

Industrial controls

Monitoring and control devices SIRIUS 3UG5 monitoring relay




Equipment Manual

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Legal information

Warning notice system

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

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


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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

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Disclaimer of Liability

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

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Introduction

Purpose of the manual

This manual describes the 3UG5 monitoring relays for stand-alone installation and the 3UG5 monitoring relays for IO-Link.

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

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

Required basic knowledge

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

Scope of the manual

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

1.1 Siemens Industry Online Support

Information and service

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

- Product support
- Application examples
- Forum
- mySupport

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

Product support

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

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

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

mySupport

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

- **Support Request**
Search for request number, product or subject
- **My filters**
With filters, you limit the content of the online support to different focal points.
- **My favorites**
With favorites you bookmark articles and products that you need frequently.
- **My notifications**
Your personal mailbox for exchanging information and managing your contacts. You can compile your own individual newsletter in the "Notifications" section.
- **My products**
With product lists you can virtually map your control cabinet, your system or your entire automation project.
- **My documentation**
Configure your individual documentation from different manuals.

- **CAx data**
Easy access to CAx data, e.g. 3D models, 2D dimension drawings, EPLAN macros, device circuit diagrams
- **My IBase registrations**
Register your Siemens products, systems and software.

1.2 DataMatrix code

DataMatrix code

A DataMatrix code is lasered onto all 3UG5 monitoring relay devices below the label.

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

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

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

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

1P	Article number	+	S	Loca- tion	/	Date	Serial number
Data iden- tifier	User content	Separa- tor	User content	Separa- tor	User content	User content	User content

Note

The information content is displayed without spaces.

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

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

1.3 Siemens Industry Online Support app

Siemens Industry Online Support app

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

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



Android



iOS

1.4 Support Request

After you have registered, you can use the Support Request form in the online support to send your question directly to Technical Support:

Support Request:	Internet (https://www.siemens.com/support-request)
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1.5 History

Release number	New features
06/2023	<ul style="list-style-type: none">Initial release

Safety instructions

2.1 Responsibility of the user for system configuration and functionality

The SIRIUS 3UG5 monitoring relays for electrical quantities enable constant monitoring of all important performance characteristics that provide information about the functional capacity of a plant.

The manufacturer is responsible for ensuring safe functioning of the complete plant or machine.

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.

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

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

Note

With regard to the design of a system, comply with all valid national installation specifications and standards.

2.2 Current information about operational safety


Important note for maintaining the operational safety of your system


Please take note of our latest information. Systems with safety-oriented characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with certain actions when monitoring the product. By subscribing to the appropriate newsletter, you will ensure that you are always up-to-date and able to make changes to your system, when necessary:

For this purpose, go to the page: SIEMENS newsletter (<https://www.siemens.com/sirius-newsletter>)

Click "Subscribe to newsletter".

2.3 General safety notes

 DANGER
<p>Hazardous voltage. Can cause death, serious injury, or property damage.</p> <p>Hazardous electrical voltage can cause electric shock, burns and damage to property.</p> <ul style="list-style-type: none">• Turn off and lock out all power supplying the system and device before working on the device.• To ensure protection against the hazard of electric shock and the degree of protection IP20 when the terminal cover is open, screw in all terminal screws that are not needed to clamp conductors.• Close the terminal covers and always keep them closed during operation.

 WARNING
<p>Risk from conductive contamination. Can cause death, serious injury, or property damage.</p> <p>The devices must be protected against conductive contamination while taking account of the ambient conditions. One way to achieve this is to install the devices in a control cabinet with the appropriate degree of protection.</p> <p>You will find more information in the IEC 60529 standard "<i>Degrees of protection provided by enclosures (IP Code)</i>".</p>

NOTICE
<p>Electromagnetic interference</p> <p>A lack of grounding can result in faults in communication.</p> <p>The following must be grounded in accordance with the regulations to ensure noise immunity of the system components:</p> <ul style="list-style-type: none">• All system components• PELV / SELV power supply units (also note the documentation for the respective power supply unit in this regard).

Note

Power supply unit

The power supply unit for the voltage must comply with the standard ES1 (IEC 62368-1) or PELV (Protective Extra Low Voltage) / SELV (Safety Extra Low Voltage).

Note

Operational faults and malfunctions in communication

If the EMC Directive 2014/30/EU is not complied with when systems and devices are installed, communication breaks may occur.

Note**Simultaneity of signals**

Depending on when a signal change takes place within the cycle, the signal change is detected either in the same cycle or not until the following cycle time.

This means it is possible for supposedly simultaneous signal changes to be detected at two different inputs by the logic, but not simultaneously.

Take this behavior into account when creating your configuration.

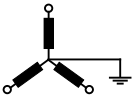
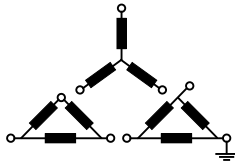
2.4 Standards

Standards

You can find the standards and approvals fulfilled by the 3UG5 monitoring relay on the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/25412/cert>).

2.5 Voltages

The specifications for 3-phase line supply according to IEC 60947-4-1 are valid for the following line system configurations:

Voltage specification U _e in the Equipment Manual	Line system configurations	
	Three-phase four-wire systems 	Three-phase three-wire systems 
[V]	[V]	[V]
230	--	230
400	230 / 400	400
440	260 / 440	440
500	--	500
690	400 / 690	--

-- not specified

2.6 Notes on the protection of device connections

The specifications for short-circuit protection (fuses, circuit breakers, or miniature circuit breakers) are available for the device connections of the main circuit and the auxiliary circuit. In order to ensure a holistic view for the protection of the device connections, the manufacturer is obliged to provide all relevant information for short-circuit protection and overcurrent protection.

If, for example, device connections for the control supply voltage, the supply voltage, or digital inputs/digital outputs are not connected to self-limiting current sources or energy sources, you can find the relevant information in the Equipment Manual or the technical data sheet.

2.7 Standards for IO-Link

IO-Link

You can find more information about communication via IO-Link, and about the valid standards for monitoring relays for IO-Link, on the Internet (<http://www.io-link.com/en>).

2.8 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 (<https://support.industry.siemens.com/cs/ww/en/ps/25412/cert>).

You will find further information in the Catalog IC 10 - SIRIUS "Industrial Controls," Chapter 10 (<https://support.industry.siemens.com/cs/ww/en/view/109771990>).

2.9 Recycling and disposal

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


2.10 Warning notice

 WARNING
Automatic restart Can cause death, serious injury, or property damage.
Make sure that no unintended restart takes place after a monitoring relay is replaced.

2.11 Electromagnetic compatibility (EMC) according to IEC 60947-5-1

This product is designed for Environment A. It may produce radio interference in domestic environments, in which case the user may be required to take adequate mitigation measures.

2.12 Hazardous Voltage

 DANGER
Hazardous voltage. Will cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

2.13 ESD Guidelines

ESD

All electronic devices are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are highly sensitive to overvoltage, and thus to any electrostatic discharge.

The acronym ESD has become the established designation for such electrostatic sensitive components/devices. This is also the international abbreviation for such devices.

ESD devices are identified by the following symbol:



NOTICE

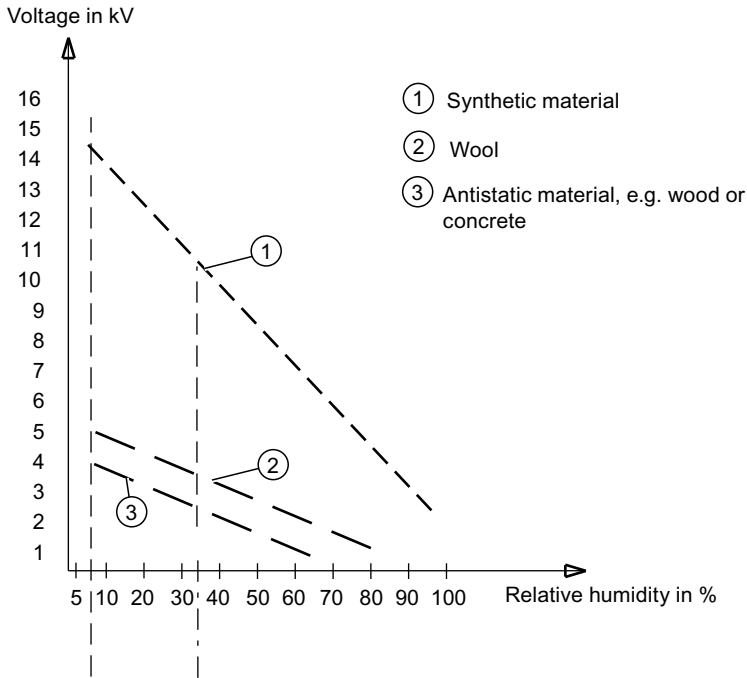
Electrostatic discharge

ESD devices can be destroyed by voltages well below the threshold of human perception. These static voltages develop when you touch a component or electrical connection of a device without having drained the static charges present on your body. The damage caused to a device by overvoltage is usually not immediately evident and is only noticed after an extended period of operation.

Electrostatic charging

Anyone who is not connected to the electrical potential of their surroundings can be electrostatically charged.

The diagram below shows the maximum electrostatic voltage which may build up on a person coming into contact with the materials specified in the diagram. These values correspond to IEC 801-2 specifications.



Basic protective measures against electrostatic discharge

- Make sure the grounding is good:
When handling electrostatic sensitive devices, ensure that your body, the workplace and packaging are grounded. In this way, you can avoid becoming electrostatically charged.
- Avoid direct contact:
As a general rule, only touch electrostatic sensitive devices when this is unavoidable (e.g. during maintenance work). Handle the devices without touching any chip pins or PCB traces. In this way, the discharged energy cannot reach or damage sensitive devices. Discharge your body before taking any necessary measurements on a device. Do so by touching grounded metallic parts. Use only grounded measuring instruments.

2.14 Radio interference

Radio interference

Note

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

2.15 Security information

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

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

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

For additional information on industrial security measures that may be implemented, please visit
<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
<https://www.siemens.com/cert>.

2.16 Information on data protection

Siemens observes standard data protection principles, in particular the principle of privacy by design.

The implications for this 3UG5 product are as follows:

The product processes / stores personal data only for pairing (e.g. MAC address, time stamp). If a user links this data with other data (e.g. a shift schedule) or stores personal data on the same storage medium (e.g. hard drive) and thus establishes a link to a person or persons, then the user is responsible for ensuring compliance with the relevant data protection regulations.

2.17 Data security in automation

The topic of data security and access protection (security) is becoming more and more important in industrial environments. Increased networking of entire industrial plants, vertical integration and networking of the levels within a company, and new technologies, such as remote maintenance, are resulting in more increased requirements for protection of the industrial plant. Security is the generic term for all protection measures:

- Loss of confidentiality due to unauthorized accessing of data
- Loss of integrity due to data manipulation
- Loss of availability due to destruction of data

To provide protection from manipulation in sensitive plant and production networks, it is not enough to apply data security solutions for offices to industrial applications without any adaptation.

Requirements

The special requirements of communication in an industrial environment (e.g. communication in real time) result in additional requirements for security in industrial use:

- Protection against interaction between automated cells
- Protection of network segments
- Protection from unauthorized access
- Scalability of the security functionality
- No influence on the network structure.

Threats

Threats can arise from external and internal manipulation. Loss of data security is not always caused by deliberate actions.

Internal threats arise due to:

- Technical faults
- Operating errors
- Errors in programs

This internal hazards are compounded by external threats. The external hazards do not differ from the known threats in the office environment:

- Computer viruses and computer worms
- Trojan horses
- Unauthorized access
- Password phishing.

Password phishing means attempting to get a user to divulge access data and passwords by masquerading as a different identity in an e-mail.

Precautions

The most important precautions against manipulation and loss of data security in an industrial environment are:

- Filtering and verification of data traffic through virtual private networks (VPN). A virtual private network is used to exchange private data in a public network (e.g. the Internet). The most common VPN technology is IPsec. IPsec is a collection of protocols based on the IP protocol at the network layer.
- Segmentation into protected automation cells. The aim of this concept is to protect devices in the network through security modules. A group of protected devices forms a protected automation cell. Only security modules in the same group or the device protected by you can be interchanged.
- Authentication (identification) of the networked devices. The security modules identify themselves to each other via a secure (encrypted) channel using authentication procedures. This prevents access to a protected segment by unauthorized persons from outside.
- Encryption of the data traffic. The confidentiality of the data is ensured by encrypting the data traffic. For this purpose, every security module is given a VPN certificate which includes the encryption key.

VDI guidelines on information security in industrial automation

The VDI/VDE Association of German Engineers "Measurement and Automation" has published a guideline for implementation of a security architecture in the industrial environment in the VDI guideline "VDI/VDE 2182 Sheet 1, IT Security for Industrial Automation - General Model". You will find the guideline under "VDI Standards" on the VDI home page: VDI guidelines (<http://www.vdi.eu>)

2.18 Monitoring relay in safety applications

2.18.1 Safety function

A phase failure and / or phase sequence error is indicated on an integral LCD or a status LED. At the same time the integrated safety-related output switches the system to a safe operating state.

The safety function of the 3UG5512-..R21 and 3UG5618-.CR21 conforms to:

- SIL 1 (IEC 62061)
- PL c (EN ISO 13849-1)

2.18.2 Approvals for use in safety-oriented applications

Standard/approvals	Designation	Comment
EN ISO 13849-1	Safety of machinery – safety-related parts of control systems - Part 1: General principles for design	Approvals for use in safety-oriented applications
IEC 61508	Functional safety of safety-related electrical/electronic/programmable electronic systems	
IEC 62061	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems	

2.18.3 Current information about operational safety

Important note for maintaining the operational safety of your system

Please take note of our latest information. Systems with safety-oriented characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with certain actions when monitoring the product. For this reason, we publish a special newsletter containing information on product features that are (or could be) relevant to operation of safety-related systems. By subscribing to the appropriate newsletter, you will ensure that you are always up-to-date and able to make changes to your system, when necessary:

For this purpose, go to the page: Safety Integrated for industrial safety technology (<https://www.siemens.com/safety-integrated>)

Click "Subscribe to newsletter".

2.18.4 Intended use

Improper use of the 3UG5 monitoring relay

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.

EU note regarding machine safety: Commissioning is absolutely prohibited until it has been ensured that the machine in which the component described here is to be installed fulfills the specifications of directive 2006/42/EC (Machinery Directive).

Note

Safe state

The basis of the safety function is the definition of the safe state.

In the case of the 3UG5 monitoring relay, this is the "OFF state".

System overview

3.1 Description

3.1.1 Product description

Product description

The tried and tested SIRIUS monitoring relays for electrical 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 3UG5 monitoring relays offer the following functions in various combinations:

- Phase sequence
- Phase failure, neutral failure
- Phase asymmetry via voltage measurement
- Undershoot and/or overshoot of voltage thresholds
- Frequency monitoring

The SIRIUS 3UG5 monitoring relays for IO-Link offer many other performance features in addition to monitoring functions:

- Measured values (including resolution and unit) to the higher-level control.
Some device versions allow you to set which value is to be transferred cyclically.
- Transmission of alarm flags to the higher-level control.
- Comprehensive diagnostics capability by querying the precise cause of the error in the diagnostic data record.
- Remote parameterization additionally possible (supplementing local parameterization or instead of local parameterization).
- Fast parameterization of identical devices by duplicating the parameter assignment in the higher-level control.
- Parameter transfer by means of Upload to the higher-level control via- IO-Link call or by parameter server¹⁾ (when using an IO-Link master in IO-Link Communication Specification V1.1 or higher).
- Local parameter assignment can be disabled via IO-Link.

3.1 Description

- To prevent automatic startup after a power failure and to avoid losing diagnostic data, errors can be configured so that they are saved to non-volatile memory.
- Linking to a higher-level control makes it possible to assign parameters to the monitoring relays via a display unit. The measured values can be displayed directly in a control room or at the machine/control cabinet.

Combining the autonomous monitoring relays with IO-Link communication reduces the wiring outlay and cuts costs.

As the availability of up-to-date measured values means that the higher-level control can take care of the control tasks within the plant, the continued availability of the output relays of the monitoring relays increases the plant's operational reliability (e.g. by shutting down the plant if thresholds that cannot be achieved under normal operating conditions are overshoot).

The monitoring relays continue to function autonomously in spite of the IO-Link connection. Parameters can be assigned locally at the device, independently of a higher-level control. As long as the 24 VDC supply voltage is available, the monitoring relays will function if the controller fails or is not yet available. If the 3UG5 monitoring relay is used for IO-Link without a connection to a higher-level control, because of the integrated SIO mode, the devices feature an additional semiconductor output that switches when settable warning thresholds are exceeded.

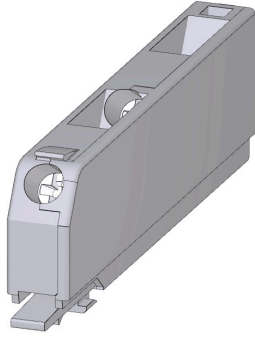
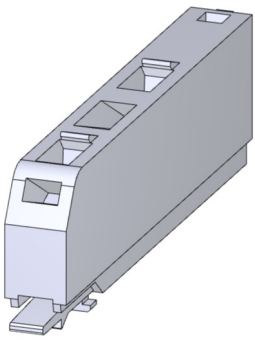
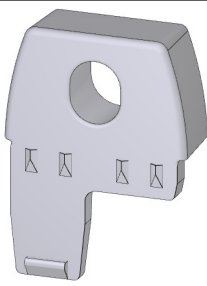
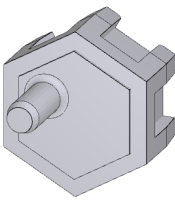
¹⁾ The parameter server provides an assurance of consistent central data management in the event of changes to parameters (made locally or via the control). The "Parameter server" function supports the automatic backup of parameter data (automatic re-assignment of parameter data if a device is replaced).

Use of SIRIUS 3UG5 monitoring relays for IO-Link is especially recommended for machines and plants in which the devices for providing the current measured values and / or for remote parameterization are to be connected to the automation level simply, fast and without error.

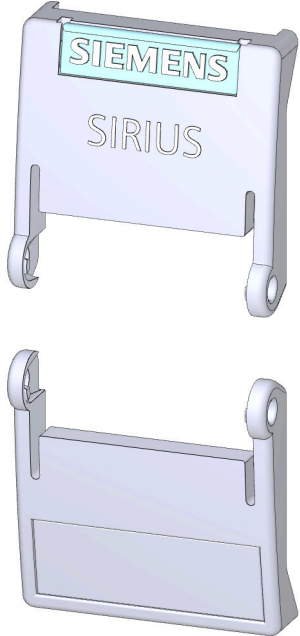

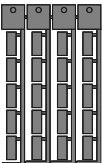
3.1.2 Accessories

3.1.2.1 Accessories for 3UG5 monitoring relay

The table below shows the accessories available for the 3UG5 monitoring relay:

Designation	Graphic	Article number
SIRIUS terminal, 2-pole, screw-type connection system, 1 x 2.5 mm ²		3ZY1122-1BA00
SIRIUS terminal, 2-pole, spring-loaded connection technology (push-in terminal), 1 x 4.0 mm ²		3ZY1122-2BA00
SIRIUS lugs for screw fastening for wall mounting (Contents: 12 units)		3ZY1311-0AA00
Coding pins for SIRIUS terminals		3ZY1440-1AA00

3.1 Description

Designation	Graphic	Article number
Spring flap for SIRIUS devices		3ZY1450-1AB00
Sealable cover		3ZY1321-2AA00
Device identification label		3RT2900-1SB20

Note**Labels for the spring flap**

You will find the labels for the spring flaps in the product data sheet of each 3UG5 monitoring relay (<https://support.industry.siemens.com/cs/ww/en/ps/25412/td>).

1. Enter the entire article number of the monitoring relay in the "Product" field and confirm with the Enter key.
 2. Click the "Technical data" link.
-

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 (<https://www.siemens.com/support-request>).

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 (<https://support.industry.siemens.com/cs/ww/en/ps/25412/cert>).

3.3 Mounting and dismantling

3.3.1 Warning notice

⚠ DANGER

Hazardous voltage.
Will cause death, serious injury, or property damage.

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

- Turn off and lock out all power supplying the system and device before working on the device.
- To ensure protection against the hazard of electric shock and the degree of protection IP20 when the terminal cover is open, screw in all terminal screws that are not needed to clamp conductors.
- Close the terminal covers and always keep them closed during operation.

3.3.2 Mounting options

Installation options

The following types of mounting are available for the SIRIUS 3UG5 monitoring relay:

- Mounting on a 35 mm DIN rail according to IEC 60715.
- Mounting on a level surface.

3.3.3 Minimum clearances and mounting positions

Minimum clearance

Minimum clearances from grounded and live parts must be complied with when installing the SIRIUS 3UG5 monitoring relays. You can also find the technical data of the product at Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/25412/td> (<https://support.industry.siemens.com/cs/cn/en/ps/25412/td>)).

Note

The side-by-side design of the 3UG5 monitoring relay is permissible.

Mounting position

It can be mounted in any position.

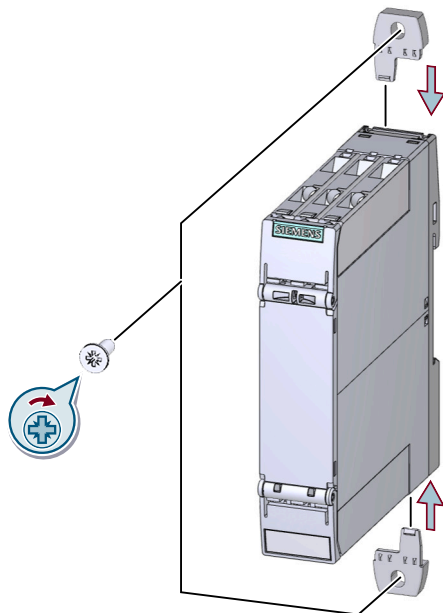
3.3.4 Mounting the devices on a level surface

Requirements

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

- Please observe the information about the mounting position in the chapter "Minimum clearances and mounting positions (Page 28)".
- Two properly executed drill holes with thread or plug on the level surface
For details of the distances between the drilled holes, please refer to the relevant dimension drawings in the chapter "Dimensional drawings (Page 143)".
- Two screws to fit the M4 x 12 holes in accordance with DIN 784.
- Two plastic push-in lugs for wall mounting
Refer to the accessories list for the relevant article number in the chapter "Accessories (Page 25)".

Procedure



- ① Insert the two push-in lugs into the openings provided on the device until they engage.
- ② Hold the device up to the level surface prepared for screw fastening.
- ③ Insert the screws through the elongated holes into the push-in lugs.
- ④ Screw the device onto the level surface so that it is secure.

Tightening torque: 1 Nm

Figure 3-1 Mounting the 3UG5 monitoring relay on a level surface

3.3.5 Disassembling the devices from a level surface

! DANGER

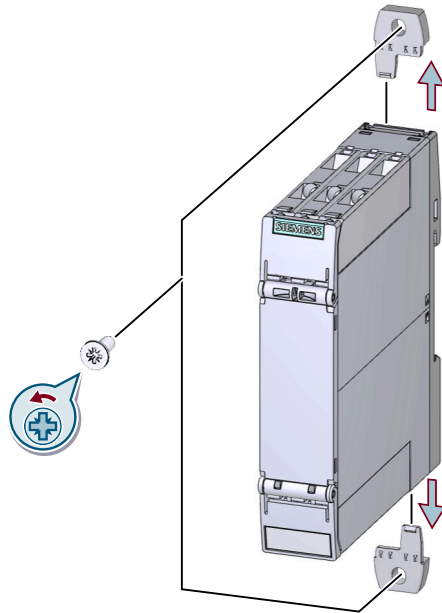
**Hazardous voltage.
Can cause death or serious injury.**

Turn off and lock out all power supplying the system and device before working on the device.

Requirements

- The terminals have been removed (Removing the terminals (Page 44)) or disconnected (Disconnecting the screw-type terminals (Page 37)) and (Disconnecting the spring-loaded terminal (push-in terminal) (Page 40)).

Procedure



- ① Hold the device firmly.
- ② Unscrew the cap screws.
- ③ Lift the device from the level surface.
- ④ Remove the push-in lugs from the device.

Figure 3-2 Removing the 3UG5 monitoring relay from a level surface

3.3.6 Mounting the devices on a standard mounting rail

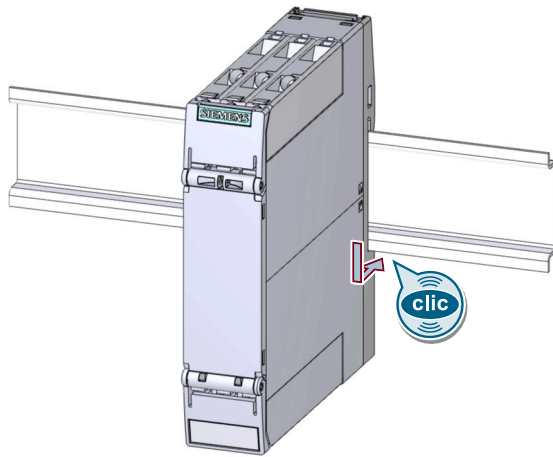
Requirements

- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.
- Please observe the information about the mounting position in chapter "Minimum clearances and mounting positions (Page 28)"

Note

Under more difficult conditions, such as intense vibrations or when mounting onto a vertical DIN rail, it is recommended that an end retainer be fitted at the beginning and the end of the device assembly respectively. The 8WA1808 end retainers, for example, can be used for this.


Procedure



- ① Place the back of the device onto the upper edge of the standard mounting rail.
- ② Press the lower half of the device against the standard mounting rail until the device engages.

Figure 3-3 Mounting of the 3UG5 monitoring relay on a DIN rail

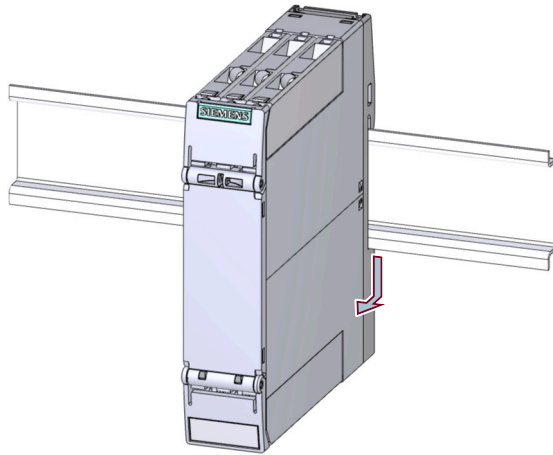
3.3.7 Disassembling devices from a standard mounting rail

 DANGER
Hazardous voltage. Can cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

Requirements

- The terminals have been removed (Removing the terminals (Page 44)) or disconnected (Disconnecting the screw-type terminals (Page 37)) and (Disconnecting the spring-loaded terminal (push-in terminal) (Page 40)).

Procedure



- ① Press the device downwards.
- ② Pull the lower half of the device away from the DIN rail.
- ③ Lift the device from the upper edge of the DIN rail.

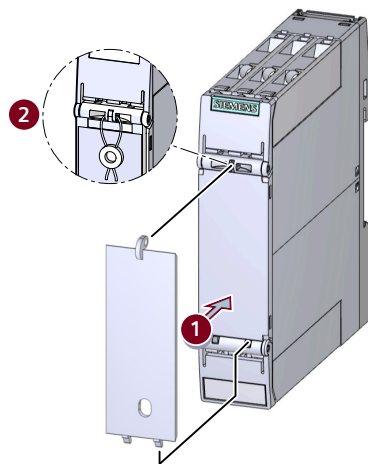
Figure 3-4 Removal of the 3UG5 monitoring relay from a DIN rail

3.3.8 Mounting the sealable cover

There is a uniform sealing cover 3ZY1321-2AA00 for the 3UG5 analog monitoring relay.

The sealable cover 3ZY1321-2AA00 is used to secure the actuators (rotary buttons) of the monitoring relays against unauthorized or unintentional manipulation.

Mounting the sealing cover



- ① Attach the hooks on the cover to the openings on the device and fold the cover up.
- ② Seal the cover to secure it against unauthorized removal.
Sealing wire diameter, max.: 2 mm

3.4 Connecting

3.4.1 Warning notice

⚠ DANGER

Hazardous voltage.
Will cause death, serious injury, or property damage.

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

- Turn off and lock out all power supplying the system and device before working on the device.
- To ensure protection against the hazard of electric shock and the degree of protection IP20 when the terminal cover is open, screw in all terminal screws that are not needed to clamp conductors.
- Close the terminal covers and always keep them closed during operation.

3.4.2 Location of the connections

Location of the connections

The inside faces of the terminal covers are labeled with the designations of the relevant terminals. The position of the label corresponds to the position of the respective terminal.

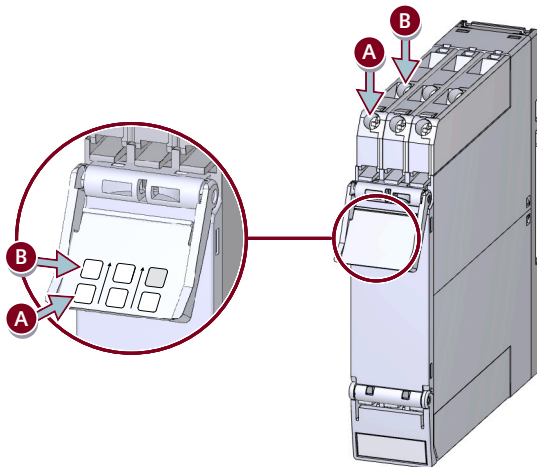


Figure 3-5 Upper terminal cover

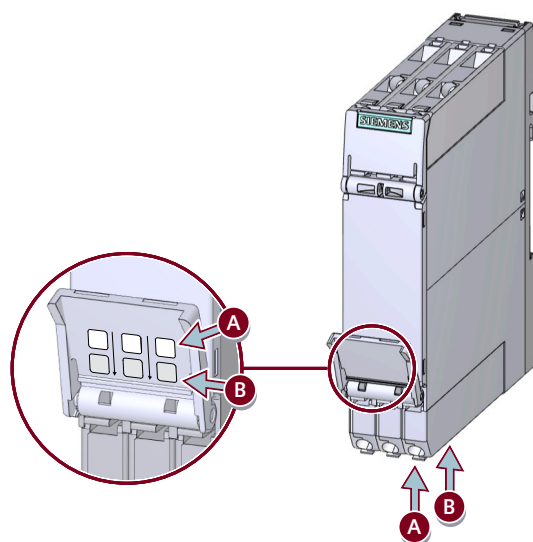


Figure 3-6 Lower terminal cover

Note**Terminal cover/article number**

The complete article number is engraved on each terminal cover (upper and lower) by laser. The article numbers permit correct assignment of the terminal cover to the unit if you have removed the terminal cover.

You can obtain replacement terminal covers from Siemens Support.

You can use the terminal labels for modules with screw terminals and spring-type terminals.

Parts of the article numbers that are not necessary for assignment to the terminal functions are represented by periods as placeholders.

NOTICE**Danger of material damage**

When using the terminals, observe the correct position of the terminals (see inside of cover).

See also

Operator controls and connection terminals (Page 59)

3.4.3 Connection systems

Screw-type connection

Use the following tool to establish the connection: The SIRIUS 3UG5 monitoring relays feature size PZ 1 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.

Spring-loaded connection technology

Spring-loaded terminals for fast, vibration-proof wiring without the need for tools and with cable routing and terminal operation from the same direction.

3.4.4 Connection tools

Tool for screw-type connection

The following tool can be used for the screw-type connection:
cross-tip screwdriver size PZ 1 x 80 (Ø 4.5 mm)

Tool for the spring-loaded terminal (Push-In)

The spring-loaded connection technology (push-in terminal) system allows wiring without tools for rigid conductors or for flexible conductors equipped with end sleeves.

For wiring rigid or flexible conductors without end sleeves onto spring-loaded connections (push-in terminals), a screwdriver is required to open the spring terminal.
DIN 5264 screwdriver, size 0.5 x 3 mm (for flexible conductors only)
(Article number of the screwdriver: 3RA2908-1A)

3.4.5 Connecting the screw-type terminals

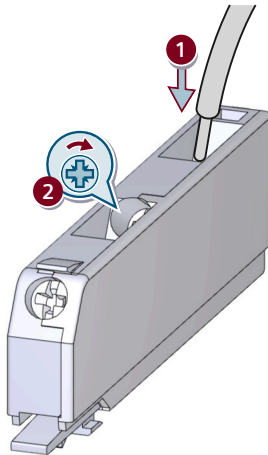


 DANGER
Hazardous voltage. Can cause death or serious injury.
Turn off and lock out all power supplying this device before working on this device.

Requirements


- Cross-tip screwdriver size PZ 1 x 80 (Ø 4.5 mm)
- Suitable conductor cross-sections are listed in Chapter "Connection data for terminals (Page 45)".

Procedure



- ① Insert the relevant cable into square on the screw terminal until it engages.
- ② Hold the cable in the screw terminal. Tighten the screw with a torque of 0.6 ... 0.8 Nm. Pull on the cable to ensure it is screwed tight.

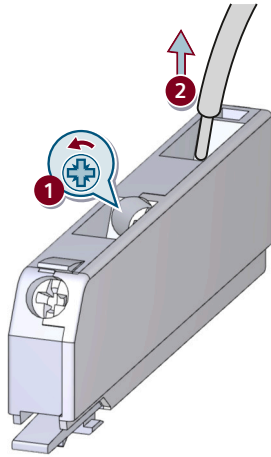
3.4.6 Disconnecting the screw-type terminals

 DANGER
Hazardous voltage. Can cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

Requirements

- Cross-tip screwdriver size PZ 1 x 80 (Ø 4.5 mm)

Procedure

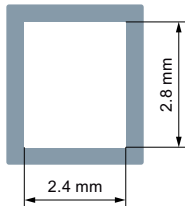


- ① Unscrew the screw of the screw-type terminal.
- ② Remove the cable from the unscrewed screw-type terminal.

3.4.7 Wiring rules for spring-type terminals (with push-in technology)

Notes on handling spring-type terminals with push-in technology

The terminal space for the spring-type terminals is rectangular. The maximum overall dimensions of the conductor to be wired must not exceed 2.4 x 2.8 mm.



Take note of the orientation of the terminal space, which may require vertical fitting of rectangular-crimped conductors.

To make optimum use of available terminal space, you are advised to choose a form of crimping that creates a corresponding rectangular contour. Trapezoidal crimping is highly suitable in this case.

When a conductor is used that utilizes the full overall height, the terminal spring is deflected to the maximum. It may therefore be difficult to remove this conductor because it requires further deflection of the spring.

3.4.8 Connecting the spring-loaded terminal (push-in terminal)

⚠ DANGER
Hazardous voltage.
Can cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

The spring-loaded connection technology (push-in terminal) system allows wiring without tools for rigid conductors or for flexible conductors equipped with end sleeves.

For wiring rigid or flexible conductors without end sleeves onto spring-loaded connections (push-in terminals), a screwdriver is required to open the spring terminal.

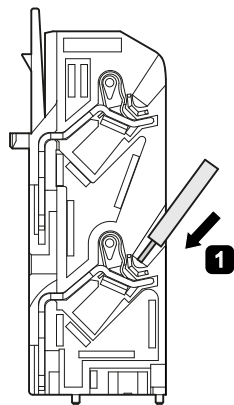
Tool

DIN 5264 screwdriver, size 0.5 x 3 mm (for flexible conductors only) (Article number of the screwdriver: 3RA2908-1A)

Requirements

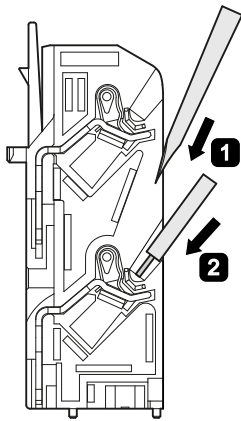
Suitable conductor cross-sections are listed in Chapter "Connection data for terminals (Page 45)".

Connecting spring-loaded terminal



- ① Insert the cable into the oval opening as far as it will go.
- ② Pull on the cable to ensure it is tight.


Figure 3-7 Rigid cables or cables equipped with end sleeves



- ① Insert the screwdriver in the rectangular opening to open the terminal spring (oval opening).
- ② Insert the cable as far as it will go into the oval opening and remove the screwdriver.
- ③ Pull on the cable to ensure it is tight.

Figure 3-8 Finely stranded cables without end sleeve

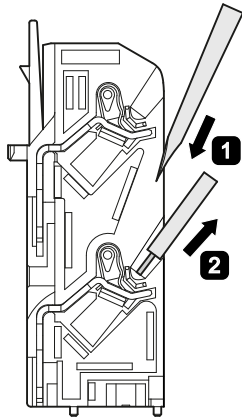
3.4.9 Disconnecting the spring-loaded terminal (push-in terminal)

 DANGER
Hazardous voltage. Can cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

Tool

DIN 5264 screwdriver with size 0.5 x 3 mm (part number of the screwdriver: 3RA2908-1A)

Disconnecting spring-loaded terminal



- ① Insert the screwdriver into the rectangular opening of the spring-type terminal until it engages.
- ② Remove the cable from the oval opening.
- ③ Remove the screwdriver.

3.4.10 Connection options for IO-Link

The IO-Link device is connected to the IO-Link master via the removable terminal and supplied with 24 V DC via this connection.

! DANGER

**Hazardous voltage.
Can cause death or serious injury.**

Turn off and lock out all power supplying the system and device before working on the device.

! WARNING

**Hazardous voltage.
Can cause death, serious injury, or property damage.**

If voltages are too high, the IO-Link device can be damaged and electric shock can result.

Use only power supplies that comply with the requirements of protective extra-low voltage (PELV).

Note

Power supply unit

The power supply unit for the voltage must comply with the standard ES1 (IEC 62368-1) or PELV (Protective Extra Low Voltage) / SELV (Safety Extra Low Voltage).

There are 2 ways of powering the monitoring relays via the control circuit.

Option 1: Connection to IO-Link master

Connect the IO-Link device with the master via the three cables L+, C / Q and L-. The IO-Link device is powered via the 2 cables L+ and L-. The monitoring relay communicates with the master via cable C / Q.

Note

Since IO-Link does not have integrated security mechanisms, access to the IO-Link line by third parties must be restricted.

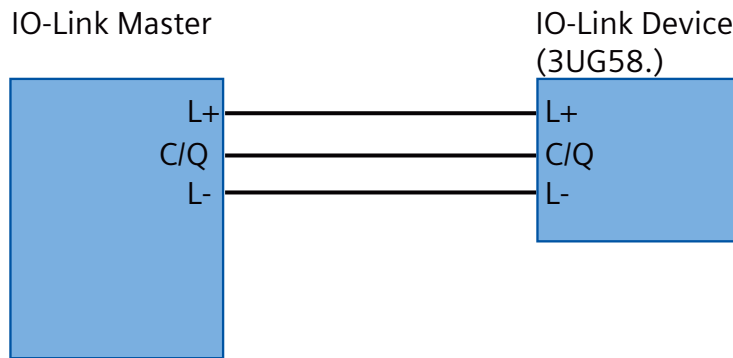


Figure 3-9 Connection to IO-Link master

Option 2: Direct voltage supply with 24 V DC

If no master is available, you can operate the IO-Link device with a 24 V DC voltage source.

For this purpose, connect the IO-Link device with the voltage source via the two cables L+ and L-. Because cable C / Q is not used in this case, communication via IO-Link is not possible.

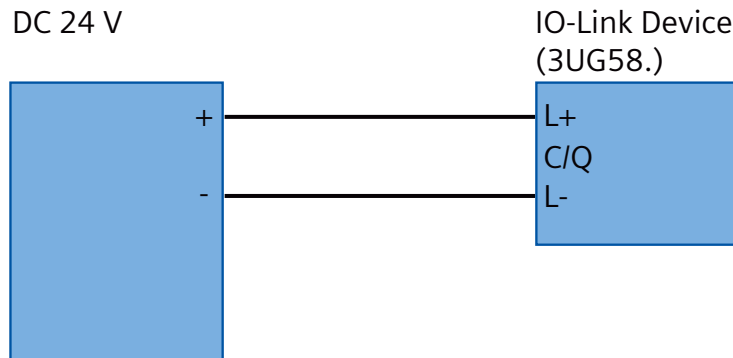


Figure 3-10 Direct voltage supply with 24 V DC

The pin assignments of the available IO-Link devices are described in the relevant product chapters.

3.4.11 Attaching the terminals

⚠ DANGER

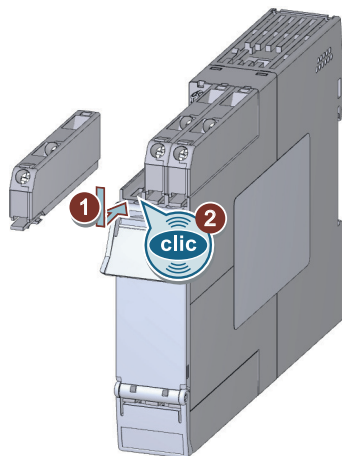
**Hazardous voltage.
Can cause death or serious injury.**

Turn off and lock out all power supplying the system and device before working on the device.

Requirements

- You must have removed the terminals, for the purpose of replacing a device, for example.

Procedure



- ① Insert the terminal into the guide rail of the device.
- ② Slide the terminal back until it audibly engages.

Note

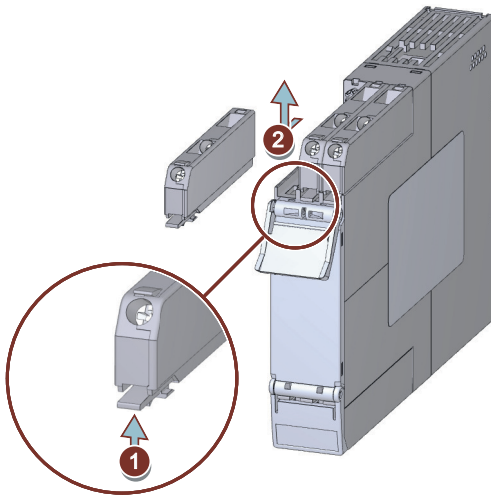
Screw terminals / Push-in terminals

Screw terminals and push-in terminals are removed from the module on the same principle.

3.4.12 Removing the terminals

! DANGER
Hazardous voltage.
Can cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

Procedure



- ① Press the clip of the terminal block upwards.
- ② Pull the terminal out to the front.
- ③ Lift the terminal out of the guide rail of the device.

Note

Screw terminals / Push-in terminals

Screw terminals and push-in terminals are removed from the module on the same principle.

3.4.13 Terminal coding

! DANGER
Hazardous voltage.
Can cause death or serious injury.
Turn off and lock out all power supplying the system and device before working on the device.

Terminal coding

You can provide the terminals with coding pins (3ZY1440-1AA00). These help you to avoid errors when replacing the terminals.

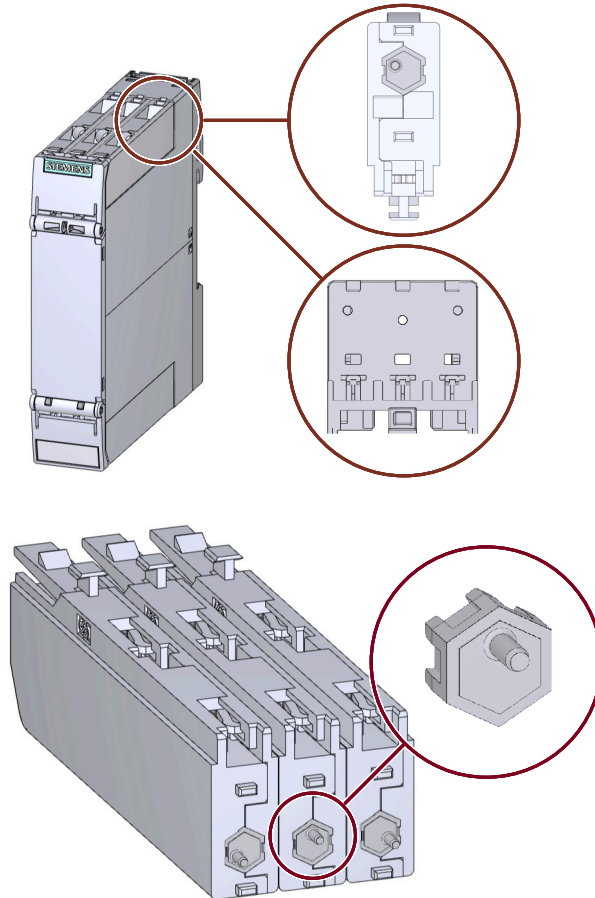



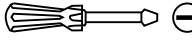
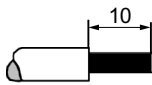
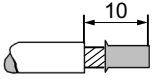
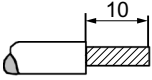


Figure 3-11 Terminal coding

3.4.14 Connection data for terminals

		
	 <p>PZ 1 x 80 (Ø 4.5 mm) 0.6 ... 0.8 Nm (5.2 to 7.0 lb.in)</p>	 <p>3RA2908-1A DIN 5264 / 0.5 x 3 mm</p>
Rigid cable 	1 x (0.5 ... 4.0) mm ² 2 x (0.5 ... 2.5) mm ²	1 x (0.5 ... 4.0) mm ²

3.5 Overview of the functions

Flexible conductor with end sleeve 	1 x (0.5 ... 4.0) mm ² 2 x (0.5 ... 1.5) mm ² ¹⁾	1 x (0.5 ... 2.5) mm ² 2 x (0.5 ... 1.5) mm ² in shared ferrule ¹⁾
Flexible cable 	-	1 x (0.5 ... 4.0) mm ²
AWG	1 x 20 to 12 2 x 20 to 14	1 x 20 to 12

1) When 2 x 1.0 mm² ferrules with a plastic sleeve are used, there may not be enough space for the sleeves; as an alternative, you are advised to use wire end ferrules without plastic sleeves.

3.5 Overview of the functions

3.5.1 Overview of the functions of the 3UG5 monitoring relay.

Table 3-1 Functions of the 3UG55 / 3UG56 monitoring relays for analog and digital setting

Function	Monitoring relays						
	3UG55				3UG56		
	11	12	12 (safety function)	14	16	18	18 (safety function)
Line monitoring and voltage monitoring							
Monitoring for phase sequence	✓	✓	✓ (SIL 1 / PL c)	✓	✓	✓	✓ (SIL 1 / PL c)
Monitoring for phase failure	○ ¹⁾	✓	✓ (SIL 1 / PL c)	✓	✓	✓	✓ (SIL 1 / PL c)
Monitoring for asymmetry	—	10%	10%	✓	✓	✓	✓
Monitoring for undervoltage	—	—	—	3p	3p	3p	3p
Monitoring for overvoltage	—	—	—	—	3p	3p	3p
Monitoring the frequency	—	—	—	—	✓	✓	✓
Monitoring for N-conductor failure	—	—	—	—	✓	✓	✓
Automatic direction of rotation correction in the case of incorrect phase sequence	—	—	—	—	—	✓	✓
Rated control supply voltage							

Function	Monitoring relays						
	3UG55				3UG56		
	11	12	12 (safety function)	14	16	18	18 (safety function)
Self-powered, without auxiliary voltage	✓	✓	✓	✓	✓	✓	✓
Externally powered, with auxiliary voltage	—	—	—	—	—	—	—

✓: Function available

3p: Monitoring is 3-phase

—: Function not available

o: Function available with limitations

¹⁾ Detection causes problems with regenerative power recovery.

3.5.2 Overview of the functions of the 3UG5 monitoring relay for IO-Link

Table 3-2 Functions of the 3UG58 monitoring relay for IO-Link

Function	Monitoring relays
	3UG58
	16
Line monitoring and voltage monitoring	
Monitoring for phase sequence	✓
Monitoring for phase failure	✓
Monitoring for asymmetry	✓
Monitoring for undervoltage	3p
Monitoring for overvoltage	3p
Monitoring for N-conductor failure	✓
Monitoring the frequency	✓
Supply voltage	
External power supply (via the IO-Link master or an external 24 V DC voltage source)	✓

✓: Function available

3p: Monitoring is 3-phase

3.5.3 True root mean square measurement (tRMS)

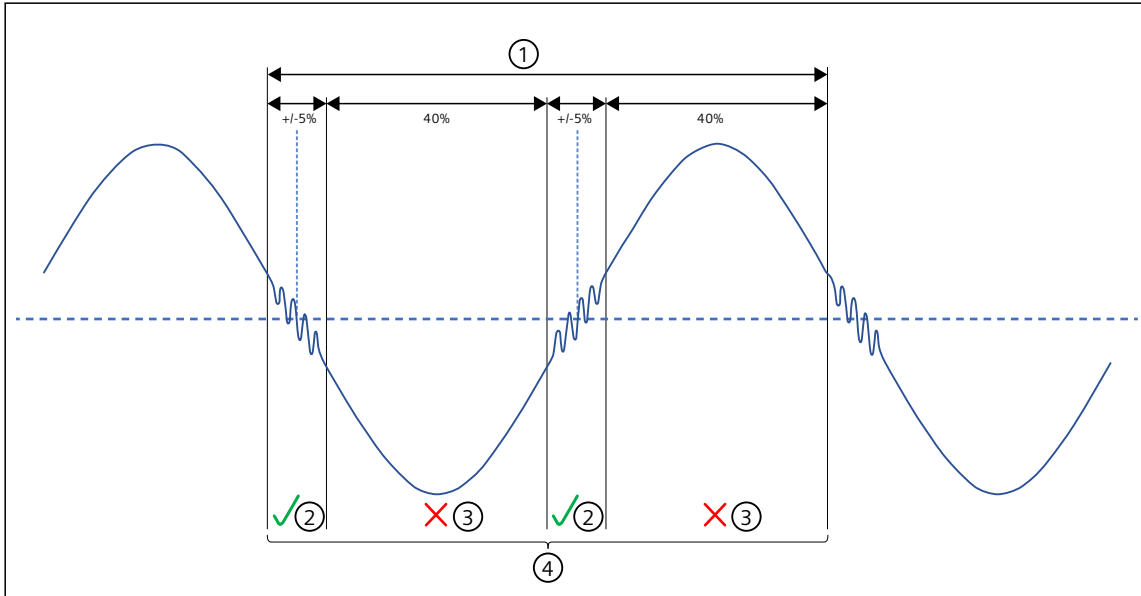
True root mean square measurement (tRMS) / use with frequency converters:

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

3.5 Overview of the functions

The measured signal must only meet the following requirements:

- Periodic waveform (sinusoidal) within the specified frequency range
- Boundary conditions for automatic zero crossing detection (factory setting: active) if there are further zero crossings in addition to those of the fundamental (see example in the figure below):



- ① Cycle duration
- ② Yes
- ③ No
- ④ Additional zero crossings permissible

If the requirements cannot be met with automatic zero crossing detection (see figure above) and the frequency of the monitored supply voltage is known, then a fixed frequency (e.g. 50 Hz) can be specified in the menu instead of automatic zero crossing detection (if available as a menu setting).

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

3.6 Menu-based operation

Operator controls

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

The two arrow keys (Up / Down) are used for menu navigation and for changing the values. Holding down the Up / Down key changes the numerical values at an accelerated rate.



Figure 3-12 Arrow keys (Up / Down)

The SET key is used for selecting and confirming a process. If the SET key is held down for more than two seconds, there is a switchover to the SET mode.



Figure 3-13 SET key (Enter)

The Back key is used in conjunction with the SET (Enter) key, for error resets.

The Back key is used in conjunction with the SET (Enter) key, for aborting an option and returning to the previous menu level. All changes remain in effect, unless they are saved or discarded when you exit the SET mode.

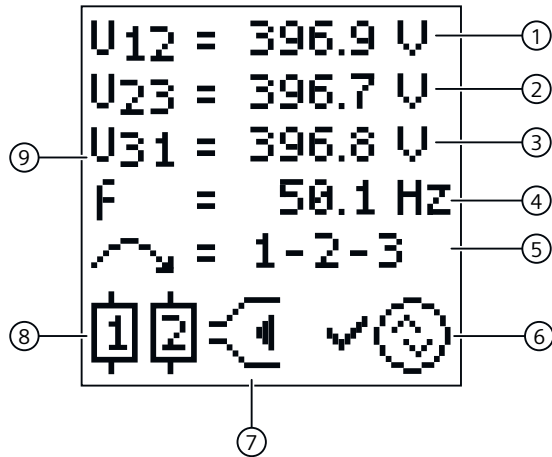


Figure 3-14 Back key

3.6.1 Menu-based operation: Indications on the display

Display information

The display of the 3UG5 monitoring relay is divided into nine different areas.



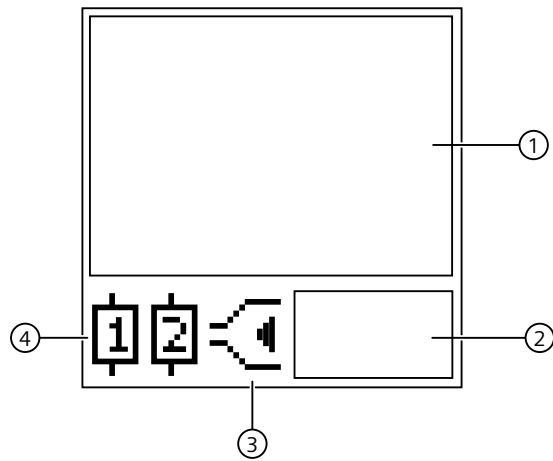
- ① Current measured value 1
- ② Current measured value 2
- ③ Current measured value 3
- ④ Current measured value of the frequency
- ⑤ Current state of the phase sequence monitoring
- ⑥ Current communication status (for line monitoring relays 3UG5816 for IO-Link only)
- ⑦ Type of monitoring
- ⑧ Symbols of the changeover contacts
- ⑨ Display area for the current measured values

Use the arrow keys to access the other sublevels of the Run menu. The current measured values are shown in the display. In addition, you can see the current state of the phase sequence monitoring and the communication status.

If all the monitored measured values are OK, the display is green. If there is a warning, the display is yellow. If there is an error message, the display is red.

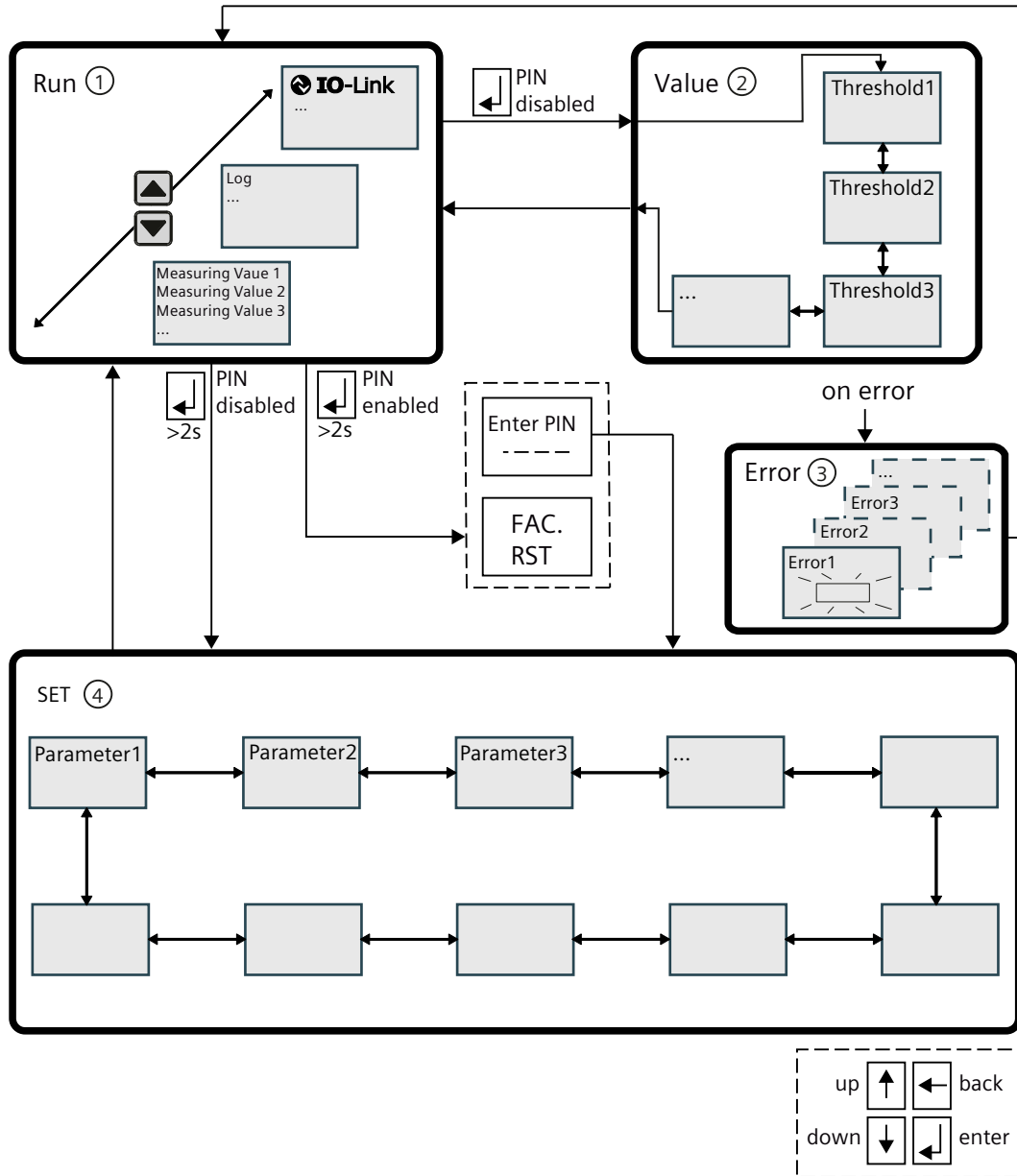
Display area for the symbols in the event of an error

The following graphic shows the different display areas if there is a warning and in the event of an error.



- ① Display area for the symbols in the event of an error
- ② Display area for warnings
- ③ Type of monitoring
- ④ Symbols of the changeover contacts

Menu-based operation



- ① RUN - OK Status display in the correct range
 - Measured value1 / Measured value2 / ...
 - Log
 - Communication status
- ② RUN - VALUE Settings of the monitored thresholds

- | | | |
|---|-------------------------|--|
| ③ | RUN - ERROR | Status display in the event of a fault
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 |

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

When first switched on, the device is automatically in the RUN menu. Depending on the type of device, the display in the RUN menu ① shows different values.

Use the Up key / Down key to switch between the current measured values, log values and the communication status.

Pressing the SET key takes you to the Value ② menu level with preset default values. When password protection is activated, you automatically enter the Value menu.

In the Value menu, parameterize the lower and / or upper (warning) limit value according to the device-specific setting ranges.

Press the SET key to confirm the set (warning) limit value. Press the Back key to return to the RUN menu level.

The device has password protection. To protect the device from an unauthorized parameter change, change the default value.

In order to access the PIN menu when password protection is activated, press the SET key for at least 2 seconds.

After entering the correct PIN you automatically gain access to the SET menu. If an incorrect PIN is entered, you are automatically returned to the RUN menu. Change the selected digit using the Up / Down keys. Confirm the selected digit by pressing the SET key. You then automatically select the next digit. This operation can be repeated. The default value of the PIN is "000". The PIN can be reset by means of "Factory Reset". This option is offered as a menu item when password protection is enabled.

In order to move from the RUN menu to the SET menu when password protection is disabled, press the SET key for at least 2 seconds.

In the menu level SET ④ you set the basic device parameters, e.g. the switching behavior of the output relays, the reset behavior in the event of a fault, and/or the tripping delay times. Using the Up / Down keys, select the parameter to be selected and then press the SET key. You are automatically taken to another sub-level, where you select the desired values using the Up / Down keys. Confirm the values by pressing the SET key. To return to the previous level and adjust values at this level, press the Back key.

To return from the SET menu to the RUN menu again, there are two options:

1. Pressing and holding the SET key (the set values are accepted).
2. Pressing and holding (2 sec.) the Back key (the set values are rejected).


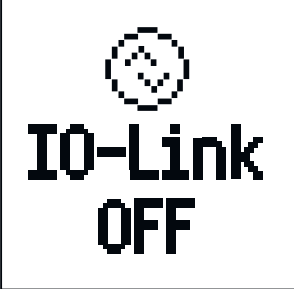

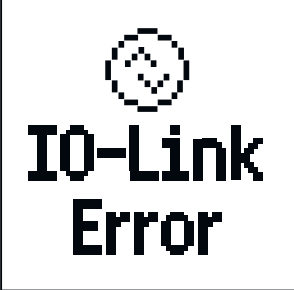
In the event of a fault, the display indicates the type of fault ③ by means of flashing symbols.

To reset the device, press the Hand RESET key once the cause of the error has been eliminated. After the key has been pressed, "Reset" appears in the display. Confirm the reset by pressing the SET key. To abort the reset, press the back key.

3.6 Menu-based operation

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

Table 3-3 Communication status

Symbol	Meaning
	<p>After switching on, the device is in standard I/O mode (SIO mode) until communication has taken place. The IO-Link master can switch the device back to standard I/O mode (SIO mode) at any time.</p>
	<p>IO-Link communication is being established¹⁾.</p>
	<p>The connected IO-Link master has switched the device to communications mode (IO-Link mode).</p>
	<p>The IO-Link communication is interrupted. The device signals a fault. The monitoring functions of the monitoring relay are still active. The IO-Link master can switch the device back to communications mode (IO-Link mode) when communication is resumed.</p>

¹⁾ If this symbol is repeated for an extended period, the connection to the IO-Link master has been interrupted during communication buildup. Perform a restart of the monitoring relay.

Information on the IO-Link communications, for example, the OK status or any occurring warning messages are shown in the display area. The Up/Down keys can be used to make an appraisal of the error that has occurred. These keys take you to the further lower levels.

The monitoring relays continue to function autonomously in spite of the IO-Link connection. Parameters can be assigned locally at the device, independently of a higher-level control. As long as the 24 VDC supply voltage is available, the monitoring relays will function if the controller fails or is not yet available. If the 3UG5 monitoring relay is used for IO-Link without a connection to a higher-level control, because of the integrated SIO-mode, the devices feature an additional semiconductor output that switches when settable warning thresholds are exceeded.

Note

If the IO-Link connection is not used, the monitoring relays work in standard I/O mode (SIO mode) and terminal C/Q is used as a semiconductor output.

If a device is in SIO mode, the semiconductor output is not shown on the display (③)!

Notes

Note**Aborting the menu switchover**

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

Note

The different setting options for the respective device types can be found in the "Operation" chapters.

Note

A return to showing the actual measured value takes place automatically 30 seconds after the last limit value change. This is only valid if there are changes in the Value menu.

Note

When you exit the SET menu level, an internal Reset is performed and the ON-delay time or stabilization time will be restarted.

3UG5.1 line monitoring relays

4.1 Product description (3UG5.1)

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
- Frequency

4.2 Application areas (3UG5.1)

Application areas

The various line monitoring relays are used, for example, in non-stationary systems such as refrigeration containers, construction site compressors, and cranes. In addition, the monitoring relays can be used for solar power plants or wind energy converters. The devices are used in the following application areas:

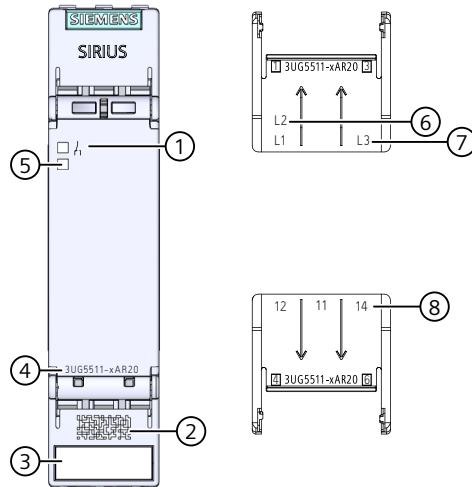
Table 4-1 Application areas of the line monitoring relays

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

4.3 3UG5511 line monitoring relays

4.3.1 Operator controls and connection terminals

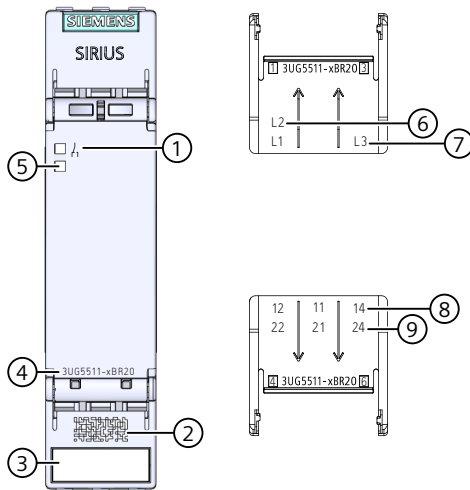
Front view / terminal labeling 3UG5511-.AR20



- ① Status display: LED contact symbol (green)
- ② Data Matrix code for unique identification of the 3UG5511-AR20 line monitoring relays
- ③ Label
- ④ Article number
- ⑤ No function
- ⑥ L2 Rated control supply voltage
- ⑦ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑧ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact

Figure 4-1 Front elements of the 3UG5511-.AR20 line monitoring relay

Front view / terminal labeling 3UG5511-.BR20



- ① Status display: LED contact symbol (green)
- ② Data Matrix code for unique identification of the 3UG5511-BR20 line monitoring relays
- ③ Label
- ④ Article number
- ⑤ No function
- ⑥ L2 Rated control supply voltage
- ⑦ L1: Rated control supply voltage
- L3 Rated control supply voltage
- ⑧ 12 Output relay K1 CO contact NC contact
- 11 Output relay K1 CO contact root
- 14 Output relay K1 CO contact NO contact
- ⑨ 22 Output relay K2 CO contact NC contact
- 21 Output relay K2 CO contact root
- 24 Output relay K2 CO contact NO contact

Figure 4-2 Front elements of the 3UG5511-BR20 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 62)".

4.3.2 Function

General functionality

The 3UG5511 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. The line monitoring relays are powered with a rated control supply voltage of 200 - 690 VAC ph-ph through terminals L1 / L2 / L3.

All 3UG5511 line monitoring relays feature at least one output relay (output relay K1 CO contact). The 3UG5511-.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.

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. When the power supply 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 3UG5511 line monitoring relays are not protected against reverse voltage, such a phase failure is not reliably detected.

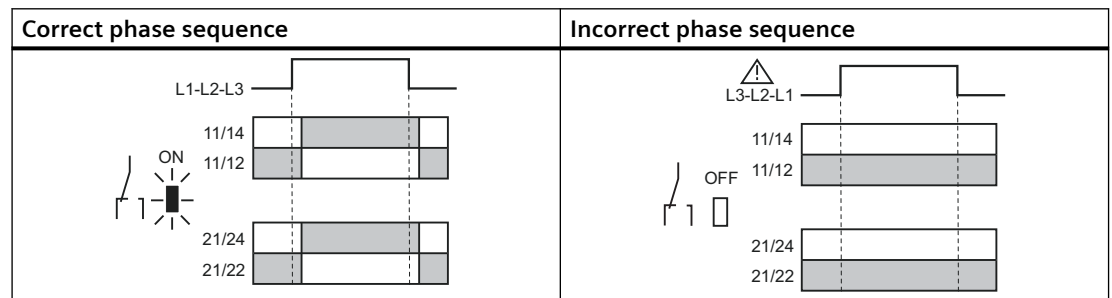
If this type of monitoring is required, the 3UG5512 line monitoring relay should be used, for example.

You will find the switching states of the output relays in the section "Function diagrams" in the chapter "Function (Page 60)."

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.



3UG5511 function diagrams



4.3.3 Diagnostics

Status display

The following information about the operating state is displayed on the 3UG5511 line monitoring relays:

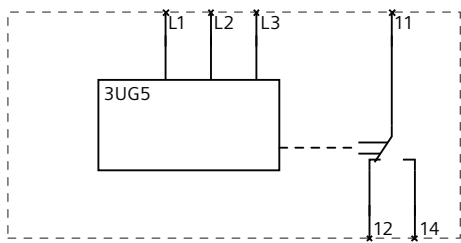
Operating status	LED contact symbol (green)	State of the output re- lays
		12/ 11/ 14 22/ 21/ 24
Correct phase sequence	On	
Incorrect phase sequence	Off	

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 60)".

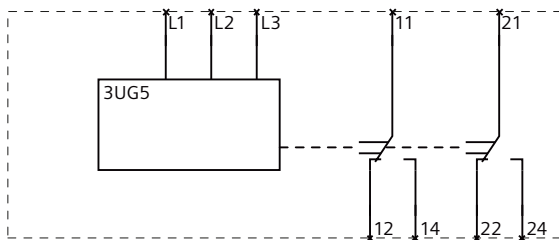
4.3.4 Circuit diagrams

Internal circuit diagrams 3UG5511

3UG5511-.A.. line monitoring relays



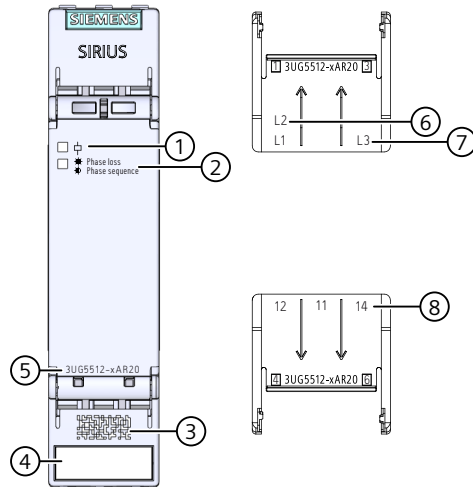
3UG5511-.B.. line monitoring relays



4.4 3UG5512 line monitoring relays

4.4.1 Operator controls and connection terminals

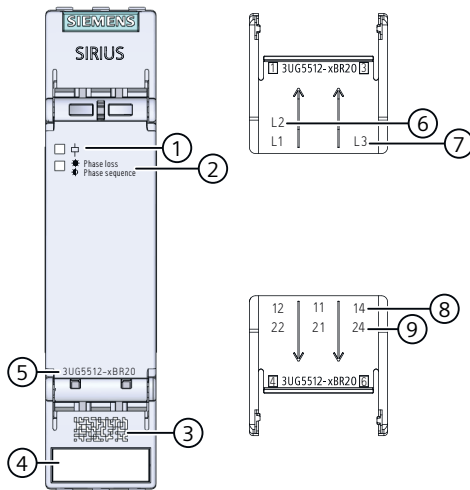
Front view / terminal labeling 3UG5512-.AR20



- ① Status display: LED coil symbol (green)
- ② Status display: LED phase failure / phase sequence (red)
- ③ Data Matrix code for unique identification of the 3UG5512-AR20 line monitoring relays
- ④ Label
- ⑤ Article number
- ⑥ L2 Rated control supply voltage
- ⑦ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑧ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact

Figure 4-3 Front elements of the 3UG5512-.AR20 line monitoring relay

Front view / terminal labeling 3UG5512-.BR20



- ① Status display: LED coil symbol (green)
- ② Status display: LED phase failure / phase sequence (red)
- ③ Data Matrix code for unique identification of the 3UG5512-BR20 line monitoring relays
- ④ Label
- ⑤ Article number
- ⑥ L2 Rated control supply voltage
- ⑦ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑧ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑨ 22 Output relay K2 CO contact NC contact
21 Output relay K2 CO contact root
24 Output relay K2 CO contact NO contact

Figure 4-4 Front elements of the 3UG5512-.BR20 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 67)".

4.4.2 Function

General functionality

The 3UG5512 line monitoring relays monitor the **phase sequence** and the **phase failure** as well as the **asymmetry** of one of the three phases in a three-phase system. The asymmetry threshold is 10%. The hysteresis amounts to 2%.

The devices are **self-powered** (measuring voltage = rated control supply voltage) and work on the closed-circuit principle. The 3UG5512 line monitoring relays monitor all phases of three-phase AC networks from 200 to 690 V through terminals L1 / L2 / L3 and also draw power from all three phases simultaneously.

All 3UG5512 line monitoring relays feature at least one output relay (output relay K1-CO contact). The 3UG5512-.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.

Monitoring

Thanks to a special measuring method, a phase failure is detected with certainty despite the wide voltage range from 200 to 690 V AC and reverse power of up to 90 % from the load even with 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 relay in the section "Function diagrams" in the chapter "Function (Page 64)."

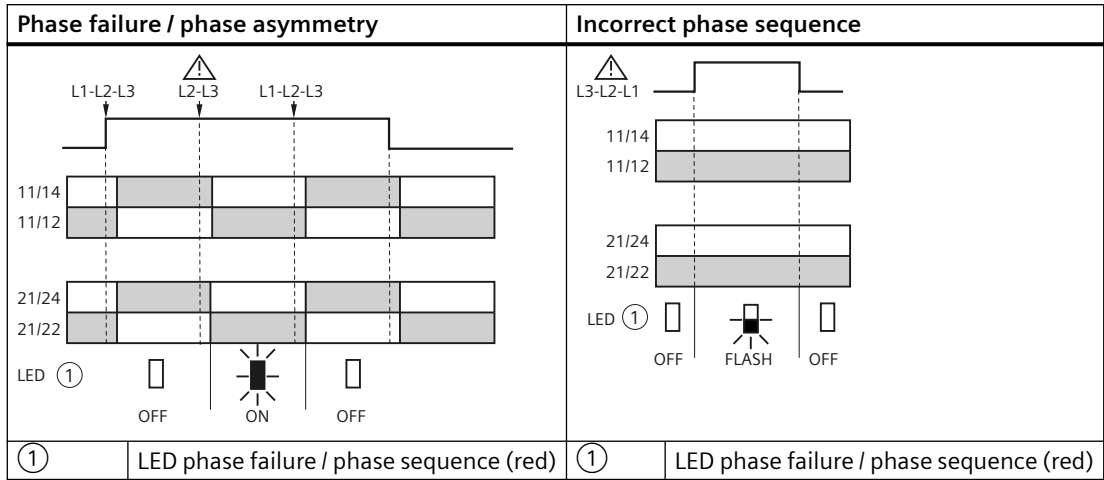
Reset response

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!

3UG5512 function diagrams



4.4.3 Diagnostics

Status display

The following information about the operating state is displayed on the 3UG5512 line monitoring relays:

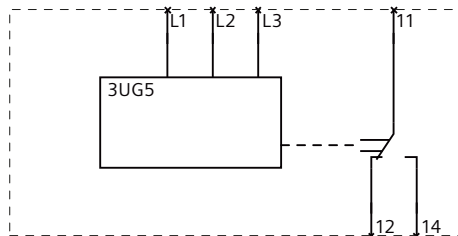
Operating status	LED		State of the output relays
	Coil symbol (green)	Phase failure / phase sequence (red)	
<ul style="list-style-type: none"> Supply voltage not present 	Off	Off	
<ul style="list-style-type: none"> Supply voltage present Correct phase sequence All phases available 	On	Off	
<ul style="list-style-type: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

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 64)".

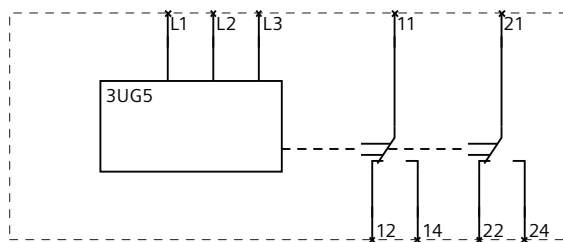
4.4.4 Circuit diagrams

Internal circuit diagrams 3UG5512

3UG5512-.A.. line monitoring relays



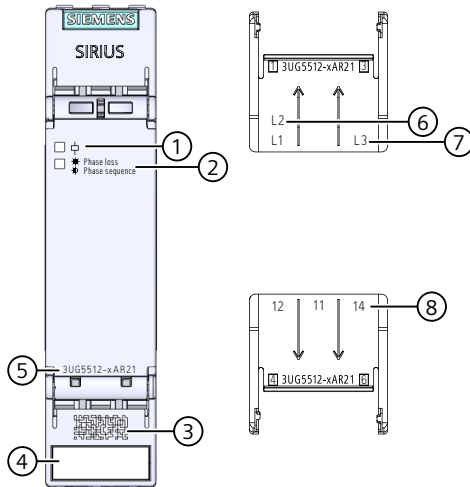
3UG5512-.B.. line monitoring relays



4.5 3UG5512-..R21 line monitoring relays with safety function

4.5.1 Operator controls and connection terminals

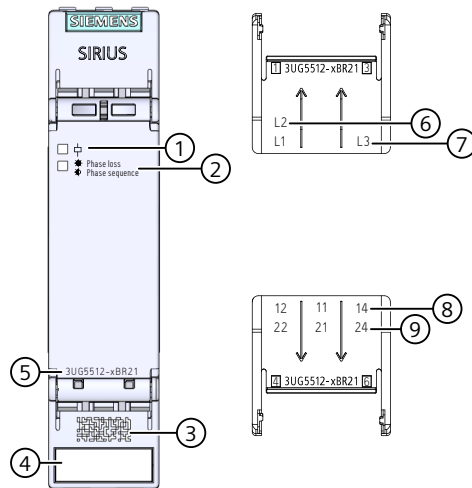
Front view / terminal labeling 3UG5512-.AR21



- ① Status display: LED coil symbol (green)
- ② Status display: LED phase failure / phase sequence (red)
- ③ Data Matrix code for unique identification of the 3UG5512-AR21 line monitoring relays
- ④ Label
- ⑤ Article number
- ⑥ L2 Rated control supply voltage
- ⑦ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑧ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact

Figure 4-5 Front elements of the 3UG5512-.AR21 line monitoring relay

Front view / terminal labeling 3UG5512-.BR21



- ① Status display: LED coil symbol (green)
- ② Status display: LED phase failure / phase sequence (red)
- ③ Data Matrix code for unique identification of the 3UG5512-BR21 line monitoring relays
- ④ Label
- ⑤ Article number
- ⑥ L2 Rated control supply voltage
- ⑦ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑧ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑨ 22 Output relay K2 CO contact NC contact
21 Output relay K2 CO contact root
24 Output relay K2 CO contact NO contact

Figure 4-6 Front elements of the 3UG5512-.BR21 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 72)".

4.5.2 Function

General functionality

The 3UG5512 line monitoring relays monitor the **phase sequence** and the **phase failure** as well as the **asymmetry** of one of the three phases in a three-phase system. The asymmetry threshold is 10%. The hysteresis amounts to 2%.

4.5 3UG5512-..R21 line monitoring relays with safety function

The devices are **self-powered** (measuring voltage = rated control supply voltage) and work on the closed-circuit principle. The 3UG5512 line monitoring relays monitor all phases of three-phase AC networks from 200 to 690 V through terminals L1 / L2 / L3 and also draw power from all three phases simultaneously.

All 3UG5512 line monitoring relays feature at least one output relay (output relay K1-CO contact). The 3UG5512-.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.

Monitoring

Thanks to a special measuring method, a phase failure is detected with certainty despite the wide voltage range from 200 to 690 V AC and reverse power of up to 90 % from the load even with 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 in the section "Function diagrams" in the chapter "Function (Page 69)."

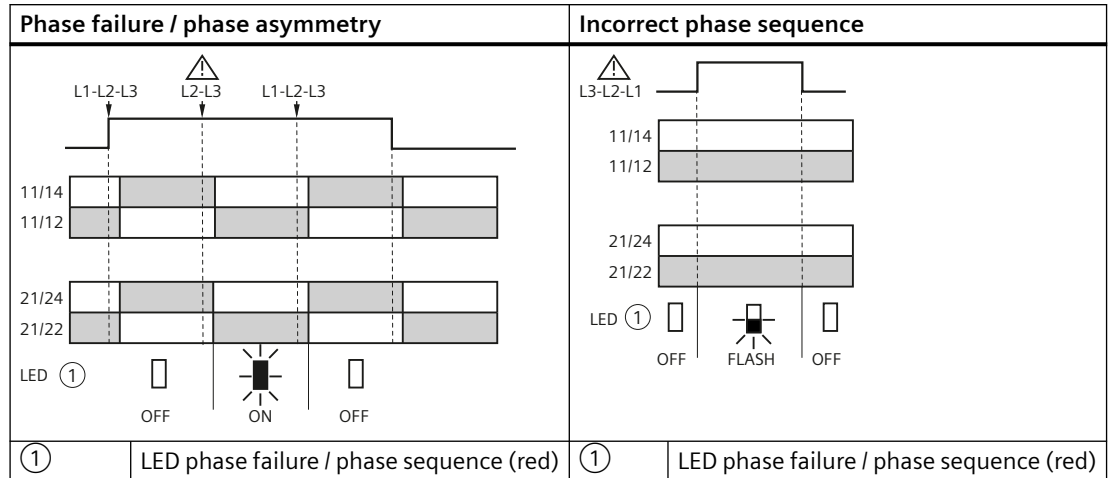
Reset response

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!

3UG5512 function diagrams



Safety function

A phase failure and / or phase sequence error is indicated on a status LED. At the same time, the integrated safety relay output switches the system to a safe operating state.

The safety function of the analog device conforms to:


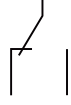
- SIL 1 (IEC 62061)
- PL c (EN ISO 13849-1)

4.5.3 Diagnostics

Status display

The following information about the operating state is displayed on the 3UG5512 line monitoring relays:

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

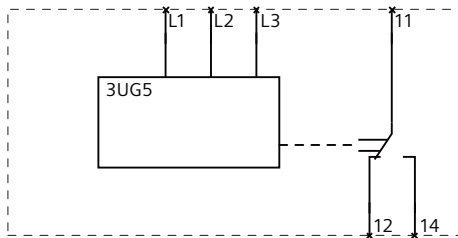
Operating status	LED		State of the output relays
	Coil symbol (green)	Phase failure / phase sequence (red)	12/ 11/ 14 22/ 21/ 24
<ul style="list-style-type: none"> Supply voltage present Incorrect phase sequence 	On	flashing	
<ul style="list-style-type: none"> Supply voltage present Phase failure 	On	On	

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 69)".

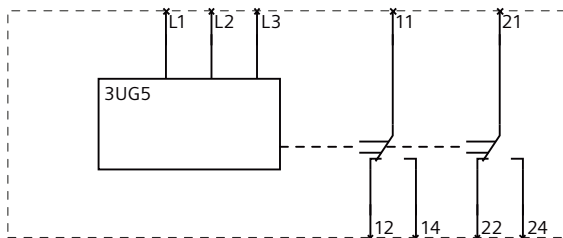
4.5.4 Circuit diagrams

Internal circuit diagrams 3UG5512

3UG5512-.A.. line monitoring relays



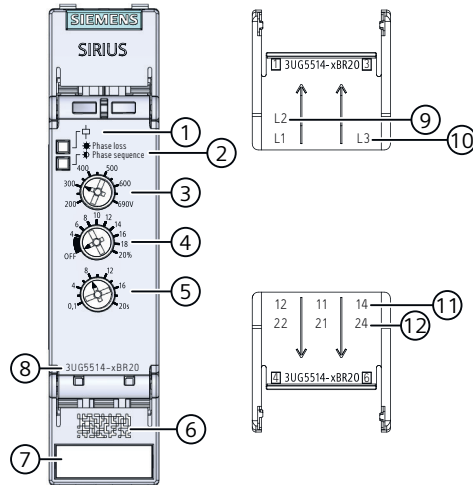
3UG5512-.B.. line monitoring relays



4.6 3UG5514 line monitoring relays

4.6.1 Operator controls and connection terminals

Front view / terminal labeling 3UG5514-.BR20



- ① Status display: LED coil symbol (green)
- ② Status display: LED phase failure / phase sequence (red)
- ③ Rotary button for setting the nominal line voltage (3- U_n)
- ④ Rotary button for setting the voltage asymmetry
- ⑤ Rotary button for setting the tripping delay (Delay)
- ⑥ Data Matrix code for unique identification of the 3UG5514-BR20 line monitoring relays
- ⑦ Label
- ⑧ Article number
- ⑨ L2 Rated control supply voltage
- ⑩ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑪ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑫ 22 Output relay K2 CO contact NC contact
21 Output relay K2 CO contact root
24 Output relay K2 CO contact NO contact

Figure 4-7 Front elements of the 3UG5514-.BR20 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

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

4.6.2 Function

General functionality

The 3UG5514 line monitoring relays monitor for **phase sequence**, **phase failure** of one of the three phases, as well as the **asymmetry** of one of the three phases and the **undershooting** of at least one line-to-line voltage of the set rated 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 3UG5514 line monitoring relays monitor all phases of three-phase AC networks with a nominal voltage of 200 to 690 V through terminals L1 / L2 / L3 and also draw power from all three phases simultaneously.

The 3UG5514 line monitoring relays have three rotary knobs for setting the nominal line voltage ($3 \sim U_n$), for setting the voltage asymmetry and for setting the tripping delay time (Delay).

The hysteresis is 5 % of the set value of the nominal line voltage. When there is an asymmetry error, the hysteresis amounts to 2%.

The 3UG5514 line monitoring relays feature 2 output relays (output relay K1 and output relay K2). The relays work synchronously.

Tripping delay

The set tripping delay time starts if the measured value overshoots or undershoots the set threshold value (Delay). After this time has expired, the output relays change the switching status.

The following behavior occurs:

1. If the tripping time has not yet elapsed and the measuring value is at the set limit and hysteresis, the switching status of the output relay does not change.
2. If the tripping time has not yet elapsed and the measuring value at the set limit is below the hysteresis, the output relay changes the switching status.

The tripping delay time is reset if the measuring value does not violate the limit value and in addition has gone out of the hysteresis range.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Circuit diagrams (Page 78)".

Monitoring

The output relays respond in accordance with the closed-circuit principle NC if the following conditions are met:

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

If the phase sequence is incorrect, the "phase failure / phase sequence" LED flashes red and the output relays remain in their quiescent position. The set delay time has no effect on the phase sequence monitoring.

If there is a phase failure, the "phase failure / phase sequence" LED lights up red continuously and the output relays are immediately switched off. The set delay time has no effect on the phase failure monitoring.

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 rated line voltage set on the front of the device, the output relays will drop out and the "phase failure / phase sequence" LED will light up red continuously after the tripping delay time set on the front has elapsed (Delay).

If the three monitored line-to-line voltages differ from the percent value of the voltage asymmetry set on the front panel, the output relays drop and the "Phase failure/Phase sequence" LED glows red continuously, after the tripping delay time (delay) that has been set on the front panel has elapsed.

Thanks to a special measuring method, a phase failure is detected with certainty despite the wide voltage range from 200 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 "Circuit diagrams (Page 92)".

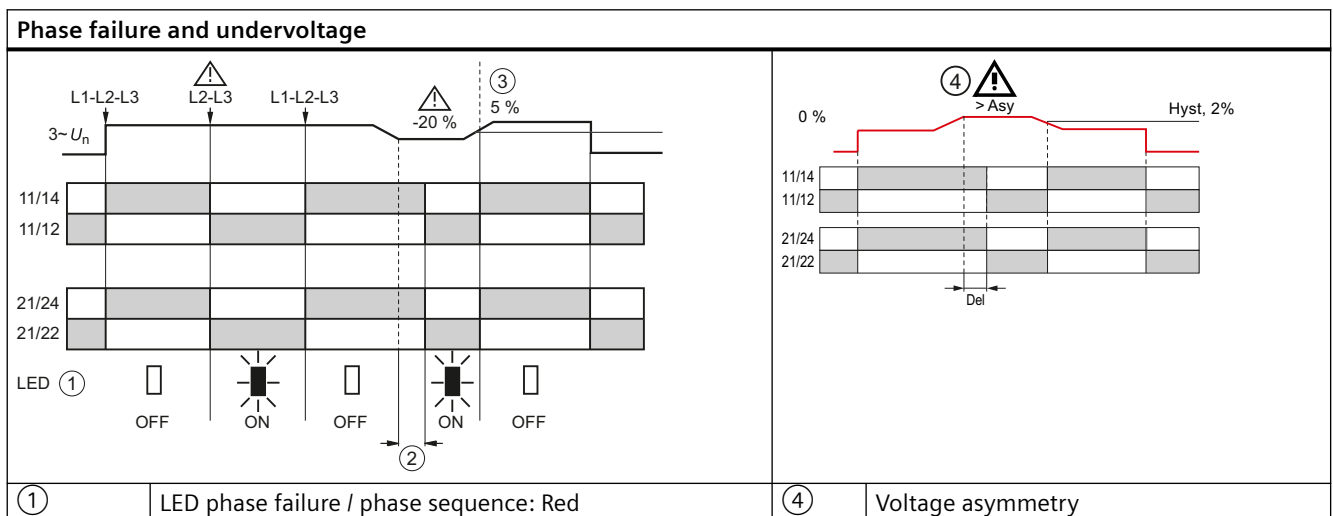
Reset response

The device features an Auto Reset function. The Auto Reset function resets the output relay to its 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!

3UG5514 function diagrams



Phase failure and undervoltage	
②	Tripping delay time
③	Hysteresis

Incorrect phase sequence

① LED phase failure / phase sequence: Red

4.6.3 Operation and parameterization

Parameters

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

Table 4-2 Parameter information, 3UG5514 line monitoring relay

Parameters	Control element ¹⁾	Setting range		Increment
		Minimum value	Maximum value	
Tripping delay time (Delay)	5	0.1 s	20 s	Continuous
Nominal line voltage (3~U _n)	3	200 V	690 V	Continuous
Threshold for voltage asymmetry	4	All < 5% corresponds to "OFF"	20%	Continuous

¹⁾ The position digits refer to the front view in the Chapter "Operator controls and connection terminals (Page 73)."

The parameters are described in the Chapter "Parameters (Page 147)".

The asymmetry is adjustable.


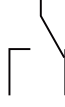
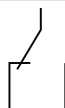

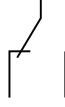

Required tools

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

4.6.4 Diagnostics

Status display

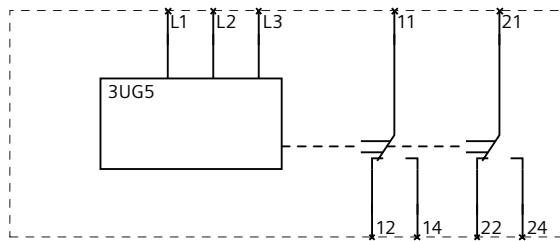
The following information about the operating state is displayed on the 3UG5514 line monitoring relays:

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

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 74)".

4.6.5 Circuit diagrams

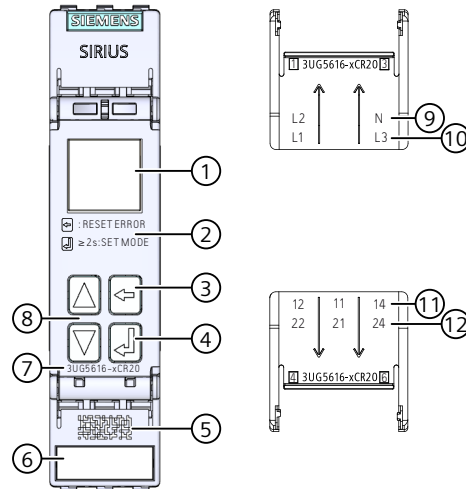
Internal circuit diagrams for 3UG5514 line monitoring relays



4.7 3UG5616 line monitoring relays

4.7.1 Operator controls and connection terminals

Front view / terminal labeling 3UG5616-.CR20



- ① Display for parameterization, actual-value indication, and diagnostics
- ② Legend for menu
- ③ Back key for menu navigation
- ④ SET key for menu navigation
- ⑤ Data Matrix code for unique identification of the 3UG5616-.CR20 line monitoring relays
- ⑥ Label
- ⑦ Article number
- ⑧ Arrow keys (Up / Down) for menu navigation
- ⑨ L2 Rated control supply voltage
N Neutral conductor
- ⑩ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑪ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑫ 22 Output relay K2 CO contact NC contact
21 Output relay K2 CO contact root
24 Output relay K2 CO contact NO contact

Figure 4-8 Front elements of the 3UG5616-.CR20 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

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

4.7.2 Function

General functionality

The 3UG5616 line monitoring relays monitor a three-phase system for **phase failure, undervoltage, overvoltage, phase sequence, asymmetry and frequency**.

Note

The monitoring of the N-conductor can be switched on / off via the menu.

The devices feature a wide-range voltage input and are **self-powered** (measuring voltage = rated control supply voltage). Depending on the parameterization of the N-conductor monitoring, the line monitoring relays are powered with a line-to-line voltage of 200 to 690 V (without N-conductor monitoring) or with a star voltage of 120 to 400 V (with N-conductor monitoring) via the terminals L1 / L2 / L3.

The 3UG5616 line monitoring relays feature 2 output relays (output relay K1 and output relay K2).

The 3UG5616 line monitoring relays have a display and are parameterized with four keys.

You will find the adjustment ranges and factory settings of the available parameters in Chapter "Operation and parameterization (Page 82)".

You can find a description of the individual parameters in Chapter "Parameters (Page 147)".

Monitoring

The 3UG5616 line monitoring relays have two output relays. The statuses of the output relay in the default state can be found in the function diagrams (Page 80).

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, voltage and frequency), 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. If there is an asymmetry error, a tripping time can be set.

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:

- 3UG5616: Line-to-line voltage between L1 and L2, L1 and L3, L2 and L3
- 3UG5616: Line-to-neutral voltage between L1 and N, L2 and N, L3 and N


Thanks to a special measuring method, a phase failure is reliably detected despite a wide voltage range of 200 to 690 V AC and feedback of up to 80% by the load, even in case of regenerative feedback.

If one of the phases fails (or there is an N-conductor failure on the 3UG5616 line monitoring relay), the output relays are switched off immediately to protect the application from consequential damage. Set delay times have no effect on the phase failure monitoring.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 88)".

Note

The following function diagram applies only to the default setting of relays K1 / K2 (Expert Mode). If the setting of the relays is adjusted, they switch accordingly.

Error case	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
		
Phase failure		
Voltage under-shoot		
Voltage overshoot		

Error case	Memory = no Relay switching behavior = NC (closed-circuit principle)	Memory = no Relay switching behavior = NO (open-circuit principle)
Frequency overshoot		
Frequency undershoot		
Voltage asymmetry overshoot		

① Stabilization delay or startup delay (Page 147)

See also

ON-delay time (Page 148)

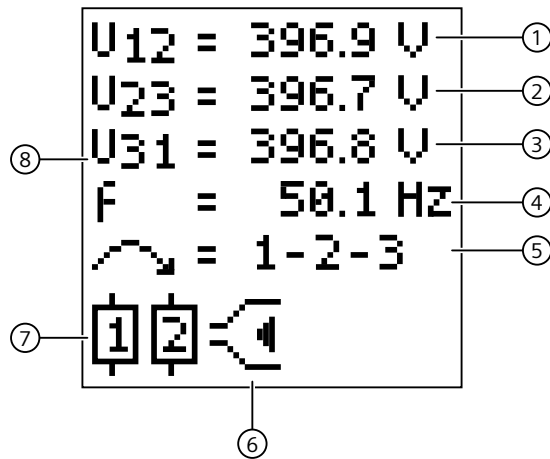
Stabilization time (Page 152)

4.7.3 Operation and parameterization

Parameters

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

The display of the 3UG5 monitoring relay is divided into eight different areas.



- ① Current measured value 1
- ② Current measured value 2
- ③ Current measured value 3
- ④ Current measured value of the frequency
- ⑤ Current state of the phase sequence monitoring
- ⑥ Type of monitoring
- ⑦ Symbols of the changeover contacts
- ⑧ Display area for the current measured values and for the symbols in the event of an error

Parameter information

The table below shows the settable parameter information of the 3UG5616 line monitoring relays:

Note

You can use the following tables as templates for documenting the set parameter information.

Table 4-3 Parameter information, 3UG5616 line monitoring relay

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		L1/2/3	L1/2/3-N		
			L1/2/3-N					
"SET"	3/4 Wire	-	-	Three-wire monitoring or four-wire monitoring	L1/2/3 or L1/2/3-N	-	-	L1/2/3-N
"SET"	Teach	Teach ?	-	Teach menu	-	-	-	-
"VALUE" / "SET"	U Par-am	U Error	Uxy ↓ / U12 ↓ UxN ↓ / U1N ↓	Threshold for voltage undershoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V

3UG5.1 line monitoring relays

4.7 3UG5616 line monitoring relays

Menu level	Menu level (display)				Parameters	Possible settings		In steps of	Factory setting
	1	2	3			L1/2/3	L1/2/3-N		
			L1/2/3	L1/2/3-N					
"VALUE" / "SET"	U Param	U Error	U23 ↓	U2N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Error	U31 ↓	U3N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Error	Uxy ↑ / U12 ↑	UxN ↑ / U1N ↑	Threshold for voltage overshoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Error	U23 ↑	U2N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Error	U31 ↑	U3N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Warn	Uxy ! ↓ / U12 ! ↓	UxN ! ↓ / U1N ! ↓	Warning threshold for voltage undershoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Warn	U23 ! ↓	U2N ! ↓	Warning threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Warn	U31 ! ↓	U3N ! ↓	Warning threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Warn	Uxy ! ↑ / U12 ! ↑	UxN ! ↑ / U1N ! ↑	Warning threshold for voltage overshoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Warn	U23 ! ↑	U2N ! ↑	Warning threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Warn	U31 ! ↑	U3N ! ↑	Warning threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"SET"	U Param	U Hyst	-	-	Hysteresis	0.1 V ... 300 V or OFF		0.1 V	5.0 V

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		L1/2/3	L1/2/3-N		
			L1/2/3-N					
"VALUE" / "SET"	f Param	f Error	f ↑	Threshold for frequency overshoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	60.0 Hz
"VALUE" / "SET"	f Param	f Error	f ↓	Threshold for frequency undershoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	40.0 Hz
"VALUE" / "SET"	f Param	f Warn	f !↑	Warning threshold for frequency overshoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	55.0 Hz
"VALUE" / "SET"	f Param	f Warn	f !↓	Warning threshold for frequency undershoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	45.0 Hz
"SET"	f Param	f Hyst	-	Hysteresis for frequency undershoot	0.1 Hz ... 50.0 Hz or OFF		0.1 Hz	2.5 Hz
"SET"	Ph Param	Ph Seq	-	Phase sequence monitoring	local: No or local: Yes		--	local: Yes
"VALUE" / "SET"	Ph Param	Asy Error	-	Threshold for voltage asymmetry	0.1 % ... 20.0 % or OFF		0.1%	5%
"VALUE" / "SET"	Ph Param	Asy Warn	-	Warning threshold for voltage asymmetry	0.1 % ... 20.0 % or OFF		0.1%	5%
"SET"	Ph Param	Asy Hyst	-	Hysteresis for voltage asymmetry	0.1 % ... 5.0 % or OFF		0.1%	2.0%
"SET"	Delay	Trp Dly ↑	-	Tripping delay time (Threshold for voltage overshoot and frequency overshoot)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	Trp Dly ↓	-	Tripping delay time (Threshold for voltage undershoot and frequency undershoot)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	Asy Dly	-	Tripping delay time (Threshold for voltage asymmetry)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	St/ On Dly	Type	Stabilization delay or startup delay	St Dly or On Dly		-	St Dly
"SET"	Delay	St/ On Dly	Time	Stabilization delay or startup delay: Setting of the time value	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	St/ On Dly	PowerON	Select stabilization delay or startup delay at Power-On and then start	No or Yes		-	Yes

3UG5.1 line monitoring relays

4.7 3UG5616 line monitoring relays

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		L1/2/3	L1/2/3-N		
			L1/2/3-N					
"SET"	Delay	St/ On Dly	Man RST	Select stabilization delay or startup delay after manual reset and then start	No or Yes		-	Yes
"SET"	Reset	-	-	Reset response	Auto (automatic RESET) or Manual (manual RESET) or Rem (retentive error memory)		-	Auto
"SET"	Rel. Test	-	Test?	Relay test menu	K1 off / K1 on K2 off / K2 on		-	-

Note

You can use the following tables as templates for documenting the set parameter information.

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		Evt Type = Error	Evt Type = Warning		
"SET"	Expert	K1 Param	Evt Type	Expert mode Signaling of concrete events (Events) for output relay K1 - Event type	Error or Warning		-	Error
"SET"	Expert	K1 Param	Events	Expert mode Signaling of concrete events (Events) for output relay K1 - Message	Uxy ↑ Uxy ↓ Asy Ph Seq ¹⁾ f ↑ ²⁾ f ↓ ²⁾	UxN !↑ UxN !↓ Asy ! - f !↑ ²⁾ f !↓ ²⁾		U ↓ f ↓ Asy PhLoss PhSeq
"SET"	Expert	K2 Param	Evt Type	Expert mode Signaling of concrete events (Events) for output relay K2 - Event type	Error or Warning		-	Error

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		Evt Type = Error	Evt Type = Warning		
"SET"	Expert	K2 Param	Events	Expert mode Signaling of concrete events (Events) for output relay K2 - Message	Uxy ↑ Uxy ↓ Asy Ph Seq ¹⁾ f ↑ ²⁾ f ↓ ²⁾	UxN !↑ UxN !↓ Asy ! - f !↑ ²⁾ f !↓ ²⁾		U ↑ f ↑ Asy PhLoss PhSeq
"SET"	Expert	Calibr.	U1 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V		0.1 V	0 V
"SET"	Expert	Calibr.	U2 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V		0.1 V	0 V
"SET"	Expert	Calibr.	U3 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V		0.1 V	0 V
"SET"	Expert	Calibr.	f Offset	Zero point calibration for voltage and frequency measurement	- 50.0 Hz ... 0.0 Hz ... 50.0 Hz		0.1 Hz	0 Hz
"SET"	Expert	Avg-Time	-	Time taken to generate averages of the voltage and frequency measurement	Short or Long		-	Short
"SET"	Expert	U Indep.	-	Independent voltage monitoring	No or Yes		-	No
"SET"	Expert	f Mode	Auto	Frequency monitoring mode	-		-	
"SET"	Expert	f Mode	Fixed	Frequency monitoring mode	15.0 Hz ... 70.0 Hz or OFF		0.1 Hz	50.0 Hz
"SET"	Expert	Circ. Pr.	-	Relay switching behavior	NC or NO		-	NC

¹⁾ Expert -> "f Mode" == "Auto" AND "Ph Param" -> "Ph Seq" == "Yes"

²⁾ Expert -> "f Mode" == "Auto" AND "Evt Type"

Note

You can use the following tables as templates for documenting the set parameter information.

Menu level	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Dev. Set	Fact.RST	Fac RST ?	Restore factory settings	-	-	-
"SET"	Dev. Set	Display	Contrast	Display parameters - Contrast	Normal or Low or High		Normal
"SET"	Dev. Set	Display	Intens.	Display parameters - Brightness	10 ... 100	10	70
"SET"	Dev. Set	Eco mode	-	Eco Mode	ON or OFF	-	OFF
"SET"	Dev. Set	PIN	Use PIN	PIN	-	-	No PIN usage
"SET"	Dev. Set	PIN	New PIN	PIN	-	-	No PIN usage

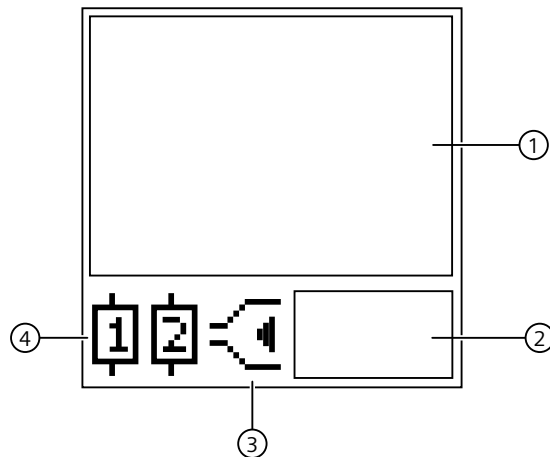
The parameters are described in the Chapter "Parameters (Page 157)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 49)".

4.7.4 Diagnostics

Display information

The following graphic shows the different display areas if there is a warning and in the event of an error.



- ① Display area for the symbols in the event of an error
- ② Display area for warnings
- ③ Type of monitoring
- ④ Symbols of the changeover contacts

Meaning of the information on the display





Note

Indicate by issuing a warning

If there is a warning, the display is yellow.

The following statuses are indicated as a diagnostic message on the display if there is a warning:

Display area	Symbol	Meaning
①	U12 = 396.9 V U23 = 396.7 V U31 = 396.8 V	The measured voltages are displayed.
①	f = 50.1 Hz	The measured frequency is displayed
①	↘ = 1-2-3	Phase sequence is displayed
②	U! 1; 3 U! 2	Warning threshold of the set voltage has been overshoot or undershot
②	AsU!	Warning threshold for voltage asymmetry has been overshoot
②	f!	Warning threshold of the set frequency has been overshoot or undershot
③	⋈	Window monitoring (monitoring for upper limit violation and lower limit violation)

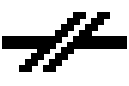
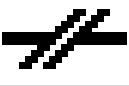
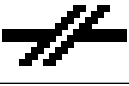
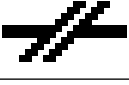
Display area	Symbol	Meaning
③		An upper limit violation has occurred
③		A lower limit violation has occurred
④		<ul style="list-style-type: none"> Not flashing: Relay contact 11/12 open, relay contact 11/14 closed Flashing: Delay time (tripping delay) is running Masked out: Relay contact 11/12 closed, relay contact 11/14 open
④		<ul style="list-style-type: none"> Not flashing: Relay contact 21/22 open, relay contact 21/24 closed Flashing: Delay time (tripping delay) is running Masked out: Relay contact 21/22 closed, relay contact 21/24 open











Note

Indications in the event of a fault

If there is an error message, the display is red.

The following statuses and power system faults are shown on the display as a diagnostic message:

Display area	Symbol	Meaning
①	internal Error	Internal fault in the device ¹⁾
①	L1 	Phase failure L1 detected ²⁾
①	L2 	Phase failure L2 detected ²⁾
①	L3 	Phase failure L3 detected ²⁾
①	N 	Phase failure N detected ²⁾
①	U_{xy}↑	Threshold for voltage overshoot has been exceeded x = 1 or 2 or 3 y = 1 or 2 or 3 or N
①	U_{xy}↓	Threshold for voltage undershoot has been undershot x = 1 or 2 or 3 y = 1 or 2 or 3 or N

Display area	Symbol	Meaning
①		Threshold for frequency overshoot has been overshoot
①		Threshold for frequency undershoot has been undershot
①		Threshold for voltage asymmetry has been overshoot
①		Incorrect phase sequence detected
③		Window monitoring (monitoring for upper limit violation and lower limit violation)
③		Voltage is in correct range
③		Threshold for overshoot exceeded
③		Threshold for undershoot violated
④		<ul style="list-style-type: none"> • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed • Flashing: Delay time (tripping delay) is running • Masked out: Relay contact 11/12 closed, relay contact 11/14 open
④		<ul style="list-style-type: none"> • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed • Flashing: Delay time (tripping delay) is running • Masked out: Relay contact 21/22 closed, relay contact 21/24 open

¹⁾ If an internal error occurs, disconnect the device briefly from the supply voltage. If the error is not rectified as a result, contact Technical Support (<https://www.siemens.com/support-request>).

²⁾ Due to interference in the lines, or different wiring, it is possible that if there is a phase failure, the displayed phase does not correspond to the failed phase. If a phase failure is detected, check the wiring of all the phases.

Note

On phase failure or phase sequence, both CO contacts respond. The reaction of the two changeover contacts can be configured in the menu.

You will find more information about the switching behavior of the output relays in Chapter "Function (Page 80)".

Reset / RESET

Resetting of the outputs is dependent on the "Reset response" parameter (see the Chapter "Reset response (Page 151)").

4.7.5 Circuit diagrams

Internal circuit diagrams 3UG5616

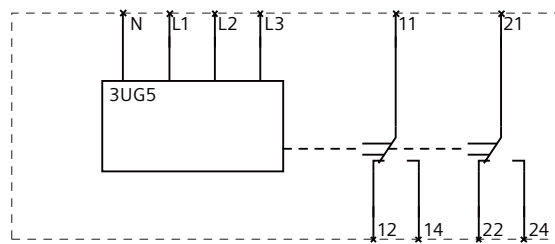
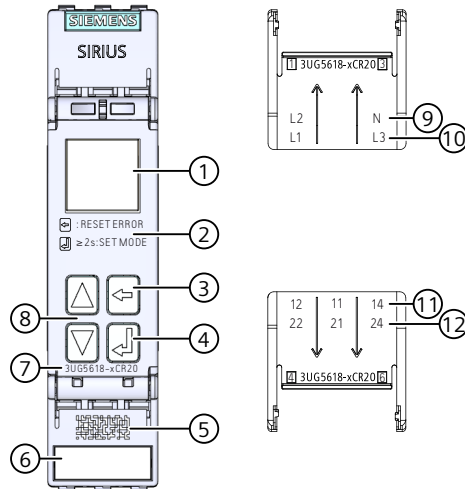


Figure 4-9 3UG5616 line monitoring relays

4.8 3UG5618 line monitoring relays

4.8.1 Operator controls and connection terminals

Front view / terminal labeling 3UG5618-.CR20



- ① Display for parameterization, actual-value indication, communication status and diagnostics
- ② Legend for menu
- ③ Back key for menu navigation
- ④ SET key for menu navigation
- ⑤ Data Matrix code for unique identification of the 3UG5618-.CR20 line monitoring relays
- ⑥ Label
- ⑦ Article number
- ⑧ 2 arrow keys (Up / Down) for menu navigation
- ⑨ L2 Rated control supply voltage
N Neutral conductor
- ⑩ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑪ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑫ 22 Output relay K2 CO contact NC contact
21 Output relay K2 CO contact root
24 Output relay K2 CO contact NO contact

Figure 4-10 Front elements of the 3UG5618-.CR20 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 103)".

4.8.2 Function

General functionality

The 3UG5618 line monitoring relays monitor a three-phase system for **phase sequence, phase failure, phase asymmetry, undervoltage, N-conductor for failure, frequency** and **overvoltage** with automatic correction of the direction of rotation.

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 parameterization of the N-conductor monitoring, the line monitoring relays are powered with a line-to-line voltage of 200 to 690 V (without N-conductor monitoring) and with a star voltage of 120 to 400 V (with N-conductor monitoring) via the terminals L1 / L2 / L3.

The 3UG5618 line monitoring relays have a display and are parameterized with four keys.

You will find the adjustment ranges and factory settings of the available parameters in Chapter "Operation and parameterization (Page 97)".

You can find a description of the individual parameters in Chapter "Parameters (Page 147)".

Monitoring

Output relay K1 is for warning or shutdown on faults in the power system (voltage, asymmetry). Output relay K2 responds differently to power system faults depending on the phase sequence. The reaction of the two changeover contacts can be configured in the menu.

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 are larger than the set lower voltage value and smaller than the set upper voltage value, i.e. they are within the voltage limits and the line voltage asymmetry 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:

- L1/2/3 → 3-wire monitoring: Line-to-line voltage between L1 and L2, L1 and L3, L2 and L3
- L1/2/3-N → 4-wire monitoring: Line-to-neutral voltage between L1 and N, L2 and N, L3 and N

Phase failure

In the case of a phase failure (or N-conductor failure for the 3UG5618 line monitoring relays), output relay K1 (relay contact 11-12-14) drops out without delay to protect the application from any damage that may result. Set delay times have no effect on phase failure monitoring. In the case of voltage undershoot, voltage overshoot, or asymmetry overshoot faults, output relay K1 drops after the set tripping delay time.

Thanks to a special measuring method, a phase failure is detected with certainty despite the wide voltage range from 200 to 690 V AC and reverse power of up to 80 % from the load in the case of regenerative power recovery.

Incorrect direction of rotation

With the CO contact 21-22-24 of the output relay K2, for example, an incorrectly fed phase sequence for a load connected downstream can be automatically corrected using an external reversing combination. The Chapter "Circuit diagrams (Page 103)" provides an example of wiring for automatic phase correction.

Note

The 3UG5618 line monitoring relays only evaluate the phase sequence while all 3 phases are present. For safety reasons, the phase sequence is not reevaluated after 2-phase operation or a phase failure after which the third phase has appeared. In this case, the output relay for the phase rotation remains in its last switching state. The phase sequence is not reevaluated until after the device has been reset or all 3 phases have been simultaneously switched off and on again.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 100)."

3UG5618 function diagrams

Error case	Correct phase sequence L1-L2-L3 Reset = Auto Switching behavior = NC	Incorrect phase sequence L3-L2-L1 Reset = Auto Switching behavior = NC
Phase failure		
Voltage under-shoot		

Error case	Correct phase sequence L1-L2-L3 Reset = Auto Switching behavior = NC	Incorrect phase sequence L3-L2-L1 Reset = Auto Switching behavior = NC
Voltage overshoot		
Frequency overshoot		
Frequency undershoot		
Voltage asymmetry overshoot		

① Stabilization delay or startup delay (Page 147)

See also

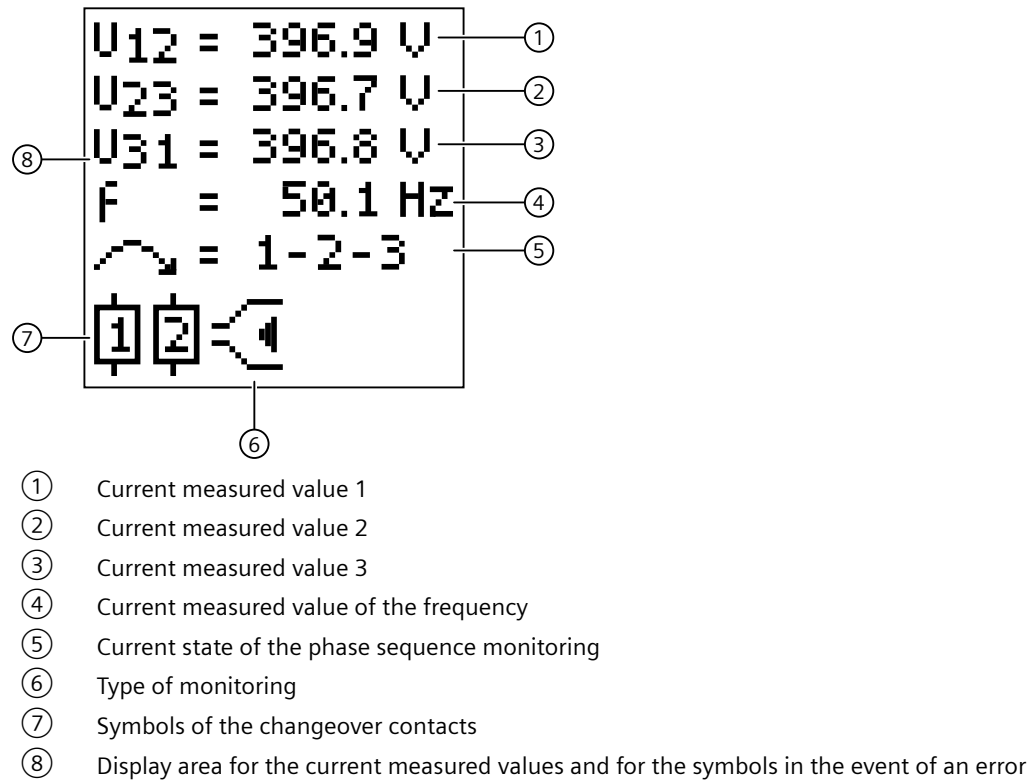
ON-delay time (Page 148)

Stabilization time (Page 152)

4.8.3 Operation and parameterization

Parameters

Parameterization of the devices is possible locally using the display and the four keys. The display of the 3UG5 monitoring relay is divided into eight different areas.



Parameter information

The table below shows the settable parameter information of the 3UG5618 line monitoring relays:

The parameters are described in the Chapter "Parameters (Page 147)".

Note

You can use the following tables as templates for documenting the set parameter information.

4.8 3UG5618 line monitoring relays

Table 4-4 Parameter information, 3UG5618 line monitoring relay

Menu level	Menu level (display)				Parameters	Possible settings		In steps of	Factory setting
	1	2	3			L1/2/3	L1/2/3-N		
			L1/2/3	L1/2/3-N					
"SET"	3/4 Wire	-	-		Three-wire monitoring or four-wire monitoring	L1/2/3 or L1/2/3-N		-	L1/2/3-N
"SET"	Teach	Teach ?	-		Teach menu	-	-	-	-
"VALUE" / "SET"	U Param	U Error	Uxy ↓ / U12 ↓	UxN ↓ / U1N ↓	Threshold for voltage undershoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Error	U23 ↓	U2N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Error	U31 ↓	U3N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET"	U Param	U Error	Uxy ↑ / U12 ↑	UxN ↑ / U1N ↑	Threshold for voltage overshoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Error	U23 ↑	U2N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET"	U Param	U Error	U31 ↑	U3N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"SET"	U Param	U Hyst	-		Hysteresis	0.1 V ... 300 V or OFF		0.1 V	5.0 V
"VALUE" / "SET"	f Param	f Error	f ↑		Threshold for frequency overshoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	60.0 Hz
"VALUE" / "SET"	f Param	f Error	f ↓		Threshold for frequency undershoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	40.0 Hz
"SET"	f Param	f Hyst	-		Hysteresis for frequency undershoot	0.1 Hz ... 50.0 Hz or OFF		0.1 Hz	2.5 Hz
"VALUE" / "SET"	Ph Param	Asy Error	-		Threshold for voltage asymmetry	0.1 % ... 20.0 % or OFF		0.1%	5.0 %
"SET"	Ph Param	Asy Hyst	-		Hysteresis for voltage asymmetry	0.1 % ... 5.0 % or OFF		0.1%	2.0%
"SET"	Delay	Trp Dly ↑	-		Tripping delay time (Threshold for voltage overshoot and frequency overshoot)	0.1 s ... 999.9 s or OFF		0.1 s	OFF

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		L1/2/3	L1/2/3-N		
			L1/2/3-N					
"SET"	Delay	Trp Dly ↓	-	Tripping delay time (Threshold for voltage undershoot and frequency undershoot)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	Asy Dly	-	Tripping delay time (Threshold for voltage asymmetry)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	St/ On Dly	Type	Stabilization delay or start-up delay	St Dly or On Dly		-	St Dly
"SET"	Delay	St/ On Dly	Time	Stabilization delay or start-up delay: Setting of the time value	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	St/ On Dly	PowerON	Select stabilization delay or startup delay at Power-On and then start	No or Yes		-	Yes
"SET"	Delay	St/ On Dly	Man RST	Select stabilization delay or startup delay after manual reset and then start	No or Yes		-	Yes
"SET"	Reset	-	-	Reset response	Auto (automatic RESET) or Manual (manual RESET) or Rem (retentive error memory)		-	Auto
"SET"	Rel.Test	-	Test?	Relay test menu	K1 off / K1 on K2 off / K2 on		-	-

Note

You can use the following tables as templates for documenting the set parameter information.

Menu level	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Expert	Calibr.	U1 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	U2 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	U3 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V

Menu level	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Expert	Calibr.	f Offset	Zero point calibration for voltage and frequency measurement	- 50.0 Hz ... 0.0 Hz ... 50.0 Hz	0.1 Hz	0 Hz
"SET"	Expert	Avg-Time	-	Time taken to generate averages of the voltage and frequency measurement	Short or Long	-	Short
"SET"	Expert	U In-dep.	-	Independent voltage monitoring	No or Yes	-	No

Note

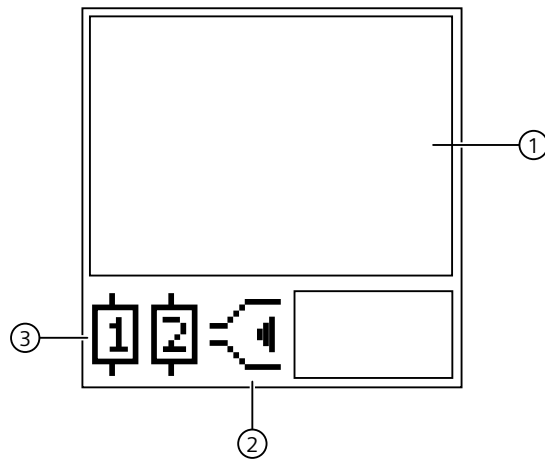
You can use the following tables as templates for documenting the set parameter information.

Menu level	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Dev. Set	Fact.RS T	Fac RST ?	Restore factory settings	-	-	-
"SET"	Dev. Set	Display	Contrast	Display parameters - Contrast	Normal or Low or High		
"SET"	Dev. Set	Display	Intens.	Display parameters - Brightness	10 ... 100	10	70
"SET"	Dev. Set	Eco mode	-	Eco Mode	ON or OFF	-	OFF
"SET"	Dev. Set	PIN	Use PIN	PIN	-	-	No PIN usage
"SET"	Dev. Set	PIN	New PIN	PIN	-	-	No PIN usage

4.8.4 Diagnostics

Display information

The following graphic shows the different display areas if there is an error.



- ① Display area for the symbols in the event of an error
- ② Type of monitoring
- ③ Symbols of the changeover contacts





Meaning of the information on the display

Note

Indications in the event of a fault

If there is an error message, the display is red.

The following statuses and power system faults are shown on the display as a diagnostic message:

Display area	Symbol	Meaning
①	internal Error	Internal fault in the device ¹⁾
①	L1 	Phase failure L1 detected ²⁾
①	L2 	Phase failure L2 detected ²⁾
①	L3 	Phase failure L3 detected ²⁾
①	N 	Phase failure N detected ²⁾
①	U_{xy}↑	Threshold for voltage overshoot has been exceeded x = 1 or 2 or 3 y = 1 or 2 or 3 or N

Display area	Symbol	Meaning
①		Threshold for voltage undershoot has been undershot x = 1 or 2 or 3 y = 1 or 2 or 3 or N
①		Threshold for frequency overshoot has been overshoot
①		Threshold for frequency undershoot has been undershot
①		Threshold for voltage asymmetry has been overshoot
①		Incorrect phase sequence detected
②		Window monitoring (monitoring for upper limit violation and lower limit violation)
②		Voltage is in correct range
②		Threshold for overshoot exceeded
②		Threshold for undershoot violated
③		<ul style="list-style-type: none"> Not flashing: Relay contact 11/12 open, relay contact 11/14 closed Flashing: Delay time (tripping delay) is running Masked out: Relay contact 11/12 closed, relay contact 11/14 open
③		<ul style="list-style-type: none"> Not flashing: Relay contact 21/22 open, relay contact 21/24 closed Flashing: Delay time (tripping delay) is running Masked out: Relay contact 21/22 closed, relay contact 21/24 open

1) If an internal error occurs, disconnect the device briefly from the supply voltage. If the error is not rectified as a result, contact Technical Support (<https://www.siemens.com/support-request>).

2) Due to interference in the lines, or different wiring, it is possible that if there is a phase failure, the displayed phase does not correspond to the failed phase. If a phase failure is detected, check the wiring of all the phases.

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 "Function (Page 94)".

RESET

How the outputs are reset depends on the "Reset response" parameter (see Chapter "Reset response (Page 151)").

4.8.5 Circuit diagrams

Internal circuit diagram 3UG5618

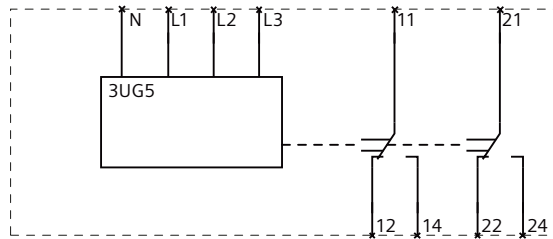


Figure 4-11 3UG5618 line monitoring relays

Automatic phase correction

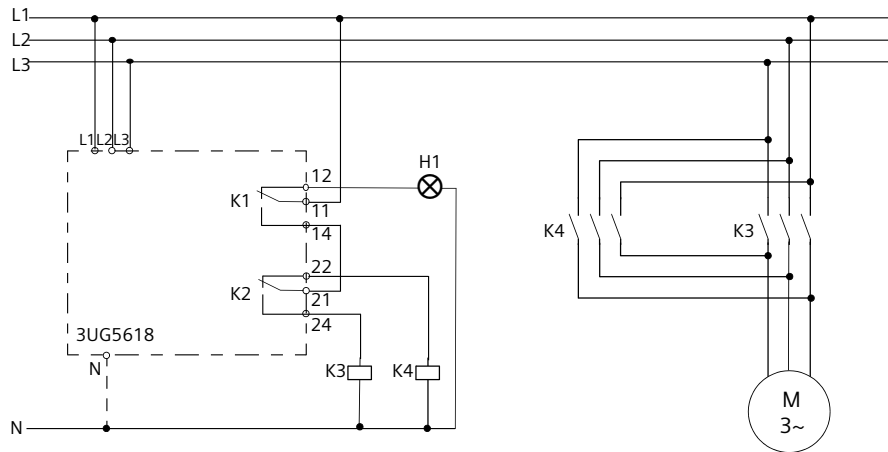
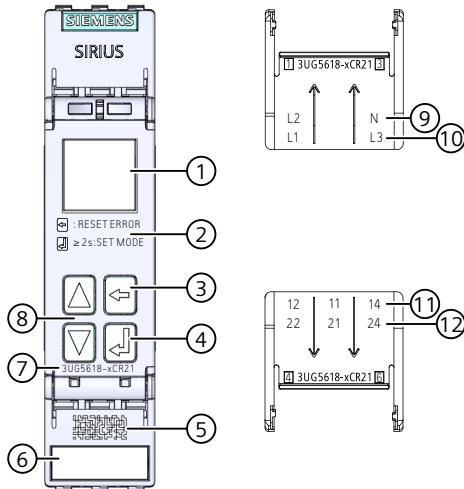


Figure 4-12 3UG5618 automatic phase correction

4.9 3UG5618-.CR21 line monitoring relays with safety function

4.9.1 Operator controls and connection terminals

Front view / terminal labeling 3UG5618-.CR21



- ① Display for parameterization, actual-value indication, communication status and diagnostics
- ② Legend for menu
- ③ Back key for menu navigation
- ④ SET key for menu navigation
- ⑤ Data matrix code for unique identification of the 3UG5618-.CR21 line monitoring relay
- ⑥ Label
- ⑦ Article number
- ⑧ 2 arrow keys (Up / Down) for menu navigation
- ⑨ L2 Rated control supply voltage
N Neutral conductor
- ⑩ L1: Rated control supply voltage
L3 Rated control supply voltage
- ⑪ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑫ 22 Output relay K2 CO contact NC contact
21 Output relay K2 CO contact root
24 Output relay K2 CO contact NO contact

Figure 4-13 Front elements of the 3UG5618-.CR21 line monitoring relay

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection data for terminals (Page 45)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 114)".

4.9.2 Function

General functionality

The 3UG5618-.CR21 line monitoring relays monitor a three-phase system for **phase sequence, phase failure, phase asymmetry, undervoltage, N-conductor for failure, frequency** and **overvoltage** with automatic correction of the direction of rotation.

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 parameterization of the N-conductor monitoring, the line monitoring relays are powered with a line-to-line voltage of 200 to 690 V (without N-conductor monitoring) and with a star voltage of 120 to 400 V (with N-conductor monitoring) via the terminals L1 / L2 / L3.

The 3UG5618-.CR21 line monitoring relays have a display and are parameterized with four keys.

You will find the adjustment ranges and factory settings of the available parameters in Chapter "Operation and parameterization (Page 108)".

You can find a description of the individual parameters in Chapter "Parameters (Page 147)".

Monitoring

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 are larger than the set lower voltage value and smaller than the set upper voltage value, i.e. they are within the voltage limits and the line voltage asymmetry 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:

- 3UG5618-.CR21: Line-to-line voltage between L1 and L2, L1 and L3, L2 and L3
- 3UG5618-.CR21: Line-to-neutral voltage between L1 and N, L2 and N, L3 and N

Phase failure

In the case of a phase failure (or N-conductor failure for the 3UG5618-.CR21 line monitoring relays), output relay K1 (relay contact 11-12-14) drops instantaneously to protect the application from any damage that may result. Set delay times have no effect on phase failure monitoring.

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

Thanks to a special measuring method, a phase failure is detected with certainty despite the wide voltage range from 200 to 690 V AC and reverse power of up to 80 % from the load in the case of regenerative power recovery.

Incorrect direction of rotation

With the CO contact 21-22-24 of the output relay K2, for example, an incorrectly fed phase sequence for a load connected downstream can be automatically corrected using an external reversing combination. The Chapter "Circuit diagrams (Page 114)" provides an example of wiring for automatic phase correction.

Note

The 3UG5618-.CR21 line monitoring relays only evaluate the phase sequence while all 3 phases are present. For safety reasons, the phase sequence is not reevaluated after 2-phase operation or a phase failure after which the third phase has appeared. In this case, the output relay for the phase rotation remains in its last switching state. The phase sequence is not reevaluated until after the device has been reset or all 3 phases have been simultaneously switched off and on again.

You will find the switching states of the output relays below in section "Function diagrams" and in Chapter "Diagnostics (Page 112)."

3UG5618-.CR21 function diagrams

Error case	Correct phase sequence L1-L2-L3 Reset = Auto Switching behavior = NC	Incorrect phase sequence L3-L2-L1 Reset = Auto Switching behavior = NC
Phase failure		
Voltage under-shoot		

Error case	Correct phase sequence L1-L2-L3 Reset = Auto Switching behavior = NC	Incorrect phase sequence L3-L2-L1 Reset = Auto Switching behavior = NC
Voltage overshoot		
Frequency overshoot		
Frequency undershoot		
Voltage asymmetry overshoot		

① Stabilization delay or startup delay (Page 147)

Safety function

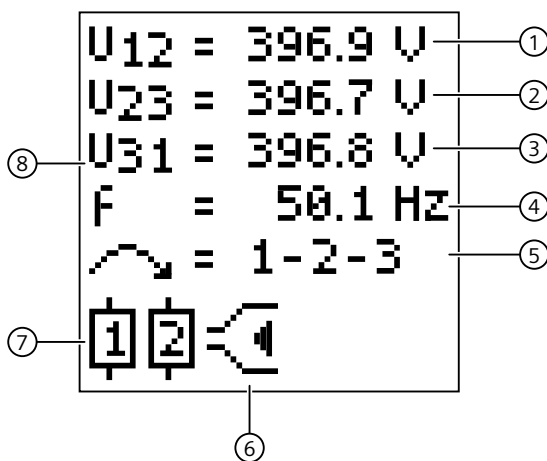
A phase failure and / or phase sequence error is indicated on an integral LCD. At the same time, the integrated safety relay output switches the system to a operating state. The safety function of the digital device conforms to:

- SIL 1 (IEC 62061)
- PL c (EN ISO 13849-1)

4.9.3 Operation and parameterization

Parameters

Parameterization of the devices is possible locally using the display and the four keys. The display of the 3UG5 monitoring relay is divided into eight different areas.



- ① Current measured value 1
- ② Current measured value 2
- ③ Current measured value 3
- ④ Current measured value of the frequency
- ⑤ Current state of the phase sequence monitoring
- ⑥ Type of monitoring
- ⑦ Symbols of the changeover contacts
- ⑧ Display area for the current measured values and for the symbols in the event of an error

Parameter information

The table below shows the settable parameter information of the 3UG5618-.CR21 line monitoring relays:

The parameters are described in the Chapter "Parameters (Page 147)".

Note

You can use the following tables as templates for documenting the set parameter information.

Table 4-5 Parameter information, 3UG5618-.CR21 line monitoring relay

Menu level	Menu level (display)				Parameters	Possible settings		In steps of	Factory setting
	1	2	3			L1/2/3	L1/2/3-N		
			L1/2/3	L1/2/3-N					
"SET"	3/4 Wire	-	-		Three-wire monitoring or four-wire monitoring	L1/2/3 or L1/2/3-N		-	L1/2/3-N
"SET"	Teach	Teach ?	-		Teach menu	-	-	-	-
"SET"	U Param	U Error	Uxy ↓ / U12 ↓	UxN ↓ / U1N ↓	Threshold for voltage undershoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"SET"	U Param	U Error	U23 ↓	U2N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"SET"	U Param	U Error	U31 ↓	U3N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"SET"	U Param	U Error	Uxy ↑ / U12 ↑	UxN ↑ / U1N ↑	Threshold for voltage overshoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"SET"	U Param	U Error	U23 ↑	U2N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"SET"	U Param	U Error	U31 ↑	U3N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"SET"	U Param	U Hyst	-		Hysteresis	0.1 V ... 300 V or OFF		0.1 V	5.0 V
"SET"	f Param	f Error	f ↑		Threshold for frequency overshoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	60.0 Hz
"SET"	f Param	f Error	f ↓		Threshold for frequency undershoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	40.0 Hz
"SET"	f Param	f Hyst	-		Hysteresis for frequency undershoot	0.1 Hz ... 50.0 Hz or OFF		0.1 Hz	2.5 Hz

Menu level	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		L1/2/3	L1/2/3-N		
			L1/2/3-N					
"SET"	Ph Param	Asy Error	-	Threshold for voltage asymmetry	0.1 % ... 20.0 % or OFF		0.1%	5.0 %
"SET"	Ph Param	Asy Hyst	-	Hysteresis for voltage asymmetry	0.1 % ... 5.0 % or OFF		0.1%	2.0%
"SET"	Delay	Trp Dly ↑	-	Tripping delay time (Threshold for voltage overshoot and frequency overshoot)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	Trp Dly ↓	-	Tripping delay time (Threshold for voltage undershoot and frequency undershoot)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	Asy Dly	-	Tripping delay time (Threshold for voltage asymmetry)	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	St/ On Dly	Type	Stabilization delay or start-up delay	St Dly or On Dly		-	St Dly
"SET"	Delay	St/ On Dly	Time	Stabilization delay or start-up delay: Setting of the time value	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET"	Delay	St/ On Dly	PowerON	Select stabilization delay or startup delay at Power-On and then start	No or Yes		-	Yes
"SET"	Delay	St/ On Dly	Man RST	Select stabilization delay or startup delay after manual reset and then start	No or Yes		-	Yes
"SET"	Reset	-	-	Reset response	Auto (automatic RESET) or Manual (manual RESET) or Rem (retentive error memory)		-	Auto
"SET"	Rel. Test	-	Test?	Relay test menu	K1 off / K1 on K2 off / K2 on		-	-

Note

You can use the following tables as templates for documenting the set parameter information.

Menu level	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Expert	Calibr.	U1 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	U2 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	U3 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	f Offset	Zero point calibration for voltage and frequency measurement	- 50.0 Hz ... 0.0 Hz ... 50.0 Hz	0.1 Hz	0 Hz
"SET"	Expert	U In-dep.	-	Independent voltage monitoring	No or Yes	-	No

Note

You can use the following tables as templates for documenting the set parameter information.

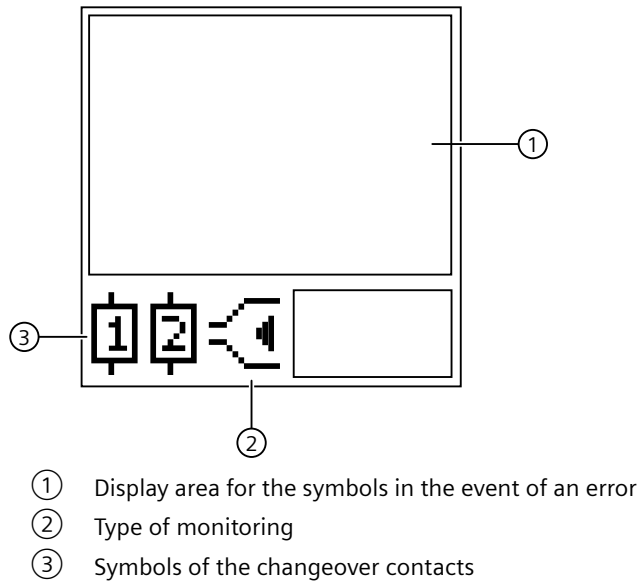
Menu level	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Dev. Set	Fact.R ST	Fac RST ?	Restore factory settings	-	-	
"SET"	Dev. Set	Display	Contrast	Display parameters - Contrast	normal or low or high		normal
"SET"	Dev. Set	Display	Intens.	Display parameters - Brightness	10 ... 100	10	70
"SET"	Dev. Set	Eco mode	-	Eco Mode	ON or OFF	-	OFF
"SET"	Dev. Set	PIN	New PIN	PIN ¹⁾	-	-	active

¹⁾ For a 3UG5618-.CR21 device, use of a PIN is always activated and cannot be disabled.

4.9.4 Diagnostics

Display information

The following graphic shows the different display areas if there is an error.



Meaning of the information on the display















Note

Indications in the event of a fault

If there is an error message, the display is red.

The following statuses and power system faults are shown on the display as a diagnostic message:

Display area	Symbol	Meaning
①	internal Error	Internal fault in the device ¹⁾
①	L1	Phase failure L1 detected ²⁾
①	L2	Phase failure L2 detected ²⁾

Display area	Symbol	Meaning
①		Phase failure L3 detected ²⁾
①		Phase failure N detected ²⁾
①		Threshold for voltage overshoot has been exceeded x = 1 or 2 or 3 y = 1 or 2 or 3 or N
①		Threshold for voltage undershoot has been undershot x = 1 or 2 or 3 y = 1 or 2 or 3 or N
①		Threshold for frequency overshoot has been overshoot
①		Threshold for frequency undershoot has been undershot
①		Threshold for voltage asymmetry has been overshoot
①		Incorrect phase sequence detected
②		Window monitoring (monitoring for upper limit violation and lower limit violation)
②		Voltage is in correct range
②		Threshold for overshoot exceeded
②		Threshold for undershoot violated
③		<ul style="list-style-type: none"> • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed • Flashing: Delay time (tripping delay) is running • Masked out: Relay contact 11/12 closed, relay contact 11/14 open
③		<ul style="list-style-type: none"> • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed • Flashing: Delay time (tripping delay) is running • Masked out: Relay contact 21/22 closed, relay contact 21/24 open

¹⁾ If an internal error occurs, disconnect the device briefly from the supply voltage. If the error is not rectified as a result, contact Technical Support (<https://www.siemens.com/support-request>).

²⁾ Due to interference in the lines, or different wiring, it is possible that if there is a phase failure, the displayed phase does not correspond to the failed phase. If a phase failure is detected, check the wiring of all the phases.

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 "Function (Page 105)".

RESET

Resetting of the outputs is dependent on the "Reset response" parameter (see the chapter "Reset response (Page 151)").

4.9.5 Circuit diagrams

3UG5618-.CR21 internal circuit diagram

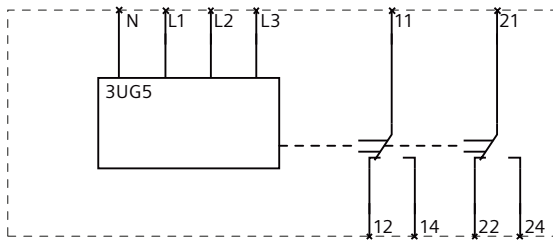


Figure 4-14 3UG5618-.CR21 line monitoring relays

Automatic phase correction

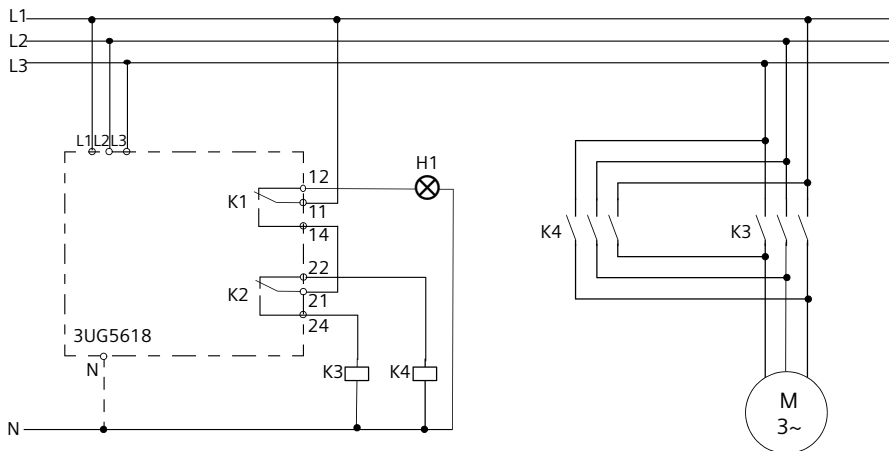


Figure 4-15 3UG5618-.CR21 automatic phase correction

4.10 3UG5816 line monitoring relays for IO-Link

Application areas

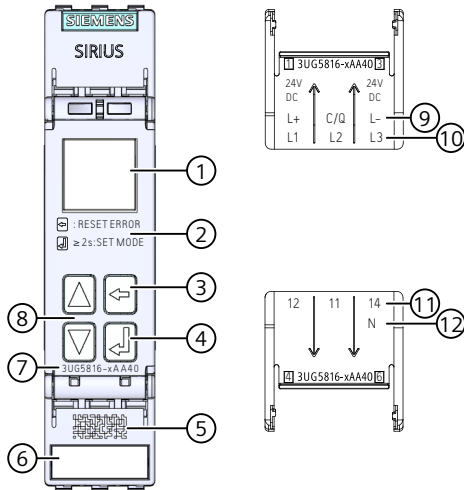
The various line monitoring relays are used, for example, in the following applications:

Table 4-6 Application areas of the line monitoring relays

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

4.10.1 Operator controls and connection terminals

Front view / terminal labeling 3UG5816-.AA40



- ① Display for parameterization, actual-value indication, communication status and diagnostics
- ② Legend for menu
- ③ Back key for menu navigation
- ④ SET key for menu navigation
- ⑤ Data matrix code for unique identification of the 3UG5816.AA40 line monitoring relay
- ⑥ Label
- ⑦ Article number
- ⑧ 2 arrow keys (Up / Down) for menu navigation
- ⑨ L+ Supply voltage for IO-Link
C/Q Communication signal / switching signal
L- Ground IO-Link
- ⑩ L1: Measuring signal (line voltage)
L2 Measuring signal (line voltage)
L3 Measuring signal (line voltage)
- ⑪ 12 Output relay K1 CO contact NC contact
11 Output relay K1 CO contact root
14 Output relay K1 CO contact NO contact
- ⑫ N Neutral conductor

Figure 4-16 Front elements of the 3UG5816-.AA40 line monitoring relay

You can find information on connecting in the Chapter "Circuit diagrams (Page 131)".

4.10.2 Function

General functionality

The 3UG5816 line monitoring relays monitor a three-phase system for **phase sequence, phase failure, undervoltage, overvoltage** and **phase asymmetry**.

The 3UG5816 line monitoring relays have a wide-range input.

The devices are supplied via the supply voltage IO-Link (L+) and ground IO-Link (L-) or via an external 24 V DC voltage source.

The 3UG5816 line monitoring relays have an output relay K1.

The 3UG5816 line monitoring relays have a display and are parameterized with three keys. The devices can also be parameterized via IO-Link and transfer the measured voltage values and error messages to a controller.

You can find the setting ranges and factory settings of the 3UG5816 line monitoring relays in the Chapter "Operation and parameterization (Page 120)".

You can find a description of the individual parameters in Chapter "Parameters (Page 147)".

You can find the full data sets in Chapter "Technical specifications (Page 141)".

Monitoring

As soon as the supply voltage is applied or the monitoring relay is reset, the set stabilization delay begins (st Dly). 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 stabilization delay.

You can find further information on the stabilization delay in Chapter "Stabilization time (Page 152)".

The output relay K1 responds in accordance with the set relay switching response (closed-circuit principle NC or open-circuit principle NO).


If a fault occurs (phase failure, incorrect phase sequence, phase asymmetry, voltage undershoot or voltage overshoot), the output relay K1 switches in accordance with the relay switching response. In the case of voltage undershoot or voltage overshoot, the output relay K1 does not respond until expiry of the set tripping delay time. If the parameterized threshold for voltage asymmetry is overshoot or undershoot, the output relay K1 does not respond until the set tripping delay time has expired. On phase failure, monitoring of the other quantities is deactivated. The measured voltage of all three phases is set to the maximum value (7FFF).

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

Even if monitoring for undervoltage is deactivated and the voltage falls below a measuring range limit 160 V (without N-conductor monitoring) or 90 V (with N-conductor monitoring), a phase failure or neutral failure will be signaled and the output relay K1 will change its switching status.

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

- 3UG5816, 3UG58: Line-to-line voltage (without N-conductor monitoring) between L1 and L2, L1 and L3, L2 and L3
- 3UG5816, 3UG58: Star voltage (with N-conductor monitoring) between L1 and N, L2 and N, L3 and N

It is possible to switch between the individual voltage values using the arrow keys .

Thanks to a special measuring method, a phase failure is detected with certainty despite the wide voltage range from 200 to 690 V AC and power recovery of up to 80% by the load.

You can find the switching states of the output relay K1 below in the section "Function diagrams" and in Chapter "Circuit diagrams (Page 145)".

SIO mode

The monitoring relays have a connection C/Q to IO-Link. If the IO-Link connection is not used for communication via IO-Link, the 3UG5816 line monitoring relays operate in standard I/O mode (SIO mode). In this mode, terminal C/Q can be used as a semiconductor output that switches on a violation of the warning threshold for undershoot, overshoot or voltage asymmetry.


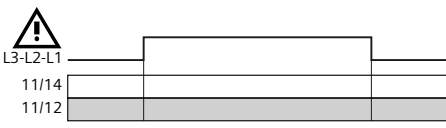
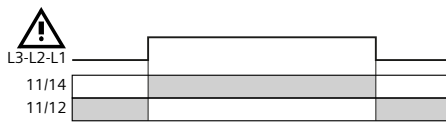
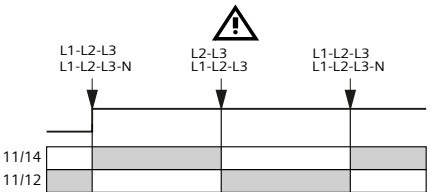
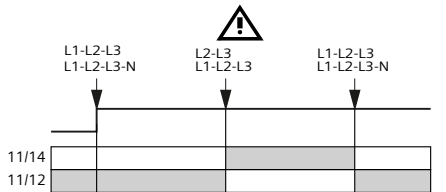
- Q on: 24 V DC supply voltage present.
- Q off: The output has a high resistance.

Function diagrams

Note

In the standard I/O mode (SIO mode), terminal C/Q is used as a semiconductor output.

The semiconductor output (Q on / Q off) switches only upon violation of the warning threshold for undershoot, overshoot or voltage asymmetry.

Error case	Reset = Auto Relay switching behavior = NC (closed-circuit principle)	Reset = Auto Relay switching behavior = NO (open-circuit principle)
		
Phase failure		

Error case	Reset = Auto Relay switching behavior = NC (closed-circuit principle)	Reset = Auto Relay switching behavior = NO (open-circuit principle)
Voltage undershoot		
Voltage overshoot		
Frequency undershoot		
Frequency overshoot		
Voltage asymmetry overshoot		

① Stabilization delay or startup delay (Page 147)

See also

ON-delay time (Page 148)

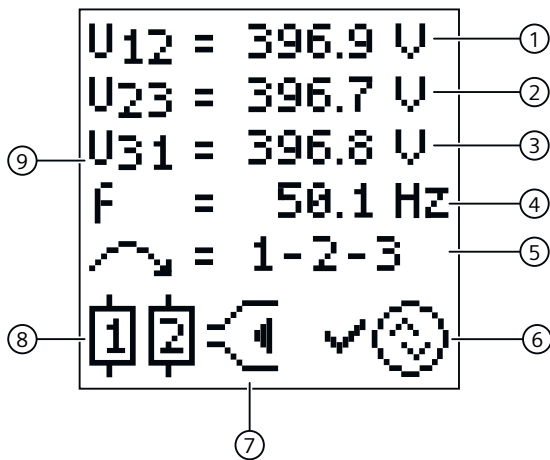
Stabilization time (Page 152)

4.10.3 Operation and parameterization

Parameters

The devices can be parameterized either locally via the display and the four keys, or via IO-Link. You can find further information on configuring via IO-Link in the chapter "Configuring the IO-Link (Page 133)".

The display of the 3UG5 monitoring relay is divided into nine different areas.



- ① Current measured value 1
- ② Current measured value 2
- ③ Current measured value 3
- ④ Current measured value of the frequency
- ⑤ Current state of the phase sequence monitoring
- ⑥ Current communication status
- ⑦ Type of monitoring
- ⑧ Symbols of the changeover contacts
- ⑨ Display area for the current measured values and for the symbols in the event of an error

Parameter information

The table below shows the settable parameter information of the 3UG5816 line monitoring relays:

Note

You can use the following tables as templates for documenting the set parameter information.

Table 4-7 Parameter information, 3UG5816 line monitoring relay

Menu level / IO-Link	Menu level (display)				Parameters	Possible settings		In steps of	Factory setting
	1	2	3			L1/2/3	L1/2/3-N		
			L1/2/3	L1/2/3-N					
"SET" / IO-Link	3/4 Wire	-	-		Three-wire monitoring or four-wire monitoring	L1/2/3 or L1/2/3-N		-	L1/2/3-N
"SET"	Teach	Teach ?	-		Teach menu	-	-	-	-
"VALUE" / "SET" / IO-Link	U Param	U Error	Uxy ↓ / U12 ↓	UxN ↓ / U1N ↓	Threshold for voltage undershoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET" / IO-Link	U Param	U Error	U23 ↓	U2N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET" / IO-Link	U Param	U Error	U31 ↓	U3N ↓	Threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET" / IO-Link	U Param	U Error	Uxy ↑ / U12 ↑	UxN ↑ / U1N ↑	Threshold for voltage overshoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET" / IO-Link	U Param	U Error	U23 ↑	U2N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET" / IO-Link	U Param	U Error	U31 ↑	U3N ↑	Threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET" / IO-Link	U Param	U Warn	Uxy ! ↓ / U12 ! ↓	UxN ! ↓ / U1N ! ↓	Warning threshold for voltage undershoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET" / IO-Link	U Param	U Warn	U23 ! ↓	U2N ! ↓	Warning threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V

3UG5.1 line monitoring relays

4.10 3UG5816 line monitoring relays for IO-Link

Menu level / IO-Link	Menu level (display)				Parameters	Possible settings		In steps of	Factory setting
	1	2	3			L1/2/3	L1/2/3-N		
			L1/2/3	L1/2/3-N					
"VALUE" / "SET" / IO-Link	U Param	U Warn	U31 ! ↓	U3N ! ↓	Warning threshold for voltage undershoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	215 V
"VALUE" / "SET" / IO-Link	U Param	U Warn	Uxy ! ↑ / U12 ! ↑	UxN ! ↑ / U1N ! ↑	Warning threshold for voltage overshoot	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET" / IO-Link	U Param	U Warn	U23 ! ↑	U2N ! ↑	Warning threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"VALUE" / "SET" / IO-Link	U Param	U Warn	U31 ! ↑	U3N ! ↑	Warning threshold for voltage overshoot (Only available if: Expert → U Indep. == Yes)	160 V ... 760 V or OFF	90 V ... 440 V or OFF	0.1 V	245 V
"SET" / IO-Link	U Param	U Hyst	-		Hysteresis	0.1 V ... 300 V or OFF		0.1 V	5.0 V
"VALUE" / "SET" / IO-Link	f Param	f Error	f ↑		Threshold for frequency overshoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	60.0 Hz
"VALUE" / "SET" / IO-Link	f Param	f Error	f ↓		Threshold for frequency undershoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	40.0 Hz
"VALUE" / "SET" / IO-Link	f Param	f Warn	f !↑		Warning threshold for frequency overshoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	55.0 Hz
"VALUE" / "SET" / IO-Link	f Param	f Warn	f !↓		Warning threshold for frequency undershoot (Only available if: Expert → f Mode == Auto)	15.0 Hz ... 70 Hz or OFF		0.1 Hz	45.0 Hz
"SET" / IO-Link	f Param	f Hyst	-		Hysteresis for frequency undershoot	0.1 Hz ... 50.0 Hz or OFF		0.1 Hz	2.5 Hz
"SET" / IO-Link	Ph Param	Ph Seq	-		Phase sequence monitoring	local: No or Yes IO-Link: Blocked or enabled		--	local: Yes IO-Link: Enabled
"VALUE" / "SET" / IO-Link	Ph Param	Asy Error	-		Threshold for voltage asymmetry	0.1 % ... 20.0 % or OFF		0.1%	5.0 %
"VALUE" / "SET" / IO-Link	Ph Param	Asy Warn	-		Warning threshold for voltage asymmetry	0.1 % ... 20.0 % or OFF		0.1%	5.0 %
"SET" / IO-Link	Ph Param	Asy Hyst	-		Hysteresis for voltage asymmetry	0.1 % ... 5.0 % or OFF		0.1%	2.0%

Menu level / IO-Link	Menu level (display)			Parameters	Possible settings		In steps of	Factory setting
	1	2	3		L1/2/3	L1/2/3-N		
			L1/2/3-N					
"SET" / IO-Link	Delay	Trp Dly ↑	-	Tripping delay time (Threshold for voltage overshoot and frequency overshoot)	0.1 s ... 999.9 s or OFF		0.1 s	0.0 s
"SET" / IO-Link	Delay	Trp Dly ↓	-	Tripping delay time (Threshold for voltage undershoot and frequency undershoot)	0.1 s ... 999.9 s or OFF		0.1 s	0.0 s
"SET" / IO-Link	Delay	Asy Dly	-	Tripping delay time (Threshold for voltage asymmetry)	0.1 s ... 999.9 s or OFF		0.1 s	0.0 s
"SET" / IO-Link	Delay	St/ On Dly	Type	Stabilization delay or start-up delay	St Dly or On Dly		-	St Dly
"SET" / IO-Link	Delay	St/ On Dly	Time	Stabilization delay or start-up delay: Setting of the time value	0.1 s ... 999.9 s or OFF		0.1 s	OFF
"SET" / IO-Link	Delay	St/ On Dly	PowerON	Select stabilization delay or startup delay at Power-On and then start	No or Yes		-	Yes
"SET" / IO-Link	Delay	St/ On Dly	Man RST	Select stabilization delay or startup delay after manual reset and then start	No or Yes		-	Yes
"SET" / IO-Link	Reset	-	-	Reset response	local: Auto (automatic RE-SET) IO-Link: Automatic or local: Manual (manual RE-SET) IO-Link: Manual or local: Rem (retentive error memory)		-	Auto
"SET"	Rel. Test	-	Test?	Relay test menu	K1 off / K1 on		-	-

The parameters are described in the Chapter "Parameters (Page 147)".

There is more information on the parameters of the 3UG5816 line monitoring relays that can be set via IO-Link in the chapter "Configuring the IO-Link (Page 133)".

Menu-based operation is described in the Chapter "Menu-based operation (Page 49)".

Note

You can use the following tables as templates for documenting the set parameter information.

Menu level / IO-Link	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Expert	Calibr.	U1 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	U2 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	U3 Offset	Zero point calibration for voltage and frequency measurement	- 50.0 V ... 0.0 V ... 50.0 V	0.1 V	0 V
"SET"	Expert	Calibr.	f Offset	Zero point calibration for voltage and frequency measurement	- 50.0 Hz ... 0.0 Hz ... 50.0 Hz	0.1 Hz	0 Hz
"SET"	Expert	Avg-Time	-	Time taken to generate averages of the voltage and frequency measurement	Short or Long	-	Short
"SET" / IO-Link	Expert	U Indep.	-	Independent voltage monitoring	local: No or Yes IO-Link: Blocked or enabled	-	local: No IO-Link: Disabled
"SET" / IO-Link	Expert	f Mode	Auto	Frequency monitoring mode	-	-	
"SET" / IO-Link	Expert	f Mode	Fixed	Frequency monitoring mode	15.0 Hz ... 70.0 Hz	0.1 Hz	50.0 Hz
"SET" / IO-Link	Expert	Circ. Pr.	-	Relay switching behavior	NC or NO	-	NC

Note

You can use the following tables as templates for documenting the set parameter information.

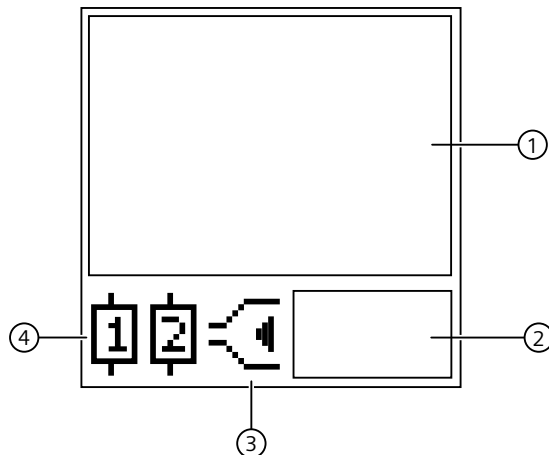
Menu level / IO-Link	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET" / IO-Link	Dev. Set	Fact.RST	Fac RST ?	Restore factory settings	-	-	-
"SET"	Dev. Set	Display	Contrast	Display parameters - Contrast	normal or low or high	-	normal
"SET"	Dev. Set	Display	Intens.	Display parameters - Brightness	10 ... 100	10	70
"SET" / IO-Link	Dev. Set	Firmware update	Update ?	Activation of the firmware update mode for IO-Link devices	-	-	-

Menu level / IO-Link	Menu level (display)			Parameters	Possible settings	In steps of	Factory setting
	1	2	3				
"SET"	Dev. Set	Eco mode	-	Eco Mode	ON or OFF	-	"OFF"
"SET"	Dev. Set	PIN	Use PIN	PIN	-	-	No PIN usage
"SET"	Dev. Set	PIN	New PIN	PIN	-	-	No PIN usage

4.10.4 Diagnostics

Display information

The following graphic shows the different display areas if there is a warning and in the event of an error.



- ① Display area for the symbols in the event of an error
- ② Display area for warnings
- ③ Type of monitoring
- ④ Symbols of the changeover contacts







Meaning of the information on the display

Note

Indicate by issuing a warning

If there is a warning, the display is yellow.

The following statuses are indicated as a diagnostic message on the display if there is a warning:










Display area	Symbol	Meaning
①	U12 = 396.9 V U23 = 396.7 V U31 = 396.8 V	The measured voltages are displayed.
①	f = 50.1 Hz	The measured frequency is displayed
①	 = 1-2-3	Phase sequence is displayed
②	U! 1; 3 U! 2	Warning threshold of the set voltage has been overshoot or undershot
②	Asy!	Warning threshold for voltage asymmetry has been overshoot
②	f!	Warning threshold of the set frequency has been overshoot or under-shot
③		Window monitoring (monitoring for upper limit violation and lower limit violation)
③		An upper limit violation has occurred
③		A lower limit violation has occurred
④		<ul style="list-style-type: none"> Not flashing: Relay contact 11/12 open, relay contact 11/14 closed Flashing: Delay time (tripping delay) is running Masked out: Relay contact 11/12 closed, relay contact 11/14 open
④		<ul style="list-style-type: none"> Not flashing: Relay contact 21/22 open, relay contact 21/24 closed Flashing: Delay time (tripping delay) is running Masked out: Relay contact 21/22 closed, relay contact 21/24 open



Note

Indications in the event of a fault

If there is an error message, the display is red.

The following statuses and power system faults are shown on the display as a diagnostic message:

Display area	Symbol	Meaning
①	internal Error	Internal fault in the device ¹⁾
①	L1 	Phase failure L1 detected ²⁾
①	L2 	Phase failure L2 detected ²⁾
①	L3 	Phase failure L3 detected ²⁾
①	N 	Phase failure N detected ²⁾
①	U_{xy}↑	Threshold for voltage overshoot has been exceeded x = 1 or 2 or 3 y = 1 or 2 or 3 or N
①	U_{xy}↓	Threshold for voltage undershoot has been undershot x = 1 or 2 or 3 y = 1 or 2 or 3 or N
①	f↑	Threshold for frequency overshoot has been overshoot
①	f↓	Threshold for frequency undershoot has been undershot
①	Asy↑	Threshold for voltage asymmetry has been overshoot
①		Incorrect phase sequence detected
③		Window monitoring (monitoring for upper limit violation and lower limit violation)
③		Voltage is in correct range
③		Threshold for overshoot exceeded
③		Threshold for undershoot violated

Display area	Symbol	Meaning
④		<ul style="list-style-type: none"> • Not flashing: Relay contact 11/12 open, relay contact 11/14 closed • Flashing: Delay time (tripping delay) is running • Masked out: Relay contact 11/12 closed, relay contact 11/14 open
④		<ul style="list-style-type: none"> • Not flashing: Relay contact 21/22 open, relay contact 21/24 closed • Flashing: Delay time (tripping delay) is running • Masked out: Relay contact 21/22 closed, relay contact 21/24 open

1) If an internal error occurs, disconnect the device briefly from the supply voltage. If the error is not rectified as a result, contact Technical Support (<https://www.siemens.com/support-request>).

2) Due to interference in the lines, or different wiring, it is possible that if there is a phase failure, the displayed phase does not correspond to the failed phase. If a phase failure is detected, check the wiring of all the phases.

You can find more information on the switching response of the output relay K1 in the Chapter "Function (Page 117)".

Diagnostics via IO-Link

3UG5816 line monitoring relays with IO-Link connection can be diagnosed via IO-Link.

The manufacturer-specific diagnostics listed in the table are reported via the diagnostics mechanism of IO-Link. The table below provides information on possible causes and remedial measures:

Table 4-8 Possible causes and remedial measures












Diagnostics and messages	Possible cause	Possible remedial measure
Invalid parameter	The set parameter is invalid.	Specify a parameter in accordance with the parameter table in the Chapter "Operation and parameterization (Page 120)".
Self-test error/internal error	Fault in internal test.	Return the device to the manufacturer.
Value above (warning) threshold for overshoot	The set voltage is higher than the set threshold for overshoot.	<ul style="list-style-type: none"> • Reduce the voltage. • Set a higher threshold.
Value below (warning) threshold for undershoot	The set voltage is lower than the set threshold for undershoot.	<ul style="list-style-type: none"> • Increase the voltage. • Set a lower threshold.
Value above (warning) threshold for voltage asymmetry	Different voltage at phases L1, L2 and L3.	<ul style="list-style-type: none"> • Check the voltages of the individual phases. • Set a higher threshold.
Phase failure L1	Connection to phase L1 interrupted.	Check the electrical connection.
Phase failure L2	Connection to phase L2 interrupted.	Check the electrical connection.

Diagnosics and messages	Possible cause	Possible remedial measure
Phase failure L3	Connection to phase L3 interrupted.	Check the electrical connection.
Phase sequence error	Error in phase sequence.	Swap the two phases.
Phase failure N-conductor ¹⁾	Connection to N-conductor interrupted.	Check the electrical connection.
Measured value is outside the range that can be measured	The measured voltage is above or below the range that can be measured.	<ul style="list-style-type: none"> Reduce the voltage. Increase the voltage.

¹⁾ Only on the 3UG5816 line monitoring relays.

The table below indicates how the manufacturer-specific diagnostics are reported:

Table 4-9 Diagnostics and messages

Diagnostics and messages	IO-Link event code ¹⁾	PII ²⁾		Data set 92	Display information	
		GE ³⁾	G W ⁴⁾		3UG5816	
Self-test error/internal error	0x5000	x	—	x	internal Error	
Threshold for overshoot exceeded	0x8C10	x	—	x		
Threshold for undershoot violated	0x8C30	x	—	x		
Threshold for voltage asymmetry exceeded	0x8C10	x	—	x		
					Three-wire monitoring	Four-wire monitoring
Phase failure L1	0x8CB1	x	—	x	L1 	L1 
Phase failure L2	0x8CB1	x	—	x	L2 	L2 
Phase failure L3	0x8CB1	x	—	x	L3 	L3 
Phase failure N-conductor	0x8CB1	x	—	x	—	N 
Phase sequence error	0x8CB1	x	—	x		
Measured value is outside the range that can be measured ⁵⁾	0x8C20	—	—	—	>xyz	

¹⁾ The manufacturer-specific diagnostic events listed in the table are reported to the IO-Link master via the diagnostics mechanism of IO-Link.

2) With the "process image input" (see Chapter "Process image output (PIQ) and input (PII) (Page 161)") for 3UG5816 you can determine via the group error (GE) bit or general warning (GW) bit in the user program whether detailed information on diagnostics or messages is present in diagnostic data set 92. If bit (= 1) is set, you can obtain detailed information on what caused a "group error" or "general warning" by reading data set 92.

3) GE = Group error: You can find detailed information in diagnostics data set 92 (see Chapter "Diagnostics - data set (index) 92 (Page 163) " for 3UG5816).

4) GW = General warning: You can find detailed information in diagnostics data set 92 (see Chapter "Diagnostics - data set (index) 92 (Page 163) " for 3UG5816).

x: Bit set

o: Not relevant

5) without N-conductor monitoring: > 690 V (line-to-line voltage) or with N-conductor monitoring: > 400V (star voltage)

Reset

Resetting of the outputs is dependent on the "Reset response" parameter (see the Chapter "Reset response (Page 151)"). On the 3UG5816, 3UG58 monitoring relays, the parameter can also be set via IO-Link.

Note

The outputs can also be reset via the process image of the outputs (PIQ) by setting the "Reset" control command or using the corresponding system command (see the Chapter "Process data and data sets (Page 159)").

Note

With the "Local reset" parameter that can be set via the IO-Link, resetting locally on the device can be disabled.

Note

The warning threshold is always reset by autoreset.

4.10.5 Circuit diagrams

Internal circuit diagrams 3UG5816

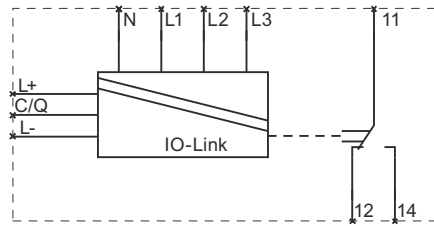


Figure 4-17 3UG5816 line monitoring relays for IO-Link

3UG5816

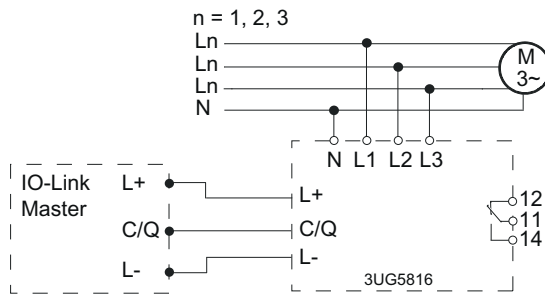


Figure 4-18 3UG5816 line monitoring relays for IO-Link

Configuring

5.1 Configuring the IO-Link

5.1.1 Combinations

IO-Link master and IO-Link device combinations are shown in the following table.

IO-Link master...	IO-Link device...	
	... according to IO-Link communication specification V1.0	... according to IO-Link communication specification V1.1
...according to IO-Link communication specification V1.0	Operation according to specification V1.0	Operation according to specification V1.0
...according to IO-Link communication specification V1.1	Operation according to specification V1.0	Operation according to specification V1.1¹⁾

¹⁾ By selection of IODD V1.0.1, the device can be operated according to IO-Link communication specification V1.0.

Differences between IO-Link communication specifications V1.0 and V1.1

- Usable IO-Link telegram length (not relevant)
- Application-specific name: V1.0: 64 bytes max./V1.1: 32 bytes max.
- IO-Link device LED: V1.0: green/V1.1: Green blinking
- Device ID: V1.0: 0x00/V1.1: 0x01
- Parameter server functionality: V1.0: not available/V1.1: available

5.1.2 Configuring with STEP 7 and the S7-PCT port configuration tool

5.1.2.1 Basic procedure and prerequisites

Procedure when configuring IO-Link master and IO-Link devices

Configuration takes place in two steps with STEP 7, V5.4 SP5 or STEP 7 TIA Portal, V12.0 or higher:

1. Configuring the IO-Link master in *HW Config*. You will find IO-Link master on the Internet (<http://www.siemens.com/industrymall>) under "Automation" > "Industrial communication" > "IO-Link" > "Master".
2. With the Port Configuration Tool *S7-PCT*, you configure the connected IO-Link devices.

Note

The block library for IO-Link (LIOLink) is available as download in the Siemens Industry Online Support (SIOS) via the following link: Library for IO-Link (LIOLink) (<https://support.industry.siemens.com/cs/ww/en/view/82981502>)

Note

An application example for using the device-specific blocks from the block library for IO-Link (LIOLink) can be found on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/90529409>).

Requirements

- STEP 7 from V5.4 SP5 or STEP 7 TIA Portal from V12.0.
- The Port Configuration Tool *S7-PCT* is installed on the PG/PC. You can either install *S7-PCT* together with or STEP 7 or you can download it from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/32469496>).
- IO-Link IODD files (IO Device Description) are installed in the *S7-PCT hardware catalog*. You can download all current IODD files for the SIRIUS devices from the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/15851/dl>). IODD files for V1.0 and V1.1 are available for the combination of an IO-Link master and an IO-Link device according to the IO-Link communication specification V1.1. You may need IODD files according to the IO-Link communication specification V1.0 when replacing devices in existing installations.
- The GSD files of the IO-Link masters are already installed in *STEP 7 HW Config*. You can download all current GSD files for the Siemens IO-Link masters from the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/14288>).

5.1.2.2 Configuration

Configuring the IO-Link master in *HW Config*

1. Start the SIMATIC Manager (*STEP 7*) or the TIA Portal and configure the project as described in the *STEP 7* online help.
2. Select the IO-Link master in the hardware catalog of *HW Config*.
3. Drag and drop the IO-Link master from the hardware catalog to the hardware configuration.
4. Select the IO-Link master in the hardware configuration (*STEP 7 V5.x*) / device view (*STEP 7 TIA*).
5. Press the right mouse button and in the shortcut menu select "**Object Properties**" (*STEP 7 V5.x*) / "**Properties**" (*STEP 7 TIA*).
Result: The "**Properties**" window of the IO-Link master opens.
6. Check the settings of the addresses.
Every IO-Link master port needs a corresponding overall address range depending on the IO-Link device used.

Configuring the IO-Link device with the *S7-PCT Port Configuration Tool*

1. Select the configured IO-Link master.
2. Press the right mouse button and select "**Start device tool**" (*STEP 7 TIA*) / "**Configure IO-Link**" (*STEP 7 V5.x*) from the shortcut menu depending on the configuration tool used.
3. Select the IO-Link device in the component catalog of the *S7-PCT Port Configuration Tool*.
4. Drag the IO-Link device out of the component catalog to the required port of the IO-Link master.
5. Start by parameterizing the IO-Link device.
More information is available in the *S7-PCT* online help.

5.1.3 Configuring with the *S7-PCT* port configuration tool (stand-alone)

5.1.3.1 Application

Configuration is always done with the *S7-PCT* Port Configuration Tool whenever no SIMATIC CPU is available and a SIMATIC IO-Link master is being used.

5.1.3.2 Basic procedure and prerequisites

Basic procedure when configuring IO-Link master and IO-Link devices with the S7-PCT Port Configuration Tool (stand-alone)

1. You configure the connected IO-Link devices with the *S7-PCT* Port Configuration Tool.

Requirements

- The *S7-PCT* Port Configuration Tool is installed on the PG/PC. You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher or STEP 7 TIA Portal V12.0 or higher, or you can download it from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/32469496>).
- IO-Link IODD files (IO Device Description) are installed in the *S7-PCT* hardware catalog. All current IODD files of the SIRIUS devices are available on the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/15851/dl>). IODD files for V1.0 and V1.1 are available for the combination of an IO-Link master and an IO-Link device according to the IO-Link communication specification V1.1. You may need IODD files according to the communication specification V1.0 when replacing devices in existing installations.

Note

Configuring with *S7-PCT* stand-alone is not possible for the CPU versions of the ET 200.

5.1.3.3 Configuration

Configuring the IO-Link device with the S7-PCT Port Configuration Tool

1. Start the *S7-PCT* Port Configuration Tool.
2. Create a new project or open an existing project as described in the online help.
3. Double-click to select a bus category (PROFIBUS DP / PROFINET IO).
4. Double-click to select an IO-Link master.
5. Select the IO-Link device in the component catalog of the *S7-PCT* Port Configuration Tool.
6. Drag the IO-Link device out of the component catalog to the required port of the IO-Link master.
7. Load the configuration into the IO-Link master before parameterizing the IO-Link device.
8. Start by parameterizing the IO-Link device.
More information is available in the *S7-PCT* online help.

Note

To be able to access the IO-Link master or an IO-Link device online, communication between the ET 200 and the higher-level controller must be active (BF LED on ET 200 interface module is off).

5.1.4 Block library for IO-Link (LIOLink)

The current block library for IO-Link (LIOLink) can be used for STEP 7 TIA Portal V16 and higher. For older STEP 7 versions, the article contains an archive download of an earlier version. The function block library for IO-Link (LIOLink) provides blocks and PLC data types to enable communication between the SIMATIC controller and IO-Link master or IO-Link device.

All blocks of the library are compatible with the SIMATIC S7-1200 / 1500 controller and mostly also with the SIMATIC S7-300 / 400 controller.

Basic blocks

The library contains the following blocks, among others:

- The LIOLink_Device block enables the reading and writing of acyclic data of an IO-Link device via the S7 program
- The LIOLink_Master block enables the backup (Backup) and restore (Restore) of device parameters and device settings of an IO-Link master via the S7 program (master exchange without engineering tool)

Device-specific blocks for simple communication with IO-Link devices

The library for IO-Link is available as download in the Siemens Industry Online Support (SIOS) via the following link:

Library for IO-Link (LIOLink) (<https://support.industry.siemens.com/cs/ww/en/view/82981502>)

Note

An application example for using the device-specific blocks for IO-Link can be found on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/90529409>).

5.1.5 Replacing an IO-Link device

To replace an IO-Link device, the devices must be isolated from communication and disconnected from the power supply. After the connections have been restored and communication has been resumed, the parameterization can be restored according to the respective IO-Link communication specification:

- IO-Link communication specification V1.0: concerning the LIOLink_Device function block.
- IO-Link communication specification V1.1: via automatic parameterization under the ET 200SP

5.1.5.1 Replacing an IO-Link device according to the IO-Link communication specification V1.0)

Procedure

Parameter data and configuration data specially optimized by the user for a specific application are stored in an IO-Link-Device. This data deviates in many cases from the default values stored in the IO-Link-Device.

In the event of replacement of an IO-Link-Device (referred to below as a "module"), the optimized data must be transferred to the new module because the parameters are stored only in the IO-Link device itself.

Data can be transferred via two channels:

- Module replacement with PG/PC
- Module replacement without PG/PC

Procedure with PG/PC

In the event of a replacement, a PG/PC is available with the SIMATIC project of the plant.

With the data stored in the SIMATIC project, and the *S7-PCT* port configuration tool, you transfer the parameters belonging to the replaced IO-Link-Device to the new IO-Link-Device.

Procedure without PG/PC

Requirements

- Implement the LIOLink_Device function block in the S7 program.
You can download the LIOLink_Device function block and the description from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/82981502>).

On completion of commissioning, a PG/PC with the project is no longer available. For backing up and restoring the parameter data and configuration data from or to a module, the LIOLink_Device function block is available for the SIMATIC S7 controllers.

With this function block, you back up all relevant data records of a module after commissioning, in a data block (DB), for example. In the event of a replacement, you write the relevant data from the data block to the replaced module with the LIOLink_Device function block.

Refer to the Appendix "Process data and data sets (Page 159)" for data records to be backed up in the case of a module.

Procedure

1. Install the block library for IO-Link (<https://support.industry.siemens.com/cs/ww/en/view/82981502>).
2. Use the LIOLink_Device function block as described in the documentation.
3. An application example for using the device-specific blocks from the block library for IO-Link (LIOLink) can be found on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/90529409>).

5.1.5.2 Replacing an IO-Link device according to the IO-Link communication specification V1.1)

Automatic saving of parameter data

If IO-Link masters and IO-Link devices according to the IO-Link Kommunikations-Spezifikation V1.1 are available, the "parameter server" function can be used to automatically back up parameter data.

When devices are replaced, this parameter data is written back to the new IO-Link device automatically on system startup.

5.1.6 Firmware update

Introduction

During operation, it may be necessary to update the firmware (e.g. to extend the available functions).

You can update the firmware of your device with a firmware update.

Note

Operating mode STOP during the update

When you carry out a firmware update on an I/O-link I/O module, the device goes into the STOP operating state during the update.

Requirement

To carry out a firmware update, you need an IO-Link Master which supports the IO-Link Firmware Update transfer mechanism.

Options for the firmware update

You have the option of carrying out a firmware update online using the Port Configuration Tool *S7-PCT*.

Reference

For additional information on the procedure, please refer to the tab "Help" > Help topics" in the Port Configuration Tool *S7-PCT*". Input "Firmware" in the search field and confirm with Enter.

Technical specifications

6.1 Technical data in Siemens Industry Online Support

Technical data sheet

You can also find the technical data of the product at Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/25412/td>).

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

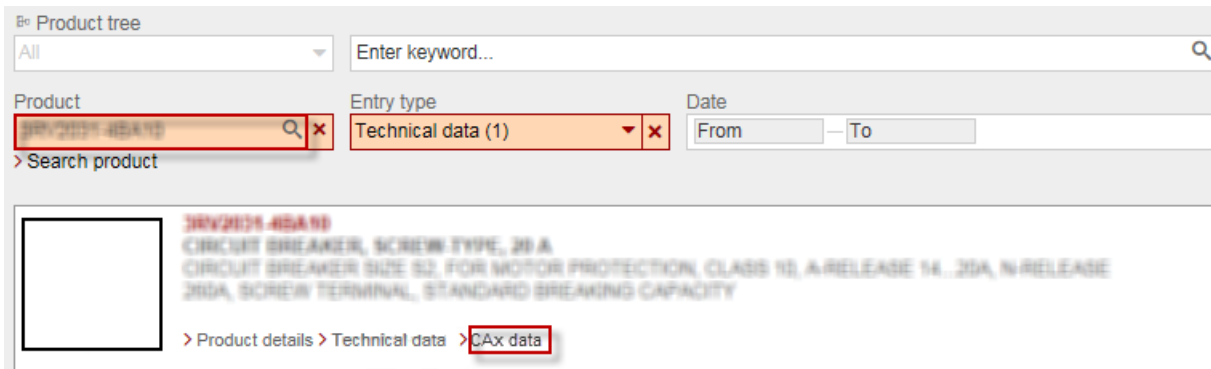
The screenshot shows the Siemens Industry Online Support search interface. At the top, there is a search bar with the text "Enter keyword..." and a magnifying glass icon. Below the search bar, there are three input fields: "Product", "Entry type", and "Date". The "Product" field contains the text "3RV2031-4BA10" and has a search icon and a close icon. The "Entry type" field contains the text "Technical data (1)" and has a dropdown arrow and a close icon. The "Date" field contains the text "From" and "To" with a dropdown arrow. Below the input fields, there is a button labeled "> Search product".

The search results are displayed in a box. The first result is for the product "3RV2031-4BA10". The product description is: "CIRCUIT BREAKER, SCREW TYPE, 20 A, CIRCUIT BREAKER SIZE S2, FOR MOTOR PROTECTION, CLASS 10, A-RELEASE 14...30A, N-RELEASE 20DA, SCREW TERMINAL, STANDARD BREAKING CAPACITY". Below the product description, there are three links: "> Product details", "> Technical data", and "> CAx data". The "Technical data" link is highlighted with a red box.

Dimensional drawings

You can find the CAx data in the Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/25412/td>).

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

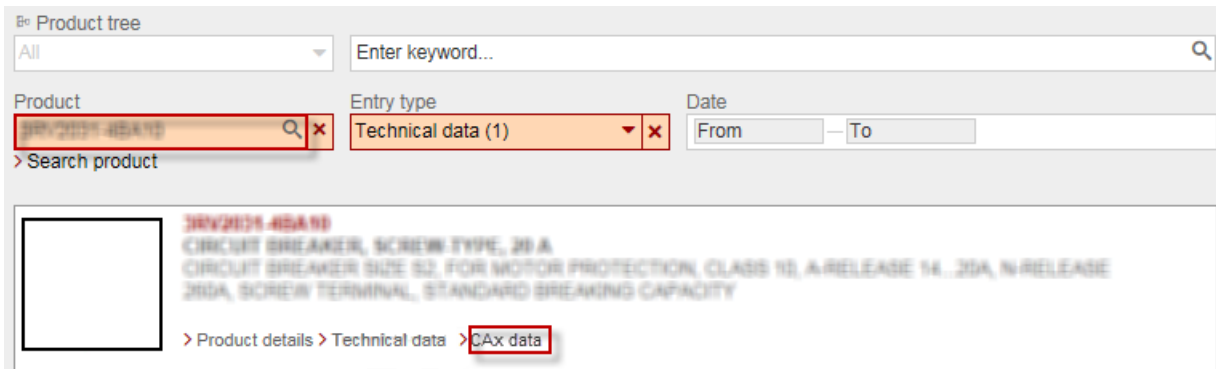


The screenshot shows the Siemens Industry Online Support search interface. At the top, there is a search bar with the text "Enter keyword..." and a magnifying glass icon. Below the search bar, there are three filters: "Product" with a dropdown menu showing "3RV2021-4BA10", "Entry type" with a dropdown menu showing "Technical data (1)", and "Date" with "From" and "To" input fields. Below the filters, there is a search button labeled "> Search product". The search results are displayed in a table with a product image placeholder and the following text: "3RV2021-4BA10", "CIRCUIT BREAKER, SCREW TYPE, 20 A", "CIRCUIT BREAKER SIZE S2, FOR MOTOR PROTECTION, CLASS 10, A-RELEASE 14...20A, N-RELEASE 20DA, SCREW TERMINAL, STANDARD BREAKING CAPACITY". Below the product details, there are navigation links: "> Product details", "> Technical data", and "> CAx data".

Circuit diagrams

You can find the CAx data in the Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/>).

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



The screenshot shows the Siemens Industry Online Support search interface. At the top, there is a search bar with the text "Enter keyword..." and a magnifying glass icon. Below the search bar, there are three filters: "Product" with a dropdown menu showing "3RV2021-4BA10", "Entry type" with a dropdown menu showing "Technical data (1)", and "Date" with "From" and "To" input fields. Below the filters, there is a search button labeled "> Search product". The search results are displayed in a table with a product image placeholder and the following text: "3RV2021-4BA10", "CIRCUIT BREAKER, SCREW TYPE, 20 A", "CIRCUIT BREAKER SIZE S2, FOR MOTOR PROTECTION, CLASS 10, A-RELEASE 14...20A, N-RELEASE 20DA, SCREW TERMINAL, STANDARD BREAKING CAPACITY". Below the product details, there are navigation links: "> Product details", "> Technical data", and "> CAx data".

Parameters

A.1 Three-wire monitoring or four-wire monitoring

Three-wire monitoring or four-wire monitoring

The line-to-line voltage is displayed and monitored.

L1/2/3: Three-wire monitoring

Conductors L1, L2 and L3 must be connected. The neutral conductor is not monitored.

L1/2/3-N: Four-wire monitoring

The star voltage is displayed and monitored. The conductors L1, L2 and L3 as well as the neutral conductor must be connected.

A.2 Stabilization delay or startup delay

With the parameter "Stabilization time or startup delay time" you can define whether the stabilization time (Page 152) or the startup delay time (Page 148) is active.

A.3 Teach menu:

The teach function allows automatic setting of the (warning) thresholds and the hysteresis for the voltage overshoot and undershoot as well as for the frequency overshoot and undershoot on the basis of the currently measured values:

- Thresholds for overshoot = currently measured value + 20%
- Thresholds for undershoot = currently measured value - 20%
- Warning threshold for overshoot = currently measured value + 10 %
- Warning threshold for undershoot = currently measured value - 10%
- Hysteresis = 5% of the currently measured value

The following applies in addition for the line monitoring relay:

- If the independent voltage monitoring is disabled, the mean value of the measured voltages of the three phases is calculated and the hysteresis for the voltage overshoot and undershoot calculated from this mean value.
- If the independent voltage monitoring is enabled, the warning thresholds for the voltage overshoot and undershoot of the three individual phases are calculated from the current measured value of the voltage of the respective phase.
The voltage hysteresis is calculated from the mean value of the voltages of the three phases.

A.4 Relay test menu

The "Relay test menu" parameter can be used for testing the correct function of the contacts of the output relay.

A.5 ON-delay time

After applying the supply voltage or resetting the monitoring relays, the set startup delay time starts. During this time, the outputs remain in the "good" position regardless of whether the set thresholds have been undershot or overshot.

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:

- **For 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.
- **Upon exiting the SET menu**
After every exit from the SET menu level, the startup delay time starts afresh.

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 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.

A.6 Start of the startup delay time

The following table shows the behavior of the startup delay time.

Device variants	Start of the startup delay time possible for:			
	"Power-ON"	Automatic reset	Manual reset	Restart
3UG5816	Yes	No	Yes	No
3UG5616	Yes	No	Yes	No
3UG5618	Yes	No	Yes	No
3UG5618-.CR21	Yes	No	Yes	No

You will find further information on the ON-delay time in the "Functionality" chapter for each monitoring relay.

A.7 Analog value coding

The "Analog value coding" parameter enables the user to transfer not just the measured value but also the unit and resolution of the analog measured value via the process image. This parameter can be used for device-specific setting of the value to be sent cyclically.

The Chapter "Analog value coding (Page 160)" contains a table listing the units and resolutions of the analog measured values to be transferred, as well as the assignment to the relevant monitoring relays.

The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.8 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.

A.9 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.

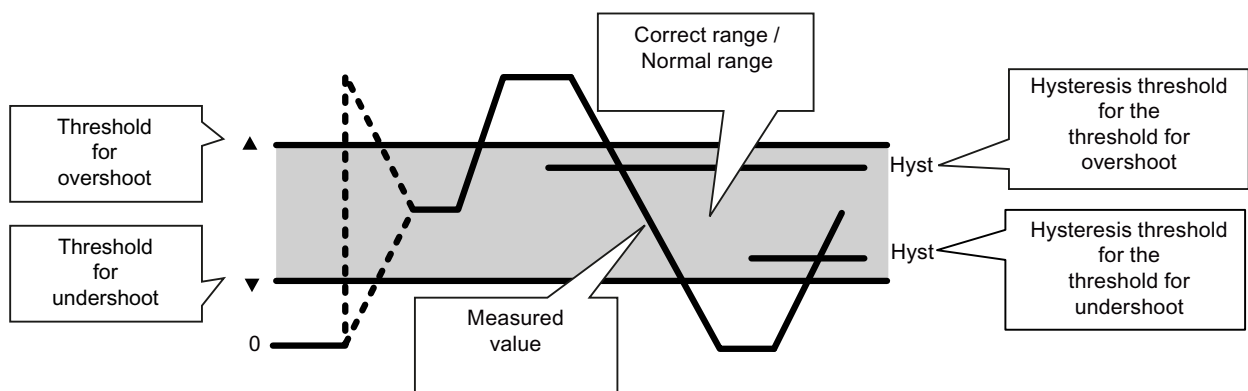


Figure A-1 Explanation of hysteresis

If, after the upper threshold value has been overshoot to such an extent that switching was necessary, the measured value returns to the normal range, and switching over to the correct range will not take place until a measured value which undershoots the hysteresis threshold has been reached. The same applies if the lower threshold value is undershot.

A.10 Local threshold change

The "Local threshold change" parameter enables the user to set product-specific limit values and warning thresholds for undershoot and overshoot locally on the monitoring relay. If the parameter is disabled, local setting on the device is prevented.

The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.11 Local parameter change

The "Local parameter change" parameter enables the user to set product-specific parameters (e.g. delay times, hysteresis, or the relay switching response) locally on the monitoring relay. If the parameter is disabled, local setting on the device is prevented.

The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.12 Local reset

The "Local reset" parameter enables the user to acknowledge the error message pending once an error has been detected directly on the monitoring device so that the normal monitoring function can be resumed. This requires the monitoring relay to be set to manual reset. If the parameter is disabled, fault acknowledgment on the device is prevented.

The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.13 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).

A.14 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 is set either locally via the three keys on the device for the 3UG5616 / 3UG5618 monitoring relays, or via IO-Link for the 3UG5816 line monitoring relay.

A.15 Phase sequence monitoring

Phase sequence monitoring can be activated or deactivated.

If the "Phase sequence monitoring" parameter has been activated and the load currents exhibit the wrong phase sequence, the changeover contact will change its switching status immediately (≤ 200 ms). Set delay times have no effect on the phase failure monitoring.

A.16 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.

Resetting of the outputs depends on the set parameter "Reset behavior".

The following settings can be selected:

- Automatic reset (Auto)
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 (Manual)
If manual RESET is selected, the switching contact remains in the current switching state even if the measured value returns to a permissible value.
- Retentive error memory (Rem)
The "Retentive error memory" parameter enables the user to save all error messages in the device in the event of a power failure. The monitoring device is not reset if the voltage fails. If the parameter is enabled, automatic restart of the system is prevented if power is restored while a fault is active. This increases plant safety.
If the parameter is disabled, error messages are discarded on power recovery.
The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.17 Group diagnostics

The "Group diagnostics" parameter enables the user to enable or completely disable "Automatic signaling" via the fieldbus. The message bits "Group error" and "General warning" in the process image are not affected by this.

The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.18 Group error diagnostics

The "Group error diagnostics" parameter enables the user to suppress "Automatic signaling" of all error messages via the fieldbus.

A.20 Start of the stabilization time

The possible settings for this parameter are listed in the chapter "Process data and data sets (Page 159)". Changes to this parameter can only be made via IO-Link.

A.19 Stabilization time

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 time. The monitoring functions are active within the stabilization time. A threshold overshoot or undershoot in this time does not result in a fault, but instead in restarting of the stabilization time.

The stabilization time starts in the following cases:

- **For 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 time 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 time (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.

A.20 Start of the stabilization time

Start of the stabilization time

The following table shows the behavior of the stabilization time (st Dly) with the 3UG5816 monitoring relays for IO-Link.

Device variants	Start of the stabilization time possible for:			
	"Power-ON"	Automatic reset	Manual reset	Restart
3UG5816	Yes	No	Yes	No
3UG5616	Yes	No	Yes	No

Device variants	Start of the stabilization time possible for:			
	"Power-ON"	Automatic reset	Manual reset	Restart
3UG5618	Yes	No	Yes	No
3UG5618-.CR21	Yes	No	Yes	No

You will find further information on the ON-delay time in the "Functionality" chapter for each monitoring relay.

A.21 (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 and is given as a percentage $((U_{x-y \text{ max}} - U_{x-y \text{ min}}) / U_{x-y \text{ max}}) * 100$.

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.

A.22 (Warning) threshold for undershoot

The device monitors a measured value for undershoot.

The measured value can be parameterized as "Threshold for undershoot" or as "Warning threshold for undershoot" (only on devices for IO-Link).

The setting for the "Warning threshold for undershoot" parameter defines the switching threshold of the relevant output relay prior to tripping due to a measured value undershoot.

If the set "Threshold for undershoot" parameter is undershot, 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).

A.24 Expert mode menu level

You can find information on the switching behavior of the output relays in the "Functionality" chapters of the relevant monitoring relays.

A.23 (Warning) threshold for overshoot

The device monitors a measured value for overshoot.

The measured value can be parameterized as "Threshold for overshoot" or as "Warning threshold for overshoot" (only on devices for IO-Link).

The setting for the "Warning threshold for overshoot" parameter defines the switching threshold of the relevant output relay prior to tripping due to a measured value overshoot.

If the set "Threshold for overshoot" parameter is overshoot, the output relay will change its switching state after expiry of the set delay time and an IO-Link message may be sent. If the measured value has reached the relevant set hysteresis value, the output relay ("Reset response" parameter set to autoreset) will immediately revert to its original state and a new IO-Link message may be sent.

Further response depends on the set reset response (see "Reset response" parameter).

You can find information on the switching behavior of the output relays in the "Functionality" chapters of the relevant monitoring relays.

A.24 Expert mode menu level

A.24.1 Expert mode

In the "Expert mode" menu level device-specific adjustments can be made:

- Assignment of concrete events (Events) for output relay K1
- Assignment of concrete events (Events) for output relay K2
- Zero point calibration for voltage and frequency measurement
- Time taken to generate averages
(To be added in the description: Time taken to generate averages of the voltage measurement and frequency measurement)
- Independent voltage monitoring
(To be added in the description: Independent voltage monitoring of the three phases L1, L2 and L3)
- Frequency monitoring mode
- Relay switching behavior

A.24.2 Message

Selection of the specific events that are to be signaled via the output relays K1 and K2:

- "U ↑" and "U ↓", or "U !↑" and "U !↓" :
The output relay switches in the event of a violation of the set (warning) thresholds for voltage overshoot and undershoot.
- "Asy" or "Asy !" :
The output relay switches in the event of a violation of the set (warning) limit values for voltage asymmetry.
- "Ph Seq" :
The output relay switches in the event of an incorrect phase sequence. This only applies to errors.
- "f ↑" and "f ↓", or "f !↑" and "f !↓" :
The output relay switches in the event of a violation of the set (warning) thresholds for frequency overshoot and undershoot.

A.24.3 Event type

Selecting which types of the following events are to be signaled via the output relays K1 and K2 - either errors or warnings.

A.24.4 Zero point calibration for voltage and frequency measurement

Zero point calibration of the voltage- and frequency measurement allows the user of the monitoring devices to correct the monitored and displayed voltage or frequency values by a settable offset. The set offset is added to the internally measured values.

Example 1:

In the customer application, a voltage of 235.3 V is measured with a calibrated measuring instrument. The voltage measured by the device and displayed is 229.7 V. By setting an offset of $(235.3 \text{ V} - 229.7 \text{ V}) = 5.6 \text{ V}$, the voltage measured by the monitoring device can be corrected by this value.

Example 2:

In the customer application, a frequency of 50.0 Hz was measured with a calibrated measuring instrument. The frequency measured by the device and displayed is 53.4 Hz. By setting an offset of $(50.0 \text{ Hz} - 53.4 \text{ Hz}) = -3.4 \text{ Hz}$, the frequency measured by the monitoring device can be corrected accordingly.

A.24.5 Relay switching behavior

The "Relay switching response" parameter allows the user to adjust the switching response of an output relay. Several variations can be distinguished here:

- Closed-circuit principle (NC)
With the closed-circuit principle, the output relay picks up when the voltage is applied (normally-open contact (NO) closed). The output relay drops out in the event of an error (normally-closed contact (NC) 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)
With the open-circuit principle, the output relay only picks up in the event of an error (normally-open contact (NO) closed). Interruptions to the 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.

A.24.6 Time taken to generate averages of the voltage and frequency measurement

With the average value, you can determine data depending on the time. You can measure these data either over a more prolonged period (long) or a shorter period (short).

Short

For networks with low short-term fluctuations in voltage and frequency. If this selection is made, the specification of the maximum response time and the measurement accuracy in the manual applies.

Long

The measured values of the voltage and frequency measurement are averaged over a longer period of time, which provides better accuracy in networks with larger short-term fluctuations of the voltage or frequency, but increases the response time.

A.24.7 Independent voltage monitoring

When enabled, the (warning) thresholds for voltage overshoot and undershoot can be set independently for the three phases.

A.24.8 Frequency monitoring mode

Automatic frequency monitoring mode (Auto)

The frequency of the system is automatically detected, measured and monitored.

Preset value of the frequency (fixed):

The frequency of the system must be specified with a fixed value. The frequency is not measured or monitored, nor is the phase sequence determined.

A.25 Device settings menu level

A.25.1 Activation of the firmware update mode for IO-Link devices

A firmware update is performed with the firmware update mode. The firmware must be triggered via IO-Link. If the use of a PIN is activated, menu navigation to the SET menu is only possible after entering the correct PIN.

A.25.2 Eco mode

With this setting, the device saves energy when not in operation. When activated, the brightness of the display in the RUN menu is automatically reduced if no key is pressed for 300 seconds.

A.25.3 PIN

With this setting, you get to the SET menu. If the use of a PIN is activated, menu navigation to the SET menu is only possible after entering the correct PIN.

A.25.4 Restore factory settings

Resetting the device and the PIN to the factory settings.

A.25.5 Display parameters - Contrast and Brightness

The display contrast and brightness are set.

Process data and data sets

B.1 Structure of the data sets

Table B-1 Device-independent data sets

Data set		Name	Access	Value	Length (bytes)
Address (dec)	Subindex supported				
0x00 (0)	Yes	Parameter Page 0	r	—	16
0x10 (16)	No	Vendor Name	r	Siemens AG	11
0x11 (17)	No	Vendor Text	r	Siemens Support (https://support.industry.siemens.com/cs/ww/en/ps/15851)	64 max.
0x12 (18)	No	Product Name	r	<i>Device name</i> ¹⁾ (e.g. SIRIUS Line Monitoring Relay for IO-Link)	64 max.
0x13 (19)	No	Product ID	r	<i>Article number</i> ¹⁾ (e.g. 3UG5816-1AA40)	14
0x15 (21)	No	Serial Number	r	Place/Date Serial Number	16
0x16 (22)	No	Hardware Revision	r	<i>Hardware version</i> ¹⁾	7
0x17 (23)	No	Firmware Revision	r	<i>Firmware version</i> ¹⁾	7
0x18 (24)	No	Application Specific Name	r / w	—	64 max.

¹⁾ Value varies for each monitoring relay.

r: readable

w: writeable

B.2 IO-Link communication parameters

Table B-2 Parameter Page 0 - IO-Link communication parameters

Address	Name	Access	Description
0x00	Master Command	r / w	—
0x01	Master Cycle Time	r / w	—
0x02	Min. Cycle Time	r	0x49
0x03	M-Sequence Capability	r	0x11
0x04	IO-Link Revision ID	r	0x11
0x05	Process data IN	r	0xC3
0x06	Process data OUT	r	0x10
0x07	Vendor ID 1	r	0x00

Address	Name	Access	Description
0x08	Vendor ID 2	r	0x2A
0x09	Device ID 1	r	Device-specific
0x0A	Device ID 2	r	Device-specific
0x0B	Device ID 3	r	Device-specific
0x0C	Function ID 1	r	0x00
0x0D	Function ID 2	—	0x00
0x0E	Reserved	—	—
0x0F	Reserved	—	—

B.3 Analog value coding

Analog value coding

The table below shows the coding for the value as unit and resolution of the analog measured values to be transferred, as well as the assignment to the relevant monitoring relays.

Table B-3 Analog value coding

Coding	Meaning	Unit	Resolution	3UG58
				16
57	U_{L1-L2} : Voltage L1-L2	V	0.1	✓
58	U_{L2-L3} : Voltage L2-L3	V	0.1	✓
59	U_{L3-L1} : Voltage L3-L1	V	0.1	✓
60	$U_{Lx-Ly \max}$: Voltage Lx-Ly max	V	0.1	✓
61	$U_{Lx-Ly \min}$: Voltage Lx-Ly min	V	0.1	✓
62	$U_{Lx-Ly \text{ avg}}$: Voltage Lx-Ly avg	V	0.1	✓
63	U_{L1-N} : Voltage L1-N	V	0.1	✓
64	U_{L2-N} : Voltage L2-N	V	0.1	✓
65	U_{L3-N} : Voltage L3-N	V	0.1	✓
66	$U_{Lx-N \max}$: Voltage Lx-N max	V	0.1	✓
67	$U_{Lx-N \min}$: Voltage Lx-N min	V	0.1	✓
68	$U_{Lx-N \text{ avg}}$: Voltage U Lx-N avg	V	0.1	✓
72	Voltage asymmetry (as defined by Siemens)	%	0.1	✓
73	Frequency	Hz	0.1	✓

Note

Entering the relevant value in the "Analog value coding" parameter defines which measured value will be cyclicly transmitted via IO-Link in the process input image (PII). Because this change is also possible during operation, the valid coding for analog value is also transmitted.

B.4 3UG5816 line monitoring relays

B.4.1 Process image output (PIQ) and input (PII)

Process image of the outputs (PIQ)

The process image of the outputs contains the control commands for the 3UG5816 line monitoring relays.

Table B-4 PIQ - control commands

DO (2 bytes)	PIQ
DO0.0	1: Start of the ON-delay
DO0.1	1: Start of the stabilization time
DO0.2	---
DO0.3	1: Reset
DO0.4	---
DO0.5	---
DO0.6	---
DO0.7	---
DO1.0 - DO1.7	---

Process image of the inputs (PII)

The process image of the inputs contains the most important status information of the 3UG5816 line monitoring relays.

Table B-5 PII - status information

DI (4 bytes)	PII
DI0.0	Ready
DI0.1	---
DI0.2	1: Group error
DI0.3	1: General warning
DI0.4	Reserved
DI0.5	Status output relay K1 ¹⁾
DI0.6	---
DI0.7	---
DI1.0 - DI1.6	Analog value coding bits 0 to 6
DI1.7	---
DI2.0 - DI3.7	Analog value ²⁾

¹⁾ 0: Contact .1 / .2 closed 1: Contact .1 / .4 closed

²⁾ The analog value is a 16-bit integer value. The complete measured value is produced together with the analog value coding (DI1.0 - DI1.6), which defines the unit and resolution

of the analog value. You can find the analog value codings accepted by the monitoring relay in the chapter "Analog value coding (Page 160)".

B.4.2 Identification data

Identification data

Identification data refers to data stored in a module that supports users in the following areas:

- When checking the system configuration
- When locating modified system hardware
- When troubleshooting a system.

Modules can be uniquely identified using the identification data.

Identification data

DPP ¹⁾	Data set	Access	Parameter	Length (bytes)	Default setting
Index (dec)	Index (dec)				
0x07 (7)	—	r	Vendor ID	2	0x00
0x08 (8)	—	r			0x2A
0x09 (9)	—	r	Device ID	3	0x09
0x0A (10)	—	r			0x08
0x0B (11)	—	r			0x11
—	0x10 (16)	r	Vendor Name	11	SIEMENS AG
—	0x11 (17)	r	Vendor Text	64 max.	http://support.automation.siemens.com/WW/view/de/37432258/133200 (http://support.automation.siemens.com/WW/view/en/37432258/133200)
—	0x12 (18)	r	Product Name	64 max.	SIRIUS Line Monitoring Relay for IO-Link
—	0x13 (19)	r	Product ID	14	3UG5816-1AA40 3UG5816-2AA40
—	0x16 (22)	r	Hardware Revision	7	<i>Hardware version</i> ²⁾
—	0x17 (23)	r	Firmware Revision	7	<i>Firmware version</i> ²⁾
—	0x18 (24)	r / w	Application Specific Name	32 max.	—

¹⁾ Direct Parameter Page

²⁾ Value varies for each monitoring relay.

B.4.3 System commands - data set (index) 2

Data set (index) 2 - system commands

Table B-6 Data set (index) 2 - system commands

Data set	Access	Parameter	Length (bytes)	Default setting
Index (dec)				
0x02 (2)	w	System Command ¹⁾	1	—

¹⁾ Permissible vendor-specific system commands:
0x80 for Device Reset
0x82 for Factory Reset

B.4.4 Diagnostics - data set (index) 92

Data set (index) 92 - diagnostics

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table B-7 Data set (index) 92 - diagnostics

Byte.Bit	Description
Operating system functions 3UG5	
0.0 ... 15.7	<i>Reserved</i>
16.0	Ready
16.1	Group error
16.2	General warning
16.3	<i>Reserved</i>
16.4	Communication error
16.5	Parameter assignment active
16.6	Invalid parameter
16.7	Self-test error/internal error
18.0 ... 19.7	Parameter error number
Line monitoring	
20.0 ... 25.7	<i>Reserved</i>

B.4 3UG5816 line monitoring relays

Byte.Bit	Description
26.0	Stabilization delay and startup delay time running
26.1	Tripping delay time running (threshold for voltage overshoot)
26.2	Tripping delay time running (threshold for voltage undershoot)
26.3	Tripping delay time running (threshold for voltage asymmetry)
26.4	Tripping delay time running (threshold for frequency overshoot)
26.5	Tripping delay time running (threshold for frequency undershoot)
26.6 ... 26.7	<i>Reserved</i>
27.0	Threshold for voltage overshoot exceeded
27.1	<i>Reserved</i>
27.2	<i>Reserved</i>
27.3	Threshold for voltage undershoot
27.4	Threshold for voltage asymmetry
27.5	<i>Reserved</i>
27.6	Threshold for frequency overshoot
27.7	<i>Reserved</i>
28.0	<i>Reserved</i>
28.1	Threshold for frequency undershoot
28.2	Warning threshold for voltage overshoot
28.3	<i>Reserved</i>
28.4	<i>Reserved</i>
28.5	Warning threshold for voltage undershoot
28.6	Warning threshold for voltage asymmetry
28.7	<i>Reserved</i>
29.0	Warning threshold for frequency overshoot
29.1	<i>Reserved</i>
29.2	<i>Reserved</i>
29.3	Warning threshold for frequency undershoot
29.4 ... 30.7	<i>Reserved</i>
31.0	Loss of phase L1
31.1	Loss of phase L2
31.2	Loss of phase L3
31.3	Phase failure N-conductor
31.4	Phase sequence L1-L2-L3
31.5	Phase sequence L3-L2-L1
31.6	Phase sequence error
31.7	<i>Reserved</i>

B.4.5 Parameters - Data set (index) 131

Data set (index) 131 (parameters)

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table B-8 Data set (index) 131 (parameters)

Byte.Bit	Designation
Operating system functions	
0.0 ... 15.7	<i>Reserved</i>
16.0	Group diagnostics Default: [1] [0] disabled [1] enabled
16.1	Group error diagnostics Default: [1] [0] disabled [1] enabled
16.2	Disable/enable group warnings
16.3	<i>Reserved</i>
16.4	Local threshold change Default: [1] [0] disabled [1] enabled
16.5	Local parameter change Default: [1] [0] disabled [1] enabled
16.6	Local reset Default: [1] [0] disabled [1] enabled
16.7	Retentive error memory Default: [0] [0] disabled [1] enabled
17.0 ... 17.7	Analog value coding Type: BYTE Default: 66 Min: 0 (disabled) Max: 255
18.0 ... 23.7	<i>Reserved</i>

B.4 3UG5816 line monitoring relays

Byte.Bit	Designation
Line monitoring	
24.0 ... 24.2	<i>Reserved</i>
24.3 ... 24.4	Reset behavior [0] manual [1] automatic
24.5 ... 24.7	<i>Reserved</i>
25.0 ... 25.1	Stabilization time/startup delay time (at power-on) Default: [1] [0] disabled [1] enabled
25.2 ... 25.3	Stabilization time/startup delay time (at manual reset) Default: [1] [0] disabled [1] enabled
25.4 ... 25.5	<i>Reserved</i>
25.6 ... 25.7	Stabilization time / startup delay time (selection) [0] Stabilization time (default) [0] disabled [1] Startup delay time
26.0 ... 26.1	<i>Reserved</i>
26.2 ... 26.3	Phase sequence monitoring Default: [1] [0] disabled [1] enabled
26.4 ... 26.5	Independent voltage monitoring Default: [0] [0] disabled [1] enabled
26.6 ... 26.7	Three-wire monitoring or four-wire monitoring Default: L1/2/3-N monitoring [0] L1/2/3 monitoring [1] L1/2/3-N monitoring
27.0 ... 27.1	Frequency monitoring Default: [1] [0] fixed [1] automatic
27.2 ... 27.7	<i>Reserved</i>
28.0 ... 29.7	Preset value of the frequency (only if frequency monitoring = [0]) Default: 50 Hz 15 ... 70 Hz [0; 150 ... 700]
30.0 ... 31.7	Stabilization time/Startup delay time Type: INT Resolution: 0.1 s = 1 Default: 0 Min: 1 or 0 (disabled) Max: 9999 * 0.1 s = 999.9 s

Byte.Bit	Designation
32.0 ... 33.7	Tripping delay time (for voltage overshoot and frequency overshoot) Type: INT Resolution: 0.1 s = 1 Default: 0 Min: 1 or 0 (disabled) Max: 9999 * 0.1 s = 999.9 s
34.0 ... 35.7	Tripping delay time (for voltage undershoot and frequency undershoot) Type: INT Resolution: 0.1 s = 1 Default: 0 Min: 1 or 0 (disabled) Max: 9999 * 0.1 s = 999.9 s
36.0 ... 37.7	Tripping delay time (in the case of asymmetry) Type: INT Resolution: 0.1 s = 1 Default: 0 Min: 1 or 0 (disabled) Max: 9999 * 0.1 s = 999.9 s
38.0 ... 39.7	Threshold for voltage overshoot U _{Lx} /U _{L1} Type: INT Resolution: 0.1 V = 1 Default: 2450 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring. For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V
40.0 ... 41.7	Threshold for voltage undershoot U _{Lx} /U _{L1} Type: INT Resolution: 0.1 V = 1 Default: 2150 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring. For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V

B.4 3UG5816 line monitoring relays

Byte.Bit	Designation
42.0 ... 43.7	<p>Threshold for voltage overshoot U_L2 Type: INT Resolution: 0.1 V = 1 Default: 2450 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>
44.0 ... 45.7	<p>Threshold for voltage undershoot U_L2 Type: INT Resolution: 0.1 V = 1 Default: 2150 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>
46.0 ... 47.7	<p>Threshold for voltage overshoot U_L3 Type: INT Resolution: 0.1 V = 1 Default: 2450 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>

Byte.Bit	Designation
48.0 ... 49.7	<p>Threshold for voltage undershoot U_L3 Type: INT Resolution: 0.1 V = 1 Default: 2150 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>
50.0 ... 51.7	<p>Threshold for voltage asymmetry Type: INT Resolution: 0.1% = 1 Default: 50 Min: 1 or 0 (disabled) Max: 200 * 0.1 % = 20 %</p>
52.0 ... 53.7	<p>Threshold for frequency overshoot Default: 60 Hz 15 ... 70 Hz [0; 150 ... 700]</p>
54.0 ... 55.7	<p>Threshold for frequency undershoot Default: 40 Hz 15 ... 70 Hz [0; 150 ... 700]</p>
56.0 ... 57.7	<p>Warning threshold for voltage overshoot U_Lx/U_L1 Type: INT Resolution: 0.1 V = 1 Default: 2450 The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>

B.4 3UG5816 line monitoring relays

Byte.Bit	Designation
58.0 ... 59.7	<p>Warning threshold for voltage undershoot U_{Lx}/U_{L1}</p> <p>Type: INT Resolution: 0.1 V = 1 Default: 2150</p> <p>The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>
60.0 ... 61.7	<p>Warning threshold for voltage overshoot U_{L2}</p> <p>Type: INT Resolution: 0.1 V = 1 Default: 2450</p> <p>The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>
62.0 ... 63.7	<p>Warning threshold for voltage undershoot U_{L2}</p> <p>Type: INT Resolution: 0.1 V = 1 Default: 2150</p> <p>The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or 1600 * 0.1 V = 160.0 V Max: 7600 * 0.1 V = 760.0 V</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or 900 * 0.1 V = 90.0 V Max: 4400 * 0.1 V = 440.0 V</p>

Byte.Bit	Designation
64.0 ... 65.7	<p>Warning threshold for voltage overshoot U_L3</p> <p>Type: INT Resolution: 0.1 V = 1 Default: 2450</p> <p>The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or $1600 * 0.1 \text{ V} = 160.0 \text{ V}$ Max: $7600 * 0.1 \text{ V} = 760.0 \text{ V}$</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or $900 * 0.1 \text{ V} = 90.0 \text{ V}$ Max: $4400 * 0.1 \text{ V} = 440.0 \text{ V}$</p>
66.0 ... 67.7	<p>Warning threshold for voltage undershoot U_L3</p> <p>Type: INT Resolution: 0.1 V = 1 Default: 2150</p> <p>The valid min. and max. values for all the voltage limits (limit value or warning threshold for voltage overshoot or voltage undershoot) depend on the set three-wire or four-wire monitoring.</p> <p>For three-wire monitoring, the following applies: Min: 0 (blocked) or $1600 * 0.1 \text{ V} = 160.0 \text{ V}$ Max: $7600 * 0.1 \text{ V} = 760.0 \text{ V}$</p> <p>For four-wire monitoring, the following applies: Min: 0 (blocked) or $900 * 0.1 \text{ V} = 90.0 \text{ V}$ Max: $4400 * 0.1 \text{ V} = 440.0 \text{ V}$</p>
68.0 ... 69.7	<p>Warning threshold for voltage asymmetry</p> <p>Type: INT Resolution: 0.1% = 1 Default: 50 Min: 1 or 0 (disabled) Max: $200 * 0.1 \% = 20 \%$</p>
70.0 ... 71.7	<p>Warning threshold for frequency overshoot</p> <p>Default: 55 Hz 15 ... 70 Hz [0; 150 ... 700]</p>
72.0 ... 73.7	<p>Warning threshold for frequency undershoot</p> <p>Default: 45 Hz 15.0 ... 70 Hz [0; 150 ... 700]</p>
74.0 ... 91.7	<i>Reserved</i>
92.0 ... 93.7	<p>Voltage hysteresis</p> <p>Type: INT Resolution: 0.1 V = 1 Default: 5 V Min: 1 or 0 (disabled) Max: 3000 V</p>

Byte.Bit	Designation
94.0 ... 95.7	Hysteresis (asymmetry) Type: INT Resolution: 0.1% = 1 Default: 2 % Min: 1 or 0 (disabled) Max: 50 * 0.1 % = 5 %
96.0 ... 97.7	Hysteresis (frequency) Default: 2.5 Hz 0.1 ... 50 Hz [0 ... 500]
98.0 ... 98.1	Relay switching behavior [0]: Closed-circuit principle (NC) [1]: Open-circuit principle (NO)
98.2 ... 102.7	Reserved

B.4.6 Measured values - data set (index) 94

Data set (index) 94 (measured values)

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table B-9 Data set (index) 94 (measured values)

Byte.Bit	Description
Line monitoring	
16.0 ... 17.7	Voltage U _{L1-L2} Min: 0.0 V Max: 1000 V
18.0 ... 19.7	Voltage U _{L2-L3} Min: 0.0 V Max: 1000 V
20.0 ... 21.7	Voltage U _{L3-L1} Min: 0.0 V Max: 1000 V

Byte.Bit	Description
22.0 ... 23.7	Voltage U _{Lx-Ly} min Min: 0.0 V Max: 1000 V
24.0 ... 25.7	Voltage U _{Lx-Ly} max Min: 0.0 V Max: 1000 V
26.0 ... 27.7	Voltage U _{Lx-Ly} avg Min: 0.0 V Max: 1000 V
28.0 ... 29.7	Voltage U L1-N Min: 0.0 V Max: 1000 V
30.0 ... 31.7	Voltage U L2-N Min: 0.0 V Max: 1000 V
32.0 ... 33.7	Voltage U L3-N Min: 0.0 V Max: 1000 V
34.0 ... 35.7	Voltage U Lx-N min Min: 0.0 V Max: 1000 V
36.0 ... 37.7	Voltage U Lx-N max Min: 0.0 V Max: 1000 V
38.0 ... 39.7	Voltage U Lx-N avg Min: 0.0 V Max: 1000 V
40.0 ... 41.7	Asymmetry Min: 0% Max: 20%
42.0 ... 43.7	Frequency Min: 0.0 Hz Max: 500 Hz

Note

If a measured value is outside the measuring range or a phase failure or neutral failure is detected, all measured values will be set to 7FFF (invalid value).

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