

Soft Starter

2-Phase and 3-Phase Scroll Compressor Softstarter Types RSBD48..CV. (2-Phase), RSBT48..CV. (3-Phase)

CARLO GAVAZZI



- Soft starting of 3-phase Scroll Compressors up to 95 Amp
- Patented auto-adaptive algorithm for optimum inrush current reduction (No user-settings required)
- Integrated bypass relays
- 2- (RSBD) and 3-phase (RSBT) controlled solutions
- Multi-voltage operation (220 – 480VAC, 50/60Hz)
- Rated operational current: 55, 70, 95AAC
- Phase sequence and undervoltage monitoring
- Overtemperature, Overcurrent, Locked Rotor protection
- Changeover relay outputs for bypass and alarm indication
- UL, cUL, CE, RoHS compliant
- Current balancing strategy (RSBD models)
- RS485 serial communication port (MODBUS-RTU) - optional

Product Description

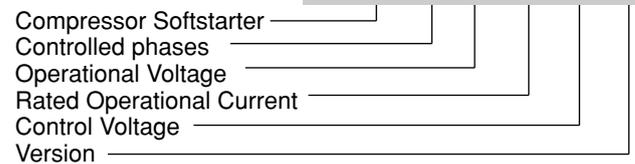
RSBD and RSBT are easy to use softstarters for scroll compressors up to 95Amp nominal current. The units are equipped with a patented auto-adaptive algorithm that automatically adapts itself to the specific compressor it is controlling ensuring that an optimum inrush current reduction is achieved. RSBD is a 2-phase controlled and RSBT is a 3-phase controlled solution with integrated bypass relays for bypassing of the semiconductors after ramp-up.

The unit is supplied inside housing and can be DIN or panel mounted (accessories included). RSB. softstarters include also 2 changeover relays for bypass and alarm indication. The units have a maximum operating temperature of 60°C (with derating from 40°C).

RSB.CVC versions are equipped with a Modbus RTU serial communication for start and stop and communication of relevant instantaneous variables that can be transmitted to a host control system.

Ordering Code

RSB T 48 55 C V0



Type Selection

Type	Rated operational voltage U_e	Rated operational Current I_e	Control voltage U_c	Versions
RSBD	48: 220 - 480VAC	55: 55Arms	C: 24VAC/DC \pm 10%	V0 : 2x Changeover relay outputs
RSBT	-15%, + 10%	70: 70Arms 95: 95Arms	and 110 - 400VAC -15%, +10%	VC: RS485 MODBUS serial communication

Selection Guide

No. of Controlled Phases	Type	Operational Voltage	Control voltage	Version	Rated Operational Current		
					55AAC	70AAC	95AAC
2	RSBD	220 - 480VAC	24VAC/DC	2 Changeover	RSBD4855CV0	RSBD4870CV0	RSBD4895CV0
3	RSBT		& 110 - 400VAC	Relay Outputs	RSBT4855CV0	RSBT4870CV0	RSBT4895CV0
				RS485 Serial communication (MODBUS RTU)	RSBD4855CVC RSBT4855CVC	RSBD4870CVC RSBT4870CVC	RSBD4895CVC RSBT4895CVC



General Specifications

Starting method	Current limit-auto adaptive
Ramp-up time	1 sec
Ramp-down time	0 sec
Initial Torque	Initial torque will vary indirectly through the variation of the current limit through the auto-adaptive algorithm.
Undervoltage/Overvoltage protection	
Undervoltage RSBx48xx	175VACrms (+/- 5%)
Overvoltage RSBx48xx	560VACrms (+/-5%)
Recovery from Undervoltage	200VACrms
Recovery from Overvoltage	500VACrms
Status Indication LEDs	
Power Supply ON	Green LED
Recovery mode (alarm condition)	Flashing Red LED
Alarm	Red LED
Form Designation	1
Vibration	Acc. to IEC60068-2-26
Frequency 1	2 [+3/ -0]Hz to 25Hz displacement +/- 1.6mm
Frequency 2	25Hz to 100Hz @ 2g (19.96m/s ²)

Input Specifications (Control Input)

Control Voltage	
Uc, A1-A2 ¹	24VAC/DC (-10%, +10%) & 110 - 400 VAC (-15% / +10%)
Max. Pick up Voltage (for 24VAC/DC input)	20.4VAC/DC
Drop Out Voltage Min. (for 24VAC/DC input)	5VAC/DC
Control Voltage Range	
Uc, A1-A2 (for 110 – 400VAC input)	93.5 - 440VACrms
Rated AC frequency	50/60Hz +/- 10%
Rated insulation voltage (Ui)	690VAC
Dielectric strength	
Dielectric withstand voltage	
Input to Heatsink	3.5kVrms
Rated impulse withstand volt.	6 kV (1.2/50µs)
Min. Control input current	0.4mA
Max. Control input current	5mA
Input to output response time	<300ms
Integrated varistor	Yes

* Note 1: For the Canadian application, the control terminals A1, A2 of the RSB. 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 1500 VA or less. The short-circuit volt ampere limit is the product of the open circuit voltage and the short circuit ampere

Output Specifications

IEC rated operational current Ie (AC-53b) @ 40°C	
RSB.4855CV.	55 A ACrms
RSB.4870CV.	70 A ACrms
RSB.4895CV.	95 A ACrms

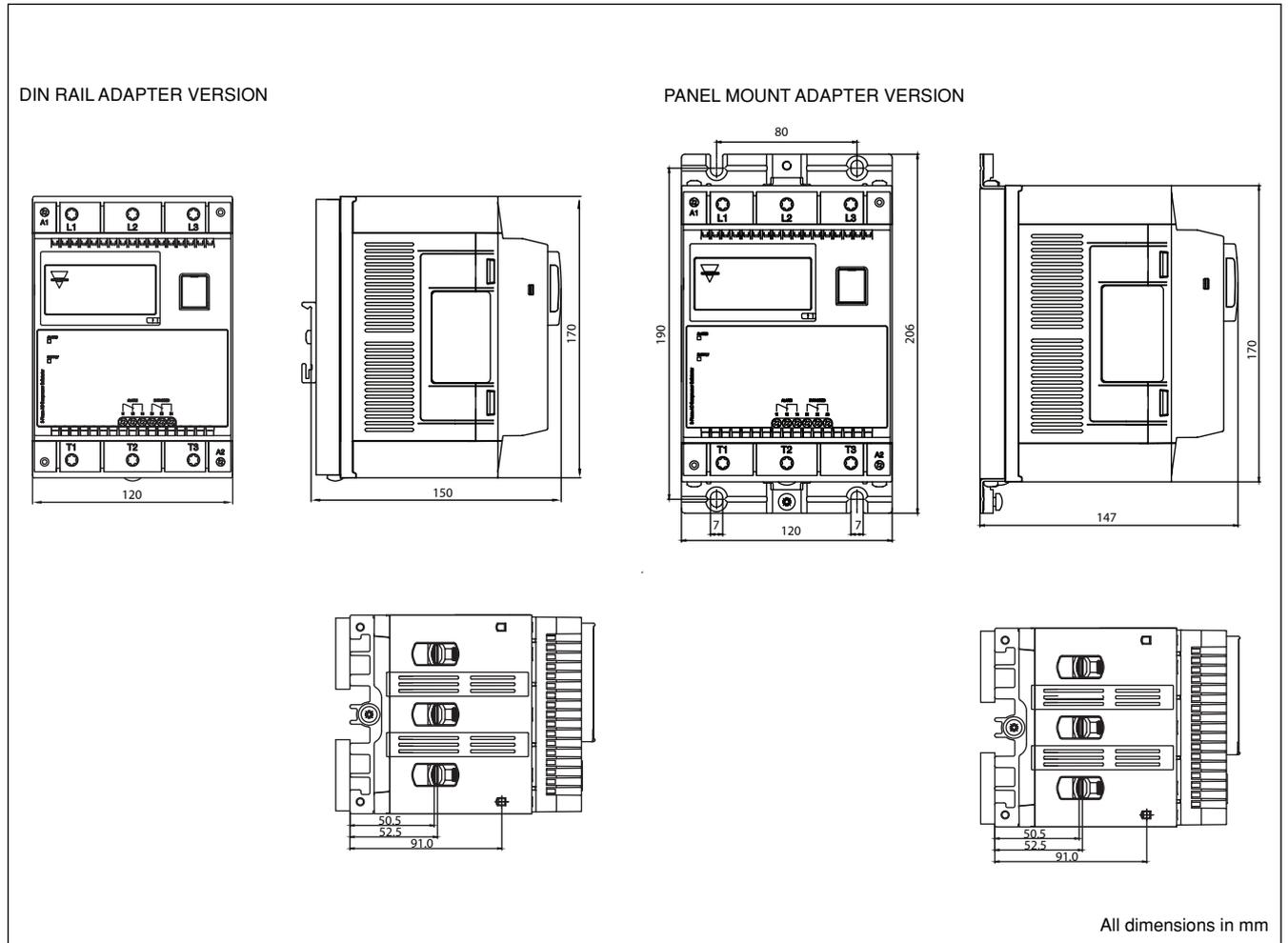
Note: For higher operating temp derating is as follows.
 RSB.4855CV. (0.8% per °C)
 RSB.4870CV. (1.2% per °C)
 RSB.4895CV. (0.8% per °C) up to a maximum of 60°C

Overload cycle according to EN/IEC 60947-4-2 @ 40°C surrounding temperature	
RSB.4855CV.	55: AC-53b:3.5-1:299
RSB.4870CV.	70: AC-53b:3.5-1:299
RSB.4895CV.	95: AC-53b:3.5-1:299
Max Number of starts per hour @ 40°C	12
Minimum full load current	5 A ACrms

RS485 Communication Specifications

Type	Bi-directional (static and dynamic variables and parameters)
Functions	Configuring the device Start/Stop Modifying set-point parameters Monitoring of measured variables
Connection	2-wires (to reduce the noise use a shielded cable and connect the shield to GND terminal and to the ground at the same point.
Address	Default: 1 1-247, selectable via software
Protocol	MODBUS (RTU)
Factory defined data format	Data bits "8", parity "none", stop bit "1" Selectable by software: Parity: None, Odd, Even
Baud Rate	Default: 9.6k bits/s Selectable by software: 4.8k, 9.6k, 19.2k, 38.4k
Insulation	
RS485 port to power	1.9kV
RS485 port to aux. relays	1.5kV
RS485 port to control	1.8kV
RS485 port to heatsink	0.5kV

Dimensions



Environmental Specifications

Operating temperature	-20°C to +60°C (-4°F to +140°F)
Storage temperature	-30°C to +85°C (-22°F to 185°F)
Relative humidity	<95% non-condensing @ 40°C
Pollution Degree	3
Degree of Protection	IP20 – Housing IP00 – Terminal block
Installation Category	III
Installation Altitude	1000m

Supply Specifications

Operational Voltage Range	L1-L3	187 – 528VACrms 50/60Hz
Supply current at standby		<40mA
Blocking Voltage		1600Vp
Rated AC Frequency		50/60Hz +/- 10%
Rated insulation voltage		690Vrms, acc to EN60947-1
Dielectric Strength		2kVrms
Supply to heatsink		2kVrms
Rated impulse withstand voltage		6kV (1.2/50µs)
Integrated varistor		Yes (across controlled phases) Across L1 - L3

Conductor Data

Line conductors:

L1, L2, L3, T1, T2, T3

according to EN 60947-1

rigid (solid or stranded)	2 x (10 ... 50mm ²)
flexible with end sleeve (ferrule)	2 x (10 ... 50mm ²)

UL/cUL rated data

Rigid (solid or stranded)	2 x (AWG8 ... 1/0)
---------------------------	--------------------

Terminal screws	M8
-----------------	----

Max. Tightening torque	12 Nm
------------------------	-------

Stripping length	16mm
------------------	------

Secondary conductors:

A1, A2

according to EN 60998

rigid (solid or stranded)	0.5 ... 2.5mm ²
flexible with end sleeve (ferrule)	0.5 ... 1.5mm ²

UL/cUL rated data

rigid (solid or stranded)	AWG18...10
---------------------------	------------

Terminal screws	M3
-----------------	----

Max. Tightening torque	0.6 Nm
------------------------	--------

Stripping length	6mm
------------------	-----

Auxiliary conductors:

11, 12, 14, 21, 22, 24, A(-), B(+), GND, T

according to EN 60998

rigid (solid or stranded)	0.05 ... 2.5mm ²
flexible with end sleeve (ferrule)	0.05 ... 1.5mm ²

UL/cUL rated data

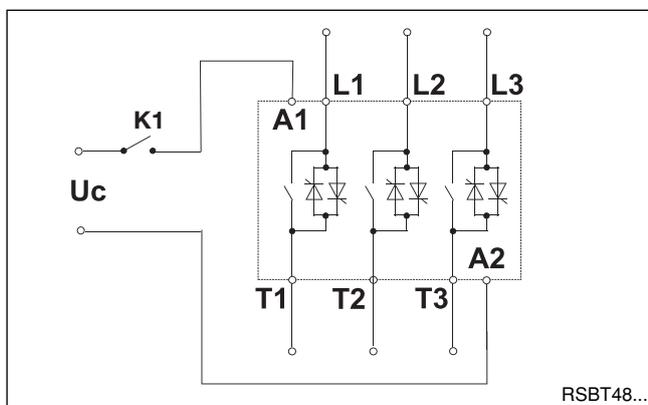
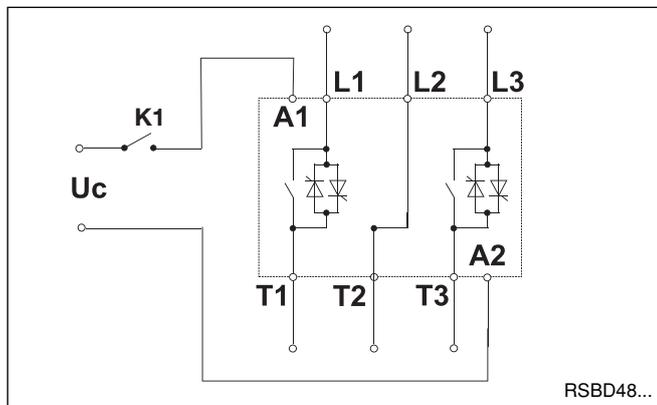
rigid (solid or stranded)	AWG30...12
---------------------------	------------

Terminal screws	M3
-----------------	----

Max. Tightening torque	0.8 Nm
------------------------	--------

Stripping length	6mm
------------------	-----

Connection Diagram



Auxiliary Relays

Auxiliary relays contact rating	3A,250VAC/3A,30VDC
Bypassed (21,22,24)	Normally Open (NO)/ Normally Closed (NC) - Changeover relay contact
Alarm (11,12,14)	Normally Open (NO)/ Normally Closed (NC) - Changeover relay contact

Note:

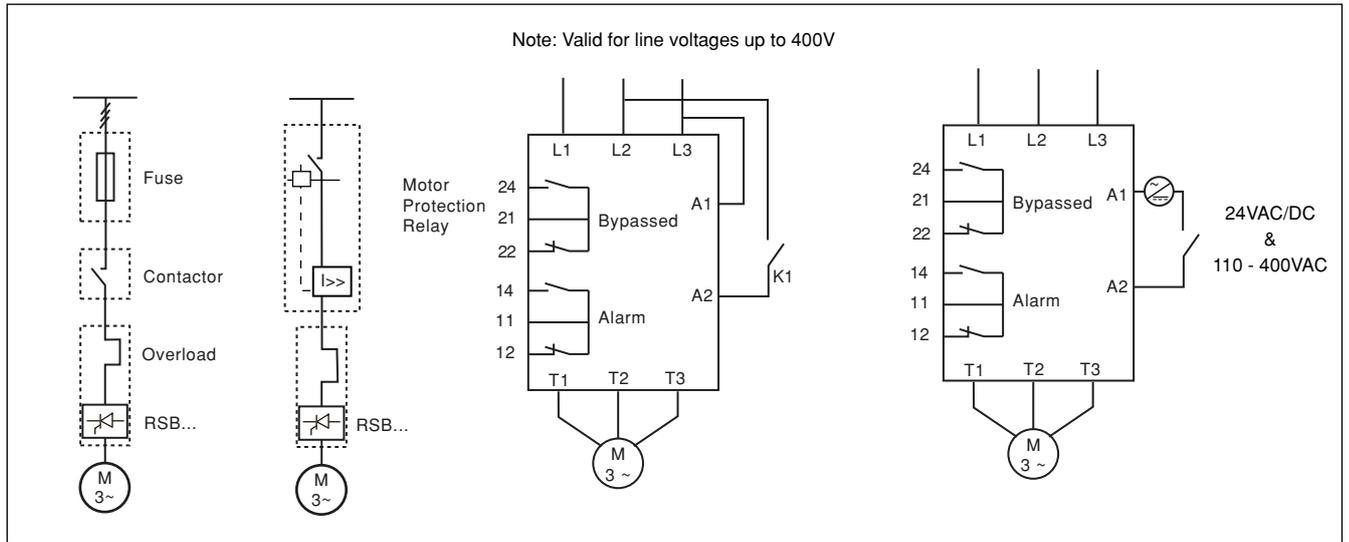
- When the RSBx softstarter goes in bypass state, relay status will change from 21-22 to 21-24
- When the RSBx softstarter is in alarm mode, relay status will change from 11-12 to 11-14 until the alarm recovers or alarm is cleared.

Housing Specifications

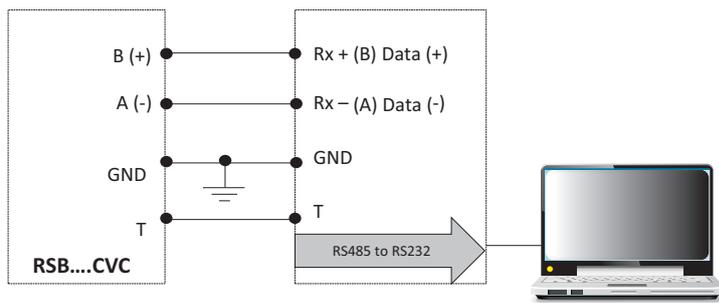
Weight	
RSBD4855...	2.5kg
RSBD4870...	2.5kg
RSBD4895...	2.7kg
RSBT4855...	2.8kg
RSBT4870...	2.8kg
RSBT4895...	3.0kg
Material	PA66
Material colour	RAL7035
Terminal colour	RAL7040
Mounting	DIN or Panel



Wiring Diagrams



RS485 Input



ATTENTION: The B(+) connection from the RSB..CVC softstarter needs to be connected to the Rx + (B) line of the communicating device and the A (-) connection from RSB..CVC needs to be connected to the Rx - (A) line of the communicating device. If this connection is not followed, there will be no communication.

Use twisted pair and shielded cables.

Note: To minimise the reflections from the end of the RS485-cable it is required to place a line termination near each of the 2 ends of the bus by a proper resistor (Refer to www.modbus.org for further details).

EMC Standards

Immunity	IEC/ EN 61000-6-2	Radiated Radio Frequency Immunity	EN 61000-4-3;10V/m, PC1
Electrostatic Discharge ESD Immunity	IEC/EN 61000-4-2 8kV air discharge, PC1 4kV contact, PC2	Conducted Radio Frequency Immunity	EN61000-4-6; 140dBuV,PC1
Electrical fast transient/ Burst Immunity	EN 61000-4-3 2kV,PC1 (4kV PC2) 2kV,PC1	Voltage dips & interruptions	EN 61000-4-11 0% Ue & Uc, 20ms, PC2 40% Ue & Uc, 200ms, PC2 70% Ue & Uc, 5000ms, PC2
Electrical Surge Immunity	IEC/ EN 61000-4-5, 1kV, PC1 2kV, PC1 1kV, PC1 1kV, PC1	Radio interference field emissions (radiated)	EN60947-4-2 Class A
Output, line to line		Radio interference voltage emissions (conducted)	EN60947-4-2 Class A
Output, line to earth			
Input, line to line			
Input, line to earth			

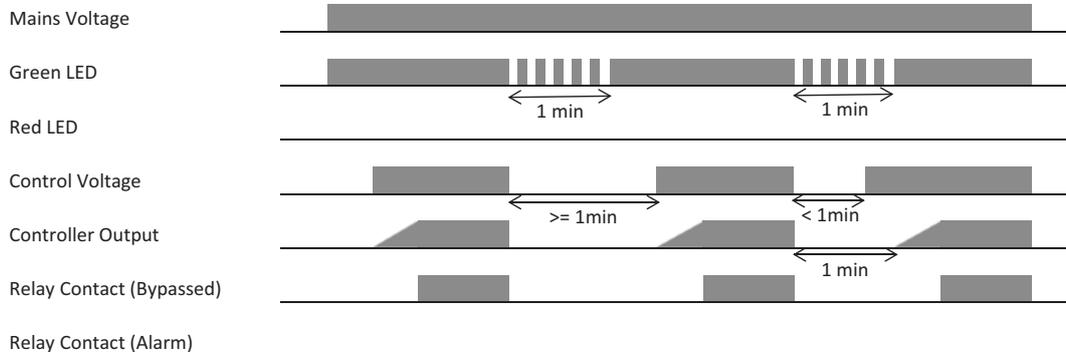
Approvals

UL, cUL Listed	Yes
Restriction of Hazardous Substances (RoHs)	Yes
CE Marking	Yes
LVD	Acc to EN60947-4-2

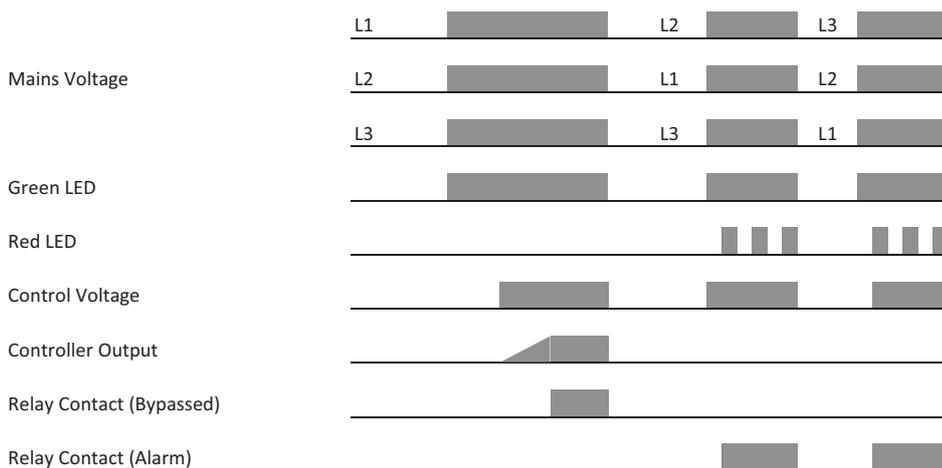


Mode of Operation

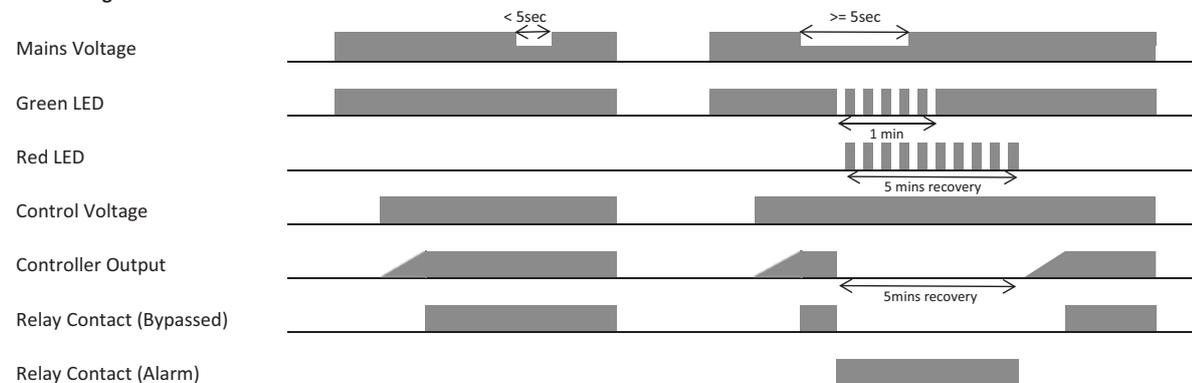
Normal Condition



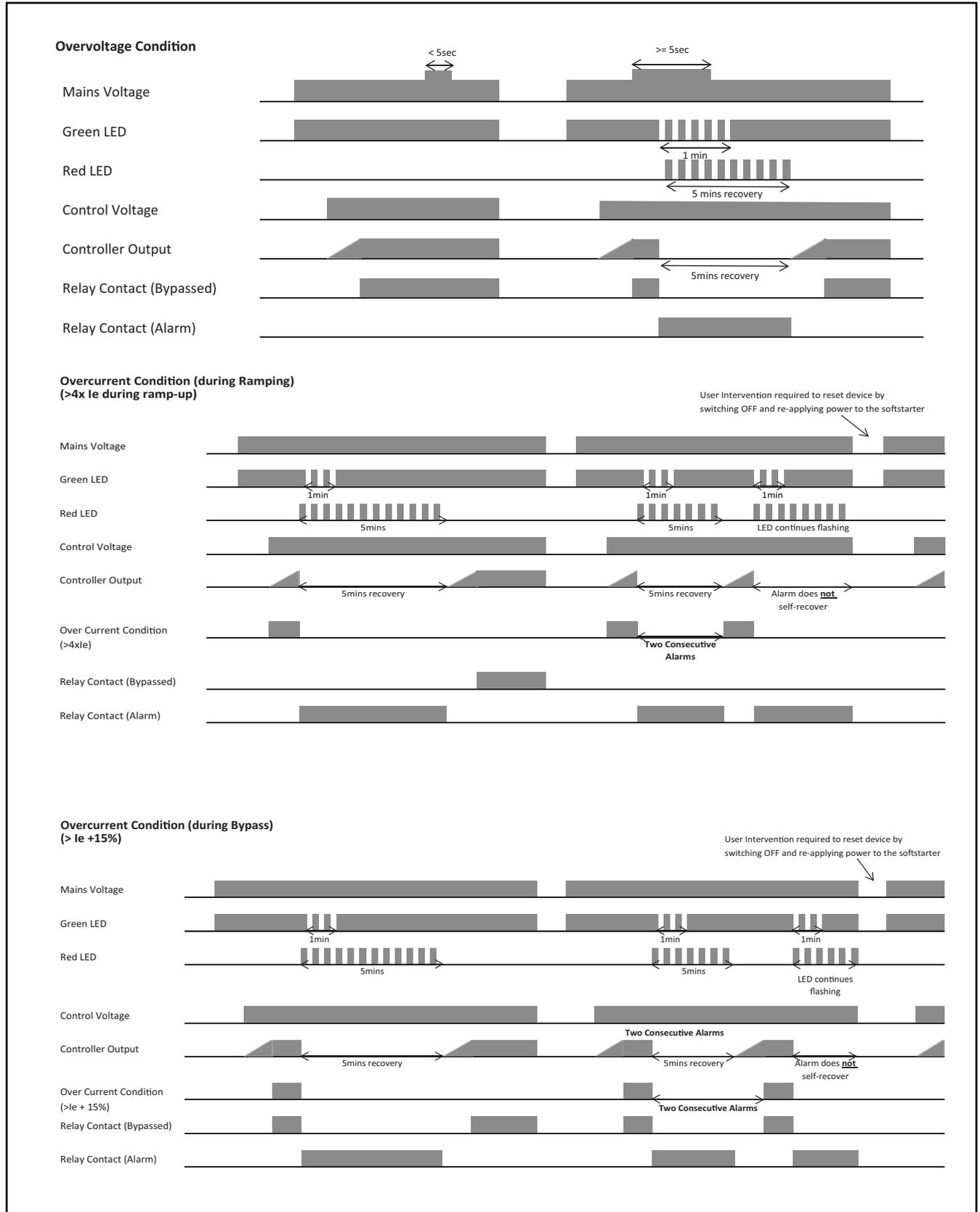
Wrong Phase Sequence



Undervoltage Condition

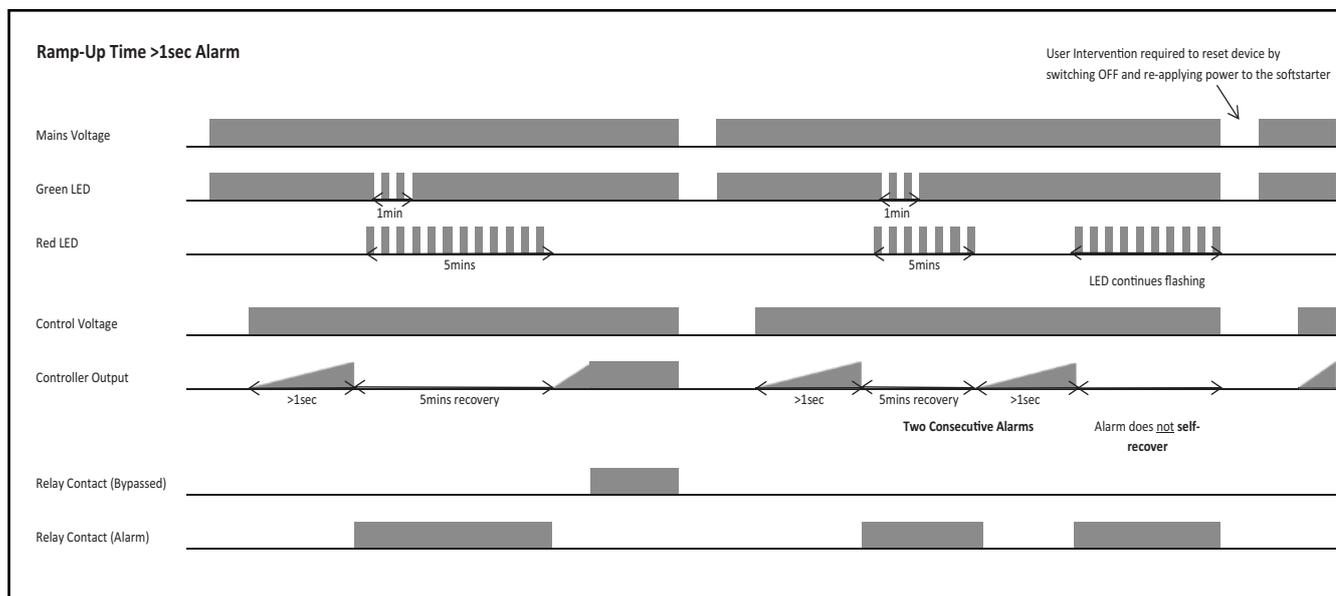


Mode of Operation





Mode of Operation



Mode of Operation

Auto Adaptive Algorithm (Patented)

RSBD and RSBT series of soft starters includes an innovative auto-adaptive algorithm (Patented) such that an optimum starting current performance is achieved at every compressor start. This feature is active at every compressor start. Appropriate parameters are automatically set by the soft starter in order to achieve an optimum inrush current reduction whilst maintaining a ramp-up time < 1sec.

In case of Locked rotor/ramp-up time alarm, default parameter settings are restored automatically. During the subsequent compressor starts, the auto-adaptive function will start optimising such parameters automatically once again.

HP Specific Mode of Operation

The RSB., RSBD and RSBT shall try to start the compressor at the set current limit. Depending on the load requirement, the current limit will be gradually increased up to a maximum of the default current limit, after which the RSBD, RSBT will switch in bypass mode.

If ramping is not achieved after a maximum of 1 second, the Incomplete Ramp alarm (5 flashes on red LED) will be triggered and the RSBD, RSBT will enter into a recovery mode for 5mins. If, at the second consecutive attempt the RSBD, RSBT raise again the Incomplete Ramp alarm, then a manual user intervention to reset power on the RSB... shall be required, as this might indicate a real locked rotor condition.

Auto-adaptive current balancing (applies to RSBD models)

RSBD soft starters use 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, the RSBD soft starter 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 motor.



Alarms

No. of Flashes Red LED	Alarm Description	Action
2	Wrong Phase sequence	User intervention (Physical change)
3	Line Voltage Out of Range	Auto Reset with 5 minutes recovery
4	Frequency Out of Range	Auto Reset with 5 minutes recovery
5	Over Current (during Ramping)	Auto Reset with 5 minutes recovery ¹
6	Ramp Up Time > 1 sec	Auto Reset with 5 minutes recovery ¹
7	Over Temperature	Auto Reset with 5 minutes recovery
8	Over Current (during Bypass) ²	Auto Reset with 5 minutes recovery
9	Supply Voltage Unbalance ²	Auto Reset with 5 minutes recovery

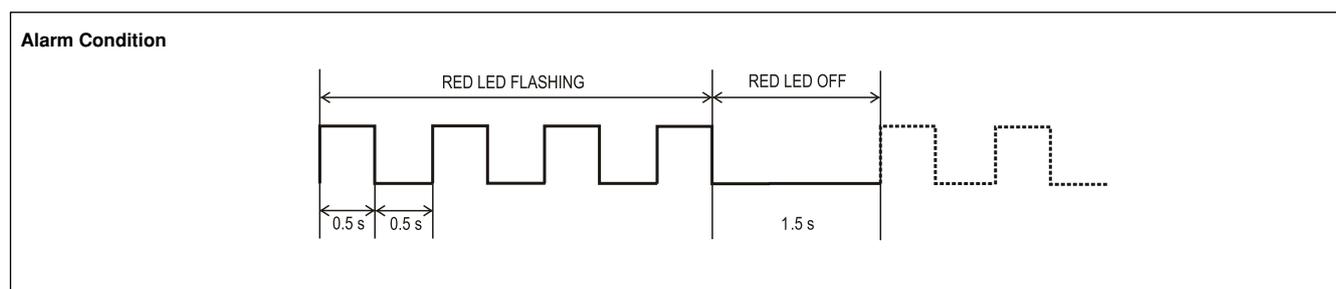
Notes:

1. If alarm is triggered at two consecutive starts, user intervention is required to reset the device. Resetting of the RSBx softstarter is achieved by removing supply to the softstarter.
2. Only active in bypass mode

LED Status Indication

State	Idle	Bypass	Alarm	Recovery from Alarm	Recovery time between starts
Green LED	ON	ON	ON	ON	Flashing
Red LED	OFF	OFF	Flashing (acc. to alarm)	Flashing	OFF

Flashing Sequence





Short circuit Protection (according to EN/IEC 60947-4-2) & UL508

	RSB.4855CV.	RSB.4870CV.	RSB.4895CV.
Type of coordination: 1 Rated short circuit current	10 kA when protected with J class fuses up to 60A	10 kA when protected with J class fuses up to 70A	10 kA when protected with RK5 fuses up to 100A
Type of coordination: 2 Rated short circuit current	10 kA when protected by semiconductor fuses 100A, class URD. Art. no. 6.900 CP URD 22 x 58 / 100	10 kA when protected by semiconductor fuses 100A, class URD. Art. no. 6.900 CP URD 22 x 58 / 100	10 kA when protected by semiconductor fuses 160A, Class URS/URQ, Art. No. 160Ac660VAC 27 x 601/ 6.9xxCP URQ 27 x 60 / 160

Current/Power Ratings

Assigned compressor rating @ 40°C/UL rating @ 40°C³

	220-240VAC	380-415VAC	440-480VAC
RSB.4855CV.	20.0 HP (15 kW)	30.0 HP (22 kW)	40.0 HP (30 kW)
RSB.4870CV.	25.0 HP (20 kW)	40.0 HP (30 kW)	50.0 HP (37 kW)
RSB.4895CV.	30.0 HP (22 kW)	50.0 HP (45 kW)	75.0 HP (55 kW)

Assigned compressor rating @ 50°C/UL rating @ 50°C³

	220-240VAC	380-415VAC	440-480VAC
RSB.4855CV.	15.0 HP (11 kW)	30.0 HP (22 kW)	30.0 HP (22 kW)
RSB.4870CV.	20.0 HP (15 kW)	30.0 HP (30 kW)	40.0 HP (37 kW)
RSB.4895CV.	30.0 HP (22 kW)	50.0 HP (37 kW)	60.0 HP (45 kW)

Assigned compressor rating @ 60°C/UL rating @ 60°C³

	220-240VAC	380-415VAC	440-480VAC
RSB.4855CV.	15.0 HP (11 kW)	25.0 HP (22 kW)	30.0 HP (22 kW)
RSB.4870CV.	20.0 HP (15 kW)	30.0 HP (22 kW)	40.0 HP (30 kW)
RSB.4895CV.	25.0 HP (20 kW)	40.0 HP (37 kW)	50.0 HP (37 kW)

Note:
3. 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.

Variable List

	Read	Write	Monitor	Description	Scaling Factor
Device Properties					
Device address	Yes	Yes	Yes	Set/read the device address	No
Baud rate	Yes	Yes	Yes	Set/read the device baud rate (4800, 9600, 19200, 38400)	No
Parity	Yes	Yes	Yes	Set/read the device parity (No, Even, Odd)	No
Inputs					
Control input status – MODBUS	Yes	No	Yes	Status of control input - MODBUS	No
Control input status – A1,A2	Yes	No	Yes	Status of control input – A1,A2 terminals	No
Control Mode	Yes	Yes	Yes	Set/read the control mode setting - either via MODBUS or via A1,A2 terminals	No
Start/stop command	Yes	Yes	Yes	Set/read the status of start and stop command	No
Soft reset	No	Yes	Yes	Reset alarms	No
Refresh interval	Yes	Yes	Yes	Set/read the refresh interval for the start/stop command	No
“Heartbeat” signal (Refresh Signal)	No	Yes	Yes	Signal to be sent within refresh interval to keep softstarter ON (if ‘heartbeat’ signal option is enabled)	No
“Heartbeat” signal Enable/Disable	Yes	Yes	Yes	Enables/disables the “heartbeat” signal requirement. If enabled, the device will wait for a refresh start/stop signal within the refresh interval (as set by the user)	No
Outputs					
Status of alarm relay	Yes	No	Yes	Read status of auxiliary contacts (11,12,14)	No
Status of top of ramp relay	Yes	No	Yes	Read status of auxiliary contacts (21,22,24)	No
Soft starter status	Yes	No	Yes	Read status of starter: Idle, Bypass, Alarm, Recovery	No
Delays					
Minimum stop to start delay	Yes	Yes	Yes	Set/read the minimum time between stop to start in secs	No
Minimum start to start delay	Yes	Yes	Yes	Set/read the minimum time between starts in secs	No
Time from last start	Yes	No	Yes	Read the time elapsed from the last start in secs	No
Protection settings					
Supply voltage unbalance	Yes	Yes	Yes	Set/read the supply voltage unbalance setting (%)	[x10]
Over voltage alarm	Yes	Yes	Yes	Set/read the over-voltage alarm setting (VAC)	[x10]
Under voltage alarm	Yes	Yes	Yes	Set/read the under-voltage alarm setting (VAC)	[x10]
IMin bypass	Yes	No	Yes	Read the value of the minimum bypass current setting (ARMS)	[x10]
IMAX bypass	Yes	No	Yes	Read the value of the maximum bypass current setting (ARMS)	[x10]
IMAX	Yes	Yes	Yes	Set/read the setting of the maximum current limit (ARMS)	[x10]
Auto-adapt	Yes	Yes	Yes	Set/read the status of the auto-adapt function	No



Variable List (cont.)

	Read	Write	Monitor	Description	Scaling Factor
Counters					
Number of ramps	Yes	No	Yes	Counter for the number of starts performed	No
Over-flow counter for number of ramps	Yes	No	Yes	If the number of starts is >65535 the Number of ramps counter will be full, hence this counter will start incrementing. The value read in this counter has to be multiplied by 65535 and the results is decremented by 1 and added to the value read from Number of ramps counter.	No
Instantaneous variables					
VL1-L3	Yes	No	Yes	Line voltage across L1-L3 (VAC)	[x10]
VL2-L3	Yes	No	Yes	Line voltage across L2-L3 (VAC)	[x10]
VL1-L2	Yes	No	Yes	Line voltage across L1-L2 (VAC)	[x10]
VT1-T3	Yes	No	Yes	Line voltage across T1-T3 (VAC)	[x10]
VT2-T3	Yes	No	Yes	Line voltage across T2-T3 (VAC)	[x10]
VT1-T2	Yes	No	Yes	Line voltage across T1-T2 (VAC)	[x10]
AL1	Yes	No	Yes	Current across L1-T1 (ARMS)	[x10]
AL2	Yes	No	Yes	Current across L2-T2 (ARMS)	[x10]
AL3	Yes	No	Yes	Current across L3-T3 (ARMS)	[x10]
WTotal	Yes	No	Yes	Total instantaneous power (Watts)	No
VATotal	Yes	No	Yes	Total instantaneous apparent power (VA)	No
PFTotal	Yes	No	Yes	Power factor	[x100]
Hz	Yes	No	Yes	Supply frequency (Hz)	[x10]
kWh	Yes	No	Yes	Active energy (kWh)	No
Alarm Indication					
Alarm type	Yes	No	Yes	Instantaneous alarm indication	No