SIEIDrive

General-Purpose Inverter
230/400/460V Class
575V Class

AGy -EV

.....Instruction Manual

GEFRAN

Thank you for choosing this Gefran product.

We will be glad to receive any possible information which could help us improving this manual. The e-mail address is the following: **techdoc@gefran.com** .

Before using the product, read the safety instruction section carefully.

Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

Gefran S.p.A has the right to modify products, data and dimensions without notice.

The data can only be used for the product description and they can not be understood as legally stated properties.

This manual is updated according to firmware version V03.04.

Table of Contents

Safety Symbol Legend - Precautions de securité

Warning!	**Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.** Indique le mode d'utilisation, la procédure et la condition d'exploitation. Si ces consignes ne sont pas strictement respectées, il y a des risques de blessures corporelles ou de mort.
Caution	**Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.** *Indique et le mode d'utilisation, la procédure et la condition d'exploitation. Si ces consignes ne sont pas strictement respectées, il y a des risques de détérioration ou de destruction des appareils*
Attention	**Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.** *Indique le mode d'utilisation, la procédure et la condition d'exploitation. Ces consignes doivent être rigoureusement respectées pour optimiser ces applications.*

Note! Indicates an essential or important procedure, condition, or statement.

Indique un mode d'utilisation, de procédure et de condition d'exploitation essentiels ou importants

Chapter 1 - Safety Precautions

According to the EEC standards the AGy-EV and accessories must be used only after checking that the machine has been produced using those safety devices required by the 89/392/EEC set of rules, as far as the machine industry is concerned. These standards do not apply in the Americas, but may need to be considered in equipment being shipped to Europe.
Drive systems cause mechanical motion. It is the responsibility of the user to insure that any such motion does not result in an unsafe condition. Factory provided interlocks and operating limits should not be bypassed or modified.
Selon les normes EEC, les drives AGy-EV et leurs accessoires doivent être employés seulement après avoir verifié que la machine ait été produit avec les même dispositifs de sécurité demandés par la réglementation 89/392/EEC concernant le secteur de l'industrie.
Les systèmes provoquent des mouvements mécaniques. L'utilisateur est responsable de la sécurité concernant les mouvements mécaniques. Les dispositifs de sécurité prévues par l'usine et les limitations operationelles ne doivent être dépassés ou modifiés.

Electrical Shock and Burn Hazard:
When using instruments such as oscilloscopes to work on live equipment, the oscilloscope's chassis should be grounded and a differential amplifier input should be used. Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made. See instrument manufacturer's instruction book for proper operation and adjustments to the instrument.
Décharge Èlectrique et Risque de Brúlure :
Lors de l'utilisation d'instruments (par example oscilloscope) sur des systémes en marche, le chassis de l'oscilloscope doit être relié à la terre et un amplificateur différentiel devrait être utilisé en entrée.
Les sondes et conducteurs doivent être choissis avec soin pour effectuer les meilleures mesures à l'aide d'un oscilloscope. Voir le manuel d'instruction pour une utilisation correcte des instruments.

Fire and Explosion Hazard:
Fires or explosions might result from mounting Drives in hazardous areas such as locations where flammable or combustible vapors or dusts are present. Drives should be installed away from hazardous areas, even if used with motors suitable for use in these locations.
Risque d'incendies et d'explosions:
L'utilisation des drives dans des zônes à risques (présence de vapeurs ou de poussières inflammables), peut provoquer des incendies ou des explosions. Les drives doivent être installés loin des zônes dangeureuses, et équipés de moteurs appropriés.

Strain Hazard:
Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.
Attention à l'Élévation:
Une élévation inappropriée peut causer des dommages sérieux ou fatals. Il doit être élevé seulement avec des moyens appropriés et par du personnel qualifié.

Drives and motors must be ground connected according to the NEC.
Tous les moteurs et les drives doivent être mis à la terre selon le Code Electrique National ou équivalent.

Replace all covers before applying power to the Drive. Failure to do so may result in death or serious injury.
Remettre tous les capots avant de mettre sous tension le drive. Des erreurs peuvent provoquer de sérieux accidents ou même la mort.

Adjustable frequency drives are electrical apparatus for use in industrial installations. Parts of the Drives are energized during operation. The electrical installation and the opening of the device should therefore only be carried out by qualified personnel. Improper installation of motors or Drives may therefore cause the failure of the device as well as serious injury to persons or material damage.
Drive is not equipped with motor overspeed protection logic other than that controlled by software.Follow the instructions given in this manual and observe the local and national safety regulations applicable.
Les drives à fréquence variable sont des dispositifs électriques utilisés dans des installations industriels. Une partie des drives sont sous tension pendant l'operation. L'installation électrique et l'ouverture des drives devrait être executé uniquement par du personel qualifié. De mauvaises installations de moteurs

ou de drives peuvent provoquer des dommages materiels ou blesser des personnes.On doit suivir les instructions donneés dans ce manuel et observer les régles nationales de sécurité.

Always connect the Drive to the protective ground (PE) via the marked connection terminals (PE2) and the housing (PE1). AGy Drives and AC Input filters have ground discharge currents greater than 3.5 mA. EN 50178 specifies that with discharge currents greater than 3.5 mA the protective conductor ground connection (PE1) must be fixed type and doubled for redundancy.
Il faut toujours connecter le variateur à la terre (PE) par les des bornes (PE2) et le châssis (PE1). Le courant de dispersion vers la terre est supérieur à 3,5 mA sur les variateurs Brushless et sur les filtres à courant alterné (CA). Les normes EN 50178 spécifient qu'en cas de courant de dispersion vers la terre, supérieur à 3,5 ma, la mise à la terre (PE1) doit avoir une double connexion pour la redondance.

The drive may cause accidental motion in the event of a failure, even if it is disabled, unless it has been disconnected from the AC input feeder.
En cas de panne, le variateur peut causer une mise en marche accidentelle, même s'il est désactivé, sauf s'il a été débranché de l'alimentateur à courant alterné.

Warning!

Never open the device or covers while the AC Input power supply is switched on. Minimum time to wait before working on the terminals or inside the device is listed in section 5.9 on Instruction manual .
Ne jamais ouvrir l'appareil lorsqu'il est suns tension. Le temps minimum d'attente avant de pouvoir travailler sur les bornes ou bien à l'intérieur de l'appareil est indiqué dans la section 5.9.

If the front plate has to be removed because of ambient temperature higher than 40 degrees, the user has to ensure that no occasional contact with live parts may occur.
Si la plaque frontale doit être enlevée pour un fonctionnement avec la température de l'environnement plus haute que 40°C, l'utilisateur doit s'assurer, par des moyens opportuns, qu'aucun contact occasionnel ne puisse arriver avec les parties sous tension.

Do not connect power supply voltage that exceeds the standard specification voltage fluctuation permissible. If excessive voltage is applied to the Drive, damage to the internal components will result.
Ne pas raccorder de tension d'alimentation dépassant la fluctuation de tension permise par les normes. Dans le cas d' une alimentation en tension excessive, des composants internes peuvent être endommagés.

Do not operate the Drive without the ground wire connected. The motor chassis should be grounded to earth through a ground lead separate from all other equipment ground leads to prevent noise coupling.
Ne pas faire fonctionner le drive sans prise de terre. Le chassis du moteur doit être mis à la terre à l'aide d'un connecteur de terre separé des autres pour éviter le couplage des perturbations. Le connecteur de terre devrait être dimensionné selon la norme NEC ou le Canadian Electrical code.

The grounding connector shall be sized in accordance with the NEC or Canadian Electrical Code. The connection shall be made by a UL listed or CSA certified closed-loop terminal connector sized for the wire gauge involved. The connector is to be fixed using the crimp tool specified by the connector manufacturer.

Le raccordement devrait être fait par un connecteur certifié et mentionné à boucle fermé par les normes CSA et UL et dimensionné pour l'épaisseur du cable correspondant. Le connecteur doit être fixé a l'aide d'un instrument de serrage specifié par le producteur du connecteur.

Caution

Do not perform a megger test between the Drive terminals or on the control circuit terminals.
Ne pas exécuter un test megger entre les bornes du drive ou entre les bornes du circuit de contrôle.

Because the ambient temperature greatly affects Drive life and reliability, do not install the Drive in any location that exceeds the allowable temperature. Leave the ventilation cover attached for temperatures of 104° F (40° C) or below.
Étant donné que la température ambiante influe sur la vie et la fiabilité du drive, on ne devrait pas installer le drive dans des places ou la temperature permise est dépassée. Laisser le capot de ventilation en place pour températures de 104°F (40°C) ou inférieures.

Caution

If the Drive's Fault Alarm is activated, consult the TROUBLESHOOTING section of this instruction book, and after correcting the problem, resume operation. Do not reset the alarm automatically by external sequence, etc.
Si la Fault Alarm du drive est activée, consulter la section du manuel concernant les défauts et après avoir corrigé l'erreur, reprendre l'opération. Ne pas réiniliatiser l'alarme automatiquement par une séquence externe, etc.

Be sure to remove the desicant dryer packet(s) when unpacking the Drive. (If not removed these packets may become lodged in the fan or air passages and cause the Drive to overheat).
Lors du déballage du drive, retirer le sachet déshydraté. (Si celui-ci n'est pas retiré, il empêche la ventilation et provoque une surchauffe du drive).

The Drive must be mounted on a wall that is constructed of heat resistant material. While the Drive is operating, the temperature of the Drive's cooling fins can rise to a temperature of 194° F (90°C).
Le drive doit être monté sur un mur construit avec des matériaux résistants à la chaleur. Pendant le fonctionnement du drive, la température des ailettes du dissipateur thermique peut arriver à 194°F (90°).

Do not touch or damage any components when handling the device. The changing of the isolation gaps or the removing of the isolation and covers is not permissible.
Manipuler l'appareil de façon à ne pas toucher ou endommager des parties. Il n'est pas permis de changer les distances d'isolement ou bien d'enlever des matériaux isolants ou des capots.

Protect the device from impermissible environmental conditions (temperature, humidity, shock etc.)
Protéger l'appareil contre des effets extérieurs non permis (température, humidité, chocs etc.).

No voltage should be connected to the output of the drive (terminals U2, V2 W2). The parallel connection of several drives via the outputs and the direct connection of the inputs and outputs (bypass) are not permissible.
Aucune tension ne doit être appliquée sur la sortie du convertisseur (bornes U2, V2 et W2). Il n'est pas permis de raccorder la sortie de plusieurs convertisseurs en parallèle, ni d'effectuer une connexion directe de l'entrée avec la sortie du convertisseur (Bypass).

A capacitative load (e.g. Var compensation capacitors) should not be connected to the output of the drive (terminals U2, V2, W2).
Aucune charge capacitive ne doit être connectée à la sortie du convertisseur (bornes U2, V2 et W2) (par exemple des condensateurs de mise en phase).

The electrical commissioning should only be carried out by qualified personnel, who are also responsible for the provision of a suitable ground connection and a protected power supply feeder in accordance with the local and national regulations. The motor must be protected against overloads.
La mise en service électrique doit être effectuée par un personnel qualifié. Ce dernier est responsable de l'existence d'une connexion de terre adéquate et d'une protection des câbles d'alimentation selon les prescriptions locales et nationales. Le moteur doit être protégé contre la surcharge

No dielectric tests should be carried out on parts of the drive. A suitable measuring instrument (internal resistance of at least 10 kΩ/V) should be used for measuring the signal voltages.
Il ne faut pas éxécuter de tests de rigidité diélectrique sur des parties du convertisseurs. Pour mesurer les tensions, des signaux, il faut utiliser des instruments de mesure appropriés (résistance interne minimale 10 kΩ/V).

NOTE! If the Drives have been stored for longer than two years, the operation of the DC link capacitors may be impaired and must be "reformed".

Before commissioning devices that have been stored for long periods, connect them to a power supply for two hours with no load connected in order to regenerate the capacitors, (the input voltage has to be applied without enabling the drive).

En cas de stockage des variateurs pendant plus de deux ans, il est conseillé de contrôler l'état des condensateurs CC avant d'en effectuer le branchement. Avant la mise en service des appareils, ayant été stockés pendant longtemps, il faut alimenter variateurs à vide pendant deux heures, pour régénérer les condensateurs : appliquer une tension d'alimentation sans actionner le variateur .

NOTE! The terms "Inverter", "Controller" and "Drive" are sometimes used interchangably throughout the industry. We will use the term "Drive" in this document.

Les mots "Inverter", "Controller" et "Drive" sont interchangeables dans le domaine industriel. Nous utiliserons dans ce manuel seulement le mot "Drive".

1.1 Power Supply and Grounding

1) GEFRAN drives are designed to be powered from standard three phase lines that are electrically symmetrical with respect to ground (TN or TT network).

   Les variateurs GEFRAN sont prévus pour être alimentés par un réseau triphasé équilibré avec un régime de neutre standard (TN ou TT).

2) In case of supply with IT network, the use of delta/wye transformer is mandatory, with a secondary three phase wiring referred to ground.

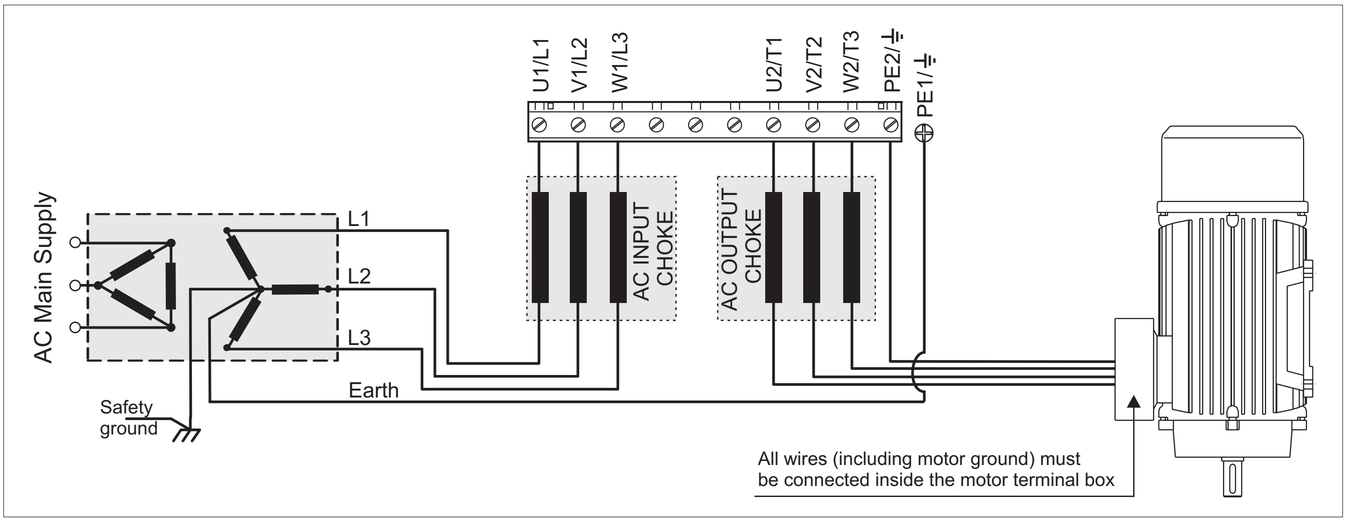
   Si le régime de neutre est IT, nous vous recommendons d'utiliser un tranformateur triangle/étoile avec point milieu ramené à la terre.

Warning!

In case of a three phase supply not symmetrical to ground, an insulation loss of one of the devices connected to the same network can cause functional problem to the drive, if the use of a delta/wye transformer is avoided.

Si le réseau n'est pas équilibré par rapport à la terre et qu'il n'y a pas de transformateur raingle/étoile, une mauvaise isolation d'un appareil électrique connecté au même réseau que le variateur peut lui causer des troubles de fonctionnement.

Please refer to the following connection sample.



Chapter 2 - General

SieiDrive - AGy-EV is an AC Digital Inverters for the variation of the speed of three-phase motors. The AGy can be supplied with a power range from 0.75kW up to 200kW (230V...480V) and from 2Hp up to 200Hp (575V).

An intermediate voltage is generated from the rectified AC voltage. The Inverter bridge then produces, from this intermediate voltage, power supply with variable voltage and frequency, by means of sinusoidal evaluated pulse-width modulation. This power supply provides motors with excellent running characteristics, even in a lower range.

The power supply voltage of the various cards is obtained through a switching from the intermediate circuit voltage.

The inverter power part is based on IGBT component (Insulated Gate Bipolar Transistor). The output is protected against short-circuits and earth faults. It is possible to switch motors on and off during the Inverter operation (see chapter 5.2.3)

If AC motors that are not specially manufactured to operate with an inverter are used, a reduction of 5...10% in supplied current must be taken into account. In case that the rated torque is requested even in the low frequency range, further reductions of the heat will be obtained by an external fan. If no assisted ventilation is available, oversizing of the power of the motor will be necessary. In both cases we suggest to consult the motor manufacturer.

For mechanical reasons (bearings, unbalanced mass, etc.) the motor manufacturer should be consulted when the motor is operated above the rated frequency.

AGy Inverters can be controlled in different ways:

- via terminal strip on the drive
- via an operator keypad
- via a standard PC program through RS 485 interface

SieiDrive - AGy-EV allows a smooth open-loop control and by using EXP-ENC-AGY option closed-loop control. With closed-loop control, an encoder (a pulse generator) provides speed feedback information.

The power section and the control electronics are galvanically isolated.

Features

- Supply voltages generated by switching starting from the intermediate circuit voltage.
- Reduction of motor noise is achieved by the use of a special PWM control procedure.
- The output of the Inverter is protected against short circuits and earth faults.
- Motors can be switched on and off at the Inverter output (see chapter 5.2.4 of the manual).
- The Inverter is protected against overcurrents, undervoltages and overvoltages.
- Voltage dips (up to 15 ms for the power section) can be bridged; for the control section (see chapter 7.6 for the automatic restart programmation).
- Sinusoidal output current generated by means of sinusoidally evaluated pulse-width modulation
- Excellent motor running characteristics, even in the lower frequency range.
- Programmable slip compensation reduces load-initiated changes in speed to a minimum.
- Voltage can be boosted in the lower frequency range, either manually or automatically (boost).
- Automatic voltage and frequency adjustment under an overload ensures the Inverter cannot stall.
- Parameters can be set either via a keypad or via an RS 485 interface.
- Reference value in the form of an analog signal 0...10 V, -10...10V, 0...20 mA, 4...20 mA as a frequency or via a serial interface.
- Ramp function generator with linear or S-shaped ramp.
- Direct current braking by commands:

  a - thru digital input;

  b - automatic injection below a set frequency;

  c - Before starting the motor; used with pump and fan drives which are driven by the medium or by the air and are already turning before the drive is started. D.C. braking prevents the Inverter being switched on when already turning.
- A range of voltage-frequency characteristics can be selected.
- Overload control.
- The last alarm 4 messages can be stored. Alarm messages are retained even after power failure.
- Open-loop or closed-loop operation, as desired.
- Indication via a potential-free contact and via the interface when a preselected speed is exceeded. Example of an application: indication of stationary drive.
- Control via an RS 485 serial interface.
- Internal brake unit.
- Programmable logic
- Save parameters from the keyboard
- Recovery of parameters from the keyboard
- Change of language set up of the keyboard from E@syDrives

Accessories / Options

- Drive version (“-C”) with CANopen / DeviceNet integrated.
- External EMC input filters.
- External Input / Output chokes.
- External braking resistors (connected between terminals C and BR1).
- Encoder expansion card: EXP-ENC-AGY (code S525L)
- Remote keypad kit (code S5WW5).
- E^2PROM key: PRG-KEY (code S6F38).
- I/O expansion card: EXP-D6A1R1-AGy (code S524L).
- 120 Vac digital input interface card : EXP-D8-120 (code S520L).
- Profibus interface card: SBI-PDP-AGy (code S5H28).

Chapter 3 - Inspection Procedure, Component Identification and Standard Specification

3.1 Upon Delivery Inspection Procedures

3.1.1 General

A high degree of care is taken in packing the AGy Drives and preparing them for delivery. They should only be transported with suitable transport equipment (see weight data). Observe the instructions printed on the packaging. This also applies when the device is unpacked and installed in the control cabinet.

Upon delivery, check the following:

- the packaging for any external damage
- whether the delivery note matches your order.

Open the packaging with suitable tools. Check whether:

- any parts were damaged during transport
- the device type corresponds to your order

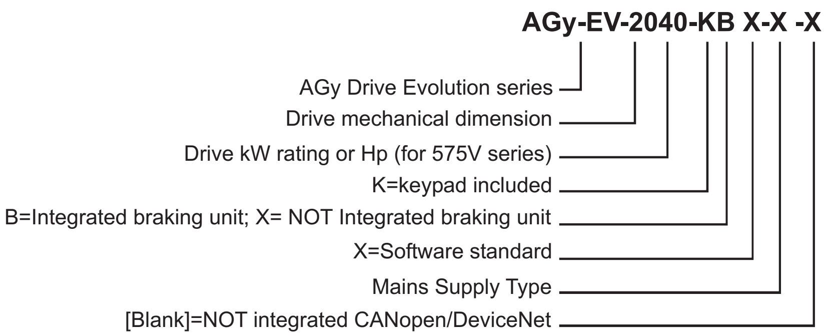
In the event of any damage or of an incomplete or incorrect delivery please notify the responsible sales offices immediately.

The devices should only be stored in dry rooms within the specified temperature ranges .

NOTE! A certain degree of moisture condensation is permissible if this arises from changes in temperature (see section 3.4.1, "Permissible Environmental Conditions"). This does not, however, apply when the devices are in operation. Always ensure that there is no moisture condensation in devices that are connected to the power supply!

3.1.2 Inverter Type Designation

The technical specification of the AGy Drive is stated in the type code. Example:



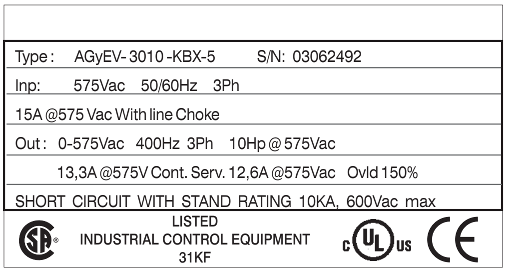
The AGy Drive selected depends on the rated current of the motor. The rated output current at the appropriate service conditions must be greater than or equal to the motor current required.

The speed of the three-phase motor is determined by the number of pole pairs and the frequency (nameplate, data sheet) of the motor concerned. Operation above the rated frequency and speed of the motor must take into account the specifications given by the manufacturer losses (bearings, unbalance etc.). This also applies to temperature specifications for continuous operation under 20 Hz (poor motor ventilation, not applicable to motors with external ventilation).

3.1.3 Nameplate

Check that all the data stated in the nameplate enclosed to the inverter correspond to what has been ordered.

Figure 3.1.3.1: Identification Nameplate (example for 575V series)

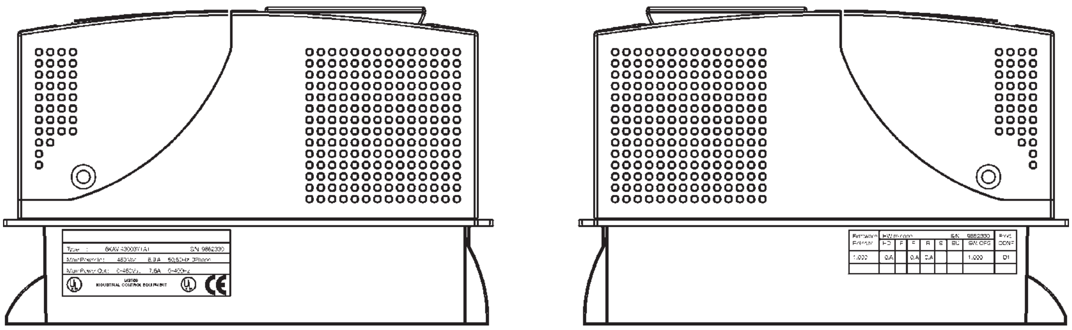


Type: Inverter model
S/N: Serial number
Main Power In: Power supply voltage - AC Input current - Frequency
Main Power Out: Output voltage - Output current - Output frequency

Figure 3.1.3.2: Firmware & Card Revision Level Nameplate

Firmware Release	HW release						S/N 0162330	Prod. CONF
	D	F	P	R	S	BU	SW . CFG	
C 2.03	A		-.A	-.-			1.000	A1

Figure 3.1.3.3: Nameplates Position



3.2 Component Identification

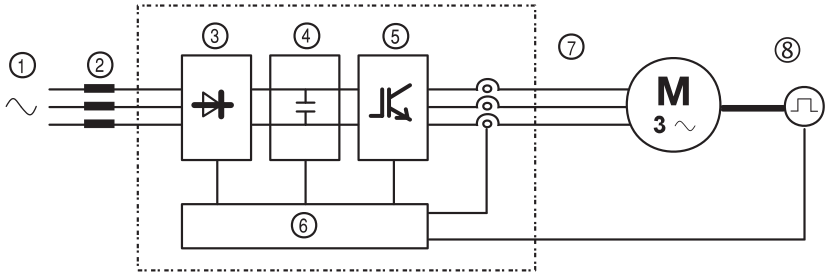


Figure 3.2.1: Basic Setup of Frequency Inverter

An AGy Drive converts the constant voltage and frequency of a three-phase power supply into a direct voltage and then converts this direct voltage into a new three-phase power supply with a variable voltage and frequency. This variable three-phase power supply can be used for the infinitely variable adjustment of the speed of three-phase asynchronous motors.

1 AC Input supply voltage: 230V ... 480V for “AGy...-4 and 575V for “AGy...-5”.

2 AC Mains choke (see section 5.7.1).

3 Three-phase rectifier bridge

Converts the alternating current into direct current using a three phase full wave bridge.

4 DC intermediate circuit

With charging resistor and smoothing capacitor.

Direct voltage (U_{DC}) = √2 x Mains voltage (U_{LN})

5 IGBT inverter

Converts direct voltage to a variable three-phase alternating voltage with variable frequency.

6 Configurable control section

Modules for open-loop and closed-loop control of the power section. This is used for processing control commands, reference values and actual values.

7 Output voltage:

Three-phase, variable alternating voltage from 0 up to 94% of Mains voltage (U_{LN}).

8 Encoder (option)

For speed feedback (see section 4.4.2).

3.3 Standard Specifications

3.3.1 Permissible Environmental Conditions

Table 3.3.1.1: Environmental Specification

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 1000m (3281 feet) above sea level; for higher altitudes a current reduction of 1.2% for every 100m (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/m³ to 25 g/m³ without moisture condensation or icing (Class 3K3 as per EN50178)
storage		5% to 95 %, 1 g/m³ to 29 g/m³ (Class 1K3 as per EN50178)
transport		95 % 3) 60 g/m 4)
		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/A11 (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 from 1007 to 3150 (230V…480V) and from 2002 to 3020 (575V)
Approvals		CE, UL, cUL, CSA

TGy0020

1) Over 40°C (104°F):
- current reduction of 2% of rated output current per K
- remove front plate (better than class 3K3 as per EN50178)

2) Current derated to 0.8 rated ouput current
Over 40°C (104°F): removal of the top cover (better than class 3K3 as per EN50178)

3) Greatest relative air humidity occurs with the temperature @ 40°C (104°F) or if the temperature of the device is brought suddenly from -25 ...+30°C (-13°...+86°F).

4) Greatest absolute air humidity if the device is brought suddenly from 70...15°C (158°...59°F).

Disposal of the Device

The AGy Drive can be disposed as electronic scraps in accordance with the currently valid national regulations for the disposal of electronic parts.

The plastic covering of the Drives are recyclable: the material used is >ABS+PC< .

3.3.2 Mains Connection and Inverter Output

The AGy Drive must be connected to an AC mains supply capable of delivering a symmetrical short circuit current lower or equal to the values indicated on table 3.3.2.1. For the use of an AC input choke see paragraph 5.7.1.

Note from the table of paragraph 3.3.2.1. the allowable mains voltages. The cycle direction of the phases is free.

Voltages lower than the min. tolerance values can cause the block of the inverter.

It is possible to obtain the automatical restart of the inverter, after another failure has occured (For further information, see paragraph 7.6, Autoreset Configuration section).

NOTE! In some cases AC Input chokes, and possibly noise suppression filters should be fitted on the AC Input side of the device. See chapter “Chokes/Filters”.

Adjustable Frequency Drives and AC Input filters have ground discharge currents greater than 3.5 mA. EN 50178 specifies that with discharge currents greater than 3.5 mA the protective conductor ground connection (PE1) must be fixed type.

Table 3.3.2.1-A: AC Input/Output Specifications for 230V...480V Drive Kw/Hp Rating

AGy Drive Type - kW rating		1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000
OUTPUT																						
Inverter Output (IEC 146 class1), Continuous service (@ 400Vac)	[kVA]	1.6	2.7	3.8	5	6.5	8.5	12	16.8	22.4	27	32	42	55	64	79	98	128	145	173	224	277
Inverter Output (IEC 146 class2),150% overload for 60s (@ 400Vac)	[kVA]	1.4	2.4	3.4	4.5	5.9	7.7	10.9	15.3	20.3	24.6	29	38.2	50	58.3	72	89.2	116.5	132	157.5	204	252
P_N mot (recommended motor output):																						
@ U_{LN}=230Vac; f_{SW}=default; IEC 146 class 1	[kW]	0.37	0.75	1.1	1.5	2.2	3	4	5.5	7.5	10	11	18.5	22	22	30	37	55	55	75	90	100
@ U_{LN}=230Vac; f_{SW}=default; IEC 146 class 2	[kW]	0.37	0.75	1.1	1.5	2.2	3	4	5.5	7.5	9	11	15	18.5	22	30	37	45	55	55	90	100
@ U_{LN}=230Vac; f_{SW}=default; IEC 146 class 1	[Hp]	0.50	1	1.5	2	3	4	5	7.5	10	10	15	25	30	30	40	50	75	75	100	125	125
@ U_{LN}=230Vac; f_{SW}=default; IEC 146 class 2	[Hp]	0.50	1	1.5	2	3	4	5	7.5	10	10	15	20	25	30	40	50	60	75	75	100	125
@ U_{LN}=400Vac; f_{SW}=default; IEC 146 class 1	[kW]	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	200
@ U_{LN}=400Vac; f_{SW}=default; IEC 146 class 2	[kW]	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	55	90	90	110	160	200
@ U_{LN}=460Vac; f_{SW}=default; IEC 146 class 1	[Hp]	1	2	3	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	150	200	250
@ U_{LN}=460Vac; f_{SW}=default; IEC 146 class 2	[Hp]	0.75	1.5	2	3	5	7.5	10	15	20	20	25	30	40	50	60	75	100	125	150	200	250
U_2 Max output voltage	[V]	0.94 x U_{LN} (AC Input voltage)																				
f_2 Max output frequency	[Hz]	500													200							
I_{2N} Rated output current :																						
@ U_{LN}=230-400Vac; f_{SW}= default; IEC 146 class 1	[A]	2.4	4	5.6	7.5	9.6	12.6	17.7	24.8	33	39	47	63	79	93	114	142	185	210	250	324	400
@ U_{LN}=230-400Vac; f_{SW}=default; IEC 146 class 2	[A]	2.2	3.6	5.1	6.8	8.7	11.5	16.1	22.5	30	35	43	57	72	85	104	129	168	191	227	295	364
@ U_{LN}=460Vac; f_{SW}=default; IEC 146 class 1	[A]	2.1	3.5	4.9	6.5	8.3	12.1	15.4	23.1	29.7	34	41	55	69	81	99	124	161	183	218	282	348
@ U_{LN}=460Vac; f_{SW}=default; IEC 146 class 2	[A]	1.9	3.2	4.4	5.9	7.6	11.0	14.0	21.0	27.0	31	37	50	63	74	90	112	146	166	198	257	317
f_{SW} switching frequency (Default)	[kHz]	8													4							
f_{SW} switching frequency (Higher)	[kHz]	16													8						4	-
I_{ovld} (short term overload current, 200% of I_{2N} for 0.5s on 60s)	[A]	4.4	7.2	10.2	13.6	17.4	23	32.2	45	60	70	86	116	144	170	208	258	338	382	454	n.a.	n.a.
Derating factor:																						
Voltage Factor K_V at 460 Vac **		0.87					0.96	0.87	0.93	0.9	0.87											
Temp. Factor K_T for ambient temperature		0.8 @ 50°C (122°F)																				
Switching frequency K_F		0.7 for higher f_{sw}																				
INPUT																						
AC U_{LN} Input voltage	[V]	230 V -15% … 480 V +10%, 3Ph																				
AC Input frequency	[Hz]	50/60 Hz ±5%																				
I_N AC Input current for continuous service :																						
- Connection with 3-phase reactor																						
@ 230Vac; IEC 146 class 1	[A]	1.7	2.9	4	5.5 *	7	9.5	14 *	18.2	25 *	32.5	39	55	69	84	98	122	158	192	220	275	n.a.
@ 400Vac; IEC 146 class 1	[A]	1.9	3.3	4.5	6.2 *	7.9	10.7	15.8 *	20.4	28.2 *	36.7	44	62	77	94	110	137	177	216	247	309	365
@ 460Vac; IEC 146 class 1	[A]	1.7	2.9	3.9	5.4 *	7	9.3	13.8 *	17.8	24.5 *	32.5	37	53	66	82	96	120	153	188	214	268	318
- Connection without 3-phase reactor																						
@ 230Vac; IEC 146 class 1	[A]	3.6	4.4	6.8	7.9 *	11	15.5	21.5 *	27.9	35.4 *	For these types an external inductance is recommended											
@ 400Vac; IEC 146 class 1	[A]	3.9	4.8	7.4	9 *	12	16.9	24.2 *	30.3	40 *												
@ 460Vac; IEC 146 class 1	[A]	3.4	4.2	6.4	7.8 *	10.4	14.7	21 *	26.4	34.8 *												
Max short circuit power without line reactor (Zmin=1%)	[kVA]	160	270	380	500	650	850	1200	1700	2250	2700	3200	4200	5500	6400	7900	9800	12800	14500	17300	22400	27700
Overvoltage threshold	[V]	440VDC (for 230VAC mains), 820VDC (for 400VAC mains), 820VDC (for 460VAC mains)																				
Undervoltage threshold	[V]	230VDC (for 230VAC mains), 380VDC (for 400VAC mains), 415VDC (for 460VAC mains)																				
Braking IGBT Unit Standard internal (with external resistor); MAX Braking torque :		150%									Option internal (with external resistor); Braking torque 150%						External braking unit (optional)					

TGy0031gb

*: For the specified power sizes, the external reactor is strongly recommended

**: Linear shapes for K_V, K_T, respectively in the ranges [400, 460] Vac, [40, 50]°C, (104, 122)°F.

Example: for AC mains = 440VAC, 400V/440V = 0.90 = K_V

Table 3.3.2.1-B: AC Input/Output Specifications for 575V Drive Hp Rating

AGy Drive Type - Hp rating		2002	2003	2005	3007	3010	3015	3020	4025	4030	4040	5050	5060	5075	6100	7125	7150	8200
OUTPUT																		
Inverter Output (IEC 146 class1), Continuous service	[kVA]	3.8	4.5	7.0	10.8	13.7	18.6	24.1	30	36	46	58	69	86	109	136	157	210
Inverter Output (IEC 146 class2), 150% overload for 60s	[kVA]	3.4	4.1	6.3	9.8	12.5	16.9	21.9	27	33	42	53	63	78	99	124	143	191
P_N mot (recommended motor output):																		
@ U_{LN}=575Vac; f_{SW}=default; IEC 146 class 1	[Hp]	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
@ U_{LN}=575Vac; f_{SW}=default; IEC 146 class 2	[Hp]	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
U_2 Max output voltage	[V]	0.94 x ULN (AC Input voltage)																
f_2 Max output frequency (*)	[Hz]	400						200										
I_{2N} Rated output current :																		
@ U_{LN}=575Vac; f_{SW}= default; IEC 146 class 1	[A]	3.8	4.5	7.0	10.8	13.8	18.7	24.2	30	36	46	58	69	86	109	137	158	211
@ U_{LN}=575Vac; f_{SW}=default; IEC 146 class 2	[A]	3.5	4.1	6.4	9.8	12.6	17.0	22.0	27	33	42	53	63	78	99	125	144	192
f_{SW} switching frequency (Default)	[kHz]	8						4									2	
f_{SW} switching frequency (Higher)	[kHz]	16						8							4			2
I_{ovld} (short term overload current, 200% of I_{2N} for 0.5s on 60s)	[A]	7.0	8.2	12.8	19.6	25.2	34	44	54	66	84	106	126	156	198	249	288	384
Derating factor:																		
K_T for ambient temperature		0.8 @ 50°C (122°F)																
K_F for switching frequency		0.7 for higher f_{SW}						0.87	0.8 for higher f_{SW}					0.64	n.a.		0.87	n.a.
INPUT																		
U_{LN} AC Input voltage	[V]	500 -10% / 575V ±10%, 3Ph																
AC Input frequency	[Hz]	50/60 Hz ±5%																
I_N AC Input current for continuous service : - Connection with 3-phase reactor																		
@ 575Vac; IEC 146 class1	[A]	3.8	4.7	7.4	11.7	15	19.8	25.9	31	35	46	60	68	85	114	140	163	216
- Connection without 3-phase reactor																		
@ 575Vac; IEC 146 class1	[A]	5.3	6.1	9.9	17	20.7	27.6	33.9	DC choke integrated									
Max short circuit power without line reactor (Zmin=1%)	[kVA]	380	450	700	1080	1370	1860	2410	3000	3600	4600	5800	6900	8600	10900	13700	15700	21000
Overvoltage threshold	[V]	1000 VDC																
Undervoltage threshold	[V]	565 VDC (for 575 VAC mains)																
Braking IGBT Unit (standard drive)		Standard internal (with external resistor); Braking torque 150%							Optional internal braking unit (with external resistor); braking torque 150%						External braking unit (optional)			

TGy0030

3.3.3 AC Input Current

NOTE! The Input current of the Drive depends on the operating state of the connected motor. The tables 3.3.2.1 shows the values corresponding to rated continuous service, keeping into account typical output power factor for each size

3.3.4 AC Output

The output of the AGy Drive is ground fault and phase to phase output short protected.

NOTE! The connection of an external voltage to the output terminals of the Drive is not permissible! It is allowed to disconnect the motor from the Drive output, after the Drive has been disabled.

The rated value of direct current output (I_{CONT}) depends on the supply voltage (K_V), the ambient temperature (K_T) and the switching frequency (K_F) if higher than the default setting:

$I_{CONT} = I_{2N} \times K_V \times K_T$ (Values of derating factor are the listed on tables 3.3.2.1) with an overload capacity $I_{MAX} = 1.5 \times I_{CONT}$ for 60 seconds.

Recommended motor outputs

The coordination of the motor rated powers with the Drive type presented in the table 3.3.2.1 refers to the use of standard motors with a rated voltage equal to the rated voltage of the input supply.

As for those motors with different voltages, the type of Drive to use is determined by the rated current of the motor.

NOTE! Max allowed overload:

136% . I_{2N} cl.1 ≡ 150% . I_{2N} cl.2

Table 3.3.4.1 shows nominal current values for typical service profiles (Ambient temperature =40°C [104°F], standard switching frequency).

Similar criteria apply for operation with additional derating factors.

Table 3.3.4.1: Nominal Drive Current

AGy…-4 (230V…480V)

Drive Type	I_{2N} (1) [A]	I_{2N} (2) [A]	I_{2N} (3) [A]	I_{2N} (4) [A]
1007	2.4	2.2	2.1	1.9
1015	4.0	3.6	3.5	3.2
1022	5.6	5.1	4.9	4.4
1030	7.5	6.8	6.5	5.9
2040	9.6	8.7	8.3	7.6
2055	12.6	11.5	12.1	11
2075	17.7	16.1	15.4	14
3110	24.8	22.5	23.1	21.0
3150	33	30	29.7	27
4185	39	35	34	31
4220	47	43	41	37
4300	63	57	55	50
4370	79	72	69	63
5450	93	85	81	74
5550	114	104	99	90
6750	142	129	124	112
7900	185	168	161	146
71100	210	191	183	166
71320	250	227	218	198
81600	324	295	282	257
82000	400	364	348	317

AGy…-5 (575V)

Drive Type	I_{2N} (5) [A]	I_{2N} (6) [A]
2002	3.8	3.5
2003	4.5	4.1
2005	7.0	6.4
3007	10.8	9.8
3010	13.8	12.6
3015	18.7	17.0
3020	24.2	22.0
4025	30	27
4030	36	33
4040	46	42
5050	58	53
5060	69	63
5075	86	78
6100	109	99
7125	137	125
7150	158	144
8200	211	192

TGy0040gb

(1): I_{2N} Rated output current (@ U_{LN}=230-400Vac), Continuous service, no overload (IEC 146 class 1)

(2): I_{2N} Rated output current (@ U_{LN}=230-400Vac), Overload service 150%x60s followed by I_N, min.cycle time 360s (IEC 146 class 2).

(3): I_{2N} x kV Rated output current (@ U_{LN}=460-480Vac), Continuous service, no overload (IEC 146 class 1)

(4): I_{2N} x kV Rated output current (@ U_{LN}=460-480Vac), Overload service 150%x60s followed by I_N, min.cycle time 360s (IEC 146 class 2).

(5) I_{2N} Rated output current (@ U_{LN}=575Vac), continuous service, no overload (IEC 146 classe 1).

(6) I_{2N} Rated output current (@ U_{LN}=575Vac), overload service 150%x60s followed by I_N, min. cycle time 360s (IEC 146 classe 2).

3.3.5 Open-Loop and Closed-Loop Control Section

No. 3 Analog inputs 3 Programmable Analog inputs:

. Analog input 1	±10 V 0.5 mA max, 10 bit + sign / unipolar or bipolar (0...10V=default)
. Analog input 2	±10 V 0.5 mA max, 10 bit + sign / unipolar or bipolar (±10 V =default)
. Analog input 3	0...20 mA, 4...20mA 10 V max, 10 bit (4...20mA=default)

No. 2 Analog outputs 2 Programmable Analog outputs: ±10 V / 5 mA max

. Analog output 1 = -10...+10V, 10 bit, Frequency output absolute value (default)
. Analog output 2 = -10...+10V, 10 bit, Output current (default)

No. 8 Digital inputs 8 Programmable Digital inputs: 0...24V / 6 mA

. Digital input 8 = Reverse (default)
. Digital input 7 = Run (default)
. Digital input 6 = External fault NO (default)
. Digital input 5 = Alarm state (default)
. Digital input 4 = Jog (default)
. Digital input 3 = Stop (3-wires) (default)
. Digital input 2 = Freq sel 2 (default)
. Digital input 1 = Freq sel 1 (default)

No. 4 Digital output 4 Programmable Digital outputs:

. Digital output 1 = Drive ready (default)
. Digital output 2 = Steady state (default)
. Digital output 3 = Alarm state (default)
. Digital output 4 = Motor running (default)

NOTE! Dig. out. 1 / 2 > open collector type: 50V / 50mA
Dig. out. 3 / 4 > relay output type: 230Vac-1A / 30Vdc-1A

Internal voltage supply

Load capacity	+ 24 Vdc	50 mA	Terminal 1
	+ 10 Vdc	10 mA	Terminal 29
	- 10 Vdc	10 mA	Terminal 32
	+ 24 Vdc	300 mA	Terminal 9
Tollerance	+ 10 Vdc	±3 %	
	+ 24 Vdc	±10 %	

No.1 Digital Encoder Input (with EXP-ENC-AGY optional card)

Voltage	5/8/24 V
Type	1channel/2channels. No zero.
Max frequency	150kHz

3.3.6 Accuracy

Reference value :	Resolution of Reference preset via terminals	0.1 Hz
	Resolution of Reference preset via interface	0.1 Hz

Speed: Open-loop speed control: Load-dependent speed fluctuations are minimized by slip compensation. The accuracy depends on the motor connected.

NOTE:

Chapter 4 - Installation Guidelines

4.1 Mechanical Specification

Figure 4.1.1: AGy Dimensions for Sizes 1007...3150 (230V...480V) and 2002... 3020 (575V)

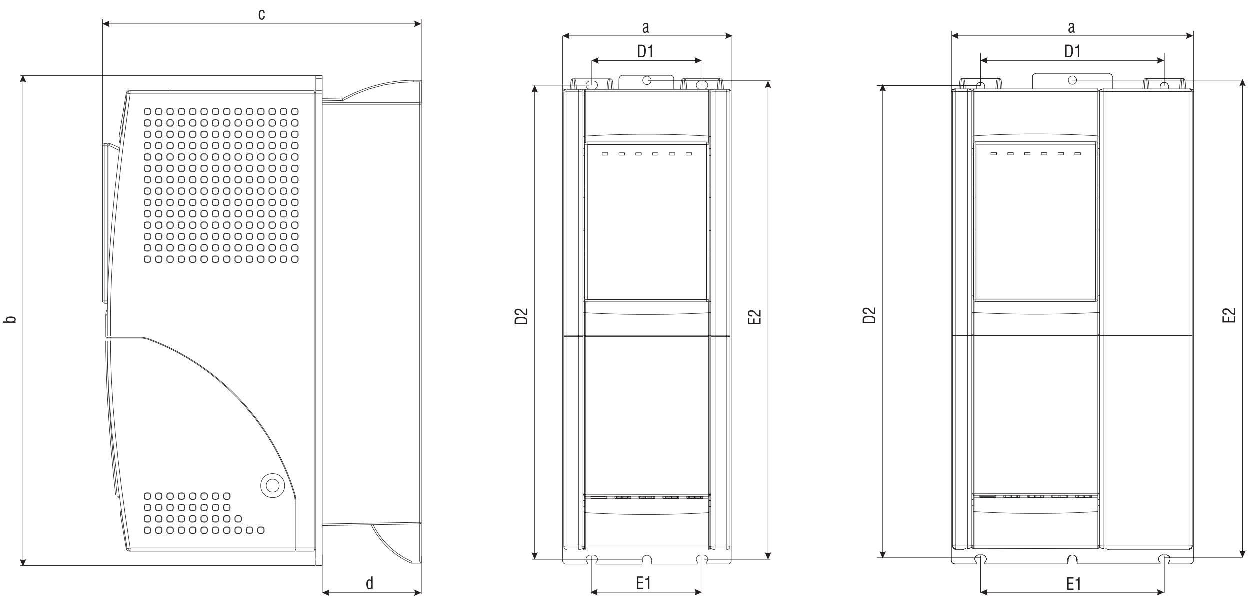
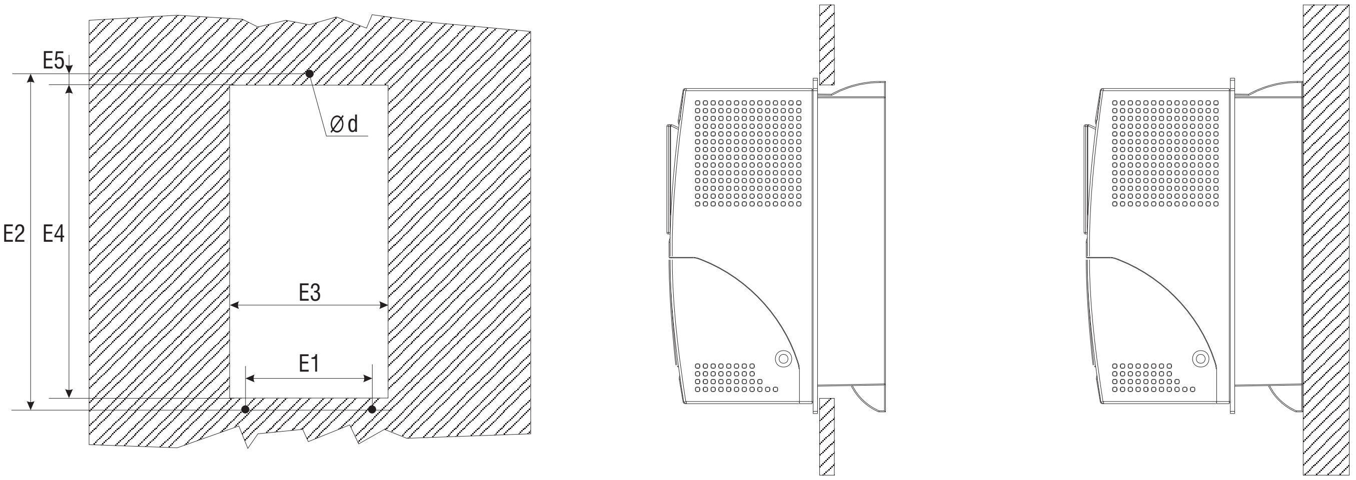


Table 4.1.1: AGy Dimensions and Weights for Sizes 1007...3150 (230V...480V) and 2002... 3020 (575V)

<table>
<tr><th rowspan="2"></th><th rowspan="2">Type</th><th colspan="8">Drive dimensions: mm (inch)</th><th>Weight</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th><th>D1</th><th>D2</th><th>E1</th><th>E2</th><th>kg (lbs)</th></tr>
<tr><td rowspan="9">AGy…-4 (230V…480V)</td><td>1007</td><td rowspan="4">105.5 (4.1)</td><td rowspan="7">306.5 (12.0)</td><td rowspan="7">199.5 (7.8)</td><td rowspan="7">62 (2.4)</td><td rowspan="4">69 (2.7)</td><td rowspan="7">296.5 (11.6)</td><td rowspan="4">69 (2.7)</td><td rowspan="7">299.5 (11.7)</td><td>3.5 (7.7)</td></tr>
<tr><td>1015</td><td>3.6 (7.9)</td></tr>
<tr><td>1022</td><td rowspan="2">3.7 (8.1)</td></tr>
<tr><td>1030</td></tr>
<tr><td>2040</td><td rowspan="3">151.5 (5.9)</td><td rowspan="3">115 (4.5)</td><td rowspan="3">115 (4.5)</td><td rowspan="3">4.95 (10.9)</td></tr>
<tr><td>2055</td></tr>
<tr><td>2075</td></tr>
<tr><td>3110</td><td rowspan="2">208 (8.2)</td><td rowspan="2">323 (12.7)</td><td rowspan="2">240 (9.5)</td><td rowspan="2">84 (3.3)</td><td rowspan="2">168 (6.6)</td><td rowspan="2">310.5 (12.2)</td><td rowspan="2">164 (6.5)</td><td rowspan="2">315 (12.4)</td><td rowspan="2">8.6 (19)</td></tr>
<tr><td>3150</td></tr>
<tr><td rowspan="7">AGy…-5 (575V)</td><td>2002</td><td rowspan="3">151.5 (5.9)</td><td rowspan="3">306.5 (12.0)</td><td rowspan="3">199.5 (7.8)</td><td rowspan="3">62 (2.4)</td><td rowspan="3">115 (4.5)</td><td rowspan="3">296.5 (11.6)</td><td rowspan="3">115 (4.5)</td><td rowspan="3">299.5 (11.7)</td><td rowspan="2">4.6 (10.1)</td></tr>
<tr><td>2003</td></tr>
<tr><td>2005</td><td>4.8 (10.6)</td></tr>
<tr><td>3007</td><td rowspan="4">208 (8.2)</td><td rowspan="4">323 (12.7)</td><td rowspan="4">240 (9.5)</td><td rowspan="4">84 (3.3)</td><td rowspan="4">168 (6.6)</td><td rowspan="4">310.5 (12.2)</td><td rowspan="4">164 (6.5)</td><td rowspan="4">315 (12.4)</td><td rowspan="2">8.2 (18)</td></tr>
<tr><td>3010</td></tr>
<tr><td>3015</td><td rowspan="2">8.8 (19.4)</td></tr>
<tr><td>3020</td></tr>
</table>

agy3100

Figure 4.1.2: AGy Mounting Methods for Sizes 1007...3150 (230V...480V) and 2002... 3020 (575V)



Mounting with external dissipator (E)

Mounting wall (D)

Table 4.1.2: AGy Mounting Methods for Sizes 1007...3150 (230V...480V) and 2002... 3020 (575V)

	Type	Drive dimensions: mm (inch)					
		E1	E2	E3	E4	E5	Ø d
AGy...-4 (230V...480V)	1007	69 (2.7)	299.5 (11.7)	99.5 (3.9)	284 (11.2)	9 (0.35)	M5
	1015						
	1022						
	1030						
	2040	115 (4.5)		145.5 (5.7)			
	2055						
	2075						
	3110	164 (6.5)	315 (12.4)	199 (7.8)	299.5 (11.8)		
	3150						
AGy...-5 (575V)	2002	115 (4.5)	299.5 (11.7)	145.5 (5.7)	284 (11.2)	9 (0.35)	
	2003						
	2005						
	3007	164 (6.5)	315 (12.4)	199 (7.8)	299.5 (11.8)		
	3010						
	3015						
	3020						

agy3101

Figure 4.1.3 : AGy Dimensions for Sizes 4185...82000 (230V...480V) and 4025... 8200 (575V)

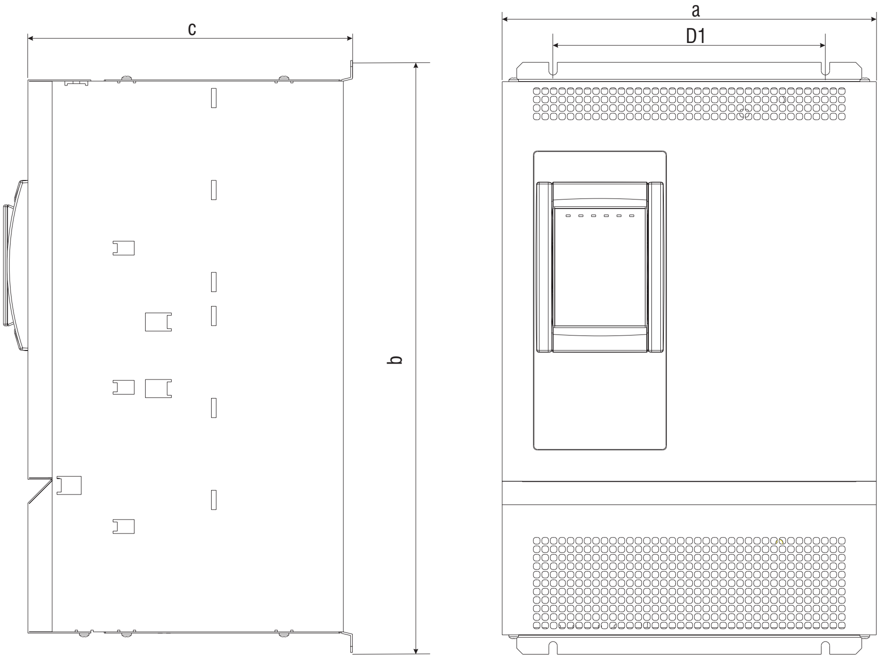


Figure 4.1.4 : AGy Mounting Methods for Sizes 4185...82000 (230V...480V) and 4025... 8200 (575V)

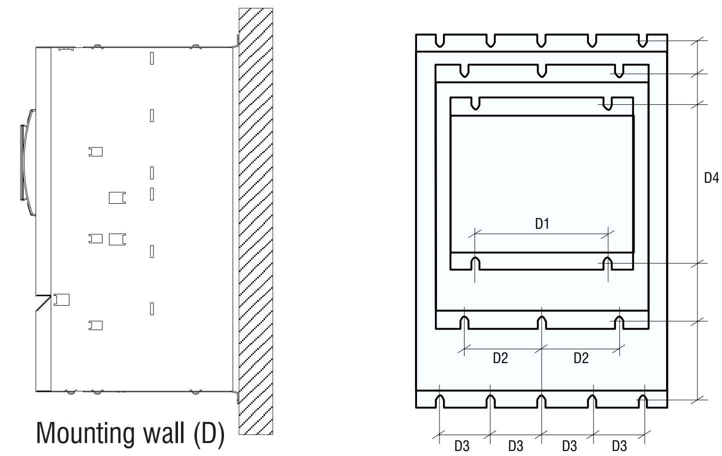


Table 4.1.3 : AGy Dimensions and Weights for Sizes 4185...82000 (230V...480V) and 4025... 8200 (575V)

	Type	Weight	Drive dimensions: mm (inch)							
		kg (lbs)	a	b	c	D1	D2	D3	D4	Ø
AGy...4 (230V...480V)	4185	18 (39.6)	309 (12.1)	489 (19.2)	268 (10.5)	225 (8.8)	-	-	475 (18.7)	M6
	4220									
	4300	22 (48.59)			308 (12.1)					
	4370	22.2 (48.9)								
	5450	34 (74.9)	376 (14.7)	564 (22.2)		-	150 (5.9)		550 (21.6)	
	5550									
	6750	59 (130)	509 (20)	741 (29.2)	297.5 (11.7)	-	-	100 (3.9)	725 (28.5)	
	7900	75.4 (166.1)		909 (35.8)					891 (35)	
	71100	80.2 (176.7)								
	71320	86.5 (190.6)								
	81600	109 (240.3)		965 (38)	442 (17.4)				947 (37.3)	
	82000									
AGy...5 (575V)	4025	28.6 (63.1)	350 (13.8)	569 (22.4)	268 (10.5)	-	150 (15.91)	-	555 (21.2)	
	4030									
	4040	31.6 (67.9)			320 (12.6)					
	5050	47 (103.6)	418 (16.4)	605 (23.8)					590 (23.2)	
	5060									
	5075									
	6100	83 (183)	509 (20)	921 (36.2)	297.5 (11.7)	-	-	100 (3.9)	903 (35.5)	
	7125	118 (260.1)		1113 (43.8)					1095 (43.1)	
	7150									
	8200	131 (288.6)		1183 (46.6)						

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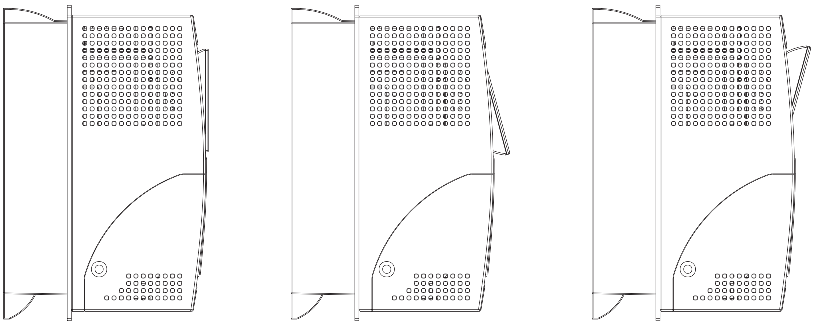
Figure 4.1.5: Keypad Positioning



To allow a confortable viewing angle, the keypad can be oriented on three different positions.

4.2 Watts Loss, Heat Dissipation, Internal Fans and Minimum Cabinet Opening Suggested for the Cooling

The heat dissipation of the Drives depends on the operating state of the connected motor. The table below shows values that refer to operation at default switching frequency (see section 3.3.4, “AC Output”), Tamb ≤ 40°C (104°F), typ. motor power factor and nominal continuous current.

Table 4.2.1: Heat Dissipation and Required Air Flow

AGy ...-4 (230V...480V) Type		1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000
P_V Heat dissipation:																						
@U_{LN}=230Vac [1]	[W]	38	62	83	110	144	184	264	304	416	448	526	691	880	1000	1264	1560	1952	2280	2720	n.a.	n.a.
@U_{LN}=400Vac [1]	[W]	48	77	104	138	180	230	330	380	520	560	658	864	1100	1250	1580	1950	2440	2850	3400	4400	5400
@U_{LN}=460Vac [1]	[W]	45	72	96.3	126.7	164.1	215.6	300.8	340	468	500	582	780	1000	1100	1390	1750	2200	2560	3050	3950	4700
[1] f_{SW}=default; I_2=I_{2N}																						
Airflow of fan:																						
Internal fan	[m³/h]	11	11	11	11	11	11	11	30	30												
Heatsink fans	[m³/h]	-	30	30	30	2x30	2x30	2x30	2x79	2x79	80		170		340		650	975			1820	2000

AGy...-5 (575) Type		2002	2003	2005	3007	3010	3015	3020	4025	4030	4040	5050	5060	5075	6100	7125	7150	8200				
P_V Heat dissipation:																						
@U_{LN}=575Vac [1]	[W]	75	80	128	215	266	338	453	515	620	810	1070	1155	1480	2150	2760	2760	3250				
[1] f_{SW}=default; I_2=I_{2N}																						
Airflow of fan:																						
Internal fan	[m³/h]	11	11	11	30	30	30	30														
Heatsink fans	[m³/h]	30	30	2x30	2x79	2x79	2x79	2x79	2x80	2x80	170	340			650	975	975	975				

agy0060gb

NOTE! All the Drives have internal fans.

NOTE! Heat dissipation losses refer to default Switching frequency

Table 4.2.2: Minimum Cabinet Opening Suggested for the Cooling

AGy...-4 (230V...480V) Type	1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000
Minimum cooling opening:																					
Control section cm² (sq.inch)	31 (4.8)							36 (5.6)		2x150 (2x 23.5)		2x200 (2x31)		2x370 (2x57.35)		2x620 (2x96.1)				2 x 1600 (2 x 248)	
Heatsink cm² (sq.inch)	36 (5.6)				72 (11.1)			128 (19.8)													

AGy...-5 (575V) Type	2002	2003	2005	3007	3010	3015	3020	4025	4030	4040	5050	5060	5075	6100	7125	7150	8200				
Minimum cooling opening:																					
Control section cm² (sq.inch)	31 (4.8)			36 (5.6)		2x150 (2x 23.5)	2x200 (2x31)		2x370 (2x57.35)					2x620 (2x96.1)							
Heatsink cm² (sq.inch)	72 (11.1)			128 (19.8)																	

agy0070gb

4.2.1 Cooling Fans Power Supply

Sizes 1007...5550 (230V...480V) and 2002... 5075 (575V)

Power supply (+24Vac) for these fans are provided from the internal drive power supply unit.

Sizes 6750 ... 82000 (230V...480V) and 6100 ... 8200 (575V)

Power supply for these fans have to be provided as follow:

- 6750 (230V...480V) and 6100 (575V): 0.8A@115V/60Hz, 0.45A@230V / 50Hz
- 7900 ... 71320 (230V...480V) and 7125 ... 8200 (575V): 1.2A@115V/60Hz, 0.65A@230V / 50Hz
- 81600, 82000: 1.65A@115V/60Hz, 0.70A@230V / 50Hz

Figure 4.2.1: UL Type Fans Connections on 7900 ... 71320 (230V...480V) and 7125 ... 8200 (575V).

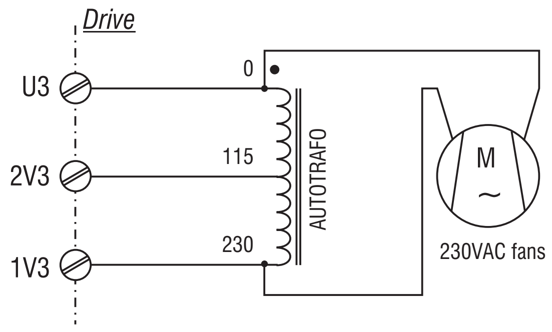


Figure 4.2.2: UL Type Fans Connections on 6750, 82000 (230V...480V) and 6100 (575Vac).

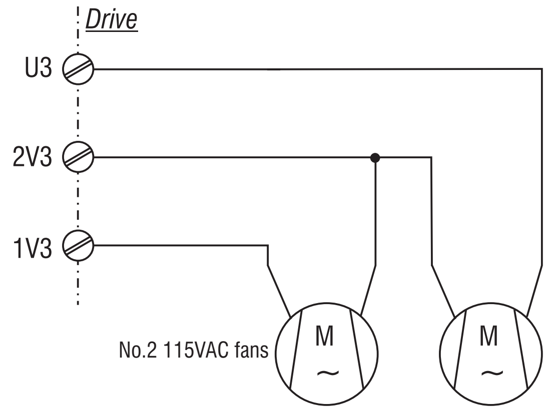
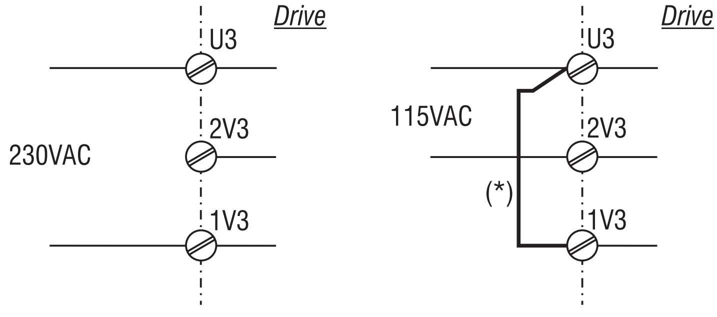


Figure 4.2.3: Example for External Connection



(*) Only for drives:
- 6750, 81600 and 82000 (230V...480V)
- 6100 (575Vac)

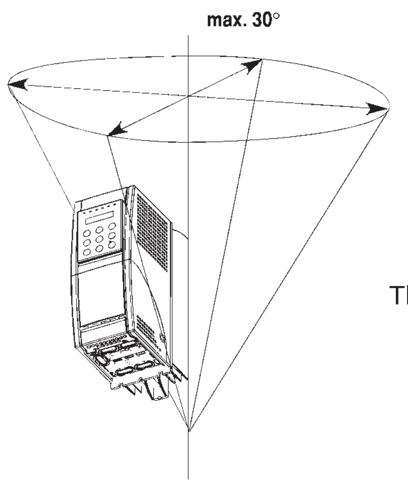
Note! An internal fuse (2.5A 250VAC slo-blo) for 7900 ... 71320 (480V) and 7125 ... 8200 (575V) sizes is provided.

On 6750 and 82000 sizes the fuse must be mounted externally.

4.3 Installation Mounting Clearance

NOTE! The dimensions and weights specifed in this manual should be taken into consideration when the device is mounted. The technical equipment required (carriage or crane for large weights) should be used. Improper handling and the use of unsuitable tools may cause damage.

Figure 4.3.1: Max. Angle of Inclination



The maximum angle of inclination is 30°

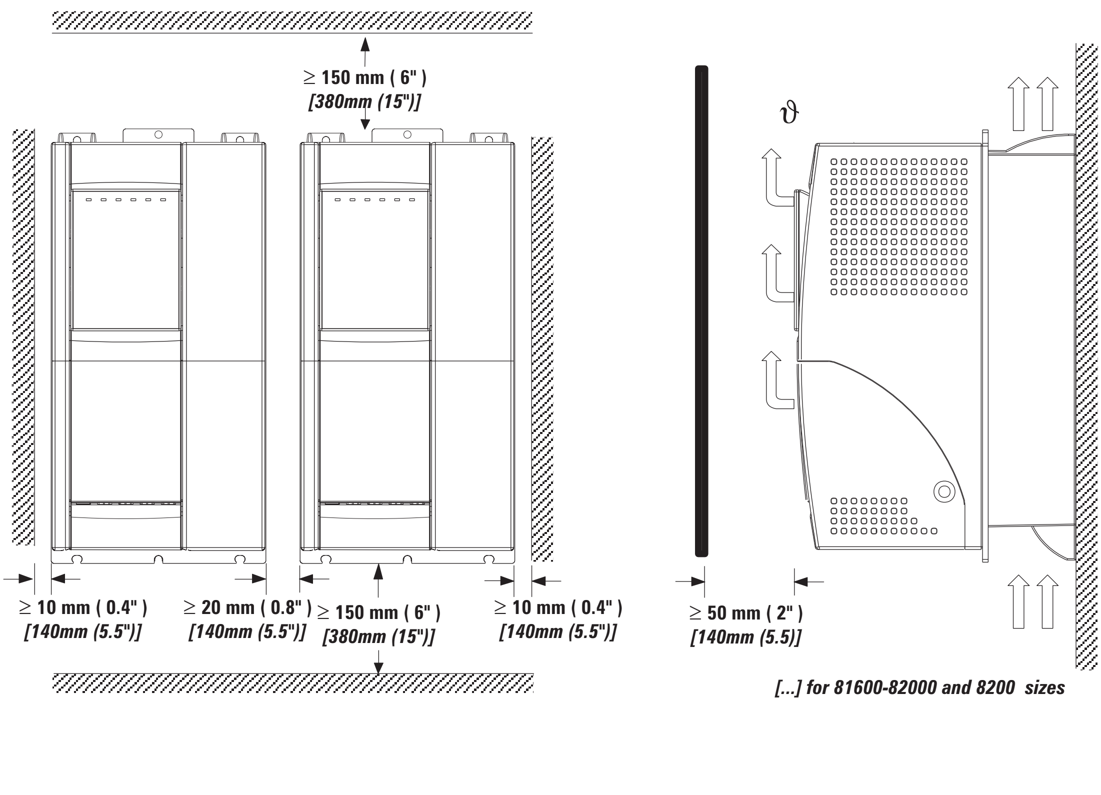
NOTE! The Drives must be mounted in such a way that the free flow of air is ensured. The clearance to the device must be at least 150 mm (6 inches). A space of at least 50 mm (2 inches) must be ensured at the front.

On sizes 81600 and 82000 (AGy...-4, 230...480Vac) and 8200(AGy...-5, 575Vac) the top and bottom clearance must be at least 380 mm (15 inches), on front and sides must be ensured a space of at least 140 mm (5.5 inches).

Devices that generate a large amount of heat must not be mounted in the direct vicinity of the frequency inverter.

Fastening screws should be re-tightened after a few days of operation.

Figure 4.3.2: Mounting Clearance



4.4 Motors and Encoder

The AGy Drives are designed for open-loop and closed-loop operation of standard three-phase induction AC motors.

4.4.1 AC Induction Motors

FOR BEST RESULTS:

Select a inverter duty single cage induction motor with a minimum slip of 3-5%.

a) Minumum motor size: motor amps no less than 30% of drive rated amps at 400 VAC continuous rating

b) General purpose motors can be used but require additional **AC output chokes**

c) Inverter duty motors are desirable and **do not require output chokes**

The electrical and mechanical data of standard three-phase motors refers to a particular operating range. The following points should be noted when these motors are connected to an AC Drive:

Is it possible to use standard induction motors?

With the AGy Drives it is possible to use standard induction motors. Some features of the motor have a great influence on the obtained performances. Notice also what is stated in section 3.3.4, “AC Output”, about the voltages and the motor power.

Star or delta connection?

Motors can be connected in both star or delta connections. Experience has shown that star connected motors have better control properties, so star connections are preferred.

Cooling

The cooling of three-phase motors is normally implemented by means of a fan that is mounted on the motor shaft. Remember that the output of the fan is reduced when the motor is running at lower speeds, which in certain circumstances may mean that the cooling is insufficient for the motor. Check with the motor manufacturer whether an external fan is required and the motor speed range in the application concerned.

Operation above the rated speed

Due to the mechanical factors involved (bearings, unbalance of rotor) and due to the increased iron losses, consult the manufacturer of the motor if this is operated above the rated speed .

What motor data is required for connecting the frequency inverter?

Nameplate specifications

- Motor rated voltage
- Motor rated current
- Motor rated frequency
- Motor rated speed
- Power factor
- Pole pairs

Motor protection

Temperature-dependent contacts in the motor winding

Temperature-dependent contacts "Klixon" type can disconnect the drive via the external control or can be reported as an external fault on the frequency inverter (terminal 6).

NOTE! The motor PTC interface circuit (or klixon) has to be considered and treated as a signal circuit. The connections cables to the motor PTC must be made of twisted pairs with a shield, the cable route should not be parallel to the motor cable or far away at least 20 cm (8 inches).

Current limitation of the frequency inverter

The current limitation can protect the motor from impermissible overloads. For this the current limitation and the motor overload control function of the Drive must be set so that the current is kept within the permissible range for the motor concerned.

NOTE! Remember that the current limitation can control an overheating of the motor only due to overload, not due to insufficient ventilation. When the drive is operated at low speeds the additional use of PTC resistors or temperature-dependent contacts in the motor windings is recommended, unless separate forced ventilation is available.

Output chokes

When using general purpose standard motors, output chokes are recommended to protect winding isolation in some cases. See section 5.7.2, " Output chokes".

4.4.2 Encoder

Encoders can be connected to the drive, only when the optional card EXP-ENC-AGY is mounted.

The card is plugged onto the regulation board through the XENC connector. The terminals on the optional card should be directed towards the terminals of the regulation card.

AGy is able to read digital encoders with either one-channel ($A/\overline{A}$) or two-channels (A / $\overline{A}$, B / $\overline{B}$).

AGy can be configured to supply and read either HTL (+24V) or TTL (+5V or +8V) encoders, with no need for external power supply.

Refer to the EXP-ENC-AGY manual for detailed electrical specifications and wiring guidelines.

Encoders are used to feed back a speed signal to the regulator. The encoder should be coupled to the motor shaft with a backlash free connection.

The encoder cable can be made of twisted pairs with a global shield, which connect to ground on the Drive side. Avoid connecting the shield on the motor side. In particular cases where the cable length is more than 100 meters (328 feet), (high electromagnetic noise), it may useful to use a cable with a shield on each conductor pair, which can be connected to the common point (0V). The global shield must always be grounded.

Table 4.4.2.1: Recommended Cable Section and Length for the Connection of Encoders

Cable section [mm^2]	0.22	0.5	0.75	1	1.5
Max Length m [feet]	27 [88]	62 [203]	93 [305]	125 [410]	150 [492]

avy3130

Requirements:

Digital encoder:

- max frequency: 50 kHz (select the appropriate number of pulses depending on required max. speed)
- Channels :
  - one-channel (A), one-channel complementary ($A,\overline{A}$)
  - two-channel (A, B), two-channel complementary (with complementary output $A,\overline{A}$; $B,\overline{B}$).

  Encoder loss detection is not possible.
- Power supply: + 24V (Internal supply) or +5V (Externally supplied)

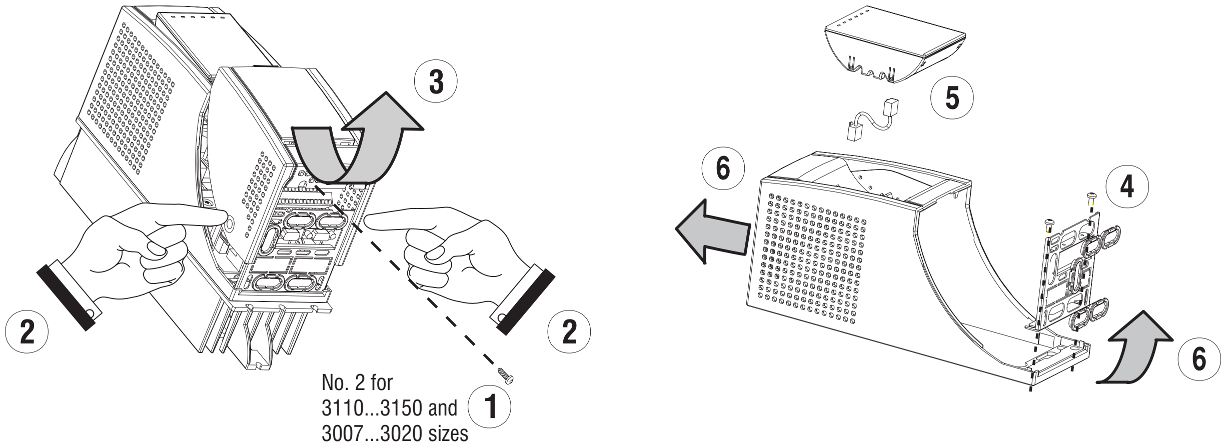
NOTE:

Chapter 5 - Wiring Procedure

5.1 Accessing to the Connectors

Note! Observe the safety instructions and warnings given in this manual. The devices can be opened without the use of force. Only use the tools specified.

Figure 5.1.1: AGy Removing Covers for Sizes 1007...3150 (230V...480V) and 2002...3020 (575V)



Sizes 1007...2075 (230V...480V) and 2002...2005 (575V)

The terminal cover and cable entry plate of the device must be removed in order to fit the electrical connections:

- unscrew the screw (1), remove the cover of devices (2) by pressing on both sides as shown on the above figure (3).
- unscrew the two screws (4) to remove the cable entry plate.

The top cover must be removed in order to mount the option card and change the internal jumper settings:

- remove the keypad and disconnect the connector (5)
- lift the top cover on the bottom side (over the connector level) and then push it to the top (6).

Sizes 3110...3150 (230V...480V) and 3007...3020 (575V)

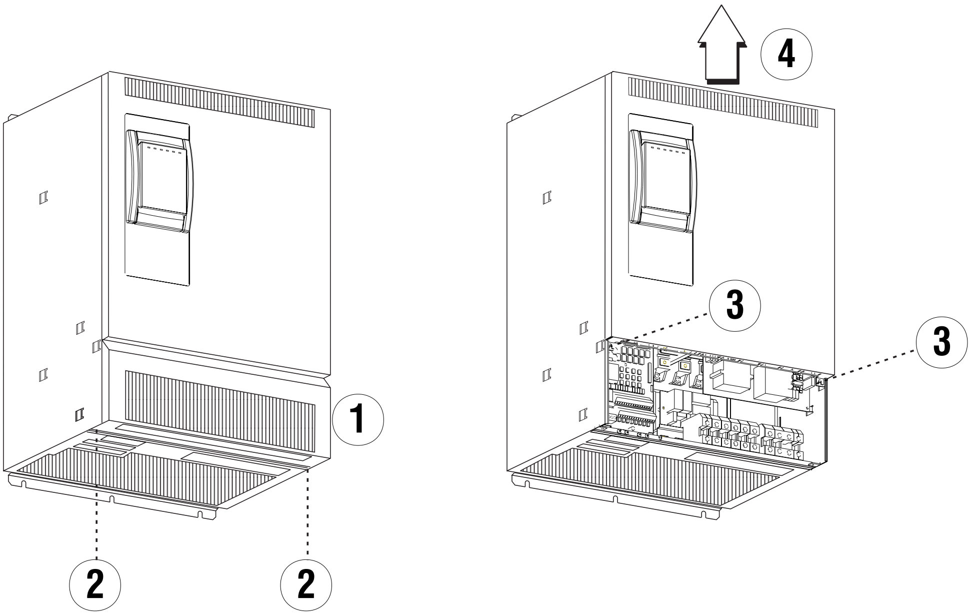
The terminal cover and cable entry plate of the device must be removed in order to fit the electrical connections:

- unscrew the two screws (1) and remove the cover of devices
- unscrew the two screws (4) to remove the cable entry plate.

The top cover must be removed in order to mount the option card and change the internal jumper settings:

- remove the keypad and disconnect the connector (5)
- lift the top cover on the bottom side (over the connector level) and then push it to the top (6).

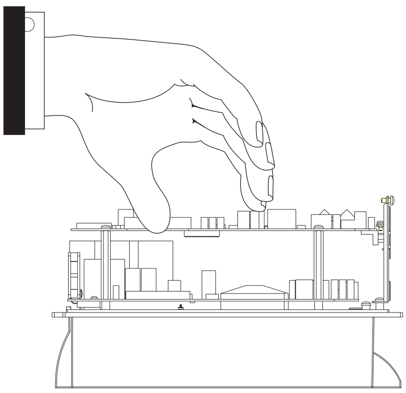
Figure 5.1.2: AGy Removing Covers for Sizes 4185...82000 (230V...480V) and 4025...8200 (575V)



Sizes 4185...82000 (230V...480V) and 4025...8200 (575V)

The terminal cover of the device must be removed in order to fit the electrical connections: unscrew the two screw (2) and remove the cover (1).

The top cover must be removed in order to mount the option card and change the internal jumper settings: unscrew the two screw (3) and remove the top cover by moving it as indicated on figure (4).

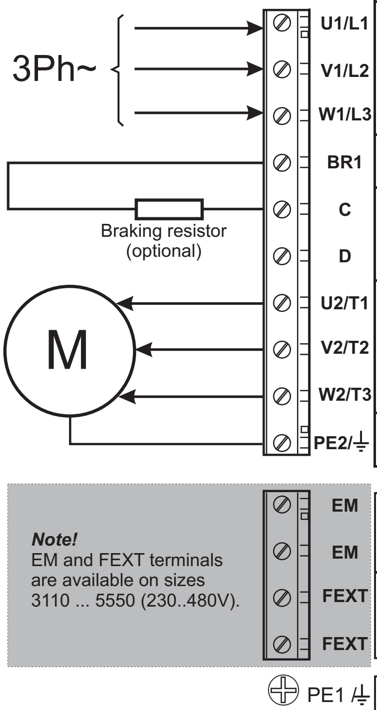


Caution

In order to avoid damages of the device it is not allowed to transport it by handling on its cards !

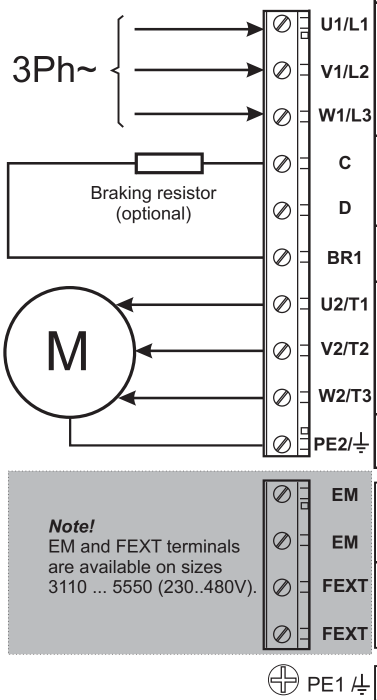
5.2 Power Section

Table 5.2.1.1: Power Section Terminals for Sizes 1007...3150 (230V...480V) and 2002...3020 (575V)



Terminal	Function	Max
U1/L1, V1/L2, W1/L3	AC mains voltage	230V -15%…480V +10% or 575 V ±10% See table 3.3.2.1
BR1	Braking unit resistor command (braking resistor must be connected between BR1 and C)	
C, D	Intermediate circuit connection	770 Vdc (230...480 Vac) 900 Vdc (575 Vac) 1.65 x I_{2N}
U2/T1, V2/T2, W2/T3	Motor connection	AC line volt 3Ph, 1.36 I_{2N}
PE2/⏚	Motor ground connection	
EM, EM	Reserved (active on lift software version only)	-
FEXT, FEXT	Reserved (active on lift software version only)	-
PE1 ⏚	Ground connection	

Table 5.2.1.2: Power Section Terminals for Sizes 4185...82000 (230V...480V) and 4025...8200 (575V)



Terminal	Function	Max
U1/L1, V1/L2, W1/L3	AC mains voltage	230V -15%…480V +10% or 575 V ±10% See table 3.3.2.1
C, D	Intermediate circuit connection	770 Vdc (230...480 Vac) 900 Vdc (575 Vac) 1.65 x I_{2N}
BR1	Braking unit resistor command (braking resistor must be connected between BR1 and C)	
U2/T1, V2/T2, W2/T3	Motor connection	AC line volt 3Ph, 1.36 I_{2N}
PE2/⏚	Motor ground connection	
EM, EM	Reserved (active on lift software version only)	-
FEXT, FEXT	Reserved (active on lift software version only)	-
PE1 ⏚	Ground connection	

Power terminals lay-out

Sizes 1007...5550 (230V...480V) and 2002... 3020 (575V)

The terminals of the devices are made accessible by removing the cover and the cable entry plate (see section 5.1, "Accessing to the connectors"), on some drive type it is also possible to extract the removable connector. All the power terminals are located on the PV33 power card.

Sizes 6750...82000 (230V...480V) and 6100...8200 (575V)

The terminals of the devices are made accessible by removing the cover (see section 5.1, "Accessing to the connectors").

5.2.1 Maximum Cable Cross Section for Power Terminals

AC input wiring is connected to a disconnected switch, which limits the size to the following ranges:

AGy...-4 (230V...400V) Type		**1007**	**1015**	**1022**	**1030**	**2040**	**2055**	**2075**	**3110**	**3150**	**4185**	**4220**	**4300**
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	14				12	10		8	6			4
	[mm2]	2				4			8	10	16		25
Tightening torque	[Nm]	0.5 a 0.6							1.2 a 1.5		2		3
BR1 terminals	AWG	14				12	10		8	6	10		8
	[mm2]	2				4			8	10	6		10
Tightening torque	[Nm]	0.5 a 0.6							1.2 a 1.5		0.9		1.6
PE1, PE2 terminals	AWG	14				12	10		8	6			6
	[mm2]	2				4			8	10	16		16
Tightening torque	[Nm]	0.5 a 0.6							1.2 a 1.5		2		3

AGy...-4 (230V...400V) Type		**4370**	**5450**	**5550**	**6750**	**7900**	**71100**	**71320**	**81600**	**82000**	
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	2		1/0	2/0	4/0	300*	350*	4xAWG2		* = kcmils
	[mm2]	35		50	70	95	150	185	4x35	150**	**=copper bar
Tightening torque	[Nm]	4			12		10-30				
BR1 terminals	AWG	8	6		terminals not available						
	[mm2]	10	16								
Tightening torque	[Nm]	1.6	3								
PE1, PE2 terminals	AWG	6		2							
	[mm2]	16		50							
Tightening torque	[Nm]	3	4								

AGy...-5 (575V) Type				**2002**	**2003**	**2005**	**3007**	**3010**	**3015**	**3020**	**4025**	**4030**
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	14					10		8			
	[mm²]	2					4		8			
Tightening torque	[Nm]	0.5 a 0.6					1.2 a 1.5				2	
BR1 terminals	AWG	14					10		8		10	
	[mm²]	2					4		8		6	
Tightening torque	[Nm]	0.5 a 0.6					1.2 a 1.5				0.9	
PE1, PE2 terminals	AWG	14					10		8		6	
	[mm²]	2					4		8		16	
Tightening torque	[Nm]	0.5 a 0.6					1.2 a 1.5				2	

AGy...-5 (575V) Type		**4040**	**5050**	**5060**	**5075**	**6100**	**7125**	**7150**	**8200**
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	6	4	2		1/0	2/0	4/0	350*
	[mm²]	16	25	35		50	70	95	185
Tightening torque	[Nm]	2	4			4	12	12	10-30
BR1 terminals	AWG	10	6			6	terminals not available		
	[mm²]	6	16			16			
Tightening torque	[Nm]	0.9	2			3			
PE1, PE2 terminals	AWG	6				2			
	[mm²]	16				50			
Tightening torque	[Nm]	2				4			

agy4040gb

NOTE! Use 60°C / 75°C (140°F / 167°F) copper conductor only.

Caution The grounding conductor of the motor cable may conduct up to twice the value of the rated current if there is a ground fault at the output of the AGy Drive.

5.2.2 Rectification and Intermediate (D.C.) Circuit

The mains voltage is rectified and buffered by capacitors. A diode bridge with a pre-charging resistor is mounted for all sizes.

In the event of an overvoltage in the intermediate circuit (message “OV” appears in the display) or undervoltage (message “UV”), the Inverter blocks and no power can be taken from the intermediate circuit.

In normal operation the intermediate (DC) circuit voltage U_{DC} is equal to $U_{LN} * \sqrt{2}$. With oversynchronous operation of the connected motor (deceleration or braking phase), energy is fed back into the intermediate circuit via the Inverter, resulting in an increase in the intermediate (DC) circuit voltage U_{DC}. Once a certain voltage is reached the Inverter is blocked, the contact between terminals 2 and 3 (alarm relay) will open. To RESET, see paragraph 7.6, Autoreset Configuration section.

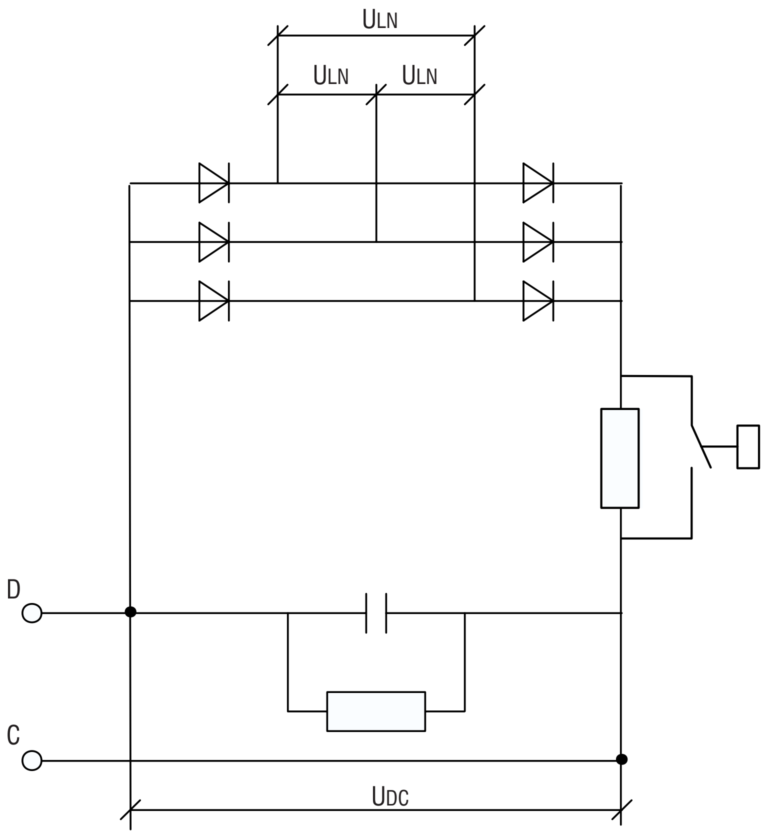


Figure 5.2.3.1: Rectification and Intermediate Circuit

The automatic restart of the Inverter can be obtained after a fault indication condition has occurred (for further information of these functions see paragraph 7.6, Autoreset Configuration section). Switching off can be prevented by extending the deceleration ramp or by the use of a suitable braking unit (see 5.8).

5.2.3 Inverter

IGBTs (Insulated Gate Bipolar Transistors) for all sizes are used. The Inverter is protected against faults of overvoltage, overcurrent, short circuit between phases and ground. In the event of a fault the Inverter is disabled and the contact between terminals 2 and 3 will open. To RESET see paragraph 7.6, Autoreset Configuration section.

The automatic restart of the Inverter can be obtained after a fault indication condition has occurred (for further information on these functions see paragraph 7.6, Autoreset Configuration section).

Table 5.2.4.1: Fault Indication of the Protection of the Inverter Bridge

Signalation	Block caused by
OV	Overvoltage
OC. OCH	Overcurrent, short-circuit between phases
OC	Short-circuit to ground

The variable output voltage is generated by pulse-width modulation of the intermediate (D.C.) circuit voltage. A special process of sinusoidal evaluation in conjunction with the inductance of the motor produces a very good sinusoidal waveform of the output current I2. Parameters can be allocated to the voltage/frequency characteristics to adapt it to the motor to be supplied.

A number of motors can be driven in parallel at the output of the Inverter. These motors can have different speeds, even if they have the same number of poles, since the slips of each motor change in relation of the load variation and of its characteristics. Motors can be connected or disconnected individually at the output. Particular care should be taken when connecting or disconnecting motor units.

The following should be noted: at the instant of disconnection, motors generate voltage peaks, since an inductive current is being broken. This is not generally a problem for the output of the Inverter if the motors are low-power devices, or if a number of other motors remain connected to the Inverter.

Caution If the last remaining motor connected to the Inverter is being connected, it should be ensured that the magnetizing current of the motor has already decayed at the instant of disconnection. For this purpose the Inverter should be blocked and the motor disconnected only after a certain time has elapsed. This time is determined by the motor and will have a magnitude of approximately 0.5 to several seconds

If a motor is to be connected to an existing Inverter network during operation, it should be borne in mind that the motor will draw a multiple of its rated current. The Inverter should be rated in such a way that the starting current lies within the range of the Inverter rated current. Furthermore it is possible to take into consideration the overload that the Inverter can give, if the connection duty cycle is within the times at which the overload is allowed.

Caution The outputs of more than one Inverter must not be connected directly in parallel.

5.3 Regulation Section

5.3.1 R-AGy Regulation Card

Figure 5.3.1.1: R-AGy Regulation Card

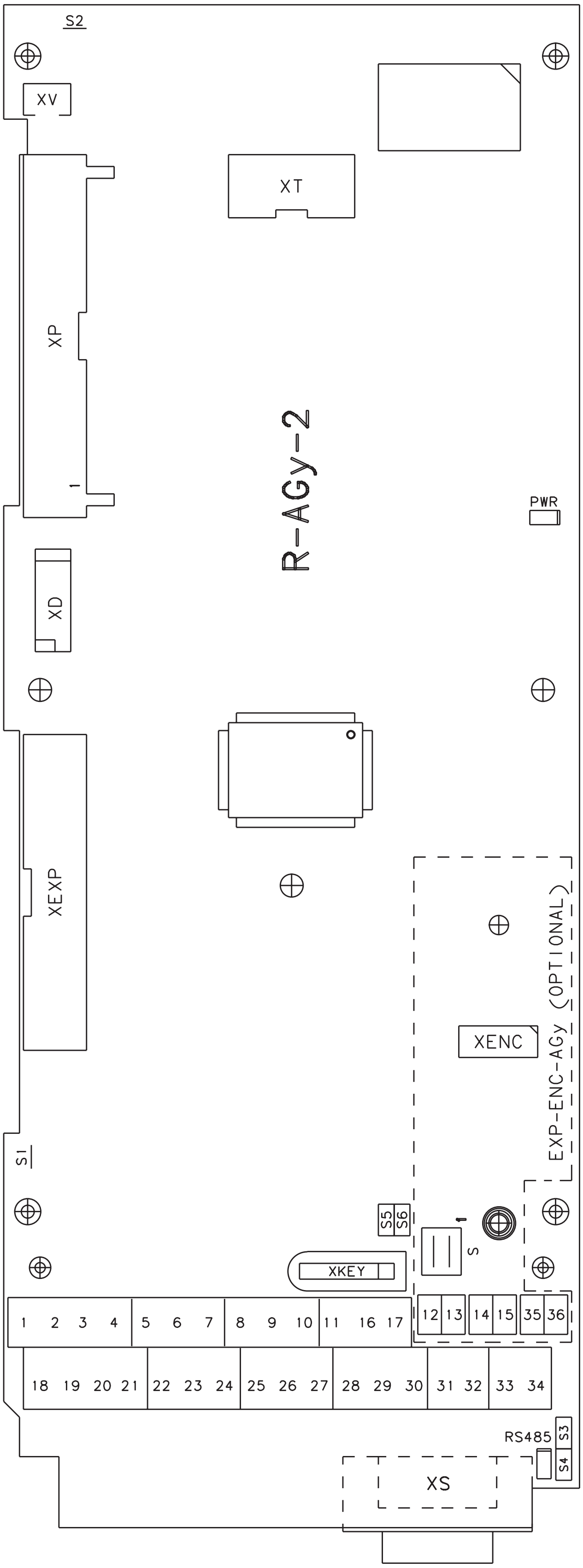


Table 5.3.1.1: LEDs, Jumpers and Connectors on R-AGy-2

LED	Color	Function
PWR	green	LED turns on when the voltage + 5V is present and at correct level
RS 485	yellow	LED turns on when Serial interface is supplied

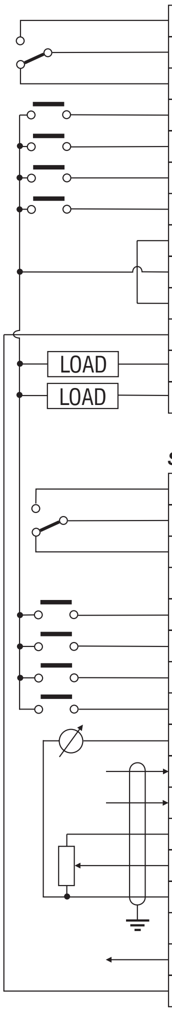
Connector	No. of pins	Function
XV	2	Reserved (Fans control)
XT	10	KGB-1 and/or KGB-LCD-A keypad connector
XENC	10	EXP-ENC-AGY optional board connection (for encoder feedback)
XS	9	9-pole SUB-D connector of RS485 serial line
XKEY	5+1	QUIX-PRG key connection
XP	40	Reserved (power board connection)
XEXP	34	Reserved (expansion boards connection)
XD	10	Reserved (FW download connection)

Jumper	Factory	Function
S1	ON	Jumper to disconnect 0V24 (regulation section) from ground. ON = 0V24 connected to ground OFF = 0V24 disconnected from ground
S2	ON	Jumper to disconnect 0V (regulation section) from ground. ON = 0V connected to ground OFF = 0V disconnected from ground
S5 S6	ON	Selection of the internal/external supply of the RS485 serial interface ON = Serial interface supplied from the regulation section OFF = Serial interface supplied from external source (see chap. 5.4) and galvanic insulation from the regulation card
S3 S4	ON	Terminating resistor for the serial interface RS485 OFF = No termination resistor ON = Termination resistor IN

Switch	Factory	Switch function of EXP-ENC-AGY optional board
S-1	OFF	OFF = HTL output logic encoder level (+24V) ON = TTL output logic encoder level (+5V)
S-2	OFF	OFF = HTL output logic encoder level (+24V) ON = TTL output logic encoder level (+5V)

ai4050g

5.3.2 Terminal Assignments on Regulation Section



Strip 1	Designation	Function	Max
1	**Digital Output 4 - NO**	Programmable digital relay output - Default: **[1] Alarm state**	1A 30Vdc 1A 250Vac
2	**Digital Output 4 - COM**		
3	**Digital Output 4 - NC**		
4	**Digital Input 8**	Programmable digital input - Default: **[2] Reverse**	6mA @ +24V
5	**Digital Input 7**	Programmable digital input - Default: **[1] Run**	
6	**Digital Input 6**	Programmable digital input - Default: **[3] Ext fault NO**	
7	**Digital Input 5**	Programmable digital input - Default: **[5] Alarm reset**	
8	**COM-IN Digital Inputs**	Supply reference for Digital inputs	-
9	**+ 24V OUT**	+ 24 V potential voltage reference	+24V / 300mA
10	**0 V 24 - GND Dig. Inputs**	V 24 reference for Digital inputs	-
11	**0 V 24 - GND Dig. Inputs**	0 V 24 reference for Digital inputs	-
16	**Digital Output 1**	Programmable digital output - Default: **[0] Drive ready**	+50V / 50mA
17	**Digital Output 2**	Programmable digital output - Default: **[6] Steady state**	
Strip 2	**Designation**	**Function**	**Max**
18	**Digital Output 3 - NO**	Programmable digital relay output - Default: **[3] Motor running**	1A 30Vdc 1A 250Vac
19	**Digital Output 3 - COM**		
20	**Digital Output 3 - NC**		
21	**GROUND REF**	Ground shield cable reference	-
22	**Digital Input 1**	Programmable digital input - Default: **[7] Freq sel 1**	6mA @ +24V
23	**Digital Input 2**	Programmable digital input - Default: **[8] Freq sel 2**	
24	**Digital Input 3**	Programmable digital input - Default: **[28] Stop (3wires)**	
25	**Digital Input 4**	Programmable digital input - Default: **[6] Jog**	
26	**Analog Output 1**	Programmable analog output - Default: **[0] Freq out abs**	±10V / 5mA
27	**Analog Input 2**	Programmable VOLTAGE analog input - Default: **[0] ±10V**	±10V / 0.5mA
28	**Analog Input 3**	Programmable CURRENT analog input - Default: **[1] 0…20mA**	20mA
29	**+ 10V OUT**	+ 10 V potential voltage reference	+10V / 10mA
30	**Analog Input 1**	Programmable VOLTAGE analog input - Default: **[1] 0...10V**	±10V / 0.5mA
31	**0 V 10 - GND**	0 V 10 reference for analog inputs/outputs	-
32	**- 10V OUT**	- 10 V potential voltage reference	-10V/10mA
33	**Analog Output 2**	Programmable analog output - Default: **[0] Output curr**	±10V / 5mA
34	**COM Digital outputs**	Common reference for Digital outputs	-

Figure 5.3.2.1: Plug-in Terminal Strip Assignments

Caution

+24Vdc voltage, which is used to externally supply the regulation card has to be stabilized and with a maximum ±10% tolerance. The maximum absorption is 1A.

It is not suitable to power supply the regulation card only through a unique rectifier and capacitive filter.

Maximum Cable Sizes for control terminals

Table 5.3.2.1: Maximum Permissible Cable Cross-section on the Plug-in Terminals of the Regulator Section

Terminals	Maximum Permissible Cable Cross-Section			Tightening torque Nm (lbt. inch)
	mm^2 (inch)		AWG	
	flexible	multi-core		
1 ... 34	0.5 … 1.5 (0.02…0.06)	0.5 ...1.5 (0.02…0.06)	28 …16	0.4 (35.4)

TGy0160

The use of a 75 x 2.5 x 0.4 mm (3 x 0.1 x 0.02 inch) flat screwdriver is recommended. Remove 6.5 mm (0.26 inch) of the insulation at the cable ends. Only one unprepared wire (without ferrule) should be connected to each terminal point.

Maximum Cable Length

Table 5.3.2.2: Maximum Control Cable Lengths

Cable section [mm^2]	0.22	0.5	0.75	1	1.5
Max Length m [feet]	27 [88]	62 [203]	93 [305]	125 [410]	150 [492]

avy3130

5.4 Serial Interface

5.4.1 In General

The RS 485 serial interface enables data transfer via a loop made of two symmetrical, twisted conductors with a common shield. The maximum transmission distance is 1200 m (3936 feet) with a transfer rate of up to 38,400 KBaud. The transmission is carried out via a differential signal. RS 485 interfaces are bus-compatible in half-duplex mode, i.e. sending and receiving take place in sequence. Up to 31 AGy-EVdevices (up to 99 address selectable) can be networked together via the RS 485 interface.

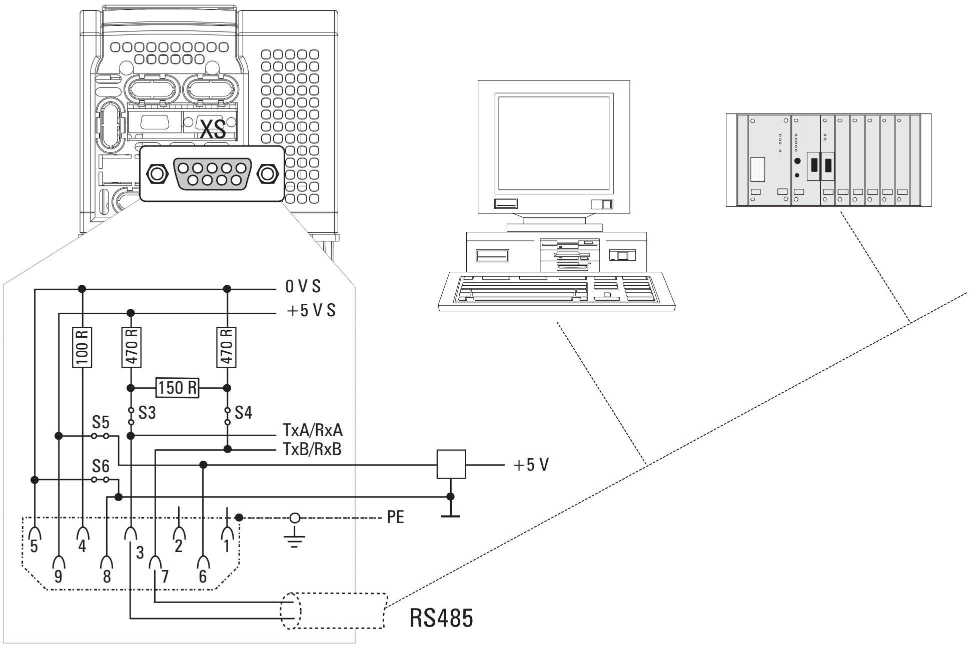


Figure 5.4.1.1: RS485 Serial Interface

The RS 485 on the AGy-EV series devices is located on the Regulation card in the form of a 9-pole SUB-D socket connector (XS). The communication may be with or without galvanic isolation: when using galvanic isolation an external power supply is necessary (+5V).

Communication without galvanic isolation is suggested only in case of temporary connections for setup with one drive connected. The differential signal is transferred via PIN 3 (TxA/RxA) and PIN 7 (TxB/RxB). Bus terminating resistors must be connected at the physical beginning and end of an RS 485 bus in order to prevent signal reflection. The bus terminatingresistors on AGy-EV drives are connected via jumpers S3 and S4. This enables a direct point-to-point connection with a PLC or PC.

NOTE! Ensure that only the first and last drop of an RS 485 bus have a bus terminating resistor (S3 and S4 mounted). In all other cases (within the line) jumpers S3 and S4 must not be mounted.

A connection point to point (without galvanic isolation) can be done using “PCI-485” option interface (S5 and S6 mounted).

With S5 and S6 mounted the drive supply the serial line. This modality is allowed on point-to-point connection without galvanic isolation only.

For multidrop connection (two or more drive), an external power supply is necessary (pin 5 / 0V and pin 9 / +5V).

Pins 6 and 8 are reserved for use with the “PCI-485” interface card.

When connecting the serial interface ensure that:

- only shielded cables are used

- power cables and control cables for contactors/relays are routed separately

NOTE! **As for the connection of the serial line, make sure that the power cables and the cables controlling the contactors and the auxiliary relays are located into different panduits.**

Serial protocol

The serial protocol is set via the "***I.600 - Serial link cfg***" parameter, which allows the selection of the following types: proprietary protocol FoxLink, RTU Modbus (default) and Jbus.

The serial address is set via the "***I.602 - Device address***" parameter. Further details about the parameter transmission, the parameter type and the value range can be found in the tables of Chapter 7.1 (INTERFACE Menu / Serial Configuration). For the RTU Modbus Protocol see chapter 8.1 of this manual.

5.4.2 RS 485 Serial Interface Connector Description

On the AGy inverter, serial connection is available on connector XS (D-SUB type).

Table 5.4.2.1: Assignment of the XS Connector for the RS 485 Serial Interface

Designation	Function	I/O	Elec. Interface
PIN 1	Internal use	–	–
PIN 2	Internal use	–	–
PIN 3	RxA/TxA	I/O	RS485
PIN 4	Internal use	–	–
PIN 5	0V (Ground for 5 V)	–	Power supply
PIN 6	Internal use	–	–
PIN 7	RxB/TxB	I/O	RS 485
PIN 8	Connected to ground	–	–
PIN 9	+5 V	–	Power supply

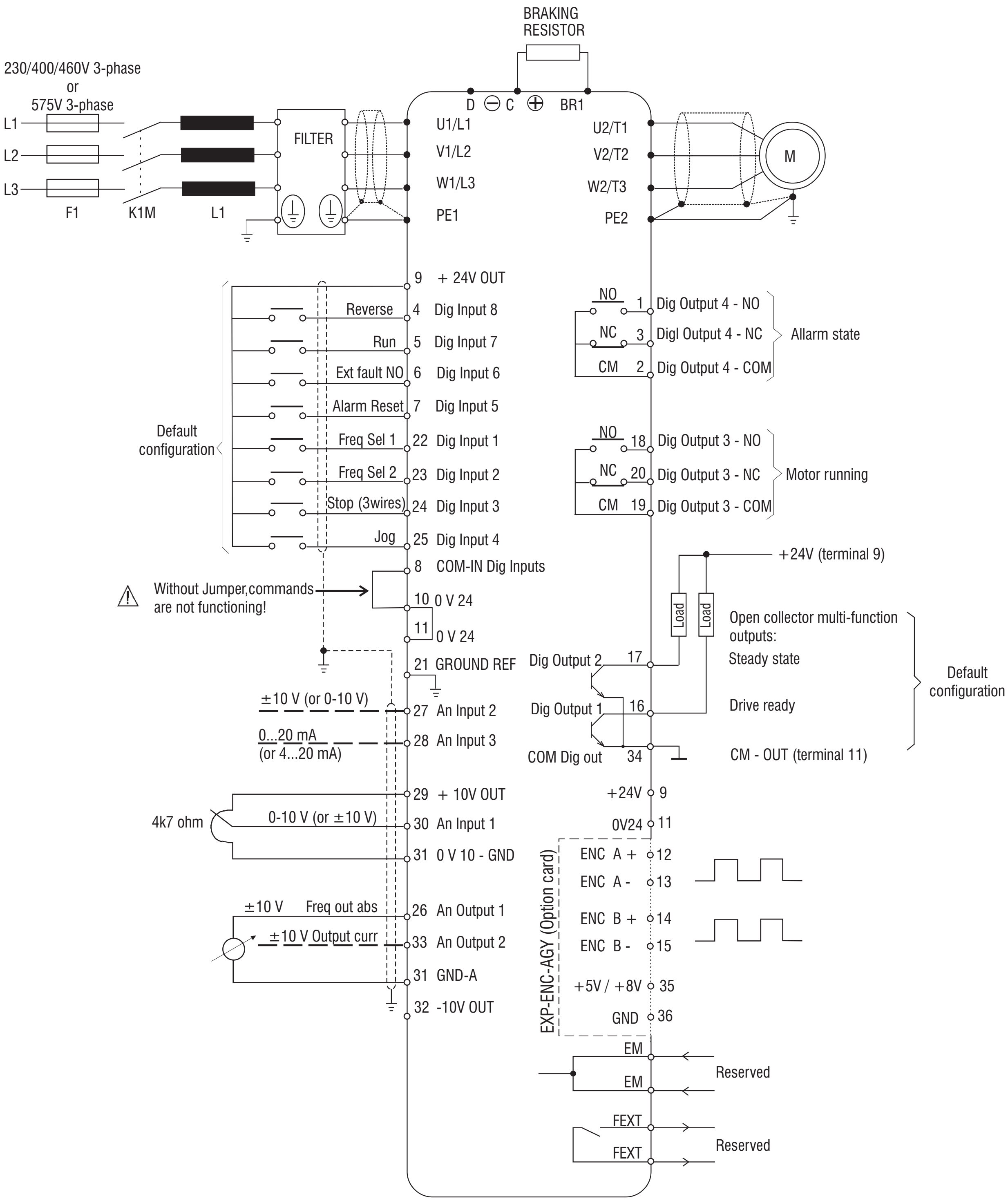
TGy0300

I = Input O = Output

5.5 Typical Connection Diagrams

5.5.1 AGy Connection

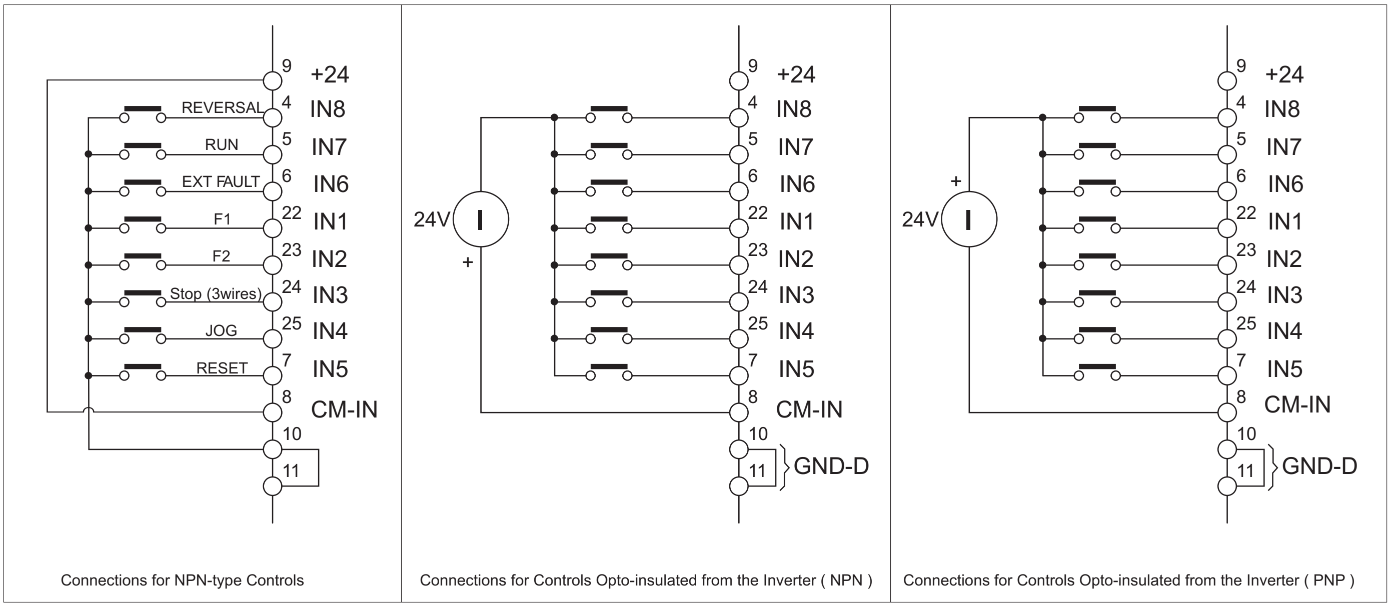
Figure 5.5.1.1: Connection through Terminals Strip, Typical Connection Diagram



NOTE! EM and FEXT terminals are available on sizes 3110 ... 5550 (230..480V) and are active on lift software only.

NOTE! The connections indicated for command inputs represent the most common solution for an PNP type command. Other examples are given on the following figures.

Figure 5.5.1.2: Other Connections



5.5.2 Engineering Notes

Cables for analog reference and correction values should be screened (connection to the following terminals 25, 26, 27, 28, 29, 30).

The screen should be **on one side** of the Inverter on terminal PE1. The same applies to the frequency signals for setting the reference value or feed back and for the connected speed and current displays (terminals 26, 33, 31).

Grounding the reference point

The reference point of shield cable for the control terminals must be normally grounded (to the terminal 21 in case of one inverter).

Where several inverters are used in a single installation, their reference points of shield cable for the control terminals should be linked and grounded to the ground reference of the cabinet (with due attention to the minimum cable cross-section stated above).

Direct connection to PLC input/output sections

The following points should be noted when the control commands or reference values are taken directly from the input/output level of a programmable controller.

Grounding of the 0 V rail of a PLC is generally required. In this instance the reference points for the control commands on the Inverter (terminals 10, 11) must not be grounded. To provide a high level of noise immunity, it is recommended that a 0,1μF 250V DC capacitor be connected between terminals 10,11 and ground. Where an installation contains several Inverters, this measure should be taken on each Inverter.

Relay on the Inverter

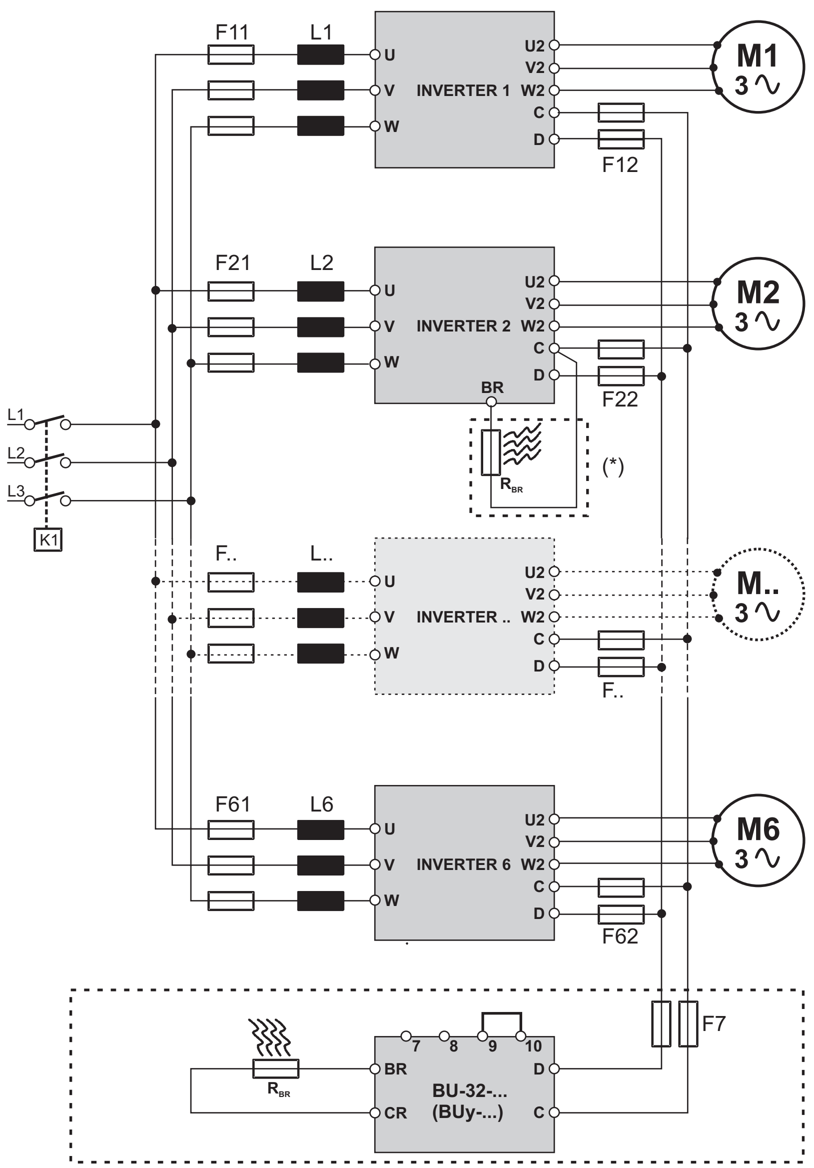
To provide improved noise immunity, RC suppressors should be connected in parallel with the contactor coils, which are switched onto the Inverter by one of the potential-free contacts.

5.5.3. Parallel Connection on the AC (Input) and DC (Intermediate Circuit) Side of Several Inverters

Features and Limits:

- The inverters used have to be all the same size.
- AC input line chokes (see chapter 5.7.1) have to be the same (provided by the same supplier).
- The mains power supply has to be simultaneous for all inverters, i.e. a single switch /line contactor has to be used.
- Such connection is suitable for a maximum of 6 inverters.
- If necessary dissipate braking energy; a single internal braking unit (with external resistor) has to be used or one (or several) external braking unit (see manual: "BU32-..." , “BUy-...").
- Fast fuses (F12...F62) have to be fitted on the dc-link side (C and D terminals) of each inverters (see chapter 5.6.2).

Figure 5.5.3.1: Parallel Connection on the AC and DC Side of Several Inverters



Caution

(*) Do not connect if external braking units (BU32-.., BUy..) are used.

5.6 Circuit Protection

5.6.1 External Fuses of the Power Section

The inverter must be fused on the AC Input side. **Use fast fuses only.**

Connections with three-phase inductance on AC input will improve the DC link capacitors life time.

Table 5.6.1.1: External Fuse Types for AC Input Side

	Drive type	DC link capacitors life time [h]	F1 - Fuses type (Code)			
			Europe	America		
			Connections without three-phase reactor on AC input			
AGy...-4 (230V...480V)	1007	25000	GRD2/10 (F4D13) or Z14GR10 (F4M03)	A70P10	FWP10	(S7G49)
	1015					
	1022	25000	GRD2/16 (F4D14) or Z14GR16 (F4M05)	A70P20	FWP20	(S7G48)
	1030	10000				
	2040	25000	GRD2/20 (F4D15) or Z14GR20 (F4M07)	A70P20	FWP20	(S7G48)
	2055	25000	GRD2/25 (F4D16) or Z14GR25 (F4M09)	A70P25	FWP25	(S7G51)
	2075	10000	GRD3/35 (F4D20) or Z22GR40	A70P35	FWP35	(S7G86)
	3110	25000	GRD3/50 (F4D21) or Z22GR40	A70P40	FWP40	(S7G52)
	3150	10000	GRD3/50 (F4D21) or Z22GR50 (F4M15)	A70P40	FWP40	(S7G52)
	4185 ... 82000	10000	For these types an external reactor is mandatory if the AC input impedence is equal or less than 1%			
			Connections with three-phase reactor on AC input			
	1007	50000	GRD2/10 (F4D13) or Z14GR10 (F4M03)	A70P10	FWP10	(S7G49)
	1015	50000				
	1022	50000		A70P10	FWP10	(S7G49)
	1030	50000	GRD2/16 (F4D14) or Z14GR16 (F4M05)	A70P20	FWP20	(S7G48)
	2040	50000				
	2055	50000	GRD2/20 (F4D15) or Z14GR20 (F4M07)	A70P20	FWP20	(S7G48)
	2075	50000	GRD2/25 (F4D16) or Z14GR25 (F4M09)	A70P25	FWP25	(S7G51)
	3110	50000	GRD3/50 (F4D21) or Z22GR40	A70P35	FWP35	(S7G86)
	3150	50000	GRD3/50 (F4D21) or Z22GR50 (F4M15)	A70P40	FWP40	(S7G52)
	4185	30000	GRD3/50 (F4D21) or Z22GR50	A70P50	FWP50	(S7G53)
	4220	25000				
	4300	25000	S00C+üf1/80/80A/660V or Z22gR80	A70P80	FWP80	(S7G54)
	4370	25000	S00C+üf1/80/100A/660V or M00üf01/100A/660V (F4G18)	A70P100	FWP100	(S7G55)
	5450	25000	S00C+üf1/80/160A/660V or M00üf01/160A/660V (F4E15)	A70P175	FWP175	(S7G57)
	5550	25000				
	6750	25000	S1üf1/110/250A/660V or M1üf1/250A/660V (F4G28)	A70P300	FWP300	(S7G60)
	7900	25000				
	71100	25000	S2üf1/110/400A/660V or M2üf1/400A/660V (F4G34)	A70P400	FWP400	(S7G62)
	71320	25000				
	81600	25000				
	82000	25000	S2üf1/110/500A/660V or M2üf1/500A/660V ( )	A70P500	FWP500	(…)
			Connections with and/or without three-phase reactor on AC input			
AGy...-5 (575V)	2002	25000 (*)	GRD2/10 (F4D13) or Z14GR10 (F4M03)	A70P10	FWP10A14F	(S7G49)
	2003	25000 (*)				
	2005	25000 (*)	GRD2-16 (F4D14)	A70P15	FWP15	(S848B)
	3007	25000 (*)	GRD2/25 (F4D16) or Z14GR25 (F4M09)	A70P25	FWP25	(S7G51)
	3010	25000 (*)	Z14GR32 (F4M11)	A70P30-1	FWP30A14F	(S7I50)
	3015	25000 (*)	GRD3/50 (F4D21) or Z22GR54 (F4M13)	A70P40	FWP40	(S7G52)
	3020	25000 (*)	GRD3/50 (F4D21) or Z22GR50 (F4M15)	A70P50	FWP50	(S7G53)
	4025	50000				
	4030	50000				
	4040	50000	Z22GR63 (F4M17)	A70P60-4	FWP60B	(S7I34)
	5050	50000	S00C+üf1/80/80A/660V (F4EAF) or Z22gR80	A70P80	FWP80	(S7G54)
	5060	50000	S00C+üf1/80/100A/660V (F4EAG) or M00üf01/100A/660V	A70P100	FWP100	(S7G55)
	5075	50000	S00C+üf1/80/125A/660V F4EAJ) or M00üf01/125A/660V	A70P125	FWP125	(S849B)
	6100	50000	S00C+üf1/80/160A/660V (F4EAL) or M00üf01/160A/660V	A70P150		(S7G56)
	7125	50000	S1üf1/110/250A/660V or M1üf1/250A/660V (F4G28)	A70P200	FWP200	(S7G58)
	7150	50000	S1üf1/110/250A/660V or M1üf1/250A/660V (F4G28)	A70P250	FWP250	(S7G59)
	8200	50000	S2üf1/110/400A/660V or M2üf1/400A/660V (F4G34)	A70P400	FWP400	(S7G62)

agy0700gb

(*) 50000 [h] only with output choke

Fuse manufacturers: Type GRD2... (E27), Z14... 14 x 51 mm, S00... ,S1... ,

Fuse manufacturers:	Type GRD2... (E27), Z14... 14 x 51 mm, S00... ,S1... ,	
	Z22... 22 x 58 mm	Jean Müller, Eltville
	A70...	Ferraz
	FWP...	Bussmann

NOTE! The technical data of the fuses, e.g. dimensions, weights, heat dissipation, auxiliary contactors, are reported in the corresponding data sheets.

5.6.2 External Fuses of the Power Section DC Input Side

Use the following fuses when a SR-32 Line Regen converter is used (see SR-32 instruction book for other details).

Table 5.6.2.1: External Fuses Type for DC Input Side

	Drive type	Europe		America		
		Fuses type	Code	Fuses type		Code
AGy...-4 (230V...480V)	1007	Z14GR6	F4M01	A70P10	FWP10A14F	S7G49
	1015	Z14GR10	F4M03	A70P10	FWP10A14F	S7G49
	1022					
	1030	Z14GR16	F4M05	A70P20-1	FWP20A14F	S7G48
	2040					
	2055	Z14GR20	F4M07	A70P20-1	FWP20A14F	S7G48
	2075	Z14GR32	F4M11	A70P30-1	FWP30A14F	S7I50
	3110	Z14GR40	F4M13	A70P40-4	FWP40B	S7G52
	3150	Z22GR63	F4M17	A70P60-4	FWP60B	S7I34
	4185	S00C+/üf1/80/80A/660V	F4EAF	A70P80	FWP80	S7G54
	4220					
	4300	S00C+/üf1/80/100A/660V	F4EAG	A70P100	FWP100	S7G55
	4370	S00C+/üf1/80/125A/660V	F4EAJ	A70P150	FWP150	S7G56
	5450	S00C+/üf1/80/160A/660V	F4EAL	A70P175	FWP175	S7G57
	5550	S00üF1/80/200A/660V	F4G23	A70P200	FWP200	S7G58
	6750	S1üF1/110/250A/660V	F4G28	A70P250	FWP250	S7G59
	7900	S1üF1/110/315A/660V	F4G30	A70P350	FWP350	S7G61
	71100	S1üF1/110/400A/660V	F4G34	A70P400	FWP400	S7G62
	71320	S1üF1/110/500A/660V	F4E30	A70P500	FWP500	S7G63
	81600					
	82000	S1üF1/110/600A/660V		A70P600	FWP600	S7G65
	Drive type	Europe		America		
		Fuses type	Code	Fuses type		Code
AGy...-5 (575V)	2002	-		A100P15	-	S85A0
	2003	-		A100P15	-	S85A0
	2005	-		A100P20	-	S85A1
	3007	-		A100P30	-	S85A2
	3010	-		A100P35	FWJ35	S85A3
	3015	-		A100P50	FWJ50	S85A4
	3020	-		A100P60	FWJ60	S85A5
	4025	-		A100P60	FWJ60	S85A5
	4030	-		A100P70	FWJ70	S85A6
	4040	-		A100P80	FWJ80	S85A7
	4050	-		A100P100	FWJ100	S85A8
	5060	-		A100P125	FWJ125	S85A9
	5075	-		A100P150	FWJ150	S85B0
	7100	-		A100P200	FWJ200	S85B1
	7125	-		A100P250	FWJ250	S85B2
	7150	-		A100P250	FWJ250	S85B2
	8200	-		A100P400	FWJ400	S85B4

agy0701gb

Fuse manufacturers:	Type Z14..., Z22, S00..., S1...	Jean Müller, Eltville
	A70P..., A100P...	Ferraz
	FWP...	Bussmann

NOTE! The technical data of the fuses, e.g. dimensions, weights, heat dissipation, auxiliary contactors, are reported in the corresponding data sheets.

5.6.3 Internal Fuses

Table 5.6.3.1: Internal Fuses

	Drive type	Designation	Protection of	Fuse (source)	Fitted on:
AGy...-4 (230V...480V)	**4185...82000**	F1	+24V	2A fast 5 x 20 mm (Bussmann: SF523220 or Schurter: FSF0034.1519 or Littlefuse: 217002)	Power card PV33-4 Power card PV33-5
	7900...82000	F3	Fans transformer	2.5A 6.3x32 (Bussmann: MDL 2.5, Gould Shawmut: GDL1-1/2, Siba: 70 059 76.2,5 , Schurter: 0034.5233)	Bottom cover (power terminals side)
AGy...-5 (575V)	**4025...8200**	F1	+24V	2A fast 5 x 20 mm (Bussmann: SF523220 or Schurter: FSF0034.1519 or Littlefuse: 217002)	Power card PV33-4N Power card PV33-5N
	7125...8200	F3	Fans transformer	2.5A 6.3x32 (Bussmann: MDL 2.5, Gould Shawmut: GDL1-1/2, Siba: 70 059 76.2,5 , Schurter: 0034.5233)	Bottom cover (power terminals side)

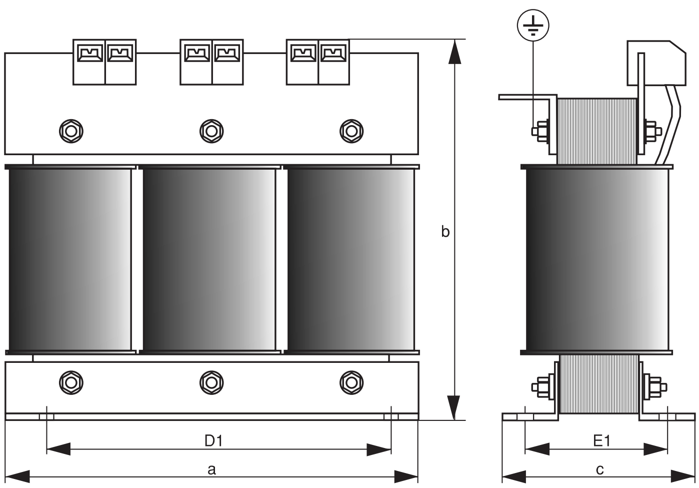
agy0702gb

5.7 Chokes / Filters (Optional)

NOTE! A three-phase inductance should be connected on the AC Input side in order to limit the input RMS current of AGy series Drives. The inductance can be provided by an AC Input choke or an AC Input transformer.

NOTE! For the use of output sinusoidal filters, please contact the nearest GEFRAN office.

Figure 5.7.1: Input / output chokes dimensions



5.7.1 AC Input Chokes

Table 5.7.1.1: 3-Phase AC Input Chokes

	Drive type	Three-phases main chokes											
		Mains inductance [mH]	Rated current [A]	Saturation current [A]	Freq. [Hz]	Model	Code	Weight kg (lbs)	Dimensions : mm (inch) a	b	c	D1	E1
AGy...-4 (230V...480V)	1007	6.1	2.5	5	50/60	**LR3y-1007**	S7AAD	1.8 (3.9)	120 (4.72)	125 (4.92)	65 (2.56)	100 (3.94)	45 (1.77)
	1015	3.69	3.7	7.4	50/60	**LR3y-1015**	S7AAE						
	1022	2.71	5.5	11	50/60	**LR3y-1022**	S7AAF	1.9 (4.2)					
	1030	2.3	6.7	14	50/60	**LR3y-1030**	S7AB3						
	2040	1.63	8.7	18	50/60	**LR3y-2040**	S7AAG	2 (4.4)					
	2055	1.29	11.8	24.5	50/60	**LR3y-2055**	S7AB5	2.2 (4.4)	120 (4.7)	125 (4.9)	75 (2.6)	100 (3.9)	55 (2.2)
	2075	0.89	17.4	36.5	50/60	**LR3y-2075**	S7AB6	4.9 (10.8)	150 (5.9)	155 (6.1)	79 (3.1)	90 (3.5)	54 (2.1)
	3110	0.68	22.4	46.5	50/60	**LR3y-3110**	S7AB7	5 (11)	150 (5.9)	155 (6.1)	79 (3.1)	90 (3.5)	54 (2.1)
	3150	0.51	30	61	50/60	**LR3y-3150**	S7AB8	6.2 (13.7)	150 (5.9)	168 (6.6)	100 (3.9)	90 (3.5)	69 (2.7)
	4185	0.35	41	83	50/60	**LR3-022**	S7FF4	7.8 (17.2)	180 (7.1)	182 (7.2)	130 (5.1)	150 (5.9)	70 (2.8)
	4220	0.35	41	83	50/60								
	4300	0.24	58	120	50/60	**LR3-030**	S7FF3	9.5 (20.9)	180 (7.1)	160 (6.3)	170 (6.7)	150 (5.9)	80 (3.1)
	4370	0.18	71	145	50/60	**LR3-037**	S7FF2	9.5 (20.9)	180 (7.1)	160 (6.3)	180 (7.1)	150 (5.9)	80 (3.1)
	5450	0.13	102	212	50/60	**LR3-055**	S7FF1	12.5 (27.6)	240 (9.4)	215 (8.5)	180 (7.1)	150 (5.9)	80 (3.1)
	5550	0.13	102	212	50/60								
	6750	0.148	173	350	50/60	**LR3-090**	S7D19	55 (121.3)	300 (11.8)	265 (10.4)	210 (8.3)	250 (9.8)	85 (3.3)
	7900	0.148	173	350	50/60								
	71100	0.085	297	600	50/60	**LR3-160**	S7D40	44 (97.0)	300 (11.8)	270 (10.6)	260 (10.2)	250 (9.8)	120 (4.7)
	71320	0.085	297	600	50/60								
	81600	0.085	297	600	50/60								
	82000	0.085	380	710	50/60	**LR3-200**	S7AE9	54 (119)	300 (11.8)	270 (10.6)	355 (13.9)	250 (9.8)	130 (5.1)
AGy...-5 (575V)	2002	4.5	4.2	8.4	50/60	**LR3y-5-002**	S7AD0	2 (4.4)	120 (4.7)	125 (4.9)	75 (2.6)	100 (3.9)	42 (1.6)
	2003	3.8	5.2	10.4	50/60	**LR3y-5-003**	S7AD2	2 (4.4)	120 (4.7)	125 (4.9)	75 (2.6)	100 (3.9)	42 (1.6)
	2005	2.3	8.1	16.2	50/60	**LR3y-5-005**	S7AD3	2.7 (6)	120 (4.7)	125 (4.9)	85 (3.3)	100 (3.9)	52 (2)
	3007	1.5	12.9	25.8	50/60	**LR3y-5-007**	S7AC7	5 (11)	150 (5.9)	152 (6)	80 (3.1)	90 (3.5)	55 (2.2)
	3010	1.2	16.5	33.0	50/60	**LR3y-5-010**	S7AC8	5 (11)	150 (5.9)	152 (6)	80 (3.1)	90 (3.5)	55 (2.2)
	3015	0.9	21.8	43.6	50/60	**LR3y-5-015**	S7AC9	5.5 (12.1)	150 (5.9)	164 (6.4)	96 (3.8)	90 (3.5)	60 (2.4)
	3020	0.7	28.5	57	50/60	**LR3y-5-020**	S7AD1	6.2 (13.7)	150 (5.9)	164 (6.4)	106 (4.2)	90 (3.5)	70 (2.8)

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For sizes up to 20Hp, an input choke is strongly reccomended in order to:

- prolong the life time of the DC link capacitors and the reliability of the input rectifier.
- reduce the AC line harmonic distortion
- reduce problems due to low impedence AC line (≤ 1%).

NOTE! The current rating of these chokes (reactors) is based on nominal current of standard motors, listed in table 3.3.4.1 in section 3.3.4, "AC Output".

NOTE! The **4025 … 8200 sizes** of AGy-5 series (575Vac), integrate as standard the input choke on intermediate circuit (DC-Link). With this configuration the **three phase input choke it is NOT required**.

5.7.2 Output Chokes

The AGy Drive can be used with general purpose standard motors or with motors specially designed for Drive use. The latter usually have a higher isolation rating to better withstand PWM voltage.

Motors designed for use with Adjustable Frequency Drives do not require any specific filtering of the voltage waveform from the Drive. For general purpose motors and using drives up to 2005 size, especially with long cable runs (typically over 100 m [328 feet]) an output choke is recommended to mantain the voltage waveform within the specified limits. Suggested choke ratings and part numbers are listed in table 5.7.2.1.

The rated current of the filters should be approx. 20% above the rated current of the frequency Drive in order to take into account additional losses due to PWM waveform.

Table 5.7.2.1: Recommended Values for Output Chokes

	Drive type	Three-phases choke										
		Mains inductance [mH]	Rated current [A]	Saturation current [A]	Model	Code	Weight kg (lbs)	Dimensions : mm (inch)				
								a	b	c	D1	E1
AGy...-4 (230V...480V)	**1007**	1.4	9.5	20	**LU3-003**	S7FG2	5.2 (11.5)	180 (7.1)	170 (6.7)	110 (4.3)	150 (5.9)	60 (2.4)
	1015											
	1022											
	1030											
	2040	0.87	16	34	**LU3-005**	S7FG3	5.8 (12.8)	180 (7.1)	170 (6.7)	110 (4.3)	150 (5.9)	60 (2.4)
	2055											
	2075	0.51	27	57	**LU3-011**	S7FG4	8 (17.6)	180 (7.1)	180 (7.1)	130 (5.1)	150 (5.9)	70 (2.8)
	3110											
	3150	0.43	32	68	**LU3-015**	S7FM2	7.5 (16.5)	180 (7.1)	160 (6.3)	170 (6.7)	150 (5.9)	70 (2.8)
	4185	0.33	42	72	**LU3-022**	S7FH3	8 (17.6)	180 (7.1)	160 (6.3)	170 (6.3)	150 (5.9)	70 (2.8)
	4220											
	4300	0.24	58	100	**LU3-030**	S7FH4	9.5 (20.9)	180 (7.1)	160 (6.3)	180 (7.1)	150 (5.9)	80 (3.1)
	4370	0.18	76	130	**LU3-037**	S7FH5	9.7 (21.4)	180 (7.1)	160 (6.3)	180 (7.1)	150 (5.9)	80 (3.1)
	5450	0.12	110	192	**LU3-055**	S7FH6	14 (30.9)	240 (9.4)	210 (8.3)	180 (7.1)	200 (7.9)	80 (3.1)
	5550											
	6750	0.07	180	310	**LU3-090**	S7FH7	18.5 (40.8)	240 (9.4)	210 (8.3)	200 (7.9)	200 (7.9)	80 (3.1)
	7900											
	71100	0.041	310	540	**LU3-160**	S7FH8	27.5 (60.6)	300 (11.8)	260 (10.2)	240 (9.4)	250 (9.8)	90 (3.5)
	71320											
	81600											
	82000				**LU3-200**	S7AF0	Please contact the nearest GEFRAN office					
AGy...-5 (575V)	**2002**	3	4.5	8.5	**LU3-5-003**	S7FI2	2 (4.4)	120 (4.7)	125 (4.9)	75 (2.6)	100 (3.9)	42 (1.6)
	2003											
	2005	1.9	7	13	**LU3-5-005**	S7FI3	2 (4.4)	120 (4.7)	125 (4.9)	75 (2.6)	100 (3.9)	42 (1.6)
	3007	1	13,8	25.3	**LU3-5-010**	S7FI4	5 (11)	150 (5.9)	152 (6)	80 (3.1)	90 (3.5)	55 (2.2)
	3010											
	3015	0.64	24,2	44.3	**LU3-5-020**	S7FI5	6.2 (13.7)	150 (5.9)	164 (6.4)	106 (4.2)	90 (3.5)	70 (2.8)
	3020											
	4025	0.51	30	54.9	**LU3-5-025**	S7FI6	6.2 (13.7)	150 (5.9)	164 (6.4)	106 (4.2)	90 (3.5)	70 (2.8)
	4030	0.43	36	65.9	**LU3-5-030**	S7FI7	6.8 (15)	180 (7.1)	182 (7.2)	122 (4.8)	150 (5.9)	64 (2.5)
	4040	0.34	46	84.2	**LU3-5-040**	S7FI8	10 (22)	180 (7.1)	165 (6.5)	170 (6.7)	150 (5.9)	84 (3.3)
	4050	0.27	58	106.1	**LU3-5-050**	S7FI9	12 (26.5)	180 (7.1)	165 (6.5)	170 (6.7)	150 (5.9)	84 (3.3)
	5060	0.22	69	126.3	**LU3-5-060**	S7FL0	12 (26.5)	180 (7.1)	165 (6.5)	170 (6.7)	150 (5.9)	84 (3.3)
	5075	0.18	86	157.4	**LU3-5-075**	S7FL1	12 (26.5)	180 (7.1)	165 (6.5)	170 (6.7)	150 (5.9)	84 (3.3)
	6100	0.14	109	200	**LU3-5-100**	S7FL4	Please contact the nearest GEFRAN office					
	7125	0.11	158	290	**LU3-5-150**	S7FL5						
	7150	0.11	158	290	**LU3-5-150**	S7FL5						
	8200	0.070	220	403	**LU3-5-200**	S7FL6						

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NOTE! When the Drive is operated at the rated current and at 50 Hz, the output chokes cause a voltage drop of approx. 2% of the output voltage.

5.7.3 Interference Suppression Filters

The inverters of AGy series must be equipped with an external EMI filter in order to reduce the radiofrequency emissions on the mains line. The filter selection is depending on the drive size and the installation environment. For this purpose see the “EMC Guidelines” instruction book.

In the Guide it is also indicated how to install the cabinet (connection of filter and mains reactors, cable shield, groundig, etc.) in order to make it EMC compliant according the EMC Directive 89/336/EEC.

The document describes the present situation concerning the EMC standards and the compliance tests made on the GEFRAN-SIEI drives.

Table 5.7.3.1: EMI filters

	Drive type	EN 61800-3:2004	Model	Code	Weight kg (lbs)	Dimensions : mm (inch) a	b	c	D1	E1	P	M
	1007…3110	(1)	EMI-C 480-25	S7DFA	0.96 (2.1)	105 (4.1)	100 (3.9)	57 (2.2)	51 (2.0)	95 (3.7)	M5	4.5x3
	1007…82000	(4)	ECF3	S4ZZ2	1.2 (2.7)	150 (5.9)	120 (4.72)	110 (4.33)	100 (3.94)	100 (3.94)		M6
AGy...4 (230V...400V)	**1007...1030**	(2)	EMI FFP 480-9	S7DEQ	1.1 (2.4)	375 (14.8)	104 (4.1)	45 (1.8)	360 (14.2)	59 (2.3)	M5	Ø6
	2040...2075	(2)	EMI FFP 480-24	S7DER	1.4 (3.1)	375 (14.8)	150 (5.9)	45 (1.8)	360 (14.2)	105 (4.1)	M5	Ø6
	3110	(2)	EMI FFP 480-30	S7DES	1.6 (3.5)	390 (15.4)	200 (7.9)	45 (1.8)	375 (14.8)	155 (6.1)	M5	Ø6
	3150	(2)	EMI FFP 480-40	S7DET	2.3 (5.1)	390 (15.4)	200 (7.9)	45 (1.8)	375 (14.8)	155 (6.1)	M5	Ø6
	4185…4220	(3)	EMI 480-45	S7DFU	1.3 (2.9)	250 (9.8)	85 (3.3)	90 (3.5)	235 (9.3)	60 (2.4)	-	M6
	4300...4370	(3)	EMI 480-70	S7DFZ	2.6 (5.7)	270 (10.6)	90 (3.5)	150 (5.9)	255 (10.0)	65 (2.6)	-	M6
	5450...5550	(3)	EMI 480-100	S7DGA	2.6 (5.7)	270 (10.6)	90 (3.5)	150 (5.9)	255 (10.0)	65 (2.6)	-	M6
	6750	(3)	EMI 480-150	S7DGB	4.4 (9.7)	400 (15.7)	120 (4.7)	170 (6.7)	365 (14.4)	102 (4.0)	-	M6
	7900	(3)	EMI 480-180	S7DGC	4.4 (9.7)	400 (15.7)	120 (4.7)	170 (6.7)	365 (14.4)	102 (4.0)	-	M6
	71100...71320	(3)	EMI 480-250	S7DGG	13 (28.7)	300 (11.8)	260 (10.2)	135 (5.31)	120 (4.72)	235 (9.25)	-	M10
	81600	(3)	EMI 480-320	S7DGH	13.2 (29.1)	300 (11.8)	260 (10.2)	135 (5.31)	120 (4.72)	235 (9.25)	-	M10
	82000	(2)	EMI 480-400	S7DGI	13.4 (29.5)	300 (11.8)	260 (10.2)	135 (5.31)	120 (4.72)	235 (9.25)	-	M10
AGy...4 (480V)	**1007...1030**	(2)	EMI FFP 480-9	S7DEQ	1.1 (2.4)	375 (14.8)	104 (4.1)	45 (1.8)	360 (14.2)	59 (2.3)	M5	Ø6
	2040...2075	(2)	EMI FFP 480-24	S7DER	1.4 (3.1)	375 (14.8)	150 (5.9)	45 (1.8)	360 (14.2)	105 (4.1)	M5	Ø6
	3110	(2)	EMI FFP 480-30	S7DES	1.6 (3.5)	390 (15.4)	200 (7.9)	45 (1.8)	375 (14.8)	155 (6.1)	M5	Ø6
	3150	(2)	EMI FFP 480-40	S7DET	2.3 (5.1)	390 (15.4)	200 (7.9)	45 (1.8)	375 (14.8)	155 (6.1)	M5	Ø6
	4185...4220	(2)	EMI 480-45	S7DFU	1.3 (2.9)	250 (9.8)	85 (3.3)	90 (3.5)	235 (9.3)	60 (2.4)	-	M6
	4300	(2)	EMI 480-55	S7DFV	2 (4.4)	250 (9.8)	85 (3.3)	90 (3.5)	235 (9.3)	60 (2.4)	-	M6
	4370	(2)	EMI 480-70	S7DFZ	2.6 (5.7)	270 (10.6)	90 (3.5)	150 (5.9)	255 (10.0)	65 (2.6)	-	M6
	5450...5550	(2)	EMI 480-100	S7DGA	2.6 (5.7)	270 (10.6)	90 (3.5)	150 (5.9)	255 (10.0)	65 (2.6)	-	M6
	6750...7900	(2)	EMI 480-150	S7DGB	4.4 (9.7)	400 (15.7)	120 (4.7)	170 (6.7)	365 (14.4)	102 (4.0)	-	M6
	71100	(2)	EMI 480-180	S7DGC	4.4 (9.7)	400 (15.7)	120 (4.7)	170 (6.7)	365 (14.4)	102 (4.0)	-	M6
	71320	(2)	EMI 480-250	S7DGG	13 (28.7)	300 (11.8)	260 (10.2)	135 (5.31)	120 (4.72)	235 (9.25)	-	M10
	81600	(2)	EMI 480-250	S7DGG	13 (28.7)	300 (11.8)	260 (10.2)	135 (5.31)	120 (4.72)	235 (9.25)	-	M10
	82000	(2)	EMI 480-320	S7DGH	13.2 (29.1)	300 (11.8)	260 (10.2)	135 (5.31)	120 (4.72)	235 (9.25)	-	M10

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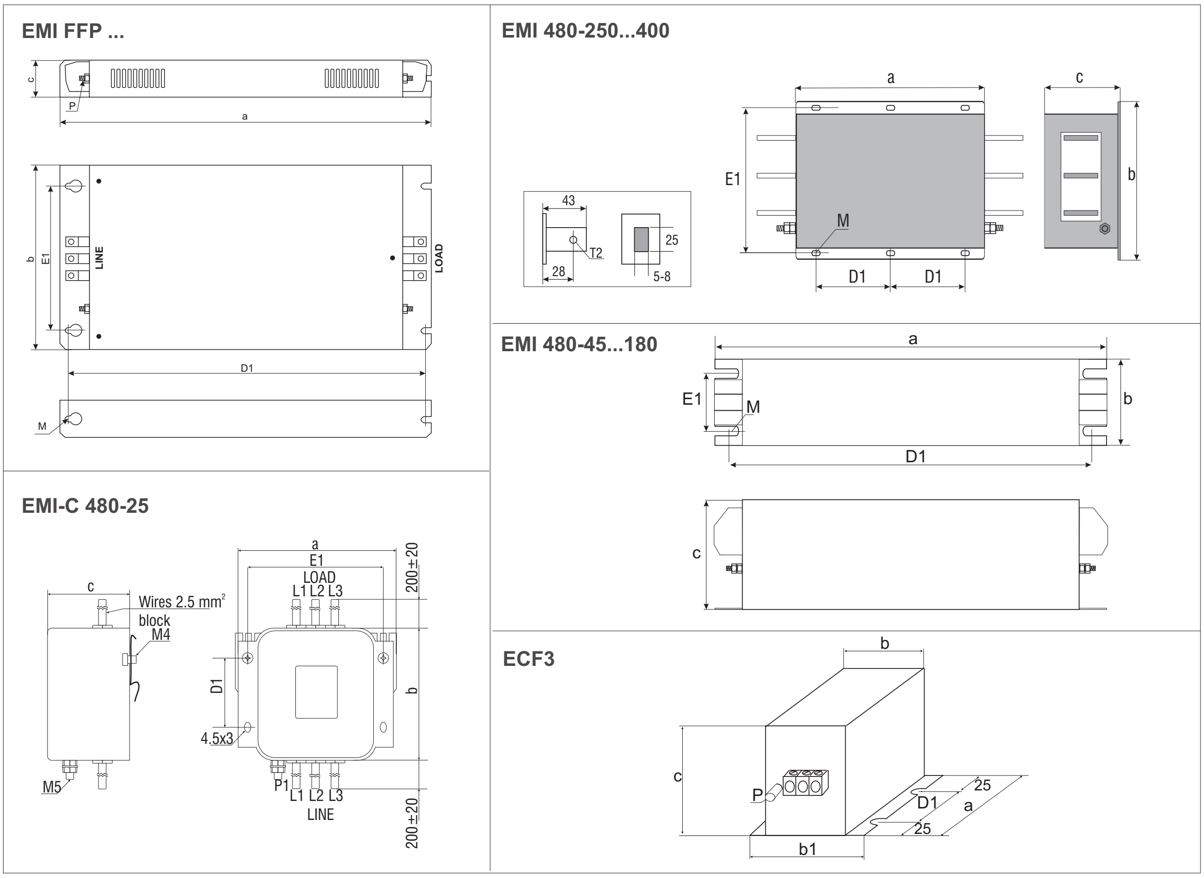
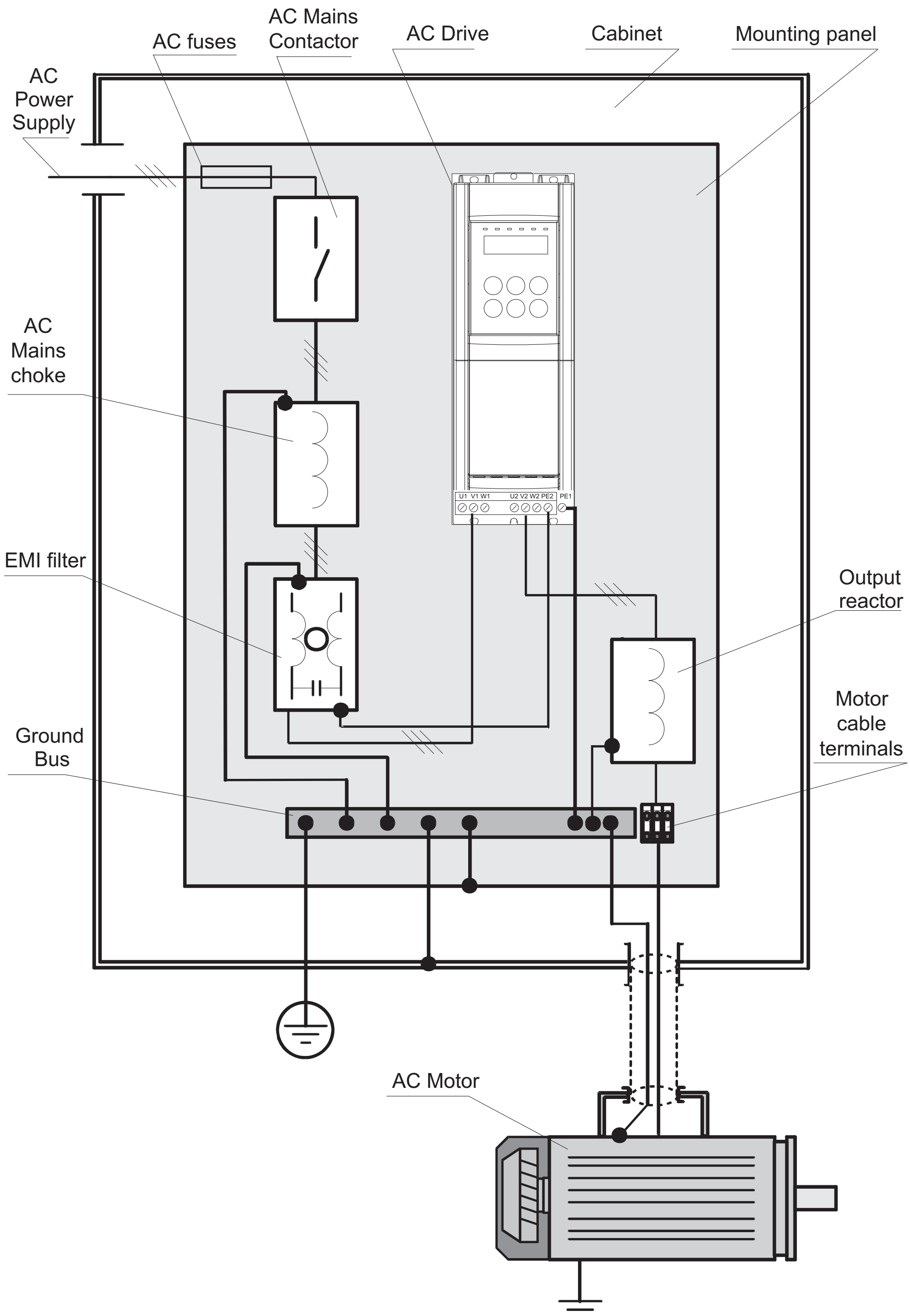
(1): Category C3, 2nd Environment, Motor cable length : max 5 m.
(2): Category C2, 1st Environment, Motor cable length : max 30 m.
(3): Category C3, 2nd Environment, Motor cable length : max 100 m.
(4): Category C4, 2nd Environment, Motor cable length : max 100 m.

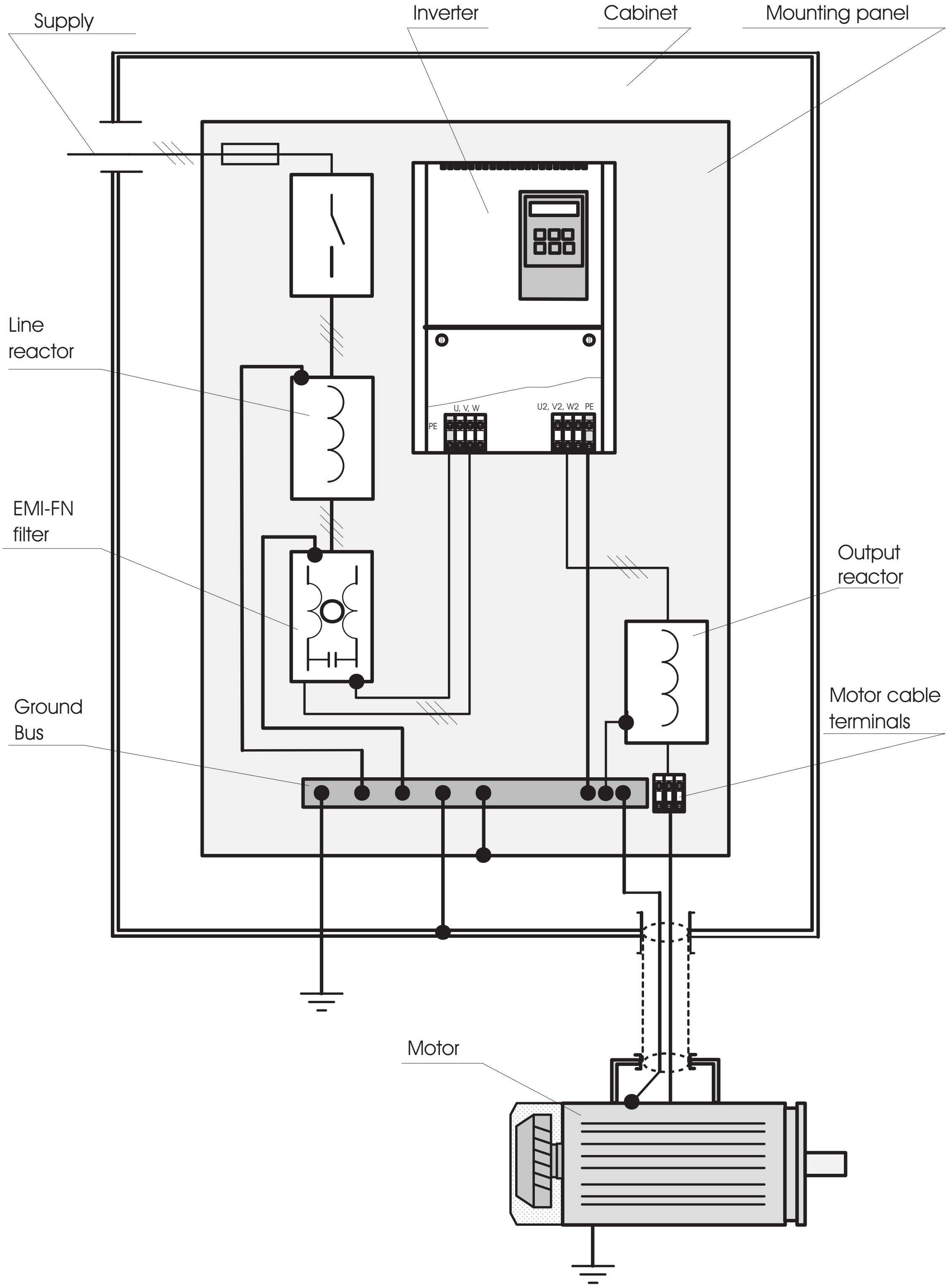
Figure 5.7.3.1: Filters dimension



5.7.3.1 EMI filter connections for Sizes 1007...3150 (230V...480V)



5.7.3.2 EMI filter connections for Sizes 4185...82000 (230V...480V)



5.8 Braking in the AGy System

Two means of braking are possible:

- Internal Braking Unit
- Injection of direct current from the Inverter into the motor (D.C. braking)

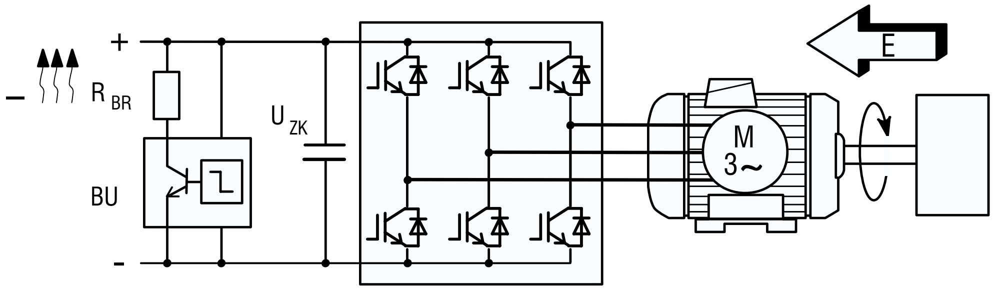
There are two essential differences between the two braking methods:

- A braking unit can be used for speed reduction (e.g.: from 1000 to 800 rpm), whereas D.C. braking can only be used for braking to standstill.
- The energy in the drive is converted into heat in both cases. This conversion takes place in a braking resistor encased in the braking unit. With D.C. braking, the energy is converted into heat in the motor itself, resulting in a further rise in motor temperature.

5.8.1 Braking Unit

In oversynchronous or regenerative operation, the frequency-controlled three-phase motor feeds energy back to the DC link circuit via the Drive. This leads to an increase in the intermediate circuit voltage. Braking units (BU) are therefore used in order to prevent the DC voltage rising to an impermissible value. When used, these activate a braking resistor that is connected in parallel to the capacitors of the intermediate circuit. The feedback energy is converted to heat via the braking resistor (R_{BR}), thus providing very short deceleration times and restricted four-quadrant operation.

Figure 5.8.1: Operation with Braking Unit (Principle)



Drive sizes 1007 up to 3150 (230V...480V) and 2002 up to 3020 (575V) have as standard an internal braking unit.

Drive sizes 4185 up to 5550 (230V...480V) and 4025 up to 5075 (575V) can be equipped with an internal braking unit (see section 3.1.2, Inverter type designation) factory mounted on request.

All the standard AGy... drive can be equipped with an external braking unit (BU-32... or BUy) connected to the terminals C and D.

The braking resistor is optional and has always to be mounted externally.

NOTE! When the circuit terminals C and D are connected to external devices, the AC Input must be protected with superfast semiconductor fuses! Observe the mounting instruction concerned.

Warning!

The braking resistors can be subject to unforeseen overloads due to possible failures.

The resistors have to be protected using thermal protection devices. Such devices do not have to interrupt the circuit where the resistor is inserted but their auxiliary contact must interrupt the power supply of the drive power section. In case the resistor foresees the precence of a protection contact, such contact has to be used together with the one belonging to the thermal protection device.

The braking threshold for the internal braking unit is dependent on the value of the supply voltage of the drive.

Table 5.8.1.1: Braking Thresholds for Different Mains

Mains voltage	Braking threshold V_{BR} [V]
220 Vac	390 Vdc
380 Vac	760 Vdc
460 Vac	760 Vdc
575 Vac	965 Vdc

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Table 5.8.1.2: Technical Data of the Internal Braking Units

	Inverter type	I_{RMS} [A]	I_{PK} [A]	T [s]	Minimum R_{BR} [ohm]
AGy…-4 (230V…480V)	**1007 … 2040**	4.1	7.8	19	100
	2055 … 2055	6.6	12	16	67
	3110	12	22	17	36
	3150	17	31	16	26
	4185 - 4220	18	52	42	15
	4300	37	78	23	10
	4370	29		37	
	5450 … 5550	50	104	22	7.5
	6750 … 82000	External braking unit (optional)			
AGy…-5 (575V)	**2002**	3.1	6.9	19	140
	2003				
	2005				
	3007	4.4	9.7	16	100
	3010				
	3015	5.8	13	17	74
	3020	10.3	23	16	42
	4025	19	42	42	23
	4030	19	42	23	23
	4040	24	54	37	18
	5050	24	54	37	18
	5060	37	84	22	11,6
	5075	37	84	22	11,6
	6100 … 8200	External braking unit (optional)			

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$\mathbf{I_{RMS}}$: Nominal current of the braking unit

$\mathbf{I_{PK}}$: Peak current deliverable for 60 seconds max.

T : Minimum cycle time for a working at $\mathbf{I_{PK}}$ for 10 seconds

5.8.1.1 External Braking Resistor

Recommended resistors for use with internal braking unit:

Table 5.8.1.3: Lists and Technical Data of the External Standard Resistors

	Drive Type	E_{BR} [kJ] (1)	E_{BR} [kJ] (2)	P_{NBR} [W]	R_{BR} [Ohm]	Resistor Type	Code	Weight kg (lbs)	Dimensions : mm (inch) a	b	c	a1	b1	C1
AGy...-4 (230V...480V)	**1007 ... 1015**	1.5	11	220	100	**RF 220 T 100R**	S8T0CE	0.5 (1.1)	300 (11.81)	27 (1.06)	36 (1.42)	290 (11.42)		
	1022 … 1030	2.5	19	300	100	**RF 300 DT 100R**	S8T0CB	1.4 (3.09)	260 (10.24)	47 (1.85)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	2040	7.5	38	750	100	**RFPD 750 DT 100R**	S8SY4	1.7 (3.75)	200 (7.9)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	2055	7.5	38	750	68	**RFPD 750 DT 68R**	S8T0CD	1.7 (3.75)	200 (7.9)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	2075	9	48	900	68	**RFPD 900 DT 68R**	S8SY5	2.2 (4.85)	200 (7.9)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	3110	11	58	1100	40	**RFPD 1100 DT 40R**	S8SY6	2.7 (5.95)	320 (12.6)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	3150	19	75	1900	28	**RFPR 1900 D 28R**	S8SZ5	4.2 (9.3)	365 (14.4)	75 (2.95)	100 (3.9)	350 (13.78)	70 (2.8)	30 (1.2)
	4185…4220	40	150	4000	15.4	**BR T4K0-15R4**	S8T00G	7.0 (15.4)	625 (24.6)	100 (3.9)	250 (9.8)	605 (23.8)	40 (1.6)	
	4300 ... 4370	40	150	4000	11.6	**BR T4K0-11R6**	S8T00H	7.0 (15.4)	625 (24.6)	100 (3.9)	250 (9.8)	605 (23.8)	40 (1.6)	
	5450 ... 5550	80	220	8000	7.7	**BR T8K0-7R7**	S8T00I	11.5 (25.)	625 (24.6)	160 (6.3)	250 (9.8)	605 (23.8)	60 (2.4)	
AGy...-5 (575V)	**2002**	1.5	11	200	140	**RF 220 T 140R**	S8T0CN	0.5 (1.1)	300 (11.81)	27 (1.06)	36 (1.42)	290 (11.42)		
	2003 … 2005	2.5	19	300	140	**RF 300 DT 140R**	S8T0CO	1.4 (3.09)	260 (10.24)	47 (1.85)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	3007	7.5	38	750	100	**RFPD 750 DT 100R**	S8SY4	1.7 (3.75)	200 (7.9)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	3010	9	48	900	100	**RFPD 900 DT 100R**	S8T0CM	2.2 (4.85)	260 (10.2)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	3015	11	58	1100	74	**RFPD 1100 DT 74R**	S8T0CL	2.7 (5.95)	320 (12.6)	70 (2.8)	106 (4.17)		17.5 (.69)	93.5 (3.68)
	3020	20	82	2100	42	**BR T2K0-42R**	S8T00M	6.2 (13.7)	625 (24.6)	100 (3.9)	250 (9.8)	605 (23.8)	40 (1.6)	
	4025 ... 4030	40	150	4000	23	**BR T4K0-23R**	S8T00N	7.0 (15.4)	625 (24.6)	100 (3.9)	250 (9.8)	605 (23.8)	40 (1.6)	
	4040 ... 4050	40	150	4000	18	**BR T4K0-18R**	S8T00O	7.0 (15.4)	625 (24.6)	100 (3.9)	250 (9.8)	605 (23.8)	40 (1.6)	
	5060 ... 5075	80	220	8000	11.6	**BR T8K0-11R6**	S8T00R	11.5 (25.)	625 (24.6)	160 (6.3)	250 (9.8)	605 (23.8)	60 (2.4)	

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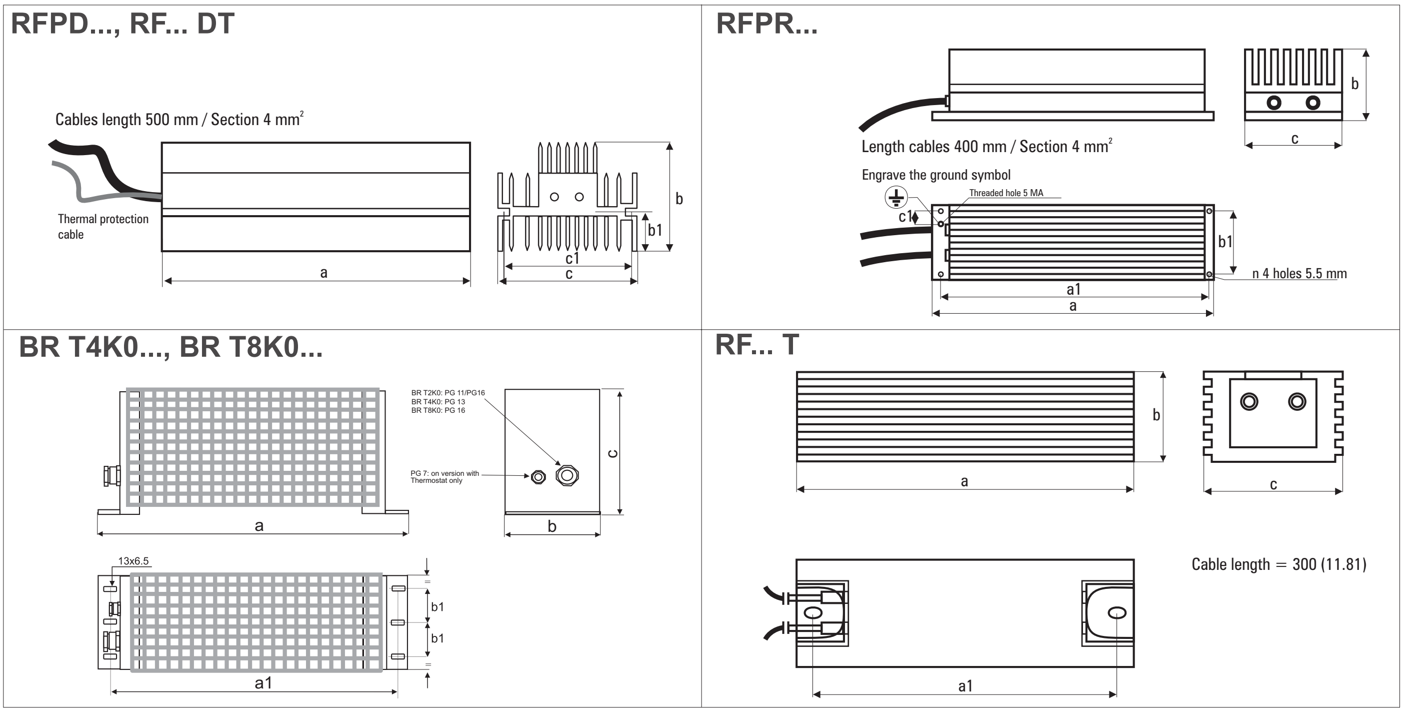
(1) Max overload energy, 1”- duty-cycle 10%; (2) Max overload energy, 30”- duty-cycle 25%

Figure 5.8.2: External resistors

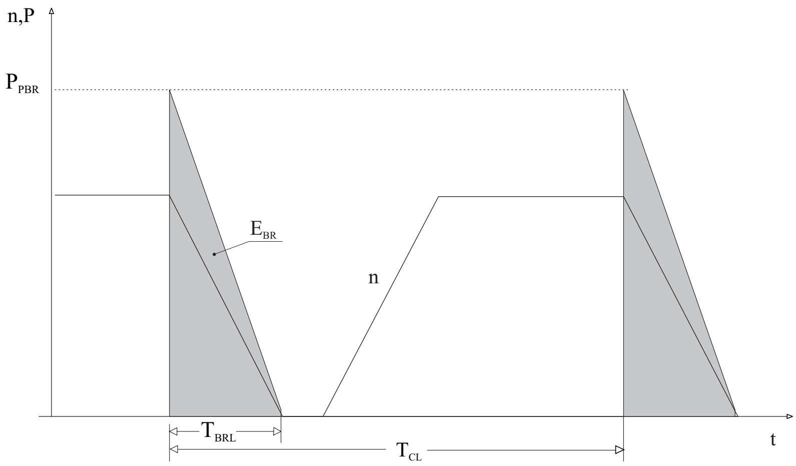


Parameters description:

P_{NBR}	Nominal power of the braking resistor
R_{BR}	Braking resistor value
E_{BR}	Max surge energy which can be dissipated by the resistor
P_{PBR}	Peak power applied to the braking resistor
T_{BRL}	Maximum braking time in condition of limit operating cycle (braking power = P_{PBR} with typical triangular profile)

$$T_{BRL} = 2\frac{E_{BR}}{P_{PBR}} = [s]$$

Figure 5.8.3: Limit Operating Braking Cycle with Typical Triangular Power Profile



T_{CL} Minimum cycle time in condition of limit operating cycle (braking power = **P_{PBR}** with typical triangular profile)

$$T_{CL} = \frac{1}{2} T_{BRL} \frac{P_{PBR}}{P_{NBR}} = [s]$$

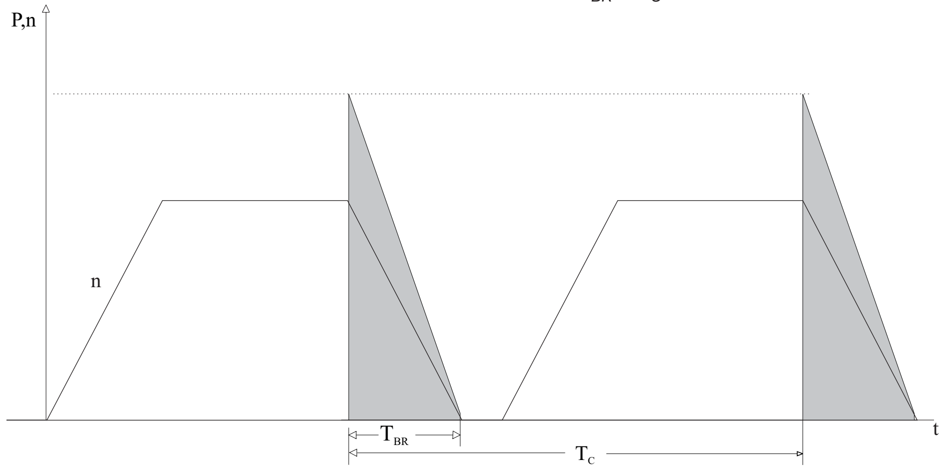
Resistor model: Standard resistor data

Example code: RFPD 900 DT 68R
RFPD = resistor type
900 = nominal power (900 W)
T= with safety thermostat
68R = resistor value (68 Ω)

NOTE! The suggested match of resistor-model and inverter-size, allows a braking stop at nominal torque with duty cycle **T_{BR} / T_C** = 20%

Where: **T_{BR}** = Braking time
T_C = Cycle time

Figure 5.8.4: Braking cycle with T_{BR} / T_C = 20%



The standard resistor can be used for couplings, different from the ones above reported.

These resistors, whose technical data are reported in the table 5.8.1.3, have been dimensioned to tolerate an overload equal to 4 time their nominal power for 10 seconds. In any event they can tolerate also an overload, whose energetic dissipation was the same of the maximum power level defined by:

$$P_{PBR} = \frac{V_{BR}^2\,[V]}{R_{BR}\,[ohm]} = [w]$$

Where: **V_{BR}** = braking unit threshold (see table 5.8.1.1)

With reference to the figure 5.8.5, where the power profile is the typical triangular one, the following example can be taken into consideration (see also table 5.8.1.3).

Resistor model: MRI/T600 100R

Nominal power **P_{NBR}** = 600 [W]

Maximum energy **E_{BR}** = 22000 [J]

Inverter mains supply = 460V

From table 5.8.1.1: **V_{BR}** =780V

$$P_{PBR} = \frac{V_{BR}^2}{R_{BR}} = \frac{780^2}{100} = 6084\ [W] \qquad T_{BRL} = 2\frac{E_{BR}}{P_{PBR}} = 2\ \frac{24000}{6084} = 7.8[s]$$

It is necessary to consider the following relation:

A) If **$T_{BR} \le E_{BR} / P_{PBR}$** verify:

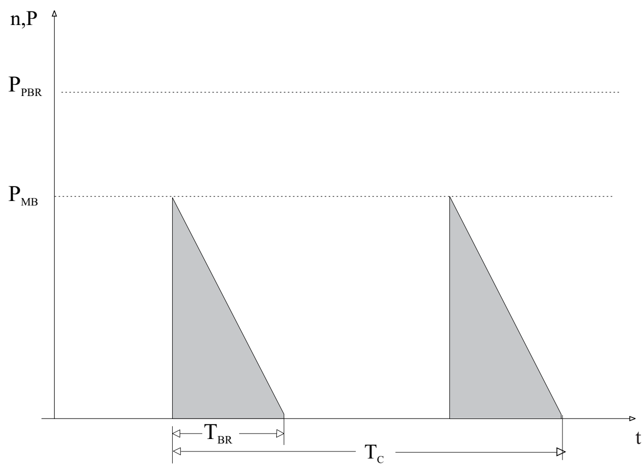
1) **$P_{MB} \le 2 \cdot E_{BR} / T_{BR}$** Where: **$P_{MB}$** is the average power of the cycle (see.fig. 5.8.5)

2) $$\frac{P_{MB} \times T_{BR}}{2T_C} \le P_{NBR}$$

The average power of the cycle must not be higher than the nominal power of the resistor.

B) If **$T_{BR} > E_{BR} / P_{PBR}$** that is to say, in case of very long braking time, it must be dimensioned **$P_{MB} \le P_{NBR}$**

Figure 5.8.5: Generic braking cycle with triangular profile



If one of the above mentioned rules is not respected, it is necessary to increase the nominal power of the resistor, respecting the limit of the internal braking unit (reported in table 5.8.1.2).

The table 5.8.1.2 can be used to choose an external resistor, different from the standard series. Generally the following condition must be satisfed

$$I_{RMS} \ge \sqrt{\frac{1}{2}\,\frac{P_{PBR}}{R_{BR}}\,\frac{T_{BR}}{T_C}}$$

In case of using more external BUs, each BU with a resistor (all the same) refers to the parameters calculation of a single unit.

5.8.2 D.C. Braking

The Inverter offers the facility of D.C. braking as a standard. To this end, the Inverter injects D.C. current into two motor phases, thereby generating braking torque. The kinetic energy of the machine is dissipated as heat in the motor.

Caution This option enables the drive to be braked to a standstill. It does not permit deceleration to a lower speed. It may be necessary to measure the braking current in the “U” phase.

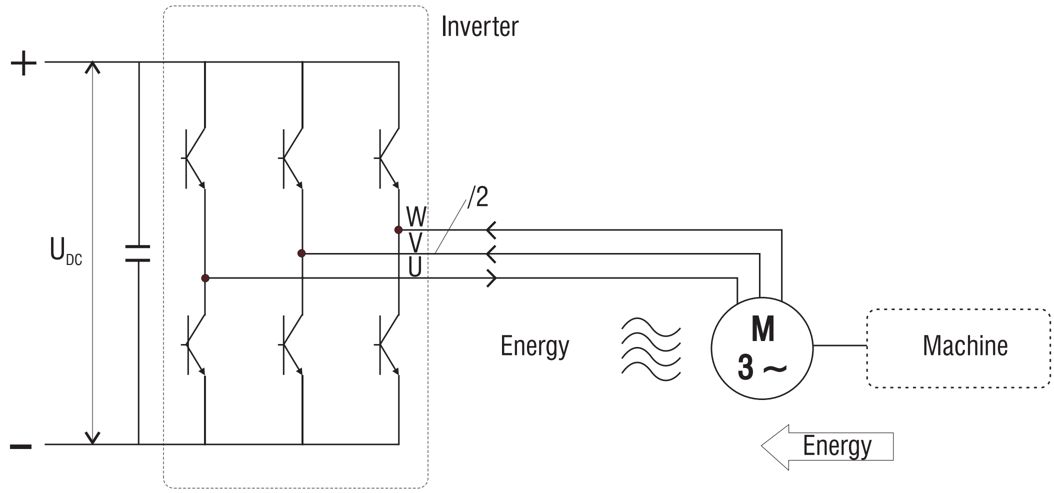


Figure 5.8.7: D.C. Braking, Schematic

5.9 Discharge Time of the DC-Link

Table 5.9.1: DC Link Discharge Times

	Type	I_{2N}	Time (seconds)
AGy...-4 (230V...480V)	1007	2.1	90
	1015	3.5	
	1022	4.9	150
	1030	6.5	
	2040	8.3	205
	2055	12.1	
	2075	15.4	
	3110	23.1	220
	3150	29.7	
	4185	34	60
	4220	41	
	4300	55	
	4370	69	90
	5450	81	120
	5550	99	
	6750	124	
	7900	161	
	71100	183	
	71320	218	
	81600	282	
	82000	348	

	Type	I_{2N}	Time (seconds)
Agy...-5 (575V)	2002	3.8	100
	2003	4.5	
	2005	7.0	200
	3007	10.8	250
	3010	13.8	
	3015	18.7	
	3020	24.2	
	4025	30	230
	4030	36	230
	4040	46	230
	4050	58	300
	5060	69	300
	5075	86	300
	6100	109	300
	7125	137	300
	7150	158	300
	8200	218	300

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This is the minimum time that must be elapsed since an AGy Drive is disconnected from the AC Input before an operator may service parts inside the Drive to avoid electric shock hazard.

CONDITION: These values consider a turn off for a Drive supplied at 480Vac +10%, without any option, (the charge for the switching supply is the regulation card, the keypad and the 24Vdc fans “if mounted”).

The Drive is disabled. This represents the worst case condition.

Chapter 6 - Drive Keypad Operation

In this chapter the parameters management is described, by using the drive keypad.

The following examples show some procedures with the two different keypads, **KBG-1** (7 segments display) and **KBG-EV-LCD** (alphanumeric LCD display). The procedures of parameters setting will be the same for both keypad types. The displaying of parameters will be different, in accordance with the keypad model mounted on the drive.

6.1 Keypad

Caution	Changes made to parameter have immediate effect on drive operation, but are not automatically stored in permanent memory. An explicit command is required to permanently store the parameters: "***C.000 - Save parameters*** **"** and confirming with Enter.

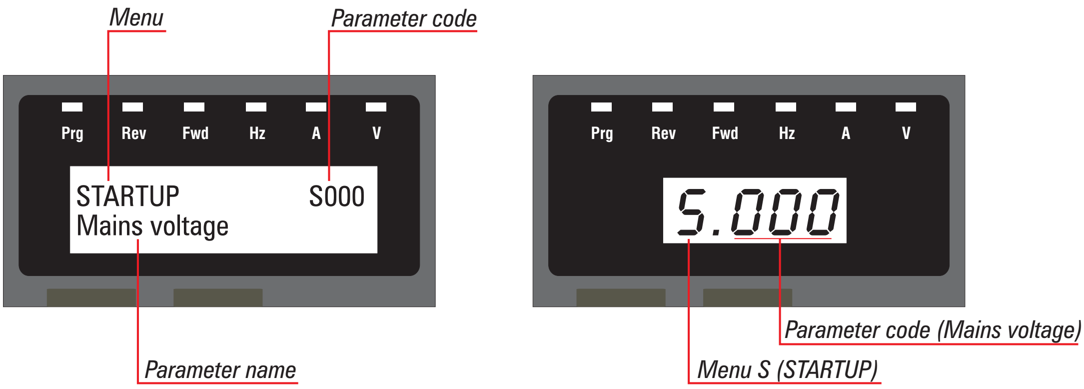
Prg	Scroll menu:	Allows navigation thruogj the drive main menu (**d.xxx**, **S.xxx**, **I.xxx**, **F.xxx**, **P.xxx**, **A.xxx** and **C.xxx**). Also used to exit the editing mode of a parameter without appling the changes.
E	Enter button:	Used to enter the editing mode of the selected parameter or to confirm the value.
▲	UP button:	Used to **scroll up** through parameters or to increase numeric values while in editing mode; it can also be used to increase motorpotentiometer reference value, when "F.000-Motorpot ref" parameter is displayed (F, FREQ RAMP menu).
▼	DOWN button:	Used to **scroll down** through parameters or to decrease numeric values while in editing mode; it can also be used to decrease motorpotentiometer reference values, when "F.000-Motorpot ref" parameter is displayed (F, FREQ RAMP menu).
I	Start button:	Used to **START** the drive via keypad; "S.200-Cms source sel = [0] Keypad" parameter setting and +24V between 5 & 8 terminals are always required to initiate a start command from Keypad.
0	Stop button:	Used to STOP the drive via keypad; The action of the Stop key can be programmed by the parameter "***P.005-Stop Key Mode***", and also depends on the actual source of drive main commands: - **P.000=0**: (default configuration) main commands are coming from keypad. Therefore, the **STOP** key will cause a normal stop of the motor. - **P.000>0** and **P.005 = 0**, pressing the **STOP** key will have no effect. - **P.000>0** and **P.005 = 1**, pressing the **STOP** key, the motor will execute an emergency stop, following the ramp programmed by F.206. After the speed reaches the zero value, the drive will trip with the dedicated alarm "EMS". An alarm reset will be needed to restore drive operation (see paragraph 9.2).

Keypad LED's meaning:

PRG (Yellow LED): flashes if the parameters have not been permanently saved to memory.
REV (Green LED): reverse running (*)
FWD (Green LED): forward running (*)
Hz,A,V (Red LEDs): Indicates the unit of measurement of the parameter currently displayed (**).

NOTE! (*) Green LEDs blinking denote the action of the motor stall prevention.
(**) Red LEDs blinking denote an active alarm condition.

The pictures below show the alphanumeric LCD display and 7 segments display meaning (both available):



6.2 Language Selection

Available only in **KB-EV-LCD/..** type keyboards.

The type keyboard has a "two languages at once" feature. The following versions are available (check the type on the label at the rear):

- **KB-EV-LCD/I** English and Italian version
- **KB-EV-LCD/F** English and French version
- **KB-EV-LCD/D** English and German version
- **KB-EV-LCD/E** English and Spanish version

The **default language** for all versions is **English**.

To select the second language (e.g. Italian in the "**KB-EV-LCD/I**" keyboard version, or French, in the "**KB-EV-LCD/F**" keyboard version) follow the procedure described below:

1 - Switch-on the drive

2 - Press the **Prg** key for about 5 sec., the display will show:

Drv 03.04.00.00 **Keypad V3.000**

3 - Press the ▼ key, the display will show:

Language: **English**

4 - To select the second language, press ▼ or ▲
5 - Press the **E** key to confirm.

6.3 Updating the language in E@syDrives

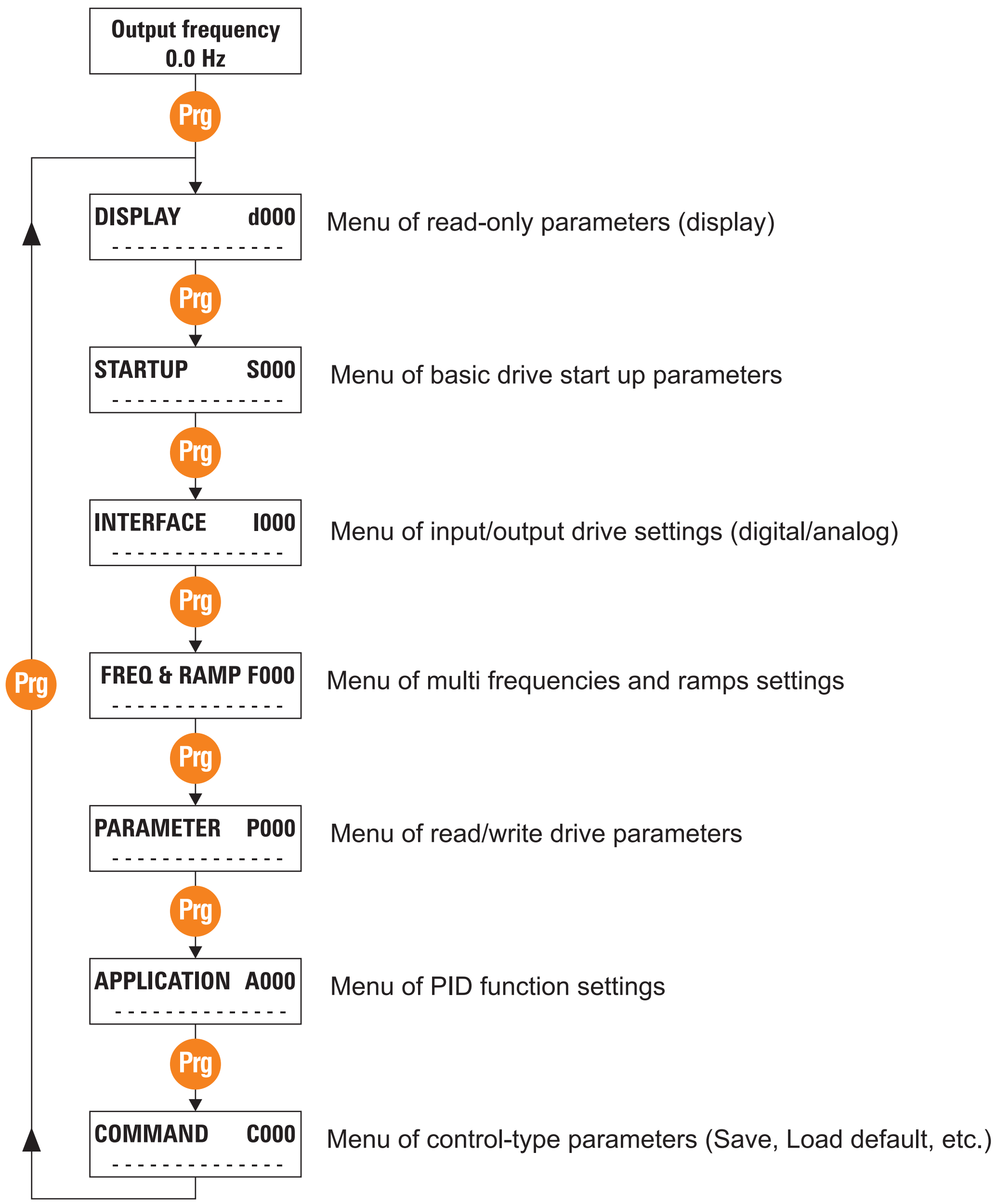
The keyboard language can be changed with another language of any version of the KB-EV-LCD/ keyboard.

Necessary tools A PC with a series connection to connect the drive, the E@sy Drives CD-Rom delivered with the drive, and the RS485 kit (protected cable with connectors and PCI485 for connection using the RS485series line: cod. S5QQ1

1) Install the E@syDrives program and connect the computer series port to the XS connector of the drive.
2) Power on the drive.
3) Follow the instructions of the E@syDrives program and begin a “Working Session”
4) Check to ensure that E@syDrives is connected to the drive (check the lower righ hand corner for the display of the "CONNECTED" message.)
5) Execute the Service\Update keypad command
6) Press the "Browse" button and search until you find the file with the language you require. The file will be found in the directory corresponding to the firmware version of the drive. (The directory corresponding to the version of the drive firmware is shown by default).
7) Click on the "Download" button. This operation will take some time. During this phase a progress bar indicates the process.
8) If the operation is completed without errors the message "Loading completed" is shown.

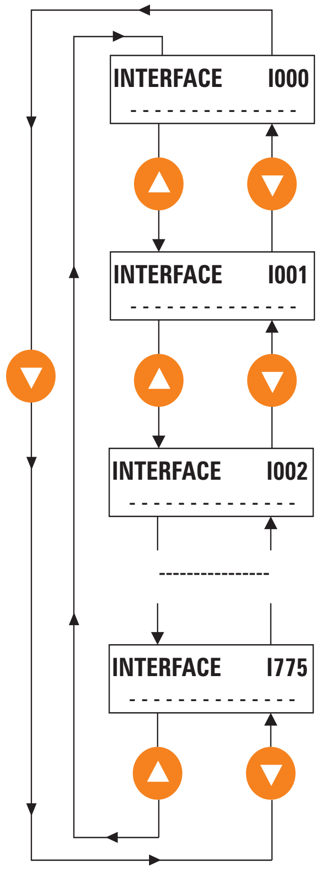
6.4 Moving Through the Drive Main Menu

Soon after, the keypad display will show "Output frequency (d.000)" parameter of DISPLAY menu.



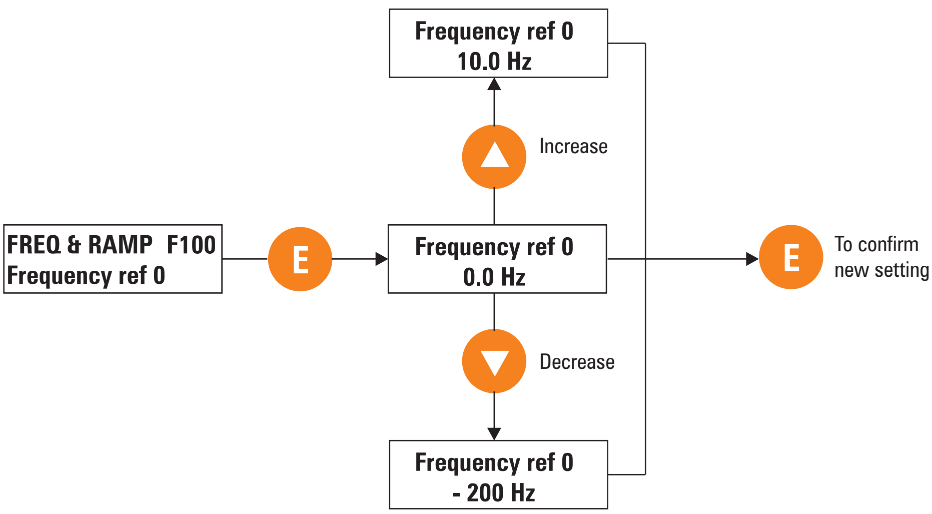
6.5 Scrolling Through the Drive Parameters

INTERFACE menu example:



6.6 Parameters Modification

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



Note! Same procedure is also valid to Enable/Disable a function (i.e.: S.401 Auto boost en) or program the drive I/Os (i.e.: I.000 Dig input 1 cfg, etc. …).

6.7 Quickstart procedure

Basic settings for trial run

1	**Goto menu S – Startup,**	and proceed to step 2.
2	**Set the drive input mains voltage**	Edit parameter ***S.000*** to set the nominal voltage of input mains (ex. 220V, 400V, 460V, 575V). Goto step 3.
3	**Set the drive input mains frequency**	Edit parameter ***S.001*** to set the nominal frequency of input mains (50Hz or 60Hz). Goto step 4.
4	**Set the maximum voltage to be applied to the motor**	Set parameter ***S.100*** to the rated voltage of the motor in use, as shown in the nameplate. Goto step 5.
5	**Set the rated current of the motor**	Set parameter ***S.150*** to the full load current of the motor in use, as shown in the nameplate. Goto step 6.
6	**Set the pole pairs of the motor**	Set parameter ***S.151*** to number of pole pairs of the motor in use (number of poles divided by 2). Goto step 7.
7	**Set the power factor of the motor**	Set parameter ***S.152*** to the rated power factor of the motor in use, as shown in the nameplate.

At this point, the drive is ready for a trial run. Applying +24V between terminals 5 and 8, and pressing the START button on the keypad, the drive will start and the motor will accelerate up to a frequency equal to the one of the input AC mains.

Note! Before executing the trial run, make sure that motor rotation at rated frequency is compatible with the applied load. If not, skip the test run and proceed to the standard settings.

It is possible to execute the trial run at reduced speed, by setting the value of parameter ***S.203*** to the desired value of the output frequency, prior to give the START command.

Standard settings

8	Select the source of drive main commands.	By default, the drive is started and stopped by pressing the START and STOP buttons on the keypad, provided +24V are applied between terminals 5 and 8, as safety interlock. If this setting is satisfactory, skip to step 9, otherwise change the value of ***S.200*** as follows: ***S.200* = [0]** Start & Stop are given by pressing the relative keypad buttons. (+24V between terminal 5 and 8 must be applied as safety interlock). This is the default setting. ***S.200* = [1]** Start & Stop are given by asserting and de-asserting drive terminal 5. ***Note!*** It is possible to program several other sources for Start and Stop commands. See chap 7.6, section Commands, for details. Goto step 9.

9	**Set the drive maximum allowed reference frequency**	By default, the reference frequency is limited to the frequency of the input mains. If the application requires higher settings of the motor reference frequency, increase the value of parameter ***S.201***. Goto step 10.
10	**Select the source of drive main frequency reference.**	By default, the drive frequency reference is the value written in parameter ***S.203***. If this setting is satisfactory, skip to step 11, otherwise change the source of the drive reference frequency, by setting ***S.202*** as follows: ***S.202* = [1]** Analog input 1 is the drive frequency reference. ***S.202* = [3]** The value of ***S.203*** is the drive frequency reference. This is the default setting. ***S.202* = [5]** Motorpotentiometer ***F.000*** is the drive frequency reference. Refer to chap. 7.5, section Motorpotentiometer, for details. ***NOTE!*** It is possible to program several other sources for the drive frequency reference. See chap 7.5, section Reference Sources, for details. Goto step 12.
11	**Set the drive acceleration and deceleration ramp times.**	Edit parameter ***S.300*** to set the desired acceleration time. This is the time needed to accelerate from zero to rated frequency, and is expressed in seconds. Edit parameter ***S.301*** to set the desired deceleration time. This is the time needed to decelerate from rated frequency to zero, and is expressed in seconds.
12	**Set the voltage boost characteristic of the drive**	If the drive is connected to multiple motors, or if the motor rated current is less than one fifth of the drive rated current, set the manual boost ***S.400*** and skip to point 15. Otherwise, enable the automatic voltage boost (***S.401* = [1]**) and goto 13. For details about the voltage boost setting, refer to chap. 7.6, section Boost.
13	**Set the slip compensation characteristic of the drive**	Slip compensation is needed if the natural speed variation of the motor due to the applied load is an issue for the application. If not, skip to point 14. Amount of slip compensation is set by the parameter ***S.450***. ***S.450* = 100%**, means that the rated slip (evaluated from nameplates and measured resistance) is assumed at rated motor current. Dynamics of the slip estimation is set by the parameter ***S.451***. Refer to chap. 7.6, section Slip Compensation for details.

14	**Measure the resistance of stator windings**	If the resistance of stator windings is known, its ohmic value can be entered in parameter ***S.153***, and the autotuning procedure can be skipped. Otherwise, execute the autotuning command (***S.900* = [1]**) and wait for the procedure to end. Goto 15.
15	**Save drive parameters.**	Execute the Save Parameter command (***S.901* = [1]**), in order to store the actual set of parameters in the drive permanent memory. If this operation is not performed, all the modified parameters will be restored to the last saved value if the power is cycled.

Advanced settings

Depending on the application, it may be necessary to change drive parameters that are not included in the Startup menu. Refer to chapters 7.4 through 7.7 for a complete explanation of available drive functions.

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, serial, etc.)
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, the functions of each drive parameter are described. Depending on the keypads type, only the "parameter code" will be displayed for the **KBG-1** (7 segments display), and for the **KBG-EV-LCD** (alphanumeric LCD display) the "parameter code and name" will be displayed (see chapter 6).

In any case, chapter 7 describes the code and the name of each single parameter.

Figure 7.1: Parameters Description Legend

Code: Parameter Code, showed on display.
Format = X.YYY:

X = Menu
- d=DISPLAY
- S=STARTUP
- I=INTERFACE
- F=FREQ & RAMPS
- P=PARAMETER
- A=APPLICATION
- C=COMMAND
- H=HIDDEN

YYY = Parameter number

LCD display: Parameter name, showed on display

[Code]: Pick List code [in braket]
LCD Selection: Text on display

Parameter default value
Parameter minimum value
Parameter maximum value
Parameter unit of measure
Parameter step of variation
Parameter sw number, used via serial

S.Menu	Parameter			Pick List		Default	Min	Max	Unit	Variation	Ipa (Alias)
	Code	LCD display	Description	[Code] LCD Selection	Description						
START-UP											
POWER SUPPLY	**S.000**	**Mains voltage**	Rated value of the line voltage	**230** **380** **400** **420** **440** **460** **480** **500** **575**	230V, only for AGy-4 380V, only for AGy-4 400V, only for AGy-4 420V, only for AGy-4 440V, only for AGy-4 460V, only for AGy-4 480V, only for AGy-4 500V, only for AGy-5 575V, only for AGy-5	(****)	(****)	(****)	V		**404** *(P.020)*
	S.001	**Mains frequency**	Rated value of the line frequency	**50** **60**	50Hz 60Hz	(****)	(****)	(****)	Hz		**405** *(P.021)*

If **IPA** bold =
not writable parameter with running motor.

Note!

(Alias): On STARTUP menu only. Parameter code of same parameter on other menu .

(*): Parameter value depends on the drive size.

(**): Parameter value depends on the drive nominal main voltage and main frequency.

(***): Value depends on the setting of another parameter.

(****): Value depends on the drive type: 400V, 460 o 575V input.

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA
	Code	LCD display	Description	[Code] LCD Selection	Description						
			DISPLAY								
Basic	**d.000**	**Output frequency**	Drive output 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)							0.01/1	008
	d.008	**Speed ref**	Drive speed reference (d.001)*(P.600)							0.01/1	009
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
	d.053	**Brake res OL**	Braking resistor overload (100%=alarm thr)						%	0.1	013
	d.054		Reserved						°C	1	058
Input/Output	**d.100**	**Dig inp status**	Digital inputs status acquired by the drive (terminal or virtual)								014
	d.101	**Term inp status**	Digital inputs terminal status of the drive regulat. board								015
	d.102	**Vir dig inp stat**	Virtual digital inputs status from drive serial link or field bus card								016
	d.120	**Exp dig inp stat**	Expansion digital inputs status (optional terminal or virtual)								017
	d.121	**Exp term inp**	Expansion digital inputs terminal status of the drive expansion board								018
	d.122	**Vir exp dig inp**	Expansion virtual digital inputs status from drive serial link or field bus card								019
	d.150	**Dig out status**	Digital outputs status on the terminals of the drive regulation board (commanded by DO functions or virtual DO)								020
	d.151	**Drv dig out sta**	Digital outputs status, commanded by DO functions								021
	d.152	**Vir dig out sta**	Virtual digital outputs status, commanded via serial link or field bus card								022
	d.170	**Exp dig out sta**	Expansion digital outputs status on the terminals of the drive regulation board (commanded by DO functions or virtual DO)								023

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
Input/Output	**d.171**	**Exp DrvDigOutSta**	Expansion digital outputs status, commanded by DO functions								024
	d.172	**Exp vir dig sta out**	Expansion virtual digital outputs status, commanded via serial link or field bus card								025
	d.200	**An in 1 cnf mon**	Analog input 1 destination; it shows the function associated to this analog input	**[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] RampExt fact** **[8] Freq Ref fact** **[9] SpdPI LimFac** **[10] Mlt rif frq 1** **[11] Mlt rif frq 2**							026
	d.201	**An in 1 monitor**	Analog input 1 output block % value								027
	d.202	**An in 1 term mon**	Analog input 1 input block % value								028
	d.210	**An in 2 cnf mon**	Analog input 2 destination; it shows the function associated to this AI	**As for d.200**							029
	d.211	**An in 2 monitor**	Analog input 2 output block % value								030
	d.212	**An in 2 term mon**	Analog input 2 input block % value								031
	d.220	**An in 3 cnf mon**	Analog input 3 destination; it shows the function associated to this AI	**As for d.200**							032
	d.221	**An in 3 monitor**	Analog input 3 output block % value								033
	d.222	**An in 3 term mon**	Analog input 3 input block % value								034
Encoder	**d.300**	**EncPulses/Sample**	Number of encoder pulses, recorded in the time interval defined by parameter I.504.							0.001	035
	d.301	**Encoder freq**	Encoder frequency reading (Motor frequency)						Hz	0.01	036
	d.302	**Encoder speed**	Encoder speed reading (d.000)*(P.600)							0.01/1	037
OPTION	**d.350**	**Option 1 state**	Drive option 1 state (expansion board type programmed)	**0** **1** **2** **3** **4** **..** **32** **33** **34** **..** **64** **65** **66**	Reserved Reserved Reserved Reserved Data exchange .. Regulation board error (board type) Regulation board error (checksum) Regulation board error (board incompatible) .. Expansion error Reserved Reserved						038

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
OPTION	**d.351**	**Option 2 state**	Drive option 2 state (expansion board type programmed)	**As for d.350**							039
	d.353	**SBI State**	Communication state between SBI and Master	**0** **1** **2** **3**	Wait parametrization Wait configuration Data exchange Error						059
	d.354	**SBI Baudrate**	Communication speed between SBI and Master	**0** **1** **2** **3** **4** **5** **6** **7** **8** **15**	12 Mbit / s 6 Mbit / s 3 Mbit / s 1.5 Mbit / s 500 Kbit / s 187.5 Kbit / s 93.75 Kbit / s 45.45 Kbit / s 19.2 Kbit / s unknown						060
PID	**d.400**	**PID reference**	PID reference signal						%	0.1	041
	d.401	**PID feedback**	PID feedback signal						%	0.1	042
	d.402	**PID error**	PID error signal						%	0.1	043
	d.403	**PID integr comp**	PID integral component						%	0.1	044
Alarm List	**d.404**	**PID output**	PID output signal						%	0.1	045
	d.800	**1st alarm-latest**	Last alarm stored by the drive alarm list	**See paragraph 9.3**							046
	d.801	**2nd alarm**	Second to last alarm								047
	d.802	**3rd alarm**	Third to last alarm								048
Drive Identification	**d.803**	**4th alarm**	Fourth to last alarm								049
	d.950	**Drive rated curr**	Drive rated current (it depends on the drive size)							0.1	050
	d.951	**SW version (1/2)**	Software version - part 1	**03.01**						0.01	051
	d.952	**SW version (2/2)**	Software version - part 2	**00.00**						0.01	052
	d.953	**Power ident code**	Reseved								053
	d.954	**Param ident code**	Reseved								054
	d.955	**Regul ident code**	Reseved								055
	d.956	**Startup id code**	Reseved								056
	d.957	**Drive size**	Drive size code	**0** **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** **11**	0.75kW - 230/400/460V 1.5kW - 230/400/460V 2.2kW - 230/400/460V 3kW - 230/400/460V 4kW - 230/400/460V 5.5kW - 230/400/460V 7.5kW - 230/400/460V 11kW - 230/400/460V 15kW - 230/400/460V 22kW - 230/400/460V 30kW - 230/400/460V 37kW - 230/400/460V						057

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
				12 **13** **14** **15** **16** **17** **18** **21** **25** **130** **131** **132** **133** **134** **135** **136** **137** **138** **139** **140** **141** **142** **143** **144** **145** **146**	45kW - 230/400/460V 55kW - 230/400/460V 75kW - 230/400/460V 90kW - 230/400/460 110kW - 230/400/460V 132kW - 230/400/460V 160kW - 230/400/460V 18.5kW - 230/400/460V 200kW - 230/400/460V 2.0Hp - 575V 3.0Hp - 575V 5.0Hp - 575V 7.5Hp - 575V 10Hp - 575V 15Hp - 575V 20Hp - 575V 25Hp - 575V 30Hp - 575V 40Hp - 575V 50 Hp - 575V 60Hp - 575V 75Hp - 575V 100Hp - 575V 125Hp - 575V 150Hp - 575V 200Hp - 575V						
Utility	**d.958**	**Drive cfg type**	Drive cofiguration type	**[0] 400Vac** **[1] 460 or 575Vac**	Standard: 400Vac, 50Hz American: 460 or 575Vac, 60Hz						061
	d.999	**Display Test**	Drive display test								099

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa (Alias)
	Code	LCD display	Description	[Code] LCD Selection	Description						
START-UP											
Power Supply	**S.000**	**Mains voltage**	Rated value of the line voltage	**230** **380** **400** **420** **440** **460** **480** **500** **575**	230V, only for AGy-4 380V, only for AGy-4 400V, only for AGy-4 420V, only for AGy-4 440V, only for AGy-4 460V, only for AGy-4 480V, only for AGy-4 500V, only for AGy-5 575V, only for AGy-5	(****)	(****)	(****)	V		404 *(P.020)*
	S.001	**Mains frequency**	Rated value of the line frequency	**50** **60**	50Hz 60Hz	(****)	(****)	(****)	Hz		405 *(P.021)*
V/f	**S.100**	**Max out voltage**	Maximum value of the voltage applied to the motor			(**)	50	(**)	V	1	413 *(P.061)*
	S.101	**Base frequency**	Rated frequency of the motor			(**)	25	500	Hz	0.1	414 *(P.062)*
Motor Data	**S.150**	**Motor rated curr**	Rated current of the motor			(*)	(*)	(*)	A	0.1	406 *(P.040)*
	S.151	**Motor pole pairs**	Pole Pairs of the motor			(*)	1	60		0.01	407 *(P.041)*
	S.152	**Motor power fact**	Motor power factor			(*)	0.01	1		0.01	408 *(P.042)*
	S.153	**Motor stator R**	Measurement of the stator resistance of the motor			(*)	0	99.99	ohm		409 *(P.043)*
Commands & References	**S.200**	**Cmd source sel**	Source of the START and STOP commands	**[0] Keypad** **[1] Terminals** **[2] Virtual** **[3] Serial** **[4] Control word**	START & STOP via keypad (+24V between 5 & 8 terminals required). START & STOP via terminal Main commands via Virtual & Terminal setting Main commands via serial line Main commands from ProfiDrive control word	0	0	4			400 *(P.000)*
	S.201	**Max ref freq**	Maximum frequency reference threshold and / or digital reference (both directions)			(****)	25	500	Hz	0.1	305 *(F.020)*
	S.202	**Ref 1 channel**	Source of the Reference 1	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Freq ref x** **[4] Multispeed** **[5] Motorpotent** **[6] Analog inp 3** **[7] Encoder** **[8] Profidrive**	Null Analog input 1 Analog input 2 Frequency reference S.203 (F.100) Multi frequencies Motorpotientometer reference Analog input 3 Encoder signal Reference by Profibus	3	0	8			307 *(F.050)*
	S.203	**Frequency ref 0**	Digital speed reference (F.100)			(****)	-S.201	S.201			311 *(F.100)*
	S.300	**Acc time 1**	Acceleration ramp delay time 1			5	1 (***)	999.9 (***)	sec	0.1 (***)	329 *(F.201)*
	S.301	**Dec time 1**	Deceleration ramp delay time 1			5	1 (***)	999.9 (***)	sec	0.1 (***)	330 *(F.202)*

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA (Alias)
	Code	LCD display	Description	[Code] LCD Selection	Description						
Functions	**S.400**	**Manual boost [%]**	Manual boost at low revolutions			1.0	0.0	25.0	% of S.100	0.1	421 *(P.120)*
Functions	**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** *(P.122)*
Functions	**S.450**	**Slip compensat**	Slip compensation			0	0	250	% of S.100	1	419 *(P.100)*
Functions	**S.451**	**Slip comp filter**	Response time of slip compensation			0.1	0	10	sec	0.1	420 *(P.101)*
Utility	**S.900**	**Measure stator R**	Motor tuning command	***(1)*** ***(2)***	No action Autotune command execution	***(1)***	***(1)***	***(2)***			**806** *(C.100)*
Utility	**S.901**	**Save parameters**	Save parameters	***(1)*** ***(2)***	No action Save parameters command execution	***(1)***	***(1)***	***(2)***			**800** *(C.000)*

***(1)* :** **AGy-4A, AGy-5 = Confirm? NO**
AGy-4 = off

***(2)* :** **AGy-4A, AGy-5 = Confirm? YES**
AGy-4 = do

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA
	Code	LCD display	Description	[Code] LCD Selection	Description						
INTERFACE											
Digital Input of the Regulation Board	**I.000**	**Dig input 1 cfg**	Digital Input 1 configuration	**[0] None**	Not active	7	0	30			**100**
				[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	Selection of the PID regulator gain.						
				[23] Motorpot Up	Motorpotentiometer reference increasing						
				[24] Motorpot Dn	Motorpotentiometer reference decreasing						
				[25] Reset Motorp	Reset of Motorpotentiometer ref.						
				[26] Fast stop	Emergency stop						
				[27] Zero freq	Output frequency forced to zero, following the ramp programmed for Fast stop (F.206).						
				[28]Stop(3wires)	Stop function (NC) with P.001 = [2] 3 Wires.						
				[29]Local/Remote	Start/Stop commands from keypad (Local) or from the source programmed by P.000 (Remote)						
				[30] En lim Steady	Activate the stationary status current regulator.						
	I.001	**Dig input 2 cfg**	Digital Input 2 configuration	**As for I.000**		8	0	30			**101**
	I.002	**Dig input 3 cfg**	Digital Input 3 configuration	**As for I.000**		28	0	30			**102**
	I.003	**Dig input 4 cfg**	Digital Input 4 configuration	**As for I.000**		6	0	30			**103**
	I.004	**Dig input 5 cfg**	Digital Input 5 configuration	**As for I.000**		5	0	30			**104**
	I.005	**Dig input 6 cfg**	Digital Input 6 configuration	**As for I.000**		3	0	30			**105**

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
Digital Input of the Expansion Board	**I.006**	**Dig input 7 cfg**	Digital Input 7 configuration	**As for I.000**		1	0	30			**106**
	I.007	**Dig input 8 cfg**	Digital Input 8 configuration	**As for I.000**		2	0	30			**107**
	I.050	**Exp dig in 1 cfg**	Expansion Digital Input 1 configuration (on Expansion board)	**As for I.000**		0	0	30			**108**
	I.051	**Exp dig in 2 cfg**	Expansion Digital Input 2 configuration (on Expansion board)	**As for I.000**		0	0	30			**109**
	I.052	**Exp dig in 3 cfg**	Expansion Digital Input 3 configuration (on Expansion board)	**As for I.000**		0	0	30			**110**
	I.053	**Exp dig in 4 cfg**	Expansion Digital Input 4 configuration (on Expansion board)	**As for I.000**		0	0	30			**111**
Programmable logic	**I.070**	**AND 1 out cfg**	Output block set up AND 1	**As for I.000**		0	0	30			**186**
	I.071	**AND 2 out cfg**	Output block set up AND 2	**As for I.000**		0	0	30			**187**
	I.072	**AND 3 out cfg**	Output block set up AND 3	**As for I.000**		0	0	30			**188**
	I.073	**OR 1 out cfg**	Output block set up OR1	**As for I.000**		0	0	30			**189**
	I.074	**OR 2 out cfg**	Output block set up OR 2	**As for I.000**		0	0	30			**190**
	I.075	**OR 3 out cfg**	Output block set up OR 3	**As for I.000**		0	0	30			**191**
	I.076	**NOT 1 out cfg**	Output block set up NOT 1	**As for I.000**		0	0	30			**192**
	I.077	**NOT 2 out cfg**	Output block set up NOT 2	**As for I.000**		0	0	30			**193**
	I.078	**NOT 3 out cfg**	Output block set up NOT 3	**As for I.000**		0	0	30			**194**
	I.079	**NOT 4 out cfg**	Output block set up NOT 4	**As for I.000**		0	0	30			**195**
Digital Output of the Regulation Board	**I.100**	**Dig output 1 cfg**	Digital Output 1 configuration	**[0] Drive Ready** **[1] Alarm state** **[2] Not in alarm** **[3] Motor run** **[4] Motor stop** **[5] REV rotation** **[6] Steady state** **[7] Ramping** **[8] UV running** **[9] Out trq>thr** **[10] Current lim**	Drive ready to start Alarm signalling (Positive logic) Alarm signalling (Negative logic) Run command active or output frequency ≠ 0Hz Run command not active and output frequency =0Hz Counter-clockwise rotation of the motor. Motor is running in steady state. Acceleration or Deceleration Ramp in progress. The drive has tripped for UV, and automatic restart is taking place. Output torque higher than the value of P.241. Current limit (during ramp or at steady state).	0	0	77			**112**

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA
	Code	LCD display	Description	[Code] LCD Selection	Description						
				[11] DC-link lim	DC Bus limit.						
				[12] Limit active	General signalling of drive limit condition.						
				[13] Autocapt run	Autocapture in progress.						
				[14] BU overload	Set when the integrator d.054 = 100%, and Reset when d.054 = 0%						
				[15] Neg pwrfact	Negative inverter output power factor.						
				[16] PID err ><	PID error is within the limits defined by A.058 and 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 within the limits defined by A.058 and A.059. (see chapter 7.7).						
				[20] PIDerr>(inh)	PID error is >A.058 (see chapter 7.7).						
				[21] PIDerr<(inh)	PID error is <=A.059 (see chapter 7.7).						
				[22] FWD enc rot	Clockwise rotation of the encoder.						
				[23] REV enc rot	Counter-clockwise rotation of the encoder.						
				[24] Encoder stop	Encoder not rotating.						
				[25] Encoder run	Encoder is rotating. general signalling.						
				[26] Extern fault	Positive logic for Ext. fault alarm signalling.						
				[27] No ext fault	Negative logic for Extern. fault alarm signalling.						
				[28] Serial TO	Serial link communication time out.						
				[29] freq=thr1	Output frequency within the range defined by P.440 and P.441.						
				[30] freq!=thr1	Output frequency outside the range defined by P.440 and P.441.						
				[31] freq>thr1	Output frequency above the values defined by P.440 and P.441.						
				[32] freq<thr1	Output frequency below the values defined by P.440 and P.441.						
				[33] freq=thr2	Output frequency within the range defined by P.442 and P.443.						
				[34] freq!=thr2	Output frequency outside the range defined by P.442 and P.443.						
				[35] freq>thr2	Output frequency above the values defined by P.442 and P.443.						
				[36] freq<thr2	Output frequency below the values defined by P.442 and P.443.						
				[37] HS temp=thr	Heatsink temp within the range defined by P.480 and P.481.						
				[38] HS temp!=thr	Heatsink temp outside the range defined by P.480 and P.481.						
				[39] HS temp>thr	Heatsink temp above the threshold defined by P.480 and P.481.						
				[40] HS temp<thr	Heatsink temp below the threshold defined by P.480 and P.481.						
				[41] Output freq	Square wave synchro-nized with the inverter output frequency						
				[42] Out freq x 2	Square wave synchro-nized with twice the inverter output frequency						

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
				[43] CoastThrough	Kinetic energy recovering during mains loss						
				[44]EmgStop	Emergency stop after mains loss detection						
				[45] DC braking	CD braking in progress						
				[46] Drv OL status	Set when the integrator d.051 = 100%, and Reset when d.051 = 0%						
				[47] Drv OL warn	Set if d.051 is greater or equal to 90%						
				[48] Mot OL state	Set when the integrator d.052 = 100%, and Reset when d.052 = 0%						
				[49] False	False assume value 0						
				[50] True	True assume value 1						
				[51] Reserved							
				[52] Reserved							
				[53] Reserved							
				[54] Reserved							
				[55] Reserved							
				[56] DI 1	State of digital input 1						
				[57] DI 2	State of digital input 2						
				[58] DI 3	State of digital input 3						
				[59] DI 4	State of digital input 4						
				[60] DI 5	State of digital input 5						
				[61] DI 6	State of digital input 6						
				[62] DI 7	State of digital input 7						
				[63] DI 8	State of digital input 8						
				[64] Exp DI 1	Digital input 1 expansion state						
				[65] Exp DI 2	Digital input 2 expansion state						
				[66] Exp DI 3	Digital input 3 expansion state						
				[67] Exp DI 4	Digital input 4 expansion state						
				[68] AND 1 out	Output block AND 1 state						
				[69] AND 2 out	Output block AND 2 state						
				[70] AND 3 out	Output block AND 3 state						
				[71] OR 1 out	Output block OR 1 state						
				[72] OR 2 out	Output block OR 2 state						
				[73] OR 3 out	Output block OR 3 state						
				[74] NOT 1 out	Output block NOT 1 state						
				[75] NOT 2 out	Output block NOT 2 state						
				[76] NOT 3 out	Output block NOT 3 state						
				[77] NOT 4 out	Output block NOT 4 state						
	I.101	Dig output 2 cfg	Digital Output 2 configuration	As for I.100		6	0	77			113
	I.102	Dig output 3 cfg	Digital Output 3 configuration	As for I.100		3	0	77			114
	I.103	Dig output 4 cfg	Digital Output 4 configuration	As for I.100		1	0	77			115
Dig. Outputof the Exp. Board	I.150	Exp DigOut 1 cfg	Expansion Digital Output 1 configuration (on Expansion board)	As for I.100		0	0	77			116
	I.151	Exp DigOut 2 cfg	Expansion Digital Output 2 configuration (on Expansion board)	As for I.100		0	0	77			117
	I.152	Exp DigOut 3 cfg	Expansion Digital Output 3 configuration (on Expansion board)	As for I.100		0	0	77			180

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA
	Code	LCD display	Description	[Code] LCD Selection	Description						
Analog Input Regulation Board	**I.200**	**An in 1 Type**	Setting of the Analog Input 1 type reference (voltage)	**[0] ± 10V** **[1] 0-10V/0-20mA**	Bipolar ± 10V Unipolar +10V	1	0	1			**118**
	I.201	**An in 1 offset**	Analog Input 1 offset			0	-99.9	99.9	%	0.1	119
	I.202	**An in 1 gain**	Analog Input 1 gain			1	-9.99	9.99	%	0.01	120
	I.203	**An in 1 minimum**	An Input 1 minimun value			0	0	99.99	%	0.01	121
	I.204	**An in 1 filter**	Time constant of digital filter on Analog input 1			0.1	0.001	0.25	sec	0.001	122
	I.205	**An In 1 DeadBand**	Analog Input 1 dead band			0	0	99.9	%	0.1	182
	I.210	**An in 2 Type**	Setting of the Analog Input 2 type reference (voltage)	**[0] ± 10V** **[1] 0-10V/0-20mA**	Bipolar ±10V Unipolar +10V	0	0	1			123
	I.211	**An in 2 offset**	Analog Input 2 offset			0	-99.9	99.9	%	0.1	124
	I.212	**An in 2 gain**	Analog Input 2 gain			1	-9.99	9.99	%	0.01	125
	I.213	**An in 2 minimum**	An Input 2 minimun value			0	0	99.99	%	0.01	126
	I.214	**An in 2 filter**	Time constant of digital filter on Analog input 2			0.1	0.001	0.25	sec	0.001	127
	I.215	**An In 2 DeadBand**	Analog Input 2 dead band			0	0	99.9	%	0.1	183
	I.220	**An in 3 Type**	Setting of the Analog Input 3 type reference (current)	**[1] 0-10V/0-20mA** **[2] 4-20mA**	0…20mA 4…20mA	1	1	2			**128**
	I.221	**An in 3 offset**	Analog Input 3 offset			0	-99.9	99.9	%	0.1	129
	I.222	**An in 3 gain**	Analog Input 3 gain			1	-9.99	9.99	%	0.01	130
	I.223	**An in 3 minimum**	An Input 3 minimun value			0	0	99.99	%	0.01	131
	I.224	**An in 3 filter**	Time constant of digital filter on Analog input 3			0.1	0.001	0.25	sec	0.001	132
	I.225	**An In 3 DeadBand**	Analog Input 3 dead band			0	0	99.9	%	0.1	184
Analog Output Regulation Board	**I.300**	**Analog out 1 cfg**	Analog Output 1 configura-tion	**[0] Freq out abs** **[1] Freq out** **[2] Output curr** **[3] Out voltage** **[4] Out trq pos** **[5] Out trq abs** **[6] Out trq** **[7] Out pwr pos** **[8] Out pwr abs** **[9] Out pwr** **[10] Out PF** **[11] Enc freq abs** **[12] Encoder freq** **[13] Freq ref abs** **[14] Freq ref** **[15] Load current** **[16] Magn current** **[17] PID output** **[18] DClink volt**	Output Frequency absolute value. Output Frequency. Output Current. Output Voltage. Output Torque positive value. Output Torque absolute value. Output Torque. Output Power positive value. Output Power absolute value. Output Power. Output Power Factor. Encoder frequency absolute value. Encoder frequency. Frequency reference absolute value. Frequency reference Load Current. Motor Magnetizing Current. PID regulator output. DC bus capacitors level.	0	0	22			133

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
				[19] U current **[20] V current** **[21] W current** **[22] Freq ref fac**	Output phase U current signal. Output phase V current signal. Output phase W current signal. Multiplier factor for frequency reference						
	I.301	**An out 1 offset**	Analog output 1 offset			0	-9.99	9.99		0.01	134
	I.302	**An out 1 gain**	Analog output 1 gain			1	-9.99	9.99		0.01	135
	I.303	**An out 1 filter**	Time constant of output filter			0	0	2.5	sec	0.01	136
	I.310	**Analog out 2 cfg**	Analog Output 2 configuration	**As for I.300**		2	0	22			137
	I.311	**An out 2 offset**	Analog output 2 offset			0	-9.99	9.99		0.01	138
	I.312	**An out 2 gain**	Analog output 2 gain			1	-9.99	9.99		0.01	139
	I.313	**An out 2 filter**	Time constant of output filter			0	0	2.5	sec	0.01	140
Analog Output Exp Board	**I.350**	**Exp an out 1 cfg**	Expansion Analog Output 1 configuration (on Exp. board)	**As for I.300**		3	0	22			141
	I.351	**Exp AnOut 1 offs**	Expansion Analog Output 1 offset			0	-9.99	9.99		0.01	142
	I.352	**Exp AnOut 1 gain**	Expansion Analog Output 1 gain			1	-9.99	9.99		0.01	143
	I.353	**Exp AnOut 1 filt**	Time constant of output filter			0	0	2.5	sec	0.01	144
Enabling Virtual I/O	**I.400**	**Inp by serial en**	Virtual Digital enabling			0	0	255			**145**
	I.410	**Exp in by ser en**	Expansion Virtual Digital Inputs enabling			0	0	15			**146**
	I.420	**Out by serial en**	Virtual Digital Outputs setting enabling			0	0	15			**147**
	I.430	**Exp OutBySer en**	Expansion Virtual Digital Outputs enabling			0	0	3			**148**
	I.440	**An Inp by ser en**	Virtual Analog Inputs enabling			0	0	255			**196**
	I.450	**An out by ser en**	Virtual Analog Outputs enabling			0	0	255			**149**
Encoder Config	**I.500**	**Encoder enable**	Enabling of the encoder measure	**[0] Disable** **[1] Enable**	Encoder measure disabled. Encoder measure enabled.	0	0	1			**150**
	I.501	**Encoder ppr**	Encoder nameplate pulses per revolution			1024	0	9999			**151**
	I.502	**Enc channels cfg**	Encoder channels configuration	**[0] One Channel** **[1] Two Channels**	A (K1) encoder channel A and B (K1 and K2) encoder channels	1	0	1			**152**
	I.503	**Enc spd mul fact**	Multiplier factor of the encoder pulses, set in the I.501			1	0.01	99.99			153
	I.504	**Enc update time**	Encoder pulses sampling time	**[0] 1ms** **[1] 4ms** **[2] 16ms** **[3] 0.25s** **[4] 1s** **[5] 5s**		0	0	5			**154**
	I.505	**Enc supply**	Encoder power supply level	**[0] 5.2V** **[1] 5.6V** **[2] 8.3V** **[3] 8.7V**		0	0	3			181

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
Serial Line Config	**I.600**	**Serial link cfg**	Serial line configuration protocol & mode	**[0] FoxLink 7E1** **[1] FoxLink 701** **[2] FoxLink 7N2** **[3] FoxLink 8N1** **[4] ModBus 8N1** **[5] JBus 8N1**	Protocol type / Data Bit / Parity / Stop Bit FoxLink 7E1 7 Even 1 FoxLink 7O1 7 Odd 1 FoxLink 7N2 7 None 2 FoxLink 7O1 8 None 1 Modbus 8N1 8 None 1 Jbus 8N1 8 None 1	4	0	5		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**
Option Config Board	**I.700**	**Option 1 type**	Expansion optional 1 card type *(Note: Selected board must be installed on drive)*	**[0] Board Off** **[1] Board master** **[2] IO Board** **[3] Board free** **[4] SBI Board**	None Reserved EXP-D6-A1R1-AGy Reseved SBI-PDP-AGy	0	0	4			**161**
	I.701	**Option 2 type**	Expansion optional 2 card type *(Note: Selected board must be installed on drive)*	**[0] Board Off** **[1] Board master** **[2] IO Board** **[3] Board free** **[4] SBI Board**	None Reserved EXP-D6-A1R1-AGy Reserved SBI-PDP-AGy	0	0	4			**162**
Field Bus Config	**I.750**	**SBI address**	SBI Address			3	0	255			**163**
	I.751	**CAN baudraute**	CAN Open baudraute	**[0] 10 Kbit/s** **[1] 20 Kbit/s** **[2] 50 Kbit/s** **[3] 125 Kbit/s** **[4] 250 Kbit/s** **[5] 500 Kbit/s** **[6] 1000 Kbit/s**		5	0	6			**164**
	I.752	**SBI Profibus mod**	SBI Profibus Mode	**[0] Custom** **[1] PPO1** **[2] PPO2** **[3] PPO3** **[4] PPO4**	Profidrive custom Profidrive type 1 Profidrive type 2 Profidrive type 3 Profidrive type 4	2	0	4			**165**
	I.753	**SBI CAN mode**	Selection of the Bus protocol	**[0] OFF** **[1] CAN Open** **[2] DeviceNet**	None CAN Open protocol DeviceNet protocol	0	0	2			**166**
	I.754	**Bus Flt Holdoff**	Delay time for Bus Fault Alarm from profibus			0.0	0.0	60.0	sec	0.1	179
	I.760	**SBI to Drv W 0**	Word 0 from SBI to drive			0	0	1999			**167**
	I.761	**SBI to Drv W 1**	Word 1 from SBI to drive			0	0	1999			**168**

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
	I.762	**SBI to Drv W 2**	Word 2 from SBI to drive			0	0	1999			**169**
	I.763	**SBI to Drv W 3**	Word 3 from SBI to drive			0	0	1999			**170**
	I.764	**SBI to Drv W 4**	Word 4 from SBI to drive			0	0	1999			**171**
	I.765	**SBI to Drv W 5**	Word 5 from SBI to drive			0	0	1999			**172**
	I.770	**Drv to SBI W 0**	Word 0 from drive to SBI			1	0	1999			**173**
	I.771	**Drv to SBI W 1**	Word 1 from drive to SBI			2	0	1999			**174**
	I.772	**Drv to SBI W 2**	Word 2 from drive to SBI			3	0	1999			**175**
	I.773	**Drv to SBI W 3**	Word 3 from drive to SBI			4	0	1999			**176**
	I.774	**Drv to SBI W 4**	Word 4 from drive to SBI			5	0	1999			**177**
	I.775	**Drv to SBI W 5**	Word 5 from drive to SBI			6	0	1999			**178**

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	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
Motorpotentiometer	**F.010**	**Mp acc/dec time**	Motorpot Accel. and Decel. ramp time			10	0.1	999.9	sec	0.1	301
Motorpotentiometer	**F.011**	**Motorpot offset**	Motopotentiometer minimum reference			0	0	F.020	Hz	0.1	**302**
Motorpotentiometer	**F.012**	**Mp output mode**	Unipolar / bipolar Motorpotentiometer	**[0] Unipolar** **[1] Bipolar**	Motorpotentiometer unipolar Motorpotentiometer bipolar	0	0	1			**303**
Motorpotentiometer	**F.013**	**Mp auto save**	Motopotenziometer auto save function	**[0] Disable** **[1] Enable**	Motorpot auto save function disabled Motorpot auto save function enabled	1	0	1			304
Motorpotentiometer	**F.013**	**MpRef at stop**	Behavior of the frequency reference from Motorpotentiometer during a Stop sequence	**[0] Last value** **[1] Follow ramp**	Mot. reference will retain its current value Mot. reference will ramp down to zero, following the deceleration ramp in use	0	0	1			**351**
Reference Limit	**F.020**	**Max ref freq**	Motor maximum frequency value (for both directions)			(****)	25	500	Hz	0.1	**305**
Reference Limit	**F.021**	**Min ref freq**	Minimum frequency value			0	0	F.020	Hz	0.1	**306**
Reference Sources	**F.050**	**Ref 1 channel**	Source of the Reference 1	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Freq ref x** **[4] Multispeed** **[5] Motorpotent** **[6] Analog inp 3** **[7] Encoder** **[8] Profidrive**	Null Analog input 1 Analog input 2 Frequency reference F.100 (S.203) Multi frequncies Motorpotientometer reference Analog input 3 Encoder signal Reference by Profibus	3	0	8			**307**
Reference Sources	**F.051**	**Ref 2 channel**	Source of the Reference 2	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Freq ref x** **[4] Multispeed** **[5] Motorpotent** **[6] Analog inp 3** **[7] Encoder** **[8] Profidrive**	Null Analog input 1 Analog input 2 Frequency reference F.101 Multispeed Motorpotientometer reference Analog input 3 Encoder signal Reference by Profibus	0	0	8			**308**
Reference Sources	**F.060**	**MltFrq channel 1**	Source of the Multispeed 1		As for F.050, Reference 1 source	3	0	8			**309**
Reference Sources	**F.061**	**MltFrq channel 2**	Source of the Multispeed 2		As for F.051, Reference 2 source	3	0	8			**310**
Reference Sources	**F.080**	**FreqRef fac src**	Frequency reference multiplier factor source	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 2	0	0	3			**342**
	F.100	**Frequency ref 0**	Digital Reference frequency 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

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA
	Code	LCD display	Description	[Code] LCD Selection	Description						
Multi Frequency Function	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.108	**Frequency ref 8**	Digital Reference frequency 8				-F.020	F.020	Hz	0.1	319
	F.109	**Frequency ref 9**	Digital Reference frequency 9			0	-F.020	F.020	Hz	0.1	320
	F.110	**Frequency ref 10**	Digital Refer. frequency 10			0	-F.020	F.020	Hz	0.1	321
	F.111	**Frequency ref 11**	Digital Refer. frequency 11			0	-F.020	F.020	Hz	0.1	322
	F.112	**Frequency ref 12**	Digital Refer. frequency 12			0	-F.020	F.020	Hz	0.1	323
	F.113	**Frequency ref 13**	Digital Refer. frequency 13			0	-F.020	F.020	Hz	0.1	324
	F.114	**Frequency ref 14**	Digital Refer. frequency 14			0	-F.020	F.020	Hz	0.1	325
	F.115	**Frequency ref 15**	Digital Refer. frequency 15			0	-F.020	F.020	Hz	0.1	326
	F.116	**Jog frequency**	Jogging frequency reference			1	-F.020	F.020	Hz	0.1	327
Ramp Config	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 999.9s 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] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 3	0	0	3			**338**
Jump frequency	F.270	**Jump amplitude**	Jump frequencies hysteresis			0	0	100	Hz	0.1	339
	F.271	**Jump frequency 1**	Jump frequency 1			0	0	500	Hz	0.1	340
	F.272	**Jump frequency 2**	Jump frequency 2			0	0	500	Hz	0.1	341

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
				PARAMETER							
Commands	**P.000**	**Cmd source sel**	It defines the use of START and STOP commands	**[0] Keypad** **[1] Terminals** **[2] Virtual** **[3] Serial** **[4] Control word**	START & STOP via keypad (+24V between 5 & 8 terminals required). START & STOP via terminal Main commands via Virtual & Terminal setting Main commands via serial line Main commands from ProfiDrive control word	0	0	4			**400**
	P.001	**RUN /REV cmd mode**	Command logic	**[0] Run / Rev** **[1] Fwd / Rev** **[2] 3-Wires**	Run and Reverse commands Run Forward and Run Reverse commands Run , Stop and Reverse commands	0	0	2			**401**
	P.002	**Reversal enable**	Reversal enabling	**[0] Disable** **[1] Enable**	Disabling reverse rotation Enabling reverse rotation	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] Ramp to stop** **[1] Coast to stop**	Ramp to stop Coast to stop	0	0	1			**493**
	P.005	**Stop Key Mode**	STOP key configuration	**[0] Not active** **[1] EmgStop&Al**	No action Emergency stop execution and tripping when zero speed is reached	1	0	1			**496**
Control Mode	**P.010**	**Control Mode**	Drive control mode	**[0] V/f open loop** **[1] V/f clsd loop**	V/f control w/o encoder feedback V/f control with encoder feedback	0	0	1			**498**
Power Supply	**P.020**	**Mains voltage**	Rated value of the line voltage	**230** **380** **400** **420** **440** **460** **480** **500** **575**	230V, only for AGy-4 380V, only for AGy-4 400V, only for AGy-4 420V, only for AGy-4 440V, only for AGy-4 460V, only for AGy-4 480V, only for AGy-4 500V, only for AGy-5 575V, only for AGy-5	(****)	(****)	(****)	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			(*)	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	0	0	1			**410**
	P.045	**Motor thermal K**	Motor thermal constant			30	1	120	min		**411**

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
V/F Curve	**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	500	Hz	0.1	**414**
	P.063	**V/f interm volt**	V/F intermediate voltage			(**)	0	P.061	V	1	**415**
	P.064	**V/f interm freq**	V/F intermediate frequency			(**)	1.0	P.062	Hz	0.1	**416**
Outp. Freq. Limit	**P.080**	**Max output freq**	Maximum output frequency			110	0	110	% of F.020	1	**417**
	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	250	%	1	419
	P.101	**Slip comp filter**	Time constant of slip compensation			0.1	0	10	sec	0.1	420
Boost	**P.120**	**Manual boost [%]**	Torque boost level			1	0	25	% of P.061	1	421
	P.121	**Boost factor src**	Boost level source	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 3	0	0	3			**422**
	P.122	**Auto boost en**	Automatic boost function enabling	**[0] Disable** **[1] Enable**	Automatic boost function disabled Automatic boost function enabled	0	0	1			**423**
Automatic Flux Regulation	**P.140**	**Magn curr gain**	Magnetizing current regulator gain			0	0	100	%	0.1	424
Anti Oscillation function	**P.160**	**Osc damping gain**	Damping gain			0	0	100		1	425
Closed Loop Speed Control	**P.170**	**SpdPgainL**	Speed loop proportional gain (low speed)			2.0	0.0	100.0	%	0.1	501
	P.171	**SpdIgainL**	Speed loop integral gain (low speed)			1.0	0.0	100.0	%	0.1	502
	P.172	**SpdPgainH**	Speed loop proportional gain (high speed)			2.0	0.0	100.0	%	0.1	503
	P.173	**SpdIgainH**	Speed loop integral gain (high speed)			1.0	0.0	100.0	%	0.1	504
	P.174	**SpdGainThrL**	Speed loop gain scheduling low threshold			0.0	0.0	F.020	Hz	0.1	507
	P.175	**SpdGainThrH**	Speed loop gain scheduling high threshold			0.0	0.0	F.020	Hz	0.1	508
	P.176	**SpdRegHLim**	Speed regulator High limit			10.0	0.0	100.0	% of F.020	0.1	509
	P.177	**SpdRegLLim**	Speed regulator Low limit			-10.0	-100.0	0.0	% of F.020	0.1	510
	P.178	**SRegLimFkSrc**	Speed regulator limits factor source	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 3	0	0	3			511

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
SW Curr. Clamp	**P.180**	**SW clamp enable**	Current clamp enable	**[0] Disable** **[1] Enable**		1	0	1			**426**
	P.181	**Clamp alm HldOff**	Hold off time for the current clamp alarm			25.5	0.0	25.5	sec	0.1	**512**
Current Limit	**P.200**	**Ramp Currlim Mode**	Enable current limitation during ramp	**[0] None** **[1] PI Limitator** **[2] Ramp freeze**	**None** **PI Limit regulator** **On/Off Ramp**	0	0	2			**427**
	P.201	**Accel curr lim**	Current limit in acceleration phase			(*)	20	(*)	% of I nom	1	428
	P.202	**En lim in steady**	Enable current limitation in steady state	**[0] Disable** **[1] Enable**		0	0	1			**429**
	P.203	**Curr lim steady**	Current limit at constant speed			(*)	20	(*)	% of I nom	1	430
	P.204	**Curr ctrl P-gain**	Current limiter proportional gain			10.0	0.1	100.0	%	0.1	431
	P.205	**Curr ctrl I-gain**	Current limiter integral gain			30.0	0.0	100.0	%	0.1	432
	P.206	**Curr ctr feedfwd**	Current limiter feed-forward			0	0	250	%	1	**433**
	P.207	**Decel curr limit**	Current limit in deceleration phase			(*)	20	(*)	% of I nom	1	494
DC Link Limit	**P.220**	**En DC link ctrl**	Stall prevention during dec. for overvoltage	**[0] None** **[1] PI Limitator** **[2] Ramp freeze**	**None** **PI Limit regulator** **On/Off Ramp**	0	0	2			**434**
	P.221	**DC-lnk ctr Pgain**	DC link voltage limiter proportional gain			3.0	0.1	100.0	%	0.1	435
	P.222	**DC-lnk ctr Igain**	DC link voltage limiter integral gain			10.0	0.0	100.0	%	0.1	436
	P.223	**DC-link ctr FF**	DC link voltage limiter feed-forward			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** **[3] 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.	0	0	3			438
	P.241	**OT curr lim thr**	Current limit for overtorque			110	20	200	%	1	439
	P.242	**OT level fac src**	Overtorque level factor source	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 3	0	0	3			**440**
	P.243	**OT signal delay**	Delay time for overtorque signaling			0.1	0.1	25	sec	0.1	441
Motor Overload Config	**P.260**	**Motor OL prot en**	Enabling of motor overload protection	**[0] Disable** **[1] Enable**		1	0	1			**444**

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
BU Config	P.280	**BU Config**	Braking unit configuration	**[0] BU disabled** **[1] BU en OL dis** **[2] BU en OL en**	BU disabled BU enabled & Overload disable BU & Overload enabled	1	0	2			**445**
	P.281	**Brake res value**	Ohmic value of braking resistor			(*)	1	250	ohm	1	446
	P.282	**Brake res power**	Braking resistor power			(*)	0.01	25	kW	0.01	447
	P.283	**Br res thermal K**	Braking resistor thermal constant			(*)	1	250	sec	1	448
DC Brake Config	P.300	**DC braking level**	DC braking level			0	0	100	% of I nom	1	**449**
	P.301	**DCB lev fac src**	DC braking level factor source	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 3	0	0	3			**450**
	P.302	**DC braking freq**	Frequency for DC braking enabling			0	0	500	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
Autocapture function	P.320	**Autocapture mode**	Flying restart mode	**[0] Disable** **[1] 1st run only** **[2] Always**	Null Flying restar at first Run after power on Flying restart at each Run command	0	0	2			454
	P.321	**Autocapture Ilim**	Catch on flight current limit			120	20	(*)	% of I nom		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
	P.324	**Autocap V scan t**	Voltage scanning time during Pick Up			0.2	0.1	25	V	0.1	459
	P.325	**Autocap spd src**	Source of the reference for Pick Up function	**[0] Frequency ref** **[1] Max freq ref** **[2] Last freq ref** **[3] Encoder**	From active frequency reference From the Max fre ref parameter (F.020). From freq. set desired From encoder	0	0	3			460
Undervoltage Config	P.340	**Undervoltage thr**	Undervoltage threshold			0	0	80	% of P.020	1	**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	**[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 Kinetic energy recovering Emergency stop mode	0	0	2			**491**
Overvoltage Config	P.360	**OV prevention**	Automatic PickUp enabling after Overvoltage	**[0] Disable** **[1] Enable**		0	0	1			**465**

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
Autoreset Config	P.380	**Autoreset attmps**	Number of autoreset attempts			0	0	255			**466**
	P.381	**Autoreset clear**	En. automatic reset of autorestart attempts			10	0	250	min	1	**467**
	P.382	**Autoreset delay**	Autoreset time delay			5	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 detection mode	**[0] Alm alw,No AR** **[1] Alm run,No AR** **[2] Alm alw, ARes** **[3] 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
Phase Loss	P.410	**Ph Loss detec en**	Phase Loss detection enabling	**[0] Disable** **[1] Enable**		1	0	1			**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	1	472
	P.422	**V fact mult src**	Source of voltage reduction factor multiplier	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3**	Null Analog input 1 Analog input 2 Analog input 3	0	0	3			**473**
Frequency Threshold	P.440	**Frequency thr 1**	Frequency 1 level detection			0	0	F.020	Hz	0.1	474
	P.441	**Freq prog 1 hyst**	Hysteresis amplitude related to P-420			0.5	0	F.020	Hz	0.1	475
	P.442	**Frequency thr 2**	Frequency 2 level detection			0	0	F.020	Hz	0.1	476
	P.443	**Freq prog 2 hyst**	Hysteresis amplitude related to P-422			0.5	0	F.020	Hz	0.1	477
Steady State Signalling	P.460	**Const speed tol**	Tolerance at constant speed			0	0	25	Hz	0.1	478
	P.461	**Const speed dly**	Ramp end signalling delay			0.1	0	25	sec	0.1	479

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION						
Heatsink Temp. Threshold	**P.480**	**Heatsnk temp lev**	Heatsink temperature signalling level			70	10	110	°C	1	480
	P.481	**Heatsnk temp hys**	Hysteresis band related to P.480			5	0	10	°C	1	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**		(*)	P.502	(*)			482
	P.501	**Sw freq reduc en**	Enabling of switching frequency reduction	**[0] Disable [1] Enable**		0	0	1			483
	P.502	**Min switch freq**	Overmodulation level	**As P.500**		(*)	0	P.500			495
	P.520	**Overmod max lev**	Overmodulation level			0	0	100	%	1	484
	P.540	**Out Vlt auto adj**	Automatic adjustment of output voltage			1	0	1			**485**
Dead Time Comp.	**P.560**	**Deadtime cmp lev**	Dead times compensation limit			(*)	0	255			486
	P.561	**Deadtime cmp slp**	Dead times compensation slope			(*)	0	255			487
Display Settings	**P.580**	**Startup display**	IPA of the parameter to be displayed at power on			1	1	1999			488
	P.600	**Speed dsply fact**	Speed conversion constant for display			1	0.01	99.99		0.01	489
Protection	**P.999**	**Param prot code**	Parameters protection code	0 Protection disabled	Stopped motor: possibility to write all parameters. Running motor: some parameters are writing protected (**IPA** in bold)	0	0	3			490
				1 Protection enabled *(*) = only with motor stopped*	All parameters are writing protected excepted: - F000, F100..F116, multispeed function parameters - P999 Param prot code - C000 Save parameter *(*)* - C020 Alarm clear - H500..H511, serial line commands.						
				2 Protection enabled *(*) = only with motor stopped*	All parameters are writing protected excepted: - P999 Param prot code - C000 Save parameter *(*)* - C020 Alarm clear - H500..H511, serial line commands.						
				3 Protection disabled	Stopped motor: possibility to write all parameters. Running motor: some parameters are writing protected (**IPA** in bold) Possibility to execute Save parameter also with running motor.						

	PARAMETER			PICK LIST		DEFAULT	MIN	MAX	UNIT	VARIATION	IPA
	CODE	LCD DISPLAY	DESCRIPTION	[CODE] LCD SELECTION	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 in sum with voltage ref from V/f curve (Feed forward) PID out not in sum with voltage ref from V/f curve (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] Analog inp 3** **[4] Frequency ref** **[5] Ramp output** **[6] Digital ref** **[7] Encoder freq**	Null Analog input 1 Analog input 2 Analog input 3 Frequency reference Ramp output Internal reference Encoder frequency	0	0	7			**1201**
	A.002	**PID fbk sel**	PID feedback selector	**[0] Null** **[1] Analog inp 1** **[2] Analog inp 2** **[3] Analog inp 3** **[4] Encoder freq** **[5] Output curr** **[6] Output torque** **[7] Output power**	Null Analog input 1 Analog input 2 Analog input 3 Encoder frequency Output peak current Output torque Output power	0	0	7			**1202**
	A.003	**PID digital ref**	PID digital reference			0	-100	100	%	0.1	1203
	A.004	**PID activat mode**	PID active in steady state only	**[0] Always** **[1] Steady state**		0	0	1			**1204**
	A.005	**PID-Encoder sync**	Enabling of encoder / PID synchronism	**[0] Disable** **[1] Enable**		0	0	1			**1205**
	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**
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	1214
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	100	%	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

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	Ipa
	Code	LCD display	Description	[Code] LCD Selection	Description						
Programmable Logic	**A.300**	**AND1 In 1 src**	Set up input block AND1	**As for I.100**		49	0	77			1355
	A.301	**AND1 In 2 src**	Set up input block AND1	**As for I.100**		49	0	77			1356
	A.302	**AND2 In 1 src**	Set up input block AND2	**As for I.100**		49	0	77			1357
	A.303	**AND2 In 2 src**	Set up input block AND2	**As for I.100**		49	0	77			1358
	A.304	**AND3 In 1 src**	Set up input block AND3	**As for I.100**		49	0	77			1359
	A.305	**AND3 In 2 src**	Set up input block AND3	**As for I.100**		49	0	77			1360
	A.306	**OR1 In 1 src**	Set up input block OR1	**As for I.100**		49	0	77			1361
	A.307	**OR1 In 2 src**	Set up input block OR1	**As for I.100**		49	0	77			1362
	A.308	**OR2 In 1 src**	Set up input block OR2	**As for I.100**		49	0	77			1363
	A.309	**OR2 In 2 src**	Set up input block OR2	**As for I.100**		49	0	77			1364
	A.310	**OR3 In 1 src**	Set up input block OR3	**As for I.100**		49	0	77			1365
	A.311	**OR3 In 2 src**	Set up input block OR3	**As for I.100**		49	0	77			1366
	A.312	**NOT1 In src**	Set up input block NOT1	**As for I.100**		49	0	77			1367
	A.313	**NOT2 In src**	Set up input block NOT2	**As for I.100**		49	0	77			1368
	A.314	**NOT3 In src**	Set up input block NOT3	**As for I.100**		49	0	77			1369
	A.315	**NOT4 In src**	Set up input block NOT4	**As for I.100**		49	0	77			1370

	PARAMETER			PICK LIST		Default	Min	Max	Unit	Variation	IPA
	Code	LCD display	Description	[Code] LCD Selection	Description						
COMMAND											
Basic	**C.000**	**Save parameters**	Save parameters command	*(1)* *(2)*	No action. Save parameters command.	*(1)*	*(1)*	*(2)*			**800**
Basic	**C.001**	**Recall param**	Recall last set of saved parameters	*(1)* *(2)*	No action. Recall last set of saved parameters.	*(1)*	*(1)*	*(2)*			**801**
Basic	**C.002**	**Load default**	Recall of the factory parameters.	*(1)* *(2)*	No action. Load default parameters.	*(1)*	*(1)*	*(2)*			**802**
Alarm Reset	**C.020**	**Alarm clear**	Reset of the the Alarm List register	*(1)* *(2)*	No action. Clear alarm register command.	*(1)*	*(1)*	*(2)*			803
External Key	**C.040**	**Recall key prog**	Recall of the parameters in the external key	*(1)* *(2)*	No action. Recall parameter from PRG-KEY key.	*(1)*	*(1)*	*(2)*			**804**
External Key	**C.041**	**Save pars to key**	Storage of the inverter parameter on the external key	*(1)* *(2)*	No action. Storage of parameters to PRG-KEY key.	*(1)*	*(1)*	*(2)*			**805**
LCD keypad	**C.070**	**Recal kbg prog**	Recall of parameters from LCD keypad	*(1)* *(2)*	No action. Recall pars from keypad	*(1)*	*(1)*	*(2)*			**809**
LCD keypad	**C.071**	**Save pars to kbg**	Storage of parameters into LCD keypad	*(1)* *(2)*	No action. Store pars into keypad	*(1)*	*(1)*	*(2)*			**810**
Tuning	**C.100**	**Measure stator R**	Motor Autotune command	*(1)* *(2)*	No action. Autotune command.	*(1)*	*(1)*	*(2)*			**806**

***(1)* :** **AGy-4A, AGy-5 = Confirm? NO**
AGy-4 = off

***(2)* :** **AGy-4A, AGy-5 = Confirm? YES**
AGy-4 = do

	PARAMETER		PICK LIST		DEFAULT	MIN	MAX	IPA
	CODE	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION				
		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/Os Commands	H.000	**Virtual digital command**			0	0	255	1000
	H.001	**Exp virtual digital command**			0	0	255	1001
	H.010	**Virtual digital state**			0	0	255	1002
	H.011	**Exp Virtual digital state**			0	0	255	1003
	H.020	**Virtual An Output 1**			0	-32768	32767	1004
	H.021	**Virtual An Output 2**			0	-32768	32767	1005
	H.022	**Exp Virtual An Output 1**			0	-32768	32767	1006
	H.025	**Virtual analog input 1**			0	-32768	32767	1082
	H.026	**Virtual analog input 2**			0	-32768	32767	1083
	H.027	**Virtual analog input 3**			0	-32768	32767	1084
Profidrive Profile	H.030	**Profidrive Control word (see Profibus instruction manual)**			0	0	65535	1007
	H.031	**Profidrive Status word (see Profibus instruction manual)**			0	0	65535	1008
	H.032	**Profidrive reference (see Profibus instruction manual)**			0	-16384	16383	1040
	H.033	**Profidrive actual reference (see Profibus instruction manual)**			1	-16384	16383	1041
Drive Status	H.034	**Drive status**			0	0	65535	1042
	H.040	**Progress**			0	0	100	1009
Parameters Reading Extension	H.050	**Drive output frequency at 32bit (LSW) (d.000)**			0	-2^{31}	$2^{31}-1$	1010
	H.052	**Drive reference frequency at 32bit (LSW) (d.001)**			0	-2^{31}	$2^{31}-1$	1012
	H.054	**Output speed (d.000)*(P.600) at 32bit (LSW) (d.007)**			0	-2^{31}	$2^{31}-1$	1014
	H.056	**Speed Ref (d.001)*(P.600) at 32bit (LSW) (d.008)**			0	-2^{31}	$2^{31}-1$	1016
	H.058	**Encoder freq at 32bit (LSW) (d.301)**			0	-2^{31}	$2^{31}-1$	1018
	H.060	**Encoder speed (d.000)*(P.600) at 32bit (LSW) (d.302)**			0	-2^{31}	$2^{31}-1$	1044
	H.062	Bitwise reading of active alarms (32 bits). Each bit is associated to a specific alarm, according to table 9.3.1.			0	$2^{32}-1$	$2^{32}-1$	1060

	PARAMETER		PICK LIST		DEFAULT	MIN	MAX	IPA
	CODE	DESCRIPTION	[CODE] LCD SELECTION	DESCRIPTION				
Remote I/Os Control	**H.100**	**Remote Digital Inputs (0..15)**			0	0	65535	1021
	H.101	**Remote Digital Inputs (16..31)**			0	0	65535	1022
	H.110	**Remote Digital Outputs (0..15)**			0	0	65535	1023
	H.111	**Remote Digital Outputs (16..31)**			0	0	65535	1024
	H.120	**Remote Analog input 1**			0	-32768	32767	1025
	H.121	**Remote Analog input 2**			0	-32768	32767	1026
	H.130	**Remote Analog output 1**			0	-32768	32767	1027
	H.131	**Remote Analog output 2**			0	-32768	32767	1028
Serial Link Commands	**H.500**	**Hardware reset**			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	1034
	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

Drive DC Bus voltage (DC) [V].

d.005 Power factor

Drive output power factor.

d.006 Power [kW]

Drive output active power

d.007 Output speed

Calculated speed **(d.000 * P.600).**

d.008 Speed ref (Speed reference)

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

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	0.1	007
d.007	Output speed						0.01 / 1	008
d.008	Speed ref						0.01 / 1	009

Overload

d.050 Heatsink temp (Heatsink temperature)

Drive heatsink temperature [°C].

d.051 Drive OL (Drive overload level)

The drive overload control function is based on a I^2t, that allows for the IEC 146 class 2 service.
The I^2t integrator level can be read in d.051, and is calculated as follows:

$$d.051[\%] = K_{OL} \times \int (I^2_{out} - I^2_{CONT})$$

Dove:

I_{out}	Inverter output current;
I_{CONT}	Inverted rated output current level, IEC 146 class 1 (see table 3.3.3.1), calculated taking into accounts all applicable deratings (see Table 3.3.2.1).
K_{OL}	I^2t integration constant, calculated in order to obtain d.0.51 = 100%, after operating for 60s with $I_{out} = 1.36 \times I_{CONT}$.

Overload time and restore time for different current levels are reported in the following figures:

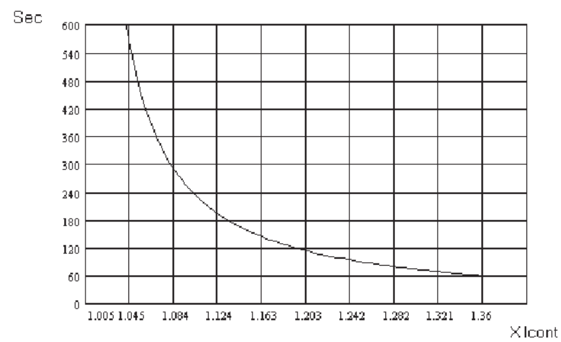


Figure 7.2.1: Overload Time

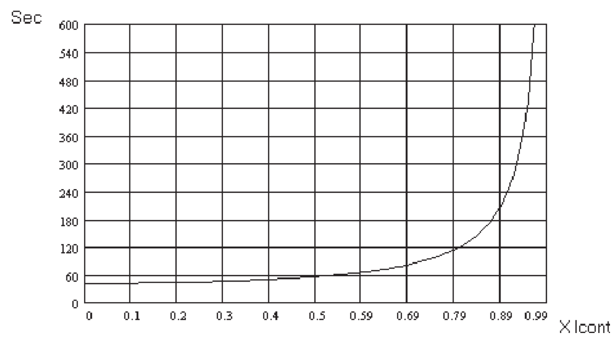


Figure 7.2.2: Pause Time

NOTE! A short overload of 200% of the inverter rated current is allowed for 0.5s.

The I^2t logic acts on the limits of the inverter output current. During normal operation, instantaneous value of the inverter output current can reach 200% of inverter rated. After 0.5s at 200%, the output current limit is reduced to 150%. When the overload level ***d.051*** reaches 100%, the output current limit is reduced to 100% of inverter rated, and stays there until the overload integrator is completely discharged. At this point, the original limit of 200% is resumed.

NOTE! If active current limiters (see ***P200***, ***P202***) and current clamp (see ***P.180***) are all disabled, the drive is not able to protect himself against excessive output current and will trip for overload as soon as the integrator reaches 100%.

Status of the overload function can be monitored on any digital output of the drive, programmed as follows (see Chap. 7.4, section Digital Inputs Regulation Board):

[46] Drv OL status	Digital output is set when the integrator ***d.05***1 reaches 100%, and is reset when the integrator is completely discharged.
[47] Drv OL warn	Digital output is set when the integrator ***d.051*** is equal or above 90%, and is reset otherwise.

d.052 Motor OL (Motor overload)

Motor overload level (100% = alarm threshold).

d.053 Brake res OL (Brake resistror overload)

Braking resistor overload level (100%=alarm thr).

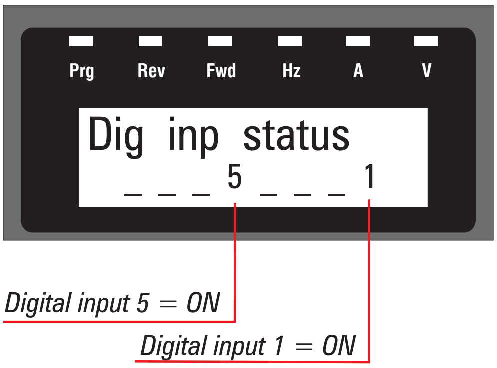
d.054 Reserved

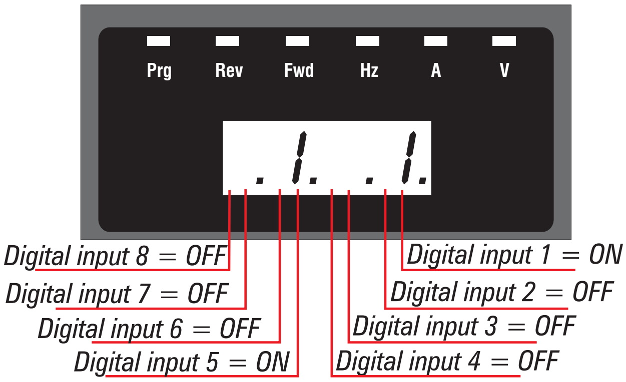
Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.050	Heatsink temp					°C	1	010
d.051	Drive OL					%	0.1	011
d.052	Motor OL					%	0.1	012
d.053	Brake res OL					%	0.1	013
d.054	Reserved							058

Inputs/Outputs

d.100 Dig inp status (Digital inputs status)

Status of the digital inputs acquired by the drive. Each of the inputs can come either from regulation board terminal , from optional field bus card or from serial line. See figure 7.4.8 .
According to the type of keypad in use, the status of digital inputs will be displayed as follows:





d.101 Term inp status (Terminal inputs status)

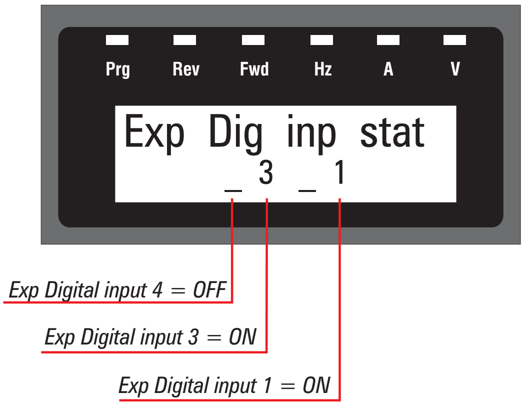
Status of the digital inputs terminal of the drive regulation board.
See example d.100

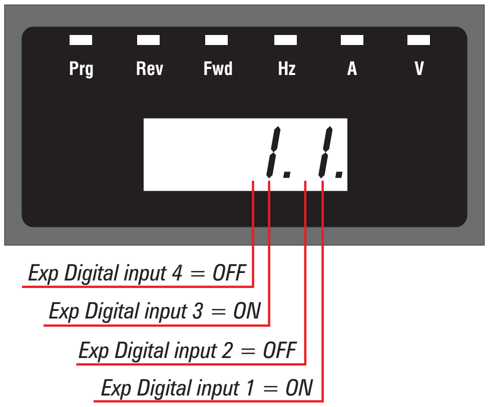
d.102 Vir dig inp stat (Virtual digital inputs status)

Status of the virtual digital inputs received by serial link or field bus card, by writing parameter H.000.
See example d.100

d.120 **Exp dig inp stat** (Expansion board digital inputs status)

Status of the expansion digital inputs acquired by the drive. Each of the inputs can come either from regulation board terminal , from optional field bus card or from serial line. See figure 7.4.8 .
According to the type of keypad in use, the status of expansion digital inputs will be displayed as follows:





d.121 **Exp term inp** (Expansion board terminal inputs status)

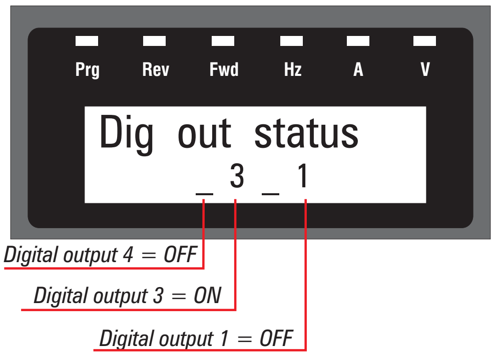
Status of the expansion digital inputs terminal of the drive expansion board.
See example d.120

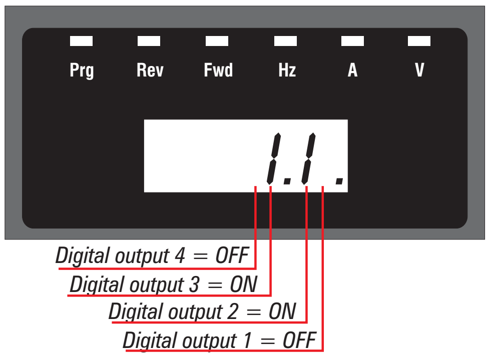
d.122 **Vir exp dig inp** (Expansion Board virtual digital inputs status)

Status of the expansion virtual digital inputs received by drive serial link or field bus card, by writing parameter H.001.
See example d.120

d.150 **Dig out status** (Digital outputs status)

Status of the digital outputs terminals of the regulation board. Each output can be set by the associated drive function (see I.100, ..., I.103) or by writing the parameter H.010 (see figure 7.4.9).
According to the type of keypad in use, the status of digital outputs will be displayed as follows:





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

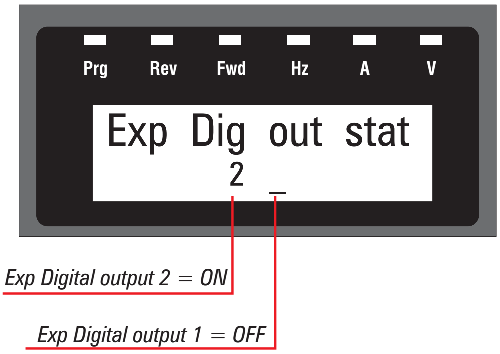
Status of the digital outputs set by the drive function programmed by parameters I.100 through I.103.
See example d.150

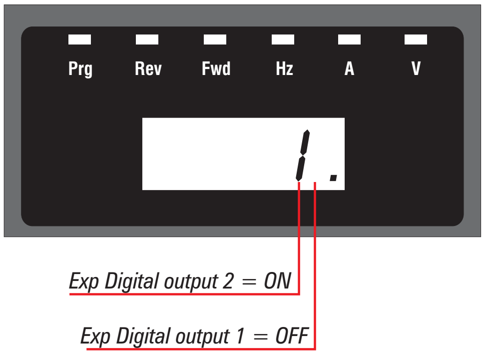
d.152 **Vir dig out sta** (Virtual digital outputs status)

Status of the virtual digital outputs set via serial link or field bus card, by writing parameter H.010.
See example d.150

d.170 Exp dig out sta (Expansion board digital outputs status)

Status of the expansion digital outputs terminals of the regulation board. Each output can be set by the associated drive function (see I.150, ..., I.152) or by writing the parameter H.010 (see figure 7.4.9).
According to the type of keypad in use, the status of expansion digital outputs will be displayed as follows:





d.171 Exp DrvDigOutSta (Expansion board terminal outputs status)

Status of the expansion digital outputs set by the drive function programmed by parameters I.100 through I.103.
See example d.170

d.172 Exp VirDigOutSta (Expansion board virtual digital outputs status)

Status of the expansion virtual digital outputs set via serial link or field bus card, by writing parameter H.010.
See example d.170

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

Monitor of the function associated to the Analog input 1:

[0] Null funct	No 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 **PARAMETERS**, section ***Ramp Config (F.260)***
[8] Freq ref fact	Multiplier factor for frequency reference	chapter **FREQ & RAMP**, section ***F.080***
[9] SpdPI LimFac	Level of speed PI limit	chapter **PARAMETERS,** section ***Closed Loop Speed Control***
[10] Mlt frq ch 1	Multi frequency reference 1	chapter **FREQ & RAMPS,** section ***Reference sources (F.060)***
[11] Mlt frq ch 2	Multi frequency reference 2	chapter **FREQ & RAMPS,** section ***Reference sources (F.061)***

d.201 An in 1 monitor (Analog input 1 monitor)

Analog input 1 - block output (%). See Fig. 7.4.1 .

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

Analog input 1 block input (%). See Fig. 7.4.1 .
It monitors the signal at the An In 1 regulation board terminals, according to the value of ***An inp 1 Type (I.200)*** parameter:

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

d.210 An in 2 cnf mon (Analog input 2 configuration monitor)

Monitor of the function associated to Analog Input 2. See param. ***d.200***.

d.211 **An in 2 monitor** (Analog input 2 monitor)

Analog input 2 - block output (%). See figure 7.4.1.

d.212 **An in 2 term mon** (Analog input 2 terminals monitor)

Analog input 2 - block input (%). See Fig. 7.4.1.
It monitors the signal at the An In 2 regulation board terminals, according to the value of ***An inp 2 Type (I.210)*** parameter:

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

d.220 **An in 3 cnf mon** (Analog input 3 configuration monitor)

Monitor of the function associated to Analog input 3. See param. ***d.200***.

d.221 **An in 3 monitor** (Analog input 3 monitor)

Analog input 3 - block output (%). See Fig. 7.4.1.

d.222 **An in 3 term mon** (Analog input 3 terminals monitor)

Analog input 3 - block input (%). See Fig. 7.4.1.
It monitors the signal at the An In 3 regulation board terminals, according to the value of ***An inp 3 Type (I.220)*** parameter:

- selection: **[1] 0-10V/0-20mA**: 0mA = 0%, 20mA = +100%
- selection: **[2] 4-20mA**: 4mA = 0%, 20mA = +100%

Code	LCD display	[Code] & LCD select.	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.120	Exp dig inp stat							017
d.121	Exp term inp							018
d.122	Vir exp dig inp							019
d.150	Dig out status							020
d.151	Drv dig out sta							021
d.152	Vir dig out stat							022
d.170	Exp dig out stat							023
d.171	Exp DrvDigOutSta							024
d.172	Exp VirDigOutSta							025
d.200	An in 1 cnf mon							026
d.201	An in 1 monitor					%		027
d.202	An in 1 term mon					%		028
d.210	An in 2 cnf mon							029
d.211	An in 2 monitor					%		030
d.212	An in 2 term mon					%		031
d.220	An in 3 cnf mon							032
d.221	An in 3 monitor					%		033
d.222	An in 3 term mon					%		034

Encoder

d.300 **EncPulses/Sample** (Encoder Pulses / Sample)

Number of encoder pulses, recorded in the time interval defined by parameter I.504.

d.301 **Encoder freq** (Encoder frequency)

Frequency detected by the encoder (Motor electrical frequency) [Hz]

d.302 Encoder speed

Speed detected by the encoder (d.000 * P.600).

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.300	EncPulses/Sample						0.001	035
d.301	Encoder freq					Hz	0.01	036
d.302	Encoder speed						0.01 / 1	037

Option

d.350 Option 1 state

It monitors the status of the optional board 1.

d.351 Option 2 state

It monitors the status of the optional board 2.

d.353 SBI State

Status of the communication between SBI optional board (Slave) and Master.

d.354 SBI Baudrate

Baudrate of the communication between SBI and Master

Code	LCD display	[Code] & LCD select.		Default	MIN	MAX	Unit	Variation	IPA
d.350	Option 1 state								038
		0...3	Reserved						
		4	Data exchange						
		..							
		32	Regulation board error (board type)						
		33	Regulation board error (checksum)						
		34	Regulation board error (board incompatible)						
		..							
		64	Expansion error						
		65 .. 66	Reserved						
d.351	Option 2 state	As per d.350							039
d.353	SBI State	0	Wait parametrization						059
		1	Wait configuration						
		2	Data exchange						
		3	Error						
d.354	SBI Baude rate	0	12 Mbit / s						060
		1	6 Mbit / s						
		2	3 Mbit / s						
		3	1.5 Mbit / s						
		4	500 Mbit / s						
		5	187.5 kbit / s						
		6	93.75 kbit / s						
		7	45.45 kbit / s						
		8	19.2 kbit / s						
		15	unknowk						

Pid

d.400 PID reference

PID reference signal (%), see figure 7.7.1.

d.401 PID feedback

PID feedback signal (%), see figure 7.7.1.

d.402 PID error

PID error signal (%), see figure 7.7.1.

d.403 PID integr comp (PID integral component)

PID integral component (%), see figure 7.7.1.

d.404 PID output

PID output signal (%), see figure 7.7.1.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
d.400	PID reference					%	0.1	041
d.401	PID feedback					%	0.1	042
d.402	PID error					%	0.1	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 stored in the drive alarm list (see paragraph 9.3).

d.801 2nd alarm

Second to last alarm stored in the drive alarm list (see paragraph 9.3).

d.802 3rd alarm

Third to last alarm stored in the drive alarm list (see paragraph 9.3).

d.803 4th alarm

Fourth to last alarm stored in the drive alarm list (see paragraph 9.3).

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 (dependent on the drive size, main voltage and programmed switching frequency): IEC146 Class 1.

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

Display example: **03.01**
03 = index of software identification
01 = 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 Gefran 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.

d.958 Drive cfg type

Drive configuration type: 0 = 400Vac/50Hz, 1 = 460 or 575Vac / 60Hz.

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	0	0.75kW - 230/400/460V		130	2.0Hp - 575V			
		1	1.5kW - 230/400/460V		131	3.0Hp - 575V			
		2	2.2kW - 230/400/460V		132	5.0Hp - 575V			
		3	3kW - 230/400/460V		133	7.5Hp - 575V			
		4	4kW - 230/400/460V		134	10Hp - 575V			
		5	5.5kW - 230/400/460V		135	15Hp - 575V			
		6	7.5kW - 230/400/460V		136	20Hp - 575V			
		7	11kW - 230/400/460V		137	25Hp - 575V			
		8	15kW - 230/400/460V		138	30Hp - 575V			
		9	22kW - 230/400/460V		139	40Hp - 575V			
		10	30kW - 230/400/460V		140	50 Hp - 575V			
		11	37kW - 230/400/460V		141	60Hp - 575V			
		12	45kW - 230/400/460V		142	75Hp - 575V			
		13	55kW - 230/400/460V		143	100Hp - 575V			
		14	75kW - 230/400/460V		144	125Hp - 575V			
		15	90kW - 230/400/460V		145	150Hp - 575V			
		16	110kW - 230/400/460V		146	200Hp - 575V			
		17	132kW - 230/400/460V						
		18	160kW - 230/400/460V						
		21	18.5kW - 230/400/460V						
		25	200kW - 230/400/460V						
d.958	Drive cfg type	0	400Vac						061
		1	460 o 575Vac						

Utility

d.999 Display Test

Drive display test. On the 7-seg display, all the segments should be on.

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 allows a quick start of the motor.These parameters are actually links to a selection of parameters present in other menus. Therefore, avy modification on a parameter in the START-UP menu is also reflected on the linked parameter found on a different menu, and vice-versa.

Power Supply

S.000 Mains voltage (linked to P.020)

Rated value of the AC input mains line to line voltage [V].
The undervoltage trip function is based on this value (see chapter **PARAMETERS**, section **Undervoltage configuration**).

S.001 Mains frequency (linked to P.021)

Rated value of the AC input mains frequency [Hz].

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.000	Mains voltage	- 230, 380, 400, 420, 440, 460, 480 (Only for "AGy...-4") - 500, 575 (Only for "AGy...-5")	(****)	230	575	V		404
S.001	Mains frequency	50 60	(****)	50	60	Hz		405

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

V/F Characteristic

S.100 Max out voltage (Maximun output voltage) (linked to P.061)

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

S.101 Base frequency (linked to P.062)

Rated frequency of the motor (given on the nameplate, see figure 7.3.2)
It is the frequency at which the inverter output voltage reaches the ***Max out voltage (S.100).***

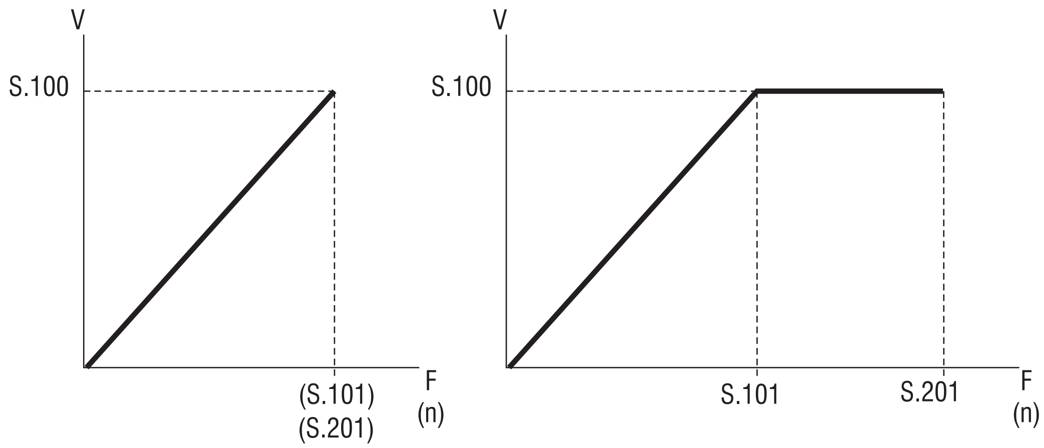


Figure 7.3.1: V/F Characteristic

NOTE! For further setting of the V/F characteristic, see the chapter **PARAMETERS**, section **V/F Curve**

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.100	Max out voltage		(**)	50	(**)	V	1	413
S.101	Base frequency		(**)	25	500	Hz	0,1	414

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

Motor Data

S.150 Motor rated curr (Motor rated current) (linked to P.040)

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 (linked to P.041)

Pole pairs of the motor.
Starting from nameplate data, the number of pole pairs is calculated as follows:

$$P = \frac{60\,[s] \times f\,[Hz]}{n_N\,[rpm]}$$

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).

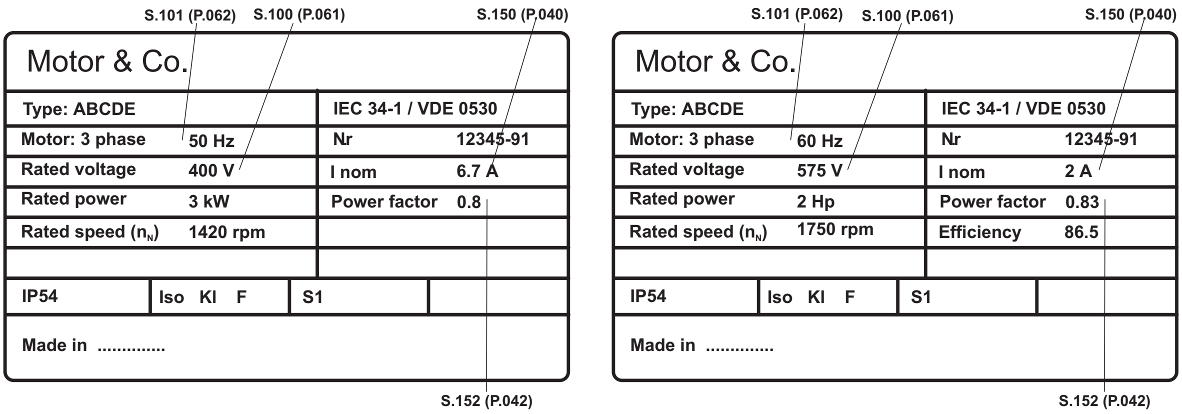


Figure 7.3.2: Motor Nameplate (Example: kW rating for 400V motor and Hp rating for 575V motor)

Example: calculation of the pole pairs of a motor having data shown in the above 400V label:

$$p\,[polepairs] = \frac{60\,[s] \times f\,[Hz]}{n_N\,[rpm]} = \frac{60\,[s] \times 50\,[Hz]}{1420\,[rpm]} = 2.1$$

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

S.152 Motor power factor (linked to P.042)

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

S.153 Motor stator R (Motor stator Resistance) (linked to P.043)

Ohmic value of the stator resistance of the motor.
This value will be automatically updated, by performing the self tune procedure.

Code	LCD display	[Code] & LCD select.	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) (linked to P.000)

It defines the source of the main commands (START and STOP) and auxiliary commands (REVERSE, ENABLE, DC-BRAKE, etc.).

S.200 = 0 START & STOP via keypad, auxliliary commands via digital input terminals.
In this configuration, START and STOP commands are given through the keypad buttons.

START button   STOP button

In order to start the motor, the Digital Input 7 (terminal 5), factory programmed as RUN, must be asserted.
If the Digital input programmed as RUN is not active, the motor will STOP with the deceleration ramp time in use.
All auxliliary commands are given via digital input terminals.

S.200 = 1 START & STOP and auxliliary commands via digital input terminals.
In this configuration, all drive commands are given through the digital input terminals.
By default, The START command i given by asserting the Digital Input 7 (terminal 5), factory set as RUN, while the STOP command is given by de-asserting the same Digital Input.
It is possible to use several other configurations for giving START, STOP and REV commands from digital input terminals. See chapter **PARAMETERS**, section **Commads**, for details.

NOTE! At power on, the motor will not start until a positive transition is seen on the Digital Input programmed as RUN (edge sensitive). See description of parameter ***P.003*** for further details.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

S.200 = 2 START & STOP and auxliliary commands via terminals or virtual digital inputs.
In this configuration, any drive command may come either from digital input terminals or from virtual digital inputs. Virtual digital inputs are used to give commands from serial line or fieldbus. Refer to chapter **INTERFACE**, section **Enabling Virtual I/O**, for explanation about the use of virtual commands.

NOTE! At power on, the motor will not start until a positive transition is seen on the Digital Input programmed as RUN (edge sensitive). See description of parameter ***P.003*** for further details.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

S.200 = 3 START & STOP and auxiliary commands via serial line.
All drive commands are given through via serial line or filedbus, by using dedicated commands. Refer to chapter **HIDDEN,** section **Commands**, for a complete description of the available commands.

NOTE! No interlock from digital input terminals is provided, when using commands from serial line.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

P.200 = 4 START & STOP and auxiliary commands via Profidrive control word.
In this configuration, all commands are given through the *Profidrive* standard control word.
The optional *ProfiBus* SBI card is needed.

NOTE! No interlock from digital input terminals is provided, when using commands from *Profidrive*.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

S.201 Max ref freq (Maximum reference frequency) (linked to F.020)

It is the maximum allowed value for the frequency reference (absolute value), which ever the source.
(See figure 7.5.1).

S.202 Ref 1 Channel (Reference 1 channel) (linked to F.050)

It defines the source of the frequency reference 1. By default, the frequency reference is supplied through the parameter ***S.203***.
For further details, refer to chapter **FREQ & RAMPS**, section **Reference Source**.

S.203 Frequency ref 0 (Frequency reference 0) (linked to F.100)

It is the effective frequency reference when ***S.202*** = [3] FreqRefx (default settings).
It is possible to set either positive or negative values that do not exceed the setting of ***S.201***.
The polarity will determine the direction of rotation of the motor.
Regardless of the polarity, the REV command will reverse the direction of rotation.

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

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.200	Cmd source sel	[0] Keypad	0	0	4			400
		[1] Terminals						
		[2] Virtual						
		[3] Serial						
		[4] Control word						
S.201	Max ref freq		(****)	25	500	Hz	0.1	305
S.202	Ref 1 channel	[0] Null	3	0	8			307
		[1] Analog inp 1 (setting through ***I.200…I.204***)						
		[2] Analog inp 2 (setting through ***I.210…I.214***)						
		[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] Analog inp 3 (setting through ***I.220…I.224***)						
		[7] Encoder (setting through ***I.500…I.505***)						
	[8] Profidrive	Reference by Profibus						
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) (linked to F.201)

The drive is equipped with a ramp generator, in order to avoid abrupt changes in output frequency when the frequency reference is changed or when the drive is started.
Acceleration time S.300 represents the time needed to ramp up the frequency from zero to the maximum value defined by “ ***S.201-Max ref freq***” parameter.

S.301 Dec time 1 (Deceleration time 1) (linked to F.202)

The drive is equipped with a ramp generator, in order to avoid abrupt changes in output frequency when the frequency reference is changed or when the drive is started.
Deceleration time S.301 represents the time needed to ramp down the frequency from the maximum value defined by “***S.201-Max ref freq***” parameter to zero .

Code	LCD display	[Code] & LCD select.	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

S.400 Manual boost [%] (linked to P.120)

The resistive impedance of the stator windings causes a voltage drop within the motor, which results in a reduction of torque in the lower speed range.
Compensation can be made for this effect by boosting the output voltage.

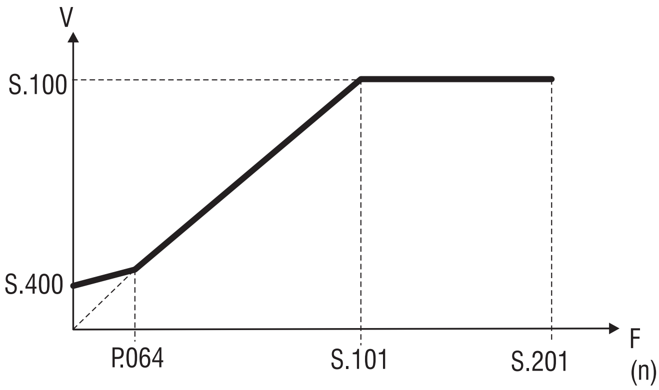


Figure 7.3.3: Manual Boost Voltage

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/f characteristic (see figure 7.3.3).

S.401 Auto boost en (Automatic boost enabling) (linked to P.122)

By enabling the automatic boost calculation, the drive will optimize the V/f profile in order to obtain constant flux level inside the motor over the whole operating speed range. This will improve torque availability at low speed, increasing the starting torque of the drive. The drive uses the stator resistance of the motor in use (either set in parameter ***S.153*** or measured by the autotuning procedure ***S.900***) and the current measured at the inverter output terminals to calculate the necessary voltage boost for the V/f profile.

NOTE! Performance achievable with the automatic voltage boost depends on motor parameters. Therefore, in order to obtain best performance, motor nameplate data should be set correctly and the stator resistance value should be measured by running the autotuning procedure.

NOTE! Automatic boost calculation must be disabled when multiple motors are connected to a single inverter.

In some applications, it can be necessary to overflux the machine in order to obtain even more starting torque. In those cases, the manual boost (set by ***S.400***) can be used in conjunction to the automatic boost. The resulting voltage boost will be the sum of the two contributions.

S.450 Slip compensat (Slip compensation) (linked to P.100)

When an induction motor is loaded, the mechanical speed of the shaft varies due to the electrical slip between stator and rotor quantities which is responsible for the generation of torque.
In order to keep the shaft speed constant, the slip compensation function of the drive can be used.
The compensation is performed by varying the inverter output frequency of an amount that is calculated from inverter output current and motor parameters. therefore, in oder to obtain best results, motor nameplate data has to be properly set, and the correct value of the stator resistance ***(S.153)*** has to be either edited or measured by self-tuning ***(S.901)***. Tuning of the slip compensation function is performed by editing the parameter ***S.450***. If ***S.450*** **= 0.0** (default), the slip compensation assumes the nominal value, calculated from nameplate data.

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

S.451 Slip comp filter (Slip compensation filter)   (linked to P.101)

It is the response time (in seconds) of the slip compensation function.
The lower the setting of this parameter, the quicker will be the response od slip compensation. However, setting too low may give rise to undesired oscillations of the speed after sudden load variations.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.400	Manual boost [%]		1.0	0.0	25.0	% of S.100	0.1	421
S.401	Auto boost en	[0] Disable [1] Enable	0	0	1			423
S.450	Slip compensat		0	250	10	% of S.101	1	419
S.451	Slip comp filter		0.1	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.
A correct value of the motor parameters will optimize drive performance in terms of torque availability and speed control, when using Automatic boost ***(P.401)*** and Slip compensation ***(P.450)***.

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

S.901 Save parameters

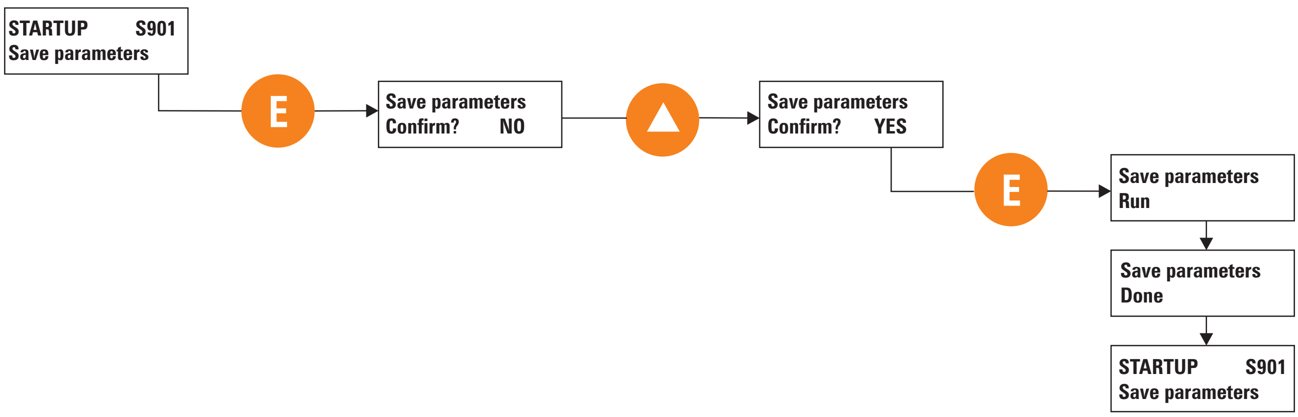
Every modification of parameter value has immediate effect on drive operation, but is not automatically stored in permanent memory
The Save parameter command is used to store the set of parameters currently in use in permanent memory.
The drive signals the presence of unsaved parameters by blinking the dedicated yellow LED (**Prg**) on the keypad.
When the drive is turned off, all unsaved modifications are lost.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
S.900	Measure stator R	*(1)* *(2)*	*(1)*	*(1)*	*(2)*			806
S.901	Save parameters	*(1)* *(2)*	*(1)*	*(1)*	*(2)*			800

(1) : **AGy-4A, AGy-5 = Confirm? NO**
AGy-5 = off

(2) : **AGy-4A, AGy-5 = Confirm? YES**
AGy-5 = do

Below, the sequence for executing the Save parameters command is shown. The sequence is also valid for ***Measure stator 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)

I.005 Dig input 6 cfg (Digital input 6 configuration)

I.006 Dig input 7 cfg (Digital input 7 configuration)

I.007 Dig input 8 cfg (Digital input 8 configuration)

The regulation board provides as standard 8 opto-coupled digital inputs. A PNP or NPN logic level, can be selected according to figure 5.5.1.2. 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. *See paragraph 7.6, P.001.*
3	**Ext Fault NO**	External fault with NO (Normal Open) contact. *See paragraph 7.6, P.400.*
4	**Ext Fault NC**	External fault with NC (Norm. Closed) contact. *See paragraph 7.6, P.400.*
5	**Alarm reset**	Alarm reset command. *See paragraph 9.2 .*
6	**Jog**	JOG frequency reference enabling. *See paragraph 7.5, F.116.*
7	**Freq sel 1**	Binary selection for Multispeed. *See paragraph 7.5, F.100 ... F.115.*
8	**Freq sel 2**	Binary selection for Multispeed. *See paragraph 7.5, F.100 ... F.115.*
9	**Freq sel 3**	Binary selection for Multispeed. *See paragraph 7.5, F.100 ... F.115.*
10	**Freq sel 4**	Binary selection for Multispeed. *See paragraph 7.5, F.100 ... F.115.*
11	**Ramp sel 1**	Binary selection for Multiramp. *See paragraph 7.5, F.100 ... F.115.*
12	**Ramp sel 2**	Binary selection for Multiramp. *See paragraph 7.5, F.100 ... F.115.*
13	**Enable NO**	Drive Enable with NO (Normal Open) contact. *See paragraph 7.6, P.004.*
14	**Enable NC**	Drive Enable with NC (Norm. Closed) contact. *See paragraph 7.6, P.004.*
15	**DCBrake en**	Enabling of the DC braking function. *See paragraph 7.6, DC Brake Configuration section.*
16	**DCBrake**	Command for execution of DC braking. *See paragraph 7.6, DC Brake Configuration section.*
17	**Autocapture**	Command for execution of Autocapture. *See paragraph 7.6, Autocapture function section.*
18	**Ramp enable**	Enabling / Disabling of the Ramp block. *See paragraph 7.5 .*
19	**Zero ref**	Force the frequency reference to zero. *See paragraph 7.5 .*
20	**PID enable**	Enabling of the PID regulation. *See paragraph 7.7, PID setting section.*
21	**PID freeze**	PID freeze command. *See paragraph 7.7, PID setting section.*
22	**PID gain sel**	Selection of the set of PID gains. *See paragraph 7.7, PID setting section.*
23	**Motorpot Up**	Motorpotentiometer reference increasing command. *See paragraph 7.5, Motorpotentiometer section.*

24	**Motorpot Dn**	Motorpotentiometer reference decreasing command. *See paragraph 7.5, Motorpotentiometer section.*
25	**Reset Motorp**	Reset of Motorpotentiometer reference. *See paragraph 7.5, Motorpotentiometer section.*
26	**Fast stop**	Emergency stop command (with ramp time F.206). *See paragraph 7.5 .*
27	**Zero freq**	Output frequency forced to zero, following the ramp programmed for Fast stop (F.206). The inverter will remain enabled even after the frequency has reached the zero value. *See paragraph 7.5 .*
28	**Stop(3wires)**	STOP (NC) function. Active when P.001 = [2] 3 Wires. *See paragraph 7.6, P.001.*
29	**Local/Remote**	START/STOP commands from keypad (Local) or from the source specified by P.000 (Remote). *See paragraph 7.6, P.000.*
30	**En lim Steady**	Activate the current regulator to stationary state. *See paragraph 7.6, P.202.*

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.000	Dig input 1 cfg	*See Digital inputs selection list*	7	0	30			100
I.001	Dig input 2 cfg	As for I.000	8	0	30			101
I.002	Dig input 3 cfg	As for I.000	28	0	30			102
I.003	Dig input 4 cfg	As for I.000	6	0	30			103
I.004	Dig input 5 cfg	As for I.000	5	0	30			104
I.005	Dig input 6 cfg	As for I.000	1	0	30			105
I.006	Dig input 7 cfg	As for I.000	1	0	30			106
I.007	Dig input 8 cfg	As for I.000	2	0	30			107

Factory settings for digital inputs are as follows:

Dig input 1 cfg (Terminal 22) = **7 Freq sel 1**
Dig input 2 cfg (Terminal 23) = **8 Freq sel 2**
Dig input 3 cfg (Terminal 24) = **28 Stop (3Wires)**
Dig input 4 cfg (Terminal 25) = **6 JOG**
Dig input 5 cfg (Terminal 7) = **5 Alarm reset**
Dig input 6 cfg (Terminal 6) = **13 External fault NO**
Dig input 7 cfg (Terminal 5) = **1 Run**
Dig input 8 cfg (Terminal 4) = **2 Reverse**

Digital Inputs Expansion Board

I.050 Exp dig in 1 cfg (Expansion digital input 1 configuration)

See list associated to I.000, ..., I.007.

I.051 Exp dig in 2 cfg (Expansion digital input 2 configuration)

See list associated to I.000, ..., I.007.

I.052 Exp dig in 3 cfg (Expansion digital input 3 configuration)

See list associated to I.000, ..., I.007.

I.053 Exp dig in 4 cfg (Expansion digital input 4 configuration)

See list associated to I.000, ..., I.007.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.050	Exp dig in 1 cfg	As for I.000	0	0	30			108
I.051	Exp dig in 2 cfg	As for I.000	0	0	30			109
I.052	Exp dig in 3 cfg	As for I.000	0	0	30			110
I.053	Exp dig in 4 cfg	As for I.000	0	0	30			111

Programmable Logic Output

I.070 AND 1 out cfg (AND 1 block output configuration)

I.071 AND 2 out cfg (AND 2 block output configuration)

I.072 AND 3 out cfg (AND 3 block output configuration)

I.073 OR 1 out cfg (OR1 block output configuration)

I.074 OR 2 out cfg (OR 2 block output configuration)

I.075 OR 3 out cfg (OR 3 block output configuration)

I.076 NOT 1 out cfg (NOT 1 block output configuration)

I.077 NOT 2 out cfg (NOT 2 block output configuration)

I.078 NOT 3 out cfg (NOT 3 block output configuration)

I.079 NOT 4 out cfg (NOT 4 block output configuration)

See the list of selections associated to standard digital inputs (I.000 ... I.007).
For more information see chapter 7.7 (A.300 ... A.315)

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.070	AND 1 out cfg		0	0	30			186
I.071	AND 2 out cfg		0	0	30			187
I.072	AND 3 out cfg		0	0	30			188
I.073	OR 1 out cfg		0	0	30			189
I.074	OR 2 out cfg		0	0	30			190
I.075	OR 3 out cfg		0	0	30			191
I.076	NOT 1 out cfg		0	0	30			192
I.077	NOT 2 out cfg		0	0	30			193
I.078	NOT 3 out cfg		0	0	30			194
I.079	NOT 4 out cfg		0	0	30			195

Digital Ouputs Regulation Board

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

I.101 Dig output 2 cfg (Digital output 2 configuration)

I.102 Dig output 3 cfg (Digital output 3 configuration)

I.103 Dig output 4 cfg (Digital output 4 configuration)

The regulation board provides as standard, 2 static opto-coupled digital outputs in Open Collector configuration and 2 relays with commutation contacts (see figure 5.5.1.1).
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**	Alarm signalling (Positive logic)
2	**Not in alarm**	Alarm signalling (Negative logic)
3	**Motor run**	RUN command active or output frequency ≠ 0Hz
4	**Motor stop**	RUN command not active and output frequency = 0Hz

5	**REV rotation**	Counter-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**	The drive has tripped for UV, and automatic restart is taking place.
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
12	**Limit active**	General signalling of drive limit condition
13	**Autocapt run**	Autocapture in progress
14	**BU overload**	Set when the integrator ***d.054* = 100%**, and Reset when ***d.054* = 0%**.
15	**Neg pwrfact**	Negative inverter output power factor
16	**PID err ><**	PID error is within the limits defined by ***A.058*** and **A.059**
17	**PID err>thr**	PID error is greater than ***A.058***
18	**PID err<thr**	PID error is less than or equal to ***A.059***
19	**PIDer><(inh)**	PID error is within the limits defined by ***A.058*** and **A.059** (*)
20	**PIDerr>(inh)**	PID error is greater than ***A.058*** (*)
21	**PIDerr<(inh)**	PID error is less than or equal to ***A.059*** (*)
22	**FWD enc rot**	Clockwise rotation of the encoder
23	**REV enc rot**	Counter-clockwise rotation of the encoder
24	**Encoder stop**	Encoder not rotating
25	**Encoder run**	Encoder is rotating
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 within the range defined by ***P.440*** and ***P.441***
30	**freq!=thr1**	Output frequency outside the range defined by ***P.440*** and ***P.441***
31	**freq>thr1**	Output frequency above the values defined by ***P.440*** and ***P.441***
32	**freq<thr1**	Output frequency below the values defined by ***P.440*** and ***P.441***
33	**freq=thr2**	Output frequency within the range defined by ***P.442*** and ***P.443***
34	**freq!=thr2**	Output frequency outside the range defined by ***P.442*** and ***P.443***
35	**freq>thr2**	Output frequency above the values defined by ***P.442*** and ***P.443***
36	**freq<thr2**	Output frequency below the values defined by ***P.442*** and ***P.443***
37	**HS temp=thr**	Heatsink temp within the range defined by ***P.480*** and ***P.481***
38	**HS temp!=thr**	Heatsink temp outside the range defined by ***P.480*** and ***P.481***
39	**HS temp>thr**	Heatsink temp above the threshold defined by ***P.480*** and ***P.481***
40	**HS temp<thr**	Heatsink temp below the threshold defined by ***P.480*** and ***P.481***
41	**Output freq**	Square wave synchronized with the inverter output frequency
42	**Out freq x 2**	Square wave synchronized with twice the inverter output frequency
43	**CoastThrough**	Kinetic energy recovering during mains loss
44	**EmgStop**	Emergency stop after mains loss detection.
45	**DC Braking**	DC braking in progress
46	**Drv OL status**	Set when the integrator ***d.051* = 100%**, and Reset when ***d.051* = 0%**.
47	**Drv OL warn**	Set if ***d.051*** is greater or equal to 90%.
48	**Mot OL state**	Set when the integrator ***d.052* = 100%**, and Reset when ***d.052* = 0%**.
49	**False**	False assume value 0
50	**True**	True assume value 1
51	**Reserved**	
52	**Reserved**	
53	**Reserved**	
54	**Reserved**	
55	**Reserved**	
56	**DI 1**	State of digital input 1
57	**DI 2**	State of digital input 2
58	**DI 3**	State of digital input 3
59	**DI 4**	State of digital input 4
60	**DI 5**	State of digital input 5
61	**DI 6**	State of digital input 6
62	**DI 7**	State of digital input 7
63	**DI 8**	State of digital input 8

64	**Exp DI 1**	Digital input 1 expansion state
65	**Exp DI 2**	Digital input 2 expansion state
66	**Exp DI 3**	Digital input 3 expansion state
67	**Exp DI 4**	Digital input 4 expansion state
68	**AND 1 out**	Output block AND 1 state
69	**AND 2 out**	Output block AND 2 state
70	**AND 3 out**	Output block AND 3 state
71	**OR 1 out**	Output block OR 1 state
72	**OR 2 out**	Output block OR 2 state
73	**OR 3 out**	Output block OR 3 state
74	**NOT 1 out**	Output block NOT 1 state
75	**NOT 2 out**	Output block NOT 2 state
76	**NOT 3 out**	Output block NOT 3 state
77	**NOT 4 out**	Output block NOT 4 state

(*) see chapter 7.7, section PID Limit.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.100	Dig output 1 cfg	*See Digital Outputs selection list*	0	0	77			112
I.101	Dig output 2 cfg	As for I.100	6	0	77			113
I.102	Dig output 3 cfg	As for I.100	3	0	77			114
I.103	Dig output 4 cfg	As for I.100	1	0	77			115

Factory settings for Digital Outputs are as follows:

Dig output 1 cfg - opto coupled type (Terminal 16) = **0 Drive ready**
Dig output 2 cfg - opto coupled type (Terminal 17) = **6 Steady state**
Dig output 3 cfg - relay type (Terminal 18 - 19 - 20) = **3 Motor running**
Dig output 4 cfg - relay type (Terminal 1 - 2 - 3) = **1 Allarm state**

Digital Outputs Expansion Board

I.150 Exp DigOut 1 cfg (Expansion Digital Output 1 configuration)

See list associated to ***I.100, ..., I.103***.

I.151 Exp DigOut 2 cfg (Expansion Digital Output 2 configuration)

See list associated to ***I.100, ..., I.103***.

I.152 Exp DigOut 3 cfg (Expansion Digital Output 3 configuration)

See list associated to ***I.100, ..., I.103***.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.150	Exp DigOut 1 cfg	*See Digital Outputs selection list*	0	0	77			116
I.151	Exp DigOut 2 cfg	As for I.100	0	0	77			117
I.152	Exp DigOut 3 cfg	As for I.100	0	0	77			180

Analog Inputs Regulation Board

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

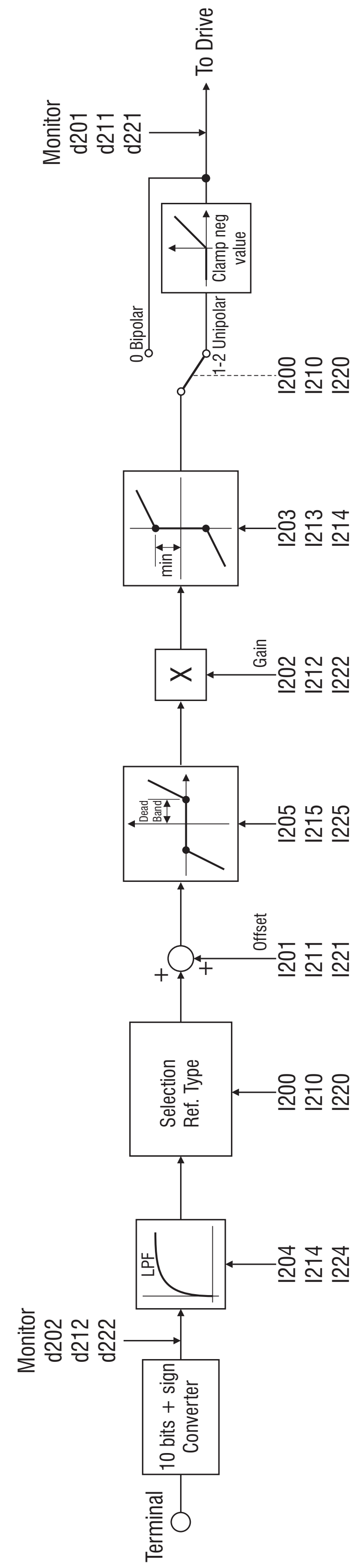


Figure 7.4.1: Analog Inputs

The regulation board provides as standard 3 analog inputs.

Analog inputs resolution:
voltage input setting: 11 bits (10 bits + sign)
current input setting: 10 bits

A typical connection is reported in figure 5.5.1.1.

Each analog input can be programmed to execute any of the functions below:

[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 **PARAMETERS**, section ***Ramp Config (F.260)***
[8] Freq ref fact	frequency reference factor	chapter **FREQ & RAMP**, section ***F.080***
[9] SpdPI LimFac	Level of speed PI limit	chapter **PARAMETERS,** section ***Closed Loop Speed Control***
[10] Mlt frq ch 1	Multi frequency reference 1	chapter **FREQ & RAMPS,** section ***Reference sources (F.060)***
[11] Mlt frq ch 2	Multi frequency reference 2	chapter **FREQ & RAMPS,** section ***Reference sources (F.061)***

Programming logic for the Analog Input function is "destination to source".
For example, to program an analog input as drive frequency reference, the user needs to properly set the parameter associated to the selection of the source for the frequency reference (F.050 or F.051, as shown in figure 7.5.1).
The function currently associated to any of the analog inputs can be monitored through parameters ***d.200***, ***d.210***, ***d.220***.

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

Setting of the characteristic of Analog Input 1 (voltage input).

I.200 = 0 Bipolar -/+10V
I.200 = 1 Unipolar +10V
I.200 = 2 Not used

I.210 An In 2 type (Analog Input 2 type)

Setting of the characteristic of Analog Input 2 (voltage input).

I.210 = 0 Bipolar -/+10V
I.210 = 1 Unipolar +10V
I.210 = 2 Not used

I.220 An In 3 type (Analog Input 3 type)

Setting of the characteristic of Analog Input 3 (current input).

I.220 = 0 Not used
I.220 = 1 0…20mA
I.220 = 2 4…20mA

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

I.211 An In 2 offset (Analog Input 2 offset)

I.221 An In 3 offset (Analog Input 3 offset)

It is used to add an offset to the characteristic of the related Analog Input.

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

I.212 An In 2 gain (Analog Input 2 gain)

I.222 An In 3 gain (Analog Input 3 gain)

Gain of the analog input.
It is used to amplify or to attenuate the analog signal at the related terminal.

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

I.213 **An In 2 minimum** (Analog Input 2 minimun)

I.223 **An In 3 minimum** (Analog Input 3 minimun)

It defines the minimum value of the output of the related analog input block (see figure 7.4.3).

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

I.214 **An In 2 filter** (Analog Input 2 filter)

I.224 **An In 3 filter** (Analog Input 3 filter)

It is the time costant of the digital filtering performed on the related Analog Input.
By using the above described parameters, it is possible to customize the input/output characteristic of each Analog input block.
Some samples are reported In the figures below.

I.205 **An In 1 DeadBand** (Analog input 1 dead band)

I.215 **An In 2 DeadBand** (Analog input 2 dead band)

I.225 **An In 3 DeadBand** (Analog input 3 dead band)

Dead band of the corresponding analog input. When the input at the terminal is below the threshold defined by the parameter, the output of the Analog input block is kept to zero. Outside the dead band, the output varies linearly from zero to 100%. (Refer to figure 7.4.5).

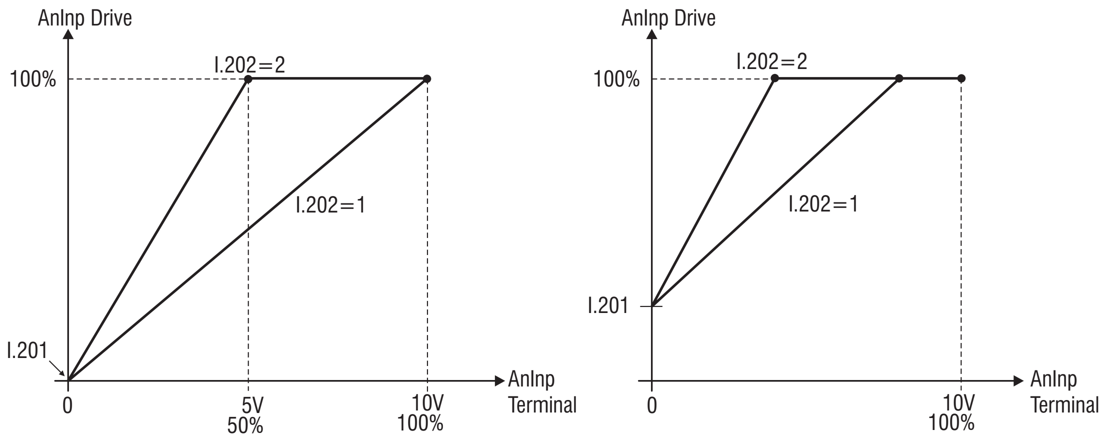


Figure 7.4.2: Analog input characteristic with offset and gain

$$\text{An Inp Drive [\%]} = \text{I.202} \times \left(\text{An Inp Terminal [\%]} + \text{I.201}\right)$$

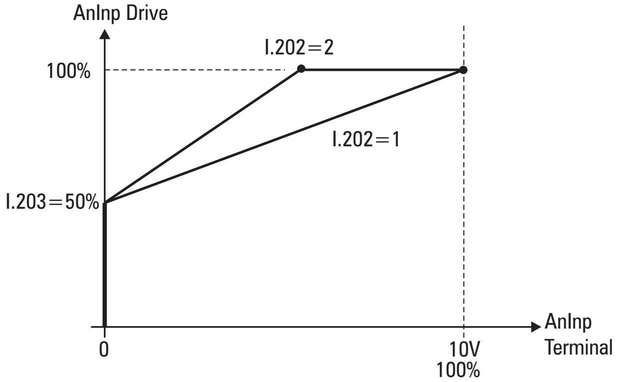


Figure 7.4.3: Analog input characteristic with minimum value, offset and gain (unipolar)

$$An\ Inp\ Drive\ [\%] = I.203 + \frac{100 - I.203}{100} \times I.202 \times \left(An\ Inp\ Terminal\ [\%] + I.201\right)$$

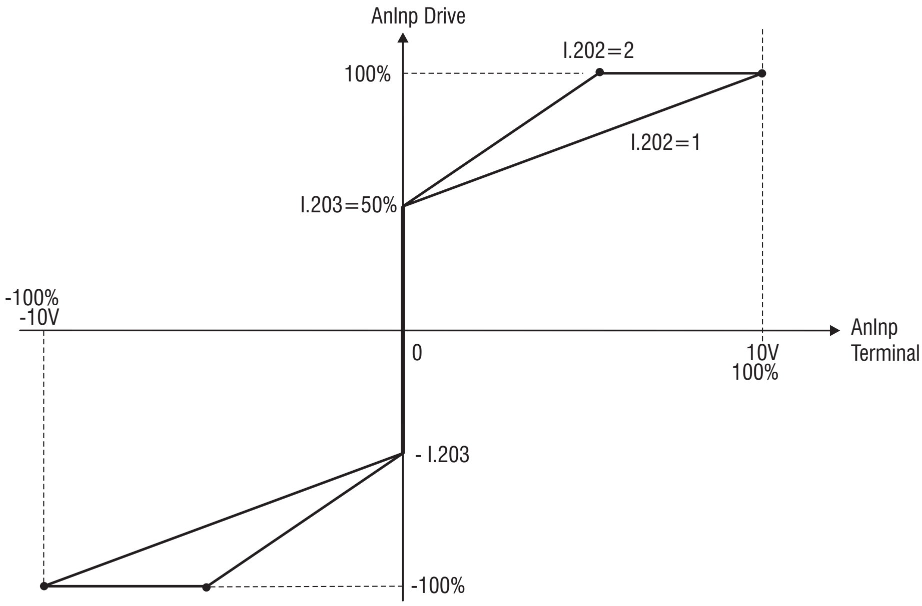


Figure 7.4.4:Analog input characteristic with minimum value, offset and gain (bipolar)

Note! When the analog input reference is set to 0V, an eventual "noise" can cause undesired speed oscillation between positive and negative values of ***I.203*** parameter.

$$An\ Inp\ Drive\ [\%] = I.203 \times signum \left[I.202 \times \left(An\ Inp\ Terminal\ [\%] + I.201\right)\right] + \frac{100 - I.203}{100} \times I.202 \times \left(An\ Inp\ Terminal\ [\%] + I.201\right)$$

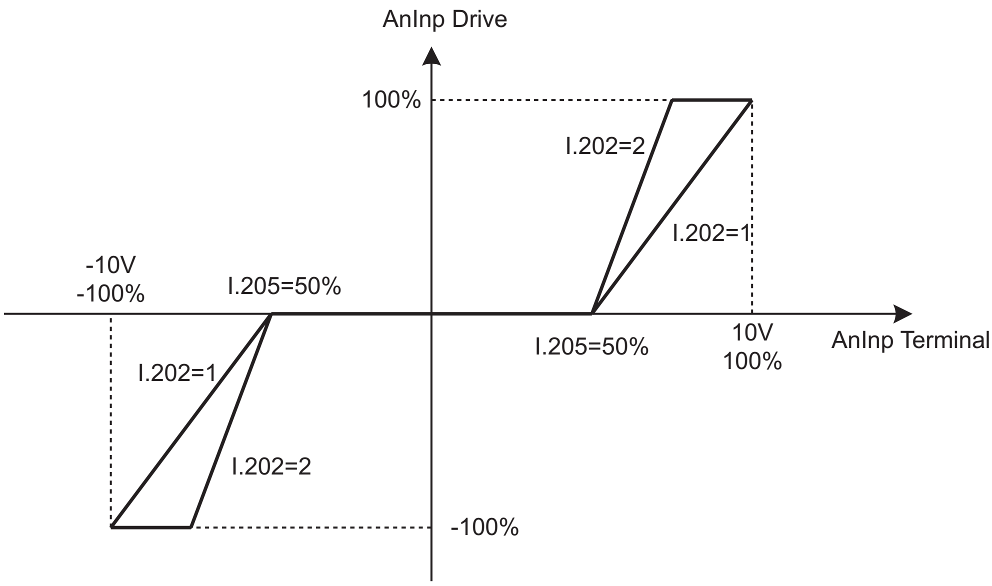


Figure 7.4.5: Analog input characteristic with dead band

$$AnInpDrive\ [\%] = \begin{cases} 0 & \text{for } |AnInp[\%]| \leq I.205 \\ \dfrac{100}{100 - I.205} \times (AnInp\ [\%] - I.205) & \text{for } |AnInp[\%]| > I.205 \end{cases}$$

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.200	An in 1 Type	[0] ±10V [1] 0...10V / 0...20mA	1	0	1			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
I.205	An In 1 DeadBand		0	0	99.9	%	0.1	182
I.210	An in 2 Type	[0] ±10V [1] 0...10V / 0...20mA	0	0	1			123
I.211	An in 2 offset		0	-99.9	99.9	%	0.1	124
I.212	An in 2 gain		1	-9.99	9.99		0.01	125
I.213	An in 2 minimum		0	0	99.99	%	0.01	126
I.214	An in 2 filter		0.1	0.001	0.25	sec	0.001	127
I.215	An In 2 DeadBand		0	0	99.9	%	0.1	183
I.220	An in 3 Type	[1] 0...10V / 0...20mA [2] 4...20mA	1	1	2			128
I.221	An in 3 offset		0	-99.9	99.9	%	0.1	129
I.222	An in 3 gain		1	-9.99	9.99	%	0.01	130
I.223	An in 3 minimum		0	0	99.99	%	0.01	131
I.224	An in 3 filter		0.1	0.001	0.25	sec	0.001	132
I.225	An In 3 DeadBand		0	0	99.9	%	0.1	184

Analog Outputs Regulation Board

The figure below, describes the block diagram of the standard Analog Outputs of the drive

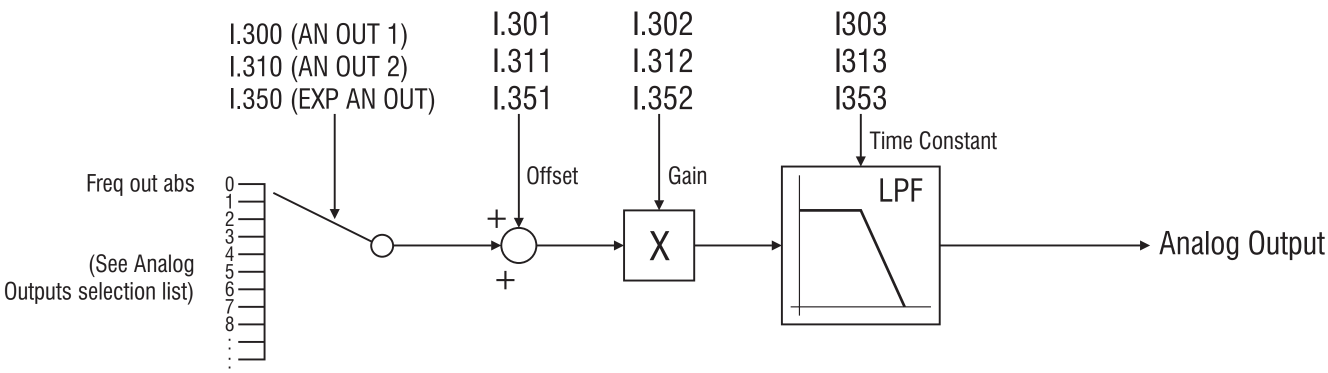


Figure 7.4.6: Analog Ouputs

The regulation board provides as standard 2 analog outputs.

Analog output resolution: 10 bits

A typical connection is reported in the figure 5.5.1.1.

Both analog outputs, can provide a full scale signal **0V / +10Vdc** (absolute and positive) or **+/-10Vdc** (generic setting), according to the parameter assigned .

I.300 **Analog out 1 cfg** (Analog output 1 configuration)

I.310 **Analog out 2 cfg** (Analog output 2 configuration)

Each output is programmable with a specific code and function, as shown in the list below.

ANALOG OUTPUTS SELECTION LIST:

Code	*LCD display*	*Description*
0	**Freq out abs**	Output Frequency, absolute value
1	**Freq out**	Output Frequency
2	**Output curr**	Output Current
3	**Out voltage**	Output Voltage
4	**Out trq pos**	Output Torque, positive value (negative values are clamped to zero)
5	**Out trq abs**	Output Torque, absolute value
6	**Out trq**	Output Torque
7	**Out pwr pos**	Output Power, positive value (negative values are clamped to zero)
8	**Out pwr abs**	Output Power, absolute value
9	**Out pwr**	Output Power
10	**Out PF**	Output Power Factor
11	**Enc freq abs**	Encoder frequency, absolute value
12	**Encoder freq**	Encoder frequency
13	**Freq ref abs**	Frequency reference, absolute value
14	**Freq ref**	Frequency reference
15	**Load current**	Load Current
16	**Magn current**	Motor Magnetizing Current
17	**PID output**	PID regulator output
18	**DClink volt**	DC bus capacitors level
19	**U current**	Output phase U current signal
20	**V current**	Output phase V current signal
21	**W current**	Output phase W current signal
22	**Freq ref fac**	Frequency reference factor

I.301 **An out 1 offset** (Analog output 1 offset)

I.311 **An out 2 offset** (Analog output 2 offset)

It is used to add an offset to the related analog output. See figure 7.4.6.

I.302 **An out 1 gain** (Analog output 1 gain)

I.312 **An out 2 gain** (Analog output 2 gain)

Gain of the analog output.
It can be used to amplify or attenuate the input value of the related analog output block. See figure 7.4.6.

I.303 **An out 1 filter** (Analog output 1 filter)

I.313 **An out 2 filter** (Analog output 2 filter)

It is the time costant of the digital filtering performed on the related Analog output. See fig.7.4.6.

By using the above described parameters, it is possible to customize the input/output characteristic of each Analog output block, as shown below. For brevity, only parameters related to AnOut1 are considered, but the same applies to Analog output 2.

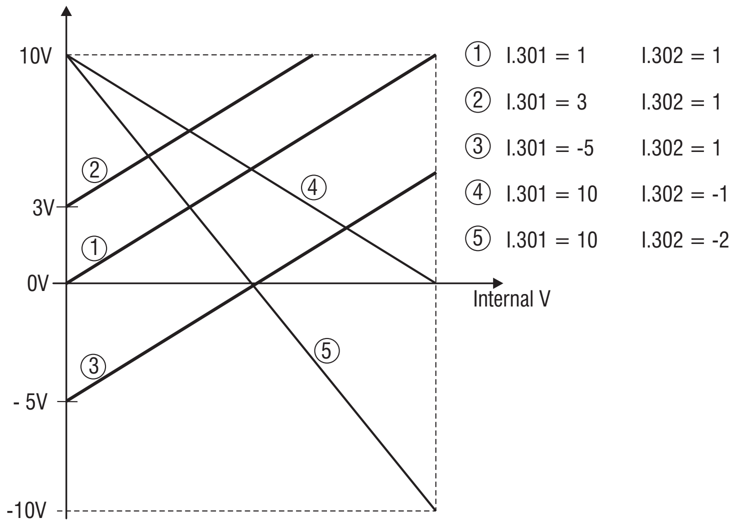


Figure 7.4.7: Scaling References and Minimum Values

$$Vout = 10 \times \left(\frac{Stp\ Var}{Fs\ Var} \times I.302 \right) + I.301$$

Where:
Vout output voltage at board terminals
Stp Var actual variable value (units of the variable)
Fs Var full scale of the variable (units of the variable)

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.300	Analog out 1 cfg	*See Analog outputs selection list*	0	0	22			133
I.301	An out 1 offset		0	-9.99	9.99		0,01	134
I.302	An out 1 gain		1	-9.99	9.99		0.01	135
I.303	An out 1 filter		0	0	2,5	sec	0.01	136
I.310	Analog out 2 cfg	As for I.300	2	0	22			137
I.311	An out 2 offset		0	-9.99	9.99		0.01	138
I.312	An out 2 gain		1	-9.99	9.99		0.01	139
I.313	An out 2 filter		0	0	2.5	sec	0.01	140

The table below shows the analog outputs scaling.

CODE	Variable	Full scale value (±10V)
0	Freq out abs	F.020 x P.080/100 [Hz] (Maximum output frequency)
1	Freq out	Same as CODE 0
2	Output curr	2 x D.950 [Arms] (2 x Inverter rated current)
3	Out voltage	P.061 [Vrms] (Maximum output voltage)
4	Out trq pos	2 x Motor rated torque [Nm]
5	Out trq abs	Same as CODE 4
6	Out trq	Same as CODE 4
7	Out pwr pos	2 x Motor rated power [W]
8	Out pwr abs	2 x Motor rated power [W]
9	Out pwr	2 x Motor rated power [W]
10	Out PF	Power factor = 1
11	Enc freq abs	F.020 x P.080/100 [Hz] (Maximum output frequency)
12	Encoder freq	F.020 x P.080/100 [Hz] (Maximum output frequency)
13	Freq ref abs	F.020 x P.080/100 [Hz] (Maximum output frequency)
14	Freq ref	F.020 x P.080/100 [Hz] (Maximum output frequency)
15	Load current	Same as CODE 2
16	Magn current	Same as CODE 2
17	PID output	100% of the PID ouput
18	DClink volt	990Vdc (AGy 400…460Vac) - 1250Vdc (AGy 575Vac)
19	U current	Same as CODE 2
20	V current	Same as CODE 2
21	W current	Same as CODE 2
22	Freq ref fac	Factor = 2

Analog Outputs Exp Board

I.350 **Exp An out 1 cfg** (Expansion analog output 1 configuration)

See description of I.300, I.310.

I.351 **Exp AnOut 1 offs** (Expansion Analog Output 1 offset)

See description of I.301, I.311.

I.352 **Exp AnOut 1 gain** (Expansion Analog Output 1 gain)

See description of I.302, I.312.

I.353 **Exp AnOut 1 filt** (Expansion Analog Output 1 filter)

See description of I.303, I.313.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.350	Exp an out 1 cfg	As for I.300	3	0	22			141
I.351	Exp AnOut 1 offs		0	-9.99	9.99		0.01	142
I.352	Exp AnOut 1 gain		1	-9.99	9.99		0.01	143
I.353	Exp AnOut 1 filt		0	0	2.5	sec	0.01	144

Enabling Virtual I/O

By using "virtual I/O", it is possible to mix digital inputs actually coming from terminals of the regulation board with a string of virtual digital inputs directly controlled via serial line or fieldbus.

Likewise, it is possible to control some of the drive digital and analog outputs directly from serial line or fieldbus.

It is possible to configure the drive so that some commands come from digital input terminals of the regulation board (terminal digital inputs), while others come from serial line or fieldbus, by writing the dedicated parameters ***H.000*** and ***H.001*** (virtual digital inputs).

The selection between terminals and virtual digital inputs is determined by the binary code written in the mask parameters ***I.400, I.410***.

Digital outputs at the terminals of the regulation board are normally driven by the drive, according to the functions programmed by the parameters ***I.000*** to ***I.152***. However, it is possible to drive any of the digital outputs on the regulation board directly from serial line or fieldbus, by writing the virtual digital outputs ***H.010, H.011.***

Whether to use the virtual settings or not is determined by mask parameters ***I.420, I.430***.

Using "virtual assignation" the analogical inputs from the terminal board of the regulator board can be combined with the virtual analogical entries controlled through the serial line or through the bus field.

The analogical output can also be directed directly through the series line or the bus field (virtual analogical outputs).

Mask parameters have to be managed bitwise. Each bit corresponds to a switch, according to the following logic.

Mask Bit i	DI i source	DO i source
0	Terminal	Drive function
1	Virtual	Virtual control

VIRTUAL DIGITAL INPUTS CONFIGURATION

Selection logics for digital input is described by the following figure:

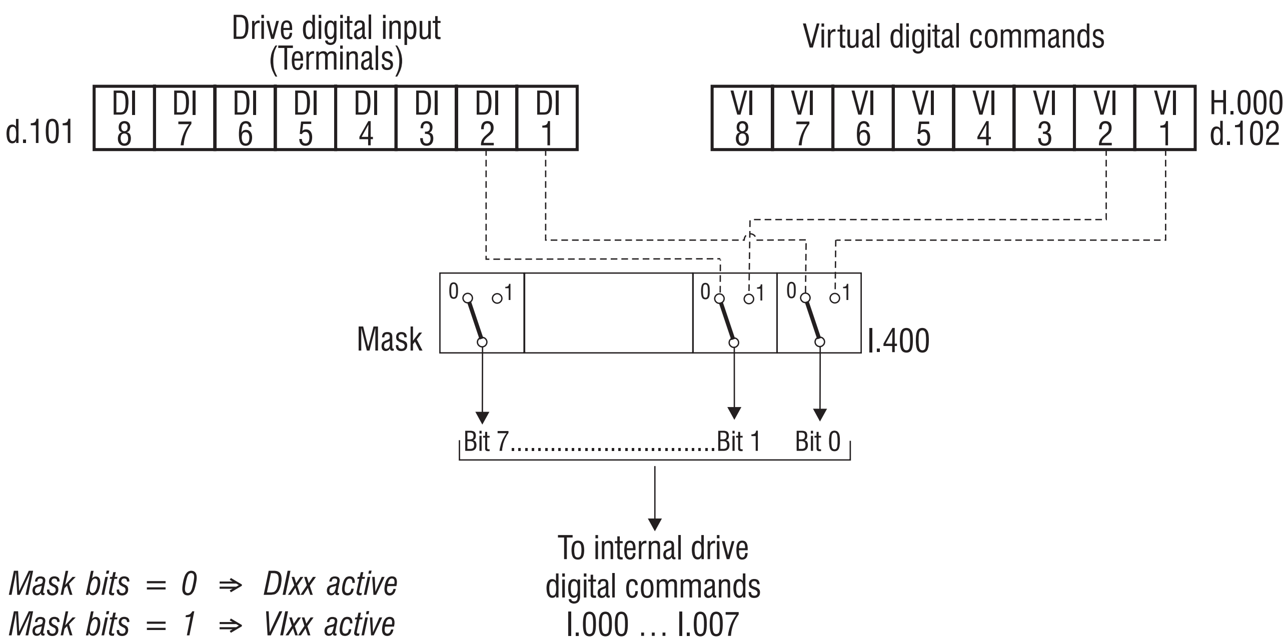


Figure 7.4.8: Virtual digital inputs configuration

VIRTUAL DIGITAL OUTPUTS CONFIGURATION

Selection logics for digital output is described by the following figure:

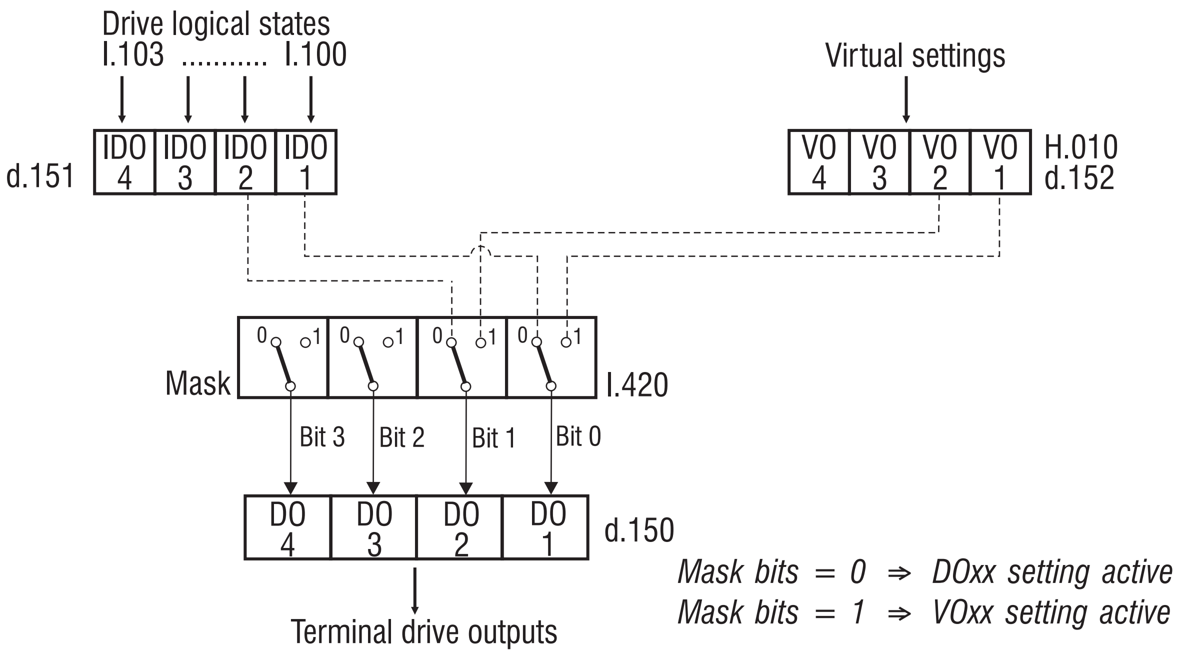


Figure 7.4.9: Virtual digital outputs configuration

VIRTUAL ANALOG INPUTS CONFIGURATION

Selection logic for analog inputs is described by the following figure:

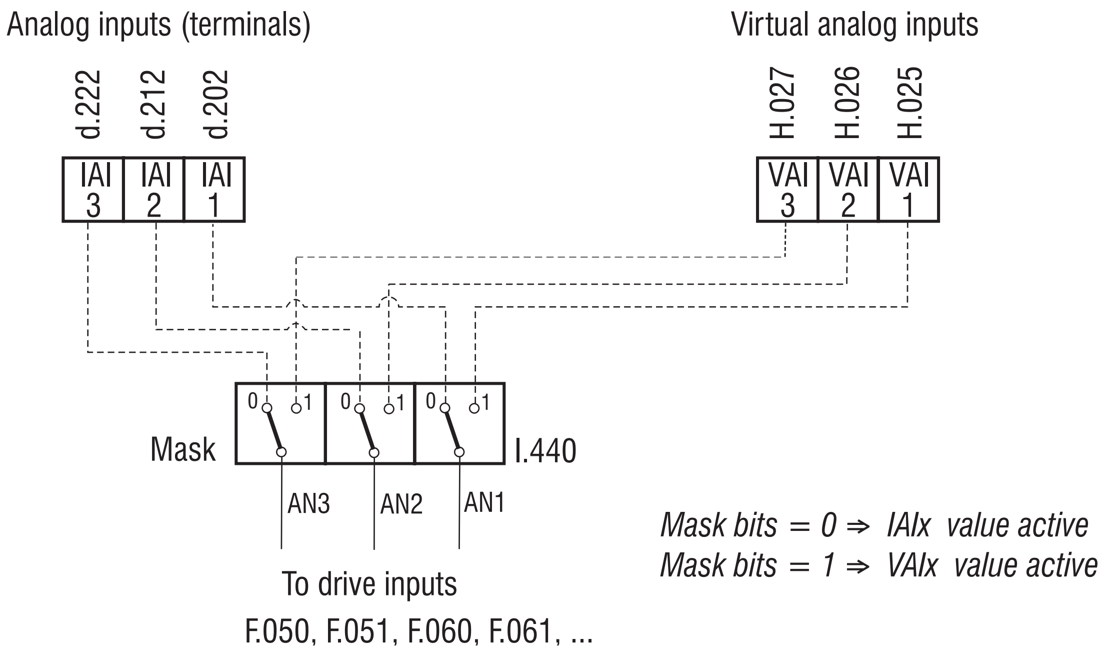


Figure 7.4.10: Virtual analog inputs configuration

VIRTUAL ANALOG OUTPUTS CONFIGURATION

Analog outputs at the terminals of the regulation board are normally written by the drive, according to the settings of parameters ***I.300***, ***I.310***, ***I.320***. However, it is possible to control the analog outputs directly from serial line or fieldbus, by writing parameters ***H.020, H.021, H.022*** .

Switching between internal and virtual source for analog output is determined by the mask parameter ***I.450***, according to the following figure

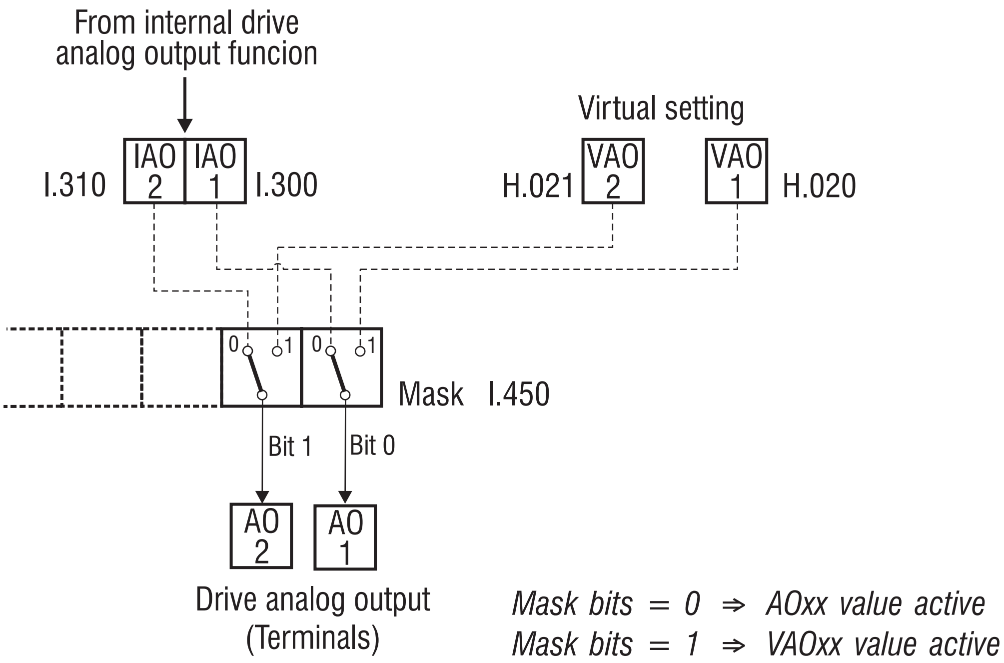


Figure 7.4.11: Virtual analog outputs configuration

Some examples about the programming of basic functions via virtual assignment are given below:

A) DIGITAL INPUTS

Programming example for:

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

P.000 = 2 or 4	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 information on ***H.000*** parameter.

The EXTERNAL FAULT command will be activated by applying +24Vdc to terminal 6 (Digital input 6).

B) DIGITAL OUTPUTS

Programming example for:

- ALARM STATE signalling on Digital output 1
- VIRTUAL SETTING on Digital output 2

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 = X 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

C) ANALOG INPUT

Programming examples for:

- Reference Channel 1 Analog entry 1 Terminal board.
- Reference Channel 2 Virtual analog input 2

F.050 = 1 Freq ref 1 Programmed in analog input 1
F.051 = 2 Freq ref 2 Programmed as analog input 2
I.440 = 2 Bit 1 is "high" (1) and Bit 2 is "low" (0)

Writing ***H.026*** = +32767 Freq ref 2 = F.020
Writing ***H.026*** = +0 Freq ref 2 = 0

D) ANALOG OUTPUTS

Programming example for:

- OUTPUT FREQUENCY signalling on Analog output 1
- VIRTUAL SETTING on Analog output 2

I.450 = 2 bit 1 is high (1) and bit 0 is low (0)
I.300 = 0 OUTPUT FREQUENCY (programmed on analog output 1)
I.310 = X ANY SELECTION (programmed on analog output 2)

Analog output 1 signal proportional to the OUTPUT FREQUENCY of the drive
Analog output 2 signal proportional to the setting of ***H.021***

H.021*:* *+ 32767 output = +10V*
H.021*:* *- 32767 output = - 10V*

I.400 Inp by serial en

Bitwise mask parameter for virtual digital input. The state of each one of the bits in this mask determines if the corresponding digital input function of the drive (programmed by I.000 ... I.007) has to be associed to the virtual digital input or to the terminal digital input. The value which must be assigned to the mask is the equivalent decimal of the binary code defined by the state of each switch, according to the following:

Mask:	= 1	Bit 0 = 1	Virtual input 1 enabling
	= 2	Bit 1 = 1	Virtual input 2 enabling
	= 4	Bit 2 = 1	Virtual input 3 enabling
	= 8	Bit 3 = 1	Virtual input 4 enabling
	= 16	Bit 4 = 1	Virtual input 5 enabling
	= 32	Bit 5 = 1	Virtual input 6 enabling
	= 64	Bit 6 = 1	Virtual input 7 enabling
	= 128	Bit 7 = 1	Virtual input 8 enabling

Example: if we want to use virtual input 3 and virtual input 6, the value to be written to the mask is (4 + 32) = 36.

I.410 Exp in by ser en (Enabling of Expansion inputs via serial line)

Bitwise mask parameter for expansion virtual digital input. The state of each one of the bits in this mask determines if the corresponding digital input function of the drive (programmed by I.050 ... I.053) has to be associed to the expansion virtual digital input or to the expansion board digital input terminal. The value which must be assigned to the mask is the equivalent decimal of the binary code defined by the state of each switch, as described for parameter I.400.

I.420 Out by serial en (Enabling of Outputs via serial line)

Bitwise mask parameter for virtual digital output. The state of each one of the bits in this mask determines if the corresponding digital output terminal of the regulation board is controlled by the drive function (programmed by I.100 ... I.103) or by the virtual digital output. The value which must be assigned to the mask is the equivalent decimal of the binary code defined by the state of each switch, according to the following:

Mask:	= 1	Bit 0 = 1	Virtual output 1 enabling
	= 2	Bit 1 = 1	Virtual output 2 enabling
	= 4	Bit 2 = 1	Virtual output 3 enabling
	= 8	Bit 3 = 1	Virtual output 4 enabling

Example: if we want to use virtual output 1 and virtual output 3, the value to be written to the mask is (1 + 4) = 5.

I.430 Exp OutBySer en (Enabling of Expansion Outputs via serial line)

Bitwise mask parameter for expansion virtual digital output.The state of each one of the bits in this mask determines if the corresponding digital output terminal of the regulation board is controlled by the drive function (programmed by I.150 ... I.152) or by the expansion virtual digital output.The value which must be assigned to the mask is the equivalent decimal of the binary code defined by the state of each switch, as described for parameter I.420 (Bit 0, Bit1and Bit 2).

I.440 An inp by ser en (Enabling of analog inputs via serial line)

Bitwise mask parameter for virtual analog input. The state of each one of the bits in this mask determines if the corresponding function of the drive has to be associated with the virtual analogical input or with the analogical input of the terminal board. The value which must be assigned to the mask is the equivalent decimal of the binary code defined by the state of each switch with respect to:

Mask:	= 1	Bit 0 = 1	Virtual input 1 enabling
	= 2	Bit 1 = 1	Virtual input 2 enabling
	= 4	Bit 2 = 1	Virtual input 3 enabling
	= 8	Bit 3 = 1	Virtual input 4 enabling

I.450 An out by ser en (Enabling of Analog outputs via serial line)

Bitwise mask parameter for virtual analog output. The status of each bit of this mask determines whether the corresponding analog output terminal of the regulation board is controlled by the drive function (programmed by I.300, I.310, I.350) or by the virtual analog output. The value which must be assigned to the mask is the equivalent decimal of the binary code defined by the state of each switch, according to the following:

Mask:	= 1	Bit 0 = 1	Virtual analog output 1 enabling
	= 2	Bit 1 = 1	Virtual analog output 2 enabling
	= 16	Bit 4 = 1	Virtual expansion analog output 1 enabling

Code	Name	Selection	Default	MIN	MAX	Unit	Variation	IPA
I.400	Inp by serial en		0	0	255			145
I.410	Exp in by ser en		0	0	15			146
I.420	Out by serial en		0	0	15			147
I.430	Exp OutBySer en		0	0	3			148
I.440	Ab In An da ser		0	0	255			196
I.450	An out by ser en		0	0	255			149

Encoder Configuration

If the optional card EXP-ENC-AGY is mounted, it is possible to read the signals from a digital encoder and use the detected speed as a feedback for closed loop speed control, or as a frequency reference to be tracked by the drive.

AGy can be configured to work with either HTL (+24V) or TTL (5V or 8V) digital encoders having one or two channels, by properly setting the HW switches on the optional card and the drive parameters. Maximum input frequency on each channel is 150kHz. Refer to the EXP-ENC-AGY manual for detailed electrical specifications and encoder wiring procedures.

I.500 **Encoder enable** (Encoder enabling)

Enabling of the encoder reading.

I.501 **Encoder ppr** (Encoder pulses per revolution)

Setting of the encoder nameplate pulses per revolution.

I.502 **Enc channels cfg** (Encoder channels configuration)

Setting of the encoder type. The drive is able to read either single-channel or double-channel encoders.

I.503 **Enc spd mul fact** (Encoder speed multiplier factor)

Multiplier factor of the encoder pulses. This parameter allows for management of an encoder that is not directly mounted on the motor shaft (E.g. an encoder mounted on the “slow shaft side” of a gearbox).
Has no effect on the closed loop speed control (P.010 Type of control = [1] V/f Clsd loop).

I.504 **Enc update time** (Encoder updating time)

Setting of the sampling time of the encoder pulses. The encoder sampling time affects both the measurement accuracy and the dynamics that can be achieved in closed loop speed control. Higher sampling times yield better accuracy on the single speed measurement (more pulses counted at a given speed), but introduce a sampling delay that reduces the dynamics achievable in closed loop speed control.

NOTE! Due to drive logic internal scaling, the encoder sampling time must be set so that the number of pulses counted in the interval defined by I.504 never exceeds 32767.

The following formulas relate the number of encoder pulses read by the drive to the actual motor frequency:

The following formulas are for the calculation of the encoder shaft frequency.

$$F_{mot}[Hz] = N_{puls} \times \frac{P.041\ [polepairs]}{I.501\ [ppr] \times T_c[s] \times I.503\ [factor]} \times \frac{1}{E_c}$$

$$N_{puls} = F_{mot}[Hz] \times \frac{I.501[ppr] \times T_c[s] \times I.503\ [factor]}{P.041\ [polepairs]} \times E_c$$

Motor electrical frequency, expressed in Hz, and motor mechanical speed, expressed in revolutions per minute, are related as follows:

$$n\,[rpm] = \frac{F_{mot}[rpm]\ \times\ 60[s]}{P.041\ [polepair]}\ ; \qquad F_{mot}\,[Hz] = \frac{n\,[rpm] \times P.041\ [polepairs]}{60[s]}$$

Where:

F_{mot}	Motor electrical frequency detected by the encoder.
n	Motor mechanical speed.
T_c	Encoder sampling time, defined by the parameter I.504.
N_{puls}	Number of encoder pulses counted by the drive in the interval (displayed as d.300)
E_c	Factor due to the encoder type: **E_c = 1** if I.502 = [0] One channel **E_c = 4** if I.502 = [1] Two channel

I.505 Enc supply (Encoder power supply)

Setting of the power supply level for the encoder. This parameter determines the voltage level at the power supply terminals of the EXP-ENC-AGY. Therefore, it is important when using TTL encoders, to select 5V or 8V range. Selection between TTL or HTL is performed by setting the switches on the EXP-ENC-AGY, as explained in the manual of the optional card.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
I.500	Encoder enable	[0] Disable [1] Enable	0	0	1			150
I.501	Encoder ppr		1024	0	9999			151
I.502	Enc channels cfg	[0] One Channel [1] Two Channels	1	0	1			152
I.503	Enc spd mul fact		1	0.01	99.99		0.01	153
I.504	Enc update time	[0] 1ms [1] 4ms [2] 16ms T_C [3] 0.25s [4] 1s [5] 5s	0	0	5	sec	0.1	154
I.505	Enc supply	[0] 5.2V [1] 5.6V [2] 8.3V [3] 8.7V	0	0	3			181

Serial Configuration

The AGy provides as standard an RS485 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 Serial Interface), are available on the regulation card.

The parameters and variables can be written and read through the serial line.

It is also possible to give commands to the drive through serial line, by setting the ***Cmd source sel (P.000)*** as follows:

P.000 = 2 Terminal or Virtual

P.000 = 3 Serial

Further information is reported in the chapter **PARAMETER**, section **Commands** .

I.600 Serial link cfg (Serial link configuration)

Selection of the serial line protocol.
Several protocols are available, as shown in the selection list of ***I.600*** at the end of the paragraph.
DEFAULT VALUE = 4 (Modbus protocol)

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

It defines the Baud rate (bit per second) of the serial communication.
Possible selections are shown on the table at the end of the paragraph.

I.602 Device address

Address at which the drive can be accessed if it is networked via the RS485 interface.
The range of the selectable addresses is between **0** and **99.**
As reported in the chapter 5.4 (Serial Line), it is possible to perform a Multidrop configuration with a maximum of 32 devices.

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

Minimum delay setting between the reception of the last byte and the beginning of the corresponding answer.
The delay will help avoid conflicts on the serial line, when the RS485 interface is not preset for an automatic Tx/Rx communication.
The ***Ser answer delay (I.603)*** parameter is specific for the standard serial line RS485.

E.g.: if in the master the communication delay Tx/Rx has a maximum of 20 ms, the setting of ***Ser answer delay (I.603)*** parameter will have to be higher than 20ms: 22ms.

I.604 Serial timeout (Serial link timeout)

Adjust the maximum time permitted after the reception of the two consecutive frames.
If this time elapsed from last activity exceeds the value written in ***I.604***, the drive will behave as programmed by ***I.605.***
Setting ***I.604*** to zero will disable the timeout check.

NOTE! Even if the timeout control function is enabled at the drive power-on, the detection of "St" alarm is temporarily 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	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	4	0	5			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

Options Configuration

I.700 Option 1 type

[0] Board Off	None	
[1] Board master	Reserved	
[2] IO Board	EXP-D6-A1R1-AGy	(Optionals I/O card, code: S524L)
[3] Board free	Reserved	
[4] SBI Board	SBI-PDP-AGy	(Profibus-DP card, code: S5H28)

I.701 Option 2 type

[0] Board Off	None	
[1] Board master	Reserved	
[2] IO Board	EXP-D6-A1R1-AGy	(Optionals I/O card, code: S524L)
[3] Board free	Reserved	
[4] SBI Board	SBI-PDP-AGy	(Profibus-DP card, code: S5H28)

Set up achieved:
I.700 Option 1 type = [2] IO Board
I.701 Option 2 type = [4] SBI Board

Code	LCD display	[Code] & LCD select.		Default	MIN	MAX	Unit	Variation	IPA
I.700	Option 1 type	[0] Board Off	Reserved	0	0	4			161
		[1] Board master	Reserved						
		[2] Scheda IO	EXP-D6-A1R1-AGy						
		[3] Board free	Reserved						
		[4] Scheda SBI	SBI-PDP-AGy						
I.701	Option 2 type	[0] Board Off	Reserved	0	0	4			162
		[1] Board master	Reserved						
		[2] Scheda IO	EXP-D6-A1R1-AGy						
		[3] Board free	Reserved						
		[4] Scheda SBI	SBI-PDP-AGy						

SBI Configuration

In this menu it is possible to perform the configuration of the SBI card.

Detailed information about the filedbus interfacing, is reported in the specific instruction manuals of the SBI cards.

I.750 SBI Address

Setting of the different addresses of the slaves connected to the bus.

I.751 CAN baudrate

CAN Open or DeviceNet baudrate.

I.752 SBI Profibus Mode

Definition of the data exchange structure, between the SBI card of the drive and the Profibus master.

5 different configurations are available: ***PP0-0….PP0-4***

PP0-0	**User defined structure**
PP0-1…PP0-4	Structures in accordance with ***Profidrive profile***

I.753 SBI CAN Mode

Selection of the fieldbus protocol for:
I.753 = 0   OFF
I.753 = 1   CANOpen
I.753 = 2   DeviceNet

I.754 Bus Flt Holdoff (Bus fault hold off from profibus)

A communication drop with the fieldbus master, is detected by the SBI card.
This parameter allows the setting of a delay for the intervention of the BUS FAULT alarm.

If the communication is restored within this time, the drive will continue working. If this time is elapsed and the communication is still missing, an alarm will occur stopping the drive.

If the communication is re-active in the time sets with this parameter, the drive will fault to an alarm storing the "**bF**" code.

During this stage, the information data (received and sent) is frozen at the status prior to the communication drop.
At the restoring of the transmission, the first data sent and received will be the one previously frozen.

I.760 SBI to Drv W 0 (SBI to Drive Word 0)

I.761 SBI to Drv W 1 (SBI to Drive Word 1)

I.762 SBI to Drv W 2 (SBI to Drive Word 2)

I.763 SBI to Drv W 3 (SBI to Drive Word 3)

I.764 SBI to Drv W 4 (SBI to Drive Word 4)

I.765 SBI to Drv W 5 (SBI to Drive Word 5)

I.770 Drv to SBI W 0 (Drive to SBI Word 0)

I.771 Drv to SBI W 1 (Drive to SBI Word 1)

I.772 Drv to SBI W 2 (Drive to SBI Word 2)

I.773 Drv to SBI W 3 (Drive to SBI Word 3)

I.774 Drv to SBI W 4 (Drive to SBI Word 4)

I.775 Drv to SBI W 5 (Drive to SBI Word 5)

Sbi to Drive Wx = Word exchanged from Sbi to Drive
Drive to Sbi Wx = Word exchanged from Drive to Sbi

The structure of the data exchange is formed by 6 words.
In parameters I.760 ... I.775 must be inserted in the IPA code of the parameter which is to be read or written.

E.g.
I.760=311 written parameter **F100 Frequency ref 0**.
I.770=0 read parameter **d000 Output frequency**

Code	Name	Selection		Default	MIN	MAX	Unit	Variation	IPA
I.750	SBI address			3	0	255			163
I.751	CAN baudrate	[0]	10 Kbit/s	5	0	6			164
		[1]	20 Kbit/s						
		[2]	50 Kbit/s						
		[3]	125 Kbit/s						
		[4]	250 Kbit/s						
		[5]	500 Kbit/s						
		[6]	1000 Kbit/s						
I.752	SBI Profibus mod	[0] Custom		2	0	4			165
		[1] PPO1							
		[2] PPO2							
		[3] PPO3							
		[4] PPO4							
I.753	SBI CAN mode	[0] OFF		0	0	2			166
		[1] CAN Open							
		[2] DeviceNet							
I.754	Bus Flt Holdoff			0.0	0.1	60	sec	0.1	179
I.760	SBI to Drv W 0			0	0	1999			167
I.761	SBI to Drv W 1			0	0	1999			168
I.762	SBI to Drv W 2			0	0	1999			169
I.763	SBI to Drv W 3			0	0	1999			170
I.764	SBI to Drv W 4			0	0	1999			171
I.765	SBI to Drv W 5			0	0	1999			172
I.770	Drv to SBI W 0			1	0	1999			173
I.771	Drv to SBI W 1			2	0	1999			174
I.772	Drv to SBI W 2			3	0	1999			175
I.773	Drv to SBI W 3			4	0	1999			176
I.774	Drv to SBI W 4			5	0	1999			177
I.775	Drv to SBI W 5			6	0	1999			178

7.5 Menu F - FREQ & RAMPS

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

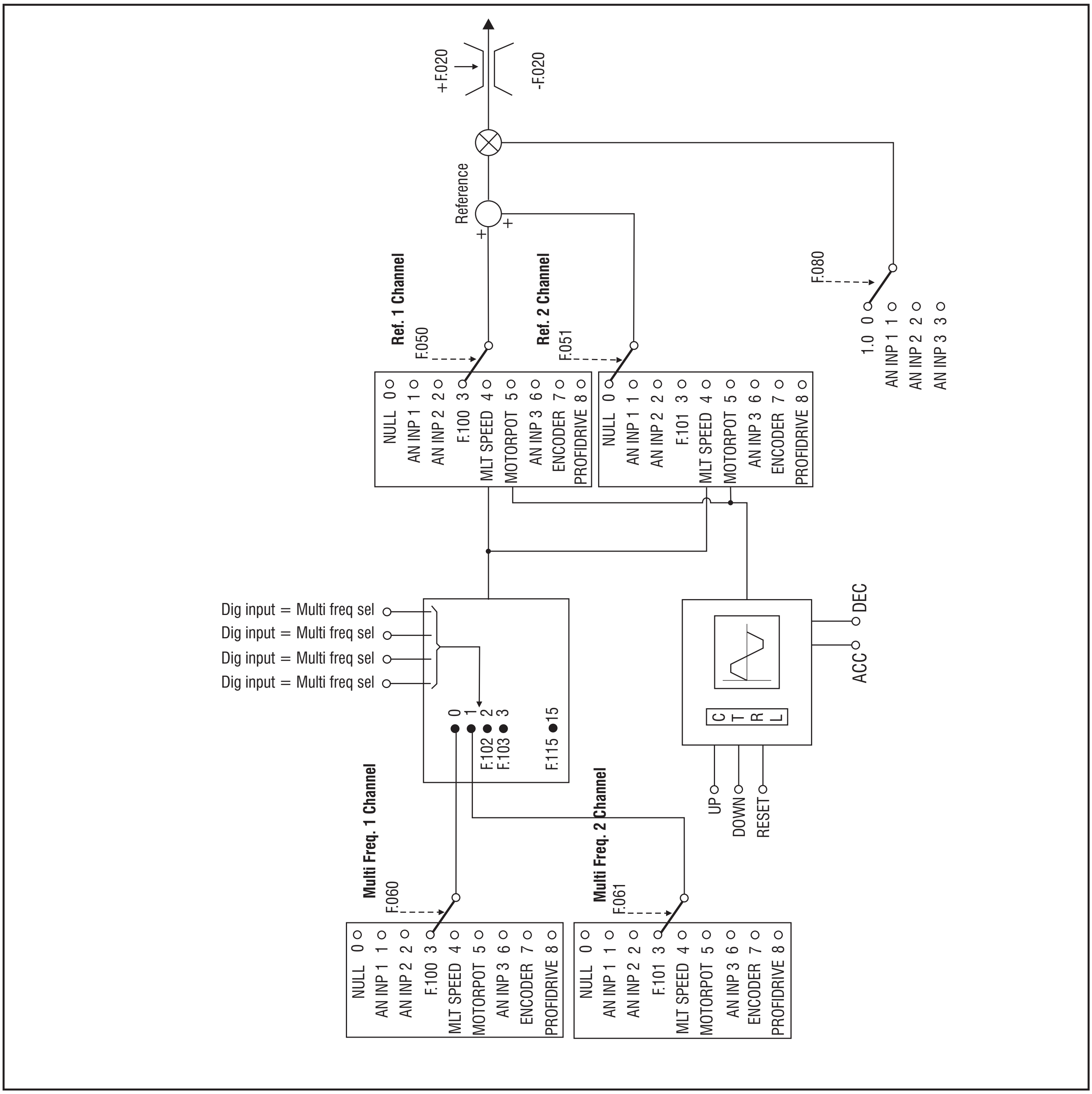


Figure 7.5.1: Reference Selection

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 increase or decrease the motor speed respectively until the keys are released.
The maximum value settable is defined by ***Max ref freq (F.020).***

NOTE! A RUN command is always necessary, in order to START the motor.

The Motorpotentiometer reference can also be changed via digital inputs, programmed as **Motorpot up** and **Motorpot down** (see par. 7.4, I.000).
It is possible to reset the Motorpotentiometer via a digital input programmed as **Reset Motorpot**.
The Motorpotentiometer is reset if the motor is not in “Run” (see par. 7.4, I.000).

F.010 Mp acc/dec time (Motorpotentiometer Acceleration / Deceleration time)

It sets the acceleration and deceleration ramp time (in seconds), for the Motorpotentiometer function.

F.011 Motorpot offset (Motorpotentiometer offset)

It is the minimum value allowed for the Motorpotentiometer, when configured as unipolar (see ***F.012***). The setting of **F.011** will have no effect if the Motorpotentiometer is configured as bipolar.

F.012 Mp output mode (Motorpotentiometer output mode)

Variation range of the frequency reference from Motorpotentiometer (unipolar or bipolar).
In either setting the HW Reverse command is active (when enabled).

F.013 Mp auto save (Motorpotentiometer auto save)

When this function is enabled, the Motorpot reference is continuously saved into non-volatile memory. At power on, the reference will start from the last saved value.
When this function is disabled, the Motorpot reference is always zero after power-on.

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

If **F.014** is set = [1] Follow ramp, **Motorpot reference** is always reset to zero, after power on, regardless of the setting of F.013 .

F.014 MpRef at stop (Stop mode of Motorpotentiometer function)

Behavior of the Motorpotentiometer reference after a STOP command.

F.014 = 0 Motorpotentiometer reference remains fixed to its current value.
F.014 = 1 Motorpotentiometer reference ramps down to zero.
When a STOP command is given, Motorpotentiometer reference follows the deceleration ramp in use.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
F.000	Motorpot ref		0	0	F.020	Hz	0.01	300
F.010	Mp acc/dec time		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	1	0	1			304
F.014	MpRef at stop	[0] Last value [1] Follow ramp	0	0	1			351

Reference Limits

F.020 Max ref freq (Maximum reference frequency)

Defines the maximum value (absolute value) allowed for the frequency reference.
This parameter applies to the sum of the two references available on the drive (***Reference 1*** and ***Reference 2***).

F.021 Min ref freq (Mimimum 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).***

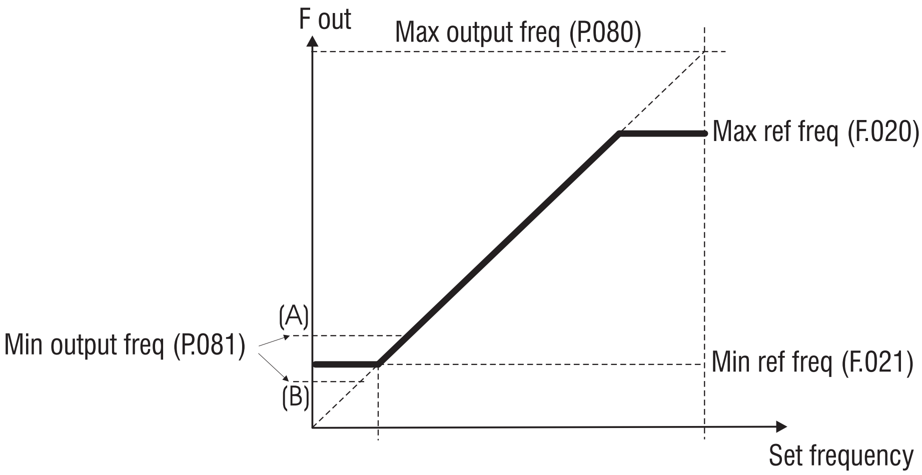


Figure 7.5.2: Min and Max Reference Frequency

Drive behaviour around minimum values

P.081 settings in A condition

- Giving the RUN command, the motor will reach the frequency set by ***P.081*** (A) without following 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 reach the frequency set by ***P.081*** (B) without following the setting of acceleration ramp time.
- References below ***F.021*** will be adjusted to the value of ***F.021***. The variation of ***P.081*** to ***F.021*** is carried out in the adjusted acceleration time.

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	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
F.020	Max ref freq		(****)	25	500	Hz	0.1	305
F.021	Min ref freq		0	0	F.020	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 figure 7.5.1, the source of each of the two frequency referencies can be independently selected. Available selections are reported in the table at the end of this paragraph. The effective frequency reference for the drive will always be the algebric sum of the two channels.

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

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

These parameters allow selection of the source of the **First** and **Second** frequency reference of the ***Multispeed function*** (See figure 7.5.1).
Available selections are reported in the table at the end of this paragraph.

In the example reported below, it is shown how to switch the source of the frequency reference, between **Analog Input 1** and **Motorpotentiometer**.

1) set: ***F.050 - Ref 1 channel*** = [4] Multispeed
2) set: ***F.060 - MltFrq channel 1*** = [1] Analog input 1
3) set: ***F.061 - MltFrq channel 2*** = [5] Motorpotentiometer
4) configure one of the digital input (eg. Dig Inp 1) as follows:

I.000 - Dig input 1 cfg = [7] Freq sel 1 (Binary selection Multispeed function)

The result of the above settings is:
a) when **Dig input 1** is OFF, the **Analog Input 1** is used as main reference
b) when **Dig input 1** is ON, the **Motorpotentiometer** is used as main reference

NOTE! When **Dig input 1** is ON, in order to use Motorpot on the keypad, it is necessary to enter the editing mode of ***F.000*** parameter.

F.080 **FreqRef fac src** (Frequency reference multiplier source)

Select the multiplier source of the frequency reference. If set to 1, 2 or 3, the frequency reference resulting by the sum of the two channels, is multiplied by the analog input value (positive only), according to the following formula:

$$F_{REF,OUT} = F_{REF,IN} \times \frac{\text{An Inp [\%]}}{\text{50 [\%]}}$$

Code	LCD display	[Code] & LCD select.		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] Analog inp 2	(setting through ***I.210…I.214***)						
		[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] Analog inp 3	(setting through ***I.220…I.224***)						
		[7] Encoder	(setting through ***I.500…I.505***)						
		[8] Profidrive	Reference from Profibus						
F.051	Ref 2 channel	[0] Null		0	0	8			308
		[1] Analog inp 1	(setting through ***I.200…I.204***)						
		[2] Analog inp 2	(setting through ***I.210…I.214***)						
		[3] Freq ref x	(setting through ***F.101***)						
		[4] Multispeed	(setting through ***F.100…F.116***)						
		[5] Motorpotent	(setting through ***F.000…F013***)						

		[6] Analog inp 3 (setting through ***I.220…I.224***)				
		[7] Encoder (setting through ***I.500…I.505***)				
		[8] Profidrive Reference by Profibus				
F.060	MltFrq channel 1	As for F.050, Ref 1 channel	3	0	8	309
F.061	MltFrq channel 2	As for F.051, Ref 2 channel	3	0	8	310
F.080	FreqRef fac src	[0] Null	0	0	2	142
		[1] Analog inp 1 (setting through ***I.200…I.204***)				
		[2] Analog inp 2 (setting through ***I.210…I.214***)				
		[3] Analog inp 3 (setting through ***I.220…I.224***)				

Multispeed Function

F.100 Frequency Ref 0 (Multi frequency channel 1)

F. ...

F.115 Frequency Ref 15 (Multi frequency channel 15)

It is possible to select up to 16 frequencies, whose value can be set by these parameters.
The selection of these frequencies is performed through the binary setting of digital inputs programmed as Freq sel.
The following table describes the basis sequence of the Multispeed selection:

Active Dig ref frequency	Freq sel 1	Freq sel 2	Freq sel 3	Freq sel 4
F.100 (Freq Ref 0)	0	0	0	0
F.101 (Freq Ref 1)	1	0	0	0
F.102 (Freq Ref 2)	0	1	0	0
F.103 (Freq Ref 3)	1	1	0	0
F.104 (Freq Ref 4)	0	0	1	0
F.105 (Freq Ref 5)	1	0	1	0
F.106 (Freq Ref 6)	0	1	1	0
F.107 (Freq Ref 7)	1	1	1	0
F.108 (Freq Ref 8)	0	0	0	1
F.109 (Freq Ref 9)	1	0	0	1
F.110 (Freq Ref 10)	0	1	0	1
F.111 (Freq Ref 11)	1	1	0	1
F.112 (Freq Ref 12)	0	0	1	1
F.113 (Freq Ref 13)	1	0	1	1
F.114 (Freq Ref 14)	0	1	1	1
F.115 (Freq Ref 15)	1	1	1	1

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DEFAULT SETTINGS: **I.000 - Dig Input 1 cfg** (terminal 22) = 7 programmed as **Freq sel 1**
I.001 - Dig Input 1 cfg (terminal 23) = 8 programmed as **Freq sel 2**

NOTE! “Freq sel 3” and “Freq sel 4” are two functios that can be associated to any of the drive digital inputs. However, in the factory settings they are not associated to any of the terminals on the regulation board.

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

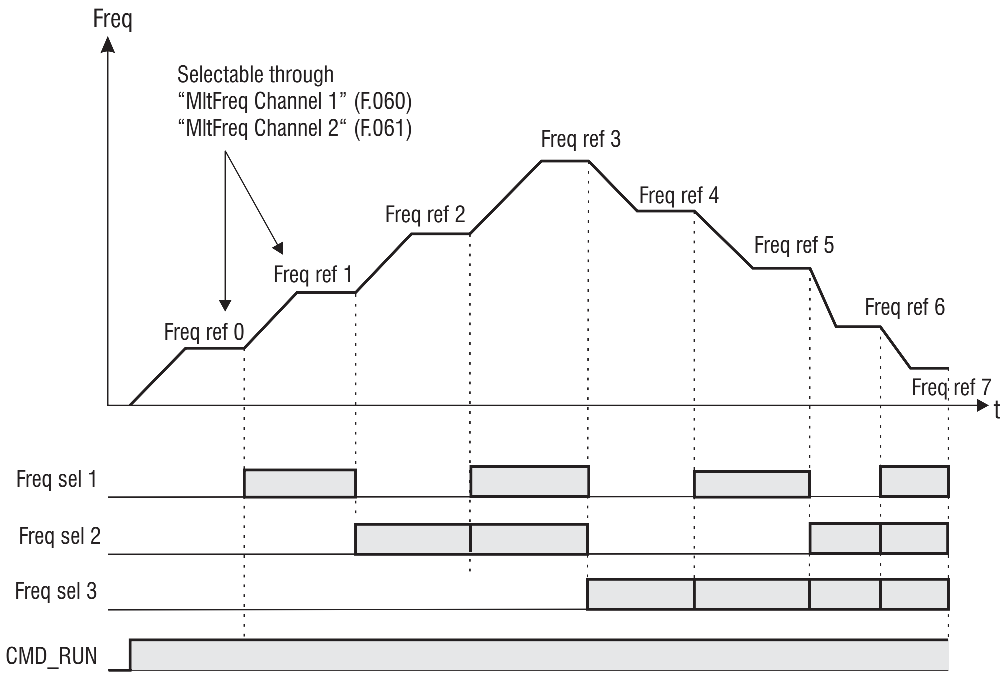

Figure 7.5.3: Multispeed Frequencies

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
F.100	Frequency ref 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.108	Frequency ref 8		0	-F.020	F.020	Hz	0.1	319
F.109	Frequency ref 9		0	-F.020	F.020	Hz	0.1	320
F.110	Frequency ref 10		0	-F.020	F.020	Hz	0.1	321
F.111	Frequency ref 11		0	-F.020	F.020	Hz	0.1	322
F.112	Frequency ref 12		0	-F.020	F.020	Hz	0.1	323
F.113	Frequency ref 13		0	-F.020	F.020	Hz	0.1	324
F.114	Frequency ref 14		0	-F.020	F.020	Hz	0.1	325
F.115	Frequency ref 15		0	-F.020	F.020	Hz	0.1	326

F.116 Jog frequency

It is the frequency reference for the JOG speed.
Jog command is given through a digital input programmed as "Jog", see par. 7.4. **Jog** command has lower priority than **Run** command. Therefore, if both commands are active, a normal **Run** will be executed.

The setting of the JOG reference value, can be either positive or negative.
Hardware **Reverse** command (code 2 of digital input) can be used to reverse the motor rotation even during Jog.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
F.116	Jog frequency		1	-F.020	F.020	Hz	0.1	327

Ramp Configuration

During normal drive operation, a ramp generator is used to ramp the drive output frequency up or down to a programmed setpoint.

It is possible to temporarily freeze the ramp generator output, by using a digital input programmed as "Ramp enabled" (DI_Ramp Enable = 0), see 7.4 paragraph, I.000.

It is also possible to force to zero the ramp generator input, programming a digital input as "Zero Ref", see 7.4 paragraph, I.000.

When "DI_ZeroRef=1", motor will stop following the standard drive ramp time; the drive will remain enabled until a STOP command is given.

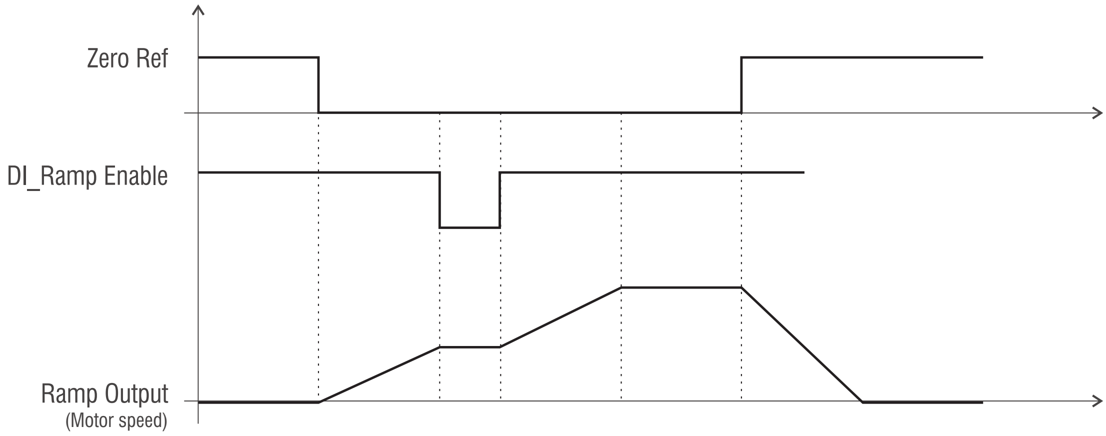

Figure 7.5.4: Ramp sequences

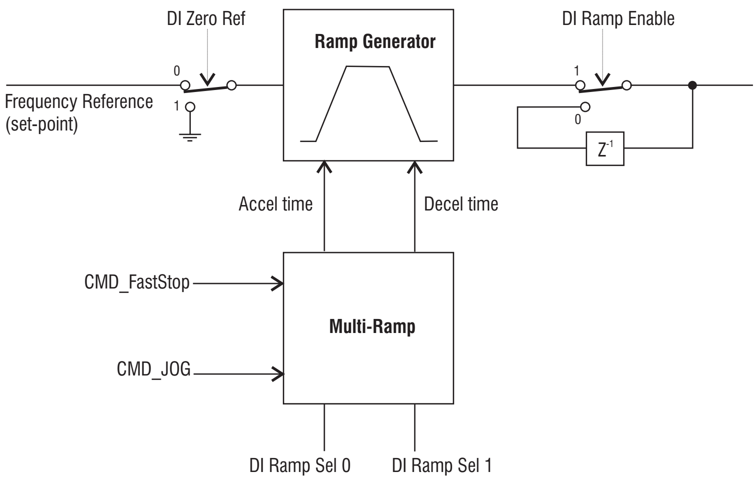

Figure 7.5.5: Block diagram of ramp generation

F.200 Ramps resolution

It defines the range and the accuracy of ramp time settings.

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)

Ramp acceleration and deceleration times are used to avoid abrupt changes in the inverter output frequency that may cause mechanical shocks, excessive motor current and excessive DC-bus voltage. Acceleration times (***F.201, F.203, F.205, F.207***) are expressed as the time that is needed to ramp up the frequency from 0 to maximum value specified by ***Max ref freq (F.020)***. Conversely, deceleration times (***F.202, F.204, F.206, F.208***) are expressed as time needed to ramp down the frequency from the maximum value specified by ***Max ref freq (F.020)*** to zero.

Each of the 4 available ramp sets can be selected by using one or two digital inputs programmed as **Ramp sel** (see par. 7.4, I.000) .

The following table describes the ramp selection process:

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

When the "FAST STOP" is activated (through digital input command, see par. 7.4, I.000), the function is executed with the ***DEC TIME 3***.

Code	LCD display	[Code] & LCD select.		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			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

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

F.250 Ramp S-shape

The S-shaped ramp can be used to obtain a smooth behaviour of the system at the beginning and at the end of the acceleration and deceleration.
The ramp time, intended as the time needed for accelerating from zero to the maximum frequency ***F.020***, is given by the sum of the linear ramp time in use and the S-shape time ***F.250***.

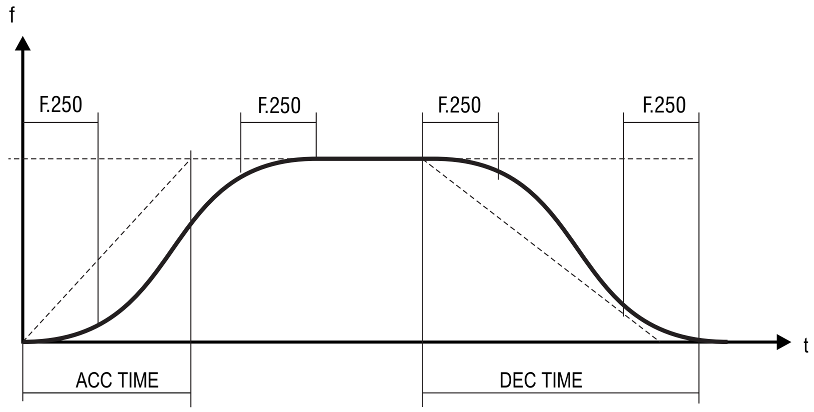


Figure 7.5.6: Ramp S-shape

Code	LCD display	[Code] & LCD select.	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)

Any of the Analog Inputs can be used to extend the programmed ramp time
This extension will change linearly according to the value applied on the Analog Input.
The programmed ramp times are multiplied by a factor ranging from 1.0, when the Analog Input is less than equal to 10%, to 10.0, when the Analog Input is 100%.

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

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
F.260	Ramp extens src	[0] Null	0	0	3			338
		[1] Analog inp 1 (setting through I**.200…I.204**)						
		[2] Analog inp 2 (setting through I**.210…I.214**)						
		[3] Analog inp 3 (setting through I**.220…I.224**)						

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, caused by mechanical resonances.
Through the parameters ***F.271*** and ***F.272***, it is possible to specify two frequencies that are forbidden for inverter operation.
The parameter ***F.270*** defines the band of the forbidden zone.

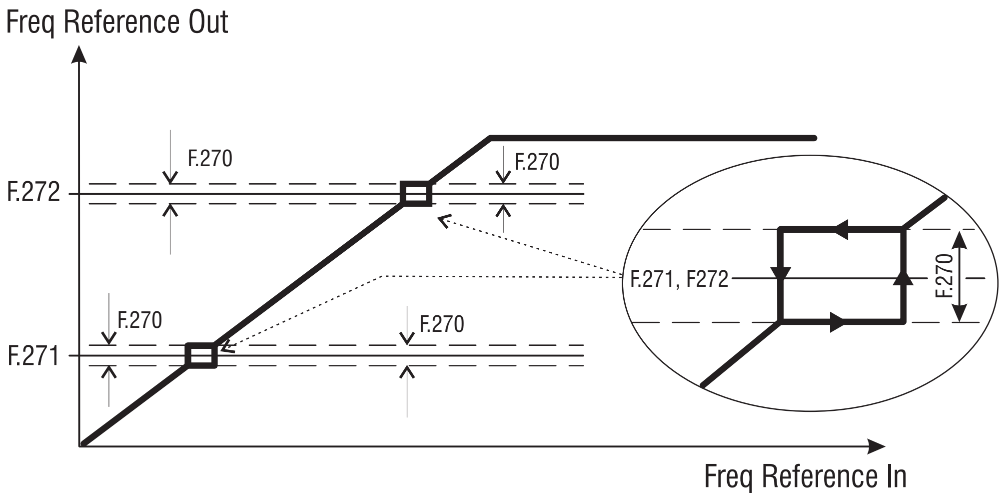


Figure 7.5.7: Jump Frequencies

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

Example:

A) Increasing the reference from values lower than ***F.271***

F.271 = 30Hz (first forbidden frequency threshold)
F.270 = 1Hz (forbidden 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 values higher than ***F.271***

F.271 = 30Hz (first forbidden frequency threshold)
F.270 = 1Hz (tolerance band: 29Hz….31Hz)

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

Setting of frequency reference = 29,5Hz
Frequency 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 of the limit of the tolerance band.

During the ramp execution the forbidden frequencies have no influence, so the output frequency will be linearly generated.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
F.270	Jump amplitude		0	0	100	Hz	0.1	339
F.271	Jump frequency 1		0	0	500	Hz	0.1	340
F.272	Jump frequency 2		0	0	500	Hz	0.1	341

Commands

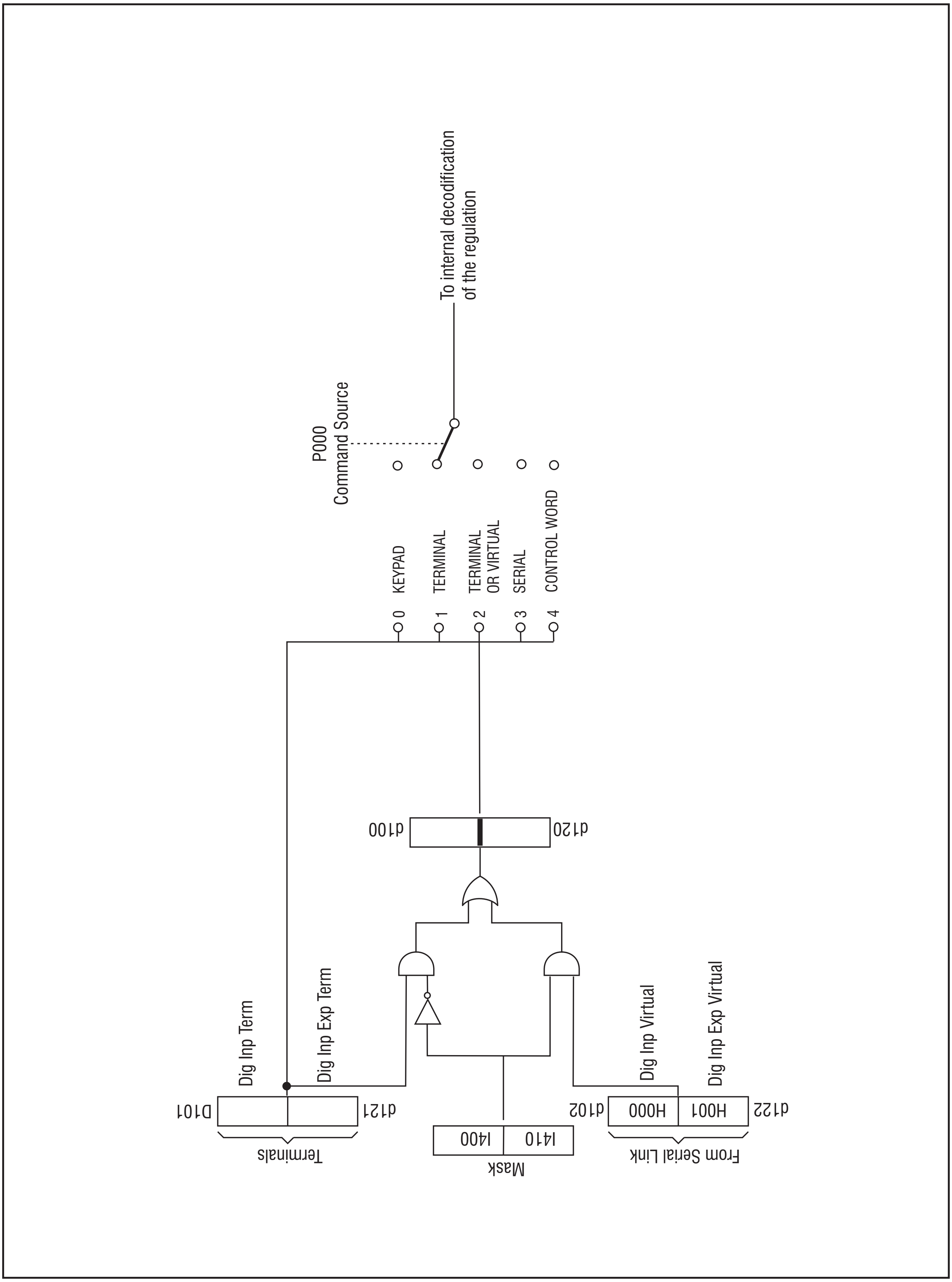


Figure 7.6.1: Basic Commands Logic Selection

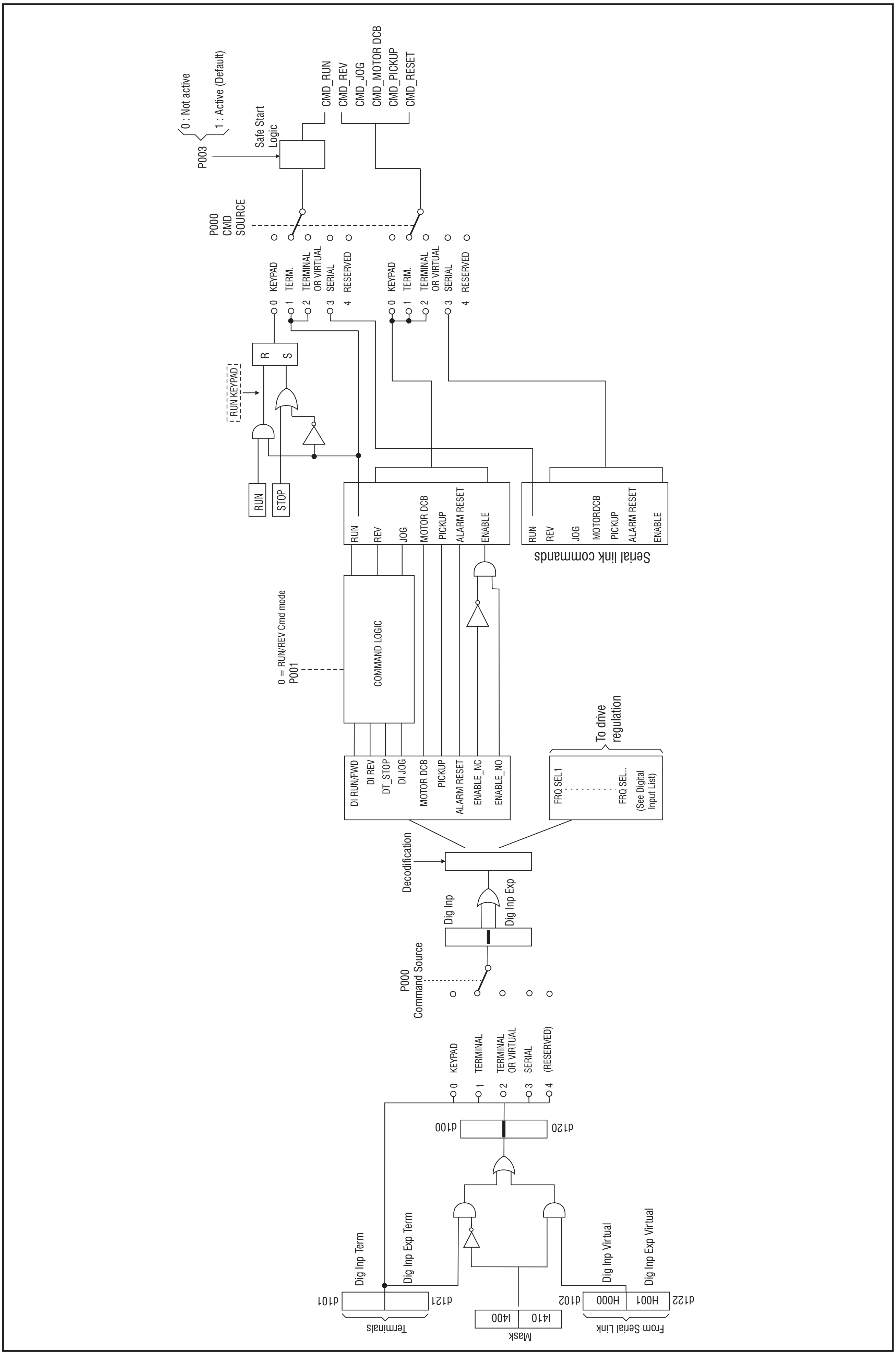


Figure 7.6.2: Main Commands Logic Selection

P.000 Cmd source sel (Command source selection)

It defines the source of the main commands (START and STOP) and auxiliary commands (REVERSE, ENABLE, DC-BRAKE, etc.).

P.000 = 0 START & STOP via keypad, auxliliary commands via digital input terminals.
In this configuration, START and STOP commands are given through the keypad buttons.

I START button O STOP button

In order to start the motor, the Digital Input 7 (terminal 5), factory programmed as RUN, must be asserted.
If the Digital input programmed as RUN is not active, the motor will STOP with the deceleration ramp time in use.
All auxliliary commands are given via digital input terminals.

P.000 = 1 START & STOP and auxliliary commands via digital input terminals.
In this configuration, all drive commands are given through the digital input terminals.
By default, The START command i given by asserting the Digital Input 7 (terminal 5), factory set as RUN, while the STOP command is given by de-asserting the same Digital Input.
It is possible to use several other configurations for giving START, STOP and REV commands from digital input terminals. See chapter **PARAMETERS**, section **Commads**, for details.

NOTE! At power on, the motor will not start until a positive transition is seen on the Digital Input programmed as RUN (edge sensitive). See description of parameter ***P.003*** for further details.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

P.000 = 2 START & STOP and auxliliary commands via terminals or virtual digital inputs.
In this configuration, any drive command may come either from digital input terminals or from virtual digital inputs. Virtual digital inputs are used to give commands from serial line or fieldbus. Refer to chapter **INTERFACE**, section **Enabling Virtual I/O**, for explanation about the use of virtual commands.

NOTE! At power on, the motor will not start until a positive transition is seen on the Digital Input programmed as RUN (edge sensitive). See description of parameter ***P.003*** for further details.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

P.000 = 3 START & STOP and auxiliary commands via serial line.
All drive commands are given through via serial line or filedbus, by using dedicated commands. Refer to chapter **HIDDEN,** section **Commands**, for a complete description of the available commands.

NOTE! No interlock from digital input terminals is provided, when using commands from serial line.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

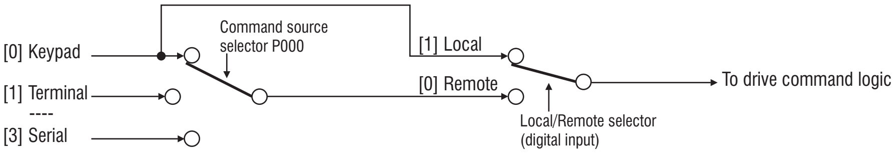
P.000 = 4 START & STOP and auxiliary commands via Profidrive control word.
In this configuration, all commands are given through the *Profidrive* standard control word.
The optional *ProfiBus* SBI card is needed.

NOTE! No interlock from digital input terminals is provided, when using commands from *Profidrive*.

NOTE! Depressing the STOP key on the keypad will cause an emergency stop of the motor. See description of parameter ***P.005*** for details.

Local/Remote command through digital input
It is possible to change the source of the main commands via digital input. In order to do so, one of the digital inpiuts has to be programmed with the code "[29]Local/Remote".

The following figure shows the selection logic for the source of START and STOP commands:



When the selector (dedicated digital input) is 0 (Remote), START and STOP commands come from the source specified by parameter P.000.
When the selector (dedicated digital input) is 1 (Local), START and STOP commands come from the keypad, regardless of what is set into parameter P.000.
The status of the digital selector is read by the drive only when the output of the inverter bridge is disabled. As a result, it is not possible to switch between local and remote source for main commands while the motor is running.

P.001 RUN/REV cmd mode (RUN input configuration)

Definition of the **RUN** and **Reverse** logic control.

P.001 = 0 Run command and Reverse command.

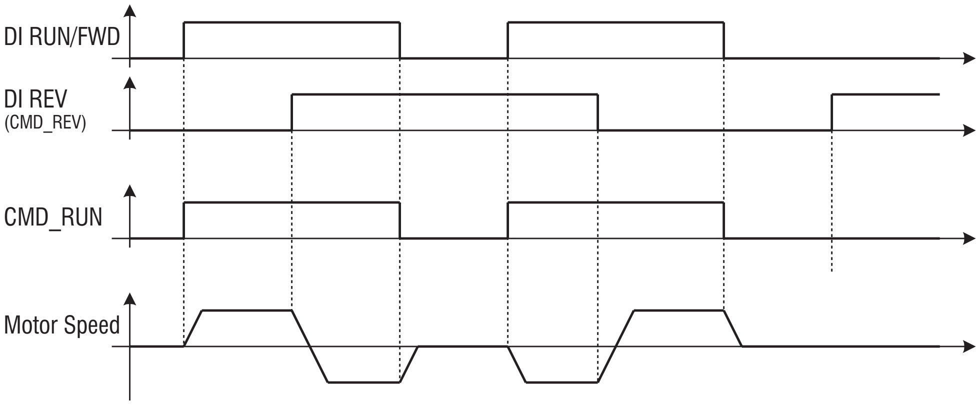


Figure 7.6.3: P.000 = 0 start sequences

P.001 = 1 Run forward command and Run reverse command.

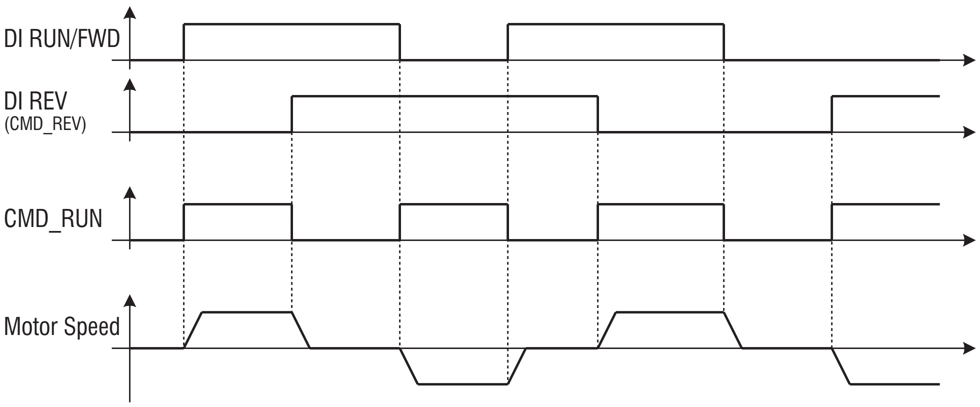


Figure 7.6.4: P.000 = 1 start sequences

P.001 = 2 Three-wires controll. Run command, Stop command and Reverse command.

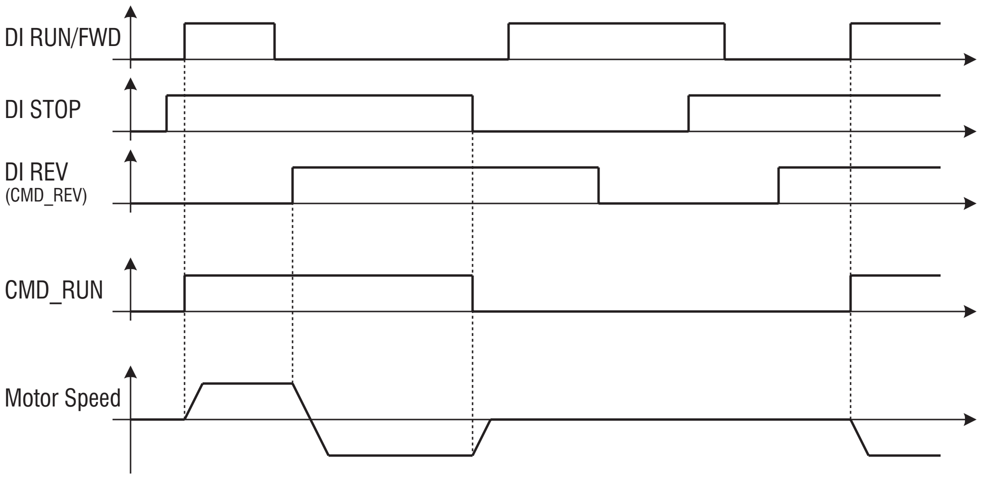


Figure 7.6.5: P.000 = 2 start sequences

P.002 Reversal enable

P.002 = 0
Motor reverse rotation **not enabled**..

P.002 = 1
Motor reverse rotation **enabled**.

The function, associated to P.002, will be applied to 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 Interlock safety disabled.
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 Interlock safety enabled.
At the drive power on, the starting of the motor is not allowed when the RUN command is already present on terminal strip (Interlock state).
The motor can be started by de-asserting and then re-asserting the RUN command.

By monitoring a digital output programmed as "Ready", it is possible to know whether the drive is ready to start or is in the interlocked condition defined above.

P.004 Stop mode

Motor stop control function.

P.004 = 0
Giving a Stop command, the motor will decelerate down to 0 Hz, following the ramp in use. As soon as the inverter output frequency reaches 0 Hz, the drive is disabled.

P.004 = 1
Giving a Stop command, the drive output will be immediately disabled, and the motor will coast to stop.

NOTE! Regardless of the setting of P.004, the drive output can be disabled at any time by de-asserting a digital input programmed with code "[13] Enable NO" or by asserting a digital input programmed as "[14] Enable NC".

P.005 Stop Key Mode

Stop key configuration.

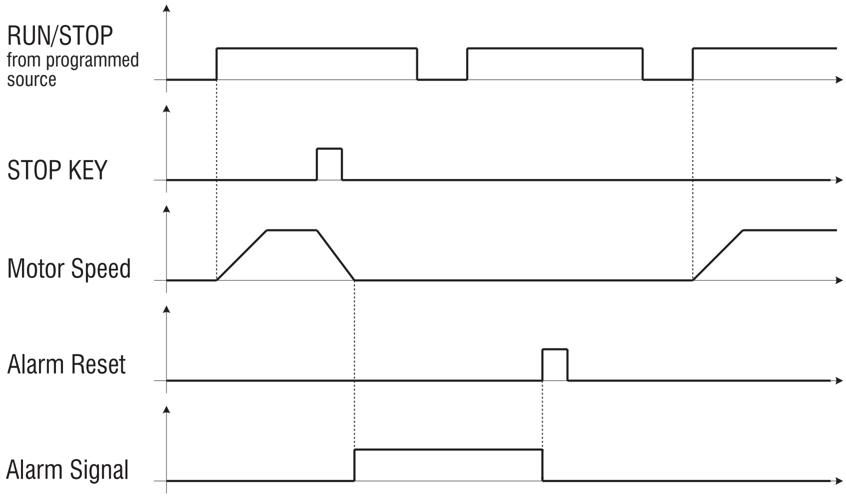


Figure 7.6.6: Stop Key Mode sequences

P.000=0 (default configuration) main commands are coming from keypad. Therefore, the **STOP** key will cause a normal stop of the motor.

P.000≠0 and **P.005 = 0**, pressing the **STOP** key will have no effect.

P.000>0 and P.005 = 1
Pressing the Stop key, the motor will execute an emergency stop, following the ramp programmed by F.206. After the speed reaches the value zero, the drive will trip with the dedicated alarm "EMS". An alarm reset will be needed to restore drive operations (see paragraph 9.2).

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.000	Cmd source sel	[0] Keypad [1] Terminals [2] Virtual [3] Serial [4] Control word	0	0	4			400
P.001	RUN input config	[0] Run / Rev [1] Fwd / Rev [2] 3-Wires	0	0	2			401
P.002	Reversal enable	[0] Disable [1] Enable	1	0	1			402
P.003	Safety	[0] OFF [1] ON	1	0	1			403
P.004	Stop mode	[0] Ramp to stop [1] Coast to stop	0	0	1			493
P.005	Stop Key Mode	[0] Inactive [1] EmcStop&Al	1	0	1			496

Control Mode

P.010 Control mode (Drive control mode)

AGy can operate either in open loop or closed loop speed control mode.
Open loop speed control is set as default, and does not require speed feedback. The natural variation in speed of the induction machine caused by the load, known as slip, can be compensated for by enabling the slip compensation function (see description of ***P.100***).
Closed loop speed control requires speed measurement from a digital encoder coupled to the motor shaft. The optional card EXP-ENC-AGY is needed in order to read the encoder signals. The speed detected by the encoder is fed back to a PI speed controller that regulates the inverter output frequency in order to keep the actual motor speed under control. See Chapter 7, section "Closed loop speed control", for a complete description of the speed regulator.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.010	Control Mode	[0] V/f open loop [1] V/f clsd loop	0	0	1			498

Power Supply

P.020 Mains voltage

Rated value of the AC input mains line to line voltage [V_{rms}].
The undervoltage trip function is based on this value (see also chapter **PARAMETERS,** function **Undervoltage configuration**).

P.021 Mains frequency

Rated value of the AC input mains frequency [Hz].

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.020	Mains voltage	- 230, 380, 400, 420, 440, 460, 480 (Only for "AGy...-4") - 500, 575 (Only for "AGy...-5")	(****)	230	575	V		404
P.021	Mains frequency	50 60	(****)	50	60	Hz		405

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

Motor Data

P.040 Motor rated curr (Motor rated current)

Rated current [A_{rms}] of the motor at rated kilowatt/horsepower and voltage (given on the nameplate, see figure 7.6.7).
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.
Starting from nameplate data, the number of pole pairs is calculated as follows:

$$P = \frac{60\ [s] \times f\ [Hz]}{n_N\ [rpm]}$$

where: p = motor pole pairs
f = rated frequency of the motor (***P.062***)
n_N = rated speed of the motor (see figure 7.6.7).

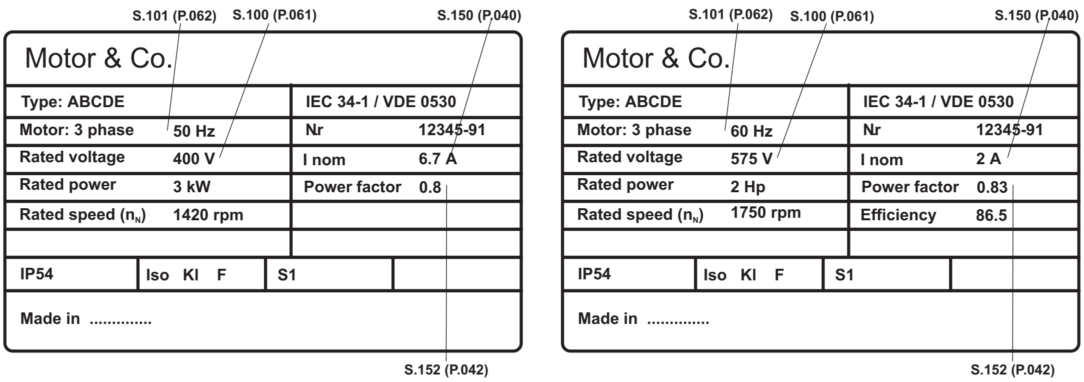


Figure 7.6.7: Motor Nameplate (Example: kW rating for 400V motor and Hp rating for 575V motor)

Example: calculation of the pole pairs of a motor having data shown in the above 400V label:

$$p\ [\text{polepairs}] = \frac{60\ [s] \times f\ [Hz]}{n_N\ [rpm]} = \frac{60\ [s] \times 50\ [Hz]}{1420\ [rpm]} = 2.1$$

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

P.042 Motor power fact (Motor power factor)

Motor power factor in rated conditions (given on the nameplate, see figure 7.6.7).

P.043 Motor stator R (Motor stator Resistance)

Ohmic value 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	LCD display	[Code] & LCD select.	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

V/F Curve

P.060 V/f shape

Selection of the curve for the V/f characteristic.
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.

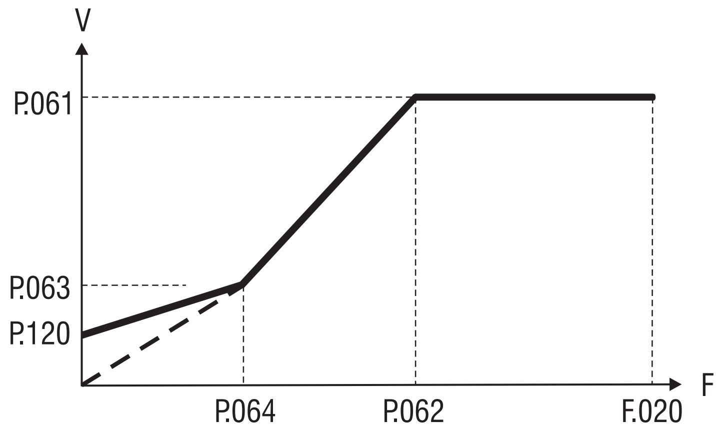


Figure 7.6.8: Custom V/f shape

P.060 = 1 (Linear)

The factory setting provides a Linear V/f characteristic, having the middle points fixed to half the values of ***P.062*** and ***P.061***.

The Boost action on the V/f curve will be executed automatically.

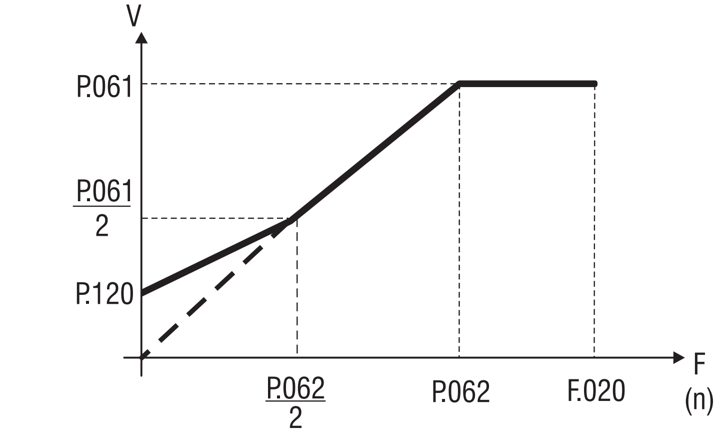


Figure 7.6.9: Linear V/f shape

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).

When this ratio is selected, the middle voltage point is fixed to 0,25% of the Max output voltage, and the middle frequency point is fixed to 50% of ***P.062***.

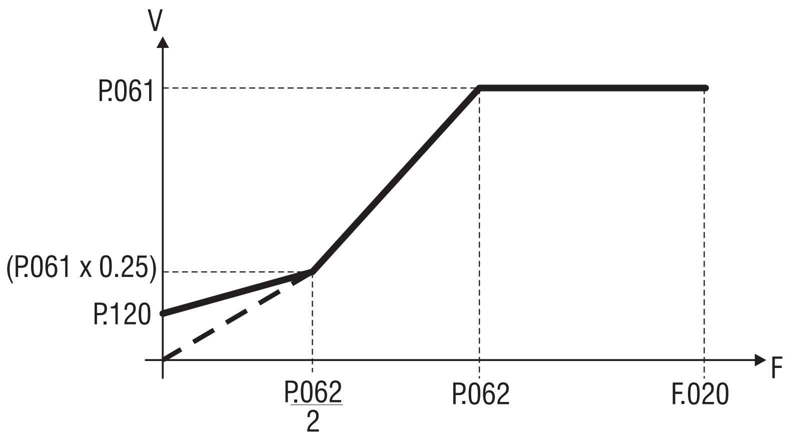


Figure 7.6.10: Quadratic V/f shape

P.061 Max out voltage (Maximum output voltage)

Maximum value of the voltage to be applied to the motor (normally set as the nameplate, see figure 7.6.7).

P.062 Base frequency

Rated frequency of the motor (given on the nameplate, see figure 7.6.7).

It is the frequency at which the inverter output voltage reaches the Max out voltage (***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 V/f characteristic (see figure 7.6.8).

Code	LCD display	[Code] & LCD select.	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	500	Hz	0.1	414
P.063	V/f interm volt		(**)	0	P.061	V	1	415
P.064	V/f interm freq		(**)	1	P.062	Hz	0.1	416

Ouput Frequency Limit

P.080 Max output freq (Maximum output frequency)

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

NOTE! When using slip compensation or PID speed regulation, P.080 should be set to a value higher than 100%, in order to allow for frequency regulation also when the frequency reference approaches its maximum value, defined by ***Max ref freq (F.020)***.

P.081 Min output freq (Minimun output frequency)

Minimum value of output frequency, under which no frequency regulation has effect.
It is expressed as percentage of ***Max ref freq (F.020).***

The parameter is correlated to the ***Min ref freq (F.021)***. See description of parameter ***F.021*** for further details.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.080	Max output freq		110	0	110	% of F.020	1	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)

When an induction motor is loaded, the mechanical speed of the shaft varies due to the electrical slip between stator and rotor quantities which is responsible for the generation of torque.
In order to keep the shaft speed constant, the slip compensation function of the drive can be used.
The compensation is performed by varying the inverter output frequency of an amount that is calculated from inverter output current and motor parameters. therefore, in oder to obtain best results, motor nameplate data has to be properly set, and the correct value of the stator resistance ***(P.043)*** has to be either edited or measured by self-tuning ***(S.901)***. Tuning of the slip compensation function is performed by editing the parameter ***P.100***. If ***P.100*** = 0.0 (default), the slip compensation assumes the nominal value, calculated from nameplate data.
P.100 = 0.0 (value by default), the slip compensation has been deactivated.
***P.100 =100.*0**, the slip compensation assumes the nominal value calculated from the motor characteristics board.

NOTE! 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) of the slip compensation function.
The lower the setting of this parameter, the quicker will be the response od slip compensation. However, setting too low may give rise to undesired oscillations of the speed after sudden load variations.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.100	Slip compensat		0	0	250	%	1	419
P.101	Slip comp filter		0.1	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 of torque in the lower speed range.
Compensation for this effect can be made by boosting the output voltage.

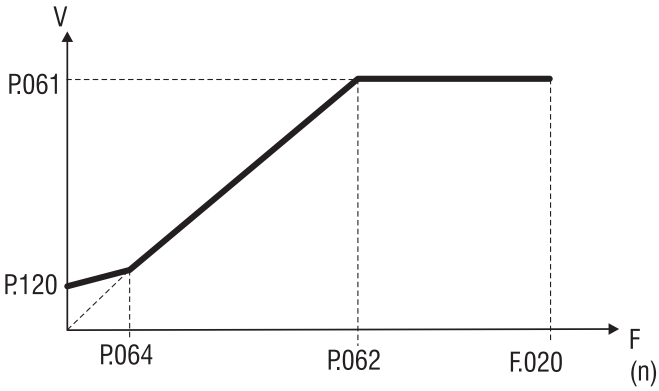


Figure 7.6.11: Manual Boost Voltage

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 by any of the Analog input of the drive.
The regulation of the Boost level will be between 0% (An Inp = 0%) and 100% of the value set in ***P.120*** (An Inp = 100%).

This parameter selects the Analog input to be used for boost modulation.

P.122 **Auto boost en** (Automatic boost enabling)

By enabling the automatic boost calculation, the drive will optimize the V/f profile in order to obtain constant flux level inside the motor over the whole operating speed range. This will improve torque availability at low speed, increasing the starting torque of the drive. The drive uses the stator resistance of the motor in use (either set in parameter ***P.043*** or measured by the autotuning procedure ***C.100***) and the current measured at the inverter output terminals to calculate the necessary voltage boost for the V/f profile.

NOTE! Performance achievable with the automatic voltage boost depends on motor parameters. Therefore, in order to obtain best performance, motor nameplate data should be set correctly and the stator resistance value should be measured by running the autotuning procedure.

NOTE! Automatic boost calculation must be disabled when multiple motors are connected to a single inverter.

In some applications, it can be necessary to overflux the machine in order to obtain even more starting torque. In those cases, the manual boost (set by ***P.120***) can be used in conjunction to the automatic boost. The resulting voltage boost will be the sum of the two contributions.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.120	Manual boost [%]		1	0	25	% of P.061	1	421
P.121	Boost factor src	[0] Null	0	0	3			422
		[1] Analog inp 1 (setting through I.200…I.204)						
	[2] Analog inp 2	(setting through I.210…I.214)						
	[3] Analog inp 3	(setting through I.220…I.224)						
P.122	Auto boost en	[0] Disable	0	0	1			423
		[1] Enable						

Automatic Flux Regulation

P.140 Magn curr gain (Magnetizing current gain)

The magnetizing current of an induction motor is approximately equal to the no-load current value at rated voltage and rated frequency.
By properly setting the parameter ***P.140***, the magnetizing current of the motor and, as a consequence, the motor flux, is controlled to its nominal value, calculated from nameplate data.
The main benefit is a higher torque availability at low speed.
An excessive value for the gain ***P.140*** may cause undesired oscillation.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.140	Magn curr gain		0	0	100	%	0.1	424

Anti Oscillation Function

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

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.
If oscillations arise, it is advised to progressively increase the value of ***P.160***, until the oscillation is damped.
Excessive values of ***P.160*** may cause instability.
The frequency operation range is around 10Hz…30Hz .

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.160	Osc damping gain		0	0	100		1	425

Closed Loop Speed Control

Tight control of the speed of the motor is possible, if a digital encoder is coupled to the shaft. The speed deviation is fed to a PI controller, which outputs the necessary correction for the inverter frequency command, in order to compensate for the slip caused by the load.
Closed loop speed control must be enabled by setting the parameter:
P.010 Control Mode = [1] V/f Clsd Loop

Note! Closed loop speed control is possible only if the drive is equipped with the optional card EXP-ENC-AGY (see chapter 4.4.2). Parameter related to the encoder configuration (***I.501*** through ***I.505***) must be properly set, prior to enable closed loop speed control.

Note! In order to obtain good dynamics, it is strongly recommended to use a two-channels digital encoder with at least 512ppr.

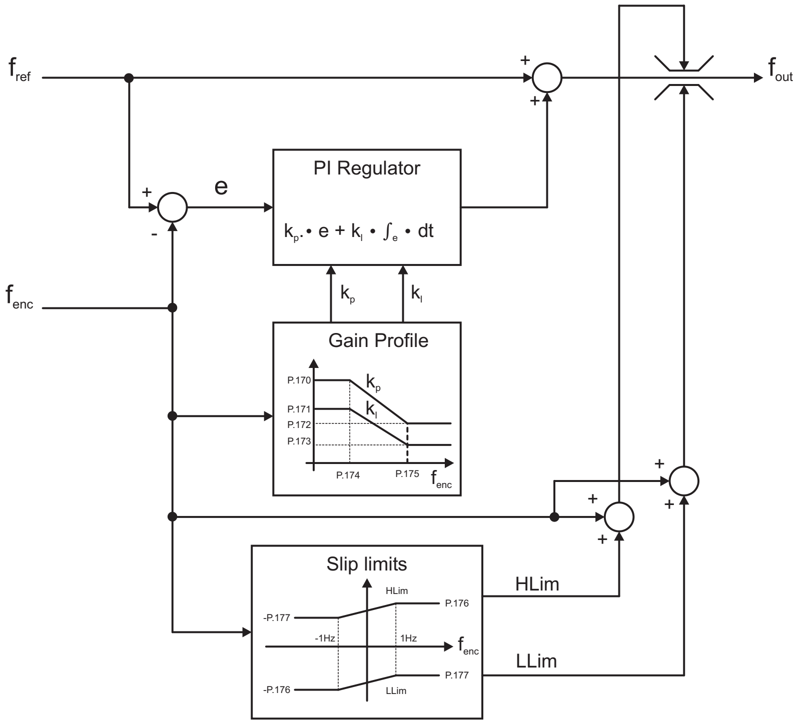


Figure 7.6.12: Speed control structure.

Proportional and integral gains can be scheduled as a function of the speed, as described in Fig.7.6.12.

The maximum amount of correction of the PI regulator is defined by the user through parameters P.176 and P.177. If the motor is transferring power to the load (motoring), the inverter frequency cannot exceed the following value:

$$|f_{out}[Hz] < |f_{enc}[Hz]| + P.176 \times \frac{F.020\ [Hz]}{100.0}$$

If the motor is draining power from the load (braking), the inverter frequency must satisfy the following:

$$|f_{out}[Hz] > |f_{enc}[Hz]| + P.177 \times \frac{F.020\ [Hz]}{100.0}$$

If the encoder frequency is within ±1.0Hz, linear interpolation is performed between motoring and braking limits, as described in Fig. 7.6.12.

P.170 SpdPgainL (Speed regulator proportional gain at low speed)

Proportional gain of the PI speed regulator, applied when the speed is below the threshold defined by ***P.174*** (see Fig.7.6.12).

P.171 SpdIgainL (Speed regulator integral gain at low speed)

Integral gain of the PI speed regulator, applied when the speed is below the threshold defined by ***P.174*** (see Fig.7.6.12).

P.172 SpdPgainH (Speed regulator proportional gain at high speed)

Proportional gain of the PI speed regulator, applied when the speed is above the threshold defined by ***P.175*** (see Fig.7.6.12).

P.173 SpdIgainH (Speed regulator integral gain at high speed)

Integral gain of the PI speed regulator, applied when the speed is above the threshold defined by ***P.175*** (see Fig.7.6.12).

P.174 SpdGainThrL (Speed regulator gain scheduling low threshold)

P.175 SpdGainThrH (Speed regulator gain scheduling high threshold)

The proportional and integral gains of the PI speed regulator equal ***P.170*** and ***P.171*** respectively, when the speed is below the threshold ***P.174***. The gains equal ***P.172*** and ***P.173*** respectively, when the speed is above the threshold ***P.175***. If the speed is within the two thresholds, the PI gains are calculated by means of linear interpolation (see Fig. 7.6.12).

P.176 MaxSlipMotor (Maximum amount of allowed slip during motoring)

The parameter defines the maximum amount of compensation allowed while motoring (see Fig. 7.6.12). It is expressed in percentage of parameter ***F.020***.

P.177 MaxSlipRegen (Maximum amount of allowed slip during regeneration)

The parameter defines the maximum amount of compensation (negative) allowed while braking (see Fig. 7.6.12). It is expressed in percentage of parameter ***F.020***.

P.178 SpdPI lim FacSrc (Speed PI limits factor source)

Each of the analog inputs can be used to modify the output limits of the speed regulator. The resulting limits will be zero when the analog input is 0% and will increase with the analog input, assuming the values determined by ***P.176*** and ***P.177*** when the analog input is 100%.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.170	SpdPgainL		20.0	0.0	100.0	%	0.1	501
P.171	SpdIgainL		10.0	0.0	100.0	%	0.1	502
P.172	SpdPgainH		20.0	0.0	100.0	%	0.1	503
P.173	SpdIgainH		10.0	0.0	100.0	%	0.1	504
P.174	SpdGainThrL		0.0	0.0	F.020	Hz	0.1	507
P.175	SpdGainThrH		0.0	0.0	F.020	Hz	0.1	508
P.176	SpdRegHLim		10.0	0.0	100.0	% of F.020	0.1	509
P.177	SpdRegLLim		-10.0	-100.0	0.0	% of F.020	0.1	510
P.178	SRegLimFkSrc	[0] Null [1] Analog inp 1 [2] Analog inp 2 [3] Analog inp 3	0	0	3			511

SW Current Clamp

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

To optimize the performance of the inverter, it is necessary to be able to accelerate and decelerate the motor with the maximum current that the inverter can supply.
The setting of very short ramp times, that would cause the output current to exceed the limits of the drive, activates the "Current Clamp"circuit, preventing the drive from tripping for overcurrent (OC).

It is possible to disable the clamp function by setting this parameter to zero.

P.181 Clamp alm HldOff (Hold off time for the current clamp alarmp)

f the drive stays at “Active Clamp” status during the time established for this parameter the “LF Fault Limit" alarm is activated.
If the value 25.5 [s] is selected for this parameter the alarms are not activated.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.180	SW clamp enable	[0] Disable (not active) [1] Enable (active)	1	0	1			426
P.181	Clamp alm HldOff		25.5	0.0	25.5	sec	0.1	512

Current Limit

The drive is provided with a function for an active limitation of the current.

It is possible to select different current limits, during the ramps or at steady state.

Current limitation is achieved by a regulating the inverter output frequency (see ***P.206*** parameter).

P.200 Ramp Currlim Mode (Current limitation mode)

P.200 = 0 Function disabled.

P.200 = 1 Enabling of the current limit control during the ramps. Current is limited using an active PI regulation of the inverter output frequency.

P.200 = 2 Enabling of current control by ramp freezing.
Current is limited by temporarily freezing the acceleration ramp.
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.
As soon as the current returns below the limit, the ramp is restarted with.
As a result, the actual ramp time is lengthened by the execution of this control.

P.201 Accel curr lim (Current limit in acceleration ramp)

Value of the current limit during acceleration ramp.
It is expressed 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)

P.202 = 0 Function disabled.
P.201 = 1 Enabling of the current limit control in steady state.
The digital entry programmed with the value "[30] En Lim Steady" conditions the state of the current limit when in stationary mode. Digital entry= 0 (deactivated limit), digital input = 1 (activated limit).
If the function is not programmed in the digital input, it will be controlled through the **P.202** parameter only.

P.202	Digital input = [30]	Stationary limit status
0	0	Disabled
0	1	Disabled
1	0	Disabled
1	1	Enabled

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

Value of the current limit in steady state.
It is expressed 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 cause a slow regulation response.
- a setting too high could cause 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 cause a slow reaction on the regulation response.
- a setting too high could can cause 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, will prevent tripping of the drive for overcurrent (OC) during fast acceleration of the load.
When the current exceeds the value of ***Lim Curr in acc***, a quick frequency step (percentage of the motor rated slip), is automatically subtracted from the reference.
This function operates only during the ramp time (not in steady state).

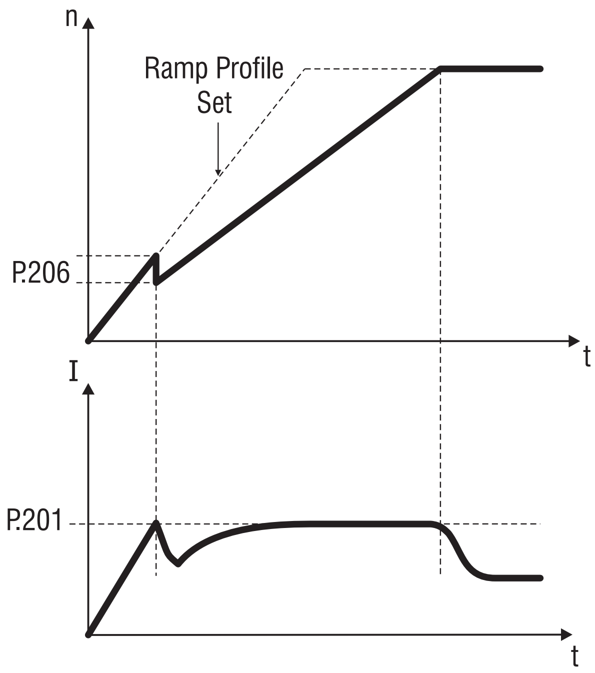


Figure 7.6.13: Current Limit Control in Ramp

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***".

P.207 **Decel curr lim** (Current limit in deceleration ramp)

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

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.200	**Ramp Currlim Mode**	[0] None [1] PI Limit regulator [2] On/Off Ramp	0	0	2			427
P.201	Accel curr lim		(*)	20	(*)	% of I nom	1	428
P.202	En lim in steady	[0] Disable [1] Enable	0	0	1			429
P.203	Curr lim steady		(*)	20	(*)	% of I nom	1	430
P.204	Curr ctrl P-gain		10.0	0.1	100.0	%	0.1	431
P.205	Curr ctrl I-gain		30.0	0.0	100.0	%	0.1	432
P.206	Curr ctr feedfwd		0	0	250	%	1	433
P.207	Decel curr lim		(*)	20	(*)	% of Inom	1	494

DC Link Limit

The function controls 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 output frequency is controlled keeping the voltage level within safe values.

Consequently, the deceleration ramp time is automatically extended, in order to achieve the deceleration of the load, avoiding 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)

P.220 = 0 Function disabled.
P.220 = 1 Enabling of the DC link control by means of PI regulation of the inverter output frequency.
P.220 = 2 Enabling of the DC link control by ramp freezing.
During fast deceleration, if the DC link level increases close to the alarm threshold, the ramp stage is momentarily blocked.
As soon as the DC link level returns within the internal safety values, the ramp is restarted.
As a result, the ramp time is 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 cause a slow regulation response.
- a setting too high could cause oscillations of the system.

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

Integral gain of the DC link control regulation.
- a setting too low can cause a slow regulation response.
- a setting too high can cause oscillations of the DC link.

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

This is the setting of the feed-forward for the DC bus voltage control function.
As the DC link level increases above a safety threshold, a quick frequency step (percentage of the motor slip) is automatically added to the reference. The voltage level decreases toward its rated value. The system will be ready to have effect, when the load generates a DC-link voltage variations to low values near the alarm threshold.

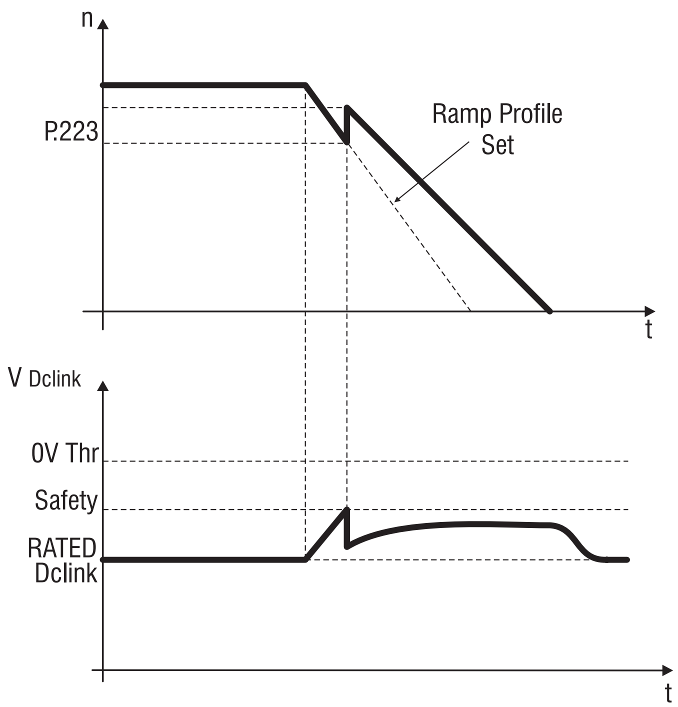


Figure 7.6.14: DC Link Voltage Control

A signaling of the "DC link" status is available on the digital output I.000 ... I.103 as "***DC bus limit***".

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.220	En DC link ctrl	[0] None [1] PI Limit regulator [2] On/Off Ramp	0	0	2			434
PP.221	DC-lnk ctr Pgain		3.0	0.1	100.0	%	0.1	435
P.222	DC-lnk ctr Igain		100	0.0	100.0	%	0.1	436
P.223	DC-link ctr FF		0	0	250	%	1	437

Over Torque Alarm Configuration

The torque of the motor is calculated by the drive, as a function of onverter output current and motor parameters.

The behaviour of the drive in case of detection of an excessive torque can be configured by the following parameters.

P.240 OverTorque mode

It defines the behaviour of the drive in case of overtorque detection.

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

Overtorque signalling threshold.
It is expressed as 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% (Analog input = 0%) and 100% of the percentage value set by ***P.241*** (Analog input = 100%).

This parameter selects the Analog input that has to be used for overtorque threshold modulation.

P.242 = 0 Null
P.242 = 1 Analog Inp 1 (setting through ***I.200…I.204***)
P.242 = 2 Analog Inp 2 (setting through ***I.210…I.214***)
P.242 = 3 Analog Inp 3 (setting through ***I.220…I.224***)

P.243 OT signal delay (Overtorque signalling delay)

Delay time for the alarm signalling.

The overtorque 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	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.240	OverTorque mode	[0] No Alm,Chk on0 [1] No Alm,Chk ss [2] Alm always [3] Alm steady st	0	0	3		438	
P.241	OT curr lim thr		110	20	200	%	1	439
P.242	OT level fac src	[0] Null [1] Analog inp 1 [2] Analog inp 2 [3] Analog inp 3	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 I2t, 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 motor overload level.
A value of 100% represent the threshold for the alarm.

The alarm will be displayed with the message "**OLM**"

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.260	Motor OL prot en	[0] Disable [1] Enable	1	0	1			444

BU Configuration

P.280 BU Config (Braking unit configuration)

The internal brake unit can be disabled by setting this parameter to zero. This is useful when an external BU is used for controlling the DC-link voltage or when several drives share the same DC-link and only one of them is in charge for DC-link voltage control.
Also, thermal protection of the braking resistance can be enabled by proper setting of this parameter. Such a protection requires proper setting of the parameters related to the braking resistor in use (***P.281***, ***P282***, ***P.283***). When thermal protection is enabled, an overheating of the braking resistor will trip the drive for “Braking resistor overload”.

P.280 = 0 Internal BU is disabled.
P.280 = 1 Internal BU is enabled; Thermal protection of braking resistor is disabled.
P.280 = 2 Internal BU is enabled; Thermal protection of braking resistor is enabled.

NOTE! The internal brake unit, when enabled, will operate even if the drive is disabled. Internal brake unit will not operate if any of the drive alarms are active.

P.281 Brake res value (Braking resistor value)

Rated Ohmic value of the braking resistance connected in use.

P.282 Brake res power (Braking resistor power)

Rated power of the braking resistance connected in use.

P.283 Br res thermal K (Braking resistor thermal costant)

Thermal constant of the braking resistance connected in use.
This data is expressed in seconds, and it is normally provided by the manufacturer of the device, as the time that the resistor takes to reach its nominal working temperature while dissipating its rated power.

For further information about the use of braking resistors and braking devices, refer to chapter 5.8.

The parameter **d.053** (menu **DISPLAY**), is the braking resistor overload level.
A value of 100% represent the threshold for the alarm.
The alarm will be displayed with the message "**OLr**".

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.280	BU config	[0] BU disabled [1] BU en OL dis [2] BU en OL en	1	0	2			445
P.281	Brake res value		(*)	1	250	ohm	1	446
P.282	Brake res power		(*)	0.01	25	kW	0.01	447
P.283	Br res thermal K		(*)	1	250	sec	1	448

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, producing a braking torque.
DC braking can be useful to brake the motor around the zero speed, either at START or at STOP, or to maintain the motor shaft locked for a short time.
It should not be used to obtain an intermediate braking.

The parameters described below, allow to fully configure the DC-brake 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)

Each of the Analog inputs can be used to modify the current level used for DC braking.
The regulation of the DC braking level will be between 0% (Analog input = 0%) and 100% of the value set by ***P.300*** (Analog input = 100%).

This parameter specifies which Analog input has to be used for DC braking current level modulation.

P.302 DC braking freq (DC Braking frequency)

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

P.303 DC braking start

Defines the DC braking duration in seconds, at 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 STOP (RUN or Reverse commands released and frequency below the threshold defined by ***P.302***).

NOTE!

- a DC brake command can be carried out also via digital inputs (see chapter **INTERFACE**, section **Digital inputs**). In this case a **DC brake** will be possible at any speed, no matter if the drive is in STOP or START condition (digital input as **DC brake**).
- the injection of direct current remains active until the DC Brake command is removed.
- a momentary disabling of the DC braking function is possible via digital input set as **DC brake en,** (see par. 7.4, I.000).

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.300	DC braking level		0	0	100	% of I nom	1	449
P.301	DCB lev fac src	[0] Null	0	0	3			450
		[1] Analog inp 1 (setting through I.200…I.204)						
	[2] Analog inp 2	(setting through I.210…I.214)						
	[3] Analog inp 3	(setting through I.220…I.224)						
P.302	DC braking freq		0	0	500	Hz	0.1	451
P.303	DC braking start		0	0	60	sec	0.1	452
P.304	DC braking stop		0	0	60	sec	0.1	453

Autocapture function

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

Without using this function, the connection of an inverter to a rotating motor could cause, the trip of the inverter for overvoltage or overcurrent, soon after the enable.

When the function is enabled, the inverter frequency output will be forced to match the motor speed, avoiding trips.

Main uses are:

- Restart after an inverter alarm
- Pumps and fans rotated by fluids
- Engage of a motor running directly under the mains

P.320 Autocapture mode

P.320 = 0   Function disabled

P.320 = 1   1st 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 activate Autocapture at any time the command is applied (regarless of the setting of ***P.320***).

P.321 Autocapture Ilim (Autocapture current limit)

During the Autocapture procedure, the inverter adjust progressively the voltage and the output frequency so that the absorbed current does not overcomes the value set in ***P.321***.
For a proper setting, the value of this parameter must be higher than the no-load current of the motor in use (***d.950,*** % of inverter nominal current).

P.322 Demagnetiz time (Autocapture demagnetization time)

Delay for the beginning of the Autocapture function.
It is the time necessary for the demagnetization of the motor. Setting too short, 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 frequency is determined by the setting of parameter ***P.325.***

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

Ramp time for the voltage recovering.
The output voltage will be gradually increased, in oder not to exceed the current limit set in ***P.321***.

P.325 Autocap spd src (Signal source for the frequency scanning)

Source of the starting frequency value for the search of the motor speed.

P.325 = 0   Frequency Ref
The starting frequency is set to the actual value of the frequency reference. ***d.001 = Frequency Ref***.

P.325 = 1   Max frequency ref
The starting frequency is set to the value defined in the parameter ***F.020 = Max ref freq.***

Such setting is recommended when the motor to be engaged has been previously connected to the AC mains (***F.020*** = 50 or 60Hz).

P.325 = 2 Last frequency ref

The starting frequency is set to the value assumed by Frequency Ref at the moment of the last inverter disable.

P.325 = 3 Encoder

The starting frequency is set to a value corresponding to the speed measured by the encoder fit on the motor. Such setting is recommendedwhen the motor is equipped with an encoder.

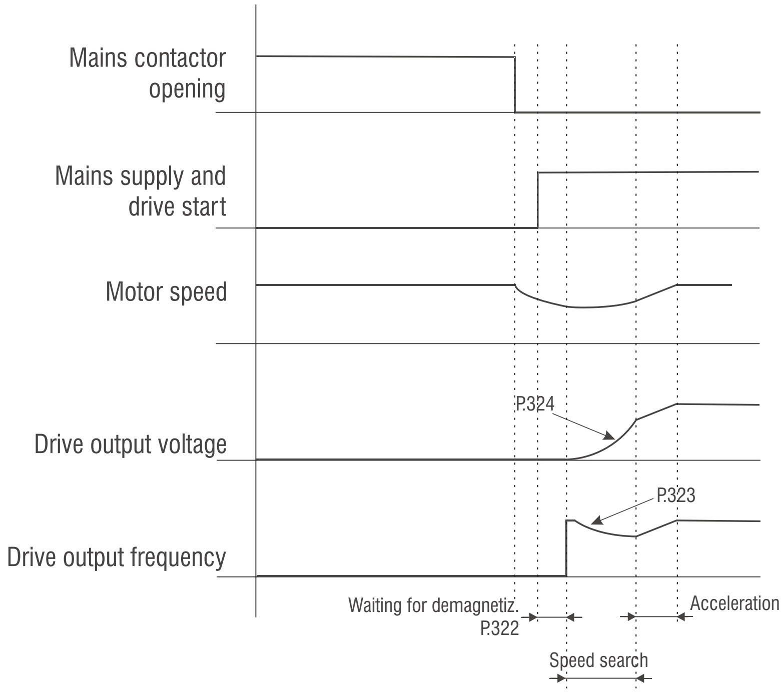


Figure 7.6.15: Autocapture function

Example for the use of the Autocapture function to engage a motor which has been previously mains-connected. ***P.325 = 1.***

Code	Name	Selection	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	(*)	% of I nom	1	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 [1] Max freq ref [2] Last freq ref [3] Encoder	0	0	3			460

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

Undervoltage Configuration

A temporary mains voltage drop is detected by the inverter intermediate circuit (DC link) as a variation of its level below a safety threshold. Such a condition causes the inverter to stop due to an undervoltage alarm (UV).

The safety threshold is set via the ***Undervoltage thr (P.340)*** parameter.

Procedures for the Undervoltage control

It is possible to configure the behaviour of the inverter in case of momentary drop of the AC mains voltage, thus avoiding unnecessary trips and improving system availability.

When the undervoltage threshold has been overcome, the inverter can initiate one of the following procedures:

- **Autorestart (P.341)**
- **Coast Through (P.343)**
- **Emg Stop (P.343)**

P.340 Undervoltage thr (Undervoltage alarm threshold)

Safety threshold for the detection of the undervoltage alarm (UV).
It is possible to move the UV threshold between a minimum value defined by the hardware (***P.340*** = 0) and a maximum value corresponding to the rated DC-link voltage (***P.340*** = 100%). In order to increase system availability, it is recommended to leave ***P.340*** = 0 (factory setting).

AC main supply	Minimum UV threshold	Nominal DC-Bus
230Vac	230Vdc	310Vdc
380Vac	380Vdc	537Vdc
400Vac	380Vdc	565Vdc
420Vac	400Vdc	594Vdc
440Vac	400Vdc	622Vdc
460Vac	415Vdc	650Vdc
480Vac	415Vdc	678Vdc

agy0160

Example:

Parameter ***S.000 (P.020) Mains voltage*** = 400Vac
UV minimum threshold = 380Vdc
DC bus rated value = 565Vdc

P.340 = 0% UV threshold = 380Vdc

P340 = 50%

$$UV = 380 + \frac{(565 - 380) \times 50}{100} = 472{,}5Vdc$$

Or, if the UV threshold has to be = 400Vdc, it is possible to calculate the value to be set in ***P.340:***

$$P.340 = \frac{(400 - 380)}{(565 - 380)} \times 100 \cong 11\%$$

AUTORESTART

When the DC bus voltage value is lower than the value set in ***P.340***, the inverter output bridge is disabled and motor coasts to stop.
DC-bus voltage is restoredbefore the time set in ***Max pwrloss time (P.341)*** elapses and if the drive regulation card remains active, the "Autorestart" function is started.
The inverter behaves as described in the "Autocapture" function, regardless of what is set in ***P.320***, therefore the following parameters have to be programmed:

P.321 Autocapture Ilim
P.322 Demagnetiz time
P.323 Autocap f scan
P.324 Autocap V scan

The following figure shows the "Autorestart" sequence after a short power dip.

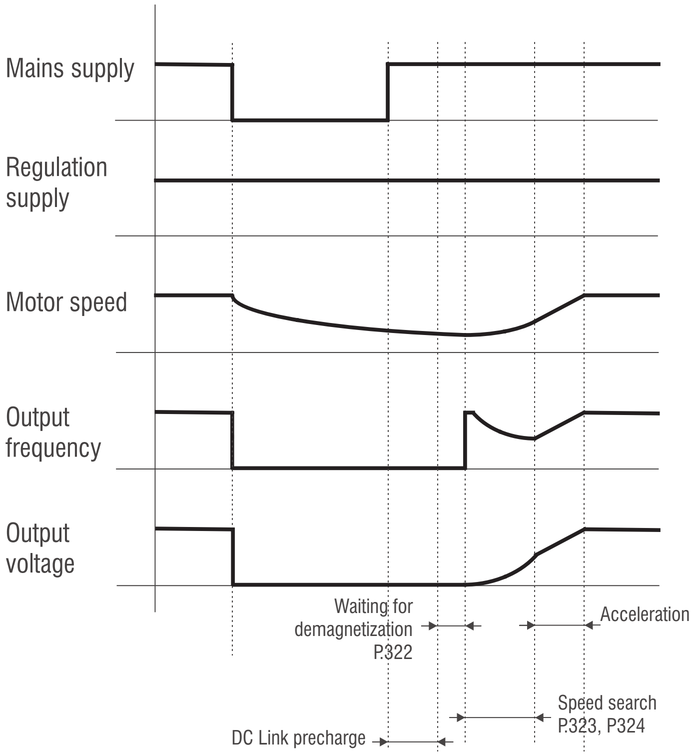


Figure 7.6.16: Autorestart after a power dip

P.341 Max pwrloss time (Maximum time for a power supply loss)

The Autorestart procedure is performed within this time if the mains voltage is restored. A longer power supply loss causes the inverter stop and a following "undervoltage" alarm.
In case the regulation card is no longer supplied because of a power dip, the restart with the Autorestart procedure is not possible.
***P.341* = 0** (default), Autorestart function disabled.

P.342 UV alarm storage (Storage of the undervoltage alarm)

This parameter specifies whether an UV alarm occured while the drive is disabled, has to be stored into the "Alarm list".

P.343 UV Trip mode (Controlled stop due to a power dip)

Such function can work properly only if the load has sufficient kinetic energy (loads with high inertia-low frictions).

P.343 = 0 Disable
In case of a power supply loss, the drive stops with an "undervoltage" alarm (UV)

P.343 = 1 Coast Through
In case of loss of the mains power supply, the drive will decrease the output frequency, recovering the kinetic energy of the load , trying to maintain the regulation board active as long as possible. If the mains voltage is restored, the drive will resume its normal operation.

P.343 = 2 Emg Stop
In case of a power supply loss, the drive decreases the output frequency trying to stop the motor within a previously fixed period (**F.206**).

COAST THROUGH

The function is enabled programming **P.343 = 1.**

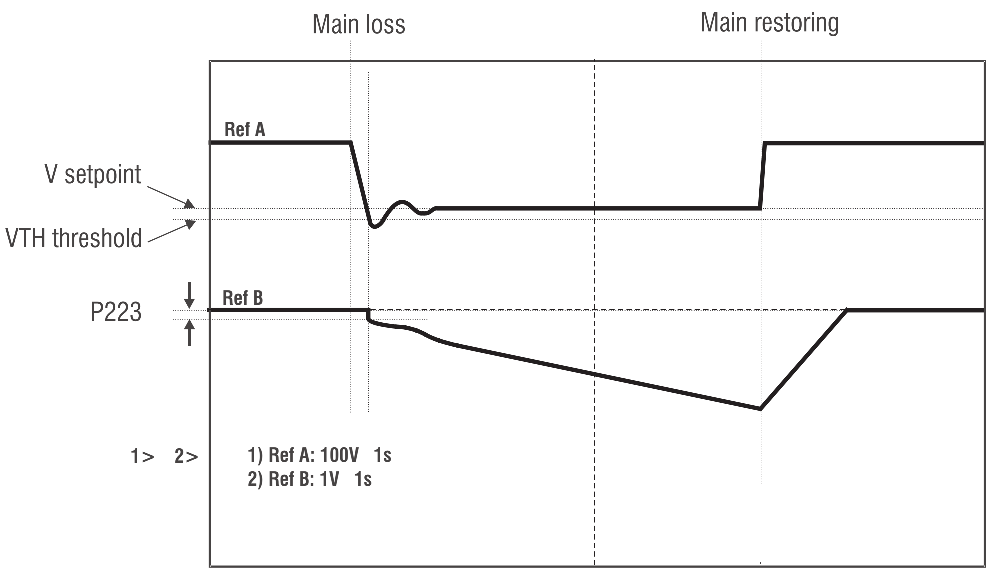


Figure 7.6.17: Coast through function

Ref A = DC Link voltage
Ref B = motor power supply frequency

Phase description:

a) The procedure for the controlled stop is automatically enabled when the DC link voltage decreases below the V_{TH}: threshold :

$$V_{TH}=(\sqrt{2} \times V_{mains}) \times 0,8$$

(V_{mains} depends on the value set in the ***S.000*** parameter)

b) The motor power supply frequency is decreased with a step corresponding to ***P.223*** in order to operate in the generating mode and to avoid further decrease of the DC bus voltage.
c) A PI regulator controls the drive output frequency and regulates it in order to bring and keep the DC link voltage at the *Vsetpoint* value:

$$V_{SETPOINT} = \frac{(\sqrt{2} \times V_{mains} \times 0.9)+V_{TH}}{2}$$

The regulator setpoint is changed linearly from V_{TH} to *Vsetpoint*

The response of the PI regulator can be tuned setting the parameters:
P.221 DC-link ctr Pgain = P gain.
P.222 DC-link ctr Igain = I gain.

In case the mains voltage is restored during the Coast through procedure, the drive recognizes the situation and the motor rotation speed is brought back to its starting value.
On the contrary, if the mains voltage is not restored, the PI regulator further decreases the drive output frequency till the motor stops (in this way the DC bus can be kept at the *Vsetpoint level*). At this point the drive Undervoltage alarm is enabled.
The motor restart can be obtained performing the safe-restart procedure with the ***P.003*** parameter.

EMG STOP (Emergency stop)

The function is enabled programming P.343 = 2.

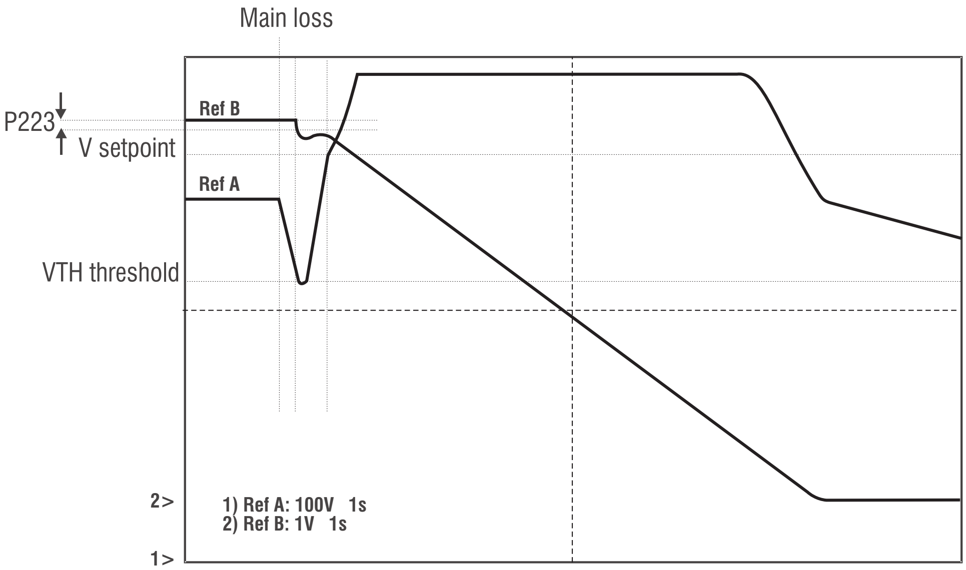


Figure 7.6.18: Emergency stop

Ref A = DC Link voltage

Ref B = motor power supply frequency

Phase description:

a) The procedure for the controlled stop is automatically enabled when the DC link voltage decreases below the V_{TH} threshold:

$$V_{TH}=(\sqrt{2} \times V_{mains}) \times 0,8$$

(V_{mains} depends on the value set in the ***S.000*** parameter)

b) The motor power supply frequency is decreased with a step corresponding to ***P.223*** in order to operate in the generating mode and to avoid further decrease of the DC bus voltage.

c) A PI voltage regulator controls the drive output frequency and regulates it in order to bring and keep the DC link voltage at the *Vsetpoint value*:

$$V_{SETPOINT} = \frac{\sqrt{2} \times V_{mains} + OV_{TH}}{2} \qquad (OV_{TH} = 800\ V_{DC})$$

The regulator setpoint is changed linearly from V_{TH} to *Vsetpoint*

The response of the PI regulator can be tuned setting the parameters:

P.221 DC-link ctr Pgain = P gain.

P.222 DC-link ctr Igain = I gain.

d) When the voltage setpoint reaches *Vsetpoint*, the regulator is disabled and the drive performs the Fast Stop ramp set with the ***F.206*** parameter.

e) During the Fast Stop ramp, the DC bus voltage can reach values suitable to enable the braking resistance ***P.220 = 0***.

In case the resistance is not connected, it is recommended to set ***P.220 = 1*** in order to avoid a possible Overvoltage alarm during the stop phase.

The ***P.207*** parameter allows the setting of the current limit during the controlled stop phase. In case the motor current tries to overcome the current limit, the Fast Stop ramp speed is decreased in order to keep the current at the programmed level.

If, on the contrary, the programmed braking ramp is too slow, the DC bus voltage could decrease below the V_{TH} value. In this condition the PI voltage regulator regains the control of the output frequency till the motor stops. At this point the drive Undervoltage alarm is enabled.

In case the mains voltage is restored during the Emg Stop procedure, the drive continues its procedure till the motor is completely stopped. The motor restart can be obtained performing the safe-restart procedure with the

P.003 parameter.
In case of high-inertia loads, it could be convenient to enable the DC braking function at stop. Such function could reduce or eliminate a small residual slip rotation of the motor.

Master - Slave function
In a configuration with multiple drive/motor, where several motors can be set with different speeds but where the ratio between the different speeds has to be constant during the machine stopping phases (for example on a carding textile line), it is possible to use the Master-Slave function.
To this purpose, it is required to enable the Emg Stop or Coast Through function only on the Master drive and to program an analog output with code 22 Freq ref factor. On the other Slave drives forming the line, no UV Trip Mode function has to be enabled but an analog input ***F.080 FreqRef fac src*** has to be programmed, for example ***F.80 = 2,*** the output frequency reference is multiplied by the analog input value (only positive).

The analog output of the drive configured as master supplies a reference corresponding to the ratio between the output frequency of the Fout drive (controlled by the UV Trip Mode function) and the Fout0 frequency reference before enabling the function:

Vout = (Fout / Fout0) x 10V

If the UV Trip Mode function is enabled (***P.343 = 1*** or ***P.343 = 2***) but not active, the analog output corresponding to 10V tends to 0V when the UV Trip Mode function is active.
By multiplying the frequency set on the slaves by Vout, it is possible to obtain a coordinated stop.
Considering that 10V on the analog input used as ***FreqRef fac src*** corresponds to a multiplication by 2 of the base frequency, the input scale has to be set to 0.5:
ex. **I.222 = An In 3 gain = 0,5**
The use of the Master-Slave function can be advantageous when all the drives forming the line are connected to a single DC bus.

Code	Name	Selection	Default	MIN	MAX	Unit	Variation	IPA
P.340	Undervoltage thr		0	0	80	% of P.020	1	462
P.341	Max pwrloss time		0	0	25	sec	0.1	463
P.342	UV alarm storage	[0] Disable [1] Enable	1	0	1			464
P.343	UV Trip mode	[0] Disabled [1] CoastThrough [2] Emg Stop	0	0	2			491

Overvoltage Configuration

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 from overvoltage alarm, by enabling 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 coast 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 correct operations it is necessary to enter the proper settings of the **Autocapture** parameters:

P.321 ***Autocapture Ilim***
P.322 ***Demagnetiz time***
P.323 ***Autocap f scan t***
P.324 ***Autocap V scan t***

- normal operation is resumed 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 above will be iterated.

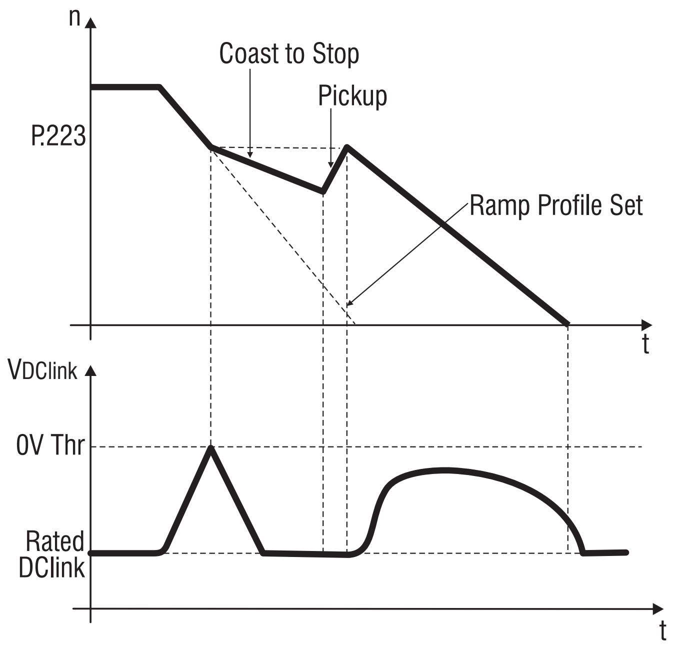


Figure 7.6.19: Overvoltage Prevention

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

Code	LCD display	[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 driveoperation, after the detection of some alarms.

It will be active only with an appropriate setting of the parameters described below and after the drive has tripped from one of the following alarms:

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

P.380 Autoreset attmps (Autoreset attempts)

Setting of the maximum number of autoreset, after the detection of an alarm. If ***P.380*** is set to 0 the function is disabled.

P.381 Autoreset clear

If enabled, it sets to zero the counter of the already-performed autoreset attempts, if no alarm condition is detected within a period of time set in the **P.381 Autoreset clear** parameter. After the counter zero setting, the number of the available restart attempts is set in the **P.380 Autoreset attmps** parameter. If **P.381 Autoreset clear** is set with 0, the counter zero setting is not performed.

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)

Defines the status of the relays and digital outputs, during the autoreset function, according the following table:

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 "Alarm 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	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.380	Autoreset attmps		0	0	255			466
P.381	Autoreset clear		10	0	250	min	1	467
P.382	Autoreset delay		5	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 the behaviour of the drive after an "**External fault alarm**".

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 "**EF Ext fault**".

Code	LCD display	[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)

The enabling of this function allows detection of the missing of any phase of the AC input mains.

P.410 = 0 Disabled Phase loss detection disabled.
P.410 = 1 Enabled Phase loss 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	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.410	Ph Loss detec en	[0] Disable [1] Enable	1	0	1			492

Voltage Reduction Configuration

It is possible to minimize the energy consumption af a motor that is running with light load by properly configuring the voltage reduction function.

P.420 Volt reduc mode (Voltage reduction mode)

Defines of the mode of 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 full torque availability during acceleration and deceleration.
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 a percentage of the voltage, resulting from the V/F characteristic (see figure 7.6.20).

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% (An Inp = 10%) and 100% of the value set in parameter ***P.421*** (An Inp = 100%).
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 characteristic.

Example:

P.421 = 30%
V/f motor characteristic = 380V / 50Hz
Motor supply voltage = 380V / 50Hz

The inverter output voltage at 50 Hz will be:

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

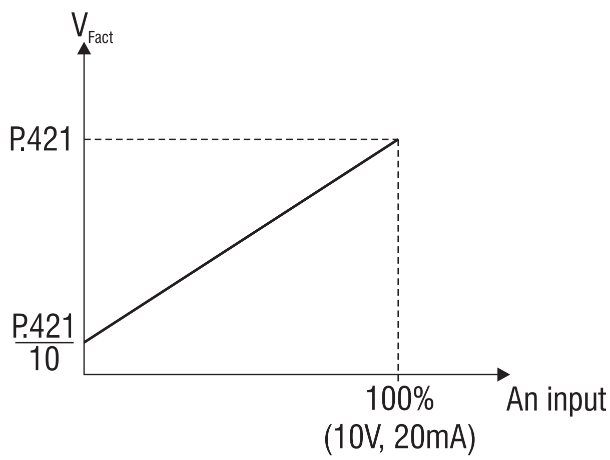


Figure 7.6.20: Voltage reduction factor multiply

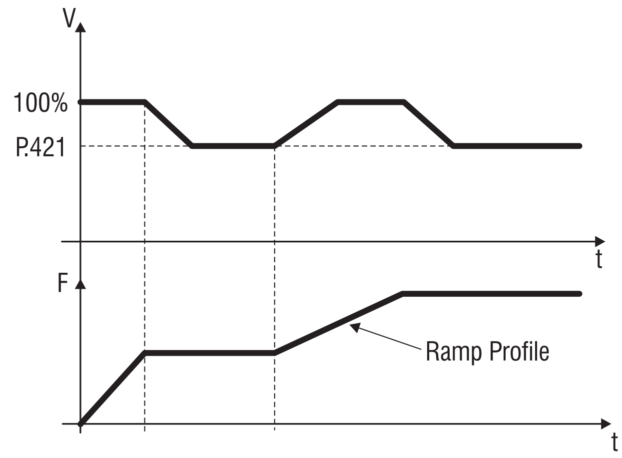


Figure 7.6.21: Output Voltage Reduction with P.420 = 1

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 enable the Output Voltage reduction at any time the command is applied.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.420	Volt reduc mode	[0] Always	0	0	1			471
		[1] Steady state						
P.421	V reduction fact		100	10	100	% of P.061	1	472
P.422	V fact mult src	[0] Null	0	0	3			473
		[1] Analog inp 1 (setting through I.200…I.204)						
	[2] Analog inp 2	(setting through I.210…I.214)						
		[3] Analog inp 3 (setting through I.220…I.224)						

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 hysteresis)

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

P.442 Frequency prog 2 (Frequency programmed 2)

Set point for the detection of the second frequency threshold.
The signalling of the frequency level detection can be programmed on the digital outputs.

P.443 Freq prog 2 hyst (Frequency programmed 2 hysteresis)

Defines a tolerance band around the ***Frequency prog 2 (P.442).***

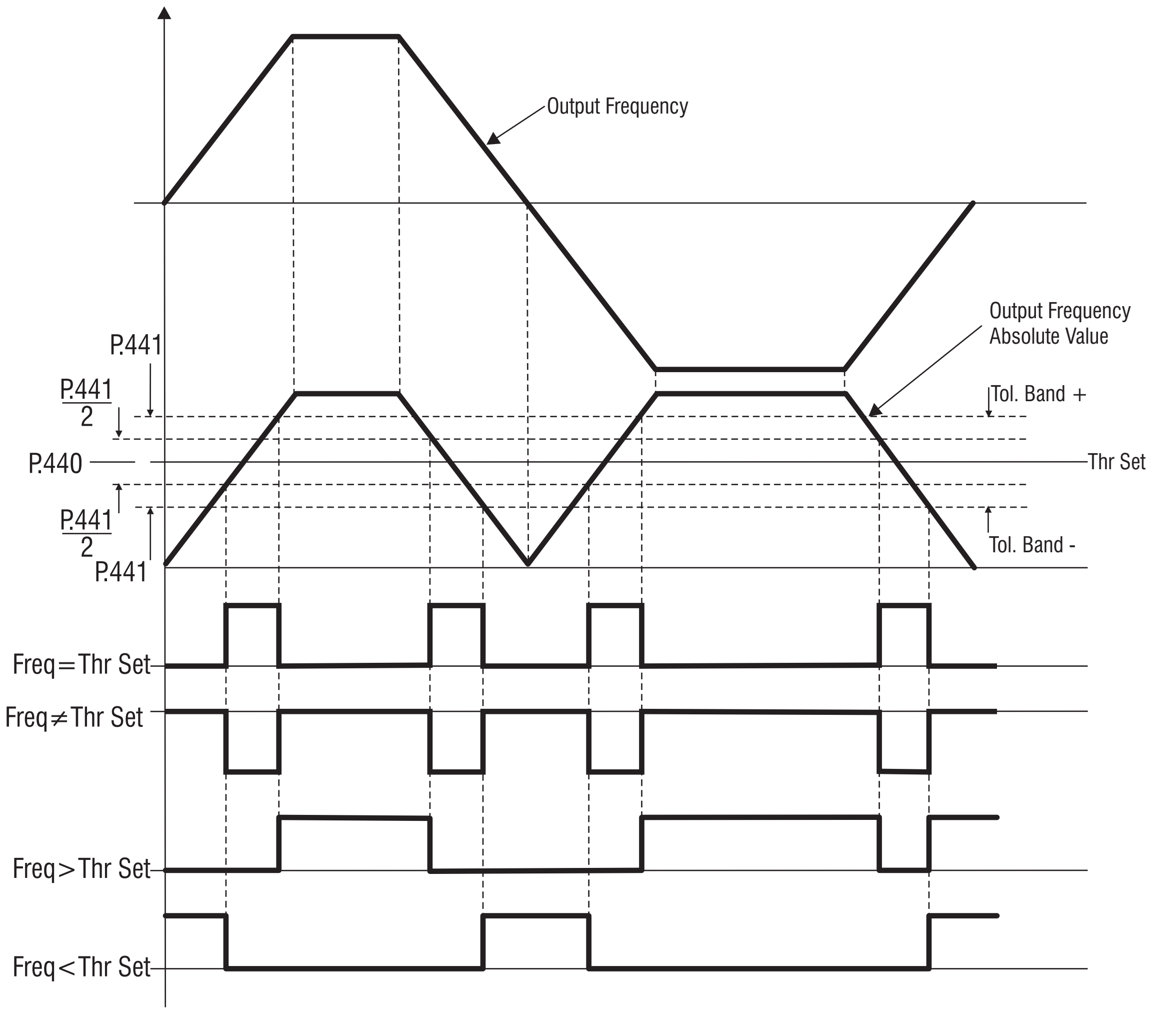


Figure 7.6.22: Program Frequency Tresholds (example of P.440 and P.441)

A signalling of the "frequency threshold" status is available on the digital output as "***Freq thr 1***" and "***Freq<thr2***".

Code	LCD display	[Code] & LCD select.	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
P.442	Frequency prog 2		0	0	F.020	Hz	0.1	476
P.443	Freq prog 2 hyst		0.5	0	F.020	Hz	0.1	477

Steady State Signalling

The signalling of the steady state condition can be configured by the following parameters.

P.460 **Const speed tol** (Constant speed tollerance)

It defines the tolerance band of the speed variation.

P.461 **Const speed dly** (Constant signalling delay)

Delay time for the signalling.

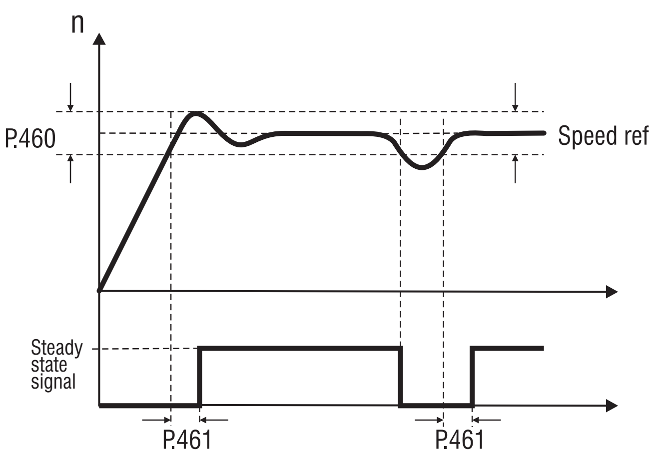


Figure 7.6.23: Constant Speed Control

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

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.460	Const speed tol		0	0	25	Hz	0.1	478
P.461	Const speed dly		0,1	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 hysteresis)

Tolerance band for the signalling of the temperature threshold.
The parameter **d.050** (menu **DISPLAY**), is the heatsink temperature level .

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

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.480	Heatsnk temp lev		70	10	110	°C	1	480
P.481	Heatsnk temp hys		5	0	10	°C	1	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 PWM carrier frequency is automatically changed, according to the inverter output frequency.
This can avoid the inverter overheating at low frequencies. Furthermore, it improves the sinewave output, providing a smoother rotation.

P.502 Min switch freq (Minimum switching frequency)

Setting of the minimum switching frequency value.

P.520 Overmod max lev (Overmodulation maximum level)

Setting of the overmodulation maximum level.
This function increases the output voltage, providing as consequence a higher torque availability.
Setting the parameter too high the parameter could increase the distortion of the output voltage and give rise to undesired vibrations of the system.

P.540 Out Vlt 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 the motor output voltage independent of eventual fluctuation of the mains, through an automatic adjustment of the first.

Code	LCD display	[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	(*)	0	(*)			482
P.501	Sw freq reduc en	[0] Disable [1] Enable	0	0	1			483
P.502	Min switch freq	As P.500	(*)	0	P.500			495
P.520	Overmod max lev		0	0	100	%	1	484
P.540	Out Vlt auto adj	[0] Disable [1] Enable	1	0	1			485

Dead Time Compensation

The "dead time compensation" function 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.

It is possible to set a voltage value and the compensation variation, called Gradient, through the following parameters.

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

Dead time compensation level.

P.561 Deadtime cmp slp (Dead time compensation slope)

Compensation gradient value.

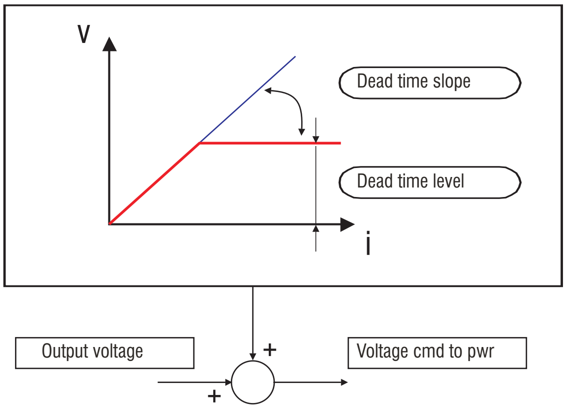


Figure 7.6.18: Dead Time Compensation

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.560	Deadtime cmp lev		(*)	0	255			486
P.561	Deadtime cmp slp		(*)	0	255			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 setting the corresponding "IPA", reported in the parameters list table, into this parameter.

P.600 Speed dsply fact (Speed display factor)

Costant used to convert frequencies to speeds.
The parameters is applied to the variable reported in the chapter DISPLAY, sections Basic and Encoder.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.580	Startup display		1	1	1999			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 Protection disabled
- Stopped motor: possibility to write all parameters.
- Running motor: some parameters are write-protected (see **IPA** in bold on main tables)

P.999 = 1 All parameters are write-protected except:
- **F.000 Motorpot ref, F.100 … F.116,** multispeed function parameters
- **P.999 Param prot code**
- **C.000 Save parameter** (only with motor stopped)
- **C.020 Alarm clear**
- **H.500...H511**, serial line commands.

P.999 = 2 All parameters are write-protected except:
- **P.999 Param prot code**
- **C.000 Save parameter** (only with motor stopped)
- **C.020 Alarm clear**
- **H.500...H511**, serial line commands.

P.999 = 3 Protection disabled
- Stopped motor: possibility to write all parameters.
- Running motor: some parameters are write-protected (see **IPA** in bold on main tables)

Possibility to execute Save parameter also with running motor.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
P.999	Param prot code		0	0	3			490

7.7 Menu A - APPLICATION

PID Setting

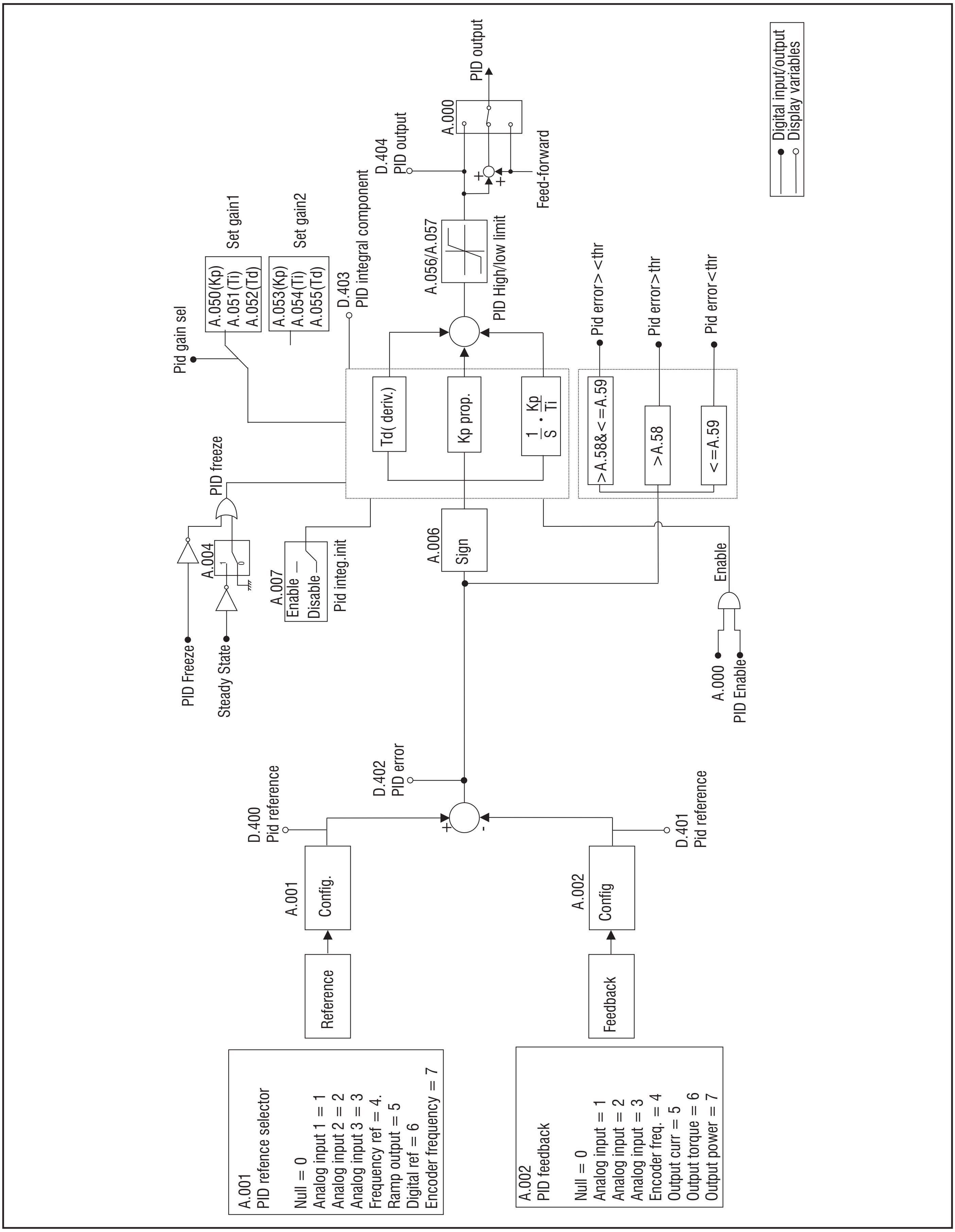


Figure 7.7.1: PID Function Block

All the parameters concerning the setting of the PID function, are contained in the Application menu.

The AGy 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

The use of the PID block as stand-alone is also possible, correlated (or not) to the RUN status of the drive.

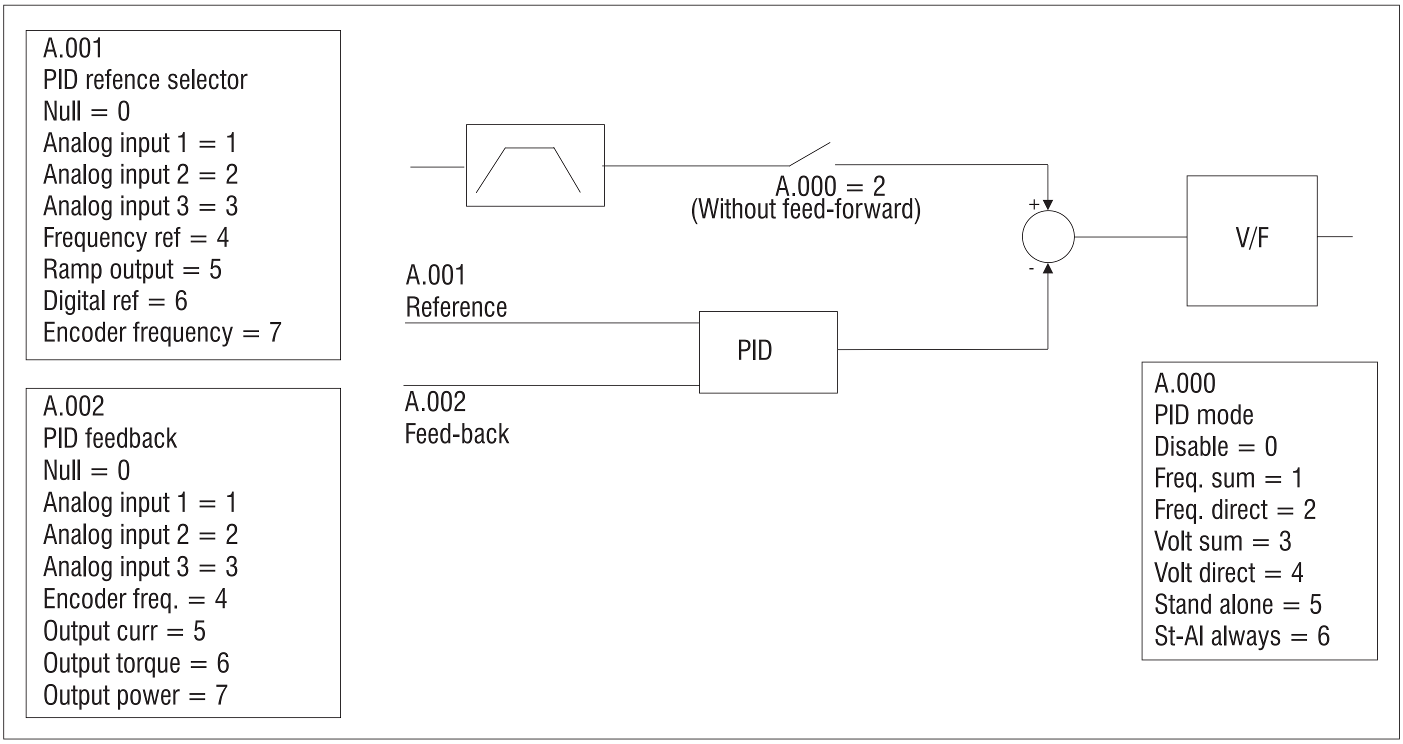


Figure 7.7.2: PID Mode as Frequency Sum or Direct (A.000=1, 2)

A.000 PID Mode

This parameter defines 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 characteristic (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.

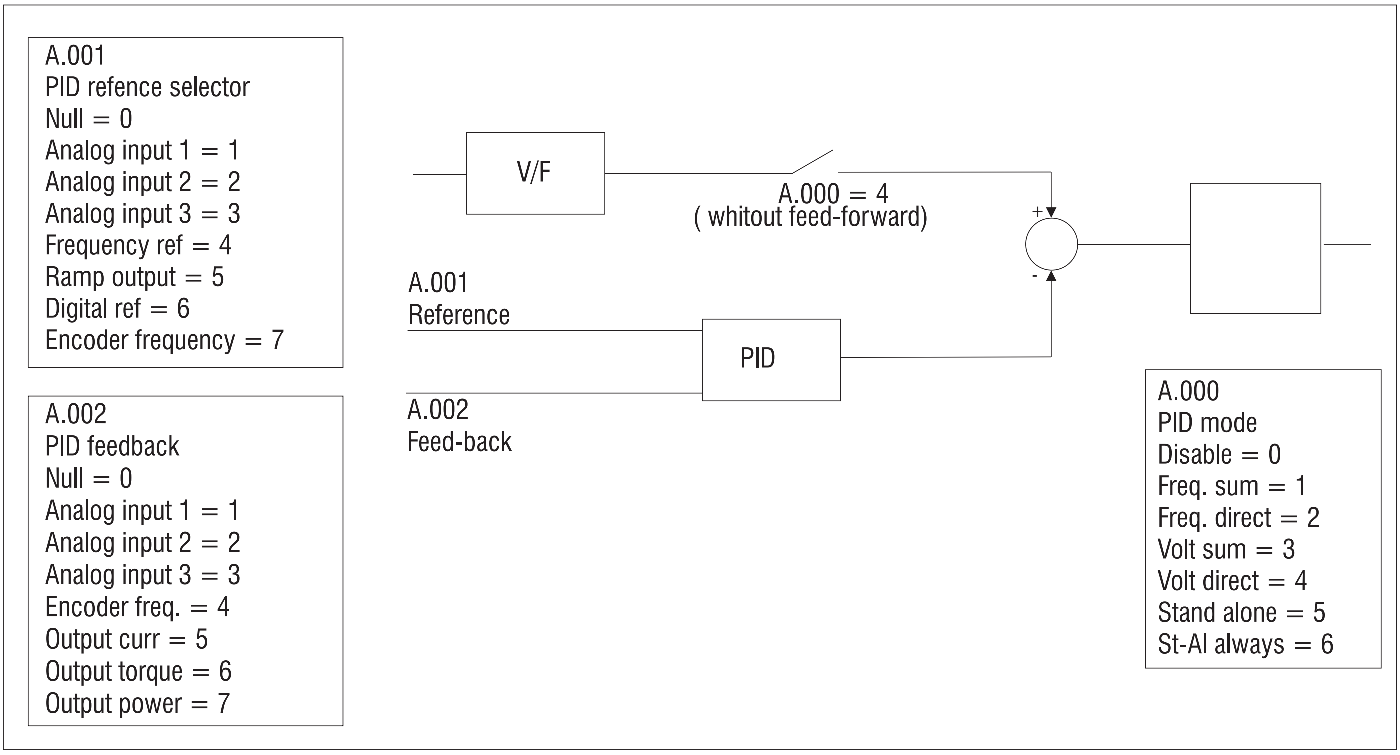


Figure 7.7.3: PID Mode as Voltage Sum or Direct (A.000=3, 4)

A.001 PID reference selector

It defines 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 Analog inp 3	PID Reference connected to Analog input 3
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 Encoder freq	PID Reference connected to Encoder frequency

A.002 PID Fbk sel (PID feedback selector)

It defines the source, from where the PID feed-back signal is provided and controlled.

A.002 = 0 Null	Null
A.002 = 1 Analog inp 1	PID Feed-back connected to Analog input 1
A.002 = 2 Analog inp 2	PID Feed-back connected to Analog input 2
A.002 = 3 Analog inp 3	PID Feed-back connected to Analog input 3
A.002 = 4 Encoder freq	PID Feed-back connected to Encoder frequency
A.002 = 5 Output curr	PID Feed-back connected to Output current signal
A.002 = 6 Output torque	PID Feed-back connected to Output torque signal
A.002 = 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 Ref sel (A.001)*** is set as “6”

A.004 PID activate mode

It defines if the PID function has to be always enabled or if it has to be active in steady state only.

A.004 = 0 Always	The PID function is always enabled.
A.004 = 1 Steady state	The PID function is enabled only in steady state.

A.005 PID-Encoder Sync (PID encoder syncronism)

The function syncronizes the updating time of the PID regulator, with the encoder updating time defined by ***I.504***.

A.005 = 0 Disable The function is not enabled. The parameter ***PID update time (A.008)*** is active.

A.005 =1 Enable The function is enabled. Setting of parameter ***A.008*** has no effect on PID regulation. PID updating time is defined by ***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 also the regulation effect is modified).

A.007 PID Integ Init en (PID integral initialization enabling)

The function allows to initialize the “integral parts” at the RUN command or during the passage from “gains set 1” to “gains set 2”. This avoids sudden variations of the regulator output.
When the function is active, the value of the integral component, is initialized 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). This parameter has no effect if ***A.005*** =1.

Code	LCD display	[Code] & LCD select.	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] Analog inp 3 [4] Frequency ref [5] Ramp output Ramp output [6] Digital ref [7] Encoder freq	0	0	7			1201
A.002	PID fbk sel	[0] Null [1] Analog inp 1 [2] Analog inp 2 [3] Analog inp 3 [4] Encoder freq [5] Output curr [6] Output torque [7] Output power	0	0	7			1202
A.003	PID digital ref		0	-100	100	%	0,1	1203
A.004	PID activat mode	[0] Always [1] Steady state	0	0	1			1204
A.005	PID-Encoder sync	[0] Disable [1] Enable	0	0	1			1205
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

A.050 PID Prop gain 1 (PID proportional gain 1)

Proportional gain (set 1).

A.051 PID Int t const1 (PID integral constant 1)

Integral action time (set 1).

A.052 PID Deriv gain 1 (PID derivative gain 1)

Derivative action time (set 1).

A.053 PID Prop gain 2 (PID proportional gain 2)

Proportional gain (set 2).

A.054 PID Int t const2 (PID derivative gain 2)

Integral action time (set 2).

A.055 PID Deriv gain 2 (PID integral constant 2)

Derivative action time (set 2).

The enabling of the PID regulator and the selection of two different set of gains, can be carried out via programmable digital inputs, as described below.

Digital input configuration to select gain 1 or gain 2.
I.100=21 PID gain sel

Discontinuity of the PID output caused by changing the set of gains, can be avoided by enabling the function:
PID Integ. Init en (A.007)

The PID function enabling, is possible by programming the digital inputs as **PID Enable** (code 20).

Code	LCD display	[Code] & LCD select.	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 Deriv 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 Deriv 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	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
A.056	PID high limit		100	-100	100	%	0.1	1215
A.057	PID low limit		-100	-100	100	%	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

APPLICATION SAMPLE: PRESSURE CONTROL

Use of the PID function for pressure control of pumps and extruder.

The analog signals relative to the set-point and to the pressure-transducer must be sent to the inverter that controls the extruder speed. If needed, also the digital command for the PID enabling has to be configured.

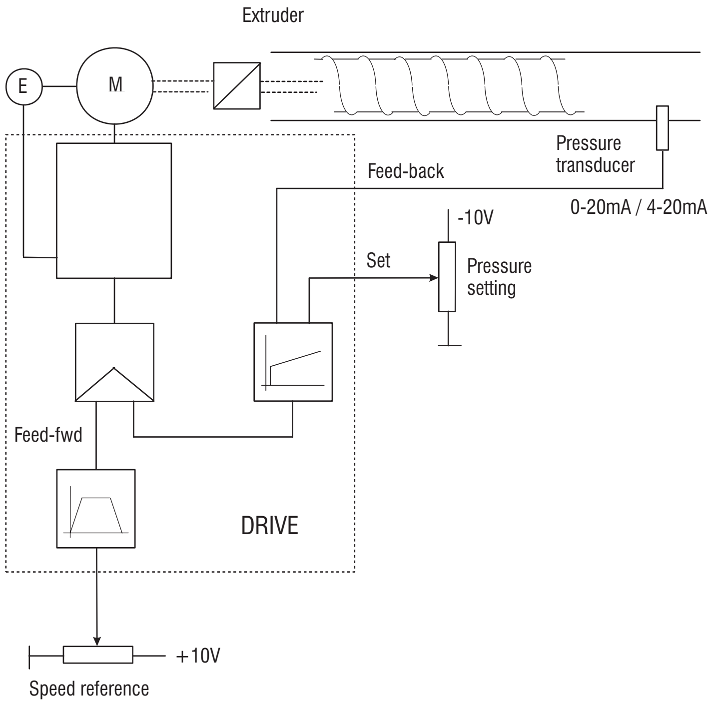


Figure 7.7.4: PID Pressure Control for Pumps and Extruders

Configuration of the ***Digital input 1*** for the PID regulator enabling.

I.000 = 20 (PID enable)

Configuration of the ***Ref 1 channel*** for the the main frequency reference.

F.050 = 1 (Analog input 1 as main SPEEDreference)

Configuration of the ***PID mode*** parameter.

A.000 = 1 (PID enabled as "Frequency sum")

Configuration of the ***PID reference selector*** parameter for the reference of the PID function.

A.001 = 2 (Analog input 2 as pressure setpoint)

Configuration of the ***PID fbk selector*** parameter for the feedback of the PID function.

A.002 = 3 (Analog input 3, only current type 0-20mA / 4-20mA, for the pressure transducer)

- In the **DISPLAY** menu, verify the correct reading of the PID reference (parameter ***d.400***) and of the PID feedback (parameter ***d.401***).
- Set the PID regulators gain as follow:

  A.050 = 2 Proportional part

  A.051 = 1 Integral part

  A.052 = 0 Derivative part

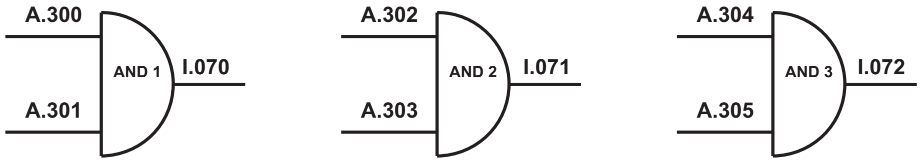
When it is deemed necessary to limit the correction of PID regulator, use the parameters ***A.056*** and ***A.057***.

Enable the PID function using the digital input 1 and execute a drive save parameters.

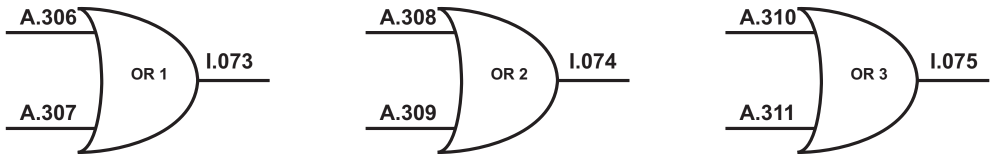
Programmable Logic Inputs

The programmable area is formed by:

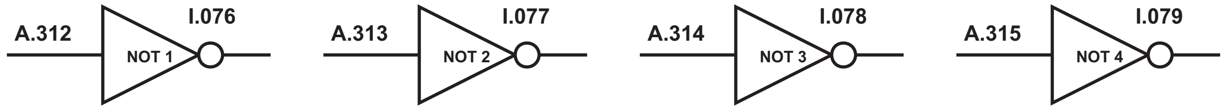
- Three AND logical gates with two inputs:



- Three OR logical gates with two inputs:



- Four logical NOT gates:



The inputs of each logical gate may be connected to any digital drive input, or to the output of another logical gate, and even to other digital variables of the drive, by programming the parameter of the output in question.

Parameter **I.100** (chapter 7.1 – List of Parameters), contains the complete list of the signals which may be assigned to any logical gate input.

The output of each one of the gates may be used to give an order, programming the output parameter relative to the order from the appropriate mode.

<u>*Example:*</u>

The Run command is converted into AND in digital input 7 and digital input 4 .

This result can be obtained by carrying out the following set up procedure:

I.006 Dig input 7 cfg	**= [0] None**
I.003 Dig input 4 cfg	**= [0] None**
I.070 AND 1 out cfg	**= [1] Run**
A.300 AND1 In 1 src	**= [62] DI 7**
A.301 AND1 In 2 src	**= [59] DI 4**

A.300 AND1 In 1 src

A.301 AND1 In 2 src

Set up input block AND1. *See the list of parameter selections I.100.*

A.302 AND2 In 1 src

A.303 AND2 In 2 src

Set up input block AND2. *See the list of parameter selections I.100.*

A.304 AND3 In 1 src

A.305 AND3 In 2 src

Set up input block AND3. *See the list of parameter selections I.100.*

A.306 OR1 In 1 src

A.307 OR1 In 2 src

Set up input block OR1. *See the list of parameter selections I.100.*

A.308 OR2 In 1 src

A.309 OR2 In 2 src

Set up input block OR2. *See the list of parameter selections I.100.*

A.310 OR3 In 1 src

A.311 OR3 In 2 src

Set up input block OR3. *See the list of parameter selections I.100.*

A.312 NOT1 In src

A.313 NOT2 In src

A.314 NOT3 In src

A.315 NOT4 In src

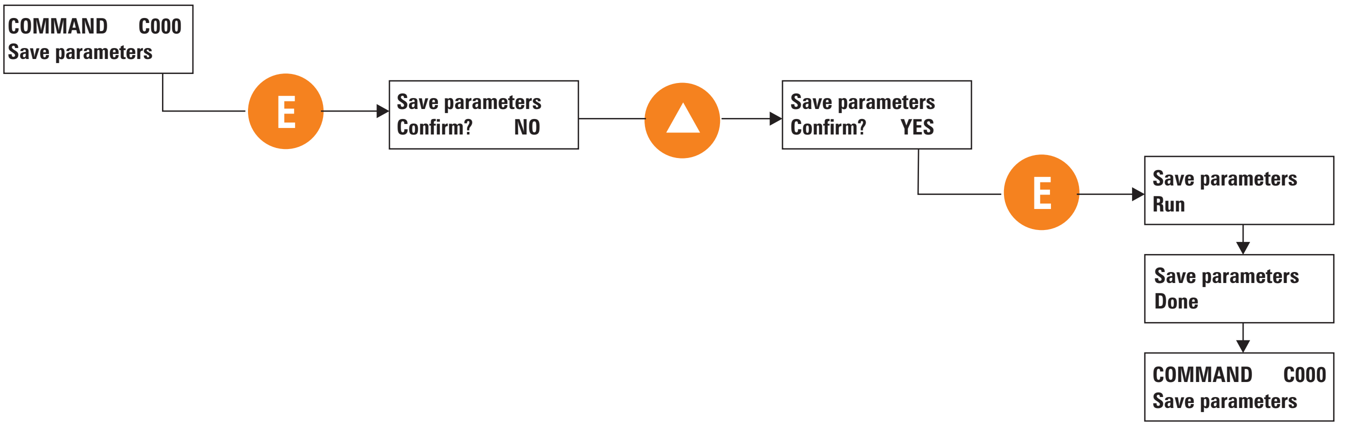
Set up input block NOT x. *See the list of parameter selections I.100.*

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
A.300	AND1 In 1 src		49	0	77			1355
A.301	AND1 In 2 src		49	0	77			1356
A.302	AND2 In 1 src		49	0	77			1357
A.303	AND2 In 2 src		49	0	77			1358
A.304	AND3 In 1 src		49	0	77			1359
A.305	AND3 In 2 src		49	0	77			1360
A.306	OR1 In 1 src		49	0	77			1361
A.307	OR1 In 2 src		49	0	77			1362
A.308	OR2 In 1 src		49	0	77			1363
A.309	OR2 In 2 src		49	0	77			1364
A.310	OR3 In 1 src		49	0	77			1365
A.311	OR3 In 2 src		49	0	77			1366
A.312	NOT1 In src		49	0	77			1367
A.313	NOT2 In src		49	0	77			1368
A.314	NOT3 In src		49	0	77			1369
A.315	NOT4 In src		49	0	77			1370

7.8 Menu C - COMMANDS

All the parameters of the COMMAND menu need to be executed according to the procedure listed below.

Save parameters command is used as example.



Basic

C.000 Save parameters

Every modification of parameter value has immediate effect on drive operation, but is not automatically stored in permanent memory

The Save parameter command is used to store the set of parameters currently in use in permanent memory.

The drive signals the presence of unsaved parameters by blinking the dedicated yellow LED (Prg) on the keypad.

When the drive is turned off, all unsaved modifications are lost.

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.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
C.000	Save parameters	*(1)* *(2)*	*(1)*	*(1)*	*(2)*			800
C.001	Recall param	*(1)* *(2)*	*(1)*	*(1)*	*(2)*			801
C.002	Load default	*(1)* *(2)*	*(1)*	*(1)*	*(2)*			802

Alarm Register Reset

C.020 Alarm clear

The function resets completely the ***Alarm List*** register (***D.800…D.803***).

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
C.020	Alarm clear	*(1)* *(2)*	*(1)*	*(1)*	*(2)*			803

External Key

C.040 Recall key prog

Recal of the parameters contained in the optional external key **PRG-KEY.**
The key has to be set in the connector JP10 on the regulation board.

C.041 Save pars to key

Storage of the inverter parameters on the optional external key **PRG-KEY.**
The key has to be set in the connector JP10 on the regulation board.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
C.040	Recall key prog	*(1)*	*(1)*	*(1)*	*(2)*			804
		(2)						
C.041	Save pars to key	*(1)*	*(1)*	*(1)*	*(2)*			805
		(2)						

LCD keypad

C.070 Recall kbg prog (Recall parameters from LCD keypad)

Recall the set of drive parameters previously stored in the permanent memory on board of the **KB-EV-LCD/..** keypad.

C.071 Save pars to kbg (Save parameters into LCD keypad)

Save the set of drive parameters in use, into the permanent memory on board of the **KB-EV-LCD/..** keypad.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
C.070	Recall kbg prog	*(1)*	*(1)*	*(1)*	*(2)*			809
		(2)						
C.071	Save pars to kbg	*(1)*	*(1)*	*(1)*	*(2)*			810
		(2)						

Tuning

C.100 Measure stator R

It measures the stator resistance of the motor connected.
A correct value of the motor parameters will optimize drive performance in terms of torque availability and speed control, when using Automatic boost ***(P.401)*** and Slip compensation ***(P.450)***.

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

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
C.100	Measure stator R	*(1)*	*(1)*	*(1)*	*(2)*			806
		(2)						

(1) :	AGy-4A, AGy-5	=	Confirm? NO
	AGy-4	=	off
(2) **:**	**AGy-4A, AGy-5**	**=**	**Confirm? YES**
	AGy-4	=	do

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

Bitwise setting of virtual digital inputs.

For further information in relation to the use of virtual digital inputs, see chapter **INTERFACE** section **Enabling Virtual I/O**.

H.001 Exp virtual digital command

Bitwise setting of expansion virtual digital inputs.

For further information in relation to the use of virtual digital inputs, see chapter **INTERFACE** section **Enabling Virtual I/O**.

H.010 Virtual digital state

Bitwise setting of virtual digital outputs.

For further information in relation to the use of virtual digital outputs, see chapter **INTERFACE** section **Enabling Virtual I/O**.

H.011 Exp Virtual digital state

Bitwise setting of expansion virtual digital outputs.

For further information in relation to the use of virtual digital outputs, see chapter **INTERFACE** section **Enabling Virtual I/O**.

H.020 Virtual An Output 1

H.021 Virtual An Output 2

Setting of the value of virtual analog outputs.

H.020 and ***H.021*** = 0 analog outputs value = 0V
H.020 and ***H.021*** = +32767 analog outputs value = +10V
H.020 and ***H.021*** = -32767 analog outputs value = -10V

For further information in relation to the use of virtual analog outputs, see chapter **INTERFACE** section **Enabling Virtual I/O**.

H.022 Exp Virtual An Output 1

Setting of virtual analog output on the expansion board. See description of parameter ***H.021***.

H.025 Virtual analog input 1

H.026 Virtual analog input 2

H.027 Virtual analog input 3

Value adjustment for virtual analog inputs.

For further information in relation to the use of virtual analogical inputs, see chapterof virtual analog inputs, see chapter **INTERFACE**, section **Enabling Virtual I/O**.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
H.000			0	0	255			1000
H.001			0	0	255			1001
H.010			0	0	255			1002
H.011			0	0	255			1003
H.020			0	-32768	32767			1004
H.021			0	-32768	32767			1005
H.022			0	-32768	32767			1006
H.025			0	-32768	32767			1082
H.026			0	-32768	32767			1083
H.027			0	-32768	32767			1084

Profidrive Parameters

H.030 Profidrive Control word

Drive control word in accordance with the ***Profidrive profile.***

For further information please refer to the instruction manual of the SBI card (Profibus).

H.031 Profidrive Status word

Drive status word in accordance with the ***Profidrive profile.***

For further information, refer to the instruction manual of the SBI card (Profibus).

H.032 Profidrive Reference

Using a Profibus SBI card, the speed reference of the drive has to be set through this parameter, in accordance with the ***Profidrive profile.***

H.032 = 0 Reference = 0Hz
H.032 = +4000 hex Reference = ***Max ref freq (F.020)***
H.032 = -4000 hex Reference = ***- Max ref freq (F.020)***

In order to activate the speed reference from profdrive, it is necessay to program the reference selector **F.050 = [8]Prof drive**. See chapter **FREQ & REF,** section **Reference suorces,** for details.

H.033 Profidrive Actual Frequency

Reading of the drive output frequency, in accordance with the ***Profidrive profile.***

In order to activate the speed reference from profdrive, it is necessay to program the reference selector **F.050 = [8]Profdrive**. See chapter **FREQ & REF,** section **Reference suorces,** for details.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
H.030			0	0	65535			1007
H.031			0	0	65535			1008
H.032			0	-16384	16383			1040
H.033			1	-16384	16383			1041

Drive Status

H.034 Drive Status

This structure, consisting of 4 bits, allows to monitor the drive status.
The meaning of each bit is the following:

Bit 0 Drive ready
Bit 1 Alarm state
Bit 2 Motor running
Bit 3 Steady state

H.040 Progress

It is the indication, in percentage, of the progress status of the “Save parameters” and "Measur stator R" commands.
A displaying of 100% means that the function has been completed.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
H.034			0	0	65535			1042
H.040			0	0	100			1009

Parameters Reading Extension

When using high value for the conversion factor (***P.600***), the resulting speed parameters reading may exceed the values irepresentable with a 16 bit word (+32767, –32767).

In this case, it is still possible to monitor the variables through the following parameters:

H.050 Drive output frequency, 32 bit

H.052 Drive reference frequency, 32 bit

H.054 Output speed (d.000)*(P.600), 32 bit

H.056 Speed Ref (d.001)*(P.600), 32 bit

H.058 Encoder freq, 32 bit

H.060 Encoder speed (d.000)*(P.600), 32 bit

H.062 Act alarm

Bitwise reading of active alarms (32 bits). Each bit is associated to a specific alarm, according to table 9.3.1.

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
H.050			0	-2^{31}	$2^{31}-1$			1010
H.052			0	-2^{31}	$2^{31}-1$			1012
H.054			0	-2^{31}	$2^{31}-1$			1014
H.056			0	-2^{31}	$2^{31}-1$			1016
H.058			0	-2^{31}	$2^{31}-1$			1018
H.060			0	-2^{31}	$2^{31}-1$			1044
H.062			0	0	$2^{32}-1$			1060

Remote I/Os Control

H.100 Remote Digital Inputs (0..15)

H.101 Remote Digital Inputs (16..31)

H.110 Remote Digital Outputs (0..15)

H.111 Remote Digital Outputs (16..31)

H.120 Remote Analog input 1

H.121 Remote Analog input 2

H.130 Remote Analog output 1

H.131 Remote Analog output 2

All the parameters are reserved

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
H.100			0	0	65535			1021
H.101			0	0	65535			1022
H.110			0	0	65535			1023
H.111			0	0	65535			1024
H.120			0	-32768	32767			1025
H.121			0	-32768	32767			1026
H.130			0	-32768	32767			1027
H.131			0	-32768	32767			1028

Serial Link Commands

As reported in the chapter **PARAMETERS** section **Commands**, when setting the ***P.000 =3 (SERIAL),*** the main commands are given exclusively via serial line or fieldbus.

A command is activate by writing "1" to the related parameter. Below, a complete list of available commands is reported.

H.500 Hardware Reset

H.501 Alarm Reset

H.502 Coast to stop

H.503 Stop with ramp

H.504 Clockwise Start

H.505 Anti-clockwise Start

H.506 Clockwise Jog

H.507 Anti-clockwise Jog

H.508 Clockwise Flying restart

H.509 Anti-clockwise Flying restart

H.510 DC Brake

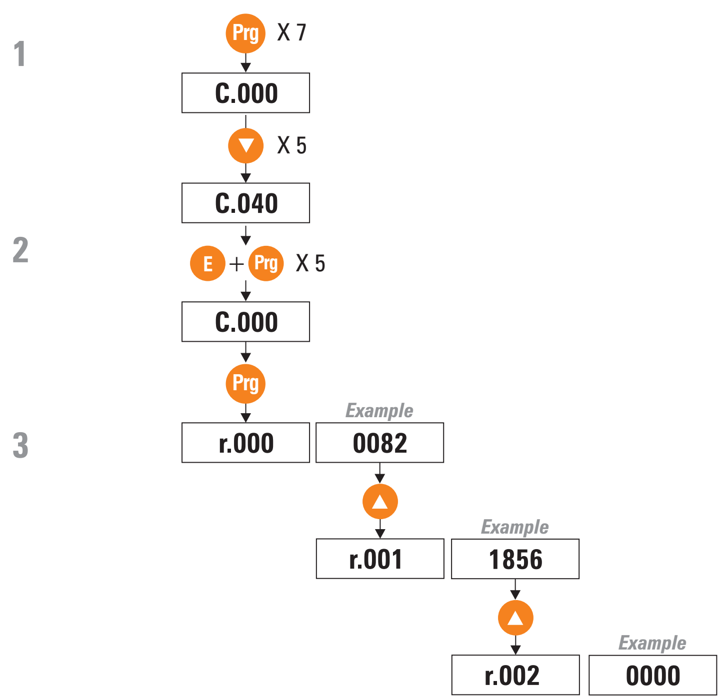
H.511 Reserved

Code	LCD display	[Code] & LCD select.	Default	MIN	MAX	Unit	Variation	IPA
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
H.511			0	0	1			1043

7.10 Other functions

7.10.1 Hour of life of the drive

1 - From menu C, select parameter
2 – Press the **E** and **PRG** keys five times in sequence
3 – At this point, the Sr-service (**r.000**) menu can be accessed:
r.000 = drive power-on cycles (hexadecimal format)
r.001 = time lower part in (hex), multiply x 5 (minutes) and divide by 60 (seconds) to obtain the hours.
r.002 = time top part in (hex) , multiply x 5 (minutes) and divide by 60 (seconds) to obtain the hours.



Chapter 8 - Serial Protocol

8.1 Modbus RTU Protocol for AGy drives

8.1.1 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.

8.1.2 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 99 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 32 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.

8.1.3 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.

8.1.3.1 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 99, 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.

8.1.3.2 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 (Not used for AGy drives)
- 02 Read Input Status (Not used for AGy drives)
- 03 Read Holding Registers
- 04 Read Input registers
- 05 Force Single Coil (Not used for AGy drives)
- 06 Preset Single register
- 07 Read Status
- 15 Force multiple Coils (Not used for AGy drives)
- 16 Preset Multiple Registers

The 01 and 02 functions, so as the 03 and 04 functions, are similar and interchangeable. See chapter 3 for a complete and detailed description of the functions.

8.1.3.3 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 (11000000000000101). 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.

8.1.3.4 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.

8.1.3.5 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

agy0800

8.1.4 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.

8.1.4.1 Read Output Registers (03)

This function allows to read 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.

Modbus example:

- Drive address 25 (19hex)
- 3 Registers from 0069 (0045_{hex}) to 0071 (0047_{hex}).

ADDR	FUNC	DATA start Addr HI	DATA start Addr LO	DATA word # HI	DATA word # LO	CRC HI	CRC LO
19	03	00	44	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 to 0.

The drive parameters must be 16 bits (1 Modbus register), unless explicitly stated (for example, H.050 to 32 bits). In the case of parameters to 32 bits the reading is carried out using 2 Modbus registers.

The first register will be the lower part, the second, the higher part.

8.1.4.2 Read Input Registers (04)

This function is similar to the previous one.

8.1.4.3 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.

Modbus example:

- 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

8.1.4.4 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).

Modbus example:

- Drive address 25 (19_{hex})

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

agy0801

8.1.4.5 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.

Modbus example:

- Drive address 17 (11_{hex})
- Starting Register 35 (0023_{hex})
- Number of registers to be written 1 (0001_{hex})
- Value 268 ($010C_{hex}$)

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	0C	6C	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

8.1.5 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”.

Modbus example:

- Drive address 10 ($0A_{hex}$)
- Coil 1186 ($04A2_{hex}$)

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

8.1.5.1 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 ACKNOWLEDGEMENT	The function can not be performed with the present operating conditions or attempt to write a read-only parameter.

8.1.6 System configuration

The configuration of the serial line can be performed by programming the parameters in the menu INTERFACE, submenu Serial Config. Some parameters are common to all the 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	4	0	5			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						160

8.2 Proprietary protocol

8.2.1 Introduction

The Fox Link protocol defines the format and the communication mode between a system controlling master and one or more slaves responding to the master requests. It defines how the master and the slaves start and end the communication, how the messages are exchanged and how the errors are detected.

It is possible to have one master and 32 slave devices connected to the line.

The slave address has to be a number included between 0 and 99.

Only the master can start a transition. A transition can have a request/response format addressed to a single slave or it can have a Broadcast format, where the message is sent to all the slaves on the line.

With the I.600 "Serial link cfg" and I.601 "Serial link bps" parameters it is possible to specify the number of data bits, parity, number of stop bits, baudrate.

Parameter	Code	Protocol type	Data bits	Parity	Stop bits
Serial link cfg	0	Foxlink 7E1	7	Even	1
Serial link cfg	1	Foxlink 7O1	7	Odd	1
Serial link cfg	2	Foxlink 7N2	7	None	2
Serial link cfg	3	Foxlink 8N1	8	None	1
Serial link cfg	4	Modbus 8N1	8	None	1
Serial link cfg	5	Jbus 8N1	8	None	1

tab 821

Parameter	Code	Baudrate
Serial link bps	0	600
Serial link bps	1	1200
Serial link bps	2	2400
Serial link bps	3	4800
Serial link bps	4	9600
Serial link bps	5	19200
Serial link bps	6	38400

tab 822

8.2.2 Message format

All transmitted characters are 7-bit ASCII format.

The parameter values are specified with integer decimal numbers and with units of measure equal to the highest foreseen resolution (if not otherwise stated).

The transmission string has the following format:

<EOT>,	<HAD>,<HAD>,<LAD>,<LAD>,	<STX>,	X,y,y,y,=,n,…,n,	<ETX>,	<CKS>,	<CR>
Start code	Slave address	Data start	Data	Data end	Control code	

tab823

<EOT> = 04H

<STX> = 02H

<ETX> = 03H

<ACK> = 06H

<NAK> = 15H

<HAD> = most significant digit of inverter address

<LAD> = least significant digit of inverter address.

<CKS> = XOR of characters between <STX> and <ETX> eventually added to 20H if XOR is less than 20H.

<CR> = 0DH end character for each string

X = letter stating the menu containing the transmitted parameter

y,y,y = numeric code representing the transmitted parameter
The numeric code has to be turned into a 3-character string filling the non-significant characters with '0'.

Example: the transmitted parameter has a numeric code equal to 1, therefore the 3-character string to be transmitted is "001".

n,…,n = value of the parameter to be read or written..

8.2.3 Address

As mentioned above, the Foxlink transitions always include the master, which controls the line, and one slave at the time (with the exception of the Broadcast messages). In order to identify the message receiver, the bytes 1,2,3,4,5 contain the address of the selected slave. Each slave is therefore identified by a single address. The legal addresses are included between 0 and 99. A message sent with a 99 address means that the message is a "broadcast" one, i.e. it is addressed to all slaves simultaneously. The message reception is granted by all mains-connected slaves while the response for the performed reception is sent only by the drive with address 99, if it is available on the mains. With the I602 "Device address" parameter it is possible to specify the slave address.

8.2.4 Control code

The checksum is calculated performing the XOR of the characters included between <STX> and <ETX>. If the obtained value is lower than 20H, the 20H value is then added.

8.2.5 Functions

The following table lists the menus and the letter representing the menu which can be reached using the Foxlink protocol.

Display	“D”	Read
Interface	“I”	Read/Write
Freq & Ramp	“F”	Read/Write
Parameter	“P”	Read/Write
Application	“A”	Read/Write
Command	“C”	Write
Hidden	“H”	Read/Write

Function	Msg Master	Msg Slave	Meaning
Display reading	...,<STX>,D,y,y,y,<ETX> , …	<STX>,D,y,y,y,=n,…,n,<ETX>,<CKS>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab824

Function	Msg Master	Msg Slave	Meaning
Interface reading	…,<STX>,I,y,y,y,<ETX>,…	<STX>,I,y,y,y,=n,…,n,<ETX>,<CKS>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception
Interface writing	…,<STX>,I,y,y,y,=,n,…,n,<ETX>,…	<ACK>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab825

Function	Msg Master	Msg Slave	Meaning
Freq & Ramp reading	…,<STX>,F,y,y,y,<ETX>,…	<STX>,F,y,y,y,=n,…,n,<ETX>,<CKS>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception
Freq & Ramp writing	…,<STX>,F,y,y,y,=,n,…,n,<ETX>,…	<ACK>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab826

Function	Msg Master	Msg Slave	Meaning
Parameter reading	…,<STX>,P,y,y,y,<ETX>,…	<STX>,P,y,y,y,=n,…,n,<ETX>,<CKS>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception
Parameter writing	…,<STX>,P,y,y,y,=,n,…,n,<ETX>,…	<ACK>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab827

Function	Msg Master	Msg Slave	Meaning
Application reading	…,<STX>,A,y,y,y,<ETX>,…	<STX>,A,y,y,y,=n,…,n,<ETX>,<CKS>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception
Application writing	…,<STX>,A,y,y,y,=,n,…,n,<ETX>,…	<ACK>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab828

Function	Msg Master	Msg Slave	Meaning
Command writing	…,<STX>,C,y,y,y,=,n,<ETX>,… dove n = 1	<ACK>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab829

Function	Msg Master	Msg Slave	Meaning
Hidden reading	…,<STX>,H,y,y,y,<ETX>,…	<STX>,H,y,y,y,=n,…,n,<ETX>,<CKS>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception
Hidden writing	…,<STX>,H,y,y,y,=,n,…,n,<ETX>,…	<ACK>,<CR>	Accepted Function
		<STX>,E,<ETX>,<CKS>,<CR>	Non-Accepted Function
		<NAK>,<CR>	Wrong Reception

tab830

8.2.6 Msg Slave meaning

The Wrong Reception Message is returned when a communication error occurs (wrong checksum).

The Non-Accepted Message is returned if:

- a read-only parameter is written,
- a non existing parameter is read or written,
- the written value is outside the allowed range,
- a parameter which can be written only with a stopped motor is written when the motor is rotating.

Notes:

Chapter 9 - Troubleshooting

9.1 Drive Alarm Condition

The drive keypad will show on the 2nd line of alphanumeric display a blinking message with the code and name of the alarm occurred.

The figure below shows an example of ***OV Overvoltage*** alarm condition during ***Output frequency (d.000)*** parameter displaying.

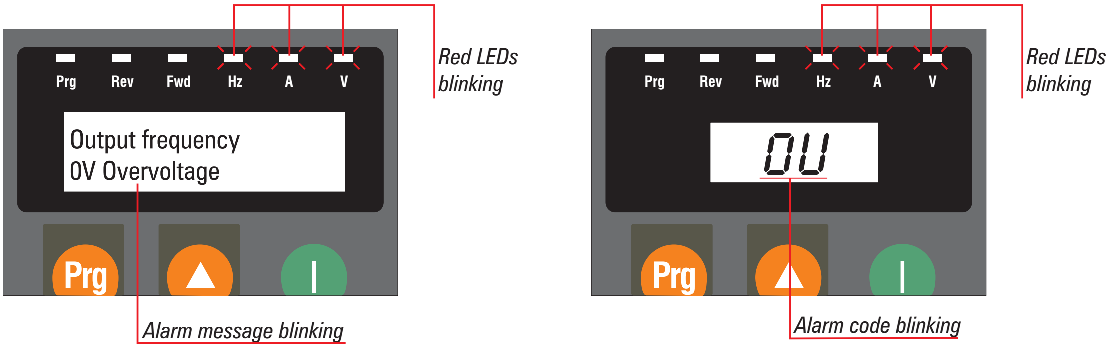


Figure 9.1.1: Alarm Displaying for LDC and 7 segments display

Alarm acknowledge

The active alarm can be acknowledged by pressing the **Prg** button on the keypad. This operation will allow menu navigation and parameter editing while the drive is in alarm state (red LEDs blinking). In order to resume drive operation, an Alarm reset command is necessary.

9.2 Alarm Reset

Alarm reset can be performed in three different ways:

- *Alarm reset by keypad* : pressing simultaneously **Up** and **Down** keys; the reset action will take effect when the buttons are released.

- *Alarm reset by digital input*: it can be performed through a programmable digital input programmed as "[5] Alarm reset", factory set to **Digital Input 5** (terminal 7).

. *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.

The figure below shows how to reset an alarm by keypad.

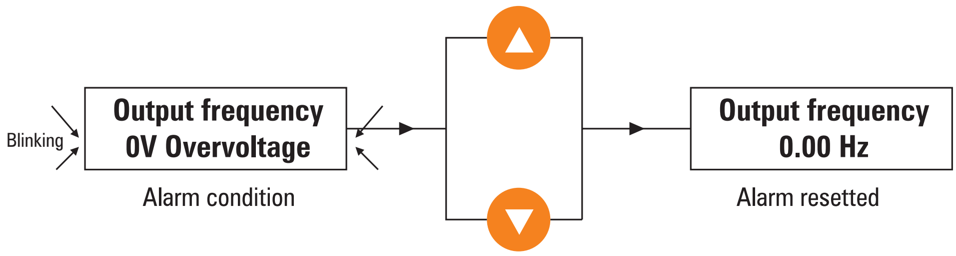


Figure 9.2.1: Alarm Reset

9.3 List of Drive Alarm Events

Table 9.3.1 provides a description of the causes for all the possible alarms.

ALARM		DESCRIPTION	Numerical code from serial	AUTORESET	Bit H.062 H.063
Cod.	Name				
EF	**EF Ext Fault**	It trips when External fault input is active	1	YES	0
OC	**OC OverCurrent**	It trips when an Overcurrent value is detected by output current sensor	2	YES	1
OU	**OV OverVoltage**	It trips when the drive DC Bus voltage is higher than the maximun threshold for the given main voltage setting (see par. 5.8.1)	3	YES	2
UU	**UV UnderVoltage**	It trips when the drive DC Bus voltage is lower than the maximun threshold for the given main voltage setting	4	YES	3
OH	**OH OverTemperat**	It trips when the drive heatsink temperature detected by the switch sensor exceeds its threshold (*)	5	NO	4
OLi	**OLi Drive OL**	It trips when the drive overload accumulator exceeded the trip threshold	6	NO	5
OLM	**OLM Motor OL**	It trips when the drive overload accumulator exceeded the trip threshold	7	NO	6
OLr	**OLr Brake res OL**	It trips when the motor overload accumulator exceeded the trip threshold	8	NO	7
Ot	**Ot Inst OverTrq**	It trips when the torque delivered by the motor exceeds the programmed level for the preset time	9	NO	8
PH	**PH Phase loss**	It trips when the supply phase lack: enabled 30 seconds after one of the supply phases has been disconnected	10	NO	9
FU	**FU Fuse Blown**	It trips when the drive input fuses are blown	11	NO	10
OCH	**OCH Desat Alarm**	IGBT desaturation or instantaneous overcurrent have been detected	12	YES	11
St	**St Serial TO**	It trips when the serial link time out exceeds the programmed level	13	YES	12
OP1	**OP1 Opt 1 Alm**	Communication failure between drive regulation board and option 1 expansion board	14	NO	13
OP2	**OP2 Opt 2 Alm**	Communication failure between drive regulation board and option 2 expansion board	15	NO	14
bF	**bF Bus Fault**	Drive comunication Bus failure	16	NO	15
OHS	**OHS OverTemperat**	It trips when the drive heatsink temperature exceeds a safety level. (*)	17	NO	16
SHC	**SHC Short Circ**	Short Circuit between output phases or Ground fault	18	NO	17
Ohr		Reserved	19		18
LF	**LF Limiter fault**	It trips when the output current limiter or the DC-Link voltage limiter fail. The failure can be caused by wrong settings of regulator gains or by the motor load. This alarm may be activated although the drive is in “Current Clamp” status for a time which exceeds the duration programmed with P181.	20	NO	19
PLC	**PLC Plc fault**	Reserved	21	NO	20
EMS	**Key Em Stp fault**	The Stop key has been depressed, while main commands source was any but the keypad and P.005 "Stop key mode" = [1] EmgStop & Al	22	NO	21
UHS	**UHS Under Temperat**	It trips when the temperature of the drive heatsink is below a safety level (typically –5°C).	23	NO	22

(*) OH switch sensor threshold and OHS analog sensor threshold depend on the drive size (75 °C ... 85 °C)

9.4 Kbg fw mismatch

When the alphanumeric display is connected to the drive, a firmware compatibility check is automatically performed. If firmware version of the alphanumeric display does not match with firmware version of the drive, the warning message “Kbg FW mismatch” is issued on the KB-EV-LCD/.. display for few seconds.

In this condition, some parameters may not be shown with the associated description string, but only with IdCode. Also, some selection list may not be visualized correctly.

By using E@syDrives configurator, it is possible to upgrade the firmware of the alphanumeric display.

Chapter 10 - EMC Directive

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 IEC 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 IEC 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 CDM/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 requirements 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 CDM/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.

INDEX PARAMETERS

MENU A - APPLICATION

MENU C - COMMANDS

MENU D - DISPLAY

MENU F - FREQ & RAMP

MENU H - HIDDEN

MENU I - INTERFACE

MENU P - PARAMETER

MENU S - STARTUP

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