SIEMENS


# Industrial Controls

## Monitoring and Control Devices

### 3UG4 / 3RR2 Monitoring Relays

Manual

Edition 02/2013

SIEMENS

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

Manual




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## Legal information

### Warning notice system

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

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

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

| ⚠ CAUTION |
|---|
| indicates that minor personal injury can result if proper precautions are not taken. |

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

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

### Qualified Personnel

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

### Proper use of Siemens products

Note the following:

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

### Trademarks

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### Disclaimer of Liability

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

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# Table of contents

# 1 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.

## Further documentation

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

The Appendix "References (Page 349)" has a list of the operating instructions.

## 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 (0) 911-895-5900 (8 a.m. to 5 p.m. CET)

Fax: +49 (0) 911-895-5907

**or on the Internet at:**

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

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

## Correction sheet

A correction sheet is included at the end of the manual. Please use it to record your suggestions for improvements, additions and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

# 2 Safety information

## 2.1 Standards

### Applicable standards

The monitoring relays comply with the following standards:

Table 2- 1 Standards - monitoring relays

| | |
|---|---|
| Device standards | • IEC / EN 60947-1 "Low-voltage switchgear and controlgear: General rules"<br>• IEC / EN 60947-4-1 "Contactors and motor-starters: Electromechanical contactors and motor-starters"<br>• IEC / EN 60947-5-1 "Control circuit devices and switching elements: Electromechanical control circuit devices"; VDE 0660 "Low-voltage switchgear"<br>• 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".<br>• DIN EN 50042 "Terminal marking"<br>• DIN EN 60044-1 "Instrument transformers - Part 1: Current transformers" |
| EMC standard[1)] | • IEC / EN 61000-6-2 "Generic standards - Immunity for industrial environments"<br>• IEC / EN 61000-6-4 "Generic standards - Emission standard for industrial environments" |
| Resistance to extreme climates | • IEC 60721-3-3 "Classification of environmental conditions"<br>The monitoring relays are climate-proof according to IEC 60721-3. |
| Touch protection | • IEC / EN 60529 "Degrees of protection provided by enclosures"<br>Monitoring relays are safe to touch in accordance with IEC / EN 60529. |

1) 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), and more information, as well as an option to download certificates, can be obtained on the Internet (www.siemens.com/automation/csi_en).

## 2.2 Product-specific safety information

### Intended use

| WARNING |
|---|
| **Intended use** |
| **Can Cause Death, Serious Injury, or Property Damage.** |
| The devices may only be used for the applications described in the catalog and the technical description, 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

| WARNING |
|---|
| **Hazardous Voltage.** |
| 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!

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## 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).

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

# System overview 3

## 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).

## 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).

# 3.3 Connection methods

## 3.3.1 Screw-type connection

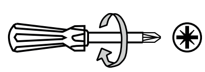
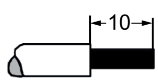
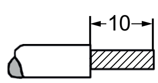
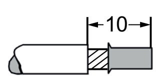
### Screw-type connection

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

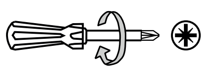
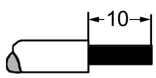
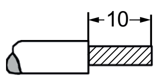
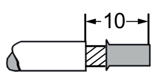
Table 3- 1 Removable terminal block with screw-type connections - monitoring relays

| | | 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) mm² |
| | | 2 x (0.5 to 2.5) mm² |
| Finely stranded without end sleeve |  | --- |
| Finely stranded with end sleeve |  | 1 x (0.5 to 2.5) mm² |
| | | 2 x (0.5 to 1.5) mm² |
| 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-section for the main conductor terminals of the 3RR2 current monitoring relays with analog and digital setting (size S00 and S0) with screw-type connection.

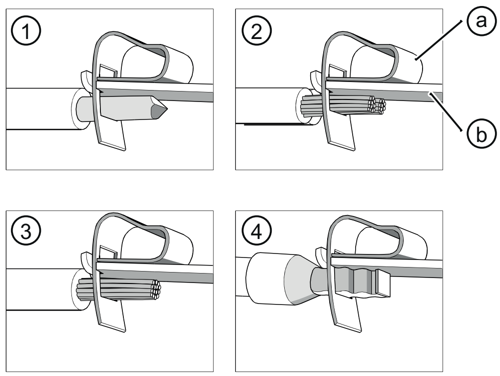
Table 3- 2 Permanently connected terminal block with screw-type connection - Main conductor terminals of the 3RR2 current monitoring relays

| | | Permanently connected terminal | |
|---|---|---|---|
| | | Size S00 | Size S0 |
| Tool |  | 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 |
| Solid |  | 2 x (0.5 to 1.5) mm² | 2 x (1 to 2.5) mm² |
| | | 2 x (0.75 to 2.5) mm² | 2 x (2.5 to 10) mm² |
| | | max. 2 x (1 ... 4) mm² | |
| Finely stranded without end sleeve |  | --- | --- |
| Finely stranded with end sleeve |  | 2 x (0.5 to 1.5) mm² | 2 x (1 to 2.5) mm² |
| | | 2 x (0.75 to 2.5) mm² | 2 x (2.5 to 6) mm² |
| | | | max. 1 x 10 mm² |
| AWG | | 2 x (20 to 14) | 2 x (16 to 12) |
| | | 1 x 12 | 2 x (14 to 8) |

## 3.3.2 Spring-loaded connection

### Spring-loaded connection

Without exception, 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.




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

Figure 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.

The devices are equipped with a two-wire connection, i.e. two independent connections per current path. 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.

Catalog IC10 "Industrial Controls" (www.siemens.com/industrial-controls/catalogs) offers a standard screwdriver (3 mm slot) that can be used as the operating tool for opening the spring-loaded connections.

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

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

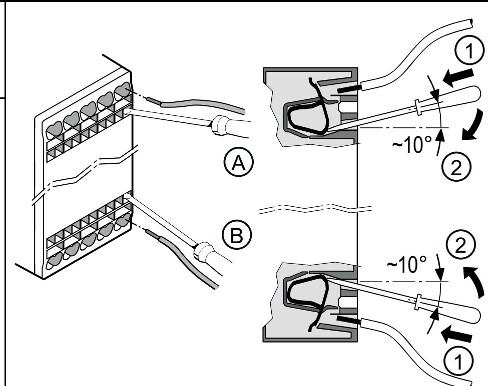
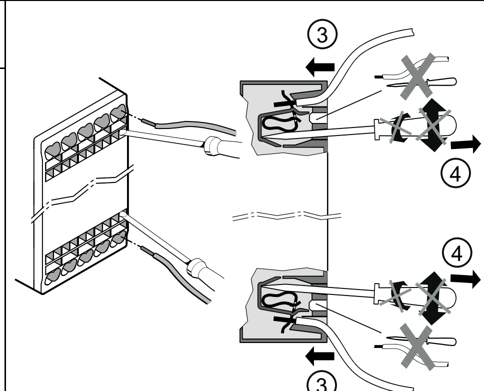
**DANGER**

**Hazardous Voltage.**

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 | Operating instruction | Image |
|---|---|---|
| 1 | Insert the screwdriver into the bottommost (A) or topmost (B) operating slot on the right-hand side. |   |
| 2 | Press the screwdriver down (A) or up (B), then push it into the operating slot as far as it will go.<br>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**

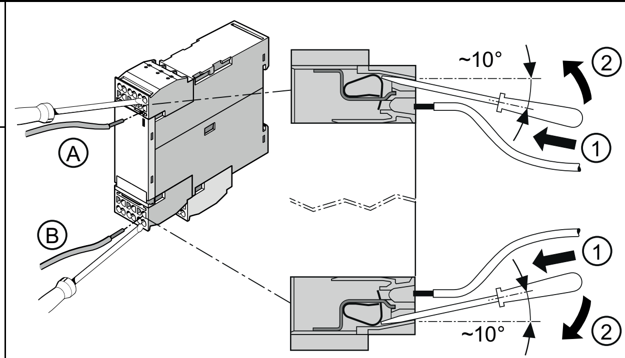
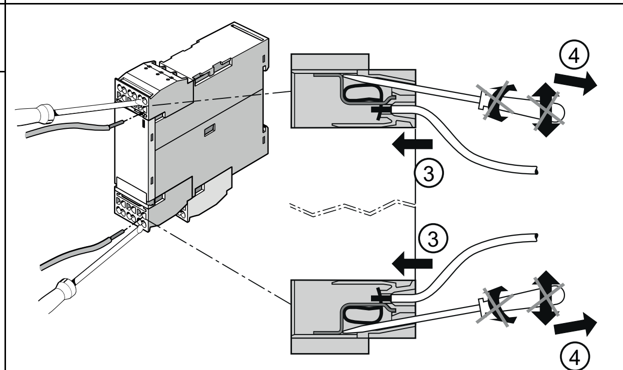
**Damage to spring-loaded terminal on the 3RR2 current monitoring relay!**

If you insert the screwdriver into the central opening on the spring-loaded terminal, this could damage the terminal.

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

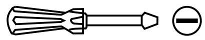
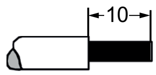
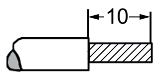
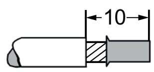
## Spring-loaded terminal for 3UG4 monitoring relay

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.<br>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 spring-loaded connections

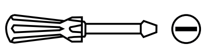
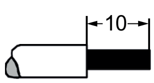
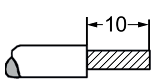
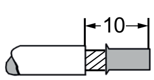
Table 3- 5 Removable terminal block with spring-loaded connections - monitoring relays

| | | Removable terminal |
|---|---|---|
| Tool |  | Ø3.0 x 0.5 (3RA2908-1A) |
| Solid and stranded |   | 2 x (0.25 to 1.5) mm² |
| Finely stranded without end sleeve |   | 2 x (0.25 to 1.5) mm² |
| Finely stranded with end sleeve |   | 2 x (0.25 to 1.5) mm² |
| 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 the 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) mm² | 1 x (1 to 10) mm² |
| Finely stranded without end sleeve |   | 1 x (0.5 to 2.5) mm² | 1 x (1 to 6) mm² |
| Finely stranded with end sleeve |   | 1 x (0.5 to 2.5) mm² | 1 x (1 to 6) mm² |
| 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.

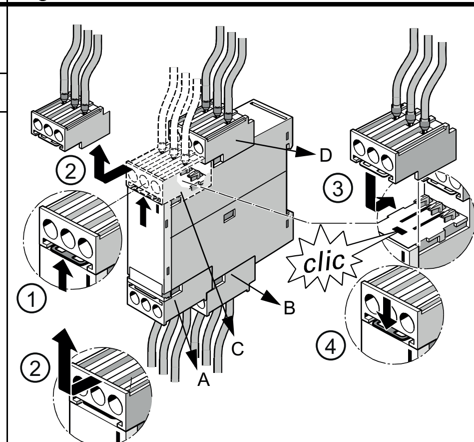
Turn off and lock out power before working on this equipment.

The removable terminals of the 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 | Operating instruction | 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 312)."

### 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

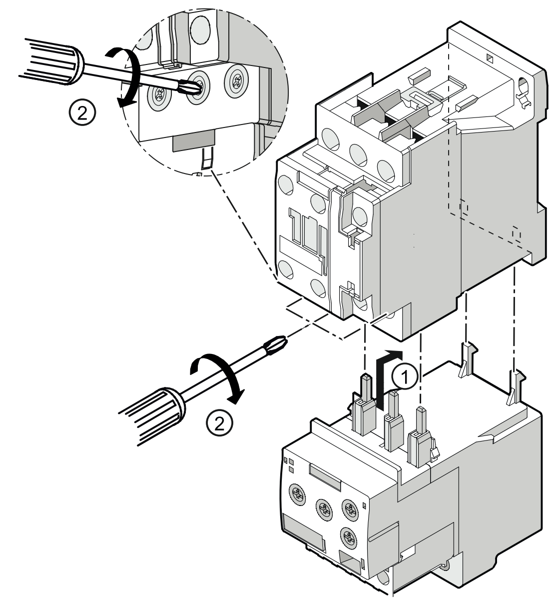
### Mounting position

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.

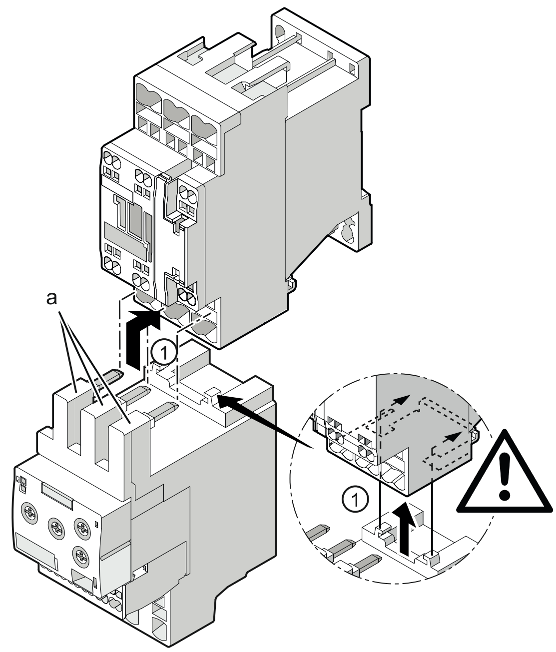
Table 3- 7 Mounting of 3RR2 current monitoring relay, screw-type connection system (size S0)

| Step | Operating instruction | 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 to 1.2 Nm). Check that the cable is clamped tight. | |

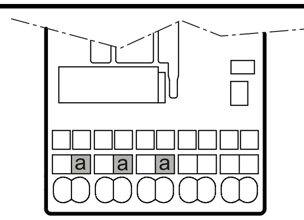
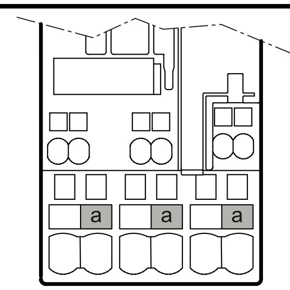
### Note

The connection cross-section of the removable and permanently connected terminal blocks with screw-type connection are described in Chapter "Screw-type connection (Page 19)."

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

| Step | Operating instruction | Figure |
|---|---|---|
| 1 | 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.<br>The current monitoring relay will sit correctly flush with the contactor on the left- and right-hand sides. |  |

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): |
|---|---|
|  |  |

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**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 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)

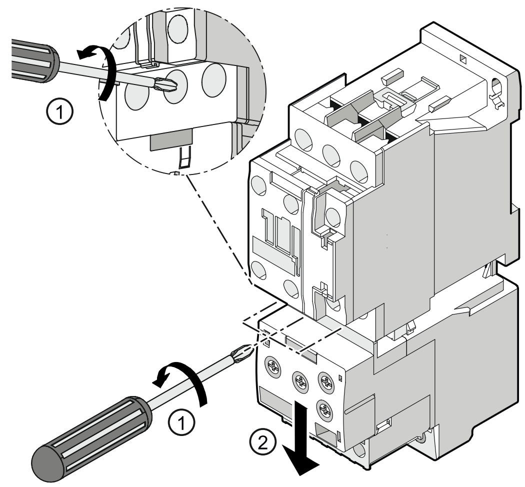
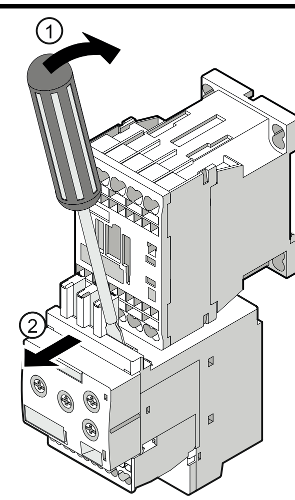
| Step | Operating instruction | Figure |
|---|---|---|
| 1 | Undo the screws on the main conductor terminals. |  |
| 2 | Pull the current monitoring relay down and away from the contactor. | |

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

| Step | Operating instruction | 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. | |

### Separately mounted

**Note**

The accessories required for separate mounting are described in Chapter "Terminal support for stand-alone assembly (Page 312)."

## 3.4.2 Mounting the 3UG4 monitoring relay

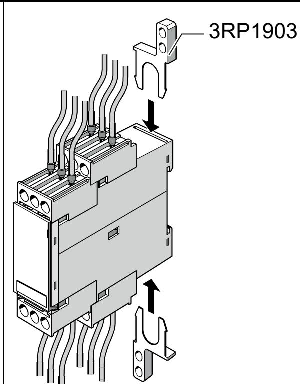
### Mounting position

It can be mounted in any position.

### Screw mounting

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

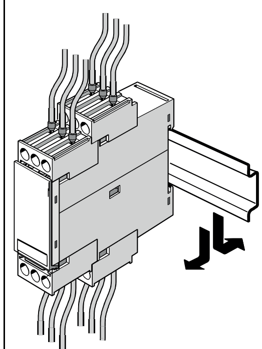
Table 3- 11 Mounting the monitoring relay (screw mounting)

| 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. |  |

## Standard-rail mounting

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

Table 3- 12 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.<br>To remove the device, press it down, pushing against the mounting springs, and swivel the device to remove it. |  |

### 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- 13 Installing the 3UG458. insulation monitoring relay (mounting onto standard rail)

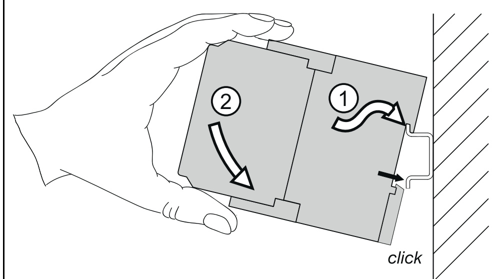
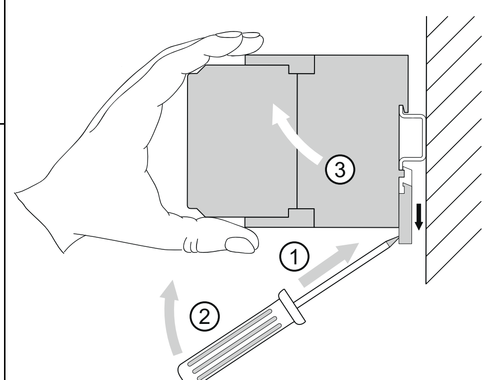
| Step | Instructions | Figure |
|---|---|---|
| 1 / 2 | Position the device on the top edge of the DIN rail and press down until it snaps onto the bottom edge of the DIN rail. |  |

Table 3- 14 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- 15 Functions of the 3RR21 / 3RR22 current monitoring relays for analog and digital setting

| Function | Current monitoring relay | |
|---|---|---|
| | 3RR21 | 3RR22 |
| **Current monitoring** | | |
| 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 | — | ✓ |
| **Supply voltage** | | |
| 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- 16 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 | 24 | 25 | 51 |
| **Line monitoring and voltage monitoring** | | | | | | | | | | | | | | | | | | | |
| Monitoring for phase sequence | — | ✓ | ✓ | ✓ | — | ✓ | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | — | — |
| Monitoring for phase failure | — | ○1) | ✓ | ✓ | — | ✓ | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | — | — |
| Monitoring for asymmetry | — | — | 10 % | 20 % | — | ✓ | ○2) | ○2) | ✓ | ✓ | — | — | — | — | — | — | — | — | — |
| Monitoring for undervoltage | — | — | — | 3p | — | 3p | 3p | 3p | 3p | 3p | 1p | 1p | 1p | — | — | — | — | — | — |
| Monitoring for overvoltage | — | — | — | — | — | — | 3p | 3p | 3p | 3p | 1p | 1p | 1p | — | — | — | — | — | — |
| Monitoring for neutral failure | — | — | — | — | — | — | — | ✓ | — | ✓ | — | — | — | — | — | — | — | — | — |
| Automatic direction of rotation correction in the case of incorrect phase sequence | — | — | — | — | — | — | — | — | ✓ | ✓ | — | — | — | — | — | — | — | — | — |
| **Power factor monitoring and current monitoring** | | | | | | | | | | | | | | | | | | | |
| Monitoring for undercurrent | — | — | — | — | — | — | — | — | — | — | — | — | — | 1p | 1p | 1p | — | — | — |
| Monitoring for overcurrent | — | — | — | — | — | — | — | — | — | — | — | — | — | 1p | 1p | 1p | — | — | — |
| Active current monitoring | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ✓ | — | — | — |
| Apparent current monitoring | — | — | — | — | — | — | — | — | — | — | — | — | — | ✓ | ✓ | — | — | — | — |
| Power factor monitoring | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ✓ | — | — | — |
| **Fault current monitoring/insulation monitoring** | | | | | | | | | | | | | | | | | | | |
| Monitoring for fault current/ground fault | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ✓ | ✓ | — |
| Insulation monitoring | — | — | — | — | ✓ | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| **Filling level monitoring** | | | | | | | | | | | | | | | | | | | |
| Monitoring for filling level overshoot/resistance overshoot | ✓ | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Monitoring for filling level undershoot/resistance undershoot | ✓ | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| **Speed monitoring** | | | | | | | | | | | | | | | | | | | |
| Monitoring for speed overshoot | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ✓ |
| Monitoring for speed undershoot | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ✓ |

| Function | Monitoring relays | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3UG45 | | | | | 3UG46 | | | | | | | | | | | | | |
| | 01 | 11 | 12 | 13 | 8 | 14 | 15 | 16 | 17 | 18 | 31 | 32 | 33 | 21 | 22 | 41 | 24 | 25 | 51 |
| **Rated control and supply voltage** | | | | | | | | | | | | | | | | | | | |
| 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)

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

# 3.6 Menu-based operation

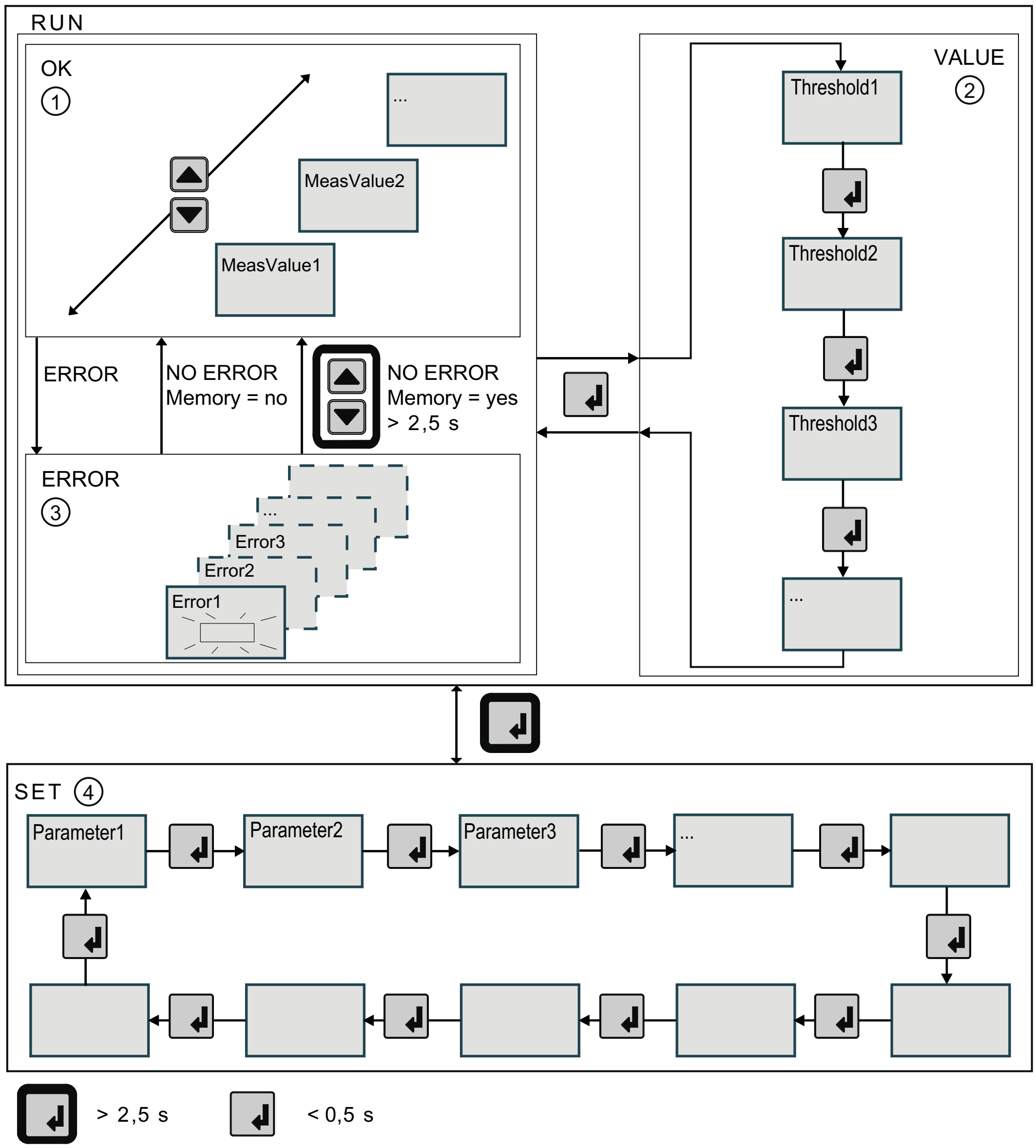
## Operator controls

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

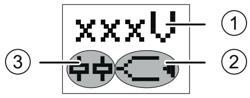
Navigation through the menu system of the monitoring relays is explained below in a schematic diagram.
Depending on the device version and as long as no faults have occurred, one or more different measuring values ① can be displayed with the help of the arrow keys. In the event of a fault, the display 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<br>If a threshold is overshot 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 (≤ 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.

- 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, SET? 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, RUN? 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

## 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.

The SIRIUS 3RR2 current monitoring relays are available in the two 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

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 Chapter "Parameters (Page 351)."

### System integration

The 3RR2 current monitoring relays have been matched to the contactors in the 3RT2 series both electrically and mechanically and 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.

The current monitoring relays are available in two sizes, S00 and S0.

### 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 Chapter "Accessories for 3RR2 current monitoring relays (Page 311)."

## 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 |
|---|---|
| • Undercurrent<br>• Overcurrent<br>• Apparent current<br>• Active current (3RR22 only)<br>• Phase failure / wire break<br>• Phase sequence (3RR22 only)<br>• Internal ground fault detection (fault current) (3RR22 only)<br>• Block current (3RR22 only) | • Emergency lighting<br>• Heating systems (electroplating plants, plastic injection machines, paintshops)<br>• Lamps (tunnels, OR lighting, traffic lights, signal systems, UV lamps, infrared radiators, laser lamps)<br>• Fan<br>• Pumps<br>• Sawing system<br>• Conveyor belt<br>• Surface grinding machine<br>• Breaking mill<br>• Milling machine<br>• Car wash<br>• Lifting platform<br>• Screw conveyor<br>• Crane<br>• Turning machine<br>• Woodworking<br>• Grain mills<br>• Steel industry |

## 4.3 Performance features of current monitoring relays

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

| Functions/Parameters | Current monitoring relays with analog setting | | Current monitoring relays with digital setting | |
|---|---|---|---|---|
| | 3RR2141-.A.30 | 3RR2142-.A.30 | 3RR2241-.F.30 | 3RR2242-.F.30 |
| Rated current | 1.6 to 16 A | 4 to 40 A | 1.6 to 16 A | 4 to 40 A |
| Frequency range | AC 50/60 Hz | AC 50/60 Hz | AC 20 to 400 Hz | AC 20 to 400 Hz |
| Supply voltage $U_s$ | • -.AA30: 24 V AC/DC<br>• -.AW30: 24 to 240 V AC/DC | | • -.FA30: 24 V AC/DC<br>• -.FW30: 24 to 240 V AC/DC | |
| Monitoring for current overshoots and/or undershoots | 2-phase | 2-phase | 3-phase | 3-phase |
| Contacts | 1 CO contact | 1 CO contact | 1 CO contact / 1 semiconductor output | 1 CO contact / 1 semiconductor output |

### 4.3.1 General data

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

| Feature | Benefit | 3RR21 Basic, analog setting | 3RR22 Standard, digital setting |
|---|---|---|---|
| Sizes | • The devices are matched to the dimensions, connections and technical features of the other devices in the SIRIUS modular system.<br>• The devices permit the mounting of slim-line and compact load feeders in widths of 45 mm (S00 and S0).<br>• The devices make configuration easier. | S00, S0 | S00, S0 |
| Current range | • The devices are matched to the other devices in the SIRIUS modular system<br>• Just 1 option per size with a wide setting range makes configuration easy. | S00: 1.6 to 16 A<br>S0: 4.0 to 40 A | S00: 1.6 to 16 A<br>S0: 4.0 to 40 A |

### 4.3.2 Properties

Table 4- 4 Equipment of 3RR2 current monitoring relays

| Feature | Benefit | 3RR21 Basic, analog setting | 3RR22 Standard, digital setting |
|---|---|---|---|
| Reset function | • Enables manual or automatic resetting of the monitoring relay<br>• Resetting directly on the device or by disconnecting and reconnecting the supply voltage (remote reset) | ✓ | ✓ |
| ON-delay time | • Enables motor starting without evaluation of the starting current<br>• Can be used to monitor motors with lengthy startup | 0 s to 60 s | 0 to 99 s |
| Tripping delay time | • Prevents frequent warnings and disconnection in response to currents in the vicinity of the thresholds<br>• Permits brief violations of thresholds during operation | 0 s to 30 s | 0 s to 30 s |
| Operator controls and displays | • For setting thresholds and delay times<br>• For selectable functions<br>• For fast and selective diagnostics<br>• Display for permanent indication of measured values | LEDs and rotary buttons | Display and buttons |
| Integrated contacts | • Allow the system or process to be shut down in the event of an irregularity<br>• Can be used to output signals | 1 CO contact | 1 CO contact<br>1 semiconductor output |

### 4.3.3 Configuration of load feeders

Table 4- 5 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) | • Provides optimum protection of the loads and operating personnel in the event of short circuits due to insulation faults or faulty switching operations | ✓ | ✓ |
| Electrical and mechanical matching to 3RT2 contactors | • Simplifies configuration<br>• Reduces connection outlay and costs<br>• Enables stand-alone assembly as well as space-saving direct mounting | ✓ | ✓ |
| Spring-loaded connection system for main circuit (option) and auxiliary circuit (option) | • Enables fast connections<br>• Ensures that connections are vibration-resistant<br>• Enables maintenance-free connections | ✓ | ✓ |

### 4.3.4 Combinations with 3RT20 contactor

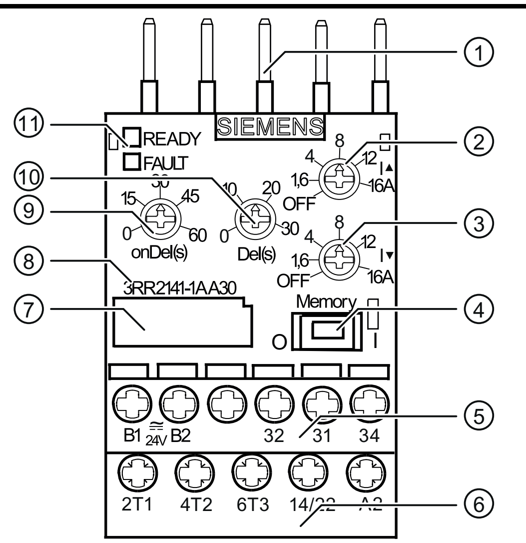
| Monitoring relay type | Current range | 3RT20 1 S00 contactors 3/4/5.5/7.5 kW | 3RT20 2 S0 contactors 5.5/7.5/11/15/18.5 kW |
|---|---|---|---|
| 3RR21 41 | 1.6 to 16 A | ✓ | (with stand-alone assembly support) |
| 3RR22 41 | 1.6 to 16 A | ✓ | (with stand-alone assembly support) |
| 3RR21 42 | 4.0 to 40 A | (with stand-alone assembly support) | ✓ |
| 3RR22 42 | 4.0 to 40 A | (with stand-alone assembly support) | ✓ |

# 4.4 3RR21 current monitoring relays

## 4.4.1 Operator controls and connection terminals

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

Front view




| Description | |
|---|---|
| **Position digits** | |
| 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 current terminal (removable):<br>The control circuit can be connected using either the screw-type or the spring-loaded connection system. |
| 6 | Primary current terminal (permanently connected) :<br>The main circuit can be connected using either the screw-type or the spring-loaded connection system. |
| 7 | Label |
| 8 | Device order 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 |
| **Terminal labels** | |
| 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 |
| 2T1, 4T2, 6T3 | Main circuit terminals |
| 14 / 22 | Feed-through contactor auxiliary switch (S00) |
| A2 | Feed-through contactor coil terminal (S00) |

You will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)".

You will find information on connecting in Chapter "Circuit diagrams (Page 50)".

### 4.4.2 Function

#### General functionality

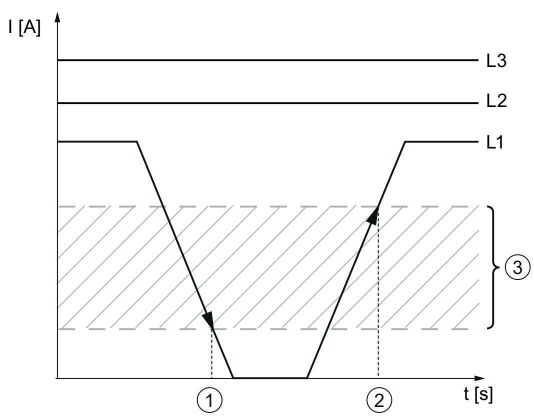
Depending on the setting, the current monitoring relays monitor an AC load current that flows through terminals 1L1 / 2T1 and 3L2 / 4T2 of the device for **overshoot** (I▲) or **undershoot** (I▼) or in **range monitoring** (I▲ and I▼ ≠ OFF).

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.

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 cabel break
③ Hysteresis cable break:
- S00: 1.2 A to 1.6 A
- S0: 3.0 A to 4.0 A

Figure 4-1 Diagram of cable break

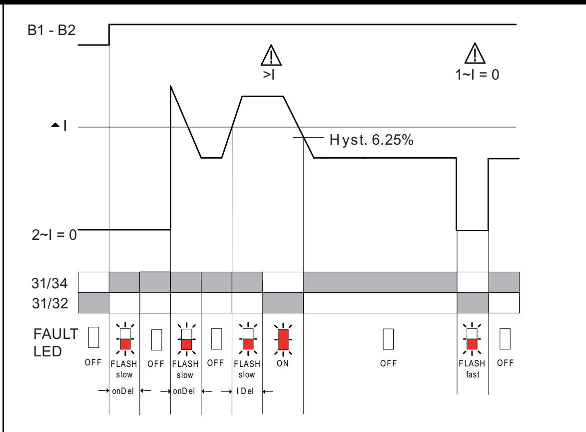
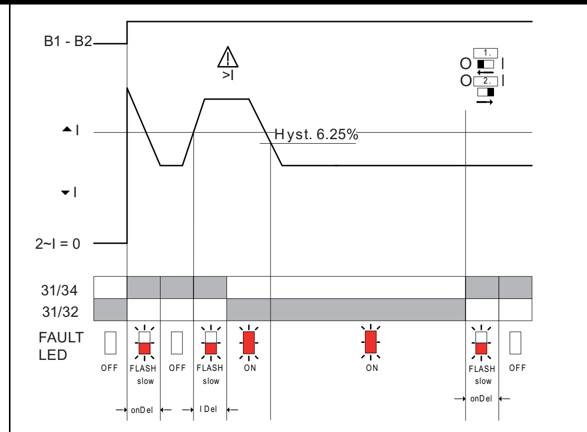
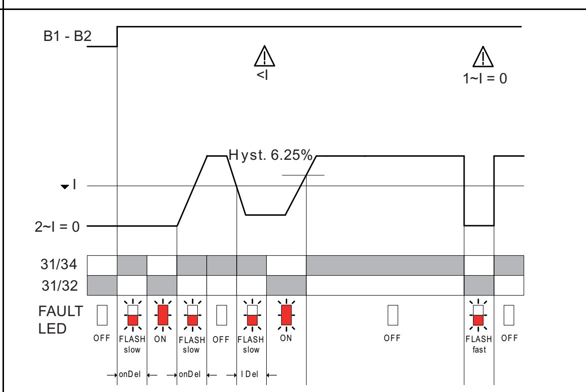
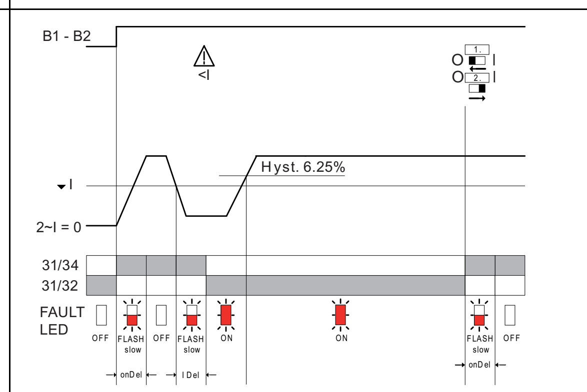
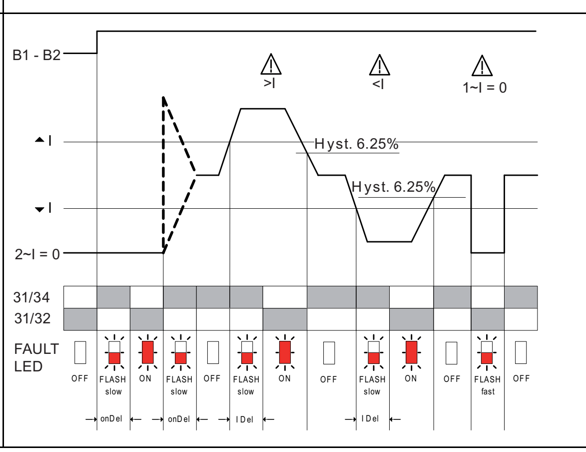
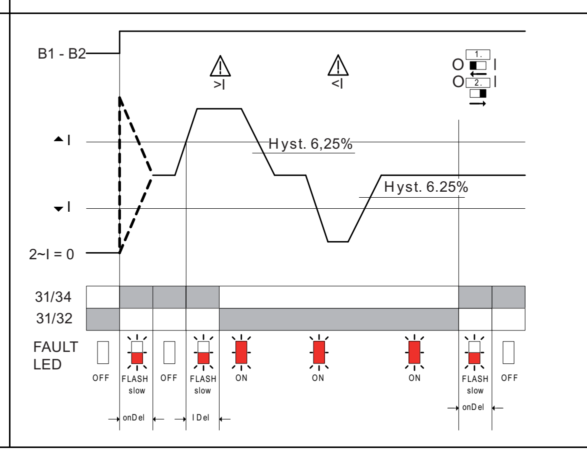
If a cable break (zero current in branch circuit 1L1 / 2T1 or 3L2 / 4T2) is detected (time ①), all running delay times are aborted and the red FAULT-LED flashes rapidly and the CO contact immediately changes its switching state.

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

If Memory = I, the tripping state is saved.

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

## Function diagrams

<table>
<tr><th></th><th>Memory = O:</th><th>Memory = I:</th></tr>
<tr><td>I▲<br>I▼ = Off</td><td>
</td><td>
</td></tr>
<tr><td>I▲ = Off<br>I▼</td><td>
</td><td>
</td></tr>
<tr><td>I▲<br>I▼</td><td>
</td><td>
</td></tr>
</table>

### 4.4.3 Operation

#### Parameters

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

Table 4- 6 Parameter information, 3RR21 current monitoring relays with analog setting

| Parameters | Control element [4] | 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▲) | 2 | 1.6 A or OFF[1]<br>4 A or OFF[2] | 16 A or OFF[1]<br>40 A or OFF[2] | Continuous | 8 A[1]<br>20 A[2] |
| Threshold for current undershoot(I▼) | 3 | 1.6 A or OFF[1]<br>4 A or OFF[2] | 16 A or OFF[1]<br>40 A or OFF[2] | Continuous | Disabled |
| Reset response (Memory) | 4 | 0 = automatic rest | 1 = manual reset [3] | -- | Automatic reset |

[1] current monitoring relay 3RR2141-.A.30

[2] current monitoring relay 3RR2142-.A.30

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

[4] The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 46)."

#### 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 Chapter "Parameters (Page 351)."

### 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)

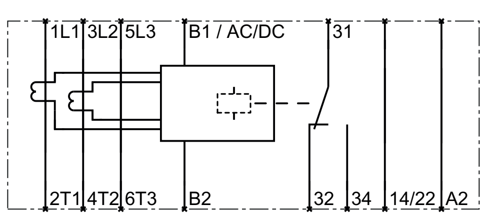
| Display | Meaning |
|---|---|
| FAULT off | Measured value is within range limits |
| FAULT steady on | Device has tripped |
| FAULT flashing slowly | Delay time is running |
| FAULT flashing rapidly | Cable break/phase failure detected |
| READY off | Voltage is not applied at B1 - B2 |
| READY on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

You will find more information about the LED display and its various settings in Chapter "Function (Page 47)."

## 4.4.5 Circuit diagrams

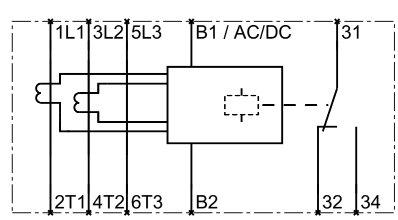
### Internal circuit diagrams 3RR21

**3RR2141-1A.30**




Current monitoring relay, 1 CO contact, 2-phase

**3RR2141-2A.30, 3RR2142-.A.30**




Current monitoring relay, 1 CO contact, 2-phase

### 4.4.6 Technical data

#### General technical specifications

| | | 3RR2141-..... | 3RR2142-..... |
|---|---|---|---|
| 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 |
| Protection class IP | | | |
| • on the front | | — | |
| • of the terminal | | — | |
| 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 | °C | -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 | |
| Resistance against vibration | | 10 ... 55 Hz / 0.35 mm | |
| Impulse voltage resistance rated value | kV | 6 | |
| Operating apparent output rated value | V·A | 3.5 | |
| Rating Rated value | W | 2.5 | |
| Item designation | | | |
| • according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | | K | |
| • according to DIN EN 61346-2 | | K | |
| 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 | |
| Precision of digital display | | — | |
| Adjustable response delay time | | | |
| • when starting | s | 0 … 60 | |
| • with lower or upper limit violation | s | 0 … 30 | |

| | | 3RR2141-..... | 3RR2142-..... |
|---|---|---|---|
| Standby time for restart after fault | s | 0.3 | |
| Phase number | | 3 | |
| Number of monitored phases | | 2 | |
| Product function | | | |
| • overcurrent monitoring | | Yes | |
| • undercurrent monitoring | | Yes | |
| • overcurrent and undercurrent monitoring | | Yes | |
| • apparent current monitoring | | Yes | |
| • active current monitoring | | No | |
| • undercurrent recognition of 3 phases | | No | |
| • phase sequence recognition | | No | |
| • can be activated or deactivated phase sequence recognition | | No | |
| • self-reset | | Yes | |
| • reset external | | No | |
| • manual RESET | | Yes | |
| Adjustable response current | | | |
| • 1 | A | 1.6 … 16 | 4 … 40 |
| • 2 | A | 1.6 … 16 | 4 … 40 |
| Factor as multiple of the current monitoring upper limit | | | |
| • for the adjustable value of a blocking current | | — … | |
| Response value residual current detection at 50/60 Hz typical | A | — | |
| Type of current for monitoring | | AC | |
| Measurable current | | | |
| • for AC | A | 1.6 … 16 | 4 … 40 |
| Adjustable switching hysteresis for measured current value | A | — … | |
| Relative switching hysteresis for measured current value | % | 6.25 | |
| Response time maximum | s | 0.3 | |
| Relative repeat accuracy | % | 2 | |
| Temperature drift per °C | %/°C | 0.1 | |
| Current-carrying capacity | | | |
| • for permanent overcurrent maximum permissible | A | 16 | 40 |
| • for overcurrent duration < 1 s maximum permissible | A | 320 | 800 |

## Connections 3RR2141 (size S00)

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

## Connections 3RR2142 (size S0)

| | | 3RR2142-1.... | 3RR2142-2.... |
|---|---|---|---|
| **Design of the electrical connection** | | | |
| • for main current circuit | | screw-type terminals | spring-loaded terminals |
| • for auxiliary and control current circuit | | screw-type terminals | spring-loaded terminals |
| **Product function** | | | |
| • removable terminal for main circuit | | No | |
| • removable terminal for auxiliary and control circuit | | Yes | |
| **Type of the connectable conductor cross-section** | | | |
| • for main contacts | | | |
| – solid | | 2x (1 ... 2.5 mm²),<br>2x (2.5 ... 10 mm²) | 1x (1 ... 10 mm²) |
| – stranded | | — | |
| – finely stranded | | | |
| – with conductor end processing | | 2x (1 ... 2.5 mm²),<br>2x (2.5 ... 6 mm²),<br>1x 10 mm² | 1x (1 ... 6 mm²) |
| – without conductor final cutting | | — | 1x (1 ... 6 mm²) |
| • for AWG conductors for main contacts | | 2 x (16 ... 14),<br>2x (14 ... 8) | 1x (18 ... 8) |
| • for auxiliary contacts | | | |
| – solid | | 1x (0.5 ... 4 mm²),<br>2x (0.5 ... 2.5 mm²) | |
| – finely stranded | | | |
| – with conductor end processing | | 1x (0.5 ... 2.5 mm²),<br>2x (0.5 ... 1.5 mm²) | 2x (0.25 ... 1.5 mm²) |
| – without conductor final cutting | | — | 2x (0.25 ... 1.5 mm²) |
| • for AWG conductors for auxiliary contacts | | 2x (20 ... 14) | 2x (24 ... 16) |
| **Tightening torque** | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | |
| **Verification of suitability** | | CE / UL / CSA | |

## Mounting, fixing, dimensions

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

## Auxiliary circuit

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

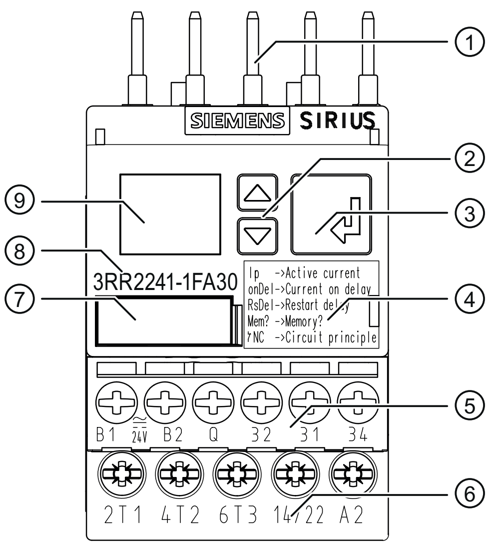
| | | 3RR214.-..A.. | 3RR214.-..W.. |
|---|---|---|---|
| Type of voltage of supply voltage | | AC/DC | |
| Supply voltage frequency | | | |
| • 1 | Hz | 50 … 60 | |
| Supply voltage 1 | | | |
| • for DC | | | |
| – rated value | V | 24 | — |
| – initial rated value | V | — | 24 |
| – final rated value | 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 |
| Stored energy time supply voltage failure minimum | 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**

| Position digits | |
|---|---|
| ① | Connection for contactor mounting or for stand-along assembly |
| ② | Arrow keys for menu navigation |
| ③ | SET key for menu navigation |
| ④ | Legend for menu |
| ⑤ | Control circuit terminal (removable):<br>The control circuit can be connected using either the screw-type or the spring-loaded connection system. |
| ⑥ | Main circuit terminal (permanently connected) :<br>The main circuit can be connected using either the screw-type or the spring-loaded connection system. |
| ⑦ | Label |
| ⑧ | Device order number |
| ⑨ | Display for parameterization, actual-value indication, and diagnostics |
| **Terminal labels** | |
| B1 | Supply voltage AC/DC+ |
| B2 | Supply voltage AC/DC- |
| 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 |
| 2T1, 4T2, 6T3 | Main circuit terminals |
| 14/22 | Feed-through contactor auxiliary switch (S00) |
| A2 | Feed-through contactor coil terminal (S00) |

You will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 66)."

## 4.5.2 Function

### General functionality

Depending on its setting, the plant is monitored for **overshoot** (I▲ CO contact, I!▲ semiconductor output) or **undershoot** (I▼ CO contact, I!▼ semiconductor output) or for a **range** (I▲ , I!▲ and I▼ , 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 1L1 / 2T1, 3L2 / 4T2 and 5L3 / 6T3 terminals of the device. 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 will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 62)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

You will find the switching states of the output relay below in the section entitled "Function diagrams" and in Chapter "Diagnostics (Page 65)."

## 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.

---

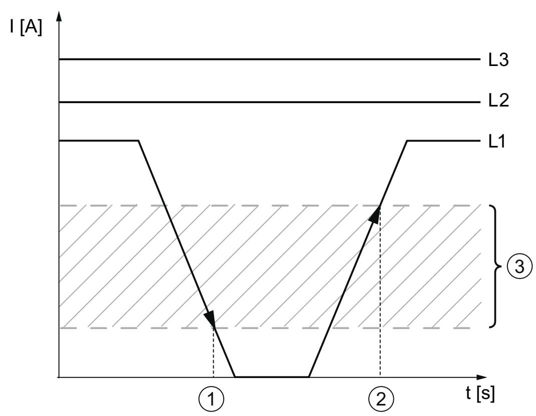
**Note**

**Semiconductor output**

The semiconductor output always responds in automatic reset.

---

## Cable break detected




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

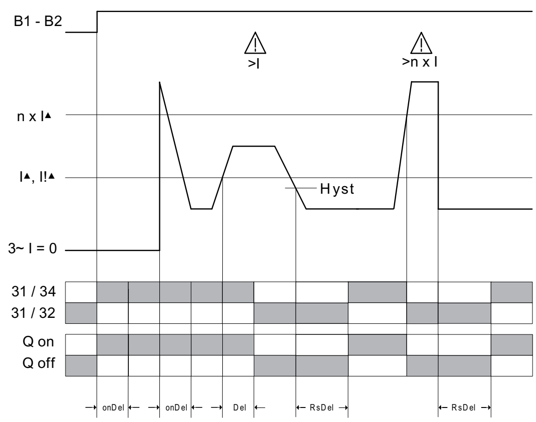
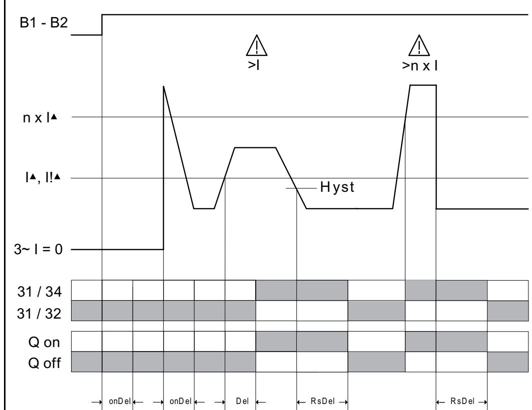
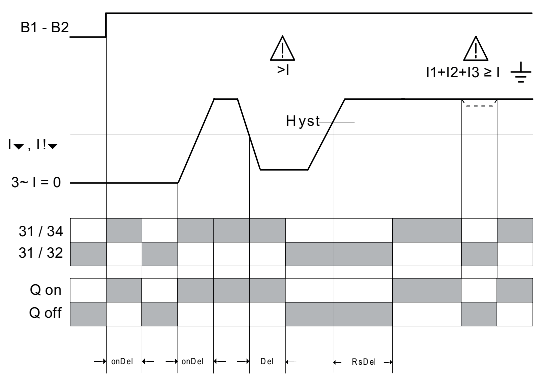
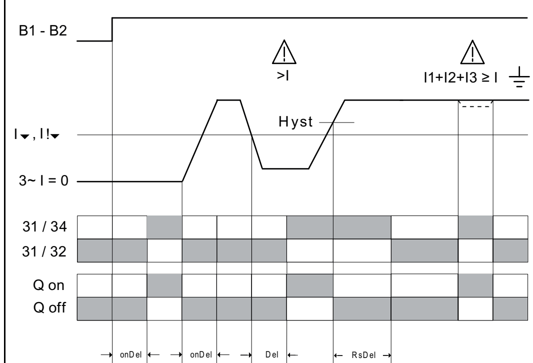
Figure 4-2 Cable break

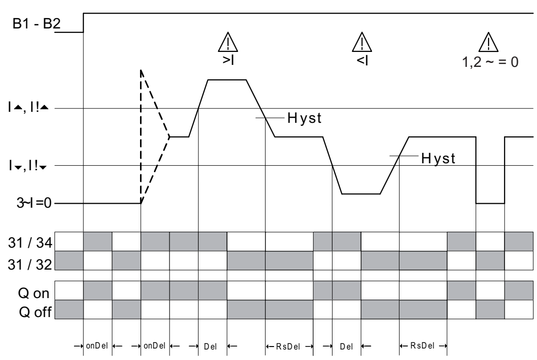
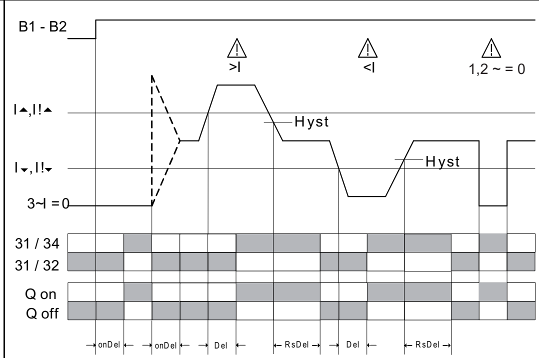
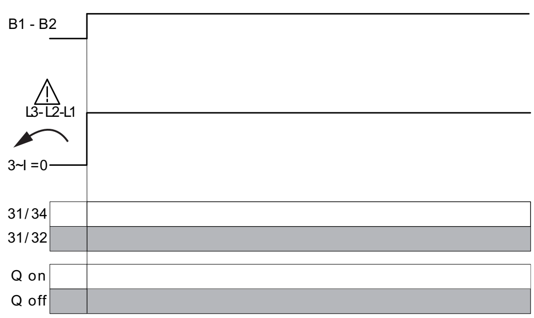
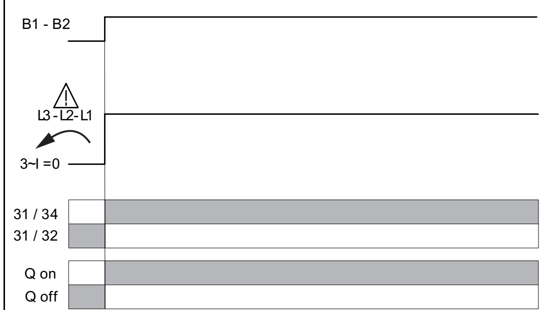
If a cable break is detected in a branch circuit (time ①), all delay times which are running (onDel, RsDel, Del) are aborted and both the CO contact and the semiconductor output change their switching state immediately (≤ 200 ms).

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

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

## Function diagrams

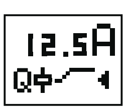
<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC (closed-circuit principle)</th><th>Memory = no<br>Relay switching behavior = NO (open-circuit principle)</th></tr>
<tr><td>I▲ / I!▲<br>I▼ / I!▼ = Off<br>n x I▲</td><td></td><td></td></tr>
<tr><td>I▲ / I!▲ = Off<br>I▼ / I!▼<br>I >> ⏚ = yes</td><td></td><td></td></tr>
</table>

| Display | Memory = no<br>Relay switching behavior = NC (closed-circuit principle) | Memory = no<br>Relay switching behavior = NO (open-circuit principle) |
|---|---|---|
| I▲ / I!▲ = Off<br>I▼ / I!▼ |  |  |
| = yes |  |  |

## 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- 7 Parmeter 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[1]<br>4 A or OFF[2] | 16 A or OFF[1]<br>40 A or OFF[2] | 0.1 A | 1.6 A[1]<br>4 A[2] |
| "RUN" | Threshold for current overshoot (I▲) | 1.6 A or OFF[1]<br>4 A or OFF[2] | 16 A or OFF[1]<br>40 A or OFF[2] | 0.1 A | 3 A[1]<br>8 A[2] |
| "RUN" | Warning threshold for current undershoot (I!▼) | 1.6 A or OFF[1]<br>4 A or OFF[2] | 16 A or OFF[1]<br>40 A or OFF[2] | 0.1 A | 1.6 A[1]<br>4 A[2] |
| "RUN" | Warning threshold for current overshoot (I!▲) | 1.6 A or OFF[1]<br>4 A or OFF[2] | 16 A or OFF[1]<br>40 A or OFF[2] | 0.1 A | 3 A[1]<br>8 A[2] |
| "SET" | Hysteresis (Hyst) | 0.1 A | 3.0 A[1]<br>8.0 A[2] | 0.1 A | 0.5 A[1]<br>0.8 A[2] |
| "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 >>⏚) | no or yes | | -- | no |
| "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

**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.

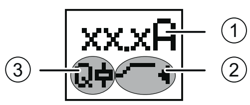
The parameters are described in Chapter "Parameters (Page 351)."

Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

### 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 x I▲ | Flashing: Current is above the set blocking current |
| ① | I>>⏚ | Flashing: Fault current detected |
| ① | L≁ | Flashing: Cable break/phase failure detected |
| ① | ! | 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 |

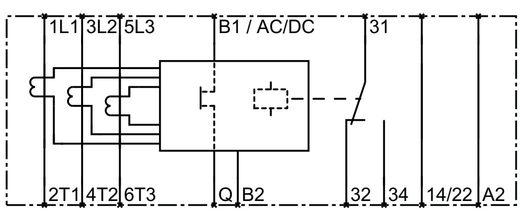
| Display area | Symbol | Meaning |
|---|---|---|
| ③ | ⏚ | • Not flashing: Relay contact 31/32 open, relay contact 31/34 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 31/32 closed, relay contact 31/34 open |
| ③ | Q | • Not flashing: Semiconductor output closed, supply voltage connected<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Semiconductor output open, supply voltage not switched through |

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 59)."

## 4.5.5 Circuit diagrams

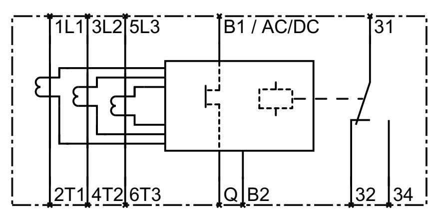
### Internal circuit diagrams 3RR22

**3RR2241-1F.30**




Current monitoring relay, 1 CO contact, 3-phase

**3RR2241-2F.30, 3RR2242-.F.30**




Current monitoring relay, 1 CO contact, 3-phase

### 4.5.6 Technical data

#### General technical specifications

| | | 3RR2241-..... | 3RR2242-..... |
|---|---|---|---|
| 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 |
| Protection class IP | | | |
| • on the front | | — | |
| • of the terminal | | — | |
| 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 | °C | -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 | |
| Resistance against vibration | | 10 ... 55 Hz / 0.35 mm | |
| Impulse voltage resistance rated value | kV | 6 | |
| Operating apparent output rated value | V·A | 3.5 | |
| Rating Rated value | W | 2.5 | |
| Item designation | | | |
| • according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | | K | |
| • according to DIN EN 61346-2 | | K | |
| 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 | |
| Precision of digital display | | +/-1 digit | |
| Adjustable response delay time | | | |
| • when starting | s | 0 … 99 | |
| • with lower or upper limit violation | s | 0 … 30 | |

| | | 3RR2241-..... | 3RR2242-..... |
|---|---|---|---|
| Standby time for restart after fault | s | 0.2 | |
| Phase number | | 3 | |
| Number of monitored phases | | 3 | |
| Product function | | | |
| • 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 | |
| Adjustable response current | | | |
| • 1 | A | 1.6 … 16 | 4 … 40 |
| • 2 | A | 1.6 … 16 | 4 … 40 |
| Factor as multiple of the current monitoring upper limit | | | |
| • for the adjustable value of a blocking current | | 2 … 5 | |
| Response value residual current detection at 50/60 Hz typical | A | 1.5 | 4 |
| Relative metering precision with regard to measured value | % | 5 | |
| Type of current for monitoring | | AC | |
| Measurable current | | | |
| • for AC | A | 1.6 … 16 | 4 … 40 |
| Adjustable switching hysteresis for measured current value | A | 0.1 … 3 | 0.1 … 8 |
| Relative switching hysteresis for measured current value | % | — | |
| Response time maximum | s | 0.2 | |
| Relative repeat accuracy | % | 2 | |

| | | 3RR2241-..... | 3RR2242-..... |
|---|---|---|---|
| Temperature drift per °C | %/°C | 0.1 | |
| Current-carrying capacity | | | |
| • for permanent overcurrent maximum permissible | A | 16 | 40 |
| • for overcurrent duration < 1 s maximum permissible | A | 320 | 800 |

## Connections 3RR2241 (size S00)

| | 3RR2241-1.... | 3RR2241-2.... |
|---|---|---|
| Design of the electrical connection | | |
| • for main current circuit | screw-type terminals | spring-loaded terminals |
| • for auxiliary and control current circuit | screw-type terminals | spring-loaded terminals |
| Product function | | |
| • removable terminal for main circuit | No | |
| • removable terminal for auxiliary and control circuit | Yes | |
| Type of the connectable conductor cross-section | | |
| • for main contacts | | |
| – solid | 2x (0.5 ... 1.5 mm$^2$), 2x (0.75 ... 2.5 mm$^2$), 2x (1 ... 4 mm$^2$) | 1x (0.5 ... 4 mm$^2$) |
| – stranded | — | |
| – finely stranded | | |
| – with conductor end processing | 2x (0.5 ... 1.5 mm$^2$), 2x (0.75 ... 2.5 mm$^2$) | 1x (0.5 ... 2.5 mm$^2$) |
| – without conductor final cutting | — | 1x (0.5 ... 2.5 mm$^2$) |
| • for AWG conductors for main contacts | 1x 12, 2x (20 ... 14) | 1x (20 ... 12) |
| • for auxiliary contacts | | |
| – solid | 1x (0.5 ... 4 mm$^2$), 2x (0.5 ... 2.5 mm$^2$) | |
| – finely stranded | | |
| – with conductor end processing | 1x (0.5 ... 2.5 mm$^2$), 2x (0.5 ... 1.5 mm$^2$) | 2x (0.25 ... 1.5 mm$^2$) |
| – without conductor final cutting | — | 2x (0.25 ... 1.5 mm$^2$) |
| • for AWG conductors for auxiliary contacts | 2x (20 ... 14) | 2x (24 ... 16) |

| | | 3RR2241-1.... | 3RR2241-2.... |
|---|---|---|---|
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | |
| Verification of suitability | | CE / UL / CSA | |

## Connections 3RR2242 (size S0)

| | | 3RR2242-1.... | 3RR2242-2.... |
|---|---|---|---|
| Design of the electrical connection | | | |
| • for main current circuit | | screw-type terminals | spring-loaded terminals |
| • for auxiliary and control current circuit | | screw-type terminals | spring-loaded terminals |
| Product function | | | |
| • removable terminal for main circuit | | No | |
| • removable terminal for auxiliary and control circuit | | Yes | |
| Type of the connectable conductor cross-section | | | |
| • for main contacts | | | |
| – solid | | 2x (1 ... 2.5 mm²),<br>2x (2.5 ... 10 mm²) | 1x (1 ... 10 mm²) |
| – stranded | | — | |
| – finely stranded | | | |
| – with conductor end processing | | 2x (1 ... 2.5 mm²),<br>2x (2.5 ... 6 mm²), 1x 10 mm² | 1x (1 ... 6 mm²) |
| – without conductor final cutting | | — | 1x (1 ... 6 mm²) |
| • for AWG conductors for main contacts | | 2 x (16 ... 14),<br>2x (14 ... 8) | 1x (18 ... 8) |
| • for auxiliary contacts | | | |
| – solid | | 1x (0.5 ... 4 mm²),<br>2x (0.5 ... 2.5 mm²) | |
| – finely stranded | | | |
| – with conductor end processing | | 1x (0.5 ... 2.5 mm²),<br>2x (0.5 ... 1.5 mm²) | 2x (0.25 ... 1.5 mm²) |
| – without conductor final cutting | | — | 2x (0.25 ... 1.5 mm²) |
| • for AWG conductors for auxiliary contacts | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | |
| Verification of suitability | | CE / UL / CSA | |

## Mounting, fixing, dimensions

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

## Auxiliary circuit

| | | 3RR2241-..... | 3RR2242-..... |
|---|---|---|---|
| Design of the contact element of the output relay | | closed-circuit current / open-circuit current | |
| Operating current at 17 V minimum | mA | 5 | |
| Number of outputs as contact-less semiconductor switching element for reporting function non-delayed | | 1 | |
| Current-carrying capacity of the semiconductor output | | | |
| • at DC-13 at 240 V | mA | 20 | |
| • at AC-14 at 240 V at 50/60 Hz | mA | 20 | |
| Residual current of the semiconductor output maximum | mA | 0.035 | |
| Number of NC contacts for auxiliary contacts | | — | |
| Number of NO contacts for auxiliary contacts | | — | |
| Number of change-over switches for auxiliary contacts | | 1 | |
| Operating current of the auxiliary contacts | | | |
| • 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.. |
|---|---|---|---|
| Type of voltage of supply voltage | | AC/DC | |
| Supply voltage frequency | | | |
| • 1 | Hz | 50 … 60 | |
| Supply voltage 1 | | | |
| • 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 |
| Stored energy time supply voltage failure minimum | ms | 10 | |

# 3UG4501 filling level monitoring relay 5

## 5.1 Application areas

### Application areas

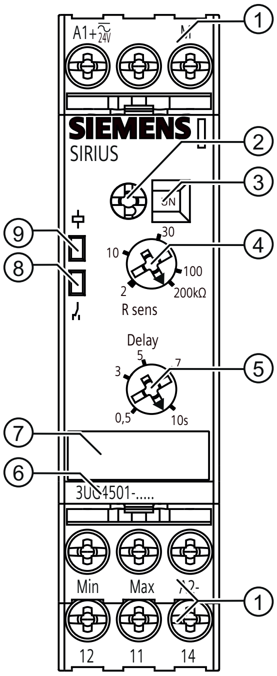
The 3UG4501 filling level monitoring relays are used, for example, in the following applications:

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

| Function | Application |
|---|---|
| • One-point filling level monitoring and two-point filling level monitoring<br>• Overflow protection<br>• Dry-run protection<br>• Leakage monitoring | • Open-loop control of a bilge pump, e.g. on ships or construction sites<br>• Filling level monitoring of lubricants<br>• Filling level monitoring of dosing containers<br>• Filling level monitoring of oil sumps<br>• Filling level monitoring of rainwater catchment basins<br>• Water supply<br>• Waste water treatment plant |

## 5.2 Operator controls and connection terminals

### Front view / terminal labeling

| Front view | Description | |
|---|---|---|
|   | **Position digits** | |
| | ① | Terminal block (removable):<br>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 order number |
| | ⑦ | Label |
| | ⑧ | Status display: LED contact symbol (yellow) |
| | ⑨ | Status display: LED coil symbol (green) |
| | **Terminal labels** | |
| | A1+ | Rated control supply voltage AC/DC+ |
| | A2- | Rated control supply voltage AC/DC- |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 81)."

## 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 317)."

---

**Note**

At the terminals, other resistance sensors in the range 2 to 200 kΩ (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

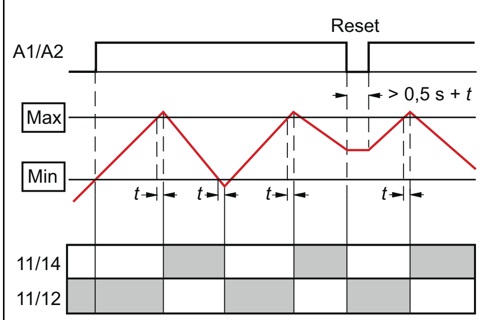
For closed loop control of only one level, the terminals for Min and Max are bridged on the filling level monitoring relay. The output relay changes its switching state as soon as the liquid level has been reached. The output relay reverts to its original switching state as soon as the probe is no longer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

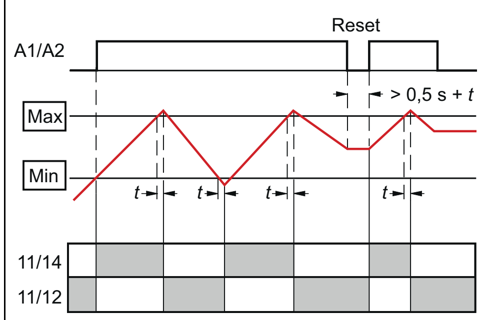
## Reset response

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 s + Delay ( t ) (device reset), the output relay switches depending on the set relay switching behavior.

## Function diagrams 3UG4501

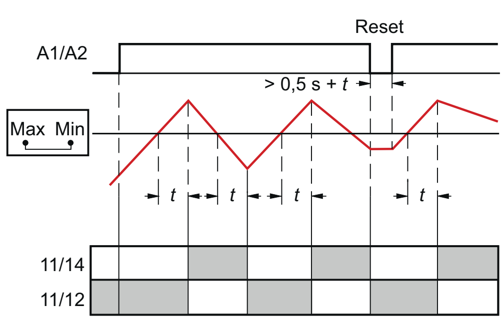
<table>
<tr><th>Drainage control (OV [1]), two-point closed-loop control</th><th>Inflow control (UN [2]), two-point closed-loop control</th></tr>
<tr><td>


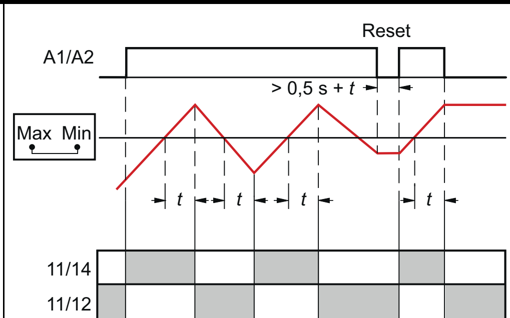

*t* = Delay 0.5 - 10 s
</td><td>



*t* = Delay 0.5 - 10 s
</td></tr>
</table>

[1] OV= overshoot

[2] UN= undershoot

<table>
<tr><th>Drainage control (OV [1]), one-point closed-loop control</th><th>Inflow control (UN [2]), one-point closed-loop control</th></tr>
<tr><td>



*t* = Delay 0.5 - 10 s
</td><td>



*t* = Delay 0.5 - 10 s
</td></tr>
</table>

[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 [2] | Setting range | | Increment |
|---|---|---|---|---|
| | | Minimum value | Maximum value | |
| Monitoring mode[1]: 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 |

[1] 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).

[2] The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 76)."

Chapter "Circuit diagrams (Page 81)" shows the wiring examples for the different monitoring modes.

The parameters are defined in Chapter "Parameters (Page 351)."

## 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 77)."

# 5.6 Circuit diagrams

## Internal circuit diagram

### 3UG4501-.A.30

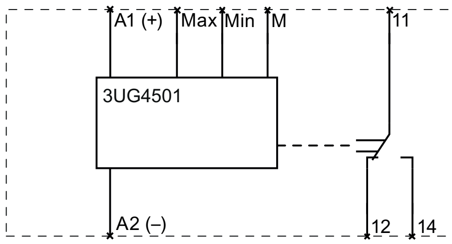
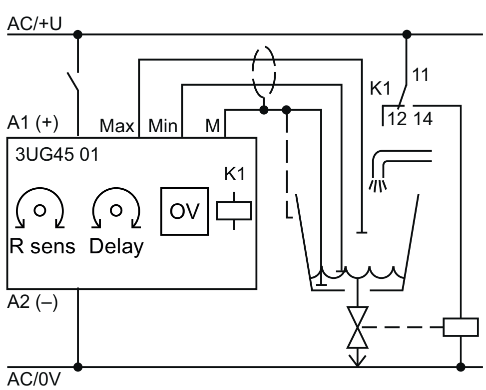


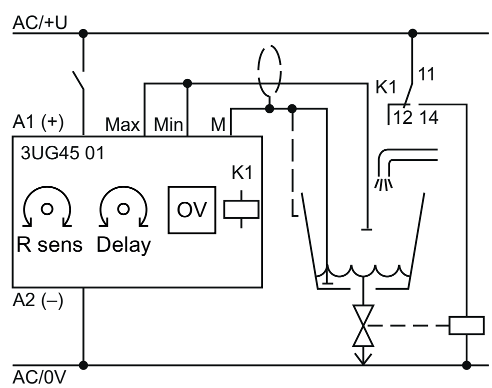

Figure 5-1 3UG4501-.A.30 filling level monitoring relay

## Wiring examples

### Drainage control

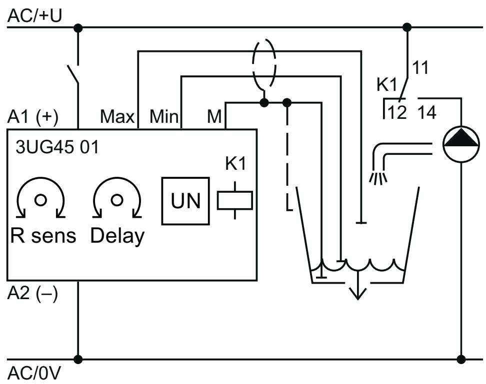



Two-step control

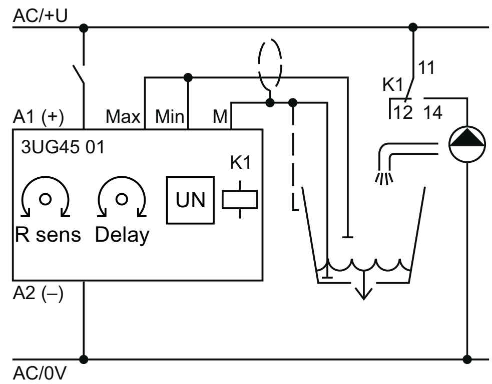



One-point closed-loop control

### Inflow control




Two-step control




One-point closed-loop control

# 5.7 Technical data

## General technical details

| | | 3UG4501-..A.. | 3UG4501-..W.. |
|---|---|---|---|
| Product function | | Monitoring relay for level monitoring | |
| Response time maximum | s | 0.3 | |
| Relative metering precision | % | 20 | |
| Temperature drift per °C | %/°C | 1 | |
| Relative repeat accuracy | % | 1 | |
| Manufacturer article number of the optional sensor | | 2-pole and 3-pole sensors 3UG3207 | |
| Cable length of the sensor maximum | m | 100 | |
| Type of display LED | | Yes | |
| Product function | | | |
| • response sensitivity adjustable | | Yes | |
| • outlet monitoring adjustable | | Yes | |
| • inlet monitoring adjustable | | Yes | |
| • reset external | | Yes | |
| Starting time after the control supply voltage has been applied | ms | 500 | |
| Type of voltage of the controlled supply voltage | | AC/DC | |
| Control supply voltage | | | |
| • 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 |
| Working range factor supply voltage rated value | | | |
| • at 50 Hz | | | |
| – for AC | | 0.85 … 1.1 | |
| • at 60 Hz | | | |
| – for AC | | 0.85 … 1.1 | |
| • for DC | | 0.85 … 1.1 | |
| 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 | |

| | | 3UG4501-..A.. | 3UG4501-..W.. |
|---|---|---|---|
| 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 | |
| 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 | |
| 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 | |
| Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value | V | 300 | |
| Degree of pollution | | 3 | |
| Apparent power consumed | | | |
| • at 24 V for AC maximum | V·A | 2 | |
| • at 240 V for AC maximum | V·A | — | 4 |
| Ambient temperature | | | |
| • during operating | °C | -25 … +60 | |
| • during storage | °C | -40 … +80 | |
| • during transport | °C | -40 … +80 | |
| Galvanic isolation between entrance and outlet | | Yes | |
| Galvanic isolation between the outputs | | No | |

| | | 3UG4501-..A.. | 3UG4501-..W.. |
|---|---|---|---|
| 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.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 92 | 94 |
| Depth | mm | 91 | |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Type of mounting | | screw and snap-on mounting | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |

| | | 3UG4501-1.... | 3UG4501-2.... |
|---|---|---|---|
| Design of the electrical connection | | screw-type terminals | spring-loaded terminals |
| Type of the connectable conductor cross-section | | | |
| • solid | | 1x (0.5 ... 4 $mm^2$),<br>2x (0.5 ... 2.5 $mm^2$) | 2x (0.25 ... 1.5 $mm^2$) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 $mm^2$),<br>2x (0.5 ... 1.5 $mm^2$) | 2 x (0.25 ... 1.5 $mm^2$) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 $mm^2$) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | |
| Number of change-over switches delayed switching | | 1 | |

## Measuring circuit

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

# 3UG4.1 line monitoring relay 6

## 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:

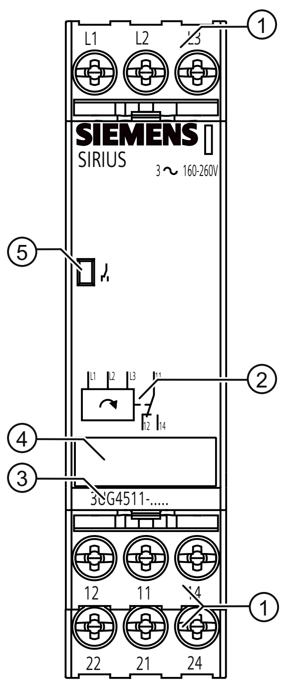
Table 6- 1 Application areas of the line monitoring relays

| Function | Application |
|---|---|
| Phase sequence | • Direction of rotation of the drive<br>• Refrigeration trucks<br>• Refrigerators<br>• Saws<br>• Pumps<br>• Rollers<br>• Transport of persons (elevators, moving staircases and walkways) |
| Phase failure | • A fuse has tripped<br>• Control supply voltage failure<br>• Cable break<br>• Crane systems<br>• Electrical welding<br>• Emergency generating sets (banks, hospitals, alarm systems, power plants)<br>• Transport of persons (elevators, moving staircases and walkways) |
| Phase asymmetry | • Motor protection (overheating of the motor through asymmetric voltage)<br>• Detection of asymmetric systems |
| Undervoltage | • Increased current on a motor with corresponding overheating<br>• Unintended device reset<br>• Mains failure – particularly with battery supply<br>• Heating systems<br>• Cranes<br>• Elevators<br>• Protection on unstable systems (switchover to emergency current, monitoring of the generator) |
| Overvoltage | • System protection against destruction caused by supply overvoltages<br>• Energy supply to the line<br>• Lamps (UV lamps, laser lamps, OP lighting, tunnels, traffic lights) |

# 6.2 3UG4511 line monitoring relay

## 6.2.1 Operator controls and connection terminals

### Front view / terminal labeling 3UG4511

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable)<br>Connection is possible using screw-type terminals or spring-loaded terminals. |
| | ② | Circuit diagram |
| | ③ | Device order number |
| | ④ | Label |
| | ⑤ | Status display: LED contact symbol (green) |
| | **Terminal labels** | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 92)."

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

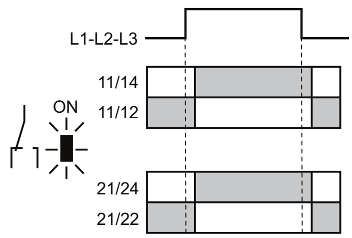
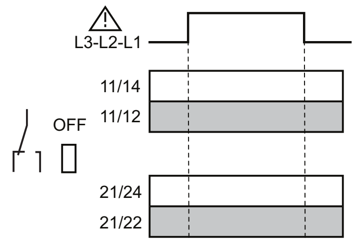
---

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 91)."

#### 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

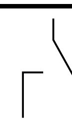
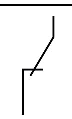
| Correct phase sequence | Incorrect phase sequence |
|---|---|
|   |   |

## 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:

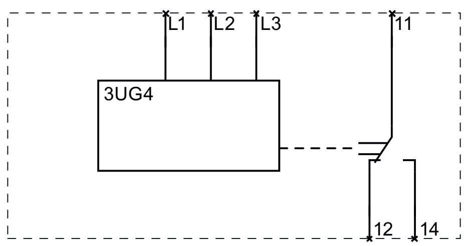
| Operating status | LED contact symbol (green) | State of the output relay<br>12/ 11/ 14<br>22/ 21/ 24 |
|---|---|---|
| Correct phase sequence | On |  |
| Incorrect phase sequence | Off |  |

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 90)."

## 6.2.4 Circuit diagrams

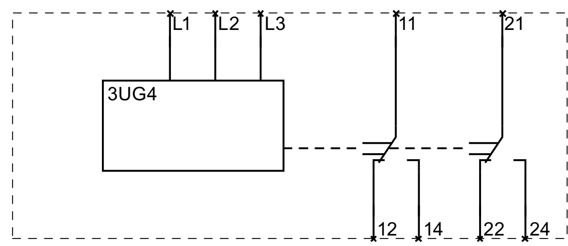
### Internal circuit diagrams 3UG4511

**3UG4511-.A..**




3UG4511-.A.. line monitoring relay

**3UG4511-.B..**




3UG4511-.B.. 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.

---

**Note**

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

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### 6.2.5 Technical data

#### Measuring circuit

| | | 3UG4511-..N | 3UG4511-..P | 3UG4511-..Q |
|---|---|---|---|---|
| Type of voltage for monitoring | | AC | | |
| Number of poles for main current circuit | | 3 | | |
| Measurable voltage | | | | |
| • for AC | V | 160 … 260 | 320 … 500 | 420 … 690 |

#### General technical details

| | | 3UG45 11-..N | 3UG45 11-..P | 3UG45 11-..Q |
|---|---|---|---|---|
| Product function | | Phase monitoring relay | | |
| Type of display LED | | Yes | | |
| Product function | | | | |
| • undervoltage recognition | | No | | |
| • overvoltage recognition | | No | | |
| • phase sequence recognition | | Yes | | |
| • phase disturbance recognition | | No | | |
| • 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 | 0.2 | | |
| Response time maximum | s | 0.45 | | |
| Temperature drift per °C | %/°C | — | | |
| Relative repeat accuracy | % | — | | |

| | | 3UG45 11-..N | 3UG45 11-..P | 3UG45 11-..Q |
|---|---|---|---|---|
| Type of voltage of the controlled supply voltage | | AC | | |
| Control supply voltage | | | | |
| • at 50 Hz at AC rated value | V | 160 … 260 | 320 … 500 | 420 … 690 |
| • at 60 Hz at AC rated value | V | 160 … 260 | 320 … 500 | 420 … 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 | | |

| | | 3UG45 11-..N | 3UG45 11-..P | 3UG45 11-..Q |
|---|---|---|---|---|
| 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 | | |
| Galvanic isolation | | | | |
| • between entrance and outlet | | Yes | | |
| • between the outputs | | Yes | | |
| • between the voltage supply and other circuits | | 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

| | | 3UG4511-1A... | 3UG4511-1B... | 3UG4511-2A... | 3UG4511-2B... |
|---|---|---|---|---|---|
| Width | mm | 22.5 | | | |
| Height | mm | 83 | 92 | 84 | 94 |
| Depth | mm | 91 | | | |
| Built in orientation | | any | | | |
| Distance, to be maintained, to earthed part | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Distance, to be maintained, to the ranks assembly | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Distance, to be maintained, conductive elements | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Type of mounting | | snap-on mounting | | | |
| Product function removable terminal for auxiliary and control circuit | | Yes | | | |

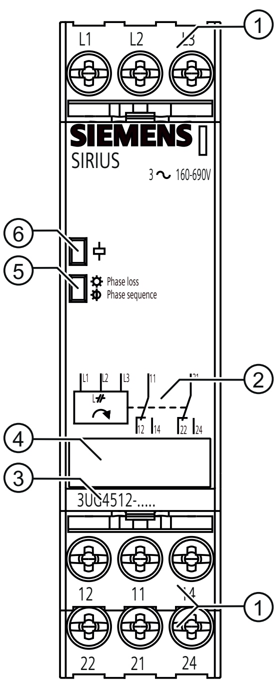
| | | 3UG4511-1A... | 3UG4511-1B... | 3UG4511-2A... | 3UG4511-2B... |
|---|---|---|---|---|---|
| Design of the electrical connection | | screw-type terminals | | spring-loaded terminals | |
| Type of the connectable conductor cross-section | | | | | |
| • solid | | 1x (0.5 ... 4 mm²),<br>2x (0.5 ... 2.5 mm²) | | 2x (0.25 ... 1.5 mm²) | |
| • finely stranded | | | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm²),<br>2x (0.5 ... 1.5 mm²) | | 2 x (0.25 ... 1.5 mm²) | |
| – without wire end processing | | — | | 2x (0.25 ... 1.5 mm²) | |
| • for AWG conductors | | | | | |
| – solid | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| – stranded | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| Tightening torque | | | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | | — … | |
| Number of change-over switches delayed switching | | 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 | |
|---|---|
| **Position digits** | |
| ① | Terminal block (removable)<br>Connection is possible using screw-type terminals or spring-loaded terminals. |
| ② | Circuit diagram |
| ③ | Device order number |
| ④ | Label |
| ⑤ | Status display: LED phase failure / phase sequence (red) |
| ⑥ | Status display: LED coil symbol (green) |
| **Terminal labels** | |
| 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 102)."

### 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 101)."

#### 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.

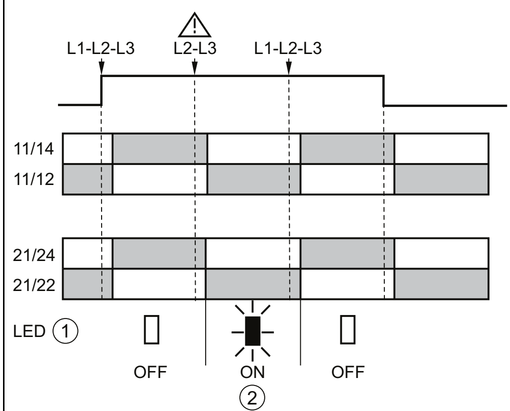
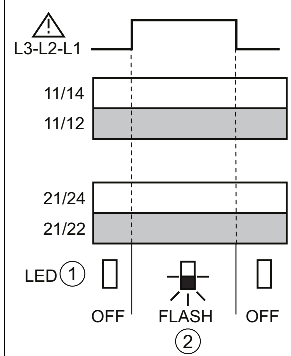
---

**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

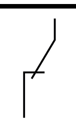
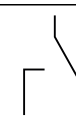
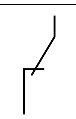
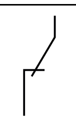
| Phase failure | | Incorrect phase sequence | |
|---|---|---|---|
|  | |  | |
| ① | Red | ① | Red |
| ② | Phase failure | ② | Phase sequence |

## 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:

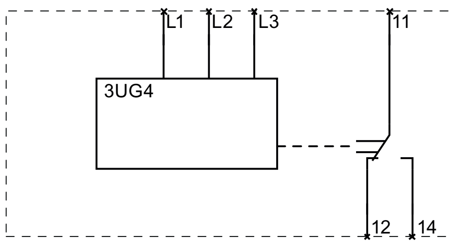
| Operating status | LED: Coil symbol (green) | LED: Phase failure / phase sequence (red) | State of the output relays 12/ 11/ 14<br>22/ 21/ 24 |
|---|---|---|---|
| • Supply voltage not present | Off | Off |  |
| • Supply voltage present<br>• Correct phase sequence<br>• All phases available | On | Off |  |
| • Supply voltage present<br>• Incorrect phase sequence | On | flashing |  |
| • Supply voltage present<br>• Phase failure | On | On |  |

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 99)."

### 6.3.4 Circuit diagrams

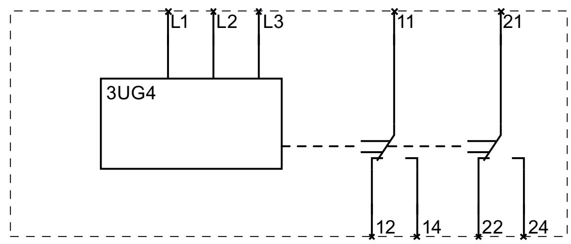
#### Internal circuit diagrams 3UG4512

**3UG4512-.A..**




3UG4512-.A.. line monitoring relay

**3UG4512-.B..**




3UG4512-.B.. 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.

---

**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 | — |
| Relative repeat accuracy | % | 1 |

| | | 3UG4512-..... |
|---|---|---|
| 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 |
| Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value | V | 690 |
| Degree of pollution | | 3 |

| | | 3UG4512-..... |
|---|---|---|
| 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 | | 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

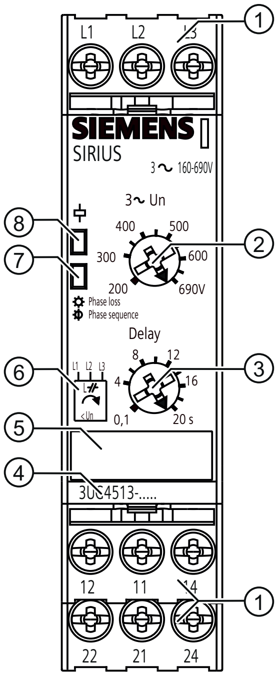
| | | 3UG4512-1A... | 3UG4512-1B... | 3UG4512-2A... | 3UG4512-2B... |
|---|---|---|---|---|---|
| Width | mm | 22.5 | | | |
| Height | mm | 83 | 92 | 84 | 94 |
| Depth | mm | 91 | | | |
| Built in orientation | | any | | | |
| Distance, to be maintained, to earthed part | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Distance, to be maintained, to the ranks assembly | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |

| | | 3UG4512-1A... | 3UG4512-1B... | 3UG4512-2A... | 3UG4512-2B... |
|---|---|---|---|---|---|
| Distance, to be maintained, conductive elements | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Type of mounting | | snap-on mounting | | | |
| Product function removable terminal for auxiliary and control circuit | | Yes | | | |
| Design of the electrical connection | | screw-type terminals | | spring-loaded terminals | |
| Type of the connectable conductor cross-section | | | | | |
| • solid | | 1x (0.5 ... 4 $mm^2$),<br>2x (0.5 ... 2.5 $mm^2$) | | 2x (0.25 ... 1.5 $mm^2$) | |
| • finely stranded | | | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 $mm^2$),<br>2x (0.5 ... 1.5 $mm^2$) | | 2 x (0.25 ... 1.5 $mm^2$) | |
| – without wire end processing | | — | | 2x (0.25 ... 1.5 $mm^2$) | |
| • for AWG conductors | | | | | |
| – solid | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| – stranded | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| Tightening torque | | | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | | — … | |
| Number of change-over switches delayed switching | | 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 | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable)<br>Connection is possible using screw-type terminals or spring-loaded terminals. |
| | ② | Rotary button for setting the nominal line voltage (3~$U_n$) |
| | ③ | Rotary button for setting the tripping delay (Delay) |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Function symbol |
| | ⑦ | Status display: LED phase failure / phase sequence (red) |
| | ⑧ | Status display: LED coil symbol (green) |
| | **Terminal labels** | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 112)."

## 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 111)."

## 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.

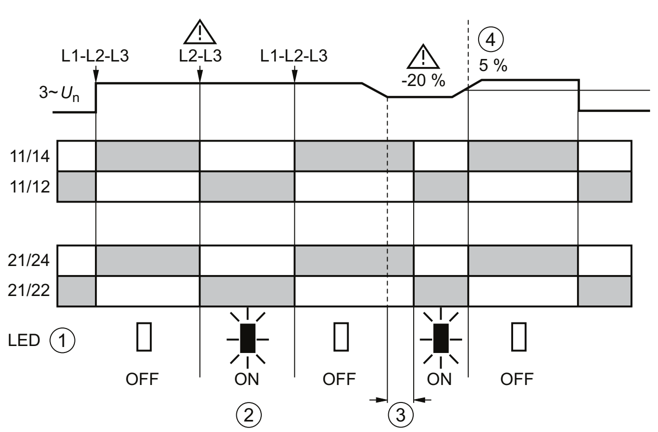
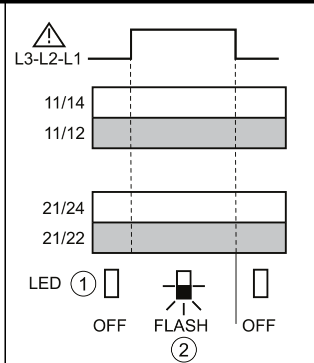
---

**Note**

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

---

## Function diagrams 3UG4513

| Phase failure and undervoltage | | Incorrect phase sequence | |
|---|---|---|---|
|  | |  | |
| ① | LED phase failure / phase sequence: Red | ① | LED phase failure / phase sequence: Red |
| ② | Phase failure | ② | Phase sequence |
| ③ | Tripping delay time | | |
| ④ | Hysteresis | | |

### 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 [1)] | Setting range | | Increment |
|---|---|---|---|---|
| | | Minimum value | Maximum value | |
| Tripping delay time (Delay) | 3 | 0.1 s | 20 s | Continuous |
| Nominal line voltage (3~$U_n$) | 2 | 200 V | 690 V [2)] | Continuous |

[1)] The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 107)."

[2)] absolute threshold

The parameters are described in Chapter "Parameters (Page 351)."

#### Required tools

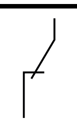
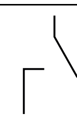
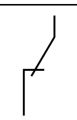
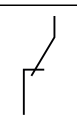
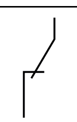
The same screwdriver can be used to set the parameters as for mounting the line monitoring relays.

## 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<br>22/ 21/ 24 |
| • Supply voltage not present | Off | Off |  |
| • Supply voltage present<br>• Correct phase sequence<br>• All phases available<br>• Line-to-line voltage OK | On | Off |  |
| • Supply voltage present<br>• Incorrect phase sequence | On | flashing |  |
| • Supply voltage present<br>• Phase failure | On | On |  |
| • Supply voltage present<br>• Line-to-line voltage undershot | On | On |  |

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 108)."

### 6.4.5 Circuit diagrams

#### Internal circuit diagrams 3UG4513

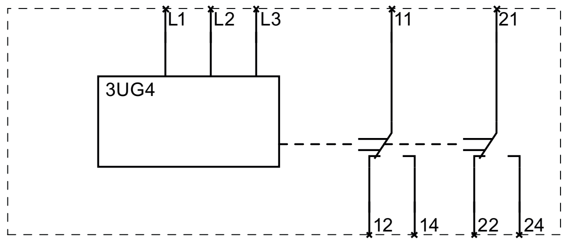



Figure 6-1 3UG4513 line monitoring relay

---

**Note**

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

---

**Note**

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

---

### 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-..... |
|---|---|---|
| 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 |
| Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value | V | 690 |
| Degree of pollution | | 3 |

| | | 3UG4513-..... |
|---|---|---|
| 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 | | 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

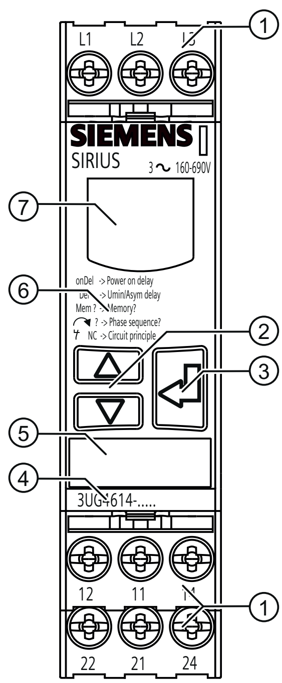
| | | 3UG4513-1.... | 3UG4513-2.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 92 | 94 |
| Depth | mm | 91 | |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |

| | | 3UG4513-1.... | 3UG4513-2.... |
|---|---|---|---|
| **Distance, to be maintained, conductive elements** | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| **Type of mounting** | | snap-on mounting | |
| **Product function removable terminal for auxiliary and control circuit** | | Yes | |
| **Design of the electrical connection** | | screw-type terminals | spring-loaded terminals |
| **Type of the connectable conductor cross-section** | | | |
| • solid | | 1x (0.5 ... 4 mm²),<br>2x (0.5 ... 2.5 mm²) | 2x (0.25 ... 1.5 mm²) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm²),<br>2x (0.5 ... 1.5 mm²) | 2 x (0.25 ... 1.5 mm²) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 mm²) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| **Tightening torque** | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | — … |
| **Number of change-over switches delayed switching** | | 2 | |

# 6.5 3UG4614 line monitoring relay

## 6.5.1 Operator controls and connection terminals

### Front view / terminal labeling 3UG4614

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 124)."

## 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 121)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

---

**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 (Ux-y) is larger than the set value
- The voltage symmetry (Asy) 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!

---

### Startup delay

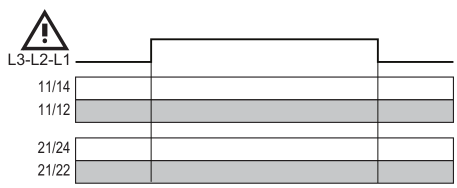
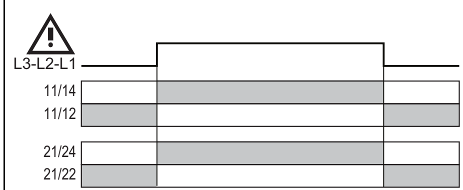
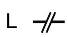
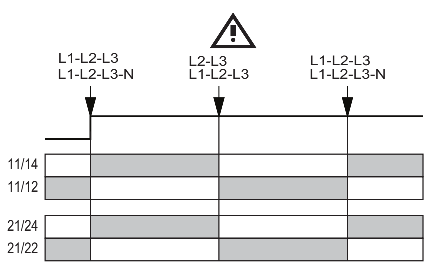
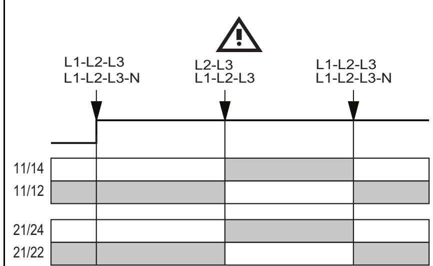
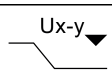
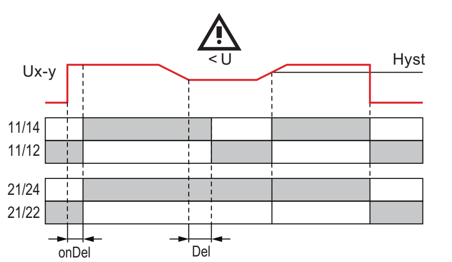
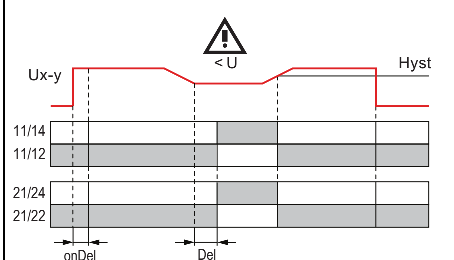
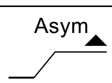
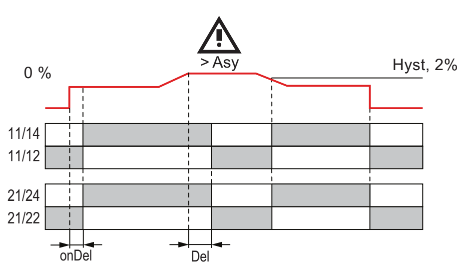
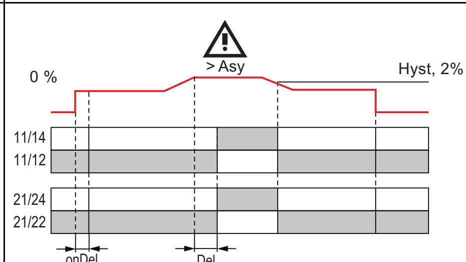
After applying the supply voltage or resetting the monitoring relays, the set ON-delay begins (onDel). During this time, undershooting or overshooting of the set threshold values will not cause the CO contact to respond but instead will result in a restart of the ON-delay.

### 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 122)."

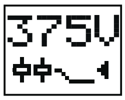
## Function diagrams 3UG4614

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

### 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 Parmeter 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▼) | 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 = Hand-RESET | -- | 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 351)."

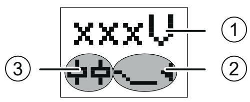
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

## 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 change-over 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 |

| Display area | Symbol | Meaning |
|---|---|---|
| ③ |  | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |
| ③ |  | • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open |

You will find more information about the switching behavior of the output relays in Chapter "Functions (Page 118)."

### 6.5.4.2 Reset

#### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

- Manual RESET (Memory = I / 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

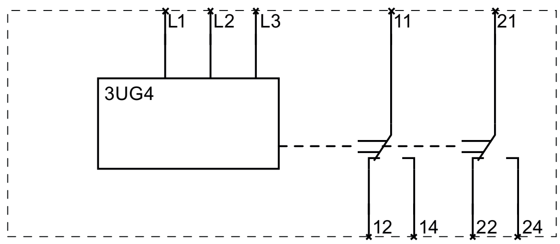



Figure 6-2 3UG4614 line monitoring relay

---

**Note**

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

---

### 6.5.6 Technical data

#### Measuring circuit

| | | 3UG4614-..... |
|---|---|---|
| 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 | 120 … 690 |
| Adjustable response delay time | | |
| • when starting | s | 0.1 … 20 |
| • with lower or upper limit violation | s | 0.1 … 20 |

#### General technical details

| | | 3UG4614-..... |
|---|---|---|
| Product function | | Phase monitoring relay |
| Type of display LED | | No |
| 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 | | Yes |
| Starting time after the control supply voltage has been applied | s | 1 |
| Response time maximum | ms | 450 |
| Relative adjustment accuracy | % | 0.2 |
| Relative repeat accuracy | % | 1 |
| Type of voltage of the controlled supply voltage | | AC |

| | | 3UG4614-..... |
|---|---|---|
| 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 |
| 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 |

| | | 3UG4614-..... |
|---|---|---|
| Galvanic isolation between entrance and outlet | | Yes |
| Galvanic isolation between the outputs | | 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

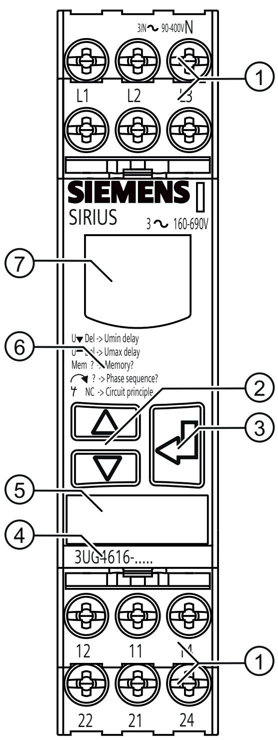
| | | 3UG4614-1.... | 3UG4614-2.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 92 | 94 |
| Depth | mm | 91 | |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Type of mounting | | snap-on mounting | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |

| | | 3UG4614-1.... | 3UG4614-2.... |
|---|---|---|---|
| Design of the electrical connection | | screw-type terminals | spring-loaded terminals |
| Type of the connectable conductor cross-section | | | |
| • solid | | 1x (0,5 ... 4 $mm^2$),<br>2x (0,5 ... 2,5 $mm^2$) | 2x (0.25 ... 1.5 $mm^2$) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0,5 ... 2,5 $mm^2$),<br>2x (0,5 ... 1,5 $mm^2$) | 2 x (0.25 ... 1.5 $mm^2$) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 $mm^2$) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | — … |
| Number of change-over switches delayed switching | | 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 | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable)<br>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 order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 136)."

### 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 133)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

---

**Note**

The specified voltages represent the absolute thresholds.

---

## 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▾Del and U▴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.

---

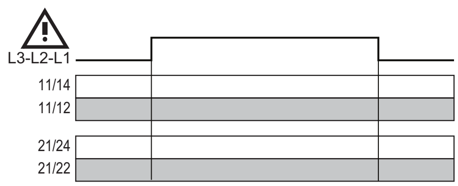
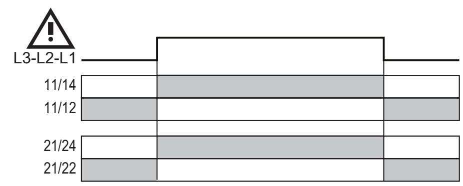
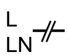
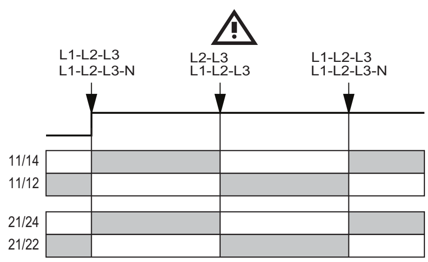
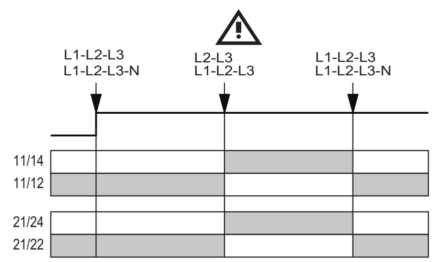
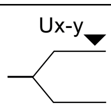
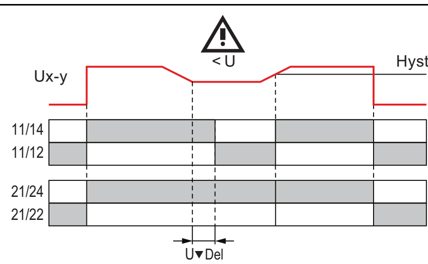
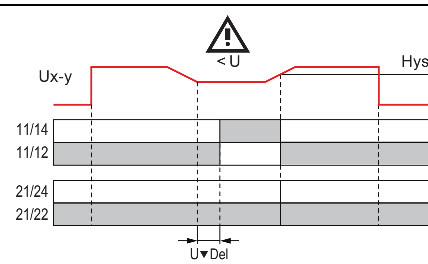
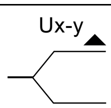
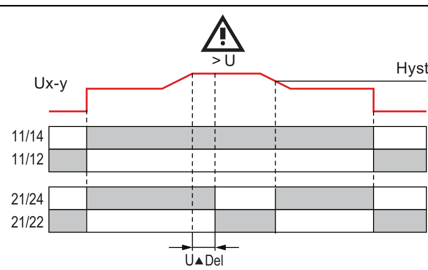
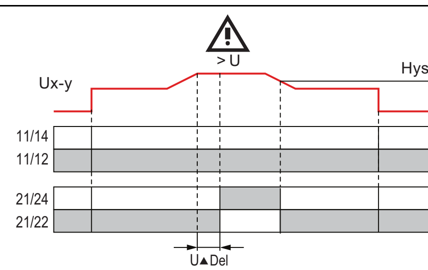
**Note**

The 3UG4615 and 3UG4616 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 section "Function diagrams" and in Chapter "Diagnostics (Page 134)."

## Function diagrams 3UG4615 / 3UG4616

| Display | Memory = no<br>Relay switching behavior = NC<br>(closed-circuit principle) | Memory = no<br>Relay switching behavior = NO<br>(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 Parmeter 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[1]<br>90 V[2] | 690 V[1]<br>400 V[2] | 0.1 V | 375 V[1]<br>215 V[2] |
| "RUN" | Threshold for overshoot (U▲) | 160 V[1]<br>90 V[2] | 690 V[1]<br>400 V[2] | 0.1 V | 425 V[1]<br>245 V[2] |
| "SET" | Hysteresis (Hyst) | 1.0 V | 20.0 V | 0.1 V | 5.0 V |
| "SET" | Tripping delay time (U▼Del) | 0.1 s | 20.0 s | 0.1 s | Disabled |
| "SET" | Tripping delay time (U▲Del) | 0.1 s | 20.0 s | 0.1 s | Disabled |
| "SET" | Reset response (Mem) | no = Autoreset | yes = Hand-RESET | -- | no = Autoreset |
| "SET" | Phase sequence monitoring () | no | yes | -- | yes |
| "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 Chapter "Parameters (Page 351)."

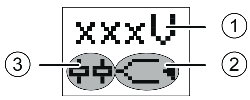
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

## 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 change-over contacts

#### Meaning of the information on the display

---

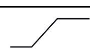
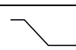
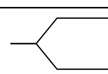
**Note**

**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 |

| Display area | Symbol | | Meaning |
|---|---|---|---|
| ③ | | U▼ | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (tripping delay) is running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |
| ③ | | U▲ | • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed<br>• Flashing: Delay time (tripping delay) is running<br>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open |

**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 130)."

### 6.6.4.2 Reset

#### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

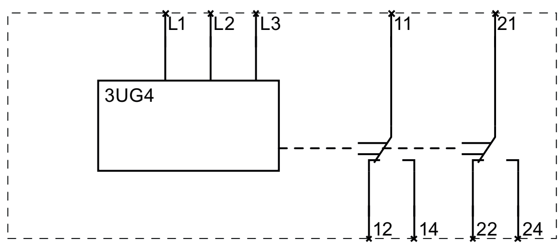
- Manual RESET (Memory = I / Mem = yes)

  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

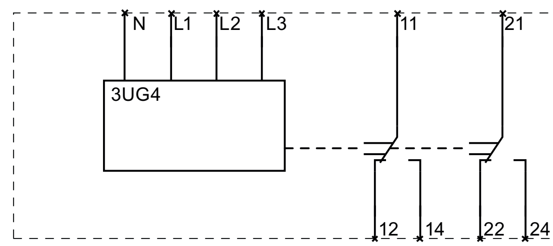
### Internal circuit diagrams 3UG4615 / 3UG4616

3UG4615




3UG4615 line monitoring relay

3UG4616




3UG4616 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.

---

### 6.6.6 Technical data

#### Measuring circuit

| | | 3UG4615-..... | 3UG4616-..... |
|---|---|---|---|
| Type of voltage for monitoring | | AC | |
| Number of poles for main current circuit | | 3 | |
| Measurable voltage<br>• 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 | |
| Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value | V | 690 | |

| | | 3UG4615-..... | 3UG4616-..... |
|---|---|---|---|
| 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 | | 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

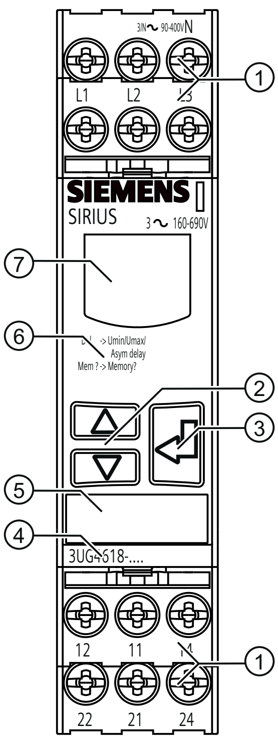
| | | 3UG4615-1.... | 3UG4616-1.... | 3UG4615-2.... | 3UG4616-2.... |
|---|---|---|---|---|---|
| Width | mm | 22.5 | | | |
| Height | mm | 92 | 102 | 94 | 103 |
| Depth | mm | 91 | | | |
| Built in orientation | | any | | | |
| Distance, to be maintained, to earthed part | | | | | |
| • forwards | mm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

| | | 3UG4615-1.... | 3UG4616-1.... | 3UG4615-2.... | 3UG4616-2.... |
|---|---|---|---|---|---|
| Distance, to be maintained, conductive elements | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Type of mounting | | snap-on mounting | | | |
| Product function removable terminal for auxiliary and control circuit | | Yes | | | |
| Design of the electrical connection | | screw-type terminals | | spring-loaded terminals | |
| Type of the connectable conductor cross-section | | | | | |
| • solid | | 1x (0.5 ... 4 $mm^2$),<br>2x (0.5 ... 2.5 $mm^2$) | | 2x (0.25 ... 1.5 $mm^2$) | |
| • finely stranded | | | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 $mm^2$),<br>2x (0.5 ... 1.5 $mm^2$) | | 2 x (0.25 ... 1.5 $mm^2$) | |
| – without wire end processing | | — | | 2x (0.25 ... 1.5 $mm^2$) | |
| • for AWG conductors | | | | | |
| – solid | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| – stranded | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| Tightening torque | | | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | | — … | |
| Number of change-over switches delayed switching | | 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 | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 148)."

## 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 145)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

---

**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 (Ux-y) are larger than the set lower voltage value (U▼) and smaller than the set upper voltage value (U▲), i.e. they are within the voltage limits and the line voltage asymmetry (Asy) 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 the phase failure monitoring.
In the case of fault cases voltage undershoot, voltage overshoot, or asymmetry overshoot, 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. Chapter "Circuit diagrams (Page 148)" provides an example of wiring for automatic phase correction.

---

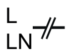
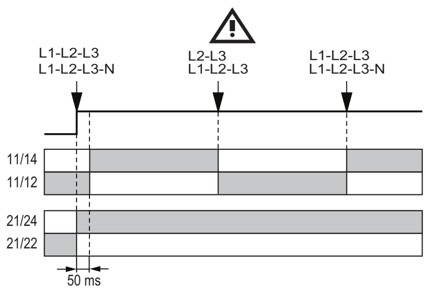
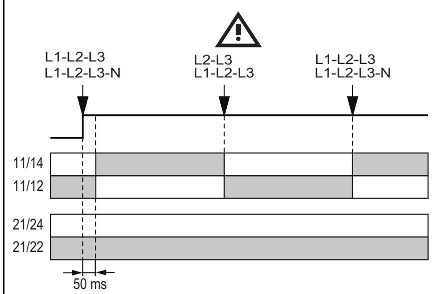
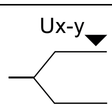
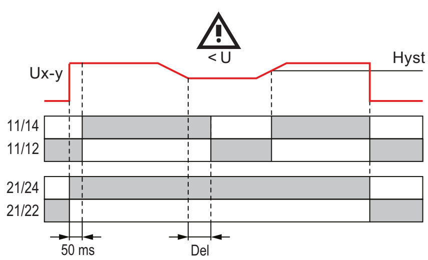
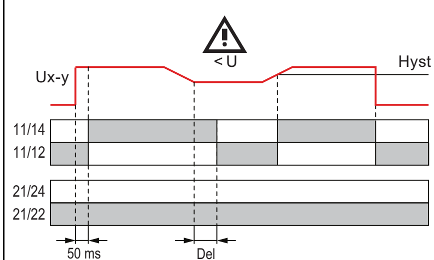
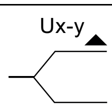
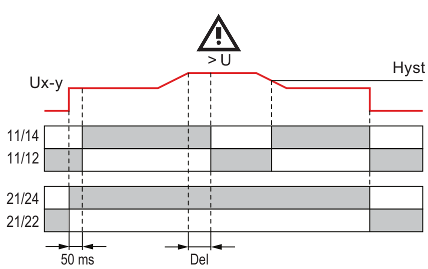
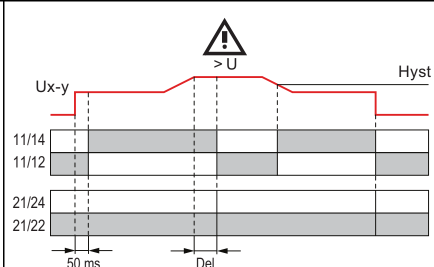
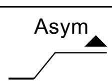
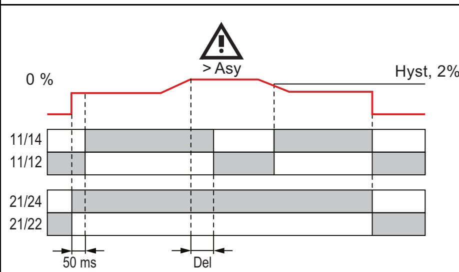
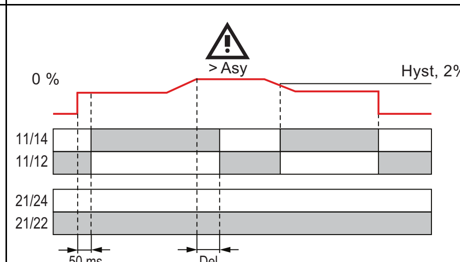
**Note**

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 section "Function diagrams" and in Chapter "Diagnostics (Page 146)."

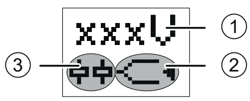
## Function diagrams 3UG4617 / 3UG4618

<table>
<tr><th>Display</th><th>Correct phase sequence L1-L2-L3<br>Memory = no</th><th>Incorrect phase sequence L3-L2-L1<br>Memory = no</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

### 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 Parmeter 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[1]<br>90 V[2] | 690 V[1]<br>400 V[2] | 0.1 V | 375 V[1]<br>215 V[2] |
| "RUN" | Threshold for voltage overshoot (U▴) | 160 V[1]<br>90 V[2] | 690 V[1]<br>400 V[2] | 0.1 V | 425 V[1]<br>245 V[2] |
| "RUN" | Voltage asymmetry (Asy) | 5 % or OFF | 20 % | 1 % | OFF |
| "SET" | Hysteresis (Hyst) | 1 V | 20.0 V | 0.1 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-RE SET | -- | no = Autoreset |

1) 3UG4617 line monitoring relay

2) 3UG4618 line monitoring relay

The parameters are described in Chapter "Parameters (Page 351)."

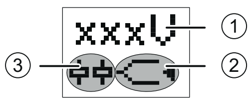
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

## 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 change-over 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 |

| Display area | Symbol | | Meaning |
|---|---|---|---|
| ③ | | Error | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (tripping delay) is running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |
| ③ | | | • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed<br>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open |

**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 142)."

### 6.7.4.2 Reset

#### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

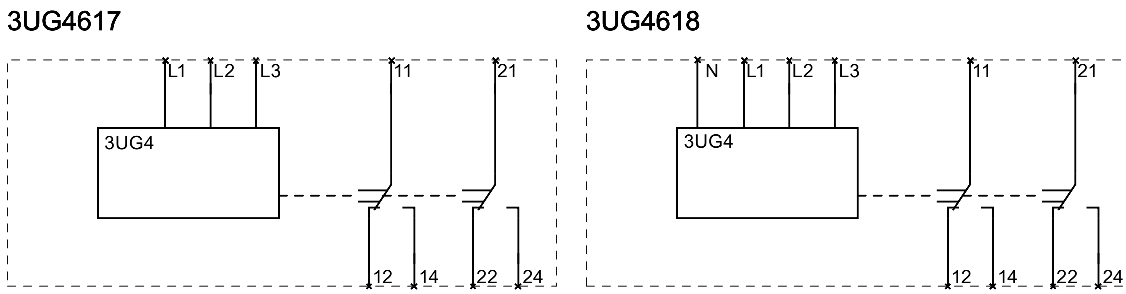
  The device is reset automatically as soon as a previously occurring error has been dealt with.
- Manual RESET (Memory = I / Mem = yes)

  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

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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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### 6.7.5.2 Wiring examples

#### Automatic phase correction

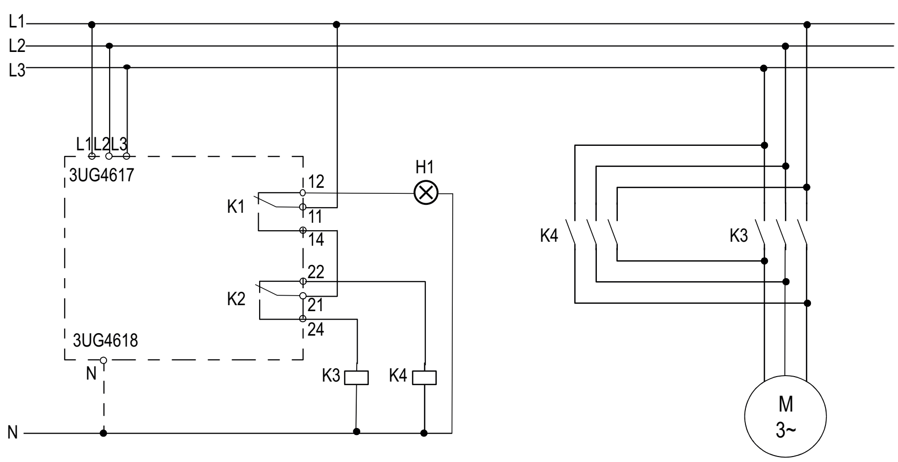



Figure 6-3 3UG4617 / 3UG4618 automatic phase correction

### 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<br>• 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<br>• undervoltage recognition<br>• overvoltage recognition<br>• phase sequence recognition<br>• phase disturbance recognition<br>• asymmetry recognition<br>• overvoltage recognition of 3 phases<br>• undervoltage recognition of 3 phases<br>• tension window recognition of 3 phases<br>• reset external<br>• self-reset<br>• open-circuit or closed-circuit current principle | | <br>Yes<br>Yes<br>Yes<br>Yes<br>Yes<br>Yes<br>Yes<br>Yes<br>—<br>Yes<br>No | |
| 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 | |

| | | 3UG4617-..... | 3UG4618-..... |
|---|---|---|---|
| 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 | |
| Insulation voltage for overvoltage category III according to IEC 60664 with degree of pollution 3 rated value | V | 690 | |

| | | 3UG4617-..... | 3UG4618-..... |
|---|---|---|---|
| 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 | | 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

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

| | | 3UG4617-1.... | 3UG4618-1.... | 3UG4617-2.... | 3UG4618-2.... |
|---|---|---|---|---|---|
| Distance, to be maintained, conductive elements | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Type of mounting | | snap-on mounting | | | |
| Product function removable terminal for auxiliary and control circuit | | Yes | | | |
| Design of the electrical connection | | screw-type terminals | | spring-loaded terminals | |
| Type of the connectable conductor cross-section | | | | | |
| • solid | | 1x (0.5 ... 4 mm²), 2x (0.5 ... 2.5 mm²) | | 2x (0.25 ... 1.5 mm²) | |
| • finely stranded | | | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm²), 2x (0.5 ... 1.5 mm²) | | 2 x (0.25 ... 1.5 mm²) | |
| – without wire end processing | | — | | 2x (0.25 ... 1.5 mm²) | |
| • for AWG conductors | | | | | |
| – solid | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| – stranded | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| Tightening torque | | | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | | — … | |
| Number of change-over switches delayed switching | | 2 | | | |

# 3UG4621/3UG4622 current monitoring relays 7

## 7.1 Application areas

### Application areas

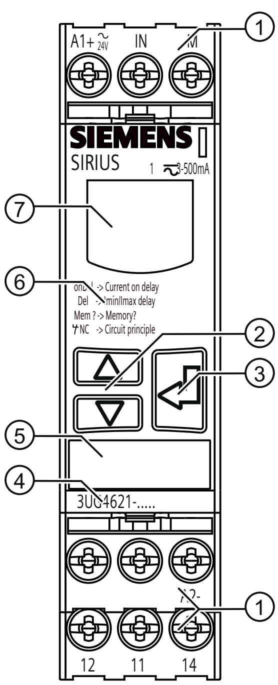
The current monitoring relays are used, for example, in the following applications:

Table 7- 1 Application areas of the current monitoring relays

| Function | Application |
|---|---|
| • Undercurrent monitoring and overcurrent monitoring<br>• Monitoring the functionality of electrical loads<br>• Wire-break monitoring | • Threshold switch for analog signals from 4 to 20 mA<br>• Emergency lighting (failure of a lamp → drop in current strength in the system)<br>• Heating systems (electroplating plants, plastic injection machines, paintshops)<br>• Lamps (tunnels, OP lighting, traffic lights, signal systems, UV lamps, infrared radiators, laser lamps) |

# 7.2 Operator controls and connection terminals

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

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | A1+ | Rated control supply voltage AC/DC+ |
| | A2- | Rated control supply voltage AC/DC- |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 162)."

# 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▲) or **undershoot** (I▼) or in **range monitoring** (I▲ and I▼). 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 159)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

## 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♦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).

---

### 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 $U_S$ = 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 / $U_S$ = 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 mA (3UG4621) or NC / I > 50 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 mA (3UG4621) or I > 50 mA (3UG4622) in combination with a set ON-delay time 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.

---

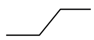
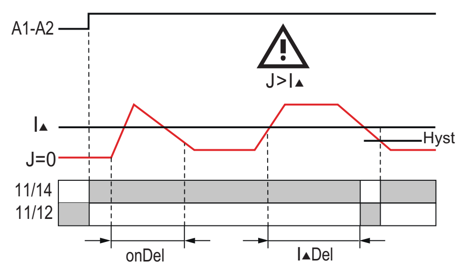
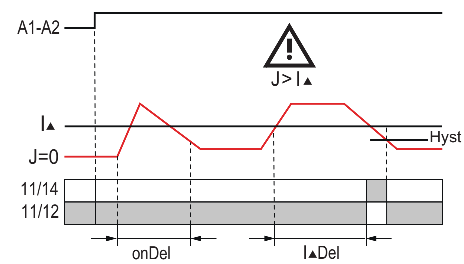
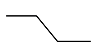
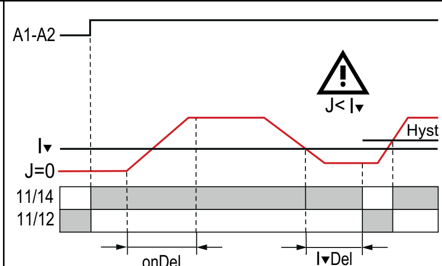
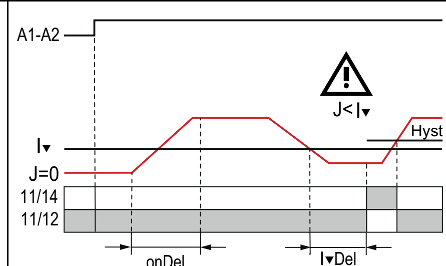
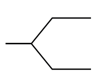
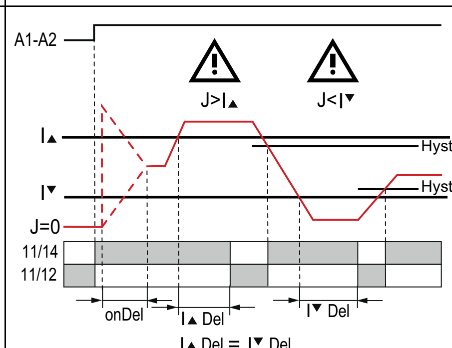
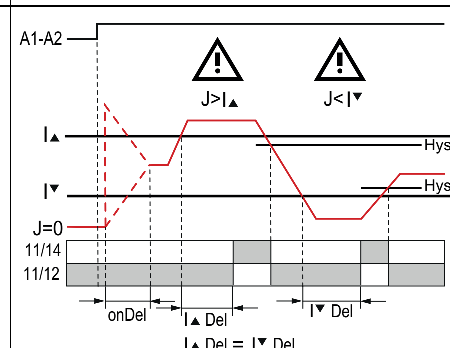
**Note**

The name of the parameter values is based on the assumption that the ON-delay time 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.

---

You will find the switching states of the output relay below in the section entitled "Function diagrams" and in Chapter "Diagnostics (Page 160)."

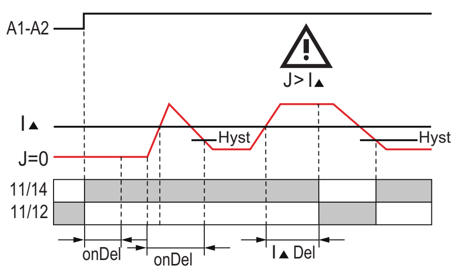
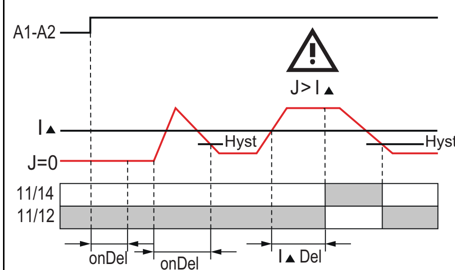
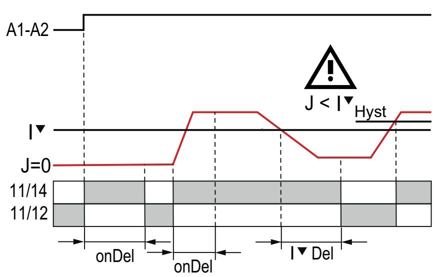
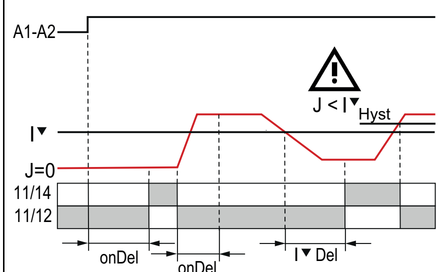
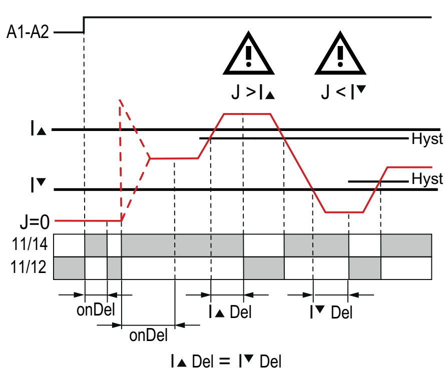
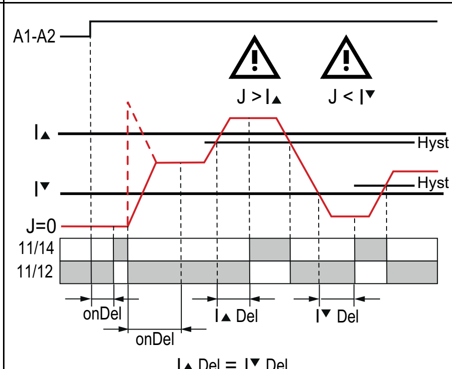
## Function diagrams (from application of the rated control supply voltage $U_S$ = on)

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC (closed-circuit principle)<br>$U_S$ = on</th><th>Memory = no<br>Relay switching behavior = NO (open-circuit principle)<br>$U_S$ = on</th></tr>
<tr><td><br>I▲<br>I▼ = off</td><td><br></td><td><br></td></tr>
<tr><td>I▲ = off<br>I▼<br></td><td><br></td><td><br></td></tr>
<tr><td>I▲<br>I▼<br></td><td><br></td><td><br></td></tr>
</table>

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 mA / 50 mA)

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC (closed-circuit principle)<br>I > 3 mA / 50 mA</th><th>Memory = no<br>Relay switching behavior = NO (open-circuit principle)<br>I > 3 mA / 50 mA</th></tr>
<tr><td>I▲<br>I▼ = off</td><td>
</td><td>
</td></tr>
<tr><td>I▲ = off<br>I▼</td><td>
</td><td>
</td></tr>
<tr><td>I▲<br>I▼</td><td>
</td><td>
</td></tr>
</table>

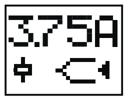
J = Currently measured current value

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 Parmeter 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[1]<br>0.05 A or OFF[2] | 500 mA[1]<br>10.0 A[2] | 0.1 mA[1]<br>0.01 A[2] | 50 mA[1]<br>1.5 A[2] |
| "RUN" | Threshold for overshoot (I▲) | 3.0 mA[1]<br>0.05 A[2] | 500 mA or OFF[1]<br>10.0 A or OFF[2] | 0.1 mA[1]<br>0.01 A[2] | 150 mA[1]<br>2.5 A[2] |
| "SET" | Hysteresis (Hyst) | 0.1 mA[1]<br>0.01 A[2] | 250.0 mA[1]<br>5.0 A[2] | 0.1 mA[1]<br>0.01 A[2] | 10.0 mA[1]<br>0.5 A[2] |
| "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 / $U_s$ = on or NO / I > 3 mA[1]<br>NC / $U_s$ = on or NO / I > 50 mA[2] | | -- | NC / $U_s$ = on |

[1] 3UG4621 current monitoring relay

[2] 3UG4622 current 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:

- Current overshoot
- Current undershoot

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

---

The parameters are described in Chapter "Parameters (Page 351)."

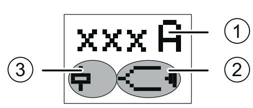
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

# 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 change-over contact |

### Meaning of the information on the display

---

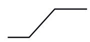
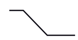
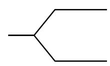
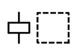
Note

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 |  | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 155)."

## 7.5.2 Reset

### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

- Manual RESET (Memory = I / 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

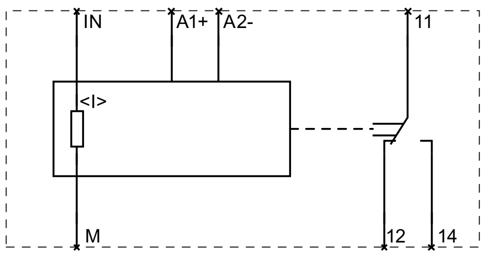



Figure 7-1 3UG4621/3UG4622 current monitoring relays

---

**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

### Wiring examples

---

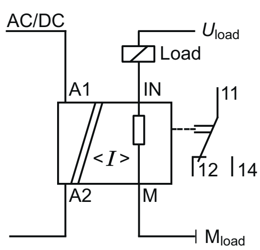
**Note**

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

---

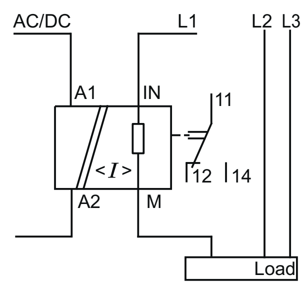
### 3UG46..-.AW30

**Single-phase operation**




3UG462.-.AW30 single-phase operation

**Three-phase operation**




3UG462.-.AW30 three-phase operation

### 3UG462.-.AA30

---

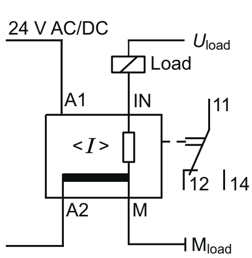
**Note**

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

---

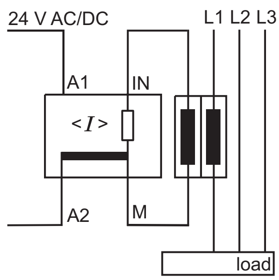
Operation with a **separate** control circuit and load current circuit

- single-phase

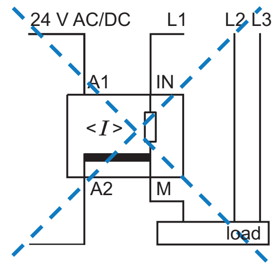


- three-phase

o.k.



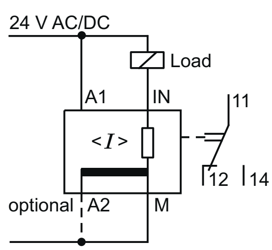

~~o.k.~~



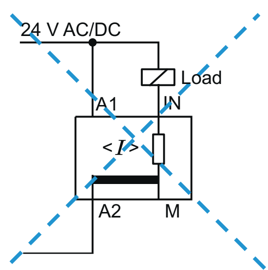

Operation with a **common** control circuit and load current circuit

- single-phase

o.k.




~~o.k.~~




---

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

## General technical details

| | | 3UG4621-..A.. | 3UG4622-..A.. | 3UG4621-..W.. | 3UG4622-..W.. |
|---|---|---|---|---|---|
| Product function | | Current monitoring relay | | | |
| Design of the display | | LCD | | | |
| Product function | | | | | |
| • 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 | | | |
| 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 | % | 5 | | | |
| Temperature drift per °C | %/°C | 0.1 | | | |
| Relative repeat accuracy | % | 1 | | | |
| Type of voltage of supply voltage | | AC/DC | | | |

| | | 3UG4621-..A.. | 3UG4622-..A.. | 3UG4621-..W.. | 3UG4622-..W.. |
|---|---|---|---|---|---|
| Supply voltage 1 | | | | | |
| • 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 | |
| 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 | | | |
| 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 | | | |
| • 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 | 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 | | | |
| 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 | | | |

| | | 3UG4621-..A.. | 3UG4622-..A.. | 3UG4621-..W.. | 3UG4622-..W.. |
|---|---|---|---|---|---|
| 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

| | | 3UG4621-1.... | 3UG4622-1.... | 3UG4621-2.... | 3UG4622-2.... |
|---|---|---|---|---|---|
| Width | mm | 22.5 | | | |
| Height | mm | 92 | | 94 | |
| Depth | mm | 91 | | | |
| Built in orientation | | any | | | |
| Distance, to be maintained, to earthed part | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Distance, to be maintained, to the ranks assembly | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Distance, to be maintained, conductive elements | | | | | |
| • forwards | mm | 0 | | | |
| • backwards | mm | 0 | | | |
| • sidewards | mm | 0 | | | |
| • upwards | mm | 0 | | | |
| • downwards | mm | 0 | | | |
| Type of mounting | | snap-on mounting | | | |

| | | 3UG4621-1.... | 3UG4622-1.... | 3UG4621-2.... | 3UG4622-2.... |
|---|---|---|---|---|---|
| **Design of the electrical connection** | | | | | |
| • for auxiliary and control current circuit | | screw-type terminals | | spring-loaded terminals | |
| • for main current circuit | | screw-type terminals | | spring-loaded terminals | |
| **Product function** | | | | | |
| • removable terminal for auxiliary and control circuit | | Yes | | | |
| • removable terminal for main circuit | | Yes | | | |
| **Type of the connectable conductor cross-section** | | | | | |
| • solid | | 1x (0.5 ... 4 mm²), 2x (0.5 ... 2.5 mm²) | | 2x (0.25 ... 1.5 mm²) | |
| • finely stranded | | | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm2), 2x (0.5 ... 1.5 mm²) | | 2 x (0.25 ... 1.5 mm²) | |
| – without wire end processing | | — | | 2x (0.25 ... 1.5 mm²) | |
| • for AWG conductors | | | | | |
| – solid | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| – stranded | | 2x (20 ... 14) | | 2x (24 ... 16) | |
| **Tightening torque** | | | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | | — … | |
| **Number of change-over switches delayed switching** | | 1 | | | |

# 3UG4624 residual current monitoring relay 8

## 8.1 Application areas

### Application areas

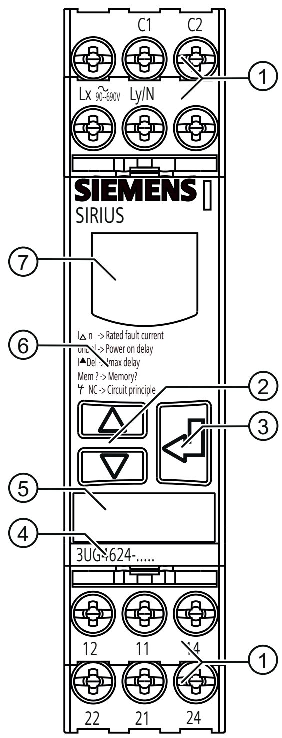
The 3UG4624 residual current monitoring relays are used, for example, in the following applications:

Table 8- 1 Applications of the 3UG4624 residual current monitoring relay

| Function | Application |
|---|---|
| • Fault current monitoring<br>• Monitoring for imperfect ground fault<br>• Monitoring for an initial insulation fault | • Woodworking<br>• Grain mills<br>• Steel industry<br>• Environments with conductive dust or humidity<br>• Furnaces<br>• Motor winding insulation |

# 8.2 Operator controls and connection terminals

## Front view / terminal labeling 3UG4624

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | Lx | Rated control supply voltage AC/DC+ |
| | Ly/N | Rated control supply voltage AC/DC- |
| | C1 | Connection of the 3UL22 summation current transformer |
| | C2 | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 180)."

## 8.3 Functions

### General functionality

The 3UG4624 fault current monitoring relays are powered with a rated control supply voltage of 90 to 690 V AC (rms value), 50 / 60 Hz through terminals Lx and Ly / N.

The 3UG4624 residual 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 177)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

The main conductors and, if present, the neutral conductor to which the load is connected, are routed through the opening of the toroidal strip-wound core of a summation current transformer. A secondary winding is placed arount this toroidal strip-wound core to which the 3UG4624 residual current monitoring relay is connected.

During fault-free operation of a plant, the sum of inflowing and outflowing currents is equal to zero. No current is then induced in the secondary winding of the summation 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 overshot.

---

**Note**

The specified voltages represent the absolute thresholds.

---

## Monitoring

If the measured residual current exceeds the set warning threshold (I!), the associated CO contact 21-22-24 changes the switching state without delay and a (!) appears on the display as an indication. If the measured fault current exceeds the set threshold (I▲), the set delay time (I▲Del) starts and the associated relay symbol flashes. After this time has expired, the associated CO contact 11-12-14 changes the switching state.

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

---

Note

The neutral conductor must no longer be grounded after the summation current transformer because otherwise the residual current monitoring function cannot be ensured.

---

### 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.

---

Note

The 3UG4624 residual current monitoring relays are only suitable for line frequencies of 50 / 60 Hz!

---

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 179)."

## Tripping conditions

The combination of the 3UG4624 residual current monitoring relay with the 3UL22 summation current transformer responds according to the following tripping conditions:

| Fault current monitoring relays | Fault current |
|---|---|
| No tripping | 0 to 50 % of the set threshold |
| Tripping not defined | 50 to 100 % of the set threshold |
| Tripping | >= 100 % of the set threshold |

## Summation current transformers

The 3UL22 summation current transformer can be used together with the 3UG4624 residual current monitoring relay to acquire residual currents in machines and plants.

These necessary accessories are described in Chapter "Summation current transformer for the 3UG4624 monitoring relay (Page 320)."

## Function diagrams 3UG4624

---

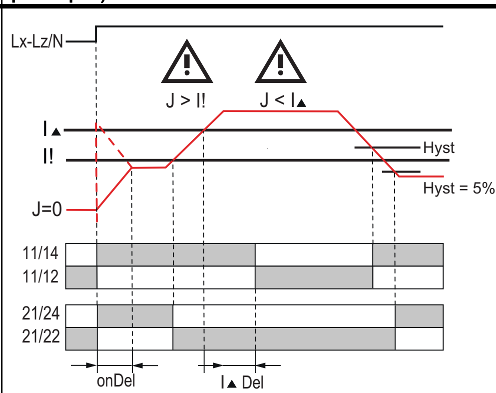
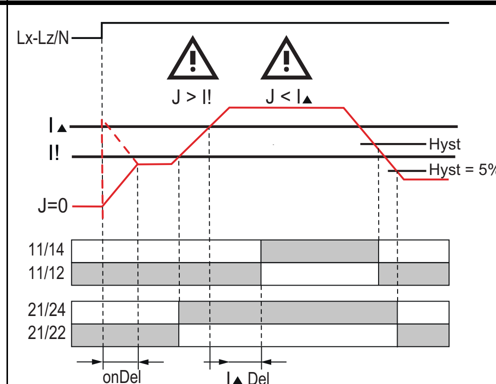
**Note**

**Difference between Hyst and Hysteresis**

In the following diagrams, the term "Hyst" refers to the "Hysteresis" parameter. The "Hysteresis" parameter refers to the monitored thresholds and can be set.

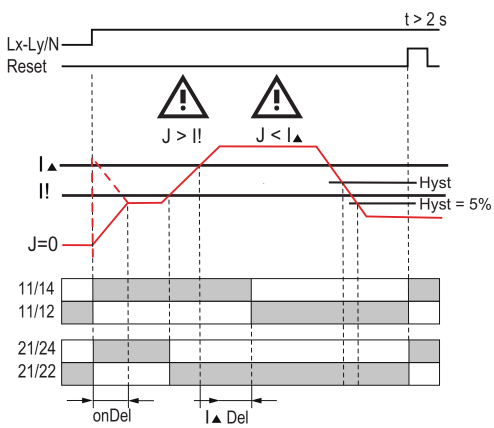
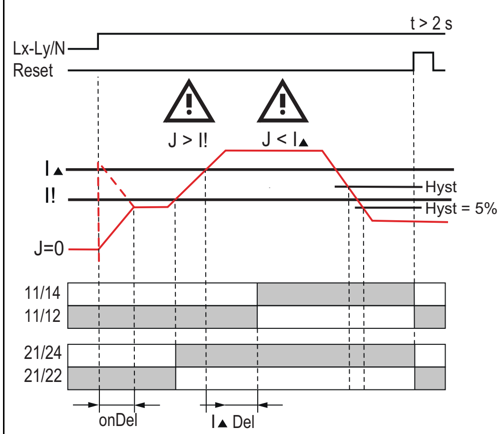
The term "Hyst = 5 %," on the other hand, refers to the warning thresholds and is permanently set to 5 %.

---

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC (closed-circuit principle)</th><th>Memory = no<br>Relay switching behavior = NO (open-circuit principle)</th></tr>
<tr><td>I▲ / I!▲<br>Mem = no</td><td>
</td><td>
</td></tr>
</table>

J = Currently measured current value

I = set threshold value for the current

| Display | Memory = yes<br>Relay switching behavior = NC (closed-circuit principle) | Memory = yes<br>Relay switching behavior = NO (open-circuit principle) |
|---|---|---|
| I▲ / I!▲<br>Mem = yes |  |  |

J = Currently measured current value

I = set threshold value for the current

---

**Note**

The neutral conductor must no longer be grounded after the summation current transformer because otherwise the residual current monitoring function cannot be ensured.

---

# 8.4 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 3UG4624 residual current monitoring relay:

Table 8- 2 Parmeter information, 3UG4624 residual monitoring relays with digital setting

| Menu level | Parameters | Setting range: Minimum value | Setting range: Maximum value | Increment | Factory setting |
|---|---|---|---|---|---|
| "RUN" | Threshold for current overshoot (I▲) | depending on IΔn [1)] | depending on IΔn [1)] | depending on IΔn [1)] | depending on IΔn [1)] |
| "RUN" | Warning threshold for current overshoot (I!) | depending on IΔn [1)] | depending on IΔn [1)] | depending on IΔn [1)] | depending on IΔn [1)] |
| "SET" | Rated residual current of the summation current transformer (IΔn) | 0,3 A | 40.0 A | 0.1 A | 10.0 A |
| "SET" | Hysteresis (Hyst) | depending on IΔn [1)] | depending on IΔn [1)] | depending on IΔn [1)] | depending on IΔn [1)] |
| "SET" | ON-delay time (onDel) | 0.1 s | 20.0 s | 0.1 s | 0.1 s |
| "SET" | Tripping delay time (I▲Del) | 0.1 s | 20.0 s | 0.1 s | 0.1 s |
| "SET" | Reset response (Mem) | no = Autoreset | yes = Hand-RESET | -- | no = Auto-reset |
| "SET" | Relay switching behavior (closed-circuit principle NC / open-circuit principle NO) | NC or NO | | -- | NC |

1) The value depends on the parameter "Rated residual current of the summation current transformer (IΔn)." You can take the value from the table "Parameter information depending on the rated residual current" in the next section.

## Display of the current residual current by rms value setting

The 3UL22 summation current transformer used with its stated residual current rating is chosen in menu "SET" as the setting value IΔn from 0.3 to 40 A in the 8 fixed steps that are possible. With this adaptation, it is possible to indicate the warning threshold for overshoot (I!) and the threshold for overshoot (I▲) as an absolute value (rms value) in amps and the currently measured value of the residual current.

The following table shows the value ranges of the settable 3UL22 summation current transformer:

Table 8- 3 Parameter information depending on the rated residual current

| 3UL2201-<br>3UL2202-<br>3UL2203- | IΔn | Display area | I▲ | I! | HysteresisI▲ | Hysteresis I!<br>(5 % of IΔn) |
|---|---|---|---|---|---|---|
| -1A | 0.3 A | 0 mA, 30 to 360 mA | 30 to 300 mA | Off,<br>30 mA to 300 mA | 1 to 150 mA | 15 mA |
| -2A | 0.5 A | 0 mA, 50 to 600 mA | 50 to 500 mA | Off,<br>50 to 500 mA | 1 to 250 mA | 25 mA |
| -3A | 1 A | 0 A, 0.10 to 1.20 A | 0.10 to 1.00 A | Off,<br>0.10 to 1.00 A | 0.01 to 0.50 A | 0.05 A |
| -1B | 6 A | 0 A, 0.6 to 7.2 A | 0.6 to 6.0 A | Off, 0.6 to 6.0 A | 0.1 to 3.0 A | 0.3 A |
| -2B | 10 A | 0 A, 1.0 to 12.0 A | 1.0 to 10.0 A | Off, 1.0 to 10.0 A | 0.1 to 5.0 A | 0.5 A |
| -3B | 16 A | 0 A, 1.6 to 19.2 A | 1.6 to 16.0 A | Off, 1.6 to 16.0 A | 0.1 to 8.0 A | 0.8 A |
| -4B | 25 A | 0 A, 2.5 to 30.0 A | 2.5 to 25.0 A | Off, 2.5 to 25.0 A | 0.1 to 12.5 A | 1.2 A |
| -5B | 40 A | 0 A, 4.0 to 48.0 A | 4.0 to 40.0 A | Off, 4.0 to 40.0 A | 0.1 to 20.0 A | 2.0 A |

**Note**

Setting OFF disables the parameter warning threshold for overshoot.

The parameters are described in Chapter "Parameters (Page 351)."

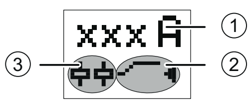
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

# 8.5 Diagnostics

## 8.5.1 Indication 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 change-over contacts

### Meaning of the information on the display

---

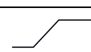
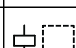
**Note**

**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 current overshoot |
| ② | ◄ | Current is in correct range |
| ② | ▲ | A current overshoot has occurred |
| ② | ! | The warning threshold has been exceeded |
| ③ |  I▲ | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |
| ③ |  I! | • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open |

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 173)."

### 8.5.2 Reset

#### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

  The device is reset automatically as soon as a previously occurring error has been dealt with.
- Manual RESET (Memory = I / 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.

## 8.6 Circuit diagrams

### 8.6.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4624

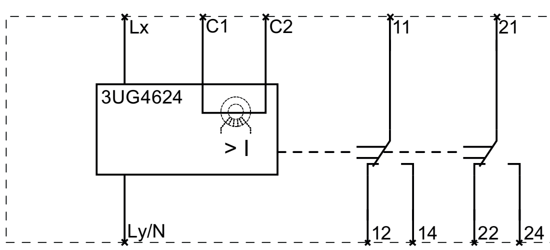



Figure 8-1 3UG4624-.CS20 residual current relays, 90 to 690 V

---

**Note**

The device is suitable for cooperation with the summation current transformers 3UL22 for external ground-fault monitoring. The output signal of the 3UL22 summation current transformer is connected with 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

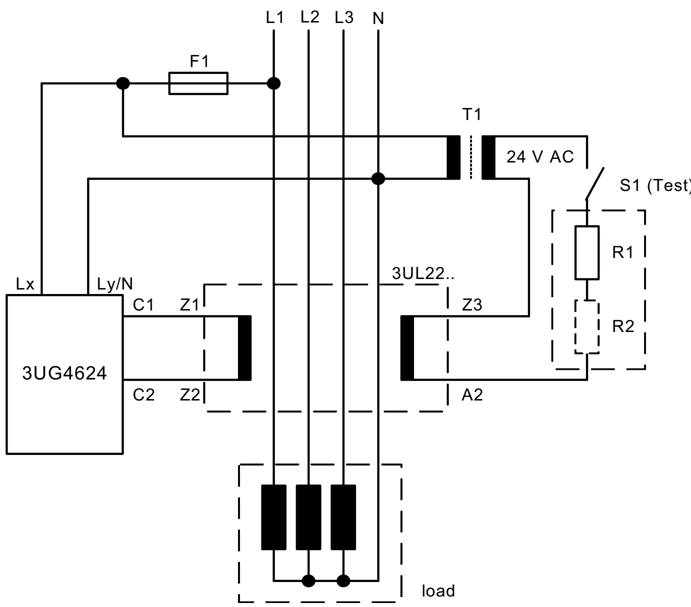



Figure 8-2 Wiring example of 3UG4624 with 3UL22

| 3UL2201-<br>3UL2202-<br>3UL2203- | IΔn | R1 | R2 |
|---|---|---|---|
| -1A | 0.3 A | 220 Ω ≥ 3 W | --- |
| -2A | 0.5 A | | |
| -3A | 1 A | | |
| -1B | 6 A | 22 Ω ≥ 6 W | 22 Ω ≥ 6 W |
| -2B | 10 A | | |
| -3B | 16 A | | |
| -4B | 25 A | | |
| -5B | 40 A | | |

Table 8- 4 3UL22 summation current transformers for external ground-fault monitoring

| Detection of fault current in machines and plants | | | | |
|---|---|---|---|---|
| Rated insulation voltage $U_i$ | Rated residual current $I_{\Delta n}$ | Bushing opening diameter | For Protodur cable (push-through) | Order number |
| 690 V AC | 0.3 A | 40 mm | max. 4 x 95 mm² | 3UL2201-1A |
| | 0.5 A | | | 3UL2201-2A |
| | 1 A | | | 3UL2201-3A |
| 690 V AC | 0.3 A | 65 mm | max. 4 x 240 mm² | 3UL2202-1A |
| | 0.5 A | | | 3UL2202-2A |
| | 1 A | | | 3UL2202-3A |
| | 10 A | | | 3UL2202-2B |
| | 16 A | | | 3UL2202-3B |
| | 25 A | | | 3UL2202-4B |
| | 40 A | | | 3UL2202-5B |
| 1000 V AC | 0.3 A | 120 mm | max. 8 x 300 mm² | 3UL2203-1A |
| | 0.5 A | | | 3UL2203-2A |
| | 1 A | | | 3UL2203-3A |
| | 6 A | | | 3UL2203-1B |
| | 10 A | | | 3UL2203-2B |
| | 16 A | | | 3UL2203-3B |
| | 25 A | | | 3UL2203-4B |
| | 40 A | | | 3UL2203-5B |

# 8.7 Technical data

## Measuring circuit

| | | 3UG4624-..... |
|---|---|---|
| Type of current for monitoring | | AC |
| Measurable line frequency | Hz | 60 … 50 |
| Adjustable response current | | |
| • 1 | A | 0.03 … 40 |
| • 2 | A | 0.03 … 40 |
| Adjustable response delay time | | |
| • when starting | s | 0.1 … 20 |
| • with lower or upper limit violation | s | 0.1 … 20 |
| Adjustable switching hysteresis for measured current value | mA | 15 … 2 |
| Stored energy time at mains power cut minimum | ms | 10 |
| Operating voltage | | |
| • rated value | V | 17 … 400 |

## General technical details

| | | 3UG4624-..... |
|---|---|---|
| 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 | s | 1 |
| Response time maximum | ms | 300 |
| Relative metering precision | % | 5 |
| Precision of digital display | | +/-1 digit |
| Temperature drift per °C | %/°C | 0.1 |
| Relative repeat accuracy | % | 1 |

| | | 3UG4624-..... |
|---|---|---|
| Type of voltage of the controlled supply voltage | | AC |
| Control supply voltage | | |
| • at 50 Hz at AC rated value | V | 90 … 690 |
| • at 60 Hz at AC rated value | V | 90 … 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 |
| Installation altitude at a height over sea level maximum | m | 2 000 |
| 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 |
| Current carrying capacity of output relay at DC-13 | | |
| • at 24 V | A | 1 |
| • at 125 V | A | 0.2 |
| • at 250 V | A | 0.1 |
| 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 | 85 … -40 |

| | | 3UG4624-..... |
|---|---|---|
| Design of the electrical isolation | | galvanic |
| Galvanic isolation | | |
| • between entrance and outlet | | Yes |
| • between the outputs | | Yes |
| • between the voltage supply and other circuits | | 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

| | | 3UG4624-1.... | 3UG4624-2.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 102 | 103 |
| Depth | mm | 91 | |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |

| | | 3UG4624-1.... | 3UG4624-2.... |
|---|---|---|---|
| Type of mounting | | screw and snap-on mounting onto 35 mm standard mounting rail | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |
| Design of the electrical connection | | screw-type terminals | spring-loaded terminals |
| Type of the connectable conductor cross-section | | | |
| • solid | | 1x (0.5 ... 4 $mm^2$),<br>2x (0.5 ... 2.5 $mm^2$) | 2x (0.25 ... 1.5 $mm^2$) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 $mm^2$),<br>2x (0.5 ... 1.5 $mm^2$) | 2 x (0.25 ... 1.5 $mm^2$) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 $mm^2$) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | — … |
| Number of change-over switches delayed switching | | 2 | |

# 3UG4625 residual current monitoring relay with 3UL23 transformer

9

## 9.1 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 9- 1 Application areas of 3UG4625 residual current monitoring relays

| Cause of fault | Application |
|---|---|
| • Dust deposits on terminals | • Woodworking, grain mills |
| • Increased levels of humidity | • Mining, power supply containers |
| • Capacitive fault currents as "basic fault load" | • For large systems (line length) |
| • Porous cables and lines | • Motor winding insulation |
| • Diminishing insulation caused by material wear | • Furnaces |

---

**Note**

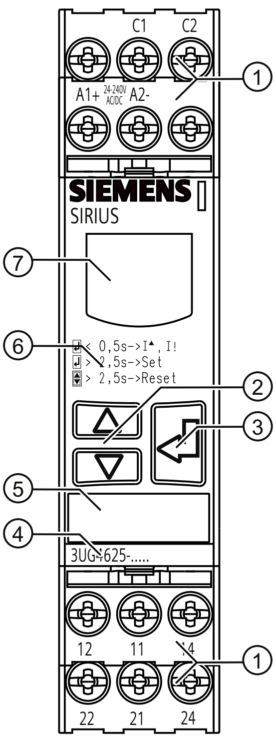
3UG4625 residual current monitoring relays monitor devices and systems for their correct function.

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

---

# 9.2 Operator controls and connection terminals

## 3UG4625 front view/terminal labeling

| Front view | Description | |
|---|---|---|
|   | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | A1+ | Rated control supply voltage AC/DC+ |
| | A2- | Rated control supply voltage AC/DC- |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection methods (Page 19)".

You will find information on connecting in Chapter "Circuit diagrams (Page 199)."

# 9.3 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 196)".

You will find a description of the individual parameters in Chapter "Parameters (Page 351)".

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 overshot.

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 189)".

- **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.

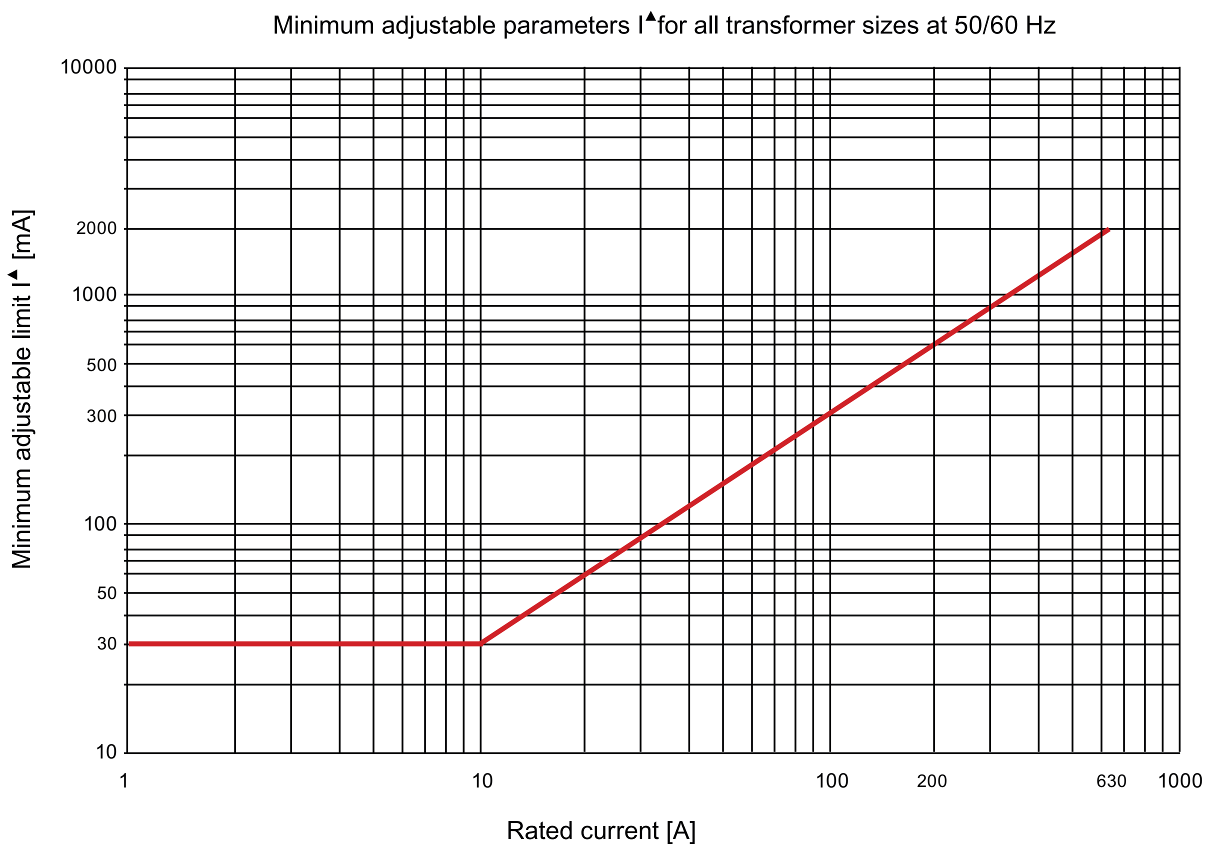
## Measuring accuracy

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.




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 323)" and "Potential for optimization (Page 327)".

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

Internal functional tests are performed upon connecting the monitoring relay to the supply voltage. In particular the connection to the 3UL23 residual current transformer is tested. During this time no fault current measurement or monitoring is performed and the display shows ---A instead.
This initial self-test takes approximately 1.6 s. Then a permanent self-test is performed without interrupting the monitoring function.
If the measured fault current exceeds the set warning threshold (I!), the corresponding CO contact 21-22-24 immediately changes the switching state and on the display the arrows highlighting that the threshold was exceeded and that the measured value is 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 197)."

## Tripping conditions

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

| Residual current monitoring relays | Fault current |
|---|---|
| No tripping | 0 to 85 % of the set threshold |
| Tripping not defined | 85 to 100 % of the set threshold |
| Tripping | >= 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 321)."

---

**Note**

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

---

## Function diagrams for 3UG4625

---

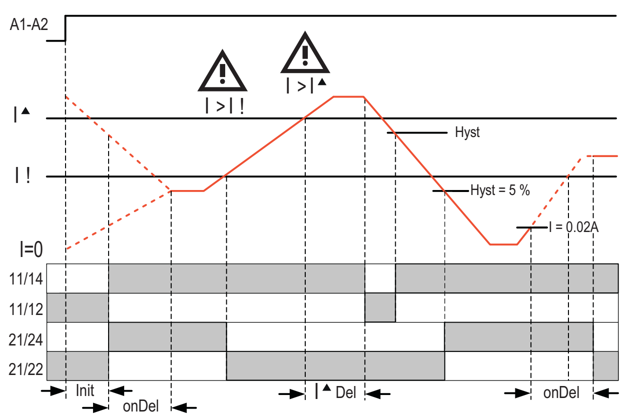
**Note**

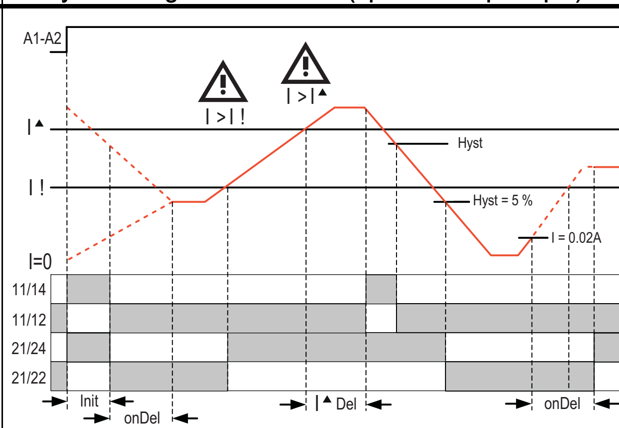
**Difference between Hyst and Hysteresis**

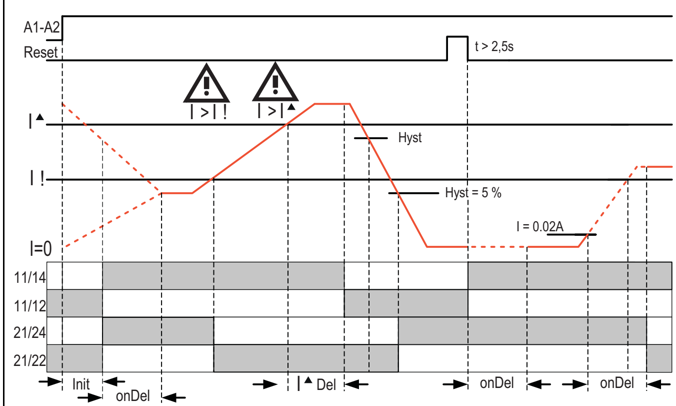
In the following diagrams, the term "Hyst" refers to the "Hysteresis" parameter. The "Hysteresis" parameter refers to the monitored limit values (**I▲**) and can be set in the SET menu.

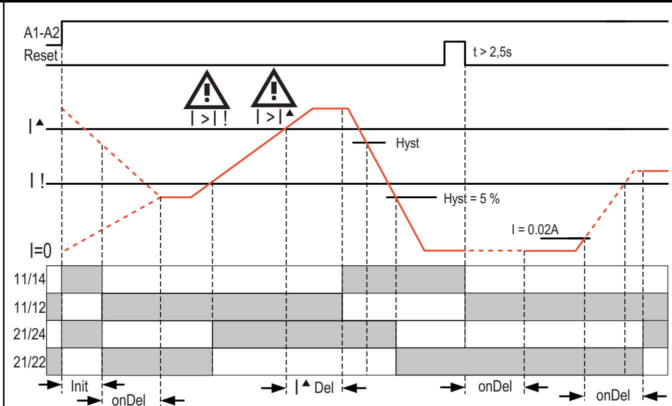
However, "Hyst = 5 %" refers to the warning thresholds (**I!**) and is permanently set to 5 %.

---

| Display | Memory = no<br>Relay switching behavior = NC (closed-circuit principle) |
|---|---|
| I▲ / I!<br>Mem = no |  |

| Display | Memory = no<br>Relay switching behavior = NO (open-circuit principle) |
|---|---|
| I▲ / I!<br>Mem = no |  |

| Display | Memory = yes<br>Relay switching behavior = NC (closed-circuit principle) |
|---|---|
| I▲ / I!<br>Mem = yes |  |

| Display | Memory = yes<br>Relay switching behavior = NO (open-circuit principle) |
|---|---|
| I▲ / I!<br>Mem = yes |  |

### Note

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

# 9.4 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 9- 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" | 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 = Auto-reset |
| "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 351)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 36)".

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

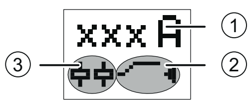
For more information on the technical data of 3UL23 residual current transformers see Chapter "Technical data (Page 334)".

# 9.5 Diagnostics

## 9.5.1 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 change-over 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 | 5.00A | | Displays the measured current |
| ② | ⎽/‾ | | Monitoring for current overshoot |
| ② | ◄ | | Current is in correct range |
| ② | ▲ | | A current overshoot has occurred |
| ② | ▲◄ | | Flashing alternately. The warning threshold has been exceeded |
| ③ | | I▲ | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |
| ③ | | I! | • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed<br>• Flashing: Delay time (ON-delay) running<br>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open |
| ① | ---A | | Self-test active, no measurements |

| Display area | Symbol | Meaning |
|---|---|---|
| ① |  | Measurement range exceeded (> 40 A) |
| ① | 0.00A | Fallen below measurement range |
| ① |  | Open-circuit |
| ① |  | Short-circuit |

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 189)."

## 9.5.2 Reset

### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

- Manual RESET (Memory = I / 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.

---

**Note**

The warning threshold is always reset by autoreset.

---

# 9.6 Circuit diagrams

## 9.6.1 Internal circuit diagrams

### 3UG4625 internal circuit diagrams

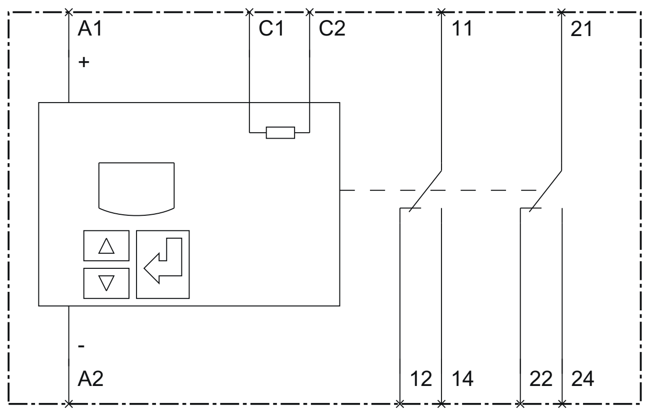



Figure 9-1 3UG4625-.CW30 residual current monitoring relay, 24 to 240 V

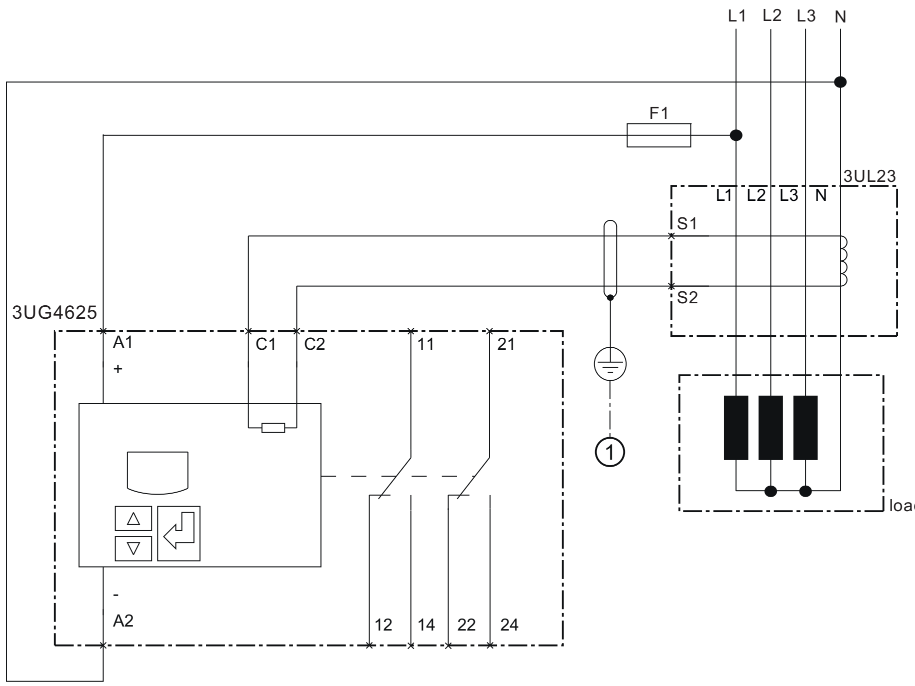
---

**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.

---

## 9.6.2 Wiring examples




① Cable shielding recommended

Figure 9-2 Wiring diagram of 3UG4625 with 3UL23

## 9.7 Technical data

### Measuring circuit

| | | 3UG4625-..... |
|---|---|---|
| Type of current for monitoring | | AC |
| Measurable line frequency | Hz | 16<br>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-..... |
|---|---|---|
| Type of voltage of the controlled supply voltage | | AC/DC |
| Control supply voltage | | |
| • 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 |
| Working range factor supply voltage rated value | | |
| • at 50 Hz | | |
| – for AC | | 0.85 … 1.1 |
| • at 60 Hz | | |
| – for AC | | 0.85 … 1.1 |
| • for DC | | 0.85 … 1.1 |
| 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 |
| 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 |
| Current carrying capacity of output relay at DC-13 | | |
| • at 24 V | A | 1 |
| • at 125 V | A | 0.2 |
| • at 250 V | A | 0.1 |
| 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 | | 4 kV contact discharge / 8 kV air discharge |
| Field-bound parasitic coupling according to IEC 61000-4-3 | | 10 V/m |

| | | 3UG4625-..... |
|---|---|---|
| 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 | 300 |
| Degree of pollution | | 3 |
| Ambient temperature | | |
| • during operating | °C | -25 … +60 |
| • during storage | °C | -40 … +85 |
| • during transport | °C | -40 … +85 |
| Design of the electrical isolation | | galvanic |
| Galvanic isolation | | |
| • between entrance and outlet | | Yes |
| • between the outputs | | Yes |
| • between the voltage supply and other circuits | | 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

| | | 3UG4625-1.... | 3UG4625-2.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 102 | 103 |
| Depth | mm | 91 | |
| mounting position | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |

| | | 3UG4625-1.... | 3UG4625-2.... |
|---|---|---|---|
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Type of mounting | | screw and snap-on mounting onto 35 mm standard mounting rail | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |
| Design of the electrical connection | | screw-type terminals | spring-loaded terminals |
| Type of the connectable conductor cross-section | | | |
| • solid | | 1x (0.5 ... 4 mm²), 2x (0.5 ... 2.5 mm²) | 2x (0.25 ... 1.5 mm²) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm²), 2x (0.5 ... 1.5 mm²) | 2 x (0.25 ... 1.5 mm²) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 mm²) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | — |
| Number of change-over switches delayed switching | | 2 | |

# 3UG458. insulation monitoring relay. 10

## 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)

# 10.1 Application areas

## Application areas

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

Table 10- 1 Application areas of the insulation monitoring relays

| Function | Application |
|---|---|
| • Insulation monitor for ungrounded systems | • Emergency power supplies<br>• Safety lighting<br>• Industrial production plants with high availability requirements (chemical industry, automobile manufacture, printing)<br>• Shipbuilding and railways<br>• Mobile power generators (aircraft)<br>• Renewable energies (wind energy and photovoltaic plants)<br>• Mining industry |

Table 10- 2 Functions of the 3UG4581/3UG4582/3UG4583 insulation monitoring relays

| Function | Insulation monitoring relays | | |
|---|---|---|---|
| | 3UG4581 | 3UG4582 | 3UG4583 |
| **Insulation monitoring** | | | |
| Monitoring for open circuit | — | ✓ | ✓ [1] |
| 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

[1] Configurable

## 10.2 Performance features of the insulation monitoring relays

### General data

Table 10- 3 General data of the 3UG4581/3UG4582/3UG4583 insulation monitoring relays

| General data | Insulation monitoring relays | | |
|---|---|---|---|
| | 3UG4581 | 3UG4582 | 3UG4583 |
| Setting range of the target pick-up values | | | |
| • 1 to 100 kΩ | ✓ | ✓ | ✓ |
| • 2 to 200 kΩ | — | — | ✓ |
| Rated voltage of the system to be monitored | | | |
| • 0 ... 250 V AC | — | ✓ | — |
| • 0 ... 400 V AC | ✓ | — | ✓ |
| • 0 ... 600 V AC | — | — | ✓[1)] |
| • 0 to 300 V DC | — | ✓ | — |
| • 0 to 600 V DC | — | — | ✓ |
| • 0 to 1000 V DC | — | — | ✓[1)] |
| Maximum discharge capacity of the system | | | |
| • 10 μF | ✓ | ✓ | — |
| • 20 μF | — | — | ✓ |
| Output contacts | | | |
| • 1 changeover contact | ✓ | ✓ | — |
| • 2 changeover contacts or 1 changeover contact + 1 changeover contact, adjustable | — | — | ✓ |
| Number of thresholds | | | |
| • 1 | ✓ | ✓ | — |
| • 1 or 2, adjustable | — | — | ✓ |
| Functional principle | Closed-circuit principle | Closed-circuit principle | Open-circuit principle or closed-circuit principle, configurable |
| Rated control and supply voltage | | | |
| • 24 ... 240 V AC / DC | ✓ | ✓ | ✓ |
| Rated frequency | | | |
| • 15 ... 400 Hz | — | ✓ | ✓ |
| • 50 ... 60 Hz | ✓ | — | — |

| General data | Insulation monitoring relays | | |
|---|---|---|---|
| | 3UG4581 | 3UG4582 | 3UG4583 |
| Autoreset or manual RESET | ✓[2] | ✓[2] | ✓[2] |
| Remote RESET | ✓<br>via control input | ✓<br>via control input | ✓<br>via control input |
| Retentive fault memory | — | — | ✓[2] |
| Open-circuit detection | — | — | ✓[2] |

✓: Function available

— : Function not available

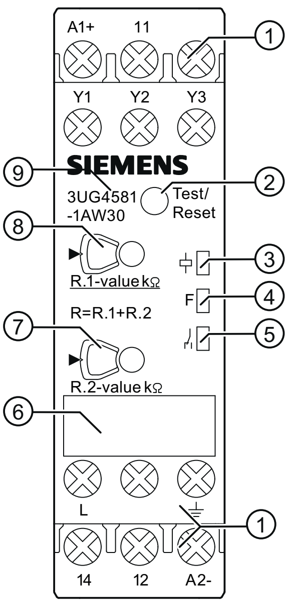
[1] With 3UG4983-1A upstream module

[2] Configurable

# 10.3 3UG4581 insulation monitoring relay

## 10.3.1 Operator controls and connection terminals

### Front view/terminal labeling 3UG4581

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block:<br>Screw-type connections are possible. |
| | ② | Test/RESET button[1)] |
| | ③ | Status display: LED for device status (green) |
| | ④ | Status display: LED for monitoring status F (red) |
| | ⑤ | Status display: LED output contact status (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) |
| | ⑨ | Device order number |
| | **Terminal labels** | |
| | A1+ | Rated control and supply voltage ~ / + |
| | A2- | Rated control and 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 changeover contact NC contact |
| | 11 | Output relay K1 changeover contact root |
| | 14 | Output relay K1 changeover 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.

You will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Technical data (Page 222)".

You will find information on connecting in Chapter "Circuit diagrams (Page 216)".

## 10.3.2 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 ⏚) 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 214)".

You will find a description of the individual parameters in the Chapter "Parameters (Page 351)".

### 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.

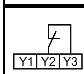
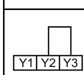
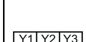
---

You will find the switching states of the output relay below in the section "Functions (Page 210)" and in Chapter "Diagnostics (Page 215)".

## Reset response and memory function

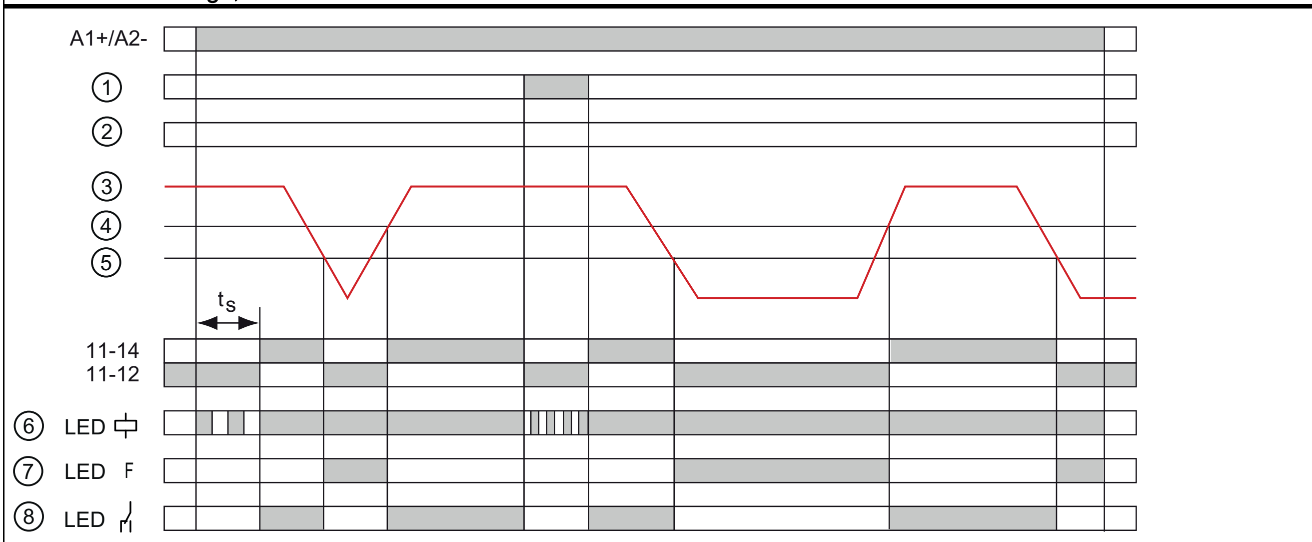
The device features an autoreset that resets output relay K1 to its original state after an fault message and rectification of the fault that has occurred. As well as autoreset, the devices can also be set to manual RESET by means of external switching.

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)<br>2) Remote reset (remote button with NC function)<br>3) A1+ / A2- (switching the supply voltage off/on) |
|   | 1) On the front (Test/Reset button)<br>2) A1+ / A2- (switching the supply voltage off/on) |
|   | 1) Autoreset (factory setting) |

## Function diagrams 3UG4581

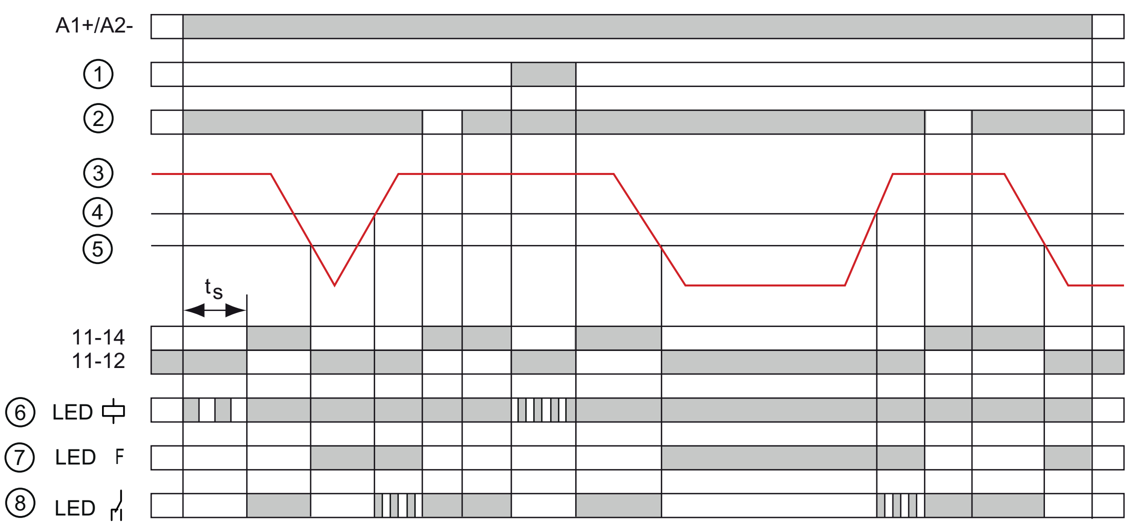
| Relay switching behavior = NC (closed-circuit principle) |
|---|
| Without fault storage, autoreset |




① Test (Y1-Y3)
② Reset (Y2-Y3)
③ Measured value
④ Hysteresis
⑤ Threshold
⑥ Green
⑦ Red
⑧ Yellow

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

| Relay switching behavior = NC (closed-circuit principle) |
|---|
| With fault storage, manual RESET |




① Test (Y1-Y3)

② Reset (Y2-Y3)

③ Measured value

④ Hysteresis

⑤ Threshold

⑥ Green

⑦ Red

⑧ Yellow

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

### 10.3.3 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 10- 4 Parameter information, 3UG4581 insulation monitoring relay

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

[1)] The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 209)".

[2)] By operating the rotary button, the tens position of the threshold for undershoot can be selected.

[3)] 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 216)" shows examples for the different monitoring modes.

The parameters are defined in the Chapter "Parameters (Page 351)".

#### 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.

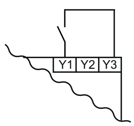


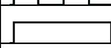
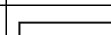
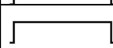
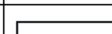
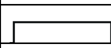
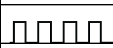
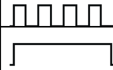

Figure 10-1 Remote test button

## 10.3.4 Diagnostics

### 10.3.4.1 Diagnostics with LEDs

### Status display

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

| Operating state | LED (green) | LED F (red) | LED (yellow) |
|---|---|---|---|
| Self-test (after $U_S$ = on) |  | Off | Off |
| No fault |  | Off |  |
| Insulation fault (threshold undershot) |  |  | Off |
| Measured result invalid |  |  | Off |
| Internal fault | Off |  | Off |
| Test function active |  | Off | Off |
| Manual RESET possible[1)] |  | [2)] |  |

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 210)".

## 10.3.5 Circuit diagrams

### 10.3.5.1 Internal circuit diagrams

#### Internal circuit diagram 3UG4581-1AW30

#### 3UG4581-1AW30

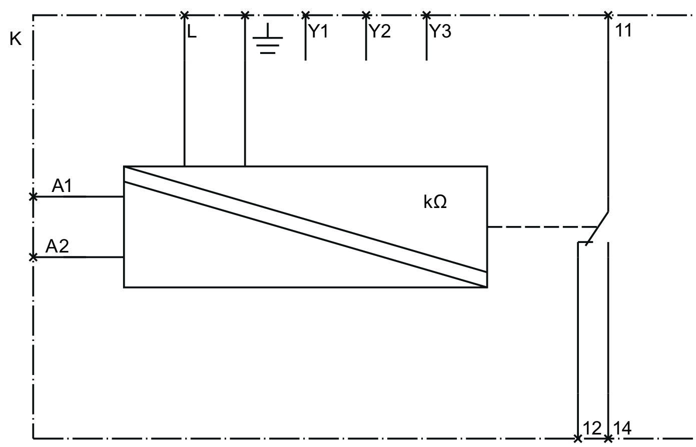
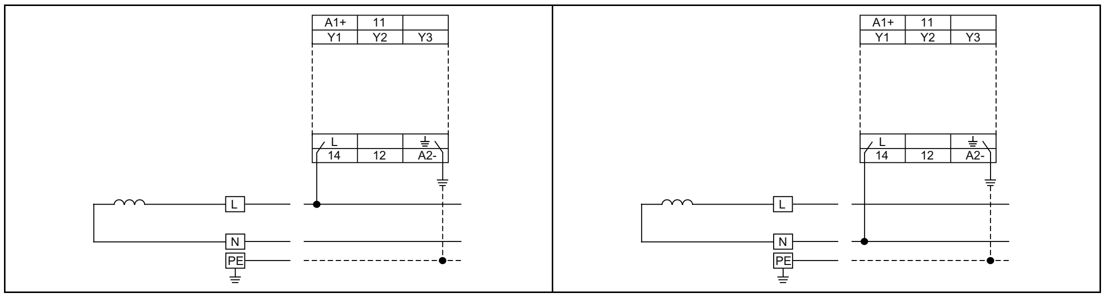



Figure 10-2 3UG4581-1AW30 insulation monitoring relay

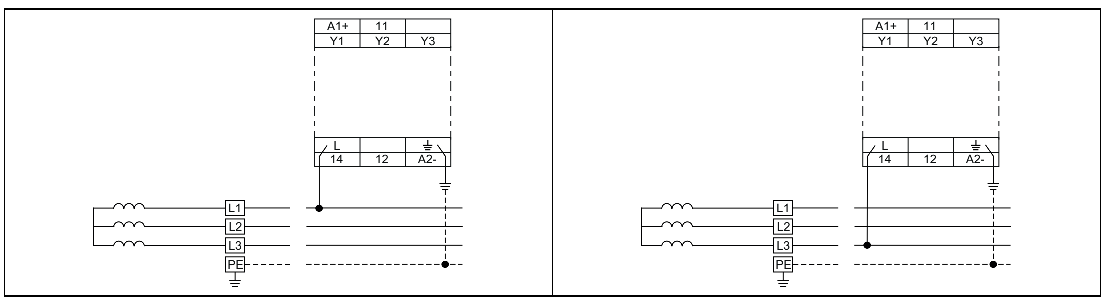
## Wiring examples 3UG4581 insulation monitoring relays

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

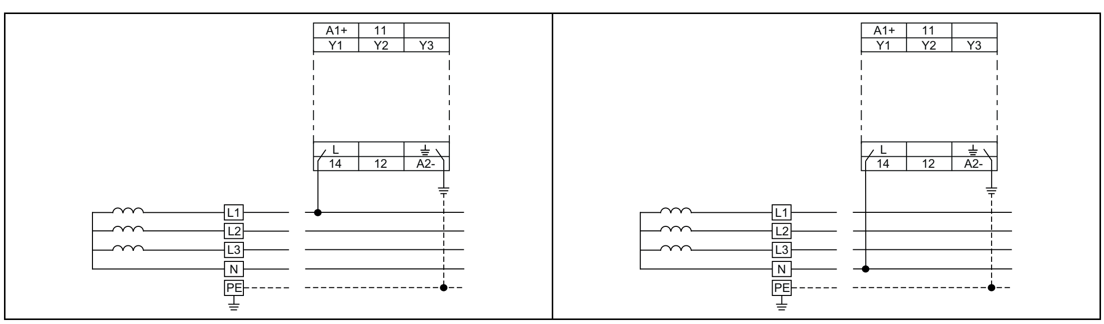
### 2-wire AC system




### 3-wire AC system

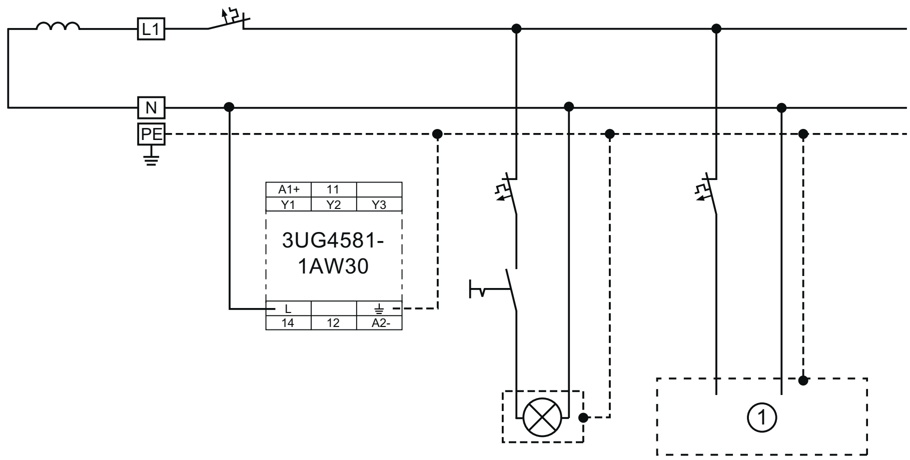



### 4-wire AC system



## 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

Figure 10-3 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.

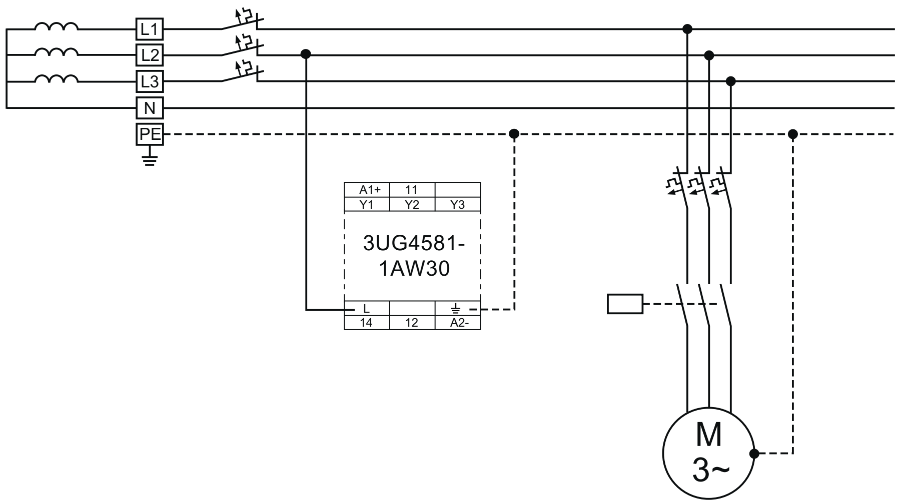



Figure 10-4 Monitoring for ground fault/insulation fault in the case of an ungrounded 4-wire IT AC system

---

Note

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

---

## 10.3.6 Characteristics

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

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

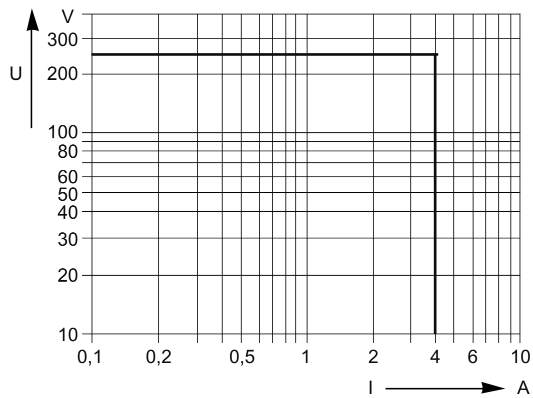



Figure 10-5 AC load (resistive)

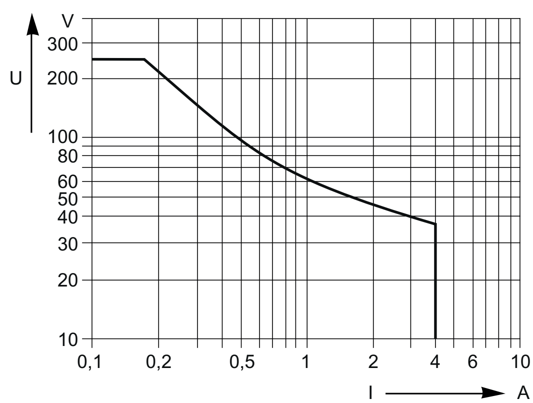



Figure 10-6 DC load (resistive)

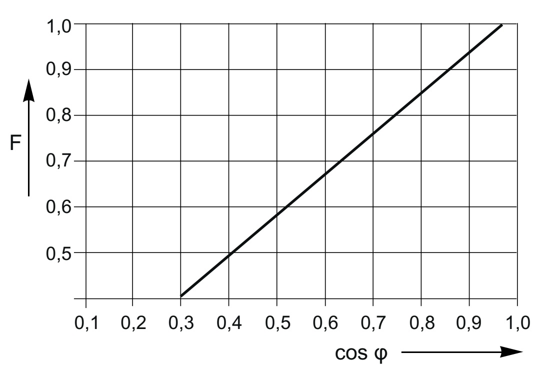
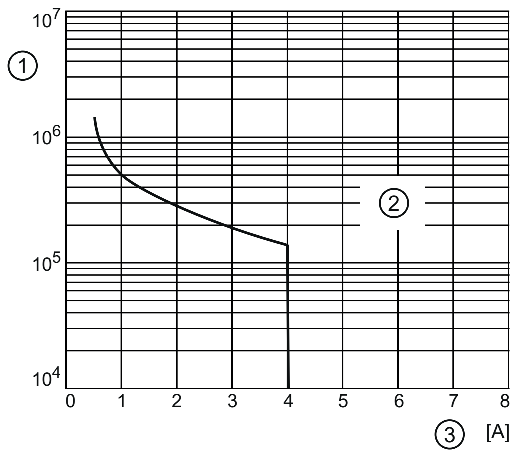



Figure 10-7 Reduction factor F in the case of inductive AC load




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

Figure 10-8 Contact service life

## 10.3.7 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 |

| | | 3UG4581-1AW30 |
|---|---|---|
| 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

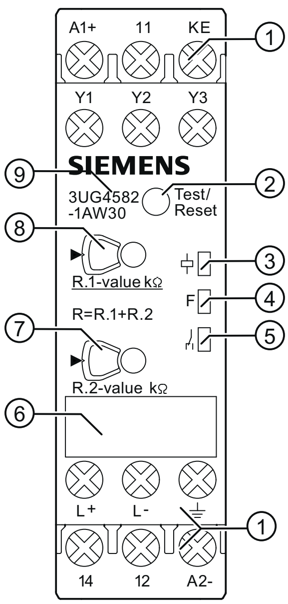
| | | 3UG4581-1AW30 |
|---|---|---|
| Width | mm | 22.5 |
| Height | mm | 78 |
| Depth | mm | 100 |
| Built in orientation | | any |
| Distance, to be maintained, to the ranks assembly | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Distance, to be maintained, conductive elements | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Distance, to be maintained, to earthed part | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | nm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Type of mounting | | snap-on fastening on 35 mm standard rail |
| Product function removable terminal for auxiliary and control circuit | | No |

| | | 3UG4581-1AW30 |
|---|---|---|
| Design of the electrical connection | | screw-type terminals |
| Conductor cross-section that can be connected<br>• solid | mm² | 0.75 … 2.5 |
| Conductor cross-section that can be connected finely stranded<br>• with wire end processing | mm² | 0.75 … 2.5 |
| AWG number as coded connectable conductor cross section<br>• solid | | 20 … 12 |
| AWG number as coded connectable conductor cross section<br>• stranded | | 18 … 14 |
| Tightening torque<br>• with screw-type terminals | N·m | 0.6 … 0.8 |
| Number of change-over switches delayed switching | | 1 |

# 10.4 3UG4582/3UG4583 insulation monitoring relays

## 10.4.1 Operator controls and connection terminals

### Front view/terminal labeling 3UG4582

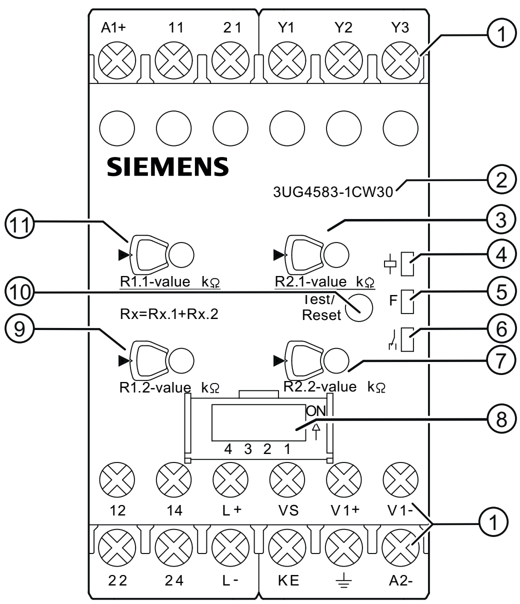
| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block:<br>Screw-type connections are possible. |
| | ② | Test/RESET button |
| | ③ | Status display: LED for device status (green) |
| | ④ | Status display: LED for monitoring status F (red) |
| | ⑤ | Status display: LED output contact status (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) |
| | ⑨ | Device order number |
| | **Terminal labels** | |
| | A1+ | Rated control and supply voltage ~ / + |
| | A2- | Rated control and 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 changeover contact NC contact |
| | 11 | Output relay K1 changeover contact root |
| | 14 | Output relay K1 changeover contact NO contact |

You will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Technical data (Page 253)".

You will find information on connecting in Chapter "Circuit diagrams (Page 243)".

## Front view/terminal labeling 3UG4583

Front view




| Description | |
|---|---|
| **Position digits** | |
| ① | Terminal block:<br>Screw-type connections are possible. |
| ② | Device order number |
| ③ | Rotary button for adjusting the insulation resistance (R2.1 for the tens position of R2) |
| ④ | Status display: LED for device status (green) |
| ⑤ | Status display: LED for monitoring status F (red) |
| ⑥ | Status display: LED output contact status (yellow) |
| ⑦ | Rotary button for adjusting the insulation resistance (R2.2 for the units position of R2) |
| ⑧ | Label |
| ⑨ | Rotary button for adjusting the insulation resistance (R1.2 for the units position of R1) |
| ⑩ | Test/RESET button |
| ⑪ | Rotary button for adjusting the insulation resistance (R1.1 for the tens position of R1) |
| **Terminal labels** | |
| A1+ | Rated control and supply voltage ~ / + |
| A2- | Rated control and supply voltage ~ / - |
| Y1<br>Y2<br>Y3 | Control inputs; isolation control<br>Y1-Y3: Remote test<br>Y2-Y3: Remote reset/autoreset |
| VS<br>V1+<br>V1- | Connection terminals for the upstream module |
| 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 changeover contact NC contact |
| 11 | Output relay K1 changeover contact root |
| 14 | Output relay K1 changeover contact NO contact |
| 22 | Output relay K2 changeover contact NC contact |
| 21 | Output relay K2 changeover contact root |
| 24 | Output relay K2 changeover contact NO contact |

You will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Technical data (Page 253)".

You will find information on connecting in Chapter "Circuit diagrams (Page 243)".

## 10.4.2 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 ⏚ 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 238)".

You will find a description of the individual parameters in the Chapter "Parameters (Page 351)".

### 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 ⏚ 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 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 (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 up to 10 s with purely AC systems. 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 ⏚ 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.

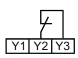
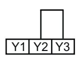
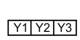
You will find the switching states of the output relays below in the section "Function diagrams (Page 232)" and in Chapter "Diagnostics (Page 241)".

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 238)".

## 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.

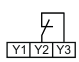
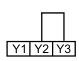
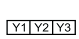
| Connection Y2-Y3 | Reset options |
|---|---|
|   | 1) On the front (Test/Reset button)<br>2) Remote reset (remote button with NC function)<br>3) A1+ / A2- (switching the supply voltage off/on) |
|   | 1) On the front (Test/Reset button)<br>2) A1+ / A2- (switching the supply voltage off/on) |
|   |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

## 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 (jumpering 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)<br>2) Remote reset (remote button with NC function)<br>3) A1+ / A2- (switching the supply voltage off/on) | 1) On the front (Test/Reset button)<br>2) Remote reset (remote button with NC function) |
|   | 1) On the front (Test/Reset button)<br>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 238)".

## 3UG4983-1A upstream module for extending the voltage range

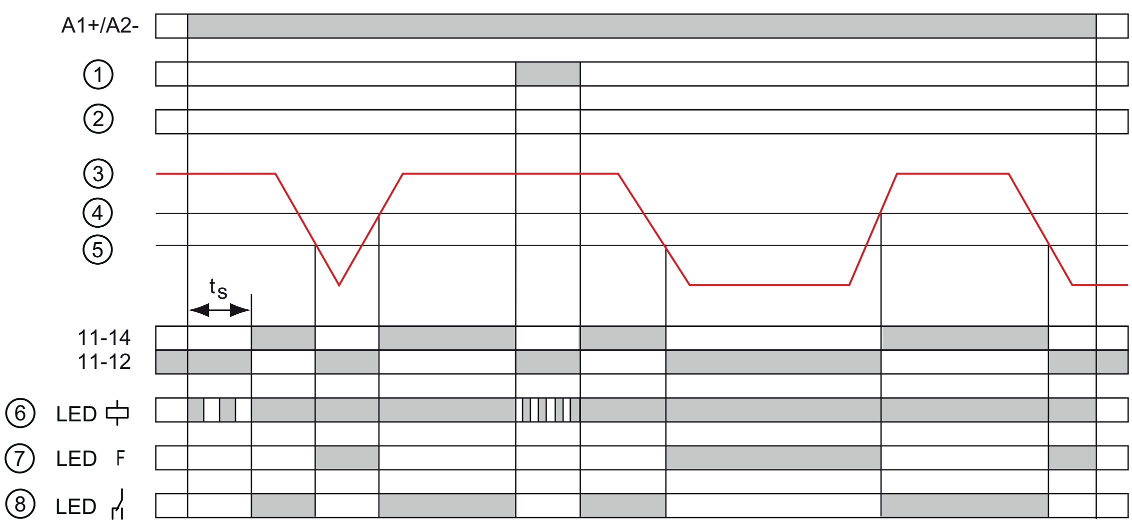
The 3UG4983-1A upstream module can be used to extend the measuring range of the rated system voltage $U_n$ to be monitored. The upstream module is used to connect the 3UG4583 insulation monitoring relay to systems with up to 690 V AC and 1000 V DC. The upstream module is connected to terminals VS, V1+ and V1- of the insulation monitoring relay.

These accessories are described in Chapter "3UG4983 upstream module for the 3UG4583 monitoring relay (Page 341)".

### 10.4.2.1 Function diagrams

## 3UG4582 function diagrams

| Relay switching behavior = NC (closed-circuit principle) |
| --- |
| Without fault storage, autoreset |




① Test (Y1-Y3)

② Reset (Y2-Y3)

③ Measured value

④ Hysteresis

⑤ Threshold

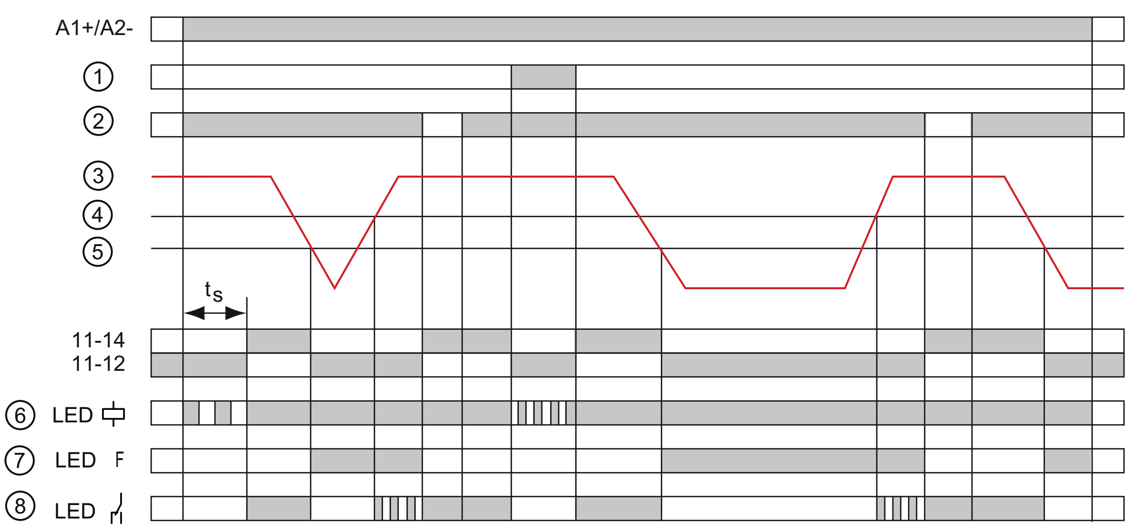
⑥ Green

⑦ Red

⑧ Yellow

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

| Relay switching behavior = NC (closed-circuit principle) |
| --- |
| With fault storage, manual RESET |




① Test (Y1-Y3)

② Reset (Y2-Y3)

③ Measured value

④ Hysteresis

⑤ Threshold

⑥ Green

⑦ Red

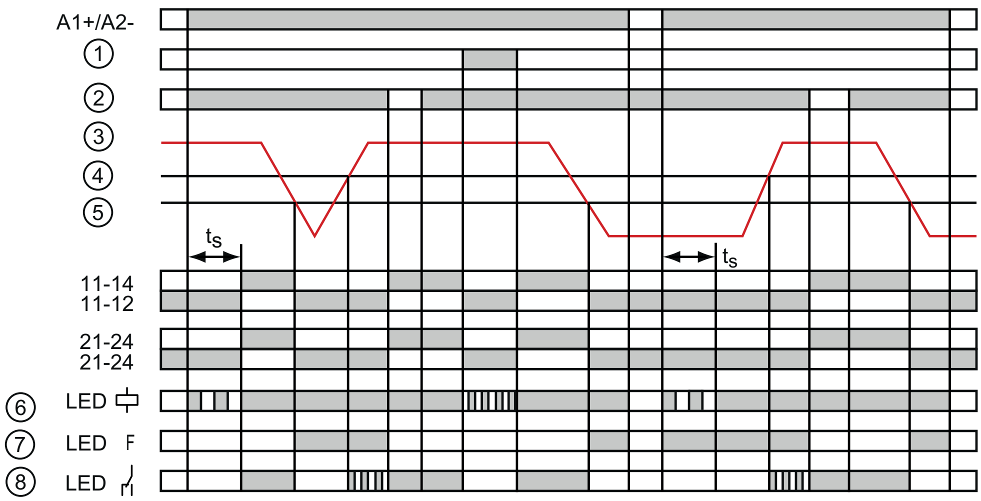
⑧ Yellow

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

## 3UG4583 function diagrams

**Relay switching behavior = NC (closed-circuit principle)**

**With fault storage, manual RESET, 1 x 2 changeover contacts, shutdown**




① Test (Y1-Y3)

② Reset (Y2-Y3)

③ Measured value

④ Hysteresis

⑤ Threshold

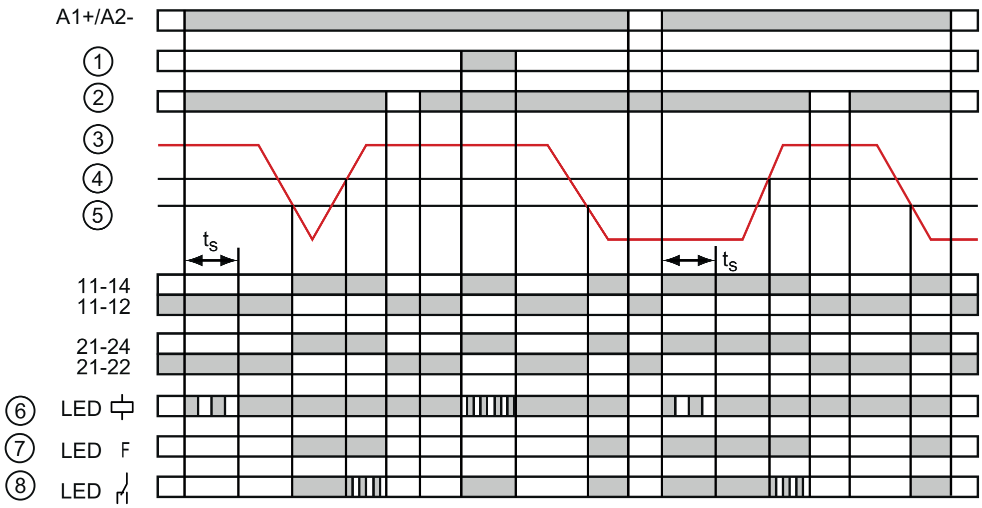
⑥ Green

⑦ Red

⑧ Yellow

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

| Relay switching behavior = NO (open-circuit principle) |
|---|
| With fault storage, manual RESET, 1 x 2 changeover contacts, shutdown |




① Test (Y1-Y3)

② Reset (Y2-Y3)

③ Measured value

④ Hysteresis

⑤ Threshold

⑥ Green

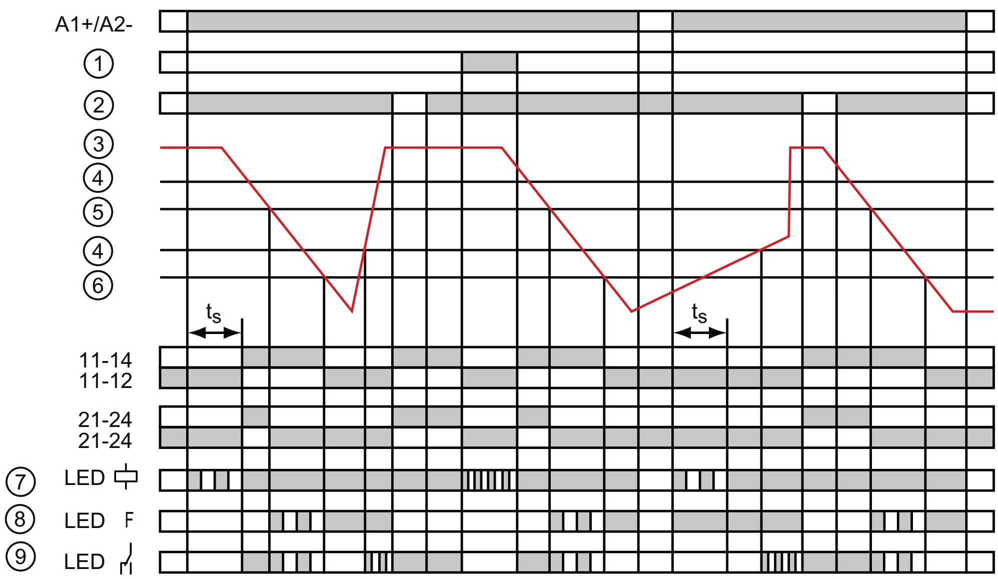
⑦ Red

⑧ Yellow

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

**Relay switching behavior = NC (closed-circuit principle)**

**With fault storage, manual RESET, 2 x 1 changeover contacts, warning and shutdown**




① Test (Y1-Y3)

② Reset (Y2-Y3)

③ Measured value

④ Hysteresis

⑤ Warning

⑥ Shutdown

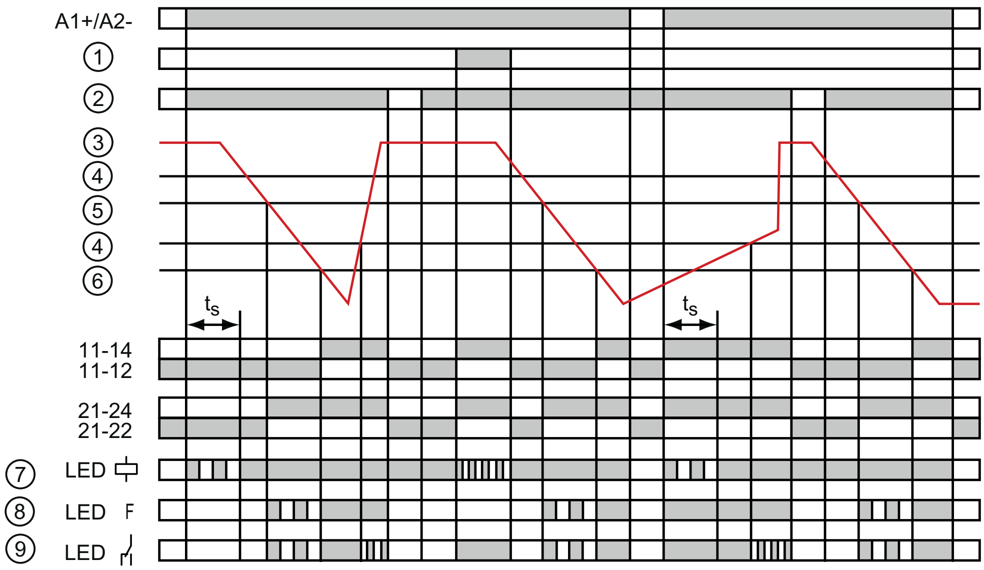
⑦ Green

⑧ Red

⑨ Yellow

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

| Relay switching behavior = NO (open-circuit principle) |
|---|
| With fault storage, manual RESET, 2 x 1 changeover contacts, warning and shutdown |




① Test (Y1-Y3)
② Reset (Y2-Y3)
③ Measured value
④ Hysteresis
⑤ Warning
⑥ Shutdown
⑦ Green
⑧ Red
⑨ Yellow

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

### 10.4.3 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 10- 5 Parameter information, 3UG4582/3UG4583 insulation monitoring relays

| Parameters | Control elements [1] | Setting range | | Increment |
|---|---|---|---|---|
| | | Minimum value | Maximum value | |
| Threshold for undershoot (R.1-value)[2] | 8 | 0 kΩ | 90 kΩ | 10 kΩ increments |
| Threshold for undershoot (R.2-value)[3] | 7 | 1 kΩ | 10 kΩ | 1 kΩ increments |
| Threshold for undershoot (R1.1-value)[4] | 11 | 0 kΩ | 90 kΩ | 10 kΩ increments |
| Threshold for undershoot (R1.2-value)[5] | 9 | 1 kΩ | 10 kΩ | 1 kΩ increments |
| Threshold for undershoot (R2.1-value)[6] | 3 | 0 kΩ | 90 kΩ | 10 kΩ increments |
| Threshold for undershoot (R2.2-value)[7] | 7 | 1 kΩ | 10 kΩ | 1 kΩ increments |
| Test / Reset | 2 (3UG4582)<br>10 (3UG4583) | Deactivated | Activated | -- |

[1] The position digits refer to the front views of the relevant 3UG4582/3UG4583 devices in Chapter "Operator controls and connection terminals (Page 225)".

[2] 3UG4582: By operating the rotary button, the tens position of the threshold for undershoot (R.1) can be selected.

[3] 3UG4582: By operating the rotary button, the units position of the threshold for undershoot (R.2) can be selected

[4] 3UG4583: By operating the rotary button, the tens position of the threshold for undershoot (R1.1) can be selected.

[5] 3UG4583: By operating the rotary button, the units position of the threshold for undershoot (R1.2) can be selected

[6] 3UG4583: By operating the rotary button, the tens position of the threshold for undershoot (R2.1) can be selected.

[7] 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 kΩ.

## 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 10- 6 DIP switch - 3UG4583

| Position | 4<br>Functional principle | 3<br>Open-circuit detection | 2<br>Non-volatile (retentive) fault storage | 1<br>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 10- 7 Definitions of the DIP switch positions - 3UG4583

| DIP switch | ON | OFF |
|---|---|---|
| Position 4<br>**Functional principle<br>2 x 1 changeover contacts /<br>1 x 2 changeover contacts** | **2 x 1 changeover contacts**<br>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). | **1 x 2 changeover contacts**<br>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<br>**Open-circuit detection** | **Open-circuit detection activated**<br>If open-circuit monitoring is activated, the insulation monitoring relay monitors cables connected to terminals L+, L-, ⏚ and KE for interruption. | **Open-circuit detection deactivated**<br>This setting deactivates open-circuit detection. |
| Position 2<br>**Non-volatile (retentive) fault storage** | **Non-volatile fault storage activated**<br>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 (jumpering of terminals Y2 / Y3). | **Non-volatile fault storage deactivated**<br>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<br>**Functional principle of output relays K1 and K2** | **Closed-circuit principle NC**<br>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. | **Open-circuit principle NO**<br>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 244)" shows examples for the different monitoring modes.

The parameters are defined in the Chapter "Parameters (Page 351)".

## 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.

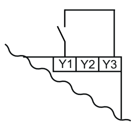



Figure 10-9 Remote test button

## 10.4.4 Diagnostics

### 10.4.4.1 Diagnostics with LEDs

### Status display

The following information indicates the operating state on the 3UG4582/3UG4583 insulation monitoring relays:

| Operating state | LED (green) | LED F (red) | LED (yellow) |
|---|---|---|---|
| Start | | Off | Off |
| No fault | | Off | • On the 3UG4582:<br>• On the 3UG4583: Dependent on the configuration |
| Advance warning1) | | | |
| Insulation fault (threshold undershot) | | | • On the 3UG4582: Off<br>• On the 3UG4583: Dependent on the configuration |
| PE/KE open circuit | | | • On the 3UG4582: Off<br>• On the 3UG4583: Dependent on the configuration |

| Operating state | LED (green) | LED F (red) | LED (yellow) |
|---|---|---|---|
| L+/L- open circuit at system start[1)]<br>/<br>Test function[1)] | <br>/<br> |  | Dependent on the configuration |
| System discharge capacity too high/measured result invalid |  |  | • On the 3UG4582: Off<br>• On the 3UG4583: Dependent on the configuration |
| Internal fault | • On the 3UG4582: Off<br>• On the 3UG4583: Dependent on the configuration |  | • On the 3UG4582: Off<br>• On the 3UG4583: Dependent on the configuration |
| Setting error[1), 2)] |  |  |  |
| Test function |  | Off | • On the 3UG4582: Off<br>• On the 3UG4583: Dependent on the configuration |
| Manual RESET possible[3)] |  | 4) |  |

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 227)".

## 10.4.5 Circuit diagrams

### 10.4.5.1 Internal circuit diagrams

#### Internal circuit diagrams 3UG4582-1AW30/3UG4583-1CW30

#### 3UG4582-1AW30

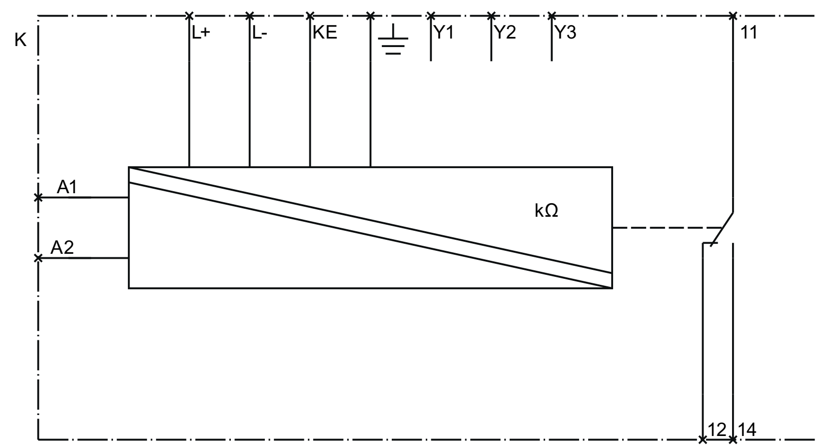



Figure 10-10 3UG4582-1AW30 insulation monitoring relay

#### 3UG4583-1CW30

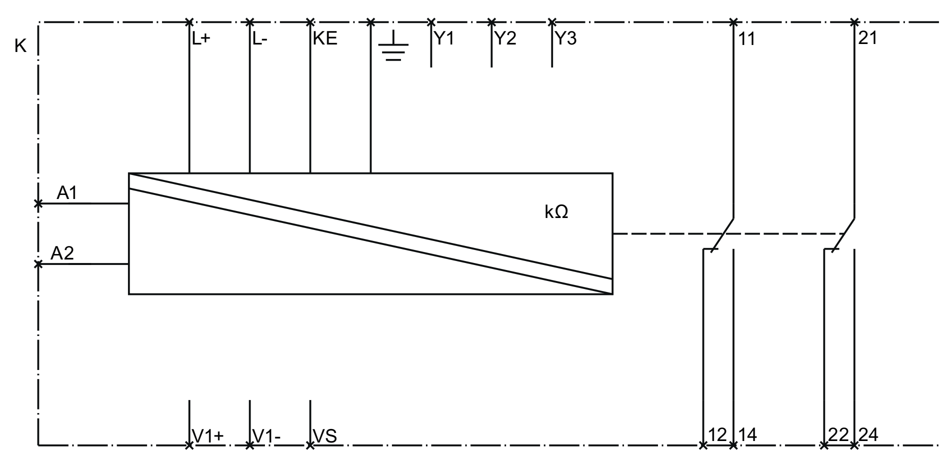



Figure 10-11 3UG4583-1CW30 insulation monitoring relay

### 10.4.5.2 Wiring examples

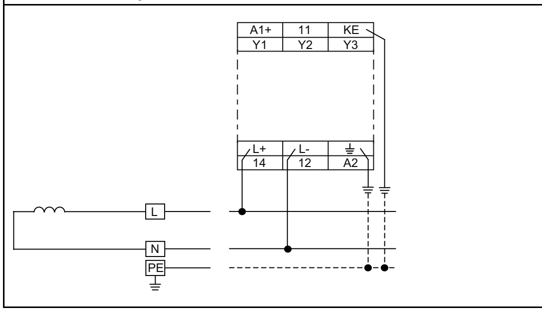
## Wiring examples 3UG4582 insulation monitoring relays

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.

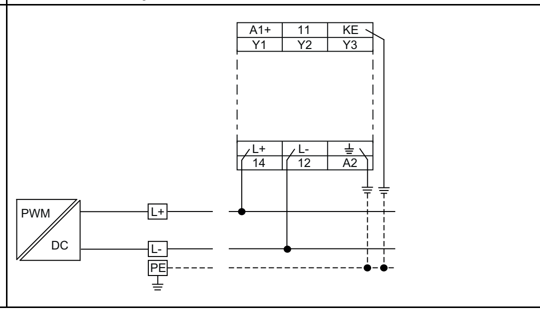
The rated system voltage is $U_n$ ≤ 250 V AC (15 to 400 Hz) or $U_n$ ≤ 300 V DC.

#### 2-wire AC system / 2-wire DC system

2-wire AC system

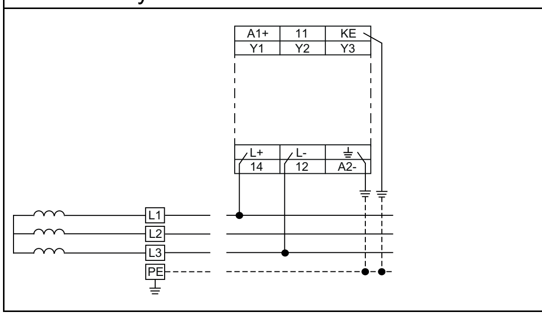



2-wire DC system

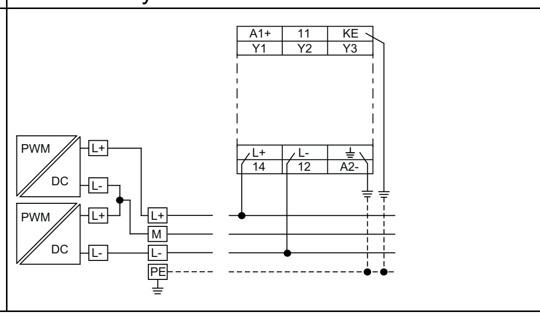



#### 3-wire AC system / 3-wire DC system

3-wire AC system

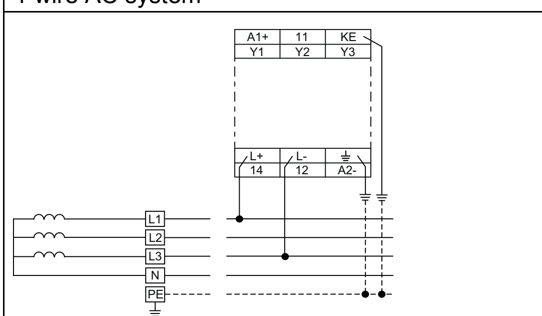


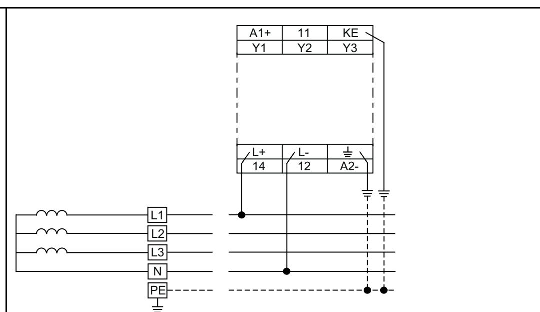

3-wire DC system




#### 4-wire AC system

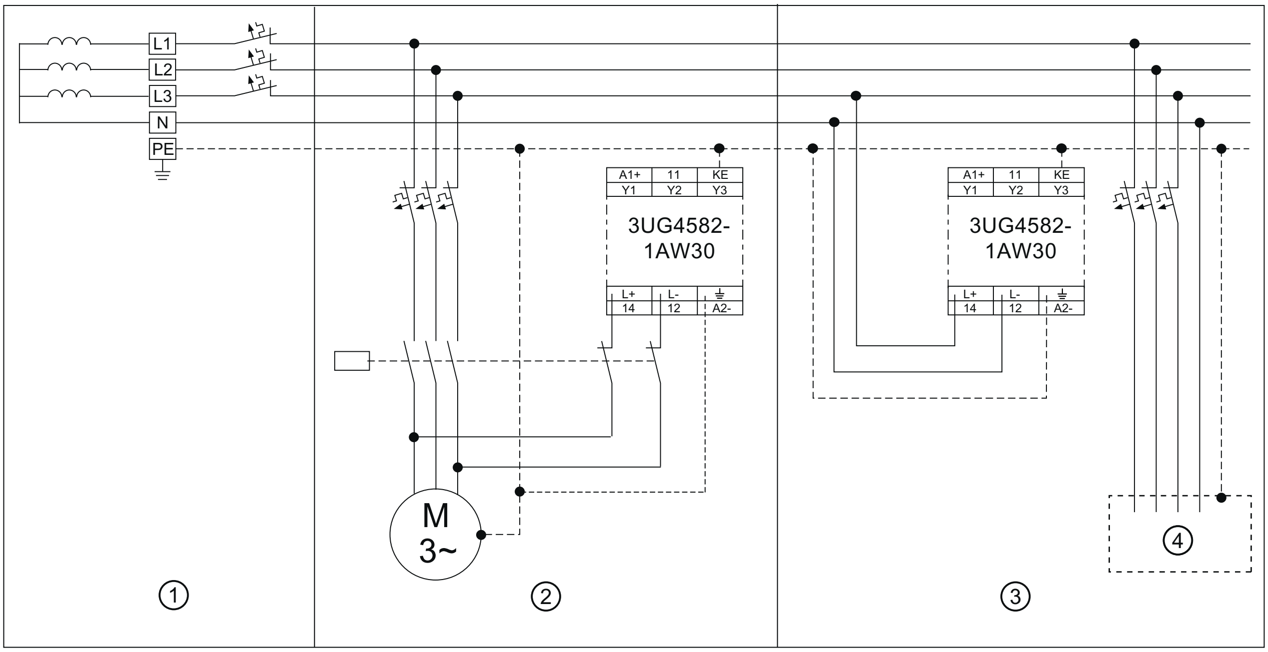
4-wire AC system



## 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

Figure 10-12 Monitoring for ground fault/insulation fault with different load circuits

**Note**

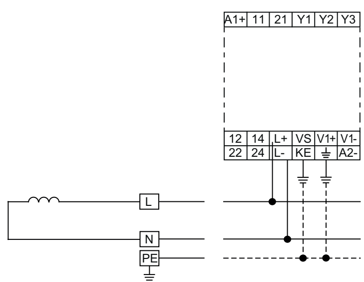
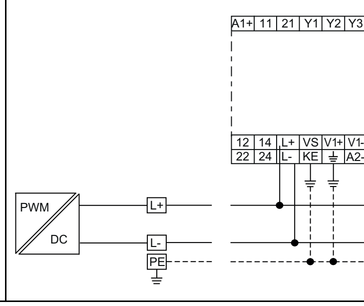
The maximum cable length of the control cables is 50 m or 100 pF/m.

## Wiring examples 3UG4583 insulation monitoring relays

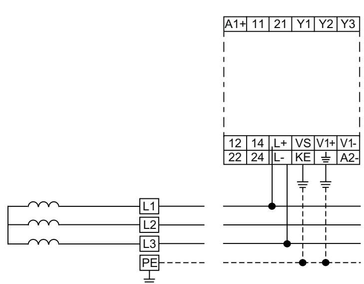
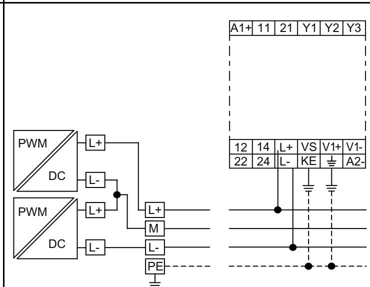
Measuring inputs L+ and L- can be connected to any conductor (phase or N conductor). Measuring inputs L+ and L- must always be connected to different conductors.

The rated system voltage is $U_n$ ≤ 400 V AC (15 to 400 Hz) or $U_n$ ≤ 600 V DC. The 3UG4983-1A upstream module must be used to monitor systems with higher voltages.

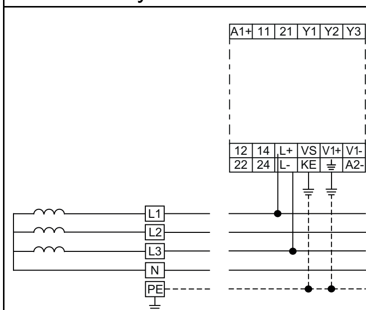
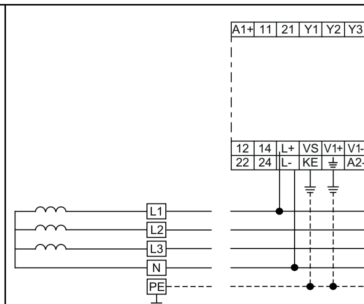
### 2-wire AC system / 2-wire DC system

| 2-wire AC system | 2-wire DC system |
| --- | --- |
|  |  |

### 3-wire AC system/3-wire DC system

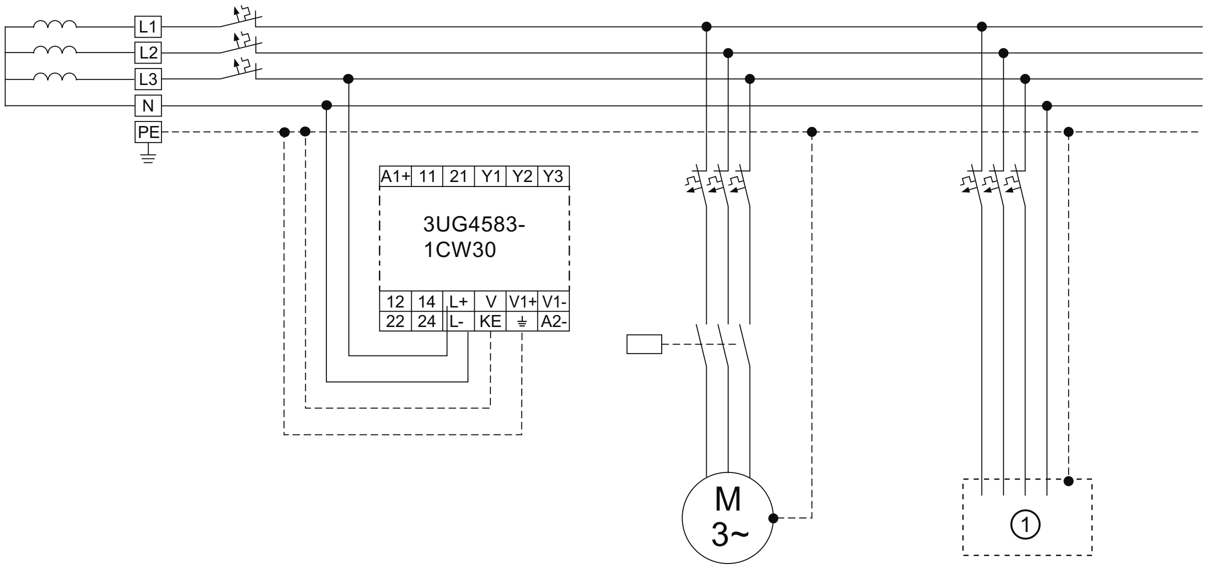
| 3-wire AC system | 3-wire DC system |
| --- | --- |
|  |  |

### 4-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 4-wire AC system.




① Loads

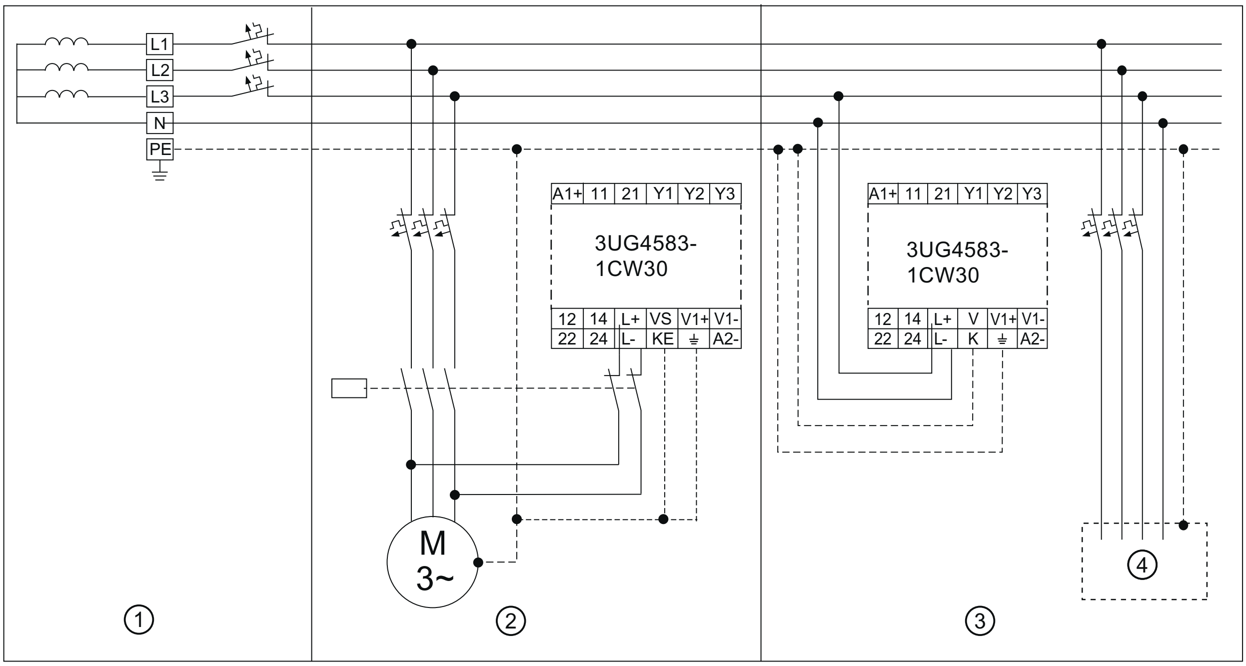
Figure 10-13 Monitoring for ground fault/insulation fault in the case of an ungrounded 4-wire AC system

---

**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

Figure 10-14 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.

---

## 10.4.6 Characteristics

### Characteristics of the 3UG4582 insulation monitoring relays

The characteristics below show the load limit curves of the 3UG4582 insulation monitoring relays.

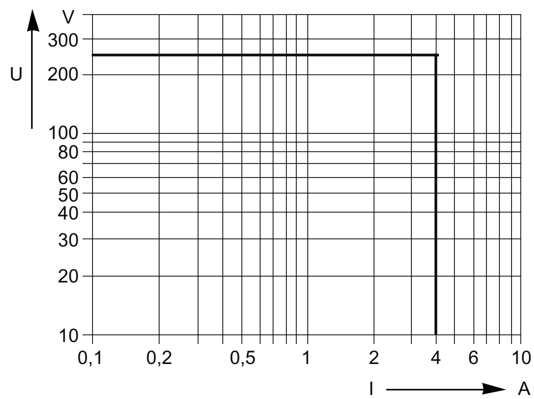



Figure 10-15 AC load (resistive)

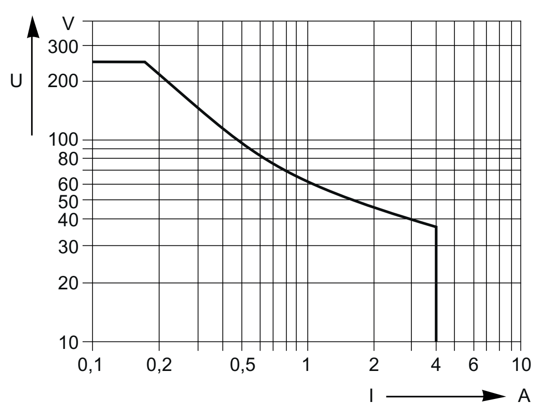



Figure 10-16 DC load (resistive)

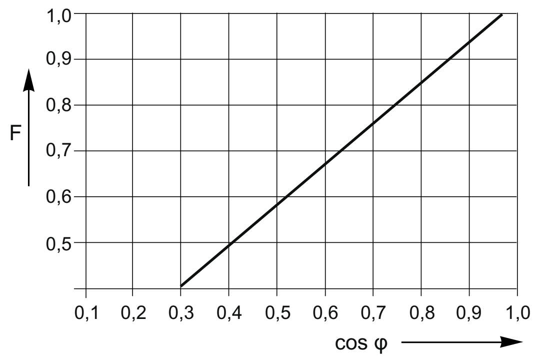
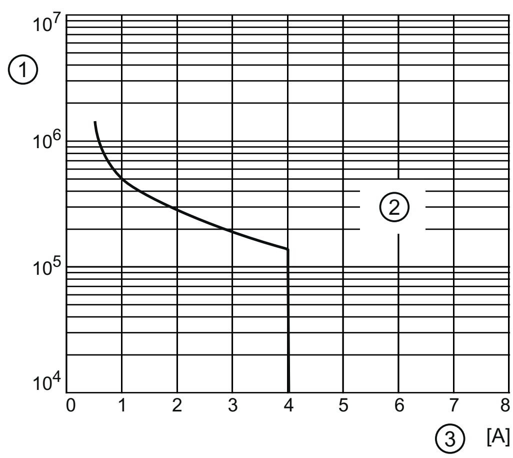



Figure 10-17 Reduction factor F in the case of inductive AC load




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

Figure 10-18 Contact service life

## Characteristics of the 3UG4583 insulation monitoring relays

The characteristics below show the load limit curves of the 3UG4583 insulation monitoring relays.

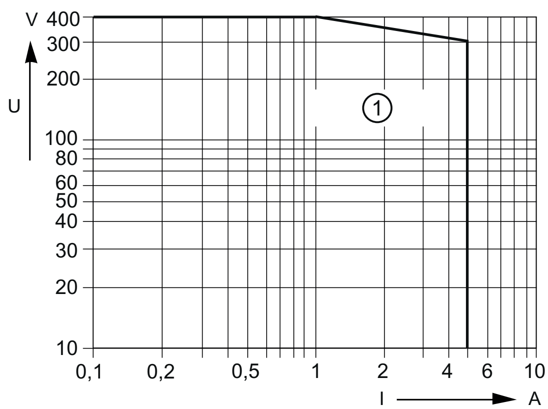



Figure 10-19 AC load (resistive)

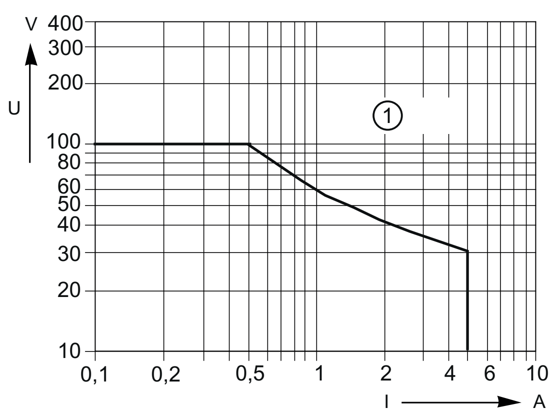



Figure 10-20 DC load (resistive)

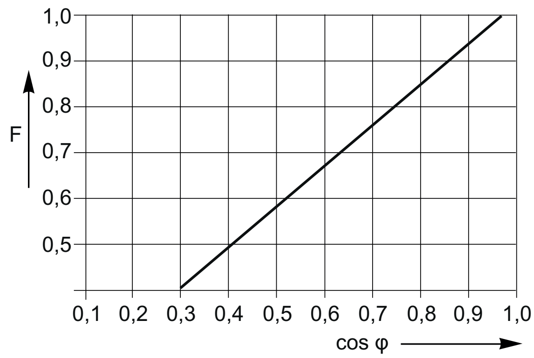
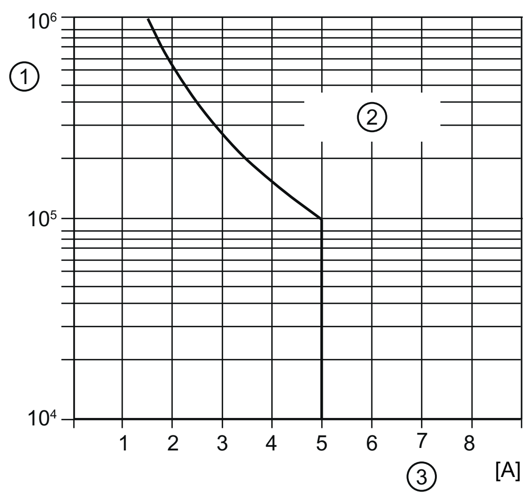



Figure 10-21 Reduction factor F in the case of inductive AC load




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

Figure 10-22 Contact service life

## 10.4.7 Technical data

### 10.4.7.1 3UG4582

#### Measuring circuit

| | | 3UG4582-1AW30 |
|---|---|---|
| Type of voltage for monitoring | | AC/DC |
| Measurable line frequency | Hz | 50 … 60 |
| Network leakage resistance | µF | 10 |
| Adjustable response value impedance | | |
| • 1 | kΩ | 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 |
|---|---|---|
| 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 | 6 |
| 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 |
| • according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | | K |

## Mechanical design

| | | 3UG4582-1AW30 |
|---|---|---|
| Width | mm | 22.5 |
| Height | mm | 78 |
| Depth | mm | 100 |
| Built in orientation | | any |
| Distance, to be maintained, to the ranks assembly | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Distance, to be maintained, conductive elements | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |

| | | 3UG4582-1AW30 |
|---|---|---|
| Distance, to be maintained, to earthed part | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Type of mounting | | snap-on fastening on 35 mm standard rail |
| Product function removable terminal for auxiliary and control circuit | | No |
| Design of the electrical connection | | screw-type terminals |
| Conductor cross-section that can be connected | | |
| • solid | $mm^2$ | 0.75 … 2.5 |
| • finely stranded | | |
| – with wire end processing | $mm^2$ | 0.75 … 2.5 |
| AWG number as coded connectable conductor cross section | | |
| • solid | | 20 … 12 … |
| • stranded | | 18 … 14 |
| Tightening torque | | |
| • with screw-type terminals | N·m | 0.6 … 0.8 |
| Number of change-over switches delayed switching | | 1 |

### 10.4.7.2 3UG4583

#### Measuring circuit

| | | 3UG4583-1CW30 |
|---|---|---|
| Type of voltage for monitoring | | AC/DC |
| Measurable line frequency | Hz | 15 … 400 |
| Network leakage resistance | µF | 20 |
| Adjustable response value impedance | | |
| • 1 | kΩ | 1 … 100 |
| • 2 | kΩ | 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 |

| | | 3UG4583-1CW30 |
|---|---|---|
| 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 |
| • according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | | K |

## Mechanical design

| | | 3UG4583-1CW30 |
|---|---|---|
| Width | mm | 45 |
| Height | mm | 78 |
| Depth | mm | 100 |
| Built in orientation | | any |
| Distance, to be maintained, to the ranks assembly | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Distance, to be maintained, conductive elements | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Distance, to be maintained, to earthed part | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |

| | | 3UG4583-1CW30 |
|---|---|---|
| Type of mounting | | snap-on fastening on 35 mm standard rail |
| Product function removable terminal for auxiliary and control circuit | | No |
| Design of the electrical connection | | screw-type terminals |
| Conductor cross-section that can be connected | | |
| • solid | mm² | 0.75 … 2.5 |
| • finely stranded | | |
| – with wire end processing | mm² | 0.75 … 2.5 |
| AWG number as coded connectable conductor cross section | | |
| • solid | | 20 … 12 |
| • stranded | | 18 … 14 |
| Tightening torque | | |
| • with screw-type terminals | N·m | 0.6 … 0.8 |
| Number of change-over switches delayed switching | | 2 |

# 3UG463. voltage monitoring relay 11

## 11.1 Application areas

### Application areas

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

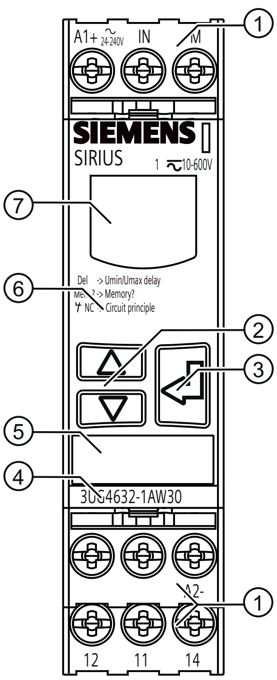
Table 11- 1 Application areas of the voltage monitoring relays

| Function | Application |
|---|---|
| • Undervoltage<br>• Overvoltage | • Increased current on a motor with corresponding overheating<br>• Unintended device reset<br>• Power system collapse on overloaded supply voltages<br>• Fork-lift trucks<br>• Heating systems<br>• Cranes<br>• Elevators<br>• Protection from undervoltage (especially with battery power; result: e.g. exhaustive discharge)<br>• System protection against destruction caused by supply overvoltages<br>• Energy supply to the line<br>• Machine switch-on when a defined voltage is reached<br>• Threshold switch for analog signals from 0.1 to 10 V |

# 11.2 3UG4631 / 3UG4632 voltage monitoring relay

## 11.2.1 Operator controls and connection terminals

### Front view / terminal labeling 3UG4631 / 3UG4632

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | A1+ | Rated control supply voltage AC/DC+ |
| | A2- | Rated control supply voltage AC/DC- |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 270)."

### 11.2.2 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▲) or **undershoot** (U▼) or in **range monitoring** (U▲ and U▼).

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 266)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

#### Monitoring

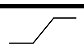
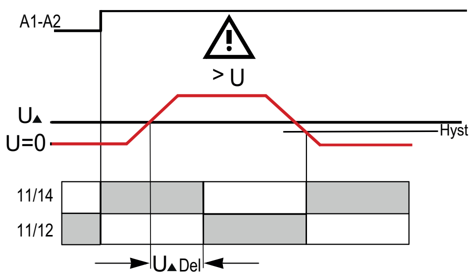
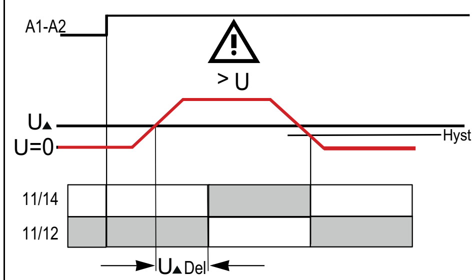
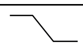
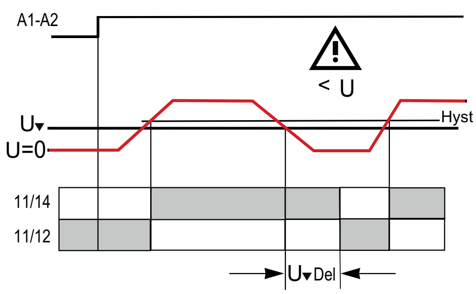
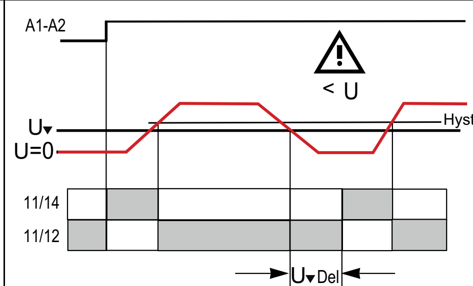
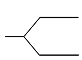
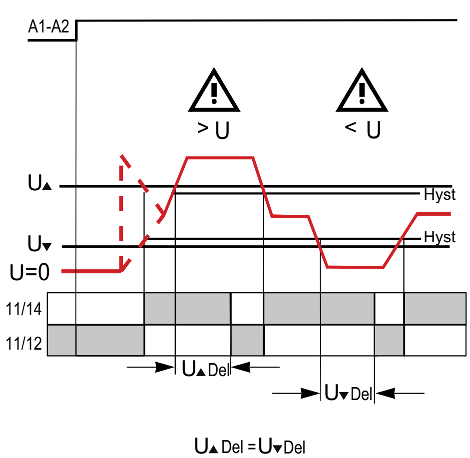
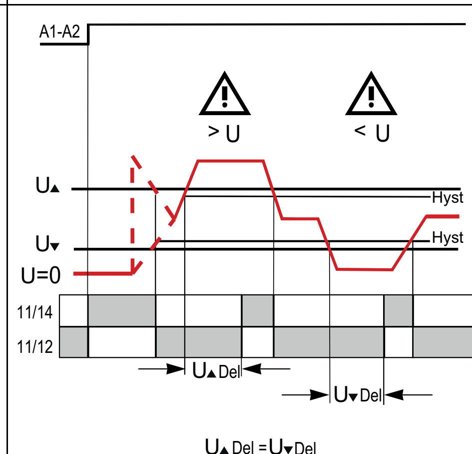
The output relay K1 responds in accordance with the set relay switching behavior (closed-circuit principle NC or open-circuit principle NO). The set tripping delay time starts if the monitored voltage overshoots or undershoots the corresponding set threshold value. After expiry of the tripping delay 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 267)."

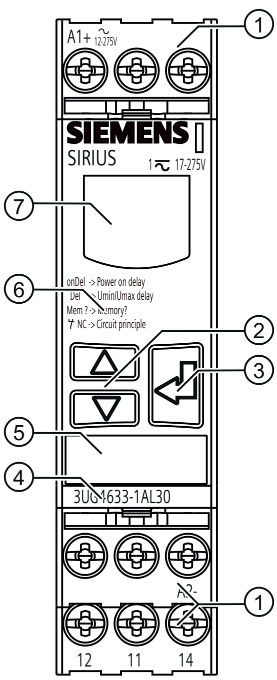
### Function diagrams 3UG4631 / 3UG4632

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC<br>(closed-circuit principle)</th><th>Memory = no<br>Relay switching behavior = NO<br>(open-circuit principle)</th></tr>
<tr><td><br>U▲<br>U▼ = off</td><td>
</td><td>
</td></tr>
<tr><td><br>U▲ = off<br>U▼</td><td>
</td><td>
</td></tr>
<tr><td>U▲<br>U▼<br></td><td>
</td><td>
</td></tr>
</table>

# 11.3 3UG4633 voltage monitoring relay

## 11.3.1 Operator controls and connection terminals

### Front view / terminal assignment 3UG4633

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



You will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 270)."

## 11.3.2 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 266)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

### 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

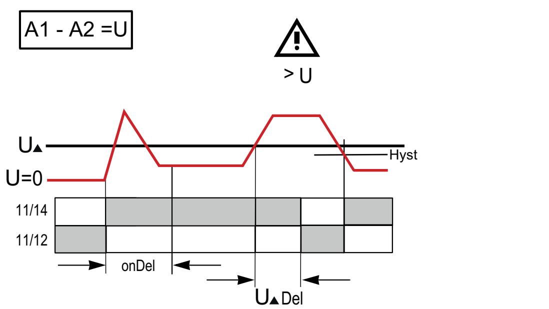
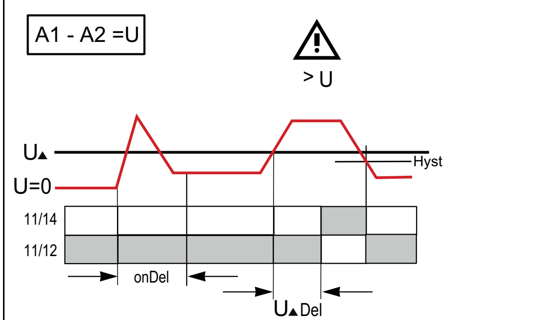
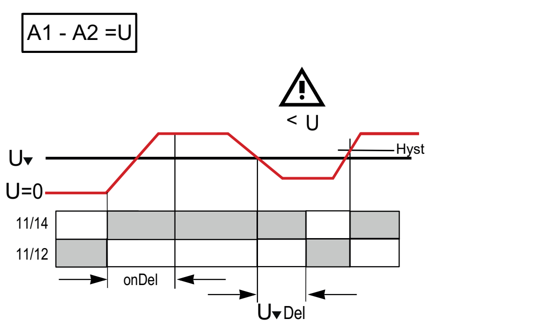
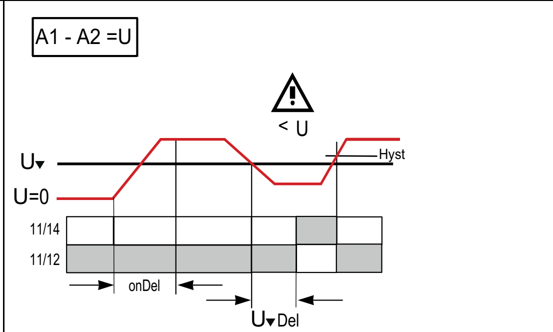
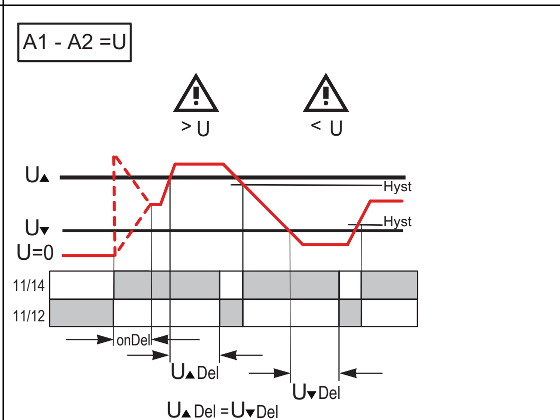
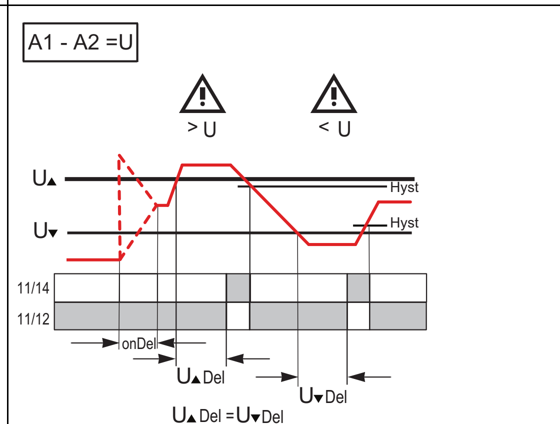
To be able to start a drive, the output relay switches to the correct state during the ON-delay time (onDel) depending on the selected open-circuit principle or closed-circuit principle, even if the measured value is still under the set value.

#### 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 267)."

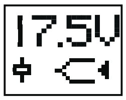
## Function diagrams 3UG4633

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC<br>(closed-circuit principle)</th><th>Memory = no<br>Relay switching behavior = NO<br>(open-circuit principle)</th></tr>
<tr><td>U▲<br>U▼ = off</td><td></td><td></td></tr>
<tr><td>U▲ = off<br>U▼</td><td></td><td></td></tr>
<tr><td>U▲<br>U▼</td><td></td><td></td></tr>
</table>

## 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 3UG463. voltage monitoring relays:

Table 11- 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[1]<br>10 V or OFF[2]<br>17 V or OFF[3] | 60 V[1]<br>600 V[2]<br>275 V[3] | 0.1 V | 20 V[1]<br>170 V[2, 3] |
| "RUN" | Threshold for overshoot (U▴) | 0.1 V or OFF[1]<br>10 V or OFF[2]<br>17 V or OFF[3] | 60 V[1]<br>600 V[2]<br>275 V[3] | 0.1 V | 30 V[1]<br>260 V[2,3] |
| "SET" | Hysteresis (Hyst) | 0.1 V | 30 V[1]<br>300 V[2]<br>150 V[3] | 0.1 V | 2 V[1]<br>5 V[2, 3] |
| "SET" | ON-delay time (onDel) | 0.1 s[3] | 20 s[3] | 0.1 s[3] | 0.1 s[3] |
| "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

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**Note**

The monitoring mode "Overshoot" or "Undershoot" is defined with the setting OFF at the threshold for undershoot or overshoot.

---

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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.

---

The parameters are described in Chapter "Parameters (Page 351)."

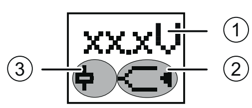
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

# 11.5 Diagnostics

## 11.5.1 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 change-over contact

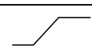
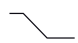
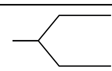
## Meaning of the information on the display

**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 |  | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 261)" (3UG4631 / 3UG4632) and "Functions (Page 264)" (3UG4633).

## 11.5.2 Reset

### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

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

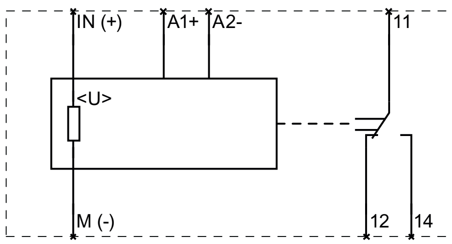
  To reset the devices with digital setting, it is necessary to press both arrow keys simultaneously for more than 2.5 s after removal of the cause of error. If the cause of the error has not been removed, a new error message appears immediately. Alternatively, the devices can be reset by switching the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

# 11.6 Circuit diagrams

## 11.6.1 Internal circuit diagrams

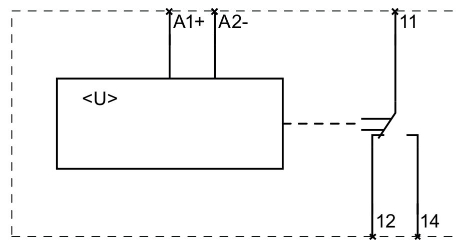
### Internal circuit diagrams 3UG4631 / 3UG4632 and 3UG4633

**3UG4631 / 3UG4632**




3UG4631 / 3UG4632 voltage monitoring relay

**3UG4633**




3UG4633 voltage monitoring relay

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**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!

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## 11.6.2 Wiring examples

### 3UG4631-.AA30 / 3UG4632-.AA30

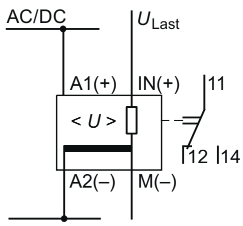



Figure 11-1 3UG4631-.AA30 / 3UG4632-.AA30

### 3UG4631-.AW30 / 3UG4632-.AW30

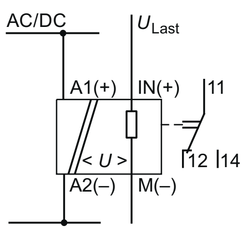



Figure 11-2 3UG4631-.AW30 / 3UG4632-.AW30

### 3UG4633

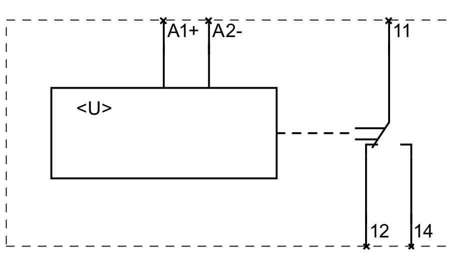



Figure 11-3 3UG4633

# 11.7 Technical data

## Measuring circuit

| | | 3UG4631-1 | 3UG4632-1 | 3UG4633-1 | 3UG4631-2 | 3UG4632-2 | 3UG4633-2 |
|---|---|---|---|---|---|---|---|
| Type of voltage for monitoring | | AC/DC | | | | | |
| Number of poles for main current circuit | | 1 | | | | | |
| Measurable line frequency | Hz | 500 … 40 | | | | | 40 … 500 |
| Measurable voltage | | | | | | | |
| • 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 |
| Adjustable voltage range | V | 0.1 … 60 | 10 … 600 | 17 … 275 | 0.1 … 60 | 10 … 600 | 17 … 275 |
| Adjustable response delay time | | | | | | | |
| • 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 |
|---|---|---|---|---|---|---|---|
| Product function | | Voltage monitoring relay | | | | | |
| Design of the display | | LCD | | | | | |
| Product function | | | | | | | |
| • 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 | | | | | |
| Starting time after the control supply voltage has been applied | s | 1 | | | | | |
| Response time maximum | ms | 450 | | | | | |
| Relative metering precision | % | 5 | | | | | |

| | | 3UG463.-1.A | 3UG463.-1.L | 3UG463.-1.W | 3UG463.-2.A | 3UG463.-2.L | 3UG463.-2.W |
|---|---|---|---|---|---|---|---|
| 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 |
| 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 | | | | | |

| | | 3UG463.-1.A | 3UG463.-1.L | 3UG463.-1.W | 3UG463.-2.A | 3UG463.-2.L | 3UG463.-2.W |
|---|---|---|---|---|---|---|---|
| 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 | | | | | |
| 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 | | | | | |

| | | 3UG463.-1.A | 3UG463.-1.L | 3UG463.-1.W | 3UG463.-2.A | 3UG463.-2.L | 3UG463.-2.W |
|---|---|---|---|---|---|---|---|
| **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.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 92 | 94 |
| Depth | mm | 91 | |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| Type of mounting | | snap-on mounting | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |

| | | 3UG463.-1.... | 3UG463.-2.... |
|---|---|---|---|
| **Design of the electrical connection** | | screw-type terminals | spring-loaded terminals |
| **Type of the connectable conductor cross-section** | | | |
| • solid | | 1x (0.5 ... 4 $mm^2$),<br>2x (0.5 ... 2.5 $mm^2$) | 2x (0.25 ... 1.5 $mm^2$) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 $mm^2$),<br>2x (0.5 ... 1.5 $mm^2$) | 2 x (0.25 ... 1.5 $mm^2$) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 $mm^2$) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| **Tightening torque** | | | |
| • with screw-type terminals | N·m | 1.2 … 0.8 | — … |
| **Number of change-over switches delayed switching** | | 1 | |

# 3UG4641 cos phi and active current monitoring relay 12

## 12.1 Application areas

### Application areas

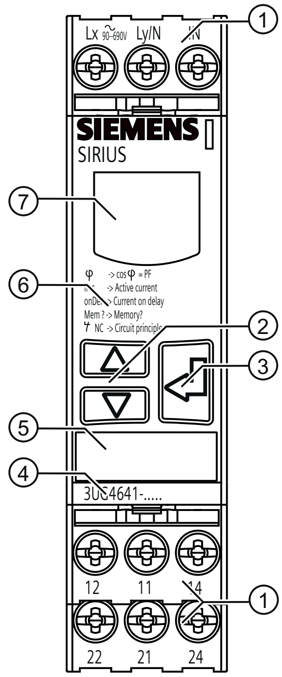
The cos phi and active current monitoring relays are used, for example, in the following application areas:

Table 12- 1 Application areas of the cos phi and active current monitoring relays

| Function | Application |
| --- | --- |
| • No-load monitoring and load shedding<br>• Underload monitoring in the low-end performance range<br>• Monitoring for overload<br>• Simple cos phi monitoring in power systems for controlling compensation systems<br>• Cable break between the control cabinet and the motor | • Fans (in the case of a broken fan belt, for example)<br>• Pumps (in the case of an idling pump, for example)<br>• Filter system (a contaminated filter system, for example)<br>• Reactive power compensation<br>• Sawing system<br>• Conveyor belt<br>• Surface grinding machine<br>• Breaking mill<br>• Milling machine<br>• Car wash<br>• Lifting platform<br>• Screw conveyor<br>• Crane<br>• Turning machine<br>• Infrared heating system |

## 12.2 Operator controls and connection terminals

### Front view / terminal labeling 3UG4641

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 288)."

# 12.3 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**($\varphi$▲ / $I_{res}$▲), **undershoot** ($\varphi$▼ / $I_{res}$▼) or **range monitoring** ($\varphi$▲ and $\varphi$▼ / $I_{res}$▲ and $I_{res}$▼) 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 285)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

---

**Note**

The specified voltages represent the absolute thresholds.

---

## 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 ($I_{res}$▼ = 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.

---

**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).

---

### Startup delay

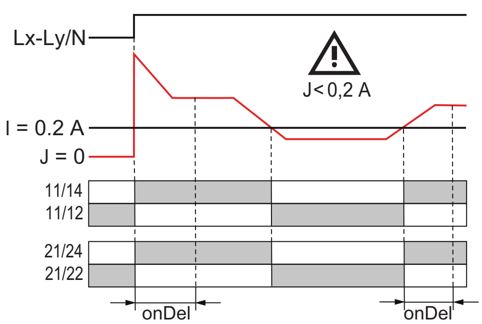
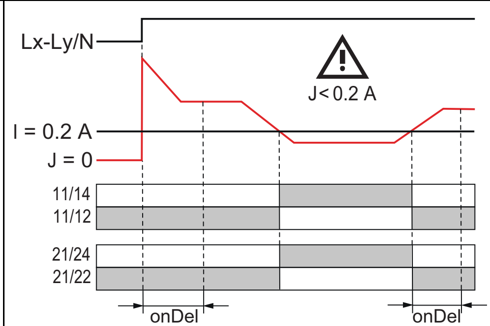
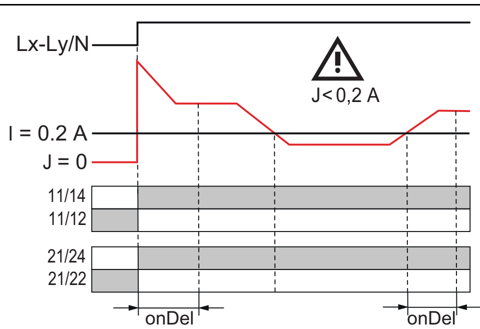
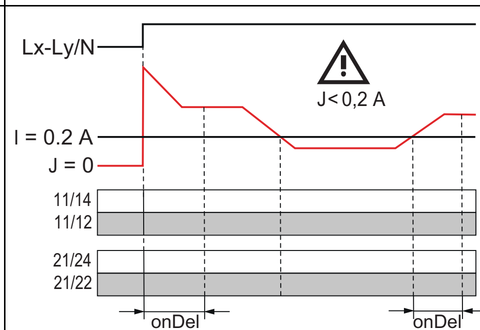
To be able to start a drive, the output relay switches to the correct state during the ON-delay time (onDel) depending on the selected open-circuit principle or closed-circuit principle, even if the measured value is still under the set value.

### 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 286)."

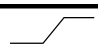
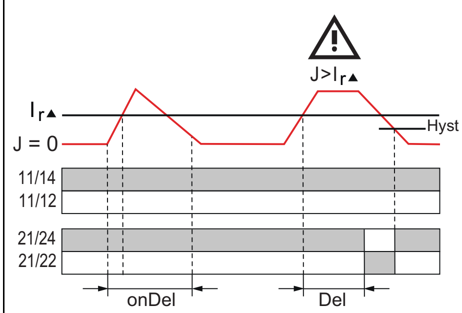
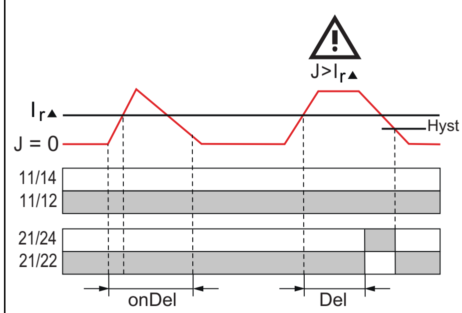
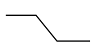
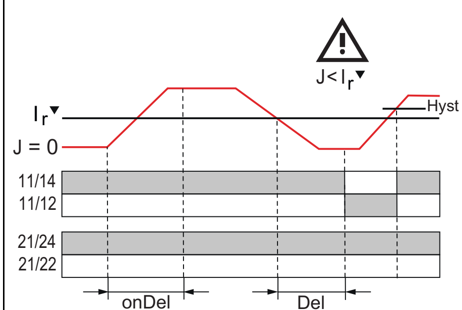
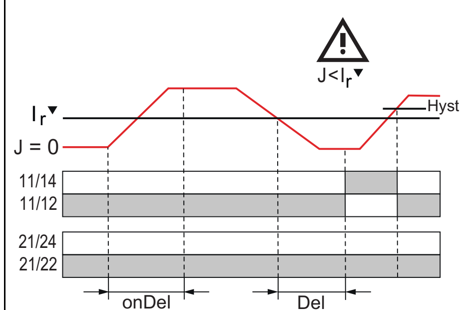
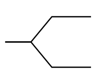
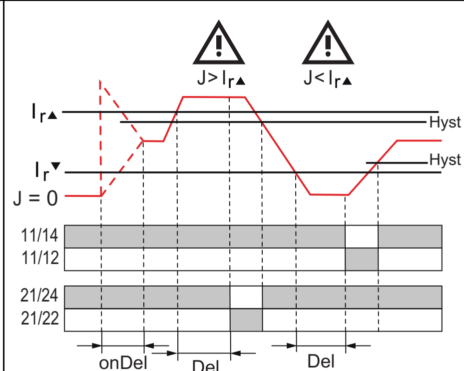
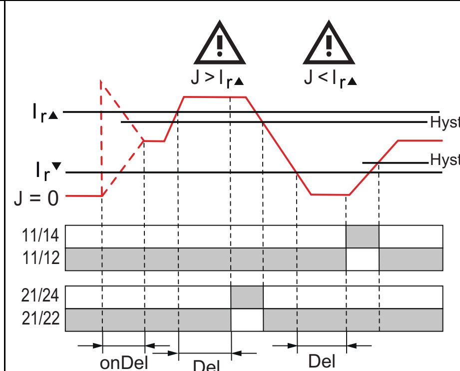
## Function diagrams 3UG4641 (lower current measuring threshold 0.2 A)

| Display | Memory = no<br>Relay switching behavior = NC (closed-circuit principle) | Memory = no<br>Relay switching behavior = NO (open-circuit principle) |
|---|---|---|
| $I_r$▼ |  |  |
| $I_r$▼ = off |  |  |

J = currently set current value

I = set threshold value for the current

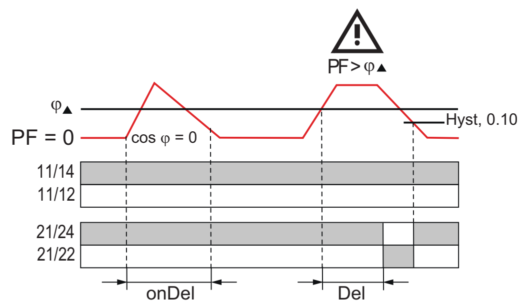
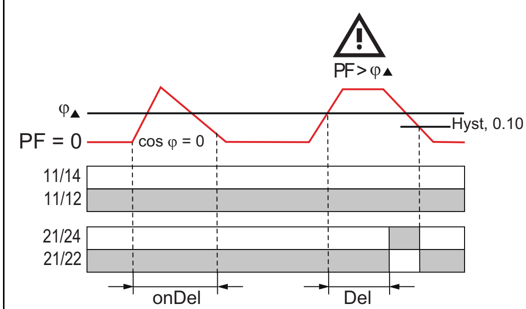
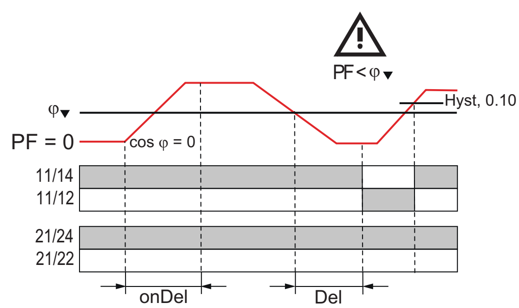
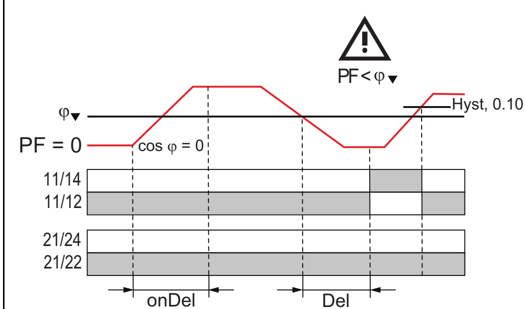
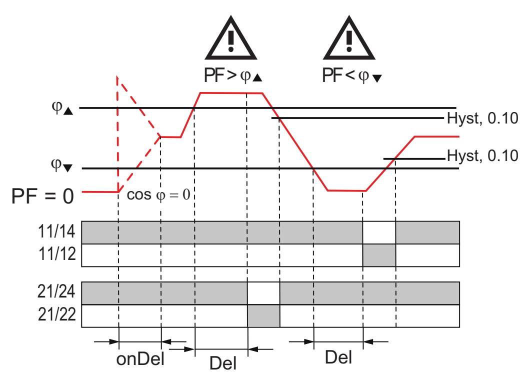
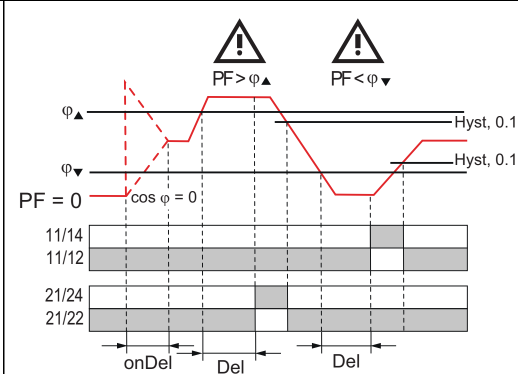
### Function diagrams 3UG4641 (active current monitoring $I_{res}$)

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC (closed-circuit principle)</th><th>Memory = no<br>Relay switching behavior = NO (open-circuit principle)</th></tr>
<tr><td><br>$I_r$▲<br>$I_r$▼ = off</td><td>
</td><td>
</td></tr>
<tr><td>$I_r$▲ = off<br>$I_r$▼<br></td><td>
</td><td>
</td></tr>
<tr><td>$I_r$▲<br>$I_r$▼<br></td><td>
</td><td>
</td></tr>
</table>

J = currently set current value

I = set threshold value for the current

## Function diagrams 3UG4641 (cos phi monitoring)

<table>
<tr><th>Display</th><th>Memory = no<br>Relay switching behavior = NC (closed-circuit principle)</th><th>Memory = no<br>Relay switching behavior = NO (open-circuit principle)</th></tr>
<tr><td>φ▲<br>φ▼ = off</td><td>
</td><td>
</td></tr>
<tr><td>φ▲ = off<br>φ▼</td><td>
</td><td>
</td></tr>
<tr><td>φ▲<br>φ▼</td><td>
</td><td>
</td></tr>
</table>

cos φ = currently set value for cos φ

PF = power factor = set threshold for cos φ

# 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 3UG4641 cos phi and active current monitoring relays:

Table 12- 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 ($I_{res}$▼) | 0.2 A or OFF | 10 A | 0.1 A | 1 A |
| "RUN" | Threshold for overshoot ($I_{res}$▲) | 0.2 A | 10 A or OFF | 0.1 A | 3 A |
| "RUN" | Threshold for undershoot (φ▼) | 0.1 or OFF | 0,99 | 0,01 | 0,2 |
| "RUN" | Threshold for overshoot (φ▲) | 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 351)."

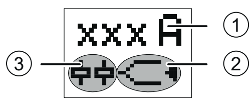
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

# 12.5 Diagnostics

## 12.5.1 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 change-over contacts

### Meaning of the information on the display

---

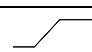
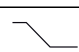
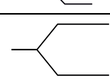
Note

**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 ($\varphi$▲ / $I_{res}$▲) (output relay K2) |
| ② |  | Monitoring for undershoot ($\varphi$▼ / $I_{res}$▼) (output relay K1) |
| ② |  | Window monitoring ($\varphi$▲ and $\varphi$▼ / $I_{res}$▲ and $I_{res}$▼) |
| ② | ◄ | Measuring values are in the correct range |
| ② | ▲ | A measuring value overshoot has occurred |
| ② | ▼ | A measuring value undershoot has occurred |

| Display area | Symbol | Meaning |
|---|---|---|
| ③ | | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |
| ③ | | • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 21/22 closed, relay contact 21/24 open |

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 281)."

## 12.5.2 Reset

### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

- Manual RESET (Memory = I / 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 3UG4641

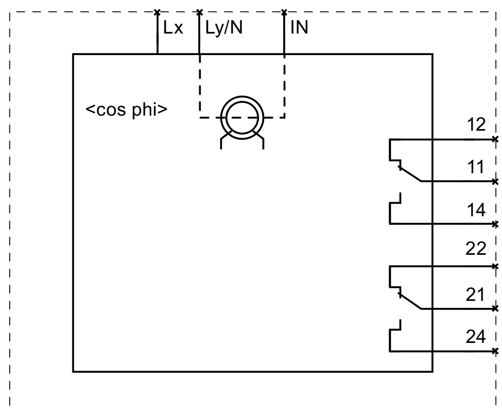



Figure 12-1 3UG4641 cos phi and active current monitoring relay

## 12.6.2 Wiring examples

### Cos phi and active current monitoring for single-phase motors

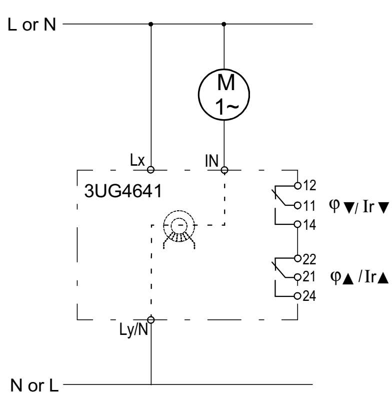
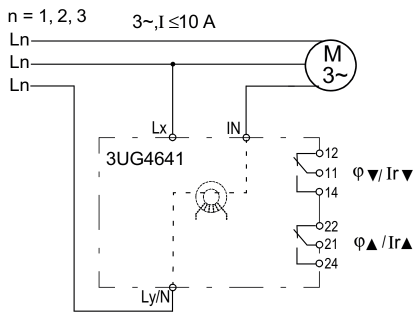
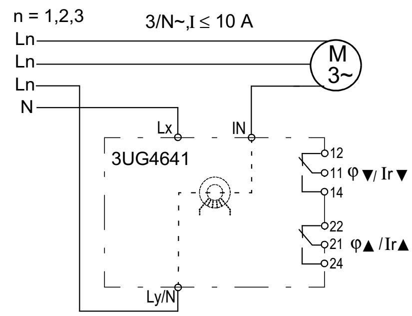



Figure 12-2 Cos phi and active current monitoring for single-phase motors

### Cos phi and active current monitoring for three-phase motors

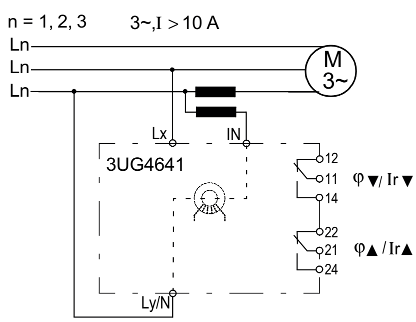



Cos phi and active current monitoring for three-phase motors

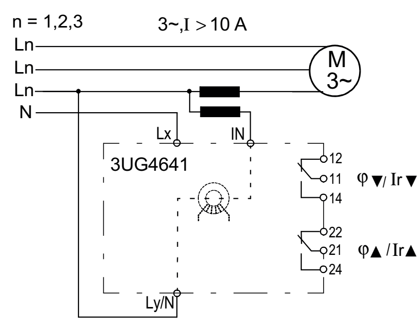



Cos phi and active current monitoring for three-phase motors (with neutral conductor)

### 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)

## 12.7 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-..... |
|---|---|---|
| Product function | | Active power monitoring relay |
| Design of the display | | LCD |
| Product function | | |
| • overcurrent recognition of 1 phase | | Yes |
| • undercurrent recognition of 1 phase | | Yes |
| • reset external | | Yes |
| • open-circuit or closed-circuit current principle | | Yes |
| Starting time after the control supply voltage has been applied | s | 1 |
| Response time maximum | ms | 300 |
| Relative metering precision | % | 10 |
| Precision of digital display | | +/-1 digit |
| Relative repeat accuracy | % | 1 |

| | | 3UG4641-..... |
|---|---|---|
| Type of voltage of the controlled supply voltage | | AC |
| Control supply voltage | | |
| • at 50 Hz at AC rated value | V | 90 … 690 |
| • at 60 Hz at AC rated value | V | 90 … 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 |
| Installation altitude at a height over sea level maximum | m | 2 000 |
| 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 |
| 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 |

| | | 3UG4641-..... |
|---|---|---|
| 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 | | 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

| | | 3UG4641-1.... | 3UG4641-2.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 102 | 103 |
| Depth | mm | 91 | |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |

| | | 3UG4641-1.... | 3UG4641-2.... |
|---|---|---|---|
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Type of mounting | | snap-on mounting | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |
| Design of the electrical connection | | screw-type terminals | spring-loaded terminals |
| Type of the connectable conductor cross-section | | | |
| • solid | | 1x (0.5 ... 4 mm²),<br>2x (0.5 ... 2.5 mm²) | 2x (0.25 ... 1.5 mm²) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm²),<br>2x (0.5 ... 1.5 mm²) | 2 x (0.25 ... 1.5 mm²) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 mm²) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 1.2 … 0.8 | — … |
| Number of change-over switches delayed switching | | 2 | |

# 3UG4651 speed monitoring relay 13

## 13.1 Application areas

### Application areas

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

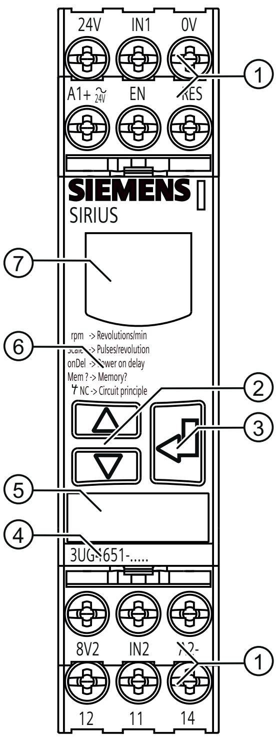
Table 13- 1 Application areas of the speed monitoring relays

| Function | Application |
|---|---|
| • Monitoring for overload/underload | • Conveyor belt (monitoring transported goods for completeness, for example)<br>• Milling machine<br>• Turning machine<br>• Slippage or tear of a drive belt |

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).

# 13.2 Operator controls and connection terminals

## Front view / terminal labeling 3UG4651

| Front view | Description | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block (removable):<br>Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | SET key for menu navigation |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Legend for menu |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | **Terminal labels** | |
| | A1+ | Rated control supply voltage AC/DC+ |
| | A2- | Rated control supply voltage AC/DC- |
| | 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 will find additional information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection methods (Page 19)."

You will find information on connecting in Chapter "Circuit diagrams (Page 303)."

# 13.3 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 300)."

You will find a description of the individual parameters in Chapter "Parameters (Page 351)."

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.

---

**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.

---

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.

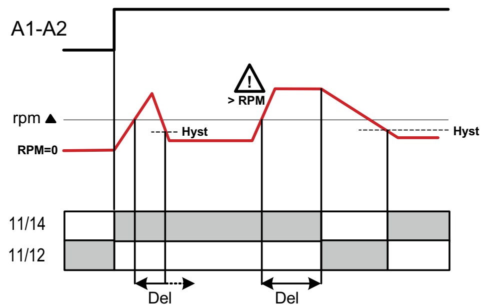
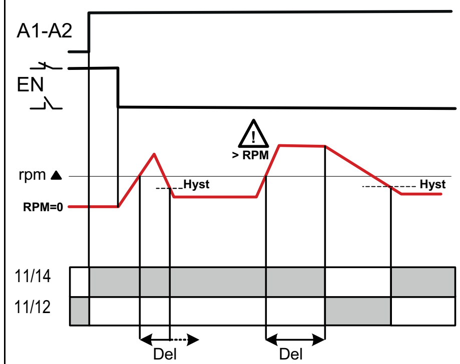
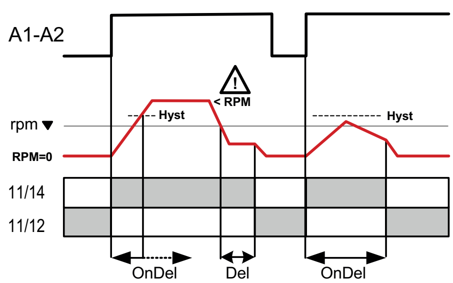
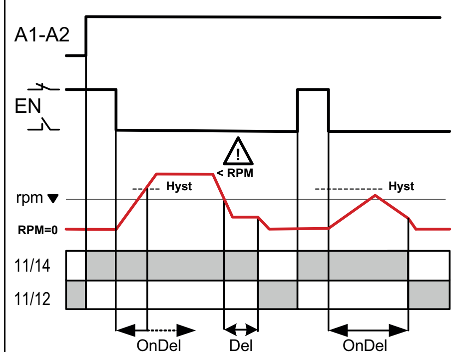
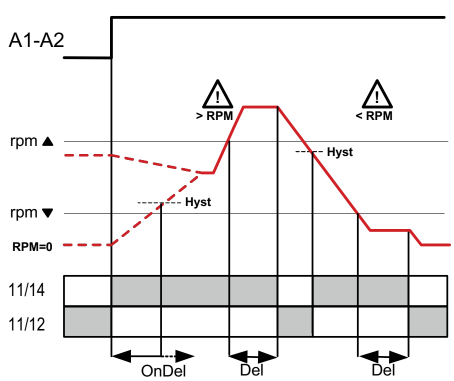
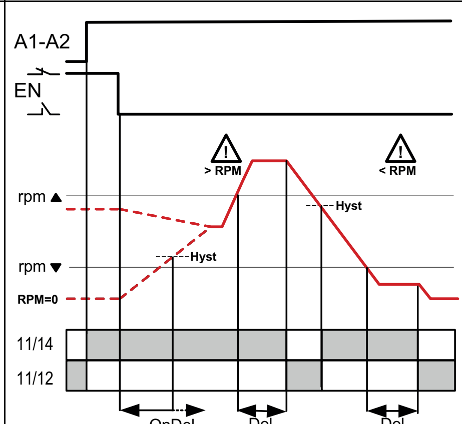
### Operating mode with/without enable contact

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 301)."

## Function diagrams 3UG4651

| Display | Memory = no<br>Relay switching behavior = NC (closed-circuit principle) | |
|---|---|---|
| | Without Enable input | With Enable input |
| rpm ▲<br>rpm ▼ = off |  |  |
| rpm ▲ = off<br>rpm ▼ |  |  |
| rpm ▲<br>rpm ▼ |  |  |

RPM = currently measured speed

rpm = set threshold for the speed

---

**Note**

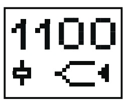
The relay control for the open-circuit principle NO is inverted to the represented function diagrams in the closed-circuit principle NC after application of the rated control supply voltage $U_S$.

---

## 13.4 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 13- 2 Parmeter 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 351)."

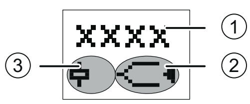
Menu-based operation is described in Chapter "Menu-based operation (Page 36)."

# 13.5 Diagnostics

## 13.5.1 Indications on the display

### Display information

The display is divided into three different areas.




① Speed measured value or fault symbol
② Type of monitoring
③ Symbol of the change-over 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 | 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 | | • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed<br>• Flashing: Delay time (ON-delay or tripping delay) running<br>• Masked out: Relay contact 11/12 closed, relay contact 11/14 open |

You will find more information about the switching behavior of the output relay in Chapter "Functions (Page 297)."

## 13.5.2 Reset

### RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 351)").

The following settings can be selected:

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

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

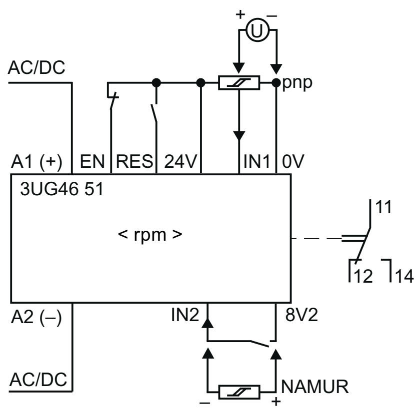
- Manual RESET (Memory = I / Mem = yes)

  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.

# 13.6 Circuit diagrams

## 13.6.1 Internal circuit diagrams

### Internal circuit diagrams 3UG4651




| | |
|---|---|
| 3UG4651-.AA30 | 24 V AC/DC |
| 3UG4651-.AW30 | 24 to 240 V AC/DC |

Figure 13-1 3UG4651 speed monitoring relay

---

**Note**

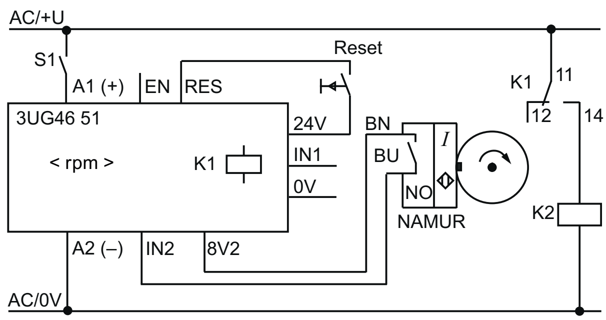
On the 24 V AC/DC versions of the 3UG4651-.AA30, terminals A1 / A2 and 0V / 24V are electrically connected in the device!

On the 24 to 240 V AC / DC versions of the 3UG4651-.AW30, terminals A1 / A2 and 0V / 24V are electrically separated!

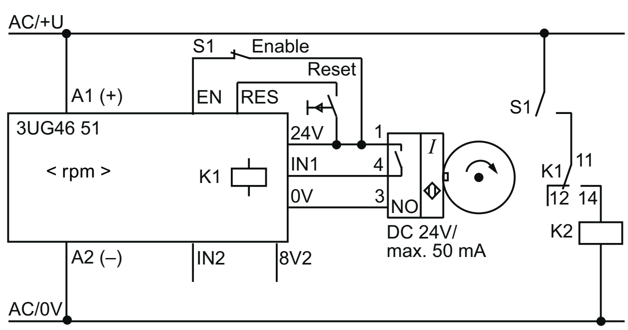
---

### 13.6.2 Wiring examples

#### Speed monitoring relays without Enable input




#### Speed monitoring relays with Enable input



# 13.7 Technical data

## Measuring circuit

| | | 3UG4651-..... |
|---|---|---|
| Measurable line frequency | Hz | 50 … 60 |
| Adjustable response delay time | | |
| • when starting | s | 1 … 900 |
| • with lower or upper limit violation | s | 0.1 … 99.9 |
| Adjustable response value revolution | 1/min | 0.1 … 2 200 |
| Input voltage at the digital input 1 | | |
| • 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 |
| Input current at the digital input 2 | | |
| • 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 |
| Design of the input reducing-entrance | | No |
| Design of the sensor | | |
| • 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 |
| Input current at the digital input 1 maximum | mA | 50 |
| Pulse duration minimum | ms | 5 |
| Pulse interval minimum | ms | 5 |
| Number of sensor signals per revolution | | 1 … 10 |
| Switching hysteresis for rotational speed | 1/min | 0 … 99.9 |

## General technical details

| | | 3UG4651-..A.. | 3UG4651-..W.. |
|---|---|---|---|
| **Product function** | | RPM monitoring relay | |
| **Design of the display** | | LCD | |
| **Product function** | | | |
| • 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 | |
| **Starting time after the control supply voltage has been applied** | ms | 500 | |
| **Number of outputs** | | | |
| • 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 | |
| **Response time maximum** | ms | 100 | |
| **Stored energy time at mains power cut minimum** | ms | 10 | |
| **Relative metering precision** | % | 10 | |
| **Precision of digital display** | | +/- 1 Digit | |
| **Relative repeat accuracy** | % | 1 | |
| **Type of voltage of the controlled supply voltage** | | AC/DC | |

| | | 3UG4651-..A.. | 3UG4651-..W.. |
|---|---|---|---|
| Control supply voltage | | | |
| • 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 |
| Working range factor supply voltage rated value | | | |
| • at 50 Hz | | | |
| – for AC | | 1.1 … 0.8 | |
| • at 60 Hz | | | |
| – for AC | | 1.1 … 0.8 | |
| • for DC | | 0.8 … 1.1 | |
| 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 | |
| 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 | — | |
| • at DC-13 | | | |
| – at 24 V | A | 1 | |
| – at 125 V | A | 0.2 | |
| – at 250 V | A | 0.1 | |
| 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 | |
| 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 | |

| | | 3UG4651-..A.. | 3UG4651-..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 | 300 | |
| Degree of pollution | | 3 | |
| Apparent power consumed | | | |
| • 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 | — | |
| Ambient temperature | | | |
| • during operating | °C | -25 … +60 | |
| • during storage | °C | -40 … +80 | |
| • during transport | °C | -40 … +80 | |
| Relative humidity during operating phase maximum | % | — | |
| Galvanic isolation | | | |
| • between entrance and outlet | | Yes | |
| • 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 | |
| Acceptability for application safety-related circuits | | No | |
| Category according to EN 954-1 | | none | |
| safety Integrated Level according to IEC 61508 | | none | |

## Mechanical design

| | | 3UG4651-1.... | 3UG4651-2.... |
|---|---|---|---|
| Width | mm | 22.5 | |
| Height | mm | 86 | |
| Depth | mm | 102 | 103 |
| Built in orientation | | any | |
| Distance, to be maintained, to earthed part | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, to the ranks assembly | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Distance, to be maintained, conductive elements | | | |
| • forwards | mm | 0 | |
| • backwards | mm | 0 | |
| • sidewards | mm | 0 | |
| • upwards | mm | 0 | |
| • downwards | mm | 0 | |
| Type of mounting | | screw and snap-on mounting | |
| Product function removable terminal for auxiliary and control circuit | | Yes | |

| | | 3UG4651-1.... | 3UG4651-2.... |
|---|---|---|---|
| Design of the electrical connection | | screw-type terminals | spring-loaded terminals |
| Type of the connectable conductor cross-section | | | |
| • solid | | 1x (0.5 ... 4 mm$^2$),<br>2x (0.5 ... 2.5 mm$^2$) | 2x (0.25 ... 1.5 mm$^2$) |
| • finely stranded | | | |
| – with wire end processing | | 1x (0.5 ... 2.5 mm$^2$),<br>2x (0.5 ... 1.5 mm$^2$) | 2 x (0.25 ... 1.5 mm$^2$) |
| – without wire end processing | | — | 2x (0.25 ... 1.5 mm$^2$) |
| • for AWG conductors | | | |
| – solid | | 2x (20 ... 14) | 2x (24 ... 16) |
| – stranded | | 2x (20 ... 14) | 2x (24 ... 16) |
| Tightening torque | | | |
| • with screw-type terminals | N·m | 0.8 … 1.2 | — … |
| Number of NO contacts delayed switching | | 0 | |
| Number of NC contacts delayed switching | | 0 | |
| Number of change-over switches delayed switching | | 1 | |

# Accessories 14

## 14.1 Accessories for 3RR2 current monitoring relays

### 14.1.1 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.

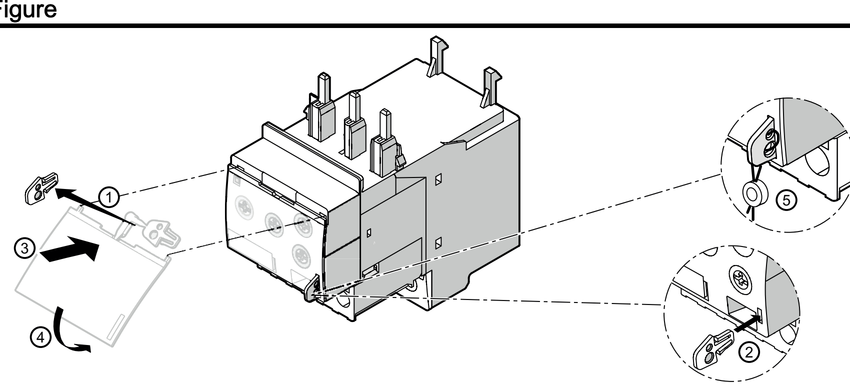
The sealable cover is used to protect the rotary buttons and the slide switch on the current monitoring relay with analog setting or the buttons on the current monitoring relay with digital setting against unauthorized or unintentional tampering.

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 14- 1 Mounting the sealable cover on the 3RR2 current monitoring relay

| Step | Operating instruction | 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. | |

## 14.1.2 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 14- 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 |

### 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 14- 3 Mounting the terminal support (screw-type connection system)

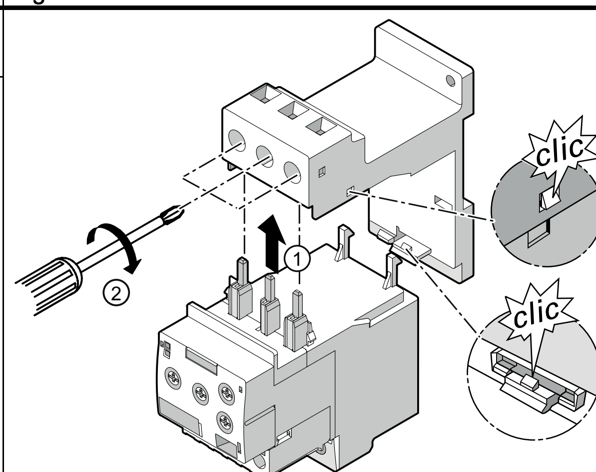
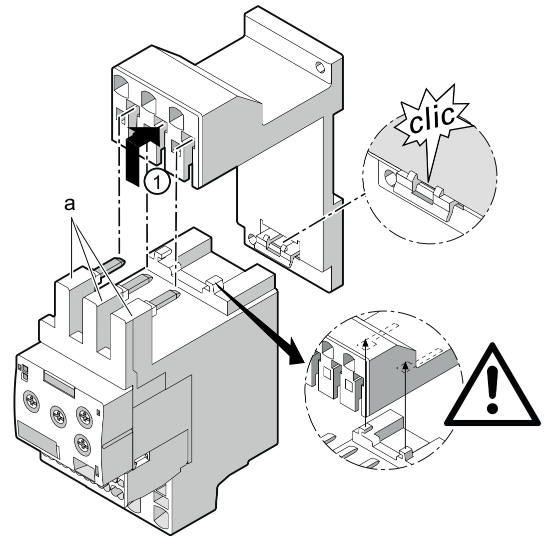
| Step | Operating instruction | Figure |
|---|---|---|
| 1 | Guide the current monitoring relay into the terminal support from below. |  |
| 2 | Tighten the screws on the terminal support with a Pozidriv size 2 (S00) or Pozidriv size 3 (S0) screwdriver (tightening torque 0.8 to 1.2 Nm).<br>Check that the cable is clamped tight. | |

Table 14- 4 Mounting the terminal support (spring-loaded connection system)

| Step | Operating instruction | 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. |  |

## Disassembly

Table 14- 5 Disassembling the terminal support (screw-type connection system)

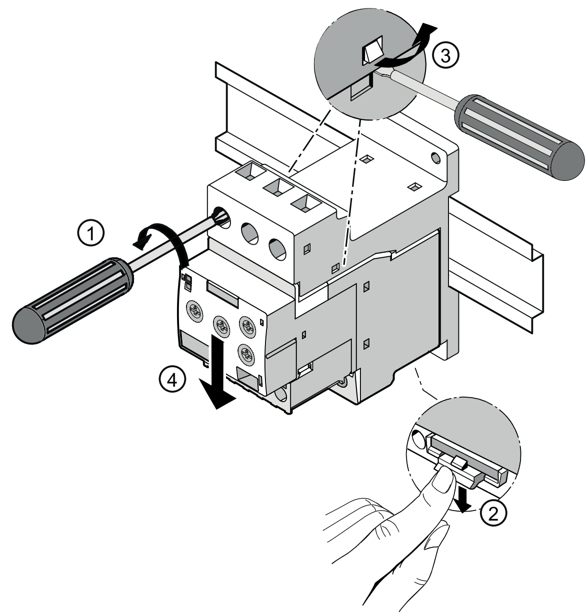
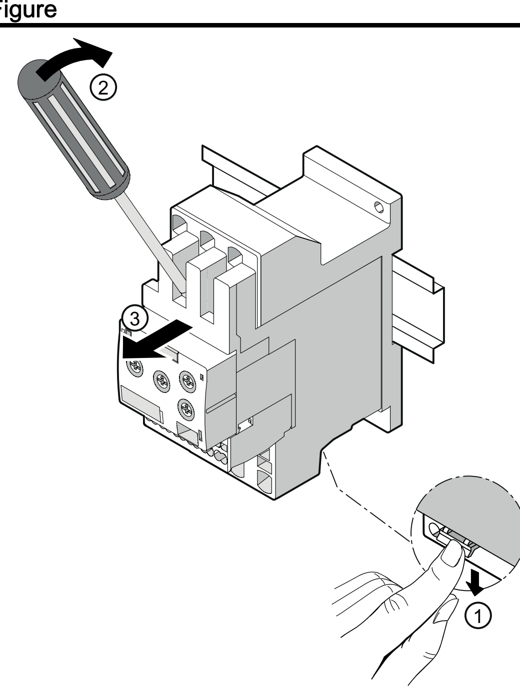
| Step | Operating instruction | Figure |
|---|---|---|
| 1 | Undo the screws on the main conductor terminals. |  |
| 2 | Release the current monitoring relay by pushing down the clip on the underside of the terminal support. | |
| 3 | Use a screwdriver to dislodge the terminal support from the current monitoring relay. | |
| 4 | Pull the current monitoring relay down and away from the contactor. | |

Table 14- 6 Disassembling the terminal support (spring-loaded connection system)

| Step | Operating instruction | 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. | |

# 14.2 Accessories for 3UG4 monitoring relays

## 14.2.1 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**

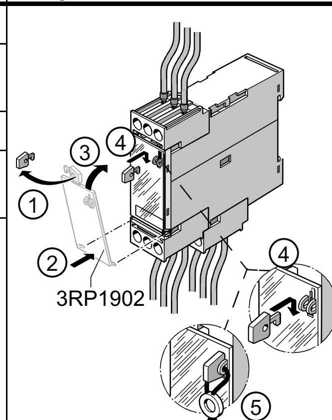
The sealable membrane does not protect keys against unauthorized or unintentional manipulation.

---

### Mounting

The figure below shows how to mount the sealable cover 3RP1902 on the monitoring relay.

Table 14- 7 Mounting the sealable cover on the monitoring relay

| Step | Operating instruction | Image |
|---|---|---|
| 1 | Break off the clip on the sealable cover. |  |
| 2 | Insert the sealable cover into the openings on the monitoring relay. | |
| 3 | Swing the sealable cover up. | |
| 4 | Insert the clip into the opening until it engages. | |
| 5 | Seal the clip to secure it against unauthorized removal. | |

## 14.2.2 Push-in lugs

### Description

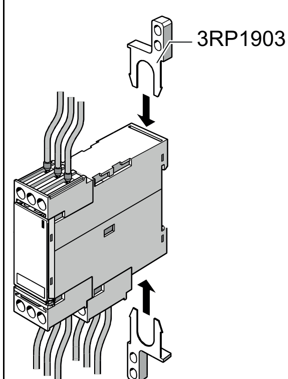
The 3RP1903 push-in lugs are available for the monitoring relays.

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 14- 8 Attaching the push-in lugs on the monitoring relay

| Step | Operating instruction | Image |
|---|---|---|
| 1 | Insert the push-in lugs at the top and bottom on the monitoring relay and tighten the push-in lugs with a screwdriver. |  |

## 14.2.3 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.

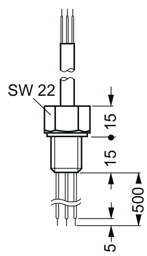



Figure 14-1 3UG3207-3A three-pole wire electrode

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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.

---

### 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.

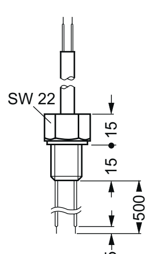


Figure 14-2 3UG3207-2A two-pole wire electrode

> **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.

## 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.

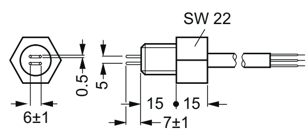


Figure 14-3 3UG3207-2B two-pole bow electrode

## 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.

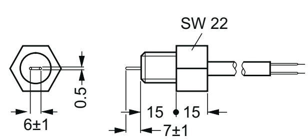


Figure 14-4 3UG3207-1B single-pole bow electrode

## 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

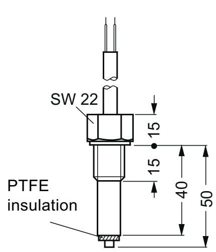


Figure 14-5 3UG3207-1C single-pole rod electrode

## Technical data

Table 14- 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 |
| Length | mm | 500 | 500 | — | — | — |
| Insulation (Teflon insulation PTFE) | | Yes | Yes | Yes | — | Yes |
| Mounting | | Vertical | Vertical | Laterally | Laterally | Laterally |
| Screw-in gland width across the flats | | 22 | | | | |
| Thread | Inch | R 3/8 | | | | |
| Connecting cable (2 m long) | $mm^2$ | 3 x 0.5 | | | | |
| Operating temperature | °C | 90 | | | | |
| Operating pressure | bar | 10 | | | | |
| Assignment: cable / electrode | | | | | | |
| • 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 | — | — |

## 14.2.4 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 ∅ 40 mm, ∅ 65 mm and ∅ 120 mm.

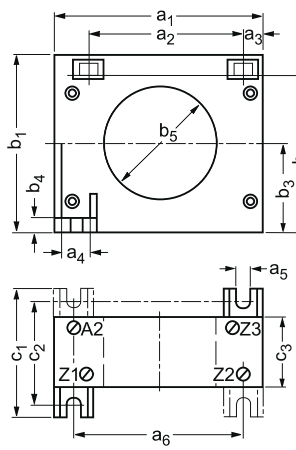


Figure 14-6 3UL22 summation current transformers

| Type | $a_1$ | $a_2$ | $a_3$ | $a_4$ | $a_5$ | $a_6$ | $b_1$ | $b_2$ | $b_3$ | $b_4$ | $b_5$ | $c_1$ | $c_2$ | $c_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 14- 10 Technical data - 3UL22 summation current transformer

| Order number | | 3UL2201 | 3UL2202 | 3UL2203 |
|---|---|---|---|---|
| Rated insulating voltage Ui | (50/60 Hz) V AC | 690 | | 1000 |
| Rated residual current IΔn 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. $mm^2$ | 4 x 95 | 4 x 240 | 8 x 300 |

## 14.2.5 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 ∅ 35 mm, ∅ 55 mm, ∅ 80 mm, ∅ 110 mm, ∅ 140 mm, and ∅ 210 mm.

### 14.2.5.1 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.

---

**Note**

3UG4.25 residual current monitoring relays are only suitable for use with 3UL23 residual current transformers.

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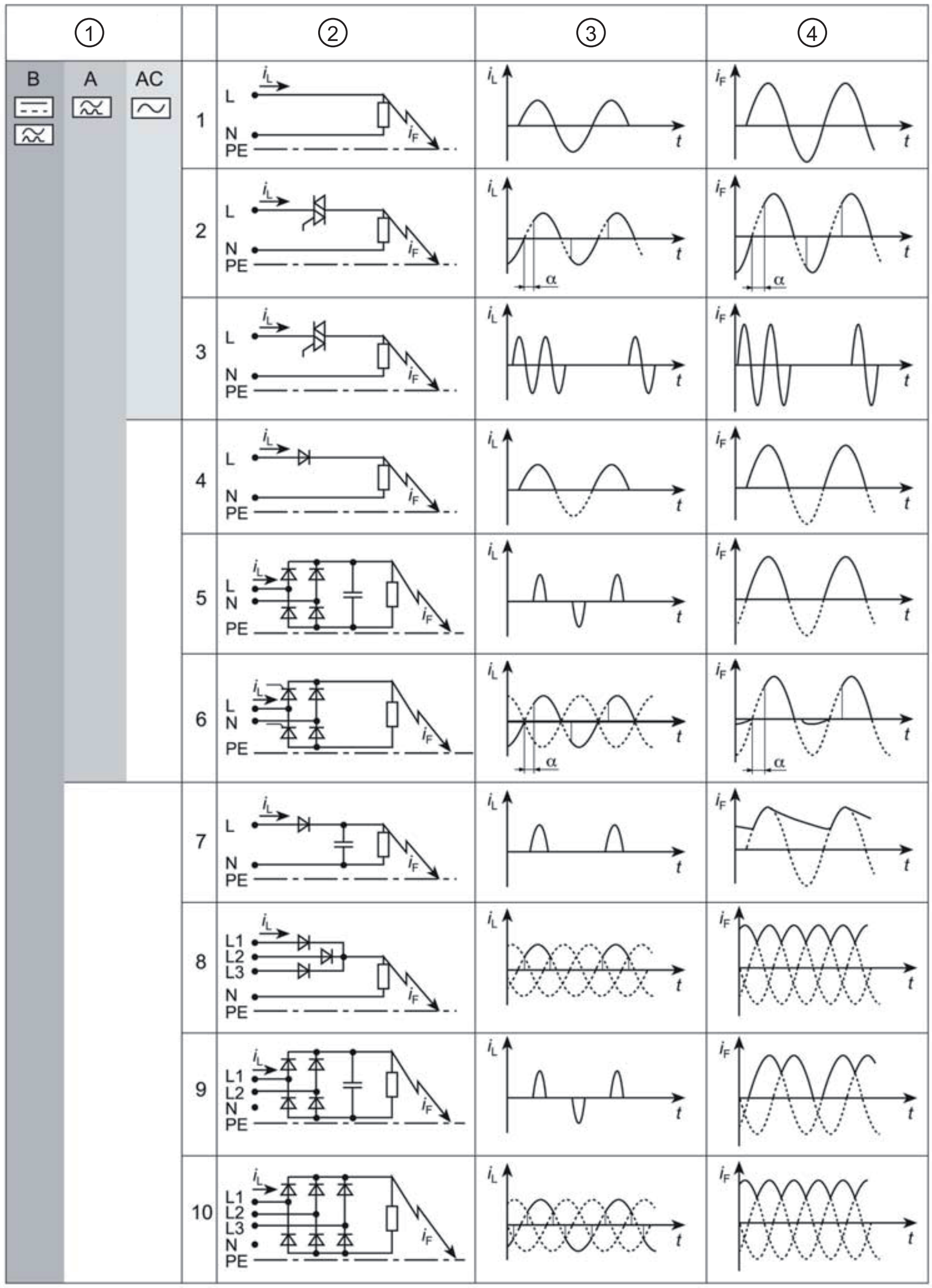



① Suitable FI type
② Circuit
③ Load current
④ Fault current

Figure 14-7 Possible fault current forms and suitable residual current devices

More information is available on the Internet (www.siemens.com/industrial-controls/support).

### 14.2.5.2 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 * 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.

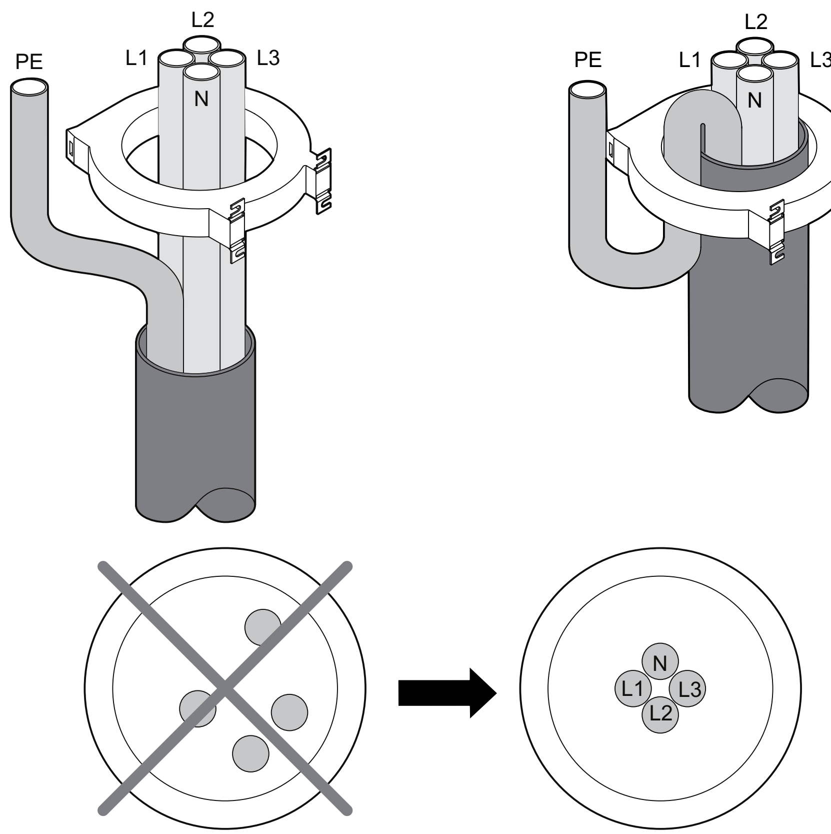
#### 3UL23 residual current transformer conductor cross-sections

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.

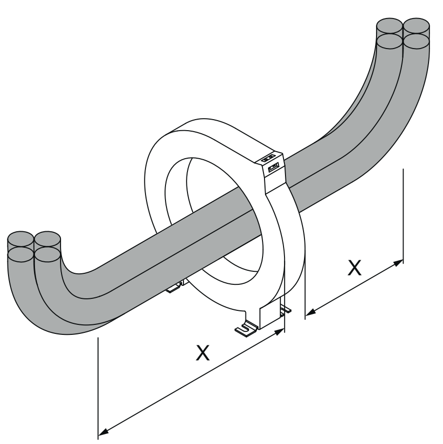
| Order number | Bushing opening Diameter [mm] | Max. conductor cross-section 3P copper cable + N [mm$^2$] | AWG [kcmil] | Rated current per phase [A] |
|---|---|---|---|---|
| 3UL2302-1A | 35 | 25 | 4 | 85 |
| 3UL2303-1A | 55 | 50 | 1 / 0 | 150 |
| 3UL2304-1A | 80 | 150 | 300 | 225 |
| 3UL2305-1A | 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

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.

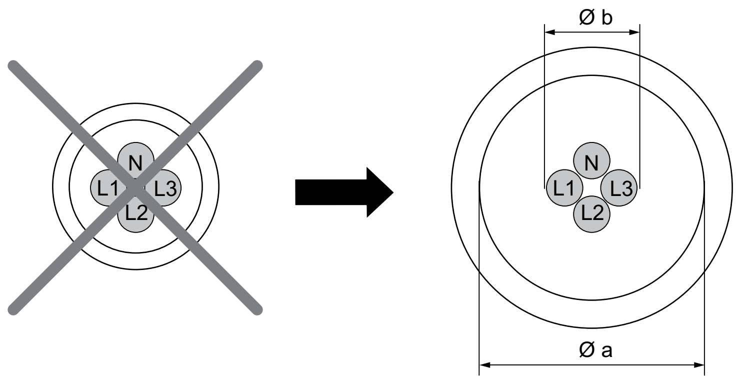



Route power cables around the residual current transformer in a straight line and ensure the area corresponds at minimum to the internal transformer diameter.




X > ∅ residual current transformer

The internal transformer diameter must be at minimum twice the size of the power cable bundle diameter.




∅ a ≥ 2 x ∅ b

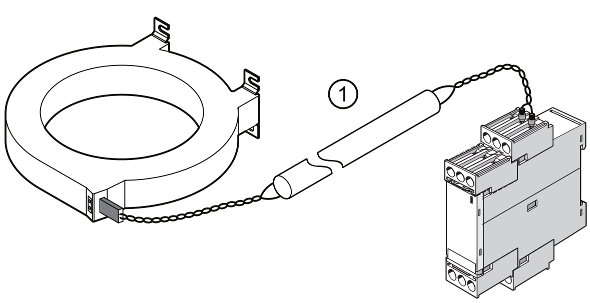
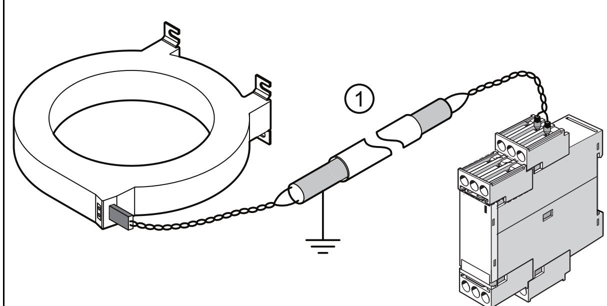
## Transformer connection

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 [mm²] | 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 | 10 | 550 |

**Note**

We recommend using twisted cables.

| | |
|---|---|
|  |  |
| ① Maximum cable lengths (see table above) | ① Length ≥ 10 m (shielded, twisted, grounded cables) |

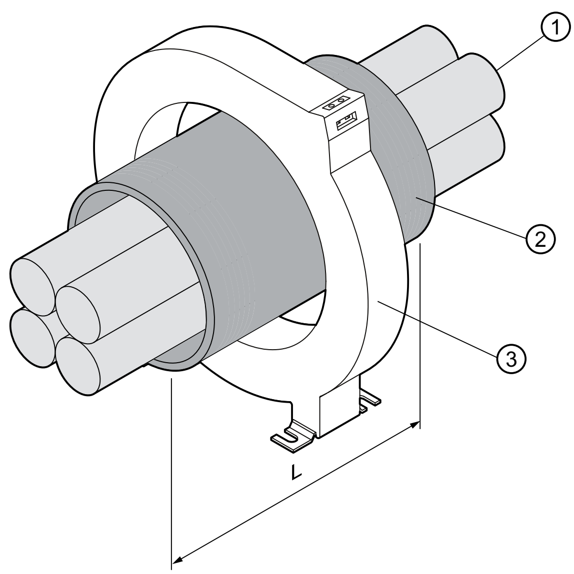
**Note**

Use shielded, twisted, and grounded cables for transformer connecting cables with a length of more than 10 m.

### 14.2.5.3 Potential for optimization

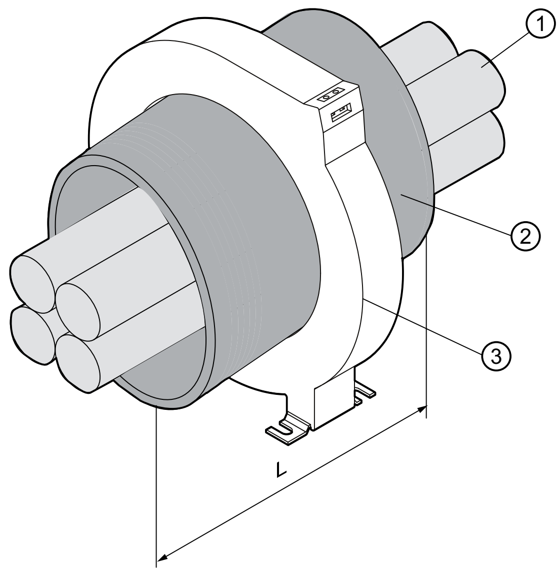
#### Potential for optimization in the event of extremely high currents, false tripping due to high starting currents or in environments with high EMC interference

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

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

### 14.2.5.4 Installation faults

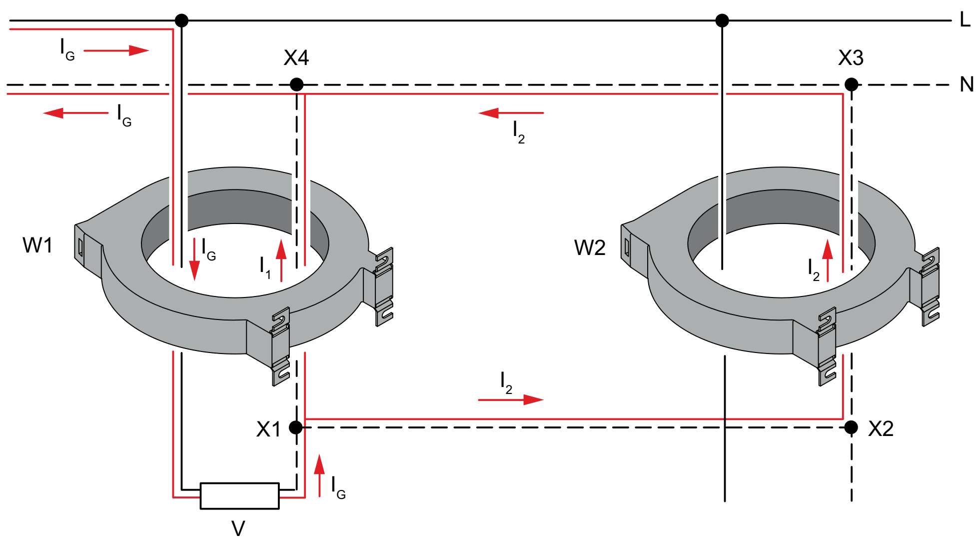
For reasons of clarity, the representations show only the residual current transformer with the currents passing through it rather than the complete residual current monitoring unit and residual current transformer. If the vectorial sum of the currents passing through the residual current transformer 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.

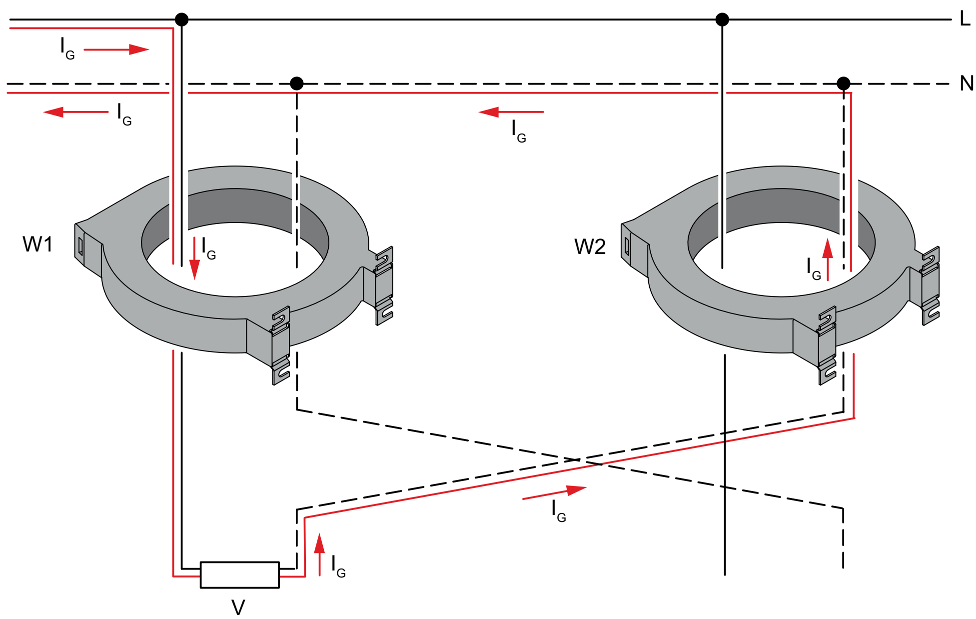
## Parallel connections of conductors

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.



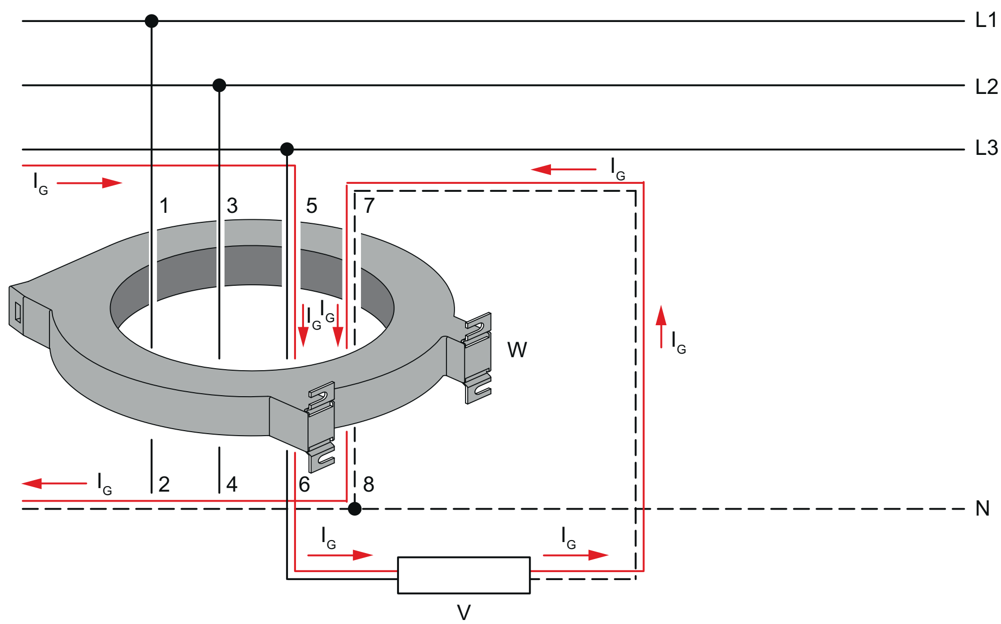
## Mixing up conductors

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.




## 14.2.5.5 Internal circuit diagram

### 3UL23 internal circuit diagram

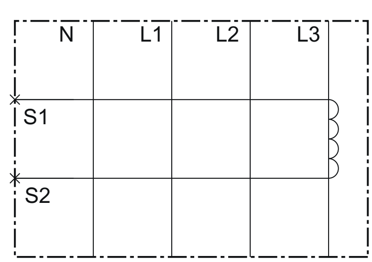
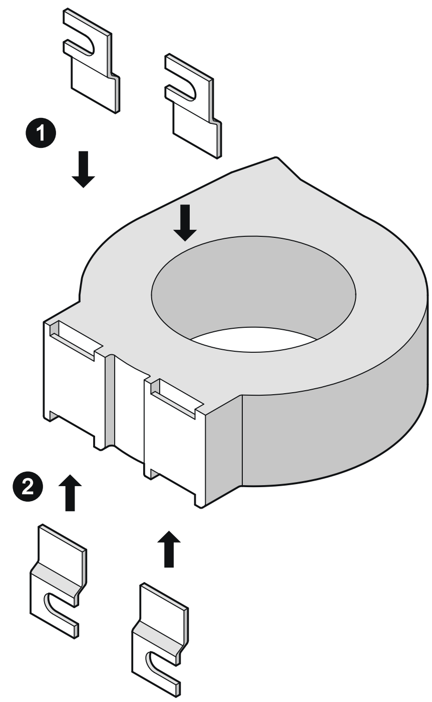



Figure 14-8 3UL23 residual current transformer

### 14.2.5.6 Installing

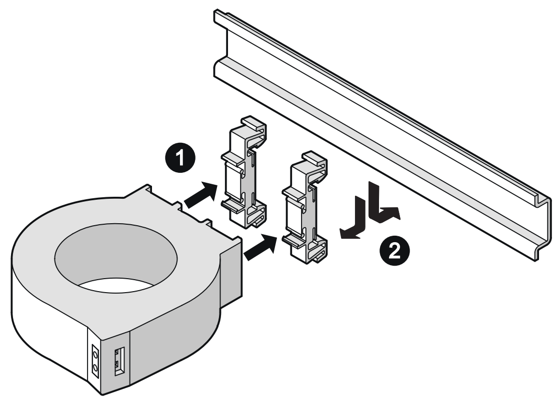
## Wall mounting procedure

| 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. | |

## Rail mounting

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 ∅ 55 mm only (3UL2302-1A, 3UL2303-1A).

| Step | Instructions | Figure |
|---|---|---|
| 1 | Mount the holder (3UL2900) to the device. |  |
| 2 | Mount the device to the rail. | |

### 14.2.5.7 Technical data

#### 3UL2302/3UL2303/3UL2304 residual current transformers for fault current monitoring

| | | 3UL2302-1A | 3UL2303-1A | 3UL2304-1A |
|---|---|---|---|---|
| Product equipment touch-protection | | Yes | | |
| Height | mm | 64 | | |
| Width | mm | 70 | 92 | 124.5 |
| Depth | mm | 75.5 | 98 | 130 |
| Ambient temperature<br>• during operating | °C | -25 … +60 | | |
| Type of mounting | | screw fixing | | |
| Diameter of the feedthrough | mm | 35 | 55 | 80 |
| Conductor cross section that can be connected of the terminal | mm² | 2.5 | | |
| Item designation<br>• according to DIN 40719 extendable after IEC 204-2 according to IEC 750<br>• according to DIN EN 61346-2 | | <br>T<br><br>B | | |
| Design of the electrical connection secondary side | | screw-type terminals | | |
| Residual current at the input rated value | A | 40 | | |

### 3UL2305/3UL2306/3UL2307 residual current transformers for fault current monitoring

| | | 3UL2305-1A | 3UL2306-1A | 3UL2307-1A |
|---|---|---|---|---|
| Product equipment touch-protection | | Yes | | |
| Height | mm | 64 | | 62 |
| Width | mm | 163 | 201 | 300 |
| Depth | mm | 169 | 207.5 | 286 |
| Ambient temperature<br>• during operating | °C | -25 … +60 | | |
| Type of mounting | | screw fixing | | |
| Diameter of the feedthrough | mm | 110 | 140 | 210 |
| Conductor cross section that can be connected of the terminal | mm² | 2.5 | | 4 |
| Item designation<br>• according to DIN 40719 extendable after IEC 204-2 according to IEC 750<br>• according to DIN EN 61346-2 | | <br>T<br><br>B | | |
| Design of the electrical connection secondary side | | screw-type terminals | | |
| Residual current at the input rated value | A | 40 | | |

### 14.2.5.8 Dimension drawings

#### 3UL23 residual current transformer

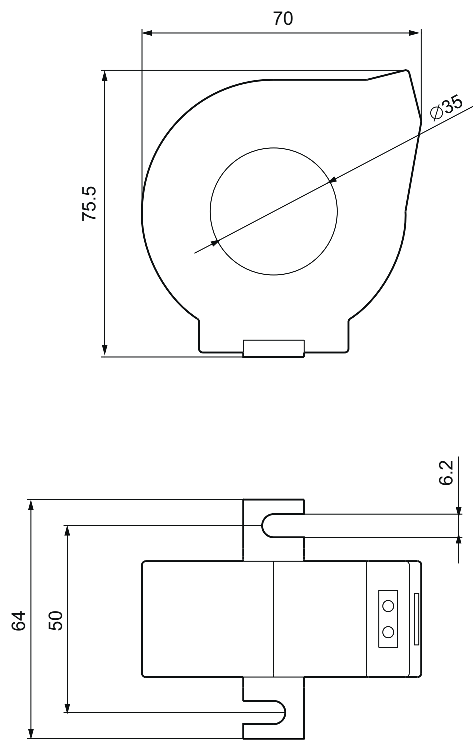



Figure 14-9 3UL2302-1A

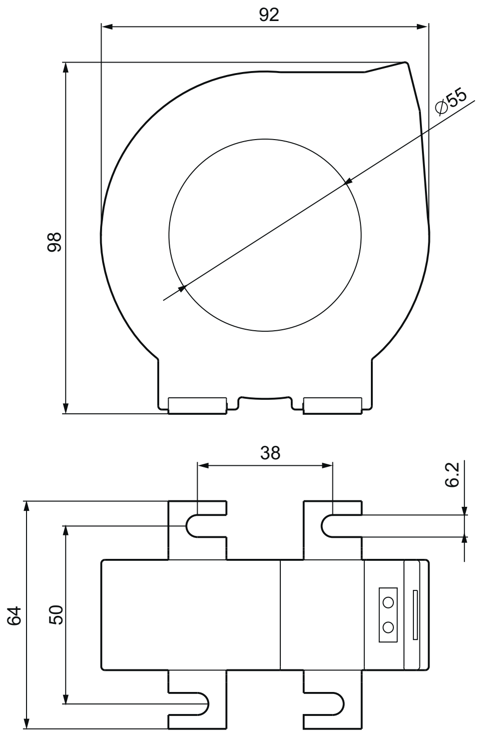



Figure 14-10 3UL2303-1A

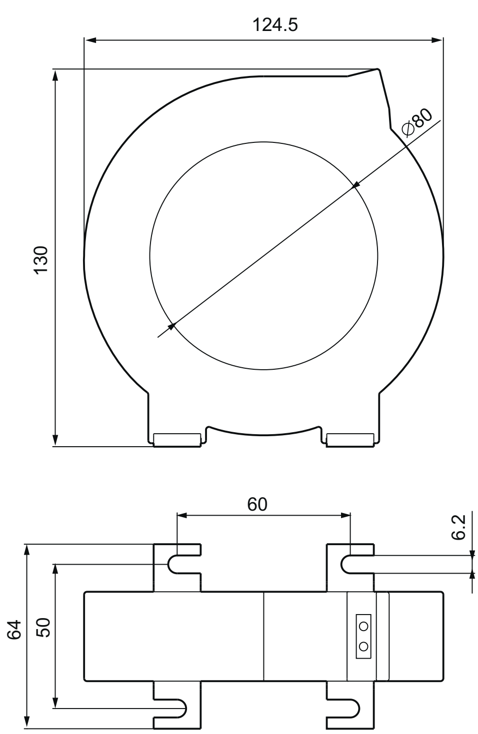



Figure 14-11 3UL2304-1A

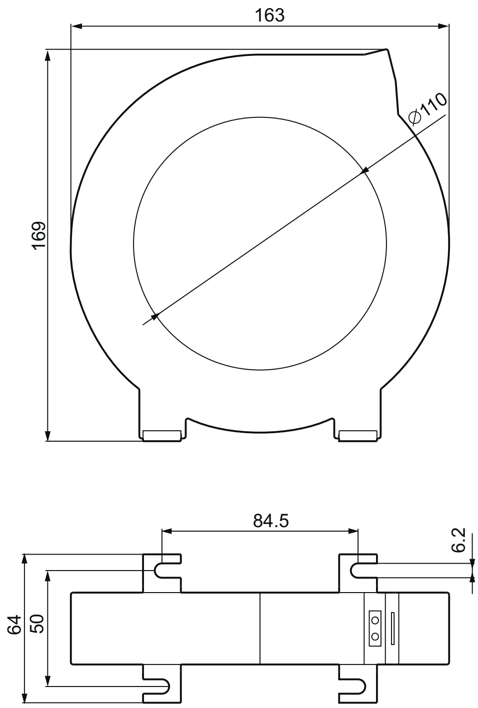



Figure 14-12 3UL2305-1A

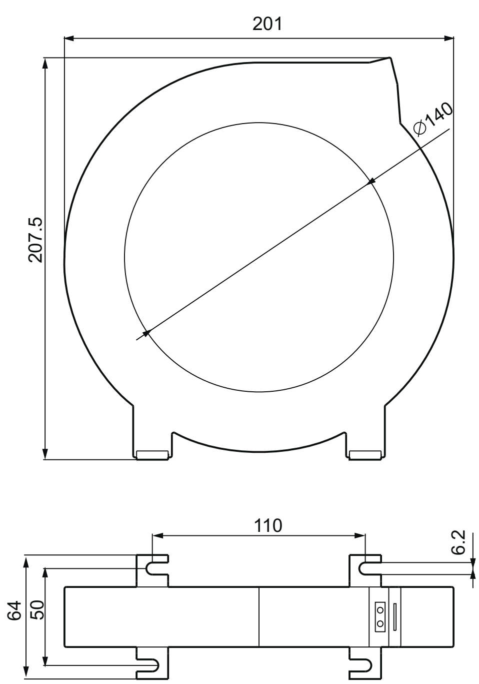



Figure 14-13 3UL2306-1A

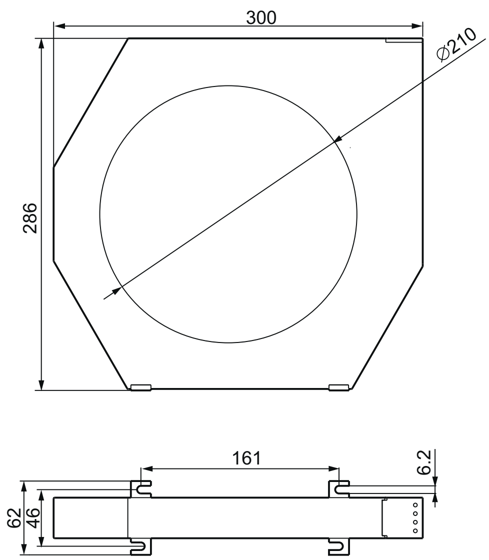



Figure 14-14 3UL2307-1A

# 14.3 Accessories for 3UG458. insulation monitoring relays.

## 14.3.1 Sealable cover

### Description

A sealable cover compatible is available for the 3UG458. insulation monitoring relays.

Table 14- 11 Versions of the sealable cover

| Sealable cover | Usability |
|---|---|
| 3UG4981-0C | 3UG4581-1AW30/3UG4582-1AW30 |
| 3UG4983-0C | 3UG4583-1CW30 |

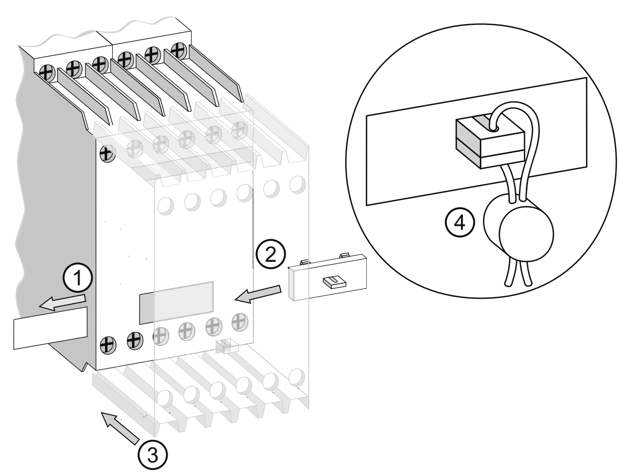
The sealable cover can be used to secure the actuators (rotary buttons and sliding switches) of the monitoring relays against unauthorized or unintentional manipulation.

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 mount the 3UG4983-0C sealable cover on the 3UG4583 monitoring relay.

Table 14- 12 Mounting the sealable cover on the monitoring relay

| Step | Instructions | Figure |
|---|---|---|
| 1 | Remove the label on 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 by sealing the clip to prevent unauthorized removal. | |

## 14.3.2 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 and supply voltage for operation, and it is connected between the 3UG4583 insulation monitoring relay and the system to be monitored.

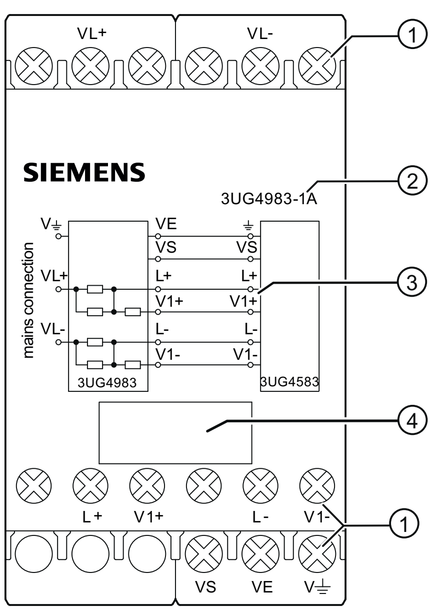
---

**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 | |
|---|---|---|
|  | **Position digits** | |
| | ① | Terminal block:<br>Screw-type connections are possible. |
| | ② | Device order number |
| | ③ | Circuit diagram |
| | ④ | Label |
| | **Terminal labels** | |
| | 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 ⏚ |
| | V⏚ | 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 14- 13 Installing the 3UG4983 upstream module (mounting onto standard rail)

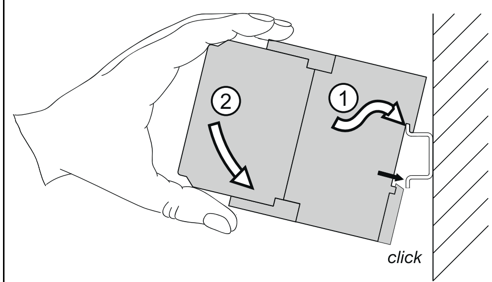
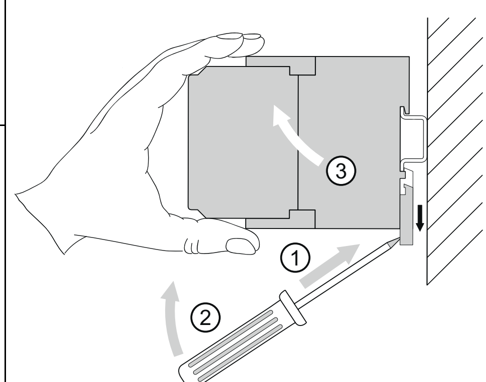
| Step | Instructions | Figure |
|---|---|---|
| 1 / 2 | Position the device on the top edge of the mounting rail and press it down until it snaps onto the bottom edge of the rail. |  |

Table 14- 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. | |

### 14.3.2.1 Internal circuit diagrams

#### Internal circuit diagram 3UG983-1A

#### 3UG4983-1A

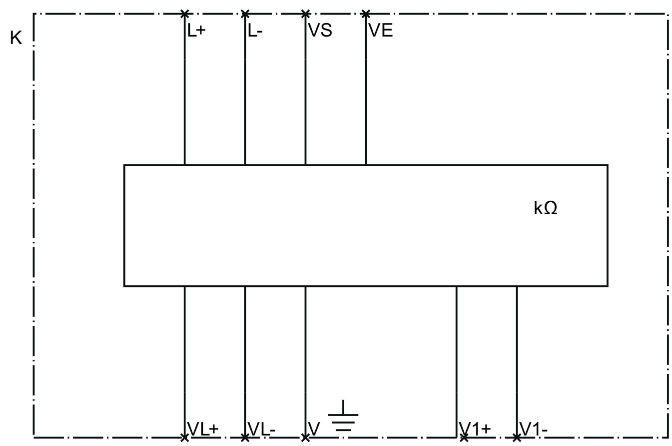



Figure 14-15 3UG4983-1A insulation monitoring relay

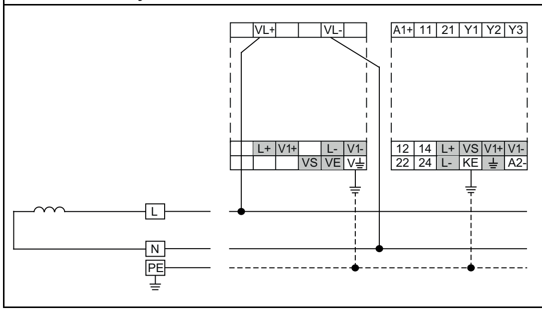
## Wiring examples for the 3UG4583 insulation monitoring relay with connected 3UG4983 upstream module

Measuring inputs L+ and L- can be connected to any conductor. Measuring inputs L+ and L- must always be connected to different conductors.

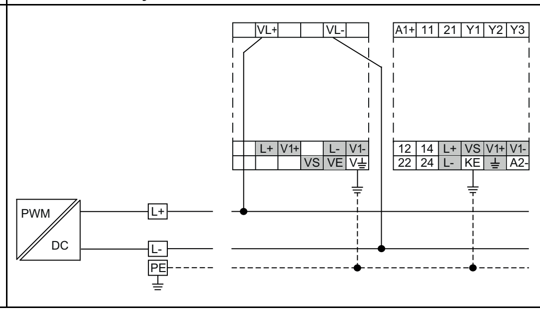
The rated system voltage is $U_n$ ≤ 690 V AC (15 to 400 Hz) or $U_n$ ≤ 1000 V DC.

### 2-wire AC system / 2-wire DC system

2-wire AC system

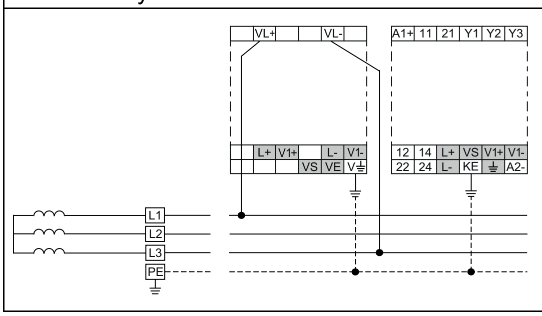



2-wire DC system

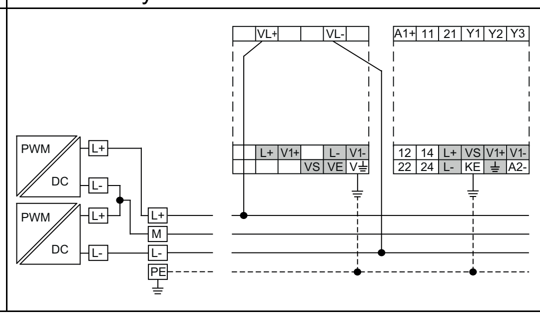



### 3-wire AC system / 3-wire DC system

3-wire AC system

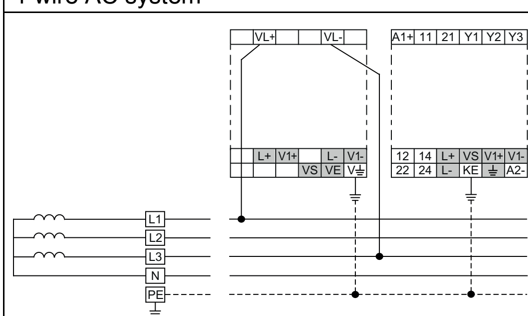



3-wire DC system




### 4-wire AC system

4-wire AC system



## Application example

The figure below shows how to connect the 3UG4983 upstream module to the 3UG4583 insulation monitoring relay.

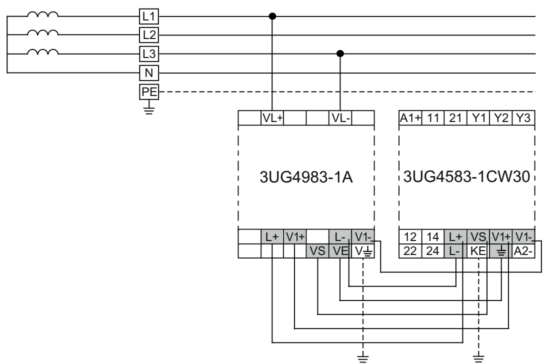



Figure 14-16 Connection example: Upstream module - insulation monitoring relay

---

### Note

The maximum cable length between the 3UG4583 insulation monitoring relay and the 3UG4983 upstream module is 0.4 m.

---

### Note

The maximum cable length of the measuring circuit connections is 50 m or 100 pF/m.

### 14.3.2.2 Technical data

#### Measuring circuit

| | | 3UG4983-1A |
|---|---|---|
| Type of voltage for monitoring | | AC/DC |
| Measurable line frequency | Hz | 15 … 400 |
| Network leakage resistance | µF | 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 |
| Distance, to be maintained, to the ranks assembly | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |

| | | 3UG4983-1A |
|---|---|---|
| Distance, to be maintained, conductive elements | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Distance, to be maintained, to earthed part | | |
| • forwards | mm | 0 |
| • backwards | mm | 0 |
| • sidewards | mm | 0 |
| • upwards | mm | 0 |
| • downwards | mm | 0 |
| Type of mounting | | snap-on fastening on 35 mm standard rail |
| Product function removable terminal for auxiliary and control circuit | | No |
| Design of the electrical connection | | screw-type terminals |
| Conductor cross-section that can be connected | | |
| • solid | mm² | 0.75 … 2.5 |
| • finely stranded | | |
| – with wire end processing | mm² | 0.75 … 2.5 |
| AWG number as coded connectable conductor cross section | | |
| • solid | | 20 … 12 |
| • stranded | | 18 … 14 |
| Tightening torque | | |
| • with screw-type terminals | N·m | 0.6 … 0.8 |
| Number of change-over switches delayed switching | | 0 |

# A 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 (www.siemens.de/automation/csi/manual). Simply enter the order number of the relevant item into the search field.

## Operating instructions

| Title | Order number |
|---|---|
| SIRIUS monitoring relay for polyphase current monitoring S00 / S0 (3RR21) | 3ZX1012-0RR21-1AA1 |
| SIRIUS monitoring relay for polyphase current monitoring S00 / S0 (3RR22) | 3ZX1012-0RR22-1AA1 |
| 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 |
| 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 |

| Title | Order number |
|---|---|
| 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

| Title | Reference |
|---|---|
| Functional safety - Use of SIRIUS 3UG4 and 3RR2 monitoring relays with integrated sensors | Internet (http://support.automation.siemens.com/WW/view/en/39863898) |

# Parameters

# B

## 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 (Ux-y max - Ux-y min) / Ux-y 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▼Del
- Tripping delay time in the case of voltage overshoot: U▲Del
- Tripping delay time in the case of (active) current undershoot: I▼Del
- Tripping delay time in the case of (active) current overshoot: I▲Del
- Tripping delay time in the case of speed undershoot: ▼Del
- Tripping delay time in the case of speed overshoot: ▲Del
- Tripping delay time on undervoltage or overshoot of the asymmetry value: Del
- Tripping delay time for asymmetry: AsyDel
- Tripping delay time in the case of undershoot of the cos phi value: φ▼Del
- Tripping delay time in the case of overshoot of the cos phi value: φ▲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 [1)] | Yes [1)] | Yes [1)] |
| 3UG4651 | Yes | No | No |

1) Setting: $I_{res}$▼= 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: φ▾ (threshold), possibly φ!▾ (warning threshold)
- Active current undershoot: $I_r$▾ (threshold), possibly $I_r$!▾ (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 overshot, 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: φ▲ (threshold), possibly φ!▲ (warning threshold)
- Active current overshoot: $I_r$▲ (threshold), possibly $I_r$!▲ (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.

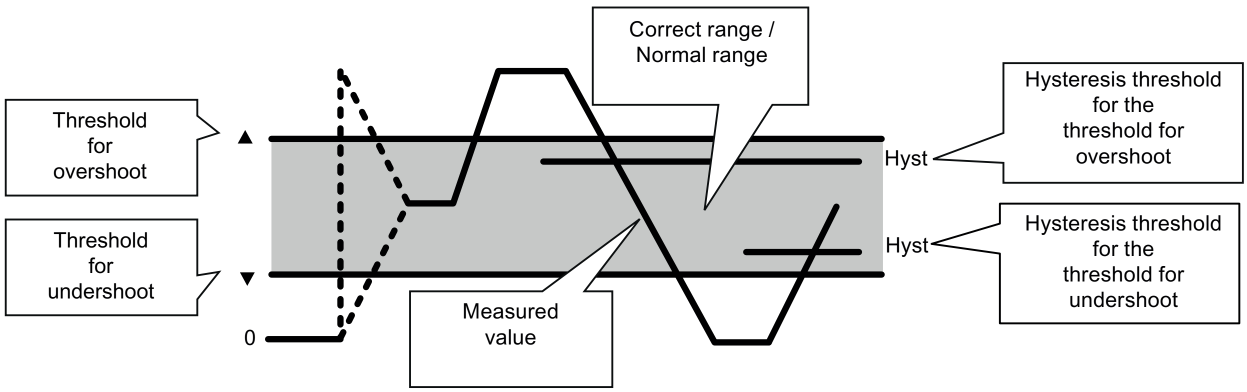



Figure B-1 Explanation of hysteresis

If, after the upper threshold value has been overshot 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

## 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▲) 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 x I▲

## Fault current monitoring

If fault current monitoring has been activated (I >> ⏚ = yes) and the total current of the load currents at terminals 1L1 / 2T1, 3L2 / 4T2 and 5L3 / 6T3 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 (≤ 200 ms).

**Indication on the display:** I >> ⏚ = 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 IΔn of the connected summation current transformer must be set.

**Possible indications on the display:** IΔn

## 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 (≤ 200 ms).

**Possible indications on the display:** ↷

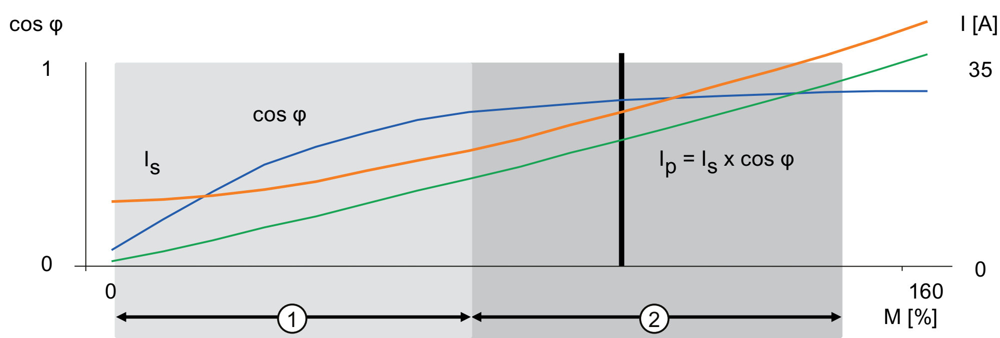
## Current monitoring principle

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 φ |
| ② | Strong change in apparent current |
| cos φ | Power factor |
| I [A] | Current |
| M [%] | Torque as a % of the rated torque |
| $I_p$ | Active current |
| $I_s$ | Apparent current |

Figure 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 φ 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 ≙ 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 overshot after the tripping delay time has expired. Contacts 11/12 are only closed when the lower threshold is undershot.

- Inflow control (UN ≙ 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 overshot, 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.

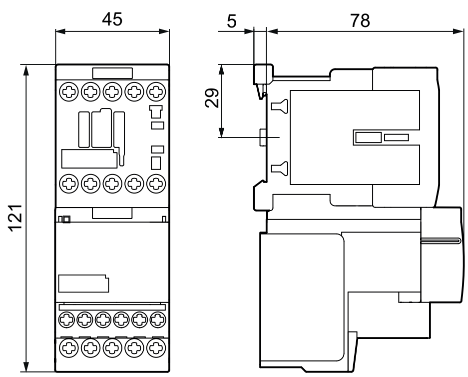
The "phase failure monitoring" parameter on the 3UG48 monitoring relays is set either locally via the three keys on the device, or via IO-Link.

**Possible indications on the display:** 

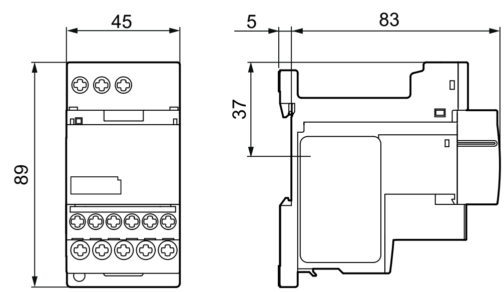
# Dimension Drawings C

## C.1 Dimension drawings 3RR2 monitoring relay

### 3RR2.41-1A.30 (screw connection, S00)

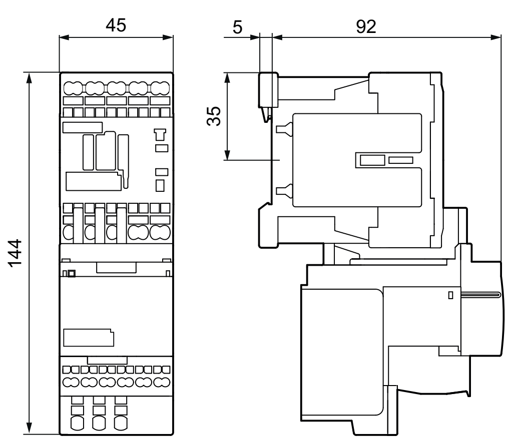



3RR2.41-1A.30 with contactor

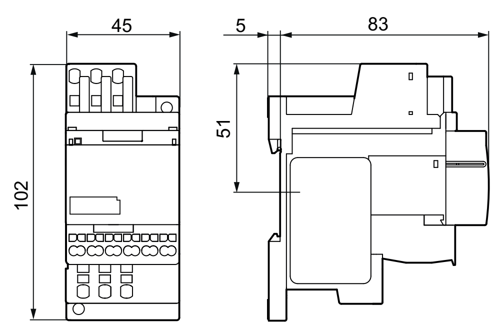



33RR2.41-1A.30 with terminal support for stand-alone assembly

### 3RR2.41-2A.30 (spring-loaded connection, S00)

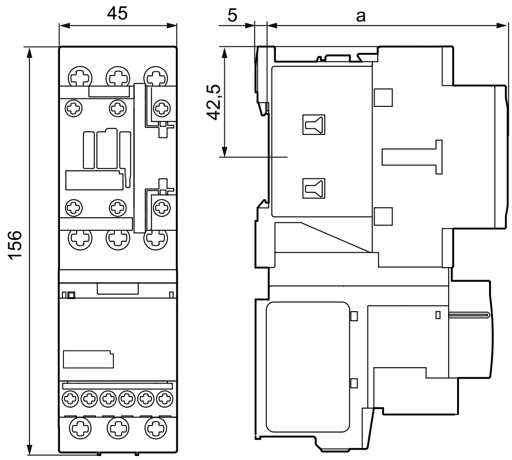



3RR2.41-2A.30 with contactor

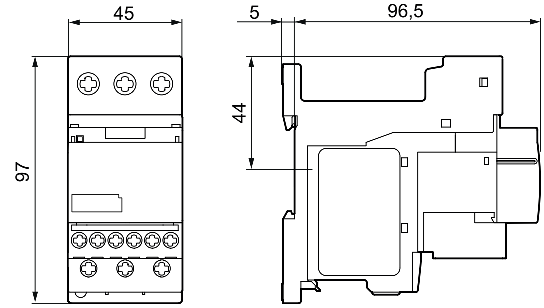



3RR2.41-2A.30 with terminal support for stand-alone assembly

## 3RR2.42-1A.30 (screw connection, S0)

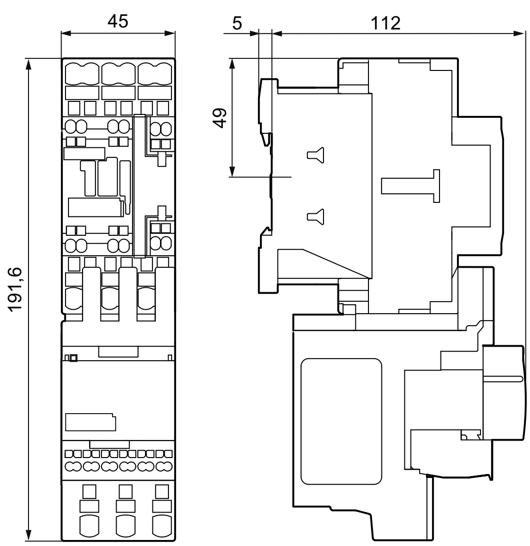



3RR2.42-1A.30 with contactor

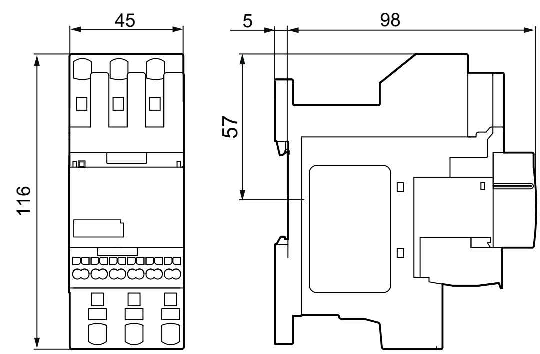



3RR2.42-1A.30 with terminal support for stand-alone assembly

## 3RR2.42-2A.30 (spring-loaded connection, S0)




3RR2.42-2A.30 with contactor




3RR2.42-2A.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)

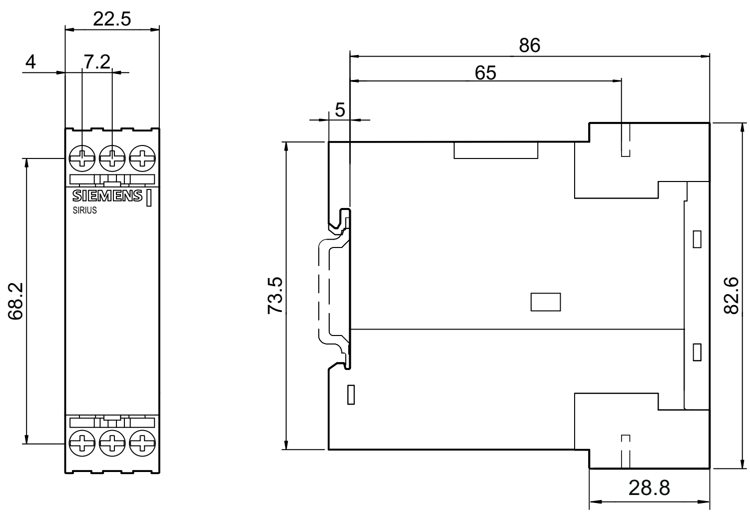



Figure C-1 3UG4. monitoring relays with 2 connecting terminals with screw-type connections

### 3UG4. monitoring relays with 2 connecting terminals (spring-loaded connections)

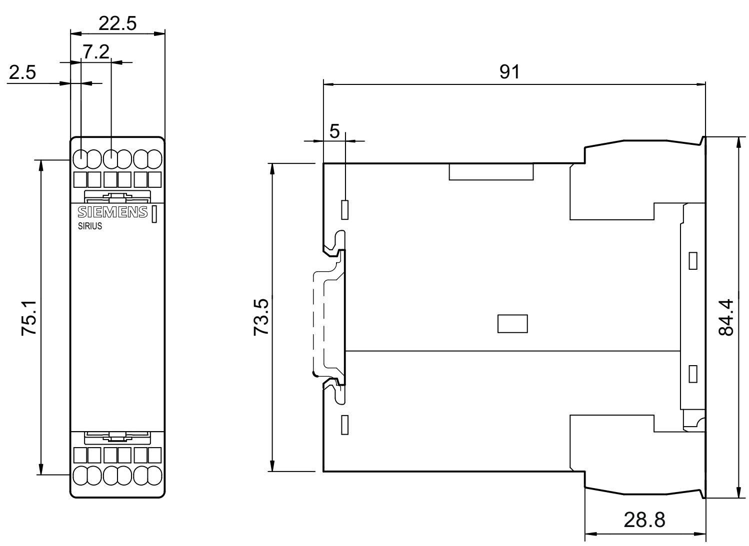



Figure C-2 3UG4. monitoring relays with 2 connecting terminals with spring-loaded connections

## C.2.2 Dimension drawings 3UG4 monitoring relays. (3 connecting terminals)

### 3UG4. monitoring relays with 3 connecting terminals (screw-type connection)

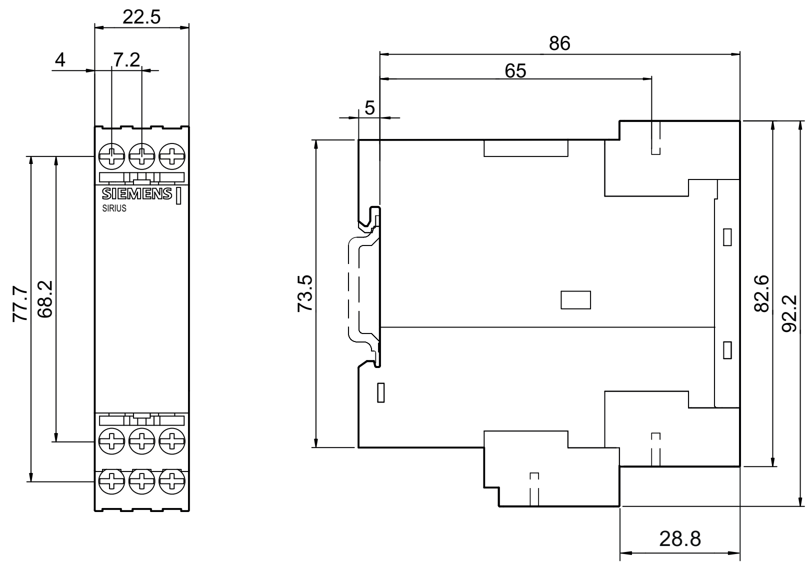



Figure C-3 3UG4. monitoring relays with 3 connecting terminals with screw-type connections

### 3UG4. monitoring relays with 3 connecting terminals (spring-loaded connections)

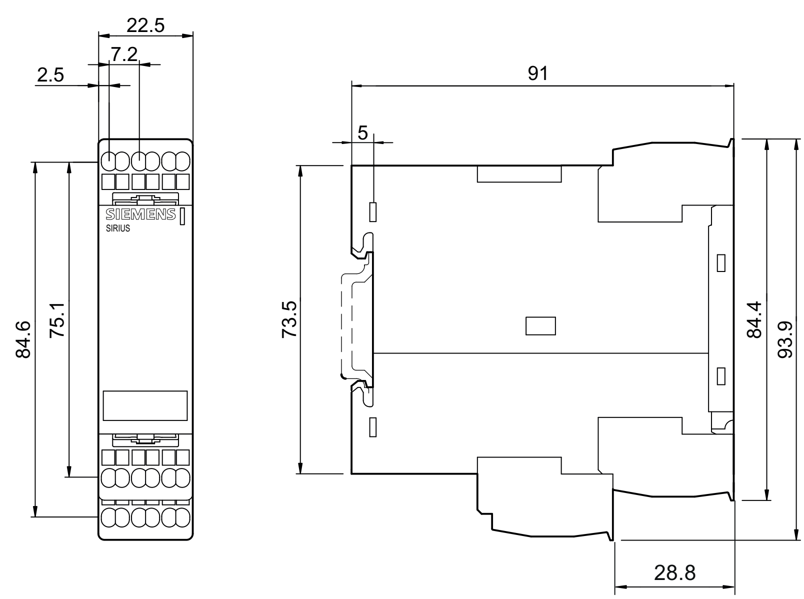



Figure C-4 3UG4. monitoring relays with 3 connecting terminals with spring-loaded connections

## C.2.3 Dimension drawings 3UG4 monitoring relays. (4 connecting terminals)

### 3UG4. monitoring relays with 4 connecting terminals (screw-type connection)

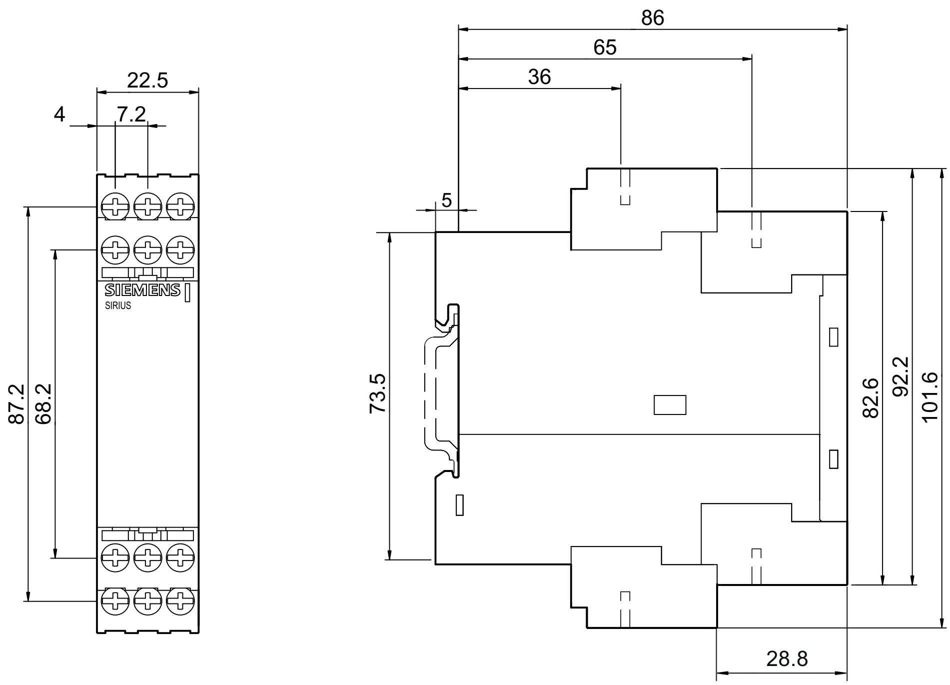



Figure C-5 3UG4. monitoring relays with 4 connecting terminals with screw-type connections

## 3UG4. monitoring relays with 4 connecting terminals (spring-loaded connections)

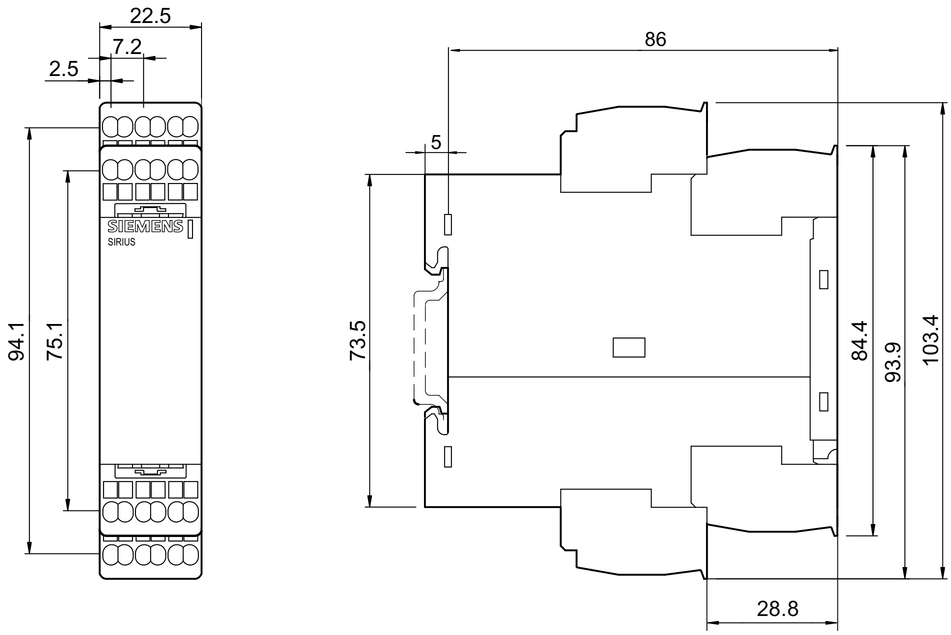



Figure C-6 3UG4. monitoring relays with 4 connecting terminals with spring-loaded connections

## C.2.4 Dimension drawings 3UG458 insulation monitoring relay. (3UG4983 upstream module)

### 3UG4581-1AW30/3UG4582-1AW30 monitoring relays

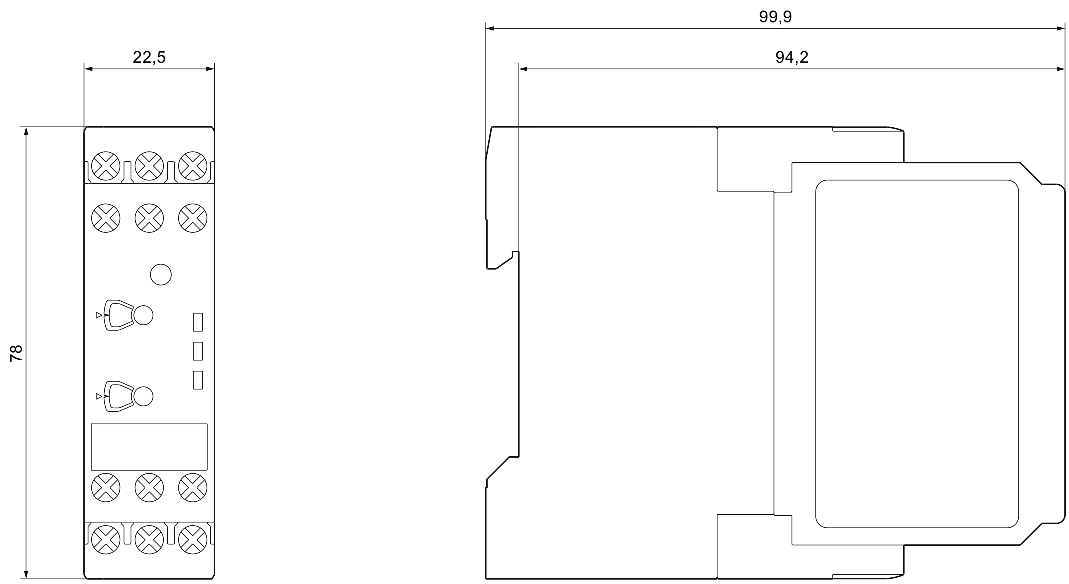



Figure C-7 3UG4581-1AW30/3UG4582-1AW30 insulation monitoring relays

### 3UG4583-1CW30 monitoring relay

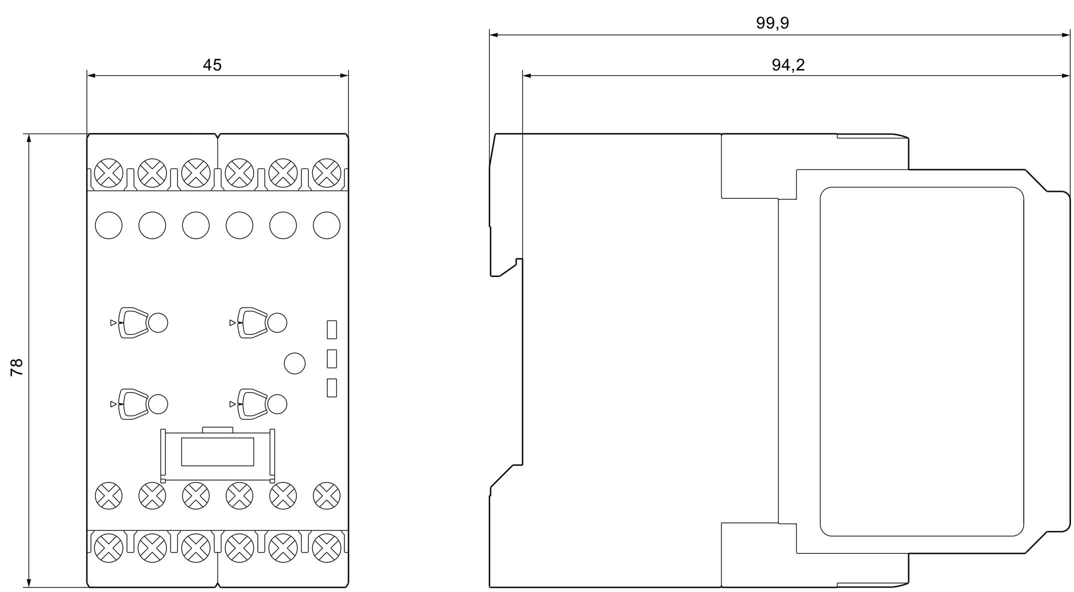



Figure C-8 3UG4583-1CW30 insulation monitoring relay

## 3UG4983-1A upstream module

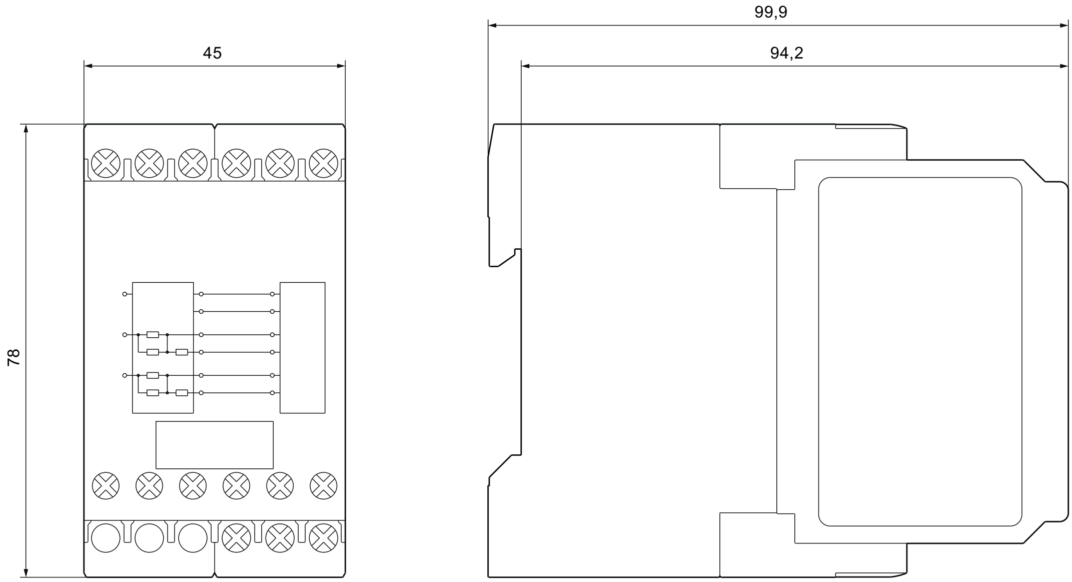
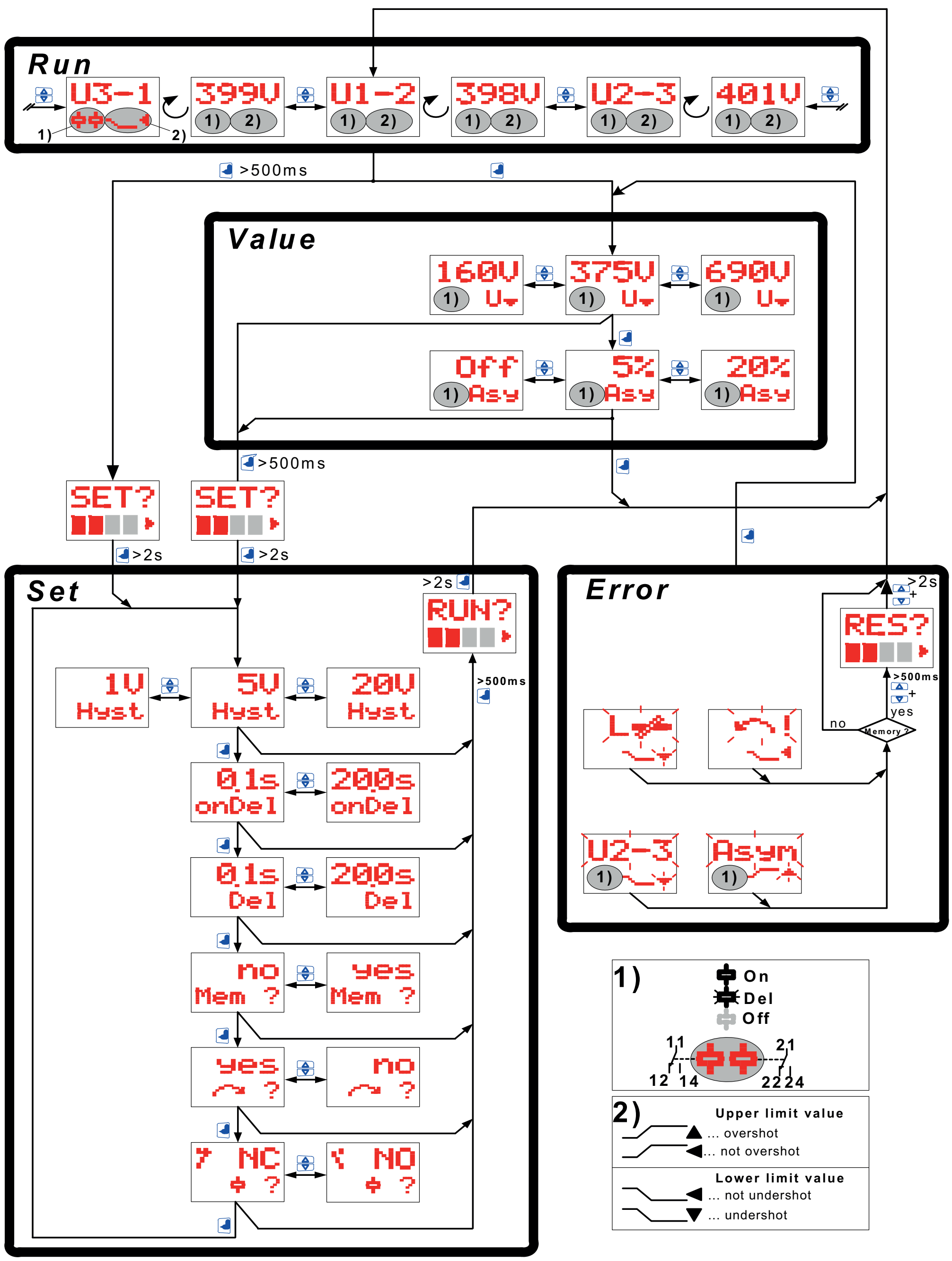



Figure C-9 3UG4983-1A upstream module

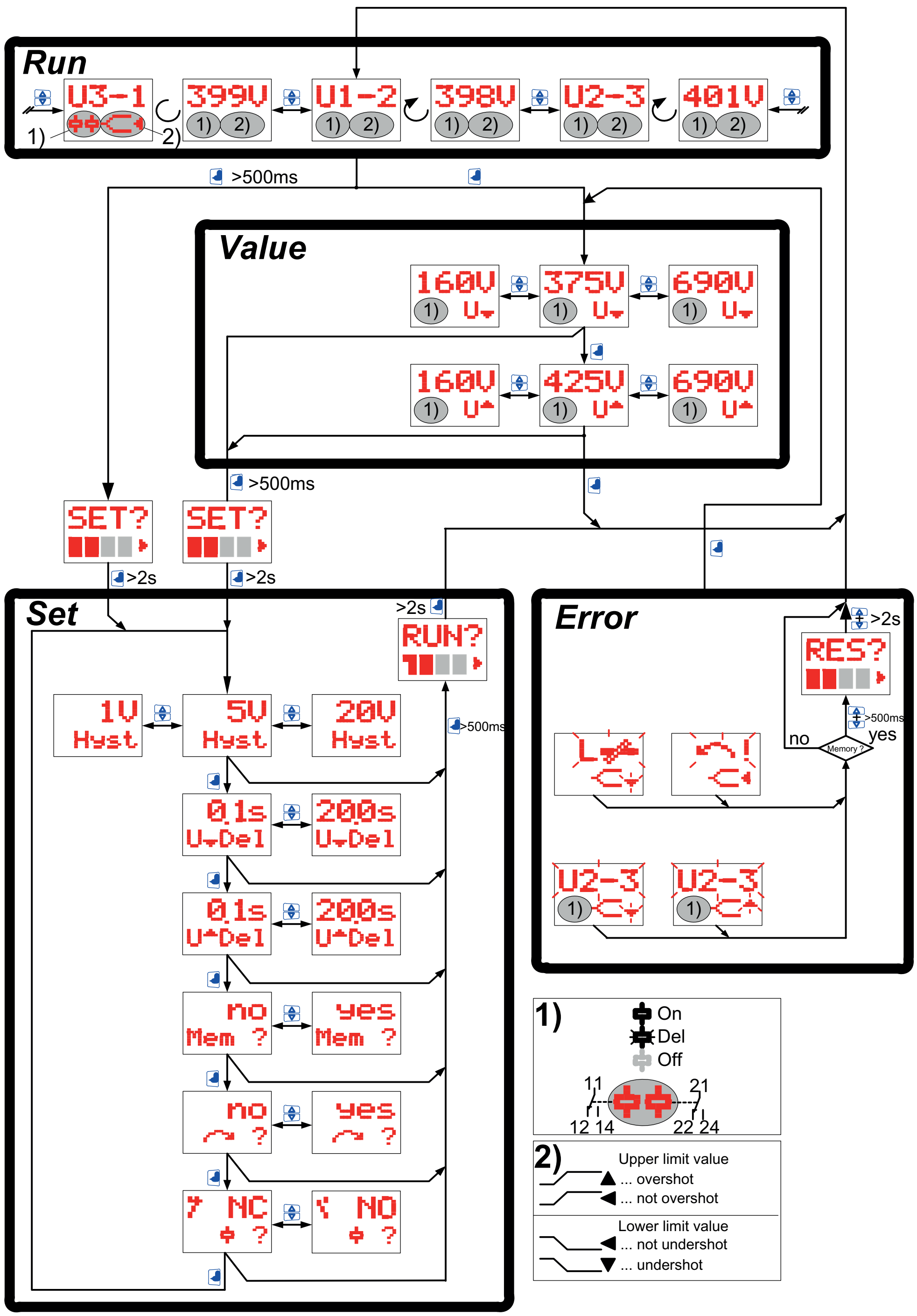
# Menu-based operation

D

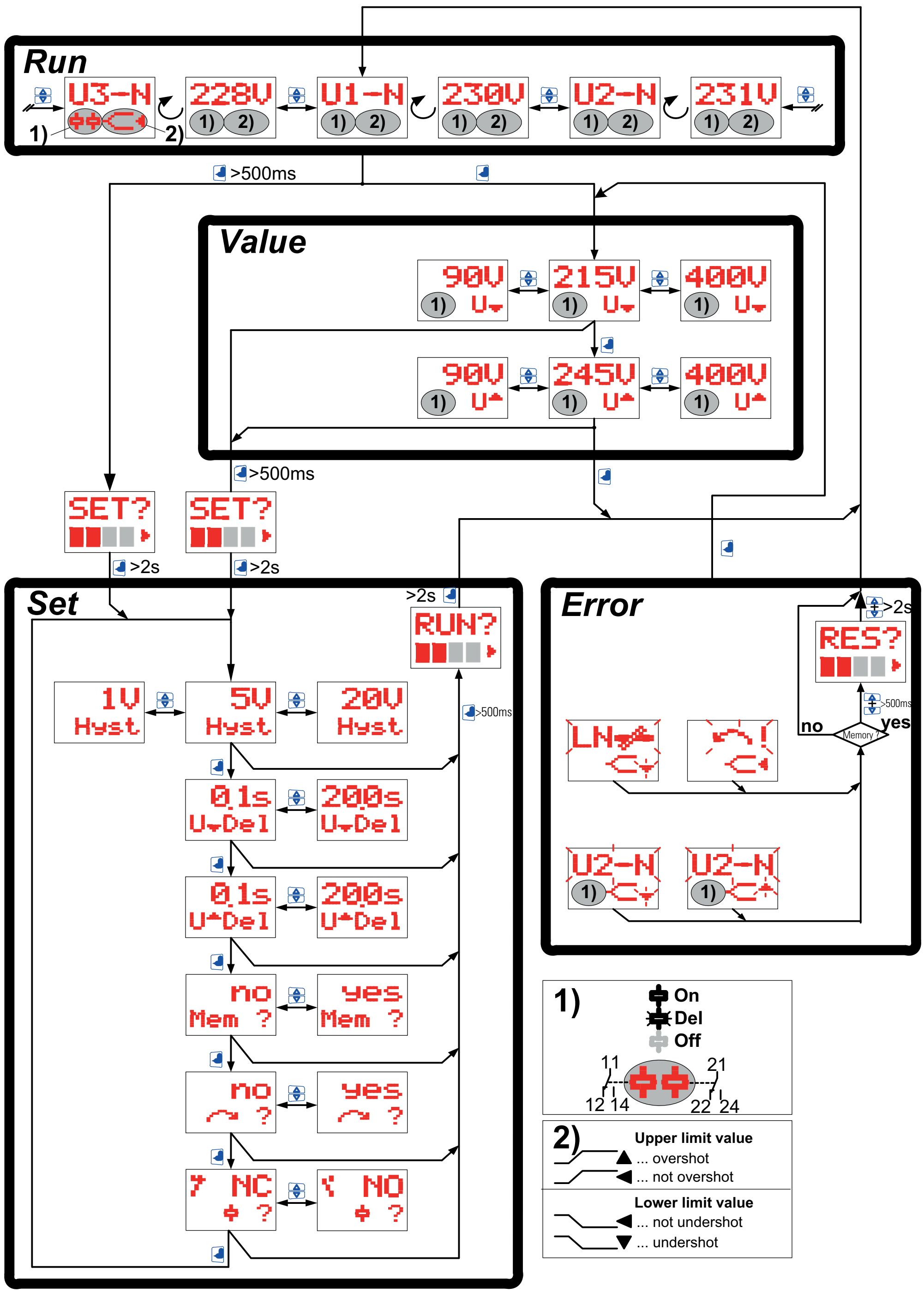
## 3UG4614 line monitoring relay



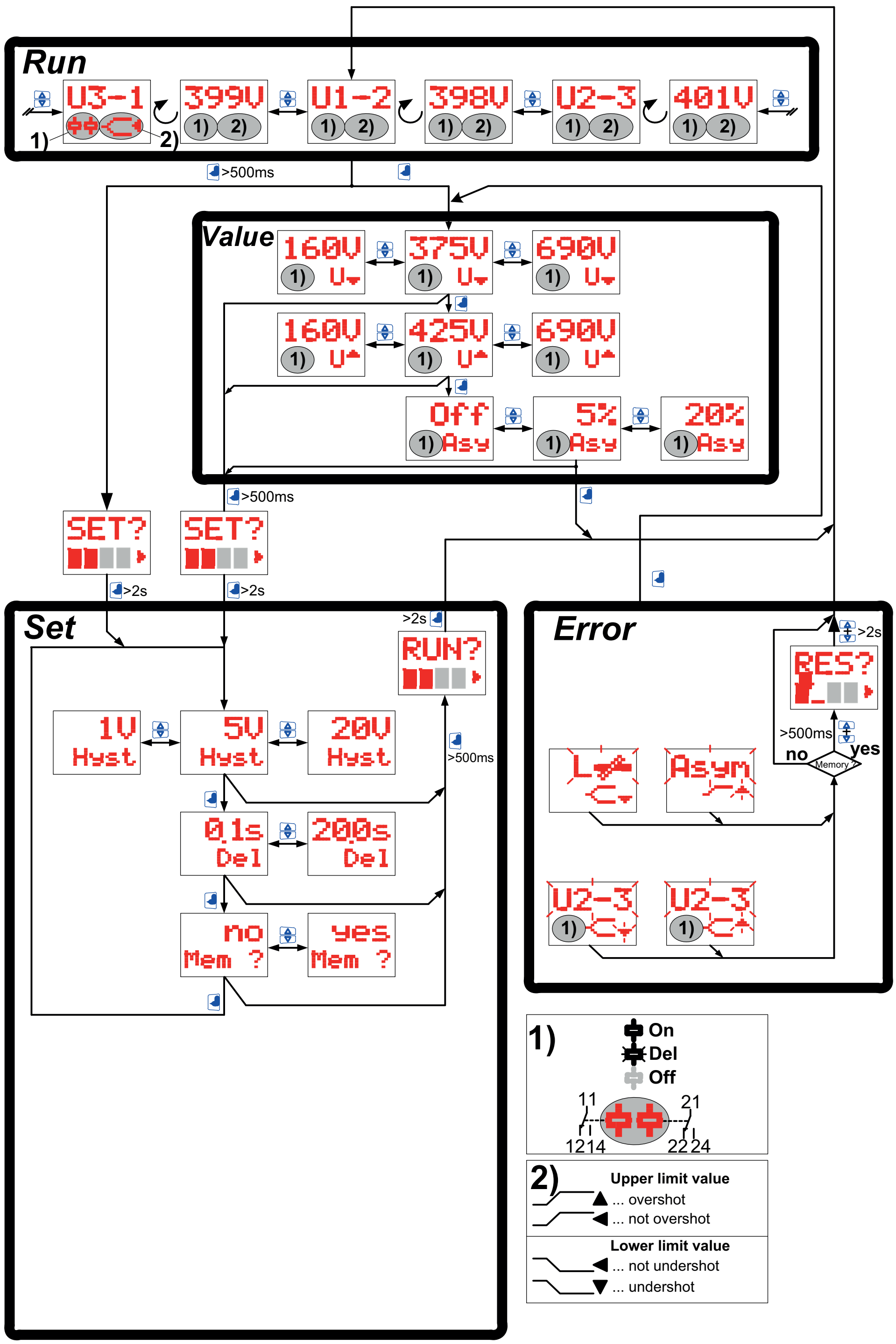
3UG4615 line monitoring relay



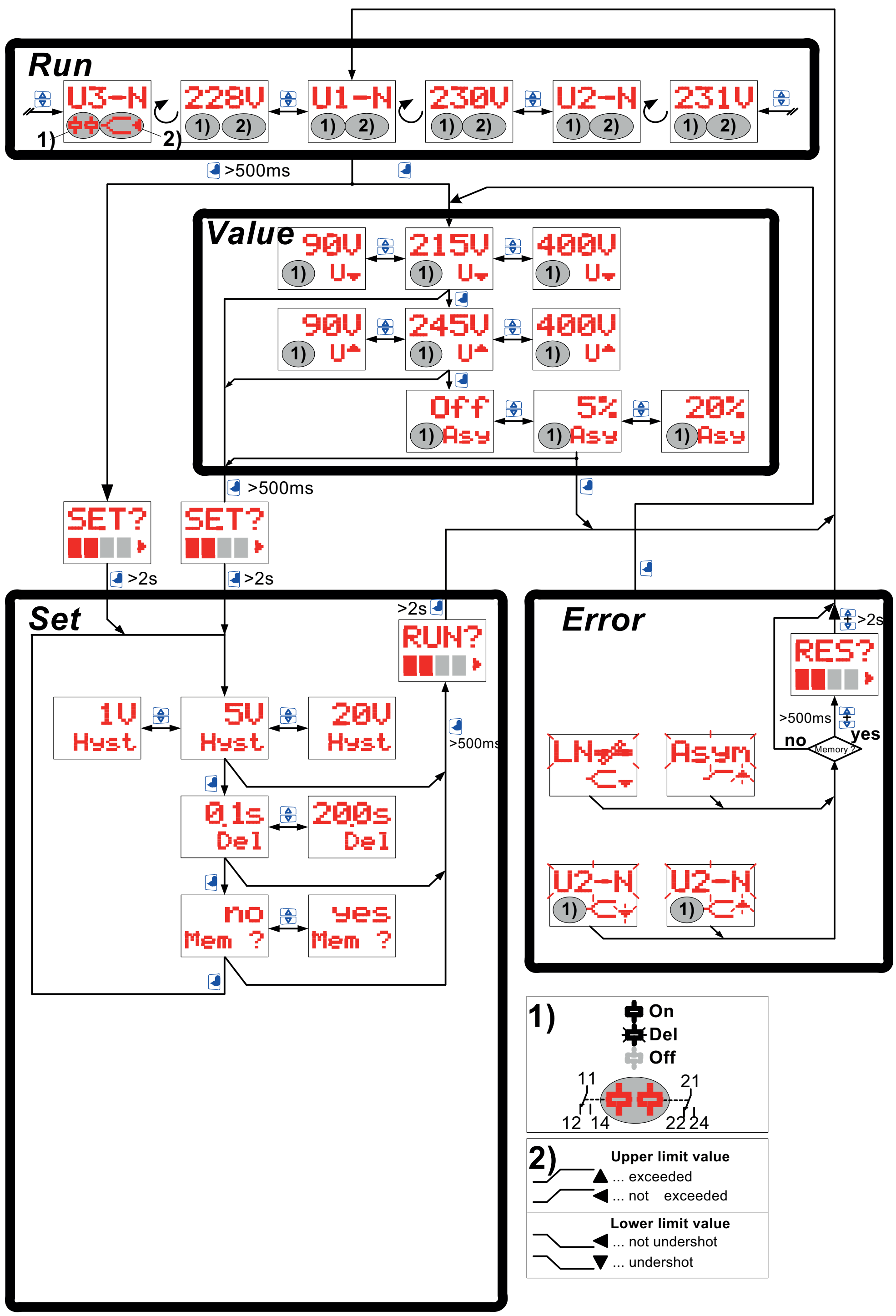
## 3UG4616 line monitoring relay



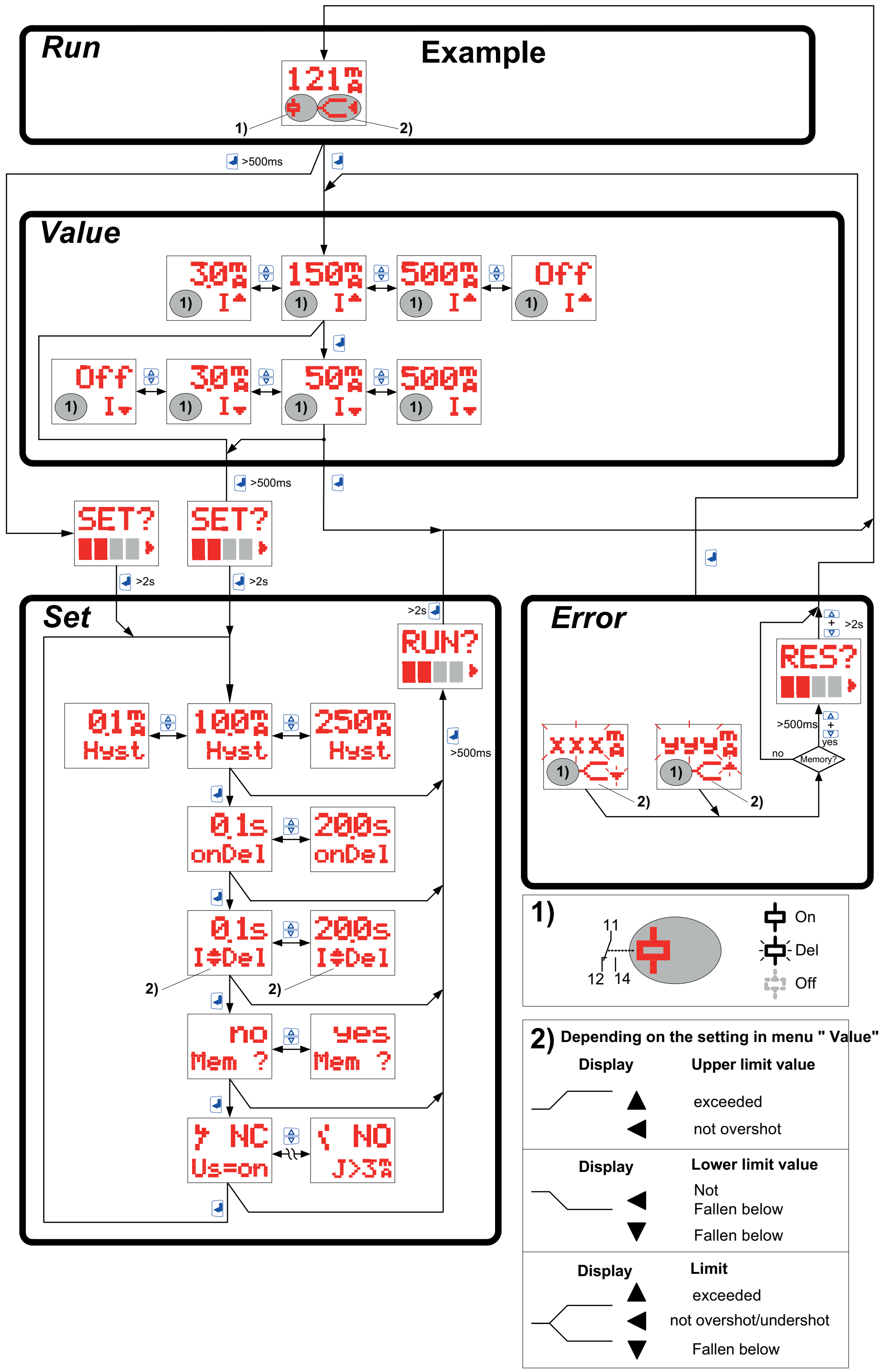
## 3UG4617 line monitoring relay



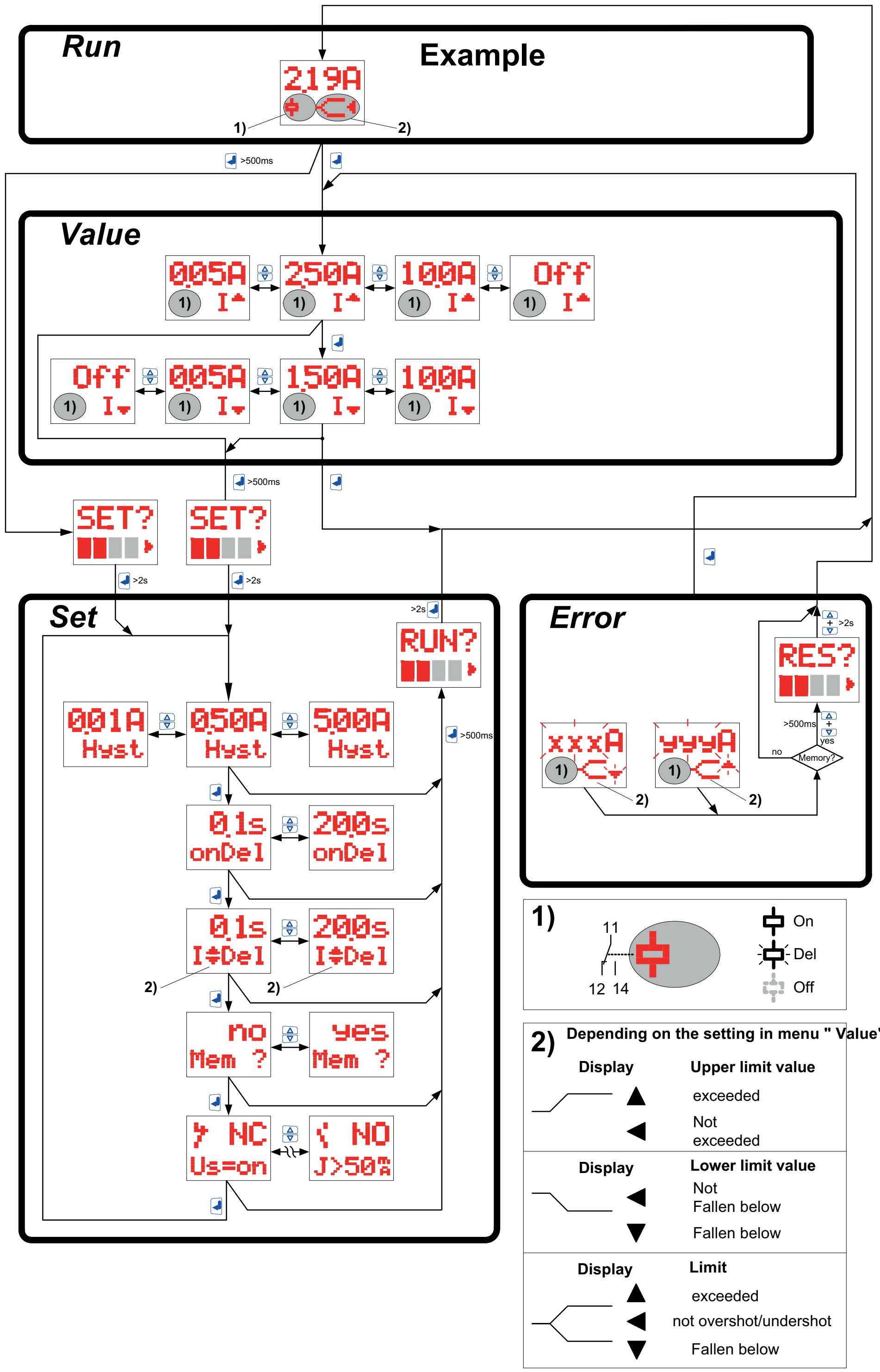
## 3UG4618 line monitoring relay



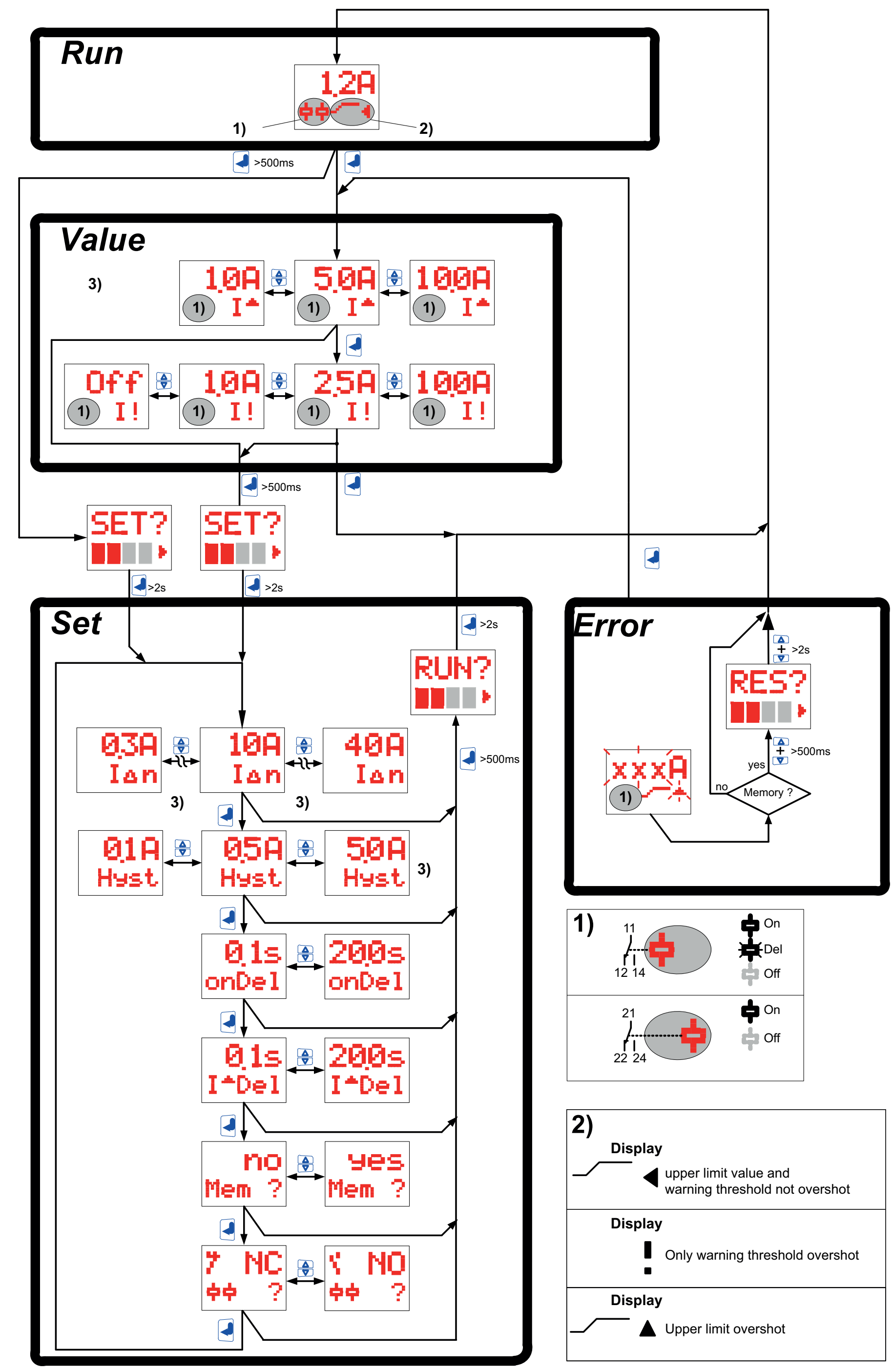
## 3UG4621 current monitoring relays



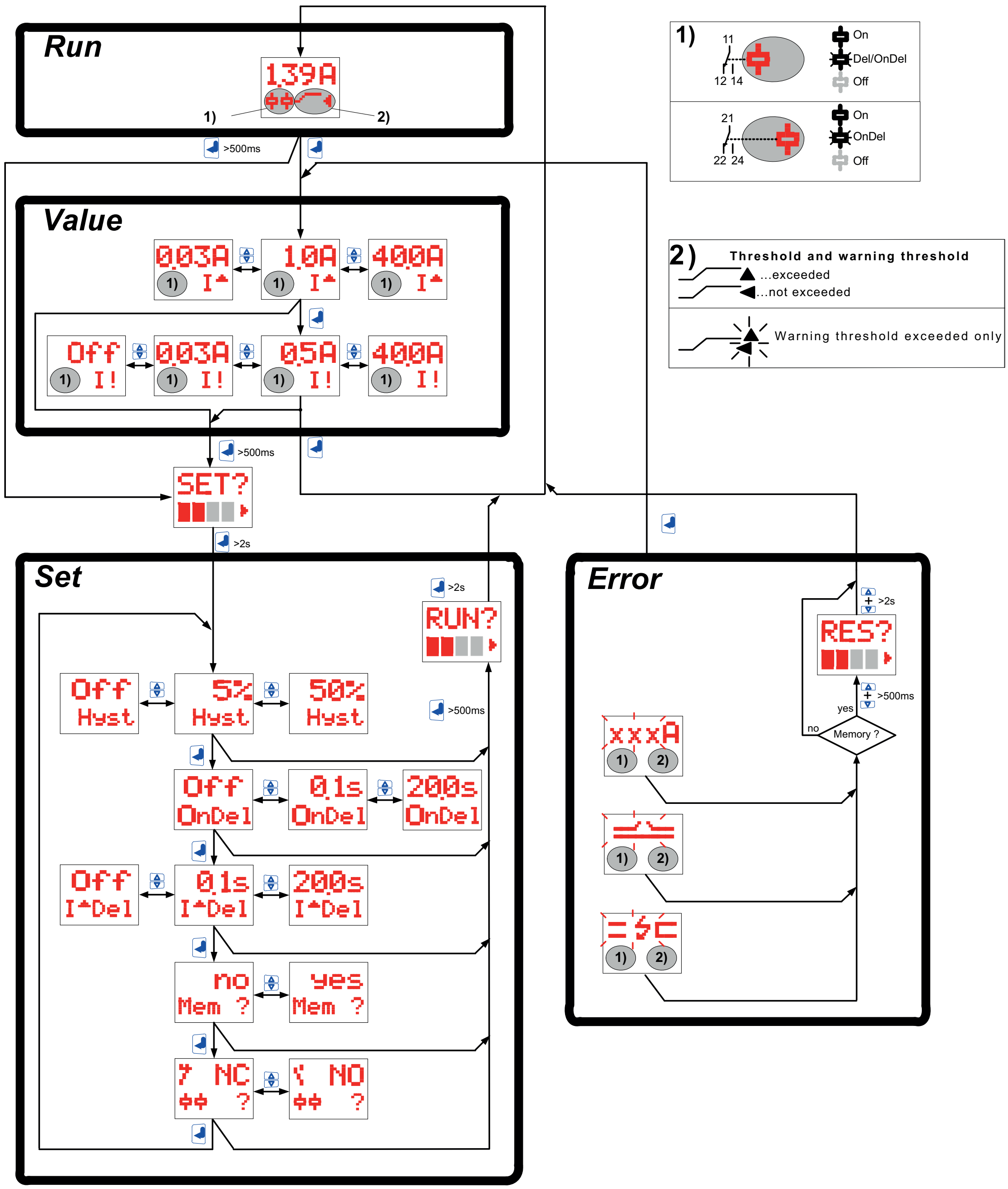
3UG4622 current monitoring relays



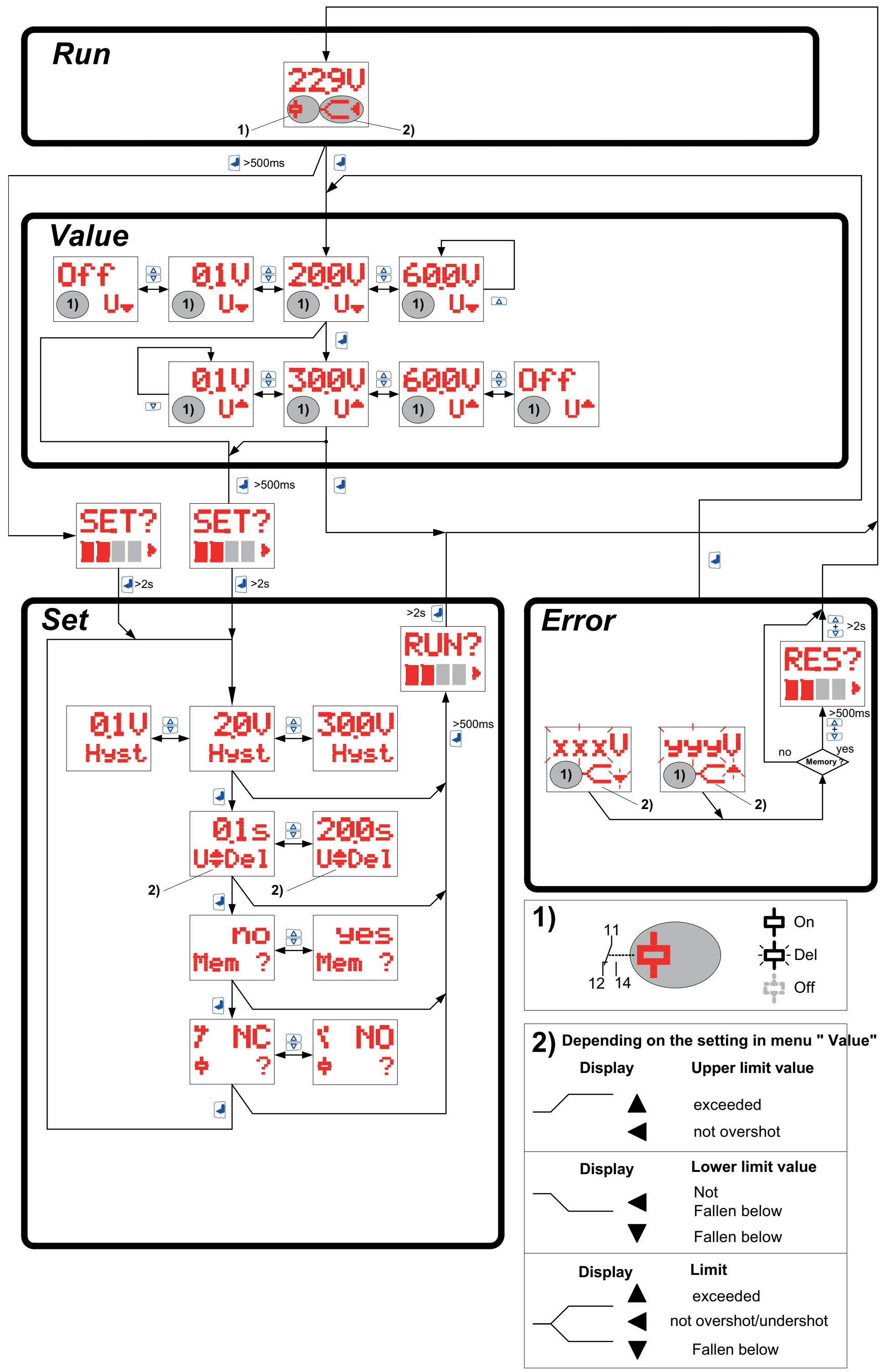
## 3UG4624 residual current monitoring relay



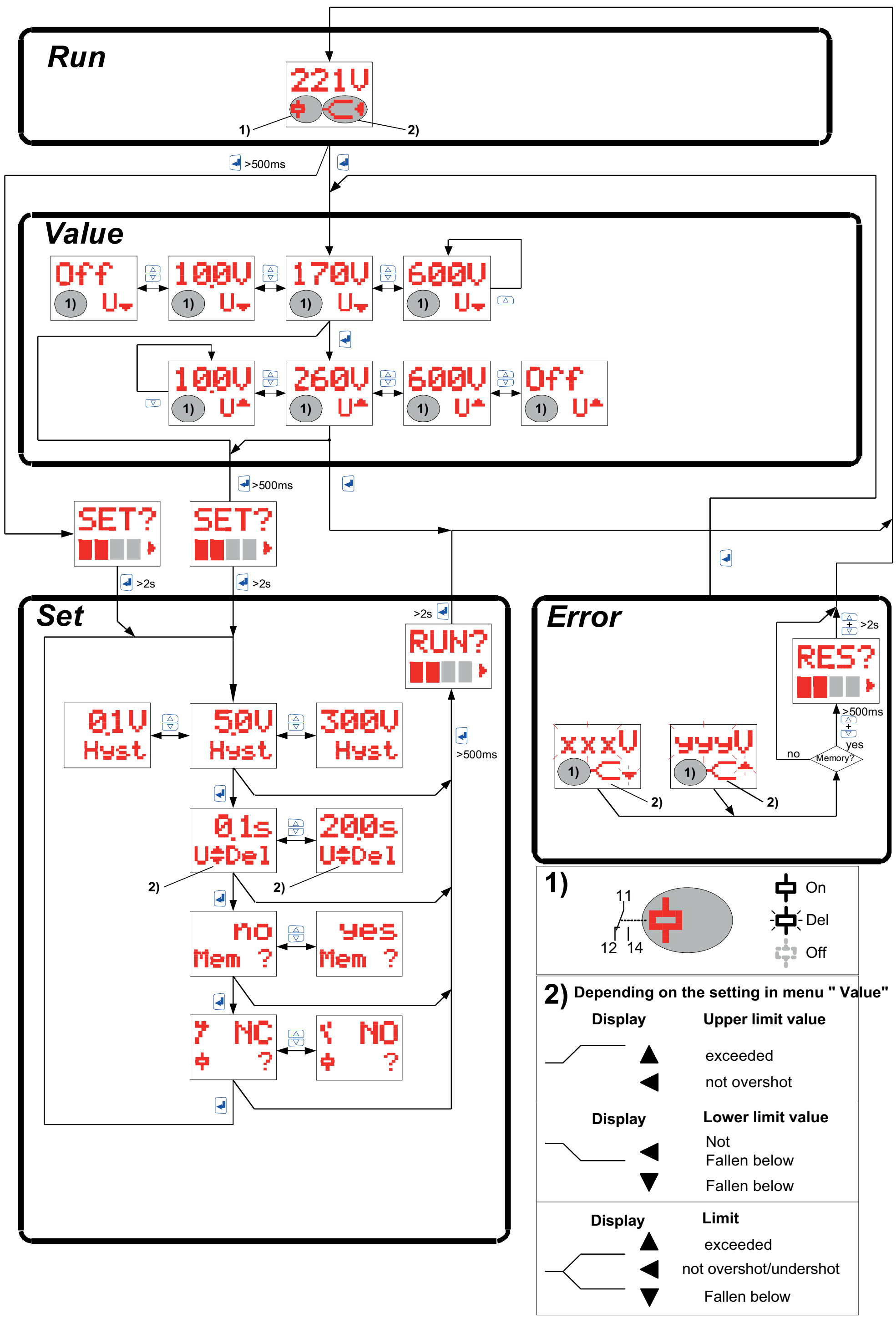
## 3UG4625 residual current monitoring relay



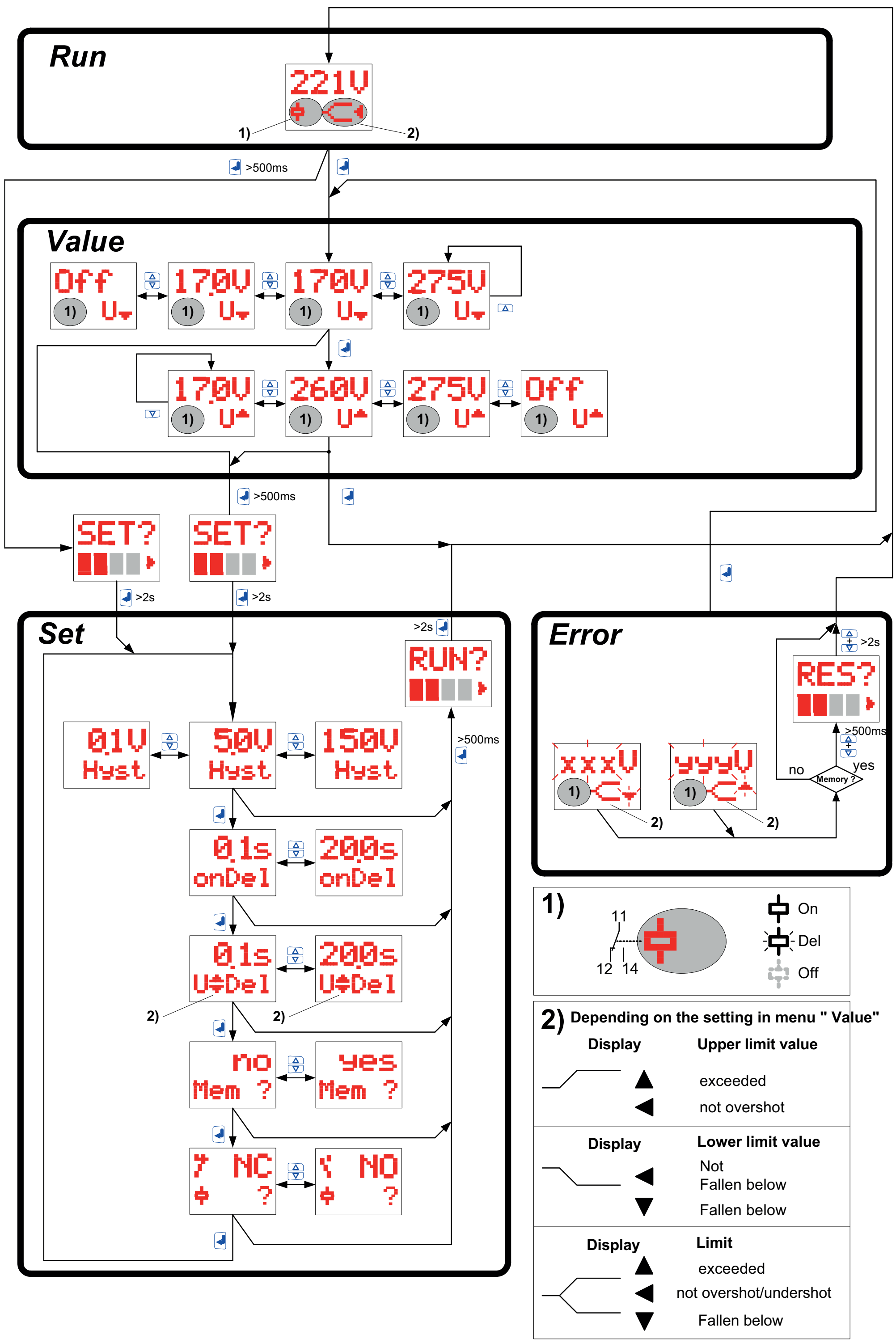
## 3UG4631 voltage monitoring relay



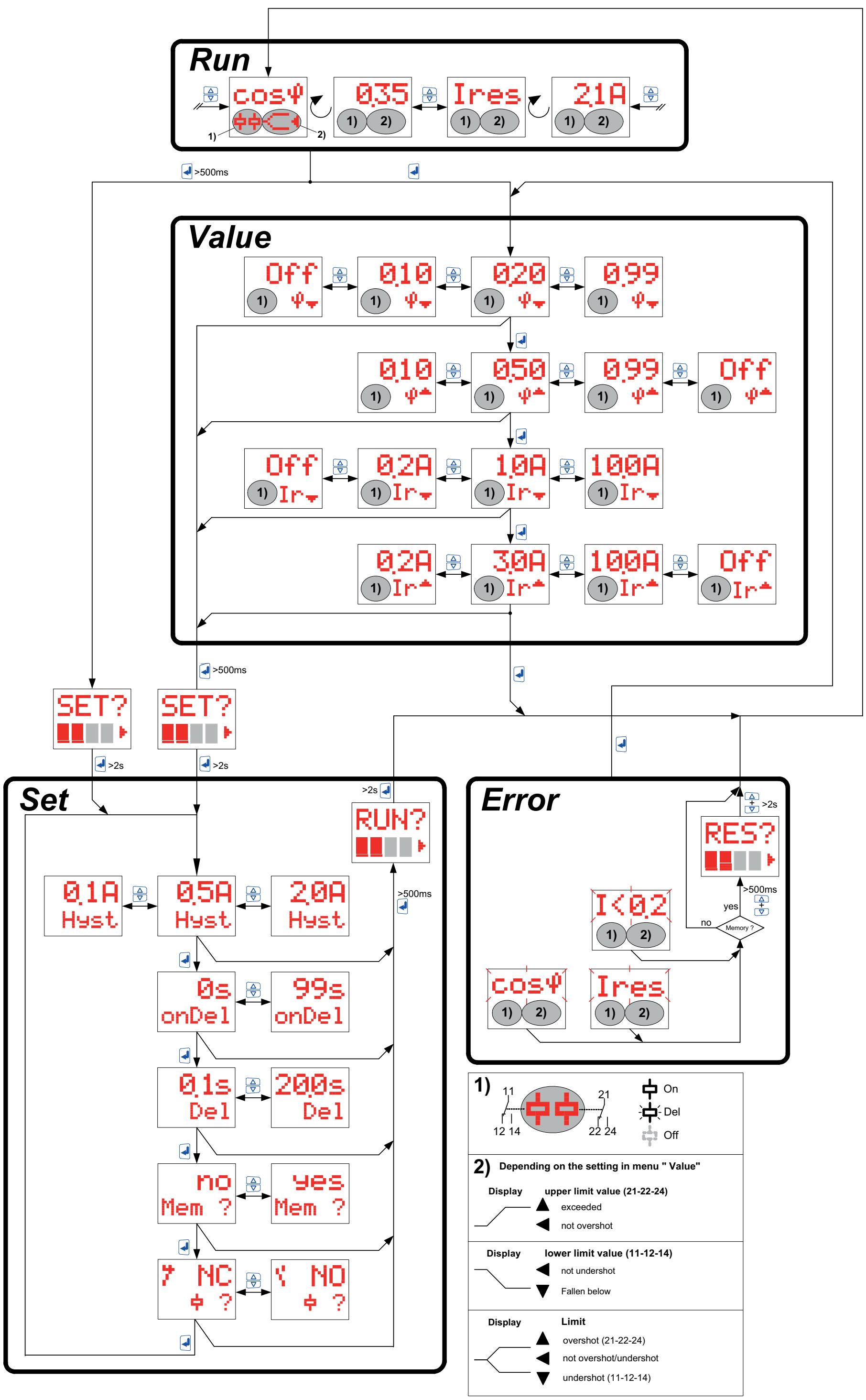
## 3UG4632 voltage monitoring relay



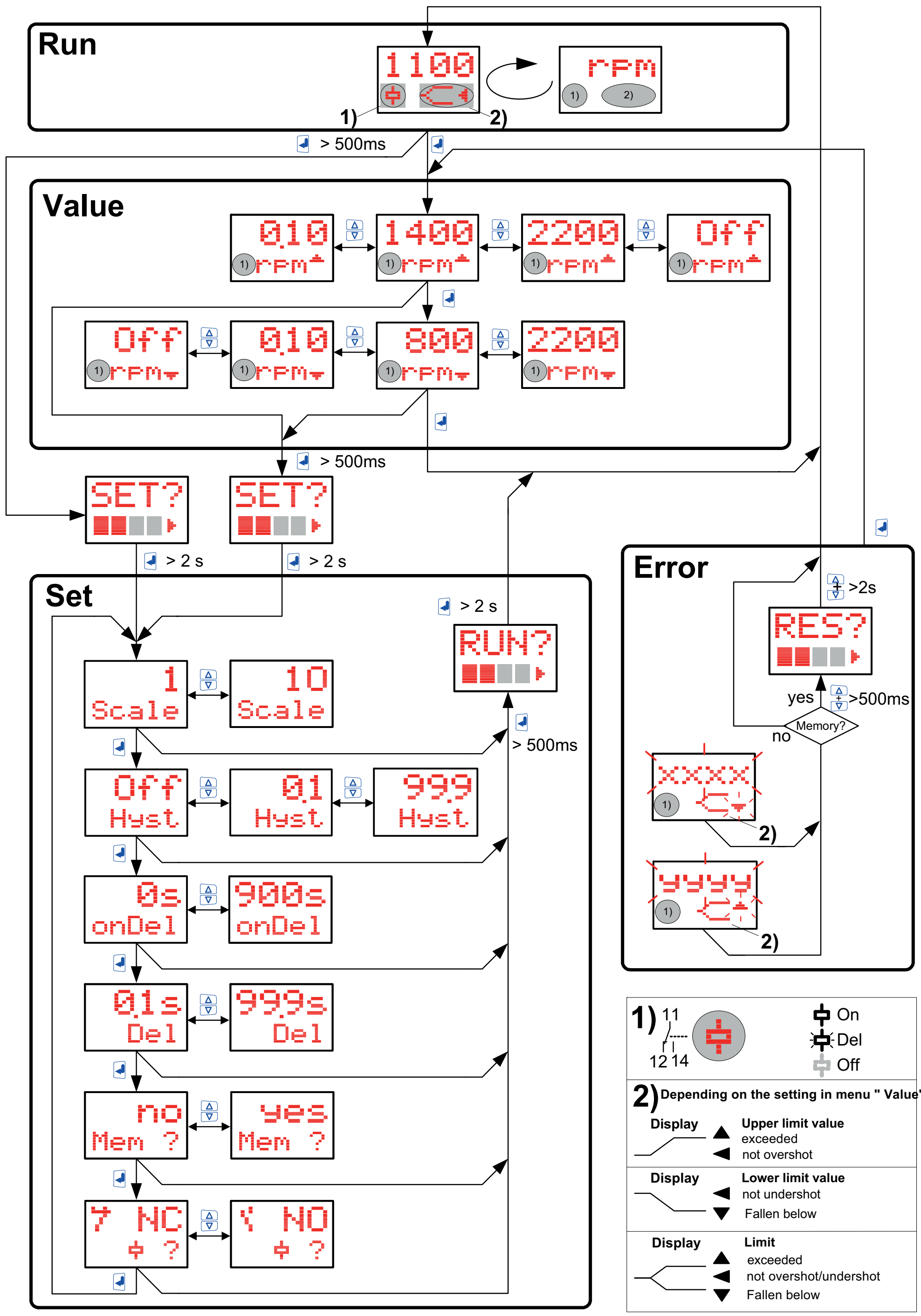
## 3UG4633 voltage monitoring relay



## 3UG4641 cos phi and active current monitoring relay



## 3UG4651 speed monitoring relay



# Correction sheet

E

## Correction sheet

Have you noticed any errors while reading this manual? If so, please use this form to tell us about them. We welcome comments and suggestions for improvement.

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| 92220 Amberg / Germany | Address |

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**Manual title:**

Table E- 1 Errors, comments, and suggestions for improvements

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