Vector AC Drives

SIEIDrive

AVy

...Quick start up guide

Specification and installation

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 the software version V1.X00.

Variation of the number replacing "X" have no influence on the functionality of the device.

The identification number of the software version can be read on the inverter nameplate or on the label on the FLASH memories mounted on the regulation card.

Table of Contents

Safety symbol legend

WARNING! Commands attention to an operating procedure, practice, condition, or statement which, if not strictly observed, could result in personai injury or death.

CAUTION! Commands attention to an operating procedure, practice, condition, or statement which, if not strictly observed, could result in damage or destruction of equipment.

The seriousness of the injuries and of the damages which could be caused by the non-observance of such indications, depends on the different conditions. Anyway, the instructions given below should always be followed with the highest attention.

NOTE! Commands attention to an operating procedure, practice, condition, or statement that must be highlighted.

0. SAFETY PRECAUTIONS - PRECAUTIONS DE SECURITÉ

ATTENTION!

According to the EEC standards the AVy 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.

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 AVy 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.

WARNING - ELECTRICAL SHOCK AND BURN HAZARD / ATTENTION – DÉCHARGE ÉLECTRIQUE ET RISQUE DE BRÚLURE :

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.

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.

WARNING - FIRE AND EXPLOSION HAZARD / ATTENTION – RISQUE D'INCENDIES ET D'EXPLOSIONS:

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.

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.

WARNING - STRAIN HAZARD / ATTENTION À L'ÉLÉVATION:

Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.

Une élévation inappropriée peut causer des dommages sérieux ou fatals. Il doit être élevé seulement avec des moyens appropriés et par du personnel qualifié.

ATTENTION – CAS DE DECHARGE ELECTRIQUE:

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.

WARNING / ATTENTION:

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.

WARNING / ATTENTION:

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.

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. Le convertisseur n'est pas pourvu de protection contre vitesse de fuite du moteur.

On doit suivir les instructions donneés dans ce manuel et observer les régles nationales de sécurité.

WARNING! - POWER SUPPLY AND GROUNDING / ATTENTION ! ALIMENTATION PUISSANCE ET MISE À LA TERRE

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 /star transformer is avoided.

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

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

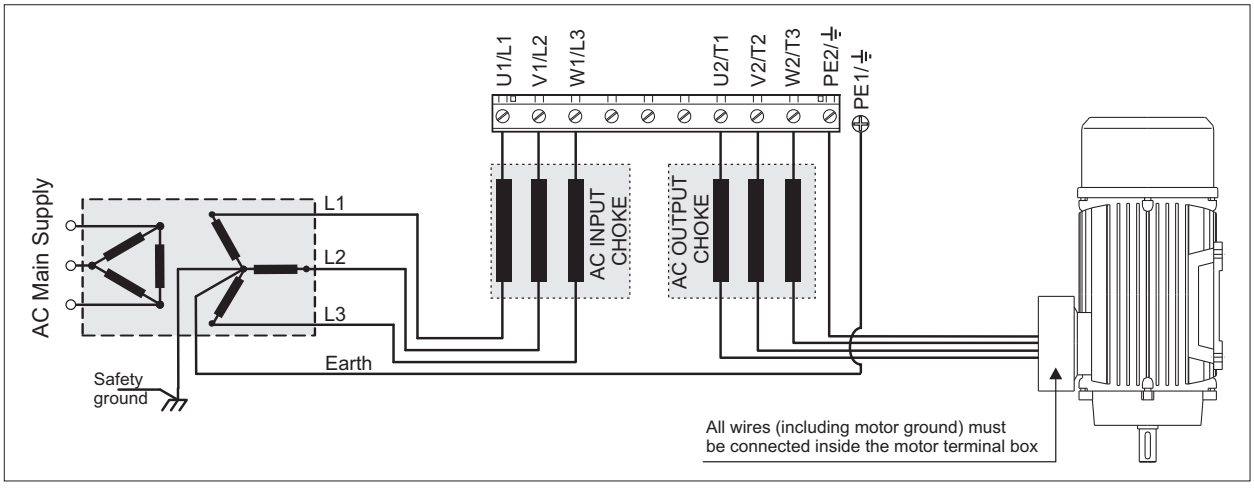
Please refer to the following connection sample.

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.

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

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

Vous pouvez trouver ci-après des exemples de câblage.



CAUTION / PRECAUTION:

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.

CAUTION / PRECAUTION:

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.

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.

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. 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 / PRECAUTION:

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.

CAUTION / PRECAUTION:

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 / PRECAUTION:

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….

CAUTION / PRECAUTION:

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).

CAUTION / PRECAUTION:

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°).

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. 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 5.11 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 5.11 (Instruction manual).

2. 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. If the front plate has to be removed because of a room temperature higher than 40 degrees, the user has to ensure that no occasional contact with live parts may occur.

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. 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.

3. Protect the device from impermissible environmental conditions (temperature, humidity, shock etc.)

Protéger l'appareil contre des effets extérieurs non permis (température, humidité, chocs etc.).

4. No voltage should be connected to the output of the frequency inverter (terminals U2, V2 W2). The parallel connection of several frequency inverters 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).

5. When engaging a running motor, the Auto capture function (Auto capture in the ADD SPEED FUNCT menu) must be activated (not applicable to **Regulation mode**=sensorless vect).

Pour reprendre des moteurs en rotation, la fonction suivante doit être activée : "Auto capture" dans le menu ADD SPEED FUNCT.

6. A capacitative load (e.g. Var compensation capacitors) should not be connected to the output of the frequency inverter (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).

7. Always connect the Drive to the protective ground (PE) via the marked connection terminals (PE2) and the housing (PE1). 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 and doubled for redundancy.

Effectuer toujours des connexions de terre (PE) par le biais des bornes (PE2) et du chassis (PE1). Le courant de dispersion vers la terre est supérieur à 3,5 mA. Selon EN 50178 il faut prévoir dans ces cas une double connexion à terre.

8. 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

9. No dielectric tests should be carried out on parts of the frequency inverter. 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).

10. If the Drives have been stored for longer than two years, the operation of the DC link capacitors may be impaired. 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 inverter).

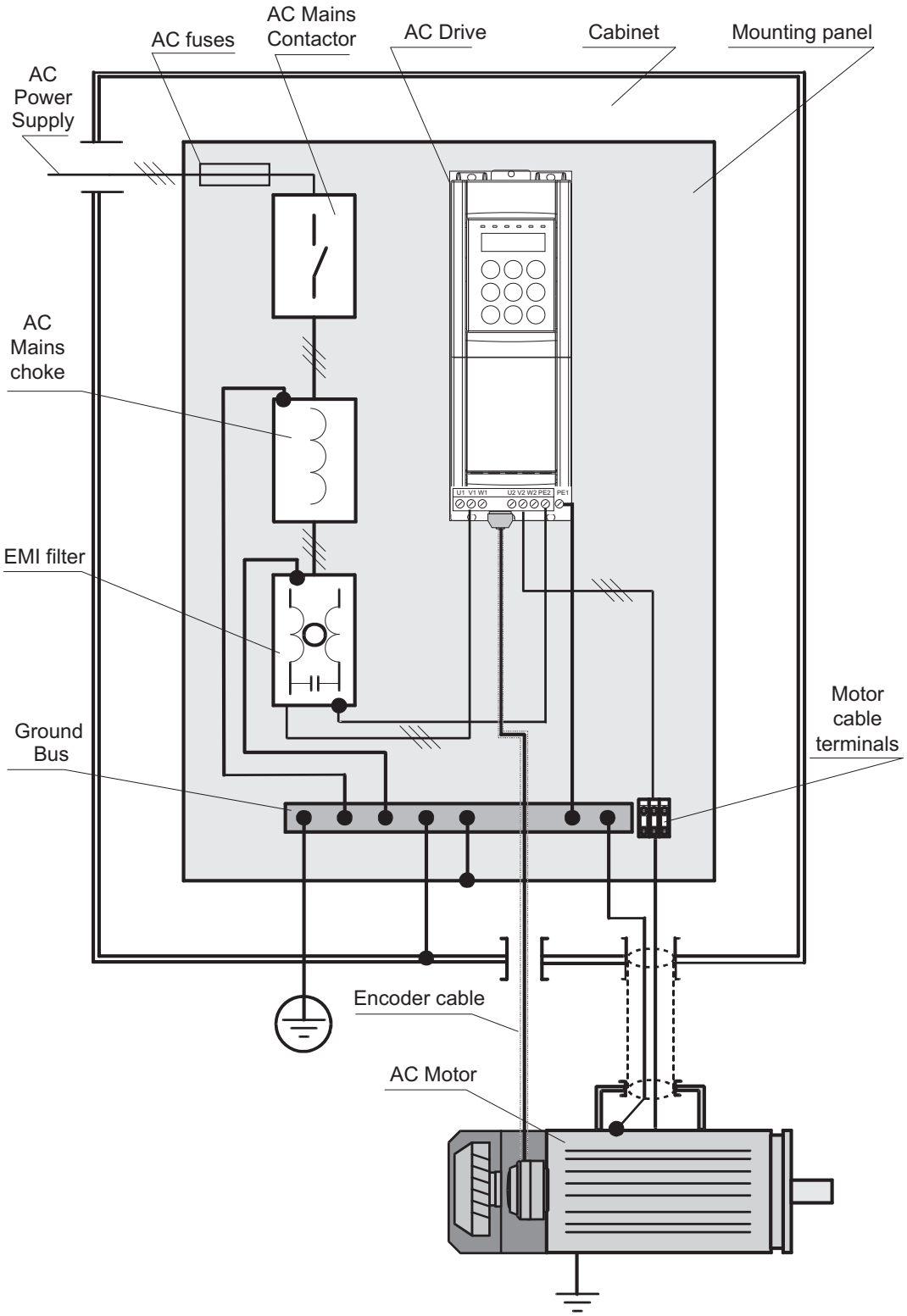
En cas de stockage des convertisseurs pendant plus de deux ans, il faut tenir compte du fait que les condensateurs du circuit intermédiaire gardent leurs caractéristiques d'origine seulement s'ils sont alimentés avant trois ans, à partir de leur date de fabrication. Avant la mise en service des appareils, qui sont restés stockés aussi longtemps, il est conseillé d'alimenter les convertisseurs pendant au moins deux heures, pour récupérer les caractéristiques d'origine des condensateurs : appliquer une tension d'entrée sans activer le convertisseur ***(Disable).***

11. The drive may start accidentally in the event of a failure, even if it is disabled, unless it has been disconnected from the AC input feeder.

L'appaeil peut rédémarrer de façon accidentel en cas d'anomalie, sauf s'il a été déconnecté du reseau.

1. QUICK START UP GUIDE

1.1. FUNCTIONAL CONNECTION DIAGRAM



NOTE: PE1 is the drive safety ground. If PE2 is used to connect the motor ground, EMI filter ground must be connected to PE1.

1.2. OVERVIEW

This guide assumes a standard start up using the keypad for a drive and motor that is to be run in either sensorless vector or flux vector (with digital or sinusoidal encoder for feedback) mode. It is also assumed that a standard scheme is to be used for control. In other words, that the drive will be run from pushbuttons (or contacts) and the speed will be set from a pot input (or 0 to 10 vdc source). While the drive has more modes of operation and dozens of combinations of more exotic and complex optional configurations, this guide will cover most applications that are not being started up by a service engineer anyway. The manual can always be used to do more complex changes to standard configuration beyond this set up.

Standard Wiring: see the manual for the standard suggested configuration for wiring. Note that if this is a system designed and wired by our factory, the set up of the drive (aside from tuning the motor) has already been done and this Quick Start up guide is not applicable. You will instead, need to use the **Quick Tuning** guide for Factory Configured Drives (AVy) located in this guide.

NOTE:

Memory: There are two memories for set-up parameters. One is the active memory which is always the one currently in use by the drive. The other is the permanent memory which is the one the drive will use if power is lost and then restored. Note that power up is the ONLY time when the drive looks at permanent memory. All file uploads and downloads, all changes, etc. are made only to the active memory and read from the active memory. The only time permanent memory is used in any way is that when it is booted into active memory on power up, and when it is changed to new values by the "Save Parameters" command. When parameters are changed during set_ up, the drive will use those parameters but unless you "SAVE PARAMETERS" these changes will not be permanent and upon recycling power, you will lose the changes. This is an advantage if you are "trying" something to see how it works and don't intend to change your permanent set-up.

Underline: Below, when words are underlined, they refer to a key on the keypad labeled that way.

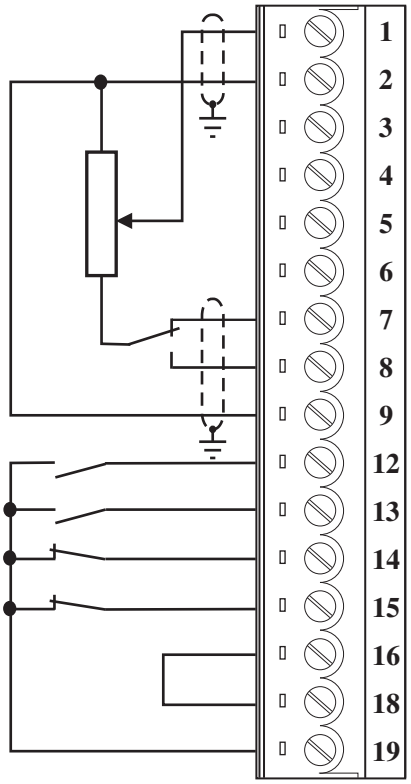
Quotes: Quote marks are put around words which will be seen in the display window of the keypad.

Menu Navigation: in the directions below, you will be directed to press keys to get to some menu item. In many cases, the key will have to be pressed more than once to get to the displayed value. Note that the display has two lines, the top line always shows the next HIGHER level of the menu than where you are. All of the menu items referred to in this start up means look for that item in the SECOND LINE of the display. What is displayed on the top line is for information only and has nothing to do with entering data. If the directions say to press the [Down arrow] to "Regulation Mode" it means keep pushing the [Down arrow] until "Regulation Mode" is displayed in the Second line. If you get confused, look in the manual and it shows the complete menu structure.

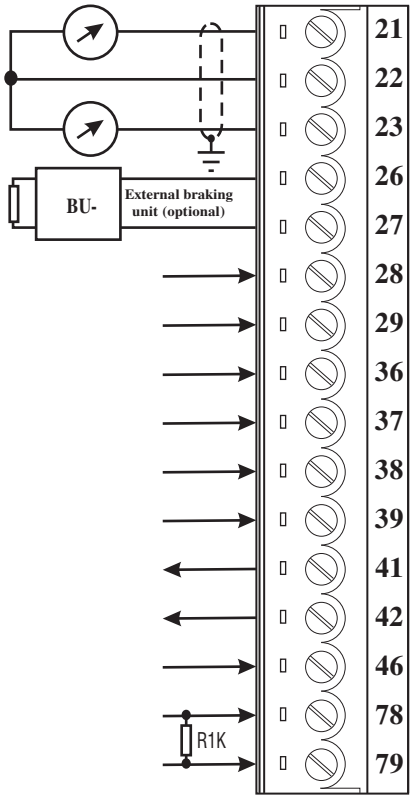
I/O Connections: *the drive WILL NOT OPERATE unless the hardware enable (I/O terminal 12) and the other interlocks are made. It is suggested to make things simple, to temporarily connect the digital inputs* as follows:

Jumper 16 to 18, jumper 19 to 15, jumper 15 to 14, jumper 12 to 13, and connect a simple switch between 13 and 14. This is low voltage logic, so if you don't have a switch, just leave two short pieces of bare wire to twist (or untwist) together. Turning the switch on and off will now enable and disable the drive (and start and stop at the same time) and all other necessary interlocks will be made correctly to test the drive. If you have control over the I/O already with the connected logic and can make the same connections with your own pushbuttons/contacts, the drive can be enabled with those, but this eliminates any possibility of external wiring problems making set up a problem.

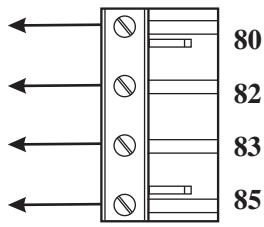
1.3. CONTROL TERMINALS



Strip X1	Function	max
Analog input 1	Programmable/configurable analog differential input. Signal: terminal 1. Reference point: terminal 2. Default setting: Ramp ref 1	±10V 0.25mA (20mA when current ref input)
Analog input 2	Programmable/configurable analog differential input. Signal: terminal 3. Reference point: terminal 4. Default setting: none	
Analog input 3	Programmable/configurable analog differential input. Signal: terminal 5. Reference point: terminal 6. Default setting: none. (1)	
+10V	Reference voltage +10V; Reference point: terminal 9	+10V/10mA
-10V	Reference voltage -10V; Reference point: terminal 9	-10V/10mA
0V	Internal 0V and reference point for±10V	-
Enable drive	Inverter enable; 0V or open: inverter disabled; +15…+30V: Inverte enabled	+30V
Start	Inverter start command; 0V or open: No start; +15…+30V: Start	3.2mA @ 15V
Fast stop	OV or open: Fast stop. +15…+30V: No Fast stop.	5mA @ 24V
External fault	OV or open: External fault. +15…+30V: No External fault	6.4mA @ 30V
COM D I/O	Reference point for digital inputs and outputs, term.12...15, 36...39, 41...42	-
0 V 24	Reference point for + 24V OUT supply, terminal 19	-
+24V OUT	+24V supply output. Reference point: terminal 18 or 27 or 28	+22…28V 120mA @ 24V



Analog output 1	Program.analog output; def.setting: Motor speed. Ref. point: term.22	±10V/5mA
0V	Internal 0V and reference point for terminals 21 and 23	-
Analog output 2	Program.analog output; def.setting: Motor current. Ref. point: term.22	±10V/5mA
BU comm. output	VeCon controlled BU-... braking units command. Ref. point: term.27.	+28V/15mA
0 V 24	Reference point for BU-... command, terminal 26	-
RESERVED		-
RESERVED		
Digital input 1	Programmable digital input; default setting: none	+30V 3.2mA @ 15V 5mA @ 24V 6.4mA @ 30V
Digital input 2		
Digital input 3	Progr. digital input; def. setting: none. Configurable as 2nd encoder index qualifier (setting via S30 jumper, "Digital input 3" parameter must be set 0=OFF)	
Digital input 4	Programmable digital input; default setting: none. Configurable as 1st encoder index qualifier ("Digital input 4" parameter must be set 0=OFF).	
Digital output 1	Programmable digital output; default setting: none	+30V/40mA
Digital output 2		
Supply D O	Supply input for digital outputs on terminals 41/42. Ref. point: term.16.	+30V/80mA
Motor PTC	Motor PTC sensing for overtemperature (cutoff R1k if used)	1.5mA



Strip X2	Function	max curr.
OK relay contact	Potential- relay contact OK relay (closed=OK)	250V AC 1 A AC11
Relay 2 contact	Potential-relay contact configurable (relay 2). Default: open 0 drive stopped	250V AC 1 A AC11

1.3.1 Maximum cable cross section for regulator terminals

Terminals	Maximum Permissible Cable Cross-Section [mm²]		AWG	Tightening torque [Nm]
	flexible	multi-core		
1 ... 79	0.14 ... 1.5	0.14 ... 1.5	28 ... 16	0.4
80 ... 85	0.14 ... 1.5	0.14 ... 1.5	28 ... 16	0.4

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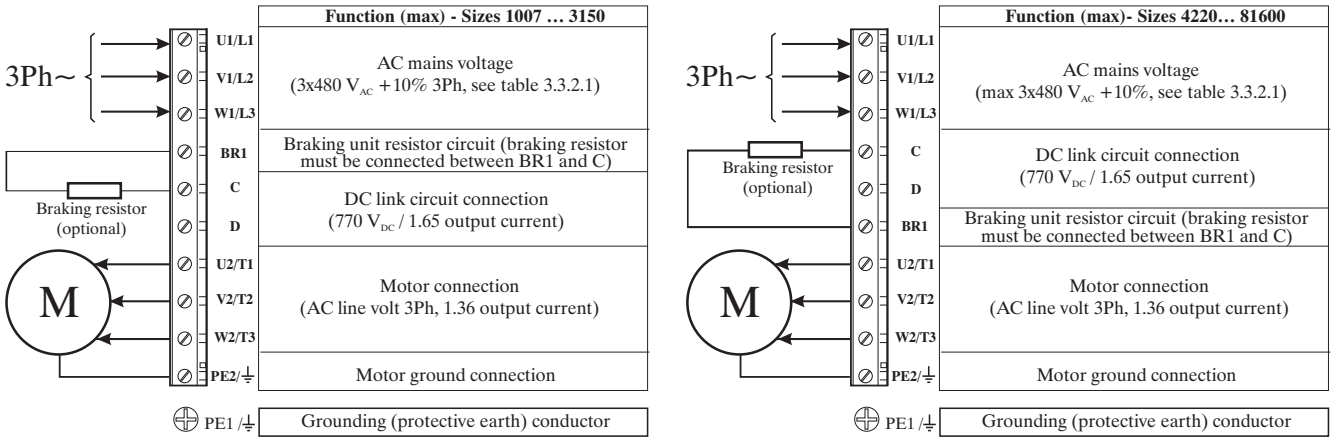
NOTE: Terminal board points are intended for 1 wire/point. Daisy chains and multiple wires/point are better done with a panel monted terminal board.

1.4. POWER TERMINALS

Figure 1.4.1: Power Terminals connection



1.4.1 Maximum cable cross section for power terminals

	1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220
AWG	14				12	10		8	6		
[mm2]	2				4			8	10	16	
[Nm]	0.5 to 0.6							1.2 to 1.5		2	
AWG	14				12	10		8	6	10	
[mm2]	2				4			8	10	6	
[Nm]	0.5 to 0.6							1.2 to 1.5		0.9	
AWG	14				12	10		8	6	6	
[mm2]	2				4			8	10	16	
[Nm]	0.5 to 0.6							1.2 to 1.5		2	

	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000	
AWG	4	2		1/0	2/0	4/0	300*	350*	4xAWG2		* = kcmils
[mm2]	25	35		50	70	95	150	185	4x35	150**	**: copper bar
[Nm]	3	4			12		10-30				
AWG	8	8	6		terminals not available						
[mm2]	10	10	16								
[Nm]	1.6	1.6	3								
AWG	6	6		2							
[mm2]	16	16		50							
[Nm]	3	3	4								

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1.5 ENCODER TERMINALS (XE CONNECTOR)

Designation		Function	I/O	Max. voltage	Max. current
PIN 1	**ENC B-**	Channel B- Incremental encoder signal B negative	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 2		+8V Encoder supply voltage	O	+8 V	200 mA
PIN 3	**ENC C+**	Channel C+ Incremental encoder signal Index positive	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 4	**ENC C-**	Channel C- Incremental encoder signal Index negative	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 5	**ENC A+**	Channel A+ Incremental encoder signal A positive	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 6	**ENC A-**	Channel A- Incremental encoder signal A negative	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 7	**GND**	Reference point for +5V encoder supply voltage	O	–	–
PIN 8	**ENC B+**	Channel B+ Incremental encoder signal B positive	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 9	**AUX+**	+5V encoder supply voltage	O	+5 V	200 mA
PIN 10	**HALL 1+/SIN+**	Channel HALL1 + / SIN+ Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 11	**HALL 1-/SIN-**	Channel HALL 1- / SIN- Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 12	**HALL 2+/COS+**	Channel HALL 2+ / COS+ Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 13	**HALL 2-/COS-**	Channel HALL 2- / COS- Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 14	**HALL 3+**	Channel HALL 3 + Reserved	I	5 V digital or 1 V pp analog	10 mA digital
PIN 15	**HALL 3-**	Channel HALL 3 - Reserved	I	5 V digital or 1 V pp analog	10 mA digital

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1.5.1 Encoder type connection

Encoder type	Shielded cable	XE CONNECTOR PIN														
		1 **B-**	**2** **+8V**	**3** **C+**	**4** **C-**	**5** **A+**	**6** **A-**	**7** **0V**	**8** **B+**	**9** **+5V**	**10** **E+**	**11** **E-**	**12** **F+**	**13** **F-**	**14** **G+**	**15** **G-**
Internal +5V Encoder Power Supply																
DE	8 pole	●		●	●	●	●	●	●	●						
SE	8 pole	●		●	●	●	●	●	●	●						
Internal +8V Encoder Power Supply																
DE	8 pole	●	●	●	●	●	●	●		●						
SE	8 pole	●	●	●	●	●	●	●		●						

ai3160

- **DE**: 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$
- **SE**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$

1.5.2 Jumpers setting

Encoder / Jumpers setting	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23
DE	OFF	OFF	OFF	OFF	OFF	OFF	ON (*)	-	-	-	-	-	-
SE	ON	ON	ON	ON	ON	ON	-	-	-	-	-	-	-

ai3150

- **DE**: 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$
- **SE**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$

(*) If the encoder is not provided with the zero channel S17=OFF

1.5.3 Maximum cable length for encoder terminals

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

1.6. LIST OF JUMPERS AND DIP-SWITCH

Designation	Function	Factory setting
S5 - S6	Terminating resistor for the serial interface RS485 ON= Termination resistor IN OFF= No termination resistor	ON (*)
S8	Adaptation to the input signal of analog input 1 (terminals 1 and 2) ON=0...20 mA / 4...20 mA OFF=0...10 V / -10...+10 V	OFF
S9	Adaptation to the input signal of analog input 2 (terminals 3 and 4) ON=0...20 mA / 4...20 mA OFF=0...10 V / -10...+10 V	OFF
S10	Adaptation to the input signal of analog input 3 (terminals 5 and 6) ON=0...20 mA / 4...20 mA OFF=0...10 V / -10...+10 V	OFF
S11 - S12 - S13 S14 - S15 - S16	Encoder setting (jumpers on kit EAM_1618 supplied with the drive) ON=Sinusoidal SE OFF=Digital DE	OFF
S17	Monitoring of the C-channel of the digital encoder ON=C-Channel monitored OFF=C-Channel not monitored (required for single-ended channels)	OFF
S18 - S19 S20 - S21	Encoder setting Pos. B= reserved Pos. A= reserved	B
S22 - S23	Analog input 3 enabling (alternative with SESC encoder) Pos. A= reserved Pos. B=analog input 3 enabled Pos. OFF= resolver	B
S26 - S27	Reserved	ON
S28	Encoder Internal power supply selection ON / ON = +5 V OFF / OFF = +8 V	ON/ON
S29	Internal use	A
S30	Second encoder qualifier input A=from EXP-… board B=from digital input "3" on RV33-4	A
S34	Jumper to disconnect 0V (+24V power supply) from ground ON = 0V connected to ground OFF = 0V disconnected from ground	ON (hard-wire)
S35	Jumper to disconnect 0V (regulation board) from ground ON = 0V connected to ground OFF = 0V disconnected from ground	ON (hard-wire)
S36	Internal use	not mounted
S37	Internal use	not mounted
S38-S39	Internal use	ON
S40-S41 (**)	Power supply for the serial interface RS485 ON = Internal power supply (from pins XS.5 / XS.9) OFF = External power supply (to pins XS.5 / XS.9)	OFF

Ay4060

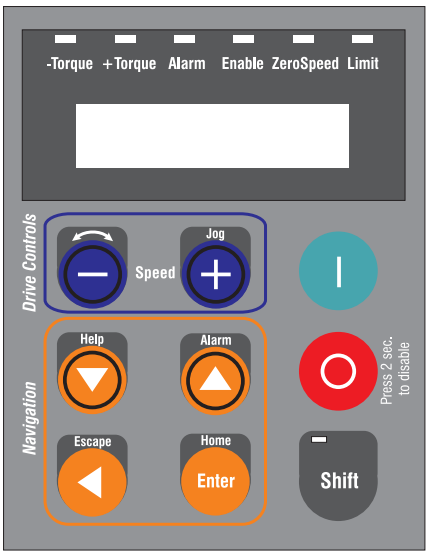
(*) on multidrop connection the jumper must be ON only for the last drop of a serial line

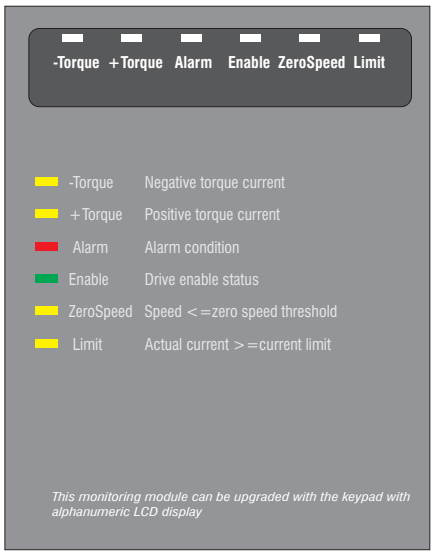
(**) see chapter 5.4

1.7. KEYBOARD OPERATION

The keypad is made of a LCD display with two 16-digit lines, seven LEDs and nine function keys. It is used:

- to control the drive, when this kind of use has been programmed (Main commands=DIGITAL)
- to display the speed, voltage, diagnostics etc. during the operation
- to set the parameters





NOTE: keypad cable longer than 20 cm must be shielded.

1.7.1 LEDs & buttons

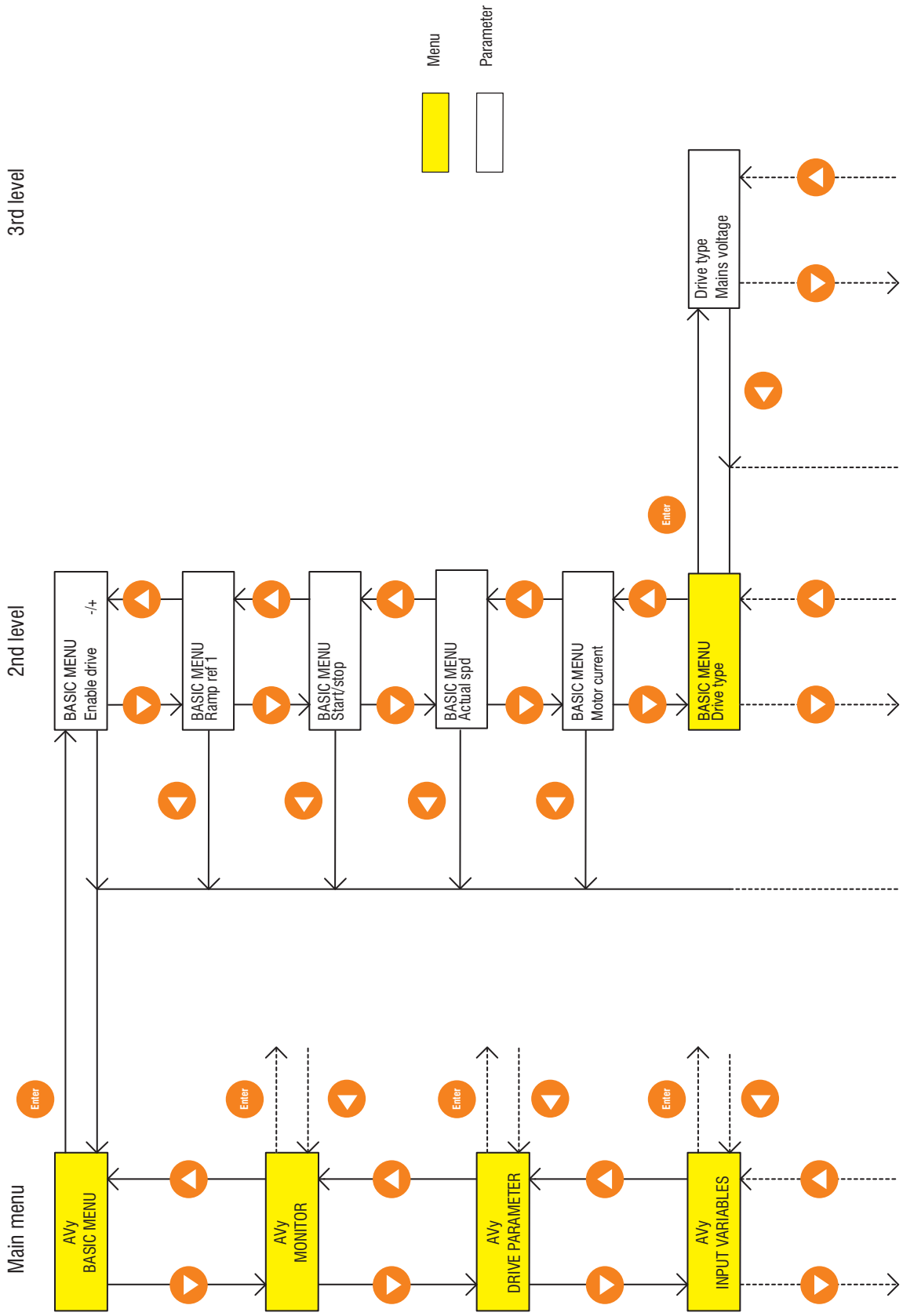
The LEDs present on the keypad are used to quickly diagnose the operating state of the drive.

Designation	Color	Function
-Torque	yellow	the LED is lit, when the drive operates with a negative torque
+Torque	yellow	the LED is lit, when the drive operates with a positive torque
ALARM	red	the LED is lit; it signals a trip
ENABLE	green	the LED is lit, when the drive is enabled
Zero speed	yellow	the LED is lit; it signals zero speed
Limit	yellow	the LED is lit, when the drive operates at a current limit
Shift	yellow	the LED is lit, when the second keypad functions are enabled

ai5010

Control buttons	Text reference	Function
	**[START]**	START button commands the Drive to the Enable (Stop control function ON) and Run state (**Main commands** = DIGITAL) When **Main commands** is set as TERMINALS the button is not active
	**[STOP]**	STOP button commands to stop the Drive from the Run state when **Main commands** is set as DIGITAL (Pressing this button for 2 sec, the drive will be disabled). When **Main commands** is set as TERMINALS the button is not active.
	**[Increase] / [Jog]**	Plus button increases the speed reference for Motor pot function. JOG command, when shift button is selected.
	**[Decrease] / [Rotation control]**	Minus button decreases the speed reference for Motor pot function. Rotation control, it changes the motor rotation direction in Jog mode and Motor pot function when shift button is selected.
	**[Down arrow] / [Help]**	Down arrow - Used to change menu or parameter selection.In parameter and reference setting modes, it changes the value of the parameter or the reference. Help – Function Not available (“Help not found” displaying when pressed and when shift button is selected)
	**[Up arrow] / [Alarm]**	Up arrow - Used to change menu or parameter selection. In parameter and reference setting modes, it changes the value of the parameter or the reference. Alarm - Failure register displaying (shift selected). Use the UP/ DOWN Arrows to scroll through the last 10 alarms.
	**[Left arrow] / [Escape]**	Left arrow, when editing numeric parameters it selects the digit of the parameter to modify. In the other cases it is used to exit from setting mode. Escape - Used to exit from setting mode and (Reset) Alarm displaying mode (when shift button is selected)
	**[Enter] / [Home]**	[Enter] - Used to [Enter] a new value for a parameter in the parameter setting mode. Home - Used to go directly to BASIC MENU (when shift button is selected)
	**[Shift]**	Shift button enables the second keypad functions (Rotation control, Jog, Help, Alarm, Escape, Home)

1.7.2 Moving inside a menu



1.8. PRE POWER CHECKS

The following should be checked **before switching ON the Drive**:

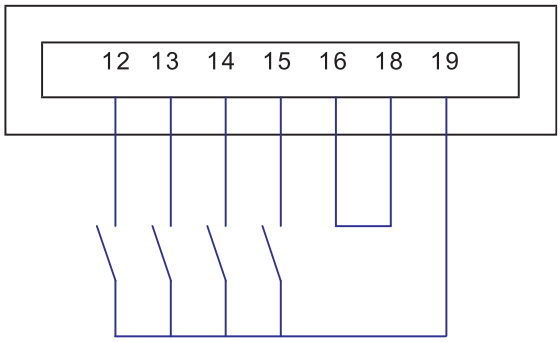
Grounds / Grounding

- Verify ground connections Drive to motor
- Verify AC Input, AC Output and control wiring aren't grounded

Connections

- Verify AC Input (U1/L1, V1/L2, W1/L3), AC Output (U2/T1, V2/T2, W2/T3), DC link connection with an optional external braking unit (C,D), Motor thermistor (78,79), OK Relay (80,82 n.o), Relay2 (83,85 n.o.) and regulation board (1.....46, XS, XE) connections

12 ENABLE DRIVE (close to activate)
13 START (close to activate)
14 FAST STOP (open to activate)
15 EXTERNAL FAULT (open to activate)
16 Common for terminal board
18 + 24V Common
19 +24VDC (internal)



Setting jumpers and switches on Regulation board

- **Enable drive (terminal 12) and Start (terminal 13) OPEN**
- **Fast stop (terminal 14) and External fault (terminal 15) CLOSED**

. Record motor name plate data, encoder information and mechanical data.

MOTOR DATA

HP (kW)		**Cos phi (power factor)**	
Amps		**Tach type**	
Volts		**Tach PPR**	
Hz		**Motor rotation for machine fwd direction [CW/CCW]**	
rpm		**Gearbox ratio**	

Dai54123

1.9. QUICK TUNING

1. After a complete check of wiring and input voltage levels and then turn the power on:

·Verify the following voltages must be present:

Terminal 7, +10V to terminal 9 (on regulation board)

Terminal 8, -10V to terminal 9 (on regulation board)

Terminal 19, +24…30V to terminal 18 (on regulation board)

·Check DC link voltage by pressing **[Down arrow]** to get "MONITOR", then **[Enter]**, then **[Down arrow]** to"measurements", then **[Enter]**, then **[Down arrow]** to "DC link voltage", then **[Enter]**.

The value should be:

480-650 vdc for 400 vac input

550-715 vdc for 460 vac input

If it is not within these values, check your line voltage, as it is unlikely the drive will work properly.

2. Default to Factory Values: If you are not already certain of the drive configuration, it is necessary to default to factory values or copy in a file from a PC to be certain you are starting from a known configuration. To default to factory values:

· **Default to working memory:** Push **[Left arrow]** to get back to "MONITOR", then **[Down arrow]** to "SPEC FUNCTIONS" and then **[Enter]**. Push **[Down arrow]** to "Load Default" and **[Enter]**. The factory values will now be loaded into working memory for all parameters but the previous values are still in permanent memory.

3. Set Line Voltage:

· Press **[Left arrow]** to "SPEC FUNCTIONS" then **[Up arrow]** to "BASIC MENU", then **[Enter]**, then **[Down arrow]** to "Drive type", then **[Enter]** to "Mains voltage" and **[Enter]**. Now using the **[Up arrow]** / **[Down arrow]** keys, change the voltage value closest to your nominal AC input rating. Then **[Enter]** to set the value.

4. Adaption to maximum ambient temperature:

· Press **[Down arrow]** to "Ambient temp" then **[Enter]**. Now using the **[Up arrow]** / **[Down arrow]** keys, set the maximum ambient temperature value: 40°C or 50°C, then **[Enter]**.

5. Load Default Motor Values:

· Press **[Left arrow]** until back to "BASIC MENU" and then **[Down arrow]** to "DRIVE PARAMETER", then **[Enter]**, then **[Down arrow]** to "Motor Parameter", **[Enter]**, then **[Down arrow]** to "Load Motor Par" and **[Enter]**. Use the **[Up arrow]**/**[Down arrow]** keys until the display is the correct motor voltage, then **[Enter]**. For 460 VAC motors, select 460, and for 380/400 VAC motors select 400.

6. Set Actual Motor Data:

· Press **[Left arrow]** until back to "DRIVE PARAMETER", then **[Enter]** to get "Mot plate data" and **[Enter]** to "Nominal Voltage" then **[Enter]** again to see the value. Using the **[Up arrow]**/**[Down arrow]** keys to change the value and the **[Left arrow]** to move the character position. When correct press **[Enter]**.

· Press **[Down arrow]** to "Nominal speed", **[Enter]**, then use the **[Up arrow]** / **[Down arrow]** keys to get the nominal speed on the motor nameplate. Press **[Enter]** to set data. Note, some manufacturers of vector motors put the synchronous speed (exactly 600, 900, 1500, 1800, 3600) for the nominal speed, rather than the slip speed it would run if run on 50 Hz power. If this is done, you MUST put a slip speed in this data. Figure 20 rpm less than the synchronous speed for these cases.

· Press **[Down arrow]** to "Nom frequency" and **[Enter]** and set to the nominal frequency on the nameplate (50 or 60 Hz usually) by using the **[Up arrow]** / **[Down arrow]** keys. Press **[Enter]** to set data.

· Press **[Down arrow]** to "Nominal current" and **[Enter]** and set to the nominal current on the motor nameplate (rated current) by using the **[Up arrow]** / **[Down arrow]** keys. Press **[Enter]** to set data.

· Press **[Down arrow]** to "Cos phi" and **[Enter]** and set to the nominal power factor on the nameplate by using the **[Up arrow]** / **[Down arrow]** keys (accept the default if you don't know). Press **[Enter]** to set data.

· Press **[Down arrow]** to "Base Voltage" and **[Enter]** and set to the base voltage by using the **[Up arrow]** / **[Down arrow]** keys (usually rated voltage). Press **[Enter]** to set data. Look in the manual for both Base Voltage and Base Frequency when operating the motor above normal synchronous speed.

· Press **[Down arrow]** to "Base Frequency" and **[Enter]**, set to the base frequency by using the **[Up arrow]** / **[Down arrow]** keys (usually rated frequency). Press **[Enter]** to set data.

· Press **[Down arrow]** to "Take motor par" and **[Enter]** and set all the motor parameters. **If, when you do this, a message saying "Over-range error XXX" appears, there is something wrong with the data you have entered.** The drive has NOT ACCEPTED the values you have entered. The most common cause of this is trying to **[Enter]** a value for "Nominal Current that is less than 30% of the drive rating. This is not allowed due to problems in control of a large drive on a very small motor. Try to go back to the **beginning** of step 6 and repeat the entries. If this doesn't work, see Overflow list in chapter 1.12, "Troubleshooting" or contact your service office.

7. Set Drive Base Values:

· Press **[Left arrow]** until back to "drive parameter" then **[Down arrow]** to "configuration", then **[Enter]**.

· Press **[Down arrow]** to "Speed Base Value" then **[Enter]** and set the nameplate rated full load speed on the motor nameplate, press **[Enter]**.

· Press **[Down arrow]** to "full load current" then **[Enter]** and set the DRIVE (not motor) rated full load current on the drive nameplate by using the **[Up arrow]** / **[Down arrow]** keys, then press **[Enter]** to set.

8. Set Regulation Mode: (V7f, Sensorless vect or Field oriented mode)

· Press **[Up arrow]** to "Regulation mode", then **[Enter]** and use **[Up arrow]** / **[Down arrow]** keys to select "sensorless vect" or "Field oriented" then **[Enter]**.

· If "Field oriented" mode is select:

· Press **[Down arrow]** until to "Motor spd fbk", then press **[Enter]**, **[Down arrow]** to "Encoder 1 type", then **[Enter]**. Use the **[Up arrow]**/ **[Down arrow]** keys to select sinusoidal encoder or digital encoder, then **[Enter]**.

· Press **[Down arrow]** to "Encoder 1 pulses", then **[Enter]** and set the value using the **[Up arrow]**/ **[Down arrow]** keys to the ppr (pulses per revolution) of your encoder (usually 1024), **[Enter]**.

9. Speed Limit:

· Press **[Left arrow]** until "Basic Menu", then **[Down arrow]** to "Limits", then **[Enter]** for "Speed Limits", then **[Enter]** for "Speed Amount", then **[Enter]** to "Speed Min Amount". Press **[Down arrow]** to "Speed Max Amount", and **[Enter]**. Change the value from 5000 rpm to the maximum speed of the motor using the **[Up arrow]**/**[Down arrow]** keys as before (for now set it to 105% of the rated motor speed). Press **[Enter]**.

10. Prepare for Self Tune:

The keypad will be used for this purpose but the I/O needs to be connected properly so the hardware enable/disable functions.

11. Save Parameters:

· Press **[Left arrow]** until to "limits", then **[Up arrow]** until "Basic Menu" then **[Enter]**, then **[Down arrow]** to "save parameters", then **[Enter]**.

The display will read "wait" until the values are permanently stored.

12. Self Tune:

Make sure power is on and drive not enabled.

Close the switch on terminal 12 (hardware enable has 24 Vdc on it).

· When the enable switch is made, Press **[Left arrow]** until "Basic Menu" then **[Down arrow]** to "Drive Parameter", then **[Enter]**, then **[Down arrow]** to "motor parameters" and **[Enter]**. Press "**[Down arrow]** to "Self Tuning" and **[Enter]** to see "self tune 1". Press **[Enter]** to see "start part 1" and **[Enter]**, "start part 1 ?" and **[Enter]** again. The keypad should show the "enable" led illuminated, if not, make sure that you have the jumpers (or external switches) set so that 24 Vdc exists on 12, 13, 14, 15, with respect to 16 or 18.

· You should now see "measuring Rs" (stator resistance). Wait until the display says "end", then disable the drive (open the switch to 12) and push **[Left arrow]** twice to see "self tune 1", press **[Enter]**, then **[Down arrow]** all the way to "take val part 1" and **[Enter]**. The display will read "wait" until the values are stored.

NOTE: "xxx range error" or "timeout" messages may also occur in some extreme parameter ranges. Repeat execution in this case. If error messages are persistent see troubleshooting section.

13. Self Tune part 2:

The initial part of self tuning that can be done without the motor rotating has been accomplished, now in order to get the best possible tuning, the motor needs to be free to turn with no load attached to the shaft. For this we use Self tune mode 2a. If, for any reason, the motor cannot be made free to rotate with no load, then a "close" level of tuning can still be accomplished by selecting Self tune mode 2b.

· Now press **[Left arrow]** to see "self tune 1" then **[Down arrow]** to "self tune 2a or 2b and press **[Enter]**. Enable the drive using the switch

to terminal 12. Press **[Enter]**, "start part 2a ?" or "start part 2b ?" then **[Enter]** and see "measure sat 2a (or b)" will appear and the motor shaft will turn (if "self tune 2a" is select). Wait until the display says "end", press **[Left arrow]** to see "self tune 2a (or b)" then **[Enter]** and press **[Down arrow]** to see "take val part 2a (or b)". Disable the drive (switch off terminal 12), then **[Enter]**.

NOTE: "xxx range error" or "timeout" messages may also occur in some extreme parameter ranges. Repeat execution in this case. If error messages are persistent see troubleshooting section.

If there was some reason you did not want to keep these values permanently, but only wanted to try to run the drive with them, there is no need to save to permanent memory. If power is cycled however, these values just obtained will be lost unless the next step is taken.

14. Self tune part 3:

The third part of self tuning (Speed regulator tuning) identifies the total inertia value at the motor shaft, the friction value and computes the proportional and integral gains of the speed regulator. The motor needs to be free to turn with load attached to the shaft.

WARNING !

This procedure requires free rotation of the motor shaft coupled to the load. Start/Stop command is disregarded, therefore it can not be used on drives with limited travel.

CAUTION !

The test is performed using the torque limit value set in Test T curr lim parameter. The torque is applied stepwise, with no ramp (profile), therefore the mechanical transmission must not have significant backlash, and it must be compatible with operation at the torque limit set in Test T curr lim parameter. The user can reduce the torque limit to a suitable value via the Test T curr lim parameter.

NOTE ! - Application where the system inertia coupled to the motor shaft is much higher than the motor inertia value , increase the Test T curr lim parameter to avoid "Time out" error.

- This procedure is not suitable for use with "hoist" or "elevator" drives.

- Encoder feedback is required when Field oriented mode is selected.

- Set the current limit (BASIC MENU\ T Current lim +/-) to a value compatible with the motor size and load. (Example when motor is 1/3 of the Drive power, the limit should be reduced compared to the default value).

- Select the torque current value to be used during the test via the **Test T curr lim** parameter

· Now press **[Left arrow]** to see "self tune 2a or 2b" then **[Down arrow]** to "self tune 3" and press **[Enter]** to Fwd-Rev spd tune, then **[Enter]**, set the motor shaft direction for this test: Forward or Reverse by using **[Up arrow]** / **[Down arrow]** keys. Press **[Enter]** to set the selection.

· Enable the drive using the switch to terminal 12 [and close terminal 13 to terminal 19 if Speed control function is enabled (default)]. Press **[Down arrow]** to "Start part 3" then press **[Enter]**, "start part 3 ?" then **[Enter]** and see "measure speed" will appear and the motor will turn. Wait until the display says "end", press **[Left arrow]** to see "self tune 3" then **[Enter]** and press **[Down arrow]** to see "take val part 3". Disable the drive, then **[Enter]**. You are now finished with the initial set up and tuning with values stored in only in the "working memory".

NOTE: "xxx range error" or "timeout" messages may also occur in some extreme parameter ranges. Repeat execution in this case. If error messages are persistent see chapter 1.12, "Troubleshooting"

NOTE: If there was some reason you did not want to keep these values permanently, but only wanted to try to run the drive with them, there is no need to save to permanent memory. If power is cycled however, these values just obtained will be lost. To save all values to permanent memory, select **Save parameters** and press **[Enter]** .

15. Set up for Running:

First, before saving, let's put the drive into the configuration you want to run it in.

The drive is factory setting to run through an external +/- 10V reference using a potentiometer connected to terminals 1, 2 (see table 5.3.2.1). If you would like to run the motor using the keypad through the Increase **[+]** and Decrease **[-]** keys (**Enable motor pot parameter** = Enabled), see the following instruction to run.

If a change of the default acceleration / deceleration ramp time value is needed, using the **Acc delta time** / **Acc delta speed** and **Dec delta time** / **Dec delta speed** is possible to set the desidered value.

1.9.1 Motor Potentiometer

Control buttons	Sequencing	Display
	Press START button to command the Drive to the Enable and Run state	
	Press STOP button commands to stop the Drive from the Run state	
	Press to display the current reference value and to increase the reference value and accelerate the drive.	**Motor pot oper +0 [rpm] POS**
	Press to decrease the reference value and decelerate the drive.	**Motor pot oper -0 [rpm] NEG**
	Press SHIFT and [-] to change the motor shaft rotation	

NOTE! (Main commands = DIGITAL)

Enable drive, terminal 12 to 24Vdc

Start, terminal 13 to 24Vdc

Resetting the speed reference value using Mot pot function

- Press **[STOP]** button to stop the motor
- Press **[Left arrow]** until to "Basic menu", then **[Down arrow]** to "Functions". **[Enter]** to motor pot, then **[Enter]** to "enab motor pot", press **[Down arrow]** to motor pot reset, then **[Enter]**.

  The diplay will read "ready" until the reference value is set to zero.

Set motor pot disable (**Enable motor pot** parameter = Disable) if you will want to use an analog voltage (pot or otherwise) into terminal 1 for speed reference (already factory set).

Jog function

NOTE! This function is already standard setting enabled. (**Enable jog** parameter = Enabled) with a speed reference value = 100 rpm.

(Main commands = DIGITAL)

Enable drive, terminal 12 to 24Vdc

Start, terminal 13 to 24Vdc

Press **[SHIFT** and **[+]** to run, the speed will be displayed

Press **[-]** to select the motor shaft rotation

Press [jog] to run the other direction

Press **[Left arrow]** to exit from jog operation

Changing jog reference

Press **[Down arrow]** until "Functions", **[Enter]**, then **[Down arrow]** until "Jog reference", **[Enter]**, using the **[Up arrow]**/**[Down arrow]** keys to change the value and the **[Left arrow]** to move the character position, set the reference value, then **[Enter]**.

If there are other changes you might want to make to set up (see Optional Things), **do them now**, and complete the following step to put everything into permanent memory.

Saving all values to Permanent Memory:

. Press **[Left arrow]** back to "Configuration" then **[Up arrow]** to "basic menu" and **[Enter]**. Press **[Down arrow]** to "save parameters" and **[Enter]**. Parameters are now stored permanently.

1.10 OPTIONAL THINGS

Encoder verification: Set the Drive in V/f mode and run the motor, enable and start the drive and set an analog reference. If the reference is positive on terminal 1 with respect to 2 (common) the motor should be turning clockwise. With the motor turning clockwise (looking at the driving shaft pointing at you.) (you can even do this by hand while not enabled), monitor the encoder measurement by clicking "Monitor/measurements/speed/speed in rpm/ Enc 1 speed". The speed should be positive, not negative. If it is negative, then A and A- or B and B- should be interchanged on the encoder. Now return to the "Set Up for Running" section.

Current Limit: The current limit will have been set to approximately 136% by default in the previous setup (exact number is a function of the power factor but the difference is very small). The value actually set can be verified by (from "Basic Menu") pressing down/ right arrow to "Limits", then **[Enter]**, then down/right arrow to "current limits", then **[Enter]**, then down right arrow to "T current lim" and **[Enter]**. The value of T current limit can be changed if you like to a higher (or lower) number. Bear in mind that the ultimate limits are based on the capacity of the drive, not the motor. T current is the torque producing component of total current. Settings in excess of 200% are possible, although the motor may not be able to handle this current. Most motors are rated only for 150% for 1 minute. The drive will protect itself though an intelligent temperature, voltage, I^2T algorithm regardless of how you set this number. The drive will provide 150% of the value in "Configuration/Full Load Current" for 1 minute (200 % for a short time).

I/O Configuration: This drive can be configured in virtually any imaginable way.

The standard drive has three standard analog inputs and gives you two analog outputs as well as six digital inputs and two digital outputs which are assignable and configurable. **The drive is defaulted already to provide the analog outputs as Actual speed and load (Torque current)**, but may require some scaling. To set up the drive for two analog outputs (one for speed and one for load) for metering or other purposes, do the following:

Refer to the "Control terminals" section of this guide showing a description of the connection of the regulation section and how to make them. A more detailed description and discussion of the I/ O are showed in the manual. The analog outputs are defaulted to a scale of 1, which means 10 volts out at max parameter value. In other words, if analog output 1 is set to maximum speed then max speed will be scaled 10 Vdc (maximum output voltage available) at "Speed Base Value" (found under Configuration). If you wanted 5 volts out at max speed then set the scale to 0.5. If the output was set to Torque current (the torque producing current, which is the part of the total motor current that actually produces torque), then 10 Vdc would be rated current. If you wanted the output to be 10 Vdc at 150% of "Full Load Current" (found under Configuration) then the scale would be 0.66. The standard factory default is already set up to put out speed (with scale factor of 1) on analog output 1 (terminals 21 and 22) and load (Torque current, with scale factor of 1) on analog output 2 (terminals 23 and 22). Note that terminal 22 is a common for both the outputs. This common can be grounded, and should be grounded somewhere, preferably at the load device (meter).

How to disable analog input 1 as ramp reference: (Analog inputs 2 and 3 are already off from default, #1 is defaulted to Ramp ref 1). This is being done now to allow us to use the keypad to set speed in digital way.

- Press **[Up arrow]/[Down arrow]** to "I/O Config", then **[Enter]**.
- Press **[Down arrow]** to "Analog inputs", then **[Enter]** for Analog input 1, then **[Enter]** to Select input 1, then **[Enter]** to display the setting, which will be "Ramp ref 1".
- Press **[Up arrow]** / **[Down arrow]** keys until "OFF" is displayed, then **[Enter]**.

How to enable analog input 2 as ramp reference

- Press **[Up arrow]/[Down arrow]** to "I/O Config" and press **[Enter]**, then down right arrow to "Analog inputs" then **[Enter]** for "Analog input 1" then **[Down arrow]** to "analog input 2 then **[Enter]** to "select input 2", then **[Enter]** again to see the set up. It says "OFF". Use the **[Up arrow]** / **[Down arrow]** keys to display "Ramp ref 1" (if this setting is not already used, or "Ramp ref 2") and **[Enter]**. This means the **Analog input 2** (terminals 3 and 4) will be the ramped (accel/decel) speed reference for the drive.

The AVy manual on CD-ROM shows the entire configuration of the I/O and other set up for the drive. It this does not help, call the customer service and we can help you with your specific configuration.

1.11 QUICK TUNING GUIDE FOR FACTORY CONFIGURED (OR PRE-CONFIGURED) DRIVES

When the drive configuration has already been set and you are simply tuning a motor which has not been tuned, you can ignore most of the preceding procedure, since it has already been done, but unless you are certain, it is recommended that you go through the steps anyway, just to verify that the data shown in the various locations indicated is OK. You can just use the **[Left arrow]** key rather than the **[Enter]** key in all the steps in which the entry is found to be correct. Start with step 4 of the full procedure and **do not default the parameters to factory parameters**. If there is any question about whether the existing setup should be saved or not, then use the configuration tool software that came with the drive and save the file to a PC first so it can be used later. Normally, drives configured at the factory will have the setup file already saved to your configuration tool diskette.

1.12 TROUBLESHOOTING

Overflow list

CODE	CAUSES
10 ; 54	The ratio between the Encoder 1 pulses[416] and the number of motor poles pair must be higher than 128
3 ; 4	The Stator resistance [436] value is too high. The motor is not compatible with the drive size used.
5 ; 8 ; 9 ; 15	The Leakage inductance [437] value is too high. The motor is not compatible with the drive size used.
16 ; 24	The Rotor resistance [166] value is too high. The motor is not compatible with the drive size used.
17	The Nominal voltage [161] and Nom frequency [163] values produce motor nominal flux (out of range) that is too high. - Verify these values: the Nominal voltage value is too high and/or the Nom Frequency value is too small.
18	The Base voltage [167] and Base frequency [168] values produce motor nominal flux (out of range) that is too high. - Verify these values: the Base voltage value is too high and/or the Base frequency value is too small
23	The ratio between nominal flux (Nominal voltage, Nom frequency) and working flux (Base voltage , base frequency) is too high. - Verify the above parameters value. The Magnetizing current [165] value is too high. - Verify that this value is lower than Full load curr.
27	The Base voltage value is too high. The maximum value is 500V.
28	The Base frequency value is too high. This value must be lower than 500Hz
59	The Magnetizing working curr [726] is too high. - Verify that the nominal flux value (Nominal voltage and Nom frequency) is lower than the working flux value (Base voltage and Base frequency). Check the parameters value. The Magnetizing current value is too high. - Verify that this value is lower than Full load curr.
64	The Motor cont curr [656] value, of the motor thermal protection function (menu Ovld mot contr), produces continuative current that is too low in comparison to the used inverter size. This error can also be due to a too low setting of the Nominal current [164] parameter ($\leq 0.3 \times I_{2N}$).
66	The Nominal speed [162] value is wrong. The set value produces too small (or too high) slip value.

LIST OF SELF TUNE ERROR MESSAGES

- Generic messages

Description	Note
"Drive disabled":	Provide enable input by setting terminal 12 high.
"Not ready":	"**Take values part 1**" or "**Take values part 2a**" or "**Take values part 2b**"or "T**ake values part 3**" can not be executed because the measurement has not been completed correctly. Repeat self tune procedure.
"Time out":	Measurement has not been completed in the proper time.
"Start part…?":	Press [ENTER] to confirm start of measurement.
"Tuning aborted":	Measurement aborted by user ([SHIFT] / [Escape] buttons has been pressed).
"Set Main cmd=Dig":	Go to CONFIGURATION menu and set **Main commands** = digital.
"Set Ctrl=Local":	Go to CONFIGURATION menu and set **Control mode** = Local.
"Reg mode NOK":	**Self tune part 3** can only be executed **Regulation mode** = **Field oriented** or **Regulation mode** = **Sensorless vect.** Go to BASIC MENU and set **Regulation mode** properly.
"Inertia range":	**Self-tuning part 3** procedure has found an inertia motor value too low, for this reason it cannot calculate the speed regulator gains. Try to repeat self tune procedure to overcome possible accidental measure error. If this error persist (inertia is really lower than the measurable minimum value), avoid to give "**Take val part 3**"command. The speed regulator will be also stable with the factory gains value. It is possible to optimize the feedback speed by using the regulator manual tuning .

- Measurement error messages

These messages may occour when extreme parameter values have to be identified. It can be useful to retry the self tune command when any of the following messages occours. If messages persist, alternative manual tuning procedures should be adopted.

Description	Note
"No break point"	**Self tune part1** failed. Check integrity of connections between inverter and motor prior to attempt repeating part 1.
"Over speed"	**Self tune part3** detected a a much higher speed than expected. Possible causes are: load causing a speed drift or bad tuning of inner loops when using Sensorless vector mode. Try repeating **Self tune 1** or the corresponding manual tune operations.
"Drive stalled":	Increase value of parameter **Test T curr lim** and repeat **Self tune 3**
"Load applied":	Nominal zero load torque at standstill was detected. **Self tune 3** is impossible for this type of load.
"T curr too high":	Reduce value of parameter **Test T curr lim** for **Self tune 3**
"Friction null":	Value of friction is zero or lower than the accuracy limit of the control system.

Failure alarms in the keypad display

FAILURE ALARM	POSSIBLE CAUSES
Blank display on the keypad	Check the cable connection between regulator board and keypad.
BU overload	The braking duty cycle is out of the allowed range
Bus loss	Failure in the Bus connection (only with interface Bus option card) Check the Bus connection EMC compatibility problem, check wiring.
Curr fbk loss	Failure in the connection between regulation card and TA transformer. Check the connection cable on XTA connector.
DSP error	Processor program error Switch off device and restart If you are unsuccessful: probably an internal fault. Contact your service office.
Enable seqerr	Drive is powered up or RESET* with ENABLE input connected to 24V (picked up) and the Drive is configured to run from the terminals. Refer to CONFIGURATION/Main Commands.
External fault	External failure, reported on terminal 15 If the "External fault" message is not used: connection missing between terminals 16 and 18 (reference point) and/or 15 and 19. If the "External fault" message is used: - The signal on terminal 15 is missing (15 ... 30 V to terminal 16). With external voltage supply: reference points must be connected with each other!
Failure supply	Fault in voltage supply = the voltages are below the permitted value CAUTION: switch off voltage before removing terminal strips. In most cases the cause is in the external wiring. Pull out the plug-in terminal strips of the regulator card and enter the Reset command. If no other failures are reported, check your wiring for a short-circuit, in some cases with the cable shielding. If this has not corrected the fault, try to RESET* once more. If you are still unsuccessful: probably an internal fault. Contact your service office.
Heatsink ot	(For sizes from 22kW ... and higher). Temperature of the heatsink drive too high. Failure of device fan. Failure in the IGBT module on power section. Fast overload current duty cycle.
Heatsink sensor	Ambient temperature too high Failure of device fan Dirty heatsink

Intake air ot

(For sizes from 22kW ... and higher). Temperature of the cooling air too high.
Failure of device fan(s).
Cooling opening obstructed.

Interrupt error

An unused interrupt has occurred
Switch off device and restart
If you are unsuccessful: probably an internal fault. Contact your service office.

Module overtemp

(For sizes from 0.75 to 15 kW). Temperature of the IGBT module too high.
Failure of device fan.
Failure in the IGBT module on power section.
Fast overload current duty cycle.

Output stages

Internal Overcurrent failure of IGBT power section
Switch off device and restart
If you are unsuccessful, contact your service office.

Overcurrent

Overcurrent in the motor circuit
Short-circuit or ground fault at the output of the drive
Current regulator optimized incorrectly
Message appears when switching on the device: drive is engaging a motor that is running. Auto capture function must be activated.
Switch off device and restart
If you are unsuccessful, contact your service office.

Overvoltage

Overvoltage in intermediate circuit due to energy feedback from motor
Lengthen deceleration ramp. If not possible:
Use a BU... braking unit to reduce the feed

Overtemp Motor

Overtemperature of the motor (indicated via thermistor on terminals 78/79)
Cable between thermistor connection on motor and terminals 78 and 79 interrupted.
Overheating of motor:

- Load cycle too extreme
- Ambient temperature at site of motor too high
- Motor has an external fan: fan failed
- Motor does not have an external fan: too large a load at low speeds. The cooling effect of the fan on the motor shaft is too low for this load cycle. Change cycle or fit external fan.

Regulation ot

Temperature of the Regulation card of the Drive too High.
Ambient temperature too high.

Speed fbk loss

Speed feedback loss
Encoder not connected, or incorrectly connected or not supplied:
Select the **Enc 1 speed** parameter in the MONITOR\ Measurement \ Speed \ Speed in rpm menu.

- With the Drive disabled turn the motor clockwise (viewed from the front of the shaft). The value indicated must be positive.
- If the indicated value does not change or random values are shown, check the power supply and the cabling of the encoder.
- If the indicated value is negative, reverse the encoder connections. Exchange channel A+ and A- or B+ and B-

Undervoltage Mains voltage parameter incorrectly set (poss. 460 V set, although the device is run on 400 V). Remedy: set parameter correctly and then acknowledge the failure via RESET*.

The incoming voltage to the power section of the device is too low due to:

- too low an AC input voltage or long voltage dips
- poor cable connections (e.g. terminals on contactor, choke, filter ... not properly fixed). Remedy: check connections.

* To RESET the alarms press **[Escape]** ([Shift] + [Left arrow]). If **Enable** and **Start** commands are configured from teminals (CONFIGURATION / Main.=Terminal), to RESET remove from these terminals the +24V potential.

NOTE: The RESET alarm operation can be also configured on a digital input (properly configured).

Other faults

FAILURE **POSSIBLE CAUSES**

Motor not turning Failure alarm is displayed: see above

Once the error has been corrected enter the failure Reset command

Keypad display is dark: AC voltage supply to terminals U1/V1/W1 missing or internal fuse faulty

Enable and/or start command missing (Check configuration of the reg. terminals)

Drive not accepting commands: incorrect or wrongly selected operating mode

Protective device of the power supply has tripped: protective device incorrectly sized or input jumper faulty.

The analog input used for the reference value was not assigned or assigned differently.

Motor turning in the wrong direction

Polarity of the reference value signal incorrect

Motor incorrectly connected. CAUTION: if the motor lets itself be controlled in the wrong direction the two encoder cables (A+ and A- or B+ and B-) have to be changed around in addition to the two lines of the motor cable

Motor not reaching nominal speed

Drive is within speed limitation. Remedy: check **Speed max amount**, **Speed max pos** and **Speed max neg** parameters

Drive working at current limit (LED Ilimit) Possible causes:

- Motor overloaded
- Inverter sized too small
- Incorrect V/f characteristics set

- T current lim reduction selected via Torque reduct

The entered value for the number of encoder pulses is too high. Remedy: check the parameters concerned (encoder 1 pulses) and set correct value.

A correction value reduces the main reference value. Remedy: check the configuration

With operation via the terminal strip: Speed base value parameter too low

Motor accelerates immediately to maximum speed

Reference value set via terminals: Check whether the value varies from min. to max. value. Potentiometer used for reference value setting: is there a 0V connection present?

Encoder not connected, or incorrectly connected or not supplied:

Select the **Enc 1 speed** parameter in the MONITOR \ Measurement \ Speed \ Speed in rpm menu.

- With the regulator disabled turn the motor clockwise (viewed from the front of the shaft). The value indicated must be positive.
- If the indicated value does not change or if random values are shown, check the power supply and the cabling of the encoder.
- If the indicated value is negative, reverse the encoder connections. Exchange channel A+ and A- or B+ and B-.

Motor accelerates too slowly

Ramp value incorrectly set

Motor running at max. current

- Motor overloaded
- Drive sized too small
- Incorrect V/f characteristics set

Motor decelerates too slowly

Ramp value incorrectly set

Motor turns slowly, although reference value = Zero

Minimum speed parameter selected

Interference due to unused analog input. Remedy: set unused analog inputs to OFF

Disconnect reference value on used analog input

- If drive now stands still, the effect is due to the cable resistance of the 0V cable.
- If the drive is still turning: carry out offset compensation of the analog input. Set **Offset input xx** parameter so that the drive stands still.

Output voltage deviates strongly under load

The value for **Rotor resistance** is not correct. See section “Checking and maunual tuning of rotor resistance for field oriented mode” in the AVy instruction book on CD.

Motor not supplying the maximum torque or maximum output power

The value for **Magnetizing curr** is less than required for the connected motor.

- The ratio **Output voltage** / **Output frequency** in the MONITOR / Measurements menu should be approx equal to the ratio of **Base voltage** / **Base frequency**
- Drive working at current limit
- Check whether the value for **Full load curr** in the CONFIGURATION menu is

correctly set

- Check the value for the current limitation
- The value for **Magnetizing curr** and/or **Rotor resistance** parameters is not correct. Optimize the tuning as described in the instruction book.

The speed during acceleration with maximum current is not linear

Reduce the **Speed I** and **Speed P** proportionally. If this does not lead to an improvement, optimize the regulator.

Speed oscillating

Check **Speed P** and **Speed I** parameter

If the operating point is in the field weak range, check the **Flux P** and **Flux I** parameters

Incorrect value for Rotor resistance

Remedy: Optimize the tuning as described in the AVy instruction book on CD.

Drive not reacting to adaptive speed regulation

Adaptive speed regulation not enabled. **Enable spd adap** = Enabled

Adap reference not assigned to an analog input if using Adap reference

Motor potentiometer function not executed

Function not enabled. **Enable motor pot** = Enabled

With operation via the terminal strip: **Motor pot up** and/or **Motor pot down** and **Motor pot sign** were not assigned to a digital inputs

Jog operation not possible

A start command is still present

Function not enabled. **Enable jog** = Enabled

With operation via terminal strip: **Jog +** and/or **Jog -** were not assigned to a digital inputs.

Internal speed reference values not actuated

Function not enabled. **Enab multi spd** = Enabled

With operation via terminal strip: **Speed sel 0, Speed sel 1** and **Speed sel 2** were not assigned to a digital inputs.

Multi-Ramp function not reacting

Function not enabled. **Enab multi rmp** = Enabled

With operation via terminal strip: **Ramp sel 0** and **Ramp sel 1** were not assigned to a digital inputs

2. FUNCTION AND FEATURE (OVERVIEW)

The AVy is a field-oriented vector Drive with excellent speed control properties and a high torque.

Available control modes are:

- Field oriented with speed sensor
- Field oriented without speed sensor (Sensorless vect mode)
- V/f control

Space vector modulation keeps the noise level to a minimum.

- Output voltage up to 98% of input voltage
- Self tuning procedure for current, flux and speed regulators

The Drives are fitted with IGBTs (insulated gate bipolar transistors).

The output is protected against ground fault and phase to phase output short.

Regulator power supply via switched-mode power supply unit from the DC Bus circuit. Power supply backup in the event of short-term voltage dips.

Galvanic isolation between control section and command terminals.

Analog inputs designed as differential inputs.

Simple operation of the drive

- via the terminal strip
- via the user-friendly keypad
- via the PC program supplied and the RS485 serial interface
- via a fieldbus connection (optional): DeviceNet, PROFIBUS-DP or GENIUS.
- Easy Drive configuration tool

Fault register storing the last ten fault alarms with the associated lifetime.

Overload control.

Engaging a running motor (Fly catching).

Three freely configurable analog inputs on the standard device.

Expansion of the analog / digital outputs and analog / digital inputs via option cards (EXP D8R4, EXP D14A4F).

Reference value entry and actual value display as a percentage of a user-defined dimension.

Speed and torque current regulation possible.

Adaptive speed regulation.

Speed-related alarms

Motor potentiometer function (Increase/Decrease speed by command)

Jog operation

8 internal speed reference values (Preset speed)

4 internal ramps

PID control

Controlled stop in case of AC mains power loss.

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 AVy 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

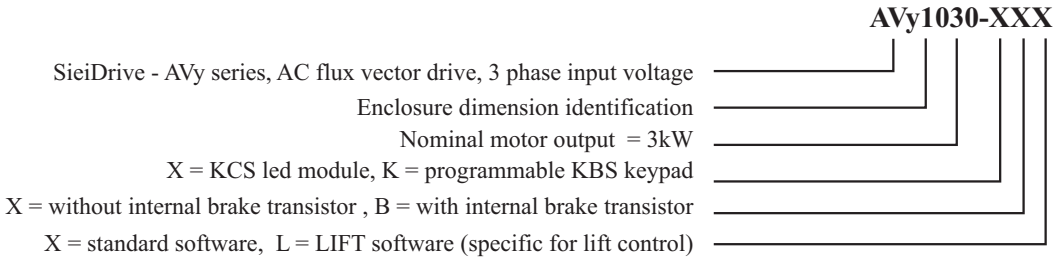
In the event of any damage or of an incomplete or incorrect delivery please notify the responsible sales offfices immediately.

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 AVy Drive is stated in the type code. Example:



The AVy 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

Type :	AVy1030-XXX			S/N 9862330
Main Power In :	480 Vac	8.9 A	50/60Hz	3Phase
Main Power Out :	0-480Vac	7.5A	0-400Hz	

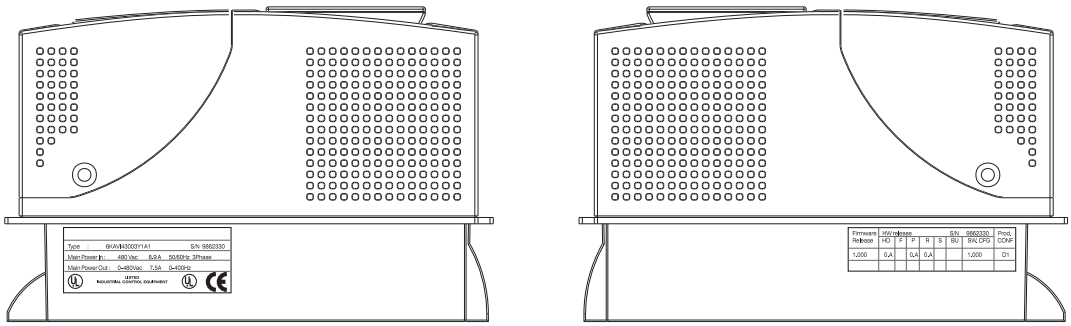
LISTED
INDUSTRIAL CONTROL EQUIPMENT

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 9862330 SW. CFG	Prod. CONF
	D	F	P	R	S	BU		
1.000	0.A		0.A	0.A			1.000	D1

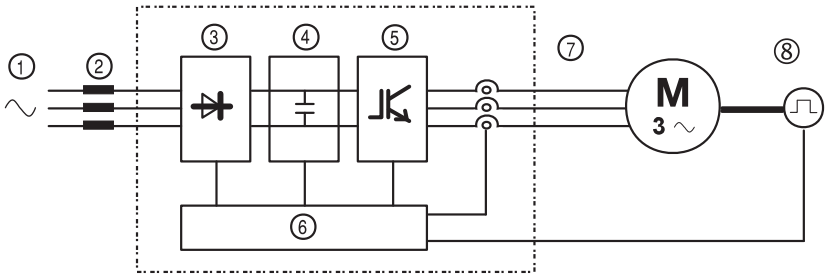
Figure 3.1.3.3: Nameplates position



3.2. COMPONENT IDENTIFICATION

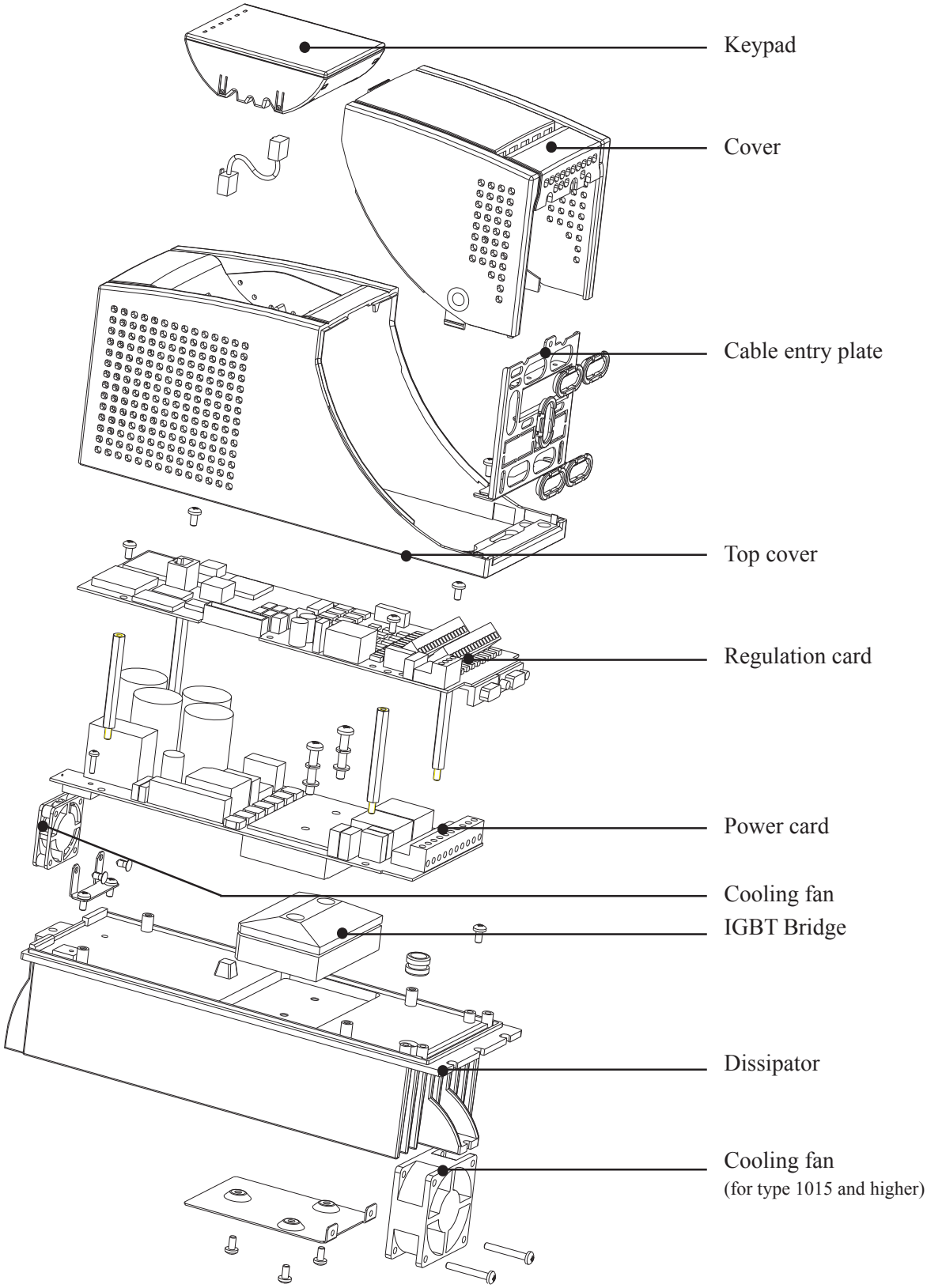
An AVy Drive converts the constant voltage and frequency of a three-phase power supply into a direct voltage and then converts this direct voltage into a new three-phase power supply with a variable voltage and frequency. This variable three-phase power supply can be used for the infinitely variable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

Figure 3.2.1: Basic Setup of Frequency Inverter



1 AC Input supply voltage	
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.
8 Encoder	For speed feedback (see section 4.4.2).

Figure 3.2.2: Drive view & components



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)
	Degree of protection		IP20
			IP54 for the cabinet with externally mounted heatsink (size type 1007 to 3150)
	Installation altitude		Up to 1000 m above sea level; for higher altitudes a current reduction of 1.2% for every 100 m of additional height applies .
	Temperature:		
	operation [1]		0…40°C (32°…104°F)
	operation [2]		0…50°C (32°…122°F)
	storage		-25…+55°C (-13…+131°F), class 1K4 per EN50178
			-20…+55°C (-4…+131°F), for devices with keypad
	transport		-25…+70°C (-13…+158°F), class 2K3 per EN50178
			-20…+60°C (-4…+140°F), for devices with keypad
	Air humidity:		
	operation		5 % to 85 %, 1 g/m^3 to 25 g/m^3 without moisture condensation or icing (Class 3K3 as per EN50178)
	storage		5% to 95 %, 1 g/m^3 to 29 g/m^3 (Class 1K3 as per EN50178)
	transport		95 % [3] 60 g/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	Climatic conditions		IEC 68-2 Part 2 and 3
	Clearance and creepage		EN 50178, UL508C, UL840 degree of pollution 2
	Vibration		IEC68-2 Part 6
	EMC compatibility		EN61800-3 (see “EMC Guidelines” instruction book)
	Approvals		CE, UL, cUL

avy2000

1) Parameter **Ambient temp** = 40°C (104°)
Ambient temp = 0 ... 40°C (32°...104°F)
Over 40°C: - current reduction of 2% of rated output current per K
- remove front plate (better than class 3K3 as per EN50178)

2) Parameter **Ambient temp** = 50°C (122°F)
Ambient temp = 0 ... 50°C (32°...122°F)
Current derated to 0.8 rated ouput current
Over 40°C (104°): 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 AVy 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 (up to size 3150) are recyclable: the material used is >ABS+PC< .

3.3.2. AC Input/Output Connection

The AVy Drive must be connected to an AC mains supply capable of delivering a symmetrical short circuit current (at 480V +10% Vmax) lower or equal to the values indicated on following table. For the use of an AC input choke see chapter 5.7.1.

No external connection of the regulator power supply to the existing AC Input supply is required since the power supply is taken from the DC Link circuit. When commissioning, set the **Mains voltage** parameter to the value of the AC Input voltage concerned. This automatically sets the threshold for the Undervoltage alarm at the appropriate level.

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 then 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.

AVy...-DC versions

In this version, the drive must be powered by a rectified DC supply of 600 Vdc.

The use of Gefran SM32 series power supplies is recommended for this, available with an output current from 185 to 2000A.

From size AVy4185, insertion of an AC mains inductance on the power supply input of the power supply unit is compulsory (for the type of inductance, consult the manual of the power supply unit), see figure 5.5.1.2.

	Type		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	[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	[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	100	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; 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; 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]	0.98 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	58	72	85	104	129	169	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	11	15.4	21.6	28.7	34	40	54	68	81	99	124	160	183	217	282	348
	@ U_{LN}=460Vac; f_{SW}=default; IEC 146 class 2	[A]	1.9	3.2	4.4	5.9	7.6	10	14	19.6	26	31	36	50	62	74	90	112	146	166	198	256	317
	f_{SW} switching frequency (Default)	[kHz]	8													4							
	f_{SW} switching frequency (Higher)	[kHz]	16													8					4	--	
	Iovld (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:																						
	K_V at 460/480Vac		0.87					0.96	0.87	0.93	0.90	0.87											
	K_T for ambient temperature		0.8 @ 50°C (122°F)																				
	K_F for switching frequency		0.7 for higher f_{SW}																				
INPUT	U_{LN} AC 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 class1	[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	n.a.	n.a.
	@ 400Vac; IEC 146 class1	[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 class1	[A]	1.7	2.9	3.9	5.4	6.7	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 class1	[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 class1	[A]	3.9	4.8	7.4	9	12	16.9	24.2	30.3	40												
	@ 460Vac; IEC 146 class1	[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]	820 V_{DC}																				
Undervoltage threshold		[V]	230 V_{DC} (for 230 V_{AC} mains), 400 V_{DC} (for 400V_{AC} mains), 460 V_{DC} for 460 V_{AC} mains)																				
Braking IGBT Unit (standard drive)			Standard internal (with external resistor); Braking torque 150%										Option internal (with external resistor); Braking torque 150%			External braking unit (optional)						

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3.3.3. AC Input current

NOTE! The Input current of the Drive depends on the operating state and the service conditions of the connected motor, and the use of input reactors. The table 3.3.2.1 shows the values corresponding to rated continuous service (IEC 146 class 1), keeping into account typical output power factor for each size

3.3.4. AC Output

The output of the AVy Drive is ground fault and phase to phase output short protected. The switching frequency is constant in the speed range and depends on the drive size.

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 value for the continuous output current rating (I_{CONT}) depends on AC Input voltage (K_V), Ambient temperature (K_T) and Switching frequency (K_F):

$I_{CONT} = I_{2N} \times K_V \times K_T \times K_F$ (Values of derating factor are the listed on table 3.3.2.1)
with an overload capacity $I_{MAX} = 1.36 \times I_{CONT}$ for 60 seconds

The applicable deratings are automatically set when selecting the appropriate values of AC Input voltage, Ambient temperature and Switching frequency.

Recommended motor outputs

The coordination of the motor rated powers with the Drive type presented in the table below refers to the use of standard 4 poles 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.

Motor nominal current cannot be lower than 0,3 x I_{2N} . Magnetizing motor current must not be higher of I_{CONT}.

NOTE! For service conditions with overload higher than 150%, the nominal current must be derated.

Table 3.3.3.1 shows nominal current values for typical service profiles (Ambient temperature =40°C [104°F], standard switching frequency). For cycles with nominal current applied after the overload, the minimum duration is also specified.

For cycles shorter than the minimum duration specified, the current following the overload should be reduced to a level lower than the nominal, so that the RMS average over the cycle does not exceed the continuous current, I_{CONT}.

Similar criteria apply for operation with additional derating factors.

Table 3.3.3.1: Nominal Drive Current

Type		1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000
- I_{2N} Rated output current (@ U_{LN}=230-400Vac) :																						
Continuous service, no overload (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
Overload service 150%x60s followed by I_N , min. cycle time 360s (IEC 146 class2)	[A]	2.2	3.6	5.1	6.8	8.7	11.5	16.1	22.5	29.9	35	43	57	72	85	104	129	168	191	228	295	364
Overload service 200%x10s followed by I_N , min. cycle time 30s	[A]	1.6	2.7	3.8	5.1	6.5	8.6	12.0	16.9	22.4	27	32	43	54	63	78	97	126	143	171	221	273
Overload service 200%x60s followed by I_N , min. cycle time 160s	[A]	1.6	2.7	3.8	5.1	6.5	8.6	12.0	16.9	22.4	27	32	43	54	63	78	97	126	143	171	221	273
Overload service 250%x10s followed by I_N , min. cycle time 25s	[A]	1.3	2.2	3.0	4.1	5.2	6.8	9.6	13.5	18	21	26	34	43	51	62	78	101	115	137	177	218
Overload service 300%x10s followed by I_N , min. cycle time 25s	[A]	1.1	1.8	2.5	3.4	4.3	5.7	8.0	11.2	15	18	21	29	36	42	52	65	84	96	114	147	182
Overload service 300%x60s followed by I_N , min.cycle time 130s	[A]	1.1	1.8	2.5	3.4	4.3	5.7	8.0	11.2	15	18	21	29	36	42	52	65	84	96	114	147	182
- I_{2N} x K_V Rated output current (@ U_{LN}=460/480Vac) :																						
Continuous service, no overload (IEC 146 class 1)	[A]	2.1	3.5	4.9	6.5	8.3	11	15.4	21.6	28.7	34	41	55	69	81	99	124	161	183	218	282	348
Overload service 150%x60s followed by I_N , min. cycle time 360s (IEC 146 class2)	[A]	1.9	3.2	4.4	5.9	7.6	10	14	19.6	26	31	37	50	63	74	90	112	146	166	198	257	317
Overload service 200%x10s followed by I_N , min. cycle time 30s	[A]	1.4	2.4	3.3	4.4	5.6	7.5	10.5	14.7	19.5	23	28	37	47	55	68	84	110	125	148	192	238
Overload service 200%x60s followed by I_N , min. cycle time 160s	[A]	1.4	2.4	3.3	4.4	5.6	7.5	10.5	14.7	19.5	23	28	37	47	55	68	84	110	125	148	192	238
Overload service 250%x10s followed by I_N , min. cycle time 25s	[A]	1.1	1.9	2.7	3.5	4.5	6.0	8.4	11.7	15.6	19	22	30	38	44	54	67	88	100	119	154	190
Overload service 300%x10s followed by I_N , min. cycle time 25s	[A]	0.9	1.6	2.2	2.9	3.8	5.0	7.0	9.8	13	15	19	25	31	37	45	56	73	83	99	128	158
Overload service 300%x60s followed by I_N , min. cycle time 130s	[A]	0.9	1.6	2.2	2.9	3.8	5.0	7.0	9.8	13	15	19	25	31	37	45	56	73	83	99	128	158

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3.3.5. Open-Loop and Closed-Loop Control Section

Enable inputs		0 / 15...30 V	3.2...6.4 mA	(5 mA @ 24 V)
Analog inputs	Selectable	0... ± 10 V	0.25 mA max	
		0...20 mA	10 V max	
		4...20 mA	10 V max	
		Max common mode voltage: 0...± 10 V		
Analog outputs		0...± 10 V	5 mA max per output	
Digital inputs		0 / 15...30 V	3.2...6.4 mA	(5 mA @ 24 V)
Digital outputs	Supply	+ 15...35 V		
	Signals	+ 15...35 V	40 mA max per output	
Encoder inputs				
Sinusoidal	Voltage	1 V pp		
	Current	8.3 mA pp per channel (input resistance = 124 Ohms).		
	No. of pulses	min 600		
	per revolution	max 9999		
	max. frequency	80 kHz		
	Cable max.	500 feet (150 m), screened, 4 twisted pairs as shown in the table 4.4.2.1		
Digital	Voltage	5 V		
	Current	10 mA		
	No. of pulses	min 600		
	per revolution	max 9999		
	Type	standard and inverted signal		
	max. frequency	150 kHz		
Int. voltage supply				
	Load capacity	+ 5 V	160 mA	Plug connector
		+ 10 V	10 mA	Terminal 7
		- 10 V	10 mA	Terminal 8
		+ 24 V	120 mA	Terminal 19
	Tolerance	+ 10 V	± 3 % [1)]	
		- 10 V	± 3 % [1)]	
		+ 24 V	+ 20 ... 30 V, not stabilized	
		XE for digital encoder, PIN 7/9		

[1)] The tolerance between positive and negative amplitudes is ± 0.5%

3.3.6. Accuracy

Output frequency:			
	temperature dependent stability error	[°C]	≤ 50 ppm/°C typical
	resolution	[Hz]	0.001 Hz at 50 Hz 0.005 Hz at 300 Hz
Internal reference value voltage:		[V]	± 10V, terminals 7 and 8
	- temperature dependent stability error	[°C]	100 ppm/°C typical
Reference values:			
	resolution via keypad / Interface bus		16 bit or 15 bit + sign
	resolution via terminals (1/2, 3/4, 5/6)		11 bit + sign
	linearity via terminals (1/2, 3/4, 5/6)		± 0.1 % of full scale
SPEED CONTROL	Speed limit / Absolute max speed	[rpm]	8000
	Digital reference resolution	[rpm]	0.25
	Field oriented (with sinusoidal Encoder):		
	speed feedback resolution	[rpm]	0.25 (for encoder pulses number ≥ 1900)
			> 0.25(for encoder pulses number <1900)
	accuracy	[%]	typical 0.01%
	control range	[rpm]	better than 1:10000
	max bandwidth	[rad/s]	300 rad/s [47 Hz] (1)
	Field oriented (with digital Encoder):		
	speed feedback resolution	[rpm]	0.5
	accuracy	[%]	typical 0.02%
	control range	[rpm]	better than 1:1000
	max bandwidth	[rad/s]	300 rad/s [47 Hz] (1)
	Sensorless vector control:		
	speed feedback resolution	[rpm]	0.002 x Nominal speed
	accuracy	[%]	0.3% @ Nominal speed
			1.3% @ 2% of Nominal speed
	control range	[rpm]	from 1:50 to 2.5 x Nominal speed
	max bandwidth	[rad/s]	100 rad /s [15,9Hz] (1)
	Constant V/f control:		
	accuracy	[rpm]	0.3 x nominal motor slip with automatic slip compensation
	control range	[%]	depending on motor nominal slip, typ. 1:50
TORQUE CONTROL	Field oriented - Sensorless:		
	resolution	[rpm]	typical 1:1.000
	accuracy	[%]	typical 5% (2)
	control range	[rpm]	1÷20
	min. response time (at load step)	[ms]	0.8
	max bandwidth		2.4 krad/s [380 Hz]

avy2030

(1) The response time and bandwidth are affected by the load and inertia. These represent limit values.
(2) This value does not include iron losses, mechanical losses and cogging torque. With Rr adaptation enabled.

4. INSTALLATION GUIDELINES

4.1. MECHANICAL SPECIFICATION

Figure 4.1.1: Drive dimensions (sizes 1007 ... 3150)

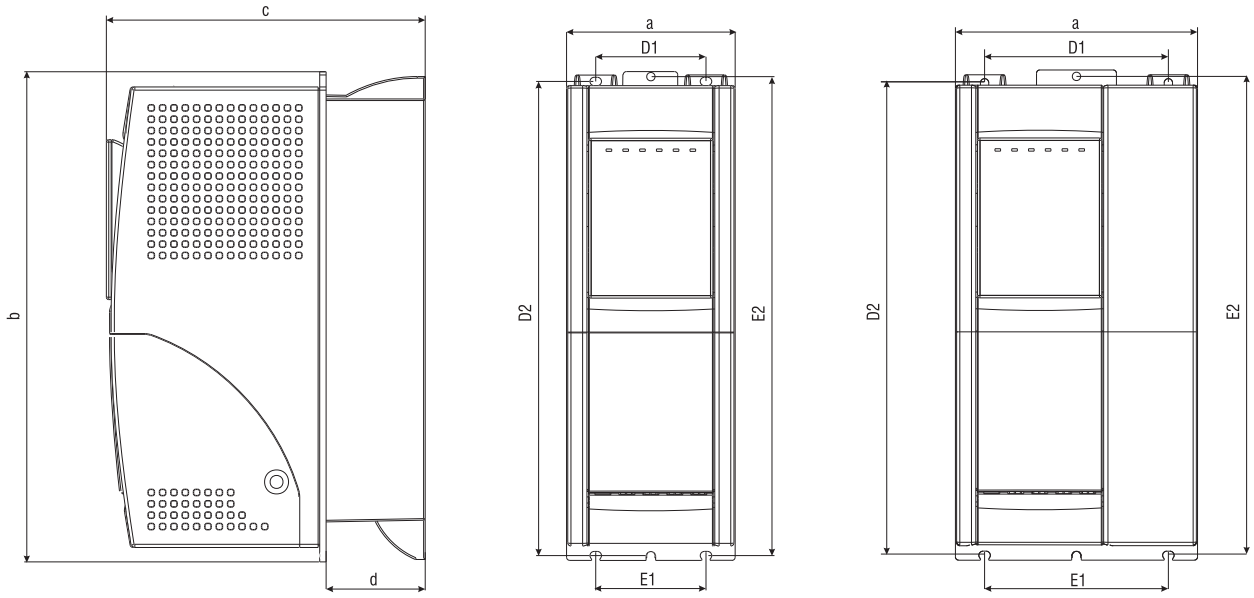
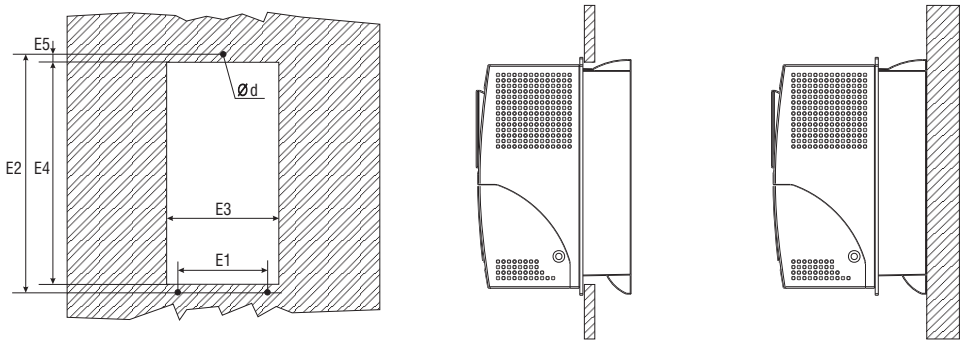


Figure 4.1.2: Mounting methods (sizes 1007 ... 3150)



Mounting with external dissipator (E)

Mounting wall (D)

Table 4.1.1: Drive dimensions and Weights (sizes 1007 ... 3150)

Type		1007	1015	1022	1030	2040	2055	2075	3110	3150
Drive dimensions:										
a	mm (inch)	105.5 (4.1)				151.5 (5.9)			208 (8.2)	
b	mm (inch)	306.5 (12.0)							323 (12.7)	
c	mm (inch)	199.5 (7.8)							240 (9.5)	
d	mm (inch)	62 (2.4)							84 (3.3)	
D1	mm (inch)	69 (2.7)				115 (4.5)			168 (6.6)	
D2	mm (inch)	296.5 (11.6)							310.5 (12.2)	
E1	mm (inch)	69 (2.7)				115 (4.5)			164 (6.5)	
E2	mm (inch)	299.5 (11.7)							315 (12.4)	
E3	mm (inch)	99.5 (3.9)				145.5 (5.7)			199 (7.8)	
E4	mm (inch)	284 (11.2)							299.5 (11.8)	
E5	mm (inch)	9 (0.35)								
Ø d		M5								
Weight	kg (lbs)	3.5 (7.7)	3.6 (7.9)	3.7 (8.1)		4.95 (10.9)			8.6 (19)	

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Figure 4.1.3: Drive dimensions (sizes 4185 ... 82000)

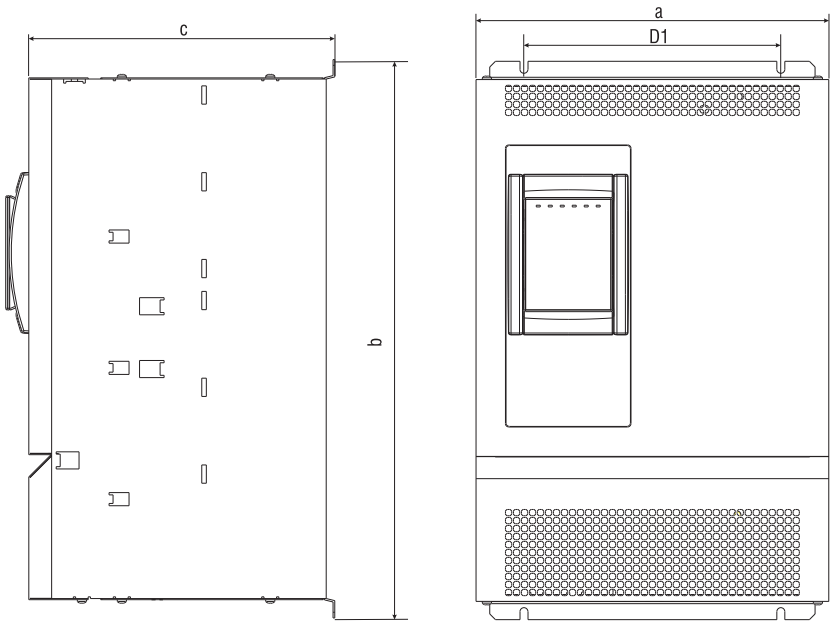


Figure 4.1.4: Mounting methods (sizes 4185 ... 82000)

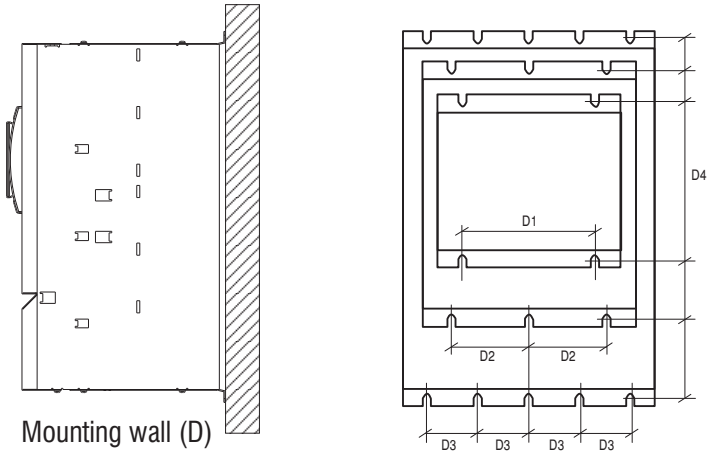
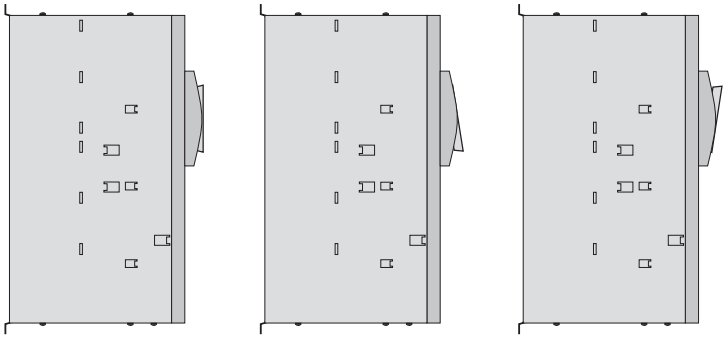


Table 4.1.2: Drive dimensions and Weights (sizes 4185 ... 82000)

Type		4185	4220	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000
Drive dimensions:													
a	mm (inch)	309 (12.1)				376 (14.7)		509 (20)					
b	mm (inch)	489 (19.2)				564 (22.2)		741 (29.2)	909 (35.8)			965 (38)	
c	mm (inch)	268 (10.5)		308 (12.1)				297.5 (11.7)				442 (17.4)	
D1	mm (inch)	225 (8.8)											
D2	mm (inch)					150 (5.9)							
D3	mm (inch)							100 (3.9)					
D4	mm (inch)	475 (18.7)				550 (21.6)		725 (28.5)	891 (35)			947 (37.3)	
Ø		M6											
Weight	**kg**	18		22	22.2	34	34	59	75.4	80.2	86.5	109	
	lbs	39.6		48.5	48.9	74.9	74.9	130	166.1	176.7	190.6	240.3	

avy3105

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, typ. motor power factor and nominal continuous current.

Table 4.2.1: Heat dissipation and Required Air Flow

Type		1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	4550	5550	6750	7900	7100	7132	8160	8200
P_V Heat dissipation:																						
@U_{LN}=400Vac [1]	[W]	48.2	77.5	104.0	138.3	179.5	233.6	327.4	373	512	546	658	864	1100	1250	1580	1950	2440	2850	3400	4400	5400
@U_{LN}=460Vac [1]	[W]	45.0	72.0	96.3	126.7	164.1	215.6	300.8	340	468	490	582	780	1000	1100	1390	1750	2200	2560	3050	3950	4700
[1] f_{SW}=default; $I_2=I_{2N}$																						
Airflow of fan:																						
Internal fan	[m^3/h]	11	11	11	11	11	11	11	30	30												
Heatsink fans	[m^3/h]	-	30	30	30	2x30	2x30	2x30	2x79	2x79	80	170	340		650	975					1820	2000

avy3110

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

Type	1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	4550	5550	6750	7900	7100	7132	8160	8200
Minimum cooling opening:																					
Control section cm^2 (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 cm^2 (sq.inch)	36 (5.6)				72 (11.1)			128 (19.8)													

avy3120

4.2.1 Cooling fans power supply

Sizes 1007 to 5550

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

Sizes 6750 to 82000

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

- AVy6750: 0.8A@115V/60Hz, 0.45A@230V / 50Hz
- AVy7900 ... AVy71320: 1.2A@115V/60Hz, 0.65A@230V / 50Hz
- AVy82000: 1.65A@115V/60Hz, 0.70A@230V / 50Hz

Figure 4.2.1: UL type fans connections on AVy7900, AVy71100 and AVy71320 sizes

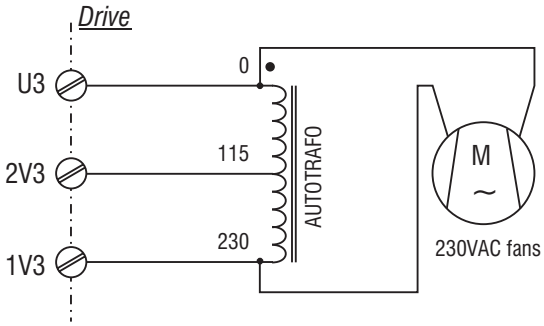


Figure 4.2.2: UL type fans connections on AVy6750 and AVy82000 sizes

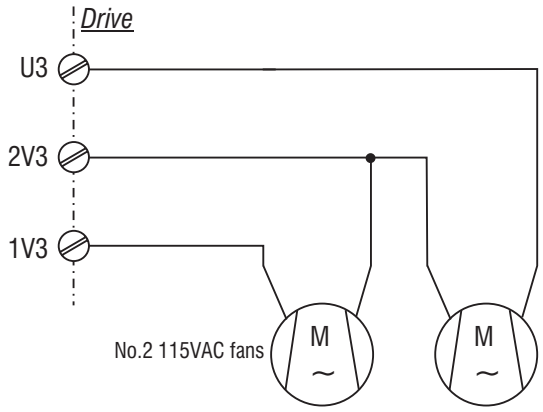
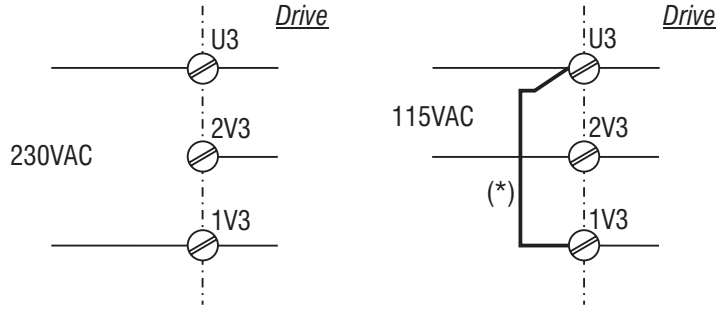


Figure 4.2.3: Example for external connection



(*) Only for AVy6750 and AVy82000 drives

NOTE!

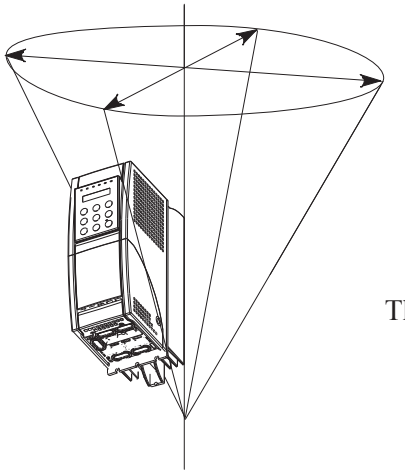
An internal fuse (2.5A 250VAC slo-blo) for AVy7900, AVy71100 and AVy71320 sizes is provided.

On AVy6750 and AVy82000 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



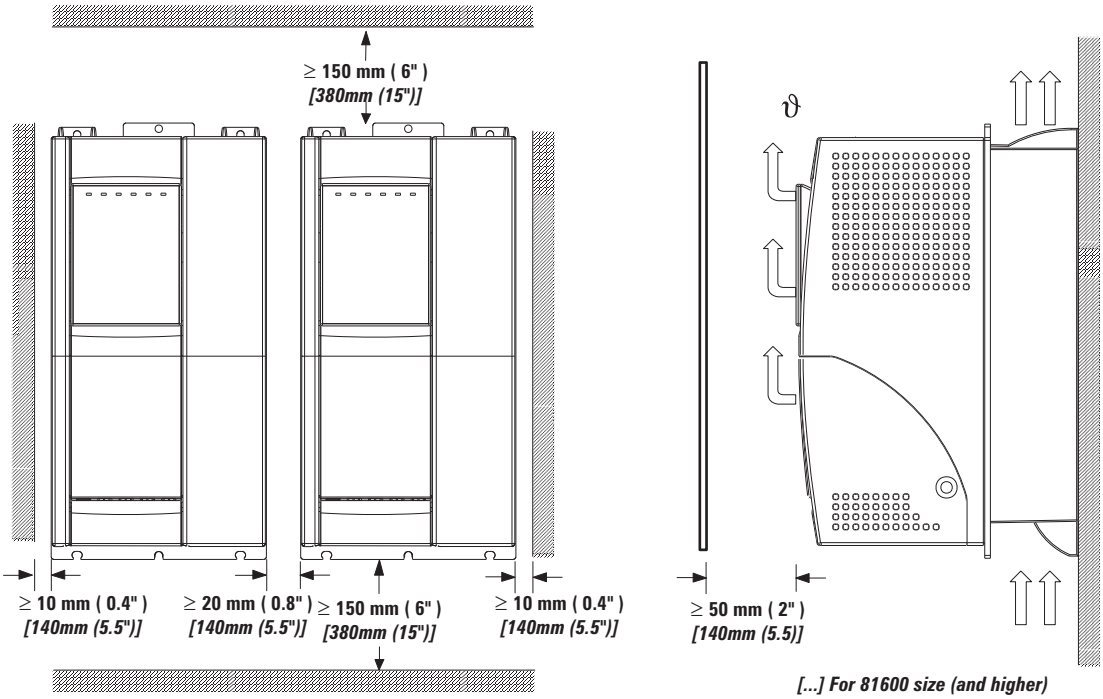
The maximum angle of inclination is 30°

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.

From size 81600 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.

Figure 4.3.2: Mounting Clearance



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

4.4. MOTORS AND ENCODERS

The AVy Drives designed for the field oriented regulation of standard three-phase induction AC motors. A sinusoidal encoder or digital encoder can be used for feedback in proportion to speed.

4.4.1. Motors

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 AVy 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.

Which properties of the asynchronous motors have an unfavorable result in operation with frequency inverters?

Motors with double squirrel-cage rotors or deep rotor bars should not be used.

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

The other data required for vector control is calculated inside the inverter. In order to optimize the drive operation it is also useful to know the values for :

- Magnetizing current
- Rotor resistance
- Stator resistance (Sensorless mode only)
- Leakage inductance (Field oriented mode with Rotor resistance adaptation enabled or Sensorless mode.).

Motor protection

Thermistors

PTC thermistors according to DIN 44081 or 44082 fitted in the motor can be connected directly to the frequency inverter via terminals 78 and 79. In this case the resistor (1Kohm) mounted between the terminals 78 and 79 has to be removed.

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 15). They can also be connected to the terminals 78 and 79 in order to have a specific error signal. In this case connect the existing 1 Kohm resistor in series to the wiring, note that one side of it must be connected directly to terminal 79.

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.

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 (“Ovld mot ctrl”) 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

One of two types of encoder may be connected to the XE connector (high density 15-pole socket, fitted on device), see the table 4.4.2.2 for the jumper settings

- **DE:** 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$
- **SE**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$

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.

Optimal regulation results are ensured when using sinusoidal encoders. Digital encoders (rotary encoders) may also be used. See section 4.3.6, “Accuracy”.

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.

Some types of sinusoidal encoders may require installation with galvanic isolation from the motor frame and shaft.

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

Table 4.4.2.2: Encoders setting via S11...S23 jumpers

Encoder / Jumpers setting	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23
DE	OFF	OFF	OFF	OFF	OFF	OFF	ON (*)	-	-	-	-	-	-
SE	ON	ON	ON	ON	ON	ON	-	-	-	-	-	-	-

ai3150

The jumper S17 selects the inhibition or the enabling of the channel C pulses reading. It has to be correctly selected in order to detect appropriately the encoder loss alarm.

S17 ON : channel C (index) reading=ON

S17 OFF: channel C (index) reading=OFF

(*) If the encoder is not provided of the zero channel : S17=OFF

Table 4.4.2.3: Encoders connections

Encoder type	Shielded cable	XE CONNECTOR PIN														
		1 B-	2 +8V	3 C+	4 C-	5 A+	6 A-	7 0V	8 B+	9 +5V	10 E+	11 E-	12 F+	13 F-	14 G+	15 G-
Internal +5V Encoder Power Supply																
DE	8 pole	●		●	●	●	●	●	●	●						
SE	8 pole	●		●	●	●	●	●	●	●						
Internal +8V Encoder Power Supply																
DE	8 pole	●	●	●	●	●	●	●		●						
SE	8 pole	●	●	●	●	●	●	●		●						

ai3160

Requirements:

Sinusoidal encoders (XE connector on Regulation card)

max. frequency	80 KHz (select the appropriate number of pulses depending on required max. speed)
Number of pulses per revolution	min 600, max 9999
Channels	two-channel, differential
Power supply	+ 5 V (Internal supply) *
Load capacity	> 8.3 mA pp per channel

Digital encoders (XE connector on Regulation card)

max. frequency	150 KHz (select the appropriate number of pulses depending on required max. speed)
Number of pulses per revolution	min 600, max 9999
Channels	- two-channel, differential A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$). An encoder loss detection is possible via firmware setting. - two channel, (A,B) only with optional card.
Power supply	+ 5 V (Internal supply) *
Load capacity	> 4.5 mA / 6.8 ... 10 mA per channel

* Via keypad ("CONFIGURATION/Motor spd fbk/ Enc 1 supply vlt" menu) it is possible to select 4 different values of internal encoder supply voltage to compensate the voltage reduction due to encoder cable length and load current encoder.

Selection available are:

- for +5 V encoder supply: 0=5.41V, 1=5.68V, 2=5.91V, 3=6.18V via **Enc 1 supply vlt** parameter.
- for +8 V encoder supply: leave standard default =0

Encoder power supply test (if the internal supply +5V is used)

During the start up of the drive:

- verify the encoder power supply to the encoders terminals with all the encoders channels connected
- via **Enc 1 supply vlt** parameter set the appropriate voltage if the encoder supply characteristic (example: +5V ± 5%) is out of range.

Terminals for external encoder connections

Male terminals type:	15 poles high density (VGA type)
Connector cover:	Standard 9 poles low profile (Example manufacturer code: AMP 0-748676-1, 3M 3357-6509)

Table 4.4.2.4: Assignment of the high density XE connector for a sinusoidal or a digital encoder

Designation		Function	I/O	Max. voltage	Max. current
PIN 1	**ENC B-**	Channel B- Incremental encoder signal B negative	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 2		+8V Encoder supply voltage	O	+8 V	200 mA
PIN 3	**ENC C+**	Channel C+ Incremental encoder signal Index positive	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 4	**ENC C-**	Channel C- Incremental encoder signal Index negative	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 5	**ENC A+**	Channel A+ Incremental encoder signal A positive	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 6	**ENC A-**	Channel A- Incremental encoder signal A negative	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 7	**GND**	Reference point for +5V encoder supply voltage	O	–	–
PIN 8	**ENC B+**	Channel B+ Incremental encoder signal B positive	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 9	**AUX+**	+5V encoder supply voltage	O	+5 V	200 mA
PIN 10	**HALL 1+/SIN+**	Channel HALL1 + / SIN+ Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 11	**HALL 1-/SIN-**	Channel HALL 1- / SIN- Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 12	**HALL 2+/COS+**	Channel HALL 2+ / COS+ Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 13	**HALL 2-/COS-**	Channel HALL 2- / COS- Reserved	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 14	**HALL 3+**	Channel HALL 3 + Reserved	I	5 V digital or 1 V pp analog	10 mA digital
PIN 15	**HALL 3-**	Channel HALL 3 - Reserved	I	5 V digital or 1 V pp analog	10 mA digital

ai3140

5. WIRING PROCEDURE

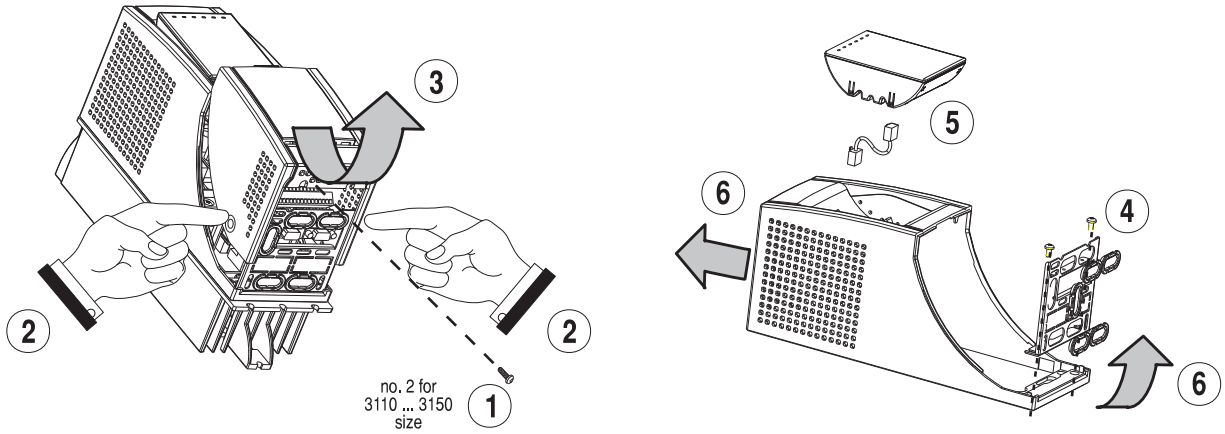
5.1. ACCESSING TO THE CONNECTORS

5.1.1 Removing the Covers

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.

See figure 3.2.2 "Drive view & components" to identify the single part.

Figure 5.1.1: Removing the covers (sizes 1007 to 3150)



Sizes 1007 to 2075

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 to 3150

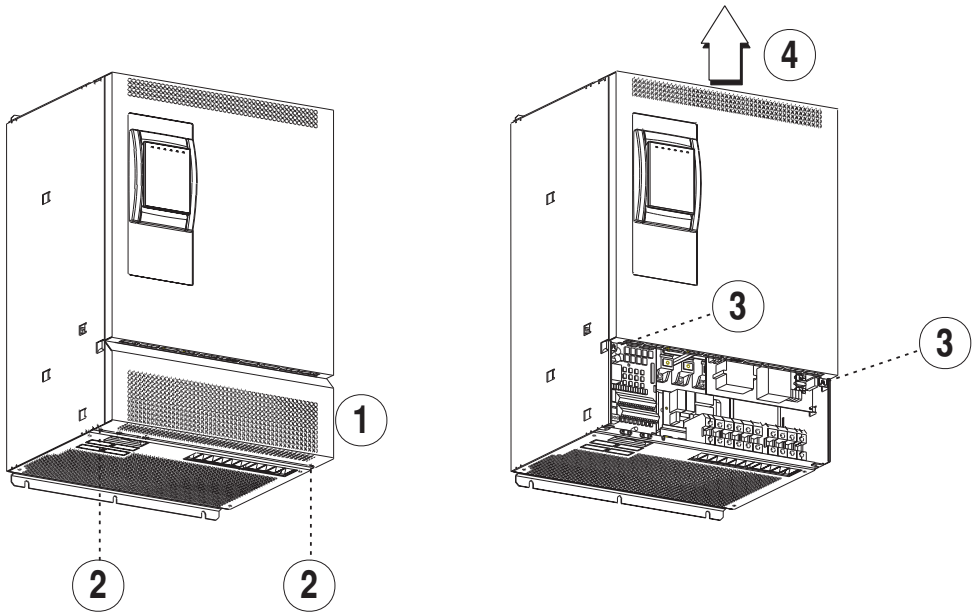
The terminal cover and cable entry plate of the device must be removed in order to fit the electrical connections:

- 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).

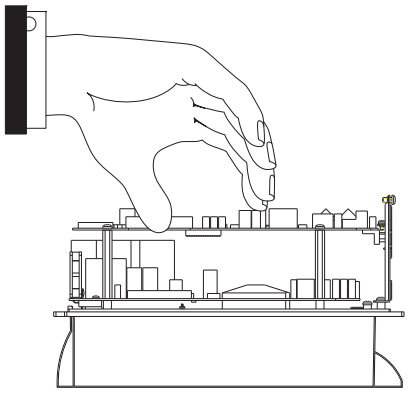
Figure 5.1.2: Removing the covers (sizes 4220 to 82000)



Sizes 4220 to 82000

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)



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

5.2. POWER SECTION

5.2.1. PV33-.. Power card

Figure 5.2.1.1: PV33-1-. power card (sizes 1007 to 1030)

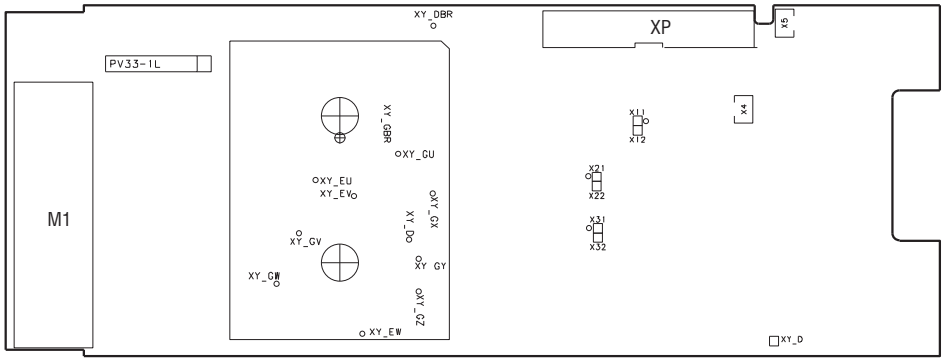


Figure 5.2.1.2: PV33-2-.. power card (sizes 2040 to 2075)

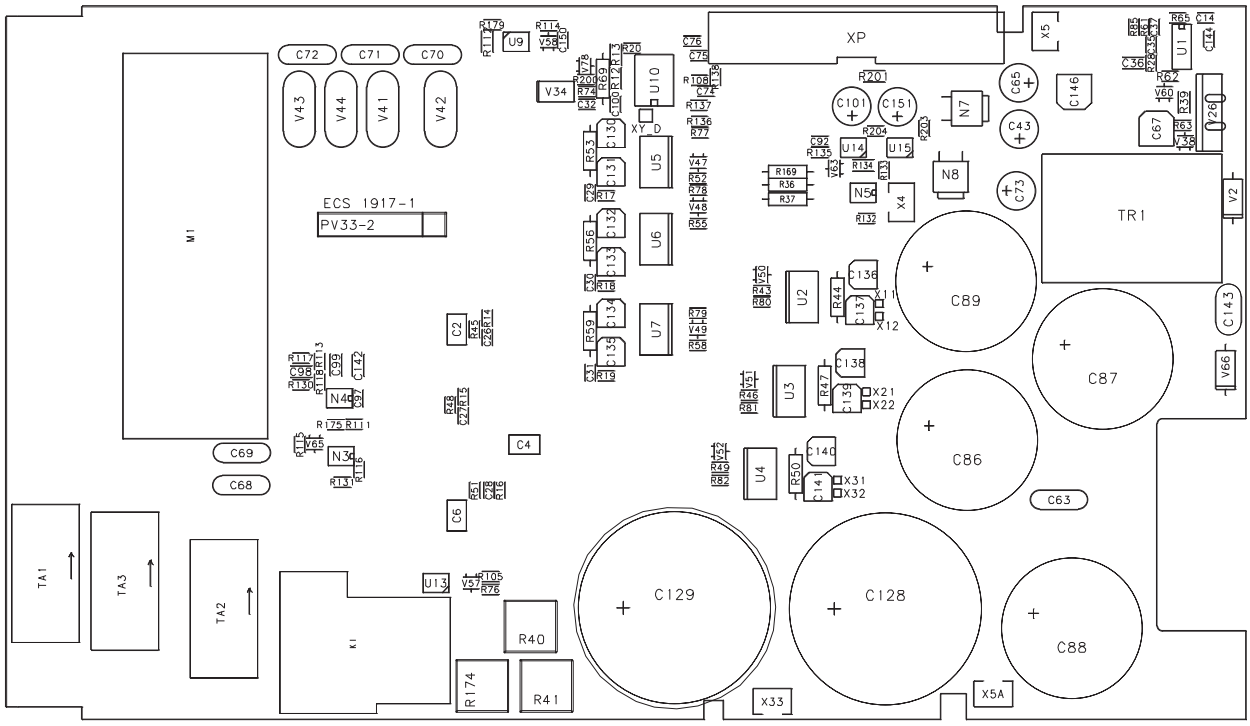


Figure 5.2.1.3: PV33-3-.. power card (sizes 3110 and 3150)

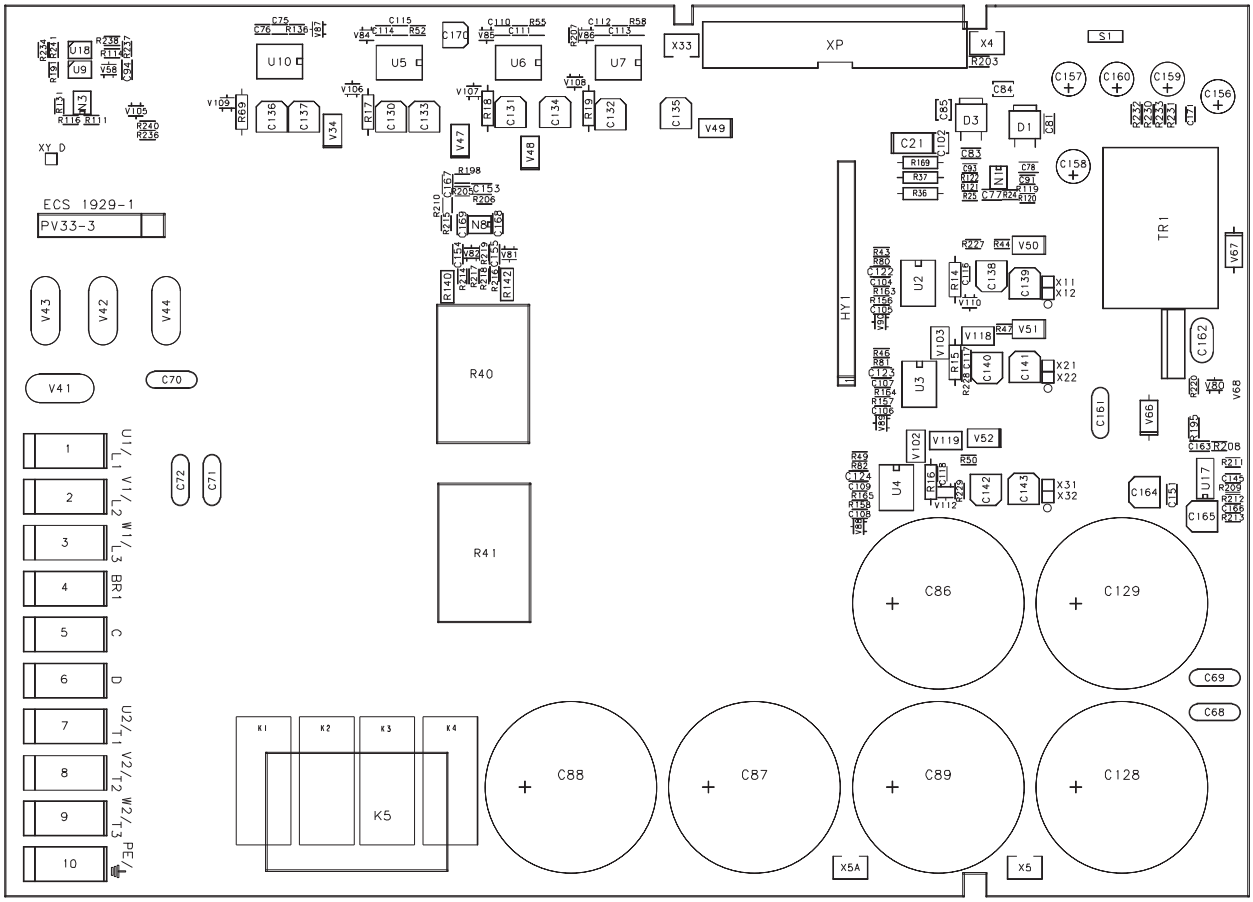


Figure 5.2.1.4: PV33-4-.. power card (sizes 4220 to 5550)

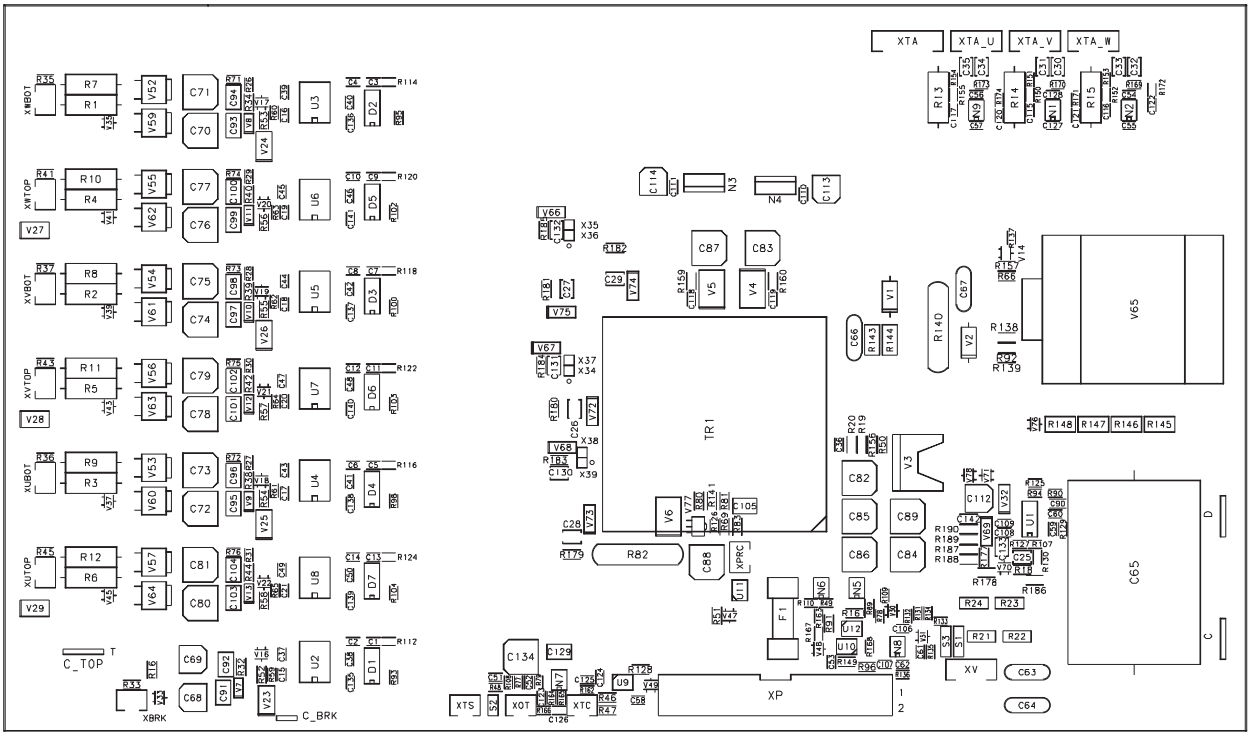


Figure 5.2.1.5: PV33-5-.. power card (sizes 6750 to 71320)

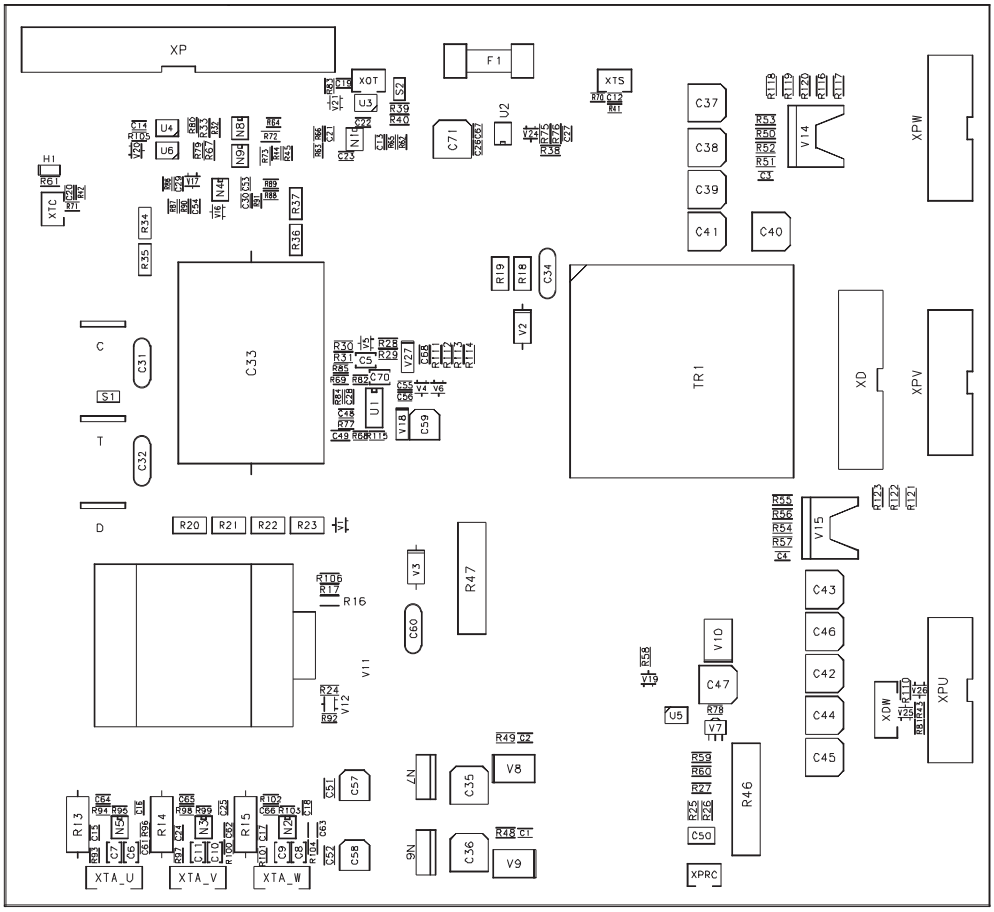
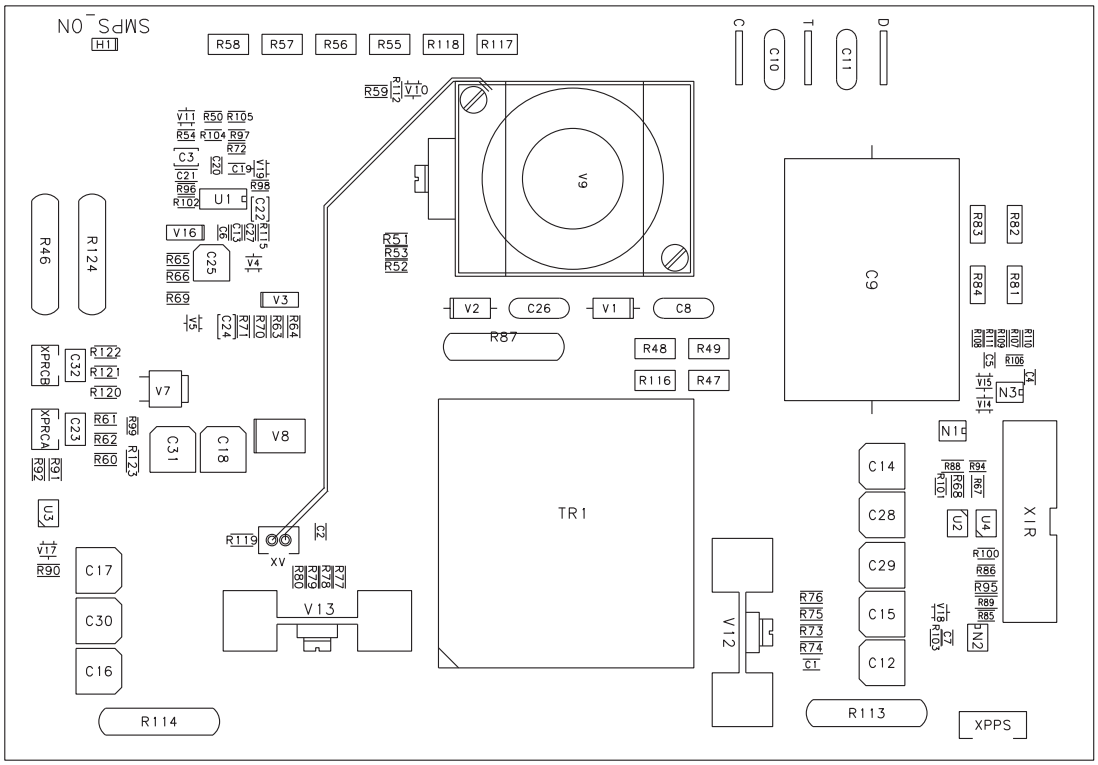
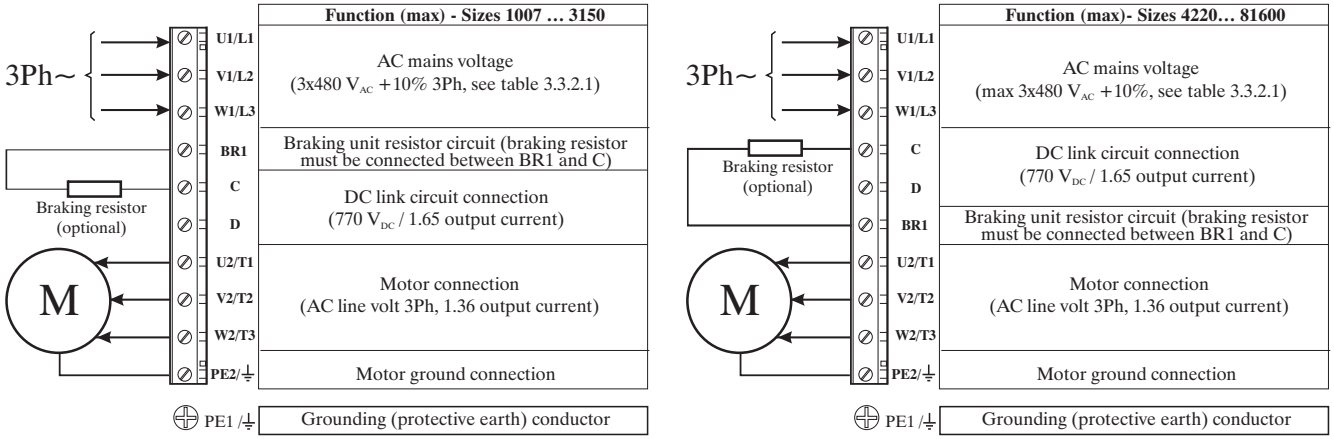


Figure 5.2.1.6: PV33-6-.. power card (sizes 81600 to 82000)



5.2.2. Terminal Assignment on Power section / Cable Cross-Section

Figure 5.2.2.1: Power Terminals connection



Power terminals lay-out

Sizes 1007 to 3150 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 power card PV33-....shown on previous chapter.

Sizes 4220 to 81600: The terminals of the devices are made accessible by removing the cover (see section 5.1, "Accessing to the connectors").

Maximum Cable Sizes for power terminals U1, V1, W1, U2, V2, W2, C, D, PE

Table 5.2.2.1: Maximum cable cross section for power terminals

	1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220
AWG	14				12	10		8	6		
[mm2]	2				4			8	10	16	
[Nm]	0.5 to 0.6							1.2 to 1.5		2	
AWG	14				12	10		8	6	10	
[mm2]	2				4			8	10	6	
[Nm]	0.5 to 0.6							1.2 to 1.5		0.9	
AWG	14				12	10		8	6	6	
[mm2]	2				4			8	10	16	
[Nm]	0.5 to 0.6							1.2 to 1.5		2	

	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000	
AWG	4	2		1/0	2/0	4/0	300*	350*	4xAWG2		* = kcmils
[mm2]	25	35		50	70	95	150	185	4x35	150**	**: copper bar
[Nm]	3	4			12		10-30				
AWG	8	8	6		terminals not available						
[mm2]	10	10	16								
[Nm]	1.6	1.6	3								
AWG	6	6		2							
[mm2]	16	16		50							
[Nm]	3	3	4								

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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 AVy Drive.

NOTE: Use 75°C copper conductor only.

5.3. REGULATION SECTION

5.3.1 RV33 Regulation Card

Figure 5.3.1.1: RV33-4 Regulation Card Switch & Jumpers

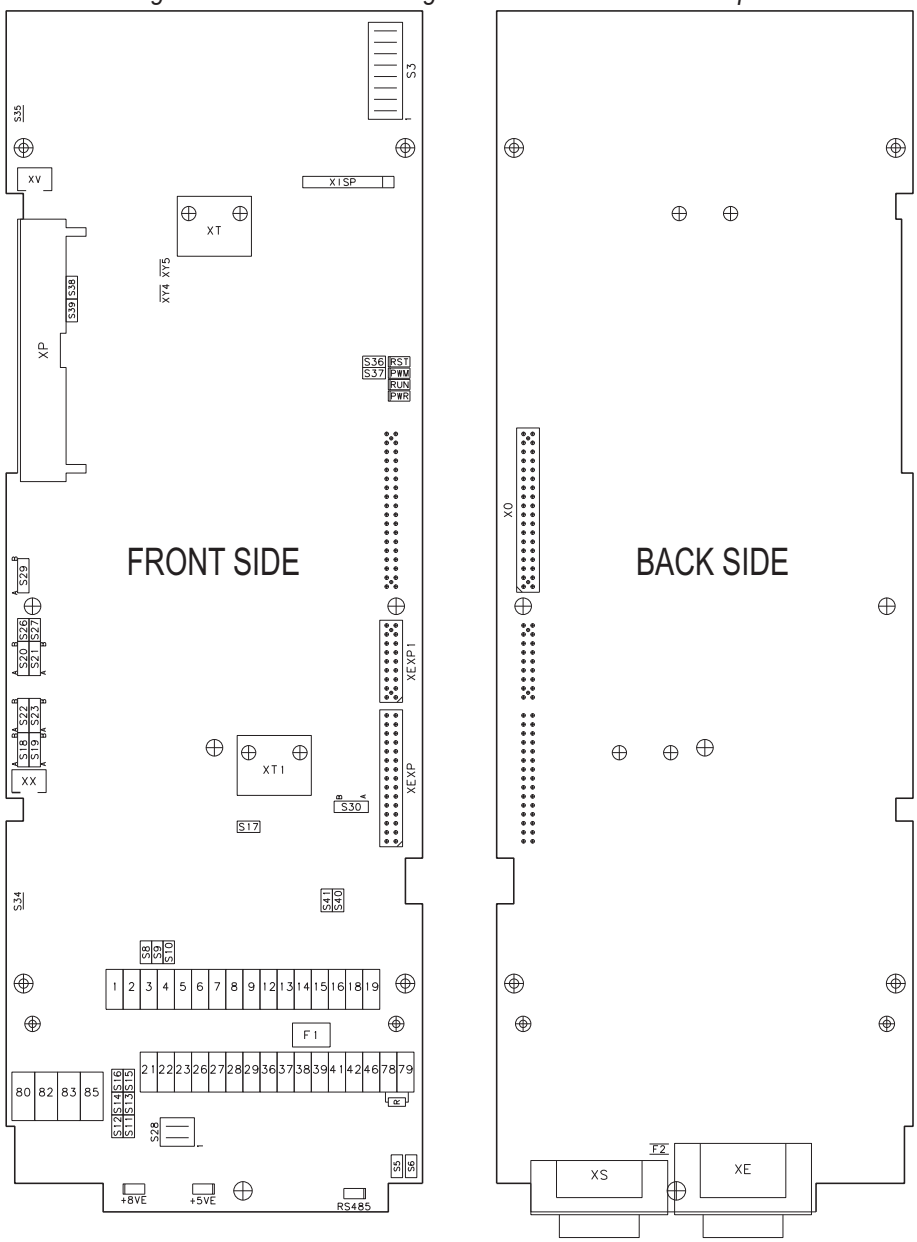

Table 5.3.1.1: LEDs & Test points on Regulation card

Designation	Color	Function
RST	red	LED lit during the Hardware Reset
PWR	green	LED lit when the voltage +5V is present and at correct level
RS485	green	LED is lit when RS485 interface is supplied
PWM	green	LED lit during IGBT modulation
RUN	green	LED is flashing when regulation is running (not in STARTUP menu)
+5VE	green	LED lit when encoder power supply +5V (XE-9)
+8VE	red	LED lit when encoder power supply +8V (XE-2)
XY4	(test point)	Phase current signal (U) (see manual "AVy Function description and parameters", table 1.3.1.2.2)
XY5	(test point)	Reference point

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Table 5.3.1.3: Jumpers on Regulation Card RV33-3

Designation	Function	Factory setting
S5 - S6	Terminating resistor for the serial interface RS485 ON= Termination resistor IN OFF= No termination resistor	ON (*)
S8	Adaptation to the input signal of analog input 1 (terminals 1 and 2) ON=0...20 mA / 4...20 mA OFF=0...10 V / -10...+10 V	OFF
S9	Adaptation to the input signal of analog input 2 (terminals 3 and 4) ON=0...20 mA / 4...20 mA OFF=0...10 V / -10...+10 V	OFF
S10	Adaptation to the input signal of analog input 3 (terminals 5 and 6) ON=0...20 mA / 4...20 mA OFF=0...10 V / -10...+10 V	OFF
S11 - S12 - S13 S14 - S15 - S16	Encoder setting (jumpers on kit EAM_1618 supplied with the drive) ON=Sinusoidal SE OFF=Digital DE	OFF
S17	Monitoring of the C-channel of the digital encoder ON=C-Channel monitored OFF=C-Channel not monitored (required for single-ended channels)	OFF
S18 - S19 S20 - S21	Encoder setting Pos. B= reserved Pos. A= reserved	B
S22 - S23	Analog input 3 enabling (alternative with SESC encoder) Pos. A= reserved Pos. B=analog input 3 enabled Pos. OFF= resolver	B
S26 - S27	Reserved	ON
S28	Encoder Internal power supply selection ON / ON = +5 V OFF / OFF = +8 V	ON/ON
S29	Internal use	A
S30	Second encoder qualifier input A=from EXP-… board B=from digital input "3" on RV33-4	A
S34	Jumper to disconnect 0V (+24V power supply) from ground ON = 0V connected to ground OFF = 0V disconnected from ground	ON (hard-wire)
S35	Jumper to disconnect 0V (regulation board) from ground ON = 0V connected to ground OFF = 0V disconnected from ground	ON (hard-wire)
S36	Internal use	not mounted
S37	Internal use	not mounted
S38-S39	Internal use	ON
S40-S41 (**)	Power supply for the serial interface RS485 ON = Internal power supply (from pins XS.5 / XS.9) OFF = External power supply (to pins XS.5 / XS.9)	OFF

Ay4060

(*) on multidrop connection the jumper must be ON only for the last drop of a serial line
(**) see chapter 5.4

Table 5.3.1.4: RV33 Regulation Card Switch S3 Settings

Type	1007	1015	1022	1030	2040	2055	2075	3110	3150	4185	4220	4300	4370	5450	5550	6750	7900	71100	71320	81600	82000
S3-1	ON	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
S3-2	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
S3-3	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
S3-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
S3-5	ON	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
S3-6	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
S3-7	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
S3-8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

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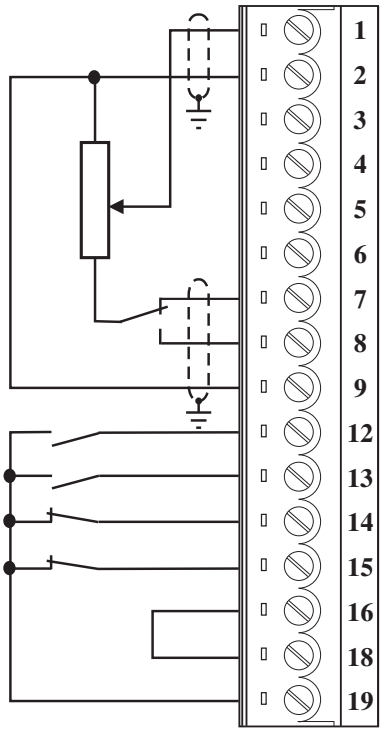
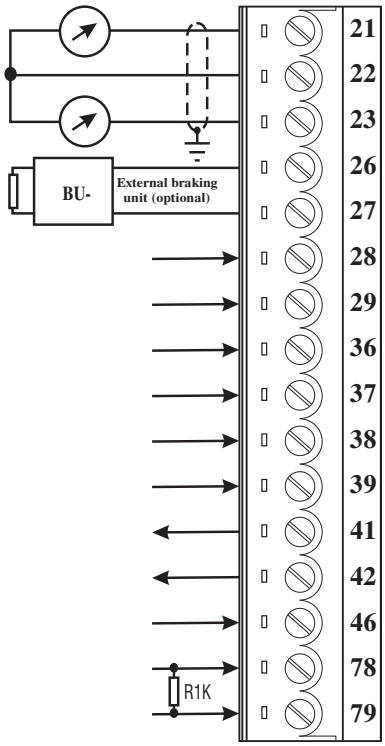
The devices are factory set accordingly.When fitting a regulation card as a spare, remember to set dip-switch S3 and encoder jumpers accordingly.

5.3.2. Terminal Assignments on regulation section

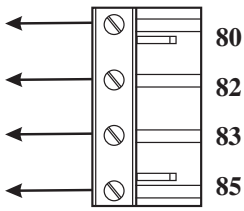
Table 5.3.2.1: Plug-in Terminal Strip Assignments



Strip X1	Function	max
Analog input 1	Programmable/configurable analog differential input. Signal: terminal 1. Reference point: terminal 2. Default setting: Ramp ref 1	±10V 0.25mA (20mA when current ref input)
Analog input 2	Programmable/configurable analog differential input. Signal: terminal 3. Reference point: terminal 4. Default setting: none	
Analog input 3	Programmable/configurable analog differential input. Signal: terminal 5. Reference point: terminal 6. Default setting: none. (1)	
+10V	Reference voltage +10V; Reference point: terminal 9	+10V/10mA
-10V	Reference voltage -10V; Reference point: terminal 9	-10V/10mA
0V	Internal 0V and reference point for±10V	-
Enable drive	Inverter enable; 0V or open: inverter disabled; +15…+30V: Inverte enabled	+30V
Start	Inverter start command; 0V or open: No start; +15…+30V: Start	3.2mA @ 15V
Fast stop	OV or open: Fast stop. +15…+30V: No Fast stop.	5mA @ 24V
External fault	OV or open: External fault. +15…+30V: No External fault	6.4mA @ 30V
COM D I/O	Reference point for digital inputs and outputs, term.12...15, 36...39, 41...42	-
0 V 24	Reference point for + 24V OUT supply, terminal 19	-
+24V OUT	+24V supply output. Reference point: terminal 18 or 27 or 28	+22…28V 120mA @ 24V



Analog output 1	Program.analog output; def.setting: Motor speed. Ref. point: term.22	±10V/5mA
0V	Internal 0V and reference point for terminals 21 and 23	-
Analog output 2	Program.analog output; def.setting: Motor current. Ref. point: term.22	±10V/5mA
BU comm. output	VeCon controlled BU-... braking units command. Ref. point: term.27.	+28V/15mA
0 V 24	Reference point for BU-... command, terminal 26	-
RESERVED		-
RESERVED		
Digital input 1	Programmable digital input; default setting: none	+30V 3.2mA @ 15V 5mA @ 24V 6.4mA @ 30V
Digital input 2		
Digital input 3	Progr. digital input; def. setting: none. Configurable as 2nd encoder index qualifier (setting via S30 jumper, "Digital input 3" parameter must be set 0=OFF)	
Digital input 4	Programmable digital input; default setting: none. Configurable as 1st encoder index qualifier ("Digital input 4" parameter must be set 0=OFF).	
Digital output 1	Programmable digital output; default setting: none	+30V/40mA
Digital output 2		
Supply D O	Supply input for digital outputs on terminals 41/42. Ref. point: term.16.	+30V/80mA
Motor PTC	Motor PTC sensing for overtemperature (cutoff R1k if used)	1.5mA



Strip X2	Function	max curr.
OK relay contact	Potential- relay contact OK relay (closed=OK)	250V AC 1 A AC11
Relay 2 contact	Potential-relay contact configurable (relay 2). Default: open 0 drive stopped	250V AC 1 A AC11

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 5.3.2.2: Maximum permissible cable cross-section on the plug-in terminals of the regulator section

Terminals	Maximum Permissible Cable Cross-Section			Tightening torque [Nm]
	[mm^2]		AWG	
	flexible	multi-core		
1 ... 79	0.14 ... 1.5	0.14 ... 1.5	28 ... 16	0.4
80 ... 85	0.14 ... 1.5	0.14 ... 1.5	28 ... 16	0.4

Ai4090

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 5.3.2.3: 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]

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Potentials of the control section

The potentials of the regulation section are isolated and can be disconnected via jumpers from ground. The connections between each potential are shown in Figure 5.3.1.2.

The digital inputs are designed as differential amplifiers.

The digital inputs are optocoupled with the control circuit. The digital inputs (terminals 12 to 15 and 36 to 39) and digital outputs have terminal 16 as a common reference point.

The analog outputs are designed as not differential amplifiers and have common reference point (terminal 22).

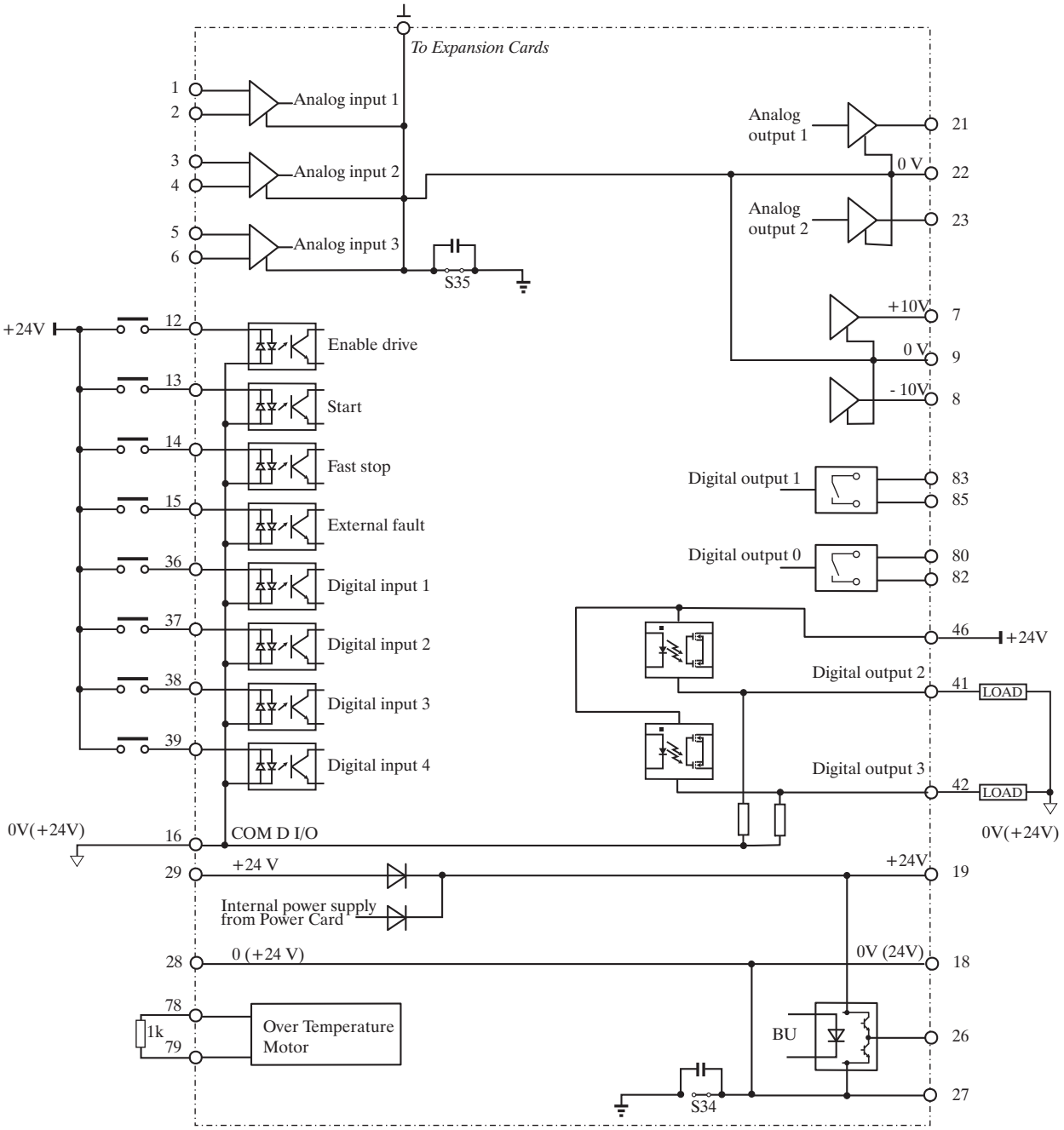
The analog outputs and the ±10V reference point have same potential (terminal 22 and 9).

The digital outputs are optocoupled with the control circuit. The terminals 41 to 42 have terminal 16 as a common reference point and terminal 46 as common supply.

It is recommended, in order to reduce the interferences on the input/output signals, to not remove the jumpers ground connection S34 and S35.

The brake unit command has reference point (terminal 27) connected to reference point +24V (terminal 18).

Figure 5.3.1.2: Potentials of the control section, Digital I/O NPN connection



5.4. SERIAL INTERFACE

5.4.1. Serial Interface Description

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 38.4 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 AVy devices (up to 128 address selectable) can be networked together via the RS 485 interface. Address setting is carried out via the **Device address** parameter. Further information concerning the parameters to be transfered, their type and value range is given in the table contained in section 8, “Parameter lists”.

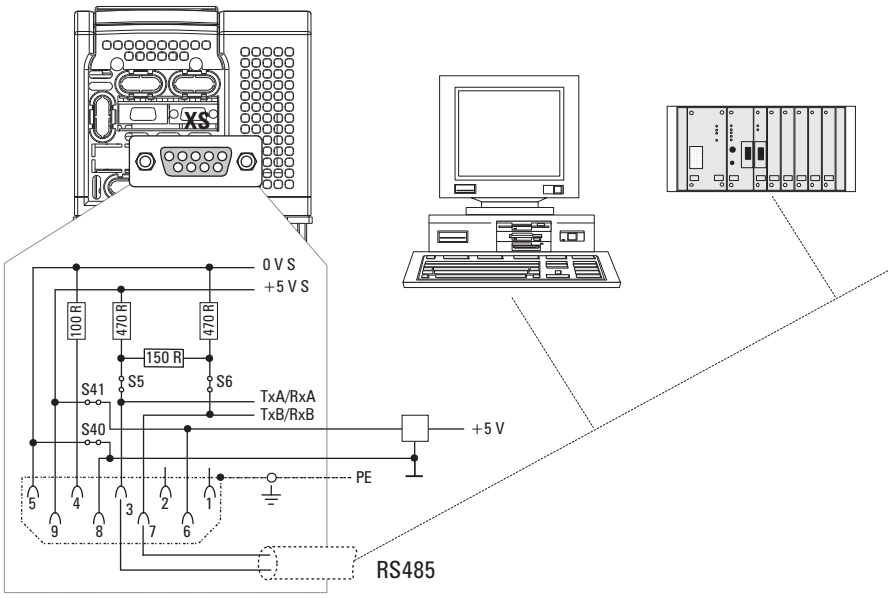


Figure 5.4.1.1: RS485 Serial Interface

The RS 485 on the AVy 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: by using galvanic isolation an external power supply is necessary (+5V). Communication without galvanic isolation are suggested only in case of temporary connection of 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 reflexion. The bus terminating resistors on AVy series devices are connected via jumpers S5 and S6. 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 (S5 and S6 mounted). In all other cases (within the line) jumpers S5 and S6 must not be mounted.

NOTE! With S40 and S41 mounted the drive supply the serial line. This modality is allowed on point-to-point connection without galvanic isolation only.

A connection point to point can be done using “PCI-485” option interface (S40 and S41 mounted).

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! See the manual “SLINK3 Communication protocol” for more detail.

5.4.2. RS 485 Serial Interface Connector Description

Table 5.4.2.1: Assignment of the plug 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	Internal use	–	–
PIN 9	+5 V	–	Power supply

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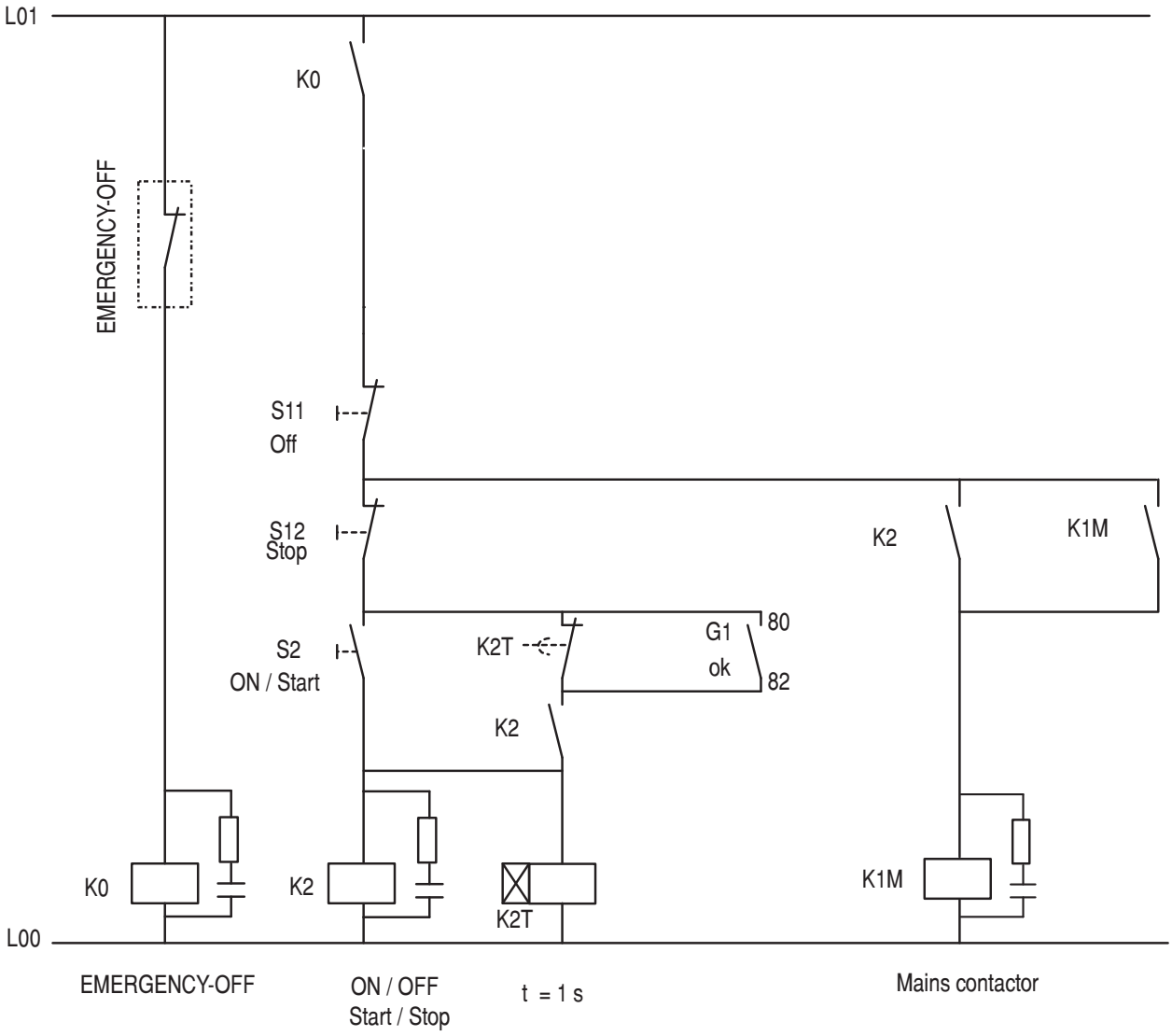
I = Input O = Output

5.5. STANDARD CONNECTION DIAGRAM

5.5.1. AVy Connections

Figure 5.5.1.1:Control sequencing



Note: OK relay must be configured as “Drive healty” for this circuit (Factory configuration)

NOTE: The connection diagram reported in the picture 5.5.1.1 (Control sequencing) is valid only when the configuration of the sequency alarm **Enable seq err** is set as **Ignore**.

Figure 5.5.1.2: Typical connection

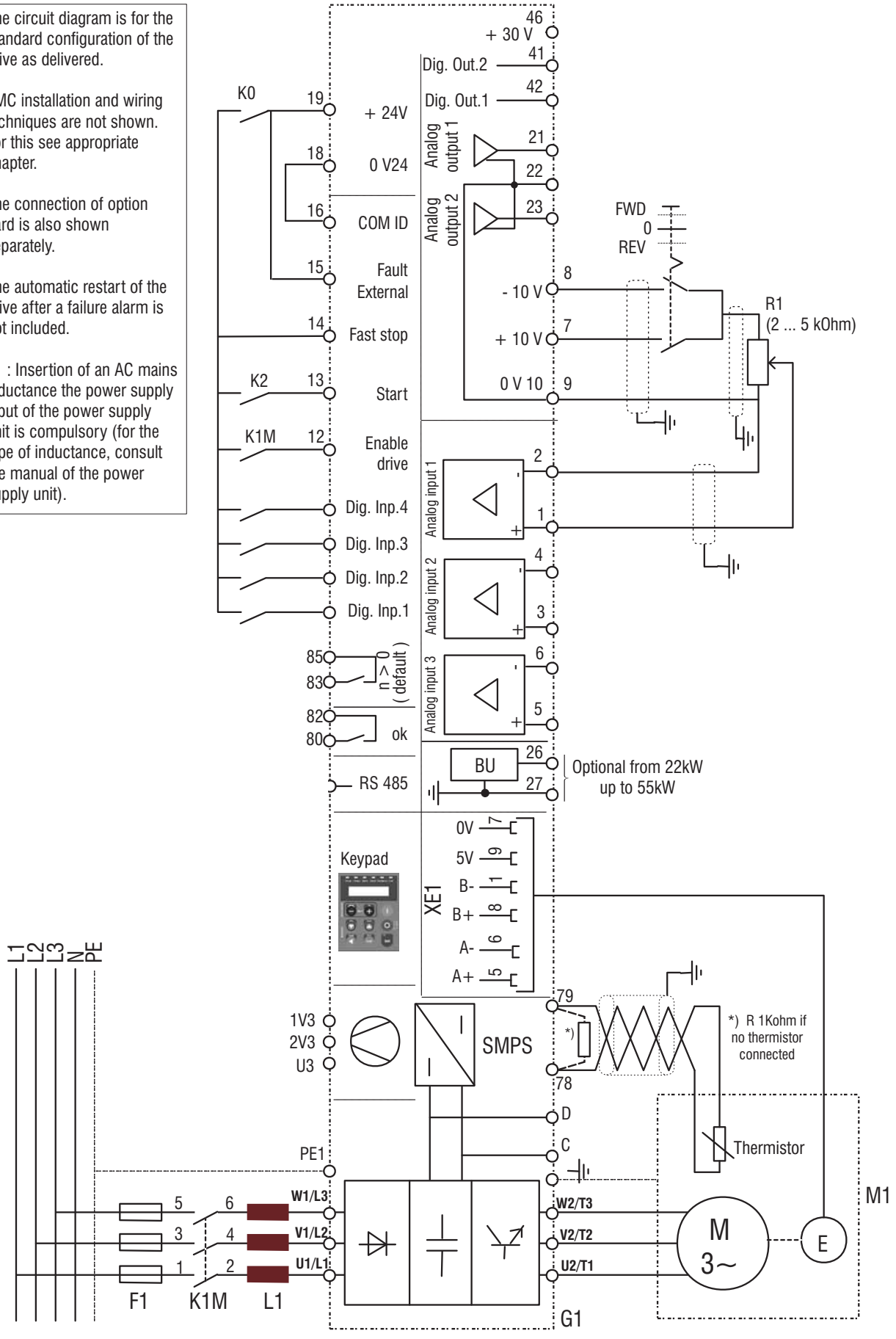
The circuit diagram is for the standard configuration of the drive as delivered.

EMC installation and wiring techniques are not shown. For this see appropriate chapter.

The connection of option card is also shown separately.

The automatic restart of the drive after a failure alarm is not included.

L1 : Insertion of an AC mains inductance the power supply input of the power supply unit is compulsory (for the type of inductance, consult the manual of the power supply unit).



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

Features and Limits:

1 The inverters used have to be all the same size.

2 AC line chokes (see chapter 5.7.1) have to be the same (provided by the same supplier).

3 The mains power supply has to be simultaneous for all inverters, i.e. a single switch /line contactor has to be used.

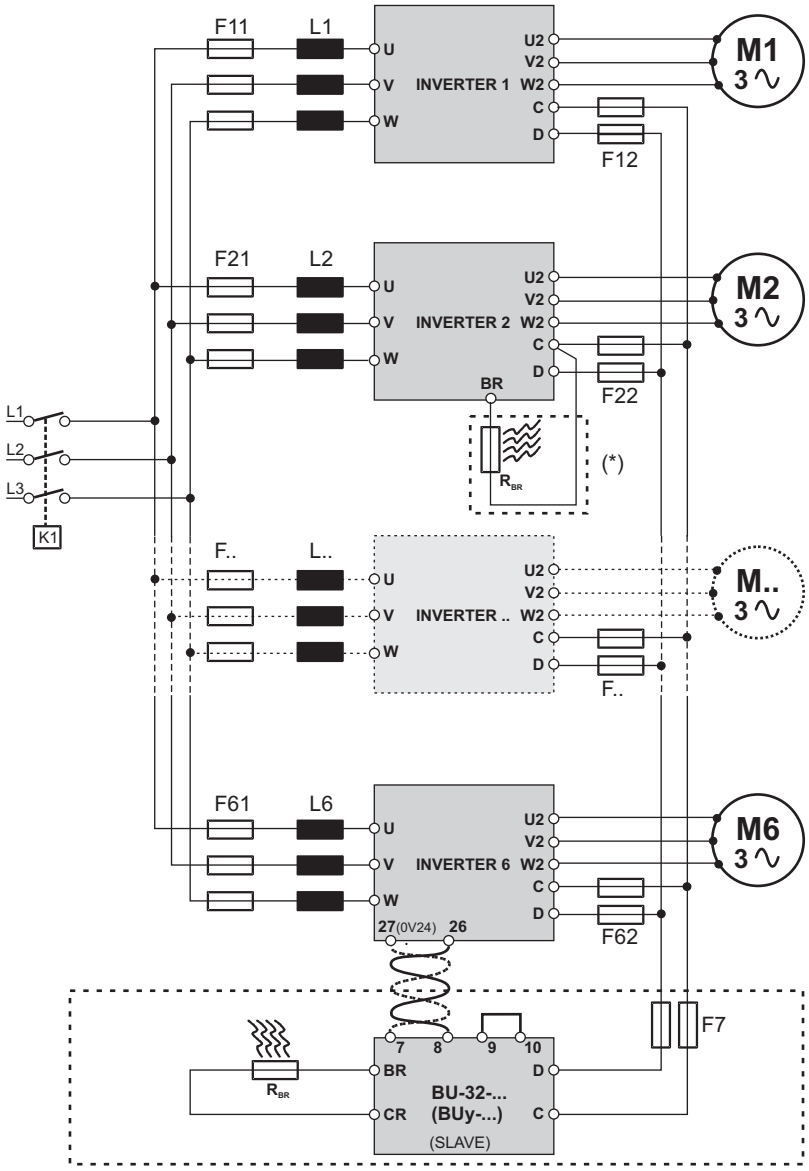
4 Such connection is suitable for a maximum of 6 inverters.

5 If necessary dissipate braking energy; a single internal braking unit (with external resistor) has to be used or one (or several) external braking unit ("BU32-.., BUy-...") configured with the inverter or a BU as master (all the other connected BUs are configured as slaves).

6 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).

(*) ATTENTION ! Do not connect if external braking unit are used.

Figure 5.5.2.1: Parallel Connection on the AC and DC Side of Several Inverters



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

F1 - Fuses type								
Drive type	**Connections without three-phase reactor on AC input**				**Connections with three-phase reactor on AC input**			
	DC link capacitors life time [h]	**Europe**	**USA**		**DC link capacitors life time [h]**	**Europe**	**USA**	
1007	25000	GRD2/10 or Z14GR10	A70P10	FWP10	50000	GRD2/10 or Z14GR10	A70P10	FWP10
1015					50000			
1022	25000	GRD2/16 or Z14GR16	A70P20	FWP20	50000	GRD2/10 or Z14GR10	A70P10	FWP10
1030	10000				50000	GRD2/16 or Z14GR16	A70P20	FWP20
2040	25000	GRD2/20 or Z14GR20	A70P20	FWP20	50000			
2055	25000	GRD2/25 or Z14GR25	A70P25	FWP25	50000	GRD2/20 or Z14GR20	A70P20	FWP20
2075	10000	GRD3/35 or Z22GR40	A70P35	FWP35	50000	GRD2/25 or Z14GR25	A70P25	FWP25
3110	25000	GRD3/50 or Z22GR40	A70P40	FWP40	50000	GRD3/50 or Z22GR40	A70P35	FWP35
3150	10000	GRD3/50 or Z22GR50	A70P40	FWP50	50000	GRD3/50 or Z22GR50	A70P40	FWP40
4185	15000	For these types an external reactor is mandatory if the AC input impedence is equal or less than 1%			30000	GRD3/50 or Z22GR50	A70P50	FWP50
4220	10000				25000			
4300	10000				25000	S00C+/üf1/80/100A/660V or Z22gR80	A70P80	FWP80
4370	10000				25000	S00C+/üf1/80/100A/660V or M00üf01/100A/660V	A70P100	FWP100
5450	10000				25000	S00C+/üf1/80/160A/660V or M00üf01/160A/660V	A70P175	FWP175
5550	10000				25000			
6750	10000				25000	S1üf1/110/250A/660V or M1üf1/250A/660V	A70P300	FWP300
7900	10000				25000			
71100	10000				25000	S2üf1/110/400A/660V or M2üf1/400A/660V	A70P400	FWP400
71320	10000				25000			
81600	10000				25000			
82000	10000				25000	S2üf1/110/500A/660V or M2üf1/500A/660V	A70P500	FWP500

avy4120

Fuse manufacturers:

Type GRD2... (E27), GRD3... (E33), M... (blade fuses), Z14... 14 x 51 mm, Z22... 22 x 58 mm, S....	Jean Müller, Eltville
A70P...	Gould Shawmut
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	Fuses type		
	Europe	USA	
1007	Z14GR6	A70P10	FWP10A14F
1015	Z14GR10	A70P10	FWP10A14F
1022			
1030	Z14GR16	A70P20-1	FWP20A14F
2040			
2055	Z14GR20	A70P20-1	FWP20A14F
2075	Z14GR32	A70P30-1	FWP30A14F
3110	Z14GR40	A70P40-4	FWP40B
3150	Z22GR63	A70P60-4	FWP60B
4185	S00C+/üf1//80/80A/660V	A70P80	FWP80
4220	S00C+/üf1//80/80A/660V	A70P80	FWP80
4300	S00C+/üf1//80/100A/660V	A70P100	FWP100
4370	S00C+/üf1//80/125A/660V	A70P150	FWP150
5450	S00C+/üf1/80/160A/660V	A70P175	FWP175
5550	S00üF1/80/200A/660V	A70P200	FWP200
6750	S1üF1/110/250A/660V	A70P250	FWP250
7900	S1üF1/110/315A/660V	A70P350	FWP350
71100	S2üF1/110/400A/660V	A70P400	FWP400
71320	S1üF1/110/500A/660V	A70P500	FWP500
81600	S1üF1/110/500A/660V	A70P500	FWP500
82000	S1üF1/110/600A/660V	A70P600	FWP600

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Fuse manufacturers:	Type Z14..., Z22, S00 ..., S1..., S2...	Jean Müller, Eltville
	A70P...	Gould Shawmut
	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:
4185 to 82000	F1	+24V	2A fast 5 x 20 mm (Bussmann: SF523220 or Schurter: FSF0034.1519 or Littlefuse: 217002)	Power card PV33-4-"D" and higher
				Power card PV33-5-"B" and higher
1007 to 82000	F1	+24V	Resettable fuse	Regulation card RV33-1C and higher
6750 to 71320	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)

avy4145

5.7. CHOKES / FILTERS

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

In the case of DC power supply, from size AVy4185 insertion of an AC mains inductance on the power supply input of the power supply unit is compulsory (for the type of inductance, consult the manual of the power supply unit), see figure 5.5.1.2.

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

5.7.1. AC Input Chokes

Table 5.7.1.1:3-Phase AC Input Chokes

Inverter type	Three-phase choke type
1007	LR3y-1007
1015	LR3y-1015
1022	LR3y-1022
1030	LR3y-1030
2040	LR3y-2040
2055	LR3y-2055
2075	LR3y-2075
3110	LR3y-3110
3150	LR3y-3150
4185	LR3-022
4220	LR3-022
4300	LR3-030
4370	LR3-037
5450	LR3-055
5550	
6750	LR3-090
7900	
71100	LR3-160
71320	
81600	
82000	LR3-200

Avy4135

For all the sizes the 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 mains harmonic distortion
- reduce the problems due to a low impedence AC mains (≤ 1%).

NOTE! The current rating of these inductances (reactors) is based on nominal current of standard motors, listed in table 3.3.3.1 in section 3.4.4, “AC Output”.

5.7.2. Output Chokes

The AVy 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.

Follow example of reference regulation:

Low voltage general purpose standard motors

VDE 0530:	max peak voltage	1kV
	max. dV/dt	500 V/us
NEMA MG1 part 30:	max. peak voltage	1 kV
	min. rise time	2 us

Low voltage motors for use on inverters

NEMA MG1 part 31:	max. peak voltage	1.6 kV
	min. rise time	0.1 us.

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 2075 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

Inverter type	Three-phase choke type
1007	LU3-003
1015	
1022	
1030	
2040	LU3-005
2055	
2075	LU3-011
3110	
3150	LU3-015
4185	LU3-022
4220	LU3-022
4300	LU3-030
4370	LU3-037
5450	LU3-055
5550	
6750	LU3-090
7900	
71100	LU3-160
71320	
81600	
82000	LU3-200

Avy4150

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

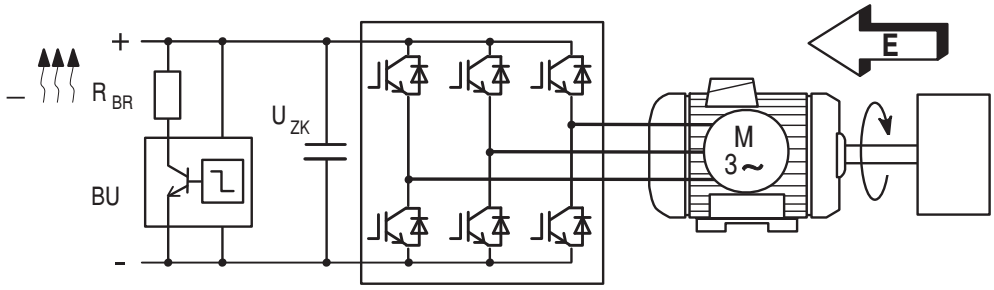
The inverters of AVy series must be equipped with an external EMI filter in order to reduce the radiofrequency emissions on the mains line. The filter selection is depending on the drive size and the installation environment. For this purpose see the "EMC Guidelines" instruction book.

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 drives.

5.8. BRAKING UNITS

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 4185 have, as standard configuration, an internal braking unit.

Drive sizes 4220 up to 5550 can have an optional internal braking unit (see section 3.1.2 “Inverter type designation”) factory mounted. All the standard AVy... drive can be equipped with an external braking unit (BU-32...) connected to the terminals C and D.

NOTE! When the internal braking unit is present, or when 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.

For braking resistor connection (terminals BR1 and C) a twisted cable has to be used. In case the braking resistor is supplied with thermal protection (klixon), it may be connected to the "External fault" drive input.

WARNING! The braking resistors can be subject to unforeseen overloads due to possible failures. The resistors have to be protected using thermal protection devices.

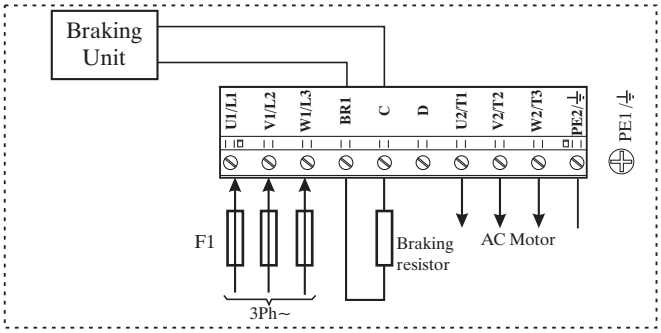
Such devices do not have to interrupt the circuit where the resistor is inserted but their auxiliary contact must interrupt the power supply of the drive power section.

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.

5.8.1. Internal braking unit

The Internal Braking Unit is included as standard (up to size 4185). The braking resistor is optional and has always to be mounted externally. For parameter setting refer to the optional “AVy-Function description and parameters” instruction manual (available on CD), section **2.15.9 Braking unit.** The figure below shows the configuration for internal brake unit operation.

Figure 5.8.1.1: Connection with internal Braking Unit and external braking resistor



5.8.2 External braking resistor

Recommended resistors for use with internal braking unit:

Table 5.8.2.1: Lists and technical data of the external standard resistors for inverters AVy1007 to 5550

Inverter Type	Resistor Type	P_{NBR} [kW]	R_{BR} [Ohm]	E_{BR} [kJ] (1)	E_{BR} [kJ] (2)
1007	RF 220 T 100R	0.22	100	1.5	11
1015					
1022	RF 300 DT 100R	0.3	100	2.5	19
1030					
2040	RFPD 750 DT 100R	0.75	100	7.5	38
2055	RFPD 750 DT 68R	0.75	68	7.5	38
2075	RFPD 900 DT 68R	0.9	68	9	48
3110	RFPD 1100 DT 40R	1.1	40	11	58
3150	RFPR 1900 D 28R	1.9	28	19	75
4185	BR T4K0-15R4	4	15.4	40	150
4220					
4300	BR T4K0-11R6	4	11.6	40	150
4370					
5450	BR T8K0-6R2	8	7.7	80	220
5550					

(1): Max overload energy, 1"- duty 10%.
(2): Max overload energy, 30"- duty 25%.

avy4190

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)

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

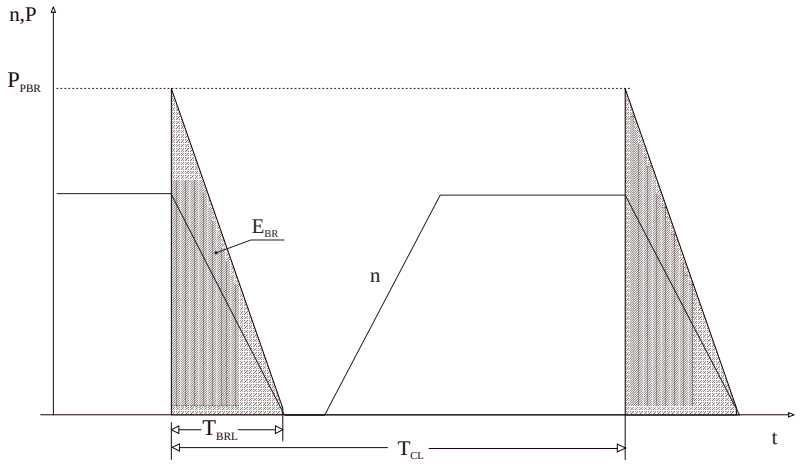


Figure 5.8.2.2: Limit operating braking cycle with typical triangular power profile

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

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

The **BU overload** alarm occurs if the duty cycle exceeds the maximum data allowed in order to prevent possible damages to the resistor.

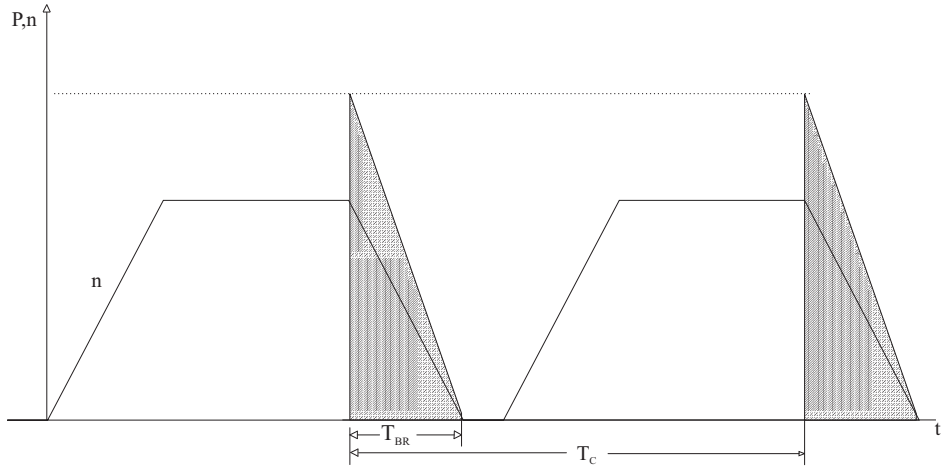
Resistor model: Standard resistor data

Example code: MRI/T900 68R
MRI = 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 $\mathbf{T_{BR}}$ / $\mathbf{T_C}$ = 20%

Where: $\mathbf{T_{BR}}$ = Braking time
$\mathbf{T_C}$ = Cycle time

Figure 5.8.2.2: 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 5.8.2.1, 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: $\mathbf{V_{BR}}$ = braking unit threshold (see table 5.8.2.2)

With reference to the figure 5.8.2.4, where the power profile is the typical triangular one, the following example can be taken into consideration (see also table 5.8.2.1).

Resistor model: MRI/T600 100R

Nominal power $\mathbf{P_{NBR}}$ = 600 [W]
Maximum energy $\mathbf{E_{BR}}$ = 22 [kJ]
Inverter mains supply = 460V
From table 5.8.2.2: $\mathbf{V_{BR}}$=780V

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

It is necessary to consider the following relation:

A) If $\mathbf{T_{BR} \leq E_{BR} / P_{PBR}}$ verify:

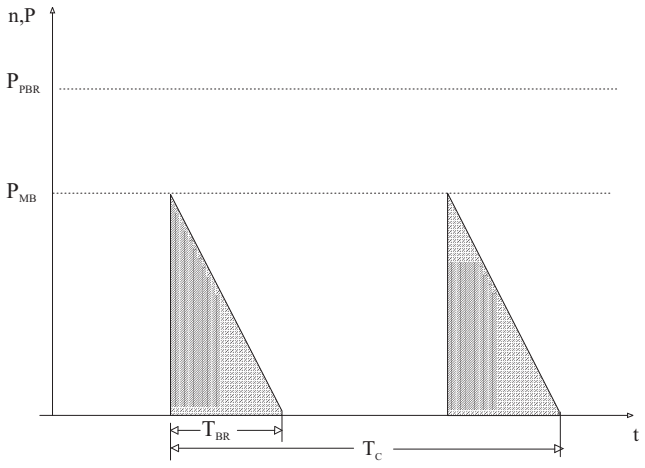
1) $\mathbf{P_{MB} \leq 2 . E_{BR} / T_{BR}}$ Where: $\mathbf{P_{MB}}$ is the average power of the cycle (see.fig. 5.8.2.3)

2) $$\frac{P_{MB} \cdot T_{BR}}{2\ T_C} \leq P_{NBR}$$

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

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

Figure 5.8.2.3: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 5.8.2.3),

In order to protect these resistors from dangerous overload, the parameters **BU ovld time** and **BU duty cycle** (menu FUNCTIONS\Brake unit) manage maximum time and duty cycle at which the resistors can tollerate their peak power $\mathbf{P_{PBR}}$.

The data must be related to the AC mains for which they are specified defined by the parameter

BU DC vlt (menu FUNCTIONS\Brake unit).

The default parameters are calculated for a braking threshold that correspond to a Mains voltage = 400V.

The use of different braking resistors from those indicated on table 5.8.2.1, requires to take into consideration the meaning of following formulas:

BU ovld time [s] = E_{BR} / P_{PBR} (time of braking at limit condition for cycle with triangular profile)

BU duty cycle % = $(P_{NBR} / P_{PBR}) \times 100$

Table 5.8.2.2: Braking thresholds for different Mains

Mains voltage	Braking threshold V_{BR} [V]
230Vac	400
400Vac	680
460Vac / 480 Vac	780

avy4200

The result of these calculations must be assigned to the corresponding parameters in menu FUNCTIONS\Brake unit. When the duty cycle exceeds the data entered, the alarm **BU overload** automatically occurs in order to prevent possible damages to the resistor.

The following table can be used to choose an external resistor, different from the standard series.

Table 5.8.2.3: Technical data of the internal braking units

Inverter type	I_{RMS} [A]	I_{PK} [A]	T [s]	Minimum R_{BR} [ohm]
1007	4.1	7.8	19	100
1015				
1022				
1030				
2040				
2055	6.6	12	16	67
2075				
3110	12	22	17	36
3150	17	31	16	26
4185	18	52	42	15
4220				
4300	37	78	23	10
4370	29		37	
5450	50	104	22	7.5
5550				
6750	External braking unit (optional)			
7900				
71100				
71320				
81600				
82000				

avy4210

I_{RMS} : Nominal current of the braking unit

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

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

Generally the following condition must be satisfed $I_{RMS} \geq \sqrt{\frac{1}{2} \frac{P_{PBR}}{R_{BR}} \frac{T_{BR}}{T_C}}$

Each drive is provided of the terminals 26 and 27 which allows control of one or more external braking units, parallel connected. The drive will act as Master and the external braking units BU32 must be configured as Slave.

In this way it will be possible to utilize the internal I^2x t protection also using external BU (see "AVy-Function description and parameters" instruction manual (available on CD), section 2.15.9 **Braking unit**).

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

5.8.3. Calculation of generic external braking resistor to be combined with the internal braking unit with an approximate method

In order to calculate resistor values different from the one stated in the table 5.8.2.1 (having, for example, different values of turn-on threshold of the braking unit), the following remarks are valid:

the peak power dissipated by the resistor is $\mathbf{P_{PBR} = V_{BR}^2 / R_{BR}\ [W]}$, where "$\mathbf{V_{BR}}$" is the turn on voltage of the braking unit (see table 5.8.2.2).

The requested maximum power $\mathbf{P_{MB}}$ by the cycle must not be higher than this value: $\mathbf{P_{MB} \leq P_{PBR}}$.

The braking resistor is normally used with an intermittent cycle. Therefore it is possible to use a resistor capable of a continuous dissipated power lower than $\mathbf{P_{MB}}$.

The following diagram is valid for rectangular load profile, it can be used in order to determine the overload value. For triangular load profile, this diagram gives a safety conservative dimensioning (similar diagrams can be provided by the manufacturer of the resistor to be used).

In order to calculate the value of the continuous power (or rated power) of the braking resistor , the overload factor should be determined using the diagram, then the following formula must be applied:

$$\text{Nominal Power } P_{MBR} = \frac{P_{MB}}{\text{Overload factor}}$$

fA003

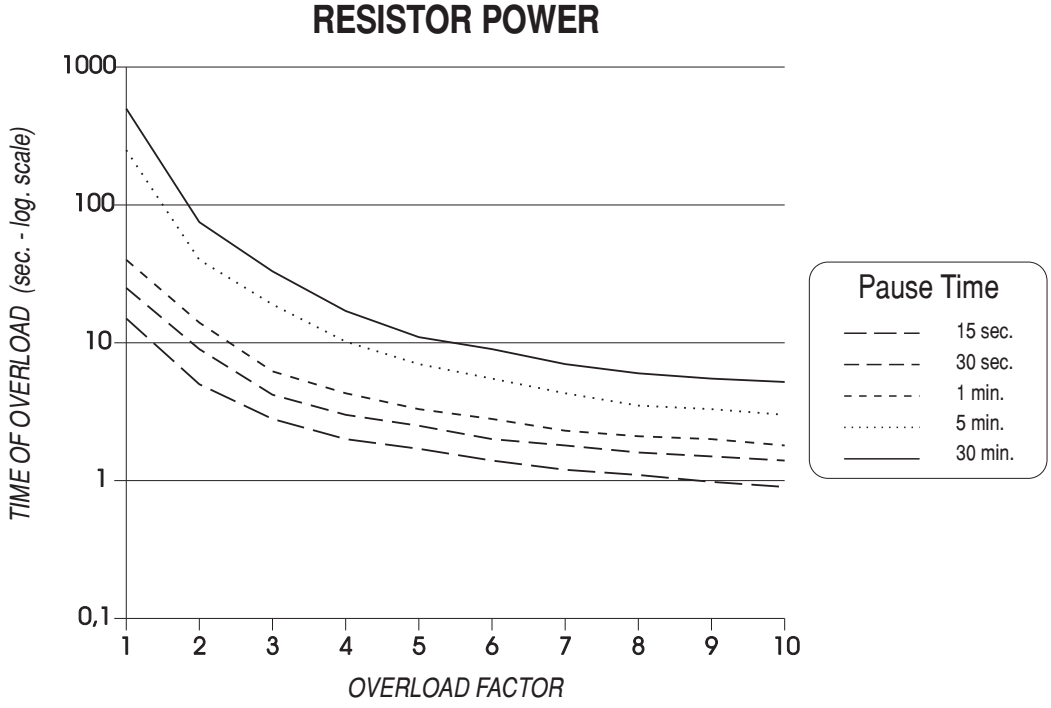


Figure 5.8.3.1: Power Resistor Overload Factor

Example: In order to stop a 18.5 kW motor (38A at 400V) with a 150% overload, the max. regenerated power is 27.75 kW. Assuming a 5-second braking time (overload time for resistance) and 1-minute pause, the diagram gives a 3.9 overload factor.

Therefore, the resistor rated power will be:

$$P_{NBR} = \frac{27750}{3.9} \cong 7100 \text{ W}$$

fA004

As for types bigger than 5550 or for particular braking cycles, it is recommended to use one or more BU-32 external braking units.

5.9. BUFFERING THE REGULATOR SUPPLY

The power supply of the control section is provided by a switched mode power supply unit (SMPS) from the DC Link circuit. The Drive is disabled as soon as the voltage of the DC Link circuit is below the threshold value (U_{Buff}). The regulator supply is buffered by the energy of the DC Link circuit until the limit value (U_{min}) is reached. The buffer time is determined by the capacitance of the DC Link capacitors. The minimum values are shown in the table below. The buffer time (t_{Buff}) can be extended (only from 11 kW drive and higher) by connecting external capacitors in parallel (on terminal C and D).

Table 5.9.1: DC Link Buffer Time

Inverter type	Internal capacitance C_{std} [μF]	Buffer time t_{Buff} (minimum value) with the internal capacitance at : AC Input voltage =400V [s]	AC Input voltage =460V [s]	Maximum permissible external capacitance C_{ext} [μF]	Maximum power required by switched mode power supply P_{SMPS} [W]
1007	220	0.165	0.25	0	65
1015	220	0.165	0.25	0	65
1022	330	0.24	0.37	0	65
1030	330	0.24	0.37	0	65
2040	830	0.62	0.95	0	65
2055	830	0.62	0.95	0	65
2075	830	0.62	0.95	0	65
3110	1500	1.12	1.72	1500	65
3150	1500	1.12	1.72	1500	65
4185	1800	1.54	2.3	4500	70
4220					
4300	2200	1.88	2.8	4500	70
4370	3300	2.83	4.2	4500	70
5450	4950	4.24	6.3	4500	70
5550	4950	4.24	6.3	4500	70
6750	6600	5.6	8.1	0	70
7900	6600	5.6	8.1	0	70
71100	9900	8.4	12.1	0	70
71320	14100	12.8	17.2	0	70
81600	14100	12.8	17.2	0	70
82000					

avy4220

SMPS = Switched Mode Power Supply

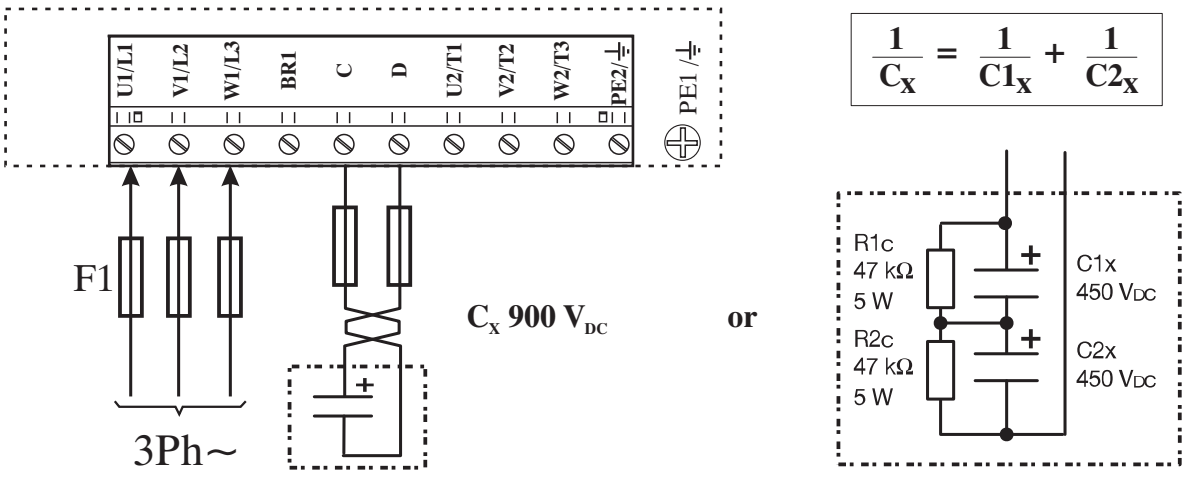


Figure 5.9.1: Buffering the Regulator Supply by Means of Additional Intermediate Circuit Capacitors

NOTE! When connecting the intermediate circuit terminals C and D the AC Input side **must** be protected with superfast semiconductor fuses!

Formula for calculating the size of the external capacitors:

$$C_{ext} = \frac{2 \bullet P_{SMPS} \bullet t_{Buff} \bullet 10^{6}}{U^2_{Buff} - U^2_{min}} - C_{std}$$

fA018

C_{ext}, C_{std}	[µF]	
P_{SMPS}	[W]	U_{Buff} = 400 V at U_{LN} = 400 V
t_{Buff}	[s]	U_{Buff} = 460 V at U_{LN} = 460 V
U_{Buff}, U_{min}	[V]	U_{min} = 250 V

Calculation example

An AVy4220 Drive is operated with an AC Input supply U_{LN} = 400 V. A voltage failure buffer is required for max. 1.5 s.

P_{SMPS}	70 W	t_{Buff}	1.5 s
U_{Buff}	400 V	U_{min}	250 V
C_{std}	1800 µF		

$$C_{ext} = \frac{2 \,.\, 70\ W \,.\, 1.5\ s \ .\ 10^{6} \mu F / F}{(400\ V)^{2} - (250\ V)^{2}} - 1800 \mu F = 2154 \mu F - 1800 \mu F = 354 \mu F$$

5.10. AVy POWER DIP RIDE THROUGH DATA AND RESTART SETUP

The AVy has a 3-phase full-wave rectifier feeding the DC link.

If the DC link reaches the Undervoltage threshold for its voltage input (see tables 5.10.1, 5.10.2 and 5.10.3), the AVy will disable the Drive, and generate an undervoltage alarm.

The undervoltage alarm can latch & trip the drive immediately, or be programmed to reset itself and restart. The undervoltage alarm settings define how many restarts are permitted. There is a 'restart time' parameter that sets how long the undervoltage condition can exist before the AVy gives up on the reset.

The DC link feeds the AVy power supply. If the DC link goes below 250 VDC the electronics reset as if just powered up. The capacity of the DC link between the undervoltage shutdown of the Drivesection, the 250 VDC power supply threshold, and the power draw of the AVy electronics & cooling fan determine how long the drive stays up under power dips or power loss.

The DC link can have extra capacitance added externally to the DC link to add time to keep the DC link above 250 VDC as long as possible. The following tables calculate how long the Drive can keep the power above 250 VDC for control power if the maximum amount of capacitance is added externally. Remember, adding capacitance holds in the power supply longer, but also takes longer to recharge.

The survival of an input power dip without shutting down the Drive section depends on the relative load (energy) that the DC bus has to output, and the magnitude and duration of the power dip. A power dip needs to be below the DC undervoltage threshold before the drive would even see any trip condition from it.

Without external capacitors, as an estimate, a power dip of 1 cycle (16.6ms @ 60Hz) when the motor is at full load will cause an undervoltage trip.

The undervoltage trip time can be calculated by means of the following formula:

$$t = \frac{(U_{dc}^2 - U_{Buff}^2) \cdot (C_{Std} + C_{ext})}{2P_{am} \cdot 10^6} \qquad \text{fA027}$$

where:

- t: undervoltage trip time [ms]
- U_{dc}: DC link voltage [V]
- U_{buff}: trip threshold voltage [V]
- C_{Std}: DC link capacitance [mF]
- C_{ext}: external capacitance [mF]
- P_{am}: motor power consumption [W]

P_{am} depends on the motor load conditions:

- at full load, it can be calculated as follows:

$$P_{am} = \frac{P_m}{\eta_m} \qquad \text{fA028}$$

where:

- P_m: motor rated power
- η_m: motor rated efficiency

- at no load, it depends on the iron losses, on mechanical losses, and stator joule losses. The sum of these terms is about 50% of the full load losses.

Full load losses Plfl are:

$$P_{lfl} = P_m \frac{1 - \eta_m}{\eta_m}$$ fA029

Maximum power supply drop out time (Buffer time/voltage failure buffer) of AVy is achieved by adding the maximum recommended capacitance to the DC bus.

The following table show the maximum power supply drop out time for different Undervoltage thresholds and inverter sizes. The meaning of the symbols in the colums is as follows:

C_{std} = internal capacitance (in uF),
C_{ext} max = max external total capacitance (in uF),
T_{buff} = max drop out time (in sec.),
P_{SMPS} = power supply (watts),
U_{buff} = volts threshold to disable drive operation (in volt),
U_{min} = min DC volts that will support the power supply (in volt)

Where T_{buff} is defined by:

$$T_{buff} = \frac{(C_{std +} C_{ext} \max) \cdot (U_{buff}^2 - U_{min}^2)}{2 \cdot P_{SMPS} \cdot 10^6}$$

Table 5.10.1: Drive Trip Times, 230-V Threshold

Size	P_{SMPS}	C_{std}	C_{ext} max	U_{buff}	U_{min}	T_{buff}
4185	70	1800	4500	230	200	0.58
4220						
4300	70	2200	4500	230	200	0.62
4370	70	3300	4500	230	200	0.72
5450	70	4950	4500	230	200	0.87
5550	70	4950	4500	230	200	0.87
6750	70	6600	0	230	200	0.61
7900	70	6600	0	230	200	0.61
71100	70	9900	0	230	200	0.91
71320	70	14100	0	230	200	1.3
81600	70	14100	0	230	200	1.3
82000	70	14100	0	230	200	1.3

avy4225

Table 5.10.2: Drive Trip Times, 400-V Threshold

Size	Psmps	C_{std}	C_{ext} max	U_{buff}	U_{min}	T_{buff}
1007	65	220	0	400	250	0.165
1015	65	220	0	400	250	0.165
1022	65	330	0	400	250	0.24
1030	65	330	0	400	250	0.24
2040	65	830	0	400	250	0.62
2055	65	830	0	400	250	0.62
2075	65	830	0	400	250	0.62
3110	65	1500	1500	400	250	1.12
3150	65	1500	1500	400	250	1.12
4185	70	1800	4500	400	200	1.54
4220	70	1800	4500	400	200	1.54
4300	70	2200	4500	400	200	1.88
4370	70	3300	4500	400	200	2.83
5450	70	4950	4500	400	200	4.24
5550	70	4950	4500	400	200	4.24
6750	70	6600	0	400	200	5.65
7900	70	6600	0	400	200	5.65
71100	70	9900	0	400	200	8.4
71320	70	14100	0	400	200	12.8
81600	70	14100	0	400	200	12.8
82000	70	14100	0	400	200	12.8

avy4230

Table 5.10.3: Drive Trip Time, 460-V Threshold

Size	P_{smps}	C_{std}	C_{ext} max	U_{buff}	U_{min}	T_{buff}
1007	65	220	0	460	250	0.25
1015	65	220	0	460	250	0.25
1022	65	330	0	460	250	0.37
1030	65	330	0	460	250	0.37
2040	65	830	0	460	250	0.95
2055	65	830	0	460	250	0.95
2075	65	830	0	460	250	0.95
3110	65	1500	1500	460	250	1.72
3150	65	1500	1500	460	250	1.72
4185	70	1800	4500	460	200	2.3
4220	70	1800	4500	460	200	2.3
4300	70	2200	4500	460	200	2.8
4370	70	3300	4500	460	200	4.2
5450	70	4950	4500	460	200	6.3
5550	70	4950	4500	460	200	6.3
6750	70	6600	0	460	200	8.1
7900	70	6600	0	460	200	8.1
71100	70	9900	0	460	200	12.1
71320	70	14100	0	460	200	17.2
81600	70	14100	0	460	200	17.2
82000	70	14100	0	460	200	17.2

avy4240

5.11. DISCHARGE TIME OF THE DC-LINK

Table 5.11.1: DC Link Discharge Times

Type	I_{2N}	Time (seconds)	Type	I_{2N}	Time (seconds)
1007	2.1	90	**4300**	58	60
1015	3.5		**4370**	76	90
1022	4.9	150	**5450**	90	120
1030	6.5		**5550**	110	
2040	8.3	205	**6750**	142	
2055	11		**7900**	180	
2075	15.4		**71100**	210	
3110	21.6	220	**71320**	250	
3150	28.7		**81600**	310	
4185	35,5	60	**82000**	365	120
4220	42	60			

avy4250

This is the minimum time that must be elapsed since an AVy 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.

6. MAINTENANCE

6.1. CARE

The SieiDrive - AVy inverters must be installed according to the relevant installation regulations. They do not require any particular maintenance. They should not be cleaned with a wet or moist cloth. The power supply must be switched off before cleaning.

6.2. SERVICE

The screws of all terminals on the device should be re-tightened two weeks after initial commissioning. This should be repeated each year.

If the drives have been stored for more than three years, the capacitance of the intermediate circuit capacitors may have been impaired. Before commissioning these devices, it is advisable to regenerate the capacitors by connecting them to the voltage for two hours with the inverter disabled. After these operations the device is ready to be installed without limitations.

6.3. REPAIRS

Repairs of the device should only be carried out by the specialist personnel (qualified by the manufacturer)

If you carry out a repair on your own, observe the following points:

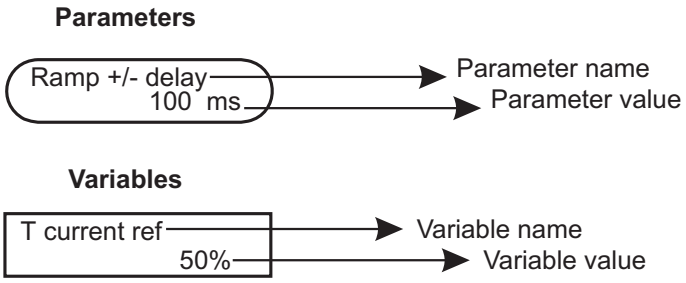
- When ordering spare parts do not only state the device type but also the device serial number (nameplate). It is also useful to state the type of the regulator card and the version of the operating system (on Firmware & Card revision level nameplate, see figure 3.1.3.2).
- When exchanging cards ensure that the positions of switches and jumpers are observed! This particularly applies to switch S3 on the regulation card.

NOTE! The manufacturer does not accept any liability for any device parts that are destroyed due to the incorrect switch position of "switch S3".

6.4. CUSTOMER SERVICE

For customer service, please contact your Gefran office.

Block diagram legend



NAVIGATION
Go To Index
Contents

Inverter Overview

BASIC CONFIGURATION

Continuos curr 2,4 A	Speed base value 1500 rpm
Mains Voltage 400V	Full load current 2,4 A
Ambient temp 40 ° C	Main commands Terminal
Regulation mode V/f Control	Control mode Local
Switching freq 8kHz	Device address 0
Npar displayed 0	SBI enable Enabled

Drive Feedbacks & Status

Ramp ref (%)	Speed ref (%)	Dc link voltage	Output voltage	Regulation temp
Ramp output (%)	Actual spd (%)	Active power	Output frequency	Heatsink temp

Drive ready	Ramp +	Encoder 1 state	Motor current	Overload 200%
Speed limited	Ramp -	Encoder 2 state	Torque	Ovld Available
Curr limit state	Spd threshold	Spd zero thr		

Input / Output Mapping — HWIO

ALARM mapping — Alarm_mp

FUNCTIONS — Funct

Speed Reference Select / Ramp

Start & Stop Management
STSP_pro

Ramp ref (d)

Ramp

Ramp output (d)

Ovr_RfSel

Speed / Torque regulator

Speed ref (d)

Actual spd (d)

Speed Regulator — Sreg

T current ref

Torque curr Reg — Tcurr_reg

Speed Feedback — Spd_Fbk

Ovr_SpTq

Motor control

T curr (%)

Flux

Motor Control — Motctrl

Digital inputs Status

DRIVE	DRIVE	EXPANSION CARD
Dig input term 1	Enable: Dig input term 9	Dig input term 5
Dig input term 2	Start: Dig input term 10	Dig input term 6
Dig input term 3		Dig input term 7
Dig input term 4	Fast stop: Dig input term 11	Dig input term 8

SERIAL COMM

Ser answer delay 0 ms	Ser protocol sel Slink3
Ser baudrate sel 9600	MB swap float Disabled

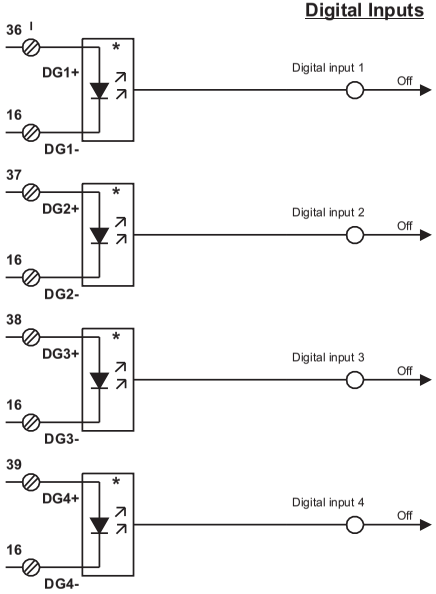
File name: AVy_Ovw.vsd

Digital Inputs/Outputs & Mapping Standard and Option cards

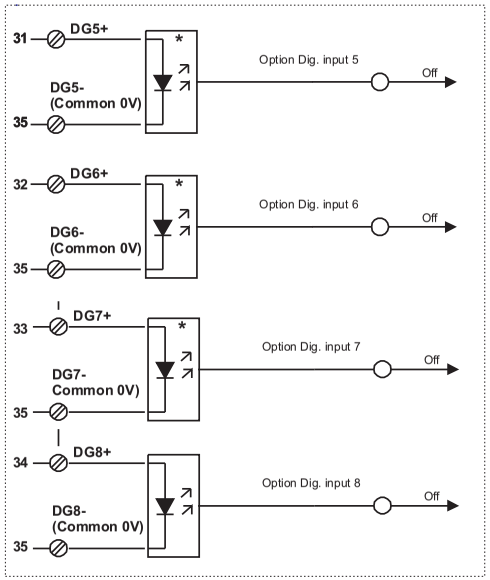
NAVIGATION

Overview: AVy_Ovw | Analog I/O: AVy_HWIOAN

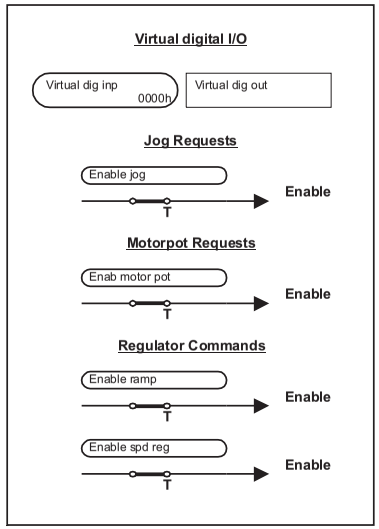
Digital Inputs



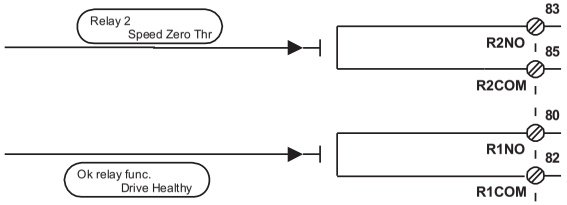
Option card



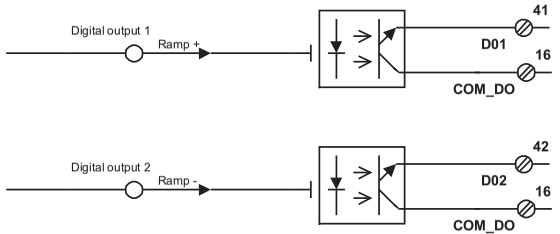
Virtual digital I/O



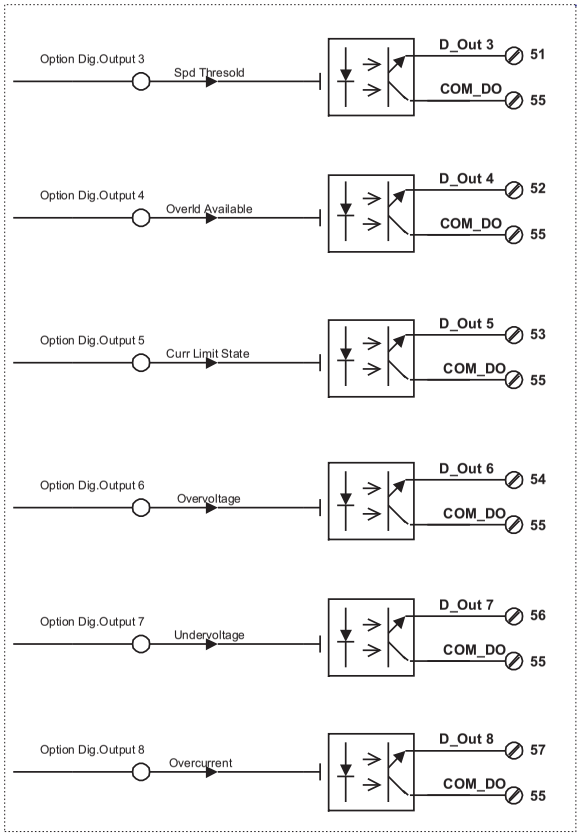
Drive Relay Output



Digital Outputs



Option card



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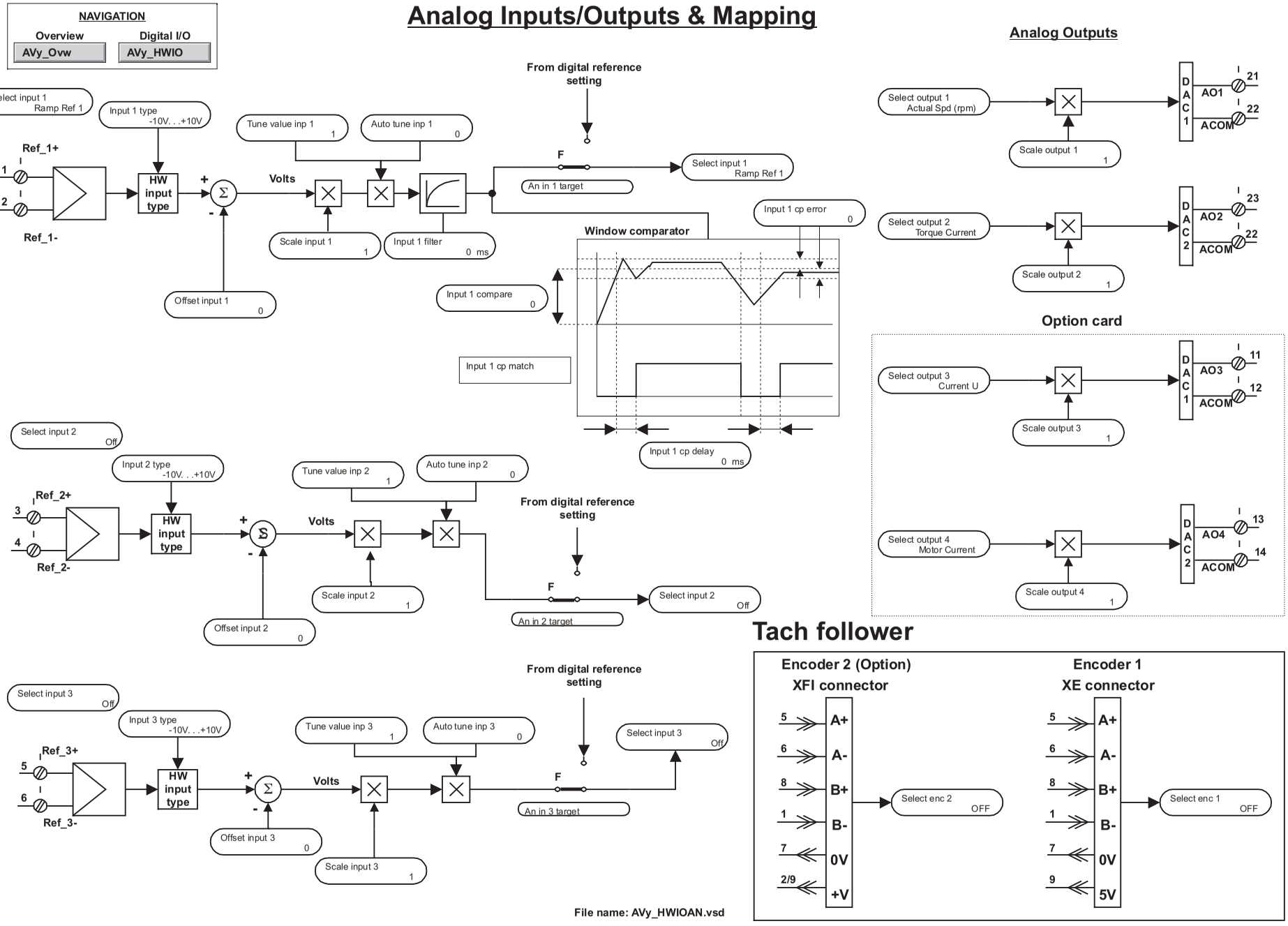
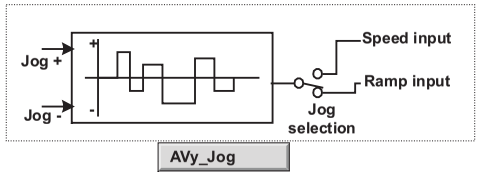
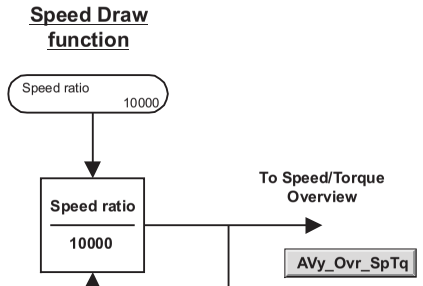
Analog Inputs/Outputs & Mapping

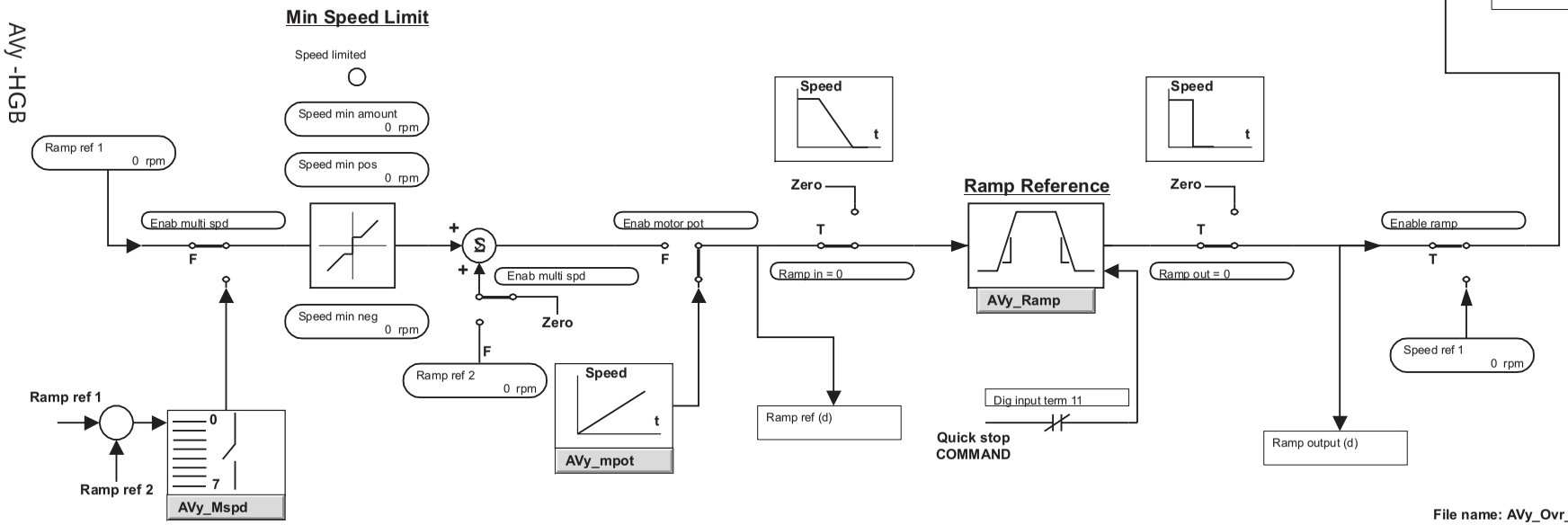


NAVIGATION
Back to Overview
AVy_Ovw

Speed Reference generation







AVy -HGB

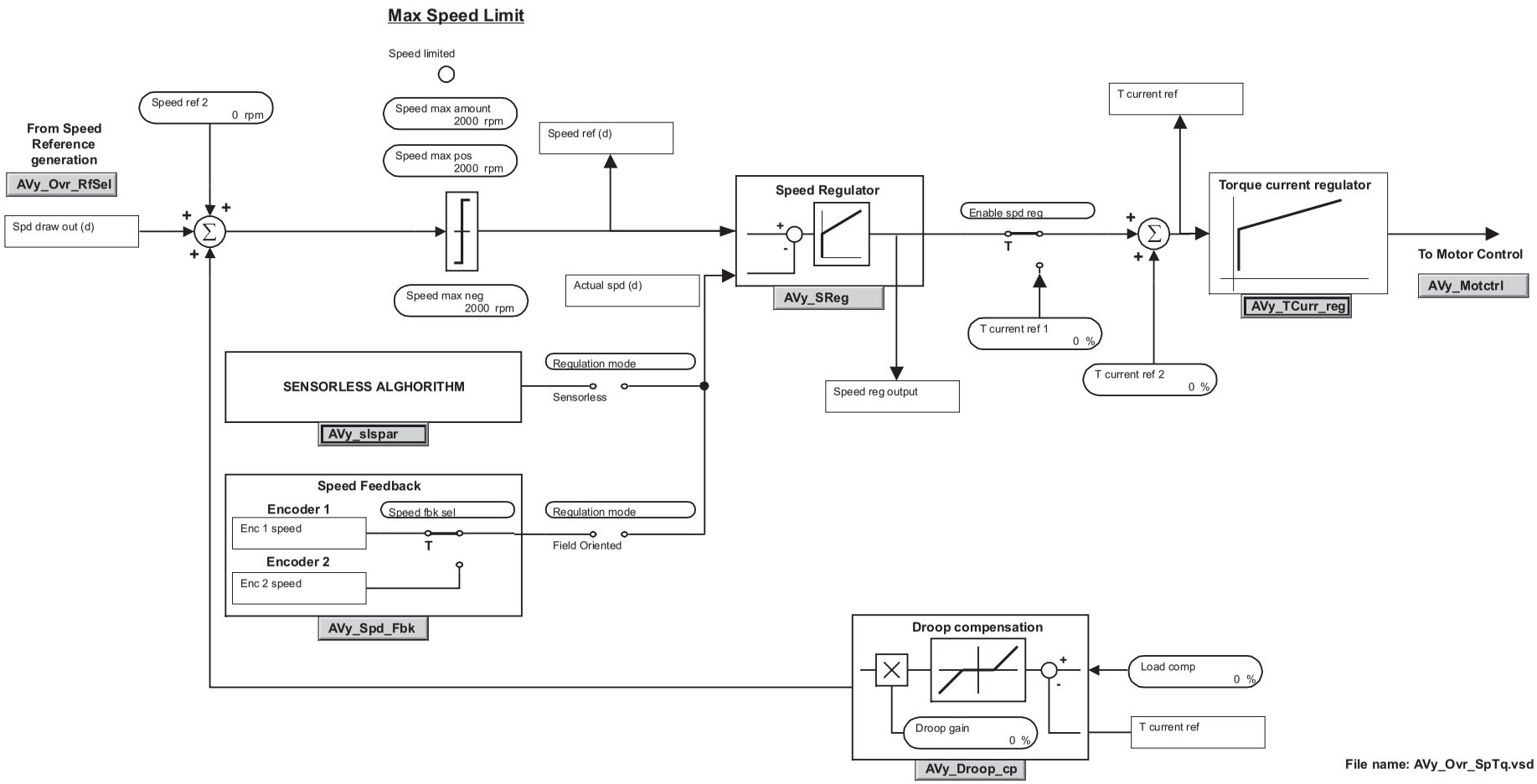
File name: AVy_Ovr_RfSel.vsd

NAVIGATION

Back to Overview

AVy_Ovw

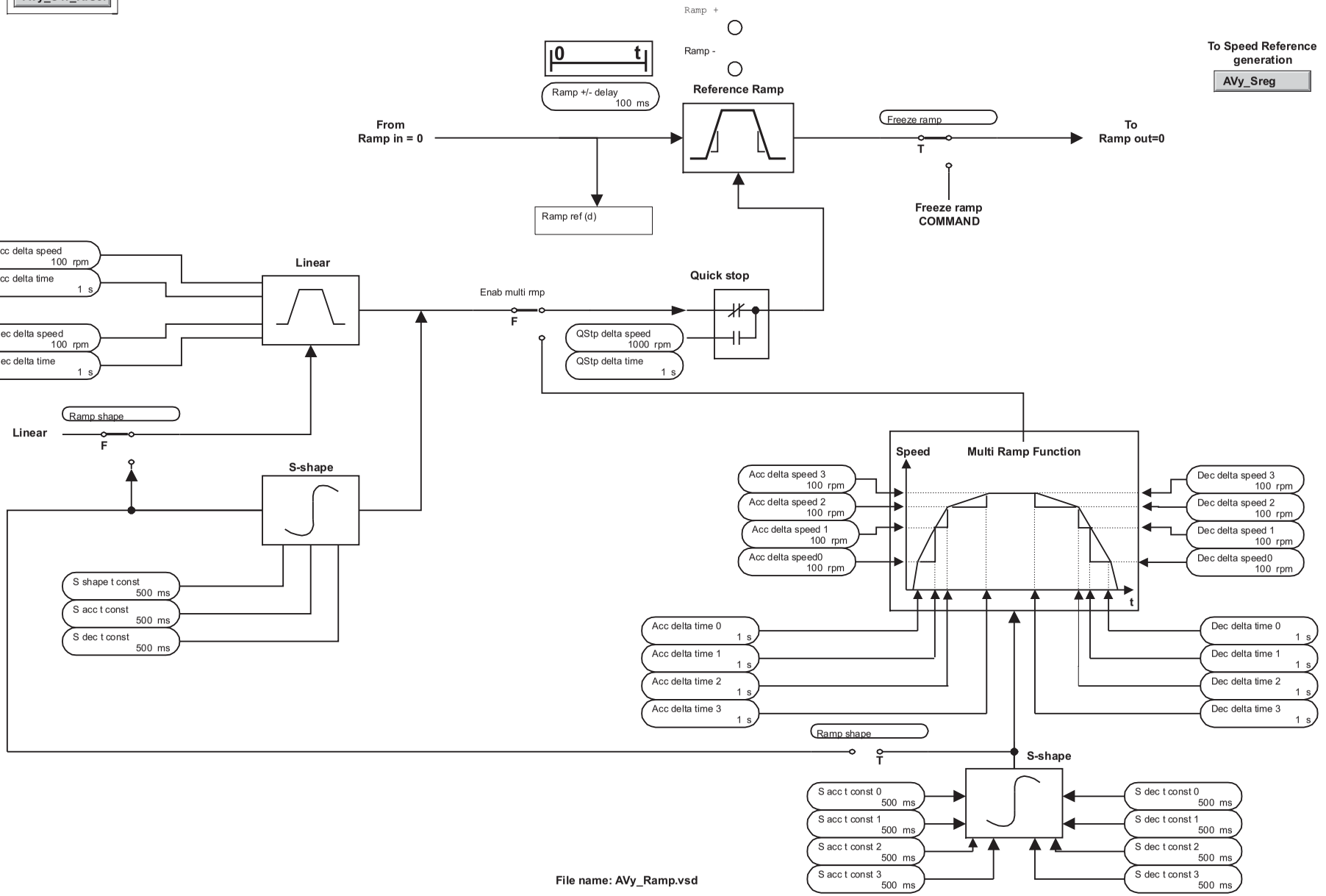
Speed / Torque regulator



File name: AVy_Ovr_SpTq.vsd

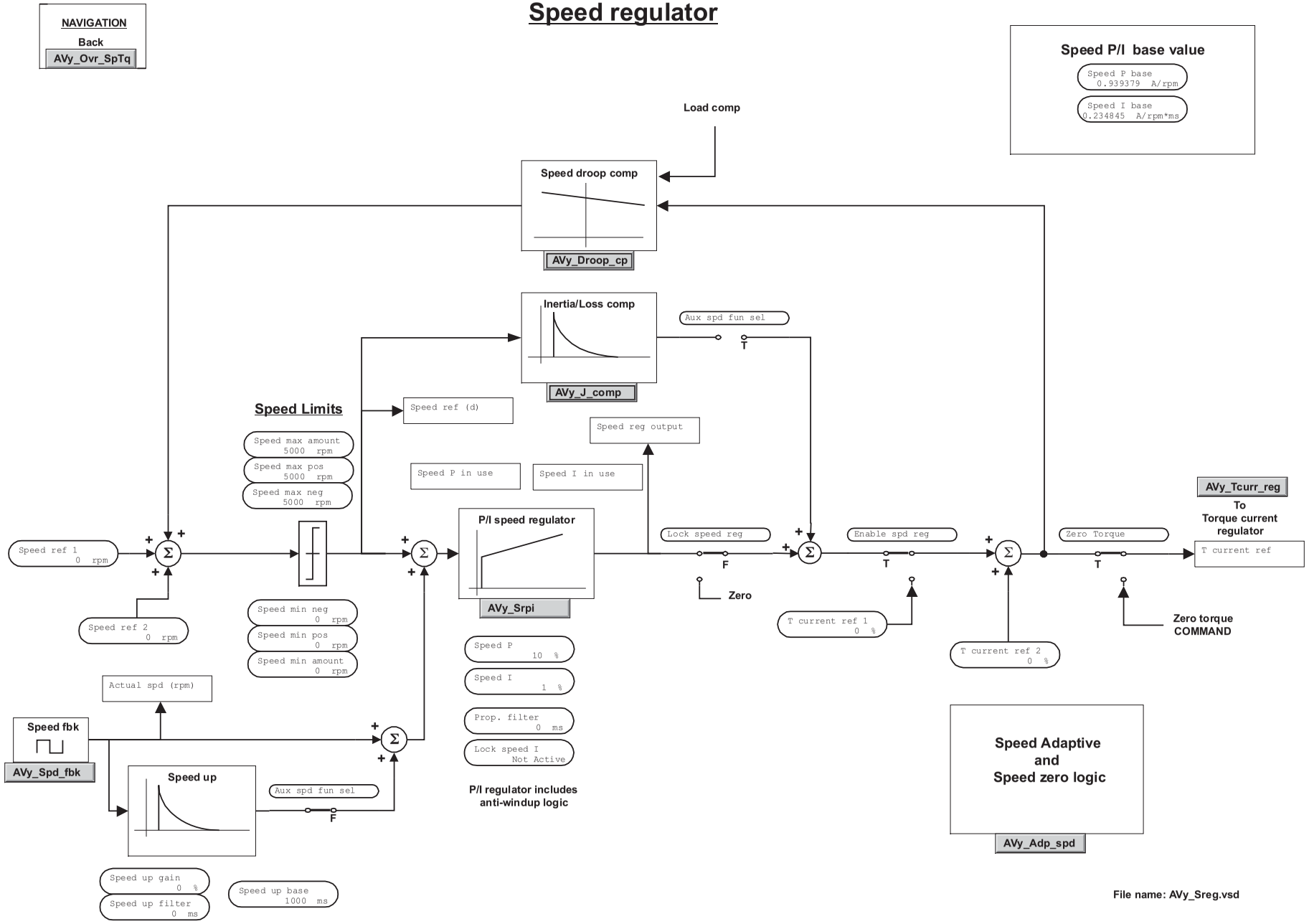
NAVIGATION
Back
AVy_Ovr_RfSel

Ramp reference Block



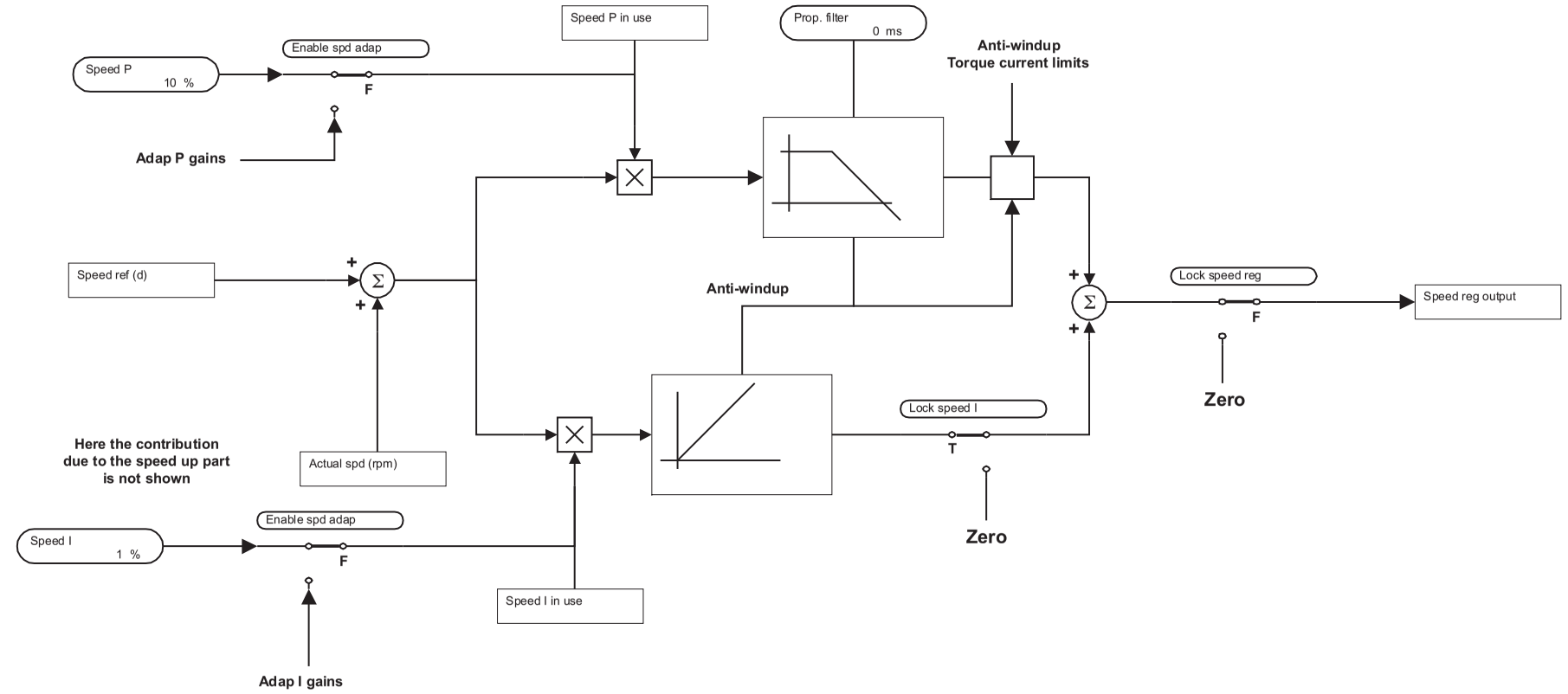
File name: AVy_Ramp.vsd

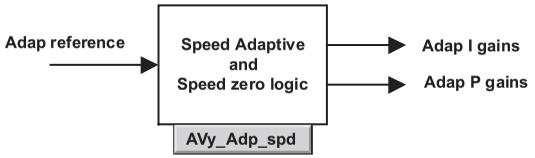
Speed regulator



NAVIGATION
Back to Overview
AVy_Sreg

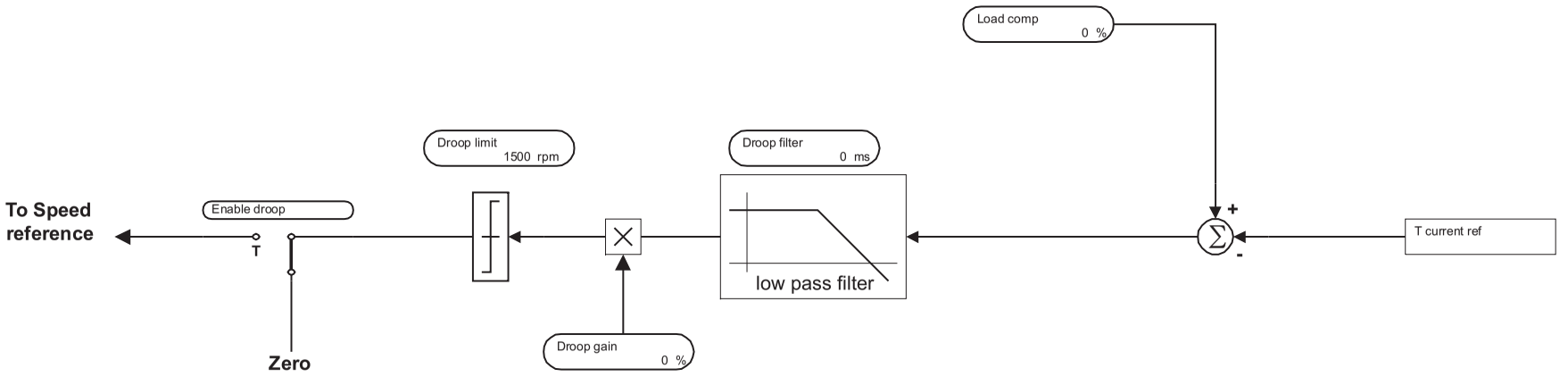
Speed regulator PI part





NAVIGATION
Back
AVy_Sreg

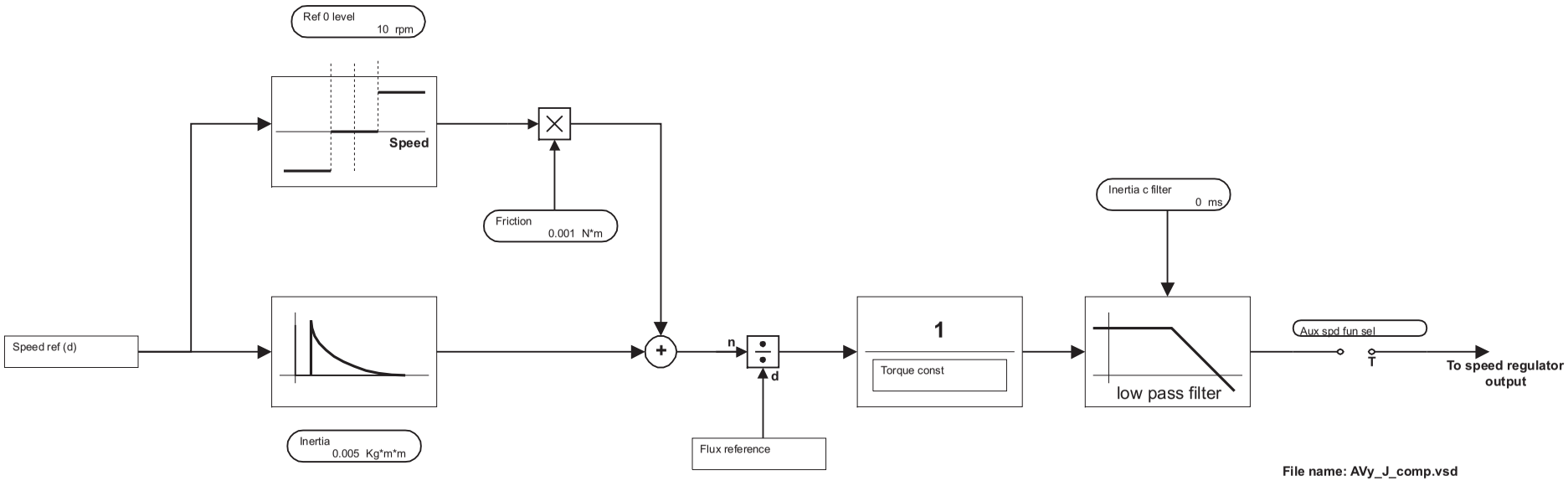
Droop compensation



File name: AVy_Droop_cp.vsd

NAVIGATION
Back
AVy_Sreg

Inertia/Loss compensation



File name: AVy_J_comp.vsd

NAVIGATION

Back to Overview

AVy_Ovr_SpTq

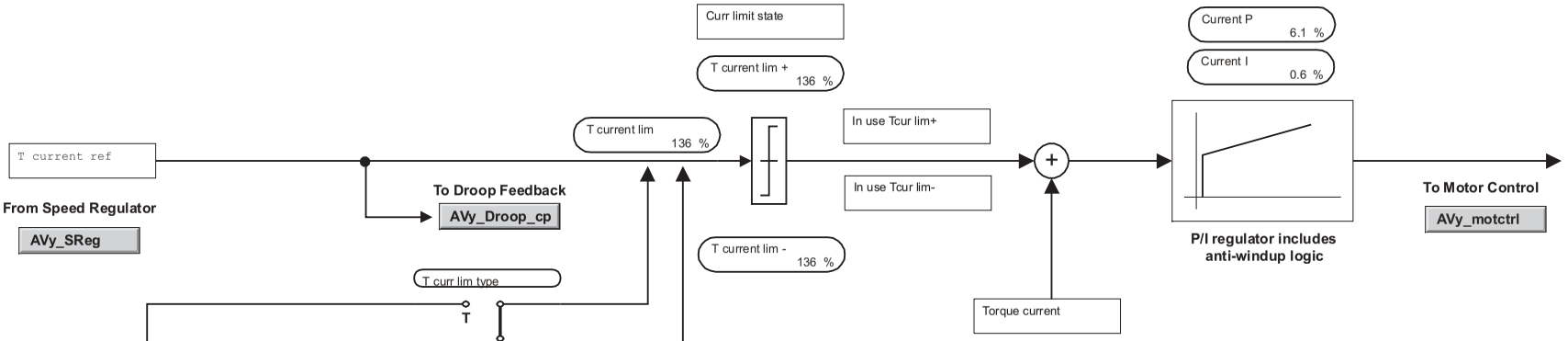
Torque current regulator

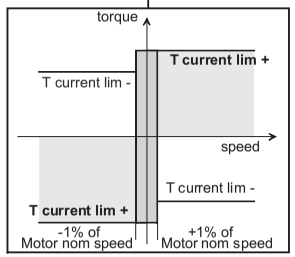
Current reg P/I base value

Current P base 475.518 V/A

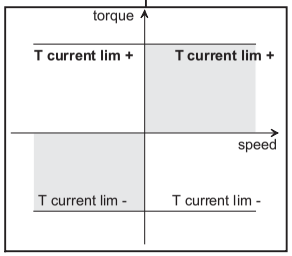
Current I base 475.518 V/A*ms

Torque current limits





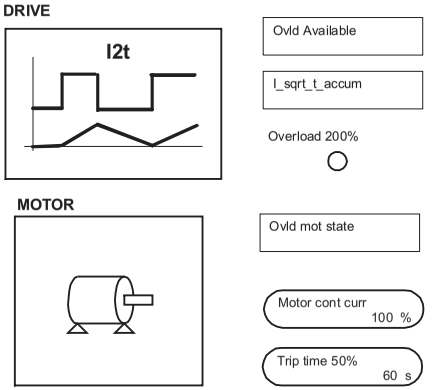
Motoring & Generating Torque Limit



Torque Limit +/-

File name: AVi_Tcurr_reg.vsd

OVERLOAD Control



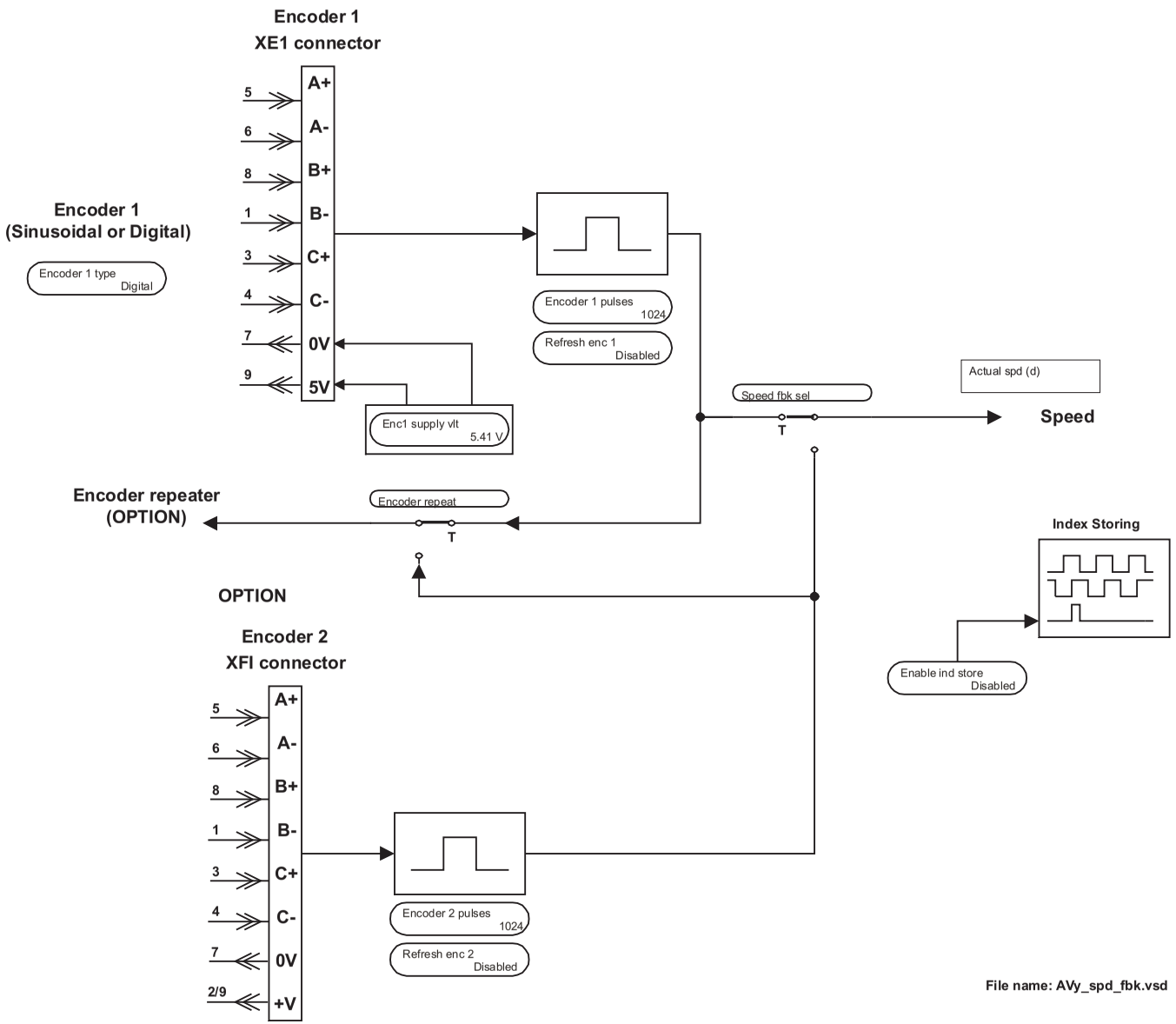
NAVIGATION

Back to Overview: AVy_Ovr_SpTq

Go to motor control: AVy_motctrl

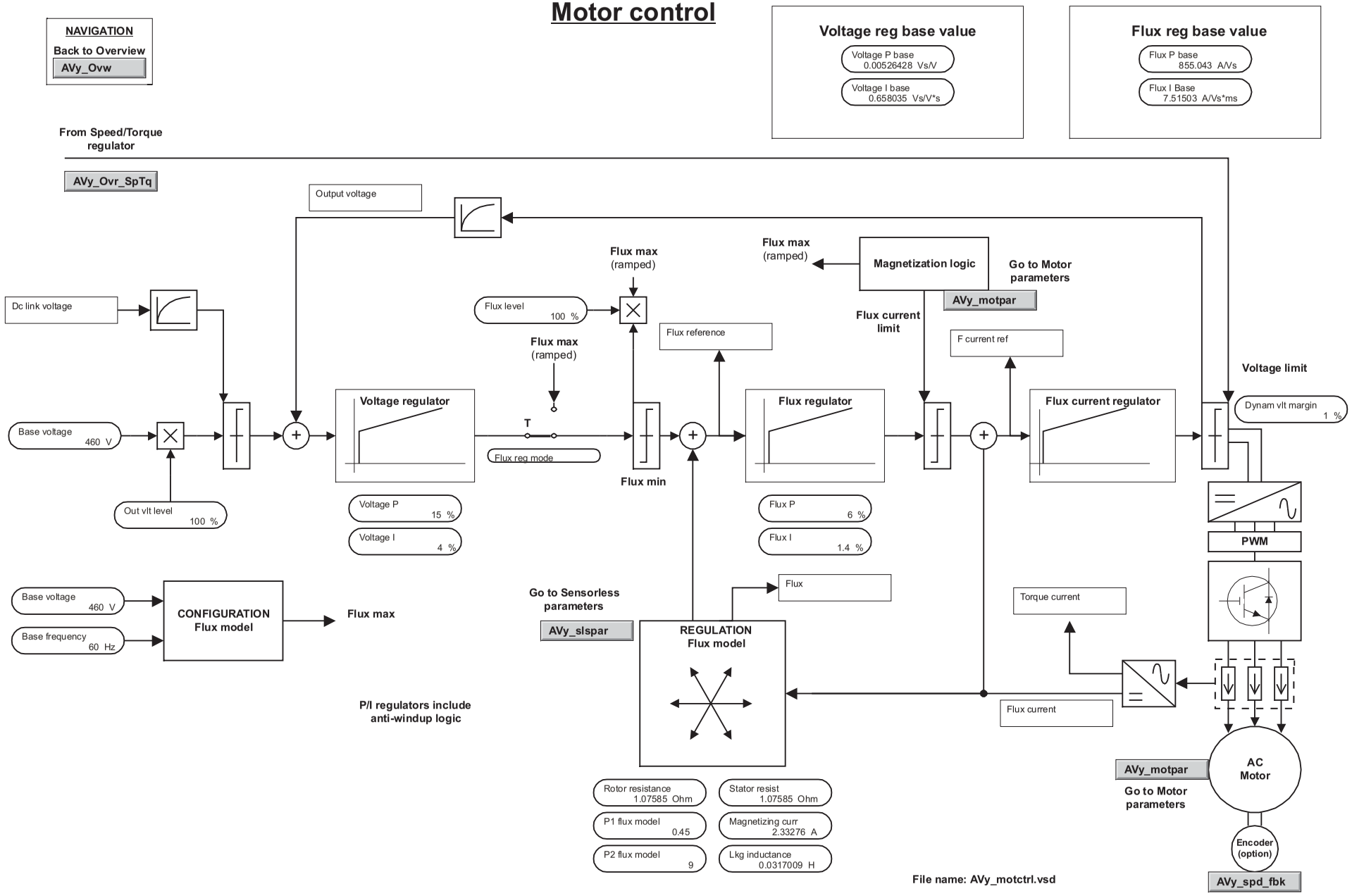
Speed Feedback

Motor Encoder Setup



File name: AVy_spd_fbk.vsd

Motor control



NAVIGATION

Back to Overview | Back to mot ctrl

AVy_Ovw | AVy_motctrl

Motor parameters

Nominal voltage 460 V

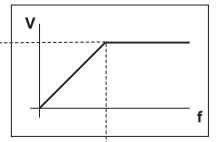
Nominal speed 1765 rpm

Nom frequency 60 Hz

Nominal current 4.8 A

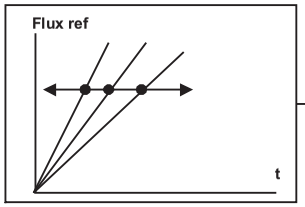
Cos phi 0.81

Base voltage 460 V



Base frequency 60 Hz

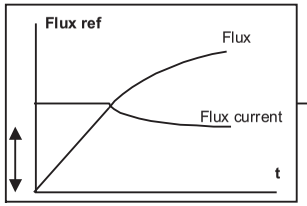
Magnetization init logic



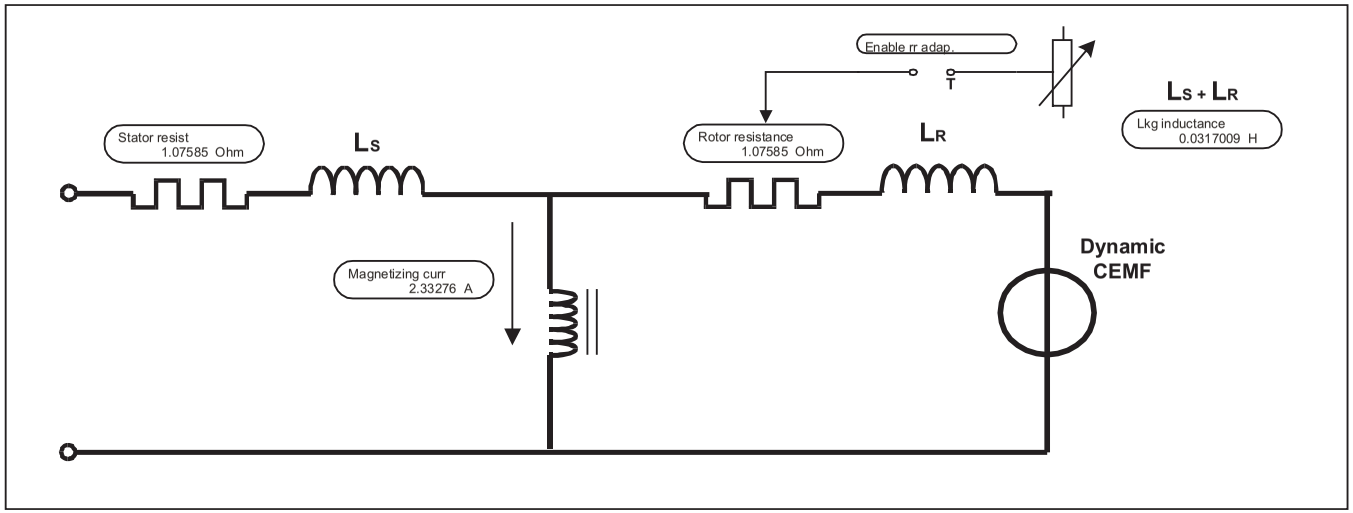
Magn ramp time 1 s

min

Flux max (ramped)



Magn boost curr. 30 %



File name: AVy_motpar.vsd

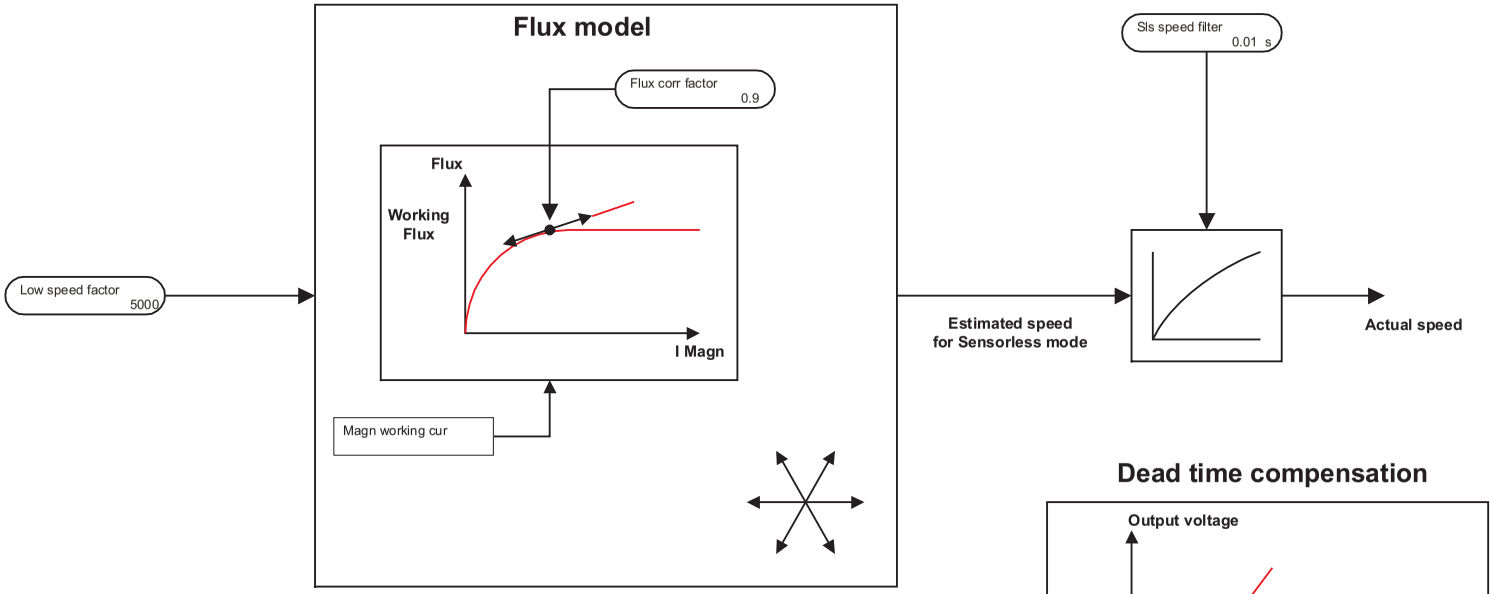
NAVIGATION

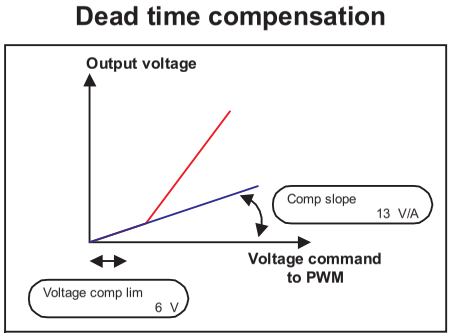
Overview: AVy_Ovw

Back to Mot control: AVy_motctrl

SENSORLESS Parameters

Regulation mode
V/f Control





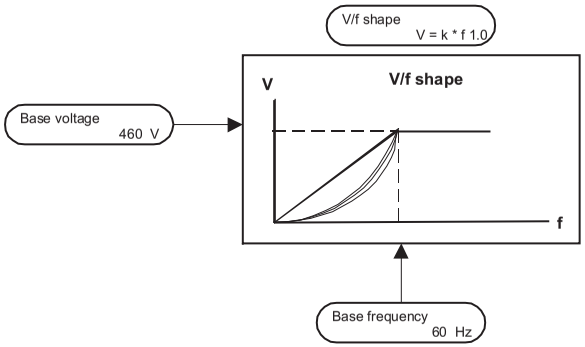
File name: AVy_slspar.vsd

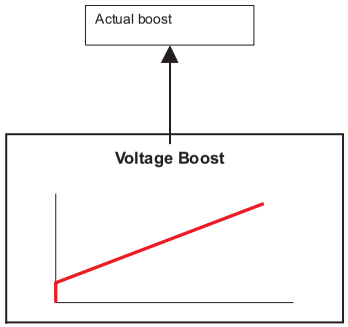
NAVIGATION

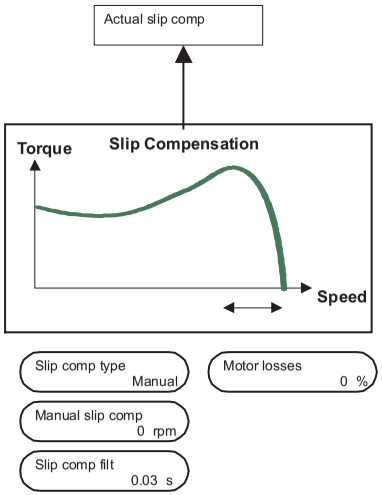
Overview	Go to functions
AVy_Ovw	AVy_Funct

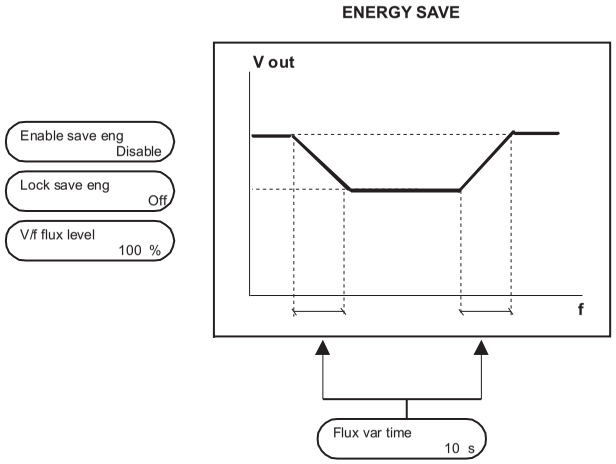
V/Hz functions

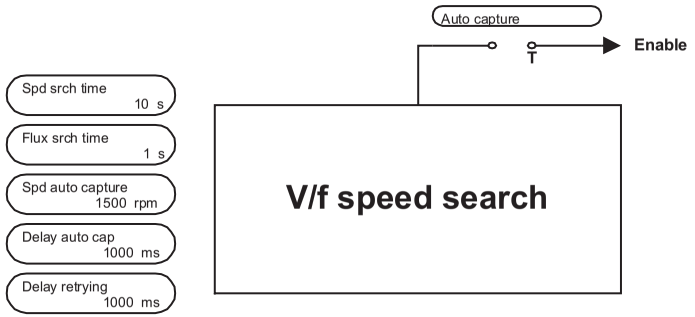
Regulation mode
V/f Control





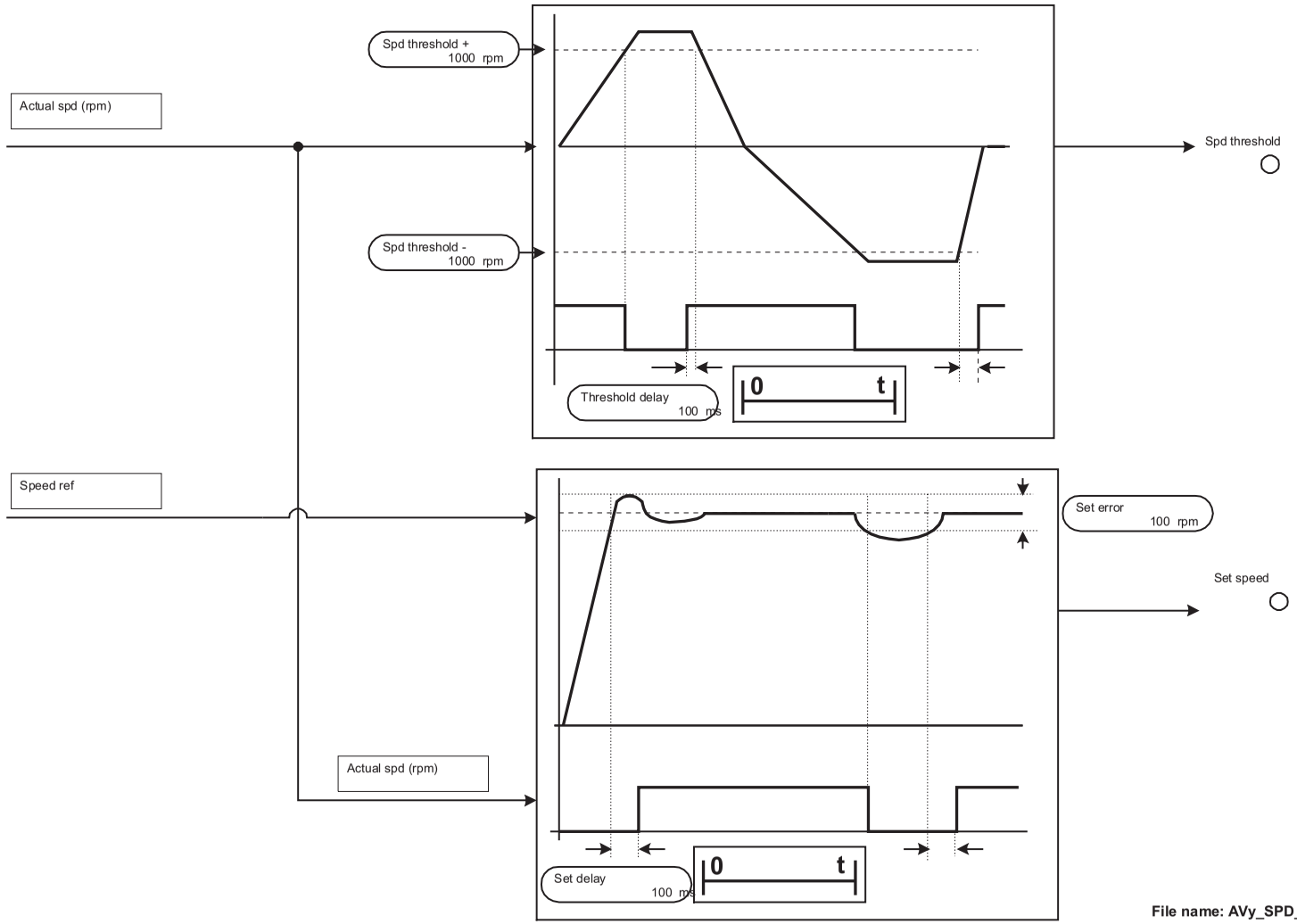






File name: AVy_Vf.vsd

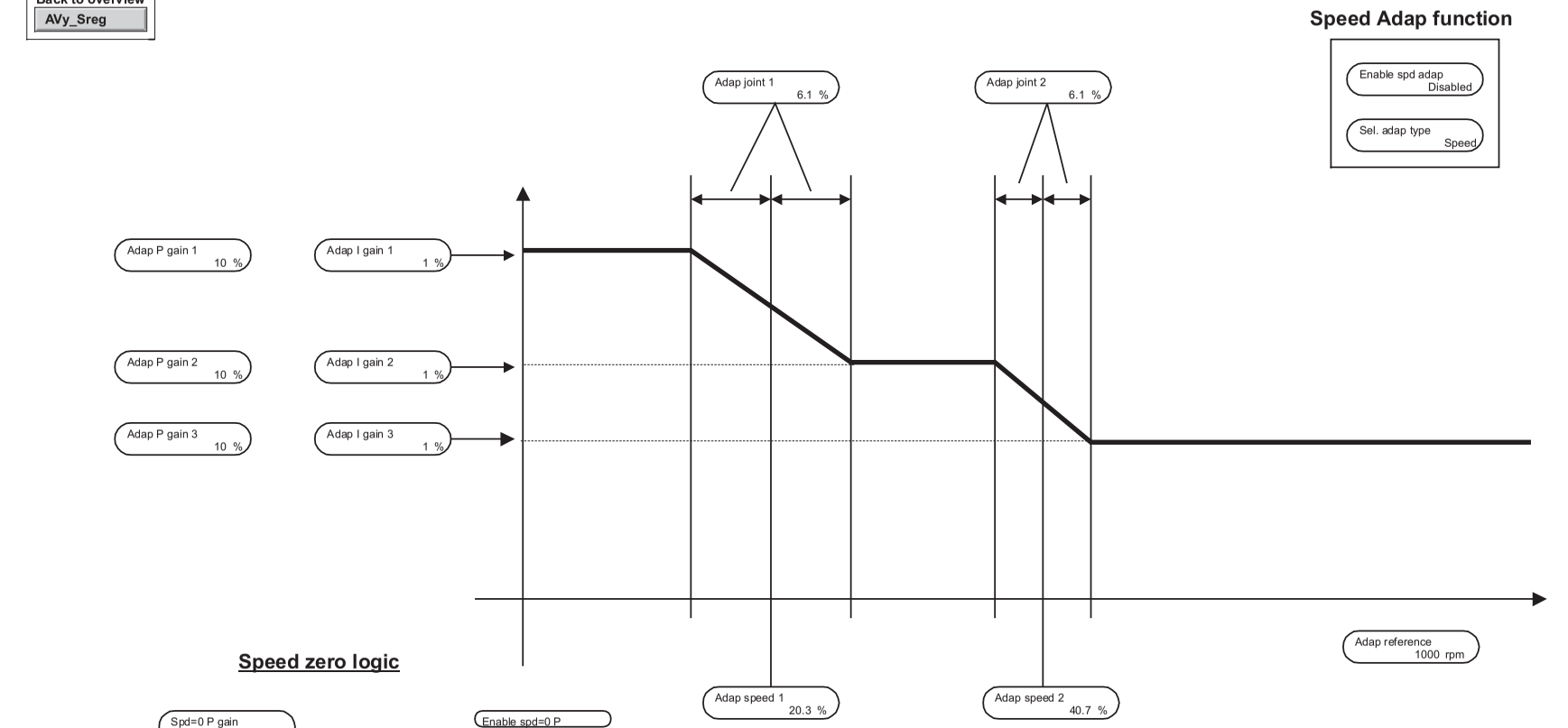
Speed Threshold / Speed control



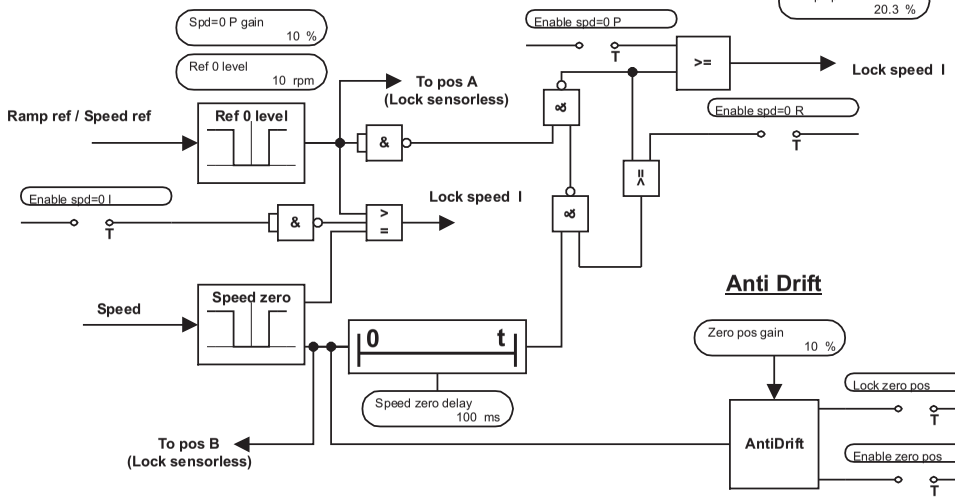
File name: AVy_SPD_THR.vsd

NAVIGATION
Back to overview
AVy_Sreg

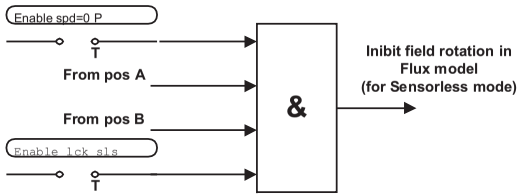
Speed adaptive and Speed zero logic



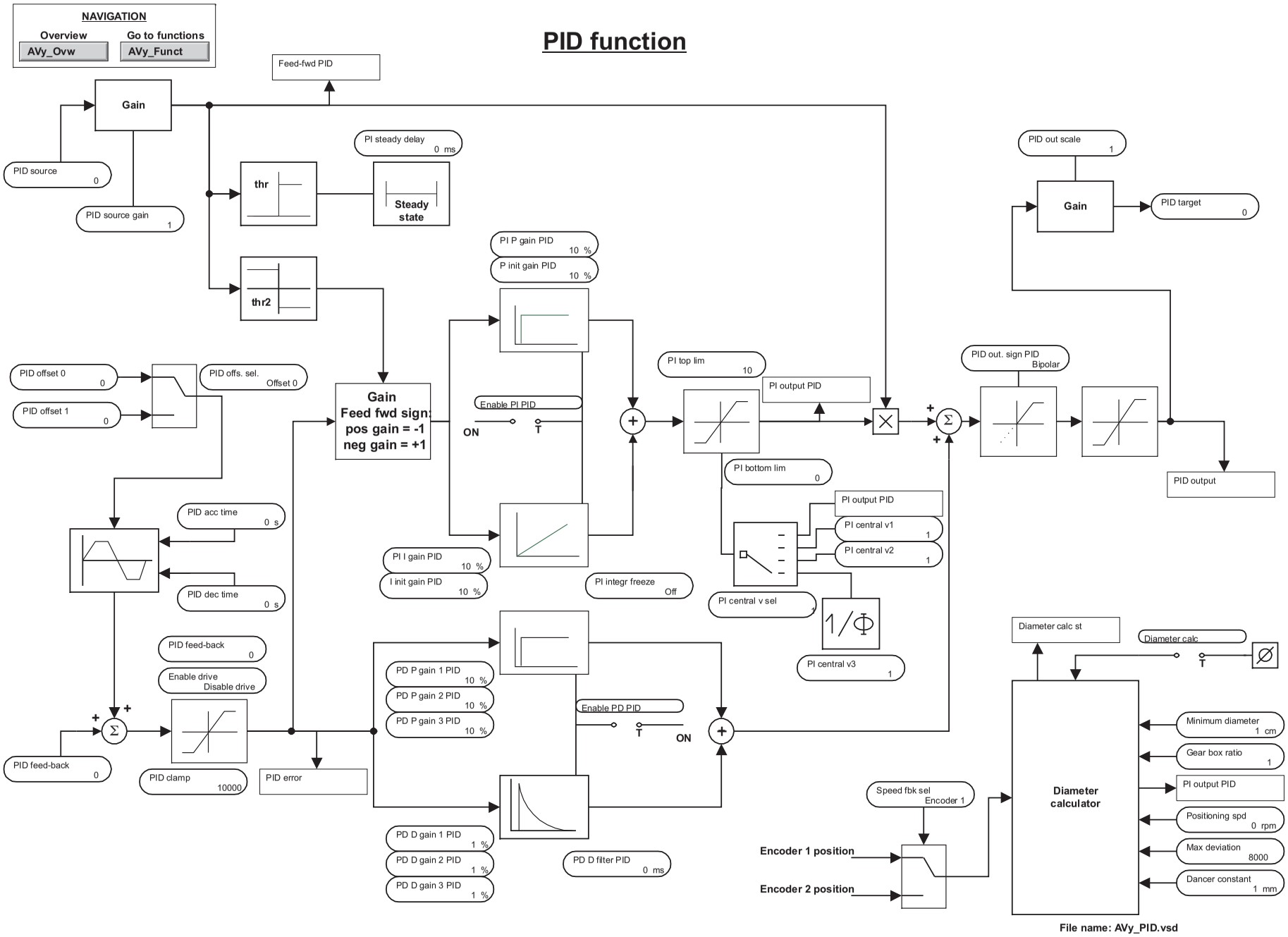
Speed zero logic



Lock Sensorless



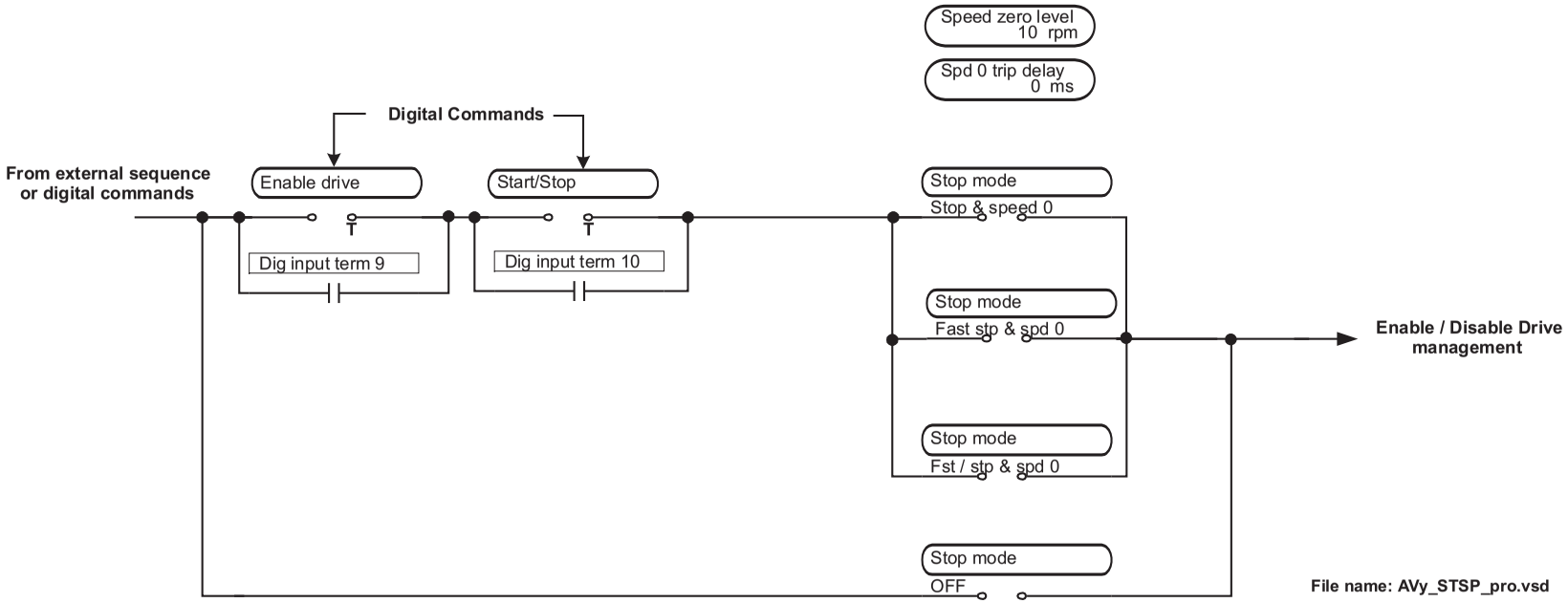
File name: AVy_Adp_spd.vsd


NAVIGATION
Overview
AVy_Ovw
Go to functions
AVy_Funct
PID function
Feed-fwd PID
Gain
PID source
0
PID source gain
1
thr
PI steady delay
0 ms
Steady state
thr2
PI P gain PID
10 %
P init gain PID
10 %
PID out scale
1
Gain
PID target
0
PID offset 0
0
PID offset 1
0
PID offs. sel.
Offset 0
Gain
Feed fwd sign:
pos gain = -1
neg gain = +1
Enable PI PID
ON
T
PI top lim
10
PI output PID
PID out. sign PID
Bipolar
PID output
PI bottom lim
0
PI output PID
PI central v1
1
PI central v2
1
PI central v sel
1/Φ
PI central v3
1
PID acc time
0 s
PID dec time
0 s
PI I gain PID
10 %
I init gain PID
10 %
PI integr freeze
Off
PID feed-back
0
Enable drive
Disable drive
PID feed-back
0
PID clamp
10000
PID error
PD P gain 1 PID
10 %
PD P gain 2 PID
10 %
PD P gain 3 PID
10 %
Enable PD PID
T
ON
PD D gain 1 PID
1 %
PD D gain 2 PID
1 %
PD D gain 3 PID
1 %
PD D filter PID
0 ms
Speed fbk sel
Encoder 1
Encoder 1 position
Encoder 2 position
Diameter calc st
Diameter calc
T
Diameter calculator
Minimum diameter
1 cm
Gear box ratio
1
PI output PID
Positioning spd
0 rpm
Max deviation
8000
Dancer constant
1 mm
File name: AVy_PID.vsd

NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

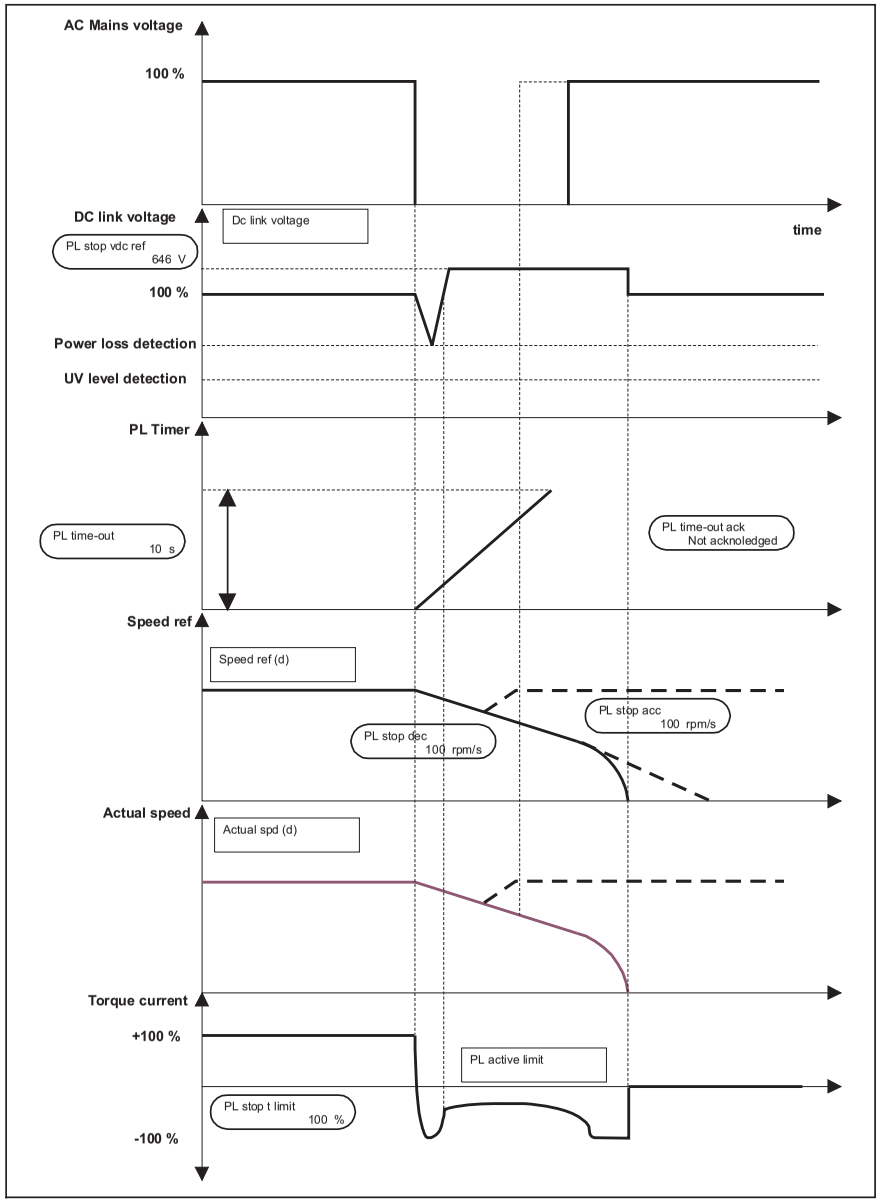
Start and Stop management

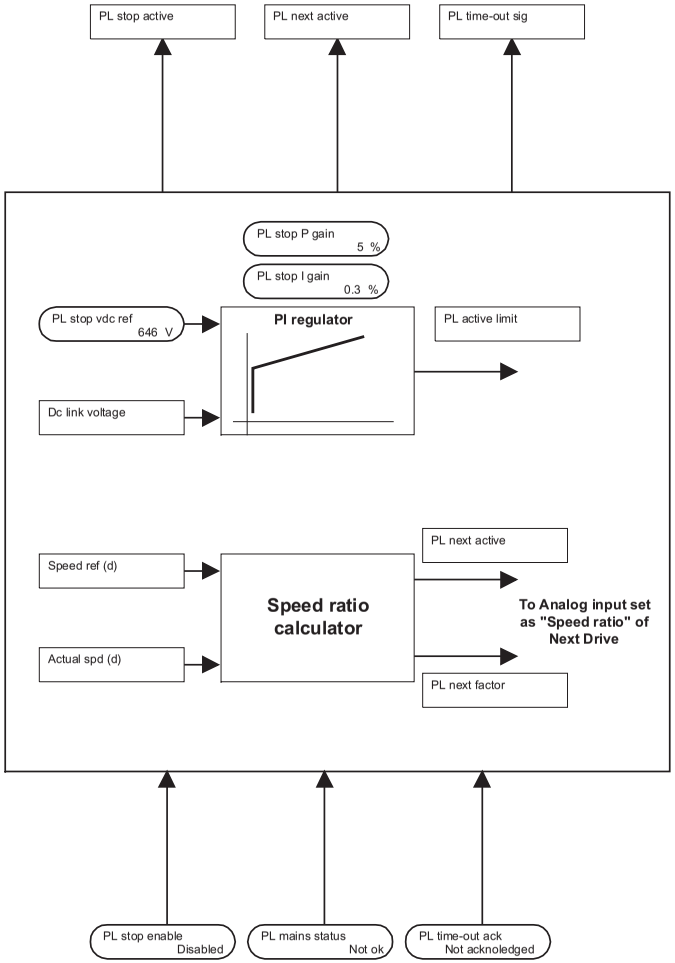


NAVIGATION

Overview: AVy_Ovw | Go to functions: AVy_Funct

Power loss stop control



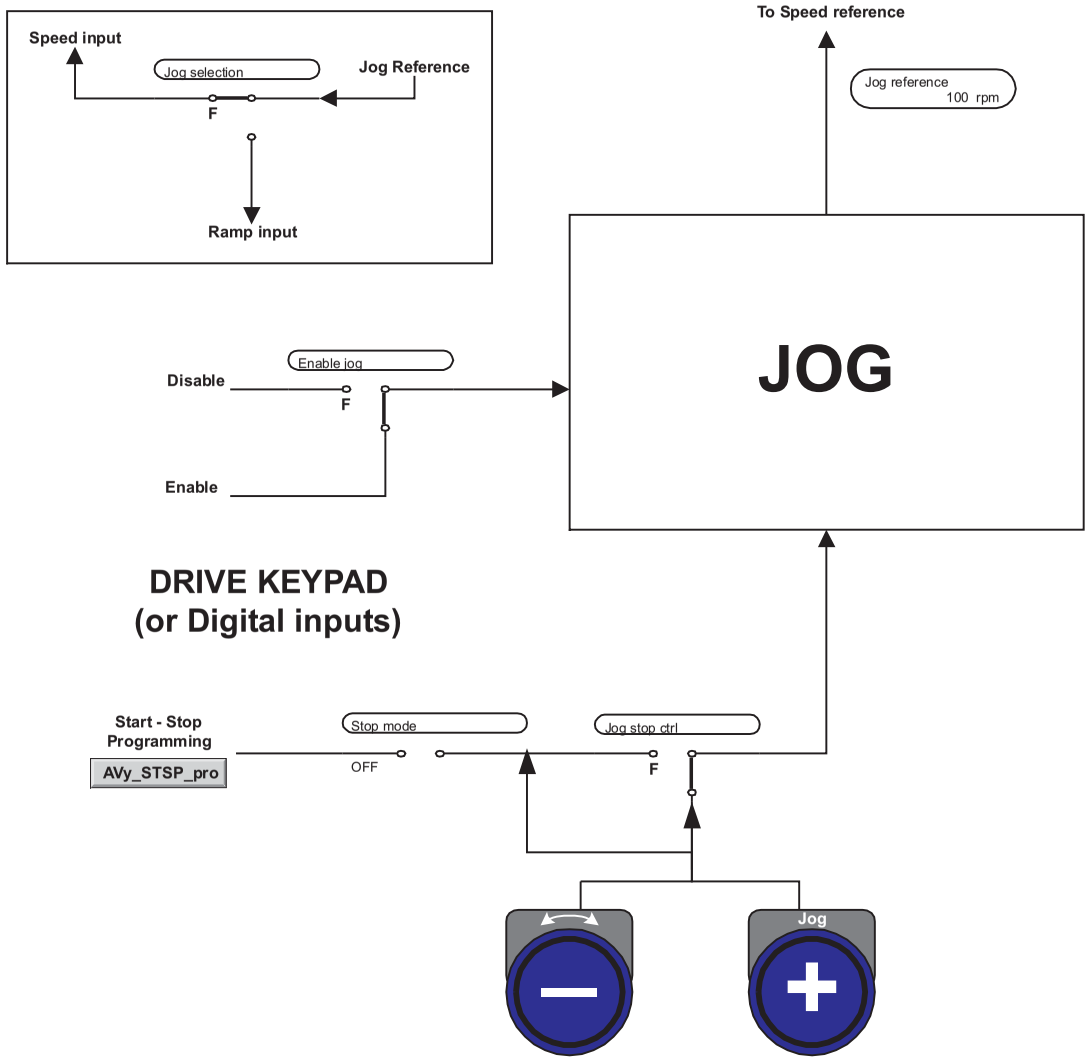


File name: AVy_pwrlss_ctrl.vsd

NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

JOG function

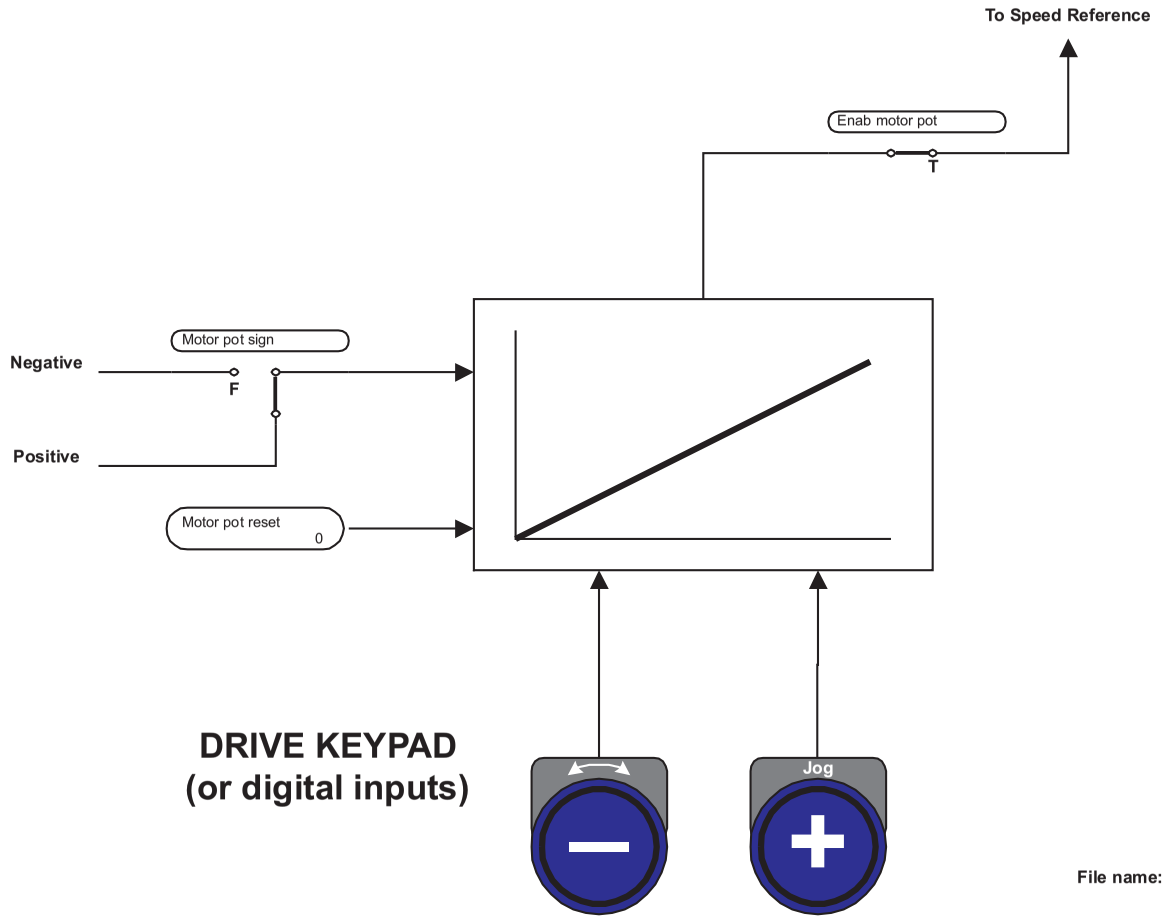


File name: AVy_jog.vsd

NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

Motor potentiometer

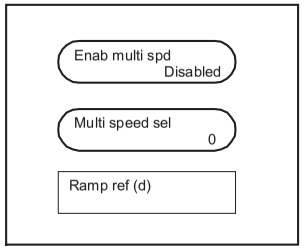


File name: AVy_mpot.vsd

NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

Multi speed



Speed sel 0 bit 0 not selected	Speed sel 1 bit 1 not selected	Speed sel 2 bit 2 not selected	REFERENCE
0	0	0	Ramp ref 1 0 rpm + Ramp ref 2 0 rpm
1	0	0	Multi speed 1 0 rpm
0	1	0	Multi speed 2 0 rpm
1	1	0	Multi speed 3 0 rpm
0	0	1	Multi speed 4 0 rpm
1	0	1	Multi speed 5 0 rpm
0	1	1	Multi speed 6 0 rpm
1	1	1	Multi speed 7 0 rpm

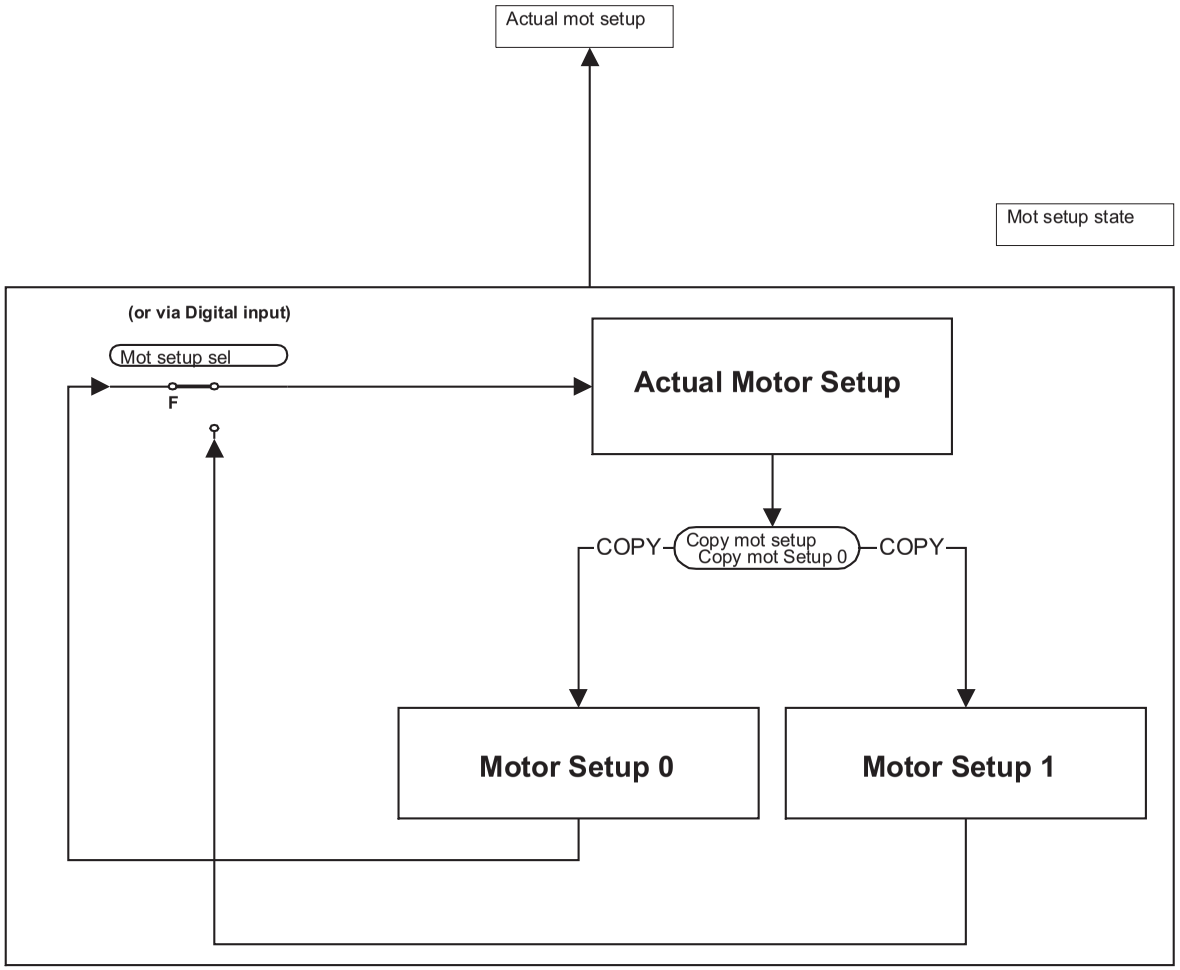
File name: AVy_mspd.vsd

NAVIGATION

Overview: AVy_Ovw

Go to functions: AVy_Funct

Dual Motor setup

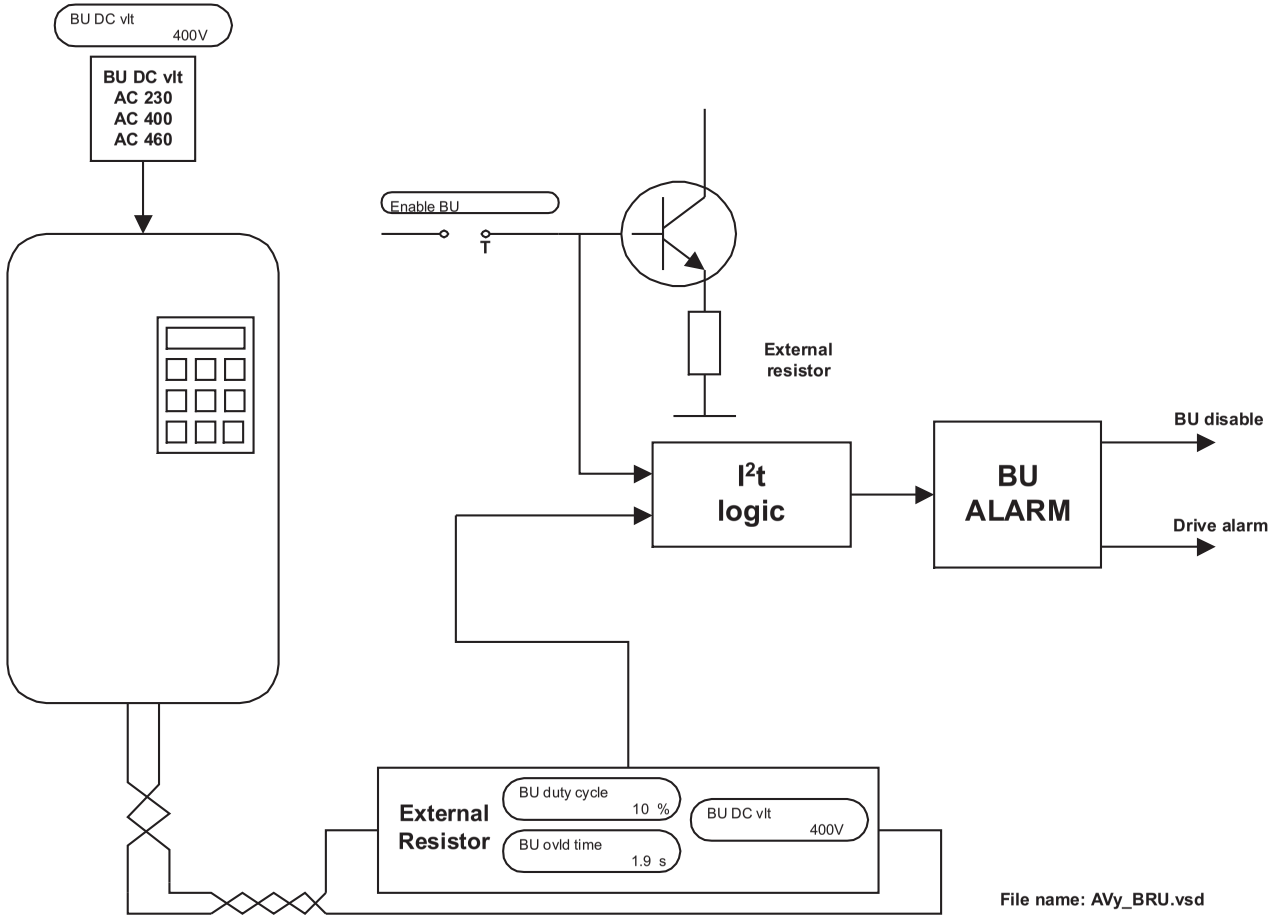


File name: AVy_motstp.vsd

NAVIGATION

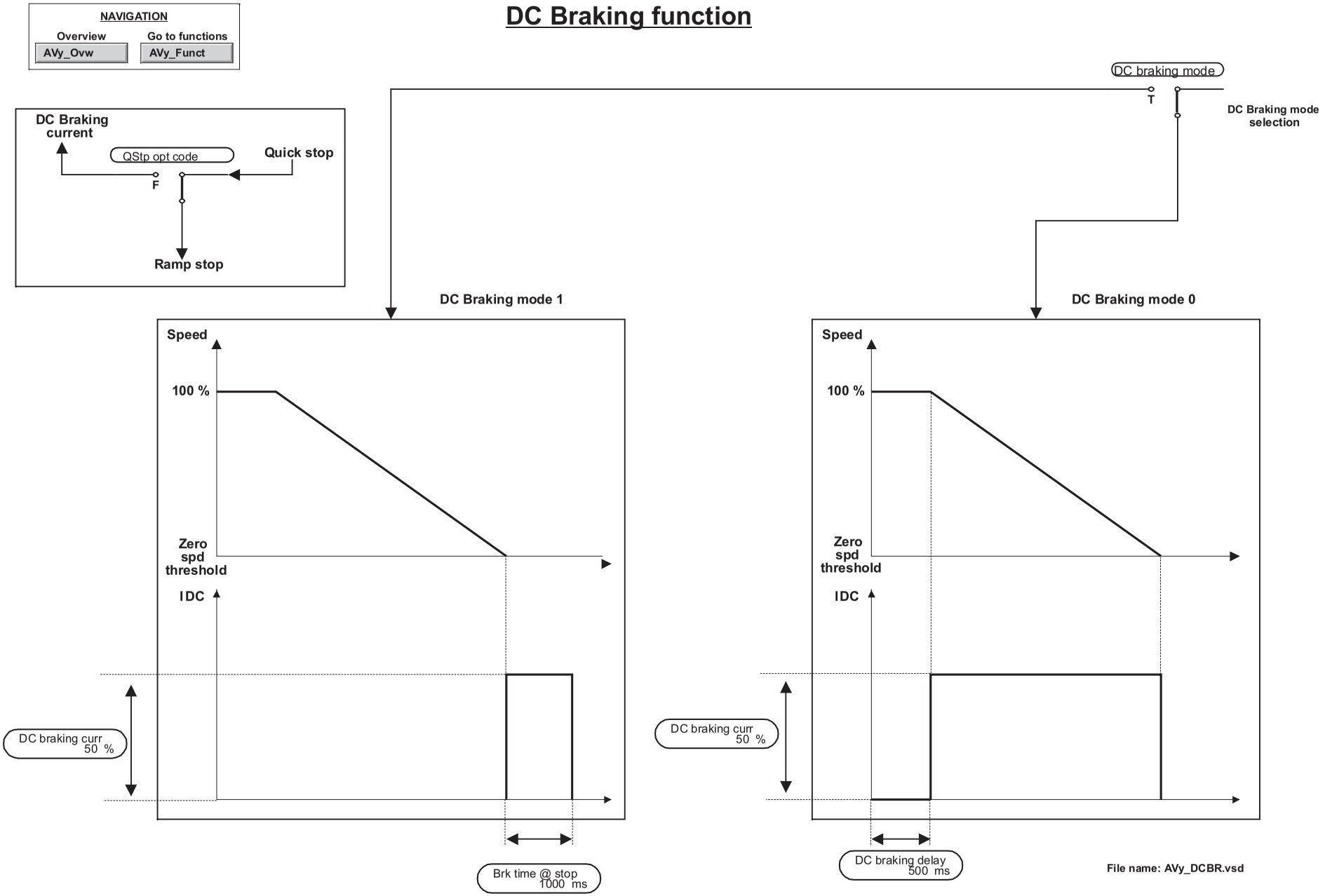
Overview	Go to functions
AVy_Ovw	AVy_Funct

Brake unit function



File name: AVy_BRU.vsd

DC Braking function

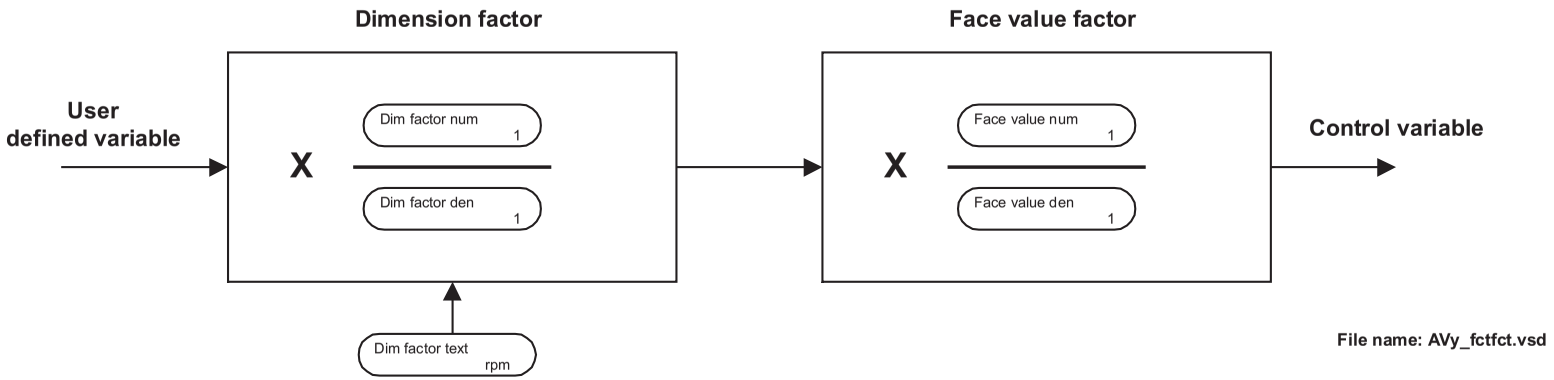


NAVIGATION

Overview: AVy_Ovw

Go to functions: AVy_Funct

Dimension factor
Face value factor

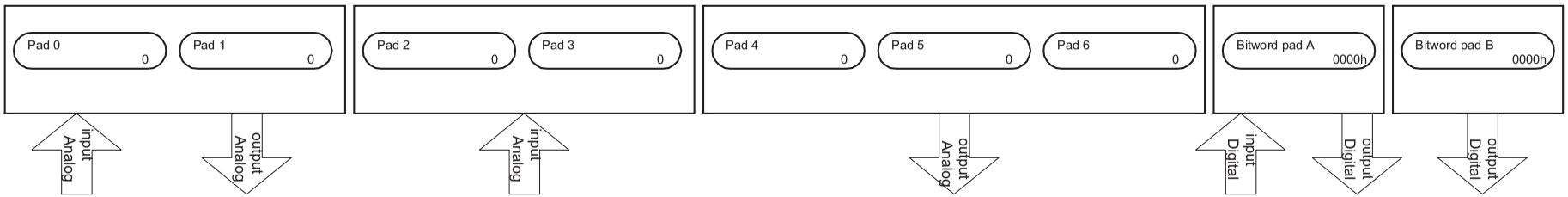


File name: AVy_fctfct.vsd

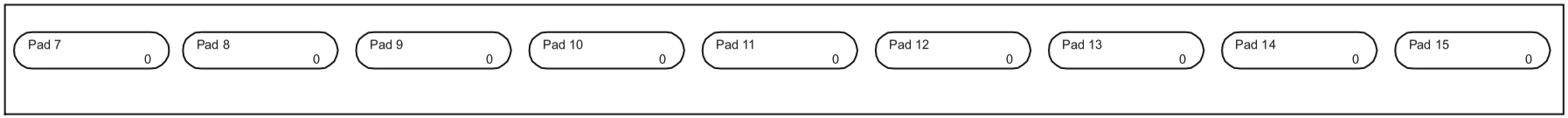
NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

PAD parameters



General PAD

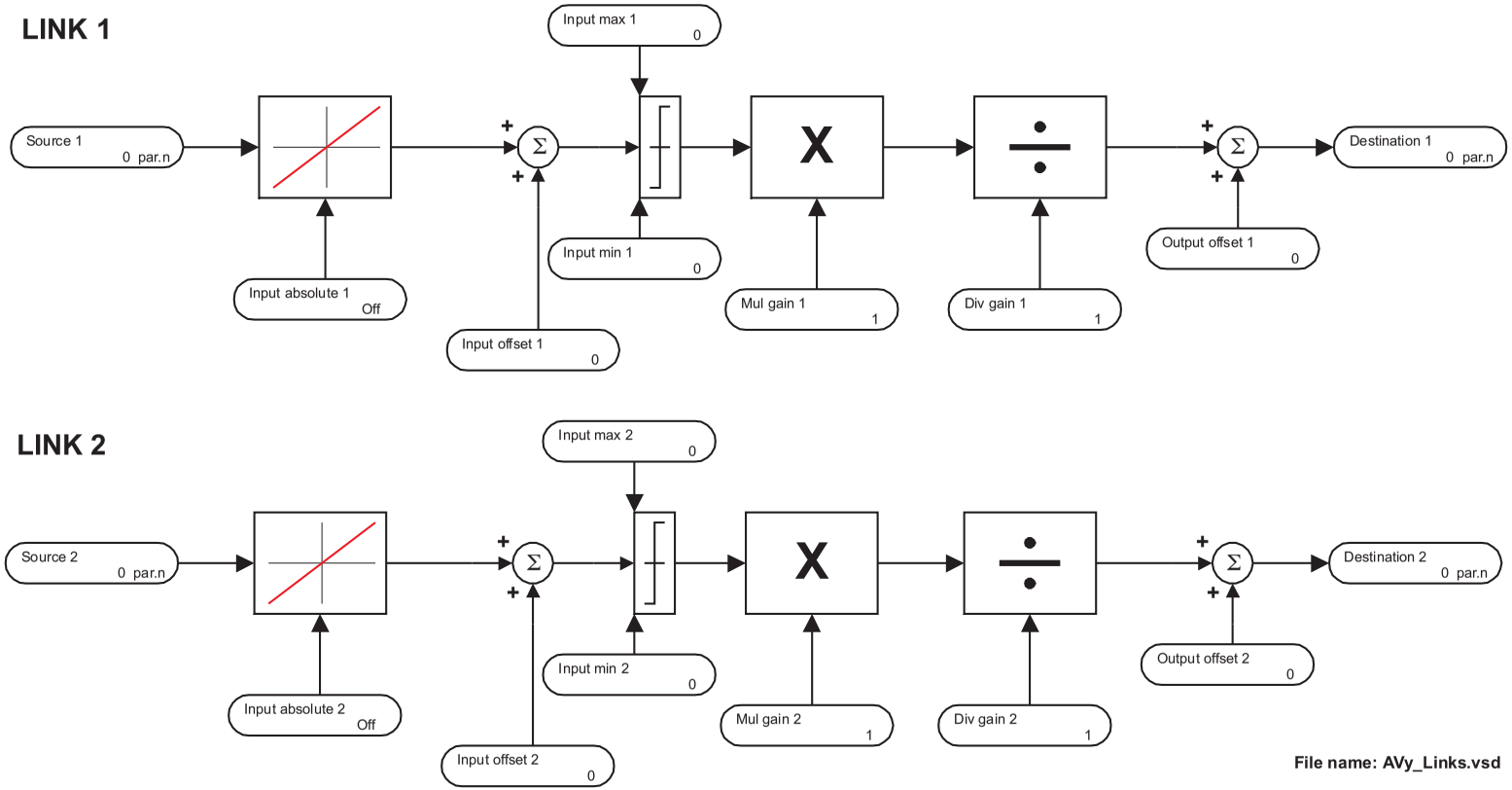


File name: AVy_PAD.vsd

NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

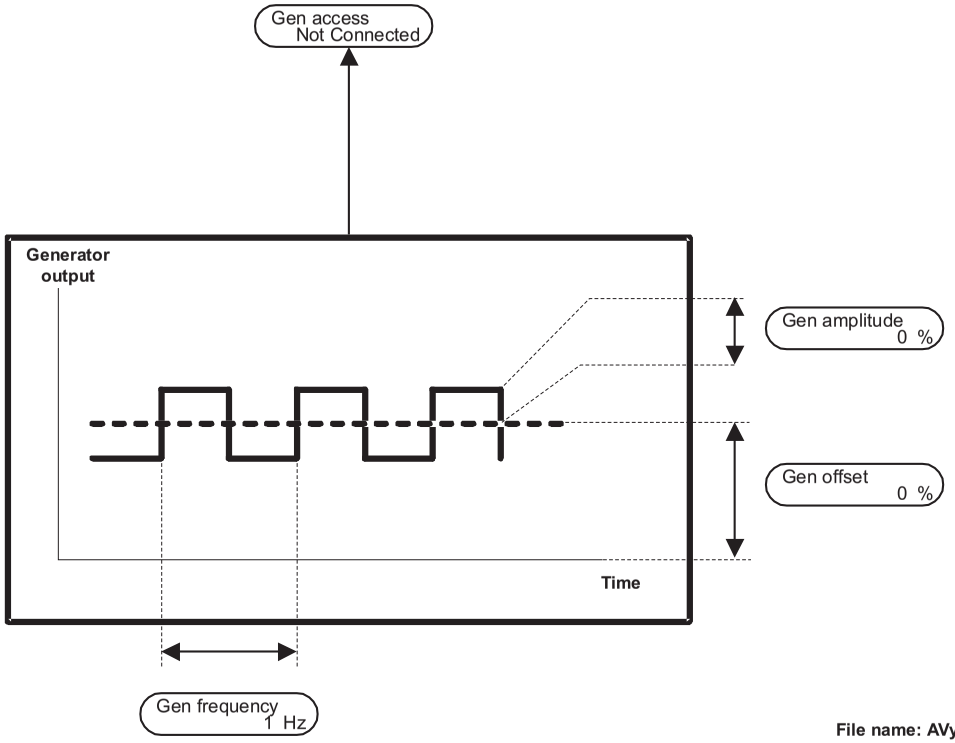
LINKS Function



NAVIGATION

Overview	Go to functions
AVy_Ovw	AVy_Funct

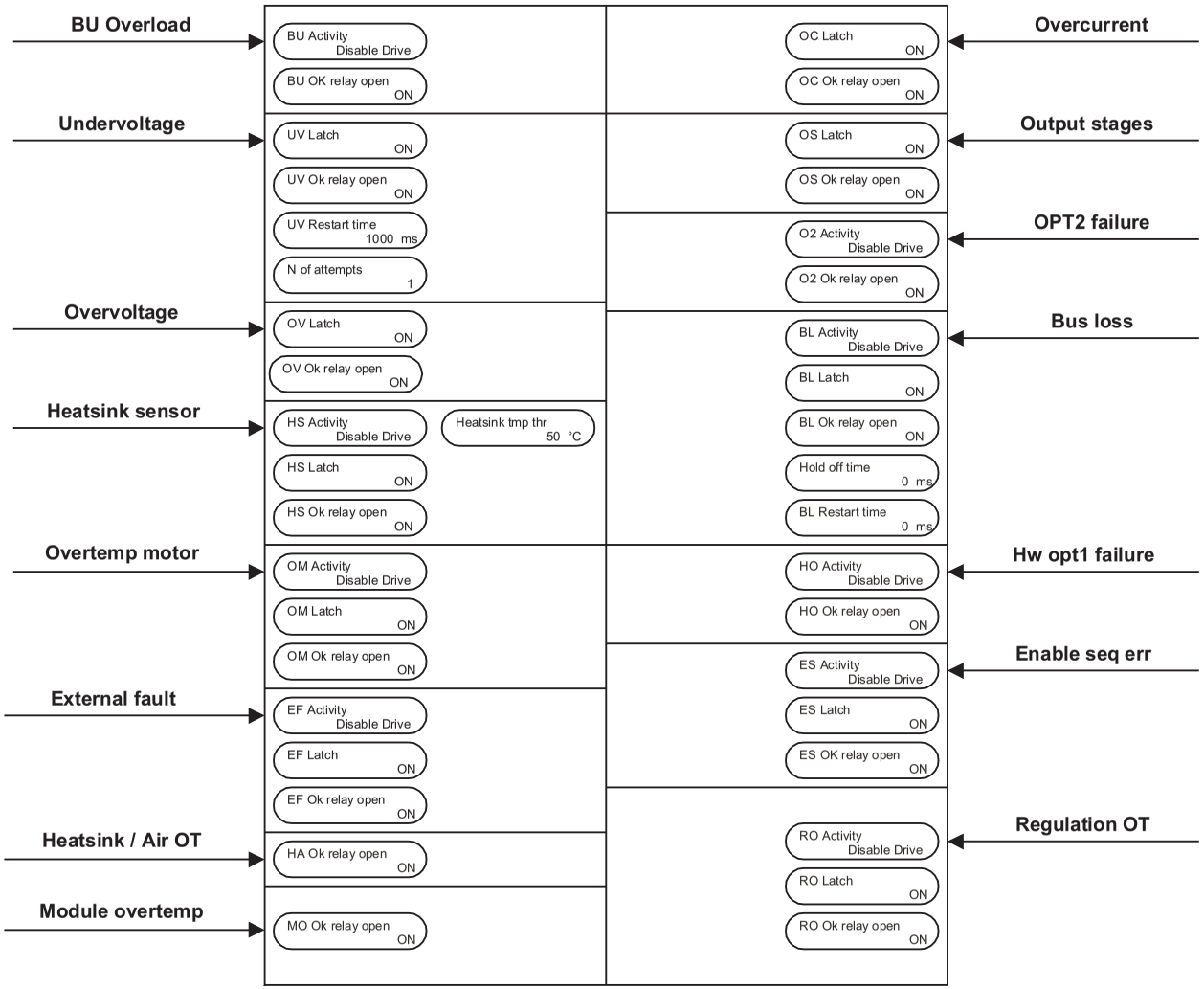
Test Generator



File name: AVy_Test_gen.vsd

NAVIGATION
Overview
Ovw

Alarm mapping



File: AVy_Alarm_mp.vsd

8. PARAMETERS LIST

Explanation of tables:

White text on black background	Menu/submenu
White text on black background in brackets	Menu does not exist in the keypad
Fields with gray background	Function not accessible via keypad. The status of the corresponding parameter is only displayed.
[FF] in the Parameter column	Dimension based on the factor function
"No." column	**Parameter number (decimal). The value 2000H (= decimal 8192) must be added to the number given in the "No." column in order to obtain the index to access the parameter via Bus , serial line or Opt2 (APC card). The parameters in the Drivecom group can be accessed using the format and index specified in the DRIVECOM power transmission profile (#21).**
"Format" column	Internal parameter format: I= Integer (Example: I16 = Integer 16 bit) U = Unsigned (Example: U32 = unsigned 32 bit) Float = Floating point
"Value" column	Minimum, maximum and factory parameter values. S = set value depending on the size of the device. F = set value depending on the **Flt 100 mF** [303] parameter
"Factory" column	S = factory set value depending on the size of the device.
"Keypad" column	√ = Parameter available via keypad
"RS485/BUS/Opt2-M" column (Low priority)	Parameter available via RS485, field Bus or via the APC Card manual communication (see the APC Card user manual) The numbers indicate what has to be sent via interface line in order to set the single parameters.
"Term." column	Parameter addressable to one of the analog or digital input/output terminals.

“Opt2-A” (Low Priority)

“PDC” (High Priority)

Parameter available via the APC Card asynchronous communication (see the APC Card user manual) and/or the Process Data Channel (PDC) of the Field bus.

NOTE: When field Bus interface parameters whose range is [min=0; max=1] can be assigned to either virtual digital inputs (if “w” access code exists) and/or virtual digital outputs (if “R” access code exists).

IA, QA, ID, QD in the "Term." column

The function can be accessed via a freely programmable analog or digital input or output.

IA = analog input

QA = analog output

ID = digital input

QD = digital output.

The possibly present number is the one by which the terminal is identified.

H, L in the "Term." column

Level of the terminal signals (H=high, L=low) which enables the single function.

R/W/Z/C

Access possibilities via the serial interface, Bus or Opt2 manual or asynchronous communication :

R = Read, W = Write, Z = Write only when drive disabled, C=Command parameter (the writing of any value causes the execution of a command).

X · Pyy

The value of this parameter can correspond to min/max X times the value of the yy parameter.

NOTE !

The parameter number shown in the following table is a base number. The value 2000H (=8192 decimal) must be added to the number given in the “No.” column in order to obtain the index to access the parametr via Bus, serial line or Opt2 (APC card). The parameters in the Drivecom group can be accessed using the format and index specified in the DRIVECOM power transmission profile (#21).

* When the parameter is accessed by Opt2-A/PDC the format is U16

** When the parameter is accessed by Opt2-A/PDC the format is I16

*** When the parameter is accessed by Opt2-A/PDC the lower word of the parameter is considered

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Drive ready	380	U16	0	1	-	-	R	QD	R
Drive ready							1	H	
Drive not ready							0	L	
Quick stop	343	U16	0	1	No quick stop (1)	-	R/W	ID	R/W
Quick stop							0	L	
No Quick stop							1	H	
Fast stop	316	U16	0	1	No fast stop (1)	-	R/W	14	R/W
Fast Stop							0	L	
No Fast Stop							1	H	
BASIC MENU									
Enable drive	314	U16	0	1	Disabled (0)	√	R/W	12	R/W
Enabled							1	H	
Disabled							0	L	
Ramp ref 1 [FF]	44	I16	-2 x P45	+2 x P45	0	√	R/W	IA, QA	R/W
(Speed input var)									
Start/Stop	315	U16	0	1	Stop (0)	√	R/W	13	R/W
Start							1	H	
Stop							0	L	
Actual spd (rpm)	122	I16	-8192	8192	-	√	R	QA	R
Motor current [A]	231	Float	0	S	-	√	R	QA	-
BASIC MENU \ Drive type									
Mains voltage	333	U16	0	2	400 V (1)	√	R/Z	-	-
230 V							0		
400 V							1		
460 V							2		
Ambient temp [°C]	332	U16	0	1	40°C (1)	√	R/Z	-	-
50°C (122°F)							0		
40°C (104°F)							1		
Rated drive curr	334	U16	0	16	S	-	R	-	R
7.5							0		
12.6							1		
17.7							2		
24.8							3		
33							4		
47							5		
63							6		
79							7		
93							8		
114							9		
142							10		
185							11		
210							12		
250							13		
324							14		
485							15		
580							16		
2.4							17		
4							18		
5.6							19		
9.6							20		
400							29		
39							30		
Continuous curr [A]	802	Float	S	S	S	√	R	-	-
Software version	331	Text	-	-	-	√	R	-	-
Drive type (AVy)	300	U16	-	-	18	-	R	-	R
BASIC MENU									
Regulation mode	321	U16	0	3	V/f control (3)	√	R/Z	-	-
Sensorless vect							0		
Self-tuning							1		
Field oriented							2		
V/f control							3		
Acc delta speed [FF]	21	U32	0	2^{32}-1	100	√	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	√	R/W	-	-
Dec delta speed [FF]	29	U32	0	2^{32}-1	100	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Dec delta time [s]	30	U16	0	65535	1	√	R/W	-	-
T current lim + [%]	8	U16	0	F	S	√	R/W	IA	R/W
T current lim - [%]	9	U16	0	F	S	√	R/W	IA	R/W
Encoder 1 type Sinusoidal Digital	415	I16	0	1	Digital (1)	√	R/Z 0 1	-	-
Encoder 1 pulses	416	Float*	600	9999	1024	√	R/Z	-	R
Speed base value [FF]	45	U32***	1	16383	1500	√	R/Z	-	R
Save parameters	256	U16	0	65535	-	√	C	-	-
MONITOR									
Enable drive Enabled Disabled	314	U16	0	1	Disabled (0)	√	R/W 1 0	12 H L	R/W
Start/Stop Start Stop	315	U16	0	1	Stop (0)	√	R/W 1 0	13 H L	R/W
MONITOR \ Measurements \ Speed \ Speed in DRC []									
Ramp ref (d) [FF]	109	I16	-32768	32767	-	√	R	-	R
Ramp output (d) [FF]	112	I16	-32768	32767	-	√	R	-	R
Speed ref (d) [FF] (Speed ref var)	115	I16	-32768	32767	-	√	R	-	R
Actual spd (d) [FF] (Act spd value)	119	I16	-32768	32767	-	√	R	-	R
F act spd (d) [FF]	925	I16	-32768	32767	-	√	R	-	R
Act spd filter [s]	923	Float	0.001	0.100	0.001	√	R/W	-	-
MONITOR \ Measurements \ Speed \ Speed in rpm									
Ramp ref (rpm)	110	I16	-32768	32767	-	√	R	QA	R
Ramp outp (rpm)	113	I16	-32768	32767	-	√	R	QA	R
Speed ref (rpm)	118	I16	-32768	32767	-	√	R	QA	R
Actual spd (rpm)	122	I16	-8192	8192	-	√	R	QA	R
Enc1 speed [rpm]	427	I16	-8192	8192	-	√	R	-	R
Enc2 speed [rpm]	420	I16	-8192	8192	-	√	R	-	R
F act spd (rpm)	924	I16	-32768	32767	-	√	R	QA	R
Act spd filter [rpm]	923	Float	0.001	0.100	0.001	√	R/W	-	-
MONITOR \ Measurements \ Speed \ Speed in %									
Ramp ref (%)	111	Float	-200.0	+ 200.0	-	√	R	-	-
Ramp output (%)	114	Float	-200.0	+ 200.0	-	√	R	-	-
Speed ref (%)	117	Float	-200.0	+ 200.0	-	√	R	-	-
Actual spd (%)	121	Float	-200.0	+ 200.0	-	√	R	-	-
MONITOR \ Measurements									
DC link voltage [V]	227	U16	0	999	-	√	R	QA	-
Active power [%]	229	Float**	-500	500	-	√	R	QA	R
Output voltage [V]	233	Float**	0	500	-	√	R	QA	R
Output frequency [Hz]	324	Float	0.0	500.0	-	√	R	-	-
Motor current [A]	231	Float	0.00	S	-	√	R	QA	-
Torque [%]	230	Float	-500	500	-	√	R	QA	-
T current ref [%]	41	I16	-500	500	-	√	R	QA	R
T curr (%)	927	I16	-500	500	-	√	R	QA	R
F T curr (%)	928	I16	-500	500	-	√	R	QA	R
T curr filter [s]	926	Float	0.001	0.250	0.100	√	R/W	-	-
Flux [%]	234	Float*	0.00	100.00	-	√	R	QA	R
Heatsink temp [°C]	881	I16	-	-	-	√	R	-	-
Regulation temp [°C]	1147	I16	-	-	-	√	R	-	-
Intake air temp [°C]	914	U16	-	-	-	√	R	QA	-
MONITOR \ I/O									
Digital I/Q	-				-	√	R	-	-
Dig input term	564	U16	0	65535	-	-	R	-	R
Dig input term 1	565	U16	0	1	-	-	R	-	R
Dig input term 2	566	U16	0	1	-	-	R	-	R
Dig input term 3	567	U16	0	1	-	-	R	-	R
Dig input term 4	568	U16	0	1	-	-	R	-	R
Dig input term 5	569	U16	0	1	-	-	R	-	R
Dig input term 6	570	U16	0	1	-	-	R	-	R
Dig input term 7	571	U16	0	1	-	-	R	-	R

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Dig input term 8	572	U16	0	1	-	-	R	-	R
Dig input term 9	573	U16	0	1	-	-	R	-	R
Dig input term 10	574	U16	0	1	-	-	R	-	R
Dig input term 11	575	U16	0	1	-	-	R	-	R
Dig input term 12	576	U16	0	1	-	-	R	-	R
Dig input term 13	577	U16	0	1	-	-	R	-	R
Dig input term 14	578	U16	0	1	-	-	R	-	R
Dig input term 15	579	U16	0	1	-	-	R	-	R
Dig input term 16	580	U16	0	1	-	-	R	-	R
Dig output term	581	U16	0	65535	-	-	R	-	R
Virtual dig inp	582	U16	0	65535	-	√	R/W	-	R/W
Virtual dig out	583	U16	0	65535	-	√	R	-	R
DRIVE PARAMETER \ Mot plate data									
Nominal voltage [V]	161	Float	1	999	400	√	R/Z	-	-
Nominal speed [rpm]	162	Float**	1	99999	S	√	R/Z	-	-
Nom frequency [Hz]	163	Float	1	999	50	√	R/Z	-	-
Nominal current [A]	164	Float	0.10	999.00	S	√	R/Z	-	-
Cos phi	371	Float	0.1	0.99	S	√	R/Z	-	-
Base voltage [V]	167	Float	1	999	400	√	R/Z	-	-
Base frequency [Hz]	168	Float	1	999	50	√	R/Z	-	-
Take motor par	694	U16	0	1	-	√	C	-	-
DRIVE PARAMETER \ Motor Parameter									
Magnetizing cur [A]	165	Float	0.10	999.00	S	√	R/W	-	-
Magn working cur [A]	726	Float	0.10	999.00	S	√	R	-	-
Rotor resistance [Ohm]	166	Float	0.0001	S	S	√	R/W	-	-
Stator resist [Ohm]	436	Float	0.0001	S	S	√	R/W	-	-
Lkg inductance [H]	437	Float	0.00001	9.00000	S	√	R/W	-	-
Load motor par	251	U16	0	1	Std400V (0)	√	Z	-	-
Std for 400V							0		
Std for 460V							1		
DRIVE PARAMETER \ Motor Parameter \ Self-tuning									
Self tune state	705	U16	0	65535	-	-	R	-	-
DRIVE PARAMETER \ Motor Parameter \ Self-tuning \ Self-tune 1									
Start part 1	676	U16	0	65535	-	√	C	-	-
Stator resist [Ohm]	436	Float	0.0001	S	S	√	R/W	-	-
Stator resist Nw [Ohm]	683	Float	S	S	-	√	R	-	-
Voltage comp lim [V]	644	Float	0.1	30.0	6.0	√	R/W	-	-
Volt comp lim Nw [V]	685	Float	0.1	30.0	-	√	R	-	-
Comp slope [V/A]	645	Float	0.1	50.0	13.0	√	R/W	-	-
Comp slope Nw [V/A]	686	Float	0.1	50.0	-	√	R	-	-
Lkg inductance [H]	437	Float	0.00001	9.00000	S	√	R/W	-	-
Lkg indutance Nw [H]	684	Float	S	S	-	√	R	-	-
Current P [%]	89	Float	0.00	100.00	S	√	R/W	-	-
Current P Nw [%]	687	Float	S	S	-	√	R	-	-
Rotor resistance [Ohm]	166	Float	0.0001	S	S	√	R/W	-	-
Rotor resist Nw [Ohm]	682	Float	S	S	-	√	R	-	-
Current I [%]	90	Float	0.00	100.00	S	√	R/W	-	-
Current I Nw [%]	688	Float	S	S	-	√	R	-	-
Take val part 1	677	U16	0	65535	-	√	Z/C	-	-
DRIVE PARAMETER \ Motor Parameter \ Self-tuning \ Self-tune 2a									
Start part 2a	678	U16	0	65535	-	√	C	-	-
P1 flux model	176	Float	0.00	1.00	S	√	R/W	-	-
P1 flux model Nw	689	Float	S	S	S	√	R	-	-
P2 flux model	692	U16	1	20	S	√	R/W	-	-
P2 flux model Nw	690	U16	S	S	S	√	R	-	-
Magnetizing curr [A]	165	Float	0.1	999.0	S	√	R/W	-	-
Magnetiz curr Nw [A]	691	Float	S	S	S	√	R	-	-
Flux P [%]	91	Float	0.00	100.00	S	√	R/W	-	-
Flux P Nw [%]	907	Float	0.00	100.00	S	√	R	-	-
Flux I [%]	92	Float	0.00	100.00	S	√	R/W	-	-
Flux I Nw [%]	908	Float	0.00	100.00	S	√	R	-	-
Voltage P [%]	1022	Float	0	100.00	15.00	√	RW	RW	-
Voltage P Nw [%]	1024	Float	100.00	0.00	S	√	R	R	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Voltage I [%]	902	Float	0.00	100.00	4.00	√	R/W	-	-
Voltage I Nw [%]	909	Float	0.00	100.00	S	√	R	-	-
Take val part 2a	679	U16	0	65535	-	√	Z/C	-	-
DRIVE PARAMETER \ Motor Parameter \ Self-tuning \ Sel-tune 2b									
Start part 2b	680	U16	0	65535	-	√	C	-	-
P1 flux model	176	Float	0.00	1.00	S	√	R/W	-	-
P1 flux model Nw	689	Float	S	S	S	√	R	-	-
P2 flux model	692	U16	1	20	S	√	R/W	-	-
P2 flux model Nw	690	U16	S	S	S	√	R	-	-
Magnetizing curr [A]	165	Float	0.1	999.0	S	√	R/W	-	-
Magnetiz curr Nw [A]	691	Float	S	S	S	√	R	-	-
Flux P [%]	91	Float	0.00	100.00	S	√	R/W	-	-
Flux P Nw [%]	907	Float	0.00	100.00	S	√	R	-	-
Flux I [%]	92	Float	0.00	100.00	S	√	R/W	-	-
Flux I Nw [%]	908	Float	0.00	100.00	S	√	R	-	-
Voltage P [%]	1022	Float	0.00	100.00	15.00	√	RW	RW	-
Voltage P Nw [%]	1024	Float	100.00	0.00	S	√	R	R	-
Voltage I [%]	902	Float	0.00	100.00	4.00	√	R/W	-	-
Voltage I Nw [%]	909	Float	0.00	100.00	S	√	R	-	-
Take val part 2b	681	U16	0	65535	-	√	Z/C	-	-
DRIVE PARAMETER \ Motor Parameter \ Self-tuning \ Sel-tune 3									
Fwd-Rev spd tune Fwd direction Rev direction	1029	U16	1	2	Fwd direction (1)	√	R/Z 1 2	-	-
Test T curr lim [%]	1048	U16	0	S	20	√	R/Z	-	-
Start part 3	1027	U16	0	65535	-	√	C	-	-
Inertia [kg*m*m*]	1014	Float	0.0010	999.9990	S	√	R/W	-	-
Inertia Nw [kg*m*m*]	1030	Float	0.0010	999.9990	-	√	R	-	-
Friction [N*m]	1015	Float	0.000	99.99	S	√	R/W	-	-
Friction Nw [N*m]	1031	Float	0.000	99.99	-	√	R	-	-
Speed P [%]	87	Float	0.00	100.00	S	√	R/W	-	-
Speed P Nw [%]	1032	Float	0.00	100.00	-	√	R	-	-
Speed I [%]	88	Float	0.00	100.00	S	√	R/W	-	-
Speed I Nw [%]	1033	Float	0.00	100.00	-	√	R	-	-
Take val part 3	1028	U16	0	65535	-	√	Z/C	-	-
DRIVE PARAMETER \ Sensorless									
Low speed factor	646	I16	0	32000	5000	√	R/W	-	-
Sls speed filter [s]	643	Float	0.01	0.50	0.01	√	R/W	-	-
Flux corr factor	647	Float	0.50	1.0	0.90	√	R/W	-	-
DRIVE PARAMETER \ V/f control									
V/f shape $V = k \cdot f^{1.0}$ $V = k \cdot f^{1.5}$ $V = k \cdot f^{1.7}$ $V = k \cdot f^{2.0}$	712	U16	0	3	$V = k \cdot f^{1.0}$ (0)	√	R/Z 0 1 2 3	-	-
DRIVE PARAMETER \ V/f control \ Voltage boost									
Vlt boost type Manual Automatic	709	U16	0	1	Manual (0)	√	R/Z 0 1	-	-
Manual boost [%]	710	Float	0.0	10.0	1.0	√	R/W	-	-
Actual boost [%]	711	Float	0.0	100.0	-	√	R	-	-
DRIVE PARAMETER \ V/f control \ Slip compens									
Slip comp type Manual Automatic	722	U16	0	1	Manual (0)	√	R/Z 0 1	-	-
Manual slip comp [rpm]	723	I16	0	200	0	√	R/W	-	-
Actual slip comp [rpm]	724	I16	-400	400	0	√	R	-	-
Slip comp filt [s]	725	Float	0.003	0.300	0.030	√	R/W	-	-
Motor losses %	727	Float	0.0	20.0	0	√	R/W	-	-
DRIVE PARAMETER \ V/f control \ V/f spd search									
Spd srch time [s]	893	Float	0.01	10.00	10.00	√	R/W	-	-
Flux srch time [s]	894	Float	0.01	20.00	1.00	√	R/W	-	-
Spd autocapture [FF]	895	I16	-32768	32767	1500	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Delay auto cap [ms]	896	U16	0	10000	1000	√	R/W	-	-
Delay retrying [ms]	897	U16	0	10000	1000	√	R/W	-	-
DRIVE PARAMETER \ V/f control \ Energy save									
Enable save eng	898	U16	0	1	Disabled (0)	√	R/Z	-	-
Enabled							1		
Disabled							0		
Lock save eng	899	U16	0	1	OFF (0)	√	R/W	ID	R/W
OFF							0	L	
ON							1	H	
V/f flux level [%]	900	U16	0	100	100	√	R/W	IA	R/W
Flux var time [s]	901	U16	1	100	10	√	R/W	-	-
INPUT VARIABLES \ Ramp ref \ Ramp ref 1									
Ramp ref 1 [FF] (Speed input var)	44	I16	-2 × P45	+2 × P45	0	√	R/W	IA, QA	R/W
Ramp ref 1 (%)	47	Float	-200.0	+200.0	0.0	√	R/W	-	-
INPUT VARIABLES \ Ramp ref \ Ramp ref 2									
Ramp ref 2 [FF]	48	I16	-2 × P45	+2 × P45	0	√	R/W	IA, QA	R/W
Ramp ref 2 (%)	49	Float	-200.0	+200.0	0.0	√	R/W	-	-
INPUT VARIABLES \ Speed ref \ Speed ref 1									
Speed ref 1 [FF]	42	I16	-2 × P45	+2 × P45	0	√	R/W	IA, QA	R/W
Speed ref 1 (%)	378	Float	-200.0	+200.0	0.0	√	R/W	-	-
INPUT VARIABLES \ Speed ref \ Speed ref 2									
Speed ref 2 [FF]	43	I16	-2 × P45	+2 × P45	0	√	R/W	IA, QA	R/W
Speed Ref 2 (%)	379	Float	-200.0	+200.0	0.0	√	R/W	-	-
INPUT VARIABLES \ T current ref									
T current ref 1 [%]	39	I16	F	F	0	√	R/W	IA, QA	R/W
T current ref 2 [%]	40	I16	F	F	0	√	R/W	IA, QA	R/W
LIMITS \ Speed limits \ Speed amount									
Speed min amount [FF]	1	U32	0	2^{32}-1	0	√	R/Z	-	-
Speed max amount [FF]	2	U32	0	2^{32}-1	5000	√	R/Z	-	-
LIMITS \ Speed limits \ Speed min/max									
Speed min pos [FF]	5	U32	0	2^{32}-1	0	√	R/Z	-	-
Speed max pos [FF]	3	U32	0	2^{32}-1	5000	√	R/Z	-	-
Speed min neg [FF]	6	U32	0	2^{32}-1	0	√	R/Z	-	-
Speed max neg [FF]	4	U32	0	2^{32}-1	5000	√	R/Z	-	-
Speed limited	372	U16	0	1		-	R	QD	R
Speed not limited							0	L	
Speed limited							1	H	
LIMITS \ Current limits									
T curr lim type	715	U16	0	1	T lim +/- (0)	√	R/Z	-	-
T lim + / -							0		
T lim mot gen							1		
T lim VDC Ctrl							3		
T current lim [%]	7	U16	0	F	S	√	R/W	IA	R/W
T current lim + [%]	8	U16	0	F	S	√	R/W	IA	R/W
T current lim - [%]	9	U16	0	F	S	√	R/W	IA	R/W
Curr limit state	349	U16	0	1		-	R	QD	R
Curr. limit not reached							0	L	
Curr. limit reached							1	H	
In use Tcur lim+ [%]	10	U16	0	F		√	R	-	R
In use Tcur lim- [%]	11	U16	0	F		√	R	-	R
Current lim red [%]	13	U16	0	F	100	√	R/W	-	R/W
Torque reduct	342	U16	0	1	Not act. (0)	√	R/W	ID	R/W
Not actived							0	L	
actived							1	H	
LIMITS \ Flux limits									
Flux level [%]	467	U16	10	100	100	√	R/W	IA QA	R/W
LIMITS \ Voltage limits									
Dynam vlt margin [%]	889	Float	10.00	10.00	1.00	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
RAMP \ Acceleration									
Acc delta speed [FF]	21	U32	0	2^{32}-1	100	√	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	√	R/W	-	-
RAMP \ Deceleration									
Dec delta speed [FF]	29	U32	0	2^{32}-1	100	√	R/W	-	-
Dec delta time [s]	30	U16	0	65535	1	√	R/W	-	-
RAMP \ Quick stop									
QStp delta speed [FF]	37	U32	0	2^{32}-1	1000	√	R/W	-	-
QStp delta time [s]	38	U16	0	65535	1	√	R/W	-	-
RAMP									
Ramp shape	18	U16	0	1	Linear (0)	√	R/Z	-	-
Linear							0		
S-Shaped							1		
S shape t const [ms]	19	Float	100	3000	500	√	R/W	-	-
S acc t const [ms]	663	Float	100	3000	500	√	R/W	-	-
S dec t const [ms]	664	Float	100	3000	500	√	R/W	-	-
Ramp +/- delay [ms]	20	U16	0	65535	100	√	R/W		-
Fwd-Rev	673	U16	0	3	Fwd (1)	√	R/W	-	R/W
No direction							0		
Fwd direction							1		
Rev direction							2		
No direction							3		
Forward sign	293	U16	0	1	not sel (0)	-	R/W	ID	R/W
FWD selected							1	H	
FWD not selected							0	L	
Reverse sign	294	U16	0	1	not sel (0)	-	R/W	ID	R/W
REV selected							1	H	
REV not selected							0	L	
Enable ramp	245	I16	0	1	Enabled (1)	√	R/Z	-	-
Enabled							1		
Disabled							0		
Ramp out = 0	344	U16	0	1	Not act. (1)	√	R/W	ID	R/W
Actived							0	L	
Not Actived							1	H	
Ramp in = 0	345	U16	0	1	Not act. (1)	√	R/W	ID	R/W
Actived							0	L	
Not Actived							1	H	
Freeze ramp	373	U16	0	1	Not act. (1)	√	R/W	ID	R/W
Actived							0	L	
Not Actived							1	H	
Ramp +	346	U16	0	1	-	-	R	QD	R
Acc. clockwise +							1	H	
Dec. counter-clockwise									
Other states							0	L	
Ramp -	347	U16	0	1	-	-	R	QD	R
Acc. counter-clockwise +							1	H	
Dec. clockwise									
Other states							0	L	
SPEED REGULAT.									
Speed ref [rpm]	118	I16	-32768	32767	-	√	R	QA	R
Speed reg output [%]	236	I16	-	-	-	√	R	QA	R
Lock speed reg	322	U16	0	1	OFF (0)	√	R/W	ID	R/W
ON							1	L	
OFF							0	H	
Enable spd reg	242	I16	0	1	Enabled (1)	√	R/Z	-	-
Enabled							1		
Disabled							0		
Lock speed I	348	U16	0	1	Not act. (1)	√	R/W	ID	R/W
Actived							0	L	
Not Actived							1	H	
Aux spd fun sel	1016	U16	0	1	Speed up (0)	√	R/Z	-	-
Speed up							0		
Inertia-loss cp							1		
Prop. filter [ms]	444	U16	0	1000	0	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
SPEED REGULAT \ Spd zero logic									
Enable spd=0 l Enabled Disabled	123	U16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Enable spd=0 R Enabled Disabled	124	U16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Enable spd=0 P Enabled Disabled	125	U16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Enable lck sls Enabled Disabled	422	U16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Spd=0 P gain [%]	126	Float	0.00	100.00	10.00	√	R/W	-	-
Ref 0 level [FF]	106	U16	1	32767	10	√	R/W	-	-
Enable zero pos Enabled Disabled	890	U16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Lock zero pos ON OFF	891	U16	0	1	OFF (0)	√	R/W 1 0	ID L H	R/W
Zero pos gain [%]	892	U16	0	100	10	√	R/W	-	-
SPEED REGULAT \ Speed up									
Speed up gain [%]	445	Float	0.00	100.00	0.00	√	R/W	-	-
Speed up base [ms]	446	Float	0	16000	1000	√	R/W	-	-
Speed up filter [ms]	447	U16	0	1000	0	√	R/W	-	-
SPEED REGULAT \ Droop function									
Droop gain [%]	696	Float	0.00	100.00	0.00	√	R/W	-	-
Droop filter [ms]	697	U16	0	1000	0	√	R/W	-	-
Load comp [%]	698	I16	F	F	0	√	R/W	IA	R/W
Droop limit [FF]	700	U16	0	2 × P45	1500	√	R/W	-	-
Enable droop Enabled Disabled	699	U16	0	1	Disabled (0)	√	R/W 1 0	ID H L	R/W
SPEED REGULAT \ Inertia/loss cp									
Inertia [kg*m*m]	1014	Float	0.001	999.999	S	√	R/W	-	-
Friction [N*m]	1015	Float	0.000	99.999	S	√	R/W	-	-
Torque const [N*m/A]	1013	Float	0.01	99.99	S	√	R	-	-
Inertia c filter [ms]	1012	U16	0	1000	0	√	R/W	-	-
CURRENT REGULAT									
Current norm	267	Float	0.00	9999.99	S	-	R	-	-
Torque current	350	Float	S	S		-	R	QA	-
Flux current	351	Float	S	S		-	R	QA	-
F current ref	352	Float	S	S		-	R	QA	-
Zero torque Actived Not Actived	353	U16	0	1	Not Act. (1)	√	R/W 0 1	ID L H	R/W
FLUX REGULATION									
Flux reg mode Constant current Voltage control	469	U16	0	1	Volt.control (1)	√	R/Z 0 1	-	-
Flux reference	500	Float*	0.0	100.0	-	√	R	QA	R
Flux	234	Float*	0.00	100.00	-	√	R	QA	R
Out vlt level [%]	921	Float*	0.0	100.0	100.0	√	R/W	IA,QA	R/W
REG PARAMETERS \ Percent values \ Speed regulator									
Speed P [%]	87	Float	0.00	100.00	S	√	R/W	-	-
Speed I [%]	88	Float	0.00	100.00	S	√	R/W	-	-
REG PARAMETERS \ Percent values \ Current reg									
Current P [%]	89	Float	0.00	100.00	S	√	R/W	-	-
Current I [%]	90	Float	0.00	100.00	S	√	R/W	-	-
REG PARAMETERS \ Percent values \ Current reg\Dead time comp									
Voltage comp lim [V]	644	Float	0.1	30.0	6.0	√	R/W	-	-
Comp slope [V/A]	645	Float	0.1	50.0	13.0	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
REG PARAMETERS \ Percent values \ Flux regulator									
Flux P [%]	91	Float	0.00	100.00	S	√	R/W	-	-
Flux I [%]	92	Float	0.00	100.00	S	√	R/W	-	-
REG PARAMETERS \ Percent values \ Voltage reg									
Voltage P [%]	1022	Float	0.00	100.00	15.00	√	R/W	-	-
Voltage I [%]	902	Float	0.00	100.00	4.00	√	R/W	-	-
REG PARAMETERS \ Base values \ Speed regulator									
Speed P base [A/rpm]	93	Float	0.001	99.999	S	√	R/Z	-	-
Speed I base[A/rpm×ms]	94	Float	0.001	99.999	S	√	R/Z	-	-
REG PARAMETERS \ Base values \ Current reg									
Current P base [V/A]	95	Float	0.1	99999.9	S	√	R/Z	-	-
Current I base [V/A×ms]	96	Float	0.1	9999.9	S	√	R/Z	-	-
REG PARAMETERS \ Base values \ Flux regulator									
Flux P base [A/Vs]	97	Float	0.1	9999.9	S	√	R/Z	-	-
Flux I base [A/Vs×ms]	98	Float	0.01	999.99	S	√	R/Z	-	-
REG PARAMETERS \ Base values \ Voltage reg									
Voltage P base [Vs/V]	1023	Float	0.00001	9.99999	S	√	R/W	-	-
Voltage I base [Vs/V x s]	903	Float	0.00001	9.99999	S	√	R/W	-	-
REG PARAMETERS \ In use values									
Speed P in use [%]	99	Float	0.00	100.00	S	√	R	-	-
Speed I in use [%]	100	Float	0.00	100.00	S	√	R	-	-
CONFIGURATION									
Main commands	252	U16	0	1	Terminals (0)	√	R/Z	-	-
Terminals							0		
Digital							1		
Control mode	253	U16	0	1	Local (0)	√	R/Z	-	-
Local							0		
Bus							1		
Speed base value [FF]	45	U32***	1	16383	1500	√	R/Z	-	R
Regulation mode	321	U16	0	3	V/f control (3)	√	R/Z	-	-
Sensorless vect							0		
Self-tuning							1		
Field oriented							2		
V/f control							3		
Full load curr [A]	179	Float	0.10	999.00	S	√	R/Z	-	-
Flt_100_mf	303	I16	0	32767	S	-	R	-	R
Magn ramp time [s]	675	Float	0.01	5.00	1.00	√	R/Z	-	-
Magn boost curr [%]	413	U16	10	136	30	√	R/Z	-	-
Ok relay funct	412	I16	0	1	Drive healthy (0)	√	R/Z	-	-
Drive healthy							0		
Ready to start							1		
Switching freq	240	U16	S	S	S	√	R/Z	-	-
4 KHz							0		
8 KHz							1		
16 KHz							2		
2 KHz							3		
Qstp opt code	713	I16	-2	-1	Ramp stop (1)	√	R/Z	-	-
Ramp stop							1		
DC braking							2		
Npar displayed	1291	U16	0	65535	0	√	R/W	-	-
Pword 1 :	85	I32	00000	99999	Disabled (0)	√	W	-	-
Enabled							1		
Disabled							0		
CONFIGURATION \ Motor spd fbk									
Speed fbk sel	414	U16	0	1	Enc.1 (1)	√	R/Z	ID	R/W
Encoder 1							1	H	
Encoder 2							0	L	
Encoder 1 type	415	I16	0	1	Digital (1)	√	R/Z	-	-
Sinusoidal							0		
Digital							1		
Encoder 1 pulses	416	Float*	600	9999	1024	√	R/Z	-	R

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Enc1 supply vlt	1146	U16	0	3	5.41 V (0)	√	R/Z		
5.41 V							0		
5.68 V							1		
5.91 V							2		
6.18 V							3		
Encoder 2 pulses	169	Float*	600	9999	1024	√	R/Z	-	R
Encoder repeat	1054	U16	0	1	Encoder 1 (1)	√	R/Z	-	-
Encoder 2							0		
Encoder 1							1		
Encoder 1 state	648	U16	0	1	-	-	R	QD	R
Encoder 1 OK							1	H	
Encoder 1 NOT OK							0	L	
Encoder 2 state	651	U16	0	1	-	-	R	QD	R
Encoder 2 OK							1	H	
Encoder 2 NOT OK							0	L	
Refresh enc 1	649	U16	0	1	Disabled (0)	√	R/W	-	-
Enabled							1		
Disabled							0		
Refresh enc 2	652	U16	0	1	Disabled (0)	√	R/W	-	-
Enabled							1		
Disabled							0		
Enable ind store	911	U16	0	1	Disabled (0)	√	R/W	-	R/W
Enabled							1		
Disabled							0		
Ind store ctrl	912	U16	0	65535	0	-	R/W	-	R/W
Index storing	913	U32	0	2^{32} -1	-	-	R	-	R
CONFIGURATION \ Drive type									
Mains voltage	333	U16	S	2	400 V (1)	√	R/Z	-	-
230 V							0		
400 V							1		
460 V							2		
Ambient temp [°C]	332	U16	0	1	40°C (1)	√	R/Z	-	-
50°C (122°F)							0		
40°C (104°F)							1		
Rated drive curr	334	U16	0	16	S	-	R	-	R
7.5							0		
12.6							1		
17.7							2		
24.8							3		
33							4		
47							5		
63							6		
79							7		
93							8		
114							9		
142							10		
185							11		
210							12		
250							13		
324							14		
485							15		
580							16		
2.4							17		
4							18		
5.6							19		
9.6							20		
400							29		
39							30		
Continuous curr [A]	802	Float	S	S	S	√	R	-	-
Software version	331	Text				√	R	-	-
Drive type (AVy)	300	U16	-	-	18	-	R	-	R
CONFIGURATION \ Dimension fact									
Dim factor num	50	I32***	1	65535	1	√	R/Z	-	R
Dim factor den	51	I32***	1	2^{32} -1	1	√	R/Z	-	R
Dim factor text	52	Text			rpm	√	R/Z	-	-
CONFIGURATION \ Face value fact									
Face value num	54	I16	1	32767	1	√	R/Z	-	R
Face value den	53	I16	1	32767	1	√	R/Z	-	R

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
CONFIGURATION \ Prog alarms \ Undervoltage									
Latch	357	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
OK relay open	358	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
Restart time [ms]	359	U16	0	65535	1000	√	R/W	-	-
N of attempts	360	U16	0	100	1	√	R/W	-	-
CONFIGURATION \ Prog alarms \ Overvoltage									
Latch	361	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	362	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Heatsink sensor									
Activity	368	U16	1	5	Disable drive (2)	√	R/Z	-	-
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Latch	369	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	370	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
Heatsink tmp thr [*C]	1294	U16	0	255	50	√	R/W	-	-
HS tmp thr state	1295	U16	0	1	0	-	-	-	R
CONFIGURATION \ Prog alarms \ Heatsink ot									
Ok relay open	1152	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Intake air ot									
Activity	1140	U16	1	5	Disable drive (2)	√	R/Z	-	-
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Latch	1141	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	1142	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Regulation ot									
Activity	1148	U16	0	1	Warning (1)	√	R/Z	-	-
Ignore							0		
Warning							1		
Latch	1149	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	1150	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Module overtemp									
Ok relay open	1151	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Overtemp motor									
Activity	365	U16	1	5	Disable drive (2)	√	R/Z	-	-
Warning							1		
Disable drive							2		

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Latch	366	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
Ok relay open	367	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ External fault									
Activity	354	U16	1	5	Disable drive (2)	√	R/Z	-	-
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Latch	355	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
OK relay open	356	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Overcurrent									
Latch	363	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
OK relay open	364	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Output stages									
Latch	210	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
OK relay open	211	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Opt2 failure									
Activity	639	U16	2	5	Disabled drive (2)	√	R/Z	-	-
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
OK relay open	640	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Bus loss									
Activity	634	U16	1	5	Disabled drive (2)	√	R/Z	-	-
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
Latch	633	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
OK relay open	635	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
Hold off time [ms]	636	U16	0	10000	0	√	R/W	-	-
Restart time [ms]	637	U16	0	10000	0	√	R/W	-	-
CONFIGURATION \ Prog alarms \ Hw opt1 failure									
Activity	386	U16	1	5	Disabled drive (2)	√	R/Z	-	-
Warning							1		

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
OK relay open	387	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Prog alarms \ Enable seq err									
Activity	728	U16	0	2	Disabled drive (2)	√	R/Z	-	-
Ignore							0		
Disable drive							2		
Latch	729	U16	0	1	ON (1)	√	R/Z	-	-
ON							1		
OFF							0		
OK relay open	730	I16	0	1	ON	√	R/W	-	-
ON					(1)		1		
OFF							0		
CONFIGURATION \ Prog alarms \ BU overload									
Activity	737	U16	1	5	Disabled drive (2)	√	R/Z	-	-
Warning							1		
Disable drive							2		
Quick stop							3		
Normal stop							4		
Curr lim stop							5		
OK relay open	738	I16	0	1	ON (1)	√	R/W	-	-
ON							1		
OFF							0		
CONFIGURATION \ Set serial comm									
Device address	319	U16	0	127	0	√	R/Z	-	-
Ser answer delay [ms]	408	U16	0	900	0	√	R/W	-	-
Ser protocol sel	323	U16	0	2	0	√	R/W	-	-
Slink3							0		
Modbus-RTU							1		
J Bus							2		
Ser baudrate sel	326	U16	0	4	1	√	R/W	-	-
19200							0		
19600							1		
4800							2		
2400							3		
1200							4		
MB swap float	1292	U16	0	1	0	√	R/W	-	-
Disabled							0		
Enabled							1		
I/O CONFIG \ Analog outputs \ Analog output 1									
Select output 1	66	U16	0	88	Actual speed (8)	√	R/Z	-	-
OFF							0		
Speed ref 1							1		
Speed ref 2							2		
Ramp ref 1							3		
Ramp ref 2							4		
Ramp ref							5		
Speed ref							6		
Ramp output							7		
Actual spd (rpm)							8		
T current ref 1							9		
T current ref 2							10		
T current ref							11		
F current ref							12		
Flux current							13		
Torque current							14		
Speed reg out							15		
Motor current							16		
Current U							17		
Current V							18		
Current W							19		

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Output voltage							20		
Voltage U							21		
Voltage V							22		
DC link voltage							23		
Analog input 1							24		
Analog input 2							25		
Analog input 3							26		
Flux							27		
Active power							28		
Torque							29		
Rr adap output							30		
Pad 0							31		
Pad 1							32		
Pad 4							33		
Pad 5							34		
Flux reference							35		
Pad 6							38		
PID output							39		
Feed fwd power							78		
Out vlt level							79		
Flux level							80		
F act spd (rpm)							81		
F T curr (%)							82		
Spd draw out							84		
PL next factor							87		
PL active limit							88		
Scale output 1	62	Float	-10.000	10.000	1.000	√	R/W	-	-
I/O CONFIG \ Analog outputs \ Analog output 2									
Select output 2 (Select like output 1)	67	U16	0	88	T current (14)	√	R/Z	-	-
Scale output 2	63	Float	-10.000	10.000	1.000	√	R/W	-	-
I/O CONFIG \ Analog outputs \ Analog output 3									
Select output 3 (Select like output 1)	68	U16	0	88	Current U (17)	√	R/Z	-	-
Scale output 3	64	Float	-10.000	10.000	1.000	√	R/W	-	-
I/O CONFIG \ Analog outputs \ Analog output 4									
Select output 4 (Select like output 1)	69	U16	0	88	Motor current (16)	√	R/Z	-	-
Scale output 4	65	Float	-10.000	10.000	1.000	√	R/W	-	-
I/O CONFIG \ Analog inputs \ Analog input 1									
Select input 1	70	U16	0	28	Ramp ref 1 (4)	√	R/Z	-	-
OFF							0		
Jog reference							1		
Speed ref 1							2		
Speed ref 2							3		
Ramp ref 1							4		
Ramp ref 2							5		
T current ref 1							6		
T current ref 2							7		
Adap reference							8		
T current lim							9		
T current lim +							10		
T current lim -							11		
Pad 0							12		
Pad 1							13		
Pad 2							14		
Pad 3							15		
Load comp							19		
PID offset 0							21		
PI central v3							22		
PID feed-back							23		
V/f flux level							24		
Flux level							25		
Out vlt level							26		
Speed ratio							28		

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
An in 1 target	295	U16	0	1	Assign. (0)	√	R/W	ID	R/W
Assigned							0	L	
Not assigned							1	H	
Input 1 type	71	U16	0	2	± 10 V (0)	√	R/Z	-	-
-10V ... + 10 V							0		
0...20 mA, 0...10 V							1		
4...20 mA							2		
Input 1 sign	389	U16	0	1	Positive (1)	√	R/W	-	R/W
Positive							1		
Negative							0		
Scale input 1	72	Float	-10000	10.000	1.000	√	R/W	-	-
Tune value inp 1	73	Float	0.1	10.000	1.000	√	R/W	-	-
Auto tune inp 1	259	U16	0	65535	-	√	C	-	-
Auto tune							1		
Input 1 filter [ms]	792	U16	0	1000	0	√	R/W	-	-
Input 1 compare	1042	I16	-10000	10000	0	√	R/W	-	-
Input 1 cp error	1043	U16	0	10000	0	√	R/W	-	-
Input 1 cp delay	1044	U16	0	65000	0	√	R/W	-	-
Input 1 cp match	1045	U16	0	1	-	-	R	QD	R
Input 1 not thr.val.							0	L	
Input 1=thr.val							1	H	
Offset input 1	74	I16	-32768	32767	0	√	R/W	-	-
I/O CONFIG \ Analog inputs \ Analog input 2									
Select input 2	75	U16	0	28	OFF (0)	√	R/Z	-	-
(Select like Input 1)									
An in 2 target	296	U16	0	1	Assign.(0)	√	R/W	ID	R/W
Assigned							0	L	
Not assigned							1	H	
Input 2 type	76	U16	0	2	± 10 V (0)	√	R/Z	-	-
-10V ... + 10 V							0		
0...20 mA, 0...10 V							1		
4...20 mA							2		
Input 2 sign	390	U16	0	1	Positive (1)	√	R/W	-	R/W
Positive							1		
Negative							0		
Scale input 2	77	Float	-10000	10.000	1.000	√	R/W	-	-
Tune value inp 2	78	Float	0.1	10.000	1.000	√	R/W	-	-
Auto tune inp 2	260	U16	0	65535	-	√	C	-	-
Auto tune							1		
Offset input 2	79	I16	-32768	32767	0	√	R/W	-	-
I/O CONFIG \ Analog inputs \ Analog input 3									
Select input 3	80	U16	0	28	OFF (0)	√	R/Z	-	-
(Select like Input 1)									
An in 3 target	297	U16	0	1	Assign. (0)	√	R/W	ID	R/W
Assigned							0	L	
Not assigned							1	H	
Input 3 type	81	U16	0	2	± 10 V (0)	√	R/Z	-	-
-10V ... + 10 V							0		
0...20 mA, 0...10 V							1		
4...20 mA							2		
Input 3 sign	391	U16	0	1	Positive (1)	√	R/W	-	R/W
Positive							1		
Negative							0		
Scale input 3	82	Float	-10000	10.000	1.000	√	R/W	-	-
Tune value inp 3	83	Float	0.1	10.000	1.000	√	R/W	-	-
Auto tune inp 3	261	U16	0	65535	-	√	C	-	-
Auto tune							1		
Offset input 3	84	I16	-32768	32767	0	√	R/W	-	-
I/O CONFIG \ Digital outputs									
Digital output 1	145	U16	0	63	Ramp + (8)	√	R/Z	-	-
OFF							0		
Speed zero thr							1		
Spd threshold							2		
Set speed							3		
Curr limit state							4		

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Drive ready							5		
Overld available							6		
Ramp +							8		
Ramp -							9		
Speed limited							10		
Undervoltage							11		
Overvoltage							12		
Heatsink sensor							13		
Overcurrent							14		
Overtemp motor							15		
External fault							16		
Failure supply							17		
Pad A bit							18		
Pad B bit							19		
Virt dig input							20		
Speed fbk loss							25		
Bus loss							26		
Output stages							27		
Hw opt 1 failure							28		
Opt 2 failure							29		
Encoder 1 state							30		
Encoder 2 state							31		
Ovld mot state							32		
Enable seq err							35		
BU overload							36		
Diameter calc st							38		
Mot setup state							46		
Input 1 cp match							49		
Overload 200%							51		
PL stop active							52		
PL next active							53		
PL time-out sig							54		
Regulation ot							55		
Module overtemp.							56		
Heatsink ot							57		
Intake air ot							62		
Heatsink tmp thr							63		
Digital output 2 (Select like output 1)	146	U16	0	63	Ramp - (9)	√	R/Z	-	
Digital output 3 (Select like output 1)	147	U16	0	63	Spd threshold (2)	√	R/Z	-	
Digital output 4 (Select like output 1)	148	U16	0	63	Overld available (6)	√	R/Z	-	-
Digital output 5 (Select like output 1)	149	U16	0	63	Curr limit state (4)	√	R/Z	-	-
Digital output 6 (Select like output 1)	150	U16	0	63	Over-voltage (12)	√	R/Z	-	-
Digital output 7 (Select like output 1)	151	U16	0	63	Under-voltage (11)	√	R/Z	-	-
Digital output 8 (Select like output 1)	152	U16	0	63	Over-current (14)	√	R/Z	-	-
Relay 2 (Select like output 1)	629	U16	0	63	Speed zero thr (1)	√	R/Z	83-85	-
I/O CONFIG \ Digital inputs									
Digital input 1	137	U16	0	67	OFF (0)	√	R/Z	-	-
OFF							0		
Motor pot reset							1		
Motor pot up							2		
Motor pot down							3		
Motor pot sign +							4		
Motor pot sign -							5		
Jog +							6		
Jog -							7		
Failure reset							8		

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Torque reduct							9		
Ramp out = 0							10		
Ramp in = 0							11		
Freeze ramp							12		
Lock speed reg							13		
Lock speed I							14		
Auto capture							15		
Input 1 sign +							16		
Input 1 sign -							17		
Input 2 sign +							18		
Input 2 sign -							19		
Input 3 sign +							20		
Input 3 sign –							21		
Zero torque							22		
Speed sel 0							23		
Speed sel 1							24		
Speed sel 2							25		
Ramp sel 0							26		
Ramp sel 1							27		
Speed fbk sel							28		
PAD A bit 0							32		
PAD A bit 1							33		
PAD A bit 2							34		
PAD A bit 3							35		
PAD A bit 4							36		
PAD A bit 5							37		
PAD A bit 6							38		
PAD A bit 7							39		
Fwd sign							44		
Rev sign							45		
An in 1 target							46		
An in 2 target							47		
An in 3 target							48		
Enable droop							49		
Quick stop							51		
Enable PI PID							52		
Enable PD PID							53		
PI int freeze PID							54		
PID offs. sel							55		
PI central v s0							56		
PI central v s1							57		
Diameter calc							58		
Lock zero pos							59		
Lock save eng							60		
Mot setup sel 0							62		
PL mains status							66		
PL time-out ack							67		
Digital input 2 (Select like input 1)	138	U16	0	67	OFF (0)	√	R/Z	-	-
Digital input 3 (Select like input 1)	139	U16	0	67	OFF (0)	√	R/Z	-	-
Digital input 4 (Select like input 1)	140	U16	0	67	OFF (0)	√	R/Z	-	-
Digital input 5 (Select like input 1)	141	U16	0	67	OFF (0)	√	R/Z	-	-
Digital input 6 (Select like input 1)	142	U16	0	67	OFF (0)	√	R/Z	-	-
Digital input 7 (Select like input 1)	143	U16	0	67	OFF (0)	√	R/Z	-	-
Digital input 8 (Select like input 1)	144	U16	0	67	OFF (0)	√	R/Z	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
I/O CONFIG \ Encoder inputs									
Select enc 1	1020	U16	0	5	OFF (0)	√	R/Z	-	-
OFF							0		
Speed ref 1							2		
Speed ref 2							3		
Ramp ref 1							4		
Ramp ref 2							5		
Select enc 2	1021	U16	0	5	OFF (0)	√	R/Z	-	-
OFF							0		
Speed ref 1							2		
Speed ref 2							3		
Ramp ref 1							4		
Ramp ref 2							5		
Encoder 1 type	415	I16	0	1	Digital (1)	√	R/Z	-	-
Sinusoidal							0		
Digital							1		
Encoder 1 pulses	416	Float*	600	9999	1024	√	R/Z	-	R
Encoder 2 pulses	169	Float*	600	9999	1024	√	R/Z	-	R
Refresh enc 1	649	U16	0	1	Disabled (0)	√	R/W	-	-
Enabled							1		
Disabled							0		
Refresh enc 2	652	U16	0	1	Disabled (0)	√	R/W	-	-
Enabled							1		
Disabled							0		
ADD SPEED FUNCT									
Auto capture	388	U16	0	1	OFF (0)	√	R/W	ID	-
ON							1	H	
OFF							0	L	
ADD SPEED FUNCT \ Adap spd reg									
Enable spd adap	181	U16	0	1	Disabled (0)	√	R/Z	-	-
Enabled							1		
Disabled							0		
Sel adap type	182	U16	0	1	Speed (0)	√	R/Z	-	-
Speed							0		
Adap reference							1		
Adap reference [FF]	183	I16	-32768	32767	1000	√	R/W	IA	R/W
Adap speed 1 [%]	184	Float	0.0	200.0	20.3	√	R/W	-	-
Adap speed 2 [%]	185	Float	0.0	200.0	40.7	√	R/W	-	-
Adap joint 1 [%]	186	Float	0.0	200.0	6.1	√	R/W	-	-
Adap joint 2 [%]	187	Float	0.0	200.0	6.1	√	R/W	-	-
Adap P gain 1 [%]	188	Float	0.00	100.00	10.00	√	R/W	-	-
Adap I gain 1 [%]	189	Float	0.00	100.00	1.00	√	R/W	-	-
Adap P gain 2 [%]	190	Float	0.00	100.00	10.00	√	R/W	-	-
Adap I gain 2 [%]	191	Float	0.00	100.00	1.00	√	R/W	-	-
Adap P gain 3 [%]	192	Float	0.00	100.00	10.00	√	R/W	-	-
Adap I gain 3 [%]	193	Float	0.00	100.00	1.00	√	R/W	-	-
ADD SPEED FUNCT \ Speed control									
Spd threshold + [FF]	101	U16	1	32767	1000	√	R/W	-	-
Spd threshold - [FF]	102	U16	1	32767	1000	√	R/W	-	-
Threshold delay [ms]	103	U16	0	65535	100	√	R/W	-	-
Spd threshold	393	U16	0	1		-	R	QD	R
Speed exceeded							0	L	
Speed not exceeded							1	H	
Set error [FF]	104	U16	1	32767	100	√	R/W	-	-
Set delay [ms]	105	U16	0	65535	100	√	R/W	-	-
Set speed	394	U16	0	1		-	R	QD	R
Speed not ref. val.							0	L	
Speed = ref. val.							1	H	
ADD SPEED FUNCT \ Speed zero									
Speed zero level [FF]	107	U16	1	32767	10	√	R/W	-	-
Speed zero delay [ms]	108	U16	0	65535	100	√	R/W	-	-
Spd zero thr	395	U16	0	1		-	R	QD	R
Drive not rotating							0	L	
Drive rotating							1	H	

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
FUNCTIONS \ Motor pot									
Enab motor pot Enabled Disabled	246	I16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Motor pot oper	-					√	-	-	-
Motor pot sign Positive Negative	248	I16	0	1	Positive (1)		R/W 1 0	ID	-
Motor pot reset	249	U16	0	65535		√	Z/C	ID H=reset	-
Motor pot up No acceleration Acceleration	396	U16	0	1	No acc. (0)	-	R/W 0 1	ID L H	R/W
Motor pot down No deceleration Deceleration	397	U16	0	1	No dec. (0)	-	R/W 0 1	ID L H	R/W
FUNCTIONS \ Jog function									
Enable jog Enabled Disabled	244	I16	0	1	Enabled (1)	√	R/Z 1 0	-	-
Jog operation	-					√	-	-	-
Jog selection Speed input Ramp input	375	U16	0	1	Spd inp. (0)	√	R/Z 0 1	-	-
Jog reference [FF]	266	I16	0	32767	100	√	R/W	IA	-
Jog + No jog forward Forward jog	398	U16	0	1	No jog+ (0)	-	R/W 0 1	ID L H	R/W
Jog - No backward jog Backward jog	399	U16	0	1	No jog- (0)	-	R/W 0 1	ID L H	R/W
FUNCTIONS \ Multi speed fct									
Enab multi spd Enabled Disabled	153	I16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Multi speed sel	208	U16	0	7	0	√	R/W	-	R/W
Multi speed 1 [FF]	154	I16	-32768	32767	0	√	R/W	-	-
Multi speed 2 [FF]	155	I16	-32768	32767	0	√	R/W	-	-
Multi speed 3 [FF]	156	I16	-32768	32767	0	√	R/W	-	-
Multi speed 4 [FF]	157	I16	-32768	32767	0	√	R/W	-	-
Multi speed 5 [FF]	158	I16	-32768	32767	0	√	R/W	-	-
Multi speed 6 [FF]	159	I16	-32768	32767	0	√	R/W	-	-
Multi speed 7 [FF]	160	I16	-32768	32767	0	√	R/W	-	-
Speed sel 0 Value 2^0 not selected Value 2^0 selected	400	U16	0	1	Not sel. (0)	-	R/W 0 1	ID L H	R/W
Speed sel 1 Value 2^1 not selected Value 2^1 selected	401	U16	0	1	Not sel. (0)	-	R/W 0 1	ID L H	R/W
Speed sel 2 Value 2^2 not selected Value 2^2 selected	402	U16	0	1	Not sel. (0)	-	R/W 0 1	ID L H	R/W
FUNCTIONS \ Multi ramp fct									
Enab multi rmp Enabled Disabled	243	I16	0	1	Disabled (0)	√	R/Z 1 0	-	-
Multi ramp sel	202	U16	0	3	0	√	R/W	-	R/W
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Acceleration 0									
Acc delta speed0 [FF]	659	U32	0	2^{32}-1	100	√	R/W	-	-
Acc delta time 0 [s]	660	U16	0	65535	1	√	R/W	-	-
S acc t const 0 [ms]	665	Float	100	3000	500	√	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 0 \ Deceleration 0									
Dec delta speed0 [FF]	661	U32	0	2^{32}-1	100	√	R/W	-	-
Dec delta time 0 [s]	662	U16	0	65535	1	√	R/W	-	-
S dec t const 0 [ms]	666	Float	100	3000	500	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
FUNCTIONS \ Multi ramp fct \ Ramp 1 \ Acceleration 1									
Acc delta speed1 [FF]	23	U32	0	2^{32}-1	100	√	R/W	-	-
Acc delta time 1 [s]	24	U16	0	65535	1	√	R/W	-	-
S acc t const 1 [ms]	667	Float	100	3000	500	√	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 1 \ Deceleration 1									
Dec delta speed1 [FF]	31	U32	0	2^{32}-1	100	√	R/W	-	-
Dec delta time 1 [s]	32	U16	0	65535	1	√	R/W	-	-
S dec t const 1 [ms]	668	Float	100	3000	500	√	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 2 \ Acceleration 2									
Acc delta speed2 [FF]	25	U32	0	2^{32}-1	100	√	R/W	-	-
Acc delta time 2 [s]	26	U16	0	65535	1	√	R/W	-	-
S acc t const 2 [ms]	669	Float	100	3000	500	√	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 2 \ Deceleration 2									
Dec delta speed2 [FF]	33	U32	0	2^{32}-1	100	√	R/W	-	-
Dec delta time 2 [s]	34	U16	0	65535	1	√	R/W	-	-
S dec t const 2 [ms]	670	Float	100	3000	500	√	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 3 \ Acceleration 3									
Acc delta speed3 [FF]	27	U32	0	2^{32}-1	100	√	R/W	-	-
Acc delta time 3 [s]	28	U16	0	65535	1	√	R/W	-	-
S acc t const 3 [ms]	671	Float	100	3000	500	√	R/W	-	-
FUNCTIONS \ Multi ramp fct \ Ramp 3 \ Deceleration 3									
Dec delta speed3 [FF]	35	U32	0	2^{32}-1	100	√	R/W	-	-
Dec delta time 3 [s]	36	U16	0	65535	1	√	R/W	-	-
S dec t const 3 [ms]	672	Float	100	3000	500	√	R/W	-	-
Ramp sel 0	403	U16	0	1	Not sel. (0)	-	R/W	ID	R/W
Value 2^0 not selected							0	L	
Value 2^0 selected							1	H	
Ramp sel 1	404	U16	0	1	Not sel. (0)	-	R/W	ID	R/W
Value 2^1 not selected							0	L	
Value 2^1 selected							1	H	
FUNCTIONS \ Stop control									
Stop mode	626	U16	0	3	1	√	R/Z	-	-
OFF							0		
Stop & Speed 0							1		
Fast stp & Spd 0							2		
Fst / stp & spd 0							3		
Spd 0 trip delay [ms]	627	U16	0	40000	0	√	R/W	-	-
Jog stop control	630	U16	0	1	OFF (0)	√	R/Z	-	-
ON							1		
OFF							0		
FUNCTIONS \ Speed draw									
Speed ratio	1017	I16	0	32767	10000	√	R/W	IA	R/W
Spd draw out (d)	1018	I16	-32767	32767	-	√	R	QA	R
Spd draw out (%)	1019	Float	-200.0	+200.0	-	√	R	-	-
FUNCTIONS \ Motor setup									
Mot setup sel	943	U16	0	1	Setup 0 (0)	√	R/Z	-	R/W
Setup 0							0		
Setup 1							1		
Mot setup sel 0	940	U16	0	1	Not sel (0)	-	R/Z	ID	R/W
Value 2° not sel							0	L	
Value 2° sel							1	H	
Copy mot setup	941	U16	0	1	Setup 0 (0)	√	R/Z	-	-
Setup 0							0		
Setup 1							1		
Mot setup state	944	U16	0	1	0	-	R	QD	R
Not running							0	L	
Running							1	H	
Actual mot setup	942	U16	0	1	Setup 0 (0)	√	R	-	R
Setup 0							0		
Setup 1							1		
FUNCTIONS \ Overload contr \ Ovld mot contr									
Motor cont curr [%]	656	U16	50	100	100	√	R/W	-	-
Trip time 50% [s]	657	U16	0	120	60	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Ovld mot state	658	U16	0	1	Not ovrl (1)	-	R	QD	R
Overload							0	L	
Not overload							1	H	
FUNCTIONS \ Overload contr \ Ovld drv contr									
I_sqrt_t_accum [%]	655	U16	0	100	0	√	R	-	R
Ovld Available	406	U16	0	1	-	-	R	QD	R
Overload not possible							0	L	
Overload possible							1	H	
Overload 200%	1139	U16	0	1	-	-	R	QD	R
Overload not possible							0	L	
Overload possible							1	H	
FUNCTIONS \ Brake unit									
Enable BU	736	U16	0	1	Disabled (0)	√	R/W	-	-
Enabled							1		
Disabled							0		
BU ovld time [s]	740	Float	0.10	50.00	S	√	R/W		
BU duty cycle [%]	741	U16	1	75	S	√	R/W	-	-
BU DC vlt [V]	801	U16	0	2	1	√	R/W	-	-
230							0		
400							1		
460							2		
FUNCTIONS \ Pwr loss stop f									
PL stop enable	1083	U16	0	2	0	√	R/W	-	-
Disabled							0		
Enabled as Mst							1		
Enabled as Slv							2		
PL stop t limit [%]	1082	U16	0	F	100	√	R/W	-	-
PL stop acc [rpm/s]	1080	U32	0	99999999	100	√	R/W	-	-
PL stop dec [rpm/s]	1081	U32	0	10000	10000	√	R/W	-	-
PL stop vdc ref [V]	1084	U16	0	800	646	√	R/W	-	-
PL time-out [s]	1087	U16	0	65535	10	√	R/W	-	-
PL stop P Gain [%]	1086	Float	0.00	100.00	5.00	√	R/W	-	-
PL stop I Gain [%]	1085	Float	0.00	100.00	0.30	√	R/W	-	-
PL stop active	1088	U16	0	1	Not active (0)	√	R	-	R
Not active							0		
Active							1		
PL active limit [%]	1089	U16	-	-	-	√	R	-	-
PL next active	1090	U16	0	1	Not active (0)	√	R	-	R
Not active							0		
Active							1		
PL next factor	1091	I16	0	32767	10000	√	R	-	R
PL time-out sig	1093	U16	0	1	Not active (0)	√	R	-	R
Not active							0		
Active							1		
PL time-out ack	1094	U16	0	1	Not acknowledged	√	R/W	-	R/W
Not acknowledged					(0)		0		
Acknowledged							1		
PL mains status	1092	U16	0	1	Not ok (0)	√	R/W	-	R/W
Not ok							0		
Ok							1		
FUNCTIONS \ VDC control f									
VDC Ctrl P Gain [%]	1289	Float	0.00	100	10	√	R/W	-	-
VDC Ctrl I Gain [%]	1290	Float	0.00	100	10	√	R/W	-	-
SPEC FUNCTIONS \ Test generator									
Gen access	58	U16	0	4	Not conn. (0)	√	R/Z	-	-
Not connected							0		
F current ref							1		
T current ref							2		
Flux ref							3		
Ramp ref							4		
Gen frequency [Hz]	59	Float	0.1	62.5	1.0	√	R/W	-	-
Gen amplitude [%]	60	Float	0.00	200.00	0.00	√	R/W	-	-
Gen offset [%]	61	Float	-200.00	200.00	0.00	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
SPEC FUNCTIONS									
Enable rr adap	435	U16	0	1	Disabled (0)	√	R/W	-	-
Enabled							1		
Disabled							0		
Save parameters	256	U16	0	65535		√	C	-	-
Load default	258	U16	0	65535		√	Z/C	-	-
Life time [h.min]	235	Float	0.00	65535.00		√	R	-	-
Failure register	-					√	R	-	-
Failure text	327	Text				-	R	-	-
Failure hour	328	U16	0	65535		-	R	-	-
Failure min	329	U16	0	59		-	R	-	-
Failure code	417	U16	0	65535		-	R	-	-
No failure							0000h		
Overcurrent							2300h		
Overvoltage							3210h		
Undervoltage							3220h		
Heatsink sensor							4210h		
Heatsink ot							4211h		
Regulation ot							4212h		
Module overtemp							4213h		
Intake air ot							4214h		
Overtemp motor							4310h		
Failure supply							5100h		
Curr fbk loss							5210h		
Output stages							5410h		
DSP error							6110h		
Interrupt error							6120h		
BU overload							7110h		
Speed fbk loss							7301h		
Opt2							7400h		
Hw Opt 1failure							7510h		
Bus loss							8110h		
External fault							9000h		
Enable seq err							9009h		
Pointer	330	U16	1	10	10	-	R/W	-	-
Failure reset	262	U16	0	65535		√	Z/C	ID H=reset	W
Failure reg del	263	U16	0	65535		√	C	-	-
SPEC FUNCTIONS \ DC braking									
DC braking mode	904	U16	0	1	0	√	R/Z	-	-
Enabled							1		
Disabled							0		
Brk time @ stop [ms]	905	U16	0	30000	1000	√	R/W	-	-
DC braking curr [%]	717	U16	0	100	50	√	R/W	-	-
DC braking delay [ms]	716	U16	0	65535	500	√	R/W	-	-
SPEC FUNCTIONS \ Links \ Link 1									
Source	484	U16	0	65535	0	√	R/W	-	-
Destination	485	U16	0	65535	0	√	R/W	-	-
Mul.Gain	486	Float	-10000	10000	1	√	R/W	-	-
Div.Gain	487	Float	-10000	10000	1	√	R/W	-	-
Input max	488	Float	-2^{31}	$2^{31}-1$	0	√	R/W	-	-
Input min	489	Float	-2^{31}	$2^{31}-1$	0	√	R/W	-	-
Input offset	490	Float	-2^{31}	$2^{31}-1$	0	√	R/W	-	-
Output offset	491	Float	-2^{31}	$2^{31}-1$	0	√	R/W	-	-
Input absolute	492	U16	0	1	OFF (0)	√	R/W	-	-
ON							1		
OFF							0		
SPEC FUNCTIONS \ Links \ Link 2									
Source	553	U16	0	65535	0	√	R/W	-	-
Destination	554	U16	0	65535	0	√	R/W	-	-
Mul.Gain	555	Float	-10000	10000	1	√	R/W	-	-
Div.Gain	556	Float	-10000	10000	1	√	R/W	-	-
Input max	557	Float	-2^{31}	$2^{31}-1$	0	√	R/W	-	-
Input min	558	Float	-2^{31}	$2^{31}-1$	0	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Input offset	559	Float	-2^{31}	2^{31} -1	0	√	R/W	-	-
Output offset	560	Float	-2^{31}	2^{31} -1	0	√	R/W	-	-
Input absolute ON OFF	561	U16	0	1	OFF (0)	√	R/W 1 0	-	-
SPEC FUNCTIONS \ Pad Parameters									
Pad 0	503	I16	-32768	32767	0	√	R/W	IA, QA	R/W
Pad 1	504	I16	-32768	32767	0	√	R/W	IA, QA	R/W
Pad 2	505	I16	-32768	32767	0	√	R/W	IA	R/W
Pad 3	506	I16	-32768	32767	0	√	R/W	IA	R/W
Pad 4	507	I16	-32768	32767	0	√	R/W	QA	R/W
Pad 5	508	I16	-32768	32767	0	√	R/W	QA	R/W
Pad 6	509	I16	-32768	32767	0	√	R/W	QA	R/W
Pad 7	510	I16	-32768	32767	0	√	R/W	-	R/W
Pad 8	511	I16	-32768	32767	0	√	R/W	-	R/W
Pad 9	512	I16	-32768	32767	0	√	R/W	-	R/W
Pad 10	513	I16	-32768	32767	0	√	R/W	-	R/W
Pad 11	514	I16	-32768	32767	0	√	R/W	-	R/W
Pad 12	515	I16	-32768	32767	0	√	R/W	-	R/W
Pad 13	516	I16	-32768	32767	0	√	R/W	-	R/W
Pad 14	517	I16	-32768	32767	0	√	R/W	-	R/W
Pad 15	518	I16	-32768	32767	0	√	R/W	-	R/W
Bitword Pad A	519	U16	0	65535	0	√	R/W	ID*, QD*	R/W
Pad A Bit 0	520	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 1	521	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 2	522	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 3	523	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 4	524	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 5	525	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 6	526	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 7	527	U16	0	1	0	-	R/W	ID, QD	R/W
Pad A Bit 8	528	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 9	529	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 10	530	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 11	531	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 12	532	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 13	533	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 14	534	U16	0	1	0	-	R/W	QD*	-
Pad A Bit 15	535	U16	0	1	0	-	R/W	QD*	-
Bitword Pad B	536	U16	0	65535	0	√	R/W	QD*	R/W
Pad B Bit 0	537	U16	0	1	0	-	R/W	QD	R
Pad B Bit 1	538	U16	0	1	0	-	R/W	QD	R
Pad B Bit 2	539	U16	0	1	0	-	R/W	QD	R
Pad B Bit 3	540	U16	0	1	0	-	R/W	QD	R
Pad B Bit 4	541	U16	0	1	0	-	R/W	QD	R
Pad B Bit 5	542	U16	0	1	0	-	R/W	QD	R
Pad B Bit 6	543	U16	0	1	0	-	R/W	QD	R
Pad B Bit 7	544	U16	0	1	0	-	R/W	QD	R
Pad B Bit 8	545	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 9	546	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 10	547	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 11	548	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 12	549	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 13	550	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 14	551	U16	0	1	0	-	R/W	QD*	-
Pad B Bit 15	552	U16	0	1	0	-	R/W	QD*	-
OPTIONS \ Option 1									
SBI enable Disabled Enabled	1293	U16	0	1	0	√	R/W 0 1	-	-
Menu	Accessible only with optional Field bus card								
OPTIONS \ Option 1\ PDC config \ PDC inputs									
Pdc in 0	1095	U16	0	65535	0	√	R/W	-	-

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
Pdc in 1	1096	U16	0	65535	0	√	R/W	-	-
Pdc in 2	1097	U16	0	65535	0	√	R/W	-	-
Pdc in 3	1098	U16	0	65535	0	√	R/W	-	-
Pdc in 4	1099	U16	0	65535	0	√	R/W	-	-
Pdc in 5	1100	U16	0	65535	0	√	R/W	-	-
OPTIONS \ Option 1\ PDC config \ PDC outputs									
Pdc out 0	1101	U16	0	65535	0	√	R/W	-	-
Pdc out 1	1102	U16	0	65535	0	√	R/W	-	-
Pdc out 2	1103	U16	0	65535	0	√	R/W	-	-
Pdc out 3	1104	U16	0	65535	0	√	R/W	-	-
Pdc out 4	1105	U16	0	65535	0	√	R/W	-	-
Pdc out 5	1106	U16	0	65535	0	√	R/W	-	-
OPTIONS \ Option 1\ PDC config \ Virt dig in									
Virt dig in 0	1107	U16	0	65535	0	√	R/W	-	-
Virt dig in 1	1108	U16	0	65535	0	√	R/W	-	-
Virt dig in 2	1109	U16	0	65535	0	√	R/W	-	-
Virt dig in 3	1110	U16	0	65535	0	√	R/W	-	-
Virt dig in 4	1111	U16	0	65535	0	√	R/W	-	-
Virt dig in 5	1112	U16	0	65535	0	√	R/W	-	-
Virt dig in 6	1113	U16	0	65535	0	√	R/W	-	-
Virt dig in 7	1114	U16	0	65535	0	√	R/W	-	-
Virt dig in 8	1115	U16	0	65535	0	√	R/W	-	-
Virt dig in 9	1116	U16	0	65535	0	√	R/W	-	-
Virt dig in 10	1117	U16	0	65535	0	√	R/W	-	-
Virt dig in 11	1118	U16	0	65535	0	√	R/W	-	-
Virt dig in 12	1119	U16	0	65535	0	√	R/W	-	-
Virt dig in 13	1120	U16	0	65535	0	√	R/W	-	-
Virt dig in 14	1121	U16	0	65535	0	√	R/W	-	-
Virt dig in 15	1122	U16	0	65535	0	√	R/W	-	-
OPTIONS \ Option 1\ PDC config \ Virt dig out									
Virt dig out 0	1123	U16	0	65535	0	√	R/W	-	-
Virt dig out 1	1124	U16	0	65535	0	√	R/W	-	-
Virt dig out 2	1125	U16	0	65535	0	√	R/W	-	-
Virt dig out 3	1126	U16	0	65535	0	√	R/W	-	-
Virt dig out 4	1127	U16	0	65535	0	√	R/W	-	-
Virt dig out 5	1128	U16	0	65535	0	√	R/W	-	-
Virt dig out 6	1129	U16	0	65535	0	√	R/W	-	-
Virt dig out 7	1130	U16	0	65535	0	√	R/W	-	-
Virt dig out 8	1131	U16	0	65535	0	√	R/W	-	-
Virt dig out 9	1132	U16	0	65535	0	√	R/W	-	-
Virt dig out 10	1133	U16	0	65535	0	√	R/W	-	-
Virt dig out 11	1134	U16	0	65535	0	√	R/W	-	-
Virt dig out 12	1135	U16	0	65535	0	√	R/W	-	-
Virt dig out 13	1136	U16	0	65535	0	√	R/W	-	-
Virt dig out 14	1137	U16	0	65535	0	√	R/W	-	-
Virt dig out 15	1138	U16	0	65535	0	√	R/W	-	-
OPTIONS \ Option 2									
Menu	Accessible only with optional DGF card (See DGF card user manual)								
Enable OPT2 Enabled Disabled	425	U16	0	1	Disabled (0)	√	R/Z 1 0		
OPTIONS \ PID									
Enable PI PID Enabled Disabled	769	U16	0	1	Disabled (0)	√	R/W 1 0	ID	R/W
Enable PD PID Enabled Disabled	770	U16	0	1	Disabled (0)	√	R/W 1 0	ID	R/W
OPTIONS \ PID \ PID source									
PID source	786	U16	0	65535	0	√	R/W	-	-
PID source gain	787	Float	-100.000	100.000	1.000	√	R/W	-	-
OPTIONS \ PID									
Feed-fwd PID	758	I16	-10000	10000	0	√	R	IA	R

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
OPTIONS \ PID \ PID references									
PID error	759	I16	-10000	10000	0	√	R	-	R
PID feed-back	763	I16	-10000	10000	0	√	R/W	IA	R/W
PID offs. Sel Offest 0 Offset 1	762	U16	0	1	Offset 0 (0)	√	R/W 0 1	ID	R/W
PID offset 0	760	I16	-10000	10000	0	√	R/W	IA	R/W
PID offset 1	761	I16	-10000	10000	0	√	R/W	-	-
PID acc time [s]	1046	Float	0.0	900.0	0.0	√	R/W	-	-
PID dec time [s]	1047	Float	0.0	900.0	0.0	√	R/W	-	-
PID clamp	757	I16	0	10000	10000	√	R/W	-	-
OPTIONS \ PID \ PI controls									
PI P gain PID %	765	Float	0.00	100.00	10.00	√	R/W	-	-
PI I gain PID %	764	Float	0.00	100.00	10.00	√	R/W	-	-
PI steady thr	695	I16	0	10000	0	√	R/W	-	-
PI steady delay [ms]	731	U16	0	60000	0	√	R/W	-	-
P init gain PID %	793	Float	0.00	100.00	10.00	√	R/W	-	-
I init gain PID %	734	Float	0.00	100.00	10.00	√	R/W	-	-
PI central v sel	779	U16	0	3	1	√	R/W	ID	R/W
PI central v1	776	Float	P785	P784	1.00	√	R/W	-	-
PI central v2	777	Float	P785	P784	1.00	√	R/W	-	-
PI central v3	778	Float	P785	P784	1.00	√	R/W	IA	-
PI top lim	784	Float	P785	10.00	10.00	√	R/W	-	-
PI bottom lim	785	Float	-10.00	P784	0	√	R/W	-	-
PI integr freeze ON OFF	783	U16	0	1	0	√	R/W 1 0	ID	R/W
OPTIONS \ PID									
PI output PID	771	I16	0	1000 x P784	1000	√	R	-	R
Real FF PID	418	I16	-10000	10000	0	√	R	-	R
OPTIONS \ PID \ PD controls									
PD P gain 1 PID [%]	768	Float	0.00	100.00	10.00	√	R/W	-	-
PD D gain 1 PID [%]	766	Float	0.00	100.00	1.00	√	R/W	-	-
PD P gain 2 PID [%]	788	Float	0.00	100.00	10.00	√	R/W	-	-
PD D gain 2 PID [%]	789	Float	0.00	100.00	1.00	√	R/W	-	-
PD P gain 3 PID [%]	790	Float	0.00	100.00	10.00	√	R/W	-	-
PD D gain 3 PID[%]	791	Float	0.00	100.00	1.00	√	R/W	-	-
PD D filter PID [ms]	767	U16	0	1000	0	√	R/W	-	-
OPTIONS \ PID									
PD output PID	421	I16	-10000	10000	0	√	R	-	R
PID out sign PID Positive Bipolar	772	U16	0	1	1	√	R/W 0 1	-	-
PID output	774	I16	-10000	10000	0	√	R	QA	R
OPTIONS \ PID \ PID target									
PID target	782	U16	0	65535	0	√	R/W	-	-
PID out scale	773	Float	-100.000	100.000	1.000	√	R/W	-	-
OPTIONS \ PID \ Diameter calc									
Diameter calc Enabled Disabled	794	U16	0	1	0	√	Z/R 1 0	ID	R/W
Positioning spd [rpm]	795	I16	-100	100	0	√	R/W	-	-
Max deviation	796	I16	-10000	10000	8000	√	R/W	-	-
Gear box ratio	797	Float	0.001	1.000	1.000	√	R/W	-	-
Dancer constant [mm]	798	U16	1	10000	1	√	R/W	-	-
Minimum diameter [cm]	799	U16	1	2000	1	√	R/W	-	-
OPTIONS \ PID									
PI central vs0	780	U16	0	1	1	-	R/W	ID	R/W
PI central vs1	781	U16	0	1	0	-	R/W	ID	R/W
Diameter calc st	800	U16	0	1	0	-	R	QD	R

Parameter	No	Format	Value			Access via			
			min	max	Factory	Keyp.	RS485/ BUS/ Opt2-M	Terminal	Opt2-A /PDC
DRIVECOM									
Malfunction code	57	U16	0	65535		√	R	-	R
No failure							0000h		
Overcurrent							2300h		
Overvoltage							3210h		
Undervoltage							3220h		
Heatsink sensor							4210h		
Heatsink ot							4211h		
Regulation ot							4212h		
Module overtemp							4213h		
Intake air ot							4214h		
Overtemp motor							4310h		
Failure supply							5100h		
Curr fbk loss							5210h		
Output stages							5410h		
DSP error							6110h		
Interrupt error							6120h		
BU overload							7110h		
Speed fbk loss							7301h		
Opt2							7400h		
Hw opt 1 failure							7510h		
Bus loss							8110h		
External fault							9000h		
Enable seq err							9009h		
Control Word	55	U16	0	65535	0	√	R/W	-	R/W
Status word	56	U16	0	65535	-	√	R	-	R
Speed input var [FF] (Ramp ref 1)	44	I16	-2 × P45	+2 × P45	0	√	R/W	IA, QA	
Speed ref var [FF] (Speed ref)	115	I16	-32768	32767		√	R	-	R
Act speed value [FF] (Actual spd)	119	I16	-32768	32767		√	R	-	R
DRIVECOM \ Speed amount									
Speed min amount [FF]	1	U32	0	2^{32} -1	0	√	R/Z	-	
Speed max amount [FF]	2	U32	0	2^{32} -1	5000	√	R/Z	-	-
DRIVECOM \ Speed min/max									
Speed min pos [FF]	5	U32	0	2^{32} -1	0	√	R/Z	-	-
Speed max pos [FF]	3	U32	0	2^{32} -1	5000	√	R/Z	-	-
Speed min neg [FF]	6	U32	0	2^{32} -1	0	√	R/Z	-	-
Speed max neg [FF]	4	U32	0	2^{32} -1	5000	√	R/Z	-	-
DRIVECOM \ Acceleration									
Acc delta speed [FF]	21	U32	0	2^{32} -1	100	√	R/W	-	-
Acc delta time [s]	22	U16	0	65535	1	√	R/W	-	-
DRIVECOM \ Deceleration									
Dec delta speed [FF]	29	U32	0	2^{32} -1	100	√	R/W	-	-
Dec delta time [s]	30	U16	0	65535	1	√	R/W	-	-
DRIVECOM \ Quick stop									
QStp opt code	713	I16	-2	-1	Ramp stop (1)	√	R/Z		-
Ramp stop							1		
DC braking curr							2		
QStp delta speed [FF]	37	U32	0	2^{32} -1	1000	√	R/W	-	-
QStp delta time [s]	38	U16	0	65535	1	√	R/W	-	-
DRIVECOM \ Face value fact									
Face value num	54	I16	1	32767	1	√	R/Z	-	R
Face value den	53	I16	1	32767	1	√	R/Z	-	R
DRIVECOM \ Dimension fact									
Dim factor num	50	I32***	1	65535	1	√	R/Z	-	R
Dim factor den	51	I32***	1	2^{32} -1	1	√	R/Z	-	R
Dim factor text	52	Text			rpm	√	R/Z	-	-
DRIVECOM									
Speed base value [FF]	45	U32***	1	16383	1500	√	R/Z	-	R
Speed input perc [%]	46	I16	-32768	32767	0	√	R/W	-	R/W
Percent ref var [%]	116	I16	-32768	32767	0	√	R	-	R
Act percentage [%]	120	I16	-32768	32767	0	√	R	-	R
SERVICE									
Password 2	86	Service				√	W	-	-

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.

Gefran worldwide

GEFRAN BENELUX
Lammerdries-Zuid, 14A
B-2250 OLEN
Ph. +32 (0) 14248181
Fax. +32 (0) 14248180
info@gefran.be

GEFRAN BRASIL ELETROELETRÔNICA
Avenida Dr. Altino Arantes,
377/379 Vila Clementino
04042-032 SÃO PAULO - SP
Ph. +55 (0) 1155851133
Fax +55 (0) 1132974012
gefran@gefran.com.br

GEFRAN DEUTSCHLAND
Philipp-Reis-Straße 9a
63500 SELIGENSTADT
Ph. +49 (0) 61828090
Fax +49 (0) 6182809222
vertrieb@gefran.de

SIEI AREG - GERMANY
Gottlieb-Daimler-Strasse 17/3
D-74385 Pleidelsheim
Ph. +49 7144 89 736 0
Fax +49 7144 89 736 97
info@sieiareg.de

GEFRAN ESPAÑA
Josep Pla, 163 2°-6ª
08020 BARCELONA
Ph. +34 934982643
Fax +34 932662713
comercial.espana@gefran.es

GEFRAN - FRANCE
4, rue Jean Desparmet - BP 8237
69355 LYON Cedex 08
Ph. +33 (0) 478770300
Fax +33 (0) 478770320
commercial@gefran.fr

GEFRAN SUISSE SA
Rue Fritz Courvoisier 40
2302 La Chaux-de-Fonds
Ph. +41 (0) 329684955
Fax +41 (0) 329683574
office@gefran.ch

GEFRAN SIEI - UK Ltd.
7 Pearson Road, Central Park
TELFORD, TF2 9TX
Ph. +44 (0) 845 2604555
Fax +44 (0) 845 2604556
sales@gefran.co.uk

GEFRAN INC
Sensors and Automation
8 Lowell Avenue
WINCHESTER - MA 01890
Toll Free 1-888-888-4474
Ph. +1 (781) 7295249
Fax +1 (781) 7291468
info@gefraninc.com

Motion Control
14201 D South Lakes Drive
NC 28273 - Charlotte
Ph. +1 704 3290200
Fax +1 704 3290217
salescontact@sieiamerica.com

GEFRAN SIEI - ASIA
Blk. 30 Loyang way
03-19 Loyang Industrial Estate
508769 SINGAPORE
Ph. +65 6 8418300
Fax. +65 6 7428300
info@gefransiei.com.sg

GEFRAN SIEI Electric
Block B, Gr.Flr, No.155, Fu Te Xi Yi Road,
Wai Gao Qiao Trade Zone
200131 Shanghai - CHINA
Ph. +86 21 5866 7816
Ph. +86 21 5866 1555
gefransh@online.sh.cn

GEFRAN SIEI DRIVES TECHNOLOGY
No.1265, Beihe Road,
Jiading District
201821 Shanghai - CHINA
Ph. +86 21 69169898
Fax +86 21 69169333
info@gefransiei.com.cn

GEFRAN INDIA PRIVATE LIMITED
Survey No.: 129/1, Nandan Park
Plot No.: 6, Chakankar Mala
Baner-Balewadi Road, Baner
Pune 411045, MH, INDIA
Ph. +91 20 66400400
Fax +91 20 66400401

GEFRAN

GEFRAN S.p.A.
Via Sebina 74
25050 Provaglio d'Iseo (BS) ITALY
Ph. +39 030 98881
Fax +39 030 9839063
info@gefran.com
www.gefran.com

Drive & Motion Control Unit
Via Carducci 24
21040 Gerenzano (VA) ITALY
Ph. +39 02 967601
Fax +39 02 9682653
infomotion@gefran.com

Technical Assistance :
technohelp@gefran.com

Customer Service :
motioncustomer@gefran.com
Ph. +39 02 96760500
Fax +39 02 96760278

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