### Protection Equipment

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- Characteristic curves
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- Overview
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# Protection Equipment

## Introduction

### Overview

1) The units are responsible in the main circuit for overload protection of the assigned electrical loads (e.g., motors), feeder cable and other switching and protection devices in the respective load feeder.

2) Size S3 up to 1000 V AC.

3) Size S2 (only with straight-through transformer), S3, S6, S10, S12 up to 1000 V AC.

4) With reference to the 3RB29.6 current measuring modules.

5) Stand-alone installation without accessories is possible.

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### Overload relays up to 630 A

<table>
<thead>
<tr>
<th>Type</th>
<th>3RU11</th>
<th>3RB20</th>
<th>3RB21</th>
<th>3RB22/3RB23</th>
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<td>Motor protection</td>
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<td>Alternating current, three-phase</td>
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<td>Alternating current, single-phase</td>
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<td>Direct current</td>
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<tr>
<td>Size of contactor</td>
<td>S00, S0, S2, S3</td>
<td>S00 ... S12</td>
<td>S00 ... S12</td>
<td>S00 ... S12</td>
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<tr>
<td>Rated operational current $I_{e}$</td>
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<td>Size S3</td>
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<td>Size S6</td>
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<td>Up to 50</td>
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<td>Size S10/S12, Size 14 (3TF6)</td>
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<td>Rated operational voltage $U_{e}$</td>
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<td>690/1000 AC 3)</td>
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<td>Trip classes</td>
<td>CLASS 10</td>
<td>CLASS 10, CLASS 20</td>
<td>CLASS 5, 10, 20, 30</td>
<td>CLASS 5, 10, 20, 30</td>
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<td>Thermal overload releases</td>
<td>A</td>
<td>0.11 ... 0.16 to 80 ... 100</td>
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<td>Solid-state overload releases</td>
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<td>0.1 ... 0.4 to 160 ... 630</td>
<td>0.1 ... 0.4 to 160 ... 630</td>
<td>0.3 ... 3 to 63 ... 630</td>
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<td>Rating for induction motor at 400 V AC</td>
<td>kW</td>
<td>0.04 to 90</td>
<td>0.04 to 90</td>
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<td>Accessories</td>
<td></td>
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<td>For sizes</td>
<td>S00</td>
<td>S0</td>
<td>S2</td>
<td>S3</td>
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<td>Terminal brackets for stand-alone installation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Cable releases for RESET</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Electrical remote RESET</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Terminal covers</td>
<td>--</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Sealable covers for setting knobs</td>
<td>Integrated in the unit</td>
<td>Integrated in the unit</td>
<td>Integrated in the unit</td>
<td>Integrated in the unit</td>
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</tbody>
</table>

1) The units are responsible in the main circuit for overload protection of the assigned electrical loads (e.g., motors), feeder cable and other switching and protection devices in the respective load feeder. Has this function or can use this accessory

2) Size S3 up to 1000 V AC.

3) Size S2 (only with straight-through transformer), S3, S6, S10, S12 up to 1000 V AC.

4) With reference to the 3RB29.6 current measuring modules.

5) Stand-alone installation without accessories is possible. -- Does not have this function or cannot use this accessory
Overview

Motor currents up to 820 A can be recorded and evaluated by a current measuring module, e.g. 3RB29 06-2BG1 (0.3 ... 3 A), in combination with a 3UF18 68-3GA00 (820 A/1 A) series transformer.

The SIRIUS 3RN thermistor motor protection devices can be used to provide additional temperature-dependent protection.

Features

Sizes
- Are coordinated with the dimensions, connections and technical characteristics of the other devices in the SIRIUS modular system (contactors, soft starters, ...)
- Permit the mounting of slim and compact load feeders in widths of 45 mm (S00), 45 mm (S0), 55 mm (S2), 70 mm (S3), 120 mm (S6) and 145 mm (S10/S12)
- Simplify configuration

Seamless current range
- Allows easy and consistent configuration with one series of overload relays (for small to large loads)

Protection functions

Tripping in the event of overload
- Provides optimum inverse-time delayed protection of loads against excessive temperature rises due to overload

Tripping in the event of phase unbalance
- Provides optimum inverse-time delayed protection of loads against excessive temperature rises due to phase unbalance

Tripping in the event of phase failure
- Minimizes heating of induction motors during phase failure

Protection of single-phase loads
- Enables the protection of single-phase loads

Tripping in the event of overheating
- Provides optimum temperature-dependent protection of loads against excessive temperature rises, e.g. for stator-critical motors or in the event of insufficient coolant flow, contamination of the motor surface or for long starting or braking operations

Tripping in the event of a ground fault
- Provides optimum protection of loads against high-resistance short-circuits or ground faults due to moisture, condensed water, damage to the insulation material, etc.

Features

RESET function
- Allows manual or automatic resetting of the relay

Remote RESET function
- Allows the remote resetting of the relay

TEST function for auxiliary contacts
- Allows easy checking of the function and wiring

TEST function for electronics
- Allows checking of the electronics

Status display
- Displays the current operating state

Large current adjustment button
- Makes it easier to set the relay exactly to the correct current value

Integrated auxiliary contacts (1 NO + 1 NC)
- Allows the load to be switched off if necessary
- Can be used to output signals

1) Motor currents up to 820 A can be recorded and evaluated by a current measuring module, e.g. 3RB29 06-2BG1 (0.3 ... 3 A), in combination with a 3UF18 68-3GA00 (820 A/1 A) series transformer.

2) The SIRIUS 3RN thermistor motor protection devices can be used to provide additional temperature-dependent protection.
Overload Relays

### General data

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design of load feeders</strong></td>
<td></td>
</tr>
<tr>
<td>Short-circuit strength up to 100 kA at 690 V (in conjunction with the corresponding fuses or the corresponding motor starter protector)</td>
<td>• Provides optimum protection of the loads and operating personnel in the event of short-circuits due to insulation faults or faulty switching operations</td>
</tr>
<tr>
<td>Electrical and mechanical matching to 3RT1 contactors</td>
<td>• Simplifies configuration&lt;br&gt;• Reduces wiring outlay and costs&lt;br&gt;• Enables stand-alone installation as well as space-saving direct mounting</td>
</tr>
<tr>
<td>Straight-through transformers for main circuit</td>
<td>• Reduces the contact resistance (only one point of contact)&lt;br&gt;• Saves wiring costs (easy, no need for tools, and fast)&lt;br&gt;• Saves material costs&lt;br&gt;• Reduces installation costs</td>
</tr>
<tr>
<td>Spring-type terminal connection system for main circuit</td>
<td>• Enables fast connections&lt;br&gt;• Permits vibration-resistant connections&lt;br&gt;• Enables maintenance-free connections</td>
</tr>
<tr>
<td>Spring-type terminal connection system for auxiliary circuits</td>
<td>• Enables fast connections&lt;br&gt;• Permits vibration-resistant connections&lt;br&gt;• Enables maintenance-free connections</td>
</tr>
<tr>
<td><strong>Other features</strong></td>
<td></td>
</tr>
<tr>
<td>Temperature compensation</td>
<td>• Allows the use of the relays at high temperatures without derating&lt;br&gt;• Prevents premature tripping&lt;br&gt;• Allows compact installation of the control cabinet without distance between the devices/load feeders&lt;br&gt;• Simplifies configuration&lt;br&gt;• Enables space to be saved in the control cabinet</td>
</tr>
<tr>
<td>Very high long-term stability</td>
<td>• Provides safe protection for the loads even after years of use in severe operating conditions</td>
</tr>
<tr>
<td>Wide setting ranges</td>
<td>• Reduce the number of variants&lt;br&gt;• Minimize the engineering outlay and costs&lt;br&gt;• Minimize storage overhead, storage costs, tied-up capital</td>
</tr>
<tr>
<td>Trip class CLASS 5</td>
<td>• Enables solutions for very fast starting motors requiring special protection (e. g. Ex motors)</td>
</tr>
<tr>
<td>Trip classes &gt; CLASS 10</td>
<td>• Enables heavy starting solutions</td>
</tr>
<tr>
<td>Low power loss</td>
<td>• Reduces power consumption and energy costs (up 98 % less power is used than for thermal overload relays).&lt;br&gt;• Minimizes temperature rises of the contactor and control cabinet – in some cases this may eliminate the need for controlgear cabinet cooling.&lt;br&gt;• Direct mounting to contactor saves space, even for high motor currents (i. e. no heat decoupling is required).</td>
</tr>
</tbody>
</table>

1) Exception: up to size S3, only stand-alone installation is possible.
2) Alternatively available for screw terminals.
Overload Relays

### General data

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
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</thead>
<tbody>
<tr>
<td><strong>Internal power supply</strong></td>
<td>• Eliminates the need for configuration and connecting an additional control circuit</td>
</tr>
<tr>
<td><strong>Variable adjustment of the trip classes</strong></td>
<td>(The required trip class can be adjusted by means of a rotary switch depending on the current start-up condition.)</td>
</tr>
<tr>
<td>• Reduces the number of variants</td>
<td>--</td>
</tr>
<tr>
<td>• Minimizes the configuring outlay and costs</td>
<td>--</td>
</tr>
<tr>
<td>• Minimizes storage overhead, storage costs, and tied-up capital</td>
<td>-- (only 3RB21)</td>
</tr>
<tr>
<td><strong>Overload warning</strong></td>
<td>• Indicates imminent tripping of the relay directly on the device due to overload, phase unbalance or phase failure</td>
</tr>
<tr>
<td>• Allows the imminent tripping of the relay to be signaled</td>
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<tr>
<td>• Allows measures to be taken in time in the event of continuous inverse-time delayed overloads</td>
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<tr>
<td>• Eliminates the need for an additional device</td>
<td>--</td>
</tr>
<tr>
<td>• Saves space in the control cabinet</td>
<td>--</td>
</tr>
<tr>
<td>• Reduces wiring outlay and costs</td>
<td>--</td>
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<tr>
<td><strong>Analog output</strong></td>
<td>• Allows the output of an analog output signal for actuating moving-coil instruments, feeding programmable logic controllers or transfer to bus systems</td>
</tr>
<tr>
<td>• Eliminates the need for an additional measuring transducer and signal converter</td>
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</tr>
<tr>
<td>• Saves space in the control cabinet</td>
<td>--</td>
</tr>
<tr>
<td>• Reduces wiring outlay and costs</td>
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</table>

1) The SIRIUS 3RU11 thermal overload relays use a bimetal contactor and therefore do not require a control supply voltage.
## General data

<table>
<thead>
<tr>
<th>Overload relay</th>
<th>Current measurement</th>
<th>Current range</th>
<th>Contactors (type, size, rating in kW)</th>
<th>3RT10 1</th>
<th>3RT10 2</th>
<th>3RT10 3</th>
<th>3RT10 4</th>
<th>3RT10 5</th>
<th>3RT10 6</th>
<th>3RT10 7</th>
<th>3TF68/69</th>
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<tbody>
<tr>
<td>3RU11 thermal overload relays</td>
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<td>0.1 … 12</td>
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<tr>
<td></td>
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</tbody>
</table>

1) When using the overload relays with trip class \( \geq \text{CLASS 20} \), see "Technical specifications", "Short-Circuit Protection with Fuses for Motor Feeders", and the Configuration Manual "SIRIUS Configuration - Selection data for Fuseless Load Feeders", Order No. 3ZX1012-0RA21-0AC0" or as a PDF file on the Internet at http://support.automation.siemens.com/WW/view/en/40625241

### Connection methods

The 3RB20 and 3RB21 relays are available with screw terminals (box terminals) or spring-type terminals on the auxiliary current side; the same applies for the evaluation modules of the 3RB22/3RB23 relays.

The 3RU11 relays come with screw terminals.

- Screw terminals (box terminals)
- Spring-type terminals

These connections are indicated in the Technical specifications by orange backgrounds.
Overview

(1) Connection for mounting onto contactors:
   Optimally adapted in electrical, mechanical and design terms to the contactors and soft starters, these connecting pins can be used for direct mounting of the overload relays. Stand-alone installation is possible as an alternative (in some cases in conjunction with a stand-alone installation module).

(2) Selector switch for manual/automatic RESET and RESET button:
   With this switch you can choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. A remote RESET is possible using the RESET module (accessories), which are independent of size.

(3) Switch position indicator and TEST function of the wiring:
   Indicates a trip and enables the wiring test.

(4) Motor current setting:
   Secures the motor current setting and the TEST function against adjustment.

(5) STOP button:
   If the STOP button is pressed, the NC contact is opened. This switches off the contactor downstream. The NC contact is closed again when the button is released.

(6) Transparent sealable cover
   Secures the motor current setting and the TEST function against adjustment.

(7) Supply terminals:
   The generously sized terminals permit connection of two conductors with different cross-sections for the main and auxiliary circuits. The auxiliary circuit can be connected with screw terminals and alternatively with spring-type terminals.

The 3RU11 thermal overload relays up to 100 A have been designed for inverse-time delayed protection of loads with normal starting (see "Function") against excessive temperature rises due to overload or phase failure. An overload or phase failure results in an increase of the motor current beyond the set rated motor current. Via heating elements, this current rise heats up the bimetal strips inside the device which then bend and as a result trigger the auxiliary contacts by means of a tripping mechanism. The auxiliary contacts then switch off the load by means of a contactor. The break time depends on the ratio between the tripping current and current setting \( I_t \) and is stored in the form of a long-term stable tripping characteristic (see "Characteristic Curve").

The "tripped" status is signaled by means of a switch position indicator. Resetting takes place either manually or automatically after the recovery time has elapsed (see "Function").

The devices are manufactured in accordance with environmental guidelines and contain environmentally friendly and reusable materials. They comply with all important worldwide standards and approvals.

Design

Device concept

The 3RU11 thermal overload relays are compact devices, i.e. current measurement and the evaluation unit are integrated in a single enclosure.

Mounting options

The 3RU11 thermal overload relays can be mounted directly onto the 3RT1 contactors (exception: size S00 with Cage Clamp terminals can only be installed as a stand-alone installation). With the matching terminal brackets the devices can still be installed as stand-alone units.

For more information on the mounting options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Connection methods

All sizes of the 3RU11 thermal overload relays with screw terminals can be connected to the auxiliary and main current paths. Rails can be connected to the main conductor connections of size S3 overload relays if the box terminals are removed.

As an alternative, the devices are also available with Cage Clamp terminals. The auxiliary conductor connections of these devices, and for size S00 the main conductor connections as well, are fitted with Cage Clamp terminals.

For more information on the connection options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Overload relays in contactor assemblies for wye-delta starting

When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

An assignment of the 3RU11 thermal overload relays to the line contactors of our 3RA contactor assemblies for wye-delta starting can be found under "Controls ---> Contactors and Contactor Assemblies".

Operation with frequency converter

The 3RU11 thermal overload relays are suitable for operation with frequency converters. Depending on the frequency of the converter, a higher current than the motor current must be used in some cases due to eddy-currents and skin effects.
Overload Relays
3RU11 Thermal Overload Relays

**Function**

**Basic functions**
The 3RU11 thermal overload relays are designed for:
- Inverse-time delayed protection of loads from overloading
- Inverse-time delayed protection of loads from phase failure

**Control circuit**
The 3RU11 thermal overload relays do not require an additional supply voltage for operation.

**Short-circuit protection**
Fuses or motor starter protectors must be used for short-circuit protection.

For assignments of the corresponding short-circuit protection devices to the 3RU11 thermal overload relays with/without contactor see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

**Trip classes**
The 3RU11 thermal overload relays are available for normal starting conditions with trip class CLASS 10. For heavy starting conditions see 3RB2 solid-state overload relays.

For details of the trip classes see "Characteristic Curves".

**Phase failure protection**
The 3RU11 thermal overload relays are fitted with phase failure sensitivity (see "Characteristic Curves") in order to minimize temperature rises of the load in the case of a phase failure during single-phase operation.

**Setting**
The 3RU11 thermal overload relays are set to the rated motor current by means of a rotary knob. The scale of the rotary knob is shown in ampere.

**Manual and automatic reset**
Automatic and manual reset is selected by pressing and turning the blue button (RESET button). If the button is set to manual reset, the overload relay can be reset directly by pressing the RESET button. Resetting is possible in combination with mechanical and electrical reset options from the range of accessories (see Catalog LV 1, "Accessories"). If the blue button is set to automatic RESET, the relay is reset automatically.

The time between tripping and resetting is determined by the recovery time.

**Recovery time**
After tripping due to overload, the 3RU11 thermal overload relays require some time until the bimetal strips have cooled down. The device can only be reset after the bimetal strips have cooled down. This time (recovery time) depends on the tripping characteristics and strength of the tripping current.

The recovery time allows the load to cool down after tripping due to overload.

**TEST function**
The TEST slide can be used to check whether the operational 3RU11 thermal overload relay is working properly. Actuating the slide simulates tripping of the relay. During this simulation the NC contact (95-96) is opened and the NO contact (97-98) is closed. This tests whether the auxiliary circuit has been correctly connected to the overload relay. If the 3RU11 thermal overload relay has been set to automatic RESET, the overload relay is automatically reset when the TEST slide is released. The relay must be reset with the RESET button if it has been set to manual RESET.

**STOP function**
If the STOP button is pressed, the NC contact is opened. This switches off the contactor downstream and thus the load. The load is switched on again when the STOP button is released.

**Display of the operating state**
The respective operating state of the 3RU11 thermal overload relay is displayed by means of the position of the marking on the TEST function/switch position indicator slide. After tripping due to overload or phase failure, the marking on the slide is to left on the "O" mark, otherwise it is on the "I" mark.

**Auxiliary contacts**
The 3RU11 thermal overload relays are fitted with an NO contact for the tripped signal, and an NC contact for disconnecting the contactor.
**Technical specifications**

<table>
<thead>
<tr>
<th>Type</th>
<th>3RU11 16</th>
<th>3RU11 26</th>
<th>3RU11 36</th>
<th>3RU11 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00</td>
<td>S0</td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>45 mm</td>
<td>55 mm</td>
<td>70 mm</td>
</tr>
</tbody>
</table>

**General data**

<table>
<thead>
<tr>
<th>Trips in the event of</th>
<th>Overload and phase failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip class acc. to IEC 60947-4-1</td>
<td>CLASS 10</td>
</tr>
<tr>
<td>Phase failure sensitivity</td>
<td>Yes</td>
</tr>
<tr>
<td>Overload warning</td>
<td>No</td>
</tr>
</tbody>
</table>

**Reset and recovery**

- Reset options after tripping
- Recovery time
- For automatic RESET
- For manual RESET
- For remote RESET

<table>
<thead>
<tr>
<th>min</th>
<th>Depends on the strength of the tripping current and characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>------------------------------------------------------------------</td>
</tr>
</tbody>
</table>

**Features**

- Display of operating state on device
- TEST function
- RESET button
- STOP button

<table>
<thead>
<tr>
<th>Yes, by means of TEST function/switch position indicator slide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
</tr>
</tbody>
</table>

**Safe operation of motors with “increased safety” type of protection**

EC type test certificate number acc. to directive 94/9/EC

- DMT 98 ATEX G 001 II (2) GD,
- DMT 98 ATEX G 001 N1

**Ambient temperature**

- Storage/transport
- Operation
- Temperature compensation
- Permissible rated current at
  - Temperature inside control cabinet 60 °C
  - Temperature inside control cabinet 70 °C

<table>
<thead>
<tr>
<th>°C</th>
<th>-55 ... +80</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>-20 ... +70</td>
</tr>
<tr>
<td>%</td>
<td>Up to 60</td>
</tr>
<tr>
<td>%</td>
<td>100 (over +60 °C current reduction is not required)</td>
</tr>
<tr>
<td>%</td>
<td>87</td>
</tr>
</tbody>
</table>

**Repeat terminals**

- Coil repeat terminal
- Auxiliary contact repeat terminal
- Degree of protection acc. to IEC 60529
- Touch protection acc. to IEC 61140
- Shock resistance with sine acc. to IEC 60068-2-27

<table>
<thead>
<tr>
<th>Yes</th>
<th>Not required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Not required</td>
</tr>
<tr>
<td>IP20</td>
<td>IP20²⁷</td>
</tr>
<tr>
<td>Finger-safe</td>
<td></td>
</tr>
<tr>
<td>8/10</td>
<td></td>
</tr>
</tbody>
</table>

**Electromagnetic compatibility (EMC) – Interference immunity**

- Conductor-related interference
  - Burst acc. to IEC 61000-4-4 (corresponds to degree of severity 3)
  - Surge acc. to IEC 61000-4-5 (corresponds to degree of severity 3)
  - Electrostatic discharge acc. to IEC 61000-4-2 (corresponds to degree of severity 3)
  - Field-related interference acc. to IEC 61000-4-3 (corresponds to degree of severity 3)

<table>
<thead>
<tr>
<th>kV</th>
<th>EMC interference immunity is not relevant for thermal overload relays</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>EMC interference immunity is not relevant for thermal overload relays</td>
</tr>
<tr>
<td>V/m</td>
<td>EMC interference immunity is not relevant for thermal overload relays</td>
</tr>
</tbody>
</table>

**Resistance to extreme climates – Air humidity**

| %  | 100 |

**Dimensions**

<table>
<thead>
<tr>
<th>See dimensional drawings</th>
</tr>
</thead>
</table>

**Installation altitude above sea level**

| m | Up to 2000; above this, please enquire |

**Mounting position**

The diagrams show the permissible mounting positions for mounting onto contactors and stand-alone installation. For installation in the hatched area, a setting correction of 10 % must be implemented.

Stand-alone installation:

Contactor + overload relay:

- 135°
- 90°
- 45°
- 0°

Type of mounting

| Direct mounting⁴⁷⁵ | Direct mounting/stand-alone installation with terminal bracket⁴⁷⁵ |

Footnotes see page 10.
### Overload Relays

#### 3RU1 Thermal Overload Relays

**3RU11 for standard applications**

<table>
<thead>
<tr>
<th>Type</th>
<th>3RU11 16</th>
<th>3RU11 26</th>
<th>3RU11 36</th>
<th>3RU11 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00</td>
<td>S0</td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>45 mm</td>
<td>55 mm</td>
<td>70 mm</td>
</tr>
</tbody>
</table>

**Main circuit**

- **Rated insulation voltage** $U_i$ (degree of pollution 3) V
  - 3RU11 16: 690 V
  - 3RU11 26: 1000 V
  - 3RU11 36: 500 V
  - 3RU11 46: 690 V

- **Rated impulse withstand voltage** $U_{imp}$ kV
  - 3RU11 16: 6 kV
  - 3RU11 26: 8 kV

- **Rated operational voltage** $U_e$ V
  - 3RU11 16: 690 V

**Type of current**

- Direct current
- Alternating current

**Current setting** A

<table>
<thead>
<tr>
<th>Value</th>
<th>3RU11 16</th>
<th>3RU11 26</th>
<th>3RU11 36</th>
<th>3RU11 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.11 ... 0.16</td>
<td>9 ... 12</td>
<td>1.8 ... 2.5</td>
<td>5.5 ... 8</td>
<td>18 ... 25</td>
</tr>
<tr>
<td>1.8 ... 2.5</td>
<td>20 ... 25</td>
<td>40 ... 50</td>
<td>80 ... 100</td>
<td></td>
</tr>
<tr>
<td>5.5 ... 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 ... 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Power loss per unit (max.)** W

<table>
<thead>
<tr>
<th>Value</th>
<th>3RU11 16</th>
<th>3RU11 26</th>
<th>3RU11 36</th>
<th>3RU11 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.9 ... 6.6</td>
<td>3.9 ... 6</td>
<td>6 ... 9</td>
<td>10 ... 16</td>
<td></td>
</tr>
</tbody>
</table>

**Short-circuit protection**

- With fuse without contactor
- With fuse and contactor

**Protective separation between main and auxiliary conducting path acc. to IEC 60947-1** V

<table>
<thead>
<tr>
<th>Value</th>
<th>3RU11 16</th>
<th>3RU11 26</th>
<th>3RU11 36</th>
<th>3RU11 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>440</td>
<td>440 / 690</td>
<td>500</td>
<td>690</td>
<td></td>
</tr>
</tbody>
</table>

#### Connection for main circuit

**Connection type**

- Terminal screw
- Tightening torque
- Conductor cross-sections (min./max.), 1 or 2 conductors
  - Solid
  - Finely stranded with end sleeve
  - Stranded
  - AWG cables, solid or stranded
  - Ribbon cable conductors
- Busbar connections
- Connection type

**Screw terminals with box terminal**

- **Pozidriv size 2**
- **Alien screw 4 mm**
- **M6 x 20**
- **2 x 70**
- **3 x 70**
- **2/0**
- **2 x (6 x 9 x 0.8)**

**Busbar connection**

- **M6 x 20**
- **4 ... 6**
- **2 x 70**
- **3 x 70**
- **2/0**
- **12**

**Connection type**

- Conductor cross-sections (min./max.)
  - Solid
  - Finely stranded without end sleeve
  - Finely stranded with end sleeve
  - Stranded
  - AWG cables, solid or stranded

**Footnotes for page 9:**

1. Remote RESET in combination with the corresponding accessories.
2. Terminal compartment: degree of protection IP00.
3. The 3RU11 16 overload relay with Cage Clamp terminals can only be installed as a stand-alone installation.
4. For screw and snap-on mounting TH 35 standard mounting rail, size S3 also for TH 75 standard mounting rail. For more detailed information about terminal brackets see "Accessories" --> "Technical specifications".

**Footnotes for page 10:**

1. The box terminal is removable. Rail and cable lug connections are possible if the box terminal is removed.
2. If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.
3. An operating voltage of 690 V with safe isolation only applies to devices with screw-type connections; for devices with spring-type connections an operating voltage of 440 V is applicable.
### 3RU11 for standard applications

**Overload Relays**

**3RU11 Thermal Overload Relays**

**Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>3RU11 16</th>
<th>3RU11 26</th>
<th>3RU11 36</th>
<th>3RU11 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00</td>
<td>S0</td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>45 mm</td>
<td>55 mm</td>
<td>70 mm</td>
</tr>
</tbody>
</table>

**Auxiliary circuit**

- **Number of NO contacts**: 1
- **Number of NC contacts**: 1

- **Rated insulation voltage** $U_{k}$ (degree of pollution 3) V 690
- **Rated impulse withstand voltage** $U_{imp}$ kV 6

**Contact rating of the auxiliary contacts**

- **NC contact with alternating current AC-14/AC-15**, rated operational current $I_{e}$ at $U_{k}$:
  - 24 V A 4
  - 120 V A 4
  - 125 V A 4
  - 230 V A 3
  - 400 V A 2
  - 600 V A 0.6
  - 690 V A 0.5

- **NO contact with alternating current AC-14/AC-15**, rated operational current $I_{e}$ at $U_{k}$:
  - 24 V A 3
  - 120 V A 3
  - 125 V A 3
  - 230 V A 2
  - 400 V A 1
  - 600 V A 0.6
  - 690 V A 0.5

- **NC contact, NO contact with direct current DC-13**, rated operational current $I_{e}$ at $U_{k}$:
  - 24 V A 1
  - 60 V A 1
  - 110 V A 0.22
  - 125 V A 0.22
  - 220 V A 0.11

- **Conventional thermal current** $I_{th}$
- **Contact reliability** (suitability for PLC control, 17 V, 5 mA)
  - Yes

**Short-circuit protection**

- **With fuse**
  - gl/GG operational class A 6
  - Quick A 10

- **With miniature circuit breaker (C characteristic)** A 6

**Protective separation between main and auxiliary conducting path**

Acc. to IEC 60947-1 V 440

### CSA, UL, UR rated data

**Auxiliary circuit – switching capacity** B600, R300

**Connection of the auxiliary circuit**

#### Screw terminals

- **Pozidriv size 2**
  - Tightening torque Nm 0.8 ... 1.2
  - Conductor cross-sections (min./max.), 1 or 2 conductors
    - Solid mm²
    - Finely stranded without end sleeve mm²
    - Finely stranded with end sleeve mm²
    - Stranded mm²
    - AWG cables, solid or stranded AWG
      - 2 x (0.5 ... 1.5)³
      - 2 x (0.75 ... 2.5)³
      - 2 x (0.5 ... 1.5)³
      - 2 x (0.75 ... 2.5)³
      - 2 x (24 ... 14)

#### Cage Clamp terminals

- 2 x (0.25 ... 2.5)
- 2 x (0.25 ... 2.5)
- 2 x (0.25 ... 1.5)
- 2 x (24 ... 14)

1) On request.
2) Up to $I_{k} \leq 0.5$ kA; $\leq 260$ V.
3) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.
### Overload Relays

#### 3RU1 Thermal Overload Relays

**Short-circuit protection with fuses/motor starter protectors for motor feeders**

With short-circuit currents up to 100 kA at rated operational voltages up to AC 50/60 Hz 690 V
Permissible short-circuit protection fuse for motor starters comprising overload relay and contactor, type of coordination 2

<table>
<thead>
<tr>
<th>Overload relay Setting range</th>
<th>3 kW ≡ 3RT10 15</th>
<th>4 kW ≡ 3RT10 16</th>
<th>5.5 kW ≡ 3RT10 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>gL/gG aM BS 88</td>
<td>gL/gG aM BS 88</td>
<td>gL/gG aM BS 88</td>
</tr>
<tr>
<td>Size S00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.11 ... 0.16</td>
<td>0.5 -- --</td>
<td>0.5 -- --</td>
<td>0.5 -- --</td>
</tr>
<tr>
<td>0.14 ... 0.2</td>
<td>1 -- --</td>
<td>1 -- --</td>
<td>1 -- --</td>
</tr>
<tr>
<td>0.16 ... 0.25</td>
<td>1 -- --</td>
<td>1 -- --</td>
<td>1 -- --</td>
</tr>
<tr>
<td>0.22 ... 0.32</td>
<td>1.6 -- 2</td>
<td>1.6 -- 2</td>
<td>1.6 -- 2</td>
</tr>
<tr>
<td>0.28 ... 0.4</td>
<td>2 -- 2</td>
<td>2 -- 2</td>
<td>2 -- 2</td>
</tr>
<tr>
<td>0.35 ... 0.5</td>
<td>2 -- 2</td>
<td>2 -- 2</td>
<td>2 -- 2</td>
</tr>
<tr>
<td>0.45 ... 0.63</td>
<td>2 -- 4</td>
<td>2 -- 4</td>
<td>2 -- 4</td>
</tr>
<tr>
<td>0.55 ... 0.8</td>
<td>4 -- 4</td>
<td>4 -- 4</td>
<td>4 -- 4</td>
</tr>
<tr>
<td>0.7 ... 1</td>
<td>4 -- 6</td>
<td>4 -- 6</td>
<td>4 -- 6</td>
</tr>
<tr>
<td>0.9 ... 1.25</td>
<td>4 -- 6</td>
<td>4 -- 6</td>
<td>4 -- 6</td>
</tr>
<tr>
<td>1.1 ... 1.6</td>
<td>6 -- 10</td>
<td>6 -- 10</td>
<td>6 -- 10</td>
</tr>
<tr>
<td>1.4 ... 2</td>
<td>6 -- 10</td>
<td>6 -- 10</td>
<td>6 -- 10</td>
</tr>
<tr>
<td>1.8 ... 2.5</td>
<td>10 -- 10</td>
<td>10 -- 10</td>
<td>10 -- 10</td>
</tr>
<tr>
<td>2.2 ... 3.2</td>
<td>10 -- 16</td>
<td>10 -- 16</td>
<td>10 -- 16</td>
</tr>
<tr>
<td>2.8 ... 4</td>
<td>16 -- 16</td>
<td>16 -- 16</td>
<td>16 -- 16</td>
</tr>
<tr>
<td>3.5 ... 5</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
</tr>
<tr>
<td>4.5 ... 6.3</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
</tr>
<tr>
<td>5.5 ... 8</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
</tr>
<tr>
<td>7 ... 10</td>
<td>-- -- --</td>
<td>20 -- 16</td>
<td>20 -- 16</td>
</tr>
<tr>
<td>9 ... 12</td>
<td>-- -- --</td>
<td>20 -- 16</td>
<td>20 -- 16</td>
</tr>
</tbody>
</table>

**Overload relay Setting range** 5.5 kW ≡ 3RT10 24 7.5 kW ≡ 3RT10 25 11 kW ≡ 3RT10 26

<table>
<thead>
<tr>
<th>A</th>
<th>gL/gG aM BS 88</th>
<th>gL/gG aM BS 88</th>
<th>gL/gG aM BS 88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size S0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8 ... 2.5</td>
<td>10 -- 10</td>
<td>10 -- 10</td>
<td>10 -- 10</td>
</tr>
<tr>
<td>2.2 ... 3.2</td>
<td>10 -- 16</td>
<td>10 -- 16</td>
<td>10 -- 16</td>
</tr>
<tr>
<td>2.8 ... 4</td>
<td>16 -- 16</td>
<td>16 -- 16</td>
<td>16 -- 16</td>
</tr>
<tr>
<td>3.5 ... 5</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
</tr>
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<td>4.5 ... 6.3</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
<td>20 -- 20</td>
</tr>
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<td>5.5 ... 8</td>
<td>25 -- 25</td>
<td>25 -- 25</td>
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</tr>
<tr>
<td>7 ... 10</td>
<td>25 -- 25</td>
<td>25 -- 25</td>
<td>25 -- 25</td>
</tr>
<tr>
<td>9 ... 12.5</td>
<td>25 -- 25</td>
<td>25 -- 25</td>
<td>25 -- 25</td>
</tr>
<tr>
<td>11 ... 16</td>
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<td>14 ... 20</td>
<td>-- -- --</td>
<td>25 -- 25</td>
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<td>17 ... 22</td>
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<td>35 -- 20</td>
<td>35 -- 20</td>
</tr>
<tr>
<td>20 ... 25</td>
<td>-- -- --</td>
<td>35 -- 20</td>
<td>35 -- 100</td>
</tr>
</tbody>
</table>

UL-listed fuses

**Motor starter protector for starter combinations at Iₚ = 50 kA/400 V AC**

For type of coordination "1" see short-circuit protection of the contactors without overload relay under "Controls - Contactors and Contactor Assemblies".

1) Assignment and short-circuit protective devices according to IEC 60947-4-1.

2) At max. 415 V.
**Overload Relays**

**3RU1 Thermal Overload Relays**

**3RU11 for standard applications**

---

**Short-circuit protection with fuses/motor starter protectors for motor feeders**

With short-circuit currents up to 100 kA at rated operational voltages up to AC 50/60 Hz 690 V

Permissible short-circuit protection fuse for motor starters comprising overload relay and contactor, type of coordination 2¹

**Overload relay**

<table>
<thead>
<tr>
<th>Setting range</th>
<th>15 kW ≈ 3RT10 34</th>
<th>18.5 kW ≈ 3RT10 35</th>
<th>22 kW ≈ 3RT10 36</th>
<th>UL-listed fuses</th>
<th>Motor starter protector for starter combinations at ( I_d = 50 \text{ kA}/400 \text{ V AC} )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size S2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5...10</td>
<td>5...10</td>
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<td>3RV13 31-4DC10</td>
</tr>
<tr>
<td></td>
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<td>80</td>
<td>125</td>
<td>3RV13 31-4EC10</td>
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<tr>
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<td>100</td>
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<td>100</td>
<td>150</td>
<td>3RV13 31-4FC10</td>
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<tr>
<td></td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>175</td>
<td>3RV13 31-4GC10</td>
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<tr>
<td></td>
<td>150</td>
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</table>

**Setting range**

<table>
<thead>
<tr>
<th>A</th>
<th>gL/gG</th>
<th>aM</th>
<th>BS 88</th>
<th>gL/gG</th>
<th>aM</th>
<th>BS 88</th>
<th>A</th>
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</table>

**Overload relay**

<table>
<thead>
<tr>
<th>Setting range</th>
<th>30 kW ≈ 3RT10 44</th>
<th>37 kW ≈ 3RT10 45</th>
<th>45 kW ≈ 3RT10 46</th>
<th>UL-listed fuses</th>
<th>Motor starter protector for starter combinations at ( I_d = 50 \text{ kA}/400 \text{ V AC} )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size S3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>18 ... 25</td>
<td>18 ... 25</td>
<td>18 ... 25</td>
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</tr>
</tbody>
</table>

**Setting range**

<table>
<thead>
<tr>
<th>A</th>
<th>gL/gG</th>
<th>aM</th>
<th>BS 88</th>
<th>gL/gG</th>
<th>aM</th>
<th>BS 88</th>
<th>A</th>
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</tr>
</tbody>
</table>

For type of coordination "1"¹ see short-circuit protection of the contactors without overload relay under "Controls - Contactors and Contactor Assemblies".

¹ Assignment and short-circuit protective devices according to IEC 60947-4-1. The contactor or starter must not endanger persons or the installation in the event of a short-circuit.

**Type of coordination "1"**: The contactor or the starter may be non-operational after every short-circuit release.

**Type of coordination "2"**: The contactor or the starter must be operational after a short-circuit release (without replacement of parts). Welding of the contact is permissible however.
Overload Relays
3RU1 Thermal Overload Relays

3RU11 for standard applications

Characteristics curves

The tripping characteristics show the relationship between the tripping time and tripping current as multiples of the current setting \( I_e \) and are given for symmetrical three-pole and two-pole loads from the cold state.

The smallest current used for tripping is called the minimum tripping current. According to IEC 60947-4-1, this current must be within specified limits. The limits of the minimum tripping current for the 3RU11 thermal overload relays for symmetrical three-pole loads are between 105 and 120 % of the current setting.

The tripping characteristic starts with the minimum tripping current and continues with higher tripping currents based on the characteristics of the so-called trip classes (CLASS 10, CLASS 20 etc.). The trip classes describe time intervals within which the overload relays have to trip with 7.2 times the current setting \( I_e \) from the cold state for symmetrical three-pole loads.

The tripping times are as follows for:

<table>
<thead>
<tr>
<th>Trip class</th>
<th>Tripping times</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS 10A</td>
<td>2 s ... 10 s</td>
</tr>
<tr>
<td>CLASS 10</td>
<td>4 s ... 10 s</td>
</tr>
<tr>
<td>CLASS 20</td>
<td>6 s ... 20 s</td>
</tr>
<tr>
<td>CLASS 30</td>
<td>9 s ... 30 s</td>
</tr>
</tbody>
</table>

The tripping characteristic for a three-pole 3RU11 thermal overload relay (see characteristic curve for symmetrical three-pole loads from the cold state) only applies if all three bimetal strips are simultaneously loaded with the same current. If only two bimetal strips are heated due to a phase failure, these two strips alone must generate the necessary force to trigger the tripping mechanism which would result in a longer tripping time or require a higher current. If these higher currents are applied over a longer period, they usually cause damage to the load. To avoid damage, the 3RU11 thermal overload relays are fitted with phase failure sensitivity which ensures faster tripping in accordance with the characteristic curve for 2-pole loads from the cold state by means of a suitable mechanical mechanism.

Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. This is taken into account by the 3RU11 thermal overload relays by reducing the tripping time to about 25 % when loaded with the current setting \( I_e \) for an extended period.

This is the schematic representation of a characteristic curve. The characteristic curves of the individual 3RU11 thermal overload relays can be ordered from "Technical Assistance":

- Either by e-mail to: technical-assistance@siemens.com
- Or on the Internet at: http://www.siemens.com/automation/service&support
Overload Relays
3RU1 Thermal Overload Relays

3RU11 for standard applications

Dimensional drawings

**Screw connection**
Lateral distance to grounded components: at least 6 mm.

**3RU11 16-..B0**
Size S00, with mechanical RESET

**3RU11 16-..B.**
Size S00, with terminal bracket for stand-alone installation, with remote RESET

**3RU11 26-..B.**
Size S2, with terminal bracket for stand-alone installation

**3RU11 36-..B.**
Size S3, with terminal bracket for stand-alone installation

---

**Cage Clamp connection**
The lateral distance to grounded components must be at least 6 mm.

**3RU11 16-..C1**
Size S00, with mechanical RESET (same for sizes S00 to S3).
Overload Relays
3RU1 Thermal Overload Relays

3RU11 for standard applications

3RU11 16 -..C1
Size S00, with remote RESET

3RU11 26-..D.
Size S0, with terminal bracket for stand-alone installation

3RU11 36-..D.
Size S2, with terminal bracket for stand-alone installation

3RU11 46-..D.
Size S3, with terminal bracket for stand-alone installation

Schematics
3RU11 16

3RU11 26 to 3RU11 46

Protection of DC motors
1-pole

2-pole

For dimensional drawings of overload relays mounted onto contactors see Contactors and Contactor Assemblies.
## Overview

The following accessories are available for the 3RU11 thermal overload relays:
- For the four overload relay sizes S00 to S3 one terminal bracket each for stand-alone installation
- One electrical remote RESET module in three voltage variants for all sizes
- One mechanical RESET module for all sizes
- One cable release for resetting devices which are difficult to access (for all sizes)
- Terminal covers

## Technical specifications

### Terminal brackets for stand-alone installation

<table>
<thead>
<tr>
<th>Type</th>
<th>3RU19 16-3AA01</th>
<th>3RU19 26-3AA01</th>
<th>3RU19 36-3AA01</th>
<th>3RU19 46-3AA01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting type</td>
<td>For screw and snap-on mounting onto TH 35 standard mounting rails, size S3 also for TH 75 standard mounting rails.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Connection for main circuit

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Screw terminals</th>
<th>Screw terminals with box terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal screw</td>
<td>Pozidriv size 2</td>
<td>Allen screw 4 mm</td>
</tr>
<tr>
<td>Conductor cross-section (min./max.), 1 or 2 conductors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid mm²</td>
<td>1 x (0.5 ... 2.5), max. 1 x (1 ... 4)</td>
<td>1 x (1 ... 6), max. 1 x (1 ... 10)</td>
</tr>
<tr>
<td>Finely stranded without end sleeve mm²</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Finely stranded with end sleeve mm²</td>
<td>1 x (0.5 ... 2.5)</td>
<td>1 x (1 ... 6)</td>
</tr>
<tr>
<td>Stranded mm²</td>
<td>1 x (0.5 ... 2.5), max. 1 x (1 ... 4)</td>
<td>1 x (1 ... 6), max. 1 x (1 ... 10)</td>
</tr>
<tr>
<td>AWG cables, solid or stranded</td>
<td>1 x (18 ... 14)</td>
<td>1 x (14 ... 10)</td>
</tr>
<tr>
<td>Ribbon cable conductors (number x width x thickness) mm</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Overload Relays
3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

Overview

1. Connection for mounting onto contactors:
   Optimally adapted in electrical, mechanical and design terms to the contactors and soft starters, these connecting pins can be used for direct mounting of the overload relays. Stand-alone installation is possible as an alternative (in some cases in conjunction with a stand-alone installation module).

2. Selector switch for manual/automatic RESET and RESET button:
   With the slide switch you can choose between manual and automatic RESET. A device set to manual RESET can be reset locally by pressing the RESET button. On the 3RB21 a solid-state remote RESET is integrated.

3. Switch position indicator and TEST function of the wiring:
   Indicates a trip and enables the wiring test.

4. Solid-state test (device test):
   Enables a test of all important device components and functions.

5. Motor current setting:
   Setting the device to the rated motor current is easy with the large rotary knob.

6. Trip class setting/internal ground-fault detection (only 3RB21):
   Using the rotary switch you can set the required trip class and activate the internal ground-fault detection dependent on the start-up conditions.

7. Connecting terminals (removable joint block for auxiliary circuits):
   The generously sized terminals permit connection of two conductors with different cross-sections for the main and auxiliary circuits. The auxiliary circuit can be connected with screw terminals and alternatively with spring-type terminals.

The 3RB20 and 3RB21 solid-state overload relays up to 630 A with internal power supply have been designed for inverse-time delayed protection of loads with normal and heavy starting (see “Technical specifications” and Catalog LV 1, “Selection and ordering data”.

For more information on the connection options see “Technical specifications” and Catalog LV 1, “Selection and ordering data.”

Connection methods

Main circuit
All sizes of the 3RB20/3RB21 solid-state overload relays can be connected with screw terminals. As an alternative for sizes S3 to S10/S12, the main current paths can be connected with the help of rails. Sizes S2 to S6 of the 3RB20/3RB21 relays are also available with a straight-through transformer. In this case, the cables of the main circuit are routed directly through the feed-through openings of the relay to the contactor terminals.

Auxiliary circuit
Connection of the auxiliary circuit (removable terminal block) is possible with either screw or spring-type terminal connection system (special device variants).

For more information on the connection options see “Technical specifications” and Catalog LV 1, “Selection and ordering data.”

Overload relays in contactor assemblies for wye-delta starting
When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

An assignment of the 3RB20 solid-state overload relays to the line contactors of our 3RA contactor assemblies for wye-delta starting can be found in Chapter 3 “Controls: Contactors and Contactor Assemblies”.

When 3RB21 solid-state overload relays are used in combination with contactor assemblies for wye-delta starting, the internal ground-fault detection must not be activated.

Operation with frequency converter
The 3RB20/3RB21 solid-state overload relays are suitable for frequencies of 50/60 Hz and the associated harmonics. This permits the 3RB20/3RB21 overload relays to be used on the input side of the frequency converter.

If motor protection is required on the outgoing side of the frequency converter, Siemens recommends the 3RN thermistor motor protection devices or the 3RU11 thermal overload relays for this purpose.

Design

Device concept
The 3RB20/3RB21 solid-state overload relays are compact devices, i.e. current measurement (transformer) and the evaluation unit are integrated in a single enclosure.

Mounting options
The 3RB20/3RB21 solid-state overload relays are suitable for direct and space-saving mounting onto 3RT1 contactors and 3RW30/3RW31 soft starters as well as for stand-alone installation.

For more information on the mounting options see “Technical specifications” and Catalog LV 1, “Selection and ordering data.”

Materials. They comply with all important worldwide standards and approvals.

"Increased safety" type of protection EEx e acc. to ATEX directive 94/9/EC
The 3RB20/3RB21 solid-state overload relays are suitable for the overload protection of explosion-proof motors with "increased safety" type of protection EEx e; see Catalog LV 1, Chapter 20 “Appendix” --> "Standards and approvals" --> "Type overview of approved devices for explosion-protected areas (ATEX Explosion Protection)".

Device concept
The 3RB20/3RB21 solid-state overload relays are compact devices, i.e. current measurement (transformer) and the evaluation unit are integrated in a single enclosure.

Main circuit
All sizes of the 3RB20/3RB21 solid-state overload relays can be connected with screw terminals. As an alternative for sizes S3 to S10/S12, the main current paths can be connected with the help of rails. Sizes S2 to S6 of the 3RB20/3RB21 relays are also available with a straight-through transformer. In this case, the cables of the main circuit are routed directly through the feed-through openings of the relay to the contactor terminals.

Auxiliary circuit
Connection of the auxiliary circuit (removable terminal block) is possible with either screw or spring-type terminal connection system (special device variants).

For more information on the connection options see “Technical specifications” and Catalog LV 1, “Selection and ordering data.”

Overload relays in contactor assemblies for wye-delta starting
When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

An assignment of the 3RB20 solid-state overload relays to the line contactors of our 3RA contactor assemblies for wye-delta starting can be found in Chapter 3 “Controls: Contactors and Contactor Assemblies”.

When 3RB21 solid-state overload relays are used in combination with contactor assemblies for wye-delta starting, the internal ground-fault detection must not be activated.

Operation with frequency converter
The 3RB20/3RB21 solid-state overload relays are suitable for frequencies of 50/60 Hz and the associated harmonics. This permits the 3RB20/3RB21 overload relays to be used on the input side of the frequency converter.

If motor protection is required on the outgoing side of the frequency converter, Siemens recommends the 3RN thermistor motor protection devices or the 3RU11 thermal overload relays for this purpose.

Materials. They comply with all important worldwide standards and approvals.

"Increased safety" type of protection EEx e acc. to ATEX directive 94/9/EC
The 3RB20/3RB21 solid-state overload relays are suitable for the overload protection of explosion-proof motors with "increased safety" type of protection EEx e; see Catalog LV 1, Chapter 20 “Appendix” --> "Standards and approvals" --> "Type overview of approved devices for explosion-protected areas (ATEX Explosion Protection)".
Function

Basic functions
The 3RB20/3RB21 solid-state overload relays are designed for:
- Inverse-time delayed protection of loads from overloading
- Inverse-time delayed protection of loads from phase unbalance
- Inverse-time delayed protection of loads from phase failure
- Protection of loads from high-resistance short-circuits (internal ground-fault detection only with 3RB21).

Control circuit
The 3RB20/3RB21 solid-state overload relays have an internal power supply, i.e. no additional supply voltage is required.

Short-circuit protection
Fuses or motor starter protectors must be used for short-circuit protection.
For assignments of the corresponding short-circuit protection devices to the 3RB20/3RB21 solid-state overload relays with/without contactor see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Trip classes
The 3RB20 solid-state overload relays are available for normal starting conditions with trip CLASS 10 or for heavy starting conditions with trip CLASS 20 (fixed setting in each case).

The 3RB21 solid-state overload relays are suitable for normal and heavy starting conditions. The required trip class (CLASS 5, 10, 20 or 30) can be adjusted by means of a rotary switch depending on the current start-up condition.
For details of the trip classes see "Characteristic Curves".

Phase failure protection
The 3RB20/3RB21 solid-state overload relays are fitted with phase failure protection (see "Characteristic Curves") in order to minimize temperature rises of the load during single-phase operation.
Phase failure protection is not effective for loads with star-connected and a grounded neutral point or a neutral point which is connected to a neutral conductor.

Setting
The 3RB20/3RB21 solid-state overload relays are set to the rated motor current by means of a rotary knob. The scale of the rotary knob is shown in amperes.
With the 3RB21 solid-state overload relay it is also possible to select the trip class (CLASS 5, 10, 20 or 30) using a second rotary knob and to switch the internal ground-fault detection on and off.

Manual and automatic reset
In the case of the 3RB20/3RB21 solid-state overload relays, a slide switch can be used to choose between automatic and manual resetting.
If manual reset is set, a reset can be carried out directly on the device after a trip by pressing the blue RESET button. Resetting is possible in combination with mechanical and mechanical reset options from the range of accessories (see Catalog LX 1, "Accessories"). As an alternative to the mechanical RESET options, the 3RB21 solid-state overload relays can be equipped with electrical remote RESET by applying a voltage of 24 V DC to the terminals A3 and A4.
If the slide switch is set to automatic RESET, the relay is reset automatically.
The time between tripping and resetting is determined by the recovery time.

Recovery time
With the 3RB20/3RB21 solid-state overload relays the recovery time after inverse-time delayed tripping is 3 minutes when automatic RESET is set. This recovery time allows the load to cool down.
If the button is set to manual RESET and automatic RESET, the 3RB20/3RB21 devices can be reset immediately after tripping.

TEST function
With motor current flowing, the TEST button can be used to check whether the relay is working correctly (device/solid-state test). Current measurement, motor model and trip unit are tested. If these components are OK, the device is tripped according to the table below. If there is an error, no tripping takes place.

<table>
<thead>
<tr>
<th>Trip classes</th>
<th>Required loading with the rated current prior to pressing the TEST button</th>
<th>Tripping within</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS 5</td>
<td>3 min</td>
<td>30 s</td>
</tr>
<tr>
<td>CLASS 10</td>
<td>5 min</td>
<td>1 min</td>
</tr>
<tr>
<td>CLASS 20</td>
<td>10 min</td>
<td>2 min</td>
</tr>
<tr>
<td>CLASS 30</td>
<td>15 min</td>
<td>3 min</td>
</tr>
</tbody>
</table>

Note: The TEST button must be kept pressed throughout the test. In this case the motor current must be equal to more than 80 % of the current setting I_e and have at least the value of the lower current setting.

After a test trip the relay is reset by pressing the RESET button.

Self-monitoring
The 3RB20/3RB21 solid-state overload relays have a self-monitoring feature, i.e. the devices constantly monitor their own basic functions and trip if an internal fault is detected.

Display of operating state
The respective operating state of the 3RB20/3RB21 solid-state overload relays is displayed by means of the position of the marking on the switch position indicator slide. After tripping due to overload, phase failure, phase unbalance or ground fault (ground-fault detection possible only with 3RB21) the marking on the slide is to left on the "O" mark, otherwise it is on the "1" mark.

Auxiliary contacts
The 3RB20/3RB21 solid-state overload relays are fitted with an NC contact for the "tripped" signal, and an NC contact for switching off the contactor.
# 3RB2 Solid-State Overload Relays

## Technical specifications

### General data

<table>
<thead>
<tr>
<th>Type</th>
<th>3RB20 16, 3RB21 13</th>
<th>3RB20 26, 3RB21 23</th>
<th>3RB20 36, 3RB21 33</th>
<th>3RB20 46, 3RB21 43</th>
<th>3RB20 56, 3RB21 53</th>
<th>3RB20 66, 3RB21 63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00</td>
<td>S0</td>
<td>S2</td>
<td>S3</td>
<td>S6</td>
<td>S10/S12</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>45 mm</td>
<td>55 mm</td>
<td>70 mm</td>
<td>120 mm</td>
<td>145 mm</td>
</tr>
</tbody>
</table>

### Trips in the event of

- Overload, phase failure, and phase unbalance + ground fault (for 3RB21 only)

### Trip class acc. to IEC 60947-4-1

- CLASS 10/20/5, 10, 20 and 30 adjustable (depending on the version)

### Phase failure sensitivity

- Yes

### Overload warning

- No

### Reset and recovery

- Reset options after tripping: Manual, automatic and remote RESET (depending on the version)
- Recovery time:
  - For automatic RESET: min. Approx. 3 min
  - For manual RESET: min. Immediately
  - For remote RESET: min. Immediately

### Features

- Display of operating state on device: Yes, by means of switch position indicator slide
- TEST function: Yes, test of electronics by pressing the TEST button / test of auxiliary contacts and wiring of control circuit by actuating the switch position indicator slide / self-monitoring
- RESET button: Yes
- STOP button: No

### Explosion protection – safe operation of motors with "increased safety" type of protection

- EC type test certificate number acc. to directive 94/9/EC (ATEX): PTB 06 ATEX 3001 II (2) GD

### Ambient temperatures

- Storage/transport: °C -40 ... +80
- Operation: °C -25 ... +60
- Temperature compensation: °C +60
- Permissible rated current at:
  - Temperature inside control cabinet 60 °C, stand-alone installation: % 100
  - Temperature inside control cabinet 60 °C, mounted on contactor: % 100
  - Temperature inside control cabinet 70 °C: % 100 or 90

### Repeat terminals

- Coil repeat terminal: Yes
- Auxiliary contact repeat terminal: Yes

### Degree of protection acc. to IEC 60529

- IP20

### Touch protection acc. to IEC 61140

- Finger-safe, for busbar connection with cover

### Shock resistance with sine acc. to IEC 60068-2-27 g/ms

- 15/11

### Electromagnetic compatibility (EMC)

- Conductor-related interference:
  - Burst acc. to IEC 61000-4-4 (corresponds to degree of severity 3): kV 2 (power ports), 1 (signal ports)
  - Surge acc. to IEC 61000-4-5 (corresponds to degree of severity 3): kV 2 (line to earth), 1 (line to line)
- Electrostatic discharge acc. to IEC 61000-4-2 (corresponds to degree of severity 3): kV 8 (air discharge), 6 (contact discharge)
- Field-related interference acc. to IEC 61000-4-3: V/m 10

### Electromagnetic compatibility (EMC) – Emitted interference

- Degree of severity B acc. to EN 55011 (CISPR 11) and EN 55022 (CISPR 22)

### Resistance to extreme climates – air humidity

- % 100

### Dimensions

- See dimensional drawings

### Installation altitude above sea level

- m Up to 2000

### Mounting position

- Any

### Type of mounting

- Direct mounting/stand-alone installation with terminal bracket
- Direct mounting/stand-alone installation

---

1) On request.
2) S0 for 6 ... 25 A, CLASS 20, \( I_{\text{e,max}} = 19 \) A; S0 for 6 ... 25 A, CLASS 30, \( I_{\text{e,max}} = 16 \) A.
3) 90 % for relay with current setting range 160 ... 630 A.
4) Terminal compartment: degree of protection IP00.
5) Signaling contact 97/98 in position “tripped”: 4/11 g/s.
Overload Relays
3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

<table>
<thead>
<tr>
<th>Type</th>
<th>3RB20 16, S00</th>
<th>3RB21 13, S0</th>
<th>3RB20 26, S2</th>
<th>3RB21 23, S3</th>
<th>3RB20 36, S3</th>
<th>3RB21 33, S3</th>
<th>3RB20 46, S3</th>
<th>3RB21 43, S3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>45 mm</td>
<td>55 mm</td>
<td>70 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Main circuit

| Rated insulation voltage $U_i$ (degree of pollution 3) | V | 690 | 690/1000$^1$ | 1000 |
| Rated impulse withstand voltage $U_{imp}$ | kV | 6 | 6/$^2$ | 8 |
| Rated operational voltage $U_o$ | V | 690 | 690/1000$^1$ | 1000 |

Type of current

- Direct current
- Alternating current

Current setting

| A | 0.1 ... 0.4 to 3 ... 12 | 0.1 ... 0.4 to 6 ... 25 | 6 ... 25 and 12.5 ... 50 | 12.5 ... 50 and 25 ... 100 |

Power loss per unit (max.) | W | 0.05 |

Short-circuit protection

- With fuse without contactor
- With fuse and contactor

Protective separation between main and auxiliary conducting path acc. to IEC 60947-1 (degree of pollution 2) | V | 690$^3$ |

Connection for main circuit

Screw terminals with box terminal

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Pozidriv size 2</th>
<th>Allen screw 4 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal screw</td>
<td>0.8 ... 1.2</td>
<td>2 ... 2.5</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>--</td>
</tr>
<tr>
<td>Conductor cross-sections (min./max.) 1 or 2 conductors</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Solid</td>
<td>2 × (0.5 ... 1.5)$^4$</td>
<td>2 × (0.75 ... 2.5)$^5$</td>
</tr>
<tr>
<td>- Finely stranded without end sleeve</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- Finely stranded with end sleeve</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- Stranded</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- AWG cables, solid or stranded</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- Ribbon cable conductors (number x width x thickness)</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Busbar connections

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Bolt M 6 × 20</th>
<th>Screw M 4 ... 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal screw</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>--</td>
</tr>
<tr>
<td>Conductor cross-section (min./max.)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- Finely stranded with cable lug</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- Stranded with cable lug</td>
<td>--</td>
<td>2 × 70</td>
</tr>
<tr>
<td>- AWG cable, solid or stranded, with cable lug AWG</td>
<td>--</td>
<td>3 × 70</td>
</tr>
<tr>
<td>- With connecting bar (max. width)</td>
<td>--</td>
<td>20</td>
</tr>
</tbody>
</table>

Connection type

<table>
<thead>
<tr>
<th>Straight-through transformers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of opening</td>
</tr>
</tbody>
</table>

1) For version with straight-through transformer up to 1000 V AC.
2) For version with straight-through transformer up to 8 kV.
3) For grounded networks, otherwise 600 V.
4) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.
## 3RB20, 3RB21 for standard applications

### Overload Relays

3RB2 Solid-State Overload Relays

### 3RB20, 3RB21 for standard applications

<table>
<thead>
<tr>
<th>Type</th>
<th>3RB20 56, 3RB21 53</th>
<th>3RB20 66, 3RB21 63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size Width</td>
<td>S6 120 mm</td>
<td>S10/S12 145 mm</td>
</tr>
</tbody>
</table>

### Main circuit

<table>
<thead>
<tr>
<th>Rated insulation voltage $U_i$ (degree of pollution 3)</th>
<th>V</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse withstand voltage $U_{imp}$</td>
<td>kV</td>
<td>8</td>
</tr>
<tr>
<td>Rated operational voltage $U_o$</td>
<td>V</td>
<td>1000</td>
</tr>
</tbody>
</table>

#### Type of current

- Direct current
- Alternating current No, Yes, 50/60 Hz ± 5%

#### Current setting

- 3RB20 56: A 50 ... 200
- 3RB20 66: 5 ... 250 to 160 ... 630

#### Power loss per unit (max.)

- 3RB20 56: W 0.05

### Short-circuit protection

- With fuse without contactor See Catalog LV 1, "Selection and ordering data"
- With fuse and contactor See "Technical specifications" (short-circuit protection with fuses for motor feeders)

### Protective separation between main and auxiliary conducting path acc. to IEC 60947-1 (degree of pollution 2)

- V 690

### Connection for main circuit

#### Connection type

- Terminal screw
- Tightening torque Nm
- Conductor cross-sections (min./max.), 1 or 2 conductors
  - Solid
  - Finely stranded without end sleeve
    - With 3RT19 55-4G box terminal: 2 x (1 x max. 50, 1 x max. 70), 1 x (10 ... 70)
    - With 3RT19 56-4G box terminal: 2 x (1 x max. 95, 1 x max. 120), 1 x (10 ... 120)
  - Finely stranded with end sleeve
    - With 3RT19 55-4G box terminal: 2 x (1 x max. 50, 1 x max. 70), 1 x (10 ... 70)
    - With 3RT19 56-4G box terminal: 2 x (1 x max. 95, 1 x max. 120), 1 x (10 ... 120)
  - Stranded
    - With 3RT19 55-4G box terminal: 2 x (max. 70), 1 x (16 ... 120)
    - With 3RT19 56-4G box terminal: 2 x (max. 120), 1 x (16 ... 120)
  - AWG cables, solid or stranded
    - With 3RT19 55-4G box terminal: 2 x (max. 120), 1 x (16 ... 120)
    - With 3RT19 56-4G box terminal: 2 x (max. 300), 1 x (6 ... 250 kcmil)
  - Ribbon cable conductors (number x width x thickness)
    - With 3RT19 55-4G box terminal: 2 x (6 x 15.5 x 0.8), 1 x (3 x 9 x 0.8 ... 10 x 15.5 x 0.8)
    - With 3RT19 56-4G box terminal: 2 x (10 x 15.5 x 0.8), 1 x (3 x 9 x 0.8 ... 10 x 15.5 x 0.8)

#### Connection type

- Busbar connections
  - Terminal screw
    - Tightening torque Nm
    - Conductor cross-section (min./max.)
      - Finely stranded with cable lug
        - With connecting bar (max. width)
          - AWG
            - With connecting bar (max. width)
              - 3RB20 56: M 8 x 25, 10 ... 14, 16 ... 95
              - 3RB20 66: M 10 x 30, 14 ... 24

#### Connection type

- Straight-through transformers
  - Diameter of opening mm
    - 3RB20 56: 24.5
    - 3RB20 66: --

---

1) For grounded networks, otherwise 600 V.
2) When connecting cable lugs according to DIN 46235, use the 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure phase spacing.
3) When connecting cable lugs according to DIN 46234 for conductor cross-sections from 240 mm² as well as DIN 46235 for conductor cross-sections from 185 mm², use the 3RT19 66-4EA1 terminal cover to ensure phase spacing.
3RB2 Solid-State Overload Relays

3RB20, 3RB21 for standard applications

**Type**

<table>
<thead>
<tr>
<th>Size</th>
<th>Width</th>
<th>3RB20 16, 3RB21 13</th>
<th>3RB20 26, 3RB21 23</th>
<th>3RB20 36, 3RB21 33</th>
<th>3RB20 46, 3RB21 43</th>
<th>3RB20 56, 3RB21 53</th>
<th>3RB20 66, 3RB21 63</th>
</tr>
</thead>
<tbody>
<tr>
<td>S00</td>
<td>45 mm</td>
<td>S00</td>
<td>S00</td>
<td>S00</td>
<td>S00</td>
<td>S00</td>
<td>S00</td>
</tr>
<tr>
<td>S0</td>
<td>45 mm</td>
<td>S0</td>
<td>S0</td>
<td>S0</td>
<td>S0</td>
<td>S0</td>
<td>S0</td>
</tr>
<tr>
<td>S2</td>
<td>55 mm</td>
<td>S2</td>
<td>S2</td>
<td>S2</td>
<td>S2</td>
<td>S2</td>
<td>S2</td>
</tr>
<tr>
<td>S3</td>
<td>70 mm</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
</tr>
<tr>
<td>S6</td>
<td>120 mm</td>
<td>S6</td>
<td>S6</td>
<td>S6</td>
<td>S6</td>
<td>S6</td>
<td>S6</td>
</tr>
<tr>
<td>S10/12</td>
<td>145 mm</td>
<td>S10/12</td>
<td>S10/12</td>
<td>S10/12</td>
<td>S10/12</td>
<td>S10/12</td>
<td>S10/12</td>
</tr>
</tbody>
</table>

**Auxiliary circuit**

- **Number of NO contacts**: 1
- **Number of NC contacts**: 1
- **Auxiliary contacts – assignment**: 1 NO for the signal "tripped", 1 NC for disconnecting the contactor
- **Rated insulation voltage** $U_i$ (degree of pollution 3) V
  - 300
- **Rated impulse withstand voltage** $U_{imp}$ kV
  - 4

**Auxiliary contacts – contact rating**

- **NC contact with alternating current AC-14/AC-15**
  - Rated operational current $I_e$ at $U_e$:
    - 24 V A 4
    - 120 V A 4
    - 125 V A 4
    - 250 V A 3
- **NO contact with alternating current AC-14/AC-15**
  - Rated operational current $I_e$ at $U_e$:
    - 24 V A 4
    - 120 V A 4
    - 125 V A 4
    - 250 V A 3
- **NC, NO contact with direct current DC-13**
  - Rated operational current $I_e$ at $U_e$:
    - 24 V A 2
    - 60 V A 0.55
    - 110 V A 0.3
    - 125 V A 0.3
    - 250 V A 0.11
- **Conventional thermal current** $I_{th}$ A
  - 5
- **Contact reliability** (suitability for PLC control; 17 V, 5 mA)
  - Yes

**Short-circuit protection**

- **With fuse, gL/gG operational class** A
  - 6

**Ground-fault protection (only 3RB21)**

- **Tripping value** $I_{Δ}$
  - $> 0.75 \times I_{motor}$
- **Operating range** $I$ (in steady-state condition) s
  - $< 1$

Integrated electrical remote reset (only 3RB21)

- **Connecting terminals** A3, A4
  - 24 V DC, 100 mA, 2.4 W short-term

**Protective separation between main and auxiliary conducting path** acc. to IEC 60947-1 V

- 300

**CSA, UL, UR rated data**

- **Auxiliary circuit – switching capacity** B300, R300

**Connection of the auxiliary circuit**

**Screw terminals**

- **Pozidriv size** 2
  - 0.8 ... 1.2

**Spring-type terminals**

- **Conductor cross-sections (min./max.), 1 or 2 conductors**
  - Solid mm²
    - $1 \times (0.5 ... 4)$, $2 \times (0.5 ... 2.5)$
  - Finely stranded without end sleeve mm²
    - $1 \times (0.5 ... 2.5)$, $2 \times (0.5 ... 1.5)$
  - Finely stranded with end sleeve mm²
    - $1 \times (0.5 ... 1.5)$
  - Stranded mm²
    - $2 \times (0.25 ... 1.5)$
  - AWG cables, solid or stranded AWG
    - $2 \times (24 ... 16)$

- **Conductor cross-sections (min./max.), 1 or 2 conductors**
  - Solid mm²
    - $2 \times (0.25 ... 1.5)$
  - Finely stranded without end sleeve mm²
    - $2 \times (0.25 ... 1.5)$
  - Finely stranded with end sleeve mm²
    - $2 \times (0.25 ... 1.5)$
  - Stranded mm²
    - $2 \times (0.25 ... 1.5)$
  - AWG cables, solid or stranded AWG
    - $2 \times (24 ... 16)$

**Footnotes for page 24:**

1. Please observe operational voltage.
2. Type of coordination and short-circuit protective devices acc. to IEC 60947-4-1: Type of coordination "1": The contactor or the starter may be non-operational after every short-circuit release. Type of coordination "2": The contactor or the starter must be operational after a release (without replacement of parts). There is a risk of contact welding.
3. $U_e = 500$ V.
4. Contactor cannot be mounted.
5. Please ensure that the maximum AC-3 operational current has sufficient safety clearance from the rated current of the fuses.
6. With 3UF18 68-3GA00 current transformer.
### Overload Relays

#### 3RB2 Solid-State Overload Relays

**Short-circuit protection with fuses for motor feeders**

For short-circuit currents up to 50 kA or 100 kA at rated operational voltages up to 690 V

#### Overload relays

<table>
<thead>
<tr>
<th>Size</th>
<th>Setting range</th>
<th>Contactors</th>
<th>CLASS 5 and 10</th>
<th>CLASS 20</th>
<th>CLASS 30</th>
<th>690 V/50 kA</th>
<th>690 V/100 kA</th>
<th>690 V/50 kA</th>
<th>415 V/50 kA</th>
<th>600 V/SSCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>S00</td>
<td>0.1 ... 0.4</td>
<td>3RT10 15</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>35</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>0.3 ... 1.25</td>
<td>3RT10 15</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>35</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1 ... 4</td>
<td>3RT10 15</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3 ... 12</td>
<td>3RT10 16</td>
<td>9</td>
<td>6.5</td>
<td>5.2</td>
<td>9</td>
<td>6.5</td>
<td>5.2</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>S0</td>
<td>0.1 ... 0.4</td>
<td>3RT10 23</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>35</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>0.3 ... 1.25</td>
<td>3RT10 23</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>35</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1 ... 4</td>
<td>3RT10 24</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3 ... 12</td>
<td>3RT10 23</td>
<td>9</td>
<td>6.5</td>
<td>5.2</td>
<td>9</td>
<td>6.5</td>
<td>5.2</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>S2</td>
<td>6 ... 25</td>
<td>3RT10 34</td>
<td>25</td>
<td>25</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>125</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>12.5 ... 50</td>
<td>3RT10 35</td>
<td>40</td>
<td>40</td>
<td>39</td>
<td>39</td>
<td>39</td>
<td>39</td>
<td>125</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>15 ... 50</td>
<td>3RT10 35</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>125</td>
<td>63</td>
</tr>
<tr>
<td>S3</td>
<td>12.5 ... 50</td>
<td>3RT10 44</td>
<td>50</td>
<td>50</td>
<td>47</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>41.7</td>
<td>41.7</td>
</tr>
<tr>
<td></td>
<td>25 ... 100</td>
<td>3RT10 45</td>
<td>80</td>
<td>80</td>
<td>78</td>
<td>78</td>
<td>78</td>
<td>78</td>
<td>41.7</td>
<td>41.7</td>
</tr>
<tr>
<td></td>
<td>50 ... 200</td>
<td>3RT10 46</td>
<td>95</td>
<td>95</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>41.7</td>
<td>41.7</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>3RT10 54</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>41.7</td>
<td>41.7</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>3RT10 55</td>
<td>150</td>
<td>150</td>
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<td>150</td>
<td>150</td>
<td>150</td>
<td>41.7</td>
<td>41.7</td>
</tr>
<tr>
<td>S6</td>
<td>50 ... 200</td>
<td>3RT10 56</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>185</td>
<td>355</td>
<td>355</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>3RT10 57</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>355</td>
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<td>150</td>
<td>3RT10 60</td>
<td>250</td>
<td>250</td>
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<td>250</td>
<td>250</td>
<td>250</td>
<td>355</td>
<td>355</td>
</tr>
<tr>
<td>S10</td>
<td>55 ... 250</td>
<td>3RT10 64</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>3RT10 65</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td>S12</td>
<td>160 ... 630</td>
<td>3RT10 64</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>3RT10 65</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>3RT10 70</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>3RT10 71</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>355</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td>S14</td>
<td>0.32 ... 1.25</td>
<td>3TFe9(b)</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>1.25</td>
<td>3TFe9(b)</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>360</td>
<td>360</td>
</tr>
</tbody>
</table>

For footnotes see page 23.

SSCR = Standard Short-Circuit Rating

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1) LV HRC, DIAZED, NEOFZED, Type 3NC, Type 3SB, Type 3SE
2) Acc. to BS 88, Listed acc. to UL, RK5 CL. L
3) for type of coordination

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*Siemens : 2011*
Characteristic curves

The tripping characteristics show the relationship between the tripping time and tripping current as multiples of the current setting $I_e$ and are given for symmetrical three-pole and two-pole loads from the cold state.

The smallest current used for tripping is called the minimum tripping current. According to IEC 60947-4-1, this current must be within specified limits. The limits of the total tripping current for the 3RB20/3RB21 solid-state overload relays for symmetrical three-pole loads are between 105 and 120 % of the current setting.

The tripping characteristic starts with the minimum tripping current and continues with higher tripping currents based on the characteristics of the so-called trip classes (CLASS 10, CLASS 20 etc.). The trip classes describe time intervals within which the overload relays have to trip with 7.2 times the current setting $I_e$ from the cold state for symmetrical three-pole loads.

The tripping times according to IEC 60947-4-1, tolerance band $E$, are as follows for:

<table>
<thead>
<tr>
<th>Trip class</th>
<th>Tripping time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS 5</td>
<td>3 … 5 s</td>
</tr>
<tr>
<td>CLASS 10</td>
<td>5 … 10 s</td>
</tr>
<tr>
<td>CLASS 20</td>
<td>10 … 20 s</td>
</tr>
<tr>
<td>CLASS 30</td>
<td>20 … 30 s</td>
</tr>
</tbody>
</table>

The tripping characteristic for a three-pole overload relay from the cold state (see illustration 1) only apply if all three phases are simultaneously loaded with the same current. In the event of a phase failure the 3RB20/3RB21 solid-state overload relays switch off the contactor more quickly in order to minimize heating of the load in accordance with the tripping characteristic for two-pole loads from the cold state (see illustration 2). With phase unbalance the devices switch off depending on the degree of the unbalance between the two characteristic curves.

Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. The tripping time of the 3RB20/3RB21 solid-state overload relays is reduced therefore to about 20 % when loaded with the current setting $I_e$ for an extended period.

The above illustrations are schematic representations of characteristic curves. The characteristic curves of the individual 3RB20/3RB21 electronic overload relays can be ordered from Technical Assistance:

- Either by e-mail to: technical-assistance@siemens.com
- Or on the Internet at: http://www.siemens.com/automation/service&support
Overload Relays
3RB2 Solid-State Overload Relays
3RB20, 3RB21 for standard applications

Dimensional drawings

3RB20 16, 3RB21 13, size S00

3RB20 16, 3RB21 13, size S00, stand-alone installation

3RB20 26, 3RB21 23, size S0

3RB20 26, 3RB21 23, size S0, stand-alone installation

3RB20 36, 3RB21 33, size S2

3RB20 46, 3RB21 43, size S3

3RB20 56, 3RB21 53, size S6

3RB20 66, 3RB21 63, size S10/S12
**Overload Relays**

**3RB2 Solid-State Overload Relays**

**3RB20, 3RB21 for standard applications**

3RB20 36, 3RB21 33, size S2 with straight-through transformer

3RB20 46, 3RB21 43, size S3 with straight-through transformer

3RB20 56, 3RB21 53, size S6 with straight-through transformer

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**Schematics**

3RB20 16

3RB20 26 to 3RB20 66

3RB21 13

3RB21 23 to 3RB21 63
3RB22/3RB23 for high-feature applications

Overview

The modular, solid-state overload relays with external power supply type 3RB22 (with monostable auxiliary contacts) and type 3RB23 (with bistable auxiliary contacts) up to 630 A (up to 820 A possible with a series transformer) have been designed for inverse-time delayed protection of loads with normal and heavy starting (see "Function") against excessive temperature rises due to overload, phase unbalance or phase failure. An overload, phase unbalance or phase failure result in an increase of the motor current beyond the set rated motor current. This current rise is detected by means of a current measuring module and electronically evaluated by a special evaluation module which is connected to it. The evaluation electronics sends a signal to the auxiliary contacts. After tripping due to overload, phase unbalance or phase failure by flickering when the limit current has been violated. This warning can also be issued as a signal through auxiliary contacts.

In addition to the described inverse-time delayed protection of loads against excessive temperature rises, the 3RB22/3RB23 solid-state overload relays also allow direct temperature monitoring of the motor windings (full motor protection) by connection with short-circuit and open-circuit detection of a PTC sensor circuit. With this temperature-dependent protection, the loads can be protected against overheating caused indirectly by reduced coolant flow, for example, which cannot be detected by means of coolant flow, for example, which cannot be detected by means of short-circuit and open-circuit detection of a PTC sensor circuit. With this temperature-dependent protection, the loads can be protected against overheating caused indirectly by reduced coolant flow, for example, which cannot be detected by means of short-circuit and open-circuit detection of a PTC sensor circuit. With this temperature-dependent protection, the loads can be protected against overheating caused indirectly by reduced coolant flow, for example, which cannot be detected by means of short-circuit and open-circuit detection of a PTC sensor circuit.

To also protect the loads against high-resistance short-circuits due to damage to the insulation, humidity, condensed water, etc., the 3RB22/3RB23 solid-state overload relays offer the possibility of internal ground-fault detection in conjunction with a function expansion module (for details see Catalog LV 1. "Selection and ordering data"; not possible in conjunction with contactor assembly for wye-delta starting). In the event of a ground fault the 3RB22/3RB23 relays trip. The "tripped" status is signaled by means of a continuously illuminated "THERMISTOR" LED.

After tripping due to overload, phase unbalance, or for feeding into analog inputs of programmable logic controllers. With an additional AS-Interface analog module the current values can also be transferred over the AS-i bus system.

The devices are manufactured in accordance with environmental guidelines and contain environmentally friendly and reusable materials. They comply with all important worldwide standards and approvals.

---

3RB22/3RB23 evaluation module
(1) Green "READY" LED:
   A continuous green light signals that the device is working correctly.
(2) Red "GND FAULT" LED:
   A continuous red light signals a ground-fault tripping.
(3) Red "THERMISTOR" LED:
   A continuous red light signals an active thermistor trip.
(4) Red "OVERLOAD" LED:
   A continuous red light signals an active overload trip; a flickering red light signals an imminent trip (overload warning).
(5) Motor current and trip class setting:
   Setting the device to the motor current and to the required trip class dependent on the start-up conditions is easy with the two rotary switches.
(6) Selector switch for manual/automatic RESET:
   With this switch you can choose between manual and automatic reset.
(7) TEST/RESET button:
   Enables testing of all important device components and functions, plus resetting of the device after a trip when manual RESET is selected.
(8) Connecting terminals (removable joint block):
   The generously sized terminals permit connection of two conductors with different cross-sections for the auxiliary, control and sensor circuits. Connection is possible with screw connection and alternatively with spring-type connection.
(9) 3RB29 85 function expansion module:
   Enables more functions to be added, e.g. internal ground-fault detection and/or an analog output with corresponding signals.

3RB29 06 current measuring module
Overload Relays
3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

“Increased safety” type of protection EEx e acc. to ATEX directive 94/9/EC

The 3RB22 (monostable) solid-state overload relays are suitable for the overload protection of explosion-proof motors with "increased safety" type of protection EEx e;
see Catalog LV 1, Chapter 20 "Appendix" --> "Standards and Approvals" --> "Type Overview of Approved Devices for Explosion-Protected Areas (ATEX Explosion Protection)".

Design

Device concept

The 3RB22/3RB23 solid-state overload relays are based on a modular device concept. Each device always comprises an evaluation module, which is independent of the motor current, and a current measuring module, which is dependent on the motor current. The two modules are electrically interconnected by a connection cable through the system interface.

The basic functionality of the evaluation module can be optionally expanded with corresponding function expansion modules. The function expansion modules are integrated in the evaluation module for this purpose through a simple plug-in connection.

Mounting options

Current measuring modules

The current measuring modules size S00/S0 and S2/S3 are designed for stand-alone installation. By contrast, the current measuring modules size S6 and S10/S12 are suitable for stand-alone installation and mounting onto contactors.

Evaluation modules

The evaluation modules can be mounted either on the current measuring module (only sizes S00/S0 and S2/S3) or separately.

For more information on the mounting options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Connection methods

Main circuit (current measuring module)

For sizes S00/S0, S2/S3 and S6, the main circuit can also be connected by the straight-through transformer method. In this case, the cables of the main circuit are routed directly through the feed-through openings of the relay to the contactor terminals.

For sizes S6 and S10/S12, the main circuit can be connected with the help of rails. In conjunction with the corresponding box terminals, screw connection is also possible.

Auxiliary circuit (evaluation module)

Connection of the auxiliary circuit (removable joint block) is possible with either screw or spring-type terminal connection system (special versions).

For more information on the connection options see "Technical specifications" and Catalog LV 1, "Selection and ordering data".

Overload relays in contactor assemblies for wye-delta starting

When overload relays are used in combination with contactor assemblies for wye-delta starting it must be noted that only 0.58 times the motor current flows through the line contactor. An overload relay mounted onto the line contactor must be set to 0.58 times the motor current.

When 3RB22/3RB23 solid-state overload relays are used in combination with contactor assemblies for wye-delta starting, the function expansion modules for internal ground-fault detection must not be used.

Operation with frequency converter

The 3RB22/3RB23 solid-state overload relays are suitable for frequencies of 50/60 Hz and the associated harmonics. This permits the 3RB22/3RB23 overload relays to be used on the input side of the frequency converter.

If motor protection is required on the outgoing side of the frequency converter, Siemens recommends the 3RN thermistor motor protection devices or the 3RU11 thermal overload relays for this purpose.
Overload Relays
3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Function

Basic functions
The 3RB22/3RB23 solid-state overload relays are designed for:

- Inverse-time delayed protection of loads from overloading
- Inverse-time delayed protection of loads from phase unbalance
- Inverse-time delayed protection of loads from phase failure
- Temperature-dependent protection of loads by connecting a PTC sensor circuit
- Protection of loads from high-resistance short-circuits (internal ground-fault detection; detection of fault currents > 30 % of the current setting \(I_{e}\))
- Output of an overload warning
- Output of an analog signal 4 to 20 mA DC as image of the flowing motor current

The basic functions of the evaluation modules in conjunction with function expansion modules are listed in the following table:

<table>
<thead>
<tr>
<th>Evaluation modules</th>
<th>Function expansion modules</th>
<th>Basic functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3RB22 83-4AA1</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>3RB22 83-4AC1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB23 83-4AA1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB23 83-4AC1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2CA1</td>
<td>Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, overload warning</td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2CB1</td>
<td>Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning</td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2AA0</td>
<td>Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, overload warning, analog output</td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2AA1</td>
<td>Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning, analog output</td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2AB1</td>
<td>Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, ground-fault signal, analog output</td>
<td></td>
</tr>
</tbody>
</table>

Control circuit
The 3RB22/3RB23 solid-state overload relays require an external power supply, i.e. an additional supply voltage is necessary. Power is supplied through a wide-range power supply unit for 24 to 240 V AC/DC.

Short-circuit protection
Fuses or motor starter protectors must be used for short-circuit protection.

Example
Rating of induction motor = 45 kW (AC 50 Hz, 400 V)
Rated motor current = 80 A
Required trip class = CLASS 20
Selected transformer: 10 ... 100 A

Solution
Step 1: Use the upper rotary knob (CLASS) to select the 100 A range
Step 2: Within the 100 A range set the trip class CLASS 20
Step 3: Set the lower rotary knob to 80 % (= 0.8) corresponding to 100 A \(\times 0.8 = 80\) A.

If the current which is set on the evaluation module does not correspond to the current range of the selected current transformer, an error will result.

Manual and automatic reset
In the case of the 3RB22/3RB23 solid-state overload relays, a slide switch can be used to choose between automatic and manual resetting.

If manual reset is set, a reset can be carried out directly on the device after a trip by pressing the blue TEST/RESET button. A remote RESET can be carried out electrically by jumpering the terminals Y1 and Y2.

If the slide switch is set to automatic RESET, the relay is reset automatically.

The time between tripping and resetting is determined by the recovery time.

Trip classes
The 3RB22/3RB23 solid-state overload relays are suitable for normal and heavy starting conditions. The required trip class (CLASS 5, 10, 20 or 30) can be adjusted by means of a rotary switch depending on the current start-up condition.

For details of the trip classes see "Characteristic Curves".

Phase failure protection
The 3RB22/3RB23 solid-state overload relays are fitted with phase failure protection (see "Characteristic Curves") in order to minimize temperature rises of the load during single-phase operation.

Setting
The 3RB22/3RB23 solid-state overload relays are set to the rated motor current by means of two rotary knobs.

- The upper rotary knob (CLASS / \(I_{e_{\text{max}}}\)) is divided into 4 ranges: 1 A, 10 A, 100 A and 1000 A. The zone must be selected which corresponds to the rated motor current and the current measuring module to be used with it. With the range selected the required trip class (CLASS 5, 10, 20 or 30) can be determined.
- The lower rotary knob with percent scale (10 ... 100 %) is then used to set the rated motor current in percent of the range selected with the upper rotary knob.

Example
Rating of induction motor = 45 kW (AC 50 Hz, 400 V)
Rated motor current = 80 A
Required trip class = CLASS 20
Selected transformer: 10 ... 100 A

Solution
Step 1: Use the upper rotary knob (CLASS) to select the 100 A range
Step 2: Within the 100 A range set the trip class CLASS 20
Step 3: Set the lower rotary knob to 80 % (= 0.8) corresponding to 100 A \(\times 0.8 = 80\) A.

If the current which is set on the evaluation module does not correspond to the current range of the selected current transformer, an error will result.

Manual and automatic reset
In the case of the 3RB22/3RB23 solid-state overload relays, a slide switch can be used to choose between automatic and manual resetting.

If manual reset is set, a reset can be carried out directly on the device after a trip by pressing the blue TEST/RESET button. A remote RESET can be carried out electrically by jumpering the terminals Y1 and Y2.

If the slide switch is set to automatic RESET, the relay is reset automatically.

The time between tripping and resetting is determined by the recovery time.
**Recovery time**

With the 3RB22/3RB23 solid-state overload relays the recovery time after inverse-time delayed tripping is approx. 3 minutes regardless of the selected reset mode. The recovery time allows the load to cool down.

However, in the event of temperature-dependent tripping by means of a connected PTC sensor circuit, the device can only be manually or automatically reset once the winding temperature at the installation location of the PTC thermistor has fallen 5 Kelvin below its response temperature.

After a ground-fault tripping the 3RB22/3RB23 solid-state overload relay trips can be reset immediately without a recovery time.

**TEST function**

The combined TEST/RESET button can be used to check whether the relay is working correctly. The test can be aborted at any time by letting go of the TEST/RESET button.

LEDs, the device configuration (this depends on which expansion module is plugged in) and the device hardware are tested while the button is kept pressed for 6 seconds. Simultaneously and for another 18 seconds a direct current proportional in size to the maximum phase of the main current is fed in at the terminals I(+) and I(-). By comparing the analog signal, which is to be measured, with the main current, the accuracy of the current measurement can be determined. In this case 4 mA corresponds to 0 % and 20 mA to 125 % of the current setting. After 24 seconds the auxiliary contacts are switched and the feeder switch off as the result, bringing the test to an end.

After a test trip a faultless relay is reset by pressing the TEST/RESET button. If a hardware fault is detected, the device trips and cannot be reset.

**Self-monitoring**

The 3RB22/3RB23 solid-state overload relays have a self-monitoring feature, i.e. the devices constantly monitor their own basic functions and trip if an internal fault is detected.

**Display of the operating state**

The particular operating state of the 3RB22/3RB23 solid-state overload relays is displayed by means of four LEDs:

- Green "READY" LED: A continuous green light signals that the overload relay is ready for operation. The 3RB22/3RB23 overload relays are not ready (LED "OFF") if there is no control supply voltage or if the function test was negative.
- Red "GND FAULT" LED: A continuous red light signals a ground fault.
- Red "THERMISTOR" LED: A continuous red light signals a temperature-dependent trip.
- Red "OVERLOAD" LED: A continuous red light signals an inverse-time delayed trip; a flickering red light signals an imminent inverse-time delayed trip (overload warning).

**Auxiliary contacts**

The 3RB22/3RB23 solid-state overload relays have two outputs, each with one NO contact and one NC contact. Their basic assignment/function may be influenced by function expansion modules.

The 3RB22 and 3RB23 differ with respect to the tripping characteristics of their auxiliary contacts – monostable or bistable:

The monostable 3RB22 solid-state overload relays will enter the "tripped" state if the control voltage fails (> 200 ms), and return to the original state they were in before the control supply voltage failed when the voltage returns. These devices are therefore especially suited for plants in which the control voltage is not strictly monitored.

The bistable 3RB23 overload relays do not change their "tripped" or "not tripped" status if the control voltage fails. The auxiliary contacts only switch over in the event of an overload and if the supply voltage is present. These devices are therefore especially suited for plants in which the control voltage is monitored separately.

**Response if the control supply voltage fails**

If the control supply voltage fails for more than 0.2 s, the output relays respond differently depending on the version: monostable or bistable.

<table>
<thead>
<tr>
<th>Response of the output relays in the event of</th>
<th>Monostable 3RB22</th>
<th>Bistable 3RB23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure of the control supply voltage</td>
<td>The device trips</td>
<td>The device trips</td>
</tr>
<tr>
<td>Return of the control supply voltage without previous tripping</td>
<td>The device resets</td>
<td>No change of the switching state of the auxiliary contacts</td>
</tr>
<tr>
<td>Return of the control supply voltage after previous tripping</td>
<td>The device remains tripped Reset: • For overload tripping, after 3 minutes • For thermostat tripping, after the temperature has fallen 5 K below the response temperature • For ground-fault tripping, immediately</td>
<td>The device remains tripped Reset: • For overload tripping, after 3 minutes • For thermostat tripping, after the temperature has fallen 5 K below the response temperature • For ground-fault tripping, immediately</td>
</tr>
</tbody>
</table>

Monostable and bistable responses of the output relays

---

*Siemens · 2011*
## Overload Relays
### 3RB2 Solid-State Overload Relays

#### 3RB22, 3RB23 for high-feature applications

### Technical specifications

<table>
<thead>
<tr>
<th>Type – Overload relay of complete system</th>
<th>3RB22, 3RB23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00 ... S10/S12</td>
</tr>
</tbody>
</table>

#### General data

<table>
<thead>
<tr>
<th>Trips in the event of</th>
<th>Overload, phase failure and phase unbalance (&gt; 40 % acc. to NEMA), + ground fault (with corresponding function expansion module) and activation of the thermistor motor protection (with closed PTC sensor circuit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip class acc. to IEC 60947-4-1</td>
<td>CLASS 5, 10, 20 and 30 adjustable</td>
</tr>
</tbody>
</table>

**Phase failure sensitivity**

- Yes, from 1.125 x Ie for symmetrical loads
- and from 0.85 x Ie for unsymmetrical loads

### Reset and recovery

- Reset options after tripping
  - For automatic RESET
    - min
  - For manual RESET
    - min
  - For remote RESET
    - min

**Recovery time**

- For tripping due to overcurrent: 3 (stored permanently)
- For tripping by thermistor: time until the motor temperature has fallen 5 K below the response temperature
- For tripping due to a ground fault: no automatic RESET
- For tripping due to overcurrent: 3 (stored permanently)
- For tripping by thermistor: time until the motor temperature has fallen 5 K below the response temperature
- For tripping due to a ground fault: immediately

### Features

- Display of operating state on device
  - Yes, with 4 LEDs: Green "Ready" LED, red "Ground Fault" LED, red "Thermistor" LED and red "Overload" LED

**Test function**

- Yes, test of LEDs, electronics, auxiliary contacts and wiring of control circuit by pressing the button TEST/RESET / self-monitoring

**RESET button**

- Yes, with the TEST/RESET button

**STOP button**

- No

### Explosion protection – safe operation of motors with "increased safety" type of protection

EC type test certificate number acc. to directive 94/9/EC (ATEX)

PTB 05 ATEX 3022 II (2) GD

### Ambient temperatures

- Storage/transport °C
- Operation °C
- Temperature compensation °C
- Permissible rated current
  - Temperature inside control cabinet 60 °C %
  - Temperature inside control cabinet 70 °C %

### Repeat terminals

- Coil repeat terminal
- Auxiliary contact repeat terminal

### Degree of protection acc. to IEC 60529

IP20\(^{2)}\)

### Touch protection acc. to IEC 61140

Finger-safe\(^{2)}\)

### Shock resistance with sine acc. to IEC 6068-2-27 g/ms

15/11

### Electromagnetic compatibility (EMC)

#### Interference immunity

- Conductor-related interference
  - Burst acc. to IEC 61000-4-4 (corresponds to degree of severity 3)
  - Surge acc. to IEC 61000-4-5 (corresponds to degree of severity 3)
  - Electrostatic discharge acc. to IEC 61000-4-2 (corresponds to degree of severity 3)
  - Field-related interference acc. to IEC 61000-4-3 (corresponds to degree of severity 3)

#### Degree of severity A acc. to EN 55011 (CISPR 11) and EN 55022 (CISPR 22)

2 (power ports), 1 (signal ports)

2 (line to earth), 1 (line to line)

8 (air discharge), 6 (contact discharge)

10

### Resistence to extreme climates – air humidity %

100

### Dimensions

See dimensional drawings

### Installation altitude above sea level m

Up to 2000

### Mounting position

Any

### Type of mounting

Evaluation module: stand-alone installation,
current measuring module size S00 to S3: stand-alone installation,
current measuring module size S6 and S10/S12: stand-alone installation and mounting onto contactors

---

1) On request.
2) Current measuring modules size S6 and S10/S12 with busbar connection in conjunction with cover.
### 3RB2 Solid-State Overload Relays

<table>
<thead>
<tr>
<th>Type – Overload relay of current measuring module</th>
<th>3RB29 06</th>
<th>3RB29 06</th>
<th>3RB29 56</th>
<th>3RB29 66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00/S0</td>
<td>S2/S3</td>
<td>S6</td>
<td>S10/S12</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>55 mm</td>
<td>120 mm</td>
<td>145 mm</td>
</tr>
</tbody>
</table>

### Main circuit

<table>
<thead>
<tr>
<th>Rated insulation voltage $U_i$ (degree of pollution 3)</th>
<th>V</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse withstand voltage $U_{imp}$</td>
<td>kV</td>
<td>6</td>
</tr>
<tr>
<td>Rated operational voltage $U_o$</td>
<td>V</td>
<td>1000</td>
</tr>
</tbody>
</table>

#### Type of current
- Direct current
- Alternating current
  - No
  - Yes, 50/60 Hz ±5%

<table>
<thead>
<tr>
<th>Current setting</th>
<th>A</th>
<th>0.3 ... 3;</th>
<th>2.4 ... 25</th>
<th>10 ... 100</th>
<th>20 ... 200</th>
<th>63 ... 630</th>
</tr>
</thead>
</table>

#### Power loss per unit (max.)
- W 0.5

### Short-circuit protection
- With fuse without contactor
- With fuse and contactor
  - See Catalog LV 1, “Selection and ordering data”.
  - See “Technical specifications” (short-circuit protection with fuses for motor feeders)

### Protective separation between main and auxiliary conducting path acc. to IEC 60947-1 (degree of pollution 2)
- V 690

### Connection for main circuit

#### Connection type
- Terminal screw
- Tightening torque Nm
  - 4 mm Allen screw
  - 10 ... 12
  - 20 ... 22
- Conductor cross-sections (min./max.), 1 or 2 conductors
  - Solid
    - 2 x (1 x max. 50, 1 x max. 70),
    - 1 x (10 ... 70)
  - Finely stranded without end sleeve
    - 2 x (1 x max. 95, 1 x max. 120),
    - 1 x (10 ... 120)
- Finely stranded with end sleeve
  - 2 x (1 x max. 95, 1 x max. 120),
  - 1 x (10 ... 120)
  - 2 x (1 x max. 95, 1 x max. 120),
  - 1 x (10 ... 120)
  - 2 x (1 x max. 95, 1 x max. 120),
  - 1 x (10 ... 120)
  - 2 x (1 x max. 95, 1 x max. 120),
  - 1 x (10 ... 120)
- Stranded
  - 2 x (max. 70),
  - 1 x (16 ... 70)
  - 2 x (max. 120),
  - 1 x (16 ... 120)
- AWG cables, solid or stranded
  - With 3RT19 55-4G box terminal:
    - 2 x (max. 3/0),
    - 1 x (6 ... 250 kcmil)
  - With 3RT19 56-4G box terminal:
    - 2 x (max. 5/0),
    - 1 x (6 ... 250 kcmil)
  - 2 x (10 x 15.5 x 0.8),
  - 1 x (3 x 9 x 0.8 ... 10 x 15.5 x 0.8)
- Ribbon cable conductors
  - (number x width x thickness)
    - 2 x (6 x 15.5 x 0.8),
    - 1 x (3 x 9 x 0.8 ... 10 x 15.5 x 0.8)

#### Busbar connections
- M8 x 25
- M10 x 30
- 10 ... 14
- 14 ... 24

#### Connection type
- Diameter of opening mm
  - 25

#### Straight-through transformers
- 15
- 25

---

1) When grounded networks, otherwise 600 V.
2) When connecting cable lugs according to DIN 4623S, use the 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm² to ensure phase spacing.

---

3) When connecting cable lugs according to DIN 46234 for conductor cross-sections from 240 mm² as well as DIN 46235 for conductor cross-sections from 185 mm², use the 3RT19 56-4EA1 terminal cover to ensure phase spacing.
### Overload Relays

#### 3RB2 Solid-State Overload Relays

**3RB2, 3RB23 for high-feature applications**

<table>
<thead>
<tr>
<th>Type – Overload relay of evaluation module</th>
<th>3RB2 83, 3RB23 83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>S00 ... S10/S12</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
</tr>
</tbody>
</table>

#### Auxiliary circuit

<table>
<thead>
<tr>
<th>Number of NO contacts</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of NC contacts</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Auxiliary contacts – assignment

1. NO for the signal "tripped due to overload and/or thermistor",
2. NC for switching off the contactor
3. NO for the signal "tripped due to ground fault",
4. NC for switching off the contactor
5. NO for the signal "tripped due to overload and/or thermistor and/or ground fault",
6. NC for switching off the contactor
7. NO for overload warning,
8. NC for switching off the contactor

<table>
<thead>
<tr>
<th>Rated insulation voltage ( U_i ) (degree of pollution 3)</th>
<th>V</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse withstand voltage ( U_{imp} )</td>
<td>kV</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Auxiliary contacts – contact rating

- **NC contact with alternating current AC-14/AC-15**
  - Rated operational current \( I_e \) at \( U_e \):
    - 24 V: A 6
    - 120 V: A 6
    - 125 V: A 6
    - 250 V: A 3

- **NO contact with alternating current AC-14/AC-15**:
  - Rated operational current \( I_e \) at \( U_e \):
    - 24 V: A 6
    - 120 V: A 6
    - 125 V: A 6
    - 250 V: A 3

- **NC, NO contact with direct current DC-13**:
  - Rated operational current \( I_e \) at \( U_e \):
    - 24 V: A 2
    - 60 V: A 0.55
    - 110 V: A 0.3
    - 125 V: A 0.3
    - 250 V: A 0.2

- **Conventional thermal current \( I_{th} \)**: A 5
- **Contact reliability**
  - (suitability for PLC control; 17 V, 5 mA)
  - Yes

#### Short-circuit protection

- **With fuse, gL/gG operational class A** A 6
- **With miniature circuit breaker (C characteristic)** A 1.6

| Protective separation between main and auxiliary conducting path |
|-----------------------------------------------------------------|-----------------|
| Acc. to IEC 60947-1                                             | V   | 300 |

#### CSA, UL, UR rated data

**Auxiliary circuit – switching capacity** B300, R300

#### Connection of the auxiliary circuit

**Connection type**

- **Screw terminals**
  - **Pozidriv size 2**
  - **Tightening torque** Nm: 0.8 ... 1.2

- **Conductor cross-section (min./max.), 1 or 2 conductors**
  - **Solid**: \( \text{mm}^2 \)
    - 1 x (0.5 ... 4), 2 x (0.5 ... 2.5)
  - **Finely stranded without end sleeve**: \( \text{mm}^2 \)
    - –
  - **Finely stranded with end sleeve**: \( \text{mm}^2 \)
    - 1 x (0.5 ... 2.5), 2 x (0.5 ... 1.5)
  - **Stranded**: \( \text{mm}^2 \)
    - –
  - **AWG cables, solid or stranded**: AWG
    - 2 x (20 ... 14)

**Connection type**

- **Spring-type terminals**
  - **Conductor cross-section (min./max.), 1 or 2 conductors**
    - **Solid**: \( \text{mm}^2 \)
      - 2 x (0.25 ... 1.5)
    - **Finely stranded without end sleeve**: \( \text{mm}^2 \)
      - –
    - **Finely stranded with end sleeve**: \( \text{mm}^2 \)
      - 2 x (0.25 ... 1.5)
    - **Stranded**: \( \text{mm}^2 \)
      - 2 x (0.25 ... 1.5)
    - **AWG cables, solid or stranded**: AWG
      - 2 x (24 ... 16)

1) The assignment of auxiliary contacts may be influenced by function expansion modules.
Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

**Type – Overload relay of evaluation module**

<table>
<thead>
<tr>
<th>3RB22 83, 3RB23 83</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
</tr>
<tr>
<td>S00 ... S10/S12</td>
</tr>
<tr>
<td><strong>Width</strong></td>
</tr>
<tr>
<td>45 mm</td>
</tr>
</tbody>
</table>

**Control and sensor circuit as well as the analog output**

<table>
<thead>
<tr>
<th></th>
<th>3RB22 83</th>
<th>3RB23 83</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated insulation voltage</strong> $U_{\text{i}}$ (degree of pollution 3)</td>
<td>300 V</td>
<td>300 V</td>
</tr>
<tr>
<td><strong>Rated impulse withstand voltage</strong> $U_{\text{imp}}$</td>
<td>4 kV</td>
<td>4 kV</td>
</tr>
<tr>
<td><strong>Rated control supply voltage</strong> $U_{\text{s}}$</td>
<td>AC 50/60 Hz 24 ... 240 V</td>
<td>DC 50/60 Hz 24 ... 240 V</td>
</tr>
<tr>
<td><strong>Operating range</strong> $U_{\text{min}}$, $U_{\text{max}}$</td>
<td>AC 50/60 Hz $0.85 \times U_{\text{min}} \leq U_{\text{s}} \leq 1.1 \times U_{\text{max}}$</td>
<td>DC 50/60 Hz $0.85 \times U_{\text{min}} \leq U_{\text{s}} \leq 1.1 \times U_{\text{max}}$</td>
</tr>
<tr>
<td><strong>Mains buffering time</strong> $t_{\text{trip}}$</td>
<td>200 ms</td>
<td>200 ms</td>
</tr>
<tr>
<td><strong>Thermistor motor protection (PTC thermistor detector)</strong></td>
<td>Summation cold resistance $k\Omega \leq 1.5$</td>
<td>Response value $k\Omega = 3.4 \ldots 3.8$</td>
</tr>
<tr>
<td><strong>Ground-fault detection</strong></td>
<td>Tripping value $I_{\Delta}$</td>
<td>The information refers to sinusoidal residual currents at 50/60 Hz</td>
</tr>
<tr>
<td></td>
<td>For $0.3 \times I_{\text{e}} &lt; I_{\text{motor}} &lt; 2.0 \times I_{\text{e}}$</td>
<td>$&gt; 0.3 \times I_{\text{e}}$</td>
</tr>
<tr>
<td></td>
<td>$&gt; 2.0 \times I_{\text{e}} &lt; 8.0 \times I_{\text{e}}$</td>
<td>$&gt; 0.15 \times I_{\text{motor}}$</td>
</tr>
<tr>
<td></td>
<td>Response time $t_{\text{trip}}$ ms</td>
<td>500 ... 1000 ms</td>
</tr>
<tr>
<td><strong>Analog output</strong></td>
<td>Output signal mA</td>
<td>4 ... 20 mA</td>
</tr>
<tr>
<td></td>
<td>Measuring range</td>
<td>0 to $1.25 \times I_{\text{e}}$, 4 mA corresponds to $0 \times I_{\text{e}}$, 16.8 mA corresponds to $1.0 \times I_{\text{e}}$, 20 mA corresponds to $1.25 \times I_{\text{e}}$</td>
</tr>
<tr>
<td><strong>Connection for the control and sensor circuit as well as the analog output</strong></td>
<td>Load, max. $\Omega$</td>
<td>100 $\Omega$</td>
</tr>
</tbody>
</table>

**Connection type**

- **Screw terminals**
  - Terminal screw
  - Tightening torque Nm 0.8 ... 1.2
  - Conductor cross-section (min./max.), 1 or 2 conductors
    - Solid mm²
    - Finely stranded without end sleeve mm²
    - Finely stranded with end sleeve mm²
    - Stranded mm²
    - AWG cables, solid or stranded AWG

- **Spring-type terminals**
  - Conductor cross-section (min./max.), 1 or 2 conductors
    - Solid mm²
    - Finely stranded without end sleeve mm²
    - Finely stranded with end sleeve mm²
    - Stranded mm²
    - AWG cables, solid or stranded AWG

1) Control circuit.
2) Sensor circuit.
3) In conjunction with corresponding function expansion module.
4) Analog input modules, e.g. SM 331, must be configured for 4-wire measuring transducers. In this case the analog input module must not supply current to the analog output of the 3RB22/3RB23 relay.
### Short-circuit protection with fuses for motor feeders

For short-circuit currents up to 50 kA or 100 kA at rated operational voltages up to 690 V

<table>
<thead>
<tr>
<th>Overload relays</th>
<th>Contac- tors</th>
<th>CLASS 5 and 10</th>
<th>CLASS 20</th>
<th>CLASS 30</th>
<th>690 V/ 50 kA</th>
<th>690 V/ 100 kA</th>
<th>690 V/50 kA</th>
<th>415 V/50 kA</th>
<th>600 V/ SSCR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fuse links</td>
<td>Type 3NA</td>
<td>Type SSB</td>
<td>Type SSE</td>
<td>Acc. to BS 88</td>
<td>Listed acc. to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LV HRC</td>
<td>DIAZED</td>
<td>NEOZED</td>
<td></td>
<td></td>
<td>UL, RK 5 CL, L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting range</th>
<th>Type rated operational current Iₚ AC-3 in A at ... V</th>
<th>Type rated operational current Iₚ AC-3 in A for type of coordination²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>400 500 600 800 900 1000 125</td>
<td>1 2 1 2 2 2 --</td>
</tr>
</tbody>
</table>

#### 3RB22, 3RB23 for high-feature applications

**Overload Relays 3RB2 Solid-State Overload Relays**

**3RB22, 3RB23 for high-feature applications**

**Short-circuit protection with fuses for motor feeders**

For short-circuit currents up to 50 kA or 100 kA at rated operational voltages up to 690 V

<table>
<thead>
<tr>
<th>Overload relays</th>
<th>Contac- tors</th>
<th>CLASS 5 and 10</th>
<th>CLASS 20</th>
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<th>690 V/ 50 kA</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fuse links</td>
<td>Type 3NA</td>
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<td>Acc. to BS 88</td>
<td>Listed acc. to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LV HRC</td>
<td>DIAZED</td>
<td>NEOZED</td>
<td></td>
<td></td>
<td>UL, RK 5 CL, L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting range</th>
<th>Type rated operational current Iₚ AC-3 in A at ... V</th>
<th>Type rated operational current Iₚ AC-3 in A for type of coordination²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>400 500 600 800 900 1000 125</td>
<td>1 2 1 2 2 2 --</td>
</tr>
</tbody>
</table>

1) Please observe operational voltage.  
   SSCR = Standard Short-Circuit Rating

2) Assignment and short-circuit protective devices according to IEC 60947-4-1:
   - The contactor or starter must not endanger persons or the installation in the event of a short-circuit.
   - Type of coordination "1": The contactor or the starter may be non-operational after every short-circuit release.
   - Type of coordination "2": The contactor or the starter must be operational after a short-circuit release (without replacement of parts). There is a risk of contact welding.

3) Contactors not mountable.

4) Please ensure that the maximum AC-3 operational current has sufficient safety clearance from the rated current of the fuses.

5) With 3UF18 68-3GA00 current transformer.
Characteristic curves

The tripping characteristics show the relationship between the tripping time and tripping current as multiples of the current setting $I_e$ and are given for symmetrical three-pole and two-pole loads from the cold state.

The smallest current used for tripping is called the minimum tripping current. According to IEC 60947-4-1, this current must be within specified limits. The limits of the minimum tripping current for the 3RB22/3RB23 solid-state overload relays for symmetrical three-pole loads lie between 105 and 120 % of the current setting $I_e$.

The tripping characteristic starts with the minimum tripping current and continues with higher tripping currents based on the characteristics of the so-called trip classes (CLASS 10, CLASS 20 etc.). The trip classes describe time intervals within which the overload relays have to trip with 7.2 times the current setting $I_e$ from the cold state for symmetrical three-pole loads.

The tripping times according to IEC 60947-4-1, tolerance band E, are as follows for:

<table>
<thead>
<tr>
<th>Trip class</th>
<th>Tripping time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS 5</td>
<td>3 … 5 s</td>
</tr>
<tr>
<td>CLASS 10</td>
<td>5 … 10 s</td>
</tr>
<tr>
<td>CLASS 20</td>
<td>10 … 20 s</td>
</tr>
<tr>
<td>CLASS 30</td>
<td>20 … 30 s</td>
</tr>
</tbody>
</table>

The tripping characteristic for a three-pole overload relay from the cold state (see illustration 1) only apply if all three phases are simultaneously loaded with the same current. In the event of a phase failure or a current unbalance of more than 40 %, the 3RB22/3RB23 solid-state overload relays switch off the contactor more quickly in order to minimize heating of the load in accordance with the tripping characteristic for two-pole loads from the cold state (see illustration 2).

Compared with a cold load, a load at operating temperature obviously has a lower temperature reserve. The tripping time of the 3RB22/3RB23 solid-state overload relays is reduced therefore to about 20 % when loaded with the current setting $I_e$ for an extended period.

The above illustrations are schematic representations of characteristic curves. The characteristic curves of the individual 3RB22/3RB23 electronic overload relays can be ordered from Technical Assistance:

- Either by e-mail to: technical-assistance@siemens.com
- Or on the Internet at: http://www.siemens.com/automation/service&support

Tripping characteristics for 3-pole loads

Tripping characteristics for 2-pole loads
Overload Relays

3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Dimensional drawings

3RB22 83-4, 3RB23 83-4 evaluation module

3RB29 06-2BG1, 3RB29 06-2DG1 current measuring module

3RB29 06-2JG1 current measuring module

3RB29 56-2TG2 current measuring module
3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

3RB29 56-2TH2 current measuring module

3RB29 66-2WH2 current measuring module
Overload Relays
3RB2 Solid-State Overload Relays

3RB22, 3RB23 for high-feature applications

Schematics

Protection of single-phase motors
(not in conjunction with internal ground-fault detection)
3RB29 06-2.G1, 3RB29 56-2TG2

Schematic representation of a possible application (3-phase)
## Overload Relays

### 3RB2 Solid-State Overload Relays

#### 3RB22, 3RB23 for high-feature applications

### Connections

<table>
<thead>
<tr>
<th>Evaluation modules</th>
<th>With function expansion module</th>
<th>Basic functions</th>
<th>Inputs</th>
<th>Outputs</th>
<th>95/96 NC</th>
<th>97/98 NO</th>
<th>05/06 NC</th>
<th>07/08 NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>3RB22 83-4AA1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB22 83-4AC1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB23 83-4AA1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB23 83-4AC1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2CA1</td>
<td></td>
<td>Inverse-time delayed protection, temperature-dependent protection, overload warning</td>
<td>Power supply 24 ... 240 V AC/DC</td>
<td>Connection for PTC sensor</td>
<td>Electrical remote RESET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2CB1</td>
<td></td>
<td>Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning</td>
<td>Power supply 24 ... 240 V AC/DC</td>
<td>Connection for PTC sensor</td>
<td>Electrical remote RESET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2AA0</td>
<td></td>
<td>Inverse-time delayed protection, temperature-dependent protection, electrical remote RESET, analog output</td>
<td>Power supply 24 ... 240 V AC/DC</td>
<td>Connection for PTC sensor</td>
<td>Electrical remote RESET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2AA1</td>
<td></td>
<td>Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, overload warning, analog output</td>
<td>Power supply 24 ... 240 V AC/DC</td>
<td>Connection for PTC sensor</td>
<td>Electrical remote RESET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2AB1</td>
<td></td>
<td>Inverse-time delayed protection, temperature-dependent protection, internal ground-fault detection, electrical remote RESET, ground-fault signal, analog output</td>
<td>Power supply 24 ... 240 V AC/DC</td>
<td>Connection for PTC sensor</td>
<td>Electrical remote RESET</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation modules</th>
<th>With function expansion module</th>
<th>Outputs</th>
<th>95/96 NC</th>
<th>97/98 NO</th>
<th>05/06 NC</th>
<th>07/08 NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>3RB22 83-4AA1</td>
<td></td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB22 83-4AC1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB23 83-4AA1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB23 83-4AC1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3RB29 85-2CA1</td>
<td></td>
<td>No</td>
<td>Disconnect the contactor (inverse-time delayed/temperature-dependent protection)</td>
<td>Signal &quot;tripped&quot;</td>
<td>Overload warning</td>
<td>Overload warning</td>
</tr>
<tr>
<td>3RB29 85-2CB1</td>
<td></td>
<td>No</td>
<td>Disconnect the contactor (inverse-time delayed/temperature-dependent protection + ground fault)</td>
<td>Signal &quot;tripped&quot;</td>
<td>Overload warning</td>
<td>Overload warning</td>
</tr>
<tr>
<td>3RB29 85-2AA0</td>
<td></td>
<td>Analog signal</td>
<td>Disconnect the contactor (inverse-time delayed/temperature-dependent protection)</td>
<td>Signal &quot;tripped&quot;</td>
<td>Overload warning</td>
<td>Overload warning</td>
</tr>
<tr>
<td>3RB29 85-2AA1</td>
<td></td>
<td>Analog signal</td>
<td>Disconnect the contactor (inverse-time delayed/temperature-dependent protection + ground fault)</td>
<td>Signal &quot;tripped&quot;</td>
<td>Overload warning</td>
<td>Overload warning</td>
</tr>
<tr>
<td>3RB29 85-2AB1</td>
<td></td>
<td>Analog signal</td>
<td>Disconnect the contactor (inverse-time delayed/temperature-dependent protection)</td>
<td>Signal &quot;tripped&quot;</td>
<td>Overload warning</td>
<td>Overload warning</td>
</tr>
</tbody>
</table>
Overload Relays
3RB2 Solid-State Overload Relays

Accessories

**Overview**

**Overload relays for standard applications**
The following accessories are available for the 3RB20/3RB21 solid-state overload relays:
- One terminal bracket each for the overload relays size S00 and S0 (sizes S2 to S12 can be installed as stand-alone installation without a terminal bracket)
- One mechanical remote RESET module for all sizes
- One cable release for resetting devices which are difficult to access (for all sizes)
- One sealable cover for all sizes
- Box terminal blocks for sizes S6 and S10/S12
- Terminal covers for sizes S2 to S10/S12

**Overload relays for high-feature applications**
The following accessories are available for the 3RB22/3RB23 solid-state overload relays:
- A sealable cover for the evaluation module
- Box terminal blocks for the current measuring modules size S6 and S10/S12
- Terminal covers for the current measuring modules size S6 and S10/S12

**Technical specifications**

**Terminal brackets for stand-alone installation**

<table>
<thead>
<tr>
<th>Type</th>
<th>3RB29 13-0AA1</th>
<th>3RB29 23-0AA1</th>
</tr>
</thead>
<tbody>
<tr>
<td>For overload relays</td>
<td>3RB20 16, 3RB21 13</td>
<td>3RB20 26, 3RB21 23</td>
</tr>
<tr>
<td>Size</td>
<td>S00</td>
<td>S0</td>
</tr>
</tbody>
</table>

**General data**

Type of mounting
For screw and snap-on mounting onto TH 35 standard mounting rail

**Connection for main circuit**

Connection type

<table>
<thead>
<tr>
<th>Type</th>
<th>Screw terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal screw</td>
<td>Pozidriv size 2</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.8 ... 1.2</td>
</tr>
<tr>
<td>Solid</td>
<td>2 ... 2.5</td>
</tr>
<tr>
<td>Conductor cross-section (min./max.), 1 or 2 conductors</td>
<td></td>
</tr>
<tr>
<td>Solid</td>
<td>1 x (0.5 ... 2.5),</td>
</tr>
<tr>
<td>max. 1 x (... 4)</td>
<td>1 x (1 ... 6),</td>
</tr>
<tr>
<td>max. 1 x (... 10)</td>
<td>1 x (1 ... 6),</td>
</tr>
<tr>
<td>max. 1 x (... 10)</td>
<td>max. 1 x (... 10)</td>
</tr>
<tr>
<td>Finely stranded without end sleeve</td>
<td>--</td>
</tr>
<tr>
<td>mm²</td>
<td>--</td>
</tr>
<tr>
<td>Finely stranded with end sleeve</td>
<td>1 x (0.5 ... 2.5)</td>
</tr>
<tr>
<td>mm²</td>
<td>1 x (1 ... 6)</td>
</tr>
<tr>
<td>Stranded</td>
<td>1 x (0.5 ... 2.5),</td>
</tr>
<tr>
<td>mm²</td>
<td>1 x (1 ... 6),</td>
</tr>
<tr>
<td>max. 1 x (... 4)</td>
<td>max. 1 x (... 10)</td>
</tr>
<tr>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>AWG</td>
<td>1 x (18 ... 14)</td>
</tr>
<tr>
<td>mm²</td>
<td>1 x (14 ... 10)</td>
</tr>
</tbody>
</table>
Service & Support

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