**• DIGITAL CONTROL INVERTER •**

# OPERATION AND PROGRAMMING MANUAL

**SINUS/IFD 7.5 - 250 kW SINUS/IFDE 4 - 15 kW**

**SINUS/IFDV 11 - 315 kW SINUS/IFDEV 5.5 - 18.5 kW**

## PROGRAMMING MANUAL

**SINUS/DCM SINUS/DCMV SINUS/IFD - IP54 SINUS/IFDV - IP54**

*20/02/2002*

**SOFTWARE VERS. 2.10 - 3.01**

**15P0080B3 R.13**

*English*



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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.

DANGER!! MECHANICAL MOVEMENT - The inverter causes the 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!! ALWAYS CONNECT THE MOTOR AND THE INVERTER TO EARTH.

DANGER!! The inverter can output a frequency up to 800Hz; in this case, the motor can generate a rotation speed that is sixteen times the rated one: the motor should never exceed the max. speed set by the manufacturer.

DANGER!! POSSIBILITY OF ELECTRIC SHOCKS - Do not touch the electrical parts of the inverter when the power supply is connected and, in any case, wait at least 5 minutes after the supply has been disconnected.

DANGER!! Never make operation on the motor when the inverter is supplied.

DANGER!! Do not perform electric connections when the inverter is supplied; even if it is in standby, the risk of electric shocks is present on the output terminals (U,V,W) and on the connection terminals for resistive braking devices (+ , - , B).

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

CAUTION: Do not connect the supply to the output terminals (U,V,W), the connection terminals for braking devices (+ , - , B), the control terminals. Connect the supply to the R,S,T terminals only.

CAUTION: Do not cause shortcircuits between + and -, + and B; do not connect braking resistors lower than the suggested ones.

CAUTION: Do not start and stop the motor using a remote control switch on the inverter supply.

CAUTION: Do not insert a remote control switch between inverter and motor.

CAUTION: Do not use the inverter 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 one inside the inverter or a thermoswitch inserted into the motor).

CAUTION: Respect the environment requirements.

CAUTION: The surface on which the inverter is installed should be able to support temperatures up to 90°C.

NOTE: The earth connection of the motor should have a separate path so as to avoid electrical noise.

# Table of contents

# 1.0 GENERAL DESCRIPTION

The inverters of the SINUS/IFD-IFDV and SINUS/IFDE-IFDEV range are full controlled digital devices for the speed adjustment of asynchronous motors up to 315 kW.
Designed and manufactured in Italy by the technical staff of Elettronica Santerno, they represent the most up-to-date electronic technology.
16-bit multiprocessor control board, vector modulation, IGBT power, high noise immunity, high overload capacity are some of the features that make the SINUS/IFD inverters suitable to almost any application.
All quantities concerning the operation can be programmed through keypad in an adequate and guided way, by means of an alphanumeric display with 2 rows of 16 characters and the organization of the constants to be programmed in a menu and submenu structure.
The SINUS/IFD-IFDV offers several standard functions such as:

- possibility to remotable keypad;
- output frequency up to 800Hz;
- PID regulator;
- braking module;
- direct current braking;
- re-locking of the motor rotation speed;
- controlled stop;
- motor thermal protection;
- autoreset;
- 16 programmable frequency levels;
- prohibit frequencies;
- 3 programmable multifunction digital outputs
- 8 programmable multifunction digital inputs;
- 3 programmable multifunction analog inputs;
- default parameters restore;
- slip compensation;
- serial interface;
- protection degree IP20;
- EMC-consistent.

A wide range of diagnostic messages allow for a quick parameters setup during the machine turning on and a quick resolution of possible problems during operation.
The inverters of the SINUS/IFD-IFDV and SINUS/IFDE-IFDEV series were developed, designed and produced in conformity with the requirements of the “Low Voltage Directive” and the “Electromagnetic Compatibility Directive”. They particularly comply with the following standards:

## Low Voltage Directive

| | |
|---|---|
| EN60146-1-1/IEC146-1-1 | Semiconductor convertors.<br>General requirements and line commutated convertors.<br>Part 1-1: Specifications for the basic prescriptions. |
| IEC146-1-2 | Semiconductor convertors.<br>General requirements and line commutated convertors.<br>Part 1-2: Application guide. |
| IEC146-2 | Semiconductor convertors.<br>Part 2: Semiconductor self-commutated convertors. |
| IEC664-1 | Insulation coordination for equipment within low-voltage systems.<br>Part 1: Principles, requirements and tests. |
| EN61800-2/IEC1800-2 | Adjustable speed electrical power drive systems.<br>Part 2: Rating specifications for low voltage adjustable frequency AC power drive systems. |
| EN60204-1/IEC204-1 | Machine safety. Machine electric equipment.<br>Part 1: General regulations. |
| EN60204-1/IEC204-1<br>Amendment 1 | Electrical equipment for industrial machines.<br>Part 2: Component designation and examples for drawings, diagrams, tables and instructions. |
| EN60529/IEC529 | Frame degree of protection (IP Code). |
| EN50178 | Electronic equipment for use in power installations. |

## Electromagnetic Compatibility Directive

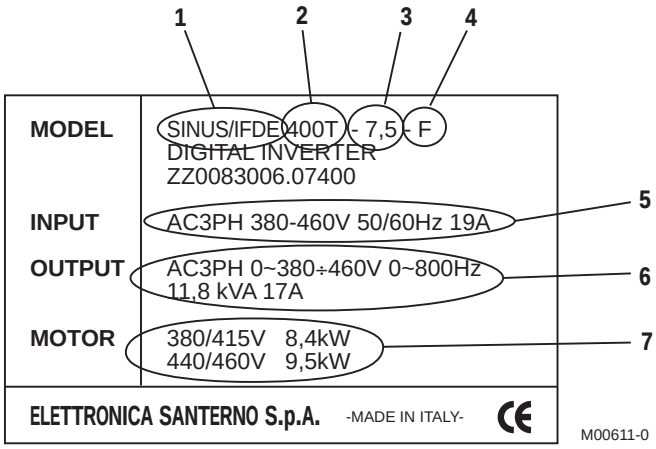
| | |
|---|---|
| EN61800-3/IEC1800-3 | Adjustable speed electrical power drive systems.<br>Part 3: Product standard relating to electromagnetic compatibility and specific testing methods. |
| EN55011/IEC CISPR11 | Measuring limits and methods for interference in industrial, scientific and medical (ISM) appliances. |
| EN61000-4-2/IEC1000-4-2 | Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques.<br>Section 2: Electrostatic discharge immunity tests. EMC Basic Publication. |
| EN61000-4-3/IEC1000-4-3 | Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques.<br>Section 3: Immunity tests over radiofrequency irradiated fields. |
| EN61000-4-4/IEC1000-4-4 | Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques.<br>Section 4: Transient/fast electric trains immunity tests. EMC Basic Publication. |
| EN61000-4-5/IEC1000-4-5 | Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques.<br>Section 5: Pulse immunity test. |
| EN61000-4-8/IEC1000-4-8 | Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques.<br>Section 8: Mains frequency magnetic fields immunity test. EMC Basic Publication. |

According to the “Machine Directive”, an inverter is considered as a component part and not as a complete machine. In conformity with this directive, Elettronica Santerno issues the Manufacturer Statement relating to the inverters of the SINUS/IFD/IFDV and SINUS/IFDE-IFDEV series.
SINUS/IFD-IFDV and SINUS/IFDE-IFDEV have been completely designed and manufactured by technicians of Elettronica Santerno; therefore, you can get in touch with Elettronica Santerno for possible customization of the product.

CAUTION!!: **Carefully read the instructions before installing the inverter.**

## 1.1 CHECKS TO BE CARRIED OUT AT RECEIPT

At equipment receipt, make sure it is free from damages and complies with your requirements, according to what is shown on the plate located on the inverter front side, as described below.
If damages are found, contact to the proper insurance company or to the supplier. If the goods is not as ordered, immediately contact the supplier.
If the device is stored before setup, make sure the storage room conditions are as required (temperature -20°C ÷ +60 °C; relative humidity <95%, without dew).
The warranty covers any manufacturing faults. The manufacturer has no responsibility for damages occurred during transportation or unpacking.
In no case, the manufacturer will be responsible for damages or faults caused by wrong operation, abuse, incorrect installation, inadequate temperature or humidity conditions, corrosive substances, as well as for failures caused by an operation exceeding the rated values. In addition, the manufacturer will not be responsible for consequential and accidental damages.
The manufacturer warranty will last 3 years starting from the delivery date.




**1 -** *model (SINUS/IFD, SINUS/IFDE for heavy applications, SINUS/IFDV, SINUS/IFDEV for generic applications);*
**2 -** *voltage class (200T three-phase 220÷240 supply, 400 T three-phase 380÷460 supply, 380 T three-phase 380 supply*
**3 -** *inverter size;*
**4 -** *presence of internal EMC filters (for SINUS/IFDE-IFDEV only);*
**5 -** *input mains characteristics (AC 3PH three-phase alternate mains, 380÷460: supply voltage, 50/60Hz: supply frequency, 19A: input current);*
**6 -** *output characteristics (AC 3PH: alternate three-phase, 0 ~380÷460: output voltage (the max. output voltage depends on the supply voltage), 0÷800Hz: output frequency, 11.8 kVA: inverter apparent power (measured at 400V output), 17A inverter rated current;*
**7 -** *motor (max. motor power which can be connected depending on the supply voltage).*

## 1.2 INSTALLATION

**1-** *Respect the following environment requirements:*
- ambient temperature 0 ÷ 40 °C,
- relative humidity 20 ÷ 90 % (without dew),
- height (lower than 1000 m a.s.l.)
- avoid direct sunlight, exposure to corrosive gases and conductive dusts.

CAUTION!!: As the ambient condition strongly affect the inverter life, do not install it in rooms which do not meet these requirements.

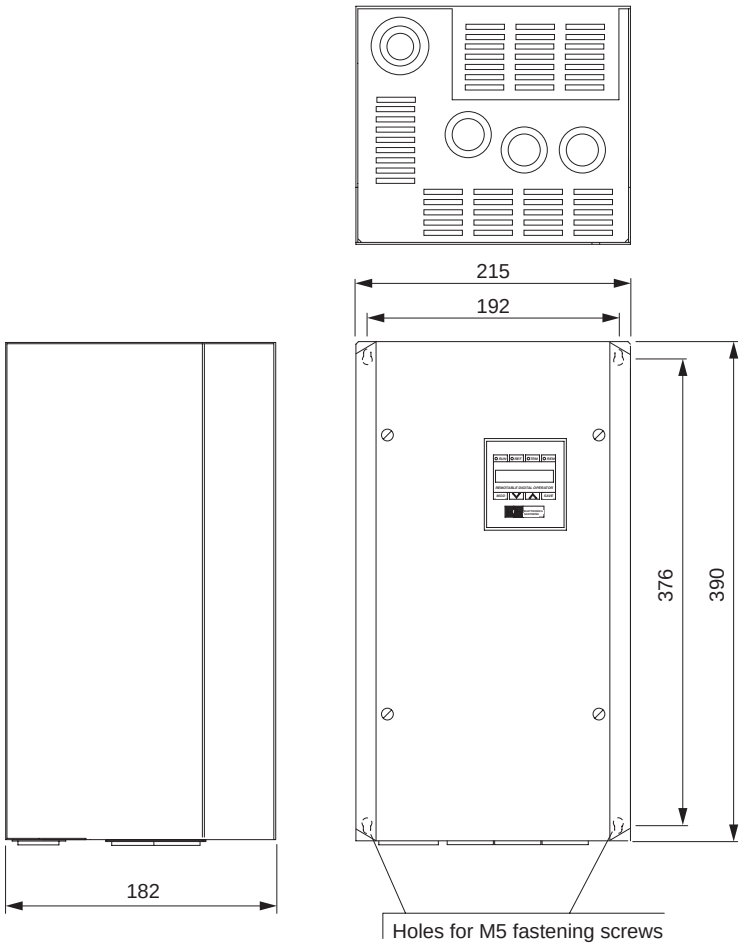
**2-** *Assembly*
- install the inverter vertically,
- leave at least 5 cm from the sides and 10 cm from top and bottom.
- use the cable leads to secure the cable position.

CAUTION!!: Do not install the inverter turned upside down or horizontally.

CAUTION!!: Do not install temperature-sensitive components above the inverter as the ventilation hot air gets out from there.

CAUTION!!: The inverter bottom surface can reach high tempertures, therefore the panel on which it is installed should not be heat-sensitive.

## 1.3 EXTERNAL DIMENSIONS OF SINUS/IFDE 200T - 4÷7,5 SINUS/IFDE 400T - 5,5÷15 SINUS/IFDEV 200T - 5,5÷7,5 SINUS/IFDEV 400T - 5,5÷18,5

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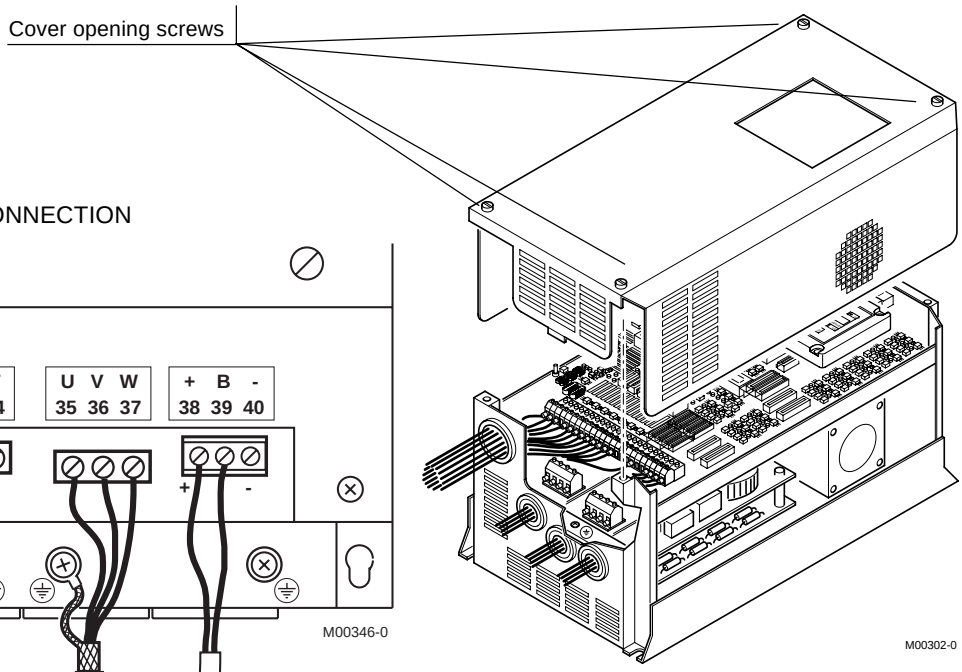


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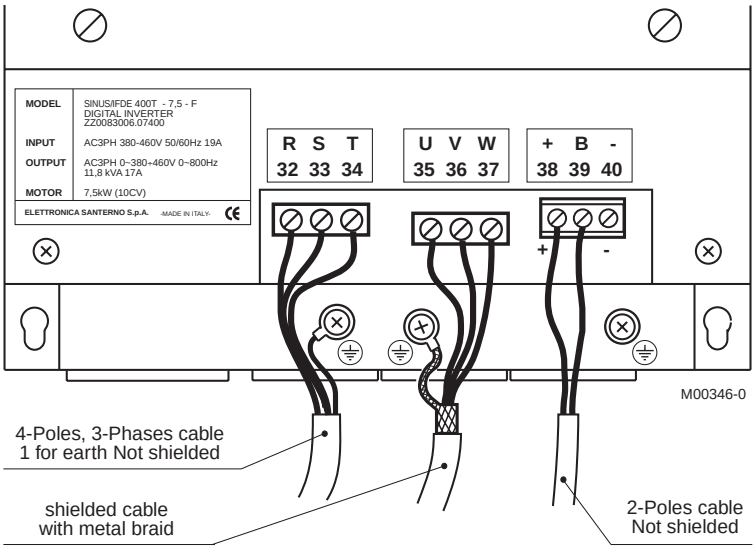
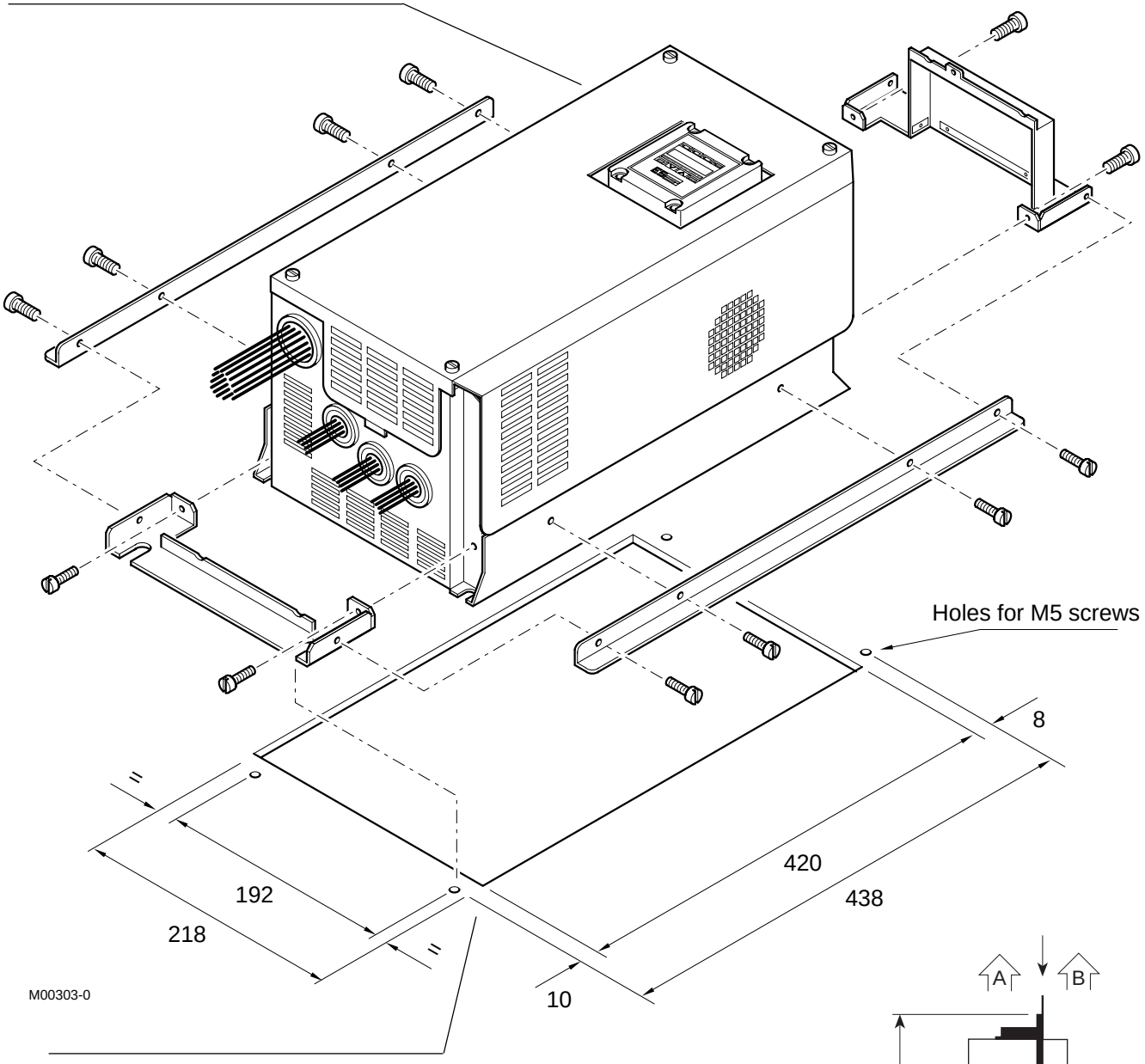
POWER TERMINAL BOARD CONNECTION




M00346-0

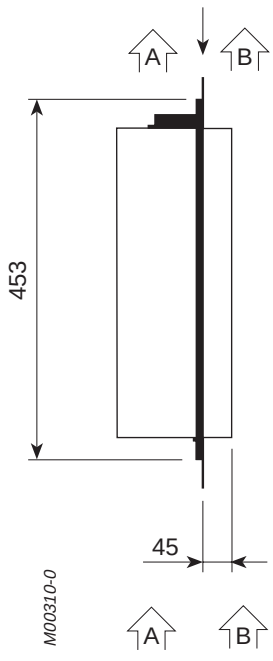
## 1.4 THROUGH-PANEL ASSEMBLY OF SINUS/IFDE 200T - 4÷7,5 SINUS/IFDE 400T - 5,5÷15 SINUS/IFDEV 200T - 5,5÷7,5 SINUS/IFDEV 400T - 5,5÷18,5

A) Install the through-panel assembly kit




B) Place the panel as shown in figure

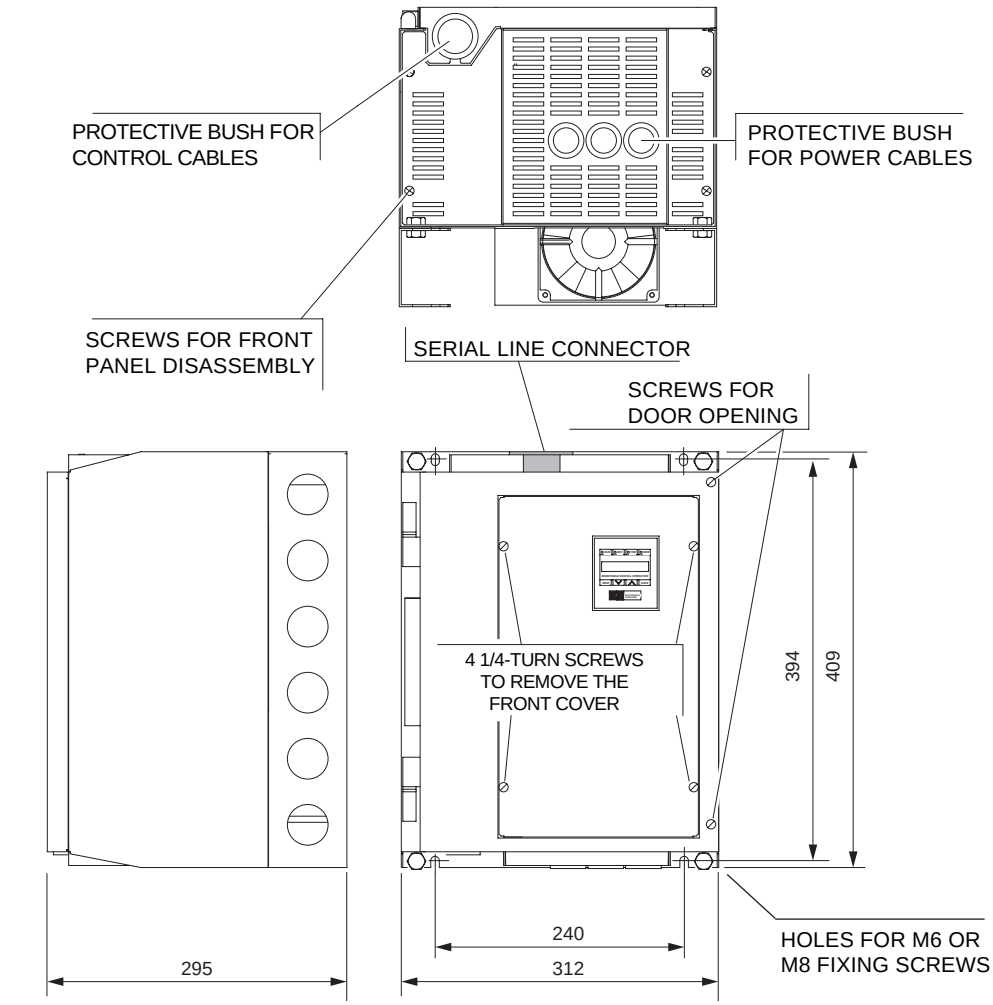
C) Install the converter

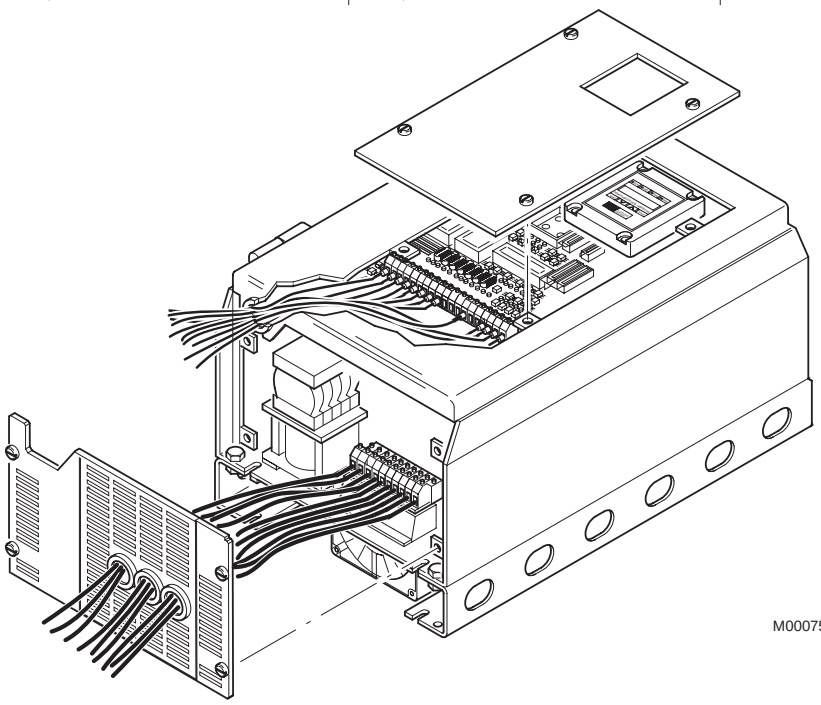



SIDE SCREW FOR THROUGH-PANEL ASSEMBLY POSITIONING

A = Cooling air for control circuits
B = Cooling air for power circuits

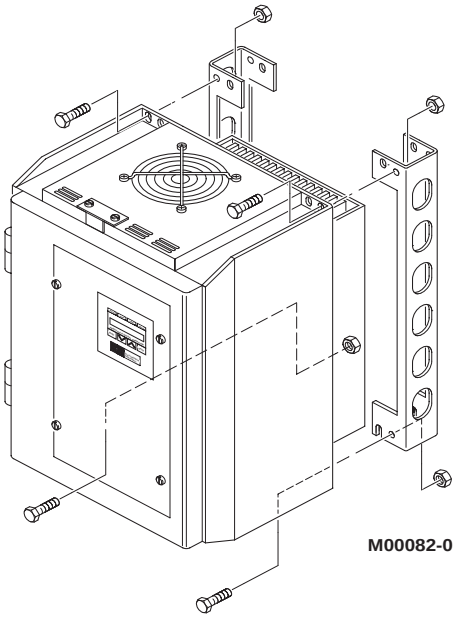
## 1.5 EXTERNAL DIMENSIONS OF SINUS/IFD 400T-15÷30 - SINUS/IFDV 400T - 18.5÷37 SINUS/IFD 200T - 7.5÷15 - SINUS/IFDV 200T - 11÷22



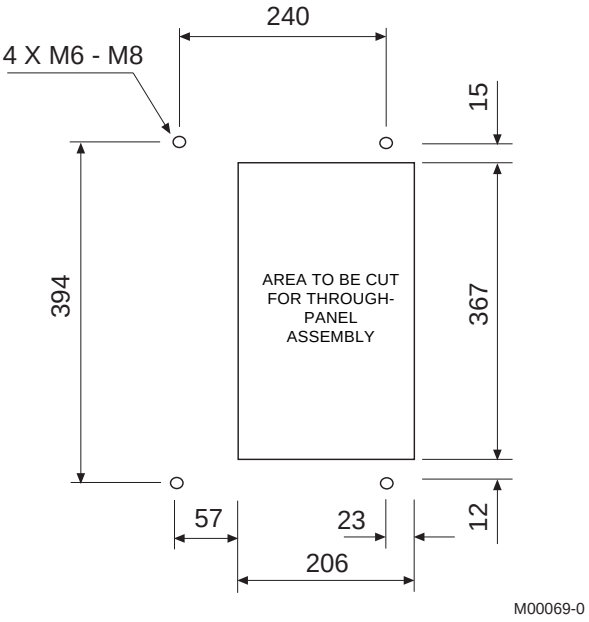



## 1.6 THROUGH-PANEL ASSEMBLY OF SINUS/IFD 400T-15÷30-SINUS/IFDV 400T 18.5÷37 SINUS/IFD 200T-7.5÷15-SINUS/IFDV 200T-11÷22

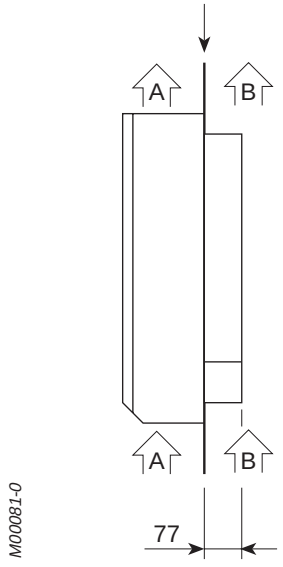
A) Remove the brackets for normal assembly using the 4 screws shown in figure.




B) Arrange the panel as shown in figure




C) Assemble the converter

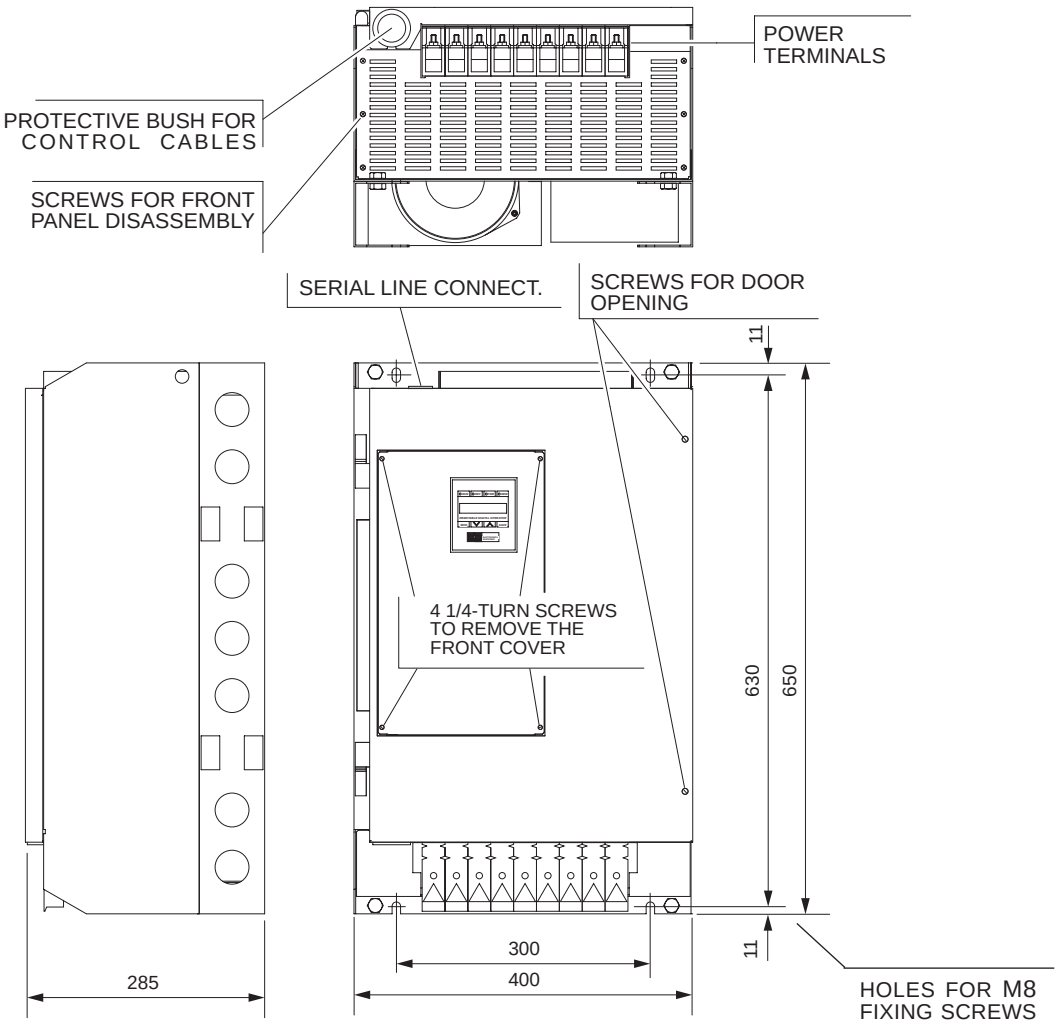


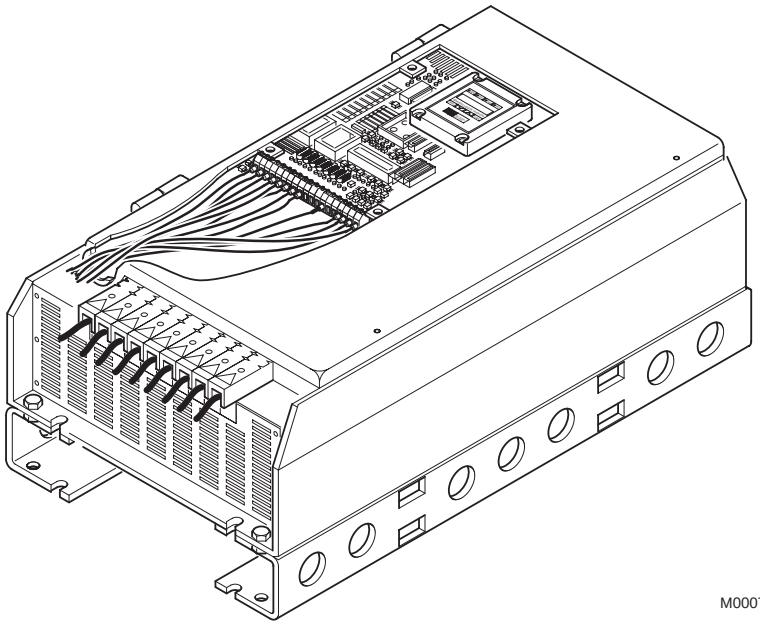

POSITIONING SIDE VIEW
FOR THROUGH-PANEL ASSEMBLY

A = DIRECTION OF THE MAIN COOLING AIR FLOW

B= DIRECTION OF THE SECONDARY COOLING AIR FLOW

## 1.7 EXTERNAL DIMENSIONS OF SINUS/IFD 400T - 37÷75 - SINUS/IFDV 400T - 45÷90 SINUS/IFD 200T - 18.5÷45 - SINUS/IFDV 200T - 30÷55

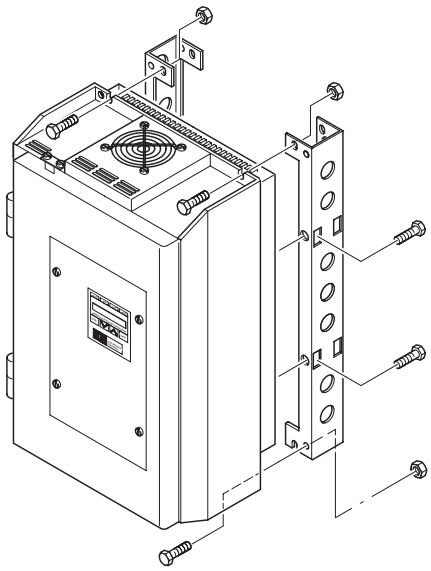


M00076-B

## 1.8 THROUGH-PANEL ASSEMBLY OF SINUS/IFD 400T-37÷75-SINUS/IFDV 400T-45÷90 SINUS/IFD 200T-18.5÷45-SINUS/IFDV 200T30÷55

A) Remove the brackets for normal assembly using the proper screws



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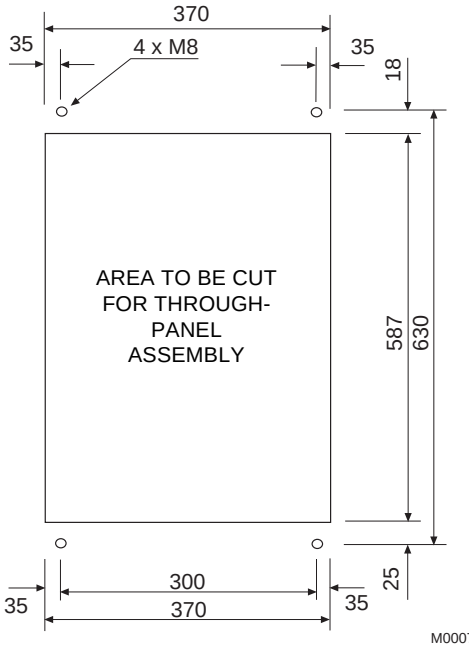
B) Arrange the panel as shown in figure

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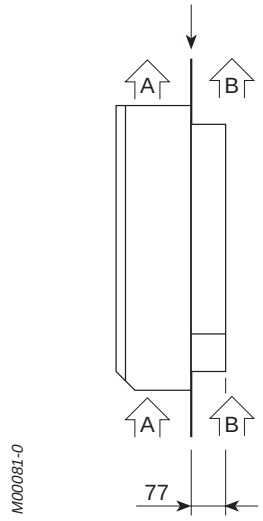
C) Assemble the converter



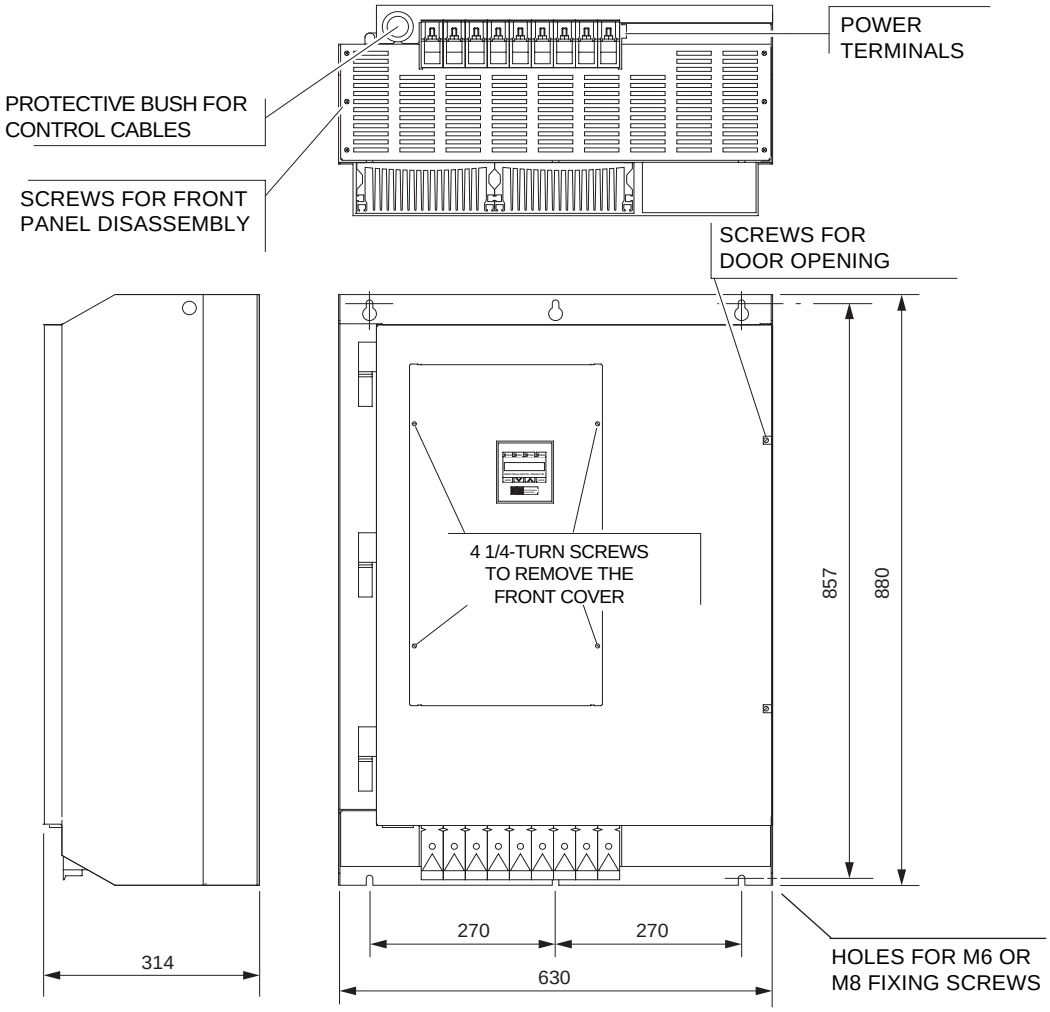

M00081-0

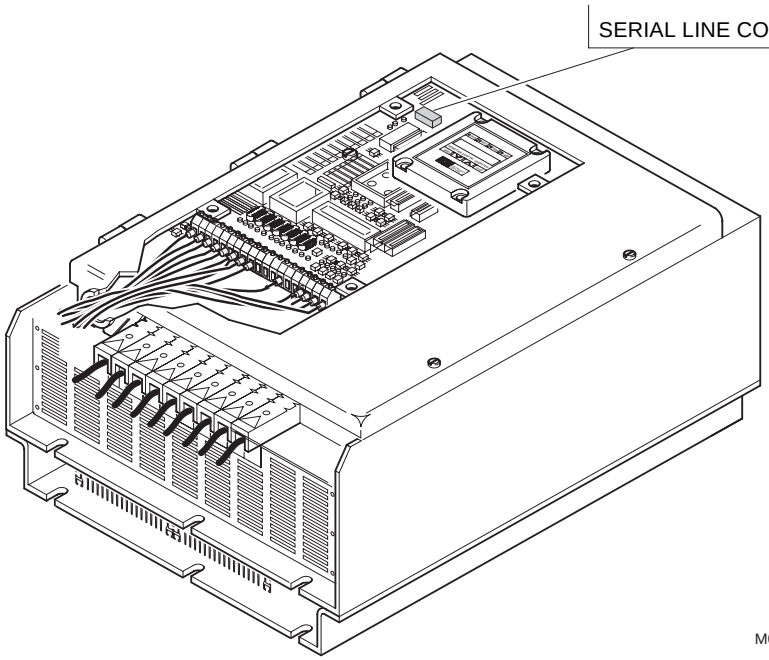
POSITIONING SIDE VIEW FOR THROUGH-PANEL ASSEMBLY

A = DIRECTION OF THE MAIN COOLING AIR FLOW

B= DIRECTION OF THE SECONDARY COOLING AIR FLOW

## 1.9 EXTERNAL DIMENSIONS OF SINUS/IFD 200T - 55÷90 SINUS/IFDV 200T - 75÷110 SINUS/IFD 400T - 90÷160 SINUS/IFDV 400T - 110÷200

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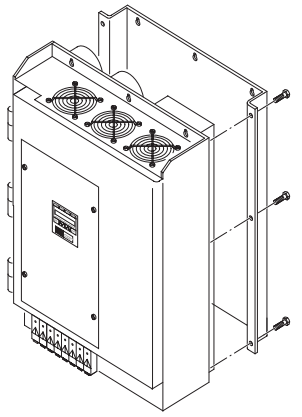
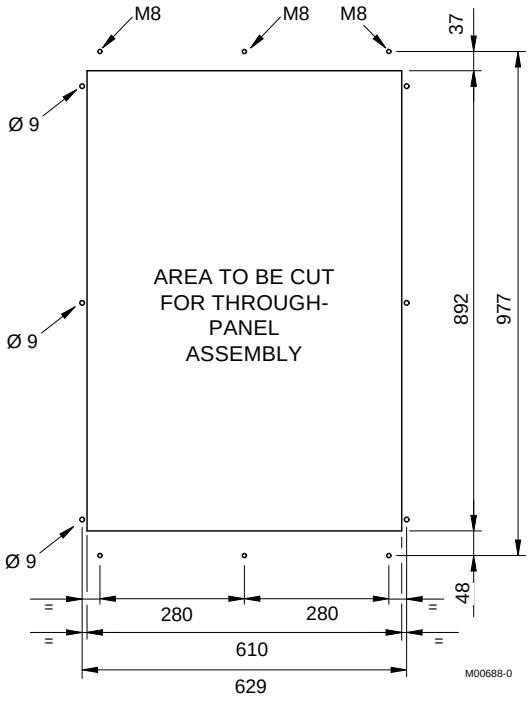
# 1.10 THROUGH-PANEL ASSEMBLY OF SINUS/IFD 200T - 55÷90 SINUS/IFDV 200T 75÷110 SINUS/IFD 400T 90÷160 - SINUS/IFDV 400T 110÷200

A) Remove the brackets for normal assembly using the proper screws.

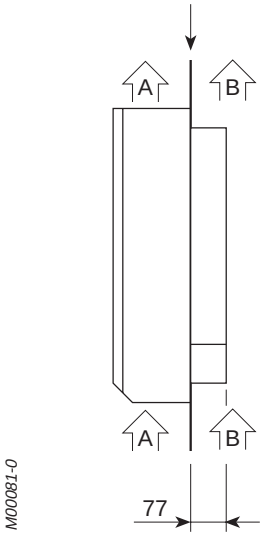


M00079-0

B) Arrange the panel as shown in figure




C) Assemble the converter

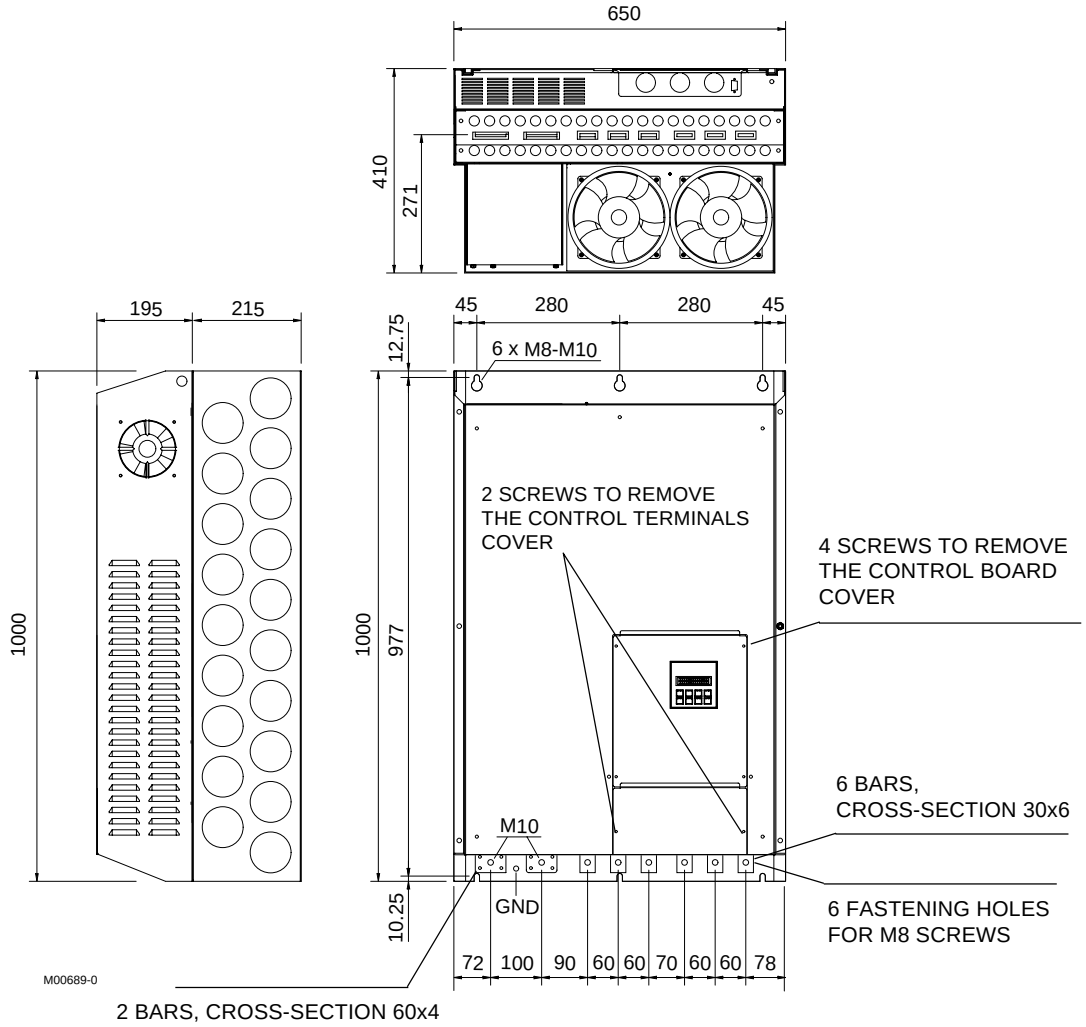


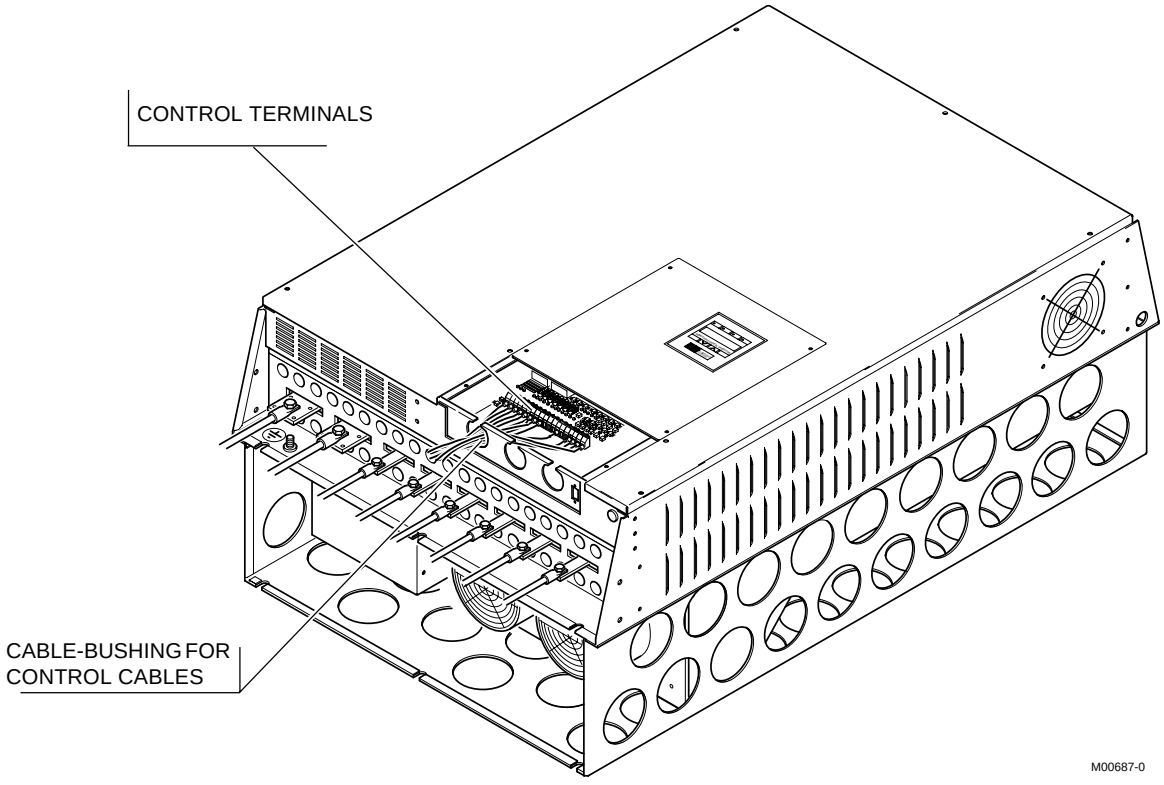

POSITIONING SIDE VIEW FOR THROUGH-PANEL ASSEMBLY

A = DIRECTION OF THE MAIN COOLING AIR FLOW

B= FLOWDIRECTION OF THE SECONDARY COOLING AIR FLOW

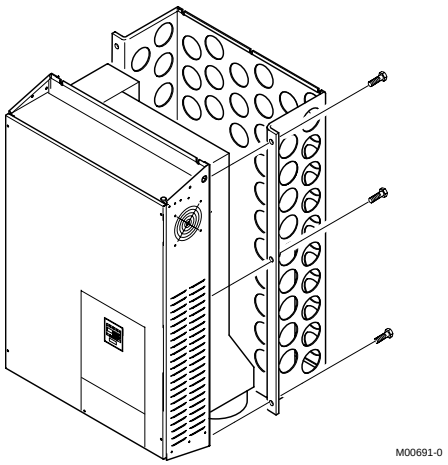
## 1.11 EXTERNAL DIMENSIONS OF SINUS/IFD 400T - 200÷250 SINUS/IFDV 400T - 250÷315



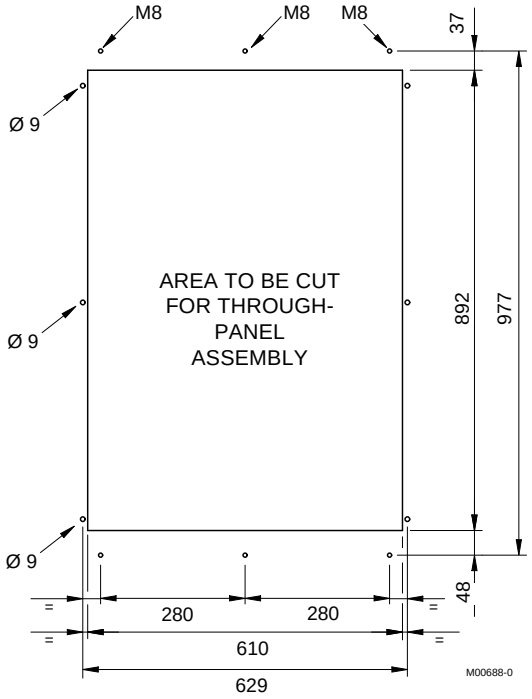



## 1.12 THROUGH-PANEL ASSEMBLY OF SINUS/IFD 400T 200÷250 - SINUS/IFDV 400T 250÷315

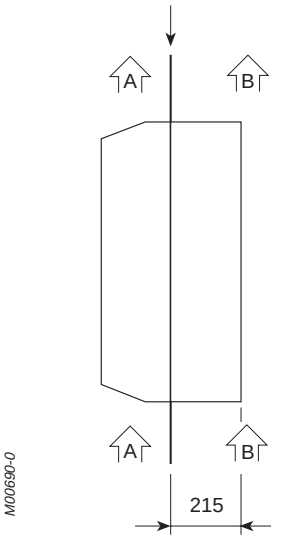
A) Remove the brackets for normal assembly using the proper screws.




B) Arrange the panel as shown in figure




C) Assemble the converter

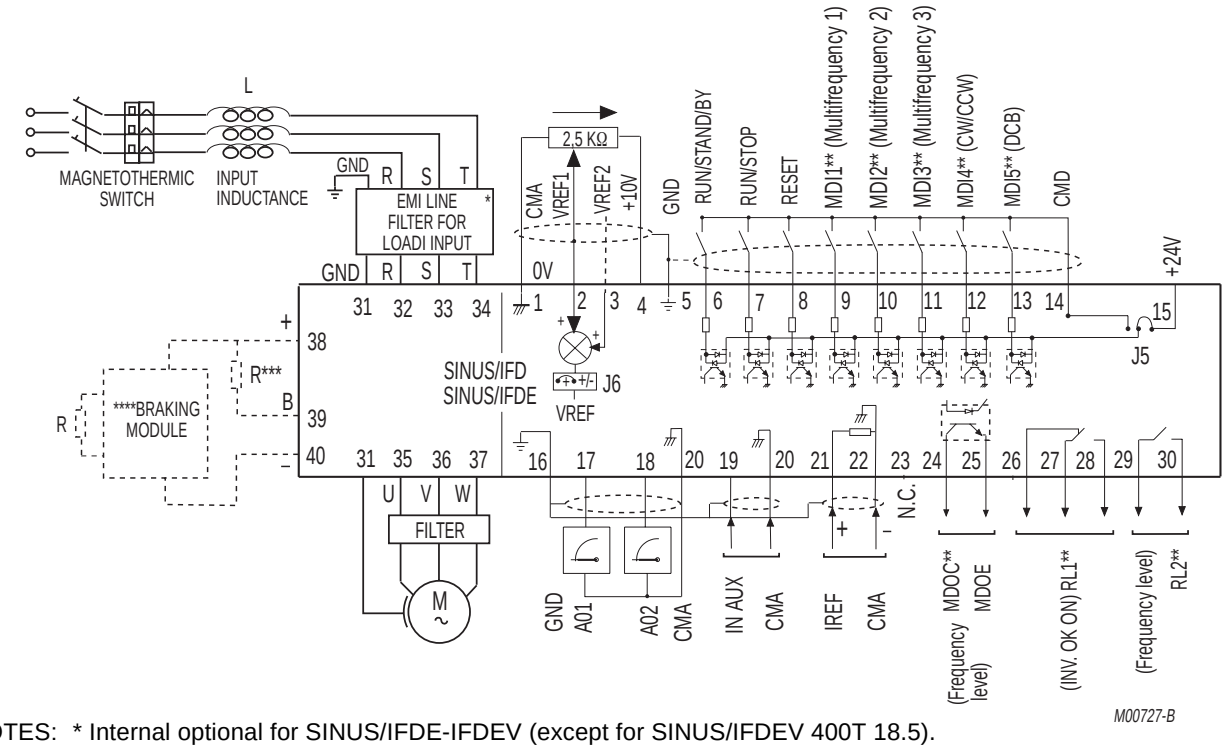



POSITIONING SIDE VIEW FOR THROUGH-PANEL ASSEMBLY

A = DIRECTION OF THE MAIN COOLING AIR FLOW

B = FLOWDIRECTION OF THE SECONDARY COOLING AIR FLOW

## 1.13 WIRING




NOTES: * Internal optional for SINUS/IFDE-IFDEV (except for SINUS/IFDEV 400T 18.5).
**The function of these terminals depends on programming (the factory programming is enclosed in brackets).
***Braking resistor (optional) to be externally connected to use the internal braking module present up to SINUS /IFDE 400T 15, SINUS/ IFDEV 400T 18,5, SINUS/IFDV 400T 22, SINUS/IFD 200T 7.5 and SINUS/IFDV 200T 11 included.
****Braking module (optional) and corresponding braking resistor (optional) for inverter starting from SINUS/IFD 400T 18.5 - SINUS/IFDV 400T 30, SINUS/IFD 200T 11 and SINUS/IFD 200T 15 included.

DANGER: Make changes to connections only 5 minutes after the inverter has been disconnected, so as to allow the complete discharge of the capacitors located on the D.C. intermediate circuit.

DANGER: Use B-type differential switches only.

CAUTION!!: Connect the supply line to supply terminals only. The supply connection to any other terminal can damage the inverter.

CAUTION!!: Always check that the supply voltage is included within the range shown on the identification plate located on the inverter front side.

CAUTION!!: Always connect the earth terminal so as to avoid electric shocks and to reduce noises.
The user has to carry out an earth connection conforming to the standards.

CAUTION!!: Once the connections are set, check that:
- all cables have been correctly connected
- no connection has been forgotten
- no shortcircuit is present between terminals or between terminals and earth.

CAUTION!!: Do not start or stop the motor through a remote control switch located on the inverter power supply.

CAUTION!!: The inverter supply should always be protected by fast-acting fuses or magnetothermic switch.

CAUTION!!: Do not supply with a single-phase voltage.

CAUTION!!: Always assemble the anti-noise filters on the coils of magnetic contactors and solenoid valves.

CAUTION: supplying the inverter with terminals 6 (RUN/STAND-BY) and 7 (RUN/STOP) on and with the reference present, the motor will start immediately. If this characteristic generates dangerous conditions, it can be disabled by setting the parameter C61 to NO (the motor starts by opening and closing terminal 6).

## 1.14 CONTROL TERMINALS

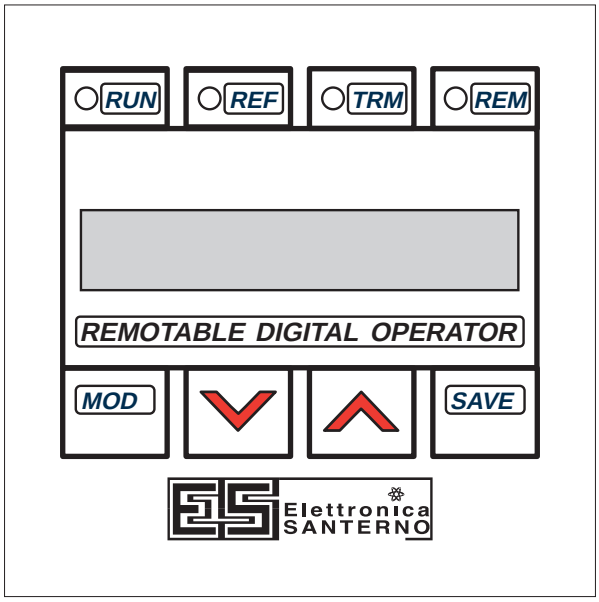
| TERM. | Description | Charact. I/O | Parameters e Jumper |
|---|---|---|---|
| 1 | **CMA** 0V for frequency reference | Control board common | |
| 2 | **VREF1** Input for voltage frequency reference | Vmax ±10V,Rin 40kΩ | J6, P16, P17, P18, |
| 3 | **VREF2** " " " " " " " | resolution: 10 bits | C29, C30 |
| 4 | **+10V** Aux. supply for adjustm. potentiometer for frequency reference | 10V Imax = 10mA | |
| 5 | **GND** Shield connection for potentiometer connection cable | Earth | |
| 6 | **RUN/ STAND-BY** RUN/STAND-BY (active input: running inverter, non-active: idle regardless of the control mode) | opto-insulated digital input | C61, J5 |
| 7 | **RUN/ STOP** run/stop (active input: running inverter, non-active input: the frequency reference is 0, the motor stops according to the deceleration ramp) | opto-insulated digital input | C21, J5 |
| 8 | **RESET** (active input: in case of trip, the inverter operation is restored). | opto-insulated digital input | C50, C51, C52 C53, C65, J5 |
| 9 | **MDI1** multifunction digital input 1 (factory setting: Multifrequency 1) | opto-insulated digital input | C23, J5 |
| 10 | **MDI2** multifunction digital input 2 (factory setting: Multifrequency 2) | opto-insulated digital input | C24, J5 |
| 11 | **MDI3** multifunction digital input 3 (factory setting: Multifrequency 3) | opto-insulated digital input | C25, J5 |
| 12 | **MDI4** multifunction digital input 4 (factory setting: CW/CCW) | opto-insulated digital input | C26, J5 |
| 13 | **MDI5** multifunction digital input 5 (factory setting: DCB) | opto-insulated digital input | C27, J5 |
| 14 | **CMD** OV opto-insulated digital inputs | common for optoins. dig. in | J5 |
| 15 | **+24V** 24V Aux. supply for opto-insulated digital inputs | +24V Imax = 100mA | J5 |
| 16 | **GND** Shield connection of connection cable | Earth | |
| 17 | **A01** Multifunction analog output 1 | Vout = 0÷10V Imax = 4mA resolution: 8 bits | P30, P32, P33, P34, P35, P36, P37 |
| 18 | **A02** Multifunction analog output 2 | Vout = 0÷10V Imax = 4mA resolution: 8 bits | P31, P32, P33, P34, P35, P36, P37 |
| 19 | **INAUX** Auxiliary analog input (factory setting: PID regulator feedback) | Vin = ±10V Rin = 20KΩ resolution: 12 bits | P21, P22, C29, C30 |
| 20 | **CMA** 0V for analog signals | Control board common | |
| 21 | **IREF** Input for current frequency reference (0 ÷ 20mA ; 4 ÷ 20mA) | Rin = 100Ω resolution: 10 bits | P19, P20, C29, C30 |
| 22 | **CMA** 0V for current frequency reference | Control board common | |
| 23 | **N.C.** Not connected | | |
| 24 | **MDOC** Open collector digital output (collector side) | Open collector NPN/PNP | P60, P63, P64, |
| 25 | **MDOE** Open collector digital output (emitter side) (Factory setting: FREQUENCY LEVEL; transistor goes on when the output frequency is higher than 2% of $F_{MAX}$) | (open collector) Vmax = 48V Imax = 50mA (see par. 5.3) | P69, P70 |
| 26 | **RL1** Relay 1 multifunction digital output (norm. closed contact) | 250 Vca, 3A | P61, P65, P66 |
| 27 | Relay 1 multifunction digital output (common) | 30 Vdc, 3A | P71 |
| 28 | Relay 1 multifunction digital output (norm. open contact) (Factory setting: INV OK ON; relay energized when inverter is ready) | | P72 |
| 29 | **RL2** Relay 2 multifunction digital output (norm. open contact) | 250 Vca, 3A | P62, P67, P68 |
| 30 | Relay 2 multifunction digital output (norm. open contact) (Factory setting: FREQUENCY LEVEL; relay energized when the output frequency is higher than 2% of $F_{MAX}$) | 30 Vdc, 3A | P73, P74 |

## 1.15 POWER TERMINALS

| Term. | Description | Abbreviation |
|---|---|---|
| 31 | Earth connection | ⏚ |
| 32-33-34 | Mains (doesn't matter the phase sequence) | R, S, T |
| 35-36-37 | Three-phase supply output for motor | U, V, W |
| 38 | Positive terminal of D.C. link for braking module or braking resistor connection | + |
| 39 | Connection terminal for braking resistor (present for sizes up to SINUS/IFD 400 T - 15, SINUS/IFDV 400T - 22, SINUS/IFD 200T 7,5 and SINUS/IFDV 200T 11) | B |
| 40 | Positive terminal of D.C. link for braking module connection. | – |

# 2.0 REMOTABLE KEYPAD

The inverters of the SINUS/IFD-IFDV and SINUS/IFDE-IFDEV series are provided with a keypad, located on the front side, used for programming and display purposes.




M00080-0

It contains 4 leds, the LCD display and 4 keys. The display shows the parameter values, the diagnostic messages and the inverter-computed quantities.

The keys are named MOD, ⋁, ⋀ and SAVE, and have the following meaning:
- MOD allows to enter and exit from menus and submenus and to make parameters editable (change from display to programming signaled by a blinking cursor);
- ⋀ increase key; scrolls menus and submenus, pages within submenus, parameters in increasing order or, during programming, increases the parameter value.
- ⋁ decrease key; scrolls menus and submenus, pages within submenus, parameters in decreasing order or, during programming, decreases the parameter value.
- SAVE; in programming mode, it saves the modified parameter value on non-volatile memory (EEPROM), so that, when supply is cut out, changes are not lost.

**The inverter use can be simplified by the following shortcuts:**
- RESET: press MOD and SAVE simultaneously.
- RETURN TO MAIN MENU: simultaneoulsy press ∨ and ∧ ; pressing ∨ and ∧ again, you go back to the previous position.
- RETURN TO THE FIRST PAGE OF A SUBMENU: simultaneously press MOD and ∨.

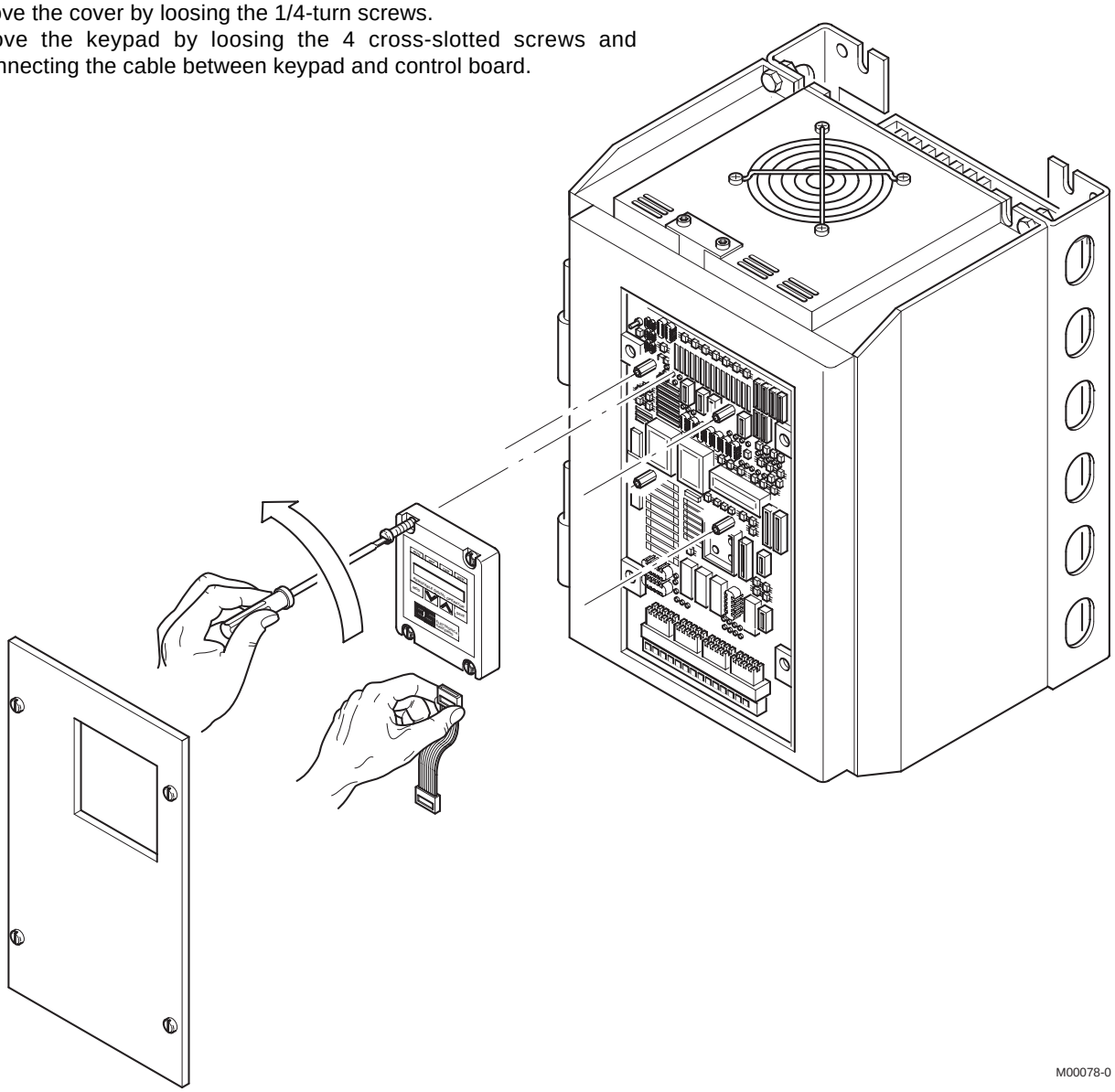
NOTE: when running, the inverter uses the parameter set available at that moment. The parameter updated through ∨ and ∧ is immediately used instead of the previous one, even if SAVE is not pressed. Of course, the new value of this parameter will be lost at power off.

The leds on top of the keypad have the following meaning:

- led RUN: on when the inverter is running, it happens when the inverter is on and a frequency reference is present.
- led REF: indicates a frequency reference other than 0 (from potentiometer, or keypad, etc.).
- led TRM: means that RUN/STOP command is entered from control terminals.
- led REM: means that RUN/STOP commands and multifunction digital input commands (MDI1÷MDI5) come from (see parameter C21) serial line.

The keypad can be remoted by means of the corresponding cable. To do so, you should be provided with the REMOTE KIT which includes:
- Mask for keypad fastening
- Remote cable
- Closing cover

Remove the cover by loosing the 1/4-turn screws.
Remove the keypad by loosing the 4 cross-slotted screws and disconnecting the cable between keypad and control board.



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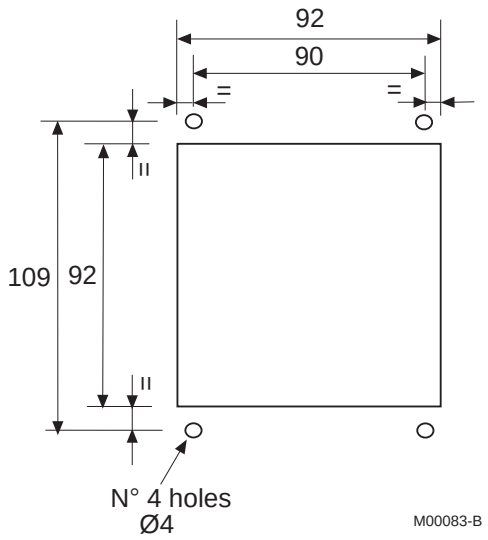
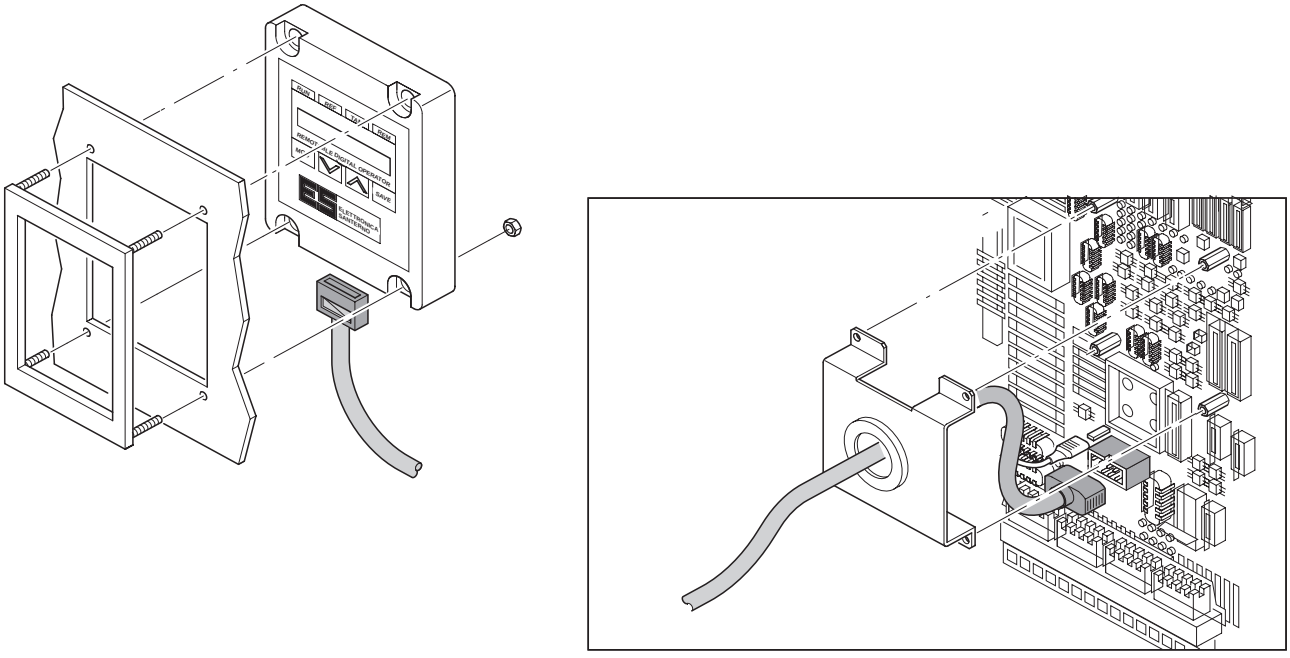
Set the holes according to the drilling scheme shown in figure (standard drilling mask for 96x96 instruments)




Fix the keypad using the proper mask by Elettronica Santerno.
Connect the keypad with the inverter through the proper cable and assemble the closing cover on the inverter.




CAUTION!!: NEVER connect or disconnect the keypad if the inverter is on.

## 2.1 SIGNALS ON BOARD ES 696 (CONTROL BOARD)

**VL red led**: Voltage limit acting during deceleration; it acts when the $V_{DC}$ voltage inside the device exceeds of 20% the rated value during dynamic braking.
**IL red led**: Inverter in current limitation during acceleration or excessive load; it acts when the motor current value exceeds the values set in C41 and C43 (I Limit menu) in acceleration and constant frequency phase respectively.
**RUN green led**: Inverter running; the led is lit when the inverter is running.

# 3.0 TECHNICAL CHARACTERISTICS

## 3.1 TECHNICAL DATA OF SINUS IFDE/IFDEV 400T

| | | | | | | |
|---|---|---|---|---|---|---|
| **INVERTER SINUS/IFDE** | | | 400T5,5 | 400T7,5 | 400T11 | 400T15 |
| SERIES SINUS/IFDE 400T | Output power (kVA) Power supply 380/415 | | 9 | 11,8 | 17,3 | 22,1 |
| | Output power (kVA) Power supply 440/460 | | 10,1 | 13,3 | 19,5 | 24,9 |
| | Applicable motor (kW) Power supply 380/415 | | 6,3 | 8,4 | 12,3 | 16 |
| | Applicable motor (kW) Power supply 440/460 | | 7 | 9,5 | 13,8 | 18 |
| | Output current (A) | | 13 | 17 | 25 | 32 |
| | Peak current (A) | | 26 | 34 | 50 | 64 |
| | Dissipated power (W) | | 158 | 200 | 285 | 400 |
| | Overload | | | 200% 120 s - 150% 240 s | | |
| | Output frequency (Hz) | | | 0 ÷ 800 | | |
| | Braking module | | internal standard | | | |
| | | Max. duty cycle (%) | 50 | | 20 | |
| | | Peak current (A) | 20 | | | |
| | | Min. resistance (Ω) | 39 | | | |
| | EMC filters | | internal optional | | | |
| | Size (l x d x h)(mm) | | 215 x 182 x 391 | | | |
| | Weight (kg) | | 10 | 10 | 11 | 11 |
| Output voltage (V) | | | 0 ÷ 380 - 460 (depending on input voltage) | | | |
| Input voltage (V) | | | 380 ÷ 460 ± 10% | | | |
| Input current (A) | | | 14,5 | 19 | 28 | 35 |
| Input frequency (Hz) | | | 50 ÷ 60 ± 5% | | | |
| Fuse or line switch size (A) | | | 20 | 35 | 35 | 50 |
| Cable section (sqmm) | | | 4 | 4 | 6 | 10 |
| Type of modulation | | | vectorial PWM | | | |
| Output freq. resolution | | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | |
| Degree of protection | | | IPXXB (IP20) | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **INVERTER SINUS/IFDEV** | | | 400T5,5 | 400T7,5 | 400T11 | 400T15 | 400T18,5 |
| SERIES SINUS/IFDEV 400T | Output power (kVA) Power supply 380/415 | | 9 | 11,8 | 17,3 | 22,1 | 27,7 |
| | Output power (kVA) Power supply 440/460 | | 10,1 | 13,3 | 19,5 | 24,9 | 31,2 |
| | Applicable motor (kW) Power supply 380/415 | | 6,3 | 8,4 | 12,3 | 16 | 20 |
| | Applicable motor (kW) Power supply 440/460 | | 7 | 9,5 | 13,8 | 18 | 23 |
| | Output current (A) | | 13 | 17 | 25 | 32 | 40 |
| | Peak current (A) | | 16 | 21 | 30 | 38 | 48 |
| | Dissipated power (W) | | 158 | 200 | 270 | 380 | 420 |
| | Overload | | | 120% 240 s | | | |
| | Output frequency (Hz) | | | 0 ÷ 800 | | | |
| | Braking module | | internal standard | | | | |
| | | Max. duty cycle (%) | 50 | | | 20 | |
| | | Peak current (A) | 20 | | | | |
| | | Min. resistance (Ω) | 39 | | | | |
| | EMC filters | | internal optional | | | | external optional |
| | Size (l x d x h)(mm) | | 215 x 182 x 391 | | | | |
| | Weight (kg) | | 10 | 10 | 10 | 11 | 11 |
| Output voltage (V) | | | 0 ÷ 380 - 460 (depending on input voltage) | | | | |
| Input voltage (V) | | | 380 ÷ 460 ± 10% | | | | |
| Input current (A) | | | 14,5 | 19 | 28 | 35 | 44 |
| Input frequency (Hz) | | | 50 ÷ 60 ± 5% | | | | |
| Fuse or line switch size (A) | | | 20 | 35 | 35 | 50 | 50 |
| Cable section (sqmm) | | | 4 | 4 | 6 | 10 | 10 |
| Type of modulation | | | vectorial PWM | | | | |
| Output freq. resolution | | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | |
| Degree of protection | | | IPXXB (IP20) | | | | |

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## 3.2 TECHNICAL DATA OF SINUS IFDE-IFDEV 200T

| INVERTER SINUS/IFDE | | | 200T4 | 200T5,5 | 200T7,5 |
|---|---|---|---|---|---|
| SERIES SINUS/IFDE 200T | Output power (kVA) | | 6,1 | 9,5 | 12,2 |
| | Applicable motor (kW) | | 4,4 | 6,6 | 8,7 |
| | Output current (A) | | 17 | 25 | 32 |
| | Peak current (A) | | 34 | 50 | 64 |
| | Dissipated power (W) | | 190 | 270 | 380 |
| | Overload | | 200% 120 s - 150% 240 s | | |
| | Output frequency (Hz) | | 0 ÷ 800 | | |
| | Braking module | | internal standard | | |
| | | Max. duty cycle (%) | 50 | 20 | |
| | | Peak current (A) | 20 | | |
| | | Min. resistance (Ω) | 18 | | |
| | EMC filters | | internal optional | | |
| | Size (l x d x h)(mm) | | 215 x 182 x 391 | | |
| | Weight (kg) | | 10 | 11 | 11 |
| Output voltage (V) | | | 0 ÷ 200 ÷ 240 (depending on input voltage) | | |
| Input voltage (V) | | | 200 ÷ 240 ± 10% | | |
| Input current (A) | | | 18 | 28 | 35 |
| Input frequency (Hz) | | | 50 ÷ 60 ± 5% | | |
| Fuse or line switch size (A) | | | 35 | 35 | 50 |
| Cable section (sqmm) | | | 4 | 6 | 10 |
| Type of modulation | | | vectorial PWM | | |
| Output freq. resolution | | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | |
| Degree of protection | | | IPXXB (IP20) | | |

| INVERTER SINUS/IFDEV | | | | 200T5,5 | 200T7,5 |
|---|---|---|---|---|---|
| SERIES SINUS/IFDEV 200T | Output power (kVA) | | | 9,5 | 12,2 |
| | Applicable motor (kW) | | | 6,6 | 8,7 |
| | Output current (A) | | | 25 | 32 |
| | Peak current (A) | | | 30 | 38 |
| | Dissipated power (W) | | | 260 | 360 |
| | Overload | | | 120% 240 s | |
| | Output frequency (Hz) | | | 0 ÷ 800 | |
| | Braking module | | | internal standard | |
| | | Max. duty cycle (%) | | 20 | |
| | | Peak current (A) | | 20 | |
| | | Min. resistance (Ω) | | 18 | |
| | EMC filters | | | internal optional | |
| | Size (l x d x h)(mm) | | | 215 x 182 x 391 | |
| | Weight (kg) | | | 10 | 11 |
| Output voltage (V) | | | | 0 ÷ 200 ÷ 240 (depending on input voltage) | |
| Input voltage (V) | | | | 200 ÷ 240 ± 10% | |
| Input current (A) | | | | 28 | 35 |
| Input frequency (Hz) | | | | 50 ÷ 60 ± 5% | |
| Fuse or line switch size (A) | | | | 35 | 50 |
| Cable section (sqmm) | | | | 6 | 10 |
| Type of modulation | | | | vectorial PWM | |
| Output freq. resolution | | | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | |
| Degree of protection | | | | IPXXB (IP20) | |

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# 3.3 TECHNICAL DATA OF SINUS IFD-IFDV 400T

| | **INVERTER SINUS/IFD** | 400T18.5 | 400T22 | 400T30 | 400T33 | 400T37 | 400T45 | 400T55 | 400T75 |
|---|---|---|---|---|---|---|---|---|---|
| SERIES SINUS/IFD 400T | Output power (kVA) Power supply 380/415 V | 27,7 | 33 | 44,3 | 51,9 | 56,7 | 69,2 | 83 | 107 |
| | Output power (kVA) Power supply 440/460 V | 31,2 | 37,1 | 49,2 | 58,4 | 63,7 | 77,9 | 93 | 120 |
| | Applicable motor (kW) Power supply 380/415 V | 20 | 25 | 34 | 37 | 45 | 55 | 65 | 85 |
| | Applicable motor (kW) Power supply 440/460 V | 23 | 28 | 38 | 45 | 50 | 62 | 75 | 95 |
| | Output current (A) | 40 | 48 | 64 | 75 | 82 | 100 | 120 | 155 |
| | Peak current (A | 80 | 96 | 128 | 150 | 164 | 200 | 240 | 310 |
| | Dissipated power (W) | 440 | 580 | 810 | 880 | 950 | 1200 | 1520 | 2100 |
| | Overload | 200% 120 s - 150% 240 s | | | | | | | |
| | Output frequency (Hz) | 0 ÷ 800 | | | | | | | |
| | Braking module | external standard | | | | | | | |
| | Size (l x d x h)(mm) | Size 2 312x295x409 | | | Size 3 400x270x650 | | | | |
| | Weight (kg) | 24 | 25 | 26 | 45 | 45 | 46 | 47 | 49 |
| Output voltage (V) | | 0 ÷ 380 ÷ 460 (depending on input voltage) | | | | | | | |
| Input voltage (V) | | 380 ÷ 460 ± 10% | | | | | | | |
| Input current (A) | | 44 | 53 | 70 | 83 | 90 | 110 | 132 | 170 |
| Input frequency (Hz) | | 50 ÷ 60 ± 5% | | | | | | | |
| Fuse or line switch size (A) | | 50 | 63 | 80 | 100 | 100 | 125 | 160 | 200 |
| Cable section (sqmm) | | 16 | 16 | 25 | 35 | 35 | 50 | 70 | 95 |
| Type of modulation | | vectorial PWM | | | | | | | |
| Output freq. resolution | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | | | | |
| Degree of protection | | IPXXB (IP20) | | | | | | | |

| | **INVERTER SINUS/IFDV** | | 400T18.5 | 400T22 | 400T30 | 400T33 | 400T37 | 400T45 | 400T55 | 400T75 |
|---|---|---|---|---|---|---|---|---|---|---|
| SERIES SINUS/IFDV 400T | Output power (kVA) Power supply 380/415 V | | 27,7 | 33 | 44,3 | 51,9 | 56,7 | 69,2 | 83 | 107 |
| | Output power (kVA) Power supply 440/460 V | | 31,2 | 37,1 | 49,2 | 58,4 | 63,7 | 77,9 | 93 | 120 |
| | Applicable motor (kW) Power supply 380/415 V | | 20 | 25 | 34 | 37 | 45 | 55 | 65 | 85 |
| | Applicable motor (kW) Power supply 440/460 V | | 23 | 28 | 38 | 45 | 50 | 62 | 75 | 95 |
| | Output current (A) | | 40 | 48 | 64 | 75 | 82 | 100 | 120 | 155 |
| | Peak current (A) | | 48 | 58 | 77 | 90 | 98 | 120 | 144 | 186 |
| | Dissipated power (W) | | 420 | 550 | 770 | 830 | 900 | 1150 | 1450 | 2000 |
| | Overload | | 120% 240 s | | | | | | | |
| | Output frequency (Hz) | | 0 ÷ 800 | | | | | | | |
| | Braking module | internal standard | external optional | | | | | | | |
| | | Max. duty cycle (%) | 50 | | | | | | | |
| | | Peak current (A) | 50 | | | | | | | |
| | | Min. resistance (Ω) | 18 | | | | | | | |
| | Size (l x d x h)(mm) | | Size 2 312x295x409 | | | | | Size 3 400x270x650 | | |
| | Weight (kg) | | 24 | 25 | 26 | 26 | 26 | 46 | 47 | 49 |
| Output voltage (V) | | | 0 ÷ 380 ÷ 460 (depending on input voltage) | | | | | | | |
| Input voltage (V) | | | 380 ÷ 460 ± 10% | | | | | | | |
| Input current (A) | | | 44 | 53 | 70 | 83 | 90 | 110 | 132 | 170 |
| Input frequency (Hz) | | | 50 ÷ 60 ± 5% | | | | | | | |
| Fuse or line switch size (A) | | | 50 | 63 | 80 | 100 | 100 | 125 | 160 | 200 |
| Cable section (sqmm) | | | 16 | 16 | 25 | 35 | 35 | 50 | 50 | 95 |
| Type of modulation | | | vectorial PWM | | | | | | | |
| Output freq. resolution | | | 0,1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | | | | |
| Degree of protection | | | IPXXB (IP20) | | | | | | | |

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| | **INVERTER SINUS/IFD** | 400T90 | 400T110 | 400T132 | 400T160 | 400T200 | 400T250 |
|---|---|---|---|---|---|---|---|
| SERIES SINUS/IFD 400T | Output power (kVA) Power supply 380/415 V | 125 | 152 | 180 | 215 | 260 | 332 |
| | Output power (kVA) Power supply 440/460 V | 140 | 170 | 202 | 241 | 292 | 374 |
| | Applicable motor (kW) Power supply 380/415 V | 100 | 120 | 140 | 170 | 210 | 265 |
| | Applicable motor (kW) Power supply 440/460 V | 115 | 135 | 160 | 190 | 235 | 300 |
| | Output current (A) | 180 | 220 | 260 | 310 | 375 | 480 |
| | Peak current (A | 270 | 330 | 390 | 465 | 560 | 720 |
| | Dissipated power (W) | 2300 | 2850 | 3450 | 4200 | 5250 | 6500 |
| | Overload | 150% 240 s | | | | | |
| | Output frequency (Hz) | 0 ÷ 120 | | | | | |
| | Braking module | external standard | | | | | |
| | Size (l x d x h)(mm) | Size 4 630x314x880 | | | | GR5 650x410x1000 | |
| | Weight (kg) | 91 | 96 | 98 | 100 | | |
| Output voltage (V) | | 0 ÷ 380 ÷ 460 (depending on input voltage) | | | | | |
| Input voltage (V) | | 380 ÷ 460 ± 10% | | | | | |
| Input current (A) | | 200 | 245 | 290 | 345 | 415 | 530 |
| Input frequency (Hz) | | 50 ÷ 60 ± 5% | | | | | |
| Fuse or line switch size (A) | | 250 | 250 | 315 | 400 | 500 | 630 |
| Cable section (sqmm) | | 120 | 150 | 180 | 210 | 2x150 | 2x180 |
| Type of modulation | | vectorial PWM | | | | | |
| Output freq. resolution | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | | |
| Degree of protection | | IPXXB (IP20) | | | | IP20 with optional accessories | |

| | **INVERTER SINUS/IFDV** | 400T90 | 400T110 | 400T132 | 400T160 | 400T200 | 400T250 | 400T315 |
|---|---|---|---|---|---|---|---|---|
| SERIES SINUS/IFDV 400T | Output power (kVA) Power supply 380/415 V | 125 | 152 | 180 | 215 | 260 | 332 | 415 |
| | Output power (kVA) Power supply 440/460 V | 140 | 170 | 202 | 241 | 292 | 374 | 467 |
| | Applicable motor (kW) Power supply 380/415 V | 100 | 120 | 140 | 170 | 210 | 265 | 340 |
| | Applicable motor (kW) Power supply 440/460 V | 115 | 135 | 160 | 190 | 235 | 300 | 380 |
| | Output current (A) | 180 | 220 | 260 | 310 | 375 | 480 | 600 |
| | Peak current (A) | 216 | 264 | 312 | 372 | 450 | 576 | 720 |
| | Dissipated power (W) | 2400 | 2700 | 3250 | 3950 | 4950 | 6200 | 7800 |
| | Overload | 120% 240 s | | | | | | |
| | Output frequency (Hz) | 0 ÷ 800 | 0 ÷ 120 | | | | | |
| | Braking module: Max. duty cycle (%) / Peak current (A) / Min. resistance (Ω) | external optional | | | | | | |
| | Size (l x d x h)(mm) | Size 3 400x270x650 | Size 4 630x314x880 | | | | GR5 650x401x1000 | |
| | Weight (kg) | 50 | 91 | 98 | 98 | 100 | | |
| Output voltage (V) | | 0 ÷ 380 ÷ 460 (depending on input voltage) | | | | | | |
| Input voltage (V) | | 380 ÷ 460 ± 10% | | | | | | |
| Input current (A) | | 200 | 245 | 290 | 345 | 410 | 530 | 660 |
| Input frequency (Hz) | | 50 ÷ 60 ± 5% | | | | | | |
| Fuse or line switch size (A) | | 250 | 250 | 315 | 400 | 450 | 630 | 800 |
| Cable section (sqmm) | | 95 | 150 | 180 | 210 | 240 | 2x180 | 2x210 |
| Type of modulation | | vectorial PWM | | | | | | |
| Output freq. resolution | | 0,1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | | | |
| Degree of protection | | IPXXB (IP20) | | | | | | |

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# 3.4 TECHNICAL DATA OF SINUS IFD-IFDV 200T

| | **INVERTER SINUS/IFD** | 200T11 | 200T15 | 200T18,5 | 200T22 | 200T30 | 200T37 | 200T45 | 200T55 | 200T75 | 200T90 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SERIES SINUS/IFD 200T | Output power (kVA) | 18,3 | 22,1 | 27,4 | 31,2 | 38 | 45,6 | 58,9 | 68,4 | 99 | 118 |
| | Applicable motor (kW) | 13 | 16 | 20 | 23 | 30 | 37 | 47 | 55 | 80 | 97 |
| | Output current (A) | 48 | 58 | 72 | 82 | 100 | 120 | 155 | 180 | 260 | 310 |
| | Peak current (A) | 96 | 116 | 144 | 164 | 200 | 240 | 310 | 270 | 390 | 465 |
| | Dissipated power (W) | 550 | 710 | 800 | 910 | 1150 | 1450 | 2000 | 2200 | 3300 | 3900 |
| | Overload | 200% 120 s - 150% 240 s | | | | | | | 150% 240 s | | |
| | Output frequency (Hz) | 0 ÷ 800 | | | | | | | | | |
| | Braking module | external optional | | | | | | | | | |
| | Size (l x d x h)(mm) | Size 2 312x295x409 | | Size 3 400x270x650 | | | | | Size 4 630x314x880 | | |
| | Weight (kg) | 25 | 26 | 44 | 45 | 46 | 47 | 49 | 96 | 98 | 100 |
| Output voltage (V) | | 0 ÷ 200 ÷ 240 (depending on input voltage) | | | | | | | | | |
| Input voltage (V) | | 200 ÷ 240 ± 10% | | | | | | | | | |
| Input current (A) | | 53 | 64 | 80 | 90 | 110 | 132 | 170 | 200 | 290 | 345 |
| Input frequency (Hz) | | 50 ÷ 60 ± 5% | | | | | | | | | |
| Fuse or line switch size (A) | | 63 | 80 | 100 | 100 | 125 | 160 | 200 | 250 | 315 | 400 |
| Cable section (sqmm) | | 16 | 25 | 35 | 35 | 50 | 70 | 95 | 120 | 180 | 210 |
| Type of modulation | | vectorial PWM | | | | | | | | | |
| Output freq. resolution | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | | | | | | |
| Degree of protection | | IPXXB (IP20) | | | | | | | | | |

| | **INVERTER SINUS/IFDV** | | 200T11 | 200T15 | 200T18,5 | 200T22 | 200T30 | 200T37 | 200T45 | 200T55 | 200T75 | 200T90 | 200T110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SERIES SINUS/IFDV 200T | Output power (kVA) | | 18,3 | 22,1 | 27,4 | 31,2 | 38,0 | 45,6 | 58,9 | 68,4 | 99 | 118 | 143 |
| | Applicable motor (kW) | | 13 | 16 | 20 | 23 | 30 | 37 | 47 | 55 | 80 | 97 | 114 |
| | Output current (A) | | 48 | 58 | 72 | 82 | 100 | 120 | 155 | 180 | 260 | 310 | 375 |
| | Peak current (A) | | 58 | 70 | 87 | 98 | 120 | 144 | 186 | 216 | 312 | 372 | 450 |
| | Dissipated power (W) | | 510 | 670 | 750 | 860 | 1100 | 1380 | 1900 | 2300 | 3100 | 3800 | 4750 |
| | Overload | | 120% 240 s | | | | | | | | | | |
| | Output frequency (Hz) | | 0 ÷ 800 | | | | | | | | | | |
| | Braking module | | internal standard | external optional | | | | | | | | | |
| | | Max. duty cycle (%) | 50 | | | | | | | | | | |
| | | Peak current (A) | 50 | | | | | | | | | | |
| | | Min. resistance (Ω) | 22 | | | | | | | | | | |
| | Size (l x d x h)(mm) | | Size 2 312x295x409 | | | | Size 3 400x270x650 | | | | Size 4 630x314x880 | | |
| | Weight (kg) | | 16 | 26 | 26 | 27 | 47 | 47 | 49 | 50 | 96 | 98 | 100 |
| Output voltage (V) | | | 0 ÷ 200 ÷ 240 (depending on input voltage) | | | | | | | | | | |
| Input voltage (V) | | | 200 ÷ 240 ± 10% | | | | | | | | | | |
| Input current (A) | | | 53 | 64 | 80 | 90 | 110 | 132 | 170 | 200 | 290 | 345 | 410 |
| Input frequency (Hz) | | | 50 ÷ 60 ± 5% | | | | | | | | | | |
| Fuse or line switch size (A) | | | 63 | 80 | 100 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 450 |
| Cable section (sqmm) | | | 16 | 25 | 35 | 35 | 50 | 50 | 95 | 95 | 180 | 210 | 240 |
| Type of modulation | | | vectorial PWM | | | | | | | | | | |
| Output freq. resolution | | | 0.1 Hz potentiometer-controlled or 0.1 Hz keypad-controlled | | | | | | | | | | |
| Degree of protection | | | IPXXB (IP20) | | | | | | | | | | |

M00696-B

| | | |
|---|---|---|
| **control data** | Inputs for frequency reference | 2 inputs 0 ÷ 10V 1 input 0÷ 20mA full configurable |
| | Acceleration and deceleration times | 0.1 to 6500s with separate adjustments through keypad |
| | Voltage/frequency ratio | It is constant up to motor rated frequency, with possible increase of the low-revolution torque; at higher frequency, a constant voltage operation is reached. The V/f ratio of the whole range can be set through keypad as needed. |
| **protections** | Undervoltage | It occurs if the supply voltage is lower than 175 Vac for 200T, 320Vac for 380T and 400T |
| | Overvoltage | It occurs if the supply voltage is higher than 280 Vac for 200T, 440Vac for 380T, 510 Vac for 400T |
| | Prot. in case of regeneration | It trips when an excessive voltage increase occurs on the D.C. link capacitors (435 V for 200T, 740V for 380T, 800V for 400T) |
| | Temperature protection | It trips if the heatsink temperature reaches critical values |
| | Thermal prot. of motor software | It trips, if enabled, in case of motor overheating |
| | Mechanical overload | In case of overload, the output frequency value is decreased so as to keep the current within safety values. |
| | Matching of flywheel load | In case of deceleration, with a high flywheel load, it increases the deceleration ramp time automatically, thus avoiding inverter tripping due to sudden regeneration. |
| | Protection during starting | If, in acceleration phase, an excessive current is required, the acceleration ramp time is automatically increased so as to avoid inverter tripping due to instantaneous overcurrent. |
| | Overcurrent instantaneous protection | It trips with too-high current peaks, such as short-circuits between output terminals (35, 36 and 37) and the output and earth terminals, so the integrity of the power section is kept. |
| **rules** | Low Voltage Directive (73/23/CEE and following amendment 93/68/CEE) | EN60146-1-1/IEC146-1-1: Semiconductor convertors. General requirements and line commutated convertors. Part 1-1: Specifications for the basic prescriptions.<br><br>IEC146-2: Semiconductor convertors. Part 2: Semiconductor self-commutated convertors.<br><br>EN50178: Electronic equipment for use in power installations. → pollution degree: 2.<br><br>EN60529/IEC529: Frame degree of protection (IP Code). → degree of protection: IP20.<br><br>EN60204-1/IEC204-1: Machine safety. Machine electric equipment. Part 1: General regulations. |

| | | |
|---|---|---|
| **rules** | Electromagnetic Compatibility Directive (89/336/CEE and following amendments 92/31/CEE, 93/68/CEE and 93/97/CEE) | - Immunity:<br>EN61000-4-2/IEC1000-4-2: Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques. Section 2: Electrostatic discharge immunity tests. EMC Basic Publication. → level 3: 6kV for contact discharge, 8kV for air discharge.<br><br>EN61000-4-3/IEC1000-4-3: Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques. Section 3: Immunity tests over radiofrequency irradiated fields. → level 3: 10V/m field intensity.<br><br>EN61000-4-4/IEC1000-4-4: Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques. Section 4: Transient/fast electric trains immunity tests. EMC Basic Publication. → level 3: 2kV/ 5kHz for the supply ports, 1kV/5kHz for the signal interface, 2kV/5kHz for the control and measuring ports<br><br>EN61000-4-5/IEC1000-4-5: Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques. Section 5: Pulse immunity tests. → level 3: 1kV for line/line coupling and 2 kV for line/ground coupling<br><br>EN61000-4-8/IEC1000-4-8: Electromagnetic compatibility (EMC). Part 4: Measuring and testing techniques. Section 8: Mains frequency magnetic fields immunity test. EMC Basic Publication. → level 3: 10A/m field intensity<br><br>Radiofrequency irradiated and conducted emissions:<br>EN61800-3/IEC1800-3, second environment (industrial sector) → without using RFI filters<br>EN61800-3, first environment (grid), EN55011 group 1, class A and B, EN55022 class A and B → by means of optional RFI filters<br>For choosing the filters to use, see paragraph 9.5 |
| **serial** | Serial interface | A serial interface is standard available for communication and remote parameter setting. The electric standard is RS485; the protocol used is MODBUS in RTU mode (starting from SW version 2.8; for the previous versions, the protocol used is ANSI x3.28), for multi-drop connections between a master (generally a PC) and up to 32 inverters (slave). If required, an opto-insulated conversion modem RS485/ RS232-c is delivered for direct connection with a PC. |
| **environ. condit.** | Working temperature<br>Relative humidity<br>Max. working height | 0 to +40°C ambient (beyond 40°C contact Elettronica Santerno)<br>20 ÷ 90% (without dew)<br>1000m (a.s.l) (beyond 1000 a.s.l. contact Elettronica Santerno) |

NOTE: First environment means an environment including home and industrial users that are directly connected, with no intermediate transformer, to a low voltage electric grid for the power supply of buildings given over to home use. Second environment means any environment including industrial users other than the ones directly connected to a low voltage electric grid for the power supply of buildings given over to home use.

CAUTION!! **The inverters with no RFI filters are never to be connected to low voltage grids in residential areas, as they may cause radiofrequency interference.**

# 4.0 STARTUP BASE PROCEDURE

Procedure valid for terminals control mode (factory setting); for terminals meaning, see the corresponding chapters ("CONTROL TERMINAL BOARD" AND "POWER TERMINAL BOARD").

**1) Connection:** When installing, follow the instructions contained in chapters IMPORTANT NOTES and INSTALLATION.

**2) Power on:** **Supply the inverter with connection to terminal 6 open (inverter in STAND/BY).**

**3) Parameters change:** Go to parameter P01 (Key parameter) and set it to 1. To go to the various parameters, use the keys MODE, DEC (down arrow), INC (up arrow) and SAVE according to the Submenu tree shown in par. 7.3.

**4) Motor parameters:** In case of standard motor (380V 50Hz) running within 0 ÷ 50Hz, go to step 5; otherwise, go to submenu V/f Pattern and set C5 (fmot1) according to the motor rated frequency, C6 (fomax1) to the max. required output frequency and C8 (Vmot1) to the motor rated voltage. Press SAVE to save a parameter each time it is changed.

**5) Start:** Supply, close terminals 6 (Run/Stand by) and 7 (Run/Stop) and send a frequency reference: the RUN and REF leds on the keypad are lit and the motor starts. Check that the motor is running in the required direction; if not, either change terminal 12 (CW/CCW), or open terminals 6 and 7, turn the inverter off and, after some minutes, exchange two phases of the motor.

**6) Troubles:** If no trouble is detected, go to step 7; otherwise, check the connection by controlling the presence of the supply voltages, the D.C. intermediate circuit and the input reference, also following possible alarm indications on the display. The Measure submenu also displays: the reference frequency (M01), the supply voltage of the control section (M05), the voltage of the D.C. intermediate circuit (M06), the state of terminals 6, 7, 8, 9, 10, 11, 12 and 13 (M08; a number other than 0 indicates that the corresponding terminal is enabled). Check that these indications match the measurements performed.

**7) Other param. changes** **Note that the Cxx parameters of the CONFIGURATION menu can be changed with inverter in STAND BY or STOP mode only.**
Any time a parameter change is needed, always remember to set parameter P01 to 1. We recommend to write down the changes on the report shown at the end of this manual.

**8) Reset:** If during the operation an alarm is detected, try to find out the problem, then reset by temporary enabling terminal 8 (Reset) or by contemporary pressing the MOD and SAVE keys. For convenience, write down the changes on the included leaflet.

DANGER: Make change in connections at least 5 minutes after disconnecting the inverter, so that the capacitors on the D.C. intermediate circuit are completely discharged.

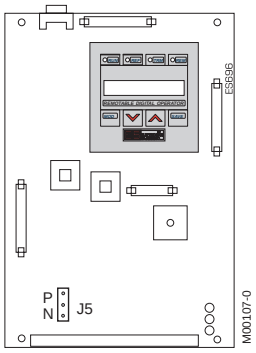
DANGER: At startup, the rotation direction can be wrong. Send a low frequency reference, check that the rotation direction is correct and, if necessary, make the required adjustment.

CAUTION: If an alarm message appears, before starting the device, try to find out the problem which caused it.

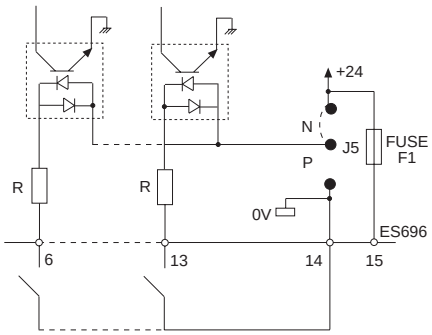
# 5.0 DESCRIPTION OF INPUT AND OUTPUT SIGNALS

## 5.1 DIGITAL CONTROL SIGNALS

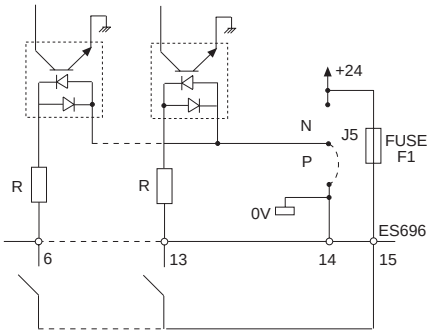
All control signals are galvanic isolated from the control board of the inverter ( ES 696), so to enable them, refer to the supplies on terminals 14 and 15.
According to J5 jumper position, the signals can be enabled both toward earth (NPN-type control) and toward + 24 (PNP-type command).
Figure 5.1 shows the different control modes, according to jumper J5 position.
The +24 auxiliary supply (terminal 15) is protected through an auto-reset fuse (F1).



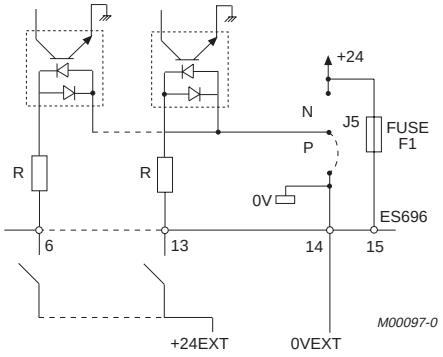

Location of J5 on the control board ES 695




NPN-type command (factory setting)




PNP-type command with the auxiliary supply




PNP-type command with an external supply source.

*Fig. 5.1 - Control mode of digital inputs*

NOTE: Terminal 14 (CMD - common of digital inputs) is galvanic isolated from terminals 1,20,22 (CMA - control board common) and terminal 25 (MDOE = emitter terminal of multifunction digital output).

The state of digital inputs is shown by parameter M08 of Measure menu. The digital inputs (except from terminals 6 and 8) are not enabled with parameter C21 set to REM. In this case, inputs 7 ÷ 13 are controlled through serial line. With parameter C21 set to Kpd, input 7 is controlled through keypad.

### 5.1.1 RUN/STANDBY (TERMINAL 6)

The RUN/STANDBY input must always be enabled to operate the inverter regardless of the control modes.
If the RUN/STANDBY input is disabled, the inverter output voltage is cut out, so the motor coasts to stop. Any undesired motor starts can be avoided, if RUN/STANDBY is enabled at device power on, the inverter will not start until terminal 6 is opened and closed again. This safety measure can be disabled through parameter C61. The RUN/STAND-BY input enabling also unlocks the PID regulator when used independently from the inverter operation (C28=Ext), if neither MD13 nor MD14 are programmed as A/M (Automatic/Manual).

NOTE: The RUN/STANDBY command enables the alarms corresponding to the mains voltage level (A30, A31) and to the integrity of the fuse located in the power section (A 10).

## 5.1.2 RUN / STOP (TERMINAL 7)

This input is enabled by programming the control modes through terminal board (factory setting; parameter C 21) . With active input, the frequency reference is enabled; with inactive input, the frequency reference is set to 0, so the output frequency decreases up to 0 according to the preset deceleration ramp. If C21 is set to KPD, keypad control, this input is disabled and its function is accomplished by the remotable keypad (see Commands menu in the chapter concerning the programming parameters).
Setting C25, C26 or C27=REV (backward run) it is possible to use the RUN/STOP input only with REV input disabled. Enabling both RUN/STOP and REV the frequency reference is set equal 0.

## 5.1.3 RESET (TERMINAL 8)

If a protection trips, the inverter is locked, the motor coasts to stop and the display shows an alarm message (see chapter 8.0 "Diagnostics"). The alarm can be released by temporarily enabling input 8 or by simultaneously pressing the MOD and SAVE push-buttons. This only happens if the alarm cause is removed and is signaled by "Inverter OK" on the display. According to factory presetting, once the inverter is unlocked, the restart is obtained by enabling and disabling the RUN/STAND-BY control. If parameter C61 ("RUN/STAND-BY") is set to YES, the RESET operation unlocks the inverter and restarts it as well.
In addition, the reset terminal allows to zero the UP/DOWN controls by setting parameter P25 "U/D RESET" to "YES".

NOTE: With factory setting, if the inverter is turned off, the alarm is not reset, because it is stored in order to appear on the display at next power-on with inverter in lock state: to unlock the inverter, a reset should be performed. To reset, turn the inverter off and set parameter **C53** (PWR Reset) to YES.

CAUTION: In case of alarm, refer to the chapter concerning the diagnostics and, after locating the problem, reset the device.

DANGER: Even with locked inverter, the electric shock risk is still present on the output terminals (U, V, W) and on the terminals connecting the resistive braking devices (+, - , B).

## 5.1.4 MDI 1, MDI 2, MDI 3, MDI 4, MDI 5 (TERMINALS 9, 10, 11, 12, 13)

The function of these command inputs depends on the programming of parameters C23, C24, C25, C26, C27 according to the following table.

| Terminal | Name | Possible functions | Factory setting | Parameter |
|---|---|---|---|---|
| 9 | MDI 1 | Multifrequency 1,<br>UP, VAR%1 | Multifrequency 1 | C23 |
| 10 | MDI 2 | Multifrequency 2,<br>DOWN, VAR%2 | Multifrequency 2 | C24 |
| 11 | MDI 3 | Multifrequency 3, A/M<br>VAR%3, CW / CCW, DCB,REV | Multifrequency 3 | C25 |
| 12 | MDI 4 | Multifrequency 4, A/M<br>Multiramp 1, DCB<br>CW/CCW, REV | CW/CCW | C26 |
| 13 | MDI 5 | DCB,Multiramp 2,<br>CW/CCW, V/F2, Ext A, REV | DCB | C27 |

### 5.1.4.1 Multifrequency - Programmable frequency levels (terminals 9, 10, 11, 12, C23 = C24 = C25 = C26 = mltf)

The function allows to generate 15 frequency references which can be programmed through parameters P40 ÷ P54. The table shows the active frequency reference, according to the state of multifrequency programmed inputs MDI 1 ÷ MDI 4 and the RUN / STOP function (this function can be enabled through terminal 7, from keypad or through serial line according to C21 programming). The frequency reference generated will be used as the one in effect with parameter P39 (M. F. FUN) set to "ABS" (factory setting). If setting P39=ADD, the frequency reference generated is added to the main one.

| Run/Stop | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MDI 1 | X | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| MDI 2 | X | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| MDI 3 | X | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| MDI 4 | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Active freq. reference | 0 | ✶ | P40 FREQ1 | P41 FREQ2 | P42 FREQ3 | P43 FREQ4 | P44 FREQ5 | P45 FREQ6 | P46 FREQ7 | P47 FREQ8 | P48 FREQ9 | P49 FREQ10 | P50 FREQ11 | P51 FREQ12 | P52 FREQ13 | P53 FREQ14 | P54 FREQ15 |

✶ : C22 = TERM, Sum of references on terminals 2, 3, 21
C22 = KPD, Frequency reference from keypad, see "COMMANDS" submenu
C22 = SER, Frequency reference sent through serial line.

**NOTE: 0 inactive command**
**1 active command**
**X negligible command**
**C23= C24 = C25 = C26 = Mltf.**

If some terminals only are programmed as multifrequency control, the other terminals having a different function have to be considered inactive.
For example, if MDI 3 and MDI 4 are programmed as multifrequency, FREQ 4, FREQ 8 and FREQ 12 are generated.
In any case, the generated frequency cannot exceed FOMAX. If REV command is enabled, the frequency reference will have opposite signum.

### 5.1.4.2 UP/DOWN (terminals 9 and 10, C23 = UP, C24 = DOWN)

The function allows to increase (UP) or decrease (DOWN) the current frequency reference. With factory setting (P23 UD/Kpd Min=0), until terminal 9 (MDI1) is kept closed, programmed as UP, the frequency reference increases according to the acceleration ramp. Until terminal 10 (MDI2) is kept closed, programmed as DOWN, the frequency reference decreases according to the deceleration ramps, till the reference reaches 0 (without inverting the rotation direction). By setting P23=+/- and keeping terminal 10 closed, the motor rotation is inverted (provided that P15 is set to +/-).
If parameter P24 (U/D MEM) is set to "YES", at power off the change of the required frequency reference is stored. Then, at next power up, if the same frequency reference is used, the reference change is kept. The UP/DOWN controls can be set to zero by enabling the (RESET) terminal after setting P25=YES.

### 5.1.4.3 CW/CCW Inversion command (terminal 12, C 26 = cw/ccw)

With terminal 12 enabling, the motor rotation direction can be changed.
Every inversion action has three separate steps:
a) a deceleration ramp up to zero
b) the rotation direction inversion
c) an acceleration ramp up to the preset speed.
The inversion command can also be sent to terminals 11 and 13 by properly programming the parameters C25 and C27 (see chapters "Parameters and programming", "OP. METHOD" submenu).

### 5.1.4.4 Direct current braking (terminal 13, C27 =DCB)

If terminal 13 is enabled, the direct current braking is performed for a programmable time (for further details, see paragraph "Direct current braking" included in this chapter).
The command for direct current braking can also be sent to terminals 11 and 12 by properly programming parameters C25 and C26 (see chapter "Programming parameters", "OP. METHOD" submenu).

### 5.1.4.5 Multiramp (terminals 12 and 13, C26 and C27 = Mltr).

Using terminals 12 and 13, four different acceleration and deceleration ramp times are available, as shown on the following table.

| | | | | |
|---|---|---|---|---|
| MDI 4 | 0 | 1 | 0 | 1 |
| MDI 5 | 0 | 0 | 1 | 1 |
| Active ramp times | Tac 1 | Tac 2 | Tac 3 | Tac 4 |
| | Tdc 1 | Tdc 2 | Tdc 3 | Tdc 4 |

Note: 0 inactive input
1 active input
C26=C27=MltR

If just one of the two inputs is configured as multiramp, the terminal used for another function is to be considered in inactive state, as shown in table.
For example, if MDI5 only is programmed as multiramp input, Tac 1 and Tdc 1 are obtained with MDI 5 not active, Tac 3 and Tdc 3 with MDI 5 active.

### 5.1.4.6 Percentage change of the reference (terminals 9,10 and 11; C23=C24=C25=VAR%)

This function allows to send a command, through the multifunction digital inputs MDI1, MDI2 and MDI3, that generates a percentage change of the active frequency reference, whose value can be programmed within -100% and +100% through parameters P75 ÷ P81.
The following table shows the frequency reference change according to the state of inputs MDI1, MDI2, MDI3 programmed as command for reference percentage change.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MDI1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| MDI2 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| MDI3 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Freq. ref. change | 0 | P75 VAR.%1 | P76 VAR.%2 | P77 VAR.%3 | P78 VAR.%4 | P79 VAR.%5 | P80 VAR.%6 | P81 VAR.%7 |

**NOTE: 0 Inactive command**
**1 Active command**
**C23 = C24 = C25 = VAR%**

In any case, the output frequency cannot exceed the max. preset frequency (see parameters C6 and C12, fomax1 and fomax2) even if a change occurs requiring a higher frequency.
If some terminals only are programmed as percentage variation command, the other terminals used for different functions are to be considered as inactive, as shown on the table.

Example: With a frequency reference of 30Hz, if a percentage change of -50% is required, an output of 15Hz is obtained.

### 5.1.4.7 V/F2 - Second voltage/frequency characteristic (terminal 13, C27 = V/F2)

This function allows to switch, through remote control switches, the inverter output among motors with different electric characteristics.
If terminal 13 is enabled and programmed as V/F2, the second frequency voltage characteristic is used.

CAUTION!!: Do not open the connection between inverter and motor with running inverter.

NOTE: The command to change the frequency voltage characteristic can only be sent with inverter in STAND-BY or STOP with output frequency set to zero.

### 5.1.4.8 Ext A - External alarm (terminal 13, C27 = Ext A)

This function locks the inverter if terminal 13 is open, programmed as Ext A. The display shows alarm A36, external alarm. To restart the device, close terminal 13 and send a RESET command.

### 5.1.4.9 REV - Reverse (terminals 11, 12 or 13; C25, C26, or C27=REV)

Available from software version 1.05. Enabling REV command the frequency reference will have an apposite signum of that present at that time. The REV command can be sent only after the disabling of RUN/STOP command. If both RUN/STOP and REV commands are sent the frequency reference is set 0 and the motor will stop according to the deceleration ramp.

### 5.1.4.10 A/M - Automatic/Manual (terminals 11 or 12; C25 or C26 = A/M)

This function is useful when using the PID regulator, that is:
- using the PID regulator independently from the inverter operation (C28 = Ext), enabling the A/M control, the regulator is locked (output = 0, integral factor = 0)
- using the regulator as frequency reference, as a correction on the frequency or output voltage (C28 = Ref F, C28 = Add F, C28 = Add V), the control locks the regulator and switches the frequency or voltage reference from the PID regulator to the active frequency reference.

### 5.1.4.11 Lock - (terminals 11 or 12 or 13; C25, C26 or C27= Lock)

If the Lock input is enabled, programming via remotable keypad is inhibited. This function is available starting from SW version 2.8.

## 5.2 MAIN FREQUENCY REFERENCE

The main frequency reference indicates the frequency reference present with active RUN/STOP command only.
This frequency reference can be sent through 2 inputs for voltage signals "Vref" (terminals 2 and 3 for signals, terminal 1 for common), an auxiliary input Inaux (terminal 19) and one input for current signals "Iref" (terminal 21 for signal, 22 for common). These inputs are enabled with parameter C22 set to Term (factory setting).
If the reference is sent to more than one input, their sum will be considered as a frequency reference.

As a voltage frequency reference Vref (terminals 2 and 3), signals 0 ÷ 10V (factory setting) or ± 10V can be sent.
A 10V auxiliary supply is available (terminal 4) which supplies the potentiometer (2.5 ÷ 10K, linear).
To input a signal with ± 10V range, proceed as follows:
- set jumper J6 to +/-
- set parameter P18 (Vref J6 Pos.) to “+/-”
- set parameter P15 (Minimum Freq.) to “+/-”

With this setting, when the frequency reference sign changes, the direction of rotation will be reversed.
Figure 5.2 shows the location of the jumper on the ES 696 control board.
Inaux input (terminal 19) may be sent a voltage with a ± 10V amplitude. With negative signs, the motor direction of rotation will be reversed.
With parameter C22 set to Kpd, the frequency reference is sent through remotable keypad; therefore, the signals applied to terminals 2, 3 and 21 have no effect.
With parameter C22 set to REM, the frequency reference is sent through serial line.

CAUTION!!: Do not apply signals higher than ±10V to terminals 2 and 3; do not apply a current higher than 20mA to terminal 21.

NOTE: Terminals 2, 3 and 21 may be used as reference inputs and for PID regulator feedback (paragraph 6.8).

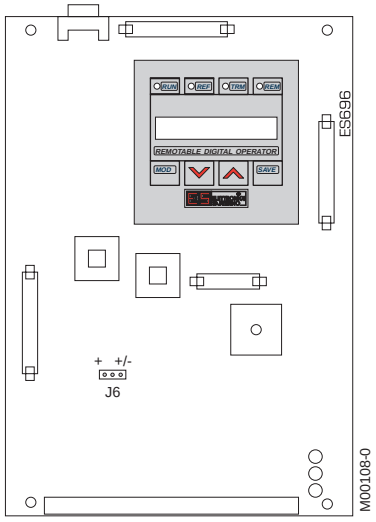



*Figure 5.2 - Location of J6 jumper on the control board*

CAUTION: Do not install any temperature-sensitive component above the inverter, as in that area there is a warm air outlet from the ventilation.

CAUTION: The inverter bottom surface can reach very high temperatures, so the panel that bears it must not be temperature-sensitive.

You can change the ratio between: the signals present on terminals 2, 3 and 21 and the frequency reference through parameters P16 (Vref Bias), P17 (Vref Gain), P19 (Iref Bias) and P20 (Iref gain). The voltage and current inputs can be separately programmed. The factory programming corresponds to input signals 0 ÷ 10V and 4 ÷ 20mA.

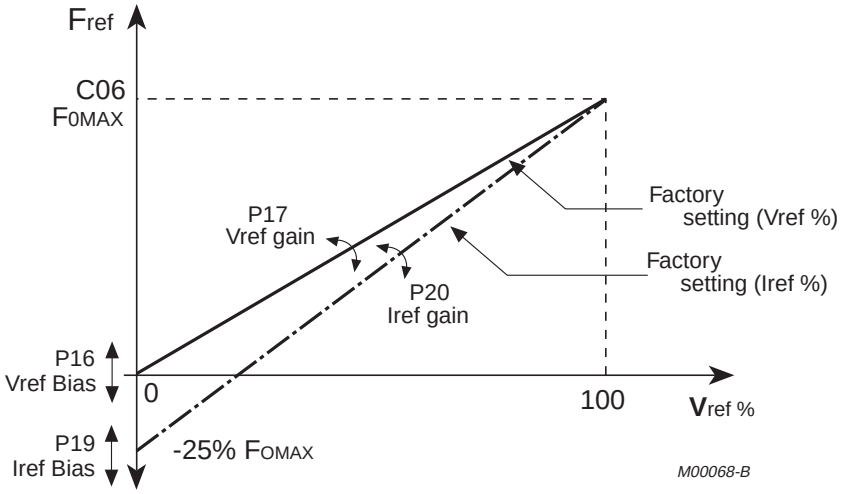



*Figure 5.3 - Parameters related to the frequency reference processing.*

With reference to figure 5.3, the programmable parameters are the following:

**P16-P19:** Vref Bias and Iref Bias; frequency reference value, expressed as a percentage of the max. output frequency (C6 fomax1), available when all the references on terminal board (morsetti 2, 3, 21) are 0.
**P17-P20:** Vref Gain and Iref Gain; proportion coefficient between the references on terminal board and the reference produced.

The frequency reference Fref, measured in Hz when the first V/f curve is active (factory presetting, see par. 6.1) is calculated according to the following formula:

**Fref = C6/100 * (P16 + Vref%/100 * P17) + C6/100 * (P19 + Iref%/100 * P20)**

where Vref% is the sum of the signals at terminals 2 and 3 measured as percentage as regards to 10 V. If the signal sum exceeds 10 V, always consider Vref% = 100%. Iref% is the signal at terminal 21 measured as percentage as regards to 20mA. C6 is the max. output frequency of the inverter measured in Hz, corresponding to the first frequency voltage curve (see par. 6.1). The first sum factor is limited between 0 and C6 with P18 (Vref J6 Pos) set to +; with P18 set to +/- it is limited to ±C6. The second sum factor is limited between 0 and C6; Fref% between ±C6.

Examples:

| | Vref Bias P16 (%) | Vref Gain P17 (%) | Iref Bias P19 (%) | Iref Gain P20 (%) | Input signals Mr 2 (V) | Mr 3 (V) | Mr 21 (mA) | J6 P18 | Output frequency C22 = Term C29 = Ext C30 = INAUX MDI1 ÷ MDI5 non-active |
|---|---|---|---|---|---|---|---|---|---|
| Default | 0 | 100 | -25 | 125 | 0÷10 | 0 | 0 | + | 0 ÷ FOMAX 1 (C6) |
| Default | 0 | 100 | -25 | 125 | 0 | 0 | 4÷20 | + | 0 ÷ FOMAX 1 (C6) |
| Example 1 | 25 | 75 | -25 | 125 | 0÷10 | 0 | 0 | + | 25%FOMAX1÷FOMAX1 (C6) |
| Example 2 | 100 | -100 | -25 | 125 | 0÷10 | 0 | 0 | + | FOMAX 1 ÷ 0 |
| Example 3 | 0 | 200 | -25 | 125 | 0÷5 | 0 | 0 | + | 0 ÷ FOMAX 1 (C6) |
| Example 4 | 0 | 100 | 0 | 100 | 0 | 0 | 0÷20 | + | 0 ÷ FOMAX 1 (C6) |
| Example 5 | 200 | -200 | -25 | 125 | 5÷10 | 0 | 0 | + | FOMAX 1 ÷ 0 |
| Example 6 | 0 | 100 | -25 | 125 | -10÷10 | 0 | 0 | +/- | -FOMAX1 (C6) ÷ FOMAX1 |

NOTE: The value set through parameter C06 (F0MAX1) is assumed as max. output frequency. If the second voltage-frequency characteristic is used, the max. output frequency corresponds to the active one (see paragraphs 5.1.4.7 and 6.1).

Fig. 5.4 shows a block diagram which reports the possible processing of the signals applied to terminal board and of the frequency reference. The position of the different switches is factory preset and corresponds to the active RUN/STOP (no. 7) signal (in addition to the RUN/STAND-BY signal enabling the inverter).

NOTE: The frequency reference range, as shown in the block diagram on Fig. 5.4, is further limited according to current controls through keyboard and digital inputs (Multifrequency, UP/DOWN, VAR%) between a value set by P15 (Minimum Freq.) and $F_{OMAX}$. That is:

- if P15=0, the frequency reference range is positive only (0 ÷ $F_{OMAX}$), so the keyboard or UP/DOWN controls do not invert the rotation direction. If negative frequency values are set in parameters P40÷P54, these ones are not generated.
The rotation direction inversion is obtained through CW/CCW control.

- if P15 is set to a given value (e.g. 10 Hz), the frequency reference changes between this value and $F_{OMAX}$ (e.g. 10 Hz to $F_{OMAX}$). In other words, lower frequency references are not generated (e.g. through the UP/DOWN or keypad controls, a value lower than 10Hz cannot be reached. If parameters P40÷P54 are set to frequency values lower than 10Hz, these ones are not generated).

- If P 15 = “+/-“ (factory presetting) the frequency reference ranges between ± $F_{OMAX,}$ so the rotation direction can be inverted through the keyboard or UP/DOWN controls, provided that parameter P23 (UP/Kpd Min) is set to “+/-“ (see following note). If parameters P40÷P54 are set to negative values, the rotation direction becomes opposite to the positive value.

NOTE: Through the UP/DOWN (terminals 9 and 10, parameters C23 and C24) and keyboard controls, the motor rotation direction can be inverted only if P15 and P23 are set to "+/-". If P23 (UD/Kpd Min) is factory preset to "0", these controls do not invert the rotation direction independently from P15 programming (Minimum freq.).

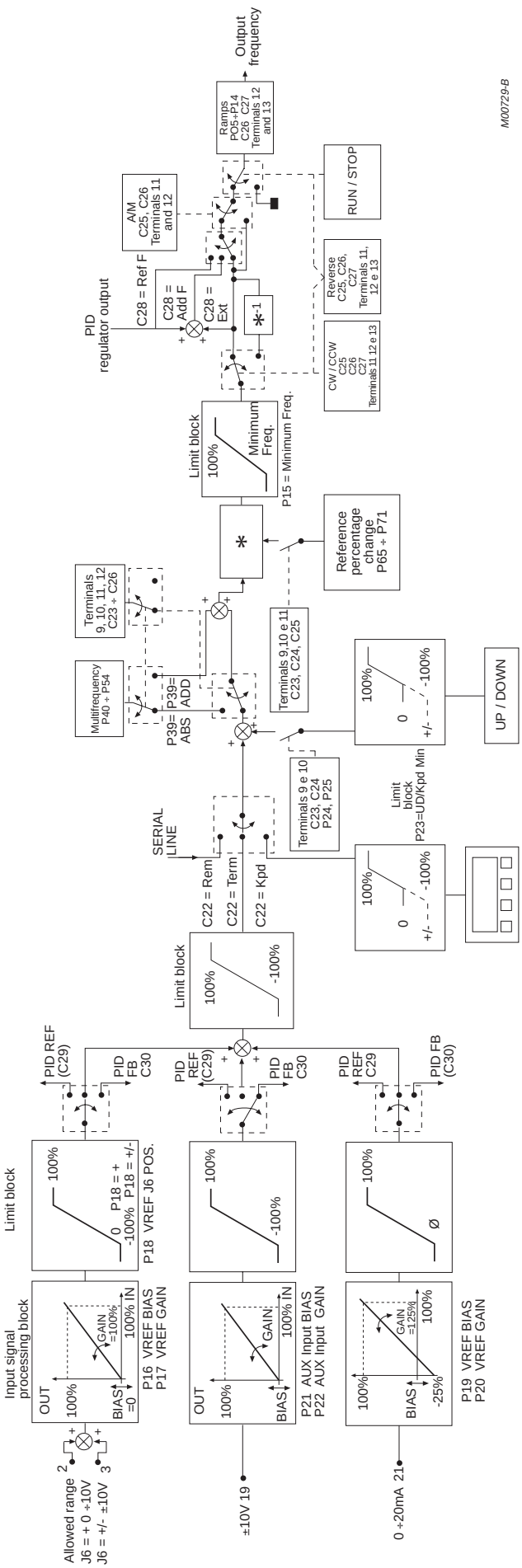



*Figure 5.4 - Block diagram of frequency reference processing*

## 5.3 AUXILIARY ANALOG INPUT

Terminal 19 has an auxiliary input to send the feedback or reference signal if the PID control is used (see Paragraph 6.9, PID regulator) or if the frequency reference is used.
The input signal should be included within ±10V. It is possible to change the ratio between the signal at terminal 19 and the value on the auxiliary input processed by the inverter.
Use parameters P21 (Aux Input Bias) and P22 Aux Input Gain in the same way as the inputs at terminals 2, 3 and 21.

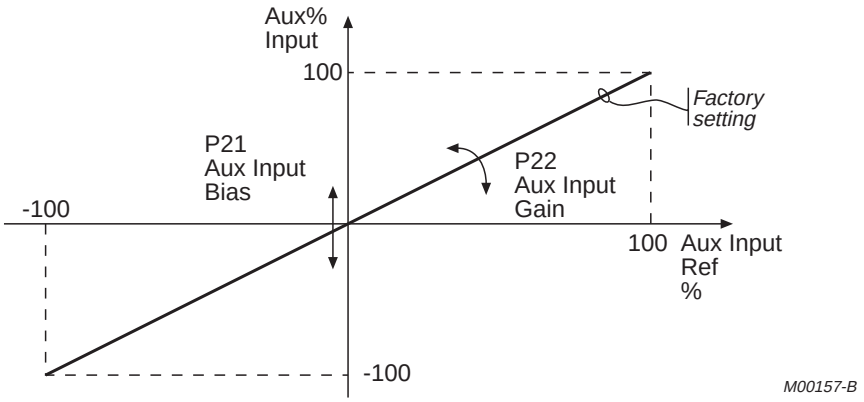



*Figure 5.5 - Parameters corresponding to auxiliary input processing*

With reference to Fig. 5.5, the parameters can be programmed as follows:

P21: Aux Input Bias; auxiliary input value expressed as percentage when the signal applied to terminal 19 is 0.
P22: Aux Input Gain; proportionality coefficient between the signal on terminal board and the value of the auxiliary input processed by the inverter.

The auxiliary input value is determined by the following formula:
Aux Input% = P21 + Aux Ref% / 100
where Aux Input Ref% is the signal at terminal 19 expressed as percentage as regards to 10V.

CAUTION: Do not apply signals higher than ±10V to terminal 19.

## 5.4 ANALOG OUTPUTS

On terminals 17 and 18, two output signals are available (0 ÷10V, $I_{MAX}$ = 4mA) for instrument connection or to send to other devices. Through OUTPUT MONITOR menu (parameters P30 ÷ P37), you can determine the meaning and ratio between output value and measured value.

CAUTION: Do not send an input voltage. Do not exceed the max. current.

## 5.5 MULTIFUNCTION DIGITAL OUTPUT

An OPEN COLLECTOR output, galvanic insulated from the control board common at terminals 24 (collector) and 25 (common terminal), able to drive a max. load of 50mA with a 48V supply.
The output function is determined by parameter P60 of the Digital Output menu. A delay can be programmed at output enabling and disabling through parameters P63 (MDO ON Delay) and P64 (MDO OFF Delay) of the Digital Output menu. (Factory setting: the transistor goes on when the output frequency is higher than 0). The figure shows an example of a relay connection to the output.

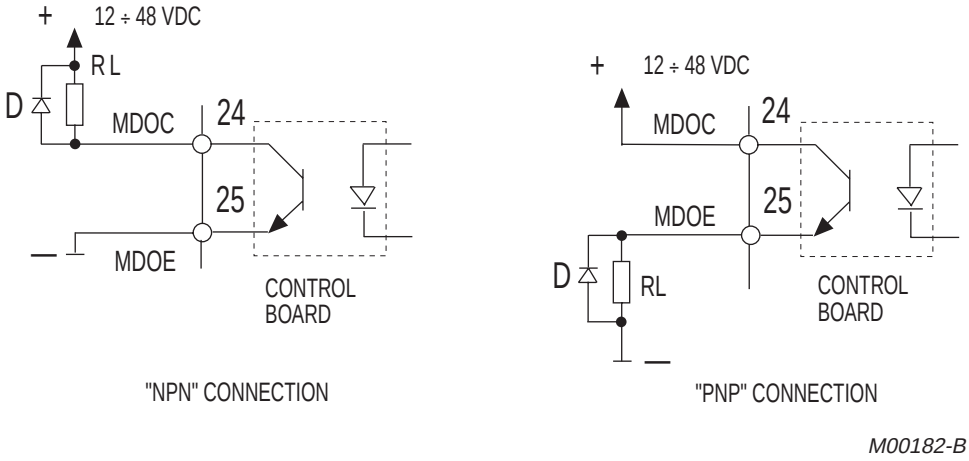



*Fig. 5.6 - Connection of a relay to the multifunction digital output*

CAUTION: When driving inductive loads (e.g. relay coils), always use the recirculation diode (D).

CAUTION: Never exceed the max. voltage and current allowed.

NOTE: Terminal 25 is galvanic isolated from terminals 1, 20, 22, (control board common) and from terminal 14 (digital input common).

NOTE: The voltage between the terminals 15 (+24V) and 14 (0V, CMD) of the control terminals can be used as external supply. The max. available current is 100mA.

## 5.6 RELAY OUTPUTS

Two relay outputs are available on terminal board:
- terminals 26, 27, 28: relay RL1;
an exchange contact (250 Vca, 3A; 30 Vdc, 3A)
- terminals 29, 30: relay RL2;
a normally open contact (250 Vca, 3A; 30Vdc, 3A)

The two relay outputs function depends on the programming of parameters P61 (RL1 Opr) and P62 (RL2 Opr) of Digital Output menu. A delay can be added both at energizing and de-energizing of relays using the Digital Output menu parameters:

- P65 RL1 Delay ON
- P66 RL1 Delay OFF
- P67 RL2 Delay ON
- P68 RL2 Delay OFF

The factory setting is as follows:

RL1: ready relay (terminals 26, 27, 28); it gets energized as soon as the inverter is ready to supply the motor.
At power on, the device takes some seconds before initialization; the relay gets de-energized as soon as an alarm condition occurs, which locks the inverter.

RL2: frequency threshold relay (terminals 29 and 30); it gets energized as soon as the output frequency reaches the frequency set through the "Digital Output" menu (parameters P73 "RL2 level", P74 "RL2 Hyst.").

CAUTION: Never exceed the max. voltage and current allowed at relay contacts.

CAUTION: When driving inductive D.C.-supplied loads, use the free wheeling diode.
When driving inductive a.c.-supplied loads, use the anti-noise filters.

# 6.0 DESCRIPTION OF THE THE MAIN FEATURES OF PROGRAMMABLE FUNCTIONS

## 6.1 FREQUENCY VOLTAGE CHARACTERISTIC

The frequency voltage characteristic generated by the inverter can be adjusted according to the application requirements. All parameters are contained in the **V/f patterns** submenu of the configuration menu. Two frequency voltage characteristics can be programmed; the inverter uses the first characteristic (parameters C5 ÷ C10). To use the second frequency voltage characteristic (parameters C11 ÷ C16), enable input MDI5 programmed as V/F2.

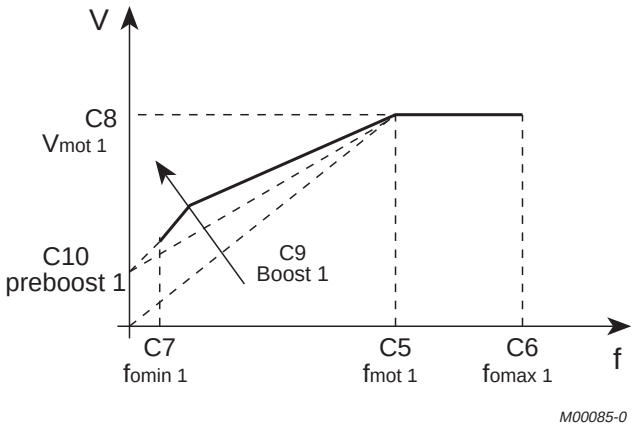



*Figure 6.1 - Parameters related to the frequency voltage characteristic*

Referring to figure 7, the programmable parameters of the frequency voltage characteristic are the following:

**C5**: $f_{mot\ 1}$, rated frequency of the motor; it determines the passage from the area operating at constant torque to the area at constant power.

**C6**: $f_{omax\ 1}$, max. frequency output from the inverter.

**C7**: $f_{omin\ 1}$, min. frequency output from the inverter (to be changed under control of Elettronica Santerno only).

**C8**: $V_{mot\ 1}$, rated voltage of the motor; it determines the output voltage of the inverter at the rated frequency of the motor.

**C9**: BOOST1; it determines the change of the output rated voltage at low frequency. (Boost>0 increases the output voltage in order to increase the starting torque; boost<0 decreases the output voltage at low frequency to reduce the energy consumption at low rev. number, to use when the load has a quadratic torque characteristic like pumps and fans).

**C10**: PREBOOST1; it determines the increase of the output rated voltage at 0Hz.

Example 1:
Programming the frequency voltage characteristic of a 380V/50Hz asynchronous motor to be used up to 80Hz.

C5 =50Hz
C6 =80Hz
C7 =.5Hz
C8 =380V
C9 =depending on the starting torque required.
C10=2.5%

Example 2:
Programming the frequency voltage characteristic of a 380V/200Hz asynchronous motor to be used up to 200Hz.

C5 =200Hz
C6 =200Hz
C7 =.5Hz
C8 =380V
C9 =depending on the starting torque required.
C10=2.5%

## 6.2 DIRECT CURRENT BRAKING

You can supply direct current to the motor in order to stop it. This can be automatically performed during the stop and/or start, or by means of a control through terminal board. All parameters concerning the direct current braking are contained in the **DC BRAKING** submenu of the configuration menu. The direct current intensity supplied is determined by the value of the constant C85 as a percentage of the inverter rated current.

### 6.2.1 DIRECT CURRENT BRAKING AT STOP

This function is activated by setting C80 to YES. The direct current braking is performed after a stop command with ramp if the output frequency is other than 0 when the command is sent. According to the programmed control mode, the direct current braking at stop can be reached as follows:
- opening the connection of terminal 7 in terminal board control mode(or disabling the REV command, if used)
- performing the STOP through keypad.

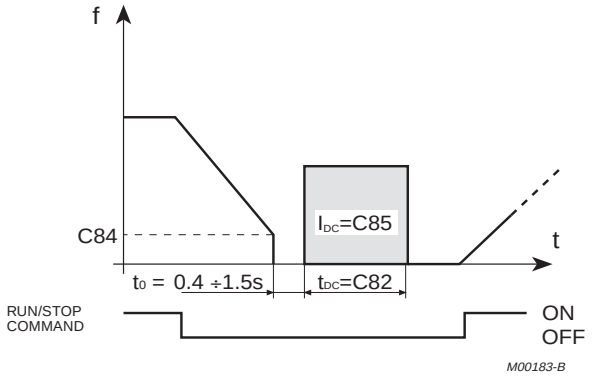



*Figure 6.2 - Output frequency and braking direct current with DC BRAKING AT STOP active*

Figure 6.2 shows the frequency and braking direct current with direct current braking active at STOP. The parameters used to program this function are:
**C80**: function enabling;
**C82**: braking duration;
**C84**: output frequency at which braking starts;
**C85**: intensity of braking current.
The time interval $t_0$ between the end of the deceleration ramp and the beginning of the direct current braking depends on the inverter size.

### 6.2.2 DIRECT CURRENT BRAKING AT START

This function is activated by setting C81 to YES. The direct current braking is performed after a RUN (or REV) command with frequency reference other than zero, before the acceleration ramp. According to the programmed control mode, the direct current braking at start can be reached as follows:
- closing the connections of terminals 6 and 7 in terminal control mode (or terminal set to REV).
- closing one of the connections of the terminals corresponding to the multifrequency digital inputs programmed as multifrequency;
- performing the RUN through keypad.

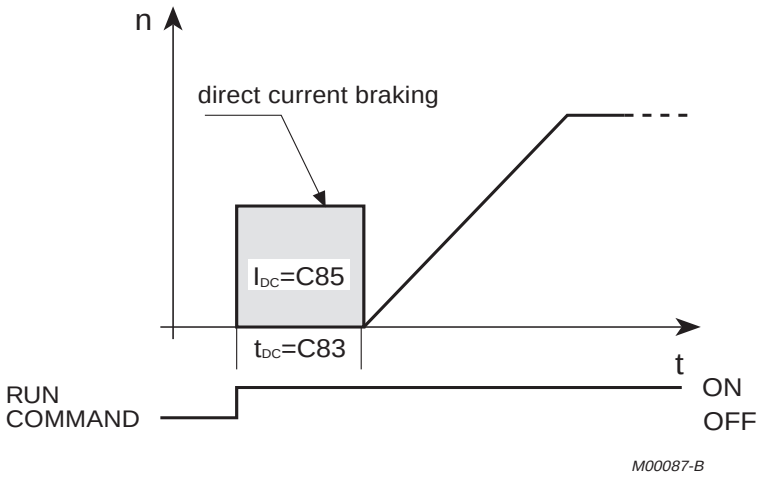



*Figure 6.3 - Output frequency and braking direct current with DC BRAKING AT START active*

Figure 6.3 shows the trend of frequency and braking direct current with D.C. braking active at start. The parameters used to program this function are:
**C81**: function enabling;
**C83**: braking duration;
**C85**: intensity of braking current.

## 6.2.3 DIRECT CURRENT BRAKING WITH TERMINAL BOARD CONTROL

The direct current braking can be controlled by enabling the multifunction digital input programmed as DCB. The motor is left in idle position for a $t_0$ time between 0.4 and 1.5 s, according to the inverter size, then the direct current braking is performed. The duration is determined according to the following formula:

$$\mathbf{t_{DC}=C82*fOUT/C84}$$ with fOUT/C84 max. equal to 10

The following possibilities are available:

a) The time during which the braking control is kept is longer than $t_{DC}+t_0$

*The direct current braking is performed, then the frequency output is generated according to the acceleration ramp.*

b) The time during which the braking control is kept is shorter than $t_{DC} + t_0$ and shorter than the disabling time of $t_{SSdis}$ (C56, see: Searching for motor rotation speed).

*The D.C. braking is interrupted as soon as terminal 13 is opened, then the frequency present before the braking control is produced through the speed searching function, if not disabled. If the speed searching function has been disabled, the acceleration ramp is performed.*

c) The time during which the braking control is kept is shorter than $t_{DC} + t_0$ and longer than the disabling time $t_{SSdis}$ (C56, see: Searching for motor rotation speed).

*The D.C. braking is interrupted as soon as terminal 13 is opened, then the output frequency is produced according to the acceleration ramp;*

d) The time during which the braking control is kept is shorter than $t_0$

*The D.C. braking is not performed, then, after $t_0$ has elapsed, the speed searching function (if enabled) or the acceleration ramp is performed.*

Figure 6.4 shows the output frequency and D.C. braking in different situations.

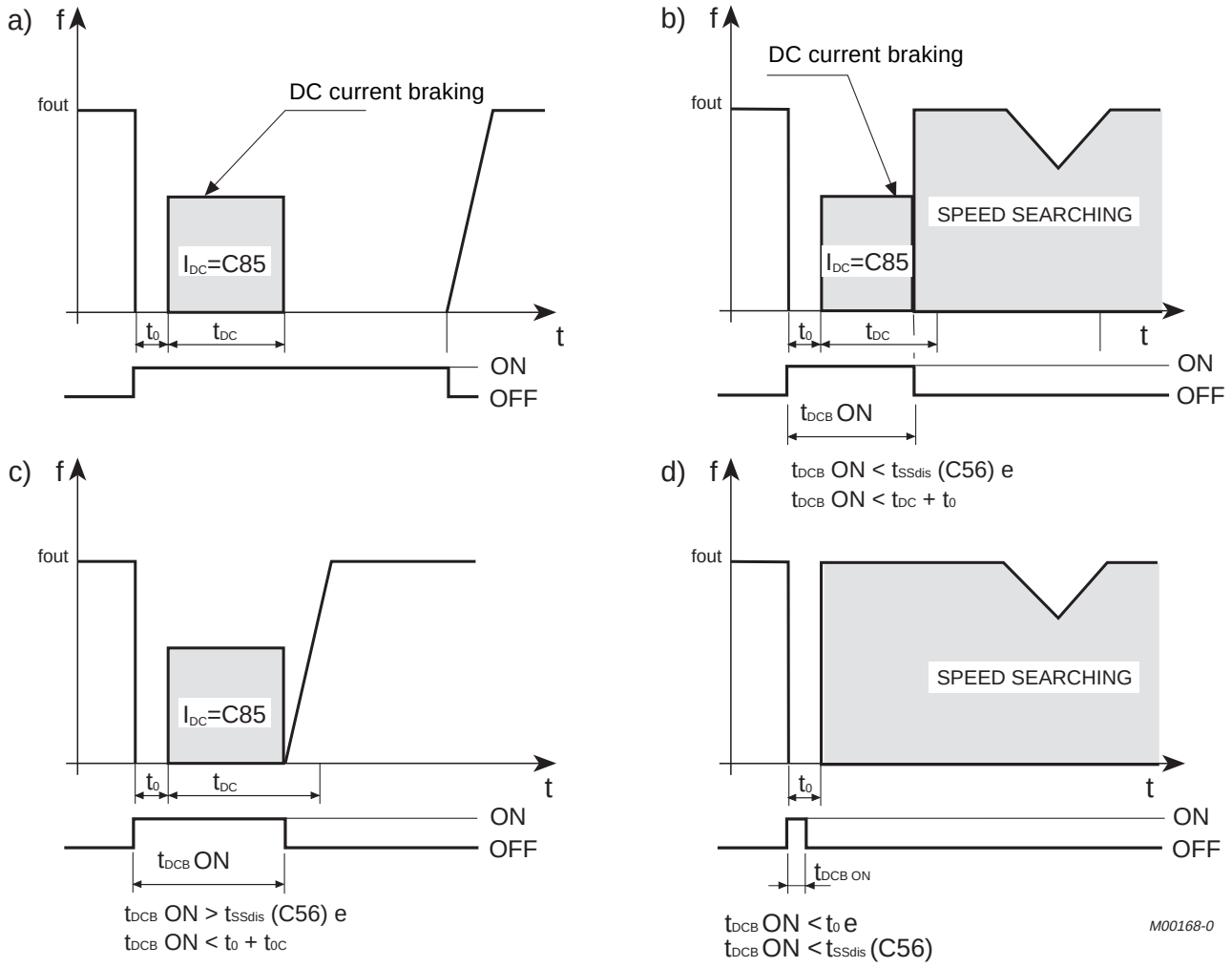



*Figure 6.4 - Output frequency and braking direct current by operating the D.C. braking control*

The parameters used to program this function are:

**C82**: braking duration at STOP;
**C84**: initial braking frequency at STOP;
**C85**: intensity of braking current.
**C56**: Disabling time of speed searching function

## 6.2.4 BRAKING WITH HOLDING DIRECT CURRENT

It is enabled by setting the CONSTANT C86 to YES. **After the stop through D.C. braking**, this determines the permanent supply of direct current with intensity equal to the value set in C87. This function applies a permanent braking action on the motor and due to the winding temperature increase caused by the current, no dew is generated on the motor.

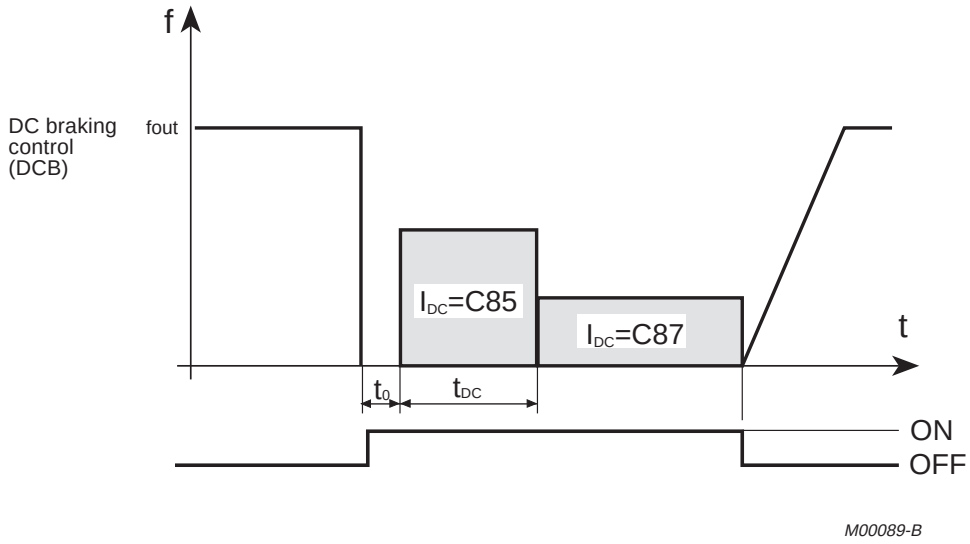



*Figure 6.5 - Output frequency and braking direct current by operating the D.C. braking control with holding direct current active*

Figure 6.5 shows the output frequency and braking direct current by operating the D.C. braking control with holding direct current active. The holding current activates after the direct current generated both from the control in terminal board and from the braking function at STOP.

The parameters used to program this function are:

**C86**: function enabling;
**C87**: intensity of the holding direct current.

## 6.3 SEARCHING FOR MOTOR ROTATION SPEED

*SPEED SEARCHING*

This function allows to match the motor rotation speed again after the inverter has been set to STAND BY and then to RUN again before the $t_{SSdis}$ time of STAND BY has elapsed (C56 of Special function submenu). The function is active when the parameter C55 of the Special function submenu of the Configuration menu is set to YES (factory setting) or YES A.
The speed searching is operated, with C55 set to YES:
- opening and closing terminal 6, before time $t_{SSdis}$ has elapsed (see Fig. 6.6a);
- removing the D.C. braking control before the present time has elapsed (see paragraph 6.2.3);
- resetting an alarm (with reference other than 0), before time $t_{SSdis}$ has elapsed (see Fig. 6.6c).

The speed searching is not performed in case of supply failure which causes the inverter to turn off.
With C55 set to YES A, the speed searching always occurs during the three above mentioned situations (Fig. 6.6a and 6.6c). However, in case of inverter power failure, $t_{SSdis}$ is calculated as the sum of the elapsed time before inverter turning off and after inverter turning on. The time during which the inverter is off is not calculated (Fig. 6.6b and Fig. 6.6d).

If the inverter is set to RUN after a time longer than tDIS, the frequency output is produced according to the acceleration ramp. If C56 is set to 0, when set to RUN the inverter will perform the speed searching operation (if enabled through C55).
Figure 6.6 shows the output frequency and the revolution number of the motor during speed searching in different cases.

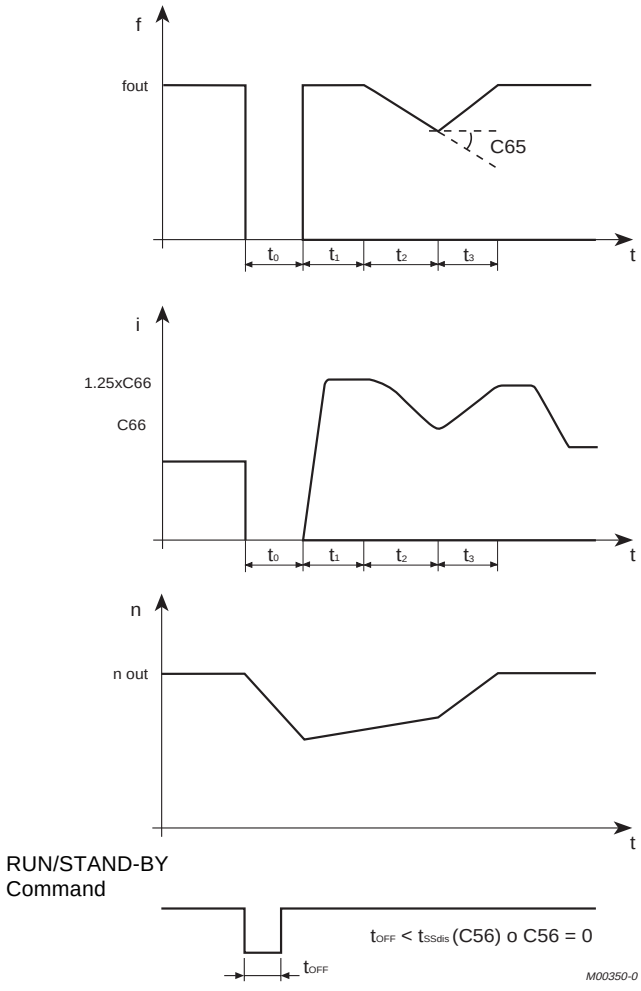
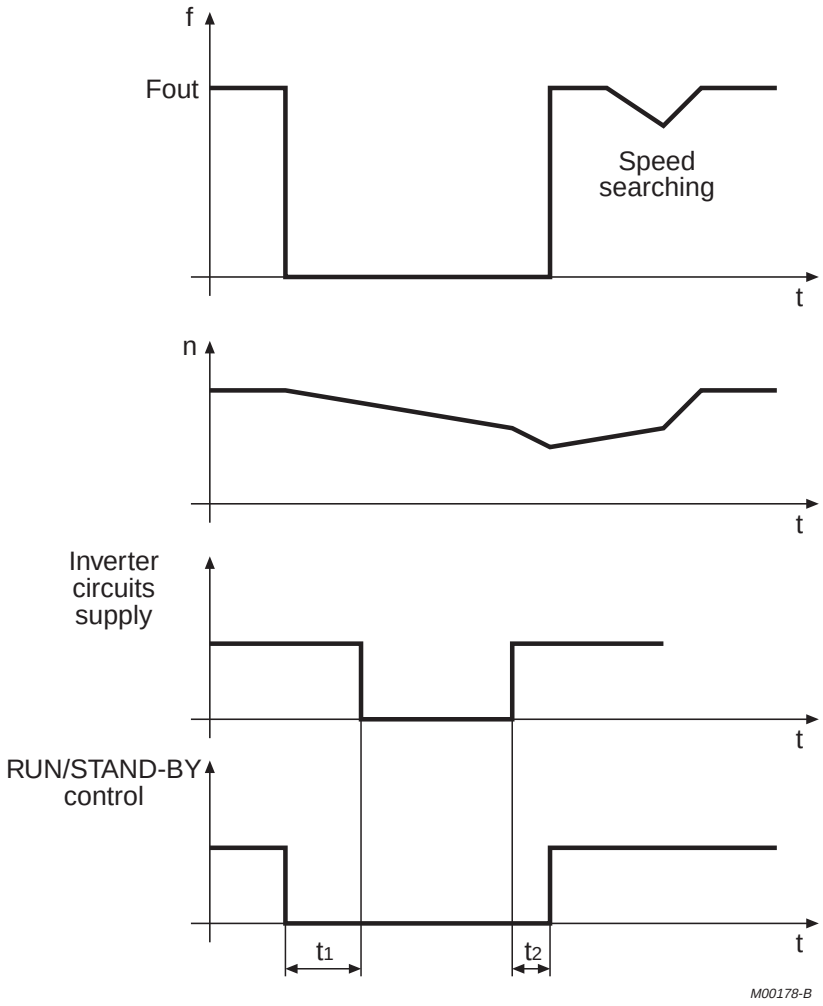



*Figure 6.6a - Output frequency and revolution number of the motor during speed searching. (C55 = YES or C55 = YES A) caused by the RUN/STAND-BY control.*

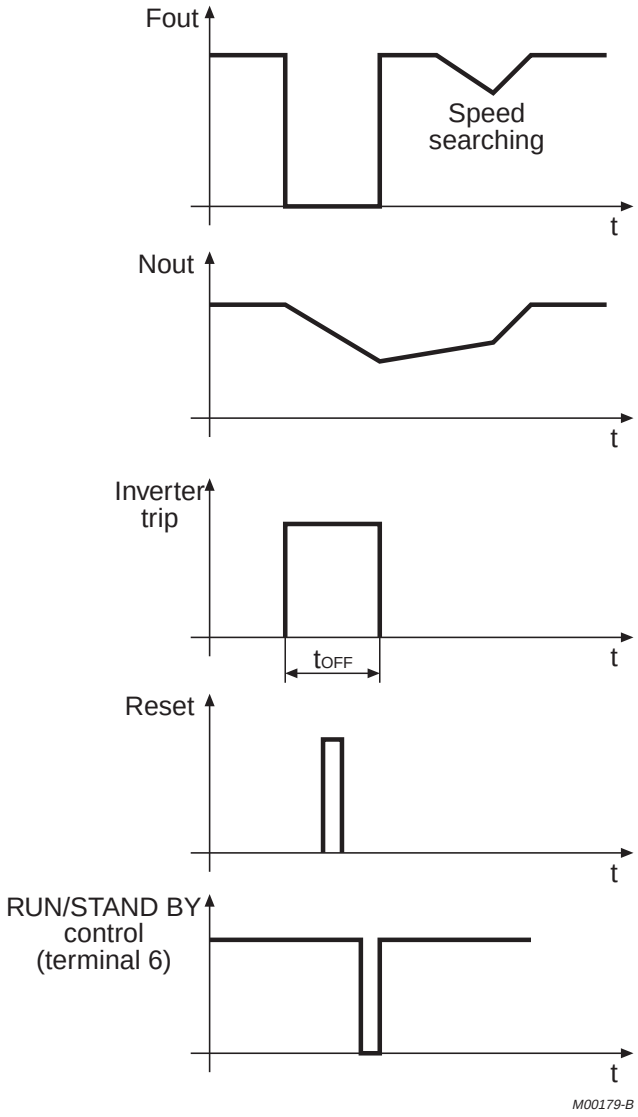
The matching of motor rotation speed, after the demagnetization time $t_0$ of the rotor has elapsed, occurs in three phases:

- the frequency present before inverter was set to STAND-BY is output during t1 time;
  in this phase, the output current reaches a value corresponding to 1.25xC66;
- during t2 time, the output frequency is decreased to match the motor rotation speed;
  that is complete when the output current falls below C66;
- during t3 time, the motor reaches the previous rotation speed according to the acceleration ramp.




$t_1 + t_2 < t_{SSdis}$ (C56) o C56 = 0

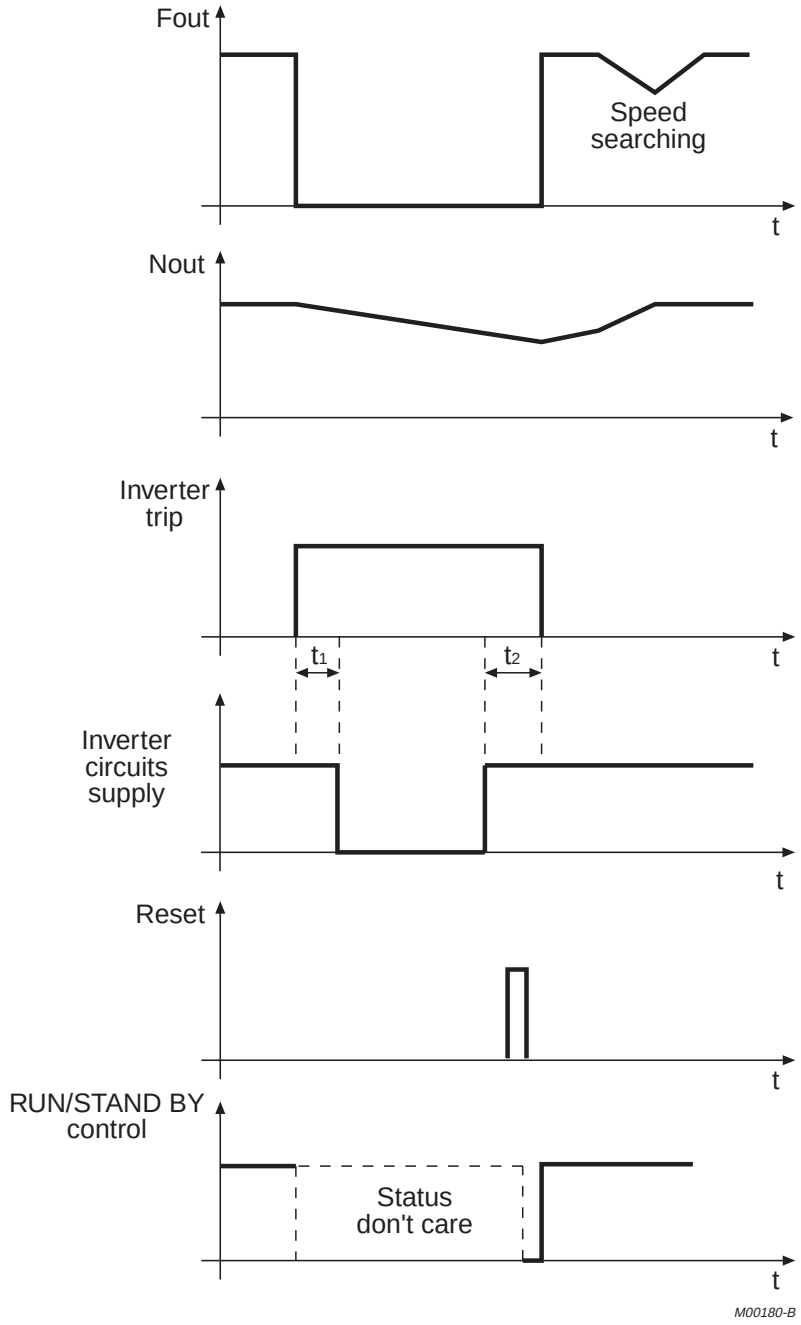
*Figure 6.6.b - Frequency and revolution number of inverter supply motor during speed searching with power failure (C55 = YES A) caused by a RUN/STAND-BY control.*




$t_{OFF} < t_{SSdis}$ (C56) or C56 = 0

*Figure 6.6.c - Output frequency, revolution number, inverter block status, reset and RUN/STAND-BY during speed searching phase generated by alarm tripping (C55 = YES or C55 = YES A)*

If parameter C61 (RUN/SBY) is set to YES, it is not necessary to open or close the RUN/STAND-BY control.




$t_1 + t_2 < t_{SSdis}$ (C56) or C56 = 0

*Figure 6.6.d - Output frequency, revolution number, inverter status, power supply, reset and RUN/STAND-BY control in case of speed searching generated by alarm reset and power failure (C55 = YES A).*

If parameter C61 (RUN/SBY) is set to YES, it is not necessary to open or close the RUN/STAND-BY control after RESET or at inverter power on with C53 set to YES (see following note)

If parameter C53 (PWR Reset) is set to YES, it is not necessary to use the reset control.

## 6.4 CONTROLLED STOP AT POWER DOWN

***POWER DOWN***

If mains goes down, this function allows to perform a controlled motor stop.
This is done using the motor and load kinetic energy to supply the inverter when the mains is not available. When a time programmable through C36 (Power Delay time) has elapsed from mains failure, a deceleration ramp is generated according to a value programmable through C37 (PD Dec. Time).

Three options are available with parameter C35:

- **C35 = NO**. Function inhibited (factory setting).
- **C35 = YES**. In case of mains failure for a time longer than C36, if RUN/STAND-BY and RUN/STOP controls are active, the controlled stop is performed.
- **C35 = YES A**. In case of mains failure for a time longer than C36, the controlled stop is performed even if the RUN/STAND-BY and RUN/STOP controls are inactive. When the mains is restored, if the RUN/STOP and RUN/STAND-BY controls are not active, the inverter remains in deceleration ramp for 5 seconds then, if RUN/STAND-BY is not yet active, the inverter is disabled and the motor enters idle operation.

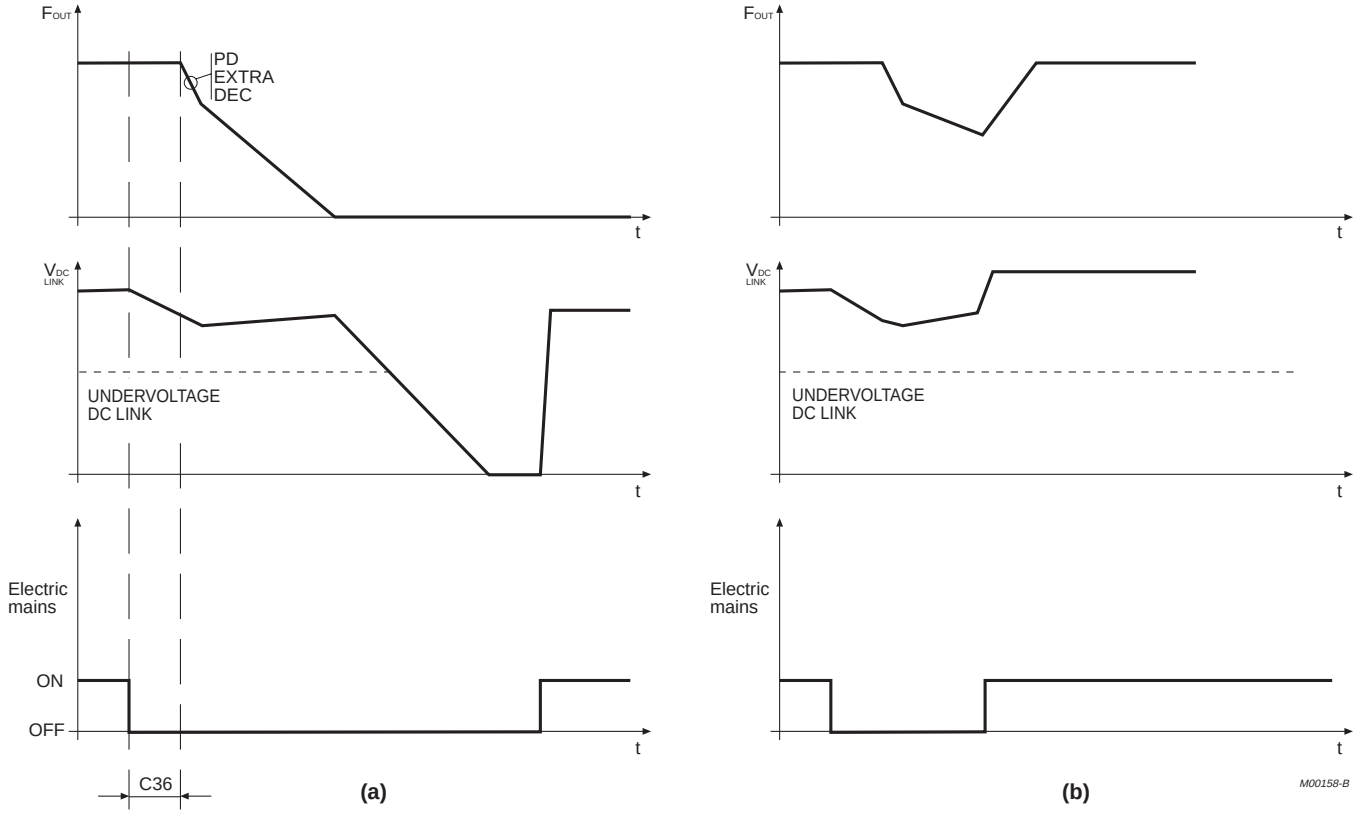



*Figure 6.7 - Output frequency ($F_{OUT}$), voltage of inverter d.c. bar ($V_{DC}$ LINK) in case of mains failure with controlled stop phase active, if the mains failure exceeds a time longer (a) or shorter (b) than the motor stop time.*

If during the controlled stop phase the inverter gets locked (e.g. due to UNDERVOLTAGE on D.C. link voltage, VDClink < 202 V for 200T or VDClink < 424 V for 400T as the energy used to keep the inverter on is not enough), at startup the speed searching will be performed only if enabled by setting C55 to YES A and if the conditions contained in paragraph 6.3 are met.

## 6.5 MOTOR THERMAL PROTECTION

**MOTOR THERMAL PROTECTION**

This function performs the thermal protection of the motor against possible overloads. It is enabled by the parameter C70 in the **Motor thermal protection** submenu.
The motor cooling system has 4 operating modes, which can be selected through parameter C70 of the MOTOR THERMAL PROTECTION submenu.

- C70 = NO the function is disabled (factory setting)
- C70 = YES the function is active with operating current independent from the operating frequency.
- C70 = YES A the function is active with operating current depending on the operating frequency with a derating suitable to motors provided with forced air cooling.
- C70 = YES B the function is active with operating current depending on the operating frequency with a derating suitable to motors provided with fan splined to the shaft.

the heating of a motor supplied with a constant current $I_0$, follows a characteristic with this law:

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

where T is the thermal time constant of the motor (C72).
This heating is proportional to the square of the effectively supplied current ($I_O^2$).
$K \cdot I_O^2 / T$ is the derivative of the characteristic in the origin.
The corresponding alarm (A22) trips if the current effectively supplied to the motor, causes the heating in the time to exceed the asymptotic value allowed.

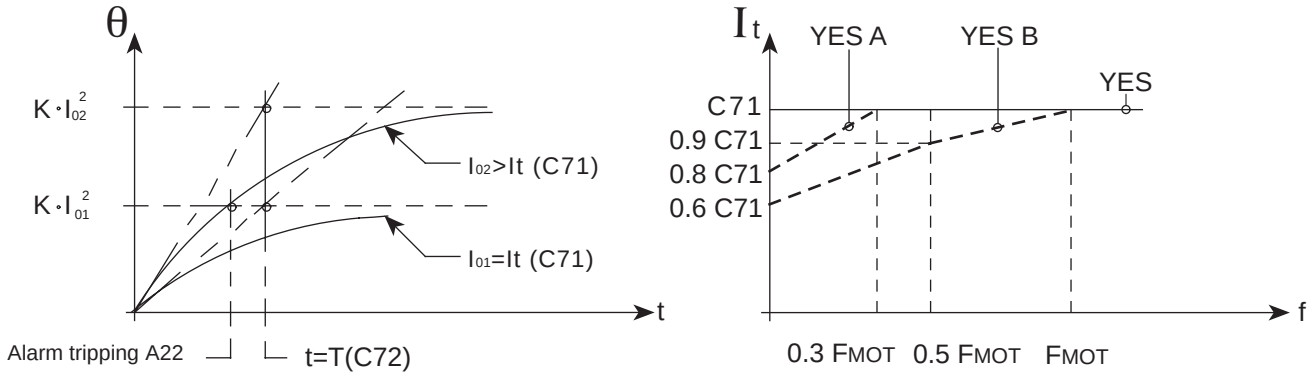



*Figure 6.8 - Motor heating with two different current values, constant in time, and protection operating current according to the frequency generated depending on parameter C70 programming.*

If the manufacturer does not declare any data, a value equal to 1/3 of the time within which the motor temperature reaches a constant value can be assumed as thermal time constant T.

The parameters used to program this function are:
- **C70** : function enabling;
- **C71** : operating current;
- **C72** : thermal time constant of the motor.

CAUTION: Always use a motor thermal protection (using either the one inside the inverter or a thermoswitch inside the motor).

## 6.6 CARRIER FREQUENCY

**CARRIER FREQUENCY**
It is possible to program carrier frequency trend as function of the output frequency as shown on fig. 6.9 using the parameters of the "Carrier Freq." submenu.

C01 MIN CARRIER: Min. value of PWM modulation frequency
C02 MAX CARRIER: Max. value of PWM modulation frequency
C03 PULSE NUMBER: Number of pulses output when ranging from minimum to maximum value.

The factory setting depends on the inverter size. In any case, the factory setting is C01 = C02, C03 = 24. The following conditions should be met:

- never exceed the max. carrier frequency (automatically generated by the inverter)
- do not use programs that generate few pulses (10 ÷ 15), in asynchronous modulation zones.

Remember the following:

- asynchronous modulation, in constant carrier areas, independently from the output frequency
- synchronous modulation, in constant pulse number areas
- the number of pulses generated is: $\frac{\text{carrier frequency}}{\text{output frequency}}$

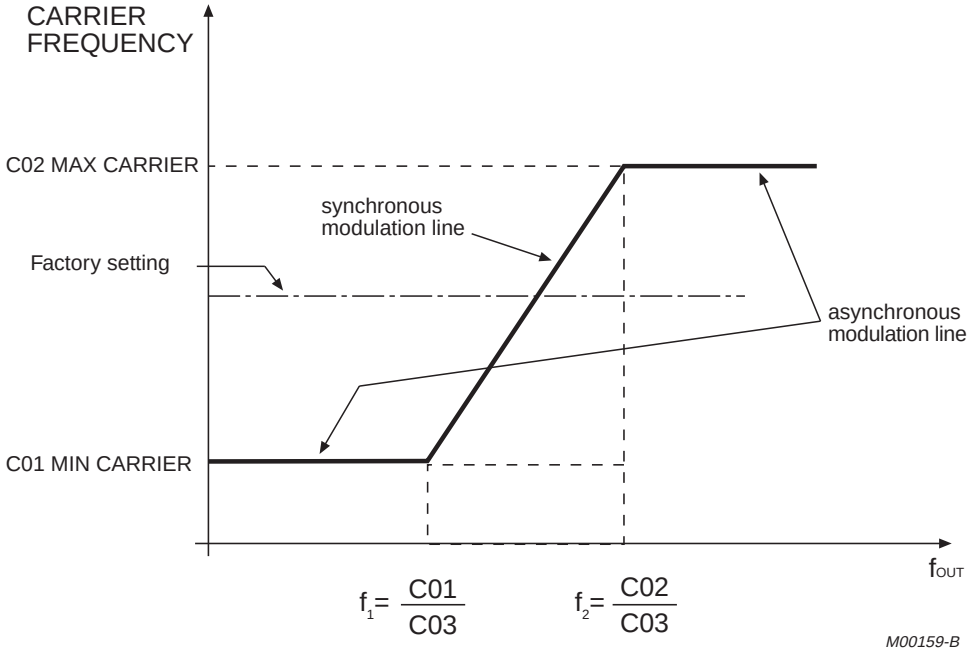



*Figure 6.9 - Carrier frequency as function of output frequency.*

As shown on fig. 6.9, the carrier frequency remains constant at C01, independently from the output frequency up to $f_1$ = C01 / C03. With $f_{OUT} > f_1$, the carrier frequency is $f_C$ = C03 * $f_{OUT}$ (constant pulses), so it increases in a linear way, up to $f_2$ = C02/C03, then reaches a constant trend at C02.
If the carrier frequency is decreased, motor performance is increased at low revolution speed, but a higher noise is produced. However, the $f_C$ carrier frequency cannot exceed 12800 Hz so, if high output frequencies are required, set C03 = 12 and try to reach a synchronous-modulation operation with high output frequency.

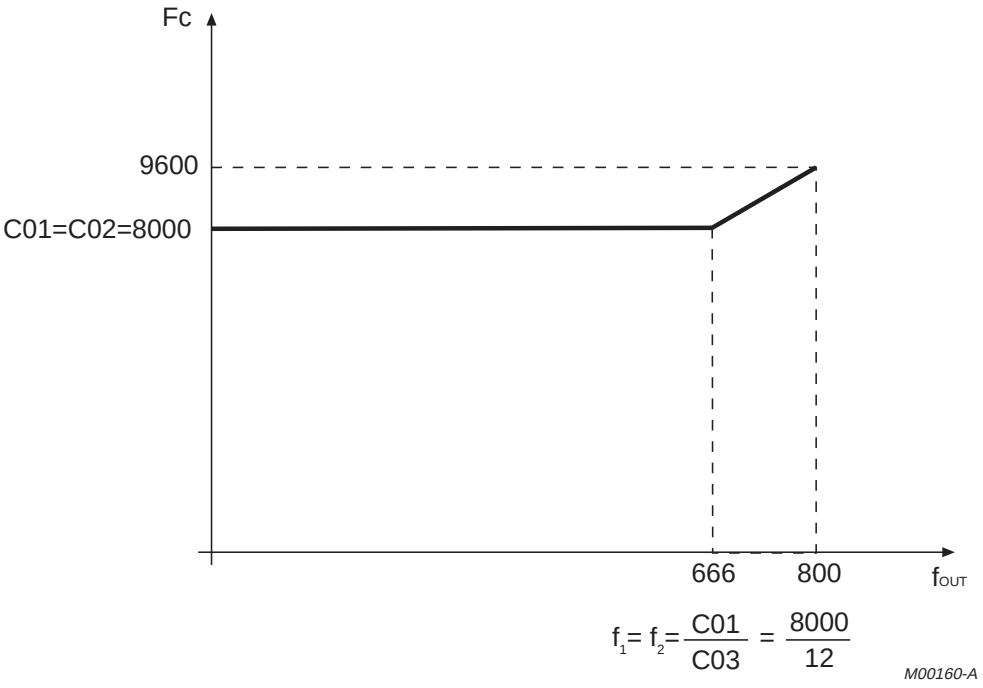



*Figure 6.10 - Carrier frequency with recommended programming for $f_{OUT}$ = 800 Hz*

An example is given in Fig. 6.10 showing the recommended carrier frequency to get a max. output frequency of 800 Hz.

## 6.7 PROHIBIT FREQUENCIES

***PROHIBIT FREQUENCIES***

This function allows to avoid motor driving with frequencies corresponding to the mechanical resonance frequencies of the machine.
Three frequency intervals, prohibited to the frequency reference, can be determined by programming the central values and a hysteresis (common to all intervals). If a central value is set to zero, the corresponding prohibit interval is overridden. The output frequency continuously changes until the new reference value is achieved.

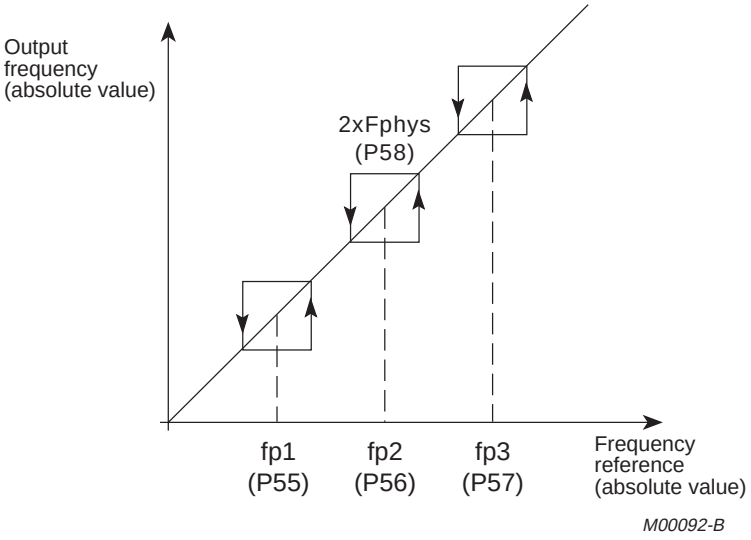



*Figure 6.11 - Prohibit frequency intervals.*

The parameters used for programming this function are:

- **P55**: central frequency of the first prohibit interval;
- **P56**: central frequency of the second prohibit interval;
- **P57**: central frequency of the third prohibit interval;
- **P58**: semi-amplitude of the prohibit intervals (hysteresis).

## 6.8 SLIP COMPENSATION

**SLIP COMPENSATION**

This function allows to compensate for speed reduction of the asynchronous motor by increasing the mechanical load (slip compensation).
When the motor current is higher than the no load current, the output frequency is increased by:

$$f_{COMP} = C77 \cdot \frac{(Iout - C76)}{(C75 - C76)} \cdot f_{REF}$$

$f_{COMP}$ = increase of output frequency (Hz)
$f_{REF}$ = frequency reference (Hz)
$I_{out}$ = output current (expressed as percentage of inverter rated current)

With C77 (nominal slip) set to 0, the function is disabled.

The parameters used to program this function are:
- **C75**: rated current of the motor;
- **C76**: no load current of the motor;
- **C77**: nominal slip of the motor.

# 6.9 PID REGULATOR

PID REGULATOR

## 6.9.1 GENERAL DESCRIPTION

The inverter is standard provided with a PID (Proportional, Integral, Derivative) regulator that allows to generate control loops such as pressure control, flow control, speed regulator, etc., without having to use devices outside the inverter.
Through parameter C28 (PID Action) of "Op Method" menu, the adjustment loop action is programmed. The following options are available:

C28 = Ext (factory setting)
The PID regulator is independent from the inverter operation. Therefore, the regulator can be used to control any external size (e.g. a thermo-regulation inside the machine on which the inverter is installed). The regulator output is available on one of the two analog outputs. However, use terminal 17 as it is characterized by a higher resolution.

C28 = Ref F
The PID output represents the inverter frequency reference, so the inverter output frequency is determined by the PID regulator.

C28 = Add F
The PID output is added to the main frequency reference, so the output frequency is corrected by the PID regulator.

C28 = Add V
The PID output is added to the inverter output voltage, so this last one is corrected by the PID regulator.

The parameter C29 (PID Ref) of "OP Method" menu determines where the regulator reference value comes from. The following options are available:
Kpd: from keyboard (factory setting)
Vref: from terminals 2 or 3 of control board
Inaux: from terminal 21 of control board
Iref: from terminal 21 of control board
Rem: from serial line (display only, it is possible to change the setting only by serial line).
A ramp can be inserted on PID reference through parameters P91 (PID Ref Acc) and P92 (PID Ref Dec)
Parameter C30 (PID F.B.) of "OP Method" menu determines which terminal the feedback signal should be applied to.
The following options are available:
Vref: from terminals 2 or 3 of control board
Iref: from terminal 21 of control board
Inaux: from terminal 19 of control board
Iout: inner value proportional to the output current
The signal can be adjusted as mentioned in paragraphs 5.2 and 5.3. Paragraphs 5.2 and 5.3 give information about the range allowed of the signals to be applied.
The regulator parameters are available in the "PID regulators" submenu.

NOTE: Do not use feedback signals that, at max. set point value, reach the maximum allowable value of the used input terminal, so as to avoid any saturation problem.

Fig. 6.12 shows a block diagram of PID regulator. Note the different options for the reference and feedback signal. The regulator aim is to keep equal the setpoint and the feedback values, expressed as percentage, generated by the input signal processing blocks. The PID regulator output includes the following:

**- A proportional factor**, that multiplies the difference between setpoint and feedback (value of the quantity to be controlled) and feedback (actual quantity value). This difference is also called "error", for a Kp constant (P86, "Prop. Gain"); if Kp is increased, the regulator response speed is increased as well, but instability problems may be encountered.

**- An integral factor**, that divides the error integral by a Ti constant (P87, "integr. Time"), i.e. the error sum during time. If Ti increases, the integral action is decreased. The integral action is important as it allows an exact matching between the reference and feedback value, i.e. the error is cleared. If P87 is set to the max. value, the integral action is disabled.

**- A derivative factor** that multiplies the feedback derivative by a Td constant (P88, Deriv. TIme). This allows to increase the regulator response speed, because as soon as a disturbance on feedback is generated, an action is output. An excessive derivative action causes output instability, because even feedback variations due to disturbance and noise are amplified. This factor is excluded by setting the derivative action constant to 0.
Another regulator parameter is the sampling time that, for fast events, should be set to about 1/10 ÷ 1/20 of the dynamics of the event to be controlled.
To calibrate, the proportional action should be programmed until the system reaches an over-shoot of 20% ÷ 30%, then set the proportional constant at about 50%. Now, increase the integral action until an acceptable response is reached. If the system is too slow or shows over-shoot, adjust the derivative action.

## 6.9.2 SUGGESTIONS FOR USE

When using the PID regulator, first set the following:

- PID regulator function (C28 - "PID ACTION");

- source of PID regulator reference (C29 PID Ref);

- where the feedback signal is applied (C30 - PID F.B.).

Example: regulation of fluid pressure inside a duct where the pump motor is operated by the inverter.

1) Set C28 = Ref F; in this way, the inverter frequency reference is generated by the PID regulator.

2) If the regulator reference has to be entered through keyboard, set C29 = Kpd. With this programming, the desired pressure value is set through the remotable keyboard.

3) According to the sensor characteristics used to measure the size to be fedback, select the terminal that will receive the feedback signal. For exambple, with a 4 ÷ 20mA signal, the signal is sent to terminal 21 and C30 = Iref. If necessary, the signal coming from the sensor can be scaled through the BIAS and GAIN functions associated to the programmed terminal.

After programming the inverter, calibrate the PID regulator constants: Kp (P86), Ti (P87) and Td (P88).
The optimum values should be empirically searched, looking for the values giving the highest stability and the best response time to the system.

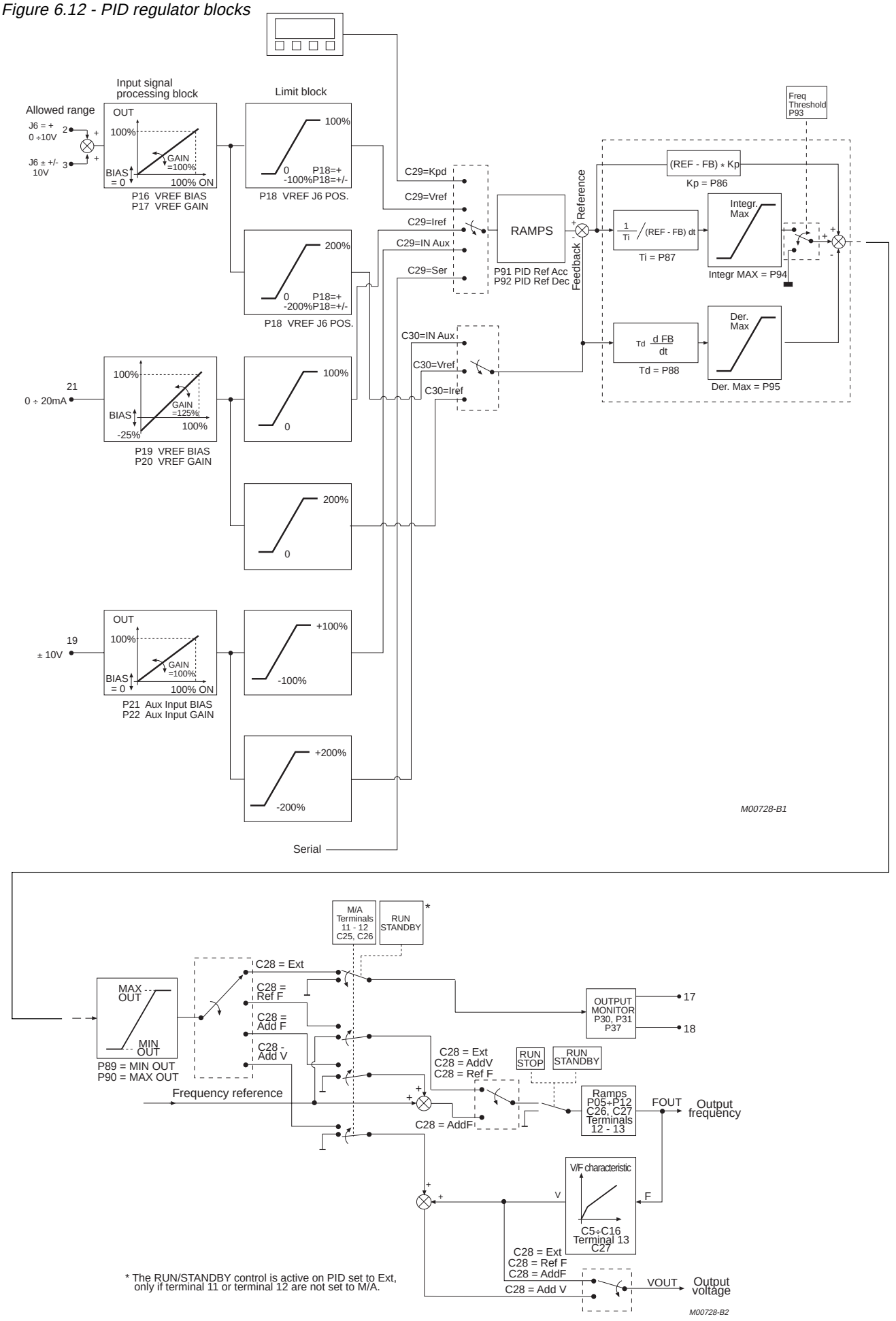
For example, the following procedure could be adopted:

- set a reference to the PID regulator. If the reference has to be sent through keyboard as shown in the example, open the Key Pad submenu of "COMMANDS" menu (see par. 7.5.1).
This display can appear at all inverter startups, by setting parameter C62 (First page) to "Key pad" and parameter P24 (U/D MEM) to YES so that, at power off, the programmed reference is not reset.

The PID regulator tries to keep the feedback signal equal to the reference signal. In this example, it increases and decreases the inverter output fequency (and the motor revolution number) in order to keep the duct pressure, detected through the sensor, equal to the programmed reference.
The reference and feedback values are expressed as percentage: let's assume, for example, that with a 0-10 bar pressure, the sensor sends a 4-20mA signal. With a factory programming of P19 (Iref BIAS) and P20 (Iref GAIN), the 100% of feedback (this value can be displayed through parameter M13 of "MEASURE" menu) correspons to a 10 bar pressure. Now, set for example a reference of 50% (5 bar), disable the integral term (P87 = NONE) and set the proportional term P86 close to 0.
Start the inverter and look at the feedback signal trend, then restart. At each restart, increase the proportional term. With low proportional terms, the feedback signal will reach values lower than the reference one. When, at startup, the feedback signal has an overshoot of approx. 50% of the reference, half of the value obtained is assumed as proportional constant. Then, set the integral action (starting from the highest value) until the system reaches a stable condition and the required dynamics, and until feedback and reference have the same value.

NOTE: as the PID regulator generates the frequency reference before the ramp lock (C28 = RefF), it may be necessary to change the acceleration and deceleration ramp values to obtain the features required by the system.

*Figure 6.12 - PID regulator blocks*



# 6.10 SERIAL COMMUNICATION

## 6.10.1 GENERAL

The SINUS/IFD inverters can be serial connected to external devices, so all those parameters that can be generally accessed through the display and the 4 keys (see corresponding chapter) are available both in reading and in writing. The electric standard used is the RS485 with 2 wires. This standard improves the immunity levels against noises even on long paths, thus reducing any possibility of communication errors.
The inverter typically behaves like a slave (i.e. it can only answer to questions made by another device) and therefore it must depend on a master that starts the communication (typically a PC).
This can be performed directly or in a converter multidrop network where a master is still available to be referenced to (see fig. 6.9).

## 6.10.2 DIRECT CONNECTION

In case of direct connection, the electric standard RS485 can be directly used if, of course, the PC has a port of this type.
The logic "1" (usually called MARK) means that the terminal TX_RX/A (terminal K5/1) is positive with regard to the terminal TX_RX/B (terminal K5/2). For the logic "0" (generally called SPACE) the condition is opposed.

## 6.10.3 NETWORK CONNECTION

The SINUS/IFD can be used within an inverter network thanks to the RS485 standard, characterized by a bus handling where single devices are "hanged on". According to connection length and transmission rate, up to 32 inverters can be connected each other. Each inverter has its own identification number that can be set through parameter C90 (Serial address, see Serial network submenu), that locates it in a unique manner within the network connected to the PC.

In both the above types of connection, an optoinsulated interface module RS485/RS232-C is available, which facilitates the interfacing with the inverter or inverter network with a PC provided with the standard port RS232-C.
In this case, the connection should be performed according to the conditions about MARK and SPACE described in previous paragraph 6.10.2.

## 6.10.4 THE SOFTWARE

The communication protocol is standard MOD BUS in mode RTU (starting from SW version 2.08; for the previous versions, standard ANSI X3.28 protocol is used).
The parameters query is made contemporaneously with the reading performed with keys and display. The parameters modification too is handled together with keypad and display, but note that the inverter will always consider valid the last set value, coming from the serial line or from the converter itself.
The control terminal inputs can be controlled through field or serial line, depending on parameters C21 and C22 programming. In any case, regardless of the programming mode, the RUN/STANDBY command must be entered through control terminals.
With C21 set to REM, the commands corresponding to the RUN/STOP digital inputs and to the multifunction inputs, must be entered through serial line, while the state of these inputs on terminal board has no effect.
With C22 set to REM, the main frequency reference must be entered through serial line and the signals applied tot terminals 2, 3 and 17 (Vref1, Vref2 and Iref) will have no effect.
For information about serial communication, ask the corresponding manual to Elettronica Santerno.

## 6.10.5 SETTING THE SERIAL PORT ON PC

The PC serial port must be properly set to allow for the connection with the inverters:
Communication speed: 9600 bauds;
Parity: N;
Data bits: 8;
Stop bits: 1.

## 6.10.6 CONNECTION

To connect to the serial line, use the K5 connector located on the ES696 control board, as shown in the figures corresponding to the external dimensions and sizes of the inverter.
The connector located on the inverter is a 9-pole male D-connector and has the following connections:

| POLE | FUNCTION |
|---|---|
| 1 | (TX/RX A) Differential A input/output (bidirectional) according to the standard RS485. Positive polarity with regard to pole 2 for a MARK. |
| 2 | (TX/RX B) Differential B input/output (bidirectional) according to the standard RS485. Negative polarity with regard to pole 1 for a MARK. |
| 3 | not connected |
| 4 | not connected |
| 5 | (GND) control board ground |
| 6 | not connected |
| 7 | not connected |
| 8 | not connected |
| 9 | +5V |

NOTE: The inverter located further from the P.C. (or the only inverter in case of direct connection) must have a line terminator inserted: jumper J2 and J3 in posion A (default).
The other inverters located in intermediate positions must have the line terminator excluded: jumper J2 and J3 in position B.

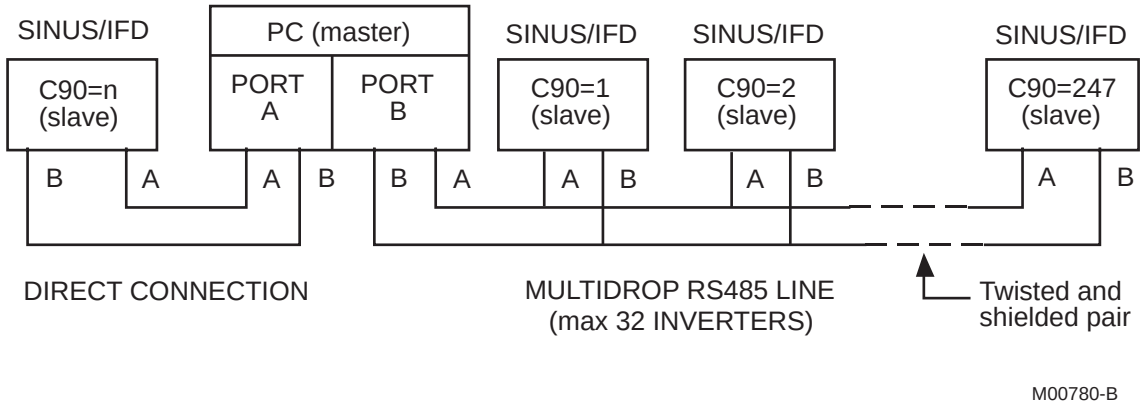



*Figure 6.13 - Several inverters connected on RS485 serial line*

# 7.0 PROGRAMMING PARAMETERS

The parameters and measures displayed are divided into 4 main menus that are divided into submenus according to a tree structure:

In the following notes:

- access pages mean pages that allow to access a more internal level of the tree structure on which the parameters are arranged (e.g. from main menus you can switch to submenus);

- first pages mean pages that allow to exit a more internal level (e.g. from inside a submenu you can switch to the various submenus composing the main menu).

Two quick controls are available:

- simultaneously press ∨ and ∧ to go to the access page to the main menus; press ∨ and ∧ again to go back to the previous position.

- simultaneously press MOD and ∨ to go to the first page of the submenu in effect.

## 7.1 MAIN MENUS

The following main menus are available:

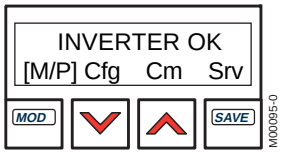
- **M/P** (measures and parameters) contains the displayed quantities and the parameters that can be changed during operation;

- **Cfg** (configuration) contains the parameters that cannot be changed during operation;

- **Com** (commands) contains the pages for inverter operation through keypad;

- **Srv** (service): this cannot be accessed by the user.

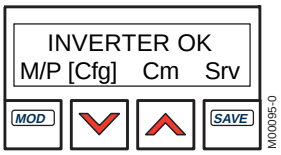
At power-up, if no anomaly is present or if not otherwise programmed, the inverter display shows the access page to the main menus.



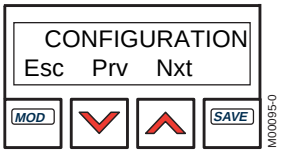

the square brackets show the main menu selected; to change this menu, use the ∨ and ∧ keys. After choosing the desired menu, use the MOD key to enter it.

Example

Select the Cfg menu (configuration) with ∨ and ∧; the display shows:

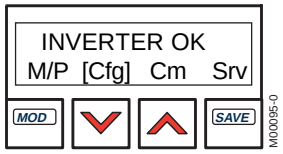



To enter the menu, press the MOD key; the display shows the first page of the configuration menu:




On the first page, press ∨ and ∧ to enter other access pages of different submenus; press MOD to go back to the main menu.

To enter another main menu, for instance the measures/parameters menu, go back to the first page of the configuration menu and use MOD to access the selection page among the menus, the displays shows:

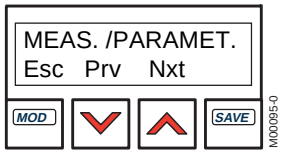



then, move the square brackets on M/P using ⌄ and ⌃, then enter this menu with MOD key.

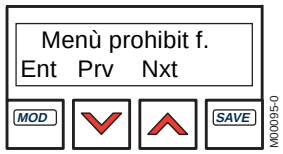
## 7.2 SUBMENUS

From the first page of a main menu, use ⌄ and ⌃ to scroll the access pages of the corresponding submenus. When the desired submenu page appears, press MOD to enter it. The display shows the first page of the submenu, then, use ⌄ and ⌃ to scroll the included parameters. To change the value of a parameter, locate it, after placing the key parameter P01=1, and press MOD (a blinking cursor appears), then press ⌄ and ⌃ to make the change. Pressing SAVE, permanently stores the change (pressing MOD, stores until the inverter is turned off). To exit the submenu, scroll the parameters until the first page of the submenu is reached (or simultaneously press MOD and ⌄), then press MOD to go back to the submenu.

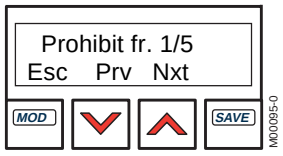
Example
Program the value of P55 (value of the first prohibit frequency).
Enter the M/P menu (measure and parameters); the display shows the first page of this menu;



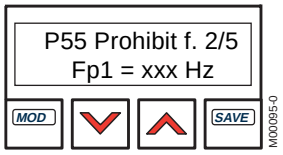

use ⌄ and ⌃ to scroll the submenus until the access page of the “prohibit frequency” submenu is reached; the display shows:



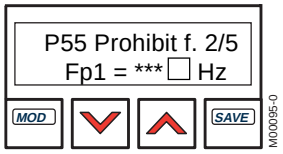

Press mode to enter the submenu; the display shows the first page of the submenu:



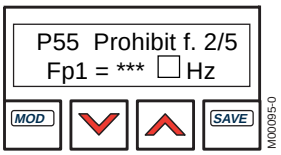

Press ⌃ to scroll the parameters until P55 is reached, the display shows:




Press MOD to change the parameter; the display shows the blinking cursor



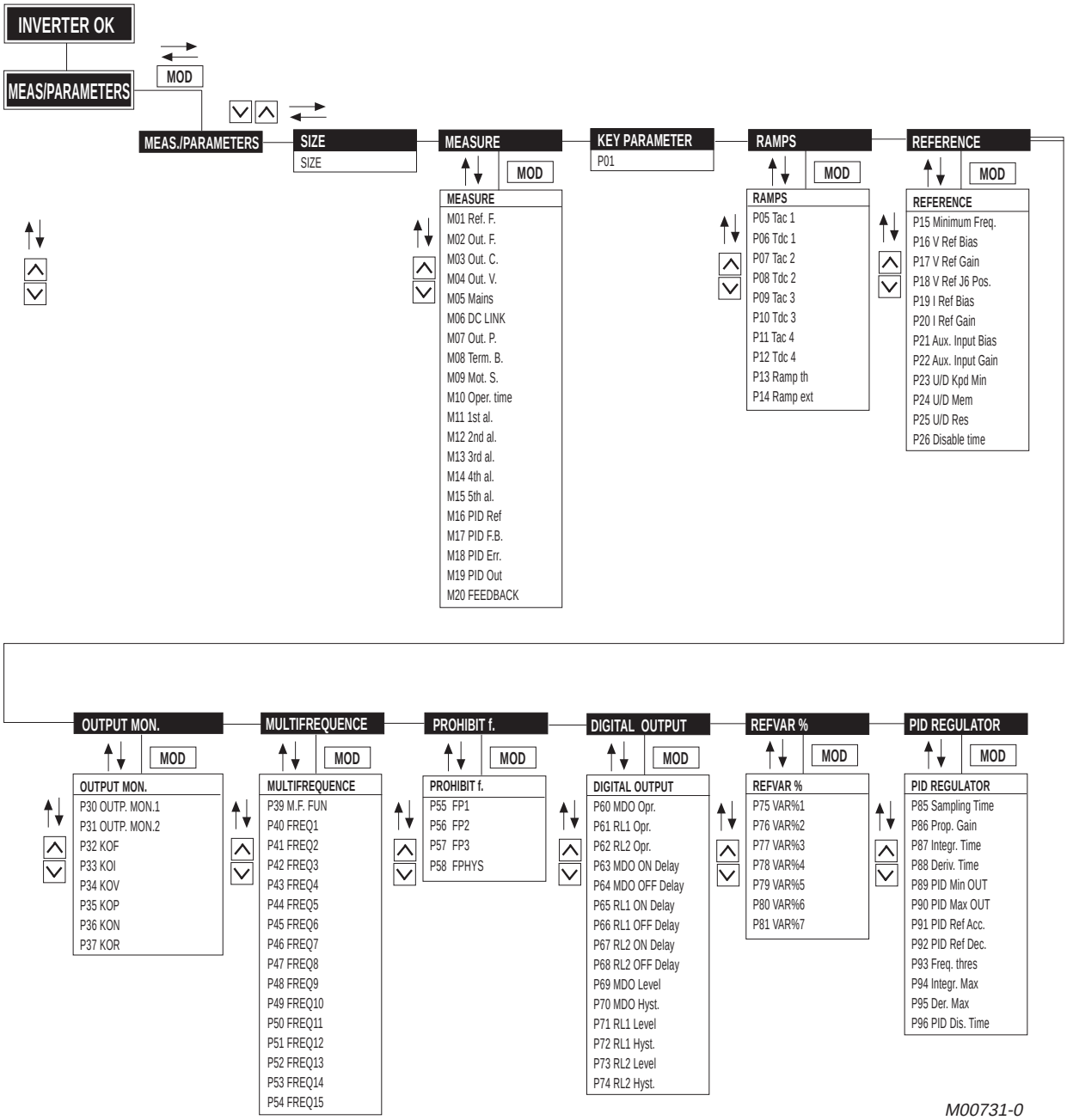

Press ⌄ and ⌃ to change the value.




Press SAVE to save the selected value.

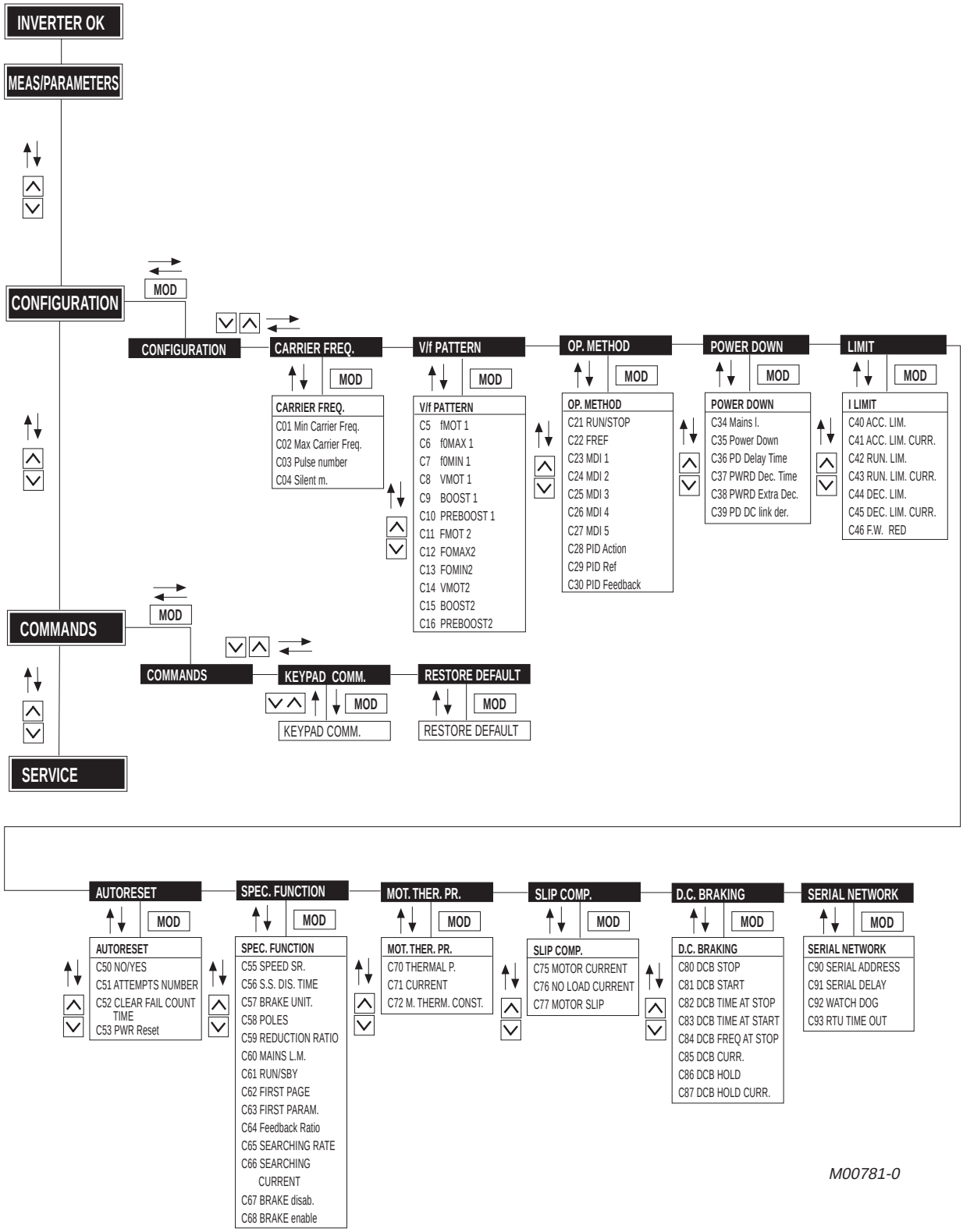
If MOD is pressed, the selected value will be saved until the inverter is turned off; at next power-on, the inverter will use the previous value.

## 7.3 MENUS AND SUBMENUS TREE




*M00731-0*

*N.B.: THE SERVICE MENU CANNOT BE ACCESSED BY THE USER*




*M00781-0*

*N.B.: THE SERVICE MENU CANNOT BE ACCESSED BY THE USER*

## 7.4 PARAMETERS LIST

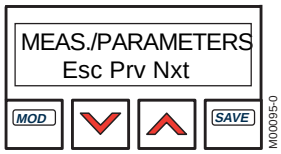
The following symbols are used:

**P** Parameter number
**R** Value range allowed
**D** Factory setting
**F** Function

### 7.4.1 MEASURE/PARAMETERS MENU

It contains the displayed quantities and the parameters that can be changed while the inverter is running; to change them, **set P01=1**.

First page

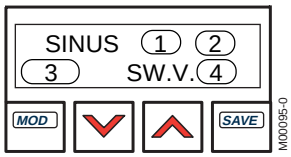



Press MOD to go back to the selection page among the main menus; use ∨ and ∧ to move between the different submenus. All parameters are contained in submenus except for the key parameter P14 which can be directly accessed scrolling the submenus.

*SUBMENU LIST*

#### 7.4.1.1 Inverter characteristics

It displays the main inverter characteristics.



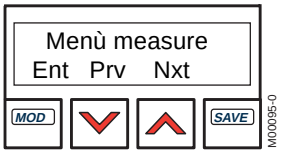

Field **1**: inverter type (IFD, IFDV IFDE, IFDEV)
Field **2**: size (4 ÷ 200)
Field **3**: supply voltage 200 T, 380 T, 400 T
Field **4**: software version

To exit the submenu, simultaneously press ∨ and ∧ .

#### 7.4.1.2 Measure menu

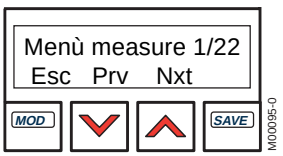
It contains the quantities displayed during the operation.

Submenu access page



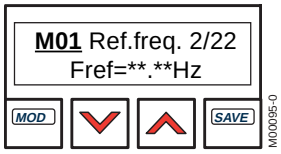

Press MOD to enter the submenu; use ∨ and ∧ to move through the other menus.

First page of submenu

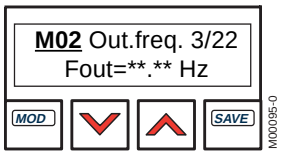



Press MOD to go back to the access page of submenu; use ∨ and ∧ to scroll the other submenu pages.

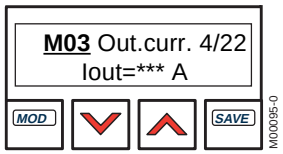
*SUBMENUS LIST*



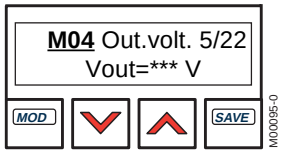

**P** M01
**R** -800 +800 Hz (for SINUS/IFD 4÷75, SINUS/IFDV 5,5 ÷90 and SINUS/IFDE 4÷15 e SINUS/IFDEV 5,5÷18,5), -120 +120 Hz (for SINUS/IFD 90÷160 and SINUS/IFDV 110÷200)
**F** Frequency reference value input to the inverter;



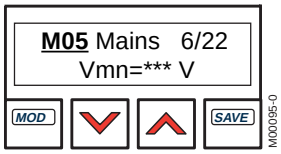

**P** M02
**R** -800 +800 Hz (for SINUS/IFD 4÷75, SINUS/IFDV 5.5÷90 and SINUS/IFDE 4÷15 e SINUS/IFDEV 5,5÷18,5), -120 +120 Hz (for SINUS/IFD 90÷160 and SINUS/IFDV 110÷200 )
**F** It shows the value of the output frequency;



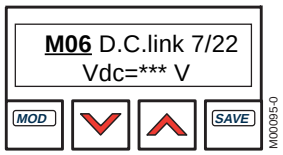

**P** M03
**R** It depends on the inverter size
**F** Output current value.



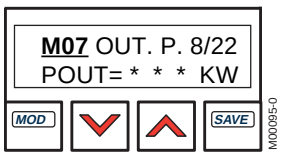

**P** M04
**R** 0....460V
**F** Output voltage value.



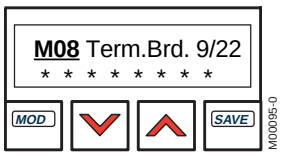

**P** M05
**R** 0....600V
**F** Mains voltage value.



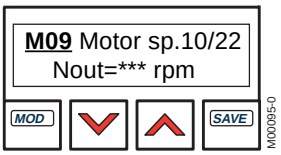

**P** M06
**R** 0...1000V
**F** It indicates the voltage value of D.C. link.




**P** M07
**R** It depends on the inverter size
**F** Value of the active power delivered to the load.



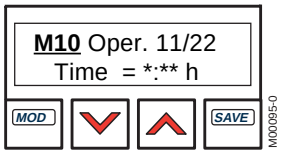

**P** M08
**F** It shows the current state of the digital inputs on the terminal board (display sequence of the terminals 6, 7, 8, 9, 10, 11, 12, 13). If a terminal is active, the display shows its number in hexadecimal form in the corresponding position, viceversa a 0 is displayed.



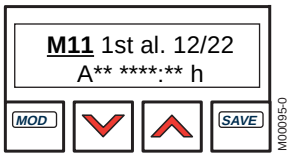

**P** M09
**R** Depends on C58 and C59 programming
**F** Rev./min. It shows a value expressed by the following formula:

$$Nout = \frac{Fout \times 60}{C58} \times C59 \times 2$$

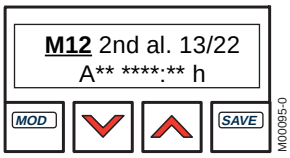
Where C58 is the motor pole number and C59 is a programmable proportional constant.



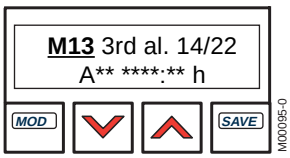

**P** M10
**R** 0÷238.000 h
**F** Time during which the inverter has been in RUN state



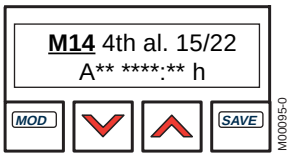

**P** M11 (available from SW version 2.10)
**R** A03 ÷ A36
**F** Stores the last alarm tripped and the corresponding value for M10.



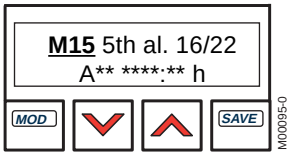

**P** M12 (available from SW 2.10)
**R** A03 ÷ A36
**F** Stores the penultimate alarm tripped and the corresponding value for M10.



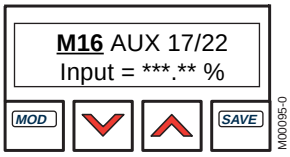

**P** M13 (available from SW version 2.10)
**R** A03 ÷ A36
**F** Stores the last but two alarm tripped and the corresponding value for M10.



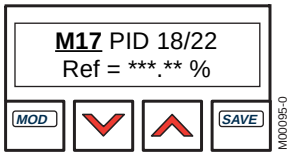

**P** M14 (available from SW version 2.10)
**R** A03 ÷ A36
**F** Stores the last but three alarm tripped and the corresponding value for M10.



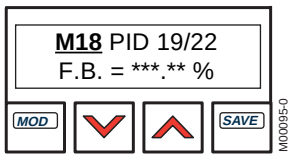

**P** M15 (available from SW version 2.10)
**R** A03 ÷ A36
**F** Stores the last but four alarm tripped and the corresponding value for M10.



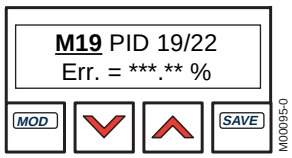

**P** M16
**R** ±200.00%
**F** Value of auxiliary input expressed in %.



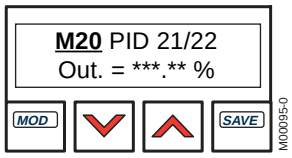

**P** M17
**R** ±100.00%
**F** Value of PID regulator reference expressed in percentage.




**P** M18
**R** ±200.00%
**F** Value of PID regulator feedback expressed as percentage.



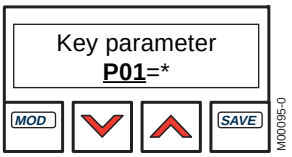

**P** M19
**R** ±200.00%
**F** Difference between PID regulator reference (M12) and feedback (M13).




**P** M20
**R** ±100.00%
**F** PID regulator output expressed in percentage.


**P** M21
**R** It depends on C64 programming
**F** Value related to the feedback signal of PID regulator. It indicates a quantity expressed by the following formula: M13*C64.

### 7.4.1.3 Key parameter

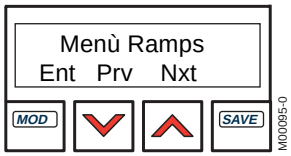



**P** 01
**R** 0....1
**D** 0
**F** Access code to programming:
0: only parameter P01 can be changed; at power on, P01 is always 0;
1: all parameters can be changed (the parameters of the configuration menu can only be changed with inverter in stand by or stop)

## 7.4.1.4 Ramps

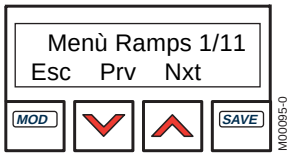
It contains the quantities corresponding to the acceleration and deceleration ramps.

Submenu access page

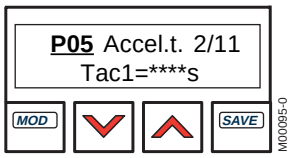



Press MOD to enter the submenu; use ∨ and ∧ to move through the other submenus.

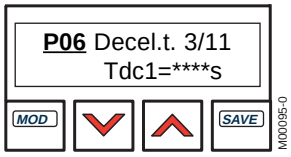
First page of submenu



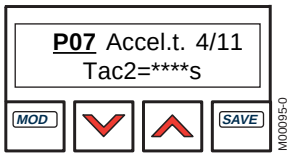

*SUBMENU PARAMETERS*



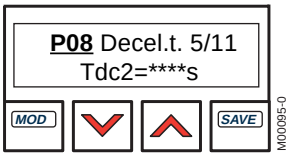

**P** P05
**R** 0....6500s
**D** 10s
**F** Duration of the acceleration ramp 1 - 0 to Fomax1 (parameter C6)



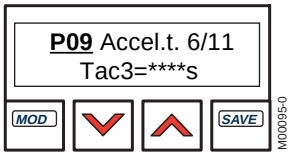

**P** P06
**R** 0...6500s
**D** 10s
**F** Duration of the deceleration ramp - Fomax1 to 0.



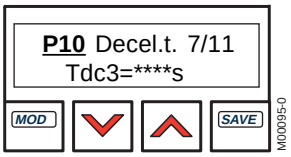

**P** P07
**R** 0...6500s
**D** 10s
**F** Duration of the acceleration ramp 2 - 0 to Fomax1.



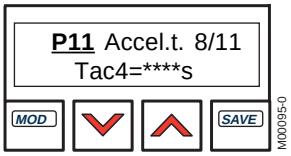

**P** P08
**R** 0....6500s
**D** 10s
**F** Duration of the deceleration ramp 2 - $f_{omax}1$ to 0.



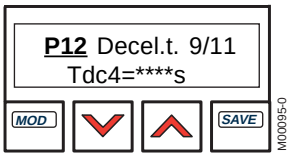

**P** P09
**R** 0...6500s
**D** 10s
**F** Duration of the acceleration ramp 3 - 0 to $f_{omax}1$.



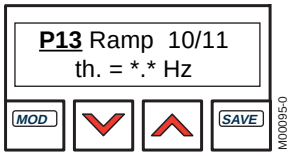

**P** P10
**R** 0....6500s
**D** 10s
**F** Duration of the deceleration ramp 3 - $F_{0MAX}1$ to 0.



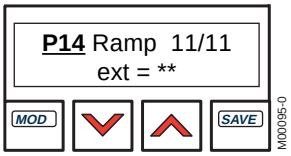

**P** P11
**R** 0....6500s
**D** 10s
**F** Duration of the acceleration ramp 4 - 0 to $F_{0MAX}1$.




**P** P12
**R** 0....6500s
**D** 10s
**F** Duration of the deceleration ramp 4 - $F_{0MAX}1$ to 0.




**P** P13 (Function available starting from SW version 2.8)
**R** 0....25Hz
**D** 0
**F** It determines the acceleration and deceleration range in which the multiplier factor is used (P14). Ex. - Ranging from 0 to 50Hz, if P13=1Hz from 0 to 1Hz and from 49 to 50Hz both with an acceleration ramp and a deceleration ramp, the active ramp will be longer according to parameter P14 programming.




**P** P14 (Function available starting from SW version 2.8)
**R** 1, 2, 4, 8, 16, 32
**D** 4
**F** Multiplier of the active ramp in the range defined through parameter P13.

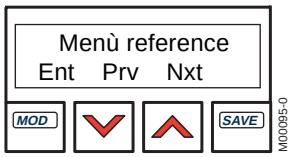
NOTE: The active ramp depends on the state of MDI4 and MDI5 inputs, if programmed to make changes to the ramp time values (see "operation method" submenu, parameters C26 and C27).

NOTE: If the second frequency voltage characteristic is active, the ramp time is referred to $F_{0MAX2}$ (parameter C12).

## 7.4.1.5 Reference

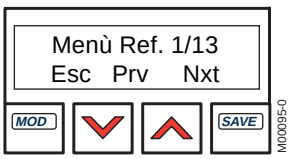
It contains the quantities for the frequency reference.

Submenu access page




Press MOD to access the subemnu; press ∨ and ∧ to scroll the other submenus.

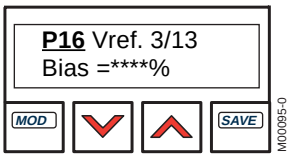
First page of submenu



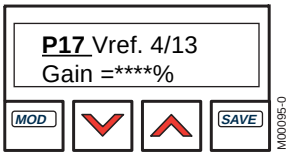

Press MOD to go back to the access page of submenu

*SUBMENU PARAMETERS*

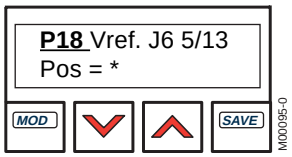

**P** P15
**R** +/-, 0...800 Hz (for SINUS/IFD 4÷75, SINUS/IFDV 5.5÷90 and SINUS/IFDE 4÷15 e SINUS/IFDEV 5,5÷18,5)
+/-, 0...120 Hz (for SINUS/IFD 90÷160, SINUS/IFDV 110÷200)
**D** +/-
**F** Min. value of frequency reference.
With "+/-", the frequency reference range is bipolar.



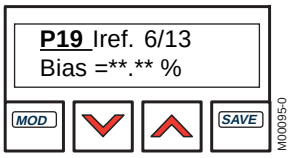

**P** P16
**R** -400%....+400%
**D** 0%
**F** Percentage value of voltage reference, expressed as percentage, when no voltage is present at terminals 2 and 3 on terminal board.



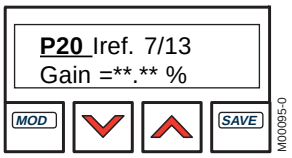

**P** P17
**R** -500%....+500%
**D** 100%
**F** Proportion coefficient between the sum of signals at terminals 2 and 3, expressed as fraction of max. allowed value (10V) and the reference generated, expressed as percentage.




**P** P18
**R** +, +/-
**D** +
**F** It determines the range of the voltage reference: 0 ÷ +10V (+), ±10V (+/-).



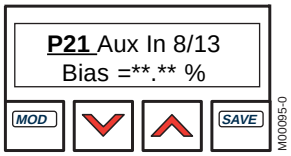

**P** P19
**R** -400%....+400%
**D** -25%
**F** Current reference value, expressed as percentage, present when no current is sent to terminal 21.



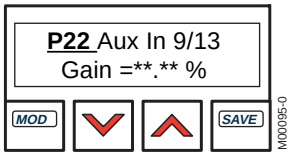

**P** P20
**R** -500%....+500%
**D** +125%
**F** Proportional coefficient between the current reference applied to terminal 21, expressed as fraction of the max. allowed value (20mA) and the reference generated, expressed as percentage.

NOTE: The parameters P19 and P20 are factory set to the current reference signal type 4÷20mA.

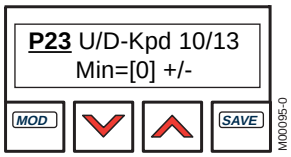
NOTE: For information on how to use parameters P16, P17, P18, P19, P20, see paragraph 5.2 "Main frequency reference".



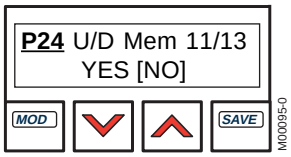

**P** P21
**R** -400%....+400%
**D** 0
**F** Value of auxiliary input, expressed as percentage, when no voltage is applied to terminal 19 on terminal board.



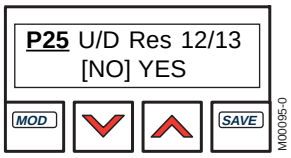

**P** P22
**R** -500%....+500%
**D** +200%
**F** Proportion coefficient between the signal applied to terminal 19, expressed as fraction of max. allowed value (±10 V), and the value generated, expressed as percentage.



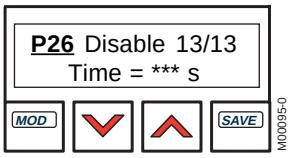

**P** P23
**R** 0, +/-
**D** 0
**F** It defines the frequency reference range enabled through UP/DOWN control (terminals 9 and 10, parameters C23 and C24) or through keyboard control:
- 0 : range 0 to $F_{OMAX}$
- +/-: range $-F_{OMAX}$ to $+F_{OMAX}$




**P** P24
**R** YES, NO
**D** YES
**F** When set to YES, it determines at power off, the storage of increase or decrease of the frequency reference value sent from terminal board through MDI1 and MDI2 set to UP and DOWN (see parameters C23 and C24) or through keyboard (see COMMAND menu).



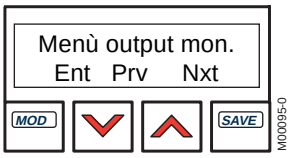

**P** P25
**R** YES, NO
**D** NO
**F** If set to YES, it allows, through RESET control, to set to zero the frequency references set through UP/DOWN controls.



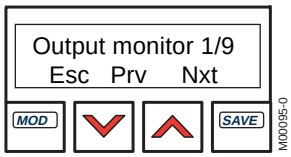

**P** P26 (Available starting from SW version 2.8)
**R** 0.120s
**D** 0s
**F** If the frequency reference is kept at a value equal to the min. value (P15) for a time longer than the time set in this parameter, the inverter will stop. The inverter will start again as soon as the frequency reference is higher than P15.
If P26=0 (default value) this function is disabled.

## 7.4.1.6 Output monitor

It determines the quantity available in the analog outputs (terminals 15 and 16)
submenu access page

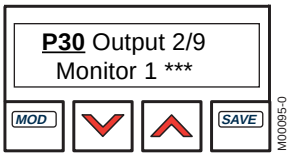



Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus.
First page of submenu

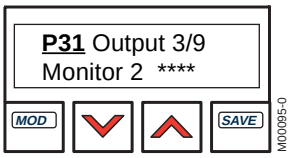



Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.

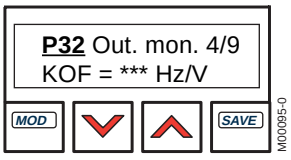
*SUBMENU PARAMETERS*



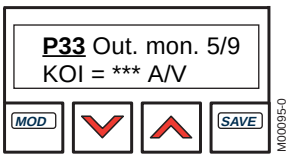

**P** P30
**R** Fref, Fout, Iout, Vout, Pout, Nout, PID 0, PID F.B.
**D** Fout
**F** It selects the quantity that must be available on the first multifunction analog output (terminal 17), between Fref (frequency reference), Fout (output frequency), Iout (output current), Vout (output voltage), Pout (output power), Nout (rev./min.), PID 0 (PID regulator output), PID F.B. (PID regulator feedback).



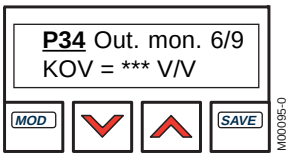

**P** P31
**R** Fref, Fout, Iout, Vout, Pout, Nout, PID 0, PID F.B.
**D** Iout
**F** It selects the quantity that must be available in the second multifunction analog output (terminal 18) between Fref (frequency reference), Fout (output frequency), Iout (output current), Vout (output voltage), Pout (output power), Nout (rev./min.), PID 0 (PID regulator output), PID F.B. (PID regulator feedback).



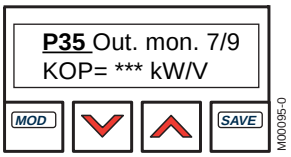

**P** P32
**R** 5...80 Hz/V
**D** 10 Hz/V
**F** It shows the ratio between output voltage at terminals (17and 18) and output frequency and the ratio between the output voltage at terminals (17 and 18) and the frequency reference.



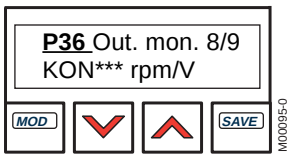

**P** P33
**R** It depends on the inverter size
**D** It depends on the inverter size
**F** It indicates the ratio between the output current on the inverter and the output voltage at terminals (17 and 18) representing the output current.




**P** P34
**R** 10...100V/V
**D** 100 V/V
**F** It indicates the ratio between the inverter output voltage and the volrage output at terminal (17 and 18) representing the output voltage.

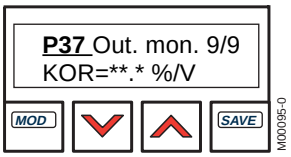



**P** P35
**R** It depends on the inverter size
**D** It depends on the inverter size
**F** It indicates the ratio between the power delivered by the inverter and the voltage output at terminal (17 and 18) representing the output power.




**P** P36
**R** 20...5000 rpm/V
**D** 200 rpm/V
**F** It indicates the ratio between the motor rev. number, expressed in rev./min. and the voltage output at terminal (17 or 18) representing the motor revolution number.

NOTE: This speed is given by the product of the output frequency Fout by the constant 60 x 2 / C58 (Poles in the Special function submenu) **without considering the motor slip.**

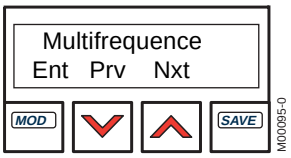



**P** P37
**R** 2.5...50 %/V
**D** 10% /V
**F** It defines the ratio between the output voltage at terminals (17 and 18) and the PID regulator output, expressed as percentage and the ratio between the output voltage at terminals 17 and 18 and the PID regulator feedback value, expressed as percentage.

## 7.1.4.7 Multifrequence

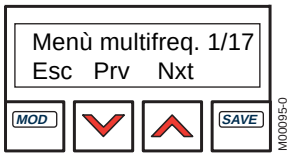
It determines the values and meaning of the reference frequencies which can be output through the multifunction digital input MDI1, MDI2, MDI3, MDI4 (see Operation Method submenu).

Submenu access page




Press MOD to enter the submenu; use ∨ and ∧ to move through the other submenus

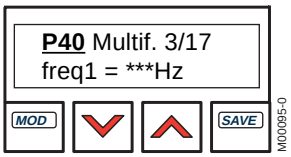
First page of submenu



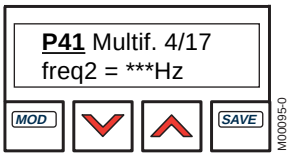

Press MODE to exit the submenu; use ∨ and ∧ to move through the other pages of the submenu.

*SUBMENU PARAMETERS*

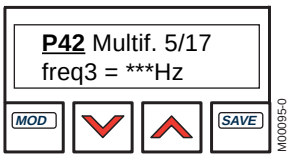

**P** P39
**R** ABS, ADD
**D** ABS
**F** It determines the use of the frequency references generated through parameters P40÷P54
ABS - the output frequency corresponds to the frequency reference generated through the active parameters P40÷P45 .
ADD - the output frequency corresponds to the sum of the main frequency reference and the active frequency reference generated.



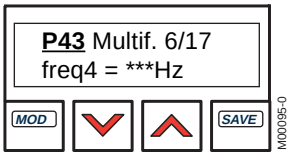

**P** P40
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with multifunction digital input 1 (terminal 9) active and programmed as multifrequency (parameter C23 OP METHOD submenu).



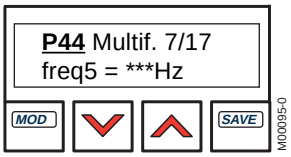

**P** P41
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the output frequency with multifunction digital input 2 (terminal 10) active and programmed as multifrequency (par. C24 OP METHOD submenu)



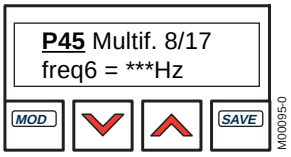

**P** P42
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with multifunction digital inputs 1 and 2 (terminals 9 e10) active and programmed as multifrequency (par. C23 and C24 OP METHOD submenu)



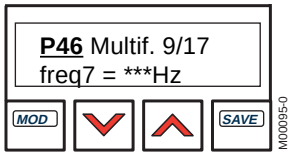

**P** P43
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with multifunction digital input 3 (terminal 11) active and programmed as multifrequency (par.C25 OP METHOD submenu)



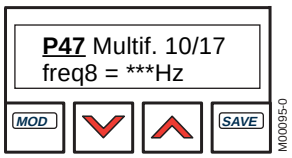

**P** P44
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 1 and 3 (terminals 9 and 11) active and programmed as multifrequency (par. C23, C24, C25 OP METHOD submenu)



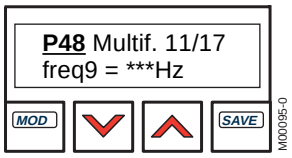

**P** P45
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 2 and 3 (terminals 10 and 11) active and programmed as multifrequency (par. C24, C25 OP METHOD submenu)



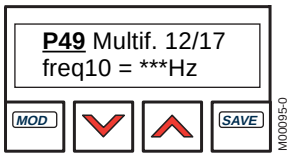

**P** P46
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 1, 2 and 3 (terminals 9, 10 and 11) active and programmed as multifrequency (par. C23, C24, C25 OP METHOD submenu)



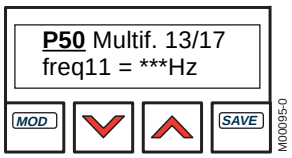

**P** P47
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with multifunction digital input 4 active (terminal 12) and programmed as multifrequency (par. C26, OP METHOD submenu)



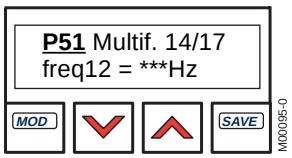

**P** P48
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 1 and 4 active (terminals 9 and 12)and programmed as multifrequency (par. C23, and C26 OP METHOD submenu)



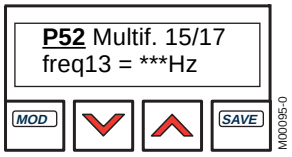

**P** P49
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 2 and 4 active (terminals 10 and 12) and programmed as multifrequency (par. C24, C26 OP METHOD submenu)



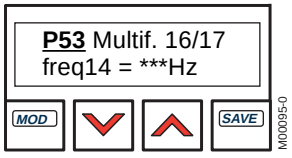

**P** P50
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency ref. generated with the multifunction digital inputs 1, 2 and 4 active (terminals 9, 10 and 12) and programmed as multifrequency (par. C23, C24, C26 OP METHOD submenu)



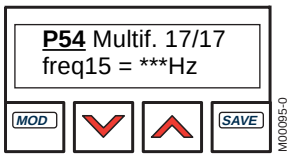

**P** P51
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 3 and 4 active (terminals 10 and 11) and programmed as multifrequency (par. C25 and C26 OP METHOD submenu)




**P** P52
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency ref. generated with the multifunction digital inputs 1, 3 and 4 active (terminals 9, 11 and 12) and programmed as multifrequency (par. C23, C25, C26 OP METHOD submenu)




**P** P53
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference output with multifunction digital inputs 2, 3 and 4 active (terminals 10, 11 and 12) and programmed as multifrequency (par. C24, C25, C26 OP METHOD submenu)

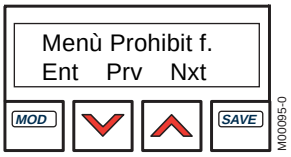



**P** P54
**R** -800 Hz ... +800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
-120 Hz ... +120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the frequency reference generated with the multifunction digital inputs 1, 2, 3 and 4 active (terminals 9, 10, 11 and 12) and programmed as multifrequency (par. C23, C24, C25 and C26 OP METHOD submenu)

## 7.4.1.8 Prohibit frequencies

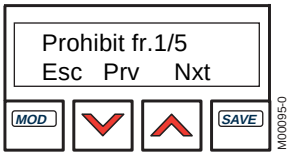
It determines the frequency intervals prohibited to the frequency reference. The output frequency changes with continuity until the new reference value is achieved. For further details, see paragraph "Prohibit frequencies" described in chapter "Description of the main characteristics".

Submenu access page



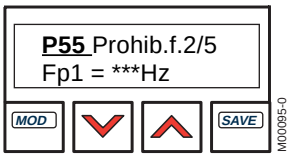

Press MOD to enter the submenu: use ⌄ and ⌃ to move through the other submenus

First page of submenu

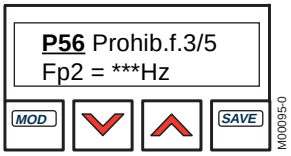



Press MOD to exit the submenu: use ⌄ and ⌃ to move through the other pages of the submenu.

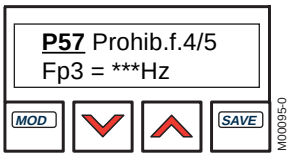
*SUBMENU PARAMETERS*



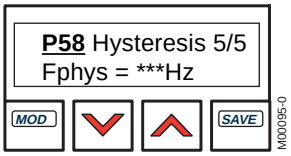

**P** P55
**R** 0 ÷ 800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
0 ÷ 120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the central value of the first prohibit frequency interval. This is an absolute value, i.e. it is independent from the rotation direction. Setting this value to 0, the interval is overridden.




**P** P56
**R** 0 ÷ 800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
0 ÷ 120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the central value of the second prohibit frequency interval. This is an absolute value, i.e. it is independent from the rotation direction. Setting this value to 0, the interval is overridden.




**P** P57
**R** 0 ÷ 800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 55 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
0 ÷ 120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** It determines the central value of the third prohibit frequency interval. This is an absolute value, i.e. it is independent from the rotation direction. Setting this value to 0, the interval is overridden.

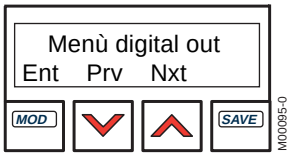



**P** P58
**R** 0 ÷ 24 Hz
**D** 1
**F** It determines the value of the semi-amplitudes of the prohibit frequency intervals.

## 7.4.1.9 Digital Output

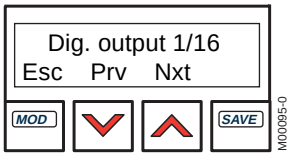
It determines the parameters corresponding to digital outputs.

Submenu access page



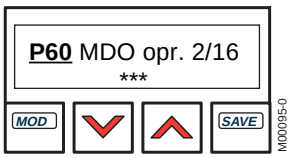

Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus of configuration menu.

First page of submenu




Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.

*SUBMENU PARAMETERS*




**P** P60

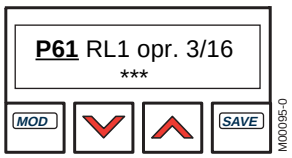
**R** Inv O.K. ON, INV O.K. OFF, Inv RUN Trip, Reference Level, Frequency Level, Forward Running, Reverse Running, Fout O.K., Current Level, Limiting, Motor Limiting, Generator Limiting, PID O.K., PID OUT MAX, PID OUT MIN, FB MAX, FB MIN, PRC OK.

**D** Frequency level

**F** It determines the meaning of Open Collector digital output (terminals 24 and 25). Use ⌄ and ⌃ to select the inverter status to be associated with the digital output status. The following options are available:
Inv. O.K. ON: active output with inverter ready.
Inv. O.K. OFF: active output with inverter-block (any condition that does not allow RUN control to be sent; see note at the end of parameter description).
Inv run trip: output active in case of inverter block during running due to protection tripping.
Reference Level: active output with inverter whose input has a frequency reference higher than the quantity entered through P69 (see figure 7.1).
Frequency Level: active output with inverter that generates a frequency higher than the value set through parameter P69, independently from the motor rotation direction (see figure 7.2).
Forward Running: active output with inverter that generates a frequency higher than the value set through parameter P69 and corresponding to a positive reference (see figure 7.2).
Reverse Running: active output with inverter that generates a frequency higher than the value set through parameter P69 and corresponding to a negative reference (see figure 7.2).
Fout O.K.: active output when the difference absolute value between frequency reference and output frequency is lower than the value set through P69 "MDO Level" (see figure 7.3).
Current Level: active output when the inverter output current is higher than the value set through P69 "MDO Level" (see figure 7.4).
Limiting: active output with inverter in limiting condition.
Motor limiting: active output with inverter in motor limiting condition.
Generator lim.: active output with inverter in regeneration limiting condition.
PID OK: active output if the difference absolute value between the reference signal and the PID regulator feedback decreases below a threshold programmable through P69 ("MDO Level") (see figure 7.5).
PID OUT MAX: active output if the PID regulator output has reached the value set through parameter P90 (PID MAX Out.) (see figure 7.6).
PID OUT MIN: active output if the PID regulator output has reached the value set through parameter P89 (see figure 7.7).
FB MAX: active output if the absolute value of PID regulator feedback is higher than the value set through P69 (see figure 7.8).
FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set through P69 (see figure 7.9).
PRC OK: active output when the inverter has achieved the precharge phase of the internal capacitor unit (available starting from SW version 2.8)

NOTE: If "INV OK OFF" is selected, the output is enabled whenever the inverter is in lock condition, due to protection tripping, or if the equipment is started after it has been turned off with inverter locked, or if the equipment is started with STAND-BY contact (terminal 6) closed and parameter C61 set to NO. With this programming, the output can be used to control a signal lamp, or to send a signal to PLC to highlight the inverter lock condition. If "Inv run trip" is selected, the output is enabled only if, with running inverter, this is locked due to protection tripping. If the equiment is turned off and on with inverter in lock condition, the output is disabled. With this programming, the output can be used to control a relay that, with a normally closed contact, enables a remote control switch located on the inverter supply line.

NOTE: A hysteresis can be added to output switching through parameter P70.




**P** P61

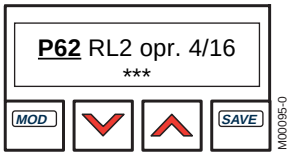
**R** Inv O.K. ON, INV O.K. OFF, Inv RUN Trip, Reference Level, Frequency Level, Forward Running, Reverse Running, Fout O.K., Current Level, Limiting, Motor Limiting, Generator Limiting, PID O.K., PID OUT MAX, PID OUT MIN, FB MAX, FB MIN, PRC OK.

**D** Inv. O.K. ON

**F** It determines the meaning of RL1 relay digital output (terminals 26, 27 and 28). Use ∨ and ∧ to select the inverter status to be associated with the digital output status. The following options are available:
Inv. O.K. ON: active output with inverter ready.
Inv. O.K. OFF: active output with inverter-block (any condition that does not allow RUN control to be sent; see note at the end of parameter description).
Inv run trip: output active in case of inverter block during running due to protection tripping.
Reference Level: active output with inverter whose input has a frequency reference higher than the quantity entered through P71 (see figure 7.1).
Frequency Level: active output with inverter that generates a frequency higher than the value set through parameter P71 independently from the motor rotation direction (see figure 7.2).
Forward Running: active output with inverter that generates a frequency higher than the value set through parameter P71 and corresponding to a positive reference (see figure 7.2).
Reverse Running: active output with inverter that generates a frequency higher than the value set through parameter P71 and corresponding to a negative reference (see figure 7.2).
Fout O.K.: active output when the difference absolute value between frequency reference and output frequency is lower than the value set through P71 "RL1 Level" (see figure 7.3).
Current Level: active output when the inverter output current is higher than the value set through P71 "RL1 Level" (see figure 7.4).
Limiting: active output with inverter in limiting condition.
Motor limiting: active output with inverter in motor limiting condition.
Generator lim.: active output with inverter in regeneration limiting condition.
PID OK: active output if the difference absolute value between the reference signal and the PID regulator feedback decreases below a threshold programmable through P71 ("RL1 Level") (see figure 7.5).
PID OUT MAX: active output if the PID regulator output has reached the value set through parameter P90 (PID MAX Out.) (see figure 7.6).
PID OUT MIN: active output if the PID regulator output has reached the value set through parameter P89 (see figure 7.7).
FB MAX: active output if the absolute value of PID regulator feedback is higher than the value set through P71 (see figure 7.8).
FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set through P71 (see figure 7.9).
PRC OK: active output when the inverter has achieved the precharge phase of the internal capacitor unit (available starting from SW version 2.8).

NOTE: If "INV OK OFF" is selected, the output is enabled whenever the inverter is in lock condition, due to protection tripping, or if the equipment is started after it has been turned off with inverter locked, or if the equipment is started with STAND-BY contact (terminal 6) closed and parameter C61 set to NO. With this programming, the output can be used to control a signal lamp, or to send a signal to PLC to highlight the inverter lock condition. If "Inv run trip" is selected, the output is enabled only if, with running inverter, this is locked due to protection tripping. If the equiment is turned off and on with inverter in lock condition, the output is disabled. With this programming, the output can be used to enable a remote control switch located on the inverter supply line.

NOTE: A hysteresis can be added to output switching through parameter P72.




**P** P62

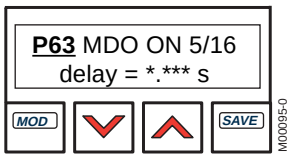
**R** Inv O.K. ON, INV O.K. OFF, Inv RUN Trip, Reference Level, Frequency Level, Forward Running, Reverse Running, Fout O.K., Current Level, Limiting, Motor Limiting, Generator Limiting, PID O.K., PID OUT MAX, PID OUT MIN, FB MAX, FB MIN, PRC OK.

**D** Frequency level

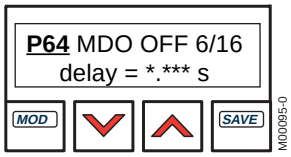
**F** It determines the meaning of RL2 relay digital output (terminals 29 and 30). Use ⋁ and ⋀ to select the inverter status to be associated with the digital output status. The following options are available:
Inv. O.K. ON: active output with inverter ready.
Inv. O.K. OFF: active output with inverter-block (any condition that does not allow RUN control to be sent; see note at the end of parameter description).
Inv run trip: output active in case of inverter block during running due to protection tripping.
Reference Level: active output with inverter whose input has a frequency reference higher than the quantity entered through P73 (see figure 7.1).
Frequency Level: active output with inverter that generates a frequency higher than the value set through parameter P73 independently from the motor rotation direction (see figure 7.2).
Forward Running: active output with inverter that generates a frequency higher than the value set through parameter P73 and corresponding to a positive reference (see figure 7.2).
Reverse Running: active output with inverter that generates a frequency higher than the value set through parameter P73 and corresponding to a negative reference (see figure 7.2).
Fout O.K.: active output when the difference absolute value between frequency reference and output frequency is lower than the value set through P73 "RL2 Level" (see figure 7.3).
Current Level: active output when the inverter output current is higher than the value set through P73 "RL2 Level" (see figure 7.4).
Limiting: active output with inverter in limiting condition.
Motor limiting: active output with inverter in motor limiting condition.
Generator lim.: active output with inverter in regeneration limiting condition.
PID OK: active output if the difference absolute value between the reference signal and the PID regulator feedback decreases below a threshold programmable through P73 ("RL2 Level") (see figure 7.5).
PID OUT MAX: active output if the PID regulator output has reached the value set through parameter P90 (PID MAX Out.) (see figure 7.6).
PID OUT MIN: active output if the PID regulator output has reached the value set through parameter P89 (see figure 7.7).
FB MAX: active output if the absolute value of PID regulator feedback is higher than the value set through P73 (see figure 7.8).
FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set through P73 (see figure 7.9).
PRC OK: active output when the inverter has achieved the precharge phase of the internal capacitor unit (available starting from SW version 2.8)

NOTE: If "INV OK OFF" is selected, the output is enabled whenever the inverter is in lock condition, due to protection tripping, or if the equipment is started after it has been turned off with inverter locked, or if the equipment is started with STAND-BY contact (terminal 6) closed and parameter C61 set to NO. With this programming, the output can be used to control a signal lamp, or to send a signal to PLC to highlight the inverter lock condition. If "Inv run trip" is selected, the output is enabled only if, with running inverter, this is locked due to protection tripping. If the equiment is turned off and on with inverter in lock condition, the output is disabled. With this programming, the output can be used to enable a remote control switch located on the inverter supply line.

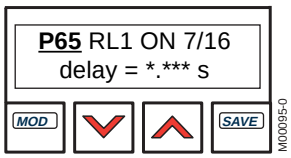
NOTE: A hysteresis can be added to output switching through parameter P74.



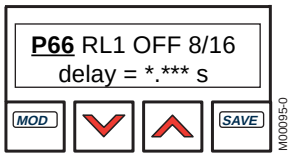

**P** P63
**R** 0.00... 650 s
**D** 0s
**F** It determines the delay at MDO multifunction digital output enabling



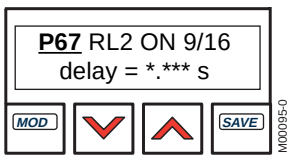

**P** P64
**R** 0.00... 650 s
**D** 0s
**F** It determines the delay at MDO multifunction digital output disabling



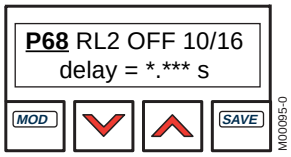

**P** P65
**R** 0.00... 650 s
**D** 0s
**F** It determines the delay at RL1 relay energizing



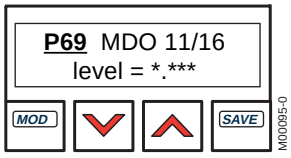

**P** P66
**R** 0.00... 650 s
**D** 0s
**F** It determines the delay at RL1 relay de-energizing



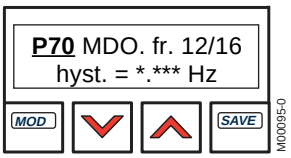

**P** P67
**R** 0.00... 650 s
**D** 0s
**F** It determines the delay at RL2 relay energizing



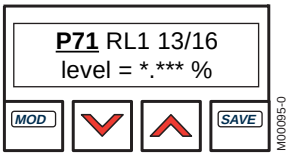

**P** P68
**R** 0.00... 650 s
**D** 0s
**F** It determines the delay at RL2 relay de-energizing



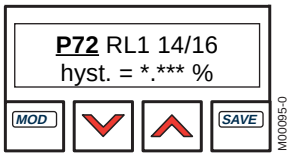

**P** P69
**R** 0 ... 200%
**D** 0
**F** It determines the value at which the open collector digital output is enabled according to the following settings: "Reference level", "Frequency level", "Forward Running", "Reverse Running", "Current level", "FB Max", "FB Min", "Fout O.K." and "PID O.K.".



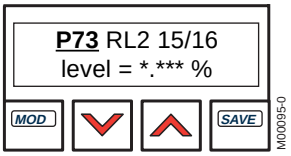

**P** P70
**R** 0 ... 200%
**D** 0
**F** With the Open Collector digital output set to "Reference Level", "Frequency level", "Forward Running", "Reverse Running", "Current level", "Fout O.K.", "PID O.K.", "FB Max", "FB Min", it determines the amplitude of the digital output enabling hysteresis.
With hysteresis other than 0, the output switching occurs at the value set through P69 when the quantity set through P60 increases, otherwise it occurs at P69-P70 when the quantity decreases (e.g. if P60 is set to "Frequency level", P69 to 50%, P70 to 10%, the output is enabled at 50% of max. preset output frequency, and is disabled at 40%).
With P70 = 0, the output switching always occurs at the value set through P69.
With Open Collector digital output MDO set to "PID Max Out" and "PID Min Out", it determines the value at which the digital output is disabled. The digital output is enabled when the PID regulator output, expressed as percentage, reaches the value defined through P90 "PID Max Out" and P89 "PID Min Out" respectively, and is disabled when it reaches P90 - P70 and P89 + P70 respectively (see figures 7.6 and 7.7)



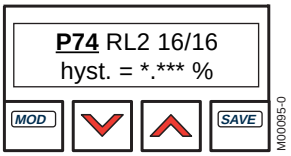

**P** P71
**R** 0 ...200%
**D** 0 %
**F** It determines the value at which the relay digital output is enabled with the following settings: "Reference level", "Frequency level", "Forward Running", "Reverse Running", "Current level", "FB Max", "FB Min", "Fout O.K." and "PID O.K.".




**P** P72
**R** 0 ... 200%
**D** 0 %
**F** With RL1 relay digital output set to "Reference Level", "Frequency level", "Forward Running", "Reverse Running", "Current level", "Fout O.K.", "PID O.K.", "FB Max", "FB Min", it determines the amplitude of the digital output enabling hysteresis.
With hysteresis other than 0, the output switching occurs at the value set through P71 when the quantity set through P61 increases, otherwise it occurs at P71-P72 when the quantity decreases (e.g. if P61 is set to "Frequency level", P71 to 50%, P72 to 10%, the output is enabled at 50% of max. preset output frequency, and is disabled at 40%).
With P72 = 0, the output switching always occurs at the value set through P71.
With RL1 relay digital output set to "PID Max Out" and "PID Min Out", it determines the value at which the digital output is disabled. The digital output is enabled when the PID regulator output, expressed as percentage, reaches the value defined through P90 "PID Max Out" and P89 "PID Min Out" respectively, and is disabled when it reaches P90 - P72 and P89 + P72 respectively (see figures 7.6 and 7.7)




**P** P73
**R** 0 ...200%
**D** 0 %
**F** It determines the value at which the Open Collector digita output is enabled according to the following settings: "Reference Level", "Frequency level", "Forward Running", "Reverse Running", "Current Level", "FB Max", "FB Min", "Fout O.K." and "PID O.K.".




**P** P74
**R** 0 ... 200%
**D** 2 %
**F** With RL2 relay digital output set to "Reference Level", "Frequency level", "Forward Running", "Reverse Running", "Current level", "Fout O.K.", "PID O.K.", "FB Max", "FB Min", it determines the amplitude of the digital output enabling hysteresis.
With hysteresis other than 0, the output switching occurs at the value set through P73 when the quantity set through P62 increases, otherwise it occurs at P73-P74 when the quantity decreases (e.g. if P62 is set to "Frequency level", P73 to 50%, P74 to 10%, the output is enabled at 50% of max. preset output frequency, and is disabled at 40%).
With P74 = 0, the output switching always occurs at the value set through P73.
With RL1 relay digital output set to "PID Max Out" and "PID Min Out", it determines the value at which the digital output is disabled. The digital output is enabled when the PID regulator output, expressed as percentage, reaches the value defined through P90 "PID Max Out" and P89 "PID Min Out" respectively, and is disabled when it reaches P90 - P74 and P89 + P74 respectively (see figures 7.6 and 7.7).

NOTE: For a better understanding, please refer to the following digital output characteristics according to some possible settings.

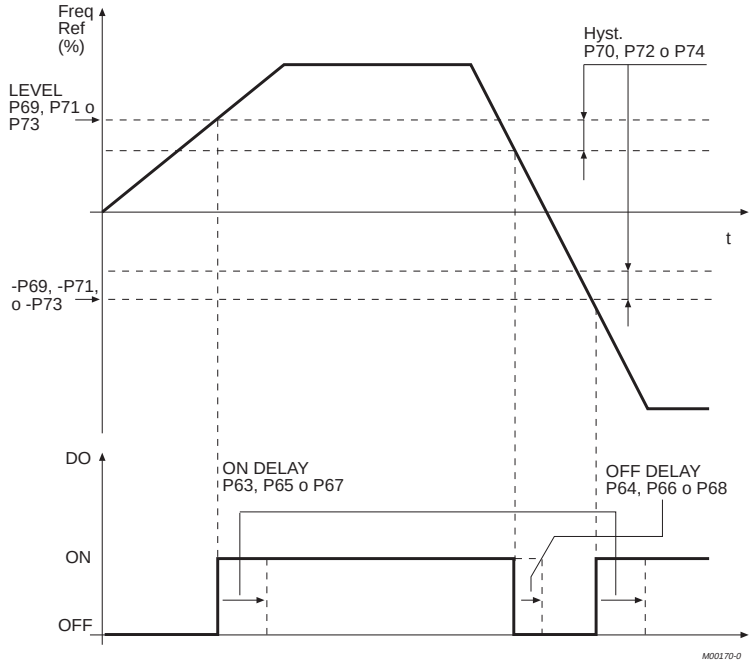



*Figure 7.1 - Digital output set as "Reference level" and frequency reference versus time. Parameters: P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay", P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level", P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst."*

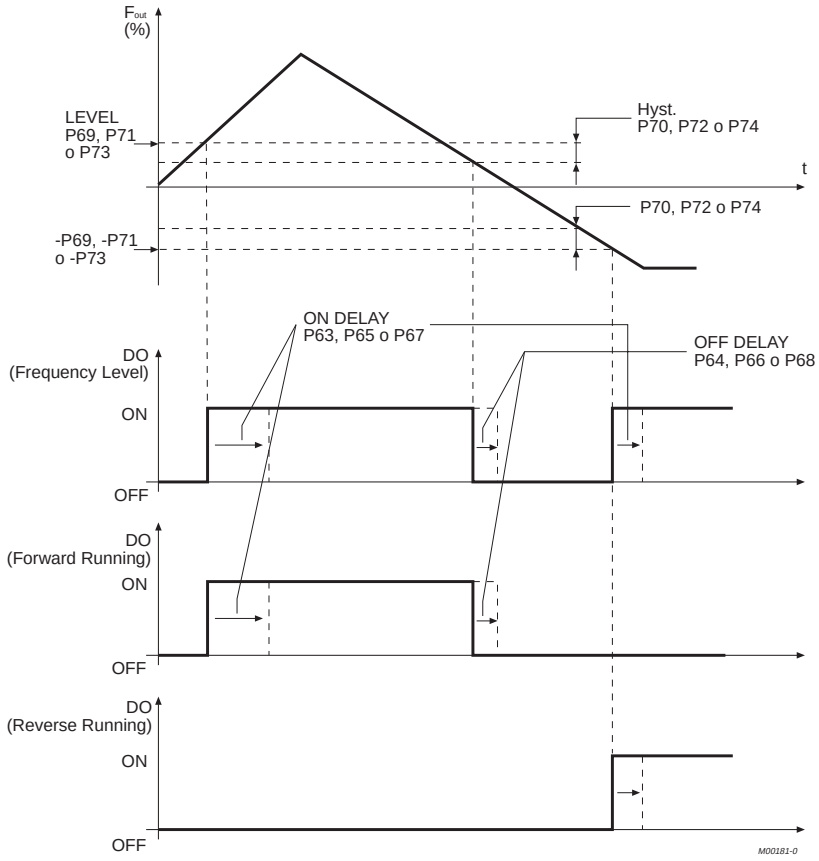



*Figure 7.2 - Digital output set as "Frequency level", to "Forward Running" and to "Reverse Running" of output frequency versus time; the negative output frequency corresponds to rotation direction inversion. Parameters: P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay" P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level", P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst.".*

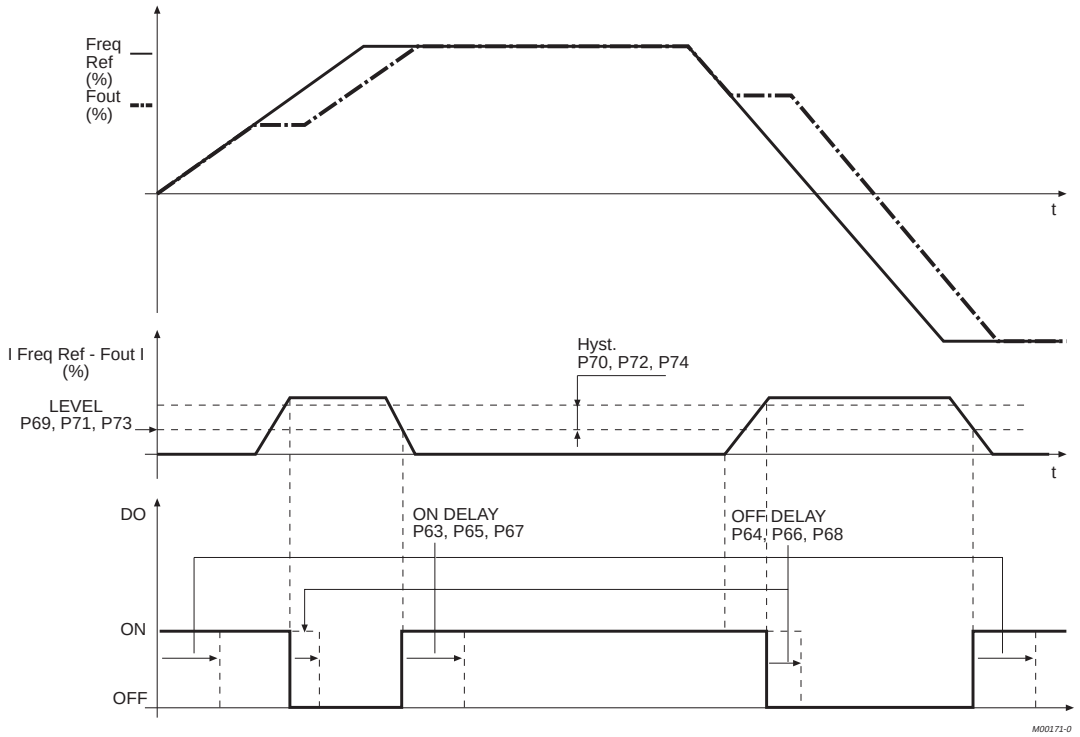



*Figure 7.3 - Digital output set as "Fout O.K.", frequency reference, output frequency and difference between reference and output frequency versus time. Parameters: P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay", P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level", P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst.".*

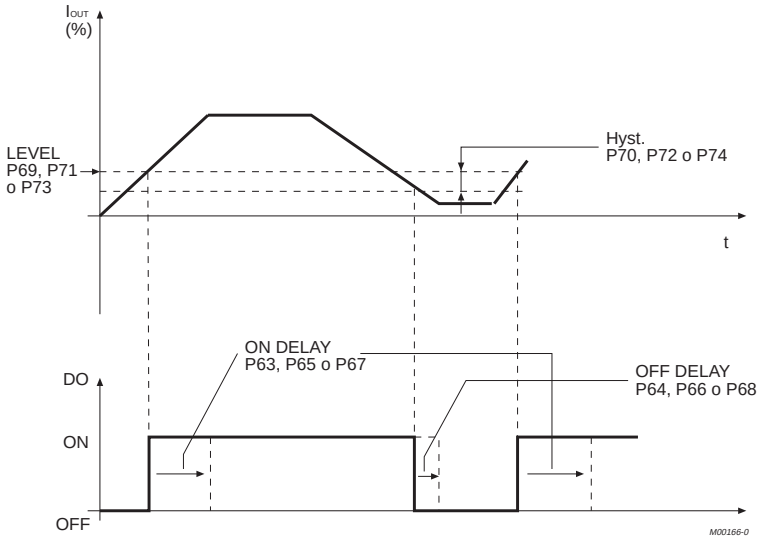



*Figure 7.4 - Digital output set as "Current level" and output frequency versus time. Parameters: P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay", P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level", P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst.".*

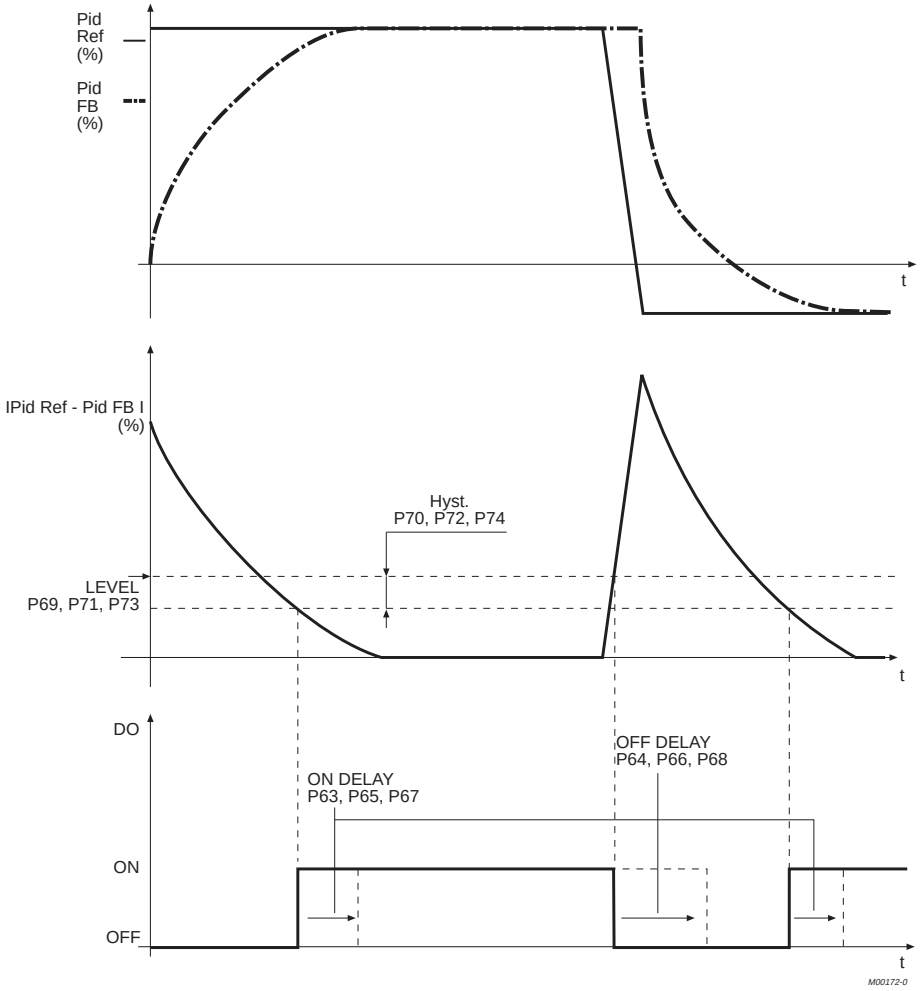



*Figure 7.5 - Digital output set as "PID O.K.", PID regulator reference (PID ref.), PID regulator feedback (PID FB), absolute value of difference between reference and feedback (PID ref. - PID FB) versus time. Parameters P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay", P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level", P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst.".*

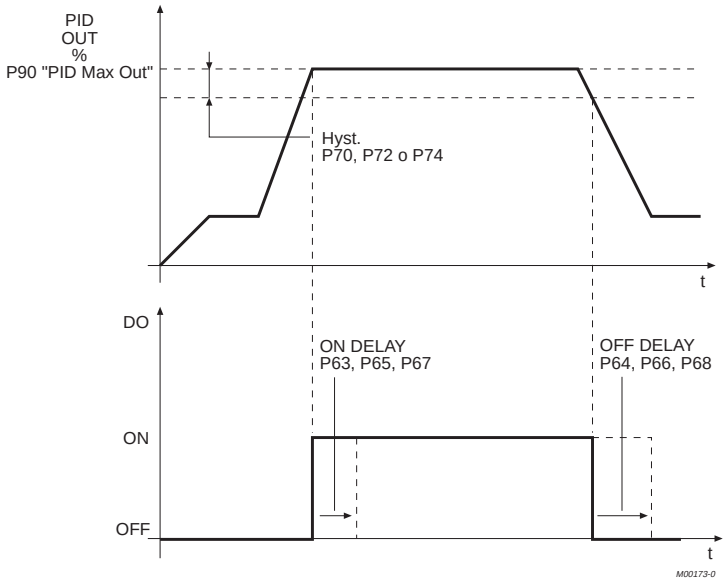



*Figura 7.6 - Digital output set as "PID OUT MAX" and PID regulator output (PID OUT) versus time. Parameters P90 "PID max out", P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay", P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level",P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst.".*

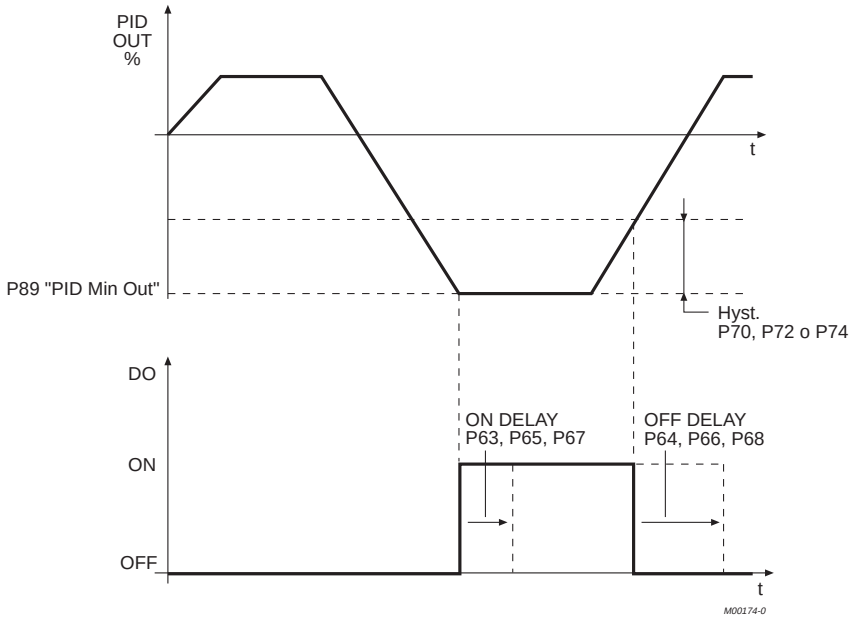



*Figure 7.7 - Digital output set as "PID OUT MIN" and PID regulator output (PID OUT) versus time. Parameters P89 "PID Min Out", P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay", P69 "MDO level", P70 "MDO Hyst.", P71 "RL1 level", P72 "RL1 Hyst.", P73 "RL2 level", P74 "RL2 Hyst.".*

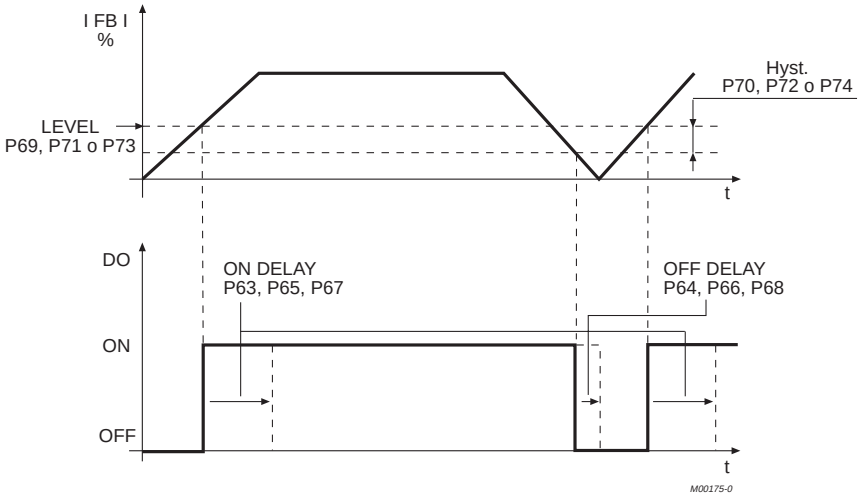



*Figure 7.8 - Digital output set as "FB MAX" and absolute value of PID regulator feedback (FB) versus time. Parameters P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay".*

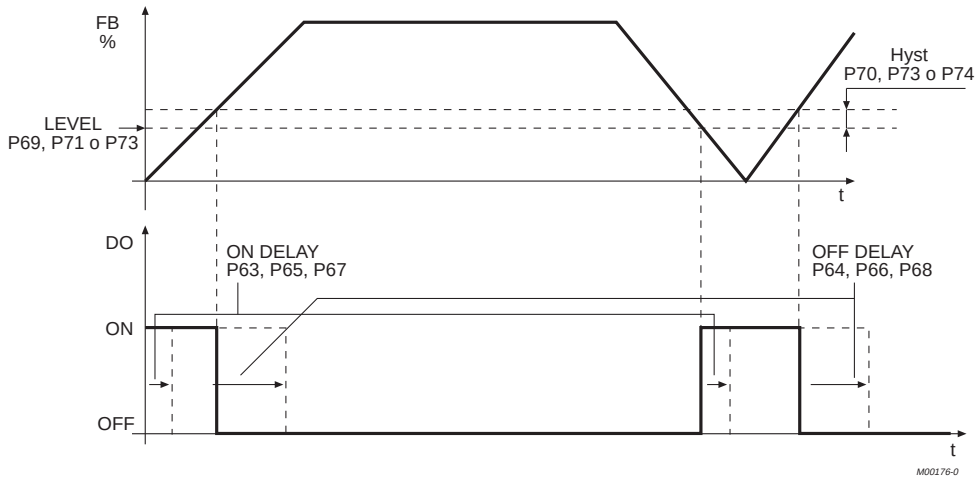
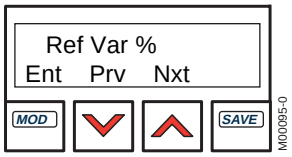



*Figure 7.9 - Digital output set as "FB MIN" and absolute value of PID regulator feedback (FB) versus time. Parameters P63 "MDO ON delay", P64 "MDO OFF delay", P65 "RL1 ON delay", P66 "RL1 OFF delay", P67 "RL2 ON delay", P68 "RL2 OFF delay".*

## 7.1.4.10 Ref. Var %

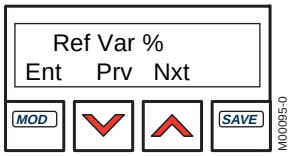
It contains the change values of the frequency reference obtained through the multifunction digital inputs MDI1, MDI2 and MDI3 programmed as control for frequency percentage change (see OP METHOD submenu).

Access page to submenu



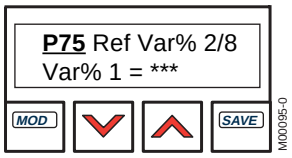

Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenu

First page of submenu

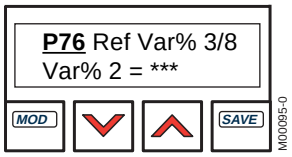



Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.

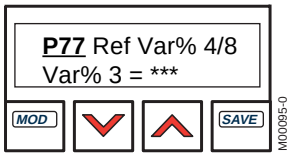
*SUBMENU PARAMETERS*



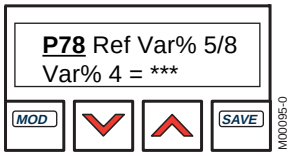

**P** P75
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital input 1 (terminal 9) active and programmed as reference percentage change (parameter C23 OP METHOD submenu)



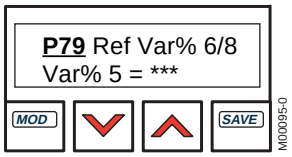

**P** P76
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital input 2 (terminal 10) active and programmed as reference percentage change (par. C24 OP METHOD submenu)



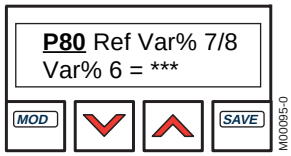

**P** P77
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital inputs 1 and 2 (terminals 9 e10) active and programmed as frequency percentage change (par. C23 and C24 OP METHOD submenu)



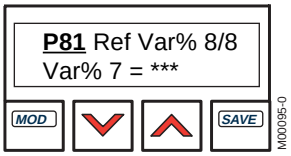

**P** P78
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital input 3 (terminal 11) active and programmed as frequency percentage change (par.C25 submenu OP METHOD)




**P** P79
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital inputs 1 and 3 (terminals 9 e11) active and programmed as frequency percentage change (par. C23 and C25 OP METHOD submenu)




**P** P80
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital inputs 2 and 3 (terminals 10 e11) active and programmed as frequency percentage change (par. C24, C25 OP METHOD submenu)

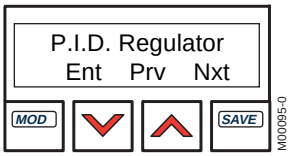



**P** P81
**R** -100% to +100%
**D** 0
**F** It determines the output frequency change with multifunction digital inputs 1, 2 and 3 (terminals 9, 10 and 11) active and programmed as frequency percentage change (par. C23, C24, C25 OP METHOD submenu)

## 7.4.1.11 PID regulator

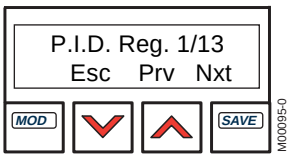
It contains the calibration parameters of PID regulator

Submenu access page



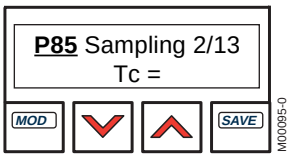

Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus

First page of submenu

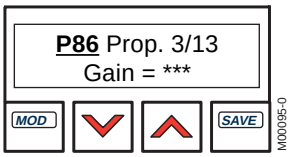



Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of submenu

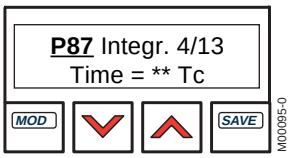
*SUBMENU PARAMETERS*



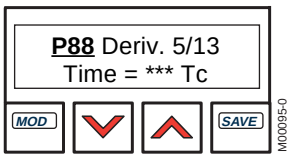

**P** P85
**R** 0.002 ÷ 4s
**D** 0.002s
**F** PID regulator cycle time (e.g. if setting 0.002S, the PID regulator is performed every 0.002s)



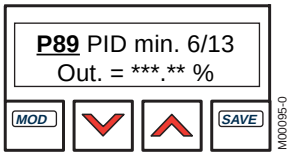

**P** P86
**R** 0 ÷ 31.9
**D** 1
**F** Multiplying constant of PID regulator proportion factor; the regulator output in % is equal to the difference between reference and feedback expressed as percentage multiplied by P86.



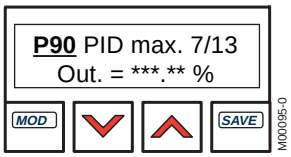

**P** P87
**R** 3 ÷ 1024 Tc
**D** 512 Tc
**F** Constant that divides the integral factor of PID regulator. This constant is expressed as multiple of sampling time. If Integr. Time = NONE (value after 1024), the integral action is cleared.



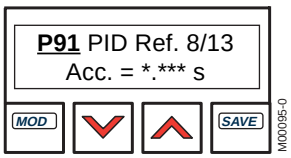

**P** P88
**R** 0 ÷ 4 Tc
**D** 0
**F** Constant that multiplies the derivative factor of PID regulator. This constant is expressed as multiple of sampling time. With Deriv. Time = 0 the derivative action is disabled.



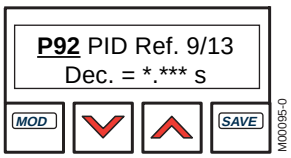

**P** P89
**R** -100 ... +100
**D** 0
**F** Min. value of PID regulator output




**P** P90
**R** -100 ... +100
**D** 100%
**F** Max. value of PID regulator output

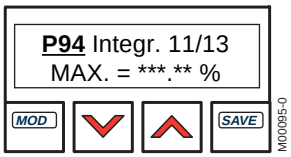



**P** P91
**R** 0 ÷ 6500 s
**D** 0
**F** Raising ramp of PID regulator reference

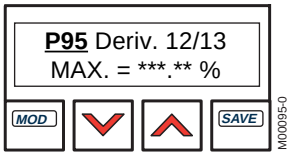



**P** P92
**R** 0 ÷ 6500 s
**D** 0
**F** Lowering ramp of PID regulator reference

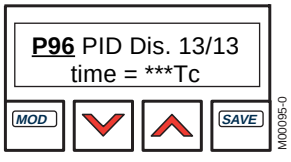

**P** P93
**R** 0 ÷ 800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 5.5 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
0 ÷ 120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 0
**F** Inverter output frequency at which the integral factor of PID regulator is enabled




**P** P94
**R** 0 ÷ 100 %
**D** 100 %
**F** Max. value of PID regulator integral factor




**P** P95
**R** 0 ÷ 10 %
**D** 10 %
**F** Max. value of PID regulator derivative factor

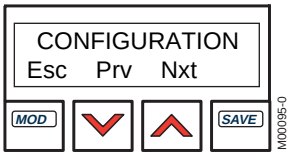



**P** P96 (available starting from SW version 2.8)
**R** 0 ÷ 60000 Tc
**D** 0 Tc
**F** If the value of PID regulator output is kept at its min. value (parameter P89) throughout the time set in P96, the inverter will stop. If P96=0Tc, this function is disabled.

## 7.4.2 CONFIGURATION MENU

It contains the parameters that cannot be changed during the operation: to change them, **set the inverter in standby** or stop and **P01=1**. The menu is divided into submenus, each one containing the parameters of a specific adjustment.

First page of the submenu



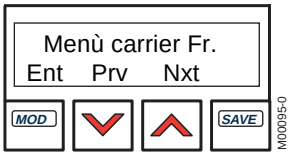

Press MOD to go back to the selection page among the main menus; use ∨ and ∧ to move through the different submenus.

*SUBMENU LIST*

### 7.4.2.1 Carrier frequency

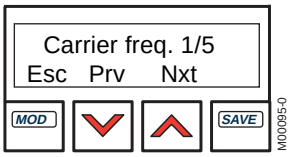
It determines the frequency of the PWM modulation produced by the inverter.

Access page to submenu



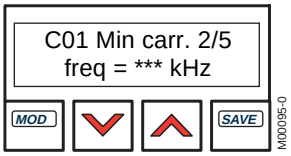

Press MODE to enter the submenu; use ∨ and ∧ to move through the other submenus.

First page of submenu

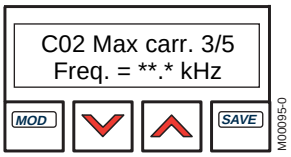



Press MODE to exit the submenu; use ∨ and ∧ to move through the other pages of the submenu.

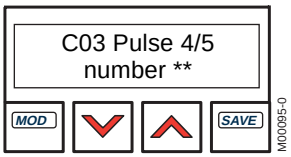
*SUBMENU PARAMETERS*



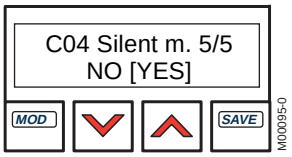

**P** C01
**R** 0.6 ÷12.8 kHz for SINUS/IFD 4÷75 and SINUS/IFDV 11÷90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5 0.6 - 0.8 kHz for SINUS/IFD 90 ÷ 250 and SINUS/IFDV 110÷315
**D** 10 kHz for SINUS/IFD 4÷30, 5kHz for SINUS/IFD 37÷75 and SINUS/IFDV 11÷90 3kHz for SINUS/IFDEV 18.5, SINUS/IFD 90÷250 and SINUS/IFDV 110/315
**F** Min. value of PWM modulation frequency




**P** C02
**R** 0.6 ÷ 12.8 kHz for SINUS/IFD 4÷7.5 and SINUS/IFDV 11÷90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5 0.6 ÷ 0.8 kHz for SINUS/IFD 90÷250 and SINUS/IFDV 110÷315
**D** 10 kHz for SINUS/IFD 4÷30, 5 kHz for SINUS/IFD 37÷75 and SINUS/IFDV 11÷90 4 kHz for SINUS/IFD 90÷250 and SINUS/IFDV 110÷315, 3kHz for SINUS/IFDEV 18.5
**F** Max. value of PWM modulation frequency




**P** C03
**R** 12, 24, 48, 96, 192, 384
**D** 24
**F** Number of pulses generated by PWM modulation when going from min. to max. PWM modulation frequency




**P** C04 (available starting from SW version 2.08)
**R** YES, NO
**D** YES
**F** Allows to use a noiseless PWM technique.

NOTE: Never programme parameter C04 = YES if the output frequency is higher than 200 Hz.

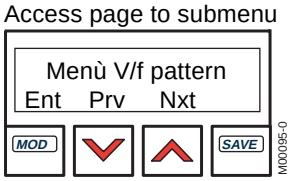
NOTE: An increase of the carrier frequency also increases the losses generated by the inverter.
When the carrier is increased as regards the default value, the inverter thermic protection may be tripped.
It is therefore recommended to increase the carrier only in the following cases: discontinuous operation, output current lower than the rated one, supply voltage lower than the max. one, room temperature lower than 40°C.

NOTE: For details, see paragraph 6.6 "Carrier frequency".

### 7.4.2.2 V/f characteristic

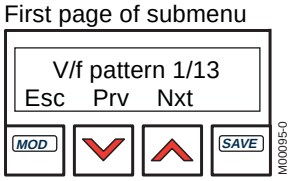
It determines the V/f pattern of inverter operation. For further details see paragraph "Frequency and voltage characteristic" in chapter "Description of the main features of programmable functions".

Access page to submenu



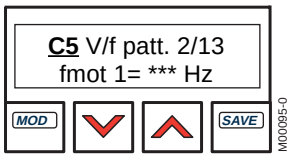

Press MODE to enter the submenu; use ∨ and ∧ to move through the other submenus of the configuration menu

First page of submenu

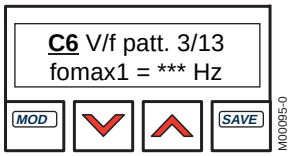



Press MODE to exit the submenu; use ∨ and ∧ to move through the other pages of the submenu.

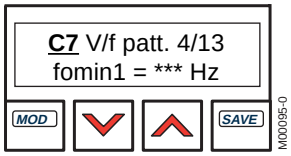
*SUBMENU PARAMETERS*



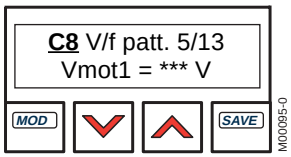

**P** C5
**R** 3.5 ÷ 800 Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 5.5 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
3.5 ÷ 120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
3.5 ÷ 800 Hz
**D** 50 Hz
**F** Rated frequency of the motor for the first frequency voltage characteristic. It determines the passage from constant V/f operation to constant V operation.



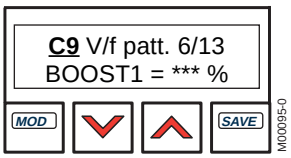

**P** C6
R 3.5...800Hz for SINUS/IFD 4 ÷ 75 and SINUS/IFDV 5.5 ÷ 90, SINUS/IFDE 4 ÷ 15 and SINUS/IFDEV 5,5 ÷ 18,5
3.5...120Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**D** 50 Hz
**F** Max. output frequency for the first frequency voltage characteristic. Inverter output frequency in correspondence to the max. reference value.



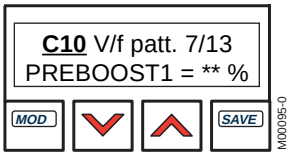

**P** C7
**R** 0.5...5Hz
**D** 0.5 Hz
**F** Min. output frequency for the first frequency voltage characteristic. Min. frequency generated at inverter output (to be changed only if required by Elettronica Santerno).



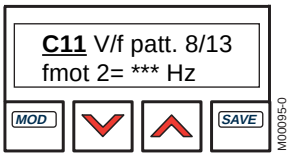

**P** C8
**R** 50...460 V
**D** 380 V
**F** Motor rated voltage related to the first frequency voltage characteristic. It determines the output voltage at motor rated frequency.



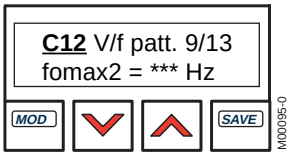

**P** C9
**R** -100%...+100%
**D** 0
**F** Torque compensation at low revolution number for the first frequency voltage characteristic. It determines the increase of the output voltage at low output frequencies as regards to the constant frequency voltage ratio.



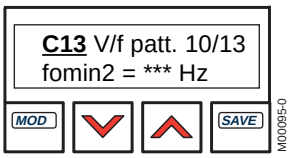

**P** C10
**R** 0...5%
**D** 2.5% for SINUS/IFD 4 ÷ 75, SINUS/IFDV 5.5 ÷ 90, SINUS/IFDE 4 ÷ 15, SINUS/IFDEV 5,5 ÷ 18,5
1.0% for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 110 ÷ 200
**F** Torque compensation at low revolution for the first frequency voltage characteristic. It determines the output voltage at 0Hz.



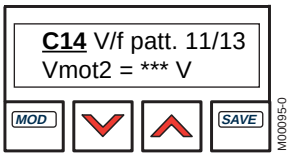

**P** C11
**R** 3.5...800 Hz for SINUS/IFD 4 ÷75, SINUS/IFDV 5.5 ÷ 90, SINUS/IFDE 4÷15, SINUS/IFDEV 5,5÷18,5
3.5...120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 90 ÷ 200
**D** 50 Hz
**F** Rated frequency of the motor for the second frequency voltage characteristic. It determines the passage from constant V/f operation to constant V operation.



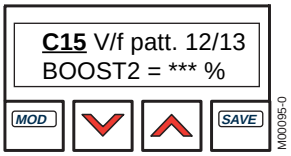

**P** C12
**R** 3.5...800 Hz for SINUS/IFD 4 ÷75, SINUS/IFDV 5.5 ÷ 90, SINUS/IFDE 4÷15, SINUS/IFDEV 5,5÷18,5
3.5...120 Hz for SINUS/IFD 90 ÷ 160 and SINUS/IFDV 90 ÷ 200
**D** 50
**F** Max. output frequency for the second frequency voltage characteristic. Inverter output frequency in correspondence to the max. reference value.



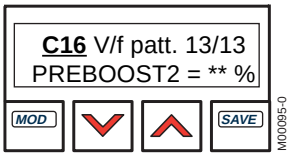

**P** C13
**R** 0.5...5Hz
**D** 0,5 Hz
**F** Min. output frequency for the second frequency voltage characteristic. Min. inverter output frequency (to be changed only if required by Elettronica Santerno).




**P** C14
**R** 50...460 V
**D** 380
**F** Motor rated voltage for the second frequency voltage characteristic. It determines the output voltage of the motor rated frequency.




**P** C15
**R** -100%...+100%
**D** 0
**F** Torque compensation at low revolution number for the second frequency voltage characteristic. It determines the increase of the output voltage at low output frequencies as regards to the constant frequency voltage ratio.



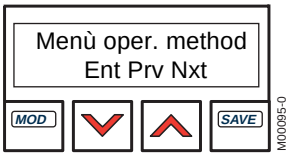

**P** C16
**R** 0...5%
**D** 2.5% for SINUS/IFD 4/75, SINUS/IFDV 5,5÷90, SINUS/IFDE 4÷15, SINUS/IFDEV 5,5÷18,5
1.0% for SINUS/IFD 90/160 and SINUS/IFDV 110÷200
**F** Torque compensation at low revolution number for the second frequency voltage characteristic. It determines the output voltage at 0Hz.

**NOTE**: The inverter normally uses the first frequency voltage characteristic, while the second characteristic is used when enabling terminal MDI5 programmed as V/F2 (see OP METHOD submenu).

## 7.4.2.3 Operation method

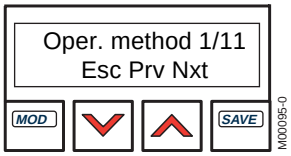
It determines the control method.

Submenu access page



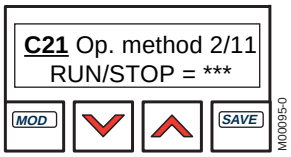

Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus of the configuration menu

First page of submenu



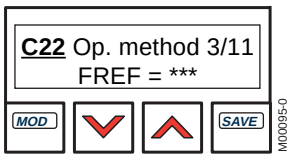

Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.

*SUBMENU PARAMETERS*



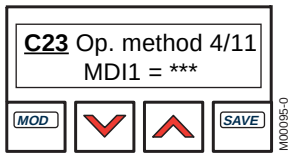

**P** C21
**R** Term Kpd Rem
**D** Term
**F** It defines the input for RUN/STOP command;
Term: from control terminals (the RUN/STOP command is sent to terminal 7 of control terminals)
Kpd (from keypad, the RUN/STOP command must be sent through keypad, see COMMANDS menu, terminal 7 is not active; anyway, all other digital inputs are active).
Rem: the commands for digital inputs (exept for terminal 6) come from serial line.

**NOTE**: No saving on non-volatile memory (EEPROM) is allowed in REM operating mode. If the device is to be serial-controlled, the PLC (or the master board) will set parameter C14 to REM after the inverter startup and during the initialization stage. The inverter starts only if terminal 6 is active.

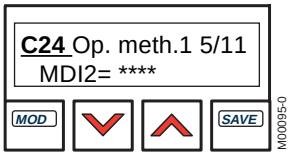



**P** C22
**R** Term, Kpd, Rem
**D** Term
**F** It indicates where the main frequency reference comes from;
- Term from control terminal: the main frequency reference comes from terminals 2, 3 and 21.
- Kpd from keypad: the main frequency reference comes from keypad, see COMMANDS submenu.
- Rem from serial line: the main frequency reference comes from serial line.

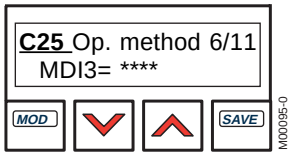
**NOTE**: In order to send the serial line command, set C14 or C16 to REM. This setting cannot be permanently stored (see Note above).



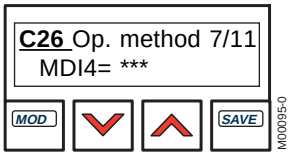

**P** C23
**R** Mltf1, Up, Var%1
**D** Mlft1
**F** It determines the action of multifunction input 1 (terminal 9).
- Mltf1: multifrequency input 1
- Up: increase key for output frequency (with parameter P24, the increase value can be saved at power off).
- Var%1: percentage change input of frequency reference 1.



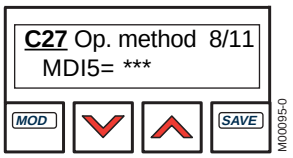

**P** C24
**R** Mltf2, Down, Var%2
**D** Mltf2
**F** It determines the action of multifunction input 2 (terminal 10).
- Mltf2: multifrequency input 2.
- Down: decrease key for output function (with parameter P24, the decrease value can be saved at power off).
- Var%2: percentage change input of frequency reference 2.



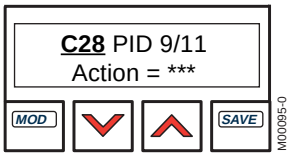

**P** C25
**R** Mltf3, CW / CCW, DCB, Var%3, REV, A/M, Lock
**D** Mltf3
**F** It determines the action of multifunction input 3 (terminal 11).
- Mltf3: multifrequency input 3.
- CW/CCW: command for rotation direction change.
- DCB: command for direct current braking.
- Var%3: percentage change input of frequency reference 3.
- REV: reverse command.
- A/M: control for PID regulator disabling.
- Lock: keypad lock command (available starting from SW version 2.8).



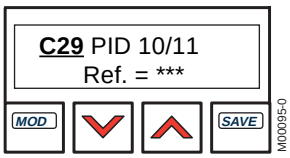

**P** C26
**R** Mltf4, Mltr1, DCB, CW/CCW, REV, A/M, Lock
**D** CW/CCW
**F** It determines the action of multifunction input 4 (terminal 12).
- Mltf4: multifrequency input 4.
- Mltr1: command for duration change of acceleration and deceleration ramps.
- DCB: command for direct current braking.
- CW/CCW: command for rotation direction change.
- REV: reverse command.
- A/M: control for PID regulator disabling.
- Lock: keypad lock command (available starting from SW version 2.8).



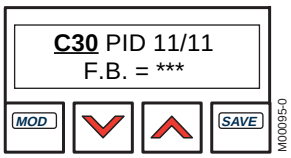

**P** C27
**R** DCB, Mltr2, CW/CCW, V/F2, ExtA, REV, Lock
**D** DCB
**F** It determines the action of multifunction input 5 (terminal 13).
- DCB: command for direct current braking.
- Mltr2: command for duration change of acceleration and deceleration ramps.
- CW/CCW: command for rotation direction change.
- V/F2: command for frequency voltage characteristic change.
- Ext A: external alarm.
- REV: reverse command.
- Lock: keypad lock command (available starting from SW version 2.8).




**P** C28
**R** Ext, Ref F, Add F, Add V
**D** Ext
**F** It determines the PID regulator action. The following options are available:
- Ext: PID regulator independent from inverter operation
- Ref F: PID regulator output is the inverter frequency reference
- Add F: PID regulator output is added to the frequency reference
- Add V: PID regulator output is added to the output voltage value generated by V/F characteristic.




**P** C29
**R** Kpd, Vref, Iref, Inaux, Rem
**D** Kpd
**F** It determines where the PID regulator reference comes from.
- Kpd, from keyboard; Vref from keyboard under voltage (terminals 2 and 3)
- Iref, from keyboard under current (terminal 21)
- Inaux from keyboard under voltage through auxiliary input (terminal 19)
- Rem, from serial line.

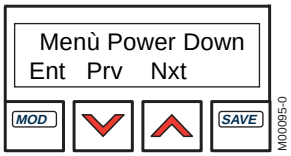



**P** C30
**R** Inaux, Vref, Iref, Iout
**D** Inaux
**F** It determines where the PID regulator feedback comes from.
- Inaux, from terminal board under voltage through auxiliary input (terminal 19)
- Vref, from terminal board under voltage (terminals 2 and 3)
- Iref, from terminal board under current (terminal 21)
- Iout, feedback consists of inverter output current.

## 7.4.2.4 Power Down

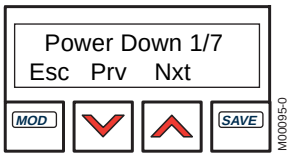
It contains the parameters of controlled stop operation in case of mains failure.

Submenu access page

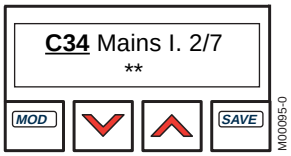



Press MOD to enter the submenu; use ∨ and ∧ to move through the other submenus of configuration menu.

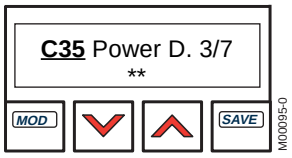
First page of submenu



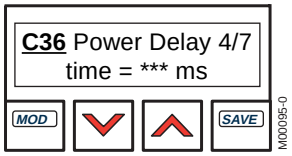

Press MOD to exit the submenu; use ∨ and ∧ to move through the other pages of submenu.



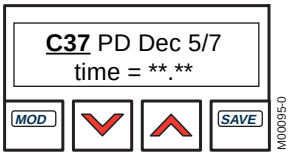

**P** C34
**R** YES, NO
**D** NO
**F** In case of power failure, it sets the inverter in stand-by. The display shows A25 Mains loss. The alarm can be delayed through parameter C36.



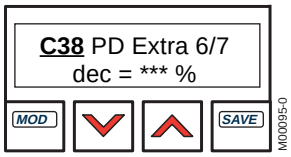

**P** C35
**R** NO, YES, YES A
**D** NO
**F** It enables the motor controlled stop in case of mains failure. The following options are available:
- NO: function disabled
- YES: motor controlled stop occurs in case of mains failure after time C36 has elapsed
- YES A: motor controlled stop in case of mains failure occurs after time C36 has elapsed, even if the RUN/STAND BY and RUN/STOP controls disappears



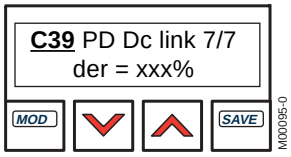

**P** C36
**R** 5 ÷ 255 ms
**D** 10 ms
**F** Time before the motor controlled stop is enabled in case of mains failure




**P** C37
**R** 0.1 ÷ 6500
**D** 10 s
**F** Deceleration ramp during controlled stop




**P** C38
**R** 0 ÷ 500 %
**D** 200 %
**F** Increase of deceleration ramp during the first phase of controlled stop.

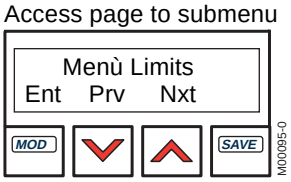



**P** C39
**R** 0 ÷ 300 %
**D** 0 %
**F** It detects the mains loss condition so as to enable the motor controlled stop

## 7.4.2.5 Limits

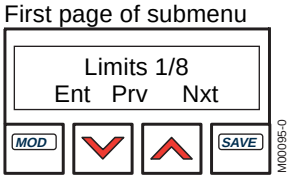
It determines the current limit operation during acceleration and at constant frequency. It also determines the voltage limit operation during deceleration.

Access page to submenu



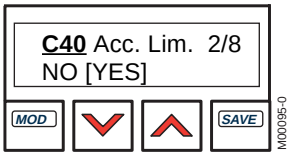

Press MOD to enter the submenu; use ⌄ and ⌃ to move to the other configuration menus.

First page of submenu

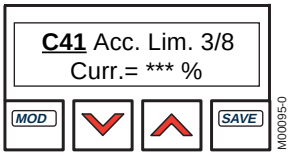



Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.

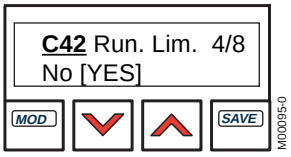
*SUBMENU PARAMETERS*



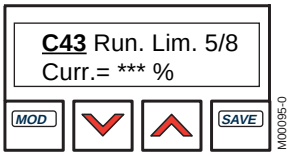

**P** C40
**R** YES NO
**D** YES
**F** Current limit enabling during acceleration.



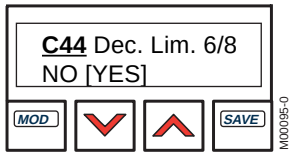

**P** C41
**R** 30...200% for SINUS/IFD 4÷75 and SINUS/IFDE 4÷15, 30÷150% for SINUS/IFD 90÷250, 30÷120% for SINUS/IFDV 5.5÷315 and SINUS/IFDEV 5,5÷18,5
**D** 150% for SINUS/IFD and SINUS/IFDE, 120% for SINUS/IFDV and SINUS/IFDEV
**F** Limit current during acceleration expressed as percentage of inverter rated current.



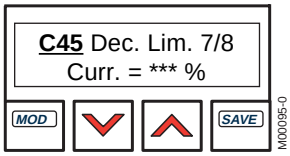

**P** C42
**R** YES, NO
**D** YES
**F** Current limit enabling at constant frequency.



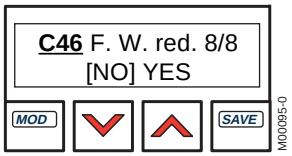

**P** C43
**R** 30...200% for SINUS/IFD 4÷75 and SINUS/IFDE 4÷15, 30÷150% for SINUS IFD 90÷250, 30...120% for SINUS/IFDV 5.5÷315 and SINUS/IFDEV 5.5÷18.5
**D** 150% for SINUS/IFD and SINUS/IFDE, 120% for SINUS/IFDV and SINUS/IFDEV
**F** Limit current at constant frequency expressed as percentage of inverter rated current.




**P** C44
**R** YES, NO
**D** YES
**F** Voltage limit enabling during deceleration.




**P** C45 (available starting from SW version 2.8)
**R** 30÷150% for SINUS/IFD 4÷250 and SINUS/IFDE 4÷15, 30÷120% for SINUS/IFDV 5,5÷315 and SINUS/IFDEV 4÷18,5.
**D** 150% for SINUS/IFD and SINUS/IFDE, 120% for SINUS/IFDV and SINUS/IFDEV.
**F** Deceleration limit current expressed as a percentage of the inverter rated current.

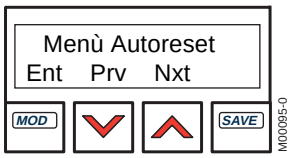



**P** C46 (presente dalla versione SW 2.8)
**R** YES, NO
**D** NO
**F** La programmazione su YES determina la riduzione del valore di limitazione di corrente oltre la frequenza nominale del motore proporzionalmente al rapporto tra frequenza prodotta e frequenza nominale (es. al doppio della frequenza nominale la limitazione diventa metà). La limitazione di corrente non può diventare comunque inferiore al 50% di quanto programmato dai relativi parametri.

## 7.4.2.6 Autoreset

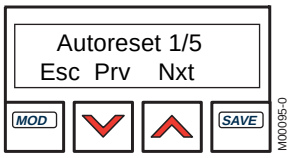
It allows to perform an automatic reset of the device in case of alarm tripping. You can set the number of possible attempts in a given time interval.

Submenu access page



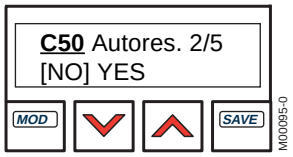

Press MOD to enter the submenu; use ∨ and ∧ to move through the other submenus of the configuration menu

First page of submenu

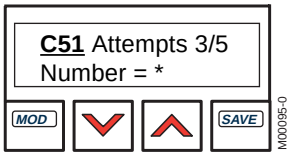



Press MOD to exit the submenu; use ∨ and ∧ to move through the other pages of the submenu.

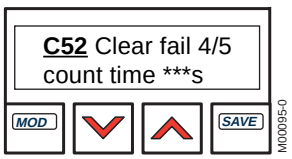
*SUBMENU PARAMETERS*



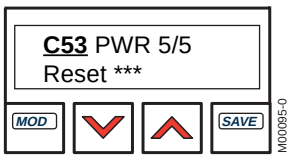

**P** C50
**R** NO, YES
**D** NO
**F** It determines if the autoreset is present or not.




**P** C51
**R** 1...10
**D** 4
**F** It determines the number of automatic resets before the function is inhibited. The count restarts from 0 if, after an alarm reset, a time longer than C52 has elapsed.




**P** C52
**R** 1...999s
**D** 300s
**F** When this time interval has elapsed without alarms, the number of resets performed is set to zero.

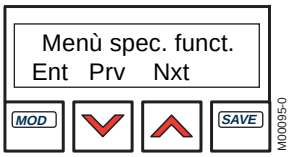



**P** C53
**R** YES, NO
**D** NO
**F** If set to YES, an alarm (if present) can be automatically reset by turning the inverter off and on again.

## 7.4.2.7 Special function

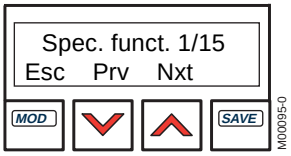
The menu contains some special functions:
- possibility of saving the power failure alarm in case of power failure for a time causing the device complete switching off.
- possibility of searching for motor rotation speed in case of RUN command given after a standby command done with output frequency different from 0 (speed search function).
- number of motor polar pairs
- possibility to apply a reduction ratio in the rounds per minute displayed
- operation mode of RUN/STBY command
- page display at power on.
- possibility to apply a multiplying constant to PID regulator feedback display.

Submenu access page



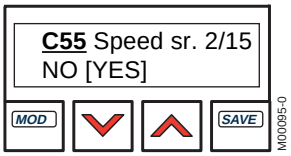

Press MOD to enter the submenu; use ∨ and ∧ to move through the other submenus of the configuration menu

First page of submenu

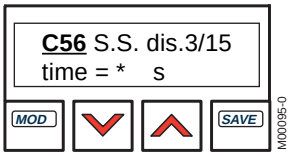



Press MOD to exit the submenu; use ∨ and ∧ to move through the other pages of the submenu.

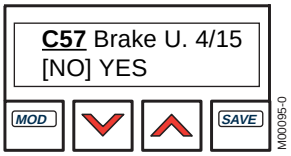
*SUBMENU PARAMETERS*



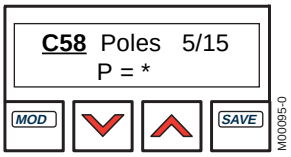

**P** C55
**R** NO, YES, YES A
**D** YES
**F** It allows to execute the speed search function (see paragraph "Searching for motor rotation speed " in chapter "Description of the main characteristics").



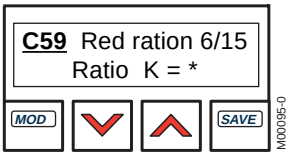

**P** C56
**R** 0...3000s
**D** 1s
**F** Disabling time of speed search function. The searching for motor rotation speed only occurs if the inverter remains in stand by for a time shorter than the one set through parameter C56. After this time has elapsed, the inverter follows the preset acceleration ramp. The 0s value keeps the speed search function ever enabled (if programmed with parameter C55).



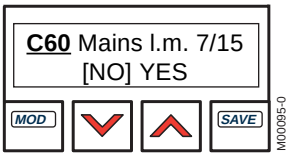

**P** C57
**R** YES, NO
**D** NO
**F** It enables the inverter to operate with braking module (inside or outside).



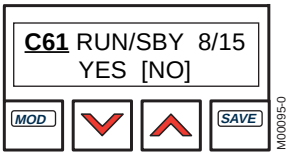

**P** C58
**R** 2, 4, 6, 8, 16
**D** 4
**F** Number of motor pole pairs to calculate the rotation speed.




**P** C59
**R** 0.001...50
**D** 1
**F** Proportion constant between the motor rev. number and what is shown on the display with parameter M09.

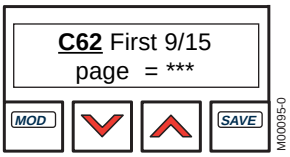



**P** C60
**R** NO, YES
**D** NO
**F** It allows to save all the alarms related to the power failure (A30 and A31), during a power failure time long enough to turn the device completely off. When power is on again, a RESET command should be sent to reset the alarms.

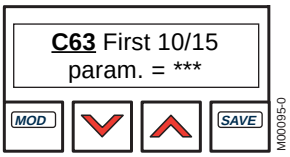



**P** C61
**R** YES, NO
**D** YES
**F** t determines the action of the RUN/STANDBY command (terminal 6) at power on and at a possible RESET of the device
YES: the RUN/STANDBY command is active at power on; if terminals 6 and 7 are active and a frequency reference is present, when the device is turned on or after a RESET, the motor is started.
NO: The RUN/STANDBY command is not active at power on or after a RESET; if terminals 6 e7 are active and a frequency reference is present, when the device is turned on or after an alarm RESET, the motor will only be started after terminal 6 is opened and closed again..

DANGER: If the parameter is set to YES, the motor can start as soon as the inverter is powered!

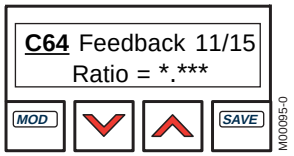



**P** C62
**R** Keypad, Status
**D** Status
**F** It determines the pages shown on the display at power on. The following options are available:
Status: Access page to main menus
Keypad: Page related to keypad control.

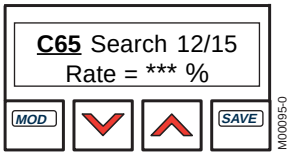



**P** C63
**R** Fref, FOUT, IOUT, VOUT, Vmn, Vdc, Pout, Tr Bd, Nout., 0 time, Aux I, Pid Rf, Pid FB, Pid Er, Pid 0, Feed B.
**D** FOUT
**F** It determines the value shown on the display at power on with parameter C62 programmed with Keypad.
The following options are available:

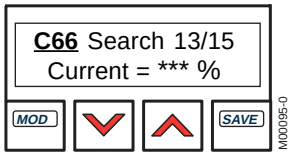
| | |
|---|---|
| Fref: | M01 - Value of frequency reference |
| FOUT: | M02 - Value of output frequency |
| IOUT: | M03 - Value of output current |
| VOUT: | M04 - Value of output voltage |
| Vmn: | M05 - Value of mains voltage |
| Vdc: | M06 - Value of D.C. intermediate circuit voltage |
| Pout: | M07 - Value of output power |
| Tr Bd: | M08 - State of digital inputs |
| Nout: | M09 - Motor rotation speed |
| O. time: | M10 - Time during which the inverter is in RUN state from startup. |
| Aux I: | M11 - Value of auxiliary input |
| Pid Rf: | M12 - Value of PID regulator reference |
| Pid FB: | M13 - Value of PID regulator feedback |
| Pid Er: | M14 - Difference between reference and feedback of PID regulator |
| Pid 0: | M15 - PID regulator output |
| Feed B.: | M16 - Value assigned to PID regulator feedback signal. |



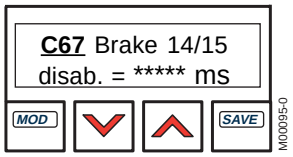

**P** C64
**R** 0.001 ÷ 50.00
**D** 1
**F** It determines the proportion constant between what is shown through parameter M 21and the absolutevalue of PID regulator feedback signal.



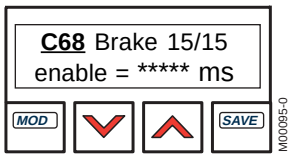

**P** C65
**R** 10 ÷ 999%
**D** 100%
**F** It determines the frequency decrease speed during the motor rotation speed search.




**P** C66
**R** 40 ÷ 105%
**D** 100%
**F** It determines the current level at which the motor rotation speed search is complete.




**P** C67 (available starting from SW version 2.8)
**R** 10 ÷ 65400 ms
**D** 9000 ms
**F** Disabling time of the internal braking module. In conjunction with parameter C65, it determines the max. duty cycle for the internal braking module.




**P** C68 (available starting from SW version 2.8)
**R** 10 ÷ 65400 ms
**D** 2250 ms
**F** Enabling time of the internal braking module. With the default values, the internal braking module may be continously enabled for max. 2,25s, then it will be disabled for 9s. The ratio between the enabling time and the duty cycle is limited to:

$$D.C.= \frac{C68}{C67 + C68}$$

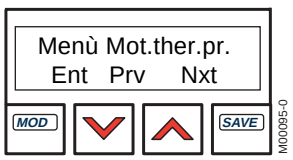
NOTE: For those applications requiring an internal braking module different than the one allowed by parameters C67 and C68 and the inverter model (see Chapter 3.2 Technical Table Data), use the external braking module.

DANGER: When programming C67 and C68, never exceed the time values mentioned in the braking resistance chapter.

## 7.4.2.8 Motor thermal protection

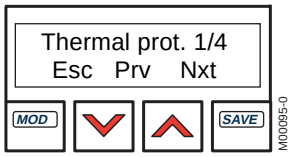
It determines the parameters corresponding to the motor software thermal protection. For further details, see paragraph "Motor thermal protection" in chapter "Description of the main characteristics".

Submenu access page

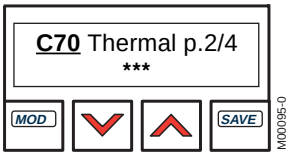



Press MOD to enter the submenu; press ∨ and ∧ to scroll the other submenus of the Configuration menu.

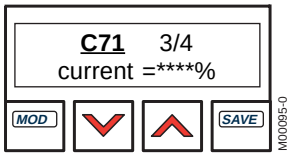
First page of the submenu



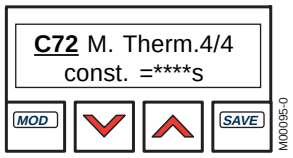

Press MOD to quit the submenu; press ∨ and ∧ to scroll the other pages of the submenu.




**P** C70
**R** NO, YES, YES A, YES B
**D** NO
**F** It enables the motor thermal protection.
NO: Thermal protection disabled.
YES: Thermal protection enabled with pick-up current independent of the output frequency.
YES A: Thermal protection enabled with pick-up current depending on the output frequency for fan-cooled motor.
YES B: Thermal protection enabled with pick-up current depending on the output frequency for a motor with a fan keyed on its shaft.




**P** C71
**R** 1...120%
**D** 105%
**F** It determines the pick-up current expressed as a percentage of the inverter rated current.

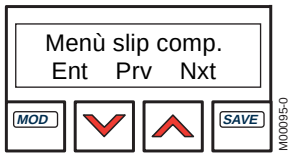



**P** C72
**R** 5...3600s
**D** 600s
**F** It determines the motor thermal time constant.

## 7.4.2.9 Slip compensation

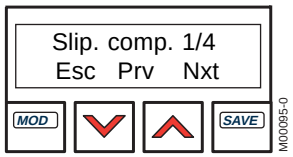
It determines the parameters relating to the slip compensation. For any further detail, see paragraph "Slip compensation" in chapter "Description of the main characteristics".

Submenu access page



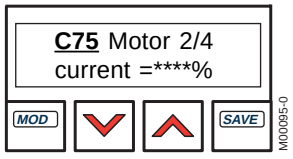

Press MOD to enter the submenu: press ∨ and ∧ to scroll the other menus of the configuration menu.

First page of the submenu

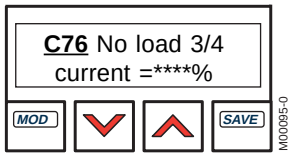



Press MOD to quit the submenu; press ∨ and ∧ to scroll the other pages of the submenu.

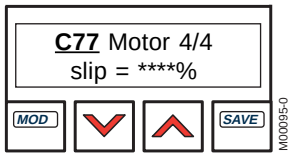
*SUBMENU PARAMETERS*




**P** C75
**R** 1...100%
**D** 100%
**F** It determines the motor rated current expressed as a percentage of the inverter rated current.




**P** C76
**R** 1...100%
**D** 30%
**F** It determines the motor no load current expressed as a percentage of the inverter rated current.

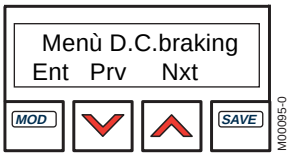



**P** C77
**R** 1...10%
**D** 0%
**F** It determines the motor rated slip expressed as a value per cent. If such value is equal to 0, the function is disabled.

## 7.4.2.10 D.C. braking

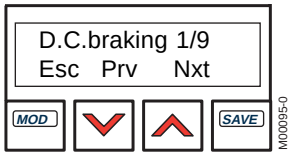
It determines the D.C. braking parameters. For further details, see paragraph "Direct current braking" in chapter "Descripion of the main characteristics".

Submenu access page



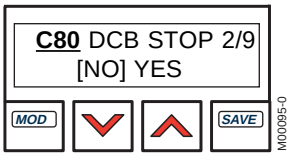

Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus of the configuration menu

First page of submenu

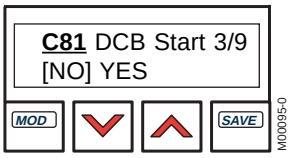



Press MODE to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.

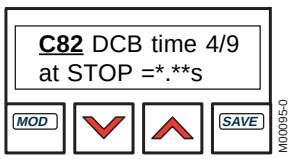
*SUBMENU PARAMETERS*



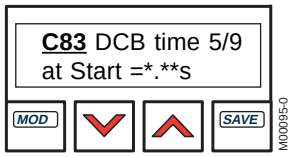

**P** C80
**R** YES NO
**D** NO
**F** It determines the presence of the D.C. braking at the end of the deceleration ramp.



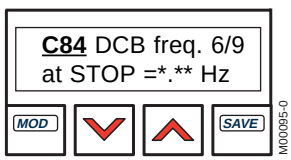

**P** C81
**R** YES NO
**D** NO
**F** It determines the presence of the D.C. braking before the acceleration ramp is performed.



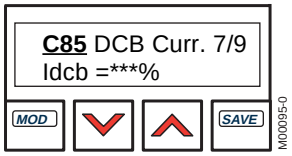

**P** C82
**R** 0.1...50s
**D** 0.5s
**F** It determines the D.C. braking duration after the deceleration ramp and affects the formula that expresses the D.C. braking through a terminal board command (see paragraph "Direct current braking with terminal board control").



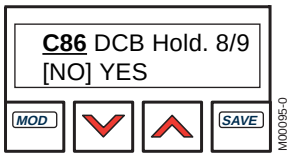

**P** C83
**R** 0.1...50s
**D** 0.5s
**F** It determines the D.C. braking duration before the acceleration ramp.



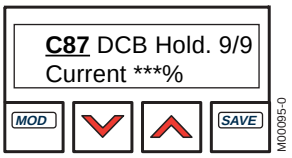

**P** C84
**R** 0...10 Hz
**D** 1 Hz
**F** It determines the output frequency at which the D.C. braking begins and controls D.C. braking duration through control terminals command (see paragraph 6.2.3 "Direct current braking with control terminals").




**P** C85
**R** 1...100%
**D** 100%
**F** It determines the intensity of the D.C. braking expressed as percentage of the inverter rated current.




**P** C86
**R** NO YES
**D** NO
**F** **After stop holding D.C. braking**, it determines the insertion of a permanent direct current to keep a braking torque on the motor shaft or to prevent dew from developping inside the motor.

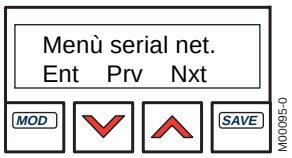



**P** C87
**R** 1...60%
**D** 10%
**F** It determines the intensity of the D.C. current permanently supplied, expressed as percentage of inverter rated current.

## 7.4.2.11 Serial network

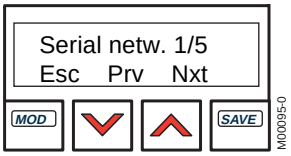
It determines the parameter of the serial communication.

Submenu access page

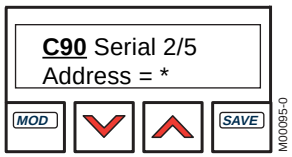



Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus of the configuration menu

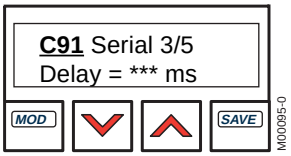
First submenu page



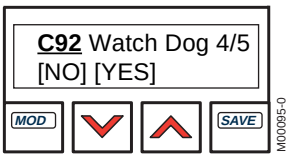

Press MOD to exit the submenu; use ⌄ and ⌃ to move through the other pages of the submenu.



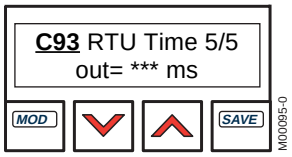

**P** C90
**R** 0...247
**D** 0
**F** It determines the address assigned to the inverter that is network connected through RS485.




**P** C91
**R** 20...500ms
**D** 20 ms
**F** It determines the inverter answer delay after a master inquiry on the RS485 line.




**P** C92 (only for SW 2.8)
**R** SI, NO
**D** NO
**F** When active, if the inverter in remote control mode does not receive any valid message from the serial line within 5 sec, the device will lock. Alarm A40 “Serial communication error” appears.

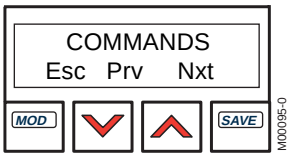



**P** C93 (available from SW version 3.1)
**R** 0...2000 ms
**D** 300 ms
**F** When the inverter is ready to receive a message, if no character is sent within the time set, the message sent to the master will be considered as complete.

## 7.5 COMMANDS MENU

It allows the operation control through keypad and the reset of factory setting.

First page



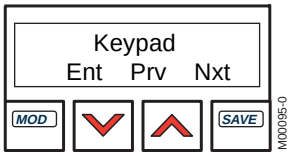

Press MODE to come back to the selection page among the main menus; use ∨ and ∧ to move through the submenus.

*SUBMENU LIST*

### 7.5.1 KEYPAD

It allows the operation control through keypad and the display of the inverter typical quantities.

Submenu access page

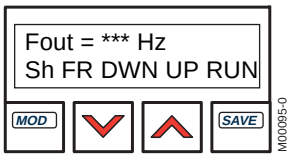



Press MOD to enter the submenu: use ∨ and ∧ to move through the other submenu del menù comandi.

First page of submenu

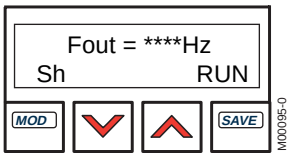
What is shown on the display depends on parameters C21 and C22 programming.

a) C21 = C22 = C29 = KPD



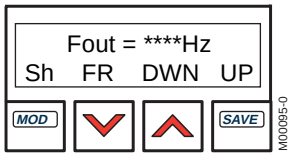

On the control terminals the inputs of the main frequency references and the RUN/STOP commands are disabled.
Simultaneously press ∨ and ∧ to exit the submenu, press ∨ to decrease the frequency reference, if FR appears next to Sh or to decrease the PID regulator reference if RG appears next to Sh. Press ∧ to increase the frequency reference if FR appears next to Sh, or PID reference if RG appears. P ress MOD to change the quantity shown on the first line of the display and the quantity controlled through ∨ and ∧ keys. Press SAVE to operate the inverter (provided that terminal 6, RUN/STANDBY, is active). Pressing SAVE again, the inverter stops. At first power on, the frequency reference is 0; at next power on, the frequency reference is present at power off if parameter P24 (UD MEM) is set to "YES"; if P24 = NO, at each power on, the frequency reference is 0.
The quantity shown on the first row of the display is programmed through parameter C63.

b) C21 = KPD
C22 = Term
C29 = KPD



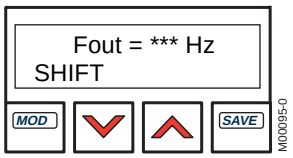

On control terminals, the RUN/STOP command (terminal 7) is disabled.
Fout displays the output frequency. Pressing SAVE, the inverter is operated (provided that terminal 6, RUN/STANDBY, is active); if SAVE is pressed again, the inverter is stopped. To exit the submenu, simultaneously press ∨ and ∧ . Press MOD to change the quantity shown on the first line of the display. Press ∨ and ∧ to decrease and increase the PID regulator reference if RG appears next to Sh. It is possible to program the quantity to be displayed through C63.

c) C21 = Term
C22 = KPD
C29 = KPD




On control terminals, the inputs for the main frequency reference are disabled.
Fout represents the output frequency; use ⌄ and ⌃ to decrease or increase the frequency reference, if FR appears next to Sh. If RG appears next to Sh, the PID reference is changed. To exit the submenu, simultaneously press ⌄ and ⌃. If a multifrequency command is sent, this becomes the current reference and the display will no longer show DOWN and UP; if the multifrequency command is removed, DOWN and UP will be displayed again.
At first power on the frequency reference is 0; at next power on, the frequency reference sent through keypad is present at power off, if parameter P24 (U/D MEM) is set to "YES"; if P24 = NO, Fout = 0 will always appear at power on.

d) C21 = C22 = Term
C29 = KPD



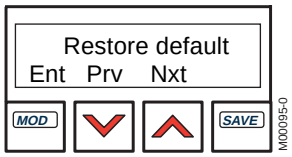

SHIFT changes the quantity displayed. Press MOD, when RG appears next to Sh, press ⌄ and ⌃ to change the PID reference.
SHIFT changes the quantity displayed; use parameter C63 to choose which quantity should be displayed at power on.

**NOTE:** At inverter power on, the keypad control page display can be programmed through parameter C62 (First page) set to "Keypad".

**NOTE:** IF C29 is different from KPD, the PID regulator reference changes do not appear.

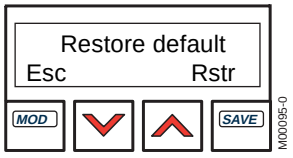
## 7.5.2 RESTORE DEFAULT

It restores automatically the default parameters of MEAS/PARAMETERS and CONFIGURATION menus (except for UP/DOWN reference and PID reference from keyboard).
Submenu access page




Press MOD to enter the submenu; use ⌄ and ⌃ to move through the other submenus. **NOTE: the submenu can be entered only if the parameter P01 of MEAS/PARAMETERS, the Key parameter, has been set to 1 and the inverter is in stand-by or stop.**

First page of submenu

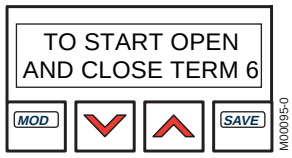



Press MOD to exit the submenu; temporarily press SAVE to restore the parameters. When the square brackets **appear**, the restore has begun, when they **disappear** (after some seconds), the operation is over.

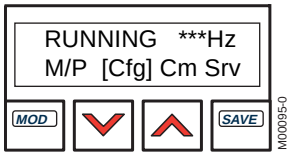
# 8.0 DIAGNOSTICS

In case of normal operation, the device displays the following messages on the main menu page:
if the output frequency is 0:

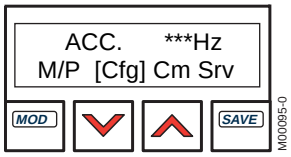

this condition occurs if the inverter is in standby, or if no run command is enabled or if the frequency reference is 0;
If the device is supplied with RUN/STANDBY input closed and parameter C61 is set to NO, the following message appears:



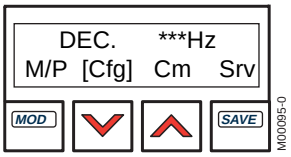

if the output frequency is other than 0, constant and equal to the reference:



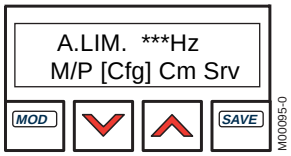

if the inverter is in acceleration phase:



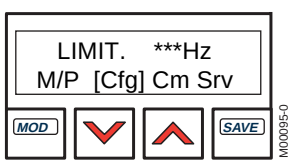

if the inverter is in deceleration phase:



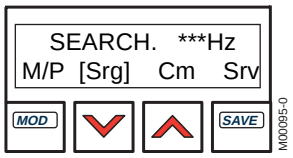

if the output frequency is constant in acceleration phase due to a current limiting during acceleration:




if the output frequency is lower than the reference frequency due to a current limiting under constant frequency operation:



if the inverter is searching for motor rotation frequency (see paragraph 6.3):




In case of anomalies, the following alarm messages will be displayed.

NOTE: If inverter is turned off, the alarm is not reset, as it is saved on EEPROM and will be shown on the display at next power on, with inverter in lock state. To unlock the inverter, close the reset contact or simultaneously press the MODE and SAVE keys. The reset is however possible by turning the inverter off and on again and setting parameter C53 to YES (PWR Reset).

**A03 EEPROM absent**

EEPROM is absent, defective or not programmed. This is the memory that saves the parameters which can be changed through keypad.
SOLUTIONS: check if EEPROM has been pro perly inserted (U14 of board ES696) and, if so, replace the control board.

**A05 NO imp. opcode**

EPROM reading error.
SOLUTIONS: Replace the control board (ES696).

**A06 UC failure**

Microcontroller failure.
SOLUTIONS: Replace the control board (ES696).

**A10 Fuse blown**

The fuse of the power section has blown out.
SOLUTIONS: it is recommended to contact the TECHNICAL SERVICE of ELETTRONICA SANTERNO.
Check the module IGBT integrity; to do so, use a digital multimeter and, after disconnecting the cables of the SINUS/IFD terminal board and setting the multimeter to "diode test", place the negative pin on terminal 38. With the positive pin, perform 3 measures on terminals 35, 36, 37. Repeat the same procedure after placing the positive pin on terminal 40.
In order to keep IGBT module integrity, all the measured values have to be approx. 350 mV and, above all, equal to each other (the measured value depends on the module size).

**A11 Bypass circ. failure**

The relay or the contactor that short-circuits the capacitor charge resistors of the D.C. link circuit is not energized.
SOLUTIONS: Contact the TECHNICAL SERVICE of ELETTRONICA SANTERNO.

**A20 Inverter Overload**

The output current exceeded the inverter rated value for long times. An overload of 50% for 1 minute or of 25% for 2 minutes blocks the SINUS/IFD and SINUS/IFDE, whil an overload of 20% for 1 minute or of 10% for 2 minutes blocks the SINUS/IFDV and SINUS/IFDEV.
SOLUTIONS: Check the current delivered by the inverter under normal operating conditions (M03 of MEASURE submenu) and the load conditions (blocks or excessive overloads during the operationg phase).

**A21 Heatsink Overheated**

Power heatsink overheating.
SOLUTIONS: check that the ambient temperature where the inverter is installed is not higher than 40°C.

**A22 Motor Overheated**

Tripping of motor software thermal protection. The output current exceeded the motor current rated value for long times.
SOLUTIONS: Check the load conditions. This protection tripping depends on the programming of parameters C70, C71 and C72. Then check that these parameters have been correctly set at inverter startup (see chapter 6.5 MOTOR THERMAL PROTECTION).

**A25 Mains loss**

Mains loss. This alarm is on only if parameter C34 is set to YES (factory setting is NO). The alarm can be delayed through C36 (Power delay time).

**A30 D.C. Link Overvoltage**

The D.C. circuit voltage reached a high value (beyond 800Vdc).
SOLUTIONS: Check that the supply voltage value does not exceed 460Vac + 10%.
This alarm could appear under a very inertial load with a too short deleceration ramp (parameter P06, P08, P10, P12 of RAMPS submenu). Increase the deceleration ramp time or, if shorter stop times are required, apply the resistive braking module.
The alarm can also appear when, during the operating cycle, the motor is entrained by the load (eccentric load); in this case we recommend to apply the braking module as well.

**A31 D.C. Link Undervoltage**

The D.C. circuit voltage had a 15% drop as regards to the rated value. The alarm storage on EEPROM is delayed by 1.2 sec. to avoid its storage at inverter power off.
SOLUTIONS: Check voltage presence on the 3 supply phases of SINUS/IFD (terminals 32, 33, 34). Then check that the measured value is not lower than 15% as regards the supply rated voltage, shown on the inverter plate.
If these values are correct, it means that the problem has not been solved, so contact the TECHNICAL SERVICE of ELETTRONICA SANTERNO.

**A32 Running overcurrent**

Tripping of instantaneous current limit at constant output frequency. This can occur in case of sudden load changes, as a consequence of an output or earth shortcircuit, or of conducted or irradiated interferences.
SOLUTIONS: Check that no shortcircuit is present between phase and phase or phase and earth at inverter output (terminals U, V, W) (for a quick check, disconnect the motor and operate the inverter in idle condition).
Check that the control signals reach the inverter with the required shielded cables (see chapter 1.10 CONNECTIONS).
Check the connections and the presence of anti-noise filters on the coils of remote control switches and solenoid valves, that can be contained inside the control panel.

**A33 Accelerating overcurrent**

Tripping of instantaneous current limit in acceleration phase.
SOLUTIONS: Besides the cases shown in the previous paragraph, this alarm can trip if a too short acceleration ramp is set or as a consequence of a too high boost. Extend the acceleration times (P05, P07, P09, P11 of RAMPS submenu). If necessary, decrease the boost and preboost action (submenu V/F PATTERN, parameters C9 and C10 or C15 and C16 if the second V/F characteristic is used).

**A34 Decelerating overcurrent**

Instantaneous current limitation tripping in deceleration phase.
SOLUTIONS: This can occur if a too short deceleration ramp has been set. In this case increase the deceleration ramp times (P06, P08, P10, P12 of RAMPS submenu).If necessary, decrease the boost and preboost action (submenu V/F PATTERN, parameters C9 and C10 or C15 and C16 if the second V/F characteristic is used).

**A35 Searching overcurrent**

Instantaneous current limitation tripping when searching for motor rotation speed, after opening and lcosing of RUN/STAND-BY contact (terminal 6).
SOLUTIONS: Check the command sequence as described in chapter 6.3 SEARCHING FOR MOTOR ROTATION SPEED contained in the SINUS/IFD-IFDV application manual.

**A36 External Alarm**

Terminal 13 (MDI5) is open, programmed as Ext.A during the operation (parameter C27).
SOLUTIONS: In this case the problem occurred outside the inverter. So, check what opens the contact connected to terminal 13 of SINUS/IFD.

Two extra diagnostics signals are available, which use the keyboard and the signaling leds on the ES696 control board:
- At power on, the display shows POWER ON and the red led VL is blinking: communication problems between the 2 microcontrollers of the control board.
SOLUTION: replace the control board and contact the TECHNICAL SERVICE of ELETTRONICA SANTERNO.
- At power on, the display shows POWER ON and the red led IL is blinking: the RAM on the ES696 control board is not correctly working.
SOLUTION: replace the control board and contact the TECHNICAL SERVICE of ELETTRONICA SANTERNO.
- The keyboard shows the message LINK MISMATCH: the communication between keyboard and inverter is interrupted.
SOLUTION: replace the control board and contact the TECHNICAL SERVICE of ELETTRONICA SANTERNO.

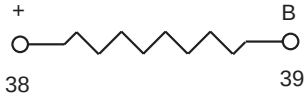
**A40 Serial comm.**

The inverter, in remote mode, has not received any serial-communication messages for a 5s- time interval. This alarm will trip only if C92 "Watch Dog" is set to YES.

# 9.0 ACCESSORIES

## 9.1 BRAKING RESISTORS

The inverters up to sizes SINUS/IFDE 400T 15, SINUS/IFDV 400T 22 and SINUS/IFDV 200T 11 included are equipped with a standard internal braking module. The breaking resistor is to be installed outside and is to be connected to terminals B and +; the braking module may be enabled by parameter C57. The table below shows the resistors to be used depending on the inverter size on the basis of a general application dissipating a power equal to max. 10% of the inverter power.
For those applications requiring a higher dissipating power or a longer braking time, contact Elettronica Santerno (applications allowing the load to be pulled for a time longer than those in the table or in case of a heavy load stopping).

| **Inverter size** | **Braking resistor** (general application) | **Code** | **Wiring** | **Mean power to be dissipated (W)** | **Max. duration (*) for continuous braking (s)** | **Size** |
|---|---|---|---|---|---|---|
| SINUS/IFDE<br>SINUS/IFDEV<br>400T 5.5 | 75 Ω<br>1300 W | RE3063750 |  | 550 | 2.25 | Fig. 9.1.A |
| SINUS/IFDE<br>400T 7,5-11<br>SINUS/IFDEV<br>400T 7.5-11 | 50 Ω<br>1100 W | RE3083500 |  | 950 | 5<br>*2.25* | Fig. 9.1.B |
| SINUS/IFDE<br>400T 15<br>SINUS/IFDEV<br>400T 15/18.5 | 39 Ω<br>1500 W | RE3093390 |  | 1100 | 4.5<br>*2.25* | Fig. 9.1.B |
| SINUS/IFDV<br>400T 18.5<br>SINUS/IFDV<br>400T 22 | 25 Ω<br>1800 W | RE3103250 |  <br>*M00618-0* | 1300 | 3.5<br>*2.25* | Fig. 9.1.B |

T00296-B

(*) Max. value to be entered in C68 Brake Enable using the resistors in the table; set C67 (Brake disable) equal to 4 times C68.

| Inverter size | Braking resistor (general application) | Code | Wiring | Mean power to be dissipated (W) | Max. duration (*) for continuous braking (s) | Size |
|---|---|---|---|---|---|---|
| SINUS/IFDE 200T 4 SINUS/IFDEV 200T 4 | 56 Ω 350 W | RE2643560 |   | 350 | 3 | Fig. 9.1.C |
| SINUS/IFDE 200T 5.5 SINUS/IFDEV 200T 5.5 | 2 x 56 Ω 350 W | 2 x RE2643560 |   | 700 | 3 | Fig. 9.1.C |
| SINUS/IFDE 200T 7.5 SINUS/IFDEV 200T 7.5 | 3 x 56 Ω 350 W | 3 x RE2643560 |   | 1050 | 3 | Fig. 9.1.C |
| SINUS/IFDV 200T 11 | 15 Ω 1100 W | RE3083150 |   | 950 | 6 | Fig. 9.1.B |

T00187-B

DANGER: The braking resistor can reach temperatures higher than 200°C.

CAUTION: The braking resistor can dissipate a power of approx. 10% of the inverter rated power. Set an adequate cooling system. Do not place the resistor next to devices or objects which are heat-sensitive.

NOTE: in case of overheating of the braking resistor, use the contact of the thermic pad installed on the braking resistor (not available for type 56Ω/350W) to lock the inverter (using, for example, the external alarm function; see paragraphs 5.1 - 4.8).

*Figura 9.1.A - External dimensions of 75Ω/1300W resistor*

| L | P |
|---|---|
| 195 | 174 |

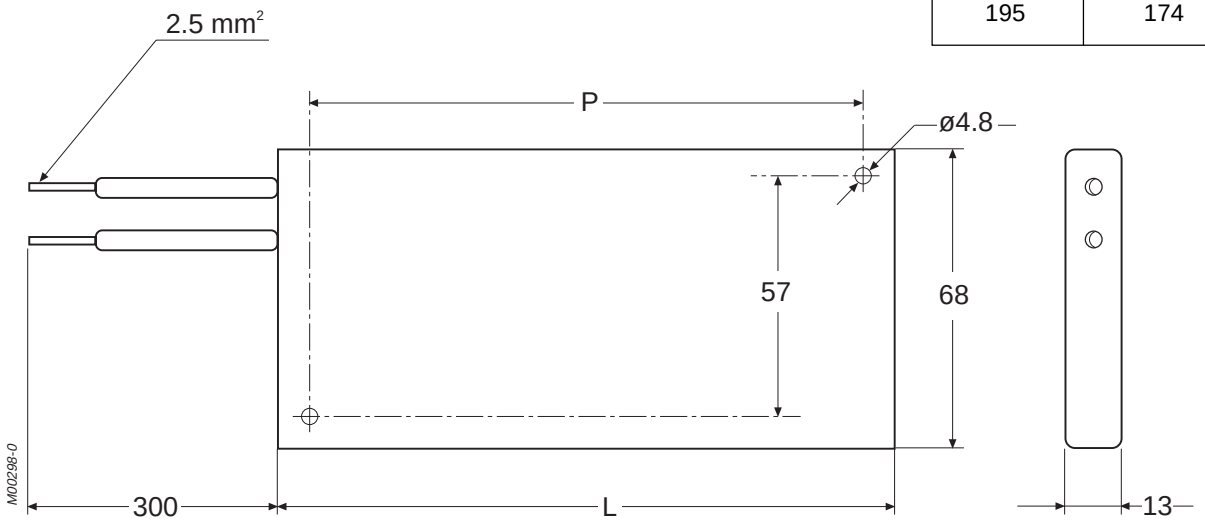
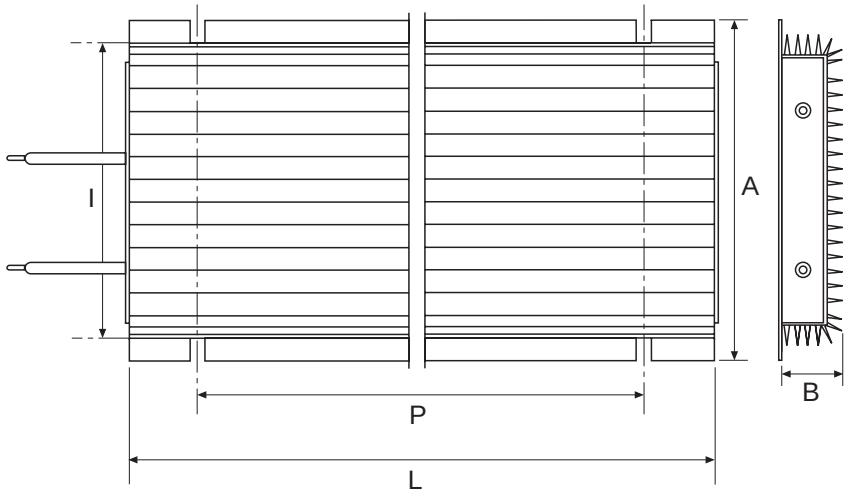
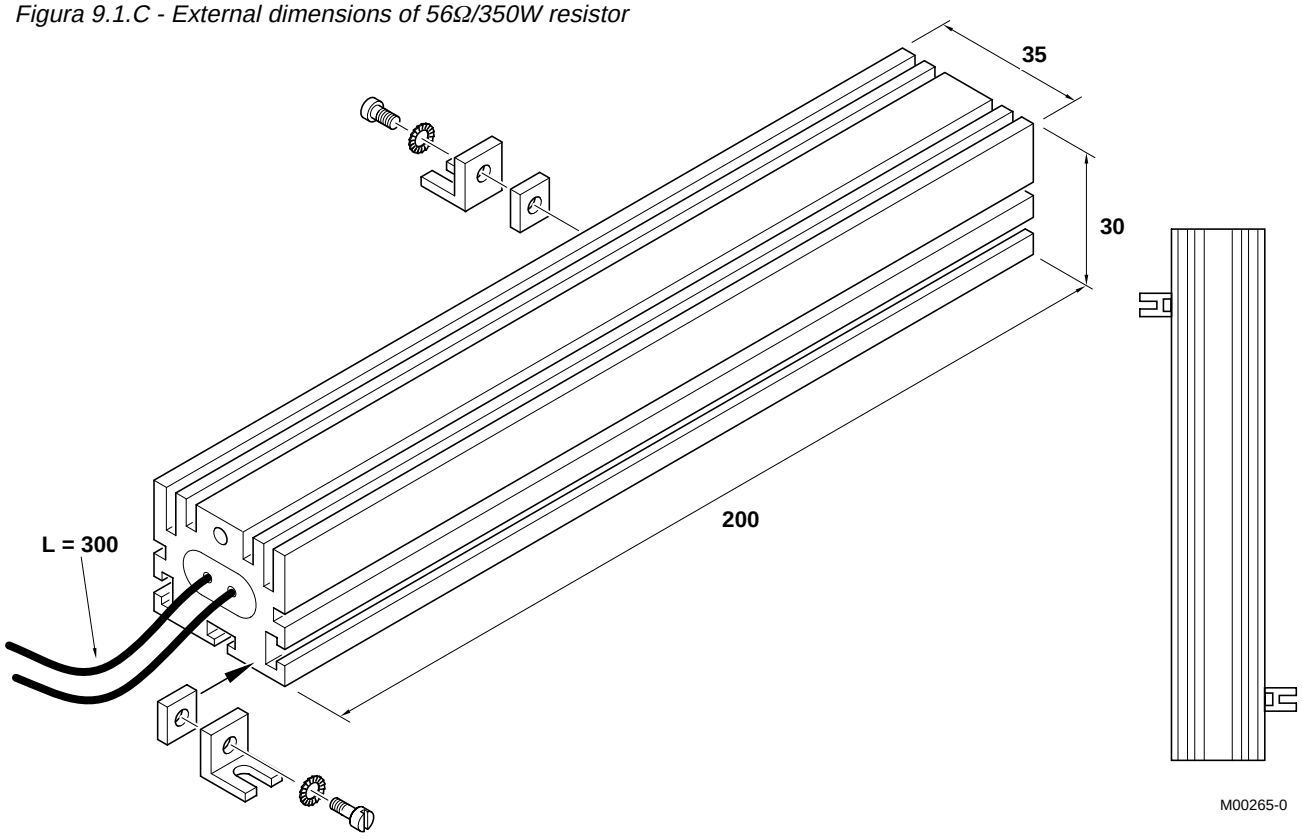


*Figure 9.1.B - External dimensions of 15Ω/1100W - 50Ω1100W - 39Ω/1500W - 25Ω/1800W resistor*




| Type | A | B | L | I | P |
|---|---|---|---|---|---|
| 15-50/1100 | 95 | 30 | 320 | 80÷84 | 240 |
| 39/1500 | 120 | 40 | 320 | 107÷112 | 240 |
| 25/1800 | 120 | 40 | 380 | 107÷112 | 300 |
| Cable standard length 300 mm | | | | | |

*Figura 9.1.C - External dimensions of 56Ω/350W resistor*



## 9.2 BRAKING MODULE

A braking module (MFI) is available, to be connected to terminals + and - of the inverter. If the deceleration phase torque has to be increased, this module can be used with inverter sizes which are not provided with such module.

## 9.3 REMOTING KIT

The keypad on the inverter can be remoted. To do so, use the remoting kit (code ZZ080702) which contains:
- mask to fasten the keypad to the cabinet door,
- remoting cable (3 m long);
- cover to close the space left by the remove of keypad.

The dimensions and instructions for keypad remoting, refer to paragraph “Remotable keypad” given in this manual.

## 9.4 INDUCTANCES

### 9.4.1 INPUT INDUCTANCES

A three-phase inductance should be applied to the supply line. It offers the following advantages:

- limitation of current peaks on the inverter input circuit, caused by mains gaps and distorted supply voltage;
- reduction of harmonic contents of supply voltage;
- increase of power factor and reduction of line current;
- life increase of levelling capacitors inside the inverter.

Two input reactor series are available, L2 and L4, using different inductance values. The following is a list of inductance characteristics according to the inverter size.

| | INDUCTANCE CHARACTERISTICS (mH) | | | | |
|---|---|---|---|---|---|
| Inverter type | Rated current (A) | Series L2 Induct. (mH) | Code | Series L4 Induct. (mH) | Code |
| SINUS/IFD 400T 5.5 - SINUS/IFDE 400T 5.5<br>SINUS/IFD 400T 7.5 - SINUS/IFDE 400T 7.5<br>SINUS/IFD 200T 4 - SINUS/IFDE 200T 4 | 18 | 1.1 | IM0120154 | 0.15 | 3xIM0100354 |
| SINUS/IFD 400T 11 - SINUS/IFDE 400T 11<br>SINUS/IFD 400T 15 - SINUS/IFDE 400T 15<br>SINUS/IFDV 400T 11 - SINUS/IFDEV 400T 11<br>SINUS/IFDV 400T 15 - SINUS/IFDEV 400T 15<br>SINUS/IFD 200T 5.5 - SINUS/IFDE 200T 5.5<br>SINUS/IFD 200T 7.5 - SINUS/IFDE 200T 7.5<br>SINUS/IFDV 200T 5.5 - SINUS/IFDEV 200T 5.5<br>SINUS/IFDV 200T 7.5 - SINUS/IFDEV 200T 7.5 | 35 | 0.6 | IM0120204 | 0.15 | 3xIM0100354 |
| SINUS/IFDEV 400T 18,5<br>SINUS/IFD 400T 18.5<br>SINUS IFD 400T 22<br>SINUS/IFD 400T 30<br>SINUS/IFDV 400T 18.5<br>SINUS/IFDV 400T 22<br>SINUS/IFDV 400T 30<br>SINUS IFD 200T 11<br>SINUS/IFD 200T 15<br>SINUS/IFDV 200T 11<br>SINUS/IFDV 200T 15 | 70 | 0.3 | IM0120254 | 0.045 | IM0122104 |
| SINUS/IFD 400T 33<br>SINUS/IFDV 400T 33<br>SINUS/IFD 400T 37<br>SINUS/IFD 400T 45<br>SINUS/IFD 400T 55<br>SINUS/IFDV 400T 37<br>SINUS/IFDV 400T 45<br>SINUS IFDV 400T 55<br>SINUS/IFD 200T 18.5<br>SINUS/IFD 200T 22<br>SINUS/IFD 200T 30<br>SINUS/IFD 200T 37<br>SINUS IFDV 200T 18.5<br>SINUS/IFDV 200T 22<br>SINUS/IFDV 200T 30<br>SINUS/IFDV 200T 37 | 120 | 0.18 | IM0120304 | 0.03 | IM0122154 |
| SINUS IFD 400T 75<br>SINUS/IFDV 400T 75<br>SINUS/IFD 200T 45<br>SINUS/IFDV 200T 45 | 170 | 0.120 | IM0120354 | 0.020 | IM0122204 |
| SINUS/IFD 400T 90<br>SINUS IFDV 400T 90<br>SINUS/IFD 400T 110<br>SINUS/IFDV 400T 110<br>SINUS/IFD 200T 55 | 235 | 0.090 | IM0120404 | 0.015 | IM0122254 |
| SINUS/IFD 400T 132<br>SINUS IFD 400T 160<br>SINUS/IFDV 400T 132<br>SINUS/IFDV 400T 160<br>SINUS IFD 200T 75<br>SINUS/IFDV 200T 75<br>SINUS IFD 200T 90<br>SINUS/IFDV 200T 90 | 335 | 0.062 | IM0120504 | 0.010 | IM0122304 |
| SINUS/IFDV 400T 200<br>SINUS/IFD 400T 200<br>SINUS/IFDV 200T 110<br>SINUS/IFDV 400T 250<br>SINUS/IFDV 400T 200 | 520 | 0.040 | IM0120604 | 0.0062 | IM0122404 |
| SINUS/VTCV 400T 315 | 780 | 0.025 | IM012704 | 0.0045 | IM0122604 |

CAUTION: always use L2 inductance in the following cases: unstable mains, presence of converters for D.C. motors, presence of loads that, when applied, cause sudden voltage changes and, in general, when mains power is higher than 500 KVA.

## 9.4.2 OUTPUT INDUCTANCE

Installations with motor cables with lengh exceeding 50 m may suffer from nuisance overcurrent trips. This is due to the capacitance of the cable causing current spikes to be draw from the inverter output. A choke may be fitted in the inverter output which limits the capacitive current. Screened cable has a higher capacitance and may cause problems in shorter runs. The recommended reactors are the same used in input side (see previous paragraph).

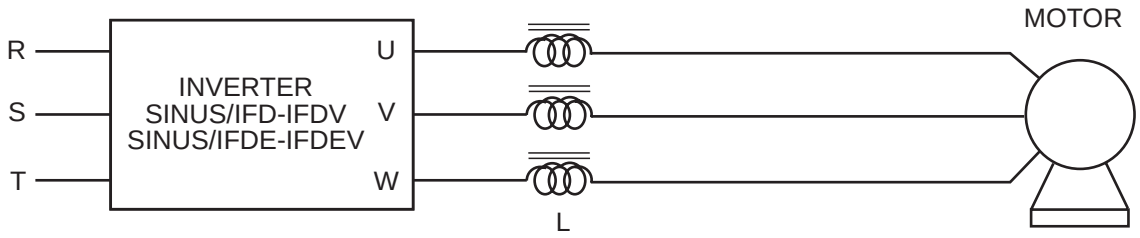


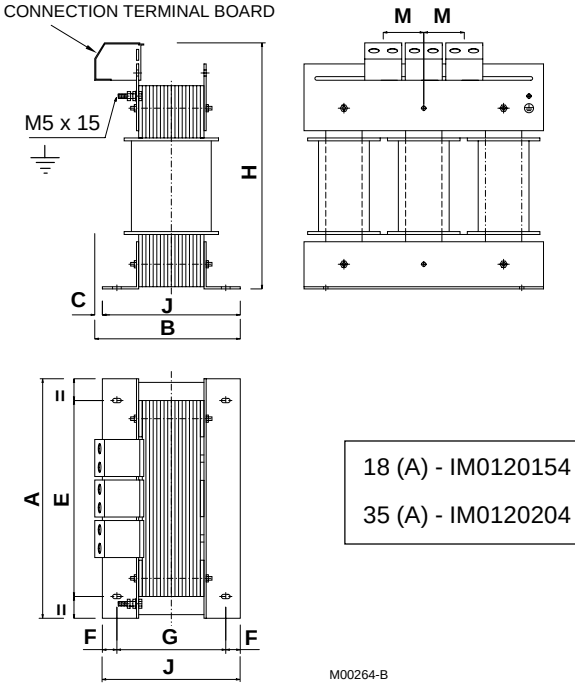

*Figura 9.1 - Output inductance connection*

WARNING: L2 series inductances can be used with inverter output frequencies not higher than 60 Hz. For higher output frequencies you must use inductances expressely designed for the max. planned operation frequenc; to this purpose contact Elettronica Santerno S.p.a.

## 9.4.3 SPECIFICATIONS FOR REACTANCE SERIES L2

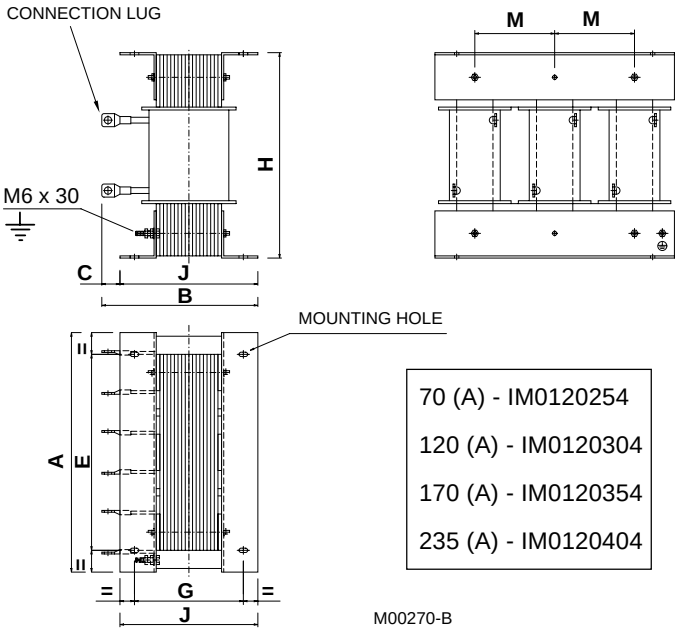
| RATED CURRENT (A) | INDUCTANCE (mH) | LOSS AT RATED CURRENT (W) | OVERALL DIMENSIONS (values in mm) | | | | | | | | | | CODE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weight (kg) | A | B | C | E | G | H | J | M | Mounting holes | |
| 18 | 1.1 | 35 | 2.5 | 120 | 75 | 14 | 67 | 55 | 130 | 61 | 25 | Ø5 | IM0120154 |
| 35 | 0.60 | 60 | 5 | 170 | 105 | 15 | 125 | 70 | 175 | 90 | 40 | 14x7 | IM0120204 |
| 70 | 0.30 | | 8 | 180 | 140 | 35 | 150 | 80 | 160 | 110 | 60 | 14x7 | IM0120254 |
| 120 | 0.18 | 100 | 9 | 180 | 145 | 40 | 150 | 80 | 160 | 109 | 60 | 14x7 | IM0120304 |
| 170 | 0.13 | 170 | 17 | 240 | 185 | 43 | 200 | 110 | 205 | 145 | 80 | 18x7 | IM0120354 |
| 235 | 0.090 | 170 | 22 | 240 | 195 | 39 | 200 | 120 | 205 | 155 | 80 | 18x7 | IM0120404 |
| 335 | 0.062 | 180 | 43 | 300 | 215 | 45 | 250 | 130 | 260 | 170 | 100 | 24x9 | IM0120504 |
| 520 | 0.040 | 300 | 53 | 300 | 230 | 60 | 250 | 130 | 290 | 170 | 100 | 24x9 | IM0120604 |
| 780 | 0.025 | 410 | 68 | 360 | 265 | 55 | 300 | 160 | 310 | 200 | 120 | 24x9 | IM0120704 |

T00302-B



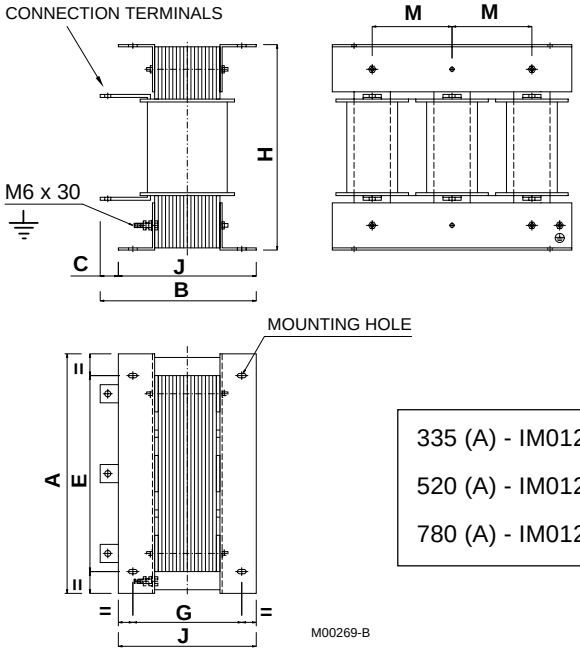

18 (A) - IM0120154
35 (A) - IM0120204

M00264-B




70 (A) - IM0120254
120 (A) - IM0120304
170 (A) - IM0120354
235 (A) - IM0120404

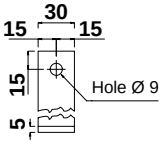
M00270-B



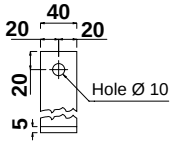

335 (A) - IM0120504
520 (A) - IM0120604
780 (A) - IM0120704

M00269-B

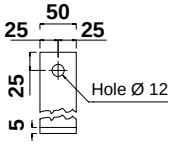
Terminals for 335 A – Flat cable 30 x 5




Terminals for 520 A – Flat cable 40 x 5



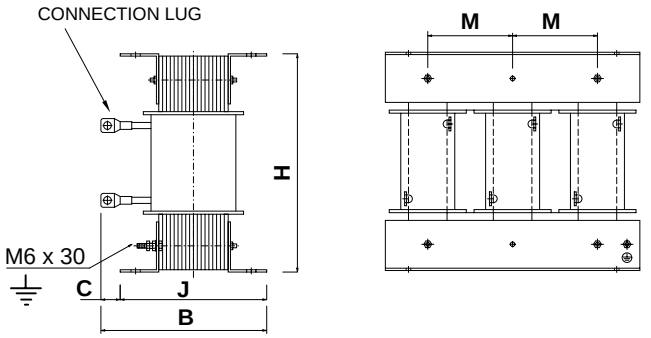

Terminals for 780 A – Flat cable 50 x 5

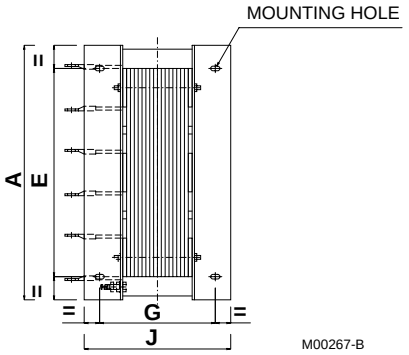


## 9.4.4 SPECIFICATIONS FOR REACTANCE SERIES L4

| RATED CURRENT (A) | INDUCTANCE (mH) | LOSS AT RATED CURRENT (W) | OVERALL DIMENSIONS (values in mm) | | | | | | | | | | CODE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weight (kg) | A | B | C | E | G | H | J | M | Mounting holes | |
| 70 | 0.045 | 25 | 4 | 150 | 105 | 29 | 125 | 60 | 135 | 76 | 50 | 14x7 | IM0122104 |
| 120 | 0.030 | 25 | 5 | 150 | 125 | 35 | 125 | 75 | 135 | 90 | 50 | 14x7 | IM0122154 |
| 170 | 0.020 | 45 | 5.5 | 180 | 150 | 55 | 150 | 65 | 160 | 95 | 60 | 14x7 | IM0122204 |
| 235 | 0.015 | 60 | 6 | 180 | 150 | 55 | 150 | 65 | 160 | 95 | 60 | 14x7 | IM0122254 |
| 335 | 0.010 | 90 | 7.5 | 180 | 130 | 35 | 150 | 65 | 160 | 95 | 60 | 14x7 | IM0122304 |
| 520 | 0.0062 | 180 | 22 | 240 | 200 | 60 | 200 | 110 | 250 | 140 | 80 | 18x7 | IM0122404 |
| 780 | 0.0045 | 300 | 28 | 240 | 190 | 55 | 200 | 100 | 260 | 135 | 80 | 18x7 | IM0122504 |

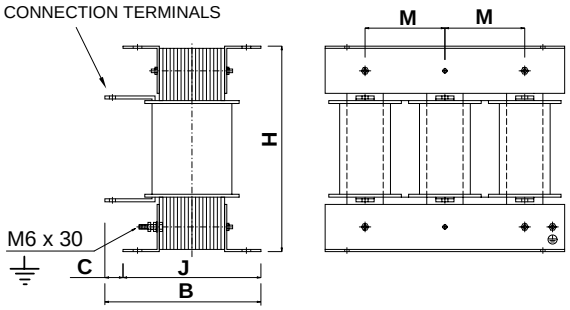
T00303-B



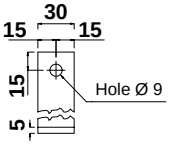




M00267-B

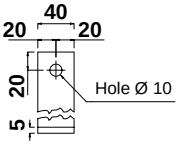
70 (A) - IM0122104
120 (A) - IM0122154
170 (A) - IM0122204



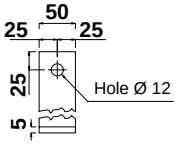

Terminals for 335 A – Flat cable 30 x 5

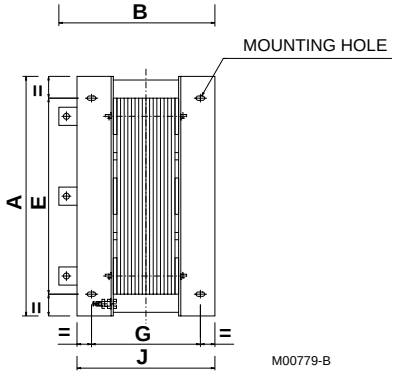



Terminals for 520 A – Flat cable 40 x 5




Terminals for 780 A – Flat cable 50 x 5



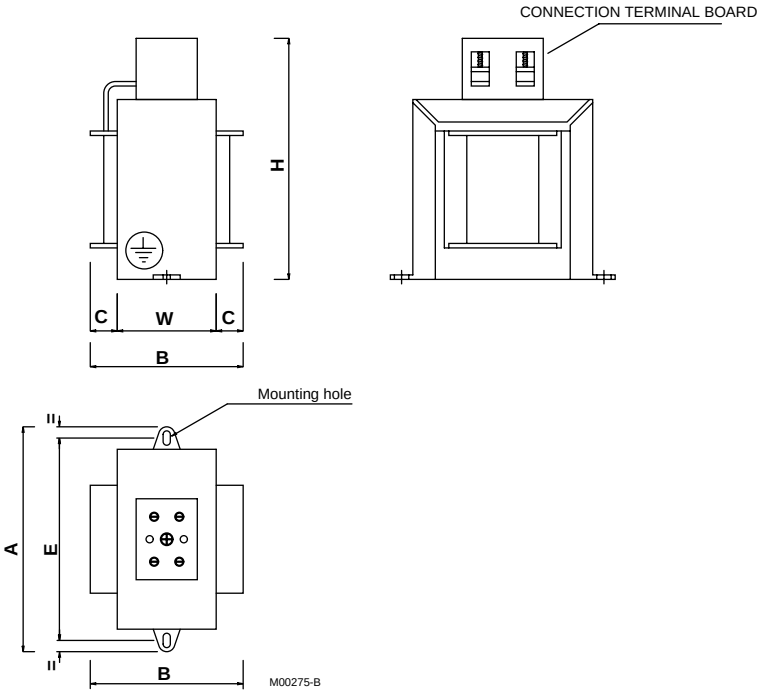

M00779-B

335 (A) - IM0122304
520 (A) - IM0122404
780 (A) - IM0122504

## 9.4.5 SPECIFICATIONS FOR SINGLE-PHASE REACTANCE SERIES L4

| RATED CURRENT (A) | INDUCTANCE (mH) | LOSS AT RATED CURRENT (W) | OVERALL DIMENSIONS (values in mm) | | | | | | | | | | CODE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weight (kg) | A | B | C | D | E | H | W | J | Mounting holes | |
| 35 | 0.15 | 6 | 1 | 95 | 58 | 12 | - | 80 | 87 | 34 | - | 8x4 | IM0100354 |

T00304-B




# 9.5 INPUT AND OUTPUT FILTERS

## 9.5.1 EMC PRODUCT STANDARD FOR ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS EN61800-3

EMC product standard for the electrical power drive systems refers to those systems including motors and relevant convertors or inverters, as well as the section concerning power supply and auxiliary circuits.
The standard defines the immunity and emission requirements for the electrical power drive systems, thus determining a sequence of tests to be applied to:
- complete drives (PDS – power drive system) composed of a motor and its drive, including transducers and sensors;
- conversion complete units (CDM – complete drive module) composed of motorless drives;
- convertors and inverters (BDM – basic drive module) including both the control section and the power section.

This standard divides the environments on the basis of commercial distributing methods for which the drives must be equipped with RFI filtering optional devices or not:

FIRST ENVIRONMENT
Environment including home users and industrial users who are directly connected, with no intermediate transformer, to a low voltage electric grid for the power supply of buildings given over to home uses.

SECOND ENVIRONMENT
Second environment means any environment including industrial users other than the ones directly connected to a low voltage electric grid for the power supply of buildings given over to home use.

| | |
|---|---|
| UNRESTRICTED DISTRIBUTION | Marketing mode where the drive is supplied also to those users who are not competent as far as EMC is concerned |
| RESTRICTED DISTRIBUTION | Marketing mode where the drive is supplied only to those users who are EMC-competent |

As for the use of RFI filters to weaken radiofrequency conducted emissions, the product standard involves different prescriptions according to the environment where the drive is installed as well as the type of marketing.

**FIRST ENVIRONMENT**

The appliances to be connected to a low voltage grid for the power supply of buildings given over to home uses must comply with the following limits:

Unrestricted distribution – I < 25A

| Size | Frequency band | Unrestricted distribution | |
|---|---|---|---|
| | | Quasi-peak | Average |
| Low power electric drive (I < 25A) | 0,15 ≤ f ≤ 0,5MHz<br>0,5 ≤ f ≤ 5,0<br>5,0 ≤ f ≤ 30,0 | 66 to 56dB(μV)<br>56<br>60 | 56 to 46dB(μV)<br>46<br>50 |

They correspond to the **limits of EN55011 gr. 1 cl. B – EN55022 cl. B – VDE0875G**

Unrestricted distribution - I ≥ 25A

| Size | Frequency band | Unrestricted distribution | |
|---|---|---|---|
| | | Quasi-peak | Average |
| Medium power electric drive (I ≥ 25A) | 0,15 ≤ f ≤ 0,5MHz<br>0,5 ≤ f ≤ 5,0<br>5,0 ≤ f ≤ 30,0 | 79dB(μV)<br>73<br>73 | 66dB(μV)<br>60<br>60 |

They correspond to the **limits of EN55011 gr. 1 cl. A – EN55022 cl. A – VDE0875N**

Restricted distribution - I < 25A

| Size | Frequency band | Restricted distribution | |
|---|---|---|---|
| | | Quasi-peak | Average |
| Low voltage electric drive (I < 25A) | 0,15 ≤ f ≤ 0,5MHz<br>0,5 ≤ f ≤ 5,0<br>5,0 ≤ f ≤ 30,0 | 79dB(μV)<br>73<br>73 | 66dB(μV)<br>60<br>60 |

They correspond to the **limits of EN55011 gr. 1 cl. A – EN55022 cl. A – VDE0875N**

Restricted distribution - I ≥ 25A

| Size | Frequency band | Restricted distribution | |
|---|---|---|---|
| | | Quasi-peak | Average |
| Medium power electric drive (I ≥ 25A) | 0,15 ≤ f ≤ 0,5MHz<br>0,5 ≤ f ≤ 5,0<br>5,0 ≤ f ≤ 30,0 | 79dB(μV)<br>73<br>73 | 66dB(μV)<br>60<br>60 |

They correspond to the **limits of EN55011 gr. 1 cl. A – EN55022 cl. A – VDE0875N**

NOTE. Standards EN55011 and 55022 above define the radio interference limits and measuring methods for certain product categories.
Namely:
EN55011/ IEC CISPR11: Limits and measuring methods for radio interference in industrial, scientific and medical (ISM) appliances.
EN55022/ IEC CISPR22: Limits and measuring methods for radio interference produced by information technology (ITE) appliances.
The limits for conducted emissions in ISM appliances belonging to group 1, class A of EN55011 correspond to those for ITE appliances belonging to class A of EN55022. The limits for conducted emissions in ISM appliances belonging to group 1 class B of EN55011 correspond to those for ITE appliances belonging to class B of EN55022.

**SECOND ENVIRONMENT**

For the time being, the product standard does not state any limits for radiofrequency conducted and irradiated emissions for the appliances intended for being connected to a low voltage industrial grid or to a grid that is not used for the power supply of buildings given over to home uses.
So, for the second environment, the product standard allows to use drives with no additional RFI filters. The installer has to make sure that no electromagnetic compatibility troubles occur with the other appliances in the system.

WARNING: **Never connect any inverter with no RFI filters to low voltage grids in residential areas, as this could cause some radiofrequency interference.**

## 9.5.2 RADIOFREQUENCY INTERFERENCE

In the environment where the inverter is installed, some radiofrequency interference (RFI) can occur.
Electromagnetic emissions with several wavelengths, which are produced by the different electric components located inside a switchboard, may take place in different ways (conduction, irradiation, inductive or capacitive coupling).
The emission troubles take place as follows:

a) Interference irradiated by the electric components or the power connection cables inside the switchboard;

b) Interference conducted and irradiated by the cables coming from the switchboard (power supply cables, motor cables, signal cables).

Fig. 9.2 shows the different troubles.

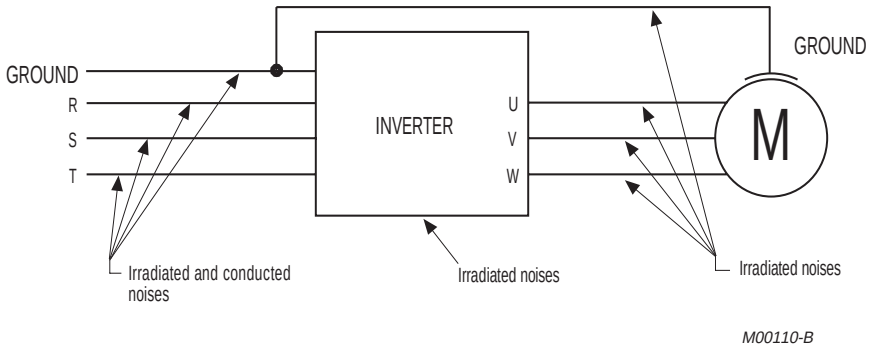



*Figure 9.2- Interference sources in a drive with inverter*

The basic countermeasures to the prior matters derive from: the ground connection optimisation, the switchboard structure modifications, the use of mains filters over the power supply and the use of output toroidal filters over the motor cables, the wiring improvement and the cable shielding.
A general rule is to limit the area exposed to noises as much as possible, so that this little interferes with the other components in the switchboard.

### 9.5.2.1 Ground and ground grid

Our experience with the inverters showed that, in the ground circuit, mainly conducted interference is to be found, which influences other circuits through the ground grid or the frame of the motor controlled by the inverter.
Such interference may give rise to sensitivity phenomena in the following appliances, which are assembled on the machines and are sensitive to conductive and irradiated interference, as they are measuring circuits operating with low voltage (_V) or current (_A) signal levels:

- transducers (tachos, encoders, resolvers):
- thermoregulators (thermocouples);
- weighing systems (loading cells);
- PLC or NC (numerical control) input/outputs
- photocells or magnetic proximity switches.

The trouble enabling such components is mainly due to the high frequency currents flowing in the ground grid and the metal parts of the machine, which cause some noises in the object sensitive part (optical, magnetic, capacitive transducer). In some cases, inducted interference may affect also the appliances assembled on other close machines with the same grounding or metal mechanical interconnections.

Possible solutions consist in optimizing the grounding for the inverter, motor and switchboard, as the high frequency currents flowing in the grounding between the inverter and the motor (capacities distributed towards the ground of the motor cable and frame) may cause a remarkable potential difference in the system.

## 9.5.2.2 Power supply

Conducted and irradiated emissions are propagated through the power supply grid.
Those two phenomena are correlated so, if conducted interference is reduced, irradiated interference will be reduced as well.
Conducted interference in the power supply grid may give rise to sensitivity phenomena both in the appliances assembled on the machine and in the appliances which are located some hundred meters away and connected to the same grid.

The most sensitive appliances to conducted interference are the following:
- computers;
- radio and TV appliances;
- biomedical appliances;
- weighing systems;
- machines using thermoregulating techniques;
- telephone installations.

The best system to weaken the intensity of the conducted interference in the grid is to install a filter reducing RFIs.

ELETTRONICA SANTERNO adopted this solution to eliminate any RFIs; paragraph 9.5.3 states the filters to be installed for the inverters. The filters are to be assembled next to the inverter, thus confining any interference irradiated by the supply cable in a small area close to the inverter.
Figure 9.3 shows the filter installation inside the frames:

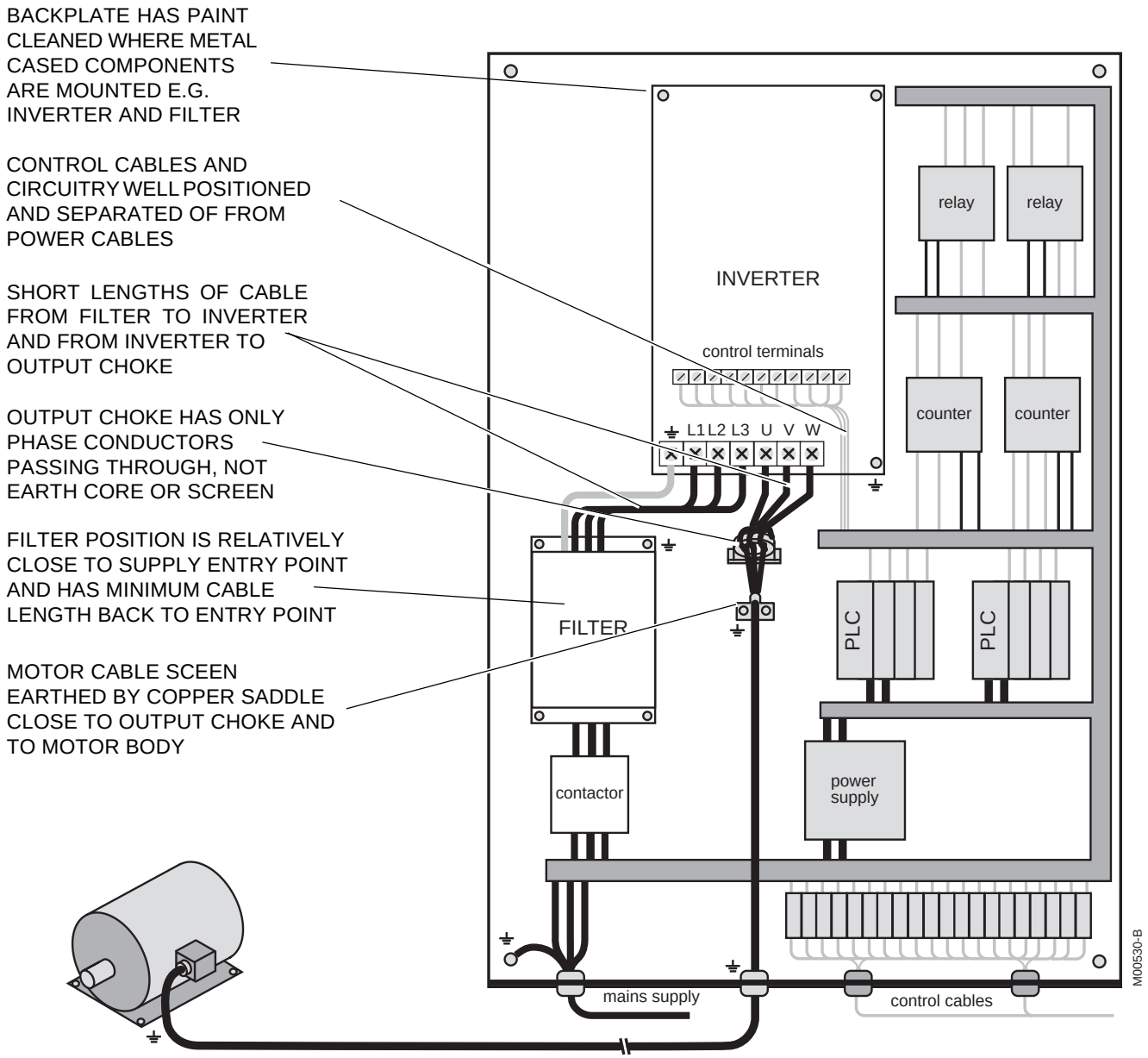



*Figure 9.3 – Filter installation inside the frame*

### 9.5.2.3 Output toroidal filters

A simple radiofrequency filter is represented by ferrite, that is a high-permeability ferromagnetic core material used to weaken common mode interference in the cables:
- in case of three-phase conductors, the three phases must go through the ferrite;
- in case of single-phase conductor (or bifilar line), the two phases must go through the ferrite (i.e. the input and output cables to be filtered must both go through the ferrite).

Paragraph 9.5.3 shows how to choose the output toroidal inductance that is required for weakening radiofrequency conducted emissions.

### 9.5.2.4 The frame

As for the changes made to the switchboard, in order to prevent electromagnetic emissions from ingoing and outgoing, pay attention to the doors, openings and cable path.
A) The frame is to be made of metallic material; the welding joints in the top, bottom, rear and side panels are to be unbroken, thus ensuring electrical continuity.
It is important to create an unpainted grounding sheet of reference on the frame rear part. That sheet or metal grid will be connected to the metal frame, which, in its turn, is connected to the appliance-grounding grid. All components must be directly riveted to the grounding sheet.
B) The hinged or mobile parts (access doors and so on) are to be made of metal; their layout must eliminate any splitting and restore the electric conductivity when they are closed.
C) Divide the cables according to their nature and the intensity of the electric quantities and the type of devices (the components able to produce electromagnetic interference and components that are particularly interference-sensitive) they connect:

| | |
|---|---|
| very sensitive | - analog inputs and outputs: voltage and current references<br>- sensors and measuring circuits (TA and TV)<br>- DC power supply (10V, 24V) |
| little sensitive | - digital inputs and outputs: optoinsulated controls, relay outputs |
| little perturber | - AC filtered power supply |
| very perturber | - general power circuits<br>- inverter unfiltered AC power supply<br>- contactors<br>- inverter-motor connecting cables |

For the installation or wiring inside the switchboard, follow the instructions below:
- Never allow sensitive signals and perturber signals to coexist inside the same cable.
- Prevent the cables carrying sensitive and perturber signals from running parallel on a close distance; reduce the length of the paths in parallel to a minimum, where possible.
- Keep the cables carrying sensitive and perturber signals distant. The higher their distance, the higher the length of their path. When possible, cross them square.

The motor or load wiring mainly produce irradiated interference. Such interference has a remarkable value only in the drive systems equipped with an inverter and may cause sensitivity phenomena in the appliances assembled on the machine or interfere with local communication circuits, that are used in the range of action of some tens of metres from the inverter (radio phones, mobile phones).
To solve those problems, follow the instructions below:
- Find the shortest path as possible for the motor cables.
- Shield the power cables to the motor by grounding the shield both at the inverter height and at the motor height. For the best results, the protecting connection (yellow-green cable) is to be outside the cable shielding (this type of cable is available up to 35 $mm^2$ section per phase); if you cannot find any shielded cable with proper section, isolate the power cables in grounded metal raceways.
- Shield the signal cables and ground their braiding on the converter side.
- Isolate the power cables in separate raceways from the ones for the signal cables.
- The signal cables must be at least 0.5 m away from the motor cables.
- Insert a common mode inductance (toroid) of approx. 100μH series-connected to the inverter-motor connection.

The interference reduction in the motor connecting cables also weakens the power supply interference.

- If shielded cables are used, the presence of cables carrying sensitive and perturber signals inside the same raceway is possible.

If shielded cables are used, 360° shielding is made by collars directly riveted to the grounding sheet.

# 9.5.3 INPUT AND OUTPUT FILTERS

## 9.5.3.1 SINUS/IFDE and SINUS/IFDEV

The SINUS/IFDE and SINUS/IFDEV series models are provided with internal input filters. In this case, the unit identifications contain the letter F (e.g. SINUS/IFDE 400T ÷ 7,5 - F).
With the internal filters, the interference amplitude does not exceed the emission limits valid for I ≥ 25A appliances installed in the first environment defined by standard EN61800-3 (limits corresponding to those of standard EN55011 for the appliances of group 1, class A and standard VDE0875N).
In order to respect the limits valid for I < 25A appliances installed in the first environment by standard EN61800-3 (corresponding to those of standard EN55011 for the appliances of group 1, class B and standard VDE0875G) just add a toroidal output filter type 2xK618, making sure that the three connecting cables between the inverter and the motor go through the core.
Figure 9.3 shows the connection diagram of line, inverter and motor.

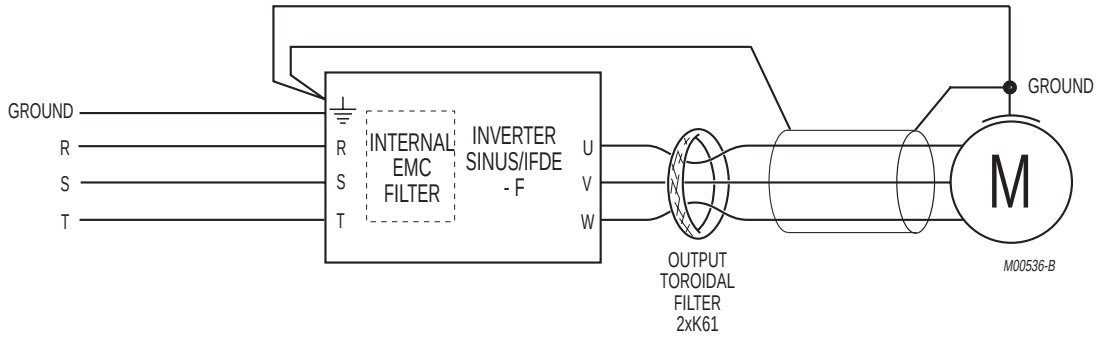



*Figure 9.4 - Connection filters for SINUS/IFDE and IFDEV*

NOTE: To meet the limits required by the standards, install both the input and output filter close to the inverter (min. distance for cable connection). Follow the instructions for connection of earth terminal, filter, motor and inverter shown in par. 9.5.2.

## 9.5.3.2 SINUS/IFD and SINUS/IFDV

The SINUS/IFD and SINUS/IFDV models require what follows:
- installation of input filters to comply with the standards EN 55011 (class A) and VD0875 N (industrial environment);
- the installation of the input filters and the output toroidal filters to comply with the standards EN 55011 class B and VDE 0875 G.

The table below shows the filters recommended for each inverter model of the SINUS/IFD and SINUS/IFDV series, so that conducted and irradiated interference respects the prescriptions stated in standards EN61800-3, EN55011 and VDE0875.

| I < 25A | | | | | | | |
|---|---|---|---|---|---|---|---|
| | EN61800-3 Second environment Restricted and unrestricted distribution | EN61800-3 First environment - Restricted distr.EN55011 gr. 1 cl.A EN55022 cl.A VDE0875N | | EN61800-3 First environment - Unrestricted distr. EN55011 gr. 1 cl.B EN55022 cl.B VDE0875G | | | |
| Type of inverter | Input filter | Input filter | | Input filter | | Output toroidal induct. | |
| | | Type | Code | Type | Code | Type | Code |
| SINUS/IFDE 400T 5,5 ÷ 7,5 | NO | internal | suffix F in the inverter ID code | internal | suffix F in the inverter ID code | 2xK618 | AC1810302 |
| SINUS/IFDEV 400T 5,5 ÷ 7,5 | | | | | | | |
| SINUS/IFDE 200T 4 | | | | | | | |

T00126-B

| I ≥ 25A | | | | | | | |
|---|---|---|---|---|---|---|---|
| | EN61800-3 Second environment Restricted and unrestricted distribution | EN61800-3 First environment - Restricted distr.EN55011 gr. 1 cl.A EN55022 cl.A VDE0875N | | EN61800-3 First environment - Unrestricted distr. EN55011 gr. 1 cl.A EN55022 cl.B VDE0875G | | | |
| Type of inverter | Input filter | Input filter | | Input filter | | Output toroidal induct. | |
| | | Type | Code | Type | Code | Type | Code |
| SINUS/IFD 400T 11 ÷15 | NO | internal | suffix F in the inverter ID code | internal | suffix F in the inverter ID code | 2xK618 | AC1810302 |
| SINUS/IFDV 400T 11 ÷15 | | | | | | | |
| SINUS/IFD 200T 5,5 ÷7,5 | | | | | | | |
| SINUS/IFDV 200T 5,5 ÷7,5 | | | | | | | |
| SINUS/IFD 400T 18,5 | NO | FX50 | AC1710506 | FX50 | AC1710506 | 2xK674 | AC1810402 |
| SINUS/IFDV 400T 18,5 | | | | | | | |
| SINUS/IFD 400T 22 | | | | | | | |
| SINUS/IFDV 400T 22 | | | | | | | |
| SINUS/IFD 200T 11 | | | | | | | |
| SINUS/IFDV 200T 11 | | | | | | | |
| SINUS/IFD 400T 30 | NO | FX65 | AC1710706 | FX65 | AC1710706 | 2xK674 | AC1810402 |
| SINUS/IFDV 400T 30 | | | | | | | |
| SINUS/IFD 200T 15 | | | | | | | |
| SINUS/IFDV 200T 15 | | | | | | | |
| SINUS/IFD 400T 33 | NO | FX90 | AC1710906 | FX90 | AC1710906 | 3xK40 | AC1810603 |
| SINUS/IFDV 400T 33 | | | | | | | |
| SINUS/IFD 400T 37 | | | | | | | |
| SINUS/IFDV 400T 37 | | | | | | | |
| SINUS/IFD 200T 18,5 ÷22 | | | | | | | |
| SINUS/IFDV 200T 18,5 ÷22 | | | | | | | |
| SINUS/IFD 400T 45 | | | | | | | |
| SINUS/IFDV 400T 45 | | | | | | | |
| SINUS/IFD 200T 30 | | | | | | | |
| SINUS/IFDV 200T 30 | | | | | | | |

T00269-A

| I ≥ 25A | | | | | | | |
|---|---|---|---|---|---|---|---|
| | EN61800-3 Second environment Restricted and unrestricted distribution | EN61800-3 First environment - Restricted distr. EN55011 gr. 1 cl.A EN55022 cl.A VDE0875N | | EN61800-3 First environment - Unrestricted distr. EN55011 gr. 1 cl.B EN55022 cl.B VDE0875G | | | |
| | Input filter | Input filter | | Input filter | | Output toroidal induct. | |
| Type of inverter | | Type | Code | Type | Code | Type | Code |
| SINUS/IFD 400T 55 | NO | FX120 | AC1711306 | FX120 | AC1711106 | 3xK40 | AC1810603 |
| SINUS/IFDV 400T 55 | | | | | | | |
| SINUS/IFD 200T 37 | | | | | | | |
| SINUS/IFDV 200T 37 | | | | | | | |
| SINUS/IFD 400T 75 | NO | FX150 | AC1711306 | FX150 | AC1711306 | 3xK40 | AC1810603 |
| SINUS/IFDV 400T 75 | | | | | | | |
| SINUS/IFD 200T 45 | | | | | | | |
| SINUS/IFDV 200T 45 | | | | | | | |
| SINUS/IFD 400T 90 | NO | FX210 | AC1711606 | FX210 | AC1711606 | 4xK40 | AC1810604 |
| SINUS/IFDV 400T 90 | | | | | | | |
| SINUS/IFD 200T 55 | | | | | | | |
| SINUS/IFDV 200T 55 | | | | | | | |
| SINUS/IFD 400T 110 | NO | FX210 | AC1711606 | FX210 | AC1711606 | 4xA84 | AC1811004 |
| SINUS/IFDV 400T 110 | | | | | | | |
| SINUS/IFD 400T 132 | NO | FLTA-B 280T | AC1711805 | FLTA-B 280T | AC1711805 | 4xA84 | AC1811004 |
| SINUS/IFDV 400T 132 | | | | | | | |
| SINUS/IFD 200T 75 | | | | | | | |
| SINUS/IFDV 400T 132 | | | | | | | |
| SINUS/IFD 400T 160 | NO | FLTA-B 360T | AC1712005 | FLTA-B 360T | AC1712005 | 4xA84 | AC1811004 |
| SINUS/IFDV 400T 160 | | | | | | | |
| SINUS/IFD 400T 200 | | | | | | | |
| SINUS/IFDV 400T 200 | | | | | | | |
| SINUS/IFD 200T 90 | | | | | | | |
| SINUS/IFDV 200T 90 | | | | | | | |
| SINUS/IFD 200T 110 | | | | | | | |
| SINUS/IFD 400T 200 | | | | | | | |
| SINUS/IFD 400T 250 | NO | FLTA-B 500T | AC1712405 | FLTA-B 500T | AC1712405 | by request | - |
| SINUS/IFDV 400T 250 | | | | | | | |
| SINUS/IFD 400T 315 | NO | FLTA-B 750T | AC1713015 | FLTA-B 750T | AC1713015 | by request | - |

T00268-B

NOTE: Leakage current for filters FLTA-B ≤ 3.5mA (@ 250V 50Hz)
Leakage current for filters FX ≤ 15mA (@ 250V 50Hz)

Figure 9.4 shows the connection diagram of filters and earth.

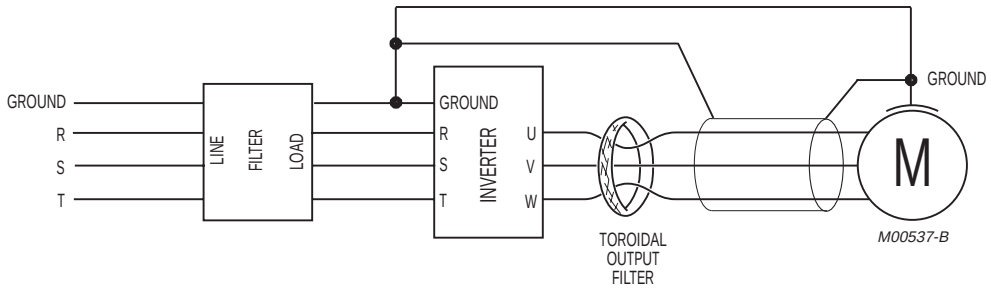


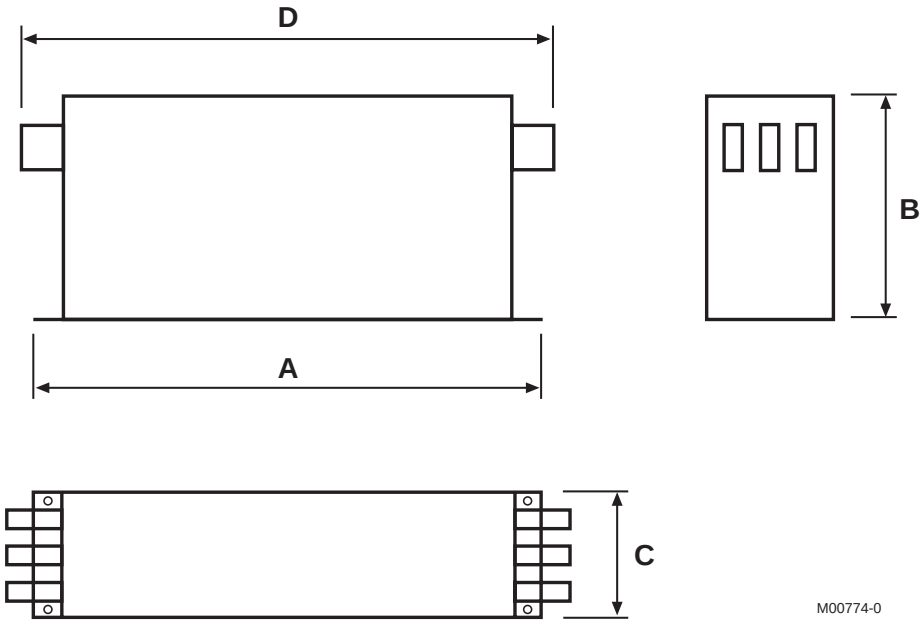

*Figure 9.5 - Filter connection for SINUS/IFD and IFDV*

NOTE: To meet the limits required by the standards, install both the input and output filter close to the inverter (min. distance for cable connection). Follow the instructions for connection of earth terminal, filter, motor and inverter shown in paragraph 9.5.2.2.

NOTE: The toroidal filter is to be installed so that the three connection cables between inverter and motor pass through the toroid.

## 9.5.3.3 Overall Dimensions of EMC Filters

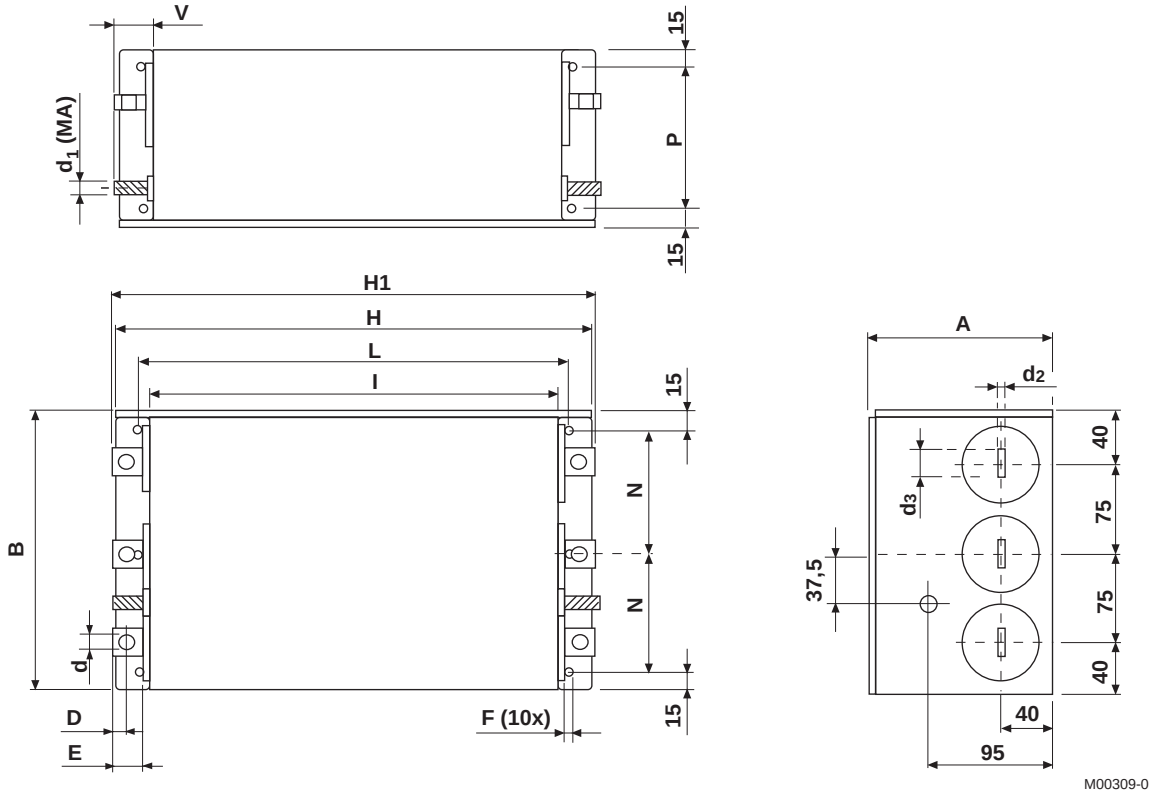
**A) FILTERS FX**




| Mechanical size (mm) | | | | | |
|---|---|---|---|---|---|
| **Type** | **A** | **B** | **C** | **D** | **Mounting template** |
| Fx50 | 329 | 185 | 70 | 365 | 314 x 45 Ø6.5mm |
| Fx65 | 329 | 185 | 80 | 375 | 314 x 55 Ø6.5mm |
| Fx90 | 329 | 220 | 80 | 375 | 314 x 55 Ø6.5mm |
| Fx120 | 379 | 220 | 90 | 435 | 364 x 65 Ø6.5mm |
| Fx150 | 429 | 240 | 110 | 485 | 414 x 80 Ø6.5mm |
| Fx210 | 438 | 240 | 110 | 500 | 414 x 50 Ø6.5mm |
| Fx280 | 438 | 240 | 110 | 490 | 414 x 50 Ø6.5mm |

T00299-B

### B) FILTERS FLTA-B




M00309-0

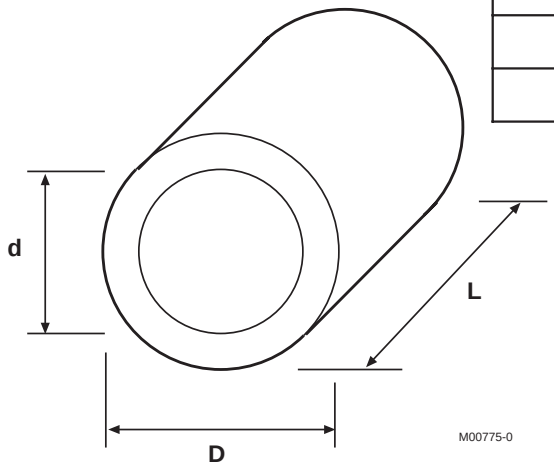
| Mechanical size (mm) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type** | **A** | **B** | **H** | **H1** | **L** | **I** | **N** | **P** | **F** | **V** | **d** | **d1** | **d2** | **d3** | **D** | **E** |
| FLTA-B360T | 130 | 230 | 420 | 434 | 400 | 380 | 100 | 100 | 6,5 | 27 | Ø8,5 | M10 | 10 | 20 | 10 | 21 |
| FLTA-B500T | 130 | 230 | 510 | 546 | 480 | 450 | 100 | 100 | 6,5 | 48 | Ø10,5 | M10 | 12 | 32 | 15 | 41 |
| FLTA-B750T | 160 | 250 | 510 | 646 | 480 | 450 | 100 | 110 | 8 | 98 | Ø14 | M12 | 23 | 40 | 20 | 90 |

T00300-B

### C) OUTPUT TOROIDAL FILTERS

| Type | Overall dimensions D (mm) x L (mm) | Internal diameter d (mm) |
|---|---|---|
| 2xK618 | 26 x 22 | 15 (13,7 min) |
| 2xK674 | 37 x 31 | 23 (21,7 min) |
| 3xK40 | 60 x 58 | 41 (39,2 min) |
| 4xK40 | 60 x 77 | 41 (39,2 min) |
| 4xA84 | 105 x 65 | 66 (63,7 min) |

T00301-B




M00775-0

# 10.0 USER PARAMETERS NOTES

Inverter No.....…….. SINUS.....…… Ser.No.....…….. Software version.....…….

| No | Name | Default | Progr. value |
|---|---|---|---|
| **Ramps menu** | | | |
| P05 | (Tac1) | (10s) | .....s |
| P06 | (Tdc1) | (10s) | .....s |
| P07 | (Tac2) | (10s) | .....s |
| P08 | (Tdc2) | (10s) | .....s |
| P09 | (Tac3) | (10s) | .....s |
| P10 | (Tdc3) | (10s) | .....s |
| P11 | (Tac4) | (10s) | .....s |
| P12 | (Tdc4) | (10s) | .....s |
| P13 | (Ramp th.) | (0Hz) | .....Hz |
| P14 | (Ramp ext) | (4) | ..... |
| **Reference menu** | | | |
| P15 | (Minimum Freq) | (+/-) | ..... |
| P16 | (V Ref Bias) | (0%) | .....% |
| P17 | (V Ref Gain) | (100%) | .....% |
| P18 | (V Ref J6 Pos.) | (+) | ..... |
| P19 | (I Ref Bias) | (-25%) | .....% |
| P20 | (I Ref Gain) | (+125%) | .....% |
| P21 | (Aux. Input Bias) | (0%) | .....% |
| P22 | (Aux. Input Gain) | (+200%) | .....% |
| P23 | (U/D/Kpd Min) | (NO) | ..... |
| P24 | (U/D Mem) | (YES) | ..... |
| P25 | (U/D Res) | (NO) | ..... |
| P26 | (Disable time) | (0s) | .....s |
| **Output monitor menu** | | | |
| P30 | (Output mon. 1) | (Fout) | ..... |
| P31 | (Output mon. 2) | (Iout) | ..... |
| P32 | (Kof) | (10 Hz/V) | ..... |
| P33 | (Koi) | (5/AV) | ..... |
| P34 | (Kov) | (100 V/V) | ..... |
| P35 | (Kop) | (5 kW/V) | ..... |
| P36 | (Kon) | (200 rpm/V) | ..... |
| P37 | (Kor) | (10%/V) | ..... |
| **Multifrequence menu** | | | |
| P39 | (M.F FUN) | (ABS) | ..... |
| P40 | (freq1) | (0Hz) | .....Hz |
| P41 | (freq2) | (0Hz) | .....Hz |
| P42 | (freq3) | (0Hz) | .....Hz |
| P43 | (freq4) | (0Hz) | .....Hz |
| P44 | (freq5) | (0Hz) | .....Hz |
| P45 | (freq6) | (0Hz) | .....Hz |
| P46 | (freq7) | (0Hz) | .....Hz |
| P47 | (freq8) | (0Hz) | .....Hz |
| P48 | (freq9) | (0Hz) | .....Hz |
| P49 | (freq10) | (0Hz) | .....Hz |
| P50 | (freq11) | (0Hz) | .....Hz |
| P51 | (freq12) | (0Hz) | .....Hz |
| P52 | (freq13) | (0Hz) | .....Hz |
| P53 | (freq14) | (0Hz) | .....Hz |
| P54 | (freq15) | (0Hz) | .....Hz |
| **Prohibit frequencies menu** | | | |
| P55 | (Fp1) | (0Hz) | .....Hz |
| P56 | (Fp2) | (0Hz) | .....Hz |
| P57 | (Fp3) | (0Hz) | .....Hz |
| P58 | (Fphys) | (1Hz) | .....Hz |
| **Digital Output menu** | | | |
| P60 | (MDO Opr.) | (Freq. Level) | ..... |
| P61 | (RL1 Opr.) | (Inv. O.K. ON) | ..... |
| P62 | (RL2 Opr.) | (Freq. Level) | ..... |
| P63 | (MDO ON Delay) | (0s) | .....s |
| P64 | (MDO OFF Delay) | (0s) | .....s |
| P65 | (RL1 ON Delay) | (0s) | .....s |
| P66 | (RL1 OFF Delay) | (0s) | .....s |
| P67 | (RL2 ON Delay) | (0s) | .....s |
| P68 | (RL2 OFF Delay) | (0s) | .....s |
| P69 | (MDO Level) | (0%) | .....% |
| P70 | (MDO Hyst.) | (0%) | .....% |
| P71 | (RL1 Level) | (0%) | .....% |
| P72 | (RL1 Hyst.) | (0%) | .....% |
| P73 | (RL2 Level) | (0%) | .....% |
| P74 | (RL2 Hyst.) | (2%) | .....% |
| **Ref Var% menu** | | | |
| P75 | (Var%1) | (0%) | .....% |
| P76 | (Var%2) | (0%) | .....% |
| P77 | (Var%3) | (0%) | .....% |
| P78 | (Var%4) | (0%) | .....% |
| P79 | (Var%5) | (0%) | .....% |
| P80 | (Var%6) | (0%) | .....% |
| P81 | (Var%7) | (0%) | .....% |
| **PID Regulator menu** | | | |
| P85 | (Sampling Time) | (0,0025) | .....s |
| P86 | (Prop. Gain) | (1) | ..... |
| P87 | (Integr. Time) | (512 Tc) | .....Tc |
| P88 | (Deriv. Time) | (0) | .....Tc |
| P89 | (PID Min Out) | (0) | .....% |
| P90 | (PID Max Out) | (100%) | .....% |
| P91 | (PID Ref. Acc.) | (0) | .....s |
| P92 | (PID Ref. Dec.) | (0) | .....s |
| P93 | (Freq. Thres) | (0) | .....Hz |
| P94 | (Integr. Max) | (0-100%) | .....% |
| P95 | (Der. Max) | (0-10%) | .....% |
| P96 | (PID Dis. time) | (0 Tc) | .....Tc |
| **Carrier Frequency menu** | | | |
| C01 | (Min carrier freq.) | (10, 5, 0,8 kHz) | .....kHz |
| C02 | (Max carrier freq.) | (10, 5, 0,8 kHz) | .....kHz |
| C03 | (Pulse number) | (24) | ..... |
| C04 | (Silent m.) | (YES) | ..... |
| **V/f pattern menu** | | | |
| C5 | (fmot1) | (50Hz) | .....Hz |
| C6 | (fomax1) | (50Hz) | .....Hz |
| C7 | (fomin1) | (0.5Hz) | .....Hz |
| C8 | (Vmot1) | (380V) | .....V |
| C9 | (Boost1) | (0%) | .....% |
| C10 | (Preboost1) | (2,5%) | .....% |
| C11 | (fmot2) | (50 Hz) | .....Hz |
| C12 | (fomax2) | (50 Hz) | .....Hz |
| C13 | (fomin2) | (0,5 Hz) | .....Hz |
| C14 | (Vmot2) | (380 V ) | .....V |
| C15 | (Boost2) | (0%) | .....% |
| C16 | (Preboost2) | (2,5%) | .....% |

| No. Name | Default | Progr. value |
|---|---|---|
| **Operation method menu** | | |
| C21 (Run/Stop) | (Term) | ..... |
| C22 (Fret) | (Term) | ..... |
| C23 (MDI 1) | (Mltf1) | ..... |
| C24 (MDI 2) | (Mltf2) | ..... |
| C25 (MDI 3) | (Mltf3) | ..... |
| C26 (MDI 4) | (CW/CCW) | ..... |
| C27 (MDI 5) | (DCB) | ..... |
| C28 (PID Action) | (Ext) | ..... |
| C29 (PID Ref) | (Kpd) | ..... |
| C30 (PID F.B.) | (In aux) | ..... |
| **Power Down menu** | | |
| **C34 (Mains l.)** | **(NO)** | **.....** |
| C35 (Power D.) | (NO) | ..... |
| C36 (Power Delay Time) | (10 ms) | .....ms |
| C37 (PD Dec. Time) | (10 s) | .....s |
| C38 (PD Extra) | (200%) | .....% |
| C39 (PD DC link der.) | (0%) | ..... |
| **I Limit menu** | | |
| C40 (Acc. Lim) | ([Yes]) | ..... |
| C41 (Acc. Lim. Curr.) | (150%)* | .....% |
| C42 (Run Lim.) | ([Yes]) | ..... |
| C43 (Run Lim. Curr.) (150%)* | | .....% |
| C44 (Dec. Lim.) | ([YES]) | ..... |
| C45 (Dec. Lim. Curr.) | (150%) | .....% |
| C46 (FW Red.) | ([NO]) | ..... |
| **Autoreset menu** | | |
| C50 (Autoreset) | ([No]) | ..... |
| C51 (Attempts N.) | (4) | .....N. |
| C52 (Clear f.c.t) | (300s) | .....s |
| C53 (PWR Reset) | (NO) | ..... |
| **Special function menu** | | |
| C55 (Speed Src) | ([Yes]) | ..... |
| C56 (S.S. Dis. time) | (1s) | .....s |
| C57 (Brake unit) | ([No]) | ..... |
| C58 (Pole ) | (4) | ..... |
| C59 (Red ratio) | (1) | ..... |
| C60 (Mains l.m.) | ([No]) | ..... |
| C61 (Run/Sby) | (YES) | ..... |
| C62 (First page) | (Status) | ..... |
| C63 (First param.) | (Fout) | ..... |
| C64 ((Feed back Ratio) | (1) | ..... |
| C65 (Search Rate) | (100%) | .....% |
| C66 (Search Current) | (100%) | .....% |
| C67 (Brake Disab.) | (9000 ms) | .....ms |
| C68 (Brake enable) | (2250 ms) | .....ms |
| **Motor thermal protection menu** | | |
| C70 (Thermal pr.) | ([No]) | ..... |
| C71 (Current) | (105%) | .....% |
| C72 (Mot.therm.c) | (600s) | .....s |
| **Slip compensation menu** | | |
| C75 (Motor cur.) | (100%) | .....% |
| C76 (No load c.) | (30%) | .....% |
| C77 (Motor slip) | (0%) | .....% |
| **D.C. braking menu** | | |
| C80 (DCB stop) | ([No]) | ..... |
| C81 (DCB start) | ([No]) | ..... |
| C82 (DCB t.stop) | (0.5s) | .....s |
| C83 (DCB t.start) | (0.5s) | .....s |
| C84 (DCB f.stop) | (1Hz) | .....Hz |
| C85 (DCB curr.) | (100%) | .....% |
| C86 (DCB hold) | ([No]) | ..... |
| C87 (DCB h. c.) | (10%) | .....% |

| No. Name | Default | Progr. value |
|---|---|---|
| **Serial Network menu** | | |
| C90 (Serial address) | (0) | ..... |
| C91 (Serial Delay) | (20 ms) | .....ms |
| C92 (Watch Dog) | ([NO]) | ..... |
| C93 (BTU Time Out) | (300 ms) | .....ms |

* 120% for SINUS/IFDV

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# 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

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# 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 SPACE VECTOR MODULATION DIGITAL THREE-PHASE AC INVERTER OF **SINUS/IFD–IFDV/IP54** TYPE, TO WHICH THIS DECLARATION RELATES, CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

| | |
|---|---|
| EN 60146-1-1 (1993-02) | Semiconductor convertors.<br>General requirements and line commutated convertors.<br>Part 1-1: Specifications of basic requirements. |
| EN 60146-2 (2000-02) | Semiconductor convertors.<br>Part 2: Self-commutated semiconductor converters including direct d.c. converters. |
| IEC 664-1 (1992-10) | Insulation coordination for equipment within low-voltage systems.<br>Part 1: Principles, requirements and tests. |
| EN 61800-2 (1998-04) | Adjustable speed electrical power drive systems.<br>Part 2: General requirements – Rating specifications for low voltage adjustable frequency a.c. power drive systems. |
| EN 60204-1 (1997-12) | Safety of machinery. Electrical equipment of machines.<br>Part 1: General requirements. |
| EN 60204-1<br>Modifica 1 (1988-08) | Electrical equipment of industrial machines.<br>Part 2: Item designation and examples of drawings, diagrams, tables and instructions. |
| EN 60529 (1991-10) | Degrees of protection provided by enclosures (IP Code). |
| EN 50178 (1997-10) | Electronic equipment for use in power installations. |

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, 02/04/2001

SIGNATURE
Vice President
Zanarini Ing. Sergio

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Cod. Fisc. 00330410374 - Part. IVA 00504051202
Cod. Identificativo IVA Intracomunitario: IT00504051202



# MANUFACTURER'S DECLARATION

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AS MANUFACTURER

## DECLARE

UNDER OUR SOLE RESPONSABILITY

THAT THE SPACE VECTOR MODULATION DIGITAL THREE-PHASE AC INVERTER OF
**SINUS/IFD –IFDV/IP54** TYPE,
TO WHICH THIS DECLARATION RELATES,
APPLIED UNDER CONDITIONS SUPPLIED IN THE USER'S MANUAL,
CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

| | |
|---|---|
| EN 60204-1 (1997-12) | Safety of machinery. Electrical equipment of machines. Part 1: General requirements. |
| EN 60204-1 Modifica 1 (1988-08) | Electrical equipment of industrial machines. 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 INCORPORED 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, 02/04/2001

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## DECLARE

UNDER OUR SOLE RESPONSABILITY

THAT THE SPACE VECTOR MODULATION DIGITAL THREE-PHASE AC INVERTER OF
**SINUS/IFDE–IFDEV/IP54** 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:

| | |
|---|---|
| EN 61800-3 (1996-10) | Adjustable speed electrical power drive systems.<br>Part 3: EMC product standard including specific test methods. |
| EN 55011 (1998-05) | Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment. |
| EN 61000-4-2 (1995-03) | Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques.<br>Section 2: Electrostatic discharge immunity test. Basic EMC Publication. |
| EN 61000-4-3 (1996-09) | Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques.<br>Section 3: Radiated, radio-frequency, electromagnetic field immunity test. |
| EN 61000-4-4 (1995-03) | Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques.<br>Section 4: Electrical fast transient/burst immunity test. Basic EMC Publication. |
| EN 61000-4-5 (1995-03) | Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques.<br>Section 5: Surge immunity test. |

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, 04/07/2001

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## DECLARE

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| EN 60529 (1991-10) | Degrees of protection provided by enclosures (IP Code). |
| EN 50178 (1997-10) | Electronic equipment for use in power installations. |

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: **01**

PLACE AND DATE OF ISSUE
Casalfiumanese, 04/07/2001

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