TDE MACNO
s.p.a. tecnologie digitali elettroniche

User Manual

DSA SERIES

0,25 – 1,1 kW

Inverter general purpose

Information in this manual is subject to change without notice, and is not therefore binding on TDE MACNO SPA in any way.

Read the safety precautions section before installing, connecting up, starting up or setting up the drive.

Keep this manual in a safe place where it is readily available to all technical personnel throughout the drive's working life.

TDE MACNO SPA declines all responsibility for any errors that may occur in this manual and for any damage that

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CODE **INVERTER**

5	**Level**	
D S	**Product**	
A	**Series**	
F	**SW Typology**	**F**= V/f
	Size (power)	**002**= 0,25 kW **004**= 0,37 kW **005**= 0,55 kW **008**= 0,75 kW **0V8**= 0,55 kW fan **011**= 1,1 kW
	Overload	
2 M	**Supply**	**2M**= 220V
0	**Brake**	**0**= no
1	**Filter**	**1**= yes
0	**Fieldbus**	**0**= no
	I/O board and keypad	**A**= RS485 optoisolated **B**= RS485 optoterminated **0**= NO RS485 **C**= I/O start/stop
0	**Customization**	**0**= no
0	**Variant**	**0**= no
V	**Sent**	

Example

5	D	S	A	H	0	0	8	B	2	M	0	1	0	A	0	0	V

Inverter at level 5, DSA series, V/f typology, nominal power 0.75 kW, 220V main supply, whitout brake, with filter, whitout profibus, RS485 optoisolated, without specific customization, no variant, sent.

Sommary

Key to Warning Symbols

This symbol identifies procedures or operating conditions that may lead to injury or even death if the specified precautions are not followed.

This symbol identifies procedures or operating conditions that may lead to damage to or destruction of the equipment if the specified precautions are not followed.

This symbol identifies procedures or operating conditions that are essential to the correct functioning of the equipment.

NOTE ! This symbol identifies information, procedures or operating conditions of particular relevance.

Chapter 1 - Safety Precautions

In compliance with EEC directives, make sure that all the safety devices required by EC standard 89/ 392/CEE governing industrial automation have been incorporated in the drive before attempting to operate it. These directives apply only in Europe and have no validity on the American continent.

This drive controls mechanical movements. It is the responsibility of the end user to ensure that these movements do not themselves cause any danger. Do not bypass or tamper with the drive manufacturer's safety interlocks or operating limits.

Risk of fire and electric shock!
When using test apparatus like oscilloscopes to take measurements from electrically live equipment, always connect the body of the oscilloscope to ground and always use a differential amplifier. To ensure accurate readings, choose probes and terminals with care and make sure that the oscilloscope is correctly set up. Refer to the manual provided by the oscilloscope manufacturer for details of how to operate and adjust the oscilloscope correctly .

Risk of fire and explosion!
Installation of the drive in hazardous areas and in the presence of flammable substances or combustible vapours or powders can lead to fire or explosion. Install the drive well away from hazardous areas even if the controlled motor is suitable for use under such conditions.

Risk of crushing!
Incorrect lifting of the drive can cause serious or even fatal injury. Only suitably trained personnel should lift the drive, and even then only with suitable lifting equipment.

Connect the drive and the motor to ground in compliance with applicable national electrical standards.

Replace any covers that may have been removed before powering up the drive. Failure to comply with this precaution can lead to serious injury or even death.

This variable frequency drive is electrical equipment designed for use in industrial installations. Parts of the drive are electrically live while it is functioning. The drive must therefore be installed and opened only by a qualified electrician. Incorrect installation of the drive or the controlled motor can damage the drive and lead to damage and injury.

The drive has no over-speed protection other than software based protection logic. Carefully follow the instructions given in this manual and observe all local and national safety standards.

Always connect the drive to a protective earth (PE) through the ground terminals (PE2) and the metallic casing (PE1). DSA SERIES drives and their AC power input filters have an earth leakage current greater than 3.5 mA. EN 50178 standard specifies that in the presence of earth leakage currents greater than 3.5 mA , the ground connection cable (PE1) must be fixed and must be doubled for redundancy.

In the event of a fault, even if the drive has been disabled it may still cause sudden movements if it has not been disconnected from the mains power.

Never open the drive or remove any covers while the drive is connected to the mains power supply. See section 5.9 in this manual for the minimum delay that must be respected before any work on the drive's terminals or internal components can be performed.

Never connect the drive to mains supplies with voltage levels outside the specified range. Excess voltage can damage the drive's internal components.

It is forbidden to operate the drive without a correct ground connection. The casing of the motor must also be grounded separately from the drive to avoid interference.

The ground connection must be comply with national electrical standards or the Canadian Electrical Code. The drive must be grounded using a closed loop connector certified to UL and CSA standards sized to match the gauge of the wire used. The connector must be fitted using

the crimping tool specified by the connector manufacturer.

Never perform insulation testing between drive terminals or control circuit terminals.

Do not install the drive in environments where temperature exceeds the specified maximum. Ambient temperature plays a major role in drive reliability.

If the drive displays any alarm condition, refer to the TROUBLESHOOTING section later in this manual and recommence normal operation only once the problem has been solved. Do not use an external routine or other such methods to reset alarms automatically.

The drive must be secured to a partition or panel constructed from heat resistant materials. The temperature of the drive's cooling fins can reach 90°C during normal functioning.

Do not touch or tamper with any drive component during normal functioning. In particular do not alter gaps between insulation or remove insulation or covers from the drive.

Protect the drive against physical and environmental stress (high temperature, humidity, impact etc.).

Never apply voltage to the drive's output terminals (U2 , V2 , W2). Likewise, never connect other drives in parallel with the drive's own outputs or bypass the drive by connecting its inputs directly to its outputs.

Do not connect capacitive loads like power factor correction capacitors to the drive's output terminals (U2 , V2 , W2).

Only qualified electricians should install and start up the drive. The electrician so doing is directly responsible for ensuring that there is an adequate ground connection and that power cables are protected in accordance with local and national standards. The controlled motor must also be protected against overload.

Do not perform dielectric rigidity testing on any parts of the drive. Only use appropriate test instruments (with a minimum internal resistance of 10 kO/V) to measure signal voltage.

NOTA! Storage of the drive for periods longer than two years could lead to malfunctioning of the DC ink capacitors. These must be regenerated prior to use as follows.

Before starting up the drive, leave it connected to the mains power supply for at least two hours with no load. The drive must be connected to the power supply but not enabled in order to regenerate the capacitors.

NOTA! The terms "inverter", "controller" and "drive" are interchangeable in industrial automation contexts. This manual uses the terms "drive" and "inverter".

1.1 Power and ground connections

1) TDE MACNO SPA. drives are designed for use with standard three phase mains power supplies, symmetrical withrespect to ground (TN or TT mains supplies).

Single phase drives must be connected to one phase, neutral and ground. Three phase drives must be connected to all three phases plus ground.

2) In the case of an IT mains supply, use a star/delta transformer with secondary wiring referenced to ground.

If IT mains power is used, loss of insulation in onen of the other devices connected to the same circuitcan cause the drive to malfunction if no star/delta transformer is provided.

Chapter 2 - General Description

DSA SERIES digital drives are designed to control the speed of three phase electric motors. They can control motors with a powerrange from 0.25 kW (0,35HP) to 1.1 kW (1,5HP) a 220 - 240 V

The drive rectifies the voltage of the mains power supply to obtain an intermediate circuit voltage, then uses an inverter bridge applying sinusoidal PWM modulation to generate a three phase power supply with variable voltage and frequency permittingregular, smooth motor control even at very low speeds.

Feed voltages to the various control cards are obtained from a switching power supply that also draws its power from the intermediate circuit.

The inverter bridge is based on IGBT (Insulated Gate Bipolar Transistor) devices. Output is protected against short circuits between the phases and to ground. If more than one motor is driven in parallel by a single drive (obviously of adequate power)motors can be switched in and out independently even during normal drive functioning (see section 5.2.3).

If the motors used are not specifically designed for inverter control, a drop in output current of around 5 - 10% must be allowed for. If nominal torque is demanded from such a motor at low speeds, an auxiliary motor cooling fan will be necessary to dissipate the heat generated. If the necessary cooling assistance cannot be provided, then the motors will have to be over-sized. In either case the user should contact the technical service of the motor manufacturer for further information.

If a motor has to function at a frequency greater than its nominal frequency, the user should again contact the manufacturer's technical service to ascertain what mechanical problems (bearing wear, balancing problems, etc.) could be incurred.

DSA SERIES drives can be controlled in a number

of ways:

-via their control terminals

-using the control keys and display

-over an RS 485 serial line

-using a standard PC control program

Note!

The electronic control circuit terminals are electrically separate from the power circuit terminals, but the control microprocessor is linked to the potential of the DC stage.

Standard functions

- Feed voltages generated from intermediate circuit voltage by switching technology.
- Reduced motor noise thanks to special PWM control technology.
- Output protected against short circuits between phases and to ground.
- Possibility of switching motors in and out of the drive output (see section 5.2.3).
- Protection against over-current, over-voltage and under-voltage.
- Ability to withstand mains power outages of up to 15 ms (see section 7.6 for automatic restart programming).
- Sinsoidal output current from sinusoidal PWM.
- Smooth, controlled motor rotation even at very low speeds.
- Programmable slip compensation to minimise load-related speed variation.
- Manual or automatic low speed voltage boost.
- Automatic voltage and frequency control in case of overload to avoid motor stalling.
- Keypad or RS 485 serial line parameter control.
- Linear or `S' acceleration/deceleration ramps.
- DC braking with the following control modes:
  - a - digital input control;
  - b - automatic braking below a set frequency;
  - c - pre-start braking for pumps and fans rotated by liquid or air movement prior to electrical start-up, to prevent switching on a motor that is already rotating.
- Wide selection of V/f ratios.
- Overload level control.
- Non-volatile memory for the last 4 alarm event messages; messages not lost even if power is switched off.
- Set speed signalling via potential-free contacts or over a serial line for signalling e.g. zero speed.
- Digital parameter or serial line referencing.

Advanced functions available from the complete version

- Referencing with 0...10 V, 0...20 mA, 4...20 mA analog signal.
- Choice of open loop or closed loop functioning.

Options

- RS 485 serial line control card (to be specified at time of order)
- E^2PROM key for saving custom settings.
- Remote keyboard kit.
- Serial keyboard.

Chapter 3 - Description, Components and Specifications

3.1. Storage and transport

3.1.1. General

DSA SERIES drives are carefully packed for shipment. Transport must be undertaken using adequate means (see weights). Respect all instructions and symbols printed on the packaging. The same applies to drives removed from their transport packaging for installation in control cabinets.

Perform the following checks as soon as you receive your drive.

- Check that the packaging has not been visibly damaged.
- Check that the details on the delivery bill correspond to those of the original order.

Unpack the drive carefully and perform the following checks.

- Check that no part of the drive has been damaged during transport.
- Check that the drive delivered corresponds to that ordered.

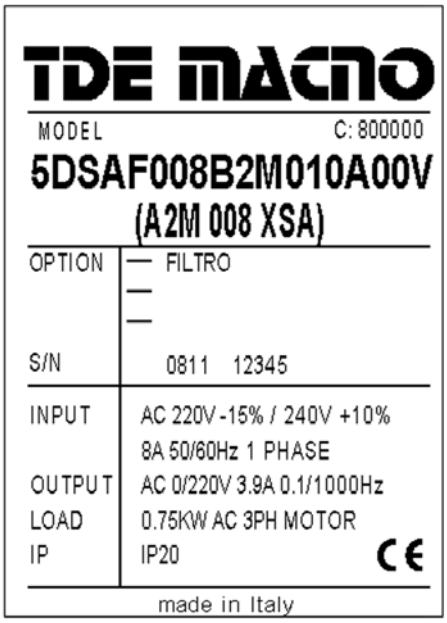
If any damage is found, or if the drive is either incomplete or incorrect, notify the supplier's sales department immediately.

The drive must only be stored in dry places and within the specified storage temperature range.

NOTA! Excessive temperature variations can cause condensation to form inside the drive. While this may be acceptable under certain storage conditions (see section 3.3.1 "Ambient conditions and standards"), the presence of condensation is absolutely unacceptable under normal drive operating conditions. Before powering your drive on for the first time, always make sure that there is no condensation inside it!

3.1. 2. Data plate

Check that the specifications on the drive's data plate correspond to the original order.



3.2. Component identification

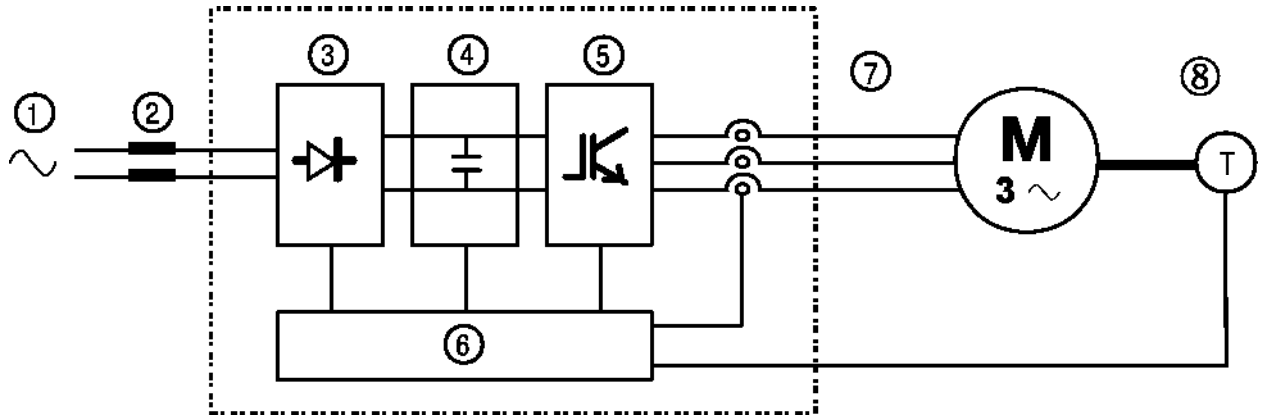


Figure 3.2.1: Basic schematic of a frequency inverter

Inverters convert a constant frequency, constant voltage mains supply into DC voltage. From this DC voltage, they then generate a three phase AC supply with variable voltage and frequency. This variabile three phase power enables smooth speed control of three phase asynchronous motors.

1 Mains supply: 220 V - 240 V single phase.

2 Mains choke (see section 5.7.1).

3 Rectifier bridge.

Uses full wave technology to convert AC into DC voltage.

4 Intermediate circuit.

Comprises precharge resistors and smoothing capacitors. DC voltage (U_{DC}) = 1.41 x mains line voltage (U_{LN})

5 IGBT inverter bridge.

Converts DC voltage into three phase AC voltage with variable amplitude and frequency.

6 Configurable control section.

Comprises all the necessary cards for the control and regulation of the closed or open loop power section. Commands, references and feedbacks are all connected to these cards.

7 Output.

AC power variable between 0 and 94% of mains power (U_{LN}).

8 Speed feedback (e.g. tachometer)

3.3. General specifications

3.3.1. Ambient conditions and standards

Table 3.3.1.1: Ambient conditions and standards

ENVIRONMENT		
T_A Ambient temperature	[°C]	0 ... +40; +40...+50 with derating
	[°F]	32 ... +104; +104...+122 with derating
Installation location		Pollution degree 2 or better (free from direct sunligth, vibration, dust, corrosive or inflammable gases, fog, vapour oil and dripped water, avoid saline environment)
Installation altitude		Up to 1000 m (3281 feet) above sea level; for higher altitudes a current reduction of 1.2% for every 100 m (328 feet) of additional height applies .
Temperature:		
operation [1]		0...40°C (32°...104°F)
operation [2]		0...50°C (32°...122°F)
storage		-25...+55°C (-13...+131°F), class 1K4 per EN50178
		-20...+55°C (-4...+131°F), for devices with keypad
transport		-25...+70°C (-13...+158°F), class 2K3 per EN50178
		-20...+60°C (-4...+140°F), for devices with keypad
Air humidity:		
operation		5 % to 85 %, 1 g/m^3 to 25 g/m^3 without moisture condensation or icing (Class 3K3 as per EN50178)
storage		5% to 95 %, 1 g/m^3 to 29 g/m^3 (Class 1K3 as per EN50178)
transport		95 % [3] 60 g/
		A light condensation of moisture may occur for a short time occasionally if the device is not in operation (class 2K3 as per EN50178)
Air pressure:		
operation	[kPa]	86 to 106 (class 3K3 as per EN50178)
storage	[kPa]	86 to 106 (class 1K4 as per EN50178)
transport	[kPa]	70 to 106 (class 2K3 as per EN50178)
STANDARD		
General standards		EN 61800-1, IEC 143-1-1.
Safety		EN 50178, UL 508C
Climatic conditions		EN 60721-3-3, class 3K3. EN 60068-2-2, test Bd.
Clearance and creepage		EN 50178, UL508C, UL840. Overvoltage category for mains connected circuits: III; degree of pollution 2
Vibration		EN 60068-2-6, test Fc.
EMC compatibility		EN61800-3 (see “EMC Guidelines” instruction book)
Rated input voltages		IEC 60038
Protection degree		IP20 according to EN 60529
		IP54 for the cabinet with externally mounted heatsink; only for sizes 1007... 3150 (230V...480V) and 2002 ... 3020 (575V)
Approvals		CE, UL, cUL

TGy0020

1) Ambient temp parameter = 40°C (10 4°F). Ambient temperature = 0 ... 40°C (32°...10 4°F) Over 40°C (104°F):
 - 2% reduction in output current.

2) Ambient temp parameter = 50°C (122°F). Ambient temperature = 0 ... 50°C (32°...122°F): Over 40°C (104°F):
 20% reduction in output current.

3) Higher airborne humidity values with temperature at 40°C (10 4°F) or if drive temperature suddenly rises between -25 ...+30°C (-13°...+86°F).

4) Higher airborne humidity values if drive temperature suddenly drops between 70...15°C (158°...59°F).

Disposing of the drive

DSA SERIES drives must be disposed of as electronic waste in compliance with national legislation. The front covers are made from recyclable ABS.

3. 3.2. Mains input and drive output connections

DSA SERIES drives must be connected to a mains supply capable of providing symmetrical short circuit power better than or equal to the values given in table 3.3.2.1. See section 5.7.1 for information on the addition of mains chokes.

See table 3.3.2.1 for the permitted mains voltages. Cyclical phase direction is irrelevant. Voltages below the minimum tolerance threshold cause the drive to lock.

The drive can be restarted automatically after an alarm condition occurs (see section 6.15 for further details on this function).

NOTA! Under certain circumstances it may be essential to add mains chokes and EMI filters to the drive input. Refer to the "Chokes and filters" section.

DSA SERIES drives and mains input filters have earth leakage currents greater than 3.5 mA. EN 50178 standard requires that in the presence of earth leakage currents greater than 3.5 mA, the ground connection (to the PE terminal) must be fixed.

Table 3.3.2.1 -A: I/O specifications for drive models in Kw/Hp at 230 V

DSA SERIES Drive Type - Hp rating		002	004	005	008	011
OUTPUT						
Inverter Output (IEC 146 class1), Continuous service (@230V)	[kVA]	0,77	1,10	1,43	1,87	2,53
Inverter Output (IEC 146 class2), 150% overload for 60s (@230V)	[kVA]	0,70	1,00	1,30	1,70	2,30
PN mot (recommended motor output):						
@ ULN=230Vac; fSW=default; IEC 146 class 1	[kW]	0,25	0,35	0,55	0,75	1,10
@ ULN=230Vac; fSW=default; IEC 146 class 2	[kW]	**0,25**	**0,35**	**0,55**	**0,75**	**1,10**
@ ULN=230Vac; fSW=default; IEC 146 class 1	[Hp]	0,35	0,50	0,75	1,00	1,5
@ ULN=230Vac; fSW=default; IEC 146 class 2	[Hp]	0,35	0,50	0,75	1,00	1,5
U2 Max output voltage	[V]	0.94 x ULN (AC Input voltage)				
f2 Max output frequency (*)	[Hz]	1000				
I2N Rated output current :						
@ ULN=230Vac; fSW = default; IEC 146 class 1	[A]	0,0	0,0	0,0	0,0	0,0
@ ULN=230Vac; fSW= default; IEC 146 class 2	[A]	**1,7**	**2,2**	**3,0**	**3,9**	**5,5**
fSW switching frequency (Default)	[kHz]	12				
fSW switching frequency (Higher)	[kHz]	18				
Derating factor:						
KT for ambient emperature		0.8 @ 50°C (122°F)				
KF for switching frequency		0.7 for higher f_{sw}				
INPUT						
ULN AC Input voltage	[V]	220 V -15% ... 240 V +10%, 1-PHASE				
AC Input frequency	[Hz]	50/60 Hz ±5%				
IN AC Input current for continuous service : - Connection without 3-phase reactor						
@ 230Vac; IEC 146 class 1	[A]	3,0	4,5	6,0	8,0	11
Max short circuit power without line reactor (Zmin=1%)						
Overvoltage threshold	[V]	400VDC (@ 230VAC)				

3. 3. 3. Mains input current

The mains input current to the drive depends on the duty status of the controlled motor. Table 3.3.2.1shows nominal continuous duty values (IEC 1 46 class 1) with typical output power factors for eachmodel of drive.

3. 3.4. Output

The output from DSA SERIES drives is protected against short circuits between phases and to ground.

NOTA! It is forbidden to connect any external voltage to the drive's output terminals! Nevertheless, once a disabled, it can be disconnected from the drive output while the drive is still functioning.

The nominal continuous output current value (I_{CONT}) depends on mains voltage (Kv), ambient temperature (K_T)

$I_{CONT} = I_{2N} \times K_V \times K_T$ (see table 3.3.2.1 for reduction factors), with a maximum overload capacity of $I_{MAX} = 1.5 \times I_{CONT}$ for 60 seconds.

Recommended motor power

The combinations of nominal motor power and inverter model specified in table 3.3.2.1 is based on the use of motors whosenominal voltages correspond to that of the mains power supply.

If the motors involved have other voltages, select the drive model on the basis of nominal motor current.

NOTA! Maximum permitted overload: 136% . I_{2N} cl.1 ≡ 150% . I_{2N} cl.2.

Table 3.3.3.1 shows nominal current values for the most typical duty profiles (ambient temperature =40°C, standard switching frequency).

A similar criterion should be applied to drive operation with additional declassing factors.

3. 3.5. Regulation and control section

4 digital inputs 4 programmable digital inputs: 0 - 15V / 7 mA

Digital input 1 = Run (default)

Digital input 2 = NO external fault (default)

Digital input 3 = Reverse (default)

Digital input 4 = Freq sel 1 (default)

1 analog input 1 programmable analog input as:

in voltage 0-10 V, 0.5 mA max, 10 bit [default]
in current 0...20 mA, 10 V max, 10 bit
in current 4...20 mA, 10 V max, 10 bit
digital input 5 (the analog input is possible to set as digital input)

1 digital output 1 programmable digital output:

Digital output 1 = Drive alarm state (default)

Relay type output: 120Vac-0.2A / 30Vdc-1A

Auxiliary voltages from drive terminals

Capacity: + 15Vdc, 50mA (terminal 4)
+ 10Vdc, 20mA (terminal 11)

Tolerance: + 15Vdc ±5 %
+ 10Vdc ±3 %

3. 3.6. Part of regulation and optional control

2° analog input (U version) 1 programmable analog input as:

in voltage 0-10 V, 0.5 mA max, 10 bit [default]
(in current with 500ohm / 0,5W on connectors)

2ª digital output (U version) digital output (open collector) programmable:

Digital output 2 = Output freq 2 [default]

3.3.7. Precision

Reference:	Resolution of reference from analog inputs to terminals [full scale function and 1 bit for sign]	0.1 Hz
	Resolution of reference from serial line	0.01 Hz

Open loop speed: Load related speed loss can be partly compensated for using 'slip compensation'. Precision nevertheless also depends on the characteristics of the controlled motor.

Chapter 4 - Installation

4.1. Mechanical specifications

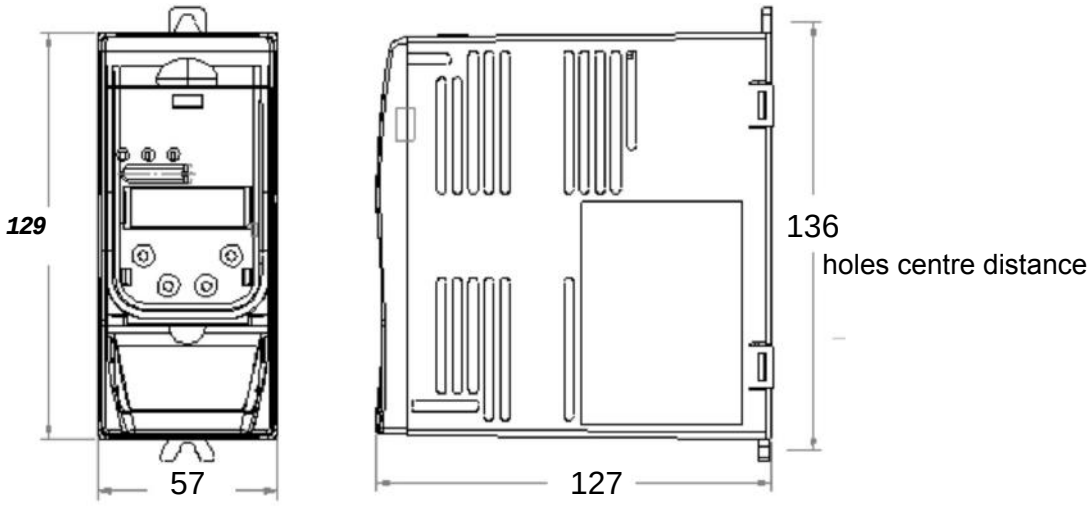
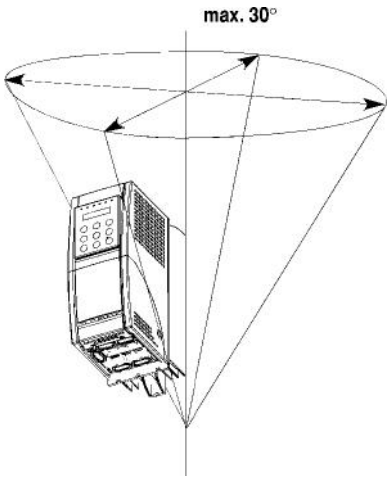


Figure 4.1.1: DSA SERIES drive dimensions

4.2. Installation distances

NOTE! Respect the distances given in this manual when installing the drive. Use only appropriate tools and equipment. Incorrect handling and the use of improper tools can damage the drive.

Figure 4.2.1: Maximum angle

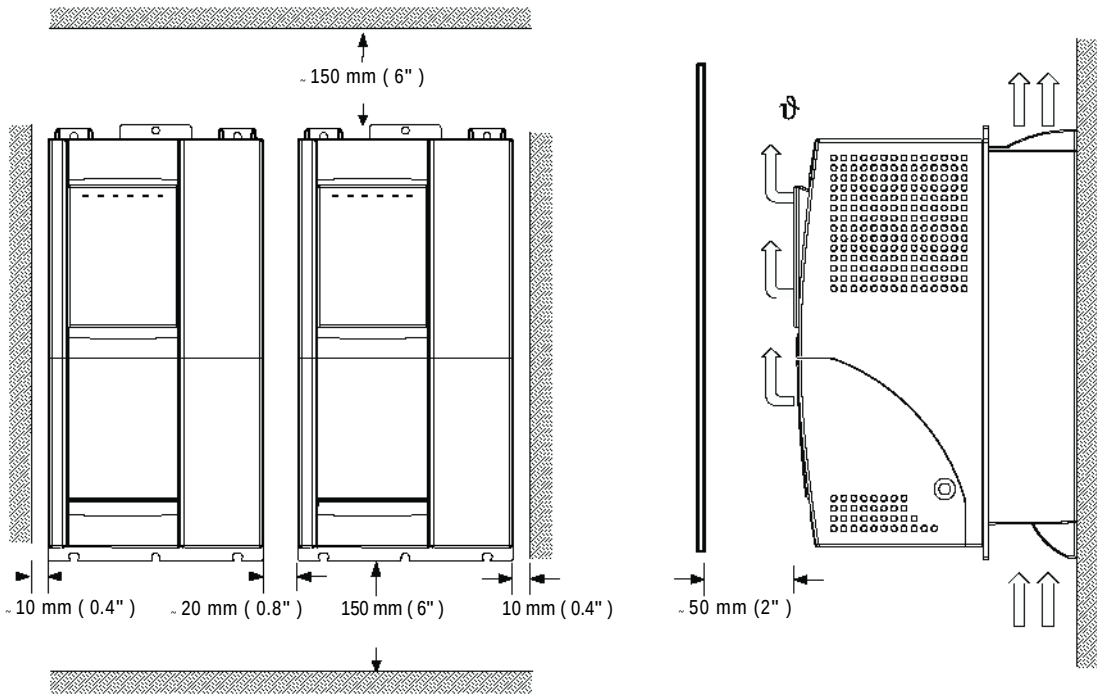


Maximum permitted angle to the vertical: 30°.

NOTE! Install the drive in such a way as to ensure free circulation of air all around it. Leave a gap of at least 150 mm above and below the drive. Leave at least 50 mm of free space in front of the drive.

Do not install other items of equipment that generate heat near the drive. Check the terminal connections for tightness after a few days of operation.

Figure 4.2.2: Installation distances



4. 3. Motors

DSA SERIES drives are designed for open or closed loop control of standard asynchronous motors.

4. 3.1. Asynchronous AC motors

FOR BEST RESULTS:

Choose an asynchronous motor with a minimum slip of 3-5 % , with a single cage rotor, designed for use with an inverter.

a) Minimum motor size. Nominal motor current must not be less than 30% of nominal drive current @ 230V.

b) General purpose motors (i.e. motors not specifically designed for inverter control) must only be used if an additional **output choke** is fitted.

c) We recommend that you use **special motors with reinforced insulation** designed for inverter control. Motors of this type **do not require the drive to be fitted with an output choke**.

The electrical and mechanical specifications of standard asynchronous motors refer to a specific functioning range. When controlling motors of this type with an inverter, always bear the following points in mind.

Can standard asynchronous motors be used?

DVS series drives can be used with standard asynchronous motors. Certain characteristics of these motors, however, have a major influence on performance. Pay special attention to the following considerations. Also bear in mind what section 3.3. 4 "Output" has to say about motor power ratings and voltages.

Star or delta connection?

Motors can be wired up either in a star or a delta configuration. Star wired motors are generally easier to control and star wiring is therefore to be preferred under most circumstances.

Cooling

Asynchronous motors are normally cooled by a fan keyed directly on to the motor shaft. Care must be taken, however, because fan efficiency drops at low motor speeds and the motor may receive insufficient cooling. Discuss motor operating conditions with the motor manufacturer's technical service to ascertain whether it is necessary to provide additional ventilation (forced cooling).

Functioning at speeds above nominal speed

If a motor has to operate above its nominal speed, contact the manufacturer's technical service to ascertain what mechanical problems (bearing wear, balancing problems etc.) and what electrical losses may occur as a result.

Motor specifications you must know for inverter control

Motor data plate specifications: - Nominal motor voltage

- Nominal motor current

- Nominal motor frequency - Nominal motor speed

- Power factor (Cos ϕ)

- Number of terminal pairs

- Connection type (star/delta)

Motor protection

Use of Klixon protectors in motor windings

The contacts of the Klixon overheating protectors can be used to disable the motor either via auxiliary control circuits or using the input to signal an alarm condition.

NOTE! The motor's Klixon interface circuit can be considered and managed to all intents and purposes like a signaling circuit. Connections to the motor's Klixon protectors must therefore use a shielded twisted pair cable laid if possible not parallel with other motor cables or at a distance of at least 20 cm (8 inches) from them.

Drive current limitation

Current limitation can be used to protect the motor against damaging overloads. To do so, the current limit and overload control parameters must be set so that current to the motor always remains within the motor's acceptable limits.

NOTE! Bear in mind that current limitation can only protect the motor against overheating caused by overload, and not against overheating caused by inadequate cooling.

Always fit the windings of motors destined for use at low speeds with the necessary temperature control plates!

Output chokes

In certain cases output chokes may be needed to protect the winding insulation of standard motors. See section 5.7.2. "Output chokes".

Chapter 5 - Electrical Connections

5.1. Accessing the electrical terminals

NOTA! Observe the safety precautions given elsewhere in this manual. The terminal covers can be removed without the use of force. Use only appropriate tools.

Figure 5.1.1: Accessing the control terminals

Remove the terminal cover to access the control card terminals. If all the terminals are going to be used, it may prove usefulto cut a corner off the cover to facilitate cable access.

Figure 5.1.2: Accessing the power terminals

part superior of drive

Figure 5.1.3: Accessing the motor terminals

part inferior of drive

5.2. The power section

Table 5.2.1.1: Power terminal identification and functions

	FUNCTION	TERMINAL
TOP	230 V SINGLE PHASE MAINS POWER	L2
		L1
	GROUND CONNECTION	PE
BOTTOM	GROUND CONNECTION	PE
	THREE PHASE POWER TO MOTOR	W
		V
		U

5.2.2 Power terminal wire cross sections

	Minimum section [mm^2]				Maximum section [mm^2]			
size	025	037	055	075	025	037	055	075
L1, L2	1,5				2,5			
PE	1,5				2,5			
PE	1,5				2,5			
U, V, W	1,5				2,5			

NOTA! Use only copper wire rated for 75°C

If the output of a DSA SERIES drive short circuits to ground, current in the motor's ground wire may reachup to twice nominal current I_{2N}

5.2. 3. The rectifier bridge and intermediate circuit

Mains power is rectified and filtered by capacitors. All models of DSA SERIES drives incorporate a precharge resistance diode bridge.
If over-voltage ("OV' signal) or under-voltage ("UV' signal) occurs in the intermediate circuit, no power can be drawn from it because the inverter bridge locks.

During normal functioning, the DC voltage of the intermediate circuit U_{DC} has a value equal to $U_{LN} * \sqrt{2}$. If the motor is turned by its load (as occurs during deceleration or braking), power flows into the intermediate circuit through the inverter bridge. Voltage in the intermediate circuit therefore increases. The inverter bridge locks at a predetermined voltage, and the contacts between terminals 1 and 3 open (provided the relay has been programmed as an alarm state signal). See section 6.15 for details on resetting.

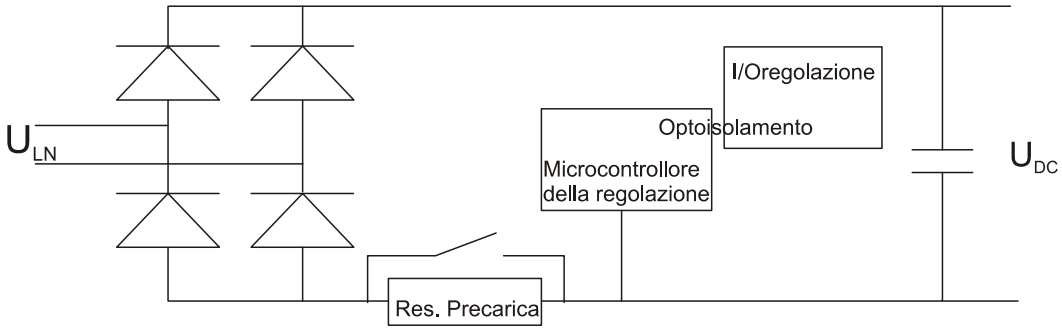


Figura 5.2.3.1 The rectifier bridge and intermediate circuit

The drive can be restarted automatically after an alarm condition. (See section 6.15 for further information on automatic restarting.)

Locking can also be prevented by extending the deceleration ramp.

5.2. 3. The inverter bridge

The inverter bridge features IGBT (Insulated Gate Bipolar Transistor) technology in all models of DVS drive. The inverter bridge is protected by internal circuitry against over-voltage, over-current, short circuit between phases and short circuit to ground. In the event a fault, the inverter bridge locks and the contacts between terminals 1 and 3 open (provided the relay has been programmed as an alarm state signal). See section 6.15 for information on resetting.

The drive can be restarted automatically after an alarm condition. (See section 6.15 for further information on automatic restarting.)

Table 5.2.4.1: Inverter bridge protection alarm signalling

Signal	Lock caused by
OV	Over-voltage
OC	Over-current, short circuit between phases
OC	Short circuit to ground

Variable voltage output is derived from the intermediate circuit voltage using PWM technology. Special sinusoidal modulation in conjunction with the motor's own inductance produces an extremely good sinusoidal curve for the output current I. The voltage/frequency ratio is programmable and can be adapted to suit the motor being controlled.

More than one motor can be connected in parallel to the drive output. Motors may run at different speeds even though they have the same number of terminal pairs, because motor slip can vary with the load applied and motor characteristics may vary too. Motors can also be switched in and out individually, though great care must be taken when doing so.

Switching a motor in or out causes voltage peaks by interrupting an inductive current flow. These voltage peaks do not normally disturb the drive output provided the motor is a low power model and other motors remain connected to the inverter after it is switched out.

If the motor being switched out is the last motor connected to the drive, make sure that the motor's magnetising current has dropped to zero before switching it out. the best way of doing this is to lock the inverter bridge and disconnect the motor only after a fixed delay calculated to suit the characteristics of the motor, in practice from about 0.5 seconds up to a number of seconds.

Motors can likewise be switched in to an already functioning inverter one at a time. If you wish to do so, bear in mind that the instant the motor is connected its inrush current far higher than its nominal current. The drive must therefore be carefully selected so that inrush currents do not exceed the drive's nominal current. You must also consider the overload that the drive is able to cope with if the duty cycle during which the new motor is connected coincides with the limited period for which overload is permitted.

More than one inverter cannot work directly in parallel.

5. 3. The control section

5. 3.1. The A 313-XX control card

Figure 5.3.1.1: The A313-XX control card

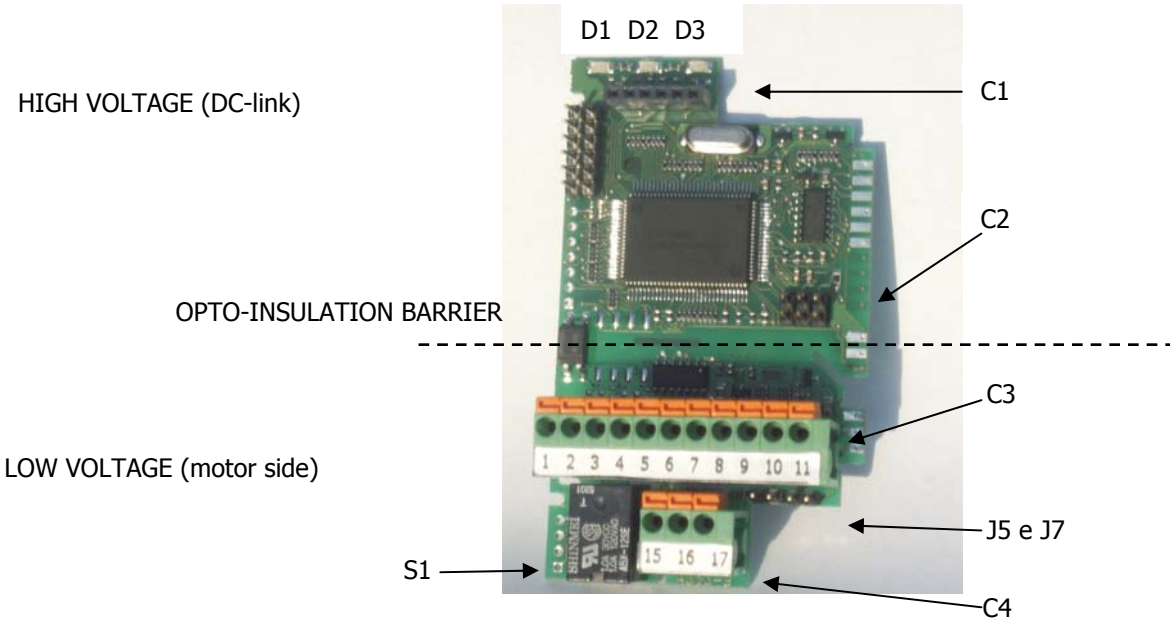


Table5.3.1.1: LEDs, jumpers and connectors on the A313-XX

LED	Colour	Function
D1	yellow	Lit = drive power Flashing = parameters changed but not saved Off = attempting to change unmodifiable parameter in Run
D2	green	Lit = Run command enabled and active
D3	red	Lit = drive in alarm state

Connector	N° pin	Function
C1	6	Programming key connector
C2	6	Keypad connector
C3	11	Control terminals
C4	3	Optional terminals
S1	4	Slot for optional cards

Jumper	Default	Function
J5	0	Transforms analog voltage input 1 into current input (Jumper on)
J7	0	Links control card 0V to ground

5. 3.2. Control card terminal identification

Figure 5.3.2.1: Control card terminal identification

No.	Terminal	Description	FUNCTION		Default		Signal type
1	**REL-CM**	Digital output 1	Programmable relay output	Common	I-100=1	ALARM	Switching capacity: 230 Vac, 0.2 A; 30 Vdc, 1A
2	**REL-NO**	Digital output 1		Norm.Open			
3	**REL-NC**	Digital output 1		Norm.Closed			
4	**+15V**	+15 V OUT	Auxiliary power for digital inputs				15V +/-5% 300mA
5	**IN 1**	Digital input 1	Programmable digital input 1		I-100=1	RUN	7mA at 15V opto-couplers for PNP logic, active connected to +15V
6	**IN 2**	Digital input 2	Programmable digital input 2		I-100=3	EF	
7	**IN 3**	Digital input 3	Programmable digital input 3		I-100=2	REV	
8	**IN 4**	Digital input 4	Programmable digital input 4		I-100=7	Freq.Sel.	
9	**GND**	0 V	Reference ground for analog input				
10	**IN AN 1**	Analog input 1	Programmable analog input		I-200=1	0-10V	0-10V, 0-20mA, 4-20 mA
11	**+10V**	+ 10 V OUT	Auxiliary power for potentiometer				10 V +/-3% 50mA

Version S			SERIAL LINE 485		opzioni
15	**GND**	0V	Reference ground		RS 485 (Modbus)
16	**FB +**	Link +	Serial line +		
17	**FB -**	Link -	Serial line -		

Version T			CANBUS		
15	**GND**	0V	Reference ground		CANBUS (CanOpen) (Devicenet)
16	**FB +**	Can H	Not inverting signal		
17	**FB -**	Can L	Inverting signal		

Version U			2° analog input, 2ª digital output		
15	**GND**	0V	Reference ground		RS 485 (Modbus)
16	**IN AN 2**	Analog input 2	Analog input prog. in voltage	**I-210=1** 0-10V	
17	**DIG OUT 2**	Digital output 2	Digital output open-collector prog.	**I-101=41** Output freq	

The options S,T,U are exclusive, and must be defined before order

Maximum wire sections for control card terminals

Table 5.3.2.1: Maximum wire sections for control card terminals

Control connection data		
Rigid / Flexible / wire size	[mm^2] / [mm^2] / AWG	0,22-1 / 0,22-1 / 26-18
Flexible with spade end with/without insulating collar	[mm^2]	0,25 - 0,34 / 0,25 - 0,34
Stripping length	[mm]	10

Maximum wire length

Table 5.3.2.2: Maximum wire length

	Maximum wire length		
Wire section [mm2]	0,5	0,75	1
Maximum length [m]	30	60	90

5.4. The RS 485 serial interface

5.4.1. General

With DSA SERIES drives, an RS 485 serial line can be used to transmit data over a twisted pair cable made of two symmetrical twisted wires with a common shield. Maximum data transmission speed is 38. 4 KBaud.

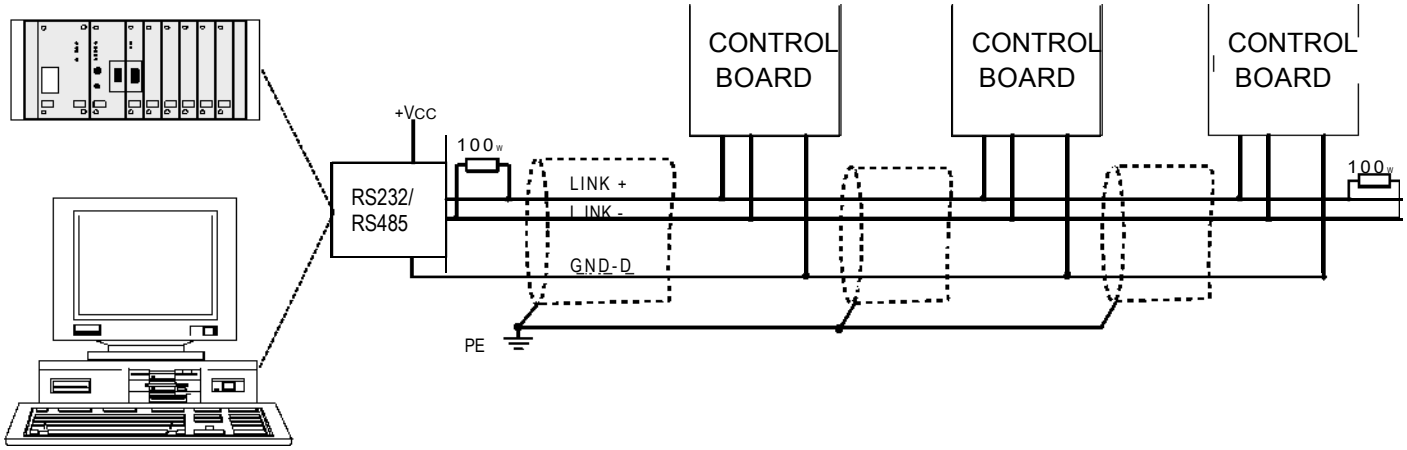
Transmission uses a standard differential RS 485 signal (half-duplex).

Up to a maximum of 32 DSA SERIES drives can be connected in Multidrop configurations.

The JP7 serial line jumper

The RS 485 serial line is supported by terminals 15, 16 and 17 on the DSA SERIES drive control card.

The differential signal is transmitted to terminal 16 and terminal 17. To prevent interference, termination resistors [100 Ohm] must be fitted at the beginning and end of the RS 485 serial line's physical connection cables.



NOTA! **When connecting and laying serial lines, make sure that the power cables are laid in separate cable runways from the switchgear and relay cables.**

Serial protocol

Serial protocol is set using the parameter "***I.600*** "[***Serial link cfg***], which provides a choice of the following protocols: FoxLink proprietary protocol, Modbus RTU (default) and Jbus protocols.

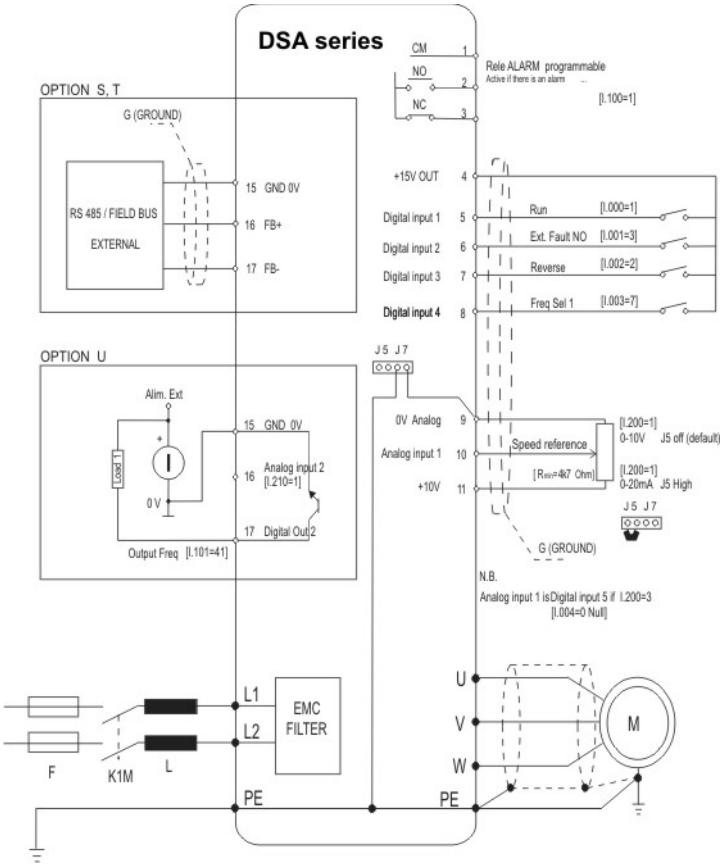
The device address on the serial line is set using the parameter "***I.602*** "[***Device address***].

See section 7.1 (INTERFACE /Serial Configuration) later in this manual for further details about data transmission parameters, protocols, ranges and values. See chapter 8 later in this manual for instructions on the use of Modbus RTU communication protocol with DSA SERIES drives.

5.5. Typical Connection Schematics

5.5.1. DSA SERIES drive connections

Figure 5.5.1.1: Control via terminals, typical connection schematic



NOTA! The control input connections shown above represent the most common connection solution for NPN control. See below for further examples.

5.5.2. Design constraints

The wires for the analog signals must be shielded (connection to terminals 9, 10, 11).

The shielding must be connected to the PE terminal at **only one side**.

Grounding of the reference potential

The terminal wire shielding potential must normally be grounded. Jumper J7 links the potential of terminal 9 (GND 0V, control reference) to protective earth (PE).

If a single installation comprises more than one drive, the different potentials of their terminal wire shields must be connected in common to the control panel's ground bus.

Direct connection to PLC inputs/outputs

Observe the following points if control commands or references are obtained directly from PLC inputs/outputs.

The PLC's 0V terminal must normally be grounded. if this is done, the drive control reference potential (J7 NOT fitted) must not be grounded.

To ensure good immunity to interference, connect a 0.1,uF 250V DC capacitor between terminal 9 and ground. If more than one drive is present in a single installation, this must be done for each individual drive.

Drive relays

To ensure good immunity to interference, install RC filters in parallel with the coils of contactors connected to the drive's potential-free contacts.

5.5. 3 Parallel mains AC input connections to more than one drive

Characteristics and limitations

- Drives installed in homogeneous groups must all be of the same model.
- All input chokes must be identical (same specifications and same supplier).
- All drives must receive power simultaneously. In other words they must all share the same switch/line contactor.
- No more than 6 drives must be connected in parallel to the same mains supply.

5.7. Chokes and filters

NOTE! A choke can be fitted to the mains input to DSA SERIES drives to limit RMS input current. Inductance can be provided either by a single phase choke or by a mains transformer.

NOTE! Contact your nearest TDEMACNO office for information on the use of sinusoidal output filters.

5.7.1. Mains input chokes

Drive tipe	Nominal current [A]	Saturation current [A]	Frequency [Hz]
002	3,8	7,6	50/60
004	5,5	11	50/60
005	7,5	15	50/60
008	10	20	50/60
011	14	28	50/60

Use of a mains choke is recommended for all drive models:

- to extend the life of the intermediate circuit capacitors and improve the reliability of the input diodes;

- to reduce harmonic distortion in the mains;

- to reduce the problems caused by power feed from a low impedence line.

NOTE! Determine the nominal current of chokes on the basis of the nominal current of the standard motors whose power ratings are specified in table 3.3.2.1.

5.7.2. Output chokes

DVS drives can be used with general purpose motors as well as motors specifically designed for inverter control. Motors designed for inverter control normally have better insulation to withstand PWM voltages.

The following are examples of applicable reference standards.

Motors designed for control by inverters do not require special inverter output filters. Standard motors on the other hand, especially those with long cables (typically longer than 30 metres) may need a choke on the inverter output to keep the voltage wave form within specified limits.

The nominal current of these chokes must be approximately 20% greater than that of the inverter itself to compensate for additional losses caused by modulation of the output wave form.

NOTA! At the drive's nominal current and a frequency of 50 Hz, output chokes cause an output voltage drop of about 2%.

5.7. 3. Noise filters

DSA SERIES drives are fitted with an EMI filter to limit radio frequency interference that could affect the mains.

XX6 models have no noise filter

XXA models have a Class A filter [default]

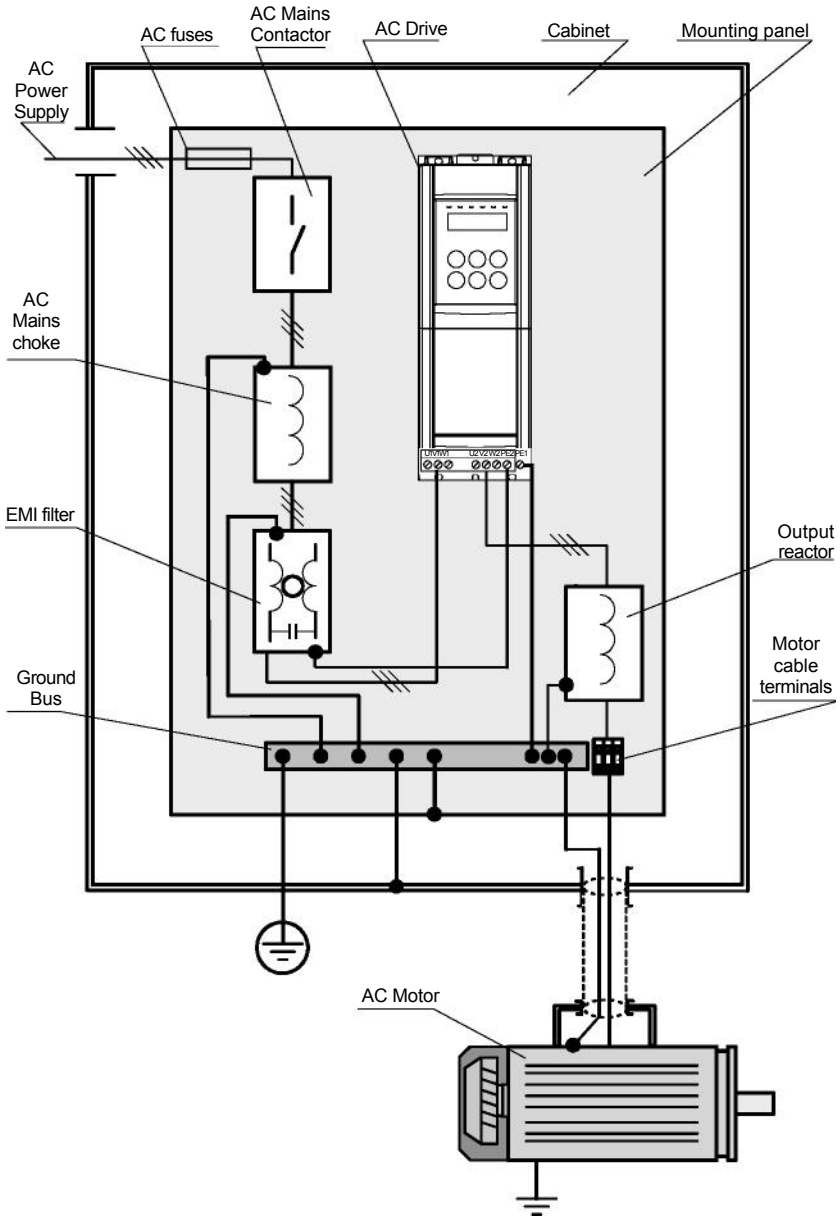
XX:1 models have a Class B filter

Consult the Electro-Magnetic Compatibility Guide for further information on the subject of noise filters. You can request a copy of the "Electro-Magnetic Compatibility Guide" from your nearest TDE office.

The Guide lists the power and control panel installation standards that must be followed to ensure EMC conformity according to Directive 89/336/EEC. (These standards cover the installation, whenever necessary, of external filters and mains chokes, cable shielding, ground connections, etc..)

The Guide also explains the background to EMC standards and lists the various conformity tests performed on TDEMACNO equipment.

5.7. 3.1 External EMI filter connections



5.8. Braking

DSA SERIES drives provide DC braking as a standard function. The DC braking function applies a DC current to two of the motor phases to generate braking torque. The machine's kinetic energy is dissipated inside the motor in the form of heat.

The DC braking function cannot provide intermediate braking [e.g. rapid braking from 1 400 to 1200 rpm], but only braking to zero speed from already low speeds. If required, braking current can be measured from phase "U".

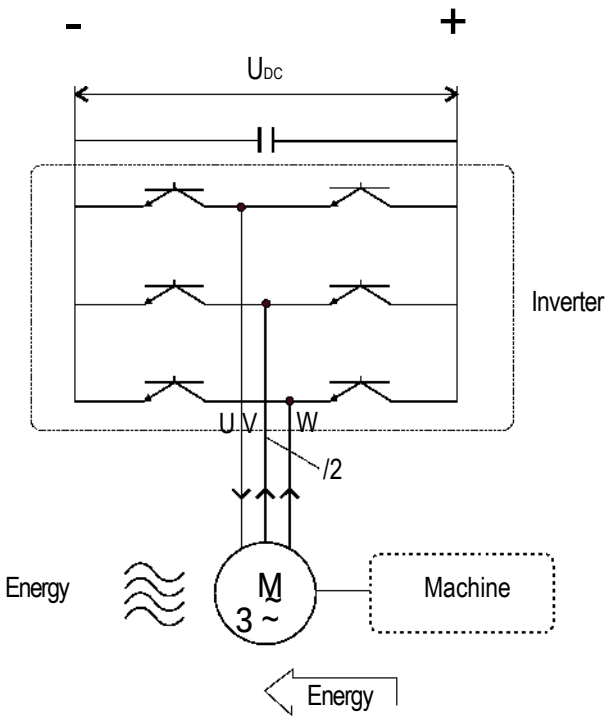


Figure 5.8.7: Principle of functioning of DC braking

5.9. Safety delay before work on the drive

After disconnecting a DSA SERIES drive from the mains supply, always respect a minimum delay of 60 seconds before starting anywork on its internal parts.

Chapter 6 - Using the Drive's Control Keys

This chapter tells you how to use the drive's front panel control keys to set drive parameters.

6.1 Control keys and LEDs

Though changes to parameter values are immediately effective, they are not automatically saved. Aspecific command, the "C.000" [Save parameters] command must be used to save changes.

M Menu scroll key: Press to scroll from one parameter menu to the next (**d.xxx , S.xxx , ~.xxx , F.xxx , P.xxx , A.xxx and C.xxx**).

E Enter key: Press to access a parameter and/or confirm its value.

▲ UP key: Press to scroll up through a list of parameters and/or to increment
the value displayed. Also increments the motor potentiometer reference in the "***F.000 - Motorpot ref***" parameter (F: FREQ & RAMPS menu).

▼ DOWN key: Press to scroll down through a list of parameters and/or decrement
the value displayed. Also decrements the motor potentiometer reference in the "***F.000 - Motorpot ref***" parameter (F: FREQ & RAMPS menu).

▲ + ▼ UP + DOWN keys: Press simultaneously to reset the drive.

Interpretation of LEDs:

POWER-PRG (Yellow LED): Lit = inverter powered on. Flashing = parameter change not yet saved.

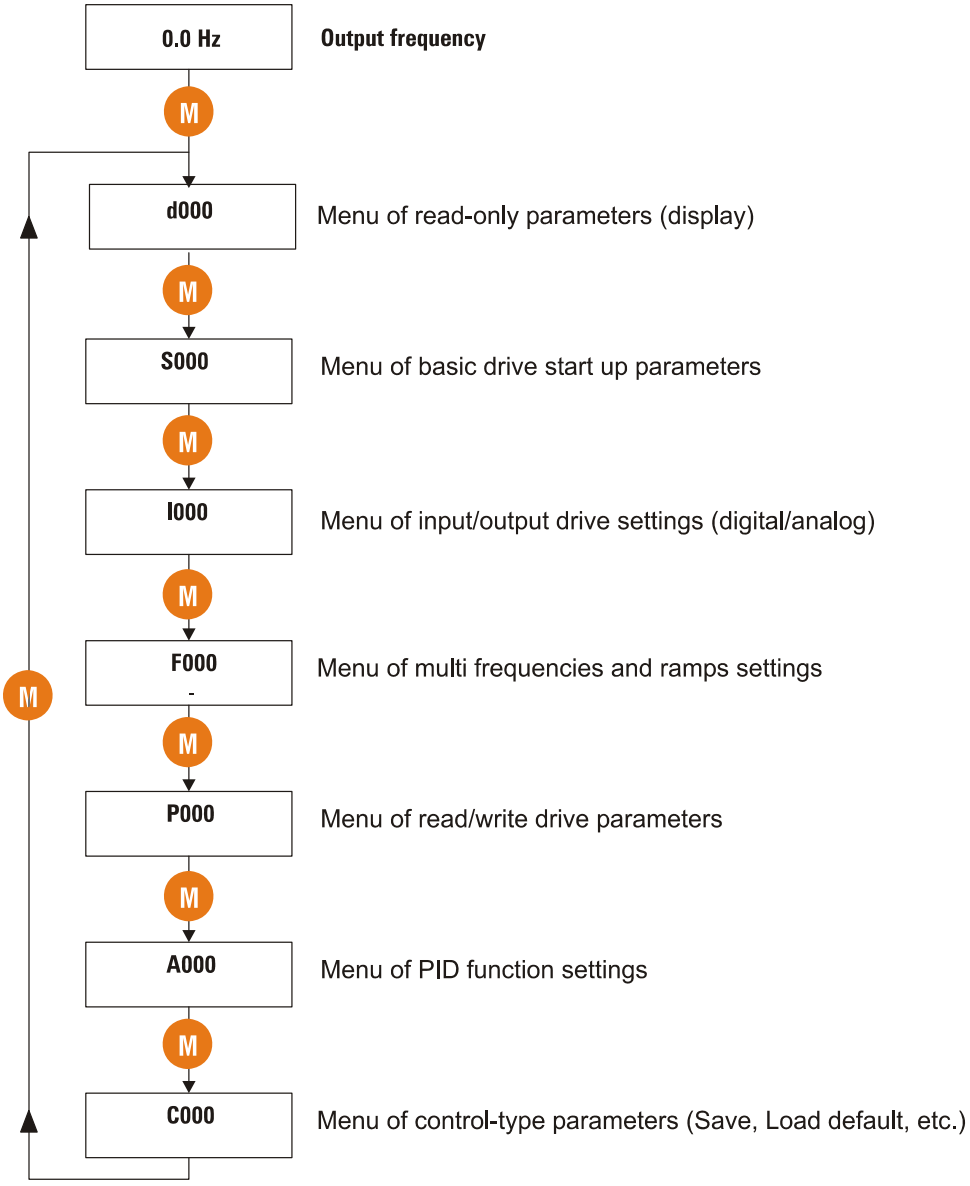
RUN (Green LED): Lit = motor running, Run command enabled and active*.

ALARM (Red LED): Lit = Drive alarm state.

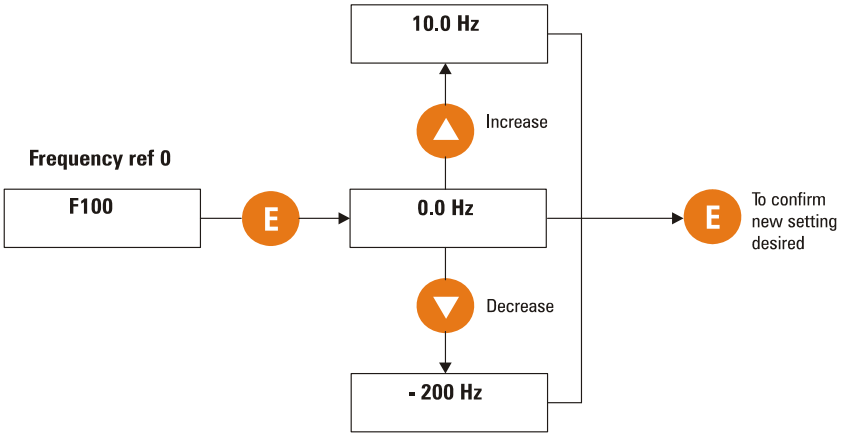
(*) NOTE: The green LED flashes to indicate the the motor stall prevention function is active.

6.2 Navigating the menus

When the drive is powered on, the display automatically shows parameter **d.000 [Output frequency]** in the DISPLAY menu.



Example: how to change a frequency reference (FREQ & RAMP menu).



6.5 Quick setup

Step	Setup sequence	What to do
1	Go to the S - Startup menu	Press the "M" key to access the Startup menu.
2	Set drive mains voltage	Got to parameter **S.000** and enter the drive's mains voltage: 220V or 240V.
3	Set drive mains frequency	Go to parameter **S.001** and enter the drive's mains frequency: 50Hz or 60Hz.
4	Set maximum drive output voltage	Go to parameter **S.100** and enter the maximum voltage the drivecan output to the motor (see data plate).
5	Set nominal frequency of motor	Go to parameter **S.101** and enter the nominal frequency of the motor (see date plate).
6	Set nominal current of motor	Go to parameter **S.150** and enter the nominal current of the motor (see data plate).
7	Set number of motor terminal pairs	Go to parameter **S.151** and enter the number of motor terminalpairs (terminals/2).
8	Set the power factor of the motor	Go to parameter **S.152** and enter the motor's power factor (cos phi) (see data plate).
9	Set control mode	Go to parameter **S.200** and enter the drive's control mode: - selection [1] = START&STOP via terminals (default) - selection [3] = START&STOP via serial line [see menu H]
10	Set the maximum reference frequency	Go to parameter **S.201** and enter the maximum threshold for the drive's reference frequency (analog and/or digital).
11	Set the reference source	Go to parameter **S.202** and enter the source of the drive's frequency reference: - selection [1] = Reference from analog input 1 (default) - selection [3] = Digital reference from parameter **S.203** Note! Go to parameter **S.203** and enter the digital reference frequency (if relevant).
12	Set drive acceleration and deceleration ramp times	Go to parameter **S. 300** and enter the acceleration ramp time (default = 5 secs). Go to parameter **S. 301** and enter the deceleration ramp time (default = 5 secs).
13	Set % manual voltage boost	Go to parameter **S.400** and enter the % of manual low speed voltage boost (if relevant)
14	Auto-calibrate motor stator resistance	Go to parameter **S.900** and activate the procedure for auto-calibrating motor stator resistance: - activate the procedure with "do" + "E"
15	Save parameters	Go to the parameter **S.901** and activate the procedure for saving parameters in the drive's non-volatile memory.

NOTE! See section 7.3 later in this manual for further information on enabling the automatic voltage boost function (**S.400**)and setting motor slip compensation (**S.450 & S.451**).

Chapter 7 - Parameter Description

7.1 Parameters List

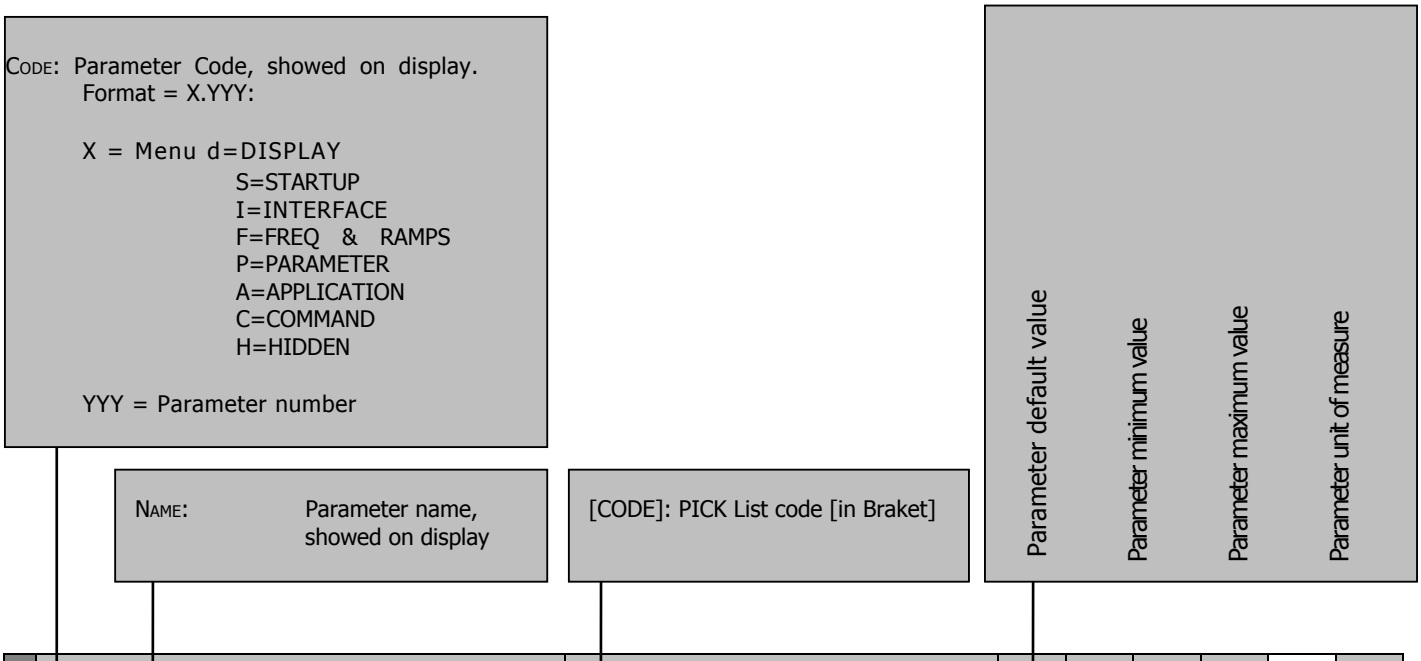
Legend of drive menu contents.

Menu d - DISPLAY	Menu of read-only parameters (display)
Menu S - STARTUP	Menu for basic drive start up
Menu I - INTERFACE	Menu of input/output settings (digital/analog)
Menu F - FREQ & RAMP	Menu of multi frequencies and ramps settings
Menu P - PARAMETER	Menu for drive regulation and optimization
Menu A - APPLICATION	Menu for PID function settings
Menu C - COMMAND	Menu of control-type parameters (Save, Load default, etc.)
Menu H - HIDDEN	Menu not available on the keypad. It is reserved to set the drive parameters through Serial line and/or through Field bus cards.

NOTE! In this chapter are described the functions of each drive parameter.

Anyway, the chapter 7 reports the description of the code and the name of each single parameter.

Figure 7.1: Parameters Description Legend



S.MENU	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
START-UP											
POWER SUPPLY	S.000	Mains voltage	Rated value of the line voltage	110 220 230 240	110V 220V 230V 240V	230	110	240	V		404 *(P.020)*
	S.001	Mains frequency	Rated value of the line frequency	50 60	50Hz 60Hz	(****)	(****)	(****)	Hz		405 (P.020)

NOTE! *(ALIAS):* On STARTUP menu only. Parameter code of same parameter on other menu .

(*): Parameter value dependent of the drive size.

(**): Parameter value dependent of the drive nominal main voltage and main frequency.

(***): Value dependent of the setting of another parameter.

(****): Value dependent of the drive type: 230 ....

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
	DISPLAY										
Basic	d.000	Output frequency	Drive outpu1t frequency						Hz	0.01	001
	d.001	Frequency ref	Drive frequency reference						Hz	0.01	002
	d.002	Output current	Drive output current (rms)						A	0.1	003
	d.003	Output voltage	Drive output voltage (rms)						V	1	004
	d.004	DC link voltage	DC Bus drive voltage (DC)						V	1	005
	d.005	Power factor	Power factor							0.01	006
	d.006	Power [kW]	Power						kW	0.01	007
	d.007	Output speed	Drive output speed (d.000)*(P.600)		P602 select Krpm e K				Hz RPM	0.01/ 1	008
	d.008	Speed ref	Drive speed reference (d.001)*(P.600)		P602 select Krpm e K				Hz RPM	0.01/ 1	009
	d.009	Estimate speed	Estimated drive speed		P602 select Krpm e K				Hz	0.01/ 1	062
Overload	d.050	Heatsink temp	Drive heatsink temperature (linear sensor measured)						°C	1	010
	d.051	Drive OL	Drive overload (100% = alarm threshold)						%	0.1	011
	d.052	Motor OL	Motor overload (100% = alarm threshold)						%	0.1	012
Input/Output	d.100	Dig inp status	Digital inputs acquired by the drive (terminal or virtual)								014
	d.101	Term inp status	Digital inputs terminal of the drive regulation board								015
	d.102	Vir dig inp stat	Virtual digital inputs received by drive serial link or field bus card								016
	d.150	Dig out status	Digital outputs executed by the drive (terminal or virtual)								020
	d.151	Term dig out sta	Digital outputs terminal of the drive regulation board								021
	d.152	Vir dig out stat	Virtual digital outputs executed by drive serial link or field bus card								022
	d.200	An in 1 cnf mon	Analog input 1 destination; it shows where the signal is programmed	[0] Null funct [1] Freq ref 1 [2] Freq ref 2 [3] Bst lev fact [4] OT lev fact [5] Vred lev fac [6] DCB lev fact [7] Ramp Ext fact [8] Freq Ref Fact							026
	d.201	An in 1 monitor	Analog input 1 output of input block % value								027
	d.202	An in 1 term mon	Analog input 1 terminal block % value								028

	d.210	An in 2 cnf mon	Analog input 2 destination; it shows where the signal is programmed	[0] Null funct [1] Freq ref 1 [2] Freq ref 2 [3] Bst lev fact [4] OT lev fact [5] Vred lev fact [6] DCB lev fact [7] Ramp Ext fact [8] Freq ref fact						029
	d.211	An 2 monitor	Analog input 2 output of input block % value								030
	d.212	An in 2 term mon	Analog input 2 terminal block % value								031
	d.290		Riservato								066
	d.291		Riservato								067
PID	d.400	PID reference	PID reference signal				-A009	A009			041
	d.401	PID feedback	PID feedback signal				-A009	A009			042
	d.402	PID error	PID error signal				-A009	A009			043
	d.403	PID integr comp	PID integral component						%	0.1	044
	d.404	PID output	PID output signal						%	0.1	045
Alarm List	d.800	1st alarm-latest	Last alarm stored by the drive alarm list								046
	d.801	2nd alarm	Second to last alarm								047
	d.802	3rd alarm	Third to last alarm								048
	d.803	4th alarm	Fourth to last alarm								049
Drive Identification	d.950	Drive rated curr	Drive rated current (it depends on the drive size)								050
	d.951	SW version (1/2)	Software version - part 1								051
	d.952	SW version (2/2)	Software version - part 2							0.1	052
	d.953	Power ident code	Reseved							0.01	053
	d.954	Param ident code	Reseved							0.01	05 4
	d.955	Regul ident code	Reseved								055
	d.956	Startup id code	Reseved								056
	d.957	Drive size	Drive size code								057
	d.999	Display Test	Drive display test								099

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
START-UP											
Power	S.000	Mains voltage	Rated value of the line voltage	110 220 230 240	110V 220V 230V 240V	230	110	240	V		404 *(P.020)*
	S.001	Mains frequency	Rated value of the line frequency	50 60	50Hz 60Hz	50	50	60	Hz		405 *(P021)*
V/f	S.100	Max out voltage	Maximum value of the voltage applied to the motor			(**)	50	(**)	V		413 *(P061)*
	S.101	Base frequency	Rated frequency of the motor			(**)	25	1000	Hz	1	41 4 *(P062)*
Motor Data	S.150	Motor rated curr	Rated current of the motor			(*)	(*)	(*)	A	0.1	406 *(P040)*
	S.151	Motor pole pairs	Pole Pairs of the motor			2	1	60		0.1	407 *(P041)*
	S.152	Motor power fact	Motor power factor			(*)	0.01	1		0.01	408 *(P042)*
	S.153	Motor stator R	Measurement of the stator resistance of the motor			(*)	0	99.99	ohm	0.01	409 *(P043)*
Commands & Referencies	S.200	Cmd source sel	Source of the START and STOP commands	[0] Keypad [1] Terminals [2] Virtual [3] H-command	START&STOP via keypad (+24V between 5 & 8 terminals required) START &STOP via terminal Main command via Virtual & Terminal setting Main command via serial line RS485	1	0	3			400 *(P000)*
	S.201	Max ref freq	Maximum frequency reference threshold and / or digital reference (both directions)			(****)	25	1000	Hz	0.1	305 *(F.020)*
	S.202	Ref 1 channel	Source of the Reference 1	[0] Null [1] Analog inp 1 [2] [3] Freq ref x [4] Multispeed [5] Motorpotent [6] [7] [8]	Null Analog input 1 Not used Frequency reference S.203 (F.100) Multi frequencies Motorpotientometer reference Not used Not used Not used	3	0	8			307 *(F.050)*
	S.203	Frequency ref 0	Digital speed reference (F.100)			0	-S.201	S.201			311 *(F.100)*
	S.300	Acc time 1	Acceleration ramp delay time 1			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	329 *(F.201)*
	S.301	Dec time 1	Deceleration ramp delay time 1			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	330 *(F.202)*
	S.400	Manual boost [%]	Manual boost at low revolutions			3	0	25	% of S.100		421 *(P120)*
	S.401	Auto boost en	Automatic boost function enabling	[0] Disable [1] Enable	Automatic boost function disabled Automatic boost function enabled	0	0	1			423 *(P122)*
Functions	S.450	Slip compensat	Slip compensation			0	0	150	%		419 *(P.100)*
	S.451	Slip comp filter	It is the response time for the reaction of the function			0.5	0	10	sec		420 *(P.101)*
Utility	S.900	Measure stator R	Motor tuning command	Confirm? NO Confirm? YES	No action Autotune command execution	OFF	OFF	DO		0.1	806 *(C.100)*
	S.901	Save parameters	Save parameters	Confirm? NO Confirm? YES	No action Save parameters command execution	OFF	OFF	DO			800 *(C.000)*

Digital Inputs Commands of the Regulation Board

PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
INTERFACE										
I.000	Dig input 1 cfg	Digital Input 1 configuration	[0] None [1] Run [2] Reverse [3] Ext Fault NO [4] Ext Fault NC [5] Alarm reset [6] Jog [7] Freq sel 1 [8] Freq sel 2 [9] Freq sel 3 [10] Freq sel 4 [11] Ramp sel 1 [12] Ramp sel 2 [13] Enable NO [14] Enable NC [15] DCBrake en [16] DCBrake [17] Autocapature [18] Ramp enable [19] Zero ref [20] PID enable [21] PID Freeze [22] PID gain sel [23] Motorpot Up [24] Motorpot Dn [25] Reset Motorpot [26] Fast stop [27] Zero freq [28] Stop 3-wire [29] Start+freq sel 1 [30] Start+freq sel 2 [31] Start+freq sel 3	Not active RUN command for the motor START Speed REVERSE command External fault with NO (Normal Open) contact External fault with NC (Norm. Closed) contact Alarm reset command JOG frequency reference enabling Binary selection for Multispeed Binary selection for Multispeed Binary selection for Multispeed Binary selection for Multispeed Binary selection for Multiramp Binary selection for Multiramp Drive Enable with NC (Norm. Closed) contact Drive Enable with NO (Normal Open) contact Enabling of the DC braking function Command for execution of DC braking Execution of the flying restart Enabling / Disabling of the Ramp block Ramp to 0Hz & main commands active Enabling of the PID regulation. Enabling PID freeze output signal. Selection of the PID regualtor gain. Motorpotentiometer reference increasing Motorpotentiometer reference decreasing Reset of Motorpotentiometer ref. Emergency stop Enabling output freq. to zero. Stop command (NC) 3-wires mode (P001=2) RUNcommand+binary selection for multispeed RUNcommand+binary selection for multispeed RUNcommand+binary selection for multispeed	1	0	31			100
I.001	Dig input 2 cfg	Digital Input 2 configuration	As for 1.000		3	0	31			101
I.002	Dig input 3 cfg	Digital Input 3 configuration	As for 1.000		2	0	31			102
I.003	Dig input 4 cfg	Digital Input 4 configuration	As for 1.000		7	0	31			103
I.004	Dig input 5 cfg	Digital Input 5 configuration	As for 1.000	Associate an analog input 1 if I.200=3	0	0	31			104
I.005	Dig input 6 cfg	Digital Input 6 configuration	As for 1.000	Associate an analog input 2 if I.210=3	0	0	31			

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT CODE	VARIATION NAME	TPA (ALIAS) DESCRIPTION
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
Digital Output State Regulation Board	I.100	Dig output 1 cfg	Digital Output 1 configuration	[0] Drive ready [1] Alarm state [2] Not in alarm [3] Motor running [4] Motor stopped [5] REV Rotation [6] Steady state [7] Ramping [8] UV running [9] Out trq>thr [10] Current lim [11] DC-link lim [12] Limit active [13] Autocapt run [14] Reserved [15] Neg pwrfact [16] PID err>< [17] PID err>thr [18] PID err<thr [19] PID er><(inh) [20] PID err>(inh) [21] PID err<(inh) [22] Reserved [23] Reserved [24] Reserved [25] Reserved [26] Extern fault [27] No ext fault [28] Serial T0 [29] freq=thr1 [30] freq≠thr1 [31] freq>thr1 [32] freq<thr1 [33] freq=thr2 [34] freq≠thr2 [35] freq>thr2 [36] freq<thr2 [37] HS temp=thr [38] HS temp≠thr [39] HS temp>thr [40] HS temp<thr [41] Output freq	Drive ready to start Positive logic for alarm signalling Negative logic for alarm signalling Run command active (Fwd, Rev, DCB) Run command not active and frequency = 0Hz Anti-clockwise rotation of the motor. Motor is running in steady state.(No Ramp) Acceleration or Deceleration Ramp on progress. Undervoltage detectetion during motor running. Output torque higher than the value of P.241. Current limit (during ramp or at steady state). DC Bus limit (during ramp or at steady state). General signalling of drive limit condition. Autocapture on progress. Reserved. Negative condition of the power factor . PID error is >A.058 & <=A.059. PID error is >A.058. PID error is <=A.059. PID error is >A.058 & <=A.059 (see chapter 7.7). PID error is >A.058 (see chapter 7.7). PID error is <=A.059 (see chapter 7.7). Positive logic for Ext. fault alarm signalling. Negative logic for Extern. fault alarm signalling. Serial link communication time out. Output frequency = to P.440 & P.441 values. Output frequency ≠ of P.440 & P.441 values. Output frequency > than P.440 & P.441 values. Output frequency < than P.440 & P.441 values. Output frequency = to P.442 & P.443 values. Output frequency ≠ of P.442 & P.443 values. Output frequency > than P.442 & P.443 values. Output frequency < than P.442 & P.443 values. Heatsink temp = to P.480 & P.481 values. Heatsink temp ≠ of P.480 & P.481 values. Heatsink temp > than P.480 & P.481 values. Heatsink temp < than P.480 & P.481 values. Frequency in synchronism with output frequency.	1	0	52			112

PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
			[42] Out freq x 2	Frequency value x 2 in synchronism with output frequency.						
			[43] Out Coast Thru	Coast thru stopping.						
			[44] Out Emg Stop	Emergency stop.						
			[45]	Not used						
			[46] I.180=thresh	Value selected by I.180=I.181&I.182						
			[47] I.180≠thresh	Value selected by I.180≠I.181&I.182						
			[48] I.180>thresh	Value selected by I.180>I.181&I.182						
			[49] I.180<thresh	Value selected by I.180<I.181&I.182						
			[50]I.180<threshod with RUN command	Value selected by I.180<I.181&I.182 only when running.						
			[51] Steady state with RUN command	Motor rotation in steady state only if running						
			[52] Alarm pulse code	Alarm pulse code						
	I.101	Dig output 2 cfg	Digital Output 2 configuration	As for 1.100	41	0	52			113
	I.180	Source selection	Values to compare	[0] None [1] Analog in 1 [2] Analog in 2 [3] Analog in 3 [4] Analog out 1 [5] Analog out 2 [6] Analog out Exp 1 [7] Output frequency [8] Reference frequency [9] Encoder frequency [10] Output voltage [11] DC link voltage [12] Output current [13] Power factor [14] Power [kW] [15] Heatsink temp [16] Regulation temperature [17] Drive overLoad [18] Motor overLoad [19]Resistor overLoad (d.053)	Not active Analog input 1 (d.201) Analog input 2 (d.211) Analog input 3 (d.221) Analog output 1 (d.250) Analog output 2 (d.260) Analog output expansion 1 (d.270) Output frequency (d.000) Reference frequency (d.001) Encoder frequency (d.301) Output voltage (rms) (d.003) Link voltage (Vdc) (d.004) Output current(rms) (d.002) Power factor (cosφ) (d.005) Output power (d.006) Heatsink temperature (d.050) Regulating board temperature (d.054) Drive overload (d.051) Motor overload (d.052) Braking resistance overload (d.053)	0	0	19		1	185
	I.181	Thershold level	Signal threshold level		0.0	0	100.0	%	0.1	186
	I.182	Hysteresis/toller ance level	Signal-threshold hysteresis(I.181)		0.5	0.1	50.0		0.1	187
	I.183	Signalling delay	Signalling delay		0.1	0.0	25.0	sec	0.1	188
	I.200	An in 1 Type	Setting of the Analog Input 1 type reference	[1]0-10V/0-20mA [2]4-20mA [3]Digital [4]4-20mA w/chk	Unipolar 0-10V o 0-20mA Unipolar 4-20mA Digital Unipolar 4-20mA with segnalation if <4mA(J5on)	1	1	4			118
	I.201	An in 1 offset	Analog Input 1 offset			0	-99.9	99.9			119
	I.202	An in 1 gain	Analog Input 1 gain			1.00	-9.99	9.99			120
	I.203	An in 1 minimum	An Input 1 minimun value			0	0	99.99			121
	I.204	An in 1 filter	Response time of the signal reaction			0.1	0.001	0.25	sec		122
	I.205	An in 1 clip level				0.5	0	25.0			181

I.210	An in 2 Type	Setting of the Analog Input 2 type reference	[1]0-10V [2]Reserved [3]Digital [4]Reserved	Unipolar 0-10V Digital	1	1	4			123
I.211	An in 2 offset	Analog Input 2 offset			0	-99.9	99.9			124
I.212	An in 2 gain	Analog Input 2 gain			1.00	-9.99	9.99			125
I.213	An in 2 minimum	An Input 2 minimun value			0	0	99.99			126
I.214	An in 2 filter	Response time of thesignal reaction			0.1	0.001	0.25			127
I.215	An in 2 clip level				0.5	0	25.0			182
I.400	1np by serial en	Virtual Digital enabling			0	0	255			145
I.420	Out by serial en	Virtual Digital Outputs setting enabling			0	0	15			147
I.600	Serial link cfg	Serial line configuration protocol & mode	Protocol type [0] Foxlink 7E1 [1] Foxlink 7O1 [2] Foxlink 7N2 [3] Foxlink 8N1 [4] ModBus 8N1 [5] JBus 8N1 [6] [7] [8] [9] Remote keypad	PROT Type BIT Parity S Foxlink 7E1 7 Even 1 Foxlink 7O1 7 Odd 1 Foxlink 7N2 7 None 2 Foxlink 8N1 8 None 1 ModBus 8N1 8 None 1 Jbus 8N1 8 None 1 Reserved Reserved Reserved Remote keypad	4	0	9		0.1	155
I.601	Serial link bps	Serial line baudrate	[0] 600 baud [1] 1200 baud [2] 2400 baud [3] 4800 baud [4] 9600 baud [5] 19200 baud [6] 38400 baud	600 baud rate 1200 baud rate 2400 baud rate 4800 baud rate 9600 baud rate 19200 baud rate 38400 baud rate	4	0	6			156
I.602	Device address	Serial line address of the drive			1	0	99		1	157
I.603	Ser answer delay	Serial line answer delay time			1	0	250	msec	1	158
I.604	Serial timeout	Serial line transmission timeout			0	0	25	sec	0.1	159
I.605	En timeout alm	Setting time out alarm	[0] Disable [1] Enable	Drive NOT in alarm and signal on a digital output Drive IN alarm and signal on a digital output	0	0	1			160

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
	FREQ & RAMP										
Motorpotentiometer	F.000	Motorpot ref	Motopot reference (it can be set using up and down commands)			0	0	F.020	Hz	0.01	300
	F.001	Motorpot ref unit	Unit of measure reference								343
	F.010	Acc/Dec time mp	Motorpot Accel. and Decel. ramp time			10	0.1	999.9	sec	0.1	301
	F.011	Motorpot offset	Motopotentiometer minimum reference			0	0	F.020	Hz	0.1	302
	F.012	Mp output mode	Unipolar / bipolar Motorpotentiometer	[0] Unipolar [1] Bipolar	Motorpotentiometer unipolar Motorpotentiometer bipolar	0	0	1			303
	F.013	Mp auto save	Motopotenziometer auto save function	[0] Disable [1] Enable	Motorpot auto save function disabled Motorpot auto save function enabled	0	0	1			304
Reference Limit	F.020	Max ref freq	Motor maximum frequency value (for both the directions)			(****)	25	1000	Hz	0.1	305
	F.021	Min ref freq	Minimum frequency value			0	0	50	Hz	0.1	306
Reference Sources	F.050	Ref 1 channel	Source of the Reference 1	[0] Null [1] Analog inp 1 [2] [3] Freq ref x [4] Multispeed [5] Motorpotent [6] [7] [8]	Null Analog input 1 Not used Frequency reference S.203 (F.100) Multi frequencies Motorpotientometer reference Not used Not used Not used	3	0	8			307
	F.051	Ref 2 channel	Source of the Reference 2	[0] Null [1] Analog inp 2 [2] [3] Freq ref x [4] Multispeed [5] Motorpotent [6] [7] [8]	Null Analog input 2 Not used Frequency reference F.101 Multi frequencies Motorpotientometer reference Not used Not used Not used	0	0	8			308
	F.060	MltFrq channel 1	Source of the Multispeed 1		As for F.050, Reference 1 source	3	0	8			309
	F.061	MltFrq channel 2	Source of the Multispeed 2		As for F.051, Reference 2 source	3	0	8			310
	F.080	Ref fact source	Selector source factor multiplier reference	[0] Disabled [1] Analog inp 1 [2] Analog inp 2 [3] Analog inp 3		0	0	3			342
Multi Frequency Function	F.100	Frequency ref 0	Digital Reference frequency 0			0	-F.020	F.020	Hz	0.1	311
	F.101	Frequency ref 1	Digital Reference frequency 1			0	-F.020	F.020	Hz	0.1	312
	F.102	Frequency ref 2	Digital Reference frequency 2			0	-F.020	F.020	Hz	0.1	313
	F.103	Frequency ref 3	Digital Reference frequency 3			0	-F.020	F.020	Hz	0.1	314
	F.104	Frequency ref 4	Digital Reference frequency 4			0	-F.020	F.020	Hz	0.1	315
	F.105	Frequency ref 5	Digital Reference frequency 5			0	-F.020	F.020	Hz	0.1	316

	F.106	Frequency ref 6	Digital Reference frequency 6			0	-F.020	F.020	Hz	0.1	317
	F.107	Frequency ref 7	Digital Reference frequency 7			0	-F.020	F.020	Hz	0.1	318
	F.116	Jog frequency	Jogging frequency reference			1	-F.020	F.020	Hz	0.1	327
	F.200	Ramp resolution	Accuracy of the ramp setting	[0] 0.01s [1] 0.1s [2] 1s	From 0.01s to 99.99s From 0.1s to 999.99s From 1s to 9999s	1	0	2			328
	F.201	Acc time 1	Acceleration ramp time delay 1			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	329
	F.202	Dec time 1	Deceleration ramp time delay 1			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	330
	F.203	Acc time 2	Acceleration ramp time delay 2			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	331
	F.204	Dec time 2	Deceleration ramp time delay 2			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	332
	F.205	Acc time 3	Acceleration ramp time delay 3			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	333
	F.206	Dec time 3 / FS	Deceleration ramp time delay 3 / Fast Stop decel.			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	334
	F.207	Acc time 4 / Jog	Accel. ramp time delay 4 / Accel. time in jogging state			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	335
	F.208	Dec time 4 / Jog	Decel. ramp time delay 4 / Decel. time in jogging state			5	0.1 (***)	999.9 (***)	sec	0.1 (***)	336
	F.250	Ramp S-shape	S Ramp shaping			0	0	10	sec	0.1	337
	F.260	Ramp extens src	Source for the Ramp time extension function	[0] Null [1] Analog inp 1 [2] Not used [3] Not used	Null Analog input 1	0	0	3			338
Jump frequency	F.270	Jump amplitude	Jump frequencies hysteresys			0	0	200	Hz	0.1	339
	F.271	Jump frequency 1	Jump frequency 1			0	0	999.9	Hz	0.1	340
	F.272	Jump frequency 2	Jump frequency 2			0	0	999.9	Hz	0.1	341

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
	PARAMETER										
Commands	P.000	Cmd source sel	It defines the use of START and STOP commands	[0] Keypad [1] Terminals [2] Virtual [3] H-command	START&STOP via keypad (+24V between 5 & 8 terminals required) START &STOP via terminal Main command via Virtual & Terminal setting Main command via serial line RS485	1	0	3			400
	P.001	RUN input config	Command logic	[0] Run / Rev [1] Fwd / Rev [2] 3 wire mode	Disable negative rotation of the motor. Enable negative rotation of the motor. Three wires command start e stop pulsed +Reverse	0	0	2			401
	P.002	Reversal enable	Reversal enabling	[0] Disable [1] Enable	Disabling of the HW reverse command Enabling of the HW reverse command	1	0	1			402
	P.003	Safety	Safe start definition	[0] OFF [1] ON	START allowed with RUN temirnal connected at the power on START not allowed with RUN temirnal connected at the power on	1	0	1			403
	P.004	Stop mode	Motor stop control function	[0] In ramp [1] Ramp to stop	Decel. ramp up to 0Hz. Ramp to stop	0	0	1			493
	P.005	Deflt rot mode	Invert sense rotation	[0] Disable [1] Enable	Disabled function Invert sense rotation	0	0	1			502
Power Supply	P.020	Mains voltage	Rated value of the line voltage	110 220 230 240	110V, 220V, 230V, 240V,	(****)	(****)	(****)	V		404
	P.021	Mains frequency	Rated value of the line voltage frequency	50 60	50Hz 60Hz	(****)	(****)	(****)	Hz		405
Motor Data	P.040	Motor rated curr	Rated current of the motor			(*)	(*)	(*)	A	0.1	406
	P.041	Motor pole pairs	Pole Pairs of the motor			2	1	60			407
	P.042	Motor power fact	Motor power factor			(*)	0.01	1		0.01	408
	P.043	Motor stator R	Measurement of the stator resistance of the motor			(*)	0	99.99	ohm	0.01	409
	P.044	Motor cooling	Motor type cooling	[0] Natural [1] Forced	Self ventilated Assisted ventilation	100	0	200	%		410
	P.045	Motor thermal K	Motor thermal constant			30	1	120	min		411
V/F Curve	P.046	Motor nom slip	Motor nominal slip			(***)	0	25.0	%		501
	P.047	Motor nom eff	Motor nominal efficency			(**)	50	100	%		50 4
	P.060	V/f shape	V/F Curve Type	[0] Custom [1] Linear [2] Quadratic	V/F curve defined by the user Linear characteristic Quadratic characteristic	1	0	2			412
	P.061	Max out voltage	Maximum output voltage			(**)	50	(**)	V	1	413
	P.062	Base frequency	Base frequency			(**)	25	999.9	Hz	0.1	41 4
	P.063	V/f interm volt	V/F intermediate voltage			(*)	0	P.061	V		415
	P.064	V/f interm freq	V/F intermediate frequency			25	25	P.062	Hz	0.1	416
	P.080	Max output freq	Maximum output frequency			110	1	110	%	0.1	417

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
	P.081	Min output freq.	Minimum output frequency			0.0	0.0	25.0	% of F.020	0.1	418
Slip Comp.	P.100	Slip compensat	Slip compensation			0	0	150	%		419
	P.101	Slip comp filter	Time constant of slip compensation			0.5	0	10	sec	0.1	420
Boost	P.120	Manual boost [%]	Torque boost level			3	0	25	% of P.061		421
	P.121	Boost factor src	Boost level source	[0] Null [1] Analog inp 1 [2] [3]	Null Analog input 1 Not used Not used	0	0	3			422
Automatic flux regulation	P.122	Auto boost en	Automatic boost enabling	[0]Disable [1] Enable		0	0	1			423
	P.140	Magn curr gain	Magnetizing current regulator gain		Blocked	0	0	0	%	0.1	424
Anti oscillation function	P.160	Osc damping gain	Damping gain		Blocked	0	0	0			425
SW curr. clamp	P.180	SW clamp enable	Current clamp enable	[0] Disable [1] Enable	Blocked	0	0	0			426
Current Limit	P.200	En lim in ramp	Enable current limitation during ramp	[0] None [1] PI Limiter [2] Ramp freeze		2	0	2			427
	P.201	Curr lim in ramp	Current limit in ramp			150	20	160	% I nom		428
	P.202	En lim in steady	Enable current limitation in steady state	[0] Disable [1] Enable		1	0	1			429
	P.203	Curr lim steady	Current limit at constant speed			150	20	160	% I nom		430
	P.204	Curr ctrl P-gain	Current limiter proportional gain			3.0	0.1	100	%	0.1	431
	P.205	Curr ctrl I-gain	Current limiter integral gain			10.0	0.0	100	%	0.1	432
	P.206	Curr ctr feedfwd	Current limiter feed-forward			0	0	250	%		433
	P.207	Curr lim dec ramp	Current limiter deceleration ramp			150	20	160	% of I nom		494
	P.208	Minimum frequency in steady state current limitation	Minimum frequency in steady state current limitation			0.0	0.0	999.9	Hz		
	P.209	Not regenerative load	Not regenerative load	[0] Disable [1] Enable	the load is of the generic or "active" type the load is substantially of the inert type	1	0	1			

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
DC Link Limit	P.220	En DC link ctrl	Stall prevention during dec. for overvoltage	[0] None [1] PI Limiter [2] Ramp freeze		2	0	2	%		43 4
	P.221	DC-lnk ctr Pgain	DC link voltage limiter proportional gain		Significant with P.220=1	3.0	0.1	100	%	0.1	435
	P.222	DC-lnk ctr Igain	DC link voltage limiter integral gain		Significant with P.220=1	10.0	0.0	100	%	0.1	436
	P.223	DC-link ctr FF	DC link voltage limiter feed-forward		Significant with P.220=1	0	0	250	%	1	437
Over Torque Alarm Config	P.240	OverTorque mode	Overtorque mode	[0] No Alm,Chk on [1] No Alm,Chk ss [2] Alm always (no autorest) [3] Alm steady st (no autorest) [4] Alm always [5] Alm steady st	0: Overtorque detection always active and Overtorque alarm disabled. 1: Overtorque detection in steady state and Overtorque alarm disabled. 2: Overtorque detection always active and Overtorque alarm enabled. 3: Overtorque detection in steady state and Overtorque alarm enabled. 4: Overtorque detection always active and Overtorque	0	0	5			438
	P.241	OT curr lim thr	Current limit for overtorque			110	20	200	%		439
	P.242	OT level fac src	Overtorque level factor source	[0] Null [1] Analog inp 1 [2] [3]	Null Analog input 1 Not used Not used	0	0	3			440
	P.243	OT signal delay	Delay time for overtorque signaling			0.1	0.1	25	sec		441
Motor Overload Config	P.260	Motor OL proten	Enabling of motor overload protection	[0] Disable[1] Enable		1	0	1		0.1	444
	P.261	Ovl ref freq 1	Curve overload of freq. 1			0.0	0.0	(***)		0.1	522
	P.262	Ovl ref load 1	Load current of freq. 1			250	1	250		1	523
	P.263	Ovl ref freq 2	Curve overload of freq. 2			(***)	0.1	500.0		0.1	524
	P.264	Ovl ref load 2	Load current of freq. 2			250	1	250		1	525
DC Brake Config	P.300	DC braking level	DC braking level			0	0	100	% of I nom		449
	P.301	DCB lev fac src	DC braking level factor source	[0]Null [1] Analog inp 1 [2] [3]	Null Analog input 1 Not used Not used	0	0	3			450
	P.302	DC braking freq	Frequency for DC braking enabling			0	0	999.9	Hz	0.1	451
	P.303	DC braking start	DC braking time at start			0	0	60	sec	0.1	452
	P.304	DC braking stop	DC braking time at stop			0	0	60	sec	0.1	453
	P.320	Autocapture mode	Flying restart mode	[0] Disable [1] 1st run only [2] Always	Null Flying restar at power on Flying restart at runcommand	0	0	2			454
	P.321	Autocapture Ilim	Catch on flight current limit			120	20	160	% of I nom	0.1	456
	P.322	Demagnetiz time	Demagnetization minimun time			(*)	0.01	10	sec	0.01	457
	P.323	Autocap f scan t	Frequency scanning time during Pick Up			1	0.1	25	sec	0.1	458

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
Autocapture function	P.324	Autocap V scan t	Voltage scanning time during Pick Up			0.2	0.1	25	V		459
	P.325	Autocap spd src	Source of the reference for Pick Up function	[1] Frequency ref [2] Max freq ref [3] Last freq ref	From active frequency reference From the Max fre ref parameter From freq. set desired Not used	0	0	3			460
Auto brake	P.330	AutoBrake Mode	Automatic brake mode selection	[0] [1] [2]	Disabled Automatic brake depending on reference frequency and output Automatic brake depending on only output frequency	0	0	2			516
	P.331	AutoBrake Level	Automatic brake level			0	0	100	% of P.061	1	517
	P.332	AutoBrake Activation Frequency	Automatic brake activation frequency			0.0	0.0	999.9	Hz	0.1	518
	P.333	AutoBrake Deactivation Hysteresis	Automatic brake activation hysteresis			0.5	0.1	25.0	Hz	0.1	519
Undervoltage Config	P.340	Undervoltage thr	Undervoltage threshold			0	0	80	% of P.061		462
	P.341	Max pwrloss time	Restart time from undervoltage			0	0	25	sec	0.1	463
	P.342	UV alarm storage	Enabling of undervoltage alarm storage P.341	[0] Disable [1] Enable		1	0	1			464
	P.343	UV Trip mode	Undervoltage tripping mode	[0] Disabled [1] CoastThrough [2] Emg stop	Function disabled Coast Through mode Emergency stop mode	0	0	2			491
Overvol. Config	P.360	OV prevention	Automatic PickUp enabling after Overvoltage	[0] Disable [1] Enable		0	0	1			465
Autoreset config.	P.380	Autoreset attmps	Number of autoreset attempts			0	0	255			466
	P.381	Autoreset clear	En. automatic reset of autorestart attempts			5	0	250	min		467
	P.382	Autoreset delay	Autoreset time delay			1.0	0.1	50	sec	0.1	468
	P.383	Autores flt rly	Alarm relay contacts behaviour during autoreset	[0] OFF [1] ON		1	0	1			469
External fault config	P.400	Ext fault mode	External fault mode	Alm alw,No AR Alm run ,No AR Alm alw, Ares Alm run, ARes	- Drive in alarm Alarm always active Alarm autoreset is not possible. - Drive in alarm Alarm active only with running motor. Alarm autoreset is not possible. - Drive in alarm Alarm always active Alarm autoreset is possible. - Drive in alarm Alarm active only with running motor Alarm autoreset is possible.	0	0	3			470
	P.410	Ph Loss detec en	Phase Loss detection enabling	[0] Disable [1] Enable	Blocked	0	0	0			492
Voltage reduction config	P.420	Volt reduc mode	Voltage reduction mode	[0] Always [1] Steady state	Always Costant speed only	0	0	1			471
	P.421	V reduction fact	Output voltage reduction factor			100	10	100	% of P.061		472
	P.422	V fact mult src	Source of voltage reduction factor multiplier	[0] Null [1] Analog inp 1 [2] Analog inp 2 [3]	Null Analog input 1 Analog input 2 Reserved	0	0	3			473

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
Frequency Threshold	P.440	Frequency prog 1	Frequency 1 level detection			0.0	0.0	F.020	Hz	0.1	474
	P.441	Freq prog 1 hyst	Hysteresis amplitude related to P-420			0.5	0.0	F.020	Hz	0.1	475
Steady State	P.460	Const speed tol	Tolerance at constant speed			0.5	0.0	25.0	Hz	0.1	478
	P.461	Const speed dly	Ramp end signalling delay			0.2	0.0	25.0	sec	0.1	479
Heatsink Temp.	P.480	Heatsnk temp lev	Heatsink temperature signalling level		OHS alarm intervene at 80°	80	10	110	°C		480
	P.481	Heatsnk temp hys	Hysteresis band related to (P. 480)			5	0	10	%		481
PWM Settings	P.500	Switching freq	Modulation frequency	[0] 1kHz [1] 2kHz [2] 3kHz [3] 4kHz [4] 6kHz [5] 8kHz [6] 10kHz [7] 12kHz [8] 14kHz [9] 16kHz [10] 18kHz [11] Reserved		(*)	0	10			482
	P.501	Sw freq reducen	Enabling of switching frequency reduction under 5Hz from P.500 to P.502	[0] Disable [1] Enable	Under 5Hz and sink temp rise	0	0	1			483
	P.502	Min modul freq	Minimum frequency modulation			7	0	P500			495
	P.503	Flat sw enable	Enabling modulation flat	[0] Disable [1]Enable	Sinusoidal modulat. Flat modulat.	1	0	1			503
	P.520	Overmod max lev	Overmodulation level			50	0	100	%		484
	P.540	Out Vlt auto adj	Automatic adjustment of output voltage	[0] Disable [1] level 1 [2] level 2 [3] level 3 [4] level 4 [5] level 5 [6] level 6	Min - - - - max	6	0	6			485
Dead Time Comp.	P.560	Deadtime cmp lev	Dead times compensation limit		Reserved	0	0	0			486
	P.561	Deadtime cmp slp	Dead times compensation slope		Reserved	0	0	0			487
Display Setting	P.580	Startup display	Display IPA at start up			1	1	1999		1	488
	P.600	Speed dsply fact	Mantissa Constant conversion		Used to display d.007-8-9 and F.001 computation	1	0.01	99.99		0.01	489
	P.601	Exponent of constant conversion			Used to display d.007-8-9 and F.001 computation	0	-4	1			496
	P.602	Speed unit select	Selector Krpm and K time d.007-d.008-d.009- F.001_	[0] Hz [1] Hz * K [2] RPM [3] RPM * K	display Hz K defined by P.600-P.601 display RPM (Hz*Krpm) K defined by P.600-P.601	2	0	3			497
Protection	P.998	Menu enable mask									500
	P.999	Param prot code	Parameters protection code		0 : All parameters are not protected 1 : Parameters F.100...F.116 are not protected; protected the others. 2 : All parameters are protected. 3 : All parameters are not protected; storage allowed while motor running. NOT RECOMMENDED.	0	0	3			490

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
	APPLICATION										
PID Settings	A.000	PID mode	PID mode	[0] Disable [1] Freq sum [2] Freq direct [3] Volt sum [4] Volt direct [5] Stand alone [6] St-Al always	Null PID out in sum with ramp out ref (Feed forward) PID out not in sum with ramp out ref (no Feed forward) PID out not in sum with voltage ref (no Feed forward) PID out not in sum with voltage ref (no Feed forward) PID function as generic control (only with drive in RUN) PID function as generic control (any drive status)	0	0	6			1200
	A.001	PID ref sel	PID reference selector	[0] Null [1] Analog Inp 1 [2] Analog Inp 2 [3] [4] Frequency ref [5] Ramp output [6] Digital ref [7]	Null Analog input 1 Analog input 2 Reserved Frequency reference Ramp output Internal reference Reserved	0	0	7			1201
	A.002	PID fbk sel	PID feedback selector	[0] Null [1] Analog Inp 1 [2] Analog Inp 2 [3] [4] [5] Output curr [6] Output torque [7] Output power	Null Analog input 1 Analog input 2 Reserved Reserved Output peak current Output torque Output power	0	0	7			1202
	A.003	PID digital ref	PID digital reference			0	-A009	A009	%	0.01	1203
	A.004	PID activat mode	PID active in steady state only	[0] Always [1] Steady state		0	0	1			120 4
	A.006	PID err sign rev	Error sign reversal	[0] Disable [1] Enable		0	0	1			1206
	A.007	PIDInteg init en	Integral term initialization at start	[0] Disable [1] Enable		0	0	1			1207
	A.008	PID update time	PID updating time			0	0	2.5	sec	0.01	1208
	A.009	PID user display constant				1.00	0.01	100		0.01	1219
PID Gains	A.050	PID Prop gain 1	Proportional term gain 1			0	0	99.99		0.01	1209
	A.051	PID Int tconst 1	Integral action time 1			99.99	0	99.99		0.01	1210
	A.052	PID Deriv gain 1	Derivative action time 1			0	0	99.99		0.01	1211
	A.053	PID Prop gain 2	Proportional term gain 2			0	0	99.99		0.01	1212
	A.054	PID Int tconst 2	Integral action time 2			99.99	0	99.99		0.01	1213
	A.055	PID Deriv gain 2	Derivative action time 2			0	0	99.99		0.01	121 4
PID Limits	A.056	PID high limit	PID output upper limit			100	-100	100	%	0.1	1215
	A.057	PID low limit	PID output lower limit			-100	-100	0	%	0.1	1216
	A.058	PID max pos err	PID max. positive error			5	0.1	100	%	0.1	1217
	A.059	PID min neg err	PID max. negative error			5	0.1	100	%	0.1	1218
	A.060	PID output max step	Maximum PID output variation			25.0	0.1	25.0	%	0.1	1224
	A.100	Reserved				0	0	240		1	1220
	A.101	Reserved				0.010	0.001	0.2		0.001	1221
	A.102	Reserved				10	1	120		1	1222
	A.103	Reserved				0.020	0.001	0.2		0.001	1223

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA (ALIAS)
	CODE	NAME	DESCRIPTION	[CODE] FUNCTION	DESCRIPTION						
	COMMAND										
Basic	C.000	Save parameters	Save parameters command	off do	No action. Save parameters command.	off	off	do			800
Basic	C.001	Recall param	Recall of the previous stored parameters	off do	No action. Recall previously parameters set.	off	off	do			801
Basic	C.002	Load default	Recall of the factory parameters.	off do	No action. Load default parameters.	off	off	do			802
Alarm res	C.020	Alarm clear	Completer reset of the the Alarm List register	off do	No action. Clear alarm register command.	off	off	do			803
External Key	C.040	Recall key prog	Recalling and storage of the parameters in the external key	off do	No action. Recall parameter from key.	off	off	do			804
External Key	C.041	Save pars to key	Storage of the inverter parameter on the external key	off do	No action. Storage parameters to key.	off	off	do			805
Tuning	C.100	Measure statorR	Motor Autotune command	off do	No action. Autotune command.	off	off	do			806
Upgrade	C.900	Show upgrade key code	Command to show upgrade key version	off do	No action. Command enabled	off	off	do			807
Upgrade	C.901	FW & Config upgrade by key	Command to upgrade the firmware and configuration files via the key	off do	No action. Command enabled	off	off	do			808
Upgrade	C.902	Config upgrade by key	Command to upgrade only the configuration files via the key	off do	No action. Command enabled	off	off	do			809

HIDDEN

This menu is not available on the keypad. The setting and the reading of the parameters here contained, can be performed exclusively via serial line or through SBI card.

Virtual I/0s Commands	H.000 Virtual digital command	0	0	255	1000
	H.010 Virtual digital state	0	0	255	1002
	H.040 Progress	0	0	100	1009
	H.050 Drive output frequency 16 bit low (d.000)	0	-2^{31}	$2^{31}-1$	1010
	H.051 Drive output frequency 16 bit high (d.000)				1011
Profidrive Profile	H.052 Drive reference frequency 16 low (d.001)	0	-2^{31}	$2^{31}-1$	1012
	H.053 Drive reference frequency 16 high (d.001)				1013
	H.054 Output speed (d.000)*(P.600)16 bit low (d.007)	0	-2^{31}	$2^{31}-1$	101
	H.055 Output speed (d.000)*(P600)16 bit high(d.007)				1015
Drive Status	H.056 Speed Ref (d.001)*(P.600) 16 bit low (d.008)	0	-2^{31}	$2^{31}-1$	1016
	H.057 Speed Ref (d.001)*(P.600)16 bit high(d.008)				1017
Parameters reading Extension	H.062 Active alarm s low				1060
	H.063 Active alarm s high				1061
	H.064 Estimated real speed 16 bit low	0	-2^{31}	$2^{31}-1$	1046
	H.065 Estimated real speed 16 bit high				1047
	H.500 Reset hardware	0	0	1	1029
	H.501 Alarm reset	0	0	1	1030
	H.502 Coast to stop	0	0	1	1031
	H.503 Stop with ramp	0	0	1	1032
	H.504 Clockwise Start	0	0	1	1033
	H.505 Anti-clockwise Start	0	0	1	103
	H.506 Clockwise Jog	0	0	1	1035
	H.507 Anti-clockwise Jog	0	0	1	1036
	H.508 Clockwise Flying restart	0	0	1	1037
	H.509 Anti-clockwise Flying restart	0	0	1	1038
	H.510 DC Brake	0	0	1	1039

7.2 Menu d - DISPLAY

Basic

d.000 Output frequency

Drive output frequency [Hz].

d.001 Frequency ref (Frequency reference)

Drive frequency reference [Hz] .

d.002 Output current

Drive output current (rms) [A].

d.003 Output voltage

Drive output voltage (rms) [V].

d.004 DC link voltage

DC Bus drive voltage (DC) [V].

d.005 Power factor

Power factor.

d.006 Power [kW]

Active power.

d.007 Output speed

Drive output speed **(d.000)*(P.600).**

d.008 Speed ref (Speed reference)

Drive speed reference **(d.001)*(P.600).**

d.009 Estimate speed (estimate speed drive)

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.000	Output frequency					Hz	0,01	001
d.001	Frequency ref					Hz	0,01	002
d.002	Output current					A	0,1	003
d.003	Output voltage					V	1	004
d.004	DC link voltage					V	1	005
d.005	Power factor						0,01	006
d.006	Power [kW]					kW	0,01	007
d.007	Output speed	P602 select Krpm e K				Hz RPM	0.01 / 1	008
d.008	Speed ref	P602 select Krpm e K				Hz RPM	0.01 / 1	009
d.009	Estimate speed	P602 select Krpm e K				Hz RPM		062

Overload

d.050 Heatsink temp (Heatsink temperature)

Drive heatsink temperature [°C] (linear sensor measured).

d.051 Drive OL (Drive overload)

Drive overload (100% = alarm threshold).

d.052 Motor OL (Motor overload)

Motor overload (100% = alarm threshold).

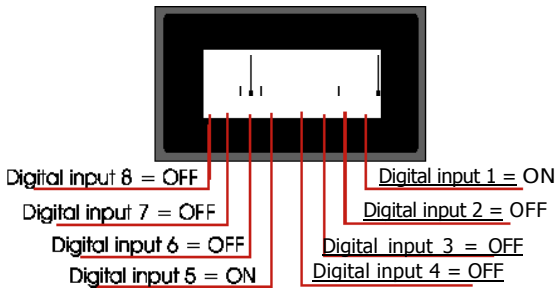
Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.050	Heatsink temp					° C	1	010
d.051	Drive OL					%	0.1	011
d.052	Motor OL					%	0.1	012

Inputs/Outputs

d.100 Dig inp status (Digital inputs status)

Status of the digital inputs acquired by the drive. They can come from drive regulation board terminal inputs or virtual inputs (ex.: by serial or field bus cards).

Example of displaying digital inputs with 7 segments display:



d.101 Term inp status (Teminal inputs status)

Status of the digital inputs terminal of the drive regulation board.

See example d.100

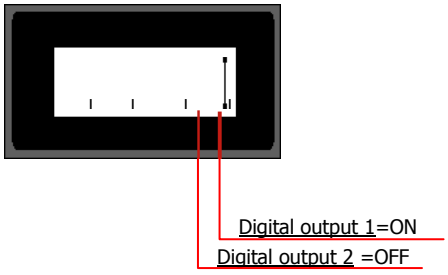
d.102 Vir dig inp stat (Virtual digital inputs status)

Status of the virtual digital inputs received by serial link or field bus card. See example d.100

d.150 Dig out status (Digital outputs status)

Status of the digital outputs executed by the drive, on the drive regulation terminal outputs or virtual outputs (ex.: by serial or field bus cards).

Example of displaying, of digital outputs with 7 segments display:



d.151 Term dig out sta (Terminal digital outputs status)

Status of the digital outputs terminal of the drive regulation board. See example d.150

d.152 Vir dig out stat (Virtual digital outputs status)

Status of the virtual digital outputs executed by the drive serial link or field bus card. See example d.150

d.200 An in 1 cnf mon (Analog input 1 configuration monitor)

It monitors the analog input 1 signal destination; it is possible to know which function is associated to this input: [0]

[0] Null funct	None function programmed	
[1] Freq ref 1	Frequency reference 1	chapter **FREQ & RAMPS**, section ***Reference sources (F.050)***
[2] Freq ref 2	Frequency reference 2	chapter **FREQ & RAMPS**, section ***Reference sources (F.051)***
[3] Boost lev fac	Level of voltage boost	chapter **PARAMETERS**, section ***Boost (P.121)***
[4] OT level fact	Level of over torque	chapter **PARAMETERS**, section ***OT level factor src (P.242)***
[5] V red lev fac	Output voltage reduction level	chapter **PARAMETERS**, section ***Voltage Red Config P.422)***
[6] DCB level fac	DC braking current level	chapter **PARAMETERS**, section ***DC brake Config (P .301)***
[7] Ramp ext fact	Ramp extension factor	chapter **FREQ & RAMPS**, section ***Ramp Config (F.260)***
[8] Freq Ref fact	Frequency reference factor	

d.201 An in 1 monitor (Analog input 1 monitor)Analog input 1 - output block (% value).

d.202 An in 1 term mon (Analog input 1 terminals monitor)

Analog input 1 input block % value (regulation board).

It monitors the input signal depending on the selection of An inp 1 Type (I.200) parameter:

• selection: [1] 0-10V/0-20mA: 0V = 0%, +10V = +100% o 0mA=0% 20mA=+100%

• selection: [2] 4-20mA: 4mA = 0%, 20mA = +100%

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
d.100	Dig inp status							014
d.101	Term inp status							015
d.102	Vir dig inp stat							016
d.150	Dig out status							020
d.151	Term dig out sta							021
d.152	Vir dig out stat							022
d.200	An in 1 cnf mon							026
d.201	An in 1 monitor							027
d.202	An in 1 term mon							028

Pid

d.400 PID reference

PID reference signal.

d.401 PID feedback

PID feedback signal.

d.402 PID error

PID error signal.

d.403 PID integr comp (PID integral component)

PID integral component.

d.404 PID output

PID output signal.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.400	PID reference			-A009	A009			041
d.401	PID feedback			-A009	A009			042
d.402	PID error			-A009	A009			043
d.403	PID integr comp						0.1	044
d.404	PID output						0.1	045

Alarm list

d.800 1st alarm-latest

Last alarm memory stored by the drive alarm list.

d.801 2nd alarm

Second to last alarm memory stored by the drive alarm list.

d.802 3rd alarm

Third to last alarm memory stored by the drive alarm list.

d.803 4th alarm

Fourth to last alarm memory stored by the drive alarm list.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.800	1st alarm-latest							046
d.801	2nd alarm							047
d.802	3rd alarm							048
d.803	4th alarm							049

Drive Identification

d.950 Drive rated curr (Drive rated current)

Drive rated current (it is dependent on the drive size).

d.951 SW version (1/2) (Software version - part 1)

Display example: 03.00
03 = index of software identification
00 = index of software revision (new functions or parameters)

d.952 SW version (2/2) (Software version - part 2)

Display example: 00.00
00 = index of revision (fixing bugs)
00 = index of identification (special version)
NOTE! to be considered as reference for SIEI personell

d.953 Power ident code (Power identification code)

Reserved.

d.954 Param ident code (Parameters identification code)

Reserved.

d.955 Regul ident code (Regulation identification code)

Reserved.

d.956 Startup id code (Startup identification code)

Reserved.

d.957 Drive size

Drive size code; Reserved.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.950	Drive rated curr						0,1	050
d.951	SW version (1/2)						0,01	051
d.952	SW version (2/2						0,01	052
d.953	Power ident code							053
d.954	Param ident code							054
d.955	Regul ident code							055
d.956	Startup id code							056
d.957	Drive size							057

Utility

d.999 Display Test

Drive display test

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.999	Display Test	Drive display test						099

7.3 Menu S - START-UP

NOTE! The START UP menu is a set of parameters and functions that allow a quick start of the motor.These parameters are duplicated in other menus of the drive, Therefore, their modification can be performed in any of the menus where the parametes are present.

Power Supply

S.000 Mains voltage

Rated value of the main voltage [V].

The undervoltage trip function is based on this value (see chapter PARAMETER, section Undervoltageconfiguration).

S.001 Mains frequency

Rated value of the line voltage frequency [Hz].

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.000	Mains voltage	110 220 230 240	230	110	240	V		404
S.001	Mains frequency	50 60	50	50	60	Hz		405

V/F Ratio

S.100 Max out voltage (Maximun output voltage)

Maximum value of the voltage applied to the motor (normally set as the nameplate, see figure 7.3.2).

S.101 Base frequency

Rated frequency of the motor (given on the nameplate, see figure 7.3.2)

It means the working frequency of the drive, at which the Max out voltage is associated (S.100).

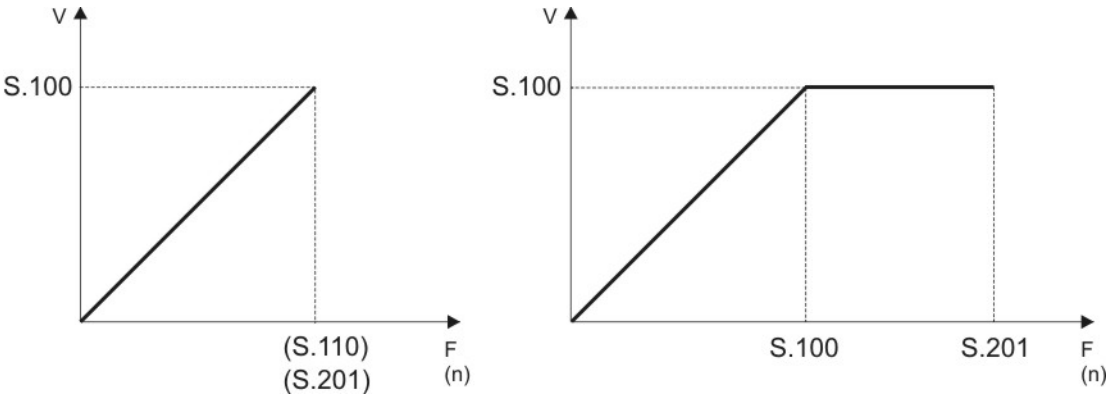


Figure 7.3.1: V/F Ratio

NOTE! For further setting of the V/F ratio, see the chapter PARAMETER, section V/F Curve

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.100	Max out voltage	Drive display test	(**)	50	(**)		1	413
S.101	Base frequency		(**)	25	1000	Hz	0,1	414

(**) parameter value dependent on drive nominal main voltage and main frequency.

Motor Data

S.150 Motor rated curr (Motor rated current)

Rated current of the motor at rated kilowatt/horsepower and voltage (given on the nameplate, see figure7.3.2).

In case of control with multiple motors, enter a value equal to the sum of the rated currents of all the motors. Do not perform any self tune.

S.151 Motor pole pairs

Pole pairs of the motor.

The setting of this data, can be easily calculated with the following formula:

$$N[rpm] = \frac{60\ [s] \times f\ [Hz]}{2p\ [polepairs]}$$

where: p = motor pole pairs
f = rated frequency of the motor (***S.101***)
n_N = rated speed of the motor (see figure 7.3.2).

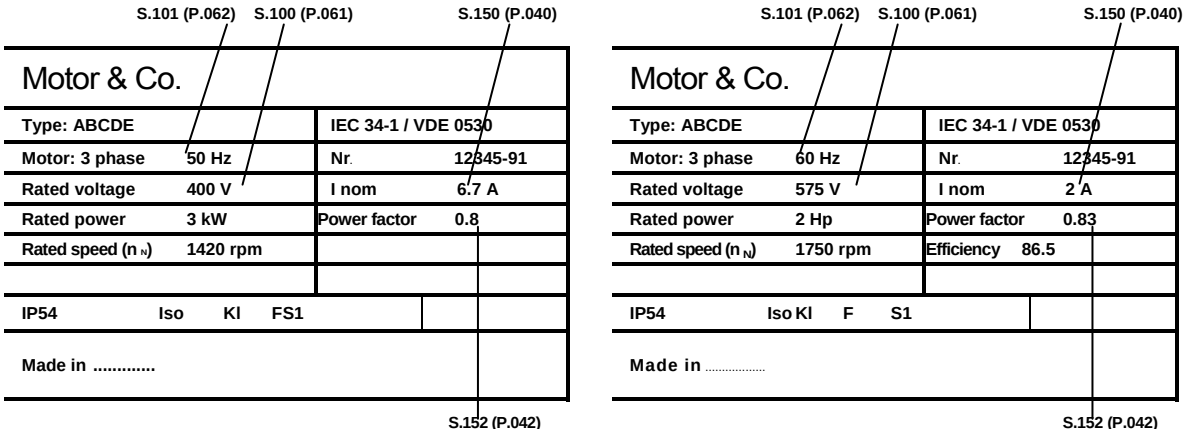


Figure 7.3.2: Motor Nameplate (Example: kW rating for 400V motor and Hp rating for 5 75V motor)

Example: calculation of the pole pairs of a motor having the data shown in the above 575V label:

$$p\ [polepairs] = \frac{60\ [s] \times f\ [Hz]}{n_N\ [rpm]} = \frac{60\ [s] \times 60\ [Hz]}{1750\ [rpm]} = 2$$

the value to set in the parameter S.152 is "2"

S.152 Motor power factor

Motor power factor (given on the nameplate, see figure7.3.2).

S.153 Motor stator R (Motor stator Resistance)

Measurements of the stator resistance of the motor.

This value will be automatically updated, by performing the self tune procedure.

Code	Name	[Code] & Function	Default	MIN	MAX	Unit	Variation	IPA
S.150	Motor rated curr		(*)	(*)	(*)	A	0.1	406
S.151	Motor pole pairs		(*)	1	60			407
S.152	Motor power fact		(*)	0.01	1		0.01	408
S.153	Motor stator R		(*)	0	99.99	ohm	0.01	409

(*) parameter value dependent on drive size.

Commands & Referencies

S.200 Cmd source sel (Command source selection)

It defines the use of the main commands START and STOP .

S.200 = 1 START & STOP via terminals

In this configuration the commands are active through the drive terminals.

The motor START command can be performed by applying the specific logic level (high level +15V) , to the Digital Input 1 (terminal 5), factory set as RUN If this connection is removed, the motor will STOP with the set ramp time.

For this connection refer to figure 5.3.2.1.

NOTE! After a cycle of main supply voltage, the drive can be started only according to the settings of P.003 Safety parameter, which allows the Start/Stop commands to respond to Edge or Level sensitive signals (see chapter 7.6 for more details).

NOTE! Other configurations for the setting of the "main commands" are described in the chapter **PARAMETERS**, section **Commands**.

Main Commands Logic Control:

"START & STOP"

- The START & STOP function configuration is correlated to other functions and parameters as well as the mode to REVERSE the motor speed.

  These functions allow additional control logic and safety control.

  For further information, see chapter **PARAMETER**, section **Commands**.

"MOTOR SPEED REVERSAL"

- There are several way to REVERSE the speed direction of the motor. As a default factory setting, the Digital Input 2 (terminal 7) is programmed to this purpose.

  All of the frequency references or other variables controlled with digital setting or analog signal, can be programmed either with positive or negative values. The polarity of the value (Digital or Analog) will determine the motor rotation direction, without the use of any external HW commands.

  Despite the polarity of the reference, the REVERSE command, if programmed on a digital input, will always reverse the speed direction of the motor.

S.201 Max ref freq (Maximun reference frequency)

It is the threshold for the analog or digital reference and the maximum speed for both directions. This parameter applies to the sum of the two references value available on the drive.

S.202 Ref 1 Channel (Reference 1 channel)

It defines the source from where the Reference 1 is provided and controlled.

For further details please refer to chapter FREQ & RAMPS, section Reference Source.

S.203 Frequency ref 0 (Frequency reference 0)

Digital speed reference.

It is also the first digital frequency of the Multispeed selection (F.100...F.116). It is possible to set setting with positive or negative values.

The polarity will determine the sense of rotation of the motor.

In either polarity the setting the HW Reverse command is active (when enabled).

The maximum settable value is correlated to Max ref freq (S.201).

Code	Nome	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.200	Cmd source sel	[0] Remote keypad [1] Terminals [2] Virtual [3] H-command	1	0	3			400
S.201	Max ref freq		(****)	25	500	Hz	0.1	305
S.202	Ref 1 channel	[0] Null [1] Analog inp 1 (setting through *I.200...I.204*) [2] not used [3] Freq ref x (setting through *S.203* or *F.100*) [4] Multispeed (setting through *F.100...F.116*) [5] Motorpotent (setting through *F.000...F013*) [6] not used [7] not used [8] not used	3	0	8			307
S.203	Frequency ref 0		0	-S.201	S.201			311

(****) parameter value dependent on drive type.

S.300 Acc time 1 (Acceleration time 1)

S.301 Dec time 1 (Deceleration time 1)

The ramp control can be set to allow a programmable delay (in seconds), for the acceleration and deceleration times of the drive reference.

This delay time will have to be set on the final system (motor and load), being strictly dependant from the inertia of the load machine.

The ramps time delay, are calculated in accordance with the Max ref freq (S.201).

The setting can be carried out as follows, according to the setting of the parameter F.200.

Code	Name	[Code] & Function	Default	MIN	MAX	Unit	Variation	IPA
S.300	Acc time 1		5	1	999.9	sec	0.1 (***)	329
S.301	Dec time 1		5	1	999.9	sec	0.1 (***)	330

Functions

S.400 Manual boost [%]

The resistive impedance of the stator windings causes a voltage drop within the motor, which result in a reduction in torque in the lower speed range.

Compensation can be made for this effect by boosting the output voltage.

This compensation is carried out continuously across the whole speed range in proportion to the output current but it is most effective at low speed.

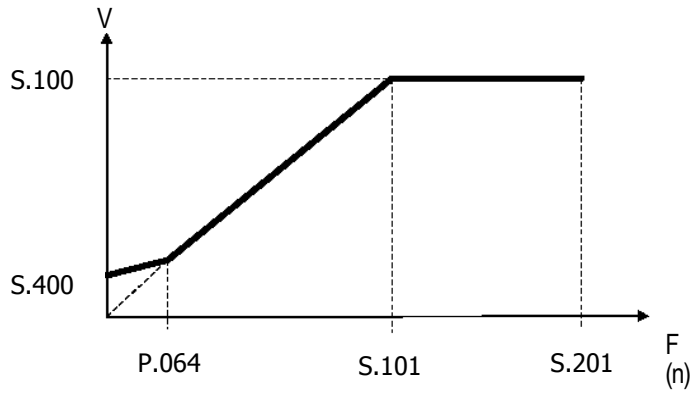


Figure 7.3.3: Manual Boost Voltage

The setting is in percentage of the ***Max out voltage (S.100)***.

NOTE! When custom V/f shape is selected (***P.060*** = 0):

P.064 parameter represents the return point of the output voltage, on the linear characteristic of V/fratio (see figure 7.3.3).

S.401 Auto boost en (Automatic boost enabling)

The boost can be automatically controlled by the enabling of this parameter. The control is continuously carried out in the whole speed range.

The Auto boost must be disabled when a multiple motor connection is being used.

NOTE! The automatic boost is automatically calculated during the execution of drive/motor self tuning (**S.901** parameter).

It is anyway possible to obtain an "Oveboost" at low speed, increasing the value of the manual boost (**S.400** parameter).

S.450 Slip compensat (Slip compensation)

If an induction motor is being used, the mechanical speed will vary with the load due to the slip of the motor. In order to adjust for this speed error the slip compensation can be used.

During this calibration, make sure that the drive is not in a current limit condition.

If this compensation is set too high it can cause instability.

The changing will be carried out as a percentage of the nominal slip, calculated when set the motor plate date.

The Slip compensation will act directly on the output frequency of the drive. To this purpose the parameter ***Max output freq (P.080)*** expressing the percentage of the ***Max ref freq (F.020)***, has to be set to a value including:

Max ref freq value + ***Slip compensat*** value.

(See also chapter **PARAMETER**, section **Output Frequency Limit**).

The Slip compensation must be disabled when a multiple motor connection is being used.

S.451 Slip comp filter (Slip compensation filter)

It is the response time (in seconds) for the reaction of the function.

Increasing this value helps damping oscillations that may arise with load steps (especially negative ones).

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.400	Manual boost [%]		3	0	25	% of S.	100	421
S.401	Auto boost en	[0] Disable [1] Enable	0	0	1			423
S.450	Slip compensat		0	0	150	%		419
S.451	Slip comp filter		0.5	0	10	sec	0.1	420

Utility

S.900 Measure stator R (Measurement of stator resistance)

It measures the stator resistance of the motor connected.

This will help to provide a smooth and uniform value of the output torque through the whole speed range. The control is assisted by the use of the ***Automatic boost (P.401)***.

Do not perform any tune when a multiple motor connection is being used.

S.901 Save parameters

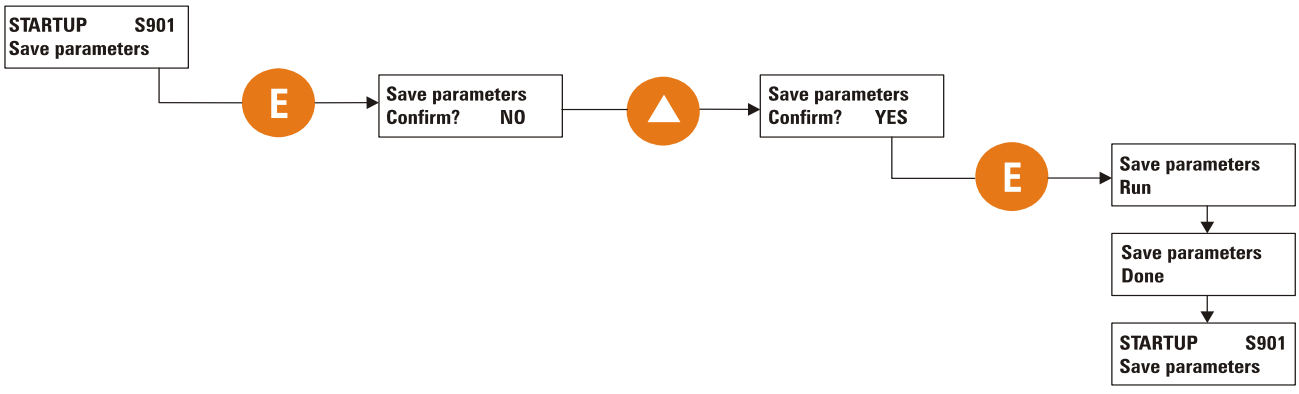
Every changing of each parameter, is accepted and executed by the drive.

However, the permanent storage of them, is performed only by the execution of this command.

The lack of this operation will cause the loss of every changed parameter when the power is disconnected from the drive.

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.900	Measure stator R	Confirm ? off Confirm ? do	off	off	do			806
S. 901	Save parameters	Confirm ? off Confirm ? do	off	off	do			800

Here below is an example of how to execute the Save parameters command. It is also valid for Measurestator R (S.900) command



7.4 Menu I – INTERFACE

Digital Inputs Regulation Board

I.000 Dig input 1 cfg (Digital input 1 configuration)

I.001 Dig input 2 cfg (Digital input 2 configuration)

I.002 Dig input 3 cfg (Digital input 3 configuration)

I.003 Dig input 4 cfg (Digital input 4 configuration)

I.004 Dig input 5 cfg (Digital input 5 configuration) associate to input if I.200=3

I.005 Dig input 6 cfg (Digital input 6 configuration) associate to input if I.200=3

The regulation board provides as standard 8 opto-coupled digital inputs. A PNP or NPN logic level, can be selected according to figure 5.5.1. Every input is programmable with a specific code and function, as shown in the list below.

DIGITAL INPUTS SELECTION LIST:

Code	*LCD display*	*Description*
0	**None**	Not active
1	**Run**	RUN command for the motor START
2	**Reverse**	Speed REVERSE command
3	**Ext Fault NO**	External fault with NO (Normal Open) contact
4	**Ext Fault NC**	External fault with NC (Norm. Closed) contact
5	**Alarm reset**	Alarm reset command
6	**Jog**	JOG frequency reference enabling
7	**Freq sel 1**	Binary selection for Multispeed
8	**Freq sel 2**	Binary selection for Multispeed
9	**Freq sel 3**	Binary selection for Multispeed
10	**Freq sel 4**	Binary selection for Multispeed
11	**Ramp sel 1**	Binary selection for Multiramp
12	**Ramp sel 2**	Binary selection for Multiramp
13	**Enable NO**	Drive Enable with NC (Norm. Closed) contact
14	**Enable NC**	Drive Enable with NO (Normal Open) contact
15	**DCBrake en**	Enabling of the DC braking function
16	**DCBrake**	Command for execution of DC braking
17	**Autocapture**	Execution of the flying restart
18	**Ramp enable**	Enabling / Disabling of the Ramp block
19	**Zero ref**	Ramp to 0Hz & main commands active
20	**PID enable**	Enabling of the PID regulation
21	**PID freeze**	Enabling PID freeze output signal.
22	**PID gain sel**	Initilizing of the Integral value of PID
23	**Motorpot Up**	Motorpotentiometer reference increasing
24	**Motorpot Dn**	Motorpotentiometer reference decreasing
25	**Reset Motorp**	Reset of Motorpotentiometer reference
26	**Fast stop**	Emergency stop (with Dec time 3 delay)
27	**Zero freq**	Enabling output freq. to zero.
28	**Stop 3-wire**	Stop command (NC) in 3 wire mode (P001=2)
29	**Start + Freq sel 1**	In 3 wire mode (P001=2) start command + freq. selector 1
30	**Start + Freq sel 2**	In 3 wire mode (P001=2) start command + freq. selector 2
31	**Start + Freq sel 3**	In 3 wire mode (P001=2) start command + freq. selector 3

Code	Name	[Code] & Function	Default	MIN	MAX	Unit	Variation	IPA
I.000	Dig input 1 cfg	See Digital inputs selection list	1	0	31			100
I.001	Dig input 2 cfg	As for 1.000	3	0	31			101
I.002	Dig input 3 cfg	As for 1.000	2	0	31			102
I.003	Dig input 4 cfg	As for 1.000	7	0	31			103

The digital inputs are FACTORY set as follow:

Dig input 1 cfg (Terminal 5) = 1 Run
Dig input 2 cfg (Terminal 6) = 3 External fault NO
Dig input 3 cfg (Terminal 7) = 2 Reverse
Dig input 4 cfg (Terminal 8) = 7 Freq. sel. 1
Dig input 5 cfg (Terminal 10) = 0 Null associate to input if I.200=3
Dig input 6 cfg (Not available/serial way) = 0 Null associate to input if I.200=3

Digital Ouputs Regulation Board

I.100 Dig output 1 cfg (Digital output 1 configuration) RELE'

I.101 Dig output 2 cfg (Digital output 2 configuration) Not available

The regulation board provides one relay with commutation contacts (see figure 5.5.1). Every output is programmable with a specific code and function, as shown in the list below.

DIGITAL OUTPUTS SELECTION LIST

Code	*LCD display*	*Description*
0	**Drive Ready**	Drive ready to start
1	**Alarm state**	Positive logic for alarm signalling
2	**Not in alarm**	Negative logic for alarm signalling
3	**Motor running**	Direction command active
4	**Motor stopped**	Direction command not active and frequency = 0Hz
5	**REV rotation**	Anti-clockwise rotation of the motor
6	**Steady state**	Motor is running in steady state
7	**Ramping**	Acceleration or Deceleration Ramp in progress
8	**UV running**	Undervoltage detection during motor running
9	**Out trq>thr**	Output torque higher than the value of **P.241**
10	**Current lim**	Current limit (during ramp or at steady state)
11	**DC-link lim**	DC Bus limit (during ramp or at steady state)
12	**Limit active**	General signalling of drive limit condition
13	**Autocapt run**	Autocapture on progress
14	**BU overload**	Overload of the braking resistor
15	**Neg pwrfact**	Negative condition of the power factor
16	**PID err ><**	PID error is >***A.058*** & <=***A.059***
17	**PID err>thr**	PID error is >***A.058***
18	**PID err<thr**	PID error is <=***A.059***
19	**PIDer><(inh)**	PID error is >***A.058*** & <=***A.059*** (*)
20	**PIDerr>(inh)**	PID error is >***A.058*** (*)
21	**PIDerr<(inh)**	PID error is <=***A.059*** (*)
22		**Not used**
23		**Not used**
24		**Not used**
25		**Not used**
26	**Extern fault**	Positive logic for Ext. fault alarm signalling
27	**No ext fault**	Negative logic for Ext. fault alarm signalling
28	**Serial TO**	Serial link communication time out
29	**freq=thr1**	Output frequency = to ***P.440*** & ***P.441*** values
30	**freq!=thr1**	Output frequency ≠ of ***P.440*** & ***P.441*** values
31	**freq>thr1**	Output frequency > than ***P.440*** & ***P.441*** values
32	**freq<thr1**	Output frequency < than ***P.440*** & ***P.441*** values
33	**freq=thr2**	Output frequency = to ***P.442*** & ***P.443*** values
34	**freq!=thr2**	Output frequency ≠ of ***P.442*** & ***P.443*** values
35	**freq>thr2**	Output frequency > than ***P.442*** & ***P.443*** values
36	**freq<thr2**	Output frequency < than ***P.442*** & ***P.443*** values
37	**HS temp=thr**	Heatsink temp = to ***P.480*** & ***P.481*** values
38	**HS temp!=thr**	Heatsink temp ≠ of ***P.480*** & ***P.481*** values
39	**HS temp>thr**	Heatsink temp > than ***P.480*** & ***P.481*** values
40	**HS temp<thr**	Heatsink temp < than ***P.480*** & ***P.481*** values
41	**Output freq**	Frequency in synchronism with output frequency
42	**Out freq x 2**	Frequency value x 2 in synchronism with output frequency
43	**OutCoastThru**	Coast Through stopping
44	**OutEmgStop**	Emergency stop
45		Not used
46	**I.180=thresh**	Value selected by I.180=I.181&I.182
47	**I.180≠thresh**	Value selected by I.180≠I.181&I.182
48	**I.180>thresh**	Value selected by I.180>I.181&I.182
49	**I.180<thresh**	Value selected by I.180<I.181&I.182

50	**I.180<threshod** (With RUNcommad)	Value selected by I.180<I.181&I.182 only when running.
51	**Steady state** (with RUN command)	Motor rotation in steady state only if running
52	**Alarm pulse code**	Alarm pulse code

(*) see chapter 7.7, section PID Limit.

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.100	Dig output 1 cfg	*See Digital Outputs selection list*	1	0	52			112

The digital outputs are FACTORY set as follow:

Dig output 1 cfg - relay type (Terminal 1 - 2 - 3) = **0 Drive Ready**

Dig output 2 cfg - (Terminal 17) = **41 Output freq**

Analog Inputs Regulation Board

The drawing below, describes the block diagram of the standard "Analog Inputs" of the drive.

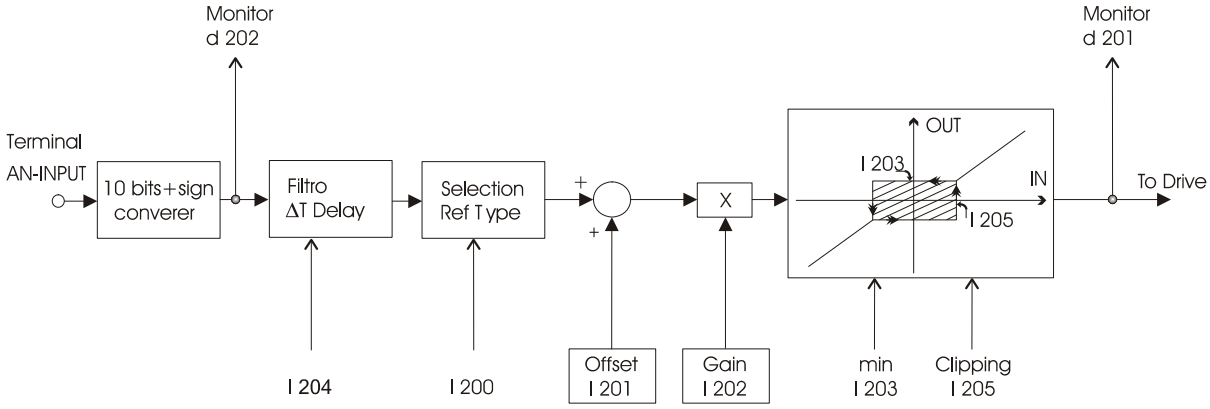


Figure 7.4.1: Analog Inputs

The regulation board provides as standard analog inputs.

Analog inputs resolution:

- voltage input setting: 11 bits (10 bits + sign)
- current input setting: 10 bits

A typical basis connection is reported in the figure 5.5.1.1.

The assignment of the Analog Inputs for a specific function, is described in the figure 7.5.1 at the menu **FREQ** and **RAMPS**.

I.200 An In 1 type (Analog Input 1 type)

Setting of the Analog Input 1, in accordance with the type of reference control, available on its HW.

I.200= 1 Unipolar +10V o 0-20mA

I.200= 2 Unipolar 4-20mA (J5 ON)

I.200= 3 Digital

I.200= 4 Unipolar 4-20mA with segnalation if < 4mA (J5 ON)

I.201 An In 1 offset (Analog Input 1 offset)

I.202 An In 1 gain (Analog Input 1 gain)

Gain of the analog input.

It can be used to amplify or reduce the ratio between signal and controlled variable, or also to set different types of control curves via analog reference, as described in the figures 7. 4.2, 7. 4.3 and 7. 4. 4.

Each parameters acts on the relative analog input.

I.203 An In 1 minimum (Analog Input 1 minimun)

It represents the minimum value of the parameter, on which the analog input is programmed (see figure 7. 4.3). Example: if the analog input 1 is programmed as speed reference, in this case L203 represents the minimum speed reference.

Each parameters acts on the relative analog input.

I.204 An In 1 filter (Analog Input 1 filter)

It is the response time of the signal reaction to the reference variations. Each parameters acts on the relative analog input.

The use of the Analog Inputs parameters set, can be useful to customize the analog reference ratio. In the figures below are reported some samples.

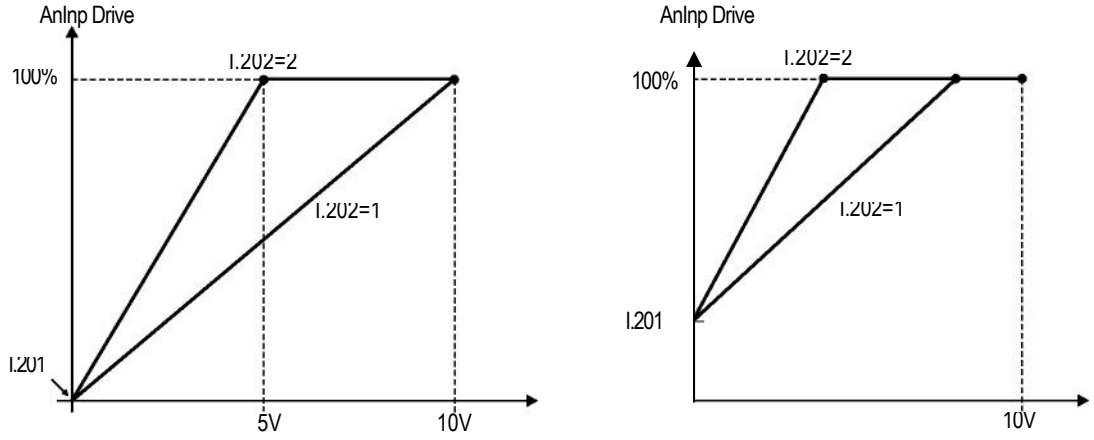


Figure 7.4.2: Analog Input Scaling 1

$$\text{An Inp Drive [\%]} = I.202 \times \left(\text{An Inp [\%]} + \frac{I.121}{10} \times 100\right)$$

NOTE! When the analog input reference is set at OV, an eventual "noise" can cause undesired speed oscillation between positive and/or negative values of ***I.203*** parameter.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
I.200	An in 1 Type	[1] 0-10V / 0-20mA [2] 4-20mA	1	1	4			118
I.201	An in 1 offset		0	-99.9	99.9	%	0.1	119
I.202	An in 1 gain		1	-9.99	9.99	%	0.01	120
I.203	An in 1 minimum		0	0	99.99	%	0.01	121
I.204	An in 1 filter		0.1	0.001	0.25	sec	0.001	122

Enabling Virtual I/O

Through a "virtual setting" via serial line or fieldbus, it is possible to use all the functions available on the digital inputs and perform a direct control of the digital and analog outputs.

The setting can be carried out in such configurations, where the digital commands are a mix of "virtual" and terminals and the outputs are a mix of "virtual" and drive function.

The virtual assignment can be performed through the parameters ***H.000...H.022*** in the **HIDDEN** menu (for further information please see this chapter).

Below are the reported the drawings describing the combination between the byte of the virtual I/Os and the drive terminals, with the relative decoder mask.

The switch between the "virtual" commands and the terminal ones and between the "virtual" output or the drive functions, is determined by programmable mask ***I.400...I.450***.

These parameters have to be managed bitwise. At each bit corresponds a switch, as follows.

Bit value	Inputs	Outputs
0	Terminal	Drive function
1	Virtual	Virtual control

The formula below describes the result of the virtual I/Os setting:

[Input/Output AND (NOT Mask)] OR (Virtual AND Mask)

VIRTUAL DIGITAL INPUTS CONFIGURATION

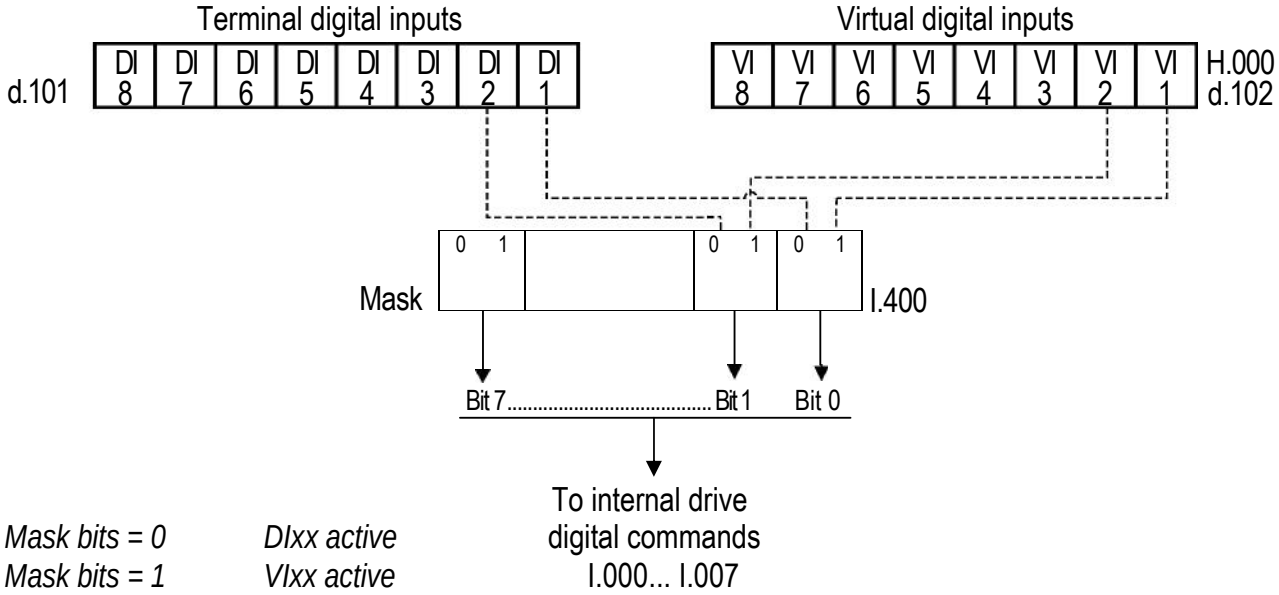


Figure 7.4.5: Virtual digital inputs configuration

VIRTUAL DIGITAL OUTPUTS CONFIGURATION

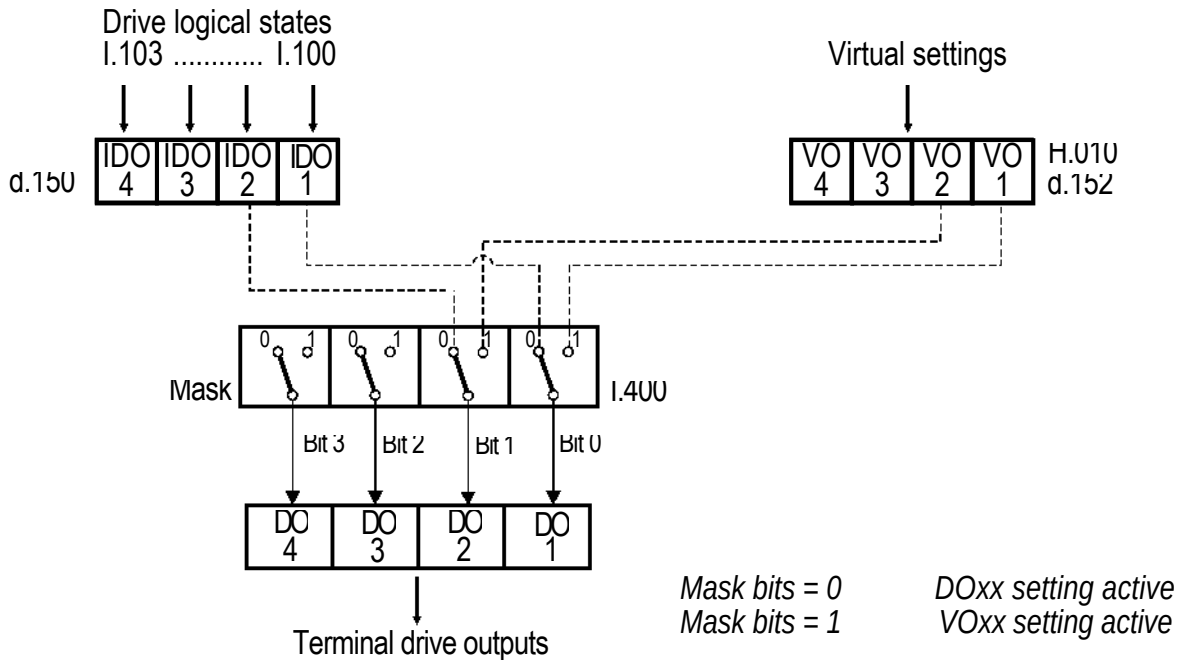


Figure 7.4.6: Virtual digital outputs configuration

VIRTUAL ANALOG OUTPUTS CONFIGURATION

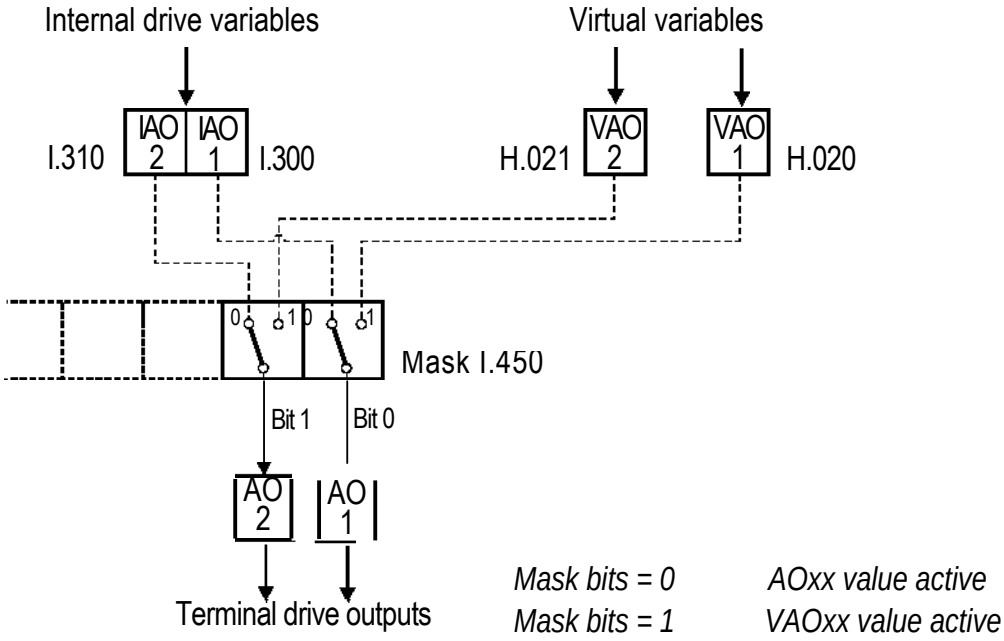


Figure 7.4. 7: Virtual analog outputs configuration

Below are some examples about the programming of the basic function via virtual assignment.

A) DIGITAL INPUTS

Programming example for:

- RUN and REVERSE commands via "virtual mode"
- EXT FAULT command via "terminal"

P.000 = 2 Function mode enabled
I.400 = 3 bit 0 and bit 1 are high (1) and bit 5 is low (0)
I.000 = 1 RUN (programmed on digital input 1)
I.001 = 2 REVERSE (programmed on digital input 2)
I.005 = 3 EXTERNAL FAULT (programmed on digital input 6)

Writing ***H.000*** = 1 the motor will turn in FORWARD direction

Writing ***H.000*** = 3 the motor will turn in REVERSE direction

Writing ***H.000*** = 0 the motor will STOP

Refer to chapter 7.9 for more informations on ***H.000*** parameter.

The EXTERNAL FAULT command will be applied removing the potential at the terminal 6 (programmed as digital input 6).

B) DIGITAL OUTPUTS

Programming example for:

- ALARM STATE signalling on Digital output 1
- VIRTUAL FUNCTION signalling on Digital outputs

P.000 = 2 Function mode enabled
I.420 = 2 bit 1 is high (1) and bit 0 is low (0)
I.100 = 1 ALARM STATE (programmed on digital output 1)
I.101 = 2 ANY SELECTION (programmed on digital output 2)

Digital output 1 active in accordance with the drive alarm status

Digital output 2 active if bit 1 of ***H.010*** = 1

not active if bit 1 of ***H.010*** = 0

I.400 1np by serial en

It defines the bits of the mask, that are active for the virtual assignment. A byte is available for the selection of 8 digital inputs, whose setting has to be carried out as decimal value.

Bit 0 = 1 Enabled

Bit 1 = 2 Enabled

Bit 2 = 4 Enabled

Bit 3 = 8 Enabled

Bit 4 = 16 Enabled

Bit 5 = 32 Enabled

Bit 6 = 64 Enabled

Bit 7 = 128 Enabled

I.420 Out by serial en (Outputs by serial line enabling)

It defines the bits of the mask, that are active for the virtual assignment. A 4 bits structure is available for the selection of 4 digital outputs, whose setting has to be carried out as decimal value.

Bit 0 = 1 Enabled

Bit 1 = 2 Enabled

Bit 2 = 4 Enabled

Bit 3 = 8 Enabled

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.400	Inp by serial en		0	0	255			145
I.420	Out by serial en		0	0	15			147

Enabling of the encoder feedback management.

Serial Configuration

The DVS provides as a standard an RS 485 serial line.

For the connection of the serial line, a 9-pin SUB-D connector, named JP7 or an AMP connector named JP15 (see chapter 5. 4.1 Serial Interface General). are available on the regulation card.

Through the serial line, all the parameters and variables can be written and read.

When control of the main command through serial line is needed, it is necessary to set ***the Cmd source sel (P.000***) as follows:

P.000 = 2 Terminal or Virtual

P.000 = 3 Serial

Further information are reported at the chapter **PARAMETER**, section **Commands** .

I.600 Serial link cfg (Serial link configuration)

Selection of the serial line protocol.

Each protocol can be chosen through the setting of the following codes. The structure of them is below reported. DEFAULT VALUE = 4 (Modbus protocol)

I.601 Serial link bps (Serial link bit per second)

It defines the Baud rate (bit per second) concerning the serial line communication speed. The selection is through the following code:

I.602 Device address

Address at which the drive can be accessed if it is networked via the RS 485 interface.

The range of the selectable addresses is between **0** and **99**.

As reported in the chapter 5. 4.1 (Serial Line General), it is possible to perform a Multidrop configuration with a maximum of 32 devices.

Further information about are reported in this chapter.

I.603 Ser answer delay (Serial link answer delay)

Minimum delay setting between the reception of the last byte and the start of its answer.

The delay will help avoid conflicts on the serial line, when the RS 485 interface is not preset for an automatic Tx/Rx communication.

The Ser answer delay (L603) parameter is specific for the standard serial line RS 485.

Eg: if on the master the Tx/Rx delay communication is 20ms max, the setting of **Ser answer delay (L603)** parameter will have to be higher than 20ms: 22ms.

I.604 Serial timeout (Serial link timeout)

It sets the time that elapses between the sending/receiving of a byte and the next one.

If this time is longer than the setting and no byte is detected (sending/receiving), the action will be the one programmed in the parameter **L605**

The alarm won't be active when set at 0 second.

It will be displayed with the message "St".

NOTE! Even if the timeout control function is enabled at the drive power-on, the detection of "St" alarm is temporary non active.

The detection of the alarm will be automatically activated after the first restore of the communication between master and slave.

I.605 En timeout alm (Enabling serial link timeout alarm)

Setting of the behaviour for Serial time out alarm.

I.605 = 0 Signalling of the alarm on a digital output (programmed to this purpose)

I.605 = 1 Drive in alarm and signalling on a digital output (programmed to this purpose)

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.600	Serial link cfg	[0] FoxLink 7E1 [1] FoxLink 701 [2] FoxLink 7N2 [3] FoxLink 8N1 [4] ModBus 8N1 [5] JBus 8N1 [6] Reserved [7] Reserved [8] Reserved [9] Remote keypad	4	0	9			155

I.601	Serial link bps	[0] 600 baud [1] 1200 baud [2] 2400 baud [3] 4800 baud [4] 9600 baud [5] 19200 baud [6] 38400 baud	4	0	6			156
I.602	Device address		1	0	99		1	157
I.603	Ser answer delay		1	0	250	msec	1	158
I.604	Serial timeout		0	0	25	sec	0,1	159
I.605	En timeout alm	[0] Disable [1] Enable	0	0	1			160

7.5 Menu F - FREQ & RAMPS

The drawing below, describes the logic for the "Reference selection".

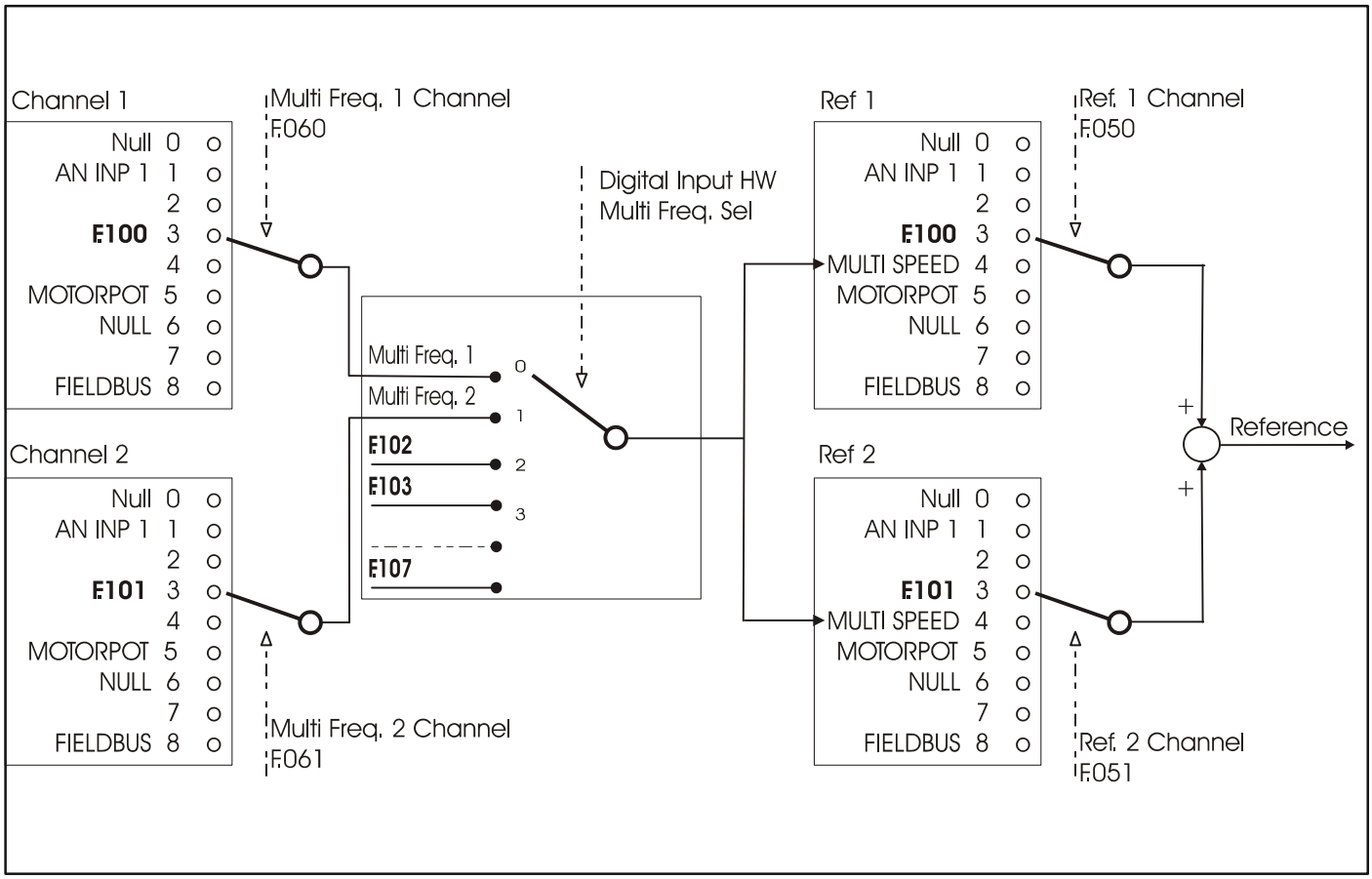


Figure 7.5.1: Reference Selection

Motorpotentiometer

F.000 Motorpot ref (Motorpotentiometer reference)

When this parameter is shown, the UP and DOWN keys are activated to increase or decrease the frequency value.

Pressing the UP and DOWN Keys will cause the motor to increase or decrease its speed respectively until the keys are released.

The maximum value settable is correlated to ***Max ref freq (F.020).***

To START the motor it is necessary a RUN command.

The Motorpotentiometer reference can also be changed via digital inputs, programmed as **Motorpot up** and **Motorpot down**.

The reset of the reference value, can be executed via digital input programmed as **Reset Motorpot**.

F.010 Mp Acc / Dec time (Motorpotentiometer Acceleration / Deceleration time)

It sets the acceleration and deceleration ramp time delay (in seconds), for the Motorpotentiometer function. The delay times are equal for the acceleration and deceleration.

F.011 Motorpot offset (Motorpotentiometer offset)

Giving the RUN command, the motor will rich automatically the frequency set (offset) following the ramp time. The Motorpot up command will be effect starting from this value, which represent the frequency minimum value attainable by Morotpot down command.

For further detail see also the section Reference Limits in this chapter.

F.012 Mp output mode (Motorpotentiometer output mode)

It defines positive and/or negative settings of the Motorpotentiometer reference value. In either setting the HW Reverse command is active (when enabled).

F.013 Mp auto save (Motorpotentiometer auto save)

Enabling this function will cause the Motorpot reference to be continuously saved into non-volatile memory. At power on, the reference will start from the last saved value.

Disabling this function will cause the Motorpot reference to be always zero after power-on.

Saving drive parameters by command ***C.000*** (or ***S.901***) will not save the Motorpot ref value.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.000	Motorpot ref		0	0	F.020	Hz	0.01	300
F.010	Acc/Dec time mp		10	0.1	999.9	sec	0.1	301
F.011	Motorpot offset		0	0	F.020	Hz	0.1	302
F.012	Mp output mode	[0] Unipolar [1] Bipolar	0	0	1			303
F.013	Mp auto save	[0] Disable [1] Enable	0	0	1			304

Reference Limits

F.020 Max ref freq (Maximun reference frequency)

It is the maximum speed for both directions.

This parameter applies to the sum of the different reference value available on the drive (***Reference 1*** and ***Reference 2***).

F.021 Min ref freq (Mimimun reference frequency)It defines the minimum frequency value, under which any regulation with analog or digital references has no effect.

The START of the motor will be carried out (with the ramp delay) at this frequency value also with null reference.

As described in the following figure, this behaviour is correlated also to the setting of ***Min output freq (P.081).***

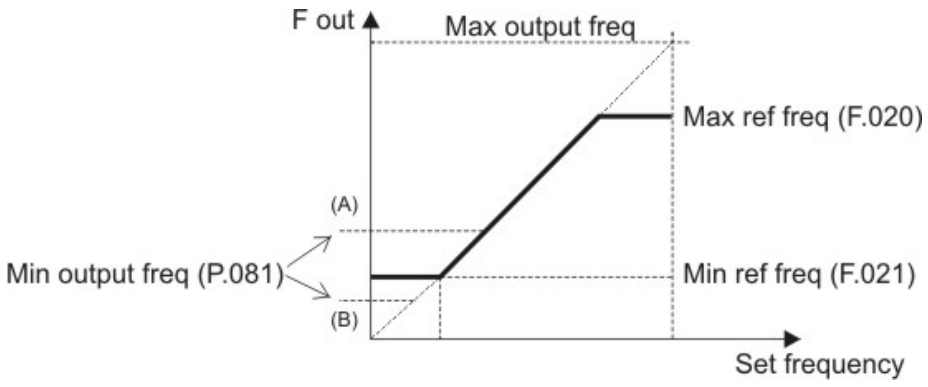


Figure 7.5.2: Min a Max Reference Frequency

Drive behaviour around minimum values

P.081 settings in A condition

• Giving the RUN command, the motor will rich the frequency set of **P.081** (A) without to follow the setting of acceleration ramp time.

• The reference action on the frequency curve, will have effect starting from the setting value of P.081 parameter.

P.081 settings in B condition

• Giving the RUN command, the motor will rich the frequency set of **P.081** (B) without to follow the setting of acceleration ramp time.

• The increasing of the reference will have effect on the frequency output, starting from the setting value of **F.021** parameter (the variation will follow the setting of acceleration ramp time).

• The reference action on the frequency curve, will have effect starting from the setting value of **F.021** parameter.

The ***Max output freq (P.080)*** and the ***Min output freq (P.081)*** are expressed as percentage of the values of ***Max ref freq (F.020).***

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.020	Max ref freq		(****)	25	999.9	Hz	0.1	305
F.021	Min ref freq		0	0	50	Hz	0.1	306

(****) parameter value depending on drive type.

Reference Sources

F.050 Ref 1 Channel (Reference 1 channel)

F.051 Ref 2 Channel (Reference 2 channel)

As shown in the figure 7.5.1, the Sources from which the 2 speed references are provided and controlled, can be chosen by following the table below.

The value of the 2 references, will always be an algebric sum.

F.060 Mlt Frq Channel 1 (Multi frequency channel 1)

F.061 Mlt Frq Channel 2 (Multi frequency channel 2)

These parameters allow to select the source, from where the First and Second frequency reference of the **Multispeed function,** can be provided and controlled (See figure 7.5.1).

The source can be chosen the following parameters the table below.

Code	Nome	[Code] & Function	Default	MIN	MAX	Unit	Variation	IPA
F.050	Ref 1 channel	[0] Null	3	0	8			307
		[1] Analog inp 1 (setting through *I.200...I.204*)						
		[2] not used						
		[3] Freq ref x (setting through *S.203* or *F.100*)						
		[4] Multispeed (setting through *F.100...F.116*)						
		[5] Motorpotent (setting through *F.000...F013*)						
		[6] reserved						
		[7] reserved						
		[8] reserved						

F051	Ref 2 channel	[0] Null [1] Analog inp 1 (setting through *I.200...I.204*) [2] not used [3] Freq ref x (setting through *F.101*) [4] Multispeed (setting through *F.100...F.116*) [5] Motorpotent (setting through *F.000...F013*) [6] reserved [7] reserved [8] reserved	0	0	8	308
F060	MltFrq channel 1	As for F050, Ref 1 channel	3	0	8	309
F061	MltFrq channel 2	As for F051, Ref 2 channel	3	0	8	310

Multispeed Function

F.100 Frequency Ref 0

. .

. .

. .

F.107 Frequency Ref 7 (Multi frequency channel 15)

It is possible to select up to 8 frequencies, whose value can be set in these parameters.

The selection of these frequencies can be performed through a binary setting of 3 programmable digital inputs. The limit of the output frequency will be clamped by ***Max ref freq (F.020).***

The following table describes the basis sequence of the binary setting, for a complete Multispeed selection.

Freq sel 1	Freq sel 2	Freq sel 3	Active ref frequency
0	0	0	F.100 Freq. Ref 0
1	0	0	F.101 Freq. Ref 1
0	1	0	F.102 Freq. Ref 2
1	1	0	F.103 Freq. Ref 3
0	0	1	F.104 Freq. Ref 4
1	0	1	F.105 Freq. Ref 5
0	1	1	F.106 Freq. Ref 6
1	1	1	F.107 Freq. Ref 7

The following figure shows the setting of a 8 Multispeed control.

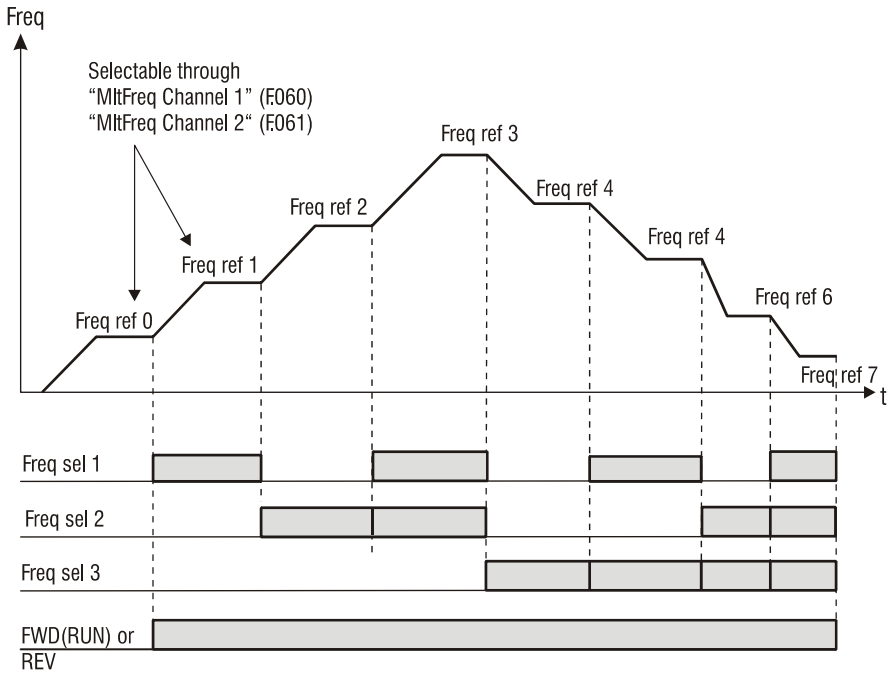


Figure 7.5.3: Multispeed Frequencies

Code	Nome	[Code] & Function	Default	MIN	MAX	Unit	Variation	IPA
F.100	Frequency ref 0		0	-F.020	F.020	Hz	0.1	311
F.101	Frequency ref 1		0	-F.020	F.020	Hz	0.1	312
F.102	Frequency ref 2		0	-F.020	F.020	Hz	0.1	313
F.103	Frequency ref 3		0	-F.020	F.020	Hz	0.1	314
F.104	Frequency ref 4		0	-F.020	F.020	Hz	0.1	315
F.105	Frequency ref 5		0	-F.020	F.020	Hz	0.1	316
F.106	Frequency ref 6		0	-F.020	F.020	Hz	0.1	317
F.107	Frequency ref 7		0	-F.020	F.020	Hz	0.1	318

F.116 Jog frequency

It is the frequency reference for the JOG speed.

This speed is activated through a programmed digital input.

The RUN command via terminal must not be given. This command will enable the main frequency reference.

The limit of the output frequency will be clamped by ***Max ref freq (F.020).***

The setting of the JOG reference value, can be either positive or negative. In both the setting the HW Reverse command is active (when enabled).

Code	LCD display	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.116	Jog frequency		1	-F020	F020	Hz	0.1	327

Ramp Configuration

F.200 Ramps resolution

It defines the range and the accuracy with which the ramps time will be set.

Code	Name	[Code] & Function.		Default	MIN	MAX	Unit	Variation	IPA
F.200	Ramp resolution	[0] 0.01s [1] 0.1s [2] 1s	From (0.01s to 99.99s) From (0.1s to 999.99s) From (1s to 9999s)	1	0	2			328

F.201 Acc time 1 (Acceleration time 1)

F.202 Dec time 1 (Deceleration time 1)

F.203 Acc time 2 (Acceleration time 2)

F.204 Dec time 2 (Deceleration time 2)

F.205 Acc time 3 (Acceleration time 3)

F.206 Dec time 3 / FS (Deceleration time 3)

F.207 Acc time 4 (Acceleration time 4)

F.208 Dec time 4 (Deceleration time 4)

NOTE! When the JOG function is activated, ***Acc time 4 (F.207)*** and ***Dec time 4 (F.208)*** are selected automatically.

When the "FAST STOP" is activated (through digital input command), the function is executed with the DEC TIME 3 delay.

The ramp control can be set for a programmable delay for the acceleration and deceleration times of the drive reference. This delay time will have to be set on the final system (motor and load), being strictly dependant from the inertia of the load machine.

The time values are expressed in seconds. The ramps time delay are calculated in accordance with the ***Max ref freq (F.020)***.

It is possible to select up to 4 different time, whose value can be set in these parameters.

The selection of these ramps can be performed through a binary setting of 2 digital inputs, programmed **as Ramp sel 1** and **Ramp sel 2**.

It is reported below the basis sequence for the full selection.

Active Ramp time	Ramp sel 1	Ramp sel 2
F.201 (Acc time 1) **F.202 (Dec time 1)**	0	0
F.203 (Acc time 2) **F.204 (Dec time 2)**	1	0
F.205 (Acc time 3) **F.206 (Dec time 3)**	0	1
F.207 (Acc time 4) **F.208 (Dec time 4)**	1	1

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Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.201	Acc time 1		5	0.1(***)	999.9(***)	sec	0.1 (***)	329
F.202	Dec time 1		5	0.1(***)	999.9(***)	sec	0.1 (***)	330
F.203	Acc time 2		5	0.1(***)	999.9(***)	sec	0.1 (***)	331
F.204	Dec time 2		5	0.1(***)	999.9(***)	sec	0.1 (***)	332
F.205	Acc time 3		5	0.1(***)	999.9(***)	sec	0.1 (***)	333
F.206	Dec time 3 / FS		5	0.1(***)	999.9(***)	sec	0.1 (***)	334
F.207	Acc time 4 / Jog		5	0.1(***)	999.9(***)	sec	0.1 (***)	335
F.208	Dec time 4 / Jog		5	0.1(***)	999.9(***)	sec	0.1 (***)	336

("Q) value depends on the setting of ***F.200*** parameter.

F.250 Ramp S-shape

The S-shaped ramp can be useful to obtain a smooth behaviour of the system during the end of the acceleration or close to the zero speed during the deceleration.

The value (in seconds) of the S-shaped ramp is added to the ramp time of the linear profile.

The ramp time is thus lengthened by the value of the S-curve constant.

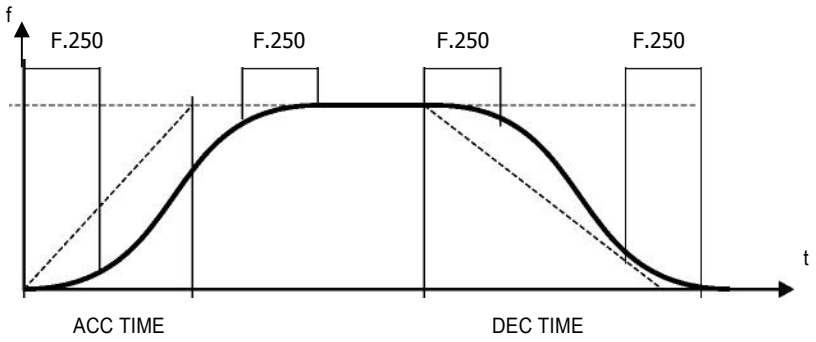


Figure 7.5.4: Ramp S-shape

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.250	Ramp S-shape		0	0	10	sec	0.1	337

F.260 Ramp extens src (Ramp extension source)

When an extension of the set ramps time is needed, it can be achieved through the Analog Inputs. This extension will change linearly according to the value applied on the Analog Input.

The function allows the ramp times extension in a range includes between multiply factor 1 (0V, 0mA o 4mA) and multiply factor 10 (+/-10V o 20mA).

The parameter select the source from where this function is provided and controlled.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.260	Ramp extens src	[0] Null [1] Analog inp 1 (setting through I.200...I.204) [2] Analog inp 2 (setting through I.210...I.214) optional [3] Not used	0	0	3			338

Jump Frequencies

F.270 Jump amplitude

F.271 Jump frequency1

F.272 Jump frequency2

In a system composed by motor and drive, at certain frequencies values, it is possible to meet the generation of noisy vibrations, characterized by mechanical resonances.

Through the parameters ***F.271*** and ***F.272***, it is possible to avoid the working of the inverter around the frequencies here set.

The parameter ***F.270*** defines the tolerance band of the critical zone.

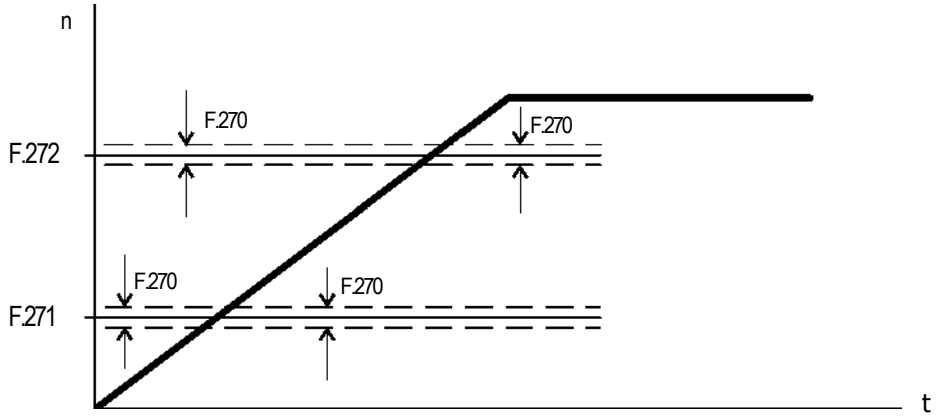


Figure 7.5.5: Jump Frequencies

When the frequency reference is set to a value within the tolerance band, the frequency output assumes the following behavior.

Example:

A) Increasing the reference from lower value of F.271 or F.272

F.271 = 30Hz (first forbidden frequency threshold)

F.270 = 1Hz (tolerance band: 29Hz....31Hz)

Setting of frequency reference = 29,5Hz

Frequency output = 29Hz

Setting of frequency reference = 30,5Hz

Frequency output = 29Hz

B) Decreasing the reference from higher value of F.271 or F.272

F.271 = 30Hz (first forbidden frequency threshold)

F.270 = 1Hz (tolerance band: 29Hz....31Hz)

Setting of frequency reference = 30,5HzFrequency output = 31Hz

Setting of frequency reference = 29,5HzFrequency output = 31Hz

The user can set any frequency reference, but if its value is within the forbidden range, the inverter will maintain automatically the speed out the limit of the tolerance band.

During the ramp execution the forbidden frequencies have not any influence, so the output frequency will be linearly generated.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
F.270	Jump amplitude		0	0	100	Hz	0.1	339
F.271	Jump frequency 1		0	0	100	Hz	0.1	340
F.272	Jump frequency 2		0	0	100	Hz	0.1	341

7.6 Menu P - PARAMETERS

Commands

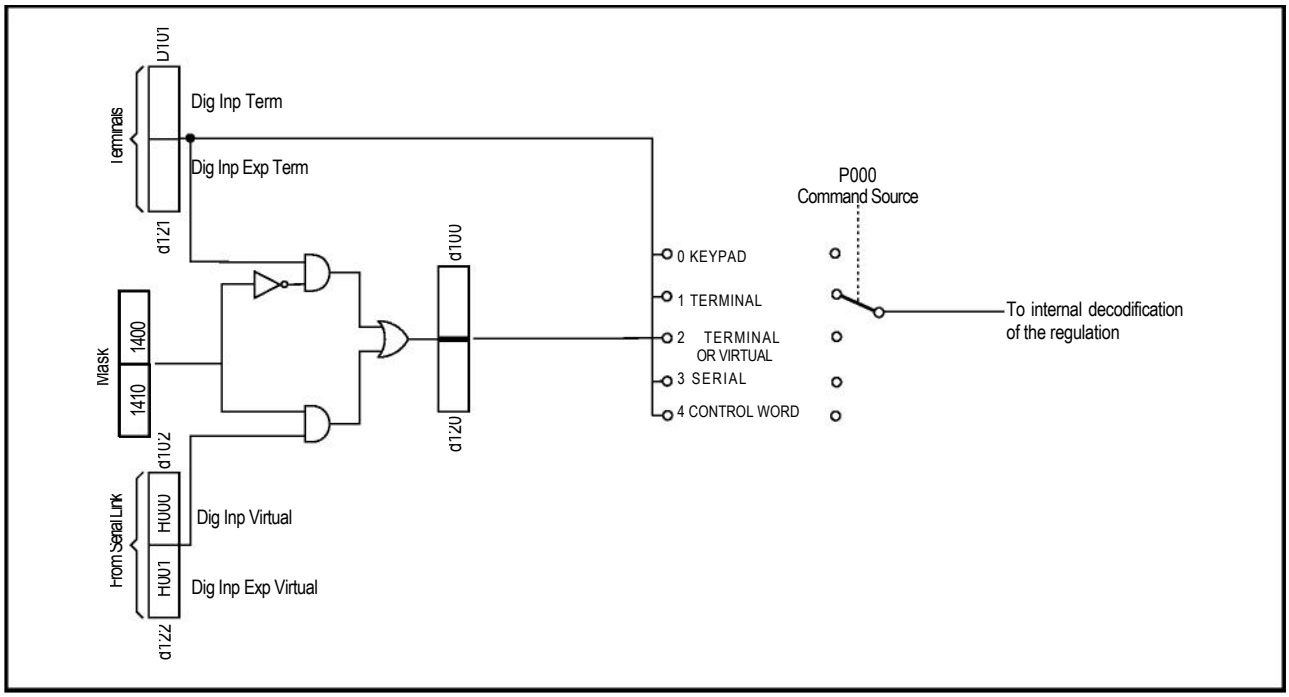


Figure 7.6.1: Basic Commands Logic Selection

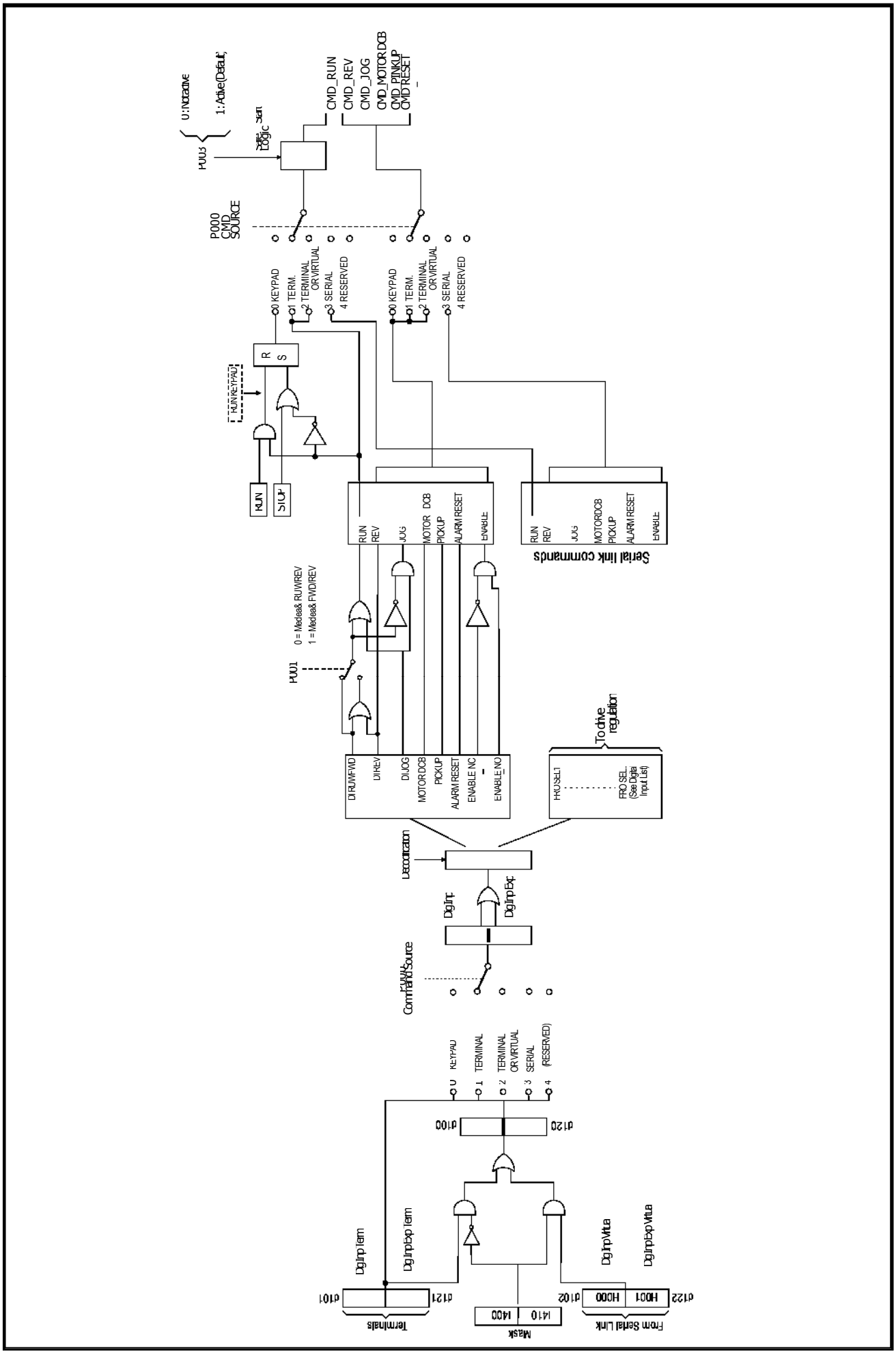


Figure 7.6.2: Main Commands Logic Selection

P.000 Cmd source sel (Command source selection)

It defines the selection mode for the main commands START and STOP.

P.000= 0 Remote keypad

In this configuration the commands are active through the keypad buttons.

Fwd RUN command **Stop** STOP command

The Digital Input 1, factory programmed as RUN , must be connected to a specific logic level (NPN or PNP), in order to allow the motor START. This connection must be considered like enabling hardware.

If this connection is removed, the motor will STOP with the set ramp time.

P.000 = 1 START & STOP via terminals

In this configuration the commands are active through the terminals.

The motor START can be performed applying the specific logic level (high level +15V , terminal 4), to the Digital Input 1 (terminal 5), factory set as RUN.

If this connection is removed, the motor will STOP with the set ramp time.

NOTE! After a cycle of main supply voltage, the drive can be started only according to the settings of ***P.003 Safety*** parameter, which allows the Start/Stop commands to respond to **Edge** or **Level** sensitive signals.

NOTE! The command **Drive enable** available as a selection of the digital inputs, adds additional safety logic for the motor running sequences.

The releasing of it, will produce a coast to stop of the motor. (see chapter **INTERFACE**, section **Digital inputs**).

P.000 = 2 Main commands & I/Os setting via virtual channels or terminals

In this configuration, the commands programmable on the digital inputs or the signalling of the digital and analog outputs, can be assigned as follows:

- **Complete selection via serial line or fieldbus as "Virtual setting "**
- **Complete selection via "Terminals setting"**
- **Mix of "Virtual and Terminal selection"**

NOTE! The requirements of commands via terminal strip is depending by virtual I/O settings.

Further information about this function, can be found in the chapters: **INTERFACE** section **Enabling Virtual I/O**

Commands addressing is described in the chapter **HIDDEN**

P.000 = 3 START & STOP & main commands via Serial line (SERIAL)

It define the selection of the main commands exclusively via serial line or filedbus.

NOTE! Commands via terminal strip are not required.

Further information about the serial line, can be found in the chapters:

INTERFACE section **Serial configuration**

Commands addressing is described in the chapter **HIDDEN**, section **Commands** for serial link.

P.001 RUN input config (RUN input configuration)

Definition of the RUN and Reverse logic control.

P.001 = 0

FWD (clockwise direction) with terminal **RUN = ON**

REV (anti-clockwise direction) with terminal **RUN = ON** and terminal **REV = ON**

P.001 = 1

FWD (clockwise direction) with terminal **RUN = ON**

REV (anti-clockwise direction) with terminal **RUN = OFF** and terminal **REV = ON**

P.002 Reversal enable

Block of the command direction of the motor.

P.002 = 0

REV (anti-clockwise direction) **DISABLED**

P.002 = 1

REV (anti-clockwise direction) **ENABLED**

The function will be applied at any kind of REV logical command (digital input, negative reference and serial line).

P.003 Safety

The parameter defines the RUN (or REVERSE) command behavior at the drive power on:

P.003 = 0 RUN command via a Level sensitive signal.

At the drive power on, the starting of the motor is allowed when the RUN command is already present on terminal strip.

P.003 = 1 RUN command via an Edge sensitive signal.

At the drive power on, the starting of the motor is not allowed when the RUN command is already present on terminal strip.

The starting of the motor can be execute cycling RUN command.

Mapping a digital output as "Ready", the drive state condition can be displayed according to the above parameter setting.

P.004 Stop mode

Motor stop control function.

P.004 = 0 The control sets the motor ramp deceleration up to 0 Hz.

P.004 = 1 The control cuts off the output voltage, so the motor coasts to stop.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P000	Cmd source sel	[0] Keypad [1] Terminals [2] Virtual [3] Serial	1	0	3			400
P001	RUN input config	[0] Run Rev [1] Fwd Rev [2] 3 wire mode	0	0	2			401
P002	Reversal enable	[0] Disable [1] Enable	1	0	1			402
P003	Safety	[0] OFF [1] ON	1	0	1			403
P004	Stop mode	[0] In ramp [1] Ramp to stop	0	0	1			493

Power Supply

P.020 Mains voltage

Rated value of the line voltage [V_{rms}].

The undervoltage trip function is based on this value (see also chapter **PARAMETERS**, function **Undervoltage configuration**).

P.021Mains frequency

Rated value of the line voltage frequency [Hz].

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P020	Cmd source sel	110	230	110	240	V		404
		220						
		230						
		240						
P021	Mains frequency	50	50	50	60	Hz		405
		60						

(****) parameter value depending on drive type.

Motor Data

P.040 Motor rated curr (Motor rated current)

Rated current [Arms] of the motor at rated kilowatt/horsepower and voltage (given on the nameplate, see figure 7.6.3).

In case of control with multiple motors, enter a value equal to the sum of the rated currents of all the motors. Do not perform any self tune.

P.041 Motor pole pairs

Pole pairs of the motor. The setting of this data, can be easily calculated with the following formula:

$$N[rpm] = \frac{60\ [s] \times f\ [Hz]}{2p\ [polepairs]}$$

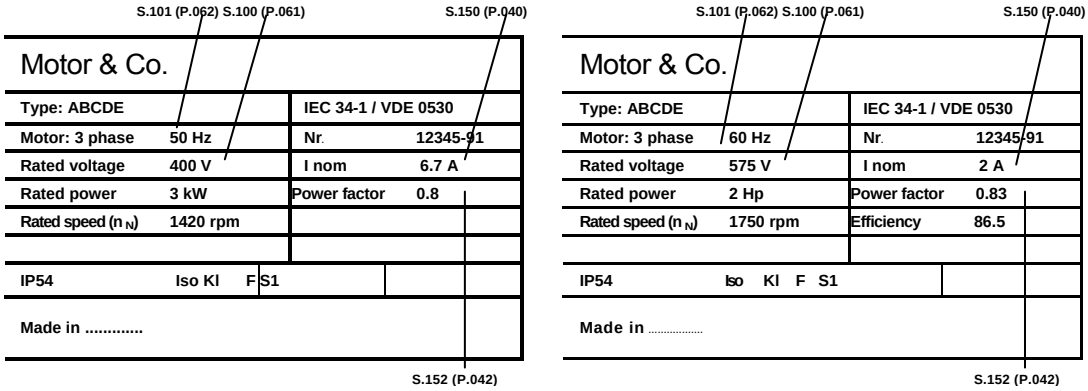


Figure 7.6.3: Motor Nameplate (Example: kW rating for 400V motor and Hp rating for 575V motor)

Example: calculation of the pole pairs of a motor aving the data shown in the above label:

$$p\ [polepairs] = \frac{60\ [s] \times f\ [Hz]}{n_N\ [rpm]} = \frac{60\ [s] \times 60\ [Hz]}{1750\ [rpm]} = 2$$

the value to set in the parameter ***P.041*** is "2".

Where: p = motor pole pairs; f = rated motor frequency (***P.062***); n_N = rated motor speed (see figure 7.6.3)

P.042 Motor power fact (Motor power factor)

Motor power factor (given on the nameplate, see figure 7.6.3).

A signalling of the "negative power factor" condition is available on the digital output as ***"Neg pwr fact"***.

P.043 Motor stator R (Motor stator Resistance)

Measurements of the stator resistance of the motor.

This value will be automatically updated, after performing the self tune procedure.

P.044 Motor cooling

Setting of the type of cooling of the motor connected.

P.045 Motor thermal K (Motor thermal costant)

Thermal characteristic of the motor connected.

The data is normally provided by the motor manufacturer, as the time needed to reach the maximum temperature at rated current.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.040	Motor rated curr		(*)	(*)	(*)	A	0.1	406
P.041	Motor pole pairs		(*)	1	60			407
P.042	Motor power fact		(*)	0.01	1		0.01	408
P.043	Motor stator R		(*)	0	99.99	ohm	0.01	409
P.044	Motor cooling	[0] Natural [1] Forced	0	0	1			410
P.045	Motor thermal K		30	1	120	min		411
P.046	Motor nominal slip		(*)	0	25			501
P.047	Motor nominal eff		(*)	50	100			504

V/F Curve

P.060 V/f shape

Selection of the curve for the V/F ratio.

P.060 = 0 (Custom)

The intermediate values of voltage and frequency, are defined by the parameters P.063 and P.064 as well as the link of the manual Boost on the characteristic.

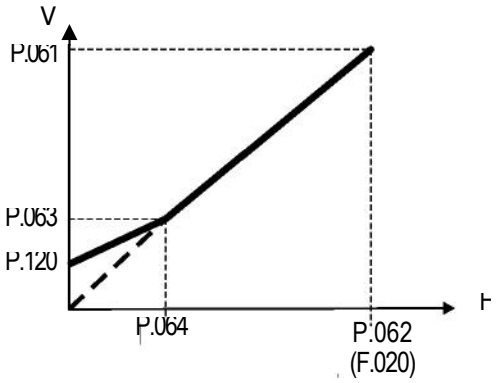


Figure 7.6.6:Quadratic V/F shape

P.060 = 1 (Linear)

The factory setting provides a Linear V/F ratio, having the middle points fixed by the half value of ***P.063*** and ***P.064***.

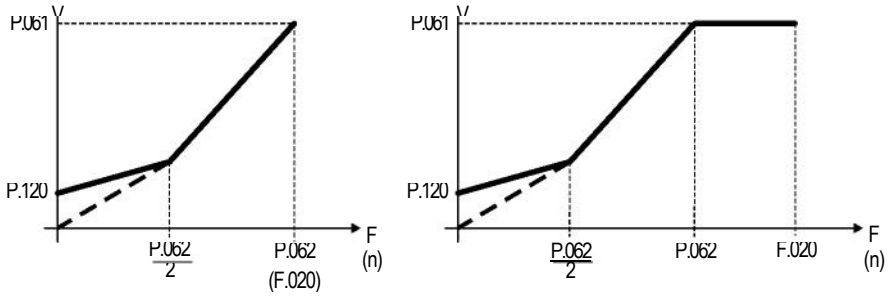


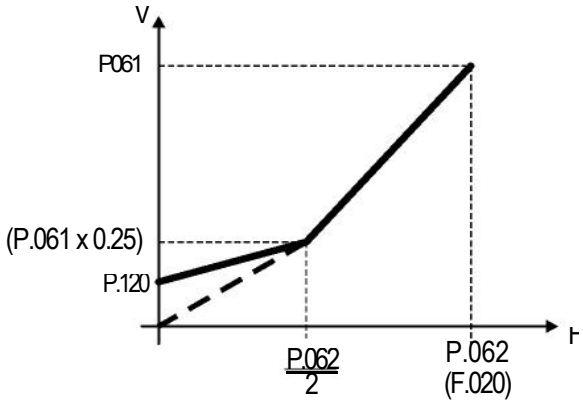
Figure 7.6.5: Linear V/F shape

P.060 = 2 (Quadratic)

The Quadratic characteristic is useful when a pump or fan has to be controlled (load where the torque is proportional to the speed squared).

The factory setting, when this ratio is selected, provides a setting of ***P.063*** equal to the 0,25% the Max output voltage, at a frequency equal to 50% of ***P.062***.

Figure 7.6.6: Quadratic V/F shape



P061 Max out voltage (Maximum output voltage)

Maximum value of the voltage applied to the motor (normally set as the nameplate, see figure 7.6.3).

P.062 Base frequency

Rated frequency of the motor (given on the nameplate, see figure 7.6.3).

It represents the working frequency of the drive, at which the Max out voltage is associated (***P.061***).

P.063 V/f interm volt (V/f intermediate voltage)

Intermediate "voltage" value of the V/F characteristic selected.

P.064 V/f interm freq (V/f intermediate frequency)

Intermediate "frequency " value of the V/F characteristic selected

NOTE! When custom V/f shape is selected (***P.060*** = 0):

P.064 parameter represents the return point of the output voltage, on the linear characteristic of V/f ratio (see figure 7.6. 4).

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.060	V/f shape	[0] Custom [1] Linear [2] Quadratic	1	0	2			412
P.061	Max out voltage		(**)	50	(**)	V	1	413
P.062	Base frequency		(**)	25	999.9	Hz	0.1	414
P.063	V/f interm volt		(**)	0	P.061	V		415
P.064	V/f interm freq		25	25	P.062	Hz	0.1	416

Ouput Frequency Limit

P.080 Max output freq (Maximun output frequency)

It is the maximum level of the output frequency, expressed as percentage of ***Max ref freq (F.020).***

This parameter takes into account the sum of all the reference frequencies and frequency variables of the drive, deriving by:

Speed references,**Slip compensation, PID regulator**

P.081 Min output freq (Minimun output frequency)

Minimum value of output frequency, under which no reference regulation has effect. It is expressed as percentage of ***Max output freq (P.080)***.

The parameter is correlated to the ***Min ref freq (F.021)***, as reported in the figure below

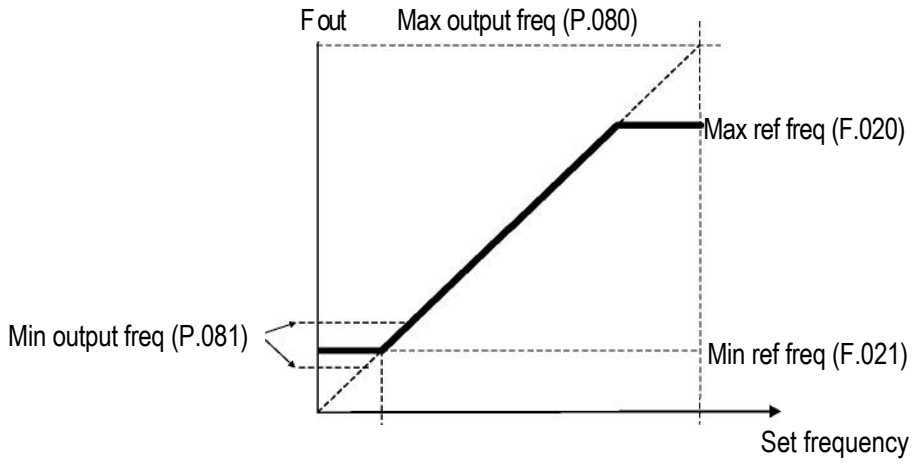


Figure 7.6. 7: Min a Max Reference Frequency

A signalling of the "output frequency" status is available on the digital output as ***"Out freq<set".***

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.080	Max output freq		110	1	110	%		417
P.081	Min output freq		0.0	0.0	25.0	% of F.020	0.1	418

Slip Compensation

P.100 Slip compensat (Slip compensation)

If an induction motor is being used, the mechanical speed will vary with the load due to the slip of the motor. In order to adjust for this speed error the slip compensation can be used.

During this calibration, make sure that the drive is not in a current limit condition.
If this compensation is set too high it can cause instability.
The changing will be carried out as a percentage of the nominal slip, calculated when set the motor plate date.
The Slip compensation will act directly on the output frequency of the drive. For this purpose the parameter ***Max output freq (P.080)*** expressing the percentage of the ***Max ref freq (F.020)***, has to be set to a value including:

Max ref freq value + **Slip compensat** value.

See chapter **"PARAMETERS"**, section **"Output Frequency Limit"**.

The Slip compensation must be disabled when a multiple motor connection is being used.

P.101 Slip comp filter (Slip compensation filter)

It is the response time (in seconds) for the reaction of the function.
Increasing this value helps damping oscillations that may arise with load steps (especially negative ones).

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.100	Slip compensat		0	0	150	%		419
P.101	Slip comp filter		0.5	0.0	10	sec	0.1	420

Boost

P.120 Manual boost [%]

The resistive impedance of the stator windings causes a voltage drop within the motor, which result in a reduction in torque in the lower speed range.
Compensation can be made for this effect by boosting the output voltage.
This compensation is carried out continuously across the whole speed range in proportion to the output current but it is most effective at low speed.

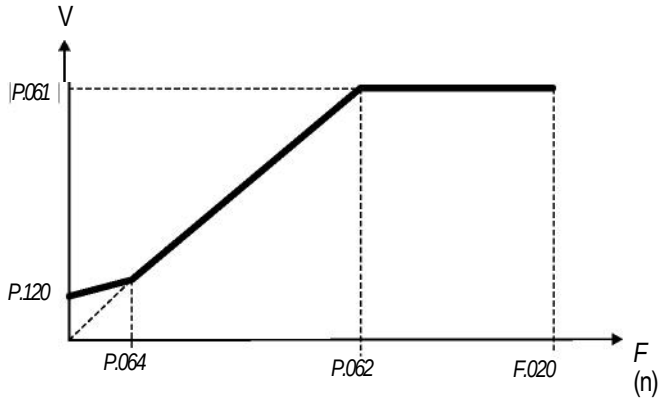


Figure 7.6.8: Manual Boost Voltage

The setting is in percentage of the ***Max out voltage (P.061)***.

P.121 Boost factor src (Factor extension source of manual Boost)

The manual Boost level can be linearly regulated through an analog reference signal.
The regulation of the Boost level will be between 0% (setting the inputs at 0V - 0mA - 4mA) and 100% of the percentage value set in ***P.120*** (+/- 10y - 20mA).

This parameter selects the source from where this function is provided and controlled.

P.122 Auto boost en (Automatic boost enabling)

The boost can be automatically controlled by the enabling of this parameter. The control is continuously carried out in the whole speed range.

NOTE! The automatic boost is automatically calculated during the execution of drive/motor self tuning (***P.043*** parameter). It is anyway possible to obtain an "Oveboost" at low speed, increasing the value of the manual boost (***P.120*** parameter).

The Auto boost must be disabled when a multiple motor connection is being used.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.120	Manual boost [%]		3	0	25	% of P.061	0.1	421
P.121	Boost factor src	[0] Null [1] Analog inp 1 setting through 1.200...1.204) [2] Not used [3] Not used	0	0	3			422
P.122	Auto boost en	[0] Disable [1] Enable	0	0	1			423

Automatic Flux Regulation

P.140 Magn curr gain (Magnetizing current gain) Blocked

The magnetizing current of the motor, has approximately the no load current value at rated voltage and frequency. A control of this variable is performed with the changing of its gain..
The benefit is substantially an availability of motor higher torque at low speeds, obtained with a modality similar to the "boost voltage" function.
A too high setting can cause undesired oscillation.

NOTE! It is not reconmmended to use this function if sustained operation below 1 Hz is required.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.140	Magn curr gain		0	0	0	%	0.1	424

Anti Oscillation Function

P.160 Osc damping gain (Anti Oscillation damping gain) Blocked

The parameter (current symmetry) is used to eliminate any oscillation or beat in the motor current resulting from tolerances or configurations capable of generating oscillations within the Inverter/cable/ motor system.
The "0" value set at the factory is effective in many cases.
If necessary this value can be altered (0...100) to provide adaptation to the application in question.
During the calibration of the optimum value it is recommended to set the variations of this parameter with slight increases.
The frequency operation range is around 10Hz...30Hz .

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.160	Osc damping gain		0	0	0			425

SW Current Clamp

P.180 SW clamp enable (Software current clamp enabling) Blocked

To optimize the performance of the inverter, it is necessary to be able to accelerate and decelerate during the whole ramp time with the maximum current that the inverter can supply to the motor.
The setting of very short ramp times, that would cause an exceeding of the allowable current limits of the drive, activates the "Current Clamp"circuit avoiding to reach the overcurrent limits and the consequent "OC" trip.

The intervention of the "Current Clamp" circuit, has as consequence an increase of the real time in which the final speed is obtained.
It is anyway possible the disabling of the function, setting this parameter at zero.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.180	SW clamp enable	[0] Disable (not active) [1] Enable (active)	1	0	1			426

Current Limit

The drive is provided with an active current limited function.
It is possible to select different current limits, during the ramps or at steady state.

Current limitation is achieved by a PI regulator effect on speed reference (see P.206 parameter).

P.200 En lim in ramp (Enabling limit in ramp)

P.200 =0 Function disabled.

P.200 = 1 1 Enabling of the current limit control during the ramps.

P.200 = 2 Ramp-curr ctrl

During speed acceleration or deceleration, if the current value exceeds the setting of ***P.201*** (Current limit during the ramp), the ramp stage will be momentary blocked and the speed kept at the value reached in this moment.

When the current will decrease again below this limit, the ramp will be restarted with the profile set. The ramp time is thus lengthened by the execution of this control.

P.201 Curr lim in ramp (Current limit in ramp)

Value of the current limit during the ramps.
It is as percentage of the nominal current of the drive (see also parameter d.950, chapter DISPLAY).

P.202 En lim in steady (Enabling limit in steady)

Enabling of the current limit control during the ramps.

P.203 Curr lim steady (Current limit in steady)

Value of the current limit during steady state.
It is as percentage of the nominal current of the drive (see also parameter d.950, chapter DISPLAY).

P.204 Curr ctrl P-gain (Current control proportional gain)

Proportional gain of the current regulator.

- a setting too low could have a slow reaction on the regulation response.
- a setting too high could can have a too fast reaction with consequent oscillations of the system.

P.205 Curr ctrl I-gain (Current control integral gain)

Integral gain of the current regulation.

- a setting too low could have a slow reaction on the regulation response.
- a setting too high could can have a too fast reaction with consequent oscillations of the system.

P.206 Curr ctr feedfwd (Current control feed forward)

As described in the figure below, the setting of the feed-forward, allows to avoid the drive trip for overcurrent (0C) during fast acceleration of the load.
When the current exceeds the value of Curr lim in ramp, a quick frequency step (percentage of the motor rated slip), is automatically sutracted to the reference.
In this case the ramp is extended in order to keep the current level under this limit.
A shortening of the extended ramp time, can be of course achieved excluding the load.

This function operates only during the ramp time (not in steady state).

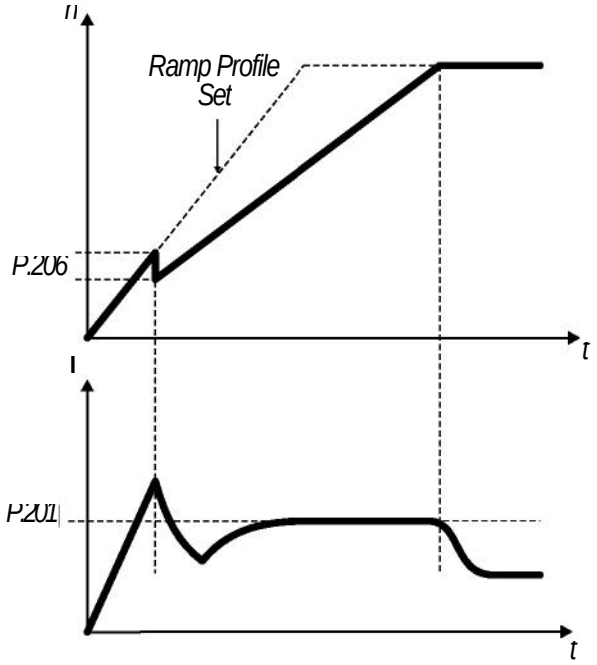


Figure 7.6.9: Current Limit Control in Ramp

A signalling of the "current limit" condition is available on the digital output as ***"Current limit"***.
A signalling of the "overcurrent" condition is available on the digital output as ***"Alarm state"***.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.200	En lim in ramp	[0] None [1] PI Limiter [2] Ramp freeze	2	0	2			427
P.201	Curr lim in ramp		150	20	160	% Inom		428
P.202	En lim in steady	[0] Disable [1] Enable	1	0	1			429
P.203	Curr lim steady		150	20	160	% of I nom		430
P.204	Curr ctrl P-gain		3.0	0.1	100	%	0.1	431
P.205	Curr ctrl I-gain		10.0	0.0	100	%	0.1	432
P.206	Curr ctr feedfwd		0	0	250	%		433

DC Link Limit

The function when enabled, performs a control on the voltage level of the DC link bus capacitor.

During fast deceleration if the load has a big inertia, the DC link value can suddenly increase close to the alarm threshold. In this case the ramp is controlled keeping the voltage level within safety values.

Consequently the deceleration ramp time is automatically extended, in order to achieve the deceleration of the load, trying to avoid an eventual block for "overvoltage" (OV alarm).

As for the current limiter, the DC-Link controller is PI-based, with the addition of a programmable feed forward term.

P.220 En DC link ctrl (Enabling DC link control)

P220 = 0 Function disabled.

P220 = 1 Enabling of the DC link control function.

P220 = 2 DC-Ramp ctrl

During fast deceleration, if the DC link level increase close to the alarm threshold, the ramp stage will be momentary blocked and the speed kept at the value reached in this moment.
When the DC link level, will decrease again within the internal safety values, the ramp will be restarted with the profile set. The ramp time is thus lengthened by the execution of this control.

P.221 DC-lnk ctr Pgain (DC link control proportional gain)

Proportional gain of the DC link control regulation.
- a setting too low could have a slow reaction on the regulation response.
- a setting too high could have a too fast reaction with consequent oscillations of the system.

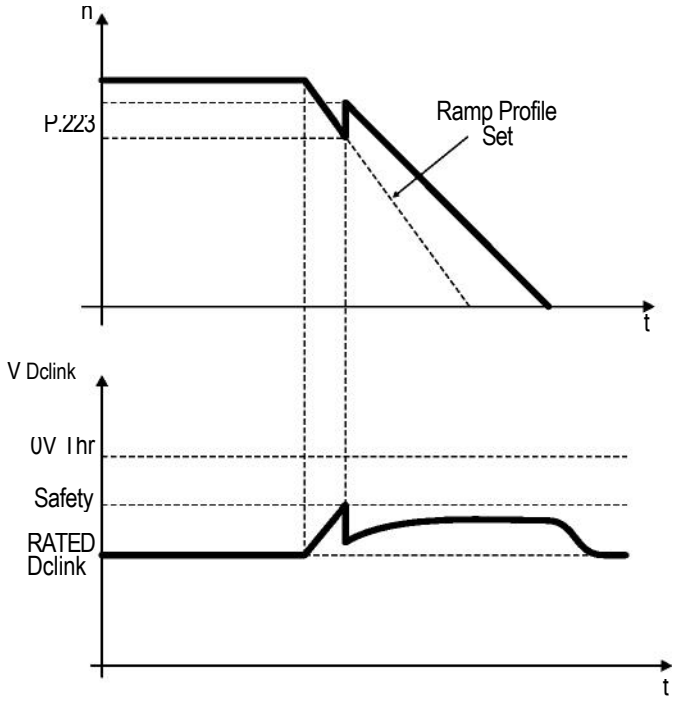
P.222 DC-lnk ctr !gain (DC link control integral gain)

Integral gain of the DC link control regulation.
- a setting too low can have a slow reaction on the regulation response.
- a setting too high can have a too fast reaction with consequent oscillations of the DC link.

P.223 DC-link ctr FF (DC link control feed forward)

As described in the figure beow, this is the setting of the feed-forward for the DC control function.
At the increasing of the DC link level, a quick frequency step (percentage of the motor slip), is automatically added to the reference. The voltage level decreases toward its rated value.

Figure 7.6.10: DC Link Voltage Control



The "overvoltage " alarm will be displayed with the message "OV".
A signalling of the "DC link" status is available on the digital output as "DC bus limit".

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.220	En D C link ctrl	[0] None [1] P! Limiter [2] Ramp freeze	0	0	2			434
P.221	D C-lnk ctr Pgain		3.0	0.1	100	%	0.1	435
P.222	D C-lnk ctr !gain		10.0	0.0	100	%	0.1	436
P.223	DC-link ctr FF		0	0	250	%		437

Over Torque Alarm Configuration

The torque of the motor (active current) can be monitored through this function.

In particular the overtorque condition and the behaviour of the drive itself, are manageable by these parameters.

P.240 OverTorque mode

It defines the status of the drive during its overtorque condition.

P.240 = 0 Overtorque signalling during ramps and at steady state. No alarm will be generated.

P.240 = 1 Overtorque signalling only at steady state. No alarm will be generated.
P.240 = 2 Overtorque alarm and signalling during ramps and at steady state.
P.240 = 3 Overtorque alarm and signalling only at steady state.
P.240= 4 as prog 2 with autoreset alarm
P.240= 5 as prog .3 with autoreset alarm

P.241 OT curr lim thr (Overtorque current limit threshold)

Overtorque signalling threshold.
It is a percentage of the ***Motor rated curr (P.040)***.

P.242 OT level fac src (Overtorque level factor source)

The overtorque level can be linearly regulated through an analog reference signal.
The regulation of this level will be performed between 0% (setting the inputs at 0V - 0mA - 4mA) and 100% ofthe percentage value setted with P.241(+1- 10y - 20mA).

This parameter selects the source from where this function is provided and controlled.

P.242 = 0 OFF
P.242 = 1 Analog Inp 1 (setting through 1.200...1.204)
P.242 = 2 Analog Inp 2 (setting through 1.210...1.214) **optional**
P.242 = 3 Not used

P.243 OT signal delay (Overtorque signalling delay)

Delay time for the alarm signalling.

The alarm will be displayed with the message "Ot"
A signalling of the "overtorque" condition is available on the digital output as Out trq>thr".

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.240	OverTorque mode	[0] No Alm, Chk on [1] No Alm, Chk ss [2] Alm always [3] Alm steady st [4] Alm always/res [5] Alm steady st/res	0	0	0	5		438
P.241	OT curr lim thr		110	20	200	%		439
P.242	OT level fac src	[0] Null [1] Analog inp 1 [2] Analog inp 2 optional [3] Not used	0	0	3			440
P.243	OT signal delay		0.1	0.1	25	sec	0.1	441

Motor Overload Configuration

P.260 Motor OL prot en (Motor overload protection enabling)

Enabling of the motor thermal protection.
The control is performed as an 12t, calculated on the basis of the setting of ***Motor rated curr (P.040)*** and ***Motor thermal K (P.045)***.
An overload of the motor, will cause the intervention of the alarm "Motor overload".

The parameter ***d.052*** (menu ***DISPLAY***), is the monitoring of the motor overload level. A value of 100% represent the threshold for the alarm.

The alarm will be displayed with the message ***"OLM"***
A signalling of the "overcurrent" condition is available on the digital output as ***"Alarm state"***.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.260	Motor IL prot en	[0] Disable [1] Enable	1	0	1			426
P.261	Ovl ref freq 1	Curve overload of freq. 1	0.0	0.0	(**)		0.1	522
P.262	Ovl ref load 1	Load current of freq. 1	250	1	250		1	523
P.263	Ovl ref freq 2	Curve overload of freq. 2	(***)	0.1	500.0		0.1	524
P.264	Ovl ref load 2	Load current of freq. 2	250	1	250		1	525

DC Brake Configuration

The drive provides as a standard a set of parameters for the DC braking management.

With this function the drive injects a DC current into the motor windings, arousing in this way a braking torque. The DC braking can be useful to brake the motor around the zero speed, either at the START and at the STOP stage, maintaining also the motor shaft locked for a short time.

It should not be used to obtain an intermediate braking.

The function parameters, allow a full control of the function.

At every DC braking command, the message "**DCB**" will appear on the display.

P.300 DC braking level

Setting of the DC current level to be injected on the motor phases.

It is a percentage of the ***Motor rated current (P.040).***

P.301 DCB lev fac src (DC Braking level factor source)

The DC braking level can be linearly regulated through an analog reference signal.

The regulation of the DC braking level will be between 0% (setting the inputs at 0V - 0mA - 4mA) and 100% of the value setted with ***P .300*** (+1- 10V - 20mA).

This parameter selects the source from where this function is provided and controlled

P.302 DC braking freq (DC Braking frequency)

It defines the frequency threshold, at which will be activated the DC braking at the STOP.

P.303 DC braking start

Defines the DC braking duration in seconds, at the START (RUN or Reverse). The motor will be locked until this time is elapsed.

P.304 DC braking stop

Defines the DC braking duration in seconds, at the STOP (RUN or Reverse commands released).

NOTE!

- a DC brake command can be carried out also via digital inputs (see chapter **INTERFAC**E, section **Digital inputs**). In this case a **DC brake** will be possible at every speed and independently if the drive is in STOP or START condition (digital input as **DC brake**).
- the injection of direct current remanin active for all the transition time of the DC Brake command.
- a **DC brake** while the drive is controlled with a JOG command, can be obtained by the setting of a digital input as DC brake.
- a momentary disabling of the **DC braking** function, is possible via digital input (digital input as **DC brake en**).

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.300	OV prevention		0	0	100	% of I nom		449
P.301	D CB lev fac src	[0] Null [1] Analog inp 1 (setting through 1.200...1.204)	0	0	3			450
P.302	D C braking freq		0	0	999.9	Hz	0.1	451
P.303	D C braking start		0	0	60	Sec	0.1	452
P.304			0	0	60	Sec	0.1	453

Autocapture function

The Autocapture function, allows to engage a motor already running.

An engaging of a motor already running, without the aid of this function, may cause the drive to trip in overvoltage (OV alarm) or overcurrent (OC alarm) when the drive is started.

Enabling the function, the inverter frequency output will be forced to match the motor speed, according to the command type selected in the Autocapture mode and the setting of the other regulation parameters of this function.

The main uses are:

- case of pumps with flow present
- restart after a fault alarm
- engage of a motor running directly under the mains

P.320 Autocapture mode

P .320 = 0 Func1ion disabled

P .320 = 1 1^{s1} RUN only

The engaging of the motor is carried out only once, when the first valid RUN command is given after drive power on.

P .320 = 2 Always

The engaging of the motor is carried out at every valid RUN command.

NOTE! The function can be enabled also through the digital inputs (see chapter **INTERFACE**, section **Digital inputs**).

In this case it will be possible to have a Autocapture at any time the command is applied (independent by the setting of ***P .320***).

P.321 Autocapture ~lim (Autocapture current limit)

Current limit threshold for the utocapture function.

For current operation, this limit must be higher than the no-load current of the motor in use. % of inverter nominal current (d.950).

P.322 Demagnetiz time (Autocapture demagnetizzation time)

Delay for the beginning of the Autocapture function.

It is the time necessary for the demagnetization the motor. Times too longer can cause the tripping of "Overcurrent" alarm.

P.323 Autocap f scan t (Autocapture frequency scanning time)

Ramp time for the frequency scanning.

The initial scanning frequency type, must be chosen via the selection of parameter **P .325**.

P.324 Autocap V scan t (Autocapture voltage scanning time)

Ramp time for the voltage recovering.

The function is correlated to the parameter **P .323**.

The output voltage will be restored, controlling automatically the current limit set in **P .321**.

P.325 Autocap spd src (Autocapture speed source)

Selection of the source for the initial scanning frequency.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.320	Autocapture mode	[0] Disable [1] 1st run only [2] Always	0	0	2			454
P.321	Autocapture Ilim		120	20	160	% of I nom		456
P.322	Demagnetiz time		(*)	0.01	10	sec	0.01	457
P.323	Autocap f scan t		1	0.1	25	sec	0.1	458
P.324	Autocap V scan t		0.2	0.1	25	V	0.1	459
P.325	Autocap spd src	[0] Frequency ref 0 [1] Max freq ref [2] Last freq ref [3] Not used	0	0	3			460

A signalling of the "Autocapture" status is available on the digital output as "Autocapture run".

Undervoltage Configuration

A temporary phase loss of line input voltage, can be detected by the inverter intermediate circuit (DC-bus) as variation of its low voltage threshold level.

This condition will cause the tripping of inverter "Undervoltage" (UV) alarm.

A correct configuration of the inverter parameters, can avoid undesired system alarms caused by main dip or instability of the line voltage.

Therefore, considering the above points the inverter will have the following behaviour:

- detection of undervoltage threshold setted with ***Undervoltage thr (P .340)*** parameter
- disabling of output control voltage: the motor will coast to stop
- enabling of ***Autocapture*** function, if the main dip of the line voltage is lower than the time sets with ***Max pwrloss time(P .341)*** parameter; an higher value will cause a tripping of undervoltage inverter alarm (UV)

The enabling of the function depends by the configuration of the following parameters:

P .321 Autocapture ,lim **P. 322 Demagnetiz time**

P .323 Autocap f scan t **P .323 Autocap V scan t**

NOTA! La configuration above described is refered to the setting of UV Trip mode (P.3 43) = 0 parameter.

P.340 Undervoltage thr (Undervoltage threshold)

"Undervoltage" alarm (UV) threshold detection.

The undervoltage threshold can be set in a range, within the minimum value allowed and its nominal input voltage selected.

See the table below for more details. Here below an example:

S.000 (P.020) Mains voltage parameter = 380Vac

DC UV minimum threshold = 380Vdc Nominal DC Link = 537Vdc.

P. 340 = 0% UV = 380Vdc

P340 = 50% $UV = 380 + \frac{(537 - 380) \times 50}{100} = 458Vdc$

AC main supply	*Minimum UV threshold*	*Nominal DC-Bus*
110Vac	110Vdc	1 48Vdc
220Vac	125Vdc	298Vdc
230Vac	125Vdc	310Vdc
2 40Vac	125Vdc	325Vdc

P.341 Max pwrloss time (Maximun power loss time)

It defines the time before the drive trip for undervoltage alarm.

If the main dip lasts a time longer than the one here set, the undervoltage alarm is issued.

P.342 UV alarm storage (Undervoltage alarm storage)

This parameter defines wheter UV alarms have to be stored into the alarm stack during the counting **of Max pwrloss time** (see chapter **DISPLAY**, section Alarm list). The alarm will be displayed with the message "**UV**". A signalling of the "undervoltage" condition is available on the digital output as "**UV running**".

P.343 UV Trip mode (Undervoltage tripping mode)

This function allows the controlled stop of a single drive/motor configuration, in case of a.c. mains power loss. Its working is correctly carried out, only if the load has a sufficient quantity of kinetics energy (eg. inertial loads). When the DC link voltage drops under the power loss detection threshold, the function is activated.

Automatically an internal threshold is detected and selected, to be higher than the undervoltage level.

The drive will act in accordance with the setting of the function and the behaviour of the mains. This is described in the drawings below.

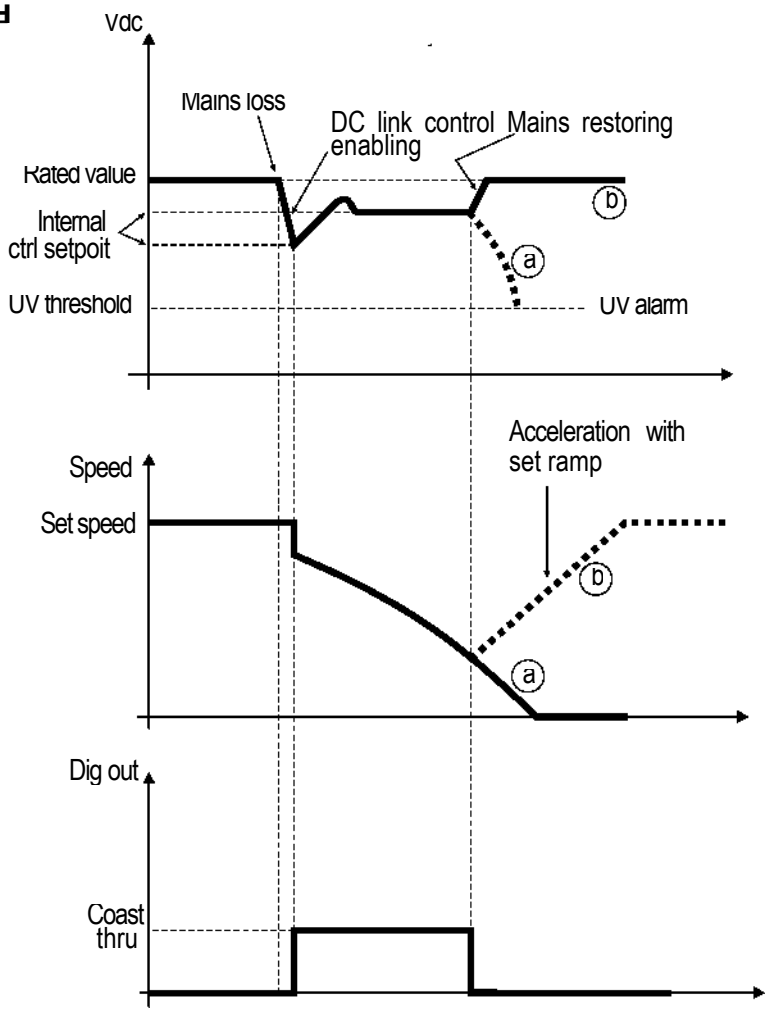
P. 343 = 0 Disable A mains power loss, will trip the drive for undervoltage alarm (UV)

P. 343 = 1 Coast Through See figure 7.6.11

P. 343 = 2 Emg Stop See figure 7.6.12

Figure 7.6.11: Coast through

COAST THROUGH



a) the load energy exhausts before the mains is recovered

b) the mains is recovered before the load exhausts its energy

• At the mains power loss, the drive will lead the motor to zero speed, with a ramp internally defined and depending by the load inertia (not the one set).

• If used, the braking device will provide the advantage to achieve as more as possible the specified deceleration fast stop time ***(F.208 - Dec time 4)***.

• When reached the zero speed and exhausted the load energy, if the mains is not recovered, the DC link will drop under the UV threshold.

• Recovering the mains power, the motor will be led back to its original speed, with the defined acceleration ramp.

The status of the "Coast Trough" function, is available on digital output, programmed as "***Coast Thru***".

EMG STOP (Emergency Stop)

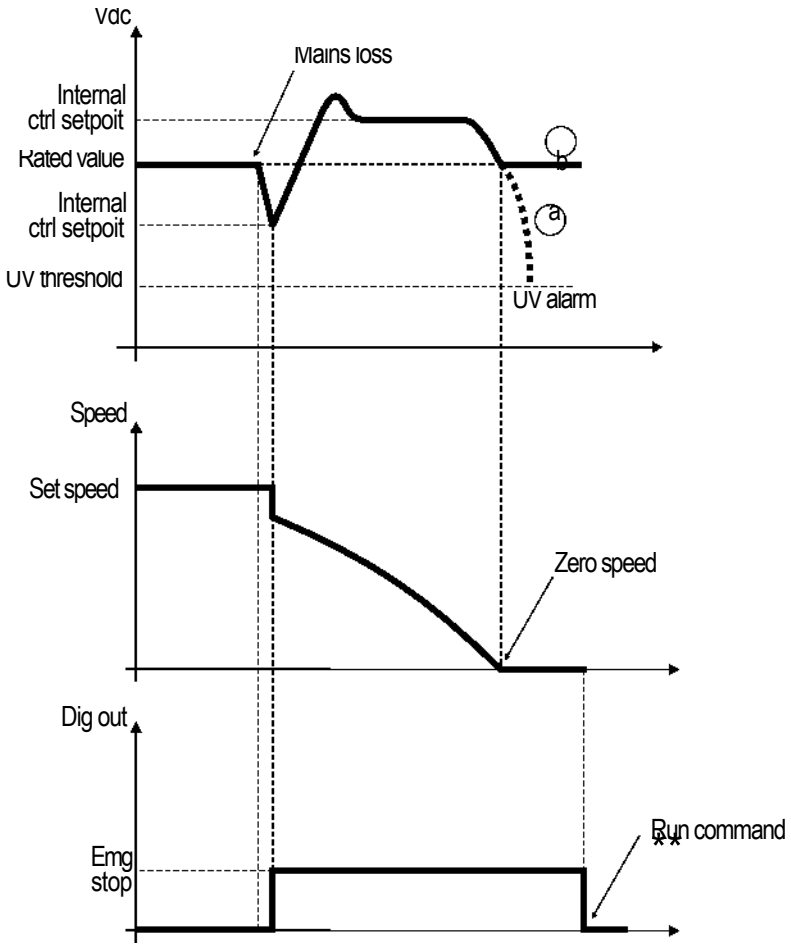


Figure 7.6.12: Emergency Stop

a) the mains power has not been recovered during the stop procedure

b) the mains power has been recovered during the stop procedure

• At the mains power loss, the drive will lead the motor to zero speed, with a ramp internally defined and depending by the load inertia (not the one set).

• If used, the braking device will provide the advantage to achieve as more as possible the specified deceleration n fast stop time ***(F.208 - Dec time 4).***

• When reached the zero speed and exhausted the load energy, if the mains is not recovered, the DC link will drop under the UV threshold.

This setting doesn't offer the possibility to lead back the motor to the original speed.

**Once at zero speed if the mains power is recovered, to restart the motor will be necessary to release the RUN command and then apply it again.

The status of the "Emergency Stop" function, is available on digital output, programmed as "***Emg Stop***" (programming code: 49).

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P340	Undervoltage thr		0	0	80	% of P061		462
P341	Max pwrloss time		0	0	25	sec	0,1	463
P342	UV alarm storage	[0] Disable [1] Enable	1	0	1			464
P343	UV Trip mode	[0] Disabled [1] CoastThrough [2] Emg Stop	0	0	2			491

P.360 OV prevention (Overvoltage prevention)

During fast deceleration or in case of deceleration with high inertia load, it is possible to prevent the drive trip for overvoltage alarm, by the enabling of this function.

Performing this control, the drive will act as follows:

- detection of the overvoltage level, without storing and displaying the alarm.
- disabling the inverter output bridge; the motor will coat to stop and DC-link will decrease toward safe values.
- automatic enabling of the Autocapture function, and engaging of the motor at the last frequency value, detected before the alarm.

For corrent operations it is necessary to enter the proper settings of the **Autocapture** parameters:

P321 Autocapture ,lim

P322 Demagnetiz time

P 323 Autocap f scan t

P324 Autocap V scan t

n

- normal operation is rersumed and the motor will be stopped following the programmed ramp.
- if during the stop, the load inertia leads again the DC bus at the limit level, the procedure described abovewill be iterated.

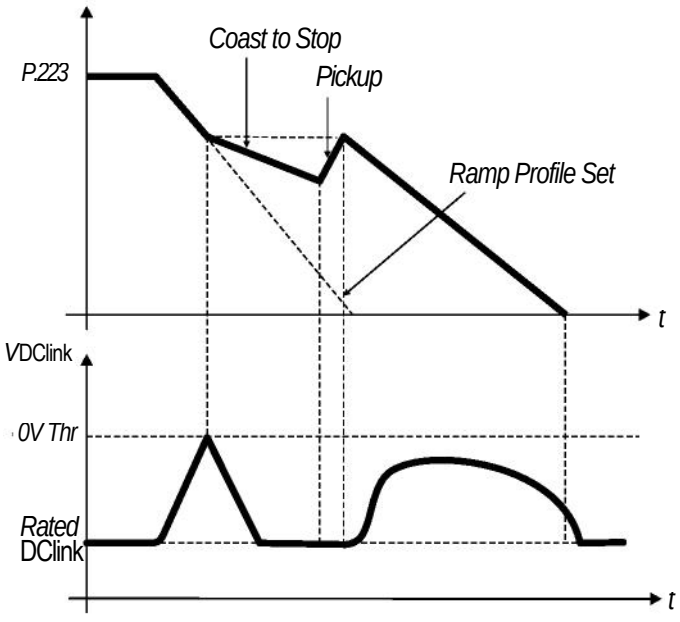


Figure 7.6.13: Overvoltage Prevention

The "overvoltage " alarm will be displayed with the message "**OV**".
A signalling of the "overvoltgae" condition is available on the digital output as "Alarm state".

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.360	OV prevention	[0] Disable [1] Enable	0	0	1			465

Autoreset Configuration

The Autoreset function allows the automatic restoring of the working of the drive, after the detection of some alarms.

It will be active only with an appropriate setting of the following parameters and if these alarms have been caused by :

- undervoltage (UV)
- overvoltage (OV)
- overcurrent (OC)
- overcurrent desat (OCH)
- external fault (programmable) (EF)
- serial time out (St)

P.380 Autoreset attmps (Autoreset attemps)

Setting of the maximum number of attempts for the restarting, after the detection of the alarms.

P.381 Autoreset clear

When enabled, it clears the number of events setted with ***Autoreset attmps*** (P .380) parameter, if for 10 minutes no alarm has been detected.

P.382 Autoreset delay

Delay that elapses between the failure detection and the beginning of the autoreset sequence.

P.383 Autores flt rly (Autoreset fault relay)

Definition of the status for the relays and digital outputs, during the autoreset function, when programmed as follows:

Parameters	"Relays & Dig Out" programming		
P.383	*Drive OK*	*Alarm state*	*No alarm state*
0	ON	OFF	ON
1	OFF	ON	OFF

tgy0340

NOTE! a normal "Reset" can be enabled also through the digital inputs (see chapter INTERFACE, section Digital inputs). The reset command will be executed only if the drive is blocked (no RUN or Reverse commands) and the cause of the alarm has been eliminated.

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.380	Autoreset attmps		0	0	255			466
P.381	Autoreset clear		5	0	250	min		467
P.3820	Autoreset delay		1.0	0.1	50	sec	0.1	468
P.383	Autores flt rly	[0] OFF [1] ON	1	0	1			469

External Fault Configuration

P.400 Ext fault mode (External fault mode)

Configuration of signalling for the "**External fault alarm**".

As per factory setting the function is programmed on the digital input 6 (terminal 6).

P.400 = 0 Always signalled - Autoreset not possible

P.400 = 1 Signalling only when applied the RUN command - Autoreset not possible

P.400 = 2 Always signalled - Autoreset possible

P.400 = 3 Signalling only when applied the RUN command - Autoreset possible

The alarm will be displayed with the massage "EF".

A signalling of the "external fault" condition is available on the digital output as "Extern fault".

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.400	Ext fault mode		0	0	3			470

Phase Loss Detection

P.410 Ph Loss detec en (Phase Loss detection enabling) blocked

The enabling of this function allows to detect the missing of any phase of the input supply.

P.410 = 0 Disabled Phase loss control detection disabled.

P.410 = 1 Enabled Phase loss control detection enabled.

The alarm will be displayed with the message "***PH***".

A signalling of the "phase loss " condition is available on the digital output as "***Alarm state***".

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.410	Ph Loss detec en	[0] Disable [1] Enable	0	0	0			492

Voltage Reduction Configuration

When a motor is found to use only partial power during normal running conditions, enabling this function reduces the motor flux current to save energy coast.

P.420 Volt reduc mode (Voltage reduction mode)

Definition of the mode for the output voltage reduction.

P.420 = 0

The output voltage reduction is always applied.

P.420 = 1

The output voltage reduction is not applied during the ramp, providing in this way the availability of the full torque up to the achieving of the maximum setup of the V/F ratio.

The voltage reduction will be activated only at constant speed (end of ramp).

P.421 V reduction fact (Voltage reduction factor)

Level of the output voltage, that will be applied on the motor terminals.

It is percentage of the voltage, resulting from the V/F ratio (see figure 7.6.1 4).

P.422 V fact mult src (Voltage reduction factor multiply source)

The output voltage level reduction, can be linearly regulated through an analog reference signal.

Its regulation will be performed in a range between 10% (setting the input at 0V - 0mA - 4mA) and 100% of the value setted with P.421 parameter (+/- 10V - 20mA).

The figure below describes this regulation.

NOTE! The level of voltage reduction, will be applied in accordance to the output voltage value, based on the characteristic of the V/F ratio.

Example:

P.421 = 30%

V/f motor characteristic = 380V / 50Hz

Motor supply voltage = 380V / 50Hz

The value of P.422 will be the following:

$$380 - \frac{380 \times 30}{100} = 266V$$

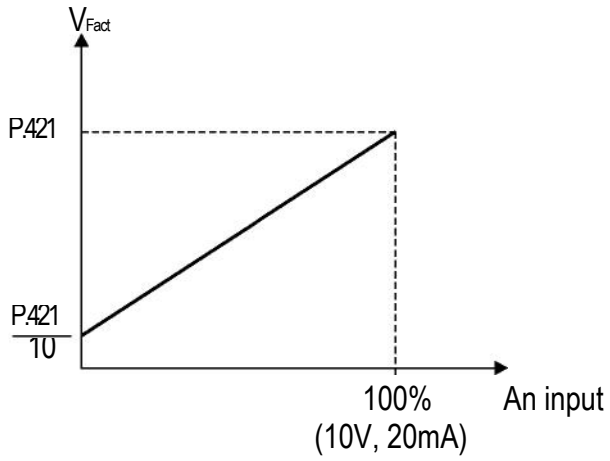


Figure 7.6.14: Voltage reduction factor multiply

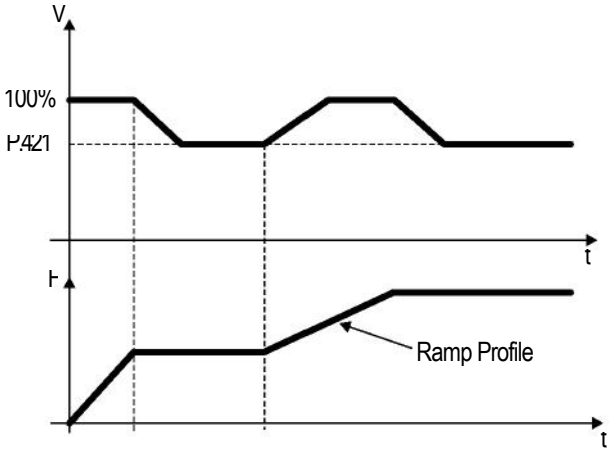


Figure 7.6.15: Output Voltage Reduction with (.420 = 1

NOTE! the function can be enabled also through the digital inputs (see chapter ***INTERFACE***, section ***Digital inputs***). In this case it will be possible to have the Output Voltage reduction and vice versa, at any timethe command is applied.

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.420	Volt reduc mode	[0] Always [1] Steady state	0	0	1			471
P.421	V reduction fact		100	10	100	% of P.061		472
P.422	V fact mult src	[0] Null [1] Analog inp 1 (setting through 1.200...1.204) op [2] Analog inp 2 (setting through 1.210...1.214) [3] Not used	0	0	3		1	473

Frequency Threshold

P.440 Frequency prog 1 (Frequency programmed 1)

Set point for the detection of the first frequency threshold.

The signalling of the frequency level detection, can be programmed on the digital outputs.

P.441 Freq prog 1 hyst (Frequency programmed 1 hysterisis)

Defines a tolerance band around the ***Frequency prog 1 (P.440).***

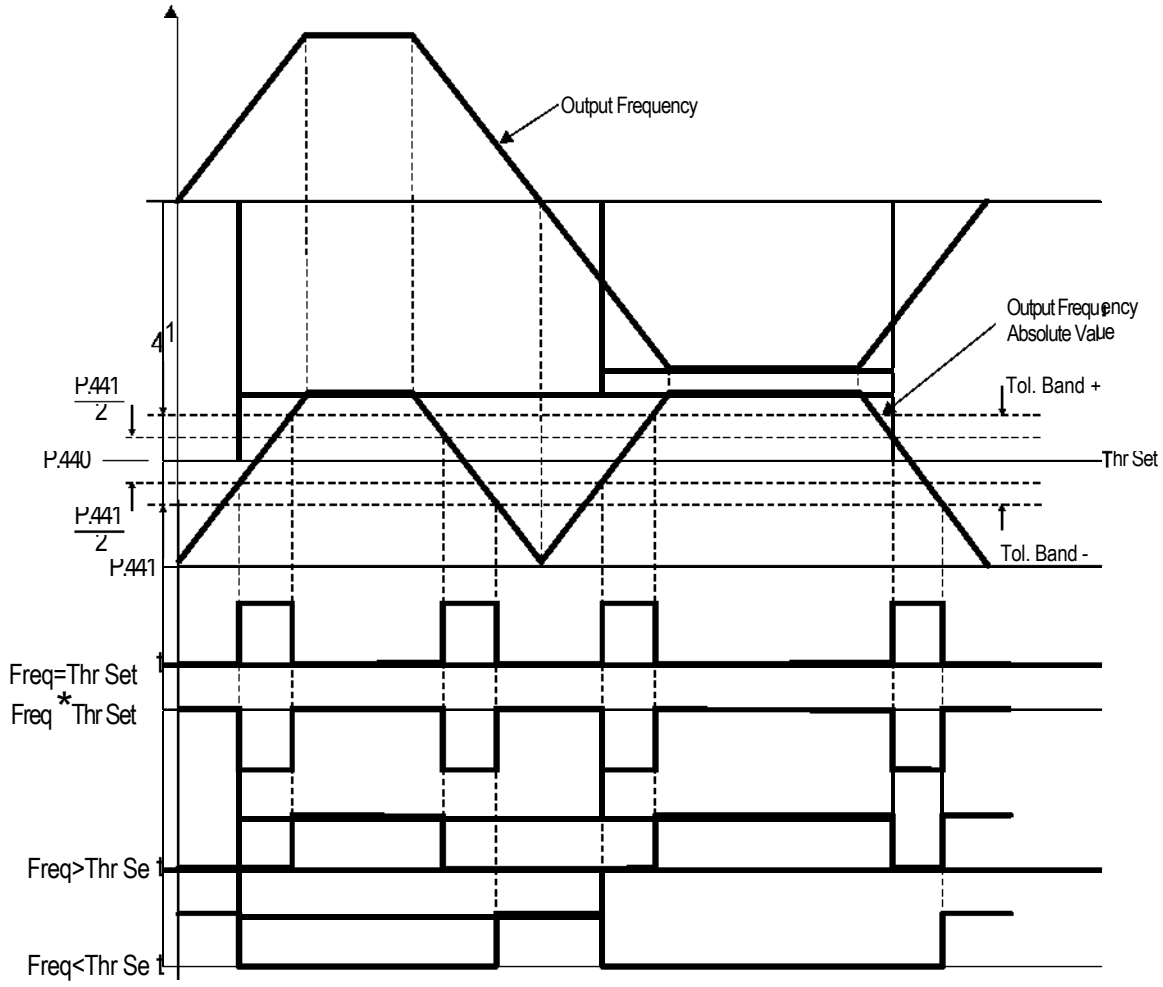


Figure 7.6.16: Program Frequency Tresholds (example of P.440 and P.441)

A signalling of the "frequency threshold" status is available on the digital output as "**Freq thr 1**" and "**Freq thr 2**".

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.440	Frequency prog 1		0	0	F.020	Hz	0.1	474
P.441	Freq prog 1 hyst		0,5	0	F.020	Hz	0.1	475

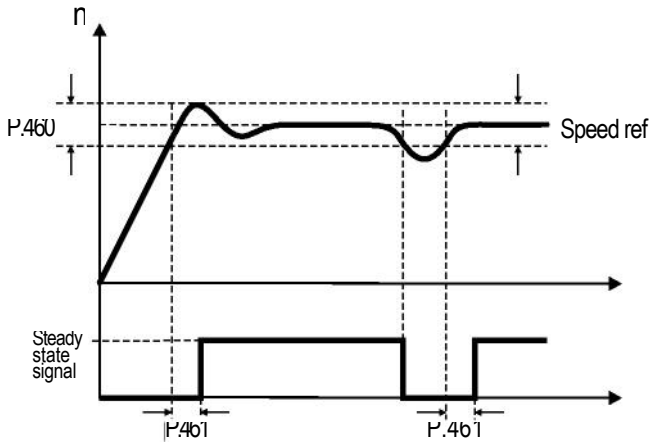
Steady State Signalling

The signalling of a speed variation when running in steady state, is possible with this parameters.

P.460 Const speed tol (Constant speed tollerance)

It defines the tollerance band of the speed variation.

P.461 Const speed dly (Constant segnalling delay)



Delay time for the signalling.

Figure 7.6.1 7: Constant Speed Control

A signalling of the "steady state" condition is available on the digital output as "Steady state".

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.460	Const speed tol		0.5	0	25	Hz	0.1	478
P.461	Const speed dly		0.2	0	25	SEC	0.1	479

Heatsink Temperature Threshold

Control and monitoring of the drive heatsink temperature.

P.480 Heatsnk temp lev (Heatsink temperature level)

Setting of the temperature threshold in °C.

P.481 Heatsnk temp hys (Heatsink temperature hysterisis)

Tolerance band for he signalling of the temperature threshold.

The parameter **d.050** (menu **DISPLAY**), is the monitoring of the heatsink temperature level .

The alarm will be displayed with the massage "**OHS**".

A signalling of the "heatsink temperature" status is available on the digital output as "Hs temp th~".

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
P.480	Heatsnk temp lev		80	10	110	° C		480
P.481	Heatsnk temp hys		5	0	10	%		481

PWM Setting

P.500 Switching freq (Switching frequency)

Setting of the modulation frequency of the drive.

P.501 Sw freq reduc en (Switching frequency reduction enabling)

When enabled, the modulation frequency is automatically reduced, when the output frequency of the drive is below 5Hz.

This in particular, can avoid the overheating of the motor at low speed ,caused by high commutation in its winding. Furthermore it improves the output sinuswave form, providing a smoother rotation.

P.520 Overmod max lev (Overmodulation maximun level)

Setting of the overmodulation maximum level.

This function increases the output voltage, providing as consequence a higher torque availability.

A setting too high of the parameter could be increases the distortions of the output voltage and create undesired vibrations of the system.

P.540 Out lilt auto adj (Output voltage automatic adjustement)

The voltage applied to the motor terminal is defined by the parameter ***Max output voltage (P.061)***, and it is strictly correlated to the value of the mains voltage.

This function can make independent the motor output voltage from eventual fluctuation of the mains, through an automatic adjustment of the first.

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.500	Switching freq	[0] 1kHz [1] 2kHz [2] 3kHz [3] 4kHz [4] 6kHz [5] 8kHz [6] 10kHz [7] 12kHz [8] 14kHz [9] 16kHz [10]18kHz [11] Reserved	(*)	0	10		1	482
P.501	Sw freq reduc en	[0] Disable [1] Enable	0	0	1		1	483
P.520	Overmod max lev		50	0	100	%		484
P.540	Out Vlt auto adj	[0] Disable [1] level 1 min [2] level 2 [3] level 3 [4] level 4 [5] level 5 [6] level 6 max	6	0	6		1	485

Dead Time Compensation

The "dead time compensation" fucnction allows for compensation of the output voltage distorsion due to IGBT voltage drop and its switching characteristics.

Distorsion of output voltage may cause non uniform, non smooth shaft rotation in open loop control.

Throgh the two parameters it is possible to set a voltage value and the compensation variation, called Gradient.

P.560 Deadtime cmp lev (Dead time compensation level) **Reserved**

Dead time compensation level.

P.561 Deadtime cmp slp (Dead time compensation slope) **Reserved**

Compensation gradient value.

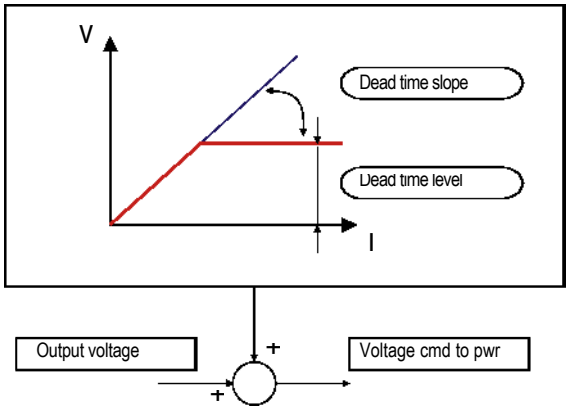


Figure 7.6.18: Dead Time Compesation

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.560	Deadtime cmp lev	Reserved	0	0	0			486
P.561	Deadtime cmp slp	Reserved	0	0	0			487

Display Setting

P.580 Startup display

It is possible to define the first parameter that will be displayed at every power-on of the drive.

The choice can be carried out by the setting of the corresponding "IPA", reported in the parameters list table.

P.600 Speed dsply fact (Startup display factor)

Costant conversion for variables displaying, as speed and speed reference .

The parameters can be applied at the variable reported at the chapter DISPLAY, section Basic and Encoder.

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.580	Startup display		1	1	1999		0.01	488
P.600	Speed dsply fact		1	0.01	99.99		0.01	489

Protection

P.999 Param prot code (Parameters protection code)

Protection against undesired modification of the parameters.

P.999 = 0 No protection and storage of the parameters with motor stopped

P.999 = 1 All the parameters are protected a part the digital frequencies F.100...F.116

P.999 = 2 All the parameters are protected

P.999 = 3 No protection and storage of the parameters with the motor running (NOT RECCOMENDED).

Code	Name	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.999	Param prot code		0	0	3			490

PID Setting

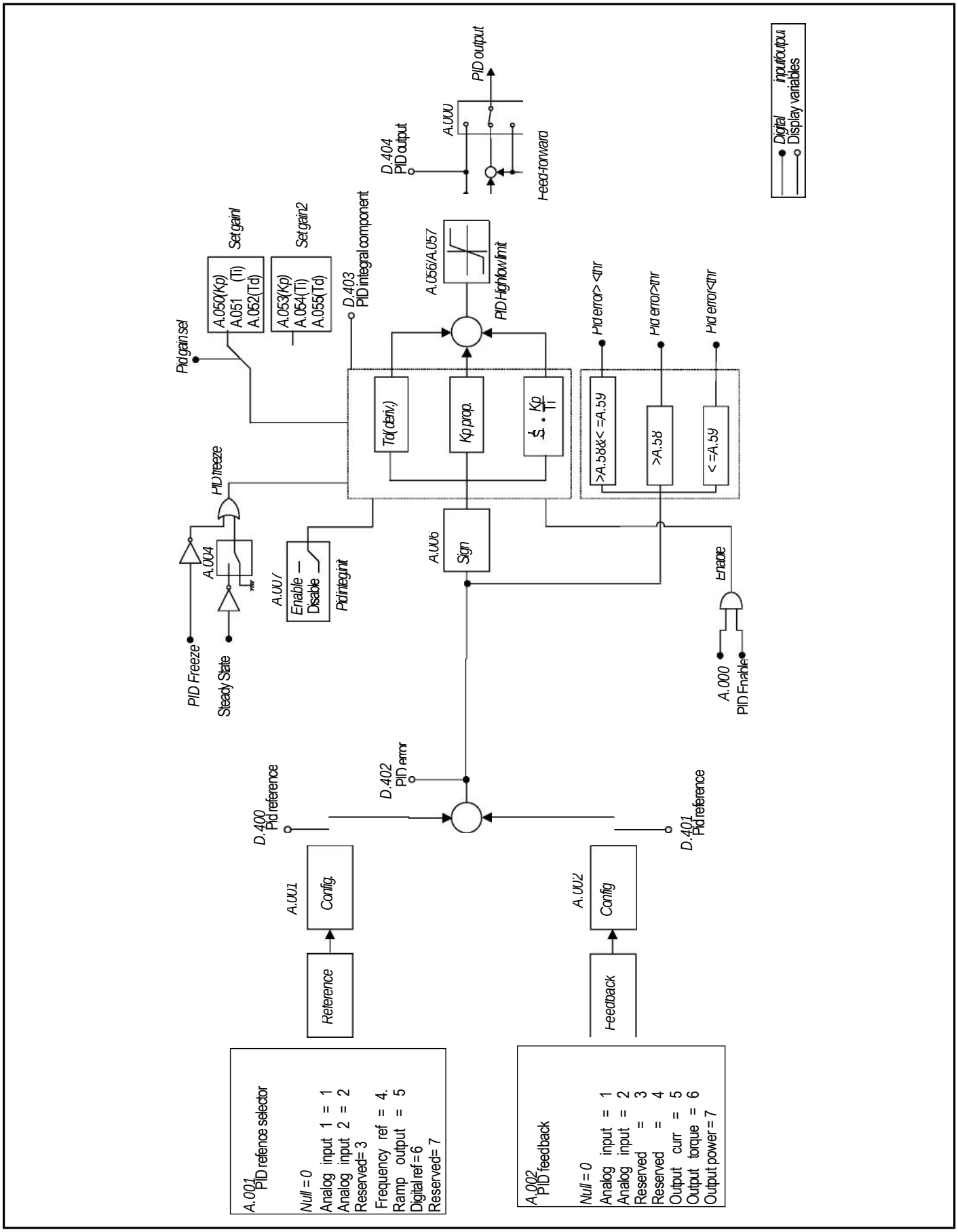


Figure 7. 7.1: PID Function Block

In the PID menu are contained all the parameters concerning the setting of the function. The DVS drive provides a PID function, engineered on purpose for the following controls:

- nip rolls with dancer or load cell
- pressure regulation for pumps and extruders
- speed loop control with encoder

A use of the PID block as stand-alone is also possible, correlated (or not) to the RUN status of the drive.

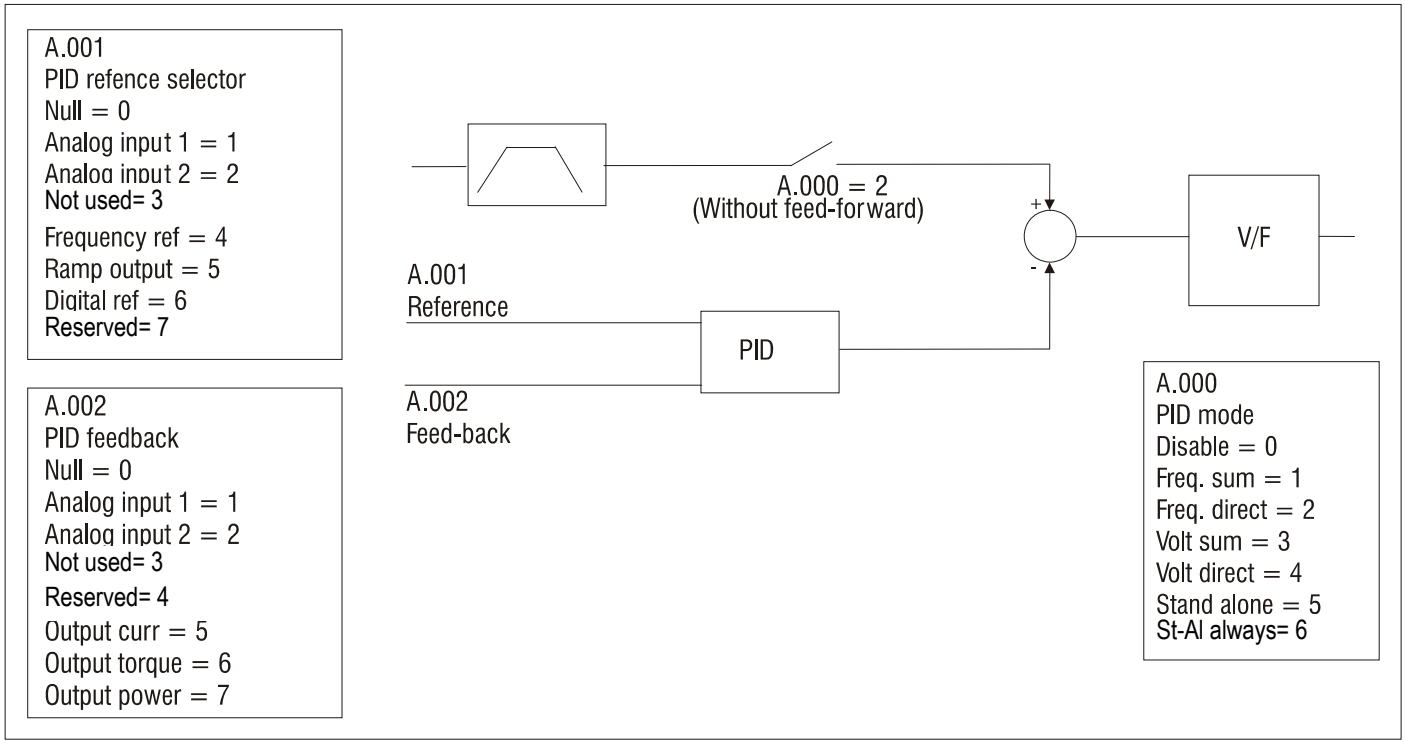


Figure 7. 7.2: PID Mode as Frequency Sum or Direct

A.000 PID Mode

This parameter allows to define the regulation mode of the PID function.

A.000 = 0 Disable	The function is disabled.
A.000 = 1 Freq.sum	The output of the PID regulator is added to the ramp output reference value (with feed-forward).
A.000 = 2 Freq.direct	The PID regulator output is directly input to the V/f profile generator. Frequency ramp output is not used.
A.000 = 3 Volt sum	The PID regulator output is added to the voltage reference, calculated in accordance with the setting of the V/F ratio (with feed-forward).
A.000 = 4 Volt direct	The PID regulator output is the voltage to be applied to the motor. V/f curve is not used.
A.000 = 5 Stand alone	The PID function can be used as generic control. The regulator will be active only when the drive will be in RUN.
A.000 = 6 St-Al always	The PID function can be used as generic control. The regulator is not correlated to the drive status.

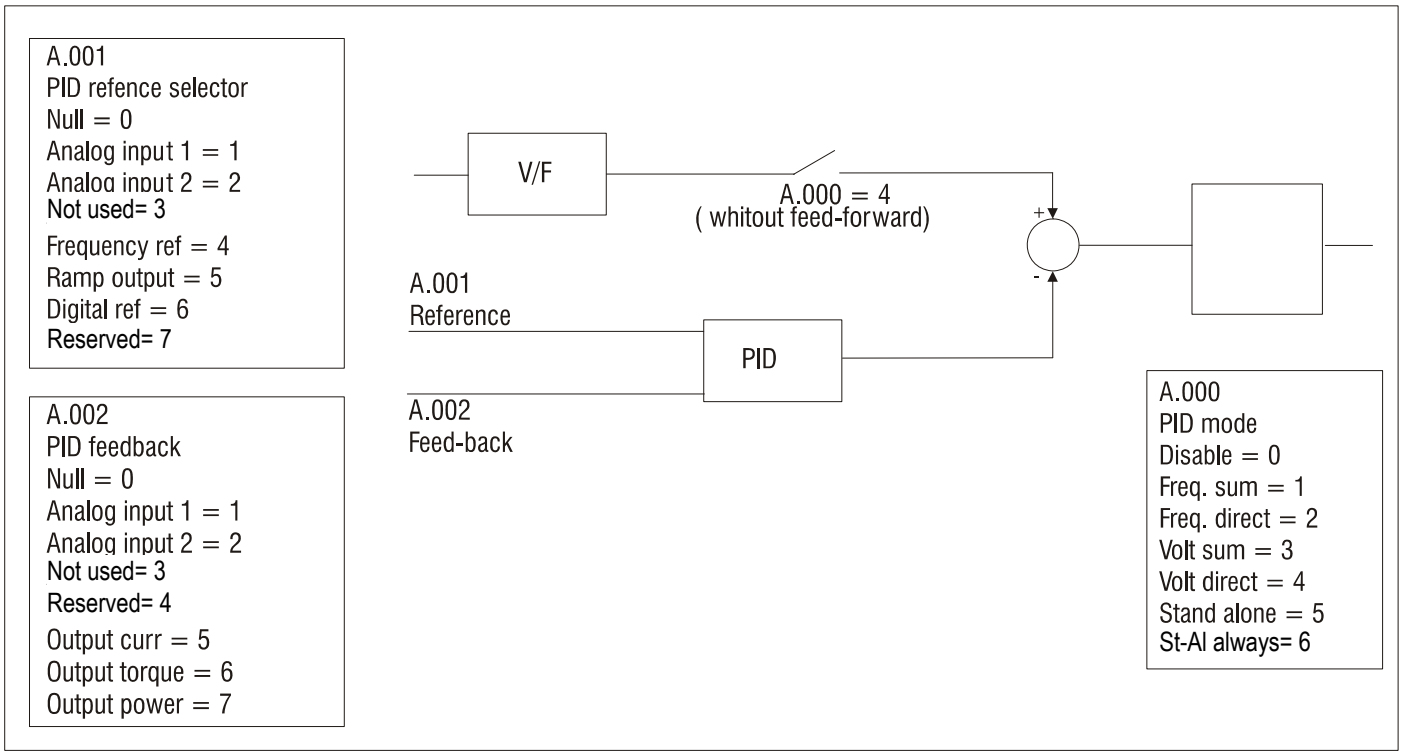


Figure 7. 7.3: PID Mode as Voltage Sum or Direct

A.001 PID reference selector

It defines and selects the source, from where the PID reference signal is provided and controlled.

A.001 = 0 Null	Null
A.001 = 1 Analog inp 1	PID Reference connected to Analog input 1
A.001 = 2 Analog inp 2	PID Reference connected to Analog input 2
A.001 = 3 Not used	
A.001 = 4 Frequency ref	PID Reference connected to Frequency reference
A.001 = 5 Ramp output	PID Reference connected to Ramp output signal
A.001 = 6 Digital ref	PID Reference connected to "PID digital ref"parameter
A.001 = 7 Reserved	PID Reference connected to Encoder frequency

A.002 PID Fbk sel (PID feedback selector)

It defines and selects the source, from where the PID feed-back signal is provided and controlled.

A.001 = 0 Null	Null
A.001 = 1 Analog inp 1	PID Feed-back connected to Analog input 1
A.001 = 2 Analog inp 2	PID Feed-back connected to Analog input 2
A.001 = 3 Not used	PID Feed-back connected to Analog input 3
A.001 = 4 Reserved	PID Feed-back connected to Encoder frequency
A.001 = 5 Output curr	PID Feed-back connected to Output current signal
A.001 = 6 Output torque	PID Feed-back connected to Output torque signal
A.001 = 7 Output power	PID Feed-back connected to Output power signal

A.003 PID digital ref (PID digital reference)

Setting of the reference for the PID function.

It will be active only if PID Fbk sel (A.002) is set as "6"

A.004 PID activate mode

It defines if the PID function has to always be enabled or if it has active in steandy state only.

A.004 = 0 Always	The PID function is always enabled.
A.004 = 1 Steady state	The PID function is enabled only at steady state.

A.005 PID-Encoder Sync (PID encoder syncronism)

The function syncronizes the updating time of the PID regulator, with the ones of the encoder feedback reading.

A.005 = 0 Disable The function is not enabled. Setting to parameter ***PID update time (A.008).***

A.005 =1 Enable The function is enabled. Setting of parameter ***A.008*** has no effect PID regulation will be updated according to ***I.504***.

A.006 PID err sign rev (PID error signal reverse)

It allows to invert the polarity of the error signal between the reference and the feed-back (as consequence alsothe regulation effect is modified).

A.007 PID Integ Init en (PID integral initializzation enabling)

The function allows to initialize the "integral parts" at the RUN command or during the passage from "gains setting 1" to "gains setting 2". This allows to avoid abrupt oscillation of the regulator output.

When the function is active, the value of the integral component, will take on a value equal to:

Iinit = Pid output - ((Kp x err) + (Kd x Derr).

A.008 PID update time

It defines the updating time of the PID regulator. The value 0.00 means minimum updating time (5ms).

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
A.000	PID mode	[0] Disable [1] Freq sum [2] Freq direct [3] Volt sum [4] Volt direct [5] Stand alone [6] St-Al always	0	0	6			1200
A.001	PID ref sel	[0] Null [1] Analog inp 1 [2] Analog inp 2 [3] Not used [4] Frequency ref [5] Ramp output Ramp output [6] Digital ref [7] Reserved	0	0	7			1201
A.002	PID fbk sel	[0] Null [1] Analog inp 1 [2] Analog inp 2 [3] Not used [4] Encoder freq [5] Output curr [6] Output torque [7] Reserved	0	0	7			1202
A.003	PID digital ref		0	-A009	A009	%	0,1	1203
A.004	PID activat mode	[0] Always [1] Steady state	0	0	1			1204
A.006	PID err sign rev	[0] Disable [1] Enable	0	0	1			1206
A.007	PIDInteg init en	[0] Disable [1] Enable	0	0	1			1207
A.008	PID update time		0	0	2.5	sec	0,01	1208

PID Gains

The enabling of the PID regulator and the selection of two different gains setting, can be carried out via programmable digital inputs. Below are reported the parameters concerning the gains regulation.

A.050 PID Prop gain 1 (PID proportional gain 1)

Proportional part gain (set 1).

A.051 PID Int t const1 (PID integral constant 1)

Integral action time (set 1).

A.052 PID Deriy gain 1 (PID derivative gain 1)

Derivative action time (set 1).

A.053 PID Prop gain 2 (PID proportional gain 2)

Proportional part gain (set 2).

A.054 PID Int t const2 (PID derivative gain 2)

Integral action time (set 2).

A.055 PID Deriy gain 2 (PID integral constant 2)

Derivative action time (set 2).

Digital input configuration to select parameter set 1 and set 2.

I.100=21 PID gain sel

Abrupt oscillation caused by the gains selection, can be avoided enabling the function.

PID Integ. Init en (A.007)

The selection of the two gains setting, is possible programming the digital input as **Pid gain sel** (code 21).

The PID function enabling, is possible programming the digital inputs as **PID Enable** (code 20).

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
A.050	PID Prop gain 1		0	0	99.99		0.01	1209
A.051	PID Int tconst 1		99.99	0	99.99		0.01	1210
A.052	PID Deriy gain 1		0	0	99.99		0.01	1211
A.053	PID Prop gain 2		0	0	99.99		0.01	1212
A.054	PID Int tconst 2		99.99	0	99.99		0.01	1213
A.055	PID Deriy gain 2		0	0	99.99		0.01	1214

PID Limits

A.056 PID high limit

Setting of the maximum allowed PID output.

A.057 PID low limit

Setting of the minimum allowed PID output.

A.058 PID max pos err (PID maximun positive error)

Setting of the maximum positive limit of the regulator error. It is expressed as percentage of the full scale value. It defines the threshold for the digital output signalling.

A.059 PID min pos err (PID minimun positive error)

Setting of the maximum negative limit of the regulator error. It is expressed as percentage of the full scale value It defines the threshold for the digital output signalling.

Digital output signalling:

18	**PID err><**	PIP error is >A.058 &<=A.059
19	**PID err>thr**	PID error is >A.058
20	**PID err<thr**	PID error is <=A.059
21	**PID er ><(inh)**	PID error>A.058 &<=A.059 (*)
22	**PID er >(inh)**	PID error is >A.058 (*)
23	**PID er <(inh)**	PID error is <=A.059 (*)

(*) The control through the digital output, can become active only when the error returns the first time in the preset interval.

Variable monitoring in the DISPLAY MENU

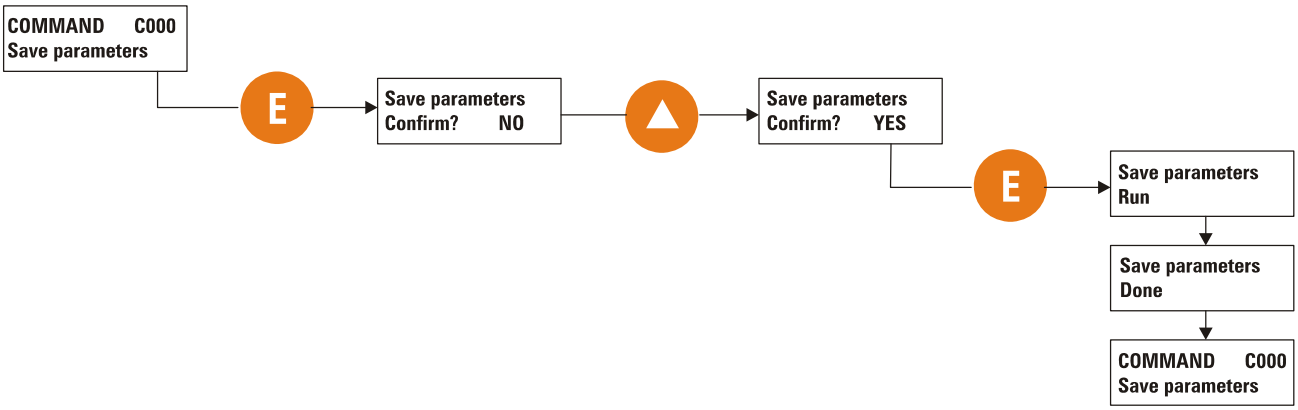
The PID variables can be monitored in the following parameters:

D.400	**PID reference**	Reference signal
D.401	**PID feedback**	Feedback signal
D.402	**PID error**	Signalling of the error between reference and feedback
D.403	**PID integral comp**	Actual value of the integral component
D.404	**PID output**	Actual value of the PID regulator output

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
A.056	PID high limit		100	0	100	%	0.1	1215
A.057	PID low limit		-100	-100	0	%	0.1	1216
A.058	PID max pos err		5	0.1	100	%	0.1	1217
A.059	PID min neg err		5	0.1	100	%	0.1	1218
A.060	PID out max step		25.0	0.1	25.0		0.1	1224

7.8 Menu C - COMMANDS

All the parameters of the COMMAND menu require to be executed according to the procedure listed below. Save parameters command is used as example.



Basic

C.000 Save parameters

Every changing of each parameter, is immediately accepted and executed by the drive. However, permanent storage of them, is performed only by the execution of this command.

Unsaved modifications to any parameter will be lost when the drive is turned off.

C.001 Recall param

The function recalls the parameters that were previously stored, replacing the ones currently in use.

C.002 Load Deafult

Recall of the factory parameters.

The storage of them is a choice of the user.

Alarm Register Reset

C.020 Alarm clear

The function reset completely the ***Alarm List*** register (***D.800...D.803***).

External Key

C.040 Recall key prog

Recalling and storage of the parameters contained in the optional external key **QUIX-PRG**. The key has to be set in the connector JP10 on the regulation board.

C.041 Save pars to key

Storage of the inverter parameter on the optional external key **QUIX-PRG**.

Tuning

C.100 Measure stator R

It measures the stator resistance of the motor connected.

This will help to provide a smooth and uniform value of the output torque through the whole speed range. The control is helped by the use of the Automatic boost (***P.401***).

Do not perform any tune when a multiple motor connection is being used

.

Upgrade

C.900 Command to show upgrade key version

This command is used for viewing the version of update key

C.901 Command to upgrade the firmware and configuration files via the key

This command is used for perfoming the firmware and configuration files from key

C.902 Command to upgrade only the configuration files via the key

This command is used for perfoming the configuration files only from key

7.9 Menu H - HIDDEN

This menu is not available on the keypad. The setting and the reading of the parameters here contained, can be performed exclusively via serial line or through SBI card.

Virtual I/O Commands

H.000 Virtual digital command

Setting of the bits for the virtual commands assignment.

A byte is available for the selection of 8 digital commands, whose setting will interact with the "decoder mask". The status of this mask will determine the switch for a virtual command (high status) or terminal command (low status).

Defining the mask for a virtual command, the function programmed on the digital inputs (***I.000...I.007***), will be executed by this parameter in accordance with the setting of its bits.

Bit 1 = 1	*Virtual command 1*	*Enabled*
Bit 2 = 2	*Virtual command 2*	*Enabled*
Bit 3 = 4	*Virtual command 3*	*Enabled*
Bit 4 = 8	*Virtual command 4*	*Enabled*
Bit 5 = 16	*Virtual command 5*	*Enabled*
Bit 6 = 32	*Virtual command 6*	*Enabled*
Bit 7 = 64	*Virtual command 7*	*Enabled*
Bit 8 = 128	*Virtual command 8*	*Enabled*

The setting of the bits at "0", will mean the disabling of the respective function.

For further information about the function programming, see chapter **INTERFACE** section **Enabling Virtual I/O**.

H.010 Virtual digital state

Setting of the bits for the virtual digital output function assignment.

A structure of 4 bits is available for the selection of the 4 digital outputs, whose setting will interact with the "decoder mask". The status of this mask will determine the switch for a virtual digital output function (high status) or the function of the drive (low status).

Defining the mask as virtual, the digital outputs function will be executed by this parameter, in accordance with the setting of its bits.

Bit 1 = 1	*Virtual function digital output 1*	*Enabled*
Bit 2 = 2	*Virtual function digital output 2*	*Enabled*
Bit 3 = 4	*Virtual function digital output 3*	*Enabled*
Bit 4 = 8	*Virtual function digital output 4*	*Enabled*

The setting of the bits at "0", will mean the disabling of the respective function.

For further information about the function programming, see chapter **INTERFACE** section **Enabling Virtual I/O**.

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation	IPA
H.000			0	0	255			1000
H.010			0	0	255			1002

H.040 Progress

It is the indication in percentage of the progress about the "Save parameters" function. A displaying of 100% means that the function has been completed.

Code	Name	[Code] & Function.		MIN	MAX	Unit	Variation	IPA
H.040			0	0	100			1009

Parameters Reading Extension

When used a high conversion factor (***P.600***), the speed parameters reading must not exceed the values included between +32767 and —32767.

Over this threshold, it is possible to monitor the variables through this parameters, whose structure allows a reading extension structure at 32 bits.

H.050 Drive output frequency 16 bit low (d.000)

H.051 Drive output frequency 16 bit high (d.000)

H.052 Drive reference frequency 16 low (d.001)

H.053 Drive reference frequency 16 high (d.001)

H.054 Output speed (d.000)*(P.600) 16 bit low (d.007)

H.055 Output speed (d.000)*(P600) 16 bit high (d.007)

H.056 Speed Ref (d.001)*(P.600) 16 bit low (d.008)

H.057 Speed Ref (d.001)*(P.600) 16 bit high (d.008)

Code	Name	[Code] & Function.		MIN	MAX	Unit	Variation	IPA
H.050			0	- 2 31	2 31 -1			1010
H.051								1011
H.052			0	- 2 31	2 31 -1			1012
H.053								1013
H.054			0	- 2 31	2 31 -1			1014
H.055								1015
H.056			0	- 2 31	2 31 -1			1016
H.057								1017

Serial Link Commands

As reported at the chapter **PARAMETERS** section **Commands**, setting the ***P.000 = 3 (SERIAL)***, the main commands areselectable exclusively via serial line or fieldbus.

The parameters listed below, are all the commands available when this function is selected.

H.500 Hardware Reset

Hardware reset

H.501 Alarm Reset

Alarm reset

H.502 Coast to stop

Coast to stop

H.503 Stop with ramp

Ramp to stop

H.504 Clockwise Start

Clockwise Start

H.505 Anti-clockwise Start

Anti-clockwise Start

H.506 Clockwise Jog

Clockwise Jog

H.507 Anti-clockwise Jog

Anti-clockwise Jog

H.508 Clockwise Flying restart

Clockwise Flying restart

H.509 Anti-clockwise Flying restart

Anti-clockwise Flying restart

H.510 DC Brake

DCBrake

Code	Name	[Code] & Function.	Default	MIN	MAX	Unit	Variation
H.500			0	0	1		1029
H.501			0	0	1		1030
H.502			0	0	1		1031
H.503			0	0	1		1032
H.504			0	0	1		1033
H.505			0	0	1		1034
H.506			0	0	1		1035
H.507			0	0	1		1036
H.508			0	0	1		1037
H.509			0	0	1		1038
H.510			0	0	1		1039

Chapter 8 - Modbus RTU Protocol for DSA SERIES drives

8.1 Introduction

In the chapter the Drive parameters are referred to as 16-bit Modbus registers; a 32-bit Drive parameter covers therefore two Modbus registers.

See chapter 7 for the following correspondences: parameter index and Modbus register.

8.2 The MODBUS Protocol

The MODBUS protocol defines the format and the communication modes between a system controlling "master" and one or more "slaves" aimed at answering to the master requests. The protocol states how the master and the slaves start and stop their communication, how the messages can be exchanged and how the errors can be detected. A common line can host one master and 2 47 slaves; this is a protocol logic limit, the device number can be further limited by the physical interface; the present implementation foresees a maximum number of 6 4 slaves to be line-connected.

A transaction can be started exclusively by the master. A transaction can have a direct demand/response format or a broadcast format. The former is addressed to a single slave, the latter to all the line slaves, which, on their turn, give no response. A transaction can have a single demand/single response frame or a single broadcast message/no response frame.

Some protocol features have not been defined. They are: interface standard, baud rate, parity, stop bit number. The protocol allows also to choose between two communication "modes": ASCII and RTU (Remote Terminal Unit). The RTU mode, which is the most efficient, is implemented in the Drives.

The JBUS protocol is similar to the MODBUS protocol; the only difference is given by the address numbering system: in MODBUS the numbering system starts from zero (0000 = 1st address) while in JBUS it starts from one (0001 = 1st address); this variance is maintained throughout the whole system. The following descriptions, if not otherwise stated, refer to both protocols.

8. 3 Message format

In order to communicate between the two devices, the message has to be contained into a "casing". The casing leaves the transmitter via a "port" and it is "brought" along the line to a similar "port" on the receiver. MODBUS states the format of the casing, which, both for the master and for the slave, contains:

- The slave address for the master stated transaction (the address 0 corresponds to a broadcast message sent to all the slaves).
- The code of the function (already performed or to be performed).
- The data to be exchanged.
- The error control according to the CRC16 algorithm.

If a slave detects an error in the received message (a format, parity or CRC16 error), the message is invalid and therefore rejected; when a slave detects an error in the message, it does not perform the required action and does not answer to the demand as if the address does not correspond to an on-line slave.

8. 3.1 The address

As stated above, the MODBUS transactions always involve the master (which controls the line) and one slave at the time (with the exception of broadcast messages). In order to detect the message receiver, the first sent character is a byte containing the numeric address of the selected slave. Each slave owns therefore a different address number for its identification. The legal addresses go from 1 to 2 47, while a master message starting with the address 0 means that this is a "broadcast" message simultaneously addressed to all the slaves (the address 0 can not be allocated to a slave). Broadcast messages are those messages which do not need a response to perform their function, i.e. the allocations.

8. 3.2 The function code

The second character of the message states the function to be performed by the master message; the slave response contains the same code, thus stating that the function has been performed.

An implemented subset of the MODBUS functions contains:

- 01 Read Coil Status
- 02 Read Input Status
- 03 Read Holding Registers
- 04 Read Input registers
- 05 Force Single Coil
- 06 Preset Single register
- 07 Read Status
- 15 Force multiple Coils
- 16 Preset Multiple Registers

The 01 and 02 functions, so as the 03 and 0 4 functions, are similar and interchangeable. See chapter 3 for a complete and detailed description of the functions.

8. 3. 3 CRC16

The last two characters of the message contain the cyclic redundancy code (Cyclic Redundancy Check) calculated according to the CRC16 algorithm. As for the calculation of these two characters, the message (address, function code and data thus rejecting the parity and the start and stop bits) is considered as a single and continuous binary number whose most significative bit (MSB) is transmitted as first. The message is multiplied by x^{16} (it undergoes a 16-bit shift on the left) and then it is divided by $x^{16}+x^{15}+x^2+1$; it is stated as a binary number (1100000000000101). The integer quotient is rejected and the 16-bit remainder (it is initialized with FFFFh in order to avoid a zero made message) is added to the sent message. The obtained message, when the receiver slave has divided it by the same polynomial ($x^{16}+x^{15}+x^2+1$), must have a zero remainder if no error occurred (if not the slave calculates the CRC again).

Considering that the data serializing device (UART) transmits first the less significative bit (LSB) instead of the MSB as required by the CRC calculation, such calculation is performed by inverting the polynomial. Furthermore, as the MSB polynomial influences only the quotient and not the remainder, the remainder is deleted by making it equal to 1010000000000001.

The step by step procedure for the CRC16 calculation is the following:

1) Load a 16-bit register with FFFFh (the bit value is 1).
2) Perform the exclusive OR of the first character with the highest byte in the register; place the result in the register.
3) Perform a one-bit shift of the register on the right.
4) If the bit outcoming the register right side (flag) is 1, perform the exclusive OR between the 1010000000000001 generating polynomial and the register.
5) Repeat the steps 3 and 4 for eight times.
6) Perform the exclusive OR of the following character with the highest byte in the register; place the result in the register.
7) Repeat the steps from 3 to 6 for all the message characters.
8) The content of the 16-bit register is the CRC redundancy code to be added to the message.

8. 3.4 Message synchronization

The message synchronization between the transmitter and the receiver is obtained by interposing a pause between the messages, such pause being equal to 3.5 times the character period. If the receiver does not receive for a period equal to 4 characters, the message is considered to be over; as a consequence the following received byte is treated as the first byte of a new message: an address.

8. 3.5 Serial line setting

The communication foresees the following settings:

- 1 start bit
- 8 data bits (RTU protocol)
- 1 stop bit
- no parity

The baud rate can be selected among the following values:

Baudrate	Timeout byte-byte
1200	33 ms
2400	16 ms
4800	8 ms
9600	4 ms
19200	2 ms
38400	1 ms
57600	668 µs
76800	501 µs
115200	334 µs

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8.4 Modbus functions for the drive

Here following is a detailed description of the MODBUS functions implemented for the Drive. All the values listed in the tables are hexadecimal.

8.4.1 Read output Registers (03)

This function allows to require the value of 16-bit (word) registers containing Drive parameters. The broadcast mode is not allowed.

Request

Together with the Drive address and the function code (03), the message contains the register starting address (starting Address) and the number of the registers to be read; they are both stated on two bytes. The maximum number of registers which can be read is 125. The register numbering system starts from zero (word1 = 0) for the MODBUS and from one (word1 = 1) for the JBUS.

Example: Modbus

- Drive address 25 (19hex)
- Registri from 0069 (00 45hex) to 0071 (0003hex).

ADDR	FUNC	DATA start Addr HI	DATA start Addr LO	DATA word# HI	DATA word# LO	CRC HI	CRC LO
11	01	00	04	00	03	46	06

Response

Together with the Drive address and the function code (03), the message includes a character containing the data byte number and some other characters containing the data. The registers require two bytes where the first one contains the most significative section.

Example: Response to the above mentioned request.

ADDR	FUNC Byte	DATA word Count	DATA word 69 HI	DATA word 69 LO	DATA word 70 HI	DATA word 70 LO	DATA word 71 HI	DATA 71 LO	CRC HI	CRC LO
19	03	06	02	2B	00	00	00	64	AF	7A

NOTE! in case the register selected range includes some reserved or missing registers, the value of these registers is set with 0.

8.4.2 Read Input Registers (04)

This function is similar to the previous one.

8.4. 3 Preset Single Register (06)

This function allows to set the value of a single 16-bit register. The broadcast mode is allowed.

Request

Together with the Drive address and the function code (06), the message contains the register address (parameter) on two bytes and the value to be allocated. The numbering system of the register addresses starts from zero (word1 = 0) for the MODBUS and from one (word1 = 1) for the JBUS.

Example: Modbus

- Drive address 38 (26_{hex})
- Register 26 ($001A_{hex}$)
- Value 926 ($039E_{hex}$)

ADDR	FUNC	DATA bit# HI	DATA bit# LO	DATA WORD HI	DATA WORD LO	CRC HI	CRC LO
26	06	00	19	03	9E	DF	82

Response

The response is given by transmitting again the received message after the register has been modified. Example: Response to the above mentioned request.

ADDR	FUNC	DATA bit# HI	DATA bit# LO	DATA WORD HI	DATA WORD LO	CRC HI	CRC LO
26	06	00	19	03	9E	DF	82

8.4.4 Read Status (07)

This function allows to read the status of eight predefined bits with a compact message. The broadcast mode is not allowed.

Request

The message contains only the Drive address and the function code (07). Example: Modbus

- Drive address 25 (19hex)

ADDR	FUNC	CRC HI	CRC LO
19	07	4B	E2

Response

Together with the Drive address and the function code (07), the message includes a character containing the status bits.

Example: Response to the above mentioned request.

ADDR	FUNC	DATA status byte	CRC HI	CRC LO
19	07	6D	63	DA

The bit meaning is the following:

Bit number	Bit meaning
0	Digital Output 1
1	Digital Output 2
2	Digital Output 3
3	Digital Output 4
4	Run
5	Steady state
6	Drive limit state
7	Not used

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8.4.5 Preset Multiple Registers (16)

This function allows to set the value of a consecutive block made of 16-bit registers. The broadcast mode is allowed.

Request

Together with the Drive address and the function code (16), the message contains the starting address of the registers to be written (starting Address), the number of registers to be written, the number of bytes containing the data and the data characters. The register numbering system starts from zero (word1 = 0) for the MODBUS and from one (word1 = 1) for the JBUS.

Example: Modbus

- Drive address 17 (11hex)
- Starting Register 35 (0023hex)
- Number of registers to be written 1 (0001hex)
- Value 268 (010Chex)

ADDR	FUNC start	DATA start Addr HI	DATA word# Addr LO	DATA word# HI	DATA Byte LO	DATA word Count	DATA word 35 HI	DATA 35 LO	CRC HI	CRC LO
11	10	00	22	00	01	02	01	0 C	6 C	87

Response

Together with the Drive address and the function code (16), the message contains the starting address (starting Address) and the number of written registers.

Example: Response to the above mentioned request.

ADDR	FUNC	DATA start Addr HI	DATA start Addr LO	DATA word# HI	DATA word# LO	CRC HI	CRC LO
11	10	00	22	00	01	A3	53

8.5 Error management

In MODBUS there are two kinds of errors which are managed in different ways: transmission errors and operating errors. The transmission errors change the format, the parity (if used) or the CRC16 of the message. When the Drive detects such errors, it considers the message invalid and gives no response. If the message format is the right one but its function can not be performed, the error is an operating one. The Drive answers to this error with a particular message. This message contains the Drive address, the code of the required function, an error code and the CRC. In order to underline that the response is aimed at stating the presence of an error, the function code is returned with the most significative bit set with "1".

Example: Modbus

Drive address 10 ($0A_{hex}$)

Coil 1186 (0 $4A2_{hex}$)

ADDR	FUNC	DATA start Addr HI	DATA start Addr LO	DATA bit# HI	DATA bit# LO	CRC HI	CRC LO
0A	01	04	A1	00	01	AC	63

Response

The request refers to the content of the Coil 1185 which does not exist in the Drive slave. The slave answers with the error code "02" (ILLEGAL DATA ADDRESS) and goes back to the function code 81h (129).

Example: Exception to the above mentioned request.

ADDR	FUNC	DATA Except. Code	CRC HI	CRC LO
0A	81	02	B0	53

8.5.1 Exception codes

This protocol implementation foresees only four exception codes:

Code	Name	Meaning
01	ILLEGAL FUNCTION	The received function code does not correspond to a function allowed on the addressed slave.
02	ILLEGAL DATA ADDRESS	The address number, which the data field refers to, is not a register allowed on the addressed slave.
03	ILLEGAL DATA VALUE	The value to be allocated, which the data field refers to, is not allowed for this register.
07	NAK - NEGATIVE ACKNOWLEDGEME	The function can not be performed with the present operating conditions or attempt to write an only-reading

8.6 System configuration

In order to select the configuration of the serial line, the AGy drives of are supplied in the main INTERFACE menu with a submenu called "Serial config"; some parameters are common to the different kinds of implemented protocols (fOX LINK, Modbus, etc); the menu contains the following parameters:

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.600	Serial link cfg	[0] FoxLink 7E1 [1] FoxLink 701 [2] FoxLink 7N2 [3] FoxLink 8N1 [4] ModBus 8N1 [5] JBus 8N1 [6] Reserved [7] Reserved [8] Reserved [9] Remote keypad	4	0	9		1	155
I.601	Serial link bps	[0] 600 baud [1] 1200 baud [2] 2400 baud [3] 4800 baud [4] 9600 baud [5] 19200 baud [6] 38400 baud	4	0	6		1	156
I.602	Device address		1	0	99		1	157
I.603	Ser answer delay		1	0	250	msec	1	158
I.604	Serial timeout		0	0	25	sec	0,1	159
I.605	En timeout alm	[0] Disable [1] Enable	0	0	1			160

Chapter 9 – Troubleshooting

9.1 Drive Alarm Condition

The drive keypad will show on the 2nd line of alphanumeric display a blinking message with code and name of the alarm occurred.

9.2 Alarm Reset

The alarm reset operation can be executed following three possibilities:

- Alarm reset by keypad buttoms: pressing simultaneously Up and Down; the reset action will take effect when the buttons when released.

  Reset allowed only with drive disabled.

- Alarm reset by digital input: it can be performed through a programmable digital input as "[5] Alarm reset".

  Reset allowed only with drive disabled.

. Alarm reset by Autoreset function: it allows an automatic reset of some drive alarms (see table 8.3.1), by the settings of ***P .380***, ***P .381***, ***P .382*** and ***P .383*** parameters.

  Autoreset allowed with drive enabled too.

The figure below shows how to reset an alarm by keypad bottoms.

9. 3 List of Drive Alarm Events

Table 9.3.1 provides a description regulation alarm events occurred during a drive alarm situation.

Table 9.3.1 Alarm List Event

ALARM		DESCRIPTION	AUTORESET
Code	LCD display		
EF	**EF Ext Fault**	It trips when External fault input is active	YES
OC	**OC OverCurrent**	It trips when an Overcurrent value is detected by output current sensor	YES
Ou	**OV OverVoltage**	It trips when the drive DC Bus voltage is higher than the maximun threshold for the given main voltage setting	YES
Uu	**UV UnderVoltage**	It trips when the drive DC Bus voltage is lower than the maximun threshold for the given main voltage setting	YES
OH	**OH OverTemperat**	It trips when the drive heatsink temperature detected by the switch sensor exceeds its threshold	NO
OLi	**OLi Drive OL**	It trips when the drive overload accumulator exceeded the trip threshold	NO
OLn	**OLM Motor OL**	It trips when the drive overload accumulator exceeded the trip threshold	NO
Ot	**Ot Inst OverTrq**	It trips when the torque delivered by the motor exceeds the programmed level for the preset time	NO
St	**St Serial TO**	It trips when the serial link time out exceeds the programmed level	YES
bF	**bF Bus Fault**	Communication failure between drive regulation board and option 2 expantion board	NO
OHS	**OHS OverTemperat**	It trips when the drive heatsink temperature detected by the analog sensor exceeds its threshold; only for: 4220 and higher (230V...480V) - 4025 and higher (575V)	NO
SHC	**SHC Short Circ**	Short Circuit between output phases or Ground fault	NO
Lf	**Limiter fault**	It trips when drive is a limit state caused by the output current or the DC link voltage. It can be origin by wrong settings of regulator gains or by the motor load.	NO
Tcl	**Term Conn Loss**	It trips when there's a internal error management terminal	YES
Tser	**Temp sens error**	It trips when there's an temperature sensor malfunction. Compare with the actual temperature reading D50	NO
4-20	**4-20mA Inp fault**	It trips where there's less input off 4mA.Check in input there's a power greater than 4mA.	NO

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NOTE! OH switch sensor threshold and OHS analog sensor threshold are depending by the drive size (75 °C ... 85 °C)

EMC DIRECTIVE

The possible Validity Fields of the EMC Directive (89/336) applied to PDS

"**CE marking**" summarises the presumption of compliance with the
Essential Requirements of the EMC Directive, which is formulated in the **EC Declaration of Conformity**
Clauses numbers [.] refer to European Commission document "Guide to the Application of Directive 89/336/EEC"
1997 edition. ISBN 92-828-0762-2

	Validity Field	Description
Relates to PDS or CDM or BDM directly	**-1-** Finished Product/ Complex component available to general public [Clauses: 3.7, 6.2.1, 6.2.3.1 & 6.3.1] A PDS (or CDM/BDM) of the Unrestricted Distribution class	Placed on the market as a single commercial unit for distribution and final use. Free movement based on compliance with the EMC Directive - EC Declaration of conformity required - CE marking required - PDS or CDM/BDM should comply with /EC 1800-3/EN 61800-3 The manufacturer of the PDS (or CDM/BDM) is responsible for the EMC behaviour of the PDS (or CDM/BDM), under specified conditions. EMC measures outside the item are described in an easy to understand fashion and could actually be implemented by a layman in the field of EMC. The EMC responsiblity of the assembler of the final product is to follow the manufacturer's recommendations and guidelines. Note: The manufacturer of the PDS (or CDM/BDM) is not responsible for the resulting behaviour of any system or installation which includes the PDS, see Validity Fields 3 or 4.
	-2- Finished Product/ Complex component only for professional assemblers [Clauses: 3.7, 6.2.1, 6.2.3.2 & 6.3.2] A PDS (or CDM/BDM) of the Restricted Distribution class sold to be included as part of a system or installation	Not placed on the marked as a single commercial unit for distribution and final use. Intended only for professional assemblers who have a level of technical competence to correctly install. - No EC Declaration of conformity - No CE marking - PDS or CDM/BDM should comply with /EC 1800-3/EN 61800-3 The manufacturer of the PDS (or CDM/BDM) is responsible for the provision of installation guidelines that will assist the manufacturer of the apparatus, system or installation to achieve compliance. The resulting EMC behaviour is the responsibility of the manufacturer of the apparatus, system, or installation, for which its own standards may apply.
Relates to application of PDS or CDM or BDM	**-3-** Installation [Clause: 6.5] Several combined items of system, finished product or other components brought together at a given place. May include PDSs (CDM or BDM), possibly of different classes -Restricted or Unrestricted	Not intended to be placed on the market as a single functional unit (no free movement). Each system included is subject to the provisions of the EMC Directive. - No EC Declaration of conformity - No CE marking - For the PDSs or C DM/BDMs themselves see Validity Fields 1 or 2 - Responsibility of the manufacturer of the PDS may include commissioning The resulting EMC behaviour is the responsibility of the manufacturer of the installation in co-operation with the user (e.g. by following an appropriate EMC plan). Essential protection re-quirements of EMC Directive apply regarding the neighbourhood of the installation.
	-4- System [Clause: 6.4] Ready to use finished item(s). May include PDSs (CDM or BDM), possibly of different classes - Restricted or Unrestricted	Has a direct function for the final user. Placed on the market for distribution as a single functional unit, or as units intended to be easily connected together. - EC Declaration of conformity required - CE marking required for the system - For the PDSs or C DM/BDMs themselves see Validity Fields 1 or 2 The resulting EMC behaviour, under specified conditions is the responsibility of the manufacturer of the system by using a modular or system approach as appropriate. Note: The manufacturer of the system is not responsible for the resulting behaviour of any installation which includes the PDS, see Validity Field 3.

Examples of application in the different Validity Fields:

1 **BDM to be used anywhere:** (example in domestic premises, or BDM available from commercial distributors), sold without any knowledge of the purchaser or the application. The manufacture is responsible that sufficient EMC can be achieved even by any unknown customer or layman (snap-in, switch-on).

2 **CDM/BDM or PDS for general purpose:** to be incorporated in a machine or for industrial application This is sold as a subassembly to a professional assembler who incorporates it in a machine, system or installation. Conditions of use are specified in the manufacturer's documentation. Exchange of technical data allows optimisation of the EMC solution.. (See restricted distribution definition).

3 **Installation:** It can consist of different commercial units (PDS, mechanics, process control etc.). The conditions of incorporation for the PDS (CDM or BDM) are specified at the time of the order, consequently an exchange of technical data between supplier and client is possible. The combination of the various items in the installation should be considered in order to ensure EMC. Harmonic compensation is an evident example of this, for both technical and economical reasons. (E.g. rolling mill, paper machine, crane, etc.)

4 **System:** Ready to use finished item which includes one or more PDSs (or CDMs/BDMs); e.g. household equipment, air conditioners, standard machine tools, standard pumping systems, etc.

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