

SERVODRIVE *BLAST-E*

INSTRUCTION AND USER MANUAL

Code:	BLAST MNU 0000 ING
Revision:	1.7
Issue :	November 2007

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1 FOREWORD

1.1 Notes about the Manual

This manual informs on details regarding the frequency inverter **BLAST-E**, in all steps such as transport, installation, disassembling, as well as all requirements to be considered and measures to be taken to grant full safety for the persons taking care of simple operating.

This manual was written thinking of **trained personnel, persons in charge of installation, assembling, commissioning and service for BLAST-E.**

Such persons must definitely :

- Know all specific safety regulations regarding the switching of electric circuits , grounding and electric circuit, device and system identification.
- Know all main physical aspects of electric system ;
- Have a full knowledge of the symbols used for electric diagrams;
- Know all criteria regarding cabling and electric components .

Neither do the operators need previous experience in the specific field of frequency converters nor have received a training on all operations (all steps from installation to service) on the device.

The data contained in this manual are not binding and are related to the device reflecting the actual state of art at the moment of selling.

This document describes the **BLAST-E performances**. The product might be further developed so that higher performances would be integrated later on.

This manual has to be considered as part of the device and must therefore kept for future reference as long as the device is used .

The instructions may not be copied without previous written agreement by **EARP SPA** claiming all rights.

1.2 Descriptions and Symbols

The manual contains three different kinds of indication :

CAUTION!

Shows not correct actions or behaviours that may generate danger for the operators. It also stresses dangers that may occur during service operations.

WARNING

Shows a procedure to be followed or avoided so to properly carry out an installation, repair or replacement without damaging the device.

NOTE

It is used to further clarify an instruction , repair or any item.

The indications will be provided with the following symbols::



Situations that may cause **serious danger to the operator**, . always going along with **CAUTION** .



Cases when **voltage** can generate **danger for the operator** . Always going along with **CAUTION** .



Means that operations are being carried out where electrostatic discharges are given . Always going along with **WARNING**.

1.3 General Safety Requirements

This section contains information regarding the safety of the personnel operating with **BLAST-E**. The general information regards the risks around operations and servicing of the devices.

Operators and personnel in charge of service must be informed on all dangers related to high voltage and frequency as well as know all related safety procedures.

CAUTION!

All maintenance and installation operations on **BLAST-E** must be carried out by trained and therefore qualified electricians.



- 1) **BLAST-E and connected** devices must be adequately grounded .
- 2) **Do not mount the** EMC filter when **BLAST-E** is connected to a floating supply .
If a **BLAST-E with integrated EMC** filter is connected to the mains without ground, the supply would be connected to the ground-frame through the filter's capacitors. Such configuration may bring lightning risk for the operator as well as damage to the drive. Disconnect the EMC filter before connecting **BLAST-E** to a not grounded mains supply.
- 3) **Do not act on BLAST-E under voltage.** After disconnecting the mains wait at least 10 minutes before operating on drive, motor or motor cable for the capacitors of the dc circuit to unload. Before any operation check the drive not to be under voltage (with a voltmeter).
- 4) The output terminals on **BLAST-E** (motor connection) have dangerous voltage values when the drive is supplied, not depending on the motor's running or not
- 5) Even when **BLAST-E** is not under voltage (mains supply open and capacitors not loaded),there could still be dangerous voltage inside coming from the auxiliary circuits connections and external control circuits. Working on the unit must happen with utmost caution, after cutting all connections. This to avoid any danger for persons , meaning even death risk.
- 6) When the drive is not running but is not cut off from the mains through the switch or other device, there might be an accidental motor shaft movement in case of failure or bad running.
- 7) It is not allowed to change the insulation distances or remove insulating materials or covers



WARNING

- 1) **BLAST-E** allows electric motor and driver machines to operate on wider field . It is therefore necessary to check for all devices to fulfil such requirements.
- 2) No operating is allowed if the motor's nominal current is lower than half the nominal input voltage of **BLAST-E** or if the motor's nominal current is lower than 1/3 of the nominal output current of **BLAST-E**. **BLAST-E** was developed to control brushless or standard squirrel cage asynchronous motors.
- 3) The **BLAST-E** output consists of short but voltage pulses , not related to the output frequency. Such voltage can reach the double value if the motor cable is too long and can cause serious damage to the motor.

4) All insulation tests must be carried out after disconnecting **BLAST-E** from the cables. Do not try and use the system beyond its nominal capacity. Not respecting the rules might damage **BLAST-E** seriously.

5) Handle the device carefully, so that no parts can be damaged.

6) The drive must be protected against not allowed conditions (temperature, humidity, blows, etc).

7) No voltage may be applied to the drive's output (terminals U2, V2 and W2). It is not allowed to connect inverters in parallel on the output; no direct connection of the input to the inverter output is allowed (By-pass).

8) No capacitive load over 5nF, may be connected to the drive output (terminals U2, V2 e W2).

9) Always carry out the ground connections (PE), from the related terminal to the round bar of the cabinet or plant.

10) No electric strength tests may be carried out on drive parts. In order to measure the signal voltage adequate instruments have to be used (min. inner resist. 10k Ω /V).

WARNING



1) The drive contains components which suffer from electrostatic charges and can be damaged if handled in a not proper way. In case of replacement or servicing on the electronic boards, the following has to be taken into account

2) The boards should be touched only when strictly necessary in order to do the planned job. Anyway a service set against electrostatic discharges has to be used (grounded metallic strip to be applied on the operator's wrist along with a piece of conductive material to put the board on).

3) The boards may not touch high insulating materials such as plastic sheets, insulating surfaces, synthetic cloth parts.

1.4 Documentation

The documentation of Blast-e inverter, as well as providing this manual, it supplies also publications for specific applications or system optional, they can be found in the CD supplied with the product.

NOTE

Requirements regarding transport storing and unpacking are contained in this manual.

2 Drive DESCRIPTION

2.1 Introduction

EARP spa has developed BLAST as Servo Drive able to:

1. Control brushless and asynchronous motors.
2. Be configured and updated anytime from a PC

NB: the product is actually available with SVC, FVC, SB, SFT, SSP mode.



The *BLAST-E drives* were conceived for most different industrial applications and allow a continuous speed control of brushless and asynchronous from 0 to a max. value.

They are extremely compact, reliable and cost attractive as well as easy to use; they can find application in all application fields for sinusoidal brushless servomotors, three-phase asynchronous and SSP motors.

The DSP control system allows high programming flexibility.

The PWM modulation and the low-loss semi-conductive devices grant the drive's high efficiency.

2.2 Use of BLAST E

The *BLAST-E* drives are suitable for single or multi-motor systems with asynchronous or sinusoidal brushless motors and can satisfy any need for most different, simple or complex applications:

- compressors, pumps, centrifuges
- centrifugal pumps for central heating stations and water sources
- Machines for textile and paper industries
- Ventilation systems
- Conveyors, conveyor belts and packaging machines
- Textile machines, machines for wood and marble manufacturing
- Lifts, goods elevators, hoist cranes
- Separators, fans and feedstuff companies mills
- Printing machines and typographic presses
- Presses supplies, steel-cut positioners and other machines for the metal manufacturing.
- Extruders, boiler plants

2.3 Identification Code and Plate

BLAST- E is encoded as follows

BLAST-E 0 0 2 2 | B B H F

Product type

Size in kW _____
(See electric data charts)

Nominal Supply Voltage:

A=220÷240 Vac, B=380÷480 Vac.

“SIZE”

$$A = 0.75\text{kW} \div 5.5\text{kW}$$
$$B = 7,5\text{kW} \div 22\text{kW}$$
$$C = 30\text{kW} \div 45\text{kW}$$
$$D = 55\text{kW} \div 75\text{kW}$$
$$E = 90\text{kW} \div 160\text{kW}$$

Duty

H = Standard overload

L = Reduced Overload

Special Versions

No letter = Standard version

F = External brake resistor (for units of power $0.75 \div 11\text{kW}$)

2.3.1 How To Read the Plate

 Ponte di Nanto (VI) www.earp.it e-mail: earp@earp.it 	
SYNERGY IN MOVEMENT	
 MODEL *BLAST-E 0011 BAH* ①	
 S/N *C012001050258* ⑥	
2002 / 2003	1 2 3 4 5 6 7 8 9 10 11 12

- ① drive abbreviation
- ② nom. Power absorbed in kVA
- ③ Supplying voltage in Volt
- ④ nom/max output current
- ⑤ output frequency
- ⑥ serial number

INPUT	VOLTAGE ③	3Ph 380-15%÷480+5% Vac
	FREQUENCY	45 ÷ 65Hz
	KVA	2,5 ②
OUTPUT	VOLTAGE	3Ph 380 ÷ 480 Vac
	CURRENT	3.5 / 7 A ④
	FREQUENCY	0 ÷ 1000 Hz ⑤

2.3.2 Option Codes

Also available:

CODE	DESCRIPTION
BLAST-E OPT 0000	Cover for option card mounted as standard
BLAST-E OPT 0010	7 segments display keypad
BLAST-E OPT 0030	Option Card RS232
BLAST-E OPT 0031	Option Card RS232 + cable L=1,5 m
BLAST-E OPT 0040	Option Card RS485
BLAST-E OPT 0041	Option Card RS485 + cable L=1.5 m
BLAST-E OPT 0050	Option Card CAN BUS with DeviceNet
BLAST-E OPT 0060	Option Card PROFIBUS DP
BLAST-E OPT 0110	Option Back-UP Card 24V
BLAST-E OPT 0120	10V supplying optional card for external potentiometer

2.4 General Features and Technical Data of the BLAST-E range

2.4.1 General Inverter Features

IGBT Frequency converter for three-phase asynchronous motors, brushless motors and SSP motors with supplying possibility for three-phase net also with integrated dissipative brake.

- **SFT** Control (*Stator Flux Torque control*)
- **SB** Control (*Sinusoidal Brushless control*)
- **FVC** Control (*Flux Vector Control*)
- **SVC** Control (*Space Vector Control*)
- **SSP** Control (*Sensorless Speed and Position control*)
- Automatic identification for motor parameters
- Running with programmable intermediate speeds
- acceleration/deceleration time in a field: 0,1÷999,9 sec.
- max frequency: 1000Hz
- Change possibility of the modulation frequency: 12kHz, 8kHz, 4kHz, 2kHz, 1,5kHz, 1kHz
- PWM Frequency of random type to reduce the noise
- Monitoring and control of monitoring speed and current/torque control
- Failures indicator
- Torque and speed operation
- SW moto-potentiometer
- Overcharge limitation
- Rotation sense setting
- Acceleration on fly
- S Characteristic of the acceleration/deceleration function
- 0,02Hz frequency digital reference resolution
- Analog/digital frequency meter output
- Password for parameters modification for keypad
- System functions (*positioning/Aspo / tension adjustment / Fast PLC/ Traverse*)
- **PID** Regulator
- Switch braking integrated up to 22kW
- Speed retroaction with encoder/resolver
- Resolver auto-timing

2.4.2 Technical Data Blast-E range

- Technical data of *Blast-e* range

SIZE A	Three-phase supplying mains	Inverter power at 400V [kW]	Output ⁽²⁾ [A] Nominal current	Output [A] maximum current	Converter [kVA] apparent power
0007 BAH	380 V -15% 480 V +5% 45/65 Hz	0.75	0.75	5	1.7
0011 BAH		1	1	7	2.4
0015 BAH		1.5	1.5	9.6	3.3
0022 BAH		2.2	2.2	12	4.2
0037 BAH		3.7	3.7	19	6.5
0055 BAH		5.5	5.5	26	9

SIZE B	Three-phase supplying mains	Inverter power at 400V [KW]	Output ⁽²⁾ [A] nominal current	Output [A] maximum current	Converter [kVA] apparent power
0075 BBH	380 V -15% 480 V +5% 45/65 Hz	7.5	16.5	33	11.4
0110 BBH		11	25	50	17.3
0150 BBH		15	31	62	22
0185 BBH		18.5	39	78	27
0220 BBH		22	45	90	32

SIZE C	Three-phase supplying mains	Inverter power at 400V [KW]	Output ⁽²⁾ [A] nominal current	Output [A] maximum current	Converter [kVA] apparent power
0300 BCH	380 V -15% 480 V +5% 45/65 Hz	30	62	125	43
0370 BCH		37	76	152	53
0450 BCH		45	90	180	63

SIZE D	Three-phase supplying mains	Inverter power at 400V [KW]	Output ⁽²⁾ [A] nominal current	Output [A] maximum current	Converter [kVA] apparent power
0550 BDH	380 V -15% 480 V +5% 45/65 Hz	55	112	224	78
0600 BDH		60	120	240	83
0750 BDH		75	150	300	104

SIZE	Three-phase supplying mains	Inverter power at 400V [KW]	Output ⁽²⁾ [A] nominal current	Output [A] maximum current	Converter [kVA] apparent power
0900 BEH	380 V -15% 480 V +5% 45/65 Hz	*90			126
1100 BEH		110	200	230	152
1320 BEH		*132			180
1600 BEH		*160			221

* in development

2.4.3 PWM Frequency of Blast-E

BLAST-E has 2 options regarding the PWM: 1 with Derating - 2 Fix PWM

Derating

By setting parameter **d2** at 1, BLAST works derating the set PWM and keeping Inom and I_{max} constant while temperature varies.

Such option is recommended for applications in which the drive must grant continuous duty.

When conditions go back to normality, the PWM goes back to the set max. frequency.

To choose the suitable BLAST with FPWM derating refer to chart 2.4.3.1

Fix PWM

The function with fix PWM means that the drive operates with set PWM until the max. allowed case temperature is reached. After that, the thermal alarm is switched and the drive is stopped.

See chart 2.4.3.1 to choose the **In** referring to the **PWM value**.

Chart 2.4.3.1 Quick drive choice according to the operation mode

CODE	SIZE	Pot. (380V)	In (A)	(2In) I _{max} (A)	F max at 40°C (kHz)	PWM derating				fix PWM			
						T _{case} °C< 12kHz	T _{case} °C< 8kHz	T _{case} °C< 4kHz	T _{case} °C< 2kHz	In at 4kHz	In at 8kHz	In at 12kHz	T case
0007 BAH	A	0,75 Kw	2,5	5	12	80	-	-	-	2,5	2,5	2,5	80
0011 BAH	A	1,1 Kw	3,5	7	8	80	-	-	-	3,5	3,5	3	85
0015 BAH	A	1,5 Kw	4,8	9,6	12	-	-	-	-	4,8	4,8	4,8	80
0022 BAH	A	2,2 Kw	6	12	12	85	-	-	-	6	6	6	85
0037 BAH	A	3,7 Kw	9,5	19	12	85	-	-	-	9,5	9,5	9	85
0055 BAH	A	5,5 Kw	13	26	8	75	80	-	-	13	11	9	85
0075BBH	B	7,5 Kw	16,5	33	8	//////	70	-	-	16,5	16,5	14	70
0110BBH	B	11 Kw	25	50	4	//////	70	80	-	25	21	16,5	80
0150BBH	B	15 Kw	31	62	8	70	80	-	-	31	25	20	85
0180BBH	B	18,5 Kw	39	78	8	70	80	-	-	39	33	25	80
0220BBH	B	22 Kw	45	90	4	//////	75	85	-	45	39	31	85
0300BCH	C	30 Kw	62	125	12	80	85	-	-	62	62	62	80
0370BCH	C	37 Kw	76	152	8	75	80	-	-	76	76	70	80
0450BCH	C	45 Kw	90	180	8	//////	80	85	-	90	90	80	80
0550BDH	D	55 Kw	112	224	8	//////	85	-	-	112	112	//////	90
0600BDH	D	60 Kw	120	240	4	//////	85	-	-	120	112	//////	90
0750BDH	D	75 Kw	150	300	4	//////	85	-	-	150	120	//////	
0900BEH		*90 Kw			8	//////	85	-	-			//////	90
1100BEH	D	110 Kw	200	240	4	//////	85	-	-	180	160	//////	90
1320BEH		*132 Kw			4	//////	85	-	-			//////	90
1600BEH		*160 Kw			4	//////	85	-	-			//////	90

In development

2.4.4 Blast-E – General Features

BLAST-E GENERAL CHARACTERISTICS	
Control system	• SFT(Stator Flux Torque Control) • SB (Sinusoidal Brushless Control) • FVC (Flux Vector Control) • SVC(Space Vector Control) • SSP (Sensorless Speed and position)
PWM Frequency	Random 1; 1.5; 2; 4; 8; 12 kHz (min. 4kHz for SB mode)
Speed Feedback	2 pole resolver / 2 equal phases encoder + top of zero line driver
Resolver Input	Supply Frequency 4 kHz , resolution 11 bit /rev.
Configuration parameters (The default parameters are referred to a standard asynchronous motor : 380V, 50Hz)	Nominal current Motor current at the nominal voltage without load Nominal frequency Nominal speed (nominal slip) Nominal voltage Nominal Power Nominal COS PHI N° pole torques
Frequency control	0-1000Hz (resolution 0.02Hz)
Torque control	From $\pm 2\%$ to $\pm 200\%$ of the nominal motor value/ for SB and FVC
Acc. / decel. ramps	0 to 999,9
Ramp type	Trapezoidal and physiological "S" form
Current control	Up to 200% of the nominal current
Overload	150% of the nom current , 1' every 10 ' 200% of the nom current , 10" every 10 '
Frequency Derating	1 – Automatic 2 – Manual with current reduction
Frequency Control Input	0 ÷ 10 kHz
Analog Control Inputs	+/-10V, 0-4/20Ma , resolution 11 bit
Configurable commands	6 inputs 24Vcc
Alarm signalling	Relay contact NO 1°-110Vac- AC1.
Cofigurable signalling	Relay contact NO 1°-110Vac AC1.
PID Control	On speed ring and current
Auxiliary output, configurable through dip switch	Analog 0÷± 10V / frequency 0± 100 kHz Resolution 8 bit + sign
Protections	Current or alarm limit Thermal Motor protection (limit or I²t at choice) Under-voltage (<400V DC) Overvoltage (>800V DC) Thermal protection drive with displayed temp. Short circuit between phases and toward ground Brake resistor thermal protection Congruence error (for feedback control only)
Basic programming	Digital programming through 4 keys (on optional keypad) And through PC with free applicative with RS 232 option
Parameter Visualization Display, electric data, machine status	4 seven segment displays (on optional keypad) or PC monitor with free applicative with RS 232 option
Serial port	DEVICE NET (not opto-insulated)
Net connection with optional board	CAN-BUS (Device-net), PROFIBUS, SERCOS RS485 (Modbus) , RS 232 for PC connection
Dynamic brake (chopper)	Built-in up to 22 Kw
Brake resistor	Buil-in up to 11 Kw

2.4.5 Environmental conditions for Blast-E operations

Protection Degree: IP20 (IEC 529)

Operating: **Environment Conditions** for **BLAST-E** installed in a fix and protected place

Weather protection according to IEC 721-3-3.

- **Room Temperature for BLAST-E:** 0÷40 °C.

In case of room temperature higher than + 40 °C, derate the nominal output current of 2.5% for each exceeding degree (max 50 °C).; or PWM derating can be set.

- **Relative Humidity** : 5÷85 %, non condensing.
- **Altitude** of the installation place: up to 1000 m above the sea level; beyond 1000 m a.s.l. the nominal output current is derated of 1% every additional 100 m (max 2000 m).

Storing: Storing environment conditions for **BLAST-E** inside its package, environment protected according to IEC 721-3-1.

- **Room Temperature BLAST-E:** -25 °C ÷ +70 °C .
- **Relative Humidity:** 5÷95%, without condensing or freezing.

Transport: Transport conditions for **BLAST-E** inside its package according to IEC 721.3.2.

- **Temperature:** -25 °C ÷ +70 °C.
- **Relative Humidity** : max 95% at 40 °C.

2.4.6 Cooling

BLAST-E has a fan inside with air flow upwards.

Type	m ³ /h Ventilation Fan flow
BLAST-E SIZE A	79
BLAST-E SIZE B	170
BLAST-E SIZE C	340
BLAST-E SIZE D	480
BLAST-E SIZE E	960

2.4.7 Regulations

BLAST-E was developed according to the regulations mentioned below, as far as applicable:

- **IEC146-1-1** Semiconductor converters. General requirements and line commutated converters. Part 1-1: Specification of basic requirements.
- **IEC146-1-2** Semiconductor converters. General requirements and line commutated converters Part 1-2: Application Guide.
- **IEC146-2** Semiconductor converters.. Part 2: Self-commutated semiconductor converters.
- **IEC664-1** Insulation coordination for equipment within low voltage systems. Part 1: Principles, requirements and tests.
- **IEC22G/24/CDV** Power electronics. Semiconductor power converters for adjustable speed drives. Part 1: Low voltage, variable frequency driver for general purpose for alternating current motors.
- **EN60204-1** Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- **EN60204-1** Electric equipment for industrial machines.
- **IEC529** Degrees of protection provided by enclosures (IP Code).
- **IEC50178** Electronic equipments used in electrical power installations .
- **IEC61800-3** Immunity and emission conducted and irradiated.

CE Marking

***BLAST-E* was developed according to the European Low Voltage Regulations (73/23/CEE and 98/68/CEE) and EMC (89/336/CEE).**

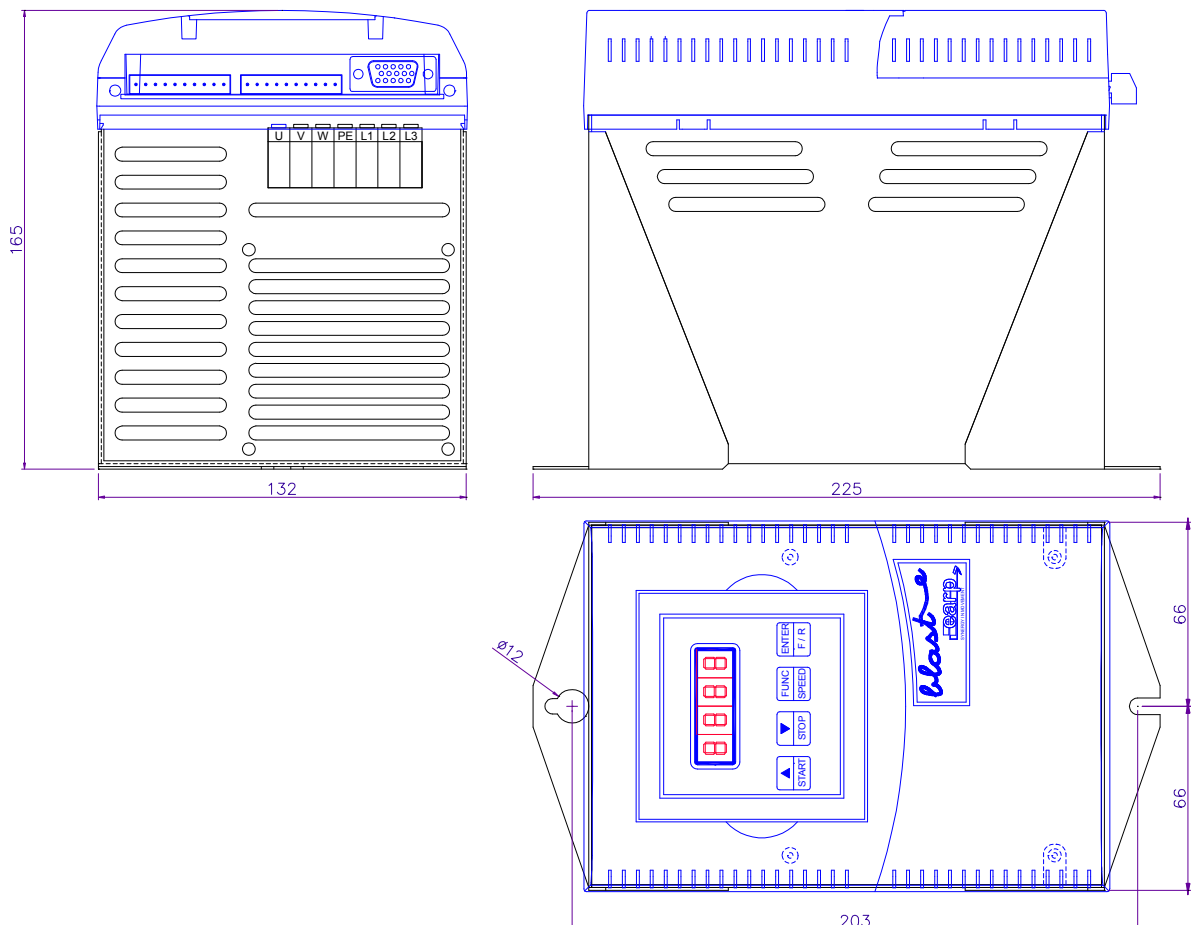
The *BLAST-E* drives are CE marked as far as EMC is concerned and regarding the inverter use according to the instructions contained in this manual.

2.5 Overall Dimensions, Weight, and Terminal Boards

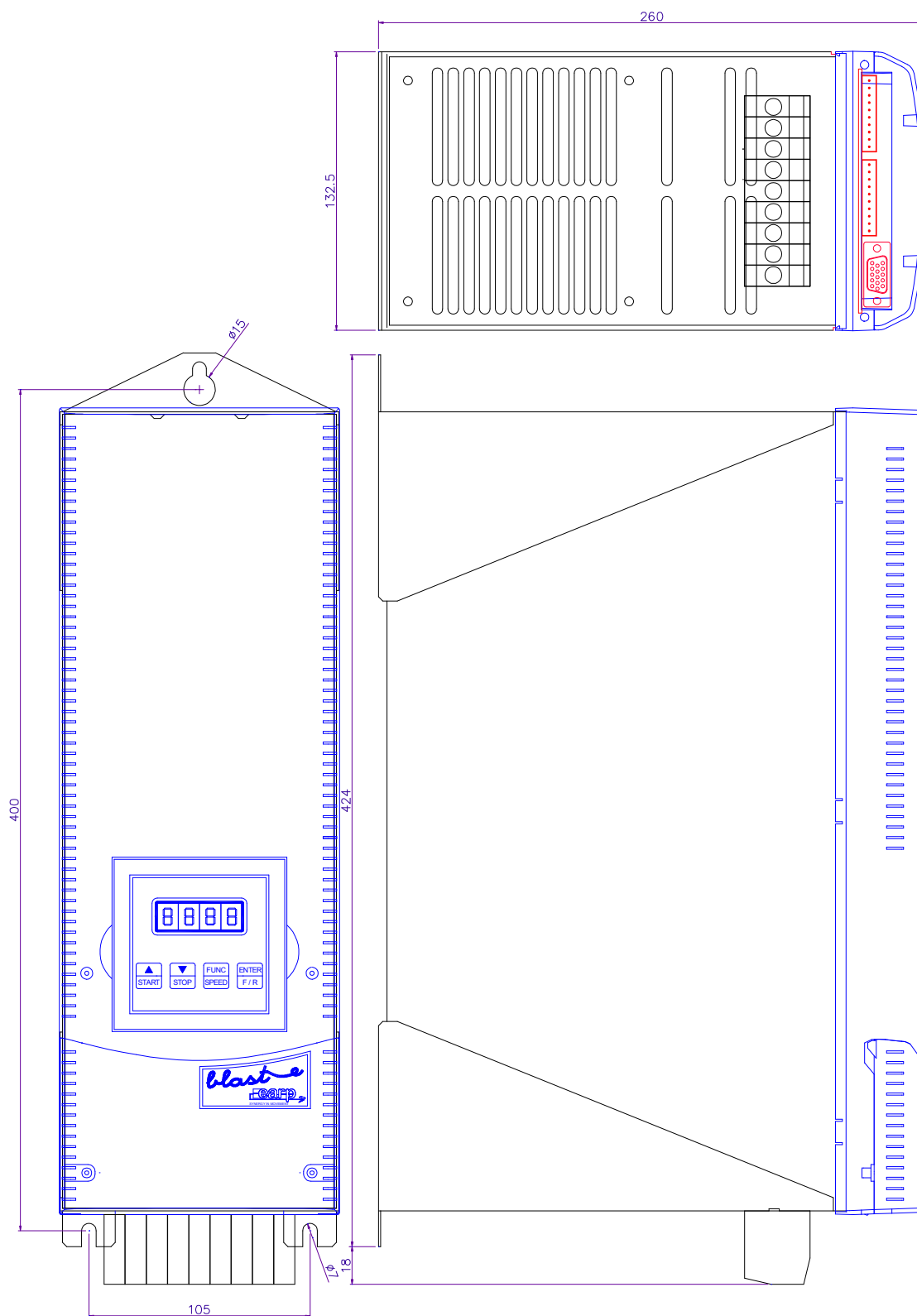
BLAST-E SIZE A, b, c, d, E (quotes in mm)

TYPE	WEIGHT (Kg)
BLAST-E SIZE A	2.5
BLAST-E SIZE B	10
BLAST-E SIZE C	21
BLAST-E SIZE D	25
BLAST-E SIZE E	*

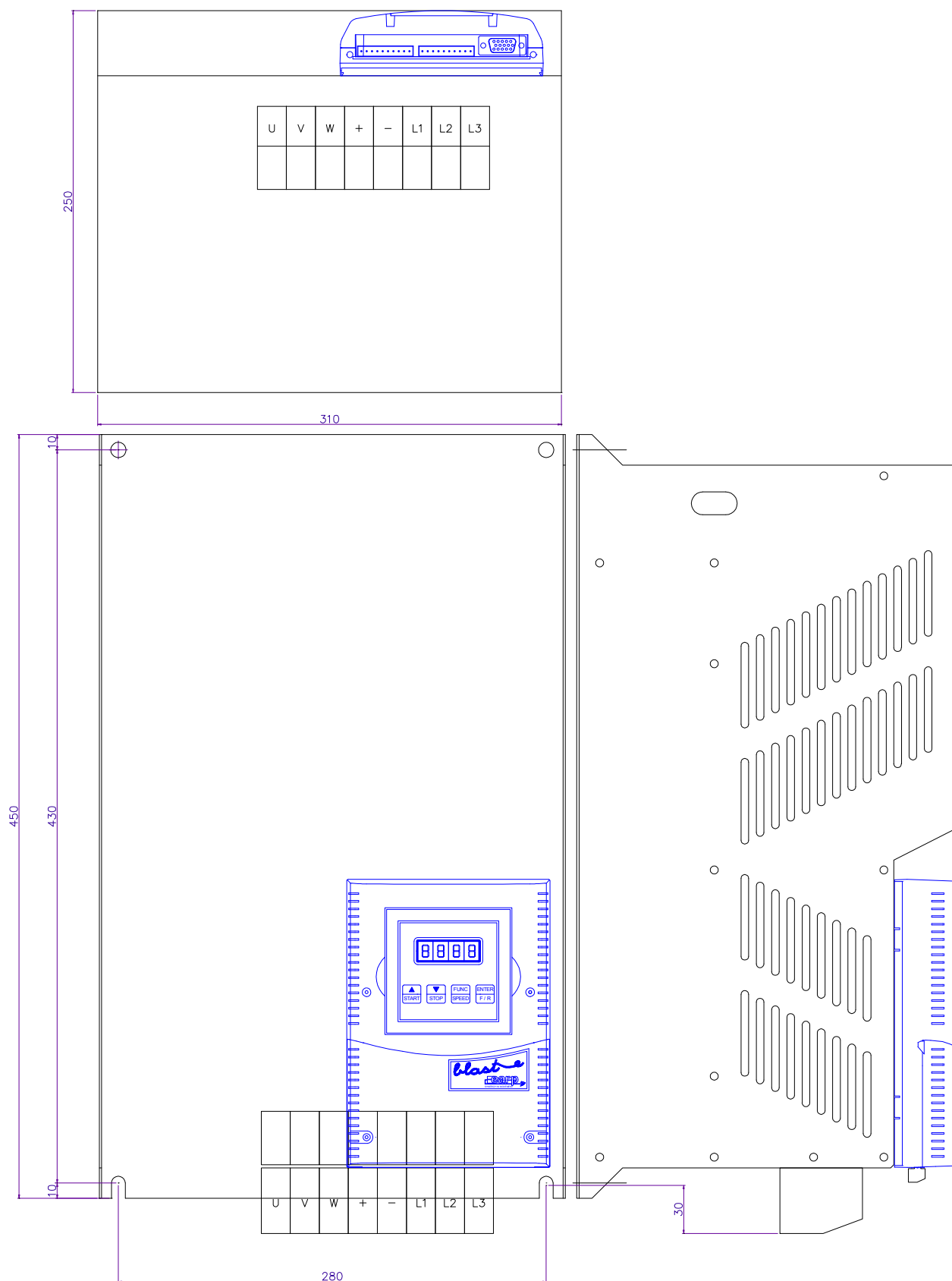
SIZE A :



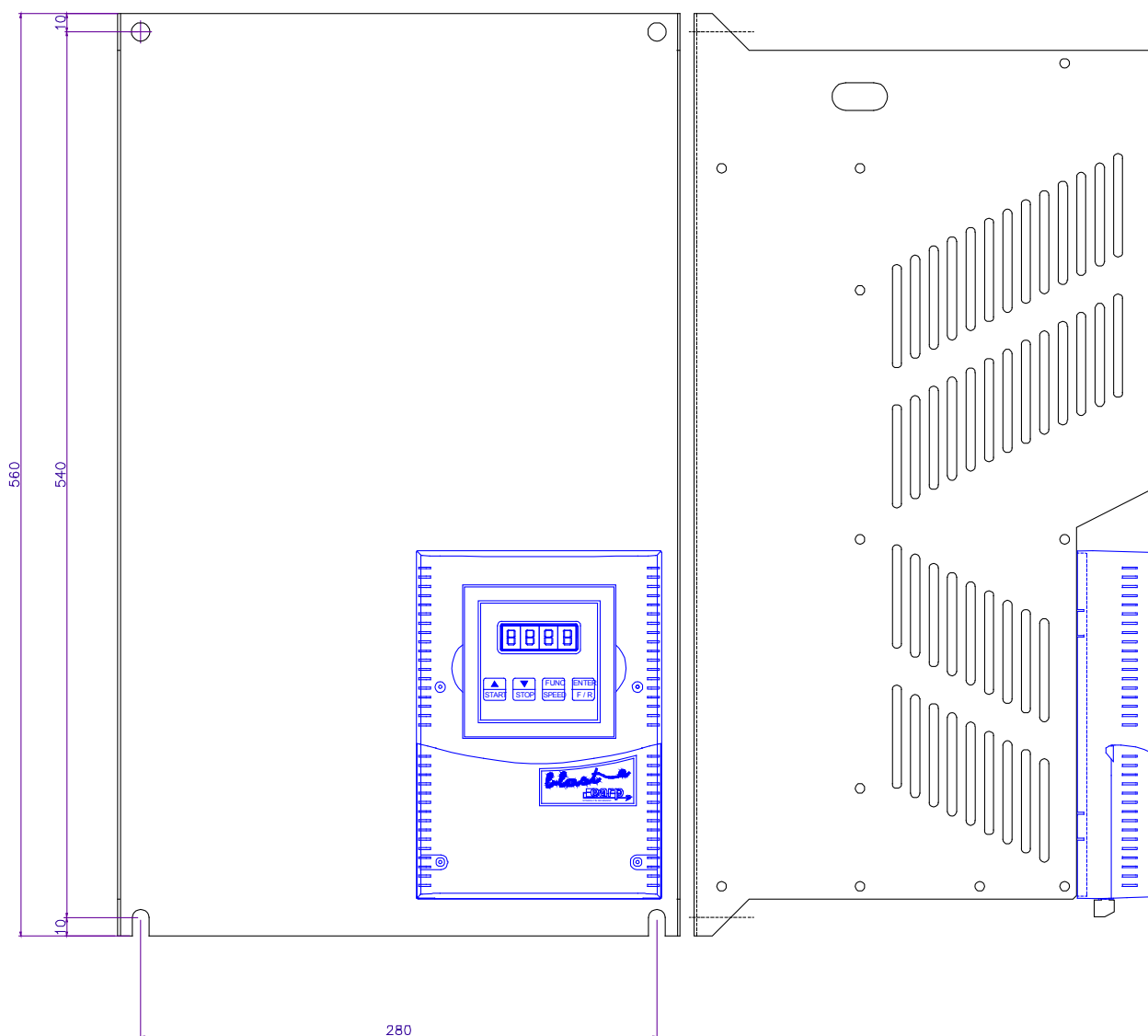
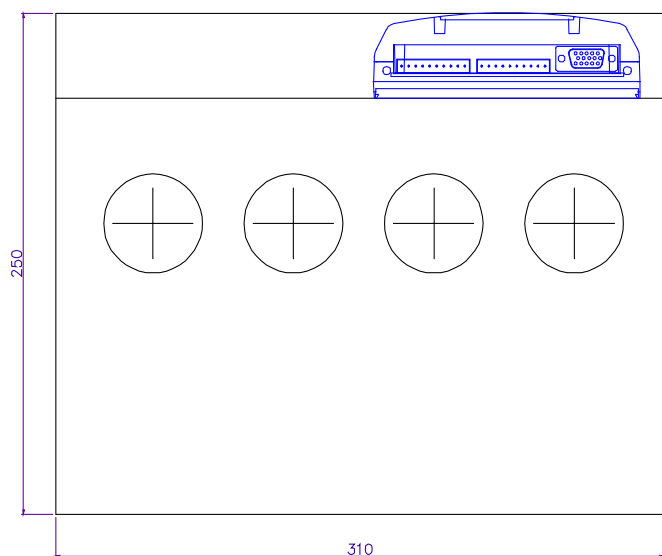
SIZE B :



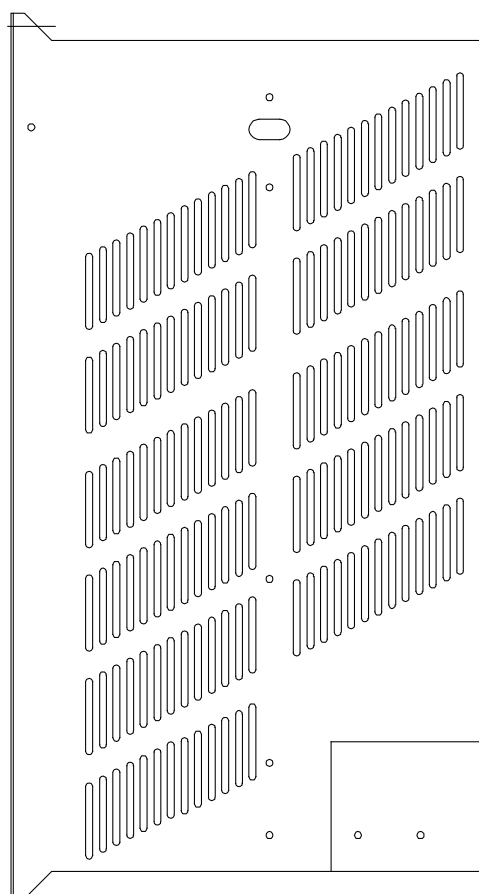
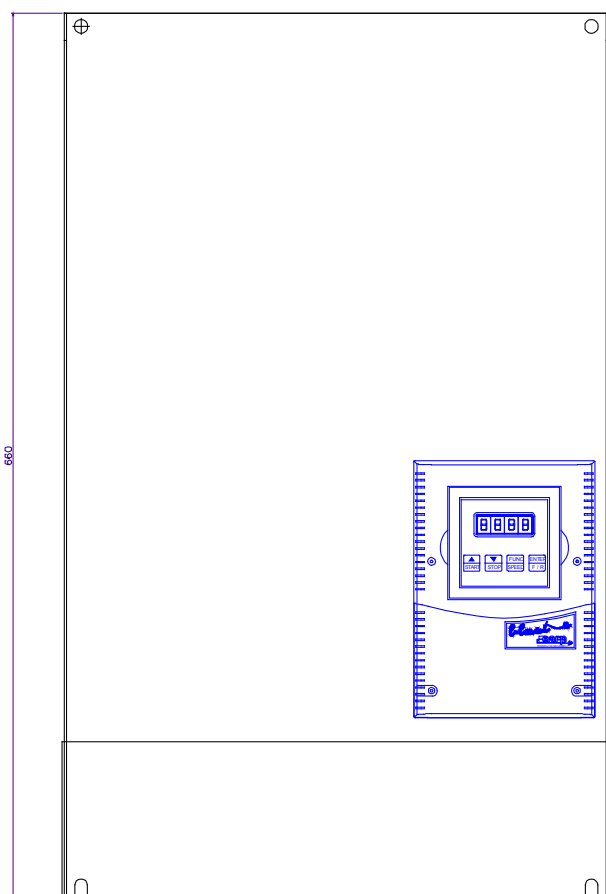
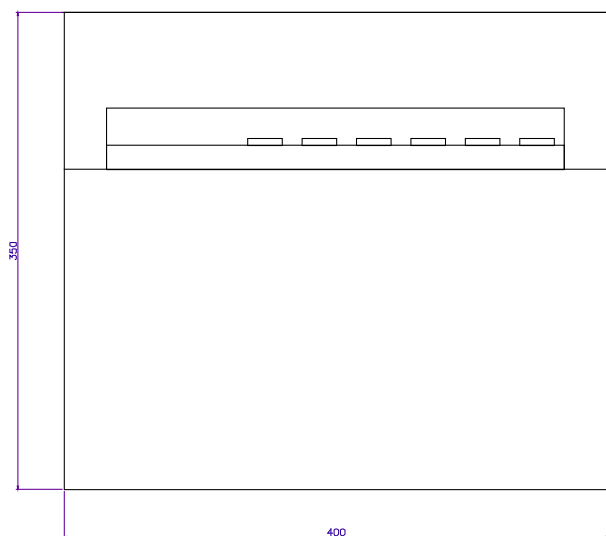
SIZE C



SIZE D



SIZE E:



2.6 Operating description

BLAST-E can be divided into two sections:

- POWER SECTION
- CONTROL SECTION

2.6.1 Power section

On this section the mains voltage applied to terminals L1, L2, L3 (three-phase), is rectified by a three-phase bridge and filtered through electrolytic capacitors. The dc voltage is tuned by 6 IGBT. Thus three alternate phase voltages are obtained on terminals U-V-W to which the motor is connected.

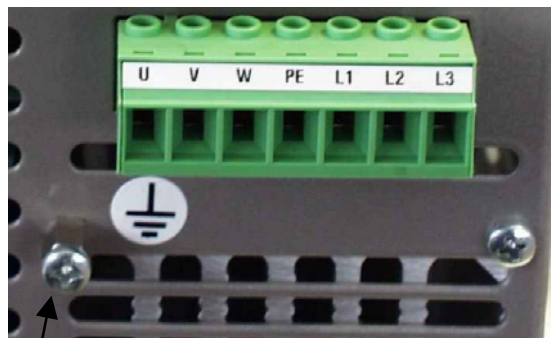
All *BLAST-E* drives up to 22 kW are provided with a built-in brake .

Symbols used to define the power terminals :

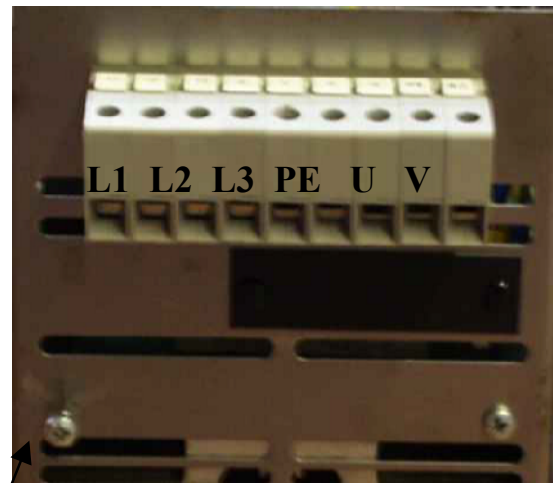
Power Terminal	BLAST-E	
Board	L1	Input Phase – MAINS
	L2	Input Phase – MAINS
	L3	Input Phase – MAINS
	PE	Ground / Shields
	U	Output Phase - U – MOTOR
	V	Output Phase – V - MOTOR
	W	Output Phase - W - MOTOR
	PE	Motor ground / Shields
	B1	External brake resistor
	B2	External brake resistor
	+	External brake unit
	-	External brake unit

2.6.2 Terminal Boards

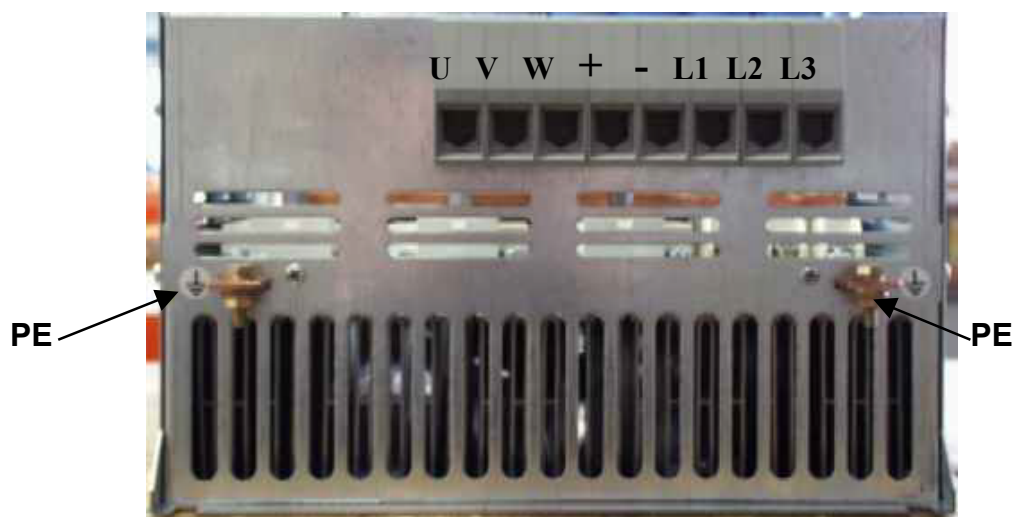
For case A and B (up to 11kW)



For case B (15 to 22kW)



For case C



2.6.3 Control section

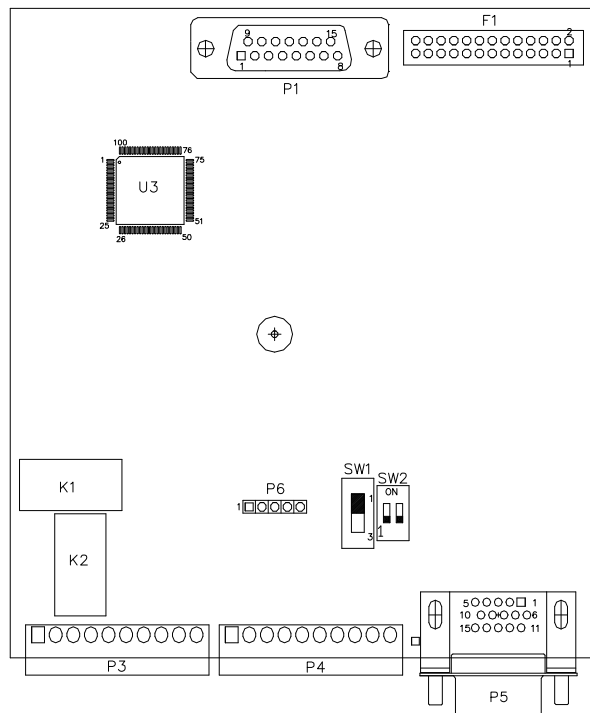
The control section consists of several interfaces and one microcontroller unit. The control board receives and operates the motor current and filter capacitor voltage signals and sends six command signals to the IGBT modules.

The access to the inverter control is given by the command and programming keys as well as the interface circuits connected to the control terminal board.

2.6.4 Control Board

Blast-e regulation board description

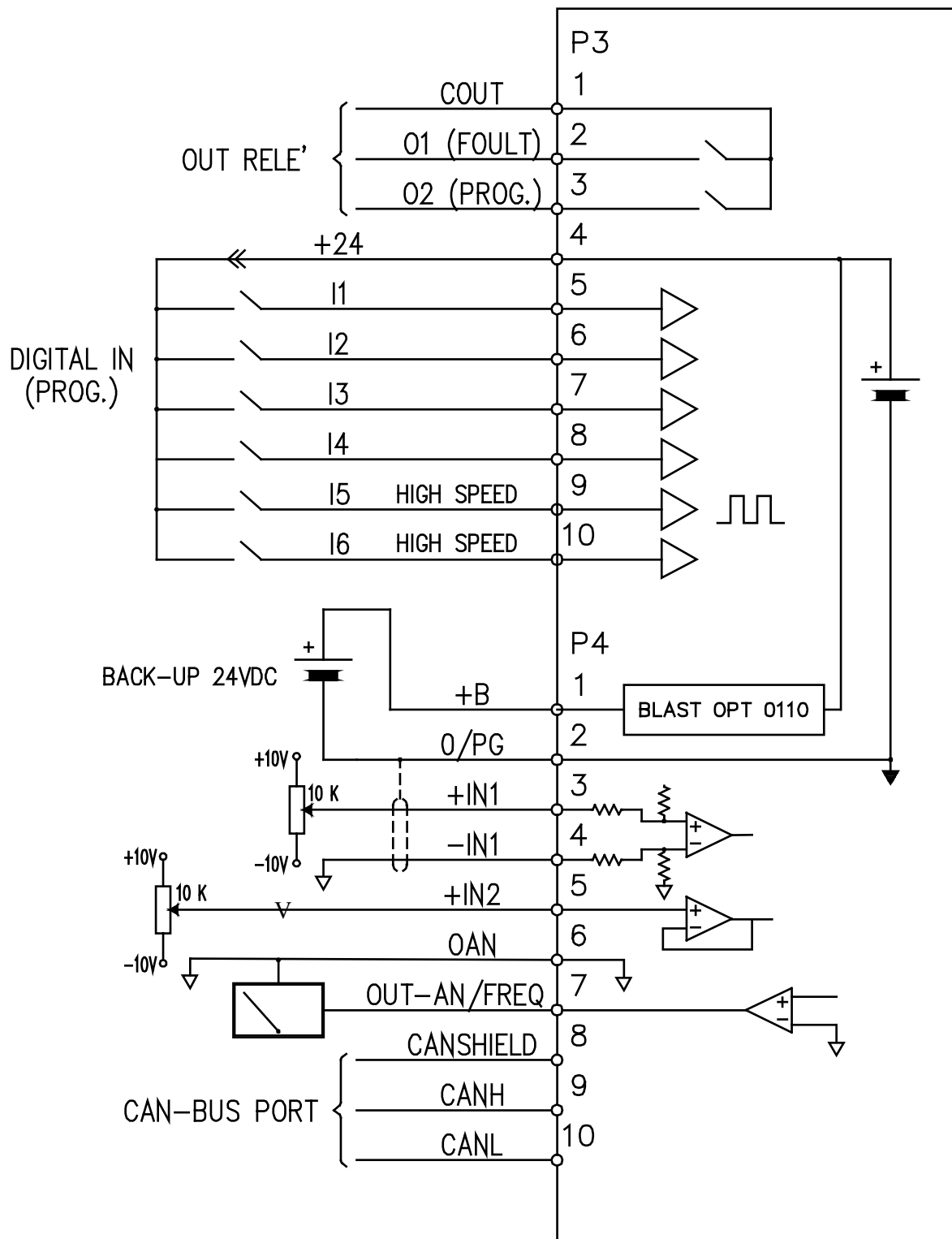
- P1: Connector for options (Display, serial ports, etc.)
- P3: Digital in / out connector
- P4: Analog in / out connector and Device Net
- P5: Encoder / resolver input connector
- P6: Connector optional back-up Switching
- F1: Supply Connector
- SW1: OD analog output selection in frequency
- SW2: Dip1=set In. 0 – 10 V , 4 – 20 mA
Dip2= Can-bus term.
- (if Can-bus is not used it must be ON)
- U3: DSP (micro-controller)



2.6.5 Control Dip Switches

SW1	1-2 2-3	Frequency Out Analog Out
SW2 (dip 1)	ON OFF	4÷20 mA input 0÷10 V input
SW2 (dip 2)	ON OFF	Can-bus term. on Can-bus term. Off

2.6.6 Description of the control terminal board



	terminal	Connector	BLAST-E	TECHNICAL CHARACTERISTICS
AUX	1 - 2	P3	RL1: relay contact DRIVE O.K	1A 110 Vac AC1
	1 - 3	P3	RL2: configurable relay contact	
Encoder Resolver	13	P5	Line-driver encoder supplying output	5V-150mA max
	12	P5	Zero encoder supplying	0V 150mA max
	15	P5	CH A input	0+5V line driver
	14	P5	CH 1A input	
	10	P5	CHB input	
	9	P5	CH1B input	
	8	P5	TOP0 input	
	7	P5	1TOP0 input	0+3V Impedance eff. 20kΩ
	5	P5	SIN + sin input	
	4	P5	SIN – sin input	
	3	P5	COS + cos inputr	
	2	P5	COS – cos input	
	1	P5	REF + supplying Resolver	4kHz 3V eff. 80mA max
	6	P5	REF – supplying Resolver	
	11	P5	GND shield connection	
DIGIT I/O: Back- up	4	P3	+24Vdc output	+24Vdc 100mA max
	5	P3	Input "I 1" SW configurable	ON≥15+30Vdc OFF≤3Vdc Impedance 2KX
	6	P3	Input "I 2" SW configurable	
	7	P3	Input "I 3" SW configurable	
	8	P3	Input "I 4" SW configurable	
	9	P3	Fast Input "I 5" SW configurable	ON≥5+30Vdc OFF≤2Vdc Fmax 100kHz
	10	P3	Fast Input "I 6" SW configurable	
	1	P4	+B positive pole for back-up supply 24Vdc	Only with optional Blast OPT 0110
	2	P4	0/PG Power ground and negative pole back-up supply	0V-I/O Digital inputs
AN. I/O	3	P4	Configurable + Differential anal. Input, configurable	±10Vdc – 40KΩ impedance or 0-20mA - 500Ω impedance
	4	P4	Configurable - Differential anal. Input	
	5	P4	Configurable + Differential anal. Input	±10Vdc – 30kΩ impedance
	6	P4	Supplying 0V	Reference -0V for P4 5 Reference +0V for P4 7
	7	P4	0 Analog output in configurable Frequency	0÷10 v 1mA 0÷100kHz 10mA
PORTA CAN	8	P4	CANSIELD	CAN Shield
	9	P4	CANH	With + signal
	10	P4	CANL	With - signal
TAST. / OPT boards		P1	Connector for keypad or OPTIONALS connection	According to the installed optional

2.7 Description of the control signals

2.7.1 Digital Commands

The **BLAST-E inverter** has command signals with PNP logic.

The commando operates when the related terminal is closed on a 24Vcc supply through a relay contact or static.

The six digital inputs "I1", "I2", "I3", "I4", "I5", "I6" are configured as follows:

Digital Inputs

DENOMINATION	NOTES
Drive ON CW	Enable input for clockwise motor rotation
Drive ON CCW	Enable input for anti-clockwise motor rotation
EN1 With Speed Reference	Enable Input Speed Reference 1 (P4 ¾)
EN2	Enable Input Reference 2 (P4 65)
CW/CCW	Input for motor rotation inversion
SETPOINT UP	Increase moto-potentiometer
SETPOINT DOWN	Decrease moto-potentiometer
JOG1	Enable input for previously set 1 speed values
JOG2	Enable input for previously set 2 speed values
JOG3	Enable input for previously set 3 speed values
EN1 With Torque Reference	Enable Input torque Reference
RESET ALARMS	Alarm reset input
DISABLE RAMPS	Disable ACC/DEC ramps
FREQUENCY INPUT (for "I5" only)	Programmable input for frequency reference
THERMAL PROBE (for "I1÷I4" only)	Thermal Motor protection (5k)
SPEED/ TORQUE	Enable torque/ speed selection
START CW	Enable the start in clockwise rotation
START CCW SELECT	Enable the start in anti-clockwise rotation

2.7.2 Digital Outputs

BLAST-E is provided with two relay outputs, one of them is used as run enable and the other one as programmable.

DENOMINATION	NOTES
01 (fix output)	Run enable output Drive OK
02 (programmable output)	- Disable - Minimum speed relay - Brake handling - Speed/quote reached ▪ Rotation direction ▪ Alarm ▪ Drive thermal warning ▪ Motor thermal warning ▪ Drive OK ▪ Motor Pre warning

2.7.3 Speed set signals

In case the speed/frequency reference from terminal board is chosen, there are several possibilities:

- 1) From potentiometer 10 k Ω (supplied with OPT 0120)
- 2) External voltage signal 0÷ $\pm$ 10V
- 3) External current signal 0÷20mA
- 4) Enabling through contacts (enabling the JOGs)
- 5) Through frequency input on I5 (0÷100kHz)
- 6) Moto-potentiometer (configuring the inputs)

Analog Inputs

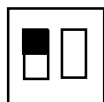
DENOMINATION	NOTES
+IN1 / -IN1	Diff. Input reference 1 +/-10V 0 - 20 mA
+IN2 / 0AN	Input auxiliary reference 2 +/-10V



WARNING

Do not connect voltage generators of equal value or higher than 13V to the analog input terminals.

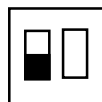
SW2 dip 1



ON

Current input 0÷20mA

SW2 dip 1

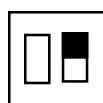


ON

Voltage input 0÷10V

NB: in case the internal CAN BUS communication is not used, SW2 dip 2 must be ON

SW2 dip 2



ON

2.7.4 Analog Outputs

BLAST-E has one analog output, configurable through switch SW1 and dip-switch SW2 shown in the 2.6.4 paragraph:

DENOMINATION	NOTES
OUT AN / 0AN	analog output or frequency 0÷100kHz 10mA

SW1



Voltage/ current
analog output

SW1



Analog output in
frequency

3 RECEIVING THE DRIVE

3.1 Transport

3.1.1 Handling

The handling is different according to the size.

♦ **SIZE A-B**

Manual handling (weight below 10 Kg)

♦ **SIZE C-D-E**

Handling with fork truck only (weight superior than 20Kg)

3.1.2 Storage

If the unit is stored before installation check for environmental condition to be adequate (chap. 2.4.5)



WARNING

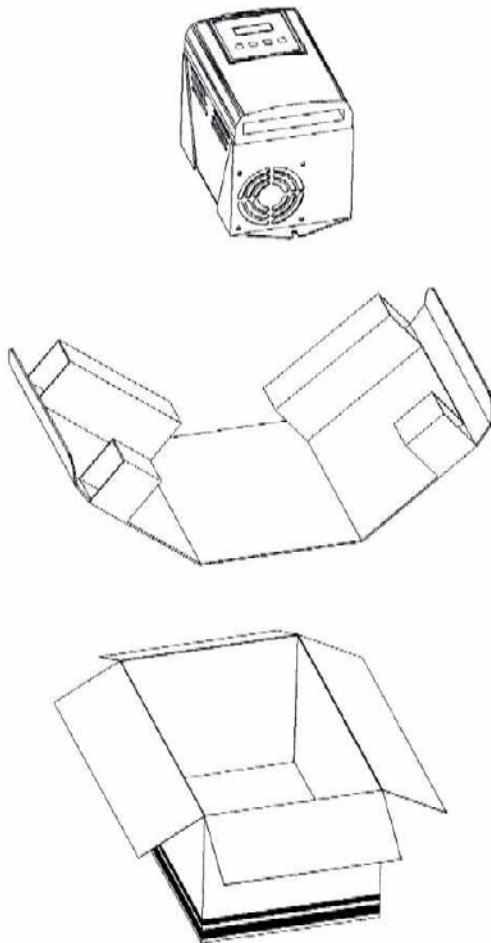
Do not place the packages one on the other

Do not load weights on the packages

Do not damage the package to avoid device damages and therefore warranty decay

3.1.3 Opening the Package

Follow the indications as per image below



3.2 Check at Delivery

BLAST-E is fully tested in the factory before shipment.

After opening the package check the following:

- Data on the label must correspond to the purchase order,
- Check for transport damages,
- Check for the quick guide + CD to be inside the package.

In case of damages and/or missing parts ask the freight forwarder and/or the manufacturer for immediate info basing on the code and **the ID plate**.

3.2.1 WARRANTY AND RELIABILITY ON THE DRIVE

EARP S.P.A. guarantees perfect quality and construction on the own products and shall repair or replace free of charge within shortest time those parts that should prove as defective, except for those cases of failure due to wrong behaviour, lack of experience of the purchaser; or wrong use beyond the agreed limits, not authorized interventions, hazard or major force. The warranty period is 24 months from delivery date, provided the goods are stored with care and in adequate environment. Nothing is due to the purchaser for the period of the plant's non-activity, nor will the purchaser claim for indemnity or compensation for suffered direct or indirect damages. Freight costs for all devices repaired at the EARP Technical Centres are on purchaser's charge. In Case of technical support on spot by specialized technical personnel related to the above mentioned events, support and out-of-pocket expenses will be on purchaser's charge. The work will be invoiced basing on the ANIE tariffs in force at the moment. Not covered by warranty are parts subject to consumption/ wear.

3.3 EMC Conformity (Electro-Magnetic Compatibility)

3.3.1 Foreword

A motors converter, if phase control (with thyristors technology) or impulse modulation (PWM) with IGBT or transistors, considering according to the EMC directive a "component" and not a "device", it does not belong to the present normative application.

The reference laws are for the product; EN 61800-3 for the converters, redacted by a IEC commission.

It is compulsory for the components manufacturers ("converters" for our case) to supply an applicative guide to help the system and/or installation manufacturer to obtain the correspondence of the application (system /installation) to the electromagnetic compatibility problems relative to the application.

Radio-frequency interference: **RFI** is the name for electromagnetic emissions (**EM**) produced by electric and electronic devices for home or industrial use whenever such emissions disturb interfere with transmission signals of telecommunication.

Such noises are given in any case of somehow disturbed transmission signal.

The distortion can show up as not correct receiving due to the intermingling of alien signals or as partial or total suppression of the transmission signal.

3.3.2 Electromagnetic Noise Sources

Any electric/electronic device able to generate EM can be a radio frequency noise source.

Common RFI signal sources are:

- circuits producing voltaic arcs (switches, relays, etc.)
- conversion circuits having non-sinusoidal or not direct output voltage (choppers, inverters, etc.)
- devices absorbing non sinusoidal current.

All other than sinusoidal waveforms are potential RFI generators due to the contained high-frequency harmonics.

The PWM principle on which inverter are based offers several technical practical and function advantages. Since the drive uses the quick voltage commutation and high current values to obtain high efficiency and a low noise level inside the motor, radio frequency energy is generated that may interfere with other systems nearby.

The signal level generated by an installed drive depends on several variables such as :

- drive power
- output frequency range
- switching frequency
- mains impedance
- mechanical and construction features of the drive (assembling, internal shields).
- mechanical and construction features of the electrical cabinets containing the drives
- wiring
- mechanical and construction features of the plant in which the drive is installed

The above described above is generally known as **electromagnetic compatibility** (EMC): the word RFI is often used as well, as the radio receiving noises are better known as common EMC form.

3.4 Speed Converter Application for Blast-e motors

The purpose of these notes is to help the systems engineers and drives installation plant engineers in systems/installations avoiding problems of electromagnetic interferences (EMI) and helping to reach the conformity to the EMC 89/336/CEE Directive and next modifications 92/31/CEE – 93/68/CEE.

Two basic EMC aspects are the emission of energy being a noise source for other devices, and immunity, which means that a device is not sensible to noises generated by external electromagnetic interferences.

Related to the latter is the concept of susceptibility level, which means the level at which a device loses the mentioned immunity.

3.4.1 EMI Compatibility

Due to the high-power and speedy commutation an inverter is able to generate EMI.

Noises generated by inverters are divided into the following groups:

- low frequency noises transmitted on mains cables (conducted emissions);
- high frequency radiated noises (radiated emissions).

The emission occurs mainly per mains and motors cable as well as ground circuit conduction, in differential or common, mostly common way.

Small inverters usually generate more noise than big ones, since they have quicker switching and therefore a different emission range.

The emissions are linked to four essential blocks, highlighted in the picture:

- Connection towards mains
- Connection towards motor
- I/O
- Converter casing

3.4.2 Towards mains

The best solution to avoid or reduce the troubles towards mains is the application of a **EMI filter**.

The main filters reduce the emission of disturbs towards the supply; they modify phase-phase and phase-earth impedance conditions; using passive components as inductances and fast capacitors, they create a filter linked to proper frequencies, realizing an easy way of leak of the noises toward the ground. The RFI reduction, through the filter and the application of other indicated item, enable the W3 serial drives to be in accordance with the European low for EN 61800-3 drives.

During the installation of the filter, take care of the following advises:

- The filter must be placed as close as possible to the Supply Module input clamps, with connecting wires with lengths lower than 30cm. If it is impossible to respect this distance, use only the shielded cable.
- The filter has to be placed on the same panel on which the drive has been installed and connected to the earth of the system.
- Do not wire the filter input connection cables at the side of filter output cables in parallel, the high frequencies filtering could vanish.
- The filter must be connected to ground before supplying the system for the first time
- The integrity of the earth connection must be verified periodically.
- The filter can be used only on supplying mains, balanced to the ground (type mains TN and TT), because it expects a capacitive coupling to dispel the generated disturbs.



WARNING

Do not connect the drive output filter (motor side)

3.4.3 Mains filter application

FIRST ENVIRONMENT:	Environment including household and non domestic uses which are directly connected without any intermediate transformer to a low voltage mains supply feeding buildings of the non-domestic type.
SECOND ENVIRONMENT:	Environment including all plants different from the ones directly connected to a low voltage mains supply feeding domestic buildings.
RESTRICTED DISTRIBUTION:	Means that the constructor limits the delivery of the equipment to suppliers, customers or users having technical experience and skill regarding EMC requirements on drive applications.
NON RESTRICTED DISTRIBUTION:	In this case the equipment is supplied independently from the customer's experience and skill in this field.

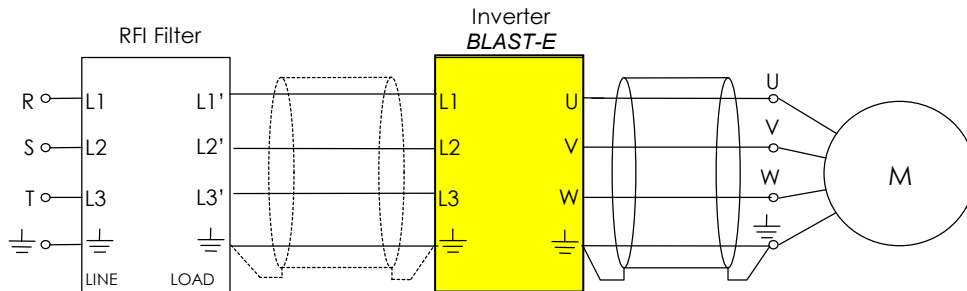
The conformity of **BLAST-E** regarding the emission for the first environment- restricted distribution or first environment – non restricted distribution, driver with nominal current $I_{NOM} \geq 25A$ according to **EN 61800-3** is achieved by placing filters between mains and inverter and taking care of the measures mentioned in this chapter.

Since the installation of the RFI filter in the second environment is not strictly necessary, it is up to the installer, who shall evacuate :

- The supply source being common to other devices or dedicated
- Immunity degree of other devices composing the cabinet

EARP proposes a mains filters range which, installed with **Blast-e**, reduces the disturbs within the normative limit.

Beyond the proposed filters, generally mains filter available in the market, if certified, could satisfy the necessity. Where it is necessary to reduce not only the perturbations towards high frequency mains, but also those with low frequency (up to 1÷1,5 kHz), it is necessary the installation of tuned harmonic filters.



In every situation it is always necessary to install at the top of the drive, a decoupling inductance dimensioned in accordance with the installed size.

A simple formula helps the dimensioning:

$$MH = k / \text{phase nominal ampere}$$

K=>20 for size A (voltage drop equal to 3% to nominal current)

>15 for size B (voltage drop equal to 2% to nominal current)

>10 for size C (voltage drop equal to 1,5% to nominal current)

- The reactance nominal current has to be equal to the nominal one of the drive, increased of 15%
- The suggested saturation current is 3Inom

3.4.4 Towards motor

The main mechanism of propagation of disturbs of the inverter is the conduction through connection cables.

The converter di / dt, especially if impulses modulation (PWM) with IGBT, creates important emissions (especially irradiated).

There are 2 possible solutions:

- Adoption of power shielded cables;
- Metallic path for cables (where it is not possible to use shielded cable): use piping / metallic wireway with 80% minimum cover, without interruptions, connecting the side close to the drive to internal earth bar to the electric board (separate the powers from other signals).

The first solution is the best for connections with limited power (cable section inside). The second one in all other cases.

The shielded cable makes the leakage current, both high frequency and normally, through the parasitic capacities, circulates from the ground motor casing or among the cables and ground, it follows an obliged path through the shielding, instead of following the metallic structure of the machine or alternative ways.

Pay more attention to the following directions:

- 1) The cable shield must be continuous and connected to ground on both ends using the related ground terminal (do not connect to the cabinet's common ground bar). The connections should be carried out at 360°.
- 2) No signal cable may be laid in parallel to the motor or drive supply cables with distance below 0.3m. Anyway use wireways separated both for the power and signals.
- 3) In case it should not be possible to avoid signal and power cable crossing, there should be an angle of 90°.

- 4) No signal cable should be placed at a distance from the drive lower than 0.3m.
- 5) The cable shield prevents from radiated noises further. The shield must be connected to the ground on one point only.
- 6) The inverter installed inside a cabinet allows very effective shielding.
- 7) Distribute the power components over the cabinet parts free from command or control devices.
- 8) In the application in which more motors are connected to only one drive and, because of a derivation terminal board of each cable, it is not possible to perform the shielding for the drive output, provide output toroids. Anyway minimize the distance between drive output and terminal and shield the cable below from the terminal towards the motor.
- 9) In pluri-motor applications and/or with power shielded cables or also, with lengths >25m (50m for non shielded cables), to compensate the capacitive dispersion current towards ground and reduce the voltage gradient on the motor, additional reactance are necessary or drive output filters. These directions help the attenuation of RFI phenomenon.

✓ NOTE

The use of ferrite rings or reactances does not satisfy the limits prescribed by the EMC.

The use of a long shielded cable for the inverter-motor connection and / or input filter may lead to the intervention of some differential switches caused by the dispersion current to the ground due to the switching frequency and the capacitors inside the filter.

Solutions:

- Replace the differential switch with a less sensitive one
- Feed the inverter through an insulation transformer.



WARNING

For shielded cables with lengths superior than 10m, verify the parasitic capacity does not induce to much phase-phase dispersion or towards mass. It can causes the block of the converter.
Anyway it can not be connected in the drive output a capacity superior than 5nF.

3.4.5 I/O

The drive emissions through I/O are the most negligible. It is necessary to pay attention to mass connections and to shielding. It is also necessary to use mostly differential analogical inputs and digital inputs provided of optocouplers.

3.4.6 Converter casing

It is important to focus on the irradiated disturbs, they have an action area very limited.

The adoption of the chassis of the metallic inverter is sufficient to obtain a satisfying attenuation and also, the dimensions of the drive are small in comparison to the RFI wave lengths, so this can not be considered a very efficient antenna.

It is necessary to grant a good ground connection.

It is to be reminded that there is already a small tract of this connection could reduce a lot also the by-pass effect of a mains filter. The direct mounting in the same metallic panel of the converter and filters is always suggested.

Respect the principle of the starry connection of the grounds.

3.4.7 RFI Compatibility

Most of RFI problems of EARP converter have been already solved in project phase. Anyway it is necessary to respect some details.

The susceptibility of a drive could come from:

- Power connection
- Environment
- I/O
- Grounding

3.4.8 Power connections

The using of RC groups and varistors in the line input with the help of the input inductance, suppress the great part of the perturbations which could come from the external. The line reactance and the RFI filter reduce the harmonic content of the absorbed current by the drives and they decouple them from the other equipments connected to the same line.

Only for mains with particular problems, for example the possible presence of lightings in line and big welding machines or compensation plants without decoupling reactances or working badly, could be necessary to protect the converter, the application of overvoltage suppressors.

In the Drive installation it is necessary to consider:

1. the placement of the Tunnel is preferable to be done in a metallic cabinet, in which the panels have to be connected electrically together, realizing low impedance contacts, leaving out the eventual insulating paint from the ground interconnecting points.
2. the reactance causes a voltage drop proportional to the absorbed current and the same inductance value; it has to be calculated for a voltage drop, in correspondence to the nominal current absorbed by the inverter, of 2÷4% of the supplying nominal voltage.

3.4.9 Environment

The using of metallic structures in the power section, coming from the EARP converters construction, creates a suitable protection from EMI problems.

Anyway it is necessary to build a good ground connection.

The tests performed evidence only a sensibility to electrostatic loads directly on the from protection of the converters (at few cm from the control microprocessor).

3.4.10 I/O

The I/O connections both of signal and power, are the most sensible because the first can not be filtered to obtain an elevate control speed (e.g.: an encoder input) and the following are sensible to the wiring typology and the applied load.

I/O signals:

1. to limit the electromagnetic susceptibility the EARP Drives are provided by differential analog inputs, filtered analog outputs, logic input and outputs filtered. The tests performed in our laboratory demonstrate a sporadic sensibility only towards disturbing events generated within 50cm from the converter CPU.

It is necessary to focus the attention on not generate electrostatic loads of important intensity next to the converters or on involved conductors.

It is required the implementation of recycling diodes on relays directed to dc, RC groups on relays and mains contactors directed to ac.

It is always suggested the installation of a toroid on the signal connection cables, next to the I/O connectors.

I/O Power:

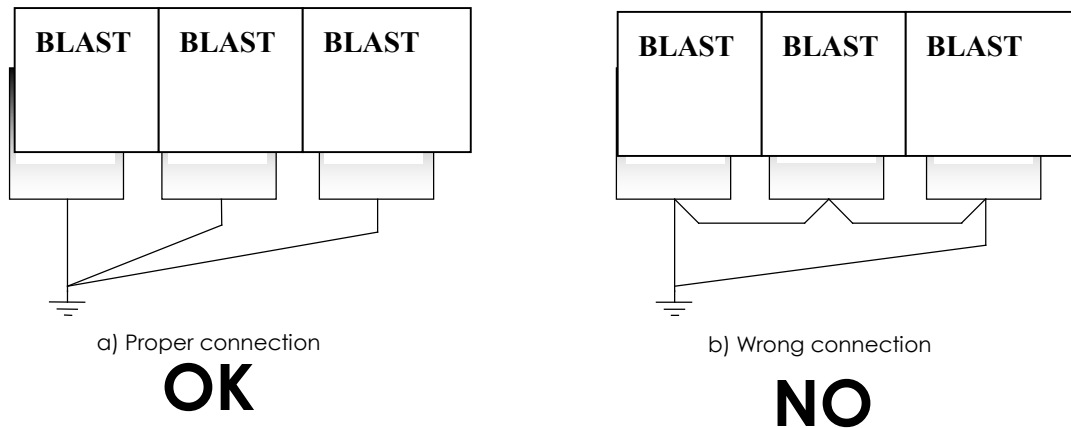
2. All the driver are protected in output against possible external short-circuits by electronic devices able to recognize quickly the circuital anomalies; the using of a long cable could cause the protection intervention. To avoid inconveniences there are two possibilities:
 - Insert in output a dV/dt limitation filter
 - Insert an output reactance between drive and motor next the Drive
 - Choose a cable at low parasitic capacity, so the sum of the phase-phase and phase-ground capacity does not exceeds the 5nF.

3.4.11 Grounding

It is important the Tunnel is appropriately connected to the ground.

The starry connection system is perfect; to such purpose the drives have been provided of an own connection point.

The following picture evidences the connection typology to be done:



Focus on the following directions:

- 1) It is necessary to provide in the electrical cabinet 2 copper ground bars of adequate size to which all system grounds are connected, separating the power grounds from those of signal; these bar has to be connected to the ground in only one point. Connect the electric board to the ground systems of the supplying mains.
- 2) The ground connections of the drives to the copper bar must be kept as short as possible.
- 3) To increase the immunity it is important to have a big surface of contact of the various ground connections.

3.4.12 Conclusions

The right application of EARP converter, as component of system, grants the feedback to the normative limits of electromagnetic compatibility. It is to memorize that the results with the converters are not determinant but of help because the whole system must be subjected to directives and CE making.

4 MECHANICAL INSTALLATION

4.1 Safety requirements

CAUTION!

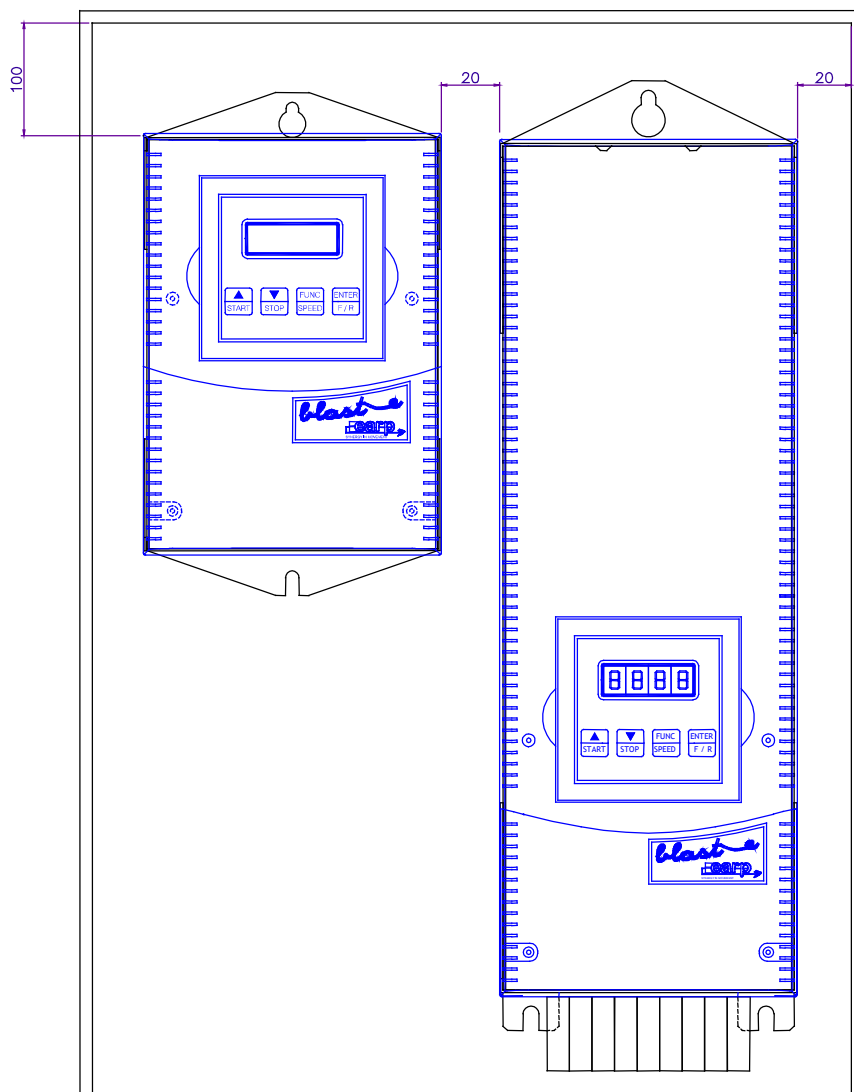


- The product is constructed to be used according to the installation and servicing procedures described in this manual and carried out by skilled personnel. The user has to take care for the installation to be carried out according to laws in force on plant and workplace safety.
- A correct installation and connection only ensure good drive operating and performances. All sections of the user manual must be read and understood before using the drive.

4.2 Checking before installation

- A) Avoid installing the drive on walls subject to vibrations.
- B) The environment for installation should be free from dust, metallic parts, oil, gas and corrosive liquids.
- C) The drive is conceived for wall mounting and must be installed in vertical position only. Horizontal assembling has to be avoided; the maximum allowed inclination under operating conditions is $\pm 30^\circ$.
- D) The drive easily operates at temperatures $0^\circ\text{C} + 50^\circ\text{C}$. A good ventilation must be ensured when the drive is installed inside a cabinet.
- E) When several drives are installed inside the same cabinet they have to be mounted one beside the other and not on top of each other.
- F) The cooling of the power components of the drive is obtained per external ventilation. Enough space around the drive must be provided allowing adequate air circulation as well as wiring; it must also be possible to operate for maintenance or service

Drawing: assembling inside the cabinet



5 ELECTRICAL INSTALLATION

5.1 Safety Requirements

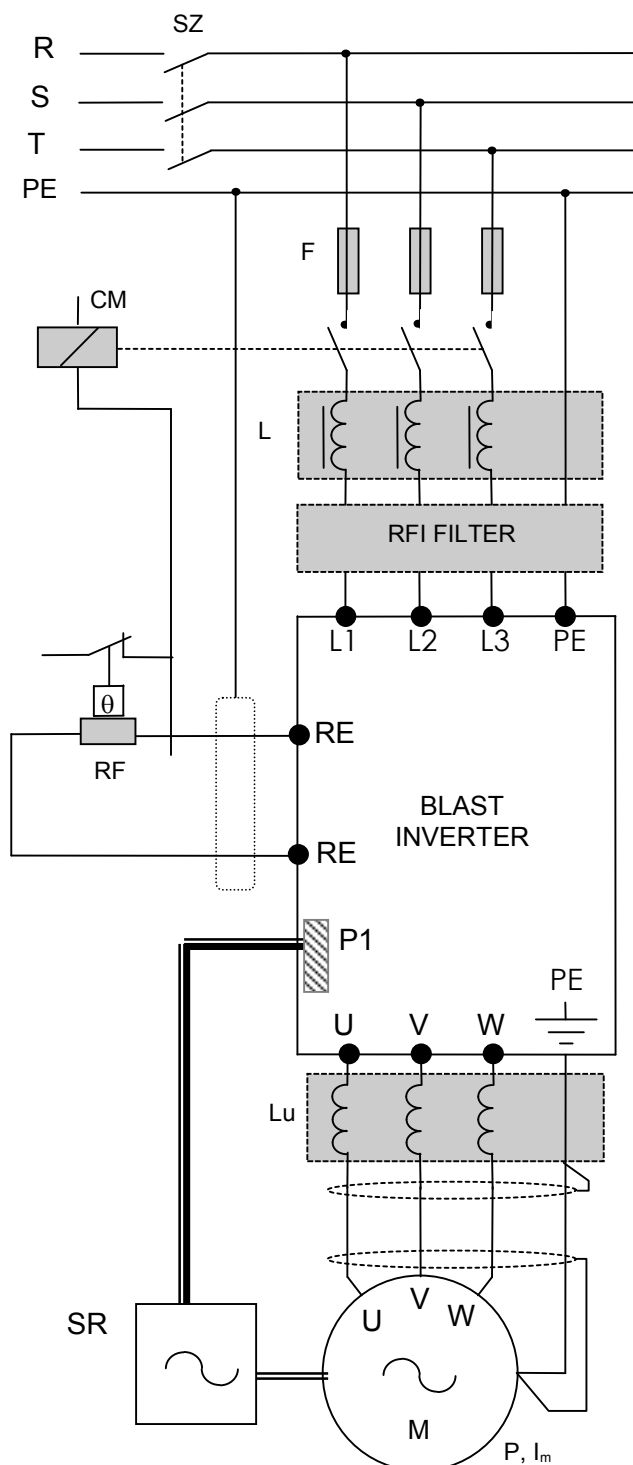
CAUTION!



- Electrocution risk!!! Disconnect the drive and wait at least 10 minutes before removing the protecting cover of the control and power terminal boards and touch internal parts to work on the drive.
- The drive must be protected by placing adequately dimensioned fuses on the mains supply
- The connection to the mains supply has to be carried out with a switch or contactor and protected with fuses. Follow regulations in force as far as fuse size and cables are regarded. See chart 5.4.1. for cable section.
- The drive must be grounded before start. Oversize cables (better flat ones) are recommended.
- Ground terminal "PE" according to the regulations in force.
- Do not mount the RFI filter on the drive output
- Make sure the drive has the correct size and is set for the motor to be connected; otherwise both may be seriously damaged or cause bad working of the machine/plant they are part of.
- Follow all the directions of 3.3 chapter "Application of CEE law on the EMC directive".

5.2 Connection Diagram

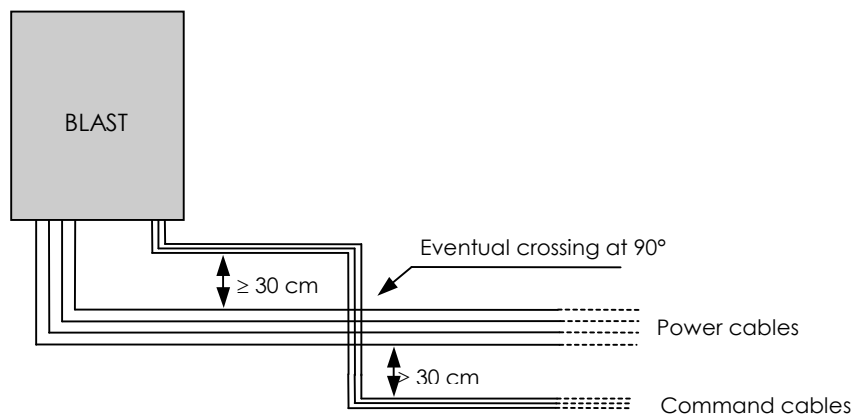
SZ	: mains switch dimensioned for Current $\geq 1,5 I_n$
F	: fuses type gG (chart 5.4.1)
CM	: contactor, dimensioned in AC1 current $\geq 1,5 I_n$
RFI	: filter at radio-frequency
L	: decoupling reactor MH x 10÷20/ I_{nom} line thermal current $\geq I_{nx} 1,15$ (chart. 3.3.5-3)
RF	: brake resistor if needed (see chapter 7)
P1	: Feedback connector (encoder, resolver)
SR	: feedback device (resolver encoder)
Lu	: see chart 3.3.5-5
M	: squirrel cage asynchronous motor or brushless or SSP motor
<u>WARNING</u> DO NOT MOUNT THE RFI FILTER ON THE DRIVE OUTPUT	



- a) instead of switch SZ and fuses it is possible to use an automatic switch having nominal current $\geq 1,2 \cdot I_m$ and an adjustable magnetic releaser ($5 \div 10 \cdot I_n$);
- b) when a protection to ground is used, a less sensible to high frequency values should be chosen; to avoid anomalies, the current threshold should be $> 200\text{mA}$ and the intervention time at least $0,1\text{s}$ (see charts 3.3.5-1 and 3.3.5-2)
In case a decoupling reactor is planned, it should be dimensioned for current $\geq 1,2 I_n$

5.3 Cable Size, Wiring, Notes on Use

- 1) the power cables must be dimensioned for 600 Va.c. e 1000 Vd.c.. In the same way the motor cables as well as those for the brake resistor. Power cables and wiring must be far away from the control ones, keeping a distance of at least 30cm between each other. It should not be possible to avoid crossing of the power and signal cables, a 90° angle should be kept. The control signal conductors must be shielded and the shield must be connected on the inverter side only. It is recommended not to exceed a length of 10m for the control signal connections: in case of highly disturbed industrial environment from an electric point of view, exceeding lengths may cause bad working of the devices.
Should the application require bigger distances between the drive and the control system, adequate devices (optocouplers, interface circuits, etc.) should be used in order to reduce noise sources as much as possible.



- 2) All contactors and relays must be provided with R-C on the winding.
- 3) In case of working conditions different from the nominal ones, especially for low speeds, an adequate external ventilation for the motor has to be planned.

Do not use the drive with motors of bigger size than the indicated one .

- 4) The drive is anyway protected against exceeding loads.
The current protection (Eoc) may intervene in the following cases:
 - a – motor failure
 - b – failure toward ground
 - c – drive re-start while the motor is turning by inertia
 - d - too short acceleration time
 - e – Excessive parasitic capacity in the drive output (max 5nF)
- 5) Inverter feeding from an independent generator (generator). The current harmonics produced by the inverter may modify the generator's voltage and cause the overheating or a deformation of the output voltage. The generator's power should therefore be at least 5 times higher than the inverter's power (in kVA).
- 6) Repeated on-off switching within short time through the remote control switch reduce the life time of the filtering capacitors.



WARNING

Never use this solution to start and restart the motor.

For BLAST-E 0007xxx to BLAST-E 0055xxx, cycles having more than three mains-on/off operations per minute may cause the switching of the protection device placed above BLAST, due to the NTC overheating.

For BLAST-E 0075xxx to BLAST-E 0220xxx, cycles having more than ten mains-on/off operations/hour may cause the burning of the pre-charge resistor and so heavy damages on the inverter.

CHART 5.4.1 – Fuses (gG type) and cable section (CEI 20-21 Ta=40 °C).

	Mains	Input without		Input with reactance	
	A	mm ²	AWG	mm ²	AWG
BLAST-E 0007	6	1.5	16	1.5	16
BLAST-E 0011	10	1.5	16	1.5	16
BLAST-E 0015	10	1.5	16	1.5	16
BLAST-E 0022	10	1.5	16	1.5	16
BLAST-E 0037	16	2.5	14	1.5	16
BLAST-E 0055	25	2.5	12	2.5	12
BLAST-E 0075	32	6	10	4	10
BLAST-E 0110	40	10	8	6	10
BLAST-E 0150	50	10	8	10	8
BLAST-E 0185	50	16	6	10	8
BLAST-E 0220	80	25	4	16	6
BLAST-E 0300	100	35	3	25	4
BLAST-E 0370	125	35	2	35	3
BLAST-E 0450	160	50	0	35	2
BLAST-E 0550	200	95	3/0	50	0
BLAST-E 0750	200	95	4/0	70	3/0
BLAST-E 0900	250	150	300*	95	4/0
BLAST-E 1100	315	185	400*	150	300*
BLAST-E 1320	355	240	500*	185	400*
BLAST-E 1600	400	2x120	2x250*	240	500*

* MCM

- Section of the control signal cables : 0,75 mm² 18 AWG
- Section of the signalling relay cables: 0,75 mm² 18 AWG

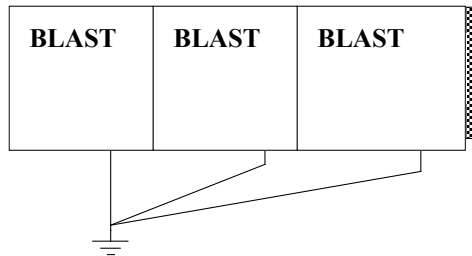
- 7) Check for the mains supply to be connected to terminals L1,L2,L3 and the motor to terminals U,V,W and not vice versa.



WARNING

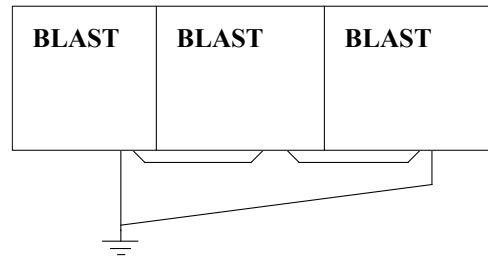
8) Avoid handling the electronic components of the control board without taking adequate measures preventing from damages caused by electrostatic discharges .

- 9) If a contactor is installed on the inverter output , make sure that opening and closing occur only with disabled drive.
- 10) Do not connect the capacitors to the drive output .
- 11) While grounding more inverters avoid ring connections (Fig. 5.4-2).



a) Proper connection

OK



b) Wrong connection

NO

12) Plan to place a choke between mains and drive in the following cases :

- a – a thristors converter or other inverters are planned on the same line;
- b - a power factor correction is planned on the same line;
- c - the unbalance of the supply voltage exceeds 3%, or the mains is very disturbed;

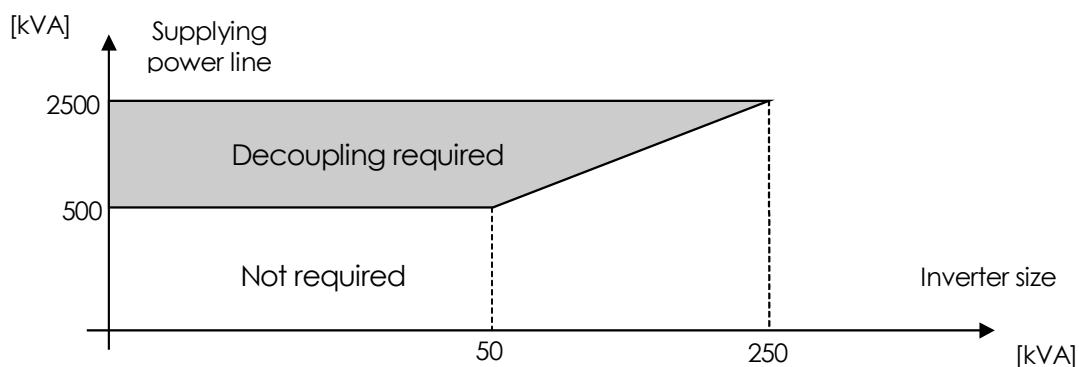
for example $\therefore V_{rs} = 400V, V_{st} = 407V, V_{tr} = 390V.$

$$V_M = \frac{V_{rs} + V_{st} + V_{tr}}{3} = 390V$$

$$F_s = 100 \cdot \frac{\text{max. deviation from } V_M}{V_M} = 100 \cdot \frac{9}{399} = 2,3\%$$

} In this example no reactance is needed

d – the power of the supplying line and the inverter power comprehend the evidenced zone in the following picture:



13) In case one drive supplies more motors and/or the distance between motor and drive is relevant (see chart 3.3.5-5) it may be necessary to place a reactance between drive and motor. This is recommended for all multi-motor applications (more motors connected to the same drive).

14) Respect the directions of 3.3 chapter “ Application of the CEE normative on the EMC directive “.

6 Data display and programming

6.1 Factory Setting

BLAST-E is set for SVC mode as default, which means to control asynchronous motors; through Hiper Terminal by Windows® the other control modes can be downloaded (SFT, VFT) from the attached CD.

After setting the mode, the user can visualize and set parameters either per keypad (option) or with software XBLAST through a normal PC having windows 95 or later versions installed. Option "BLAST OPT0031" is needed as well (see 2.3.2).

6.2 Modifying Parameters

The parameters can be modified through keypad or software XBLAST (delivered along with the product). The parameters displayed by the keypad or through the XBLAST menu are shown below:

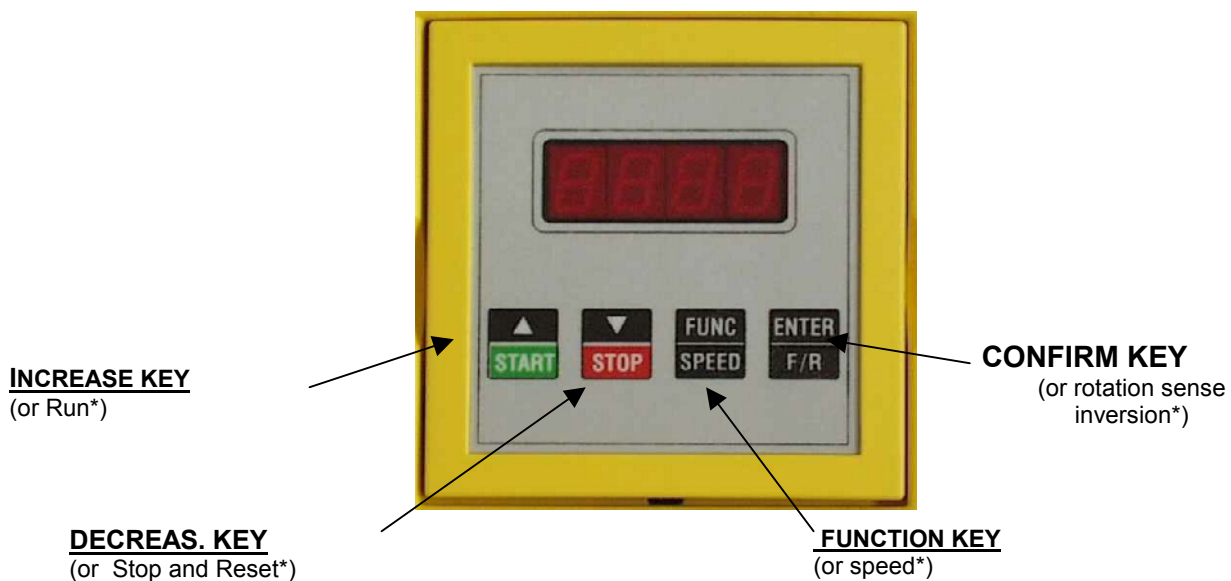
DISPLAY	DESCRIPTION	XBLAST MENU
M.	(=Motor parameters),	MOTOR
r.	(=Start parameters),	RUN
d.	(=Control parameters),	DRIVE
I.	(=Parameters of the drive's inputs and outputs),	I/O
o.	(=Parameters of the drive's outputs),	I/O
c.	(=Communication parameters),	COMM.
P.	(=P.I.D parameters.),	P.I.D.
A.	(=Parameters for the option cards),	OPT. CARD

6.3 Description of the integral keypad

The keypad is an optional part allowing the parameters input and display, as well as the display of occurring alarms and operating status .

The inverter visualization unit consists in 4 displays with 7 segments:

- **UP / START:** Increasing the displayed variable.
- **DOWN / STOP:** Decreasing the displayed variable; or alarms RESET.
- **FUNC / SPEED:** Function selection or **ESCAPE**.
- **ENTER / F-R:** Confirms the selected operation.



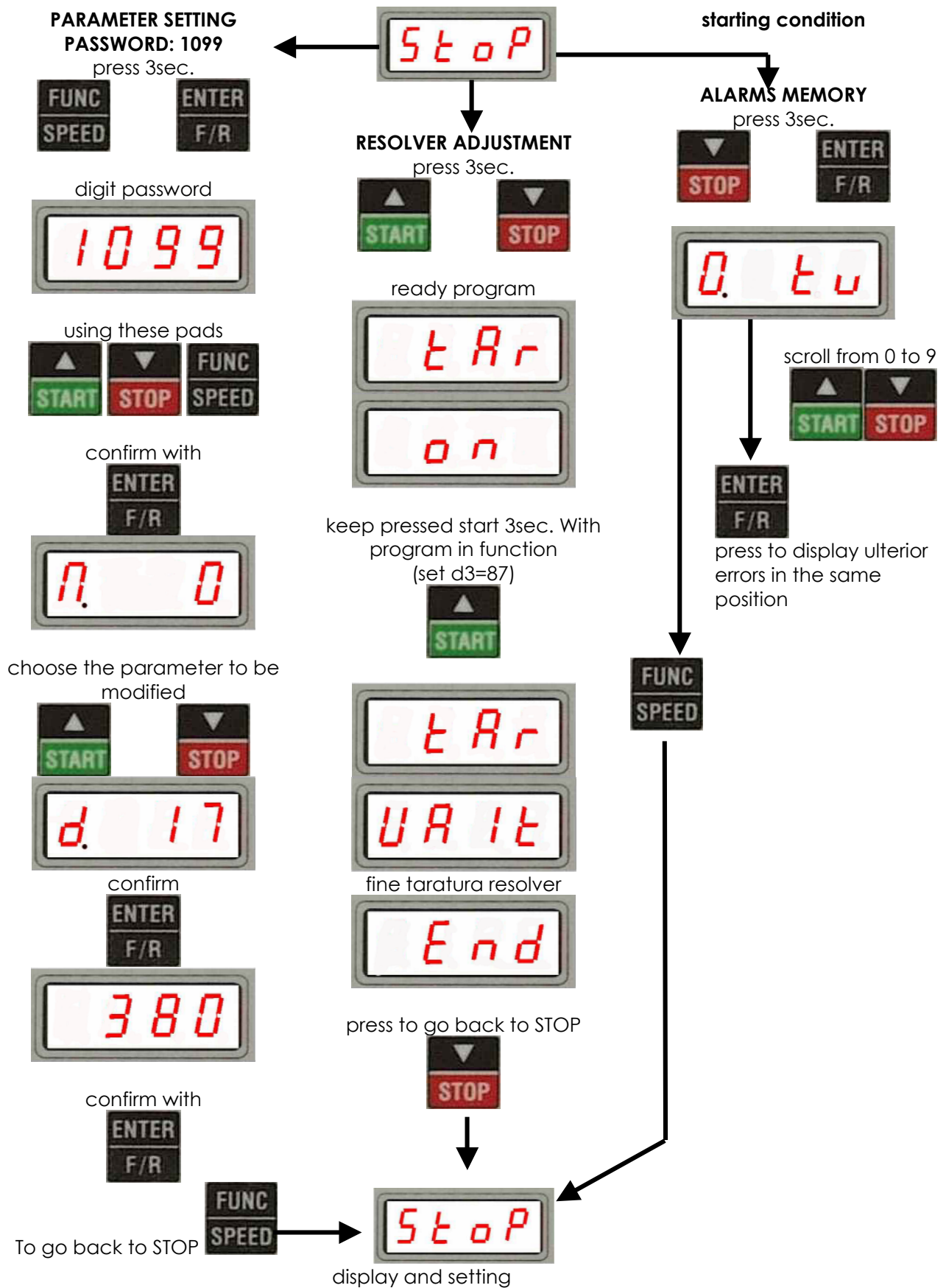
(*) These key functions are active when the drive is controlled through keypad (d3= setup).

6.3.1 Programming With Keypad

Three main operations are selected through the keypad:

1. Parameter setting
2. Resolver setting
3. Alarm memory

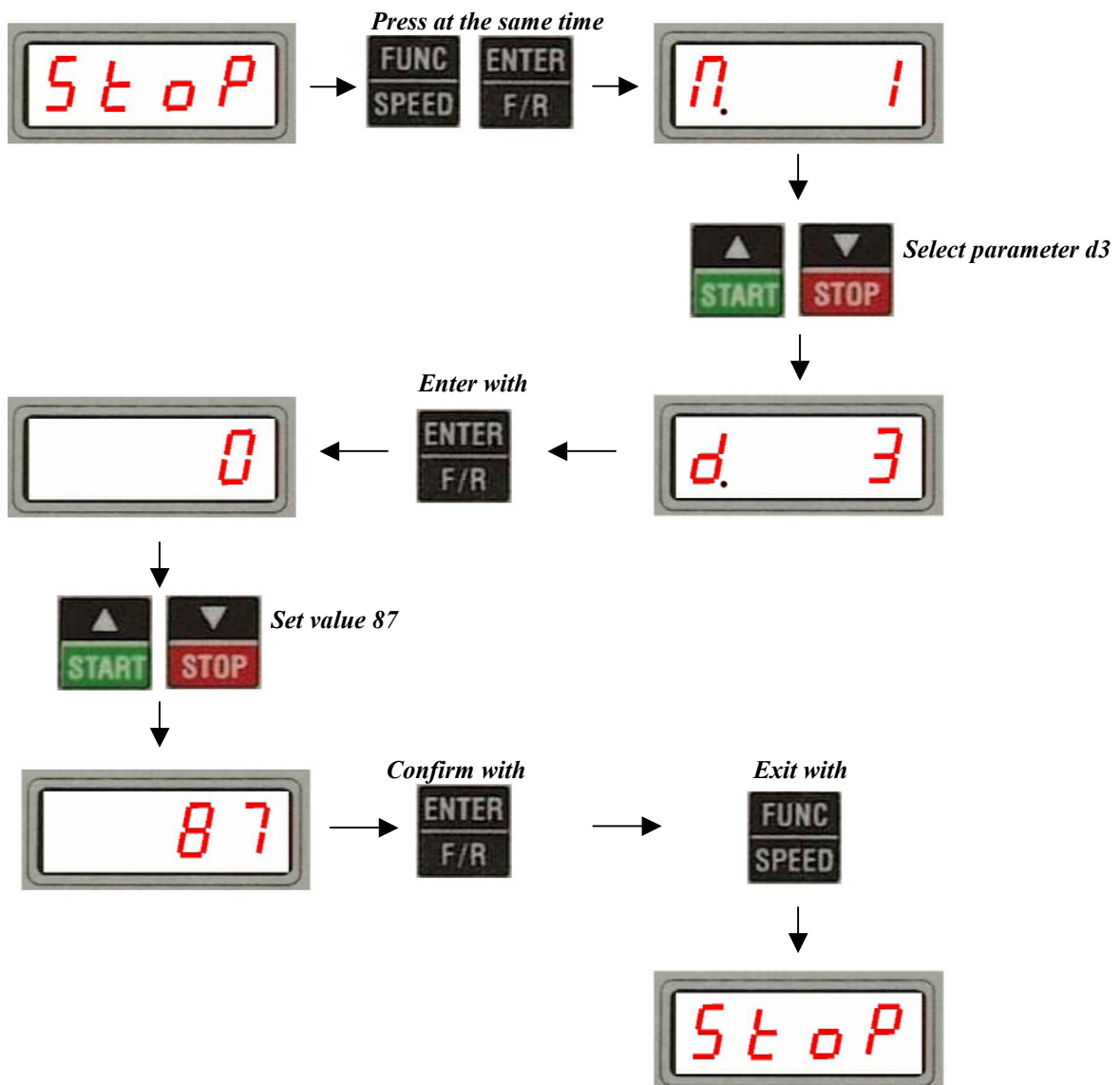
Some examples are shown below.





To use the drive quickly, the keypad has a motopotentiometer function, to use by setting parameter d3 = 87 (obligatory for the resolver setting).

As follows there is the modification of d3 variables for the Motopotentiometer function selection.



NOTE: the way of programming is common to all the variables.

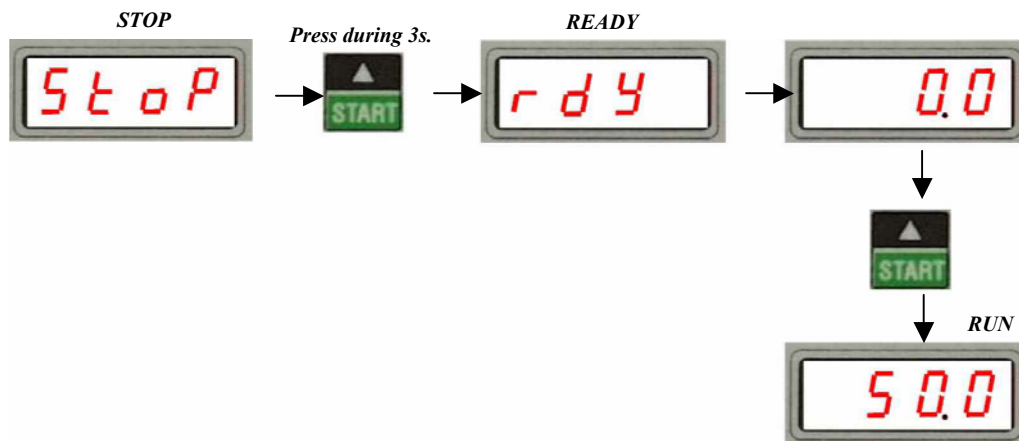
6.4 Control From Keypad (Motopotentiometer)

The functions of the keypad set on Motopotentiometer are shown below (d3=87)

The Motopotentiometer function is useful during commissioning , since it allows an immediate start-up from keypad; start-stop increases or decreases the reference; Forward and Reverse.

6.4.1 Start / Run Command

The Start key, pressed during 3s, enables the drive for the READY status; by pressing START again, the RUN mode is selected RUN and the drive reaches the latest set reference (in the example the Hz of the asynchronous motor).

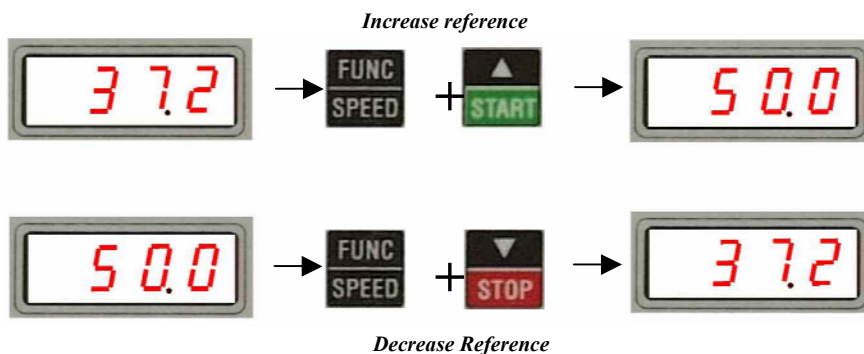


NB: If the set reference is zero in RUN mode, the motor does not start. Increase the reference as described in the following paragraph.

6.4.2 Reference Increase/ Decrease Command

The RUN mode mentioned above can increase/decrease the reference through key SPEED followed by ▲ to increase; SPEED + ▼ to decrease.

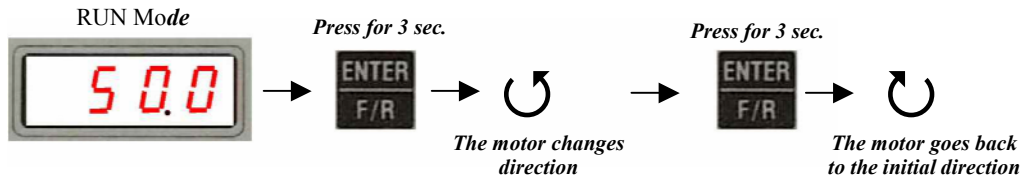
The variation will be displayed.



The latest set reference is stored in the memory .

6.4.3 Forward / Reverse Command

On RUN mode, key F/R changes the rotation sense.

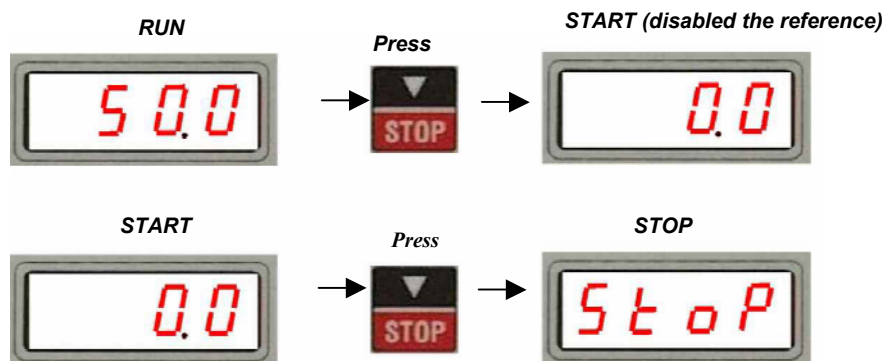


Caution: The sudden rotation sense change of the motor may damage persons and things. Make sure that the operation is carried out with care and by qualified personnel.

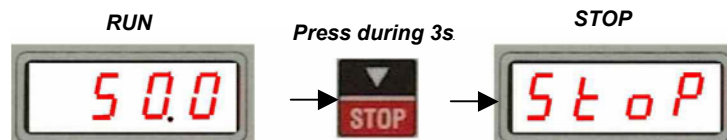
6.4.4 Stop Command

The Stop key allows two kinds of stop:

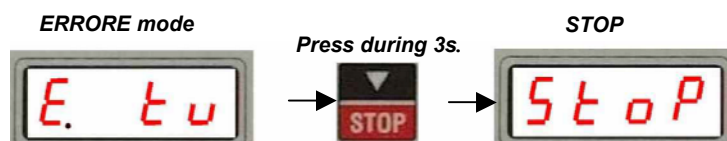
1 With STOP double command:



2 With lasting STOP:



6.4.5 Reset Command



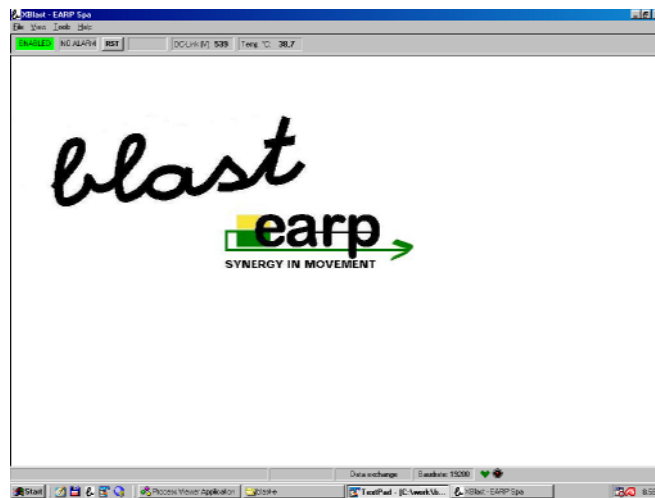
6.5 Reset of Saved Data

In case of error E.set, disconnect the DRIVE, wait 5s and connect the drive again.

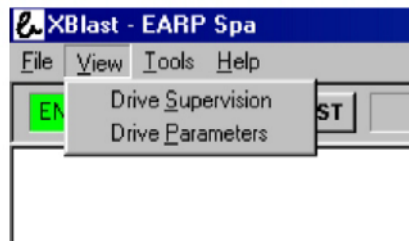
6.6 Data Display & Parameterization through XBLAST software

Data display and modification parameters through XBLAST are easy, thanks to the Windows interface.

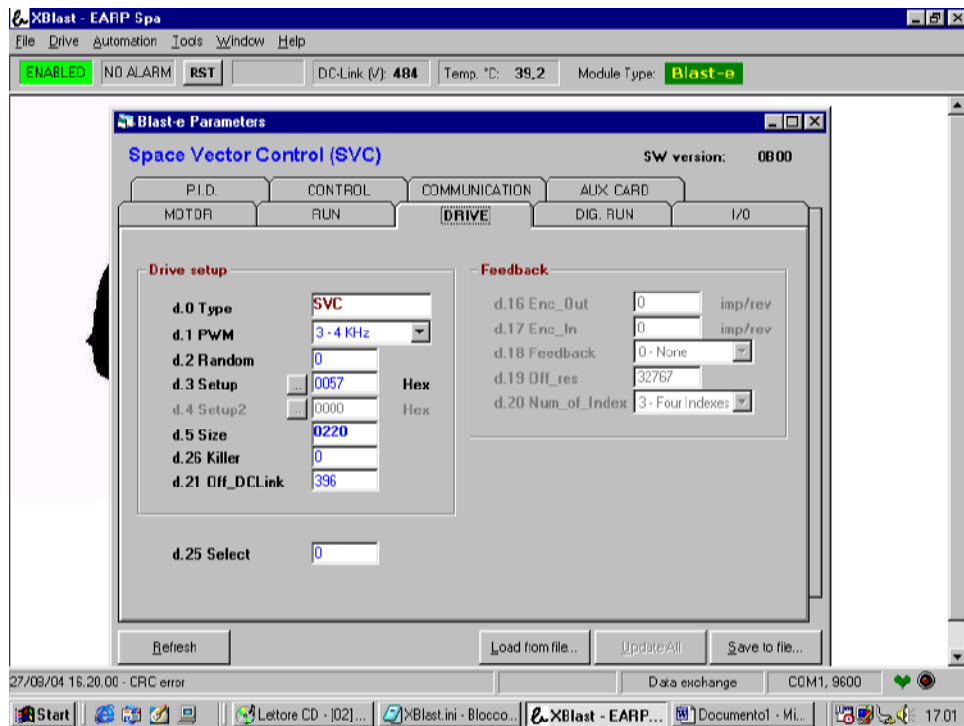
Ckclick on  to start the program, which will open the first page:



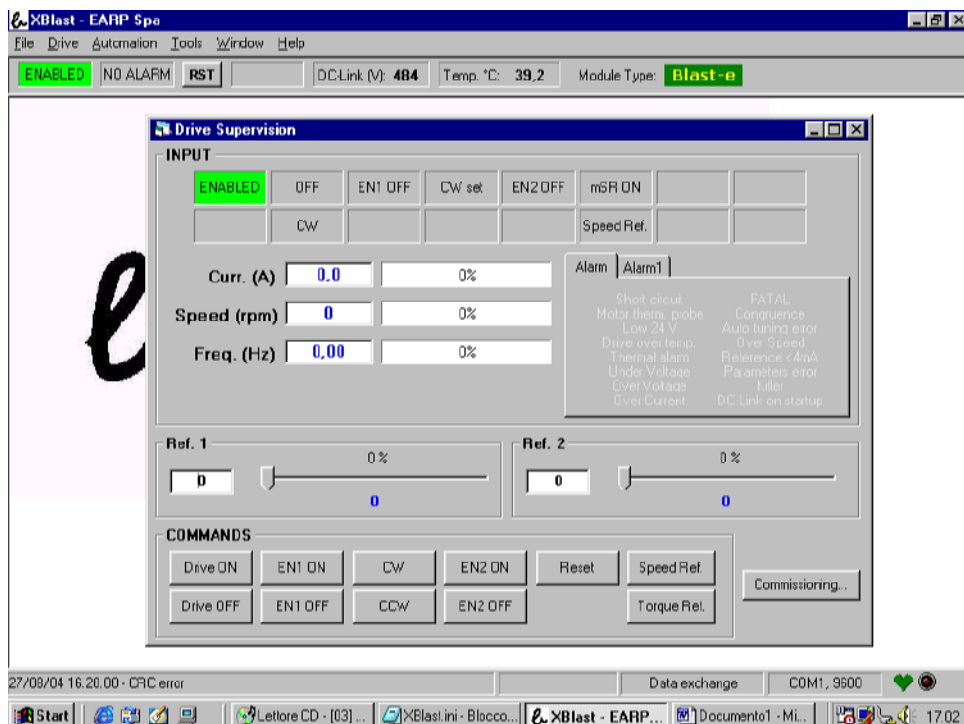
Through Menu VIEW, it is possible to enter to Menu DRIVE SUPERVISION and DRIVE PARAMETERS.



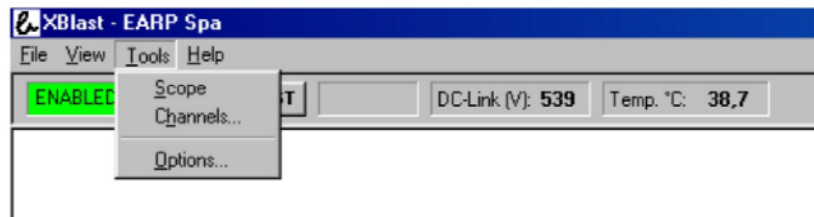
with DRIVE SUPERVISION the drive is entered directly, so the START, STOP, RESET command can be given, the reference can be changed, alarms and DRIVE status are displayed.



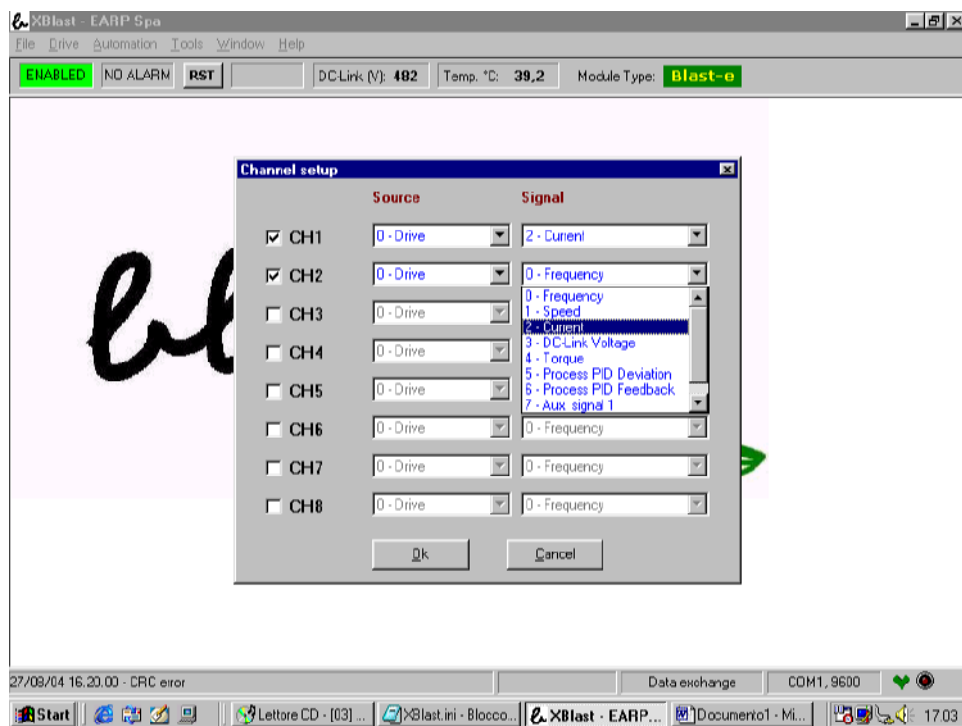
Menu DRIVE PARAMETER displays the control mode and all parameters; their values can be changed. The parameters are displayed in the sequence shown in chapter 7, PARAMETERS, and organized in different folders for applicative typology.



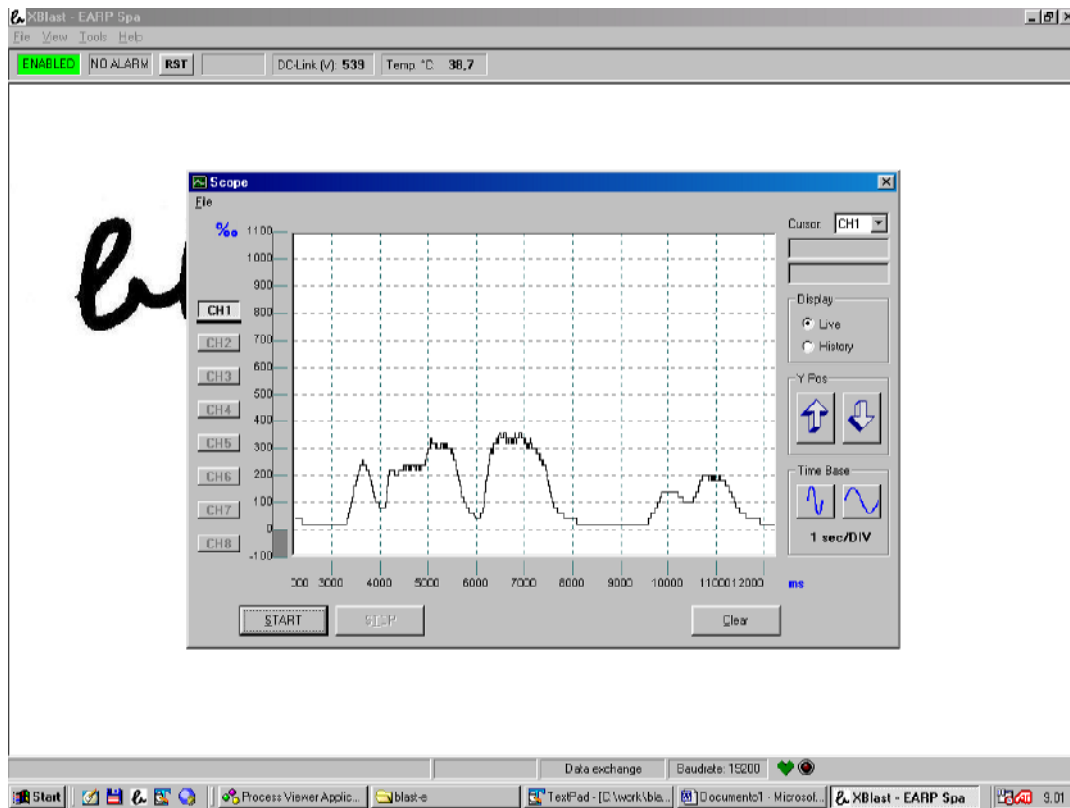
XBLAST, beside the supervision, permits through TOLLS/CHANNEL the channels to be monitored. There are 8 channels associable to different dimensions.



First of all, it must be configured through TOLLS/CHANNEL the channels to be monitored. There are 8 channels associabile to different dimensions.

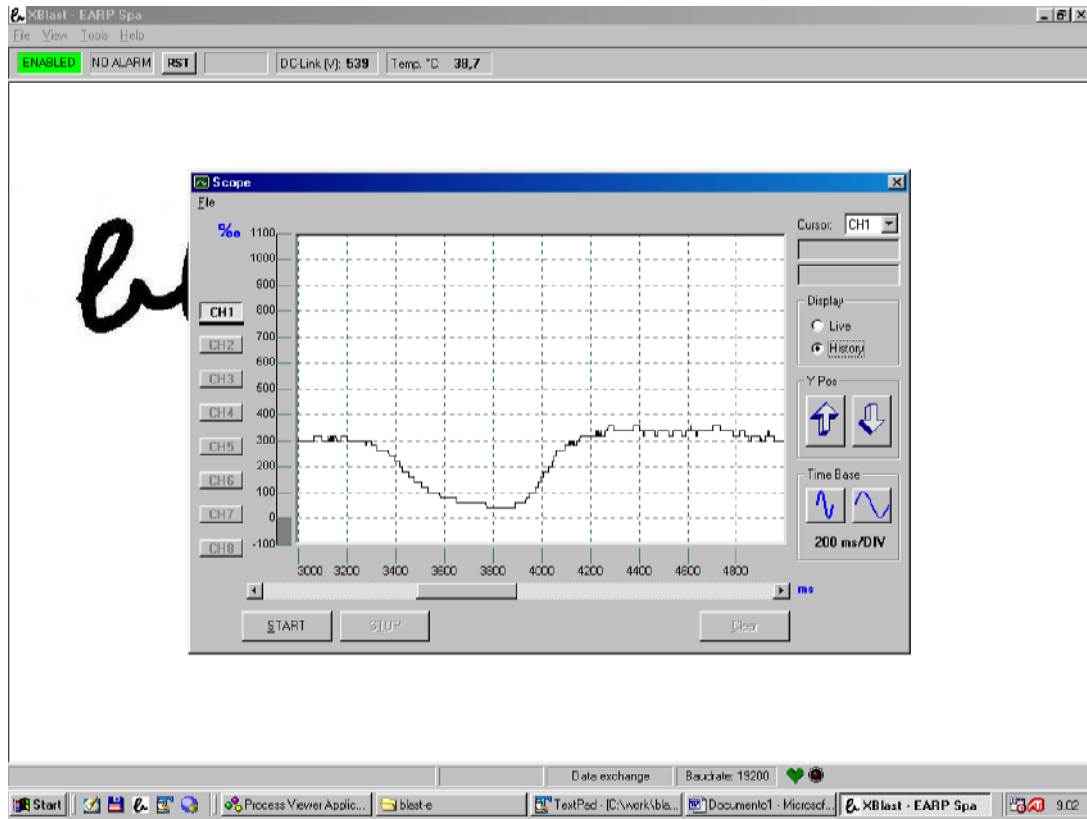


Now SCOPE under menu TOOLS can be selected :



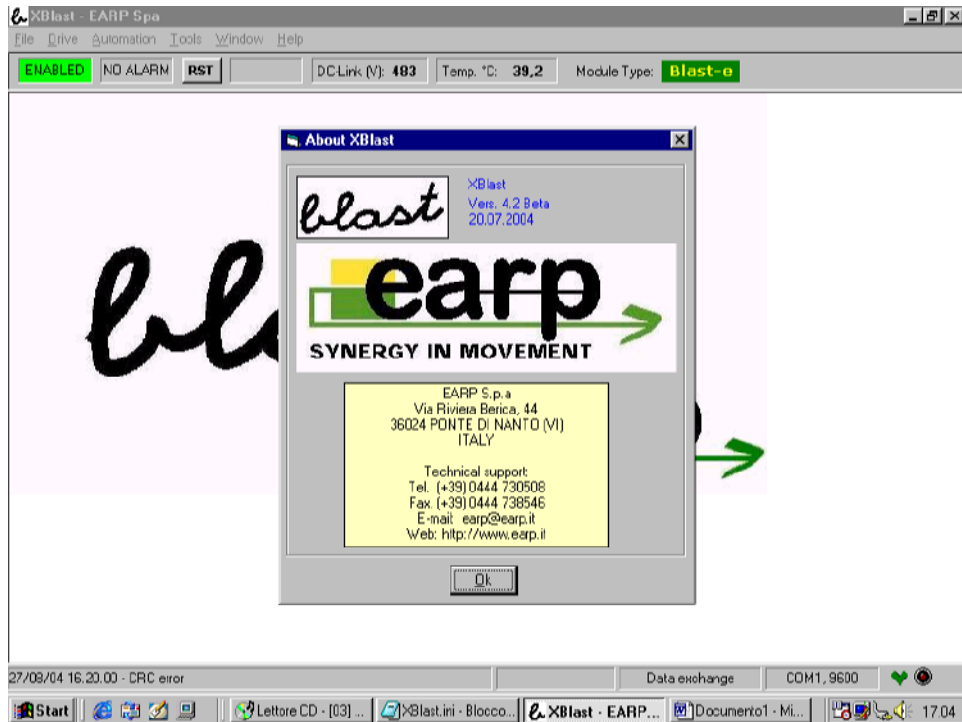
With key START, acquisition begins; with STOP, it is stopped.

The sampling can now be checked by changing the Time BASE



and then, by using SCROLL, the whole stored “Time Base”.

Menu HELP About there are the XBLAST applicable version and information about EARP SPA .



To exit XBLAST, select EXIT from 'file' menu.



7 PARAMETERS

7.1 Factory Setting

BLAST-E is in SVC mode, so it is suitable for Asynchronous motors, nevertheless through Hyper Terminal by Windows® the other control modes which are inside the attached CD with the product.

The available controls are:

SB (Sinusoidal Brushless)	= as standard setting
SFT (Stator Flux Torque)	= Direct Torque Control
SVC (Space Vector Control)	= Voltage vector control
FVC (Flux Vector Control)	= Pure vector control
SSP (Sensorless Speed and Position)	= Position and Speed Sensorless control
Positioner (Posiblast)	= Positioner available in BR and SSP modes.

The user, once programmed the Drive with the dedicated SW, can display and set all parameters through the optional keypad (optional) or through a 232 serial door (optional) and software XBLAST with a PC provided with windows 95 or later versions.

7.2 List of Parameters

Each control Typology is divided into groups to be easily handled by the user:

MOTOR, RUN, DRIVE, DIGRUN, I/O, P.I.D., CONTROL, COMUNICATION and AUXCARD.

The keypad displays a short form: every type of control expects a parameter specific set (see below).

NAME	Keypad Code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
MOTOR (MOTOR PARAMETERS)									
IaN	M1	A	0.0-I _n (size)	Nominal motor current	@	@	@	@	@
I _{max}	M2	A	0.0-I _{max} (size)	Allowed overload current	@	@	@	@	@
U _{ln}	M3	V	280-600	Nominal motor voltage	@	@	@		
f _{ln}	M4	Hz	25-1000	Nominal motor frequency	@	@	@		
f _{max}	M5	Hz	0.0-999.9	Max. operating frequency	@		@		
f _{min}	M6	Hz	0.0-f _{max}	Min. operating frequency	@				
N _n	M7	rpm	0-30000	Motor nominal revolutions	@	@	@		
N _{max}	M8	rpm	0-30000	Max operating revolutions number		@	@	@	@
Cosφ _i	M9	-	0.30-0.99	Power factor	@	@	@		
Poles	M10	-	1-5	Number of poles couples	@	@	@	@	
R _s	M11	Ohm		Phase resistor for star connected motors, or 1/3 of the phase resistor connected in triangle		@	@	@	@
L _s	M12	mH		Stator inductance		@	@	@	
τ _R	M13	ms		Time constant of the stator R _d circuit		@	@		
L _m	M14	mH		Magnetization inductance			@		

NAME	Keypad Code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
RUN (PARAMETRI DI MARCIA)									
S Ramp	r0	%	0-100%	Variation time on the speed set	@	@	@	@	@
ACC	r1	s	0.0-999.9	Accelerating time at the start	@	@	@	@	@
DEC	r2	s	0.0-999.9	Decelerating Time at the stop	@	@	@	@	@
Tlmax	r3	s	0.1-10.0	Motor's overload limit time I ² t	@	@	@	@	@
Msr	r4	Hz	0.3-Fmax	Min. speed relay threshold in Hz	@	@	@	@	@
T_cong	r5	s		Congruence error limit time (for SVC only if feedback)	@	@	@	@	@
S_cong	r6	rpm		Window for congruence error handling (for SVC only if feedback)	@	@	@	@	@
R1_mem o	r7	Hz		START_UP stored reference	@	@	@	@	
V0	r8	V	0-30%U _{ln}	Voltage Boost for RI compensation	@				
f0	r9	Hz	0.0-60%F _{ln}	Frequency level at which V0 stops	@				
Tbrake	r10	S	0.00-10.00	Rif. abilitation delay for parking brake	@	@	@	@	@
Ftw	r11	Hz		Low-filter cutting on the speed observer. In SSP control it works as filter for speed Pid.		@	@	@	@
KSlip	r12	-		Unused					
DRIVE (DRIVES PARAMETERS)									
Type	d0	-	SVC SB FVC SSP SFT	Indicates the drive type: (depending on the Fw inserted)	@	@	@	@	@
PWM	d1	-	0-5	Modulation frequency: for SVC and FVC 0= 1,5KHz 1= 2KHz 2= 3KHz 3= 4KHz 4= 8KHz 5= 12KHz per SB 0= 4KHz 1= 8KHz 2= 12KHz	@	@	@	@	@
Random	d2	-	0-10	Random frequency Size on set PWM	@	@			

NAME	Keypad Code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
Setup	d3	Hex		Drive commands designation to the serial door (0= hardware commando). Possible Selections: - Drive enabling; - Reference enabling; - CW/CCW; - auxiliary reference enabling; - alarm reset; - Torque/Speed selection; - 1 Hw/SW reference; - Hw/sw auxiliary reference; - moto-potentiometer; - analog/frequency auxiliary OUT; - 10÷10V/4-20mA reference.	@	@	@	@	@
Setup2	d4	Hex		Configuration of the current supplied managing, possible selections: -Re-entry in overvoltage - Overload alarm in overcharge - PWM re-entry in over-calibration - fix PWM (declassing in function of the selected PWM) - SFT with 1-8 outflow - SFT with 1-4 outflow		@	@	@	
Size	d5	-	0-max size	Module size (see Sizes chart)	@	@	@	@	@
Killer	d26	-	0-10	Limited by the duration of the intervention of the braking resistance 0= 160ms max in 10s 1= 250ms max in 10s 2= 500ms max in 10s 3= 750ms max in 10s 4= 1000ms max in 10s 5= 1500ms max in 10s 6= 2000ms max in 10s 7= 3000ms max in 10s 8= 4000ms max in 10s 9= 6000ms max in 10s 10= not limited intervention	@	@	@	@	@
Off_DCLink	d21	-	100-450	Offset voltage DC Link (<i>accessible only by pad: reserved calibration</i>)	@	@	@	@	@
Enc_Out	d16	imp/rev		Encoder simulation revolution pulses				@ *	
Enc_In	d17	imp/rev		Nominal revolution pulses of the feedback encoder		@	@	@	
Feedback	d18	-		Feedback type: 0= no-one 1= encoder 2= 2 poles resolver	@	@	@	@	

NAME	Keypad code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
Off_res	d19	-		Resolver offset (timing)				@	
Num_of_Index	d20	-		Index number in the encoder revolution (TOP ZERO number): 0= 1 index 1= 2 indexes 2= 4 indexes				@	
Select	d25	-		Available only from XBlast					
DIG. RUN (GEAR CONFIGURATION)									
Jog1	d6	Hz	0.00-Fmax	1 pulses speed	@	@	@	@	@
Jog2	d7	Hz	0.00-Fmax	2 pulses speed	@	@	@	@	@
Jog3	d8	Hz	0.00-Fmax	3 pulses speed	@	@	@	@	@
Dig Ref1	d9	%	±100.0% Fmax	Digital reference. To enable it selection "Select 0/1/2" on the settable input (DIN 1÷6) to which it is associated the hardware command for the digital activation (see also "digital speed function").	@	@	@	@	@
Dig Ref 2	d10	%	±100.0% Fmax						
Dig Ref 3	d11	%	±100.0% Fmax						
Dig Ref 4	d12	%	±100.0% Fmax						
Dig Ref 5	d13	%	±100.0% Fmax						
Dig Ref 6	d14	%	±100.0% Fmax						
Dig Ref 7	d15	%	±100.0% Fmax						
Skip f1*	d22	Hz		Frequency hop N°1	@*				
Skip f2*	d23	Hz		Frequency hop N°2	@*				
Delta f*	d24	Hz		Frequency hop quantity	@*				
Tab.V/Hz*	d27			It selects the LOOP kind for SVC: 0= open speed ring (sensorless) 1= closed speed ring (with encoder)	@*				

NAME	KEYPAD CODE	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
I/O (INPUT/OUTPUT CONFIGURATION)									
Polarity	I0		0-21	Inputs/outputs polarity: 0= positive 1= negative	@	@	@	@	@
Din1	I1		0-21	Settable digital input function: 0= disable 1= drive ON CW 2= drive ON CCW 3= EN1 4= EN2 5= CW/CCW 6= Reference UP 7= Reference DOWN 8= Jog1 9= Jog2 10=Jog3 11= Speed/Torque (not available) 12= Reset ALARMS 13= Bypass ramps 14= Thermal probe (only for "I1+I4") 15= Frequency input (only for "I5") 16= Start CW 17= Start CCW 18= Select_0 19= Select_1 20= Select_2 21= Out AN Selection	@	@	@	@	@
Din2	I2		0-21	Come Din1	@	@	@	@	@
Din3	I3		0-21	Come Din1	@	@	@	@	@
Din4	I4		0-21	Come Din1	@	@	@	@	@
Din5	I5		0-21	Come Din1	@	@	@	@	@
Din6	I6		0-21	Come Din1	@	@	@	@	@
OFF_R/1	I8		±20%	AN1 analog input offset	@	@	@	@	@
OFF_R/2	I9		±20%	AN2 analog input Offset	@	@	@	@	@
DO1/ DO2	O0/O1		0-8	Functions associable to the settable digital output: 0= disable (enabled analog out) 1= msr 2= brake 3= speed set reached 4= direction 5= alarm 6= drive thermal warning 7= motor thermal warning 8= drive OK	@	@	@	@	@

* in Development

NAME	Keypad code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
DAC Analog Output Out_AN1	O3	-	1-6	Settable analog output: 0= disable 1= speed $\pm 10V$ 2= current $0 \pm 10V$ 3= DC Link voltage $0 \div 10V$ (10=1000Vdc) 4= ... 5= Proc. PID deviation $0 \div 10V$ 6= Proc. PID feedback $0 \div 10V$	@	@	@	@	@
Off_Out_AN DAC *	O4	-		AN1 analog output Offset	@	@	@	@	
kOut_AN 1 DAC*	O5	-	0.01-99.99	Analog output range scale factor	@	@	@	@	@
Out_DAC Anaux *	O9	-	0-6	Auxiliary analog output (active with Din input configuration)	@	@	@	@	@
kOut_DAC Anaux *	O10	-	0.01-99.99	Auxiliary analog output scale factor	@	@	@	@	@
Ftw_Out_AN *DAC	O11	Hz	1-100	Analog output filter	@	@	@	@	@
PID (LOOPS CALIBRATION)									
Kpl Current Loop	P0	-	0-9999	Constant proportional to the current regulator (SVC current hook)	@	@	@	@	@
Kil	P1	-	0-9999	Integral Constant of the current regulator (current hook for SVC)	@	@	@	@	@
Kpw Speed Loop	P2	-		Proportional constant of the speed regulator		@	@	@	@
Kiw	P3	-		Integral constant of the speed regulator		@	@	@	@
Kdw	P4	-		Constant from the speed regulator		@	@	@	@
Tdw	P5	-		Limit of the filter passband on the feedback for the Kdw constant		@	@	@	@
Kpflx	P6	-		Proportional constant of the flux regulator		@	@		@
Kiflx	P7	-		Integral constant of the flux regulator		@	@		@
K Feedback Process Loop	P8	-	0.0-10.00	Scale factor of the processing feedback	@	@	@	@	@

NAME	KEYPA D code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
Gain	P9	-	0.00- 100.0	Processing regulator gain	@	@	@	@	@
Ti	P10	S	0.00- 10.00	Integrative rime constant	@	@	@	@	@
PID Proc.	P12	-	0-2	0= no PID 1= positive correction 2= negative correction	@	@	@	@	@
FB_val_ Display	P13	-	0.01- 10.00	Visualization scale factor	@	@	@	@	@
CONTROL (SSP & EVC CONFIGURATION)									
Kl_cmpV	P15	-		Proportional Constant of the compensator from DC link		@			
KP_cmpV	P14	-		Integral constant of the DC link compensator		@			
StartKlq	P17	rpm	$1.5N_M \div N_{MAX}$	Starting of outflow torque limiter		@			
Iq_break_ dwn	P16	%		Limit from the torque limiter in outflow		@			
X.RAM 1 Debug	/	-		Reserved parameters					
X.RAM 2	/	-		Reserved parameters					
shift	P31	-		Reserved parameters					
SSP CONTROL									
Kfil_Ldest	P18	-		reading only: it shows the filter on the flow					@
Kfil_Lqest	P19	-		Reading only: it shows the filter on the flow					@
KLS	P20	-		Model gain at low speed					@
KHS	P21	-		Model contribute at high speed in the operation at low speed					@
KHH	P22	-		Gain of the model at high speed					@
Ky	P23	-		Reading only: adapting constant of the curves					@
Injection	P24	-		Size of the injection signal					@
max_track	P25	-		Reading only: tracking max speed					@
Ld_set	P26	-		Size of the flow reference.					@
Kp_track	P27	-		Reading only: proportional constant of flow PI					@
Ki_track	P28	-		Reading only: integral constant of PI flow					@
Ftw	P29	Hz		It filters the speed visualization in the display					@
Iq_start	P30	%		Increasing of the starting torque					@
Speed_min	P32	rpm		Threshold under which it is halved the speed PID					@

AUXILIARY BOARDS

COMUNICATION (COMUNICATION SETTING)									
NAME	Keypad code	UNIT	RANGE	DESCRIPTION	SVC	FVC	SFT	SB	SSP
Protocol on board RS 232	C0	-	0-1	0= PROPRIETARY BUS (W3 Reel) 1= MODBUS RTU	@	@	@	@	@
Baudrate	C1	bps	0-3	0= 9600 1= 19200 2= 38400 3= 57600	@	@	@	@	@
Parity	C2	-	0-2	0= none 1= ODD 2= EVEN (<i>solo in MODBUS</i>)	@	@	@	@	@
Address	C3	-	1-247		@	@	@	@	@
Display	A0	-	0-4	0= CURRENT [A] 1= SPEED [RPM] 2= VOLTAGE [V] 3= TEMPERATURE [°C]	@	@	@	@	@

7.3 Main Parameter Description

The BLAST-E parameters are divided in to different groups for easy use: MOTOR, RUN, DRIVE, DIGRUN, I/O, P.I.D., CONTROL, COMUNICATION, and AUXCARD.



To enter to the parameters from the integrated keypad press "FUNC SPEED" and "ENTER F/R" for 5 seconds, digit the password 7305 using "▲" and "▼" to increase/decrease the value, or start the "X BLAST" available in the CD supplied with the product.

7.3.1 MOTOR Parameters

The motor parameters are used for the motor's correct setting. The parameters not used for the selected control mode are disabled.

The parameters have the same sequence as in the XBLAST software under menu MOTOR.

To such group belong all typical motor parameters (parameters of keypad group M).

M.0 Version (available only from keypad)

The control and automation software version installed is indicated as follows:

SS.AA : SS is the software version in hexadecimal; AA is the automation software version that could be installed, also in hexadecimal. If no automation is installed the two SS figures will be =00. (see also parameter d.0 Type).

M.1 I_{an}

Nominal motor current (plate data) in Ampere.

The range for this parameter is from 0.1 A to a max. value depending on the drive size and, in case of SB control mode, on the modulation frequency also (see d.19 setup2). See chart 7.1.

M.2 I_{max}

Max. current delivered by the drive in Ampere.

The range covers values from 0,1 A to a value twice the module's nominal current .
See chart 7.1

Chart 7.1 shows the ratio between the nominal and maximum current for each drive size.

Size	Variable FPWM		Fix FPWM			POTENZA
	I _{an}	I _{max}	I _{nom} (4kHz)	I _{nom} (8kHz)	I _{nom} (12kHz)	
0007	2.5 A	5.0 A	2.5 A	2.5 A	2.5 A	0.7kW
0011	3.5 A	7.0 A	3.5 A	3.5 A	3.0 A	1.1 kW
0015	4.8 A	9.6 A	4.8 A	4.8 A	4.8 A	1.5 kW
0022	6.0 A	12.0 A	6.0 A	6.0 A	6.0 A	2.2 kW
0037	9.5 A	19.0 A	9.5 A	9.5 A	9.0 A	3.7 kW
0055	13.0 A	26.0 A	13.0 A	11.0 A	9.0 A	5.5 kW
0075	16.5 A	33.0 A	16.5 A	16.5 A	14 A	7.5 kW
0110	25.0 A	50.0 A	25.0 A	21.0 A	16.5 A	11 kW
0150	31.0 A	62.0 A	31.0 A	31.0 A	22.0 A	15 kW
0180	39.0 A	78.0 A	39.0 A	33.0 A	25.0 A	18 kW
0220	45.0 A	90.0 A	45.0 A	39.0 A	31.0 A	22 kW
0300	62.0 A	124.0 A				30 kW
0370	76.0 A	152.0 A				37 kW
0450	90.0 A	180.0 A				45 kW
0550	112.0 A	224.0 A				55 kW
0600	120.0 A	240.0 A				60 kW
0750	150.0 A	300.0 A				75 kW
0900	180.0 A	360.0 A				90 kW
1100	220.0 A	440.0 A				110 kW
1320	260.0 A	520.0 A				132 kW
1600	300.0 A	600.0 A				160 kW

M.3 U_{ln}

Nominal motor voltage in Volt.
Range 280 V ÷ 600 V.

M.4 F_{ln}

Nominal motor frequency in Hz.
Range 25 Hz ÷ 999 Hz.

M.5 F_{max}

Max. output frequency of the inverter in 1/10 Hz.
Range 0.1 Hz ÷ 999.9 Hz.

M.6 F_{min}

Parameter in 1/10 Hz indicating the min. frequency for the drive to start operating.
If the parameter is set at 0,0 the drive delivers a continuous current to the motor which is proportional to the value set under variable r.9 .
Range 0.0 Hz ÷ F_{max}.

M.7 n_N

Nominal motor speed in rpm.
Range 0 rpm ÷ 30.000 rpm.

M.8 n_{Max}

Scale end speed reference in rpm.
Range 1 rpm ÷ 30.000 rpm.

NOTES

- do not exceed the motor's plate data
- Besides 9999rpm the keypad changes automatically the display in Krpm (rpm x 1000): E.g. 20.000rpm= 20,00K.

M.9 [Cosphi](#)

Power factor of the motor .

Range 0,50 ÷ 0,99.

M.10 [Poles](#)

Number of pole pairs on the motor .

Range 1÷5 pole pairs = 2÷10 poles

M.11 [Rs](#)

Stator resistor of the motor starry connected or 1/3 of the phase resistance for triangle connections expressed in 1/100 Ohm.

In case of SFT control mode this parameter must be entered to improve the motor's performance at low speed.

There are more ways:

1. motor parameters auto-acquisition with injection of current;
2. automatic calculation of the resistor basing on the plate data being entered.

In the second or third case the sequence to follow, with XBLAST applicative, to do the automatic calculation is described in "COMMISSIONING" paragraph. .

M.12 [sIs](#)

Typical stator inductance of the motor being used , in 1/100 mH, as RJ, this value is automatically available with some distance automatism in the "COMMISSIONING" paragraph.

M.13 [TauR](#)

Rotor time constant in ms.

M.14 [Lm](#)

Magnetization inductance expressed in 1/100mH.

7.3.2 RUN parameters

To such group belong all typical RUN parameters (parameter group r).

r.0 [S Ramp](#)

Easier quote arrival on the reference set.

r.1 [Acc](#)

Time indicated in 1/10 sec, needed to carry out a positive speed variation from zero to a max. value set with parameter no.8 (nMax).

Range 0.0 s ÷ 999.9 s.

r.2 [Dec](#)

Time in 1/10 sec needed to carry out a negative speed variation from the max. value set with parameter no.8 (nMax) to zero.

Range 0.0 s ÷ 999.9 s.

r.3 T_{imax}

Maximum delivery time of the current set under parameter I_{max}.

The drive measures the current delivered beyond nominal current I_{an}, carries out the integral and compares the value to the threshold which is equal to: T_{imax} * (I_{max} - I_{an}). Once exceeded, the current is limited to the I_{an} value (in SB controls, SSP and FVC) or intervenes the E alarm. The "Thermal Alarm" (in SVC, SFT control).

Range 0.0 s ÷ 10.0 s.

r.4 msr_Hz and msR_rpm

Min. speed relay threshold in Hz and rpm in accordance of the used control.

Range 0.3 Hz ÷ F_{max} in Hz and 5rpm ÷ N_{max}.

r.5 T_{cong}

Max. operating time in presence of a congruence error. It is linked to parameter S_{cong}, with which alarm I "congruence error" is handled. Range 0.0 s ÷ 255.0 s.

r.6 S_{cong}

This parameter handles the "congruence error" alarm together with T_{cong}

Range 0 rpm ÷ N_{max}.

This alarm occurs when the motor speed does not follow the speed set correctly: if (for a longer time than the set one with the parameter r.5(T_{cong})) the error between the set speed setpoint and the feedback exceeds the value set with parameter r.6 (S_{Cong}), there is the congruency alarm.

The alarm is not handled when one or both parameters is =0.

The control is useful both in case of overload on the motor shaft and in case of failure of the feedback transducer.

r.7 R1 memo

Parameter saving the initial digital speed reference.

r.8 V₀

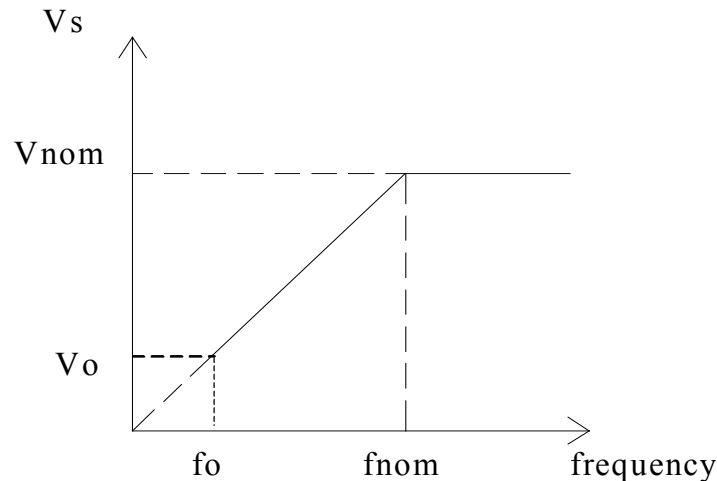
Voltage value applied to the motor at frequency f₀. This parameter has a value only for the SVC control mode. Range 0 Volt ÷ 30% U_{ln}.

r.9 f₀

the meaning of the two previous parameters is in the example in figure#.

r.10 T_{brake}

Managing time of the handbrake (if programmed).



r.11 [FiW](#)

Speed observation filter. It determines the cut frequency of the low filter useful to minimize the feedback disturbs (for the sensorless it acts on the feedback estimate). It has to be calibrated at lower values than 50Hz in sensorless vectorial controls (SFT and SSP).

7.3.3 DRIVE Parameters

To this group belong the drive related parameters (group d).

d.0 [Type](#)

Indicates the control mode installed in the drive and it is not changeable (reading only).

The modes are:

- **Inverter standard SVC**

They apply a linear law of the „voltage/frequency“ ratio to an asynchronous motor.

Fixed the nominal points, e.g. 50Hz / 400V, the drive imposes a voltage and a frequency to the motor (at 25Hz the motor is supplied at 200V; at 15Hz 120V etc).

Only at low regimes the ratio changes, to deliver the voltage drop on the internal motor resistance, which limit the suppliable current and the torque.

For frequency value, superior than the nominal, the voltage is constant (e.g. 70Hz-400V), with consequent decrease of the torque, to be obtained at current parity; this tract is called “constant power” or for analogy “deflowing”.

The Blast “SVC” W3 control uses the V/Hz relation in the vectorial way: in the calculation algorithm the “voltage” parameter is like a vector in rotation to the required frequency.

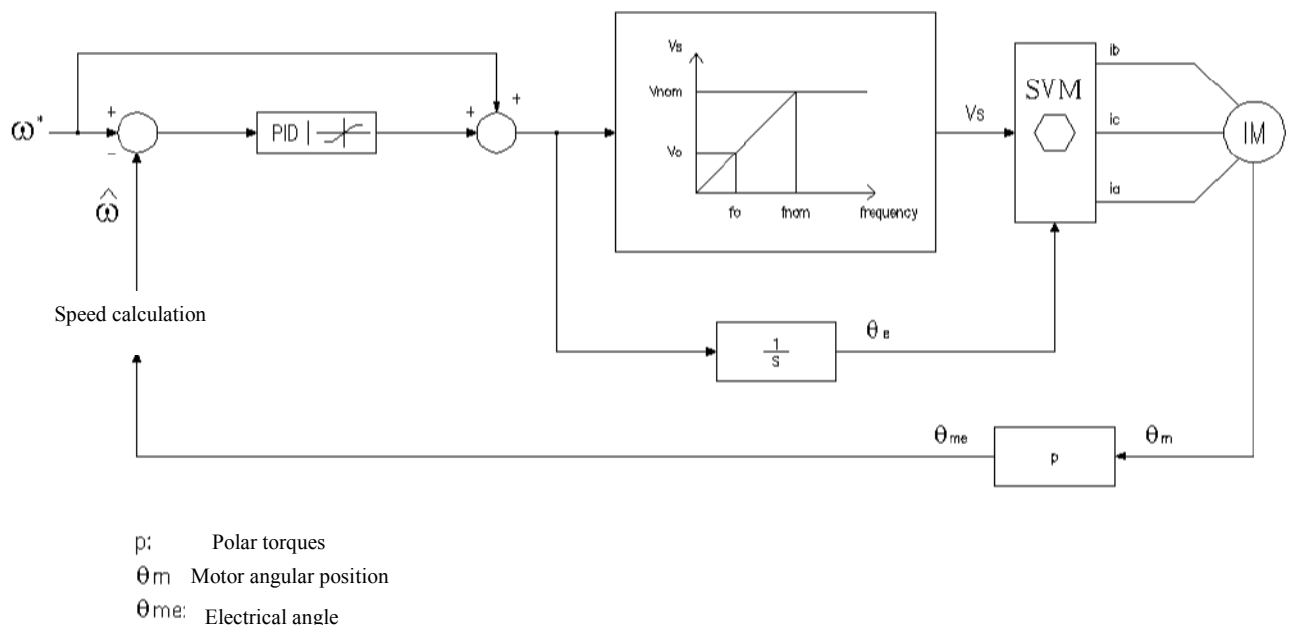
In this way, the compensations actuated by the control to the various speeds grant an elevate level of torque already at very low revolutions.

At a supply frequency of 1Hz there is the nominal torque of the motor supplying the only plate current.

The voltage vectorial control is especially indicated for applications where more motors are connected in parallel and piloted by the same drive, not accepted condition by other controls as "the pure vectorial inverter".

The major advantage of this control is that it does not require the speed feedback, only to compensate precisely the increase of the flowing according to the load (condition not always required, because a partial compensation is already sensorless).

V/Hz CONTROL SCHEME



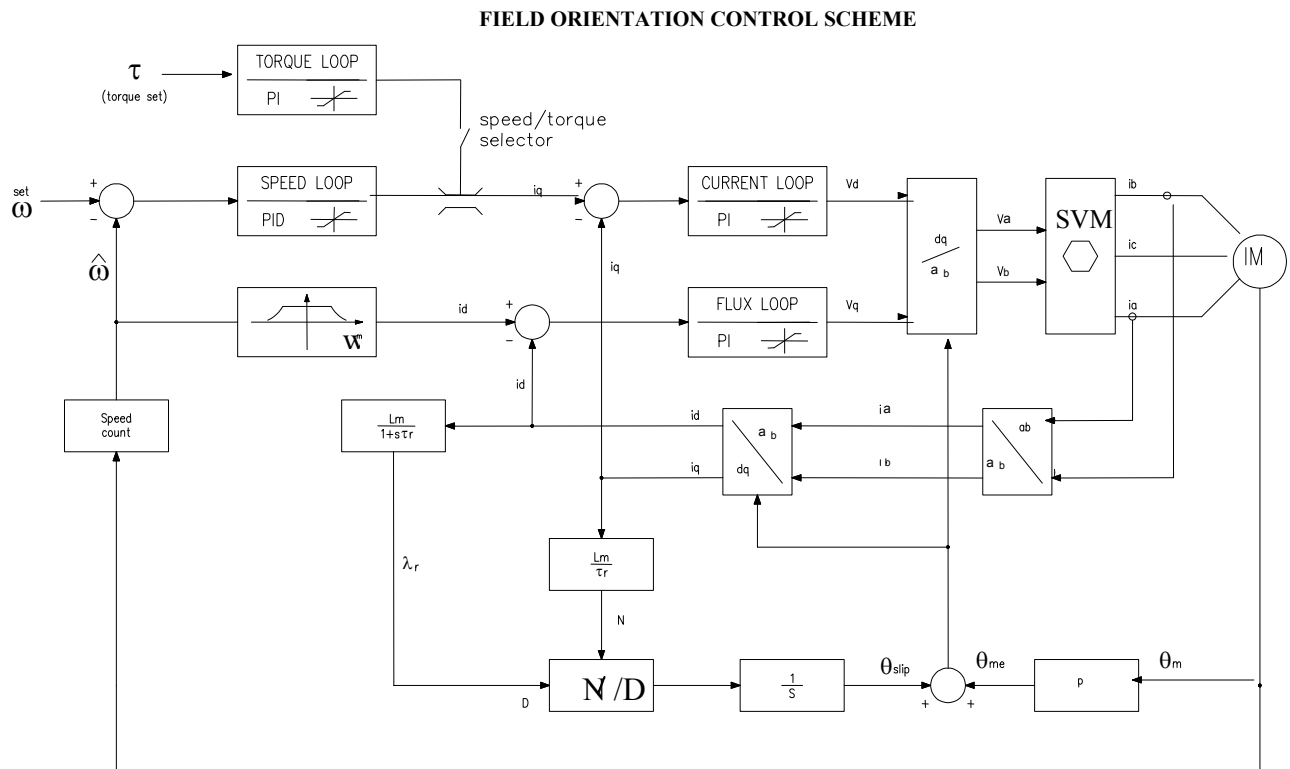
• FVC pure vectorial inverter

It is in absolute control and performing for drive with asynchronous motors.

Differently from the impressed voltage inverter, it is able to manage the supplied current to the motor, distinguishing the flow component (I_d) from the examined one to the torque (I_q).

The electronics examines constantly all the phase currents, it compares them to the applied voltage by measuring their phase shift, calculates the instant $\cos$, finds mathematically the current components, estimates the induction to the rotor, estimates the supplied torque and decides in real time which current component is to be changed to obtain the necessary speed and torque.

Measuring, furthermore, the instant speed and finds the flowing compensating it entirely.



The estimate precision is directly linked to the knowledge of some parameters, as the stator resistance (phase-phase), the rhetoric time constant, the dispersion inductance, the curve of the motor magnetization.

All of these limits the application to a single motor, because it is impossible to compensate independently more motors connected in parallel.

In order to do precisely the compensations above, BLAST is able to auto-acquire the motor parameters, following an automatic procedure, that expects the current injection at 0 speed.

To obtain the maximum performances it is available a special asynchronous motor different for the square shape of the housing. This motor, apposite applications with inverter, is servo-ventilated when it is required the permanence at low speed regimes.

The meeting between pure vectorial control and square motor, realizes as status, a drive which permits the enabling to elevated handlings, both for dynamic answer and for high level of torque at 0 revolutions.

- **Inverter at direct control of the SFT torque**

It is the result of mathematical models of the application to the industrial handling.

The SFT control disturbs the classical system of IGBT modulation for the stator current control, also if the structure of the power bridge is common to all the controls.

The supply of current is the result of a mathematic elaboration, able to control constantly the magnetization flow parameters and developed torque without need of a speed feedback.

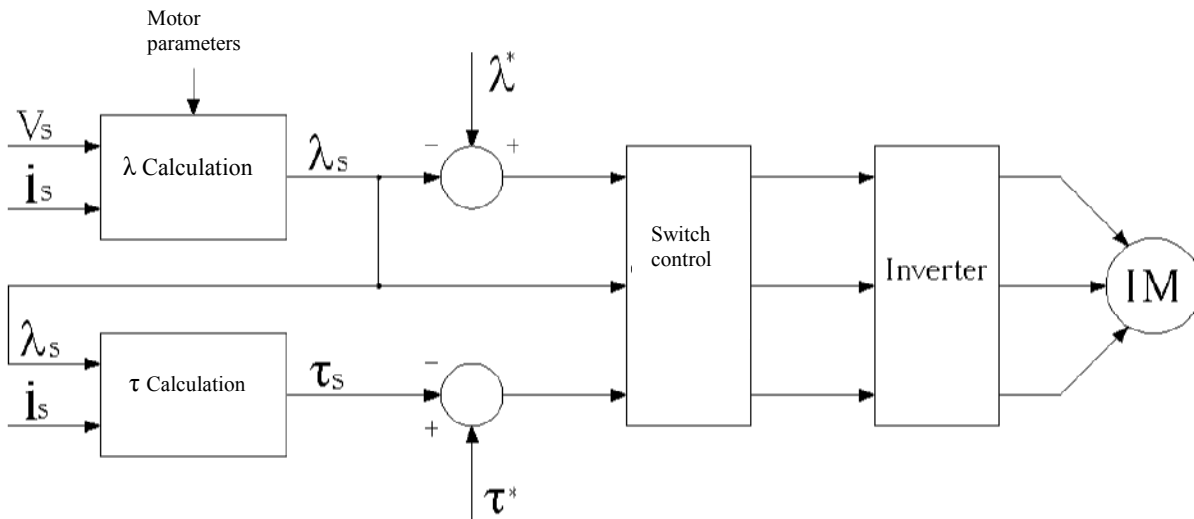
The control, with the only measure of the phase currents, can calculate precisely all the variables of the motor.

Regarding a program cycle, that lasts few dozens of microseconds, it is examined the status of the motor and decided which IGBTs to be changed to satisfy the instant request of torque speed.

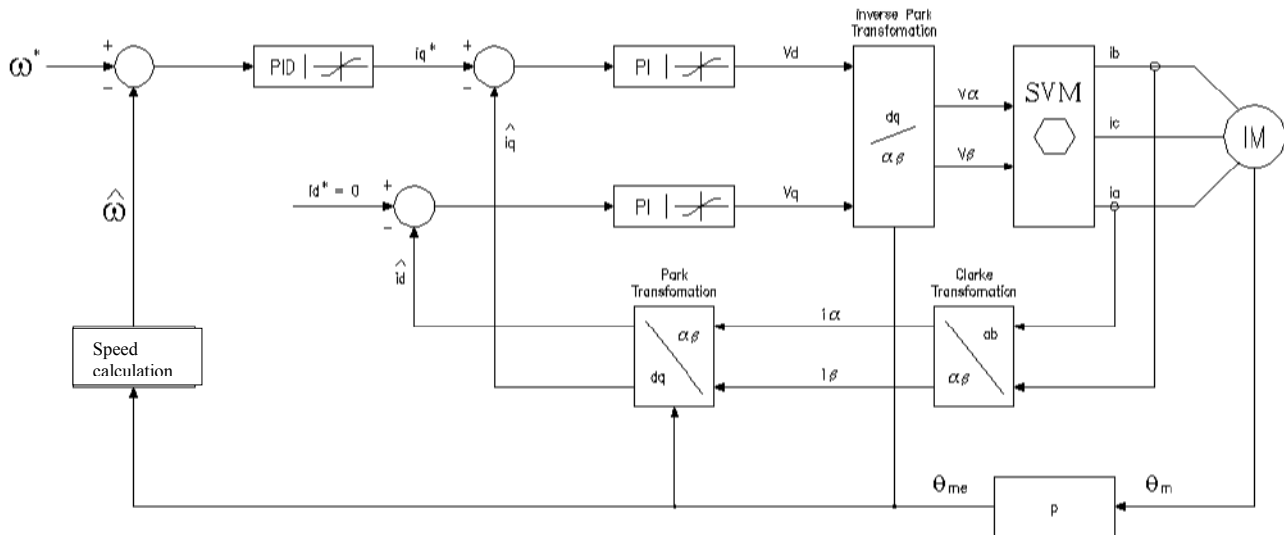
Resuming, if in the normal systems at pulse modulation (PWM) a current ring requires to the modulator the supply and it deals with the commutation of the IGBTs, in the torque direct

control system is the torque/ flow regulator which decides the commutations, according to what has been elaborated at the same time. The result is a drive able to answer to torque couple in few milliseconds, with a speed precision lower than 0,5% (according to the motor nominal flowing), without speed feedback, to reach the 0,1% with a sufficient speed feedback. This special modulation technique permits to "save" the IGBT commutation number; the middle modulation frequency is lower also of the 30% in comparison to a normal PWM control, with consequent reduction of the thermal dissipation (losses) of the drive. This kind of control is damaged only at very low revolutions (lower to 1Hz for a motor of 50Hz), where the working frequency, particularly low and, the commutation pulses (because of the low voltage to be applied to the motor) limit the precision degree of electrical measures. Anyway, it is not kept a limit in the 95% of the applications, because it is considered transitory.

Scheme of torque direct control



SINUSOIDAL BRUSHLESS CONTROL SCHEME



p: polar torques
 θ_m : motor angular position
 θ_{me} : electrical angle

▪ Sensorless control pf SSP "speed and position"

It is a "Drive-Motor" system focused on the estimate of the rotor position to permit always the correct orientation of the field and the maximum torque.

An algorithm based on the perfect knowledge of motor parameters, BLAST is able to control the rotation corner position of SSP motor and then its speed, with absolute precision.

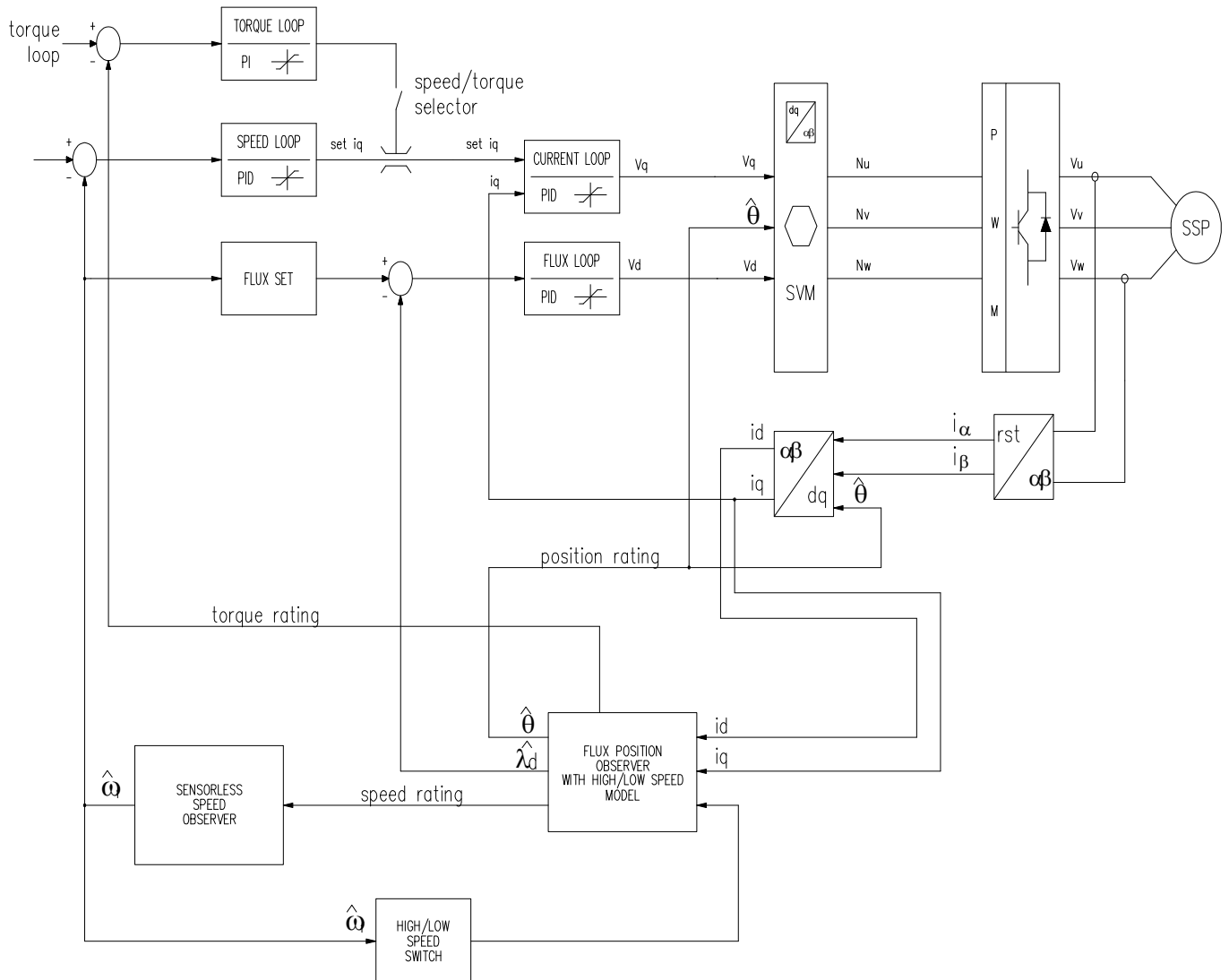
SSP, Sensorless Speed and Position, is bound to change and substitute the great part of the handlings realized with controls with closed ring and not.

The drive observe analytically the flowing of the current supplied to the SSP motor, which, thanks to its special construction, brings the necessary information to find the drive shaft position.

The position is reached "reading" the same motor as it is a sensor, to obtain:

- Speed precision absolute in absolute SENSORLESS, for all the regimes;
- Control of the position or the space done WITHOUT THE FEEDBACK AUXIL

The granted speed is the set one, with an error margin of 0,01% (1/10.000), which is comparable to the declared error by a good control with closed ring (feedbacked by a speed transducer of good technology), the position error of the drive shaft position, is +/- 1,5 mechanical degrees, the availability on the same position is +/- 0,1...0,2°.



The SSP motor does not have electromagnetic brush and magnets, so, it has the same liability of an asynchronous motor: it does not need programmed maintenance, except for the bearings. Its inertia moment, compared to the one of a classical asynchronous motor, is very inferior thanks to the major specific power (at parity with the mechanical quantity) and the lighter motor. The torque ripple is comparable to the servomotor one.

d.1 PWM

It shows the working modulation frequency of the drive.

0 = 1,5KHz

1 = 2KHz

2 = 3KHz

3 = 4KHz

4 = 8KHz

5 = 12KHz

Current ↓5E N.B. In this way (SVC) the drive in case of too high temperature of IGBT, reduces automatically the working currents.

It is possible to decide to use a fix modulation frequency, not changeable automatically. This choice could lead, in certain cases dependent by the size and chosen modulation frequency, to a

derating of the drive with consequent decrease of the nominal current and maximum suppliable from the module.

d.2 [Random](#)

Set amplitude of Random frequency possible on PWM: it permits to have a variable PWM within the limits imposed by this parameter reducing the acoustic emission of the motor.

d.3 [Setup](#)

the parameter selects the possibility to command the drive with hardware or software controls. The choice of the command mode of the drive happens through the selection of the "keypad value" in the parameter Setup d.3 (see chart 7.3.3.1).

Chart 7.3.3.1

Keypad value	Function
1	Drive On 0=HW 1=SW
2	Reference1 On 0=HW 1=SW EN1
4	<i>Direction</i> 0=HW 1=SW
8	Reference2 On 0=HW 1=SW EN2
16	<i>Alarm Reset</i> 0=HW 1=SW
32	Torque Control 0=HW 1=SW
64	<i>Reference 1 Value</i> 0=HW 1=SW
128	<i>Reference 2Value</i> 0=HW 1=SW
256	Enable Motopotentiometer
512	Analog out 0=analog 1=freq. 0-200kHz
1024	Ref.1 Type 0= 0-10V 1=4-20mA

The drive can be controlled both through 6 digital inputs (HW) and through the Keypad or the use of a pc or an external supervisor connected via serial port to the drive (SW) or both at the same time.

So it is possible to decide from where the various commands have to be heard.

For example it can be possible to control the start and stop of the motor and its speed through serial port but, to e sure, disable completely the modulation through an hardware command connected to a digital input. To do so it is necessary to set the bit 0 Drive On= 0 (HW) the bit 1 reference 1 On =1 (SW) and the bit 6 reference 1 Value= 1 (SW).

$$0 \cdot 2^0 + 1 \cdot 2^1 + 1 \cdot 2^6 = 0 + 2 + 64 = 66$$

the bit 12 decides if is to be generated the speed output in analogical way (bit 12=0) or through a frequency from 0 to 100KHz (bit 12=1). To obtain the operation desired it will be also necessary to set the dip-switch SW1 correctly.

The bit 13 permits to choose if use the main reference controlled in voltage (range – 10 .. 10V) or in current (range 4 .. 20mA). This setting imposes the will to use such input in analogical mode and excludes the possibility to set the bit 6. Also in this case, beside to set such bit, it will be necessary to set the dip-switch SW2.

d.4 [Setup 2](#)

Configuration of the managing of the supplied current, possible selections:

Behaviour in overload
- re-entry to the nominal in overload
- overload alarm in overcharge
- PWM re-enter in over-calibration
- Fix PWM (operating derating I of the selected PWM)
- SFT with deflowing 1-8
- SFT with deflowing 1-4

d.5 [Size](#)

the parameter identifies the size of the module in kW. In chart 7.1 (chapter 7, paragraph 3) there are the characteristics of the various available sizes.

Such parameter can not be changed by pc but only by keypad with EARP reserved code.

d.26 [killer](#)

Thermal protection constant of the brake resistor.

Setting range 0-10. In case the brake circuit is switched, the drive makes a calculation of the resistor switching time sum on a 10 second base.

The thermal resistor protection switches as soon as the time reaches the limit value set under parameter d20, with 1= 160ms, 10= 1,6 s. If set at 0, variable d20 selects the brake resistor missing.

d.21 [Off Dclink](#)

Parameter set in the testing phase at EARP. Needed to compensate measure tolerances on the dc link voltage. This parameter cannot be edited.

d.16 [Enc Out](#)

Pulses per revolution of the encoder simulation output on board.

Range: 2048, 1024, 512, 256 ppr.

d.17 [Enc In](#)

Selects the ppr for the encoder connected to board

Range: 64 pulse/rev to 8192 ppr.

d.18 [Feedback](#)

Selects the kind of feedback used for the position/speed detecting.

Set Value	feedback
0	Sensorless
1	Bidirectional Encoder
2	Resolver

d.19 [Off res](#)

Offset for the Resolver tuning. Usually this data is calculated automatically by the drive on the command. Through this parameter it is possible to set it also by hands. The range of variation is 0 ÷ 65535.

Such parameter, to be displayed on the option board, is divided per 8 and so, a value displayed on PC of, for example, 3412, on the keypad will be displayed equal to 3412/8=426.

d.20 Num_of_index

Number of synchronization pulses (also called *index* or *zero top pulses*) given on the feedback encoder.

In case no pulse should be available or the related channel should not be connected to the input, this parameter has no influence on the correct operating.

Set Value	ZERO top NUMBER
0	1
1	2
2	4

d.25 [Select](#)

This parameter, available only for BLAST, is exclusively for a request for re-programming of the firmware inside the DSP.

Dig.Run Parameters

d.6 JOG1

Value of the first settable fix speed

d.7 JOG2

Value of the second settable fix speed

d.8 JOG3

Value of the third settable fix speed

d.9 ÷ d.15 Dif. Ref.1 ÷ Dif. Ref.7

"Digital speeds" is a function which permits to fix 8 speed levels liable through the activation of 3 hardware inputs associable to Din 1 ÷ Din 6 settable inputs, according to the chart below:

Select 0	Select 1	Select 2	Activated selection
0	0	0	- - -
0	0	1	Dif. Ref. 1
0	1	0	Dif. Ref. 2
0	1	1	Dif. Ref. 3
1	0	0	Dif. Ref. 4
1	0	1	Dif. Ref. 5
1	1	0	Dif. Ref. 6
1	1	1	Dif. Ref. 7

d.22 Skip F1

No used

d.23 Skip F2

No used

d.24 Delta f

No used

d.27 Tab_vhz

It enables the managing at closed ring of the SVC control

Set Value	Control selection
0	Open ring SVC
1	Closed ring SVC

7.3.4 I/O Parameters

To this category belong all the parameters proper of inputs and drive outputs (parameters of group I and group O).

I.0 Polarity

Input/output polarity

Keypad value	Function
1	DIN 1 Active Low
2	DIN 2 Active Low
4	DIN 3 Active Low
8	DIN 4 Active Low
16	DIN 5 Active Low
32	DIN 6 Active Low
256	DOUT 1 Active Low
512	DOUT 2 Active Low

I1 ÷ I6: DIN1 ÷ DIN 6

Digital programming inputs.

Value set by keypad	meaning	Value set by keypad	meaning
0	DISABILITATO	11	SPEED/TORQUE
1	DRIVE ON CW	12	RESET ALARMS
2	DRIVE ON CCW	13	DISABILITA RAMPE
3	EN 1	14	SONDA TERMICA MOTORE (SOLO DIN 1-4)
4	EN 2	15	FREQUENCY INPUT (SOLO DIN 5)
5	CW/CCW	16	START CW
6	SETPOINT UP	17	START CCW
7	SETPOINT DOWN	18	SELECT – 0
8	JOG 1	19	SELECT – 1
9	JOG 2	20	SELECT – 2
10	JOG 3	21	OUT AN SELECTION

I.8 Off_Rif1

Parameter indicating the offset on the analog input 1. Range +20% ÷ -20% of scale end.

I.9 Off_Rif2

Parameter indicating the offset on the analog input 2. Range +20% ÷ -20% of scale end.

O0-O1 D01 / D02

Set Value	Meaning
0	disabled
1	min. speed relay
2	brake
3	speed set reached
4	rotation sense motor
5	alarm
6	thermal warning
7	motor thermal warning
8	drive ok
9*	pre warning motor

* The function "motor pre-warning" thermal pre-alarm permits to distinguish the thermal problems that come from the drive motor, advancing the alarm.

- If intervenes the thermal sensor placed in protection of the motor, the output is suddenly disabled, the alarm is delayed 10 seconds.
- If the drive protects the motor with the intervention of the "electronic thermal" (see R3 parameter "ti max"), the output pre warning is activated in advanced of 5 seconds.

O.4 Off_DAC

Offset adjustment on analog outputs Out1. Resolution ±10 bit.

O.5 KOUT-AN1

Analog output gain calibration.

- **0 = SVC** (Space Vector Control)

SVC combines the IGBT vector driving with the traditional V/Hz control. Considering the voltage applied to a three-phase motor as sinusoidal and not taking the voltage drop due to the stator resistance into account, at normal conditions we have.

O.3 OUT-AN1

Parameters for the analog output programming.

Set value	Meaning
0	Disabled
1	Speed output ±10V
2	Current output ±10V
3	DC_LINK voltage output 10V=1000Vdclink
4	-
5	Proc. PID deviation
6	Proc. PID feedback

7.3.5 PID parameters

To this category belong all current PI, speed PID, auxiliary reference PID and flux PI (group P).

P.0 Kpl

Proportional constant of the current PI control . Range 0 ÷ 3000.

P.1 Kil

Integral constant of the current PI control. Range 0 ÷ 3000.

P.2 Kpw

Proportional constant of the speed PID control. Range 0 ÷ 9999.

P.3 Kiw

Integral constant of the speed PID control . Range 0 ÷ 9999.

P.4 Kdw

Derivative constant of the speed PID control. Range 0 ÷ 9999.

P.5 tdw

Time constant of the PB filter on the speed PID derivative function. Range 0 ms ÷ 30000 ms. If set at "0" , the filter is bypassed.

P.6 Kpflx

Proportional constant of the flux PI control . Acts in flux reduction only and for the FVC control mode. Range 0 ÷ 3000.

P.7 Kiflx

Integral constant of the flux PI control . Active in flux reduction only and for the FVC control mode. Range 0 ÷ 3000.

P.8 K Feedback

Feedback scale in case of processing PMS using. Range: 0.0 to 10.0.

e.g. if at 1, with 2V at the analog input AN2 it is read a feedback level of 10% of the scale end value.

P.9 Gain

Proportional constant used by the processing PID control. Range 0.00 ÷ 100.0.

P.10 TI

Time Constant, in seconds, associated to the integral action of the PID. Range 0.00÷ 1.00 sec. If at 0 it disables the integral action, and its effect increases for small values (0,1 → max effect).

P.11 Td

Time constant in seconds, associated to the PID derivative action. Range 0.00÷ 1.00 sec. If at 0 it disables the derivative action (0,1 → max effect) (1 → min. effect).

P.12 PROC. PID

Abilitation/setting of processing PID; there are 3 selections available and precisely:

0 → PID disabled, the drive operates in the standard way.

1 → positive correction → if the feedback decreases its value, as the setpoint, the output frequency increases. Vice versa a feedback increase will cause a decrease of the output frequency.

2 → Negative correction → if the feedback increases, as the setpoint, the output frequency will increase. Vice versa if the feedback decreases, there will be an other decrease of the output frequency.

P.13 FB. VAL. DISP:

Values from 0,01 to 10.000. Scale factor referred to the keypad display of the feedback signal useful for the conversion of the measure unit displayed with HZ or Rpm and other scales, as meters/minutes etc.

E.g. if placed at 2 and feedback –10%, it will display 20.

7.3.6 Control parameters

This parameters category optimizes the behaviour with the SSP and FUC controls (vectorial control).

DC-LINK Compensation for TVC control.

p.15 KI_cmpV.

Proportional constant of the Dc-link compensator

p.14 KP_cmpV

integral constant of Dc-link compensator

p.17 StarKiq

deflowing torque starting limitation.

p. 16 Iq_break_dwn

Limit of the deflowing torque limitator.

DEBUG

XRAM1 reserved parameter

XRAM2 reserved parameter

P.31 SHIFT reserved parameter

SSP Control

P.18 Kfil_idest

Filter on the flux feedback

P.19 Kfil_iqest

Flux feedback Filter Value

P.20 KLS

Gain of the low speed model

P.21 KHS

Gain of the high speed model in the operation at low speed

P.22 KHH

Gain of the high speed model

P.23.Ky

Curves adapting constant

P.24 Injection

Amplitude of the injection signal for the position recognition. The control modifies the current sinusoid with a “disturb” to recognize the corner position. This disturb if could be heard, if it is possible to decrement it, penalizing the precision of the control. It determines the signal (with medium null heat) on the supplied current, useful for the determination of the rhetoric position at low speed. A calibration very low cause a decrease of the available torque at low revolutions; a calibration too high cause an increase of the noise linked to the injection.

P.25 max_track

Max value of Tracking PI. It determines also the max speed allowed.

P.26 Ld_set

Amplitude of the reference of the motor flux, it is I function of the SSP motor typology.

P.27 Kp_track

Proportional constant of the Tracking PI of the sensorless corner.

P.28 Ki_track

Integral constant pf Tracking PI of sensorless corner.

P.29 Ftw

Parameters that defines the time constant of "low filter placed in the output of the speed information. It has effect in the display of the keypad, in the speed analog output (when programmed) and in the information expressed by the master to the user program.

P.30 Iq_start

Percentage of Iq (torque current) for the motor starting with high load.

P.32 Speed_min

Speed level under there are automatically reduced the constants of the speed PID to obtain a better linearity stability of the revolution.

7.3.7 OPT.CARD Parameters

To this category belong all the parameters proper of the display and communication.

C.0=Protocol	0= Reel W3 1= Modbus RTU
C.1=Baudrate	0= 9600 1= 19200 2= 36400 3= 57600
C.2=Parity	0= none 1= ODD 2= EVEN
C.3=Address	

A.0 Opt Keypad Display

Set value	Control selection
0	CURRENT [A]
1	SPEED [RPM]
2	VOLTAGE [V]
3	TEMPERATURE [°C]
4	PROC. PID feedback

CAN DeviceNet

A.2 MAC ID

A.3 Baudrate 0=125
1=250
2=500

A.4 OutPut inst.

A.5 InPut inst.

Profibus

A.6 Slave Address

A.7 Ident No.

RS485

A.8 Protocol 0= Reel W3
1= ModBus RTU

A.9 Baudrate 0= 9600
1= 19200
2= 38400
3= 57600
4= 76800
5= 115200
6= 230400

A.10 Address

A.11 Parity 0= none
1= ODD
2= EVEN

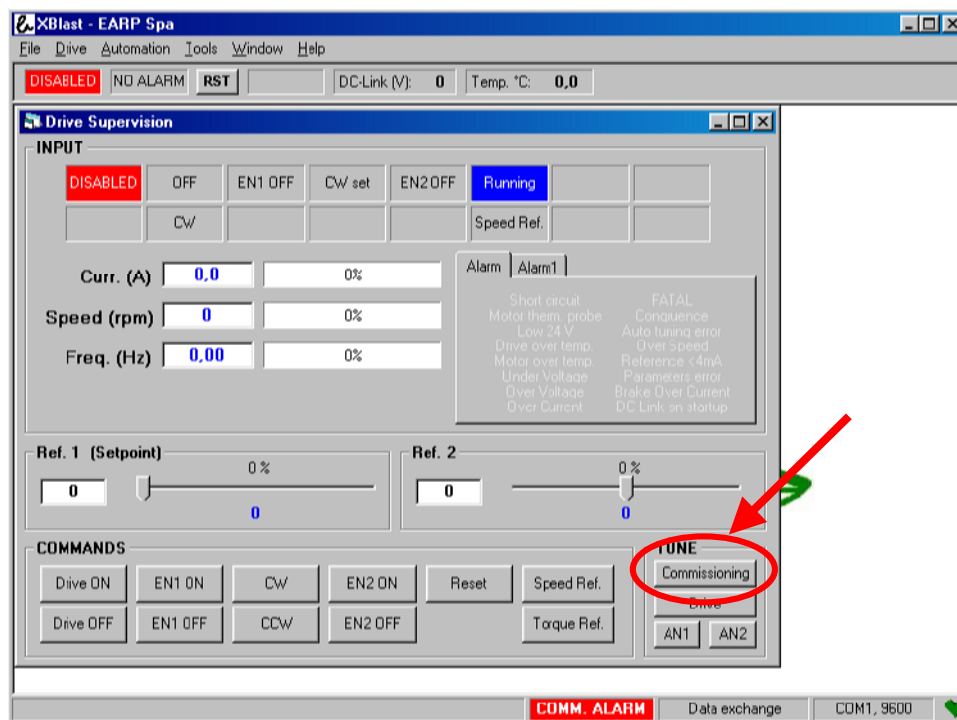
7.4 Commissioning

Blast has been developed to automatically perform the main calibrations of the various controls, to ease and accelerate the starting operations. First of all the process is about the acquisition of the intrinsic motor parameters, the current ring calibration (when implemented).

The starting operations of the auto-calibration process are common to all the variables of the “commissioning” menu and could come from the XBLAST applicative software. According to the requested commissioning, the procedures change.

Commissioning Starting with PC:

- from the supervision menu select “drive supervision”
- push the **commissioning** pad
- select the wanted available function
- push the **start** pad



Picture 1

7.5 Commissioning “Motor Parameter” for AC Motor

7.5.1 Meanings

In: nominal current of the motor

Uln: nominal voltage of the motor (referred to the nominal voltage)

Nn: nominal revolutions of the motor, this is the value obtained reducing to the synchronism speed the nominal flowing of the motor.

Cosfi: cosfi

Rs: phase stator resistance

Lm: magnetization inductance

sLs: leakage inductance

TaurR: rotor time constant

Introduction

The auto-tuning is a function which permits to obtaining automatically the main electrical parameters of the motor.

This is possible in two ways:

1. Off-line Tuning (Drive pad on Xblast):

STARTING FROM THE PLATE DATA OF THE MOTOR (IN, ULN, NN, COSFI) THERE IS THE MATHEMATIC CALCULATION OF THE FOLLOWING ELECTRICAL PARAMETERS: RS, LM, SLS, TAUR.

IT CONCERNS A METHOD WHICH DOES NOT ADMIT THE CURRENT INJECTION IN THE MOTOR AND CAN BE DONE WITH DISABLED DRIVE.

7.5.2 On-Line Tuning (Commissioning pad on Xblast):

Anyway it is necessary to log the plate data of the motor (In, Uln, nN, cosfi), but the calibration admits an current injection in the motor and shaft revolution, till the 80% of the nominal speed.

WARNING!!!

The drive shaft must be free from mechanical constraints. The absence of this advert damages the results and could cause damages to the people or things because of the revolution which is automatically controlled.

7.5.3 “On Line” calibration procedure with SFT

1. Log on the plate data: In, Uln, nN, Cosfi.
2. first of all do the pre-calibration in “**off-line tuning**” pushing the Drive pad on the Xblast interface (mode 1)
3. enable the drive and verify that the idling motor (without load) rotates correctly. If necessary use the speed, optimizing the constants, eventually penalize the performances, till a stable rotation. Disable the drive.
4. **With the free drive shaft**, push the Commissioning pad on Xblast and select the DRIVE ON command. On the interface there is a yellow led to notice that the calibration is in process. It is possible to interrupt the procedure in every moment inviting the DRIVE OFF command. The auto-tuning finishes with the shutting down of the yellow led on Xblast; it is necessary to send the DRIVE OFF command.
5. Enable the drive and verify the rotation stability. If necessary act on the PID constants to optimize the passband of the speed ring.

7.6 Commissioning of the resolver position for sb

7.6.1 Start of the Commissioning with Xblast

- Select the **drive supervision** item
- Push the **tune resolver** pad
- Push the drive on pad after selecting the software enabling (setup variable)

The drive controls the drive of the drive shaft in more different positions, reads the mechanical position of the resolver/phase-motor.

The **OFFSET** is automatically saved in the **Off_res** variable. The variation is anyway directly available, both to do eventual verifications and to **OFFSET** setting already known.

Procedure:

WARNING

- During the commissioning there is a direct current to the motor which will lead it to place in a specific mechanical point, to do then a series of movements it is equal to the current set in the **INOM** variable;
- The resolver timing is to be done with **free shaft**;
- Assure that the set current with the **INOM** parameter does not exceed the plate current of the motor;
- At the end of the calibration, note the eventual changed parameters to the predetermined value.

1. the timing procedure started with the commissioning starting, according to the modes described before.
2. the motor is positioned by the drive in a certain mechanical point with the injection of direct current; it follows a series of spring movements.
3. the control backups automatically the **Poles** and **Off_res** variables; it is possible to control the new value pushing the **Refresh** pad (from the Xblast applicative) or with the access of the variables from the option Keypad.

The intervention of the "AUTO-TUNING ERROR" alarm, during the resolver commissioning is caused by one of the following cases:

- 1- **wrong cyclic sense of the U-V-W exit phases of the drive:** check the right correspondence of the U-V-W phases of the drive with the U-V-W of the motor
- 2- **wrong feedback connection:** check the wiring of the feedback cable
- 3- **"oscillations" of the drive shaft during the resolver timing due to the load presence:** put the motor in free shaft
- 4- **"oscillations" of the drive shaft during the resolver timing due to the current ring instability:** calibrate the current ring
- 5- **Non suitable resolver characteristics:** check the hardware compatibility of the resolver

NOTES

WARNING

- The oscillation of the drive shaft during the automatic timing could compromise the right result.
- The "FEEDBACK" alarm indicates the resolver connection lack, also partial.

7.7 Commissioning current loop 4 pin

The variables involved are K_{pl} and K_{il} , the calibration could be done experimentally or automatically.

7.7.1 Automatic method

Insert in the **RS - SLS** variables the value of the resistance and stator inductance taken from the data-sheet of the motor in use.

Start the "**Drive Supervision**" function from the programming applicative.

Push the "**Drive**" pad from the "**Tune**" menu

Verify the value, checking the variables K_{PI} and K_{II} after pressed the "**Refresh**" pad.

7.7.2 Experimental method

1. Reset the speed ramps.
2. Block mechanically the motion of the drive shaft.



*The drive, once enabled, will supply the maximum current set on the **Imax** variable with maximum torque. Assure the enabling of the system can not damage to the mechanics, especially if there are parking brakes.*

Take the appropriate precautions.

3. Do several time the running (with reset speed ramps) looking at the current signal with the tools "**SCOPE**" of the Xblast applicative.
*The monitored signal has to be a step without overshoot. At the presence of overshoot or, with too slow answers, modify the **Kpl** variables and **Kpl**.*
4. Leave out the forcings already done.

7.8 Control calibrations

Below there are some notes for the optimization of the dynamic characteristics in the various available controls.

7.8.1 Parameters description

Motor Parameters (SVC; FVC; SFT controls)

- R_s : **phase resistance** [Ω]
- sL_s : **leakage inductance** [mH]
- τ_R : **rotor time constant** [mS]
- L_m : **magnetization inductance** [mH]

These parameters could be calculated automatically by the plate data of the motor to have a starting point useful to optimize the control as already described in the "Commissioning Motor Parameter" paragraph. It is necessary to insert correctly U_{ln} , F_{ln} , poles, $\cos\phi$, N_{nom} and push the "drive" pad on Xblast. It concerns an Off-line mathematic calibration to be done exclusively with disabled drive; it does not include the shaft revolution and so it can be also with blocked/constrained shaft.

To obtain higher control performances it can be necessary to manually modify the values.

7.8.2 Modulator (SVC; FVC; SFT; SB controls)

FPWM: modulation frequency [kHz]

It is possible to choose the modulation frequency between the following: 2kHz, 3kHz, 4kHz, 8kHz, 12kHz. Notice that at the frequency increasing, the thermal dispersions of the IGBT module increase (because of the greatest number of commutations). For modulation frequencies of 8kHz and 12 kHz, the suppliable current from the module is decreased, as shown in the Blast manual chart.

Nevertheless consider that a modulation frequency of at least 4KHz is indispensable for the control of a motor with thrust outflow ($\geq \frac{1}{2}$) or with high frequency (> 80 Hz)

Current regulator (SVC; FVC; SFT; SB controls)

Kpl: proportional part of the current regulator

Kil: integral part of the current regulator

Speed regulator (FVC; SFT; SB; SSP controls)

Kpw: proportional part of the speed regulator

Kiw: integral part of the speed regulator

Kdw: derived part of the speed regulator

Taud: time constant of the derived action

Flux regulator (FVC; SFT; SSP controls)

Kpflux: proportional part of the flux regulator

Kiflux: integral part of the flux regulator

DC-Link Compensation (FVC control):

KpVCmp: proportional part of the DC-Link compensation

KiVCmp: integral part of the DC-Link compensation

This regulator reduces the magnetization flux maintaining the counter-electric-motor power (f_{cem} / b_{emf}) in the limit allowed by the dc-link voltage. In this way, even if the DC-link voltage decreases, the effect of voltage saturation will be limited.

Suggested values: $KpV_{cmp}=100$ $KiV_{cmp}=5$.

Example:

$V_{nom} = 400V_{rms}$

Available line voltage = 380V

The regulator permits to maintain the sinusoidal current even if the voltage requested passes the maximum available one.

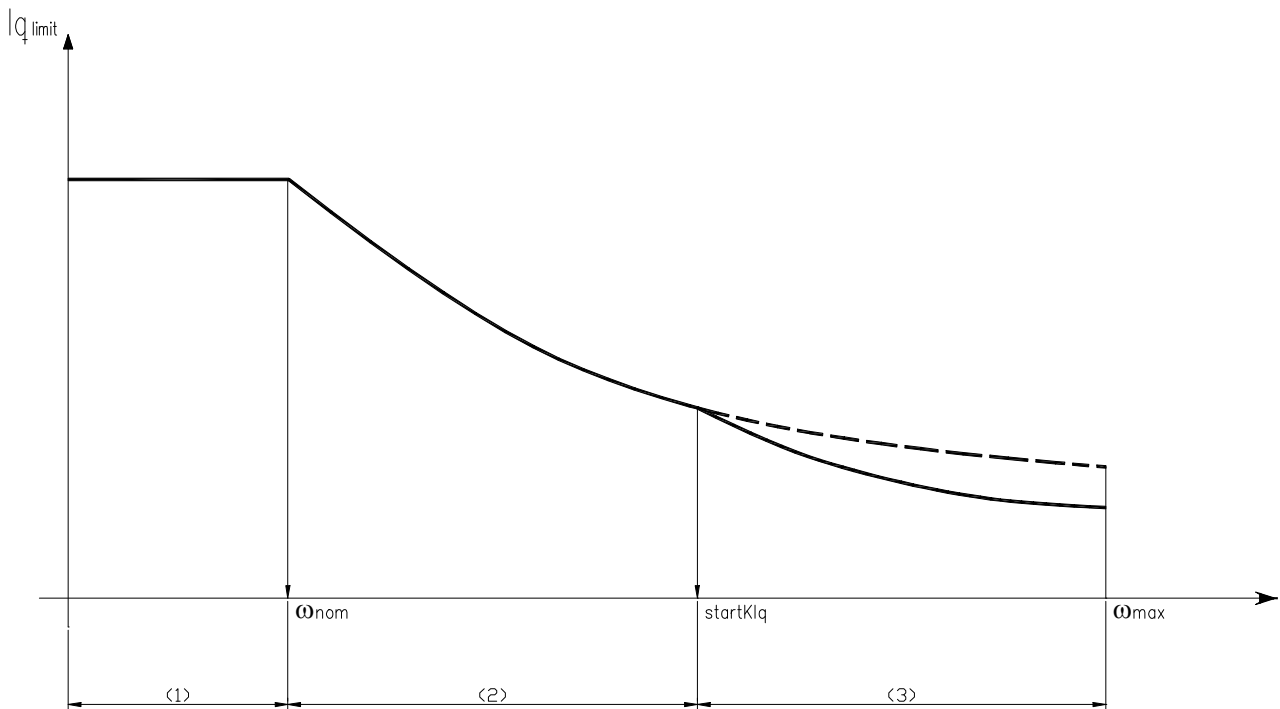
NOTE

The sil Dc link compensators ($KpVCmp$ e $KiVCmp$) are developed at Earp.

Torque limitation (FVC control)

IqBreakdwn [10-100%]

StartKIq [rpm] ($1,5 N_{nom} - N_{max}$)



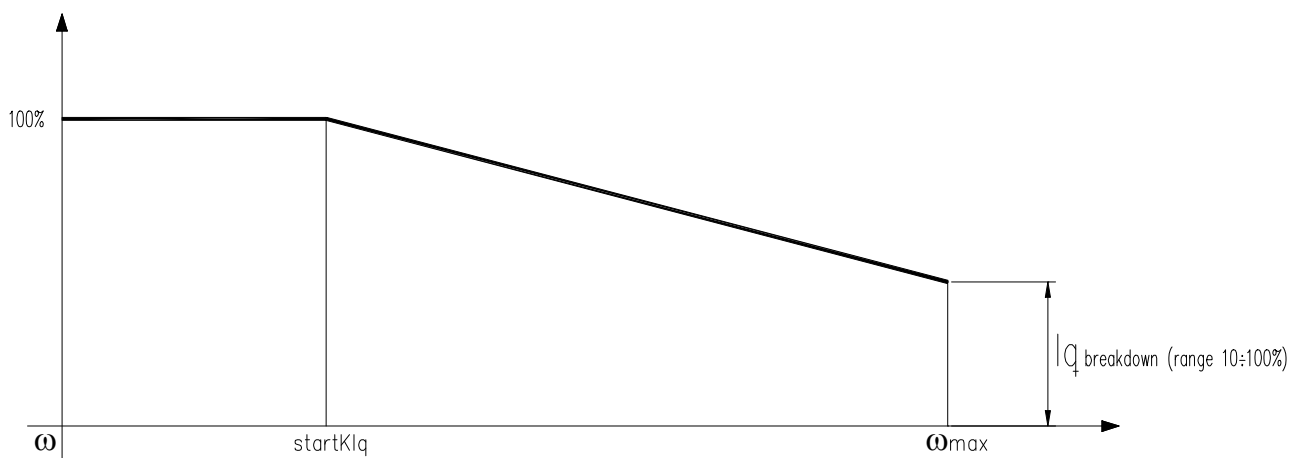
Picture 2

These two last parameters permit the limitation of the I_q current (responsible of the torque generation) to avoid to pass the breakdown threshold.

Such threshold, depends on the motor typology and shows the maximum suppliable torque limit.

THE LQ LIMIT FOLLOWS THE PROCEDURE SHOWN IN PICTURE 2 BUT, STARTING FROM THE SET SPEED $startKlq$, THERE IS AN ULTERIOR REDUCTION OF THE COURSE SHOWN IN PICTURE 3, TO IMPLY LQ BREAKDOWN IN A MAX.

It is recommended to set the $I_qBreakdown=100\%$ parameter in the way to disable the compensation, using it only in case of necessity.



Picture 3

7.8.3 Speed loop calibration

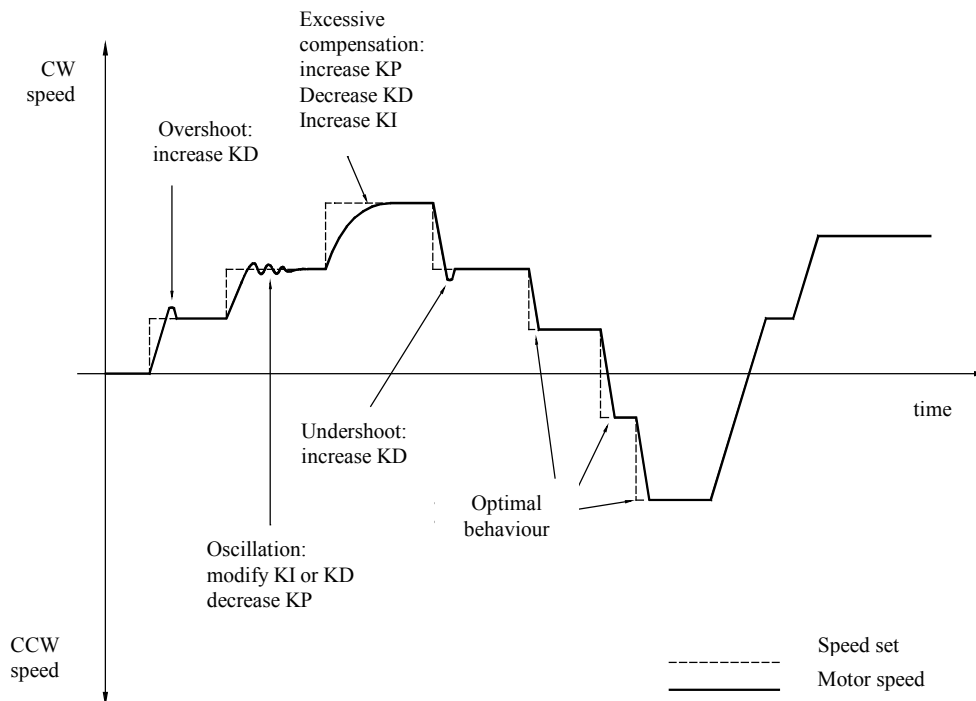


The motor will begin to rotate; if the converter does not control the revolutions, invert:

- Set the first gear with the «IMAX» parameter equal to 1/2 of the nominal current of the motor, to limit the suppliable torque; verify the general behaviour (drive and mechanics) and set again the proper value;
- The speed loop calibration is to be performed after the current loop calibration, as described in the “Commissioning Current Loop Gain” paragraph.

1. Monitor the motor speed signal with the tools “SCOPE” of the application.
2. Do several speed steps with progressive amplitude
3. Optimize the dynamic behaviour managing the variables **Kpw - Kiw - Kdw - Tdw** with the consequent progression:
 - Increase the “K Dw” variable to cancel the eventual speed overshoot
 - Increase the “T Dw” if the KD increment has introduced instability to the constant speed regime
 - Increase the “KP” variables and/or “KI” to increase the dynamic performances.
 - Decrease the “KP” variables and/or “KI” to obtain the stabilizing effect

The graphic below evidences the action to be chosen depending on the dynamic behaviour, to obtain a correct speed behaviour:



Picture 4

Set again the acceleration ramps to the wanted value and verify the behaviour in all the speed field.

Repeat the tests with the maximum load and the current breaks of acceleration.

8. SERIAL INTERFACE

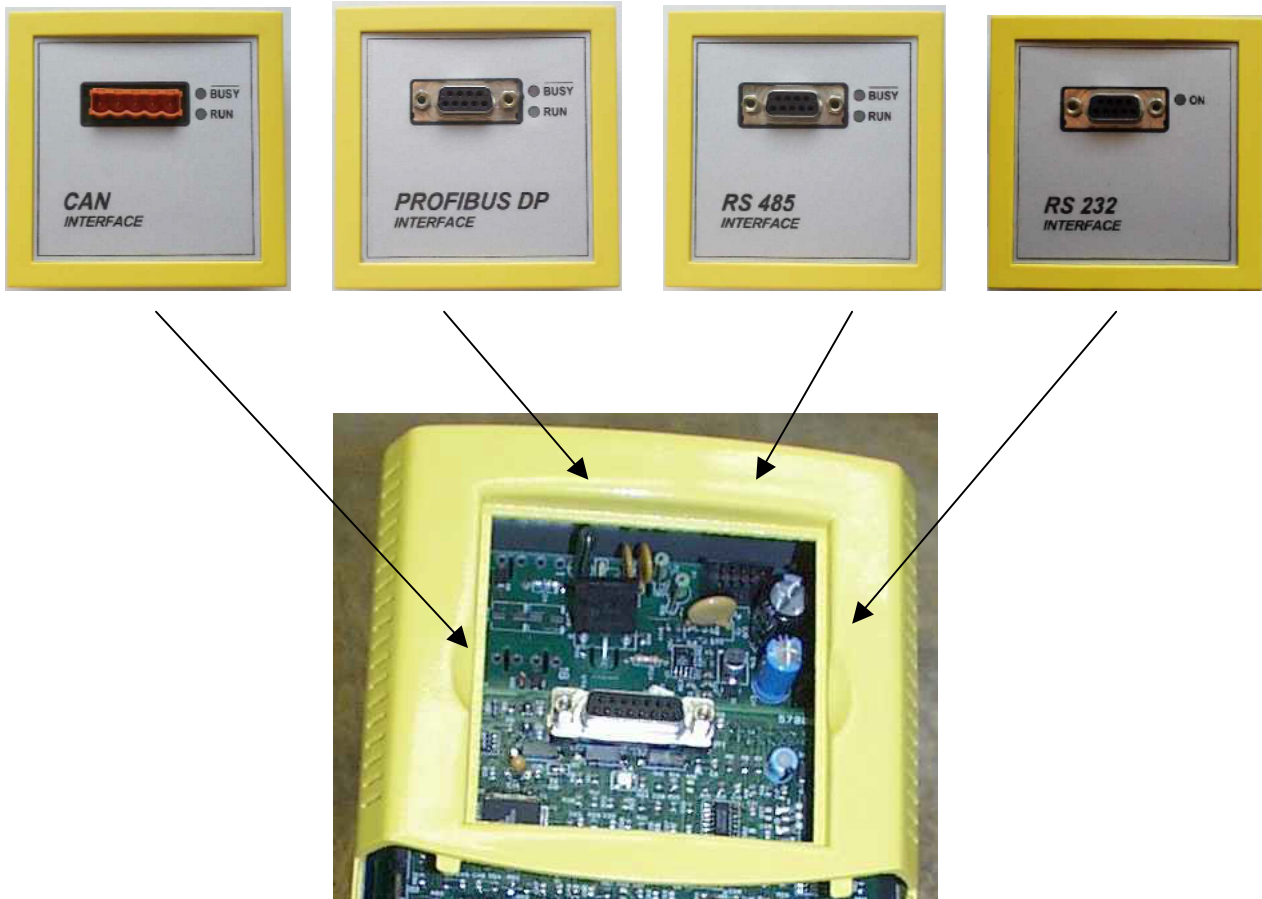
8.1 Introduction

The serial interface connects BLAST to an external device to control and monitor the system .

BLAST has as standard a DeviceNet interface on user terminal board (not optocoupled, 500kB).

Further options for net communication:

- PROFIBUS DP,
- RS485,
- CANBUS with DeviceNet protocol (optocoupled)
- RS232



Interface RS232 is very useful for the drive handling with PC and software XBLAST, as well as to download the firmware for a personalization of the product. The available firmware are supplied in the CD attached with the product.

8.2 Serial Interface CAN With DeviceNet Protocol

With the XBLAST software it is possible:

- Enter in all the BLAST parameters. The parameters have been divided in groups according to their characteristics.
- Display of all the working parameters: current, speed, alarms, DC-link voltage, IGBT temperature.
- Alarms reset

The alarm reset is possible only if the drive has been disabled.

- Storage in the PC the parameters and double them into another BLAST
- “Oscilloscope” function” to display up to 8 selectable traces among the following positioners working parameters:
 1. motor speed
 2. absorbed current by the motor
 3. real position
 4. position set-point
 5. linear speed
 6. DC-LINK voltage
 7. ...

→ For further information about the XBLAST software, refer to chapter n. 6.

9. SOFTWARE update WITH RS232

9.1 Firmware programming in short

Operations to carry out in order to download the software update:

1. Disable the drive .
2. Enter variable **“Select”** through program **“XBlast”** inside parameter group **“DRIVE”** and set 1.
The set value is automatically zeroed by the positioning function.
If that does not happen, the drive is not disabled yet.
3. Close **“XBlast”** and execute **“HyperTerminal”**.
4. Switch BLAST off and then on again.
5. On the HyperTerminal the message sent by the positioner will appear

**“(c) EARP SpA - S-Record loader Version 1.1
Waiting for data in 30s....”**

6. Select **“Send text file”** under menu **“Transfer”** , then enter updating FILE **“.S”** (anyway within 30 sec.)
7. Wait for transfer end and close **“HyperTerminal”**.
8. After transfer ends the new program is carried out automatically.
9. The wait time-out for the new update sending is 30 seconds.
After this time the program already stored is executed.
In this case the cycle has to be repeated starting from point 2.

Instructions for a detailed programming are available in the cd attached with the product.

9.1.1 Available modes

The DRIVE BLAST grows configured as inverter for asynchronous motors, but it can be configured with the following software:

FVC
SVC
SB
SFT
BR POSITIONER
SSP
SSP POSITIONER

For further reviews, it is recommendable to look at the firmware books, supplied in the CD attached with the product.

10 ALARMS

10.1 Foreword

In case of one or more alarms occurring, the system stores and signals them with “E”.
The letter means alarm followed by the alarm code.

The alarms are stored in a alarm memory in chronological order (up to 10 alarms). Several alarms occurred at the same time are stored in an order which depends on the priority assigned to each of them.

10.1.1 Alarm Display

The alarms are automatically displayed on the keypad.
The alarm is displayed in short form with a 2 letter code and “E”

- **ENTER:** alarms
- Key **DOWN / STOP** pressed for 3 sec. makes a **RESET** of all the alarms

The alarm reset is carried when the drive is disabled only.
Furthermore the last 10 alarms are stored in “ALARM MEMORY”

ALARM CODES CHART 10.1.1.1

Alarm Code	Alarm DISPLAYED ON PC	DescriPTION
E.cc	Short circuit	Short Circuit
E.1t	Thermal alarm	I ² t
E.24	Low 24 Volt	Electronic supply low: drive reset
E.ot	Power thermal alarm	Drive Overtemperature
E.th	Motor thermal probe	Drive Thermal probe
E.Uu	Min. Voltage	DC-Link low voltage
E.o.u	Max. Voltage	Max voltage limit exceeded (=800V)
E.oc	Over Current	If measured current > I _{max}
E.co	Congruence	Incongruence between real speed and commanded speed. The positioning automatic setting must be carried out again.
E.tU	Auto Tuning Error	Alarm during the resolver tuning
E.oS	Over speed	Over-speed (passing of the maximum programmed speed)

E.SEt	Param Config	Wrong parameters.
E.br	Brake Overcurrent	Brake Overcurrent Default: 160ms/10s

E.AS	Irreversible alarm	HW problems: - PLL x TAL not hooked - FAULT active during startup
E.rF	Reference 4-20mA	Ref. ≤ 3mA
E.dC	Not pre-charged DC LINK	Capacitor charging failed
E.r	Detached resolver	Error in the resolver connection in SB mode

E.nF	Missed phase	Missing of one of the three supplying phases (only for size > 22kW)
E.Sc	SSP configuration	Missing of the motor chart for SSP control
E.SS	Wrong SSP chart	Motor chart for SSP control, incongruent if compared to the BLAST size in use.

10.1.2 Alarm Memory Display

To enter the alarm memory press keys **DOWN / STOP** and **ENTER** together

The last 10 occurred events can be displayed .

Alarm number “**from 0 to 9**” is shown on the display's left side.

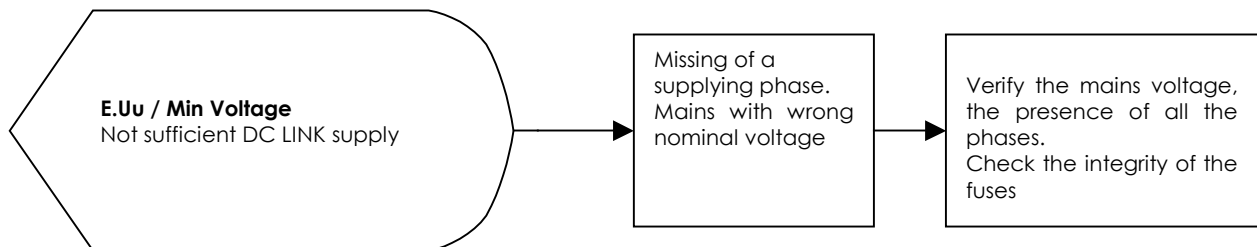
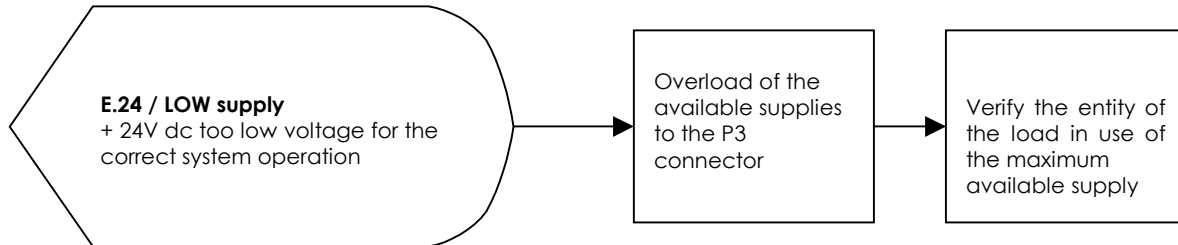
0=latest alarm , 9= oldest alarm, followed by the alarm code (see code chart).

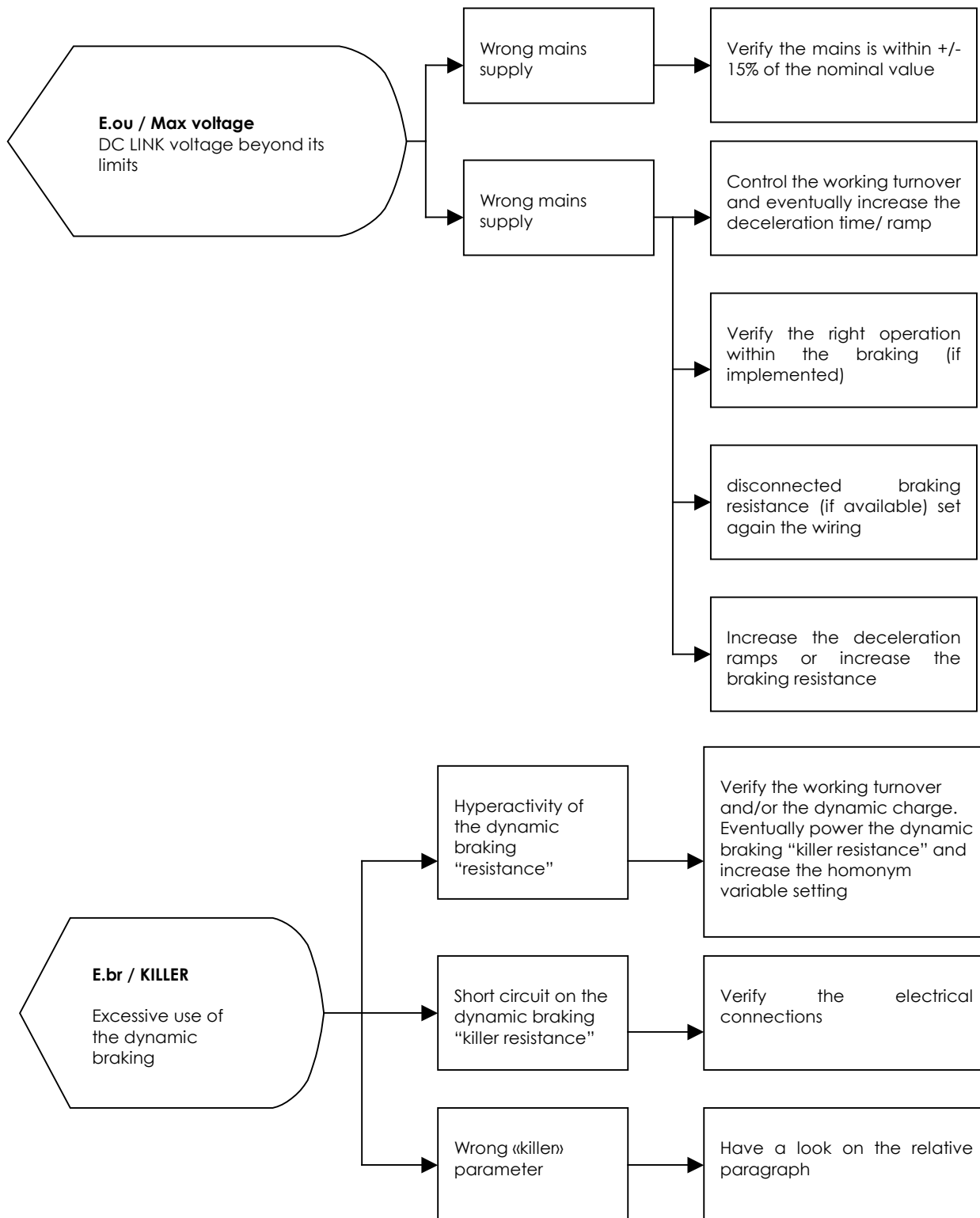
- **UP / START** displays the next less new alarm .
- Key **DOWN / STOP** display the following oldest alarm
- Key **FUNC / SPEED** goes back to the main page (ESCAPE).

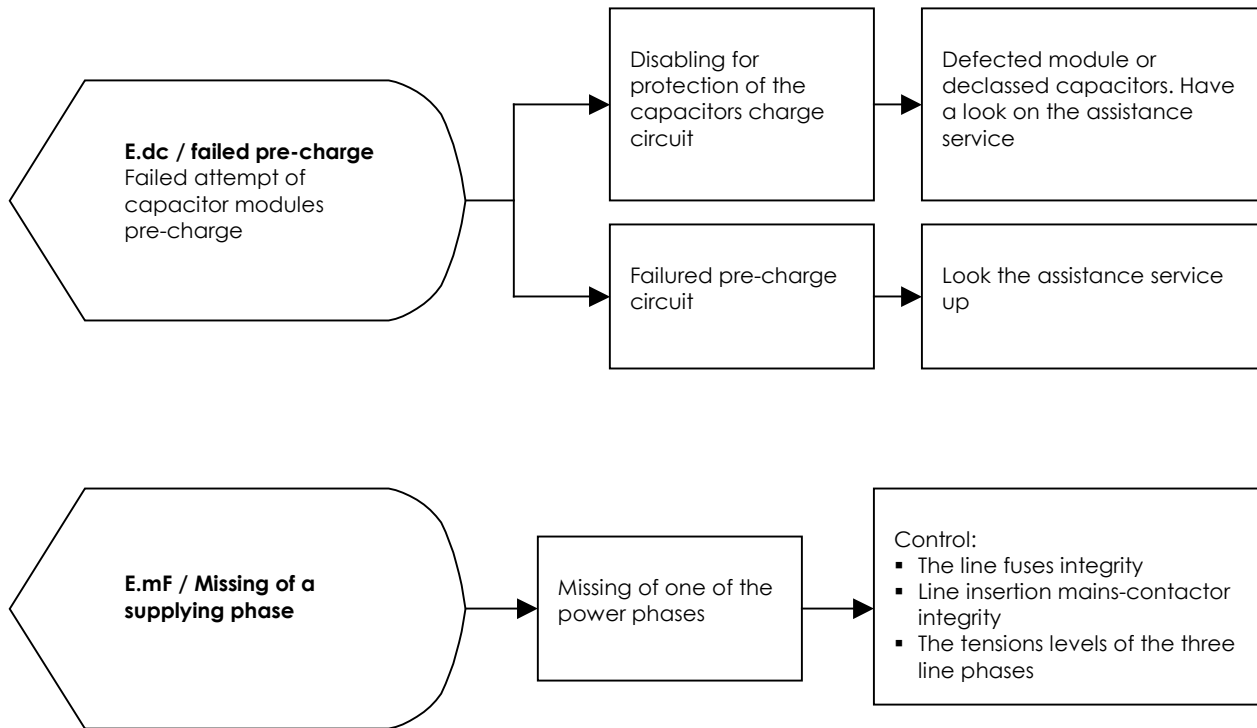
Alarm memory chart 5.2.5-1

ALARM NUMBER	ALARM CODE
0.	Latest (most recent) alarm .
(1...8).	Intermediate alarms .
9.	Oldest alarm .

10.2 Error description/ Removing causes







11. BRAKE UNIT

11.1 Foreword

The drives up to 22kW are provided with a brake unit, which is needed when the required brake torque is about 20%> than the motor's nominal torque related to the drive; brake torque values >150% are not allowed (class 2).

The drive is delivered with built-in brake resistor up to 11kW, with brake unit up to 22kW (optional ext. resistor); from 30kW upwards the brake unit is an ext.option.

It is possible to ask for a special configuration in the code from the letter F adding, because of this, for the user there is the possibility to connect an external braking resistance also for the size up to 11kW.

E.g. :

- **BLAST E 0022 BAH** standard method which has the resistance inside the DRIVE
- **BLAST E 0022 BAHF** special method which has the exit (B1 and B2) for the connection with an external resistance

Chart 11.1.1 - Max. currents for modules with external braking Resistance.

PRODUCT	I MAX BRAKE
BLAST E 0007 BAH	10 A
BLAST E 0011 BAH	10 A
BLAST E 0015 BAH	10 A
BLAST E 0022 BAH	10 A
BLAST E 0037 BAH	10 A
BLAST E 0055 BAH	10 A
BLAST E 0075 BBH	17A
BLAST E 0110 BBH	25A

11.2 Installation

The external brake resistors must be installed in a position not damaging the drive .

Under normal conditions, the resistor duty cycle does not exceed 20%, and their power is chosen according to this data. They must therefore be protected by an adequate thermal relay, whom intervention must open the supplying line of the inverter and not the resistance supply.

CAUTION!



EACH RESISTOR NEEDS ADEQUATE THERMAL RELAY PROTECTION
OPENING THE MAINS CONTACTOR IN CASE OF INTERVENTION.

11.3 Resistor Choice

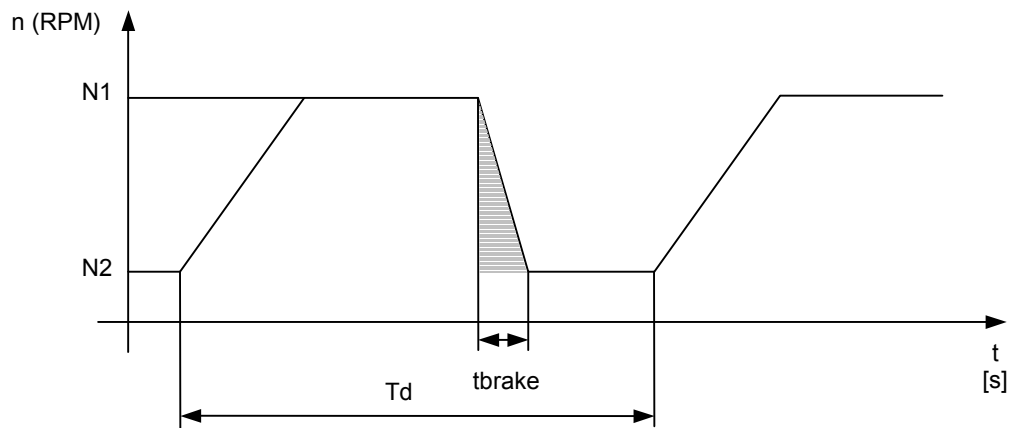
When the speed (frequency) of an asynchronous motor decreases very quickly, the motor itself acts as asynchronous generator and recovers energy to the drive.

Part of that energy is dissipated as losses, (10-20% of the motor's nominal power) ,while the rest is charged on the capacitor of the intermediate circuit with consequent voltage increase at its ends.

To avoid the voltage on the capacitor to reach too high levels, the dynamic brake unit is used.

An electronic circuit detects the voltage on the capacitor; when the voltage exceeds a certain value, a command is given to a transistor activating the brake resistor in parallel to the capacitor .

The resistor value and its power are basing on the drive type, the inertia of the moving masses, the resistor torque and deceleration time.



Symbols used for the formulas:

M	= brake torque to take the motor speed from N1 to N2 within time tb.	[Nm]
J	= total inertia to the motor axis .	[Kgm ²]
M	= resistor torque to the motor axis	[Nm]
P	= average resistor power .	[W]
W	= brake energy .	[J]
R	= brake resistor	

$$MN = \text{nominal motor torque in Nm} = \frac{60 \cdot P}{2\pi \cdot N}$$

n = nominal motor speed in RPM.

P = nominal power in W.

$$M = \frac{2\pi \cdot J \cdot (N1 - N2)}{60 \cdot t_{brake}} - M \quad [\text{Nm}]$$

$$R = \frac{V^2}{0.10472 \cdot M \cdot N1} \cdot \frac{1}{1.2} \quad [\Omega]$$

$$W = \frac{0.10472 \cdot (M - 0.2 \cdot MN) \cdot (N1 - N2)}{2} \cdot t_{brake} \quad [\text{J}]$$

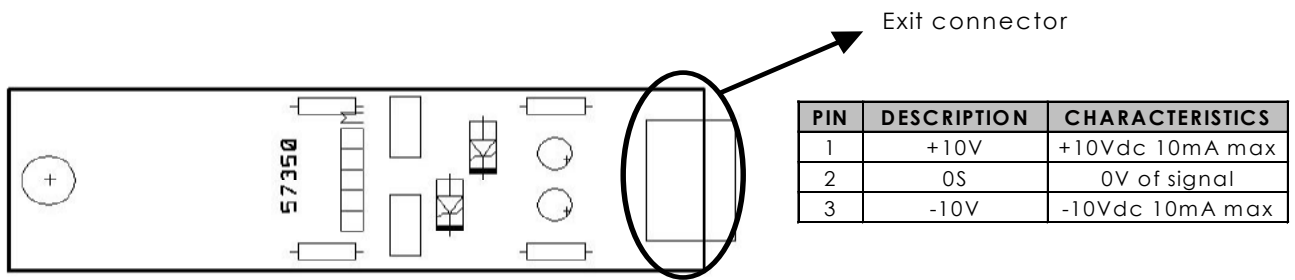
$$P = \frac{W}{Td} \quad [\text{W}]$$

Data needed by the resistor manufacturer

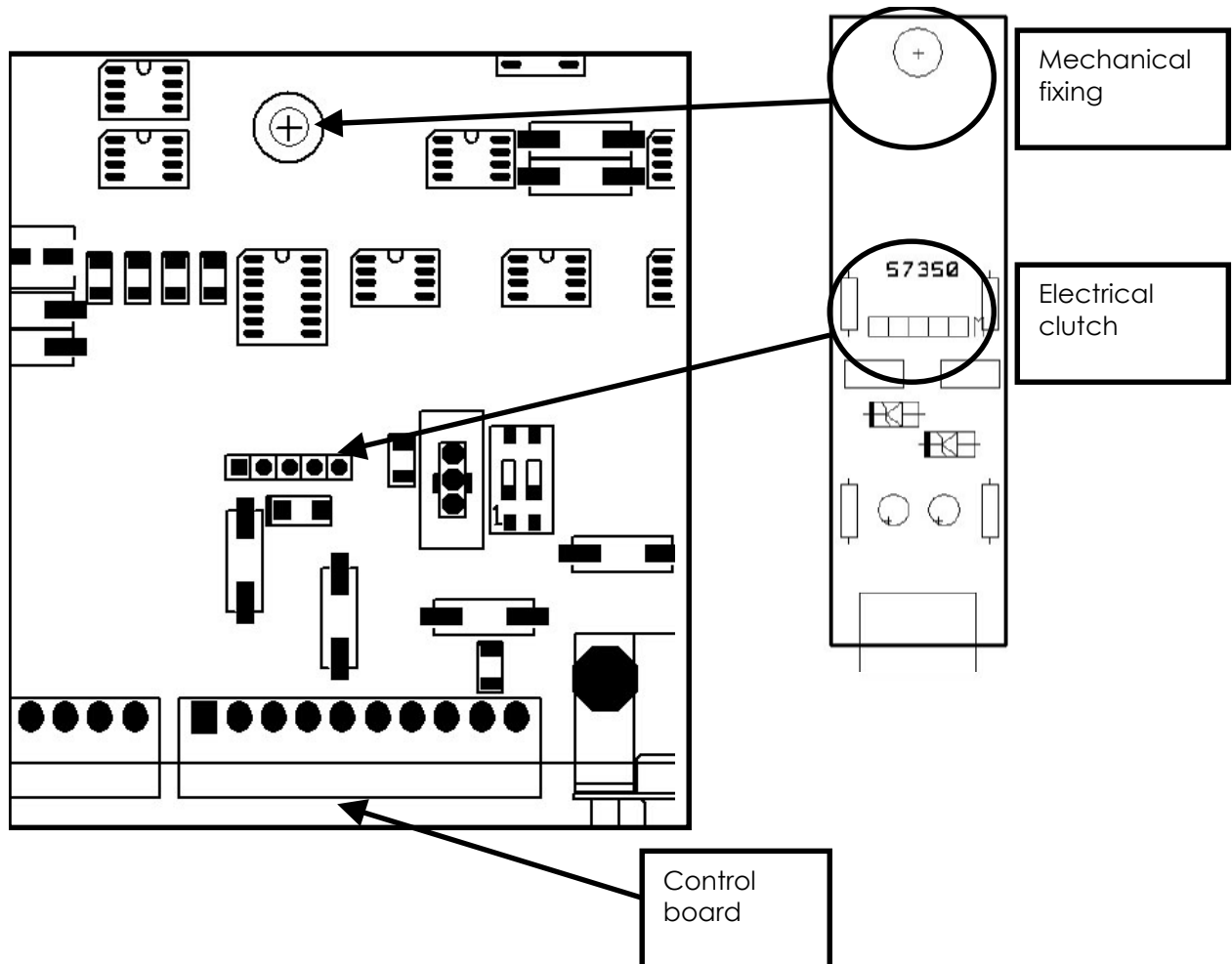
- ohm value (Ω) chosen according to the max. current allowed by the drive
- brake energy (J)
- duty cycle.

11.4 Opt +/-10 v board

A simple adding file supplies the dual supply +/-10Vdc useful for the supply of the external circuits, for example: potentiometers or transducers, where it is required the possibility to control Blast_e with an analogical way.

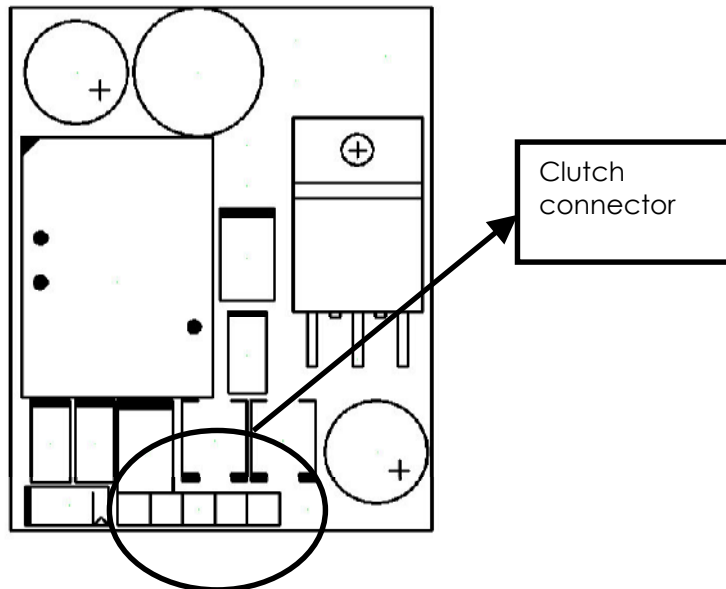


The chart is not supplied with the product and it allows the direct clutch on the control board 57003. Thanks to the 5 poles streep connector the mechanical fixing is assure by an insulator support.

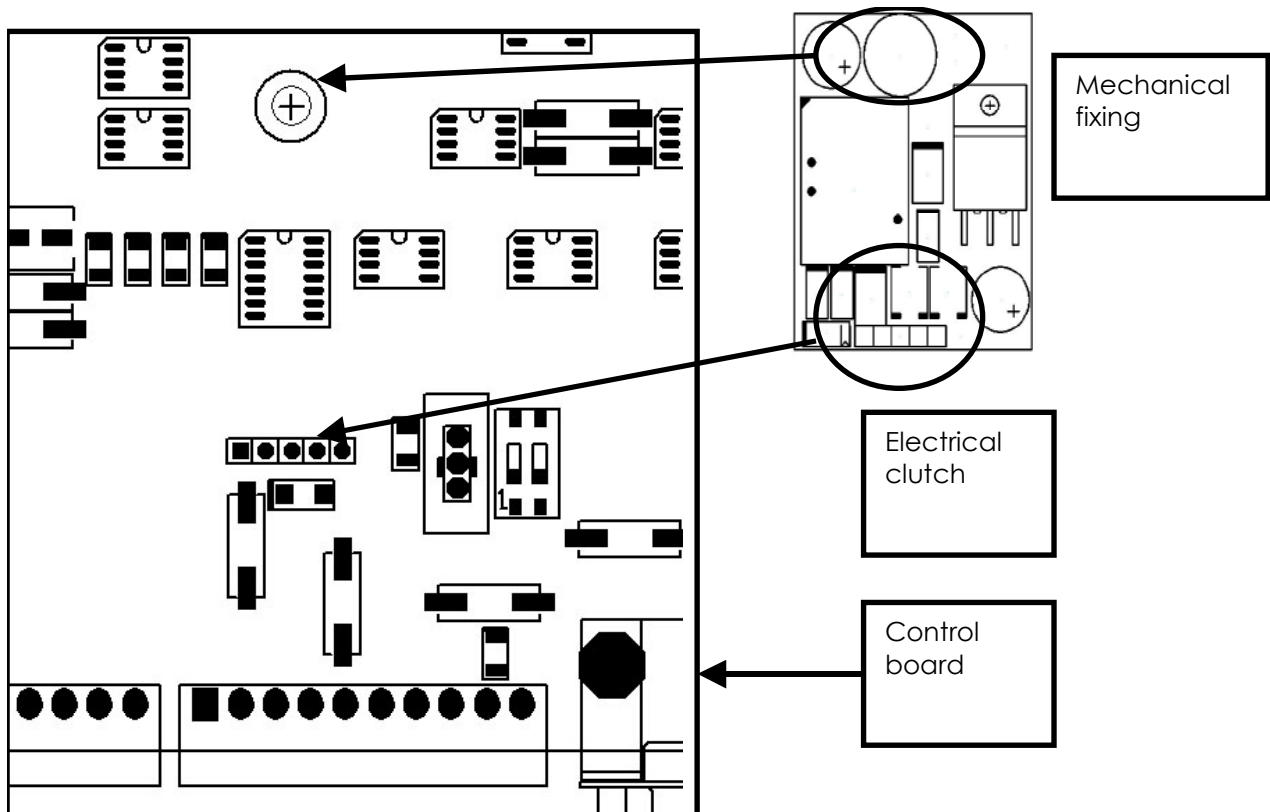


11.5 OPT BACK_UP board

An adding board produces the back-up supplies for all the internal circuits, starting from 24V to supply on the mother terminal board 57003.



The board is supplied separately from the product and allows the direct clutch on the control board 57003. Thanks to a 5 poles streep connector the mechanical fixing is assured by an insulator support.



12 MAINTENANCE & CHECKS

12.1 Introduction

The drive can be inspected by trained personnel only. The access to internal parts may cause damage to the electronic components (IGBT, CMOS, ...) and afterwards wiring mistakes during reconnection. No claim can be laid on EARP for failures or accidents in case this warning is not observed.

12.2 Ordinary maintenance

Blast needs a programmed maintenance for the fans and capacitors only. It is enough to grant a clean and without dust environment, especially if conductive.

The **maintenance period** is in accordance with the environment quality where the drive operate, especially for the ventilation. Because of the ageing of the mechanical and electronic components it is recommended to substitute:

- **The boards capacitors inside the system: every 5 years (after the eventual inspection)**
- **The fuses: after 10 years.**

13 NOTES

13.1 Selection

- The drive size has to be chosen according to the current (and not power). The drive's output current must be $\leq 10\%$ than the nominal current of the controlled motor.
- When one single drive supplies more motors in parallel it is necessary to choose a drive having output current (I_N) 10% higher than the 4% of the sum of the current of all motors. A single thermal motor protection has to be planned. The built-in protection is not significant.
- The selection of a vector control mode (FVC, SFT, SSP and SB) excludes the possibility of controlling motors in parallel with one inverter.
- If just one inverter controls motors in parallel for a system needing to switch on /off the single motors during operating. A drive has to be chosen having max. current (1,1 I_N for cl. 1 and 1,5 I_N for cl. 2) higher than the sum of the nominal currents of the switched motors and the start currents of the motors to be switched during operating. A decoupling reactor is needed between drive and motor.
- **N.B.** The electromechanical coupling/ decoupling of the motors is allowed when the motor current is $\leq 10\%$ of the drive's nominal current.
- The starting torque and acceleration of a motor controlled by inverter is limited by the drive's maximum current; as regards the direct start from the mains, the performances are limited. In case a high starting torque is needed, a bigger drive size should be chosen.
- The drive's nominal current does not change with the operating quadrants. The brake switch needed in case the braking energy is dissipated, is dimensioned for duty factor 20%.

13.2 Connections

- The drive may be damaged if:
 - the supply voltage is applied to the output terminals
 - the RF filter is connected between drive and motor
 - capacitors are connected on the drive output
 - Frequent switch handling on the drive input reduce the lifetime of the filter capacitors and can cause the burning of the pre-charge resistor with heavy damages to the drive.
 - In case a contactor is needed on the drive output, this should be done with disabled drive. Provide an auxiliary contact NA on the contactor to disable the drive with at least 500 m/s anticipation.
 - If the drive trips due to a protection or in case of mains failure, the motor is left by the drive and stops per inertia. In case this is not supposed to happen or should be dangerous for any reason, a mechanical brake has to be added.
 - If the drive supplied by a generator, the harmonic distortion generated by the drive has to be checked with the manufacturer regarding the acceptability.

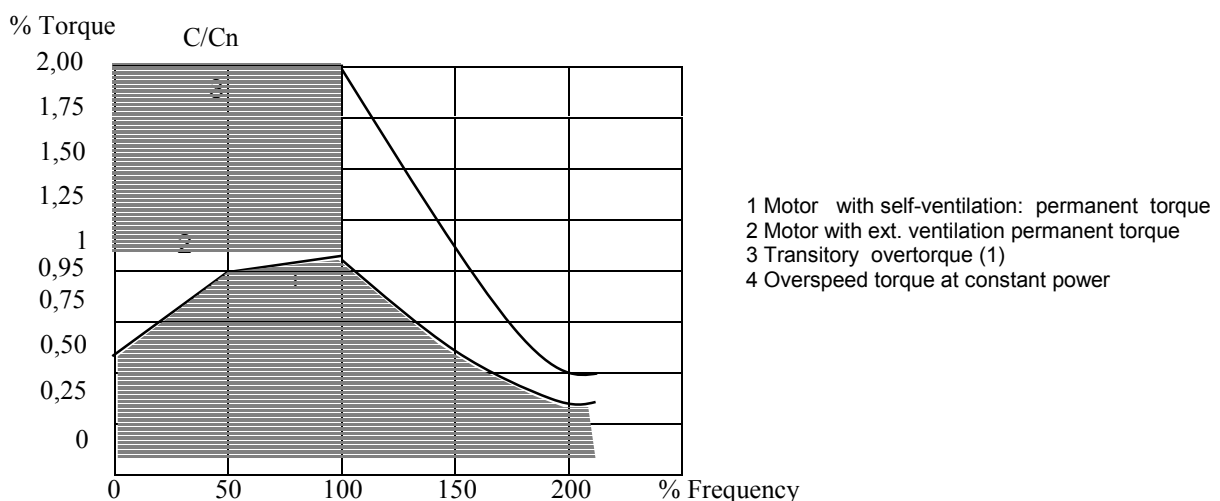
13.3 Calibration

- The drive output delivers max. frequency 1000Hz, which means possible dangers at high speed. Select the max. speed compatible with the application and the machine; choose a modulation frequency that guarantees an adequate current resolution. An adequate min. FPWM has obviously to be selected.
- Acceleration/deceleration time depends on the torque delivered by the drive system (motor+ inverter) related to the load torque and the system inertia. A too short time (especially for the SVC mode) can cause the intervention of the max voltage and / or max. current protection.: the automatically adjusting acceleration/deceleration function increases the time in order to avoid the protections.

13.4 Motors

- APPLICATION WITH STANDARD OR ALREADY EXISTING MOTORS. The continuous torque delivered by the motor, due to the reduced ventilation (fan on motor shaft) decreases according to the typical law. The motor performances have to be previously checked with the manufacturer.

Typical curves

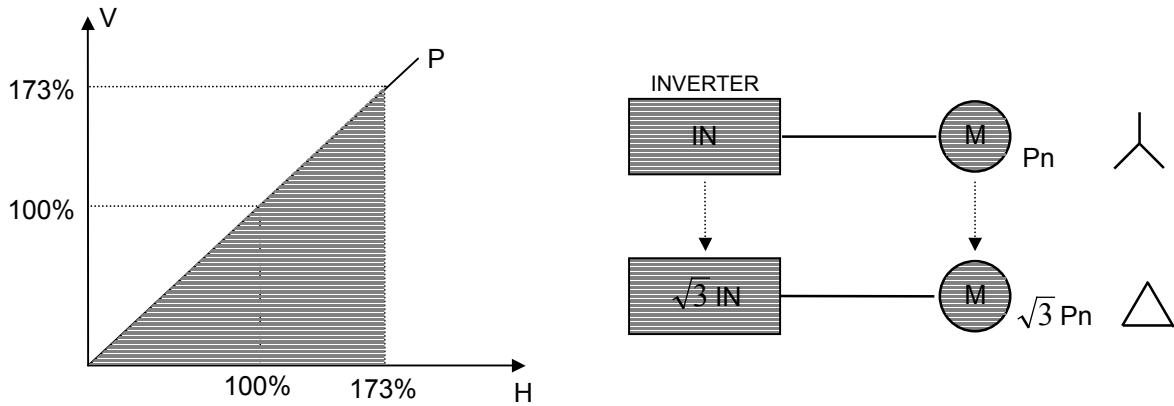


(1) Overtorque limited at 1.1 Cn applied at variable.

N.B. Exceeding the motor's nominal speed must always be allowed by the manufacturer due to the necessary checks from a mechanical point of view (bearings , balancing, etc.)

- APPLICATIONS exceeding F nom. The manufacturer must be contacted.
 - There may be vibration problems: unbalance of the rotor, load vibrations;
 - the motor noise may increase (fan fitted on the axis).
- NOISE. The motor noise increases compared to the operating through mains supply. The noise is reduced and neutralized by using 'output reactors, sinusoidal filters or by activating random modulation frequency.
- USE OF A MOTOR WITH Δ CONNECTION CONSTANT TORQUE UP TO 87/104Hz
A 400V-50Hz motor with Δ connection can be used at constant torque up to 173% Vnom;

if λ connected: in this case the initial motor and related drive power are multiplied by $\sqrt{3}$ (N.B. the drive size must be adequate and check with the manufacturer of the motor that the mechanical parts support the high speed).



13.4.1 Applications with Special Motors

- **MOTOR WITH BRAKE.** The brake needs separate supply. The brake supply must be derived above the drive. When the brake is inserted the drive must be disabled.
- **MOTORS WITH CONICAL ROTOR.** * The brake is controlled by the motor's magnetic field; the boost has to be set adequately and in some cases a bigger drive size will be necessary.
- **MOTORS WITH DOUBLE WINDING** The drive's output current must be higher than the nominal current of each winding. The winding commutation has to be carried out with stopped motor and drive disabled for at least 500 msec.
- **CLASSIFIED MOTORS.** The drive cannot be assembled where there is explosion or fire risk, since is not explosion proof. The motor must be certified together with the feeding drive.
- **GEARED MOTORS.** the lubrication method and rotation limits vary according to the manufacturer; in case of oil lubrication, continuous operations at low speed may cause overheating due to lacking lubrication. Speed values corresponding to frequency values higher than the nominal one must be checked with the constructor.
- **SYNCHRONOUS MOTORS.** * An output reactance on the drive output is recommended, as such motors have a low inductivity. The slip compensation must be disabled.
- **MOTORS FOR UNDERWATER PUMPS.** The nominal current of such motors is higher than the standard one, so an adequate drive size is necessary.
- **SINGLE-PHASE MOTORS.** They cannot be supplied by inverter.

* **NOT:** do not use VFC and SFT