

# Monitoring Relays

## 3UG Monitoring Relays for Electrical and Additional Measurements

Line monitoring

### Overview



Solid-state line monitoring relays provide maximum protection for mobile machines and plants or for unstable networks. Network and voltage faults can be detected early and rectified before far greater damage ensues.

Depending on the version, the relays monitor phase sequence, phase failure with and without N conductor monitoring, phase unbalance, undervoltage or overvoltage.

Phase unbalance is evaluated as the difference between the greatest and the smallest phase voltage relative to the greatest phase voltage. Undervoltage or overvoltage exists when at least one phase voltage deviates by 20 % from the set rated system voltage or the directly set limit values are overshoot or undershot. The rms value of the voltage is measured.

With the 3UG46 17 or 3UG46 18 relay, a wrong direction of rotation can also be corrected automatically.

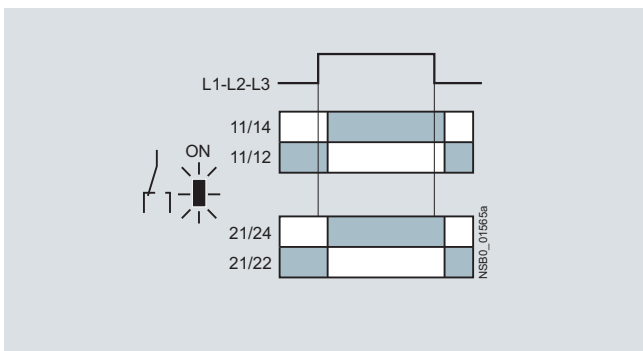
### Function

#### 3UG45 11 monitoring relays

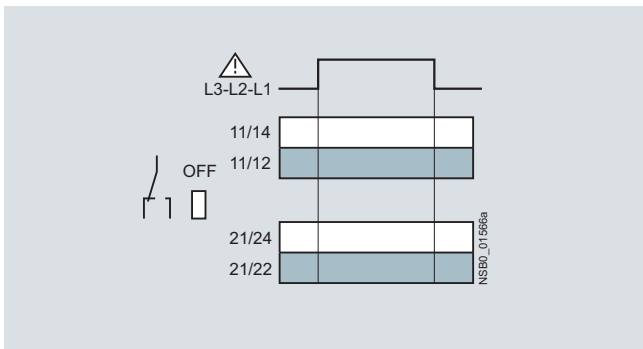
The 3UG45 11 phase sequenced relay monitors the phase sequence in a three-phase network. No adjustments are required for operation. The device has an internal power supply and works using the closed-circuit principle. If the phase sequence at the terminals L1-L2-L3 is correct, the output relay picks up after the delay time has elapsed and the LED is lit. If the phase sequence is wrong, the output relay remains in its rest position.

*Note: When one phase fails, connected loads (motor windings, lamps, transformers, coils, etc.) create a feedback voltage at the terminal of the failed phase due to the network coupling. Because the 3UG45 11 relays are not resistant to voltage feedback, such a phase failure is not detected. Should this be required, then the 3UG45 12 monitoring relay must be used.*

#### Correct phase sequence



#### Wrong phase sequence



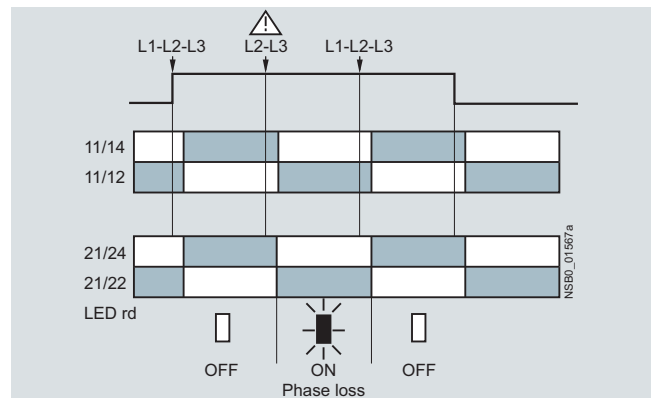
#### 3UG45 12 monitoring relays

The 3UG45 12 line monitoring relay monitors three-phase networks with regard to phase sequence, phase failure and phase unbalance of 10 %. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback through the load of up to 90 %. The device has an internal power supply and works using the closed-circuit principle. No adjustments are required.

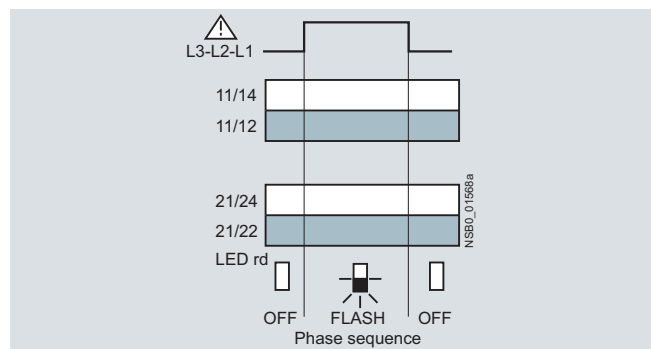
When the mains voltage is switched on, the green LED is lit. If the phase sequence at the terminals L1-L2-L3 is correct, the output relay picks up. If the phase sequence is wrong, the red LED flashes and the output relay remains in its rest position. If a phase fails, the red LED is permanently lit and the output relay drops.

*Note: The red LED is a fault diagnostic indicator and does not show the current relay status. The 3UG45 12 monitoring relay is suitable for line frequencies of 50/60 Hz.*

#### Phase failure



#### Wrong phase sequence



# Monitoring Relays

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### Line monitoring

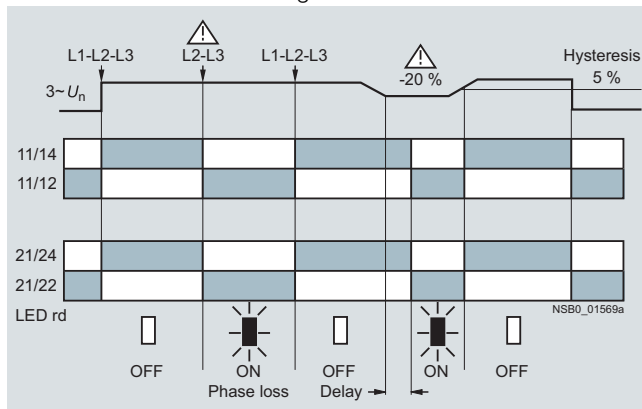
#### 3UG45 13 monitoring relays

The 3UG45 13 line monitoring relay monitors three-phase networks with regard to phase sequence, phase failure, phase unbalance and undervoltage of 20 %. The device has an internal power supply and works using the closed-circuit principle. The hysteresis is 5 %. The integrated response delay time is adjustable from 0 ... 20 s and responds to undervoltage. If the direction is incorrect, the device switches off immediately. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback up to 80 % through the load. When the mains voltage is switched on, the green LED is lit. If the phase sequence at the terminals L1-L2-L3 is correct, the output relay picks up. If the phase sequence is wrong, the red LED flashes and the output relay remains in its rest position. If a phase fails, the red LED is permanently lit and the output relay drops.

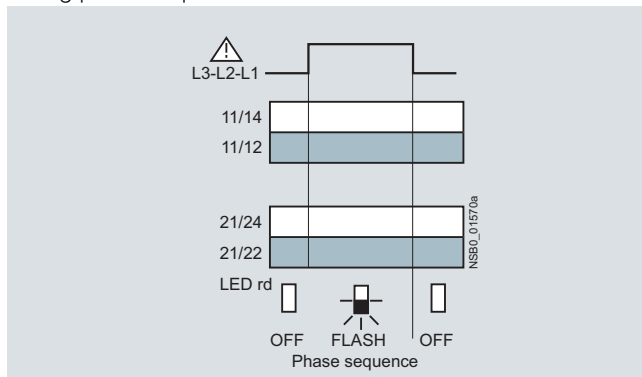
#### Note:

The red LED is a fault diagnostic indicator and does not show the current relay status. The 3UG45 13 monitoring relay is suitable for line frequencies of 50/60 Hz.

#### Phase failure and undervoltage



#### Wrong phase sequence



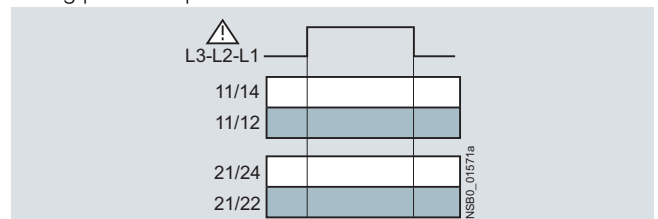
#### 3UG46 14 monitoring relays

The 3UG46 14 line monitoring relay has a wide voltage range and an internal power supply. The device is equipped with a display and is parameterized using three buttons. It monitors three-phase networks with regard to phase unbalance from 5 ... 20 %, phase failure, undervoltage and phase sequence. The hysteresis is adjustable from 1 ... 20 V. In addition the device has a response delay and ON-delay from 0 ... 20 s in each case. The integrated response delay time responds to phase unbalance and undervoltage. If the direction is incorrect, the device switches off immediately. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback up to 80 % through the load.

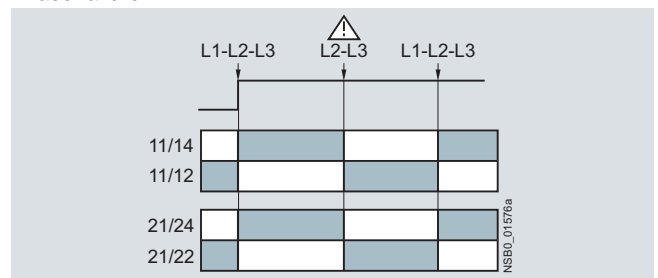
The 3UG46 14 monitoring relay can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET.

#### With the closed-circuit principle selected

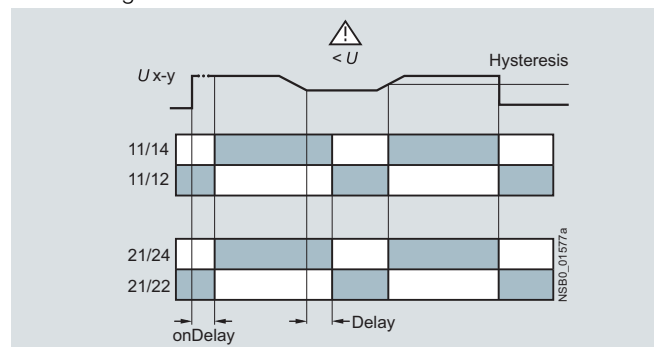
##### Wrong phase sequence



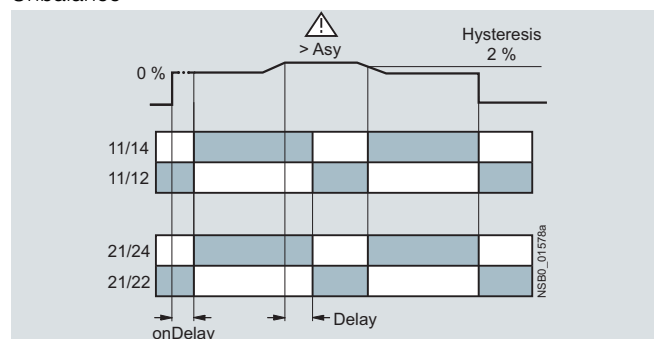
##### Phase failure



##### Undervoltage



##### Unbalance



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Line monitoring

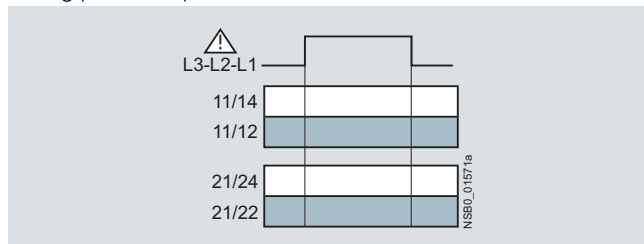
### 3UG46 15/3UG46 16 monitoring relays

The 3UG46 15/3UG46 16 line monitoring relay has a wide voltage range and an internal power supply. The device is equipped with a display and is parameterized using three buttons. The 3UG46 15 device monitors three-phase networks with regard to phase failure, undervoltage, overvoltage and phase sequence. The 3UG46 16 monitoring relay monitors the neutral conductor as well. The hysteresis is adjustable from 1 ... 20 V. In addition the device has two separately adjustable delay times for overvoltage and undervoltage from 0 ... 20 s in each case. If the direction is incorrect, the device switches off immediately. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback through the load of up to 80 %.

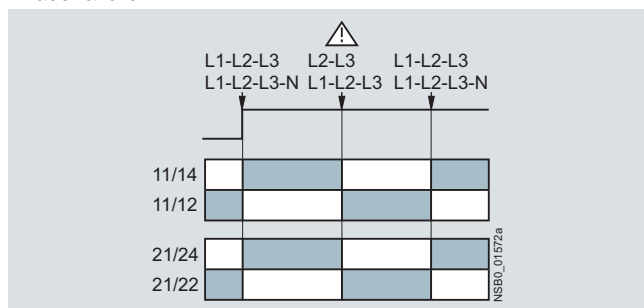
The 3UG46 15/ 3UG46 16 monitoring relay can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET.

#### With the closed-circuit principle selected

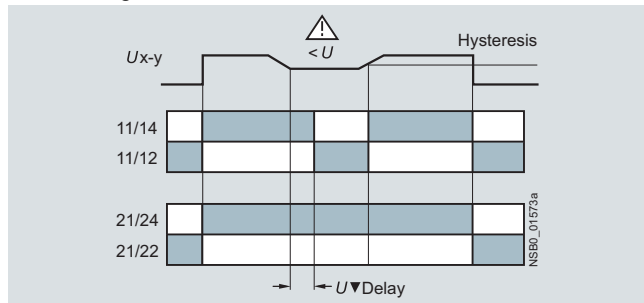
##### Wrong phase sequence



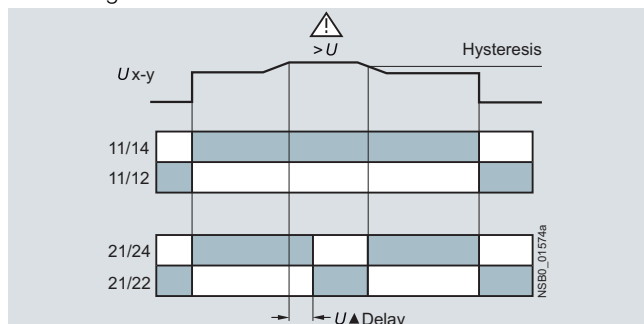
##### Phase failure



##### Undervoltage



##### Overvoltage

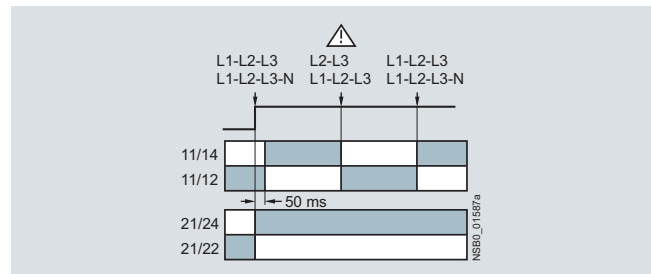


### 3UG46 17/3UG46 18 monitoring relays

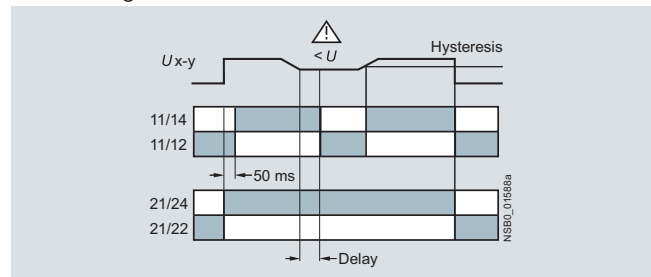
The 3UG46 17/ 3UG46 18 line monitoring relay has an internal power supply and can automatically correct a wrong direction of rotation. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback through the load of up to 80 %. The device is equipped with a display and is parameterized using three buttons. The 3UG46 17 line monitoring relay monitors three-phase networks with regard to phase sequence, phase failure, phase unbalance, undervoltage and overvoltage. The 3UG46 18 monitoring relay monitors the neutral conductor as well. The hysteresis is adjustable from 1 ... 20 V. In addition the device has delay times from 0 ... 20 s in each case for overvoltage, undervoltage, phase failure and phase unbalance. The 3UG46 17/ 3UG46 18 monitoring relay can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET. The one changeover contact is used for warning or disconnection in the event of power system faults (voltage, unbalance), the other responds only to a wrong phase sequence. In conjunction with a contactor reversing assembly it is thus possible to change the direction automatically.

#### With the closed-circuit principle selected

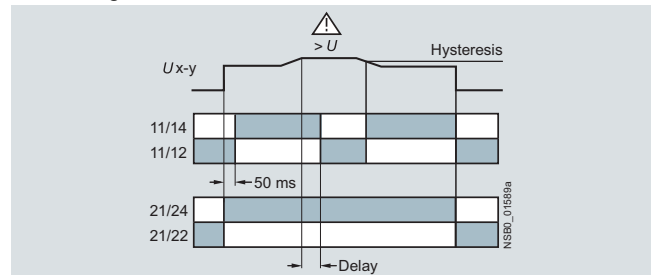
##### Phase failure



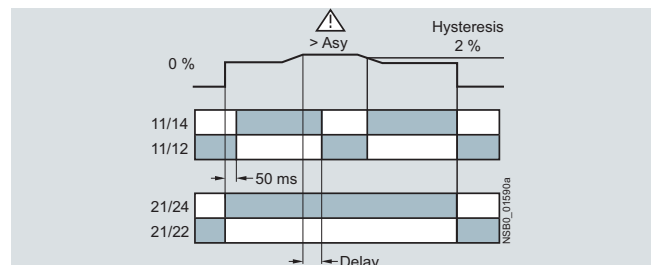
##### Undervoltage



##### Overvoltage



##### Unbalance





# Monitoring Relays

## 3UG Monitoring Relays for Electrical and Additional Measurements

### Line monitoring

#### Technical specifications

Type		3UG45 11- ..N20	3UG45 11- ..P20	3UG45 11- ..Q20	3UG45 12	3UG45 13	3UG46 14	3UG46 15 3UG46 17	3UG46 16 3UG46 18	
<b>General data</b>										
<b>Rated control supply voltage <math>U_s</math></b>	V	160 ... 260	320 ... 500	420 ... 690	160 ... 690				90 ... 400	
Absolute limit values										
<b>Rated frequency</b>	Hz	50/60								
<b>Rated power</b> , typical										
• At AC 230 V	W/VA	2/4	--	--	2/2.5					
• At AC 400 V	W/VA	--	2/8	--	2/3.5					
• At AC 460 V	W/VA	--	--	2/8	2/4					
<b>Width</b>	mm	22.5								
<b>RESET</b>		Auto-RESET					Automatic/manual			
<b>Principle of operation</b>		Closed-circuit					Closed-circuit, open-circuit (3UG46 17/3UG46 18: closed-circuit)			
<b>Availability time</b> after application of $U_s$	ms	200			1.000					
<b>Response time</b> once a switching threshold is reached	ms	Max. 450								
<b>Unbalance</b>	%	--			10	20	0; 5 ... 20	3UG46 15/3UG46 16: Through threshold values 3UG46 17/3UG46 18: 0; 5 ... 20		
<b>Adjustable tripping delay time</b>	s	--				0.1 ... 20				
<b>Adjustable ON-delay time</b>	s	--					0.1 ... 20	--		
<b>Mains buffering time</b> , minimum	ms	10			30					
<b>Rated insulation voltage <math>U_i</math></b> Degree of pollution 3 Overvoltage category III acc. to IEC 60664	V	690								
<b>Rated impulse withstand voltage</b>	kV	6								
<b>Permissible ambient temperature</b>										
• During operation	°C	-25 ... +60								
• During storage	°C	-40 ... +85								
<b>EMC tests<sup>1)</sup></b>		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4								
<b>Degree of protection</b> acc. to IEC 60529		IP40 Enclosure IP20 Terminals								
<b>Mounting position</b>		Any								
<b>Vibration resistance</b> acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 g								
<b>Shock resistance</b> acc. to IEC 60068-2-27	g/ms	15/11								
<b>Connection type</b>		 <b>Screw terminals</b>								
• Terminal screw		M 3 (standard screwdriver, size 2 and Pozidriv 2)								
• Solid	mm <sup>2</sup>	1 x (0.5 ... 4)/2 x (0.5 ... 2.5)								
• Finely stranded with end sleeve	mm <sup>2</sup>	1 x (0.5 ... 2.5)/2 x (0.5 ... 1.5)								
• AWG cables, solid or stranded	AWG	2 x (20 ... 14)								
• Tightening torque	Nm	0.8 ... 1.2								
<b>Connection type</b>		 <b>Spring-type terminals</b>								
• Solid	mm <sup>2</sup>	2 x (0.25 ... 1.5)								
• Finely stranded, with end sleeves	mm <sup>2</sup>	2 x (0.25 ... 1.5)								
• Finely stranded	mm <sup>2</sup>	2 x (0.25 ... 1.5)								
• AWG cables, solid or stranded	AWG	2 x (24 ... 16)								
<b>Measuring circuit</b>										
<b>Measuring range</b> AC 50/60 Hz rms value	V	160 ... 260	320 ... 500	420 ... 690	160 ... 690					
<b>Setting range</b>	V					200...690	160...690		90...400	
<b>Measuring accuracy</b>	%	--			±5					
<b>Repeat accuracy</b> At constant parameters	%	--			±1					
<b>Setting accuracy</b>		--			±10 % referred to setting		±1 V			
<b>Accuracy of digital display</b>		--					±1 digit			
<b>Deviations</b> for temperature fluctuations	%/°C	--			±0.1					
<b>Hysteresis</b> for voltage	V	--			5 % from setting		1 ... 20 V			
<b>Hysteresis</b> for unbalance	%	--					(setting - 2) 3UG46 17/3UG46 18: (setting - 2)			
<b>Deviation for frequency fluctuation</b>	%	--			±1					

1) Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

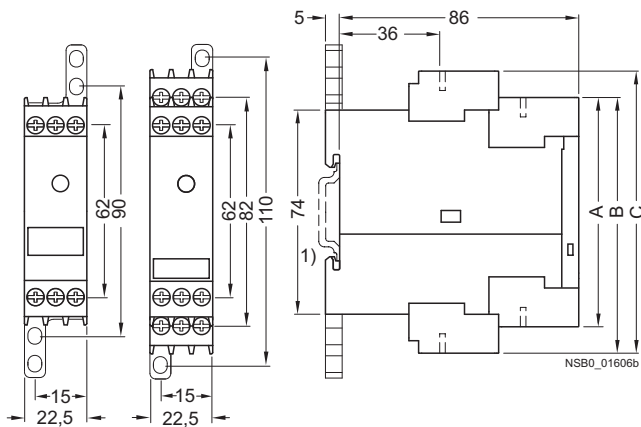
# Monitoring Relays

## 3UG Monitoring Relays for Electrical and Additional Measurements

Line monitoring

	3UG45 11- ..N20	3UG45 11- ..P20	3UG45 11- ..Q20	3UG45 12	3UG45 13	3UG46 14	3UG46 15 3UG46 17	3UG46 16 3UG46 18
<b>Control circuit</b>								
<b>Load capacity of the output relay</b>								
• Conventional thermal current $I_{th}$	A	5						
<b>Rated operational current <math>I_g</math> at</b>								
• AC-15 at 24 ... 400 V	A	3						
• DC-13 at 24 V	A	1						
• DC-13 at 125 V	A	0.2						
• DC-13 at 250 V	A	0.1						
<b>Minimum contact load</b> at 17 V DC	mA	5						
<b>Output relay with DIAZED fuse</b>	A	4						
gL/gG operational class								
<b>Electrical endurance</b> AC-15, 3 A, Million operating cycles	0.1							
<b>Mechanical endurance</b> Million operating cycles	10							

### Dimensional drawings



Type	3UG45 11-.A 3UG45 12-.A	3UG45 11-.B 3UG45 12-.B 3UG45 13 3UG46 14 3UG46 15 3UG46 17	3UG46 16 3UG46 18
	A	B	C

#### Removable terminal

Screw-type terminal	83	92	102
Spring-loaded terminal	84	94	103

1) For standard mounting rail according to EN 60715.

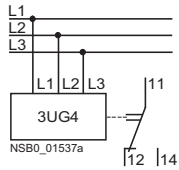
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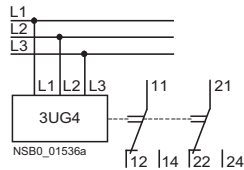
### Line monitoring

#### Schematics

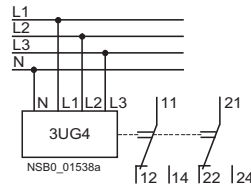
3UG45 11-A  
3UG45 12-A



3UG45 11-B  
3UG45 12-B  
3UG45 13  
3UG46 14  
3UG46 15  
3UG46 17



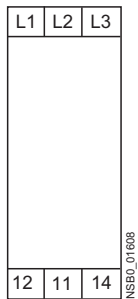
3UG46 16  
3UG46 18



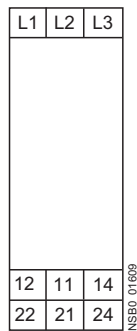
*Note: It is not necessary to protect the measuring circuit for device protection. The protective device for line protection depends on the cross-section used.*

#### Position of the terminals

3UG45 11-A  
3UG45 12-A



3UG45 11-B  
3UG45 12-B  
3UG45 13  
3UG46 14  
3UG46 15  
3UG46 17



3UG46 16  
3UG46 18

