

# Soft Starter Centrifugal Pump Soft Starter Series Type RSWT

CARLO GAVAZZI



- Optimised algorithm for centrifugal pumps
- Simple User Interface
- 3-phase controlled
- Internally bypassed
- Multi voltage operation
- Integrated overload protection\*\*
- Relay Outputs for Alarm/Top of Ramp/Run\*
- RSWT40 models: Internally supplied
- RSWT60 models: 24VAC/DC ("F" version) and 100-240VAC ("G" version) control/supply options
- Auto- or manual reset of alarms\*\*
- Remote reset function\*\*

\* For RSWT...32.. - RSWT...90.. models only

\*\* For RSWT...V10/ V110 / V111 models only

## Product Description

RSWT is a 3-phase controlled soft starter for centrifugal pumps. RSWT controls all the three phases to achieve current balancing on all the phases so as to minimise vibrations during starting and stopping of centrifugal pumps.

Through a dedicated self-learning algorithm, the RSWT manages to achieve a very smooth starting and stopping performance of centrifugal pumps with minimal settings resulting in a very easy to use solution. The RSWT up to 25A (11kW @ 400V) comes in a compact 45mm housing thus facilitating replacement of contactors and star/delta starters.

The RSWT...V00/V01. version requires just 1 knob setting for the soft-starting/soft-stopping time of the pump. No further adjustments are required in this case.

The RSWT...V10/V11. version includes an overload protection (Class 10) and soft-starting and soft-stopping times can be set independently for a finer pump control. In this case there are 3 knobs to

adjust: start time, stop time and full load current (FLC) setting for the overload protection.

RSWT is equipped with a number of diagnostic functions including phase sequence, over- and under-voltage monitoring, locked rotor protection and also shorted SCR for improved pump protection in case of abnormal conditions.

Soft starter status indication is provided by means of three LEDs (green, yellow, red) for supply, ramping, and alarm indication. Additionally, RSWT (45mm) is also equipped with two output relays for alarm (Normally closed - NC) and top of ramp (Normally Open - NO) indication. In case of the RSWT...V10/ V11. series, there is a 4th LED to select whether alarms follow an auto- or manual recovery. In case of manual recovery of alarms, a push button is also available to reset the soft starter from alarm status.

RSWT...32 up to RSWT...90 are also equipped with a run relay.

Note:

- (1) Short circuit and overload protection are not provided with the RSWT...V00/RSWT...V01. version and must be procured separately
- (2) Short circuit protection is not provided with the RSWT...V10/ RSWT...V11. versions and must be procured separately.

## Ordering Code

**RSWT 40 16 E 0 V 1 0**

Centrifugal pump softstarter \_\_\_\_\_  
 Operational Voltage \_\_\_\_\_  
 Operational Current \_\_\_\_\_  
 Control Voltage \_\_\_\_\_  
 Supply Voltage \_\_\_\_\_  
 Options \_\_\_\_\_  
 Overload protection \_\_\_\_\_  
     0: No overload protection  
     1: Integrated Overload protection  
 PTC input \_\_\_\_\_  
     0: No PTC input

Note: above ordering code applies to RSWT models up to 25A

## Ordering Code

**RSWT 40 32 E 0 V 0 1 1**

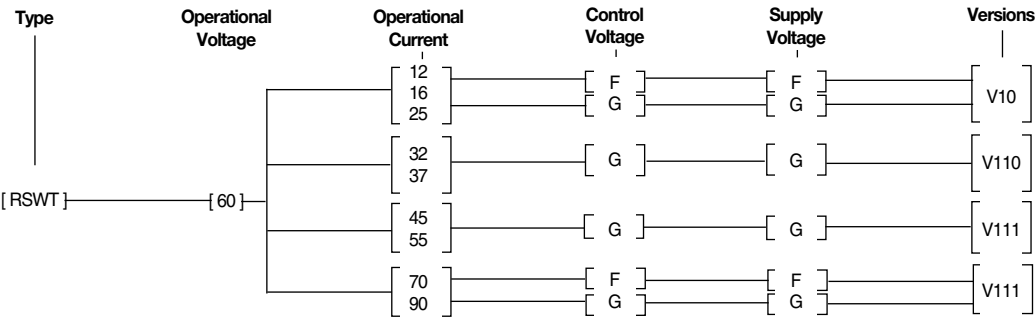
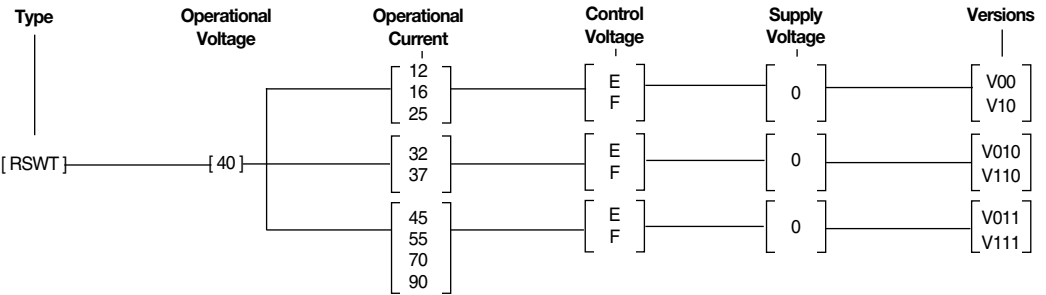
Centrifugal pump softstarter \_\_\_\_\_  
 Operational Voltage \_\_\_\_\_  
 Operational Current \_\_\_\_\_  
 Control Voltage \_\_\_\_\_  
 Supply Voltage \_\_\_\_\_  
 Options \_\_\_\_\_  
 Overload protection \_\_\_\_\_  
     0: No overload protection  
     1: Integrated Overload protection  
 PTC input \_\_\_\_\_  
     1: PTC input  
 Cooling method \_\_\_\_\_  
     0: Natural convection  
     1: Cooling fan

Note: above ordering code applies to RSWT models from 32A - 90A



Type Selection

Type	Operational Voltage Ue	Rated Operational Current Ie @ 40°C	Control Voltage Uc	Supply Voltage Us	Options
RSWT: Centrifugal pump soft starter	40: 220 – 400 VAC +10% -15%  60: 220 – 600 VAC +10% -15%	12: 12 Arms 16: 16 Arms 25: 25 Arms 32: 32 Arms 37: 37 Arms 45: 45 Arms 55: 55 Arms 70: 70 Arms 90: 90 Arms	E: 110 – 400 VAC +10% -15%  F: 24VAC/DC +10% -10%  G: 100 – 240VAC +10% -15%	0: Internally supplied  F: 24VAC/DC +10% -10%  G: 100 – 240VAC +10% -15%	V00, V010: No overload V011: No overload + Fan V10, V110: Overload protection V111: Overload protection + Fan



## Selection Guide

Operational Voltage U <sub>e</sub>	Control Voltage U <sub>c</sub>	Supply Voltage U <sub>s</sub>	Options	Rated Operational current I <sub>e</sub>			
Housing 1 (45mm)				12Arms	16Arms	25Arms	
220 - 400 VAC	110 - 400VAC	Internally Supplied	No options	RSWT4012E0V00	RSWT4016E0V00	RSWT4025E0V00	
			Overload Protection	RSWT4012E0V10	RSWT4016E0V10	RSWT4025E0V10	
	24VAC/DC		No options	RSWT4012F0V00	RSWT4016F0V00	RSWT4025F0V00	
			Overload Protection	RSWT4012F0V10	RSWT4016F0V10	RSWT4025F0V10	
220 - 600 VAC	24VAC/DC	24VAC/DC	Overload Protection	RSWT6012FFV10	RSWT6016FFV10	RSWT6025FFV10	
	100 - 240VAC	100 - 240VAC	Overload Protection	RSWT6012GGV10	RSWT6016GGV10	RSWT6025GGV10	
Housing 2 (75mm)				32Arms	37Arms	45Arms	55Arms
220 - 400 VAC	110 - 400VAC	Internally Supplied	No options	RSWT4032E0V010	RSWT4037E0V010	RSWT4045E0V011	RSWT4055E0V011
			Overload Protection	RSWT4032E0V110	RSWT4037E0V110	RSWT4045E0V111	RSWT4055E0V111
	24VAC/DC		No options	RSWT4032F0V010	RSWT4037F0V010	RSWT4045F0V011	RSWT4055F0V011
			Overload Protection	RSWT4032F0V110	RSWT4037F0V110	RSWT4045F0V111	RSWT4055F0V111
220 - 600 VAC	100 - 240VAC	100 - 240VAC	Overload Protection	RSWT6032GGV110	RSWT6037GGV110	RSWT6045GGV111	RSWT6055GGV111

Note: RSWT versions 45, 55Arms are equipped with a ventilation fan - internally supplied and internally controlled.

Housing 3 (120mm)				70Arms	90Arms
220 - 400 VAC	110 - 400VAC	Internally Supplied	No options	RSWT4070E0V011	RSWT4090E0V011
			Overload Protection	RSWT4070E0V111	RSWT4090E0V111
	24VAC/DC		No options	RSWT4070F0V011	RSWT4090F0V011
			Overload Protection	RSWT4070F0V111	RSWT4090F0V111
220 - 600 VAC	24VAC/DC	24VAC/DC	Overload Protection	RSWT6070FFV111	RSWT6090FFV111
	100 - 240VAC	100 - 240VAC	Overload Protection	RSWT6070GGV111	RSWT6090GGV111

Note: RSWT versions (70, 90Arms) are equipped with 2 ventilation fans - internally controlled and internally supplied.

## General Specifications

Ramp-up time	1...20s	Status Indication LEDs	
Ramp-down time		Power Supply ON	Green LED
RSWT...V00/ V010/ V011	1...20s	Ramping/Bypass	Yellow LED
RSWT...V10/ V110/ V111	0...20s	Alarm	Red LED
Full load current (FLC)		Auto/ Manual reset of alarms	Yellow LED
range setting			(for RSWT...V10/V110/V111 models only)
RSWT..12..V10	6 ...12	Vibration	Acc. To IEC60068-2-6
RSWT..16..V10	10 ...16	Frequency 1	2 [+3/-0]Hz to 25Hz
RSWT..25..V10	13 ... 25		Displacement +/- 1.6mm
RSWT..32..V110	20 ... 32	Frequency 2	25Hz to 100Hz @ 2g
RSWT..37..V110	25 ... 37		(19.96m/s <sup>2</sup> )
RSWT..45..V111	33 ... 45		
RSWT..55..V111	43 ... 55		
RSWT..70..V111	52 ... 70		
RSWT..90..V111	66 ... 90		

## Input Specifications

	RSWT40..E0V..	RSWT40..F0V..	RSWT60..GGV..	RSWT60..FF..
Control Voltage Uc	A1 – A2: 110 – 400 VAC +10%, -15%	A1 – A2: 24 VAC/DC +10%, -10%	ST: 100 - 240 VAC +10%, -15%	ST: 24 VAC/DC +10%, -10%
Control Voltage Range Uc	93.5 – 440 VAC	21.6 – 26.4 VAC/DC	85 – 264 VAC	21.6 - 26.4 VAC/DC
Max. Pick Up Voltage	80 VAC	20.4 VAC/DC	80 VAC	20.4 VAC/DC
Min. Drop Out Voltage	20 VAC	5 VAC/DC	20 VAC	5 VAC/DC
Supply Voltage range Us	-	-	A1 - A2: 100 - 240 VAC +10%, -15%	A1 - A2: 24 VAC/DC +10%, -10%
Rated AC frequency	45 – 66 Hz	45 – 66 Hz (applies to 24VAC supply)	45 – 66 Hz	45 – 66 Hz (applies to 24VAC supply)
Rated Insulation Voltage Ui	500 VAC			
Overvoltage category	III			
Dielectric Strength				
Dielectric withstand voltage	2 kVrms			
Rated Impulse withstand Voltage	4 kVrms			
Control Input Current	0.5....5mA	0.4....1mA	0.4....3mA	0.4....1mA
Input to Output response time	< 300 msec			
Integrated varistor	Yes			

\* **Note 1:** For the Canadian application, the control terminals A1, A2 (or A1, A2, ST for RSWT60 versions) of the RSWT 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:** RSWT60 soft starters require a separate single phase control source. RSWT60...FF versions: 24VAC/DC and RSWT60...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).

## Output Specifications

Overload cycle acc. to EN/IEC 60947-4-2 @ 40°C surrounding temperature	RSWT..12....		RSWT..16....	RSWT..25....	RSWT..32....	RSWT..37....
	AC53b:4-6:174			AC53b: 3.5-5:175	AC53b: 4 - 6:174	RSWT40: AC53b: 3.5 - 6: 174  RSWT60: AC53b: 4 - 6: 174
	Maximum number of starts per hour @ 40°C @ rated overload cycle				20	
	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	29 AAC	34 AAC
	Rated operational current @ 60°C	10 AAC	13 AAC	21 AAC	27 AAC	31 AAC
	Minimum load current	2 AAC	2 AAC	2 AAC	5 AAC	5 AAC

Overload cycle acc. to EN/IEC 60947-4-2 @ 40°C surrounding temperature	RSWT..45....	RSWT..55....	RSWT..70....	RSWT..90....	
	RSWT40: AC53b: 3.5 - 6: 174  RSWT60: AC53b: 4 - 6: 174	AC53b: 3 - 12: 168	AC53b: 4-6: 174		
	Maximum number of starts per hour @ 40°C @ rated overload cycle				
	Rated operational current @ 40°C	45 AAC	55 AAC	70 AAC	90 AAC
	Rated operational current @ 50°C	41 AAC	50 AAC	64 AAC	83 AAC
Rated operational current @ 60°C	37 AAC	46 AAC	59 AAC	76 AAC	
Minimum load current	5 AAC	5AAC	5 AAC	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:4-6:174 means that the soft starter can handle a starting current of 4x Ie for 6 seconds followed by an OFF time of 174 seconds.

## Environmental Specifications

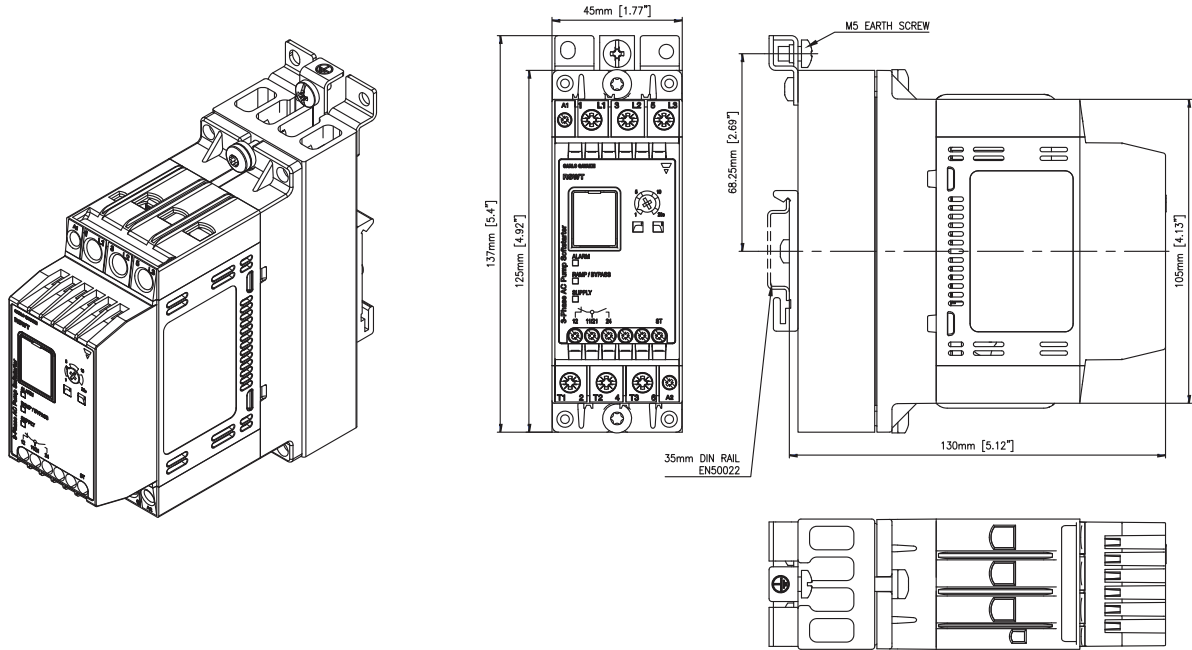
Operating Temperature	-20°C to +60°C (-4°F to +140°F) Note: For operating temperatures >40°C derating applies	Pollution Degree	2
Storage Temperature	-40°C to +80°C (-40°F to 176°F)	Degree of Protection (control circuit)	IP20 (EN/IEC 60529)
Relative Humidity	<95% non-condensing @ 40°C	Installation Category	III
		Installation Altitude	1000 m

## Supply Specifications

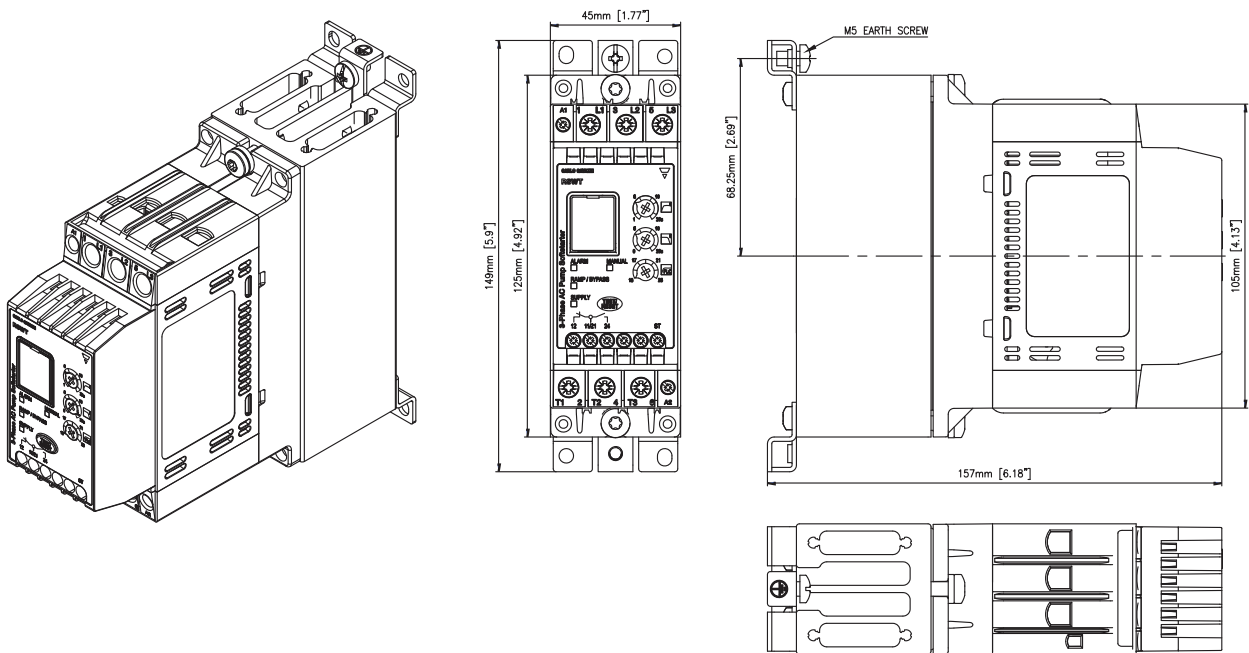
	RSWT40..	RSWT60..
Operational Voltage Range	187 – 440 VACrms	187 – 660 VACrms
Supply Current at idle	< 30 mAAC	< 30 mAAC
Blocking Voltage	1200 Vp	1600 Vp
Rated AC frequency	50/60 Hz +/-10%	
Rated Insulation Voltage	630 VAC	690 VAC
Dielectric Strength		
Dielectric withstand voltage		
Supply to Input	2.5 kVrms	
Supply to Heatsink	2.5 kVrms	
Integrated Varistor	Yes	

Dimensions

RSWT..12.., RSWT..16.. models

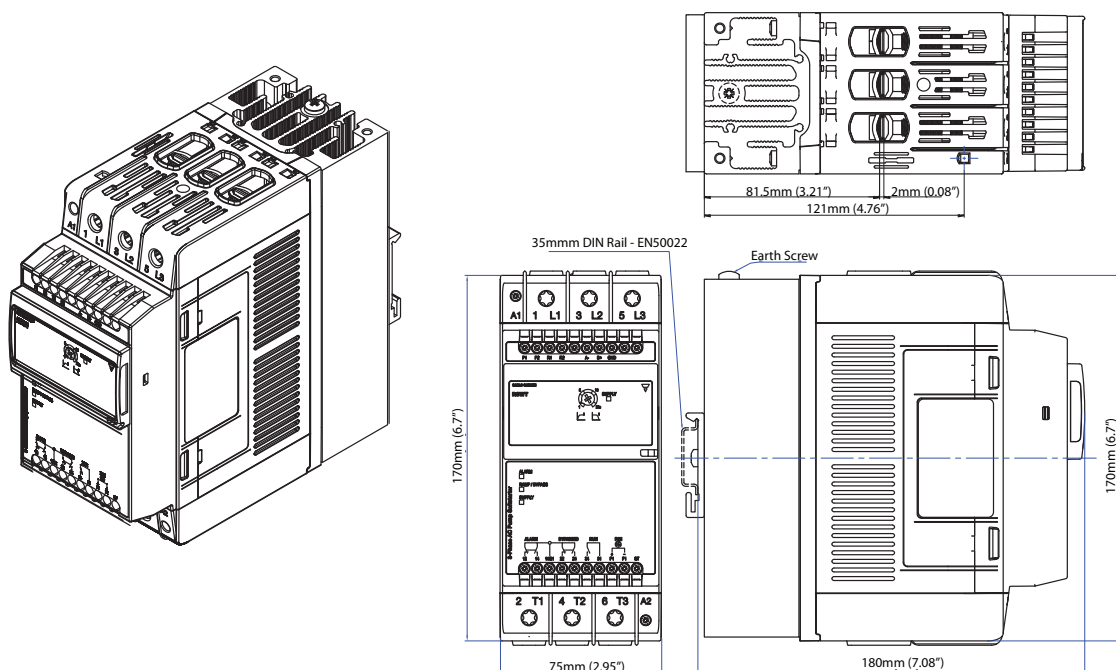


RSWT..25.. models

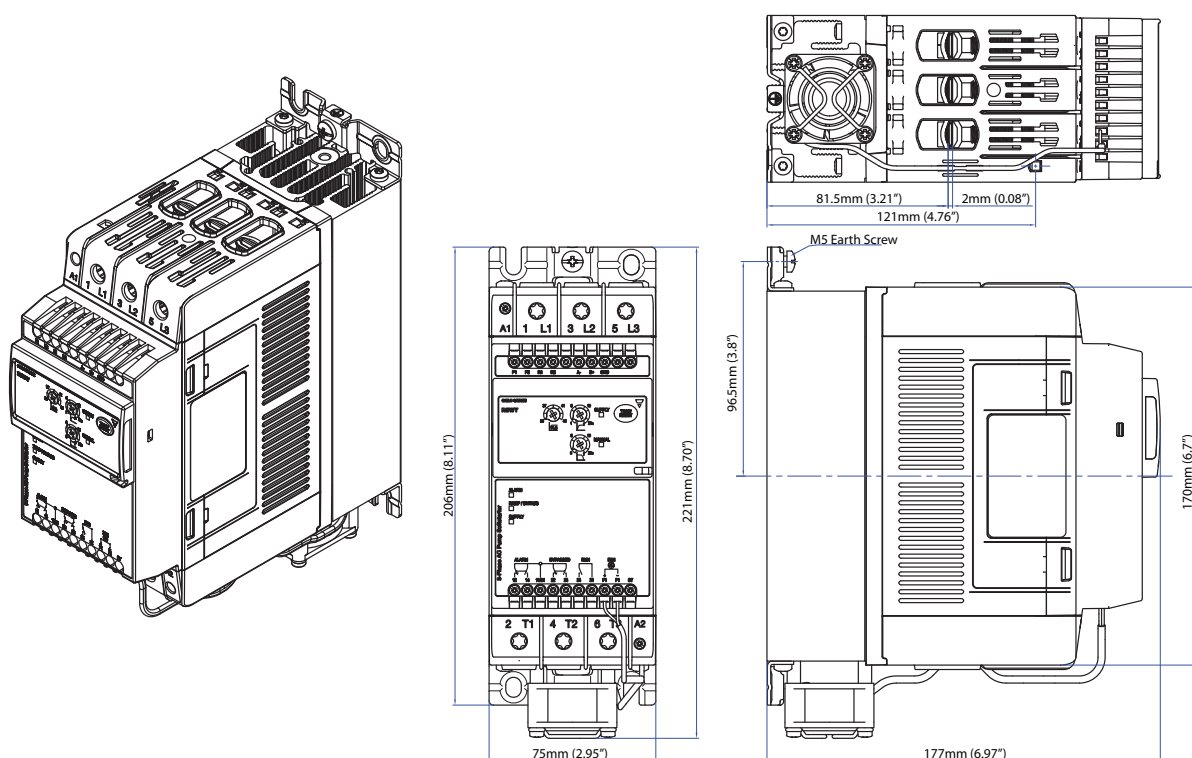


## Dimensions

RSWT...32V...10 to RSWT...37V..... models (DIN rail mount)

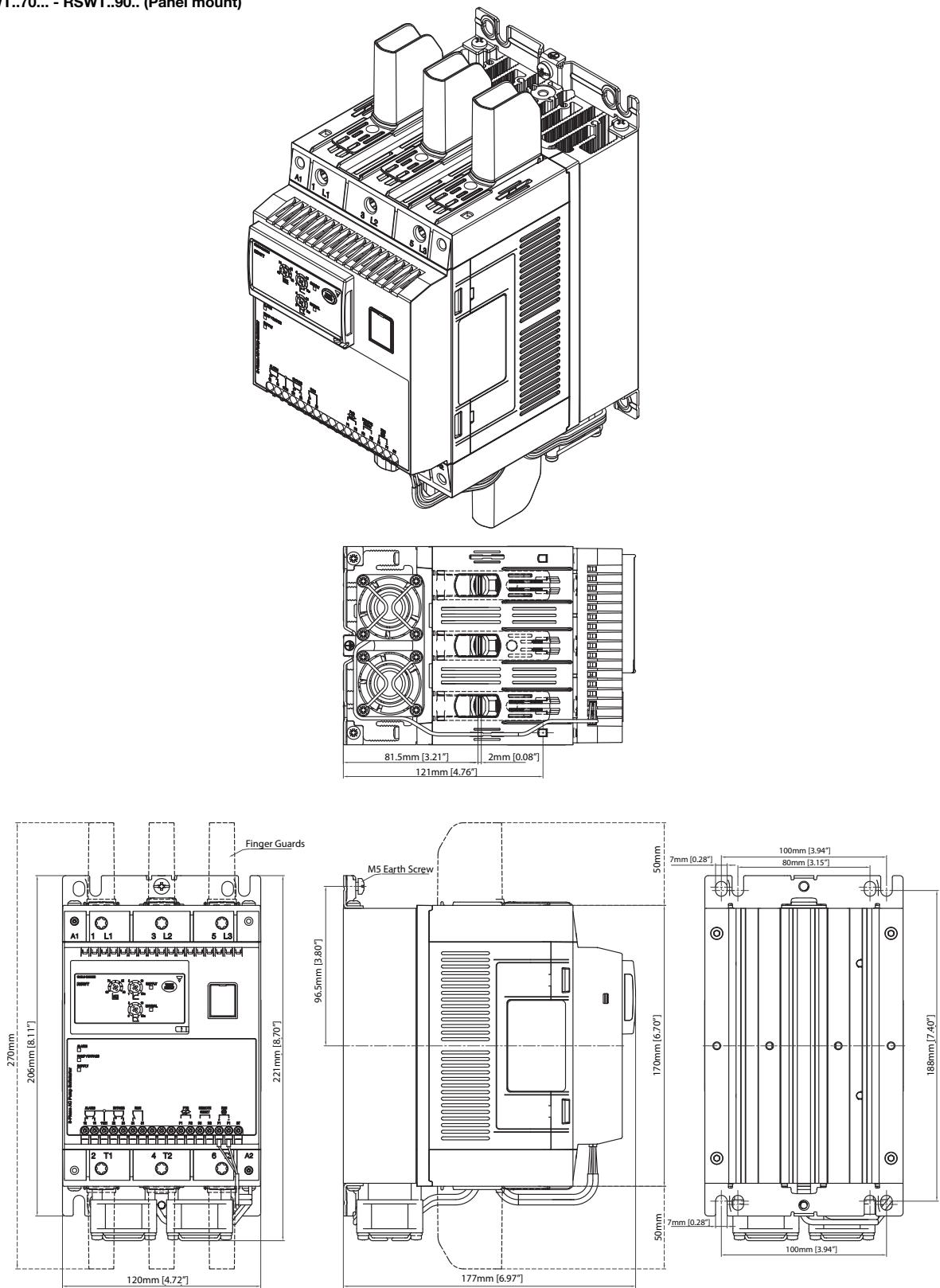


RSWT...45V... to RSWT...55V..... models (Panel mount)



Dimensions

RSWT..70... - RSWT..90.. (Panel mount)

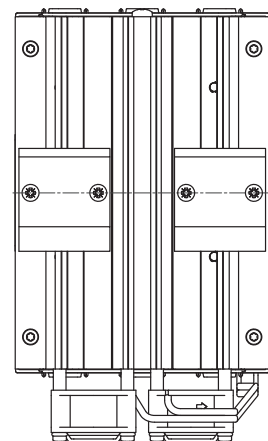
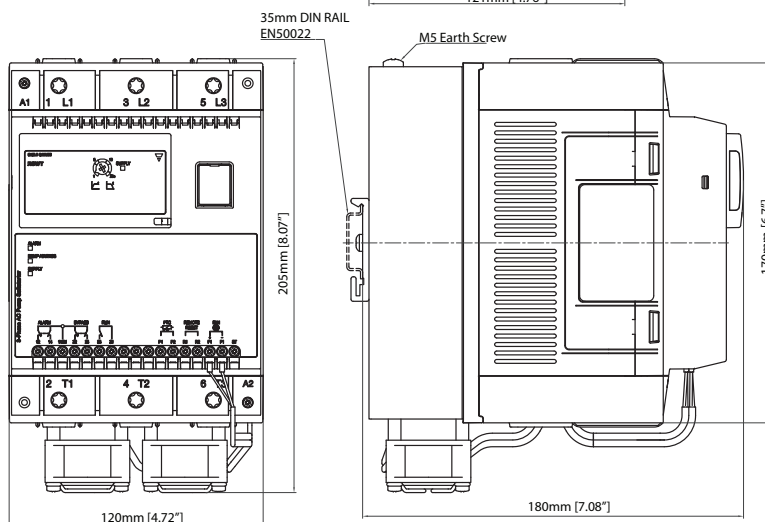
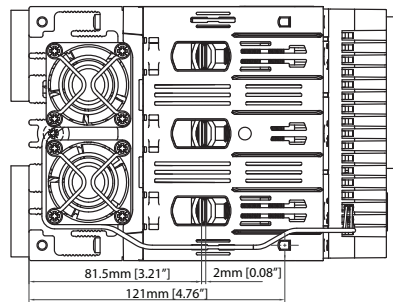
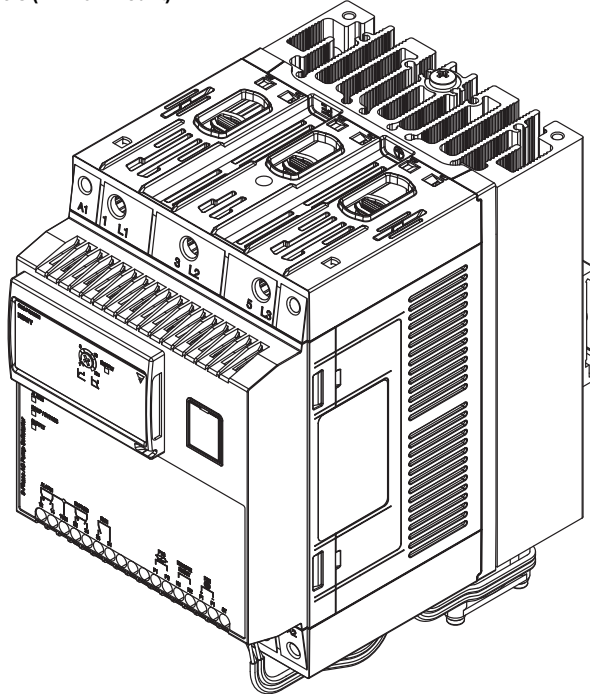


Note: Finger guards shown in the image are optional accessories (ordering code: RFCGx6)



## Dimensions

RSWT..70... - RSWT..90.. models (DIN rail mount)



## Connection Specifications

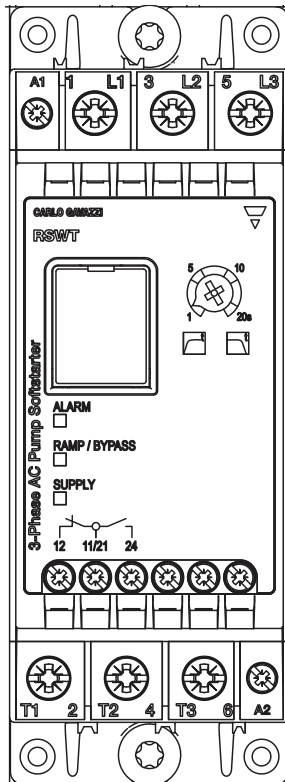
	RSWT...12 to RSWT...25	RSWT...32 to RSWT...90
<b>Line conductors</b> 1 L1, 3 L2, 5 L3, 2 T1, 4 T2, 6 T3 Acc. to EN60947-1		
Flexible	2.5 ..... 10 mm <sup>2</sup> 2.5 ..... 2 x 4 mm <sup>2</sup>	- 2x(10...50 mm <sup>2</sup> )
Rigid (solid or stranded)	2.5 ..... 10 mm <sup>2</sup>	
Flexible with end sleeve (ferrule)	2.5 ..... 10 mm <sup>2</sup>	2x(10...50 mm <sup>2</sup> )
UL/cUL rated data		
Rigid (stranded)	AWG 6...14	
Rigid (solid)	AWG 10...14	
Rigid (solid or stranded)	AWG 2 x 10...2 x 14	2x(AWG 8...1/0)
Terminal screws	M4	M8
Max. 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 mm
<b>Secondary conductors</b> A1, A2 Acc. to EN60998		
Flexible	0.5 ..... 1.5 mm <sup>2</sup>	0.5 ... 1.5 mm <sup>2</sup>
Rigid (solid or stranded)	0.5 ..... 2.5 mm <sup>2</sup>	0.5 ... 2.5 mm <sup>2</sup>
Flexible with end sleeve (ferrule)	0.5 ..... 1.5 mm <sup>2</sup>	0.5 ... 1.5 mm <sup>2</sup>
UL/cUL rated data		
Rigid (solid or stranded)	AWG 10...18	AWG 10...18
Terminal screws	M3	M3
Max. tightening torque	0.6Nm (5.3lb.in) with Posidrive bit 0	0.6Nm (5.3 lb.in) with Positive bit 0
Stripping length	6.0 mm	6.0 mm
<b>Auxiliary conductors</b> 11, 12, 21, 24, (31, 34)*, ST		
Rigid (solid or stranded)	0.05 ... 2.5 mm <sup>2</sup>	0.05 ... 2.5 mm <sup>2</sup>
Flexible with end sleeve (ferrule)	0.05 ... 1.5 mm <sup>2</sup>	0.05 ... 1.5 mm <sup>2</sup>
UL/cUL rated data		
11, 12, 21, 24, (31, 34)*, ST	AWG 30 ... 12	AWG 30 ... 12
Rigid (solid or stranded)	AWG 24 ... 12	AWG 24 ... 12
Terminal screws		
11, 12, 21, 24, (31, 34)*, ST	M3	M3
Max. tightening torque		
11, 12, 21, 24, (31, 34)*, ST	0.45 Nm (4.0 lb.in)	0.45 Nm (4.0 lb.in)
Stripping length	6 mm	6 mm

Use 75°C Copper (Cu) conductors

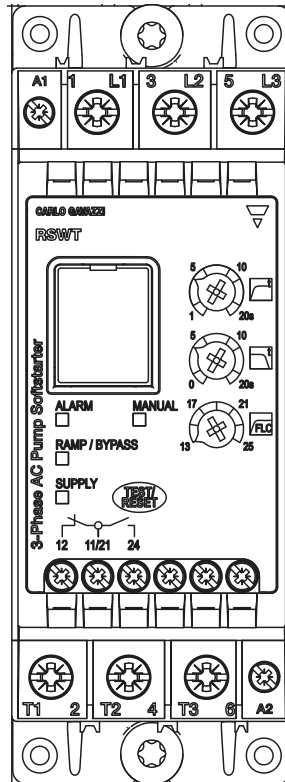
\* For RSWT...32 to RSWT...90 models only

## Terminal Markings

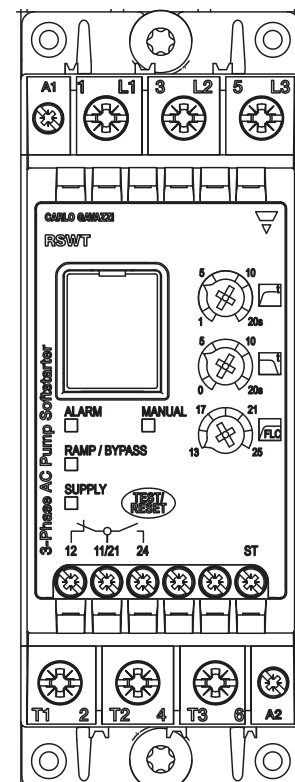
RSWT40...V00



RSWT40...V10



RSWT60...



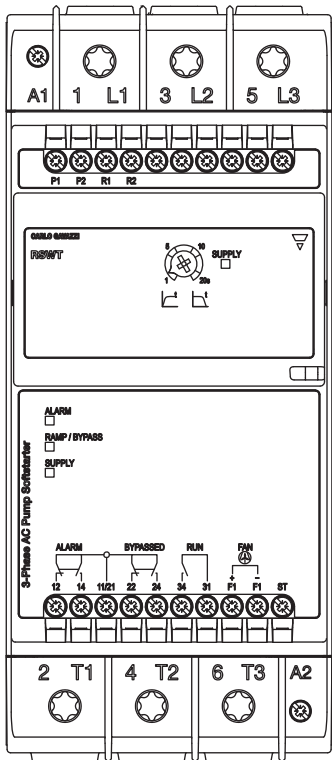
- 1L1, 3L2, 5L3:** Line connections  
**2T1, 4T2, 6T3:** Load connections  
**A1, A2:** Control voltage  
**11, 12:** Alarm indication (Normally Closed, NC)  
**21, 24:** Top of Ramp indication (Normally Open, NO)

Note: For the 24VDC option, A1 is to be connected to the positive (+) and A2 to the negative (-) terminal.

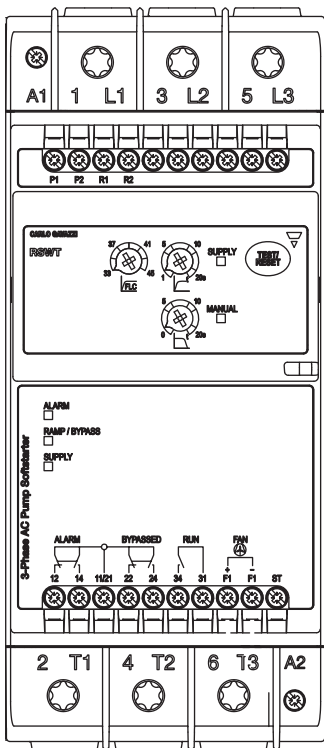
- 1L1, 3L2, 5L3:** Line connections  
**2T1, 4T2, 6T3:** Load connections  
**A1, A2:** Supply voltage  
**ST:** Control voltage  
**11, 12:** Alarm indication (Normally Closed, NC)  
**21, 24:** Top of Ramp indication (Normally Open, NO)

Terminal Markings

RSWT..32.V01. to RSWT..90.V01. (without Overload Protection)



RSWT..32.V11. to RSWT..90.V11.



- 1L1, 3L2, 5L3: Line connections
- 2T1, 4T2, 6T3: Load connections
- A1, A2: Control voltage (Supply voltage for RSWT60 models)
- 11, 12, 14: Alarm indication (NO, NC, changeover)
- 21, 22, 24: Top of Ramp indication (NO, NC, changeover)
- 31, 34: Run relay indication (NO, normally open)
- F1+, F1-: Cooling fan connection\*\*
- P1, P2: PTC connection
- ST\*: Control voltage (start signal)

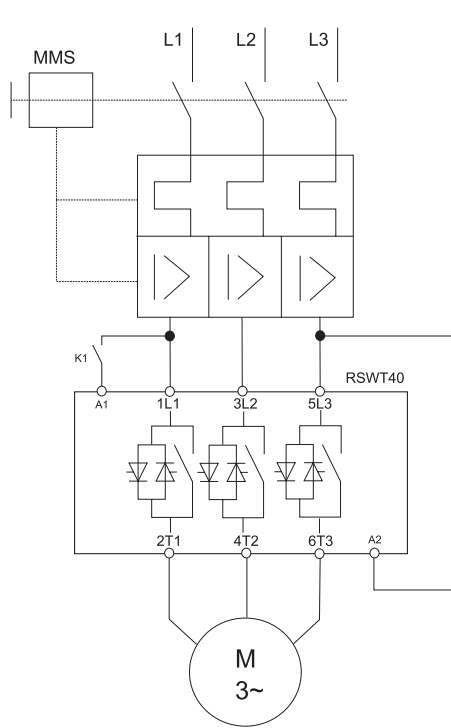
\* only for RSWT60.. models  
\*\* only for RSWT..V011 and RSWT..V111 models

- 1L1, 3L2, 5L3: Line connections
- 2T1, 4T2, 6T3: Load connections
- A1, A2: Control voltage (Supply voltage for RSWT60 models)
- 11, 12, 14: Alarm indication (NO, NC, changeover)
- 21, 22, 24: Top of Ramp indication (NO, NC, changeover)
- 31, 34: Run relay indication (NO, normally open)
- F1+, F1-: Cooling fan connection\*\*
- P1, P2: PTC connection
- R1, R2 \*\*: Remote reset connection
- ST\*: Control voltage (start signal)

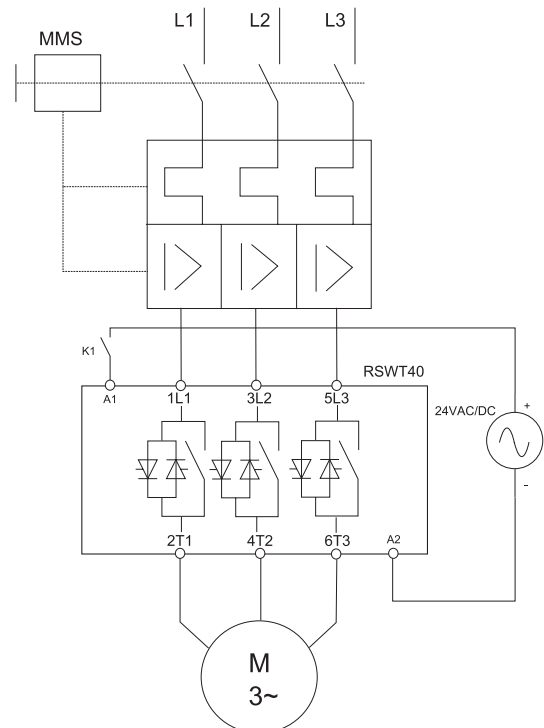
Note: The same terminal markings apply for RSWT..70, RSWT..90 models.

## Wiring Diagrams

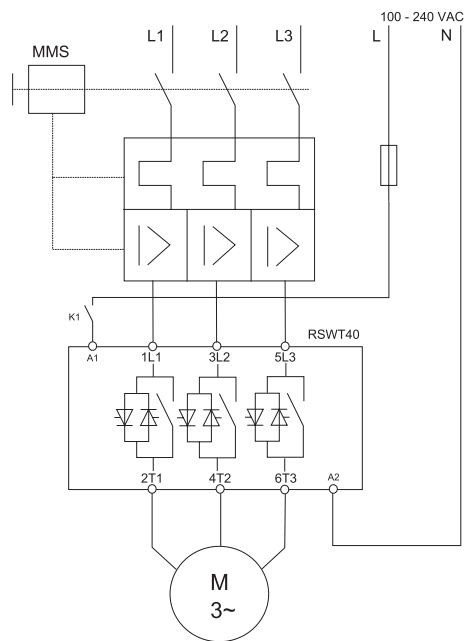
Valid up to 400VAC



RSWT40...E0V..



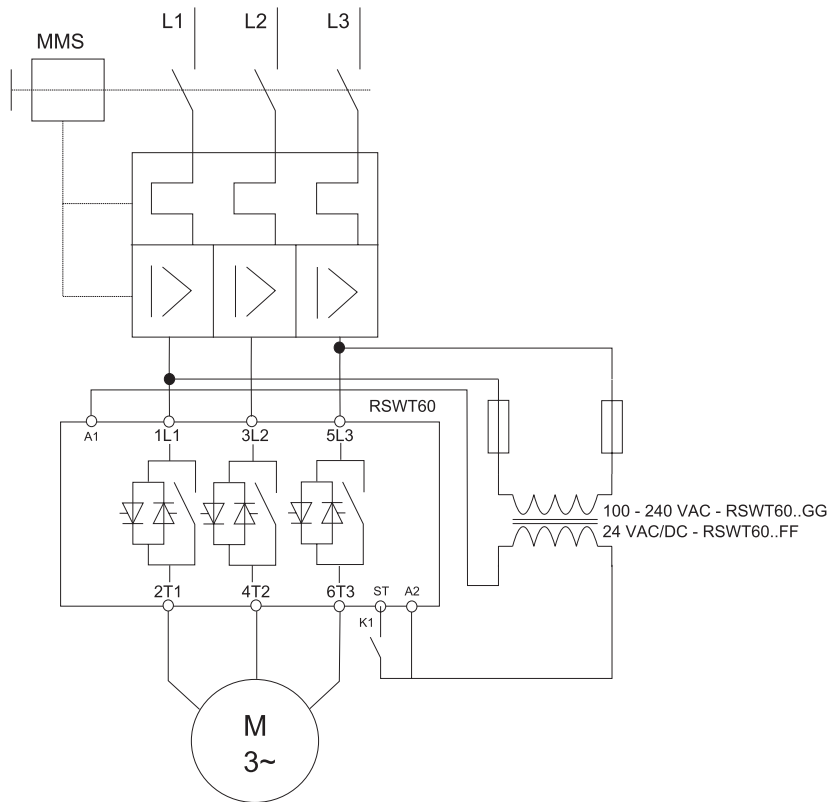
RSWT40...F0V..



RSWT40...E0V..

Wiring Diagrams (cont.)

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).



RSWT60...FFV../ RSWT60...GG..

Note 1: For RSWT60..FFV... models apply 24VAC/DC across A1, A2 terminals. For RSWT60..GGV... models apply 100 - 240VAC across A1, A2 terminals.  
Note 2: For DC supply, 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)

Housing Specifications

Weight (approx.)	
RSWT..12.. - RSWT..16..	735 g
RSWT..25..	850 g
RSWT..32.. - RSWT..55..	2.3 kg
RSWT..70.. - RSWT..90..	3.5 kg
Material	PA66
Material colour	RAL7035
Terminal colour	RAL7040
Mounting	DIN or Panel (accessory included)

## Auxiliary Relays

	RSWT..12.... - RSWT..25....	RSWT..32.... - RSWT..90....
Rated operational voltage	250VAC/ 30VDC	250VAC/ 30VDC
Rated insulation voltage	250VAC	250VAC
Dielectric withstand voltage (Coil to contacts)	2.5kV	2.5kV
Overvoltage category	II	II
Number of output relays	2	3
Overload/Fault		
Terminal markings	11/ 12	11/ 12 / 14
Type of control circuit	Electromechanical relay	Electromechanical relay
Number of contacts	1	2
Type of contacts	NC - Normally Closed	Changeover (NO, NC)
Type of current	AC/DC	AC/DC
Rated operational current	3A, 250VAC 3A, 30VDC	3A, 250VAC 3A, 30VDC
Bypassed (Top of ramp)		
Terminal markings	21/ 24	21/ 22/ 24
Type of control circuit	Electromechanical relay	Electromechanical relay
Number of contacts	1	2
Type of contacts	NO - Normally Open	Changeover (NO, NC)
Type of current	AC/DC	AC/DC
Rated operational current	3A, 250VAC 3A, 30VDC	3A, 250VAC 3A, 30VDC
Run		
Terminal markings	-	31/34
Type of control circuit	-	Electromechanical relay
Number of contacts	-	1
Type of contacts	-	NO - Normally open
Type of current	-	AC/DC
Rated operational current	-	3A, 250VAC 3A, 30VDC

## Electromagnetic Compatibility

Immunity	IEC/EN 61000-6-2	Immunity	IEC/EN 61000-4-3
Electrostatic Discharge (ESD)		3V/m, 80 - 1000 MHz	Performance Criteria 1
Immunity	IEC/EN 61000-4-2	Conducted Radio Frequency	IEC/EN 61000-4-6
Air discharge, 8kV	Performance Criteria 2	Immunity	
Contact, 4kV	Performance Criteria 2	10V/m, 0.15 - 80 MHz	Performance Criteria 1
Electrical Fast Transient (Burst) Immunity	IEC/EN 61000-4-4	Voltage Dips Immunity	IEC/EN 61000-4-11
Output: 2kV	Performance Criteria 2	0% for 10ms/20ms,	Performance Criteria 2
Input: 1kV	Performance Criteria 2	40% for 200ms	Performance Criteria 2
Electrical Surge Immunity	IEC/EN 61000-4-5	70% for 500ms	Performance Criteria 2
Output, line to line, 1kV	Performance Criteria 2	Emission	IEC/EN 61000-6-3
Output, line to earth, 2kV	Performance Criteria 2	Radio Interference	
Input, line to line, 1kV	Performance Criteria 2	field emission (Radiated)	IEC/EN 55011
Input, line to earth, 2kV	Performance Criteria 2	30 - 1000MHz	Class A (Industrial)
		Radio interference	
		field emissions (conducted)	IEC/EN 55011
			Class A (Industrial)

Radiated Radio Frequency

## Agency Approvals and Conformances

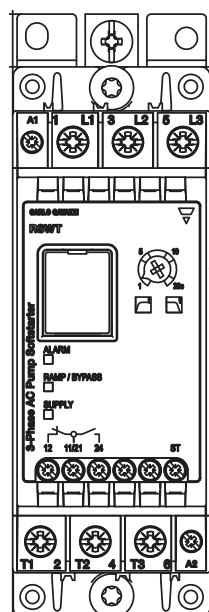
<b>Conformance</b>	EN/IEC 60947-4-2 UL508 Listed (E172877) cUL Listed (E172877) CCC, pending
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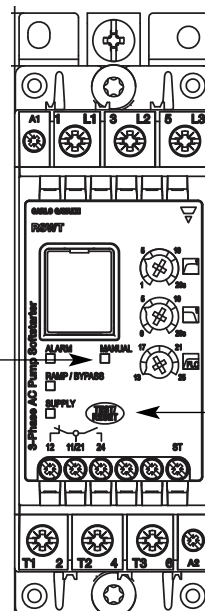
## Soft Starter Setting Procedure

RSWT...V00/ V010/ V011

RSWT...V10/ V110/ V111



1. Ramp-up / Ramp-down

5. Manual/Auto reset of alarms  
(LED indication)

1. Ramp-up

2. Ramp-down

3. Full load current (FLC)  
[for overload protection]

4. Test/Reset button

The RSWT...V00/ V010/ V011 soft starter series features just 1 knob setting for start/stop time of the pump.

**Step 1:** Set the knob to the desired starting time as required for the specific application.

The RSWT will then self-adjust the starting torque at every pump start until an optimum starting torque is achieved. This will take a minimum of 5 starts until the starting parameters stabilise.

For more details on how this is done refer to the Mode of Operation section.

Note: In this case, the ramp-down will have the same duration of the ramp-up time setting.

**IMPORTANT:** The RSWT knob settings are only checked during IDLE status. Changes in the knob settings during Ramping/Bypass status will only be affected during the following start/ stop.

The RSWT...V10/ V110/ V111 soft starter series features 3-knob settings and an additional push button to test the overload protection, reset the alarms and for setting the alarm recovery to Manual or Auto.

### Step 1: Set the ramp-up time

- Set the knob to the desired starting time as required for the specific application.

### Step 2: Set the ramp-down time

- Set the knob to the desired stopping time as required for the specific application. In this case ramp-down time can be set to a different value from that of the ramp-up time.
- Note: If no soft-stop is required, set the ramp-down knob from 0 to 1sec.

### Step 3: Set the full load current (FLC)

- Adjust the knob setting to the FLC value corresponding to the pump/motor name plate to ensure proper overload protection

### Step 4: Set the alarm recovery mode

- Make sure the RSWT is in idle mode (Green LED ON)
- To set the alarm recovery to auto, press the Test/Reset button for a minimum of 5secs. The MANUAL LED (yellow LED) will turn OFF indicating that the alarms will follow an auto-recovery routine.
- To set the alarm recovery to MANUAL the same procedure as described above applies
- Note: The RSWT...V10/ V110/ V111 have a default setting of auto alarm recovery (yellow LED MANUAL OFF)

### Step 5: Test the overload function

- To make sure that the overload function is working properly press the TEST/RESET button (during Idle) for about 1sec. The RSWT will trip and the red LED will flash 8 times indicating an overload alarm. The alarm relay (11,12) will also change state to Open.

Note: For RSWT32 to RSWT90 models, relay (11, 12, 14) will change state.



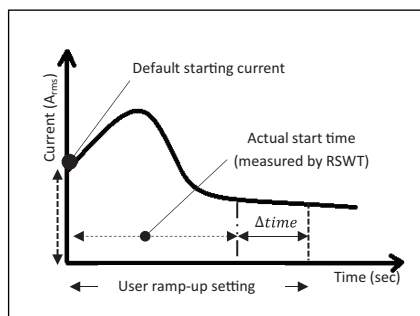
## Mode of Operation

### Starting Method

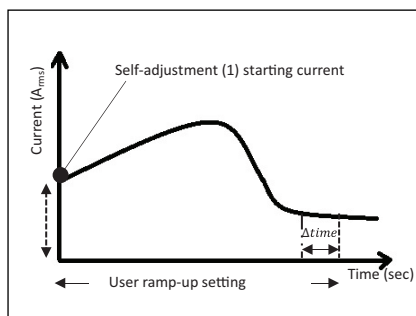
The RSWT series of soft starters is based on a current ramp starting methodology to limit the pump starting current and, at the same time minimise water hammering effects. Additionally, the RSWT is equipped with an intelligent and self-learning algorithm to adjust the starting torque automatically at every pump start. The algorithm makes use of the internal current and voltage measurement circuits to detect when the pump starts to rotate. During every start, the RSWT adjusts the starting parameters to achieve a ramp-up time as close as possible to the one set by the user. This function is done automatically by the RSWT and within 5 starts (typically) the proper starting parameters will be found (assuming the load is the same).

During ramp-down, the RSWT will use the “self-learned” parameters to adjust the ramp-down time in such a way to respect the setting done by the user on the ramp-down knob. In the case of the RSWT...V00/ V010/ V011 versions this will be the same as the ramp-up setting.

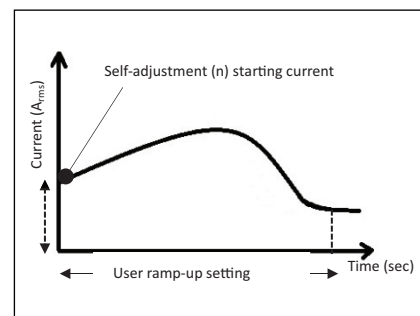
**Important:** Due to the self-learning algorithm present on the RSWT series, when the RSWT is first tested on a small motor, the starting parameters will be optimised for that motor size. If the same RSWT is then installed/ tested on a larger motor, the starting parameters will be optimised during the first start and the RSWT might trigger an alarm. If this happens, following the alarm recovery period, the RSWT will update the (self-learned) start parameters and perform another start. This process will then continue during successive starts such that the optimal starting parameters are found.



**Start 1:** RSWT starts from default starting voltage/torque (internal) value. The pump start time can be shorter/longer than user ramp-up setting.



**Start 2:** During the 2nd start, the RSWT will start with the “self-learned” start parameters (from the previous start) to reduce the difference between the user-set ramp-time vs the actual ramp-time measured by the RSWT ( $\Delta$  time).



**Start n:** For the nth start, the RSWT algorithm will keep the ramp-time as close as possible to the user set-ramp time. The self-adjusting algorithm will remain active at every start to make sure that the RSWT adapts the starting parameters to any load changes.

Note: During motor starting, the RSWT will limit the current to a maximum of 3.5xI<sub>e</sub> for RSWT....V00/RSWT....V01. models and 3.5xFLC setting for RSWT....V10/RSWT....V11. models respectively.

## Mode of Operation

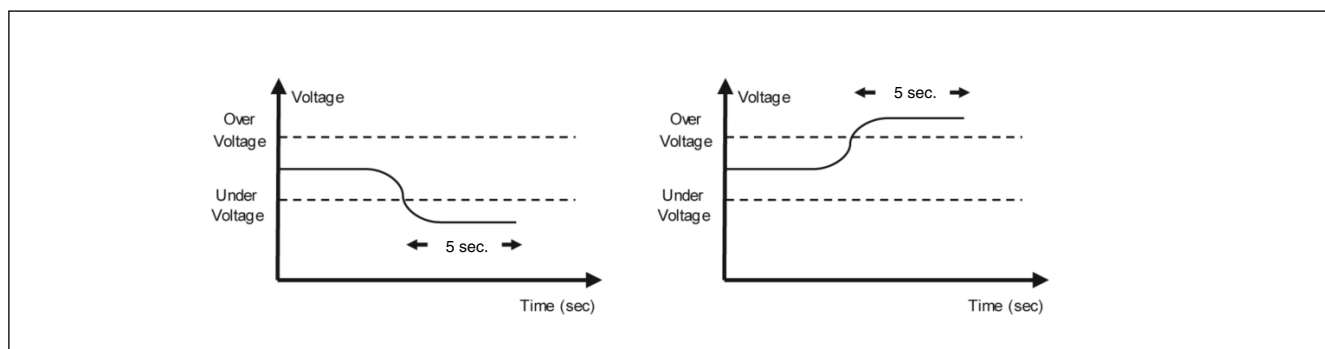
### Alarms description

The RSWT includes a number of diagnostic and protection features each of which is signalled through a flashing sequence on the red LED. For the RSWT...V00/RSWT...V01. versions, all alarms follow an auto-recovery routine (except for Wrong phase sequence, Shorted SCR and Internal fault alarms) as described in the datasheet. For the RSWT...V10/RSWT...V11. the user can select whether to have an auto-reset or manual reset of alarms. In auto-reset (auto-recovery) mode, alarms (3,4,5,6,7,8,9 flashes) will recover after a minimum recovery time of 5 minutes. In case the same alarm is triggered for 5 consecutive times, then a power supply reset will be required to reset the alarm.

#### Wrong phase sequence (2 flashes)

If the connection to the soft starter is not done in the correct sequence (L1, L2, L3), the RSWT soft starter will trigger the wrong phase sequence alarm and the motor will not be started. In such case, user intervention is required to change the wiring sequence as the alarm does not self-recover.

#### Line voltage out of range (3 flashes)



At every power-up the RSWT 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. 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.

\* Applies to RSWT60 models only.

Note: For RSWT60 models over-voltage alarm level (for the case of a 600V supply) is 675V. (600V + 11%)

#### Phase loss (Motor side) (4 flashes)

If any of the phases on the load (motor) side becomes open the RSWT will trip after 5seconds to protect the motor from running/starting on 2 phases.

Note: This alarm will also be triggered when a current unbalance of >20% is detected on any of the three line currents for a minimum of 5secs. Additionally if a SCR and/or bypass relay is open (damaged) the same alarm will be triggered.

#### Locked rotor (5 flashes)

If a current 5xI<sub>e</sub> for 1sec (for RSWT...V00/RSWT...V01.) or 8xFLC setting for 100msec(for RSWT...V10/RSWT...V11. models) is detected, the RSWT will issue the locked rotor alarm (5flashes).

This alarm may indicate a number of different conditions:-

1. The RSWT soft starter rating is small with respect to the load it is controlling
2. Motor windings are damaged
3. Pump with locked rotor

## Mode of Operation

### Excess ramp-up time (6 flashes)

During ramping-up state, if the RSWT detects that the starting current is equal to the maximum starting current allowed ( $3.5 \times I_e$  for RSWT..V00/RSWT....V01. or  $3.5 \times FLC$  setting for RSWT..V10/RSWT....V11. models) for 80% of the ramp-up time setting, the RSWT will trigger this alarm.

### Over-temperature (7 flashes)

The RSWT soft starter constantly measures the heatsink and thyristors (SCRs) temperature. If the maximum internal temperature is exceeded (for a minimum of 0.5sec) an over-temperature alarm is triggered and the RSWT will enter into a self-recovery mode to allow the soft starter to cool down. This condition can be triggered by too many starts per hour, an overload condition during starting and/or stopping or a high surrounding temperature.

### Overload (8 flashes)

Before going into bypass state, the RSWT will check if the measured current is  $> I_{max}$  bypass. If this condition is detected, the alarm will be triggered. If during bypass state, the measured current by RSWT is  $> I_{max}$  bypass for a minimum of 5sec the alarm will be triggered.

The overload alarm may also be triggered through an external PTC input (terminals P1, P2) which should be connected on the motor windings. Note: in the event of an overload alarm indication, always check that P1, P2 terminals are bridged by a connector if no PTC is used.

RSWT..V10/RSWT....V11. models: The RSWT has built-in thermal model motor overload protection. The motor current is continuously monitored and the expected temperature is calculated based on this monitored current. The RSWT is equipped with a virtual motor model to estimate the motor windings temperature. Depending on the level of overload, determined through the internal current measurement, RSWT will trigger the overload alarm based on a certain delay in accordance with overload trip class 10 characteristics.

Note:  $I_{max} bypass = 1.05 \times I_e$

### Motor Overheat Protection

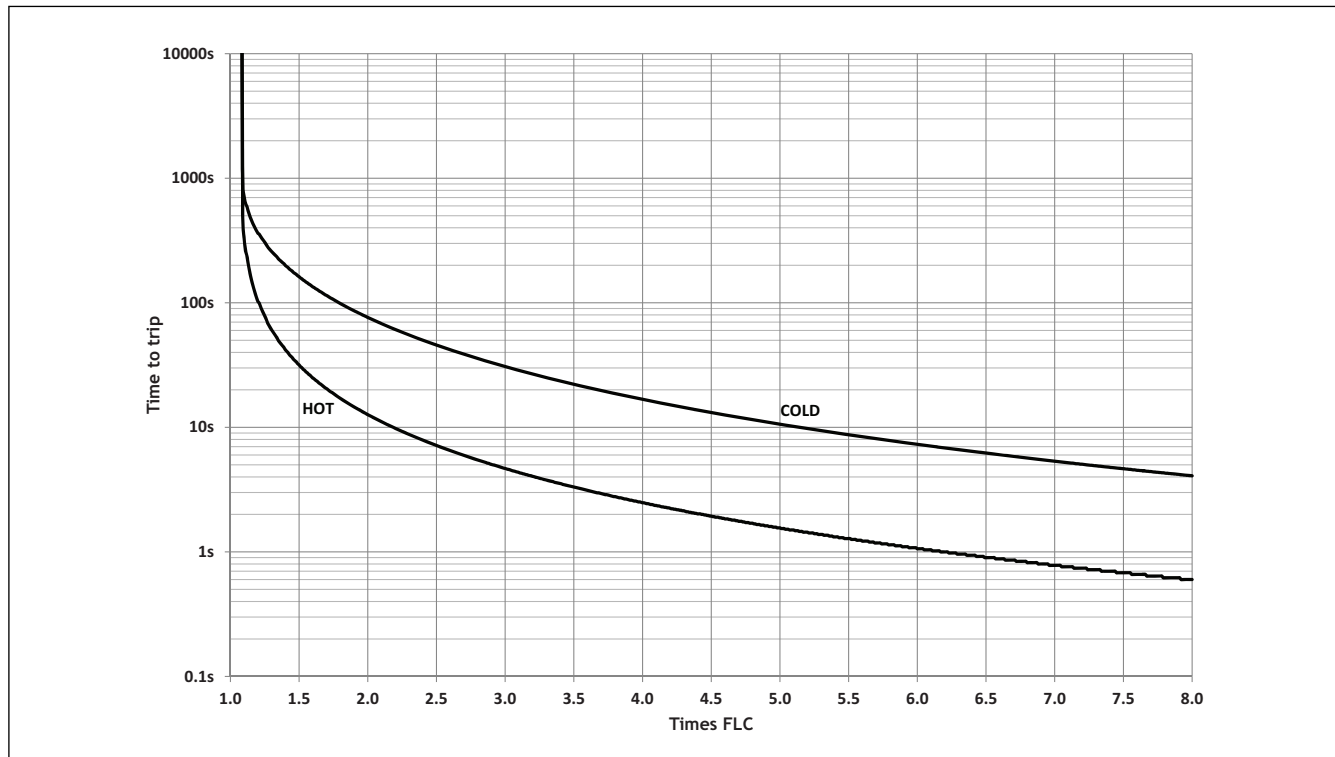
Motor PTC connection	P1:P2
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### PTC Resistance

$< 500\Omega$	No Trip:	Normal Running
$> 1000\Omega$	Trip:	Overload Alarm (8 flashes) & Alarm Relay Activated
$< 300\Omega$	Reset	

## Mode of Operation

### Overload Trip Curves



#### Supply voltage unbalance (9 flashes)

The unit measures the voltages on all the three phases and if there is a difference of more than 20% for  $\geq 5$ sec between any of the phases, the RSWT triggers the voltage unbalance alarm to prevent motor damage.

#### Shorted SCR (10 flashes)

In case the RSWT detects that there is a damaged (shorted) thyristor (SCR) on any of the three phases, the soft starter will trip. Note: this alarm is not resettable and it is suggested to replace the unit and contact a Carlo Gavazzi representative should this alarm occur.

#### Internal fault (Red LED continuously ON)

In the case there is an internal fault in the RSWT circuitry, the Red LED will remain continuously ON.

Note: This alarm is not resettable and it is suggested to replace the unit and contact a CG representative should this alarm occur.

## LED Indications, Relay Contact Position

Green LED (Supply)	Yellow LED (Ramp/Bypass)	Red LED (Alarm)	Yellow LED (MANUAL) <sup>1,2</sup>	Relay Contact Position			Condition
				Alarm (11, 12, 14)	Bypass (21, 22, 24)	Run (31, 34)	
ON	OFF	OFF	OFF/ON	11, 12	21, 22	Open	Idle State
ON	Flashing	OFF	OFF/ON	11, 12	21, 22	Closed	Ramping State
ON	ON	OFF	OFF/ON	11, 12	21, 24	Closed	Bypass State
ON	OFF	Flashing	OFF	11, 14	21, 22	Open	Alarm State – Auto-recovery of alarms
ON	OFF	Flashing	ON	11, 14	21, 22	Open	Alarm State – Manual recovery of alarms (user needs to press the reset button to reset the alarm)
ON	OFF	ON	OFF/ON	11, 14	21, 22	Open	Internal Fault

## Alarm LED Indications (Red LED) 3,4

Flashes	Description of Fault	Yellow LED (Manual) <sup>1,2</sup>	Action <sup>1,2</sup>
2	Wrong Phase Sequence	OFF/ ON	Physical change of supply connection (L1,L2,L3)
3	Line Voltage Out of Range	OFF	Auto reset with 5mins recovery
		ON	Press TEST/RESET button to reset alarm
4	Phase Loss (Motor Side)	OFF	Auto reset with 5mins recovery
		ON	Press TEST/RESET button to reset alarm
5	Locked rotor	OFF	Auto reset with 5mins recovery
		ON	Press TEST/RESET button to reset alarm
6	Excess ramp-up time	OFF	Auto reset with 5mins recovery
		ON	Press TEST/RESET button to reset alarm
7	Over Temperature	OFF	Auto reset (recovery time depends on the cool-down time of the RSWT) <sup>2</sup>
		ON	Press TEST/RESET button to reset alarm (allow enough time for the RSWT to cool down)
8	Overload	OFF	Auto reset (recovery time depends on the cool-down time of the RSWT) <sup>2</sup>
		ON	Press TEST/RESET button to reset alarm (allow enough time for the RSWT to cool down)
9	Supply Voltage Unbalance	OFF	Auto reset with 5mins recovery
		ON	Press TEST/RESET button to reset alarm
10	Shorted SCR	OFF	Contact Carlo Gavazzi representative (Alarm is non-resettable)
		ON	
Cont. ON	Internal Fault	OFF	Contact Carlo Gavazzi representative (Alarm is non-resettable)
		ON	

1. TEST/RESET button is only available on RSWT...V10/RSWT....V11. models. RSWT...V00/V01. will always perform an auto-recovery from alarms.

2. A 5min alarm recovery will start as soon as the RSWT internal temperature falls within specific limits. In case of manual alarm recovery, alarm can only be reset if the RSWT internal temperature falls within specific limits.

3. Remote reset of alarms can be performed by shorting terminals R1 and R2 for a minimum of 2 seconds. This applies to RSWT...V110 and RSWT...V111 models only. Make sure that alarm reset mode is set to Manual (yellow LED "Manual" OFF). Note: Do not apply voltage across R1, R2 terminals as this might damage the RSWT.

4. For RSWT60 versions, in the event of a trip caused by voltage, current or load related alarms (Alarms 2, 3, 4, 9), the RSWT will immediately enter in recovery mode. As soon as recovery time has elapsed, if control signal (ST) is present, RSWT will check if any fault is still present. If a fault is still present, the RSWT will not attempt to start the motor.

## 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 5,000A\* rms Symmetrical Amperes, 400 or 600 Volts maximum when protected by fuses. Tests at 5,000A\* 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.

\* For RSWT..70, RSWT..90 models 10,000 symmetrical amperes apply.

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

Part No.	Max. Fuse Size [A]	Class	Current [kA]	Max. Voltage [VAC]
RSWT..12.V....	20	RK5	5	600
RSWT..16.V....	20	RK5	5	600
RSWT..25.V....	25	RK5	5	600
RSWT..32.V....	60	RK5	5	600
RSWT..37.V....	60	RK5	5	600
RSWT..45.V....	60	RK5	5	600
RSWT..55.V....	60	RK5	5	600
RSWT..70.V....	100	RK5	10	600
RSWT..90.V....	100	RK5	10	600

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

Part No.	Model No.	Current [kA]	Max. Voltage [VAC]
RSWT..12.V....	GMS32H-17A	5 / 3	400 / 600
RSWT..16.V....	GMS32H-17A	5 / 3	400 / 600
RSWT..25.V....	GMS32H-32A	5 / 3	400 / 600
RSWT..32.V....	GMS63H-32A	10	400
RSWT..37.V....	GMS63H-40A	10	400
RSWT..45.V....	GMS63H-50A	10	400
RSWT..55.V....	GMS63H-63A	10	400
RSWT..70.V....	GMS100S-75A	10	400
RSWT..90.V....	GMS100S-100A	10	400

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 2.5mm<sup>2</sup>, for products rated 32, 37, 45, 55A the maximum cross-sectional area shall be of 16mm<sup>2</sup> and for products rated 70, 90A this shall be of a maximum of 50mm<sup>2</sup>.

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

## Short Circuit Protection (cont.)

### Co-ordination Type 2 (IEC/EN 60947-4-2) – Semiconductor Fuses

Part No.	Max. Fuse Size [A]	Model No.	Current [kA]	Max. Voltage [VAC]
RSWT..12.V....	35	A70 QS 35-4	5	600
RSWT..16.V....	35	A70 QS 35-4	5	600
RSWT..25.V....	50	A70 QS 50-4	5	600

### Current /Power Ratings: kW (IEC 60947-4-2) & HP (UL508) @ 40°C

Part No.	IEC Rated Current	220 – 240 VAC	380 – 415 VAC	440 – 480 VAC	550 – 600 VAC
RSWT4012.....	12 AAC	3 kW / 3 HP	5.5 kW / 5 HP	-	-
RSWT4016.....	16 AAC	4 kW / 5 HP	7.5 kW / 7.5 HP	-	-
RSWT4025.....	25 AAC	5.5 kW / 7.5 HP	11 kW / 10 HP	-	-
RSWT4032.....	32 AAC	9 kW / 10 HP	15 kW / 15 HP	-	-
RSWT4037.....	37 AAC	9 kW / 10 HP	20 kW / 20 HP	-	-
RSWT4045.....	45 AAC	11 kW / 15 HP	22 kW / 25 HP	-	-
RSWT4055.....	55 AAC	15 kW / 20 HP	30 kW / 30 HP	-	-
RSWT4070.....	70 AAC	20 kW / 25 HP	37 kW / 40 HP	-	-
RSWT4090.....	90 AAC	22 kW / 30 HP	45 kW / 50 HP	-	-

RSWT6012.....	12 AAC	3 kW / 3 HP	5.5 kW / 5 HP	5.5 kW / 7.5 HP	9 kW / 10 HP
RSWT6016.....	16 AAC	4 kW / 5 HP	7.5 kW / 7.5 HP	9 kW / 10 HP	11 kW / 15 HP*
RSWT6025.....	25 AAC	5.5 kW / 7.5 HP	11 kW / 10 HP	11 kW / 15 HP	20 kW / 20 HP
RSWT6032.....	32 AAC	9 kW / 10 HP	15kW / 15 HP	18.5kW / 20 HP	22 kW / 30 HP
RSWT6037.....	37 AAC	9 kW / 10 HP	20 kW / 20 HP	22 kW / 25 HP	30 kW / 30 HP
RSWT6045.....	45 AAC	11 kW / 15 HP	22 kW / 25 HP	22 kW / 30 HP	37 kW / 40 HP
RSWT6055.....	55 AAC	15 kW / 20 HP	30 kW / 30 HP	30 kW / 40 HP	45 kW / 50 HP
RSWT6070.....	70 AAC	20 kW / 25 HP	37 kW / 40 HP	45 kW / 50 HP	55 kW / 60 HP
RSWT6090.....	90 AAC	22 kW / 30 HP	45 kW / 50 HP	55 kW / 60 HP	75 kW / 75 HP

\* For RSWT6016.. version overload protection is only available up to 16AAC.



Accessories

RFCG (Finger Guards)



Ordering Key **RFCG X6**

Finger/ cable guards \_\_\_\_\_  
6 pcs per box \_\_\_\_\_

- For RSWT...32 to RSWT...90 models only

RFAN (Cooling Fans)



Ordering Key **RFAN -75 -40 12 X1**

Cooling fan \_\_\_\_\_  
Accessory for RSWT..xx (where xx = 45, 55) \_\_\_\_\_  
40 x 40mm \_\_\_\_\_  
Supply: 12VDC (internally supplied) \_\_\_\_\_  
1 pc per box \_\_\_\_\_

Ordering Key **RFAN -120 -40 12 X2**

Cooling fan \_\_\_\_\_  
Accessory for RSWT..xx (where xx = 70,90) \_\_\_\_\_  
40 x 40 mm (size of each fan) \_\_\_\_\_  
Supply: 12VDC (internally supplied) \_\_\_\_\_  
2pcs per box \_\_\_\_\_



## Accessories

### GMS (Manual Motor Starters)



**GMS32H**

#### Ordering Key

**GMS-32H-17A**

Type \_\_\_\_\_  
 H: High breaking capacity  
 Rated operational current \_\_\_\_\_

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



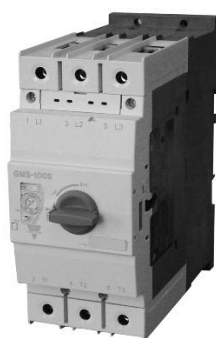
**GMS63H**

#### Ordering Key

**GMS-63H-32A**

Type \_\_\_\_\_  
 H: High breaking capacity  
 Rated operational current \_\_\_\_\_

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



**GMS100S**

#### Ordering Key

**GMS-100S-100A**

Type \_\_\_\_\_  
 S: Standard breaking capacity  
 Rated operational current \_\_\_\_\_

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