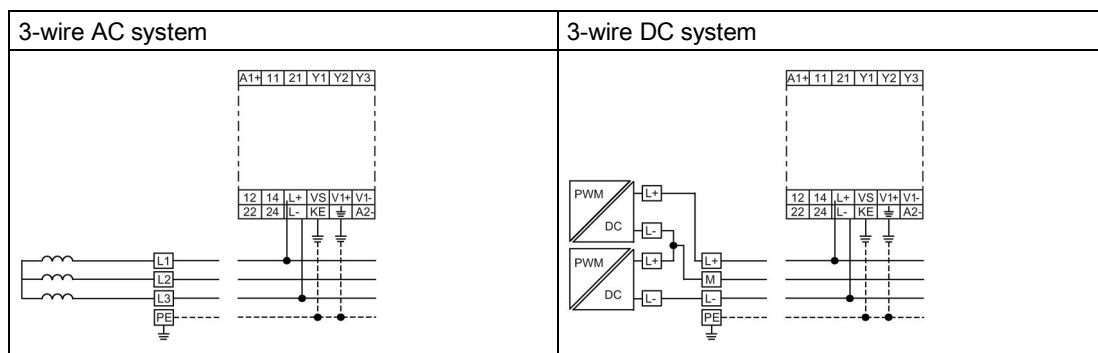
Measuring inputs L+ and L- can be connected to any conductor (phase or N conductor).  
 Measuring inputs L+ and L- must always be connected to different conductors.

The rated system voltage is  $U_n \leq 400 \text{ V AC}$  (15 to 400 Hz) or  $U_n \leq 600 \text{ V DC}$ . The 3UG4983-1A upstream module must be used to monitor systems with higher voltages.

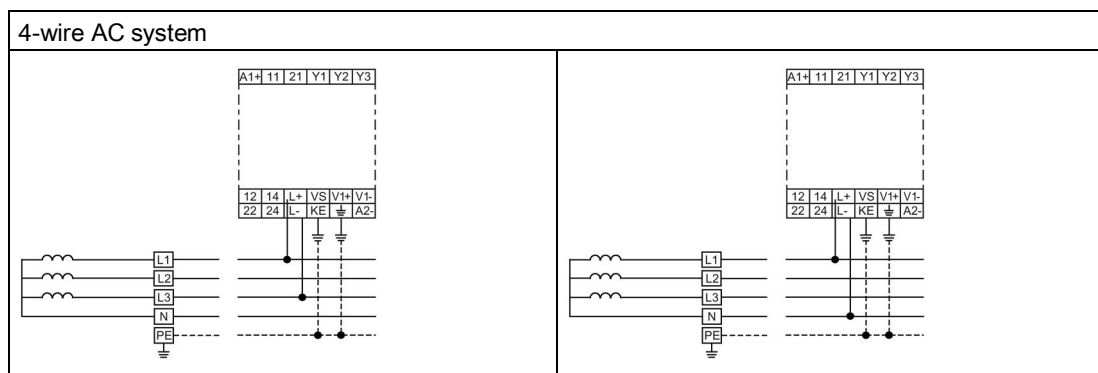
#### 2-wire AC system / 2-wire DC system



#### 3-wire AC system/3-wire DC system

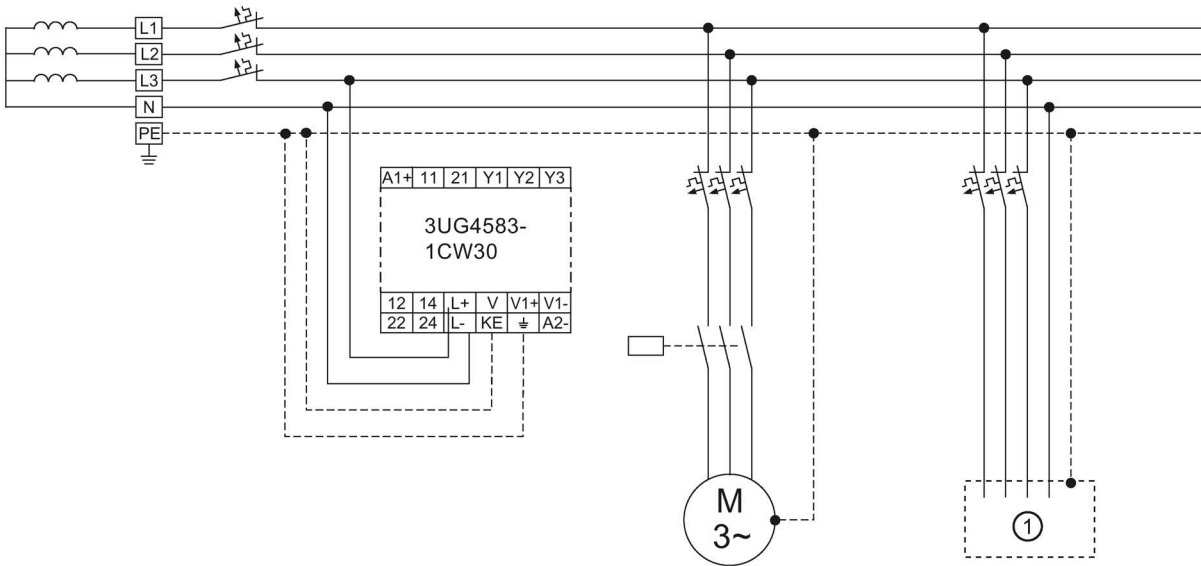


#### 4-wire AC system



**Application examples**

The figure below shows monitoring for ground fault/insulation fault in the case of an ungrounded 4-wire AC system.

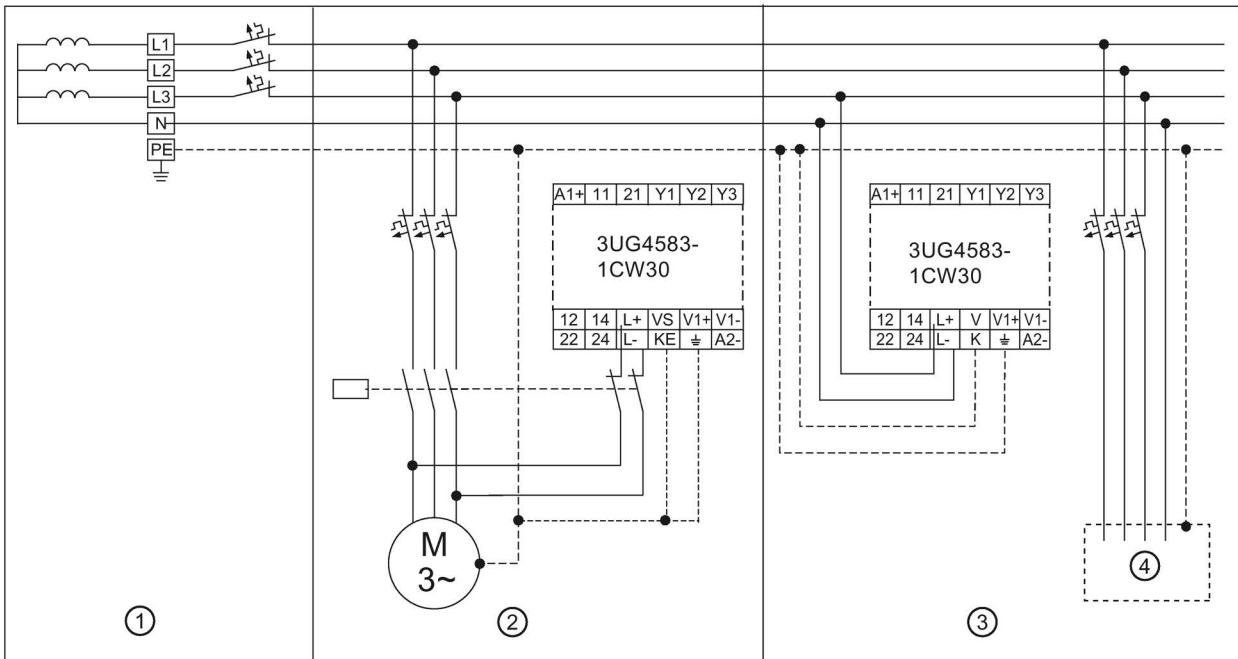


① Loads

Image 9-10 Monitoring for ground fault/insulation fault in the case of an ungrounded 4-wire AC system

**Note**

The maximum cable length of the control cables is 50 m or 100 pF/m.



- ① The voltage source is the secondary side of an isolating transformer that galvanically isolates the system and the downstream circuit.
- ② The insulation resistance of this motor feeder is always monitored when the motor is switched off. If the motor contactor drops out, the two NC contacts connect the measuring circuit with the motor cables.
- ③ The 3UG4583-1CW30 insulation monitoring relay permanently monitors the insulation resistance of the remaining system with all connected loads.
- ④ Loads

Image 9-11 Monitoring for ground fault/insulation fault with different load circuits

**Note**

The maximum cable length of the control cables is 50 m or 100 pF/m.

## 9.4.6 Characteristics

### Characteristics of the 3UG4582 insulation monitoring relays

The characteristics below show the load limit curves of the 3UG4582 insulation monitoring relays.

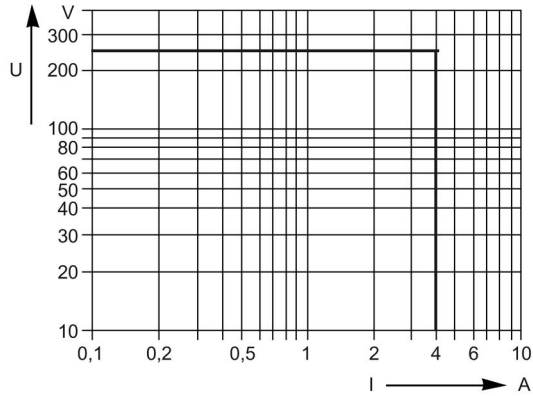


Image 9-12 AC load (resistive)

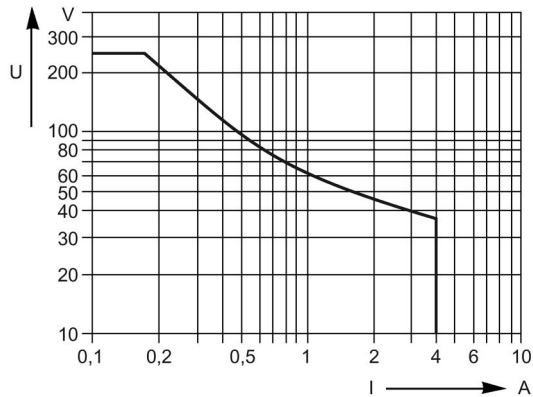


Image 9-13 DC load (resistive)

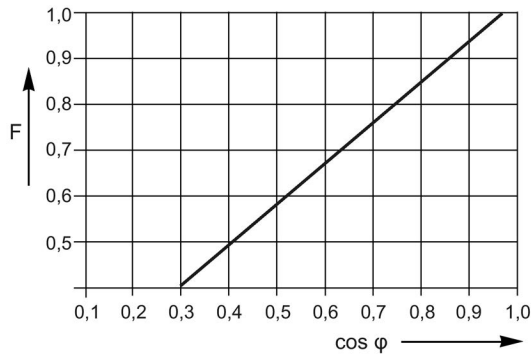
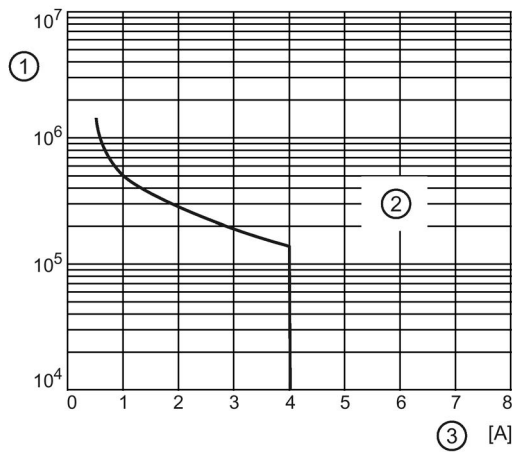


Image 9-14 Reduction factor F in the case of inductive AC load



- ① Operating cycles
- ② 250 V, resistive load
- ③ Switching current

Image 9-15 Contact service life

### Characteristics of the 3UG4583 insulation monitoring relays

The characteristics below show the load limit curves of the 3UG4583 insulation monitoring relays.

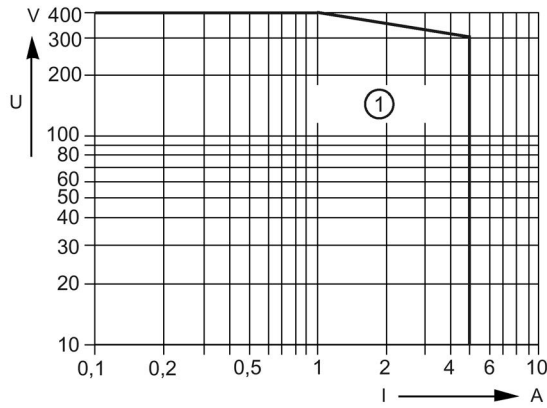


Image 9-16 AC load (resistive)

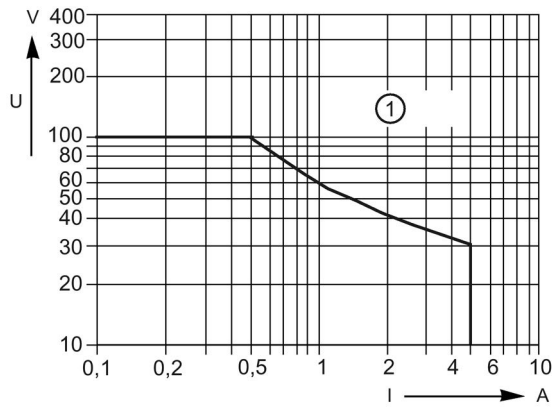


Image 9-17 DC load (resistive)

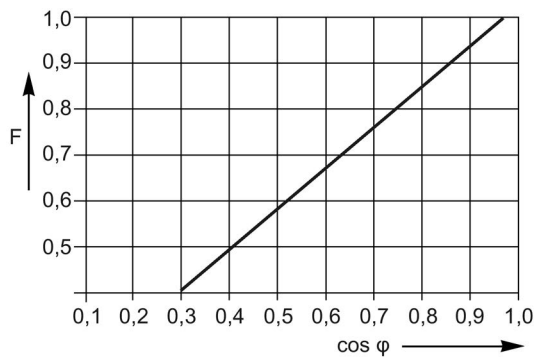
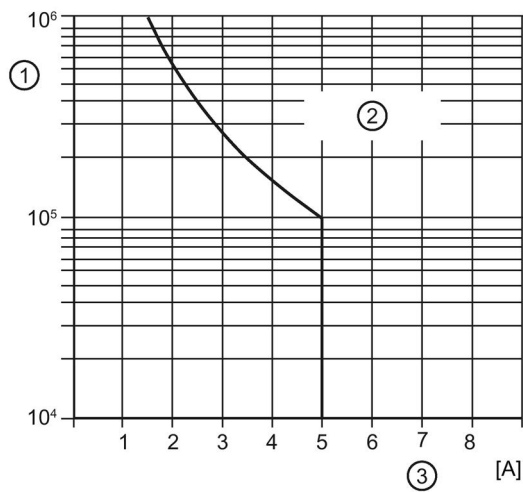


Image 9-18 Reduction factor F in the case of inductive AC load



- ① Operating cycles
- ② 250 V, resistive load
- ③ Switching current

Image 9-19 Contact service life



## 9.4.7 Technical data

### 9.4.7.1 3UG4582

#### Measuring circuit

		3UG4582-1AW30
Type of voltage for monitoring		AC/DC
Measurable line frequency	Hz	50 ... 60
Network leakage resistance	$\mu\text{F}$	10
Adjustable response value impedance		
• 1	$\text{k}\Omega$	1 ... 100

#### General technical details

		3UG4582-1AW30
Product function		insulation monitor
• isolation control		Yes
• defect storage		Yes
Type of voltage of the controlled supply voltage		AC/DC
Operating frequency		
• rated value	Hz	15 ... 400
Control supply voltage		
• for DC		
– rated value	V	24 ... 240
• at 50 Hz at AC		
– rated value	V	24 ... 240
• at 60 Hz at AC		
– rated value	V	24 ... 240

3UG4582-1AW30		
<b>Working range factor supply voltage rated value</b>		
• for DC		0.85 ... 1.1
• at 50 Hz		
– for AC		0.85 ... 1.1
• at 60 Hz		
– for AC		0.85 ... 1.1
<b>Impulse voltage resistance rated value</b>	kV	6
<b>Thermal current of the contact-affected switching element maximum</b>	A	4
<b>Protection class IP</b>		IP20
<b>Ambient temperature</b>		
• during operating	°C	-25 ... +60
<b>Item designation</b>		
• according to DIN EN 61346-2		K
• according to DIN 40719 extendable after IEC 204-2 according to IEC 750		K

## Mechanical design

		3UG4582-1AW30
<b>Width</b>	mm	22.5
<b>Height</b>	mm	78
<b>Depth</b>	mm	100
<b>Built in orientation</b>		any
<b>Distance, to be maintained, to the ranks assembly</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, conductive elements</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, to earthed part</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0

		3UG4582-1AW30
<b>Type of mounting</b>		snap-on fastening on 35 mm standard rail
<b>Product function removable terminal for auxiliary and control circuit</b>		No
<b>Design of the electrical connection</b>		screw-type terminals
<b>Conductor cross-section that can be connected</b>		
<ul style="list-style-type: none"> <li>• solid</li> </ul>	mm <sup>2</sup>	0.75 ... 2.5
<ul style="list-style-type: none"> <li>• finely stranded</li> <li>– with wire end processing</li> </ul>	mm <sup>2</sup>	0.75 ... 2.5
<b>AWG number as coded connectable conductor cross section</b>		
<ul style="list-style-type: none"> <li>• solid</li> </ul>		20 ... 12 ...
<ul style="list-style-type: none"> <li>• stranded</li> </ul>		18 ... 14
<b>Tightening torque</b>		
<ul style="list-style-type: none"> <li>• with screw-type terminals</li> </ul>	N·m	0.6 ... 0.8
<b>Number of change-over switches delayed switching</b>		1

## 9.4.7.2 3UG4583

## Measuring circuit

		3UG4583-1CW30
Type of voltage for monitoring		AC/DC
Measurable line frequency	Hz	15 ... 400
Network leakage resistance	$\mu\text{F}$	20
Adjustable response value impedance		
• 1	k $\Omega$	1 ... 100
• 2	k $\Omega$	2 ... 200

## General technical details

		3UG4583-1CW30
Product function		insulation monitor
• isolation control		Yes
• defect storage		Yes
Type of voltage of the controlled supply voltage		AC/DC
Operating frequency		
• rated value	Hz	15 ... 400
Control supply voltage		
• for DC		
– rated value	V	24 ... 240
• at 50 Hz at AC		
– rated value	V	24 ... 240
• at 60 Hz at AC		
– rated value	V	24 ... 240
Working range factor supply voltage rated value		
• for DC		0.85 ... 1.1
• at 50 Hz		
– for AC		0.85 ... 1.1
• at 60 Hz		
– for AC		0.85 ... 1.1
Impulse voltage resistance rated value	kV	4
Thermal current of the contact-affected switching element maximum	A	4
Protection class IP		IP20
Ambient temperature		
• during operating	$^{\circ}\text{C}$	-25 ... +60
Item designation		
• according to DIN EN 61346-2		K
• according to DIN 40719 extendable after IEC 204-2 according to IEC 750		K

## Mechanical design

		3UG4583-1CW30
<b>Width</b>	mm	45
<b>Height</b>	mm	78
<b>Depth</b>	mm	100
<b>Built in orientation</b>		any
<b>Distance, to be maintained, to the ranks assembly</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, conductive elements</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, to earthed part</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Type of mounting</b>		snap-on fastening on 35 mm standard rail
<b>Product function removable terminal for auxiliary and control circuit</b>		No
<b>Design of the electrical connection</b>		screw-type terminals
<b>Conductor cross-section that can be connected</b>		
• solid	mm <sup>2</sup>	0.75 ... 2.5
• finely stranded		
– with wire end processing	mm <sup>2</sup>	0.75 ... 2.5
<b>AWG number as coded connectable conductor cross section</b>		
• solid		20 ... 12
• stranded		18 ... 14
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.6 ... 0.8
<b>Number of change-over switches delayed switching</b>		2

## 3UG463. voltage monitoring relay

### 10.1 Application areas

#### Application areas

The voltage monitoring relays are used, for example, in the following applications:

Table 10- 1 Application areas of the voltage monitoring relays

Function	Application
<ul style="list-style-type: none"> <li>• Undervoltage</li> <li>• Overvoltage</li> </ul>	<ul style="list-style-type: none"> <li>• Increased current on a motor with corresponding overheating</li> <li>• Unintended device reset</li> <li>• Power system collapse on overloaded supply voltages</li> <li>• Fork-lift trucks</li> <li>• Heating systems</li> <li>• Cranes</li> <li>• Elevators</li> <li>• Protection from undervoltage (especially with battery power; result: e.g. exhaustive discharge)</li> <li>• System protection against destruction caused by supply overvoltages</li> <li>• Energy supply to the line</li> <li>• Machine switch-on when a defined voltage is reached</li> <li>• Threshold switch for analog signals from 0.1 to 10 V</li> </ul>

## 10.2 3UG4631 / 3UG4632 voltage monitoring relay

### 10.2.1 Operator controls and connection terminals

#### Front view / terminal labeling 3UG4631 / 3UG4632

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Device article number
	⑤	Label
	⑥	Legend for menu
	⑦	Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>	
	A1+	Rated control supply voltage ~ / +
	A2-	Rated control supply voltage ~ / -
	M (GND)	Measuring signal input -
	IN	Measuring signal input +
12	Output relay K1 CO contact NC contact	
11	Output relay K1 CO contact root	
14	Output relay K1 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 281)".



## 10.2.2 Functions

### General functionality

Depending on the setting, the 3UG4631 / 3UG4632 voltage monitoring relays are powered with a rated control supply voltage of 24 V AC/DC or 24 to 240 AC/DC and monitor an AC voltage or DC voltage at terminals IN and M of the device for **overshoot** (U<sup>▲</sup>) or **undershoot** (U<sup>▼</sup>) or in **range monitoring** (U<sup>▲</sup> and U<sup>▼</sup>).

The 3UG4631 / 32 voltage monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 278)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

### Monitoring

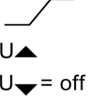
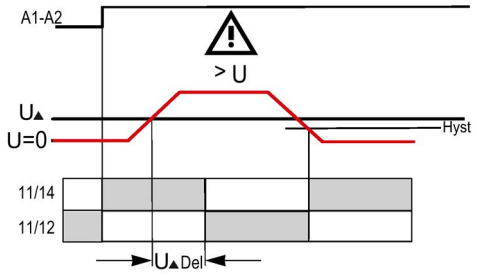
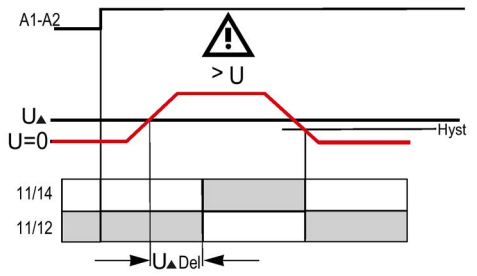
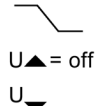
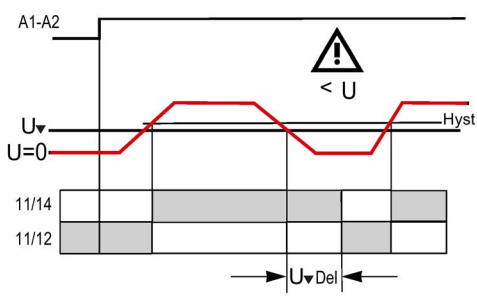
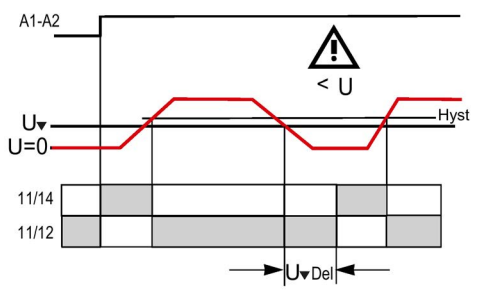
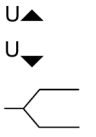
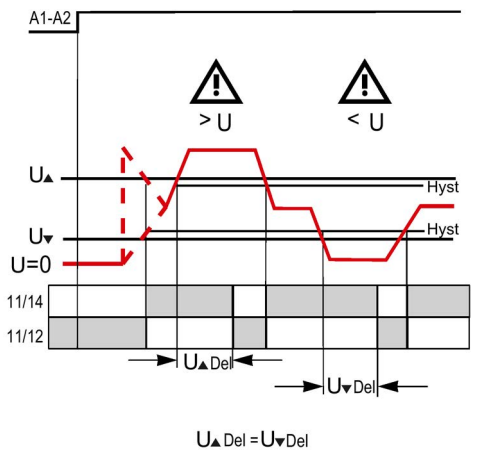
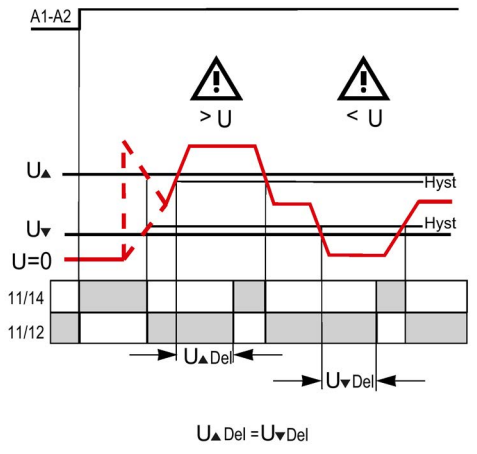
The output relay K1 responds in accordance with the set relay switching behavior (closed-circuit principle NC or open-circuit principle NO). The set tripping delay time starts if the monitored voltage overshoots or undershoots the corresponding set threshold value. After expiry of the tripping delay time, the output relay K1 changes the switching state. On the display, the currently displayed measuring value and the symbol for undershoot or overshoot flash.

An output change-over contact is available as a signaling contact.

If the rated control supply voltage is switched on and no monitoring voltage is yet present, the display indicates 0.0 V and shows a symbol for voltage overshoot monitoring, voltage undershoot monitoring, or range monitoring.

You will find the switching states of the output relay below in the section entitled "Function diagrams" and in Chapter "Diagnostics (Page 279)."

Function diagrams 3UG4631 / 3UG4632

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
 <p>U▲ = on U▼ = off</p>		
 <p>U▲ = off U▼ = on</p>		
 <p>U▲ = on U▼ = on</p>	 <p style="text-align: center;"><math>U_{\Delta Del} = U_{\nabla Del}</math></p>	 <p style="text-align: center;"><math>U_{\Delta Del} = U_{\nabla Del}</math></p>

## 10.3 3UG4633 voltage monitoring relay

### 10.3.1 Operator controls and connection terminals

#### Front view / terminal assignment 3UG4633

Front view	Description
	<b>Position digits</b>
	① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	② Arrow keys for menu navigation
	③ SET key for menu navigation
	④ Device article number
	⑤ Label
	⑥ Legend for menu
	⑦ Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>
	A1+ Rated control supply voltage ~ / +
	A2- Rated control supply voltage ~ / -
	12 Output relay K1 CO contact NC contact
	11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 281)".

## 10.3.2 Functions

### General functionality

Depending on the setting, the 3UG4633 voltage monitoring relays are **self-powered** (measuring voltage = rated control supply voltage) and monitor an AC voltage or DC voltage at terminals A1 and A2 of the device for **overshoot** (U▲) or **undershoot** (U▼) or in **range monitoring** (U▲ and U▼).

The voltage monitoring relays are powered with a rated control supply voltage of 17 to 275 V AC/DC through terminals A1/A2.

The 3UG4633 voltage monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 278)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

### Monitoring

Output relay K1 responds in accordance with the set relay switching behavior (closed-circuit principle NC or open-circuit principle NO).

An output change-over contact is available as a signaling contact.

If the voltage is switched on, the display will show the current measured value and a symbol for monitoring for voltage overshoot, voltage undershoot, or range monitoring.

#### Startup delay

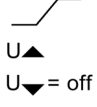
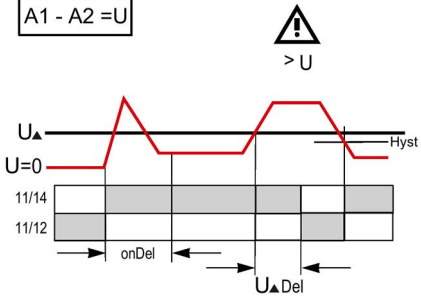
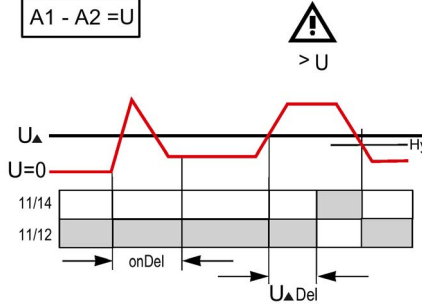
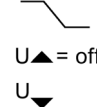
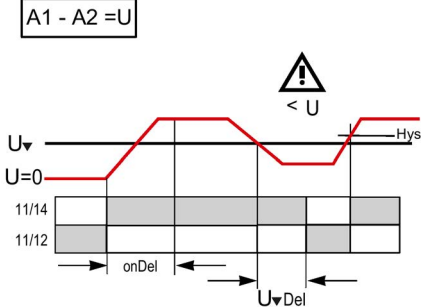
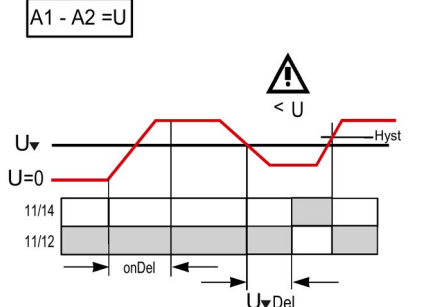
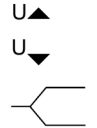
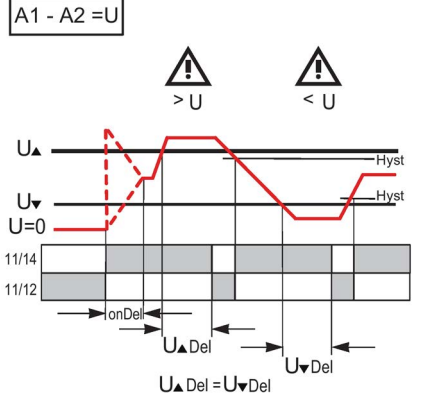
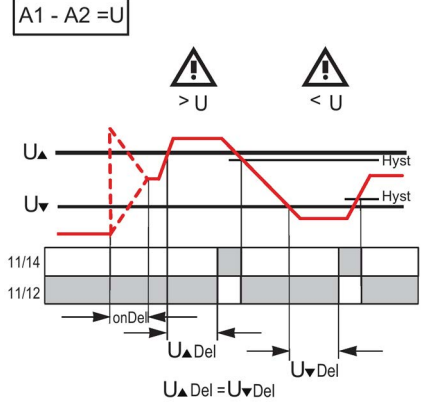
To be able to start a drive, the output relay switches to the correct state during the ON-delay time (onDel) depending on the selected open-circuit principle or closed-circuit principle, even if the measured value is still under the set value.

#### Tripping delay

If the measured value overshoots or undershoots the set threshold after expiry of the ON-delay time (onDel), the set tripping delay time (Del) and the relay symbol will flash. After expiry of this time, the output relays change the switching state. On the display, the current measuring value and the symbol for undershoot or overshoot flash.

You will find the switching states of the output relay below in the section entitled "Function diagrams" and in Chapter "Diagnostics (Page 279)."

Function diagrams 3UG4633

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
 <p>U▲ = on U▼ = off</p>	<p>A1 - A2 = U</p> 	<p>A1 - A2 = U</p> 
 <p>U▲ = off U▼ = on</p>	<p>A1 - A2 = U</p> 	<p>A1 - A2 = U</p> 
 <p>U▲ U▼</p>	<p>A1 - A2 = U</p>  <p><math>U_{\blacktriangle}Del = U_{\blacktriangledown}Del</math></p>	<p>A1 - A2 = U</p>  <p><math>U_{\blacktriangle}Del = U_{\blacktriangledown}Del</math></p>

## 10.4 Operation

### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



### Parameter information

The table below shows the settable parameter information of the 3UG463. voltage monitoring relays:

Table 10- 2 Parmeter information, 3UG463. voltage monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for undershoot (U▼)	0.1 V or OFF <sup>1)</sup> 10 V or OFF <sup>2)</sup> 17 V or OFF <sup>3)</sup>	60 V <sup>1)</sup> 600 V <sup>2)</sup> 275 V <sup>3)</sup>	0.1 V	20 V <sup>1)</sup> 170 V <sup>2), 3)</sup>
"RUN"	Threshold for overshoot (U▲)	0.1 V or OFF <sup>1)</sup> 10 V or OFF <sup>2)</sup> 17 V or OFF <sup>3)</sup>	60 V <sup>1)</sup> 600 V <sup>2)</sup> 275 V <sup>3)</sup>	0.1 V	30 V <sup>1)</sup> 260 V <sup>2),3)</sup>
"SET"	Hysteresis (Hyst)	0.1 V	30 V <sup>1)</sup> 300 V <sup>2)</sup> 150 V <sup>3)</sup>	0.1 V	2 V <sup>1)</sup> 5 V <sup>2), 3)</sup>
"SET"	ON-delay time (onDel)	0.1 s <sup>3)</sup>	20 s <sup>3)</sup>	0.1 s <sup>3)</sup>	0.1 s <sup>3)</sup>
"SET"	Tripping delay time (U#Del)	0.1 s	20 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC	NO	--	NC

- 1) 3UG4631 voltage monitoring relay  
 2) 3UG4632 voltage monitoring relay  
 3) 3UG4633 voltage monitoring relay

---

#### Note

The monitoring mode "Overshoot" or "Undershoot" is defined with the setting OFF at the threshold for undershoot or overshoot.

---

#### Note

##### Deactivating monitoring

If the upper and lower threshold values are deactivated (OFF), monitoring will cease for:

- Voltage overshoot
- Voltage undershoot

The up-to-date measured value is displayed permanently.

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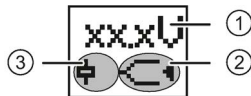
The parameters are described in Chapter "Parameters (Page 363)."  
 Menu-based operation is described in Chapter "Menu-based operation (Page 39)."

## 10.5 Diagnostics

### 10.5.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Voltage measured value or fault symbol
- ② Type of monitoring
- ③ Symbol of the changeover contact

#### Meaning of the information on the display

##### Note

##### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and faults are indicated on the display as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	20.0V	Measured voltage is displayed
②		Monitoring for voltage overshoot
②		Monitoring for voltage undershoot
②		Range monitoring (monitoring for voltage overshoot and undershoot)
②	◀	Voltage is in correct range
②	▲	A voltage overshoot has occurred
②	▼	A voltage undershoot has occurred
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 273)" (3UG4631 / 3UG4632) and "Functions (Page 276)" (3UG4633).

## 10.5.2 Reset

### RESET



How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

- Manual RESET (Memory = 1 / Mem = yes)

To reset the devices with digital setting, it is necessary to press both arrow keys   simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

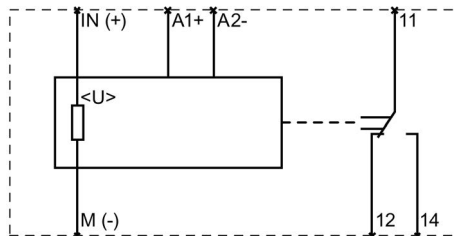


## 10.6 Circuit diagrams

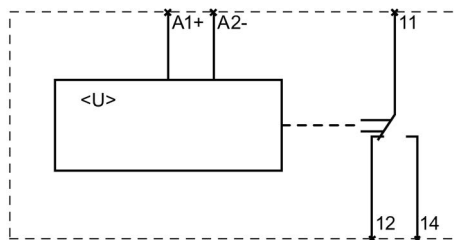
### 10.6.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4631 / 3UG4632 and 3UG4633

##### 3UG4631 / 3UG4632 voltage monitoring relays



##### 3UG4633 voltage monitoring relay



#### Note

On the 24 V AC/DC versions of the 3UG4631-.AA30 and 3UG4632-.AA30, terminals A2 and M (GND) are electrically connected in the device!

On the 24 to 240 V AC/DC versions of the 3UG4631-.AW30 and 3UG4632-.AW30, terminals A2 and M (GND) are electrically separated!

10.6.2 Wiring examples

3UG4631-.AA30 / 3UG4632-.AA30

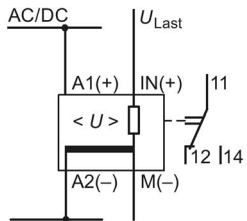


Image 10-1 3UG4631-.AA30 / 3UG4632-.AA30

3UG4631-.AW30 / 3UG4632-.AW30

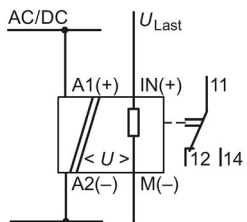


Image 10-2 3UG4631-.AW30 / 3UG4632-.AW30

3UG4633

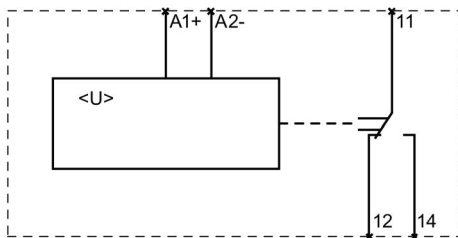


Image 10-3 3UG4633

## 10.7 Technical data

### Measuring circuit

		3UG4631-1	3UG4632-1	3UG4633-1	3UG4631-2	3UG4632-2	3UG4633-2
<b>Type of voltage for monitoring</b>		AC/DC					
<b>Number of poles for main current circuit</b>		1					
<b>Measurable line frequency</b>	Hz	500 ... 40					40 ... 500
<b>Measurable voltage</b>							
• for AC	V	0.1 ... 60	10 ... 600	17 ... 275	0.1 ... 60	10 ... 600	17 ... 275
• for DC	V	0.1 ... 60	10 ... 600	17 ... 275	0.1 ... 60	10 ... 600	17 ... 275
<b>Adjustable voltage range</b>	V	0.1 ... 60	10 ... 600	17 ... 275	0.1 ... 60	10 ... 600	17 ... 275
<b>Adjustable response delay time</b>							
• when starting	s	—	—	0.1 ... 20	—	—	0.1 ... 20
• with lower or upper limit violation	s	0.1 ... 20					

**General technical details**

	3UG463.-1.A	3UG463.-1.L	3UG463.-1.W	3UG463.-2.A	3UG463.-2.L	3UG463.-2.W
<b>Product function</b>	Voltage monitoring relay					
<b>Design of the display</b>	LCD					
<b>Product function</b>						
• tension window recognition of 1 phase	Yes					
• tension window recognition of 3 phases	No					
• tension window recognition DC	Yes					
• overvoltage recognition of 1 phase	Yes					
• overvoltage recognition of 3 phases	No					
• overvoltage recognition DC	Yes					
• undervoltage recognition of 1 phase	Yes					
• undervoltage recognition of 3 phases	No					
• undervoltage recognition DC	Yes					
• reset external	Yes					
• self-reset	Yes					
• open-circuit or closed-circuit current principle	Yes					

	3UG463.-1.A	3UG463.-1.L	3UG463.-1.W	3UG463.-2.A	3UG463.-2.L	3UG463.-2.W	
Starting time after the control supply voltage has been applied	s	1					
Response time maximum	ms	450					
Relative metering precision	%	5					
Precision of digital display		+/-1 digit					
Relative temperature-related measurement deviation	%	0.1					
Relative repeat accuracy	%	1					
Type of voltage of the controlled supply voltage		AC/DC					
Control supply voltage							
• at 50 Hz at AC							
– rated value	V	24	17 ... 275	24 ... 240	24	17 ... 275	24 ... 240
• at 60 Hz at AC							
– rated value	V	24	17 ... 275	24 ... 240	24	17 ... 275	24 ... 240
• for DC							
– rated value	V	24	17 ... 275	24 ... 240	24	17 ... 275	24 ... 240
Working range factor supply voltage rated value							
• at 50 Hz for AC		0.85 ... 1.15	1	0.85 ... 1.1	0.85 ... 1.15	1	0.85 ... 1.1
• at 60 Hz for AC		0.85 ... 1.15	1	0.85 ... 1.1	0.85 ... 1.15	1	0.85 ... 1.1
• for DC		0.85 ... 1.15	1	0.85 ... 1.1	0.85 ... 1.15	1	0.85 ... 1.1

## 10.7 Technical data

		3UG463.-1.A	3UG463.-1.L	3UG463.-1.W	3UG463.-2.A	3UG463.-2.L	3UG463.-2.W
Impulse voltage resistance rated value	kV	4					
Recorded real power	W	2					
Protection class IP		IP20					
Electromagnetic compatibility		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4					
Operating current at 17 V minimum	mA	5					
Continuous current of the DIAZED fuse link of the output relay	A	4					
Resistance against vibration according to IEC 60068-2-6		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g					
Resistance against shock according to IEC 60068-2-27		sinusoidal half-wave 15g / 11 ms					
Installation altitude at a height over sea level maximum	m	2 000					
Maximum permissible voltage for safe disconnection							
• between control and auxiliary circuit	V	300					
• between auxiliary circuit and auxiliary circuit	V	300					
Conductor-bound parasitic coupling BURST according to IEC 61000-4-4		2 kV					
Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5		2 kV					
Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5		1 kV					
Electrostatic discharge according to IEC 61000-4-2		6 kV contact discharge / 8 kV air discharge					

	3UG463.-1.A	3UG463.-1.L	3UG463.-1.W	3UG463.-2.A	3UG463.-2.L	3UG463.-2.W
Field-bound parasitic coupling according to IEC 61000-4-3	10 V/m					
Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value	V	690				
Ambient temperature						
• during operating	°C	-25 ... +60				
• during storage	°C	-40 ... +85			85 ... -40	-40 ... +85
• during transport	°C	-40 ... +85			85 ... -40	-40 ... +85
Design of the electrical isolation	Safe isolation					
Galvanic isolation						
• between entrance and outlet	Yes					
• between the outputs	Yes					
• between the voltage supply and other circuits	No		Yes	No		Yes
Mechanical operating cycles as operating time typical	10 000 000					
Electrical operating cycles as operating time at AC-15 at 230 V typical	100 000					
Operating cycles with 3RT2 contactor maximum	1/h	5 000				

## Mechanical design

		3UG463.-1....	3UG463.-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	92	94
<b>Depth</b>	mm	91	
<b>Built in orientation</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
<b>Type of mounting</b>		snap-on mounting	
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes	
<b>Design of the electrical connection</b>		screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-section</b>			
• solid		1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
• finely stranded			
– with wire end processing		1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2 x (0.25 ... 1.5 mm <sup>2</sup> )
– without wire end processing		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors			
– solid		2x (20 ... 14)	2x (24 ... 16)
– stranded		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	1.2 ... 0.8	— ...
<b>Number of change-over switches delayed switching</b>		1	



# 3UG4641 cos phi and active current monitoring relay

# 11

## 11.1 Application areas

### Application areas

The cos phi and active current monitoring relays are used, for example, in the following application areas:

Table 11- 1 Application areas of the cos phi and active current monitoring relays

Function	Application
<ul style="list-style-type: none"><li>• No-load monitoring and load shedding</li><li>• Underload monitoring in the low-end performance range</li><li>• Monitoring for overload</li><li>• Simple cos phi monitoring in power systems for controlling compensation systems</li><li>• Cable break between the control cabinet and the motor</li></ul>	<ul style="list-style-type: none"><li>• Fans (in the case of a broken fan belt, for example)</li><li>• Pumps (in the case of an idling pump, for example)</li><li>• Filter system (a contaminated filter system, for example)</li><li>• Reactive power compensation</li><li>• Sawing system</li><li>• Conveyor belt</li><li>• Surface grinding machine</li><li>• Breaking mill</li><li>• Milling machine</li><li>• Car wash</li><li>• Lifting platform</li><li>• Screw conveyor</li><li>• Crane</li><li>• Turning machine</li><li>• Infrared heating system</li></ul>

## 11.2 Operator controls and connection terminals

### Front view / terminal labeling 3UG4641

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	②	Arrow keys for menu navigation
	③	SET key for menu navigation
	④	Device article number
	⑤	Label
	⑥	Legend for menu
	⑦	Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>	
	Lx	Power supply (measuring signal) ~ / +
Ly/N	Power supply (measuring signal) ~ / +	
IN	Measuring signal input (current)	
12	Output relay K1 CO contact NC contact	
11	Output relay K1 CO contact root	
14	Output relay K1 CO contact NO contact	
22	Output relay K2 CO contact NC contact	
21	Output relay K2 CO contact root	
24	Output relay K2 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 299)".

## 11.3 Functions

### General functionality

The 3UG4641 cos phi and active current monitoring relays are **self-powered** (measuring voltage = rated control supply voltage) and monitor the power factor value in one phase (PF: power factor) and the resulting active current  $I_{res}$  (I resistive), for **overshoot**( $\varphi^{\blacktriangle} / I_{res}^{\blacktriangle}$ ), **undershoot** ( $\varphi^{\blacktriangledown} / I_{res}^{\blacktriangledown}$ ) or **range monitoring** ( $\varphi^{\blacktriangle}$  and  $\varphi^{\blacktriangledown} / I_{res}^{\blacktriangle}$  and  $I_{res}^{\blacktriangledown}$ ) depending on the setting. The load to be monitored is connected upstream of the terminal IN. The load current flows through terminals IN and Ly / N. The devices are powered with a voltage of 90 to 690 V through the terminals Lx and Ly / N .

The 3UG4641 cos phi and active current monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 296)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

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#### Note

The specified voltages represent the absolute thresholds.

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### Monitoring

If the motor is switched on and the current value overshoots the measuring range limit 0.2 A, the set ON-delay time begins (onDel). During this time, undershooting or overshooting of the set threshold values will not result in a relay response of the CO contact.

If monitoring for active current undershoot is switched off ( $I_{res}^{\blacktriangledown} = \text{off}$ ), and if the load current undershoots the lower measuring range threshold (0.2 A), the change-over contacts remain unchanged. If a threshold is set for monitoring for active current undershoot, undershoot of the measuring range threshold (0.2 A) will result in a relay response of the change-over contacts.

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#### Note

In the case of active currents  $I_{res} > 10$  A, commercially available current transformers, e.g. 4NC, can be used as accessories. You will find more information in Catalog LV10 ([www.siemens.com/lowvoltage/infomaterial](http://www.siemens.com/lowvoltage/infomaterial)).

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### **Startup delay**

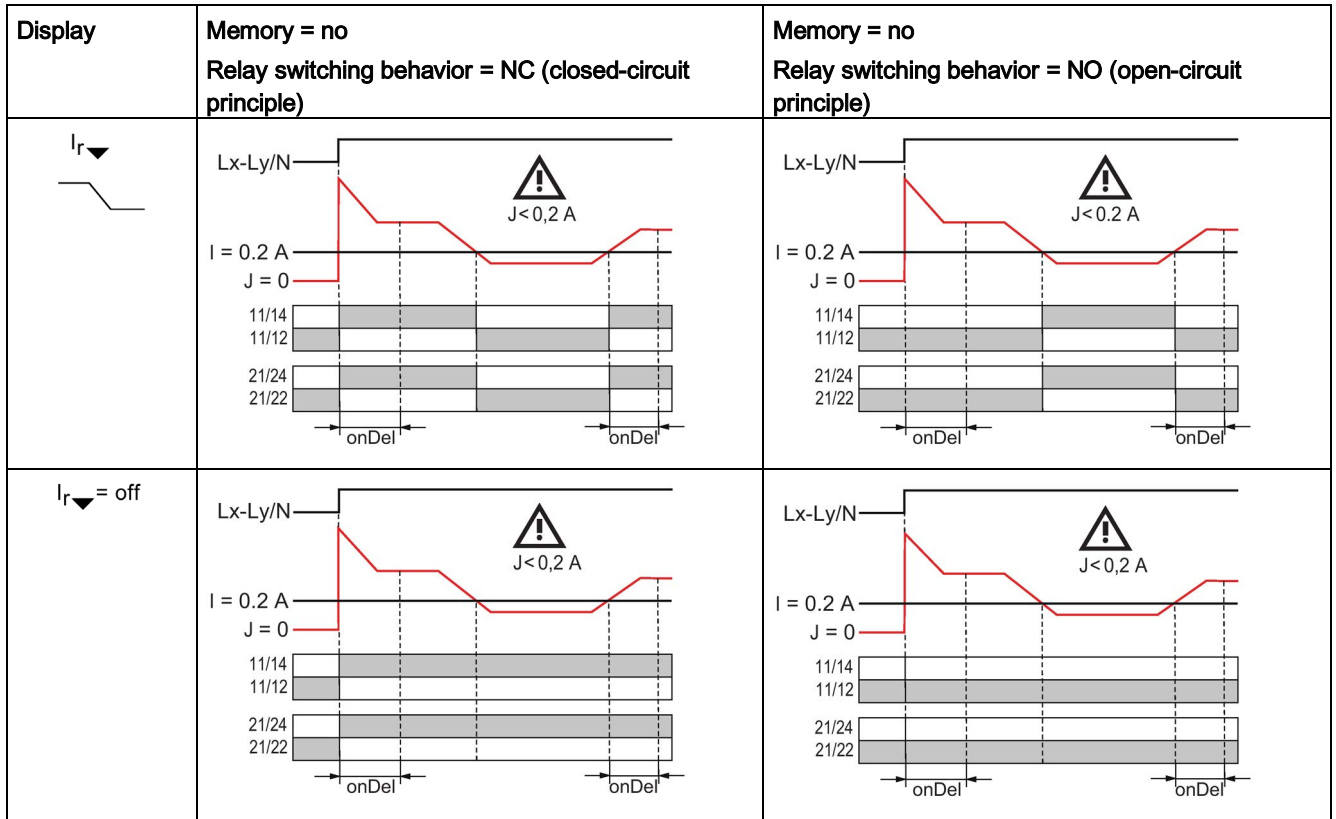
To be able to start a drive, the output relay switches to the correct state during the ON-delay time (onDel) depending on the selected open-circuit principle or closed-circuit principle, even if the measured value is still under the set value.

### **Tripping delay**

If the measured value overshoots or undershoots the set threshold after expiry of the ON-delay time (onDel), the set tripping delay time (Del) and the relay symbol will flash. After expiry of this time, the output relays change the switching state. On the display, the current measuring value and the symbol for undershoot or overshoot flash.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 297)."


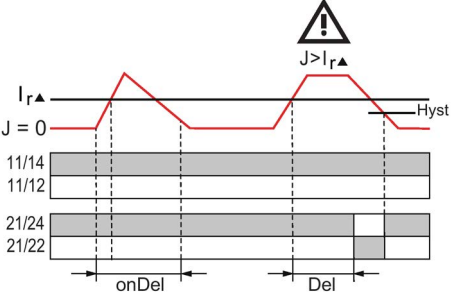
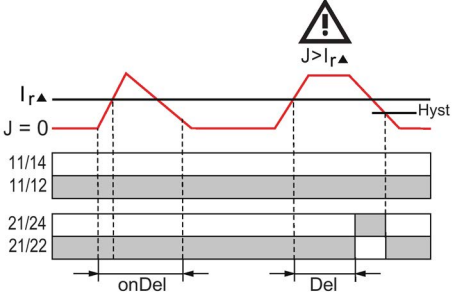

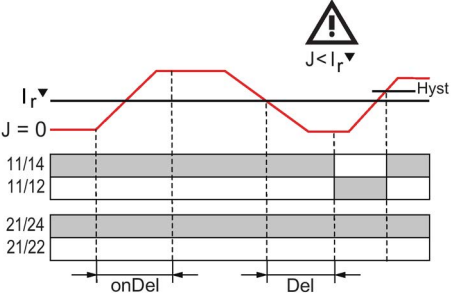
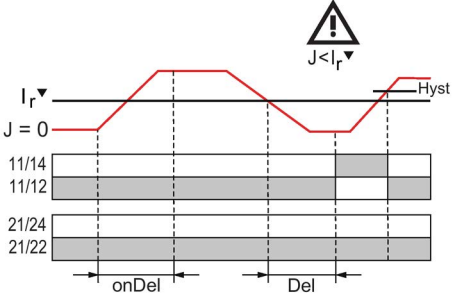

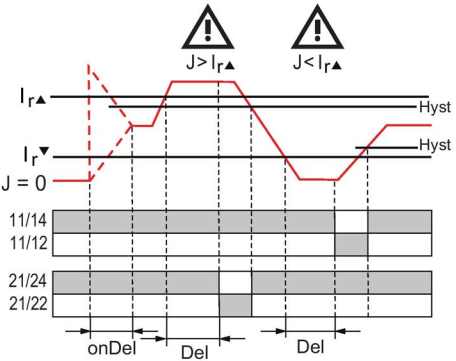
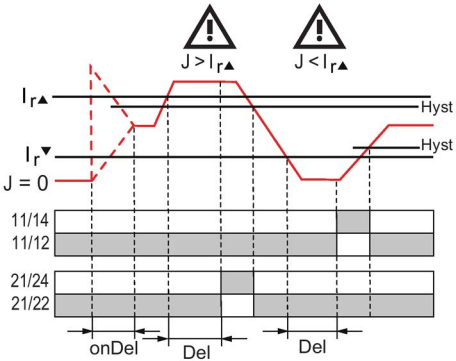
Function diagrams 3UG4641 (lower current measuring threshold 0.2 A)



J = currently set current value

I = set threshold value for the current


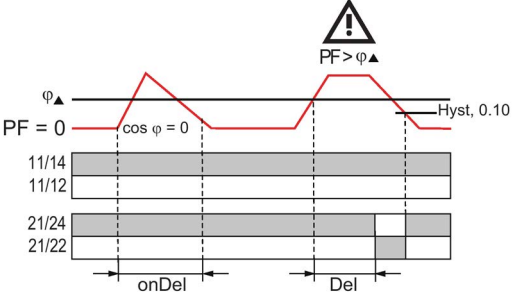
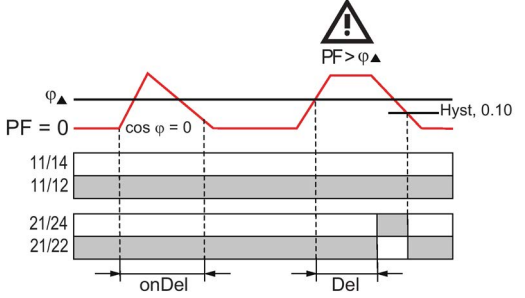

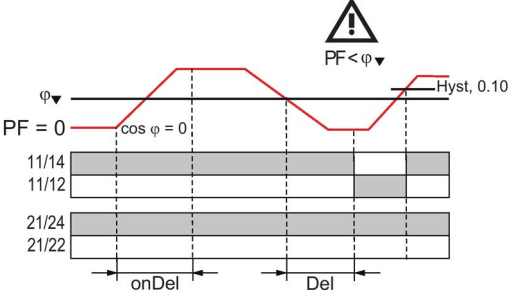
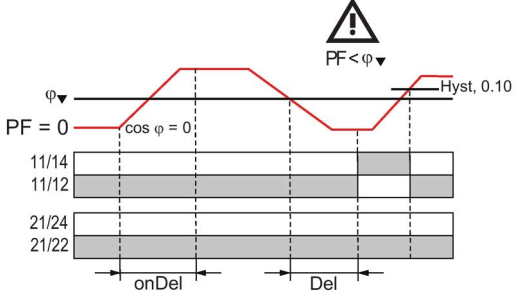
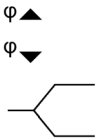
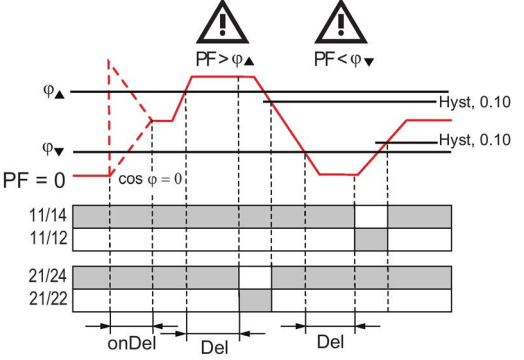
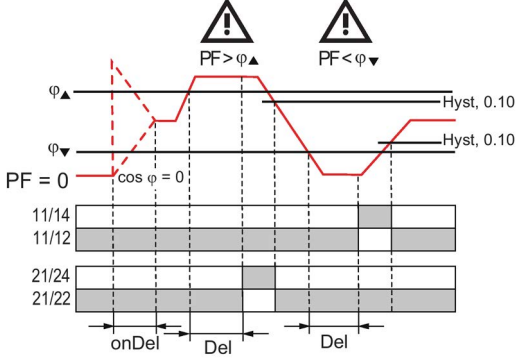
Function diagrams 3UG4641 (active current monitoring  $I_{res}$ )

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
 <p><math>I_{r\blacktriangle}</math> <math>I_{r\blacktriangledown}</math> = off</p>		
<p><math>I_{r\blacktriangle}</math> = off <math>I_{r\blacktriangledown}</math></p> 		
<p><math>I_{r\blacktriangle}</math> <math>I_{r\blacktriangledown}</math></p> 		

J = currently set current value

I = set threshold value for the current

Function diagrams 3UG4641 (cos phi monitoring)

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
 <p><math>\varphi \blacktriangle</math> <math>\varphi \blacktriangledown = \text{off}</math></p>		
<p><math>\varphi \blacktriangle = \text{off}</math> <math>\varphi \blacktriangledown</math></p> 		
		

$\cos \varphi$  = currently set value for  $\cos \varphi$   
 PF = power factor = set threshold for  $\cos \varphi$

## 11.4 Operation

### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



### Parameter information

The table below shows the settable parameter information of the 3UG4641 cos phi and active current monitoring relays:

Table 11- 2 Parameter information, 3UG4641 cos phi and active current monitoring relay with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for undershoot ( $I_{res\downarrow}$ )	0.2 A or OFF	10 A	0.1 A	1 A
"RUN"	Threshold for overshoot ( $I_{res\uparrow}$ )	0.2 A	10 A or OFF	0.1 A	3 A
"RUN"	Threshold for undershoot ( $\varphi\downarrow$ )	0.1 or OFF	0,99	0,01	0,2
"RUN"	Threshold for overshoot ( $\varphi\uparrow$ )	0,1	0.99 or OFF	0,01	0,5
"SET"	Hysteresis (Hyst)	0.1 A	2 A	0.1 mA	0.5 A
"SET"	ON-delay time (onDel)	0 s	99 s	1 s	Deactivated (0 s)
"SET"	Tripping delay time (Del)	0.1 s	20 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC or NO		--	NC

#### Note

The monitoring mode "Overshoot" or "Undershoot" is defined with the setting OFF at the threshold for undershoot or overshoot.

The parameters are described in Chapter "Parameters (Page 363)."

Menu-based operation is described in Chapter "Menu-based operation (Page 39)."



## 11.5 Diagnostics

### 11.5.1 Indications on the display

#### Display information

The display is divided into three different areas.



- ① Current measuring value / cos phi measuring value or error symbol
- ② Type of monitoring
- ③ Symbols of the changeover contacts

#### Meaning of the information on the display

##### Note

##### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and faults are indicated on the display as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	5.0A	Displays the measured current
②		Monitoring for overshoot ( $\varphi^{\blacktriangle}$ / $I_{res}^{\blacktriangle}$ ) (output relay K2)
②		Monitoring for undershoot ( $\varphi^{\blacktriangledown}$ / $I_{res}^{\blacktriangledown}$ ) (output relay K1)
②		Window monitoring ( $\varphi^{\blacktriangle}$ and $\varphi^{\blacktriangledown}$ / $I_{res}^{\blacktriangle}$ and $I_{res}^{\blacktriangledown}$ )
②	◀	Measuring values are in the correct range
②	▲	A measuring value overshoot has occurred
②	▼	A measuring value undershoot has occurred
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>
③		<ul style="list-style-type: none"> <li>• Not flashing: Relay contact 21/22 open, relay contact 21/24 closed</li> <li>• Flashing: Delay time (ON-delay or tripping delay) running</li> <li>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open</li> </ul>

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 291)."

## 11.5.2 Reset

### RESET



How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

- Manual RESET (Memory = 1 / Mem = yes)

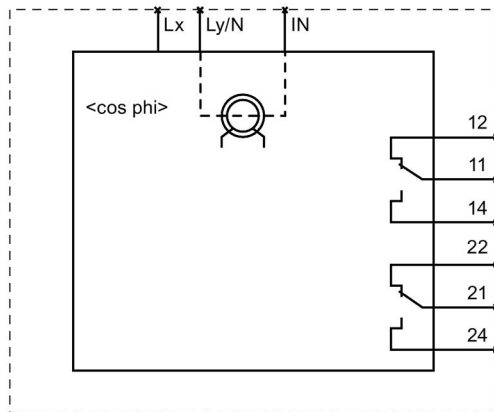
To reset the devices with digital setting, it is necessary to press both arrow keys   simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

## 11.6 Circuit diagrams

### 11.6.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4641

##### 3UG4641 cos phi and active current monitoring relay



### 11.6.2 Wiring examples

#### Cos phi and active current monitoring for single-phase motors

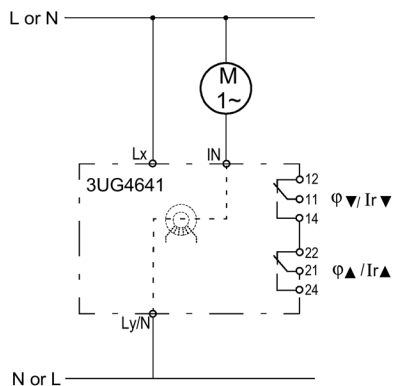
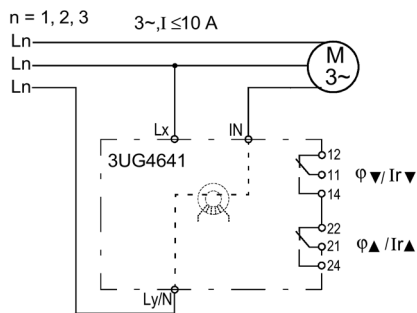
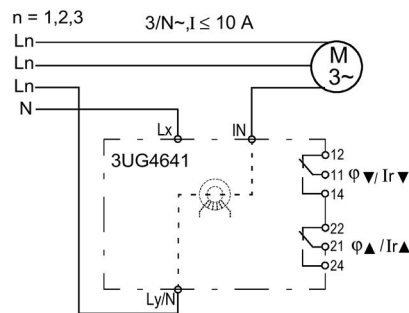


Image 11-1 Cos phi and active current monitoring for single-phase motors

#### Cos phi and active current monitoring for three-phase motors

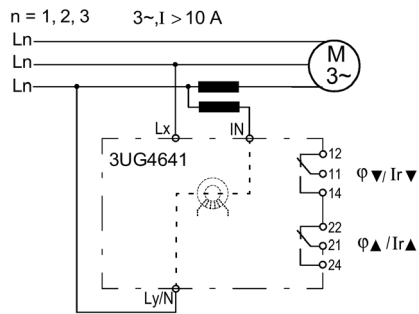


Cos phi and active current monitoring for three-phase motors

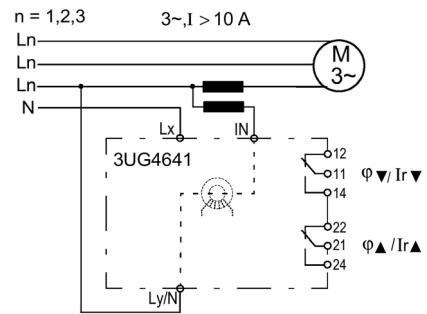


Cos phi and active current monitoring for three-phase motors (with neutral conductor)

Cos phi and active current monitoring for three-phase motors with transformers for currents



Cos phi and active current monitoring for three-phase motors with transformers for currents



Cos phi and active current monitoring for three-phase motors with transformer for currents (with neutral conductor)

## 11.7 Technical data

### Measuring circuit

		3UG4641
Number of poles for main current circuit		2
Phase number		1
Adaptable response value phase angle	°	0.1 ... 0.99
Type of current for monitoring		AC
Measurable current	A	0.2 ... 10
Adjustable response current 1	A	0.2 ... 10
Adjustable response current 2	A	0.2 ... 10
Adjustable response delay time		
• when starting	s	0 ... 99
• with lower or upper limit violation	s	0.1 ... 20
Adjustable switching hysteresis for measured current value	A	0.1 ... 2
Stored energy time at mains power cut minimum	ms	10
Operating voltage		
• rated value	V	90 ... 690

## General technical details

		3UG4641-.....
<b>Product function</b>		Active power monitoring relay
<b>Design of the display</b>		LCD
<b>Product function</b>		
• overcurrent recognition of 1 phase		Yes
• undercurrent recognition of 1 phase		Yes
• reset external		Yes
• open-circuit or closed-circuit current principle		Yes
<b>Starting time after the control supply voltage has been applied</b>	s	1
<b>Response time maximum</b>	ms	300
<b>Relative metering precision</b>	%	10
<b>Precision of digital display</b>		+/-1 digit
<b>Relative repeat accuracy</b>	%	1
<b>Type of voltage of the controlled supply voltage</b>		AC
<b>Control supply voltage</b>		
• at 50 Hz at AC rated value	V	90 ... 690
• at 60 Hz at AC rated value	V	90 ... 690
<b>Working range factor supply voltage rated value</b>		
• at 50 Hz for AC		1
• at 60 Hz for AC		1
<b>Impulse voltage resistance rated value</b>	kV	6
<b>Recorded real power</b>	W	2
<b>Protection class IP</b>		IP20
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4
<b>Operating current at 17 V minimum</b>	mA	5
<b>Continuous current of the DIAZED fuse link of the output relay</b>	A	4
<b>Resistance against vibration according to IEC 60068-2-6</b>		1 ... 6 Hz: 15 mm, 6 ... 500 Hz: 2g
<b>Resistance against shock according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms
<b>Installation altitude at a height over sea level maximum</b>	m	2 000

11.7 Technical data

		3UG4641-.....
<b>Current carrying capacity of output relay</b>		
• at AC-15		
– at 250 V at 50/60 Hz	A	3
– at 400 V at 50/60 Hz	A	3
• at DC-13		
– at 24 V	A	1
– at 125 V	A	0.2
– at 250 V	A	0.1
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV
<b>Electrostatic discharge according to IEC 61000-4-2</b>		6 kV contact discharge / 8 kV air discharge
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m
<b>Thermal current of the contact-affected switching element maximum</b>	A	5
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	690
<b>Degree of pollution</b>		3
<b>Ambient temperature</b>		
• during operating	°C	-25 ... +60
• during storage	°C	-40 ... +85
• during transport	°C	-40 ... +85
<b>Galvanic isolation</b>		
• between entrance and outlet		Yes
• between the outputs		Yes
• between the voltage supply and other circuits		Yes
<b>Mechanical operating cycles as operating time typical</b>		10 000 000
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000



## Mechanical design

		3UG4641-1....	3UG4641-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	102	103
<b>Depth</b>	mm	91	
<b>Built in orientation</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Type of mounting</b>		snap-on mounting	
<b>Product function removable terminal for auxiliary and control circuit</b>		Yes	

11.7 Technical data

		3UG4641-1....	3UG4641-2....
<b>Design of the electrical connection</b>		screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-section</b>			
• solid		1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
• finely stranded			
– with wire end processing		1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> )	2 x (0.25 ... 1.5 mm <sup>2</sup> )
– without wire end processing		—	2x (0.25 ... 1.5 mm <sup>2</sup> )
• for AWG conductors			
– solid		2x (20 ... 14)	2x (24 ... 16)
– stranded		2x (20 ... 14)	2x (24 ... 16)
<b>Tightening torque</b>			
• with screw-type terminals	N·m	1.2 ... 0.8	— ...
<b>Number of change-over switches delayed switching</b>		2	

## 3UG4651 speed monitoring relay

### 12.1 Application areas

#### Application areas

The speed monitoring relays are used, for example, in the following applications:

Table 12- 1 Application areas of the speed monitoring relays

Function	Application
<ul style="list-style-type: none"> <li>Monitoring for overload/underload</li> </ul>	<ul style="list-style-type: none"> <li>Conveyor belt (monitoring transported goods for completeness, for example)</li> <li>Milling machine</li> <li>Turning machine</li> <li>Slippage or tear of a drive belt</li> </ul>

The speed monitoring relays can also be used for all functions where a continuous pulse signal is to be monitored (e.g. belt travel monitoring, completeness check, pass monitoring, or cycle time monitoring).

## 12.2 Operator controls and connection terminals

### Front view / terminal labeling 3UG4651

Front view	Description
	<b>Position digits</b>
	① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.
	② Arrow keys for menu navigation
	③ SET key for menu navigation
	④ Device article number
	⑤ Label
	⑥ Legend for menu
	⑦ Display for parameterization, actual-value indication, and diagnostics
	<b>Terminal labels</b>
	A1+ Rated control supply voltage ~ / +
	A2- Rated control supply voltage ~ / -
	24V Supply voltage for pulse input IN1 (24 V / max. 50 mA)
	IN1 Pulse input for pnp-switching three-wire sensor (for 0 V DC/ +24 V pulses)
	0V Supply voltage for pulse input IN1 (0 V / max. 50 mA)
EN Enable	
RES Reset	
IN2 Pulse input for two-wire NAMUR sensor or mechanical contact	
8V2 Supply voltage for pulse input IN2	
12 Output relay K1 CO contact NC contact	
11 Output relay K1 CO contact root	
14 Output relay K1 CO contact NO contact	

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 21)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 315)".

## 12.3 Functions

### General functionality

Depending on the setting, the speed monitoring relays monitor a speed in revolutions per minute (rpm) for **overshoot** (rpm▲), **undershoot** (rpm▼) or in **range monitoring** (rpm▲ and rpm▼). Depending on their design, the devices are powered with a rated control supply voltage of 24 V AC/DC or 24 to 240 V AC/DC supply voltage through terminals A1/A2.

The 3UG4651 speed monitoring relays have a display and are parameterized with three keys.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 312)."

You will find a description of the individual parameters in Chapter "Parameters (Page 363)."

Speed monitoring functions according to the principle of period duration measurement.

In the speed monitoring relay, the time interval between two consecutive rising edges of the pulse encoder is measured and compared with the minimum and/or maximum permissible period duration calculated from the set threshold values for the speed. Period duration measurement detects a speed deviation after only two pulses.

By using up to ten pulse encoders distributed simultaneously across the range, the period duration, and thus the response time, can be reduced. By taking account of the number of sensors in the speed monitoring relay, the speed continues to be displayed in revolutions per minute.

The number of pulses supplied by the pulse encoder can be defined with the help of entering a scaling value (Scale). This allows the revolutions per minute to be read direct on the display.

The speed monitoring relays have two different pulse inputs. Only one of these may be used! A pnp-switching three-wire sensor for 0 V / +24 V DC pulses can be connected at terminal IN1. It is supplied from the output relay via terminals 0V and 24V / with up to 50 mA. Use of a mechanical pulse contact with an external DC supply of 4.5 to 30 V is also permissible at terminal IN1.

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#### Note

To detect the edges reliably, the pulses and pauses between pulses of the pulse encoders used must be applied for at least 5 ms. A pause is detected when the voltage level < 1 V. A pulse requires a minimum value of 4.5 V.

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Alternatively, a two-wire NAMUR sensor supplied from terminal 8V2, or a mechanical contact, can be connected at terminal IN2.

## Monitoring

### Startup delay

To be able to start a drive, the output relay switches to the correct state during the ON-delay time (onDel) depending on the selected open-circuit principle or closed-circuit principle, even if the measured value is still under the set value.

The ON-delay time is started either by switching on the rated control supply voltage or, if the rated control supply voltage is present, by actuating the relevant contact (e.g. auxiliary contact of a contactor).

### Tripping delay

If the measured value overshoots or undershoots the set threshold after expiry of the ON-delay time (onDel), the set tripping delay time (Del) and the relay symbol will flash. After expiry of this time, the output relays change the switching state. On the display, the current measuring value and the symbol for undershoot or overshoot flash.


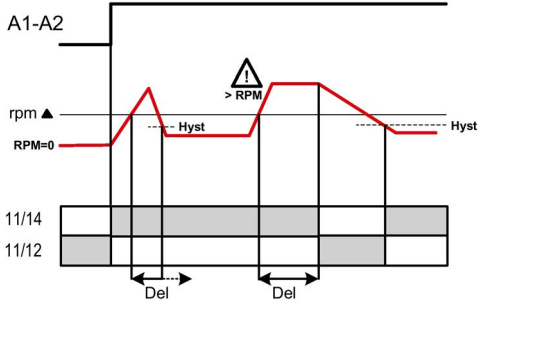
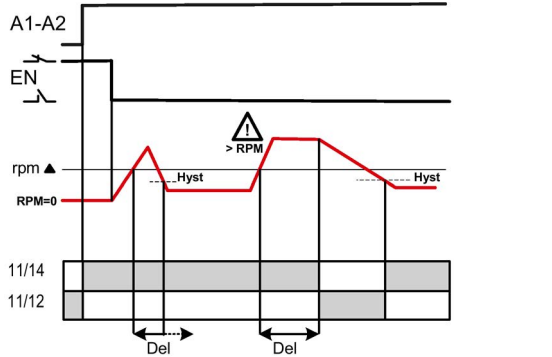

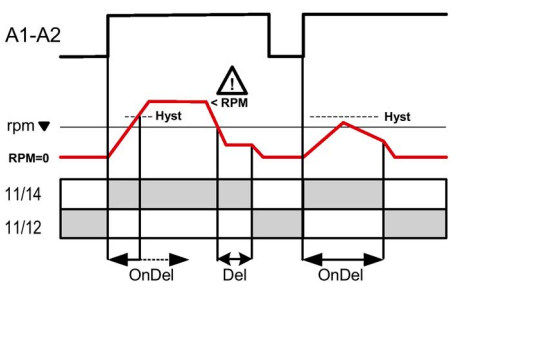
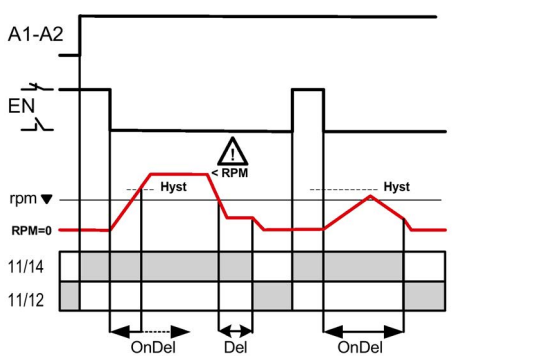

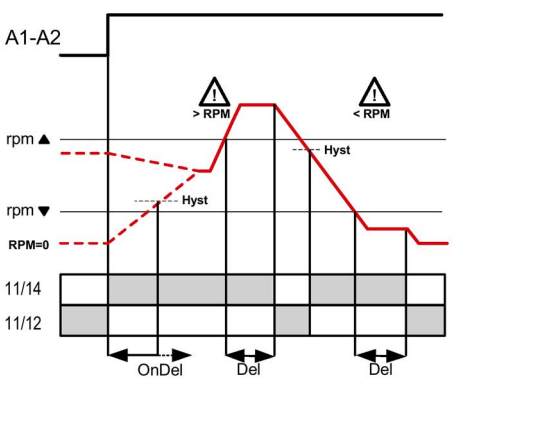
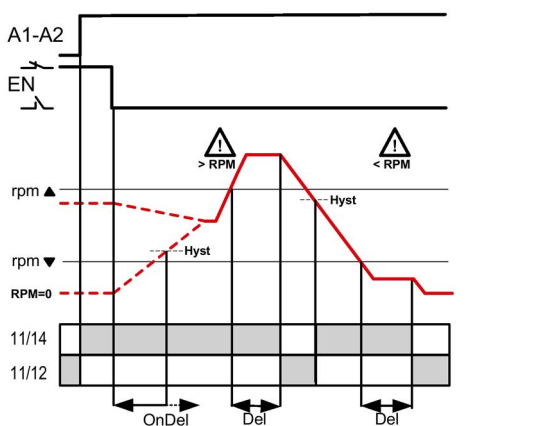
### Operating mode with/without enable contact

In the operating mode without enable contact (terminal EN = Enable not connected), the output relay responds when the rated control supply voltage is switched in accordance with the set closed-circuit principle NC or open-circuit principle NO (relay control is inverted to the closed-circuit principle NC), and the ON-delay time (onDel) is started, provided the lower threshold is not at OFF. If the speed reaches the lower threshold value plus the set hysteresis during this time, the ON-delay time is stopped and normal monitoring begins. If this value has not yet been reached after expiry of the ON-delay time, the output relay switches to the fault state depending on the selected relay switching behavior.

For the functioning of the operating mode with enable contact (terminal EN = Enable is connected to terminal 24V with an isolated NC contact), a rated control supply voltage must be present at terminals A1 and A2 on the monitoring relay. Only when this NC contact is actuated will the ON-delay time (onDel) and the drive (with a second contact, for example) be started.

You will find the switching states of the output relay below in the section entitled "Function diagrams" and in Chapter "Diagnostics (Page 313)."

Function diagrams 3UG4651

Display	Memory = no Relay switching behavior = NC (closed-circuit principle)	
	Without Enable input	With Enable input
<p>rpm ▲ rpm ▼ = off</p> 		
<p>rpm ▲ = off rpm ▼</p> 		
<p>rpm ▲ rpm ▼</p> 		

RPM = currently measured speed

rpm = set threshold for the speed

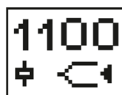
**Note**

The relay control for the open-circuit principle NO is inverted to the represented function diagrams in the closed-circuit principle NC after application of the rated control supply voltage  $U_s$ .

## 12.4 Operation

### Parameters

Parameterization of the devices is possible locally using the display and the three keys.



### Parameter information

The table below shows the settable parameter information of the 3UG4651 speed monitoring relays:

Table 12- 2 Parameter information, 3UG4651 speed monitoring relays with digital setting

Menu level	Parameters	Setting range		Increment	Factory setting
		Minimum value	Maximum value		
"RUN"	Threshold for undershoot (rpm▼)	0.10 or OFF	2200 or OFF	0,1	800
"RUN"	Threshold for overshoot (rpm▲)	0.10 or OFF	2200 or OFF	0,1	1400
"SET"	Scaling factor (Scale)	1	10	1	1
"SET"	Hysteresis (Hyst)	0.1 or OFF	99,9	0,1	Disabled (OFF)
"SET"	ON-delay time (onDel)	0 s	900.0 s	0.1 s	Deactivated (0 s)
"SET"	Tripping delay time (Del)	0.1 s	99.9 s	0.1 s	0.1 s
"SET"	Reset response (Mem)	no = Autoreset	yes = Hand-RESET	--	no = Autoreset
"SET"	Relay switching behavior (closed-circuit principle NC / open-circuit principle NO)	NC or NO		--	NC

#### Note

The monitoring mode "Overshoot" or "Undershoot" is defined with the setting OFF at the threshold for undershoot or overshoot.

The parameters are described in Chapter "Parameters (Page 363)."

Menu-based operation is described in Chapter "Menu-based operation (Page 39)."

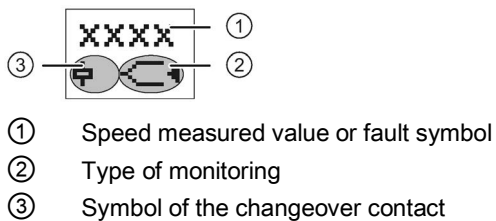


## 12.5 Diagnostics

### 12.5.1 Indications on the display

#### Display information

The display is divided into three different areas.



#### Meaning of the information on the display

##### Note

##### Indications in the event of a fault

The symbols on the display flash to indicate an error.

The following statuses and faults are indicated on the display as a diagnostics message with flashing symbols:

Display area	Symbol	Meaning
①	1100	Measured speed is displayed
②		Monitoring for speed overshoot (rpm▲)
②		Monitoring for speed undershoot (rpm▼)
②		Range monitoring (rpm▲ and rpm▼)
②	◀	Speed is in the correct range
②	▲	A speed overshoot has occurred
②	▼	A speed undershoot has occurred
③		<ul style="list-style-type: none"> <li>Not flashing: Relay contact 11/12 open, relay contact 11/14 closed</li> <li>Flashing: Delay time (ON-delay or tripping delay) running</li> <li>Masked out: Relay contact 11/12 closed, relay contact 11/14 open</li> </ul>

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 309)."

## 12.5.2 Reset

### RESET


How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 363)").

The following settings can be selected:

- Automatic reset (Memory = 0 / Mem = no)

The device is reset automatically as soon as a previously occurring error has been dealt with.

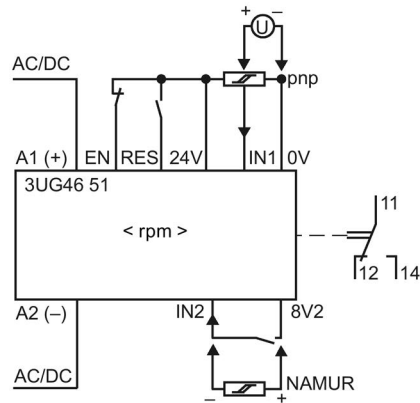
- Manual RESET (Memory = 1 / Mem = yes)

To reset the devices with digital setting, it is necessary to press both arrow keys  simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the rated control supply voltage on and off.

## 12.6 Circuit diagrams

### 12.6.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4651 speed monitoring relay



3UG4651-.AA30	24 V AC/DC
3UG4651-.AW30	24 to 240 V AC/DC

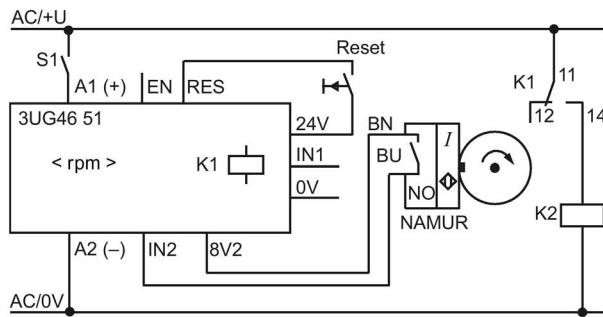
#### Note

On the 24 V AC/DC versions of the 3UG4651-.AA30, terminals A1 / A2 and 0V / 24V are electrically connected in the device!

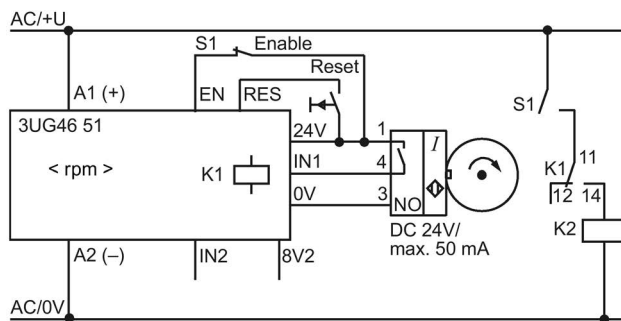
On the 24 to 240 V AC / DC versions of the 3UG4651-.AW30, terminals A1 / A2 and 0V / 24V are electrically separated!

### 12.6.2 Wiring examples

#### Speed monitoring relays without Enable input



#### Speed monitoring relays with Enable input



## 12.7 Technical data

### Measuring circuit

		3UG4651-.....
<b>Measurable line frequency</b>	Hz	50 ... 60
<b>Adjustable response delay time</b>		
• when starting	s	1 ... 900
• with lower or upper limit violation	s	0.1 ... 99.9
<b>Adjustable response value revolution</b>	1/min	0.1 ... 2 200
<b>Input voltage at the digital input 1</b>		
• initial value for signal<0>-recognition	V	0
• final value for signal<0>-recognition	V	1
• initial value for signal<1>-recognition	V	4.5
• final value for signal<1>-recognition	V	30
<b>Input current at the digital input 2</b>		
• initial value for signal<0>-recognition	mA	0
• final value for signal<0>-recognition	mA	1.2
• initial value for signal<1>-recognition	mA	2.1
• final value for signal<1>-recognition	mA	8.2
<b>Design of the input reducing-entrance</b>		No
<b>Design of the sensor</b>		
• at the digital input 1 connectable		PNP switching three-wire sensor or mechanical impulse contact with external DC supply (4.5 V ... 30 V)
• at the digital input 2 connectable		2-conductor Namur sensor or mechanical impulse contact
<b>Input current at the digital input 1 maximum</b>	mA	50
<b>Pulse duration minimum</b>	ms	5
<b>Pulse interval minimum</b>	ms	5
<b>Number of sensor signals per revolution</b>		1 ... 10
<b>Switching hysteresis for rotational speed</b>	1/min	0 ... 99.9

## General technical details

	3UG4651-..A..	3UG4651-..W..
<b>Product function</b>	RPM monitoring relay	
<b>Design of the display</b>	LCD	
<b>Product function</b>		
• rotation speed monitoring	Yes	
• standstill monitoring	No	
• defect storage	Yes	
• reset external	Yes	
• self-reset	Yes	
• manual RESET	Yes	
• open-circuit or closed-circuit current principle	Yes	
<b>Starting time after the control supply voltage has been applied</b> ms	500	
<b>Number of outputs</b>		
• as contact-affected switching element		
– safety-related		
– delayed switching	0	
– non-delayed	0	
– for reporting function		
– delayed switching	1	
– non-delayed	0	
• as contact-less semiconductor switching element		
– safety-related		
– delayed switching	0	
– non-delayed	0	
– for reporting function		
– delayed switching	0	
– non-delayed	0	
<b>Response time maximum</b> ms	100	
<b>Stored energy time at mains power cut minimum</b> ms	10	
<b>Relative metering precision</b> %	10	
<b>Precision of digital display</b>	+/- 1 Digit	
<b>Relative repeat accuracy</b> %	1	

		3UG4651-..A..	3UG4651-..W..
Type of voltage of the controlled supply voltage		AC/DC	
<b>Control supply voltage</b>			
• at 50 Hz at AC			
– rated value	V	24	24 ... 240
• at 60 Hz at AC			
– rated value	V	24	24 ... 240
• for DC			
– rated value	V	24	24 ... 240
<b>Working range factor supply voltage rated value</b>			
• at 50 Hz			
– for AC		1.1 ... 0.8	
• at 60 Hz			
– for AC		1.1 ... 0.8	
• for DC		0.8 ... 1.1	
<b>Impulse voltage resistance rated value</b>	kV	4	
<b>Recorded real power</b>	W	2	
<b>Protection class IP</b>		IP20	
<b>Electromagnetic compatibility</b>		IEC 60947-1 / IEC 61000-6-2 / IEC 61000-6-4	
<b>Operating current at 17 V minimum</b>	mA	5	
<b>Continuous current of the DIAZED fuse link of the output relay</b>	A	4	
<b>Current carrying capacity of output relay</b>			
• at AC-15			
– at 250 V at 50/60 Hz	A	3	
– at 400 V at 50/60 Hz	A	—	
• at DC-13			
– at 24 V	A	1	
– at 125 V	A	0.2	
– at 250 V	A	0.1	
<b>Resistance against shock according to IEC 60068-2-27</b>		sinusoidal half-wave 15g / 11 ms	
<b>Installation altitude at a height over sea level maximum</b>	m	2 000	
<b>Conductor-bound parasitic coupling BURST according to IEC 61000-4-4</b>		2 kV	
<b>Conductor-bound parasitic coupling conductor-earth SURGE according to IEC 61000-4-5</b>		2 kV	
<b>Conductor-bound parasitic coupling conductor-conductor SURGE according to IEC 61000-4-5</b>		1 kV	

12.7 Technical data

		3UG4651-..A..	3UG4651-..W..
<b>Electrostatic discharge according to IEC 61000-4-2</b>		6 kV contact discharge / 8 kV air discharge	
<b>Field-bound parasitic coupling according to IEC 61000-4-3</b>		10 V/m	
<b>Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value</b>	V	300	
<b>Degree of pollution</b>		3	
<b>Apparent power consumed</b>			
• at 24 V for AC maximum	V·A	2.5	4
• at 240 V for AC maximum	V·A	—	9
• at 24 V for DC maximum	V·A	—	
<b>Ambient temperature</b>			
• during operating	°C	-25 ... +60	
• during storage	°C	-40 ... +80	
• during transport	°C	-40 ... +80	
<b>Relative humidity during operating phase maximum</b>	%	—	
<b>Galvanic isolation</b>			
• between entrance and outlet		Yes	
• between the outputs		No	
<b>Mechanical operating cycles as operating time typical</b>		10 000 000	
<b>Electrical operating cycles as operating time at AC-15 at 230 V typical</b>		100 000	
<b>Operating cycles with 3RT2 contactor maximum</b>	1/h	5 000	
<b>Acceptability for application safety-related circuits</b>		No	
<b>Category according to EN 954-1</b>		none	
<b>safety Integrated Level according to IEC 61508</b>		none	



## Mechanical design

		3UG4651-1....	3UG4651-2....
<b>Width</b>	mm	22.5	
<b>Height</b>	mm	86	
<b>Depth</b>	mm	102	103
<b>Built in orientation</b>		any	
<b>Distance, to be maintained, to earthed part</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, to the ranks assembly</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	
<b>Distance, to be maintained, conductive elements</b>			
• forwards	mm	0	
• backwards	mm	0	
• sideways	mm	0	
• upwards	mm	0	
• downwards	mm	0	

12.7 Technical data

	3UG4651-1....	3UG4651-2....
<b>Type of mounting</b>	screw and snap-on mounting	
<b>Product function removable terminal for auxiliary and control circuit</b>	Yes	
<b>Design of the electrical connection</b>	screw-type terminals	spring-loaded terminals
<b>Type of the connectable conductor cross-section</b>		
<ul style="list-style-type: none"> <li>• solid</li> </ul>	1x (0.5 ... 4 mm <sup>2</sup> ), 2x (0.5 ... 2.5 mm <sup>2</sup> )	2x (0.25 ... 1.5 mm <sup>2</sup> )
<ul style="list-style-type: none"> <li>• finely stranded                             <ul style="list-style-type: none"> <li>– with wire end processing</li> <li>– without wire end processing</li> </ul> </li> </ul>	1x (0.5 ... 2.5 mm <sup>2</sup> ), 2x (0.5 ... 1.5 mm <sup>2</sup> ) —	2 x (0.25 ... 1.5 mm <sup>2</sup> ) 2x (0.25 ... 1.5 mm <sup>2</sup> )
<ul style="list-style-type: none"> <li>• for AWG conductors                             <ul style="list-style-type: none"> <li>– solid</li> <li>– stranded</li> </ul> </li> </ul>	2x (20 ... 14) 2x (20 ... 14)	2x (24 ... 16) 2x (24 ... 16)
<b>Tightening torque</b>		
<ul style="list-style-type: none"> <li>• with screw-type terminals</li> </ul>	N·m	0.8 ... 1.2 — ...
<b>Number of NO contacts delayed switching</b>	0	
<b>Number of NC contacts delayed switching</b>	0	
<b>Number of change-over switches delayed switching</b>	1	

## Accessories

### 13.1 Accessories for 3RR2 current monitoring relays

#### 13.1.1 Sealable cover

##### Description

A sealable cover for use with all sizes (3RR2940) is available for the 3RR2 current monitoring relays with digital and analog setting.

The sealable cover is used to protect the rotary buttons and the slide switch on the current monitoring relay with analog setting or the buttons on the current monitoring relay with digital setting against unauthorized or unintentional tampering.

Siemens also offers a sealable membrane (3TK2820-0AA00) for securing the current monitoring relays with analog setting. The sealable membrane is fixed to the front of the device and secures the rotary buttons and sliding switches against unintentional tampering.

##### Mounting

The diagram below shows an example mounting scenario based on mounting the sealable cover on the 3RR21 current monitoring relay with analog setting, size S0. The mounting sequence for the sealable cover for size S00 is exactly the same as that for size S0.

Table 13- 1 Mounting the sealable cover on the 3RR2 current monitoring relay

Step	Instructions	Figure
1	Remove the key from the cover.	
2	Insert the key into the designated opening.	
3	Attach the hooks on the cover to the openings on the current monitoring relay.	
4	Tilt the cover down.	
5	Lock the cover with the key connector to secure it against unauthorized removal.	

13.1 Accessories for 3RR2 current monitoring relays

13.1.2 Terminal support for stand-alone assembly

Description

For a stand-alone assembly or if an overload relay is being used at the same time, adapters for stand-alone installation are available for separate DIN rail mounting or screw mounting.

The accessories are exactly the same as the accessories for the 3RU21 thermal overload relay and the 3RB3 solid-state overload relay.

Table 13- 2 Stand-alone assembly of the 3RR2 current monitoring relay

Size	Connection system	Terminal support for stand-alone assembly
S00	Screw-type	3RU2916-3AA01
	Spring-loaded	3RU2916-3AC01
S0	Screw-type	3RU2926-3AA01
	Spring-loaded	3RU2926-3AC01
S2	Screw-type	3RU2936-3AA01

## Mounting

The terminal supports can be snapped onto 35 mm DIN rails according to DIN EN 50022. They can also be screw-mounted.

The figure below shows how the terminal support for stand-alone assembly is mounted and disassembled, based on the example of an analog setting current monitoring relay.

Table 13- 3 Mounting the terminal support (screw connection in the main circuit)

Step	Instructions	Figure
1	Guide the current monitoring relay into the terminal support from below.	
2	Tighten the screws on the terminal support with a Pozidriv size 2 (S00) or Pozidriv size 3 (S0) screwdriver (tightening torque 0.8 to 1.2 Nm). Check that the cable is clamped tight.	

Table 13- 4 Mounting the terminal support (spring-loaded connection in the main circuit)

Step	Instructions	Figure
1	Insert the contacts (a) into the central opening of the main terminals on the terminal support, with the contacts flush to the right. Make sure that the guide tabs are inserted into the designated slots on the terminal support.	

13.1 Accessories for 3RR2 current monitoring relays

Disassembly

Table 13- 5 Removing the terminal support (screw connection in the main circuit)

Step	Instructions	Figure
1	Undo the screws on the main conductor terminals.	
2	Release the current monitoring relay by pushing down the clip on the underside of the terminal support.	
3	Use a screwdriver to dislodge the terminal support from the current monitoring relay.	
4	Pull the current monitoring relay down and away from the contactor.	

Table 13- 6 Removing the terminal support (spring-loaded connection in the main circuit)

Step	Instructions	Figure
1	Release the current monitoring relay by pushing down the clip on the underside of the terminal support.	
2	Position the screwdriver on the terminal support as shown in the figure. Carefully dislodge the current monitoring relay from the contactor.	
3	Pull the current monitoring relay toward you and away from the terminal support.	

## 13.2 Accessories for 3UG4 monitoring relays

### 13.2.1 Sealable cover

#### Description

There is a uniform sealable cover for the monitoring relays with an overall width of 22.5 mm.

The sealable cover can be used to secure the actuators (rotary buttons, sliding switches, and keys) of the monitoring relays against unauthorized or unintentional manipulation.

Siemens also offers a sealable membrane (3TK2820-0AA00) for securing the monitoring relays with analog setting. The sealable membrane is affixed to the front of the device and secures rotary buttons and sliding switches against unintentional manipulation.

#### Note

The sealable membrane does not protect keys against unauthorized or unintentional manipulation.

#### Mounting

The figure below shows how to attach the 3RP1902 sealable cover to the monitoring relay.

Table 13- 7 Mounting the sealable cover on the monitoring relay

Step	Instructions	Figure
1	Break off the clip on the sealable cover.	
2	Insert the sealable cover into the openings on the monitoring relay.	
3	Fold up the sealable cover.	
4	Insert the clip into the opening until it engages.	
5	Seal the clip to secure it against unauthorized removal.	

### 13.2.2 Push-in lugs

#### Description

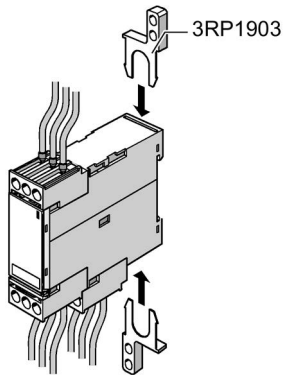
The 3RP1903 push-in lugs are available for the monitoring relays.

With the help of the push-in lugs, the monitoring relays can be secured with screws on a level surface (e.g. a wall). Two push-in lugs are required per device.

#### Mounting

The figure below shows how to attach the 3RP1903 push-in lugs to the monitoring relay.

Table 13- 8 Attaching the push-in lugs on the monitoring relay

Step	Instructions	Figure
1	Insert the push-in lugs at the top and bottom on the monitoring relay and tighten the push-in lugs with a screwdriver.	 The diagram illustrates the installation of a 3RP1903 push-in lug on a monitoring relay. The relay is shown in a perspective view with several wires extending from its top and bottom. Two U-shaped lugs are shown: one being pushed onto the top of the relay and another being pushed onto the bottom. Arrows indicate the direction of insertion. A label '3RP1903' points to the top lug.



### 13.2.3 Probes for the 3UG4501 monitoring relay

#### 3UG3207-3A three-pole wire electrode

The 3UG3207-3A three-pole wire electrode can be used for two-point filling level controls in an insulating tank. In addition to the common reference electrode there is one electrode for the min. value and one for the max. value. The three-pole wire electrode has a length of 500 mm.

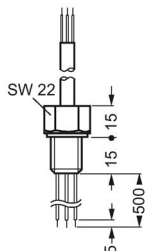


Image 13-1 3UG3207-3A three-pole wire electrode

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#### Note

The wire electrode can be cut to the required length or bent before or after installation. The Teflon insulation must be stripped back about 5 mm.

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#### 3UG3207-2A two-pole wire electrode

The 3UG3207-2A two-pole wire electrode can be used for two-point filling level control in a tank if the conductive tank is used as a reference electrode. The probe can also be used for alarm messages on overflow or undershoots. The two-pole wire electrode has a length of 500 mm.

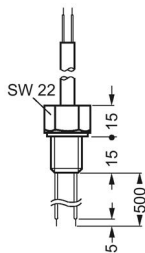


Image 13-2 3UG3207-2A two-pole wire electrode

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#### Note

The wire electrode can be cut to the required length or bent before or after installation. The Teflon insulation must be stripped back about 5 mm.

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### 3UG3207-2B two-pole bow electrode

Because of the small space requirement on side installation, the 3UG3207-2B two-pole bow electrode for leakage monitoring and level monitoring can be used in small vessels and tubes. The probe can also be used to warn of the ingress of water into a casing.

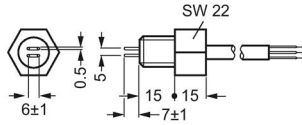


Image 13-3 3UG3207-2B two-pole bow electrode

### 3UG3207-1B single-pole bow electrode for side mounting

The 3UG3207-1B single-pole bow electrode for side mounting can also be used as a max. value electrode or for alarming in conductive tanks or tubes.

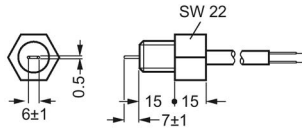


Image 13-4 3UG3207-1B single-pole bow electrode

### 3UG3207-1C single-pole rod electrode for side mounting

The 3UG3207-1C single-pole rod electrode for side mounting can be used to monitor high flow velocities

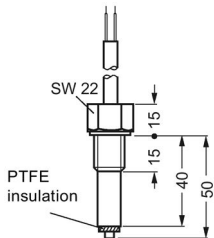


Image 13-5 3UG3207-1C single-pole rod electrode

## Technical data

Table 13- 9 Technical data - Probes for the 3UG4501 monitoring relay

Order number		3UG3207-3A	3UG3207-2A	3UG3207-2B	3UG3207-1B	3UG3207-1C
		Three-pole	Two-pole	Two-pole	Single-pole	Single-pole
<b>Length</b>	mm	500	500	—	—	—
<b>Insulation</b> (Teflon insulation PTFE)		Yes	Yes	Yes	—	Yes
<b>Mounting</b>		Vertical	Vertical	Laterally	Laterally	Laterally
<b>Screw-in gland width across the flats</b>		22				
<b>Thread</b>	Inch	R 3/8				
<b>Connecting cable</b> (2 m long)	mm <sup>2</sup>	3 x 0.5				
<b>Operating temperature</b>	°C	90				
<b>Operating pressure</b>	bar	10				
<b>Assignment: cable / electrode</b>						
• Brown cable		Medium electrode	Cannot be assigned	Gland	Gland	Gland
• White cable		Cannot be assigned	Cannot be assigned	Cannot be assigned	Electrode	Electrode
• Green cable		Cannot be assigned	—	Cannot be assigned	—	—

### 13.2.4 Summation current transformer for the 3UG4624 monitoring relay

#### Description

The 3UL22 summation current transformers acquire residual current in machines and plants. Together with the 3UG4624 residual current monitoring relay or the motor management and control unit SIMOCODE 3UF, residual current monitoring and ground-fault monitoring are possible. The 3UL22 summation current transformer is available in three sizes with a bushing opening of  $\varnothing 40$  mm,  $\varnothing 65$  mm and  $\varnothing 120$  mm.

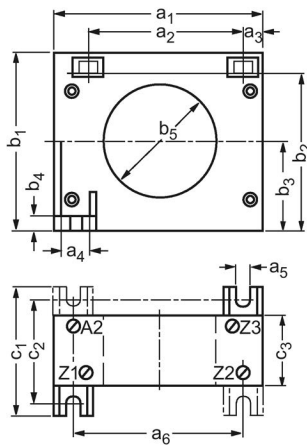


Image 13-6 3UL22 summation current transformers

Type	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	a <sub>6</sub>	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	b <sub>5</sub>	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>
3UL2201	100	75	10	15	for M4	80	85	72,5	42,5	7,5	40	65	50	40
3UL2202	125	95	10	15	for M4	100	110	97,5	55	7,5	65	70	60	45
3UL2203	200	165	20	20	for M4	170	200	100	100	10	120	85	70	55

#### Technical data

Table 13- 10 Technical data - 3UL22 summation current transformer

Order number		3UL2201	3UL2202	3UL2203
Rated insulating voltage U <sub>i</sub>	(50/60 Hz) V AC	690		1000
Rated residual current I $\Delta$ <sub>n</sub> without a response delay	A	0,3 ... 1	0,3 ... 40	0,3 ... 40
Permissible ambient temperature	°C	-20 ... +70		
Feed-through opening	mm	40	65	120
For Protodur cable push-through	max. mm <sup>2</sup>	4 x 95	4 x 240	8 x 300

## 13.2.5 3UL23 residual current transformers for 3UG4625 monitoring relays

### Description

3UL23 residual current transformers detect fault currents in machines and systems. Together with the residual current monitoring relay or the 3UF7510 SIMOCODE motor management and control device ground-fault module, residual current monitoring and ground-fault monitoring are possible. The 3UL23 residual current transformer is available in six sizes with bushing opening diameters of  $\varnothing$  35 mm,  $\varnothing$  55 mm,  $\varnothing$  80 mm,  $\varnothing$  110 mm,  $\varnothing$  140 mm, and  $\varnothing$  210 mm.

### 13.2.5.1 General information

#### Various circuit types with resulting fault currents

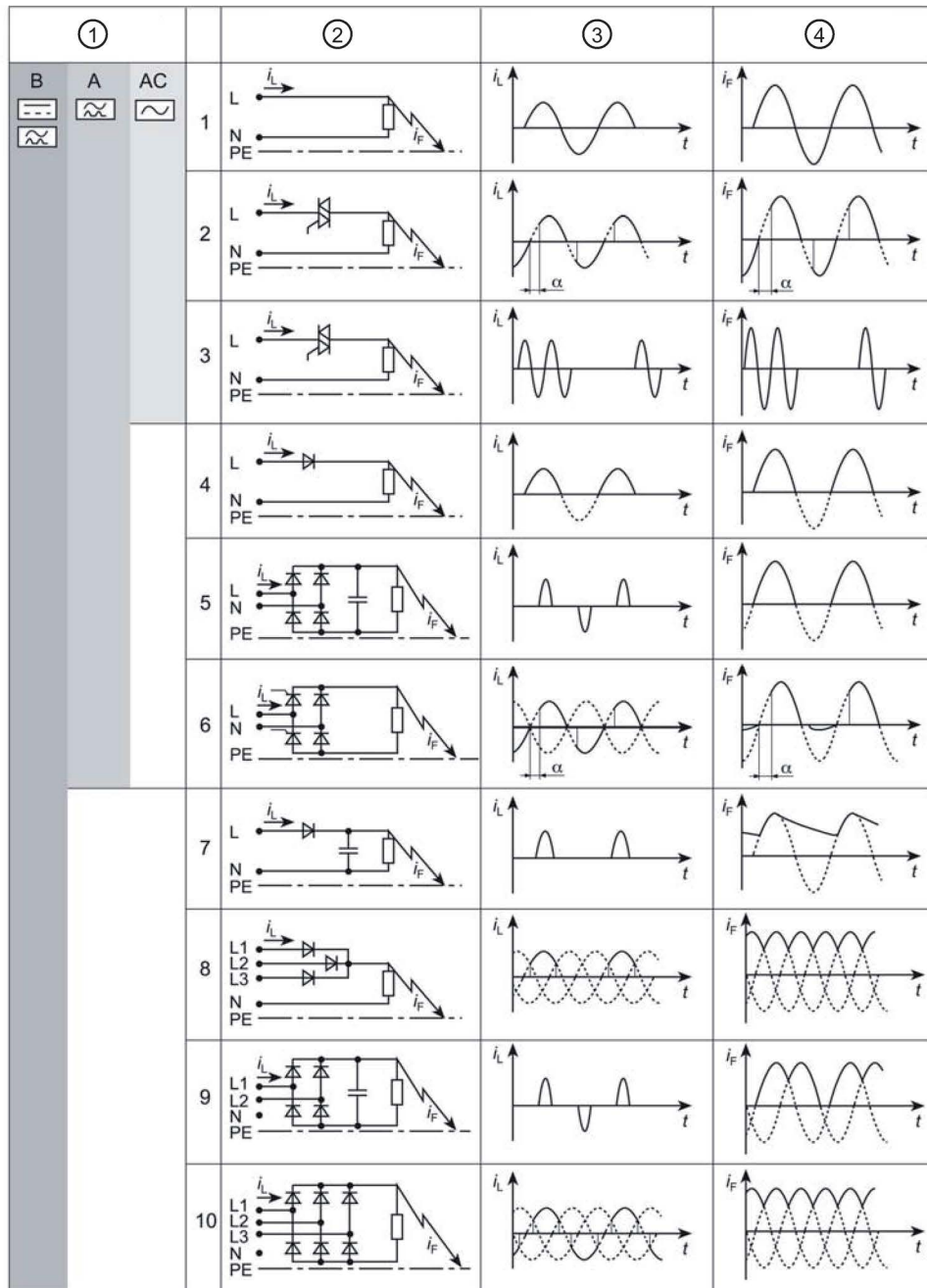
The following table shows various circuit types and the resulting fault currents in the event of a ground fault. Circuits 1 to 6 create pure AC fault currents or AC fault currents with a pulsating direct fault current component. This type of fault current can be detected by type A transformers in accordance with DIN VDE 0100-530, such as 3UL23 residual current transformers.

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#### Note

3UG4.25 residual current monitoring relays are only suitable for use with 3UL23 residual current transformers.

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- ① Suitable FI type
- ② Circuit
- ③ Load current
- ④ Fault current

Image 13-7 Possible fault current forms and suitable residual current devices

More information is available on the Internet ([www.siemens.com/industrial-controls/support](http://www.siemens.com/industrial-controls/support)).

### 13.2.5.2 Installation specifications

#### Note

Please ensure strict adherence to the installation specifications for live cables.

#### WARNING

##### Open-circuit voltage may result in death, serious injury or material damage

The current transformer output is a constant current power supply. In accordance with  $U = R \cdot I$ , the output voltage increases with an increasing resistance. If the connecting terminals of the current transformer are open, the output voltage may become high enough for you to put your life at risk or permanently damage the current transformer.

Avoid operating the unit when open. Operating a network for monitoring safely and without faults requires that the monitoring relay and the 3UL23 residual current transformer have been installed completely. It is absolutely necessary to short-circuit previously installed 3UL23 residual current transformers when the units are not connected to a monitoring relay.

#### 3UL23 residual current transformer conductor cross-sections

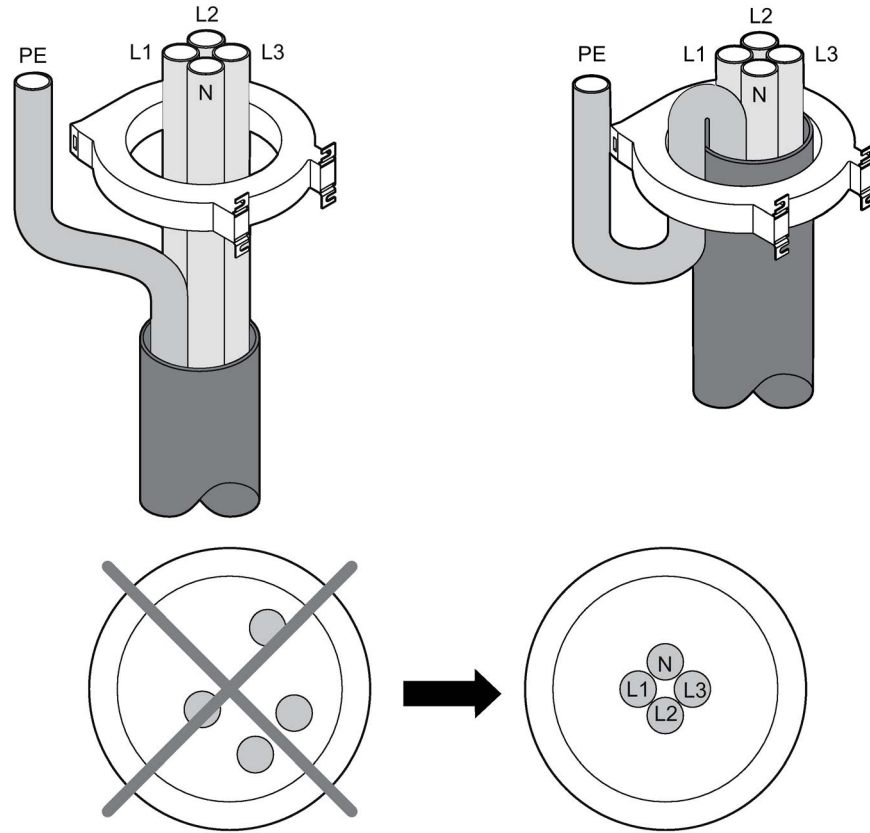
In accordance with DIN EN 60204-1 "Safety of machinery", the current carrying capacity of conductors is limited depending on their cross-section. This results in the ideally suitable residual current transformer to be used as per the following table. Please observe potentially deviating, local installation specifications.

Order number	Bushing opening Diameter [mm]	Max. conductor cross-section 3P copper cable + N [mm <sup>2</sup> ]	AWG [kcmil]	Rated current per phase [A]
3UL2302-1A	35	25	4	85
3UL2303-1A	55	50	1 / 0	150
3UL2304-1A	80	150	300	225
3UL2305-1A	110	240	500	400
3UL2306-1A	140	2 x 185	2 x 350/400	500
3UL2307-1A	210	2 x 240	2 x 500	630

3UL23 residual current transformers for external fault current monitoring

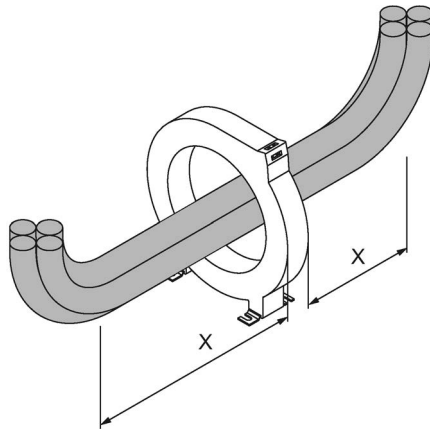
13.2 Accessories for 3UG4 monitoring relays

All live cables must be routed as close to the center of the transformer as possible. Any neutral conductor must be routed through the transformer. Grounded protective conductors must not be routed through the transformer or need to be routed through the transformer in both directions.



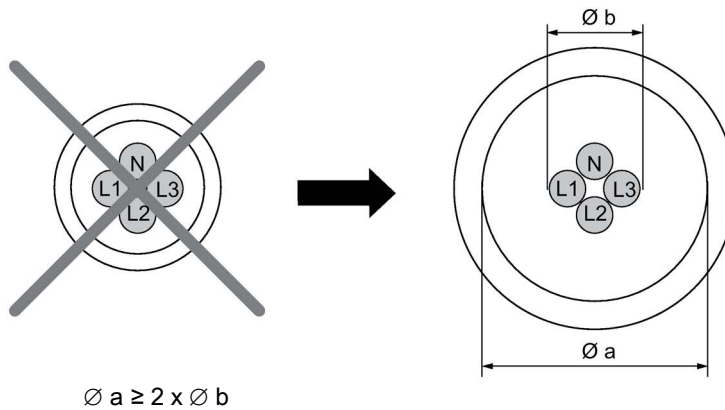


Route power cables around the residual current transformer in a straight line and ensure the area corresponds at minimum to the internal transformer diameter.



$X > \varnothing$  residual current transformer

The internal transformer diameter must be at minimum twice the size of the power cable bundle diameter.



**Transformer connection**

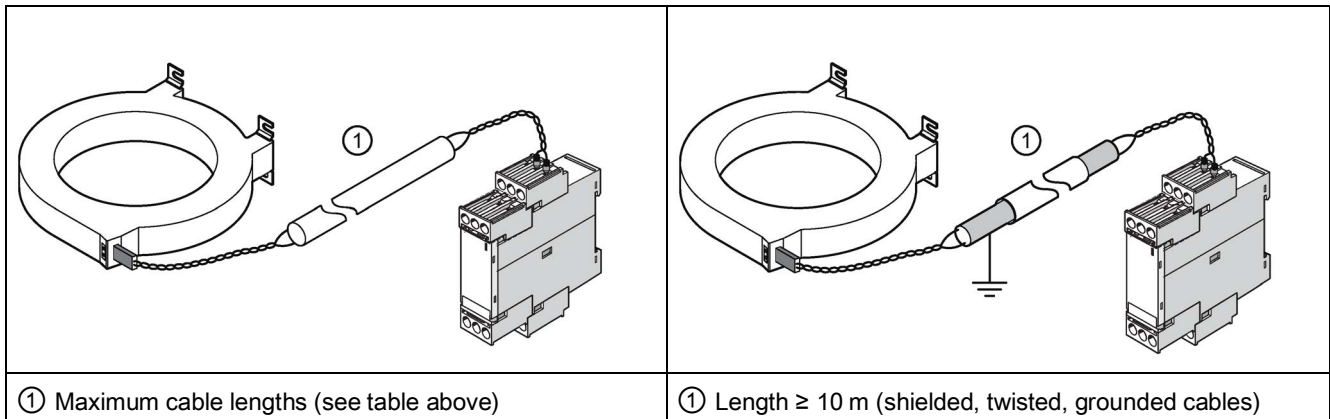
Transformer connecting cables must be twisted and not routed in parallel to live cables to protect from emitted interference. Keep the length of the connecting cables to a minimum. The resistance at the transformer connecting cable must not exceed 5 Ω to ensure correct fault current monitoring. This is ensured by the following limits given here as examples.

Conductor cross-section [mm <sup>2</sup> ]	AWG/[kcmil]	Max. cable length [m]
0.5	20	70
1.0	18	140
1.5	16	210
2.5	14 / 12	300
4.0 <sup>1)</sup>	10	550

<sup>1)</sup> only possible in the case of transformers with a 210 mm diameter

**Note**

We recommend using twisted cables.



**Note**

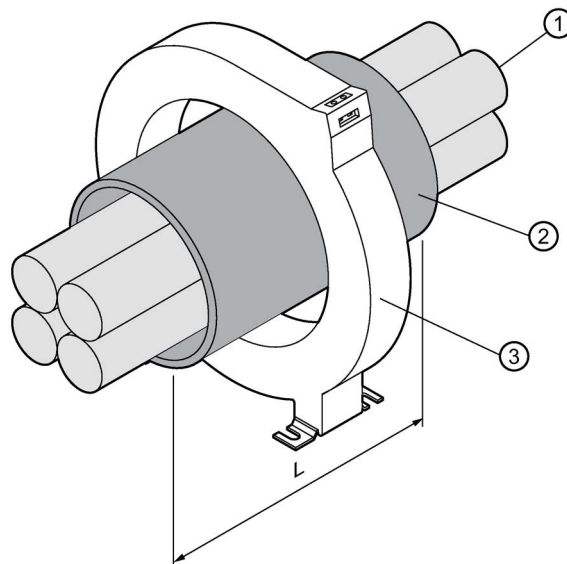
Use shielded, twisted, and grounded cables for transformer connecting cables with a length of more than 10 m.

### 13.2.5.3 Potential for optimization

#### Potential for optimization in the event of extremely high currents, false tripping due to high starting currents or in environments with high EMC interference

1. Extend the ON-delay time to fade out fault currents measured during motor startup.
2. Extend the tripping delay time to prevent false tripping due to EMC interference.
3. Select a residual current transformer with a larger internal diameter. The reduced magnetic field strength that passes through the transformer due to the extended distance between power cables and transformer reduces the measuring accuracy but also the susceptibility to interference.
4. Route the transformer connecting cables at a greater distance to live cables
5. a) Using solid shield sleeves or wound shield sleeves made of soft iron sheet metal may be advisable to be able to monitor for small fault currents at extremely high rated currents.

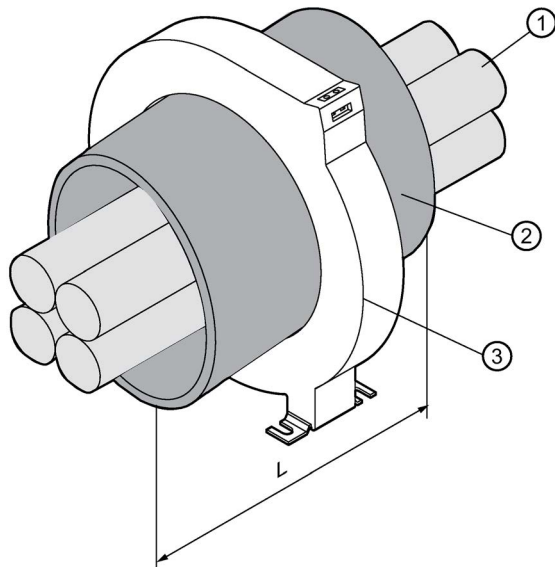
We recommend using a soft iron sheet metal shield with a thickness of 0.1 mm at minimum and fold it around the cable bundle several times so that the overall shield is 1 mm at minimum. The shielding sleeve length (L) must correspond to the internal diameter of the transformer used.



- ① Phase (and neutral conductor)
- ② Shield sleeve
- ③ Residual current transformer

13.2 Accessories for 3UG4 monitoring relays

b) A solid shield sleeve, e.g. turned from a normal, low-carbon tool steel must be precisely in contact with the internal ring of the residual current transformer. The wall thickness of the sleeve must be 1 mm at minimum, the length of the sleeve (L) must correspond to the internal diameter of the transformer used.



- ① Phase (and neutral conductor)
- ② Shield sleeve
- ③ Residual current transformer

### 13.2.5.4 Installation faults

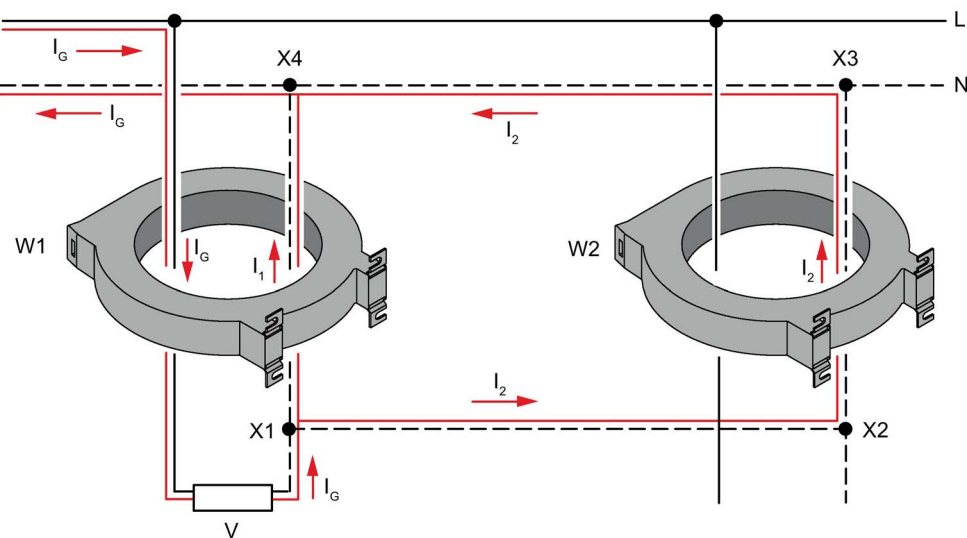
For reasons of clarity, the representations show only the residual current transformer with the currents passing through it rather than the complete residual current monitoring unit and residual current transformer. If the vectorial sum of the currents passing through the residual current transformer does not equal zero, part of the current is bypassing the transformer to ground and the residual current monitoring relay triggers a warning or an alarm if the current is correspondingly high.

In some instances, false alarms may occur for no apparent reason. However, these represent installation faults.

The following examples demonstrate the most common installation faults.

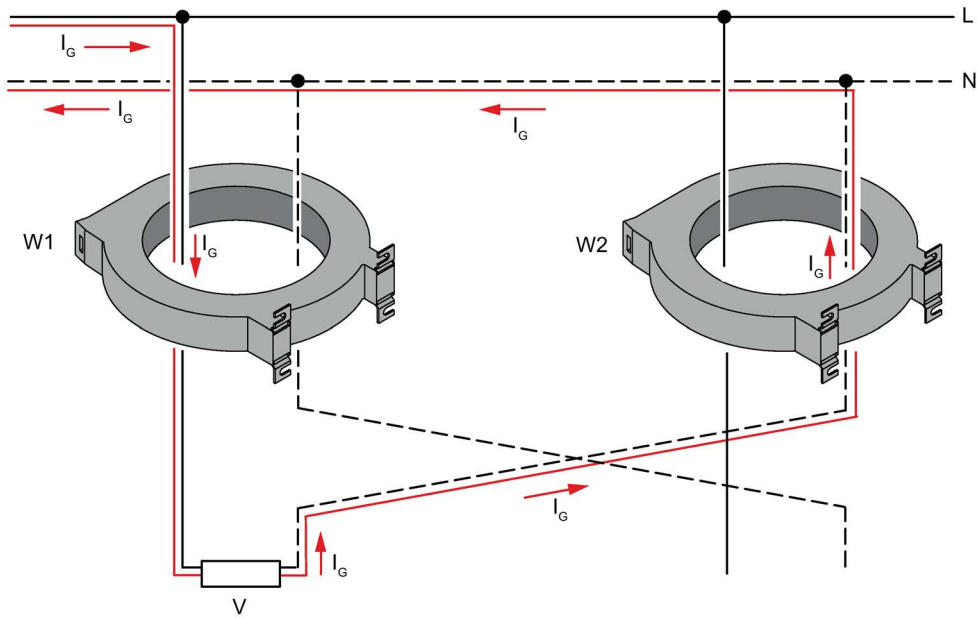
#### Parallel connections of conductors

If several residual current monitoring relays are installed in one network, a conductor routed through several residual current transformers must not be connected to itself downstream of the transformer, as this would effectively represent a parallel connection of the conductor. This fault occurs particularly often with neutral conductors. This fault causes the currents to be distributed across the conductor. This means that the current flowing through the load to be monitored is no longer 100 % of the total current and all integrated monitoring relays measure fault currents.



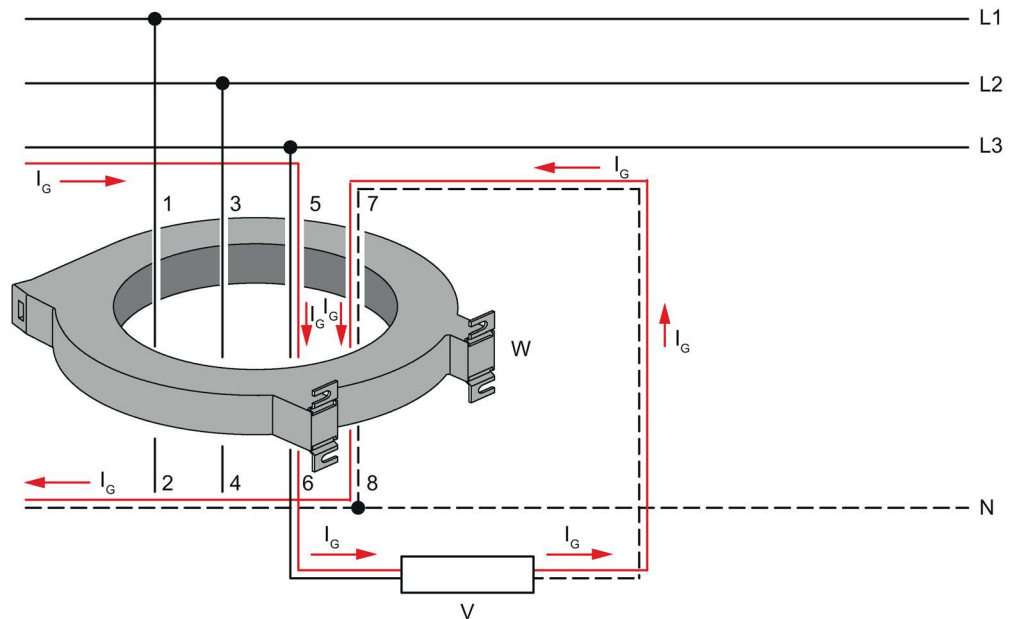
### Mixing up conductors

In a network with several loads there is the risk that active conductors of loads that are to be separately monitored for fault currents can get mixed up. This fault leads to false tripping as the inflowing and outflowing currents are not always exactly the same strength, even if the loads are identical.



**Routing contrary to the current flow**

To be able to form the vectorial sum of currents to and from a load correctly, all active conductors must be routed through the residual current transformer from the same direction. Due to the restricted space in a control cabinet it may be easier to route the neutral conductor through the transformer in the opposite direction to the phase conductor. This means the vectorial sum of currents does not equal zero, even without a ground fault, and the residual current monitoring relay trips.



**13.2.5.5 Internal circuit diagram**

**3UL23 internal circuit diagram**

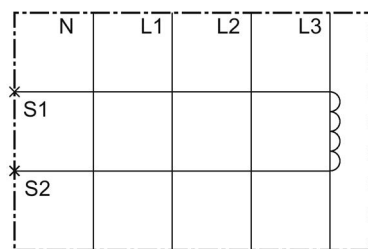
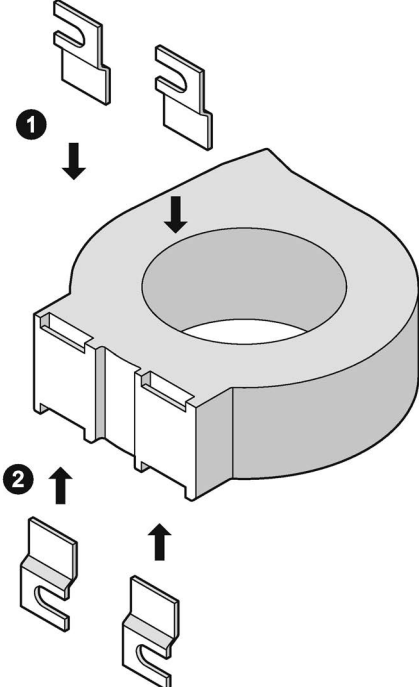


Image 13-8 3UL23 residual current transformer

### 13.2.5.6 Installing

#### Wall mounting procedure

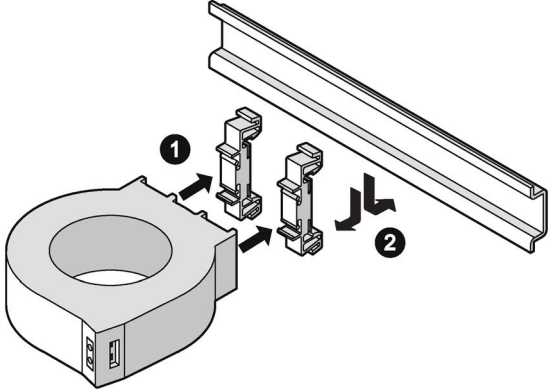
Step	Instructions	Figure
1 / 2	Insert the fixing lugs into the designated openings in the unit until they reach the stop.	
3	Place the device against the wall surface prepared for establishing a screw connection.	
4	Insert the head screws through the corresponding elongated holes in the fixing lugs.	
5	Screw the device onto the level surface so that it is secure.	



### Mounting onto standard rail

Requirement: At the installation location, a horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured.

Rail mounting is possible with residual current transformers with bushing opening diameters of up to  $\varnothing$  55 mm only (3UL2302-1A, 3UL2303-1A).

Step	Instructions	Figure
1	Mount the holder (3UL2900) to the device.	
2	Mount the device on the rail.	

## 13.2.5.7 Technical data

## 3UL2302/3UL2303/3UL2304 residual current transformers for fault current monitoring

		3UL2302-1A	3UL2303-1A	3UL2304-1A
<b>Product equipment touch-protection</b>		Yes		
<b>Height</b>	mm	64		
<b>Width</b>	mm	70	92	124.5
<b>Depth</b>	mm	75.5	98	130
<b>Ambient temperature</b>				
• during operating	°C	-25 ... +60		
<b>Type of mounting</b>		screw fixing		
<b>Diameter of the feedthrough</b>	mm	35	55	80
<b>Conductor cross section that can be connected of the terminal</b>	mm <sup>2</sup>	2.5		
<b>Item designation</b>				
• according to DIN 40719 extendable after IEC 204-2 according to IEC 750		T		
• according to DIN EN 61346-2		B		
<b>Design of the electrical connection secondary side</b>		screw-type terminals		
<b>Residual current at the input rated value</b>	A	40		

## 3UL2305/3UL2306/3UL2307 residual current transformers for fault current monitoring

		3UL2305-1A	3UL2306-1A	3UL2307-1A
<b>Product equipment touch-protection</b>		Yes		
<b>Height</b>	mm	64		62
<b>Width</b>	mm	163	201	300
<b>Depth</b>	mm	169	207.5	286
<b>Ambient temperature</b>				
• during operating	°C	-25 ... +60		
<b>Type of mounting</b>		screw fixing		
<b>Diameter of the feedthrough</b>	mm	110	140	210
<b>Conductor cross section that can be connected of the terminal</b>	mm <sup>2</sup>	2.5		4
<b>Item designation</b>				
• according to DIN 40719 extendable after IEC 204-2 according to IEC 750		T		
• according to DIN EN 61346-2		B		
<b>Design of the electrical connection secondary side</b>		screw-type terminals		
<b>Residual current at the input rated value</b>	A	40		

13.2.5.8 Dimension drawings

3UL23 residual current transformer

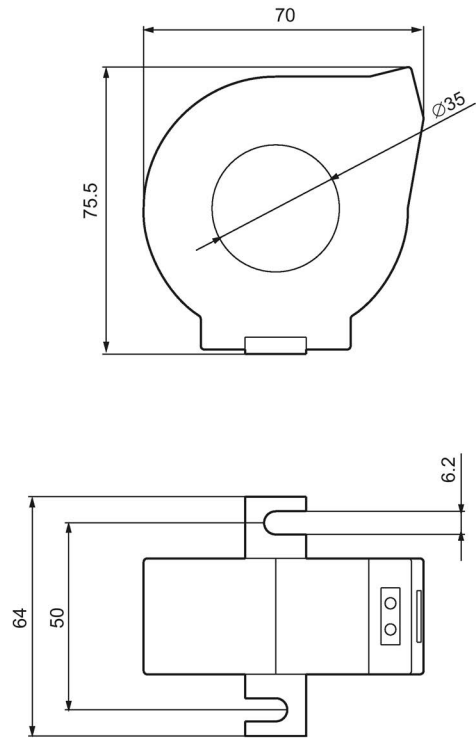


Image 13-9 3UL2302-1A

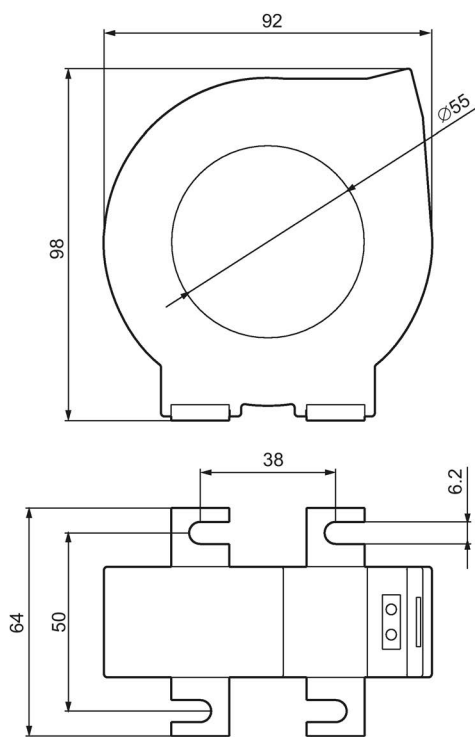


Image 13-10 3UL2303-1A

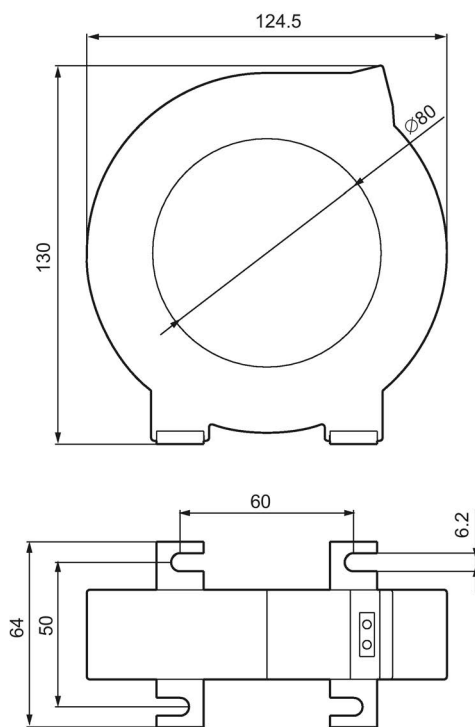


Image 13-11 3UL2304-1A

13.2 Accessories for 3UG4 monitoring relays

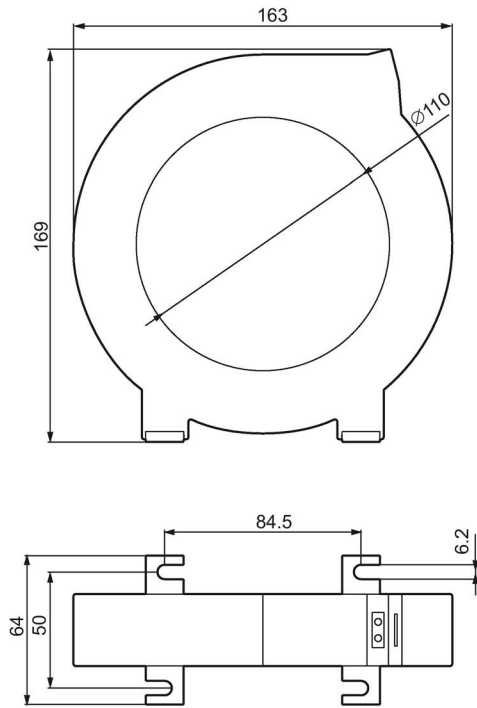


Image 13-12 3UL2305-1A

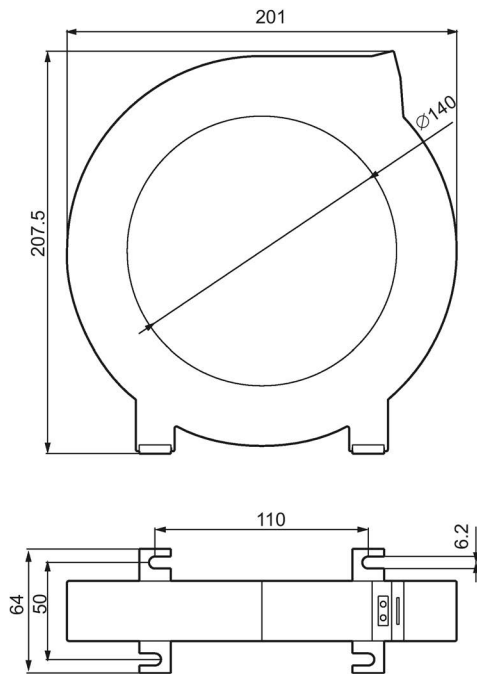


Image 13-13 3UL2306-1A

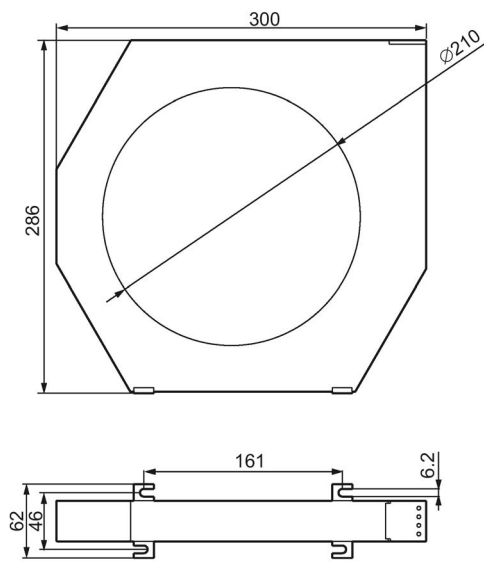


Image 13-14 3UL2307-1A

### 13.3 Accessories for 3UG458. insulation monitoring relays.

#### 13.3.1 Sealable cover

##### Description

A sealable cover compatible is available for the 3UG458. insulation monitoring relays.

Table 13- 11 Versions of the sealable cover

Sealable cover	Usability
3UG4981-0C	3UG4581-1AW30/3UG4582-1AW30
3UG4983-0C	3UG4583-1CW30

The sealable cover can be used to secure the actuators (rotary buttons and sliding switches) of the monitoring relays against unauthorized or unintentional manipulation.

Siemens also offers a sealable membrane (3TK2820-0AA00) with a width of 22.5 mm for securing the monitoring relays. The sealable membrane is affixed to the front of the device and secures rotary buttons and sliding switches against unintentional operation.

##### Installation

The figure below shows how to attach the 3UG4983-0C sealable cover to the 3UG4583 insulation monitoring relay.

Table 13- 12 Mounting the sealable cover on the monitoring relay

Step	Instructions	Figure
1	Remove the label from the monitoring relay	
2	Insert the clip into the opening on the device until it engages.	
3	Slide the sealable cover onto the monitoring relay.	
4	Secure the sealable cover against unauthorized removal with a seal on the clip.	



### 13.3.2 3UG4983 upstream module for the 3UG4583 monitoring relay

#### Description

The 3UG4983-1A passive upstream module is used for extending the measuring range of the 3UG4583 insulation monitoring relays. The upstream module enables monitoring of the insulation resistance in systems with rated system voltages of up to 690 V AC (15 to 400 Hz) and 1000 V DC in accordance with IEC 61557-8. The device does not require any rated control supply voltage for operation, and it is connected between the 3UG4583 insulation monitoring relay and the system to be monitored.

#### Note

If the continuously present voltage is greater than 600 V, a minimum gap of 10 mm must be maintained between the neighboring devices.

#### Front view/terminal labeling 3UG4983

Front view	Description	
	<b>Position digits</b>	
	①	Terminal block: Screw-type connections are possible.
	②	Device article number
	③	Circuit diagram
	④	Label
		<b>Terminal labels</b>
	VL+	Measuring signal input, connection to the system
	VL-	Measuring signal input, connection to the system
	VS	Connection to 3UG4583 terminal VS
	VE	Connection to 3UG4583 terminal
	Measuring signal input, ground connection	
L+	Connection to 3UG4583 terminal L+	
L-	Connection to 3UG4583 terminal L-	
V1+	Connection to 3UG4583 terminal V1+	
V1-	Connection to 3UG4583 terminal V1-	

**Mounting onto standard rail**

The figure below shows how to install the 3UG4983 upstream module on a standard rail.

Table 13- 13 Installing the 3UG4983 upstream module (mounting onto standard rail)

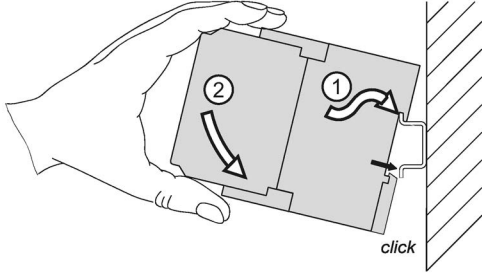
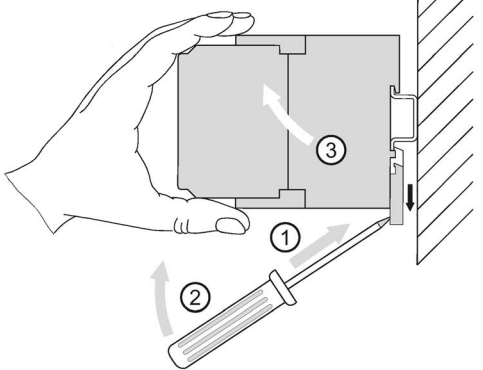
Step	Instructions	Figure
1 / 2	Position the device on the top edge of the mounting rail and press it down until it snaps onto the bottom edge of the rail.	

Table 13- 14 Disassembling the 3UG4983 upstream module (mounting onto standard rail)

Step	Instructions	Figure
1 / 2	To remove, apply the screwdriver to the device and push it up with a twisting motion against the tension of the fixing spring.	
3	Swing the device upwards to remove it.	

### 13.3.2.1 Internal circuit diagrams

#### Internal circuit diagram 3UG983-1A

#### 3UG4983-1A

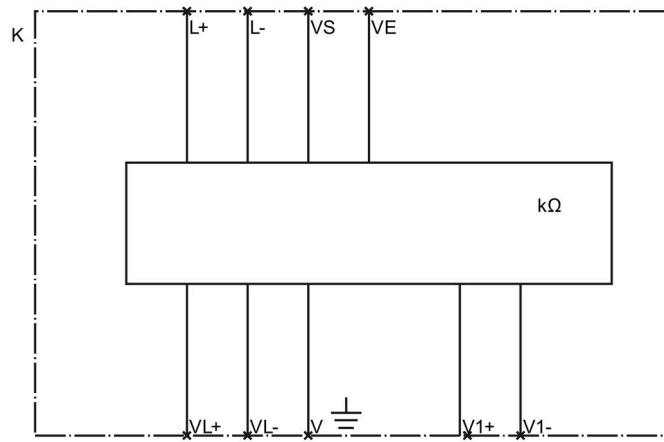


Image 13-15 3UG4983-1A insulation monitoring relay

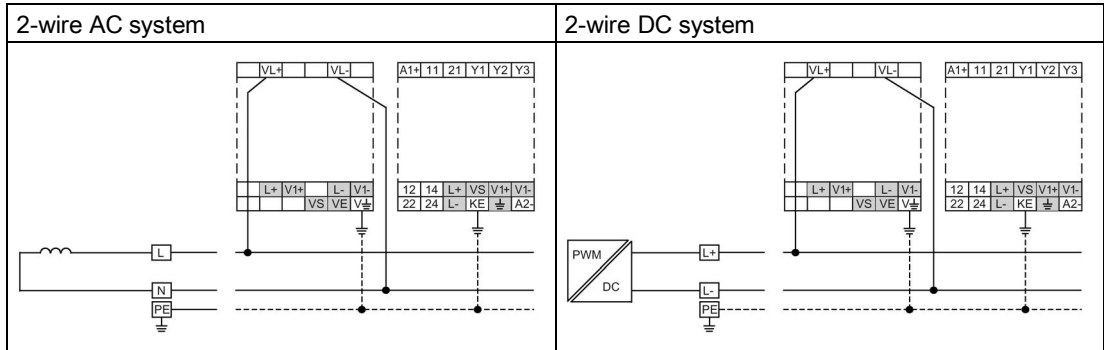
13.3 Accessories for 3UG458. insulation monitoring relays.

**Wiring examples for the 3UG4583 insulation monitoring relay with connected 3UG4983 upstream module**

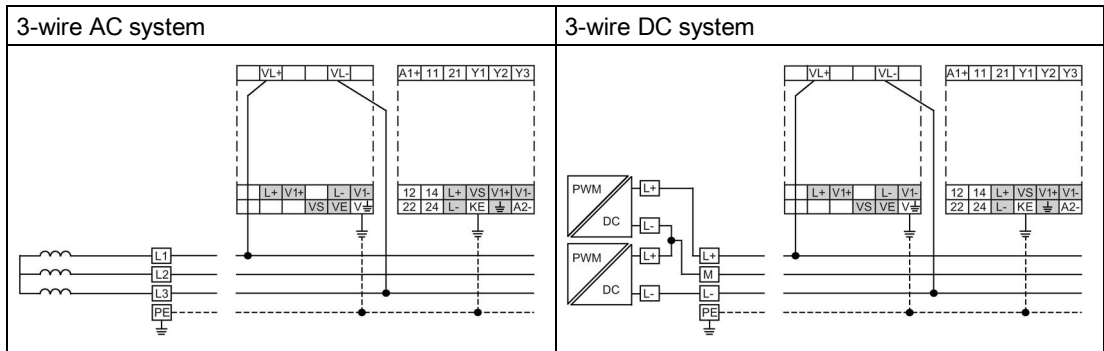
Measuring inputs L+ and L- can be connected to any conductor. Measuring inputs L+ and L- must always be connected to different conductors.

The rated system voltage is  $U_n \leq 690$  V AC (15 to 400 Hz) or  $U_n \leq 1000$  V DC.

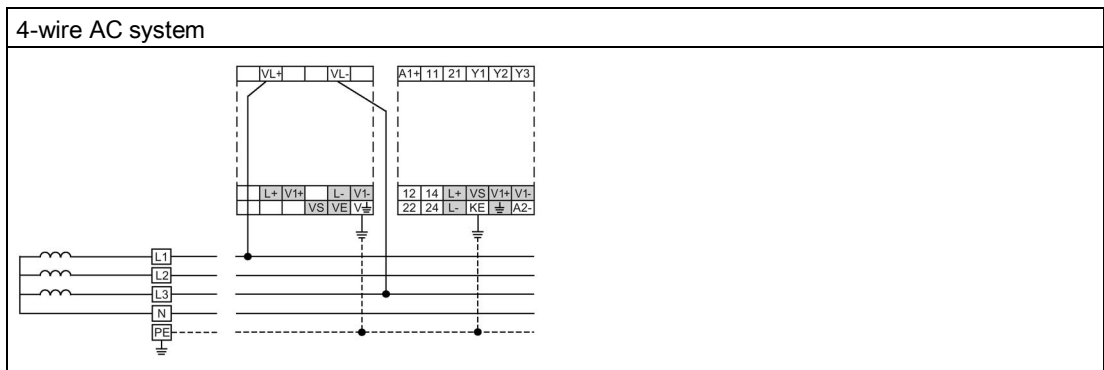
**2-wire AC system / 2-wire DC system**



**3-wire AC system / 3-wire DC system**



**4-wire AC system**



### Application example

The figure below shows how to connect the 3UG4983 upstream module to the 3UG4583 insulation monitoring relay.

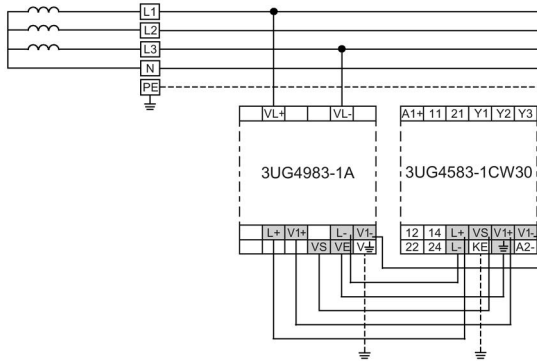


Image 13-16 Connection example: Upstream module - insulation monitoring relay

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#### Note

The maximum cable length between the 3UG4583 insulation monitoring relay and the 3UG4983 upstream module is 0.4 m.

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#### Note

The maximum cable length of the measuring circuit connections is 50 m or 100 pF/m.

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## 13.3.2.2 Technical data

## Measuring circuit

3UG4983-1A		
Type of voltage for monitoring		AC/DC
Measurable line frequency	Hz	15 ... 400
Network leakage resistance	$\mu$ F	20

## General technical details

3UG4983-1A		
Product function		upstream module
Type of voltage of the controlled supply voltage		AC/DC
Impulse voltage resistance rated value	kV	8
Protection class IP		IP20

## Mechanical design

3UG4983-1A		
Width	mm	45
Height	mm	78
Depth	mm	100
Built in orientation		any
<b>Distance, to be maintained, to the ranks assembly</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Distance, to be maintained, conductive elements</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0

## 13.3 Accessories for 3UG458. insulation monitoring relays.

		3UG4983-1A
<b>Distance, to be maintained, to earthed part</b>		
• forwards	mm	0
• backwards	mm	0
• sideways	mm	0
• upwards	mm	0
• downwards	mm	0
<b>Type of mounting</b>		snap-on fastening on 35 mm standard rail
<b>Product function removable terminal for auxiliary and control circuit</b>		No
<b>Design of the electrical connection</b>		screw-type terminals
<b>Conductor cross-section that can be connected</b>		
• solid	mm <sup>2</sup>	0.75 ... 2.5
• finely stranded		
– with wire end processing	mm <sup>2</sup>	0.75 ... 2.5
<b>AWG number as coded connectable conductor cross section</b>		
• solid		20 ... 12
• stranded		18 ... 14
<b>Tightening torque</b>		
• with screw-type terminals	N·m	0.6 ... 0.8
<b>Number of change-over switches delayed switching</b>		0

*13.3 Accessories for 3UG458. insulation monitoring relays.*



## References

### Further references

You will find further information on the 3RR2 and 3UG4 monitoring relays on the Internet (<http://support.automation.siemens.com/WW/view/en/20356134/133300>).

In addition to this manual, please refer to the operating instructions and manuals for any accessories. You can download the relevant documentation from the Internet (<http://www.siemens.com/sirius/manuals>). Simply enter the article number of the relevant item into the search field.

### Operating instructions

Title	Article number
SIRIUS monitoring relay for polyphase current monitoring S00 / S0 (3RR21)	3ZX1012-0RR21-1AA1
SIRIUS monitoring relay for polyphase current monitoring S2 (3RR2143)	3ZX1012-0RR21-4AA1
SIRIUS monitoring relay for polyphase current monitoring S00 / S0 (3RR22)	3ZX1012-0RR22-1AA1
SIRIUS monitoring relay for polyphase current monitoring S2 (3RR2243)	3ZX1012-0RR22-4AA1
SIRIUS monitoring relay for level monitoring of conductive liquids (3UG4501)	3ZX1012-0UG45-0BA1
SIRIUS monitoring relay for phase sequence monitoring (3UG4511)	3ZX1012-0UG45-3AA1
SIRIUS monitoring relay for phase sequence and phase failure monitoring (3UG4512)	3ZX1012-0UG45-2AA1
SIRIUS monitoring relay for phase sequence and undervoltage monitoring (3UG4513)	3ZX1012-0UG45-1AA1
SIRIUS monitoring relay for phase sequence, asymmetry, and undervoltage monitoring (3UG4614)	3ZX1012-0UG46-6AA1
SIRIUS monitoring relay for three-phase line monitoring (3UG4615 and 3UG4616)	3ZX1012-0UG46-1AA1
SIRIUS monitoring relay for three-phase line monitoring with phase correction (3UG4617 and 3UG4618)	3ZX1012-0UG46-3AA1
SIRIUS monitoring relay for single-phase current monitoring (3UG4621 and 3UG4622)	3ZX1012-0UG46-2AA1
SIRIUS monitoring relay for residual current monitoring, with transformer 3UL22 (3UG4624)	3ZX1012-0UG46-2BA1
SIRIUS monitoring relay for residual current monitoring, with 3UL23 (3UG4625) transformer	3ZX1012-0UG40-0AA0

<b>Title</b>	<b>Article number</b>
SIRIUS monitoring relay for single-phase voltage monitoring (3UG4631 and 3UG4632)	3ZX1012-0UG46-5AA1
SIRIUS monitoring relay for single-phase voltage monitoring, self-powered (3UG4633)	3ZX1012-0UG46-4AA1
SIRIUS monitoring relay for power factor and active current monitoring (3UG4641)	3ZX1012-0UG46-4BA1
SIRIUS monitoring relay for speed monitoring (3UG4651)	3ZX1012-0UG46-5BA1

## Manuals

<b>Title</b>	<b>Reference</b>
Functional safety - Use of SIRIUS 3UG4 and 3RR2 monitoring relays with integrated sensors	Internet ( <a href="http://support.automation.siemens.com/WW/view/en/39863898">http://support.automation.siemens.com/WW/view/en/39863898</a> )

# Parameters

## Nominal line voltage

The nominal voltage is the value of the electrical voltage during normal operation specified by the manufacturer. The nominal voltage is usually stated with a maximum permissible tolerance range. In Europe, the nominal value of the line voltage, the nominal line voltage, is 230 V (line / neutral) or 400 V (line / line).

## (Warning) threshold for voltage asymmetry

Voltage asymmetry is the difference between the highest and the lowest phase voltage in relation to the highest phase voltage  $(U_{x-y \text{ max}} - U_{x-y \text{ min}}) / U_{x-y \text{ max}}$ .

---

### Note

#### Deviation from the definition according to IEC/NEMA

The definition given above for voltage asymmetry deviates from the definition according to IEC/NEMA. It usually results in a greater value for voltage asymmetry than that arrived at from the definition according to IEC/NEMA, so that a higher level of measuring accuracy is achieved.

---

Voltage asymmetry can be parameterized as "Threshold for voltage asymmetry" or as "Warning threshold for voltage asymmetry" (only on devices for IO-Link).

If the warning threshold is reached on device variants for IO-Link, this is transmitted cyclicly via IO-Link and the relevant bits are set in the diagnostics data set or the semiconductor output (terminal C/Q) is switched in SIO mode.

If the threshold has been reached, the output relays are switched accordingly and an IO-Link message may be sent.

**Possible indications on the display:** Asy (threshold), possibly Asy! (warning threshold)

## Tripping delay time

If the measured value overshoots or undershoots the set limit value, the delay time that can be set using the "Tripping delay time" parameter starts. On expiry of this time, the switching contact changes state and a message may be sent via IO-Link.

### Possible indications on the display:

- Tripping delay time in the case of voltage undershoot:  $U\blacktriangledown\text{Del}$
- Tripping delay time in the case of voltage overshoot:  $U\blacktriangle\text{Del}$
- Tripping delay time in the case of (active) current undershoot:  $I\blacktriangledown\text{Del}$
- Tripping delay time in the case of (active) current overshoot:  $I\blacktriangle\text{Del}$
- Tripping delay time in the case of speed undershoot:  $\blacktriangledown\text{Del}$
- Tripping delay time in the case of speed overshoot:  $\blacktriangle\text{Del}$
- Tripping delay time on undervoltage or overshoot of the asymmetry value:  $\text{Del}$
- Tripping delay time for asymmetry:  $\text{AsyDel}$
- Tripping delay time in the case of undershoot of the cos phi value:  $\varphi\blacktriangledown\text{Del}$
- Tripping delay time in the case of overshoot of the cos phi value:  $\varphi\blacktriangle\text{Del}$

## ON-delay time

The setting of the "ON-delay time" parameter prevents limit violations such as undershoots (typical of inductive loads) while the system engages from generating a switching response.

The ON-delay time starts in the following cases, depending on the parameter settings:

- **At restart**

If a measurable signal is again detected after the lower measuring range limit has been undershot.

- **At Power-ON**

Re-connection of the supply voltage (Power-ON) of the device after switching off the current flow (zero current).

- **At manual reset**

A fault is acknowledged by a manual reset. Following this, the device behaves in the same way as when the supply voltage is switched on again.

### Starting the ON-delay time via IO-Link

The ON-delay time can also be started through the process image of the outputs (PIQ) by setting the control command "Start ON delay time." This is a simple method of permitting brief load steps during operation if these are predictable.

The ON-delay time can be set either locally via the three keys on the device, or via IO-Link. The requirements governing the starting of the ON-delay time (Power-ON, manual reset and/or restart) can only be modified via IO-Link.

---

#### Note

After exiting the menu level SET, the ON-delay time starts again.

---

### Start of the ON-delay

The following table shows the behavior of the ON-delay time (onDel) with the device variants 3UG4 monitoring relay and 3RR2 current monitoring relay.

Device variants	Start of the ON-delay possible for:		
	"Power-ON"	Automatic reset	Manual reset
3RR21	Yes	Yes	Yes
3RR22	Yes	Yes	Yes
3UG4614	Yes	No	No
3UG4621 / 3UG4622	Yes	Yes	Yes
3UG4624	Yes	No	No
3UG4625	Yes	No	Yes
3UG4633	Yes	No	No
3UG4641	Yes <sup>1)</sup>	Yes <sup>1)</sup>	Yes <sup>1)</sup>
3UG4651	Yes	No	No

<sup>1)</sup> Setting: I<sub>res</sub>▼ = OFF

You will find further information on the ON-delay time in the "Functionality" chapter for each monitoring relay.

**Possible indications on the display:** onDel

### (Warning) threshold for undershoot

The device monitors a measured value for undershoot.

The measured value can be parameterized as a threshold or as a warning threshold (on the 3RR22 and 3UG4583 devices only) for undershoot.

The warning threshold defines the switching threshold of the relevant output relay prior to tripping by measured value undershoot.

If the set threshold is undershot, the output relay changes its switching state after expiry of the set delay time, and an IO-Link message may be sent. If the measured value has reached the relevant set hysteresis value, the output relay (reset response is set to autoreset) will immediately revert to its original state and a new IO-Link message may be sent.

Further response depends on the set reset response (see "Reset response" parameter).

You can find information on the switching behavior of the output relays in the "Functionality" chapters of the relevant monitoring relays.

#### Possible indications on the display:

- Current undershoot: I▼ (threshold), I!▼(warning threshold)
- Voltage undershoot: U▼ (threshold), possibly U!▼ (warning threshold)
- Speed undershoot: rpm▼ (threshold), possibly rpm!▼ (warning threshold)
- Power factor undershoot:  $\varphi$ ▼ (threshold), possibly  $\varphi$ !▼ (warning threshold)
- Active current undershoot: I<sub>r</sub>▼ (threshold), possibly I<sub>r</sub>!▼ (warning threshold)

#### Possible LED indications:

- Level undershoot: Yellow LED lights up as soon as the output relay picks up, depending on the functional principle selected
- Insulation resistance undershoot: Red LED lights up continuously
- Voltage undershoot: Red LED lights up continuously

## (Warning) threshold for overshoot

The device monitors a measured value for overshoot.

The measured value can be parameterized as "Threshold for overshoot" or as "Warning threshold for overshoot" (only on devices for IO-Link).

The setting for the "Warning threshold for overshoot" parameter defines the switching threshold of the relevant output relay prior to tripping due to a measured value overshoot.

If the set "Threshold for overshoot" parameter is overshoot, the output relay will change its switching state after expiry of the set delay time and an IO-Link message may be sent. If the measured value has reached the relevant set hysteresis value, the output relay ("Reset response" parameter set to autoreset) will immediately revert to its original state and a new IO-Link message may be sent.

Further response depends on the set reset response (see "Reset response" parameter).

You can find information on the switching behavior of the output relays in the "Functionality" chapters of the relevant monitoring relays.

### Possible indications on the display:

- Current overshoot: I▲ (threshold), I!▲ (warning threshold)
- Voltage overshoot: U▲ (threshold), possibly U!▲ (warning threshold)
- Speed overshoot: rpm▲ (threshold), possibly rpm!▲ (warning threshold)
- Power factor overshoot:  $\varphi$ ▲ (threshold), possibly  $\varphi$ !▲ (warning threshold)
- Active current overshoot: I<sub>r</sub>▲ (threshold), possibly I<sub>r</sub>!▲ (warning threshold)
- Fault current overshoot: I▲(threshold), possibly I! (warning threshold)

## Reset response

The setting of the "Reset response" parameter controls how the device behaves after tripping in the event of an error, and the subsequent reversion of the measured values to the normal range once the cause of the error has been dealt with.

The outputs are reset dependent on the setting of the "Reset response" parameter. The following settings can be selected:

- Automatic reset

If the device is set to automatic reset, the switching contact will respond once the normal range plus the hysteresis threshold have been reached. The device is reset automatically as soon as a previously occurring error has been dealt with. The overshoot or undershoot which triggered the response is not saved.

- Manual RESET

If manual RESET is selected, the switching contact remains in the current switching state even if the measured value returns to a permissible value.

### Possible indications on the display: Mem

## Hysteresis

Hysteresis is the continuation of an effect within the hysteresis range after its cause has been removed; its purpose is to prevent repeated response in the threshold value range.

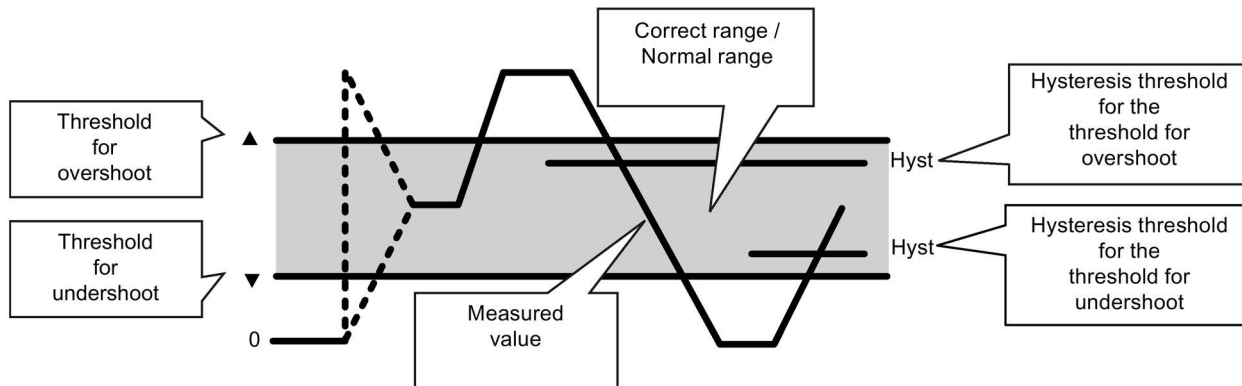


Image B-1 Explanation of hysteresis

If, after the upper threshold value has been overshoot to such an extent that switching was necessary, the measured value returns to the normal range, and switching over to the correct range will not take place until a measured value which undershoots the hysteresis threshold has been reached. The same applies if the lower threshold value is undershot.

The hysteresis is only active if the "Reset response" parameter is set to autoreset.

**Possible indications on the display:** Hyst

## Initialization

When the monitoring relay is connected to the supply voltage, the initialization phase starts and internal functional tests are performed. During the initialization phase that lasts approximately 1.6 s, the connection to the 3UL23 residual-current transformer is one of the things that is checked. During this time, no measurement or monitoring of the fault current takes place. -- A is shown on the display. The relay switching behavior during the initialization phase can be determined with the help of the "Init" parameter. In the factory setting ("Init" parameter = **ERR**), the output relays switch to the fault state until completion of the initialization phase because there is no valid measuring result of the fault current.

If the parameter is set to "OK", it is assumed that there is no internal fault and the fault current will be within the set limits. For this reason, the output relays are switched to the work position when the supply voltage is present.

After completion of the initialization phase, a permanent self-test takes place without interrupting the monitoring function.



### Restart delay time

If autoreset is activated on the monitoring relay, the restart delay will start as soon as the measured value to be monitored reenters to the correct range after an overshoot or undershoot. The associated hysteresis threshold is taken into consideration here. At the end of this time the contacts switch back to normal operation.

The restart delay time permits motor cooling if the device has tripped due to a temperature rise.

**Possible indications on the display:** RsDel

### Blocking current monitoring

If the load current overshoots the value of the set threshold for overshoot ( $I^{\Delta}$ ) by a multiple of  $n$  during operation, a blocking current error has occurred. The tripping delay time that is running due to the current threshold overshoot is stopped and the outputs are switched.

**Indication on the display:**  $n \times I^{\Delta}$

### Residual current monitoring

If residual current monitoring has been activated ( $I \gg \frac{I}{n} = \text{yes}$ ) and the total current of the load currents at terminals 1/L1 - 2/T1, 3/L2 - 4/T2 und 5/L3 - 6/T3 rises above the permissible threshold (S00: 1.5 A / S0: 4 A), the ON-delay time onDel, the tripping delay time Del, and the restart delay time RsDel are stopped and both the CO contact and the semiconductor output change their switching state immediately ( $\leq 200$  ms).

**Indication on the display:**  $I \gg \frac{I}{n} = \text{yes}$

### Nominal fault current of the summation current transformer

The 3UL22 summation current transformers differ in size (size of the let-through opening) and within each size by different nominal currents for which the summation current transformers are rated.

For the 3UG4624 fault current monitoring relay to be able to indicate the real fault current, the nominal fault current  $I_{\Delta n}$  of the connected summation current transformer must be set.

**Possible indications on the display:**  $I_{\Delta n}$

### Phase sequence monitoring

If phase sequence monitoring has been activated and the load currents exhibit the wrong phase sequence, the CO contact and the semiconductor output will change their switching status immediately ( $\leq 200$  ms).

**Possible indications on the display:** 

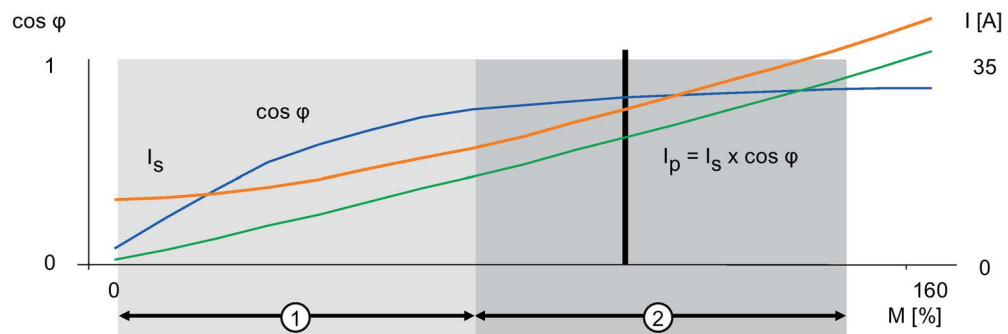
### Current monitoring principle

The monitoring relays monitor an AC load current which flows through the device terminals depending on whether monitoring has been set to check for overshoot or undershoot, or window monitoring.

There are two current monitoring principles:

- Apparent current  $I_s$
- Active current  $I_p$

Whereas apparent current monitoring is primarily used in the rated torque range or for overload, active current monitoring can be used to observe and evaluate the degree of loading across a motor's entire torque range.



- ① Strong change in  $\cos \varphi$
- ② Strong change in apparent current

$\cos \varphi$	Power factor
$I$ [A]	Current
$M$ [%]	Torque as a % of the rated torque
$I_p$	Active current
$I_s$	Apparent current

Image B-2 Load current monitoring diagram (shown using the example of a real motor)

The diagram shows that it only makes sense to use the power factor  $\cos \varphi$  to monitor the rated current up to approx. 70%. At a higher rated current the change in the power factor is too slight to produce measured values of any significance. In contrast, the monitoring quality of the apparent current  $I_s$  increases along with the torque, in other words as the rated current rises. It is for this reason that monitoring of the apparent current is primarily used if a load needs to be protected against overload. Integrated monitoring from no-load operation up to overload is only possible by monitoring the active current  $I_p$ , the product of power factor and apparent current.

#### Note

##### Determining the thresholds in practice

You can determine the thresholds by operating the motor at the load limits, for example. You can then read the thresholds as the up-to-date measured values off the display of the monitoring relay.

## Relay switching behavior

An output relay responds in accordance with the set switching behavior. Several variations can be distinguished here:

- Closed-circuit principle (NC)

If the closed-circuit principle is selected, the output relay picks up when the voltage is applied (contact .1/.4 closed). The output relay drops out in the event of a fault (contact .1/.2 closed). If the supply voltage fails, the output relay also returns to this position so that a supply voltage failure is detected and reported.

The semiconductor output responds as an NC contact, in other words, if a fault is detected, the output Q has a high resistance.

- Open-circuit principle (NO)

If the open-circuit principle is selected, the output relay only picks up in the event of a fault (contact .1/.4 closed). Interruptions to the supply voltage or the rated control supply voltage are not displayed.

The semiconductor output responds as an NO contact, in other words, if a fault is detected, the supply voltage is present at output Q.

- Drainage control (OV  $\triangleq$  NO) (on 3UG4501 only)

If the rotary button is in the OV (Overshoot) position, monitoring mode drainage control is selected. On the drainage control, contacts 11/14 are closed when the upper threshold is overshoot after the tripping delay time has expired. Contacts 11/12 are only closed when the lower threshold is undershot.

- Inflow control (UN  $\triangleq$  NC) (on 3UG4501 only)

When the rotary button is in the UN (Undershoot) position, the monitoring mode inflow control is selected and the output relay picks up when the supply voltage is applied (contact .1 / .4 closed). When the upper threshold is overshoot, the output relay drops out (contact .1/.2 closed). When the lower threshold is undershot, the output relay picks up again (contact .1/.4 closed).

Unlike with pure reconnection at the CO contact output, with use of the relay switching behavior parameter, it is possible to prevent unwanted pumping in the absence of a supply voltage.

### Possible indications on the display:

- Closed-circuit principle: NC
- Open-circuit principle: NO

## Sensor sensitivity

The sensor sensitivity is the sensitivity R sens, with which the filling level monitoring relay must respond.

The working principle of the filling level monitoring relays is based on resistance measurement of conductive liquids (conductive measurement method). This method can be used with all liquids and substances that have a resistivity < 200 kΩ.

Table B- 1 Resistivity of liquids

Product	kΩ	Product	kΩ
Buttermilk	1	Natural water	5
Fruit juice	1	Waste water treatment	5
Vegetable juice	1	Starch solution	5
Milk	1	Oil	10
Soup	2,2	Condensation	18
Beer	2,2	Soap foam	18
Coffee	2,2	Jellies	45
Ink	2,2	Gelatin	45
Salt water	2,2	Sugar solution	90
Wine	2,2	Whisky	220
		Distilled water	450

## Scaling factor

The "scaling factor" parameter allows the user to set the number of pulses per revolution provided by the pulse encoder. This allows the revolutions per minute to be read direct on the display.

**Possible indications on the display:** Scale

## Stabilization delay

An output is only switched to the "correct position" after switching on the supply voltage if all monitored measured values are stable for the duration of the stabilization delay. The monitoring functions are active within the stabilization delay. A threshold overshoot or undershoot in this time does not result in a fault, but instead in restarting of the stabilization delay.

The stabilization delay starts in the following cases:

- **At Power-ON**

Reapplication of the supply voltage (Power-ON) of the device after disconnection of the current flow (zero current).

- **At manual reset**

A fault is acknowledged by a manual reset. After this, the device responds in the same way as when the supply voltage is connected.

### Starting the stabilization delay via IO-Link

The stabilization time can also be started through the process image of the outputs (PIQ) by setting the control command "Start stabilization time."

The "Stabilization time" parameter is set either locally using the three keys on the device, or via IO-Link. The requirements governing the starting of the stabilization delay (Power-ON and/or manual reset) can only be modified via IO-Link.

The stabilization of line voltage is useful, for example, in the case of generator operation.

---

### Note

Whenever the menu level is exited SET, the stabilization time starts again.

---

**Indication on the display:** stDel

## Phase failure monitoring

If the "phase failure monitoring" parameter is activated, an immediate shutdown is carried out in the event of a failure of one of the phases (or of the N conductor) to protect the application from follow-on damage.

Set delay times have no effect on phase failure monitoring.

The "phase failure monitoring" parameter on the 3UG48 monitoring relays is set either locally via the three keys on the device, or via IO-Link.

**Possible indications on the display:**  $\text{--//}$



## Dimension Drawings

### C.1 Dimension drawings 3RR2 monitoring relay

3RR2.41-1A.30 (screw connection, S00)

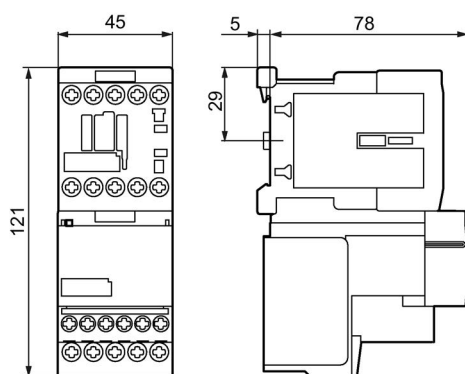


Image C-1 3RR2.41-1A.30 with contactor

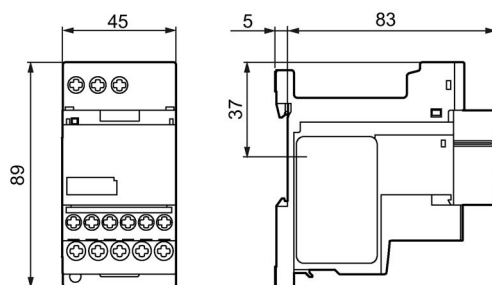


Image C-2 3RR2.41-1A.30 with terminal support for stand-alone assembly

3RR2.41-2A.30 (spring-loaded connection, S00)

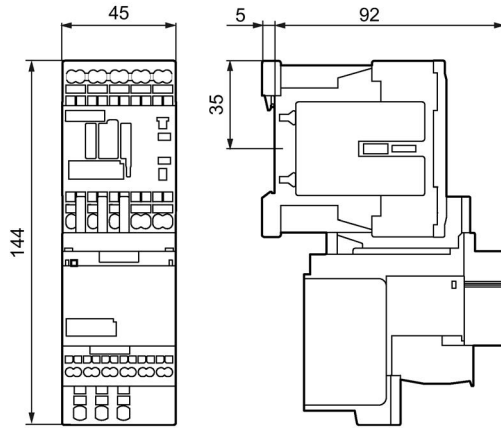


Image C-3 3RR2.41-2A.30 with contactor

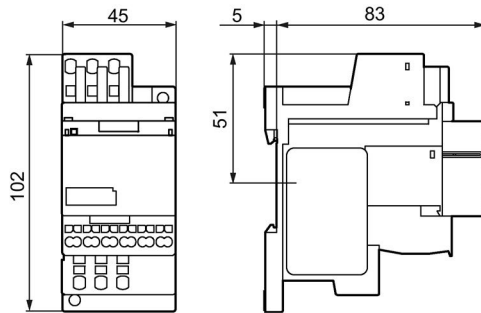


Image C-4 3RR2.41-2A.30 with terminal support for stand-alone assembly



3RR2.42-1A.30 (screw connection, S0)

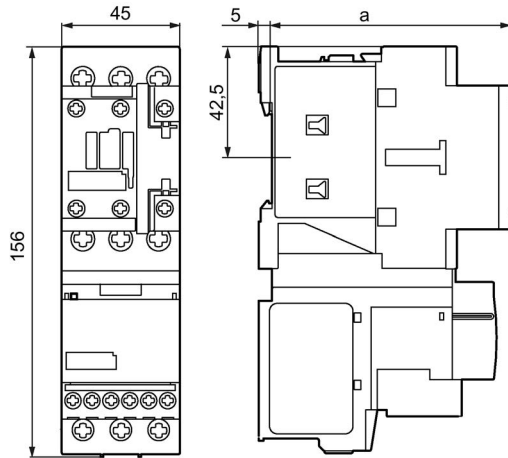


Image C-5 3RR2.42-1A.30 with contactor

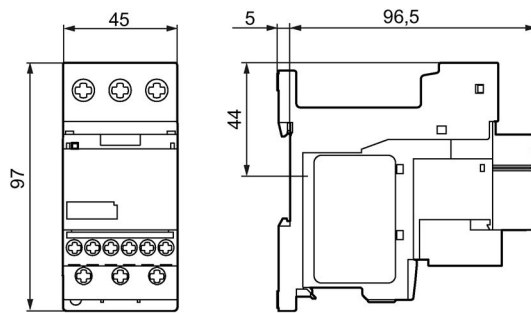


Image C-6 3RR2.42-1A.30 with terminal support for stand-alone assembly

3RR2.42-2A.30 (spring-loaded connection, S0)

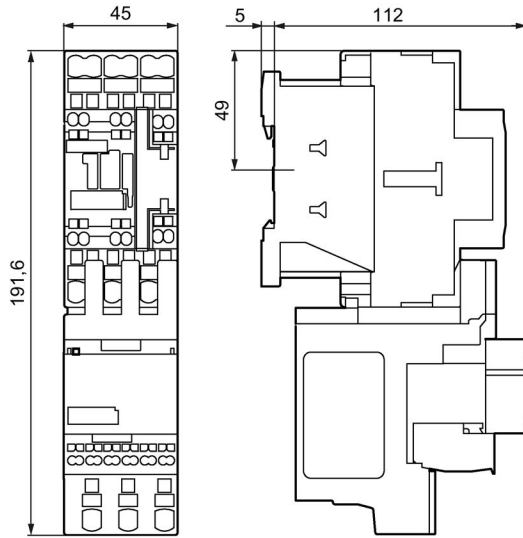


Image C-7 3RR2.42-2A.30 with contactor

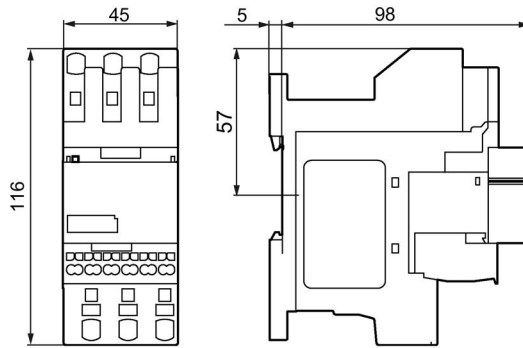


Image C-8 3RR2.42-2A.30 with terminal support for stand-alone assembly

3RR2143-1A.30 (S2)

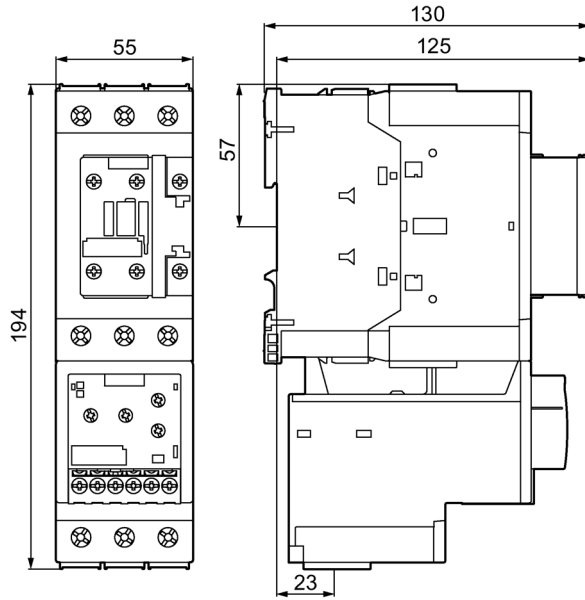


Image C-9 3RR2143-1A.30 with contactor

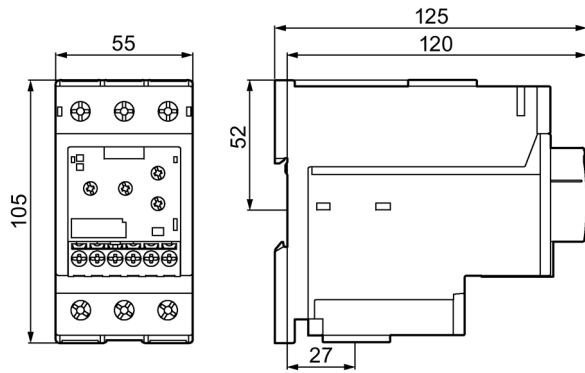


Image C-10 3RR2143-1A.30 with terminal support for stand-alone assembly

3RR2143-3A.30 (S2)

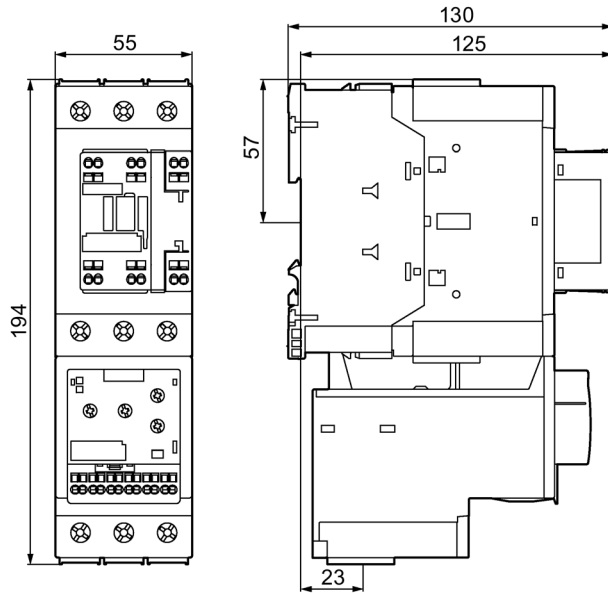


Image C-11 3RR2143-3A.30 with contactor

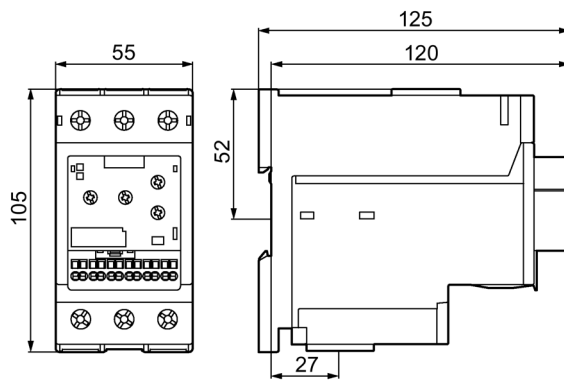


Image C-12 3RR2143-3A.30 with terminal support for stand-alone assembly

3RR2243-1F.30 (S2)

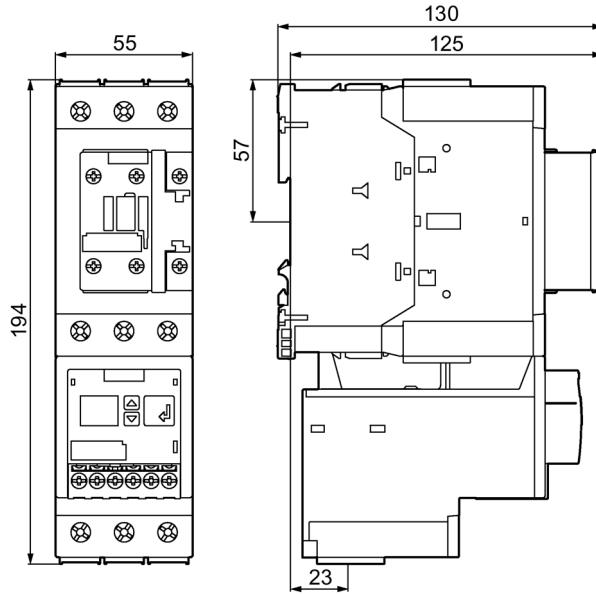


Image C-13 3RR2243-1F.30 with contactor

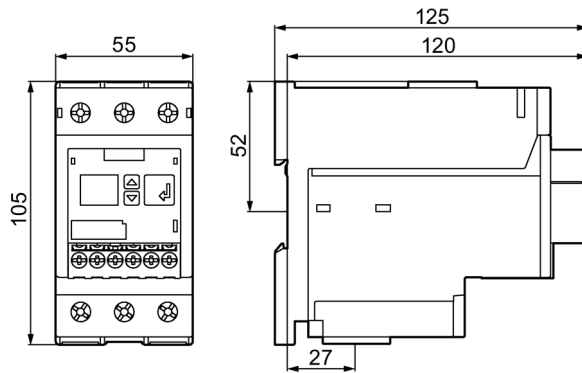


Image C-14 3RR2243-1F.30 with terminal support for stand-alone assembly

3RR2243-3F.30 (S2)

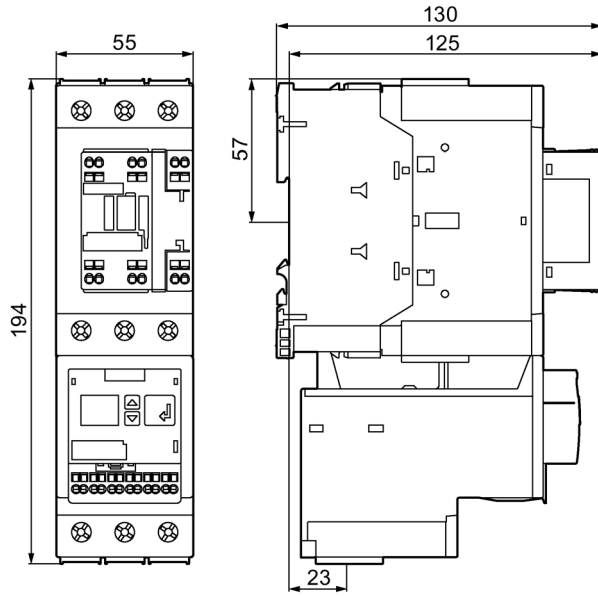


Image C-15 3RR2243-3F.30 with contactor

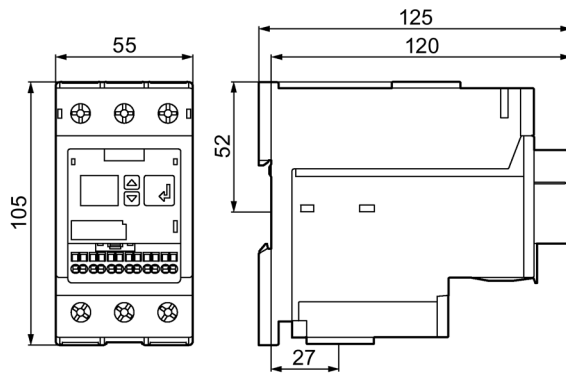


Image C-16 3RR2243-3F.30 with terminal support for stand-alone assembly

## C.2 Dimension drawings 3UG4 monitoring relays

### C.2.1 Dimension drawings 3UG4 monitoring relays. (2 connecting terminals)

#### 3UG4. monitoring relays with 2 connecting terminals (screw-type connection)

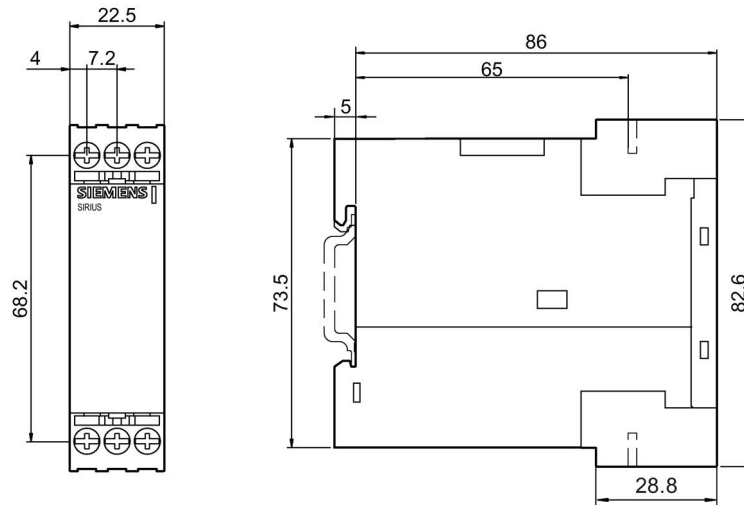


Image C-17 3UG4. monitoring relays with 2 connecting terminals with screw-type connections

#### 3UG4. monitoring relays with 2 connecting terminals (spring-loaded connections)

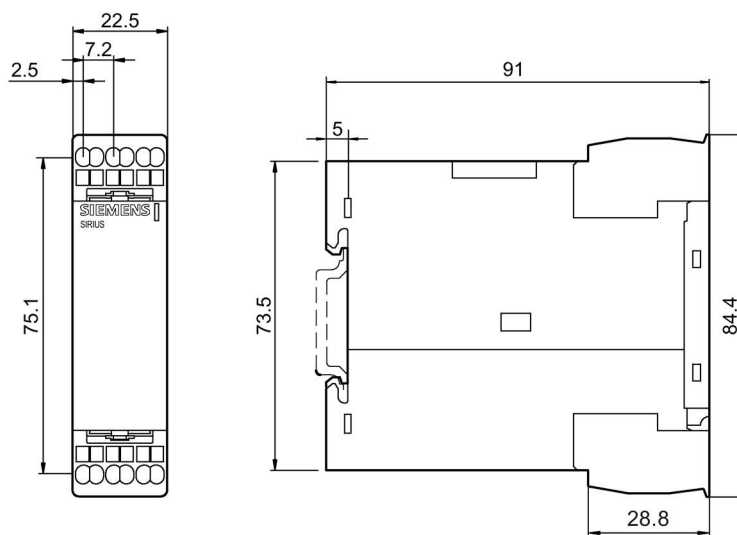


Image C-18 3UG4. monitoring relays with 2 connecting terminals with spring-loaded connections

### C.2.2 Dimension drawings 3UG4 monitoring relays. (3 connecting terminals)

#### 3UG4. monitoring relays with 3 connecting terminals (screw-type connection)

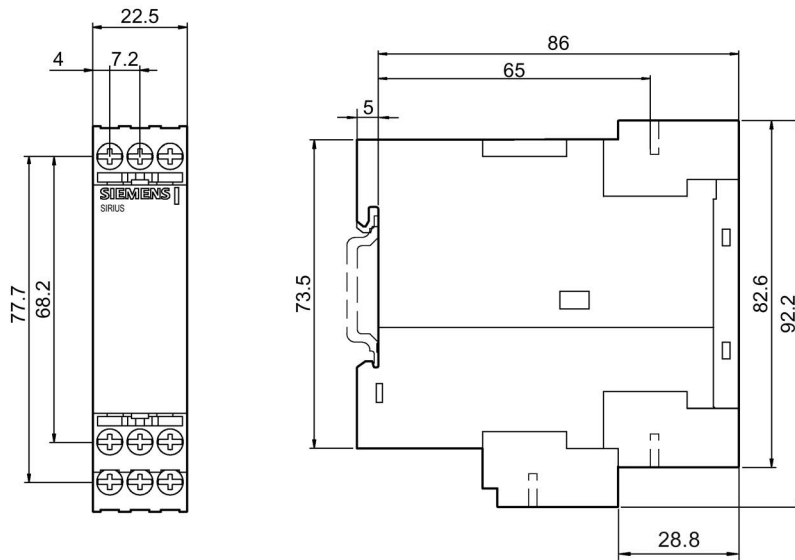


Image C-19 3UG4. monitoring relays with 3 connecting terminals with screw-type connections

#### 3UG4. monitoring relays with 3 connecting terminals (spring-loaded connections)

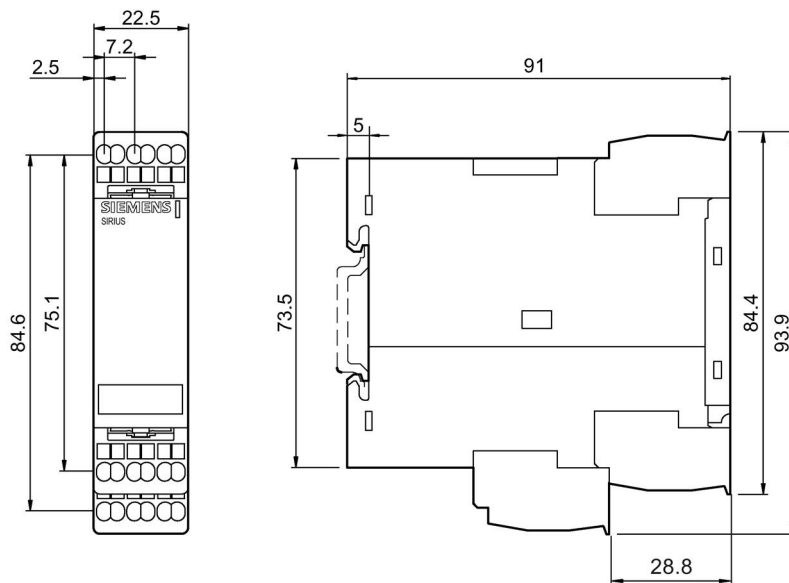


Image C-20 3UG4. monitoring relays with 3 connecting terminals with spring-loaded connections



### C.2.3 Dimension drawings 3UG4 monitoring relays. (4 connecting terminals)

#### 3UG4. monitoring relays with 4 connecting terminals (screw-type connection)

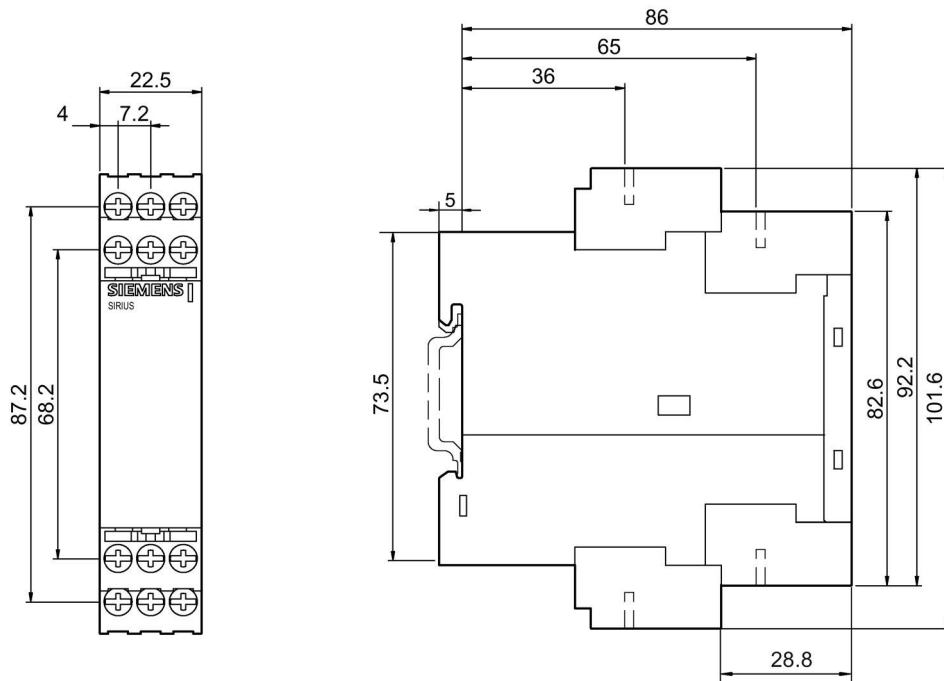


Image C-21 3UG4. monitoring relays with 4 connecting terminals with screw-type connections

**3UG4. monitoring relays with 4 connecting terminals (spring-loaded connections)**

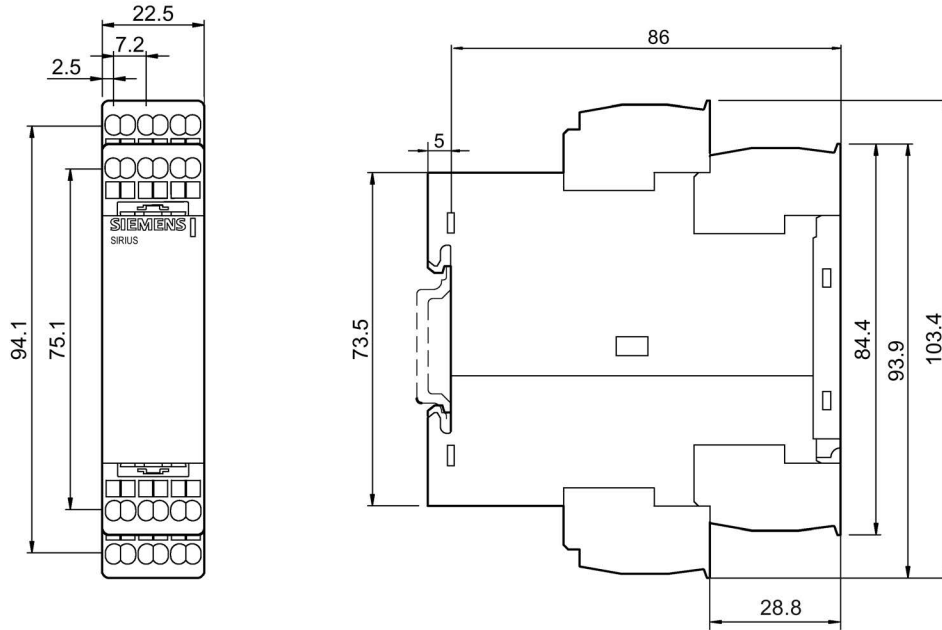


Image C-22 3UG4. monitoring relays with 4 connecting terminals with spring-loaded connections

**C.2.4 Dimension drawings 3UG458 insulation monitoring relay. (3UG4983 upstream module)**

**3UG4581-1AW30/3UG4582-1AW30 monitoring relays**

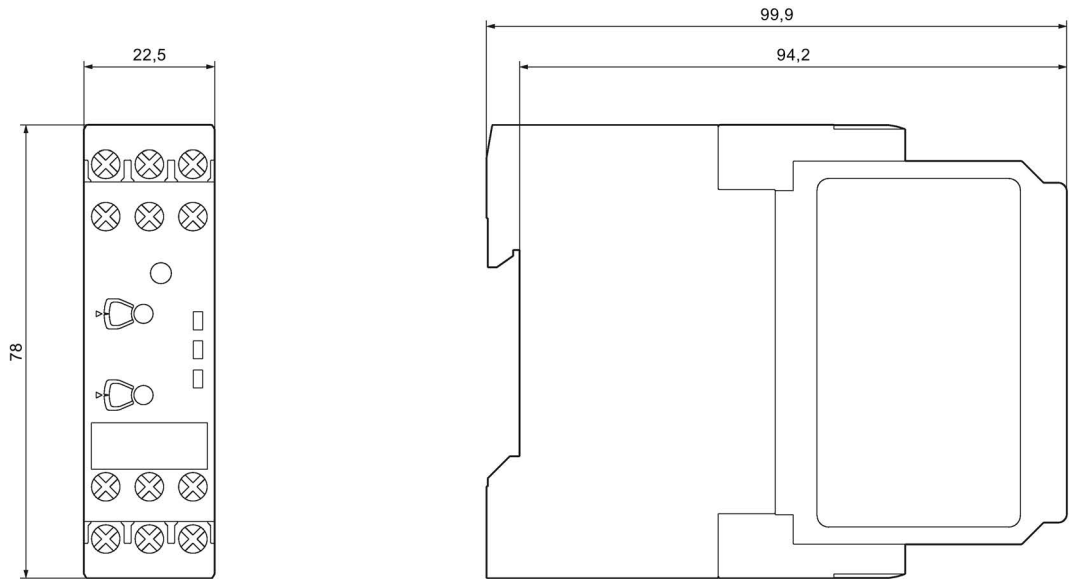


Image C-23 3UG4581-1AW30/3UG4582-1AW30 insulation monitoring relays

**3UG4583-1CW30 monitoring relay**

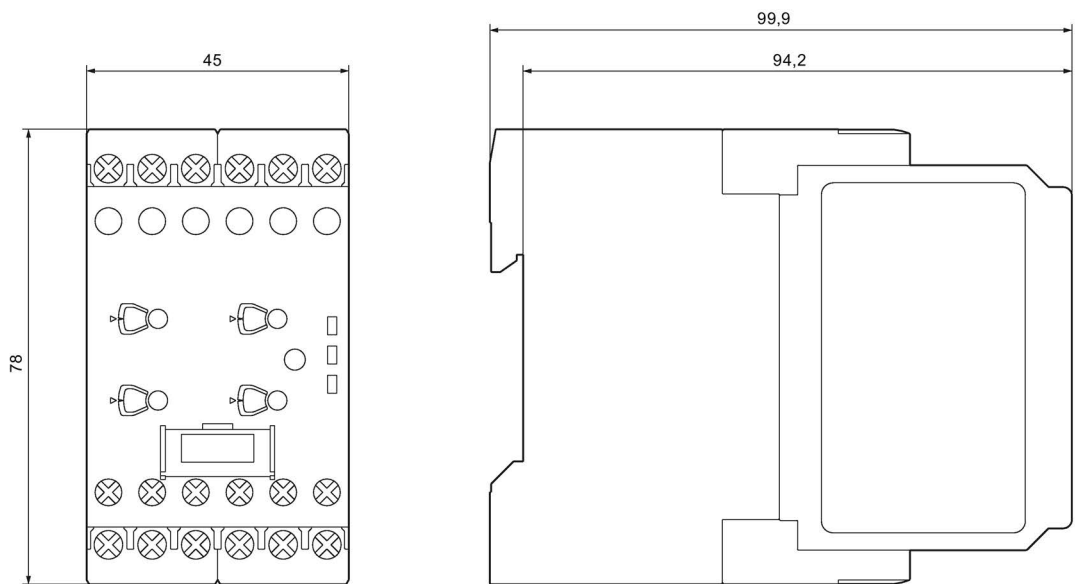


Image C-24 3UG4583-1CW30 insulation monitoring relay

**3UG4983-1A upstream module**

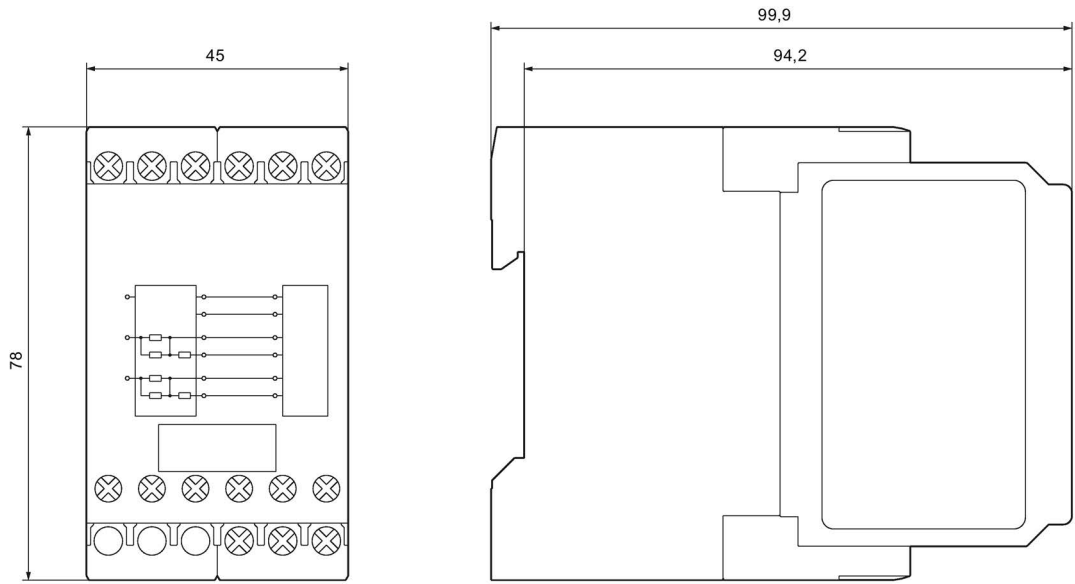
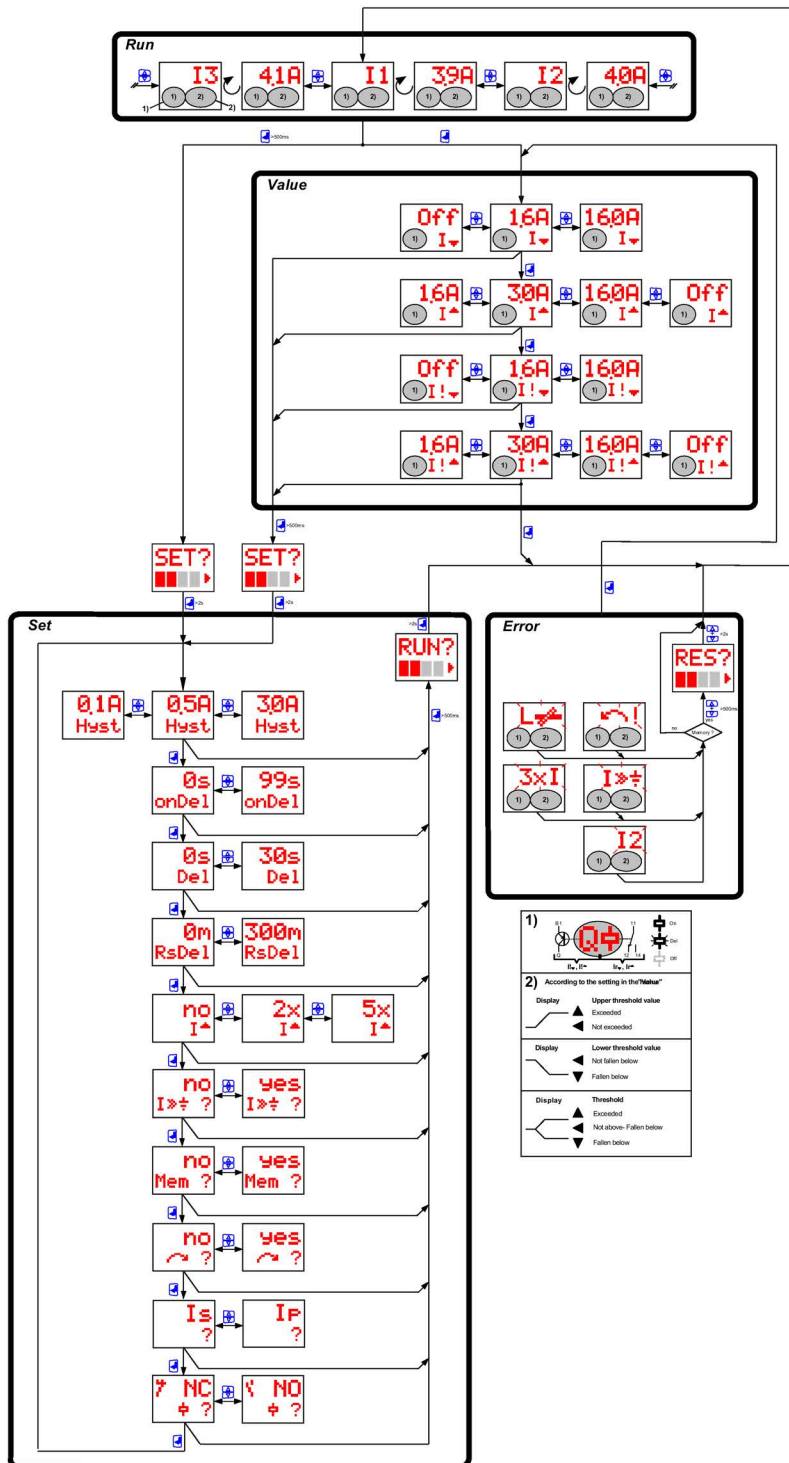


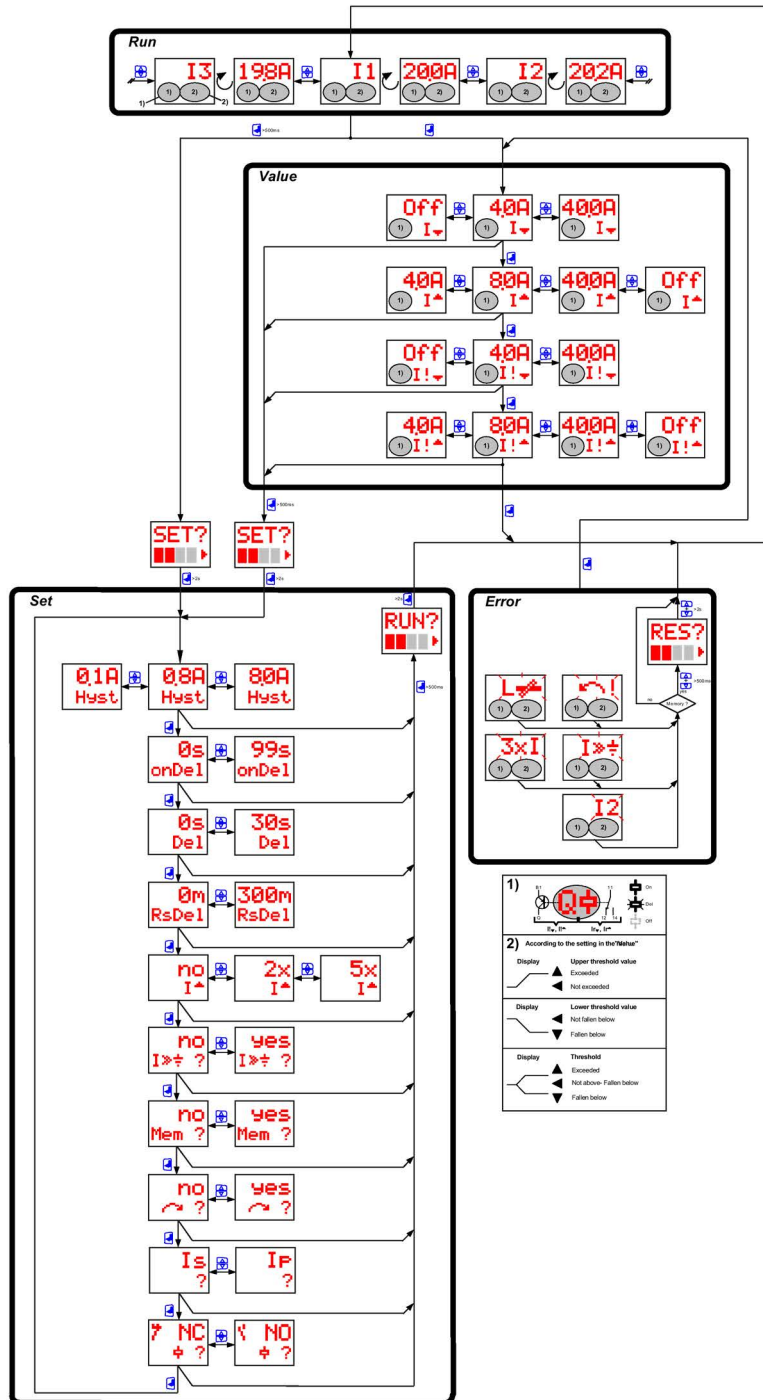
Image C-25 3UG4983-1A upstream module

## Menu-based operation

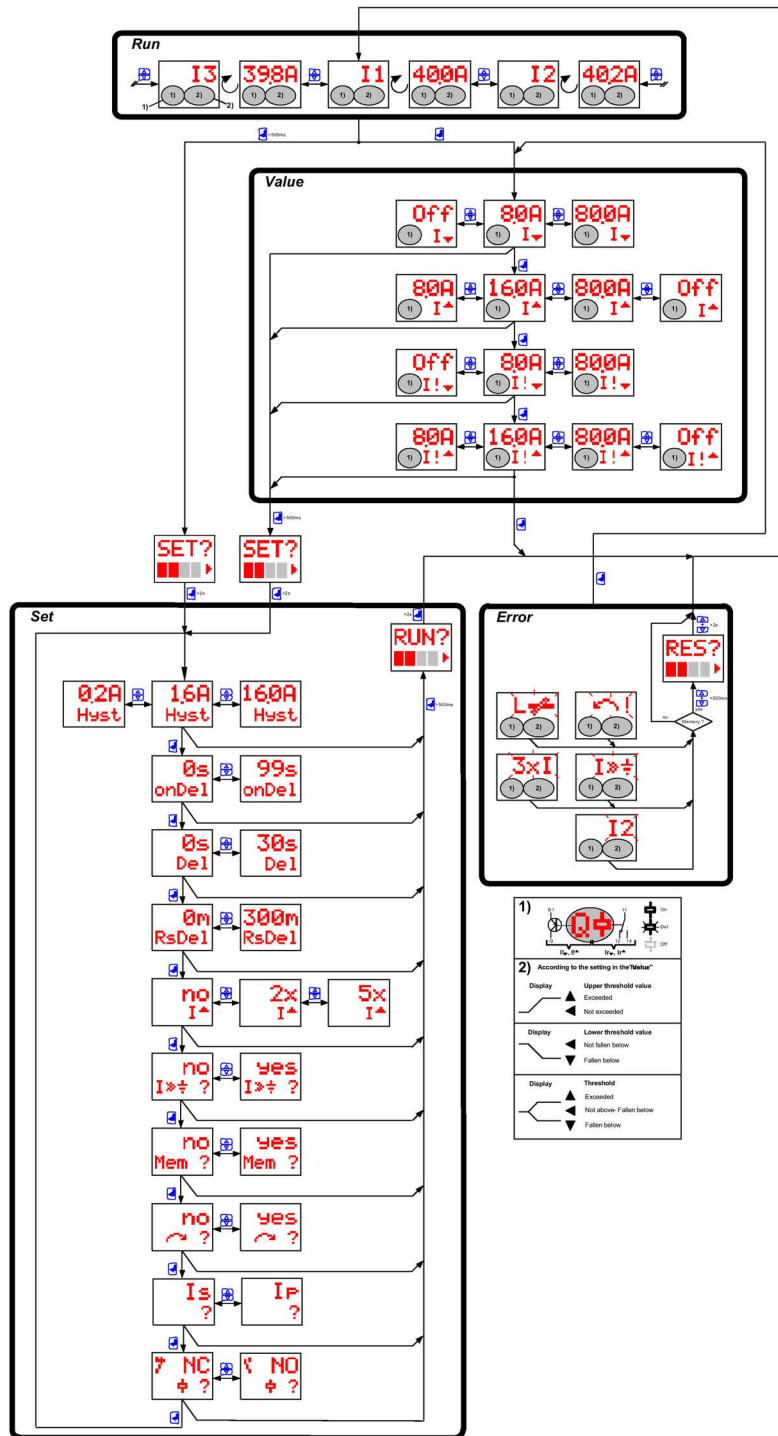
3RR2241 current monitoring relay



3RR2242 current monitoring relay

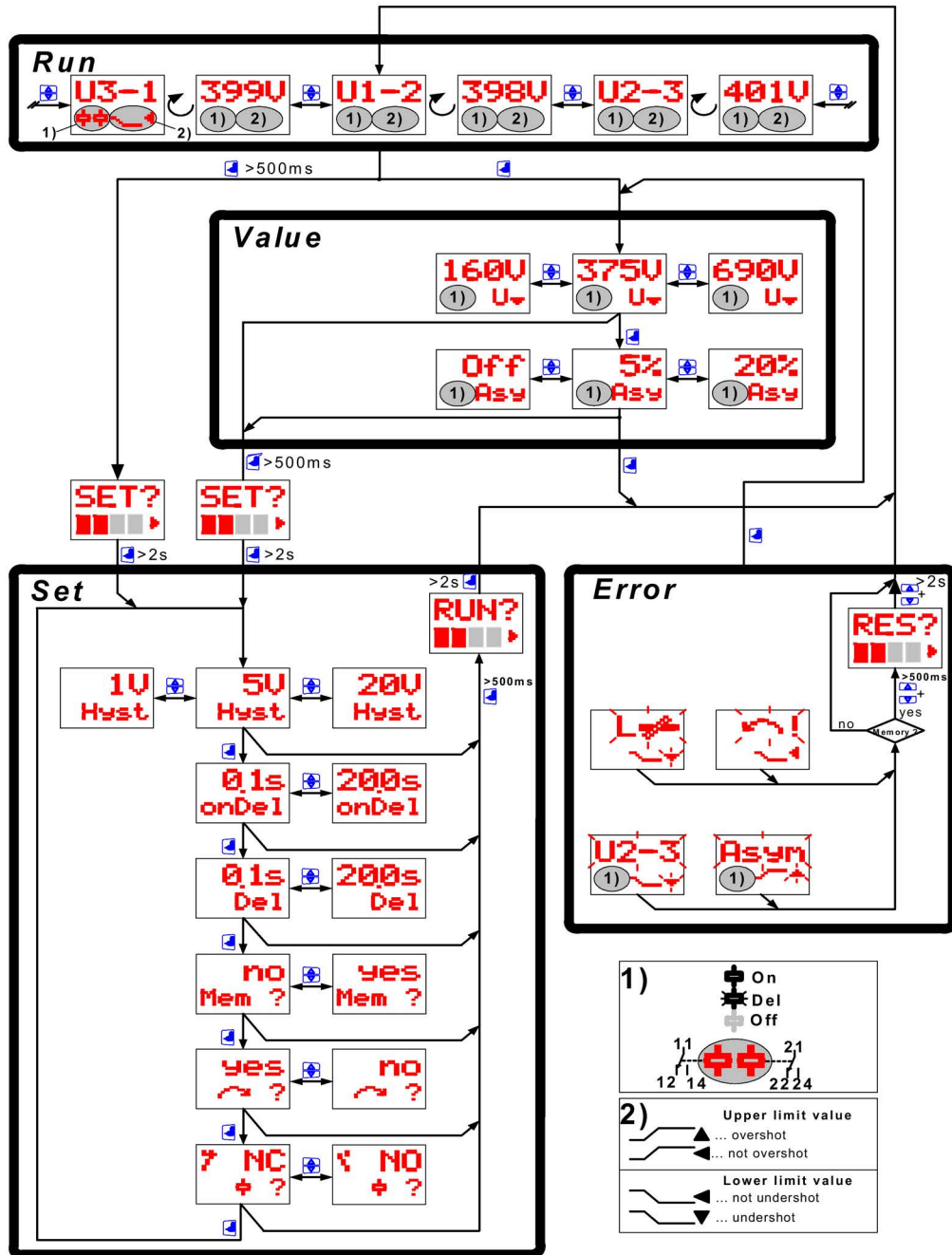


3RR2243 current monitoring relay

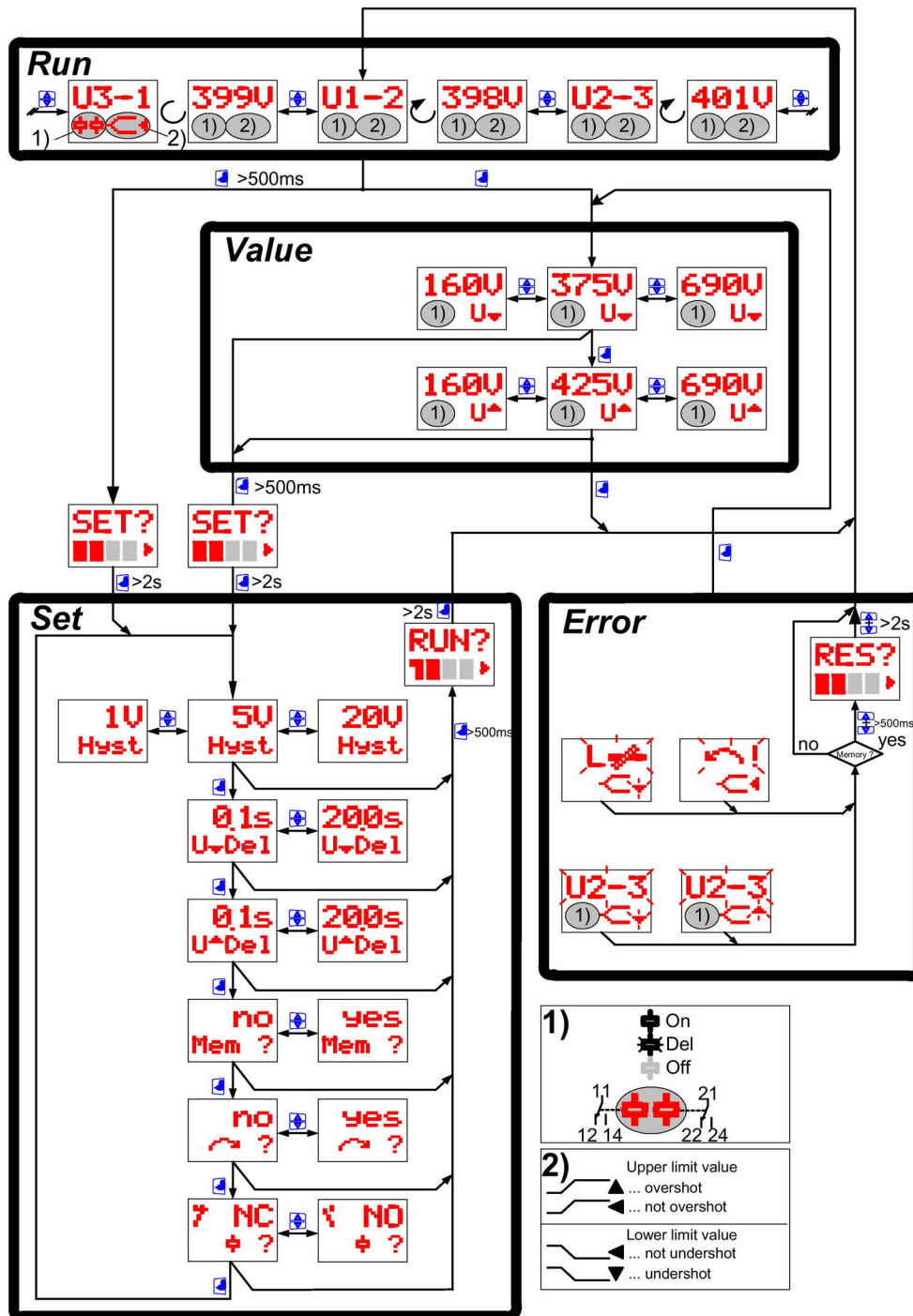




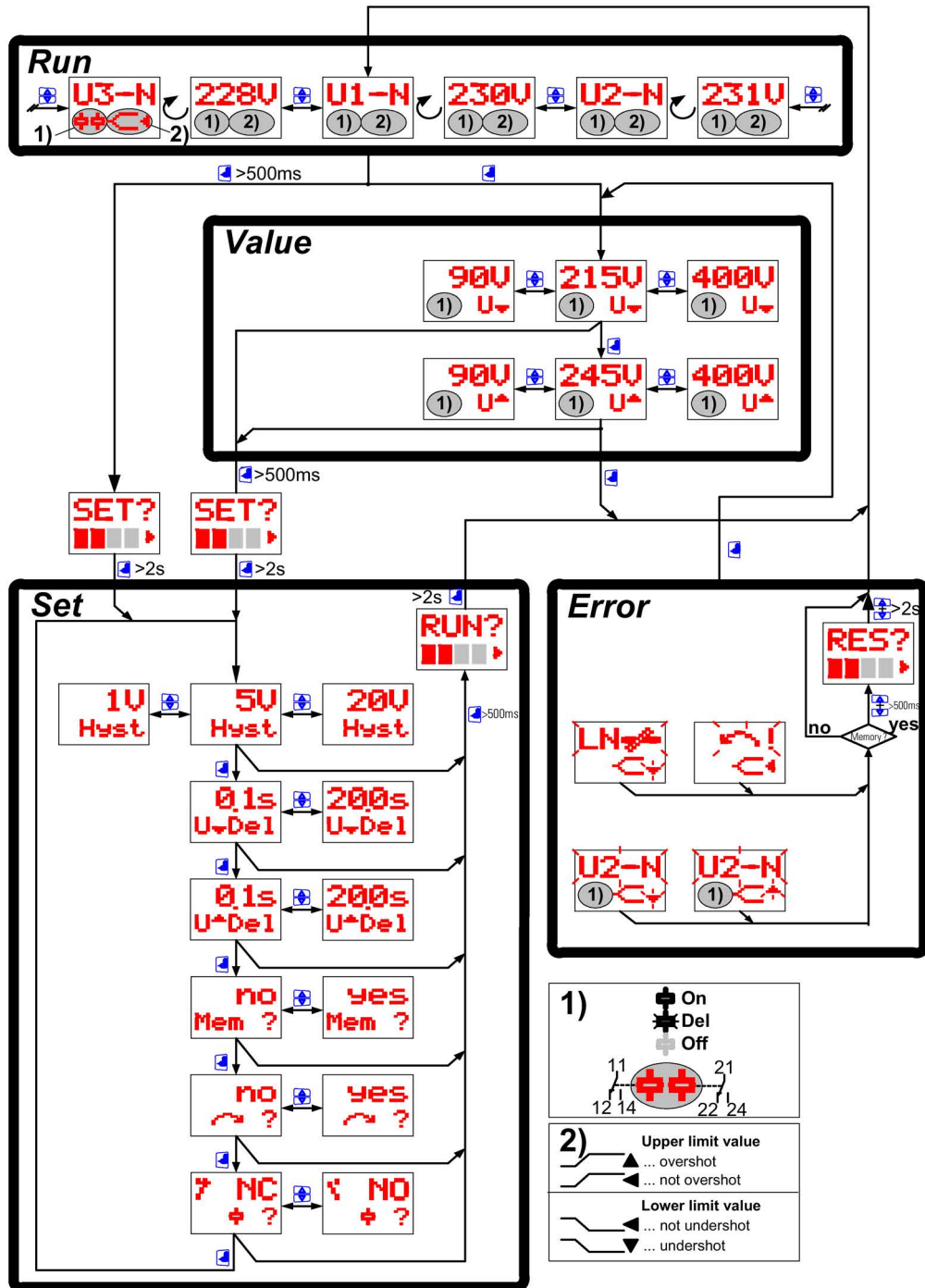
3UG4614 line monitoring relay



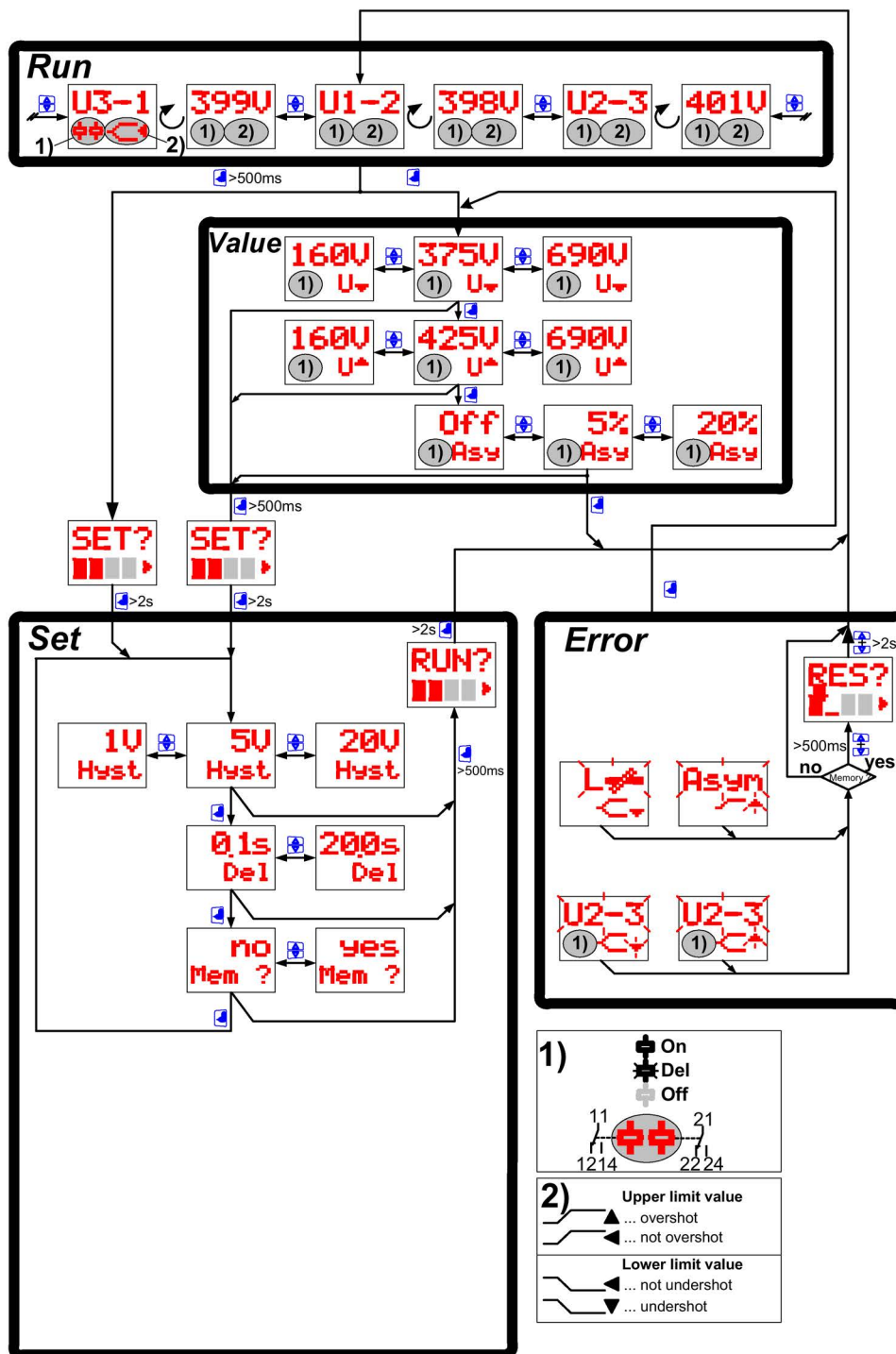
3UG4615 line monitoring relay



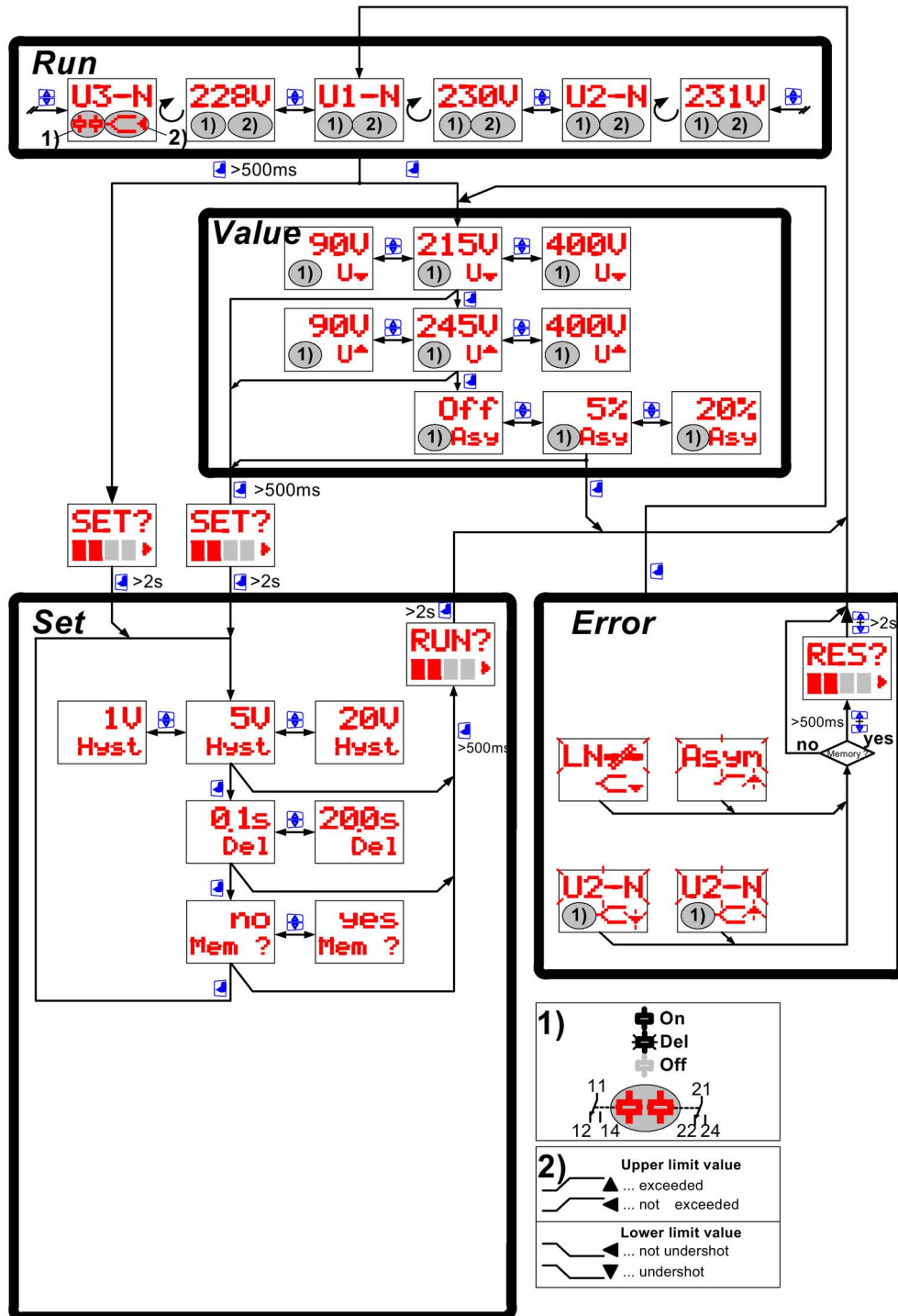
3UG4616 line monitoring relay



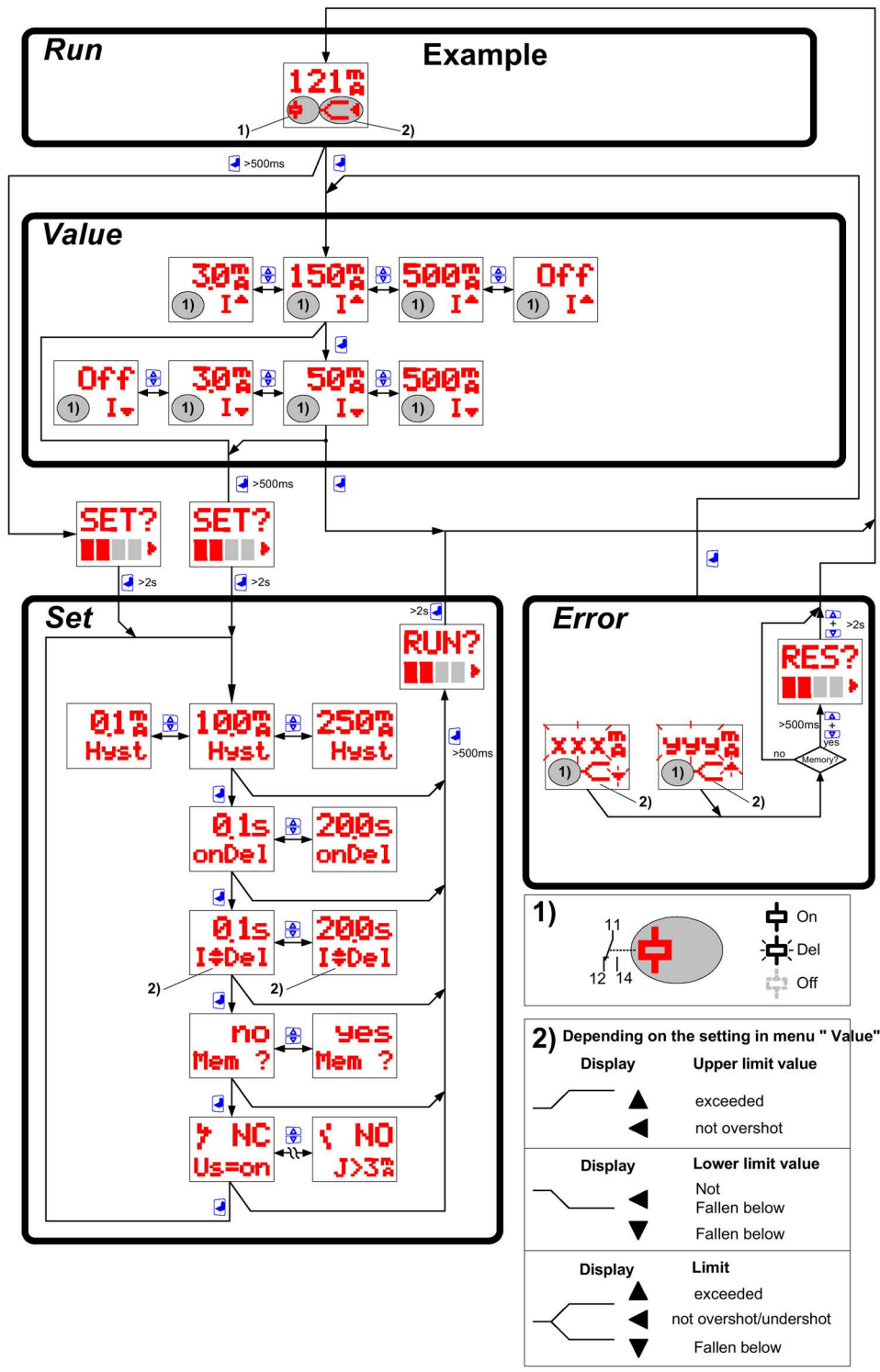
3UG4617 line monitoring relay



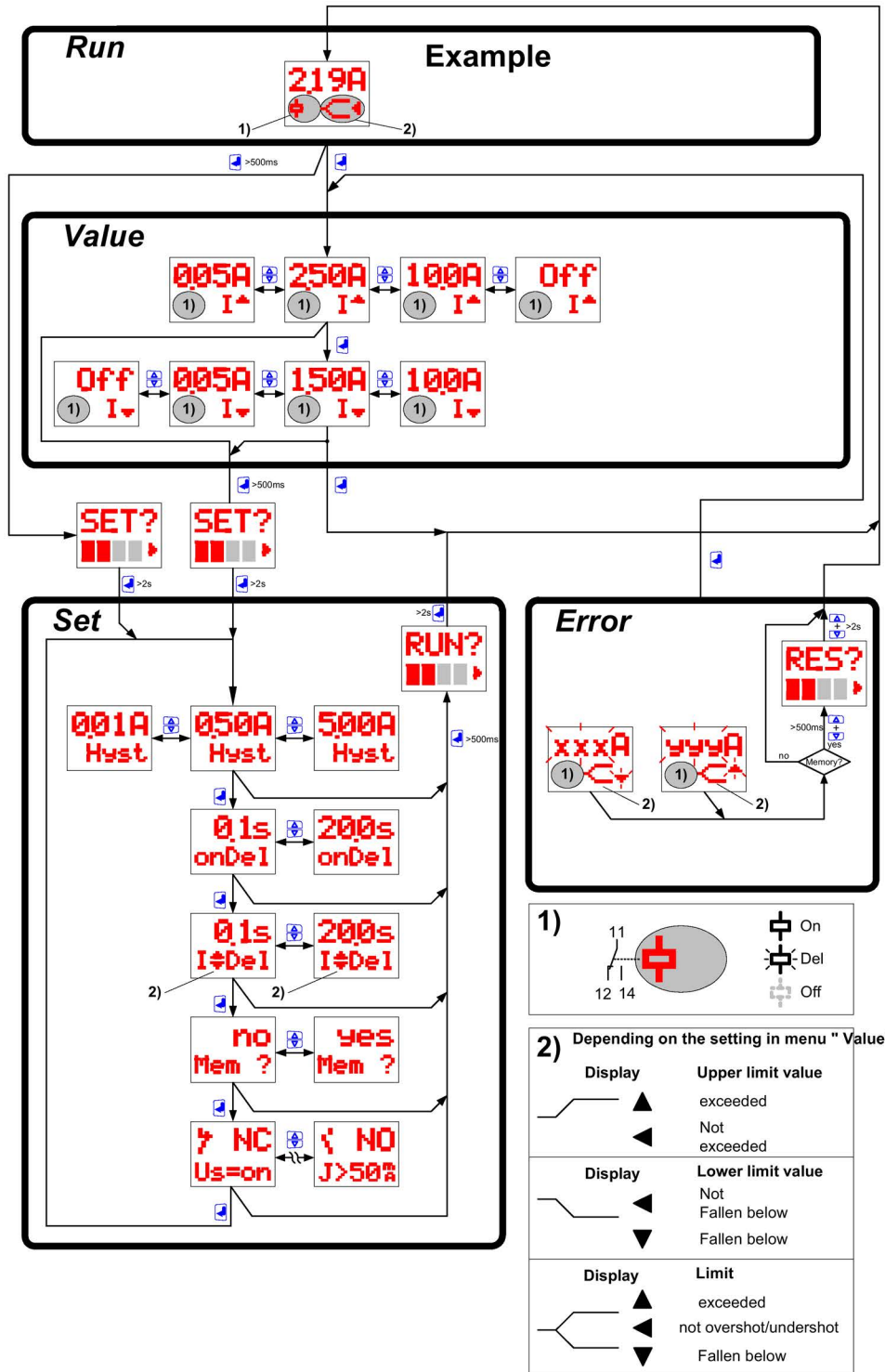
3UG4618 line monitoring relay



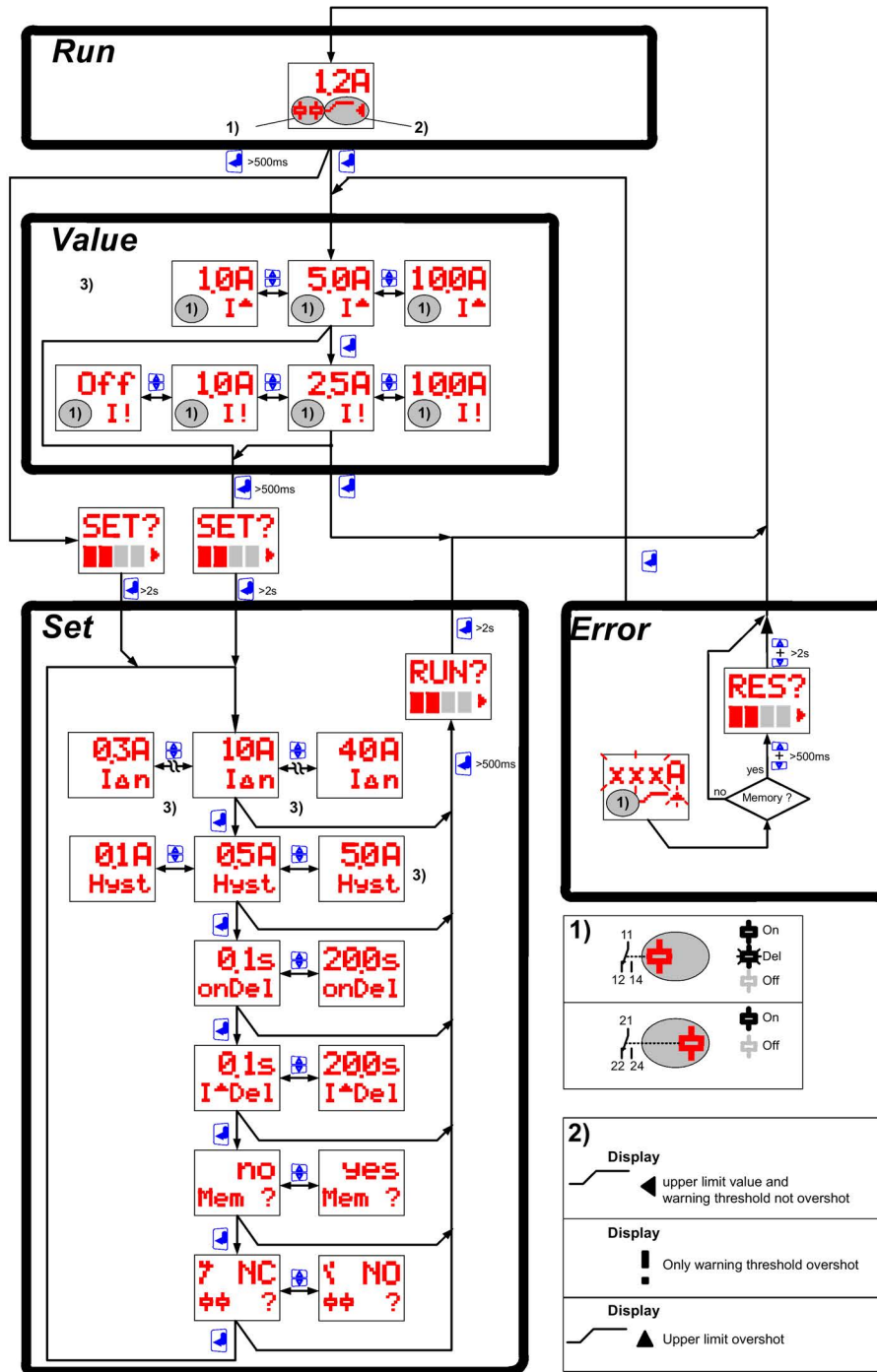
3UG4621 current monitoring relays



3UG4622 current monitoring relays

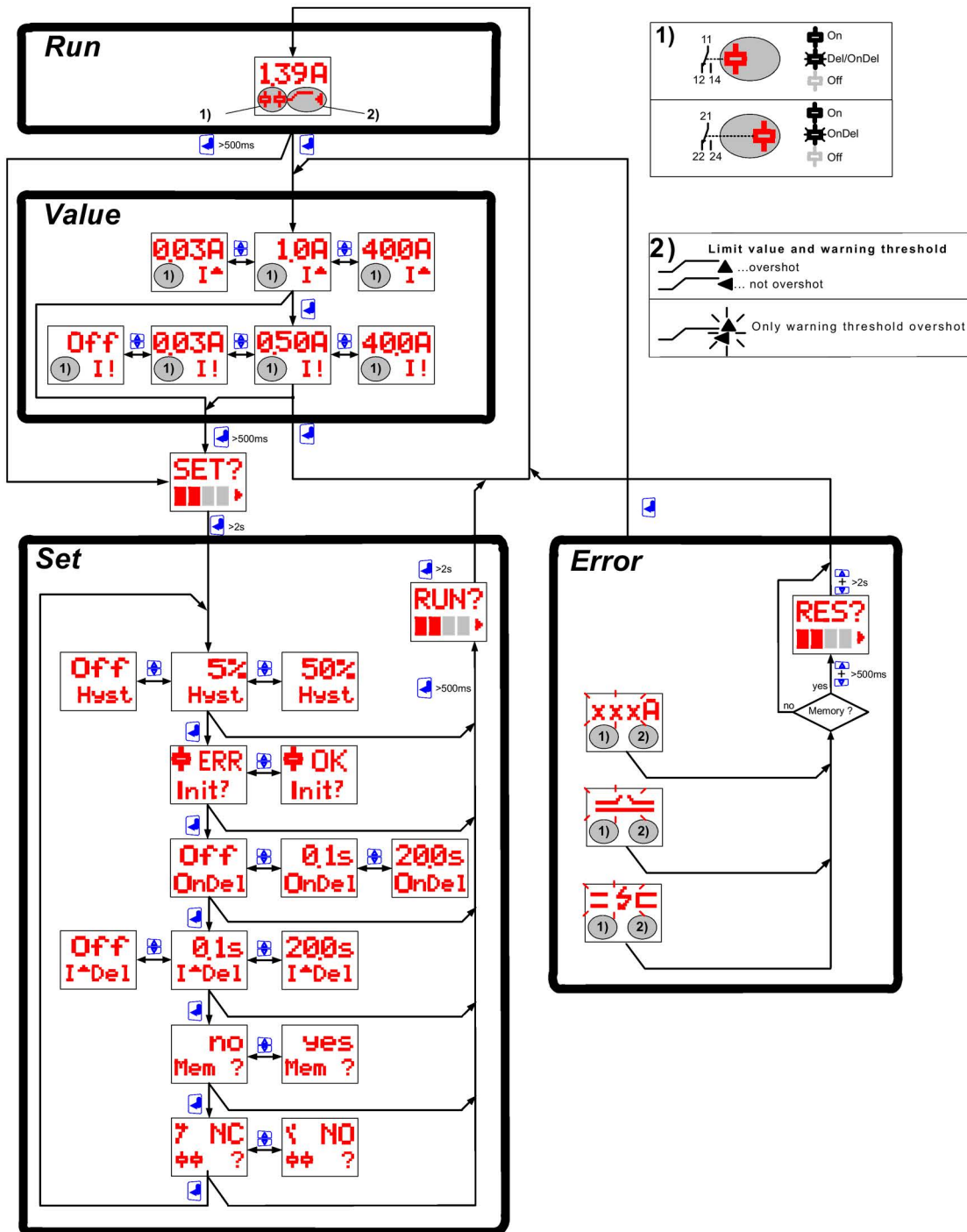


3UG4624 residual current monitoring relay

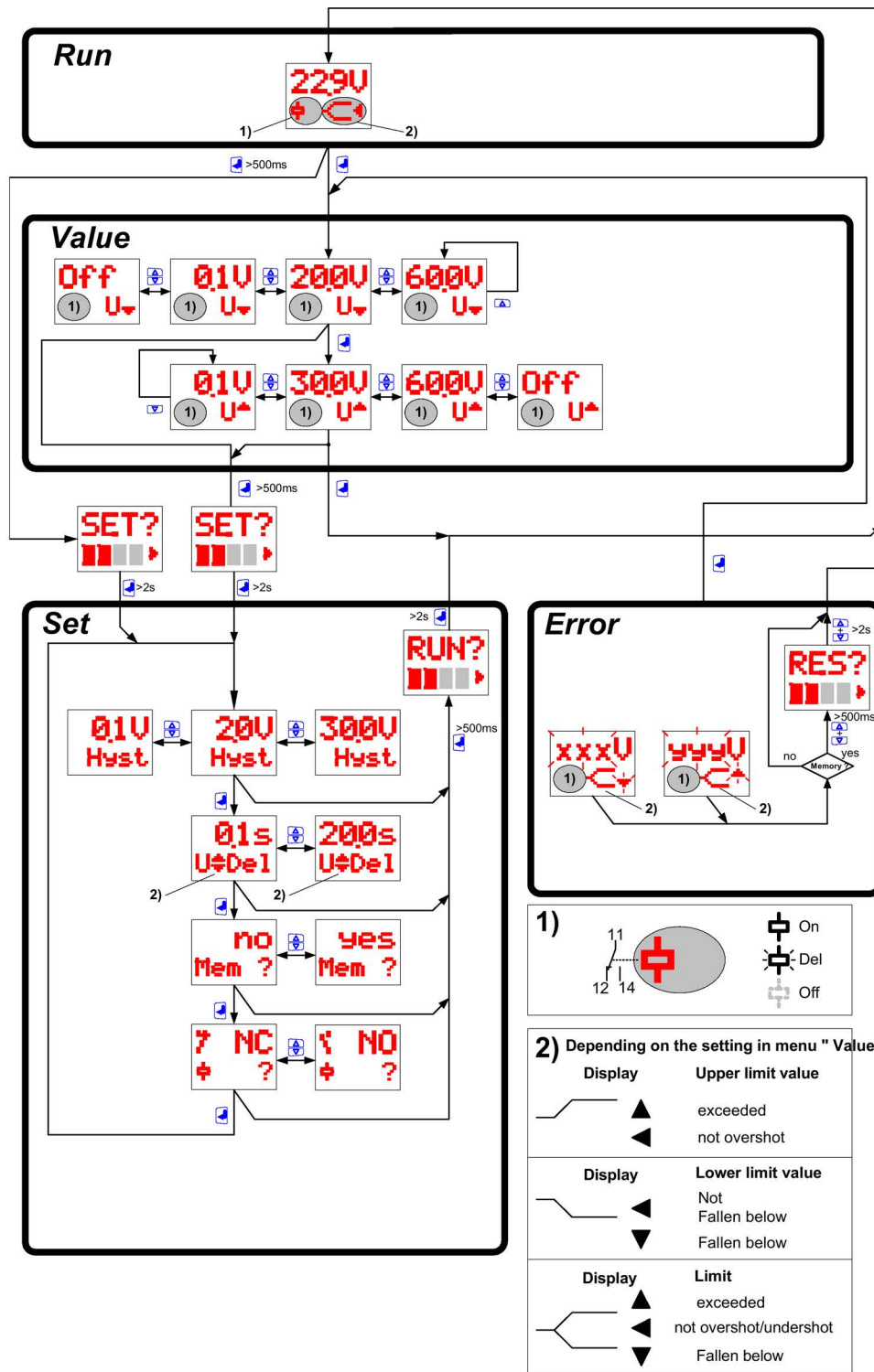




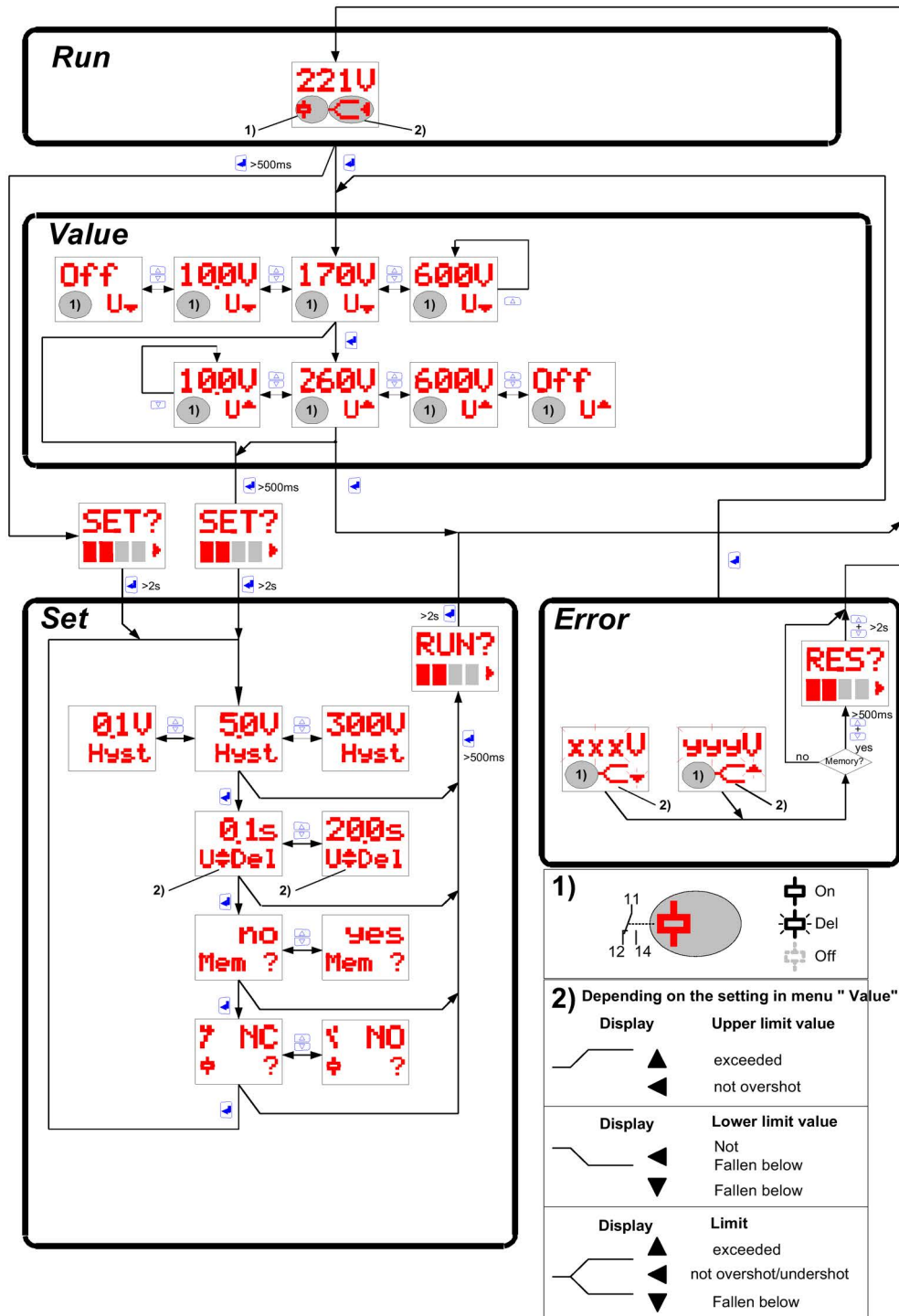
3UG4625 residual current monitoring relay



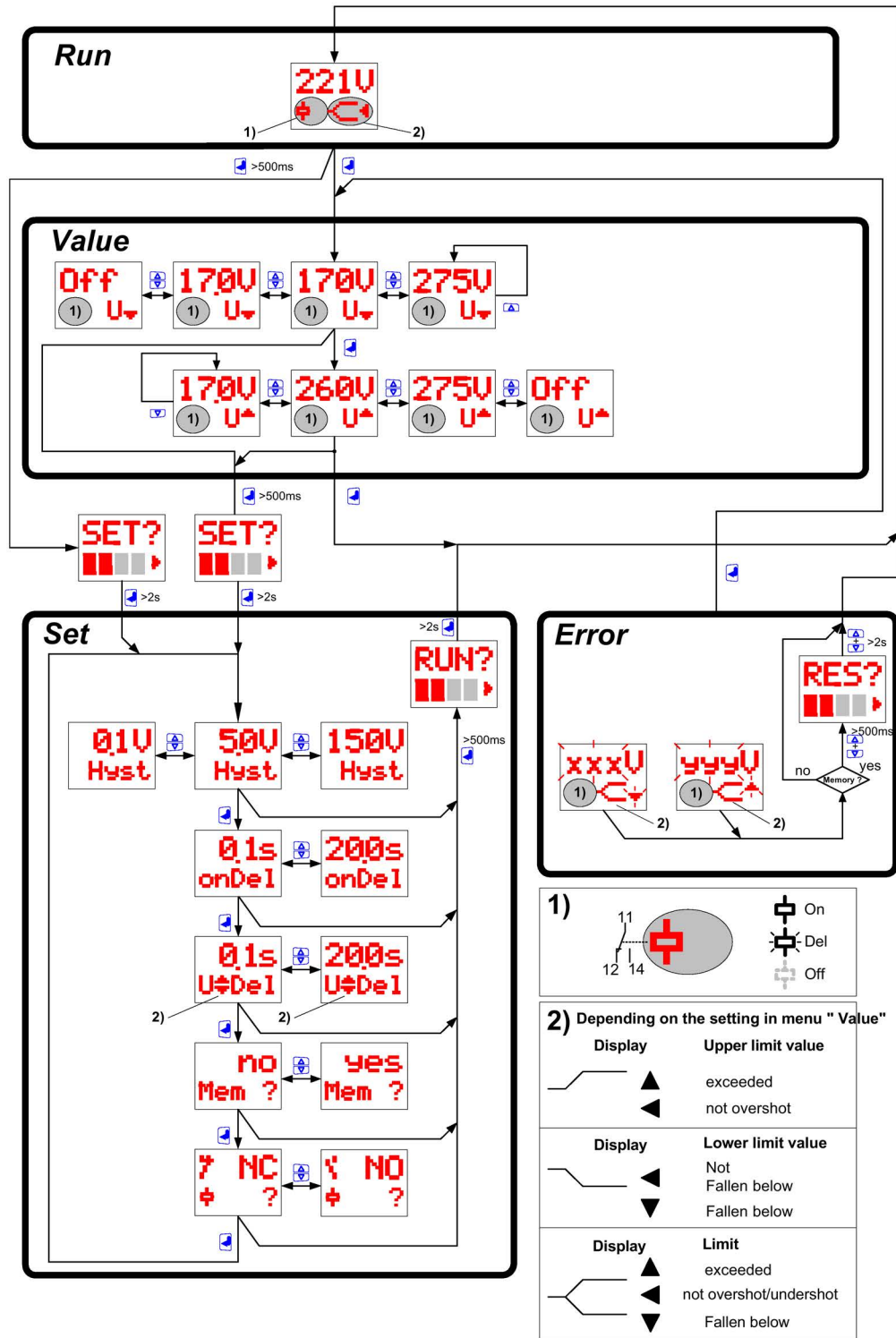
3UG4631 voltage monitoring relay



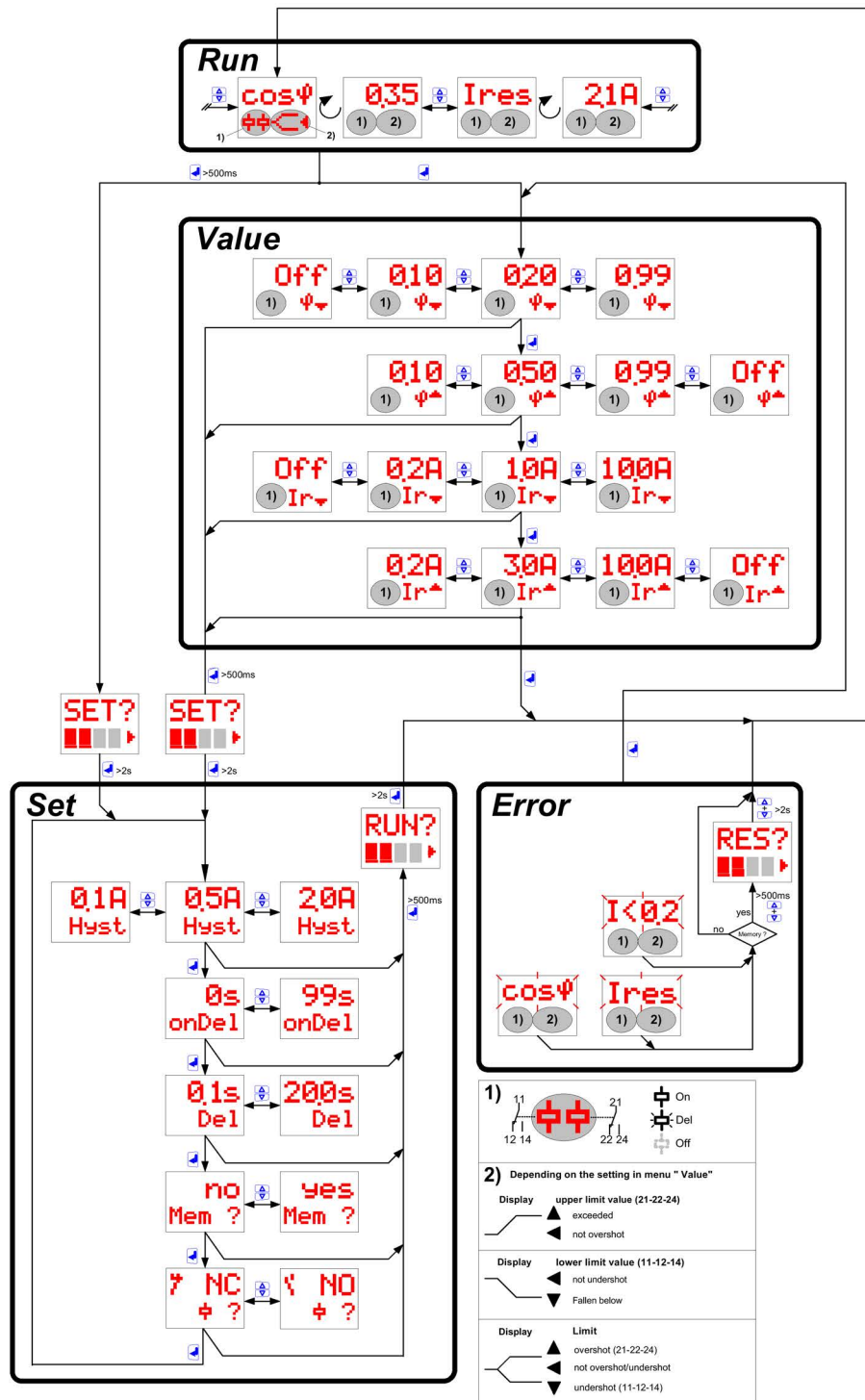
3UG4632 voltage monitoring relay



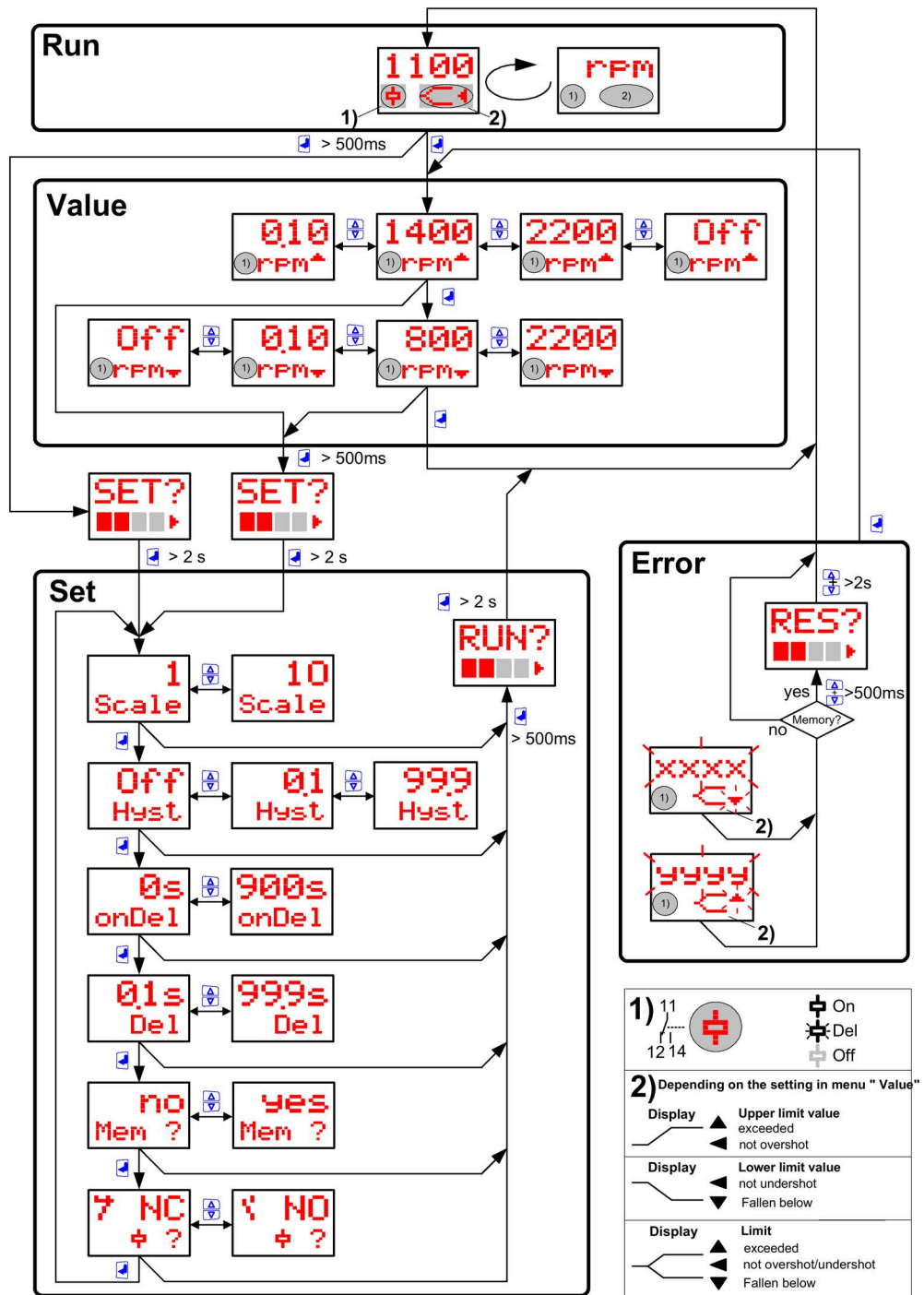
3UG4633 voltage monitoring relay



3UG4641 cos phi and active current monitoring relay



3UG4651 speed monitoring relay



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