

# Motor Controllers

## AC Semiconductor Motor Controller

### Type RSDR



- Soft starting, soft stopping of 3-phase induction motors
- 2 Phase controlled with internal bypass relays
- Rated operational voltage: 230-460VAC 3-phase
- Rated operational current: up to 500A (280kW) AC-53b
- Auxiliary relay outputs (2x NO)
- Overcurrent "shearpin" protection
- Ramp-up and Ramp-down time settings up to 30sec
- IP20 Up to 55kW
- UL approved up to RSDR40280B

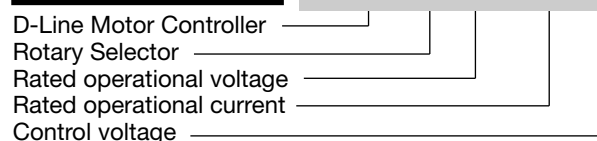
### Product Description

RSDR is a 2-phase controlled, internally bypassed soft starter for 3-phase induction motors. Initial torque, ramp-up and ramp-down parameters

can be selected via rotary knobs. Two Normally Open (NO) auxiliary relay contacts are also available for Run and Ready/Fault indication.

### Ordering Key

**RSD R 40 280 B**



### Type Selection

| Type | Rated operational voltage $U_e$ | Rated operational Current $I_e$ |                             | Control voltage $U_c$ |
|------|---------------------------------|---------------------------------|-----------------------------|-----------------------|
| RSDR | 40: (230-460VACrms)             | 55: 55 AACrms                   | 195: 195AACrms              | B: 24VDC/ 110VAC*     |
|      |                                 | 66: 66 AACrms                   | 230: 230AACrms              |                       |
|      |                                 | 80: 80 AACrms                   | 280: 280AACrms              |                       |
|      |                                 | 97: 97 AACrms                   | 350: 350AACrms <sup>1</sup> |                       |
|      |                                 | 132: 132 AACrms                 | 430: 430AACrms <sup>1</sup> |                       |
|      |                                 | 160: 160 AACrms                 | 500: 500AACrms <sup>1</sup> |                       |

\* externally supplied

### Selection Guide

| Rated operational voltage $U_e$                        | Control voltage $U_c$ | Rated operational current $I_e$ |                         |                         |
|--|-----------------------|---------------------------------|-------------------------|-------------------------|
| 230 - 460 VACrms<br>(-15%, + 10%)<br>50/60Hz (+/- 2Hz) | 24VDC/ 110VAC         | <b>55A AC-53b</b>               | <b>66A AC-53b</b>       | <b>80A AC-53b</b>       |
|  |                       | RSDR40055B                      | RSDR40066B              | RSDR40080B              |
|  |                       | <b>97A AC-53b</b>               | <b>132A AC-53b</b>      | <b>160A AC-53b</b>      |
|  |                       | RSDR40097B                      | RSDR40132B              | RSDR40160B              |
|  |                       | <b>195A AC-53b</b>              | <b>230A AC-53b</b>      | <b>280A AC-53b</b>      |
|  |                       | RSDR40195B                      | RSDR40230B              | RSDR40280B              |
|  |                       | <b>350A AC-53b</b>              | <b>430A AC-53b</b>      | <b>500A AC-53b</b>      |
|  |                       | RSDR40350B <sup>1</sup>         | RSDR40430B <sup>1</sup> | RSDR40500B <sup>1</sup> |

<sup>1</sup> Not UL approved

## Environmental Specifications

|                     |   |                       |   |
|---------------------|---|-----------------------|---|
| Ambient temperature | 0°C to 40°C (32°F to 104°F)<br>Above 40°C de-rate linearly by 2% of unit FLC per °C to a derate of 40% at 60°C. | Degree of Protection  | IP20 up to 55kW<br>IP00 - 75kW to 280kW                             |
| Storage temperature | -25°C to +60°C<br>-13°F to 140°F  | Installation altitude | 1000m. Above 1000m de-rate linearly by 1% of unit altitude of 2000m |
| Relative Humidity   | <85% non-condensing, not exceeding 50% @ 40°C   | Pollution Degree      | 2 (For use in Pollution degree 2 environment)                       |

## General Specifications

|  |                              |
|--|------------------------------|
| Ramp up time                           | 1...30s                      |
| Ramp down time                         | 0...30s                      |
| Initial torque                         | 30% ... 100%                 |
| Operational voltage (Ue)               | 230 - 460 VACrms (-15% +10%) |
| Rated frequency                        | 50 - 60Hz (+/- 2Hz)          |
| Rated insulation voltage(Ui)           | 500V                         |
| Form designation                       | Form 1                       |
| Status indication LEDs                 |                              |
| Power supply ON                        | LED, Green (continuous)      |
| Alarm                                  | LED, Red (flashing)          |
| Tripped and Reset                      | LED, Orange (flashing)       |
| Control voltage (Uc) A1-A2:            | 24VDC/110VAC                 |
| Rated impulse withstand voltage (Uimp) | 4kV                          |

## Output Specifications

|  |   |
|--|---|
| IEC rated operational current Ie (AC53b)     | 55/66/80/97/132/160<br>195/230/280/350/430/500A |
| Overload cycle according to EN/IEC 60947-4-2 | AC53b: 3-5:355 (10starts/hour)                  |
| Auxiliary relay outputs                      |   |
| Run relay (13, 14)                           | 230VAC 3AAC<br>Normally Open (NO)               |
| Ready (23, 24)                               | 230VAC 3AAC<br>Normally Open (NO)               |

## External Supply Specifications

|                                  |   |
|----------------------------------|---|
| External supply voltage (X1, X2) | 24VDC (4VA approx. per starter)<br>RSDR40055B up to<br>RSDR40195B<br>24VDC (12VA approx per starter)*<br>RSDR40230B up to<br>RSDR40500B |
| Residual ripple                  | 100 mV  |
| Spikes/ switching peaks          | 240 mV  |
| Turn On/ Off response            | No overshoot of V out   |
| Oversvoltage protection          | Output voltage must be clamped to < 30V   |

\* Power supply must be capable of 4Amps for 250ms  
Refer to Accessories Section in the datasheet for recommended power supplies.

## Motor Ratings - In Line

Assigned motor kW rating @ 400V  
UL rating HP @ 460V

|   |   |   |
|---|---|---|
| <b>RSDR40055B</b><br>30kW<br>40HP               | <b>RSDR40066B</b><br>37kW<br>50HP               | <b>RSDR40080B</b><br>45kW<br>60HP               |
| <b>RSDR40097B</b><br>55kW<br>75HP               | <b>RSDR40132B</b><br>75kW<br>100HP              | <b>RSDR40160B</b><br>90kW<br>125HP              |
| <b>RSDR40195B</b><br>110kW<br>150HP             | <b>RSDR40230B</b><br>132kW<br>150HP             | <b>RSDR40280B</b><br>160kW<br>200HP             |
| <b>RSDR40350B<sup>1</sup></b><br>200kW<br>250HP | <b>RSDR40430B<sup>1</sup></b><br>250kW<br>350HP | <b>RSDR40500B<sup>1</sup></b><br>280kW<br>400HP |

## Conductor Data

|   | <b>RSDR40055B</b>     | <b>RSDR40066B</b><br><b>RSDR40080B</b><br><b>RSDR40097B</b> | <b>RSDR40132B</b><br><b>RSDR40160B</b><br><b>RSDR40195B</b> | <b>RSDR40230B</b><br><b>RSDR40280B</b> | <b>RSDR40350B<sup>1</sup></b><br><b>RSDR40430B<sup>1</sup></b><br><b>RSDR40500B<sup>1</sup></b> |
|---|-----------------------|---|---|--|---|
| <b>Line conductors:</b><br>1L1, 3L2, 5L3, PE<br>/2T1, 4T2, 6T3<br>according to IEC60947 | 6...16mm <sup>2</sup> | 16...35mm <sup>2</sup>                                      | 50...95mm <sup>2*</sup>                                     | 2x 95mm <sup>2**</sup>                 | 2x150mm <sup>2</sup>  |
| UL rated data   | AWG 8...4             | AWG 6...1   | AWG 1/0...250 Kcmil   | AWG 2x 2/0                             | AWG 2x 350 Kcmil  |
| Terminal screws   | 0.8 x 4 mm            | 1.2 x 6.5 mm  | 7xM8  | 7xM10                                  | 7xM10   |
| Tightening torque   | 2Nm (18 lb.in)        | 2.5Nm (27 lb.in)  | 12Nm  | 14Nm (123.9 lb.in)                     | 14Nm (123.9 lb.in)  |
| Stripping length  | 13mm                  | 17mm  | -   | -                                      | -   |

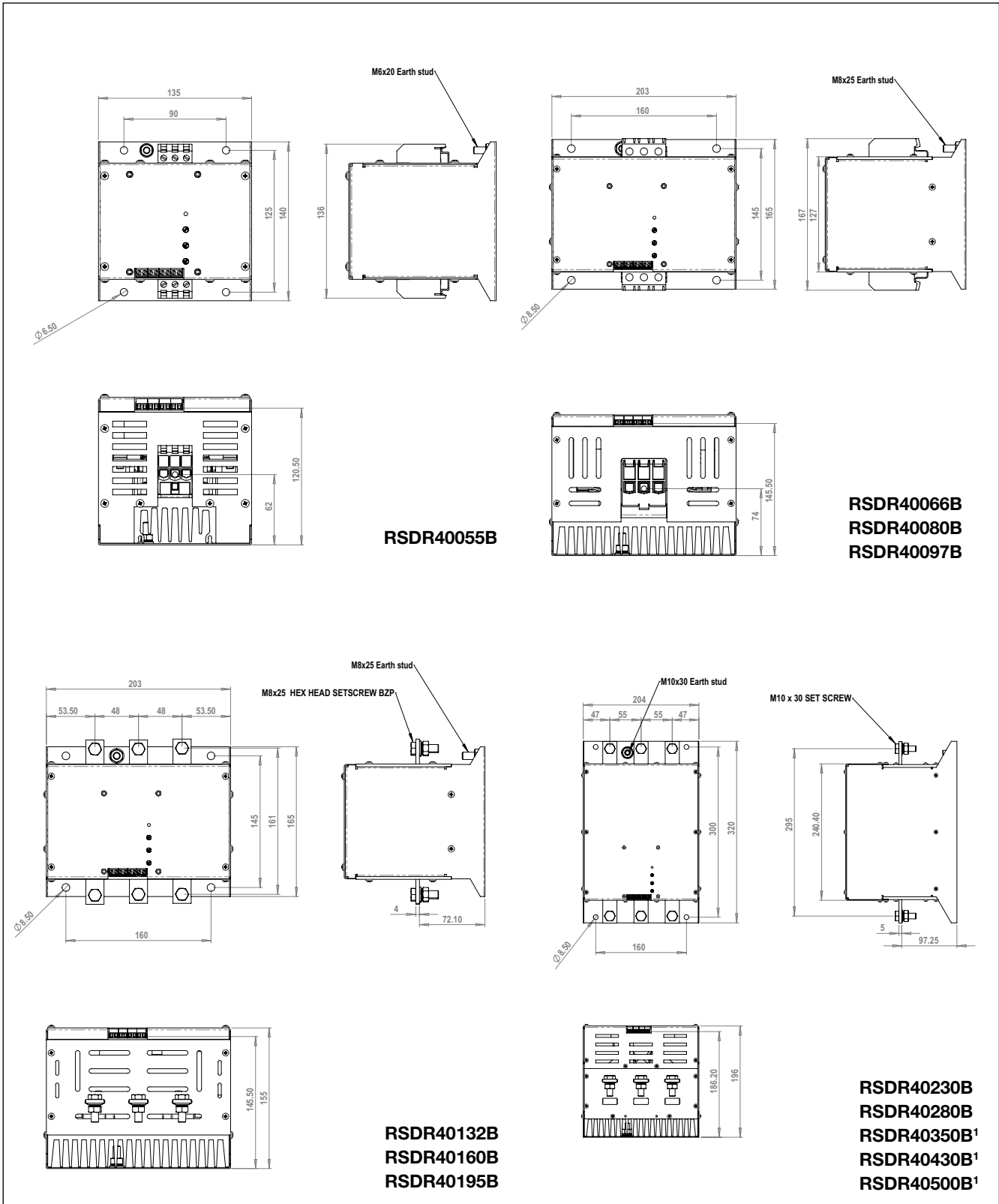
\* Kit installation with insulation KIT part number MIS854\_CG is required for UL compliance.

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|   | <b>RSDR40....</b>  |
|---|--|
| <b>Secondary conductors:</b><br>X1, X2, 13, 14<br>A1, A2, 23, 24<br>according to IEC60947 | 1 x 0.75 ... 2.5mm <sup>2</sup><br>2 x 0.75 ... 1.0mm <sup>2</sup> |
| UL rated data   | AWG 18...12  |
| Terminal screws   | 0.5 x 3.5 mm   |
| Tightening torque   | 0.8Nm  |
| Stripping length  | 1x 6mm<br>2x 11mm  |

<sup>1</sup> Not UL approved

# Dimensions



<sup>1</sup> Not UL approved

All dimensions in mm

## Short circuit protection

| Model Name<br>400/ 460V<br>Range | Class 5 (Standard Rating)<br>3 X FLC for 5 seconds<br>10 starts per Hr |                 | Class 10B<br>3.5 x FLC for 12 seconds<br>10 starts per Hr                      |                 | Siba semiconductor<br>fuse for type 1 coordination<br>Short Circuit Protection |
|----------------------------------|--|-----------------|--|-----------------|--|
|                                  | Ie (Arms)  | Motor kW @ 400V | Ie (Arms)  | Motor kW @ 400V |  |
| RSDR40055B                       | 55A  | 30kW            | 41A  | 22kW            | 2018920.125A   |
| RSDR40066B                       | 66A  | 37kW            | 55A  | 30kW            |  |
| RSDR40080B                       | 80A  | 45kW            | 66A  | 37kW            | 2061032.200A   |
| RSDR40097B                       | 97A  | 55kW            | 66A  | 37kW            |  |
| RSDR40132B                       | 132A   | 75kW            | 97A  | 55kW            | 2061032.250A   |
| RSDR40160B                       | 160A   | 90kW            | 116A   | 60kW            | 2061032.400A   |
| RSDR40195B                       | 195A   | 110kW           | 160A   | 90kW            |  |
| Model Name<br>400/ 460V<br>Range | Class 10A @40°C<br>3 X FLC for 12 seconds<br>3 starts per Hr           |                 | Siba semiconductor<br>Fuse for Type 1 Coordination<br>Short Circuit Protection |                 | Rated Short Circuit<br>current (Iq)  |
|                                  | Ie (Arms)  | Motor kW @ 400V |  |                 |  |
| RSDR40230B                       | 230A   | 132kW           | 2062032.630  |                 | 18kA   |
| RSDR40280B                       | 280A   | 160kW           |  |                 | 18kA   |
| RSDR40350B                       | 350A   | 200kW           | 2063032.1000   |                 | 18kA   |
| RSDR40430B                       | 430A   | 250kW           |  |                 | 18kA   |
| RSDR40500B                       | 500A   | 280kW           |  |                 | 18kA   |

## UL ratings and protection requirements

### Maximum surrounding air temperatures

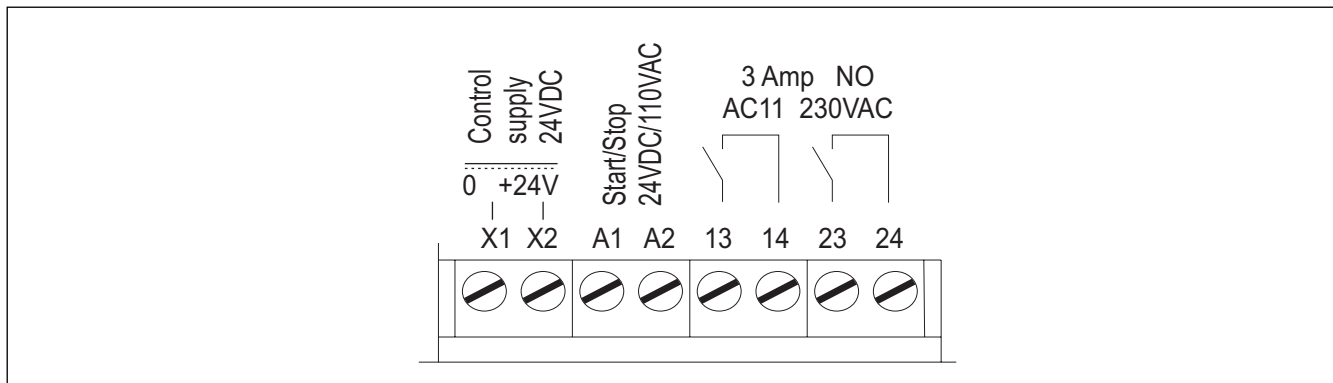
| Model 480v rated | Maximum 40°C  |       | Maximum 50°C  |       |
|------------------|---------------|-------|---------------|-------|
|                  | Input Current | Power | Input Current | Power |
| RSDR40055B       | 55 A          | 40hp  | 45 A          | 30hp  |
| RSDR40066B       | 66 A          | 50hp  | 60 A          | 40hp  |
| RSDR40080B       | 80 A          | 60hp  | 72 A          | 50hp  |
| RSDR40097B       | 97 A          | 75hp  | 78 A          | 60hp  |
| RSDR40132B       | 132 A         | 100hp | 119 A         | 75hp  |
| RSDR40160B       | 160 A         | 125hp | 144 A         | 100hp |
| RSDR40195B       | 195 A         | 150hp | 176 A         | 125hp |
| RSDR40230B       | 241 A         | 200hp | 193 A         | 150hp |
| RSDR40280B       | 280 A         | 200hp | 224 A         | 150hp |

### Short Circuit Protection

Suitable for use on a circuit capable of delivering not more than the rms symmetrical amperes indicated below, 480 volts maximum, when protected by fuses or inverse-time circuit breakers, rated maximum amperes as indicated below:

| Model      | Short circuit rating | RK5 time delay fuse rated 600VAC | Circuit breaker rated 600VAC |
|------------|----------------------|----------------------------------|------------------------------|
| RSDR40055B | 5 kA                 | 80 A                             | -                            |
| RSDR40066B | 10 kA                | 125 A                            | -                            |
| RSDR40080B | 10 kA                | 175 A                            | -                            |
| RSDR40097B | 10 kA                | 200 A                            | -                            |
| RSDR40132B | 10 kA                | 250 A                            | 350 A                        |
| RSDR40160B | 10 kA                | 350 A                            | 450 A                        |
| RSDR40195B | 10 kA                | 400 A                            | 500 A                        |
| RSDR40230B | 18 kA                | 450 A                            | -                            |
| RSDR40280B | 18 kA                | 450 A                            | -                            |

## Connection Diagram



## Alarms

| No. of Flashes<br>Red LED | Green LED | Fault Description                              |
|---------------------------|-----------|--|
| 1                         | ON        | SCR/Supply Fault                               |
| 2                         | ON        | Over-temperature                               |
| 3                         | ON        | Control voltage <24V                           |
| 4                         | ON        | Bypass Relay Failure                           |
| 5*                        | ON        | Shearpin (Load current > 4.5x I <sub>e</sub> ) |
| 6*                        | ON        | Overload - refer to chart above                |
| Rapid flashes*            | ON        | Overcurrent                                    |
| Red LED not Flashing      | OFF       | Fault  |
| Orange LED Flashing       | Flashing  | Tripped and Reset, Ready for next start        |

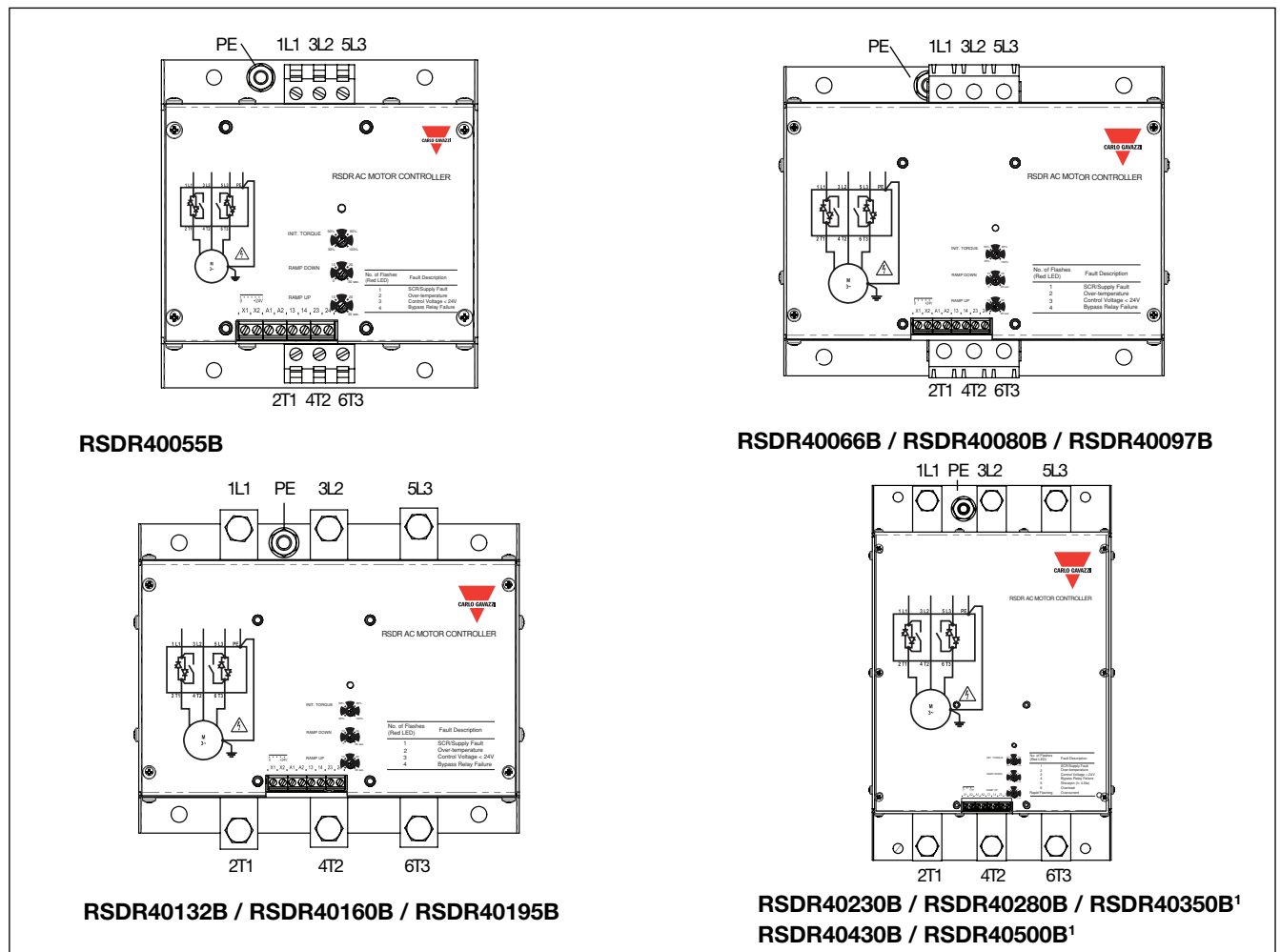
\* Only available on RSDR models RSDR40230B to RSDR40500B

## Standards

|   |  |  |  |
|---|--|--|--|
| <b>Approvals</b>  | UL*,<br>UL508 Industrial Control Equipment             | <b>Radiated Radio Frequency Immunity</b>               | IEC/EN 61000-4-3<br>10V/m, 80 - 1000 Mhz   |
| <b>CE Marking</b> EMC/LVD   | IEC/EN 60947-4-2                                       | <b>Conducted Radio Frequency Immunity</b>              | IEC/EN 61000-4-6<br>140dbµV, 0.15 - 80 MHz |
| <b>Electrostatic Discharge (ESD) Immunity</b>                                   | IEC/EN 61000-4-2<br>8kV, Air discharge<br>4kV, Contact | <b>Radio Interference field emission (radiated)</b>    | IEC/EN 55011, Class A                      |
| <b>Electrical Fast Transient Burst Immunity</b>                                 | IEC/EN 61000-4-4<br>Output, 2kV<br>Input, 1kV          | <b>Radio Interference voltage emission (conducted)</b> | IEC/EN 55011, Class A                      |
| <b>Electrical Surge Immunity</b><br>Input, line to line<br>Input, line to earth | 1kV<br>2kV   |  |  |

\* Applicable to RSDR40055B up to RSDR40280B units

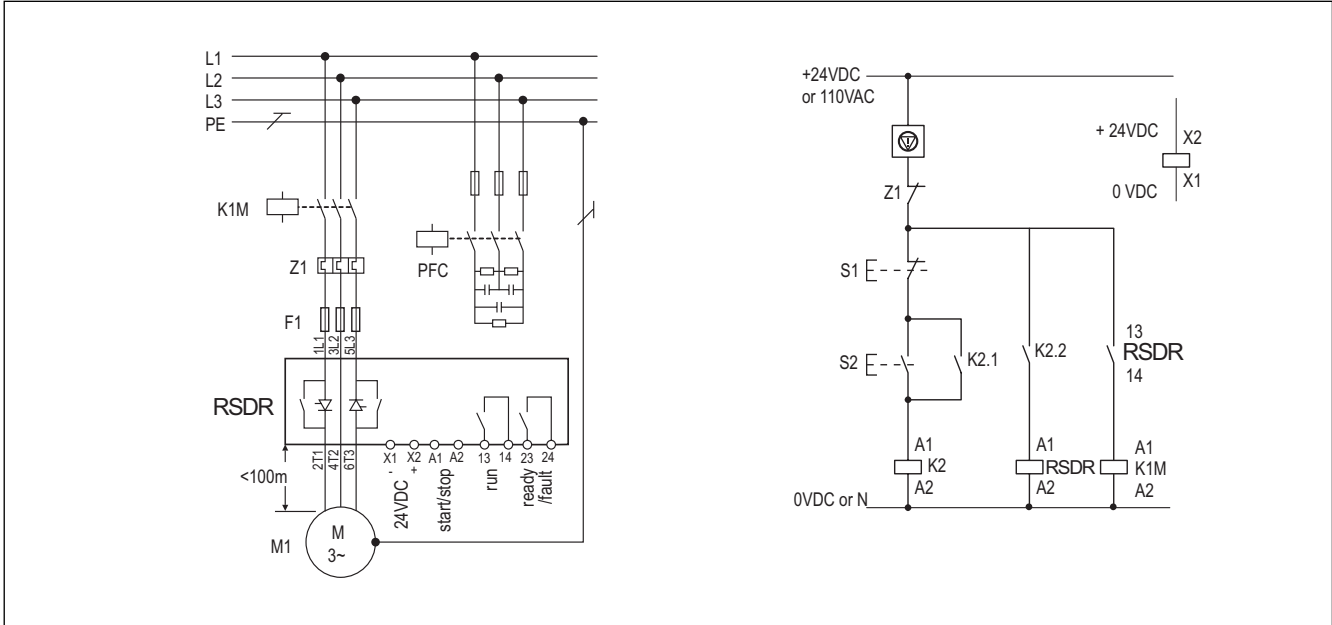
## Terminal Diagram



1. Not UL approved

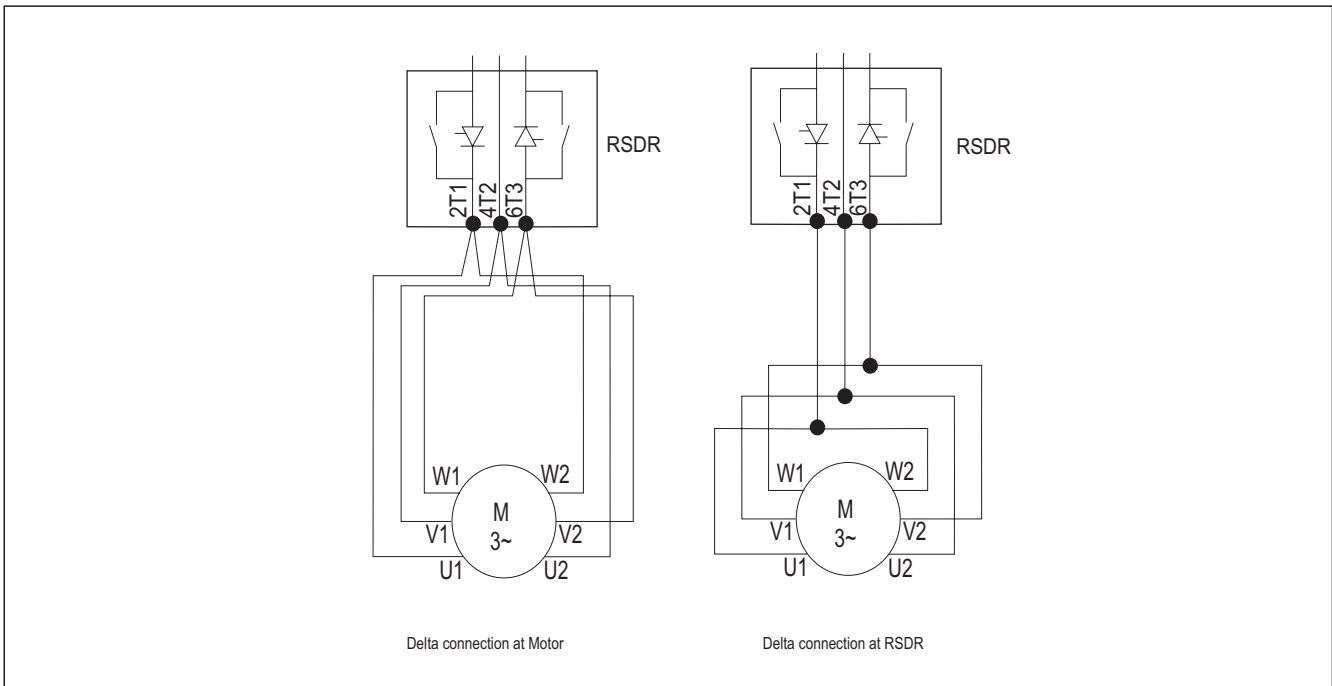
## Wiring Diagrams

### Soft starter connection using mains contactor



- K1M - Mains contactor
- Z1 - Overload relay
- F1 - Semiconductor fuse for type 1 coordination
- M1 - Load (3-phase motor)

### Delta Connection of RSDR



RSDR series offers the possibility of connecting the softstarter in the delta as shown above. Delta connection can be made either at the motor side or at the soft starter (RSDR) side. Where several conductors are to be connected, the difference between the wires/cables used must not exceed one DIN Standard size level.



## Application Guide (for Determination of appropriate Trip Class)

| Application                | Trip class | Start time (sec.) | Notes   |
|----------------------------|------------|-------------------|---|
| Standard start             | 5          | 5                 | Star/Delta applications with < 5sec Star time. Motor starting off load. |
| Unloaded conveyor          | 5          | 5                 | Starting of unloaded conveyor   |
| Unloaded compressor        | 5          | 5                 | Dedicated circuits ensure motor starts unloaded                         |
| Unloaded mixer             | 5          | 5                 | Mixer starting with no material in basin                                |
| Centrifugal pump           | 10         | 10                | Generally easy to start when pumping water                              |
| Positive displacement pump | 10         | 12                | Can be difficult to start   |
| Loaded compressor          | 10         | 12                | Certain compressor systems can be hard to start                         |
| High inertia fan           | 10         | 23                | Starting of fans > 45kW   |
| Heavy start                | 10B        | 12                | Suitable for star/Delta applications with, 12sec Star time              |
| High torque                | 20         | 12                | Application requires more starting torque than Star/ Delta              |
| Heavy mixer                | 20         | 12                | Starting of load mixer  |

## Application Guide (based on Application Trip Class)

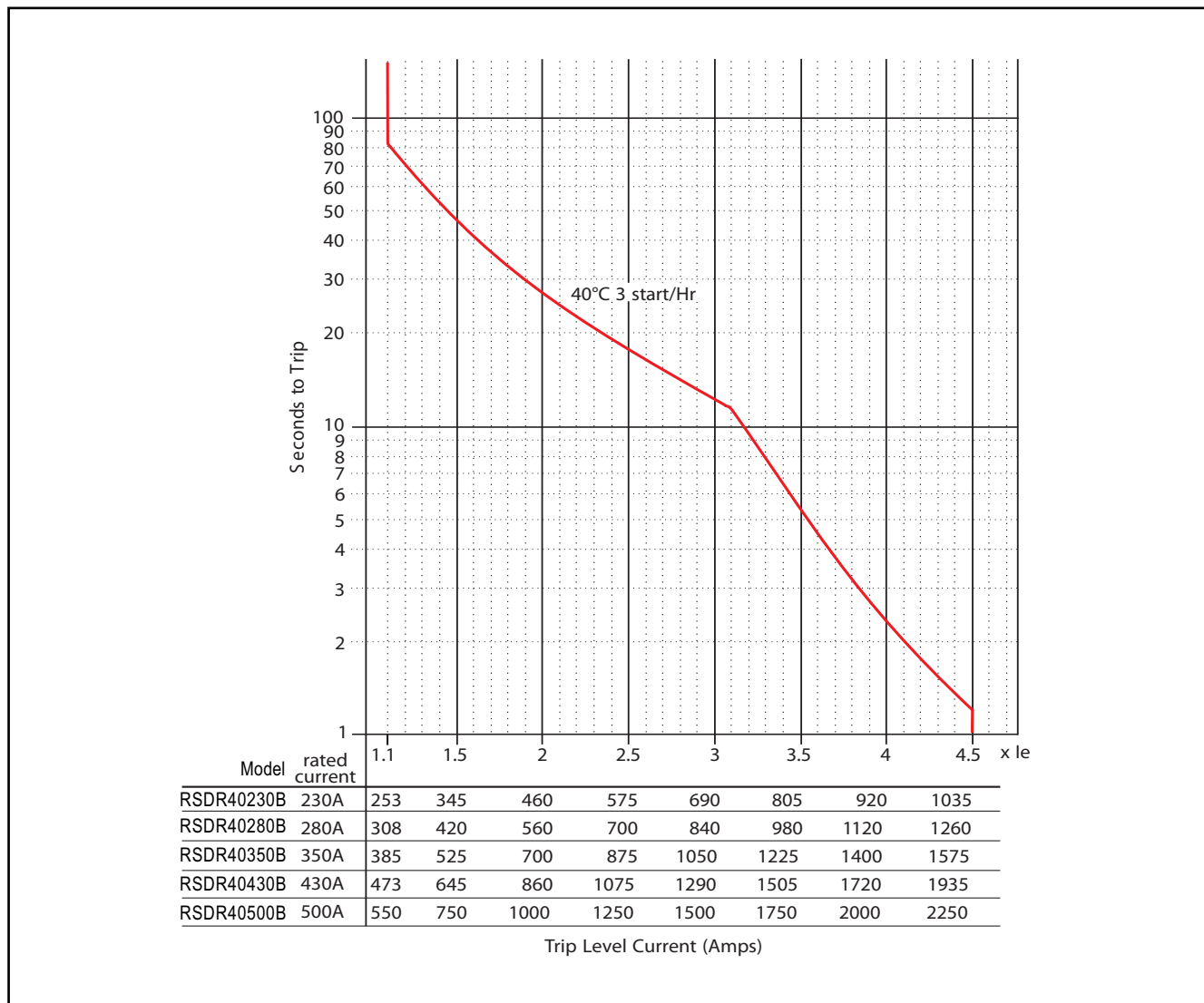
| le (Amp)<br>@ 400V | In Line kW<br>@ 400V | Trip Class 5<br>3-5: 355<br>10 starts/hr | Trip Class 10B<br>3.5-12: 708<br>5 starts/hr | Trip Class 10<br>3-23: 697<br>5 starts/hr | Trip Class 20<br>4-19: 701<br>5 starts/hr | Trip Class 30<br>4-29: 691<br>5 starts/hr |
|--------------------|----------------------|--|--|---|---|---|
| 55A                | 30kW                 | RSDR40055B                               | RSDR40066B                                   | RSDR40066B                                | RSDR40097B                                | RSDR40132B                                |
| 66A                | 37kW                 | RSDR40066B                               | RSDR40080B                                   | RSDR40080B                                | RSDR40132B                                | RSDR40132B                                |
| 80A                | 45kW                 | RSDR40080B                               | RSDR40132B                                   | RSDR40132B                                | RSDR40132B                                | RSDR40160B                                |
| 97A                | 55kW                 | RSDR40097B                               | RSDR40132B                                   | RSDR40132B                                | RSDR40160B                                | RSDR40195B                                |
| 132A               | 75kW                 | RSDR40132B                               | RSDR40195B                                   | RSDR40195B                                | RSDR40230B *                              | RSDR40280B *                              |
| 160A               | 90kW                 | RSDR40160B                               | RSDR40230B *                                 | RSDR40230B *                              | RSDR40230B *                              | RSDR40280B *                              |
| 195A               | 110kW                | RSDR40195B                               | RSDR40230B *                                 | RSDR40230B *                              | RSDR40280B *                              | RSDR40430B * <sup>1</sup>                 |
| 230A               | 132kW                | RSDR40230B                               | RSDR40280B *                                 | RSDR40350B * <sup>1</sup>                 | RSDR40430B * <sup>1</sup>                 | RSDR40500B * <sup>1</sup>                 |
| 280A               | 160kW                | RSDR40280B                               | RSDR40350B * <sup>1</sup>                    | RSDR40430B * <sup>1</sup>                 | RSDR40500B * <sup>1</sup>                 | Note                                      |
| 350A               | 200kW                | RSDR40350B <sup>1</sup>                  | RSDR40500B * <sup>1</sup>                    | RSDR40500B * <sup>1</sup>                 | Note                                      | Note                                      |
| 430A               | 250kW                | RSDR40430B <sup>1</sup>                  | Note   | Note                                      | Note                                      | Note                                      |
| 500A               | 280kW                | RSDR40500B <sup>1</sup>                  | Note   | Note                                      | Note                                      | Note                                      |

Note: Contact Carlo Gavazzi representative

\*. Trip class rating of 3 starts/hr

1. Not UL approved

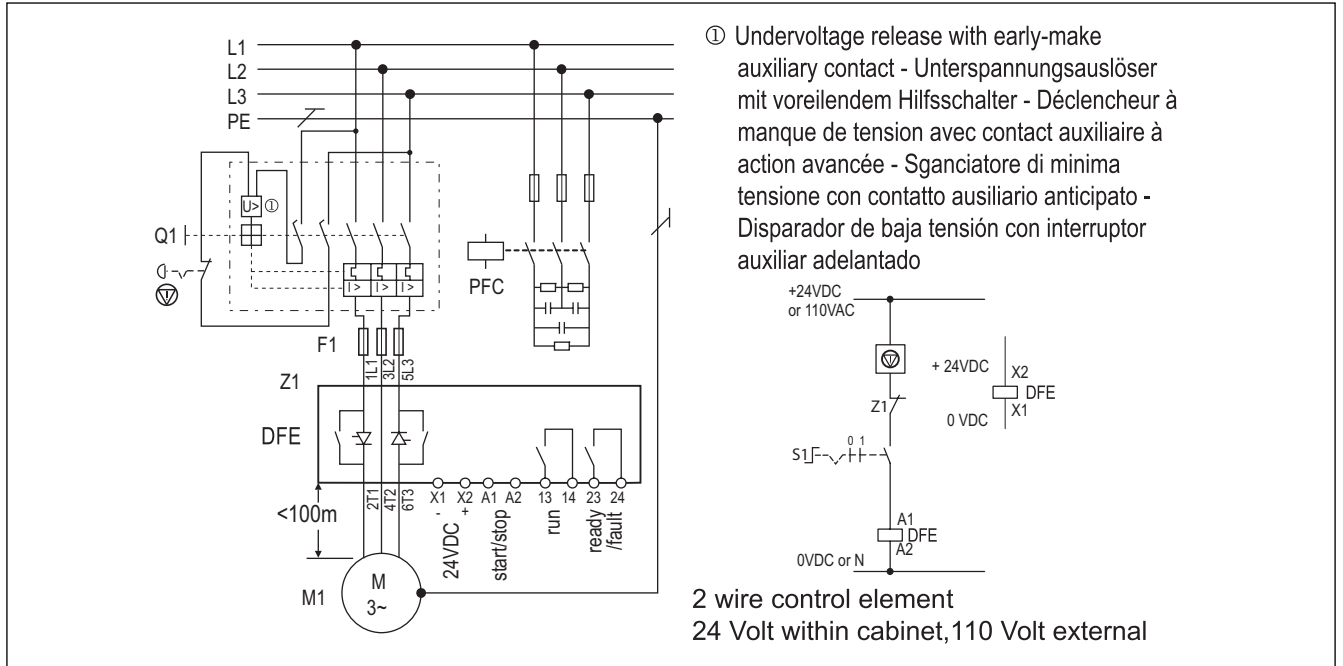
## Application Guide (cont.)



The above trip curves can be used as a guidance to identify the required unit for the application duty. Subsequent restarts, following an overload trip, can be restricted due to a cooling time. The severity of the overload determines the cooling time which has a maximum value of 10 minutes.

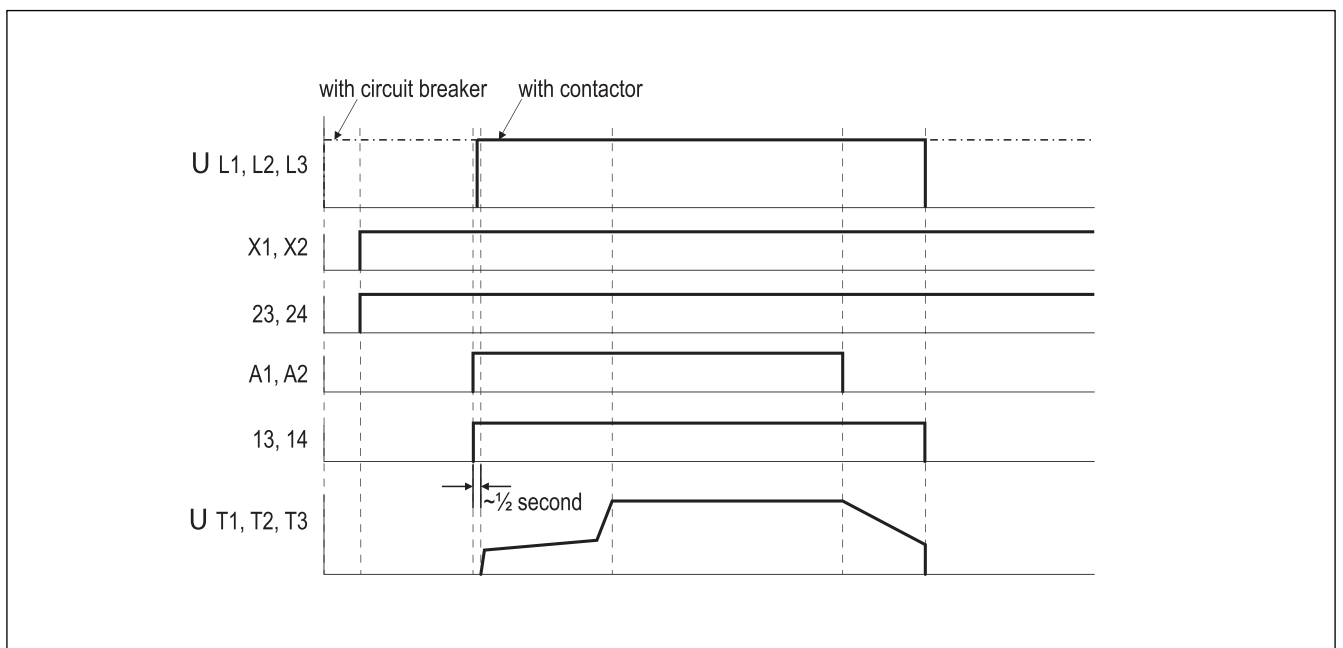
## Wiring Diagrams (cont.)

### Soft starter connection using semiconductor contactor



- Q1 - Cable protection
- Z1 - Overload relay
- F1 - Semiconductor fuse for type 2 coordination, in addition to Q1
- RSDR - Soft starter
- Emergency Stop
- Undervoltage release with early-make auxiliary contact

## Timing Diagram



## Accessories - External Power Supply 24VDC

For RSDR40055B to RSDR40195B, an external control supply with 24VDC, 5W output needs to be provided to terminals X1-X2. The following power supplies can be used:-

### SPD24101



|               |                         |
|---------------|-------------------------|
| Input Voltage | 90-265VAC<br>120-370VDC |
| Output Power  | 10W                     |
| Terminal Type | Screw terminal          |

### SPD24101B



|               |                         |
|---------------|-------------------------|
| Input Voltage | 90-265VAC<br>120-370VDC |
| Output Power  | 10W                     |
| Terminal Type | Spring terminal         |

For RSDR40230B to RSDR40500B, a power supply capable of supplying 4Amps for 250ms is required across terminals X1-X2. The following power supply can be used:-

### SPD241001



|               |                         |
|---------------|-------------------------|
| Input Voltage | 90-264VAC<br>120-375VDC |
| Output Power  | 100W                    |
| Terminal Type | Screw terminal          |