

## Three-Phase Scroll Compressor Soft Starter



### Description

RSBD is an easy to use soft starter for scroll compressors up to 95 Arms nominal current. The units are equipped with a patented auto-adaptive algorithm that automatically adapts itself to the specific compressor it is controlling ensuring that an optimum inrush current reduction is achieved.

RSBD is a 2-phase controlled solution and is internally bypassed - resulting in less heat dissipation inside the panel.

Short Circuit and Overload protection are not provided with the controller and must be procured separately.

### Benefits

- **Easy to use.** The RSBD is equipped with a self-learning algorithm that automatically adjusts the start parameters to reduce the compressor starting current.
- **Fast installation and set-up.** No settings are required.
- **Compact dimensions.** 12 - 45 Arms in 45 mm wide housing, 55 - 95 Arms in 75 mm wide housing.
- **Guided model selection.** Easy to use online selection tool to select the appropriate soft starter model depending on the compressor brand/model. Go to [http://gavazziautomation.com/nsc/HQ/EN/soft\\_starters](http://gavazziautomation.com/nsc/HQ/EN/soft_starters).
- **Tamper proof.** No user adjustments are available. RSBD automatically adjusts its internal parameters to ensure optimal starting at any condition.
- **Adjusts to load requirements.** The built-in HP function ensures that the compressor starts in < 1 second even under high pressure difference during start.


### Applications

Scroll compressors, heat pumps, chiller, air-conditioning units

### Main features

- Self-learning algorithm adjusts start parameters according to load
- No user adjustments required
- Limits starting current of 3 phase compressors

## References

 **Order code**

 **RSBD**    **V 61HP**

Enter the code entering the corresponding option instead of

| Code                     | Option | Description   | Notes                            |
|--------------------------|--------|---|----------------------------------|
| R                        | -      |   |                                  |
| S                        | -      | Soft starter  |                                  |
| B                        | -      | Scroll compressor series  |                                  |
| D                        | -      | 2 phase   |                                  |
| <input type="checkbox"/> | 40     | 220 – 400 VAC +10% -15% operational voltage (Ue)                      |                                  |
|                          | 60     | 220 – 600 VAC +10% -15% operational voltage (Ue)                      | RSBD60 models only               |
| <input type="checkbox"/> | 12     | 12 Arms   | Rated operational current @ 40°C |
|                          | 16     | 16 Arms   |                                  |
|                          | 25     | 25 Arms   |                                  |
|                          | 32     | 32 Arms   |                                  |
|                          | 37     | 37 Arms   |                                  |
|                          | 50     | 45 Arms   |                                  |
|                          | 55     | 55 Arms   |                                  |
|                          | 70     | 70 Arms   |                                  |
|                          | 95     | 95 Arms   |                                  |
| <input type="checkbox"/> | E      | 110 - 400 VAC +10% -15% control voltage (Uc)                          |                                  |
|                          | F      | 24 VAC/DC +10% -10% control voltage (Uc)<br>Supply voltage: 24 VAC/DC |                                  |
|                          | GG     | 100 - 240 VAC +10% -15% control/supply voltage                        | RSBD 60 models only              |
|                          | FF     | 24 VAC/DC +10% -10% control/supply voltage: 24 VAC/DC                 |                                  |
| V                        | -      | Product versions  |                                  |
| 61HP                     | -      | Auxiliary relay outputs and HP algorithm                              |                                  |

## Selection guide

| Rated operational current (Ie) | Housing | Operational voltage: 220 - 400VAC |                           | Operational voltage: 220 - 600VAC    |                                  |
|--------------------------------|---------|-----------------------------------|---------------------------|--------------------------------------|----------------------------------|
|                                |         | Control voltage 110 - 400 VAC     | Control voltage 24 VAC/DC | Control/supply voltage 100 - 240 VAC | Control/supply voltage 24 VAC/DC |
| 12 Arms                        | 45 mm   | RSBD4012EV61HP                    | RSBD4012FV61HP            | -                                    | -                                |
| 16 Arms                        |         | RSBD4016EV61HP                    | RSBD4016FV61HP            | -                                    | -                                |
| 25 Arms                        |         | RSBD4025EV61HP                    | RSBD4025FV61HP            | -                                    | -                                |
| 32 Arms                        |         | RSBD4032EV61HP                    | RSBD4032FV61HP            | -                                    | -                                |
| 37 Arms                        |         | RSBD4037EV61HP                    | RSBD4037FV61HP            | -                                    | -                                |
| 45 Arms                        |         | RSBD4050EV61HP                    | RSBD4050FV61HP            | -                                    | -                                |
| 55 Arms                        | 75 mm   | RSBD4055EV61HP                    | RSBD4055FV61HP            | RSBD6055GGV61HP                      | RSBD6055FFV61HP                  |
| 70 Arms                        |         | RSBD4070EV61HP                    | RSBD4070FV61HP            | RSBD6070GGV61HP                      | RSBD6070FFV61HP                  |
| 95 Arms                        |         | RSBD4095EV61HP                    | RSBD4095FV61HP            | RSBD6095GGV61HP                      | RSBD6090FFV61HP                  |

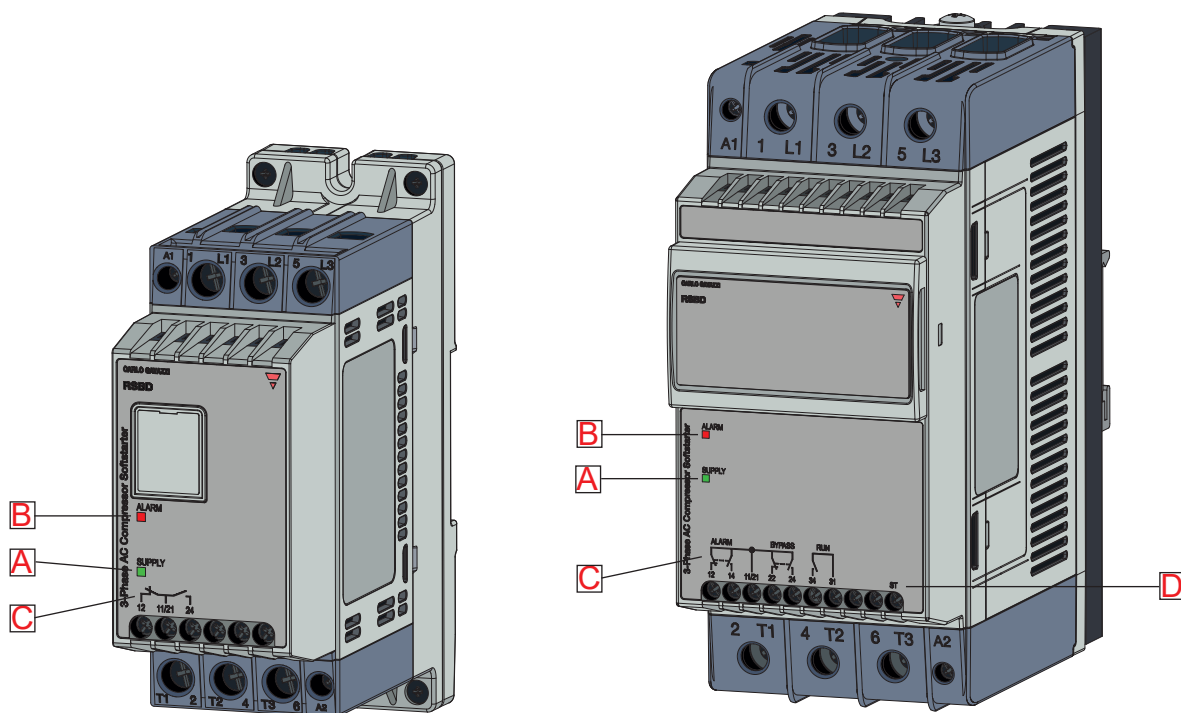
## Further reading

| Information                                  | Where to find it  |
|--|---|
| RSBD 45mm instruction manual                 | <a href="http://www.productselection.net/MANUALS/UK/mc_rsbd_il.pdf">http://www.productselection.net/MANUALS/UK/mc_rsbd_il.pdf</a> |
| RSBD 75mm instruction manual                 | <a href="http://www.productselection.net/MANUALS/UK/mc_rsbd_il.pdf">http://www.productselection.net/MANUALS/UK/mc_rsbd_il.pdf</a> |
| CAD drawings (RSBD 45mm)                     | <a href="http://www.productselection.net/DXF/mc_rsbd_45mm.zip">http://www.productselection.net/DXF/mc_rsbd_45mm.zip</a>           |
| CAD drawings (RSBD 75mm)                     | <a href="http://www.productselection.net/DXF/mc_rsbd_75mm.zip">http://www.productselection.net/DXF/mc_rsbd_75mm.zip</a>           |
| Scroll compressor soft starter selector tool | <a href="http://gavazziautomation.com/nsc/HQ/EN/soft_starters">http://gavazziautomation.com/nsc/HQ/EN/soft_starters</a>           |

## CARLO GAVAZZI compatible components

| Purpose               | Component name/code   | Notes  |
|-----------------------|---|--|
| Manual motor starters | GMS-32 <input type="checkbox"/> - <input type="checkbox"/><br>GMS-63 <input type="checkbox"/> - <input type="checkbox"/><br>GMS-100 <input type="checkbox"/> - <input type="checkbox"/> | <input type="checkbox"/> :<br>S: standard<br>H: high breaking capacity |
| Finger guards         | RFCG X6   | 6 pcs per box<br>(RSBD 75mm models only)                               |

# Structure



| Element | Component       | Function  |
|---------|-----------------|---|
| A       | LED indicators  | Supply. Indicates that the RSBD supply is ON.   |
| B       | LED indicators  | Alarm. Indicates that the RSBD is in alarm. The number of flashes indicates the alarm type.   |
| C       | Digital outputs | RSBD 45mm:<br>11, 12: NC relay output for alarm indication.<br>21, 24: NO relay output for top of ramp indication.<br><br>RSBD 75mm:<br>11, 12, 14: Changeover relay (NO, NC) for alarm indication.<br>21, 22, 24: Changeover relay (NO, NC) for top of ramp indication.<br>31, 34: NO relay output for run indication. |
| D       | Start signal    | ST: Start signal (applicable to RSBD60 models only).  |

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## Mode of operation

### Auto Adaptive Algorithm (Patented)

- RSBD series of soft starters includes an innovative auto-adaptive algorithm (Patented) that limits the compressor starting current and minimises current unbalance. Appropriate parameters are automatically set by RSBD in order to achieve an optimum inrush current reduction whilst maintaining a ramp-up time < 1 sec. This feature is active at every compressor start to ensure that the RSBD adapts its parameters according to the load requirements at different operating conditions.

### First start of RSBD

- At the very first start, the RSBD will start the compressor with the default current limit setting.

Note: The default current limit is equal to  $3.5 \times I_e$  (where  $I_e$  = soft starter rated current). Depending on the values of specific parameters, that are automatically measured by RSBD, it will adjust the current limit setting to a lower value. This new self-learned current limit setpoint will then be used by RSBD during the subsequent start.

### High pressure (HP) function

- During the ramp-up sequence, the RSBD will check if the compressor is rotating. If the RSBD finds the compressor in locked rotor condition, it will trigger the HP function. During the HP sequence, the RSBD will gradually increase the current limit setpoint. The maximum value is  $\leq 3.5 \times I_e$ .

Note: Even during HP mode of operation the ramp-up time will be limited to a maximum of 1 sec. If the compressor does not reach full speed during a maximum of 1 sec, the RSBD will trigger the End of ramp alarm (5 flashes) and will go in alarm state.

### Current balancing

- RSBD uses a two-phase control strategy with two anti-parallel thyristors across L1-T1 and L3-T3. Phase L2-T2 is the uncontrolled phase. During every start, RSBD measures a number of parameters and dynamically adjusts the starting parameters to minimise the current unbalance in the phase L2-T2 resulting in a smoother starting performance of the compressor.

# Features

## General

|                      | RSBD 45mm           | RSBD 75mm |
|----------------------|---------------------|-----------|
| Material             | PA66                |           |
| Assembly             | DIN or panel        |           |
| Protection grade     | IP20 (EN/IEC 60529) |           |
| Weight               | 430 g               | 2.2 kg    |
| Overvoltage category | II                  |           |

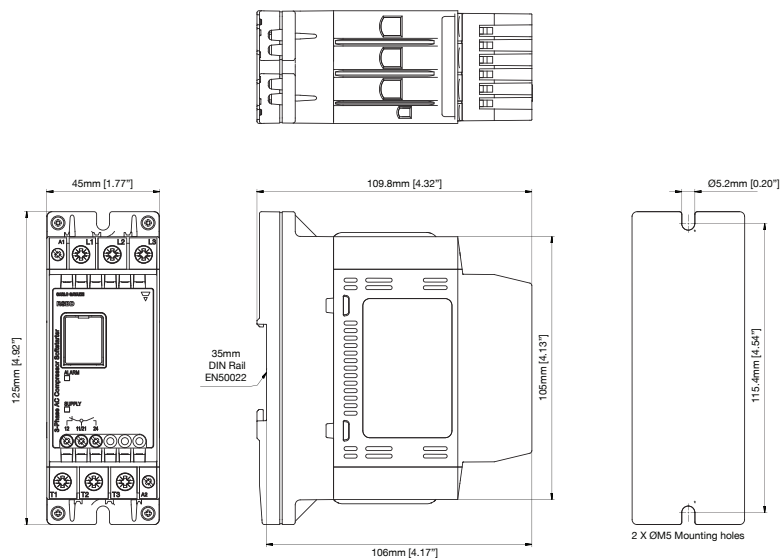


Fig. 1 RSBD...12.. to RSBD...50..

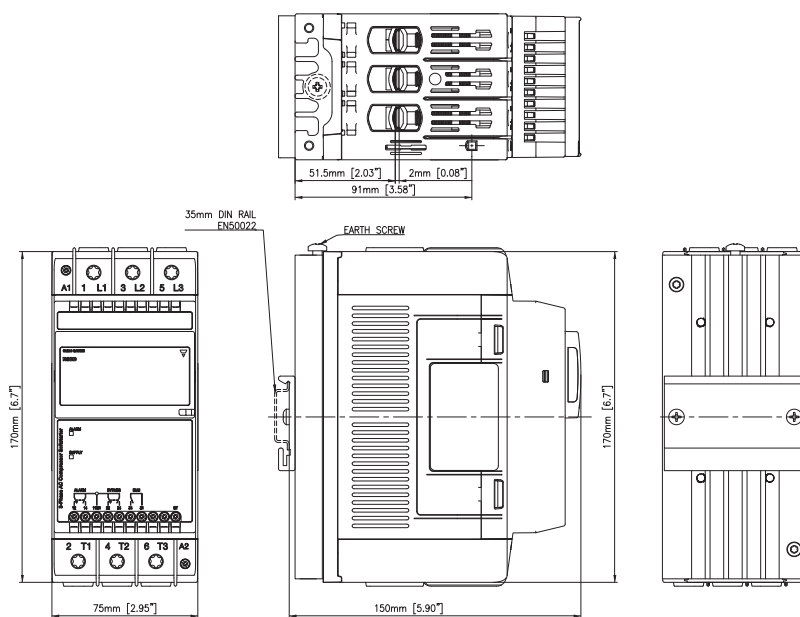


Fig. 2 RSBD...55.. to RSBD...95..

## Settings

|                | RSBD 45mm                        | RSBD 75mm |
|----------------|----------------------------------|-----------|
| Ramp-up time   | Not required                     |           |
| Ramp-down time | 0 sec                            |           |
| Initial torque | Automatically determined by RSBD |           |





## Power Supply

|                               | RSBD40..           | RSBD60..         |
|-------------------------------|--------------------|------------------|
| Operational voltage range     | 187 - 440 VACrms   | 187 - 660 VACrms |
| Supply current at idle        | < 30 mAAC          |                  |
| Blocking voltage              | 1200 Vp            | 1600 Vp          |
| Rated AC frequency            | 50/60 Hz (+/- 10%) |                  |
| Rated insulation voltage      | 630 VAC            | 690 VAC          |
| Dielectric withstand voltage: |                    |                  |
| Supply to input               | 2.5 kVrms          |                  |
| Supply to heatsink            | 2.5 kVrms          |                  |
| Integrated varistor           | Yes                |                  |

## Environmental

|  |  |
|--|--|
| Working temperature                    | -20°C to +60°C (-4°F to +140°F)<br>Note: For operating temperatures >40°C derating applies |
| Storage temperature                    | -40°C to +80°C (-40°F to 176°F)  |
| Relative humidity                      | <95% non-condensing @ 40°C   |
| Pollution degree                       | 2  |
| Degree of Protection (control circuit) | IP20 (EN/IEC 60529)  |
| Installation category                  | III  |
| Installation altitude                  | 1000 m   |
| Vibration                              | Acc. to IEC60068-2-6   |
| Frequency 1                            | 2 [+3/-0]Hz to 25Hz<br>Displacement +/- 1.6mm  |
| Frequency 2                            | 25Hz to 100Hz @2g<br>(19.96m/s <sup>2</sup> )  |

## Compatibility and conformity

|             |   |
|-------------|---|
| Conformance | EN/IEC 60947-4-2<br>UL508 Listed (E172877)<br>cUL Listed (E172877)<br>CCC   |
| Approvals   |     |

| Electromagnetic compatibility (EMC) - immunity  |  |
|---|--|
| Immunity  | IEC/EN 61000-6-2   |
| Electrostatic discharge (ESD) Immunity<br>Air discharge, 8kV<br>Contact, 4kV  | IEC/EN 61000-4-2<br>Performance Criteria 2<br>Performance Criteria 2   |
| Radiated radio frequency Immunity<br>3V/m, 80 - 1000 MHz  | IEC/EN 61000-4-3<br>Performance Criteria 1   |
| Electrical Fast Transient (Burst) Immunity<br>Output: 2kV<br>Input: 1kV   | IEC/EN 61000-4-4<br>Performance Criteria 2<br>Performance Criteria 2   |
| Conducted Radio Frequency Immunity<br>10V/m, 0.15 - 80 MHz  | IEC/EN 61000-4-6<br>Performance Criteria 1   |
| Electrical Surge Immunity<br>Output, line to line, 1kV<br>Output, line to earth, 2kV<br>Input, line to line, 1kV<br>Input, line to earth, 2kV | IEC/EN 61000-4-5<br>Performance Criteria 2<br>Performance Criteria 2<br>Performance Criteria 2<br>Performance Criteria 2 |
| Voltage Dips Immunity<br>0% for 10ms/20ms,<br>40% for 200ms<br>70% for 500ms  | IEC/EN 61000-4-11<br>Performance Criteria 2<br>Performance Criteria 2<br>Performance Criteria 2                          |

| Electromagnetic compatibility (EMC) - emissions              |                                      |
|--|--------------------------------------|
| Emission   | IEC/EN 61000-6-3                     |
| Radio Interference field emission (Radiated)<br>30 - 1000MHz | IEC/EN 55011<br>Class A (Industrial) |
| Radio interference field emissions (conducted)               | IEC/EN 55011<br>Class A (Industrial) |



## Inputs

|  | RSBD40..EV..                            | RSBD40..FV..                                | RSBD60..GGV..                           | RSBD60..FFV..                               |
|--|---|---|---|---|
| <b>Control voltage (Uc)</b>  | A1 - A2:<br>110 - 400 VAC<br>+10%, -15% | A1 - A2:<br>24 VAC/VDC<br>+10%, -10%        | ST: 100 - 240 VAC<br>+10%, -15%         | ST:<br>24 VAC/VDC<br>+10%, -15%             |
| <b>Control voltage range (Uc)</b>  | 93.5 - 440 VAC                          | 21.6 - 26.4<br>VAC/DC                       | 85 - 264 VAC                            | 21.6 - 26.4<br>VAC/DC                       |
| <b>Maximum pick-up voltage</b>   | 80 VAC                                  | 20.4 VAC/DC                                 | 80 VAC                                  | 20.4 VAC/DC                                 |
| <b>Minimum drop out voltage</b>  | 20 VAC                                  | 5 VAC/DC                                    | 20 VAC                                  | 5 VAC/DC                                    |
| <b>Supply voltage range (Us)</b>   | -                                       | -   | A1 - A2:<br>100 - 240 VAC<br>+10%, -15% | A1 - A2:<br>24 VAC/DC<br>+10%, -10%         |
| <b>Rated AC frequency</b>  | 45 - 66 Hz                              | 45 - 66 Hz<br>(applies to 24 VAC<br>supply) | 45 - 66 Hz                              | 45 - 66 Hz<br>(applies to 24 VAC<br>supply) |
| <b>Rated insulation voltage (Ui)</b>   | 500 VAC                                 |   |   |   |
| <b>Overvoltage category</b>  | III                                     |   |   |   |
| <b>Dielectric strength:<br/>Dielectric withstand voltage<br/>Rated impulse withstand voltage</b> | 2 kVrms<br>4 kVrms                      |   |   |   |
| <b>Control input current</b>   | 0.5...5 mA                              | 0.4...1 mA                                  | 0.4...3 mA                              | 0.5...1.5 mArms                             |
| <b>Input to output response time<br/>(Mains supply already present)</b>                          | < 300 msec                              |   |   | 1.5 sec                                     |
| <b>Input to output response time<br/>(Mains supply applied with<br/>control)</b>                 | 2.5 sec                                 |   | 2 sec                                   |   |
| <b>Integrated varistor</b>   | Yes                                     |   |   |   |

\* Note 1: For the Canadian application, the control terminals A1, A2 (or A1, A2, ST for RSBD60 versions) of the RSBD devices shall be supplied by a secondary circuit where power is limited by a transformer, rectifier, voltage divider, or similar device that derives power from a primary circuit, and where the short-circuit limit between conductors of the secondary circuit or between conductors and ground is 1500VA or less. The short-circuit volt ampere limit is the product of the open circuit voltage and the short circuit ampere.

Note 2: RSBD60 soft starters require a separate single phase control source. RSBD60...GG versions: 100-240VAC. Output connections (1 L1, 3 L2, 5 L3, 2 T1, 4 T2, 6 T3) are not galvanically isolated from the external supply connections (A1, A2, ST).

## Outputs

|  | RSBD4012....    | RSBD4016.... | RSBD4025.... | RSBD4032.... | RSBD4037.... |
|--|-----------------|--------------|--------------|--------------|--------------|
| Overload cycle acc. to EN/IEC 60947-4-2 @ 40°C surrounding temperature | AC53b:3.5-1:299 |              |              |              |              |
| Maximum number of starts per hour @ 40°C @ rated overload cycle        | 12              |              |              |              |              |
| Rated operational current @ 40°C                                       | 12 AAC          | 16 AAC       | 25 AAC       | 32 AAC       | 37 AAC       |
| Rated operational current @ 50°C                                       | 11 AAC          | 15 AAC       | 23 AAC       | 28 AAC       | 34 AAC       |
| Rated operational current @ 60°C                                       | 10 AAC          | 13 AAC       | 21 AAC       | 25 AAC       | 31 AAC       |
| Minimum time between stop and start                                    | 1 sec           |              |              |              |              |
| Minimum time between starts  | 300 sec         |              |              |              |              |
| Minimum load current   | 2 AAC           | 2 AAC        | 2 AAC        | 5 AAC        | 5 AAC        |

|  | RSBD4050...     | RSBD..55... | RSBD..70.... | RSBD..95.... |
|--|-----------------|-------------|--------------|--------------|
| Overload cycle acc. to EN/IEC 60947-4-2 @ 40°C surrounding temperature | AC53b:3.5-1:299 |             |              |              |
| Maximum number of starts per hour @ 40°C @ rated overload cycle        | 12              |             |              |              |
| Rated operational current @ 40°C                                       | 45 AAC          | 55 AAC      | 70 AAC       | 95 AAC       |
| Rated operational current @ 50°C                                       | 39 AAC          | 50 AAC      | 64 AAC       | 87 AAC       |
| Rated operational current @ 60°C                                       | 35 AAC          | 46 AAC      | 59 AAC       | 80 AAC       |
| Minimum time between stop and start                                    | 1 sec           |             |              |              |
| Minimum time between starts  | 300 sec         |             |              |              |
| Minimum load current   | 5 AAC           |             |              |              |

Note: The overload cycle describes the switching capability of the soft starter at a surrounding temperature of 40°C as described in EN/IEC 60947-4-2. An overload cycle AC53b:3.5-1:299 means that the soft starter can handle a starting current of 3.5xI<sub>e</sub> for 1second followed by an OFF time of 299 seconds.

## Auxiliary relays

|   | RSBD4012... - RSBD4050...                                   | RSBD..55... - RSBD..95...  |
|---|---|--|
| Number of output relays                         | 2   | 3  |
| Function of relays                              | Alarm, bypassed (top of ramp).                              | Alarm, bypassed (top of ramp), run.                                |
| Rated operational voltage                       | 250 VAC / 30 VDC  |  |
| Rated insulation voltage                        | 250 VAC   |  |
| Dielectric withstand voltage (Coil to contacts) | 2.5 kV  |  |
| Overvoltage category                            | II  |  |
| Type of control circuit                         | Electromechanical relay                                     |  |
| Number of contacts                              | Alarm and bypassed: 1                                       | Alarm and bypassed: 2<br>Run: 1                                    |
| Type of contacts                                | Alarm: normally closed (NC)<br>Bypassed: normally open (NO) | Alarm and bypassed: changeover (NO, NC)<br>Run: normally open (NO) |
| Type of current                                 | AC / DC   |  |
| Rated operational current                       | 3 Arms @ 250 VAC, 3 Arms @ 30 VDC                           |  |

## Performance

Current / power ratings: kW and HP @ 40°C

| Model                      | 220 - 240 VAC   | 380 - 415 VAC   | Max. Current limit level<br>I <sub>rms</sub> |
|----------------------------|-----------------|-----------------|--|
| RSBD4012.V....             | 3 kW / 3 HP     | 5.5 kW / 5 HP   | 42 Arms                                      |
| RSBD4016.V....             | 4 kW / 5 HP     | 7.5 kW / 7.5 HP | 56 Arms                                      |
| RSBD4025.V....             | 5.5 kW / 7.5 HP | 11 kW / 10 HP   | 87.5 Arms                                    |
| RSBD4032.V....             | 9 kW / 10 HP    | 15 kW / 15 HP   | 112 Arms                                     |
| RSBD4037.V....             | 9 kW / 10 HP    | 18.5 kW / 20 HP | 129.5 Arms                                   |
| RSBD4050.V....             | 11 kW / 15 HP   | 22 kW / 25 HP   | 175 Arms                                     |
| RSBD4055.... / RSBD6055... | 15 kW / 20 HP   | 30 kW / 30 HP   | 192.5 Arms                                   |
| RSBD4070.... / RSBD6070... | 20 kW / 25 HP   | 37 kW / 40 HP   | 245.0 Arms                                   |
| RSBD4095.... / RSBD6095... | 22 kW / 30 HP   | 45 kW / 50 HP   | 285.0 Arms                                   |
|                            | 440 - 480 VAC   | 550 - 600 VAC   | Max. Current limit level<br>I <sub>rms</sub> |
| RSBD6055.V....             | 30 kW / 30 HP   | 45 kW / 50 HP   | 192.5 Arms                                   |
| RSBD6070.V....             | 45 kW / 50 HP   | 55 kW / 75 HP   | 245.0 Arms                                   |
| RSBD6095.V....             | 55 kW / 75 HP   | 75 kW / 75 HP   | 285.0 Arms                                   |

Ratings:

kW rating according to: IEC/EN 60947-4-2

HP rating according to: UL508

Note: Motor kW ratings are provided as a reference. User shall always ensure that compressor operational current and overload current of the compressor during starting does not exceed the rating of the softstarter being used.

# Connection Diagrams

## Terminal markings

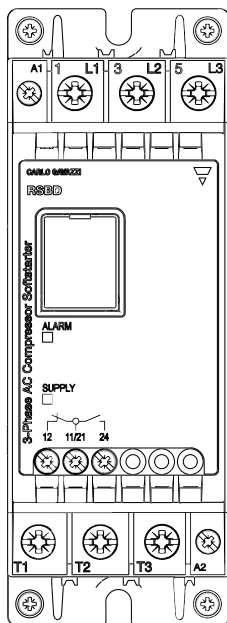


Fig. 3 RSBD 45mm

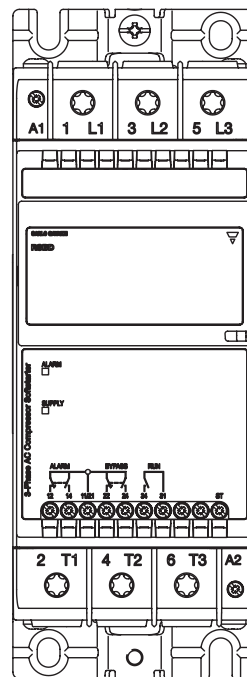


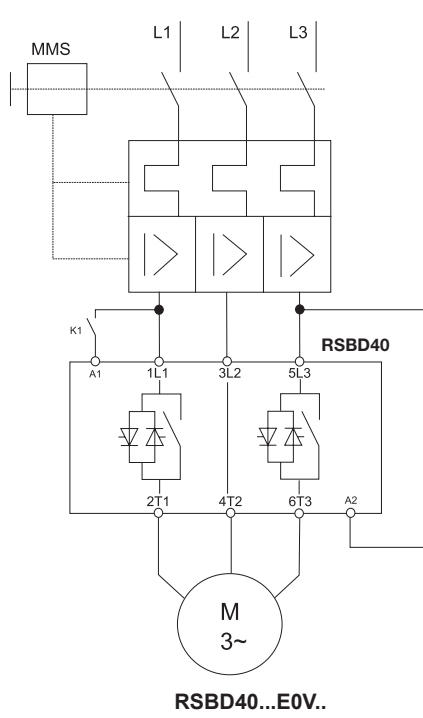
Fig. 4 RSBD 75mm

| Marking       | RSBD 45mm  | RSBD 75mm                                   |
|---------------|--|---|
|               | RSBD..12.. to RSBD..50..                           | RSBD..55.. to RSBD..95..                    |
| 1L1, 3L2, 5L3 | Line connections                                   |   |
| 2T1, 4T2, 6T3 | Load connections                                   |   |
| A1, A2        | Control voltage (Supply voltage for RSBD60 models) |   |
| 11, 12, 14    | Alarm indication (Normally Closed, NC)             | Alarm indication (NO, NC, changeover)       |
| 21, 22, 24    | Top of Ramp indication (Normally Open, NO)         | Top of Ramp indication (NO, NC, changeover) |
| 31, 34        | -  | Run relay indication (NO, normally open)    |
| ST*:          | -  | Control voltage (start signal)              |

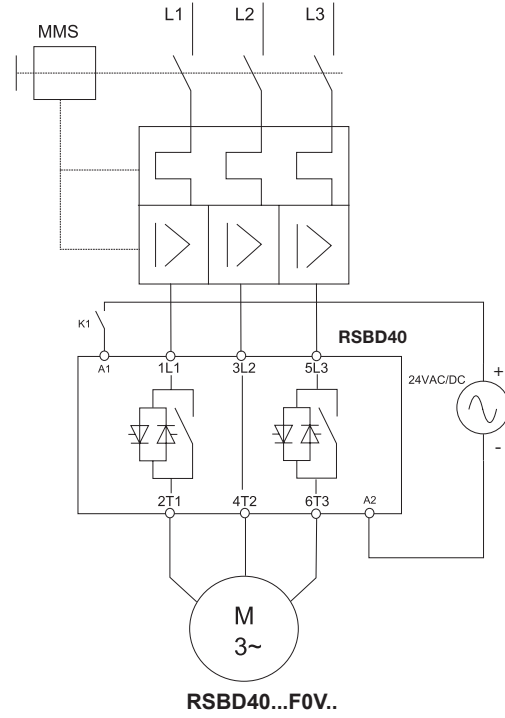
\* only for RSBD60.. models

Wiring diagrams

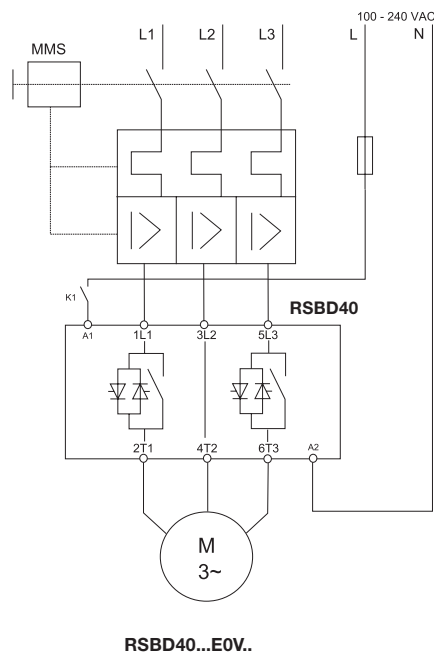
Valid up to 400 VAC



RSBD40...E0V..



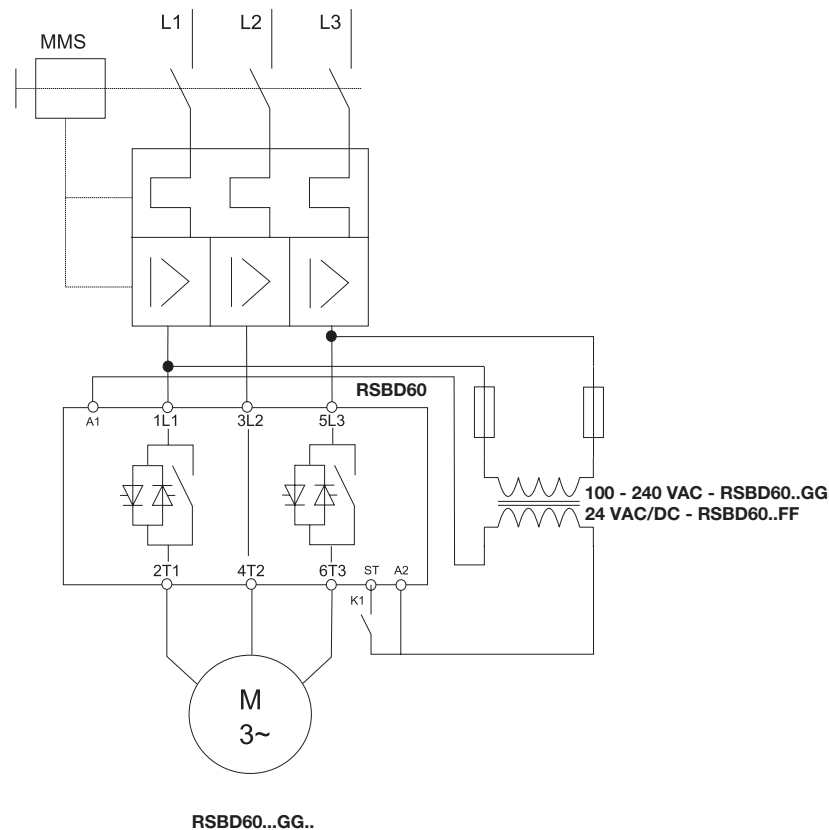
RSBD40...F0V..



RSBD40...E0V..

## Wiring diagrams

**IMPORTANT:** L1, L2, L3 should already be connected when A1, A2 and ST signals are applied. A minimum delay of 200ms should be allowed between switching of L1, L2, L3 and A1, A2 and ST respectively. If L1, L2 and L3 are not present, when A1, A2 is applied the "Line voltage out of range alarm will be triggered". The alarm will automatically recover if L1, L2, L3 are within operational range for 1 sec (on power up only).



Note 1: For RSBD60..GG... models apply 100 - 240VAC across A1, A2 terminals.

Note 2: For RSBD60..FF... models, connect A1 to the positive (+) and A2 to the negative (-) terminal of the power supply.

Note 3: ST terminal has to be at the same potential of A2 (refer to wiring diagrams)

**Connection specifications**

| Line conductors 1 L1, 3 L2, 5 L3, 2 T1, 4 T2, 6 T3 Acc. to EN60947-1 |   |                                      |
|--|---|--------------------------------------|
|  | RSBD...12 to RSBD...50                                  | RSBD...55 to RSBD...95               |
| Flexible   | 2.5 - 10 mm <sup>2</sup><br>2.5 - 2 x 4 mm <sup>2</sup> | -                                    |
| Rigid (solid or stranded)  | 2.5 .... 10 mm <sup>2</sup>                             | 2 x (10...50 mm <sup>2</sup> )       |
| Flexible with end sleeve (ferrule)                                   | 2.5 .... 10 mm <sup>2</sup>                             | 2 x (10...50 mm <sup>2</sup> )       |
| UL/cUL rated data  |   |                                      |
| Rigid (stranded)   | AWG 6...14  |                                      |
| Rigid (solid)  | AWG 10...14   |                                      |
| Rigid (solid or stranded)  | AWG2 x 10...2 x 14                                      | 2 x (AWG 8...1/0)                    |
| Terminal screws  | M4  | M8                                   |
| Maximum tightening torque  | 2.5 Nm (22 lb.in) with posidrive bit 2                  | 12 Nm (106 lb.in) with Torx TT40 bit |
| Stripping length   | 8.0 mm  | 20.0 mm                              |

| Secondary conductors A1, A2 Acc. to EN60998 |                              |   |
|---|------------------------------|---|
|   | RSBD...12 to RSBD...50       | RSBD...55 to RSBD...95                  |
| Flexible                                    | 0.5 .... 1.5 mm <sup>2</sup> | -                                       |
| Rigid (solid or stranded)                   |                              | 0.5 .... 2.5 mm <sup>2</sup>            |
| Flexible with end sleeve (ferrule)          |                              | 0.5 .... 1.5 mm <sup>2</sup>            |
| UL/cUL rated data                           |                              |   |
| Rigid (solid or stranded)                   |                              | AWG 10...18                             |
| Terminal screws                             |                              | M3                                      |
| Maximum tightening torque                   |                              | 0.6 Nm (5.3 lb.in) with posidrive bit 0 |
| Stripping length                            |                              | 6.0 mm                                  |

| Auxiliary conductors 11, 12, 21, 24, (31, 34)*, ST** |                        |                                     |
|--|------------------------|-------------------------------------|
|  | RSBD...12 to RSBD...50 | RSBD...55 to RSBD...95              |
| Rigid (solid or stranded)                            |                        | 0.05 ... 2.5 mm <sup>2</sup>        |
| Flexible with end sleeve (ferrule)                   |                        | 0.05 ... 1.5 mm <sup>2</sup>        |
| UL/cUL rated data                                    |                        |                                     |
| 11, 12, 21, 24, (31, 34)*, ST**                      |                        | AWG 30 ... 12                       |
| Rigid (solid or stranded)                            |                        | AWG 24 ... 12                       |
| Terminal screws                                      |                        | M3                                  |
| 11, 12, 21, 24, (31, 34)*, ST**                      |                        |                                     |
| Maximum tightening torque                            |                        | 0.45 Nm (4.0 lb.in) posidrive bit 0 |
| 11, 12, 21, 24, (31, 34)*, ST**                      |                        |                                     |
| Stripping length                                     |                        | 6.0 mm                              |

Use 75°C Copper (Cu) conductors

\* For RSBD...55 to RSBD...95 models only

\*\*For RSBD60 models only

# Troubleshooting

## LED status indications

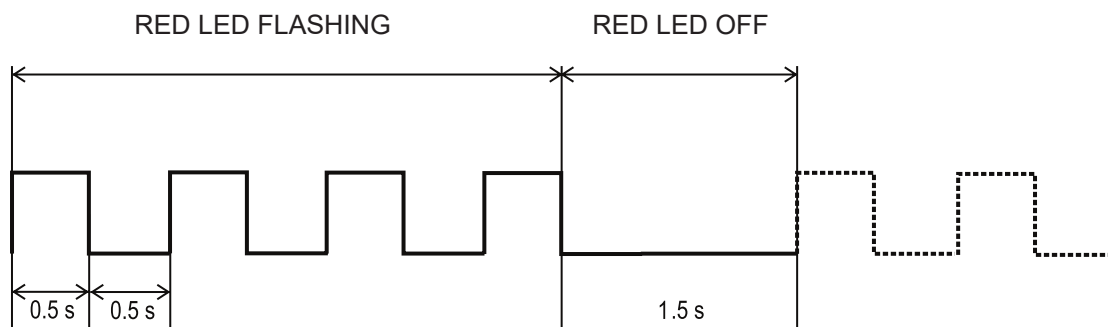
| State          | Supply (green LED) | Alarm (red LED) |
|----------------|--------------------|-----------------|
| Idle           | ON                 | OFF             |
| Ramping        | ON                 | OFF             |
| Bypass         | ON                 | OFF             |
| Alarm          | ON                 | Flashing        |
| Internal fault | ON                 | ON              |

## Relay status indication

| State          | Relay contact position |                 |                    |                     |              |
|----------------|------------------------|-----------------|--------------------|---------------------|--------------|
|                | RSBD 45 mm             |                 | RSBD 75 mm         |                     |              |
|                | Alarm (11, 12)         | Bypass (21, 24) | Alarm (11, 12, 14) | Bypass (21, 22, 24) | Run (31, 34) |
| Idle           | Closed                 | Open            | 11, 12             | 21, 22              | Open         |
| Ramping        | Closed                 | Open            | 11, 12             | 21, 22              | Closed       |
| Bypass         | Closed                 | Closed          | 11, 12             | 21, 24              | Closed       |
| Alarm          | Open                   | Open            | 11, 14             | 21, 22              | Open         |
| Internal fault | N/A                    | N/A             | 11, 14             | 21, 22              | Open         |

## Alarms

The RSBD includes a number of diagnostics and protection features each of which is signalled through a flashing sequence on the red LED.





|  |   |
|--|---|
| <b>Number of flashes</b>                 | 2   |
| <b>Alarm</b>                             | Wrong phase sequence  |
| <b>Alarm description</b>                 | If the connection to the soft starter is not done in the correct sequence (L1, L2, L3), the RSBD will trigger the wrong phase sequence alarm and the motor will not be started. |
| <b>Alarm recovery period</b>             | N/A   |
| <b>Consecutive alarms for hard reset</b> | 1   |
| <b>Action to recover alarm</b>           | User intervention is required to change the wiring sequence to recover alarm.   |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>Check that wiring on L1, L2, L3 is in the correct sequence.</li> </ul>   |

|  |   |
|--|---|
| <b>Number of flashes</b>                 | 3   |
| <b>Alarm</b>                             | Line voltage out of range   |
| <b>Alarm description</b>                 | <p>At every power-up the RSBD automatically detects the supply voltage level and determines whether it is working on a 220, 400, 480* or 600* V supply. The under- or over- voltage alarm level is then set at a level of -20% and +20% (from the measured supply voltage level) respectively.</p> <p>If the supply voltage level is out of these limits for more than 5 seconds then the line voltage out of range alarm will be triggered.</p> <p>* Applies to RSBD60 models.</p> <p>Note: for RSBD60 over-voltage alarm level (for the case of a 600V supply) is 675V (600V + 11%).</p> <p>Note: RSBD 45mm models have a fixed level for undervoltage (174VAC) and for over-voltage (466VAC). The alarm will trigger when the voltage level measured is outside these limits for at least 5 seconds.</p> |
| <b>Alarm recovery period</b>             | 5 minutes   |
| <b>Consecutive alarms for hard reset</b> | 4   |
| <b>Action to recover alarm</b>           | The alarm will self-recover after 5 minutes from when the supply voltage is within limits.  |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>Check supply voltage level across L1, L2, L3 terminals.</li> <li>Make sure that you are not using a RSBD40 model on a supply voltage &gt; 440 VAC.</li> </ul>  |

|  |  |
|--|--|
| <b>Number of flashes</b>                 | 4  |
| <b>Alarm</b>                             | Frequency out of range   |
| <b>Alarm description</b>                 | If the frequency measured by the RSBD is >66.5Hz and <44.5Hz for at least 1 second, this alarm will trigger.   |
| <b>Alarm recovery period</b>             | 5 minutes  |
| <b>Consecutive alarms for hard reset</b> | N/A  |
| <b>Action to recover alarm</b>           | Check for any disturbance on the voltage network. The voltage waveform may be disrupted when unfiltered variable frequency drives are used.              |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>In the case where variable frequency drives are present, ensure that proper EMI filters are installed.</li> </ul> |

|  |  |
|--|--|
| <b>Number of flashes</b>                 | 5  |
| <b>Alarm</b>                             | Locked rotor condition (during ramp)   |
| <b>Alarm description</b>                 | If a current $\geq 4 \cdot I_e$ for 100 msec is detected, the RSBD will issue the locked rotor alarm.  |
| <b>Alarm recovery period</b>             | OK   |
| <b>Consecutive alarms for hard reset</b> | 2  |
| <b>Action to recover alarm</b>           | The alarm will self-recover after 5 minutes. If the soft starter remains in alarm for more than 5 minutes (due to consecutive alarms) then a power reset (reset of L1, L2, L3 for RSBD40 and reset of A1, A2 for RSBD60 models) is required. |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>Check that the RSBD model is suitably rated for the motor.</li> <li>Check motor windings resistance to check if motor is damaged.</li> </ul>  |

|  |  |
|--|--|
| <b>Number of flashes</b>                 | 6  |
| <b>Alarm</b>                             | Ramp-up time (> 1sec)  |
| <b>Alarm description</b>                 | The RSBD measures the current during bypass state. If the current is >1.05 * I <sub>le</sub> for at least 1 second, the RSBD will trigger this alarm and switch OFF the output. This condition can result in case of an overload condition or because the RSBD model under-rated for the load it is controlling. |
| <b>Alarm recovery period</b>             | 5 minutes  |
| <b>Consecutive alarms for hard reset</b> | 2  |
| <b>Action to recover alarm</b>           | The alarm will self-recover after a period of 5 minutes.<br>If the alarm is triggered twice consecutively, then the user must switch OFF and then ON the mains (L1, L2, L3 or A1, A2 for RSBD60 models) to perform a hard reset. This will reset the alarm.  |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>• Check that the correct model of RSBD is being used</li> <li>• Check that the connections to the compressor are correct</li> <li>• Check for any mechanical blockage on the compressor</li> </ul>  |

|  |  |
|--|--|
| <b>Number of flashes</b>                 | 7  |
| <b>Alarm</b>                             | Over-temperature   |
| <b>Alarm description</b>                 | The RSBD constantly measures the heatsink and thyristors (SCRs) temperature. If the maximum internal temperature is exceeded (for a minimum of 0.5 sec) an over-temperature alarm is triggered. This condition can be triggered by too many starts per hour, an over-load condition during starting and/or stopping or a high surrounding temperature. |
| <b>Alarm recovery period</b>             | Depends on the cooling period.<br>(If MANUAL reset mode is applied, alarm can be reset by pressing the Test/Reset button).<br>The RSBD will only recover if the internal temperature is within safe limits.  |
| <b>Consecutive alarms for hard reset</b> | 4  |
| <b>Action to recover alarm</b>           | The alarm will self-recover - the recovery period will depend on the cooling time required by RSBD. The higher the surrounding temperature, the longer the cooling period.   |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>• Check that the specified number of starts/hr are not exceeded.</li> <li>• Check that the surrounding temperature around the soft starter is within limits.</li> </ul>   |

|  |   |
|--|---|
| <b>Number of flashes</b>                 | 8   |
| <b>Alarm</b>                             | Current not normal (during bypass)  |
| <b>Alarm description</b>                 | The RSBD measures the current during bypass state. If the current is >1.15 * I <sub>le</sub> for at least 1 second, the RSBD will trigger this alarm and switch OFF the output. This condition can result in case of an overload condition or because the RSBD model under-rated for the load it is controlling.  |
| <b>Alarm recovery period</b>             | 5 minutes   |
| <b>Consecutive alarms for hard reset</b> | 2   |
| <b>Action to recover alarm</b>           | The alarm will self-recover after a period of 5 minutes.<br>If the alarm is triggered twice consecutively, then the user must switch OFF and then ON the mains (L1, L2, L3 or A1, A2 for RSBD60 models) to perform a hard reset. This will reset the alarm.   |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>• Check that the correct model of RSBD is being used.</li> <li>• Check that the connections to the compressor are correct.</li> <li>• Measure the current with a clamp meter on any of L1, L2, L3 phases and check if the current is within the expected levels. If the current is higher than the RSBD rated current, change the RSBD to a larger model.</li> </ul> |



|  |  |
|--|--|
| <b>Number of flashes</b>                 | 9  |
| <b>Alarm</b>                             | Supply voltage unbalance   |
| <b>Alarm description</b>                 | The RSBD monitors the voltage levels on all the phases and if it measures a difference of at least 10% between any of L1, L2, L3 for at least 5 seconds, the alarm 9 will be triggered. When the alarm is triggered the RSBD will switch OFF the output.   |
| <b>Alarm recovery period</b>             | 5 minutes (from the moment the %voltage unbalance between all the phases is < 10%)   |
| <b>Consecutive alarms for hard reset</b> | N/A  |
| <b>Action to recover alarm</b>           | The alarm will start a self-recovery of 5 minutes from the moment the voltages on L1, L2, L3 are within 10% of each other. If the voltage unbalance remains >10%, the RSBD will remain in alarm state.   |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>• Check for any loose connections on the mains and load side.</li> <li>• Check voltage across L1 - L2, L2 - L3, L1 - L3 and see if there is any unbalance.</li> <li>• Check resistance on motor windings to see if any of the coils are damaged.</li> </ul> |

|  |   |
|--|---|
| <b>Number of flashes</b>                 | Fully ON *  |
| <b>Alarm</b>                             | Internal fault  |
| <b>Alarm description</b>                 | In case there is an internal fault in the RSBD circuitry, the Red LED will remain continuously ON.  |
| <b>Alarm recovery period</b>             | -   |
| <b>Consecutive alarms for hard reset</b> | 1   |
| <b>Action to recover alarm</b>           | Note: this alarm is not resettable and it is suggested to replace the unit and contact a Carlo Gavazzi representative should this alarm occur.  |
| <b>Troubleshooting</b>                   | <ul style="list-style-type: none"> <li>• Check resistance across L1 - T1 and L3 - T3 to check for any short.</li> <li>• If any of the SCRs is damaged, replace the soft starter.</li> </ul> |

\* For RSBD...55 to RSBD...95 models only

## Short circuit protection

### Protection Co-ordination, Type 1 vs Type 2

Type 1 protection implies that after a short circuit, the device under test will no longer be in a functioning state.

In Type 2 co-ordination the device under test will still be functional after the short circuit. In both cases, however the short circuit has to be interrupted. The fuse between enclosure and supply shall not open. The door or cover of the enclosure shall not be blown open. There shall be no damage to conductors or terminals and the conductors shall not separate from terminals. There shall be no breakage or cracking of insulating bases to the extent that the integrity of the mounting of live parts is impaired. Discharge of parts or any risk of fire shall not occur.

The product variants listed in the table hereunder are suitable for use on a circuit capable of delivering not more than 5,000Arms (or 10,000Arms for RSBD..70 - RSBD..95) Symmetrical Amperes, 400Volts (or 600V for RSBD60 models) maximum when protected by fuses.

Tests at 5,000Arms (or 10,000Arms for RSBD..70 - RSBD..95) were performed with Class RK5 fuses, fast acting; please refer to the table below for maximum allowed ampere rating of the fuse. Use fuses only.

#### Co-ordination Type 1 (UL508) – Time Delay Fuses

| Part No.                   | Max. fuse size [A] | Class | Current [kA] | Max. voltage [VAC] |
|----------------------------|--------------------|-------|--------------|--------------------|
| RSBD4012....               | 20                 | RK5   | 5            | 600                |
| RSBD4016....               | 20                 |       |              |                    |
| RSBD4025....               | 25                 |       |              |                    |
| RSBD4032....               | 35                 |       |              |                    |
| RSBD4037....               | 50                 |       |              |                    |
| RSBD4050....               | 50                 |       |              |                    |
| RSBD4055.... / RSBD6055... | 60                 |       |              |                    |
| RSBD4070.... / RSBD6070... | 100                |       | 10           |                    |
| RSBD4095.... / RSBD6095... | 100                |       |              |                    |

#### Co-ordination Type 1 – Manual Motor Starters

| Item No.                   | Model No.            | Current [kA] | Max. voltage [VAC] |
|----------------------------|----------------------|--------------|--------------------|
| RSBD4012....               | GMS32S-17 /GMS32H-17 | 10           | 400                |
| RSBD4016....               | GMS32S-17 /GMS32H-17 |              |                    |
| RSBD4025....               | GMS32H-32            |              |                    |
| RSBD4032....               | GMS32H-32            |              |                    |
| RSBD4037....               | GMS63S-50 /GMS63H-50 |              |                    |
| RSBD4050....               | GMS63S-50 /GMS63H-50 |              |                    |
| RSBD4055.... / RSBD6055... | GMS63H-63A           |              |                    |
| RSBD4070.... / RSBD6070... | GMS100S-75A          |              |                    |
| RSBD4095.... / RSBD6095... | GMS100S-100A         |              |                    |

Products protected with manual motor starters must be wired with a minimum length of 1.5m Cu wire conductor. For products rated 12, 16, 25A the maximum cross sectional area shall be of 2.5 mm<sup>2</sup> , for products rated 32, 37, 45, 55A the maximum cross-sectional area shall be of 16 mm<sup>2</sup> and for products rated 70, 95A this shall be of a maximum of 50mm<sup>2</sup>.

The length includes the conductors from the voltage source to the manual manual starter, from the manual motor starter to the soft starter and from the soft starter to the load.

## Accessories

### ▶ RTPM (Interconnecting Clip)



#### ▶ Ordering Key

Interconnecting clip for GMS-32-H motor starter  
 • Qty: 10pcs per bag

**RTPMGMS32HL**

Interconnecting clip for GMS-32-S motor starter  
 • Qty: 10pcs per bag

**RTPMGMS32SL**

For RSBD 45mm models only

### ▶ RFCG (Finger Guards)



#### ▶ Ordering Key

**RFCG X6**

Finger/ cable guards  
 6 pcs per box

• For RSBD 75mm models only

## Accessories

### GMS (Manual Motor Starter)



#### Ordering Key

**GMS-32S-13A**

Type \_\_\_\_\_  
 S: Standard, H: High breaking capacity  
 Rated operational current \_\_\_\_\_

- Overload and short-circuit protection
- Operational current range: 0.16 up to 32AAC
- Magnetic release 13xI<sub>e</sub> max
- Adjustable thermal release
- Ambient temperature compensation
- Trip Class 10
- CE, cULus

#### Ordering Key

**GMS-63H-13A**

Type \_\_\_\_\_  
 S: Standard, H: High breaking capacity  
 Rated operational current \_\_\_\_\_

- Overload and short-circuit protection
- Operational current range: 10 up to 63AAC
- Magnetic release 13xI<sub>e</sub> max
- Adjustable thermal release
- Ambient temperature compensation
- Trip Class 10
- CE, cULus

Note: For higher trip classes please contact your Carlo Gavazzi representative

#### Ordering Key

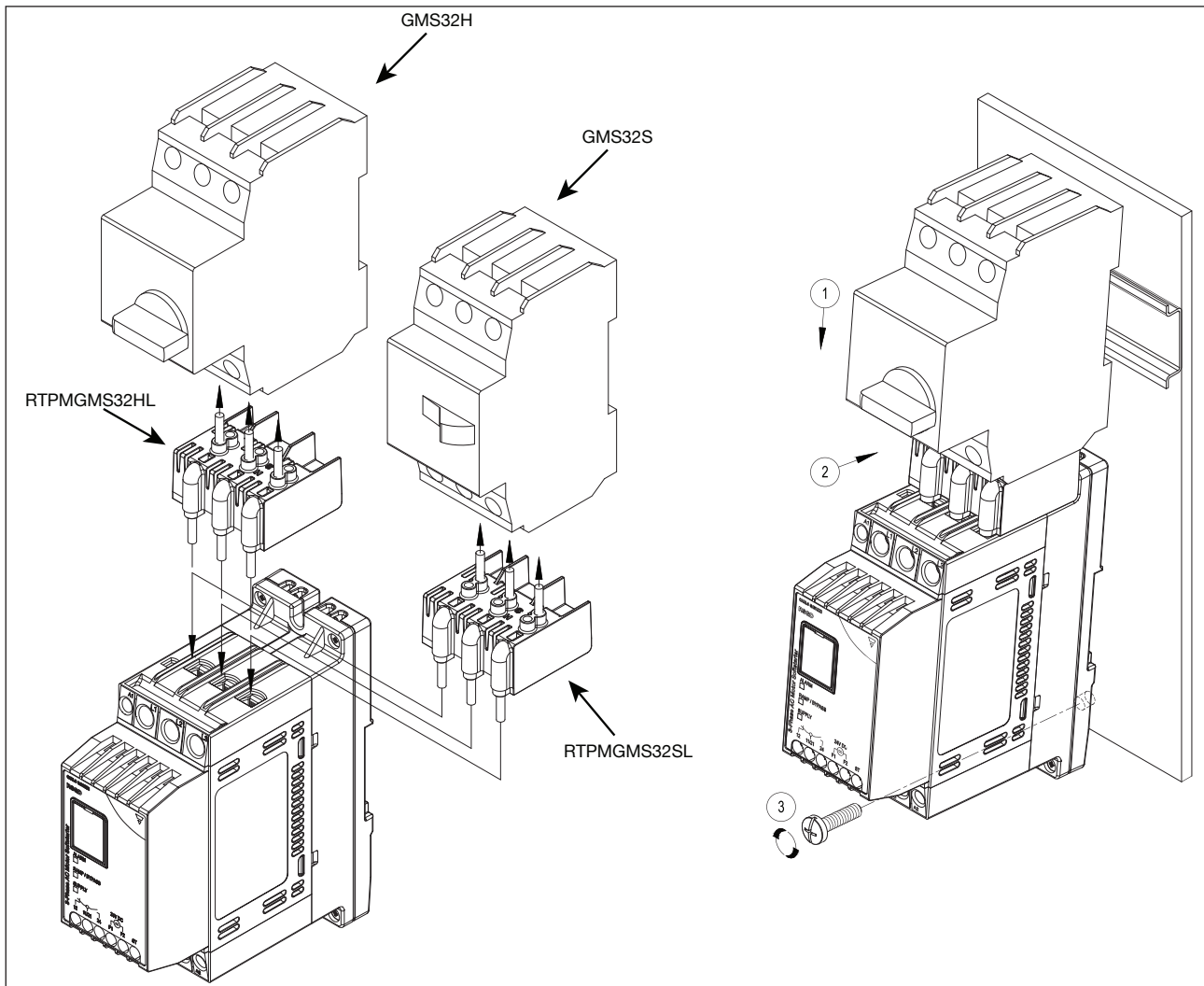
**GMS-100S-100A**

Type \_\_\_\_\_  
 S: Standard, H: High breaking capacity  
 Rated operational current \_\_\_\_\_

- Overload and short-circuit protection
- Operational current range: up to 100AAC
- Magnetic release 13xI<sub>e</sub> max
- Adjustable thermal release
- Ambient temperature compensation
- Trip Class 10
- CE, cULus

# Accessories

## GMS Mounting Instructions



The following procedure should be followed when mounting the GMS motor starter onto the RSBD 45mm soft starter:-

**Step 1:** Unscrew the terminals on the RSBD and GMS units and insert the proper RTPM clip in the respective terminals.

**Step 2:** Tighten the screws on the GMS and RSBD units respecting the maximum torque specified.

**Step 3:** Mount the complete assembly to the DIN rail and screw the RSBD to the panel as shown in the diagram.

**Note:** Always mount the GMS motor starter on the supply side (L1, L2, L3) of the RSBD soft starter.

**Important:** Make sure that the handle on the GMS starter is in the OFF position before installing and uninstalling.

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