



## **MRA1 – Trip circuit supervision**

**Manual MRA1 (Revision A)**

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# 1. Introduction and application

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The MRA1 - relay of the HIGH TECH LINE is used to supervise the tripping circuit of protective devices taking into consideration the following protective criteria:

- supervision of the auxiliary voltage for the tripping circuit and for the supply of protective devices
- supervision of the tripping circuit with regard to cable break
- supervision of the mechanical functions of the circuit breaker

# 2. Features and characteristics

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- high breaking capacity of the relay contacts
- in compliance with the requirements as per BS 142 and IEC 255
- manual/automatic reset
- coil resistance of tripping coil may be up to 12 k $\Omega$
- supervision independent of the circuit breaker position
- wide range power supply for all nominal supply voltages

### 3. Design

#### 3.1 Connections

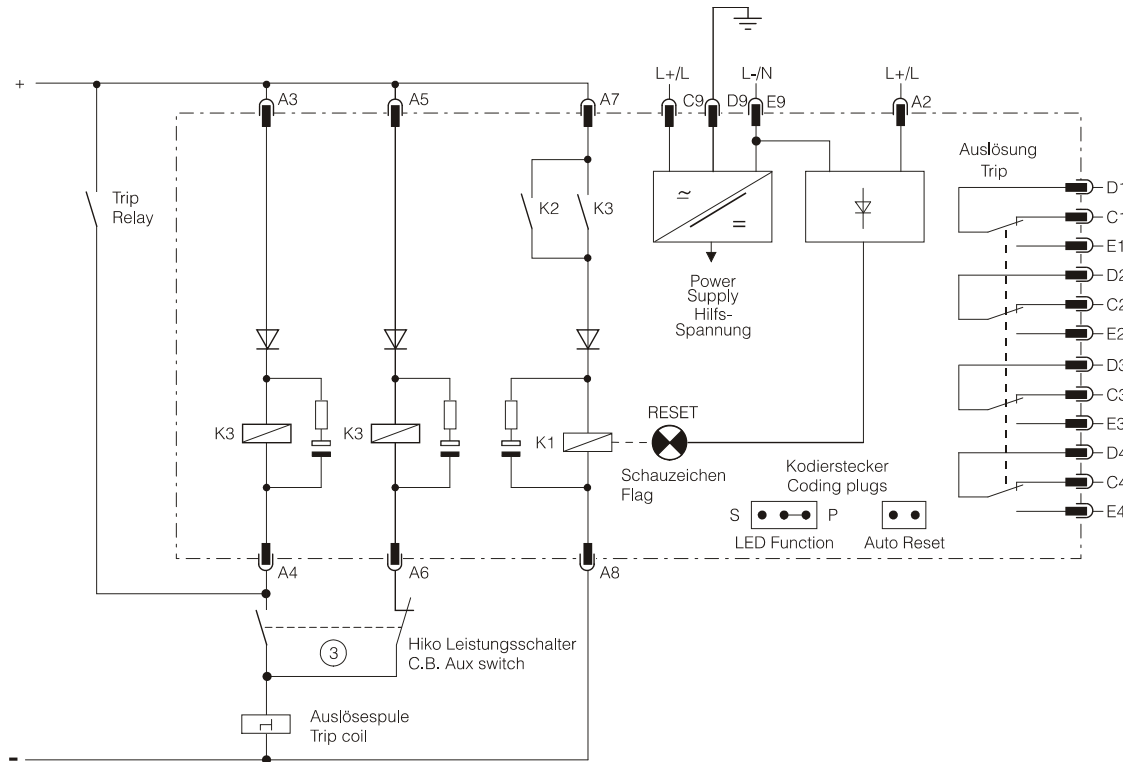


Figure 3.1: Connection diagram MRA1 Version "A" Application with opener and shutter contacts of the circuit breaker

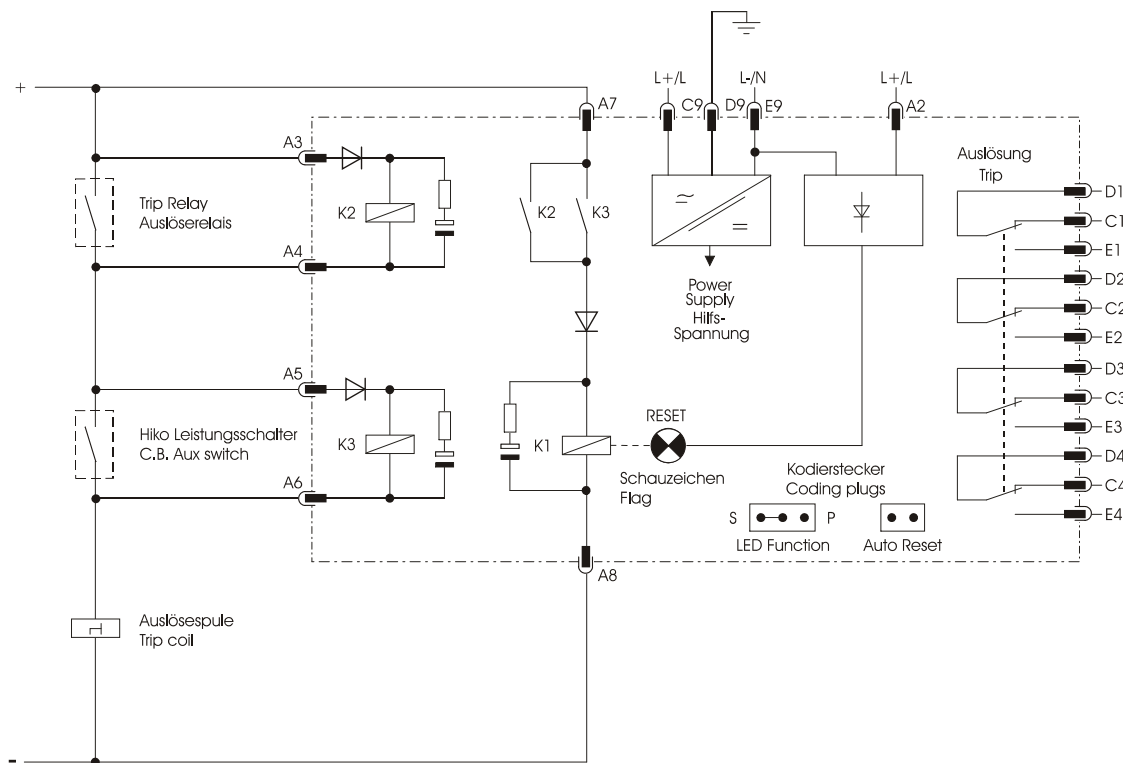


Figure 3.2: Connection diagram MRA1 Version "B" Trip supervision with a shutter contact

## 3.2 Coding plug

Switching thresholds of the input circuitry

The MRA1 has a wide-range power pack for all commonly used voltage values. For this reason the pick-up thresh-olds of the internal relays K1, K2, K3 and the reset input must be adjusted to the existing rated voltage.

There are 4 switching thresholds available which can each be changed by 2 coding plugs.

| Switching threshold | Coding plug A | Coding plug B |
|---------------------|---------------|---------------|
| 9V                  | plugged       | plugged       |
| 30V                 | Not plugged   | plugged       |
| 65V                 | plugged       | Not plugged   |
| 100V                | Not plugged   | Not plugged   |

This means that each input can be switched separately. (Refer to set-ting lists on last page)

The coding plugs are located inside the device on the bottom side of the relay card.

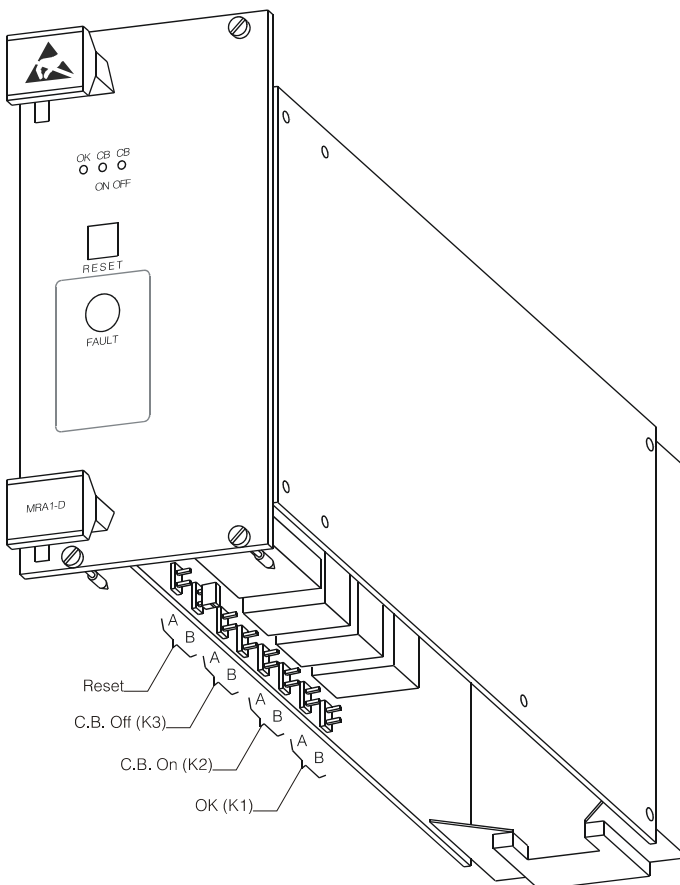


Figure 3.3: Coding of the pick-up thresholds of the internal relays K1, K2, K3 and the reset function

### 3.3 Coding of the LED function

The MRA1 can be used for two different monitoring concepts.

- a) Supervision of the circuit breaker by two supervision circuits. The opener and the shutter contacts of the circuit breaker are supervised separately. (P = parallel connection)
- b) Supervision of the circuit breakers by one supervision circuit (S=serial connection)

For this reason the switch position indication, which is shown by LEDs on the front plate of the MRA1, must be coded.

In circuit version "A" the coding plug must be in position "P" and for the circuit version "B" it must be in position "S".

The coding plugs are located inside the device on the bottom side of the relay card.

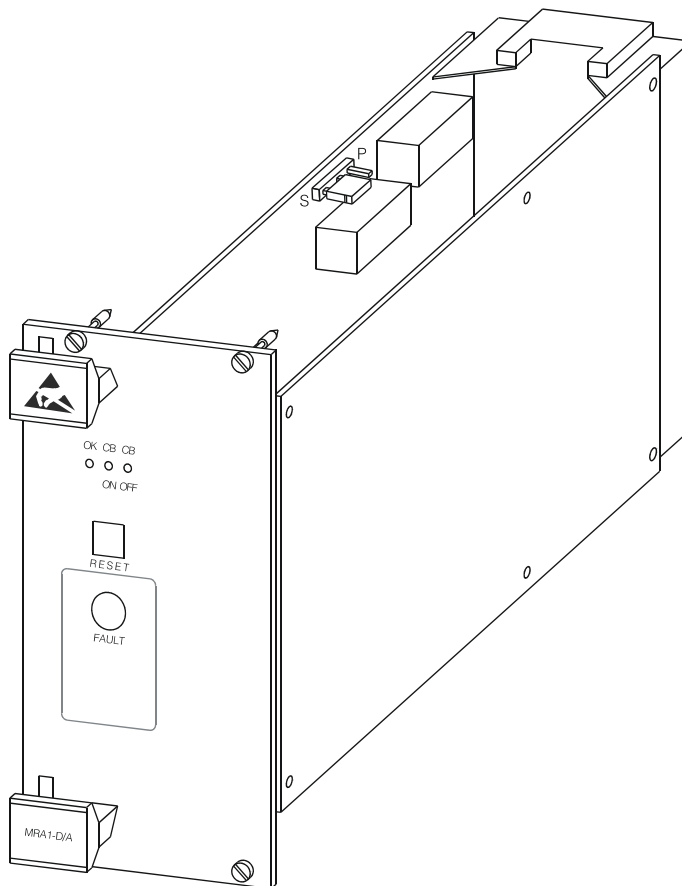


Figure 3.4: Coding plug MRA1 LED function

### 3.4 Coding Auto/Manual Reset

Behind the front plate of the MRA1, on the bottom side, there is a coding plug for pre-setting the reset behavior of the output relay.

If the coding plug is plugged in, the output relay and the indicator are set back if the fault, e.g. line break, has been corrected.

If the coding plug is not plugged in, the output relays and the must be reset manually by activating the reset key or the external reset function.

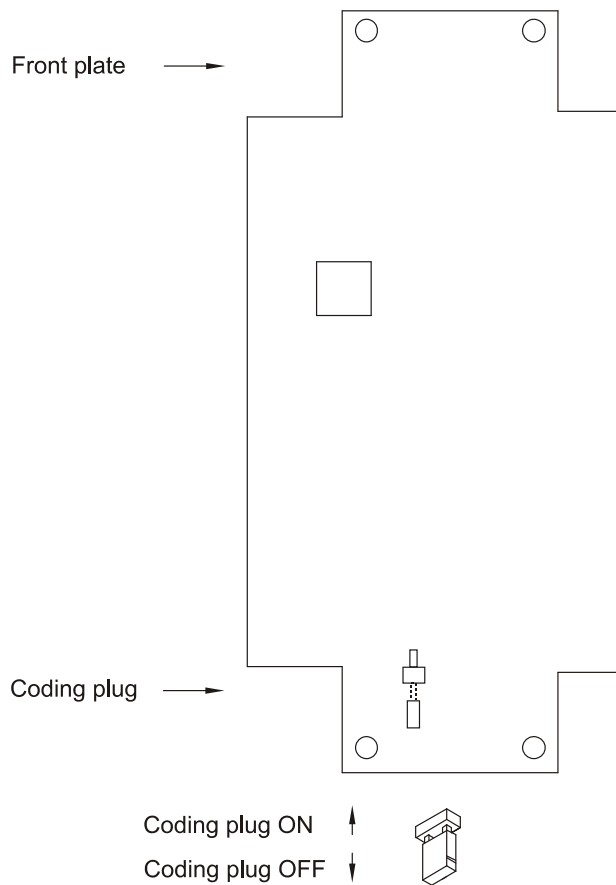


Figure 3.5: Position of coding plugs



## 4. Functions

### 4.1 Supervision of the voltage supply of the protection devices

Relay K1 is released if the voltage drops below the voltage pre-set with the coding plugs (refer to Chapter 3.2). The relay is energized in steps of 5 V each above the release point of the coded switch point. In order to bridge brief drops (up to approx. 200 ms), an RC circuit is connected in parallel. The "OK" LED lights up green if the tripping circuit is free of faults. Relay K1 is in pick-up condition if the entire tripping circuit is in order.

### 4.2 Cable break supervision

The MRA1 can be used for two different monitoring concepts.

- a) Supervision of the circuit breaker by two supervision circuits. The opener and shutter contacts of the circuit breaker are supervised separately. (P=parallel connection)
- b) Supervision of the circuit breakers by one supervision circuit (S=serial connection).

Version "A": Depending on the position of the circuit breaker, K2 or K3 will be energized and thus switch relay K1 on. The LEDs OK and CB OFF light up green. The LED CB ON lights up red. In case of a cable break, the relevant relay (K2 or K3) and K1 are released.

#### Position of the circuit breaker:

Circuit breaker – OFF:

The aux. contact (opener) of the circuit breaker is closed and K3 is active.

In case of supply voltage failure, K1 is released and the relay trips.

If the tripping coil of the circuit breaker is interrupted, K3 is re-leased and consequently also K1, and the relay trips.

Circuit breaker – ON:

K3 releases with delay.

K2 is energized undelayed via the aux. contact (shutter) of the circuit breaker and K1 remains active.

#### Protection trips:

K2 release is delayed about 400 ms, which thus bridges the protection relay contact time-wise. If the circuit breaker does not switch off despite the switch-off command, the contact of the protection relay remains closed. After approx. 400ms K2 and K2 are released. The trip relay K1 is then in trip position. (Refer Figure 3.1)

Version "B": With this With this version relays K2 and K3 are energized. In case of a cable break K2 and K3 are released and subsequently also K1.

#### Position of the circuit breaker:

Circuit breaker – OFF:

Switch position indication only re-quires one shutter contact of the circuit breaker. If the circuit breaker is switched off, K2 and K3 are active. In case of supply voltage failure K1 releases and the relay trips.

If the trip coil of the circuit breaker is interrupted, K2 and K3 are released and consequently also K1, and the relay trips.

**Circuit breaker – ON:**

K3 is released with delay action by short-circuiting the circuit breaker by means of aux. contact (shutter). K1 remains active as K2 remains energized.

**Protection trips:**

Tripping of the protection relay will bridge K2. On account of the release delay by 400 ms, the protection relay contact is bridged timewise. If the circuit breaker does not switch off despite switch-off command, the contact of the protection relay remains closed. After approx. 400ms K2 and K1 will be released. The trip relay K1 is then in release position. (Refer to Figure 3.2)

### 4.3 Front plate

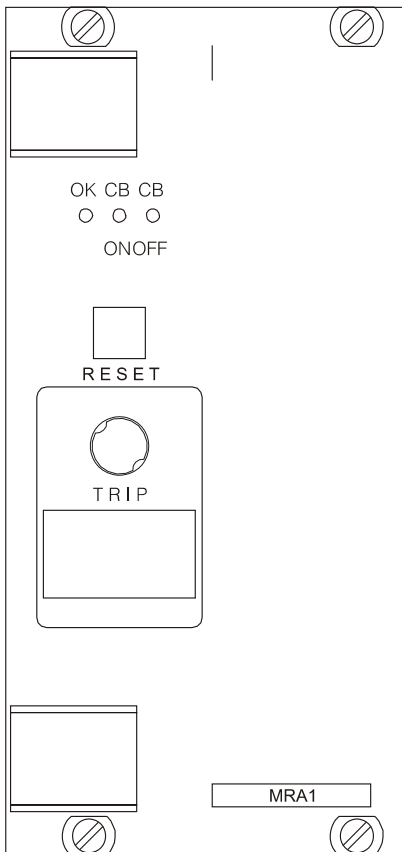


Figure 4.1: Front plate MRA1

## 4.4 LEDs

Located on the front plate of the MRA1 are three light-emitting diodes. The LED OK serves for indicating readiness for operation and emits a green light. The LEDs CB ON and CB OFF signal that the circuit breaker is switched on or off. The LED CB ON emits a red light, the LED CB OFF emits a green light. The correct indication of the LEDs must be coded in accordance with the circuitry version. (refer to chapter 3.3)

**Note:**

With version "B" a cable break may lead to over-functioning of the LEDs "CB ON" and "CB OFF" (switch position indication). If there is a cable break at terminals A5 or A6 (refer to Figure 3.2) while the circuit breaker is switched on, the MRA1 will signal this fault, but simultaneously display the circuit breaker in position "OFF". LED "CB OFF" will emit light although the circuit breaker is still switched on.

## 4.5 Status indicator

The status indicator or visual signal indicates, whether the MRA1 has tripped or not. Red means that the MRA1 has tripped. A dark display means that there is no fault. If the internal supply voltage of the device fails, the status indication will always switch to the position released.

## 4.6 Resetting

The MRA1 must be reset at every tripping action, also after the protection relay is switched on for the first time. The tripping relay is energized and the indicator moves into position dark.

There are three possible ways of resetting the protection relay.

### **RESET – key**

The Reset key permits resetting of the output relay and the indicator once the fault has been corrected.

### **External – RESET**

By applying the supply voltage, the output relay and the indicator can be reset via input terminals A2 – E9, when the fault has been eliminated.

### **Automatic – RESET**

Once the fault has been corrected, the output relays and indicators are reset without delay. The function is activated by means of the coding plug which is located behind the front plate. (refer to Chapter 3.4)

## 4.7 Terminal block

The plug-in module MRA1 has a very compact base with plug connectors and screw-type connectors:

- 8 screw-type terminals (connection plug row A) for voltage inputs
- 27 poles tab terminals for relay outputs, supply voltage etc. (terminal connectors series C, D and E, max. 6A current carrying capacity).  
Connection with tabs 6.3 mm x 0.8 mm for cable up to max. 1.5 mm<sup>2</sup> or with tabs 2.8 mm x 0.8 mm for cable up to max. 1 mm<sup>2</sup>.  
By using 2.8 x 0.8 mm tabs a bridge connection between different poles is possible.

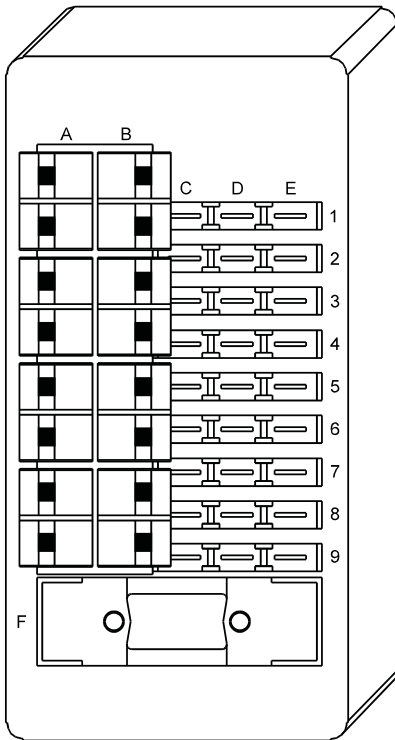


Figure 4.2: Terminal block

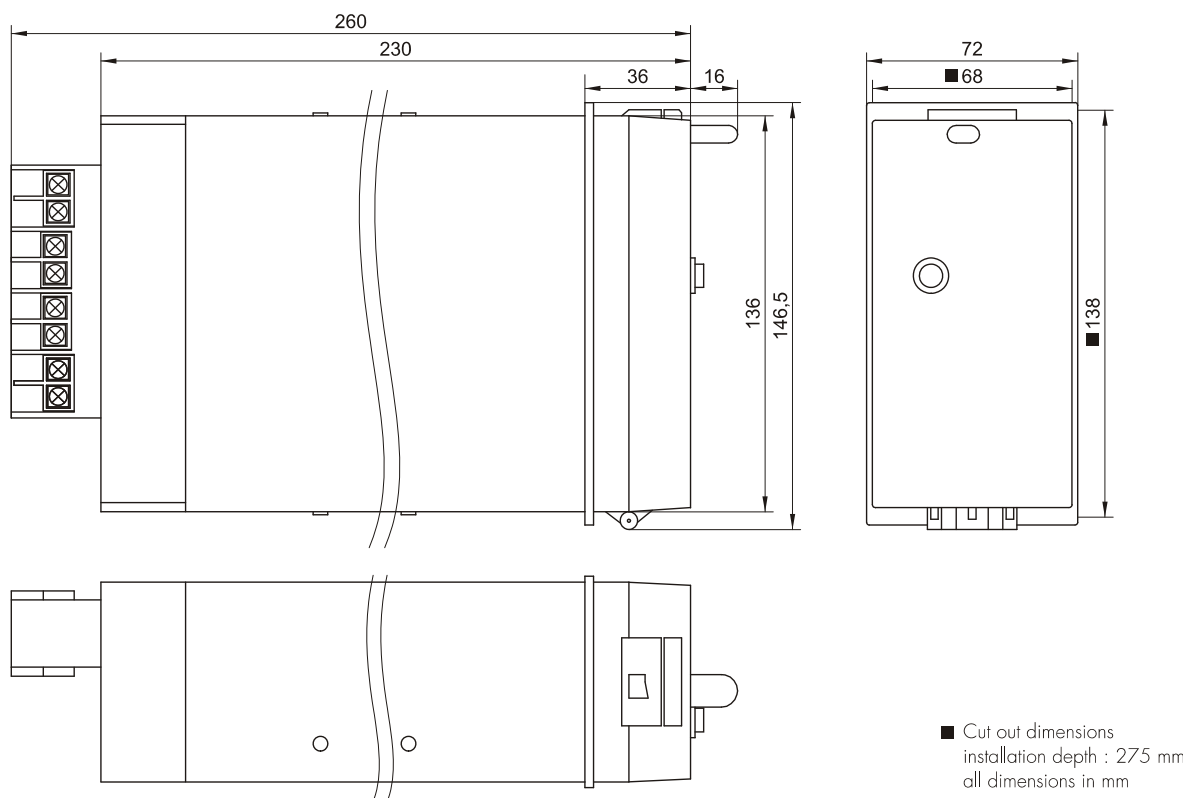


Figure 4.3: Dimensional drawing

**Please observe:**

A distance of 50 mm is necessary when the units are mounted one below the other for the front cover to be easily opened. The front cover can be opened downwards.

## 5. Testing the relay and commissioning

The following testing instructions serve for testing the functions of the device and for commissioning it. In order to prevent destruction of the device and to ensure correct functioning, the following points must be adhered to:

- The rated auxiliary voltage of the device must be the same as the auxiliary voltage available at site.
- All control and measuring circuits as well as the output relays must be connected correctly.
- The coding plugs for the switch-on thresholds of the relays must be adjusted to the respective rated voltage.

### 5.1 Connecting the auxiliary voltage

**Please note!**

Before connecting the device to the auxiliary voltage it must be ensured that this voltage is the same as the rated auxiliary voltage of the device stated on the type plate.

### 5.2 Testing the supervision circuits

The MRA1 must be connected as shown in the test circuit diagram.

**Testing circuit MRA1**

The coding plug for the LED function must be set to position "P" (refer to Chapter 3.3). The coding plug for the reset function should not be plugged in.

After the supply voltage has been switched on, the indicator remains in the position "tripped".

Actuating switch S1 energizes the relay K2. The LED »CB ON« emits a red light. After switch S1 has been re-set, relay K2 is released again with delay action (approx. 400ms). LED »CB ON« extinguishes again.

Actuating switch S2 energizes the relay K3. The LED »CB OFF« emits a green light. After switch S2 has been reset, relay K3 is released again with delay action (approx. 400ms). LED »CB OFF« extinguishes again.

Actuate switch S1 or S2 again. After switch S3 has been actuated, nothing happens at first. It is only after the Reset key has been pressed that the LED »OK« lights up green and the indicator is set back.

Reset S3. After approx. 200ms the »OK« LED goes out and the indicator shows the fault status.

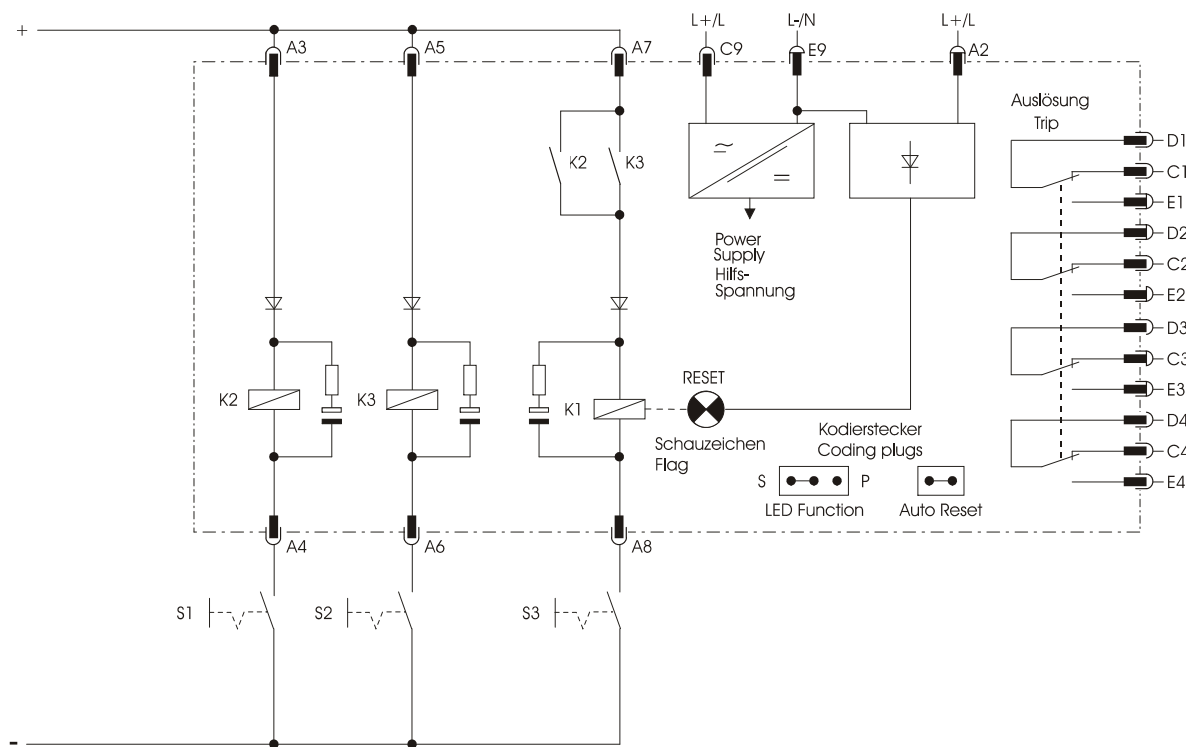


Figure 5.1: Testing circuit MRA1

### 5.3 Testing the AUTO-RESET function

If the coding plug Auto-Reset located behind the front plate is set (refer to Chapter 3.4), the »OK« LED lights up immediately when switch S3 and switch S1 or S2 are set. The indicator is then reset automatically.

### 5.4 Testing the external RESET inputs

The external Reset function is to be tested. The coding plug for automatic reset must not be plugged in. Switches S3 and S2 or S1 must be set. The auxiliary voltage must be connected to terminals A2 and E9. The »OK« LED lights up and the indicator is reset.

### 5.5 Testing the LED function

The MRA1 has two possible ways of monitoring. For this reason there are two possible functioning methods for the LEDs »CB ON« and »CB OFF«. The coding plug is located on the upper side of the relay card (refer to chapter 3.3). Position "P" was already tested when the supervision circuits were tested (refer to chapter 5.2). Set coding plug for the LED function to position "S". After the auxiliary voltage has been switched on, the LED »CB ON« lights up. Actuate switch S3. The LED »CB ON« extinguishes and LED »CB OFF« lights up.

## 6. Technical Data

|   |  |
|---|--|
| Supply voltage:   | 16 – 360 V/DC<br>16 – 270 V/AC                                       |
| Output relays:  |  |
| Output contacts:  | 4 change-over contacts   |
| Breaking capacity AC:   | 2000 VA / max. 250 V   |
| Breaking capacity DC:   |  |
| ohmic:  | 30 V / 8 A<br>110 V / 0.5 A<br>300 V / 0.3 A                         |
| inductive (L/R < 40 ms):  | 24 V / 1 A<br>110 V / 0.2 A<br>230 V / 0.15 A                        |
| Power consumption:  | at 24 V: max. 9.2 W<br>at 110 V: max. 9.4 W<br>at 220 V: max. 9.8 W  |
| <b>Measuring inputs:</b>  |  |
| Operating time:   |  |
| Reset:  | < 100 ms   |
| Tripping:   | at switching failure >400 ms<br>at failure of supply voltage >200 ms |
| Trip coil:  | coil resistance 0 - 12 k $\Omega$                                    |
| <b>System data:</b>   |  |
| Design standards:   |  |
| Generic standard:   | EN 50082-2, EN 50081-1   |
| Product standard:   | EN 60255-6, BS142  |
| Specified ambient service temperature limits  |  |
| in operation:   | -10°C to +55°C   |
| at storage:   | -25°C to +70°C   |
| Moisture-carrying capacity class F as per DIN 40040 and per DIN IEC 68, part 2-3:   | rel. humidity <95 % at 40°C for 56 days                              |
| Insulation test voltage, inputs and outputs between themselves and to the relay frame as per EN 60255-6, IEC 255-5:                     | 2.5 kV (eff.) / 50 Hz.; 1 min.                                       |
| Impulse test voltage, inputs and outputs between themselves and to the relay frame as per EN 60255-6, IEC 255-5:                        | 5 kV; 1.2 / 50 $\mu$ s, 0.5 J  |
| High frequency interference test voltage, inputs and outputs between themselves and to the relay frame as per EN 60255-6, IEC 255-22-1: | 2.5 kV / 1 MHz   |



|   |   |
|---|---|
| Electrical discharge (ESD)<br>test as per EN 61000-4-2,<br>IEC 255-22-2:              | 8 kV air discharge, 6 kV contact discharge                  |
| Electrical fast transient (Burst)<br>test as per EN 61000-4-4,<br>IEC 255-22-4:       | 4 kV / 2.5 kHz, 15 ms                                       |
| Radiated electromagnetic field<br>disturbance test as per<br>ENV 50140, IEC 255-22-3: | electric field strength: 10 V / m                           |
| Guided radiated electromagnetic<br>field disturbance test as per<br>ENV 50141:        | electric field strength: 10 V / m                           |
| Surge immunity test as per<br>EN 61000-4-5:   | 4 kV  |
| <b>Radio interference suppression</b><br>test as per EN 55011:                        | limit value class B   |
| Radio interference radiation<br>test as per EN 55011:                                 | limit value class B   |
| <b>Mechanical tests:</b>  |   |
| Shock   | class 1 as per DIN IEC 25-21-2                              |
| Vibration   | class 1 as per DIN IEC 25-21-1                              |
| Degree of protection<br>(front of the device):  | IP 54 at closed front cover (only D-version single housing) |
| Vibration test:   | 0.5 g, 10 - 300 Hz  |

## 7. Order form

|                                 |                |              |                          |
|---------------------------------|----------------|--------------|--------------------------|
| <b>Trip circuit supervision</b> |                | <b>MRA1-</b> | <input type="checkbox"/> |
| Housing (12 TE)                 | 19"- rack      |              | <b>A</b>                 |
|                                 | Flush mounting |              | <b>D</b>                 |

## Setting list MRA1

Project: \_\_\_\_\_ Woodward-Job.-No.: \_\_\_\_\_

Function group: = \_\_\_\_\_ Location: + \_\_\_\_\_ Relay code: - \_\_\_\_\_

Relay function: \_\_\_\_\_ Password: \_\_\_\_\_

All settings must be checked at site and should the occasion arise, adjusted to the object/item to be protected.

### Device coding

| Function          | Default settings |     |     |              | Actual settings |     |     |              |
|-------------------|------------------|-----|-----|--------------|-----------------|-----|-----|--------------|
|                   | A and B          | B   | A   | No code plug | A und B         | B   | A   | No code plug |
| Code plug plugged |                  |     |     |              |                 |     |     |              |
| Threshold value   | 9V               | 30V | 65V | 100V         | 9V              | 30V | 65V | 100V         |
| Relay K2 (CB_ON)  | X                |     |     |              |                 |     |     |              |
| Relay K3 (CB_OFF) | X                |     |     |              |                 |     |     |              |
| Threshold value   | 16V              | 38V | 80V | 140V         | 16V             | 38V | 80V | 140V         |
| Relay K1 (Ok)     | X                |     |     |              |                 |     |     |              |
| External Reset    | X                |     |     |              |                 |     |     |              |

### Recommended device coding at different rated voltages and operation modes

| Function                    | Circuit version A |   |   |              | Circuit version B |   |   |              |
|-----------------------------|-------------------|---|---|--------------|-------------------|---|---|--------------|
|                             | A and B           | B | A | No code plug | A and B           | B | A | No code plug |
| Code plug/<br>rated voltage |                   |   |   |              |                   |   |   |              |
| 24V DC                      | X                 |   |   |              | X                 |   |   |              |
| 48V DC                      | X                 |   |   |              | X                 |   |   |              |
| 60V DC                      |                   | X |   |              | X                 |   |   |              |
| 110V DC                     |                   |   | X |              |                   | X |   |              |
| 220V DC                     |                   |   |   | X            |                   |   | X |              |



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