

# Solid State Relays SOLITRON MIDI Current Sensing Type RJCS, RJCSR

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- AC semiconductor contactor
- Integrated current monitoring
- Zero switching (RJCS1A)
- Direct copper bonding (DCB) technology
- LED-indication
- Cage clamp output terminals
- 4-32 VDC control input
- Operational ratings up to 50 AACrms and 600 VAC
- Local and remote alarm status
- Set-point adjustable
- Time delay adjustable
- Local and remote setup

## Preliminary Datasheet

## Product Description

The SOLITRON Midi Current Sensing is a compact, single-phase SSR that is sensitive to variations in load conditions in industrial heating applications. This microprocessor-based device is ideal for detection of partial load failure and to ensure the highest process quality. Current sensing is integrated inside to eliminate the need to install an external current transformer. A membrane "button" on the front is used to effect a simple "teach in" of the current setpoint. Alarm delay time is set by a potentiometer. A drop in setpoint current of more than 13% will trigger an open collector alarm. In the case of the Autoranging RJCS (RJCSR), an open collector

alarm is triggered with a load deviation (drop/increase) in setpoint current of more than 13%.

Up to 50 alarm outputs can be connected in parallel to a standard PLC input. Typical conditions that can be detected are heater break or open-circuit, blown fuse, semiconductor short-circuit and faulty power connection.

Device over-temperature protection is integrated as a standard feature.

The product is ready to mount on DIN-rail or chassis and comes with integral heatsink. The standard housing dimensions enable straightforward replacement of alternative products.

## Ordering Key RJCSR1A60D50EPNO

|                             |   |
|-----------------------------|---|
| Solid State Relay           | — |
| Current Sensing             | — |
| Autoranging (option)        | — |
| Number of poles             | — |
| Switching mode              | — |
| Rated operational voltage   | — |
| Control voltage             | — |
| Rated operational current   | — |
| Terminal layout             | — |
| Over-temperature protection | — |
| Alarm output type           | — |

## Type Selection

| Options                          | Switching mode | Rated operational voltage        | Control voltage | Rated operational current      | Terminal layout | Protection               | Alarm output type                                |
|----------------------------------|----------------|----------------------------------|-----------------|--------------------------------|-----------------|--------------------------|--|
| R: Autoranging A: Zero switching |                | 23: 230 VACrms<br>60: 600 VACrms | D: 4 - 32 VDC   | 30: 30 AACrms<br>50: 50 AACrms | E: Contactor    | P: Over-temp. protection | NO: NPN, Normally open<br>PO: PNP, Normally open |

## Selection Guide

| Options      | Rated operational voltage | Non-rep. voltage | Control voltage | Supply voltage | Alarm output type | Rated operational current |                  |
|--------------|---------------------------|------------------|-----------------|----------------|-------------------|---------------------------|------------------|
|              |                           |                  |                 |                |                   | 30 A                      | 50A              |
| -            | 230 VACrms                | 650 Vp           | 4 - 32 VDC      | 24 VDC         | NPN, NO           | -                         | RJCSR1A23D50EPNO |
|              |                           |                  |                 |                | PNP, NO           | -                         | RJCSR1A23D50EPPO |
|              | 600 VACrms                | 1200 Vp          | 4 - 32 VDC      | 24 VDC         | NPN, NO           | -                         | RJCSR1A60D50EPNO |
|              |                           |                  |                 |                | PNP, NO           | -                         | RJCSR1A60D50EPPO |
| Auto-ranging | 230 VACrms                | 650 Vp           | 4 - 32 VDC      | 24 VDC         | NPN, NO           | RJCSR1A23D30EPNO          | RJCSR1A23D50EPNO |
|              |                           |                  |                 |                | PNP, NO           | RJCSR1A23D30EPPO          | RJCSR1A23D50EPPO |
|              | 600 VACrms                | 1200 Vp          | 4 - 32 VDC      | 24 VDC         | NPN, NO           | RJCSR1A60D30EPNO          | RJCSR1A60D50EPNO |
|              |                           |                  |                 |                | PNP, NO           | RJCSR1A60D30EPPO          | RJCSR1A60D50EPPO |

## General Specifications

|   | RJCS.1.23..               | RJCS.1.60..         |
|---|---------------------------|---------------------|
| Operational voltage range                           | 24 to 265 VAC             | 42 to 660 VAC       |
| Non-rep. peak voltage                               | 650 V <sub>p</sub>        | 1200 V <sub>p</sub> |
| Operational frequency range                         | 45 to 65 Hz               | 45 to 65 Hz         |
| Power factor  | ≥ 0.5 @ 230 VACrms        | ≥ 0.5 @ 600 VACrms  |
| Approvals*  | UL, cUL                   |                     |
| CE-marking  | Yes                       |                     |
| Supply status indication                            | Green LED, half intensity |                     |
| Control status indication                           | Green LED                 |                     |
| Over-temperature alarm trip indication              | Red LED, intermittent     |                     |
| Alarm indication (except for over-temperature trip) | Red LED                   |                     |

\* Approvals for RJCSR... pending

## Input Specifications

|                               |             |
|-------------------------------|-------------|
| Control voltage range         | 4 - 32 VDC  |
| Pick-up voltage               | 3.8 VDC     |
| Reverse voltage               | 32 VDC      |
| Drop-out voltage              | 1.2 VDC     |
| Maximum control input current | 1.5 mA      |
| Response time pick-up         | ≤ 1/2 cycle |
| Response time drop-out        | ≤ 1/2 cycle |

## Supply Specifications

|   |                     |
|---|---------------------|
| Power supply voltage, V <sub>cc</sub>             | 24 VDC ± 15%        |
| Max. supply current                               | 22 mA (per device)  |
| Max. PLC current @ 24VDC during normal conditions | 275 μA (per device) |

## Alarm Specifications

|                                |  |
|--------------------------------|--|
| Output current, i <sub>o</sub> | ≤50 mADC                                 |
| Output voltage                 |  |
| NPN                            | 1 + 0.15i <sub>o</sub>                   |
| PNP                            | V <sub>cc</sub> - 1 - 0.15i <sub>o</sub> |
| No. of outputs in parallel     | ≤50                                      |

## Housing Specifications

|                             |   |
|-----------------------------|---|
| Weight                      | Approx. 380 g   |
| Housing material            | PBT Flame retardant   |
| Control terminal cable size |   |
| Min                         | 1 x 0.5 mm <sup>2</sup> (1 x AWG20)   |
| Max                         | 1 x 4.0 mm <sup>2</sup> (1 x AWG12) or<br>2 x 2.5 mm <sup>2</sup> (2 x AWG14) |
| Mounting torque max.        | 0.6 Nm Posidriv 0 bit   |
| Control terminal screws     | M3  |
| Power terminal cable size   |   |
| Min                         | 1 x 4 mm <sup>2</sup> (1 x AWG12)   |
| Max                         | 1 x 25 mm <sup>2</sup> (1 x AWG3) or<br>2 x 10 mm <sup>2</sup> (2 x AWG6)     |
| Mounting torque max.        | 2.5 Nm Posidriv 2 bit   |
| Power terminal screws       | M5  |

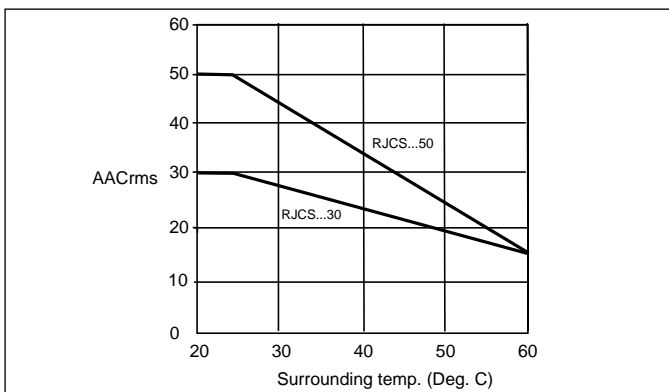
## Thermal Specifications

|                       |                                |
|-----------------------|--------------------------------|
| Operating temperature | -20 to +60°C (-4 to +140 °F)   |
| Storage temperature   | -40 to +100°C (-40 to +212 °F) |

## Insulation

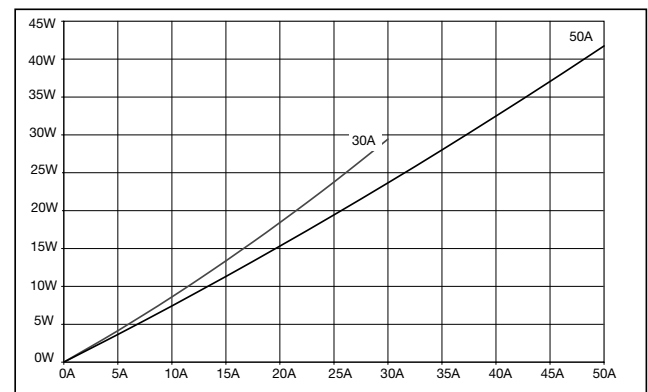
|                          |               |
|--------------------------|---------------|
| Rated insulation voltage |               |
| Input to output          | ≥ 4000 VACrms |
| Output to case           | ≥ 4000 VACrms |

## Derating Curve



Note: Based on 100% duty cycle

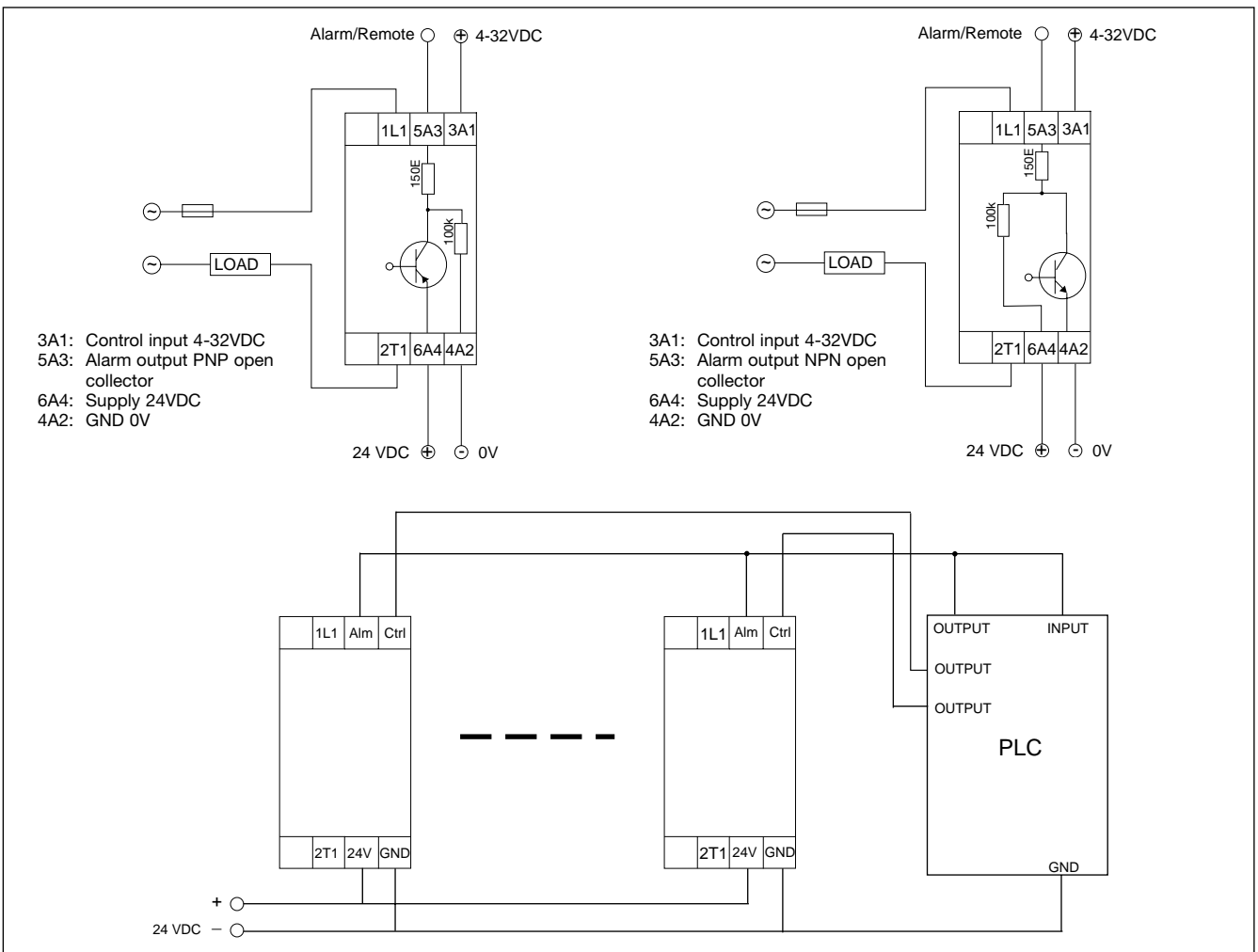
## Dissipation Curve



## Output Specifications

|  |                         | RJCS.1...30           | RJCS.1...50                     |
|--|-------------------------|-----------------------|---------------------------------|
| Rated operational current<br>AC51 @Ta=25°C             |                         | 30 AACrms             | 50 AACrms                       |
| Measuring range  | RJCS1A...<br>RJCSR1A... | -<br>0.3 - 30 AACrms  | 8 - 50 ACrms<br>0.5 - 50 AACrms |
| Min. TEACH current                                     | RJCS1A...<br>RJCSR1A... | -<br>0.3 AACrms       | 8 AACrms<br>0.5 AACrms          |
| Min. partial load current                              | RJCS1A...<br>RJCSR1A... | -<br>0.05 AACrms      | 1.3 AACrms<br>0.083 AACrms      |
| Non rep. surge current (t=10ms)                        |                         | 600 Ap                | 1900 Ap                         |
| Off-state leakage current @rated voltage and frequency |                         | < 5 mArms             | < 5 mArms                       |
| I <sup>2</sup> t for fusing (t = 10 ms)                |                         | 1800 A <sup>2</sup> s | 18000 A <sup>2</sup> s          |
| On-state voltage drop @ rated current                  |                         | 1.6 Vrms              | 1.6 Vrms                        |
| Critical dV/dt off-state                               |                         | 1000 V/μs             | 1000 V/μs                       |

## Connection Examples



**Notes:**

1. Control input (terminal A1) and 24VDC supply (terminal A3) must have common ground
2. RJCS ... and PLC should be sourced from the same 24VDC supply
3. RJCS ... PO and RJCS ...NO should not be connected to the same alarm line
4. It is recommended that up to 6 identical loads are connected in parallel

## Alarm Operation

### 1.1 Current Setpoint

The current setpoint is the nominal operating current that is expected when all the heater loads are functioning properly. If the heater loads are faulty or the supply voltage is not close to the nominal level, the wrong setpoint will be stored.

### 1.2 Initialisation

When the device is shipped, no setpoint is stored in the flash memory. Both green and red LEDs will flash intermittently to indicate that a setpoint must be stored using the **TEACH** procedure.

### 1.3 Local Functions

Local functions can be activated by using the push button on the front of the device. While an alarm is being issued by any SSR connected to the common alarm line, no local commands are accepted.

#### 1.3.1 Local TEACH

Press and hold the push button for approximately 3 seconds. The red LED will flash after each second. After the LED flashes 3 times, release the button. If the "teach" command has been accepted the heater loads are automatically switched ON. The red LED will flash quickly 10 times. When the current setpoint has been stored successfully, the red and green LEDs will scroll intermittently to indicate that the **TEACH** procedure has been completed.

It is very important to hold the button down for only 3 flashes of the red LED to make a successful **TEACH**. If the **TEACH** procedure is not successful, the device will automatically reset to factory default (i.e. no setpoint stored).

#### 1.3.2 Local RESET

When an alarm has occurred the device can be locally **RESET** by pressing the push button for 1 second. The red LED will flash once. This will reset the alarm. If the alarm condition has been cleared the device will return to normal operation. If the alarm condition is still active, the

device will automatically go back to alarm status.

#### 1.3.3 Local TEST

In the absence of a signal on the "control input" terminal, a local TEST can be made by pressing and holding the button for 5 seconds. After the red LED flashes 5 times, release the button. The device will switch ON the loads for 1 second. This test detects if there is an under-current or heater break alarm condition.

### 1.4 Remote Setup Procedure

Remote functions can be activated with a PLC or any other logic controller by applying timed pulses to the alarm terminal: >10V for RJCS...PO and <10V for RJCS...NO.

#### 1.4.1 Remote TEACH

Apply a 3 second pulse. The red LED will flash after each second. After the LED flashes 3 times and the "teach" command has been accepted, the heater loads (of all SSRs connected to the same alarm line) are automatically switched ON and the red LED will flash quickly 10 times. When the current setpoint has been stored successfully, the red and green LEDs will scroll intermittently to indicate that the **TEACH** procedure has been completed.

#### 1.4.2 Remote RESET/UNBLOCK

When an alarm has occurred the device can be remotely **RESET** by applying a 1 second pulse. A 1 second pulse will also unblock local **TEACH** of all SSRs connected to the similar alarm line. The red LED will flash once. This will reset the alarm. If the alarm condition has been cleared the device will return to normal operation. If the alarm condition is still active, the device will automatically go back to alarm status.

#### 1.4.3 Remote BLOCK

Applying a 5 second pulse will induce the device to block local **TEACH**. After this, no local **TEACH** com-

mands are accepted. To unblock this situation, a remote **RESET** must be issued. If 24V supply is removed, local **TEACH BLOCK** is lost. Another **REMOTE BLOCK** should be issued.

## 2 Alarms

### 2.1 Alarm DELAY

A potentiometer on the front of the device allows a time delay on the heater change alarm between 2s and 40s for the RJCS1A... and between 0 and 40s for the RJCSR1A...

For an alarm signal to occur, the alarm condition must persist throughout this time period. The alarm output is enabled only after this time delay has passed. However, if the control input is disabled for a period of time equal to four times the delay setting, the internal alarm delay count is reset automatically.

### 2.2 Relay remains OFF due to Line Voltage Loss or Thyristor Open Circuit Failure.

The device generates one pulse with duration of 7 seconds on the alarm terminal. This alarm is non-latching. The red LED remains ON after this alarm condition until a **RESET** is issued.

### 2.3 Heater Change.

A **Heater Change** alarm is given if the current measured through the device is 13% less than the Current Setpoint stored in the flash memory. For the RJCSR1A..., the heater change alarm is given also in the case the current measured through the device is 13% more than the current setpoint stored in flash memory. The device generates one pulse with duration of 8 seconds on the alarm terminal. The alarm signal is non-latching. The red LED remains ON after this alarm condition until a **RESET** is made. If the measured current changes to within 10% of the Current Setpoint, before the **Alarm DELAY** time has elapsed,

the **Alarm DELAY** timer is reset.

### 2.4 Over-temperature or Over-current.

This alarm occurs if any one of following two conditions is true:

1. The device detects an internal over-temperature condition at any time during operation and switches off the output. The red LED flashes intermittently.
2. A current above the nominal device rating is measured during current setpoint **TEACH**. This action erases the current setpoint from flash memory and both red and green LEDs will flash intermittently until a **TEACH** procedure with an acceptable current is carried out.

In both cases, the device generates one pulse with duration of 9 seconds on the alarm terminal. The alarm signal is non-latching.

### 2.5 Thyristor Short Circuit.

The device generates one pulse with duration of 10 seconds on the alarm terminal. The alarm signal is non-latching.

The red LED remains ON after this alarm condition until a **RESET** is made.

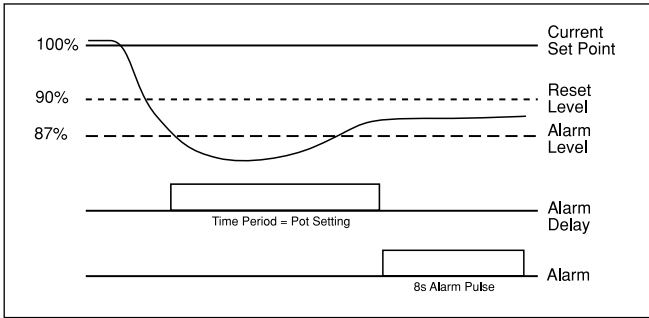
### 2.6 Alarms Connected in Parallel to one PLC Input and one PLC Output.

For **REMOTE** operation, up to 50 devices can be connected in parallel to at least one PLC input. This PLC input must also be connected in parallel to the PLC output. The PLC input must be programmed to detect alarms while the PLC output must be programmed to supply the pulses required for **REMOTE Setup**. When more than one device is present, pulses from the PLC output or alarm pulses from any device will cause the red LEDs on all devices in parallel to flash intermittently for a max. of 6.25 seconds. After this time, if there is a device in alarm condition, only the red LED of that device will be ON.

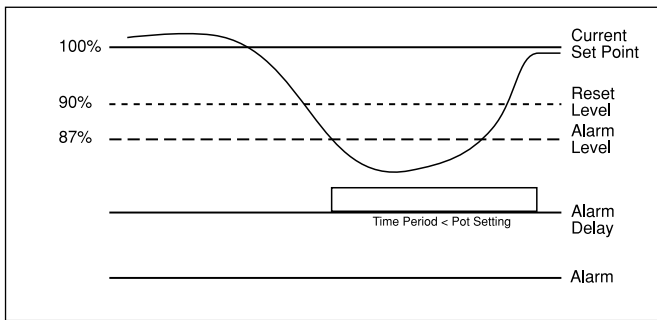
### Example

The alarm delay is set at 2s (min). If the full load current is set at 30A, then there will be an alarm condition if the current is under 26.1A for more than 2s. (Any fluctuation in the load current that is present for <2s will not be signalled – this is intended to eliminate false alarms due to short duration under-voltage conditions on the supply provided the control input goes on again within 8s (4x2s). If the control input goes off within the 2s, the alarm timer will not be reset

### Alarm Operation

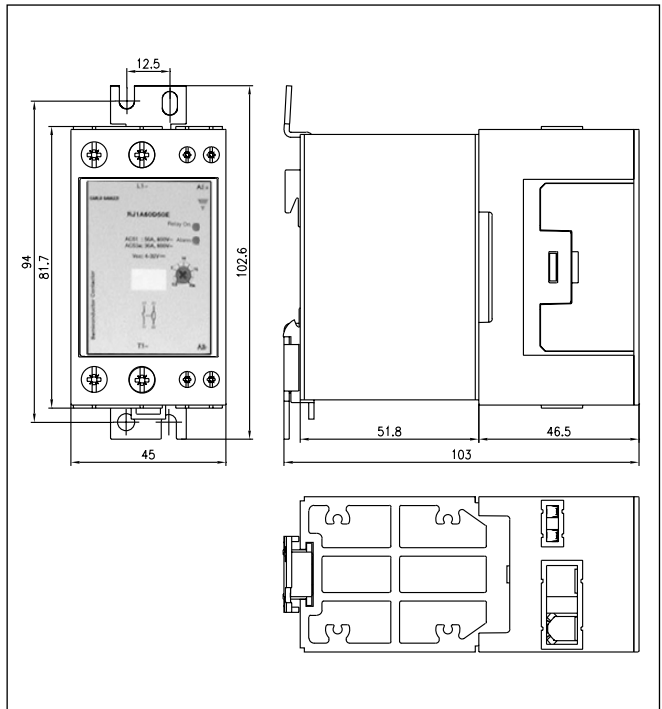


Alarm Condition



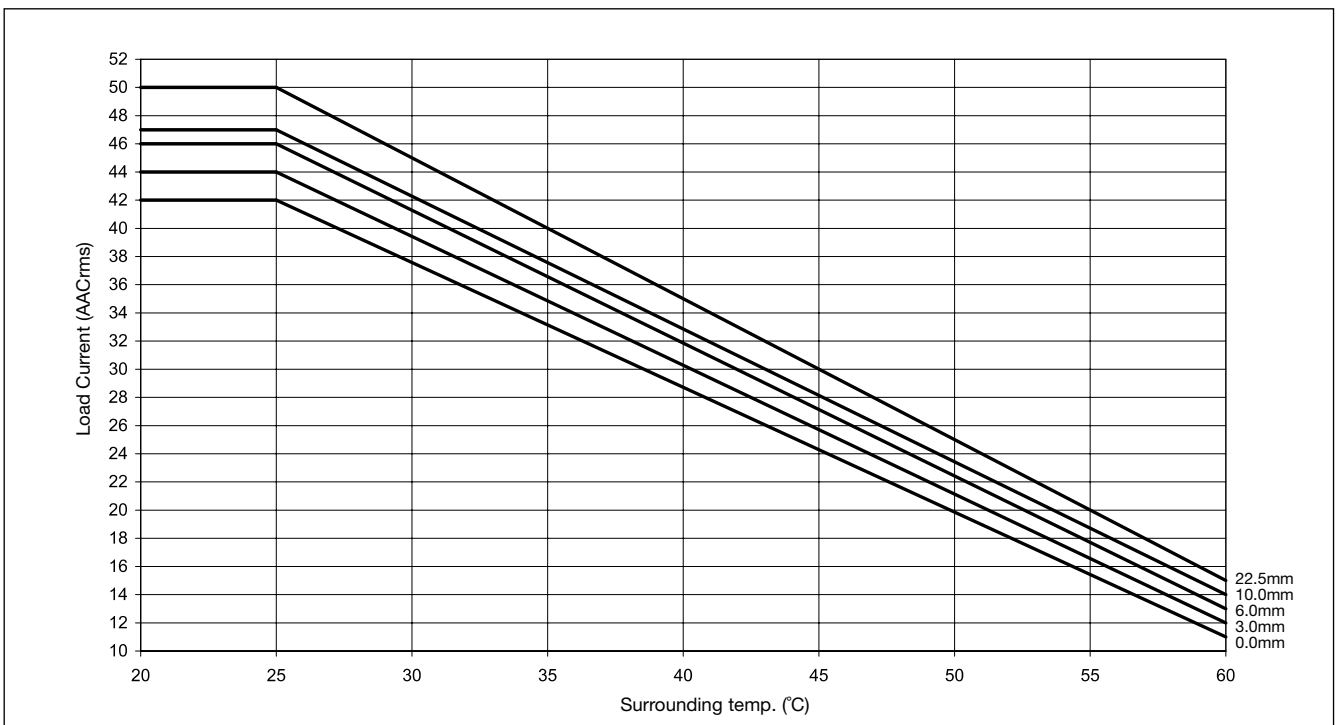
Reset Condition

### Dimensions



All dimensions in mm.

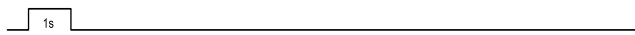
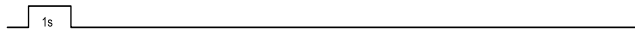
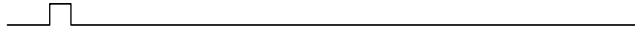
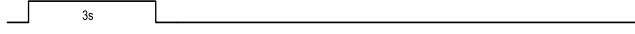
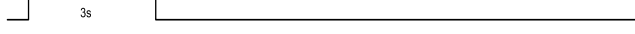
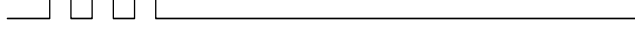

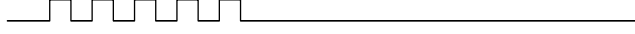
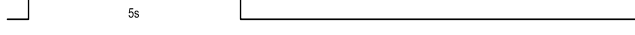





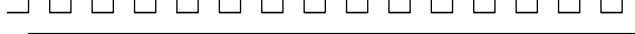
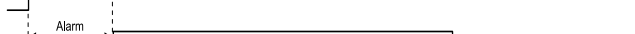
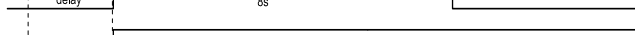
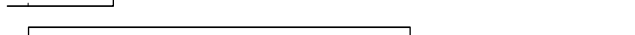
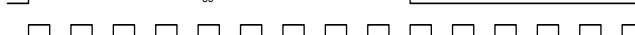
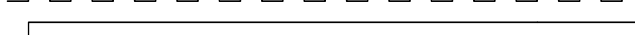

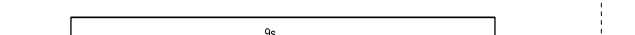

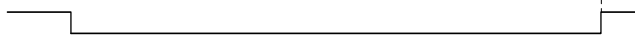

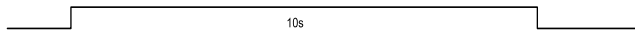
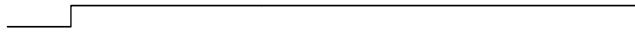
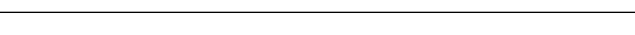
### Derating vs. Spacing Curves (RJCS.1A...50)



Note: Based on 100% duty cycle

Specifications are subject to change without notice (10.10.2006)

# Setup and Alarms

|                         |  |  |  |
|-------------------------|--|--|--|
| RESET                   | Remote reset   | PLC output to alarm terminal high >1s (<2s)  |    |
|                         | Local reset  | Push and hold button for >1s (<2s)   |    |
|                         | Visual indication  | Red LED ON   |    |
| TEACH                   | Remote teach   | PLC output to alarm terminal high >3s (<4s)  |    |
|                         | Local teach  | Push and hold button for >3s (<4s)   |    |
|                         | Visual indication  | Red LED ON   |    |
| TEST                    | Remote test  | Not available  |  |
|                         | Local test   | Push and hold button for >5s (<6s)   |    |
|                         | Visual indication  | Red LED ON   |    |
| BLOCK                   | Remote block   | PLC output to alarm terminal high >5s (<6s)  |    |
|                         | Local Block  | Not available  |  |
|                         | Visual Indication  | Red LED ON   |    |
| ALARMS                  | Control input  | Green LED - full intensity   |    |
|                         | Relay remains OFF due to line voltage loss or thyristor open circuit fault | Transistor alarm non-latching pulse (7s)   |    |
|                         | Visual indication  | Red LED ON (latching)  |   |
|                         | A current less than 84% of minimum TEACH current flows during TEACH        | Transistor alarm non-latching pulse (7s)   |  |
|                         | Visual indication  | Red and GREEN LEDs flashing together   |  |
|                         | Control input  | Green LED - full intensity   |  |
|                         | Heater change alarm  | Transistor alarm non-latching pulse (8s)   |  |
|                         | Visual indication  | Red LED ON (latching)  |  |
|                         | Current over-range detected during TEACH                                   | Transistor alarm non-latching pulse (8s)   |  |
|                         | Visual indication  | Red and GREEN LEDs flashing together   |  |
| Control input           | Green LED - full intensity   |  |  |
| Reset                   | Local or remote 1s pulse   |  |  |
| Over-temperature alarm  | Transistor alarm non-latching pulse (9s)                                   |  |  |
| Visual indication       | Red LED flashing   |  |  |
| SSR output              | Output is switched off during an OTP alarm                                 |  |  |
| Control input           | Green LED - full intensity   |  |  |
| Thyristor short-circuit | Transistor alarm non-latching pulse (10s)                                  |  |  |
| Visual indication       | Red LED ON (latching)  |  |  |

Note: Above shows pulses for PNP device