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SINUS K

FULL DIGITAL INVERTER

USER MANUAL

-Programming Instructions-

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IFD V2.05x / VTC V2.05x
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English

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0.3. PRODUCTS COVERED IN THIS MANUAL

This Programming Manual covers all inverters of the SINUS K, SINUS BOX K and SINUS CABINET K series with supply voltage ranging from 200Vac to 500Vac: from Size S05 to Size S65 with IFD application software; supply voltage ranging from 200Vac to 500Vac: from Size S05 to Size S50 with VTC application software.

For LIFT software (lift applications) a separate Programming Manual is available.

NOTE This manual covers the programming modes for standard functionality of the products above.
For special purposes, such as using spare control boards, please refer to the user manuals of the components concerned.

1. INPUT SIGNALS AND OUTPUT SIGNALS

1.1. DIGITAL INPUTS

All digital inputs are galvanically isolated with respect to zero volt of the inverter control board (ES778/2). Consider power supply on terminals 14 and 15 before activating the inverter digital inputs.
Depending on the position of jumper J10, signals may be activated both to zero volt (NPN–type command) and to + 24 Volts (PNP–type command).
The figure below shows the different control modes based on the position of jumper J10.
Auxiliary power supply +24 VDC (terminal 15) is protected by a self–resetting fuse.

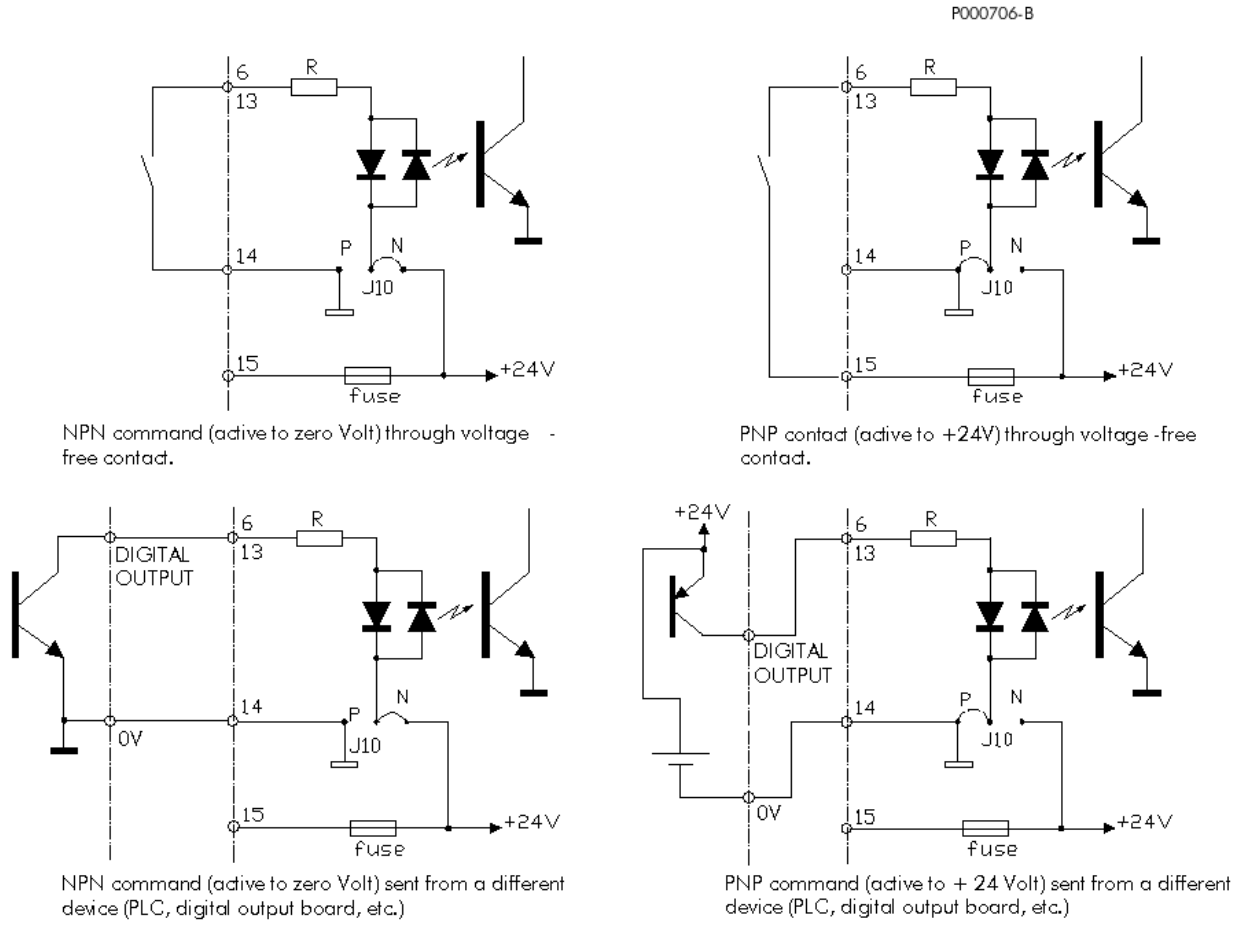


Figure 1: Digital input control modes

NOTE Terminal 14 (CMD – digital input zero volt) is galvanically isolated from terminals 1, 20, 22 (CMA – control board zero volt) and from terminal 25 (MDOE = emitter terminal of multifunction digital output).

Parameter M08 (IFD SW) or M11 (VTC SW) in the Measure submenu indicates digital input conditions. Digital inputs are inactive when parameter C21 (IFD SW) or C14 (VTC SW) is set to REM; in that case, commands are sent via serial communications. If parameter C21 (IFD SW) or C14 (VTC SW) is set to Kpd, input 7 command is sent via keypad (START and STOP key).

1.1.1. ENABLE (TERMINAL 6)

ENABLE input is always to be activated to enable the inverter operation regardless of the control mode.
If ENABLE input is disabled, the inverter output voltage is set to zero, so the motor performs a cost to stop. If the ENABLE command is active at power on, the inverter will not start until terminal 6 is opened and closed again. This safety measure may be disabled through parameter C61 (IFD SW) or C53 (VTC SW). The ENABLE command also unlocks PID regulator – if used regardless of the inverter operation – whether neither MDI3 nor MDI4 are set as A/M (Automatic/Manual).

NOTE

When the ENABLE command is active, alarms A04 (Wrong user's par.), A15 ENCODER Alarm (VTC SW only), A16 (Speed maximum) (VTC SW only), A25 (Mains Loss) (IFD SW only), A30 (DC OverVoltage) and A31 (DC UnderVoltage) are enabled as well.

1.1.2. START (TERMINAL 7)

To enable the Start input, set the control modes via terminal board (factory setting). When the START input is active, the main reference is enabled; otherwise, the main reference is set to zero. The output frequency (IFD SW) or the speed motor (VTC SW) drops to zero with respect to the preset deceleration ramp. If C21 (IFD SW) or C14 (VTC SW) is set to Kpd (command sent via keypad), the START input is disabled and its functionality is performed by the inverter remotable keypad (see the COMMANDS MENU section). If the REV function ("reverse rotation") is active, the START input may be used only when the REV input is inactive; if START and REV are enabled at a time, the main reference is set to zero.
The Start input may be used along with MDI1 input configured as STOP with parameters C23 (IFD SW) or C17 (VTC SW) for a button-control mode instead of a switch-control mode.

1.1.3. RESET (TERMINAL 8)

If an alarm trips, the inverter stops, the motor performs a coast to stop and the display shows an alarm message (see the DIAGNOSTICS section). Open the reset input for a while or press the RESET key to reset the alarm. This happens only if the cause responsible for the alarm has disappeared and the display shows "Inverter OK". If factory setting is used, enable and disable the ENABLE command to restart the inverter. If parameter C61 (IFD SW) or C53 (VTC SW) is set to [YES], the inverter is reset *and* restarts. The reset terminal also allows resetting the UP/DOWN commands; to do so, set parameter P25 "U/D RESET" to [YES].

DANGER

Shock hazard persists even when the inverter is locked on output terminals (U, V, W) and on the terminals used for the connection of resistive braking devices (+, –, B).

CAUTION

If an alarm trips, see the DIAGNOSTICS section and reset the equipment after detecting the cause responsible for the alarm.

NOTE

Factory setting does not reset alarms at power off. Alarms are stored and displayed at next power on and the inverter is locked. To reset the inverter, turn it off and set parameter C53 (IFD SW) or C48 (VTC SW) to [YES].

1.1.4. MDI1÷5 (TERMINALS 9, 10, 11, 12, 13)

Functionality of these control inputs depends on programming of parameters C23÷C27 (IFD SW) or C17÷C21 (VTC SW). See table below.

		IFD SW			VTC SW		
Term.	Name	Parameter	Factory Setting	Possible Functions	Parameter	Factory Setting	Possible Functions
9	MDI1	C23	Mltf1 (Multifrequency1)	Mltf1, Up, Var%1 Stop, Fire Mode	C17	Mlts1 (Multispeed1)	Mlts1, Up, Stop, Slave
10	MDI2	C24	Mltf2 (Multifrequency 2)	Mltf2, Down, Var%2, Loc/Rem, Fire Mode	C18	Mlts2 (Multispeed2)	Mlts2, Down, Slave, Loc/Rem
11	MDI3	C25	Mltf3 (Multifrequency 3)	Mltf3, CW/CCW, Var%3, DCB, REV, A/M, Lock, Loc/Rem	C19	Mlts3 (Multispeed3)	Mlts3, CW/CCW, DCB, REV, A/M, Lock, Slave, Loc/Rem
12	MDI4	C26	CW/CCW	Mltf4, Mltr1, DCB, CW/CCW, REV, A/M, Lock, Loc/Rem	C20	CW/CCW	Mltr1, DCB, CW/CCW, REV, A/M, Lock, Slave, Loc/Rem
13	MDI5	C27	DCB	DCB, Mltr2, CW/CCW, V/F2, Ext A, REV, Lock, Fire Mode	C21	DCB	DCB, Mltr2, CW/CCW, ExtA, REV, Lock, Slave

1.1.4.1. MULTIFREQUENCY/MULTISPEED– PROGRAMMABLE REFERENCE LEVELS

Terminals 9, 10, 11, 12 (IFD SW) or 9, 10, 11 (VTC SW)

C23÷C26 = MLTF (IFD SW) or C17÷C19 = MLTS (VTC SW)

This function is used to produce 15 programmable frequency/speed/torque references (IFD SW) or 7 programmable frequency/speed references. References may be programmed through parameters P40÷P54 or P40÷P46 respectively. The table below indicates the active reference depending on the condition of programmable inputs MDI1÷MDI4 set as multifrequency/multispeed and on the START function (this function may be enabled by terminal 7 via keypad or via serial link). The reference obtained will be used as the frequency/speed reference with parameter P39 (M. F. FUN) set as "ABS" (factory setting). Setting P39=ADD, the reference obtained will be summed up to the main reference.

IFD SW																	
START	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MDI1	X	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
MDI2	X	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
MDI3	X	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
MDI4	X	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Active 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

VTC SW									
START	0	1	1	1	1	1	1	1	1
MDI1	X	0	1	0	1	0	1	0	1
MDI2	X	0	0	1	1	0	0	1	1
MDI3	X	0	0	0	0	1	1	1	1
Active reference	0	(*)	P40 Spd1	P41 Spd2	P42 Spd3	P43 Spd4	P44 Spd5	P45 Spd6	P46 Spd7

(*): C22 (IFD SW) or C16 (VTC SW) = TERM: sum of the references sent to terminals 2, 3, 21
C22 (IFD SW) or C16 (VTC SW) = KPD; reference sent via keypad (see the Keypad Submenu)
C22 (IFD SW) or C16 (VTC SW) = Rem: reference sent via serial communications.

NOTE
0 ⇒ inactive input;
1 ⇒ active input;
X ⇒ input having no effect

If only certain terminals are set as a multifrequency/multispeed command, the terminals which are not used (and which are available for other functions) are to be considered as inactive (0).
For example, if MDI2 and MDI3 are set as multifrequency/multispeed, references P41, P43 and P45 may be obtained.

NOTE The reference obtained must never exceed FOMAX (IFD SW) or Spdmax (VTC SW). If the REV command is enabled, the reference obtained will have the opposite sign.

1.1.4.2. UP/DOWN

Terminals 9, 10
C23 (IFD SW) or C17 (VTC SW) = UP, C24 (IFD SW) or C18 (VTC SW) = DOWN

This function allows the active frequency/speed/torque reference to be incremented (UP) or decremented (DOWN). When factory setting (P23 UD/Kpd Min=0) is active, the reference increases based on the acceleration ramp until terminal 9 (MDI1) set to UP is kept closed; until terminal 10 (MDI2) set to DOWN is kept closed, the reference decreases based on the deceleration ramp until it is set to 0 (the motor direction of rotation is not reversed). Set P23=+/– and keep terminal 10 closed to reverse the motor direction of rotation (provided that P15 is set as +/–). If P24 (UD MEM) is set to [YES], the frequency reference variation is stored at power off and is available at next power on. The UP/DOWN commands may be reset by enabling terminal 8 (RESET) if P25=[YES].

1.1.4.3. CW/CCW – REVERSE COMMAND

Terminals 11, 12 or 13
C25, C26 or C27 (IFD SW) or C19, C20 or C21(VTC SW) = CW/CCW

Terminals 11, 12 or 13 allow reversing the motor direction of rotation (for more details, see the DC BRAKING section).
To do so, three steps are needed:
a) a deceleration ramp to zero;
b) the reversal of the motor direction of rotation;
c) an acceleration ramp up to the preset speed.

1.1.4.4. DCB – DIRECT CURRENT BRAKING

Terminals 11, 12, 13
C25, C26, C27 (IFD SW) or C19, C20, C21(VTC SW) = DCB

Enable terminals 11, 12 or 13 to obtain DC braking for a preset time (see the DC BRAKING section for any details).

1.1.4.5. MULTIRAMP

Terminals 12, 13
C26/C27 (IFD SW) or C20/C21(VTC SW) = MLTR

Terminals 12 and 13 allow using four different acceleration and deceleration ramp times:

MDI4	0	1	0	1
MDI5	0	0	1	1
Active ramp time	P05 Tacc1	P07 Tacc2	P09 Tacc3	P11 Tacc4
	P06 Tdec1	P08 Tdec 2	P10 Tdec3	P12 Tdec4

NOTE

0 ⇒ inactive input:
1 ⇒ active input.

If only one input is set as a multiramp input, the terminal which is not used is to be considered as inactive (0). For example, if only MDI5 is set as a multiramp input, P05 and P06 with MDI 5 inactive are obtained (input state= 0); P09 and P10 with MDI 5 active are obtained (input state = 1).

1.1.4.6. VAR% – REFERENCE VARIATION PERCENT (IFD SW ONLY)

Terminals 9, 10, 11
C23=C24=C25=VAR%

This function allows sending a command generating a variation percent of the active frequency reference, which is programmable from –100% to +100% through parameters P75÷P81.
The table below shows the frequency reference variation based on the condition of inputs MDI1, MDI2, MDI3 set as a reference variation percent.

MDI1	0	1	0	1	0	1	0	1
MDI2	0	0	1	1	0	0	1	1
MDI3	0	0	0	0	1	0	1	1
Frequency reference variation	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 input.
1 ⇒ active input.

If only one of the three inputs is set as a variation %, the terminals which are not used are to be considered as inactive (0).
For example, if only MDI3 is set as a variation percent, 0 is obtained with MDI3 inactive (input state = 0); P78 is obtained with MDI3 active (input state = 1).

The output frequency will never exceed the max. preset frequency (see parameters C07 and C13, fomax1 and fomax2) even if a higher frequency is required.

1.1.4.7. V/F2 – SECOND VOLTAGE/FREQUENCY PATTERN (IFD SW ONLY)

Terminal 13
C27 = V/F2

One inverter can be used to control two motors having different ratings. To do so, two different parameter sets are to be programmed. Each parameter set is selected with a digital command sent to terminal 13. Each motor will be then controlled with the most suitable V/F pattern based on its ratings. The commutation of the motor operation must be performed downstream from the inverter through disconnecting switches or contactors; in that case, perform commutation only when the inverter is disabled (no ENABLE command is sent). If the inverter is enabled (ENABLE contact close) or the START command is active, the commutation command will not be acknowledged.
If terminal 13 is inactive or is not set to V/F2, the first voltage/frequency pattern is produced (parameters C06÷C11 and C18÷C20).
If terminal 13 is active and set to V/F2, the second voltage/frequency pattern is produced (parameters C12÷C17).

CAUTION Do not disconnect the motor from the inverter if the inverter is running.

1.1.4.8. EXT A – EXTERNAL ALARM

Terminal 13
C27 (IFD SW) or C21 (VTC SW) = Ext A

This function locks the inverter is terminal 13 (set as Ext. A) is open. Message A36 External alarm is displayed. Close terminal 13 and send a RESET command to restart the inverter.

1.1.4.9. REV – REVERSE ROTATION

Terminals 11, 12 or 13
C25, C26 or C27 (IFD SW) or C19, C20 or C21(VTC SW) = REV

The REV command is the same as the START command but implies the reversal of the motor direction of rotation. It has to be sent to the inverter only after sending the START command. If both START and REV commands are sent, the frequency/speed produced is null because one command neutralizes the other (the START command sets the forward rotation, whereas the REV command sets the reverse rotation). The motor will stop following a deceleration ramp.
Enable terminals 11, 12, or 13 to select that logic function.

1.1.4.10. A/M – AUTOMATIC/MANUAL

Terminals 11 or 12
C25 or C26 (IFD SW) or C19 or C20 (VTC SW) = A/M

This function is used for PID regulator control:
– C28 = Ext (IFD SW) or C22 = Ext (VTC SW): PID regulator used independently of the inverter operating mode. PID regulator is disabled by enabling the A/M command: PID regulator output and internal integral term are forced to zero; PID regulator no longer controls the external physical variable associated to its operation;
– C28 = Ref F, Add F, Add V (IFD SW) or C22 = Ref Spd, Add Spd (VTC SW): PID regulator used to produce a frequency/speed reference or used to adjust the frequency/speed reference obtained. The A/M command locks PID regulator; the reference produced by PID regulator is switched to the active reference.

1.1.4.11. LOCK

Terminals 11, 12 or 13
C25, C26 or C27 (IFD SW) or C19, C20 or C21 (VTC SW) = Lock

If an input is set to Lock, the function disables any parameter alteration via remotable keypad.

1.1.4.12. STOP

Terminal 9
C23 (IFD SW) or C17 (VTC SW) = Stop

If terminal 9 is set to Stop, this function allows starting and stopping the inverter through the Start/Stop buttons instead of using the START contact (terminal 7) as a switch.
The activation (closing) of the Start button starts the inverter; the activation (opening) of the Stop button stops the inverter. The inverter stops even if both Start and Stop buttons are activated at a time.

1.1.4.13. SLAVE (VTC SW ONLY)

Terminals 9, 10, 11, 12 or 13
C17, C18, C19, C20 or C21 = Slave

Enable the input programmed as Slave. The Slave function allows bypassing the speed loop and turning the main reference into a torque reference.

1.1.4.14. MOTOR THERMAL PROTECTION INPUT (PTC)

Terminal 13
C27 (IFD SW) or C19 (VTC SW) = Ext A

The inverter manages the signal sent from a thermistor incorporated in the motor windings to obtain a hardware thermal protection of the motor. The thermistor ratings must comply with BS4999 Pt.111 (DIN44081/DIN44082):

Resistor corresponding to trip value: 1000 ohm (typical rating)
Resistor at Tr–5°C: < 550 ohm
Resistor at Tr+5°C: > 1330 ohm

Do the following to use the thermistor:

1) Set jumper J9 to position 1–2,
2) Connect thermistor between terminals 13 and 14 in the control board,
3) Set MDI5 as auxiliary trip.

In that way, the inverter will stop and indicate an auxiliary trip ("external alarm") as soon as the motor temperature exceeds threshold value Tr.

1.1.4.15. 15 LOC/REM

Terminals 10,11 or 12
C24, C25 or C26 (SW IFD) otherwise C18, C19 or C20 (VTC SW) = Loc/Rem

Enable the input programmed as Loc/Rem. This function allows overriding parameters C21/C22 (IFD SW) or C14/C16 (VTC SW) and using them in local mode (Keypad). If the input is disabled, prior setup is reset.

1.1.4.16. FIRE MODE (IFD SW ONLY)

Terminals 9, 10, 13
C23=C24=C27= Fire Mode

When inputs set as Fire Mode are enabled, any protection feature of the inverter is ignored, so that no alarm trips (see the FIRE MODE FUNCTION (IFD SW only) section for more details).

CAUTION

If an asterisk (*) appears next to INVERTER OK on the display, the product guarantee is no longer valid.
The asterisk appears if at least one condition requiring the activation of a protection feature occurs when the inverter is running in Fire Mode.

1.2. DIGITAL OUTPUTS

1.2.1. OPEN COLLECTOR OUTPUT

An OPEN COLLECTOR output is available on terminals 24 (collector) and 25 (common terminal). The OC output is galvanically isolated from zero volt of the control board and is capable of driving a load up to 50mA with 48V power supply.
The output functionality is determined by parameter P60 in the "Digital output" submenu.
The output enabling/disabling delay may be programmed through the parameters below:
– P63 MDO ON Delay
– P64 MDO OFF Delay.

The factory setting is the following:
frequency/speed threshold: the transistor activates when the output frequency (IFD SW) or the motor speed (VTC SW) attains the level set through the "Digital Output" menu (parameters P69 "MDO level", P70 "MDO Hyst.").

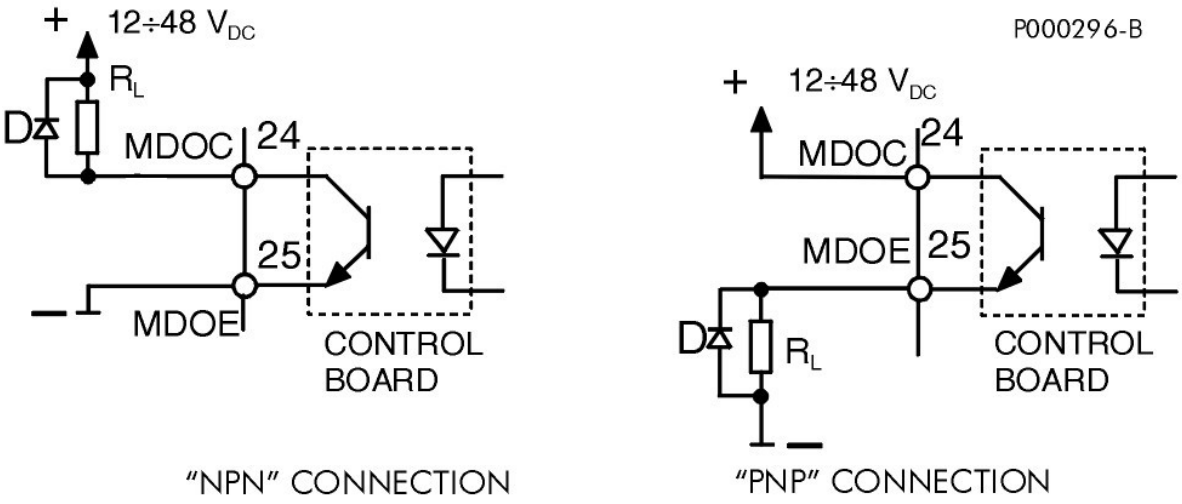


Figure 2: Connecting a relay to the OPEN COLLECTOR output

The figure shows an example of a relay connected to the output.

	CAUTION	Always use freewheeling diode (D) for inductive loads (e.g. relay coils).
	CAUTION	Never exceed max. allowable voltage and max. allowable current values.
	NOTE	Terminal 25 is galvanically isolated from terminals 1, 20, 22, (CMA – control board zero volt) and from terminal 14 (CMD – digital input zero volt).
	NOTE	As an auxiliary power supply, voltage at terminal 15 (+24V) and terminal 14 (CMD) (control terminals) may be used. Max. allowable current: 100mA.

1.2.2. RELAY OUTPUTS

Two relay outputs are available:
– terminals 26, 27, 28: relay RL1; reverse contact (250 VAC, 3A; 30 VDC, 3A)
– terminals 29, 30, 31: relay RL2; reverse contact (250 VAC, 3A; 30 VDC, 3A)

Parameters P61 (RL1 Opr) and P62 (RL2 Opr) in the Digital Output submenu affect the relay output functionality. Relay energizing and de–energizing may be delayed through the following parameters:

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

Factory–setting is as follows:

RL1: relay "ready" (terminals 26, 27 and 28); energizes when the inverter is ready to supply the motor.

At power on, the equipment takes some seconds before initializing; the relay energizes when an alarm trips. The alarm trip locks the inverter.

RL2: "frequency/speed threshold" relay (terminals 29, 30 and 31); energizes when the output frequency (IFD SW) or the motor speed (VTC SW) attains the level set through the "Digital Output" menu (parameters P73 "RL2 level", P74 "RL2 Hyst.").

CAUTION Never exceed max. voltage and max. current values allowed by relay contacts.

CAUTION Use freewheeling diode for DC inductive loads.
Use antidisturbance filters for AC inductive loads.

1.3. ANALOG INPUTS

1.3.1. AUXILIARY ANALOG INPUT

Terminal 19 is an auxiliary input capable of receiving an analog signal controlled by PID regulator as a reference or as a feedback of a physical variable (see the PID REGULATOR section); this reference may also be the inverter main reference (frequency reference or speed reference).
The input signal should range from +10V to –10V. It is possible to change the relationship between terminal 19 signal and the value of the variable managed by the inverter.
Adjust parameters P21 (Aux Input Bias) and P22 (Aux Input Gain) similarly to inputs relating to terminals 2, 3 and 21.
With reference to Fig. 1.3, the programmable parameters are the following:

P21: Aux Input Bias; value of the signal processed by the inverter (expressed as a value percent) when the signal applied to terminal 19 is equal to zero.
P22: Aux Input Gain; amplification coefficient (or weakening coefficient) with which the terminal analog signal is processed.
The processed value is determined by the following formula:

(Aux Input%) = P21 + P22*(Aux Input Ref%)/100

where Aux Input Ref% represents the signal sent to terminal 19 expressed as a percentage with respect to 10V.

CAUTION Never send signals exceeding ±10V to terminal 19.

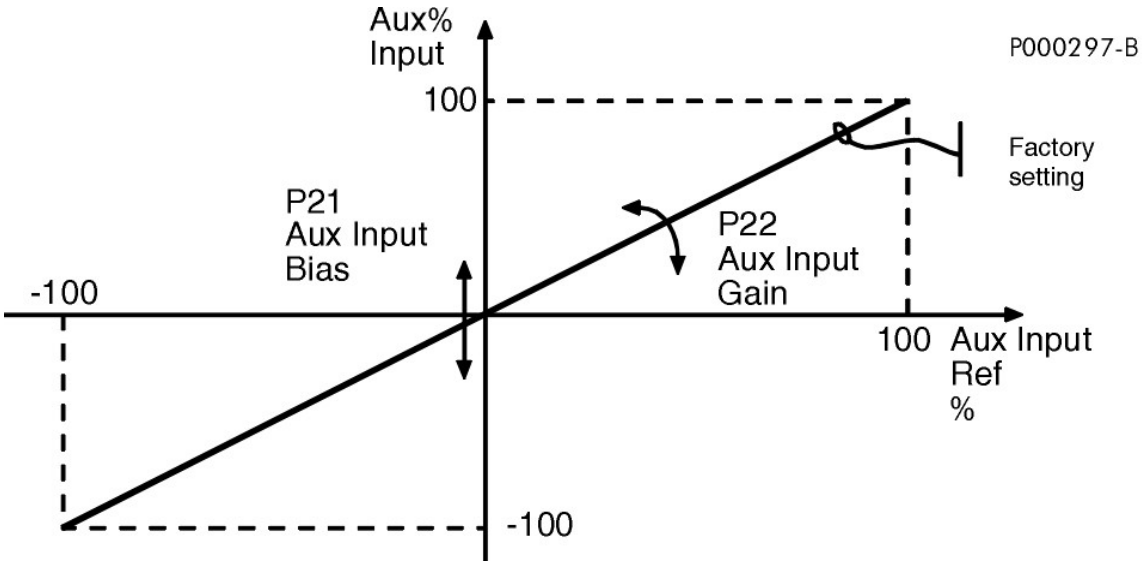


Figure 3: Parameters relating to auxiliary input processing

1.4. ANALOG OUTPUTS FEATURES

1.4.1. ANALOG OUTPUTS

Two analog outputs are located on terminal 17 and terminal 18. Analog outputs may be used to connect additional devices or to generate a signal to be sent to other devices. Some particular configuration jumpers located on control board ES778/2 allow selecting the type of output signal (0–10V, 4–20mA or 0–20mA).

Output Type	Terminal 17 AO1		Terminal 18 AO2	
	Configuration Jumper		Configuration Jumper	
	J7	J5–J8	J4	J3–J6
0–10V	pos 2–3	X	pos 2–3	X
4–20mA	pos 1–2	pos 1–2	pos 1–2	pos 1–2
0–20mA	pos 1–2	pos 2–3	pos 1–2	pos 2–3

X=any position

Through the OUTPUT MONITOR menu, set the quantity for the analog output and the ratio between the value of the output signal and the measured quantity.
The ratio between the output signal and the measured quantity is expressed as the ratio between the quantity value and the relevant voltage value on the analog output (e.g. Hz/V for IFS SW). When setting the jumpers to configure the output as 4–20mA or 0–20mA, multiply by 10 the value set to obtain the quantity value when the output delivers 20mA (e.g.: if P32=10Hz/V, the analog output will deliver 20mA when the inverter delivers 100Hz).

CAUTION Never deliver input voltage to analog outputs. Do not exceed max. allowable current.

2. MAIN REFERENCE

The main reference is the frequency reference (IFD SW) or the speed/torque reference (VTC SW) acquired when only the START command is active.
This reference may be sent by two inputs for voltage signals "Vref" (terminals 2 and 3 for signals, terminal 1 for zero volt), one auxiliary input In aux (terminal 19) and one input "Iref" for a current signal (terminal 21 for the signal, terminal 22 for zero volt). These inputs are active if parameters C22 (IFD SW) or C14 (VTC SW) are set to Term (factory setting).
If a signal is sent to more than one analog input, the signal addition is considered as the main reference.
Voltage signal Vref (terminals 2 and 3) may be unipolar (0÷10V, factory setting) or bipolar (±10V) depending on the position of jumper J14.
Auxiliary power supply (+10V, terminal 4) is available to power an external potentiometer (2.5÷10 kΩ).

Do the following to use a bipolar signal (± 10 V) at the inverter input:
– set jumper J14 to position 1–2 (+/–)
– set parameter P18 (Vref J14 Pos.) as "+/–"
– set parameter P15 (Minimum Ref) as "+/–"
The motor direction of rotation changes when the main reference sign becomes opposite.

Bipolar voltage (±10V) may be sent to input Inaux (terminal 19). The motor direction of rotation changes when negative signals are sent.
Analog input Iref (terminal 21) acknowledges a current value ranging from 0 to 20mA as an input signal (factory setting: 4÷20 mA).
If parameters C22 (IFD SW) or C16 (VTC SW) are set to Kpd, the main reference is sent via keypad; signals applied to terminals 2, 3, and 21 will have no effect.
If parameters C22 (IFD SW) or C16 (VTC SW) are set to REM, the main reference is sent via serial link.

CAUTION Do not apply signals exceeding ±10V to terminals 2 and 3. Do not send current values higher than 20mA to terminal 21.

NOTE Terminals 2 and 3 and terminal 21 may also be used as inputs for reference and PID regulator feedback (see the PID REGULATOR section).

Parameters P16 (Vref Bias), P17 (Vref Gain), P19 (Inmax), and P20 (Iref Gain) allow changing the relationship between the signals sent to terminals 2, 3, and 21 and the main reference. Two separate settings are possible for voltage inputs and current inputs. Factory setting corresponds to 0÷10V input signals and to 4÷20mA input signals.

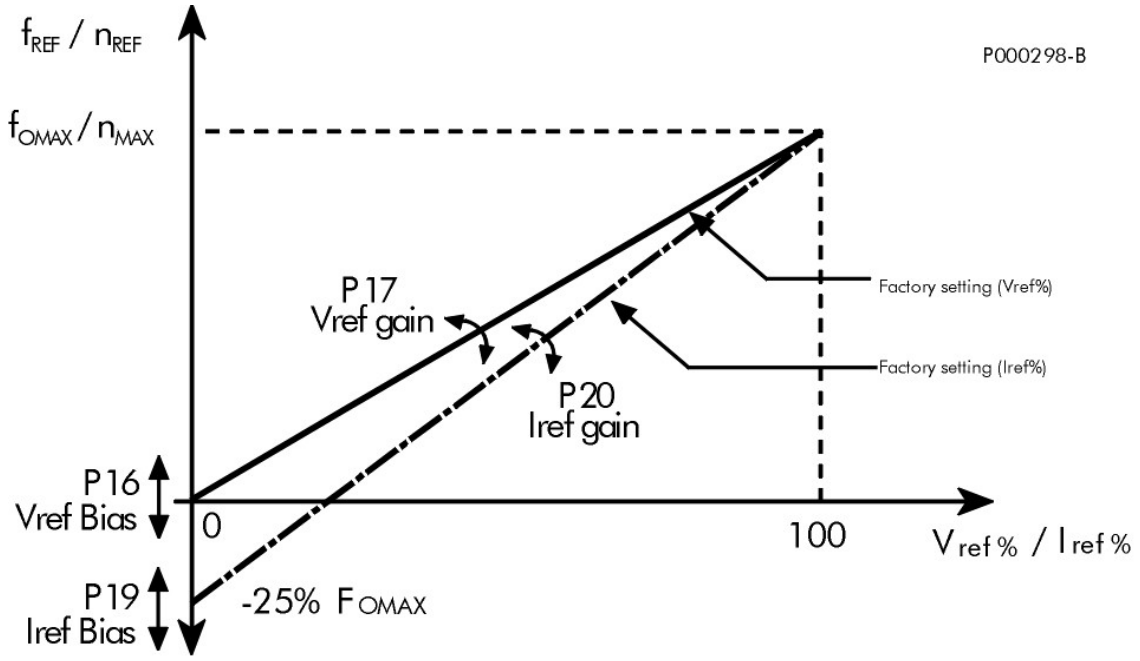


Figure 4: Parameters relating to main reference processing.

With reference to Figure 4, configurable parameters are the following:

P16 and P19: Vref Bias and Iref Bias; main reference value – expressed as a percentage of the max. output frequency (IFD SW) or the max. speed of the motor (VTC SW) – produced when all reference signals sent via terminal board (terminals 2, 3, 21) are set to zero.
P17 and P20: Vref Gain and Iref Gain; amplification coefficient (or weakening coefficient) between the signals sent via terminal board and the main reference that is obtained.

Example (IFD SW):
Frequency reference Fref expressed in Hz when the first V/f pattern is active (for factory setting, see the VOLTAGE/FREQUENCY PATTERN (V/F PATTERN) (IFD SW only) section) is calculated as follows:

Fref = C07/100 * (P16 + Vref%/100 * P17) + C07/100 * (P19 + Iref%/100 * P20)

where:

Vref% is the sum of the signals sent to terminals 2 and 3, expressed as a percentage with respect to 10V; if the signal addition exceeds 10V, still consider Vref% = 100%.
Iref% is the signal sent to terminal 21 expressed as a percentage with respect to 20mA.
C07 is the max. output frequency of the inverter expressed in Hz and relating to the first voltage/frequency.
The first term of the addition is limited from zero to C07 by parameter P18 (Vref J14 Pos) set as +; if P18 is set as +/–, it is limited to ±C07. The second term of the addition is limited from zero to C07; Fref% between ±C07.

Examples:

	Vref Bias	Vef Gain	Iref Bias	Iref Gain	Input signals			J14	Output frequency C22 = Term C29 = Ext C30 = INAUX MDI1÷MDI5 inactive
	P16 (%)	P17 (%)	P19 (%)	P20 (%)	terminal 2 (V)	terminal 3 (V)	terminal 21 (ma)	P18	
Default	0	100	–25	125	0÷10	0	0	+	0÷FOMAX 1
Default	0	100	–25	125		0	4÷20	+	0÷FOMAX 1
Ex. 1	25	75	–25	125	0÷10	0	0	+	25%FOMAX1÷FOMAX1
Ex. 2	100	–100	–25	125	0÷10	0	0	+	FOMAX 1÷0
Ex. 3	0	200	–25	125	0÷5	0	0	+	0÷FOMAX 1
Ex. 4	0	100	0	100		0	0÷20	+	0÷FOMAX 1
Ex. 5	200	–200	–25	125	5÷10	0	0	+	FOMAX 1÷0
Ex. 6	0	100	–25	125	–10÷10	0	0	+/–	–FOMAX 1÷FOMAX 1

NOTE The value set through parameter C07 ($F_{0MAX}1$) is the maximum output frequency. If the second voltage/frequency pattern is used, the maximum output frequency will match with the active frequency (see the V/F2 – Second Voltage/Frequency Pattern (IFD SW only) section).

Figure 5 shows a block diagram for the possible processing of the terminal signals and the frequency reference. The positions of the different switches correspond to the factory setting and the activation of the ENABLE signal (terminal 6) and the START signal (terminal 7).

NOTE The block diagram in Figure 5 shows that the frequency range is limited downstream of the current commands sent via keypad and digital inputs (Multifrequency, UP/DOWN, VAR%) between a value set by P15 (Minimum Freq) and F_{OMAX}. As a result: if P15=0, the frequency reference range is positive only ($0 \div F_{OMAX}$); the direction of rotation is not reversed by the command sent via keypad or through the UP/DOWN command. If negative values are set in parameters P40÷P54, no frequency value is produced.

NOTE The direction of rotation is reversed only using the CW/CCW command.

NOTE If a certain value is assigned to P15 (e.g. 10 Hz), the frequency reference will vary between this value and F_{OMAX} (e.g. from 10 Hz to F_{OMAX}); this means that lower frequency references are not produced (for instance, no value is produced under 10Hz through the UP/DOWN command or via keypad; if values under 10Hz are set in parameters P40÷P54, no frequency value is produced).

NOTE Set P15 = "+/–" (factory setting) to obtain a frequency reference ranging from $\pm F_{OMAX}$ to reverse the direction of rotation via keypad or sending the UP/DOWN command, provided that parameter P23 (UP/Kpd Min) is set as "+/–" (see next Note). If negative values are set in parameters P40÷P54, the direction of rotation will be opposite to the positive value.

NOTE The motor direction of rotation may be reversed through the UP/DOWN commands (terminals 9 and 10, parameters C23 and C24) and the command sent via keypad only if P15 and P23 are set as "+/–". Factory setting of P23 (UD/Kpd Min) as "0" inhibits the direction of rotation reversal regardless of the configuration of parameter P15 (Minimum Freq).

Similar considerations may be done as per the block diagram in Figure 6 (VTC SW).

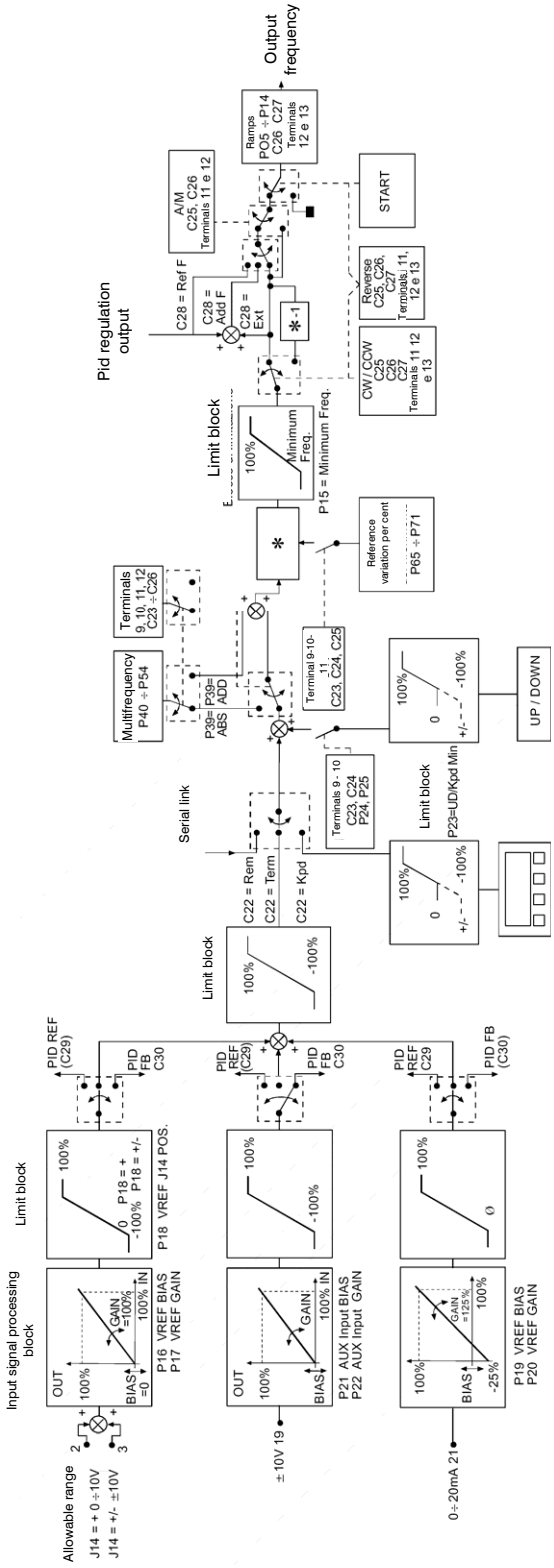


Figure 5: Block diagram of main reference processing for IFD SW.

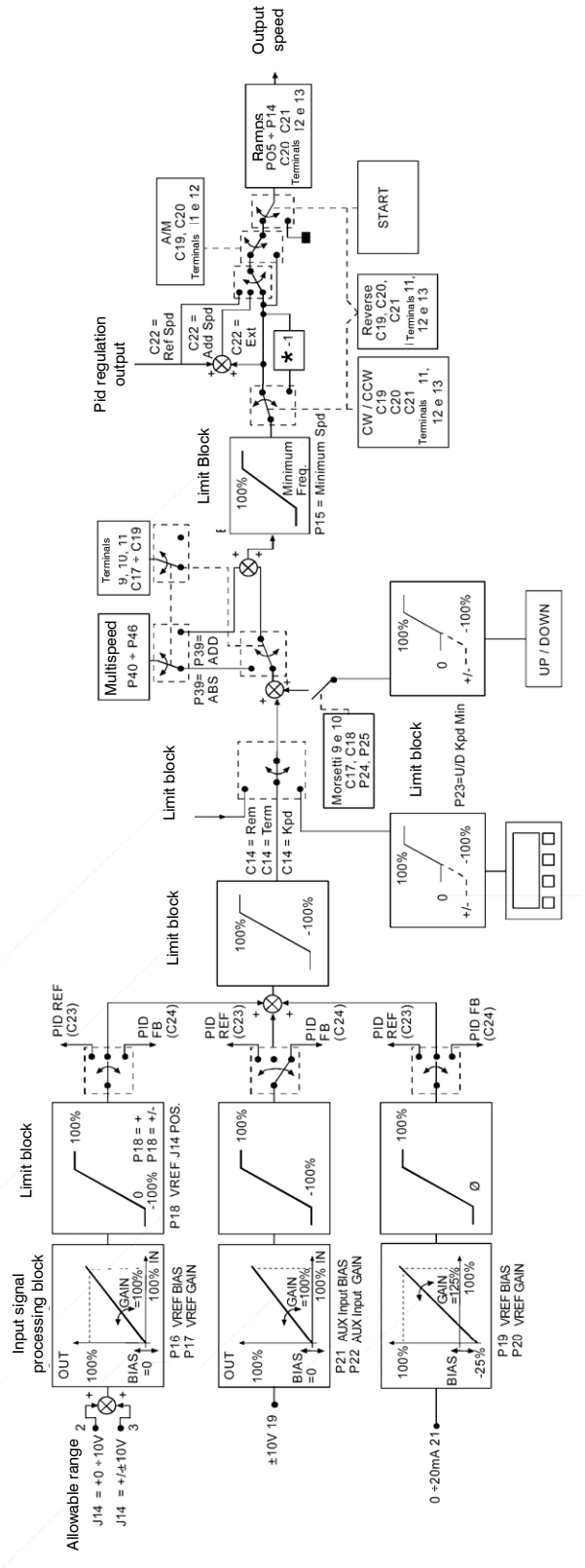


Figure 6: Block diagram of main reference processing for VTC SW.

3. PROGRAMMABLE FUNCTIONS

3.1. VOLTAGE/FREQUENCY PATTERN (V/F PATTERN) (IFD SW only)

The voltage/frequency pattern produced by the inverter may be customized based on the application requirements.
All parameters relating to this function are included in the V/f patterns submenu (Configuration menu).
Two different voltage/frequency patterns may be programmed. The inverter generally uses the first pattern (parameters C06÷C11 and C18÷C20). To switch to the second V/f pattern (parameters C12÷C17), enable input MDI5 set as V/F2 (see the V/F2 – Second Voltage/Frequency Pattern (IFD SW only) section).

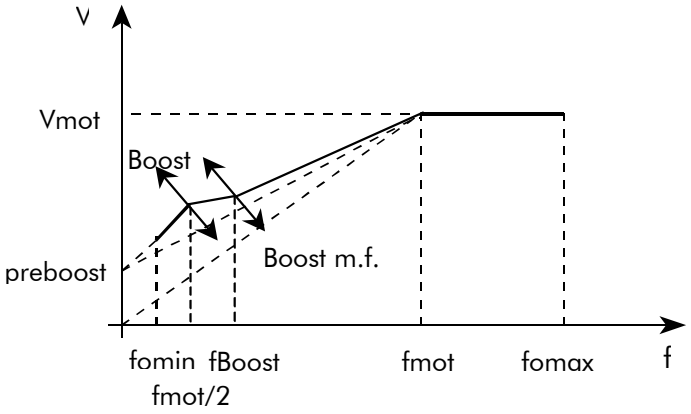


Figure 7: Parameters relating to the voltage/frequency pattern

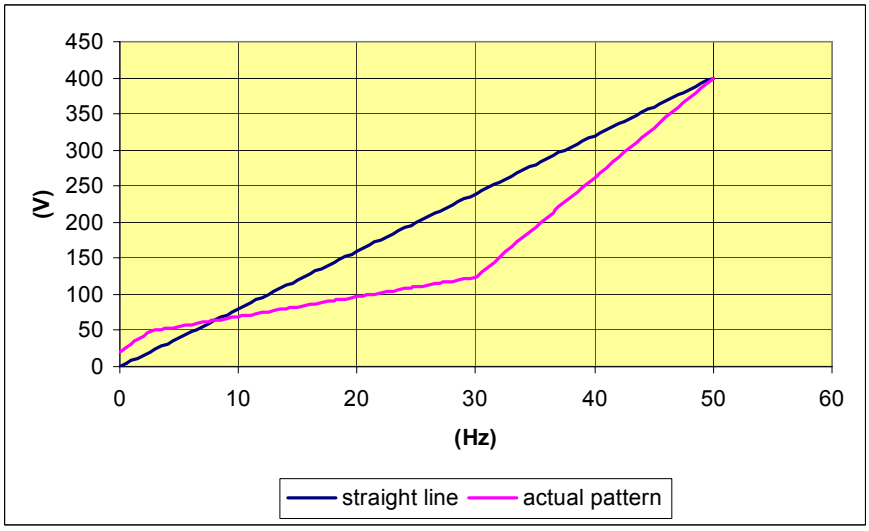
Considering .Figure 7 the configurable parameters are the following:

	V/f 1	V/f 2	Description
fmot	C06	C12	motor rated frequency; determines the switching from constant–torque operation to constant–power operation
fomax	C07	C13	maximum output frequency produced by the inverter
fomin	C08	C14	minimum output frequency produced by the inverter (always contact Elettronica Santerno before altering this value)
Vmot	C09	C15	motor rated voltage corresponding to the rated value; this is the voltage obtained at the motor rated frequency
Boost	C10	C16	determines the variation of the output voltage @ fmot/20: Boost>0 determines an increase in the output voltage to increase the starting torque; Boost<0 determines a decrease in the output voltage to decrease energy consumption at low rpm if the load pulled by the motor has a quadratic torque characteristic with respect to speed (e.g. pumps and fans)
preboost	C11	C17	determines the increases of the output voltage at 0 Hz
Boost m.f.	C19	——	determines the variation of the output voltage at fBoost frequency
fBoost	C20	——	determines the frequency level to which the variation of the output voltage as set with in Boost m.f. corresponds

Example 1:
Programming the V/f pattern of a 400V/50Hz motor to be used up to 80 Hz:
C06 = 50 Hz
C07 = 80 Hz
C08 = 0.1 Hz
C09 = 400 V
C10 = depending on the required starting torque.
C11 = 1%

Example 2:
Programming a voltage/frequency pattern of a 400V/200Hz motor to be used up to 200 Hz:
C06 = 200 Hz
C07 = 200 Hz
C08 = 0.1 Hz
C09 = 400 V
C10 = depending on the required starting torque.
C11 = 1%

Example 3:
Programming the V/f pattern of a 400V/50Hz motor to be used up to 50Hz with the following parameters (depending on application requirements):
C06 = 50 Hz
C07 = 50 Hz
C09 = 400 V
C10 = 25 %
C11 = 5 %
C19 = –50 %
C20 = 60 %
the V/f pattern effectively obtained is the following:



NOTE

Because decreasing voltages values could stall the motor when frequency increases, the inverter will avoid negative trends depending on V/f characteristic set with V/f pattern parameters: in that cases, a horizontal segment is produced (constant V when frequency increases).

Besides forcing a torque compensation depending on operating frequency only, voltage may be increased (only positive) based on the actual motor stress, i.e. based on the motor torque. This compensation (AutoBoost) is obtained as follows:

$\Delta V = C09 \times (C18/100) \times (T / Tn)$

where T is the expected motor torque and Tn is the motor rated torque.
Tn is calculated as follows:

$Tn = [(Pn - Rs \times I^2) \times \text{pole pairs}] / 2\pi f =$
$= [(C75 - C78 \times M06^2) \times C74 / 2] / (2\pi \times C06)$

NOTE AutoBoost compensation is active only when selecting the first voltage/frequency pattern.

Programmable parameters for the AutoBoost function are:

C18 (AutoBoost): variable torque compensation expressed as a percentage of the motor rated voltage (C09). The value set for C18 represents the voltage increment when the motor runs with the rated torque.
C74 (poles).
C75 (Pn): Rated power of the connected motor.
C78 (Rs): Stator resistance of the connected motor.

3.2. CARRIER FREQUENCY (IFD SW only)

Carrier frequency may be programmed based on output frequency as shown in Fig. 8. Adjust parameters in the "Carrier Freq" submenu (Configuration menu):

C01	MIN CARRIER:	Minimum value of PWM modulation frequency
C02	MAX CARRIER:	Maximum value of PWM modulation frequency
C03	PULSE NUMBER:	Number of output pulses produced when switching from the minimum value to the maximum value.
C04	SILENT MODULATION:	Electrical noise due to switching frequency is weakened and becomes similar to mechanical noise

Factory setting is dependent on the inverter size, but is always C01 = C02, C03 = 24. Always do the following:

- never exceed the maximum allowable carrier frequency (automatically actuated by the inverter)
- do not set a low pulse number (10÷15) for asynchronous modulation

Note that:

- asynchronous modulation occurs with constant carrier independently on output frequency
- synchronous modulation occurs with constant pulse number
- pulse number is equal to $\dfrac{\text{carrier frequency}}{\text{output frequency}}$

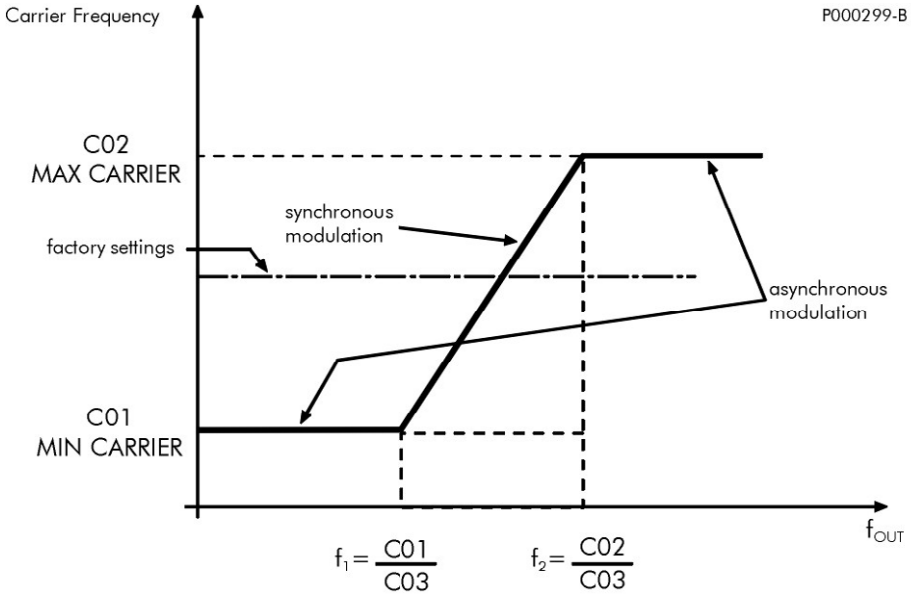
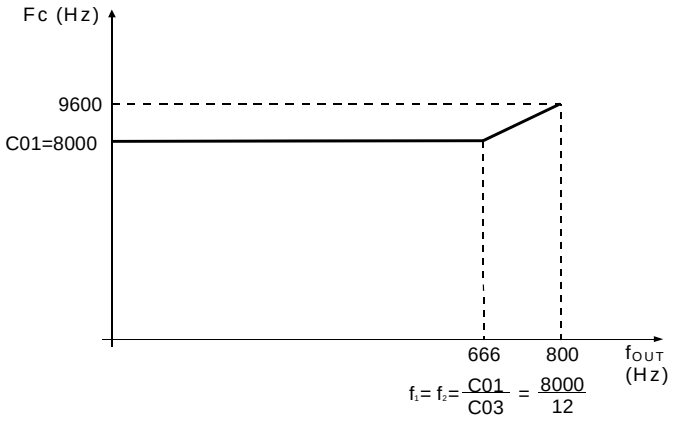


Figure 8: Carrier frequency based on output frequency.

– For $f_{OUT} < f_1$, carrier frequency is kept constant and equal to C01 independently on output frequency up to f_1 = C01 / C03;
– For $f_1 < f_{OUT} < f_2$, carrier frequency increases in a linear way because the pulse number is constant; carrier frequency is f_C = C03 * f_{OUT};
– For $f_{OUT} > f_2$, carrier frequency is kept constant and equal to C02.

A decreasing carrier frequency improves the motor performance at low rpm but implies a louder noise. Because carrier frequency f_C can never exceed 16000 Hz, if a high output frequency is required, set C03 = 12 to obtain synchronous modulation when maximum output frequency is attained.



The diagram shows an example of the carrier frequency recommended to obtain a maximum output frequency of 800 Hz. C02 is expected to be 10000 Hz (factory setting).

Figure 9 Carrier frequency with the recommended setup for f_{OUT} = 800 Hz.

3.3. SLIP COMPENSATION (IFD SW only)

This function allows compensating for the decrease of the asynchronous motor speed when the mechanical load is increased (slip compensation).
All parameters relating to this function are included in the Slip Compensation submenu (Configuration menu).
When the motor current exceeds the no–load current set through parameter C76, the output frequency is increased by:

$$f_{COMP} = C77 \cdot \frac{(Iout - C76)}{(C05 - C76)} \cdot f_{REF}$$

where C05 is the motor rated current.
Set C77 (rated slip) to 0 to disable this function.

Slip compensation is programmed with the following parameters:

– C76: motor no–load current;
– C77: motor rated slip.

3.4. SPEED SEARCHING (IFD SW only)

Once the inverter is disabled, the motor idles; if the inverter is enabled when the motor is idling, it will search the motor speed.
All parameters relating to this function are included in the Special Functions submenu (Configuration menu).
Speed searching is enabled when parameter C55 is set to [YES] (factory setting) or to [YES A].

When parameter C55 is set to [YES], do the following to enable speed searching:
– open and close terminal 6 (ENABLE) before t_{SSdis} is over (see Fig. 10);
– disable DC braking before the time set is over (see the DC Braking Command Sent Via Terminal Board section);
– reset an alarm trip (with a reference other than 0), before t_{SSdis} is over (see Fig. 12).
Speed searching is not performed when voltage is removed from the inverter for a time long enough to shut off the inverter.

When parameter C55 is set to [YES A], speed searching is always enabled under the above–mentioned conditions (Fig. 10 and 12), but if voltage is removed from the inverter, t_{SSdis} is considered as the sum of the time period before the inverter power off and after the next power on; the time period when the inverter is off is not considered (Fig. 11 and 13).
If the inverter is turned on after a time period longer than t_{DIS}, frequency output is generated based on the acceleration ramp.
If C56 is set to zero, speed searching (if enabled with C55) will occur when the inverter enters the RUN mode.
The diagrams on the next page show output frequency and motor rpm during speed searching under different conditions.

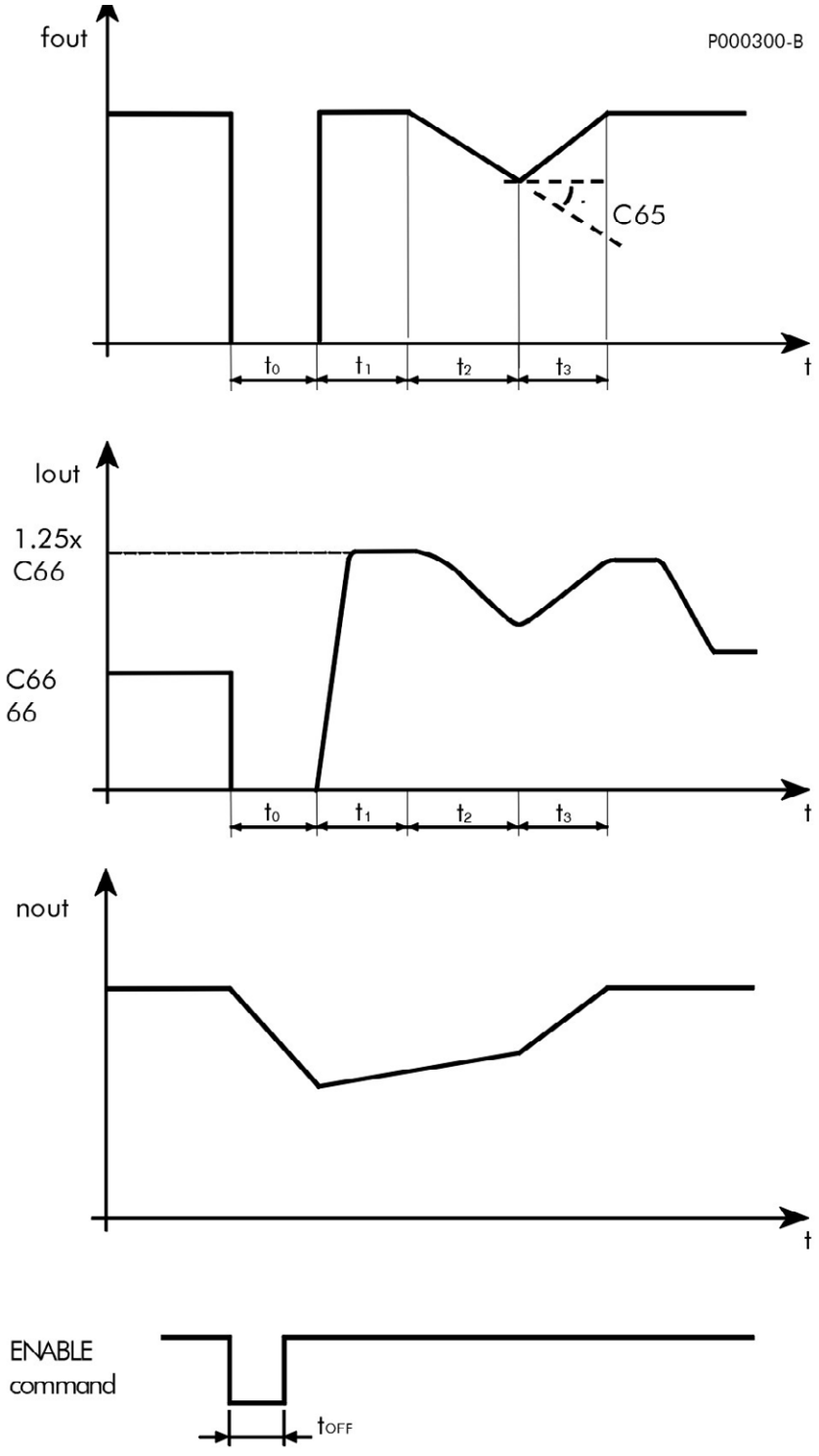


Figure 10: Output frequency and motor rpm during speed searching (C55 = [YES] or C55 = [YES A]) activated by the ENABLE command. $t_{OFF} < t_{SSdis}$ (C56) or C56 = 0.

Once the rotor demagnetizing time (t_0) is over, speed searching takes place in three steps:

during time t_1 the last frequency value on inverter power off is generated. The output current attains a value corresponding to 1.25xC66;

during time t_2 output frequency is decreased to perform speed searching. Speed searching occurs when the output current drops below the value set in C66;

during time t_3 the motor attains its prior speed following the acceleration ramp.

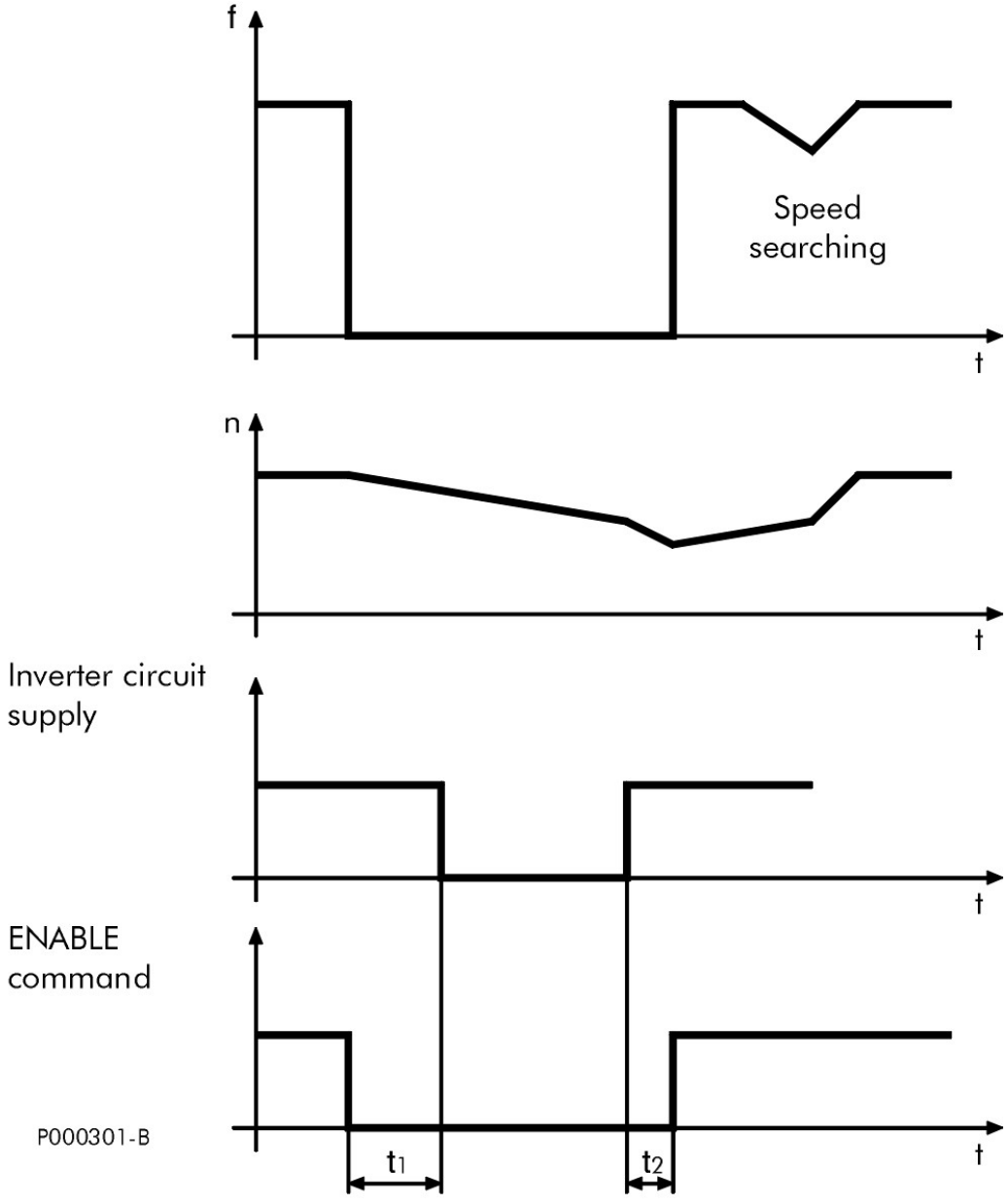


Figure 11: Frequency, rpm of the inverter motor during speed searching (power off, C55 =[YES A]) due to the adjustment of the ENABLE command. $t_1 + t_2 < t_{SSdis}$ (C56) or C56 = 0.

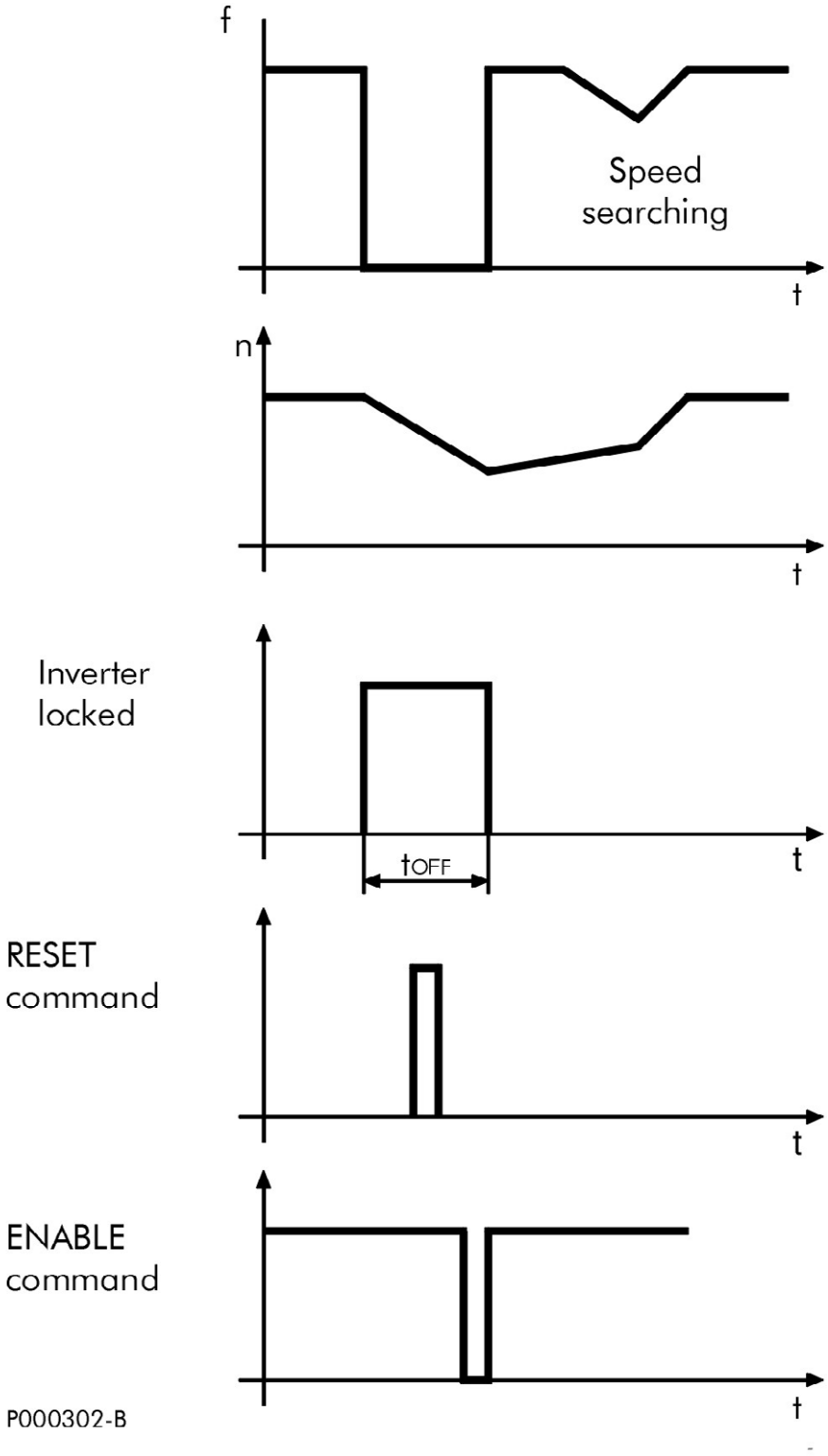


Figure 12: Output frequency, rpm, inverter locked, reset and ENABLE commands during speed searching due to an alarm trip (C55 = [YES] or C55 = [YES A]). $t_{OFF} < t_{SSdis}$ (C56) or C56 = 0.

If parameter C61 is set to [YES], it is not necessary to open and close the ENABLE command.

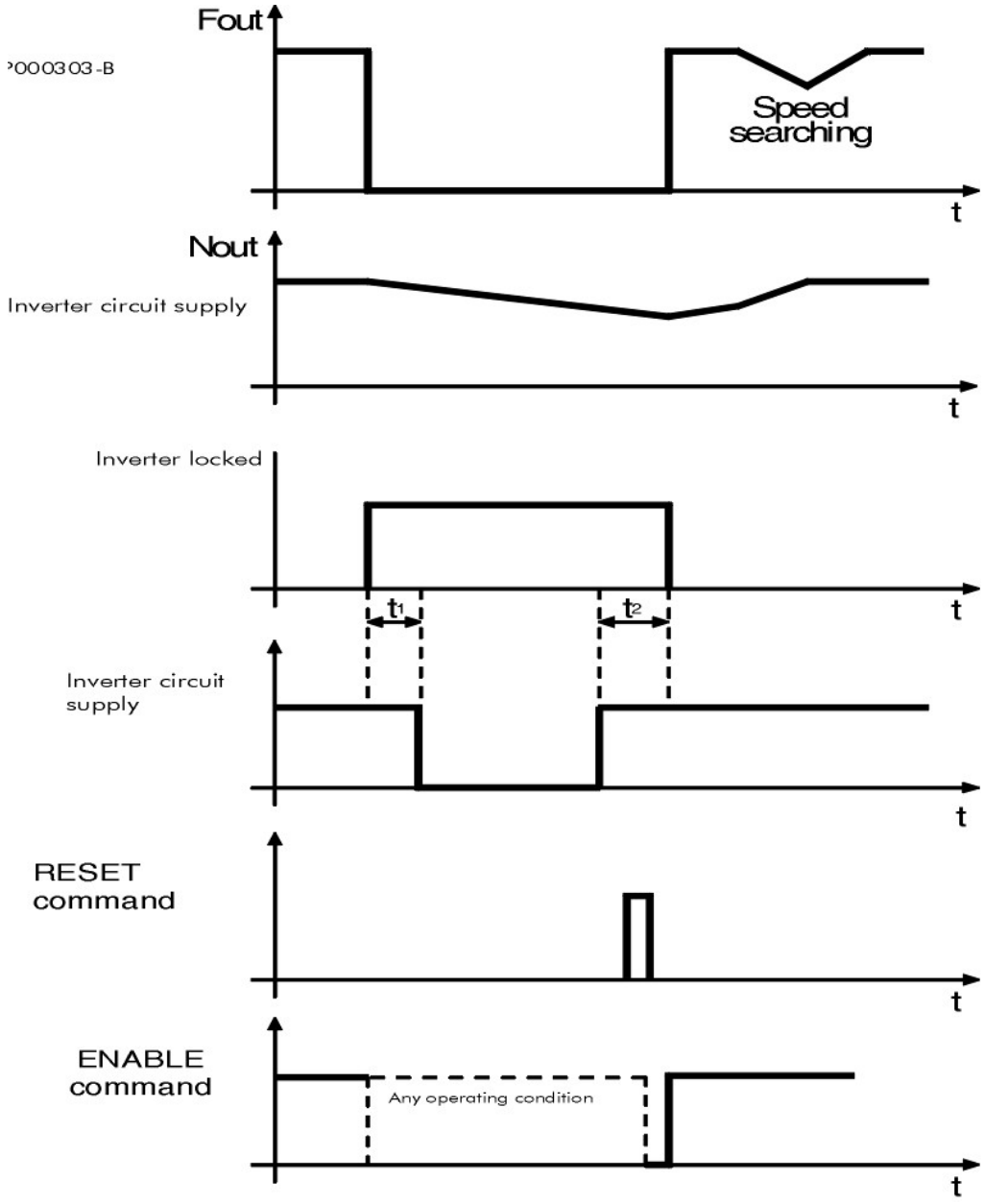


Figure 13: Output frequency, rpm, inverter condition, power supply, reset and ENABLE commands when speed searching is due to an alarm reset and to voltage removal from the inverter (C55 = [YES A]). $t_1 + t_2 < t_{SSdis}$ (C56) or C56 = 0.

If parameter C61 (ENABLE) is set to [YES], it is not necessary to open and close the ENABLE command after resetting the alarm or switching on the inverter when C53 is set to [YES].
If parameter C53 (PWR Reset) is set to [YES], it is not necessary to use the RESET command.

3.5. FIRE MODE FUNCTION (IFD SW only)

When the digital input set as Fire Mode is activated, any protection feature of the inverter is ignored, so that no alarm trips.

CAUTION

The Fire Mode function must be used only when strictly necessary in order to safeguard people's safety (e.g. applications for fire pumps).
It must not be used to prevent alarms from tripping in standard domestic or industrial applications.

When operating in Fire Mode, the inverter:

- exploits the frequency reference set with P38;
- exploits 10-second UP and DOWN ramps (that cannot be altered);
- can activate the digital output (if any) set with parameters P60, P61, P62;
- ignores the following alarms:
    - A11 Bypass Circuit Failure
    - A18 Fan Fault Overtemperature
    - A18 Second Sensor Overtemperature
    - A20 Inverter Overload
    - A21 Heatsink Overheated
    - A22 Motor Overheated
    - A25 Mains Loss
    - A36 External Failure
    - A40 Serial Communications Error
- activates an infinite number of AutoReset functions for the following alarms: Overcurrent, DC Overvoltage, DC Undervoltage.

CAUTION

If an asterisk (*) appears next to INVERTER OK on the display, the product guarantee is no longer valid.
The asterisk appears if at least one condition requiring the activation of a protection feature occurs when the inverter is running in Fire Mode.

3.6. SENSORLESS VECTOR CONTROL (VTC SW only)

Sensorless vector control is the most advanced control technique of an asynchronous motor.
Processing the equations controlling the operation of an asynchronous motor both at constant speed and during transients, sensorless vector control decouples the torque control from the motor flux control with no need to use any speed transducer or position transducer.
This allows controlling the connected motor torque or mechanical speed under any load condition and within a speed range ranging from 0 to three times the motor rated speed.
The operator should know the parameters of the asynchronous machine equivalent circuit in order to use sensorless vector control (see Figure 14).

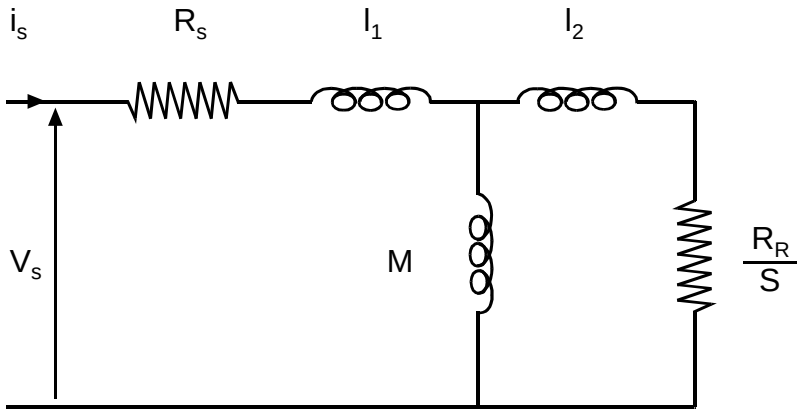


Figure 14: Equivalent circuit of the asynchronous machine

Where:
R_S : Stator resistance (wiring included)
R_R : Rotor resistance
l_1+l_2 : Full leakage inductance
M : Mutual inductance (not required for control enabling)
S : Slip
Because motor parameters are usually unknown, SINUS K is capable of automatically detect them. This is done by producing adequate DC voltage models with no machine rotation (see the "STARTUP" section in the Sinus K's Installation Instructions Manual).
Manual adjustment is also possible to fine–tune the parameter values for specific applications.

3.7. TORQUE CONTROL (VTC SW only)

Vector control allows the torque control of an asynchronous motor.
Set parameter C15 (command) as Torque. The value of the main reference corresponds to the torque needed by the motor ranging from 0 to 100% of the max. torque value set through parameter C42 (Running Torque). Parameter C42 is expressed as a percentage of the motor rated torque.

For example, using an inverter SINUS K 0020 connected to a 15kW motor, C42 factory setting is equal to 120% of the motor rated torque. This means that with 10V to terminal 2 (C14 = TERM), the torque reference is equal to 120%.

If a 7.5kW motor is connected to the inverter, parameter C42 may be increased over 200%; with respect to the value set in C42, a torque higher than 200% may be obtained.

The motor rated torque is calculated as follows:

$C=P/\omega$

where P is the rated power expressed in W and ω is the rated speed of rotation expressed in radiant/sec.
Example: a 15kW motor at 1420RPM has a rated torque equal to:

$$C = \frac{15000}{1420 \cdot 2\pi/60} = 100.9 \text{ Nm}$$

In that case, the starting torque will be equal to

rated torque * 120% = 121.1 Nm

3.8. POWER DOWN

In case of mains failure, it is possible to keep the inverter running by exploiting the kinetic energy of the motor and load: energy recovered during the motor slowing down is used to supply power to the inverter, thus avoiding loosing control due to a mains black–out.
All parameters relating to this function are included in the Power Down submenu (Configuration menu).

The following options may be selected through parameter C35 (SW IFD) or C32 (SW VTC):
– [NO]: the function is disabled (factory setting);
– [YES]: once a time period set through parameter C36 (Power Delay time) is over, a deceleration ramp takes place. Its duration may be programmed through C37 (PD Dec. Time);
– [YES V] (VTC SW only): in case of mains failure for a time longer than the value set in C36, power down is performed and DC voltage in the DC link is kept constant at the value set in C33. This is done through a PI regulator (proportional–integral regulator) adjusted through two parameters: proportional (C34) and integral (C35).

NOTE Power down may be performed only if the ENABLE command and START command are active.

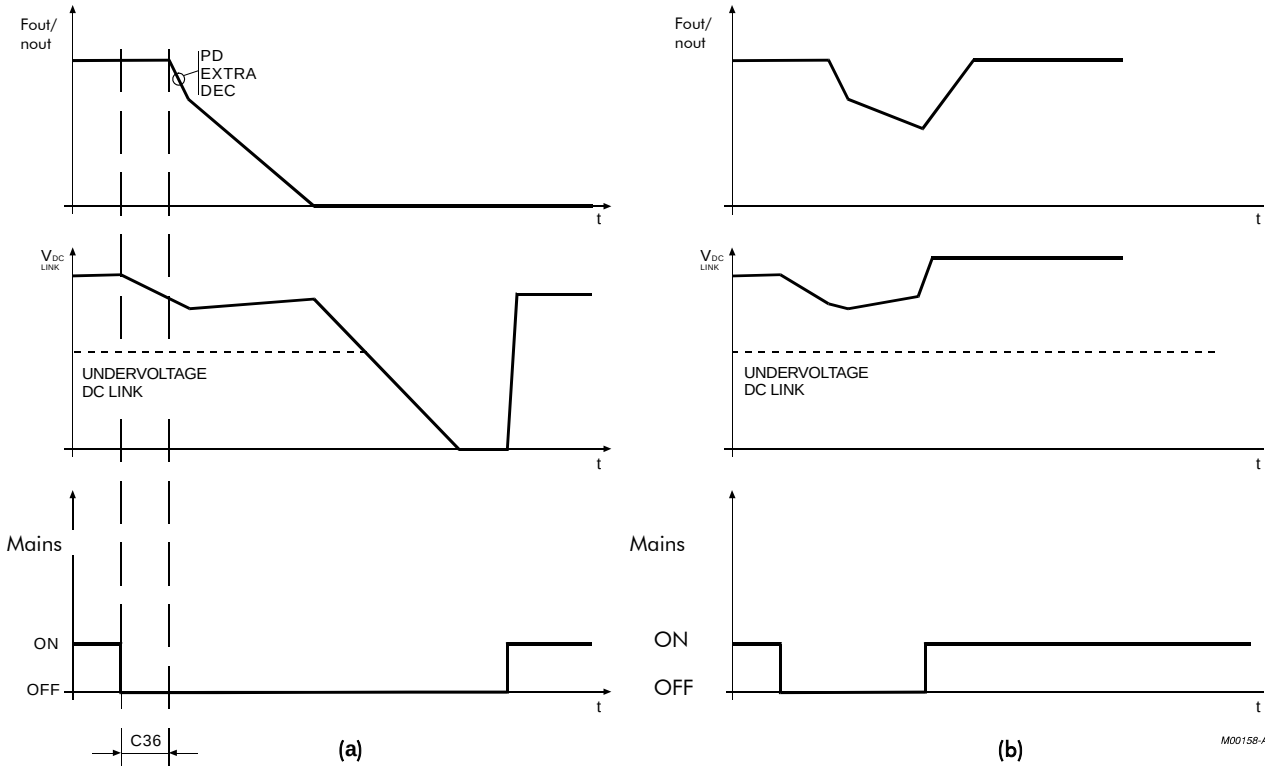


Figure 15: Output frequency/speed and DC bus voltage of the inverter ($V_{DC\ LINK}$) in case of mains failure with a higher (a) or shorter (b) duration than the motor stop time.

NOTE
(IFD SW only):

At power down, if the inverter stops due to Undervoltage alarm of the bus voltage (because energy recovered for the inverter operation is not sufficient), speed searching will occur only if this function is enabled (C55 set to [YES A]) and under the conditions stated in the SPEED SEARCHING (IFD SW only) section.

3.9. DC BRAKING

DC injection is used to stop the connected motor. This can be automatically done at stop and/or start or through a command sent via terminal board.
All parameters relating to this function are included in the DC BRAKING submenu (Configuration menu).
DC injection intensity is determined by the value of C85 constant (IFD SW) or C75 (VTC SW) as a percentage of the motor rated current.

3.9.1. DC BRAKING AT STOP

To activate this function, set

- C80 to [YES] (IFD SW) or
- C70 to [YES] or [YES A] (VTC SW) as shown in the table below. The function setting is dependent on Power Down operating mode of the inverter (see the POWER DOWN section).

C70	BRAKING AT STOP	BRAKING AT POWER DOWN BELOW STOP SPEED
NO	NO	NO
YES	YES	NO
YES A	YES	YES
YES B	NO	YES

DC braking at stop occurs when a ramped stop command is sent. Depending on the preset control mode, do the following to obtain DC braking at stop:
– open terminal 7 connection when terminal board control mode is active (or disable the REV command, if used);
– send a STOP command via keypad.

Fig. 16 shows the output frequency/speed and braking direct current when the DC braking at stop function is active. Use the following parameters to set this function:
C80 (IFD SW) or C70 (VTC SW): function enabling;
C82 (IFD SW) or C72 (VTC SW): braking time period;
C84 (IFD SW) or C74 (VTC SW): output frequency /speed of the motor determining DC braking;
C85 (IFD SW) or C75 (VTC SW): braking current intensity.

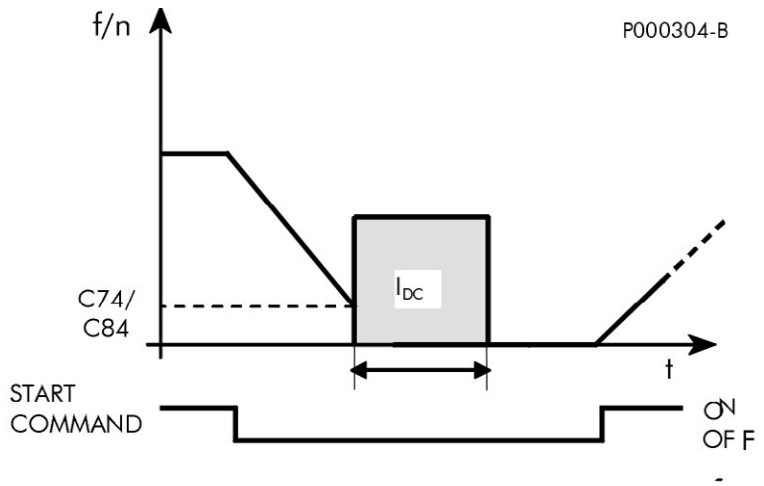


Figure 16: Output frequency/speed and DC braking current when the DC BRAKING AT STOP function is enabled.

3.9.2. DC BRAKING AT START

Set C81 (IFD SW) or C71 (VTC SW) to [YES] to activate this function.
DC braking is activated sending a START (or REV) command with a frequency/speed reference other than zero and before the acceleration ramp is performed. Depending on the equipment control mode, DC braking at start can be obtained:
– sending a START command (terminal 7) via terminal board (or through the terminal set as REV);
– using one of the digital inputs programmed as multifrequency/multispeed;
– controlling the equipment run via keypad.

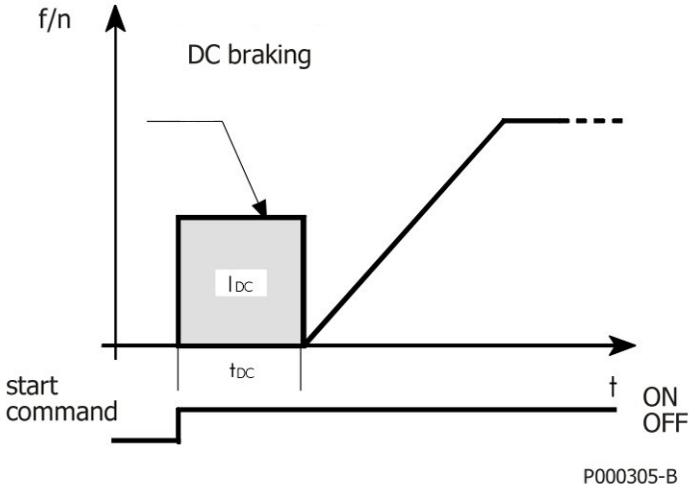


Figure 17: Output frequency/speed and braking DC current when the DC BRAKING AT START function is active.

Use the following parameters to program this function:

C81 (IFD SW) or C71 (VTC SW): function enabling;
C83 (IFD SW) or C73 (VTC SW): braking time;
C85 (IFD SW) or C75 (VTC SW): braking current intensity.

3.9.3. DC BRAKING COMMAND SENT VIA TERMINAL BOARD

The activation of a multifunction digital input set as DCB manages DC braking. DC braking time is obtained as follows:

t_{DC}=C82*f_{OUT}/C84 f_{OUT}/C84 equal to 10 (max. value for IFD SW) or
t_{DC}=C72*n_{OUT}/C74 n_{OUT}/C74 equal to 10 (max. value for VTC SW)

The following options are available:

a) time interval t_{DCB} ON when the braking command is active exceeds t_{DC}:
⇒ DC braking is performed: output frequency/speed is produced based on the acceleration ramp;

b) DC braking time is under t_{DC}:
IFD SW:
b1) DC braking time is under disabling time t_{SSdis} (see the Special Functions Submenu, parameter C56):
⇒ DC braking stops when terminal set as DCB opens; the equipment generates the frequency output produced before the DC braking command was sent if the speed searching function is enabled. Otherwise, the acceleration ramp is performed;
b2) this time period exceeds disabling time t_{SSdis} (see the Special Functions Submenu, parameter C56):
⇒ DC braking stops when terminal set as DCB opens; frequency output is performed depending on the acceleration ramp;

VTC SW:
⇒ DC braking stops when the terminal set as DCB opens, so the acceleration ramp takes place.

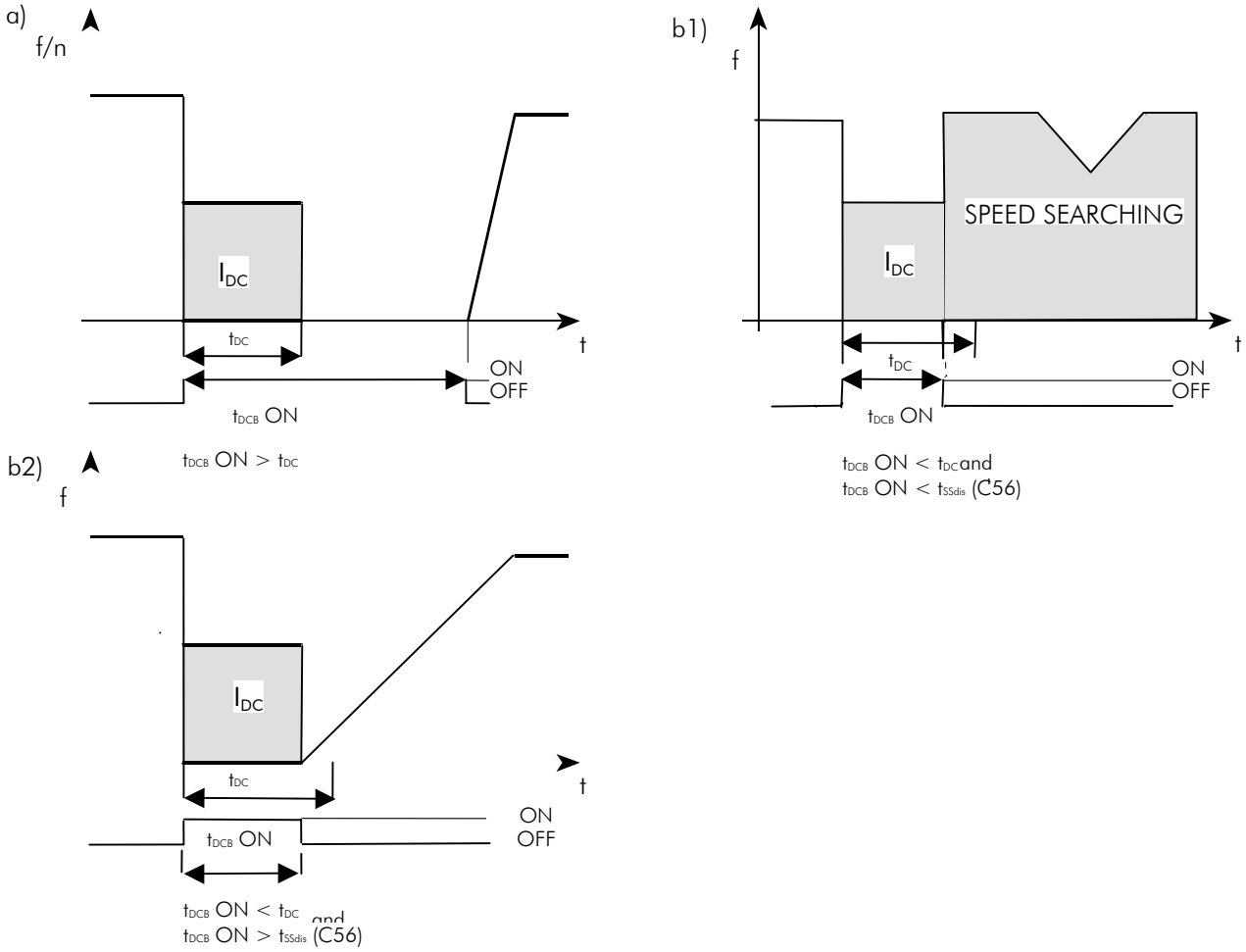


Figure 18: Output frequency and braking direct current when the DC braking command is activated.

Figure 18 shows frequency and DC braking under three different conditions.

Use the following parameters to program this function:

C82 (IFD SW) or C72 (VTC SW): braking time period at STOP;
C84 (IFD SW) or C74 (VTC SW): initial braking frequency at STOP;
C85 (IFD SW) or C75 (VTC SW): braking current intensity;
C56 (IFD SW only): disabling time of the Speed Searching function.

3.9.4. DC BRAKING HOLDING (IFD SW ONLY)

Set parameter C86 to [YES] to activate this function. Once the motor stops due to DC braking, direct current keeps being applied to the motor. DC intensity is equal to the value set in C87. This ensures a continuous motor braking; current flowing in the motor windings also determines a rise in temperature, thus avoiding condensation.

Figure 19 shows the output frequency and braking DC when this function is activated. Holding direct current activates after the injection of direct current both via terminal board and through the DC braking at stop function.
Use the following parameters to program this function:
C86: function enabling;
C87: intensity of the holding direct current.

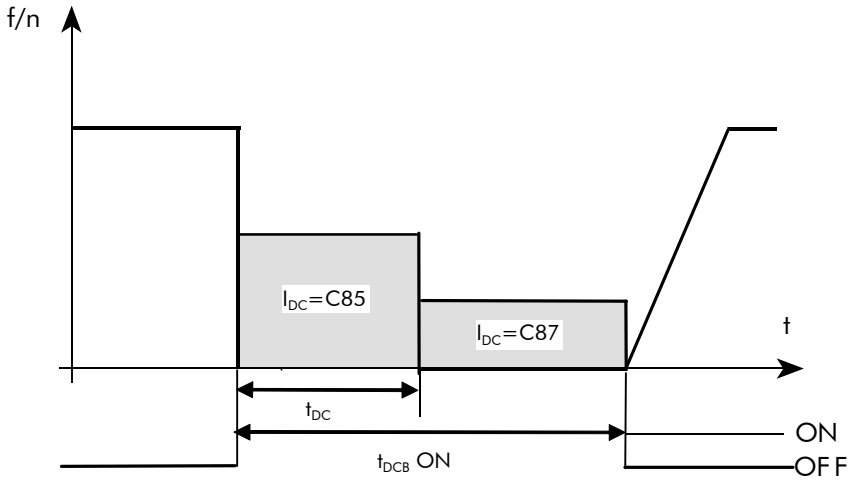


Figure 19: Output frequency and braking DC when the DC braking holding function is active

3.10. MOTOR THERMAL PROTECTION

This function protects the motor against possible overloads.
All parameters relating to this function are included in the Motor thermal protection submenu (Configuration menu).
Four motor protection options are available. They can be selected through parameter C70 (IFD SW) or C65 (VTC SW):

[NO]	the function is locked (factory setting);
[YES]	the function is active; pick–up current is independent of the operating frequency/speed;
[YES A]	the function is active; pick–up current is depending on the operating frequency/speed with a special derating for motors provided with forced air–cooling;
[YES B]	the function is active; pick–up current is depending on the operating frequency/speed with a special derating for motors provided with a fan keyed to the shaft.

The heating of a motor where constant current I_o flows depends on time and current intensity:

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

where T is the motor thermal time constant (C72 IFD SW or C67 VTC SW).
Heating is proportional to the efficient current^2 ($I_0{}^2$).
Overheating alarm (A22) trips if the current flowing in the motor determines a higher temperature than the allowable asymptotic value set with It (C71 IFD SW or C66 VTC SW):

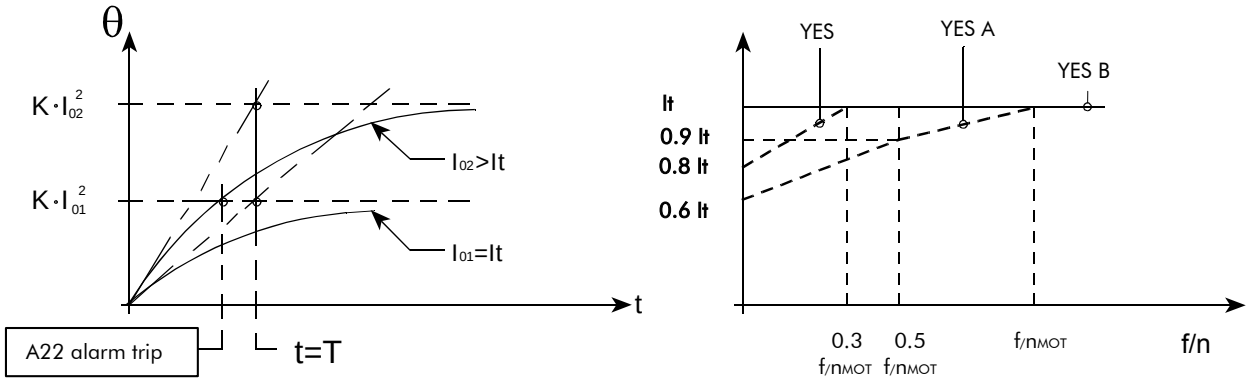


Figure 20: Motor heating with two different, constant current values (I_{01} and I_{02}) and pick–up current It of the protection with respect to the frequency/speed depending on the configuration of parameter C70 (IFD SW) or C65 (VTC SW).

If thermal time constant τ is not known, enter a value equal to 1/3 of the time interval needed to obtain a constant motor temperature.

Use the following parameters to program this function:
– C70 (IFD SW) or C65 (VTC SW): function enabling;
– C71 (IFD SW) or C66 (VTC SW): pick–up current;
– C72 (IFD SW) or C67 (VTC SW): motor thermal time constant.

CAUTION always provide the motor with a thermal protection (use the inverter thermal protection or install a thermistor in the motor)

3.11. PROHIBIT FREQUENCIES/SPEEDS

This function avoids controlling the motor with frequency values corresponding to the machine resonance frequency (IFD SW) or it prevents the motor from reaching a speed corresponding to the machine resonance frequency (VTC SW).
All parameters relating to this function are included in the Prohibit Frequency/Speed submenu (configuration menu).
Three prohibit frequency/speed ranges may be programmed. To do so, set up intermediate values and a hysteresis common to all three ranges. Set an intermediate value to zero to disable the relevant prohibit range. The output frequency/range varies until the new reference value is reached.

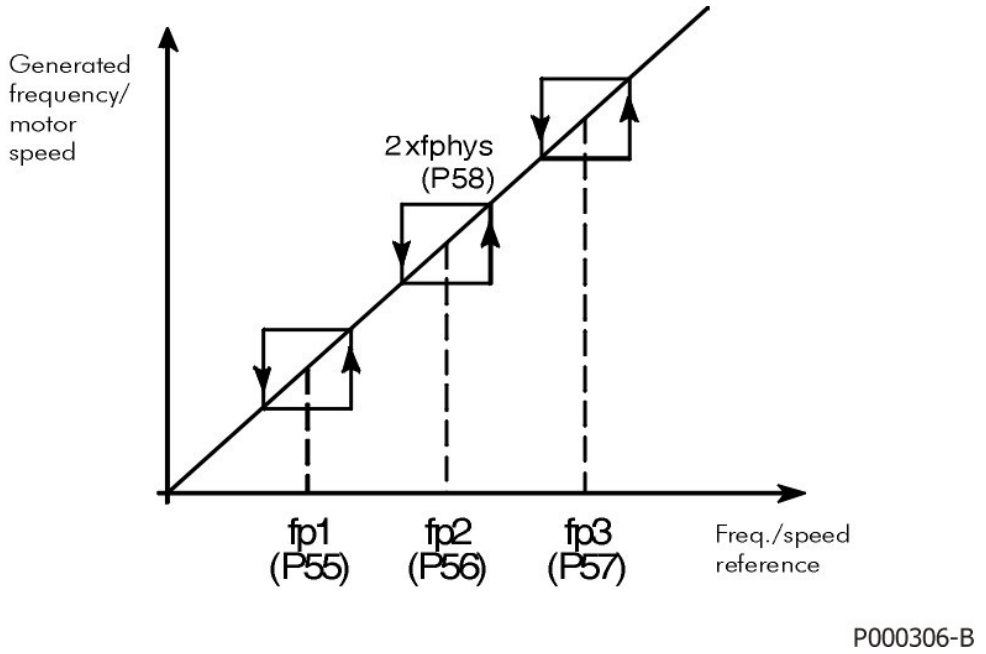


Figure 21: Prohibit frequency/speed ranges.

Use the following parameters to program this function:

– P55: intermediate frequency/speed of the first prohibit range;
– P56: intermediate frequency/speed of the second prohibit range;
– P57: intermediate frequency/speed of the third prohibit range;
– P58: semiamplitude of prohibit ranges (hysteresis).

3.12. PID REGULATOR

3.12.1. GENERAL FEATURES AND OUTPUT OPERATION

The inverter is supplied with a PID (Proportional, Integral, Derivative) regulator allowing regulating physical variables, such as pressure, capacity, speed, etc. provided that signal transducers are installed.
PID regulator parameters are included in the PID Regulator submenu (Measure/Parameters menu) and the Operation method submenu (Configuration menu).
PID regulator loops may be programmed through parameter C28 (PID Action) (IFD SW) or C22 (VTC SW) in the "Op. Method" submenu. Two options are available:

– Ext (factory setting)
⇒ PID regulator is independent of the inverter operation. It can be used to regulate any external physical variable (thermoregulation on the machine where the inverter is installed). PID regulator output is available on one of the two analog outputs. We suggest that terminal 17 be used, as it offers a better resolution.

– Ref
⇒ PID regulator output represents the frequency/speed reference used by the inverter; the motor speed is determined by the regulator with respect to the physical values it is controlling.

– Add F / Add R
⇒ PID regulator output is summed to the main frequency/speed reference; the motor speed is "adjusted" by PID regulator.

– Add V (IFD SW only)
⇒ PID regulator output is used to adjust the inverter output voltage (but not the inverter output frequency); the inverter behaves as a frequency generator whose voltage is managed by PID regulator.

3.12.2. MANAGING PID REGULATOR INPUT SIGNALS

Parameters C29 (PID Ref) (IFD SW) or C23 (VTC SW) in the "Op. Method" submenu determine the origin of the PID regulator reference value; you may choose between:

- Kpd: from keypad (factory setting)
- Vref: from voltage terminals (terminals 2 or 3)
- Inaux: from voltage terminals (terminal 19)
- Iref: from current terminals (terminal 21)
- Rem: from serial line

Use parameters P91 (PID Ref Acc) and P92 (PID Ref Dec) to program an acceleration or deceleration ramp for the PID reference.
Parameters C30 (PID F.B.) (IFD SW) or C24 (VTC SW) in the "Op. Method" submenu determine the terminal which the feedback signal is to be applied to.

The following options are available:

- Vref: from voltage terminals (terminal 2 or 3) (factory setting)
- Iref: from current terminals (terminal 21)
- Inaux: from voltage terminals (terminal 19)
- Iout: internal value proportional to output current

3.12.3. PID REGULATOR ERROR INVERSION

An optional negative gain can be added to the adjusting loop by means of parameter C31 (PID Inv) (SW IFD) or C28 (SW VTC) of the "Op. Method" submenu. In particular, the value of the PID error is inverted (reference as selected from PID Ref – retroaction as selected from the PID F.B.).

Feedback signals may be adjusted as stated in the MAIN REFERENCE section and in the ANALOG INPUTS section (see those sections for the allowable feedback signal ranges).

NOTE

Because analog channels only acknowledge feedback signals of max. 10V, the signal produced by the transducer should be lower than 10V for the full–scale value of the physical quantity to adjust. The lower the signal, the better is the PID regulator control (avoiding overshoot conditions that can bring feedback signals over 10V).

Figure 22 shows the block diagram for PID regulator, including the acquisition of the reference signal and the feedback signal. The values of the reference and the quantity (feedback) by PID regulator are kept constant by PID regulator itself. Reference values and feedback values are generated by input signal processing blocks. PID regulator output is the algebraic sum of three terms:

– proportional term (P), multiplying the difference between the reference (value to be obtained from the physical quantity to adjust) and the feedback (value measured by the physical quantity). That difference is called an “error” and is multiplied by a Kp constant (P86, “Prop. Gain”). When Kp increases, the incidence of the proportional term in the regulator output signal also increases (regulator becomes more “sensitive”) if the error is the same. Instability occurs if Kp value is too high.

– integral term (I), calculated by summing the integral term of the prior sampling to the ratio between the current error and a Ti constant (P87, “Integr. Time”). If Ti is decreased, the instant incidence of this ratio increases. The integral term allows the reference value to perfectly match with the feedback value. Set P87 to its maximum value to disable integral action.
The maximum allowable value for the integral term can be set through parameter P94.

– derivative term (D), calculated by multiplying the difference between the feedback variable instant value and the feedback variable value stored for the prior sampling by a Td coefficient (P88, “Deriv. Time”). If the physical variable tends to increase (positive derivative), the derivative term is to be subtracted from the incidence of the proportional term and integral term. Set P88 to zero to clear the derivative action.
The maximum allowable value for the derivative term can be set through parameter P95.

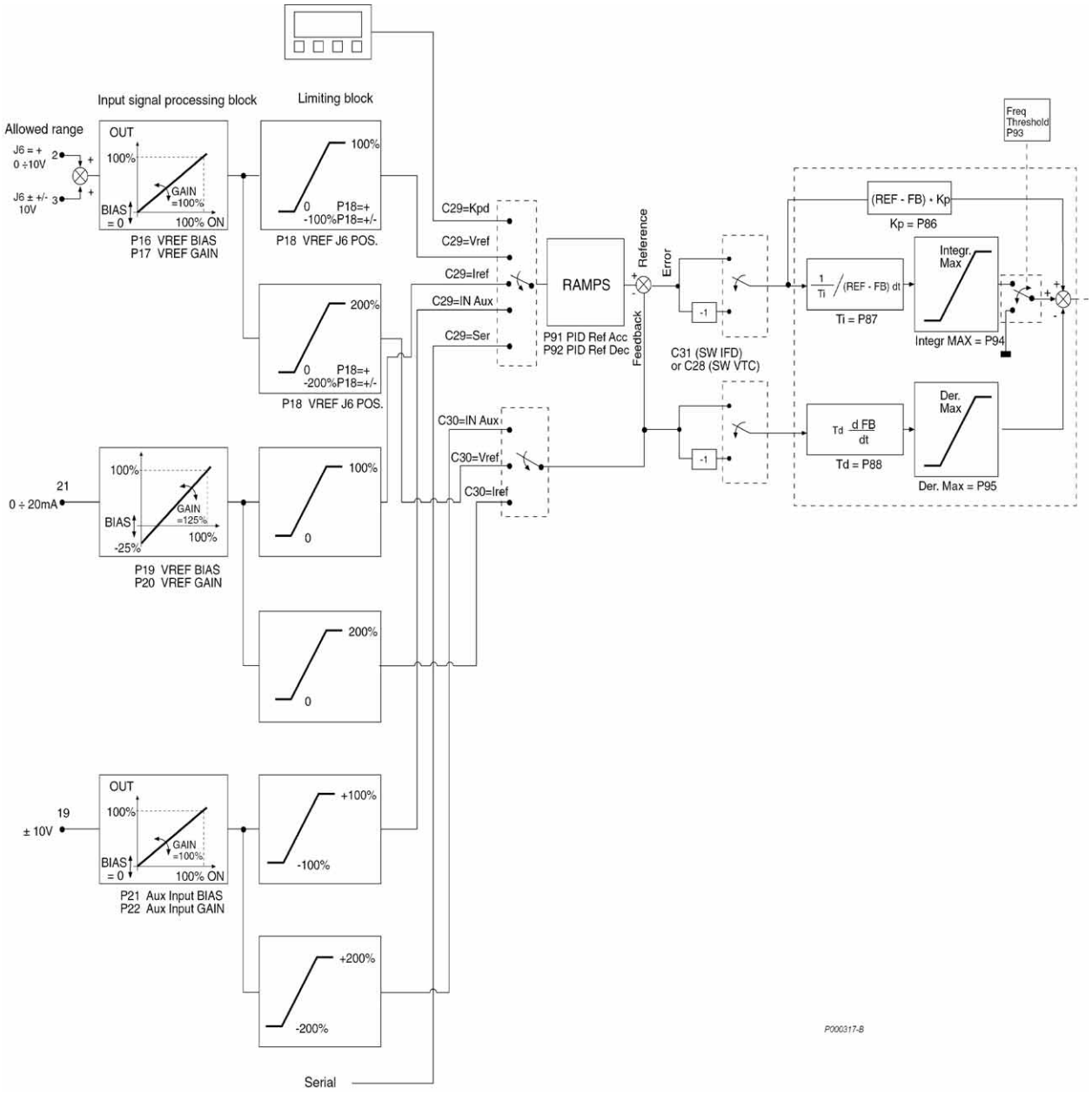


Figure 22: PID regulator block diagram (common section).

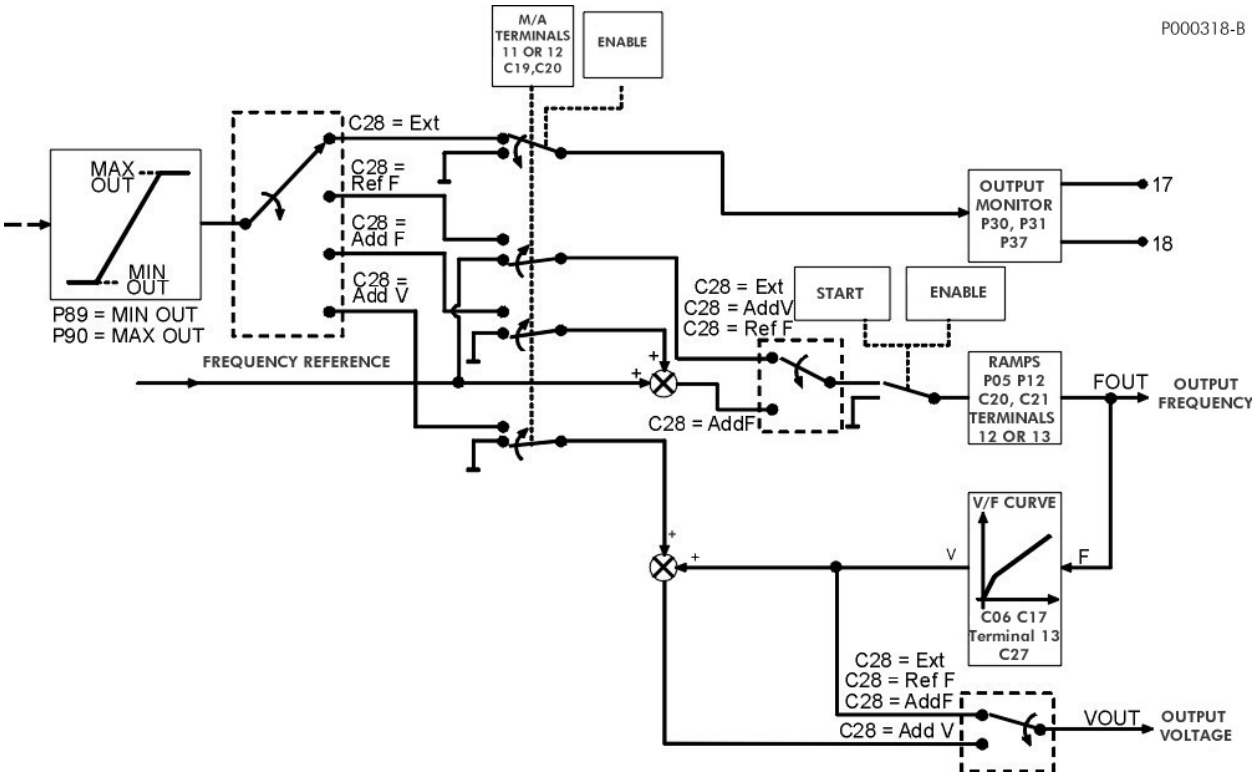
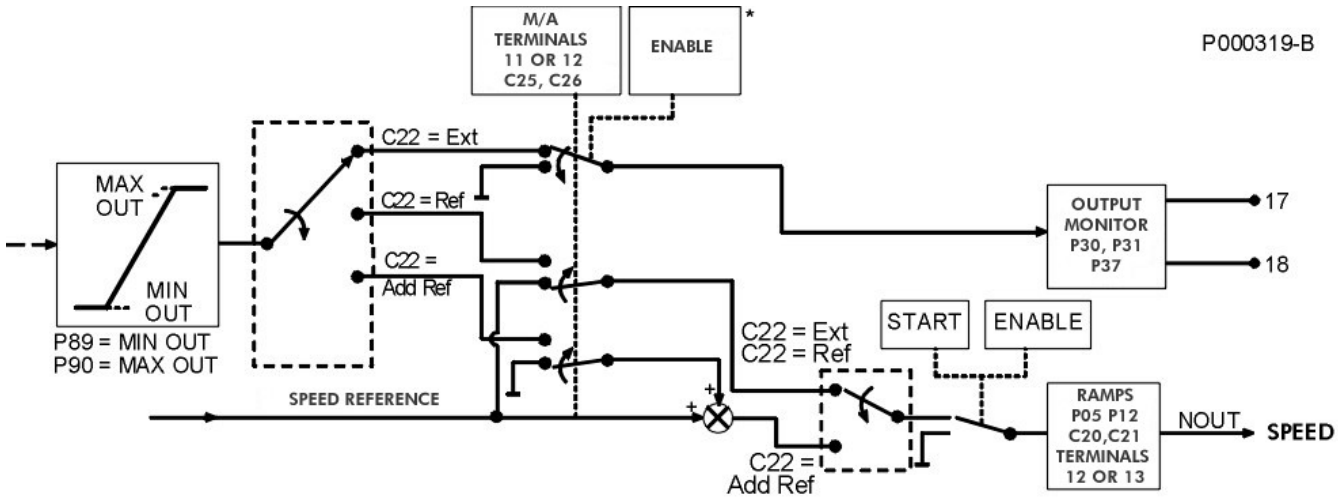


Figure 23: PID regulator block diagram (relating to IFD SW only).



* The ENABLE command is activated for the PID set as Ext only if terminal 11 or terminal 12 are not set as M/A.

Figure 24: PID regulator block diagram (relating to VTC SW only).

4. PROGRAMMING PARAMETERS

Operating parameters and variables are included in four main menus. Main menus include a tree structure of submenus.

Submenus also include:

– access pages, allowing to access the different parameter levels (for example, access pages allow accessing the submenus from the main menus);

– first page of a submenu, allowing to quit a submenu and to access the upper level of the tree structure (from within a submenu, the first page of a submenu allows accessing the different submenus forming a main menu).

Two shortcuts are available:

– press the MENU key to access directly to the main menu access page; press the MENU key again to return to the previous page;

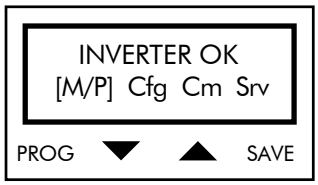
– press the HOME key to access directly to the first page of the submenu.

4.1. MAIN MENUS

Main menus are the following:

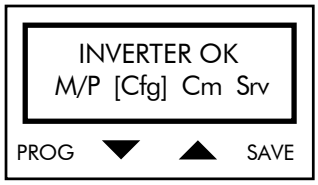
- M/P (measure/parameter): relates to the values displayed and to the parameters that can be altered when the inverter is running;
- Cfg (configuration): includes those parameters that cannot be altered when the inverter is running;
- Cm (commands): includes the pages relating to the inverter operation managed through the keypad;
- Srv (service): the Service menu cannot be accessed by the user.

At power on, the access page to the main menus is displayed (this is the factory setting programming if no failure occurs):

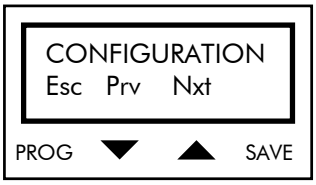


The active menu is in square brackets. Use the arrow keys (↑ and ↓) to select a different menu. Press the PROG key to access the selected menu.

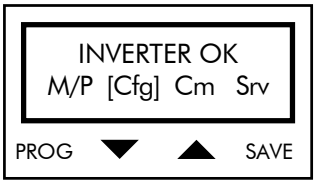
Example
Select the Cfg (configuration) menu with ↑ and ↓ ; the inverter display shows:



Press PROG to access the menu; the first page of the Configuration menu is displayed:



Press ↑ (Nxt) and ↓ (Prv) to access the access pages of the different submenus. Press PROG (Esc) to return to the main menu.
Press PROG (Esc) from the first page of the Configuration menu to access another main menu, e.g. Measure/Parameter. The display shows:

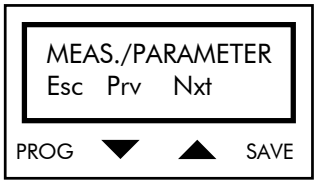


Press ↑ and ↓ to select M/P and press PROG to access the M/P menu.

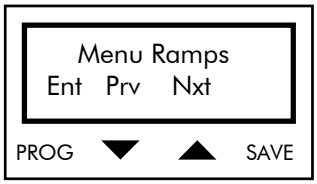
4.2. SUBMENUS

Press ↑ and ↓ from the first page of a main menu to scroll through the submenu access pages. Press PROG to access the page displayed. The first page of the submenu appears. Press ↑ and ↓ to scroll through the parameters of the submenu.
To alter a parameter value, set key parameter P01 to 1, select the parameter to alter and press the PROG key; a flashing cursor appears unless the P00 = 0 key parameter is set or the system is running ; press ↑ and ↓ to increase or decrease the parameter value. Press SAVE to store the new value; press PROG to store the new value until the inverter is turned off. To quit the submenu, scroll the different parameters up to the first page of the submenu or press the HOME key; press PROG to access the submenu level.

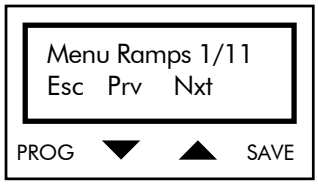
Example
Programming parameter P05 (acceleration time 1).
Access the M/P menu (Measure/Parameter); the first page of the M/P menu is displayed.



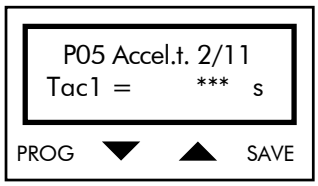
use ↑ (Nxt) and ↓ (Prv) to scroll the submenus up to the access page of the "Ramps" submenu:



Press PROG (Ent) to access the submenu. The first page of the submenu appears:



Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters up to parameter P05:



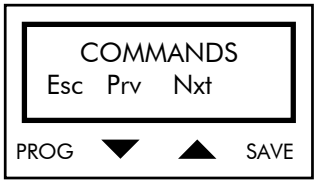
Press PROG; the flashing cursor appears and allows altering the parameter value.
Press ↑ and ↓ to increase or decrease the parameter value.
Press SAVE to store the new value to non–volatile memory.
Press PROG to store the new value until the inverter is turned off. At next power on, the inverter will use the last value saved to non–volatile memory.

5. COMMON MENUS TO IFD SW AND VTC SW

5.1. COMMANDS MENU

Enables keypad commands (Keypad Submenu), factory setting restoring (Restore Default Submenu) and the storage of all inverter parameters (Save User's Parameters Submenu).

First page

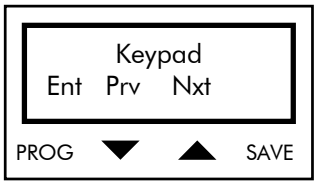


Press PROG (Esc) to return to the page for the selection of the main menus; press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

5.1.1. KEYPAD SUBMENU

The Keypad submenu allows the inverter to be controlled via keypad and displays the inverter operating variables.

Access page



Press PROG (Ent) to access the Keypad submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the other submenus of the Commands menu.

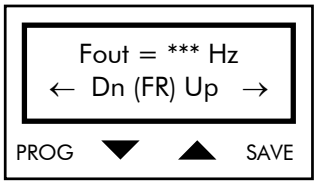
First page

Use parameter C63 (IFD SW) or C55 (VTC SW) to setup the variable displayed on the first line at power on.

The contents of the second line depend on the programming of parameters Start Operation, Ref Operation and PID Ref (C21, C22, C29 for IFD SW; C14, C16, C23 for VTC SW respectively).

1) Start Operation = Ref Operation = PID Ref = KPD

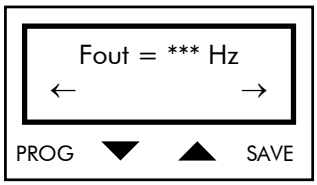
Inputs for the main reference and the START command are disabled in the terminal board.



Press MENU to quit the submenu.
Press ↓ (Dn) and ↑ (Up) to decrease or increase the main reference if (FR) is displayed; press ↓ (Dn) and ↑ (Up) to decrease or increase PID regulator reference if (RG) is displayed.
Press PROG (←) or SAVE (→) to display a different variable in the first line and the quantity managed with ↓ and ↑.
At first power on, the main reference is set to zero. Then, the reference stored at power off is displayed if parameter P24 (UD MEM) is set to [YES]. Otherwise, i.e. if P24 = [NO], the main reference is always set to 0 when the inverter is turned on.

2) Start Operation = KPD
Ref Operation = Term
PID Ref = KPD

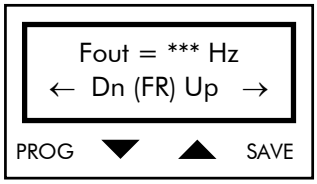
The START command (terminal 7) is disabled in the terminal board.



Press MENU to quit the submenu.
Press PROG (←) or SAVE (→) to display a different variable in the first line.
Press ↓ (Dn) and ↑ (Up) to decrease or increase PID regulator reference if (RG) is displayed.

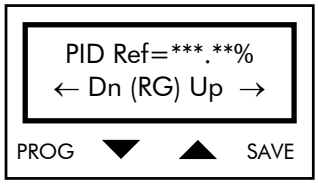
3) Start Operation = Term
Ref Operation = KPD
PID Ref = KPD

Inputs for the frequency main reference are disabled in the terminal board.



Press MENU to quit the submenu.
Press PROG (←) or SAVE (→) to display a different variable in the first line.
Press ↓ (Dn) and ↑ (Up) to decrease or increase the main reference if (FR) is displayed; press ↓ (Dn) and ↑ (Up) to decrease or increase PID regulator reference if (RG) is displayed.
If a multifrequency/multispeed command is sent, this will become the current reference.
At first power on, the main reference is set to zero. Then the reference stored at power off is displayed if parameter P24 (UD MEM) is set to [YES]. Otherwise, i.e. if P24 = [NO], the main reference is always set to 0 when the inverter is turned on.

4) Start Operation = Ref Operation = Term
PID Ref = KPD



Press MENU to quit the submenu.
Press PROG (←) or SAVE (→) to display a different variable in the first line.
Press ↓ (Dn) and ↑ (Up) to decrease or increase PID regulator reference if (RG) is displayed.

NOTE Set parameter C62 (IFD SW) or C54 (VTC SW) (First page) to "Keypad" to display the commands sent via keypad at power on.

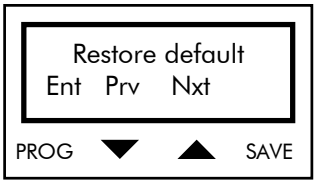
NOTE If PID Ref programming is different than KPD's, no PID regulator reference value is displayed.

NOTE In steps 1) 2) 3), "Fout = *** Hz" is replaced by "Spdout = ***rpm" in VTC SW.

5.1.2. RESTORE DEFAULT SUBMENU

The Restore Default submenu allows the default parameters of the MEAS/PARAMETER menu and the CONFIGURATION menu to be automatically restored (except for UP/DOWN reference and PID reference sent from keypad).

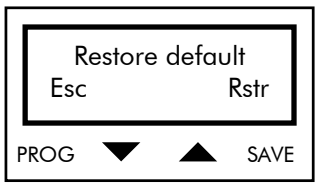
Access page



Press PROG (Ent) to access the submenu: press ↑ (Nxt) and ↓ (Prv) to scroll through the other submenus of the Commands menu.

NOTE The Restore Default submenu can be accessed only if parameter P00 (MEAS/PARAMETERS, Key parameter) is set to 1 (default) . The inverter must not be in RUN mode.

First page

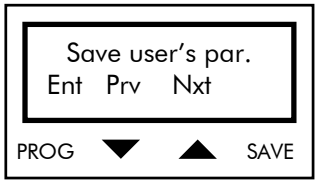


Press PROG (Esc) to quit the Restore Default submenu. Press SAVE (Rstr) for a few seconds to automatically restore the default parameters. Square brackets indicate that parameter restoration is occurring; when square brackets disappear (after a few seconds), parameter restoration is over.

5.1.3. SAVE USER'S PARAMETERS SUBMENU

The Save User's Parameters submenu allows storing to non–volatile memory (EEPROM) all active inverter parameters.

Access page

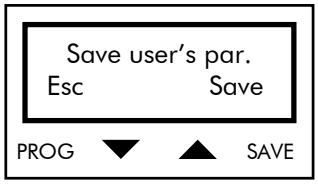


Press PROG (Ent) to access the Save User's Parameters submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the other submenus of the Commands menus.

NOTE

To access the submenu, set parameter P00 (MEAS/PARAMETERS, Key parameter) to 1 (default) . The inverter must not be in RUN mode.

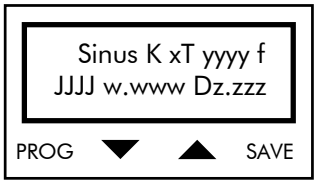
First page



Press PROG (Esc) to quit the Save User's Parameters submenu; press SAVE for a few seconds to save all parameters. Square brackets indicate that parameters are being saved to Eeprom; when square brackets disappear (after a few seconds), parameter saving is over.

5.2. INVERTER RATINGS

Displays the main ratings of the inverter.



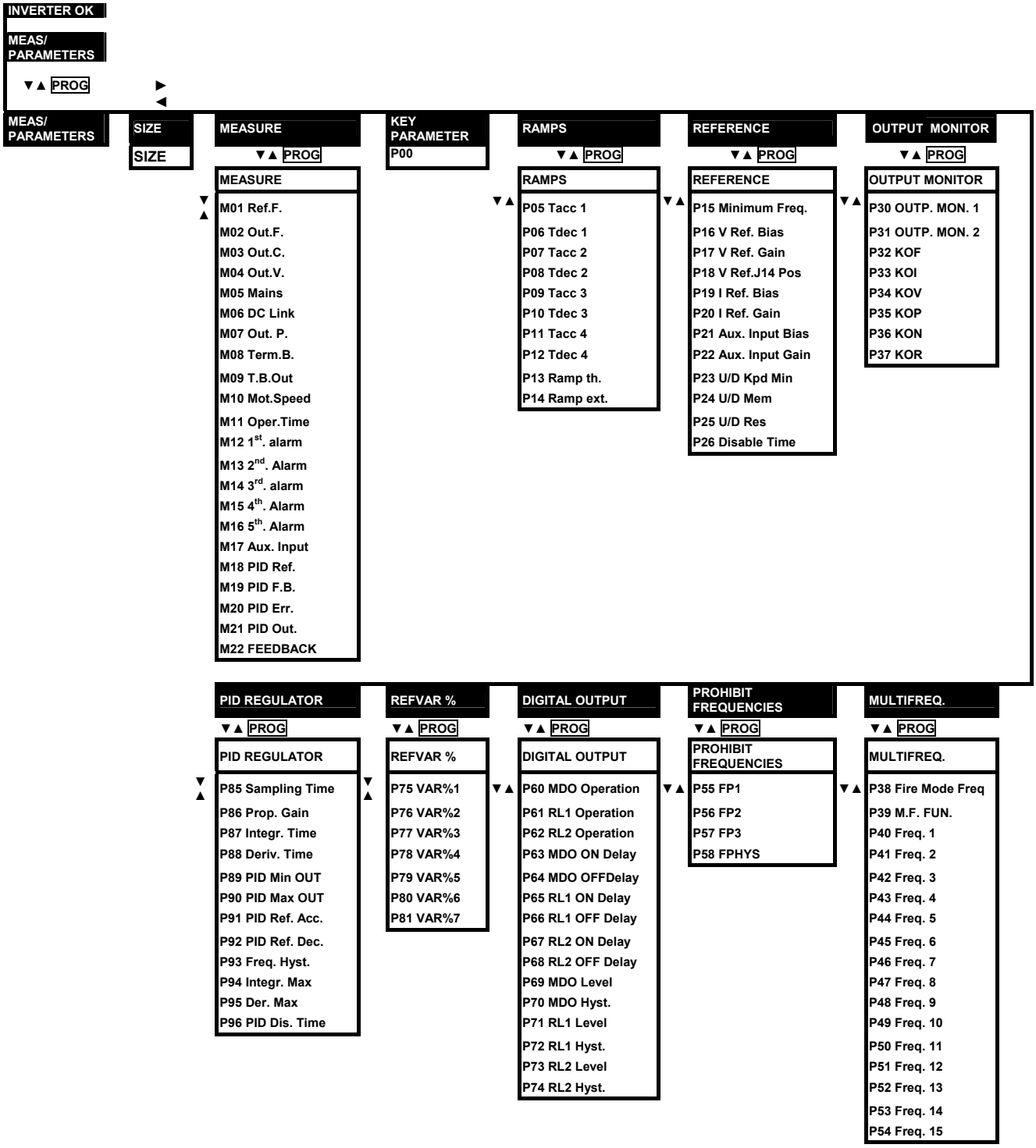
Field x:	Supply voltage (2=200÷240Vaca, 4=380÷500Vac)
Field yyyy:	Size (0005÷0831)
Field f:	Fan control mode B =no control; S=fan state reading only; P=fan state reading + control depending on thermoswitch; N=fan state reading + control depending on NTC)
Field JJJJ:	Software installed: IFD, VTC, LIFT (not covered in this manual)
Field w.www:	FLASH software version (human interface)
Field z.zzz:	Software DSP version (motor control)

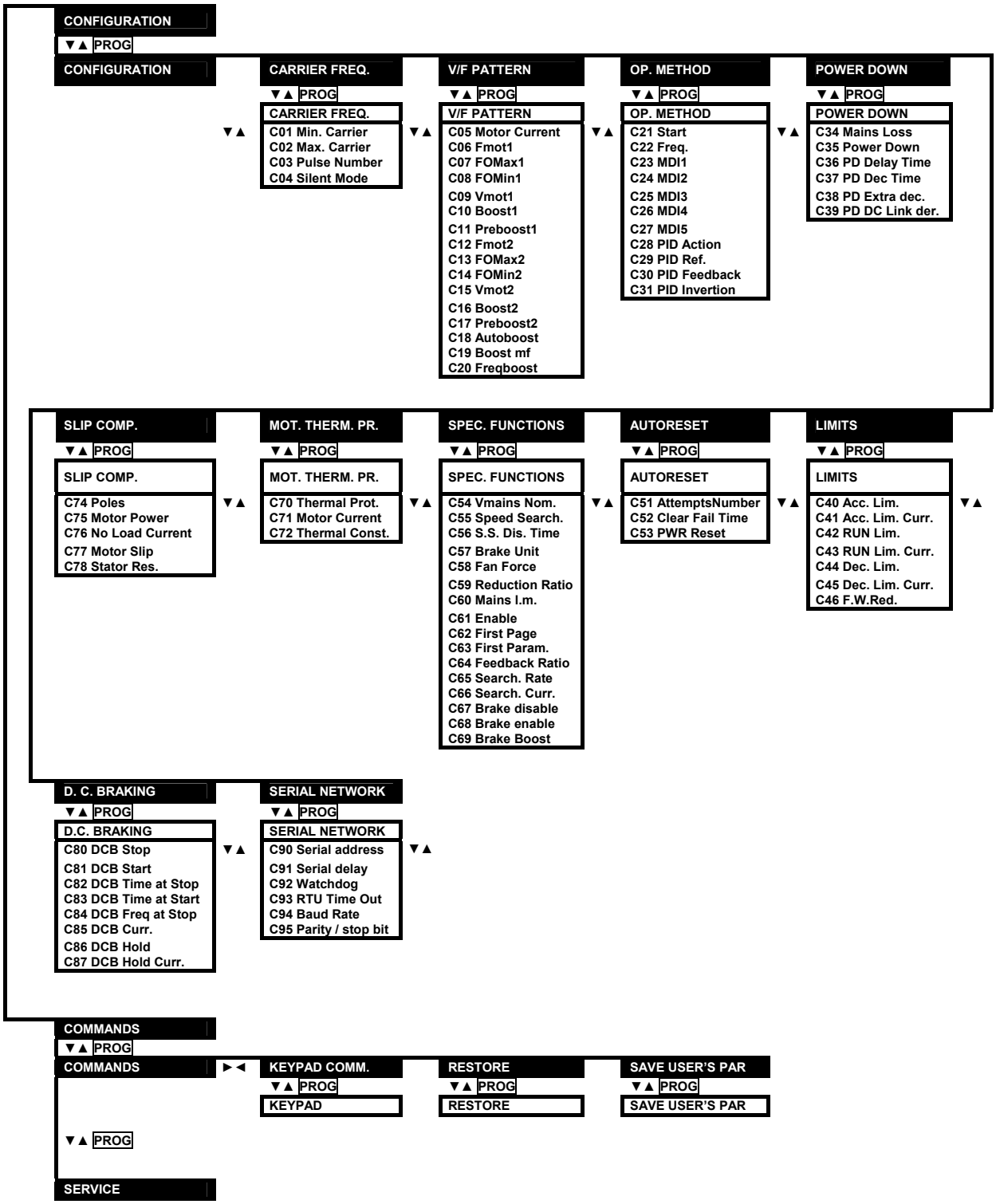
NOTE If software version w.www for the human interface is incompatible with software version z.zzz for the motor control (even if they both relate to IFD or VTC), alarm A01 Wrong Software trips.

Press MENU to quit the submenu.

6. LIST OF IFD SW PARAMETERS

6.1. MENU AND SUBMENU TREE STRUCTURE – IFD SW




CONFIGURATION
▼▲ PROG
CONFIGURATION
CARRIER FREQ.
▼▲ PROG
CARRIER FREQ.
C01 Min. Carrier
C02 Max. Carrier
C03 Pulse Number
C04 Silent Mode
V/F PATTERN
▼▲ PROG
V/F PATTERN
C05 Motor Current
C06 Fmot1
C07 FOMax1
C08 FOMin1
C09 Vmot1
C10 Boost1
C11 Preboost1
C12 Fmot2
C13 FOMax2
C14 FOMin2
C15 Vmot2
C16 Boost2
C17 Preboost2
C18 Autoboost
C19 Boost mf
C20 Freqboost
OP. METHOD
▼▲ PROG
OP. METHOD
C21 Start
C22 Freq.
C23 MDI1
C24 MDI2
C25 MDI3
C26 MDI4
C27 MDI5
C28 PID Action
C29 PID Ref.
C30 PID Feedback
C31 PID Invertion
POWER DOWN
▼▲ PROG
POWER DOWN
C34 Mains Loss
C35 Power Down
C36 PD Delay Time
C37 PD Dec Time
C38 PD Extra dec.
C39 PD DC Link der.
SLIP COMP.
▼▲ PROG
SLIP COMP.
C74 Poles
C75 Motor Power
C76 No Load Current
C77 Motor Slip
C78 Stator Res.
MOT. THERM. PR.
▼▲ PROG
MOT. THERM. PR.
C70 Thermal Prot.
C71 Motor Current
C72 Thermal Const.
SPEC. FUNCTIONS
▼▲ PROG
SPEC. FUNCTIONS
C54 Vmains Nom.
C55 Speed Search.
C56 S.S. Dis. Time
C57 Brake Unit
C58 Fan Force
C59 Reduction Ratio
C60 Mains I.m.
C61 Enable
C62 First Page
C63 First Param.
C64 Feedback Ratio
C65 Search. Rate
C66 Search. Curr.
C67 Brake disable
C68 Brake enable
C69 Brake Boost
AUTORESET
▼▲ PROG
AUTORESET
C51 AttemptsNumber
C52 Clear Fail Time
C53 PWR Reset
LIMITS
▼▲ PROG
LIMITS
C40 Acc. Lim.
C41 Acc. Lim. Curr.
C42 RUN Lim.
C43 RUN Lim. Curr.
C44 Dec. Lim.
C45 Dec. Lim. Curr.
C46 F.W.Red.
D. C. BRAKING
▼▲ PROG
D.C. BRAKING
C80 DCB Stop
C81 DCB Start
C82 DCB Time at Stop
C83 DCB Time at Start
C84 DCB Freq at Stop
C85 DCB Curr.
C86 DCB Hold
C87 DCB Hold Curr.
SERIAL NETWORK
▼▲ PROG
SERIAL NETWORK
C90 Serial address
C91 Serial delay
C92 Watchdog
C93 RTU Time Out
C94 Baud Rate
C95 Parity / stop bit
COMMANDS
▼▲ PROG
COMMANDS
KEYPAD COMM.
▼▲ PROG
KEYPAD
RESTORE
▼▲ PROG
RESTORE
SAVE USER'S PAR
▼▲ PROG
SAVE USER'S PAR
▼▲ PROG
SERVICE

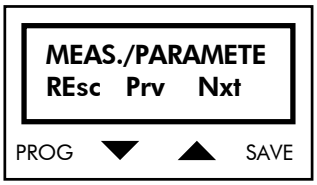
Each parameter includes the following items:

P ⇒ Parameter number
R ⇒ Allowable programmable range
D ⇒ Factory setting (default setting)
F ⇒ Function

6.2. MEASURE/PARAMETER MENU

The Measure/Parameter menu includes the Mxx values and the Pxx parameters that can be altered when the inverter is running. Always set P00=1 (default) to enable parameter alteration.

First page

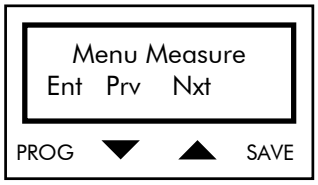


Press PROG (Esc) to return to the main menu selection page; press ↑ (Nxt) and ↓ (Prv) to scroll the submenus. All parameters are included in different submenus, except for key parameter P01 and the parameters relating to the inverter ratings. Scroll the submenus to directly access these parameters.

6.2.1. MEASURE SUBMENU

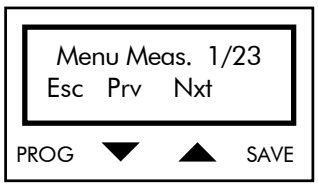
The Measure submenu contains the variables displayed when the inverter is running.

Access page



Press PROG (Ent) to access the first page of the Measure submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Measure submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE MEASURE SUBMENU

M01 Ref.Freq 2/23	P	M01
Fref=**.**Hz	R	–C07÷+C07 or –C13÷+C13 depending on the selected V/f pattern
	F	Value of the inverter input frequency reference.

M02 Out.Freq 3/23	P	M02
Fout=**.** Hz	R	–C07÷+C07 or –C13÷+C13 depending on the selected V/f pattern
	F	Output frequency value.

M03 Out.curr. 4/23	P	M03
Iout=*** A	R	Depending on the inverter size.
	F	Output current value.

M04 Out.volt. 5/23	P	M04
Vout=*** V	R	Depending on the inverter class.
	F	Output voltage value.

M05 Mains 6/23	P	M05
Vmn=*** V	R	Depending on the inverter class.
	F	Mains voltage value.

M06 D.C.link 7/23	P	M06
Vdc=*** V	R	Depending on the inverter class.
	F	Value of DC link voltage.

M07 OUT. P. 8/23	P	M07
POUT=*** kW	R	Depending on the inverter size.
	F	Value of active power delivered to the load.

M08 Term.Brd.9/23	P	M08
* * * * * * * *	F	Condition of digital inputs in the terminal board (display order: terminals 6, 7, 8, 9, 10, 11, 12, 13). If an input is active, the number of the relevant terminal in hexadecimal notation is displayed. Otherwise, "0" is displayed.

M09 T.B.out10/23	P	M09
* * *	F	Condition of digital outputs in the terminal board (display order: terminals 24, 27, 29). If an output is active, the number of the relevant terminal is displayed. Otherwise, "0" is displayed.

M10 Motor sp.11/23	P	M10
Nout=*** rpm	R	Depending on programming of C58 and C59.
	F	RPM. Indicates a quantity expressed by the formula: $Nout = \frac{Fout \times 60 \times C59 \times 2}{C58}$ where C58 stands for the motor pole number and C59 is a programmable proportional constant.

M11 Oper 12/23	P	M11
Time = *:** h	R	0÷238.000 h
	F	Time period of the inverter operation in RUN mode.

M12 1st al. 13/23	P	M12
A** ****:** h	R	A01÷A40
	F	Stores the last alarm tripped and relevant M11 value.

M13 2nd al. 14/23	P	M13
A** ****:** h	R	A01÷A40
	F	Stores the last–but–one alarm tripped and relevant M11 value.

M14 3rd al. 15/23	P	M14
A** ****:** h	R	A01÷A40
	F	Stores the last–but–two alarm tripped and relevant M11 value.

M15 4th al. 16/23	P	M15
A** ****:** h	R	A01÷A40
	F	Stores the last–but–three alarm tripped and relevant M11 value.

M16 5th al. 17/23	P	M16
A** ****:** h	R	A01÷A40
	F	Stores the last–but–four alarm tripped and relevant M11 value.

M17 AUX 18/23	P	M17
Input = ***.** %	R	±200.00%
	F	Auxiliary input value expressed as a percentage.

M18 PID 19/23	P	M18
Ref = ***.** %	R	±100.00%
	F	Value of PID regulator reference expressed as a percentage.

M19 PID 20/22	P	M19
F.B. = ***.** %	R	±200.00%
	F	Value of PID regulator feedback expressed as a percentage.

M20 PID 21/23	P	M20
Err. = ***.** %	R	±200.00%
	F	Difference between PID regulator reference (M18) and feedback (M19).

M21 PID 22/23	P	M21
Out. = ***.** %	R	±100.00%
	F	PID regulator output expressed as a percentage.

M22 FEED 23/23	P	M22
BACK = ***.**	R	Depending on the programming of C64
	F	Value assigned to PID regulator feedback signal. Indicates a quantity expressed by the formula: M19*C64.

6.2.2. KEY PARAMETER

Key parameter	P	P00
P00=*	R	0÷1
	D	1
	F	0: only parameter P00; may be altered. 1: all parameters may be altered (parameters included in the Configuration menu can be altered only if the inverter is disabled).

NOTE

Parameter P00 can be saved: if P00=0 is saved, the alteration of the other parameters is inhibited at the following start-up.

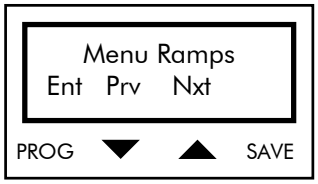
NOTE

The parameters of the configuration menu (Cxx) can be altered only if the inverter is not in RUN mode.

6.2.3. RAMPS SUBMENU

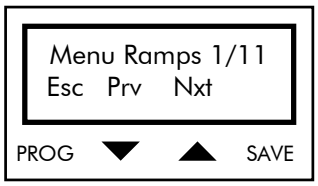
The Ramps submenu includes the variables relating to acceleration ramps and deceleration ramps.

Access page



Press PROG (Ent) to access the first page of the Ramps submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Ramps submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE RAMPS SUBMENU

P05 Accel.t. 2/11	P	P05
Tac1=****s	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 1 from 0 to FOMAX1 (par. C6).

P06 Decel.t. 3/11	P	P06
Tdc1=****s	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 1 from FOMAX1 to 0.

P07 Accel.t. 4/11	P	P07
Tac2=****s	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 2 from 0 to FOMAX1.

P08 Decel.t. 5/11	P	P08
Tdc2=****s	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 2 from FOMAX1 to 0.

P09 Accel.t. 6/11		
Tac3=****s	P	P09
	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 3 from 0 to FOMAX1.

P10 Decel.t. 7/11		
Tdc3=****s	P	P10
	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 3 from FOMAX1 to 0.

P11 Accel.t. 8/11		
Tac4=****s	P	P11
	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 4 from 0 to FOMAX1.

P12 Decel.t. 9/11		
Tdc4=****s	P	P12
	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 4 from FOMAX1 to 0.

P13 Ramp 10/11		
th. = *.* Hz	P	P13
	R	0÷25Hz
	D	0
	F	Determines the time interval of the acceleration and deceleration ramp when ramp increase is used (P14). Example – The active ramp is increased by the value set in P14 when going from 0 to 50Hz and if P13=1Hz from 0 to 1Hz and from 49 to 50Hz both when accelerating and decelerating.

P14 Ramp 11/11		
ext = **	P	P14
	R	1, 2, 4, 8, 16, 32
	D	4
	F	Multiplicative factor of the active ramp in the time interval defined by parameter P13.

NOTE

The active ramp depends on the condition of inputs MDI4 and MDI5 whether they are programmed to alter ramp time periods (see the Operation Method Submenu, parameters C26 and C27).

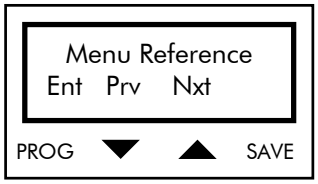
NOTE

When the second V/f pattern is active, the ramp time relates to FOMAX2 (parameter C13).

6.2.4. REFERENCE SUBMENU

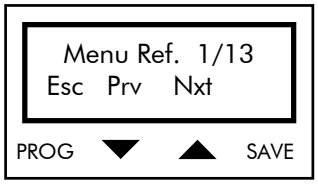
Includes the quantities relating to the frequency reference.

Access page



Press PROG (Ent) to access the first page of the Reference submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Reference submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE REFERENCE SUBMENU

P15 Minimum 2/13	P	P15
Freq = ***.** Hz	R	+/–, 0÷800 Hz for S05÷S30
	R	+/–, 0÷120 Hz for S40÷S65
	D	+/–
	F	Minimum value of the frequency reference. Set "+/–" to obtain a bipolar frequency reference range.

P16 Vref .3/13	P	P16
Bias =****%	R	–400%÷+400%
	D	0%
	F	Voltage percent value when no voltage is applied to terminals 2 and 3.

P17 Vref. 4/13	P	P17
Gain =****%	R	–500%÷+500%
	D	100%
	F	Proportional coefficient between the sum of signals on terminals 2, 3 expressed as a fraction of the maximum allowable value (10V) and the reference obtained expressed as a percentage.

P18 Vref. J14 5/13	P	P18
Pos = *	R	+, +/–
	D	+
	F	Determines the variation range of the voltage reference: 0÷+10V (+), ±10V (+/–)

P19 Iref. 6/13	P	P19
Bias =**.** %	R	–400%÷+400%
	D	–25%
	F	Current reference value % when no current is delivered to terminal 21.

P20 Iref. 7/13	P	P20
Gain =**.** %	R	–500%÷+500%
	D	+125%
	F	Proportional coefficient between the current reference sent to terminal 21, expressed as a fraction of the maximum allowable value (20mA), and the reference obtained expressed as a percentage.

NOTE

Factory setting of parameters P19 and P20 corresponds to 4÷20mA current reference signal.

NOTE

For any detail on how to use parameters P16, P17, P18, P19, P20, see the "Main Frequency Reference" section.

P21 Aux In 8/13	P	P21
Bias =**.** %	R	–400%÷+400%
	D	0
	F	Value of the auxiliary input, expressed as a percentage, when no voltage is applied to terminal 19.

P22 Aux In 9/13	P	P22
Gain =**.** %	R	–400%÷+400%
	D	+200%
	F	Proportional coefficient between the signal applied to terminal 19, expressed as a fraction of the maximum allowable value (±10 V), and the value obtained expressed as a percentage.

P23 U/D–Kpd 10/13	P	P23
Min=[0] +/–	R	0, +/–
	D	0
	F	Defines the range of the frequency reference which is activated through the UP/DOWN command (terminals 9 and 10, parameters C23 and C24) or through the command sent via keypad: 0 : Range 0 to FOMAX +/–: Range –FOMAX to +FOMAX

P24 U/D Mem 11/13	P	P24
NO [YES]	R	NO, YES
	D	YES
	F	If set to YES, stores the increment or decrement of the frequency reference value sent either via terminal board through MDI1 and MDI2 and set as UP and DOWN (see parameters C23 and C24) or via keypad (see the COMMANDS MENU).

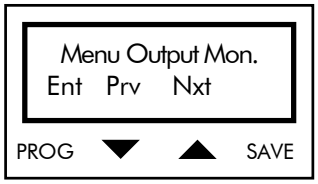
P25 U/D Res 12/13	P	P25
[NO] YES	R	NO, YES
	D	NO
	F	If set to YES, allows resetting references of the frequency set with the UP/DOWN command.

P26 Disable 13/13	P	P26
Time = *** s	R	0,120s
	D	0s
	F	The inverter stops when the frequency reference is active for a longer time than the time set in this parameter with a value equal to the min. value (P15). The inverter restarts as soon as the frequency reference exceeds P15. If P26=0 (default value) this function is disabled.

6.2.5. OUTPUT MONITOR SUBMENU

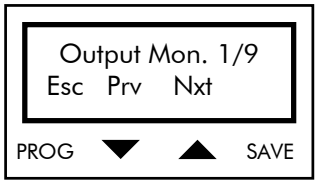
The Output Monitor submenu determines the quantities for multifunction digital inputs (terminals 17, 18).

Access page



Press PROG (Ent) to access the first page of the Output Monitor submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the access page of the Output Monitor submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE OUTPUT MONITOR SUBMENU

P30 Output 2/9	P	P30
Monitor 1 ***	R	Fref, Fout, Iout, Vout, Pout, Nout, PID 0, PID F.B.
	D	Fout
	F	Selects the quantity for the first multifunction analog output (terminal 17) among Fref (frequency reference), Fout (output reference), Iout (output current), Vout (output voltage), Pout (output power), Nout (rpm), PID 0. (PID regulator output), PID F.B. (PID regulator feedback).

P31 Output 3/9	P	P31
Monitor 2 ****	R	Fref, Fout, Iout, Vout, Pout, Nout, PID 0, PID F.B.
	D	Iout
	F	Selects the quantity for the second multifunction analog output (terminal 18) between Fref (frequency reference), Fout (output reference), Iout (output current), Vout (output voltage), Pout (output power), Nout (rpm), PID 0. (PID regulator output), PID F.B. (PID regulator feedback).

P32 Out. mon. 4/9	P	P32
KOF = *** Hz/V	R	5÷100 Hz/V
	D	10 Hz/V
	F	Ratio between output voltage at terminals 17–18 and output frequency, and ratio between output voltage at terminals 17–18 and frequency reference.

P33 Out. mon. 5/9	P	P33
KOI = *** A/V	R	Depending on the inverter size.
	D	Depending on the inverter size.
	F	Ratio between inverter output current and output voltage at terminals 17 and 18.

P34 Out. mon. 6/9	P	P34
KOV = *** V/V	R	20÷100V/V
	D	100 V/V
	F	Ratio between inverter output voltage and output voltage at terminals 17 and 18.

P35 Out. mon. 7/9	P	P35
KOP= *** kW/V	R	Depending on the inverter size.
	D	Depending on the inverter size.
	F	Ratio between power delivered by the inverter and output voltage at terminals 17 and 18.

P36 Out. mon. 8/9	P	P36
KON*** rpm/V	R	90÷10000 rpm/V
	D	200 rpm/V
	F	Ratio between motor RPM and output voltage at terminals 17 and 18.

NOTE

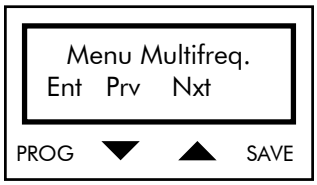
Motor RPM is given by Fout (output frequency) multiplied by constant 60 x 2/C58 (parameter Poles, Special functions submenu) without considering the motor slip.

P37 Out. mon. 9/9	P	P37
KOR=**.* %/V	R	2.5÷50 %/V
	D	10 %/V
	F	Ratio between output voltage at terminals 17 & 18 and PID regulator output (expressed as a percentage) and ratio between output voltage at terminals 17 and 18 and PID regulator feedback value expressed as a percent value.

6.2.6. MULTIFREQUENCY SUBMENU

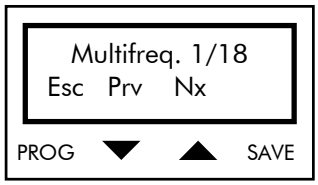
The Multifrequency submenu determines the values and configurations of the reference frequencies that can be output through multifunction digital inputs MDI1, MDI2, MDI3, MDI4 (see the Operation Method Submenu), or when the Fire Mode function is activated.

Access page



Press PROG (Ent) to access the first page of the Multifrequency submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Multifrequency submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE MULTIFREQUENCY SUBMENU

P38 FireMode 2/18	P	P38
freq = ***Hz	R	-800÷800 Hz for S05÷S30
	R	-120÷120 Hz for S40÷S65
	D	25 Hz
	F	Determines the frequency reference which is active in Fire Mode.
P39 Multif. 3/18	P	P39
M.F.FUN = ***	R	ABS, ADD
	D	ABS
	F	Determines the application of frequency references obtained through par. P40÷P54. ABS – output frequency matches with the frequency reference obtained when parameters P40÷P45 are activated. ADD – output frequency matches with the sum of the frequency main reference and the active frequency reference.

P40 Multif. 4/18	P	P40
freq1 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital input 1 (terminal 9) is active and set as multifrequency (parameter C23, OP METHOD submenu).

P41 Multif. 5/18	P	P41
freq2 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital input 2 (terminal 10) is active and set as multifrequency (par. C24, OP METHOD submenu).

P42 Multif. 6/18	P	P42
freq3 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1 and 2 (terminals 9 and 10) are active and set as multifrequency (par. C23 and C24, OP METHOD submenu).

P43 Multif. 7/18	P	P43
freq4 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital input 3 (terminal 11) is active and set as multifrequency (par. C25, OP METHOD submenu).

P44 Multif. 8/18	P	P44
freq5 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1 and 3 (terminals 9 and 11) are active and set as multifrequency (par. C23 and C25, OP METHOD submenu).

P45 Multif. 9/18	P	P45
freq6 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 2 and 3 (terminals 10 and 11) are active and set as multifrequency (par. C24 and C25, OP METHOD submenu).

P46 Multif. 10/18	P	P46
freq7 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1, 2, and 3 (terminals 9, 10, and 11) are active and set as multifrequency (par. C23, C24, and C25, OP METHOD submenu).

P47 Multif. 11/18	P	P47
freq8 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital input 4 (terminal 12) is active and set as multifrequency (par. C26, OP METHOD submenu).

P48 Multif. 12/18	P	P48
freq9 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1 and 4 (terminals 9 and 12) are active and set as multifrequency (par. C23 and C26, OP METHOD submenu).

P49 Multif. 13/18	P	P49
freq10 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 2 and 4 (terminals 10 and 12) are active and set as multifrequency (par. C24 and C26, OP METHOD submenu).

P50 Multif. 14/18	P	P50
freq11 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1, 2, and 4 (terminals 9, 10, and 12) are active and set as multifrequency (par. C23, C24, and C26, OP METHOD submenu).

P51 Multif. 15/18	P	P51
freq12 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 3 and 4 (terminals 11 and 12) are active and set as multifrequency (par. C25 and C26, OP METHOD submenu).

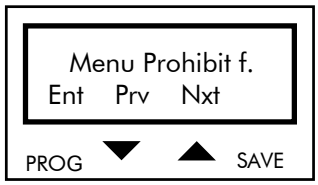
P52 Multif. 16/18	P	P52
freq13 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1, 3, and 4 (terminals 9, 11, and 12) are active and set as multifrequency (par. C23, C25, and C26, OP METHOD submenu).

P53 Multif. 17/18	P	P53
freq14 = ***Hz	R	–800÷800 Hz for S05÷S30
	R	–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 2, 3, and 4 (terminals 10, 11, and 12) are active and set as multifrequency (par. C24, C25, and C26, OP METHOD submenu).
P54 Multif. 18/18	P	P54
freq15 = ***Hz	R	–800÷800 Hz for S05÷S30
		–120÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the frequency reference obtained when multifunction digital inputs 1, 2, 3, and 4 (terminals 9, 10, 11, and 12) are active and set as multifrequency (par. C23, C24, C25, and C26, OP METHOD submenu).

6.2.7. PROHIBIT FREQUENCIES SUBMENU

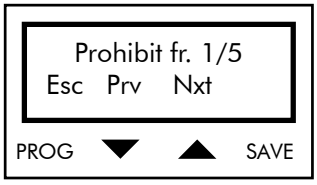
The Prohibit Frequencies submenu determines prohibit frequency ranges to frequency reference. Output frequency varies continuously until the new frequency value is reached. For more details, see the PROHIBIT FREQUENCIES/SPEEDS section.

Access page



Press PROG (Ent) to access the first page of the Prohibit Frequencies submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Prohibit Frequencies submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE PROHIBIT FREQUENCIES SUBMENU

P55 Prohib.f.2/5	P	P55
Fp1 = ***Hz	R	0÷800 Hz for S05÷S30
		0÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the intermediate value for the first prohibit frequency range. The intermediate value is an absolute value, i.e. is not depending on the direction of rotation. Set it to 0 to disable the prohibit frequency range.

P56 Prohib.f.3/5	P	P56
Fp2 = ***Hz	R	0÷800 Hz for S05÷S30
		0÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the intermediate value for the second prohibit frequency range. The intermediate value is an absolute value, i.e. is not depending on the direction of rotation. Set it to 0 to disable the prohibit frequency range.

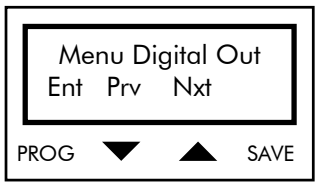
P57 Prohib.f.4/5	P	P57
Fp3 = ***Hz	R	0÷800 Hz for S05÷S30
		0÷120 Hz for S40÷S65
	D	0 Hz
	F	Determines the intermediate value for the third prohibit frequency range. The intermediate value is an absolute value, i.e. is not depending on the direction of rotation. Set it to 0 to disable the prohibit frequency range.

P58 Hysteresis 5/5	P	P58
Fphys = ***Hz	R	0÷24 Hz
	D	1 Hz
	F	Determines the value of semiamplitudes for prohibit frequency ranges.

6.2.8. DIGITAL OUTPUT SUBMENU

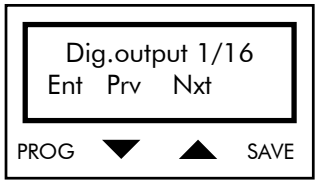
The Digital Output submenu determines the parameters relating to digital outputs.

Access page



Press PROG (Ent) to access the first page of the Digital Output submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Digital Output submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE DIGITAL OUTPUT SUBMENU

P60 MDO opr. 2/16	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 O.K., Fan Fault, Fire Mode Active.
	D	Frequency level
	F	Configuration of Open Collector digital output (terminals 24 and 25). You have these possibilities: Inv. O.K. ON: active output; the inverter is ready to run. Inv. O.K. OFF: active output; the inverter is in emergency mode (any condition locking the RUN command; see note at the end of the description of parameter P60). Inv run trip: active output if inverter in emergency mode due to a protection trip. Reference Level: active output; frequency reference at the inverter input exceeds the value set with P69 (see Fig. 6.1). Frequency Level: active output; the inverter is generating a higher frequency than the one set with P69, independently of the motor direction of rotation (see Fig. 6.2). Forward Running: active output; the inverter is generating a higher frequency than the one set with P69 (positive reference; see Fig. 6.2). Reverse Running: active output; the inverter is generating a higher frequency than the one set with P69 (negative reference; see Fig. 6.2). Fout O.K.: active output; the absolute value of the difference between the frequency reference and the output frequency is lower than the value set with P69 "MDO Level" (see Fig. 6.3). Current Level: active output; the inverter output current exceeds the value set with P69 "MDO Level" (see Fig. 6.4). Limiting: active output; inverter in limiting stage. Motor limiting: active output; the inverter is limited by the motor. Generator lim.: active output; limit during regeneration stage. PID OK: active output if the absolute value of the difference between the reference signal and PID regulator feedback has dropped below a threshold set with P69 ("MDO Level") (see Fig. 6.5). PID OUT MAX: active output if PID regulator output has reached the value set for P90 (PID MAX Out.) (see Fig. 6.6). PID OUT MIN: active output if PID regulator output has reached the value set for P89 (see Fig. 6.7). FB MAX: active output if the absolute value of PID regulator feedback has exceeded the value set for P69 (see Fig. 6.8). FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set with P69 (see Fig. 6.9). PRC O.K.: active output; the inverter has finished precharging its capacitor stack. Fan Fault: active input with fan failure (P or N models); active input when fans are locked or off (S models); no input control provided for other operating conditions (see the INVERTER RATINGS section). Fire Mode Active: active output in Fire Mode.

NOTE

Select "INV OK OFF" to activate a digital output in the case of emergency (protection trip; inverter switched off when in emergency mode; inverter turned on with ENABLE contact – terminal 6 – closed and parameter C61 set to [NO]). If "INV OK OFF" is selected, the digital output may be used to control an indicator light or to send emergency signals to the PLC. If "Inv run trip" is selected, the digital output activates only if the inverter enters the emergency mode due to a protection trip. Turn off and on the equipment in emergency mode to deactivate the digital output. In this operating mode, the digital output may be used to control a relay activating a contactor installed on the inverter supply line. The contactor is controlled by an NC contact in the relay.

NOTE

Use parameter P70 to set a hysteresis for the commutation of a digital output.

P61 RL1 opr. 3/16	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 O.K., Fan Fault, Fire Mode Active.
	D	Inv. O.K. ON
	F	Configuration of relay digital output RL1 (terminals 26, 27, and 28). You have these possibilities: Inv. O.K. ON: active output; the inverter is ready to run. Inv. O.K. OFF: active output; the inverter is in emergency mode (any condition locking the RUN command; see note at the end of the description of parameter P61). Inv run trip: active output if inverter in emergency mode due to a protection trip. Reference Level: active output; frequency reference at the inverter input exceeds the value set with P71 (see Fig. 6.1). Frequency Level: active output; the inverter is generating a higher frequency than the one set with P71, independently of the motor direction of rotation (see Fig. 6.2). Forward Running: active output; the inverter is generating a higher frequency than the one set with P71 (positive reference; see Fig. 6.2). Reverse Running: active output; the inverter is generating a higher frequency than the one set with P71 (negative reference; see Fig. 6.2). Fout O.K.: active output; the absolute value of the difference between the frequency reference and the output frequency is lower than the value set with P71 "RL1 Level" (see Fig. 6.3). Current Level: active output; the inverter output current exceeds the value set with P71 "RL1 Level" (see Fig. 6.4). Limiting: active output; inverter in limiting stage. Motor limiting: active output; the inverter is limited by the motor. Generator lim.: active output; limit during regeneration stage. PID OK: active output if the absolute value of the difference between the reference signal and PID regulator feedback has dropped below a threshold set with P71 ("RL1 Level") (see Fig. 6.5). PID OUT MAX: active output if PID regulator output has reached the value set for P90 (PID MAX Out.) (see Fig. 6.6). PID OUT MIN: active output if PID regulator output has reached the value set for P89 (see Fig. 6.7). FB MAX: active output if the absolute value of PID regulator feedback has exceeded the value set for P71 (see Fig. 6.8). FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set with P71 (see Fig. 6.9). Fan Fault: active input with fan failure (P or N models); active input when fans are locked or off (S models); no input control provided for other operating conditions (see the INVERTER RATINGS section). Fire Mode Active: active output in Fire Mode.

Select "INV OK OFF" to activate a digital output in the case of emergency (protection trip; inverter switched off when in emergency mode; inverter turned on with ENABLE contact – terminal 6 – closed and parameter C61 set to [NO]). If "INV OK OFF" is selected, the digital output may be used to control an indicator light or to send emergency signals to the PLC. If "Inv run trip" is selected, the digital output activates only if the inverter enters the emergency mode due to a protection trip. Turn off and on the equipment in emergency mode to deactivate the digital output. In this operating mode, the digital output may be used to control a relay activating a contactor installed on the inverter supply line.

NOTE

NOTE Use parameter P72 to set a hysteresis for the commutation of a digital output.

P62 RL2 opr. 4/16	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 O.K., Fan Fault, Fire Mode Active.
	D	Frequency level
	F	Configuration of relay digital output RL2 (terminals 29, 30, and 31). You have these possibilities: Inv. O.K. ON: active output; the inverter is ready to run. Inv. O.K. OFF: active output; the inverter is in emergency mode (any condition locking the RUN command; see note at the end of the description of parameter P62). Inv run trip: active output if inverter in emergency mode due to a protection trip. Reference Level: active output; frequency reference at the inverter input exceeds the value set with P73 (see Fig. 6.1). Frequency Level: active output; the inverter is generating a higher frequency than the one set with P73, independently of the motor direction of rotation (see Fig. 6.2). Forward Running: active output; the inverter is generating a higher frequency than the one set with P73 (positive reference; see Fig. 6.2). Reverse Running: active output; the inverter is generating a higher frequency than the one set with P73 (negative reference; see Fig. 6.2). Fout O.K.: active output; the absolute value of the difference between the frequency reference and the output frequency is lower than the value set with P73 "RL2 Level" (see Fig. 6.3). Current Level: active output; the inverter output current exceeds the value set with P73 "RL2 Level" (see Fig. 6.4). Limiting: active output; inverter in limiting stage. Motor limiting: active output; the inverter is limited by the motor. Generator lim.: active output; limit during regeneration stage. PID OK: active output if the absolute value of the difference between the reference signal and PID regulator feedback has dropped below a threshold set with P73 ("RL2 Level") (see Fig. 6.5). PID OUT MAX: active output if PID regulator output has reached the value set for P90 (PID MAX Out.) (see Fig. 6.6). PID OUT MIN: active output if PID regulator output has reached the value set for P89 (see Fig. 6.7). FB MAX: active output if the absolute value of PID regulator feedback has exceeded the value set for P73 (see Fig. 6.8). FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set with P73 (see Fig. 6.9). Fan Fault: active input with fan failure (P or N models); active input when fans are locked or off (S models); no input control provided for other operating conditions (see the INVERTER RATINGS section). Fire Mode Active: active output in Fire Mode.

NOTE

Select "INV O.K. OFF" to activate a digital output in the case of emergency (protection trip; inverter switched off when in emergency mode; inverter turned on with ENABLE contact – terminal 6 – closed and parameter C61 set to [NO]). If "INV OK OFF" is selected, the digital output may be used to control an indicator light or to send emergency signals to the PLC. If "Inv run trip" is selected, the digital output activates only if the inverter enters the emergency mode due to a protection trip. Turn off and on the equipment in emergency mode to deactivate the digital output. In this operating mode, the digital output may be used to control a relay activating a contactor installed on the inverter supply line.

NOTE

Use parameter P74 to set a hysteresis for the commutation of a digital output.

P63 MDO ON 5/16	P	P63
delay = *.*** s	R	0.00÷ 650 s
	D	0s
	F	Determines activation delay of Open Collector digital output

P64 MDO OFF 6/16	P	P64
delay = *.*** s	R	0.00÷650 s
	D	0s
	F	Determines deactivation delay of Open Collector digital output.

P65 RL1 ON 7/16	P	P65
delay = *.*** s	R	0.00÷650 s
	D	0s
	F	Determines energizing delay of relay RL1.

P66 RL1 OFF 8/16	P	P66
delay = *.*** s	R	0.00÷650 s
	D	0s
	F	Determines de–energizing delay of relay RL1.

P67 RL2 ON 9/16	P	P67
delay = *.*** s	R	0.00÷650 s
	D	0s
	F	Determines energizing delay of relay RL2.

P68 RL2 OFF 10/16	P	P68
delay = *.*** s	R	0.00÷650 s
	D	0s
	F	Determines de–energizing delay of relay RL2.

P69 MDO 11/16	P	P69
Level = *.*** %	R	0÷200%
	D	0%
	F	Determines the value for the activation of Open collector digital output for the following settings: “Reference level”, “Frequency level”, “Forward Running”, “Reverse Running”, “Current level”, “FB Max”, “FB Min”, “Fout O.K.”, “PID O.K.”.

P70 MDO. fr. 12/16	P	P70
hyst. = *.***%Hz	R	0÷200%
	D	0%
	F	When Open Collector digital output is set as “Reference Level”, “Frequency level”, “Forward Running”, “Reverse Running”, “Current level”, “Fout O.K.”, “PID O.K.”, “FB Max”, “FB Min”, this parameter determines the digital output hysteresis range. If the hysteresis is other than 0, the value set with P69 when the quantity set with P60 increases determines the output commutation; when the output decreases, commutation occurs when the value set in P69–P70 is reached (Example: Set P60 = “Frequency level”, P69 = 50%, P70 = 10%; the digital output activates when 50% of the preset maximum output frequency is reached and deactivates when 40% is reached). If P70 = 0, commutation occurs when the value set in P69 is reached. Open Collector MDO digital output set as “PID Max Out” and “PID Min Out” determines the value for the digital output deactivation. The digital output activates when PID regulator output (expressed as a percentage) reaches the value set for P90 “PID Max Out” and P89 “PID Min Out” respectively, and deactivates when the value set for P90 – P70 and P89 + P70 is reached (see Figure 6.6 and Figure 6.7)

P71 RL1 13/16	P	P71
Level = *.*** %	R	0 ÷200%
	D	0 %
	F	Determines the value for the activation of relay digital output RL1 for the following settings: “Reference level”, “Frequency level”, “Forward Running”, “Reverse Running”, “Current level”, “FB Max”, “FB Min”, “Fout O.K.”, “PID O.K.”.

P72 RL1 14/16	P	P72
hyst. = *.*** %	R	0÷200%
	D	0 %
	F	When relay digital output RL1 is set as “Reference Level”, “Frequency level”, “Forward Running”, “Reverse Running”, “Current level”, “Fout O.K.”, “PID O.K.”, “FB Max”, “FB Min”, this parameter determines the digital output hysteresis range. If the hysteresis is other than 0, the value set with P71 when the quantity set with P61 increases determines the output commutation; when the output decreases, commutation occurs when the value set in P71–P72 is reached (Example: Set P61 = “Frequency level”, P71 = 50%, P72 = 10%; the digital output activates when 50% of the preset maximum output frequency is reached and deactivates when 40% is reached). If P72 = 0, commutation occurs when the value set in P71 is reached. Relay digital output RL1 set as “PID Max Out” and “PID Min Out” determines the value for the digital output deactivation. The digital output activates when PID regulator output (expressed as a percentage) reaches the value set for P90 “PID Max Out” and P89 “PID Min Out” respectively, and deactivates when the value set for P90 – P72 and P89 + P72 is reached (see Figure 6.6 and Figure 6.7).

P73 RL2 15/16	P	P73
level = *.*** %	R	0 ÷200%
	D	0 %
	F	Determines the value for the activation of relay digital output RL2 for the following settings: “Reference Level”, “Frequency level”, “Forward Running”, “Reverse Running”, “Current Level”, “FB Max”, “FB Min”, “Fout O.K.”, “PID O.K.”.

P74 RL2 16/16	**P**	P74
hyst. = *.*** %	**R**	0÷200%
	D	2 %
	F	When relay digital output RL2 is set as "Reference Level", "Frequency level", "Forward Running", "Reverse Running", "Current level", "Fout O.K.", "PID O.K.", "FB Max", "FB Min", this parameter determines the digital output hysteresis range. If the hysteresis is other than 0, the value set with P73 when the quantity set with P62 increases determines the output commutation; when the output decreases, commutation occurs when the value set in P73–P74 is reached (Example: Set P62 = "Frequency level", P73 = 50%, P74 = 10%; the digital output activates when 50% of the preset maximum output frequency is reached and deactivates when 40% is reached). If P74 = 0, commutation occurs when the value set in P73 is reached. Relay digital output RL2 set as "PID Max Out" and "PID Min Out" determines the value for the digital output deactivation. The digital output activates when PID regulator output (expressed as a percentage) reaches the value set for P90 "PID Max Out" and P89 "PID Min Out" respectively, and deactivates when the value set for P90 – P74 and P89 + P74 is reached (see Figure 6.6 and Figure 6.7).

NOTE The figure below shows the characteristics of a digital output for particular settings.

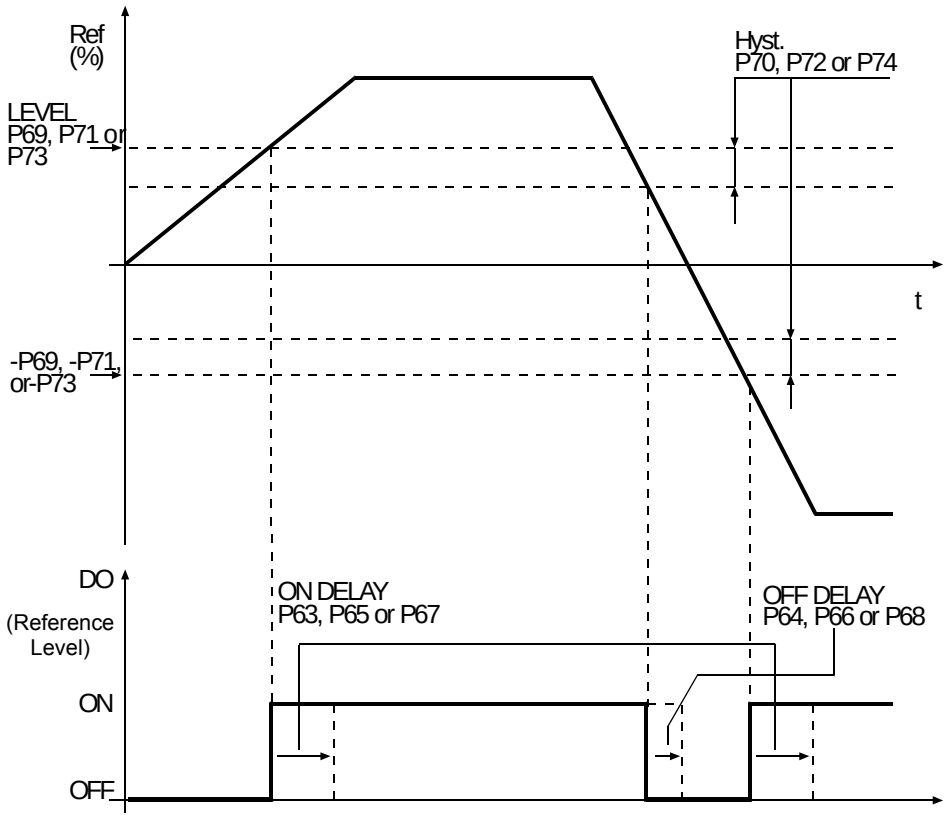


Figure 25: Digital output programming with "REFERENCE LEVEL" programmed P60-P62

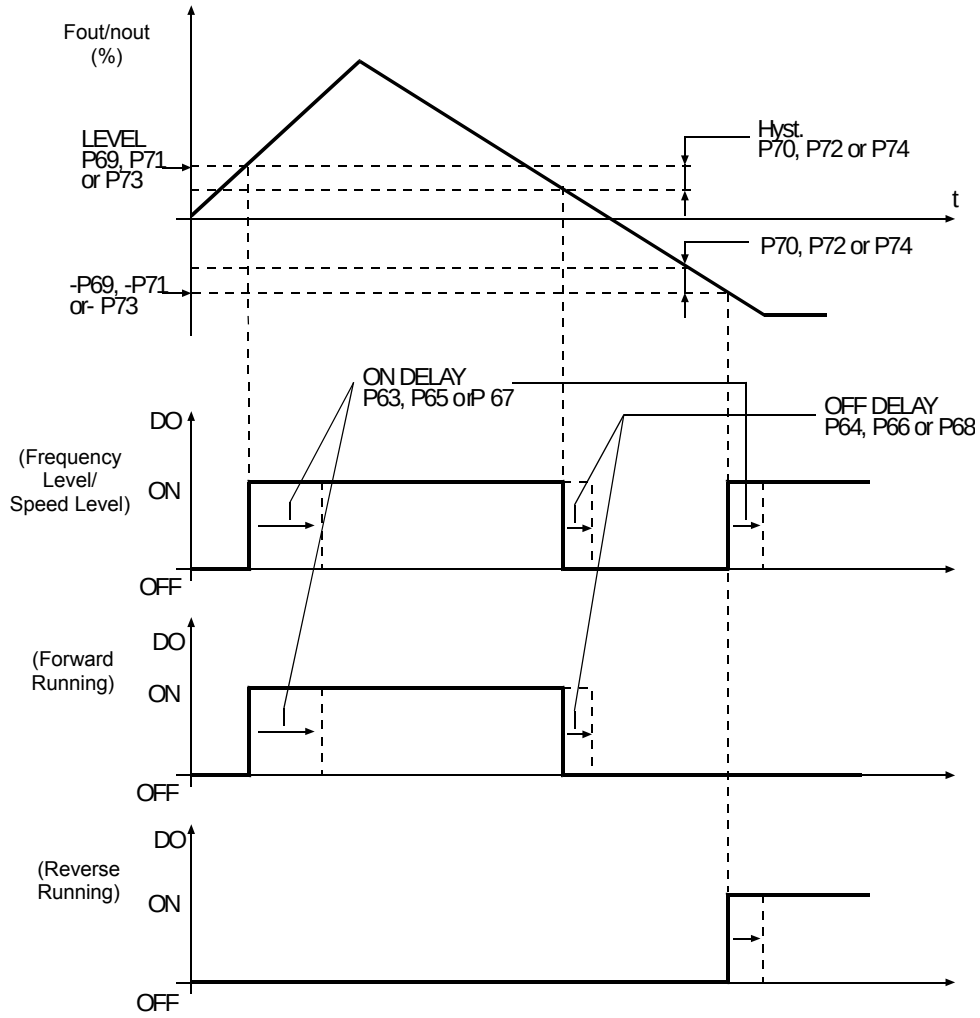


Figure 26: MDO with P60-P62 programmed as 1-FREQUENCY SPEED LEVEL 2-FORWARD RUNNING, 3-REVERSE RUNNING

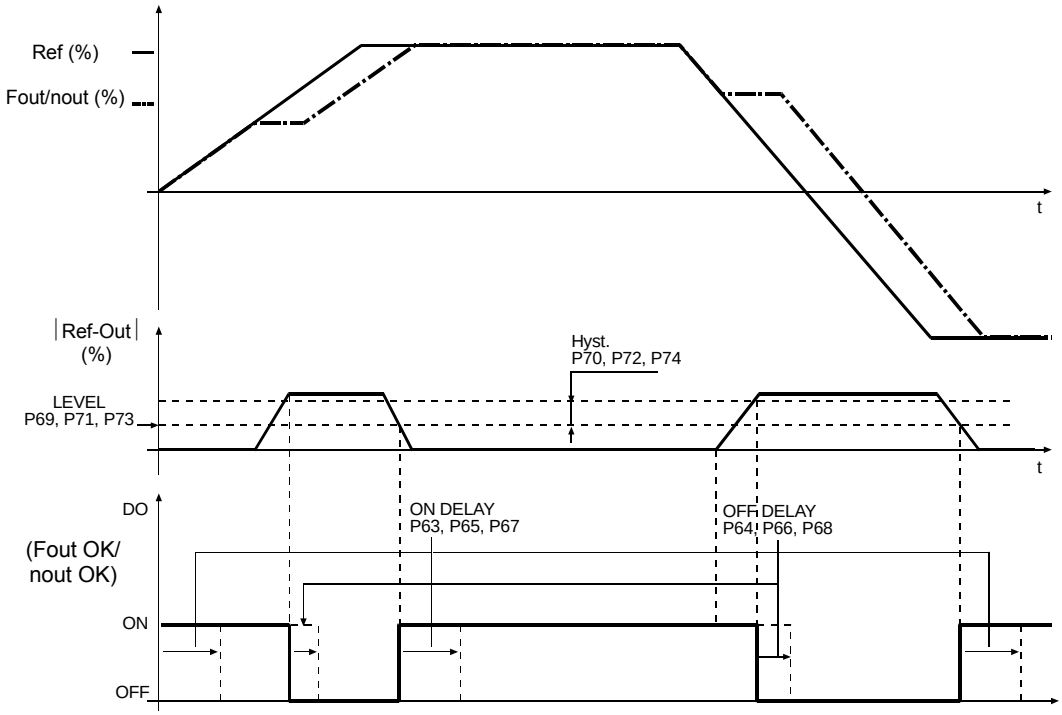


Figure 27: MDO with P60-P62 programmed as Fout/Nout ok

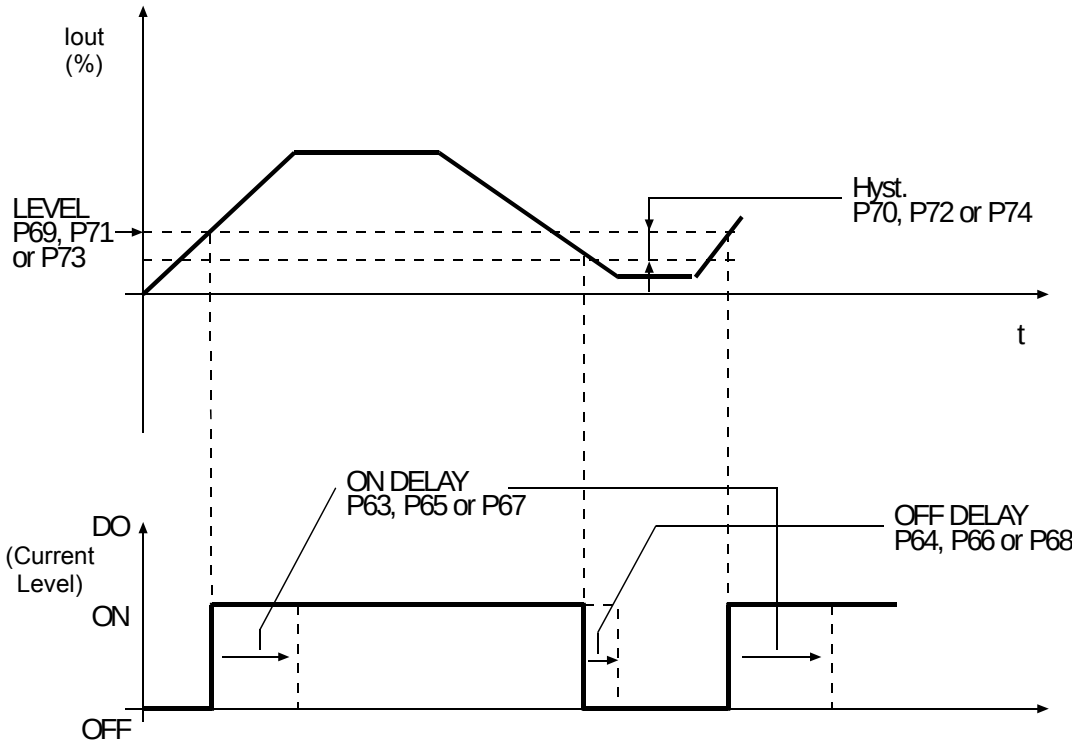


Figure 28: MDO with P60-P62 programmed as current level

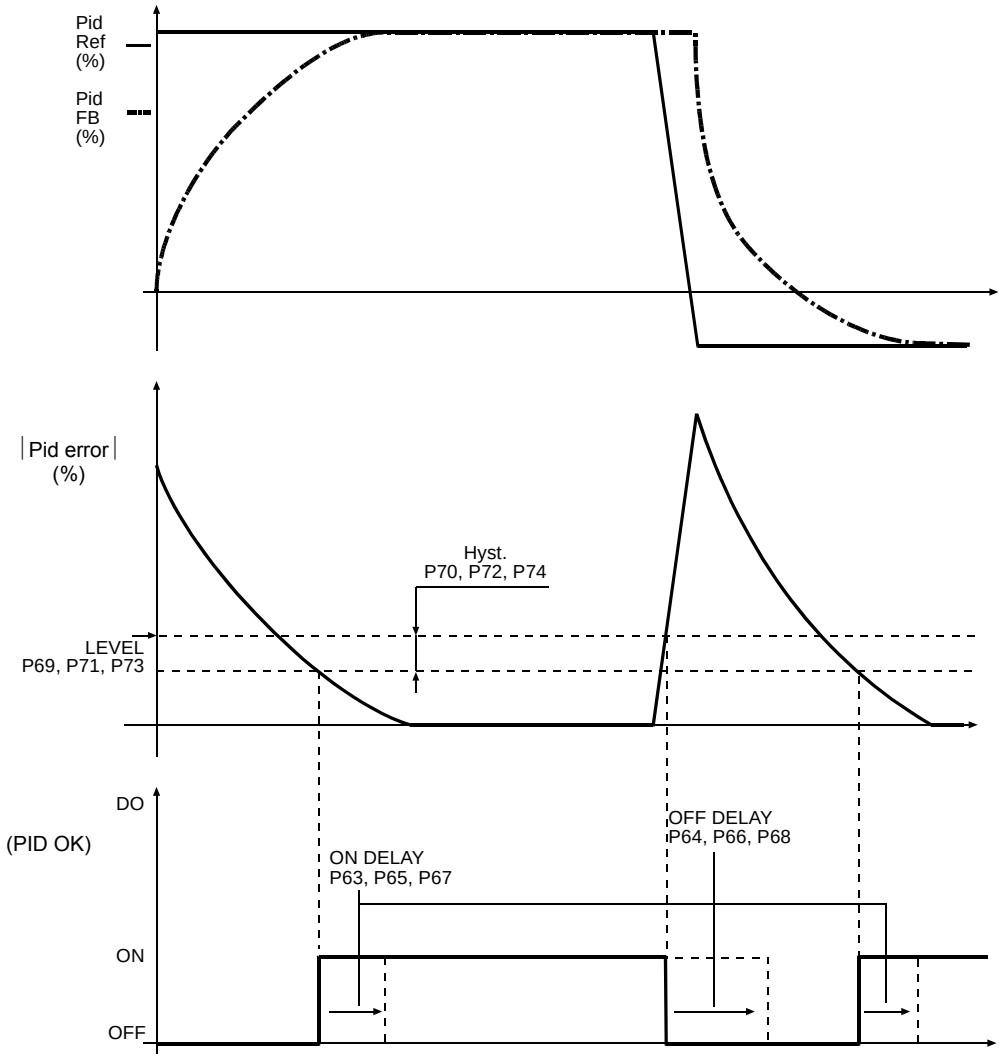


Figure 29: MDO with P60-P62 programmed as "PID ERROR"

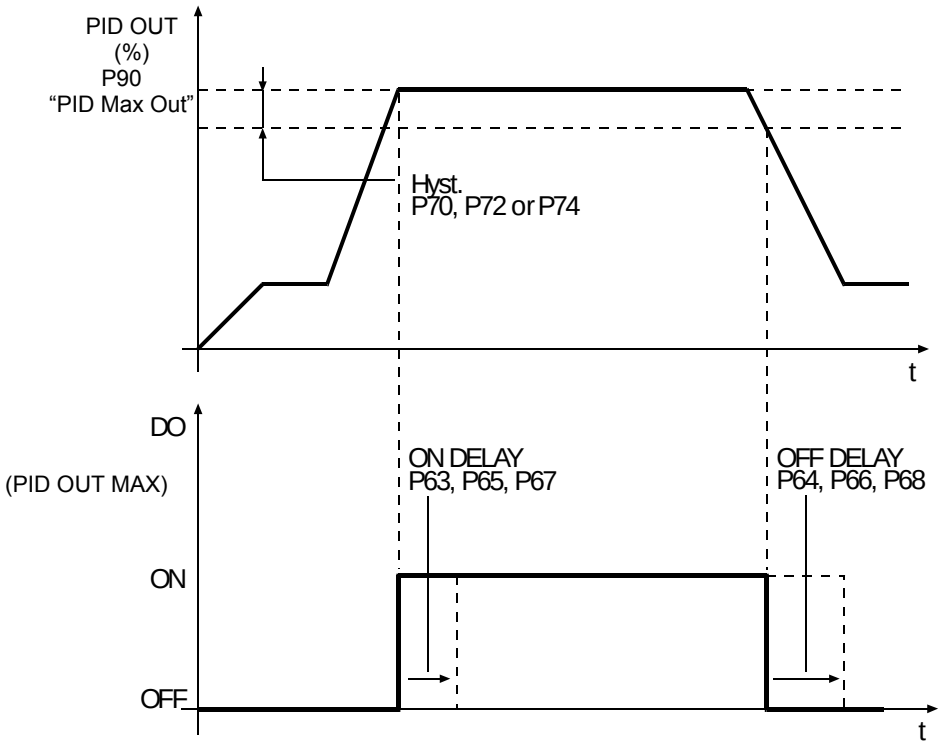


Figure 30: MDO with P60-P62 programmed as "PID MAX OUT

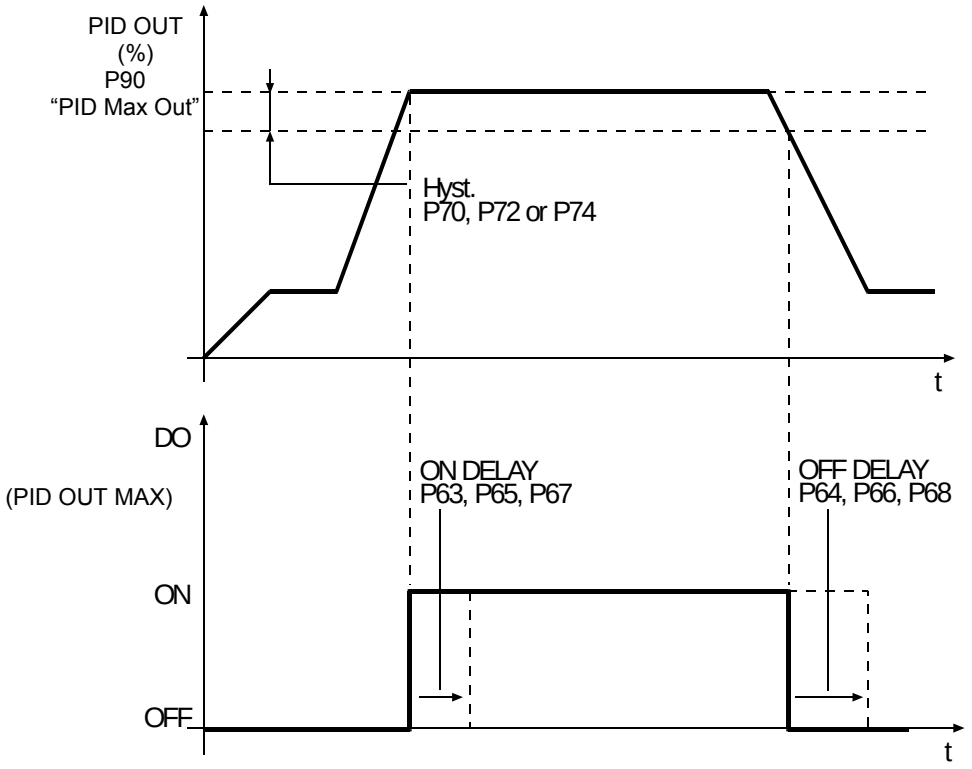


Figure 31: MDO with P60-P62 programmed as "PID OUT MIN"

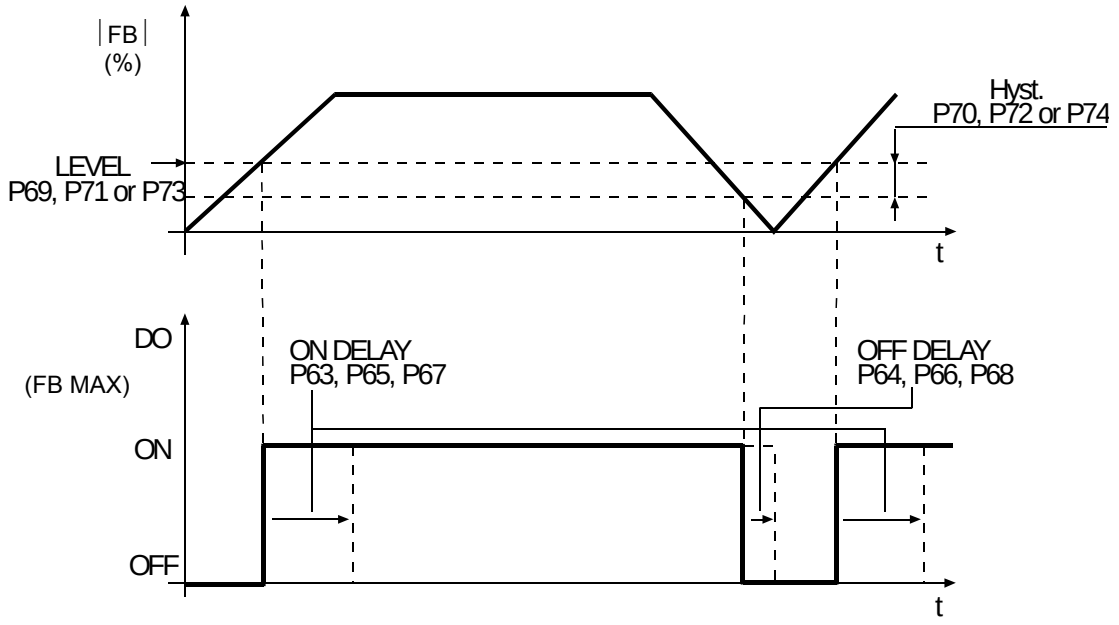


Figure 32: MDO with P60-P62 programmed as "FB MAX"

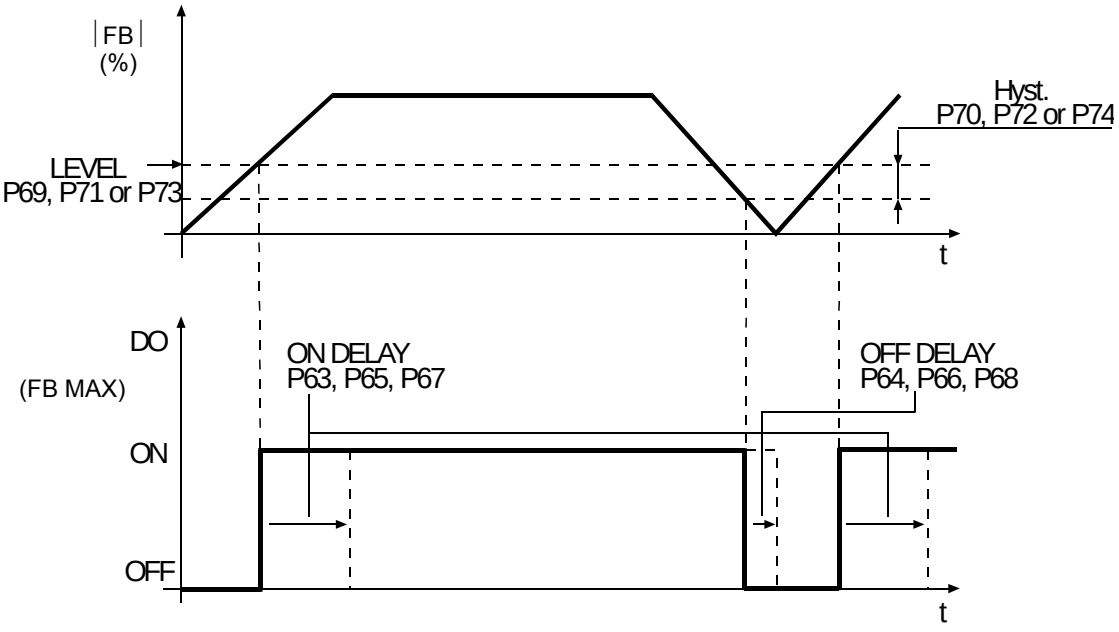
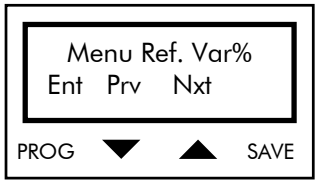


Figure 33: MDO with P60-P62 programmed as "FB MIN"

6.2.9. REF. VAR% SUBMENU

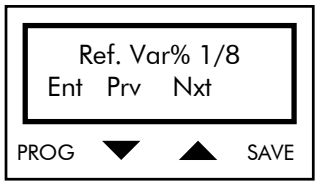
The Ref Var% submenu includes frequency reference variation values. Variation values are obtained through multifunction digital inputs MDI1, MDI2, MDI3 set as frequency variation % command (see the Operation Method Submenu).

Access page



Press PROG (Ent) to access the first page of the Ref Var% submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Digital Output submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE REF VAR% SUBMENU

P75 Ref Var% 2/8	P	P75
Var% 1 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital input 1 (terminal 9) is active and set as percent reference variation (parameter C23, OP METHOD submenu).

P76 Ref Var% 3/8	P	P76
Var% 2 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital input 2 (terminal 10) is active and set as percent reference variation (parameter C24, OP METHOD submenu).

P77 Ref Var% 4/8	P	P77
Var% 3 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital inputs 1 and 2 (terminals 9 and 10) are active and set as percent reference variation (parameters C23, C24, OP METHOD submenu).

P78 Ref Var% 5/8	P	P78
Var% 4 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital input 3 (terminal 11) is active and set as reference percent variation (parameter C25, OP METHOD submenu).

P79 Ref Var% 6/8	P	P79
Var% 5 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital inputs 1 and 3 (terminals 9 and 11) are active and set as percent reference variation (parameter C23, C25, OP METHOD submenu).

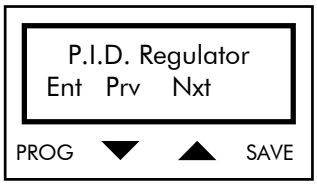
P80 Ref Var% 7/8	P	P80
Var% 6 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital inputs 2 and 3 (terminals 10 and 11) are active and set as percent reference variation (parameter C24, C25, OP METHOD submenu).

P81 Ref Var% 8/8	P	P81
Var% 7 = ***	R	–100% ÷ +100%
	D	0%
	F	Determines the output frequency variation when multifunction digital inputs 1, 2, and 3 (terminals 9, 10, 11) are active and set as percent reference variation (parameter C23, C24, C25, OP METHOD submenu).

6.2.10. PID REGULATOR SUBMENU

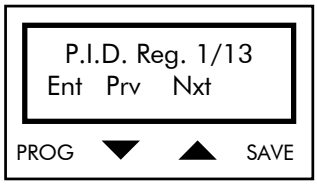
The PID Regulator submenu includes PID regulator adjusting parameters.

Access page



Press PROG (Ent) to access the first page of the PID Regulator submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the PID Regulator submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE PID REGULATOR SUBMENU

P85 Sampling 2/13	P	P85
Tc = ***	R	0.002÷4s
	D	0.002s
	F	Duty cycle of PID regulator (e.g. set 0.002S to execute PID regulator every 0.002S)

P86 Prop. 3/13	P	P86
Gain = ***	R	0÷31.9
	D	1
	F	Multiplicative constant of PID regulation proportional term. PID regulator output % is equal to the difference between reference and feedback expressed as a value percent multiplied by P86.

P87 Integr. 4/13	P	P87
Time = ** Tc	R	3÷1024 Tc; NONE
	D	512 Tc
	F	Constant dividing PID regulator integral term. It is expressed as a multiple value of the sampling time. Set Integr. Time = NONE (value following 1024) to override integral action.

P88 Deriv. 5/13	P	P88
Time = *** Tc	R	0÷4 Tc
	D	0 Tc
	F	Constant multiplying PID regulator derivative term. It is expressed as a multiple value of the sampling time. Set Deriv. Time = 0 to override derivative action.

P89 PID min. 6/13	P	P89
Out. = ***.** %	R	–100%÷+100%
	D	0%
	F	Minimum value of PID regulator output.

P90 PID max. 7/13	P	P90
Out. = ***.** %	R	–100%÷+100%
	D	100%
	F	Maximum value of PID regulator output.

P91 PID Ref. 8/13	P	P91
Acc. = *.*** s	R	0÷6500 s
	D	0 s
	F	Rise ramp of PID regulator reference.

P92 PID Ref. 9/13	P	P92
Dec. = *.*** s	R	0÷6500 s
	D	0 s
	F	Fall ramp of PID regulator reference.

P93 FREQ 10/13	P	P93
Thresh = *.*** Hz	R	0÷800 Hz for S05÷S30
	R	0÷120 Hz for S40÷S65
	D	0 Hz
	F	Inverter output frequency determining the activation of PID regulator integral term.

P94 Integr. 11/13	P	P94
MAX. = ***.** %	R	0÷100 %
	D	100 %
	F	Maximum value of PID regulator integral term.

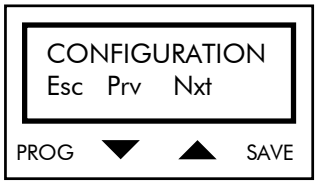
P95 Deriv. 12/13	P	P95
MAX. = ***.** %	R	0÷10 %
	D	10 %
	F	Maximum value of PID regulator derivative term.

P96 PID Dis. 13/13	P	P96
time = ***Tc	R	0÷60000 Tc
	D	0 Tc
	F	The inverter stops if the output value of PID regulator remains equal to the minimum value (parameter P89) for the time set in P96. Set P96 to 0 Tc to disable this function.

6.3. CONFIGURATION MENU

The Configuration menu includes the Cxx parameters that can be altered when the inverter is not running. Set P00=1 (default) to enable parameter alteration.

First page

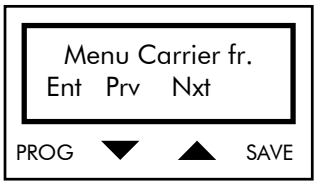


Press PROG (Esc) to return to the page for the selection of the main menus; press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

6.3.1. CARRIER FREQUENCY SUBMENU

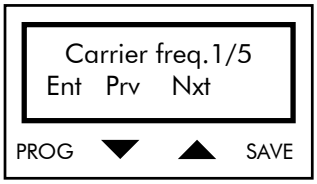
The Carrier Frequency submenu determines the frequency for PWM modulation generated by the inverter.

Access page



Press PROG (Ent) to access the first page of the Carrier Frequency submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Carrier Frequency submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE CARRIER FREQUENCY SUBMENU

C01 Min carr. 2/5	P	C01
freq = *** kHz	R	0.8 kHz÷C02
	D	Column "Carrier def", CONFIGURATION TABLE FOR IFD SW PARAMETERS.
	F	Minimum value of PWM modulation frequency.

C02 Max carr. 3/5	P	C02
freq = **.* kHz	R	C01÷Column "Carrier max", CONFIGURATION TABLE FOR IFD SW PARAMETERS.
	D	Column "Carrier def", CONFIGURATION TABLE FOR IFD SW PARAMETERS.
	F	Maximum value of PWM modulation frequency.

C03 Pulse 4/5	P	C03
number **	R	12, 24, 48, 96, 192, 384
	D	24
	F	Number of pulses generated by PWM modulation when switching from the minimum frequency of PWM modulation freq. to the maximum frequency of PWM modulation.

C04 Silent m. 5/5	P	C04
NO [YES]	R	NO, YES
	D	YES
	F	Allows the application of a noiseless PWM technique.

NOTE Never set parameter C04 = YES with an output frequency exceeding 200Hz.

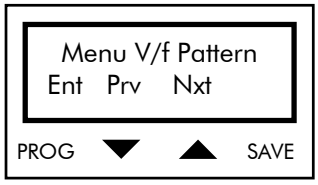
NOTE An increase in carrier frequency determines an increase in the inverter leakage. The carrier increase with respect to the default value may cause the inverter protection to trip. Carrier should be increased in the following cases only: uneven operation, output current lower than rated current, supply voltage lower than maximum voltage, ambient temperature lower than 40°C.

NOTE For more details, see the CARRIER FREQUENCY (IFD SW only) section.

6.3.2. V/F PATTERN SUBMENU

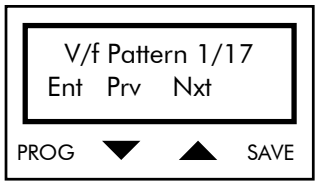
The V/f pattern submenu determines the V/f characteristic for the inverter operation. For more details, see the VOLTAGE/FREQUENCY PATTERN (V/F PATTERN) (IFD SW only) section.

Access page



Press PROG (Ent) to access the first page of the V/f Pattern submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the V/f Pattern submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE V/F PATTERN SUBMENU

C05 V/f patt. 2/17	P	C05
I mot. = *** A	R	1A÷Column "Inom", Table 6.4
	D	Column "Imot", Table 6.4
	F	Rated current of the connected motor

C06 V/f patt. 3/17	P	C06
fmot 1= *** Hz	R	3.5÷800 Hz for S05÷S30
	R	3.5÷120 Hz for S40÷S65
	D	50 Hz
	F	Motor rated frequency relating to the first v/f pattern. Determines switching from the inverter operation at constant V/f to the inverter operation at constant V.

C07 V/f patt. 4/17	P	C07
Fomax1 = *** Hz	R	3.5÷800 Hz for S05÷S30
	R	3.5÷120 Hz for S40÷S65
	D	50 Hz
	F	Maximum output current relating to the first voltage/frequency pattern. Inverter output frequency at maximum reference value.

C08 V/f patt. 5/17	P	C08
Fomin1 = *** Hz	R	0.1÷5Hz
	D	0.1 Hz
	F	Minimum output frequency relating to the first V/f pattern. Minimum frequency generated at the inverter output (can be altered only after contacting Elettronica Santerno).

C09 V/f patt. 6/17	P	C09
Vmot1 = *** V	R	5÷500V (class 2T, 4T)
	D	230V for class 2T
	D	400V for class 4T
	F	Motor rated frequency relating to the first V/f pattern. Determines output voltage at motor rated frequency.

C10 V/f patt. 7/17	P	C10
Boost1 = *** %	R	–100%÷+100%
	D	0 %
	F	Torque compensation at low rpm relating to the first V/f pattern. Determines output voltage increment at low output frequency with respect to a constant V/f ratio.

C11 V/f patt. 8/17	P	C11
Prebst1 = ** %	R	0÷5%
	D	1% for S05÷S30
		0.5% for S40÷S65
	F	Torque compensation at low rpm relating to the first V/f pattern. Determines output voltage at 0Hz. (given in percentage of the rated voltage of the motor C09)

C12 V/f patt. 9/17	P	C12
fmot 2= *** Hz	R	3.5÷800 Hz for S05÷S30
	R	3.5÷120 Hz for S40÷S65
	D	50 Hz
	F	Motor rated frequency relating to the second V/f pattern. Determines switching from the inverter operation at constant V/f to the inverter operation at constant V.

C13 V/f patt. 10/17	P	C13
fomax2 = *** Hz	R	3.5÷800 Hz for S05÷S30
	R	3.5÷120 Hz for S40÷S65
	D	50 Hz
	F	Maximum output frequency relating to the second V/f pattern. Inverter output frequency at max. reference value.

C14 V/f patt. 11/17	P	C14
fomin2 = *** Hz	R	0.1÷5Hz
	D	0.1 Hz
	F	Minimum output frequency relating to the second V/f pattern. Minimum frequency generated at the inverter output (can be altered only after contacting Elettronica Santerno).

C15 V/f patt. 12/17	P	C15
Vmot2 = *** V	R	5÷500V (class 2T, 4T)
	D	230V for class 2T
	D	400V for class 4T
	F	Motor rated voltage relating to the second V/f pattern. Determines output voltage at motor rated frequency.

C16 V/f patt. 13/17	P	C16
Boost2 = *** %	R	–100%÷+100%
	D	0%
	F	Torque compensation at low rpm relating to the second V/f pattern. Determines output voltage increment at low output frequency with respect to a constant V/f ratio.

C17 V/f patt. 14/17	P	C17
Prebst2 = ** %	R	0÷5%
	D	1% for S05÷S30
		0.5% for S40÷S65
	F	Torque compensation at low rpm relating to the second V/f pattern. Determines output voltage at 0Hz (given in pertange of the nominal voltage of the motor C15)

C18 V/f patt. 15/17	P	C18
Autobst = ** %	R	0÷10%
	D	1%
	F	Variable torque compensation expressed as a percentage of motor rated voltage (C09). The value set in C18 stands for a voltage increment when the connected motor operates at rated torque.

C19 V/f patt. 16/17	P	C19
B.mf=***%	R	–100÷400 %
	D	0%
	F	Determines the variation of the output voltage at the frequency selected with C20 with respect to the constant V/f ratio. (Boost > 0 increases the output voltage).

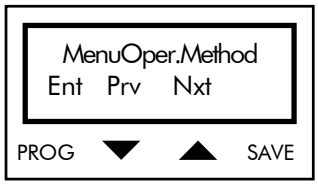
C20 V/f patt. 17/17	P	C20
Freqbst=***%	R	6 ÷ 99%
	D	50%
	F	Determines the frequency level (expressed as a percentage of C06) corresponding to the output voltage variation set for C19.

NOTE

The inverter normally uses the first V/f pattern. To enable the second V/f pattern, activate terminal MDI5 set as V/F2 (see the Operation Method Submenu).

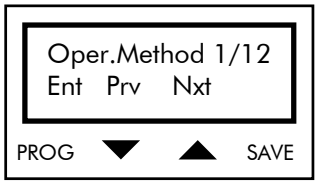
6.3.3. OPERATION METHOD SUBMENU

The Operation Method submenu determines the inverter operating mode.
Access page



Press PROG (Ent) to access the first page of the Operation Method submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Operation Method submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE OPERATION METHOD SUBMENU

C21 Op. method 2/12	P	C21
START = ***	R	Term, Kpd, Rem.
	D	Term
	F	Defines the input for the START command; Term: from terminal board (the START command and the commands relating to multifunction digital inputs are sent from terminal board); Kpd: from keypad (the START command is sent from keypad; see the COMMANDS MENU. Terminal 7 is inactive; all other digital inputs are active); Rem: the START command and the commands relating to multifunction digital inputs are sent from serial link.

NOTE The inverter goes running only if terminal 6 is close.
So it must ALWAYS be closed, independently of par. C21 programming.

C22 Op. method 3/12	P	C22
FREF = ***	R	Term, Kpd, Rem
	D	Term
	F	Par. C22 is used to program the source of main frequency reference; Term: from terminal board: main frequency reference is sent from terminals 2, 3, 21. Kpd: from keypad: main frequency reference is sent via keypad, see the COMMANDS MENU. Rem: from serial link: main frequency reference is sent via serial link.

C23 Op. method 4/12	P	C23
MDI1 = ***	R	Mltf1, Up, Var%1, Stop, Fire Mode
	D	Mltf1
	F	Determines functionality of multifunction input 1 (terminal 9): Mltf1: multifrequency input 1. Up: output frequency increment key (P24 allows the new value to be stored at power off). Var%1: input percent variation of frequency reference 1. Stop: Stop button (to be used in conjunction with the Start contact – terminal 7 – which will act as a button). Fire Mode: any protection feature of the inverter is ignored, so that no alarm trips when the inverter is running.

CAUTION

Due to the activation of the Fire Mode function, the inverter guarantee should be no longer valid if the conditions for the activation of a protection function occur.
If an asterisk (*) appears next to INVERTER OK on the display, the inverter guarantee is no longer valid.

C24 Op. meth.1 5/12	P	C24
MDI2= ***	R	Mltf2, Down, Var%2, Loc/Rem, Fire Mode
	D	Mltf2
	F	Determines functionality of multifunction input 2 (terminal 10): Mltf2: multifunction input 2. Down: output frequency decrement key (P24 allows the new value to be stored at power off). Var%2: input percent variation of frequency reference 2. Loc/Rem: KeyPad mode forced. Fire mode: any protection feature of the inverter is ignored, so that no alarm trips when the inverter is running.

CAUTION

Due to the activation of the Fire Mode function, the inverter guarantee should be no longer valid if the conditions for the activation of a protection function occur.
If an asterisk (*) appears next to INVERTER OK on the display, the inverter guarantee is no longer valid.

C25 Op. method 6/12	P	C25
MDI3= ***	R	Mltf3, CW/CCW, DCB, Var%3, REV, A/M, Lock, Loc/Rem
	D	Mltf3
	F	Determines functionality of multifunction input 3 (terminal 11): Mltf3: multifunction input 3. CW/CCW: reversal of the direction of rotation. DCB: direct current braking command. Var%3: variation per cent input of frequency reference 3. REV: reverse direction command. A/M: PID regulator deactivation command. Lock: keypad lock command. Loc/Rem: KeyPad mode forced.

C26 Op. method 7/12	P	C26
MDI4= ***	R	Mltf4, Mltr1, DCB, CW/CCW, REV, A/M, Lock, Loc/Rem
	D	CW/CCW
	F	Determines functionality of multifunction input 4 (terminal 12): Mltf4: multifrequency input 4. Mltr1: variation of acceleration ramp time and deceleration ramp time. DCB: direct current braking command. CW/CCW: reversal of the direction of rotation. REV: reverse rotation command. A/M: PID regulator deactivation command. Lock: keypad lock command. Loc/Rem: KeyPad mode forced.

C27 Op. method 8/12	P	C27
MDI5= ***	R	DCB, Mltr2, CW/CCW, V/F2, ExtA, REV, Lock, Fire Mode
	D	DCB
	F	Determines functionality of multifunction input 5 (terminal 13): DCB: direct current braking command. Mltr2: variation of acceleration ramp time and deceleration ramp time. CW/CCW: reversal of the direction of rotation. V/F2: variation of V/f pattern command. Ext A: auxiliary trip (external alarm). REV: reverse rotation command. Lock: keypad locked. Fire mode: any protection feature of the inverter is ignored, so that no alarm trips when the inverter is running.

CAUTION

Due to the activation of the Fire Mode function, the inverter guarantee should be no longer valid if the conditions for the activation of a protection function occur.
If an asterisk (*) appears next to INVERTER OK on the display, the inverter guarantee is no longer valid.

C28 PID 9/12	P	C28
Action = ***	R	Ext, Ref F, Add F, Add V
	D	Ext
	F	Determines PID regulator operation: Ext: PID regulator independent of the inverter operation. Ref F: PID regulator output represents the inverter frequency reference. Add F: PID regulator output is summed up to the frequency reference. Add V: PID regulator output is summed up to the output voltage value generated by the selected V/F pattern.

C29 PID 10/12	P	C29
Ref. = ***	R	Kpd, Vref, Iref, Inaux, Rem
	D	Kpd
	F	Determines the source of PID regulator reference: Kpd: keypad. Vref: voltage terminals (terminals 2 and 3). Iref: current terminals (terminal 21). Inaux: voltage terminal through auxiliary input (terminal 19). Rem: from serial link: the reference of the PID regulator comes from serial link.

NOTE Setting C29=Vref deletes the frequency reference from Term.

C30 PID 11/12	P	C30
F.B. = ***	R	Vref, Inaux, Iref, Iout
	D	Inaux
	F	Determines the source of PID regulator feedback: Vref: voltage terminals (terminals 2 and 3). Inaux: voltage terminals through auxiliary input (terminal 19). Iref: current terminals (terminal 21). Iout: feedback is the inverter output current.

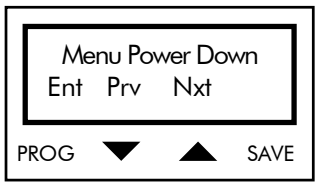
NOTE Setting C30=Vref deletes the frequency reference from Term.

C31 PIDinv.12/12	P	C31
[NO] YES	R	NO, YES
	D	NO
	F	If C31=YES is programmed, it adds a unit negative gain to the PID loop, i.e. it inverts the PID error (see relevant chapter).

6.3.4. POWER DOWN SUBMENU

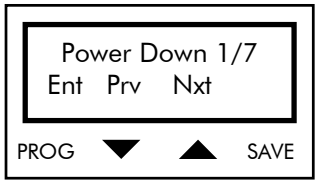
The Power Down submenu contains Power Down operating parameters in case of mains failure.

Access page



Press PROG (Ent) to access the first page of the Power Down submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Power Down submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE POWER DOWN SUBMENU

C34 Mains l. 2/7	P	C34
[NO] YES	R	NO, YES
	D	NO
	F	Disables the inverter in case of mains failure. Alarm A25 Mains loss is displayed. The alarm is delayed by a delay time to be programmed through parameter C36.

NOTE Setting C34= YES forces C35=NO anyway.

C35 Power D. 3/7	P	C35
[NO] YES	R	NO, YES
	D	NO
	F	Enables motor power down in case of mains loss when the time interval set for C36 is over.

NOTE Setting C35= YES forces C34=NO anyway.

C36 Power Delay 4/7	P	C36
time = *** ms	R	5÷255 ms
	D	10 ms
	F	Period that has to elapse before the alarm A25 Main Loss is active (if C34=YES) or before the power down activation (if C35=YES) in case of mains failure.

C37 PD Dec 5/7	P	C37
time = **.**	R	0.1÷6500 s
	D	10 s
	F	Deceleration ramp during power down.

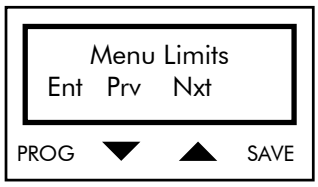
C38 PD Extra 6/7	P	C38
dec = *** %	R	0÷500 %
	D	200 %
	F	Increment of ramp during the first stage of power down condition.

C39 PD Dc link 7/7	P	C39
der = *** %	R	0÷300 %
	D	0 %
	F	Speeds up mains failure detection to enable motor power down.

6.3.5. LIMITS SUBMENU

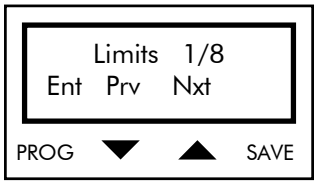
The Limits submenu determines the operation of current limits while accelerating, at constant frequency and of voltage while decelerating.

Access page



Press PROG (Ent) to access the first page of the Limits submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Limits submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE LIMITS SUBMENU

C40 Acc. Lim. 2/8	P	C40
***	R	NO, YES, YES A
	D	YES
	F	YES: Enables current limit while accelerating. YES A: Like YES, but with optimized control algorithm for very inertial loads. NOTE: Current level is set through parameter C41.

C41 Acc. Lim. 3/8	P	C41
Curr.= *** %	R	50÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 6.4)
	D	See Table 6.4 (HEAVY overload)
	F	Current limit while accelerating expressed as a percentage of the motor rated current.

C42 Run. Lim. 4/8	P	C42
No [YES]	R	NO, YES
	D	YES
	F	YES: Enables current limit at steady frequency. NOTE: Current level is set through parameter C43.

C43 Run. Lim. 5/8	P	C43
Curr.= *** %	R	50÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 6.4)
	D	See Table 6.4 (HEAVY overload)
	F	Current limit at constant frequency while the accelerating expressed as a percentage of the motor rated current.

C44 Dec. Lim. 6/8	P	C44
NO [YES]	R	NO, YES
	D	YES
	F	YES: Enables voltage and current limit while decelerating. NOTE: Current level is set through parameter C45; voltage level cannot be programmed.

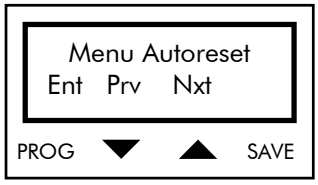
C45 Dec. Lim. 7/8	P	C45
Curr. = *** %	R	50÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 6.4)
	D	See Table 6.4 (HEAVY overload)
	F	Current limit while decelerating expressed as a percentage of the motor rated current.

C46 F. W. red. 8/8	P	C46
[NO] YES	R	NO, YES
	D	NO
	F	Set to YES to decrease the current limit value over the motor rated frequency proportionally to the ratio between the generated frequency and the rated frequency (e.g. current limit is reduced by a half when rated frequency is twofold). Current limit must never drop below 50% of the values set with the relevant parameters.

6.3.6. AUTORESET SUBMENU

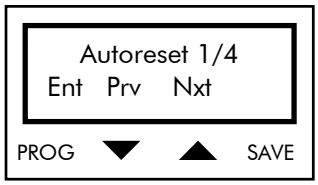
The Autoreset submenu enables the automatic reset of the equipment in case of alarms. Autoreset attempts may be set in a given time interval.

Access page



Press PROG (Ent) to access the first page of the Autoreset submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the PID Regulator submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE AUTORESET SUBMENU

C51 Attempts 2/4	P	C51
Number = *	R	0÷10
	D	4
	F	Determines the number of automatic reset operations performed before locking the function. Autoreset count starts from 0 after a time period longer than the one set in C52.

NOTE If C51 = 0 the autoreset function is locked.

C52 Clear fail 3/4	P	C52
count time ***s	R	1÷999s
	D	300s
	F	Determines the time interval clearing the autoreset count if no alarm trips.

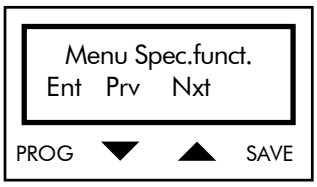
C53 PWR Reset 4/4	P	C53
[NO] YES	R	NO, YES
	D	NO
	F	Set to YES to automatically reset an alarm by switching off and on the inverter.

6.3.7. SPECIAL FUNCTIONS SUBMENU

The Special Functions submenu includes the following:

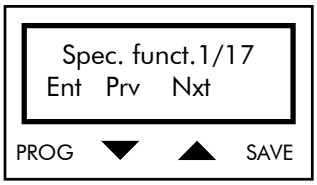
- selection of the rated mains voltage;
- storage of mains failure alarm if mains failure causes the equipment power off;
- speed searching in case a START command is sent after a stand–by command sent when the output frequency is other than 0 (Speed Searching);
- reduction ratio to be entered for rpm display;
- operating mode of ENABLE command;
- page displayed at power on;
- multiplicative constant to be entered for PID regulator feedback display:
- heatsink fan startup.

Access page



Press PROG (Ent) to access the first page of the Special Functions submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Special Functions submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE SPECIAL FUNCTIONS SUBMENU

C54 MainsNom 2/17	P	C54
***	R	200÷240V cannot be altered (class 2T) 380÷480V, 481÷500V (class 4T)
	D	200÷240V (class 2T) 380÷480V (class 4T)
	F	Sets the range for the rated mains voltage. This parameter affects the following: UnderVoltage and OverVoltage alarms; Mains Loss alarm; Power Down control; braking unit control; voltage limit.

NOTE This parameter can be altered only for class 4T inverters.

C55 Speed sr. 3/17	P	C55
***	R	NO, YES, YES A
	D	YES
	F	Enables speed searching. See the SPEED SEARCHING (IFD SW only) section.

C56 S.S. dis. 4/17	P	C56
time = * s	R	0÷3000s
	D	1s
	F	Time period after which the speed searching function is disabled. Speed searching occurs if the inverter is in stand by for a shorter time than the time set through parameter C56. Once the time period is over, the preset acceleration ramp is performed. Set 0s to keep the speed searching function enabled (if set through par. C55).

C57 Brake U. 5/17	P	C57
[NO] YES	R	NO, YES
	D	NO
	F	Braking module enabling or disabling (built–in or external braking module).

C58 FanForce 6/17	P	C58
[NO] YES	R	NO, YES
	D	NO
	F	Fan startup forced. NO: Fan starts when heatsink temperature > 60°C; YES: Fan continuous operation.

CAUTION

This parameter is effective for inverter models where fans are controlled by the inverter control board ("P" or "N" appear in the relevant field – see the INVERTER RATINGS section).
This parameter has no effect for inverter models where fans are controlled directly from the power circuit ("B " or "S" appear in the relevant field).

C59 Reduction 7/17	P	C59
Ratio K = *	R	0.001÷50
	D	1
	F	Proportionality constant between the motor rpm and the value displayed through parameter M10.

C60 Mains l.m. 8/17	P	C60
[NO] YES	R	NO, YES
	D	NO
	F	Stores any alarm relating to mains failure (A30 and A31) causing the equipment power off. When power supply is restored, send a RESET command to reset the alarms tripped.

C61 ENABLE 9/17	P	C61
NO [YES]	R	NO, YES
	D	YES
	F	Operation of ENABLE command (terminal 6) at power on or when a RESET command is sent. YES: ENABLE activated at power on; if terminals 6 and 7 are active and a frequency reference is sent, the motor starts at power on or after a few seconds a RESET command is sent. NO: ENABLE command deactivated at power on or after RESET; if terminals 6 and 7 are active and a frequency reference is sent at power on or after an alarm RESET, the motor does not start until terminal 6 is opened and closed again.

DANGER

Setting parameter C61 to YES may start the motor as soon as the inverter is turned on

C62 First 10/17	P	C62
page = ***	R	Keypad, Status
	D	Status
	F	Determines which pages are displayed at power on: Status: Access page to the main menus. Keypad: Page relating to the command sent via keypad.

C63 First 11/17	P	C63
param. = ***	R	Fref, Fout, Iout, Vout, Vmn, Vdc, Pout, Tr Bd, T.B.Out, Nout, 0per. time, 1st al., 2nd al., 3rd al., 4th al., 5th al., Aux I, Pid Ref, Pid FB, Pid Err, Pid 0ut, Feed Back
	D	Fout
	F	Determines the quantity displayed at power on when parameter C62 is set to Keypad: Fref: M01 – Frequency reference value Fout: M02 – Output frequency value Iout: M03 – Output current value Vout: M04 – Output voltage value Vmn: M05 – Mains voltage value Vdc: M06 – DC link voltage value Pout: M07 – Value of the power delivered to the connected load Tr Bd: M08 – Digital input state T.B.Out: M09 – Digital output state Nout: M10 – Motor speed of rotation Oper. time: M11 – Time period of RUN mode after startup 1st al.: M12 – Last alarm 2nd al.: M13 – Penultimate alarm 3rd al.: M14 – Last–but–two alarm 4th al.: M15 – Last–but–three alarm 5th al.: M16 – Last–but–four alarm Aux I: M17 – Auxiliary input value Pid Ref: M18 – PID regulator reference value Pid FB: M19 – PID regulator feedback value Pid Err: M20 – Difference between reference and feedback of PID regulator Pid 0ut: M21 – PID regulator output Feed Back: M22 – Value assigned to PID regulator feedback signal

C64 Feedback 12/17	P	C64
Ratio = *.***	R	0.001÷50.00
	D	1
	F	Determines the proportionality constant between the value displayed for parameter M22 and the absolute value of PID regulator feedback signal (M19).

C65 Search 13/17	P	C65
Rate = *** %	R	10÷999%
	D	100%
	F	Determines the frequency decreasing rate during speed searching.

C66 Search 14/17	P	C66
Current = *** %	R	40÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 6.4)
	D	75%
	F	Determines the current level which terminates speed searching procedure expressed as a percentage of the motor rated current.

C67 Brake 15/17	P	C67
disab. = ***** ms	R	0÷65400 ms
	D	18000 ms
	F	OFF time period of the built–in braking module. C67=0 braking module always ON; if also C68=0, braking module is always OFF.

C68 Brake 16/17	P	C68
enable = ***** ms	R	0÷65400 ms
	D	2000 ms
	F	ON time period of the built–in braking module. C68=0 braking module always OFF (independently of C67 value).

NOTE

Use the external braking module for applications requiring higher levels than the levels allowed by parameters C67 and C68 and by the inverter model (see the "BRAKING RESISTORS" section in the Sinus K's Installation Instructions manual).

DANGER

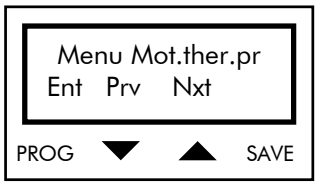
Do not exceed values stated in section 4.1 "BRAKING RESISTORS" in the Installation Manual for the programming of C67 and C68.

C69 BrkBoost 17/17	P	C69
NO [YES]	R	NO, YES
	D	YES
	F	This parameter enhances the braking power of the motor during the deceleration ramp.

6.3.8. MOTOR THERMAL PROTECTION SUBMENU

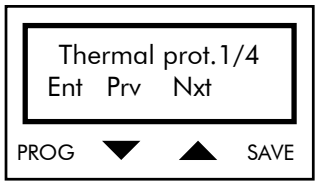
The Motor Thermal Protection submenu determines the parameters relating to the software thermal protection of the motor. See section 3.10 "MOTOR THERMAL PROTECTION" for more details.

Access page



Press PROG (Ent) to access the first page of the Motor Thermal Protection submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Motor Thermal Protection submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE MOTOR THERMAL PROTECTION SUBMENU

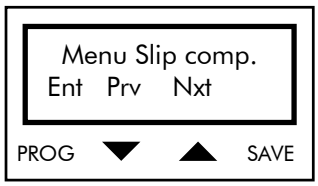
C70 Thermal p.2/4	P	C70
***	R	NO, YES, YES A, YES B
	D	NO
	F	Activates the motor thermal protection. NO: Motor thermal protection disabled. YES: Motor thermal protection enabled with pick–up current independent of output frequency. YES A: Motor thermal protection enabled with pick–up current depending on output frequency, with forced air–cooling system. YES B: Motor thermal protection enabled with pick–up current depending on output frequency, with a fan keyed to the motor shaft.

C71 Motor 3/4	P	C71
current =****%	R	1% ÷120%
	D	105%
	F	Determines the pick–up current expressed as a percentage of the motor rated current.

C72 M. Therm.4/4	P	C72
const. =****s	R	5÷3600s
	D	600s
	F	Determines the motor thermal time constant.

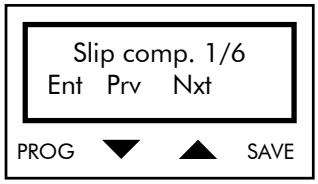
6.3.9. SLIP COMPENSATION SUBMENU

The Slip Compensation submenu determines the parameters relating to the slip compensation function. For more details, see the "SLIP COMPENSATION" section.
Access page



Press PROG (Ent) to access the first page of the Slip Compensation submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Slip Compensation submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE SLIP COMPENSATION SUBMENU

C74 Poles 2/6	P	C74
P = *	R	2, 4, 6, 8, 10, 12, 14, 16.
	D	4
	F	Number of motor poles for the calculation of the motor rotation speed.

C75 Motor 3/6	P	C75
power = ** kW	R	0.5÷1000 KW
	D	Column "Pnom", Table 6.4
	F	Rated power of the connected motor.

C76 No load 4/6	P	C76
current =****%	R	1÷100%
	D	40%
	F	Determines the motor no–load current expressed as a percentage of the motor rated current.

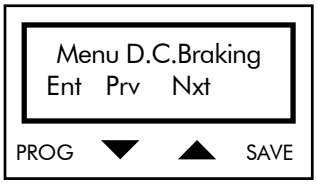
C77 Motor 5/6	P	C77
slip = ****%	R	1÷10%
	D	0%
	F	Determines the motor rated slip expressed as a percentage. Setting it to 0 disables this function.

C78 Stator 6/6	P	C78
res. = ***** ohm	R	0 ÷8.5 ohm
	D	0 ohm
	F	Stator phase resistance. With a star connection, par. C78 corresponds to the value of one phase resistance (half the resistance value measured between two terminals); with a delta connection, par. C78 corresponds to 1/3 of the phase resistance (half the value measured between two terminals).

6.3.10. D.C. BRAKING SUBMENU

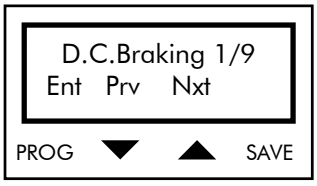
The D.C. Braking submenu includes the parameters relating to direct current braking. For more details, see the DC BRAKING section.

Access page



Press PROG (Ent) to access the first page of the D.C. Braking submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the D.C. Braking submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE D.C. BRAKING SUBMENU

C80 DCB STOP 2/9	P	C80
[NO] YES	R	NO, YES
	D	NO
	F	Determines if DC braking is enabled at the end of the deceleration ramp.

C81 DCB Start 3/9	P	C81
[NO] YES	R	NO, YES
	D	NO
	F	Determines if DC braking is enabled before performing the acceleration ramp.

C82 DCB time 4/9	P	C82
at STOP =*.**s	R	0.1÷50s
	D	0.5s
	F	Determines DC braking time after the deceleration ramp and affects the formula expressing DC braking time period when the command is sent via terminal board (see the DC Braking Command Sent Via Terminal Board section).

C83 DCB time 5/9	P	C83
at Start =*.**s	R	0.1÷50s
	D	0.5s
	F	Determines DC braking time before the acceleration ramp.

C84 DCB Freq 6/9	P	C84
at STOP =*.** Hz	R	0÷10 Hz
	D	1 Hz
	F	Determines the output frequency for DC braking at stop and affects the formula expressing DC braking time when the command is sent via terminal board (see the DC Braking Command Sent Via Terminal Board section).

C85 DCB Curr. 7/9	P	C85
Idcb =***%	R	1÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 6.4)
	D	100%
	F	Determines DC braking intensity expressed as a percentage of the motor rated current.

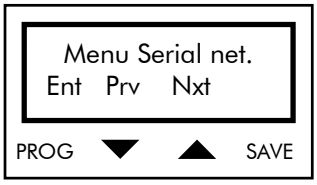
C86 DCB Hold. 8/9	P	C86
[NO] YES	R	NO, YES
	D	NO
	F	After stopping the equipment through DC current braking, it determines a continuous DC injection to maintain a braking torque over the motor shaft and to avoid condensation inside the motor.

C87 DCB Hold. 9/9	P	C87
Current ***%	R	1%÷100%
	D	10%
	F	Determines the intensity of the permanently injected direct current expressed as a percentage of the motor rated current.

6.3.11. SERIAL NETWORK SUBMENU

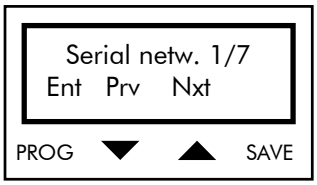
The Serial Network submenu determines the parameters relating to the serial link.

Access page



Press PROG (Ent) to access the first page of the Serial Network submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Serial Network submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE SERIAL NETWORK SUBMENU

C90 Serial 2/7	P	C90
Address = *	R	1÷247
	D	1
	F	Determines the address assigned to the inverter networked through RS485.

C91 Serial 3/7	P	C91
Delay = *** ms	R	0÷500 ms
	D	0 ms
	F	Determines the delay between the master query and the inverter response.

C92 Watch Dog 4/7	P	C92
[NO] YES	R	NO, YES
	D	NO
	F	When active, the inverter locks in remote control mode if no valid message is received within 5s. Alarm A40 “Serial communications error” is displayed.

C93 RTU Time 5/7	P	C93
out= *** ms	R	0÷2000 ms
	D	0 ms
	F	When the inverter is ready to receive, the message sent from the master is considered as complete and processed if no character is received within the time set through C83.

C94 Baud 6/7	P	C94
rate= *** baud	R	1200, 2400, 4800, 9600 baud
	D	9600 baud
	F	Sets the baud rate as bits per second.

C95 Parity 7/7	P	C95
***	R	None / 2 stop bit, Even / 1 stop bit, None / 1 stop bit
	D	None / 2 stop bit
	F	Defines parity (None or Even) and the stop bit number (1 or 2)

NOTE

Not all combinations are possible.
Odd parity cannot be set.

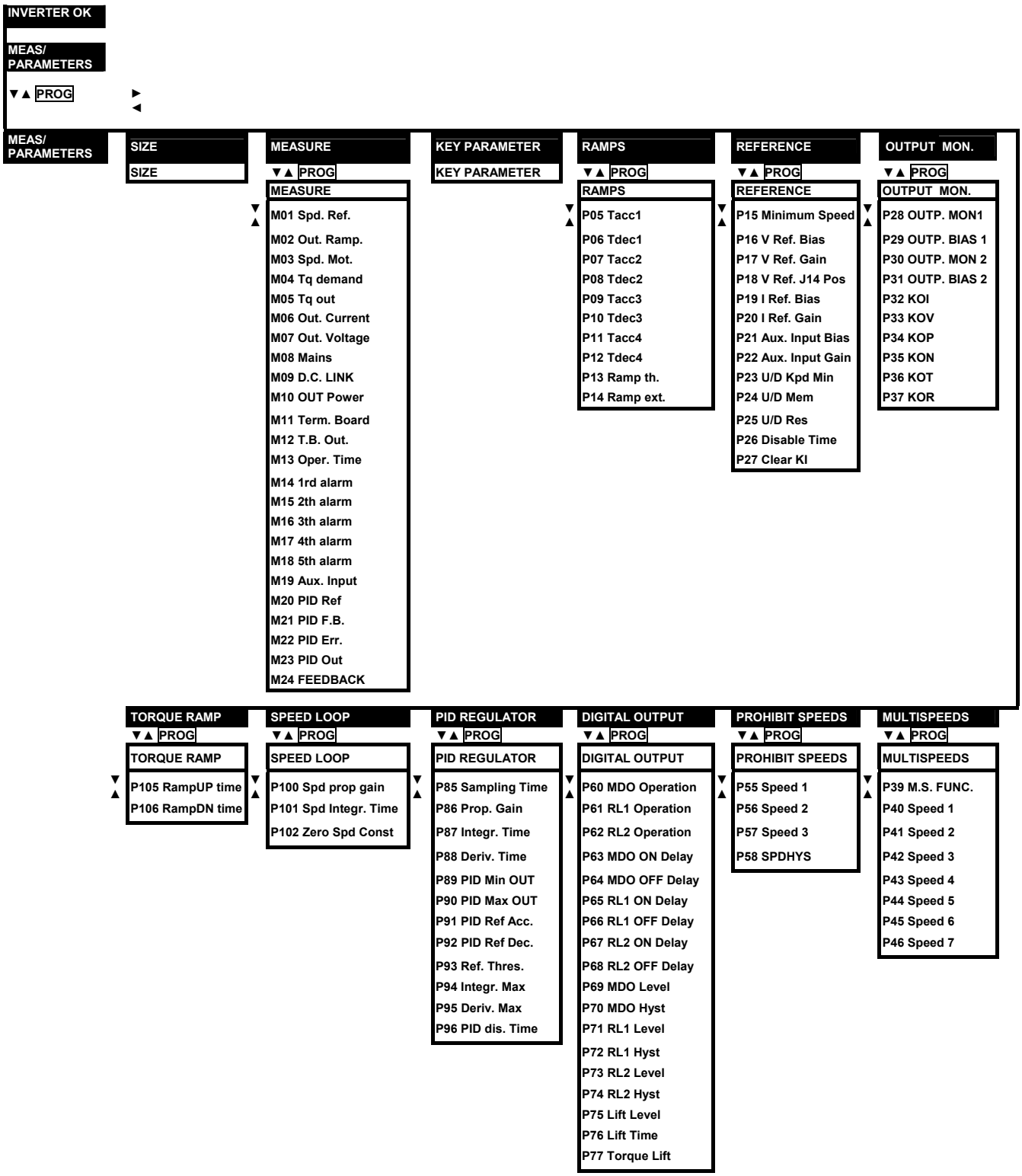
6.4. CONFIGURATION TABLE FOR IFD SW PARAMETERS

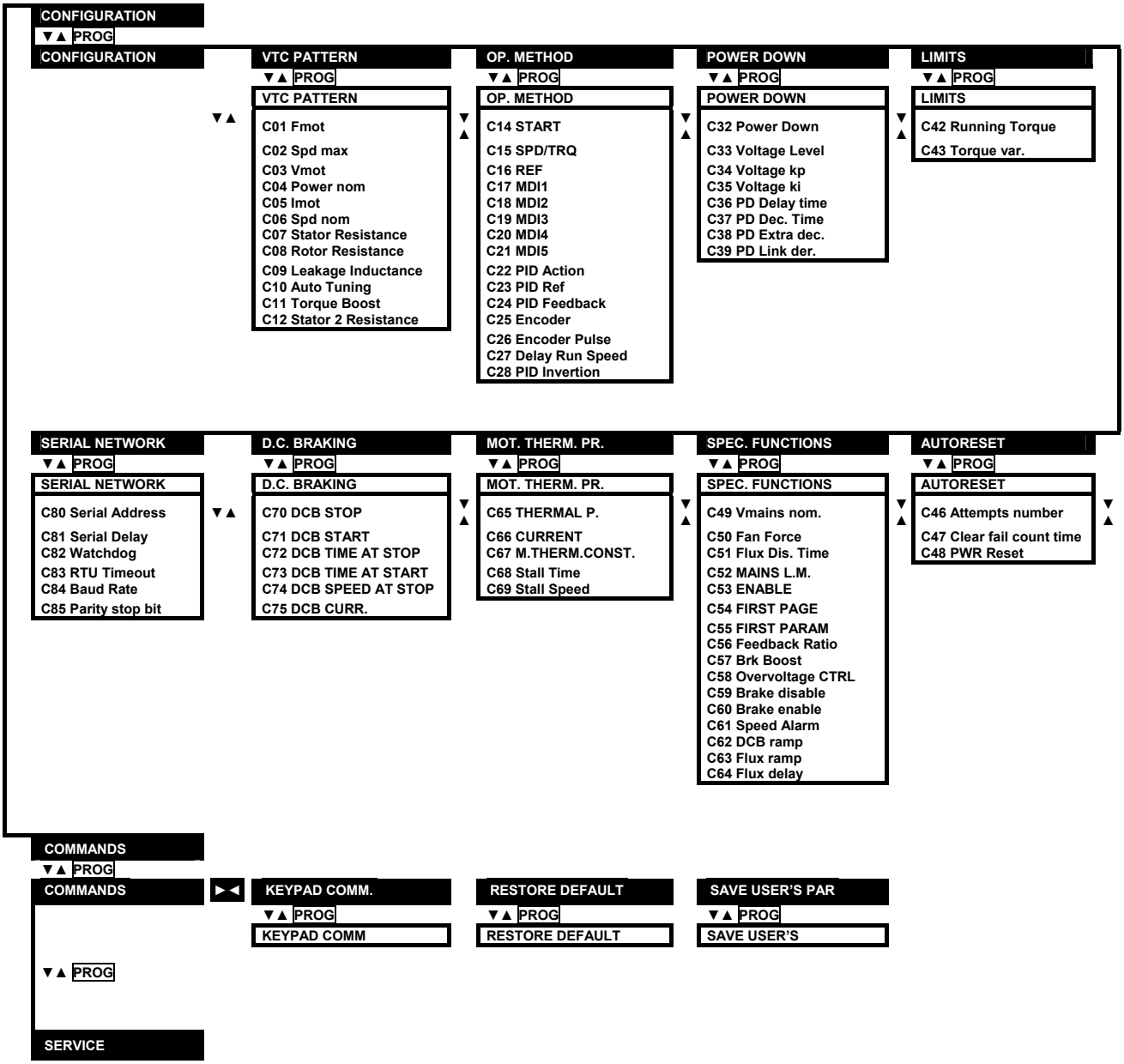
SIZE	MODEL	C05 (Imot) def [A]	Inverter Inom [A]	Inverter Imax [A]	C75 (Pnom) def @ 4T [kW]	C79 (Rs) def @ 4T (Ω)	C01/02 (carrier) def [kHz]	C01/02 (carrier) max [kHz]	C41/43 (I limit) def [%]	C45 (I limit) def [%]
S05	0005	6.4	10.5	11.5	3	2.500	5	16	150	
	0007	8.4	12.5	13.5	4	2.000	5	16	150	
	0008	8.5	15	16	[*]		5	16	150	
	0009	9	16.5	17.5	4.5	1.600	5	16	150	
	0010	11	17	19	[*]		5	16	150	
	0011	11.2	16.5	21	5.5	1.300	5	16	150	
	0013	13.2	19	21	[*]		5	16	150	
	0014	14.8	16.5	25	7.5	1.000	5	16	150	
	0015	15	23	25	[*]		5	16	150	
S05/S10 /S12	0016	17.9	30	32	9.2	0.800	5	16	150	
	0020	17.9	27	30	11	0.600	5	16	150	
S10/ S12	0017	21	30	36	9.2	0.800	5	16	150	
	0023	25.7	38	42	[*]		5	16	150	
	0025	29	41	48	15	0.400	5	16	150	
	0030	35	41	56	18.5	0.300	3	16	150	
	0033	36	51	56	[*]		5	16	150	
	0034	41	57	63	22	0.250	3	16	150	
	0035	41	41	72	22	0.250	5	16	150	
	0036	46	60	72	25	0.200	5	16	150	
	0037	50	65	72	[*]		5	16	150	
S15	0038	46	67	75	25	0.200	5	16	150	
	0040	46	72	80	25	0.200	5	16	150	
	0049	55	80	96	30	0.150	5	12.8	150	
S20	0060	67	88	112	37	0.120	5	12.8	150	
	0067	80	103	118	45	0.100	5	12.8	147	
	0074	87	120	144	50	0.080	5	12.8	150	
	0086	98	135	155	55	0.060	5	12.8	150	
S30	0113	133	180	200	75	0.040	3	10	150	
	0129	144	195	215	80	0.040	3	10	149	
	0150	159	215	270	90	0.030	3	5	150	
	0162	191	240	290	110	0.020	3	5	150	
S40	0179	212	300	340	120	0.018	2	4	150	120
	0200	228	345	365	132	0.018	2	4	150	120
	0216	264	375	430	150	0.015	2	4	150	120
	0250	321	390	480	185	0.012	2	4	149	120
S50	0312	375	480	600	220	0.012	2	4	150	120
	0366	421	550	660	250	0.010	2	4	150	120
	0399	480	630	720	280	0.010	2	4	150	120
S60	0457	528	720	880	315	0.008	2	4	150	120
	0524	589	800	960	355	0.007	2	4	150	120
S65	0598	680	900	1100	400	0.006	2	4	150	120
	0748	841	1000	1300	500	0.003	2	4	150	120
	0831	939	1200	1440	560	0.002	2	4	150	120

[*] This model is available for class 2T only.

7. LIST OF VTC SW PARAMETERS

7.1. MENU AND SUBMENU TREE STRUCTURE – VTC SW




CONFIGURATION
▼▲ PROG
CONFIGURATION
VTC PATTERN
▼▲ PROG
VTC PATTERN
C01 Fmot
C02 Spd max
C03 Vmot
C04 Power nom
C05 Imot
C06 Spd nom
C07 Stator Resistance
C08 Rotor Resistance
C09 Leakage Inductance
C10 Auto Tuning
C11 Torque Boost
C12 Stator 2 Resistance
OP. METHOD
▼▲ PROG
OP. METHOD
C14 START
C15 SPD/TRQ
C16 REF
C17 MDI1
C18 MDI2
C19 MDI3
C20 MDI4
C21 MDI5
C22 PID Action
C23 PID Ref
C24 PID Feedback
C25 Encoder
C26 Encoder Pulse
C27 Delay Run Speed
C28 PID Invertion
POWER DOWN
▼▲ PROG
POWER DOWN
C32 Power Down
C33 Voltage Level
C34 Voltage kp
C35 Voltage ki
C36 PD Delay time
C37 PD Dec. Time
C38 PD Extra dec.
C39 PD Link der.
LIMITS
▼▲ PROG
LIMITS
C42 Running Torque
C43 Torque var.
SERIAL NETWORK
▼▲ PROG
SERIAL NETWORK
C80 Serial Address
C81 Serial Delay
C82 Watchdog
C83 RTU Timeout
C84 Baud Rate
C85 Parity stop bit
D.C. BRAKING
▼▲ PROG
D.C. BRAKING
C70 DCB STOP
C71 DCB START
C72 DCB TIME AT STOP
C73 DCB TIME AT START
C74 DCB SPEED AT STOP
C75 DCB CURR.
MOT. THERM. PR.
▼▲ PROG
MOT. THERM. PR.
C65 THERMAL P.
C66 CURRENT
C67 M.THERM.CONST.
C68 Stall Time
C69 Stall Speed
SPEC. FUNCTIONS
▼▲ PROG
SPEC. FUNCTIONS
C49 Vmains nom.
C50 Fan Force
C51 Flux Dis. Time
C52 MAINS L.M.
C53 ENABLE
C54 FIRST PAGE
C55 FIRST PARAM
C56 Feedback Ratio
C57 Brk Boost
C58 Overvoltage CTRL
C59 Brake disable
C60 Brake enable
C61 Speed Alarm
C62 DCB ramp
C63 Flux ramp
C64 Flux delay
AUTORESET
▼▲ PROG
AUTORESET
C46 Attempts number
C47 Clear fail count time
C48 PWR Reset
COMMANDS
▼▲ PROG
COMMANDS
KEYPAD COMM.
▼▲ PROG
KEYPAD COMM
RESTORE DEFAULT
▼▲ PROG
RESTORE DEFAULT
SAVE USER'S PAR
▼▲ PROG
SAVE USER'S
▼▲ PROG
SERVICE

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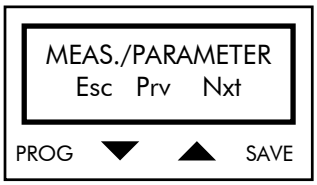
Each parameter includes the following items:

P ⇒ Parameter number
R ⇒ Allowable range
D ⇒ Factory setting (default setting)
F ⇒ Function

7.2. MEASURE/PARAMETER MENU

The Measure/Parameter menu includes the Mxx operating variables and the Pxx parameters that can be altered when the inverter is running. P00 must always be =1 (default) to enable parameter alteration.

First page

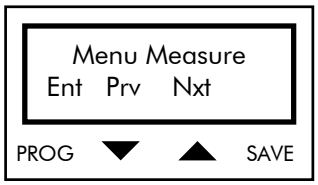


Press PROG (Esc) to return to the main menu selection page; press ↑ (Nxt) and ↓ (Prv) to scroll the submenus. All parameters are included in submenus, except for key parameter P00 and the parameters relating to the inverter ratings. Scroll the submenus to access directly to these parameters.

7.2.1. MEASURE MENU

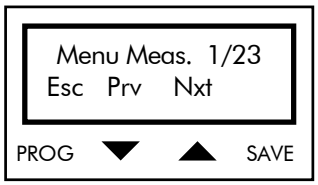
The Measure menu contains the variables displayed during the inverter operation.

Access page



Press PROG (Ent) to access the first page of the Measure menu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Measure menu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE MEASURE SUBMENU

M01Spdref/Tqref 2/25	P	M01
Nref=*** rpm Tref= *** %	R	Motor controlled with a speed ref.: Spd Ref ± 9000 rpm. Motor controlled with a torque ref.: Tq Ref= ± 100% (with respect to the rated current of the connected motor and limited to C42, maximum torque).
	F	Value of speed/torque reference at the inverter input.

M02 Out.Ramp. 3/25	P	M02
Nref=*** rpm Tref= *** %	R	Motor controlled with a speed ref.: Spd Ref ± 9000 rpm. Motor controlled with a torque ref.: Tq Ref= ± 100% (with respect to the rated torque of the connected motor and limited to C42, maximum torque).
	F	Indicates the reference value obtained after the acceleration/deceleration ramp.

M03 Spd mot 4/25	P	M03
Nout= *** rpm	R	±9000 rpm
	F	Rpm of the connected motor.

M04 Tq demand 5/25	P	M04
Tref=*** %	R	±400% (with respect to the motor rated torque and limited to the value set in C42, maximum torque)
	F	Torque demand.

M05 Tq out 6/25	P	M05
Tout=*** %	R	±400%
	F	Torque generated by the connected motor.

M06 Out. c. 7/25	P	M06
Iout=*** A	R	Depending on the inverter size.
	F	Output current value.

M07 Out. v. 8/25	P	M07
Vout=*** V	R	Depending on the inverter class.
	F	Output voltage value.

M08 Mains 9/25	P	M08
Vmn=*** V	R	Depending on the inverter class.
	F	Mains voltage value.

M09 DC Link 10/25	P	M09
Vdc=*** V	R	Depending on the inverter class.
	F	DC link voltage value.

M10 Out. P. 11/25	P	M10
Pout= *** kW	R	Depending on the inverter class and size.
	F	Value of the active power delivered to the load.

M11 Term.B.12/25	P	M11
* * * * * * * *	F	Condition of digital inputs in the terminal board (display order: terminals 6, 7, 8, 9, 10, 11, 12, 13). If an input is active, the display shows the number of the relevant terminal in hexadecimal notation (6, 7, 8, 9, A, B, C, D). Otherwise, "0" is displayed.

M12 T.B.out13/25	P	M12
* * *	F	Condition of digital outputs in the terminal board (display order: terminals 24, 27, 29). If an output is active, the display shows the number of the relevant terminal; otherwise, "0" is displayed.

M13 Oper. 14/25	P	M13
Time = *:** h	R	0÷238.000 h
	F	Time period of the inverter RUN operating mode.

M14 1st al. 15/25	P	M14
A** ***:** h	R	A01÷A40
	F	Stores the last alarm tripped and relevant M13 value.

M15 2nd al. 16/25	P	M15
A** ***:** h	R	A01÷A40
	F	Stores the last–but–one alarm tripped and relevant M13 value.

M16 3rd al. 17/25	P	M16
A** ***:** h	R	A01÷A40
	F	Stores the last–but–two alarm tripped and relevant M13 value.

M17 4th al. 18/25	P	M17
A** ***:** h	R	A01÷A40
	F	Stores the last–but–three alarm tripped and relevant M13 value.

M18 5th al. 19/25	P	M18
A** ***:** h	R	A01÷A40
	F	Stores the last–but–four alarm tripped and relevant M13 value.

M19 Aux 20/25	P	M19
input = ***.** %	R	±200.00%
	F	Auxiliary input value expressed as a percentage.

M20 PID 21/25	P	M20
Ref. = ***.** %	R	±100.00%
	F	Value of PID regulator reference expressed as a percentage.

M21 PID 22/25	P	M21
FB = ***.** %	R	±200.00%
	F	Value of PID regulator feedback expressed as a percentage.

M22 PID 23/25	P	M22
Err. = ***.** %	R	±200.00%
	F	Difference between PID regulator reference (M20) and feedback (M21).

M23 PID 24/25	P	M23
Out. = ***.** %	R	±100.00%
	F	PID regulator output expressed as a percentage.

M24 FEED 25/25	P	M24
BACK = ***.**	R	Depending on C56 programming
	F	Value assigned to PID regulator feedback signal. Indicates a quantity expressed by the formula: M21*C56.

7.2.2. KEY PARAMETER

Key parameter	P	P00
P00=*	R	0÷1
	D	0
	F	Programming access code:
		0: only parameter P01 may be altered. P01 is always set to 0 at power on; 1: all parameters may be altered (parameters included in the Configuration menu can be altered only if the inverter is disabled).

NOTE

Parameter P00 can be saved: if P00=0 is saved, the alteration of the other parameters is inhibited at the following start-up.

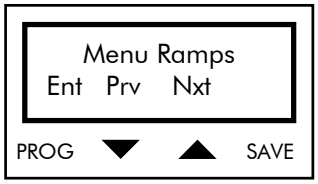
NOTE

The parameters of the configuration menu (Cxx) can be altered only if the inverter is not in RUN mode.

7.2.3. RAMPS SUBMENU

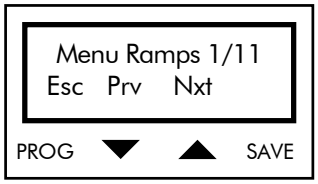
The Ramps submenu includes the variables relating to acceleration ramps and deceleration ramps.

Access page



Press PROG (Ent) to access the first page of the Ramps submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Ramps submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE RAMPS SUBMENU

P05 Accel.t. 2/11	P	P05
Tac1=***s	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 1 from 0 to Spdmax (par. C02).

P06 Decel.t. 3/11	P	P06
Tdc1=***s	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 1 from Spdmax to 0.

P07 Accel.t. 4/11	P	P07
Tac2=***s	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 2 from 0 to Spdmax.

P08 Decel.t. 5/11	P	P08
Tdc2=***s	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 2 from Spdmax to 0.

P09 Accel.t. 6/11		
Tac3=***s	P	P09
	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 3 from 0 to Spdmax.

P10 Decel.t. 7/11		
Tdc3=***s	P	P10
	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 3 from Spdmax to 0.

P11 Accel.t. 8/11		
Tac4=***s	P	P11
	R	0÷6500s
	D	10s
	F	Time interval of acceleration ramp 4 from 0 to Spdmax.

P12 Decel.t. 9/11		
Tdc4=***s	P	P12
	R	0÷6500s
	D	10s
	F	Time interval of deceleration ramp 4 from Spdmax to 0.

P13 Ramp 10/11		
th.=*.*rpm	P	P13
	R	0÷750rpm
	D	2rpm
	F	Determines the time interval of the acceleration and deceleration ramp when ramp increase is used (P14). Example : The active ramp is increased by the value set in P14 when going from 0 to 1500 rpm and if P13=30 rpm from 0 to 30 rpm and from 1470 to 1500 rpm both when accelerating and decelerating.

P14 Ramp 11/11		
Ext =***	P	P14
	R	1, 2, 4, 8, 16, 32
	D	4
	F	Multiplicative factor of the active ramp in the time interval defined by parameter P13.

NOTE

The active ramp depends on the condition of inputs MDI4 and MDI5 whether they are programmed to alter ramp times (see the Operation Method Submenu, parameters C20 and C21).

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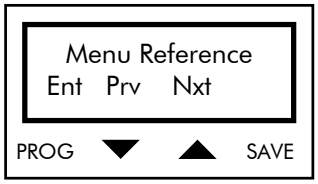
7.2.4. REFERENCE SUBMENU

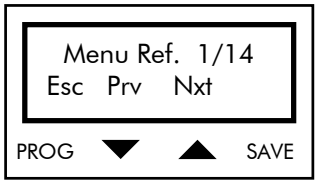
The Reference submenu includes the quantities relating to the speed/torque reference.

Access page



Press PROG (Ent) to access the first page of the Reference submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Reference submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE REFERENCE SUBMENU

P15 Minimum 2/14	P	P15
Speed = ***.** rpm	R	+/–, 0÷900 rpm
	D	+/–
	F	Minimum value of the speed reference. Set "+/–" to obtain a bipolar speed reference range.

P16 V Ref. 3/14	P	P16
Bias =***%	R	–400%÷+400%
	D	0%
	F	Voltage percent value when no voltage is applied to terminals 2 and 3.

P17 V Ref. 4/14	P	P17
Gain =***%	R	–500%÷+500%
	D	100%
	F	Proportional coefficient between the sum of signals on terminals 2, 3 expressed as a fraction of the maximum allowable value (10V) and the output reference expressed as a percentage.

P18 V Ref. 5/14	P	P18
J14 Pos = *	R	+, +/–
	D	+
	F	Determines the variation range of the voltage reference: 0÷+10V (+), ±10V (+/–)

P19 I Ref. 6/14	P	P19
Bias =**.** %	R	–400%÷+400%
	D	–25%
	F	Current reference value expressed as a percentage, when no current is delivered to terminal 21.

P20 I Ref. 7/14	P	P20
Gain =**.** %	R	–500%÷+500%
	D	+125%
	F	Proportional coefficient between the current reference sent to terminal 21, expressed as a fraction of the maximum allowable value (20mA), and the output reference expressed as a percentage.

NOTE Factory setting of parameters P19 and P20 corresponds to 4÷20mA current reference signal.

NOTE For further details on how to use parameters P16, P17, P18, P19, P20 see the MAIN REFERENCE section.

P21 Aux. In. 8/14	P	P21
Bias =**.** %	R	–400%÷+400%
	D	0
	F	Auxiliary input value, expressed as a percentage, when no voltage is applied to terminal 19.

P22 Aux. In. 9/14	P	P22
Gain =**.** %	R	–400%÷+400%
	D	+200%
	F	Proportional coefficient between the signal applied to terminal 19, expressed as a fraction of the maximum allowable value (±10 V), and the value obtained expressed as a percentage.

P23 UD/Kpd 10/14	P	P23
Min=[0] +/–	R	0, +/–
	D	0
	F	Defines the range of the speed reference which is activated through the UP/DOWN command (terminals 9 and 10, parameters C17 and C18) or through a command sent via keypad: 0: Range 0 to Nmax +/–: Range –Nmax to +Nmax

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P24 UD Mem 11/14	P	P24
NO [YES]	R	NO, YES
	D	YES
	F	If set to YES, it stores the increment or decrement of the speed reference value sent either via terminal board through MDI1 and MDI2 and set as UP – DOWN (see parameters C17 and C18) or via keypad (see the COMMANDS MENU).

P25 UD Res 12/14	P	P25
[NO] YES	R	NO, YES
	D	NO
	F	If set to YES, it allows resetting the speed reference set with the UP/DOWN command.

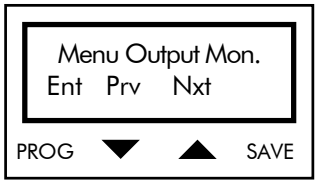
P26 Disable 13/14	P	P26
Time = ***s	R	0÷120s
	D	0s
	F	The inverter stops when the speed reference is active for a longer time than the time set in this parameter with a value equal to the min. value (P15). The inverter restarts as soon as the speed reference exceeds P15. If P26=0 (default value) this function is disabled.

P27 Clear KI 14/14	P	P27
[NO] YES	R	NO, YES
	D	NO
	F	If set to YES, it resets speed loop P101 integral coefficient when the inverter stops due to the activation of function P26.

7.2.5. OUTPUT MONITOR SUBMENU

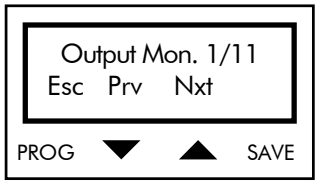
The Output Monitor submenu determines the quantities available on analog outputs (term. 17 and 18).

Access page



Press PROG (Ent) to access the first page of the Output Monitor submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the access page of the Output Monitor submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE OUTPUT MONITOR SUBMENU

P28 Output 2/11	P	P28
monitor 1 ***	R	Refer, Rampout, Spdout, Tqdem, Tqout, Iout, Vout, Pout, PID O., PID F.B., A Refer, A Ramp 0, A Spd0, A Tq dem, A Tq out, A Pout, A PIDO, A PID Fb.
	D	Spdout
	F	Selects the quantity for the first multifunction analog output (terminal 17) among Refer (speed/torque reference), Rmpout (speed/torque reference after ramp block), Spdout (rpm), Tqout (output torque), Tq dem (output torque required by speed loop), Iout (output current), Vout (output voltage), Pout (output power), PID O. (PID regulator output), PID FB (PID regulator feedback), ARefer (torque/speed reference absolute value), ARmpo. (absolute value of speed/torque reference after ramp block), ASpdo. (motor rpm absolute value), ATqdem (demanded torque absolute value), ATqout (general torque absolute value), APout (output power absolute value), APid O (absolute value of PID regulator output), APidFb (absolute value of PID regulator feedback).

P29 Output1 3/11	P	P29
Bias = *** mV	R	0÷10.000 mV
	D	0 mV
	F	Offset of the first analog output.

P30 Output 4/11	P	P30
Monitor 2 ***	R	Refer, Rampout, Spdout, Tqdem, Tqout, Iout, Vout, Pout, PID O., PID F.B., A Refer, A Ramp 0, A Spd0, A Tq dem, A Tq out, A Pout, A Pid0, A Pid Fb.
	D	Iout
	F	Selects the quantity for the second multifunction analog output (terminal 18) among Refer (speed/torque reference), Rmpout (speed/torque reference after ramp block), Spdout (rpm), Tqout (output torque), Tq dem (output torque required by speed loop), Iout (output current), Vout (output voltage), Pout (output power), PID O. (PID regulator output), PID FB (PID regulator feedback), ARefer (torque/speed reference absolute value), ARmpo. (absolute value of speed/torque reference after ramp block), ASpdo. (motor rpm absolute value), ATqdem (demanded torque absolute value), ATqout (general torque absolute value), APout (output power absolute value), APid O (absolute value of PID regulator output), APidFb (absolute value of PID regulator feedback).

P31 Output2 5/11	P	P31
Bias = *** mV	R	0÷10.000 mV
	D	0 mV
	F	Offset of the second analog output.

NOTE

If +/– outputs are used, consider that they produce positive voltage only; in order to distinguish positive values from negative values, use par. P29 or P31 to set an offset value depending on the output being used (e.g. if Spdout is used for terminal 17 with values ranging between ±2000 rpm, set an offset of 5V for P29 and a scale–factor of 400 rpm/V for P35. The output will be 0V with –2000 rpm, 5V with 0 speed, 10V with +2000 rpm).

P32 Out. Mon. 6/11	P	**P32**
KOI = *** A/V	R	Depending on the inverter size.
	D	Depending on the inverter size.
	F	Ratio between the inverter output current and output voltage at terminals 17 and 18.

P33 Out. Mon. 7/11	P	P33
KOV = *** V/V	R	20÷100V/V
	D	100 V/V
	F	Ratio between the inverter output voltage and output voltage at terminals 17 and 18.

P34 Out. Mon. 8/11	P	P34
KOP= *** kW/V	R	Depending on the inverter size.
	D	Depending on the inverter size.
	F	Ratio between power delivered by the inverter and output voltage at terminals 17 and 18.

P35 Out. Mon. 9/11	P	P35
KON*** rpm/V	R	50÷5000 rpm/V
	D	200 rpm/V
	F	Ratio between motor rpm and output voltage at terminals 17 and 18; ratio between the speed reference before and after the ramp block and output voltage at terminals 17 and 18.

P36 Out.Mon.10/11	P	P36
KOT*** %/V	R	5÷400%/V
	D	10%/V
	F	Ratio between the motor torque with respect to the rated torque and voltage at terminals 17 and 18, the required torque and voltage at terminals 17 and 18.

P37Out. Mon.11/11	P	P37
KOR=**.* %/V	R	2.5÷50 %/V
	D	10%/V
	F	Ratio between output voltage at terminals 17–18 and PID regulator output (expressed as a percentage) and ratio between output voltage at terminals 17 and 18 and PID regulator feedback value expressed as a percentage.

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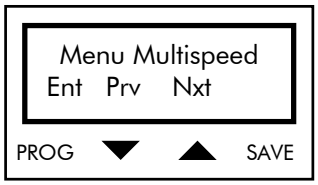
7.2.6. MULTISPEED SUBMENU

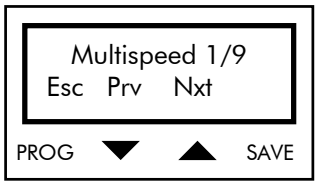
The Multispeed submenu determines the values and configuration of the speed references that can be output through multifunction digital inputs MDI1, MDI2, MDI3 (see the Operation Method Submenu).

Access page



Press PROG (Ent) to access the first page of the Multispeed submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Multispeed submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE MULTISPEED SUBMENU

P39 Multispd 2/9	P	P39
MS func. = ***	R	ABS, ADD
	D	ABS
	F	Determines the application of speed references obtained through par. P40÷P46. ABS – output speed matches with the speed reference output when parameters P40÷P46 are active. ADD – output speed matches with the sum of the main speed reference and the active speed reference.

P40 Multispd 3/9	P	P40
speed1 ***rpm	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital input 1 (terminal 9) is active and set as multispeed (parameter C17, OP METHOD submenu).

P41 Multispd 4/9		
speed2 = ***rpm	P	P41
	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital input 2 (terminal 10) is active and set as multispeed (parameter C18, OP METHOD submenu).

P42 Multispd 5/9		
speed3 = ***rpm	P	P42
	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital inputs 1 and 2 (terminals 9 and 10) are active and set as multispeed (par. C17 and C18, OP METHOD submenu).

P43 Multispd 6/9		
speed4 = ***rpm	P	P43
	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital input 3 (terminal 11) is active and set as multispeed (par. C19, OP METHOD submenu).

P44 Multispd 7/9		
speed5 = ***rpm	P	P44
	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital inputs 1 and 3 (terminals 9 and 11) are active and set as multispeed (par. C17 and C19, OP METHOD submenu).

P45 Multispd 8/9		
speed6 = ***rpm	P	P45
	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital inputs 2 and 3 (terminals 10 and 11) are active and set as multispeed (par. C18 and C19, OP METHOD submenu).

P46 Multispd 9/9		
speed7 = ***	P	P46
	R	–9000÷+9000 rpm
	D	0
	F	Determines the speed reference obtained when multifunction digital inputs 1, 2, and 3 (terminals 9, 10, and 11) are active and set as multispeed (par. C17, C18, and C19, OP METHOD submenu).

NOTE

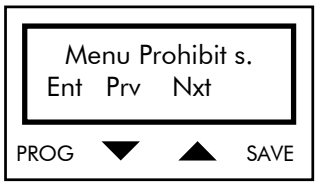
The preset speed reference cannot exceed the maximum speed value set through parameter C02 Spdmax.

VTC

7.2.7. PROHIBIT SPEEDS SUBMENU

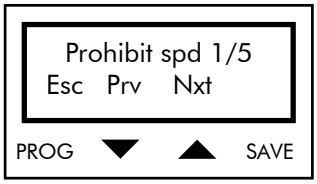
The Prohibit Speeds submenu determines prohibit speed ranges to speed reference. For more details, see the PROHIBIT FREQUENCIES/SPEEDS section.

Access page



Press PROG (Ent) to access the first page of the Prohibit Speeds submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Prohibit Speeds submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE PROHIBIT SPEEDS SUBMENU

P55 Prohib.s.2/5	P	P55
speed1 = ***rpm	R	0÷9000 rpm
	D	0
	F	Determines the intermediate value for the first prohibit speed range. The intermediate value is an absolute value, i.e. is not depending on the direction of rotation. Set it to 0 to disable the prohibit speed range.

P56 Prohib. s.3/5	P	P56
speed2 = ***rpm	R	0÷9000 rpm
	D	0
	F	Determines the intermediate value for the second prohibit speed range. The intermediate value is an absolute value, i.e. is not depending on the direction of rotation. Set it to 0 to disable the prohibit speed range.

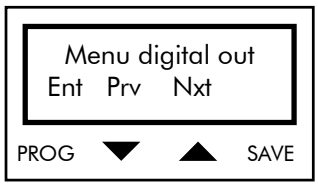
P57 Prohib. s.4/5	P	P57
speed3 = ***rpm	R	0÷9000 rpm
	D	0
	F	Determines the intermediate value for the third prohibit speed range. The intermediate value is an absolute value, i.e. is not depending on the direction of rotation. Set it to 0 to disable the prohibit speed range.

P58 Hysteresis5/5	P	P58
spdhys = ***rpm	R	0÷250 rpm
	D	50rpm
	F	Determines the values of semiamplitude for prohibit speed ranges.

7.2.8. DIGITAL OUTPUT SUBMENU

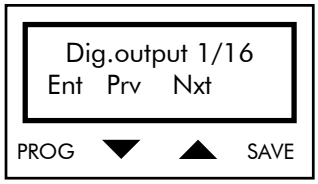
The Digital Output submenu determines the parameters relating to digital outputs.

Access page



Press PROG (Ent) to access the first page of the Digital Output submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Digital Output submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE DIGITAL OUTPUT SUBMENU

P60 MDO opr. 2/19	P	P60
	R	Inv O.K. ON, INV O.K. OFF, Inv RUN Trip, Reference Level, Rmpout level, Speed Level, Forward Running, Reverse Running, Speedout O.K., Tq out level, Current Level, Limiting, Motor Limiting, Generator Limiting, PID O.K., PID OUT MAX, PID OUT MIN, FB MAX, FB MIN, PRC O.K., Speed O.K., RUN, Lift, Lift1, Fan Fault
	F	Configuration of Open Collector digital output (terminals 24 and 25): Inv. O.K. ON: active output; the inverter is ready to run. Inv. O.K. OFF: active output; the inverter is in emergency mode (any condition locking the RUN command; see note at the end of the description of parameter P60). Inv run trip: active output if inverter in emergency mode due to a protection trip. Reference Level: active output; speed reference at the inverter input is higher than the one set with P69. Rmpout level: active output; ramp block output is higher than the one set with P69. Speed Level: active output when the motor speed exceeds the value set for P69 independently of the motor direction of rotation. Forward Running: active output when the speed motor exceeds the value set in P69 and matches with a positive reference. Reverse Running: active output when the motor speed exceeds the value set in P69 and matches with a negative reference. Speedout O.K.: active output; the absolute value of the difference between the speed reference and the motor speed is lower than the value set with P69 "MDO Level". Tq out level: active output; the motor outputs a higher torque than the value set in P69 with respect to the maximum allowable torque. Current Level: active output; the inverter output current exceeds the value set with P69 "MDO Level". Limiting: active output; inverter in limiting stage. Motor limiting: active output; inverter limited by the motor. Generator lim.: active output; limit during braking stage. PID OK: active output if the absolute value of the difference between the reference signal and PID regulator feedback has dropped below a threshold set with P69 ("MDO Level"). PID OUT MAX: 0 active output if PID regulator output has reached the value set for P90 (PID MAX Out.) (see Fig. 6.6). PID OUT MIN: active output if PID regulator output has reached the value set for P89 (see Fig. 6.7). FB MAX: active output if the absolute value of PID regulator feedback has exceeded the value set for P69 (see Fig. 6.8). FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set with P69 (see Fig. 6.9). PRC O.K.: active output; the inverter has finished precharging its capacitor stack. Speed O.K.: active output when the absolute value of the difference between the ramp block output and the motor speed is lower than the value set in P69 (MDO level).

	F	RUN: active output when the inverter is in RUN mode. Lift: the output deactivates (brake locked) when one of the following occurs (logical OR): inverter disabled, alarm trip, ramp block output lower than P69 and inverter decelerating, activation of the function set through parameters P75 and P76. The output activates (brake unlocked) when all the following conditions occur (logical AND): inverter accelerating, no alarm trip, ramp block output other than 0, inactive function set through parameters P75 and P76 (error > P75 for the time set in P76), output torque exceeding the value set in P77. Lift1: like Lift, but the last condition for the brake unlocking is that the output torque exceeds the value calculated by the inverter as the optimum value depending on the connected load. Fan Fault: active input with fan failure (P or N models); active input when fans are locked or off (S models); no input control provided for other operating conditions (see the INVERTER RATINGS section).

Select "INV OK OFF" to activate a digital output in the case of emergency (protection trip; inverter switched off when in emergency mode; inverter turned on with ENABLE contact (terminal 6) closed and parameter C59 set to [NO]). If "INV OK OFF" is selected, the digital output may be used to control an indicator light or to send emergency signals to the PLC. If "Inv run trip" is selected, the digital output activates only if the inverter enters the emergency mode due to a protection trip. Turn off and on the equipment in emergency mode to deactivate the digital output. In this operating mode, the digital output may be used to control a relay activating a contactor installed on the inverter supply line. The contactor is controlled by an NC contact in the relay.

NOTE

NOTE

Use parameter P70 to set a hysteresis for the commutation of a digital output.

VTC

P61 RL1 opr. 3/19	P	P61
	R	Inv O.K. ON, INV O.K. OFF, Inv RUN Trip, Reference Level, Rmpout level, Speed Level, Forward Running, Reverse Running, Speedout O.K., Tq out level, Current Level, Limiting, Motor Limiting, Generator Limiting, PID O.K., PID OUT MAX, PID OUT MIN, FB MAX, FB MIN, PRC O.K., Speed O.K, RUN, Lift, Lift1, Fan Fault
	D	Inv. O.K. ON
	F	Configuration of relay digital output RL1 (terminals 26, 27, and 28): Inv. O.K. ON: active output; the inverter is ready to run. Inv. O.K. OFF: active output; the inverter is in emergency mode (any condition locking the RUN command; see note at the end of the description of parameter P61). Inv run trip: active output if inverter in emergency mode due to a protection trip. Reference Level: active output; speed reference at the inverter input is higher than the one set with P71. Rmpout level: active output; ramp block output is higher than the one set with P71. Speed Level: active output when the motor speed exceeds the value set for P71 independently of the motor direction of rotation. Forward Running: active output when the speed motor exceeds the value set in P71 and matches with a positive reference. Reverse Running: active output when the motor speed exceeds the value set in P71 and matches with a negative reference. Speedout O.K.: active output; the absolute value of the difference between the speed reference and the motor speed is lower than the value set with P71 "RL1 Level". Tq out level: active output; the motor outputs a higher torque than the value set in P71 with respect to the maximum allowable torque. Current Level: active output; the inverter output current exceeds the value set with P71 "RL1 Level". Limiting: active output; inverter in limiting stage. Motor limiting: active output; inverter limited by the motor. Generator lim.: active output; limit during braking stage. PID OK: active output if the absolute value of the difference between the reference signal and PID regulator feedback has dropped below a threshold set with P71 ("RL1 Level"). PID OUT MAX: 0 active output if PID regulator output has reached the value set for P90 (PID MAX Out.) (see Fig. 6.6). PID OUT MIN: active output if PID regulator output has reached the value set for P89 (see Fig. 6.7). FB MAX: active output if the absolute value of PID regulator feedback has exceeded the value set for P71 (see Fig. 6.8). FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set with P71 (see Fig. 6.9). PRC O.K.: active output; the inverter has finished precharging its capacitor stack. Speed O.K.: active output when the absolute value of the difference between the ramp block output and the motor speed is lower than the value set in P71 (RL1 Level).

	F	RUN: active output when the inverter is in RUN mode. Lift: the output deactivates (brake locked) when one of the following occurs (logical OR): inverter disabled, alarm trip, ramp block output lower than P71 and inverter decelerating, activation of the function set through parameters P75 and P76. The output activates (brake unlocked) when all the following conditions occur (logical AND): inverter accelerating, no alarm trip, ramp block output other than 0, inactive function set through parameters P75 and P76 (error > P75 for the time set in P76), output torque exceeding the value set in P77. Lift1: like Lift, but the last condition for the brake unlocking is that the output torque exceeds the value calculated by the inverter as the optimum value depending on the connected load. Fan Fault: active input with fan failure (P or N models); active input when fans are locked or off (S models); no input control provided for other operating conditions (see the INVERTER RATINGS section).

NOTE

Select "INV OK OFF" to activate a digital output in the case of emergency (protection trip; inverter switched off when in emergency mode; inverter turned on with ENABLE contact (terminal 6) closed and parameter C61 set to [NO]). If "INV OK OFF" is selected, the digital output may be used to control an indicator light or to send emergency signals to the PLC. If "Inv run trip" is selected, the digital output activates only if the inverter enters the emergency mode due to a protection trip. Turn off and on the equipment in emergency mode to deactivate the digital output. In this operating mode, the digital output may be used to control a relay activating a contactor installed on the inverter supply line.

NOTE

Use parameter P72 to set a hysteresis for the commutation of a digital output.

P62:RL2opr.4/9	P	P62
	R	Inv O.K. ON, INV O.K. OFF, Inv RUN Trip, Reference Level, Rmpout level, Speed Level, Forward Running, Reverse Running, Speedout O.K., Tq out level, Current Level, Limiting, Motor Limiting, Generator Limiting, PID O.K., PID OUT MAX, PID OUT MIN, FB MAX, FB MIN, PRC O.K., Speed O.K, RUN, Lift, Lift1, Fan Fault
	D	Speed level
	F	Configuration of relay digital output RL2 (terminals 29,30 anf 31): Inv. O.K. ON: active output; the inverter is ready to run. Inv. O.K. OFF: active output; the inverter is in emergency mode (any condition locking the RUN command; see note at the end of the description of parameter P61). Inv run trip: active output if inverter in emergency mode due to a protection trip. Reference Level: active output; speed reference at the inverter input is higher than the one set with P73. Rmpout level: active output; ramp block output is higher than the one set with P73. Speed Level: active output when the motor speed exceeds the value set for P73 independently of the motor direction of rotation. Forward Running: active output when the speed motor exceeds the value set in P73 and matches with a positive reference. Reverse Running: active output when the motor speed exceeds the value set in P73 and matches with a negative reference. Speedout O.K.: active output; the absolute value of the difference between the speed reference and the motor speed is lower than the value set with P73 "RL2 Level". Tq out level: active output; the motor outputs a higher torque than the value set in P73 with respect to the maximum allowable torque. Current Level: active output; the inverter output current exceeds the value set with P73 "RL2 Level". Limiting: active output; inverter in limiting stage. Motor limiting: active output; inverter limited by the motor. Generator lim.: active output; limit during braking stage. PID OK: active output if the absolute value of the difference between the reference signal and PID regulator feedback has dropped below a threshold set with P73 ("RL2 Level"). PID OUT MAX: 0 active output if PID regulator output has reached the value set for P90 (PID MAX Out.) (see Fig. 6.6). PID OUT MIN: active output if PID regulator output has reached the value set for P89 (see Fig. 6.7). FB MAX: active output if the absolute value of PID regulator feedback has exceeded the value set for P73 (see Fig. 6.8). FB MIN: active output if the absolute value of PID regulator feedback is lower than the value set with P73 (see Fig. 6.9). PRC O.K.: active output; the inverter has finished precharging its capacitor stack. Speed O.K.: active output when the absolute value of the difference between the ramp block output and the motor speed is lower than the value set in P73 (RL2 Level).

	F	RUN: active output when the inverter is in RUN mode. Lift: the output deactivates (brake locked) when one of the following occurs (logical OR): inverter disabled, alarm trip, ramp block output lower than P73 and inverter decelerating, activation of the function set through parameters P75 and P76. The output activates (brake unlocked) when all the following conditions occurs (logical AND): inverter accelerating, no alarm trip, ramp block output other than 0, inactive function set through parameters P75 and P76 (error > P75 for the time set in P76), output torque exceeding the value set in P77. Lift1: like Lift, but the last condition for the brake unlocking is that the output torque exceeds the value calculated by the inverter as the optimum value depending on the connected load. Fan Fault: active input with fan failure (P or N models); active input when fans are locked or off (S models); no input control provided for other operating conditions (see the INVERTER RATINGS section).

NOTE

Select "INV O.K. OFF" to activate a digital output in the case of emergency (protection trip; inverter switched on again after being locked in emergency mode; inverter turned on with ENABLE contact – terminal 6 – closed and parameter C53 set to [NO]). If "INV OK OFF" is selected, the digital output may be used to control an indicator light or to send emergency signals to the PLC. If "Inv run trip" is selected, the digital output activates only if the inverter enters the emergency mode due to a protection trip. Turn off and on the equipment in emergency mode to deactivate the digital output. In this operating mode, the digital output may be used to control a relay activating a contactor installed on the inverter supply line.

NOTE

Use parameter P74 to set a hysteresis for the commutation of a digital output.

P63 MDO ON 5/19	P	P63
delay=*.***s	R	0.0÷ 650.0 s
	D	0s
	F	Determines the activation delay of Open Collector digital output.

P64 MDO OFF 6/19	P	P64
delay = *.*** s	D	0s
	R	0.0÷ 650.0 s
	F	Determines the deactivation delay of Open Collector digital output.

P65 RL1 ON 7/19	P	P65
delay = *.*** s	R	0.0÷ 650.0 s
	D	0s
	F	Determines the energizing delay of relay RL1.

P66 RL1 OFF 8/19	P	P66
delay = *.*** s	R	0.0÷ 650.0 s
	D	0s
	F	Determines the de–energizing delay of relay RL1.

P67 RL2 ON 9/19	P	P67
delay = *.*** s	R	0.0÷ 650.0 s
	D	0s
	F	Determines the energizing delay of relay RL2.

P68 RL2 OFF 10/19	P	P68
delay = *.*** s	R	0.0÷ 650.0 s
	D	0s
	F	Determines the de–energizing delay of relay RL2.

P69 MDO 11/19	P	P69
level = *.***%	R	0÷200%
	D	0%
	F	Determines the value for the activation of Open collector digital output for the following settings: “Rmpout level”, “Reference level”, “Speed level”, “Forward Running”, “Reverse Running”, “Tq out level”, “Current level”, “FB Max”, “FB Min”, “Speedout O.K.”, “PID O.K.”.

P70 MDO. 12/19	P	P70
hyst. = *.*** %	R	0÷200%
	D	0 %
	F	When Open Collector digital output is set as "Rmpout Level", "Reference Level", "Speed level", "Forward Running", "Reverse Running", "Tq out level", "Current level", "Speedout O.K.", "PID O.K.", "FB Max", "FB Min", this parameter determines the digital output hysteresis range. If the hysteresis is other than 0, the value set with P69 when the quantity set with P60 increases determines the output commutation; when the output decreases, commutation occurs when the value set in P69–P70 is reached (Example: Set P60 = "Speed level", P69 = 50%, P70 = 10%; the digital output activation occurs when 50% of the preset maximum speed is reached; deactivation occurs when 40% is reached). If P70 = 0, commutation occurs when the value set in P69 is reached. Open Collector MDO digital output set as "PID Max Out" and "PID Min Out" determines the value for the digital output deactivation. The digital output activates when PID regulator output (expressed as a percentage) reaches the value set for P90 "PID Max Out" and P89 "PID Min Out" respectively, and deactivates when the value set for P90 – P70 and P89 + P70 is reached (see Figure 6.6 and Figure 6.7)

P71 RL1 13/19	P	P71
level = *.*** %	R	0 ÷200%
	D	0 %
	F	Determines the value for the activation of relay digital output RL1 for the following settings: "Rmpout level", "Reference level", "Speed level", "Forward Running", "Reverse Running", "Tq out level", "Current level", "FB Max", "FB Min", "Speedout O.K." e "PID O.K.".

P72 RL1 14/19	P	P72
hyst. = *.*** %	R	0÷200%
	D	0 %
	F	When relay digital output RL1 is set as "Rmpout Level", "Reference Level", "Speed level", "Forward Running", "Reverse Running", "Tq out level", "Current level", "Speedout O.K.", "PID O.K.", "FB Max", "FB Min", this parameter determines the digital output hysteresis range. If the hysteresis is other than 0, the value set with P71 when the quantity set with P61 increases determines the output commutation; when the output decreases, commutation occurs when the value set in P71–P72 is reached (Example: Set P61 = "Speed level", P71 = 50%, P72 = 10%; the digital output activation occurs when 50% of the preset maximum speed is reached; deactivation occurs when 40% is reached). If P72 = 0, commutation occurs when the value set in P71 is reached. Relay digital output RL1 set as "PID Max Out" and "PID Min Out" determines the value for the digital output deactivation. The digital output activates when PID regulator output (expressed as a percentage) reaches the value set for P90 "PID Max Out" and P89 "PID Min Out" respectively, and deactivates when the value set for P90 – P72 and P89 + P72 is reached (see Figure 6.6 and Figure 6.7).

P73 RL2 15/19	P	P73
level = *.*** %	R	0 ÷200%
	D	5%
	F	Determines the value for the activation of relay digital output RL2 for the following settings: “Rmpout level”, “Reference Level”, “Speed level”, “Forward Running”, “Reverse Running”, “Tq out level”, “Current Level”, “FB Max”, “FB Min”, “Speedout O.K.” e “PID O.K.”.

P74 RL2 16/19	P	P74
hyst. = *.*** %	R	0÷200%
	D	2 %
	F	When relay digital output RL2 is set as “Rmpout Level”, “Reference Level”, “Speed level”, “Forward Running”, “Reverse Running”, “Tq out level”, “Current level”, “Speedout O.K.”, “PID O.K.”, “FB Max”, “FB Min”, this parameter determines the digital output hysteresis activation range. If the hysteresis is other than 0, the value set with P73 when the quantity set with P62 increases determines the output commutation; when the output decreases, commutation occurs when the value set in P73–P74 is reached (Example: Set P62 = “Speed level”, P73 = 50%, P74 = 10%; the digital output activation occurs when 50% of the preset maximum speed is reached; deactivation occurs when 40% is reached). If P74 = 0, commutation occurs when the value set in P73 is reached. Relay digital output RL2 set as “PID Max Out” and “PID Min Out” determines the value for the digital output deactivation. The digital output activates when PID regulator output (expressed as a percentage) reaches the value set for P90 “PID Max Out” and P89 “PID Min Out” respectively, and deactivates when the value set for P90 – P74 and P89 + P74 is reached (see Figure 6.6 and Figure 6.7).

P75 Lift 17/19	P	P75
level = *.*** %	R	0÷200%
	D	5%
	F	Error level between the ramp block output and the motor speed determining the output activation in mode Lift and Lift1.

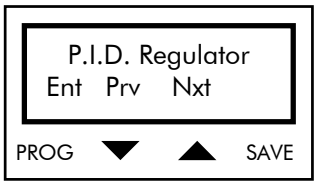
P76 Lift 18/19	P	P76
time = ***.* s	R	0÷60 s
	D	1 s
	F	Time interval for the activation of the output in mode Lift and Lift1 if the error between the ramp block output and the motor speed exceeds the value set in P75.

P77 Torque 19/19	P	P77
lift = *** %	R	0÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 7.4)
	D	100%
	F	Torque value for the output activation in mode Lift.

7.2.9. PID REGULATOR SUBMENU

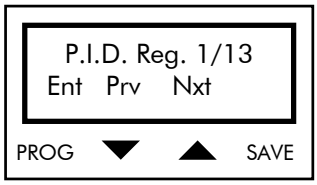
The PID Regulator submenu includes PID regulator adjusting parameters.

Access page



Press PROG (Ent) to access the first page of the PID Regulator submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the PID Regulator submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE PID REGULATOR SUBMENU

P85 Sampling 2/13	P	P85
Tc = ***	R	0.002÷4s
	D	0.002s
	F	Duty cycle of PID regulator (e.g. set 0.002S to execute PID regulator every 0.002S).

P86 Prop. 3/13	P	P86
gain = ***	R	0÷31.9
	D	1
	F	Multiplicative constant of PID regulation proportional term. PID regulator output % is equal to the difference between reference and feedback expressed as a value percent multiplied by P86.

P87 Integr. 4/13	P	P87
Time = ** Tc	R	3÷1024 Tc
	D	512 Tc
	F	Constant dividing PID regulator integral term. It is expressed as a multiple value of the sampling time. Set Integr. Time = NONE (value following 1024) to override integral action.

P88Deriv. 5/13	P	P88
Time = *** Tc	R	0÷4 Tc
	D	0 Tc
	F	Constant multiplying PID regulator derivative term. It is expressed as a multiple value of the sampling time. Set Deriv. Time = 0 to override derivative action.

P89 PID min 6/13	P	P89
Out. = ***.** %	R	–100÷+100 %
	D	0%
	F	Minimum value of PID regulator output.

P90 PID max 7/13	P	P90
Out. = ***.** %	R	–100÷+100 %
	D	100%
	F	Maximum value of PID regulator output.

P91 PID Ref. 8/13	P	P91
acc. = *.*** s	R	0÷6500 s
	D	0 s
	F	Rise ramp of PID regulator reference.

P92 PID Ref. 9/13	P	P92
dec. = *.*** s	R	0÷6500 s
	D	0 s
	F	Fall ramp of PID regulator reference.

P93 Ref. 10/13	P	P93
thresh = *.***	R	0÷200 %
	D	0%
	F	Value of the reference (speed or torque reference depending on C15 setting) with respect to the maximum reference activating PID regulator integral term.

P94 Integr. 11/13	P	P94
MAX = ***.** %	R	0÷100 %
	D	100 %
	F	Maximum value of PID regulator integral term.

P95 Deriv. 12/13	P	P95
MAX = ***.** %	R	0÷20 %
	D	10 %
	F	Maximum value of PID regulator derivative term.

P96 PID dis. 13/13	P	P96
time =***s	R	0÷60000 Tc
	D	0 Tc
	F	The inverter stops if the output value of PID regulator remains equal to the minimum value (parameter P89) for the time set in P96. Set P96 to 0 Tc to disable this function.

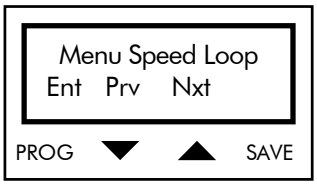
NOTE

For further details on how to use functionality of the PID REGULATOR menu, see the PID REGULATOR section.

7.2.10. SPEED LOOP SUBMENU

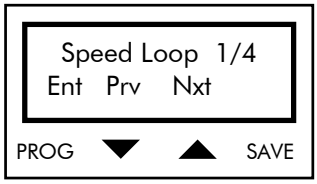
The Speed Loop submenu includes the parameters relating to speed regulator adjustment.

Access page



Press PROG (Ent) to access the first page of the PID Regulator submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Speed Loop submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE SPEED LOOP SUBMENU

P100 Spd Prop2/4	P	P100
gain = ***	R	0÷32
	D	5.0
	F	Defines the value of speed regulator proportional term.

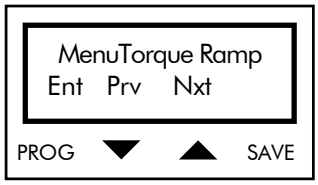
P101 Spd Int 3/4	P	P101
time = ***s	R	0÷10 s – NONE
	D	0.5 s
	F	Defines the value of speed regulator integral time. Set "NONE" to disable integral term.

102 ZeroSpd 4/4	P	P102
const = ***%	R	0÷500%
	D	100%
	F	Multiplicative constant of the proportional term, which is applied with a speed reference = 0 and the START contact (terminal 7) open.

7.2.11. TORQUE RAMPS SUBMENU

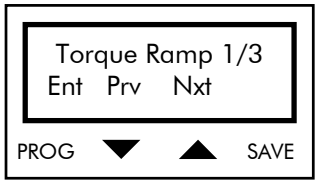
The Torque Ramps submenu contains the parameters relating to rise ramps and fall ramps to be entered in the torque reference.

Access page



Press PROG (Ent) to access the first page of the Torque Ramp submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Torque Ramp submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE TORQUE RAMPS SUBMENU

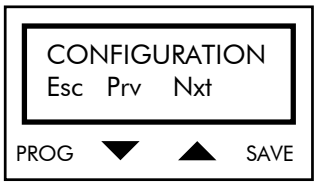
P105 Ramp Up 2/3	P	P105
Time = ***s	R	0÷6500s
	D	0s
	F	Determines the rise ramp time of the torque reference.

P106 Ramp Dn 3/3	P	P106
Time = ***s	R	0÷6500s
	D	0 s
	F	Determines the fall ramp time of the torque reference.

7.3. CONFIGURATION MENU

The Configuration menu contains the Cxx parameters that can be altered when the inverter is not running. P00 must always be =1 (default) to enable parameter alteration.

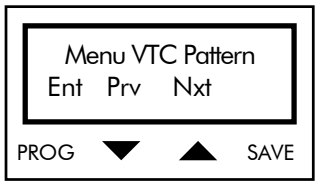
First page



Press PROG (Esc) to return to the page for the selection of the main menus; press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

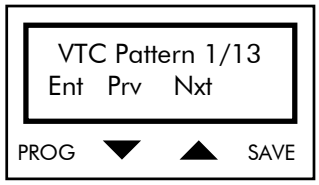
7.3.1. VTC PATTERN SUBMENU

The VTC Pattern submenu includes the parameters relating to vector sensorless control. See also the SENSORLESS VECTOR CONTROL (VTC SW only) section.
Access page



Press PROG (Ent) to access the first page of the VTC Pattern submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the VTC Pattern submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE VTC PATTERN SUBMENU

C01 VTC Patt. 2/13	P	C01
fmot = **.** Hz	R	5÷150 Hz
	D	50 Hz
	F	Motor rated frequency. Determines the speed for the commutation to flux weakening operating mode.

C02 VTC Patt. 3/13	P	C02
spdmax = *** rpm	R	100÷C06*3 limited to 9000 rpm
	D	1500 rpm
	F	Maximum allowable speed. Speed corresponding to the maximum reference value.

C03 VTC Patt. 4/13	P	C03
V mot = *** V	R	5÷500V
	D	230V for class 2T.
	D	400V for class 4T.
	F	Motor rated voltage.

C04 VTC Patt. 5/13	P	C04
P.nom. = *** kW	R	25% to 200% of column “C04 default”, Table 7.4
	D	Column “C04 default”, Table 7.4
	F	Motor rated power.

C05 VTC Patt. 6/13	P	C05
I mot. = *** A	R	25% to 100% of column “Inom”, Table 7.4
	D	Column “C05 default”, Table 7.4
	F	Motor rated current.

C06 VTC Patt. 7/13	P	C06
Spd nom = *** rpm	R	0÷9000 rpm
	D	1420 rpm
	F	Motor rated speed at frequency set with C01.

C07 Stator 8/13	P	C07
Resist. = *** ohm	R	0÷30 ohm
	D	Column "C07 default", Table 7.4
	F	Stator winding resistance. With a star connection, C07 corresponds to the resistance value of one phase (half the resistance value measured between two terminals); with a delta connection, C07 corresponds to 1/3 of the phase resistance (half the value measured between two terminals).

C08 Rotor 9/13	P	C08
Resist. =**. *** ohm	R	0÷30 ohm
	D	Column "C08 default", Table 7.4
	F	Rotor winding resistance. With a star connection, C08 corresponds to the resistance value of one phase (half the resistance measured between two terminals); with a delta connection, C08 corresponds to 1/3 of the phase resistance (half the value measured between two terminals).

C09 Leakage 10/13	P	C09
Induct. = *** mH	R	0÷100 mH
	D	Column "C09 default", Table 7.4
	F	Value of the motor full leakage inductance. With a star connection, this value corresponds to the full inductance of one phase; with a delta connection, it corresponds to 1/3 of the full inductance of one phase.

C10 Autotun 11/13	P	C10
[NO] YES	R	NO, YES
	D	NO
	F	Choose YES to enable autotuning, which will be activated when ENABLE contact closes (terminal 6).

C11 Torque 12/13	P	C11
Boost = *** %	R	0÷50%
	D	0%
	F	Increases stator resistance at low speed.

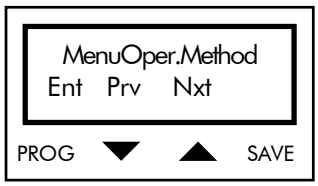
C12 Stator2 13/13	P	C12
Resist. = *** ohm	R	0÷30 ohm
	D	0 ohm
	F	Resistors of stator winding with a negative speed. In standard applications, this value is to be set to 0 (if C12=0, the value set in C07 is used in any operating mode).

VTC

7.3.2. OPERATION METHOD SUBMENU

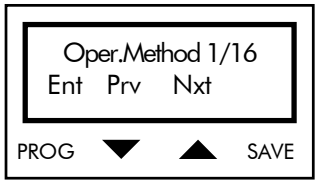
The Operation Method submenu determines the inverter control mode.

Access page



Press PROG (Ent) to access the first page of the Operation Method submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Operation Method submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE OPERATION METHOD SUBMENU

C14 Op. Meth. 2/16	P	C14
START = ***	R	Term Kpd Rem
	D	Term
	F	Defines the source of the START command and the multifunction digital inputs. Term: terminal board (the START command and the command relating to multifunction digital inputs are sent via terminal board) Kpd: keypad (the START command is sent via keypad, see the COMMANDS MENU; terminal 7 is inactive; all other digital inputs are active). Rem: the START command and the commands relating to multifunction digital inputs are sent via serial link.

NOTE

The inverter runs only if terminal 6 is active.
Therefore, terminal 6 must ALWAYS be closed, independently of par. C14 programming.

C15 Op. Meth. 3/16	P	C15
Command = ***	R	Speed, Torque
	D	Speed
	F	Determines main reference configuration: Speed: speed reference (enters the speed loop as a setpoint and is compared to the speed feedback); Torque: torque reference (enters directly downstream of the speed loop).

C16 Op. Meth. 4/16	P	C16
REF = ***	R	Term, Kpd, Rem
	D	Term
	F	Defines the source of speed/torque main reference; Term: terminal board (main reference is to be sent to terminals 2, 3, or 21) Kpd: keypad (main reference is sent via keypad, see the COMMANDS MENU). Rem: main reference is sent via serial link.

C17 Op. Meth. 5/16	P	C17
MDI1 = ***	R	Mlts1, Up, Stop, Slave
	D	Mlts1
	F	Determines functionality of multifunction input 1 (terminal 9). Mlts1: multispeed input 1 Up: Speed reference increment key (P24 allows the new value to be stored at power off) Stop: Stop button (use along with Start contact – terminal 7 – which also behaves as a button) Slave: Slave command

C18 Op. Meth. 6/16	P	C18
MDI2= ***	R	Mlts2, Down, Slave, Loc/Rem
	D	Mlts2
	F	Determines functionality of multifunction input 2 (terminal 10). Mlts2: multispeed input 2 Down: output function decrement key (P24 allows the new value to be stored at power off). Loc/Rem: setting in Keypad position

C19 Op. Meth. 7/16	P	C19
MDI3= ***	R	Mlts3, CW/CCW, DCB, REV, A/M, Lock, Slave, Loc/Rem
	D	Mlts3
	F	Determines functionality of multifunction input 3 (terminal 11). Mlts3: multispeed input 3 CW/CCW: reversal of the direction of rotation DCB: direct current braking command REV: reverse rotation command A/M: PID regulator deactivation command Lock: keypad lock command Loc/Rem: setting in Keypad position

VTC

C20 Op. Meth. 8/16	P	C20
MDI4= ***	R	Mltr1, DCB, CW/CCW, REV, A/M, Lock, Slave, Loc/Rem
	D	CW/CCW
	F	Determines functionality of multifunction input 4 (terminal 12). Mltr1: variation of acceleration/deceleration ramp time DCB: direct current braking command CW/CCW: reversal of the direction of rotation REV: reverse rotation command A/M: PID regulator deactivation command Lock: keypad lock command Loc/Rem: setting in Keypad position

C21 Op. Meth. 9/16	P	C21
MDI5= ***	R	DCB, Mltr2, CW/CCW, ExtA, REV, Lock, Slave
	D	DCB
	F	Determines functionality of multifunction input 5 (terminal 13). DCB: direct current braking command Mltr2: variation of acceleration/deceleration ramp time CW/CCW: reversal of the direction of rotation Ext A: auxiliary trip (external alarm) REV: reverse rotation command Lock: keypad locked Slave: Slave command

C22 PID 10/16	P	C22
Action = ***	R	Ext, Ref, Add Ref
	D	Ext
	F	Determines PID regulator action: Ext: PID regulator independent of the inverter operation Ref: PID regulator output represents the reference Add Ref: PID regulator output is summed up to the reference

C23 PID 11/16	P	C23
Ref. = ***	R	Kpd, Vref, Iref, Inaux, Rem
	D	Kpd
	F	Determines the source of PID regulator reference: Kpd: keypad. Vref: voltage terminals (terminals 2 and 3). Iref: current terminals (terminal 21). Inaux: voltage terminals through auxiliary input (terminal 19). Rem: serial link.

NOTE Setting C23=Vref deletes the speed reference from Term.

C24 PID 12/16	P	C24
F.B. = ***	R	Inaux, Vref, Iref, Iout
	D	Inaux
	F	Determines the source of PID regulator feedback: Inaux, voltage terminals through auxiliary inputs (terminal 19). Vref, voltage terminals (terminals 2 and 3). Iref: current terminals (terminal 21). Iout: feedback is the inverter output current.

NOTE Setting C24=Vref deletes the speed reference from Term.

C25 Encoder 13/16	P	C25
***	R	NO, YES, YES A
	D	NO
	F	Determines the source of speed feedback: NO – through inverter processing YES – encoder board ES836 (optional board – See the Sinus K's Installation Instructions Manual) YES A – see YES, but with a different control algorithm

C26 Encoder 14/16	P	C26
pulse = ***	R	100÷10000
	D	1024
	F	Number of the encoder pulses per revolution.

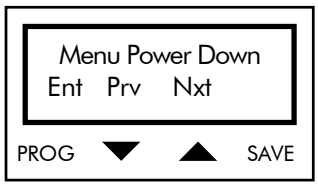
C27 Delay 15/16	P	C27
Run spd = *** rpm	R	0÷1500 rpm
	D	0 rpm
	F	If this speed value is not increased, no start command is acknowledged after a stop command until the deceleration ramp is over, time set in C51 is over and the inverter is disabled. Set C27=0 to disable this function. If C51 is set to 0, the run command is locked because the sequence cannot be terminated. Always set C51 other than 0 when using this function.

C28 PIDinv.16/16	P	C28
[NO] YES	R	NO, YES
	D	NO
	F	If C28=YES is programmed, it adds a unit negative gain to the PID loop, i.e. it inverts the PID error (see the PID REGULATOR section).

7.3.3. POWER DOWN SUBMENU

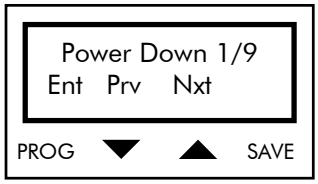
The Power Down submenu contains operating parameters for power down operation in case of mains failure.

Access page



Press PROG (Ent) to access the first page of the Power Down submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Power Down submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE POWER DOWN SUBMENU

C32 Power D. 2/9	P	C32
***	R	NO, YES, YES V
	D	NO
	F	Enables motor power down in case of mains failure: NO: function disabled YES: motor power down in case of mains failure once the time set in C36 is over. YES V: like YES, with an automatic deceleration ramp to keep DC voltage constant at the value set in C33 with C34 (proportional) and C35 (integral).

C33 Voltage 3/9	P	C33
level = *** V	R	200÷800 V
	D	368 V (class 2T)
	D	640 V (class 4T)
	F	DC voltage value during power down.

C34 Voltage 4/9	P	C34
kp = ***	R	0÷32.000
	D	512
	F	Proportional constant for DC voltage adjusting loop.

C35 Voltage 5/9	P	C35
ki = ***	R	0÷32.000
	D	512
	F	Integral constant for DC voltage adjusting loop.

C36 PD Delay 6/9	P	C36
time = *** ms	R	5÷255 ms
	D	10 ms
	F	Period that has to elapse before power down activation in case of mains failure.

C37 PD Dec. 7/9	P	C37
time = **.**	R	0.1÷6500 s
	D	10 s
	F	Deceleration ramp during power down.

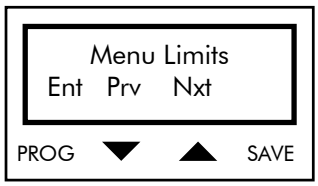
C38 PD Extra 8/9	P	C38
dec = *** %	R	0÷500 %
	D	200 %
	F	Speeding of deceleration ramp during the first stage of power down condition.

C39 PD Link 9/9	P	C39
der = *** %	R	0÷300 %
	D	0 %
	F	Speeds up mains failure detection to enable motor power down.

7.3.4. LIMITS SUBMENU

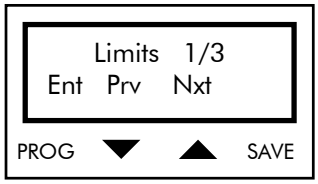
The Limits submenu determines the operation of current limit.

Access page



Press PROG (Ent) to access the first page of the Limits submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Limits submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE LIMITS SUBMENU

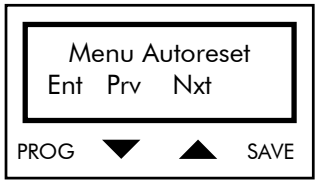
C42 Torque 2/3	P	C42
run. = ***%	R	50÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see section CONFIGURATION TABLE FOR VTC SW PARAMETERS)
	D	See section CONFIGURATION TABLE FOR VTC SW PARAMETERS (HEAVY overload)
	F	Torque limit expressed as a percentage of the motor rated torque (calculated based on VTC pattern menu parameters).

C43 Trq Var. 3/3	P	C43
[NO] YES	R	NO, YES
	D	NO
	F	Enables torque limit variation through INAUX.

7.3.5. AUTORESET SUBMENU

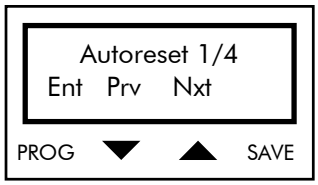
The Autoreset submenu enables the automatic reset of the equipment when alarms trip. Autoreset attempts may be set in a given time interval.

Access page



Press PROG (Ent) to access the first page of the Autoreset submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Autoreset submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE AUTORESET SUBMENU

C46 Attempts 2/4	P	C46
Number = *	R	0÷10
	D	0
	F	Determines the number of automatic reset operations performed before locking the function. Autoreset count starts from 0 after a time period longer than the one set in C52 is over.

NOTE If C46 = 0 is set, the autoreset function is locked.

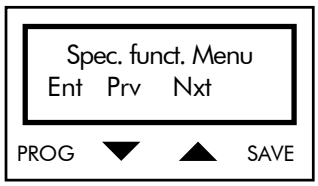
C47 Clear fail 3/4	P	C47
count time ***s	R	1÷999s
	D	300s
	F	Determines the time interval clearing the autoreset count if no alarm trips.

C48 PWR Reset 4/4	P	C48
[NO] YES	R	NO, YES
	D	NO
	F	Set to YES to automatically reset an alarm by switching off and on the inverter.

7.3.6. SPECIAL FUNCTIONS SUBMENU

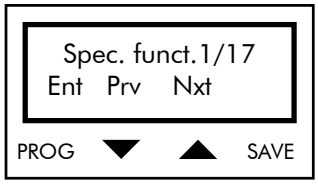
The Special Functions submenu includes the following:
– selection of the rated mains voltage;
– storage of mains failure alarm if mains failure causes the equipment power off
– operating mode of ENABLE command
– page displayed at power on
– multiplicative constant to be entered for PID regulator feedback display.

Access page



Press PROG (Ent) to access the first page of the Special Functions submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Special Functions submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE SPECIAL FUNCTIONS SUBMENU

C49 MainsNom 2/17	P	C49
***	R	200÷240V cannot be altered (class 2T) 380÷480V, 481÷500V (class 4T)
	D	200÷240V (class 2T) 380÷480V (class 4T) Sets the range for the rated mains voltage. This parameters affects the following: UnderVoltage and OverVoltage alarms; Mains Loss alarm; Power Down control; braking unit control; voltage limit.

NOTE This parameter can be altered only for class 4T inverters.

C50 FanForce 3/17	P	C50
[NO] YES	R	NO, YES
	D	NO
	F	Fan startup forced. NO: Fan starts when heatsink temperature > 60°C; YES: Fan continuous operation.

CAUTION

This parameter is effective for inverter models where fans are controlled by the inverter control board ("P" or "N" appear in the relevant field – see the INVERTER RATINGS section).
This parameter has no effect for inverter models where fans are controlled directly from the power circuit ("B " or "S" appear in the relevant field).

C51 FluxDis. 4/17	P	C51
time = *** s	R	0÷1350 s
	D	0 s
	F	Time period after which the inverter automatically deactivates if terminal 6 closes, terminal 7 opens and reference drops to 0. Set this parameter to 0 to disable this function.

C52 Mains l.m 5/17	P	C52
[NO] YES	R	NO, YES
	D	NO
	F	Stores any alarm relating to mains failure (A30 and A31) causing the equipment power off. When power supply is restored, send a RESET command to reset the alarms tripped.

C53 ENABLE 6/17	P	C53
NO [YES]	R	NO, YES
	D	YES
	F	Operating conditions of ENABLE command (terminal 6) at power on or when a RESET command is sent: NO: ENABLE command deactivated at power on or after RESET; if terminals 6 and 7 are active and a speed reference is sent, at power on or after an alarm RESET, the motor does not start until terminal 6 is opened and closed again. YES: ENABLE activated at power on; if terminals 6 and 7 are active and a speed reference is sent, the motor starts at power on or after a few seconds a RESET command is sent.

DANGER

Setting parameter C53 to YES may start the motor as soon as the inverter is switched on.

C54 First 7/17	P	C54
page = ***	R	Keypad, Status
	D	Status
	F	Determines which pages are displayed at power on: Status: Access page to the main menus Keypad: Page relating to the command sent via keypad.

VTC

C55 First 8/17	P	C55
param. = ***	R	Spdref/Tq ref, Rmpout, Spdout, Tq dem, Tqout, Iout, Vout, Vmn, Vdc, Pout, Trm Bd, T Bd O, O.time, Hist.1, Hist.2, Hist.3, Hist.4, Hist.5, Aux. I, Pid Rf, Pid FB, Pid Er, Pid O., Feed B
	D	Spdout
	F	Determines the variable displayed at power on when parameter C54 is set to Keypad: Spdref/Tq ref: M01 – Speed/torque reference value Rmpout: M02 – Reference value after ramp block Spdout: M03 – Motor speed value Tq dem: M04 – Torque demand Tqout: M05 – Output torque Iout: M06 – Output current value Vout: M07 – Output voltage value Vmn: M08 – Mains voltage value Vdc: M09 – DC link voltage value Pout: M10 – Value of the power delivered to the connected load Trm Bd: M11 – Digital input state T Bd O: M12 – Digital output state O. time: M13 – Time period of RUN mode after startup Hist.1: M14 – Last alarm tripped Hist.2: M15 – Last–but–one alarm tripped Hist.3: M16 – Last–but–two alarm tripped Hist 4: M17 – Last–but–three alarm tripped Hist.5: M18 – Last–but–four alarm tripped Aux I: M19 – Auxiliary input value Pid Rf: M20 – PID regulator reference value Pid FB: M21 – PID regulator feedback value Pid Er: M22 – Difference between reference and feedback of PID regulator Pid O: M23 – PID regulator output Feed B.: M24 – Value assigned to PID regulator feedback signal.

C56 Feedback 9/17	P	C56
Ratio = *.***	R	0.001÷50.00
	D	1
	F	Determines proportionality constant between the value displayed for parameter M24 and the absolute value of PID regulator feedback signal (M21).

C57 Brk Boost 10/17	P	C57
NO [YES]	R	NO, YES
	D	YES
	F	Increases motor flux during deceleration ramps with DC voltage increase.

C58 OV Ctrl 11/17	P	C58
NO [YES]	R	NO, YES
	D	YES
	F	Automatically controls deceleration ramp in case of excessive DC voltage.

C59 Brake 12/17	P	C59
disab. = ***** ms	R	0÷65400 ms
	D	18000 ms
	F	OFF time period of the built–in braking module. C59=0 braking module always ON; if also C60=0, braking module is always OFF.

C60 Brake 13/17	P	C60
enable = ***** ms	R	0÷65400 ms
	D	2000 ms
	F	ON time period of the built–in braking module. C68=0 braking module always OFF (independently of C59 value).

C61 Speed 14/17	P	C61
alarm = *** %	R	0÷200%
	D	0 %
	F	Alarm A16 trip (percentage of C02). The alarm threshold trip depends on formula C02+ C02*C61/100. If set to 0, this function is disabled.

C62 DCB ramp 15/17	P	C62
time = *** ms	R	2÷255 ms
	D	100 ms
	F	Flux decreasing ramp before DCB.

C63 Flux 16/17	P	C63
ramp = *** ms	R	30÷4000 ms
	D	300 ms for S05÷S30
	D	450 ms for S40÷S70
	F	Motor flux ramp.

C64 Flux 17/17	P	C63
delay = *** ms	R	0÷4000 ms
	D	0 ms
	F	Delay time after motor flux ramp before enabling motor startup. This parameter may be useful if contacts ENABLE (terminal 6) and START (terminal 7) are to be simultaneously closed.

NOTE

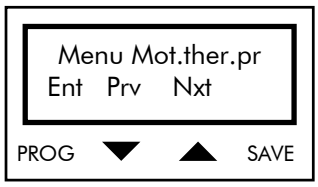
The entire time interval required for the motor fluxing is obtained by summing up the values of C63 and C64. The motor will start only after this time period is over.

VTC

7.3.7. MOTOR THERMAL PROTECTION SUBMENU

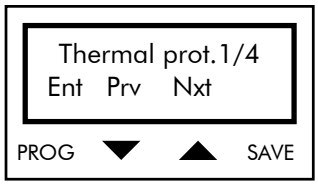
The Motor Thermal Protection submenu determines the parameters relating to the software thermal protection of the motor. See the MOTOR THERMAL PROTECTION section.

Access page



Press PROG (Ent) to access the first page of the Motor Thermal Protection submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Motor Thermal Protection submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE MOTOR THERMAL PROTECTION SUBMENU

C65 Thermal p.2/6	P	C65
prot. ***	R	NO, YES, YES A, YES B
	D	NO
	F	Activates the motor thermal protection. NO: Motor thermal protection disabled. YES: Motor thermal protection enabled with pick–up current independent of motor frequency. YES A: Motor thermal protection enabled with pick–up current depending on motor speed, with forced air–cooling system. YES B: Motor thermal protection enabled with pick–up current depending on motor speed, with a fan keyed to the motor shaft.

C66 Motor 3/6	P	C66
current =****%	R	1% ÷120%
	D	105%
	F	Determines the pick–up current expressed as a percentage of the motor rated current.

C67 M. therm.4/6	P	C67
const. =****s	R	5÷3600s
	D	600s
	F	Determines the motor thermal time constant.

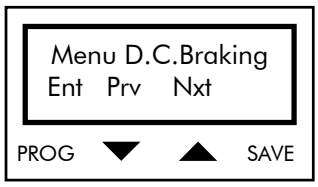
C68 Stall 5/6	P	C68
time = **s	R	0÷10s
	D	0s
	F	Determines the maximum allowable time of current limit at startup below speed value set with C69. Once this time period is over, a stall condition is acknowledged and another startup can be attempted (the inverter is disabled, waits for the time set in C51 + 4s and restarts). C68 =: function disabled.

C69 Stall 6/6	P	C69
speed =*** rpm	R	0÷200 rpm
	D	50 rpm
	F	If this speed value is not exceeded at startup by the time set in C68, antistall condition at startup takes place (see previous parameter).

7.3.8. D.C. BRAKING SUBMENU

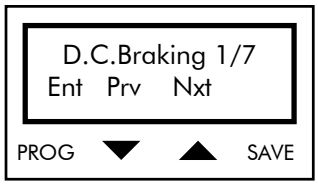
The D.C. Braking submenu includes the parameters relating to direct current braking. For more details, see the DC BRAKING section.

Access page



Press PROG (Ent) to access the first page of the D.C. Braking submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the D.C. Braking submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE D.C. BRAKING SUBMENU

C70 DCB Stop 2/7	P	C70
***	R	NO, YES, YES A, YES B
	D	NO
	F	Determines if DC braking is enabled at the end of the deceleration ramp and/or power down (if selected through parameter C32) as follows:

	At the end of the deceleration ramp	At the end of power down
NO	No	No
YES	Yes	No
YES A	Yes	Yes
YES B	No	Yes

C71 DCBStart 3/7	P	C71
[NO] YES	R	NO, YES
	D	NO
	F	Determines if DC braking is enabled before performing the acceleration ramp.

C72 DCB Time 4/7	P	C72
at STOP =*.**s	R	0.1÷50s
	D	0.5s
	F	Determines DC braking time period after the deceleration ramp and affects the formula expressing DC braking time period with a command sent via terminal board (see the DC Braking Command Sent Via Terminal Board section).

C73 DCB Time 5/7	P	C73
at Start =*.**s	R	0.1÷50s
	D	0.5s
	F	Determines DC braking time period before the acceleration ramp.

C74 DCB Spd 6/7	P	C74
at Stop =*** rpm	R	0÷300 rpm
	D	50 rpm
	F	Determines the motor speed for DC braking at stop and affects the formula expressing DC braking time period with a command sent via terminal board (see the DC Braking Command Sent Via Terminal Board section).

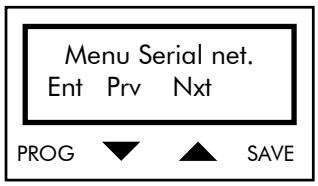
C75 DCB Curr 7/7	P	C75
Idcb =***%	R	1÷400% Important: the maximum programmable value is equal to (Imax/Imot)*100 (see Table 7.4)
	D	100%
	F	Determines DC braking intensity expressed as a percentage of the motor rated current.

VTC

7.3.9. SERIAL NETWORK SUBMENU

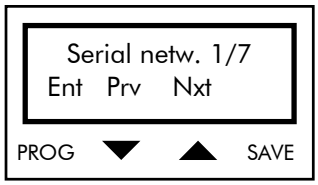
The Serial Network submenu determines the parameters relating to the serial link.

Access page



Press PROG (Ent) to access the first page of the Serial Network submenu. Press ↑ (Nxt) and ↓ (Prv) to scroll through the submenus.

First page



Press PROG (Esc) to return to the Serial Network submenu access page. Press ↑ (Nxt) and ↓ (Prv) to scroll through the parameters.

PARAMETERS OF THE SERIAL NETWORK SUBMENU

C80 Serial 2/7	P	C80
Address = *	R	1÷247
	D	1
	F	Determines the address assigned to the inverter networked through RS485.

C81 Serial 3/7	P	C81
Delay = *** ms	R	20÷500 ms
	D	0 ms
	F	Determines the delay between the master query and the inverter response.

C82 Watchdog 4/7	P	C82
[NO] YES	R	NO, YES
	D	NO
	F	When active, the inverter locks in remote control mode if no valid message is received within 5s. Alarm A40 “Serial communications error” is displayed.

C83 RTU Time 5/7	P	C83
out= *** ms	R	0÷2000 ms
	D	0 ms
	F	When the inverter is ready to receive, the message sent from the master is considered as complete and processed if no character is received within the time set through C83.

C84 Baud 6/7	P	C84
rate= *** baud	R	1200, 2400, 4800, 9600 baud
	D	9600 baud
	F	Sets the baud rate as bits per second.

C85 Parity 7/7	P	C85
***	R	None / 2 stop bit, Even / 1 stop bit, None / 1 stop bit
	D	None / 2 stop bit
	F	Defines parity (None or Even) and the stop bit number (1 or 2).

NOTE

Not all combinations are possible.
Odd parity cannot be set.

VTC

7.4. CONFIGURATION TABLE FOR VTC SW PARAMETERS

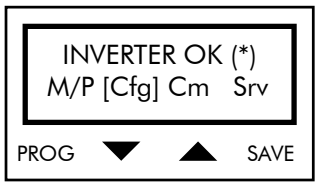
SIZE	MODEL	C04 (Pnom) def @ 4T [kW]	C05 (Imot) def [A]	Inom [A]	Imax [A]	C07 (Rs) def @ 4T [Ω]	C08 (Rr) def @ 4T [Ω]	C09 (Ls) def @ 4T [mH]	C42 (Ilimit) def [%]
S05	0005	3	6.4	10.5	11.5	2.500	1.875	30.00	150
	0007	4	8.4	12.5	13.5	2.000	1.500	25.00	150
	0008	[*]	8.5	15	16	[*]			150
	0009	4.5	9	16.5	17.5	1.600	1.200	16.00	150
	0010	[*]	11	17	19	[*]			150
	0011	5.5	11.2	16.5	21	1.300	0.975	12.00	150
	0013	[*]	13.2	19	21	[*]			150
	0014	7.5	14.8	16.5	25	1.000	0.750	8.00	150
	0015	[*]	15	23	25	[*]			150
S05/S10 /S12	0016	9.2	17.9	30	32	0.800	0.600	6.00	150
	0020	11	17.9	27	30	0.600	0.600	5.00	150
S10/ S12	0017	9.2	21	30	36	0.800	0.450	6.00	150
	0023	[*]	25.7	38	42	[*]			150
	0025	15	29	41	48	0.400	0.300	3.00	150
	0030	18.5	35	41	56	0.300	0.225	2.50	150
	0033	[*]	36	51	56	[*]			150
	0034	22	41	57	63	0.250	0.188	2.00	150
	0035	22	41	41	72	0.250	0.188	2.00	150
	0036	25	46	60	72	0.200	0.188	2.00	150
	0037	[*]	50	65	72	[*]			150
S15	0038	25	46	67	75	0.200	0.150	2.00	150
	0040	25	46	72	80	0.200	0.150	2.00	150
	0049	30	55	80	96	0.150	0.113	2.00	150
S20	0060	37	67	88	112	0.120	0.090	2.00	150
	0067	45	80	103	118	0.100	0.075	1.20	147
	0074	50	87	120	144	0.080	0.060	1.20	150
	0086	55	98	135	155	0.060	0.045	1.00	150
S30	0113	75	133	180	200	0.040	0.030	1.00	150
	0129	80	144	195	215	0.040	0.030	1.00	149
	0150	90	159	215	270	0.030	0.023	1.00	150
	0162	110	191	240	290	0.020	0.015	1.00	150
S40	0179	120	212	300	340	0.018	0.014	1.00	120
	0200	132	228	345	365	0.018	0.014	0.90	120
	0216	150	264	375	430	0.015	0.011	0.80	120
	0250	185	321	390	480	0.012	0.009	0.60	120
S50	0312	220	375	480	600	0.012	0.009	0.56	120
	0366	250	421	550	660	0.010	0.008	0.40	120
	0399	280	480	630	720	0.010	0.008	0.30	120

[*] This model is available for class 2T only.

8. DIAGNOSTICS

8.1. INVERTER OPERATING CONDITIONS

When the inverter runs smoothly, the following messages are displayed in the main menu page:
1) if the output frequency (IFD SW) or the motor speed (VTC SW) is equal to zero:

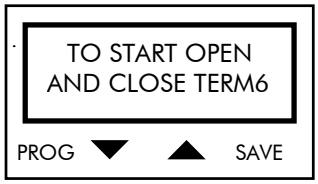


This occurs if the inverter is disabled (IFD SW and VTC SW) or no run command is sent or the frequency reference is equal to zero (IFD SW).

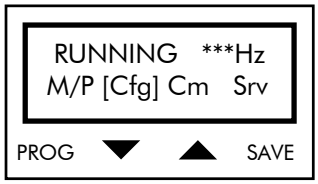
CAUTION

If an asterisk (*) appears next to INVERTER OK on the display, the product guarantee is no longer valid (IFD SW only).
The asterisk appears if at least one condition requiring the activation of a protection feature occurs when the inverter is running in Fire Mode.

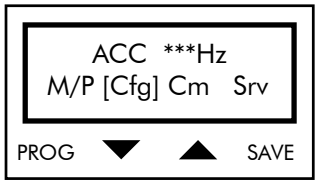
2) If the equipment is enabled when the ENABLE input is closed and parameter C61 (IFD SW) or C53 (VTC SW) is set to [NO], the following message is displayed:



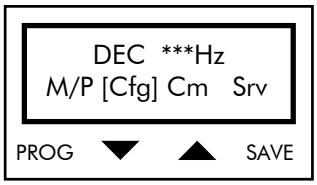
3) If the output frequency is constant, other than zero and equal to the reference (IFD SW) or the inverter is in RUN mode, the ramp block is constant and equal to the reference (VTC SW):



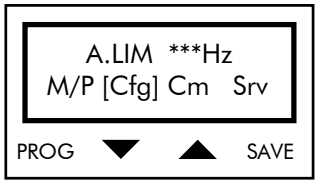
4) If the inverter is accelerating:



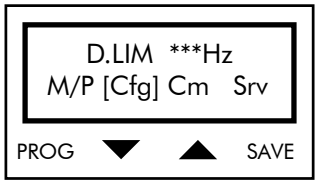
5) If the inverter is decelerating:



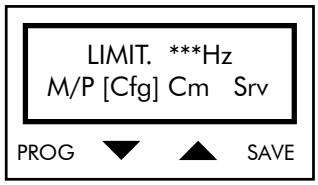
6) If the output frequency (IFD SW) or the motor speed (VTC SW) is constant while accelerating due to current limit activation (IFD SW) or torque limit activation (VTC SW) while accelerating:



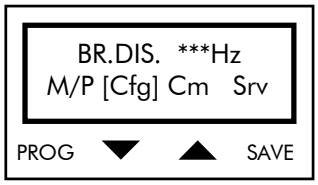
7) If the output frequency (IFD SW) or the motor speed (VTC SW) is constant while decelerating due to current limit or voltage activation (IFD SW) or torque limit activation (VTC SW) while decelerating :



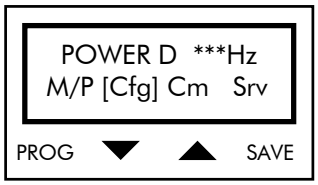
8) If the output frequency (IFD SW) or the motor speed (VTC SW) is under the reference value for current limit activation (IFD SW) or torque limit activation (VTC SW) at constant frequency:



9) When the operation of built–in braking module exceeds the time periods set through parameters C67/C68 (IFD SW) or C59/C60 (VTC SW):

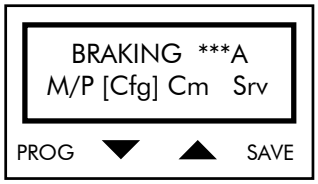


10) With POWER DOWN (see the POWER DOWN section):

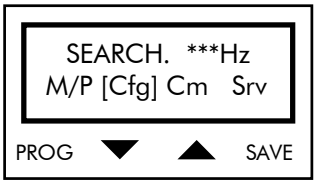


NOTE NOTE: Steps 3) 4) 5) 6) 7) 8) 9) 10): VTC SW displays “rpm” instead of “Hz”

11) During DC braking (see the DC BRAKING section):

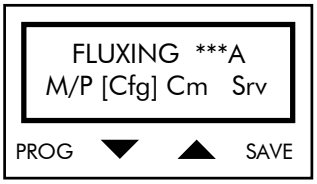


12) If the inverter is performing SPEED SEARCHING (IFD SW only) (see the SPEED SEARCHING (IFD SW only) section):

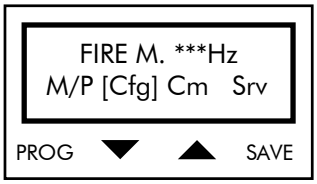


13) In case of motor parameter autotuning (VTC SW only):

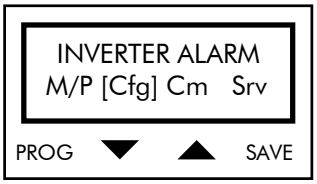
14) In case of motor fluxing (ENABLE closed and START open) (VTC SW only):



15) When the inverter is running in Fire Mode, once the output frequency set with parameter P38 (IFD SW only) is attained:



If faults occur, the display shows:



The display LEDs start flashing; alarm messages detailed in the ALARM MESSAGES section may be displayed.

NOTE

Factory setting: the inverter shuts off but the alarm is not cleared, as it is stored to EEPROM. The alarm tripped is displayed at next power on and the inverter is still locked. Close reset contact or press the RESET button.
Alarm reset is also possible by turning off and on the inverter and by setting parameter C53 to [YES] (SW IFD) or parameter C48 (VTC SW) to [YES] (PWR Reset).

8.2. ALARM MESSAGES

A01 Wrong Software

Even though jumpers J15 and J19 are consistently set up (see the SELECTING THE APPLICATION SW (IFD SW or VTC SW) section, the software version of the FLASH memory (human interface) is incompatible with the DSP version (motor control) (see the INVERTER RATINGS section).
SOLUTION: Contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE

A02 Wrong size

A wrong VTC SW size (> S50.) was selected through jumpers J15 and J19.
SOLUTION: Reset jumpers to IFD SW position (see the SELECTING THE APPLICATION SW (IFD SW or VTC SW) section); VTC SW cannot be set up for this inverter size.

A03 EEPROM absent

EEPROM is not installed, is blank or damaged. EEPROM memory contains all customized parameters.
SOLUTION: Check if EEPROM is properly installed (U45 in board ES778/2/2) and if jumper J13 is correctly positioned (pos. 1–2 for 28C64; pos. 2–3 for 28C16). If so, control board ES778/2 is to be replaced. Please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.

A04 Wrong user's par.

No Restore Default procedure occurred after switching to another application through jumpers J15 and J19.
SOLUTION: Do a Restore Default procedure (see the SELECTING THE APPLICATION SW (IFD SW or VTC SW) section).

A05 NO imp. opcode
A06 UC failure

Microcontroller failure.
SOLUTION: Reset the alarm. If the alarm condition persists, please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.

A11 Bypass circ. failure

Faulty relay or contactor for the short–circuit of precharge resistors for DC link capacitors.
SOLUTION: Reset the alarm. If the alarm condition persists, please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.

A15 ENCODER Alarm (VTC SW only)

Alarm A15 Encoder trips only if parameter C25 = [YES] or [YES A], when a difference between the expected speed and the measured speed is detected.
SOLUTION: Check to see if the encoder is not properly connected, is not energized or CHA and CHB are reversed. See also the Sinus K's Installation Instructions Manual for the encoder connection to optional board ES836.

A16 Speed maximum (VTC SW only)

Speed exceeds the maximum allowable value set through parameter C61. Set C61=0 to disable A16.

A18 Fan fault overtemperature

Heatsink overheated due to a locked fan.
SOLUTION: Replace fan.
If the alarm condition persists, please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.

A19 2nd sensor overtemperature

Heatsink overheated with fan off.
SOLUTION: Failure in the temperature and/or ventilation control devices. Please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.

A20 Inverter Overload

Output current exceeds the inverter rated current – persistent condition: Imax +20% for 3 seconds; Imax for 60 seconds (S40÷S65); Imax for 120 seconds (S05÷S30). See column "Imax", Table 6.4 (IFD SW) or 7.4 (VTC SW).
SOLUTION: Check the inverter output current under normal operating conditions (par. M03, MEASURE submenu) and any mechanical condition of the load (overload or load locked during duty cycle).

A21 Heatsink Overheated

Heatsink overheated with fan on.
SOLUTION: Make sure that the ambient temperature does not exceed 40°C, that motor current is properly programmed and that carrier frequency is not exceeding the application ratings (IFD SW only).

A22 Motor Overheated

Software thermal protection of the connected motor tripped. Output current has been exceeding the motor rated current for a long time.
SOLUTION: Check the load mechanical conditions. A22 trip depends on programming of parameters C70, C71, C72 (IFD SW) or C65, C66, C67 (VTC SW). Make sure that these parameters were properly set at the inverter startup (see the MOTOR THERMAL PROTECTION section).

A23 Autotune interrupted (VTC SW only)

Alarm A32 trips if ENABLE (terminal 6) opens before the autotuning procedure is over.

A24 Motor not connected (VTC SW only)

Alarm A24 trips during autotuning or DCB stage if the motor is not connected or does not match with the inverter size (rated power lower than minimum programmable value for C04).

A25 Mains loss (IFD SW only)

Mains failure. Alarm A25 is active only if parameter C34 is set to [YES] (factory setting is [NO]). This alarm may be delayed through parameter C36 (Power delay time).

A30 D.C. Link Overvoltage

DC link overvoltage.
SOLUTION: Make sure that supply voltage is not over 240Vac + 10% for class 2T or over 480Vac + 10% for class 4T.
A highly inertial load or a too short deceleration ramp may activate A30 (parameters P06, P08, P10, P12, RAMPS submenu). Increase deceleration ramp time or make use of resistive braking module if a short stop time is required.
A30 may trip even if the motor is pulled by the load (eccentric load). Make use of resistive braking module.

A31 D.C. Link Undervoltage

Supply voltage has dropped below 200Vac – 25% for class 2T or below 380Vac – 35% for class 4T.
SOLUTION: Make sure that voltage is supplied to all three phases (terminals 32, 33, 34) and that the measured value is not under the above–mentioned voltage values.
A31 may trip even if supply voltage temporarily drops below 200VAC (e.g. load direct connection).
If voltage values are normal, please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.

A26 SW Running overcurrent
A32 Running overcurrent

Instant current limit at constant speed. This alarm trips in case of sudden load variations, output short–circuit or ground short–circuit, disturbance and radiated interference.
SOLUTION: Make sure that no short–circuit is present between two phases or a phase and the grounding connection at the inverter output (terminals U, V, W) (for a quick inspection, disconnect the motor and operate the inverter in no–load condition).
Make sure that command signals are sent to the inverter through screened cables where required (see the "WIRING" section in the Sinus K's Installation Instructions Manual).
Check wiring and antidisturbance filters on contactor and solenoid valve coils installed in the cabinet (if any).
Decrease torque limit value if required (C42).

A28 SW Accel. overcurrent
A33 Accelerating overcurrent

Instant current limit while accelerating.
SOLUTION: See alarms A26 and A32. Alarm A33 may also trip when a too short acceleration ramp is programmed. If so, set longer acceleration time periods (P05, P07, P09, P11, RAMPS submenu) and decrease BOOST and PREBOOST (V/F PATTERN submenu, parameters C10 and C11, or parameters C16 and C17 if the second V/F pattern is used) for IFD SW. Decrease torque limit value (C42) for VTC SW.

A29 SW Decel. overcurrent
A34 Decelerating overcurrent

Instant current limit while decelerating.
SOLUTION: This alarm trips if a too short deceleration ramp is programmed. If so, set longer deceleration time periods (P06, P08, P10, P12, RAMPS submenu) and decrease BOOST and PREBOOST (V/F PATTERN submenu, parameters C10 and C11, or parameters C16 and C17 if the second V/F pattern is used) for IFD SW. Decrease torque limit value (C42) for VTC SW.

A27 SW Searching overcurrent (IFD SW only)
A35 Searching overcurrent (IFD SW only)

Instant current limit during speed searching stage due to opening and closing of ENABLE contact (terminal 6).
SOLUTIONS: Make sure that the command sequence is correct (see the SPEED SEARCHING (IFD SW only) section).

A36 External Alarm

Opening of terminal 13 (MDI5) set as Ext.A with parameter C27 (IFD SW) or C21 (VTC SW).
SOLUTION: Find out the reason why the contact connected to terminal 13 opens during ordinary operation.
NOTE: The same alarm message is displayed when PTC opens (see the Motor Thermal Protection Input (PTC) section).

A40 Serial comm. error

The inverter in remote mode (C21 or C22=Rem for IFD software or C14 or C16=Rem for VTC software) has not received any valid messages from the serial link for at least 5 seconds. The alarm is ON only if parameter C92 (IFD SW) or C82 (VTC SW) "Watch Dog" is set to [YES] and if ENABLE (terminal 6) is closed.
SOLUTION: If the inverter is remote–controlled by a master device, make sure that the master device cyclically sends at least one legal message (“read” message or “write” message) within 5 seconds.

Not recognized failure

Unknown alarm.
SOLUTION: Reset the alarm. If the alarm condition persists, please contact ELETTRONICA SANTERNO’s AFTER–SALES SERVICE.

8.3. DISPLAY and LEDs

Additional alarm messages exist, that can be displayed or indicated by the LEDs located in control board ES778. The display always shows "POWER ON" or "LINK MISMATCH" instead of the display pages covered in this manual.
See table below:

VL LED	IL LED	Failure
Off	Off	Fault of the microcontroller in the control board or no communication link between inverter and keypad
Blinking	Off	Communication failure between microcontroller and DSP in the control board
Off	Blinking	Errors occurred in the RAM (U47) in the control board
Blinking	Blinking	User interface (FLASH – see jumper J15) is set up with a different SW type than the motor control (DSP – see jumper J19) (IFD SW for FLASH and VTC SW for DSP or viceversa)

Do the following:

Turn off and on the inverter. If the alarm conditions persist, please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE to replace control board ES778/2.

9. SERIAL COMMUNICATIONS

9.1. GENERAL FEATURES

Inverters of the SINUS K series may be connected to other devices through a serial link. This allows reading (download) and writing (upload) the parameters accessed through remotable keypad.

Elettronica Santerno also supplies the RemoteDrive software package for the inverter control through a computer connected via serial link.

The RemoteDrive offers the following functions: image copy, keypad emulation, oscilloscope functions and multifunction tester, history data table compiler, parameter setting and data reception–transmission–storage from and to a computer, scan function for the automatic detection of the connected inverters (up to 247 connected inverters).

9.2. MODBUS–RTU PROTOCOL

Messages and data are sent by means of standard protocol MODBUS in RTU mode. This standard protocol performs control procedures using an 8–bit binary representation.
In RTU mode, a message begins with a silence interval equal to 3.5 times the transmission time of a character. If the character transmission stops for a time equal to 3.5 times the transmission time of a character, the controller will consider this time interval as the end of the message. Similarly, a message starting with a shorter silence time is considered as a part of the previous message.

Message beginning	Address	Function	Data	Error control	End of message
T1–T2–T3–T4	8 bits	8 bits	n x 8 bits	16 bits	T1–T2–T3–T4

Use parameter C93 (TimeOut) (IFD SW) or parameter C83 (VTC SW) to increase the silence time interval up to max. 2000ms.

Address

The address field acknowledges any value ranging from 1 to 247 as the address of the slave peripheral device. The master device queries the peripheral device specified in the address field; the peripheral device will respond with a message containing its address to let the master device know the slave source of the response. A master device query with a 0 address is addressed to all slave devices, which will not respond at all (broadcast mode).

Function

The function related to the message may be chosen within the legal field ranging from 0 to 255. A response of the slave device to a message of the master device will simply return the function code to the master device if no error took place; otherwise, the most significant bit in this field is set to 1.
The only function allowed are 03h: Read Holding Register e 10h: Preset Multiple Register (see below).

Data

The data field contains any additional information for the function being used.

Error Control

The error control is performed with the CRC (Cyclical Redundancy Check) method. The16–bit value of the relevant field is computed when the message is sent by the transmitter and is then re–computed and checked by the receiver.

Register CRC is computed as follows:

1. Register CRC is set to FFFFh
2. Exclusive OR is executed between register CRC and the first 8 bits of the message; the result is saved to a 16–bit register.
3. This register is right–shifted of one place.
4. If the right bit is 1, exclusive OR is executed between the 16–bit register and value 1010000000000001b.
5. Steps 3 and 4 are repeated until 8 shifts are performed.
6. Exclusive OR is performed between the 16–bit register and the next 8 bits of the message.
7. Steps 3 to 6 are repeated until all message bytes are processed.
8. The result is a CRC, that is attached to the message by sending the less significant byte as the first byte.

Supported Functions

03h: Read Holding Register

Allows reading the register state of the slave device. This function does not allow the broadcast mode (address 0). Additional parameters are the address of the basic digital register to be read and the output number to be read.

QUERY	RESPONSE
Slave address	Slave address
Function 03h	Function 03h
Register address (high)	Byte number
Register address (low)	Data
Register No. (high)	…
Register No. (low)	Data
Error correction	Error correction

10h: Preset Multiple Register

Allows setting the state of multiple registers for the slave device. In broadcast mode (address 0), the state of those registers is set in all connected slave devices. Additional parameters are the basic register address, the number of registers to be set, the relevant value and the number of bytes used for the data items.

QUERY	RESPONSE
Slave address	Slave address
Function 10h	Function 10h
Register addr. (Hi)	Register addr. (Hi)
Register addr. (Lo)	Register addr. (Lo)
Register No. (Hi)	Register No. (Hi)
Register No. (Lo)	Register No. (Lo)
Byte number	Error correction
Register value (Hi)	
Register value (Lo)	
…	
Register value (Hi)	
Register value (Lo)	
Error correction	

Error Messages

If a message error is detected, the inverter will send a message to the master:

Slave address	Function (MSB = 1)	Error code	Error correction

The error code meaning is the following:

CODE	NAME	DESCRIPTION
01h	ILLEGAL FUNCTION	The function is not implemented in the slave device (different from 03h and 10h)
02h	ILLEGAL DATA ADDRESS	The specified address is illegal for the slave device (1: you attempted to write a Read Only parameter; 2: the address is not included in the lists that follow)
03h	ILLEGAL DATA VALUE	The value is not allowable for the specified location (it does not range between the values stated in Min / Max columns)
06h	SLAVE DEVICE BUSY	The slave cannot accept writing (1: you attempted to write a Cxx parameter when the inverter was in RUN mode; 2: a long-lasting operation is occurring, e.g. Restore Default)

9.3. GENERAL FEATURES and EXAMPLES

Parameters are queried along with the reading performed through the inverter keypad and display. Parameter alteration is also managed along with the inverter keypad and display. Not that the inverter will always use the latest value set (sent both via serial link or from the inverter itself).

When writing (10h function: Preset Multiple Register), the inverter will check value ranges only if failures may occur. If illegal ranges are detected, the inverter will respond with the error message 03h=ILLEGAL DATA VALUE (see above).

Data are read/written as 16–bit, full data (words) based on scaling factors (K) stated in the tables below.

9.3.1. SCALING

The scaling constant (K) is like follows:

true value = value read by MODBUS / K
value written to MODBUS = true value * K

IFD SW Example:

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P05	TAC1	Acceleration time 1	0	0	10	0.1	6500	10	s
P06	TDC1	Deceleration time 1	1	1	10	0.1	6500	10	s

Because K=10, a reading of address 0 with a value equal to 100 (dec) is to be intended as acceleration time 1 equal to 100/10=10s

Vice versa, to set a deceleration time 1 equal to 20s, send value 20*10=200 (dec) to address 1 via serial link.

Some variables related to the inverter size (current) and/or class (voltage) are grouped as follows:

Table T000[]: index (SW3) at address 477 (1DDh)

	I full scale (A)	Max freq out (Hz)	Def carrier	Max carrier	Def preboost
	T000[0]	T000[1]	T000[2]	T000[3]	T000[4]
0	25	800	7	12	1
1	50	800	7	12	1
2	65	800	5	12	1
…	…	…	…	…	…

Table reading:

	Name	Description	Addr. (dec) READ	Addr. (hex) READ	Min	Max	K	Unit of measure
M03	IOUT	Output current	1026	402			50*65536/(T000[0]*1307)	A

Because K=50*65536/(T000[0]*1307), do the following to convert current reading to A:

1) read address 477 (dec) for "I full–scale"; the result is the index of array T000[]. For this parameter, consider column T000[0], as other columns refer to different parameters. One reading is sufficient;
2) read address 1026 (dec).

If address 477 reading returns "2" (⇒ 65A) and if address 1026 returns "1000", output current will be equal to 1000 / K = 1000 / (50*65536/(T000[0]*1307)) = 1000 / (50*65536/(65*1307)) = 25.9 A.

9.3.2. BIT PARAMETERS

Bit parameters are different in reading and writing.
For example, parameter P39 of IFD SW:

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
P39	MS. FUNCTION	Use of parameters P40 – P54	512	200	772.0	304.0	0	0	1

To read parameter P39, just read address 772 (dec) and parse bit 0 of the return value (0=LSB, 15=MSB).
To set P39, write 1 to address 512 (dec); write 0 to the same address to reset P39.
For peculiar reading/writing, refer to Notes in the following tables.

9.3.3. SUPPORT VARIABLES

For very long formulas, you can use support variables to split them into two or multiple simpler forms. The example below relates to parameter SP03 for VTC SW:

SP03	Serial Ref.	770	302	0	IF_C15=0_ –C02_ ELSE_–C42	IF_C15=0_ C02_ ELSE_C42	IF_C15=0_65536/76444 _ ELSE_C04*1000000/X999 *4	IF_C15=0_ rpm_ELSE_%
X999	Support variables						T000[0]*C06*1.27845	

formula C04*1000000/X999*4 is the same as C04*1000000/(T000[0]*C06*1.27845)*4.

10. PARAMETERS SENT VIA SERIAL LINK (IFD SW)

10.1. MEASURE PARAMETERS (Mxx) (Read Only)

	Name	Description	Addr. (dec) READ	Addr. (hex) READ	Min	Max	K	Unit of measure
M01	FREF	Current reference	1024	400			10	Hz
M02	FOUT	Output reference	1025	401			40	Hz
M03	IOUT	Output current	1026	402			50*65536/(T000[0]*1307)	A
M04	VOUT	Output voltage	1027	403			65536/2828	V
M05	VMN	Mains voltage	1028	404			512/1111	V
M06	VDC	Bus voltage	1029	405			1024/1000	V
M07	POUT	Output power	1030	406			5000*65536/(T000[0]*3573)	kW
M08	Term. B.	Digital inputs	768	300			Note 01	–
M09	TB Out	Digital outputs	774	306			Note 02	–
M10	NOUT	Motor speed	1025	401			40*C58/(120*C59)	rpm
M11	OP.T.	Operation time	1032 1033	408 409			5 Note 03	s
M12	1st alarm	Fault list 1	1034 1035	40A 40B			5 Note 04	s
M13	2nd alarm	Fault list 2	1036103 7	40C 40D			5 Note 04	s
M14	3rd alarm	Fault list 3	1038103 9	40E 40F			5 Note 04	s
M15	4th alarm	Fault list 4	1040104 1	410 411			5 Note 04	s
M16	5th alarm	Fault list 5	1042104 3	412 413			5 Note 04	s
M17	AUX I	Auxiliary analog input	1044	414			4096/ 100	%
M18	PID REF	Reference for PID regulator	1045	415			20	%
M19	PID FB%	Feedback for PID regulator (expressed as a percentage)	1046	416			20	%
M20	PID ERR	PID regulator error	1047	417			20	%
M21	PID OUT	PID regulator output	1048	418			20	%
M22	PID FB	PID regulator feedback	1046	416			20/C64	–

Note 01 State of digital inputs in the terminal board (1= active input) based on the table below:

bit	
0	MDI1
1	MDI2
2	MDI3
3	MDI4
4	START
5	ENABLE
6	MDI5
7	RESET

IFD

Note 02 State of digital outputs in the terminal board (1= active output) based on the table below:

bit	
2	OC
3	RL1
4	RL2

Note 03 Operation time is represented by a double word (32 bits). It is sent using two addresses formatted as follows: most significant word to higher address (1033); less significant word to lowest address (1032).

Note 04 Fault list is sent using two addresses formatted as follows:

	bit	
	15 8	7 0
higher address (e.g.1035)	Alarm number	Time instant – bit 23÷16
lower address (e.g. 1034)	Time instant – bit 15÷0	

Time instant relating to the alarm number is a 24–bit value with a 0.2s time base. Its most significant portion (bits 23÷16) can be read in the lower byte of the word to the higher address, whereas its less significant portion (bits 15÷0) can be read in the word to the lower address.

The higher byte of the word to the higher address includes the alarm number coded as in **Note 12** (inverter state) (see Note 12).

The last alarm displayed in parameter M12 is the alarm with the longest time period. The other alarms are displayed up to M16 with the shortest time period.

10.2. PROGRAMMING PARAMETERS (Pxx) (Read/Write)

10.2.1. RAMPS MENU P0X – P1X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P05	TAC1	Acceleration time 1	0	0	10	0	6500	10	s
P06	TDC1	Deceleration time 1	1	1	10	0	6500	10	s
P07	TAC2	Acceleration time 2	2	2	10	0	6500	10	s
P08	TDC2	Deceleration time 2	3	3	10	0	6500	10	s
P09	TAC3	Acceleration time 3	4	4	10	0	6500	10	s
P10	TDC3	Deceleration time 3	5	5	10	0	6500	10	s
P11	TAC4	Acceleration time 4	6	6	10	0	6500	10	s
P12	TDC4	Deceleration time 4	7	7	10	0	6500	10	s
P13	RAMP. TH.	Software level for dual ramp	8	8	0	0	25	10	Hz
P14	Ramp ext	Ramp multiplicative factor	78	4E	2	0	5	List	–

List for parameter P14:

0	1
1	2
2	4
3	8
4	16
5	32

10.2.2. REFERENCE MENU P1X – P2X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P15	MIN S.	Minimum reference	9	9	–0.1	–0.1 Note 05	T000[1]	10	Hz
P16	VREF B.	Reference with voltage inputs at 0	10	A	0	–400	400	8192/400	%
P17	VREF G.	Factor between voltage inputs and reference	11	B	100	–500	500	5120/500	%
P19	IREF B.	Reference with current input at 0	12	C	–25	–400	400	8192/400	%
P20	IREF G.	Factor between current inputs and reference	13	D	125	–500	500	5120/500	%
P21	AUX B.	Reference with auxiliary input at 0	14	E	0	–400	400	16384/400	%
P22	AUX G.	Factor between auxiliary input and reference	15	F	200	–400	400	16384/400	%
P26	DIS. TIME	Ref. disabling time at minimum	16	10	0	0	120	1	s

Note 05 Range: 0 to T000[1] Hz. Value –0.1 corresponds to value +/– on the display.

Reference Menu P1x – P2x: Bit Parameters

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P18	VREF J14 POSITION	Position of jumper J14	518	206	772.6	304.6	0	0	1
P23	U/D MIN	UP/D and KPD reference range	513	201	772.1	304.1	0	0	1
P24	U/D MEM	Storage of reference UP/D and KPD	528	210	773.0	305.0	1	0	1
P25	U/D RESET	Reset of reference UP/D and KPD	532	214	773.4	305.4	0	0	1

IFD

10.2.3. OUTPUT MONITOR MENU P3X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P30	OMN1	Analog output 1 functionality	17	11	1	0	7	List	–
P31	OMN2	Analog output 2 functionality	18	12	2	0	7	List	–
P32	KOF	Constant for analog output (frequency)	19	13	10	1.5	100	10	Hz/V
P33	KOI	Constant for analog output (current)	20	14	25*T000[0] /500	6*T000[0]/500	100*T000[0]/ 500	500/ T000[0]	A/V
P34	KOV	Constant for analog output (voltage)	21	15	100	20	100	1	V/V
P35	KOP	Constant for analog output (power)	22	16	25*T000[0] /500	6*T000[0]/500	40*T000[0]/ 500	500/ T000[0]	kW/V
P36	KON	Constant for analog output (speed)	23	17	200	90*C59	10000*C59	1/C59	rpm/V
P37	KOR	Constant for analog output (PID output)	24	18	10	2.5	50	10	%/V

List for parameters P30, P31:

0: Fref
1: Fout
2: Iout
3: Vout
4: Pout
5: Nout
6: PID O.
7: PID FB

10.2.4. MULTIFREQUENCY MENU P3X – P5X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P38	FREQ FIREMODE	Output frequency in Fire Mode	79	4F	25	-T000[1]	T000[1]	10	Hz
P40	FREQ1	Output frequency 1 (MLTF)	25	19	0	–T000[1]	T000[1]	10	Hz
P41	FREQ2	Output frequency 2 (MLTF)	26	1A	0	–T000[1]	T000[1]	10	Hz
P42	FREQ3	Output frequency 3 (MLTF)	27	1B	0	–T000[1]	T000[1]	10	Hz
P43	FREQ4	Output frequency 4 (MLTF)	28	1C	0	–T000[1]	T000[1]	10	Hz
P44	FREQ5	Output frequency 5 (MLTF)	29	1D	0	–T000[1]	T000[1]	10	Hz
P45	FREQ6	Output frequency 6 (MLTF)	30	1E	0	–T000[1]	T000[1]	10	Hz
P46	FREQ7	Output frequency 7 (MLTF)	31	1F	0	–T000[1]	T000[1]	10	Hz
P47	FREQ8	Output frequency 8 (MLTF)	32	20	0	–T000[1]	T000[1]	10	Hz
P48	FREQ9	Output frequency 9 (MLTF)	33	21	0	–T000[1]	T000[1]	10	Hz
P49	FREQ10	Output frequency 10 (MLTF)	34	22	0	–T000[1]	T000[1]	10	Hz
P50	FREQ11	Output frequency 11 (MLTF)	35	23	0	–T000[1]	T000[1]	10	Hz
P51	FREQ12	Output frequency 12 (MLTF)	36	24	0	–T000[1]	T000[1]	10	Hz
P52	FREQ13	Output frequency 13 (MLTF)	37	25	0	–T000[1]	T000[1]	10	Hz
P53	FREQ14	Output frequency 14 (MLTF)	38	26	0	–T000[1]	T000[1]	10	Hz
P54	FREQ15	Output frequency 15 (MLTF)	39	27	0	–T000[1]	T000[1]	10	Hz

Multifrequency Menu P3x – P5x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
P39	MS. FUNCTION	Use of parameters P40 – P54	512	200	772.0	304.0	0	0	1

10.2.5. PROHIBIT FREQUENCY MENU P5X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P55	FP1	Prohibit frequency 1	40	28	0	0	T000[1]	10	Hz
P56	FP2	Prohibit frequency 2	41	29	0	0	T000[1]	10	Hz
P57	FP3	Prohibit frequency 3	42	2A	0	0	T000[1]	10	Hz
P58	FPHYS	Semiamplitude prohibit ranges	43	2B	1	0.1	24	10	Hz

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10.2.6. DIGITAL OUTPUTS MENU P6X – P7X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P60	MDO OP.	O.C. output operation	44	2C	4	0	18	List	–
P61	RL1 OP.	Relay output RL1 operation	45	2D	0	0	18	List	–
P62	RL2 OP.	Relay output RL2 operation	46	2E	4	0	18	List	–
P63	MDO ON DELAY	O.C. output enabling delay	47	2F	0	0	650	10	s
P64	MDO OFF DELAY	O.C. output disabling delay	48	30	0	0	650	10	s
P65	RL1 ON DELAY	Relay output RL1 enabling delay	49	31	0	0	650	10	s
P66	RL1 OFF DELAY	Relay output RL1 disabling delay	50	32	0	0	650	10	s
P67	RL2 ON DELAY	Relay output RL2 enabling delay	51	33	0	0	650	10	s
P68	RL2 OFF DELAY	Relay output RL2 disabling delay	52	34	0	0	650	10	s
P69	MDO LEVEL	O.C. output enabling level	53	35	0	0	200	10	%
P70	MDO HYS	O.C. output disabling hysteresis	54	36	0	0	200	10	%
P71	RL1 LEVEL	Relay output RL1 enabling level	55	37	0	0	200	10	%
P72	RL1 HYS	Relay output RL1 disabling hysteresis	56	38	0	0	200	10	%
P73	RL2 LEVEL	Relay output RL2 enabling level	57	39	0	0	200	10	%
P74	RL2 HYS	Relay output RL2 disabling hysteresis	58	3A	2	0	200	10	%

List for parameters P60, P61, P62:

0: Inv. O.K. on	10: Motor limiting
1: Inv. O.K. off	11: Generator lim.
2: Inv. run. trip	12: PID O.K.
3: Reference level	13: PID OUTMAX
4: Frequency level	14: PID OUTMIN
5: Forward running	15: FB MAX
6: Reverse running	16: FB MIN
7: Fout O.K.	17: PRC O.K.
8: Current level	18: Fan fault
9: Limiting	19: Fire Mode active

10.2.7. % REFERENCE VAR. MENU P7X – P8X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P75	VARP1	Freq. per cent var. 1	59	3B	0	–100	100	10	%
P76	VARP2	Freq. per cent var. 2	60	3C	0	–100	100	10	%
P77	VARP3	Freq. per cent var. 3	61	3D	0	–100	100	10	%
P78	VARP4	Freq. per cent var. 4	62	3E	0	–100	100	10	%
P79	VARP5	Freq. per cent var. 5	63	3F	0	–100	100	10	%
P80	VARP6	Freq. per cent var. 6	64	40	0	–100	100	10	%
P81	VARP7	Freq. per cent var. 7	65	41	0	–100	100	10	%

10.2.8. P.I.D. REGULATOR MENU P8X – P9X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P85	SAMP.T.	Sampling time	66	42	0.002	0.002	4	500	s
P86	KP	Proportional gain	67	43	1	0	31.999	1024	
P87	TI	Integral time	68	44	512	3	1025 Note 06	1	Tc
P88	TD	Derivative time	69	45	0	0	4	256	Tc
P89	PID MIN	PID output min. value	70	46	0	–100	100	20	%
P90	PID MAX	PID output max. value	71	47	100	–100	100	20	%
P91	PID R.A.	Increasing time over the PID reference	72	48	0	0	6500	10	s
P92	PID R.D.	Decreasing time over the PID reference	73	49	0	0	6500	10	s
P93	FREQ TH.	Integral unlocking threshold	74	4A	0	0	T000[1]	10	Hz
P94	MAX I	Integral term max. absolute value	75	4B	100	0	100	20	%
P95	MAX D	Derivative term max. absolute value	76	4C	10	0	10	20	%
P96	PID DIS TIME	PID reset counting at min. value	77	4D	0	0	60000	1	Tc

Note 06 Integral time is expressed as a multiple value of sampling time P85. Real integral time is P85*P87; upper value is 1024; 1025 disables integral adjustment.

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10.3. CONFIGURATION PARAMETERS (Cxx) (Read/Write with inverter disabled, Read Only with inverter in RUN mode)

10.3.1. CARRIER FREQUENCY MENU C0X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C01	FCARR	Min. carrier frequency	1280	500	T000[2]	0	C02	List	–
C02	FC. MAX	Max. carrier frequency	1281	501	T000[2]	C01	T000[3]	List	–
C03	PULSE N.	Pulse number	1282	502	1	0	5	List	–

List for parameters C01 and C02

0: 0.8 kHz
1: 1.0 kHz
2: 1.2 kHz
3: 1.8 kHz
4: 2.0 kHz
5: 3.0 kHz
6: 4.0 kHz
7: 5.0 kHz
8: 6.0 kHz
9: 8.0 kHz
10: 10.0 kHz
11: 12.8 kHz
12: 16.0 kHz

List for parameter C03

0: 12
1: 24
2: 48
3: 96
4: 192
5: 384

Carrier Frequency Menu C0x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C04	SILENT MODUL.	Silent modulation	529	211	773.1	305.1	1	0	1

10.3.2. V/F PATTERN MENU C0X – C1X

	Name	Description	Addr. (dec) R/W	Addr (hex) R/W	Def	Min	Max	K	Unit of meas.
C05	MOT.CUR.	Motor rated current	1324	52C	T002[0]	1	T002[1]	10	A
C06	FMOT1	Motor rated frequency 1	1283	503	50	3.5	T000[1]	10	Hz
C07	FOMAX1	Max. output frequency 1	1284	504	50	3.5	T000[1]	10	Hz
C08	FOMIN1	Min. output frequency 1	1285	505	0.1	0.1	5	10	Hz
C09	VMOT1	Motor rated voltage 1	1286	506	T001[0]	5	500	1	V
C10	BOOST1	Torque compensation 1	1287	507	0	–100	100	1	%
C11	PREBST1	Torque compensation (at 0Hz) 1	1288	508	T000(4)	0	5	10	%
C12	FMOT2	Motor rated frequency 2	1289	509	50	3.5	T000[1]	10	Hz
C13	FOMAX2	Max. output frequency 2	1290	50A	50	3.5	T000[1]	10	Hz
C14	FOMIN2	Min. output frequency 2	1291	50B	0.1	0.1	5	10	Hz
C15	VMOT2	Motor rated voltage 2	1292	50C	T001[0]	5	500	1	V
C16	BOOST2	Torque compensation 2	1293	50D	0	–100	100	1	%
C17	PREBST2	Torque compensation (at 0Hz) 2	1294	50E	T000(4)	0	5	10	%
C18	AUTOBST	Automatic torque compensation	1336	530	1	0	10	10	%
C19	B.MF	Intermediate torque compensation 1	1341	53D	0	–100	400	1	%
C20	FBOOST MF	Freq. for implementation of intermediate torque compensation 1	1340	53C	50	6	99	1	%

10.3.3. OPERATION METHOD MENU C1X – C2X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C23	OP.MT.MDI1	Operation method MDI1	1295	50F	0	0	2	List	–
C24	OP.MT.MDI2	Operation method MDI2	1296	510	0	0	3	List	–
C25	OP.MT.MDI3	Operation method MDI3	1297	511	0	0	7	List	–
C26	OP.MT.MDI4	Operation method MDI4	1298	512	0	0	7	List	–
C27	OP.MT.MDI5	Operation method MDI5	1299	513	0	0	6	List	–
C28	PID ACT.	PID operating mode	1300	514	0	0	3	List	–
C29	PID REF.	PID reference selection	1301	515	0	0	4	List	–
C30	PID FB	PID feedback selection	1302	516	1	0	3	List	–

List for parameter C23:

0: Mltf1
1: UP
2: Var%1
3: Stop
4: Fire Mode

List for parameter C24:

0: Mltf2
1: DOWN
2: Var%2
3: Loc/Rem
4: Fire Mode

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List for parameter C25:

0: Mltf3
1: CWCCW
2: Var%3
3: DCB
4: REV
5: A/M
6: Lock
7: Loc/Rem

List for parameter C26:

0: Mltf4
1: Mltr1
2: DCB
3: CWCCW
4: REV
5: A/M
6: Lock
7: Loc/Rem

List for parameter C27:

0: DCB
1: Mltr2
2: CWCCW
3: Vf2
4: Ext A
5: REV
6: Lock
7: Fire Mode

List for parameter C28:

0: Ext.
1: Ref F
2: Add F
3: Add V

List for parameter C29:

0: Kpd
1: Vref
2: Inaux
3: Iref
4: Rem

List for parameter C30:

0: Vref
1: Inaux
2: Iref
3: Iout

Operation Method Menu C1x – C2x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C21	START OPER. M.	START control mode	516	204	772.4	304.4	1	0	1
C22	FREF	FREF control mode	517	205	772.5	304.5	1	0	1
C21	START REM	Enabling START for Serial **Note 07**	539	21B	773.11	305.11	0	0	1
C22	FREF REM	Enabling REF from Serial **Note 08**	540	21C	773.12	305.12	0	0	1
C31	PID INV	PID error inversion	522	20°	772.10	304.10	0	0	1

Note 07 In **Rem** mode, the inverter acknowledges the inputs simulated by the master device (SP00) via serial link instead of the terminal board inputs.

Note 08 In **Rem** mode, the inverter acknowledges the reference sent by the master device (SP02) via serial link instead of the reference sent from the terminal board.

C21

	bit 773.11	bit 772.4
Kpd	0	0
Term	0	1
Rem	1	1

C22

	bit 773.12	bit 772.5
Kpd	0	0
Term	0	1
Rem	1	1

IFD

10.3.4. POWER DOWN MENU C3X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C36	PD Delay	Power down delay	1303	517	10	5	255	1	ms
C37	PD DEC T	Deceleration time at power down	1304	518	10	0.1	6500	10	s
C38	PDEXTRA	Extra deceleration at power down	1305	519	200	0	500	32/100	%
C39	DC LINK D.	Mains loss acknowledgement speed increase	1306	51A	0	0	300	256/100	%

Power Down Menu C3x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C34	MAINS L.	Mains failure alarm enabling	536	218	773.8	305.8	0	0	1
C35	POWER DOWN	Power down enabling	533	215	773.5	305.5	0	0	1

10.3.5. LIMITS MENU C4X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C41	ACC. CURR.	Acceleration lim. Current	1307	51B	MIN((T002[2]* 100/C05),150)	50	MIN((T002[2]* 100/C05),400)	1	%
C43	RUN. CUR.	Constant frequency lim. Enabling	1308	51C	MIN((T002[2]* 100/C05),150)	50	MIN((T002[2]* 100/C05),400)	1	%
C45	DEC. CURR.	Lim current while deceleration.	1309	51D	IF_T000<10_ MIN((T002[2]* 100/C05),150) _ ELSE_ MIN((T002[2]* 100/C05),120)	50	IF_T000<10_ MIN((T002[2]* 100/C05),400)_ ELSE_ MIN((T002[2]* 100/C05),120)	1	%

Limits Menu C4x : Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C40	ACC. LIM.	Acceleration limit enabling bit 772.8	520	208	772.8	304.8	1	0	1
C40	ACC. LIM.	Acceleration limit enabling bit 773.6	534	216	773.6	305.6	0	0	1
C42	RUN. LIM.	Constant frequency limit enabling	521	209	772.9	304.9	1	0	1
C44	DEC. LIM.	Deceleration limit enabling	535	217	773.7	305.7	0	0	1
C46	F. W. REDUCTION	Flux weakening current limit	538	21A	773.10	305.10	0	0	1

C40

	bit 773.6	bit 772.8
NO	0	0
Yes	0	1
Yes A	1	1

10.3.6. AUTORESET MENU C4X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C51	ATT.N.	Autoreset attempt number	1310	51E	4	1	10	1	–
C52	CL.FAIL T.	Attempt reset time	1311	51F	300	1	999	50	s

Autoreset Menu C4x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C53	PWR RESET	Alarm reset at power off	531	213	773.3	305.3	0	0	1

IFD

10.3.7. SPECIAL FUNCTIONS MENU C5X – C6X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C56	S.S. DIS.T	Speed searching disabling time	1312	520	1	0	30000	1	s
C58	POLES	Poles	1313	521	4	2	16	0.5	–
C59	RED. R.	Reduction ratio	1314	522	1	0.001	50	1000	–
C63	FIRST PARAM.	First parameter at power on	1315	523	1	0	21	List	–
C64	FB R.	Feedback ratio	1316	524	1	0.001	50	1000	–
C65	SEARCH.R	Searching rate	1317	525	100	10	999	1	%
C66	SEARCH.C	Searching current	1318	526	75	40	MIN((T002[2]* 100/C05),400)	1	%
C67	Brk Disable	Brake disabling time	1319	527	18000	0	65400	1	ms
C68	Brk enable	Brake enabling time	1320	528	2000	0	65400	1	ms
C69	Stator Res	Stator resistance	1339	533	0	0	8.5	100	ohm

List for parameter C63:

0	M01 Fref
1	M02 Fout
2	M03 Iout
3	M04 Vout
4	M05 Vmn
5	M06 Vdc
6	M07 Pout
7	M08 Trm. Bd.
8	M09 TB Out
9	M10 Nout
10	M11 O. time
11	M12 Hist.1
12	M13 Hist.2
13	M14 Hist.3
14	M15 Hist.4
15	M16 Hist.5
16	M17 Aux. I
17	M18 PID Ref
18	M19 PID FB
19	M20 PID Err
20	M21 PID Out
21	M22 Feed Back

Special Functions Menu C5x – C6x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C54	HIGH V	Rated mains voltage	541	21D	773.13	305.13	0	0	1
C55	SPEED SEARCHING	Speed searching present bit 772.12	524	20C	772.12	304.12	1	0	1
C55	SPEED SEARCHING	Speed searching present bit 773.2	530	212	773.2	305.2	0	0	1
C57	BRAKE UNIT	Braking module provided	515	203	772.3	304.3	0	0	1
C58	FANFORCE	Forcing starting fan	534	21F	773.6	305.6	0	0	1
C60	MAIN LOSS MEM.	Mains loss saving	523	20B	772.11	304.11	0	0	1
C61	ENABLE OPER.	ENABLE terminal operation	527	20F	772.15	304.15	1	0	1
C62	FIRST PAGE	First page at power on	514	202	772.2	304.2	0	0	1
C69	BRK BOOST	Extrafluxing for deceleration ramp	542	21E	773.14	305.14	1	0	1

C55

	bit 773.2	bit 772.12
NO	0	0
Yes	0	1
Yes A	1	1

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10.3.8. MOTOR THERMAL PROTECTION MENU C6X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C65	THR.PRO.	Thermal protection enabling	1321	529	0	0	3	List	–
C66	MOT.CUR.	Thermal protection pick–up current	1322	52A	105	1	120	1	%
C67	TH.C .	Motor thermal constant	1323	52B	600	5	3600	1	s

10.3.9. SLIP COMPENSATION MENU C7X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C74	POLES	Poles	1313	521	4	2	16	0.5	–
C75	PMOT	Motor nominal power	1337	531	IF_T001=0_ T002[4]_ ELSE_T002[3]	0.5	1000	10	kW
C76	NO LOAD	Motor no–load current	1325	52D	40	1	100	1	%
C77	M.SLIP	Motor rated slip	1326	52E	0	0	10	10	%
C78	Stator Res.	Stator resistance	1339	533	IF_T001=0_ T002[6]_ ELSE_T002[5]	0	8.5	1000	ohm

10.3.10. D.C. BRAKING MENU C8X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C82	DCB T.SP.	DCB at STOP time period	1327	52F	0.5	0.1	50	10	s
C83	DCB T.ST	DCB at START time period	1328	530	0.5	0.1	50	10	s
C84	DCB FR.	DCB at STOP starting frequency	1329	531	1	0	10	10	Hz
C85	DCB CUR.	DCB current	1330	532	100	1	MIN((T002[2]* 100/C05),400)	1	%
C87	DCB H.C.	Holding current	1331	533	10	1	100	1	%

D.C. Braking Menu C8x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C80	DCB AT STOP	DCB at STOP enabling	525	20D	772.13	304.13	0	0	1
C81	DCB AT START	DCB at START enabling	526	20E	772.14	304.14	0	0	1
C86	DCB HOLD	DCB holding enabling	519	207	772.7	304.7	0	0	1

10.3.11. SERIAL LINK MENU C9X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C90	ADDRESS	Inverter address	1332	52C	1	1	247	1	–
C91	S. DELAY	Response delay	1333	52D	0	0	500	20	ms
C93	RTU Timeout	MODBUS RTU serial time–out	1334	52E	0	0	2000	1	ms
C94	BaudRate	Serial connection baud rate	1335	52F	3	0	3	List	–
C95	Parity	Serial Link parity	1338	53A	0	0	2	List	–

List for parameter C94:

0	1200 bps
1	2400 bps
2	4800 bps
3	9600 bps

List for parameter C95:

0	None / 2 stop bit
1	Even / 1 stop bit
2	None / 1 stop bit

Serial Link Menu C9x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C92	WD	Serial watchdog enabling	537	219	773.9	305.9	0	0	1

10.4. SPECIAL PARAMETERS (SPxx) (Read Only)

	Description	Addr. (dec)	Addr. (hex)	Min	Max	K	Unit of meas.
SP01	Terminals reference	769	301	0	1023	1 Note 09	
SP04	Configuration bit	772	304			Note 10	
SP05	Configuration bit	773	305			Note 11	
SP09	Inverter condition	777	309	0	24	Note 12	

Note 09 Result of 10–bit A/D conversion of analog inputs in terminal board RIFV1, RIFV2, RIFI downstream of processing with parameters P16, P17, P18, P19, P20.

Note 10 SP04 Configuration bit: address 772 (304 hex)

	Bit		
P39 MF.FUNCTION	0	0 Absolute	1 Sum
P23 U/D – KPD MIN	1	0 0	1 +/–
C62 FIRST PAGE	2	0 Status	1 Keypad
C57 BRAKE UNIT	3	0 Provided	1 Not provided
C21 START OPER. M.	4	Along with bit 773.11.	
C22 REF OPERATION M.	5	Along with bit 773.12.	
P18 VREF J14 POSITION	6	0 Unipolar	1 Bipolar
C86 DCB HOLD	7	0 Disabled	1 Enabled
C40 ACCELERATION LIM.	8	Along with 773.6	
C42 RUNNING LIM.	9	0 Disabled	1 Enabled
C31 PID INVERSION	10	0 Disabled	1 Enabled
C50 AUTORESET	10	0 Disabled	1 Enabled
C60 MAINS LOSS MEM.	11	0 Not stored	1 Stored
C55 SPEED SEARCHING	12	Along with bit 773.2	
C80 DCB AT STOP	13	0 Disabled	1 Enabled
C81 DCB AT START	14	0 Disabled	1 Enabled
C61 ENABLE OPERATION	15	0 Activated after opening	1 Immediately activated

Note 11 SP05 Configuration bit: address 773 (305 hex)

	Bit		
P24 UP/DOWN MEM.	0	0 Not stored	1 Stored
C04 SILENT MODULATION	1	0 Disabled	1 Enabled
C55 SPEED SEARCHING	2	Along with bit 772.2	
C53 PWR RESET	3	0 Disabled	1 Enabled
P25 UP/DOWN RESET	4	0 Disabled	1 Enabled
C35 POWER DOWN	5	0 Disabled	1 Enabled
C40 ACCELERATION LIM.	6	Along with bit 772.8	
C44 DECELERATION LIM.	7	0 Disabled	1 Enabled
C34 MAINS L.	8	0 Disabled	1 Enabled
C92 WATCHDOG	9	0 Disabled	1 Enabled
C46 F. W. RED.	10	0 Disabled	1 Enabled
C21 START REM ENABLE	11	Along with bit 772.4	
C22 FREF REM ENABLE	12	Along with bit 772.5	
C54 HIGH V	13	0 380-480V (4T) Not used (2T)	1 481-500V (4T)
C69 BRK BOOST	14	0 Disabled	1 Enabled
C58 FANFORCE	15	0 Fans start if T>60°C	1 Fans always ON

IFD

Note 12

0	INVERTER OK
1	A30 D. C. Link Overvoltage
2	A31 D. C. Link Undervoltage
3	A03 Wrong user's par.
4	A22 Motor overheated
5	A20 Inverter overload
6	A05 Eprom reading error
7	A03 EEPROM absent
8	A36 External Alarm
9	A25 Mains loss
11	A11 Bypass circ. failure
12	A01 Wrong software
13	A26 Running overcurrent SW
14	TO START OPEN AND CLOSE TERM6
15	A27 Searching overcurrent SW
16	A21 Heatsink overheated
17	A06 Microcontroller Failure
18	A32 Running overcurrent
19	A33 Accelerating overcurrent
20	A34 Decelerating overcurrent
21	A35 Searching overcurrent
22	A40 Serial comm. error
23	A28 Accelerating overcurrent SW
24	A29 Decelerating overcurrent SW
25	A18 Fan fault overtemperature
26	A19 2nd sensor overtemperature

10.5. SPECIAL PARAMETERS (SWxx) (Read Only)

	Description	Addr. (dec)	Addr. (hex)	Min	Max	K
SW1	Software version	475	1DB			Note 13
SW2	Product ID	476	1DC			Note 14
SW3	PIN (Part Identification Number)	477	1DD	0	22	index of T000[]
SW4	Current class	478	1DE	0	42	index of T002[]
SW5	Voltage class	479	1DF	0	1	index of T001[]

Note 13 Decimal number corresponding to the inverter firmware version. Example:
Response 2030 = version V2.030

Note 14 ASCII code corresponding to 'IK': 494Bh.

10.6. SPECIAL PARAMETERS (SPxx) (Write Only)

	Description	Addr. (dec)	Addr. (hex)	Def	Min	Max	K	Unit of measure
SP00	Terminals simulated via serial link	768	300				Note 15	
SP02	Serial reference	770	302	0	Note 16	Note 16	10	Hz
SP03	Serial PID reference	771	303	0	–100	100	20	%
SP10	Parameter saving	778	30A				Note 17	
SP11	Default restoration	779	30B				Note 18	

Note 15 Terminals are simulated by sending a byte to the inverter; the byte bits simulate the active state of an input. Structure is the same as the one stated in **Note 01** (see Note 01). Bit 5 ENABLE is set to AND with the similar bit read from the terminal board.
Note 16 Value ranging from –FOMAX1 to FOMAX1 (C07) or from FOMAX2 to FOMAX2 (C13) depending on the active V/f pattern (selected by MDI5 if C27=3).

Note 17 Any writing with any data item forces the inverter to store to EEPROM all new parameter values.

Note 18 Any writing with any data forces the inverter to restore default programming (factory setting).

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Table T000[]: index (SW3) at address 477 (1DDh)

	I Full-scale (A)	Max. freq. out (Hz)	Def. carrier	Max. carrier	Def. preboost
	T000[0]	T000[1]	T000[2]	T000[3]	T000[4]
0	25	800	7	12	1
1	50	800	7	12	1
2	50	800	7	12	1
3	65	800	7	12	1
4	65	800	7	12	1
5	65	800	7	12	1
6	100	800	5	12	1
7	100	800	7	12	1
8	100	800	7	12	1
9	125	800	5	12	1
10	130	800	7	12	1
11	130	800	7	12	1
12	130	800	7	12	1
13	210	800	7	12	1
14	210	800	7	11	1
15	280	800	7	11	1
16	390	800	5	10	0.5
17	480	800	5	7	0.5
18	650	120	4	6	0.5
19	865	120	4	6	0.5
20	1300	120	4	6	0.5
21	1750	120	4	6	0.5
22	2640	120	4	6	0.5

Table T001[]: index (SW5) at address 479 (1DFh)

	Class (V)
	T001[0]
0	230 (2T)
1	400 (4T)

Table T002[]: index (SW4) at address 478 (1DEh)

	Model	Imot default (A)	Inom (A)	Imax (A)	C75 default @ 4T	C75 default @ 2T	C78 default @ 4T	C78 default @ 2T
		T002[0]	T002[1]	T002[2]	T002[3]	T002[4]	T002[5]	T002[6]
0	0005	6.4	10.5	11.5	3	1.7	2.500	1.443
1	0007	8.4	12.5	13.5	4	2.3	2.000	1.154
2	0008	8.5	15	16	3.9	2.2	1.733	1.000
3	0009	9	16.5	17.5	4.5	2.5	1.600	0.923
4	0010	11	17	19	5.3	3	1.386	0.800
5	0011	11.2	16.5	21	5.5	3.1	1.300	0.750
6	0013	13.2	19	21	6.5	3.7	1.126	0.650
7	0014	14.8	16.5	25	7.5	4.3	1.000	0.577
8	0015	15	23	25	7	4	1.040	0.600
9	0016	17.9	27	30	9.2	5.3	0.800	0.461
10	0017	17.9	30	32	9.2	5.3	0.800	0.461
11	0020	21	30	36	11	6.3	0.600	0.346
12	0023	25.7	38	42	13	7.5	0.520	0.300
13	0025	29	41	48	15	8.6	0.400	0.230
14	0030	35	41	56	18.5	10.6	0.300	0.173
15	0033	36	51	56	19.2	11	0.347	0.200
16	0034	41	57	63	22	12.7	0.250	0.144
17	0035	41	41	72	22	12.7	0.250	0.144
18	0036	46	60	72	25	14.4	0.250	0.144
19	0037	50	65	72	26	15	0.174	0.100
20	0038	46	67	75	25	14.4	0.200	0.115
21	0040	46	72	75	25	14.4	0.200	0.115
22	0049	55	80	96	30	17.3	0.150	0.086
23	0060	67	88	112	37	21.3	0.120	0.069
24	0067	80	103	118	45	25.9	0.100	0.057
25	0074	87	120	144	50	28.8	0.080	0.046
26	0086	98	135	155	55	31.7	0.060	0.034
27	0113	133	180	200	75	43.3	0.040	0.023
28	0129	144	195	215	80	46.1	0.040	0.023
29	0150	159	215	270	90	51.9	0.030	0.017
30	0162	191	240	290	110	63.5	0.020	0.011
31	0179	212	300	340	120	69.2	0.018	0.010
32	0200	228	345	365	132	76.2	0.018	0.010
33	0216	264	375	430	150	86.6	0.015	0.008
34	0250	321	390	480	185	106.8	0.012	0.006
35	0312	375	480	600	220	127	0.012	0.006
36	0366	421	550	660	250	144.3	0.010	0.005
37	0399	480	630	720	280	161.6	0.010	0.005
38	0457	528	720	880	315	181.8	0.008	0.004
39	0524	589	800	960	355	204.9	0.007	0.004
40	0598	680	900	1100	400	230.9	0.006	0.003
41	0748	841	1000	1300	500	288.6	0.003	0.001
42	0831	939	1200	1440	560	323.3	0.002	0.001

IFD

11. PARAMETERS SENT VIA SERIAL LINK (VTC SW)

11.1. MEASURE PARAMETERS (Mxx) (Read Only)

	Name	Description	Addr. (dec) READ	Addr. (hex) READ	Min	Max	K	Unit of measure
M01	REF	Speed/torque reference	1024	400			IF_C15=0_65536/76444_ ELSE_C04*1000000/X999*4	IF_C15=0_rpm ELSE_%
M02	RMPOUT	Ramp block output	1025	401			IF_C15=0_65536/19111_ ELSE_C04*1000000/X999	IF_C15=0_rpm ELSE_%
M03	SPDMOT	Motor speed	1026	402			65536/19111	rpm
M04	TQ.DEM.	Required torque	1028	404			C04*1000000/X999	%
M05	TQ.OUT	Motor torque	1029	405			C04*1000000/X999	%
M06	IOUT	Output current	1027	403			50*65536/T000[0]*1307	A
M07	VOUT	Output voltage	1030	406			4096/1000	V
M08	VMN	Mains voltage	1031	407			512/1111	V
M09	VDC	Bus voltage	1032	408			1024/1000	V
M10	POUT	Output power	1033	409			655*100/T000[0]	kW
M11	Term. B.	Digital inputs	768	300			**Note 01**	–
M12	TB Out	Digital outputs	778	30A			**Note 02**	–
M13	OP.T.	Operation time	1034 1035	40A 40B			5 **Note 03**	s
M14	1st alarm	Fault list 1	1036 1037	40C 40D			5 **Note 04**	s
M15	2nd alarm	Fault list 2	1038 1039	40E 40F			5 **Note 04**	s
M16	3rd alarm	Fault list 3	1040 1041	410 411			5 **Note 04**	s
M17	4th alarm	Fault list 4	1042 1043	412 413			5 **Note 04**	s
M18	5th alarm	Fault list 5	1044 1045	414 415			5 **Note 04**	s
M19	AUX I	Auxiliary analog input	1046	416			4096/100	%
M20	PID REF	PID reference	1047	417			20	%
M21	PID FB%	PID feedback as a percentage	1048	418			20	%
M22	PID ERR	PID error	1049	419			20	%
M23	PID OUT	PID output	1050	41A			20	%
M24	PID FB	PID feedback	1048	418			20/C56	–

Note 01 State of digital inputs in the terminal board (1= active input) based on the table below:

bit	
0	MDI1
1	MDI2
2	MDI3
3	MDI4
4	START
5	ENABLE
6	MDI5
7	RESET

Note 02 State of digital outputs in the terminal board (1= active output) based on the table below:

bit	
2	OC
3	RL1
4	RL2

Note 03 Operation time is represented by a double word (32 bits). It is sent using two addresses formatted as follows: most significant word to higher address (1035); less significant word to lower address (1034).

Note 04 Fault list is sent using two addresses formatted as follows:

	bit	
	15 8	7 0
Higher address (e.g.1037)	Alarm number	Time instant – bit 23÷16
Lower address (e.g.1036)	Time instant – bit 15÷0	

Time instant relating to the alarm number is a 24–bit value with a 0.2s time base. Its most significant portion (bits 23÷16) can be read in the lower byte of the word to the higher address, whereas its less significant portion (bits 15÷0) can be read in the word to the lower address.

The higher byte of the word to the higher address includes the alarm number coded as in **Note 14** (inverter state) (see Note 12).

The last alarm displayed in parameter M14 is the alarm with the longest time period. The other alarms are displayed up to M18 with the shorter time period.

11.2. PROGRAMMING PARAMETERS (Pxx) (Read/Write)

11.2.1. RAMPS MENU P0X – P1X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P05	TAC1	Acceleration time 1	0	0	10	0.1	6500	10	s
P06	TDC1	Deceleration time 1	1	1	10	0.1	6500	10	s
P07	TAC2	Acceleration time 2	2	2	10	0.1	6500	10	s
P08	TDC2	Deceleration time 2	3	3	10	0.1	6500	10	s
P09	TAC3	Acceleration time 3	4	4	10	0.1	6500	10	s
P10	TDC3	Deceleration time 3	5	5	10	0.1	6500	10	s
P11	TAC4	Acceleration time 4	6	6	10	0.1	6500	10	s
P12	TDC4	Deceleration time 4	7	7	10	0.1	6500	10	s
P13	RAMP TH	Ramp increase time	8	8	2	0	250	1	rpm
P14	RAMP EXT	Ramp multiplicative factor	9	9	0	0	5	List	–

List for parameter P14:

0	1
1	2
2	4
3	8
4	16
5	32

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11.2.2. REFERENCE MENU P1X – P2X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P15	MIN S.	Min. speed reference	10	A	–1*1194/1024	0 Note 05	9000	1024/1194	rpm
P16	VREF B.	Reference with voltage inputs at 0	11	B	0	–400	400	8192/400	%
P17	VREF G.	Factor between voltage inputs and reference	12	C	100	–500	500	5120/500	%
P19	IREF B.	Reference with current input at 0	13	D	–25	–400	400	8192/400	%
P20	IREF G.	Factor between current inputs and reference	14	E	125	–500	500	5120/500	%
P21	AUX B.	Reference with auxiliary input at 0	15	F	0	–400	400	16384/400	%
P22	AUX G.	Factor between auxiliary input and reference	16	10	200	–400	400	16384/400	%
P26	DIS. TIME	Disabling time	17	11	0	0	120	1	s

Note 05 Range: 0 to 9000 rpm. Value –1 corresponds to value +/– on the display.

Reference Menu P1x – P2x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
P18	VREF J14 POSITION	Position of jumper J14	518	206	772.6	304.6	0	0	1
P23	U/D MIN	UP/D and KPD reference range	513	201	772.1	304.1	0	0	1
P24	U/D MEM	Storage of UP/D and KPD reference	528	210	773.0	305.0	1	0	1
P25	U/D RESET	Reset of UP/D and KPD reference	532	214	773.4	305.4	0	0	1
P27	Clear KI	Integrator reset	524	20C	772.12	304.12	0	0	1

11.2.3. OUTPUT MONITOR MENU P2X – P3X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P28	OMN1	Analog output 1 function	18	12	2	0	17	List	–
P29	OUT1 BIAS	Analog output 1 offset	19	13	0	0	10000	250/10000	mV
P30	OMN2	Analog output 2 function	20	14	5	0	17	List	–
P31	OUT2 BIAS	Analog output 2 offset	21	15	0	0	10000	256/10040	mV
P32	KOI	Analog output constant (current)	22	16	25*T000[0] /500	6*T000[0]/500	100*T000[0]/ 500	500/T000[0]	A/V
P33	KOV	Analog output constant (voltage)	23	17	100	20	100	1	V/V
P34	KOP	Analog output constant (power)	24	18	25*T000[0] /600	6*T000[0]/600	40*T000[0]/ 600	600/T000[0]	kW/V
P35	KON	Analog output constant (speed)	25	19	200	50	5000	1	rpm/V
P36	KOT	Analog output constant (torque)	26	1A	10	5	100	1	%/V
P37	KOR	Analog output constant (PID output)	27	1B	10	2.5	50	10	%/V

List for parameters P28 and P30:

0: Refer
1: Rmp out
2: Spd out
3: Tq demand
4: Tq out
5: Iout
6: Vout
7: Pout
8: PID Out
9: PID Fb
10: ARefer
11: ARmp out
12: ASpd out
13: ATq demand
14: ATq out
15: Apout
16: APID Out
17: APID Fb

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11.2.4. MULTISPEED MENU P3X – P4X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P40	MLTS1	Speed reference 1 (MLTS)	28	1C	0	–9000	9000	1024/1194	rpm
P41	MLTS 2	Speed reference 2 (MLTS)	29	1D	0	–9000	9000	1024/1194	rpm
P42	MLTS 3	Speed reference 3 (MLTS)	30	1E	0	–9000	9000	1024/1194	rpm
P43	MLTS 4	Speed reference 4 (MLTS)	31	1F	0	–9000	9000	1024/1194	rpm
P44	MLTS 5	Speed reference 5 (MLTS)	32	20	0	–9000	9000	1024/1194	rpm
P45	MLTS 6	Speed reference 6 (MLTS)	33	21	0	–9000	9000	1024/1194	rpm
P46	MLTS 7	Speed reference 7 (MLTS)	34	22	0	–9000	9000	1024/1194	rpm

Multispeed Menu P3x – P4x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
P39	MS.FUNCTION	Use of parameters P40 – P46	512	200	772.0	304.0	0	0	1

11.2.5. PROHIBIT SPEED MENU P5X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P55	SPDP1	Prohibit speed 1	35	23	0	0	9000	1024/1194	rpm
P56	SPDP2	Prohibit speed 2	36	24	0	0	9000	1024/1194	rpm
P57	SPDP3	Prohibit speed 3	37	25	0	0	9000	1024/1194	rpm
P58	SPDHYS	Semiamplitude of prohibit ranges	38	26	50	0	250	1024/1194	rpm

11.2.6. DIGITAL OUTPUTS MENU P6X – P7X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P60	MDO OP.	O.C. output operation	39	27	5	0	24	List	–
P61	RL1 OP.	Relay output RL1 operation	40	28	0	0	24	List	–
P62	RL2 OP.	Relay output RL2 operation	41	29	5	0	24	List	–
P63	MDO ON DELAY	O.C. output enabling delay	42	2A	0	0	650	10	s
P64	MDO OFF DELAY	O.C. output disabling delay	43	2B	0	0	650	10	s
P65	RL1 ON DELAY	Relay output RL1 enabling delay	44	2C	0	0	650	10	s
P66	RL1 OFF DELAY	Relay output RL1 disabling delay	45	2D	0	0	650	10	s
P67	RL2 ON DELAY	Relay output RL2 enabling delay	46	2E	0	0	650	10	s
P68	RL2 OFF DELAY	Relay output RL2 disabling delay	47	2F	0	0	650	10	s
P69	MDO LEVEL	O.C. output enabling level	48	30	0	0	200	10	%
P70	MDO HYS	O.C. output disabling hysteresis	49	31	0	0	200	10	%
P71	RL1 LEVEL	Relay output RL1 enabling level	50	32	0	0	200	10	%
P72	RL1 HYS	Relay output RL1 disabling hysteresis	51	33	0	0	200	10	%
P73	RL2 LEVEL	Relay output RL2 enabling level	52	34	5	0	200	10	%
P74	RL2 HYS	Relay output RL2 disabling hysteresis	53	35	2	0	200	10	%
P75	LIFT LEVEL	Lift level	54	36	5	0	200	10	%
P76	LIFT TIME	Lift time	55	37	1	0	650	10	s
P77	TOR. LIFT	Brake unlocking torque level	56	38	100	0	T002[2]* 100/C05	1	%

List for parameters P60, P61, P62:

0: Inv. O.K. on
1: Inv. O.K. off
2: Inv. run. trip
3: Reference level
4: Rmpout level
5: Speed level
6: Forward running
7: Reverse running
8: Spdout O.K.
9: Tq out level
10: Current level
11: Limiting
12: Motor limiting
13: Generator lim.
14: PID O.K.
15: PID OUTMAX
16: PID OUTMIN
17: FB MAX
18: FB MIN
19: PRC OK
20: Speed O.K.
21: RUN
22: LIFT
23: LIFT1
24: Fan Fault

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11.2.7. P.I.D. REGULATOR MENU P8X – P9X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P85	SAMP.T.	Sampling time	57	39	0.002	0.002	4	500	s
P86	KP	Proportional gain	58	3A	1	0	31.999	32767/ 31.999	–
P87	TI	Integral time	59	3B	512	3	1025 Note 06	1	Tc
P88	TD	Derivative time	60	3C	0	0	4	256	s
P89	PID MIN	PID output min. value	61	3D	0	–100	100	20	%
P90	PID MAX	PID output max. value	62	3E	100	–100	100	20	%
P91	PID R.A.	Increasing ramp over the PID reference	63	3F	0	0	6500	10	s
P92	PID R.D.	Decreasing ramp over the PID reference	64	40	0	0	6500	10	s
P93	FREQ TH.	Integral unlocking threshold	65	41	0	0	100	10	Hz
P94	MAX I	Integral term max. absolute value	66	42	100	0	100	20	%
P95	MAX D	Derivative term max. absolute value	67	43	10	0	10	20	%
P96	PID DIS TIME	PID reset counting at min. value	68	44	0	0	60000	1	Tc

Note 06 Integral time is expressed as a multiple value of sampling time P85. Real integral time is P85*P87; upper value is 1024; 1025 disables integral adjustment.

11.2.8. SPEED LOOP MENU P10X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P100	SPD P.G.	Speed loop proportional gain	69	45	5	0	31.999	32767/ 31.999	–
P101	SPD INT.	Speed loop integral time	70	46	0.5	0.002	10 Note 07	1024	s
P102	ZERO SPD K	Gain increase at zero speed	71	47	100	0	500	1	%

Note 07 Upper range limit is 10.000s; any higher value disables integral action.

11.2.9. TORQUE RAMP MENU P10X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
P105	RMPUP	Torque ramp up	72	48	0	0	6500	10	s
P106	RMPDN	Torque ramp down	73	49	0	0	6500	10	s

11.3. CONFIGURATION PARAMETERS (Cxx) (Read/Write with inverter disabled, Read Only with inverter in RUN mode)

11.3.1. VTC PATTERN MENU C0X – C1X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C01	FMOT	Motor rated frequency	1280	500	50	5	150	10	Hz
C02	SPDMAX	Max. motor speed	1281	501	1500	100	MIN((C06*3),9000)	1	rpm
C03	VMOT	Motor rated voltage	1282	502	T001[0]	5	500	1	V
C04	PMOT	Motor rated power	1283	503	IF_SW5=0_ T002[7]_ ELSE_T002[3]	IF_ SW5=0_ T002[7]/4_ ELSE_T002[3]/4	IF_ SW5=0_ T002[7]*2_ ELSE_T002[3]*2	10	kW
C05	IMOT	Motor rated current	1284	504	T002[0]	T002[1]/4	T002[1]	10	A
C06	SPDNOM	Motor rated speed	1285	505	1420	0	9000	1	rpm
C07	STATOR	Stator resistance	1286	506	IF_SW5=0_ T002[8]_ ELSE_T002[4]	0	30	1000	ohm
C08	ROTOR	Rotor resistance	1287	507	IF_SW5=0_ T002[9] ELSE_ T002[5]	0	30	1000	ohm
C09	LEAKAGE	Leakage inductance	1288	508	IF_SW5=0_ T002[10] ELSE_ T002[6]	0	100	100	mH
C11	Trq. Boost	Torque boost	1289	509	0	0	50	1	%
C12	Stator2	Stator resistance 2	1328	530	0	0	30	1000	ohm

VTC Pattern Menu C0x – C1x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C10	AUTOTUNE	Autotuning	539	21B	774.2	306.3	0	0	1

VTC

11.3.2. OPERATION METHOD MENU C1X – C2X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C17	MDI1	Operating mode MDI1	1290	50A	0	0	3	List	–
C18	MDI2	Operating mode MDI2	1291	50B	0	0	3	List	–
C19	MDI3	Operating mode MDI3	1292	50C	0	0	7	List	–
C20	MDI4	Operating mode MDI4	1293	50D	2	0	7	List	–
C21	MDI5	Operating mode MDI5	1294	50E	0	0	6	List	–
C22	PID ACT.	PID operating mode	1295	50F	0	0	2	List	–
C23	PID REF.	PID reference selection	1296	510	0	0	4	List	–
C24	PID FB	PID feedback selection	1297	511	1	0	3	List	–
C26	ENC. STEP	Encoder pulse number	1298	512	1024	100	10000	1	–
C27	Delay Spd	Run delay threshold	1329	531	0	0	1500	1	rpm

List for parameter C17:

0: Mlts1
1: UP
2: Stop
3: Slave

List for parameter C18:

0: Mlts2
1: DOWN
2: Slave
3: Loc/Rem

List for parameter C19:

0: Mlts3
1: CWCCW
2: DCB
3: REV
4: A/M
5: Slave
6: Lock
7: Loc/Rem

List for parameter C20:

0: Mltr1
1: DCB
2: CWCCW
3: REV
4: A/M
5: Slave
6: Lock
7: Loc/Rem

List for parameter C21:

0: DCB
1: Mltr2
2: CWCCW
3: EXT A
4: REV
5: Slave
6: Lock

List for parameter C22:

0: Ext.
1: Ref
2: Add R

List for parameter C23:

0: Kpd
1: Vref
2: Inaux
3: Iref
4: Rem

List for parameter C24:

0: Vref
1: Inaux
2: Iref
3: Iout

Operation Method Menu C1x – C2x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C14	START OPER. M.	START command function	516	204	772.4	304.4	1	0	1
C16	REF OPER. M.	REF command function	517	205	772.5	304.5	1	0	1
C14	REM ENABLE	START command function **Note 08**	535	217	773.7	305.7	0	0	1
C16	REF ENABLE	REF enable from serial **Note 09**	536	218	773.8	305.8	0	0	1
C15	SPD/TRQ	SPD/TRQ control mode	544	220	774.7	306.7	0	0	1
C25	ENC.	Encoder feedback, bit 774.1	538	21A	774.1	306.2	0	0	1
C25	ENC.	Encoder feedback, bit 774.9	546	222	774.9	306.9	0	0	1
C28	PID INV	PID error inversion	522	20A	772.10	304.10	0	0	1

Note 08 In **Rem** mode, the inverter acknowledges the inputs simulated by the master device (SP01) via serial link instead of the terminal board inputs.

Note 09 In **Rem** mode, the inverter acknowledges the reference sent by the master device (SP03) via serial link instead of the reference sent from the terminal board.

List for parameter C14:

	bit 773.7	bit 772.4
Kpd	0	0
Term	0	1
Rem	1	1

List for parameter C16:

	bit 773.8	bit 772.5
Kpd	0	0
Term	0	1
Rem	1	1

List for parameter C25:

	bit 774.9	bit 774.1
NO	0	0
Yes	0	1
Yes A	1	1

11.3.3. POWER DOWN MENU C3X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C33	V. Level	Constant voltage for POWER DOWN	1299	513	IF_SW5=0_368_ ELSE_640	200	800	4	V
C34	V. Kp	POWER DOWN loop Kp constant	1300	514	512	0	32000	1	–
C35	V. Ki	POWER DOWN loop Ki constant	1301	515	512	0	32000	1	–
C36	PD Delay	Power down delay	1302	516	10	5	255	1	ms
C37	PD DEC T	Deceleration time during power down	1303	517	10	0.1	6500	10	s
C38	PDEXTRA	Extra deceleration during power down	1304	518	200	0	500	32/100	%
C39	DC LINK D.	Power failure detection speed increase	1305	519	0	0	300	256/100	%

Power Down Menu C3x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C32	POWERD.	Power down enabling, bit 773.5	533	215	773.5	305.5	0	0	1
C32	POWERD.	Power down enabling, bit 773.6	534	216	773.6	305.6	0	0	1

C32:

	bit 773.6	bit 773.5
NO	0	0
Yes	0	1
Yes V	1	1

11.3.4. LIMITS MENU C4X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C42	TRQ.MAX.	Maximum torque	1306	51A	MIN((T002[2] * 100/C05),150)	50	T002[2]*100/C05	1	%

Limits Menu C4x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C43	TRQ.VAR.	Torque limit with IN AUX.	537	219	774.0	306.0	0	0	1

11.3.5. AUTORESET MENU C4X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C46	ATT.N.	Autoreset attempts	1307	51B	4	1	10	1	–
C47	CL.FAIL T.	Autoreset attempt reset	1308	51C	300	1	999	50	s

Autoreset Menu C4x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C48	PWR R.	Alarm reset at power off	531	213	773.3	305.3	0	0	1

VTC

11.3.6. SPECIAL FUNCTIONS MENU C5X – C6X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C51	FLUX DIS. TIME	Delay time before flux disabling	1316	524	0	0	1350	10	ms
C55	F. PARAM	First parameter at power on	1309	51D	2	0	23	List	–
C56	FB R.	Feedback ratio	1310	51E	1	0.001	50	1000	–
C59	Brk Disable	Brake disabling time	1311	51F	18000	0	65400	1	ms
C60	Brk enable	Brake enabling time	1312	520	2000	0	65400	1	ms
C61	Speed alr	A16 Speed alarm enabling	1313	521	0	0	200	1	%
C62	DCB ramp time	Flux ramp before DCB	1314	522	100	2	255	1	ms
C63	Flux ramp	Flux ramp	1315	523	T000[1]	30	4000	1	ms
C64	Flux delay	Delay after flux ramp	1332	534	0	0	4000	1	ms

List for parameter C55:

0	M01 Spd ref/ Tq ref
1	M02 Rmp out
2	M03 Spd out
3	M04 demand
4	M05 Tq out
5	M06 Iout
6	M07 Vout
7	M08 Vmn
8	M09 Vdc
9	M10 Pout
10	M11 Tr. Bd
11	M12 TB Out
12	M13 O. Time
13	M14 Hist.1
14	M15 Hist.2
15	M16 Hist.3
16	M17 Hist.4
17	M18 Hist.5
18	M19 Aux I
19	M20 Pid Rf
20	M21 Pid FB
21	M22 Pid Er
22	M23 Pid O.
23	M24 Feed B.

Special Functions Menu C5x – C6x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C49	HIGH V	Rated mains voltage	537	219	773.9	305.9	0	0	1
C50	FANFORCE	Fan startup forcing	519	207	772.7	304.7	0	0	1
C52	M.L. MEM.	Mains loss saving	523	20B	772.11	304.11	0	0	1
C53	ENABLE OP.	ENABLE terminal (6) operation	527	20F	772.15	304.15	1	0	1
C54	F. PAGE	Page displayed at power on	514	202	772.2	304.2	0	0	1
C57	EXTRA	Extra fluxing enabling	545	221	774.8	306.8	1	0	1
C58	OV Ctrl	Overvoltage control	515	203	772.2	304.3	1	0	1

11.3.7. MOTOR THERMAL PROTECTION MENU C6X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C65	THR.PRO.	Thermal protection enabling	1317	525	0	0	3	List	–
C66	MOT.CUR.	Thermal protection pick–up current	1318	526	105	1	120	1	%
C67	TH.C.	Motor thermal constant	1319	527	600	5	3600	1	s
C68	Stall time	Stall time	1330	532	0	0	10	10	s
C69	Stall speed	Stall threshold	1331	533	50	0	200	1	rpm

List for parameter C65:

0: No
1: Yes
2: Yes A
3: Yes B

VTC

11.3.8. D.C. BRAKING MENU C7X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C72	DCB T.SP.	DCB at STOP time	1320	528	0.5	0.1	50	10	s
C73	DCB T.ST.	DCB at START time	1321	529	0.5	0.1	50	10	s
C74	DCB SP.	DCB at STOP starting speed	1322	52A	50	1	250	1024/1194	rpm
C75	DCB CUR.	DCB current	1323	52B	100	1	T002[2]*100/C05	1	%

D.C. Braking Menu C7x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C70	DCB STP	DCB at STOP enabling, bit 772.9	521	20D	772.9	304.9	0	0	1
C70	DCB STP	DCB at STOP enabling, bit 772.13	525	20D	772.13	304.13	0	0	1
C70	DCB STP	DCB at STOP enabling, bit 772.1	529	20D	773.1	305.1	0	0	1
C71	DCB STR	DCB at START enabling	526	20E	772.14	304.14	0	0	1

List for parameter C70:

	bit 772.13	bit 772.9	bit 772.1
NO	0	0	0
Yes	0	0	1
Yes A	0	1	1
Yes B	1	1	1

11.3.9. SERIAL LINK MENU C8X

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K	Unit of meas.
C80	ADDRESS	Inverter address	1324	52C	1	1	247	1	–
C81	S. DELAY	Response delay	1325	52D	0	0	500	20	ms
C83	RTU Timeout	Serial MODBUS RTU time out	1326	52E	0	0	2000	1	ms
C84	BaudRate	Serial link baud rate	1327	52F	3	0	3	List	–
C85	Parity	Serial link parity	1333	535	0	0	2	List	–

List for parameter C84:

0	1200 bps
1	2400 bps
2	4800 bps
3	9600 bps

List for parameter C85:

0	None / 2 stop bit
1	Even / 1 stop bit
2	None / 1 stop bit

Serial Link Menu C8x: Bit Parameters

	Name	Description	Addr. (dec) WRITE	Addr. (hex) WRITE	Addr. (dec) READ	Addr. (hex) READ	Def	Min	Max
C82	WD	Communication watchdog enabling	520	208	772.8	304.8	0	0	1

VTC

11.4. SPECIAL PARAMETERS (SPxx) (Read Only)

	Name	Description	Addr. (dec) R/W	Addr. (hex) R/W	Def	Min	Max	K
SP02	Analog reference from terminal board	769	301	0	0	2030	1 **Note 10**	
SP05	Configuration bit	772	304				**Note 11**	
SP06	Configuration bit	773	305				**Note 12**	
SP07	Configuration bit	774	306				**Note 13**	
SP08	Inverter state	775	307		0	22	**Note 14**	

Note 10 Result of 10–bit A/D conversion of analog inputs in terminal board RIFV1, RIFV2, RIFI downstream of processing with parameters P16, P17, P18, P19, P20.

Note 11 SP05 Configuration bit: address 772 (304 hex).

	Bit		
P39 MF.FUNCTION	0	0 Absolute	1 Sum
P23 U/D – KPD MIN	1	0 0	1 +/–
C54 FIRST PAGE	2	0 Status	1 Keypad
C58 OV Ctrl	3	0 Disabled	1 Enabled
C14 START OPER. M.	4	Along with 773.7 bit	
C16 REF OPERATION M.	5	Along with 773.7 bit	
P18 VREF J14 POSITION	6	0 Unipolar	1 Bipolar
C50 FANFORCE	7	0 Fans start if T>60°C	1 Fans always ON
C82 WD	8	0 Disabled	1 Enabled
C70 AT STOP	9	Along with bit 13 and 773.1	
C45 AUTORESET	10	0 Disabled	1 Enabled
C52 MAINS LOSS MEM.	11	0 Not stored	1 Stored
P27 Clear KI	12	0 Disabled	1 Enabled
C70 DCB AT STOP	13	Along with bit 9 and 773.1	
C 28 PID INVERSION	10	0 Disabled	1 Enabled
C71 DCB AT START	14	0 Disabled	1 Enabled
C53 ENABLE OPERATION	15	0 Enabled after opening	1 Immediately enabled

Note 12 SP06 Configuration bit: address 773 (305 hex)

	Bit		
P24 UP/DOWN MEM.	0	0 Not stored	1 Stored
C70 DCB AT STOP	1	Along with bit 772.9 and 772.13	
not used	2		
C48 PWR RESET	3	0 Disabled	1 Enabled
P25 UP/DOWN RESET	4	0 Disabled	1 Enabled
C32 POWER DOWN	5	Along with bit 6	
C32 POWER DOWN	6	Along with bit 5	
C14 START REM ENABLE	7	Along with bit 772.4	
C16 REF REM ENABLE	8	Along with bit 772.5	
C49 HIGH V	9	0 200-240V(2T), 380-480V(4T)	1 200-240V(2T), 481-500V(4T)
not used	9÷15		

Note 13 SP07 Configuration bit: address 774 (306 hex)

	Bit		
C43 TRQ VAR.	0	0 Disabled	1 Enabled
C25 ENCODER.	1	Along with bit 9	
C10 AUTOTUNE	2	0 Disabled	1 Enabled
not used	3÷6		
C15 COMMAND	7	0 Speed	1 Torque
C57 EXTRA	8	0 Disabled	1 Enabled
C25 ENCODER	9	Along with bit 1	
not used	10÷15		

Note 14

0	INVERTER OK
1	A30 DC Link Overvoltage
2	A31 DC Link Undervoltage
3	A04 Wrong user's par.
4	A22 Motor overheated
5	A20 Inverter Overload
6	A05 EPROM reading error
7	A03 EEPROM absent
8	A36 External alarm
9	A15 Encoder Alarm
10	A01 Wrong software
11	A11 Bypass circ. failure
12	A24 Motor not connected
13	A23 Autotune interrupted
14	TO START OPEN AND CLOSE TERM 6
15	A16 Speed maximum
16	A21 Heatsink overheated
17	A06 UC Failure
18	A32 Running overcurrent
19	A33 Accelerating overcurrent
20	A34 Decelerating overcurrent
21	A02 Wrong size
22	A40 Serial comm. error
23	A18 Fan fault overtemperature
24	A19 2nd sensor overtemperature

VTC

11.5. SPECIAL PARAMETERS (SWxx) (Read Only)

	Description	Addr. (dec)	Addr. (hex)	Min	Max	K
SW1	Software version	475	1DB			**Note 15**
SW2	Product ID	476	1DC			**Note 16**
SW3	PIN (Part Identification Number)	477	1DD	0	20	index of T000[]
SW4	Current class	478	1DE	0	37	index of T002[]
SW5	Voltage class	479	1DF	0	1	index of T001[]

Note 15 Decimal number corresponding to the inverter firmware version. Example:
Response 2050 = version V2.050

Note 16 ASCII code corresponding to 'VK': 564Bh.

11.6. SPECIAL PARAMETERS (SPxx) (Write Only)

	Description	Addr. (dec)	Addr. (hex)	Def	Min	Max	K	Unit of measure
SP01	Terminals simulated from serial link	768	300				**Note 17**	
SP03	Reference from serial link	770	302	0	IF_C15=0 _–C02_ ELSE_–C42	IF_C15=0 _C02_ ELSE_C42	IF_C15=0_65536/ 76444_ ELSE_C04*1000000/ X999*4	IF_C15=0 rpm ELSE_%
X999	Support variable						T000[0]*C06* 1.27845	
SP04	PID reference from serial link	771	303	0	–100	100	20	%
SP09	Parameter saving	776	308				**Note 18**	
SP10	Default restoration	777	309				**Note 19**	

Note 17 Terminals are simulated by sending a byte to the inverter; the byte bits simulate the active state of an input. Structure is the same as the one stated in **Note 01** (see Note 01). Bit 5 ENABLE is set to AND with the similar bit read from the terminal board.

Note 18 Any writing with any data item forces the inverter to store to EEPROM all new parameter values.

Note 19 Any writing with any data forces the inverter to restore default programming (factory setting).

Table T000[]: index (SW3) at address 477 (1DDh)

	I Full-scale (A)	C63 default
	T000[0]	T000[1]
0	25	300
1	50	300
2	50	300
3	65	300
4	65	300
5	65	300
6	100	300
7	100	300
8	100	300
9	125	300
10	130	300
11	130	300
12	130	300
13	210	300
14	210	300
15	280	300
16	390	300
17	480	300
18	650	450
19	865	450
20	1300	450

Table T001[]: index (SW5) at address 479 (1DFh)

	Class(V)
	T001[0]
0	230
1	400

Table T002[]: index (SW4) at address 478 (1DEh)

	Model	Imot (C05) default (A)	Inom (A)	Imax (A)	C04 default @ 4T	C07 default @ 4T	C08 default @ 4T	C09 default @ 4T
		T002[0]	T002[1]	T002[2]	T002[3]	T002[4]	T002[5]	T002[6]
0	0005	6.4	10.5	11.5	3	2.500	1.875	30.00
1	0007	8.4	12.5	13.5	4	2.000	1.500	25.00
2	0008	8.5	15	16	3.9	1.733	1.300	20.80
3	0009	9	16.5	17.5	4.5	1.600	1.200	16.00
4	0010	11	17	19	5.3	1.386	1.040	13.00
5	0011	11.2	16.5	21	5.5	1.300	0.975	12.00
6	0013	13.2	19	21	6.5	1.126	0.845	10.40
7	0014	14.8	16.5	25	7.5	1.000	0.750	8.00
8	0015	15	23	25	7	1.040	0.780	8.67
9	0016	17.9	27	30	9.2	0.800	0.600	6.00
10	0017	17.9	30	32	9.2	0.800	0.600	6.00
11	0020	21	30	36	11	0.600	0.450	5.00
12	0023	25.7	38	42	13	0.520	0.390	4.34
13	0025	29	41	48	15	0.400	0.300	3.00
14	0030	35	41	56	18.5	0.300	0.225	2.50
15	0033	36	51	56	19.2	0.347	0.260	2.60
16	0034	41	57	63	22	0.250	0.188	2.00
17	0035	41	41	72	22	0.250	0.188	2.00
18	0036	46	60	72	25	0.250	0.188	2.00
19	0037	50	65	72	26	0.174	0.131	2.00
20	0038	46	67	75	25	0.200	0.150	2.00
21	0040	46	72	75	25	0.200	0.150	2.00
22	0049	55	80	96	30	0.150	0.113	2.00
23	0060	67	88	112	37	0.120	0.090	2.00
24	0067	80	103	118	45	0.100	0.075	1.20
25	0074	87	120	144	50	0.080	0.060	1.20
26	0086	98	135	155	55	0.060	0.045	1.00
27	0113	133	180	200	75	0.040	0.030	1.00
28	0129	144	195	215	80	0.040	0.030	1.00
29	0150	159	215	270	90	0.030	0.023	1.00
30	0162	191	240	290	110	0.020	0.015	1.00
31	0179	212	300	340	120	0.018	0.014	1.00
32	0200	228	345	365	132	0.018	0.014	0.90
33	0216	264	375	430	150	0.015	0.011	0.80
34	0250	321	390	480	185	0.012	0.009	0.60
35	0312	375	480	600	220	0.012	0.009	0.50
36	0366	421	550	660	250	0.010	0.008	0.40
37	0399	480	630	720	280	0.010	0.008	0.30

(continued)

VTC

(continued)

	Model	C04 default @ 2T	C07 default @ 2T	C08 default @ 2T	C09 default @ 2T
		T002[7]	T002[8]	T002[9]	T002[10]
0	0005	1.7	1.443	1.082	17.32
1	0007	2.3	1.154	0.866	14.43
2	0008	2.2	1.000	0.750	12.00
3	0009	2.5	0.923	0.692	9.23
4	0010	3	0.800	0.600	7.50
5	0011	3.1	0.750	0.562	6.92
6	0013	3.7	0.650	0.487	6.00
7	0014	4.3	0.577	0.433	4.61
8	0015	4	0.600	0.450	5.00
9	0016	5.3	0.461	0.346	3.46
10	0017	5.3	0.461	0.346	3.46
11	0020	6.3	0.346	0.259	2.88
12	0023	7.5	0.300	0.225	2.50
13	0025	8.6	0.230	0.173	1.73
14	0030	10.6	0.173	0.129	1.44
15	0033	11	0.200	0.150	1.50
16	0034	12.7	0.144	0.108	1.15
17	0035	12.7	0.144	0.108	1.15
18	0036	14.4	0.144	0.108	1.15
19	0037	15	0.100	0.075	1.150
20	0038	14.4	0.115	0.086	1.15
21	0040	14.4	0.115	0.086	1.15
22	0049	17.3	0.086	0.065	1.15
23	0060	21.3	0.069	0.051	1.15
24	0067	25.9	0.057	0.043	0.69
25	0074	28.8	0.046	0.034	0.69
26	0086	31.7	0.034	0.025	0.57
27	0113	43.3	0.023	0.017	0.57
28	0129	46.1	0.023	0.017	0.57
29	0150	51.9	0.017	0.013	0.57
30	0162	63.5	0.011	0.008	0.57
31	0179	69.2	0.010	0.008	0.57
32	0200	76.2	0.010	0.008	0.51
33	0216	86.6	0.008	0.006	0.46
34	0250	106.8	0.006	0.005	0.34
35	0312	127.0	0.006	0.005	0.28
36	0366	144.3	0.005	0.004	0.23
37	0399	161.6	0.005	0.004	0.17

12. SELECTING THE APPLICATION SW (IFD SW OR VTC SW)

CAUTION This procedure can be performed only for the inverters equipped with SW Vers. 2.xxx or greater.
VTC SW cannot be selected for sizes >S50.

The inverter is supplied with the application software required (IFD SW or VTC SW). This section explains how to switch from IFD SW to VTC SW and from VTC SW to IFD SW.

Control board ES778/2 is provided with two programmable devices:

- FLASH 29F040 (U46 in the control board);
- DSP TMS320F240 (U12 in the control board).

FLASH 29F040 performs the user interface for the inverter by managing the parameters and functionality described above.
DSP TMS320F240 performs the motor control.

Use both devices to select the application SW required.

12.1. FLASH PROGRAMMING

Use jumper J15 to select either IFD SW or VTC SW.

Set jumper J15 to position 2–3 for IFD SW and to position 1–2 for VTC SW.

CAUTION Remove voltage from the inverter first

12.2. DSP PROGRAMMING

Use jumper J19 to select either IFD SW or VTC SW.

Set jumper J19 to position 1–2 for IFD SW and to position 2–3 for VTC SW.

CAUTION Remove voltage from the inverter first

Both devices must be programmed with the same application SW. If not, the inverter will not start up.

Jumper Position	IFD SW	VTC SW	Illegal settings	
J15	2–3	1–2	1–2	2–3
J19	1–2	2–3	1–2	2–3

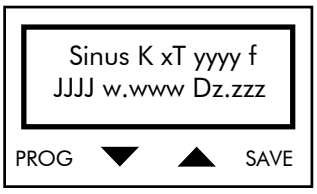
If an illegal setting is attempted, the inverter will not start up. An alarm trips and VL LED and IL LED start blinking together (see the DISPLAY and LEDs section).

The section below explains how to program the application SW required (IFD SW or VTC SW).

12.3. SELECTING THE APPLICATION SOFTWARE

Do the following:

1 – Check the SW version by accessing the SIZE page in the Measure/Parameter menu. The SW version is displayed as follows:

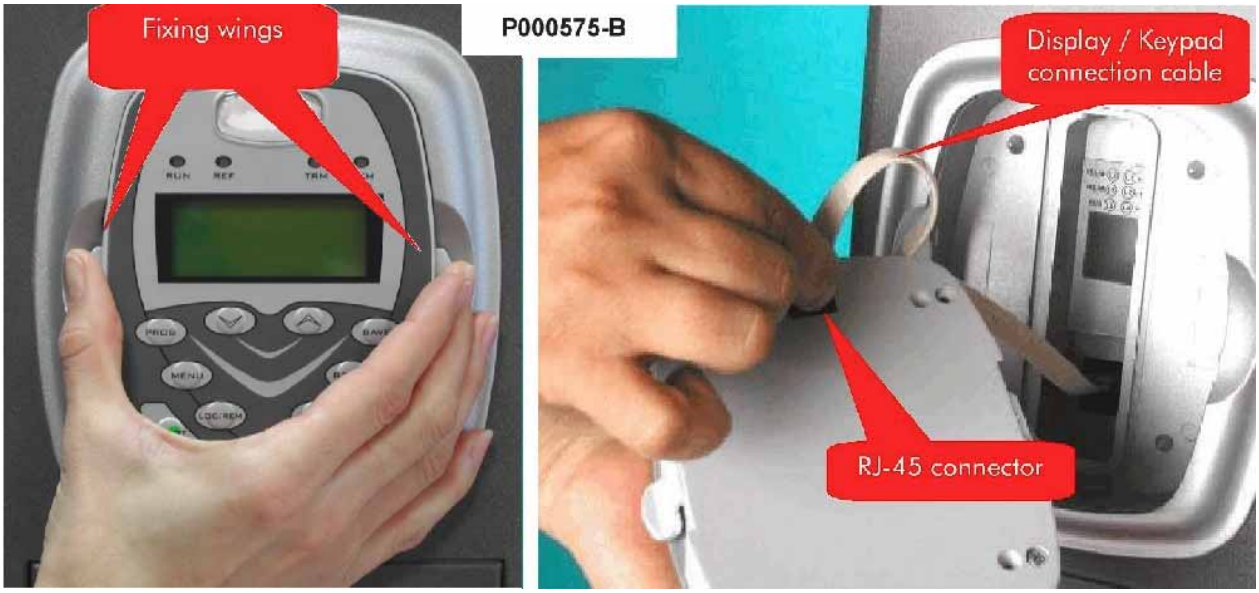


Field JJJJ relates to the application SW programmed (IFD SW or VTC SW).
Field w.www relates to the FLASH SW Version.
Field z.zzz relates to the DSP SW version.

The SW version must be 2.xxx or greater; SW version 1.xxx does not allow this programming procedure.

2 – Remove voltage from the inverter and wait at least one minute when the keypad backlit display turns off (if no keypad is fit, wait at least one minute when the indicator LED for voltage detection in the control board are off).

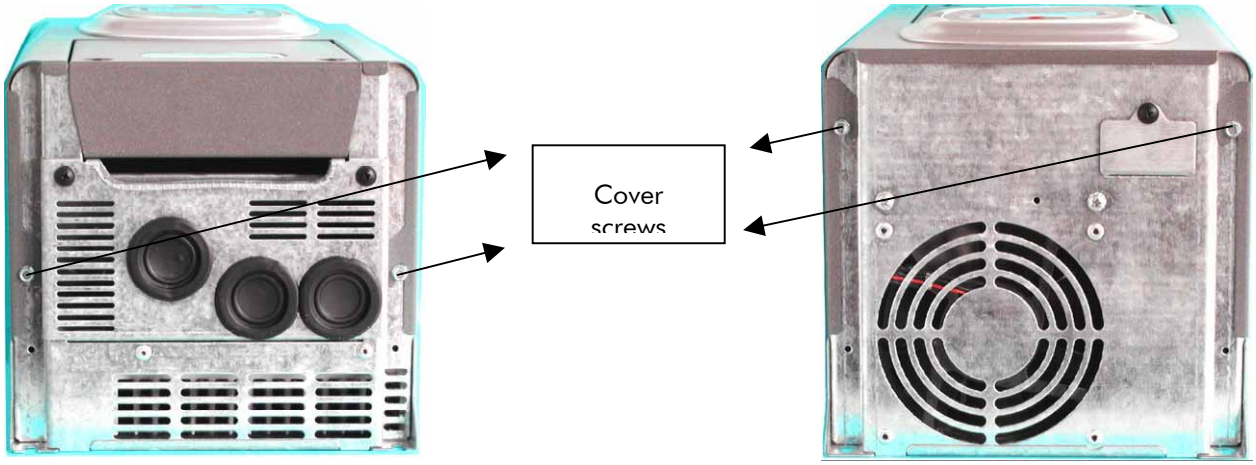
3 – Remove the keypad and its wire. Remove the keypad by pushing its side tabs. A short 8–pole telephone wire connects the keypad to the inverter. Push the wire tab to remove it from the inverter side.

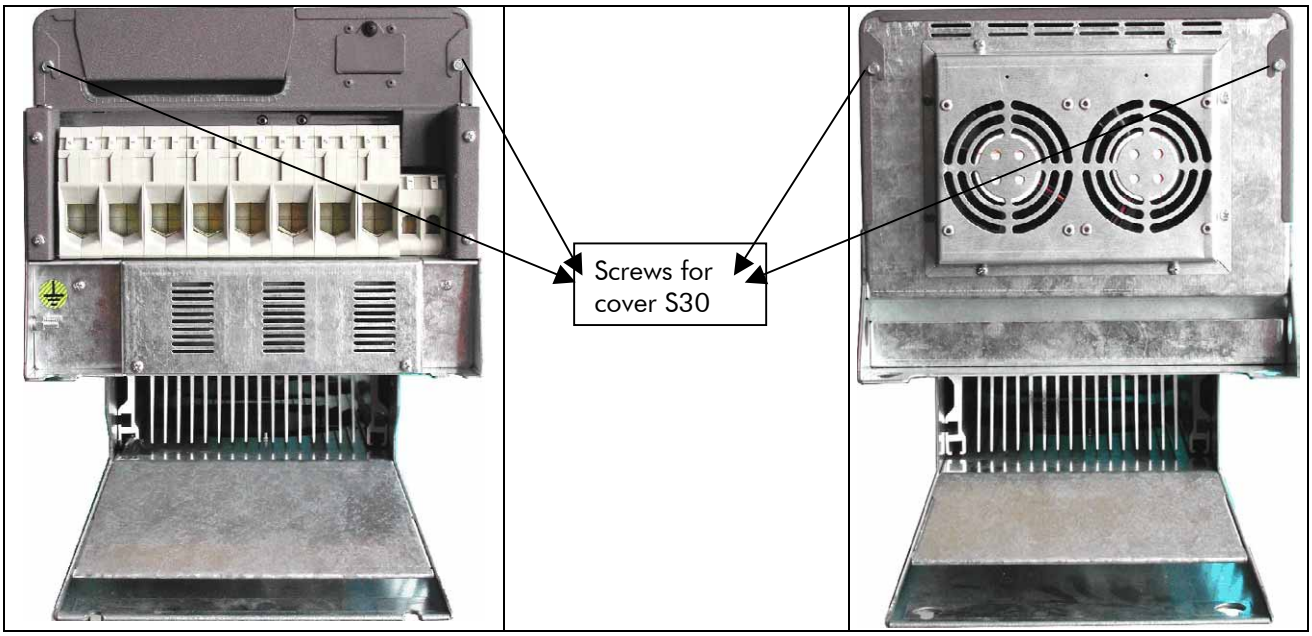


4 – Remove the terminal cover fastening screws as shown in the figure below.

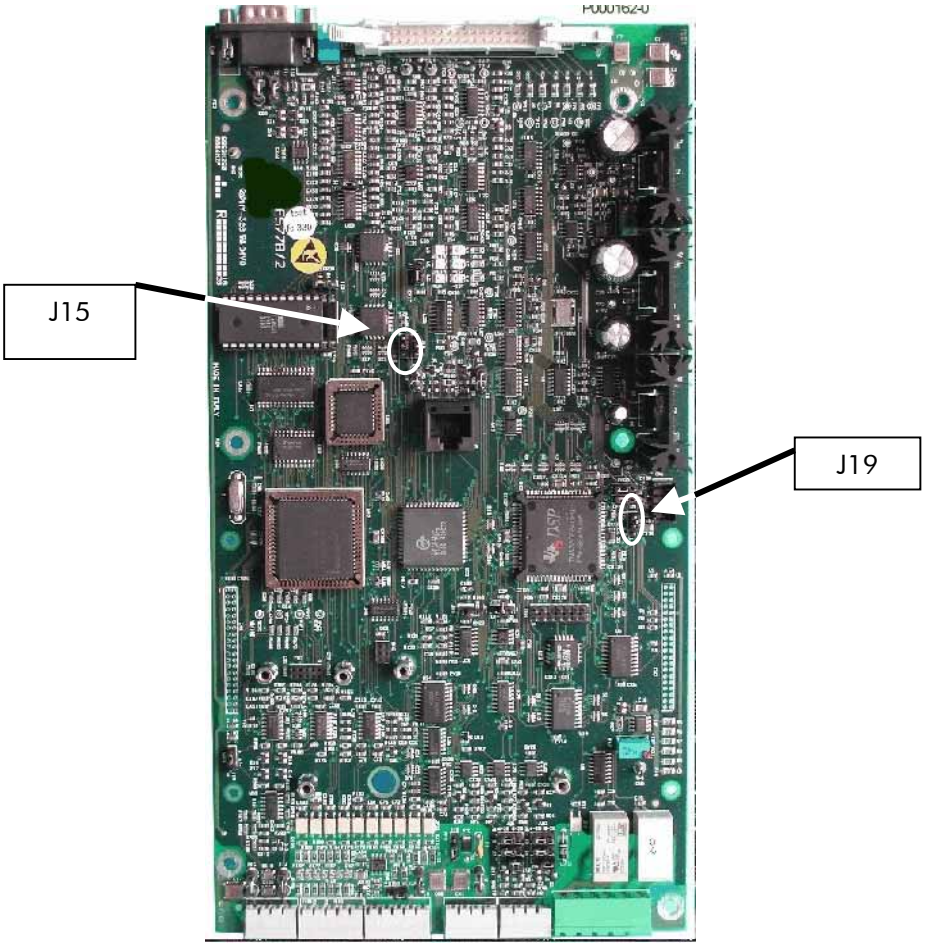
5–Remove the inverter cover.

Unloose the fastening screws in the inverter cover. The screws are located in the top and bottom side of the inverter. As an example, the figures below show the location of fastening screws for size S10 and size S30; fastening screws for the other inverter sizes are located more or less in the same way. For any inverter size, except for S05, just unloosen the fastening screws to remove the inverter cover.





6 – Gain access to the control board and set jumpers J15 and J19 as stated in the relevant table in the DSP PROGRAMMING section.



7 – Reassemble the inverter cover, the terminal board cover and the keypad.

CAUTION **Always** reassemble the inverter cover before switching on the inverter.

7 – Turn on the inverter and make sure that SW programming is correct: access the SIZE page containing the inverter ratings and check that the new application SW is displayed (see step 1 above).

8 – Adjust the parameters relating to the new application SW as explained in this manual.

12.4. ALARMS RELATING TO SW SELECTION PROCEDURE

If the SW selection procedure is not properly performed, the following alarm conditions may occur:

1) The inverter does not start. VL LED and IL LED start blinking together (see the DISPLAY and LEDs section). This may occur if the SW type in the DSP does not match with the SW installed in the user interface on FLASH memory (one is programmed with IFD SW and the other is programmed with VTC SW). Check position of jumpers J15 and J19.
2) Alarm "A02 Wrong Size" trips: VTC SW was selected for size > S50. Reset IFD software.
3) Alarm "A04 Wrong user's parameters" trips: an error was detected in the user parameter memory. Do a "Restore default" procedure of the user parameters (see Commands Menu).
4) Alarm "A01 Wrong Software" trips. Please contact ELETTRONICA SANTERNO's AFTER–SALES SERVICE.