# Soft Starter
# Centrifugal Pump and Ventilator Soft Starter Series
# Type RSWT

**CARLO GAVAZZI**



- Optimised algorithm for centrifugal pumps and ventilators
- 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

## Product Description

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

Through a dedicated self-learning algorithm, the RSWT manages to achieve a very smooth starting and stopping performance 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 includes an overload protection (Class 10) and soft-starting and soft-stopping times can be set independently for a finer 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 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. 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.

Additionally, RSWT series is also equipped with two output relays for alarm (Normally closed - NC) and top of ramp (Normally Open - NO) indication. RSWT...32 up to RSWT...90 are also equipped with a run relay.

Note:
(1) 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

Pump and ventilator soft starter
Operational Voltage
Operational Current
Control Voltage
Supply Voltage
Options
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 1 1 0

Pump and ventilator soft starter
Operational Voltage
Operational Current
Control Voltage
Supply Voltage
Options
Overload protection
PTC input
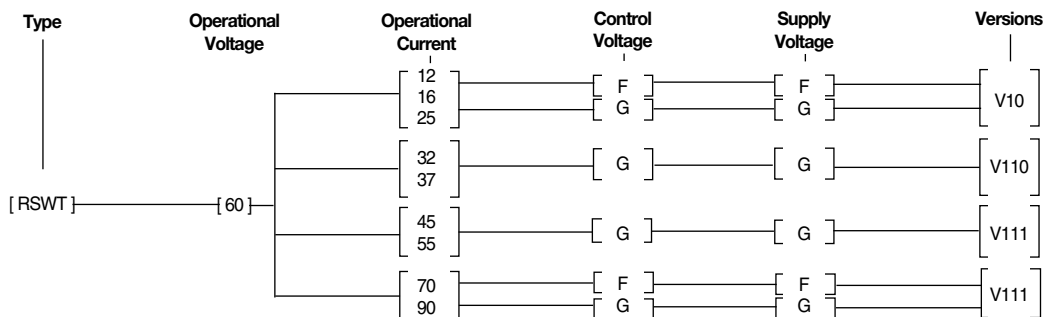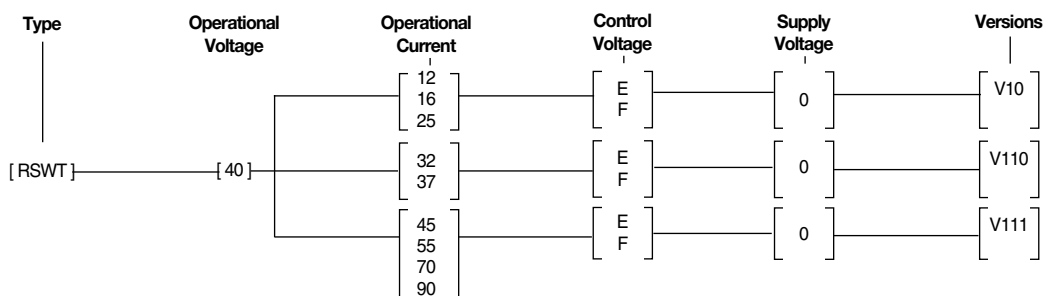  1: PTC input
Cooling method
  0: Natural convection
  1: Cooling fan

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

**CARLO GAVAZZI**

## Type Selection

| Type | Operational Voltage Ue | Rated Operational Current Ie @ 40°C | Control Voltage Uc | Supply Voltage Us | Options |
|---|---|---|---|---|---|
| **RSWT:**<br>Pump and ventilator soft starter | 40: 220 – 400 VAC +10% -15%<br><br>60: 220 – 600 VAC +10% -15% | 12: 12 Arms<br>16: 16 Arms<br>25: 25 Arms<br>32: 32 Arms<br>37: 37 Arms<br>45: 45 Arms<br>55: 55 Arms<br>70: 70 Arms<br>90: 90 Arms | E: 110 – 400 VAC +10% -15%<br><br>F: 24VAC/DC +10% -10%<br><br>G: 100 – 240VAC +10% -15% | 0: Internally supplied<br><br>F: 24VAC/DC +10% -10%<br><br>G: 100 – 240VAC +10% -15% | V10, V110: Overload protection<br>V111: Overload protection + Fan |

| Type | Operational Voltage | Operational Current | Control Voltage | Supply Voltage | Versions |
|---|---|---|---|---|---|
| [ RSWT ] | { 40 } | 12<br>16<br>25 | E<br>F | 0 | V10 |
| | | 32<br>37 | E<br>F | 0 | V110 |
| | | 45<br>55<br>70<br>90 | E<br>F | 0 | V111 |

| Type | Operational Voltage | Operational Current | Control Voltage | Supply Voltage | Versions |
|---|---|---|---|---|---|
| [ RSWT ] | { 60 } | 12<br>16<br>25 | F<br>G | F<br>G | V10 |
| | | 32<br>37 | G | G | V110 |
| | | 45<br>55 | G | G | V111 |
| | | 70<br>90 | F<br>G | F<br>G | V111 |

Specifications are subject to change without notice (11.08.2016)

**CARLO GAVAZZI**

# Selection Guide

| Operational Voltage Ue | Control Voltage Uc | Supply Voltage Us | Rated Operational current Ie | | |
|---|---|---|---|---|---|
| **Housing 1 (45mm)** | | | **12Arms** | **16Arms** | **25Arms** |
| 220 - 400 VAC | 110 - 400VAC | Internally Supplied | RSWT4012E0V10 | RSWT4016E0V10 | RSWT4025E0V10 |
| | 24VAC/DC | | RSWT4012F0V10 | RSWT4016F0V10 | RSWT4025F0V10 |
| 220 - 600 VAC | 24VAC/DC | 24VAC/DC | RSWT6012FFV10 | RSWT6016FFV10 | RSWT6025FFV10 |
| | 100 - 240VAC | 100 - 240VAC | RSWT6012GGV10 | RSWT6016GGV10 | RSWT6025GGV10 |

| Operational Voltage Ue | Control Voltage Uc | Supply Voltage Us | Rated Operational current Ie | | | |
|---|---|---|---|---|---|---|
| **Housing 2 (75mm)** | | | **32Arms** | **37Arms** | **45Arms** | **55Arms** |
| 220 - 400 VAC | 110 - 400VAC | Internally Supplied | RSWT4032E0V110 | RSWT4037E0V110 | RSWT4045E0V111 | RSWT4055E0V111 |
| | 24VAC/DC | | RSWT4032F0V110 | RSWT4037F0V110 | RSWT4045F0V111 | RSWT4055F0V111 |
| 220 - 600 VAC | 100 - 240VAC | 100 - 240VAC | RSWT6032GGV110 | RSWT6037GGV110 | RSWT6045GGV111 | RSWT6055GGV111 |

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

| Operational Voltage Ue | Control Voltage Uc | Supply Voltage Us | Rated Operational current Ie | |
|---|---|---|---|---|
| **Housing 3 (120mm)** | | | **70Arms** | **90Arms** |
| 220 - 400 VAC | 110 - 400VAC | Internally Supplied | RSWT4070E0V111 | RSWT4090E0V111 |
| | 24VAC/DC | | RSWT4070F0V111 | RSWT4090F0V111 |
| 220 - 600 VAC | 24VAC/DC | 24VAC/DC | RSWT6070FFV111 | RSWT6090FFV111 |
| | 100 - 240VAC | 100 - 240VAC | RSWT6070GGV111 | RSWT6090GGV111 |

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

**CARLO GAVAZZI**

# General Specifications

| Ramp-up time | 1…20s |
|---|---|
| Ramp-down time | 0...20s |
| Full load current (FLC) range setting | |
| RSWT..12..V10 | 6 ...12 |
| RSWT..16..V10 | 10 ...16 |
| RSWT..25..V10 | 13 ... 25 |
| RSWT..32..V110 | 20 ... 32 |
| RSWT..37..V110 | 25 ... 37 |
| RSWT..45..V111 | 33 ... 45 |
| RSWT..55..V111 | 43 ... 55 |
| RSWT..70..V111 | 52 ... 70 |
| RSWT..90..V111 | 66 ... 90 |

| Status Indication LEDs | |
|---|---|
| Power Supply ON | Green LED |
| Ramping/Bypass | Yellow LED |
| Alarm | Red LED |
| Auto/ Manual reset of alarms | Yellow LED |
| | |
| Vibration | Acc. To IEC60068-2-6 |
| Frequency 1 | 2 [+3/-0]Hz to 25Hz |
| | Displacement +/- 1.6mm |
| Frequency 2 | 25Hz to 100Hz @ 2g |
| | (19.96m/s$^2$) |

# 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).

Specifications are subject to change without notice (11.08.2016)

**CARLO GAVAZZI**

## Output Specifications

| | RSWT..12.... | RSWT..16.... | RSWT..25.... | RSWT..32.... | RSWT..37.... |
|---|---|---|---|---|---|
| Overload cycle acc. to EN/IEC 60947-4-2 @ 40˚C surrounding temperature | 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 | | | 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 |

| | RSWT..45.... | RSWT..55.... | RSWT..70.... | RSWT..90.... |
|---|---|---|---|---|
| Overload cycle acc. to EN/IEC 60947-4-2 @ 40˚C surrounding temperature | 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 | 20 | | | |
| 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 40ºC 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.
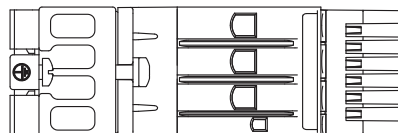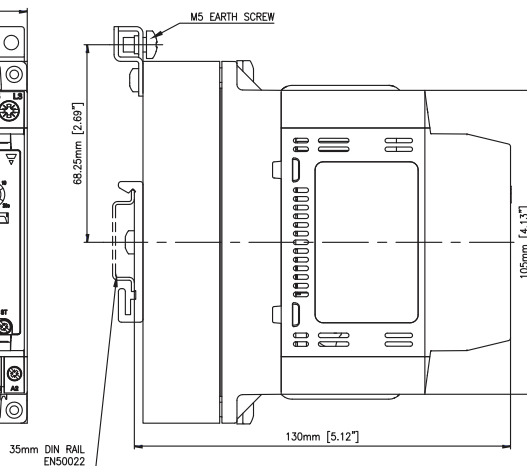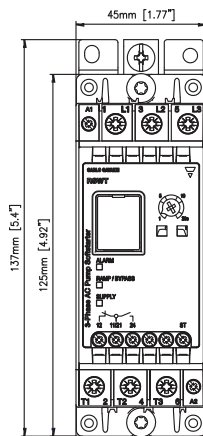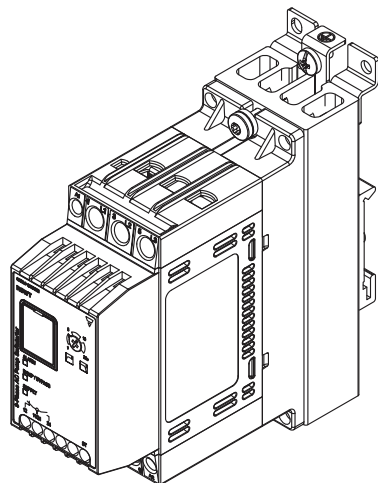
## Environmental Specifications

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

## Supply Specifications
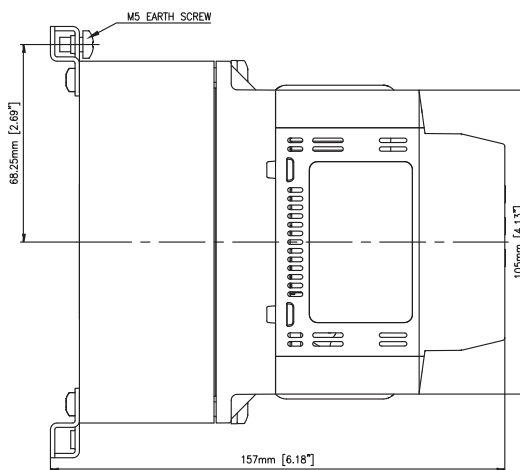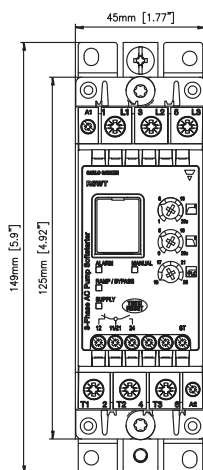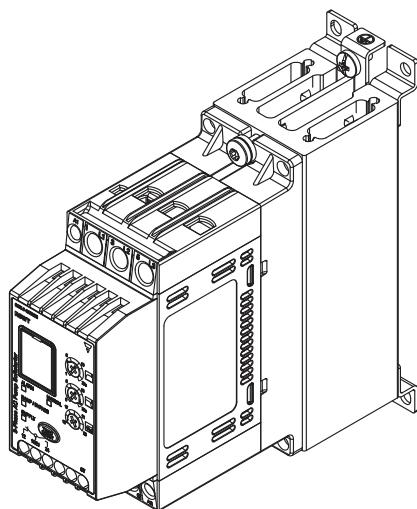
| | RSWT40.. | RSWT60.. |
|---|---|---|
| Operational Voltage Range | 187 – 440 VACrms | 187 – 660 VACrms |
| Supply Current at idle | < 30 mAAC | < 30 mAAC |
| Blocking Voltage | 1200 Vp | 1600 Vp |
| Rated AC frequency | 50/60 Hz +/-10% | |
| Rated Insulation Voltage | 630 VAC | 690 VAC |
| Dielectric 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**



45mm [1.77"]
137mm [5.4"]
125mm [4.92"]
68.25mm [2.69"]
M5 EARTH SCREW
105mm [4.13"]
130mm [5.12"]
35mm DIN RAIL EN50022

**RSWT..25.. models**



45mm [1.77"]
149mm [5.9"]
125mm [4.92"]
68.25mm [2.69"]
M5 EARTH SCREW
105mm [4.13"]
157mm [6.18"]

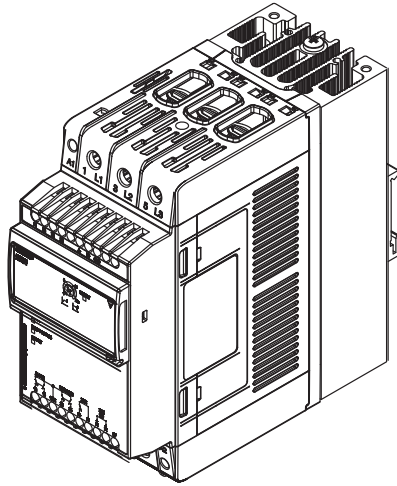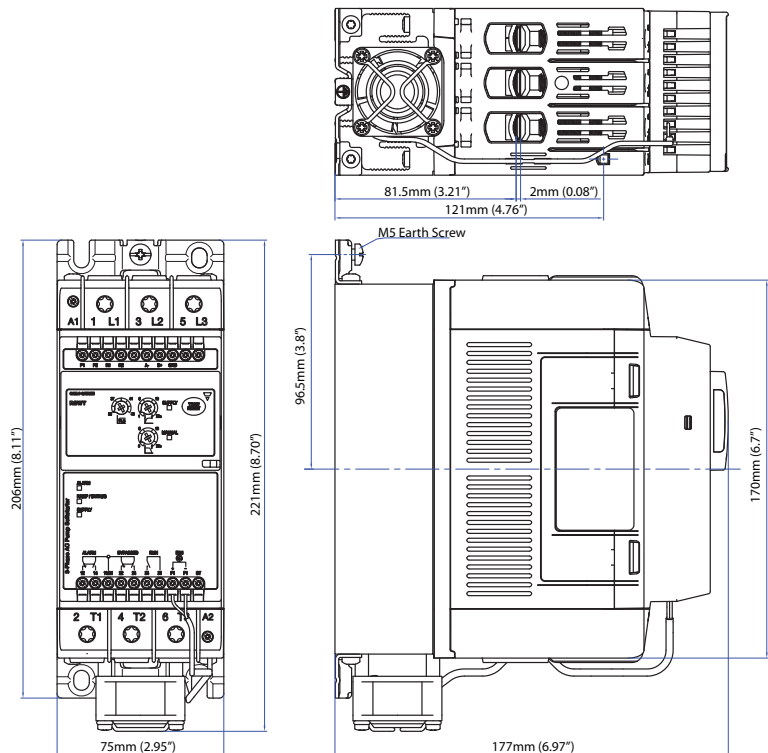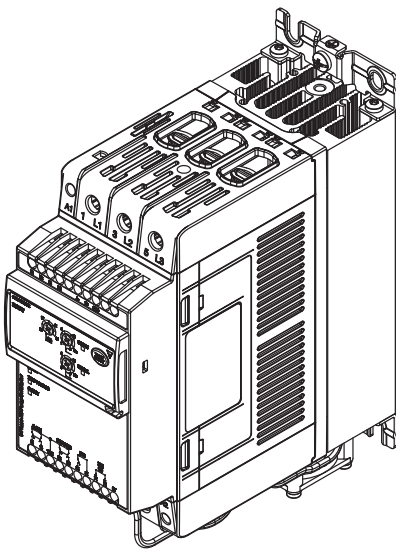Specifications are subject to change without notice (11.08.2016)

**CARLO GAVAZZI**
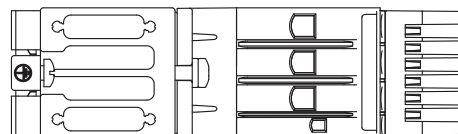
# Dimensions

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



81.5mm (3.21") · 2mm (0.08")
121mm (4.76")

35mmm DIN Rail - EN50022 · Earth Screw
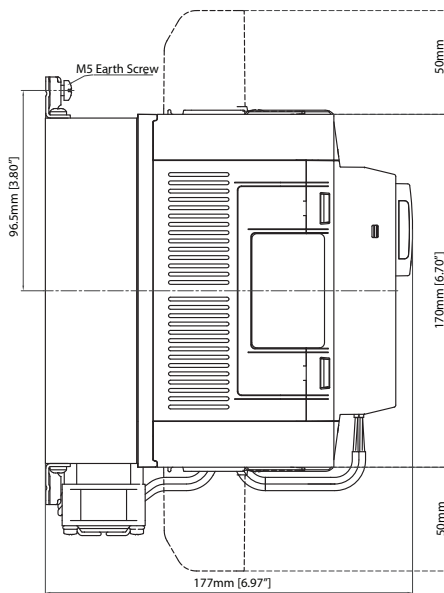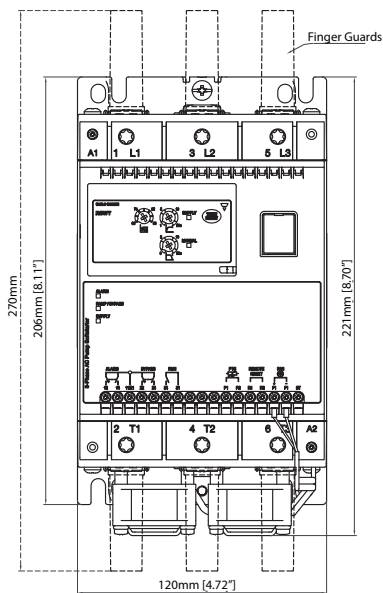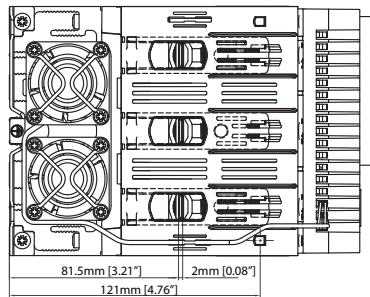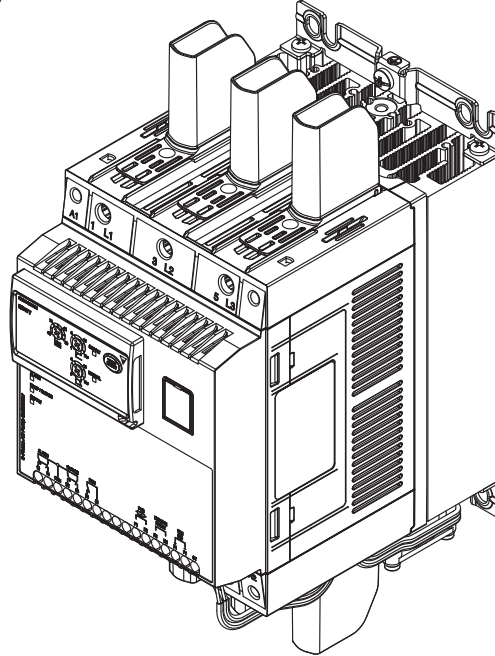
170mm (6.7") · 170mm (6.7")

75mm (2.95") · 180mm (7.08")
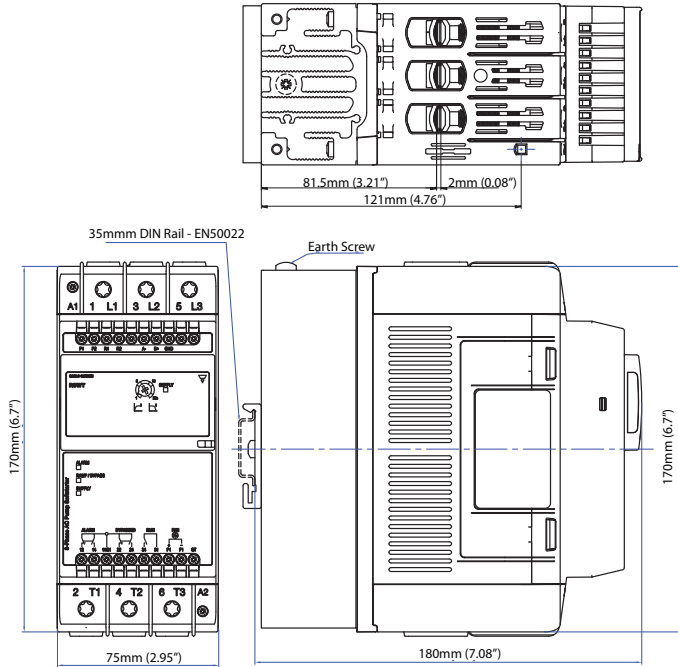
**RSWT..45V... to RSWT..55V..... models (Panel mount)**



81.5mm (3.21") · 2mm (0.08")
121mm (4.76")

M5 Earth Screw

96.5mm (3.8") · 170mm (6.7")

206mm (8.11") · 221mm (8.70")

75mm (2.95") · 177mm (6.97")

CARLO GAVAZZI

# Dimensions

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



Finger Guards

81.5mm [3.21"]
2mm [0.08"]
121mm [4.76"]

M5 Earth Screw

50mm
7mm [0.28"]
100mm [3.94"]
80mm [3.15"]

270mm
206mm [8.11"]
221mm [8.70"]

96.5mm [3.80"]

170mm [6.70"]
188mm [7.40"]

A1 1 L1    3 L2    5 L3

2 T1    4 T2    6 A2

50mm
7mm [0.28"]
100mm [3.94"]

120mm [4.72"]
177mm [6.97"]
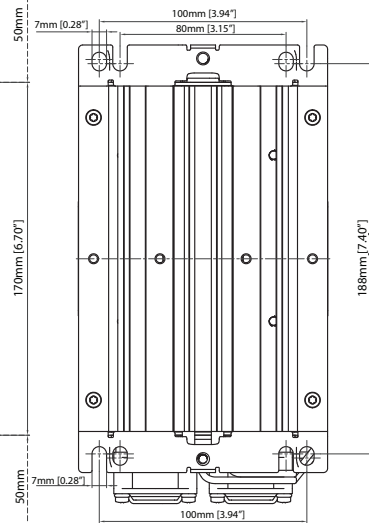
Note: Finger guards shown in the image are optional accessories (ordering code: RFCGx6)

**CARLO GAVAZZI**

# Dimensions

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



81.5mm [3.21"]  2mm [0.08"]

121mm [4.76"]

35mm DIN RAIL
EN50022

M5 Earth Screw

205mm [8.07"]

170mm [6.7"]

120mm [4.72"]

180mm [7.08"]

**CARLO GAVAZZI**
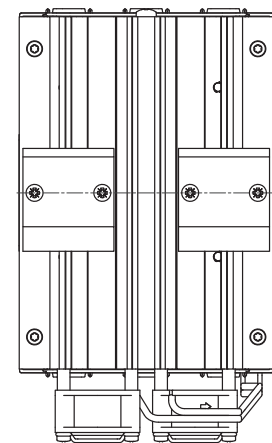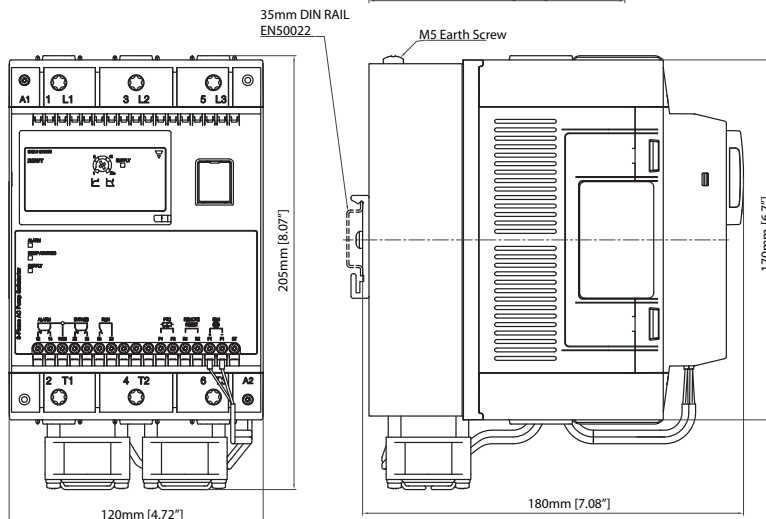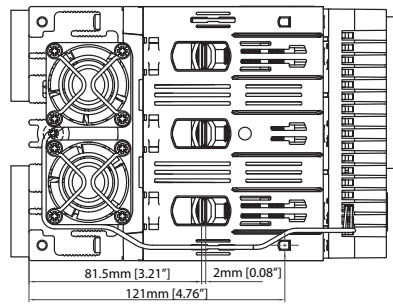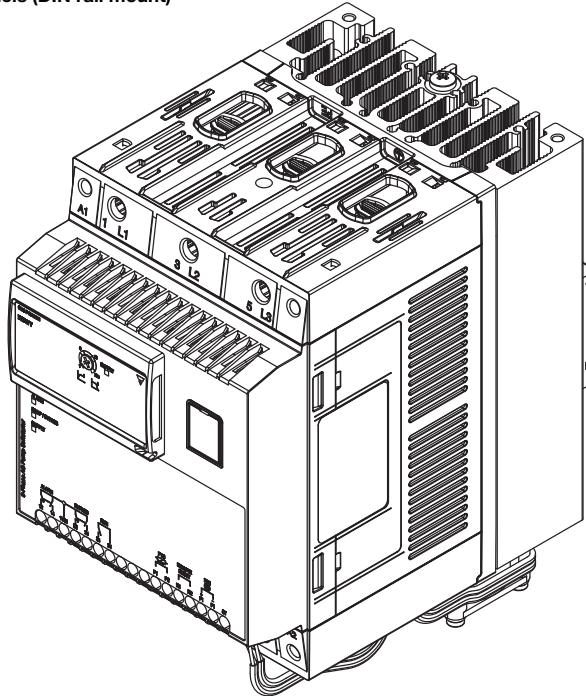
# Connection Specifications

| | RSWT...12 to RSWT...25 | RSWT...32 to RSWT...90 |
|---|---|---|
| **Line conductors**<br>1 L1, 3 L2, 5 L3, 2 T1, 4 T2, 6 T3<br>Acc. to EN60947-1 | | |
|    Flexible | 2.5 ….. 10 mm²<br>2.5 ….. 2 x 4 mm² | - |
|    Rigid (solid or stranded) | 2.5 ….. 10 mm² | 2x(10...50 mm²) |
|    Flexible with end sleeve<br>   (ferrule) | 2.5 ….. 10 mm² | 2x(10...50 mm²) |
| 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 |
| **Secondary conductors**<br>A1, A2<br>Acc. to EN60998 | | |
|    Flexible | 0.5 ….. 1.5 mm² | 0.5 ... 1.5 mm² |
|    Rigid (solid or stranded) | 0.5 ….. 2.5 mm² | 0.5 ... 2.5 mm² |
|    Flexible with end sleeve<br>   (ferrule) | 0.5 ….. 1.5 mm² | 0.5 ... 1.5 mm² |
| 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 |
| **Auxiliary conductors**<br>11, 12, 21, 24, (31, 34)*, ST | | |
|    Rigid (solid or stranded) | 0.05 ... 2.5 mm² | 0.05 ... 2.5 mm² |
|    Flexible with end sleeve (ferrule) | 0.05 ... 1.5 mm² | 0.05 ... 1.5 mm² |
| UL/cUL rated data<br>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<br>11, 12, 21, 24, (31, 34)*, ST | M3 | M3 |
| Max. tightening torque<br>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 75ºC Copper (Cu) conductors

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

**RSWT**

CARLO GAVAZZI

# Terminal Markings

RSWT40...V10

RSWT60...V10



| 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) |

CARLO GAVAZZI

# Terminal Markings

**RSWT..32.V11. to RSWT..55.V11.**
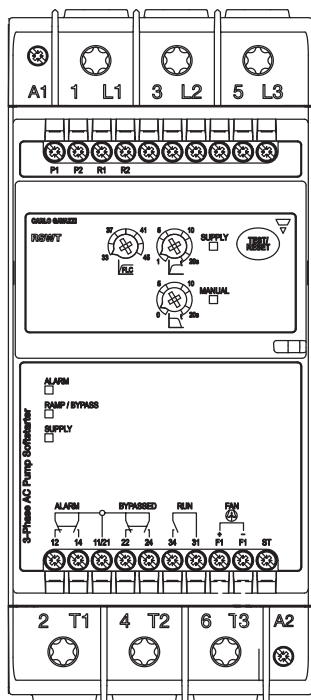
**RSWT..70.V111 to RSWT..90.V111**
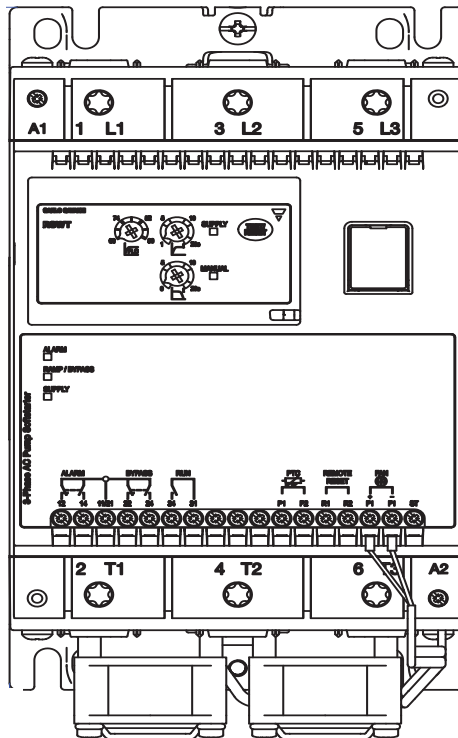


| | |
|---|---|
| **1L1, 3L2, 5L3:** | Line connections |
| **2T1, 4T2, 6T3:** | Load connections |
| **A1, A2:** | Control voltage (Supply voltage for RSWT60 models) |
| **11, 12, 14:** | Alarm indication (NO, NC, changeover) |
| **21, 22, 24:** | Top of Ramp indication (NO, NC, changeover) |
| **31, 34:** | Run relay indication(NO, normally open) |
| **$F_1^+$, $F_1^-$:** | Cooling fan connection** |
| **$P_1$, $P_2$:** | PTC connection |
| **$R_1$ $R_2$ :** | Remote reset connection |
| **ST*:** | Control voltage (start signal) |

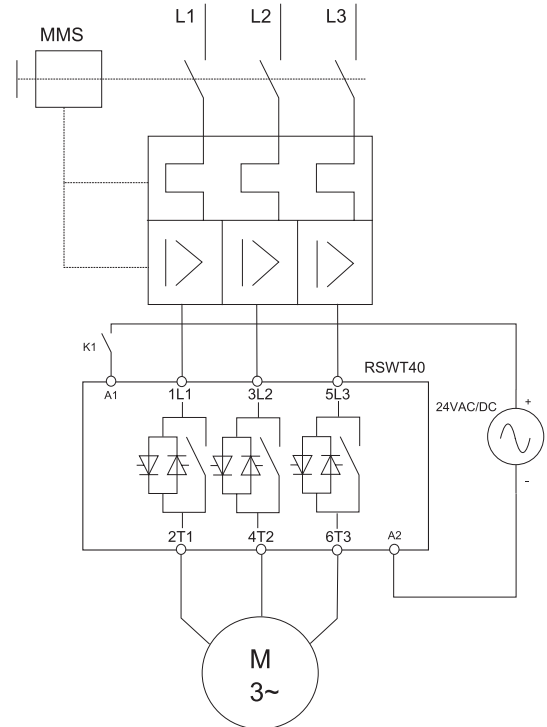\* only for RSWT60.. models
\*\* only for RSWT..V111 models

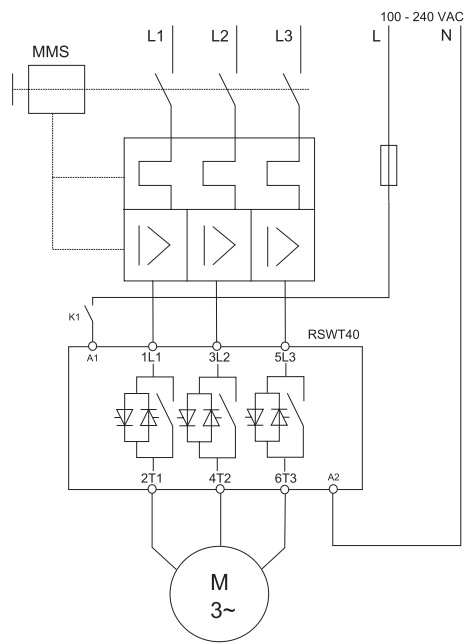Note: The same terminal markings apply for RSWT..70, RSWT..90 models.

# Wiring Diagrams

**Valid up to 400VAC**
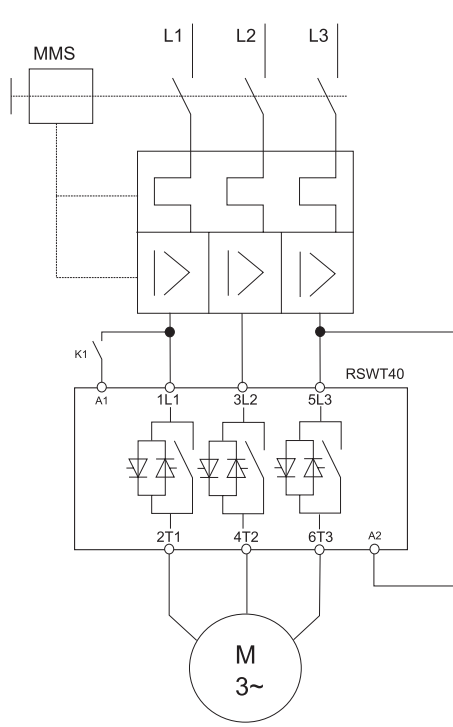
**RSWT40...E0V..**

**RSWT40...F0V..**

**RSWT40...E0V..**

# Wiring Diagrams (cont.)

IMPORTANT: L1, L2, L3 should already be connected when $A_1$, $A_2$ and ST signals are applied. A minimum delay of 200ms should be allowed between switching of L1, L2, L3 and $A_1$, $A_2$ and ST respectively. If L1, L2 and L3 are not present, when $A_1$, $A_2$ 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).
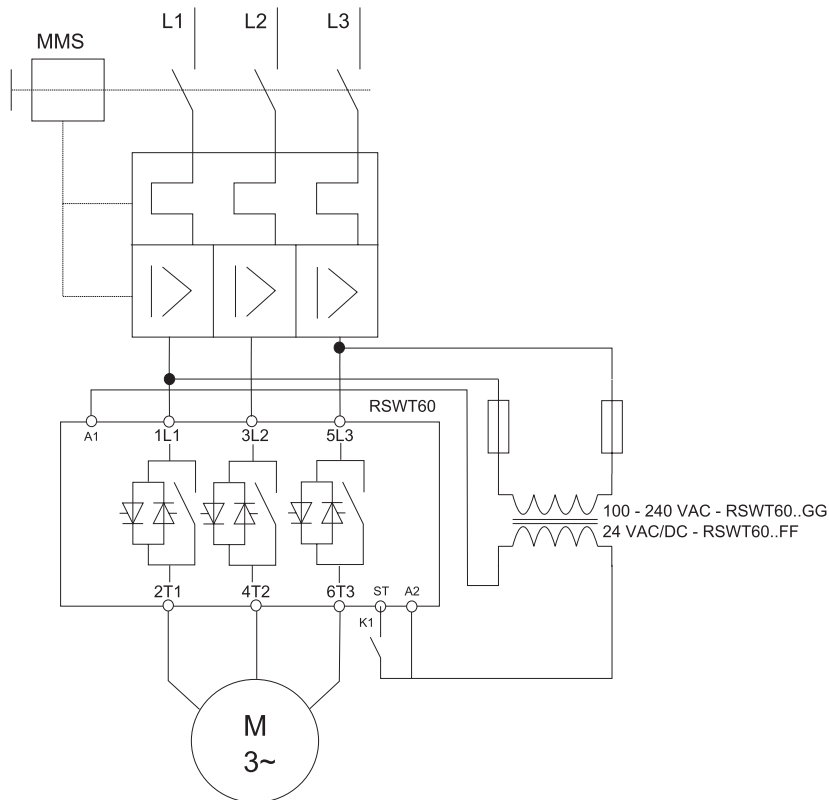


**RSWT60...FFV../ RSWT60...GG..**

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) |

CARLO GAVAZZI

# 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, 250VAC |
| | 3A, 30VDC | 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, 250VAC |
| | 3A, 30VDC | 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 | Radiated Radio Frequency Immunity 3V/m, 80 - 1000 MHz | IEC/EN 61000-4-3 Performance Criteria 1 |
| Electrostatic Discharge (ESD) | | Conducted Radio Frequency Immunity | IEC/EN 61000-4-6 |
| Immunity | IEC/EN 61000-4-2 | | |
| Air discharge, 8kV | Performance Criteria 2 | 10V/m, 0.15 - 80 MHz | Performance Criteria 1 |
| Contact, 4kV | Performance Criteria 2 | Voltage Dips Immunity | IEC/EN 61000-4-11 |
| Electrical Fast Transient | | 0% for 10ms/20ms, | Performance Criteria 2 |
| (Burst) Immunity | IEC/EN 61000-4-4 | 40% for 200ms | Performance Criteria 2 |
| Output: 2kV | Performance Criteria 2 | 70% for 500ms | Performance Criteria 2 |
| Input: 1kV | Performance Criteria 2 | Emission | IEC/EN 61000-6-3 |
| Electrical Surge Immunity | IEC/EN 61000-4-5 | Radio Interference field emission (Radiated) | IEC/EN 55011 |
| Output, line to line, 1kV | Performance Criteria 2 | 30 - 1000MHz | Class A (Industrial) |
| Output, line to earth, 2kV | Performance Criteria 2 | Radio interference field emissions (conducted) | IEC/EN 55011 Class A (Industrial) |
| Input, line to line, 1kV | Performance Criteria 2 | | |
| Input, line to earth, 2kV | Performance Criteria 2 | | |

# Agency Approvals and Conformances

| **Conformance** | EN/IEC 60947-4-2 |
| | UL508 Listed (E172877) |
| | cUL Listed (E172877) |
| | CCC, pending |

c UL us LISTED  C E

CARLO GAVAZZI

# Soft Starter Setting Procedure

**RSWT...V10/ V110/ V111**



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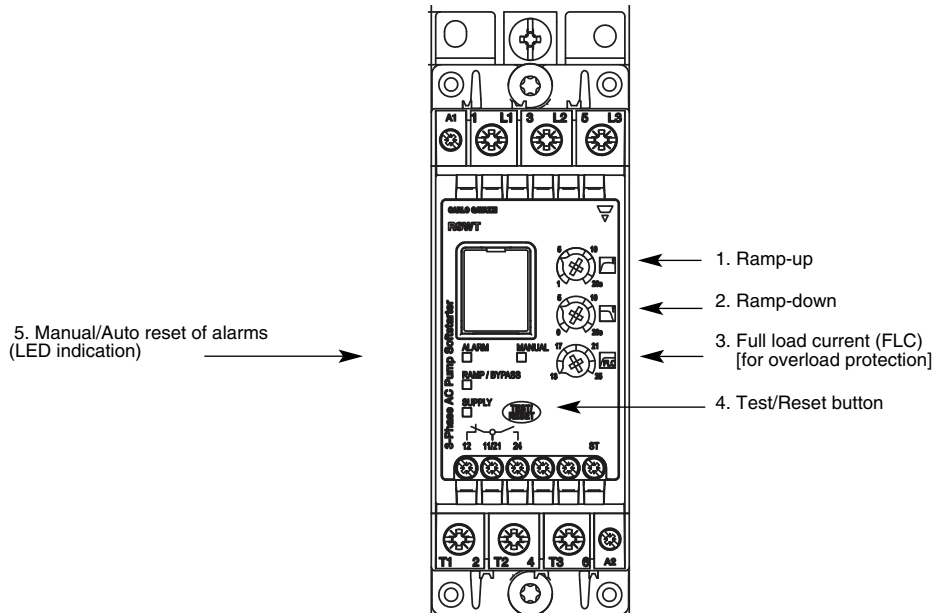
The RSWT…V10/ V110/ V111 soft starter series features 3-knob settings and an additional push button to test the overload protection, reset the alarms and for setting the alarm recovery to Manual or Auto.

**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.

---

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.

---

**CARLO GAVAZZI**

# Mode of Operation

**Starting Method**
The RSWT series of soft starters is based on a current ramp starting methodology to limit the motor 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 start. The algorithm makes use of the internal current and voltage measurement circuits to detect when the motor 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.

**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.
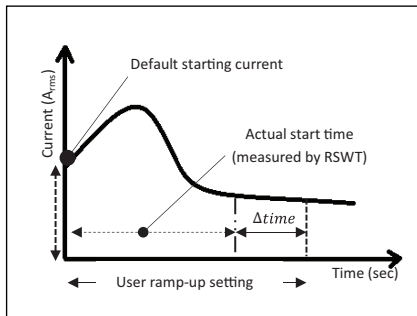


**Start 1**: RSWT starts from default starting voltage/torque (internal) value. The pump start time can be shorter/longer than user ramp-up setting.
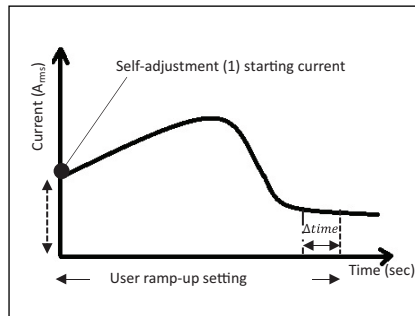
**Start 2**: During the 2nd start, the RSWT will start with the "self-learned" start parameters (from the previous start) to reduce the difference between the user-set ramp-time vs the actual ramp-time measured by the RSWT ( Δ time).
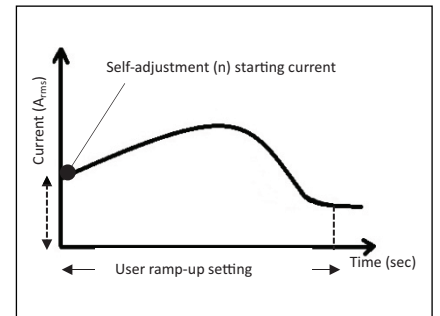
**Start n**: For the nth start, the RSWT algorithm will keep the ramp-time as close as possible to the user set-ramp time. The self-adjusting algorithm will remain active at every start to make sure that the RSWT adapts the starting parameters to any load changes.

Note: During motor starting, the RSWT will limit the current to a maximum of 3.5xFLC setting.

CARLO GAVAZZI

# 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…V10/RSWT….V11. the user can select whether to have an auto-reset or manual reset of 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)
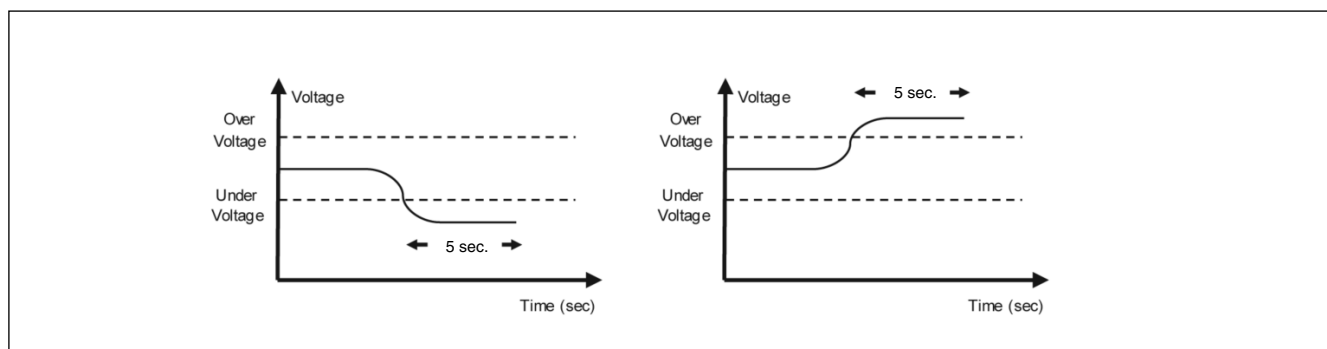


At every power-up the RSWT automatically detects the supply voltage level and determines whether it is working on a 220, 400, 480* or 600* V supply. The under- or over- voltage alarm level is then set at a level of -20% and + 20% (from the measured supply voltage level) respectively. If the supply voltage 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 of 8xFLC setting for 100msec is detected, the RSWT will issue the locked rotor alarm (5 flashes).

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

**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 > Imax bypass. If this condition is detected, the alarm will be triggered. If during bypass state, the measured current by RSWT is > Imax 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.

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 x Ie
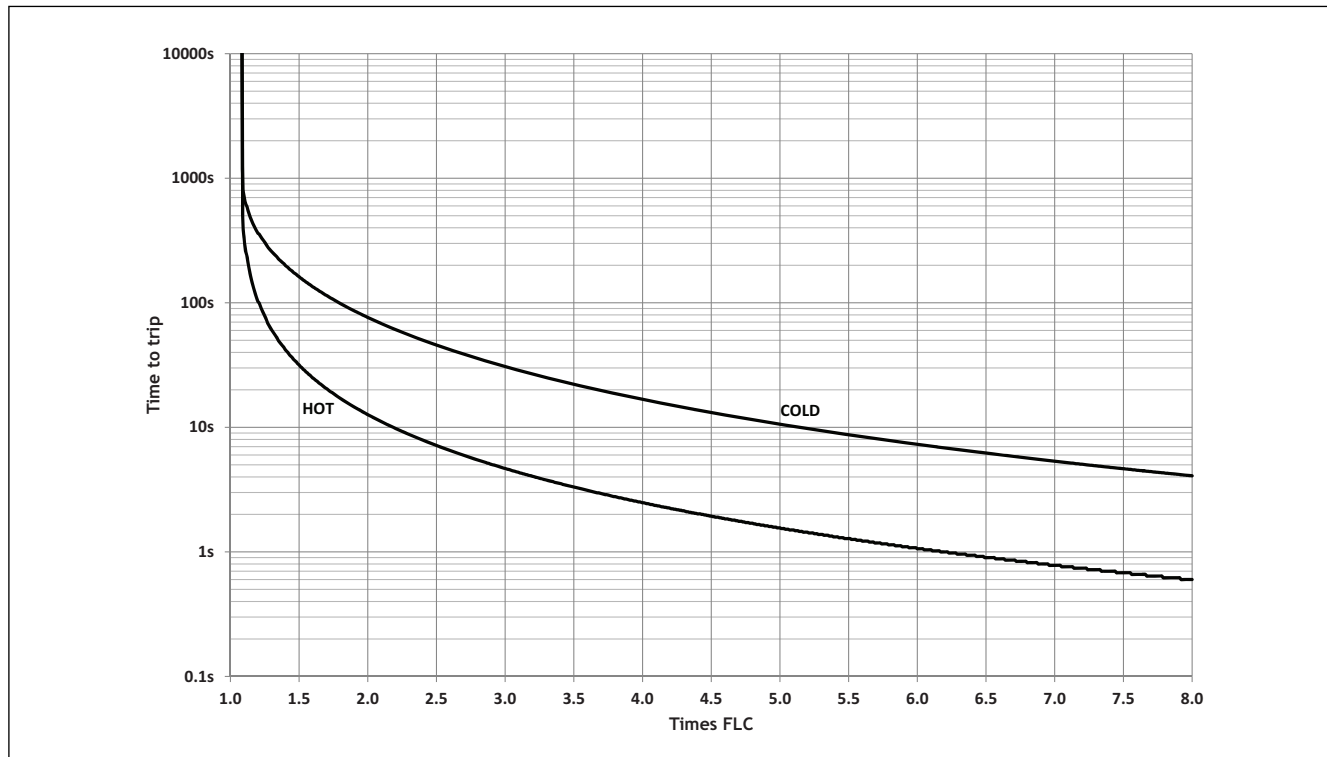
**Motor Overheat Protection**

| Motor PTC connection | P1:P2 |
|---|---|

**PTC Resistance**

| < 500Ω | No Trip: | Normal Running |
|---|---|---|
| > 1000Ω | Trip: | Overload Alarm (8 flashes) & Alarm Relay Activated |
| < 300Ω | Reset | |

**CARLO GAVAZZI**

# 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 >=5sec 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.

**CARLO GAVAZZI**

## LED Indications, Relay Contact Position

| Green LED (Supply) | Yellow LED (Ramp/Bypass) | Red LED (Alarm) | Yellow LED (MANUAL) [1] | 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) [2,3]

| Flashes | Description of Fault | Yellow LED (Manual) [1] | Action [1] |
|---|---|---|---|
| 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 |
| 7 | Over Temperature | OFF | Auto reset (recovery time depends on the cool-down time of the RSWT) [1] |
| | | 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) [1] |
| | | 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. 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.

2. Remote reset of alarms can be performed by shorting terminals R1 and R2 for a minimum of 2 seconds. 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.

3. 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$^2$, for products rated 32, 37, 45, 55A the maximum cross-sectional area shall be of 16mm$^2$ and for products rated 70, 90A this shall be of a maximum of 50mm$^2$.

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

Specifications are subject to change without notice (11.08.2016)

**CARLO GAVAZZI**

# 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.

CARLO GAVAZZI

# 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