# RSBT

## 3-phase scroll compressor soft starter



### Description

**RSBT** is an easy to use soft starter for scroll compressors up to 95 A nominal current.

The **RSBT** is 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.

**RSBT** is a 3-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 RSBT 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.** 16 - 32 Arms in 45 mm wide housing, 55 - 95 Arms in 120 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://www.productselection.net/SoftStarters/SoftStartersNew.php?LANG=UK
- **Tamper proof.** No user adjustments are available. RSBT 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

- Heat pumps, chillers, roof tops, refrigeration display cabinets

### Main features

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

## Order code

**RSBT ☐ ☐ ☐ V ☐**

Enter the code entering the corresponding option instead of ☐.

| Code | Option | Description | Comments |
|------|--------|-------------|----------|
| R | - | | |
| S | - | Scroll compressor soft starter | |
| B | - | | |
| T | - | Switching mode: 3 phase | |
| ☐ | 40 | 220 - 400 VAC + 10% - 15% | Operational voltage range |
| | 48 | 220 - 480 VAC + 10% - 15% | |
| ☐ | 16 | 16 Arms | Rated operational current at 40°C |
| | 25 | 25 Arms | |
| | 32 | 32 Arms | |
| | 55 | 55 Arms | |
| | 70 | 70 Arms | |
| | 95 | 95 Arms | |
| ☐ | E | 110 – 400 VAC, +10% -15% | Control voltage (Only for RSBT40 models) |
| | F | 24 VAC/DC ±10% | Control voltage (Only for RSBT40 models) |
| | C | 24 VAC/DC ±10% and 110 - 400 VAC +10% -15% | Control voltage (Only for RSBT48 models) |
| ☐ | V11HP | DIN Mount | Only for RSBT40 Modbus |
| | V21HP | DIN Mount and relay output (RFPMV10 module) | |
| | VC1HP | RS485 MODBUS serial communication | Only for RSBT 40 models |
| | V0 | Relay outputs | Only for RSBT 48 models |
| | VC | RS485 Modbus serial communication | |

## Selection guide - RSBT 45 mm

| Operational voltage | Control voltage | Features | Rated operational current per pole @ 40°C | | |
|---|---|---|---|---|---|
| | | | 16 Arms | 25 Arms | 32 Arms |
| **220 - 400 VAC** | 110 - 400 VAC | HP | RSBT4016EV11HP | RSBT4025EV11HP | RSBT4032EV11HP |
| | | HP + Relay output | RSBT4016EV21HP | RSBT4025EV21HP | RSBT4032EV21HP |
| | 24 VAC / DC | HP | RSBT4016FV11HP | RSBT4025FV11HP | RSBT4032FV11HP |
| | | HP + Relay output | RSBT4016FV21HP | RSBT4025FV21HP | RSBT4032FV21HP |
| | 110 - 400 VAC (or Modbus) | RS485 Modbus communication | RSBT4016EVC1HP | RSBT4025EVC1HP | RSBT4032EVC1HP |
| | 24 VAC / DC (or Modbus) | | RSBT4016FVC1HP | RSBT4025FVC1HP | RSBT4032FVC1HP |

## Selection guide - RSBT 120 mm

| Operational voltage | Control voltage | Features | Rated operational current per pole @ 40°C | | |
|---|---|---|---|---|---|
| | | | 55 Arms | 70 Arms | 95 Arms |
| **220 - 480 VAC** | 24 VAC/DC and 100 - 400 VAC | Relay outputs | RSBT4855CV0 | RSBT4870CV0 | RSBT4895CV0 |
| | 24 VAC/DC and 100 - 400 VAC (or Modbus) | RS485 + Relay outputs | RSBT4855CVC | RSBT4870CVC | RSBT4895CVC |

## Further reading

| Information | Where to find it | QR |
|---|---|---|
| RSBT instruction manual | http://cga.pub/?8ed4cc | |
| RSBT troubleshooting guide | http://cga.pub/?a8d9de | |
| CAD drawings (45 mm) | http://cga.pub/?f98c30 | |
| CAD drawings with module (45mm) | http://cga.pub/?d9bb77 | |
| CAD drawings (120 mm) | http://cga.pub/?dbe689 | |
| RSBT Monitor software | http://cga.pub/?cabe83 | |

# Structure
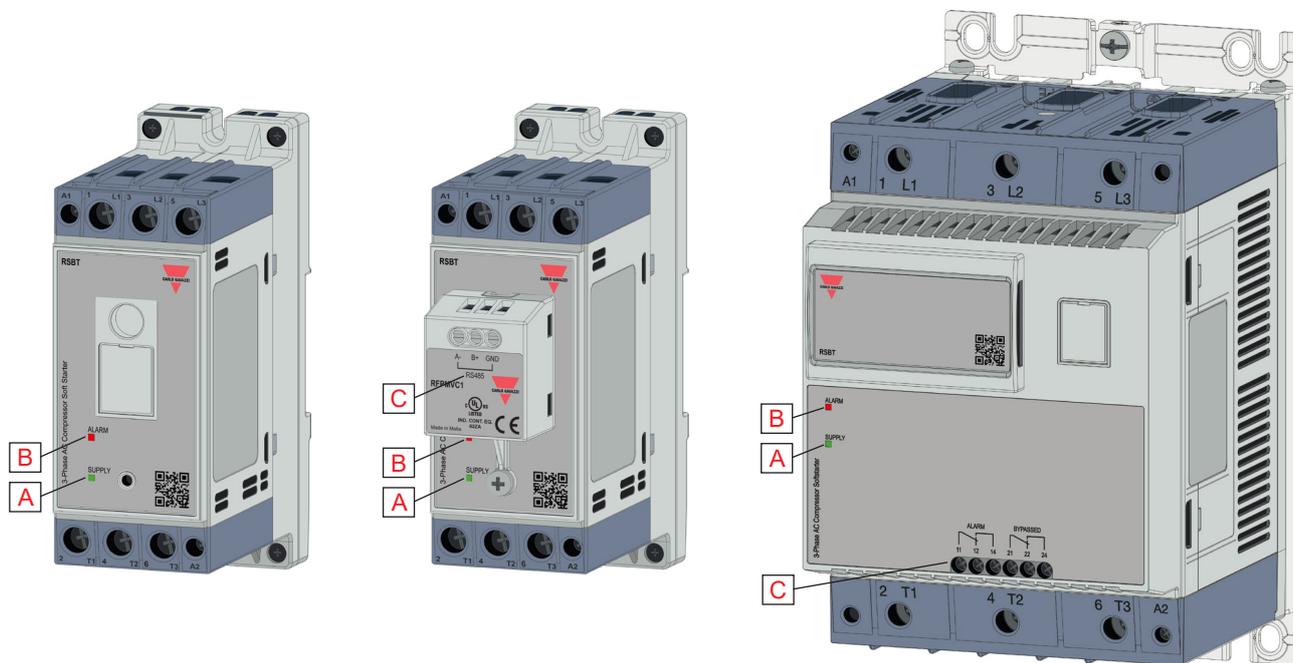


| Element | Component | Function | |
|---------|-----------|----------|---|
| A | LED indicators | Supply. Indicates that the RSBT supply is ON. | |
| B | LED indicators | Alarm. Indicates that the RSBT is in alarm. The number of flashes indicates the alarm type. | |
| C | | **RSBT 45 mm** | **RSBT 120 mm** |
| | Digital outputs | Version: V21, 11, 12, 14: Changeover relay (NO, NC) for alarm indication | 11, 12, 14: Changeover relay (NO, NC) for alarm indication. |
| | | | 21, 22, 24: Changeover relay (NO, NC) for top of ramp indication. |
| | Communication interface | Version VC1 A-, B+, GND: connection for Modbus (RS485) | Version CVC A-, B+, GND, T: connection for Modbus (RS485) |

# Mode of operation

## ► Auto Adaptive Algorithm (Patented)

RSBT 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 RSBT 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 RSBT adapts its parameters according to the load requirements at different operating conditions.
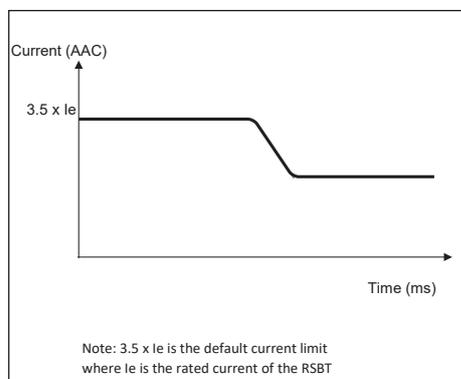
## ► First start of RSBT

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

Note: The default current limit is approximately 3.5 x Ie (where Ie = soft starter rated current). Depending on the values of specific parameters, that are automatically measured by RSBT, it will adjust the current limit setting to a lower value. This new self-learned current limit setpoint will then be used by RSBT during the subsequent start.
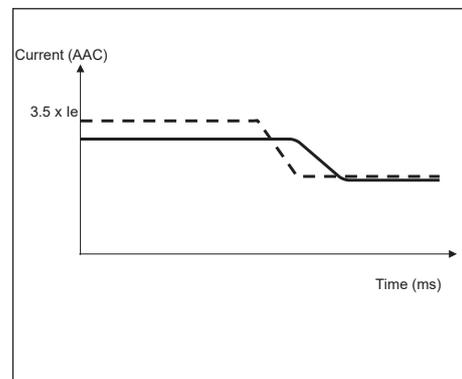
## ► High pressure (HP) function

During the ramp-up sequence, the RSBT will check if the compressor is rotating. If the RSBT finds the compressor in locked rotor condition, it will trigger the HP function. During the HP sequence, the RSBT will gradually increase the current limit setpoint. The maximum value is ≤ 3.5 x Ie.
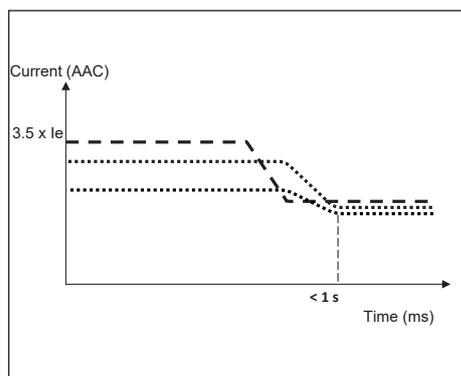
Note: Even during HP mode of operation the ramp-up time will be limited to a maximum of 1 sec. If the compressor does not reach full speed during a maximum of 1 sec, the RSBT will trigger the End of ramp alarm (5 flashes) and will go in alarm state.
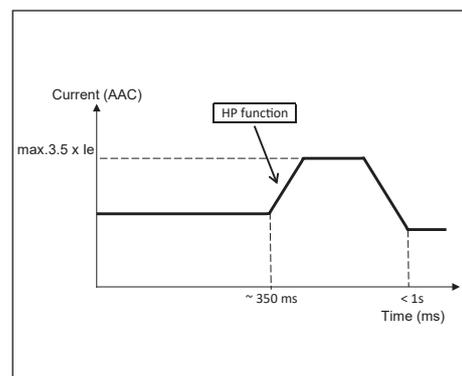
**Start 1**

**Start 2**

**Start 3**

**Start 4**

# Features

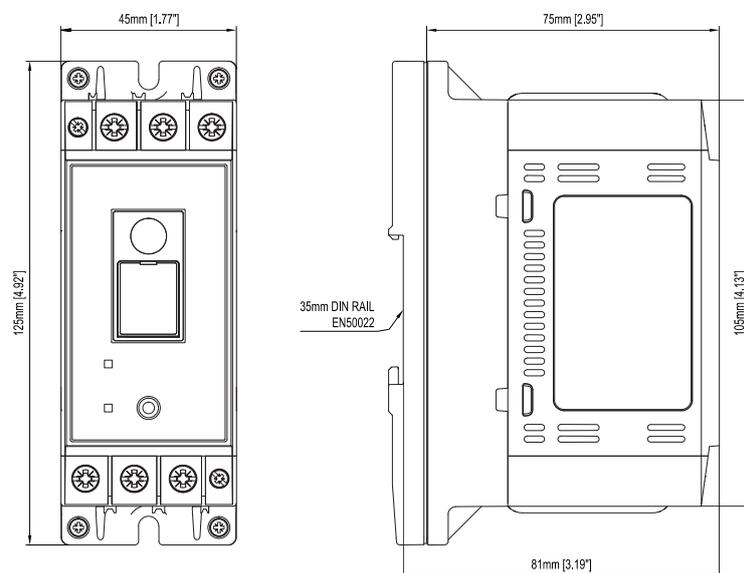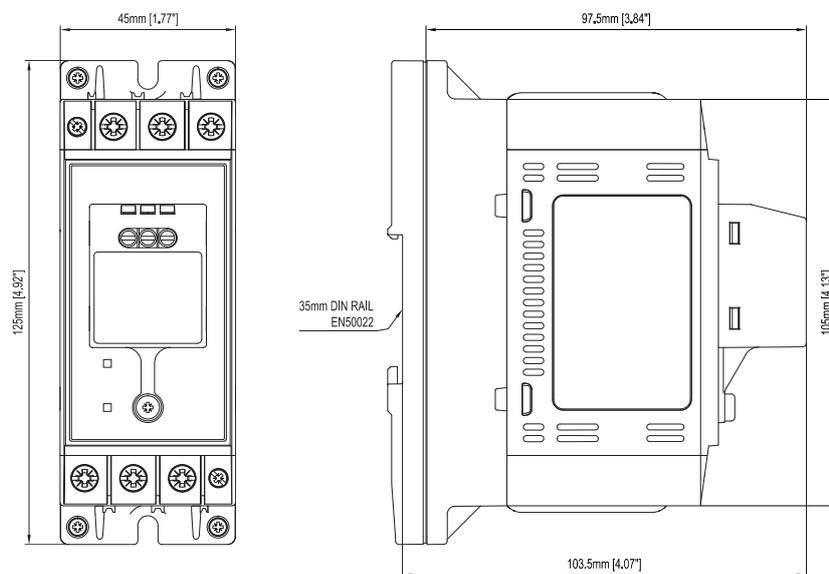| Material | PA66 |
|---|---|
| Assembly | DIN or panel |
| Touch protection | IP20 |
| Weight | RSBT..V11..: approx. 425 g<br>RSBT..V21..: approx. 460 g<br>RSBT4855..: approx. 2.8 kg<br>RSBT4870..: approx. 2.8 kg<br>RSBT4895..: approx. 3.0 kg |
| Overvoltage category | III |



**Fig. 1** *RSBT..V11 HP versions*



**Fig. 2** *RSBT..V21/C1 HP versions*
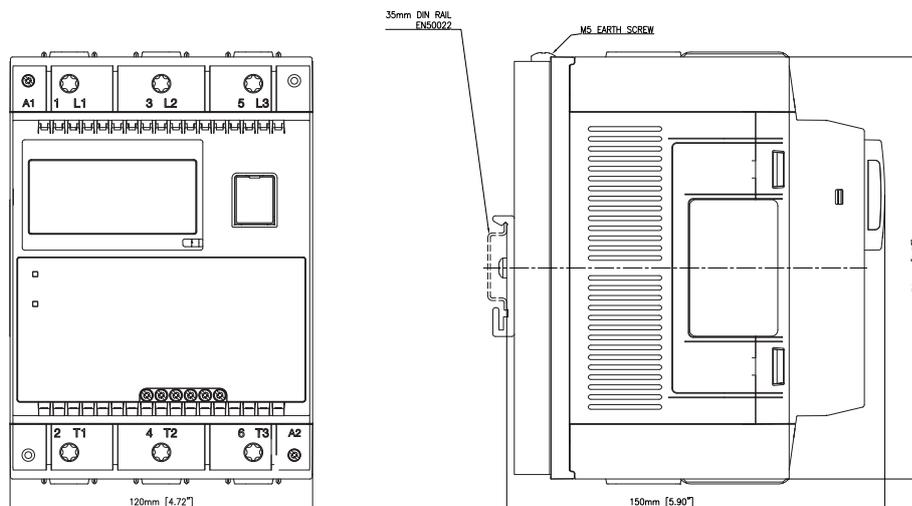
**Fig. 3** *RSBT48.. versions (DIN rail mount)*
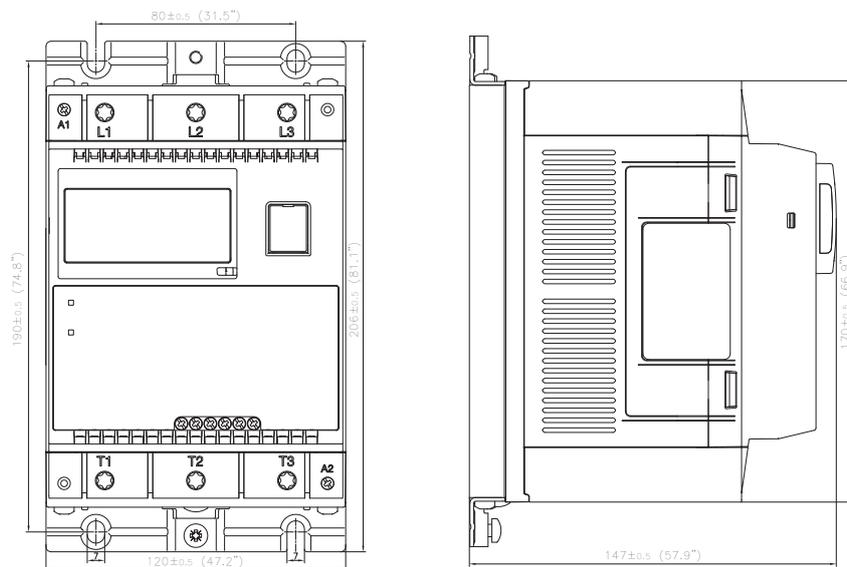


**Fig. 4** *RSBT48.. versions (Panel mount)*

## ▶ Settings

| Ramp-up time | < 1s |
|---|---|
| Ramp-down time | Not applicable |
| Initial torque | Initial torque will vary indirectly through the variation of the current limit through the autoadaptive algorithm |

## Environmental

| | |
|---|---|
| **Working temperature** | RSBT..16EV..: -20ºC to +60ºC (-4ºF to +140ºF)<br>RSBT..25EV..: -20ºC to +55ºC (-4ºF to +131ºF)<br>RSBT..32EV..: -20ºC to +50ºC (-4ºF to +122ºF)<br>RSBT48..: -20ºC to +60ºC (-4ºF to +140ºF) |
| **Storage tempreature** | RSBT40..: -40ºC to +80ºC (-40ºF to 176ºF)<br>RSBT48..: -30ºC to +85ºC (-22ºF to 185ºF) |
| **Relative humidity** | <95% non condensing @ 40ºC |
| **Pollution degree** | RSBT40..: 2<br>RSBT48..: 3 |
| **Installation category** | III |
| **Installation altitude** | 0 - 1000 m |
| **Vibration resistance** | 2g / axis (2 - 100 Hz, IEC60068-2-6, EN50155, EN61373) |
| **Impact resistance** | 15/11 g/ms (EN50155, EN61373) |
| **EU RoHS compliant** | Yes |

## Inputs

| | RSBT..EV.. | RSBT..FV... | RSBT..CV.. |
|---|---|---|---|
| **Control voltage (Uc)** | A1 – A2:<br>110 – 400 VAC<br>(+10%, -15%) | A1 - A2: 24VAC/DC<br>(-10%, +10%) | A1 – A2:<br>24 VAC/DC (-10%, +10%)<br>110 - 400 VAC (-15%, + 10%) |
| **Control voltage range (Uc)** | 93.5 – 440 VAC | 21.6 - 26.4 VAC/DC | 21.6 – 26.4 VAC/DC<br>(applies to 24 VAC/DC supply)<br>93.5 - 440 VAC<br>(applies to 110 - 400 VAC supply) |
| **Maximum pick-up voltage** | 80 VAC | 20.4 VAC/DC | 20.4 VAC/DC<br>(applies to 24 VAC/DC supply) |
| **Minimum drop out voltage** | 20 VAC | 5 VAC/DC | 5 VAC/DC (applies to 24 VAC/DC supply) |
| **Rated AC frequency** | 50/60 Hz | | |
| **Rated insulation voltage (Ui)** | 630 VAC | | 630 VAC |
| **Overvoltage category** | II | | |
| **Dielectric strength:**<br>**Dielectric withstand voltage**<br>**Rated impulse withstand voltage**<br>**Input to heatsink** | 2 kVrms<br>4 kVrms<br>Not applicable | | Not applicable<br>6 kVrms<br>3.5 kVrms |
| **Control input current** | 3...6 mAAC | 0.4 mAAC, 0.8 mADC | 0.4...5 mAAC |
| **Input to output response time** | < 100 ms | < 140 ms | < 300 ms |
| **Integrated varistor** | Yes | | |

## Outputs

| | RSBT..16.. | RSBT..25.. | RSBT..32.. | RSBT..55.. | RSBT..70.. | RSBT..95.. |
|---|---|---|---|---|---|---|
| **Overload cycle @ 40ºC surrounding temperature (acc. to IEC/EN 60947-4-2)** | AC53b:2.5-1:299 | AC53b:3.6-1:299 | AC53b:3.4-1:299 | AC53b:3.5-1:299 | | |
| **Maximum number of starts/hr @ rated overload cycle @ 40ºC surrounding temperature** | 12 | | | | | |
| **Rated operational current @ 40°C** | 16 AAC | 25 AAC | 32 AAC | 55 AAC | 70 AAC | 95 AAC |
| **Rated operational current @ 50°C** | 16 AAC | 25 AAC | 25 AAC | 50 AAC | 62 AAC | 87 AAC |
| **Rated operational current @ 60°C** | 16 AAC | 16 AAC | 16 AAC | 46 AAC | 54 AAC | 80 AAC |
| **Minimum time between stop and start** | 1 s | | | | | |
| **Minimum time between starts** | 299 s | | | | | |
| **Minimum operational current** | 2 AAC | | | 5 AAC | | |

Note: The overload cycle describes the switching capability of the soft starter at a surrounding temperature of 40ºC 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 3.5xIe for 1 second followed by an OFF time of 299 seconds.

## Compatibility and conformance

| Conformance | IEC/EN 60947-4-2<br>UL Listed (E172877)<br>cUL Listed (E172877)<br>CCC<br>VDE (applicable to RSBT..EV versions only): acc. to EN60335-1, EN60335-2-40 (Up to 15Arms load current) |
|---|---|
| Approvals | CE  cULus LISTED  CCC  VDE  EAC |
| UL short circuit current rating | RSBT...16/25/32: 5kArms<br>RSBT..55: 10 kArms (when protected with J class fuses up to 60A).<br>RSBT..70: 10 kArms (when protected with J class fuses up to 70A).<br>RSBT..95: 10 kArms (when protected with RK5 fuses up to 100A). |

| Electromagnetic compatibility (EMC) - immunity | | |
|---|---|---|
| | **RSBT40...** | **RSBT48...** |
| **Electrostatic discharge (ESD)** | EN/IEC 61000-4-2<br>8 kV air discharge (PC2)<br>4 kV contact (PC2) | EN/IEC 61000-4-2<br>8 kV air discharge (PC1)<br>4 kV contact (PC2) |
| **Radiated radio frequency** | EN/IEC 61000-4-3<br>3 V/m, 80 MHz - 1GHz (PC1)<br>10 V/m, 1 - 2.7GHz - N/A | EN/IEC 61000-4-3<br>3 V/m, 80 MHz - 1GHz - N/A<br>10 V/m, 1 - 2.7GHz (PC1) |
| **Electrical Fast Transient (Burst)** | EN/IEC 61000-6-2<br>Output: 2 kV, 5 kHz, 100 kHz (PC1)<br>Output: 4 kV (PC2)<br>Input: 2 kV, 5kHz, 100 kHz (PC1) | EN/IEC 61000-6-2<br>Output: 2 kV (PC1)<br>Output: 4 kV (PC2)<br>Input: 1 kV (PC1) |
| **Conducted Radio Frequency** | EN/IEC 61000-4-6<br>10 V/m, from 0.15 to 80 MHz (PC1) | EN/IEC 61000-4-6<br>140 dBuV, Frequency Range (PC1) |
| **Electrical Surge** | EN/IEC 61000-4-5<br>Output, line to line: 1 kV (PC2)<br>Output, line to earth: 2 kV (PC2)<br>Input, line to line: 1 kV (PC1)<br>Input, line to earth: 2 kV (PC2) | EN/IEC 61000-4-5<br>Output, line to line: 1 kV (PC1)<br>Output, line to earth: 2 kV (PC1)<br>Input, line to line: 1 kV (PC1)<br>Input, line to earth: 1 kV (PC1) |
| **Voltage Dips** | EN/IEC 61000-6-2<br>0% for 20ms (PC1)<br>40% for 200ms (PC2)<br>70% for 500ms (PC2) | EN/IEC 61000-6-2<br>0% for 20ms (PC2)<br>40% for 200ms (PC2)<br>70% for 500ms (PC2) |
| **Voltage interruptions** | EN/IEC 61000-6-2<br>0% for 5000 ms (PC2) | EN/IEC 61000-6-2<br>0% for 5000 ms (PC2) |
| **Harmonics** | IEC/EN 61000-3-2[1]<br>IEC/EN 61000-3-12[1] | |
| **Flicker** | IEC/EN 61000-3-3[1]<br>IEC/EN 61000-3-11[1] | |
| **Emission of Discontinuous Conducted (Click) RF noise** | EN55014   Pass (exception 4) [1] | |

| Electromagnetic compatibility (EMC) - emissions | | |
|---|---|---|
| | **RSBT40...** | **RSBT48...** |
| **Radio Interference field emission (Radiated)** | EN/IEC 55011 Class B: from 30 to 1000 MHz | EN/IEC 55011 Class A: from 30 to 1000 MHz |
| **Radio interference field emissions (conducted)** | EN/IEC 55011 Class B: from 0.15 to 30 MHz | EN/IEC 55011 Class A: from 0.15 to 30 MHz |

1. Load conditions apply

Note:
• Performance Criteria 1 (PC1): No degradation of performance or loss of function is allowed when the product is operated as intended.
• Performance Criteria 2 (PC2): During the test, degradation of performance or partial loss of function is allowed. However when the test is complete the product should return operating as intended by itself.
• Performance Criteria 3 (PC3): Temporary loss of function is allowed, provided the function can be restored by manual operation of the controls.

## ◤ Modbus RTU

| **Type** | Bi-directional (static and dynamic variables and parameters) |
|---|---|
| **Functions** | Configuration of device Start/Stop Modification of set-point parameters Monitoring of measured variables |
| **Connection** | 2-wires Note: To reduce the noise use a shielded cable |
| **Address** | Default : 1 Selectable via software: range 1 – 247 |
| **Protocol** | Modbus (RTU) |
| **Factory defined data format** | Data bits: 8 Parity: none Stop bit: 1 Selectable via software: parity: none (2 stop bits), odd (1 stop bit), even (1 stop bit) |
| **Baud rate** | Default: 9.6k bits/s Selectable via software: 9.6k, 19.2k, 38.4k bits/s |

# Performance

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

| Model | IEC rated current | 220 - 240 VAC | 380 - 415 VAC | 440 - 480 VAC |
|---|---|---|---|---|
| **RSBT4016EV...** | 16 Arms | 4 kW / 5 HP | 7.5 kW / 7.5 HP | - |
| **RSBT4025EV...** | 25 Arms | 5.5 kW / 7.5 HP | 11 kW / 10 HP | - |
| **RSBT4032EV...** | 32 Arms | 9 kW / 10 HP | 15 kW / 15 HP | - |
| **RSBT4855CV..** | 55 Arms | 15 kW / 20 HP | 22 kW / 30 HP | 30 kW / 40 HP |
| **RSBT4870CV..** | 70 Arms | 20 kW / 25 HP | 30 kW / 40 HP | 37 kW / 50 HP |
| **RSBT4895CV..** | 95 Arms | 22 kW / 30 HP | 45 kW / 60 HP | 55 kW / 75 HP |

Ratings:

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

HP rating according to UL60947-4-2

# Connection diagrams
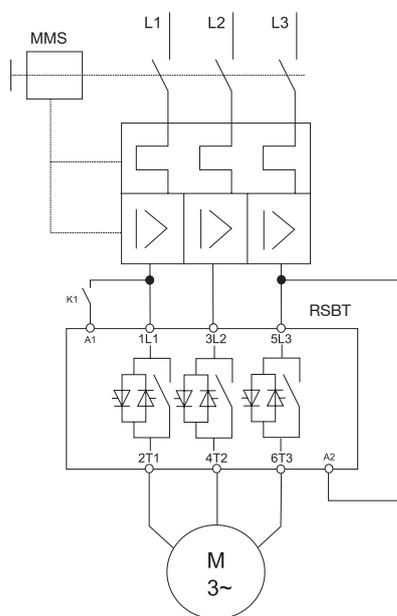
▶ **Connection configuration**
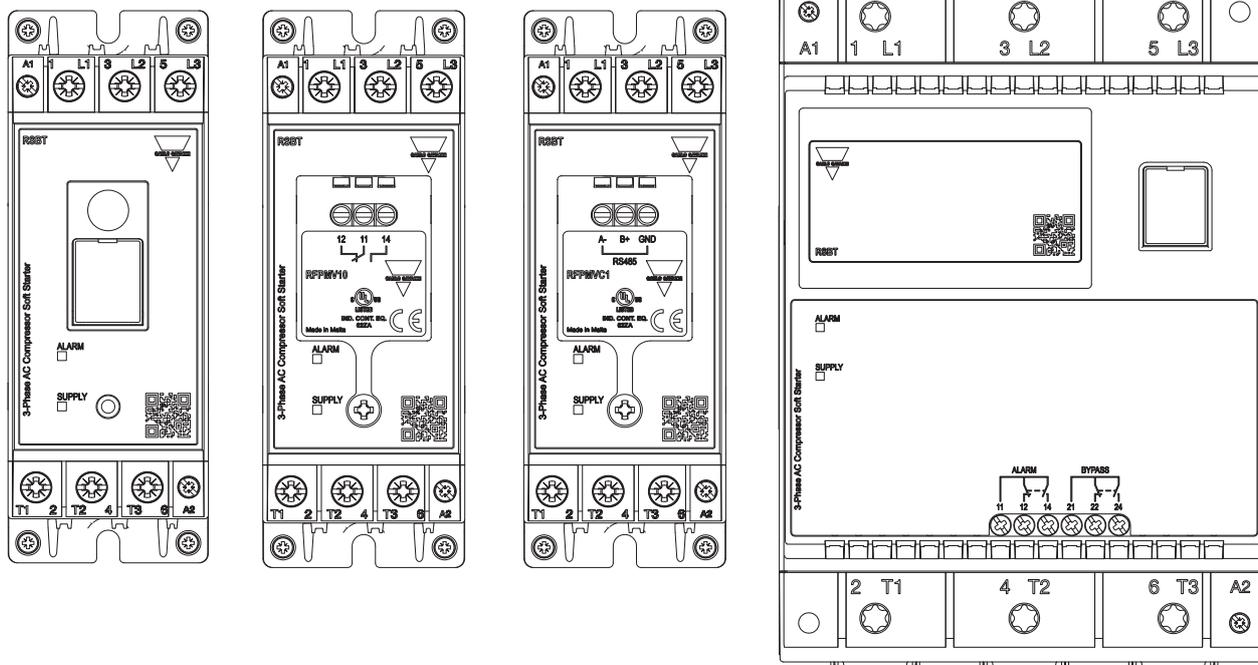


▶ **Terminal markings**

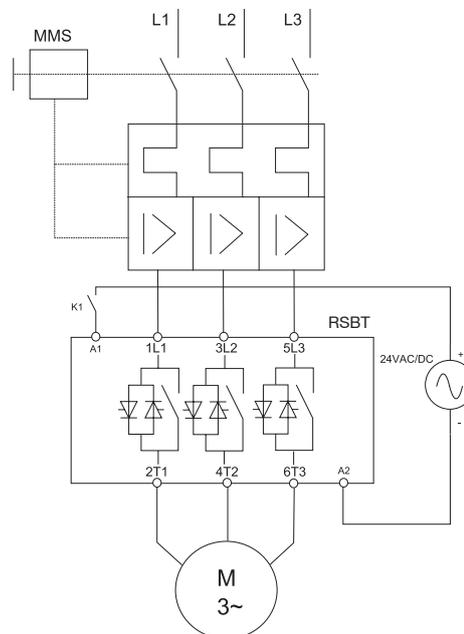| Marking | |
|---|---|
| **1 L1, 3 L2, 5 L3** | Line connections |
| **2 T1, 4 T2, 6 T3** | Load connections |
| **A1, A2** | Control voltage connections |
| **11, 12, 14** | Alarm indication |
| **21, 22, 24** | Top of ramp indication (applies to RSBT48 models only) |
| **A (-), B (+), GND, T\*** | Serial communication connections |

* Only for RSBT48 models
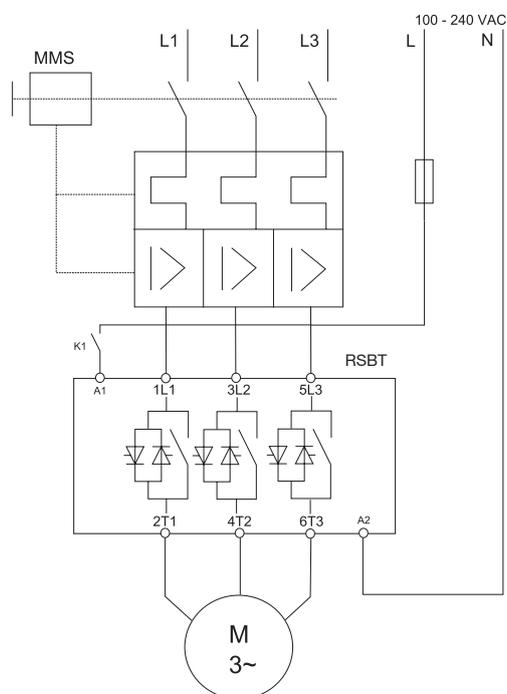
# Wiring Diagrams

**Valid up to 400 VAC**



RSBT40..EV.. / RSBT48



RSBT40..FV.. / RSBT48



RSBT40..EV.. / RSBT48

## Connection Specifications

| Line conductors L1, L2, L3, T1, T2, T3 Acc. to EN60947-1 | | |
|---|---|---|
| | **RSBT40..** | **RSBT48..** |
| **Flexible** | 2.5…10 mm²<br>2.5…2 x 4 mm² | 2 x (10...50 mm²) |
| **Rigid (solid or stranded)** | 2.5…10 mm² | 2 x (10...50 mm²) |
| **Flexible with end sleeve (ferrule)** | 2.5…10 mm² | 2 x (10...50 mm²) |
| **UL/cUL rated data**<br>**Rigid (stranded)**<br>**Rigid (solid)**<br>**Rigid (solid or stranded)** | AWG 6...14<br>AWG 10...14<br>AWG 2x10...2x14 | -<br>-<br>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 mm | 20 mm |

| Secondary conductors A1, A2 Acc. to EN60998 | | |
|---|---|---|
| | **RSBT40..** | **RSBT48..** |
| **Flexible** | 0.05...1.5 mm² | 0.05...1.5 mm² |
| **Rigid (solid or stranded)** | 0.05...2.5 mm² | 0.05...1.5 mm² |
| **Flexible with end sleeve (ferrule)** | 0.05...1.5 mm² | 0.05...2.5 mm² |
| **UL/cUL rated data**<br>**Rigid (solid or stranded)** | AWG 10...18 | |
| **Terminal screws** | M3 | |
| **Maximum tightening torque** | 0.6Nm (5.3lb.in) with Posidrive bit 0 | |
| **Stripping length** | 6 mm | |

| Auxiliary conductors 11, 12, 21, 22, 24 | | |
|---|---|---|
| | **RSBT40..** | **RSBT48..** |
| **Rigid (solid or stranded)** | 0.2...4 mm² | 0.05...2.5 mm² |
| **Flexible with end sleeve (ferrule)** | 0.2...2.5 mm² | 0.05...1.5 mm² |
| **UL/cUL rated data**<br>**Rigid (solid or stranded)** | AWG 24...12 | AWG 30...12 |
| **Terminal screws** | M2.5 | M3 |
| **Maximum tightening torque** | 0.5 Nm (4.0 lb.in) | |
| **Stripping length** | 6 mm | |

Note: Use 75ºC Copper (Cu) conductors

# Troubleshooting

## LED Status indications

| State | Supply (Green LED) | Alarm (Red LED) |
|---|---|---|
| Idle | ON | OFF |
| Ramping | ON | OFF |
| Bypass | ON | OFF |
| Alarm | ON | Flashing |

## Relay status indication

| State | Relay contact position | | |
|---|---|---|---|
| | RSBT40 | RSBT48 | |
| | Alarm (11, 12, 14) | Alarm (11, 12, 14) | Top of Ramp (21, 22, 24) |
| Idle | 11, 14 | 11, 12 | 21, 22 |
| Ramping | 11, 14 | 11, 12 | 21, 22 |
| Bypass | 11, 14 | 11, 12 | 21, 24 |
| Alarm | 11, 12 | 11, 14 | 21, 22 |

## Alarms

The RSBT includes a number of diagnostics and protection features each of which is signalled through a flashing sequence on the red LED.
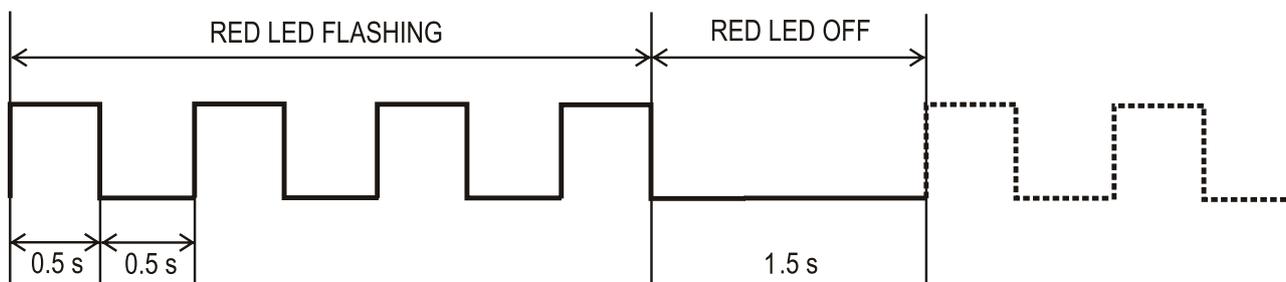
| Number of flashes | 2 |
|---|---|
| Alarm | Wrong phase sequence |
| Alarm description | If the connection to the soft starter is not done in the correct sequence (L1, L2, L3), the RSBT will trigger the wrong phase sequence alarm and the motor will not be started. |
| Alarm recovery period | N/A |
| Consecutive alarms for hard reset | 1 |
| Action to recover alarm | User intervention is required to change the wiring sequence to recover alarm. |
| Troubleshooting | • Check that wiring on L1, L2, L3 is in the correct sequence. |

| Number of flashes | 3 | | |
|---|---|---|---|
| Alarm | Line voltage out of range | | |
| Alarm description | RSBT 48 models have fixed over-voltage and under voltage alarm limits. When the mains voltage is out of these limits for more than 5 seconds the line voltage out of range alarm will be triggered. RSBT40 models have auto-adjustable over-voltage and under-voltage alarm limits, that can be modified by user as well. Unless they are modified, they will automatically adjust according to the supply voltage. Once any or both are modified, the change/s will be retained until the user changes again any or both limits. When the mains voltage is out of these limits for more than 5 seconds the line voltage out of range alarm will be triggered. | | |
| | **Model** | **Under-voltage limit** | **Over-voltage limit** |
| | RSBT40 | 187/330 | 250/470 |
| | RSBT48 | 175 | 560 |
| Alarm recovery period | 5 minutes | | |
| Consecutive alarms for hard reset | 4 | | |
| Action to recover alarm | The alarm will self-recover after 5 minutes from when the supply voltage is within limits. | | |
| Troubleshooting | • Check supply voltage level across L1, L2, L3 terminals.<br>• Make sure that you are not using a RSBT40 model on a supply voltage > 440 VAC. | | |

| Number of flashes | 4 |
|---|---|
| Alarm | Frequency out of range |
| Alarm description | If the frequency measured by the RSBT is >66.5Hz and <44.5Hz for at least 1 second, this alarm will trigger. |
| Alarm recovery period | 5 minutes |
| Consecutive alarms for hard reset | N/A |
| Action to recover alarm | Check for any disturbance on the voltage network. The voltage waveform may be disrupted when unfiltered variable frequency drives are used. |
| Troubleshooting | • In the case where variable frequency drives are present, ensure that proper EMI filters are installed. |

| Number of flashes | 5 |
|---|---|
| Alarm | Locked rotor condition (during ramp) |
| Alarm description | If a current >= 4 * Ie for 100 msec is detected, the RSBT will issue the locked rotor alarm. |
| Alarm recovery period | 5 minutes |
| Consecutive alarms for hard reset | 2 |
| Action to recover alarm | 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 is required. |
| Troubleshooting | • Check that the RSBT model is suitably rated for the motor.<br>• Check motor windings resistance to check if motor is damaged. |

| Number of flashes | 6 |
|---|---|
| Alarm | Ramp-up time (> 1sec) |
| Alarm description | The RSBT will trigger this alarm if the compressor does not reach full speed within 1 second. This alarm protects the bypass relays from switching a high current. |
| Alarm recovery period | 5 minutes |
| Consecutive alarms for hard reset | 2 |
| Action to recover alarm | 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) to perform a hard reset. This will reset the alarm. |
| Troubleshooting | • Check that the correct model of RSBT is being used<br>• Check that the connections to the compressor are correct<br>• Check for any mechanical blockage on the compressor |

| Number of flashes | 7 |
|---|---|
| Alarm | Over-temperature |
| Alarm description | The RSBT 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. |
| Alarm recovery period | Depends on the cooling period.<br>The RSBT will only recover if the internal temperature is within safe limits. |
| Consecutive alarms for hard reset | 4 |
| Action to recover alarm | The alarm will self-recover - the recovery period will depend on the cooling time required by RSBT. The higher the surrounding temperature, the longer the cooling period. |
| Troubleshooting | • Check that the specified number of starts/hr are not exceeded.<br>• Check that the surrounding temperature around the soft starter is within limits. |

| Number of flashes | 8 |
|---|---|
| Alarm | Current not normal (during bypass) |
| Alarm description | The RSBT measures the current during bypass state. If the current is >1.15 * Ie for at least 1 second, the RSBT will trigger this alarm and switch OFF the output. This condition can result in case of an overload condition or because the RSBT model under-rated for the load it is controlling. |
| Alarm recovery period | 5 minutes |
| Consecutive alarms for hard reset | 2 |
| Action to recover alarm | 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) to perform a hard reset. This will reset the alarm. |
| Troubleshooting | • Check that the correct model of RSBT is being used.<br>• Check that the connections to the compressor are correct.<br>• 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 RSBT rated current, change the RSBT to a larger model. |

| | |
|---|---|
| **Number of flashes** | 9 |
| **Alarm** | Supply voltage unbalance |
| **Alarm description** | The RSBT 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 RSBT will switch OFF the output. |
| **Alarm recovery period** | 5 minutes (from the moment the %voltage unbalance between all the phases is < 10%) |
| **Consecutive alarms for hard reset** | N/A |
| **Action to recover alarm** | The alarm will start a self-recvery 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 RSBT will remain in alarm state. |
| **Troubleshooting** | • Check for any loose connections on the mains and load side.<br>• Check voltage across L1 - L2, L2 - L3, L1 - L3 and see if there is any unbalance.<br>• Check resistance on motor windings to see if any of the coils are damaged. |

## 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 5,000 (RSBT 45mm) and 10,000 (RSBT 120mm) Symmetrical Amperes, 415 Volts (RSBT 45mm) and 480 Volts (RSBT 120mm) maximum when protected by fuses. Tests at 5,000 Arms (RSBT 45mm) and 10,000 Arms (RSBT 120mm) were performed with Class RK5 or J fuses, fast acting; please refer to the table below for maximum allowed ampere rating of the fuse. Use fuses only.

| Protection co-ordination Type 1 according to UL 60947-4-2 | | | | |
|---|---|---|---|---|
| Part No. | Prospective short circuit current [kArms] | Max fuse size [A] | Class | Voltage [VAC] |
| RSBT..16.... | 5 | 40 | RK5 | 400 |
| RSBT..25... | | | | |
| RSBT..32... | | | | |
| RSBT4855CV.. | 10 | 60 | J | 480 |
| RSBT4870CV.. | | 70 | | |
| RSBT4895CV.. | | 100 | RK5 | |

| Protection co-ordination Type 2 | | | | |
|---|---|---|---|---|
| Part No. | Prospective short circuit current [kArms] | Ferraz Shawmut (Mersen) | | Voltage [VAC] |
| | | Max fuse size [A] | Part number | |
| RSBT4855CV.. | 10 | 100 | 6.900CP URD22 x 58 / 100 | 480 |
| RSBT4870CV.. | | | | |
| RSBT4895CV.. | | 160 | 160Ac660VAC 27 x 601 / 6.9xxCPURQ 27 x 60 / 160 | |

Note: xx = 00 or 21

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