

APPLICATION MANUAL

• 15P0058B2 •

SFTM SFTM-B

22/02/01
SOFTWARE VERS. S4.00 ÷ S4.09
R.05

English

- This manual is an integral and essential part of the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
- This device shall be used only for the purposes it is aimed at. Any other use is to be considered as improper and dangerous. The manufacturer is not responsible for any possible damage caused by improper, erroneous and irrational uses.
- Elettronica Santerno are responsible for the device in its original setting.
- Any changes to the structure or operating cycle of the device must be performed or authorized by Elettronica Santerno's Engineering Department.
- Elettronica Santerno are not responsible for the consequences resulting from the use of non-original spare parts.
- Elettronica Santerno reserve the right to make any technical changes to this manual and the device without prior notice. Any misprint or spelling mistake will be edited in the new versions of this manual.
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IMPORTANT SAFETY NOTES

LEGEND:



DANGER!! It indicates working steps that, **if not correctly performed**, can cause accidents or death because of electric shocks.



DANGER!! It indicates working steps that, **if not correctly performed**, can cause accidents or death.



CAUTION!! It indicates working steps that, **if not correctly performed**, can cause serious damages to the equipment.



NOTE: It contains important information about the equipment use.

HERE IS A LIST OF SUGGESTIONS TO BE FOLLOWED TO ENSURE SAFETY CONDITIONS DURING EQUIPMENT USAGE AND INSTALLATION:



NOTE: Before starting the equipment, always read this manual carefully.



CAUTION: The static drive cannot be used as a cutoff or sectioning device, according to standard EN60204-1, 1992, chap. 5.



CAUTION - When using the AUTORESET function, if the motor has been stopped by a drive block, the motor can be re-started as soon as the block cause is removed.



DANGER!! MECHANICAL MOVEMENT - The SOFT-STARTER causes a mechanical movement. The user has the responsibility to check that this movement does not generate dangerous conditions.



DANGER!! EXPLOSION AND FIRE - Explosion and fire risk if the equipment is installed in rooms where inflammable gases are present. Assemble the equipment outside rooms subject to explosion and fire risk even if the motor is located there.



DANGER!! For user safety, the SOFT STARTER has to be grounded according to the local standards.



DANGER!! POSSIBILITY OF ELECTRIC SHOCKS.
Do not touch the electrical parts of the SOFT-STARTER when the power supply is connected



DANGER!! Never make operation on the motor when the SOFT-STARTER is supplied.



DANGER!! Do not perform electric connections when the SOFT-STARTER is supplied; even if it is in standby. The risk of electric shocks is present on the output terminals U,V,W.



CAUTION: Do not connect supply voltages higher than the rated one. If this occurs, the internal circuits can be damaged.



CAUTION: Do not use the SOFT-STARTER without first connecting it to earth.



CAUTION: In case of alarm, refer to the diagnostics chapter and, after locating the trouble, restart the equipment.



CAUTION: Do not perform insulation tests between power terminals or control terminals.



CAUTION: Make sure that the screws of the control and power terminal are perfectly tight.



CAUTION: Do not connect power factor correction capacitors to the motor.



CAUTION: **Do not connect single-phase motors.**



CAUTION: Always use a thermal protection of the motor (either using the I^2t function typical of the SOFT-STARTER, a temperature sensor located on motor windings or a thermal relay located on motor supply current).



CAUTION: Respect the environment requirements.



CAUTION: The surface on which the SOFT-STARTER is installed should withstand temperatures up to 90°C.



CAUTION: ELETTRONICA SANTERNO assumes no responsibility in case of non-observance of the required standards.

TABLE OF CONTENTS

IMPORTANT SAFETY NOTES.....	0 - 2
1 OVERVIEW	1 - 1
1.1 CHECKING AT RECEPTION	1 - 2
1.2 INSTALLATION.....	1 - 3
1.2.1 AMBIENT CONDITIONS.....	1 - 3
1.2.2 ASSEMBLY.....	1 - 3
1.3 EXTERNAL DIMENSIONS OF SFTM SIZE 1.....	1 - 4
1.4 THROUGH-PANEL ASSEMBLY OF SFTM SIZE 1.....	1 - 5
1.5 EXTERNAL DIMENSIONS OF SFTM SIZE 2.....	1 - 6
1.6 EXTERNAL DIMENSIONS OF SIZE 2A.....	1 - 7
1.7 THROUGH-PANEL ASSEMBLY OF SFTM SIZE 2 - 2A.....	1 - 8
1.8 EXTERNAL DIMENSIONS SFTM SIZE 3.....	1 - 9
1.9 EXTERNAL DIMENSIONS OF SFTM SIZE 4.....	1 - 10
1.10 CONNECTIONS OF SFTM SIZE 1... 2A FOR A MAINS UP TO 500VAC	1 - 11
1.11 POWER CONNECTIONS OF MODULAR SFTM FOR A MAINS UP TO 500 VAC.....	1 - 12
1.12 DESCRIPTION OF THE POWER CONNECTIONS FOR A MAINS UP TO 500V.....	1 - 13
1.13 THYRISTOR POSITIONING IN SFTM SIZE 1 ... 2A (COMPACT MODELS).....	1 - 13
1.14 CONTROL TERMINAL BOARD.....	1 - 14
1.15 POWER TERMINALS AND AUXILIARY TERMINAL BOARDS.....	1 - 15
1.16 POWER UNIT ELECTRIC DIAGRAM OF MODULAR SFTM	1 - 16
1.17 DESCRIPTION OF EXTRACTABLE CONNECTORS FOR MODULAR SFTM.....	1 - 17
1.18 SFTM POWER CONNECTIONS FOR A MAINS EXCEEDING 500VAC.....	1 - 18
2 TECHNICAL CHARACTERISTICS.....	2 - 1
2.1 TECHNICAL DATA TABLES.....	2 - 1
2.2 GENERIC DATA.....	2 - 6
3 PROGRAMMING	3 - 1
3.1 CONTROL KEYBOARD.....	3 - 1
3.2 DISPLAY THROUGH LEDS LOCATED ON THE CONTROL BOARD.....	3 - 2
3.3 KEY PARAMETER.....	3 - 3
3.4 PARAMETER DISPLAY.....	3 - 4
4 BASIC START-UP PROCEDURE.....	4 - 1
5 DESCRIPTION OF INPUT AND OUTPUT SIGNALS.....	5 - 1
5.1 DIGITAL CONTROL SIGNALS.....	5 - 1
5.1.1 RUN/STANDBY AND START/STOP IN MODE 1	5 - 2
5.1.2 RUN/STANDBY AND START/STOP IN MODE 2.....	5 - 2
5.1.3 RESET (TERMINAL 27).....	5 - 3
5.1.4 DI1, DI2 (TERMINALS 16, 17).....	5 - 3
5.1.5 EXTERNAL START-UP SELECTION (TERMINALS 16,17).....	5 - 3
5.1.6 SELECTION OF MOTOR CHARACTERISTIC SETS (TERMINALS 16 AND 17).....	5 - 4
5.1.7 EXTERNAL ALARM (TERMINAL 17).....	5 - 4
5.1.8 TERMINAL 16 AND 17 CONFIGURATION SUMMARIZING TABLE.....	5 - 5
5.2 ANALOG OUTPUTS.....	5 - 5
5.2.1 OUTAUX (TERMINAL 9).....	5 - 5
5.2.2 OUT I (TERMINAL 10).....	5 - 6
5.2.3 OUT V (TERMINAL 11).....	5 - 6
5.3 RELAY MULTI-FUNCTION DIGITAL OUTPUTS (MDO1, MDO2, MDO3, MDO4).....	5 - 7
6 DESCRIPTION OF BASIC FUNCTIONS.....	6 - 1
6.1 START-UP PROFILES.....	6 - 1
6.1.1 CURRENT STEP (P02 = 0).....	6 - 1
6.1.2 CURRENT RAMP (P02 = 1).....	6 - 4
6.1.3 KICK START (P02 = 2).....	6 - 6
6.1.4 VOLTAGE RAMP (P02 = 2).....	6 - 9
6.1.5 SPEED RAMP START (P02 = 3).....	6 - 11

6.2	STOP PROFILES.....	6 - 12
6.2.1	COAST TO STOP.....	6 - 12
6.2.2	PHASE RAMP STOP.....	6 - 12
6.2.3	SPEED RAMP STOP.....	6 - 13
6.3	CONNECTION WITH BY-PASS CONTACTOR	6 - 14
6.4	MULTIPLE MOTOR START-UP.....	6 - 15
6.4.1	PHASE RAMP STOP OF SEVERAL MOTORS.....	6 - 17
6.5	AUTORESET	6 - 18
6.6	ENERGY SAVING	6 - 20
6.7	I2T MOTOR.....	6 - 21
6.8	TACHO GENERATOR.....	6 - 22
6.8.1	PROCEDURE FOR TACHO GENERATOR CONNECTION.....	6 - 23
6.9	LINE CONTACTOR CONTROL.....	6 - 24
6.10	BRAKING AND ANTICONDENSATE DIRECT CURRENT (SFTM-B).....	6 - 25
6.10.1	BRAKING DIRECT CURRENT.....	6 - 25
6.10.2	ANTICONDENSATE DIRECT CURRENT (TERMINAL 16).....	6 - 26
7	OPERATION PARAMETERS.....	7 - 1
7.1	PARAMETER LIST.....	7 - 1
7.2	MEASUREMENT PARAMETERS.....	7 - 1
7.2.1	M00: SOFT STARTER STATE.....	7 - 1
7.2.2	M01: OUTPUT CURRENT.....	7 - 1
7.2.3	M02: OUTPUT VOLTAGE.....	7 - 2
7.2.4	M04: MOTOR SPEED.....	7 - 2
7.2.5	M05: THYRISTOR FIRING ANGLE.....	7 - 2
7.2.6	M06: MAINS FREQUENCY.....	7 - 2
7.2.7	M07: MAINS VOLTAGE.....	7 - 2
7.2.8	M08: VOLTAGE AUXILIARY OUTPUT.....	7 - 3
7.2.9	M09: HEATSINK TEMPERATURE.....	7 - 3
7.2.10	M10: DIGITAL INPUT STATE.....	7 - 3
7.2.11	M11: DIGITAL OUTPUT STATE.....	7 - 3
7.2.12	M12: SOFT STARTER OPERATION TIME.....	7 - 4
7.2.13	M14: LENGTH OF LAST START-UP.....	7 - 4
7.2.14	M19: START-UP TYPE.....	7 - 4
7.2.15	M21: LAST ALARM.....	7 - 4
7.2.16	M22: PENULTIMATE ALARM.....	7 - 4
7.2.17	M23: ANTEPENULTIMATE ALARM.....	7 - 4
7.3	PROGRAMMING PARAMETERS.....	7 - 5
7.3.1	P00: PROGRAMMING CODE.....	7 - 5
7.3.2	P01: PROGRAMMING LEVELS.....	7 - 5
7.3.3	P02: START-UP PROFILES.....	7 - 6
7.3.4	P03: MOTOR CURRENT.....	7 - 6
7.3.5	P04: STARTING CURRENT.....	7 - 6
7.3.6	P05: FINAL START-UP CURRENT.....	7 - 7
7.3.7	P06: FINAL START-UP CURRENT LIMIT.....	7 - 7
7.3.8	P07: STARTING IN-RUSH VOLTAGE.....	7 - 7
7.3.9	P08: VOLTAGE AFTER STARTING IN-RUSH.....	7 - 8
7.3.10	P09: INITIAL START-UP TIME.....	7 - 8
7.3.11	P10: TIME OF INITIAL IN-RUSH VOLTAGE	7 - 8
7.3.12	P11: STARTING RAMP TIME.....	7 - 8
7.3.13	P12: STOPPING RAMP TIME.....	7 - 9
7.3.14	P13: LIMIT TIME FOR MOTOR START-UP.....	7 - 9
7.3.15	P14: STOP TYPE.....	7 - 9
7.3.16	P15: BRAKING APPLICATION BEFORE STARTING.....	7 - 10
7.3.17	P16: BRAKING APPLICATION WHILE STOPPING.....	7 - 10

7.3.18	P17: DURATION OF BRAKING APPLICATION BEFORE STARTING.....	7 - 10
7.3.19	P18: DURATION OF BRAKING APPLICATION WHILE STOPPING.....	7 - 11
7.3.20	P19: STOP RAMP LOCKING LEVEL.....	7 - 11
7.3.21	P20: DIRECT CURRENT BRAKING INTENSITY.....	7 - 11
7.3.22	P21: ANTICONDENSATE DIRECT CURRENT SUPPLY.....	7 - 12
7.3.23	P22: ANTICONDENSATE DIRECT CURRENT INTENSITY.....	7 - 12
7.3.24	P23: MOTOR I2T SELECTION.....	7 - 12
7.3.25	P24: MOTOR THERMAL CURRENT.....	7 - 12
7.3.26	P25: MOTOR THERMAL TIME CONSTANT.....	7 - 13
7.3.27	P26: MOTOR SPEED.....	7 - 13
7.3.28	P27: AUTOMATIC RESTART (AUTORESET).....	7 - 13
7.3.29	P28: NUMBER OF MOTOR RESTARTS.....	7 - 13
7.3.30	P29: ZERO SETTING OF RESTART COUNTER.....	7 - 14
7.3.31	P30: MOTOR START-UP SAFETY	7 - 14
7.3.32	P31: MODE CONFIGURATION FOR START/STOP CONTROLS	7 - 14
7.3.33	P32: CONFIGURATION OF TERMINAL 16.....	7 - 14
7.3.34	P33: CONFIGURATION OF TERMINAL 17.....	7 - 15
7.3.35	P34: POWER/SYNCHRONIZATION RATIO.....	7 - 15
7.3.36	P36: CONFIGURATION OF ANALOG OUTPUT.....	7 - 16
7.3.37	P37: SCALE FACTOR OF ANALOG OUTPUT CURRENT	7 - 16
7.3.38	P38: SCALE FACTOR OF ANALOG OUTPUT VOLTAGE.....	7 - 17
7.3.39	P42: PROGRAMMABLE DIGITAL OUTPUT MDO1.....	7 - 17
7.3.40	P43: CURRENT THRESHOLD FOR OUTPUT MDO1 TRIPPING.....	7 - 17
7.3.41	P44: VOLTAGE THRESHOLD FOR OUTPUT MDO1 TRIPPING.....	7 - 18
7.3.42	P45: MDO1 ENABLING DELAY TIME	7 - 18
7.3.43	P46: MDO1 DISABLING DELAY TIME.....	7 - 18
7.3.44	P47: TRIPPING HYSTERESIS LEVEL FOR MDO1	7 - 18
7.3.45	P48: OUTPUT ENABLING LOGIC.....	7 - 19
7.3.46	P79: SOFT-STARTER SERIAL ADDRESS.....	7 - 21
7.3.47	P80: SERIAL CONNECTION BAUD RATE.....	7 - 21
7.3.48	P81: SERIAL CONNECTION PARITY CONTROL.....	7 - 21
7.3.49	P82: SERIAL TIMEOUT.....	7 - 22
7.3.50	P83: SERIAL RESPONSE DELAY.....	7 - 22
7.3.51	P85: ENERGY SAVING ON.....	7 - 22
7.3.52	P86: CURRENT FOR ENERGY SAVING ON	7 - 22
7.3.53	P87: CURRENT FOR ENERGY SAVING OFF.....	7 - 22
7.3.54	P88: OUTPUT VOLTAGE LEVEL WITH ENERGY SAVING.....	7 - 23
7.3.55	P98: GAIN PROPORTIONAL TO VOLTAGE LOOP.....	7 - 23
7.3.56	P99: INTEGRAL TIME OF VOLTAGE LOOP.....	7 - 23
7.3.57	P100: ALARM FOR TACHO GENERATOR FAULT.....	7 - 23
7.3.58	P101: ALARM FOR LOAD INTERRUPTED.....	7 - 24
7.3.59	P102: FREQUENCY ALARM TRIPPING.....	7 - 24
7.3.60	P103: OUT OF TOLERANCE MAINS ALARM TRIPPING.....	7 - 24
7.3.61	P104: POWER FAILURE ALARM TRIPPING.....	7 - 24
7.3.62	P105: ALARM A03 DELAY.....	7 - 24
7.3.63	P106: ALARM A04/A05 DELAY.....	7 - 25
7.3.64	P107: MAINS FREQUENCY CHANGE.....	7 - 25

8	DIAGNOSTICS.....	8 - 1
8.1	ALARM PARAMETERS.....	8 - 1
8.1.1	A01: WRONG CYCLIC SENSE.....	8 - 1
8.1.2	A02: MAINS FREQUENCY OUT OF TOLERANCE.....	8 - 1
8.1.3	A03: UNSTABLE MAINS FREQUENCY.....	8 - 1
8.1.4	A04: MAINS VOLTAGE OUT OF TOLERANCE.....	8 - 1
8.1.5	A05: POWER FAILURE.....	8 - 2
8.1.6	A11: TACHO GENERATOR FAILURE.....	8 - 2
8.1.7	A12: CURRENT HIGHER THAN 200% OF THE MAX. OVERLOAD OF THE SOFT STARTER.....	8 - 2
8.1.8	A14: MOTOR OVERHEATING	8 - 2
8.1.9	A15: START-UP FAILURE.	8 - 2
8.1.10	A16: INTERRUPTED LOAD	8 - 2
8.1.11	A17: EXTERNAL ALARM.....	8 - 3
8.1.12	A30: NO 24VDC IN THYRISTOR PILOT SECTION.....	8 - 3
8.1.13	A31: HEATSINK TOO HIGH TEMPERATURE.....	8 - 3
8.1.14	A32: SYNCHRONISM FAILURE.....	8 - 3
8.1.15	A33: EEPROM MEMORY BLANK OR NOT FITTED.....	8 - 3
8.1.16	A35: WRONG EEPROM PARAMETERS.....	8 - 3
8.1.17	A36: WRONG BACKUP PARAMETERS	8 - 4
8.1.18	A37: CONTROL UNIT FAILURE	8 - 4
8.2	WARNING PARAMETERS.....	8 - 4
8.2.1	W00: EXCESSIVE HEATSINK TEMPERATURE FOR START-UP	8 - 4
8.2.2	W01: SAFETY AT START-UP.....	8 - 4
9	ACCESSORIES.....	9 - 1
9.1	MAINS FUSES.....	9 - 1
10	ANNEXES.....	10 - 1
10.1	ANNEX A: USER PARAMETER RECORDING TABLES - DEFAULT MOTOR.....	10 - 1
10.2	ANNEX B: PARAMETER TABLE - MOTOR A.....	10 - 4
10.3	ANNEX C: PARAMETER TABLE - MOTOR B.....	10 - 5

1 OVERVIEW

The direct star/delta start-up of three-phase asynchronous motors can be a source of strong mechanical and electric stresses which can affect the operation of rotating machines. To solve these problems, ELETTRONICA SANTERNO has designed and manufactured a new starter series applying the latest electronic technology.

Thanks to the thyristor bridges handled by a 16 bit microprocessor-based control board, the high calculation power and the high number of programmable functions, the SFTM digital starters are suitable to start 15kW to 1050kW three-phase asynchronous motors in a number of heavy applications.

The use of the SFTM digital starters eliminates mechanical stresses, system maintenance, the use of sophisticated coupling devices. Further, the use of SFTM digital starters reduces the starting current and the sizing of electromechanical components and power electric connections. They allow to avoid expensive service breaks due to malfunctions or anomalies. The system lifetime is increased and a special function is available to significantly reduce the energy consumption.

All values for starter operation can be easily programmed through keyboard thanks to the alphanumeric LCD display.

The SFTM static starter is standard delivered with:

- User interface: 4 keys and 2x16 LCD display for parameter visualization and setting
- 4 start-up types: current steps, current ramp, kick start and voltage ramp
- 12 start-up/hour
- Start-up and stop times ranging from 0 to 180 s
- Adjustable overlimitation current and time: during start-up phase up to 30s
- Cascade start-up of several motors having different electric characteristics
- Motor thermal protection
- Energy save function
- Operation time display
- Automatic motor restart in case of block
- Storage of last alarms
- Display of fundamental electric values, such as motor electric voltage, line voltage, current, revolution number, etc.
- Parameters reset: DEFAULT and BACK-UP of entered parameters

The SFTM static starters have been developed, designed and manufactured in compliance with the “Low voltage regulation” and “EMC regulation” requirements. In particular, they meet the following standards:

EN60146-1-1	Semiconductor converters. General requirements and line switch converters. Parte 1-1: Specifications for basic requirements
IEC146-1-2	Semiconductors converters General requirements and line switched converters Part 1-2: Application guide
IEC664-1	Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests
EN60204-1	Machine safety. Machine electric equipment . Part 1: General rules
EN60204-1	Electric equipment of industrial machines
Amendment 1	Part 2: Denomination of components and examples of drawings, diagrams, tables and instructions
EN60529	Protection degrees of casings (IP code)
prEN50178	Electronic equipment for use in power installations
EN61800-3	Variable speed electric drives Part 3: Product standards concerning electromagnetic and specific test methods
EN55011	Measurement limit and methods for radio noise of industrial, science and medical equipments (ISM)
EN61000-4-2	Electromagnetic compatibility (EMC) . Part 4: Test and measurement techniques. Section 2: Electrostatic discharge immunity tests. EMC base publication
EN61000-4-4	Electromagnetic compatibility (EMC). Part 4: Test and measurement techniques. Section 4: Transient/quick electric train immunity test EMC base publication
EN61000-4-5	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 5: Pulse immunity test
IEC1000-4-3	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 3: Radiated, radio-frequency, electromagnetic field immunity test

As SFTM has been entirely designed and manufactured by Elettronica Santerno technicians, you can directly contact Elettronica Santerno for any product customization.



NOTE: When an asynchronous motor is controlled by a SOFT STARTER, the available starting torque will be remarkably decreased if compared to the one of a directly mains-supplied motor.

Particularly, if the soft starter generates a max. current equal to $I_{os} = \frac{I_0}{n}$, where I_0 represents the current absorbed by the motor when starting if the motor were directly connected to the mains, available starting torque C_{os} will be decreased by $\frac{1}{n^2}$ with respect to torque C_0 that can be obtained if the motor is directly controlled by the mains, i.e. $C_{os} = \frac{1}{n^2} \cdot C_0$.



CAUTION:
Carefully read this manual before installing the static converter.

1.1 CHECKING AT RECEPTION

When receiving the unit, check that no damage is visible and its compliance with your requirements. To do that, refer to the plate (see following figure) located on the converter front side. If the unit is damaged, contact the insurance company or the supplier. If the unit is stored before it is used, check that the storage area conditions are acceptable (temperatures ranging from -20°C and +60°C, relative humidity lower than 95% and no dew).

The warranty covers any manufacturing faults. The manufacturer has no responsibility for damages occurred during transportation or unpacking.

In no case and in no circumstances, the manufacturer will be responsible for damages or failures due to wrong usage, abuse, wrong installation or incorrect temperature, humidity or corrosive materials, as well as for faults caused by operation exceeding the rated values. The manufacturer will not be responsible for consequential or accidental damages.

The manufacturer provides a 12-month warranty, starting from the delivery date.

	1	2	
MODEL	SFTM.	32	Digital Soft Starter Circuit W3C ZZ0058006.03410
INPUT	AC3PH 380-440V 50/60Hz 32A		
OUTPUT	AC3PH 0...380-440V 50/60Hz 32A		
	Overload: 135A		
MOTOR	15kW (20CV)		
ELETTRONICA SANTERNO S.p.a. -MADE IN ITALY- 			

M00314-0

- 1 SFTM model: SOFT STARTER
- 2 SOFT STARTER size (max. motor rated current)
- 3 Input mains characteristics (AC 3PH three-phase alternate mains, 380÷440V rated supply voltage, 50/60Hz: supply frequency, 32A: input current)
- 4 Output characteristics (AC 3PH three-phase alternate mains, 0...380÷440V output voltage (The max. output voltage depends on the supply voltage) 50/60Hz: frequency, 32A: output rated current)
- 5 Max. current at start-up
- 6 Motor (max. allowed motor power)

1.2 INSTALLATION

1.2.1 AMBIENT CONDITIONS

- Ambient temperature ranging from 0 and 50°C (for temperature ranging from 40 °C and 50 °C , derate by 2% every °C beyond 40 °C)
- Relative humidity ranging within 20% and 90% (without dew)
- Height lower than 1000 m a.s.l. (for higher heights, derate by 1% every 100m)
- Avoid exposition to direct sunlight, corrosive gases or conductive powder



CAUTION: observe the installation ambient conditions.

1.2.2 ASSEMBLY

- Install the static converter in vertical position.
- Leave a free space of approx. 5 cm around sides and 10 cm (15 cm for SFTM size 2 and 20 cm for SFTM size 2A) in the top and bottom sides. Make sure the supply cables do not obstruct the fan air flow.



CAUTION: Do not install the static converter in a tilted or horizontal position.

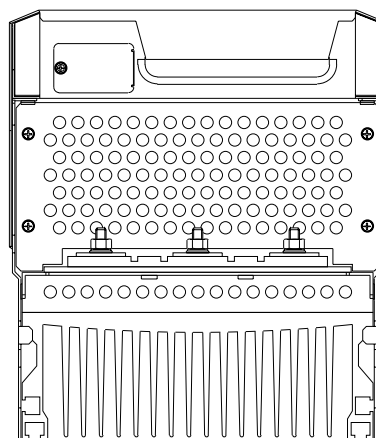
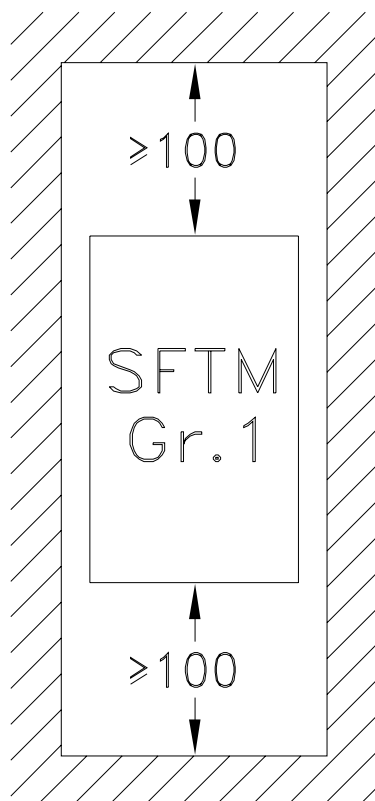


CAUTION: Do not install temperature-sensitive components on the SOFT-STARTER as ventilation warm air exits from that area.

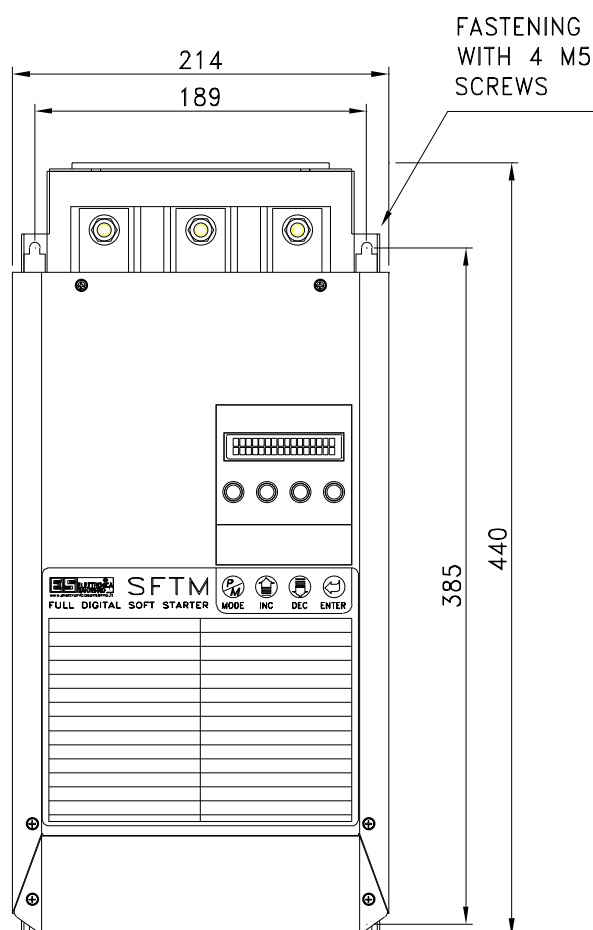
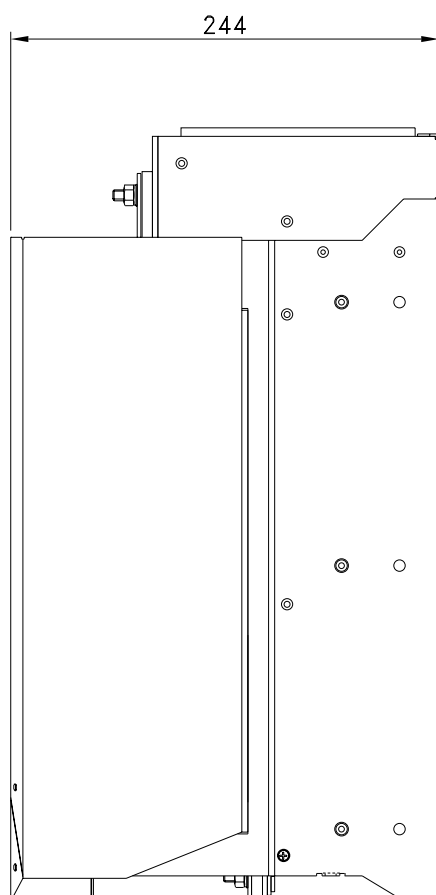


CAUTION: The bottom surface temperature can reach 90°C, so the surface where the unit is installed has to withstand this temperature.

1.3 EXTERNAL DIMENSIONS OF SFTM SIZE 1

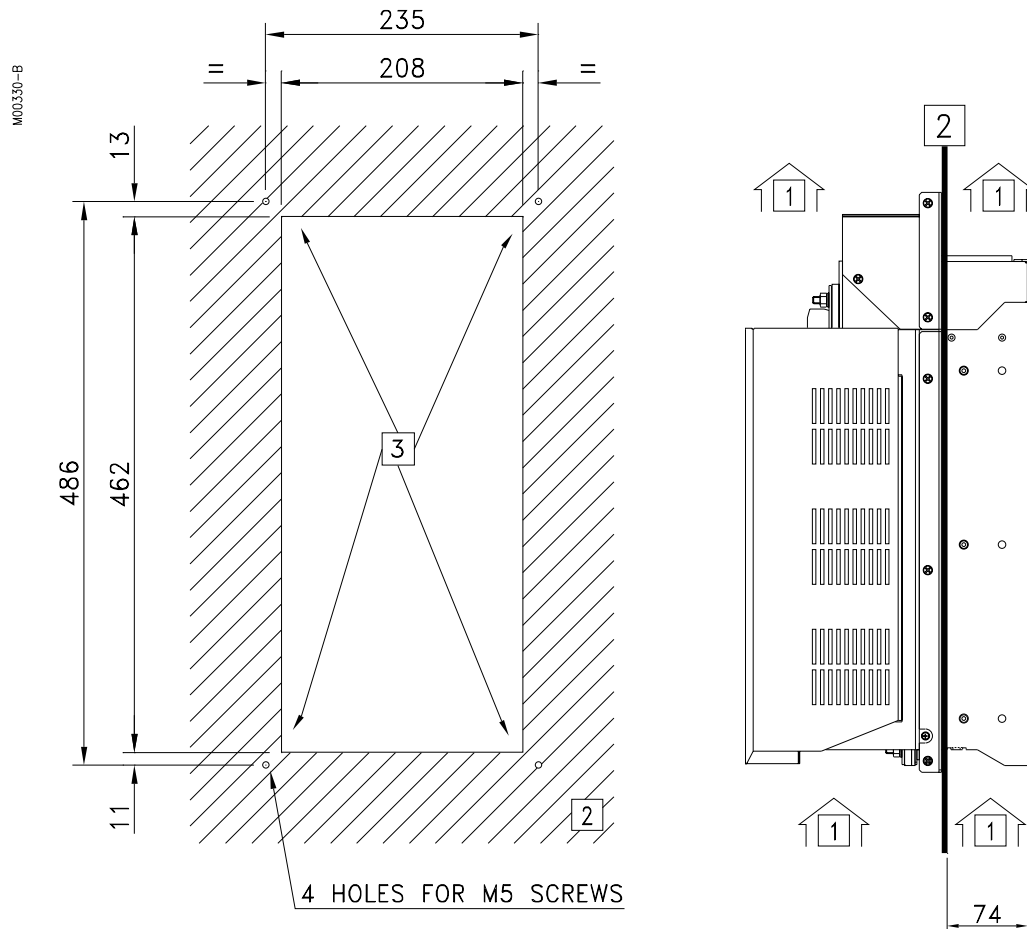


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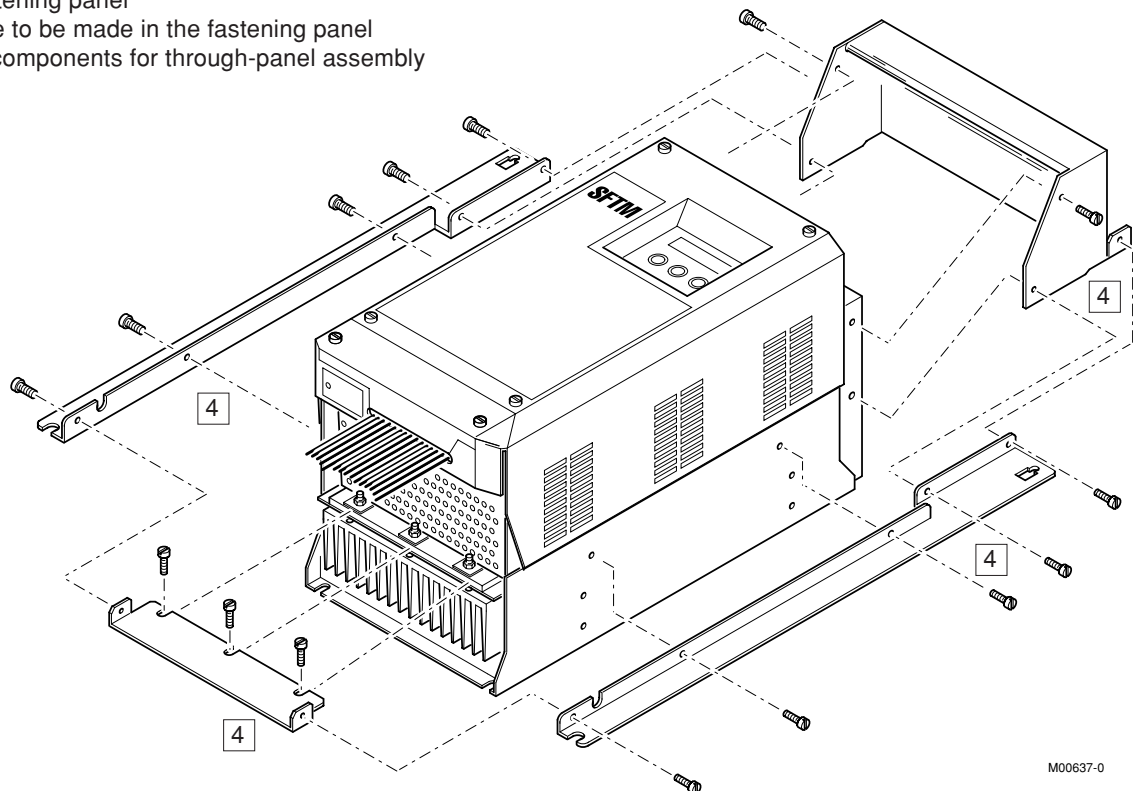


1.4 THROUGH-PANEL ASSEMBLY OF SFTM SIZE 1

The through-panel assembly can be performed using the proper (optional) kit as shown in figure.

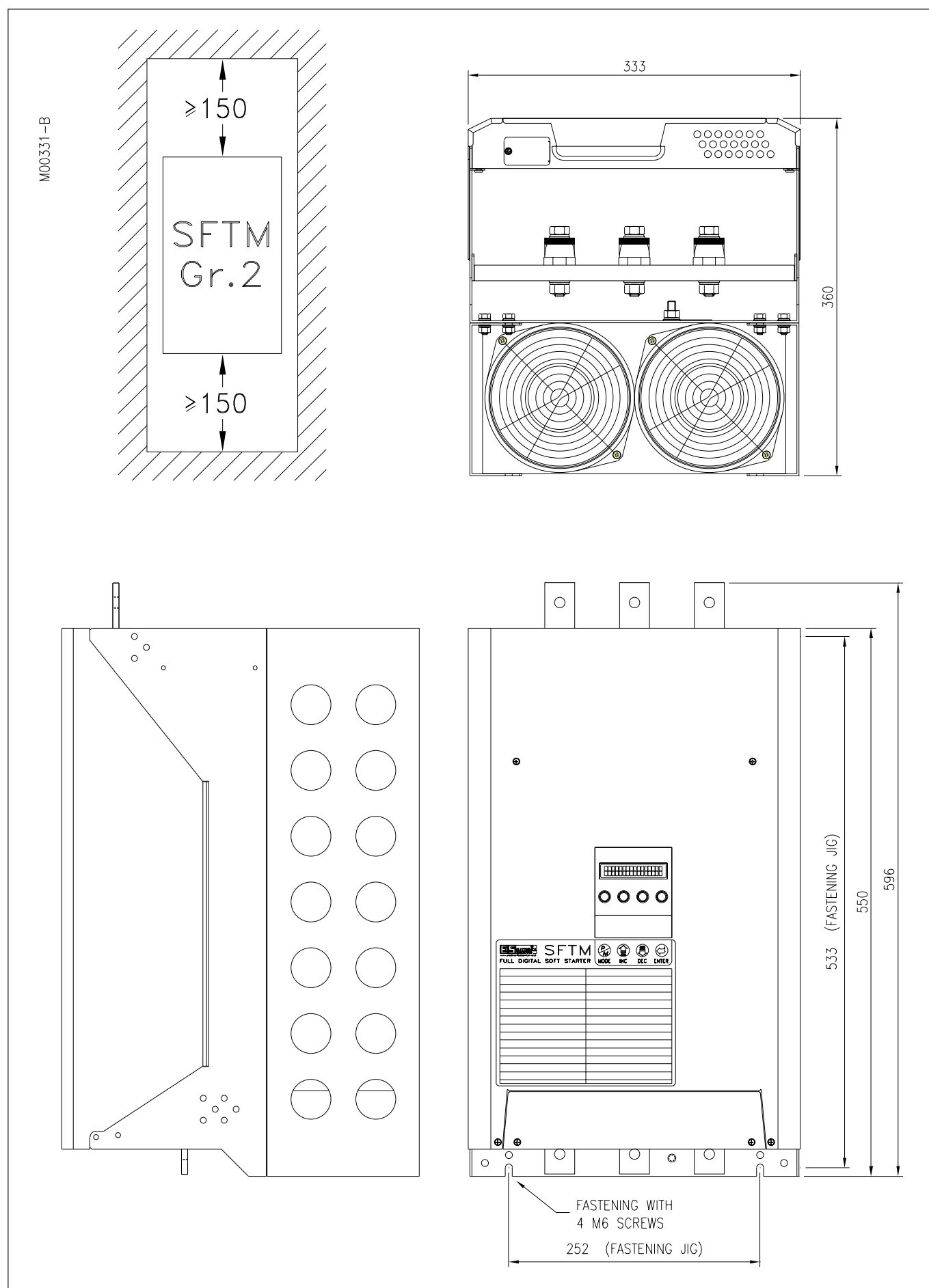


- 1 - Direction of the cooling air flow
- 2 - Fastening panel
- 3 - Hole to be made in the fastening panel
- 4 - Kit components for through-panel assembly

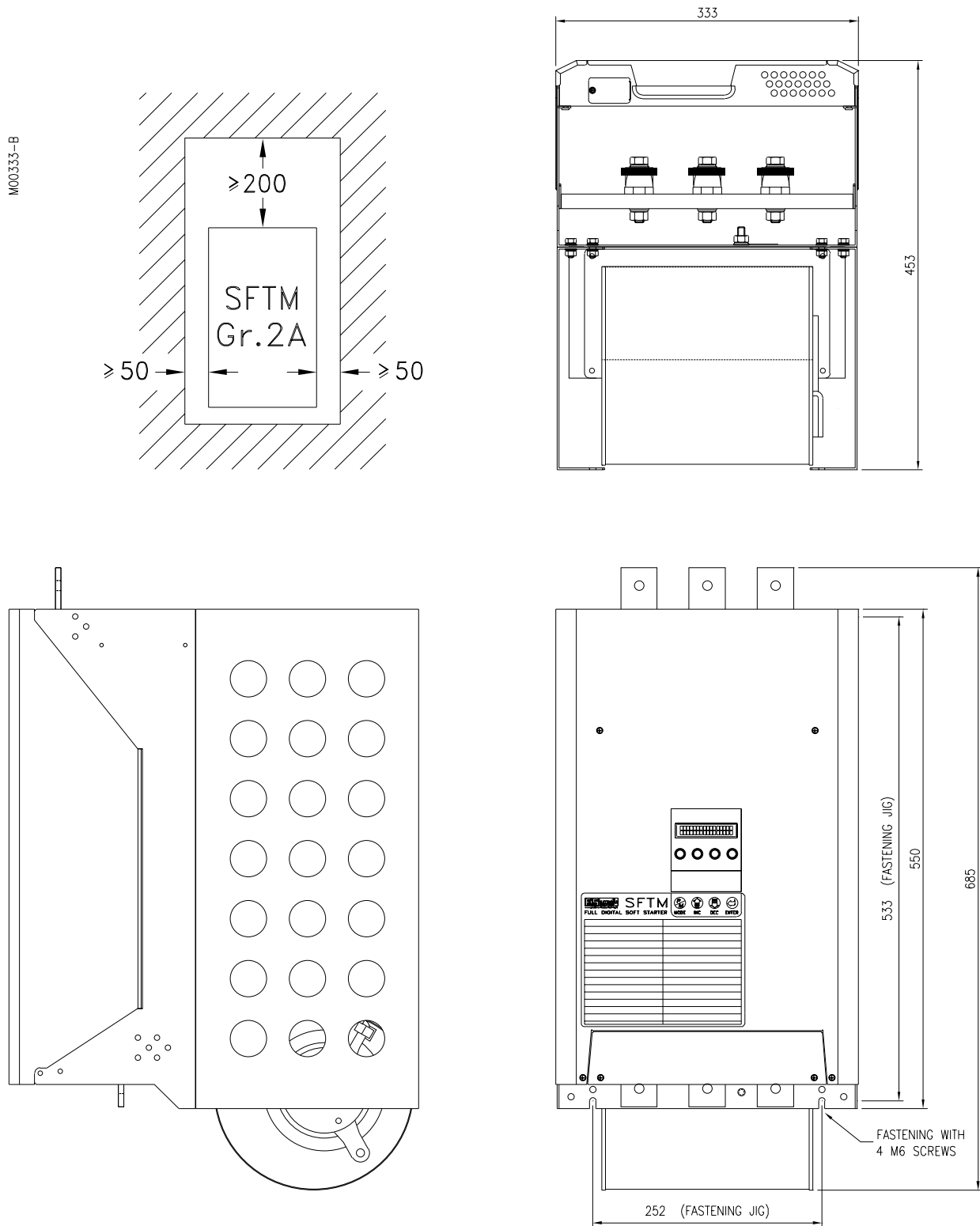


M00637-0

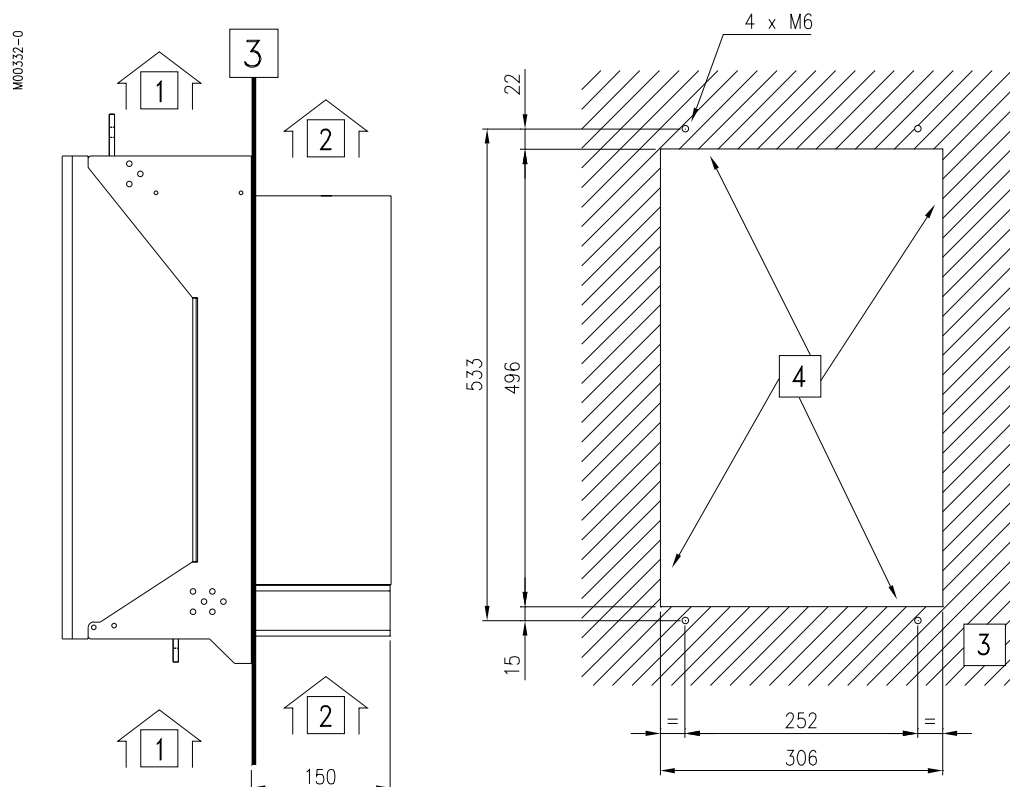
1.5 EXTERNAL DIMENSIONS OF SFTM SIZE 2



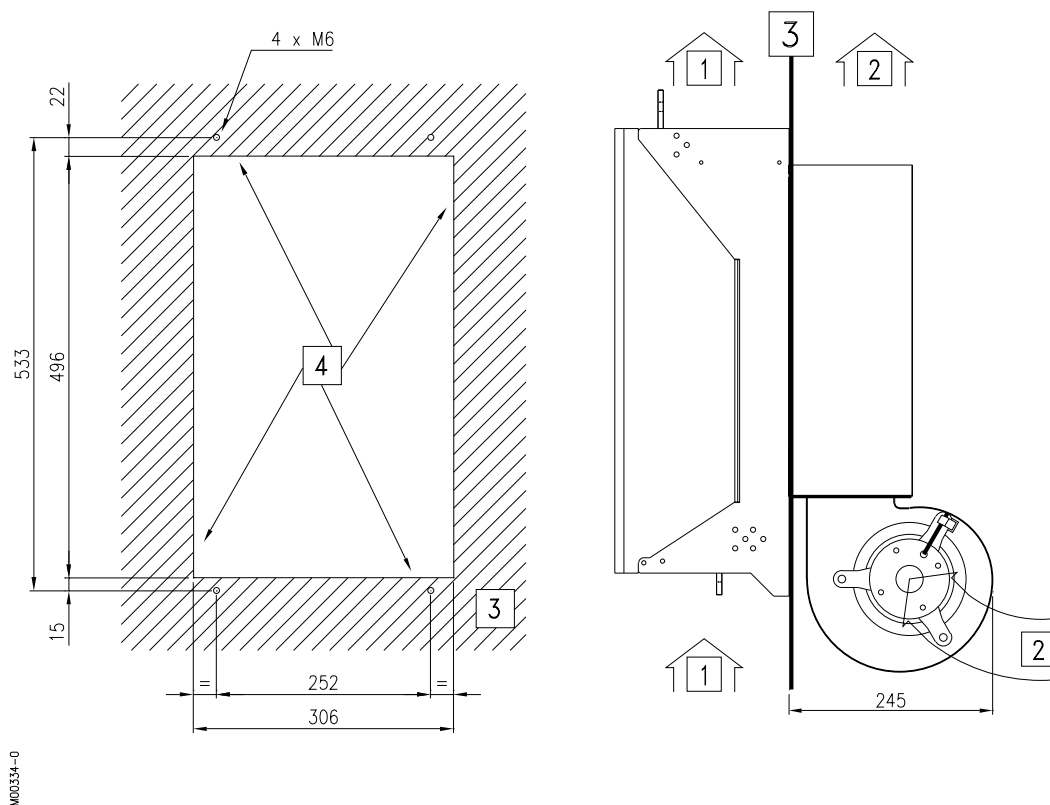
1.6 EXTERNAL DIMENSIONS OF SIZE 2A



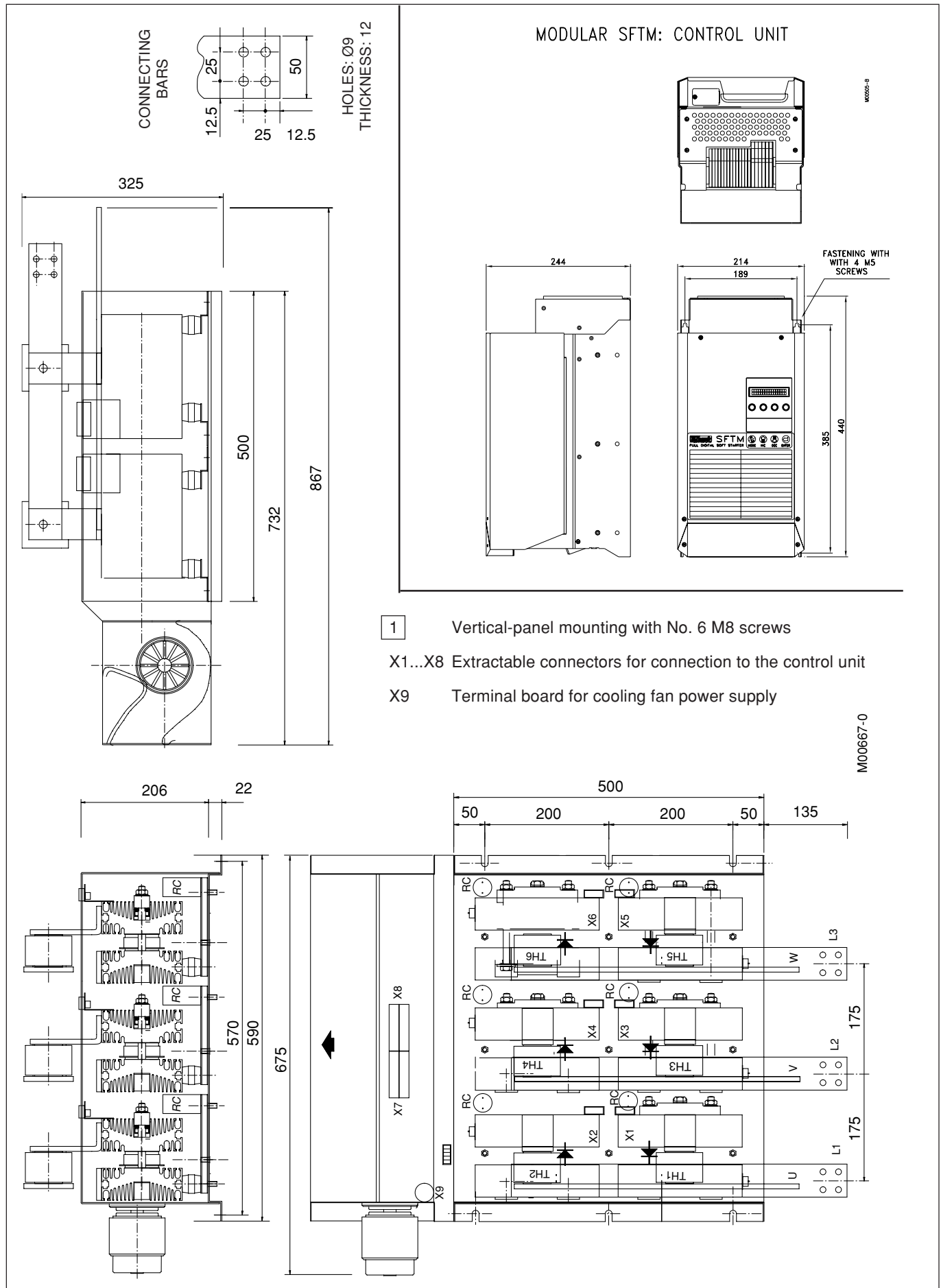
1.7 THROUGH-PANEL ASSEMBLY OF SFTM SIZE 2 - 2A



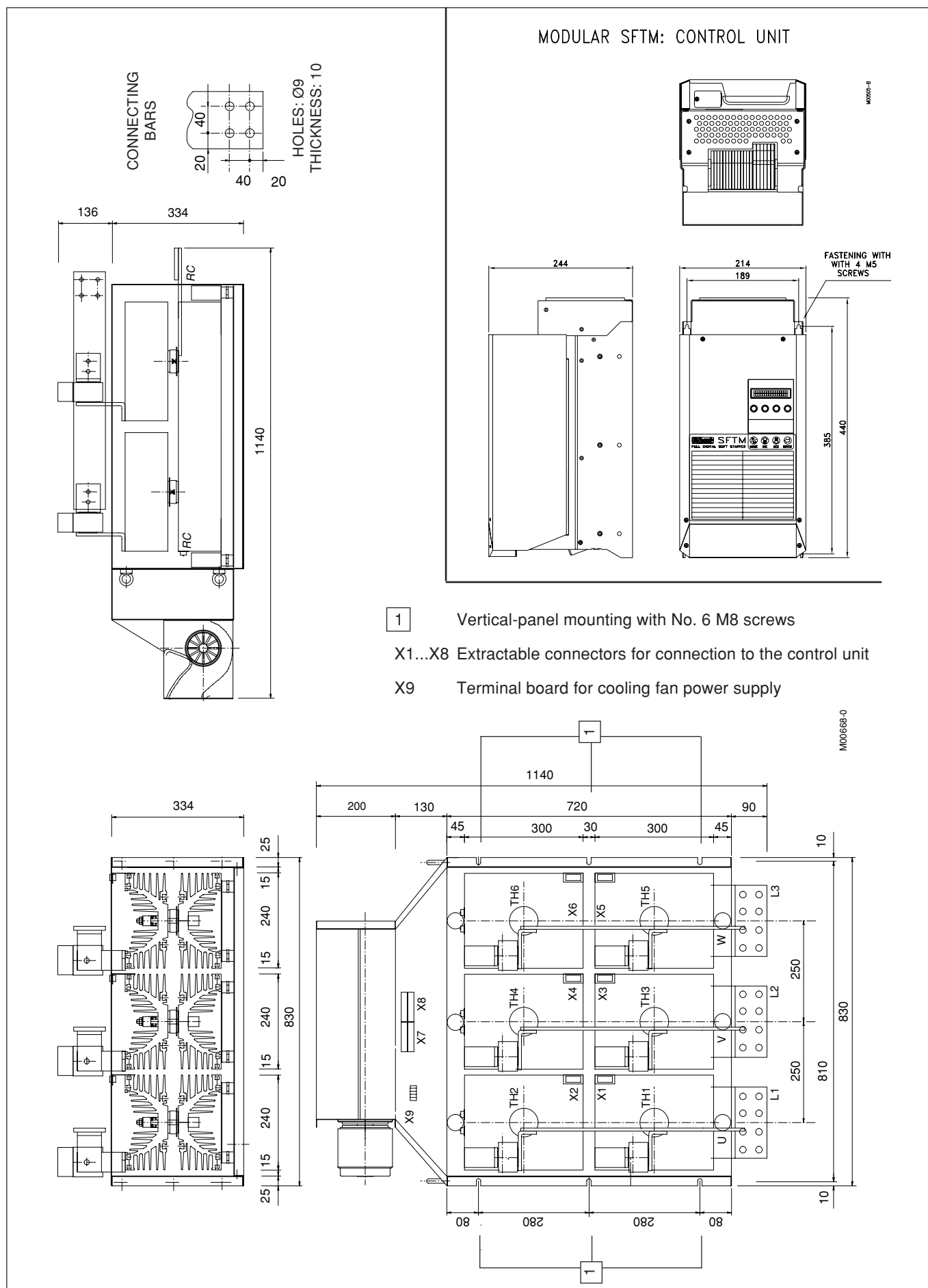
- 1 - Direction of secondary cooling air flow
- 2 - Direction of primary cooling air flow
- 3 - Fastening panel
- 4 - Hole to be made in the fastening panel



1.8 EXTERNAL DIMENSIONS SFTM SIZE 3



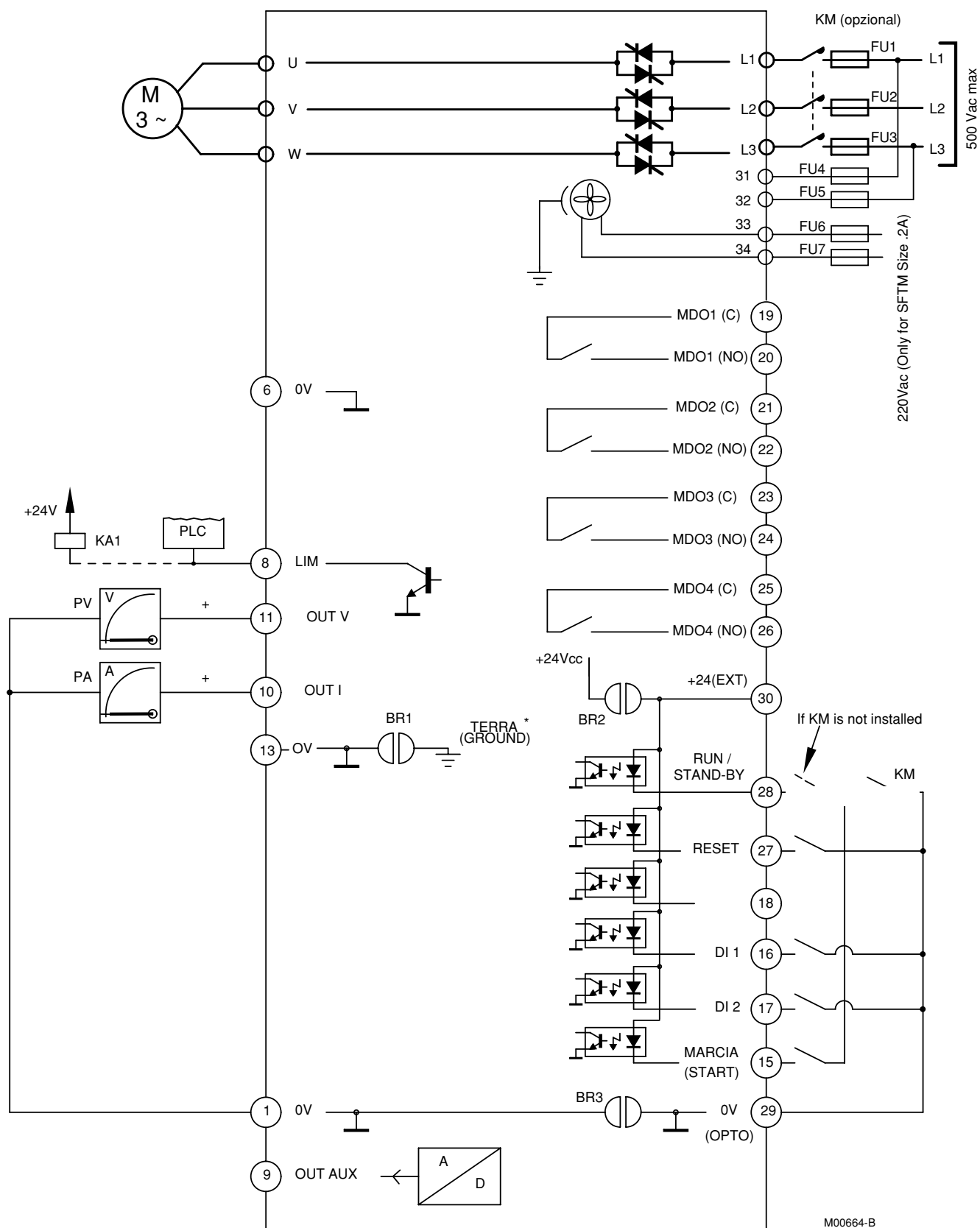
1.9 EXTERNAL DIMENSIONS OF SFTM SIZE 4



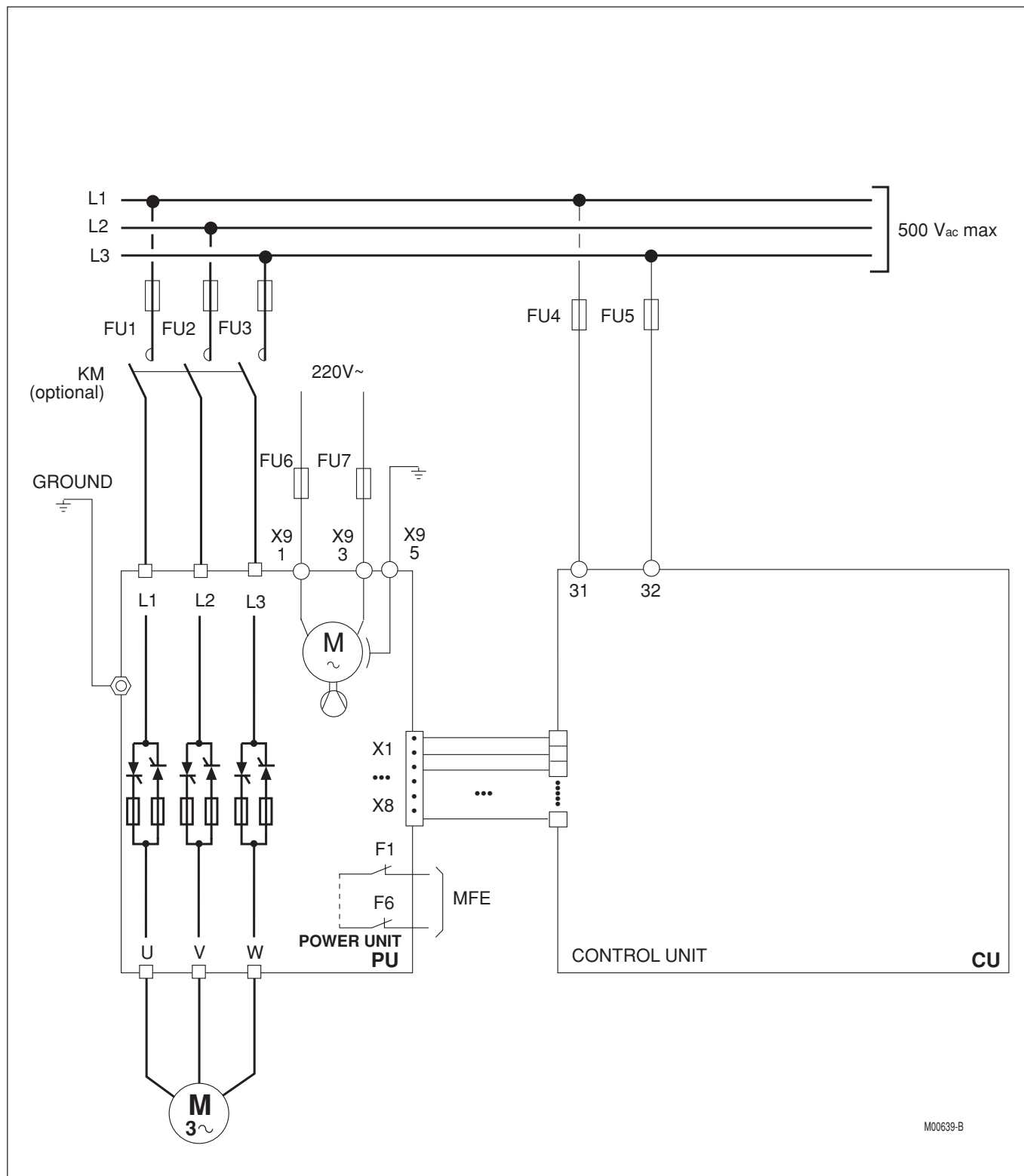
1.10 CONNECTIONS OF SFTM SIZE 1... 2A FOR A MAINS UP TO 500VAC



Connect terminals 31 and 32 IN PHASE with bars L1 and L3.



1.11 POWER CONNECTIONS OF MODULAR SFTM FOR A MAINS UP TO 500 VAC



Connect terminals 31 and 32 of the control unit IN PHASE with bars L1 and L3 of the power unit.



Concerning MODULAR SFTM size 4, current transformers TAR and TAT have to be externally mounted by Customer, across the two lines connected to the input bars L1 and L3, with “P1” sides facing the drive, and with secondary taps connected as shown in POWER UNIT ELECTRIC DIAGRAM OF MODULAR SFTM.

1.12 DESCRIPTION OF THE POWER CONNECTIONS FOR A MAINS UP TO 500V



When ordering the equipment, always state the power supply range chosen: 200...240V, 380...440V, 441...500V.

L1/L2/L3	50/60 Hz supply 3-phase mains (standard 380...440 Vac).
FU1/FU2/FU3	Ultrafast fuses for SFTM Size 1...2A and delayed fuses for MODULAR SFTM (for the fuse type and value, see "accessories" section in the MAINS FUSES paragraph).
FU4/FU5	1A Fuses to protect terminal 31/32 connection to the three-phase mains.
FU6/FU7	2.5A Fuses for SFTM Size 2A and 4A for MODULAR SFTM (for air-cooling unit). N.B. these are necessary only for SFTM Size 2A and for MODULAR SFTM.
KM	Optional contactor for AC/AC bridge power supply. It is to be dimensioned with respect to class AC1.
M3~	Asynchronous motor
PA	Amperometer
PV	Voltmeter
CU	Control Unit for MODULAR SFTM
PU	Power Unit for MODULAR SFTM
MFE	Microswitches signalling the opening of the ultrafast fuses located inside MODULAR SFTM power module. Warning: They are to be introduced into the external sequence for any alarm signalling.



DANGER!!

Changes to the connections should be performed after disconnecting the SOFT STARTER from the supply only.



CAUTION!! - If the SOFT-STARTER is supplied with RUN enabling terminals connected to 0V, the motor is started. This can be avoided through parameter P30.



CAUTION!! - Always connect the ground terminal so as to avoid electric shocks and to reduce the noises. The user has the responsibility to make a grounding complying with the local regulations.



CAUTION!! - The supply line should be connected to the SUPPLY TERMINALS only. If connected to any other terminal, the SOFT-STARTER can be damaged.



CAUTION!! - Always check the power supply for being included in the range shown on the identification plate located on SOFT STARTER front side.



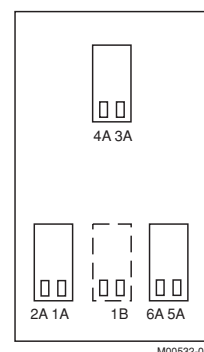
CAUTION!! - Once connections have been performed, check that:
All cables are properly connected
No connection has been omitted
No short-circuits are present between terminals and ground terminal.



CAUTION!! - Do not supply using a single-phase voltage.

1.13 THYRISTOR POSITIONING IN SFTM SIZE 1 ... 2A (COMPACT MODELS)

The firing terminals for two-thyristor modules are positioned as follows.



1.14 CONTROL TERMINAL BOARD

TERMINAL	Description	I/O characteristics	Parameters, jumpers, trimmers
1	0V - Control board ground	Control board ground	
2	n.c.		
3	n.c.		
4	n.c.		
5	n.c. Up to Vers. S4.05: input for tacho < 50Vdc	+50Vdc max Rin = 25Kohm approx.	P02, P14, trimmer RV5
6	0V	Control board ground	
7	n.c. Up to Vers. S4.05: input for tacho < 50Vdc	240Vdc max Rin= 125Kohm approx.	P02, P14, trimmer RV5
8	LIM - transistor on with converter in current limitation	OPEN-COLLECTOR Vmax = 24V Imax = 500mA	
9	OUT-AUX - voltage analog output, proportional to voltage output-factory setting: 0::+10V for 0::800V.	Vout= +10V max	P36
10	OUT I - voltage analog output, proportional to output current (0 :: +4V for 0:: Imax)	Iout = 5mA max	trimmer RV4
11	OUT V - voltage analog output, proportional to motor output voltage. Factory setting: 0V:: +10V for 0:: 800V.	Iout = 5mA max	trimmer RV7
12	n.c.		
13	0V - Control board ground	Control board ground	
14	n.c.		
15	START - Configurable operating mode. If disconnected from 0V (with P31= <i>Mode 1</i>) it controls the ramp stop. Factory setting: <i>Mode 1</i>	Digital input to be opto-insulated	P31
16	DI 1 - programmable digital input. Factory setting: <i>SM1</i>	Digital input to be opto-insulated	P32
17	DI 2 - programmable digital input. Factory setting: <i>SM2</i>	Digital input to be opto-insulated	P33
18	n.c.		
19-20	MDO 1 - multifunction relay output factory setting: <i>START END</i>	250Vca, 5A 30Vdc, 5A	P42,P43,P44,P45,P46,- P47,P48
21-22	MDO 2 - multifunction relay output factory setting: <i>ALARM</i>	250Vca, 5A 30Vdc, 5A	P52,P53,P54,P55,P56 P57,P58
23-24	MDO 3 - multifunction relay output factory setting: <i>BYPASS</i>	250Vca, 5A 30Vdc, 5A	P62,P63,P64,P65,P66 P67,P68
25-26	MDO 4 - multifunction relay output factory setting: <i>LINE CONTACTOR</i>	250Vca, 5A 30Vdc, 5A	P72,P73,P74,P75,P76 P77,P78
27	RESET - reset input (it restores the SOFT-STARTER operation in case of locking)	Digital input to be opto-insulated	
28	RUN/STANDBY - if connected to 0V (with P31= <i>Mode 1</i>) the SOFT STARTER running is enabled. Configurable operating mode. Factory setting: <i>Mode 1</i> .	Digital input to be opto-insulated	P31
29	0V-OPTO - digital input opto-insulators ground	factory connected through BR3 to control board ground	BR3
30	+24ext - input for external supply of digital input opto-insulators	factory connected through BR2 to +24V of control board	BR2

T00232-B

1.15 POWER TERMINALS AND AUXILIARY TERMINAL BOARDS

L1 - L2 - L3	Three-phase supply voltage of the Power Section. N.B.: respect the phase sequence. N.B.: connect terminal 31 in phase with L1 and terminal 32 in phase with L3
U - V - W	Asynchronous motor output terminals.
31 - 32	Control Section power supply terminals N.B.: connect terminal 31 in phase with L1 and terminal 32 in phase with L3 The connections are to be made upstream from the contactor installed before the static converter.
33 - 34	220 Vac power supply terminals for the centrifugal fan. N.B.: installed on SFTM Size 2A only.
35 - 36 - 37	Input for external ATs for the current control in by-pass. N.B.: on demand only
55 - 56 - 57	Inputs for voltage feedback N.B.: required for a mains exceeding 500Vac only

T00233-B

Table 1.0-2



NOTE: MAKE SURE that inputs **L1- L2 - L3** respect the cyclic sense.



CAUTION - MAKE SURE that outputs **U V W** are properly connected to the corresponding markings shown on the motor **SO AS TO AVOID ROTATIONS OPPOSITE to the required one.**



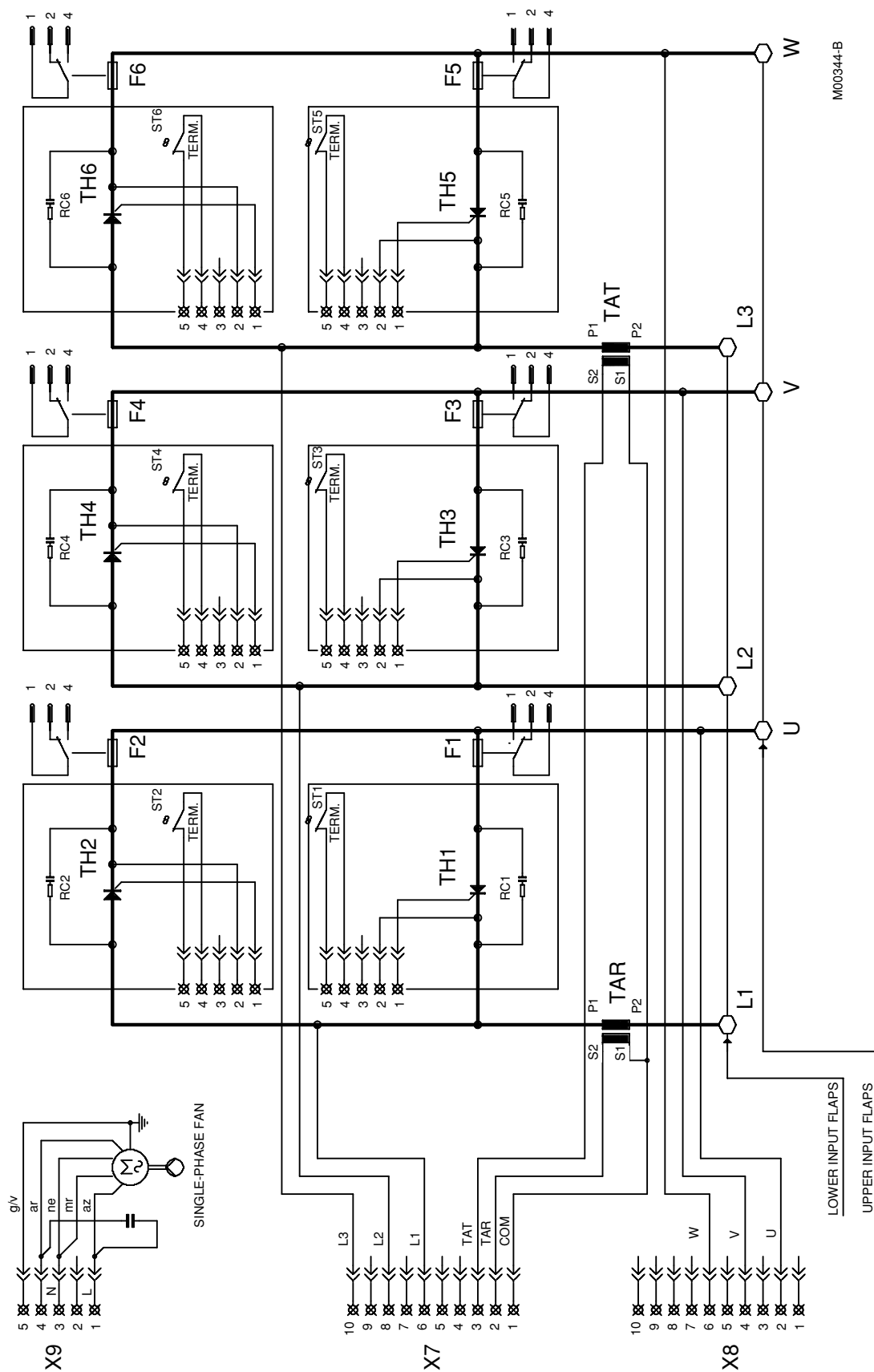
NOTE: MAKE SURE that **31 is in phase with L1 and 32 is in phase with L3 upstream the remote control switch (SEE CONNECTION DIAGRAM).**

If the cyclic sense is not observed, or if the voltage applied to terminal 31 or 32 is not in phase with L1 or L3 respectively, as soon as the converter is operated alarm A01 (wrong cyclic sense) will be activated.



NOTE: The wrong cyclic sense alarm is not activated if 31 is connected to L3 and 32 is connected to L1.

1.16 POWER UNIT ELECTRIC DIAGRAM OF MODULAR SFTM



1.17 DESCRIPTION OF EXTRACTABLE CONNECTORS FOR MODULAR SFTM

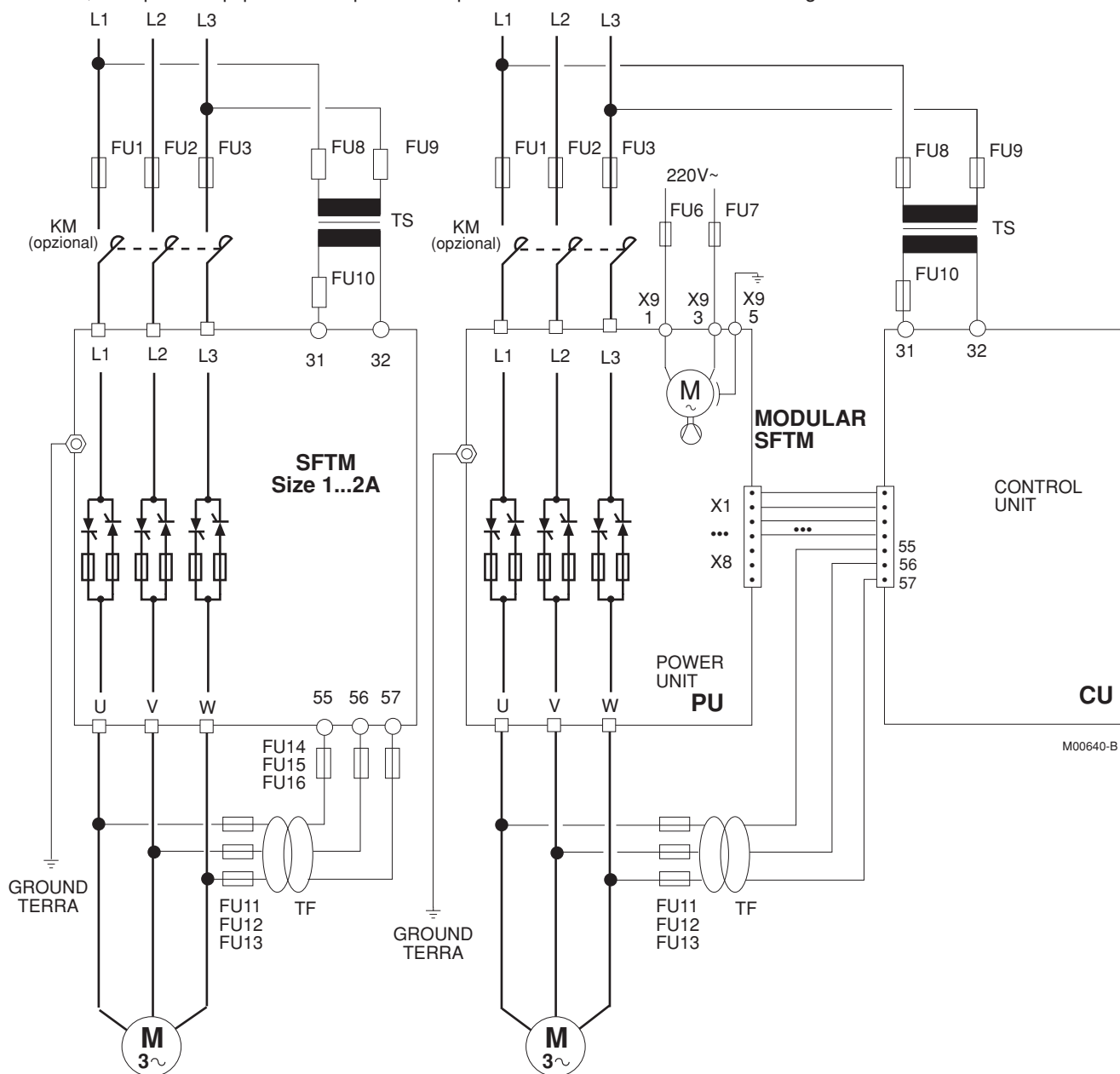
X1.1	TH1 thyristor gate	(to terminal G1 of the Control Unit)
X1.2	TH1 thyristor cathode	(to terminal K1 of the Control Unit)
X1.4	TH1 heatsink switch	(to terminal P0 of the Control Unit)
X1.5	TH1 heatsink switch	(short-circuited with X3.4)
X2.1	TH2 thyristor gate	(to terminal G2 of the Control Unit)
X2.2	TH2 thyristor cathode	(to terminal K2 of the Control Unit)
X2.4	TH2 heatsink switch	(to terminal P0 of the Control Unit)
X2.5	TH2 heatsink switch	(short-circuited with X4.4)
X3.1	TH3 thyristor gate	(to terminal G3 of the Control Unit)
X3.2	TH3 thyristor cathode	(to terminal K3 of the Control Unit)
X3.4	TH3 heatsink switch	(short-circuited with X1.5)
X3.5	TH3 heatsink switch	(short-circuited with X5.4)
X4.1	TH4 thyristor gate	(to terminal G4 of the Control Unit)
X4.2	TH4 thyristor cathode	(to terminal K4 of the Control Unit)
X4.4	TH4 heatsink switch	(short-circuited with X2.5)
X4.5	TH4 heatsink switch	(short-circuited with X6.4)
X5.1	TH5 thyristor gate	(to terminal G5 of the Control Unit)
X5.2	TH5 thyristor cathode	(to terminal K5 of the Control Unit)
X5.4	TH5 heatsink switch	(short-circuited with X3.5)
X5.5	TH5 heatsink switch	(to terminal P5 of the Control Unit)
X6.1	TH6 thyristor gate	(to terminal G6 of the Control Unit)
X6.2	TH6 thyristor cathode	(to terminal K6 of the Control Unit)
X6.4	TH6 heatsink switch	(short-circuited with X4.5)
X6.5	TH6 heatsink switch	(to terminal PR of the Control Unit)
X7.1	Current transformers common	(to terminal 35 of the Control Unit)
X7.2	TAR current transformer output	(to terminal 36 of the Control Unit)
X7.3	TAT current transformer output	(to terminal 37 of the Control Unit)
X7.6	L1 bar potential	(to terminal L1 of the Control Unit)
X7.8	L2 bar potential	(to terminal L2 of the Control Unit)
X7.10	L3 bar potential	(to terminal L3 of the Control Unit)
X8.2	U bar potential	(1)
X8.4	V bar potential	(1)
X8.6	W bar potential	(1)

N.B. All pins of the extractable connectors that are not stated in the list above are NOT CONNECTED.

(1) NOTE: Terminals 55-56-57 in the Control Unit are to be connected to terminals X8.2 - X8.4 - X8.6 in the Power Unit for a mains up to 500Vac, whereas they are to be directly connected to the secondary of three-phase transformer TF for a mains exceeding 500Vac. In that case, terminals X8.2 - X8.4 - X8.6 in the Power Unit are to be kept disconnected.

1.18 SFTM POWER CONNECTIONS FOR A MAINS EXCEEDING 500VAC

In this case, the special equipment is required. The power connections are shown in the figure below.



To mount the current transformers in case of MODULAR SFTM size 4, please refer to warning of chapter POWER CONNECTIONS OF MODULAR SFTM FOR A MAINS UP TO 500VAC.



Connect terminals 31 and 32 IN PHASE with bars L1 and L3.

FU8-9 1A Delayed fuses for TS transformer primary protection.

FU10 1A Fast fuse for TS transformer secondary protection.

FU11- 12- 13 1A Delayed fuses for TF transformer primary protection.

FU14- 15- 16 1A Fast fuses for TF transformer secondary protection.
N.B. They are required for SFTM Size 1...2A only.

TS Single-phase 150VA transformer with 0° shift for control section power supply.

TF Three-phase 50VA transformer with 0° shift for voltage feedback.

1. When ordering the equipment, always mention the range including the nominal value of **Vnom** voltage for the **power section** to bars L1-2-3. The allowable voltage ranges are the following:

- a. 501...600V
- b. 601...690V

2. As for the **control section** supply to terminals 31 and 32, the equipment is usually delivered with the following control section power supply range: 380...500V.

This limits the transformation ratio of **TS** transformer shown in the figure. The transformation ratio is to be set in parameter **P34** (*Power/Sync Ratio*) and is represented by the ratio between the voltage nominal value (Vnom) to the primary for the power section and the corresponding voltage to the secondary for the control section.

In cases a. and b. above, limits are as follows:

$1.2 \leq P34 \leq 1.4$ if Vnom voltage ranges from 501 to 600V

$1.4 \leq P34 \leq 1.6$ if Vnom voltage ranges from 601 to 690V

As a TS, ELETTRONICA SANTERNO may supply a 700/500 single-phase transformer (150VA), i.e. with a transformation ratio equal to 1.4 (the TS code is TR0112260).

3. On demand, the **control section** of the equipment may be supplied with a power ranging from 200 to 240V.

This limits the transformation ratio of TS transformer. The transformation ratio is to be set in parameter P34 (*Power/Sync Ratio*).

In cases a. and b. above, the limits are as follows:

$P34 = 2.5$ if Vnom voltage ranges from 501 to 600V

$2.9 \leq P34 \leq 3$ if Vnom voltage ranges from 601 to 690V

The 200 ... 240V voltage range for the control section may be useful if the customer does already have the single-phase transformer required.

4. As the figure above shows, the **three-phase transformer for the voltage feedback (TF)** is to be installed. TF must have a transformation ratio equal to 1.4.

As a TF, ELETTRONICA SANTERNO may supply a 700/500 single-phase transformer (50VA), i.e. with a transformation ratio equal to 1.4 (the TF code is TR0108007).

2 TECHNICAL CHARACTERISTICS

2.1 TECHNICAL DATA TABLES

COMPACT SFTM

200...240Vac max. power supply for POWER circuit

200...240Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR with 200...240Vac		OUTPUT POWER with 230Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT 30s every 300s	LEAKAGE (W)	WEIGHT (kg)
			(kW)	(HP)						
1	214x244x440	SFTM.32	9	12	13	32	135	4.2 Inom	130	15
		SFTM.45	13	18	18	45	135	3 Inom	180	
		SFTM.60	17	23	24	60	216	3.6 Inom	240	
		SFTM.72	22	30	29	72	216	3 Inom	290	
		SFTM.86	25	34	34	86	315	3.7 Inom	350	18
		SFTM.105	30	41	42	105	315	3 Inom	430	
2	333x360x596	SFTM.145	45	61	58	145	645	4.4 Inom	590	39
		SFTM.170	55	75	68	170	645	3.8 Inom	690	
		SFTM.215	65	88	86	215	645	3 Inom	870	
		SFTM.250	75	102	100	250	1140	4.6 Inom	1010	42
		SFTM.310	95	129	124	310	1140	3.7 Inom	1260	
		SFTM.380	120	163	151	380	1140	3 Inom	1540	
		SFTM.450	140	190	179	450	1350	3 Inom	1820	
2A	333x453x685	SFTM.550	175	238	219	550	1650	3 Inom	2230	45

T00206-B

MODULAR SFTM

200...240Vac max. power supply for POWER circuit

200...240Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR with 200...240Vac		OUTPUT POWER with 230Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT 30s every 300s	LEAKAGE (W)	WEIGHT (kg)
			(kW)	(HP)						
3	control unit 214x244x440	SFTM.660	200	272	263	660	1980	3 Inom	2680	70
		SFTM.770	245	333	307	770	3450	4.5 Inom	3120	
	power unit 675x325x867	SFTM.900	285	387	359	900	3450	3.8 Inom	3650	
		SFTM.1150	370	503	458	1150	3450	3 Inom	4660	
4	control unit 214x244x440 power unit 830x470x1140	SFTM.2000	630	856	797	2000	6000	3 Inom	8110	106

T00207-B

COMPACT SFTM

380...440Vac max. power supply for POWER circuit

380...440Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR				OUTPUT POWER with 400Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT <i>30s every 300s</i>	LEAKAGE (W)	WEIGHT (kg)
			with 380...415Vac		with 440Vac							
			(kW)	(HP)	(kW)	(HP)						
1	214x244x440	SFTM.32	15	20	18.5	25	22	32	135	4.2 Inom	130	15
		SFTM.45	22	30	25	34	31	45	135	3 Inom	180	
		SFTM.60	30	41	37	50	42	60	216	3.6 Inom	240	
		SFTM.72	37	50	45	61	50	72	216	3 Inom	290	
		SFTM.86	45	61	55	75	60	86	315	3.7 Inom	350	18
		SFTM.105	55	75	65	88	73	105	315	3 Inom	430	
2	333x360x596	SFTM.145	75	102	90	122	100	145	645	4.4 Inom	590	39
		SFTM.170	90	122	110	149	118	170	645	3.8 Inom	690	
		SFTM.215	110	149	140	190	149	215	645	3 Inom	870	
		SFTM.250	132	179	160	217	173	250	1140	4.6 Inom	1010	42
		SFTM.310	160	217	200	272	215	310	1140	3.7 Inom	1260	
		SFTM.380	200	272	250	340	263	380	1140	3 Inom	1540	
		SFTM.450	250	340	300	408	312	450	1350	3 Inom	1820	
2A	333x453x685	SFTM.550	315	428	370	503	381	550	1650	3 Inom	2230	45

T00212-B

MODULAR SFTM

380...440Vac max. power supply for POWER circuit

380...440Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR				OUTPUT POWER with 400Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT 30s every 300s	LEAKAGE (W)	WEIGHT (kg)
			with 380...415Vac		with 440Vac							
			(kW)	(HP)	(kW)	(HP)						
3	control unit 214x244x440	SFTM.660	355	482	410	557	457	660	1980	3 Inom	2680	70
		SFTM.770	450	611	510	693	533	770	3450	4.5 Inom	3120	
	power unit 675x325x867	SFTM.900	500	679	595	808	624	900	3450	3.8 Inom	3650	
		SFTM.1150	630	856	760	1033	797	1150	3450	3 Inom	4660	
4	control unit 214x244x440 power unit 830x470x1140	SFTM.2000	1100	1495	1295	1760	1386	2000	6000	3 Inom	8110	106

T00208-B

COMPACT SFTM

441...500Vac max. power supply for POWER circuit

441...500Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR				OUTPUT POWER with 500Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT <i>30s every 300s</i>	LEAKAGE (W)	WEIGHT (kg)
			with 460Vac		with 480...500Vac							
			(kW)	(HP)	(kW)	(HP)						
1	214x244x440	SFTM.32	18.5	25	20	27	28	32	135	4.2 Inom	130	15
		SFTM.45	25	34	30	41	39	45	135	3 Inom	180	
		SFTM.60	37	50	40	54	52	60	216	3.6 Inom	240	
		SFTM.72	45	61	50	68	62	72	216	3 Inom	290	
		SFTM.86	55	75	60	82	74	86	315	3.7 Inom	350	18
		SFTM.105	65	88	70	95	91	105	315	3 Inom	430	
2	333x360x596	SFTM.145	90	122	105	143	126	145	645	4.4 Inom	590	39
		SFTM.170	110	149	125	170	147	170	645	3.8 Inom	690	
		SFTM.215	140	190	150	204	186	215	645	3 Inom	870	
		SFTM.250	160	217	175	238	217	250	1140	4.6 Inom	1010	42
		SFTM.310	200	272	220	299	268	310	1140	3.7 Inom	1260	
		SFTM.380	250	340	270	367	329	380	1140	3 Inom	1540	
		SFTM.450	300	408	315	428	390	450	1350	3 Inom	1820	
2A	333x453x685	SFTM.550	370	503	395	537	476	550	1650	3 Inom	2230	45

T00213-B

MODULAR SFTM

441...500Vac max. power supply for POWER circuit

441...500Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR				OUTPUT POWER with 500Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT 30s every 300s	LEAKAGE (W)	WEIGHT (kg)
			with 460Vac		with 480...500Vac							
			(kW)	(HP)	(kW)	(HP)						
3	control unit 214x244x440	SFTM.660	410	557	445	605	572	660	1980	3 Inom	2680	70
		SFTM.770	510	693	555	754	669	770	3450	4.5 Inom	3120	
	power unit 675x325x867	SFTM.900	595	808	645	876	779	900	3450	3.8 Inom	3650	
		SFTM.1150	760	1033	825	1121	996	1150	3450	3 Inom	4660	
4	control unit 214x244x440 power unit 830x470x1140	SFTM.2000	1295	1760	1405	1909	1732	2000	6000	3 Inom	8110	106

T00209-B

COMPACT SFTM

501...600Vac max. power supply for POWER circuit

380...500Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR with 525...600Vac		OUTPUT POWER with 600Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT <i>30s every 300s</i>	LEAKAGE (W)	WEIGHT (kg)
			(kW)	(HP)						
1	214x244x440	SFTM.32	22	30	33	32	135	4.2 Inom	130	15
		SFTM.45	30	41	47	45	135	3 Inom	180	
		SFTM.60	48	65	62	60	216	3.6 Inom	240	
		SFTM.72	55	75	75	72	216	3 Inom	290	
		SFTM.86	65	88	89	86	315	3.7 Inom	350	18
		SFTM.105	80	109	109	105	315	3 Inom	430	
2	333x360x596	SFTM.145	120	163	151	145	645	4.4 Inom	590	39
		SFTM.170	145	197	177	170	645	3.8 Inom	690	
		SFTM.215	175	238	223	215	645	3 Inom	870	
		SFTM.250	205	279	260	250	1020	4.1 Inom	1010	42
		SFTM.310	255	346	322	310	1020	3.3 Inom	1260	
		SFTM.340	275	374	353	340	1020	3 Inom	1380	
2A	333x453x685	SFTM.380	320	435	395	380	1140	3 Inom	1540	45

T00214-B

MODULAR SFTM

501...600Vac max. power supply for POWER circuit

380...500Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR with 525...600Vac		OUTPUT POWER with 600Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT <i>30s every 300s</i>	LEAKAGE (W)	WEIGHT (kg)
			(kW)	(HP)						
3	control unit 214x244x440	SFTM.580	515	700	603	580	1740	3 Inom	2350	70
	power unit 675x325x867	SFTM.850	730	992	883	850	2550	3 Inom	3450	
4	control unit 214x244x440	SFTM.910	785	1067	946	910	2730	3 Inom	3690	106
	power unit 830x470x1140	SFTM.1900	1595	2167	1975	1900	5700	3 Inom	7700	

T00210-B

COMPACT SFTM

601...690Vac max. power supply for POWER circuit

380...500Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR with 660...690Vac		OUTPUT POWER with 690Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT <i>30s every 300s</i>	LEAKAGE (W)	WEIGHT (kg)
			(kW)	(HP)						
1	214x244x440	SFTM.32	30	41	38	32	135	4.2 Inom	130	15
		SFTM.45	40	54	54	45	135	3 Inom	180	
		SFTM.60	55	75	72	60	216	3.6 Inom	240	
		SFTM.72	70	95	86	72	216	3 Inom	290	
		SFTM.86	80	109	103	86	315	3.7 Inom	350	18
		SFTM.105	95	129	125	105	315	3 Inom	430	
2	333x360x596	SFTM.145	140	190	173	145	645	4.4 Inom	590	39
		SFTM.170	170	231	203	170	645	3.8 Inom	690	
		SFTM.215	205	279	257	215	645	3 Inom	870	
		SFTM.250	240	326	299	250	1020	4.1 Inom	1010	42
		SFTM.310	300	408	370	310	1020	3.3 Inom	1260	
		SFTM.340	320	435	406	340	1020	3 Inom	1380	
2A	333x453x685	SFTM.380	370	503	454	380	1140	3 Inom	1540	45

T00215-B

MODULAR SFTM

601...690Vac max. power supply for POWER circuit

380...500Vac power supply for CONTROL circuit

SIZE	DIMENSIONS LxDxH (mm)	MODEL	APPLICABLE MOTOR with 660...690Vac		OUTPUT POWER with 690Vac (kVA)	RATED CURRENT Inom (A)	MAXIMUM CURRENT Imax (A)	STARTING CURRENT <i>30s every 300s</i>	LEAKAGE (W)	WEIGHT (kg)
			(kW)	(HP)						
3	control unit 214x244x440	SFTM.440	425	577	526	440	1320	3 Inom	1780	70
	power unit 675x325x867	SFTM.770	765	1039	920	770	2310	3 Inom	3120	
4	control unit 214x244x440	SFTM.840	830	1128	1004	840	2520	3 Inom	3410	106
	power unit 830x470x1140	SFTM.1500	1470	1997	1793	1500	4500	3 Inom	6080	

T00211-B

2.2 GENERIC DATA

Control mode		4 start-up types: current steps, current ramp, kick start, voltage ramp. 2 stop types: natural, extended
Protections	Undervoltage	Present if the supply voltage is lower than 15% of the min. rated supply, that is: • supply 200 ÷ 240 Vac 170Vac • supply 380 ÷ 440 Vac 323Vac • supply 441 ÷ 500 Vac 375Vac • supply 501 ÷ 600 Vac 426Vac • supply 601 ÷ 690 Vac 511Vac
	Overvoltage	Present if the supply voltage is higher than 10% of the max. rated supply. • supply 200 ÷ 240Vac 264Vac • supply 380 ÷ 440 Vac 484Vac • supply 441 ÷ 500Vac 550Vac • supply 501 ÷ 600 Vac 660Vac • supply 601 ÷ 690 Vac 759Vac
	Temperature protection	Present if heatsink temperature reaches critical values
	Thermal protection of motor software	Present, if enabled, in case of motor overheating
	Overcurrent instantaneous protection	Present if too high current peaks are detected. This protection does not protect the equipment against output shortcircuits. For this purpose, always install fast-acting fuses on supply lines, except for MODULAR SFTMs as, for these, they are already included in the Power Unit.
EMC	IMMUNITY : Electrostatic discharges Burst Surge Radio-freq. electromagnetic fields	Level 3 EN 61000 - 4 - 2 Level 3 EN 61000 - 4 - 4 Level 3 EN 61000 - 4 - 5 Level 4 EN 61000 - 4 - 8
	EMISSION: Radio-freq. electromagnetic fields	EN 55011 class B
Ambient cond.	Working temperature	0° C up to 40° C : room temperature without derating; from 40° C to 50° C: derate by 2% for every ° C beyond 40° C
	Relative humidity	20 ÷ 90 % (without dew)
	Max. working height	1000m asl (beyond 1000m asl derate by 1% every 100m)

T00234-B

3 PROGRAMMING

3.1 CONTROL KEYBOARD

The SFTM front side is provided with a 4-key keyboard and one LCD display with two 16-character rows.

The display shows the parameter values, the diagnostic messages and the values processed by the static converter. The four keys are called:

 MA0338-0 MODE	Press MOD to alternatively switch from BLINKING DISPLAY CURSOR (PROGRAMMING MODE) to INACTIVE DISPLAY CURSOR (DISPLAY MODE) and viceversa	
 MA0337-0 INC	Two operation modes are available: BLINKING CURSOR:	it allows to increase the currently displayed parameter value
	INACTIVE CURSOR:	it allows to go to the parameter following the currently displayed parameter
 MA0338-0 DEC	Two operation modes available: BLINKING CURSOR:	it allows to decrease the currently displayed parameter value. N.B. Starting from Vers. S4.03 , if that parameter is included in the list at the bottom of this page, it may be changed with the INC key only, and cannot be changed with the DEC key anymore.
	INACTIVE CURSOR:	it allows to go to the parameter preceding the currently displayed parameter
 MA0339-0 ENTER	Two operation modes available: BLINKING CURSOR:	it allows to permanently store (in EEPROM) the currently displayed parameter
	INACTIVE CURSOR:	no effect

T00104-B

In case of alarm, the SFTM operation can be RESET by simultaneously pressing the keys:



CAUTION - If case of alarm, before starting the unit try to locate the cause that generated the alarm.

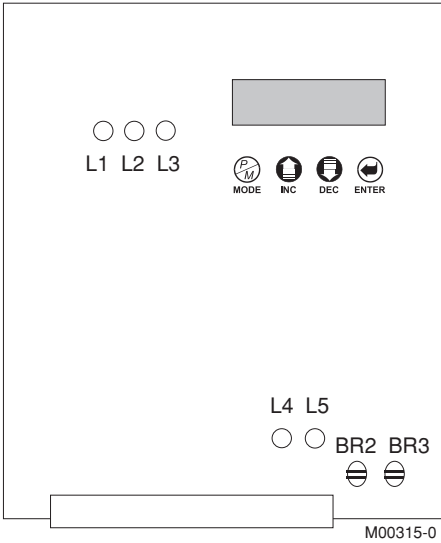


NOTE: For the following parameters:

P01, P02, P14, P15, P16, P21, P23, P27, P28, P31, P32, P33, P36, P42, P48, P52, P58, P62, P68, P72, P78, P85, P100, P101, P102, P103, P104, P105, P106, P107 the DEC key is DISABLED.

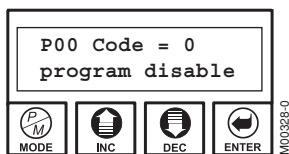
Press the INC key many times to select the possible values or functions assigned to the parameters above.

3.2 DISPLAY THROUGH LEDS LOCATED ON THE CONTROL BOARD



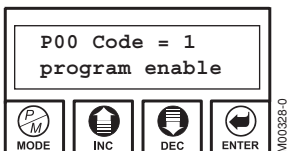
L1 (+15V)	Presence of +15Vdc supply used for circuit analog side
L2 (-15V)	Presence of -15Vdc supply used for circuit analog side
L3 (+5V)	Presence of +5Vdc supply used for circuit digital side
L4(ON)	Drive running (SCR on)
L5(LIM)	Motor output current at max. value set through P06 (I3)
BR2	It connects term. 30 to the +24V inner voltage (the soldered jumper is series installed).
BR3	It connects term. 29 to inner 0V (the soldered jumper is series installed).

3.3 KEY PARAMETER



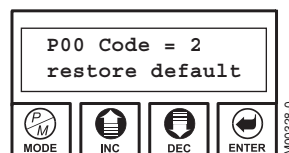
The value P00=0 indicates that the Pxx parameters can ONLY be shown on the display, BUT CANNOT BE CHANGED.

Pxx CANNOT
BE CHANGED

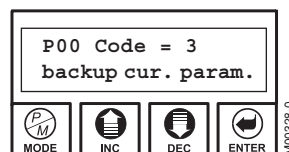


It indicates the value to be set for parameter P00 in order to change the Pxx parameters

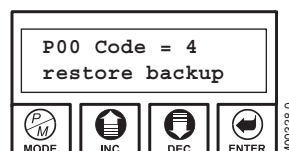
Pxx
CAN BE CHANGED



Default parameter transfer. The factory setting is restored.



Back up of current parameters: current parameters are copied in another area of the EEPROM memory. After changing parameters, it can be used to restore the old values.



Restore of parameters for which a backup has been previously performed.



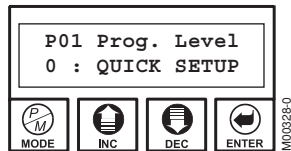
NOTE: To change parameters, set P00 = 1

3.4 PARAMETER DISPLAY

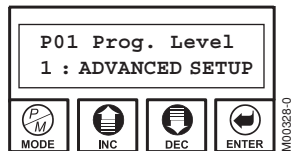
Parameter display includes three levels:

- | | |
|-------------------------|-----------------------------|
| • QUICK SETUP | quick programming |
| • ADVANCED SETUP | advanced programming |
| • ENGINEERING | complete programming |

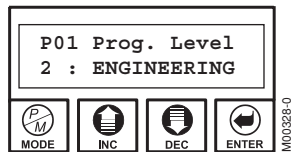
The parameter concerned with this different representation is:



It allows to access parameters
from **P00** to **P31** (motor 0 selected) or
from **P00A** to **P31A** (motor A selected) or
from **P00B** to **P31B** (motor B selected)



It allows to access parameters
from **P00** to **P88** (motor 0 selected) or
from **P00A** to **P88A** (motor A selected) or
from **P00B** to **P88B** (motor B selected)



It allows to access parameters
from **P00** to **P107** (motor 0 selected) or
from **P00A** to **P107A** (motor A selected) or
from **P00B** to **P107B** (motor B selected)

By default, the quick programming (QUICK SETUP) is selected.

4 BASIC START-UP PROCEDURE

Procedure suitable for terminal board control mode (factory setting). See the paragraphs concerning with terminal meaning ("CONTROL TERMINAL BOARD" and "POWER TERMINAL BOARD" chapters).

1. **Preliminary checks:** When installing, check that the mains rated voltage does not exceed the **supply voltage range** stated in the adhesive label in the equipment front part. The starter standard configuration allows a voltage supply ranging from 380 to 440Vac and from 45 to 65 Hz.



If the three-phase supply does not derive from the mains but from a **generator**, you might need to properly set **parameters #107** (max. allowable frequency change) and **#105** (A03 unstable frequency alarm writing delay); their default values are 1Hz/s alarm threshold and the alarm immediate trip.

2. **Wiring:** When installing, follow the instructions mentioned in IMPORTANT SAFETY NOTES and INSTALLATION chapters.

3. **Power on:** Connect the equipment **except for the power unit**. In ES600 control board, make sure that the following LEDs turn on:

LED1 +15V
LED2 -15V
LED3 +5V

Check that the ventilating unit works properly - it has to blow upwards.



If **an alarm is displayed**, reset it (simultaneously press INC and DEC).
If the alarm displayed does not disappear (i.e. the cause responsible for the alarm persists) see section 8.1 (ALARM PARAMETERS).

Disconnect the cable on terminal 28 (RUN/STAND-BY) and on terminal 15 (START/STOP).

4. **Cyclic sense check:** After checking that parameter P31 is on *Mode 1* value (if on *Mode 2* it has to be changed) close the line contactor and the contact on terminal 15.



If **alarm A01 "Wrong cyclic sense"** trips, invert the first and third phase on the supply set **upstream from the branching point** of the control and power supply. When the converter is turned on again, this alarm is to be reset.

If alarm A01 has not tripped, open the line contactor and the contact on terminal 15 again.

5. **Parameter change:** Access parameter P00 (key parameter) and set it to 1. Press the MOD, DEC, INC, ENTER keys to access the other parameters.

6. **Motor parameters:** Check that the motor current Imot (P03) and the profile type (P02) are properly set.

7. **Start-up:** Close the power contactor making sure that the relevant contact on terminal 28 and on terminal 15 close as well.
The motor starts: check that the direction of rotation is correct. If not, DISCONNECT THE SOFT-STARTER and INVERT TWO MOTOR PHASES.

8. **Troubles:** If no trouble occurred, go to the next step (9), otherwise inspect wiring by checking if the supply voltages required are to be found. Any alarm is shown on the display. Through measure parameters (Mxx) the following items can be checked: power unit (M07) supply voltage, mains voltage frequency (M06), digital input condition (M10), type of start-up (M19) preset, last alarms report (M21,M22,M23).

9. Parameter change while starting

up:

YOU MAY CHANGE the parameters relating to the starting stage current/voltage (P04, P05, P06, P07, P08, P09, P10, P11, P12, P13) even when the motor is starting.

ON THE OTHER HAND, THE STARTUP PROFILE (P02) MAY NOT BE CHANGED WHEN STARTING HAS ALREADY BEGUN.

Each time you need to change some parameters, do not forget to set parameter P00 to 1.
Note down your changes in the table at the end of this manual.

10. Reset:

Should an alarm trip, determine the cause responsible for the alarm and reset the equipment by temporarily enabling terminal 27 (RESET) or simultaneously pressing the INC, DEC keys.



DANGER!! Before making any wiring change, make sure that the SOFT STARTER is disconnected.



CAUTION - When the equipment is started up, its direction of rotation could be wrong. In that case, DISCONNECT the equipment and INVERT two motor phases.



CAUTION - If an alarm trip, determine the cause responsible for the alarm before starting the equipment.

5 DESCRIPTION OF INPUT AND OUTPUT SIGNALS

5.1 DIGITAL CONTROL SIGNALS

To activate, close the digital control inputs to 0V-OPTO.
All the control digital signals can be galvanically insulated from the SOFT STARTER control board through jumpers to be soldered BR2 and BR3 (see figure) having the following meaning:

- BR2 closed: It brings the inner +24Vdc to terminal board (for digital inputs). **By default, BR2 is CLOSED.**
- BR2 open: For digital inputs an external +24Vdc is used. Inputs are therefore opto-insulated.
- BR3 closed: It brings the inner 0V to terminal board (for digital inputs). **By default, BR3 is CLOSED.**
- BR3 open: For digital inputs an external 0V is used. Inputs are therefore opto-insulated.

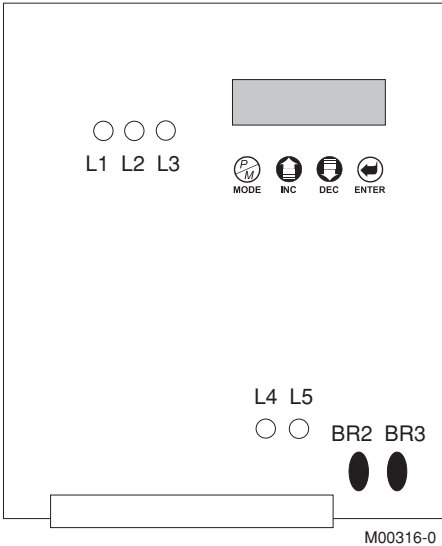


Figure 5.1-0 Diagram of NOT INSULATED connection

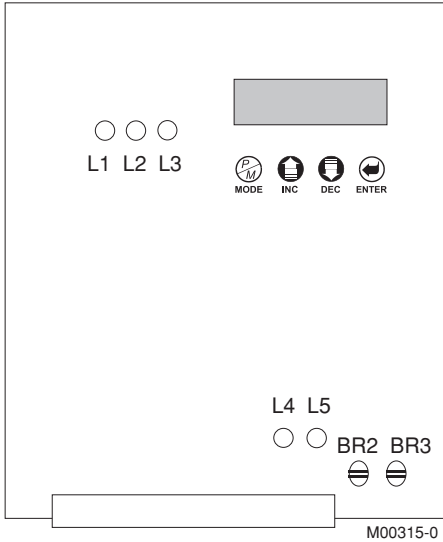
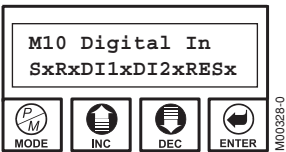


Figure 5.1-1 Diagram of INSULATED connection

The digital input state is shown through parameter M10.

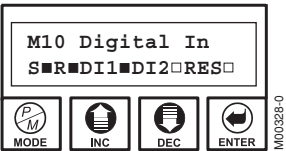
where:



S	input logical state	terminal 15
R	input logical state	terminal 28
DI1	input logical state	terminal 16
DI2	input logical state	terminal 17
RES	input logical state	terminal 27

T00007-B

EXAMPLE
If



it means that terminal 15 (S) is **closed** to 0V, terminal 28 is **closed** to 0V, terminal 16 is **closed** to 0V, while terminals 17 and 27 are **OPEN**.

5.1.1 RUN/STANDBY and START/STOP in *Mode 1*

If the RUN/STANDBY function (terminal 28) and the START/STOP function (terminal 15) are configured by parameter P31 in *Mode 1* (factory setting), the following operating procedure will take place:

Mode 1	Inputs 28 and 15 controlled by switch contacts, selector contacts, relay contacts and so on, both active if permanently closed to 0V. The motor starting and <u>idle stop</u> commands are enabled if terminal 28 contact is closed and opened again, with terminal 15 contact that must be closed to 0V at start, and that may be left closed at stop. The motor starting and <u>ramp stop</u> commands are enabled if terminal 15 contact is closed and opened again, with terminal 28 contact that must always be closed to 0V, both at start and at stop.
	P31 Configure term 15-28 Mode1     MOD328-0 Factory setting.

T00105-B

To avoid undesired start-ups, a protection (P30: START/STOP SECURITY) is available. If enabled (YES), it prevents the motor from starting when the unit is supplied through terminals 15 and 28 both set to 1 and closed.

5.1.2 RUN/STANDBY and START/STOP in *Mode 2*

If the RUN/STANDBY function (terminal 28) and the START/STOP function (terminal 15) are configured by parameter P31 in *Mode 2*, the following operating procedure will take place:

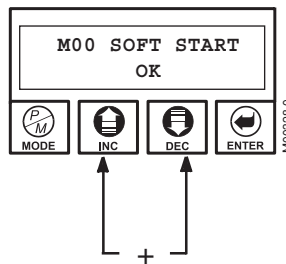
Mode 2	Input 28 controlled by a button normally closed contact, with the contact opening edge enabling. Input 15 controlled by a button normally open contact, with the contact closing edge enabling. The motor starting command is enabled with a closing pulse to terminal 15 contact. The <u>ramp stop</u> command is enabled with an opening pulse to terminal 28 contact. This mode enables a self-retaining START/STOP sequence through two buttons connected to terminals 15 and 28.
	P31 Configure term 15-28 Mode2     MOD328-0

T00060-B

5.1.3 RESET (terminal 27)

It restores the converter operation in case of lock.

With converter blocked due to an alarm condition, the reset can be performed by simultaneously pressing the push-buttons INC + DEC.



CAUTION - When an alarm message appears, before re-starting the unit, locate the cause that generated the alarm.



NOTE: With factory setting, the SOFT STARTER power off does not reset the alarm as this one is stored to be displayed again at next power-on, with SOFT STARTER still blocked: to unlock the SOFT STARTER, the reset operation is required.

5.1.4 DI1, DI2 (terminals 16, 17)

The function of these inputs can be programmed through P32 and P33.

Terminal	Name	Possible functions	Factory presetting	Parameter
16	DI1	SM1, SETA, DCB HOLD	SM1	P32
17	DI2	SM2, SETB, EXT.A	SM2	P33

T00057-B

5.1.5 EXTERNAL START-UP SELECTION (terminals 16,17)

If **P02 = 3 (ext.start.sel.)**, (**P02 = 4 (ext.start.sel.)** only up to vers. S4.05) setting **P32=SM1** and **P33=SM2**, terminals 16 and 17 are used to select the type of motor start-up.

terminal 16	terminal 17	start-up type
OFF	OFF	CURRENT STEP
X	ON	KICK START
ON	OFF	CURRENT RAMP

T00235-B

Up to vers. S4.05

terminal 16	terminal 17	start-up type
OFF	OFF	CURRENT STEP
OFF	ON	KICK START
ON	OFF	CURRENT RAMP
ON	ON	TACHO GENERATOR

T00058-B



NOTE: If P32=SM1 and P33≠SM2, the contact on terminal 17 is considered OFF. If P32≠SM1 and P33=SM2, the contact on terminal 16 is considered OFF.

5.1.6 SELECTION OF MOTOR CHARACTERISTIC SETS (terminals 16 and 17)

Setting **P32=SETA** and **P33=SETB**, terminals 16 and 17 are used to select which motor characteristics set, under three possibilities, must be used by the converter. The following table shows the selection criteria:

Term. 16	Term. 17	Motor no.
0	0	default
1	0	mot. A
0	1	mot. B
1	1	mot. B

T00012-B



NOTE: If you want to select two possible parameter sets only, **using terminal 17 only**, set P32=SM1 and P33=SETB (the state of terminal 16 does not affect this operation). The valid table is the following:

Term. 17	Motor characteristic set
0	default mot.
1	mot. B

T00013-B



NOTE: If you want to select two possible parameter sets only, **using terminal 16 only**, set P33=SM2 and P32=SETA (the state of terminal 17 does not affect this operation). The valid table is the following:

Term. 16	Motor characteristic set
0	default mot.
1	mot. A

T00014-B

5.1.7 EXTERNAL ALARM (terminal 17)

Setting **P32=SM1** and **P33=EXTA**, terminal 17 is used as an external alarm.

open contact	EXTERNAL ALARM condition
closed contact	OK EXTERNAL condition

T00015-B

5.1.8 TERMINAL 16 AND 17 CONFIGURATION SUMMARIZING TABLE

The table below summarizes all the functions that may be obtained by matching the possible configurations of terminal 16 and 17 through parameters P32 and P33.

P32 (term. 16)	P33 (term. 17)	Possible selections
SM1	SM2	With P02=4, all four starting profiles through combination of terminals 16 and 17
SETA	SETB	Three different motors through combination of terminals 16 and 17
SETA	SM2	Two motors with terminal 16, and two starting profiles with terminal 17 (P02 =4)
	EXT.A	Two motors with terminal 16, and external alarm contact on terminal 17
SM1 DCB HOLD	SET B	Two starting profiles with terminal 16 (P02=4) and two motors with terminal 17
		DC supply for anticondensate with terminal 16, and two motors with terminal 17
DCB HOLD	SM2	DC supply for anticondensate with terminal 16, and starting profiles with terminal 17 (P02=4)
	EXT.A	DC supply for anticondensate with terminal 16, and external alarm contact on terminal 17
SM1	EXT. A	Two starting profiles with term. 16 (P02=4), and external alarm contact on terminal 17

T00066-B



NOTE: for the “DCB HOLD” function, see the following chapter 6.10.2 ANTICONDENSATE DIRECT CURRENT.

5.2 ANALOG OUTPUTS

5.2.1 OUTAUX (TERMINAL 9)

This is a programmable analog output whose value can range from 0V to +10V, with a max. current of 5mA. It can be used to connect measuring instruments or to send this signal to other units.

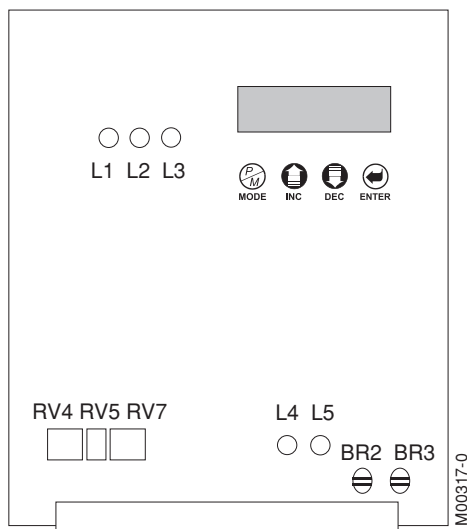
This output can be programmed through parameter OutMonitor (P36).



CAUTION - This is an output. DO NOT APPLY INPUT VOLTAGE.
Do not exceed the max. allowed current.

5.2.2 OUT I (terminal 10)

Analog output proportional to the motor current. By default, there are 4V corresponding to the max. output current of the SOFT STARTER. Trimmer RV4 can be used to change the ratio between the output voltage and the motor current. The output signal can range from 0 and +10V; the max. output current available is 5mA.



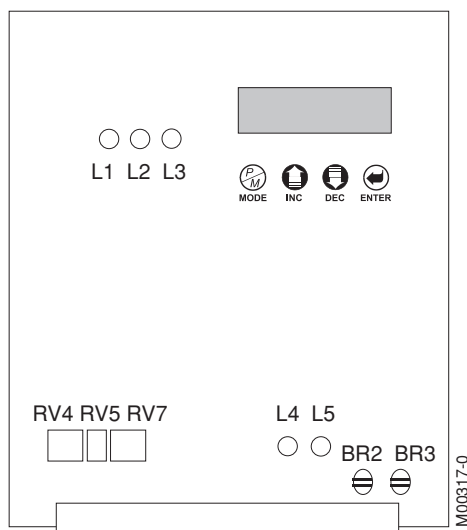
NOTE: For this output, accuracy is equal to 5% of the full-scale voltage.



CAUTION - This is an output. DO NOT APPLY INPUT VOLTAGE.
Do not exceed the max. allowed current.

5.2.3 OUT V (terminal 11)

Analog output proportional to the motor voltage. By default, there are +10V corresponding to 800Vrms. Trimmer RV7 can be used to change the ratio between the output voltage and the motor voltage. The output voltage can range from 0V to +10V; the max. output current available is 5mA.



CAUTION - This is an output. DO NOT APPLY INPUT VOLTAGE.
Do not exceed the max. allowed current.

5.3 RELAY MULTI-FUNCTION DIGITAL OUTPUTS (MDO1, MDO2, MDO3, MDO4)

The terminal board is provided with four programmable relay outputs:

Terminals	Description	Contact type	Output characteristics	Factory setting
19-20	MDO1	normally open	250Vac, 5A, 30Vdc 5A	START END
21-22	MDO2	normally open	250Vac, 5A, 30Vdc 5A	SOFT STARTER OK
23-24	MDO3	normally open	250Vac, 5A, 30Vdc 5A	BYPASS
25-26	MDO4	normally open	250Vac, 5A, 30Vdc 5A	LINE CONTACTOR

T00061-B

6 DESCRIPTION OF BASIC FUNCTIONS

6.1 START-UP PROFILES

The SOFT STARTER allows to start the motor in three ways:

- with 2-level current reference (current step)
- with current ramp (current ramp)
- with voltage ramp (possible initial unlocking voltage) (kick start)

To choose the start-up type, the following options are available:

- through parameter START MODE (P02)
- through external selectors

6.1.1 CURRENT STEP (P02 = 0)

At start-up the current limitation is set as percentage of motor rated current $I_{\text{mot}} = P03$. The time required for start-up comes from the set current limit and from the resisting torque of the load.

CURRENT STEP
 $(I_1, I_2 \leq 7I_{\text{mot}}; I_3 \leq 3I_{\text{mot}})$

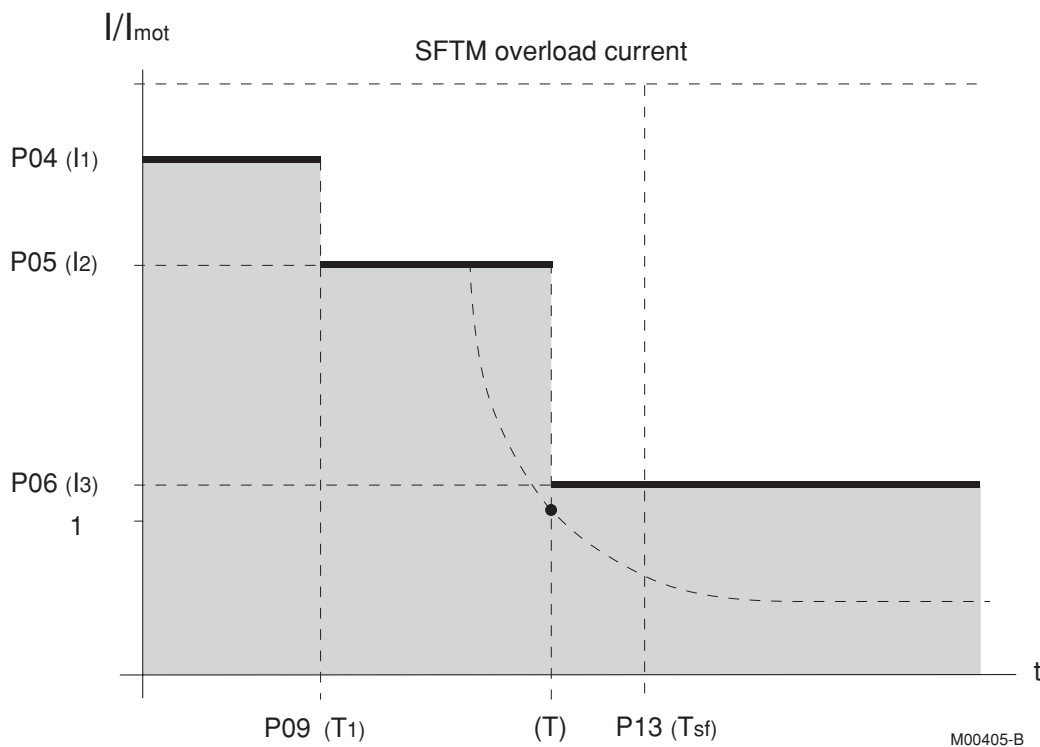


Figure 6.1.1-1 Trend of motor supply current during a CURRENT STEP start-up.
 N.B. In this picture, T represents the moment when the soft-starter detects the start end.

Parameters considered for this start-up type:

P02 Start mode


MODE


INC


DEC


ENTER

M00328-0

It allows to set the desired start-up among the three available types.

P03 Imot = ***%
motor current


MODE


INC


DEC


ENTER

M00328-0

It allows to set the motor rated current.
The current values to be set, according to the various operation phases, are expressed as percentage OF THIS VALUE.

P04 I1 = ***%
starting current


MODE


INC


DEC


ENTER

M00328-0

It expresses, as percentage of motor rated current (P03), the initial value of the current reference to be kept for a time equal to T1. This value cannot exceed 500% of Imot and the max. overload limit set for SFTM, variable from 300% to 560% depending on size.

P05 I2 = ***%
second start. cur.


MODE


INC


DEC


ENTER

M00328-0

It expresses, as percentage of motor rated current (P03), the current reference value in the second and last start-up phase. The selectable value limits are the same shown in I1.

P06 I3 = ***%
final current


MODE


INC


DEC


ENTER

M00328-0

It allows to set the max. current, expressed as percentage of motor rated current (P03), that can circulate inside the motor once the start-up is complete. If the motor requires a higher current, the SOFT STARTER output voltage is limited.

P09 T1 = *****
start. curr. time


MODE


INC


DEC


ENTER

M00328-0

Expressed in seconds, it represents the time during which the current reference I1 is set.

P13 Tsf = *****
start fail. time


MODE


INC


DEC


ENTER

M00328-0

It indicates the max. allowed time during which motor can be started.

EXAMPLE:

Start-up of a 30kW motor having a 60A rated current and connected to a pump or a load that does not require a large starting torque. The CURRENT STEP start-up is selected, having an initial overload current equal to 300% of the motor rated current for a max. time T1=10sec.

Then, this current overload has to be set at 250%. The start-up should be performed within a max. time limit set at 30 sec. When the start-up is complete, the SOFT STARTER still controls the current that has NOT TO EXCEED 180% of the rated current.

The following parameters are concerned:

P09 T1 = 10s
start.curr.time

6.1.2 CURRENT RAMP (P02 = 1)

The current delivered to the motor is progressively increased (increasing ramp) or decrease (pickup BOOSTER) within a time set using the parameter.

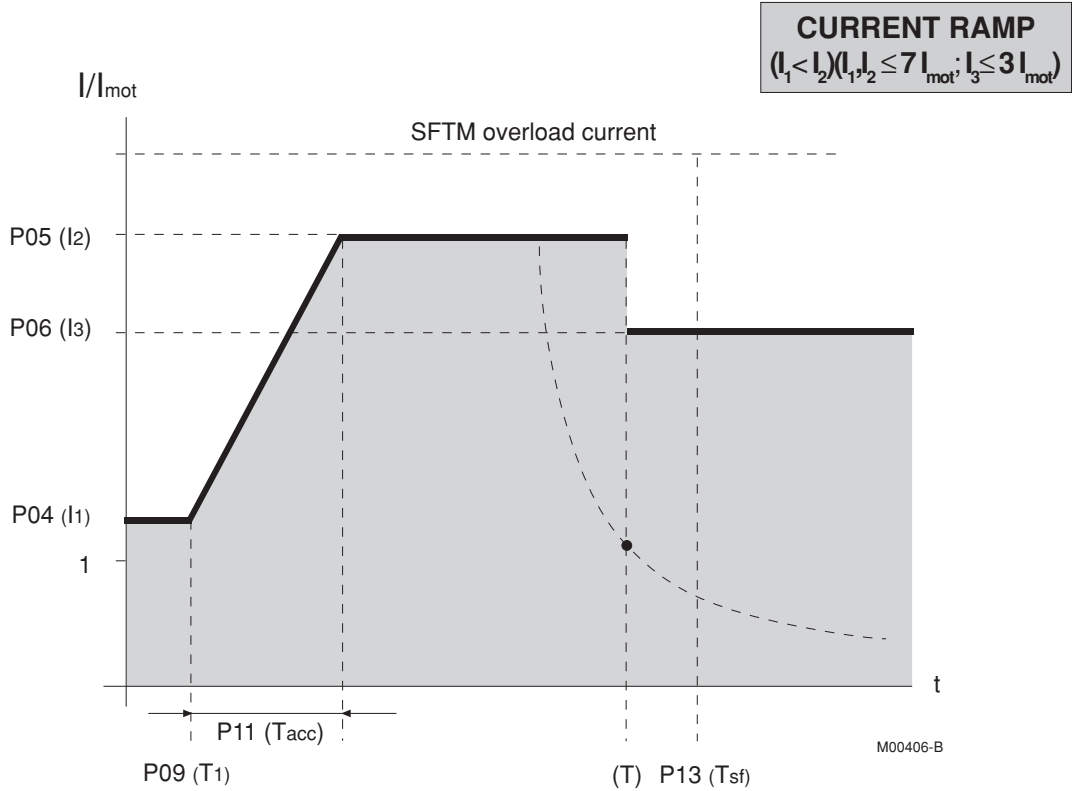


Figure 6.1.2-1 Trend of motor supply current during a CURRENT RAMP start-up.
N.B. In this picture, T represents the moment when the soft-starter detects the start end.

The following parameters are set:

P02 Start mode

MODE INC DEC ENTER

It allows to set the desired start-up among the three available types.

P03 Imot = ***%
motor current

MODE INC DEC ENTER

It allows to set the motor rated current.
All percentage current included in this manual ARE REFERRED TO THIS SET VALUE.

P04 I1 = ***%
Starting current

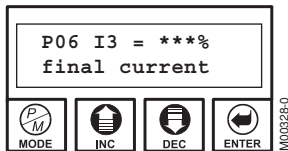
MODE INC DEC ENTER

It expresses, as percentage of motor rated current, the initial value of the current reference to be kept for a time equal to T1. This value cannot exceed 500% of Imot and the max. overload limit set for SFTM size.

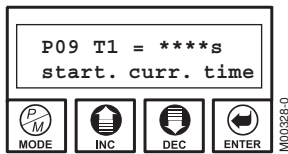
P05 I2 = ***%
second start. cur.

MODE INC DEC ENTER

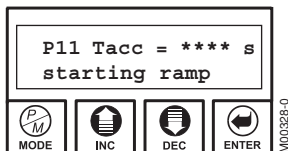
It expresses, as percentage of motor current, the second current reference value for ramp generation. The selectable value limits are the same shown in I1.



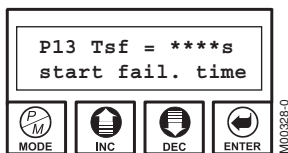
It allows to set the max. current, expressed as percentage of motor rated current (P03), that can circulate inside the motor once the start-up is complete. If the motor requires a higher current, the SOFT STARTER output voltage is limited.



Expressed in seconds, it represents the time during which the current reference I1 is set.



Expressed in seconds, it represents the time required to enter the current ramp from I1 value to I2 value.



It indicates the max. allowed time during which motor can be started.

EXAMPLE:

Start-up of a 30kW motor having a 60A rated current and connected to a pump or a load that does not require a very large starting torque.

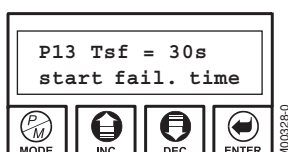
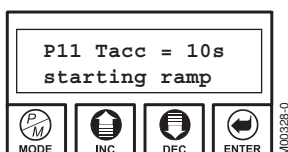
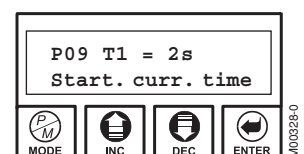
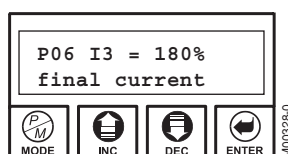
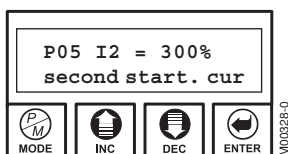
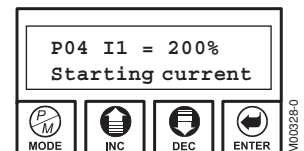
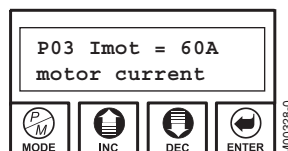
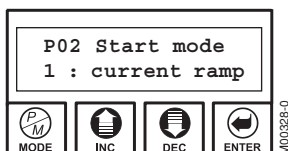
The CURRENT RAMP start-up is selected, having an initial current equal to 200% of the motor rated current. This current should be kept constant for 2 sec.

Then, within 10 seconds, a 300% current overload has to be reached.

The max. time in which the start-up is to be performed is 30 sec.

When the start-up is complete, a max. current equal to 180% of the rated current should flow inside the motor.

The following parameters should be set:



6.1.3 KICK START (P02 = 2)

To overcome high torques resisting to the in-rush current, at start-up signal a voltage level is applied to the motor as percentage of max. voltage. The length of this start-up pulse can be set through a parameter. Then, the voltage ramp and the current limitation are enabled.

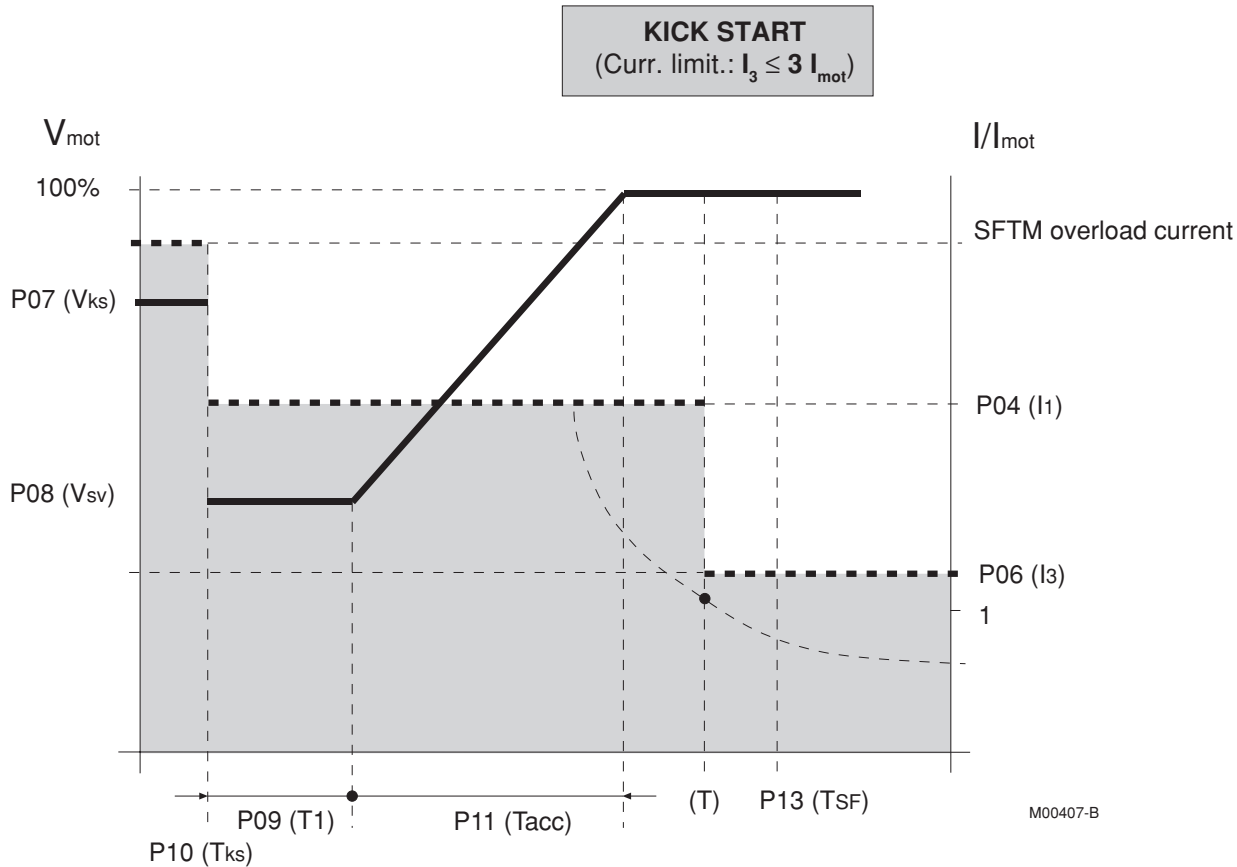
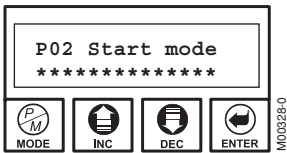
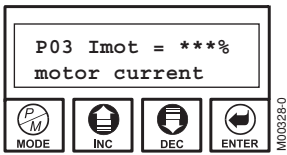


Figure 6.1.3-0 Trend of output voltage and current limits in KICK START mode.
N.B. In this picture, T represents the moment when the soft-starter detects the start end.

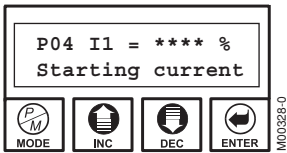
 Note: The preset ramp represented in the diagram refers to the VOLTAGE REFERENCE RAMP TIME set. As for the time took to start the motor, this will generally be equal to the first one, but may also be LONGER (starter in current limiting).



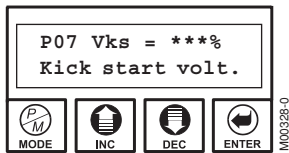
It allows to set the desired start-up among the three available types.



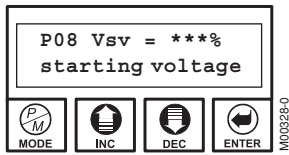
It allows to set the motor rated current.
All percentage currents included in this manual ARE REFERRED TO THIS SET VALUE.



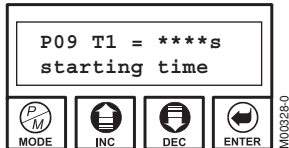
It expresses, as percentage of motor current, the limit current value that has not to be exceeded for a time equal to T1 and Tacc.



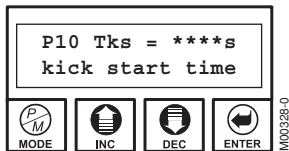
It expresses, as percentage of mains current, the initial value of the voltage reference to be kept for a time equal to Tks. This value can range from 0% to 100% max.



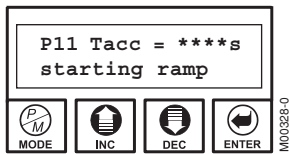
It expresses, as percentage of motor voltage, the starting value of the voltage ramp. This value is kept for a time equal to T1. It can range from 0% to 100%.



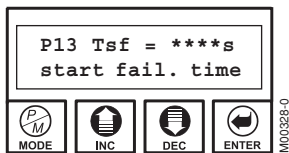
Expressed in seconds, it represents the time during which the voltage reference **Vsv** is set.



Expressed in seconds, it represents the time during which the voltage reference **Vks** is set. The m. current value is set to the max. current supported by the SOFT-STARTER.

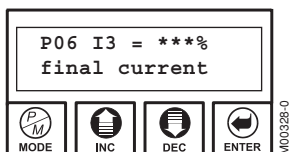


It represents the ramp time set to pass the motor output voltage from **Vsv** to the motor rated voltage.



It expresses the max. time allowed in which the motor has to start.

The current is limited to the peak current delivered by the SOFT-STARTER and to I1 value during the initial phase; it is limited to I3 during the following phases.



It allows to set the max. current, expressed as percentage of motor rated current (P03), that can circulate inside the motor once the start-up is complete. If the motor requires a higher current, the SOFT STARTER output voltage is limited.

EXAMPLE:
Start-up of a 90kW motor having a 160A rated current and connected to a load requiring a very large starting torque, e.g. a loaded mill.
The KICK START mode is selected, with a starting voltage pulse having an amplitude equal to 100% of the mains voltage for 500 msec.
Then, a voltage equal to 50% of the mains voltage is to be applied to the motor.
After 2 sec., 100% of the mains voltage is to be reached in 20 sec. with a voltage ramp. The max. current after the first starting time and for the whole starting duration is to be limited to 300% of the motor rated current. The start-up max. time is 50 sec. When the start-up is complete, the motor current is to be limited to 150% of the rated current.

The parameters to be set in sequence are:

P02 Start mode
3 : Kick start

MODE

INC

DEC

ENTER

M00328-0

P03 Imot = 160A
motor current

MODE

INC

DEC

ENTER

M00328-0

P04 I1 = 300 %
Starting current

MODE

INC

DEC

ENTER

M00328-0

P06 I3 = 150%
final current

MODE

INC

DEC

ENTER

M00328-0

P07 Vks = 100%
Kick start volt.

MODE

INC

DEC

ENTER

M00328-0

P08 Vsv = 50%
starting voltage

MODE

INC

DEC

ENTER

M00328-0

P09 T1 = 2s
starting time

MODE

INC

DEC

ENTER

M00328-0

P10 Tks = 0.50 s
kick start time

MODE

INC

DEC

ENTER

M00328-0

P11 Tacc = 20s
starting ramp

MODE

INC

DEC

ENTER

M00328-0

P13 Tsf = 50s
start fail. time

MODE

INC

DEC

ENTER

M00328-0

6.1.4 VOLTAGE RAMP (P02 = 2)

The output voltage delivered to the motor is gradually increased starting from an initial value that can be calibrated up to 100% of the final value. The time in which this progression must be executed can be set with a parameter.

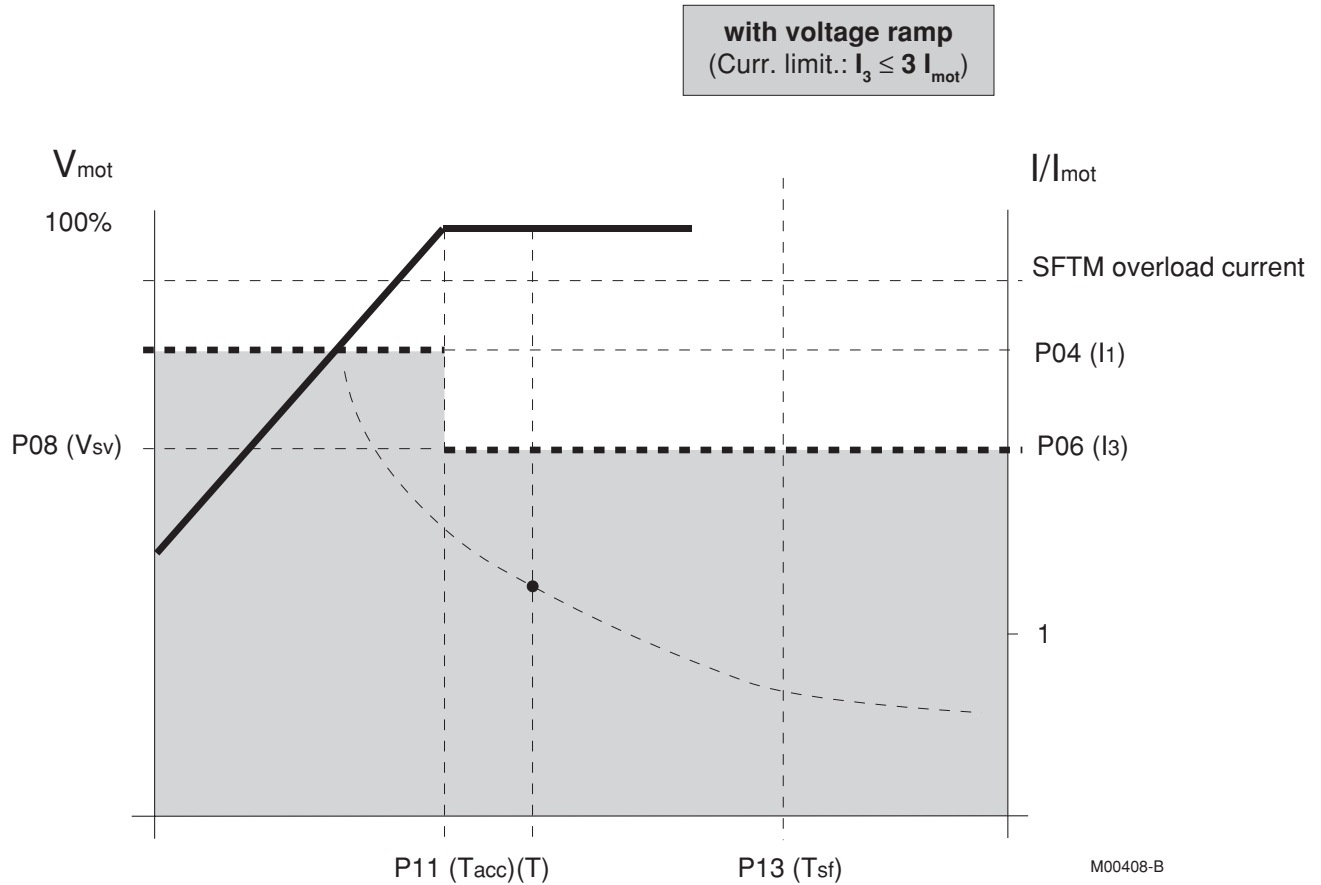


Figure 6.1.4-0 Trend of output voltage and current limits in VOLTAGE RAMP mode.
N.B. In this picture, T represents the moment when the soft-starter detects the start end.



Note: The preset ramp represented in the diagram refers to the VOLTAGE REFERENCE RAMP TIME set. As for the time took to start the motor, this will generally be equal to the first one, but may also be LONGER (starter in current limiting).

The parameters concerned are the same used for the KICK START mode, but in this profile type you have to set

$$T_{ks}=0, V_{ks} = 0$$

If required, you can set an initial fixed time to keep the motor at the V_{sv} voltage.

EXAMPLE:
Start-up of a 90kW motor having a 160A rated current and connected to a general load, e.g. a conveyor.
The VOLTAGE RAMP mode is selected, starting with a voltage equal to 50% of the mains voltage and performing the motor ramp up to the rated voltage in 20 sec.
During the motor ramp, the current is limited to 300% of the motor rated current. The start-up max. time is 40 sec.
When the start-up is complete, the motor max. current is not to exceed 150% of the rated current.

The parameters to be set in sequence are:

P02 Start mode
3 : Kick start

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P03 Imot = 160
motor current

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P04 I1 = 300 %
Starting current

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P06 I3 = 150%
final current

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P07 Vks = 0%
Kick start volt.

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P08 Vsv I1 = 50 %
starting voltage

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P09 T1 = 20s
starting time

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P10 Tks = 0.00 s
kick start time

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P11 Tacc = 20s
starting ramp

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

P13 Tsf = 40s
start fail. time

P

M

MODE

↑

INC

↓

DEC

↻

ENTER

M00328-0

6.1.5 SPEED RAMP START (P02 = 3)

This type of starting is available only **up to version S4.05**.

In that case, a tacho has to be connected to the relevant terminals (terminals 5-6 if the tacho generator output is lower than 50V, terminals 7-6 if the tacho generator output is higher than 50V). The POSITIVE polarity is to be sent to terminal 7 (5) with respect to terminal 6.

This allows to control the motor starting through a speed ramp during a set time.

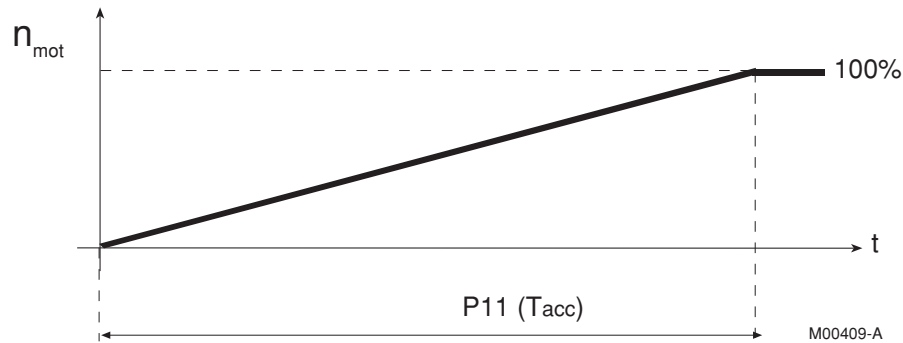
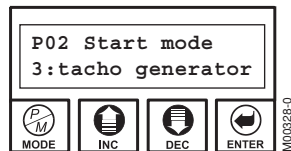


Figure 6.1.5-0 Speed diagram in case of SPEED START

The parameters concerned by this type of starting are P02 and P11:



The second parameter defines the time during which the speed increases from 0 to the max. value. For further information about the tacho generator and its parameters, see paragraph 6.8.1.



NOTE: During the whole starting sequence, the motor peak current may be set through I1 (P04).

6.2 STOP PROFILES

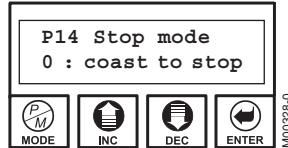
The SOFT STARTER allows to stop the motor in 2 different ways:

- coast to stop
- phase ramp

6.2.1 COAST TO STOP

This is an idle stop. When opening contact 15 the motor coasts to stop.

The parameter to be set for this type of stop is:



6.2.2 PHASE RAMP STOP

The motor stop is delayed in time with respect to the natural stop.

This stop is useful when you want to prevent a motor rush stop in applications with low inertia and high resistant torque. The current that flows to the motor cannot never exceed the value set with I3 (P06).

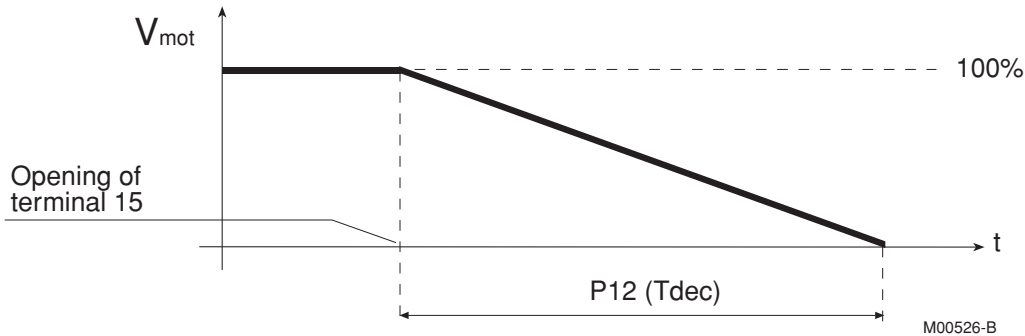
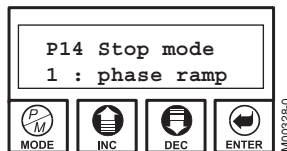
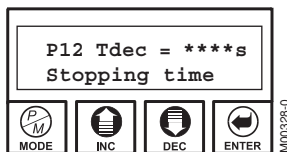


Figura 6.2.2-0 Trend of output voltage on the motor in case of PHASE RAMP STOP

The parameters concerned with this type of stop, except for in **Vers. S4.03**, are:



and



that allows to set the duration of this type of stop.



NOTE: Starting from Vers. S4.03, if the direct current braking has **not** been programmed, e. g. when it is **not** available, the value set to parameter P19 (see P19) determines the ramp down level resulting in the motor automatic idle running.



NOTE: The torque quadratic decrease is proportional to the decrease of the voltage applied to the motor, thus it is not possible to determine exactly when the motor stops, as it depends on the load applied.



NOTE: During the entire stop sequence, the max. motor current can be set through I3 (P06).

6.2.3 SPEED RAMP STOP

This type of starting is available only **up to version S4.05**.

In this case you must connect a tacho generator to the corresponding terminals (terminals 5-6 if the tacho generator output is lower than 50V, terminals 7-6 if the tacho generator output is higher than 50V). The polarity to be sent to terminal 7 (5) with respect to terminal 6 is the POSITIVE ONE.

It allows to check the motor stop by means of a speed ramp that must be performed in a given time.

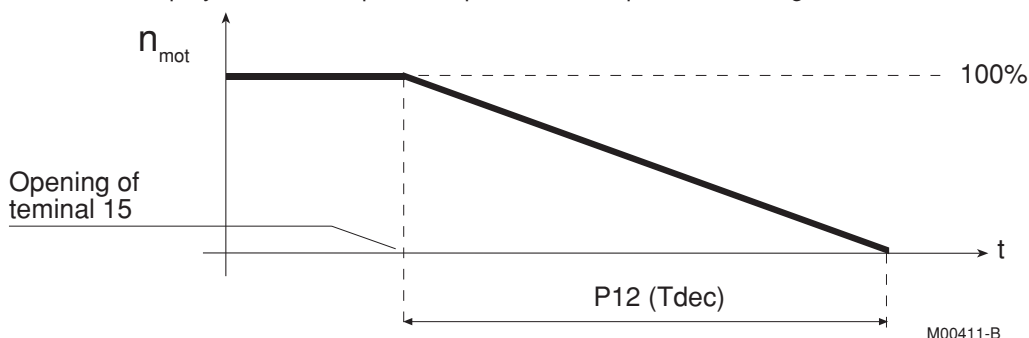
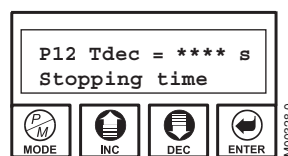
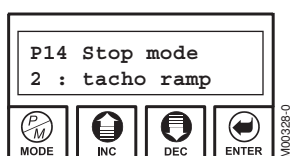


Figure 6.2.3-0 Trend of speed in case of SPEED RAMP

The parameters concerned with this type of stop, except for **in Vers. S4.03**, are P14 and P12:



The second one defines the time within which the speed must decline, in ramp, from its max. value to 0. For additional information concerning the tacho generator and its corresponding parameters, see par. 6.8.1.



NOTE: During the entire stop sequence, the max. motor current can be set through I3 (P06).

6.3 CONNECTION WITH BY-PASS CONTACTOR

This connection is required when, after the motor starting, you want to short-circuit the SOFT-STARTER with a remote control switch.

The SOFT STARTER remains however connected to the motor and can therefore be inserted again in line to perform the stop operation.

The connection to be made in this case is the following. The connection to be made is shown in Figure A and B.

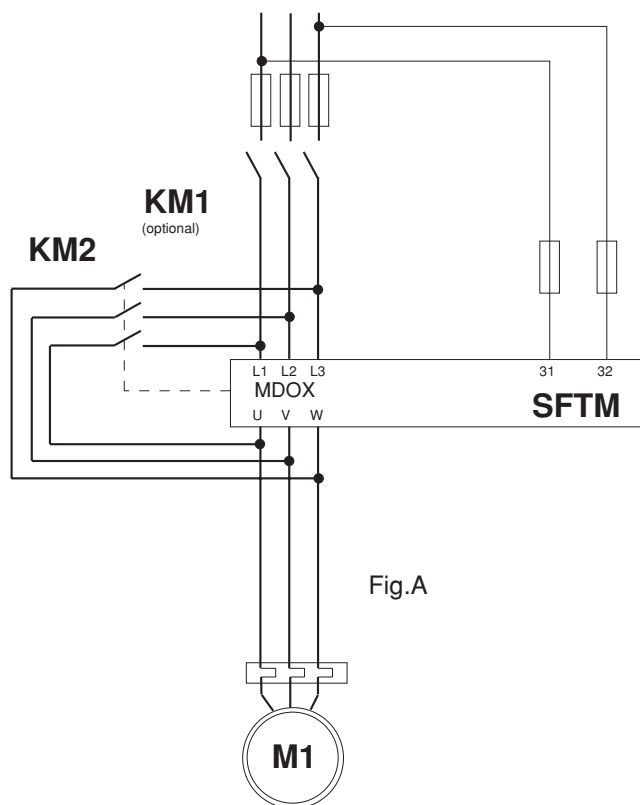


Fig.A

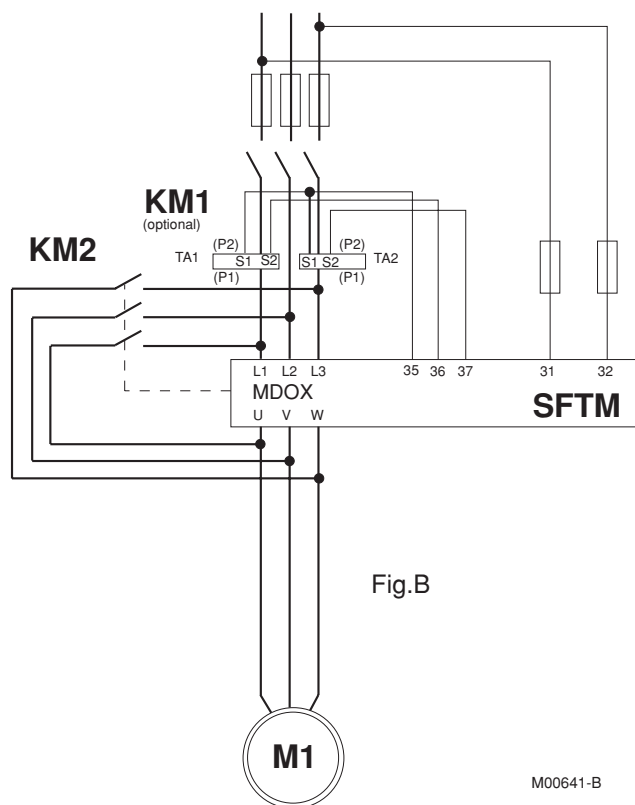


Fig.B

M00641-B

No check on the motor current will be performed after bypassing the SOFT STARTER. If the by-pass is performed as in Fig. A, the motor current will not be controlled once the SOFT STARTER is by-passed; in that case, a thermal relay is to be connected in series to the motor. Otherwise, the BY-PASS may be performed according to the diagram in Fig. B, where two external current transformers (TA1 and TA2) are required, thus avoiding installing the thermal relay on the motor side. In that case, SFTM is not the standard one: it has to be customized for that function.

In order to be able to make this connection you must have the SOFT STARTER check the contactor KM2. To this purpose select on one of the 4 programmable digital output (MDO1, MDO2, MDO3 and MDO4), the **BY-PASS** function (the factory preset **BY-PASS** function is implemented in MDO3).

At the end of motor start, the relay of the selected MDOx output is activated, that activates the contactor KM2 by closing the contact (or opening it if the output is normally closed) that bypasses the SOFT STARTER.

The converter remains however connected to the mains even if it is not used. This, in fact, allows the user to perform a SOFT STARTER-controlled stop operation.



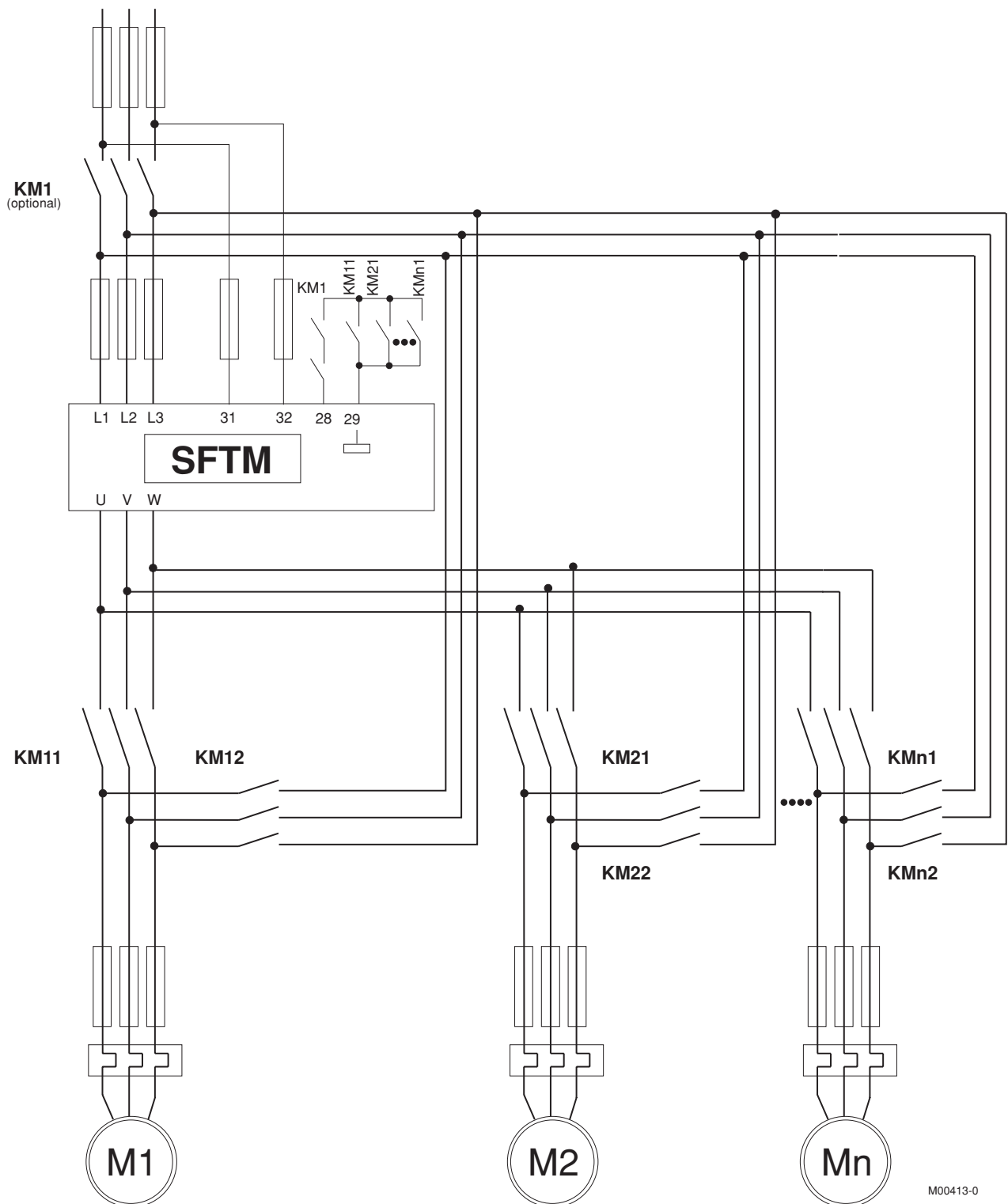
NOTE: if the BY-PASS is enabled, once the start-up is complete, the motor will be controlled by the SOFT STARTER during motor stop phase only, unless two external current transformers are installed (a special preset starter has to be required).



WARNING: Always install a filter parallel-connected to the coil of KM2 contactor (RC unit with an AC coil or a diode with a DC coil).

6.4 MULTIPLE MOTOR START-UP

The motors can be sequentially started using the same SOFT-STARTER, even if they have different characteristics (up to **three characteristic sets**).



M00413-0

Figure 6.4.1 Connection for cascade start-up of multiple motors



WARNING: Always install a filter parallel-connected to the coil of KM12...KMn2 by-pass contactors (RC unit with an AC coil or a diode with a DC coil).

The cascade start provides the possibility of starting in sequence several motor with different characteristics, through the same SFTM (se up to three characteristics sets can be programmed).

The selection of the characteristics to be associated to the motor to be started is done by means of adequately programmed inputs 16/17.

Use a programmable logical controller (PLC) to perform the following functions:

- control the start-up contactors KM11, KM21--KMn1 allowing to start the different motors;
- control the by-pass contactors KM12, KM22--KMn2 to directly connect the motors to the mains once they have been started according to the state of the SOFT STARTER start-up relay;
- control the state of the contactors through the corresponding auxiliary contacts;
- send the start-up controls to the SOFT STARTER through terminal 28 using auxiliary contacts NO of the different contactors and a possible further contact;
- select the characteristics of the motor to be started through terminals 16 and 17.

Figure 6.4.2 shows the logical sequence corresponding to the cascade start-up of N motors.

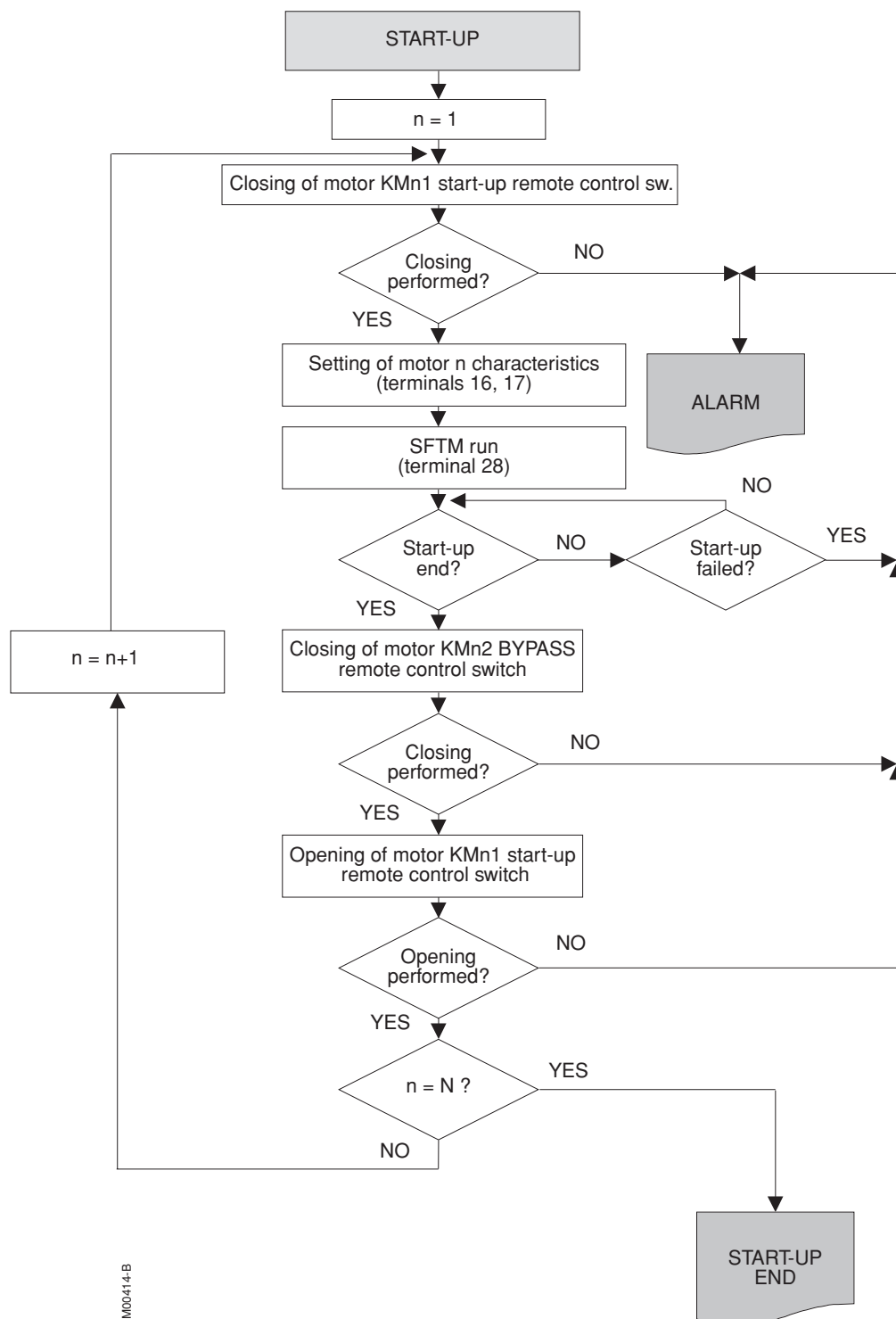
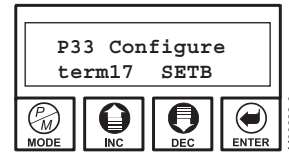
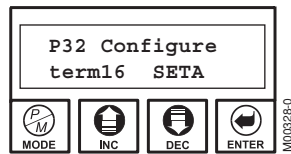


Figure 6.4.2 Logical sequence corresponding to the cascade start-up of N motors

To select the three characteristic sets to be associated to the motors, proceed as follows:

- **MAKE SURE** that contact 15 and contact 28 are both **OPEN (INACTIVE)** or supply the control section only
- set



- **OPEN** contacts 16,17 (motor 0)
- **Set** the parameters of **motor 0** (Im motor current, start-up mode for motor 0, etc.)
- **CLOSE** contact 16, keep contact 17 **OPEN** (selection of **motor A**)

Each parameter shows the letter A to indicate the selection of motor A parameters.

- **Set** the parameters for motor A as described for generic motor
- **CLOSE contacts 16, 17** or **CLOSE** contact 17, keeping **OPEN** contact 16 (**selection of motor B**) In this case, each parameter will show the letter B to indicate the selection of motor B parameters
- **SET** the parameters of MOTOR B as described for the other two motors.

6.4.1 Phase ramp stop of several motors

After starting N motors in sequence with one SOFT STARTER, their phase ramp stop may also be done. The features of the motor to be stopped may be selected through inputs 16/17 if they are properly programmed.

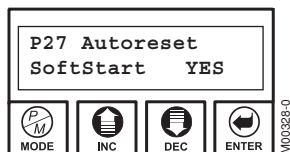
With reference to the example shown in fig. 6.4.1, in case of the nth motor stop you have to set one of the four digital outputs MDO to *8:full voltage* and one to *4:voltage thres*; for the latter, you have to set both a voltage threshold close upon zero and a disabling delay (when required).

Then, do the following:

1. Close KMn1 contactor.
2. Send the run command.
3. As soon as *8:full voltage* digital output is enabled, open KMn2 by-pass contactor.
4. Send the voltage ramp command.
5. Once the motor has come to a complete stop and as soon as *4:voltage thres* digital output is enabled, open KMn1 contactor.
6. Do the same for the others n-1 motors.

6.5 AUTORESET

The autoreset function can be selected when the unit automatic reset is required due to an alarm.
The user can define the number of retries allowed within a given time interval.
The parameters concerned with the autoreset function are:



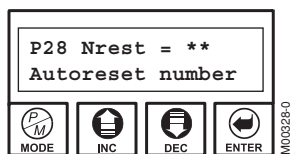
autoreset **enabled**



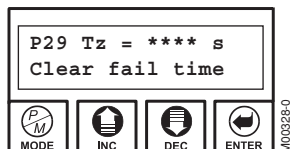
autoreset **disabled**



NOTE: If safety is active in START/STOP (see P30), **THE AUTORESET CANNOT BE SELECTED.**



It indicates the number of autoreset retries. If, a time equal or longer than **P29** elapses after an alarm reset, the autoreset count restarts from 0.



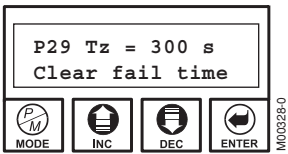
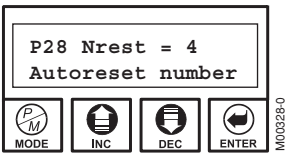
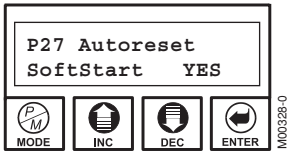
It indicates the time interval, after which, if no alarm is detected, the number of autoreset retries restarts from 0.



CAUTION - **Before selecting AUTORESET**, make sure that this function is compatible with the system.
The user has to check this condition **so as to avoid** the start-up of machines or systems that could be damaged by this function.

Examples of parameter programming

The SOFT STARTER has to be automatically restarted after it has been stopped by an alarm condition.
The max. number of retries is 4. If within 300 seconds no alarm is detected, the automatic restart counter restarts from 0.
The parameters to be set are:



If alarms are detected during operation, the motor will be restarted. If a block occurs after 4 restarts within 300s from the previous restart, the unit will remain blocked until a manual reset is performed.

Instead, if **NO ALARM** is detected within a Tz time, the allowed restart number will be set to zero.

6.6 ENERGY SAVING

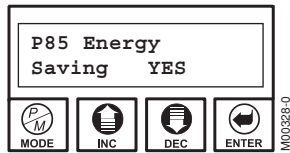
The energy saving function, when its application is possible or advantageous, consists in reducing the amount of the voltage supplied to the motor once the starting phase is over. It is aimed at holding the motor rotation at a constant rpm, but at reducing the stator magnetizing current, thus decreasing the offset between voltage and current, and thus decreasing the active and reactive power.

The energy saving function has to be enabled only in case of highly inertial load, or when the load may be temporarily disabled and the motor is in "no load" mode.

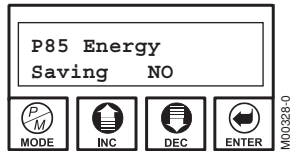
If this function is enabled, it will reduce the voltage applied only when the current is lower than a preset value, while it will bring the voltage to the rated value when the current exceeds that value. In practice, to avoid any oscillation due to the energy saving enabling/disabling, a hysteresis may be introduced into this switching by setting two values with a 10% difference between them (recommended value).

In addition, when the energy saving function is enabled, we recommend not to apply a voltage with a too low value, to prevent the motor from coming to a deadlock due to a sudden load demand.

The energy saving function can be set through parameter

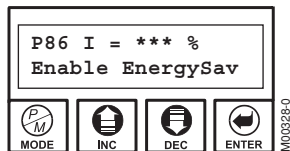


Energy saving enabled

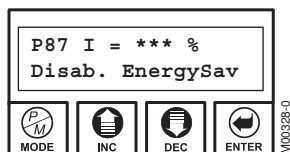


Energy saving disabled

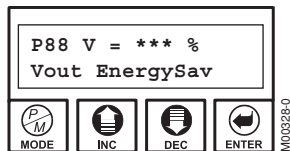
The parameters concerned with the energy saving function are:



As a percentage of the motor rated current, it detects the operating current level at steady state below which the energy saving function has to be enabled. This threshold will reduce the voltage applied to the motor.



As a percentage of the motor rated current, it detects the operating current level at steady state beyond which the energy saving function has to be disabled.



As a percentage of the mains voltage, it detects the value to be applied to the load in case of energy saving condition.



NOTE: With the energy saving function enabled, the STOP MODE P14 has to **NECESSARILY** perform a voltage feedback, but **not** a tacho feedback, i.e. P14 can be 0 or 1, except for **in Vers. S4.03**.

6.7 I²T MOTOR

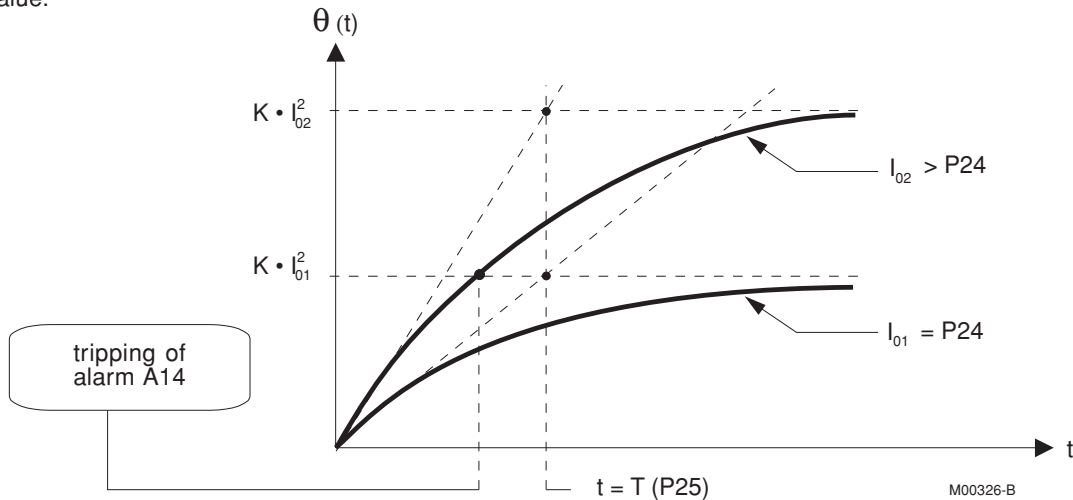
While heating, the motor shows the following curve type:

$$\theta(t) = K \cdot I_0^2 \cdot (1 - e^{-t/T})$$

The heating is proportional to the square of the current actually delivered to the motor (I_0^2).

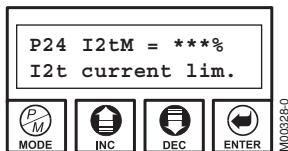
$K \cdot I_0^2 / T$: defines the curve slope at the origin.

The alarm (A14) is detected when the current actually delivered to the motor is such that the heating exceeds the max. allowed asymptotic value.

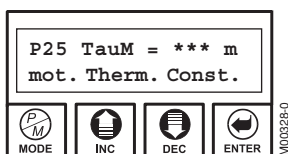


If the manufacturer's data are not available, the thermal time constant $T = \text{TauM}$ (P25) can be set as a value equal to 1/3 of the time within which the motor temperature reaches the steady state.

The motor parameters are:

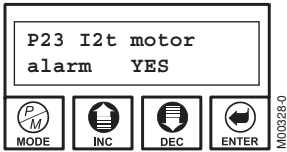


Expressed as a percentage of the motor rated current (P03), it indicates the current at which the motor thermal image has to be calculated.

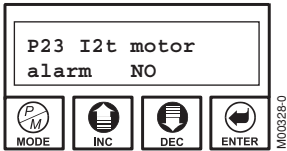


It indicates, in minutes, the time constant according to which the motor thermal image has to be calculated.

This alarm can be disabled through parameter P23:



alarm I²t **enabled**



alarm I²t **disabled**

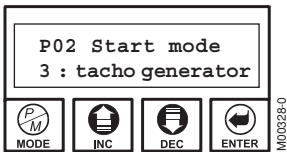
6.8 TACHO GENERATOR

The tacho generator can be fitted only **up to vers. S4.05**.

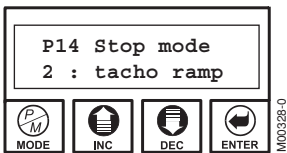
The tacho generator, if fitted, may be used to do the following:

- motor speed feedback in start or stop phase with speed ramp
- motor speed display once start-up is complete

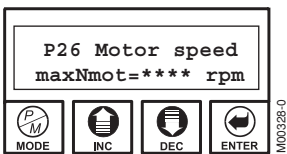
The following parameters are concerned:



Start in **speed ramp**: it can be selected only in case of tacho generator feedback.



Stop in **speed ramp**: it can be selected only in case of tacho generator feedback.
Value P14 = 2 is always valid, except for **in Vers. S4.03**.

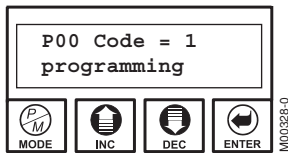


Used to set the motor speed.
The motor rating speed, expressed in rpm, has to be stated there.

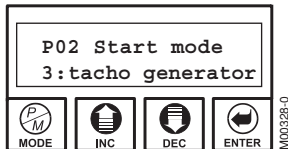
6.8.1 PROCEDURE FOR TACHO GENERATOR CONNECTION

This procedure concerns the software releases **up to Vers. S4.05 only**.

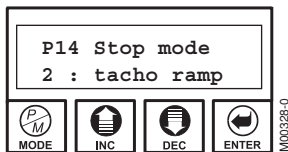
Here is the procedure to be followed when connecting a tacho generator for the motor feedback:



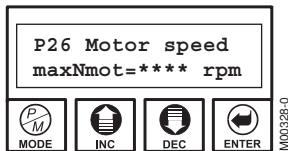
It allows to change the Pxx parameters.



The tacho generator input is enabled in case of speed ramp start.

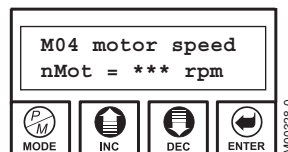


The tacho generator input is enabled in case of speed stop start.
Value P14 = 2 is always valid, except for **in Vers. S4.03**.



The motor rated speed is set for scaling.
Factory setting is 1500 rpm.

- The motor is started
- When starting is over, set



to display the motor speed.

- Adjust multirev trimmer RV5 located on ES600 control board so that M04 shows the correct motor rpm (use the revolution counter or measure the direct voltage level coming from the tacho generator (terminals 5/6 or 7/6)).

N.B.: Trimmer RV5 is correctly factory-set only if the max. voltage coming from the tacho is 90 Vdc (e.g. in case of 1500 rpm and of a tacho with a 0.06V/rpm transduction ratio). In all other cases, trimmer RV5 has to be adjusted on purpose.

- If the tacho is used for the motor start or stop, enable its alarm A11 by setting parameter P100 to YES.



NOTE: If the motor is in the **START-UP PHASE**, the stop-mode parameter cannot be changed. The parameter relating to the start-mode may be changed only if the motor is off and no current is absorbed.



NOTE: The motor rpm is not displayed in the following cases:

- The speed start (P02 is other than 3) or the speed stop (P15 is other than 2) is not selected.
- The energy saving function is enabled.

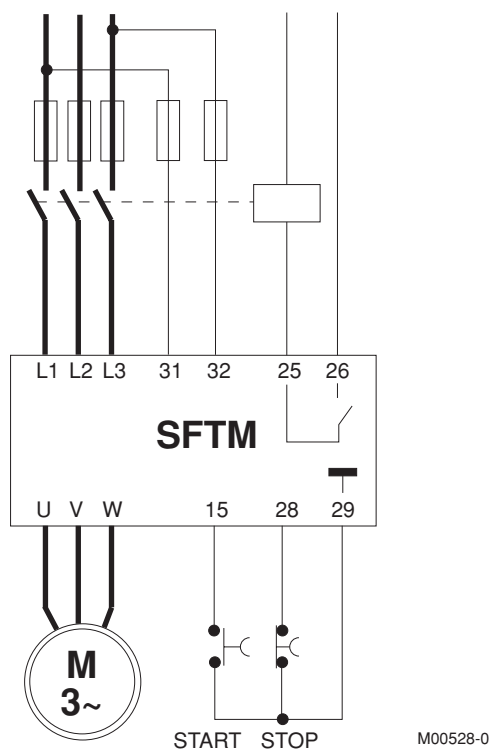
In these two cases, parameter M04 shows some dashes '----'

6.9 LINE CONTACTOR CONTROL

If P31=Mode 2, terminals 15 and 28 are configured to perform a start/stop operation with internal self-retention, by means of a N.O. push-button at terminal 15 and a N.C. push-button at terminal 28.

In these conditions, if a line contactor KM exists and supplies the soft starter, its coil must compulsorily be controlled by a digital output configured as “line contactor” (see subparagraph for P42 in the “Operation Parameters” section).

In the figure you can see the connection that must be done if you use the digital output at terminals 25-26 configured as “line contactor” and “normally open” (P72=7, P78=Norm. open).



6.10 BRAKING AND ANTICONDENSATE DIRECT CURRENT (SFTM-B)

Through output bars U and W you may supply the asynchronous motor controlled by SFTM with direct current. This will generate a braking torque to shorten the stopping time in case of highly inertial loads, to prevent the motor from rotating before starting and/or stopping due to external torques or to keep the motor - when it does not rotate - at a min. temperature in order to avoid condensate formation.

The parameters relating to this function are P15 to P22.

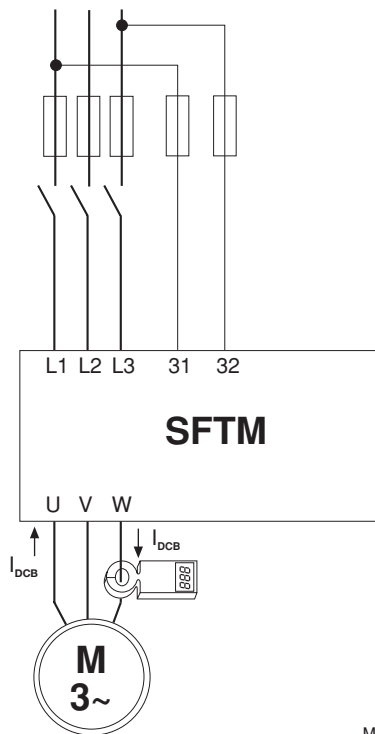


NOTE: The direct current supply function is available in soft starter version SFTM-B only. In this version, parameters from P15 to P22 may be accessed and changed. On the other hand, in version SFTM the direct current supply function is not available and the above-mentioned parameters are not to be found in the menu.

6.10.1 BRAKING DIRECT CURRENT

If you want the motor to be supplied with direct current before starting (so as to keep it locked) do the following to program this function: set parameter P15 to YES, set the direct current supply duration with parameter P17 and set the direct current intensity with parameter P20. We recommend to **start with low values** (a low percentage) measuring the current circulating as shown in the figure.

Use a **direct current amperemeter** to be connected to phase U or phase W.



M00415-0



NOTE: To measure the direct current at issue, never use any ordinary alternating current amperemetric clip.



CAUTION!!! As the asynchronous motor usually self-ventilates only while rotating, limit both the direct current intensity and the supply duration not to damage the motor winding. Contact the motor manufacturer for further details.

If the direct current braking is required while stopping (e.g. in case of highly inertial load involving too long stopping times) first program this function setting parameter P16 to YES, then set the duration of the direct current supply through parameter P18; current may be supplied even when the motor real stop is over.

Through parameter P19, set the level achieved by the down ramp programmed (P12) from which the direct current braking has to start.

The stop mode set through parameter P14 has to be an extended stop, like the phase ramp stop. If P14=0 (idle stop) no direct current braking will take place, but a mere idle stop.

The braking current intensity is determined by parameter P20.

The direct current obtained is to be measured with an amperemeter, to avoid too high values which could damage the motor.

The first max. limit we recommend to set might be 1...1.5 Imot. Also consider the direct current supply duration set by the value in parameter P18.

6.10.2 ANTICONDENSATE DIRECT CURRENT (TERMINAL 16)

In those periods when the motor is inactive (i.e. it is not supplied with alternating current either by the soft starter or the mains) it can be supplied with direct current in order to achieve a constant temperature avoiding any condensate formation.

Such function may be enabled through the keyboard by setting parameter P21 to YES, or it may be enabled when terminal 16 contact closes to 0V if parameter P32 is set to DCB HOLD (this setting allows the opening/closing of terminal 16 contact to PREVAIL over any setting made through parameter P21).

If the LINE CONTACTOR function has been programmed in one of the four digital outputs to be configured through MDO1...4, the line contactor will automatically close - otherwise, it must be closed.

The anticondensate current intensity is to be set through parameter P22. Carefully measure the direct current obtained considering that the current supply - if not disabled through the keyboard or terminal 16 opening - may have an indefinite duration.

7 OPERATION PARAMETERS

7.1 PARAMETER LIST

Parameter description includes the following symbols:

- P** : Parameter number
- R** : Allowed value range
- D** : Factory setting
- F** : Function

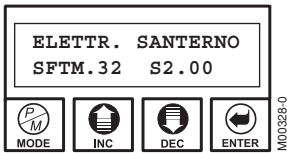
7.2 MEASUREMENT PARAMETERS

These are the display parameters indicated by the letter **M** followed by the parameter number. With multiple motor operation, the parameter number is followed by the letter indicating the selected characteristic set ('A', 'B').

7.2.1 M00: SOFT STARTER state

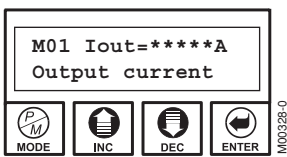


It indicates the SOFT STARTER state: if everything is correct, this is the corresponding display, otherwise if an alarm is detected, it indicates which one has been stored.



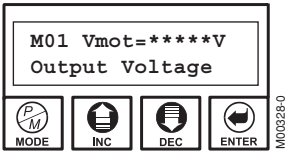
When this parameter is displayed, if P00=1 had already been set (see sub-paragraph PROGRAMMING PARAMETERS) a presson of the MODE key displays the page represented hereafter, showing the manufacturer (ELECTRONICA SANTERNO) the device type (SFTM), its size, that is its rated current (in the exemple 32A), the software release contained in the control board (in the exemple S2.00)

7.2.2 M01: Output current



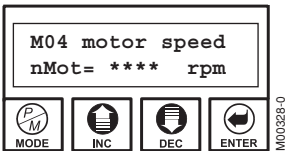
- P** M01
- R** SFTM overload current
- F** It indicates, in Ampères, the SOFT STARTER output current.

7.2.3 M02: Output voltage



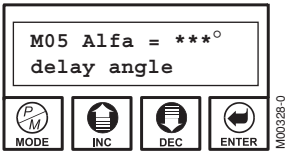
- P** M02
- R** 0.. max. applied voltage
- F** It indicates, in volts, the voltage present on the motor (on SOFT STARTER output). The feedback fine calibration can be performed using the keys INC, DEC after pressing the key MODE.

7.2.4 M04: Motor speed



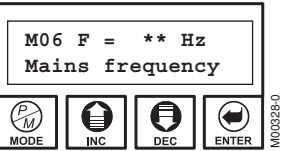
- P** M04 (Up to Vers. S4.05)
- R** it depends on the tacho generator characteristics
- F** It represents the motor speed measure with tacho generator connection. If the STOP MODE parameter does not indicate the tacho generator feedback, this display has no meaning and the string '——' is displayed.

7.2.5 M05: Thyristor ignition angle



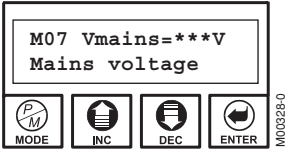
- P** M05
- R** 0 .. 150°
- F** It indicates, in electrical degrees, the measure of the delay angle for thyristor bridge ignition.

7.2.6 M06: Mains frequency



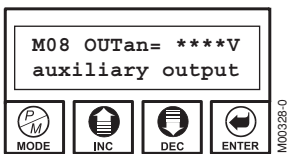
- P** M06
- R** 45 .. 65 Hz
- F** It indicates, in Hertz, the mains frequency value.

7.2.7 M07: Mains voltage



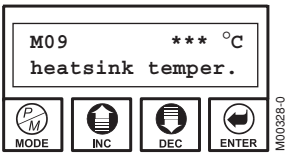
- P** M07
- R** It depends on the SOFT STARTER model.
- F** It indicates, in volts, the supply voltage value on the power section.

7.2.8 M08: Voltage auxiliary output



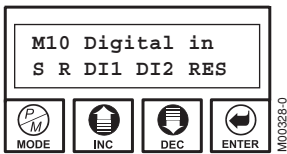
- P** M08
- R** 0 .. +10V
- F** It indicates the voltage value, in Volts, on the configurable analog output (terminal 9). If this output has been programmed as speed value and no tacho generator is connected, the string '—' will be displayed to indicate it has not meaning. If, in case of wrong configuration of KOI, KOV factors, the output is saturated at terminal 9, the letter V is REPLACED with S on the display.

7.2.9 M09: Heatsink temperature



- P** M09
- R** 0...100°C
- F** It indicates the heatsink temperature in degrees centigrade.

7.2.10 M10: Digital input state

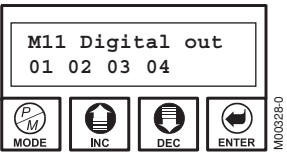


- P** M10
- R** □ ... ■
- F** It displays the available digital input state. The letters and corresponding input terminals are shown hereafter.

S	input logical state terminal 15
R	input logical state terminal 28
DI1	input logical state terminal 16
DI2	input logical state terminal 17
RES	input logical state terminal 27

T00007-B

7.2.11 M11: Digital output state

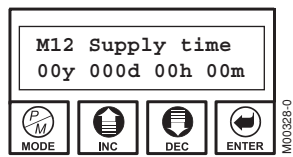


- P** M11
- R** □ ... ■
- F** It displays the output state. The symbol/terminal combination is as follows:

O1	<i>MDO1</i> terminal pair 19 - 20
O2	<i>MDO2</i> terminal pair 21 - 22
O3	<i>MDO3</i> terminal pair 23 - 24
O4	<i>MDO4</i> terminal pair 25 - 26

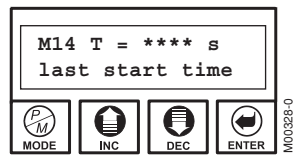
T00019-B

7.2.12 M12: SOFT STARTER OPERATION TIME



- P** M12
- R** 0.. 99 Y 365D 23H 59M
- F** It indicates in
YEARS (y)
DAYS (d)
HOURS (h)
MINUTES (m)
the time during which the SOFT-STARTER has been supplied.

7.2.13 M14: Length of last start-up



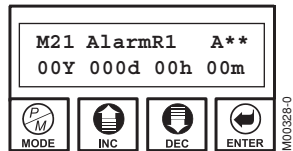
- P** M14
- R** 0 .. 1800 s
- F** It indicates, in seconds, the time required by the last start-up.

7.2.14 M19: Start-up type



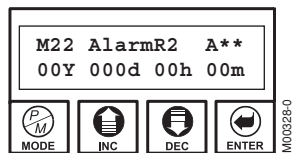
- P** M19
- R** current step, current ramp, kick start
- F** It displays the selected start-up type.

7.2.15 M21: Last alarm



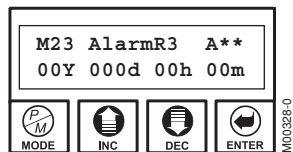
- P** M21
- R** Axx xxy xxxd xxh xxm
- F** It indicates the **last** detected alarm (**Axx**) and the moment it has occurred.

7.2.16 M22: Penultimate alarm



- P** M22
- R** Axx xxy xxxd xxh xxm
- F** It indicates the **penultimate** detected alarm (**Axx**) and the moment it has occurred.

7.2.17 M23: Antepenultimate alarm

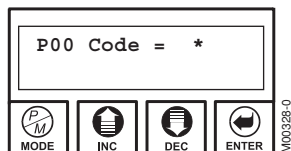


- P** M23
- R** Axx xxy xxxd xxh xxm
- F** It indicates the **antepenultimate** detected alarm (**Axx**) and the moment it has occurred.

7.3 PROGRAMMING PARAMETERS

These are the programming parameters which are signalled on the display by the letter **P** followed by the parameter number. With multiple-motor operation, the parameter number is followed by the letter identifying the selected characteristic set (" ", "A", "B").

7.3.1 P00: Programming code



P P00

R 0 ..4

D 0

F Access key parameter.
0: Code. This parameter only can be changed.
1: Programming. The user can only change the Pxx parameters. The other parameters (Mxx, Sxx) can be changed by the manufacturer using another access key.
2: Restore default. Default parameters are transferred from EPROMs to E2PROM.
3: Backup act. Par. Back-up of current parameters.
4: Restore backup. Restore of previously backed-up parameters.



NOTE: If the motor is rotating and is energized by the soft-starter, or – in a SFTM-B – if a direct current braking is on (braking or anticondensate), function P00 = 2 (3) (4) cannot be performed.

7.3.2 P01: Programming levels



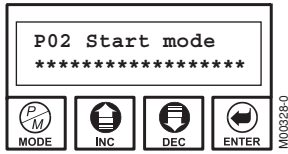
P P01

R 0..2

D 0

F It allows to select one of the three programming types. The display only shows the following parameters.
0: QUICK SETUP: parameters from P00...P30 or P00A...P30A or P00B...P30B
1: ADVANCED SETUP
 parameters from P00...P90 or P00A...P90A or P00B...P90B
2: ENGINEERING all available parameters.

7.3.3 P02: Start-up profiles



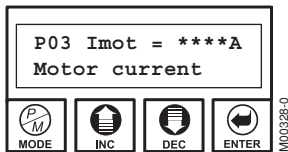
P P02

R 0 ..3

D 1 (Up to Vers. S4.05: 2)

F It defines the start-up mode to be set.
0: Current step It selects a start-up according to a two-level current reference, selectable through parameters I1, I2, T1.
1: Current ramp It selects a start-up according to a ramp current reference, selectable through parameters I1, I2, Tr, T1: possibility to keep at I1 current for a T1 time before starting in ramp from I1 to I2.
2: Kick start It selects a start-up according to a ramp voltage reference, selectable through parameters Vks, Vsv, T1, Tr, with a current limit set through parameter P04 (I1) while starting.
 Possibility to keep Vsv at constant voltage for a T1 time after the voltage pulse Vks. (Only up to vers. S4.05)
3: Tacho generator Through tacho reaction, it selects a starting depending on a speed reference in ramp lasting Tacc (P11) and with a current limit set through P04 (I1). The ramp time may be changed during the motor start.
3: Ext.start.sel. (4: Ext.start.sel up to Vers. S4.05) It allows to select the start-up type through the external contacts connected to the digital inputs of terminals 16 and 17 only if P32=SM1 and P33=SM2. See 5.1.5 External start-up selection.

7.3.4 P03: MOTOR CURRENT



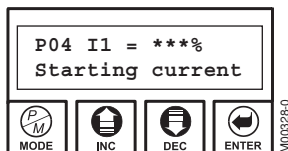
P P03

R 0 .. SFTM rated current (corresponds to the SOFT-STARTER size)

D SOFT-STARTER rated current

F It indicates the **motor rated current**, in Amperes. In general, this current corresponds to the SOFT STARTER rated current.
 This parameter allows to start motors having a rated current lower than the SOFT STARTER one.
 The parameters I1, I2, I_{max} depend on this parameter, i.e. they are percentage of it. This parameter can be changed with running motor as well. If, changing Imot, I1 or I2 or I_{max} exceeds the MAX. OVERLOAD CURRENT SELECTABLE FOR THAT SFTM SIZE, a software protection limits the above three parameters to this last value.

7.3.5 P04: Starting current



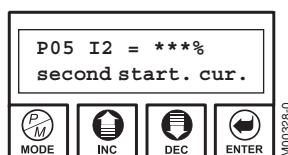
P P04

R 0..700% or 0..max SOFT STARTER overload percentage

D 200% (Up to Vers. S4.05: 300%)

F It indicates, **as a percentage of the motor current**, the current reference starting value for the current step and current ramp start-up modes. It also indicates the current limit to be set during a kick start and tacho generator start mode.
 The I1 value cannot exceed 700% of Imot or the limit value of the MAX. OVERLOAD SELECTABLE for the desired SOFT-STARTER model.
 Possibility to change the percentage during start: useful if the motor cannot perform the in-rush with the set value. It can be changed with running motor.

7.3.6 P05: Final start-up current



P P05

R 0..700% or 0..overload SOFT-STARTER current

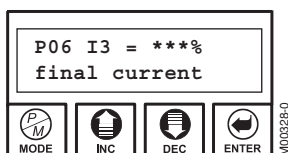
D 300%

F It expresses, **as a percentage of the motor current**, the current reference value in the second and last part of start-up phase, for the current step and current ramp start-up modes.

The I2 value cannot exceed 700% of Imot or the limit value of the MAX. OVERLOAD SELECTABLE for the desired SOFT-STARTER model.

Possibility to change the percentage during start: useful if the motor cannot perform the in-rush with the set value. If the set ramp time (P11) is null, the motor starts with step profile and I2 is the in-rush percentage. This happens for an indefinite time, limited by the limit value of max. start-up time (if the motor does not start, a start-failure alarm will be detected).

7.3.7 P06: Final start-up current limit



P P06

R 0..300% or 0..overload SOFT-STARTER current

D 180% (**Up to Vers. S4.05: 200%**)

F It expresses, **as a percentage of the motor current**, the current limit value present after a start-up performed in current step and current ramp modes, i.e. the limit present after a start-up performed in kick start and tacho generator mode.

The I3 value cannot exceed 300% of Imot.

In addition, I3 cannot exceed the limit value of the MAX. SELECTABLE OVERLOAD. P06 can be changed when start-up is complete.

7.3.8 P07: Starting in-rush voltage



P P07

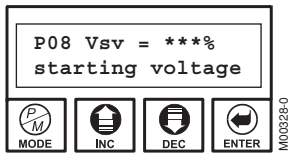
R 0..100%

D 100% (**Up to Vers. S4.05: 0%**)

F For a start-up in Kick Start mode, it expresses, **as a percentage of the motor rated voltage**, the voltage to be applied to the motor, for a Tks time.

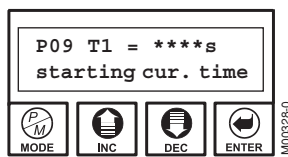
This voltage will be actually applied to the motor if the current does not exceed the overload SOFT STARTER current.

7.3.9 P08: Voltage after starting in-rush



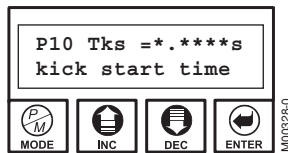
- P** P08
- R** 0..100%
- D** 50% (**Up to Vers. S4.05: 40%**)
- F** For a start-up in Kick Start mode, it expresses, **as percentage of motor rated voltage**, the voltage value applied to the motor after the KICK START phase, for a T1 time. At ramp end, unless the current limit is enabled, the voltage value applied to the motor will reach the max. value corresponding to the mains voltage value (start-up complete).

7.3.10 P09: Initial start-up time



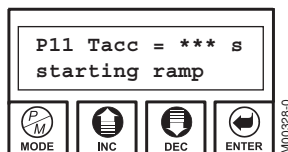
- P** P09
- R** 0..180s
- D** 2s (**Up to Vers. S4.05: 0s**)
- F** For a start-up in current step mode, it expresses **in seconds** the time during which the I1 current reference is set.
For a start-up in current-ramp mode, it represents time during which the I2 current reference is kept before starting in current ramp.
In kick-start mode, it represents the time during which a constant voltage level Vsv is kept after the initial pulse for a Tks time.

7.3.11 P10: Time of initial in-rush voltage



- P** P10
- R** 0 .. 1.0000s
- D** 0.5s (**Up to Vers. S4.05: 0.00s**)
- F** In Kick Start mode, it expresses, **in seconds**, the time during which the Vks voltage reference is set.
This voltage is actually applied to the motor provided that the current does not exceed the SOFT STARTER max. overload limit.

7.3.12 P11: Starting ramp time



- P** P11
- R** 0 .. 180s
- D** 10s
- F** It indicates, **in seconds**, the reference ramp time for a start-up in current ramp mode (current ramp) in Kick Start mode (voltage ramp) or in tachogenerator mode (speed ramp).

7.3.13 P12: Stopping ramp time



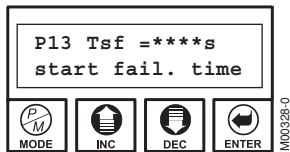
P P12

R 0 .. 600s

D 10s

F It indicates, in seconds, the time within which motor has to be decelerated both with prolonged stop (output voltage ramp) and with tacho generator.

7.3.14 P13: Limit time for motor start-up



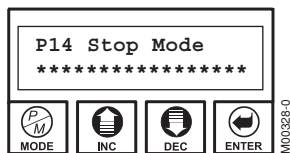
P P13

R 0 .. 1800s

D 30s

F It expresses the max. time, **in seconds**, within which the motor has to be started. If not, the start failure alarm is enabled, with consequent SOFT STARTER block.

7.3.15 P14: Stop type



P P14

R 0:coast to stop, 1:phase ramp

D 0

F It indicates the type of stop to be performed:
0: coast to stop, i.e. idle stop (NATURAL STOP)
1: phase ramp, through a phase shut with a duration equal to Tdec.
 (IMPORTANT: Tdec must be longer than the time required for the natural stop!)
 (Only **up to Vers. S4.02** and **in Vers. S4.04 ...S4.05**) **2: tacho ramp**, with a tacho generator as a speed transducer for a speed ramp stop to be performed within a Tdec time.
 This parameter cannot be changed during start-up.

In Vers. S4.03 only:

F It indicates the type of stop to be performed:
0: coast to stop, i.e. idle stop (NATURAL STOP)
1: phase ramp, through a phase shut with a duration equal to Tdec
2: voltage ramp, through a voltage control stop ramp with a duration equal to Tdec (to be used mostly with heavy loads).
3: tacho ramp, with a tacho generator as a speed transducer for a speed ramp stop to be performed within a Tdec time.
 This parameter cannot be changed during start-up.



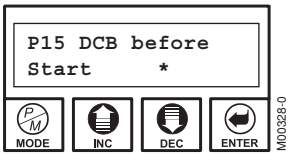
WARNING: The programming of extended stop **P14=1:phase ramp** may give fully satisfactory results in case of a quadratic load (e.g. a fan). Otherwise, in case of non-inertial loads, the motor should suddenly stop before the fall ramp is over.



NOTE: If a deceleration ramp like the one above is used, you may not obtain any stop time shorter than the idle stop time. To shorten this stop time, the direct current braking is to be enabled.

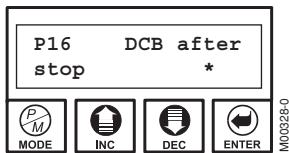
 NOTE: The parameters below, starting from Vers. S4.03 from P15 to P22 except for P19, and up to Vers. S4.02 from P15 to P22, may be accessed and changed in Version SFTM-B only.

7.3.16 P15: braking application before starting



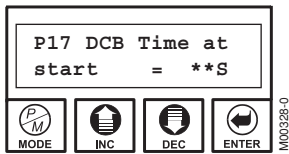
- P** P15
- R** YES/NO
- D** NO
- F** It enables (YES) or disables (NO) a direct current supply to hold a motor in braking when it is exposed to external torques which could make it rotate before starting in the mode chosen. The direct current supply duration is set through parameter P17, whereas the current intensity is set through parameter P20.

7.3.17 P16: braking application while stopping



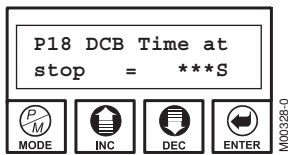
- P** P16
- R** YES/NO
- D** NO
- F** It enables (YES) or disables (NO) a direct current supply for the application of a braking torque to a motor during a ramp stopping phase depending on what has been set with parameter P14.
If the idle stop has been set (P14=0), **no** direct current supply will take place.

7.3.18 P17: Duration of braking application before starting



- P** P17
- R** 0 ..60s
- D** 5s
- F** It expresses, in seconds, the application time - before starting - of a braking torque if the latter is selected with P15. That braking torque is applied to the start command sent to terminals 15 and 28 depending on parameter P31 setting mode. Once this time interval is over, the real start will take place.

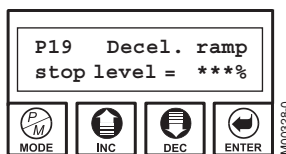
7.3.19 P18: Duration of braking application while stopping



- P** P18
- R** 0...600s
- D** 10s

F It expresses, in seconds, the application time of a braking torque starting from the time set through parameter P19 (within the deceleration ramp) up to a time even following the motor real stop.

7.3.20 P19: Stop ramp locking level



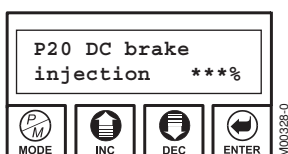
- P** P19
- R** 0..100% (90% in **Version S4.05**)
- D** 0% (100% **up to Vers. S4.02**)

F **Starting from Vers. S4.03**, such parameter has the two functions a) and b) below while, **up to Vers. S4.02**, it only has function a).

a) If the direct current braking has been programmed, it indicates when it indicates when the direct current braking - if programmed with P16 - has to start during the stop phase programmed with P14 (except for idle stop). This parameter percentage refers to the value of the down ramp while stopping. For instance, 100% stands for the max. start value of that ramp, so, if P19=100% braking will start just after the stop command.

b) If the direct current braking has not been programmed, P19 value indicates the ramp down level beyond which the motor automatically idles. This will prevent the motor from locking and absorbing current towards the end of the ramp, if speed has neutralized due to an inadequate torque.

7.3.21 P20: Direct current braking intensity

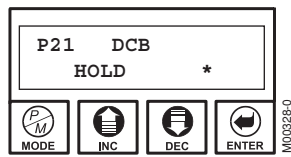


- P** P20
- R** 0..100%
- D** 100%

F It expresses the intensity of the direct current supplied to the motor for braking, if the motor braking has been selected before starting (parameter P15) and/or during the stop phase (parameter P16).

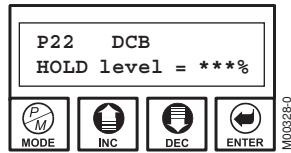
This parameter percentage refers to the intensity of the direct voltage applied between two motor terminals in order to generate a braking torque.

7.3.22 P21: Anticondensate direct current supply



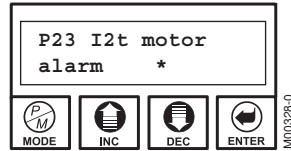
- P** P21
- R** YES/NO
- D** NO
- F** It enables (YES) or disables (NO) an anticondensate direct current supply to hold the motor at a min. temperature. The supply of an anticondensate direct voltage may be enabled by a contact on terminal 16 as well, if parameter P32 is set to DCB HOLD: in that case, terminal 16 programming **prevails** over the programming through keypad with P21, which will only display terminal 16 contact condition. For further information about how to use terminal 16 for this function, see paragraph 6.10.2 ANTICONDENSATE DIRECT CURRENT.

7.3.23 P22: Anticondensate direct current intensity



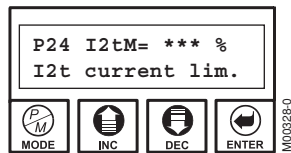
- P** P22
- R** 0..100%
- D** 5%
- F** It expresses the direct current intensity the motor is supplied with to hold a min. temperature so as to avoid any condensate formation. This parameter percentage refers to the the intensity of the direct voltage applied between two motor terminals for a min. temperature holding.

7.3.24 P23: Motor I²t selection



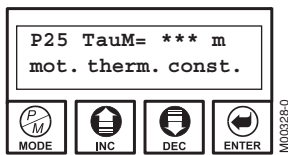
- P** P23
- R** YES/NO
- D** YES
- F** Possibility to disable (NO) the A14 alarm of I²t motor, that is normally enabled (YES).

7.3.25 P24: Motor thermal current



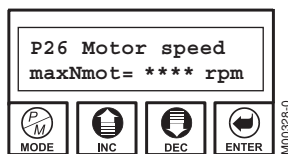
- P** P21
- R** 0 .. 120%
- D** 110%
- F** It indicates, **as a percentage of the motor rated current**, the current for which the motor thermal image has to be calculated.

7.3.26 P25: Motor thermal time constant



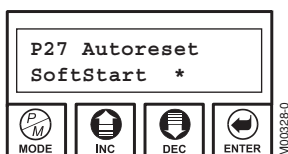
- P** P25
- R** 1 .. 180 min
- D** 20 min
- F** It indicates, in minutes, the time constant according to which the motor thermal image is calculated.

7.3.27 P26: Motor speed



- P** P26 (available up to Vers. S4.05)
- R** 375 .. 3600 rpm
- D** 1500 rpm
- F** It allows to set the motor rating speed. Used to display the speed when the tachogenerator is connected.

7.3.28 P27: Automatic restart (autoreset)



- P** P27
- R** YES/NO
- D** NO
- F** Automatic motor restart after an alarm condition (AUTORESET).

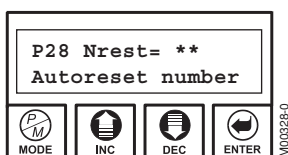


NOTE: This function has effect only if the run and stop controls (terminals 15 and 28) are set to mode 1 (P31).



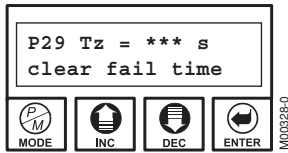
NOTE: The autoreset function cannot be enabled if the motor start-up safety is on (P30).

7.3.29 P28: Number of motor restarts



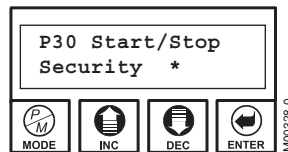
- P** P28
- R** 1..10
- D** 4
- F** Number of automatic start retries. If, after an alarm reset a time longer than or equal to P29 has elapsed, the counting restarts from 0.

7.3.30 P29: Zero setting of restart counter



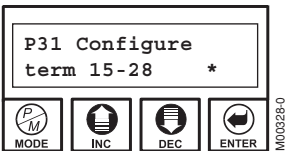
- P** P29
- R** 1 .. 999s
- D** 300s
- F** It indicates the time interval at the end of which, with no alarm, the restart counter has to be reset.

7.3.31 P30: Motor start-up safety



- P** P30
- R** YES/NO
- D** NO
- F** YES: It avoids start-up in the following conditions:
 - with soft starter supplied, terminals 15 and 28 are closed to ground and set to mode 1 (P31)
 - alarm reset with terminals 15 and 28 closed to ground and set to mode 1 (P31)
 In both cases, the display shows 'open and close term. 28'; in this way, the motor is started.
 With P30 set to YES, the autoreset function (P27) cannot be enabled.
 N.B.: By supplying the unit (control and power) or resetting an alarm, the terminals 15 and 28 are already closed to ground and set to 1 (P31), the motor is started.

7.3.32 P31: Mode configuration for start/stop controls

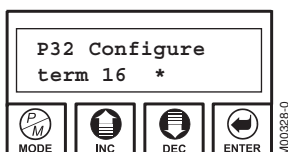


- P** P31
- R** Mode1, Mode2, MDBUS (Mode 1, Mode 2 **up to Vers. S4.05**)
- D** Mode1
- F** **Mode1:** input 15, input 28 active if permanently closed.
 With 15 open, a ramp stop is performed.
Mode2: input 15 enabled by NORMALLY OPEN external push-button: press the push-button once to start the motor. Input 28 connected to NORMALLY CLOSED push-button: press the push-button once to stop the motor. See paragraphs 5.1.1 and 5.1.2.
MDBUS: selects the soft-starter control via MODBUS. If no character has been received via serial communication for about 20sec., this selection will automatically switch to Mode1. The commands may no longer be sent, but data can still be read.



NOTE: Mode2 for inputs 15, 28 performs a two-button RUN/STOP operation.

7.3.33 P32: Configuration of terminal 16



- P** P32
- R** SM1, SETA, DCB HOLD
- D** SM1
- F** **SM1:** Input 16 is used to select the start-up type. See paragraph 5.1.5 External start-up selection.
SETA: It displays the parameter menu from P00A to P26A (and so on).

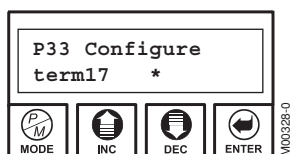
The motor parameter cannot be changed during motor start-up.

If TERM16 is set to select motor characteristic, this selection depends on both digital inputs (TERM16, TERM17) to define the characteristic to be used. See paragraph 5.1.6 Selection of motor characteristic set.

DCB HOLD: input 16 is used to enable an anticondensate direct current supply in the asynchronous motor windings. This also happens if such supply has been disabled by parameter P21=NO.

For all possible configurations to be set through parameters P32 and P33, see also paragraph 5.1.8 TERMINAL 16 AND 17 CONFIGURATION SUMMARIZING TABLE.

7.3.34 P33: Configuration of terminal 17



P P33

R SM2, SET B, Ext.A

D SM2

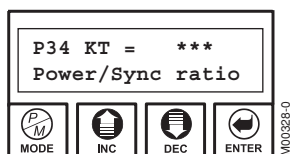
F **SM2:** Input 17 is used to select the start-up type. See paragraph 5.1.5 External start-up selection. **SET B:** It displays the parameter menu from P00B to P26B (and so on). The motor parameter cannot be changed while the motor is starting or stopping.

If TERM17 is set to select motor characteristic, this selection depends on the state of both digital inputs TERM16, TERM17. See paragraph 5.1.6 Selection of motor characteristic sets.

Ext.A: external alarm. The input is kept closed to 0V. If not, alarm A17 is tripped and detected: the SOFT STARTER goes in STAND BY and the motor is idle stopped.

For all possible configurations to be set through parameters P32 and P33, see also paragraph 5.1.8 TERMINAL 16 AND 17 CONFIGURATION SUMMARIZING TABLE.

7.3.35 P34: Power/synchronization ratio



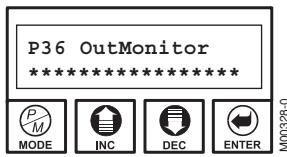
P P34

R 1.00 3.50

D 1.00

F This ratio may be viewed and set in the equipment that can be supplied in case the power section voltage exceeds 500Vac (factory setting). In that case, as single-phase TS transformer is to be installed (see chapter POWER CONNECTION OF SFTM FOR MAINS EXCEEDING 500Vac), this parameter will have the function to set the transformer coil ratio. The above-mentioned chapter also states the **range** for this transformation ratio.

7.3.36 P36: Configuration of analog output



P P36

R 0:Vmot, 1:I_{mot}, 2:I_{ref}, 3:Alfa, 4>Error I, 5:Reserved

D 1:I_{mot}

F It configures the **analog output at term. 9**.
0: Vmot. (Up to Vers. S4.05: 0: Vout). The analog output has a signal proportional to the voltage applied to the motor, according to the factor KOV (P38).
1: Imot. (Up to Vers. S4.05: 1: Iout). The analog output has a signal proportional to the motor current, according to the factor KOI (P37).
2: Iref. A signal proportional to the current reference (10V at 100% of reference) is sent to the analog output.
3: Alfa. A signal proportional to the ignition delay angle of SCRs (starting from **Vers. S4.03**, equal to 10V with an ignition delay angle equal to 180°, and equal to 150° for the prior versions) is sent to the analog output.
(Up to Vers. S4.05). 3: Refn. A signal proportional to the voltage loop input is sent to the analog output (10V at 100% of this input).
4: Error I. Error signal to current loop input (10V at 100% of the error signal) **(Up to Vers. S4.05: 4: Alfa)**.
5: Reserved. Analog output reserved for factory tests.
(Up to Vers. S4.05). 5: Ern_f. A signal proportional to the error on the voltage loop input (10V at 100% of the error) is sent to the analog output.

Only **up to Vers. S4.05**:

6: Out PI V. A signal proportional to the voltage PI output (10V at 100% of this output) is sent to the analog output.

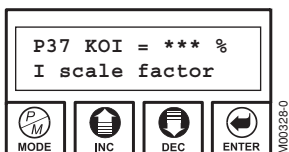
7: nout A signal proportional to the motor rotation speed is sent to the analog output.



NOTE: The analog output configured as nout has no effect in the following cases:

- if the energy saving function is activated
- if the speed ramp stop is not selected P14≠2

7.3.37 P37: Scale factor of analog output current



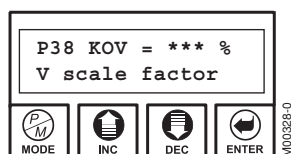
P P37

R 0 .. 300%

D 100%

F Scale factor for analog output at term. 9 corresponding to the **current circulating inside the motor**.
 With current at max. value (max. overload percentage of SFTM size) and P37=100%, the output is 10V, representing the max. allowed value.

7.3.38 P38: Scale factor of analog output VOLTAGE



P P38

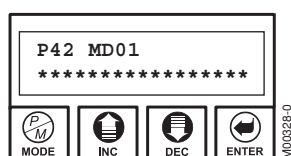
R 0 .. 300%

D 100%

F Scale factor for analog output at term. 9 corresponding to the **voltage applied to the motor**.

With voltage at a value of 800Vac and P38=100%, the output is 10V, representing the max. allowable value.

7.3.39 P42: Programmable digital output MDO1



P P42

R 0:start end, 1:current limit, 2:failed start, 3: current thres., 4:voltage thres., 5:soft starter OK, 6:bypass, 7: line contactor, 8:full voltage.

D 0:start end

F It configures the **digital output at term. 19-20**.

0: start end (fine start-up)

1: current limit (soft start in current limit)

2: failed start (failed start-up)

3: current thres (set current threshold reached)

4: voltage thres (set voltage threshold reached)

5: soft starter OK . (no alarm)

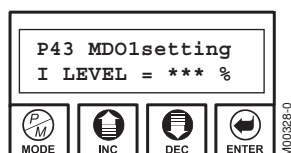
6: bypass (control for BYPASS contactor)

7: line contactor (line remote switch control)

Starting **from Version S4.08**:

8:full voltage (by-pass reopening signal for voltage ramp)

7.3.40 P43: Current threshold for output MDO1 tripping



P P43

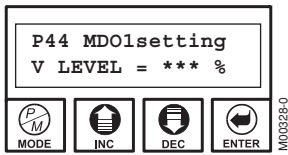
R 0 .. 300%

D 100%

F It represents, **as percentage of motor rated current**, the current value beyond which the output MDO1 state is changed, configured as P42=3.

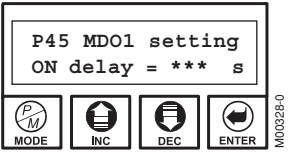
There is a software block that avoids setting a current level higher than the max. allowed limit for that moment.

7.3.41 P44: Voltage threshold for output MDO1 tripping



- P** P44
- R** 0 .. 100%
- D** 100%
- F** It represents, **as percentage of motor rated voltage**, the voltage value beyond which the output MDO1 state is changed configured as P42=4.

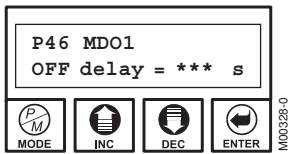
7.3.42 P45: MDO1 ENABLING delay time



- P** P45
- R** 0 .. 100s
- D** 0s
- F** It expresses, **in seconds**, the delay after which the output MDO1 is enabled.

 NOTE: With P42=3 (current thresh.), P42=4 (voltage thresh.), P42=7 (line contactor) or P42=8 (full voltage) NO enabling delay may be applied.

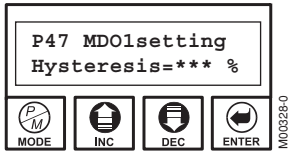
7.3.43 P46: MDO1 DISABLING DELAY TIME



- P** P46
- R** 0 .. 100s
- D** 0s
- F** It expresses, **in seconds**, the delay after which the output MDO1 is disabled.

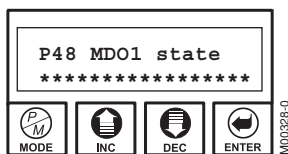
 NOTE: With P42=3 (current thresh.), P42=4 (voltage thresh.), P42=7 (line contactor) or P42=8 (full voltage) NO enabling delay may be applied.

7.3.44 P47: Tripping hysteresis level for MDO1



- P** P47
- R** 0 .. 300%
- D** 0%
- F** It expresses, **as percentage of motor rated current or rated voltage**, the hysteresis to be added to the preset level before enabling or disabling the output at the required terminals if configured as P42=3 or P42=4.
This value defines two comparison thresholds:
A lower threshold, (I Level or V Level) + Hysteresis, above which the output is ON.
A lower threshold, (I Level or V Level) - Hysteresis, below which the output is OFF.

7.3.45 P48: Output enabling logic



P P48

R NORMALLY OPEN, NORMALLY CLOSED

D NORMALLY OPEN

F It indicates the enabling logic of digital output MDO1, for all meanings that can be configured on this output.
 NORMALLY OPEN means that with output on, the corresponding relay is energized, and the contact to the terminals is closed.
 NORMALLY CLOSED means that with output on, the contact to the terminals is open.

As all the four relay outputs can be programmed in the same way, the four outputs and the corresponding parameters are shown:

Relay RY1 (term. 19-20)		Relay RY2 (term. 21-22)		Relay RY3 (term. 23-24)		Relay RY4 (term. 25-26)	
<u>P42</u>	MDO1	<u>P52</u>	MDO2	<u>P62</u>	MDO3	<u>P72</u>	MDO4
<u>P43</u>	MDO1 setting I level	<u>P53</u>	MDO2 setting I level	<u>P63</u>	MDO3 setting I level	<u>P73</u>	MDO4 setting I level
<u>P44</u>	MDO1 setting V level	<u>P54</u>	MDO2 setting V level	<u>P64</u>	MDO3 setting V level	<u>P74</u>	MDO4 setting V level
<u>P45</u>	MDO1 setting ON delay	<u>P55</u>	MDO2 setting ON delay	<u>P65</u>	MDO3 setting ON delay	<u>P75</u>	MDO4 setting ON delay
<u>P46</u>	MDO1 setting OFF delay	<u>P56</u>	MDO2 setting OFF delay	<u>P66</u>	MDO3 setting OFF delay	<u>P76</u>	MDO4 setting OFF delay
<u>P47</u>	MDO1 setting Hysteresis	<u>P57</u>	MDO2 setting Hysteresis	<u>P67</u>	MDO3 setting Hysteresis	<u>P77</u>	MDO4 setting Hysteresis
<u>P48</u>	MDO1 state	<u>P58</u>	MDO2 state	<u>P68</u>	MDO3 state	<u>P78</u>	MDO4 state

T00020-B

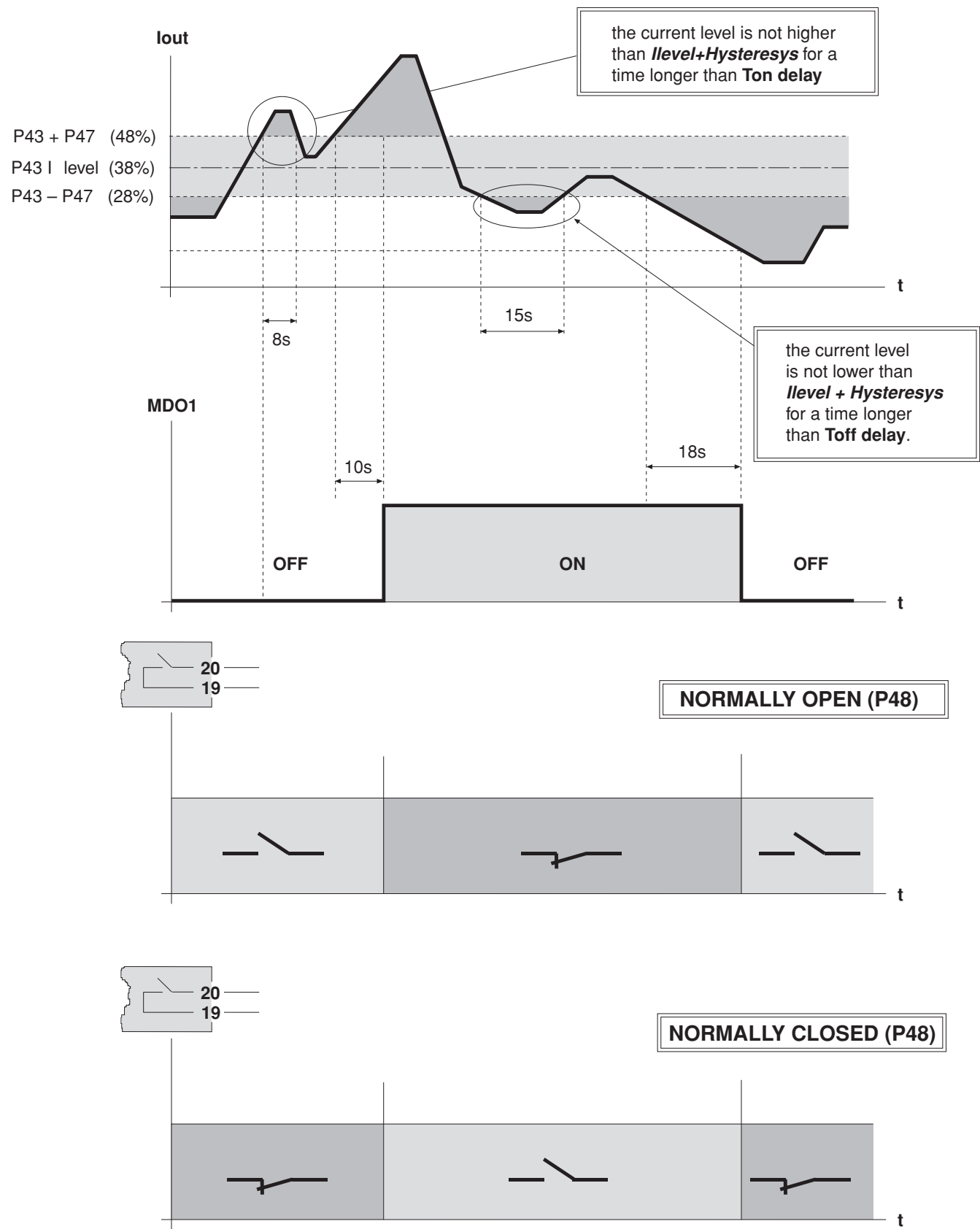


NOTE: The meanings attributed by DEFAULT to the four configurable digital outputs are the following:
 MD01: Start end (P42=0).
 MD02: Soft starter OK (P52=5).
 MD03: Bypass (P62=6) Activation delay time: 1 s by default.
 MD04: Line contactor (P72=7).



NOTE: Even if the output MDO1 is programmed as NORMALLY CLOSED, with the SOFT STARTER not supplied AND DURING the ignition TRANSIENT, **THE RELAY CONTACT IS OPEN**. When the transient is over, the contact is set to the predefined logic.
 This programming must then be done only when the contact state can be ignored with a SOFT STARTER not supplied or during the supply transient.

The following figure shows the trends of a digital output:



M00327-B

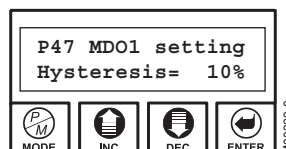
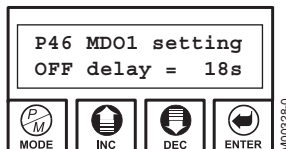
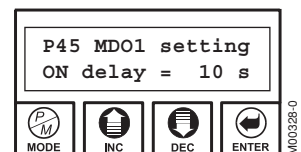
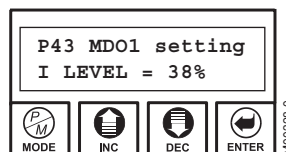
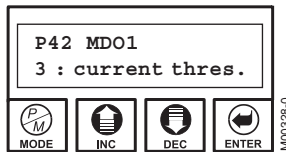
Figure 7.1 Trend of MDO1 after setting: P42 = 3, P43 = 38%, P45 = 10s, P46 = 18s, P47 = 10%

Example.

The output MDO1 will trip at a current threshold of 38% of motor rated current. The output enabling should be delayed by 10 seconds. A hysteresis as to be applied to this threshold current: the selected value is 10% the motor rated current.

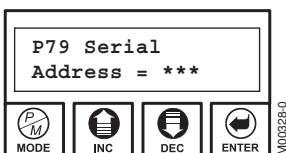
The motor should be disabled with a delay of 18 seconds.

Here is the sequence of the parameters to be set:



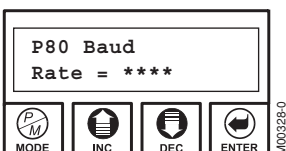
The parameters ranging from P79 to P83 and relating to the serial communication between the soft-starter and a PC are available starting **from Vers. S4.08 only**.

7.3.46 P79: Soft-starter serial address



- P** P79
- R** 1...247
- D** 1
- F** Hardware address of soft-starter SFTM identifying the soft-starter itself for the MODBUS connection relating to the serial network it is connected to.

7.3.47 P80: Serial connection baud rate



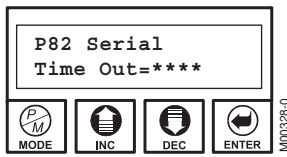
- P** P80
- R** 1200...2400 bps
- D** 2400 bps
- F** It expresses, in bits per second, the serial connection baud rate.
1200. The baud rate is 1200 bps.
2400. The baud rate is 2400 bps.

7.3.48 P81: Serial connection parity control



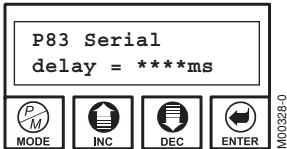
- P** P81
- R** NO, YES
- D** NO
- F** It states whether the parity control is available or not.
NO: No parity control is available. Each character ends with two STOP BITS.
YES: The parity control is available and is of the "even" type (the data sent is added a bit so that the total number of "1" is even). Each character ends with one STOP BIT.

7.3.49 P82: Serial timeout



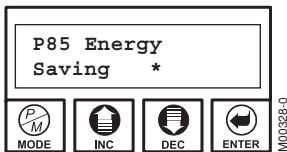
- P** P82
- R** 9.9...2000 ms
- D** 339.9 ms
- F** It expresses, in milliseconds, the timeout range for the soft starter when receiving a character before considering the master message as complete.

7.3.50 P83: Serial response delay



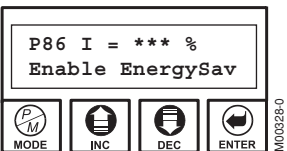
- P** P83
- R** 0.00...2000 ms
- D** 0.00 ms
- F** This parameter only deals with the *half duplex* transmission mode such as two-wire RS485 standard. It expresses, in milliseconds, the delay time allowing the soft-starter to respond to a master query in order to guarantee that the master is already waiting for a response.

7.3.51 P85: Energy saving on



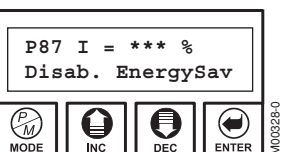
- P** P85
- R** YES/NO
- D** NO
- F** It enables the energy saving function.

7.3.52 P86: Current for Energy saving on



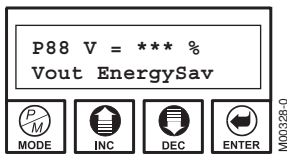
- P** P86
- R** 50% .. 70%
- D** 70%
- F** It defines, **as a percentage of the motor rated current (P03), the current threshold absorbed by the motor below which the energy saving function has to be enabled:** if the motor absorbs a current lower than the one set in P86, the motor output voltage can be decreased until the value set in P88 is reached. This threshold will cause a partialization of the load output voltage.

7.3.53 P87: Current for Energy saving off



- P** P87
- R** 50% .. 80%
- D** 80%
- F** It defines, **as a percentage of the motor rated current (P03), the current level at steady state beyond which the energy saving function has to be disabled:** if the motor absorbs a current higher than P87, the output voltage is restored to the max. value. Between the enabling and disabling threshold, a hysteresis of 10% is present to avoid any oscillation between saving on/saving off.

7.3.54 P88: Output voltage level with energy saving



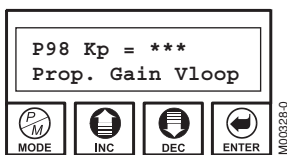
P P88

R 70% .. 90%

D 80%

F It defines, **as a percentage of the mains voltage**, the voltage value applied to the motor with energy saving on. It is a fixed value that cannot be changed after setting.

7.3.55 P98: Gain proportional to voltage loop



P P98 (available **up to Vers. S4.05**)

R 0 .. 100

D 1.00

F It defines the proportional gain Kp of the voltage loop according to the formula $G(s) = Kp \cdot (1 + 1/(Ti \cdot s))$



CAUTION!! - The setting of this parameter can be critical, causing some instability problems. When programming this parameter, increase it without generating instability events.

7.3.56 P99: Integral time of voltage loop



P P99 (available **up to Vers. S4.05**)

R 0.01s .. 1s

D 1.000s

F It defines, in seconds, the integral time of the voltage loop, according to the formula $G(s) = Kp \cdot (1 + 1/(Ti \cdot s))$



CAUTION!! - The setting of this parameter can be critical, causing some instability problems. When programming this parameter, increase it without generating instability events.

7.3.57 P100: Alarm for tacho generator fault



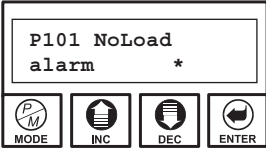
P P100 (available **up to Vers. S4.05**)

R YES, NO

D NO

F Activates (YES) or desactivates (NO) the alarm tripping for tacho generator fault.

7.3.58 P101: Alarm for load interrupted



MO0328-0

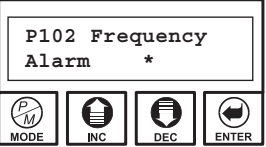
P P101

R YES, NO

D NO

F Activates (YES) or desactivates (NO) the alarm tripping for load interrupted.

7.3.59 P102: Frequency alarm tripping



MO0328-0

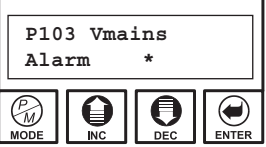
P P102

R YES,NO

D YES

F It enables (YES) or disables (NO) the alarm for out-of-tolerance frequency or unstable frequency.

7.3.60 P103: Out of tolerance mains alarm tripping



MO0328-0

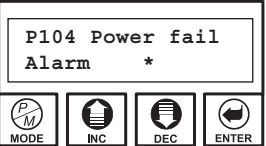
P P103

R YES,NO

D YES

F It enables (YES) or disables (NO) the alarm for mains voltage out of tolerance.

7.3.61 P104: Power failure alarm tripping



MO0328-0

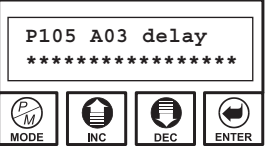
P P104

R YES,NO

D YES

F It enables (YES) or disables (NO) the alarm for power failure.

7.3.62 P105: Alarm A03 delay



MO0328-0

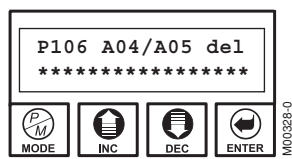
P P105

R 0:0 sec, 1:0.4sec, 2:0.8sec, 3:1.6sec

D 1

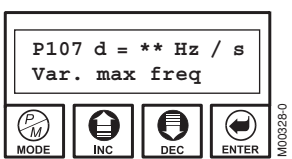
F Delay of unstable frequency alarm.
0: 0 sec.
1: 0.4 sec.
2: 0.8 sec.
3: 1.6 sec.

7.3.63 P106: Alarm A04/A05 delay



- P** P106
- R** 0:0 sec, 1:0.4sec
- D** 1
- F** Delay of out-of-tolerance mains voltage and/or power failure alarm.
0: 0 sec.
1: 0.4 sec

7.3.64 P107: Mains frequency change

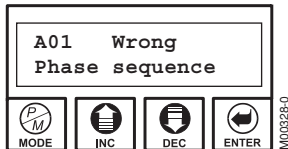


- P** P107
- R** 1,2,4,8,16,32,64 Hz/s
- D** 32 Hz/s
- F** It expresses, in **Hertz per second**, the max. change allowed for mains frequency. This parameter is useful with power unit supply, in order to limit the unstable frequency alarm.

8 DIAGNOSTICS

8.1 ALARM PARAMETERS

8.1.1 A01: Wrong cyclic sense



P A01

F

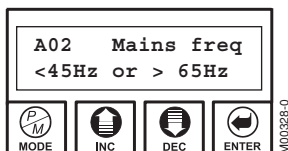
This alarm may trips under the two following conditions:

- the RST cyclic sequence of the power section (bas L1-L2-L3) is inverted or
- the phase at terminals 31-32 is not the same as the one on bars L1-L3.



NOTE: This alarm does not cover the condition: L1/L2/L3=R/S/T, 31/32=T/R.

8.1.2 A02: Mains frequency out of tolerance



P A02

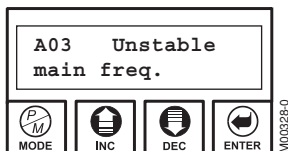
F

It occurs under the two following conditions:

- the mains frequency is lower than 45 Hz
- the mains frequency is higher than 65Hz

This alarm can be disabled using parameter P102.

8.1.3 A03: Unstable mains frequency

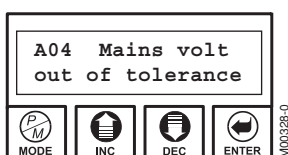


P A03

F

It occurs if the mains frequency changes exceed the max. set values. The max. tolerance is set through parameter P107. This alarm can be delayed using parameter P105. This alarm can be disabled through parameter P102.

8.1.4 A04: Mains voltage out of tolerance



P A04

F

This alarm trips when the mains voltage exceeds the limits allowed for the different cases.

It trips if the supply voltage is lower than 15% of the supply voltage:

- 200÷240 Vac supply 170Vac
- 380÷440 Vac supply 320Vac
- 441÷500 Vac supply 375Vac

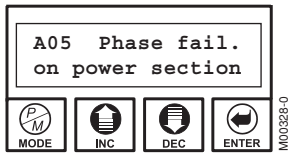
It trips if the voltage is higher than 10% of the supply voltage:

- 200÷240 Vac supply 265Vac
- 380÷440 Vac supply 485Vac
- 441÷500 Vac supply 550Vac

This alarm can be masked using parameter P103.

It can be delayed using parameter P106.

8.1.5 A05: Power failure



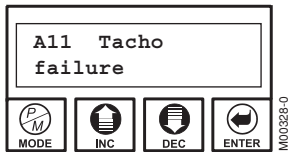
P A05

F Alarm tripping in case of power failure in the power section (at least one phase of the power section is missing due, for example, to a blown fuse on the phases). This alarm can be enabled/disabled using parameter P104. The tripping time can be delayed using parameter P106.



CAUTION!! - The alarm is delayed of approx. 2 seconds by the closing edge of the contacts 28 and 15. It trips immediately or after 0,4s if the unit is running (depending on parameter P106) .

8.1.6 A11: Tacho generator failure



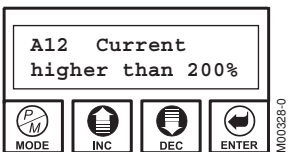
P A11 (Up to Vers.S4.05 only)

F This alarm trips under the following conditions:

- the tacho generator is disconnected from one of the two terminals 5/6 or 7/6
- the tacho generator is reverted (the terminals are exchanged)
- the tacho generator is faulty

This alarm can be included or excluded by means of the parameter P100.

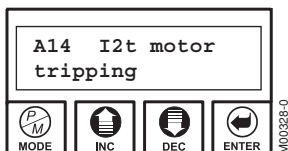
8.1.7 A12: Current higher than 200% of the max. overload of the SOFT STARTER



P A12

F Alarm tripping when the instantaneous output current (peak value) exceeds 200% of the max. overload current of the starter (value depending on the size).

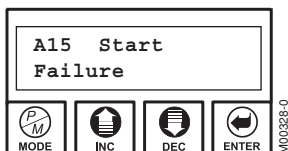
8.1.8 A14: Motor overheating



P A14

F Alarm tripping in case of motor overheating. It can be disabled using P23. The parameters to be set are P24 and P25.

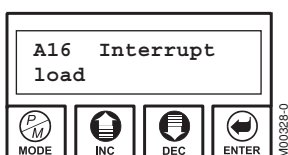
8.1.9 A15: Start-up failure



P A15

F Alarm tripping when a time longer than **Tsf** is required to start the motor.

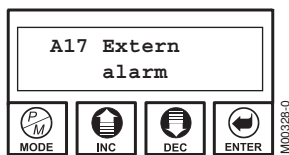
8.1.10 A16: Interrupted load



P A16

F Alarm tripping when the output connection to the motor is interrupted, i.e. the circuit on one phase is open. The alarm is delayed by approx. 5 seconds and is on when both contacts 15 and 28 are closed. This alarm can be included/excluded using parameter P101.

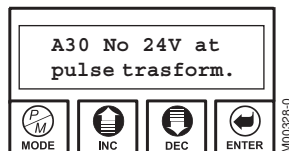
8.1.11 A17: External alarm



P A17

F Alarm tripping when parameter P33 is programmed for external alarm (EXT. ALARM) and terminal 17 is **OPEN**.

8.1.12 A30: No 24Vdc in thyristor pilot section



P A30

F Alarm tripping when the thyristors cannot be turned on for +24V voltage failure on the primaries of pulse transformers on the pilot board.

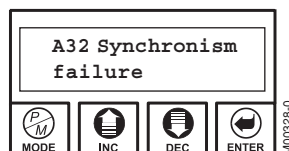
8.1.13 A31: Heatsink too high temperature



P A31

F Alarm tripping when the heatsink temperature during ordinary operation exceeded the allowable limit.

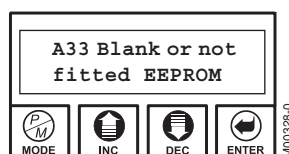
8.1.14 A32: Synchronism failure



P A32

F Alarm tripping in case of synchronization problems of the voltage and/or current wave form.

8.1.15 A33: EEPROM memory blank or not fitted



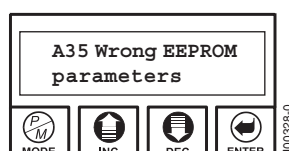
P A33

F Alarm tripping when:

- EEPROM is missing
- EEPROM is not programmed
- EEPROM is faulty
- jumper J9 on the board does not match the EEPROM size.

In all these cases the converter can operate with the standard set of parameters stored in the EPROM (that can be changed but obviously not saved).

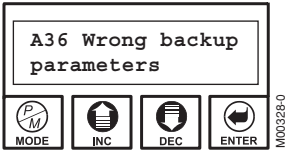
8.1.16 A35: Wrong EEPROM parameters



P A35

F Alarm tripping when the contents of some EEPROM areas is altered. This work area is checked every time the SOFT STARTER is powered. In this case, if at the end of the commissioning the right parameters have been backed-up (par. P000=3) you have to reset the alarm and then restore the back-up parameters (par. P00=4), re-writing the working area of the EEPROM. If the alarm A36 trips as well (see later) you have to reset the alarm and then restore the default values (par. P00=2). Finally you'll have to manually change all parameters you noted at the end of the commissioning.

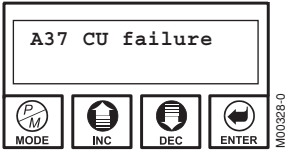
8.1.17 A36: Wrong BACKUP parameters



- P** A36
- F** Alarm tripping when the backup parameters are incorrect.

This back-up area is controlled every time the back-up parameters are restored. In this case that area cannot be used: after having reset the alarm you'll have to restore the default values (par. P00=2). Finally you'll have to manually change all parameters you noted at the end of the commissioning.

8.1.18 A37: Control unit failure



- P** A37
- F** Alarm tripping when troubles are to be found in the control unit. You just need to reset the alarm.

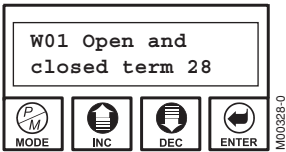
8.2 WARNING PARAMETERS

8.2.1 W00: Excessive heatsink temperature for start-up



- P** W00
- F** WARNING appearing when the heatsink temperature is too high for start-up. To restart the motor, wait until the temperature falls below the max. allowed threshold, and then open and close again contacts. When started, the soft-starter achieves the starting stage, even if the temperature at issue is exceeded.

8.2.2 W01: Safety at start-up



- P** W01
- F** WARNING appearing when the start/stop safety (P30) is on and the SOFT STARTER is supplied with terminals 15 and 28 closed.

9 ACCESSORIES

9.1 MAINS FUSES

If a COMPACT SFTM (Size 1...2A) is installed, some **ULTRAFAST FUSES** are required for the three-phase mains. By contrast, if a MODULAR SFTM is installed (Size 3 and 4), some **DELAYED FUSES** are required, unless the upstream switch protects the starter against any short-circuit. The fuse value depends on the starter size.

The fuses to be used are the following:

	Model	Recommended Fuse	I ² t Thyristor (KA ² s)	I ² t Fuse at 440 Vca (KA ² s)
ULTRAFAST FUSES	SFTM.45-32	100A 00T/80	9.1	3.1
	SFTM.72-60	160A 00T/80	15	8.8
	SFTM.105-86	250A 00T/80	100	27
	SFTM.215-170-145	450A 2T/80	350/750	74
	SFTM.380-340-310-250	800 A 3T/80	1200/750	310
	SFTM.550-450	1000A 3T/80	1200	616
DELAYED FUSES	SFTM.350	450A	-	-
	SFTM.440	550A	-	-
	SFTM.580	800A	-	-
	SFTM.660	900A	-	-
	SFTM.770	1000A	-	-
	SFTM.850-840	1100A	-	-
	SFTM.910-900	1250A	-	-
	SFTM.1200-1150	1600A	-	-
	SFTM.1500	2000A	-	-
	SFTM.2000-1900	2500A	-	-

T00205-B

10 ANNEXES

10.1 ANNEX A: User parameter recording tables - Default motor

SFTM no. _____ Size _____ Serial no. _____ Software version _____

parameter	meaning	factory setting	allowed value range	value stored on ____/____/____	value stored on ____/____/____	value stored on ____/____/____
P00	Code	0	0 .. 4	cannot be stored	cannot be stored	cannot be stored
P01	Prog. level	0	0 .. 2			
P02	Start mode	1	0 .. 3			
P03	Imot	Inom. SFTM	0 .. Inom. SFTM			
P04	I1	200% Imot	0 .. 700% Imot			
P05	I2	300% Imot	0 .. 700% Imot			
P06	I3	180% Imot	0 .. 300% Imot			
P07	Vks	100%	0 .. 100% Vmot			
P08	Vsv	50% Vmot	0 .. 100% Vmot			
P09	T1	2s	0 .. 180s			
P10	Tks	0.5s	0 .. 1.00s			
P11	Tacc	10s	0 .. 180s			
P12	Tdec	10s	0 .. 600s			
P13	Tsf	30s	1 .. 1800s			
P14	Stop mode	0	0 .. 1			
P15	DCB before start	NO	YES - NO			
P16	DCB after stop	NO	YES - NO			
P17	DCB time at start	5s	0 .. 60s			
P18	DCB time at stop	10s	0 .. 600s			
P19	Decel. ramp stop level	0%	0 .. 100%			
P20	DC brake injection	100%	0 .. 100%			
P21	DCB HOLD	NO	YES - NO			
P22	DCB HOLD level	5%	0 .. 100%			
P23	I ² t mot alarm	YES	YES - NO			
P24	I ² t mot current	110% Imot	0 .. 120% Imot			
P25	I ² t mot therm. const.	20 min	1 .. 180 min			
P27	Autoreset	NO	YES - NO			
P28	Nrest	4	1 .. 10			
P29	Tz	300s	1 .. 999s			
P30	Start/stop security	NO	YES - NO			
P31	Configure term. 15-28	Mode 1	mode1 - mode2 - MDBUS			
P32	Configure term. 16	SM1	SM1, SETA			

parameter	configuration	factory setting	allowable value range	value stored on ____/____/____	value stored on ____/____/____	value stored on ____/____/____
P33	Configure term. 17	SM2	SM2,SETB, EXT A			
P34	Power/Sync ratio	1	1 .. 3.5			
P36	Out monitor	1	0 .. 5			
P37	KOI	100%	0 .. 300%			
P38	KOV	100%	0 .. 300%			
P42	MDO1	0	0 .. 8			
P43	MDO1 setting I level	100% Imot	0 .. 300% Imot			
P44	MDO1 setting V level	100% Vmot	0 .. 100% Vmot			
P45	MDO1 setting ON delay	0s	0 .. 100s			
P46	MDO1 setting OFF delay	0s	0 .. 100s			
P47	MDO1 setting hysteresis	0%	0 .. 300%			
P48	MDO1 state	normally open	normally open-normally closed			
P52	MDO2	5	0 .. 8			
P53	MDO2 setting I level	100% Imot	0 .. 300% Imot			
P54	MDO2 setting V level	100% Vmot	0 .. 100% Vmot			
P55	MDO2 setting ON delay	0s	0 .. 100s			
P56	MDO2 setting OFF delay	0s	0 .. 100s			
P57	MDO2 setting hysteresis	0%	0 .. 300%			
P58	MDO2 state	normally open	normally open-normally closed			
P62	MDO3	6	0 .. 8			
P63	MDO3 setting I level	100% Imot	0 .. 300% Imot			
P64	MDO3 setting V level	100% Vmot	0 .. 100% Imot			
P65	MDO3 setting ON delay	1s	0 .. 100s			
P66	MDO3 setting OFF delay	0s	0 .. 100s			
P67	MDO3 setting hysteresis	0%	0 .. 300%			
P68	MDO3 state	normally open	normally open-normally closed			
P72	MDO4	7	0 .. 8			
P73	MDO4 setting I level	100% Imot	0 .. 300% Imot			
P74	MDO4 setting V level	100% Vmot	0 .. 100% Imot			
P75	MDO4 setting ON delay	0s	0 .. 100s			
P76	MDO4 setting OFF delay	0s	0 .. 100s			

T00237-B

parameter	configuration	factory setting	allowable value range	value stored on _/_/_	value stored on _/_/_	value stored on _/_/_
P77	MDO4 setting hysteresis	0%	0 .. 300%			
P78	MDO4 state	normally open	normally open- normally closed			
P79	Serial address	1	1 .. 247			
P80	Band rate	2400 bps	1200 .. 2400 bps			
P81	Parity	NO	NO - YES			
P82	Serial Time Out	339.9 ms	0 .. 2000 ms			
P83	Serial delay	0 ms	0 .. 2000 ms			
P85	Energy saving	NO	YES - NO			
P86	I enable energy saving	70% Imot	50 .. 100% Imot			
P87	I disable energy saving	80% Imot	50 .. 100% Imot			
P88	Vout energy saving	80% Vmains	70 .. 90% Vmains			
P101	No load alarm	NO	YES - NO			
P102	Frequency alarm	YES	YES - NO			
P103	Vmains alarm	YES	YES - NO			
P104	Power fail alarm	YES	YES - NO			
P105	A03 delay	1	0 .. 3			
P106	A04/A05 delay	1	0 .. 1			
P107	Max freq variation	32 Hz/s	1 .. 64 Hz/s			

T00238-B

10.2 Annex B: Parameter table - Motor A

SFTM no. _____ Size _____ Serial no. _____ Software version: _____

parameter	configuration	factory setting	allowable value range	value stored on _/_/_	value stored on _/_/_	value stored on _/_/_
P02A	Start mode	1	0 .. 3			
P03A	Imot	Inom. SFTM	0 .. Inom. SFTM			
P04A	I1	200% Imot	0 .. 700% Imot			
P05A	I2	300% Imot	0 .. 700% Imot			
P06A	I3	180% Imot	0 .. 300% Imot			
P07A	Vks	100%	0 .. 100% Vmot			
P08A	Vsv	50% Vmot	0 .. 100% Vmot			
P09A	T1	2s	0 .. 180s			
P10A	Tks	0.5s	0 .. 1.00s			
P11A	Tacc	10s	0 .. 180s			
P12A	Tdec	10s	0 .. 600s			
P13A	Tsf	30s	1 .. 1800s			
P14A	Stop mode	0	0 .. 1			
P15A	DCB before start	NO	YES - NO			
P16A	DCB after stop	NO	YES - NO			
P17A	DCB time at start	5s	0 .. 60s			
P18A	DCB time at stop	10s	0 .. 600s			
P19A	Decel. ramp stop level	0%	0 .. 100%			
P20A	DC brake injection	100%	0 .. 100%			
P21A	DCB HOLD	NO	YES - NO			
P22A	DCB HOLD level	5%	0 .. 100%			
P23A	I ² t mot alarm	YES	YES - NO			
P24A	I ² t mot current	110% Imot	0 .. 120% Imot			
P25A	I ² t mot therm. const.	20 min	1 .. 180 min			

T00239-B

10.3 Annex C: Parameter table - Motor B

SFTM no. _____ Size _____ Serial no. _____ Software version: _____

parameter	configuration	factory setting	allowable value range	value stored on _ / _ / _	value stored on _ / _ / _	value stored on _ / _ / _
P02B	Start mode	1	0 .. 3			
P03B	Imot	Inom. SFTM	0 .. Inom. SFTM			
P04B	I1	200% Imot	0 .. 700% Imot			
P05B	I2	300% Imot	0 .. 700% Imot			
P06B	I3	180% Imot	0 .. 300% Imot			
P07B	Vks	100%	0 .. 100% Vmot			
P08B	Vsv	50% Vmot	0 .. 100% Vmot			
P09B	T1	2s	0 .. 180s			
P10B	Tks	0.5s	0 .. 1.00s			
P11B	Tacc	10s	0 .. 180s			
P12B	Tdec	10s	0 .. 600s			
P13B	Tsf	30s	1 .. 1800s			
P14B	Stop mode	0	0 .. 1			
P15B	DCB before start	NO	YES - NO			
P16B	DCB after stop	NO	YES - NO			
P17B	DCB time at start	5s	0 .. 60s			
P18B	DCB time at stop	10s	0 .. 600s			
P19B	Decel. ramp stop level	0%	0 .. 100%			
P20B	DC brake injection	100%	0 .. 100%			
P21B	DCB HOLD	NO	YES - NO			
P22B	DCB HOLD level	5%	0 .. 100%			
P23B	I ² t mot alarm	YES	YES - NO			
P24B	I ² t mot current	110% Imot	0 .. 120% Imot			
P25B	I ² t mot therm. const.	20 min	1 .. 180 min			

T00240-B

EC DECLARATION OF CONFORMITY

Elettronica Santerno S.p.A.
Via G. Di Vittorio, 3 - 40020 Casalfiumanese (BO) - Italy

AS MANUFACTURER

DECLARE

UNDER OUR SOLE RESPONSABILITY

THAT THE DIGITAL SOFT STARTERS FOR ASYNCHRONOUS MOTORS OF **SFTM** TYPE,
AND RELATED ACCESSORIES, TO WHICH THIS DECLARATION RELATES, APPLIED UNDER
CONDITIONS SUPPLIED IN THE USER'S MANUAL,
CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

EN61800-3	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods.
EN55011	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
EN61000-4-2	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge immunity test. Basic EMC Publication.
EN61000-4-4	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 4: Electrical fast transient/burst immunity test. Basic EMC Publication.
EN61000-4-5	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 5: Surge immunity test.
EN61000-4-8	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test. Basic EMC Publication.
IEC1000-4-3	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 3: Radiated, radio-frequency, electromagnetic field immunity test.
IEC947-4-2	Low-voltage switchgear and controlgear. Part 4: Contactors and motor-starters. Section 2: AC semiconductor motor controllers and starters.

FOLLOWING THE PROVISIONS OF ELECTROMAGNETIC COMPATIBILITY DIRECTIVE
89/336/EEC AND SUBSEQUENT AMENDMENTS 92/31/EEC, 93/68/EEC AND 93/97/EEC.

PLACE AND DATE OF ISSUE
Casalfiumanese, 01/10/1997

SIGNATURE
General manager
Ing. Pietro CASELLI

EC DECLARATION OF CONFORMITY

Elettronica Santerno S.p.A.
Via G. Di Vittorio, 3 - 40020 Casalfiumanese (BO) - Italy

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TO WHICH THIS DECLARATION RELATES,
CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

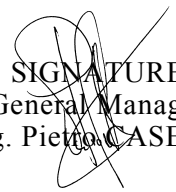
EN60146-1-1	Semiconductor convertors. General requirements and line commutated convertors. Part 1-1: Specifications of basic requirements.
IEC146-1-2	Semiconductor convertors. General requirements and line commutated convertors. Part 1-2: Application guide.
IEC146-6	Semiconductor convertors. Part 6: Application guide for the protection of semiconductor convertors against overcurrent by fuses.
IEC664-1	Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests.
EN60204-1	Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
EN60204-1 Amendment 1	Electrical equipment of industrial machines. Part 2: Item designation and examples of drawings, diagrams, tables and instructions.
EN60529	Degrees of protection provided by enclosures (IP Code).
prEN50178	Electronic equipment for use in power installations.
IEC947-4-2	Low-voltage switchgear and controlgear. Part 4: Contactors and motor-starters. Section 2: AC semiconductor motor controllers and starters.
IEC60947-4-2 Amendment 1	Low-voltage switchgear and controlgear. Part 4: Contactors and motor-starters. Section 2: AC semiconductor motor controllers and starters.

FOLLOWING THE PROVISIONS OF LOW VOLTAGE DIRECTIVE 73/23/EEC AND SUBSEQUENT
AMENDMENT 93/68/EEC.

LAST TWO DIGITS OF THE YEAR IN WHICH THE CE MARKING WAS AFFIXED: **97**

PLACE AND DATE OF ISSUE
Casalfiumanese, 01/10/1997

SIGNATURE
General Manager
Ing. Pietro CASELLI



MANUFACTURER'S DECLARATION

Elettronica Santerno S.p.A.
Via G. Di Vittorio, 3 - 40020 Casalfiumanese (BO) - Italy

AS MANUFACTURER

DECLARE

UNDER OUR SOLE RESPONSABILITY

THAT THE DIGITAL SOFT STARTERS FOR ASYNCHRONOUS MOTORS OF **SFTM** TYPE,
TO WHICH THIS DECLARATION RELATES,
APPLIED UNDER CONDITIONS SUPPLIED IN THE USER'S MANUAL,
CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

EN60204-1	Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
EN60204-1	Electrical equipment of industrial machines.
Amendment 1	Part 2: Item designation and examples of drawings, diagrams, tables and instructions.

AND MUST NOT BE PUT INTO SERVICE UNTIL THE MACHINERY INTO WHICH IT IS TO BE
INCORPORATED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF
MACHINERY DIRECTIVE 89/392/EEC AND SUBSEQUENT AMENDMENTS 91/368/EEC,
93/44/EEC AND 93/68/EEC.

PLACE AND DATE OF ISSUE
Casalfiumanese, 01/10/1997

SIGNATURE
General Manager
Ing. Pietro CASELLI