

**INDUCTION MOTOR SOLID-STATE REDUCED VOLTAGE STARTER (SOFTSTARTER) WITH SOFTSTOP FEATURE** *(PRELIMINARY DATA)*

celduc relais<sup>®</sup> SMCV can be employed everywhere using a costly and relatively big variable speed controller is not required (pumps, fans, compressors, conveyors, ...).

Its **six thyristor** structure working like a full wave phase angle controller (both positive and negative cycles are controlled), allows to reduce efficiently the induction motor starting current as well as the motor starting torque. This **motor starting current reduction** allows to optimize the mains grid as well as its protections and **avoid having voltage fluctuations** leading to ambient light variations also called "flicker".

Built to help the user to get his assembly in compliance with the European directives and standards, this product easy fits in the existing application without any modification of the wiring field configuration. Thus, the SMCV can easily replace an electromechanical star-delta starter **without changing the motor coupling!** In a project including a three phase induction motor it can be implemented like a usual three phase electromechanical contactor. Furthermore, its ability to be installed inside the delta wiring allows this device to drive **1.73 times more current** than a standard on line softstarter,

The SMCV also have **diagnostic and self-test functions** to inform people involved in the machine maintenance and **to reduce the cost and the delay to restart the production.**

**SMCW6080**

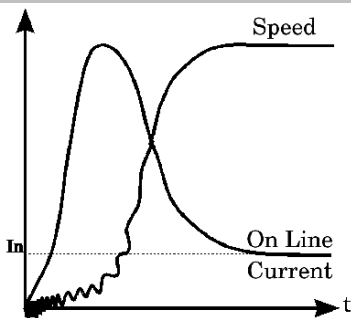


**Induction Motor Softstarter**

**200 - 480VAC**  
->7.5kW (Y)  
->13kW (D)

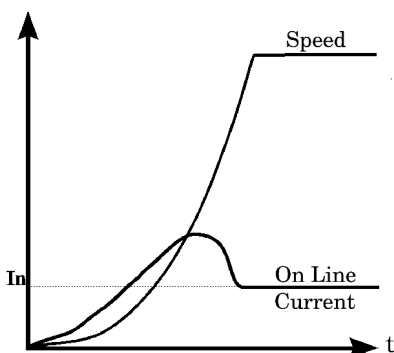
| MAIN CHARACTERISTICS   |        |           |        |              |             |                        |                 |             |                |                       |                       |
|------------------------|--------|-----------|--------|--------------|-------------|------------------------|-----------------|-------------|----------------|-----------------------|-----------------------|
| Max. Motor Power @40°C |        |           |        | IAC53a @40°C |             | Phase to Phase Voltage | Mains Frequency | Input       | Status Outputs | In/Out/Case Isolation | Operating Temperature |
| Star (Y)               |        | Delta (D) |        | Max.         | EN60947-4-2 |                        |                 |             |                |                       |                       |
| 400VAC                 | 230VAC | 400VAC    | 230VAC |              |             | 200 to 480VAC          | 40 to 65Hz      | 10 to 24VDC | 24V / 1A AC/DC | 4kV                   | -40 to +100°C         |
| 7.5kW                  | 4.3kW  | 13kW      | 7.5kW  | 16A          | 11.5A       |                        |                 |             |                |                       |                       |

**BENEFIT FOR MOTOR STARTING**  
**DIRECT ON LINE (DOL) STARTING**



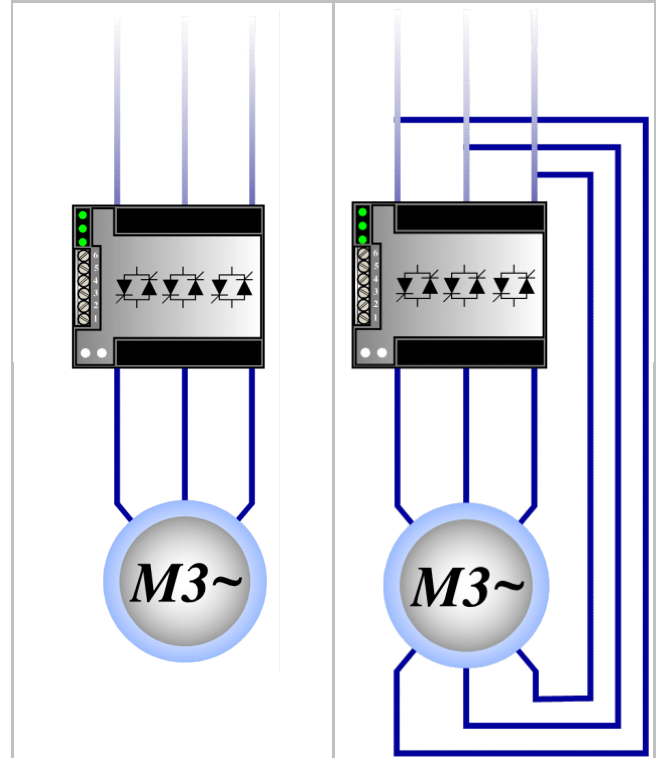
- **Mechanical part stress:**
  - noise
  - Maintenance costs
- **High inrush current:**
  - Motor and mains protections oversized
  - Risk of flicker

**SOFTSTARTING WITH SMCV**



- **Softstarting:**
  - Noise reduction
  - Maintenance cost reduction
- **No more high inrush current:**
  - Motor and mains protections optimization
  - No more harmonic or flicker problems

**TYPICAL WIRINGS**

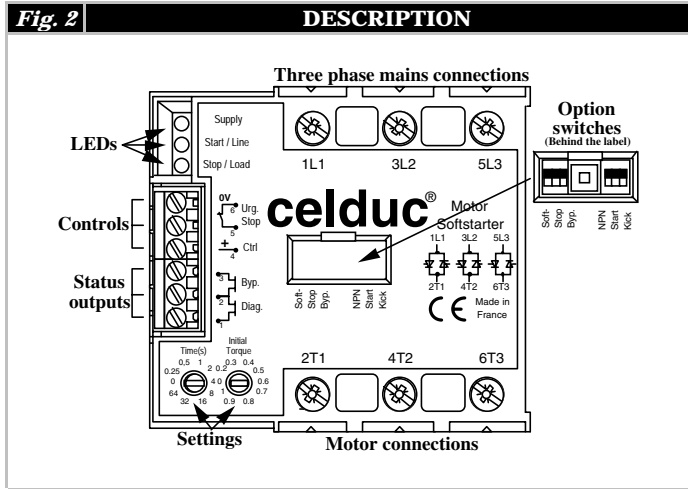
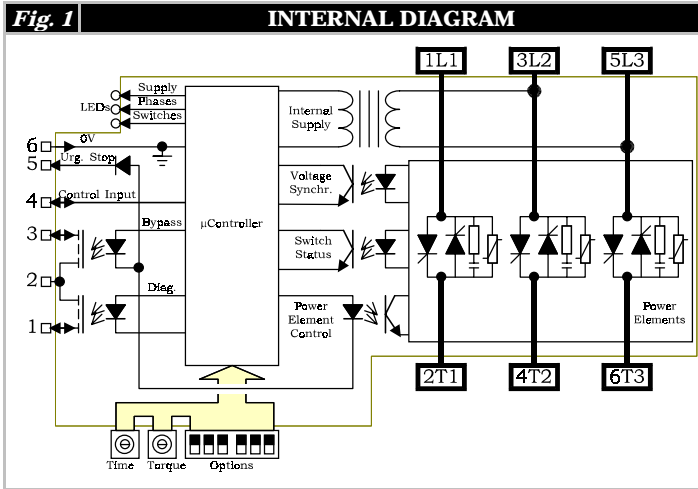




# Solid State Relays For Motor Control

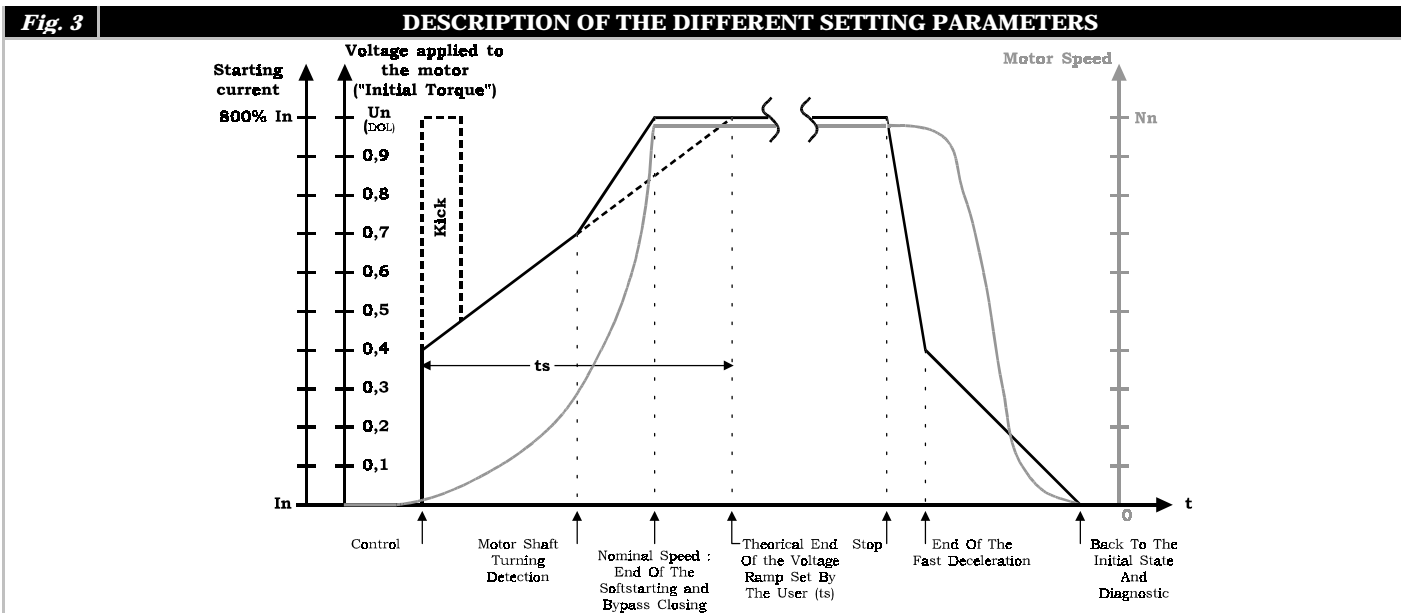


## SETTINGS AND DIAGNOSTIC



| DESCRIPTION OF THE CONNECTIONS |               |               |                         |               |                                |                           |
|--------------------------------|---------------|---------------|-------------------------|---------------|--------------------------------|---------------------------|
| Terminals                      | 1,2           | 2,3           | 4,6                     | 5,6           | 1L1, 3L2, 5L3                  | 2T1, 4T2, 6T3             |
| Function                       | Diagnostic    | Bypass        | Control                 | Urgent stop   | Three phase mains (Obligatory) | Motor supply (Obligatory) |
| Input/Output                   | Output        | Output        | Input                   | Input         | Input                          | Output                    |
| Activated when ...             | Closed        | Closed        | High (PNP) or Low (NPN) | Open          | Since 3x200VAC                 | 100ms after control       |
| Polarization                   | NO (AC or DC) | NO (AC or DC) | Yes (4+ / 6-)           | Yes (5+ / 6-) | NO (AC)                        | NO (AC)                   |

| DESCRIPTION OF THE SETTINGS AND OPTIONS |                                  |                                            |                                    |                                                    |                                      |                               |
|-----------------------------------------|----------------------------------|--------------------------------------------|------------------------------------|----------------------------------------------------|--------------------------------------|-------------------------------|
| Setting / Option                        | Time                             | Initial Torque                             | Soft-stop                          | By.                                                | NPN / START                          | Kick                          |
| Function                                | Increasing voltage ramp duration | Min. voltage applied to the motor at start | Decreasing voltage ramp duration   | Bypass presence diagnostic option (if bypass used) | Softstarter type of control option   | Motor shaft breakaway         |
| Possibilities                           | Ts= 0 up to 64s                  | 0 up to 100 %                              | 0, 1/2, 1 or 2 x ts up to 64s max. | -                                                  | PNP, NPN or since the mains presence | 0 up to 100ms depending on ts |
| Proceeding                              |                                  |                                            |                                    |                                                    |                                      |                               |



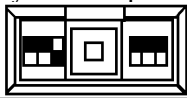


**SETTINGS AND DIAGNOSTIC**

**DESCRIPTION OF THE DIAGNOSTIC INFORMATION IN NORMAL OPERATION**

| Visualization |      |      | Status Outputs |       | Motor                    | Cause probable                                                                                                 |
|---------------|------|------|----------------|-------|--------------------------|----------------------------------------------------------------------------------------------------------------|
| Supply        | Line | Load | By.            | Diag. |                          |                                                                                                                |
| ○             | ○    | ○    | —              | —     | Stopped                  | No mains or device not correctly wired                                                                         |
| ●             | ●    | ●    | —              | —     | Stopped                  | Mains voltage and phases OK, Motor detected,<br>No control                                                     |
| ●             | ●●   | ○    | —              | —     | Starting                 | Mains voltage and phases OK, Motor detected,<br>Control detected and beginning of the <b>softstarting</b> ramp |
| ●             | ●    | ○    | —              | —     | Running to nominal speed | Mains voltage and phases OK, Motor detected,<br>Control detected and end of the <b>softstarting</b> ramp       |
| ●             | ○    | ●●   | —              | —     | Decelerating             | Mains voltage and phases OK, Motor detected,<br>No control and beginning of the <b>softstopping</b> ramp       |

**DIAGNOSTICS IN CASE OF FAILURE**

| Visualization |      |      | Status Outputs |       | Motor   | Possible Cause                                                                                                                                                | Solution                                                                                                                                  |
|---------------|------|------|----------------|-------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Supply        | Line | Load | By.            | Diag. |         |                                                                                                                                                               |                                                                                                                                           |
| ●○            | ○    | ●○   | —              | —     | Stopped | Mains voltage too low                                                                                                                                         | Check the phases 3L2 and 5L3                                                                                                              |
| ○             | ●    | ○    | —              | —     | Stopped | Phase(s) missing,<br>Mains frequency out of range,<br>Too much interference                                                                                   | Check the phases                                                                                                                          |
| ○             | ●    | ○    | —              | —     | Running | Phase(s) missing                                                                                                                                              | Check the phases                                                                                                                          |
| ○             | ●    | ●    | —              | —     | Stopped | Load missing,<br>Short-circuited thyristor                                                                                                                    | Check the motor connections and the solid state switches                                                                                  |
| ○             | ●●   | ●●   | —              | —     | Stopped | Bypass missing (its checking is required by the corresponding option)<br> | Check the bypass connections or if not used, cancel the checking option                                                                   |
| ●○            | ●○   | ●○   | —              | —     | Stopped | The solid state switches can not close                                                                                                                        | Check if the connection between 5 and 6 of the control terminal block is correctly done. Check as well if the load current is sufficient. |
| ●             | ●    | ●    | —              | —     | Stopped | Microcontroller malfunction                                                                                                                                   | Disconnect the softstarter from the mains for a while                                                                                     |
| ○●            | ●○   | ○    | —              | —     | Stopped | A problem occurred on the mains (no voltage or a phase missing, ...) then disappeared but the control voltage was applied                                     | Remove the control for a while                                                                                                            |
| ○●            | ●○   | ●○   | —              | —     | Stopped | A problem occurred on the load (temporary disconnection,...) then disappeared but the control voltage was applied                                             | Remove the control for a while                                                                                                            |

**LEGEND**

|     |       |     |                    |                  |
|-----|-------|-----|--------------------|------------------|
| ○   | ●     | ●   | ●●                 | ○●               |
| Off | Green | Red | Flashing off/green | Flashing Off/red |

**IMPORTANT INFORMATION ABOUT THE DIAGNOSTIC**

- The device makes a complete diagnostic (mains, load and itself) since it has enough supply voltage (On the mains or on the control side).
- The device only checks the presence of the phases and the closing of the solid state switches during the voltage ramps (Softstart and softstop) and during the full on state period.
- The control overrides the diagnostic.
  - If a problem occurs during the control period, the device will close all the solid state switches. If the problem goes on during the full on state period, the corresponding information will be given to the user according to the table above.
  - Likewise, if a problem occurs during the softstopping period, the device will stop immediately in order to reach the off state diagnostic period.
- On a hard stop (no softstop) and case of driving a large motor, the device may temporary display a problem concerning the mains. This is due to an important residual voltage across the motor windings (Back EMF generated by the motor rotation and the remaining magnetic field). This security allows the user to avoid connecting the motor to the mains in bad conditions. This phenomenon can be cancelled by using the softstop feature that slowly reduces the remanent magnetic field inside the motor. This allows as well to avoid overvoltage across the solid state switches (increasing the lifetime expectancy of the integrated varistors). Therefore, softstop is recommended even with high inertia motor loads.

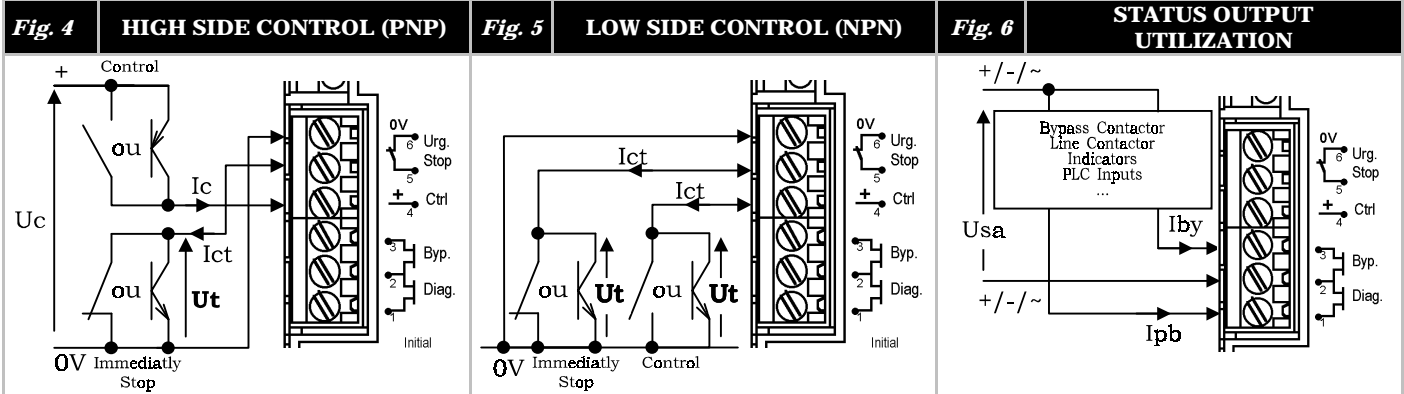


## Solid State Relays For Motor Control



### CONTROL

#### CONTROL INPUTS AND STATUS OUTPUTS



#### ELECTRICAL CHARACTERISTICS OF THE STARTING AND STOPPING INPUTS

| CHARACTERISTICS                                     | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) |                        |                                     | REMARKS                 |
|-----------------------------------------------------|--------|--------------------------------------------------------------|------------------------|-------------------------------------|-------------------------|
|                                                     |        | Ctrl                                                         |                        | Urg. Stop                           |                         |
| Input Function                                      |        | Controlling the device                                       |                        | Immediately stop the device         |                         |
| Control Type<br>(Depending on the option switches)  |        | High side control (PNP)                                      | Low side control (NPN) | Opening the connection to zero volt |                         |
| Concerned Terminals                                 |        | 4 & 6                                                        | 4 & 6                  | 5 & 6                               |                         |
| Control Voltage Range<br>(according to EN60947-4-2) | Uc     | 10->24VDC                                                    | -                      | -                                   |                         |
| Min. Control Voltage                                | Ucmin. | 8.5V                                                         | -                      | -                                   |                         |
| Max. Voltage Drop                                   | Ut     | -                                                            | 2.5VDC                 | 1.5VDC                              |                         |
| Max. Input Voltage                                  |        | Ucmax=28VDC                                                  | Utmax=28VDC            | Utmax=6VDC                          |                         |
| Max. Reverse Voltage                                |        | -Ucmax=28VDC                                                 | -Utmax=28VDC           | -Utmax=6VDC                         |                         |
| Release Voltage                                     |        | Uc<1VDC                                                      | Ut>2.5VDC              | Ut>1.5VDC                           |                         |
| Control Current                                     | Ic     | 5->19mADC                                                    | -                      | -                                   | See curve fig. 7 page 5 |
| Current To Switch                                   | Ict    | -                                                            | 50->100µADC            | 20mADC                              | Depends on Ut           |

#### STATUS OUTPUT CHARACTERISTICS

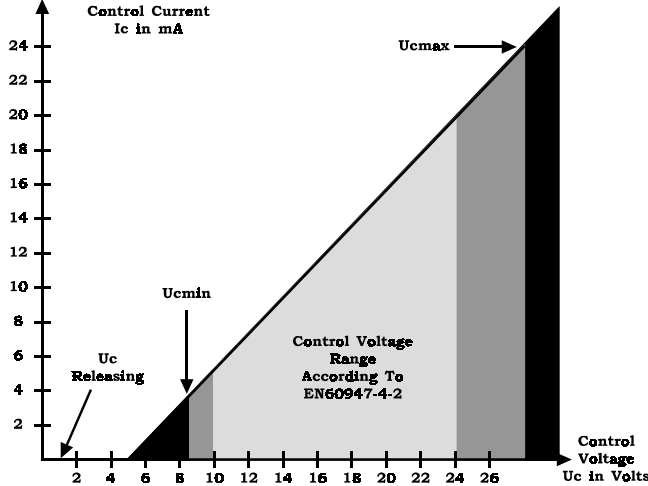
| CHARACTERISTICS                   | LABELS           | VALUES<br>(Given at 20°C ambient unless otherwise specified) |                                                                                                          | REMARKS                        |
|-----------------------------------|------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------|
|                                   |                  | Diag.<br>1 & 2                                               | Byp.<br>2 & 3                                                                                            |                                |
| Output Function                   |                  | Environment problem detection or faulty device indication    | Indicates the end of the starting period and can be used to control a bypass electromechanical contactor |                                |
| Nom. Operating Voltage            | Usan             | 24VAC/DC                                                     |                                                                                                          |                                |
| Operating Voltage Range           | Usa              | 0->28VAC/DC                                                  |                                                                                                          |                                |
| Non-repetitive Max. Peak Voltage  | Usapmax          | 60V                                                          |                                                                                                          |                                |
| Protection Against Overvoltage    |                  | Yes<br>25V size 7 varistors integrated                       |                                                                                                          | See curves fig. 11 & 12 page 5 |
| Min. Load Current                 | Ibymin<br>Ipbmin | 0                                                            |                                                                                                          |                                |
| Max. Permanent Current            | Iby/Ipb          | 1A AC/DC                                                     |                                                                                                          | See curve fig. 8 page 5        |
| Overload Current                  | Ibyp/Ipbp        | 2.4A AC/DC                                                   |                                                                                                          | @100ms<br>10% of the cycle     |
| Protection Against Short-Circuits |                  | No                                                           |                                                                                                          |                                |
| On-state Resistance               | Ron              | 500mΩ                                                        |                                                                                                          | See curve fig. 9 page 5        |
| Off-state Resistance              | Roff             | 100MΩ                                                        |                                                                                                          |                                |
| Off-state Capacitance             | Coff             | 130pF                                                        |                                                                                                          | See curve fig. 10 page 5       |
| Turn-on Time                      | Toff             | 0.5ms                                                        |                                                                                                          |                                |
| Turn-off Time                     | Ton              | 2ms                                                          |                                                                                                          |                                |



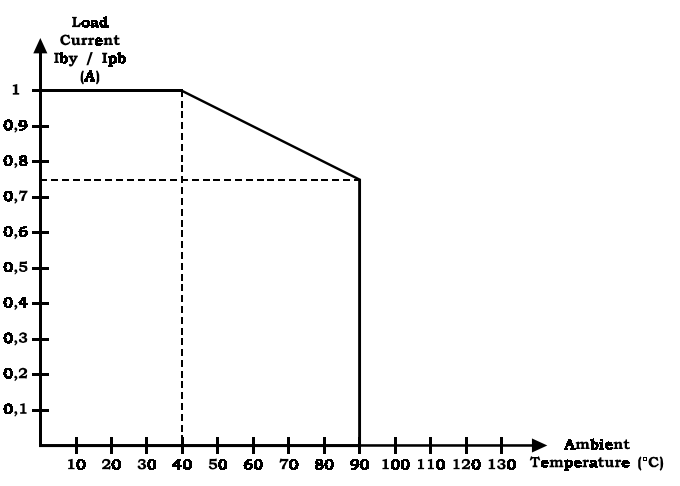
**CONTROL**

**CHARACTERISTIC CURVES OF THE CONTROLLING INPUTS AND STATUS OUTPUTS**

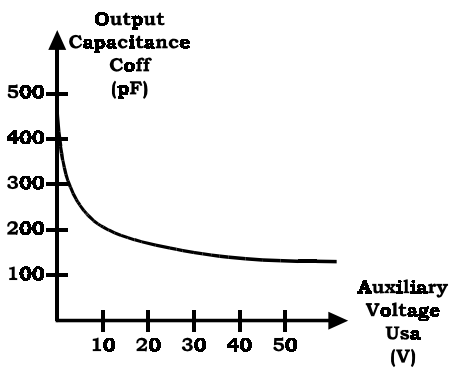
**Fig. 7** Control Input Current/Voltage Characteristic In PNP Mode (High Side Control)



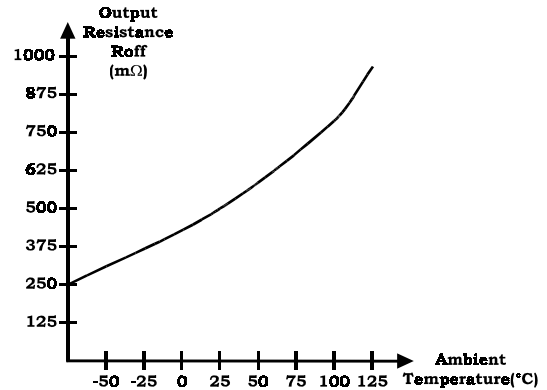
**Fig. 8** Curve Giving Max. Output Status Current Versus Ambient Temperature



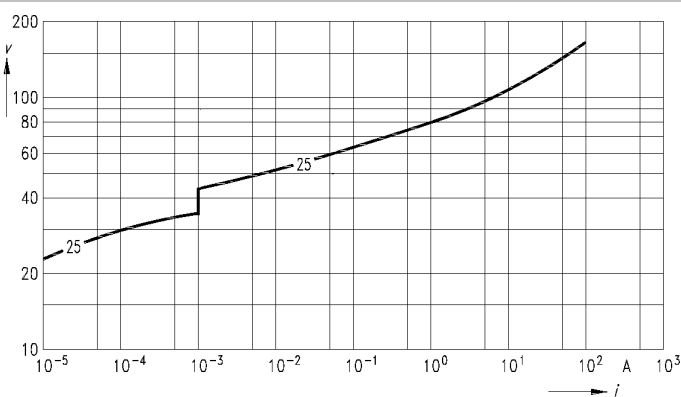
**Fig. 9** Off-state Status Output Parasitic Capacitance Versus Output Voltage



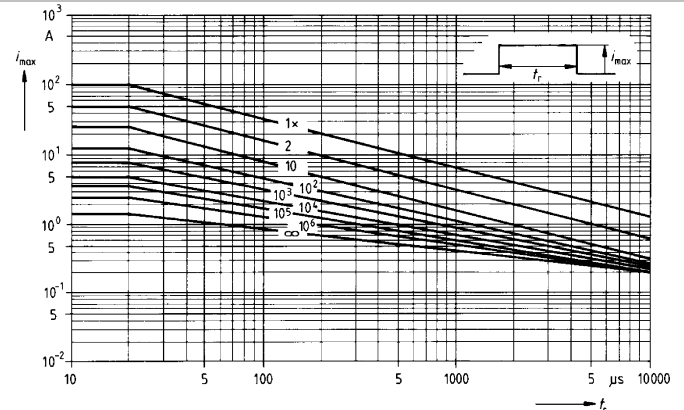
**Fig. 10** On-state Status Output Resistance Versus Ambient Temperature



**Fig. 11** Status Output Overvoltage Protection Characteristic



**Fig. 12** Curve Giving The Max. Number Of Overload Pulses Regarding Their Duration For The Overvoltage Protection Of The Status Outputs





## Solid State Relays For Motor Control



### POWER

| INTERNAL SUPPLY ELECTRICAL CHARACTERISTICS |        |                                                              |                                           |
|--------------------------------------------|--------|--------------------------------------------------------------|-------------------------------------------|
| CHARACTERISTICS                            | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS                                   |
| Concerned Terminals                        |        | 3L2 & 5L3                                                    | <b>See internal diagram fig. 1 page 2</b> |
| Voltage Range                              | Ue     | 200->480VAC                                                  |                                           |
| Consumption                                | Is     | 1mA typical                                                  |                                           |
| Frequency Range                            | f      | 40-65Hz                                                      |                                           |
| Turn-on Time                               | tm     | 100ms                                                        |                                           |

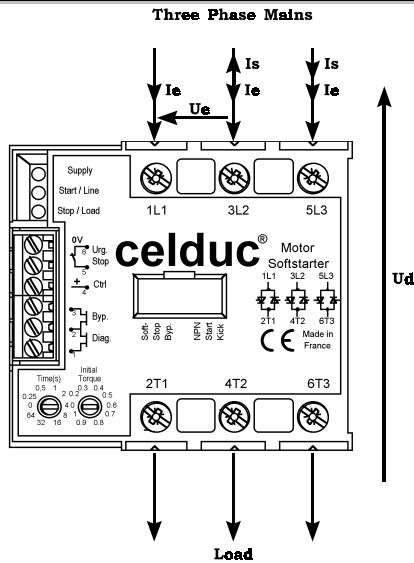
| POWER SIDE CHARACTERISTICS                                    |                  |                                                              |                                               |
|---------------------------------------------------------------|------------------|--------------------------------------------------------------|-----------------------------------------------|
| CHARACTERISTICS                                               | LABELS           | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS                                       |
| Concerned Terminals                                           |                  | 1L1, 2T1, 3L2, 4T2, 5L3, 6T3                                 |                                               |
| Max Power Of The Motor @400VAC Star Wiring (Y)                | Pn               | 7.5kW                                                        |                                               |
| Max Power Of The Motor @230VAC Star Wiring (Y)                | Pn               | 4.3kW                                                        |                                               |
| Max Power Of The Motor @400VAC Delta Wiring (D)               | Pn               | 13kW                                                         | Device wired inside the delta                 |
| Max Power Of The Motor @230VAC Delta Wiring (D)               | Pn               | 7.5kW                                                        | Device wired inside the delta                 |
| Nom. Operating Voltage                                        | Uen              | 230VAC & 400VAC                                              |                                               |
| Operating Voltage Range                                       | Ue               | 200->480VAC                                                  |                                               |
| Max. Non-repetitive Peak Voltage                              | Uep              | 1200V                                                        |                                               |
| Integrated Overvoltage Protection                             |                  | Yes<br>510V size 14 varistors                                | See curves fig. 16 & 17 page 7                |
| AC53a Nom. Current according to EN60947-4-2 (Induction Motor) | Ie (AC53a)       | 11.5A                                                        | Hard conditions<br>See curve fig. 15 page 7   |
| AC53a Max. Permanent Current (Induction Motor)                | Ie (AC53a)       | 16A                                                          | Normal conditions<br>See curve fig. 15 page 7 |
| Max. AC1 Permanent Current (Resistive Loads)                  | Ith (AC1)        | 22A                                                          | E.g. softstarting lamps                       |
| Non-repetitive Peak Overload Current (1 cycle of 10ms)        | ITSM             | 1000A                                                        | See Curve fig. 14 page 7                      |
| Fusing Limit Current For Choosing The Protecting Fuses        | I <sup>2</sup> t | 5000A <sup>2</sup> s                                         | @10ms                                         |
| Min. Load Current                                             | Iemin            | 100mA                                                        |                                               |
| Max. Leakage Current                                          | Ilk              | 7mA                                                          | @400VAC50Hz                                   |
| Power Factor                                                  | Pf               | 0->1                                                         |                                               |
| Operating Mains Frequency Range                               | F                | 40->65Hz                                                     |                                               |
| Off-state Dv/Dt                                               | dv/dt            | 500V/μs                                                      |                                               |
| Integrated Transient Voltage Protection                       |                  | YES<br>RC network                                            |                                               |
| Max. Current Rising Time                                      | di/dt            | 50A/μs                                                       |                                               |
| Direct Voltage Drop                                           | Ud               | 1.4V                                                         | @Ith                                          |
| Resistive Part Of The Direct Voltage Drop                     | rt               | 6.5mΩ                                                        | @125°C                                        |
| Threshold Part Of The Direct Voltage Drop                     | Vto              | 0.9V                                                         | @125°C                                        |
| Max. Junction Temperature                                     | Tjmax            | 125°C                                                        |                                               |
| Junction/Plate Thermal Resistance Per Power Element           | Rthjc            | 0.4°K/W                                                      | Total = 3 power elements                      |
| Plate/Heatsink Thermal Resistance                             | Rthcs            | 0.05°K/W                                                     |                                               |
| Vertically Mounted Heatsink Thermal Resistance                | Rthra            | 1.2°K/W                                                      | @ΔTra=60°C                                    |
| Heatsink Thermal Time Constant                                | Tthra            | 25min                                                        | @ΔTra=60°C                                    |



**CHARACTERISTIC CURVES OF THE POWER ELEMENTS**

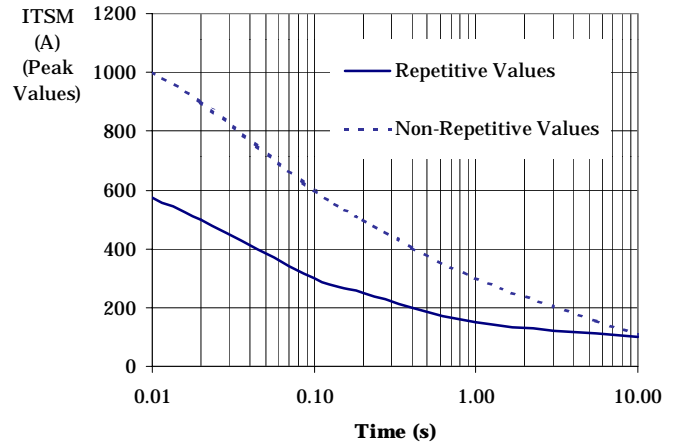
**Fig. 13**

**Electrical Label Description**



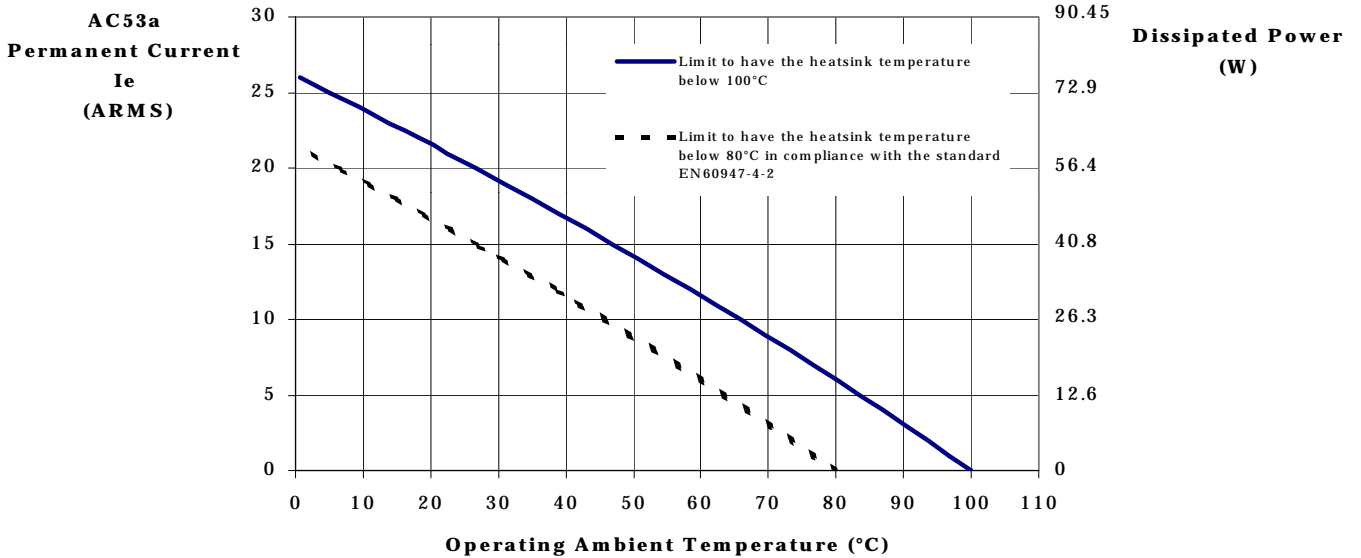
**Fig. 14**

**Overload Current Characteristic Regarding Overload Duration**



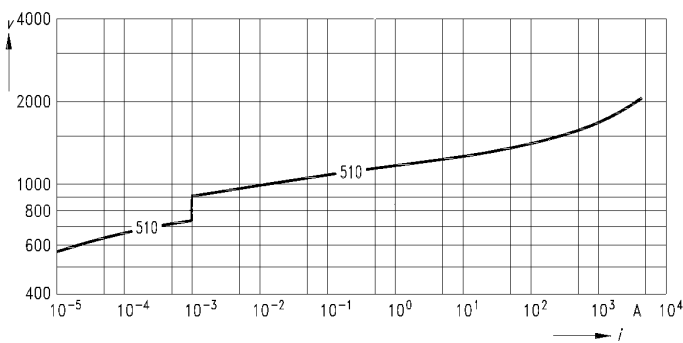
**Fig. 15**

**Nominal Currents Versus Ambient Temperature**



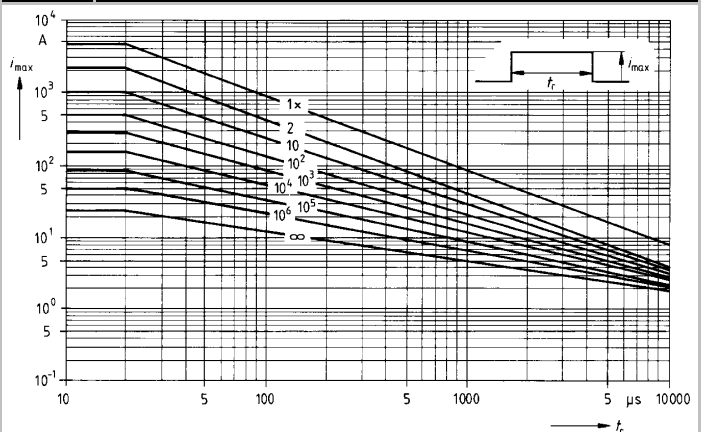
**Fig. 16**

**Overvoltage Protection Characteristic (Varistors)**



**Fig. 17**

**Curve Giving The Max. Number Of Overload Pulses Regarding Their Duration For The Overvoltage Protection Of The Power Elements**





## Solid State Relays For Motor Control



### GENERAL

| INPUT/OUTPUT ISOLATION CHARACTERISTIC |        |                                                              |         |
|---------------------------------------|--------|--------------------------------------------------------------|---------|
| CHARACTERISTICS                       | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS |
| Power Output/Input Isolation          | Uimp   | 4kV                                                          |         |
| Status Outputs / Input Isolation      | Uied   | 2.5kV                                                        |         |
| Plate/Input Isolation                 | Uimp   | 4kV                                                          |         |
| Status Output/Plate Isolation         | Uimp   | 4kV                                                          |         |
| Isolation Resistance                  | Rio    | 1GΩ                                                          |         |
| Isolation Capacitance                 | Cio    | <8pF                                                         |         |

| CLIMATIC OPERATING ENVIRONMENT      |        |                                                              |         |
|-------------------------------------|--------|--------------------------------------------------------------|---------|
| CHARACTERISTICS                     | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS |
| Storage Ambient Temperature         | Tstg   | -40->+100°C                                                  |         |
| Ambient Operating Temperature       | Tamb   | -40->+90°C                                                   |         |
| Max. Heatsink Temperature           | Tc     | 100°C                                                        |         |
| Wet Heat Resistance<br>(continuous) |        | According to I.E.C. 68 parts 2 & 3                           |         |
| Wet Heat Resistance<br>(cyclical)   |        | According to I.E.C. 68 parts 2 & 30                          |         |

| CONNEXIONS AND REQUIRED TOOLS ON THE CONTROL SIDE |        |                                                              |         |
|---------------------------------------------------|--------|--------------------------------------------------------------|---------|
| CHARACTERISTICS                                   | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS |
| Connections                                       |        | Screwed                                                      |         |
| Screwdriver                                       |        | 0.8 x 2mm                                                    |         |
| Wire Cross Section                                |        | 2.5mm <sup>2</sup>                                           |         |
| Min. And Max. Tightening Torque                   |        |                                                              |         |

| CONNEXIONS AND REQUIRED TOOLS ON THE POWER SIDE               |        |                                                              |         |
|---------------------------------------------------------------|--------|--------------------------------------------------------------|---------|
| CHARACTERISTICS                                               | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS |
| Connections                                                   |        | Screwed                                                      |         |
| Screwdriver                                                   |        | Posidriv 2 or 0.8 x 5.5mm                                    |         |
| Wire Cross Section                                            |        | 1,5->6mm <sup>2</sup> (10mm <sup>2</sup> without ferrule)    |         |
| Min. And Max. Tightening Torque                               |        | 1.8->3N.m                                                    |         |
| Possible Number Of Connected Wires For The Max. Cross Section |        | 2                                                            |         |

| CHARACTERISTICS AND REQUIRED TOOLS FOR THE SETTINGS |        |                                                              |                   |
|-----------------------------------------------------|--------|--------------------------------------------------------------|-------------------|
| CHARACTERISTICS                                     | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS           |
| Setting                                             |        | "Time" and "Initial Torque"                                  | Option Switches   |
| Screwdriver                                         |        |                                                              |                   |
| Number Of Positions                                 |        | 10                                                           | 2 for each switch |
| Changing Position<br>Required Torque                |        | >1.5N.cm +/- 50%                                             | >3N.cm +/- 50%    |
| Angle Between Each Position                         |        | 36°                                                          | 0°                |

| MISCELLANEOUS CHARACTERISTICS |        |                                                                        |         |
|-------------------------------|--------|------------------------------------------------------------------------|---------|
| CHARACTERISTICS               | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified)           | REMARKS |
| Housing                       |        | UL94V0                                                                 |         |
| Mounting                      |        | Omega DIN rail (DIN50022) or screwed                                   |         |
| Noise Level                   |        | Low audible vibration during the softstarting and softstopping periods |         |
| Weight                        |        | 1500g                                                                  |         |





## Solid State Relays For Motor Control

### STANDARDS

#### IMMUNITY LEVEL WITHIN ELECTROMAGNETIC COMPATIBILITY (E.M.C.)

| CHARACTERISTICS                 | LABELS           | VALUES<br>(Given at 20°C ambient unless otherwise specified)                                                               | REMARKS                          |
|---------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Electrostatic discharges        | EN<br>61000-4-2  | 8kV in the air<br>4kV contact                                                                                              | No state changing or destruction |
| Radiated Electromagnetic Fields | EN<br>61000-4-3  | 10V/m                                                                                                                      | No state changing or destruction |
| Fast Transient Bursts           | EN<br>61000-4-4  | 2kV direct coupling on the power side<br>2kV clamped coupling on the input side                                            | No state changing or destruction |
| Electric chocks                 | EN<br>61000-4-5  | 1kV direct coupling differential mode (Input and output sides)<br>2kV direct coupling common mode (Input and output sides) | No state changing or destruction |
| Voltage Drop                    | EN<br>61000-4-11 |                                                                                                                            |                                  |

#### EMISSION LEVEL WITHIN ELECTROMAGNETIC COMPATIBILITY (E.M.C.)

| CHARACTERISTICS              | LABELS  | VALUES<br>(Given at 20°C ambient unless otherwise specified)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | REMARKS |
|------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Conducted Disturbances       | EN55011 | In compliance with the standards for industrial field<br>In compliance with the standards for domestic field with an external bypass contactor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |
| Radiated Disturbances        | EN55011 | <30dbµV for the frequency range 30->230MHz<br><37dbµV for the frequency range 230->1000MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |
| Remarks Concerning Filtering |         | <p>The conducted or radiated disturbances generated by solid state relays depend on the wiring and load configuration.</p> <p>The test method recommended by the European standards and concerning electromagnetic compatibility leading to results far from reality, we decided to advise our customer in order to adapt their filtering scheme to their application.</p> <p>The European standard EN60947-4-2 requires the measurement to be done at full on state (end of the softstarting period). Therefore, our products are below the industrial field required levels on inductive load like the induction motor and <b>no additional filter</b> is needed.</p> <p>The starting period that may last several minutes generates enough interference to disturb sensitive devices located near the softstarter. If any, please contact us so that we can help you to choose the right filter.</p> |         |

#### LOW VOLTAGE DIRECTIVE

| CHARACTERISTICS             | LABELS | VALUES<br>(Given at 20°C ambient unless otherwise specified)   | REMARKS |
|-----------------------------|--------|----------------------------------------------------------------|---------|
| Standard                    |        | EN60947-4-2                                                    |         |
| Protection Level            | IP     | 2L0                                                            |         |
| Protection For Direct Touch |        | According to V.D.E. 160 part 100 : Back hand and finger safety |         |

#### APPROVALS

| CHARACTERISTICS | LABELS          | VALUES<br>(Given at 20°C ambient unless otherwise specified) | REMARKS            |
|-----------------|-----------------|--------------------------------------------------------------|--------------------|
| CE Marking      | EN<br>60947-4-2 | Yes                                                          |                    |
| c UL US         | UL508           | Pending                                                      |                    |
| VDE 0805        | EN60950         | Pending                                                      | Office environment |



**INSTALLATION**

**IMPORTANT**



**DANGER!**

The installation of this product must be done by qualified people, informed about electric hazards (electrocution risks linked to the voltage levels in the circuit).

Any intervention on the installation must be operated the circuit disconnected from the electric grid by an electromechanical mean insuring a sufficient galvanic isolation.

The device concerned by this document is composed of silicon based solid state switches. They never ensure a safe function when they are not controlled (Important leakage current and untimely closing). Therefore, we advise you to use an electromechanical device in series with the softstarter, which can ensure a safe operation in the disconnected circuit.

The emergency stop must not be done by the softstarter. It must be done by an electromechanical with sufficient current breaking possibility.

In order to operate in the circuit in safe condition, the control part of the softstarter will have to be disconnected from the control or auxiliary supplies as well.

**ATTENTION**

- 1- The SMCV does not correctly operate on three phase mains with the motor neutral connected to the neutral of the mains. If any, please contact us.**
- 2- The overload relay must be adapted to the motor.**
- 3- Please take care not to make short-circuits while installing the by-pass contactor or the backward wires for delta wiring.**
- 4- In case of devices planned to be used connected to a by-pass contactor (SMCW...1 reference), the control voltage will have to be held sufficiently to allow the by-pass to close. Take care not to remove the by-pass checking option "byp."**
- 5- In case of fast softstarting and softstopping controls without waiting for the end of the ramps, the motor may heat up. Please contact your motor supplier to choose an adapted model.**

**ENVIRONMENT OF THE SOFTSTARTER**

| DEVICES                                                         | LABELS | DESCRIPTION                                                  | REMARKS |
|-----------------------------------------------------------------|--------|--------------------------------------------------------------|---------|
| On Line Fuses<br>(Hard conditions<br>according to EN60947-4-2)  |        | FERRAZ 14 x 51 am 20/500V                                    |         |
| On Line Fuses<br>(Normal conditions)                            |        | To be determine by the user                                  |         |
| Overload Relay<br>(Hard conditions<br>according to EN60947-4-2) |        | Moeller Z00-16 class 10A                                     |         |
| Overload Relay<br>(Normal conditions)                           |        | To be determine by the user                                  |         |
| Breaking Capability Of The By-pass<br>Contactor                 | KM1    | 16A AC1                                                      |         |
| By-pass Contactor Coil                                          | A1/A2  | 15VAm <sub>ax</sub> . / 15W max.                             |         |
| Thermal Protection                                              | T°C    | Not available                                                |         |
| Wiring / Settings                                               |        | Comply with the characteristics given in general information |         |



# Solid State Relays For Motor Control



## INSTALLATION

### WIRING POSSIBILITIES

Fig. 19

#### High Side Control (PNP)

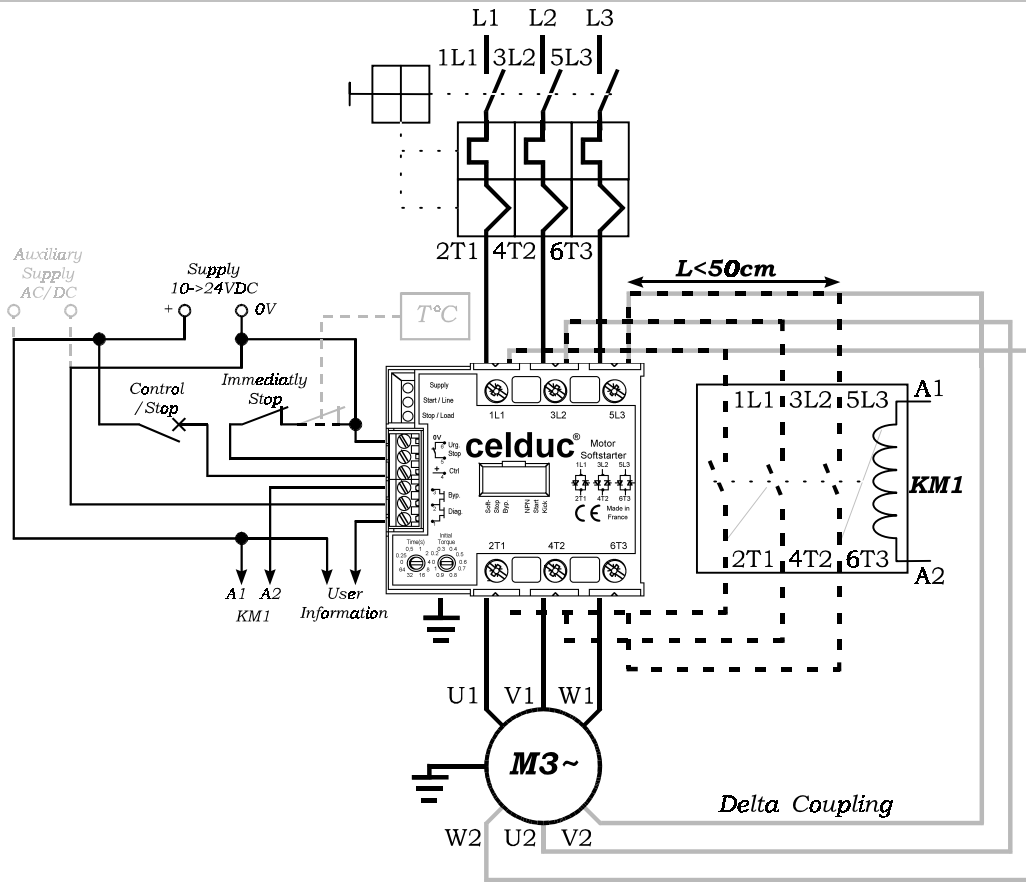
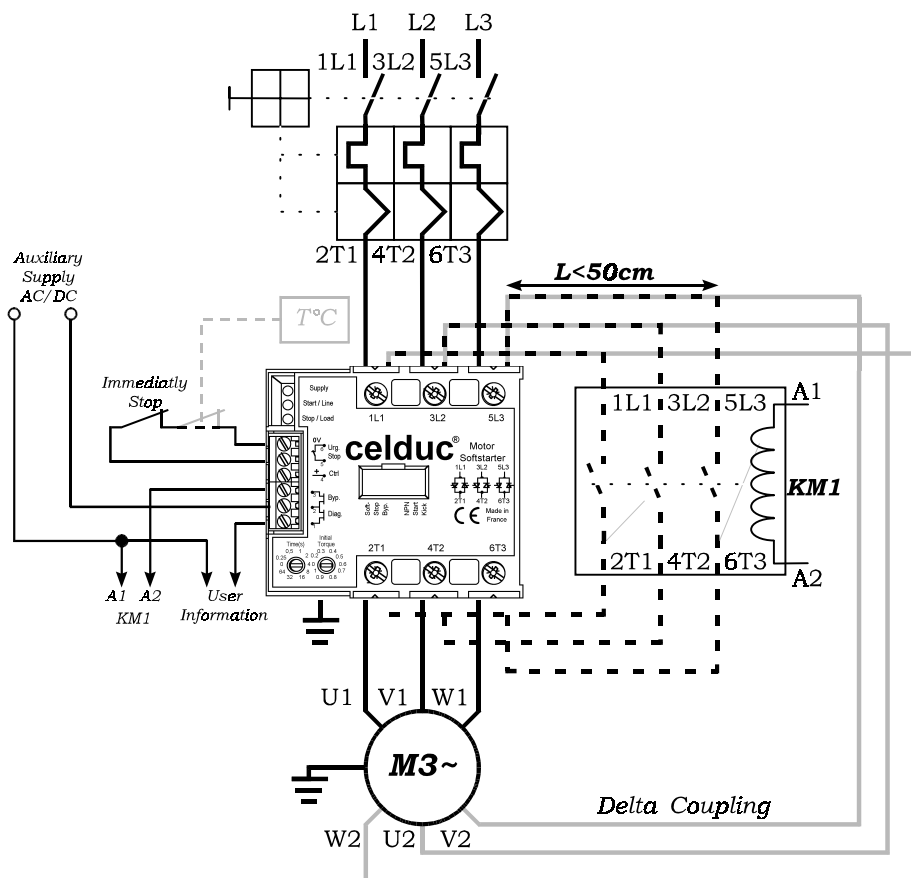


Fig. 20

#### Low Side Control (NPN)



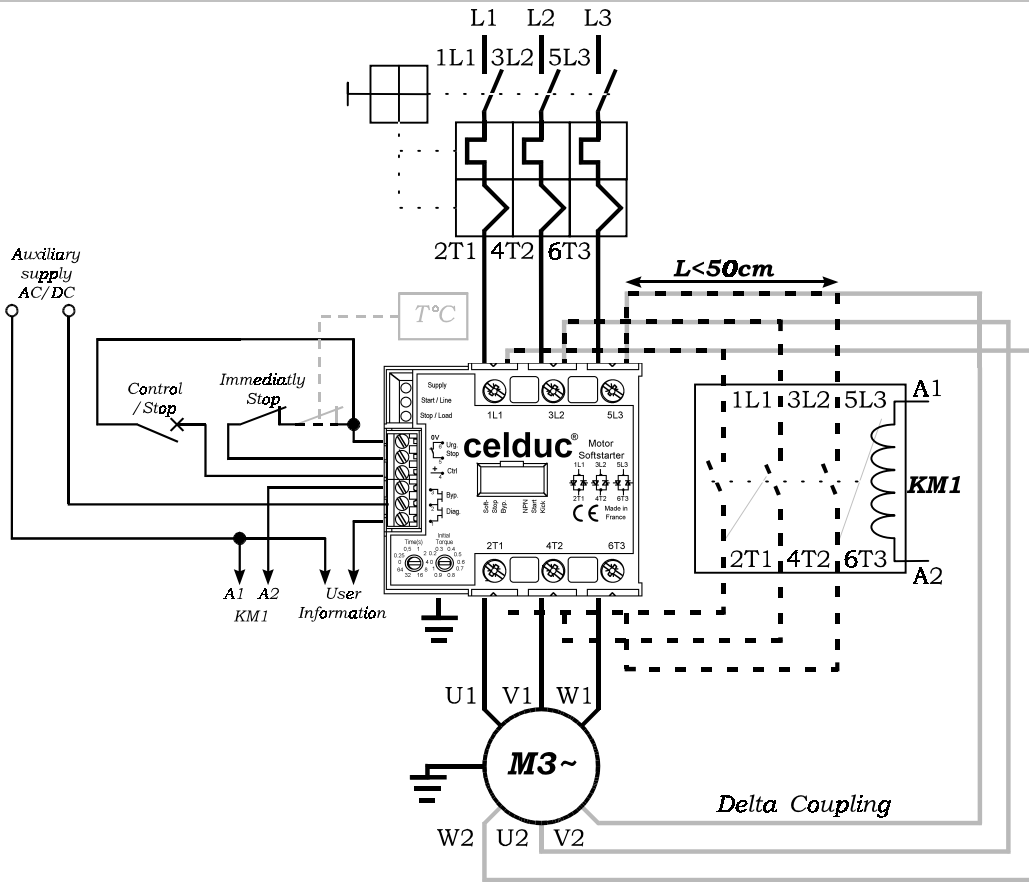


**INSTALLATION**

**WIRING POSSIBILITIES**

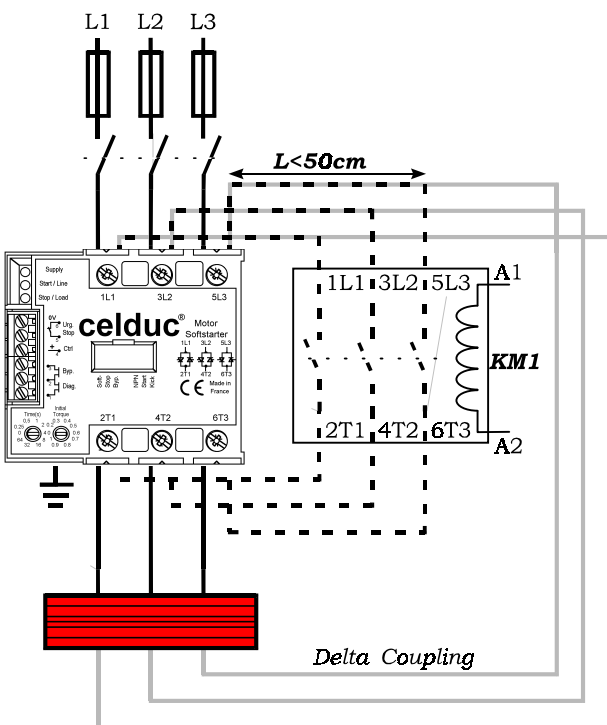
Fig. 21

**Upon The Mains Control**

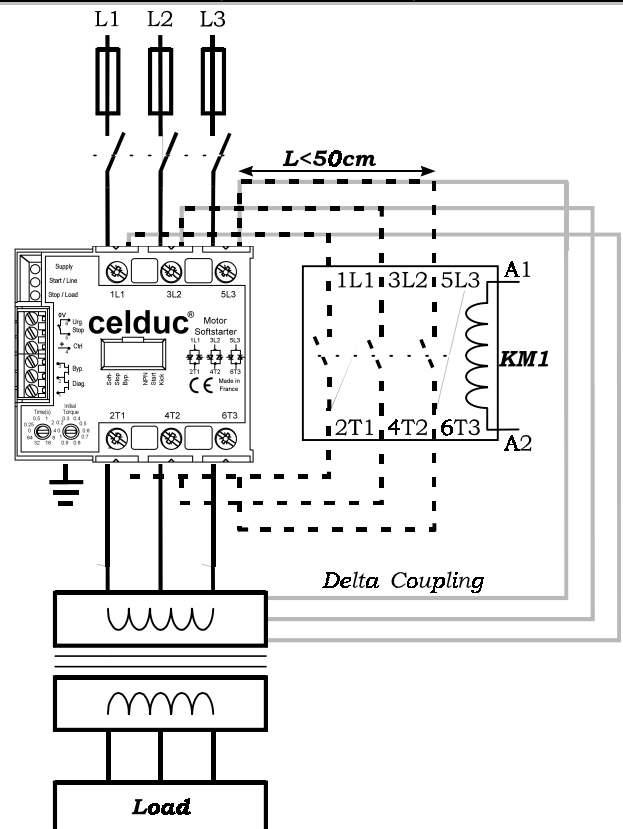


**OTHER LOAD POSSIBILITIES**

**Softstarting Incandescent Or Infrared Lamps (AC1 Current)**



**Softstarting Three Phase Loaded Transformers (Please consult us)**





# Solid State Relays For Motor Control



## INSTALLATION

### MOUNTING

#### Mounting Precautions :

The heatsink fins must be mounted vertically to ensure a good thermal convection.  
A minimum space must be left free around the assembly.

Fig. 22

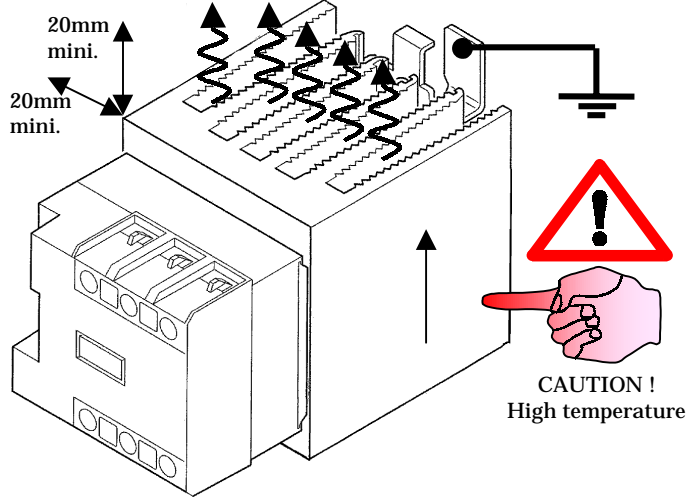
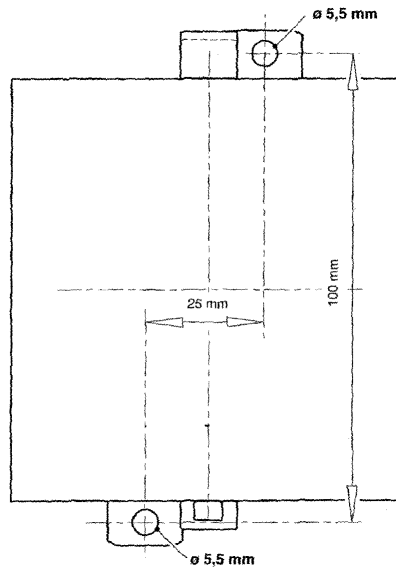


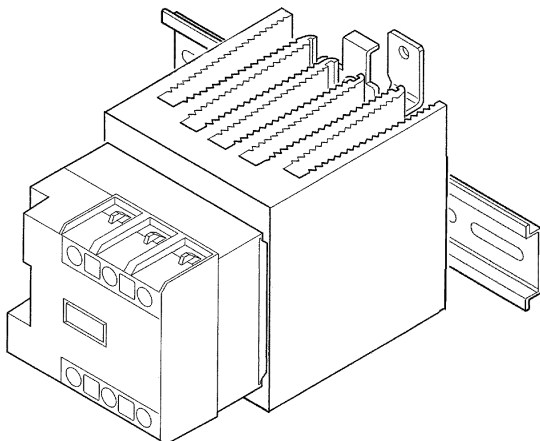
Fig. 24

### Mounting With Screws

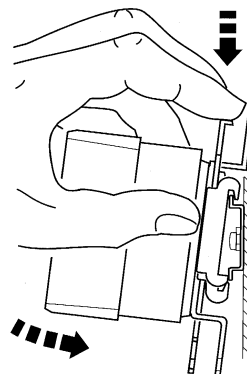


### Omega DIN Rail Mounting (EN50022)

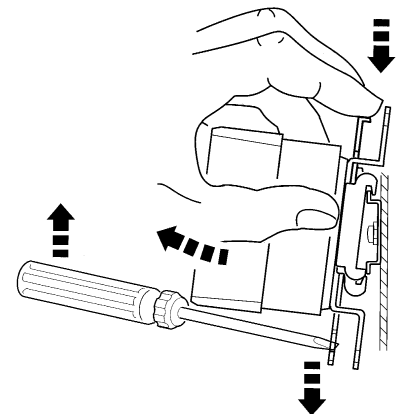
#### Mounting



#### Fixing



#### Removing





**INSTALLATION**

**ADVISES FOR THE SETTINGS**

**ATTENTION**

Obtaining a particular starting time value is only a consequence of the motor torque reduction and can not be guaranteed or easily repeatable. The rotary switch « Time (s) » setting values only give the duration of the voltage ramp applied to the motor but not necessarily its starting time. The main SMCV function is to obtain a motor torque reduction to take care of the motor load and the electric grid. The motor starting time is only a consequence and completely depends on the motor itself, its load and the settings done by the user.

The SMCV can not break a motor driving a load that has much inertia. The user can only obtain a stop time equal or longer than a simple disconnection from the electric grid. Using the softstop feature can only be justified when the motor load tends to break the motor (pumps, ...) or when the products treated by the machine need to be stop slowly (conveyors,...). In the case of load with high inertia, the softstop feature can help to reduce slowly the magnetic field inside the motor to avoid long time overvoltage in the circuit.

**Setting Examples**

| Direct On Line Starting (DOL) | Long Starting Time For lamps, Transformers, ...<br>(On a motor, it may hum) | Advise Settings<br>For Testing The Motor Starting |
|-------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------|
|                               |                                                                             |                                                   |
|                               |                                                                             |                                                   |

**Loads With Increasing Torque Like N<sup>2</sup>  
And Increasing Power Like N**

| Load Examples                    | Advised Time Setting                                 |
|----------------------------------|------------------------------------------------------|
| Fans<br>Centrifugal Pumps<br>... | Depending on the user starting time requirement      |
|                                  | Advised Torque Setting                               |
| <b>Torque Curve</b>              | Adjusted to avoid the motor to hum                   |
| C                                | <b>Softstop</b>                                      |
|                                  | ½ of the starting time<br>(Magnetic field reduction) |

**Loads With Decreasing Torque Like 1/N  
And Constant Power**

| Load Examples                                                                                        | Advised Time Setting                                 |
|------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Winding material around a shaft (cable, paper, metal, textile, plastic, ...)<br>Chip disposal<br>... | Maximum (64s)                                        |
|                                                                                                      | Advised Torque Setting                               |
| <b>Torque Curve</b>                                                                                  | Depending on the user starting current requirement   |
| C                                                                                                    | <b>Softstop</b>                                      |
|                                                                                                      | ½ of the starting time<br>(Magnetic field reduction) |

**Loads with Constant Torque  
And Power Increasing Like N**

| Load Examples                                    | Advised Time Setting                                  |
|--------------------------------------------------|-------------------------------------------------------|
| Conveyors, cranes, constant volume pumps,<br>... | Maximum (64s)                                         |
|                                                  | Advised Torque Setting                                |
| <b>Torque Curve</b>                              | Depending on the user starting current requirement    |
| C                                                | <b>Softstop</b>                                       |
|                                                  | Depending on the user stopping smoothness requirement |

**Loads Increasing Like N  
And Constant Power**

| Load Examples                           | Advised Time Setting                                  |
|-----------------------------------------|-------------------------------------------------------|
| Machine tools,<br>Rolling mills,<br>... | Depending on the user starting time requirement       |
|                                         | Advised Torque Setting                                |
| <b>Torque Curve</b>                     | Adjusted to avoid the motor to hum                    |
| C                                       | <b>Softstop</b>                                       |
|                                         | Depending on the user stopping smoothness requirement |



**Solid State Relays  
For Motor Control**

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N° 1993/1106a

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