# Soft Starter (SMC 33 / three controlled phases)

- Rated operational voltage up to 480 VAC 50/60Hz
- Rated operational current up to 86A (inside delta DBP)
- Output signal for By-Pass and Start/Stop
- Ramp Up and Down time adjustable
- Initial Torque adjustable with kick start
- Wide control voltage range
- Meets EN 60947-4-2 requirements
- High number of start/stop operations pr. hour. See data.

## Item selection and technical specifications (see also motor table at page 11)

| Load ratings<br>[1]Inside delta configuration | Item number by 208-240VAC 50/60Hz Line Voltage | Item number by 400-480VAC 50/60Hz Line Voltage | Item number by 550-600VAC 50/60Hz Line Voltage | Ramp-Up / Down adjustment | Torque adjustment | Module-width |
|---|---|---|---|---|---|---|
| 15A AC-53a | | SMC 33 DA 4015 | | Ramp-up time 0.5 - 30 sec.<br>Ramp-down time 0.5 - 60 sec. | 0- 85% adjustable of norminal torque with selectable kick start 200ms (break loose function) | 90 mm |
| 15A AC-53a no by-pass | | SMC 33 DA 4025BP | | | | 90 mm |
| 27A AC-53b w. by-pass | | SMC 33 DA 4025BP | | | | 90 mm |
| 35A AC-53a no by-pass | | SMC 33 DA 4050BP* | | | | 180 mm |
| 50A AC-53b w. by-pass | | SMC 33 DA 4050BP* | | | | 180 mm |
| **Items for Inside delta configuration** | | | | | | |
| [1]25A AC-53a no by-pass | | SMC 33 DA 4040DBP | | | | 90 mm |
| [1]43A AC-53b w. by-pass | | SMC 33 DA 4040DBP | | | | 90 mm |
| [1]60A AC-53a no by-pass | | SMC 33 DA 4085DBP* | | | | 180 mm |
| [1]86A AC-53b w. by-pass | | SMC 33 DA 4085DBP* | | | | 180 mm |

## Load specified with utilisation category AC-53a

SMC 33 DA XXXX **BP** AC-53a: No by-pass contactors is nessesary during running, shall be connected as inline confirguration

SMC 33 DA XXXX **DBP** AC-53a: No by-pass contactors is nessesary but motor shall be connected in an inside-delta confirguration

## Load specified with utilisation category AC53b

SMC 33 DA XXXX **BP** AC-53b: By-pass contactor shall be used for bypas-sing the soft starter during running, shall be connected as inline confirgu-ration

SMC 33 DA XXXX **DBP** AC-53b: By-pass contactor shall be used and motor connected in an inside-delta configuration

## Output load specification (90mm module) more info page 45

| | |
|---|---|
| Overload current profile AC-53a (without by-pass contactor) | X-Tx:6-5 : 100-120 |
| Overload current profile AC-53b (with by-pass contactor) | X-Tx:5-5 : 30 |
| Overload relay trip class AC-53a/AC53b | 10 or 10A |

Leakage current: 5mA ACmax. | Min. operational current: 50mA

## Output load specification (180mm module) more info page 45

| | |
|---|---|
| Overload current profile AC-53a (without by-pass contactor) | X-Tx:6-6 : 100-120 |
| Overload current profile AC-53b (with by-pass contactor) | X-Tx:6-6 : 30 |
| Overload relay trip class AC-53a/AC53b | 10 or 10A |

Leakage current: 5mA ACmax. | Min. operational current: 50mA

## Control terminal specifications

| | |
|---|---|
| Control voltage by line voltage 208-240VAC **A1-A2** | 24 - 230 VAC/DC |
| Control voltage by line voltage 400-600VAC **A1-A2** | 24 - 480 VAC/DC |
| Pick-up voltage max. | 20.4 VAC/DC |
| Drop-out voltage min. | 5 VAC/DC |
| Max. control current for no operation | 1mA |
| Response time max. | 70msec. |
| Control current / power max. | 15mA / 2VA |

## Auxiliary contacts

**Terminal: 13-14,** AC SCR output for start/stop function,
**Terminal: 23-24,** AC SCR output for connection of by-pass contactor.

**Output specifications for 90mm module:** AC SCR: 0.5A AC-14, AC15 24-230/480V AC 50-60Hz Fusing: gI/gG Max $i^2t$ $72A^2S$

**Output specifications for 180mm module:** AC SCR: 1.0A AC-14, AC15 24-230/480V AC 50-60Hz Fusing: gI/gG Max $i^2t$ $72A^2S$

**Terminal: 11-12,** have no connection with the internal circuit. Can be used in conjunction with a thermal overload protection or for other wiring purposes. See under general technical information.

## Thermal specification

| | |
|---|---|
| Power dissipation for continuous operation PDmax | 3 W/A without BP |
| Power dissipation with semiconductor by-passed | 5 W Max. with BP |
| Cooling method | Natural convection |
| Mounting | Vertical +/-$30^o$ |
| Operating temperature range EN 60947-4-2 | -$5^o$C to $40^o$C |
| Max. operating temperature with current derating | $60^o$C |
| Storage temperature EN 60947-4-2 | -$20^o$C to $80^o$C |

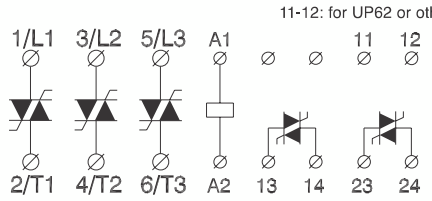
Operation in ambient temperatures exceeding $40^o$C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty-cycle of the soft starter as shown in the table. Max.cycle time 15min.

| By $40^o$C | By $50^o$C | By $60^o$C |
|---|---|---|
| 100% load Duty-cycle 100% | 80% load Duty-cycle max. 0,8 | 70% load Duty-cycle max. 0,65 |

* NOT cUL APPROVED

# Soft Starter (SMC 33 / three controlled phases)

## Wiring specifications (90mm module)

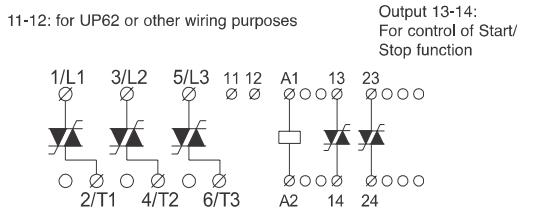



Control voltage A1-A2

Output 13-14:
For control of Start/ Stop function
**Do not include SMC 33 DA XX15**

Output 23-24:
By end of ramp up time for by-pass contactor
**Do not include SMC 33 DA XX15**

## Wiring specifications (180mm module)

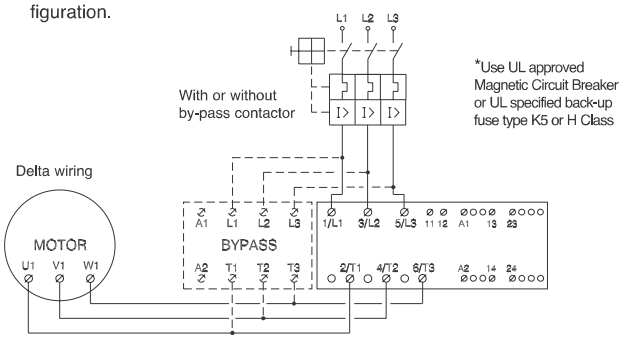



Control voltage A1-A2

Output 23-24:
By end of ramp up time for by-pass contactor

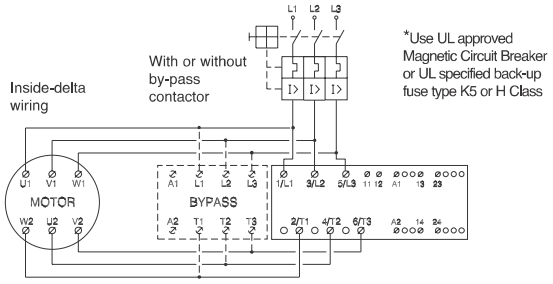
## Wiring information: Delta configuration

Standard wiring of a softstarter to a 3-phase motor in delta configuration.



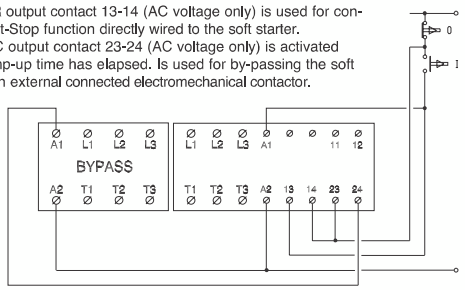

## Wiring information: Inside-delta configuration

Inside-delta wiring of a softstarter to a 3- phase motor.



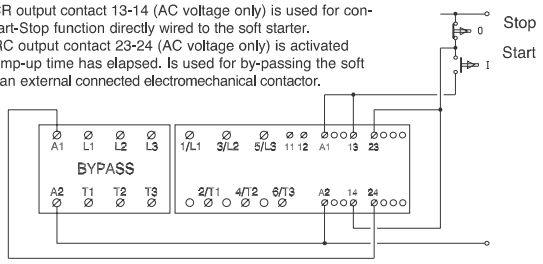

## Wiring example Start/Stop - By-pass (90 mm modul)

Auxiliary SCR output contact 13-14 (AC voltage only) is used for controlling a Start-Stop function directly wired to the soft starter.
Auxiliary SRC output contact 23-24 (AC voltage only) is activated when the ramp-up time has elapsed. Is used for by-passing the soft starter with an external connected electromechanical contactor.




## Wiring example Start/Stop - By-pass (180 mm modul)

Auxiliary SCR output contact 13-14 (AC voltage only) is used for controlling a Start-Stop function directly wired to the soft starter.
Auxiliary SRC output contact 23-24 (AC voltage only) is activated when the ramp-up time has elapsed. Is used for by-passing the soft starter with an external connected electromechanical contactor.




## Short-circuit protection by circuit breaker or fuses

**Two type of short-circuit protection can be used:**
a) Short-circuit protection by circuit breaker.
b) Short-circuit protection by fuses.

Short-circuit protection is divided into 2 levels **Type 1 or Type 2**

**Co-ordination Type1:** Short-circuit protects the installation

**Co-ordination Type 2:** Short-circuit protects the installation and the semiconductors inside the motor controller

**a) Short-circuit protection**
Co-ordination type 1 will be obtained when using magnetic circuit breakers or standard gI/GI fuses.
Co-ordination type 2 will be obtained when using semiconductor fuses. When using semiconductor fuses the SCR will not be damaged due to transients and short circuits. The table indicates suitable fuses for co-ordination type 2 protection.

**b) Short-circuit protection by fuses**

| | |
|---|---|
| Type 1: SMC 33 DA XX15 | Protection max. 50 A gL/gG |
| Type 1: SMC 33 DA XX25 BP | Protection max. 80 A gL/gG |
| Type 1: SMC 33 DA XX40 DBP | Protection max. 80 A gL/gG |
| Type 1: SMC 33 DA XX50 BP | Protection max. 125 A gL/gG |
| Type 1: SMC 33 DA XX85 DBP | Protection max. 125 A gL/gG |
| Type 2: SMC 33 DA XX15 | Protection max. $i^2t$ of the fuse 1800 $A^2S$ |
| Type 2: SMC 33 DA XX25 BP | Protection max. $i^2t$ of the fuse 6300 $A^2S$ |
| Type 2: SMC 33 DA XX40 DBP | Protection max. $i^2t$ of the fuse 6300 $A^2S$ |
| Type 2: SMC 33 DA XX50 BP | Protection max. $i^2t$ of the fuse 25300 $A^2S$ |
| Type 2: SMC 33 DA XX85 DBP | Protection max. $i^2t$ of the fuse 25300 $A^2S$ |

**Fuses from e.g. Ferraz, Siba, Bussmann can be used as short-circuit protection Type 2**

More information concerning Co-ordination Type 2 see page 45

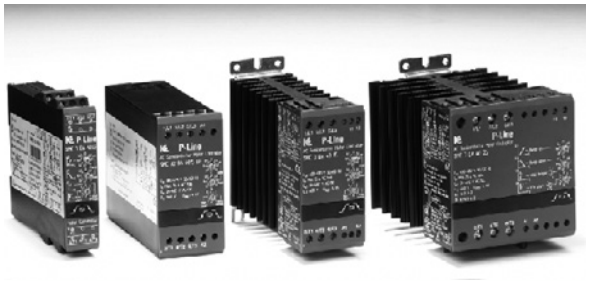
## Approval

cUL Std No. 508 (Not approved SMC 33 DA XX50BP and SMC 33 DA XX85DBP)

## Application, adjustment hints and general specifications

See page 10-11 / 44-45

# Soft Starter (SMC 3 / SMC 32 two controlled phases)



- Rated operational voltage up to 600 VAC 50/60Hz
- Rated operational current up to 25A/30A
- Output signal for By-Pass and Start/Stop
- Ramp Up and Down time adjustable
- Initial Torque adjustable with kick start
- Wide control voltage range
- Meets EN 60947-4-2 requirements
- High number of start/stop operations pr. hour. See data

## Item selection and technical specifications (see also motor table at page 11)

| Load ratings | Item number by 208-240VAC 50/60Hz Line Voltage | Item number by 400-480VAC 50/60Hz Line Voltage | Item number by 550-600VAC 50/60Hz Line Voltage | Ramp-Up / Down adjustment | Torque adjustment | Module-width |
|---|---|---|---|---|---|---|
| **Items with built-in by-pass relays** | | | | | | |
| 3.5A AC-53b | SMC 3 DA 2303 | SMC 3 DA 4003 415V | SMC 3 DA 6003 | | | 22.5mm |
| 3.5A AC-53b | | SMC 3 DA 4803 480V | | | | 22.5mm |
| 15A AC-53b | | SMC 32 DA 4015BP 415V* | | Ramp-up time 0.5 - 10 sec. Ramp-down time 0.5 - 10 sec. | 0- 85% adjustable of norminal torque with selectable kick start 200ms (break loose function) | 45mm |
| 15A AC-53b | | | | | | 45mm |
| **Items for 100% duty-cycle (AC-53a)** | | | | | | |
| 15A AC-53a | SMC 3 DA 2315 | SMC 3 DA 4015 | SMC 3 DA 6015 | | | 45mm |
| 25A AC-53a | SMC 3 DA 2325 | SMC 3 DA 4025 | SMC 3 DA 6025 | | | 90mm |
| 25A AC-53a | SMC 3 DA 2325BP | SMC 3 DA 4025BP | SMC 3 DA 6025BP | Ramp-up / Ramp down time 0.5 - 20 sec. | | 90mm |
| 27A AC-53b w. by-pass | SMC 3 DA 2325BP | SMC 3 DA 4025BP | SMC 3 DA 6025BP | | | 90mm |

## Output current profile

| | | | |
|---|---|---|---|
| **SMC 3 DA XX03 / SMC 32 DA XX15BP AC-53b** | More info. page 45 | **SMC 3 DA XX25BP AC-53a / AC-53b** | More info. page 45 |
| Overload current profile XX03 (with internal by-pass relay) | X-Tx:4-10 : 110 | Overload current profile (without by-pass contactor) | X-Tx:6-5 : 100-120 |
| Overload current profile XX15BP (with internal by-pass relay) | X-Tx:8-3 : 110 | Overload current profile (with by-pass contactor) | X-Tx:5-5 : 30 |
| Overload relay trip class | 10 or 10A | Overload relay trip class | 10 or 10A |
| **SMC 3 DA XX15/25 AC-53a** | More info. page 45 | **SMC 3 DA 4025BP** | |
| Overload current profile | X-Tx:8-3 : 100-3000 | *Note: External by-pass contactor shall be used for bypassing the soft starter during running by 30A/15kW load @400V. | |
| Overload relay trip class | 10 or 10A | | |
| SMC 3: Leakage current: 5mA ACmax. / Min. operational current: 50mA | | SMC 32: Leakage current: 5mA ACmax. / Min. operational current: 50mA | |

## Control voltage specifications

| | |
|---|---|
| Control voltage by line voltage 208-240VAC **A1-A2** | 24 - 230 VAC/DC |
| Control voltage by line voltage 400-600VAC **A1-A2** | 24 - 480 VAC/DC |
| Pick-up voltage max. | 20.4 VAC/DC |
| Drop-out voltage min. | 5 VAC/DC |
| Max. control current for no operation | 1mA |
| Response time max. | 70msec. |
| Control current / power max. | 15mA / 2VA |

## AC auxiliary contacts / SMC 3 DA XX25BP

**Auxiliary specifications:**

**Terminal: 13-14,** AC SCR Output for start/stop function,
**Terminal: 23-24,** AC SCR Output for connection of by-pass contactor.

**Load specifications:** AC SCR: 0.5A AC-14, AC15 24-230/480VAC 50-60Hz
Fusing: gl/gG Max $i^2t$ 72$A^2S$

**General for terminal: 11-12,** have no connection with the internal circuit. Can be used in conjunction with a thermal overload protection or for other wiring purposes. See general technical information.

## Common thermal specifications

| | |
|---|---|
| Power dissipation for continuous operation PDmax | 2 W/A without BP |
| Power dissipation with semiconductor by-passed | 4 W Max. |
| Cooling method | Natural convection |
| Mounting | Vertical +/-30° |
| Operating temperature range EN 60947-4-2 | -5°C to 40°C |
| Max. operating temperature with current derating | 60°C |
| Storage temperature EN 60947-4-2 | -20°C to 80°C |

Operation in ambient temperatures exceeding 40°C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty-cycle of the soft starter as shown in the table. Max.cycle time 15min.
Note: SMC 3 DA XX03 / SMC 32 DA XX15BP see page 45.

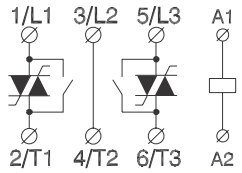
| By 40°C | By 50°C | By 60°C |
|---|---|---|
| 100% load Duty-cycle 100% | 80% load Duty-cycle max. 0.8 | 70% load Duty-cycle max. 0.65 |

* NOT cUL APPROVED

# Soft Starter (SMC 3 / SMC 32 two controlled phases)

## Wiring specifications

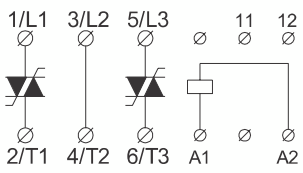
**SMC 3 DA XX03**
**SMC 32 DA XX15BP**




Control voltage A1-A2

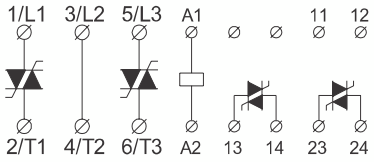
**SMC 3 DA XX15/25**

11-12: for UP62 or other wiring purposes




**SMC 3 DA XX25 BP**

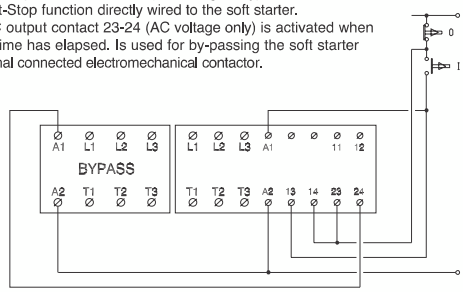
11-12: for UP62 or other wiring purposes




Control voltage A1-A2 | Output 13-14: For control of Start/ Stop function | Output 23-24: By end of ramp up time for by-pass contactor

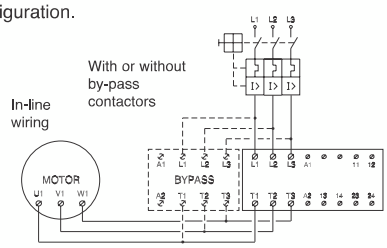
## Wiring example Start/Stop-By-pass (SMC 3 DA XX25 BP)

Auxiliary SCR output contact 13 - 14 (AC voltage only) is used for controlling a Start-Stop function directly wired to the soft starter.
Auxiliary SRC output contact 23-24 (AC voltage only) is activated when the ramp-up time has elapsed. Is used for by-passing the soft starter with an external connected electromechanical contactor.




## Motor wiring with or without by-pass (SMC 3 DA XX25 BP)

Standard wiring of a softstarter to a 3-phase motor in delta configuration.




*Use UL approved Magnetic Circuit Breaker or UL specified back-up fuse type K5 or H Class

## Short-circuit protection by circuit breaker or fuses

**Two type of short-circuit protection can be used:**
a) Short-circuit protection by circuit breaker.
b) Short-circuit protection by fuses.

Short-circuit protection is divided into 2 levels **Type 1 or Type 2**

**Co-ordination Type 1:** Short-circuit protects the installation

**Co-ordination Type 2:** Short-circuit protects the installation and the semiconductors inside the motor controller

**a) Short-circuit protection**
Co-ordination type 1 will be obtained when using magnetic circuit breakers or standard gI/GI fuses.
Co-ordination type 2 will be obtained when using semiconductor fuses. When using semiconductor fuses the SCR will not be damaged due to transients and short circuits. The table indicates suitable fuses for co-ordination type 2 protection.

**b) Short-circuit protection by fuses**

| | |
|---|---|
| Type 1: SMC 3 DA XX03 | Protection max. 25 A. gL/gG |
| Type 1: SMC 32 DA XX15 BP | Protection max. 50 A. gL/gG 63A T |
| Type 1: SMC 3 DA XX15 | Protection max. 50 A. gL/gG 63A T |
| Type 1: SMC 3 DA XX25 | Protection max. 80 A. gL/gG 63A T |
| Type 1: SMC 3 DA XX25 BP | Protection max. 80 A. gL/gG 63A T |

| | |
|---|---|
| Type 2: SMC 3 DA XX03 | Protection max. $i^2t$ of the fuse 72 $A^2S$ |
| Type 2: SMC 32 DA XX15 BP | Protection max. $i^2t$ of the fuse 1800 $A^2S$ |
| Type 2: SMC 3 DA XX15 | Protection max. $i^2t$ of the fuse 1800 $A^2S$ |
| Type 2: SMC 3 DA XX25 | Protection max. $i^2t$ of the fuse 6300 $A^2S$ |
| Type 2: SMC 3 DA XX25 BP | Protection max. $i^2t$ of the fuse 6300 $A^2S$ |

**Fuses from e.g. Ferraz, Siba, Bussmann can be used as short-circuit protection Type 2**

More information concerning Co-ordination Type 2 see page 45

## Approval

cUL Std No. 508 (Not approved SMC 32 DA XX15BP)

## Application, adjustment hints and general specifications

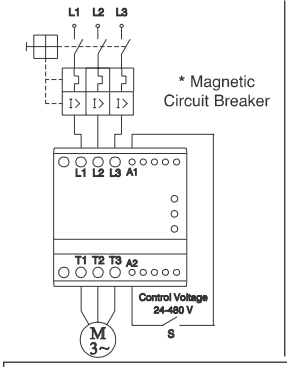
See page 10-11 / 44-45

## Dimensions (see also page 44)

| Type | H | D | W |
|---|---|---|---|
| 22.5 mm module | 94 mm | 123.8 mm | 22.5 mm |
| 45 mm module | 94 mm | 128.1 mm | 45 mm |
| 90 mm module | 94 mm | 128.1 mm | 90 mm |

# Application, adjustment hints and general specifications for SMC 3/32/33

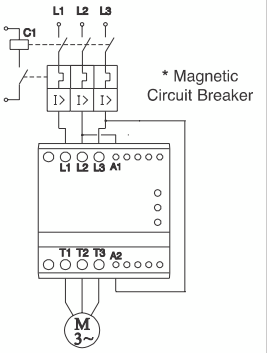
## Input controlled soft-start




When the control input is switched to the ON-state (S closed) the motor controller will soft start the motor according to the settings of the ramp-up time and initial torque adjustments.
When the control input is switched to the Off-state (S open) the motor will be switched Off instantaneously only if the Ramp-Down time is adjusted to 0.
With any other setting the motor will be soft stopped according to the settings of the Ramp-Down time adjustment.

*Use UL approved Magnetic Circuit Breaker or UL specified back-up fuse type K5 or H Class

## Line controlled soft-start

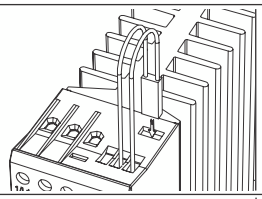



When the contactor C1 is switched to the ON-state, the motor controller will soft start the motor according to the settings of the ramp-up time and initial torque adjustments.
When the contactor C1 is switched to the OFF-state, the motor will be switched Off instantaneously.
In this application the contactor will have no load during making operation. The contactor will carry and break the nominal motor current when switching off.

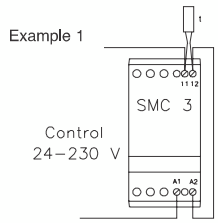
*Use UL approved Magnetic Circuit Breaker or UL specified back-up fuse type K5 or H Class

*UL: Use thermal overload protection as required by the National Electric Code. When protected by a non-time delay K5 or H Class fuse, rated 266% of motor FLA, this device is rated for use on a circuit capable of delivering not more than 5,000 rms. symmetrical amperes, 600 V maximum. Maximum surrounding temperature 40°C.

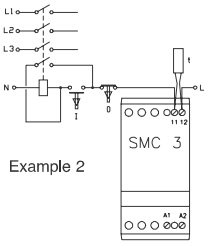
## Thermal overload protection (see also page 44)



Optional thermal overload protection is possible by inserting a thermostat in a slot on the right hand side of the soft starter. Type number UP62




The thermostat can be connected in series with the control circuit of the soft starter.
When the temperature of the heatsink exceeds 90°C the soft starter will switch Off.
**Note:**
When the temperature has dropped approx. 30°C the soft starter will automatically be switched on again.

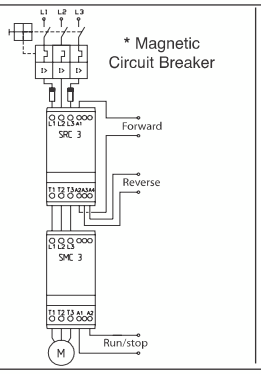



The thermostat is connected in series with the control circuit of the main contactor.
**Note:**
When the temperature of the heatsink exceeds 90°C the main contactor will switch Off.
A manual reset is necessary to restart this circuit.

## Dimensions (see also page 44)

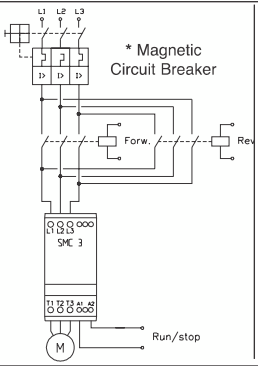
| Type | H | D | W |
|---|---|---|---|
| 22.5 mm module | 94 mm | 123.1 mm | 22.5 mm |
| 45 mm module | 94 mm | 128.1 mm | 45 mm |
| 90 mm module | 94 mm | 128.1 mm | 90 mm |
| 180 mm module | 140 mm | 144.8 mm | 180 mm |

## Combining Reversing Electronic Contactor & Soft Starter




**Soft-reversing of motors up to 10A**
A Soft-Reversing of a motor can easily be achieved by connecting a reversing relay to the Soft Starter. The reversing relay type SRC 3 DX will determine the direction of rotation Forward or Reverse and the Soft Starter type SMC 3/32/33 will perform soft-starting and soft-stopping of the motor.
If soft-stop is not required the application can be simplified by connecting the control circuit of the Soft Starter to the main terminals as shown under Line Controlled Soft-Start. A delay of approx. 0.5 sec. between forward and reverse control signal must be allowed to avoid influence from the voltage generated by the motor during turn Off.

## Combining reversing mechanical contactor & soft starter




**Soft-reversing of motors up to 85A**
A Soft-Reversing of motors can easily be achieved when the motor load exceeds 10A by connecting a mechanical reversing contactor to the Soft Starter. The reversing contactor will determine the direction of rotation forward or reverse and the Soft Starter type SMC3/32/33 will perform soft-starting and soft-stopping of the motor.
If the contactors are always switched in no load conditions the lifetime of the contactors will normally exceed 10 million cycles.

## Insulation specifications

| | |
|---|---|
| Rated insulation voltage | Ui 660 Volt |
| Rated impulse withstand voltage | Uimp. 4 kVolt |
| Installation catagory | III |

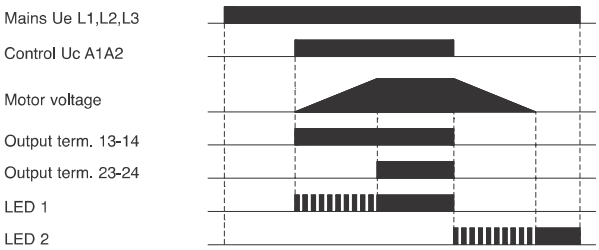
## Environment

| | | | |
|---|---|---|---|
| Degree of protection | IP 20 | Pollution degree | 3 |

## EMC

These components meets the requirements of the product standard EN60947-4-2 and is CE marked according to this standard.
They are designed for class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

## Functional diagram



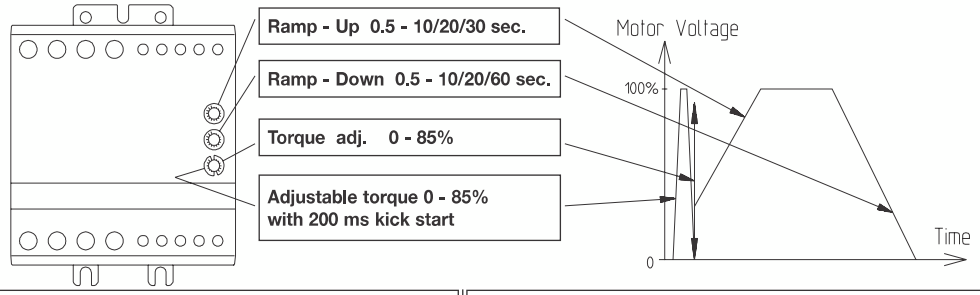

**Output: Terminal 13-14 Start-Stop** (AC voltage only)
For control of Start-Stop function directly wired to the soft starter
**Output: Terminal 23-24 By-Pass** (AC voltage only)
For signalling Full-On state. By-Pass in AC-53b operation
**LED information:**
**Note:** When both LED's are flashing, no connection to the motor **(SMC 3 only)**
**Note:** When both LED's are flashing, one phase is missing **(SMC 33 only)**

## Mounting and cable wiring information

Mounting information see page 44
Cable wiring see page 45

# Application, adjustment hints and general specifications for SMC 3/32/33

## How to adjust ramp times and initial torque




### A. Ramp-Up time and initial torque (standard load)

A1) Set the *Ramp-Up* switch to maximum.

A2) Set the *Ramp-Down* switch to minimum.

A3) Set the *Initial Torque* switch to minimum.

A4) Apply control signal for a few seconds.
If the load does not rotate immediately increment the *Initial Torque* and try again. Repeat until the load starts to rotate immediately on start-up.

A5) Adjust *Ramp-Up* time to the estimated start time (scale is in seconds) and start the motor.

A6) Decrease the *Ram-Up* time until mechanical surge is observed during start.

A7) Increase the time one step to eliminate the surge.

### B. Kick-Start / Break loose. High inertia loads.

If it is not possible to reach a time sufficient for the application (step A7) it may be necessary to kick-start the load.

B1) Set the *Ramp-Up* switch to maximum.

B2) Set the *Ramp-Down* switch to minimum.

B3) Set the *Initial Torque* switch to minimum Kick-start torque.

B4) Apply control signal for a few sec. If the load stops right after the 200 ms “kick” increment the initial torque and try again. Repeat until the load continues to rotate after the “kick”

B5) Adjust *Ramp-Up* time to the desired start time (the scale is in seconds) and start the motor.

### C. Ramp-Down time. E.g. Pump loads

Follow procedure A or B to set *Ramp-Up* and *initial torque*

C1). Set the *Ramp-Down* switch to maximum.

C2) Switch off the control voltage and observe any mechanical surges on the load. If none decrement *Ramp-Down* switch and try again. Repeat until mechanical surges on the load is observed.

C3) Increase the time one step to eliminate the surge.

### Note:

a) Control of the motor torque is achieved by acting on the motor voltage. The motor speed depends on the torque produced by the motor and the load on the motor shaft.

b) A motor with little or no load will reach full speed before the voltage has reached its maximum value.

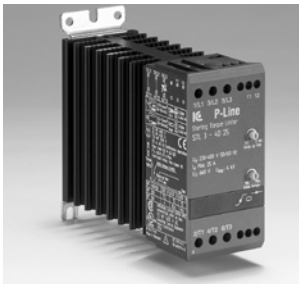
c) The soft starter will read time and torque settings in the off state. Repeated starts may trip the motor protection relay.

d) Make sure NOT to set the rotary switches in between positions as this corrupts the time and torque adjustment. Use screwdriver 2 mm x 0.5 mm

## Typical motor current by different line voltages

| kW | HP | 220-230 VAC | 380-400 VAC | 415 VAC | 440 VAC | 460-480 VAC | 600 VAC |
|---|---|---|---|---|---|---|---|
| 0.37 | 0.5 | 1.8 A | 1 A | 1 A | 1 A | 1 A | 1 A |
| 0.55 | 0.75 | 2.75 A | 1.6 A | 1.5 A | 1.4 A | 1.4 A | 1.1 A |
| 0.75 | 1 | 3.5 A | 2 A | 2 A | 1.7 A | 1.7 A | 1.3 A |
| 1.1 | 1.5 | 4.4 A | 2.6 A | 2.5 A | 2.4 A | 2.4 A | 1.8 A |
| 1.5 | 2 | 6.1 A | 3.5 A | 3.5 A | 3.1 A | 3 A | 2.3 A |
| 2.2 | 3 | 8.7 A | 5 A | 5 A | 4.5 A | 4.4 A | 3.4 A |
| 3 | 4 | 11.5 A | 6.6 A | 6.5 A | 5.8 A | 5.6 A | 4.3 A |
| 4 | 5 | 14.5 A | 8.5 A | 8.3 A | 8 A | 7.8 A | 6 A |
| 5.5 | 7.5 | 20 A | 11.5 A | 11 A | 10.4 A | 10 A | 7.7 A |
| 7.5 | 10 | 27 A | 15.5 A | 14 A | 13.7 A | 13 A | 10 A |
| 11 | 15 | 39 A | 22 A | 21 A | 20 A | 19 A | 15 A |
| 15 | 20 | 52 A | 30 A | 28 A | 26 A | 25 A | 20 A |
| 18.5 | 25 | 64 A | 37 A | 35 A | 33 A | 32 A | 25 A |
| 22 | 30 | 75 A | 43 A | 40 A | 38 A | 36 A | 28 A |
| 30 | 40 | | 58 A | 54 A | 52 A | 50 A | 38 A |
| 37 | 50 | | 70 A | 64 A | 61 A | 59 A | 45 A |
| 45 | 60 | | 83 A | 78 A | 75 A | 73 A | 56 A |

# Starting Torque Limiter (STL Soft Starter for 1&3-phase motors, one controlled phase)



- Rated operational voltage up to 600 VAC 50/60 Hz
- Rated operational current: 15 Amp or 25 Amp
- Ramp Up adjustable from 0.5-5 sec
- Initial torque adjustable from 0-85%
- LED status indication
- Meets EN 60947-4-2 requirements
- High number of start/stop operations pr. hour. See data

## Item selection and technical specifications (see also motor table at page 11)

| Load ratings | Item number by 110-127VAC 50/60Hz Line Voltage | Item number by 208-480VAC 50/60Hz Line Voltage | Item number by 550-600VAC 50/60Hz Line Voltage | Ramp-Up adjustment | Torque adjustment | Module-width |
|---|---|---|---|---|---|---|
| **Items for 1-phase motors** | | | | | | |
| 15A AC-53a | STL 1 1215 | STL 1 4015 | STL 1 6015 | | | 45mm |
| 25A AC-53a | STL 1 1225 | STL 1 4025 | STL 1 6025 | Ramp-up time 0.5 - 5 sec. | 0- 85% adjustable of norminal torque | 45mm |
| **Items for 3-phase motors** | | | | | | |
| 15A AC-53a | STL 3 1215 | STL 3 4015 | STL 3 6015 | | | 45mm |
| 25A AC-53a | STL 3 1225 | STL 3 4025 | STL 3 6025 | | | 45mm |

## Load specified with utilisation category AC-53a

**STL 1 and 3 XX/15/25** AC-53a:
No by-pass contactors is nessesary during running

## Output load specification

| **STL 1 and 3 XX15** | More info. page 45 | **STL 1 and 3 XX25** | More info. page 45 |
|---|---|---|---|
| Overload current profile AC-53a | X-Tx:8-3 : 100-3000 | Overload current profile AC-53a | X-Tx:8-3 : 100-3000 |
| Overload relay trip class AC-53a | 10 or 10A | Overload relay trip class AC-53a | 10 or 10A |
| | Min. operational current: 50mA | | Min. operational current: 50mA |

## Thermal specification

| | |
|---|---|
| Power dissipation for continuous operation PDmax | 1W/A |
| Power dissipation for intermittent operation PD | 1W/A x dutycycle |
| Cooling method | Natural convection |
| Mounting | Vertical +/-30$^{o}$ |
| Operating temperature range EN 60947-4-2 | -5C$^{o}$ to 40$^{o}$C |
| Max. operating temperature with current derating | 60$^{o}$C |
| Storage temperature EN 60947-4-2 | -20C$^{o}$ to 80$^{o}$C |

Operation in ambient temperatures exceeding 40$^{o}$C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty-cycle of the soft starter as shown in the table. Max.cycle time 15min.

| By 40$^{o}$C (STL X XX25) | By 50$^{o}$C (STL X XX25) | By 60$^{o}$C (STL X XX25) |
|---|---|---|
| 100% load Duty-cycle 100% | 80% load Duty-cycle max. 0,8 | 70% load Duty-cycle max. 0,65 |

## Insulation specifications

| | |
|---|---|
| Rated insulation voltage | Ui 660 Volt |
| Rated impulse withstand voltage | Uimp. 4 kVolt |
| Installation catagory | III |

## Environment

| | | | |
|---|---|---|---|
| Degree of protection | IP 20 | Pollution degree | 3 |

## Approval

cUL Std No. 508

*UL:Use thermal overload protection as required by the National Electric Code. When protected by a non-time delay K5 or H Class fuse, rated 266% of motor FLA, this device is rated for use on a circuit capable of delivering not more than 5,000 rms. symmetrical amperes, 600 V maximum. Maximum surrounding temperature 40°C.

## Functional diagram


## Mounting and cable wiring information

Mounting information see page 44 / Cable wiring see page 45

## Dimensions (se also page 36)

| Type | H | D | W |
|---|---|---|---|
| 45 mm module | 94 mm | 128.1 mm | 45 mm |

## EMC

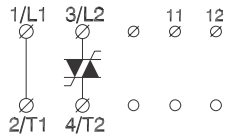
This component meets the requirements of the product standard EN60947-4-2 and is CE marked according to this standard. These products has been designed for class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

# Starting Torque Limiter (STL Soft Starter for 1&3-phase motors, one controlled phase)

## Wiring specifications

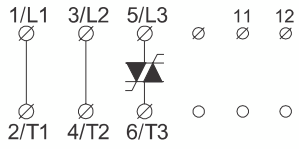
**STL 1**

11-12: for UP62 or other wiring purposes

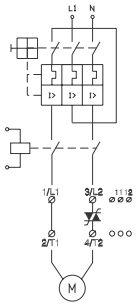



**STL 3**

11-12: for UP62 or other wiring purposes

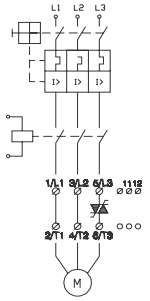



**STL 1 1-phase configuration**



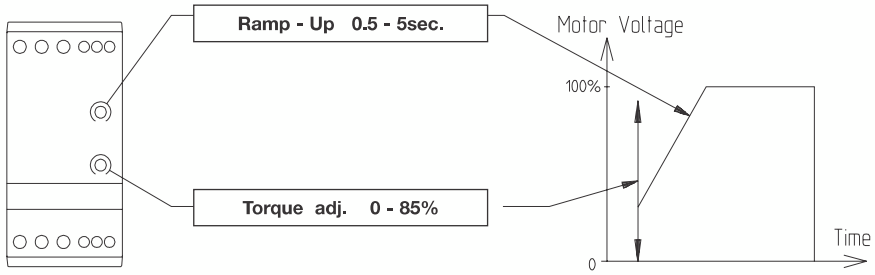

Magnetic Circuit Breaker

**STL 3 3-phase configuration**




Magnetic Circuit Breaker

## How to adjust ramp times and initial torque




## A. Ramp-Up time and initial torque (standard load) Use screwdriver 2 mm x 0.5 mm for adjustment

1) Set the *Ramp-Up* switch to maximum

2) Decrease the *Ram-Up* time until desired start is achieved

3) Set the *Initial Torque* switch to minimum

4) Switch the contactor ON for a short time. If the load does not rotate immediately increment the *Initial Torque* and try again. Repeat until the load starts to rotate immediately on start-up

**NOTE:**
a) Control of the motor torque is achieved by acting on the motor voltage. The motor speed depends on the torque produced by the motor and the load on the motor shaft.
b) A motor with little or no load will reach full speed before the voltage has reached its maximum value.
c) Repeated starts may trip the motor protection relay.

## Short-circuit protection by circuit breaker or fuses

**Two type of short-circuit protection can be used:**
a) Short-circuit protection by circuit breaker.
b) Short-circuit protection by fuses.

Short-circuit protection is divided into 2 levels **Type 1 or Type 2**

**Co-ordination Type 1:** Short-circuit protects the installation

**Co-ordination Type 2:** Short-circuit protects the installation and the semi-conductors inside the motor controller

**a) Short-circuit protection**
Co-ordination type 1 will be obtained when using magnetic circuit breakers or standard gl/Gl fuses.
Co-ordination type 2 will be obtained when using semiconductor fuses. When using semiconductor fuses the SCR will not be damaged due to transients and short circuits. The table indicates suitable fuses for co-ordination type 2 protection.

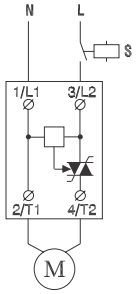
**b) Short-circuit protection by fuses**

| | |
|---|---|
| Type 1: STL 1/3 XX15 | Protection max. 50 A gL/gG |
| Type 1: STL 1/3 XX25 | Protection max. 80 A gL/gG 63A T |
| Type 2: STL 1/3 XX15 | Protection max. $i^2t$ of the fuse 1800 $A^2S$ |
| Type 2: STL 1/3 XX25 | Protection max. $i^2t$ of the fuse 6300 $A^2S$ |

**Fuses from e.g. Ferraz, Siba, Bussmann can be used as short-circuit protection Type 2**

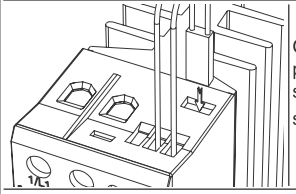
More information concerning Co-ordination Type 2 see page 45

## Start of single phase motor (application example)




- By start S shall be switched On
- The STL starts to Ramp-Up the motorvoltage
- When the motor has to stop, S shall be switched off
- The STL 1 is now ready for a new start
- The STL 1 is applicable for standard single phase motors, capacitive motors, transformers etc.

## Thermal overload protection (see also page 44)



Optional thermal overload protection is possible by inserting a thermostat in a slot on the right hand side of the soft starter. Type number UP62

# Soft Starter with Dynamic Brake (SMBC 3 two controlled phases)

- Rated operational voltage up to 480VAC 50/60Hz
- Rated operational current 1-25A
- Output signal for By-Pass and control of mechanical brake
- Ramp Up time and initial torque adjustable with kick start
- Adjustable Brake current
- Automatic stop detection
- Fast action brake mode with automatic motor field reduction
- Meets EN 60947-4-2 requirements

## Item selection and technical specifications (see also motor table at page 11)

| Load ratings | Item number by 208-240VAC 50/60Hz Line Voltage | Item number by 400-480VAC 50/60Hz Line Voltage | | Ramp-Up / Brake-adjustment | Torque adjustment | Module-width |
|---|---|---|---|---|---|---|
| 25A AC-53a | SMBC 3 DA 2325 | SMBC 3 DA 4025 | | Ramp-up time 0.5 - 10 sec. | 0- 85% adjustable of norminal torque with selectable kick start 200ms (break loose function) | 90mm |
| 27A AC-53b w. by-pass | | SMBC 3 DA 4025 | | Brake current 0-50ADC. | | 90mm |

## Load specified with utilisation category AC-53a

**SMBC 3 DA XX25** AC-53a: No by-pass contactors is nessesary during running

## Load specified with utilisation category AC53b

**SMBC 3 DA 4025** AC-53b: By-pass contactor shall be used for bypassing the soft starter during running of the motor by 27A/15kW 400V load

## Output load specification

| **SMBC 3 DA XX25 (without by-pass contactor)** | More info. page 45 | **SMBC 3 DA XX25 (with by-pass contactor)** | More info. page 45 |
|---|---|---|---|
| Overload current profile AC-53a | X-Tx:8-3 : 100-3000 | Overload current profile AC-53b | X-Tx:5-5 : 30 |
| Overload relay trip class AC-53a | 10 or 10A | Overload relay trip class AC-53b | 10 or 10A |
| Leakage current | 5mA ACmax. | Min. operational current | 1A |

## Control terminal specifications

| | |
|---|---|
| Control voltage by line voltage 208-240VAC **A1-A2** | 24 - 230 VAC/DC |
| Control voltage by line voltage 400-480VAC **A1-A2** | 24 - 480 VAC/DC |
| Pick-up voltage max. | 20.4 VAC/DC |
| Drop-out voltage min. | 5 VAC/DC |
| Max. control current for no operation | 1mA |
| Response time max. | 100msec. |
| Control current / power max. | 15mA / 2VA |

## AC Auxiliary contacts

**Output specifications for SMBC 3 DA XXXX BP**

**Terminal: 13-14,** AC SCR output for start/stop function,
**Terminal: 23-24,** AC SCR output for connection of by-pass contactor.

**Output specifications:** SCR: 0.5A AC-14, AC15 24-230/480V 50-60Hz Fusing:gI/gG Max $i^2t$ 72$A^2S$

**Terminal: 11-12,** have no connection with the internal circuit. Can be used in conjunction with a thermal overload protection or for other wiring purposes. See under general technical information.

## Thermal specification

| | |
|---|---|
| Power dissipation for continuous operation PDmax | 2W/A without BP |
| Power dissipation with semiconductor by-passed | 4 W Max. |
| Cooling method | Natural convection |
| Mounting | Vertical +/-30° |
| Operating temperature range EN 60947-4-2 | -5°C to 40°C |
| Max. operating temperature with current derating | 60°C |
| Storage temperature EN 60947-4-2 | -20°C to 80°C |

Operation in ambient temperatures exceeding 40°C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty-cycle of the soft starter as shown in the table. Max.cycle time 15min.

| By 40°C | By 50°C | By 60°C |
|---|---|---|
| 100% load Duty-cycle 100% | 80% load Duty-cycle max. 0.8 | 70% load Duty-cycle max. 0.65 |

## Insulation specifications

| | |
|---|---|
| Rated insulation voltage | Ui 660 Volt |
| Rated impulse withstand voltage | Uimp. 4 kVolt |
| Installation catagory | III |

## Approval

cUL Std No. 508

UL:Use thermal overload protection as required by the National Electric Code. When protected by a non-time delay K5 or H Class fuse, rated 266% of motor FLA, this device is rated for use on a circuit capable of delivering not more than 5,000 rms. symmetrical amperes, 600 V maximum. Maximum surrounding temperature 40°C.

## Environment

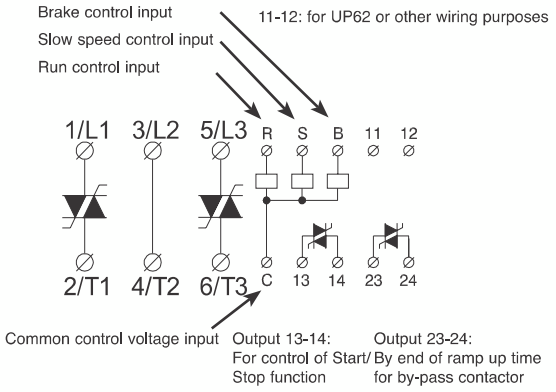
| | | | |
|---|---|---|---|
| Degree of protection | IP 20 | Pollution degree | 3 |

## EMC

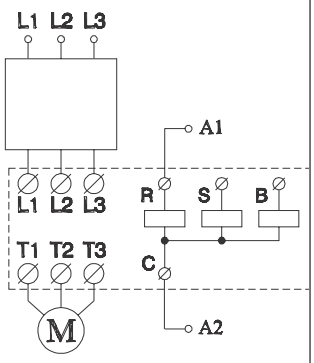
This component meets the requirements of the product standard EN60947-4-2 and is CE marked according to this standard.
This products has been designed for class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

# Soft Starter with Dynamic Brake (SMBC 3 two controlled phases)

## Wiring diagram

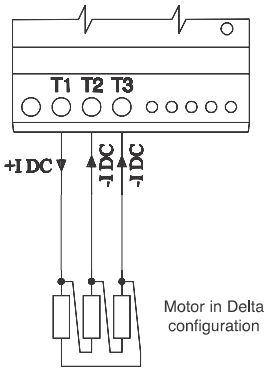



## Wiring example: automatic brake to stop function




Set Ramp-Up and Initial Torque adjustments for best start-up function. Adjust brake torque to reach a complete stop after each working cycle

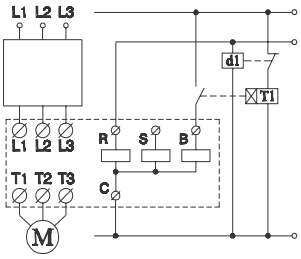
## Wiring example: DC brake current configuration




To achieve maximum brake torque the DC current is applied on all 3 motor windings.
Direction of current is from T1 to T2 and T3.

**Do not open any switches in the DC current path during the braking cycle as this might cause severe burning of the contacts.**

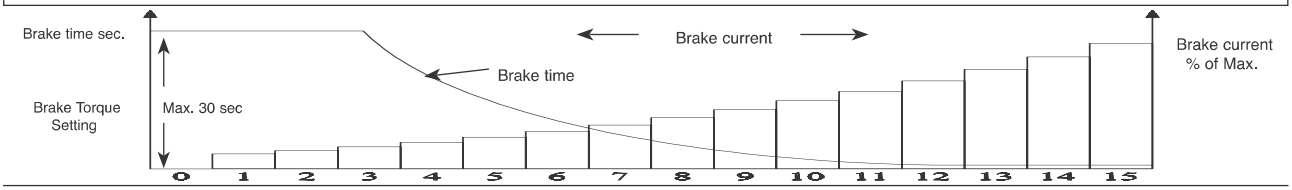
## Wiring example: Timer controlled brake cycle




If the application only can accept a low braking torque below the sensing range of the stop detection it is possible to connect an external "delay on" operate timer to the Brake control input.

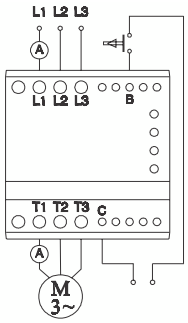
Functional description:
When control relay d1 and Run input is switched off timer T1 will activate the Brake input for the adjusted time.

## Adjusting the brake current (connexion between brake torque, setting, brakecurrent and braketime)




When the Brake current is set it is actually a DC voltage that is adjusted. The current is therefore depending on the ohmic resistance of the windings and the actual connection of the motor (Delta).
For small motors a high DC voltage is necessary and for bigger motors a low voltage can produce sufficient brake current. Therefore the brake current must be adjusted for the actual application.
Before start-up of an unknown application set the Brake Torque adjustment to 1. Increase until the desired stop time is achieved.
If it is impossible to reach a time long enough for the application an external timer must be connected. See also application information next page.

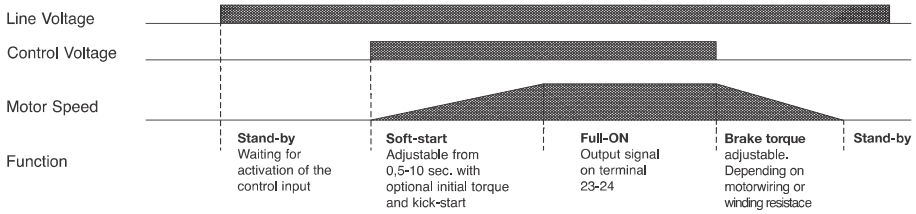
## Automatic stop detection




The motor speed is detected by sensing the DC brake current. As this controller can operate a wide range of motors with different wiring configurations, the ohmic resistance of the actual motor has a wide range, it is therefore necessary to adjust the "Brake Torque" (DC Brake current) to achieve correct function in the actual application.
If the current is set to a low value the brake will be switched off before the motor has come to a complete stop. If the current is set too high, it will be out of the detection range and cannot be switched off before end of the build-in maximum time (30 sec.).
The LED's will flash to indicate failure condition. The mains must be switched off and reapplied to reset this condition

**CAUTION !** For bigger motors the current can be adjusted to a value that will destroy the controller or open the circuit breaker or fuse.
Before start-up of an unknown application set the Brake Torque adjustment to 1. To measure the Brake current activate the Brake Control input.
The DC brake current can be measured on the out put of T1 only. The AC value of the Brake current can be measured in L1 or L2. The DC current is approx. 1,5 times the AC current.

## Functional diagram




**Basic application.**

When the control voltage is applied the motor will soft-start. When the control voltage is switched off the automatic Brake cycle will operate. The application shall be overload- and shortcircuit protected by fuses or circuit breaker.

# Application, adjustment hints and general specifications for SMBC 3

## Short-circuit protection by circuit breaker or fuses

**Two type of short-circuit protection can be used:**
a) Short-circuit protection by circuit breaker.
b) Short-circuit protection by fuses.

Short-circuit protection is divided into 2 levels **Type 1 or Type 2**

**Co-ordination Type 1:** Short-circuit protects the installation

**Co-ordination Type 2:** Short-circuit protects the installation and the semiconductors inside the motor controller

**a) Short-circuit protection**
Co-ordination type 1 will be obtained when using magnetic circuit breakers or standard gI/GI fuses.
Co-ordination type 2 will be obtained when using semiconductor fuses. When using semiconductor fuses the SCR will not be damaged due to transients and short circuits. The table indicates suitable fuses for co-ordination type 2 protection.

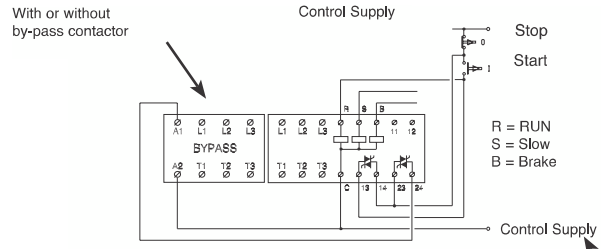
**a1) Short-circuit protection by circuit breaker (continued)**
It is recommended to overload protect the soft starter by a manual motor starter which is insensitive to the unbalanced operation condition during braking operation. The motor is thus protected also during the brake cycle. The manual motor starter will also short-circuit protect the Controller if prospective short-circuit limits are observed (Co-ordination 2.)
NOTE: Due to the integral brake function the motor is overload protected during the brake cycle. The phase unbalance in this mode might trip an overload relay with high sensitivity to phase unbalance.
Danfoss CTI 25 is not sensitive to unbalanced loads.

**b) Short-circuit protection by fuses**

Type 1: SMBC 3 DA XX25 — Protection max. 80 A gL/gG 63A T
Type 2: SMBC 3 DA XX25 — Protection max. $i^2t$ of the fuse 6300 $A^2S$

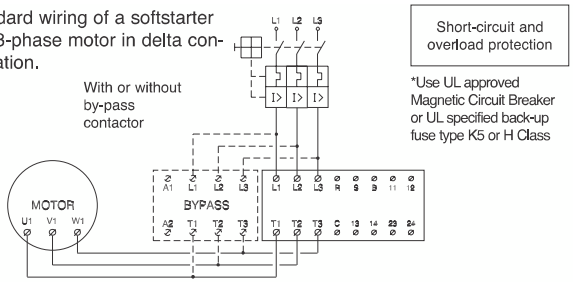
**Fuses from e.g. Ferraz, Siba, Bussmann can be used as short-circuit protection Type 2**
**More information concerning Co-ordination Type 2 see page 45**

## Wiring example (Start/Stop with or without By-pass contactor)

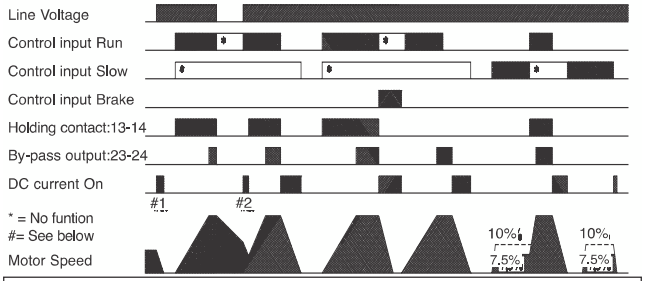



## Motor wiring with or without by-pass

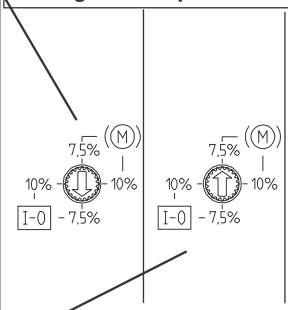
Standard wiring of a softstarter to a 3-phase motor in delta configuration.




## Functional diagram of start-stop/control/by-pass contator




## Setting of the operation mode selector

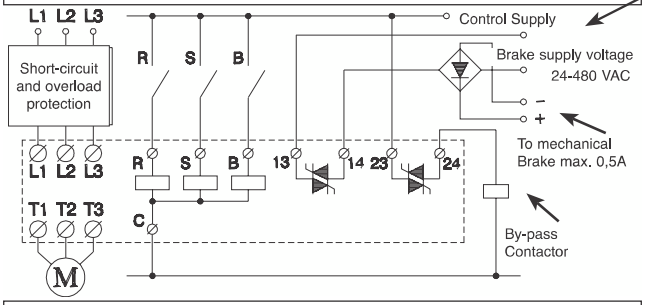



**NOTE:**

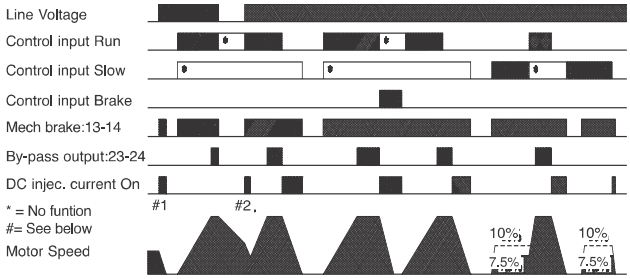
When terminal 13-14 is used as Start/Stop function, and 23-24 is used for by-pass:
**Set the selector in position I-0**
(7.5% or 10% if slow speed is used)

When terminal 13-14 & 23-24 is used as brake control:
**Set the selector in position M**
(7.5% or 10% if slow speed is used)

## Control of mechanical brake and by-pass contactor

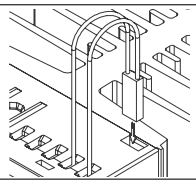



## Functional diagram of mechanical brake/by-pass contact.

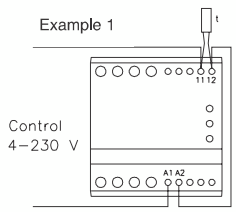



Note: #1. If the motor is running when the soft starter is switched On, the Auto Brake mode will stop the rotation.
Note: #2. With "RUN" signal present on Power-Up the soft starter will start the motor.

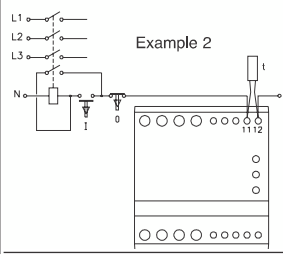
## Thermal overload protection (see also page 44)



Optional thermal overload protection is possible by inserting a thermostat in a slot on the right hand side of the soft starter. Type number UP62



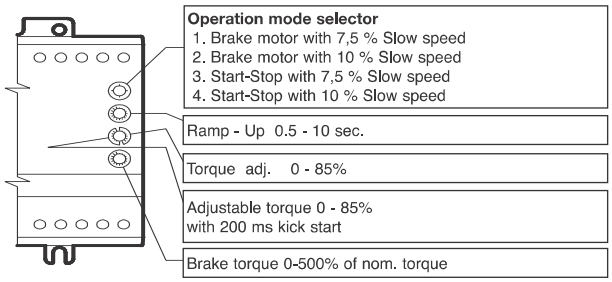

The thermostat can be connected in series with the control circuit of the soft starter.
When the temperature of the heatsink exceeds 90°C the soft starter will switch Off.
**Note:**
When the temperature has dropped approx. 30°C the soft starter will automatically be switched on again.

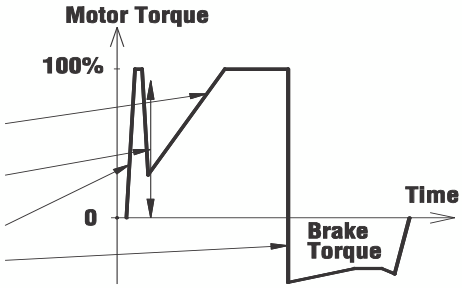



The thermostat is connected in series with the control circuit of the main contactor.
When the temperature of the heatsink exceeds 90°C the main contactor will switch Off.
**Note:** A manual reset is necessary to restart this circuit.

# Application, adjustment hints and general specifications for SMBC 3

## How to adjust ramp time, initial torque and brake torque




### A. Standard load with automatic brake cycle

A1) Set the *Ramp-Up* switch to maximum.

A2) Set the *Brake Torque* switch to 1

A3) Set the *Initial Torque* switch to minimum.

A4) Apply control signal for a few seconds.
If the load does not rotate immediately increment the *Initial Torque* and try again. Repeat until the load starts to rotate immediately on start-up.

A5) Adjust *Ramp-Up* time to the desired starting time (scale is in seconds) is obtained.

A6) Adjust *Brake Torque* until the desired stop time is obtained
Note. If the current is set too high, the zero speed detect will not function.
If the current is set too low, the zero speed detect will not function.
To achieve a longer braking time an external timer must be installed as shown in application example page 15

### B. High inertia loads with stiction

If it is not possible to reach a smoth start for an application it might be it may be necessary to kick-start / Break loose function.

B1) Set the *Ramp-Up* switch to maximum.

B2) Set the *Brake-Torque* switch to 1.

B3) Set the *Initial Torque* switch to minimum in the *Kick-start* mode.

B4) Apply control signal for a few sec. If the motor stops right after the 200 ms "kick" increment the *initial torque* and try again. Repeat until the load continues to rotate after the "kick".

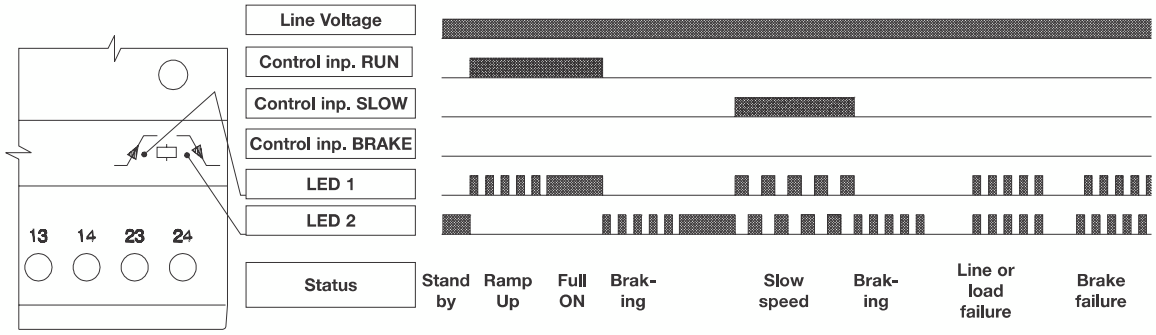
B5) Adjust *Ramp-Up* time to the desired start time (the scale is in seconds) and start the motor.

B6) Adjust *Brake Torque* until the desired stop time is obtained

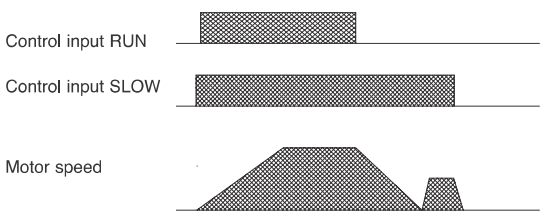
**LED information:**
**Note:** When both LED's are flashing, no connection to the motor

**Please note:**
a) The Soft Starter will read time and torque settings in stand by mode i.e. after the Brake cycle. Repeated starts may trip the motor protection relay.
b) Make sure NOT to set the rotary switches in between positions as this corrupts the time and torque adjustment. Use screwdriver 2 mm x 0.5 mm
c) Caution: Set the Brake Torque switch to 1, before switching the controller ON
**CAUTION!**
For bigger motors the Brake Torque can be adjusted to a value that will destroy the controller or open the circuit breaker or fuse. Only increase Brake Torque in single steps for an unknown application.

## LED status indication




## Slow speed-operation (funtional diagram)




The Slow speed option is intended for short time operation in applications where an exact positioning is needed, for example cranes. The motor operates at full speed until the application reaches the early limit switch, where the motor is braked until stop is detected, then it will continue until final position and brake down to stop in the exact position. There is 2 selectable speeds 7,5 % and 10 % of nominal speed. **NB.Torque levels are lower than nominal torque.** In slow speed 7,5 % mode the operational current in L2 is approx. 2.5 times the nominal current. In slow speed 10 % mode the operational current in L2 is approx. 2 times the nominal current but with lower torque.
Note: RUN input signal has priority over SLOW input signal. If Brake Torque is adjusted to "0" Slow speed will be ignored.

## Mounting and cable wiring information

Mounting information see page 44 / Cable wiring see page 45

## Dimensions (se also page 44)

| Type | H | D | W |
|---|---|---|---|
| 90 mm module | 94 mm | 128.1 mm | 90 mm |

# 3-Phase electronic reversing contactor (SRC)

- Rated operational voltage up to 480 VAC 50/60Hz
- Rated operational current up to 10A AC-53
- Two separate control inputs with mutual interlock
- Control voltage from 5-24VDC or 24-230VAC/DC
- LED Status indication
- Meets EN 60947-4-2 requirements
- Requires only 45 mm DIN rail space

## Item selection and technical specifications

| Load ratings AC-53 motor load stand. AC-4 motor load inching / plugging | Control voltage | | Item number by 24-480VAC 50/60Hz Line Voltage | | Module-width |
|---|---|---|---|---|---|
| 10A AC-53 / 8A AC-4 | 5-24 VDC | | SRC 3 DD 4010 | | 45mm |
| 10A AC-53 / 8A AC-4 | 24-230 VAC/DC | | SRC 3 DA 4010 | | 45mm |

## Output load specification

| | | | |
|---|---|---|---|
| Operational current AC-53 | 10A | Leakage current | 5mA ACmax. |
| Operational current AC-4 | 8A | Min. operational current | 50mA |
| Duty cycle | 100% | | |

## Control terminal specifications

| SRC 3 DD 4010 | | SRC 3 DA 4010 | |
|---|---|---|---|
| Control voltage | 5 - 24 VDC | Control voltage | 24- 230 VAC/DC |
| Pick-up voltage max. | 4.25 VDC | Pick-up voltage max. | 20.4 VAC/DC |
| Drop-out voltage min. | 1.5 VDC | Drop-out voltage min. | 7.2 VAC/DC |
| Control current | 25mA @ 4VDC | Control current / power max. | 6mA / 1.5VA@24VDC |
| Response time max. | 1/2 cycle | Response time max. | 1cycle |
| Interlock time max. | 80 msec. | Interlock time max. | 150 msec. |

## Thermal specification

| | |
|---|---|
| Power dissipation for continuous operation PDmax | 2.2 W/A |
| Power dissipation for intermittent operation PD | 2.2 W/A x dutycycle |
| Cooling method | Natural convection |
| Mounting | Vertical +/-30° |
| Operating temperature range EN 60947-4-2 | -5°C to 40°C |
| Max. operating temperature with current derating | 60°C |
| Storage temperature EN 60947-4-2 | -20°C to 80°C |

Operation in ambient temperatures exceeding 40°C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty-cycle of the contactor as shown in the table. Max.cycle time 15min.

| By 40°C | By 50°C | By 60°C |
|---|---|---|
| 100% load Duty-cycle 100% | 80% load Duty-cycle max. 0.8 | 70% load Duty-cycle max. 0.65 |

## Insulation specifications

| | |
|---|---|
| Rated insulation voltage | Ui 660 Volt |
| Rated impulse withstand voltage | Uimp. 4 kVolt |
| Installation catagory | III |

## Environment

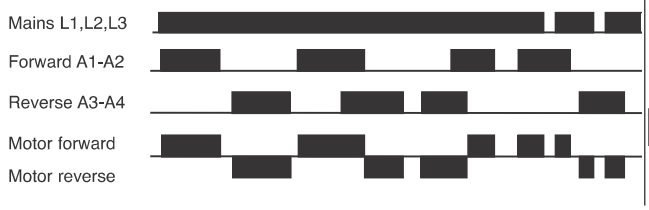
| | | | |
|---|---|---|---|
| Degree of protection | IP 20 | Pollution degree | 3 |

## Approval

cUL Std No. 508

*UL:Use thermal overload protection as required by the National Electric Code. When protected by a non-time delay K5 or H Class fuse, rated 266% of motor FLA, this device is rated for use on a circuit capable of delivering not more than 5,000 rms. symmetrical amperes, 600 V maximum. Maximum surrounding temperature 40°C.

## Functional diagram




## EMC

This component meets the requirements of the product standard EN60947-4-2 and is CE marked according to this standard. This products has been designed for class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

## Dimensions (se also page 44)

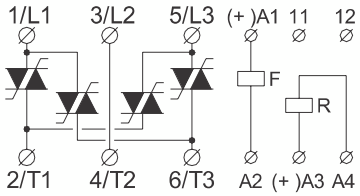
| Type | H | D | W |
|---|---|---|---|
| 45 mm module | 94 mm | 128.1 mm | 45 mm |

# 3-Phase electronic reversing contactor (SRC)

## Wiring specifications

**SRC 3 DX 4010**

11-12: for UP 62 or other wiring purposes




Control voltage A1-A2 Control voltage A3-A4

## Short-circuit protection by circuit breaker or fuses

**Two type of short-circuit protection can be used:**
a) Short-circuit protection by circuit breaker.
b) Short-circuit protection by fuses.

Short-circuit protection is divided into 2 levels **Type 1 or Type 2**

**Co-ordination Type 1:** Short-circuit protects the installation

**Co-ordination Type 2:** Short-circuit protects the installation and the semi-conductors inside the motor controller

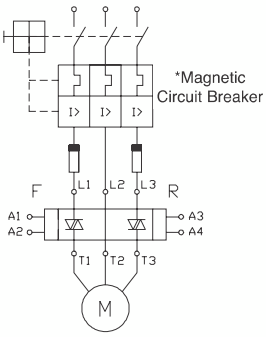
**a) Short-circuit protection**
Co-ordination type 1 will be obtained when using magnetic circuit breakers or standard gl/Gl fuses.
Co-ordination type 2 will be obtained when using semiconductor fuses. When using semiconductor fuses the SCR will not be damaged due to transients and short circuits. The table indicates suitable fuses for co-ordination type 2 protection.

**b) Short-circuit protection by fuses**

Type 1: SRC 3 DX 4010 Protection max. 50 A gL/gG
Type 2: SRC 3 DX 4010 Protection max. $i^2t$ of the fuse 610 $A^2S$

**Fuses from e.g. Ferraz, Siba, Bussmann can be used as short-circuit protection Type 2**
More information concerning Co-ordination Type 2 see page 45

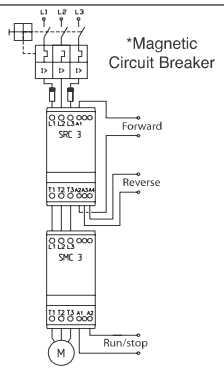
## Overload Protection in Motor Control Reversing




Overload protection of the motor is easily achieved by installing a manual thermal magnetic circuit breaker on the supply side of the motor.
The circuit breaker provides means for padlocking and the necessary clearance for use as a circuit isolator according to EN 60204-1.

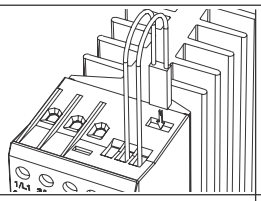
Adjust the current limit on the MCB according to the rated nominal current of the motor
*Use UL approved Magnetic Circuit Breaker or UL specified back-up fuse type K5 or H Class

## Combining Reversing Electronic Contactor & Soft Starter

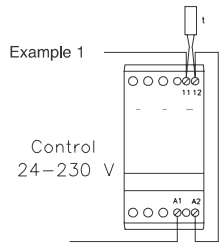



**Soft-reversing of motors up to 10A**
A Soft-Reversing of a motor can easily be achieved by connecting a reversing relay to the Soft Starter. The reversing relay type SRC 3 DX will determine the direction of rotation Forward or Reverse and the Soft Starter type SMC 3/32/33 will perform soft-starting and soft-stopping of the motor. If soft-stop is not required the application can be simplified by connecting the control circuit of the Soft Starter to the main terminals as shown under Line Controlled Soft-Start. A delay of approx. 0.5 sec. between forward and reverse control signal must be allowed to avoid influence from the voltage generated by the motor during turn Off.

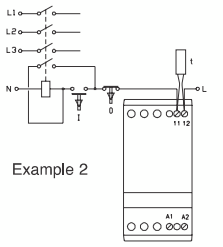
## Thermal overload protection (see also page 44)



Optional thermal overload protection is possible by inserting a thermostat in a slot on the right hand side of the contactor. Type number UP62




The thermostat can be connected in series with the control circuit of the contactor.
When the temperature of the heatsink exceeds 90°C the soft starter will switch Off.
**Note:**
When the temperature has dropped approx. 30°C the contactor will automatically be switched on again.




The thermostat is connected in series with the control circuit of the main contactor.
When the temperature of the heatsink exceeds 90°C the main contactor will switch Off.
**Note:** A manual reset is necessary to restart this circuit.

## Utilisation Categories EN60947-4-2

**Category AC-53:** Starting, switching off motors during running

**Category AC-4:** Starting, plugging, reversing the motors rapidly while the motor is during.

## Mounting and cable wiring information

Mounting information see page 44 / Cable wiring see page 45

# 3-Phase electronic motor contactor (SMC 3 DOL Direct On Line)

- For Direct On Line start of 3 phase motors
- Rated operational voltage up to 600 VAC 50/60 Hz
- Rated operational current up to 15A AC-53
- Control voltage: 24-60VDC / 24-480VAC
- High number of start/stop operations / hour
- LED Status indication
- Meets EN 60947-4-2 requirements
- Requires only 45 mm DIN rail space

## Item selection and technical specifications

| Load ratings AC-53 motor load stand. AC-4 motor load inching / plugging | Control voltage | Item number by 208-240VAC 50/60Hz Line Voltage | Item number by 400-480VAC 50/60Hz Line Voltage | Item number by 550-600VAC 50/60Hz Line Voltage | Module-width |
|---|---|---|---|---|---|
| 15A AC-53 | 24-60VDC / 24-480VAC | SMC 3 DA 2315 DOL | SMC 3 DA 4015 DOL | SMC 3 DA 6015 DOL | 45mm |

## Output load specification

| | | | |
|---|---|---|---|
| Operational current AC-53 | 15A | Min. operational current | 50mA |
| Leakage current | 5mA ACmax. | Duty cycle | 100% |

## Control terminal specifications

| | | | |
|---|---|---|---|
| Control voltage | 24-60 VDC/24-480 VAC | Control current / power max. | 6mA / 1.5 VA |
| Pick-up voltage max. | 20.4 VAC / DC | Max. control voltage | 510 VAC |
| Drop-out voltage min. | 5 VAC / DC | Response time max. | 1 cycle |

## Thermal specification

| | |
|---|---|
| Power dissipation for continuous operation PDmax | 2.2 W/A |
| Power dissipation for intermittent operation PD | 2.2 W/A x dutycycle |
| Cooling method | Natural convection |
| Mounting | Vertical +/-30$^{o}$ |
| Operating temperature range EN 60947-4-2 | -5$^{o}$C to 40$^{o}$C |
| Max. operating temperature with current derating | 60$^{o}$C |
| Storage temperature EN 60947-4-2 | -20$^{o}$C to 80$^{o}$C |

Operation in ambient temperatures exceeding 40$^{o}$C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty-cycle of the soft starter as shown in the table.

| By 40$^{o}$C | By 50$^{o}$C | By 60$^{o}$C |
|---|---|---|
| 100% load Duty-cycle 100% | 80% load Duty-cycle max. 0.8 | 70% load Duty-cycle max. 0.65 |

## Insulation specifications

| | |
|---|---|
| Rated insulation voltage | Ui 660 Volt |
| Rated impulse withstand voltage | Uimp. 4 kVolt |
| Installation catagory | III |

## Environment

| | | | |
|---|---|---|---|
| Degree of protection | IP 20 | Pollution degree | 3 |

## Approval

cUL Std No. 508
*UL:Use thermal overload protection as required by the National Electric Code. When protected by a non-time delay K5 or H Class fuse, rated 266% of motor FLA, this device is rated for use on a circuit capable of delivering not more than 5,000 rms. symmetrical amperes, 600 V maximum. Maximum surrounding temperature 40°C.

## Utilisation Categories EN60947-4-2

| | |
|---|---|
| **Category AC - 53** | Starting, switching off motors during running. |
| **Category AC - 4** | Starting, plugging, reversing the motor rapidly while the motor is running. |
| **CategoryAC - 52a** | Control of slipring motor stators |
| **CategoryAC - 53a** | Control of squirrel cage motor |
| **Category AC - 58a** | Control of hermetic refrigerant compressors with automatic resetting of overload releases |

## EMC

This component meets the requirements of the product standard EN60947-4-2 and is CE marked according to this standard.
This products has been designed for class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

## Mounting and cable wiring information

Mounting information see page 44 / Cable wiring see page 45

## Dimensions (se also page 44)

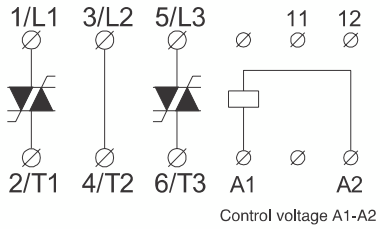
| Type | H | D | W |
|---|---|---|---|
| 45 mm module | 94 mm | 128.1 mm | 45 mm |

# 3-Phase electronic motor contactor (SMC 3 DOL Direct On Line)

## Wiring specifications

**SMC 3 DA XX15 DOL**

11-12: For UP62 or other wiring purposes




## Short-circuit protection by circuit breaker or fuses

**Two type of short-circuit protection can be used:**
a) Short-circuit protection by circuit breaker.
b) Short-circuit protection by fuses.

Short-circuit protection is divided into 2 levels **Type 1 or Type 2**

**Co-ordination Type 1:** Short-circuit protects the installation

**Co-ordination Type 2:** Short-circuit protects the installation and the semi-conductors inside the motor controller

**a) Short-circuit protection**
Co-ordination type 1 will be obtained when using magnetic circuit breakers or standard gI/GI fuses.
Co-ordination type 2 will be obtained when using semiconductor fuses. When using semiconductor fuses the SCR will not be damaged due to transients and short circuits. The table indicates suitable fuses for co-ordination type 2 protection.

**b) Short-circuit protection by fuses**

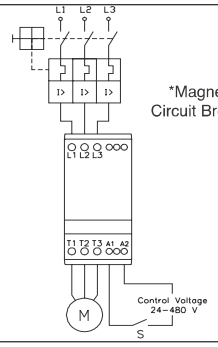
Type 1: SMC 3 DA XX15 DOL — Protection max. 50 A gL/gG

Type 2: SMC 3 DA XX15 DOL — Protection max. $i^2t$ of the fuse 1800 $A^2S$

**Fuses from e.g. Ferraz, Siba, Bussmann can be used as short-circuit protection Type 2**

More information concerning Co-ordination Type 2 see page 45

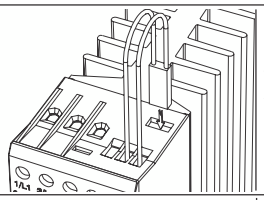
## Overload Protection in Motor Control Reversing



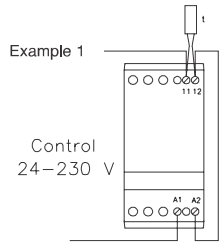

Overload protection of the motor is easily achieved by installing a manual thermal magnetic circuit breaker on the supply side of the motor.
The circuit breaker provides means for padlocking and the necessary clearance for use as a circuit isolator according to EN 60204-1.

Adjust the current limit on the MCB according to the rated nominal current of the motor
*Use UL approved Magnetic Circuit Breaker or UL specified back-up fuse type K5 or H Class

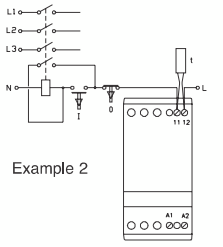
## Thermal overload protection (see also page 44)



Optional thermal overload protection is possible by inserting a thermostat in a slot on the right hand side of the soft starter. Type number UP62




The thermostat can be connected in series with the control circuit of the soft starter.
When the temperature of the heatsink exceeds 90°C the soft starter will switch Off.
**Note:**
When the temperature has dropped approx. 30°C the soft starter will automatically be switched on again.




The thermostat is connected in series with the control circuit of the main contactor.
When the temperature of the heatsink exceeds 90°C the main contactor will switch Off.
**Note:**
A manual reset is necessary to restart this circuit.

## SMC 3 DOL General application information

The SMC 3 DOL has been developed for cranes and other harsh applications where inching, jogging and plugging is frequently used and where a high number of operating cycles are essential. In such applications the lifetime of the equipment is normally limited by the short lifetime of the electromechanical contactor. Electromechanical contactors are not designed to switch off motors in locked rotor- or overload conditions where the current is 6 times the nominal operational current (AC-4). The servere arcing will burn the contact elements resulting in unreliable contact function.The Semiconductor Contactor will close the contacts in the zero crossing of the mains voltage and switch-Off will always occur in the zero crossing of the motor current in this way voltage kickback from the inductive motor windings is avoided. The lifetime, therefore, of the Semiconductoc Contactor will always be at least one decade longer than the electromechanical contactor.

## Comparison of lifetime in different utilization categories

| Utilization-categories | Typical applications | Electro-mechanical Contactor | Semiconductor Contactors SMC3DA....DOL |
|---|---|---|---|
| AC-52a | Control of slip-ring motors, starting, switching Off | 0.7 Mill. Cycles | 25 Mill. Cycles |
| AC-53a | Control of squirrel-cage motors, starting, switching Off | 1.3 Mill. Cycles | 25 Mill. Cycles |
| AC-4 | Control of squirrel-cage motors, starting, plugging, inching | 0.06 Mill. Cycles | 5 Mill. Cycles |