GEI-100429G
(Supersedes GEI-100429F)

GE Industrial Systems

AV-300i™ Version 2

Hardware & Quick Start Up Guide

This book is referred to SW version 2.X00

These instructions do not purport to cover all details or variations in equipment, nor to provide every possible contingency to be met during installation, operation, and maintenance. If further information is desired or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to GE Industrial Systems, Salem, Virginia, USA.

Safety Symbol Legend / Légende des Signes de Sécurité

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

Attire l'attention sur les modes d'utilisation et les procédés et conditions d'exploitation qui, en cas d'inobservation, pourraient entraîner des blessures corporelles ou la mort.

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.

Attire l'attention sur les modes d'utilization et les procédés et conditions d'exploitation qui, en cas d'inobservation, pourraient entraîner la détérioration ou la destruction des appareils.

La gravité des blessures et des dommages matériels possibles dépendent de différent facteurs. Toutefois, les instructions mentionées ci-dessous devraient être toujours suivies avec la plus grande attention.

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

Attire l'attention sur les modes d'utilization et les procédés et conditions d'exploitation qui présentent un intéret particulier.

Table of Contents

List of Tables

List of Figures

Chapter 0 - Safety Precautions / Precautions de securité

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”.

WARNING! / ATTENTION!

- According to the EEC standards the AV300i 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.

  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.
- 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 internal devices is listed in section 5.11 of this instruction book.
- If the front plate has to be removed because the ambient temperature is higher than 40 degrees, the user has to ensure that no occasional contact with live parts will occur.
- 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.
- The drive may cause accidental motion in the event of a failure, even if it is disabled, unless it has been disconnected from the AC input feeder.

- *Selon les normes EEC, les drives AV300i 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.
- *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 (this instruction book).*
- *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.*
- *L’appaeil peut rédémarrer de façon accidentel en cas d’anomalie, sauf s’il a été déconnecté du reseau.*
- *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.*

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.

WARNING! - ELECTRIC SHOCK HAZARD / ATTENTION! - CAS DE DECHARGE ELECTRIQUE:

- Drives and motors must be grounded according to NEC.
- Replace all covers before applying power to the Drive. Failure to do so may result in death or serious injury.
- Adjustable frequency drives are electrical apparatus for use in industrial installations. Parts of the Drives are at high voltage 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. Follow the instructions given in this manual and observe the local and national safety regulations applicable.

- *Tous les moteurs et les drives doivent être mis à la terre selon le Code Electrique National ou équivalent.*
- *Remettre tous les capots avant de mettre sous tension le drive. Des erreurs peuvent provoquer de sérieux accidents ou même la mort.*
- *Les drives à fréquence variable sont des dispositifs électriques utilisés dans des installations industriels. Une partie des drives sont sous tension pendant l'operation. L'installation électrique et l'ouverture des drives devrait être executé uniquement par du personel qualifié. De mauvaises installations de moteurs ou de drives peuvent provoquer des dommages materiels ou blesser des personnes.On doit suivir les instructions donneés dans ce manuel et observer les régles nationales de sécurité.*

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.
- 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.
- Do not perform a megger test between the Drive terminals or on the control circuit terminals.
- 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**.**
- 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.

- 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).
- 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).
- Do not touch or damage any components when handling the device. Changing of isolation gaps or removing the isolation covers is not permissible.
- Protect the device from disallowed environmental conditions (temperature, humidity, shock etc.)
- 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.
- A capacitative load (e.g. Var compensation capacitors) should not be connected to the output of the frequency inverter (terminals U2, V2, W2).
- 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.
- 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.

- *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.*
- *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.*
- *Ne pas exécuter un test megger entre les bornes du drive ou entre les bornes du circuit de contrôle.*
- *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.*
- *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….*
- *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).*
- *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°).*
- *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.*
- *Protéger l'appareil contre des effets extérieurs non permis (température, humidité, chocs etc.).*
- *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).*
- *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).*
- *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

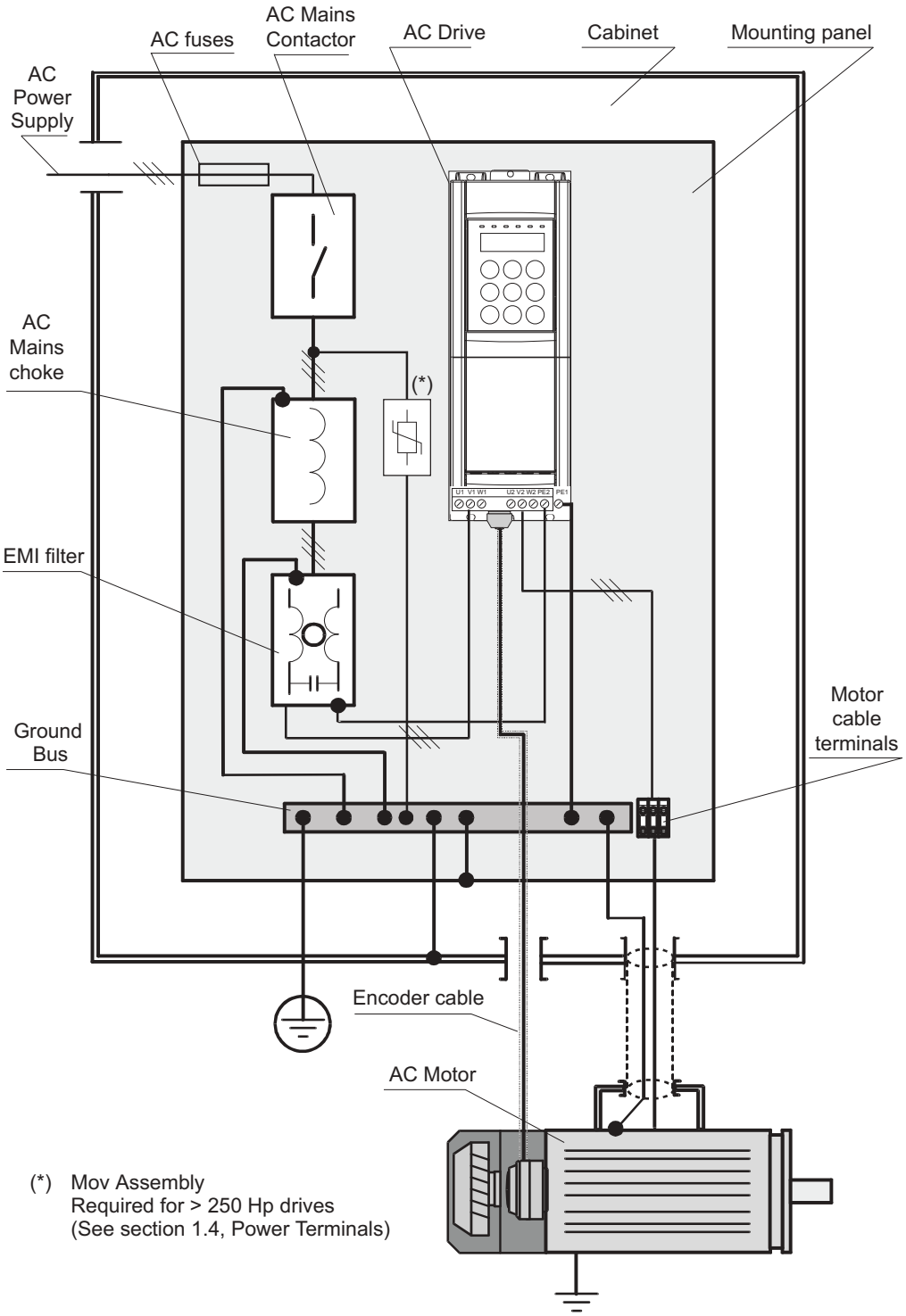
- *Il ne faut pas éxécuter de tests de rigidité diélectrique sur des parties du convertisseurs. Pour mesurer les tensions, des signaux, il faut utiliser des instruments de mesure appropriés (résistance interne minimale 10 kΩ/V).*

NOTE! If the Drives have been stored for longer than three 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 trois 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).***

Chapter 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 any of the available regulation modes. 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 either the keypad or a pot input (or 0 to 10 vdc source). While the drive has more modes of operation and dozens of combinations of configurations, this guide will cover most applications that are not being started up by a service engineer.

The instruction book can be used to make more complex changes to standard configuration beyond this set up.

Standard Wiring scheme: see instruction book for full information. Note that if this drive comes prewired into a panel assembled at our factory, you can skip the following sections and go directly to section 1.9 “Software startup”.

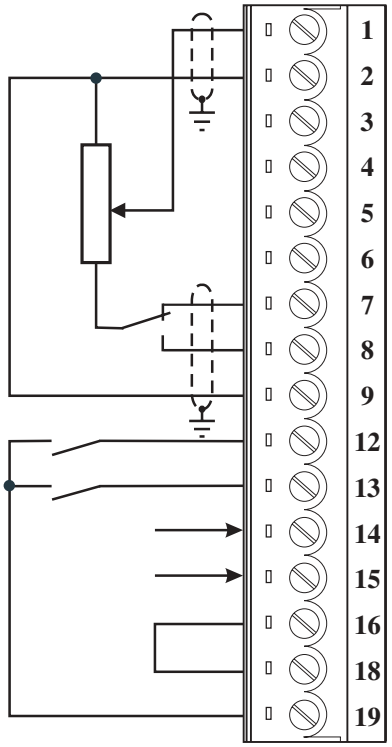
1.2.1 Conventions Used in This Guide

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

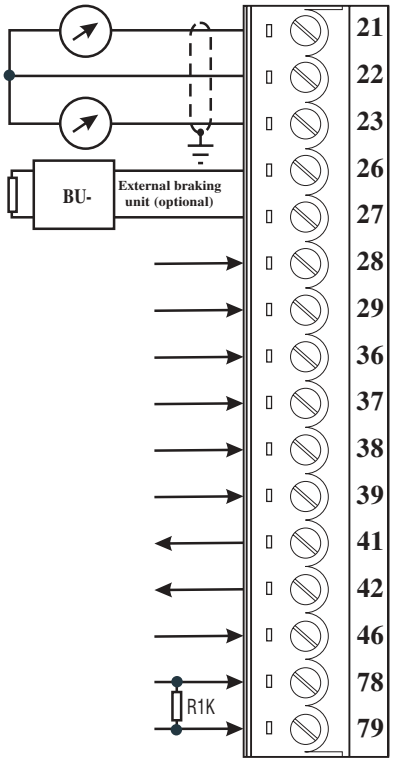
Quotes: Quote marks are put around text which will be seen in the display window of the keypad. ***Example:*** “Restart - please wait...”.

Bold + italics: bold italic characters are used to quote descriptors of drive database items (eg. : parameters, variables, etc.).
Example: Term Str Stp src, Ramp ref 1.

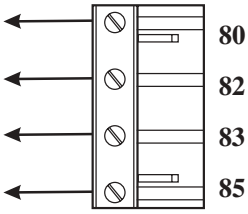
1.3 Control Terminals



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 loop 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/ Digital input 0	Inverter enable, active=high. Concurrently, it can be used as a programmable input. (Default none)	+30V 3.2mA @ 15V 5mA @ 24V 6.4mA @ 30V
Digital input 1	Programmable inputs, Default: Term StrStp src	
Digital input 2	Programmable inputs, Default=none	
Digital input 3		
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	Programmable analog output; def.setting: none	±10V/5mA
0V	Internal 0V and reference point for terminals 21 and 23	-
Analog output 2	Programmable analog output; default setting: none	±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 4	Programmable digital inputs; default setting: none	+30V 3.2mA @ 15V 5mA @ 24V 6.4mA @ 30V
Digital input 5		
Digital input 6		
Digital input 7		
Digital output 2	Programmable digital outputs; default setting: none	+30V/40mA
Digital output 3		
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.
Digital output 0 Relay	Potential- free relay contact, programmable output, Default=Drive OK when closed	250V AC 1 A
Digital output 1 Relay	Potential- free relay contact, programmable output, Default=Speed is zero when closed	250V AC 1 A

1.3.1 Maximum Cable Cross Section for Regulator Terminals

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.

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

1.4 Power Terminals

Refer to table 3.3.2.1 for ratings.

Table 1.4.1: Power Terminals from 0.75 Hp to 20 Hp

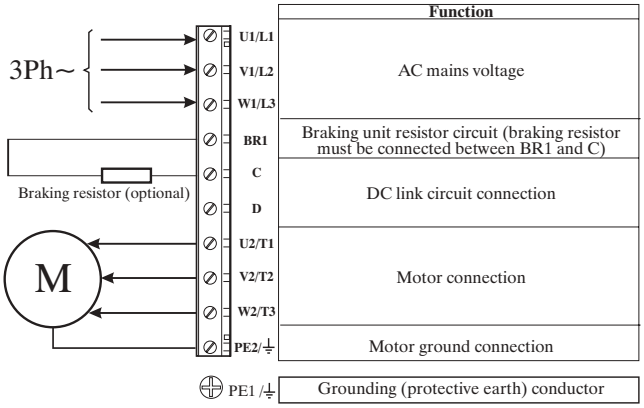
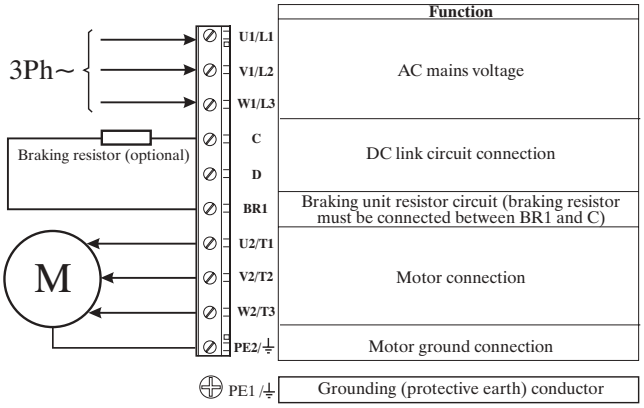
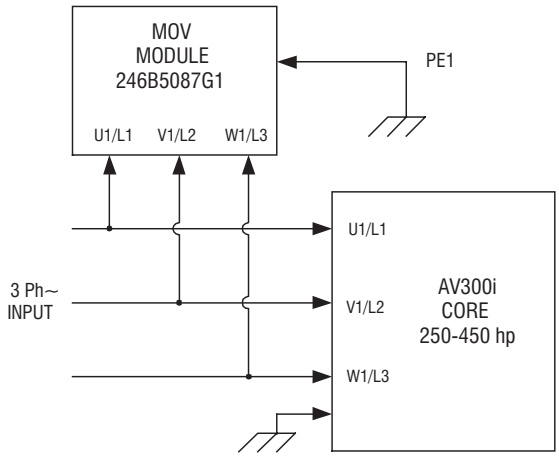


Table 1.4.2: Power Terminals from 25 Hp to 200 Hp



250-450 hp Drive Requirements

If purchasing a 250-450hp drive **core only**, use external MOV module (246B5087G1) for AC input line protection. This MOV module is not included with the drive core



1.4.1 Maximum Cable Cross Section for Power Terminals

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

Type		3F75	3001	3002	3003	3005	3007	3010	3015	3020	3025	3030
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	14				12	10		8	6		4
	[mm^2]	2				4			8	10	16	25
Tightening torque	[Nm]	0.5 to 0.6							1.2 to 1.5		2	3
BR1 terminals	AWG	14				12	10		8	6	10	8
	[mm^2]	2				4			8	10	6	10
Tightening torque	[Nm]	0.5 to 0.6							1.2 to 1.5		0.9	1.6
PE1, PE2 terminals	AWG	14				12	10		8	6		6
	[mm^2]	2				4			8	10	16	16
Tightening torque	[Nm]	0.5 to 0.6							1.2 to 1.5		2	3

Type		3040	3050	3060	3075	3100	3125	3150	3200
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	2		1/0	2/0	4/0	300*	350*	4xAWG2
	[mm^2]	35		50	70	95	150	185	4x35
Tightening torque	[Nm]	4			12		10-30		
BR1 terminals	AWG	8	6	terminals not available					
	[mm^2]	10	16						
Tightening torque	[Nm]	1.6	3						
PE1, PE2 terminals	AWG	6	2						
	[mm^2]	16	50						
Tightening torque	[Nm]	3	4						

Type	3250	3300	3350	3400	3450	3500	3600	3700	3800
Max wire size	Two 350 MCM	Three 350 MCM				bus bar: no wire size limitation			

ai4040

* = kcmils

**= AC input wiring for the monitor is connected to bus bars and has no wire size limitation.

1.5 Encoder Terminals (XE connector)

Designation	Function	I/Q	max. voltage	max. current
PIN 1	Channel B- For B- digital or B- COS incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 2	-			
PIN 3	Channel C+ For C+ digital or analog zero pulse or index	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 4	Channel C- For C- digital or analog zero pulse or index	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 5	Channel A+ For A+ digital or A+ SIN incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 6	Channel A- For A- digital or A- SIN incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 7	Reference point for +5V encoder supply voltage	Q	–	–
PIN 8	Channel B+ For B+ digital or B+ COS incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 9	+5V encoder supply voltage	Q	+5 V	200 mA
PIN 10	Channel E+ For E+ digital commutation or SIN+ absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 11	Channel E- For E- digital commutation or SIN- absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 12	Channel F+ For F+ digital commutation or COS+ absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 13	Channel F- For F- digital commutation or COS- absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 14	Channel G+ For G+ digital commutation signal	I	5 V digital or 1 V pp analog	10 mA digital
PIN 15	Channel G- For G- digital commutation signal	I	5 V digital or 1 V pp analog	10 mA digital

ai3140

1.5.1 Encoder Type Connection

Encoder type	Shielded cable	XE CONNECTOR PIN														
		1 B-	2	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-
DE	8 pole	●		●	●	●	●	●	●	●						
SE	8 pole	●		●	●	●	●	●	●	●						
SESC	12 pole	●		●	●	●	●	●	●	●	●	●	●	●		
DEHS	14 pole	●		●	●	●	●	●	●	●	●	●	●	●	●	●
SEHS	14 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 / $\overline{C}$
- **DEHS**: 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and three Hall sensor digital position signals (for AC Brushless motors only, not supported in the standard product)
- **SESC**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and and two sin/cos traces for absolute position (not supported in the standard product)
- **SEHS**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and three Hall sensor digital position signals (for AC Brushless motors only, not supported in the standard product)

NOTE! Refer to table 3.3.5.1 to select proper PPR rating for the encoder

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	-	-	-	-	-	-	-
SESC	ON	ON	ON	ON	ON	ON	-	A	A	A	A	A	A
DEHS	OFF	OFF	OFF	OFF	OFF	OFF	ON (*)	B	B	B	B	B	B
SEHS	ON	ON	ON	ON	ON	ON	-	B	B	B	B	B	B

ai3150

- **DE**: 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$
- **SE**: 5V with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$
- **DEHS**: 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and three Hall sensor digital position signals (for AC Brushless motors)
- **SESC**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and and two sin/cos traces for absolute position (for AC Brushless motors or positioning)
- **SEHS**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and three Hall sensor digital position signals (for AC Brushless motors)

(*) 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-switches

Designation	Function	Factory setting
S0	The setting must not be changed	OFF
S1	The setting must not be changed	OFF
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...10V / -10...+10V	OFF
S9	Adaptation to the input signal of analog input 2 (terminals 3 and 4) ON=0...20 mA / 4...20 mA OFF=0...10V / -10...+10V	OFF
S10	Adaptation to the input signal of analog input 3 (terminals 5 and 6) ON=0...20 mA / 4...20 mA OFF=0...10V / -10...+10V	OFF
S11 - S12 - S13 S14 - S15 - S16	Encoder setting (**) ON=Sinusoidal SE or SESC encoder OFF=Digital DE or DEHS encoder	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. A=digital DEHS encoder Pos. B= sinusoidal SESC encoder	B
S22 - S23	Analog input 3 enabling (alternative with SESC encoder) Pos. A= if SESC encoder is used Pos. B=analog input 3 enabled	B
S24	Jumper to disconnect 0V (of 24V) from ground ON=0V connected to ground OFF=0V disconnected from ground	ON
S25	Jumper to disconnect 0V (regulation section) from ground ON=0V connected to ground OFF=0V disconnected from ground	ON
S26 - S27	Internal use	ON

(*) on multidrop connection the jumper must be ON only for the last drop of a serial line ai4060

(**) jumpers on kit EAM_1618 supplied with the drive

1.7 Pre-power Checks

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

Grounds / Grounding

- Verify ground connections drive to motor
- Verify AC Inputs, AC Outputs and control wiring are clear of grounds
- Drive power supply may be intentionally grounded

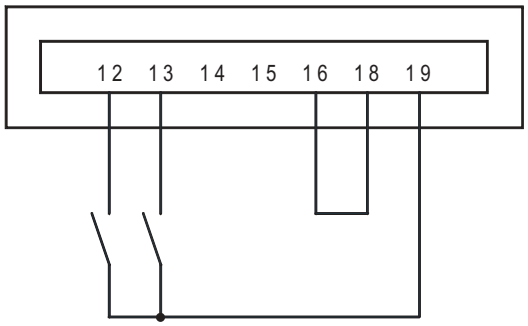
Connections

- Check AC Inputs (U1/L1, V1/L2, W1/L3), AC Outputs (U2/T1, V2/T2, W2/T3) for tightness and good connections
- DC connection with an optional external Braking Unit (C,D)
- Motor thermistor (**78**,**79**)
- "Digital Output 0" Relay (**80**,**82** n.o), "Digital Output 1" Relay (**83**,**85** n.o)
- Regulation Board connections:

1.....46	on connectors XS, XE
12	ENABLE Drive (close to active)
13	Digital input 1
16	Common for terminal board
18	+ 24V Common
19	+ 24VDC (internal)

- Any option board connections

Figure 1.7.1: Terminal connections



- Encoder connections (if used)
- Record Motor Name Plate Data, encoder infomation and mechanical data.

MOTOR DATA

Table 1.8.1: 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	

1.8 Keypad Operation

The keypad (*Fig. 1.8.1.*) is made of a LCD display with two 16-digit lines, seven LEDs and nine function keys. It is used:

- to start and stop the drive (this function can be disabled)
- to increase/decrease speed and jog
- to display the speed, voltage, diagnostics etc. during the operation
- to set parameters and enter commands

The LED module is made of 6 LEDs. It is used to display status and diagnostic information during the operation. Keypad and LED module can be installed or removed also while the drive is running.

Figure 1.8.1: Keypad

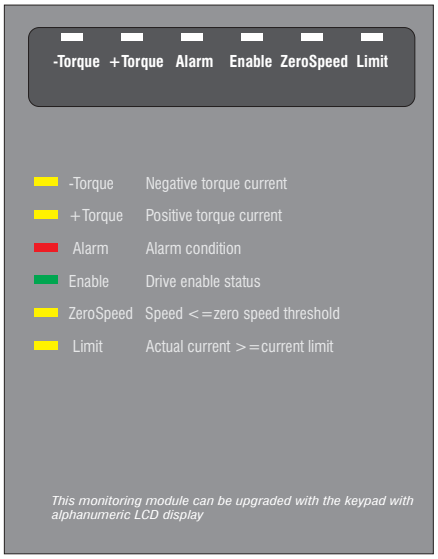


Figure 1.8.2: LED Module

NOTE! a replacement keypad cable longer than 20 cm must be shielded.

1.8.1 LEDs & Keys

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 when the drive signals a trip
ENABLE	green	the LED is lit when the drive is enabled
Zero speed	yellow	the LED is lit when motor speed is zero
Limit	yellow	the LED is lit when the drive operates at a current limit
Shift	yellow	the LED is lit when the keypad second functions are enabled

ts030g

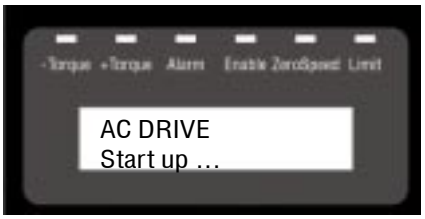
Control keys	Text reference	Function
	**[START]**	START key commands the Drive to the Enable (***Stop mode*** = off) and Run state. When ***IO keys mode*** = Disabled the key is not active. ***Command select*** = I O key
	**[STOP]**	STOP key commands to stop the Drive from the Run state. (***Command select*** = I O key) **Warning** this may have safety critical impact. It is suggested not to change the default setting. Pressing this button for 2 sec, the drive will be disabled. Stop key also resets the sequencer after an alarm event
	**[Increase] / [Jog]**	Plus key increases the speed reference for Motor pot function. After pressing shift key, holding this key causes the drive to Jog (default direction = forward = CW)
	**[Decrease] / [Rotation control]**	Minus key decreases the speed reference for Motor pot function. After pressing shift key, this key toggles motor rotation direction in Jog mode and Motor pot function.
	**[Down arrow] / [Help]**	Used to scroll down menu items in menu navigation, picklists in selectors, or digit values in numeric editing. After pressing shift key, an item-specific information menu is entered when applicable. Help menu can be browsed with up/down arrows. Left arrow returns to normal mode.
	**[Up arrow] / [Alarm]**	Used to scroll up menu items in menu navigation, picklists in selectors, or digit values in numeric editing. After pressing Shift key, the Alarm list display mode is entered. Active alarms and Alarms pending for acknowledge can be browsed with up/downs arrows. Alarms can be acknowledged whit the Enter key. Left arrow returns to normal mode.
	**[Left arrow] / [Escape]**	Used to go up one level in menu navigation; to scroll digits in numeric edit mode, to return to normal mode from alarm list or help modes. After pressing shift key, it is used to Escape out of numeric edit or selection with no change.
	**[Enter] / [Home]**	Used to go down one level in menu navigation; to enter Selections or numeric values after editing, to issue commands, to acknowledge alarms in the Alarm list mode. Home second function is not implemented.
	**[Shift]**	Shift button enables the keypad second functions (Rotation control, Jog, Help, Alarm, Escape, Home)

1.8.2 Power Up

Power up the drive.

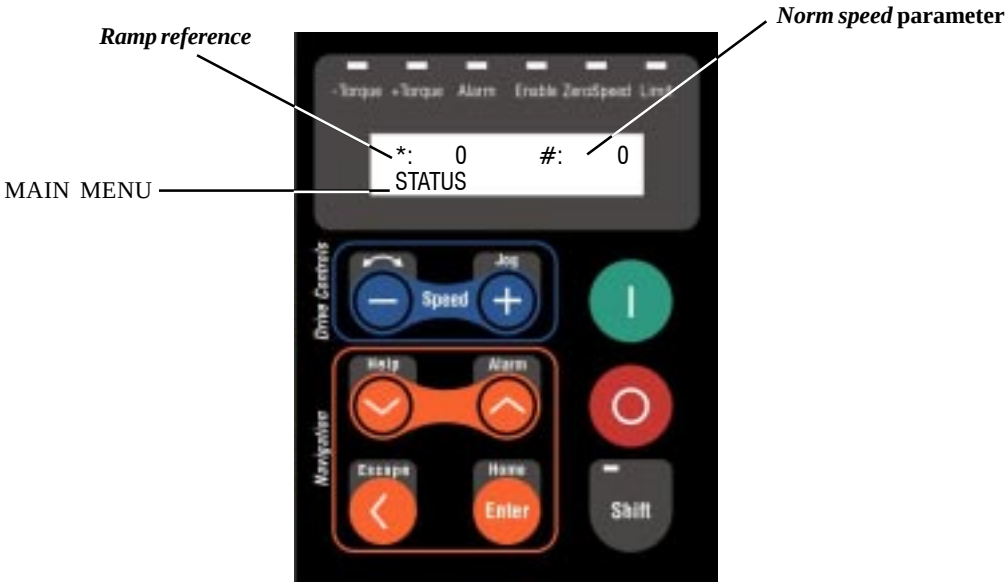
The drive will begin a self test and initialization procedure which will take approximately **10 seconds**. During this period, the display will cycle through various indications.

During this process, the below message will appear on the display and all LED's will simultaneously blink one time:



NOTE! During this operation "Drive OK" relay (teminals 80-82 on regulation board) is not active. The self test and initialization must be complete before the status of the relay is correct.

After the **10 seconds,** the keypad will display the following:

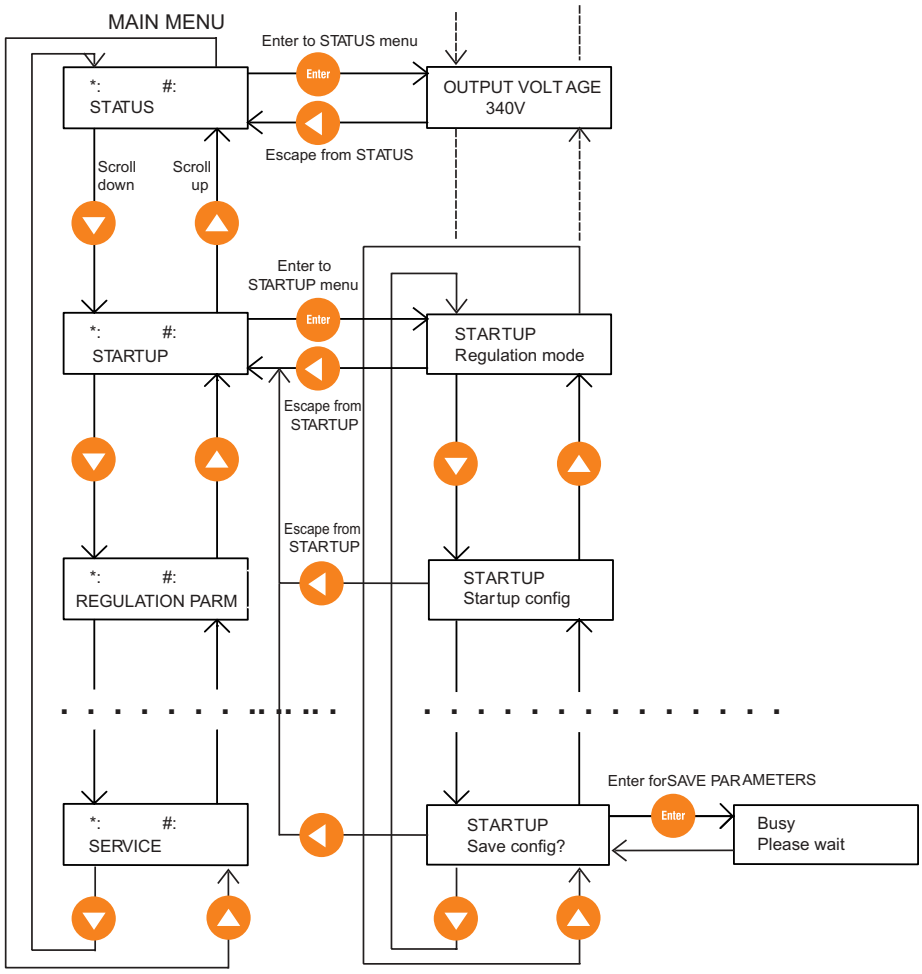


The field indicated by the "***:**" is used to show the Ramp reference value (***Ramp out mon***) once the motor is running.

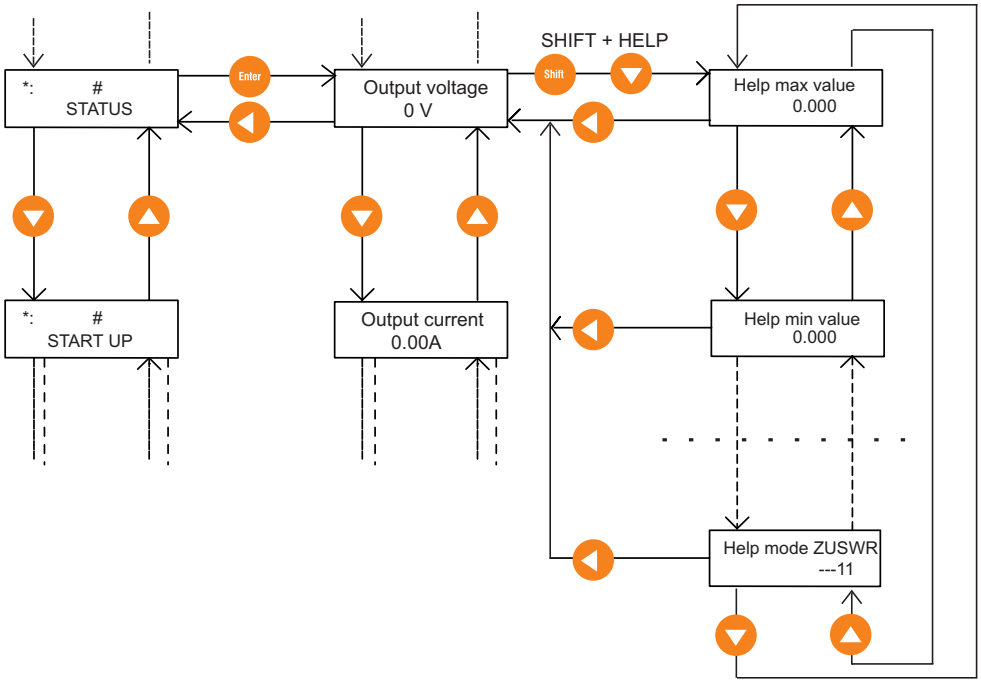
The field indicated by the "**#:**" is used to show the motor speed in RPM (***Norm speed***) once the motor is running.

NOTE! If the drive is connected to a 230V input, the red "Alarm" LED will blink indicating an UNDERVOLTAGE condition since the drive is factory configured for 460V. Proceed to the Drive initial setup procedure in section 1.9.1 for instructions on completing the configuration and startup.

1.8.3 Moving Inside a Menu



1.8.4 Using Keypad Help (Help is not avaible for some menu entries)



1.8.5 Using Keypad Alarm List

When the red “Alarm” LED blinks, it is indicating one (or more) alarm conditions.

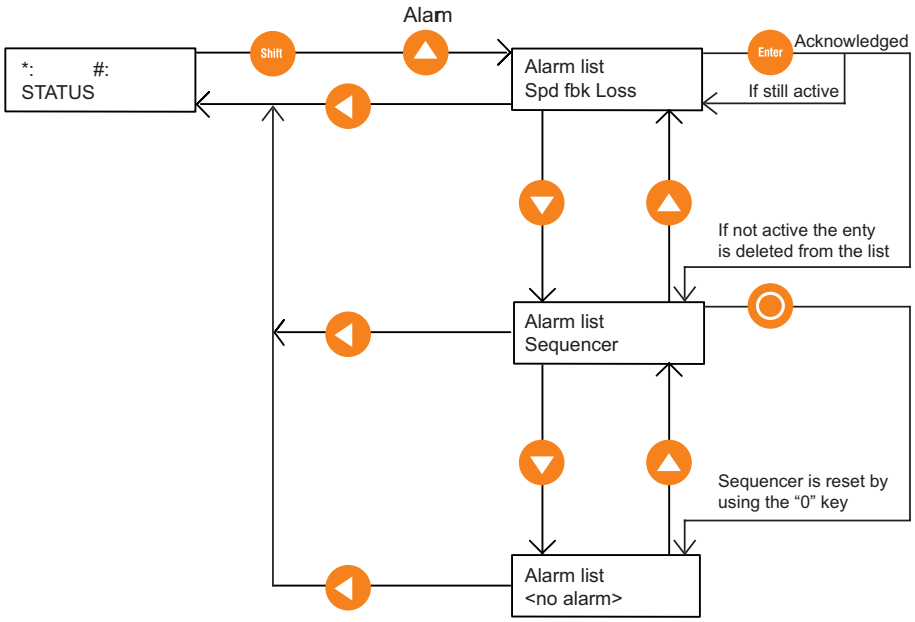
See following steps to reset it:

1) Press Shift + Alarm

The “Alarm list” will be displayed.

2) Press Enter

Press Enter one or more times untill “Sequencer” message appears, to acknowledge the alarms.



NOTE! If the alarm is still active, red LED will blink again. If it not active, red LED will stop.

3) Press [O] key to reset the Sequencer.

The Alarm List shows all the occurred alarms, both if they are due to protections and to errors when limit values are exceeded.

In order to disappear from the alarm list, alarm have to be acknowledged. The acknowledgement is possible only if the alarm is no longer active. The alarms are automatically acknowledged after two minutes.

NOTE! Pressing Enter will acknowledge the alarm. Acknowledging the alarm will only remove it from the active alarm list. If the alarm condition also resulted in a drive trip, the sequence will also need to be reset. This can be done by pressing the [O] key. The drive cannot be re-enabled or started after a trip condition unless the drive sequencer is reset.

The drive State Machine, controls the drive running and starting, accounting for protection & alarming, command sequence, and reset status.

The table below displays various operation states by Sequencer status number:

Sequencer status	State
1	Magnetization running
2	Magnetization completed, Stop
3	Start
4	Fast stop, Stop
5	Fast stop, Start
9	No alarm, drive is ready to accept all commands
10	Magnetization running and Start command already present
12	Alarm active
16	Alarm not active, waiting for reset

TAV3i020

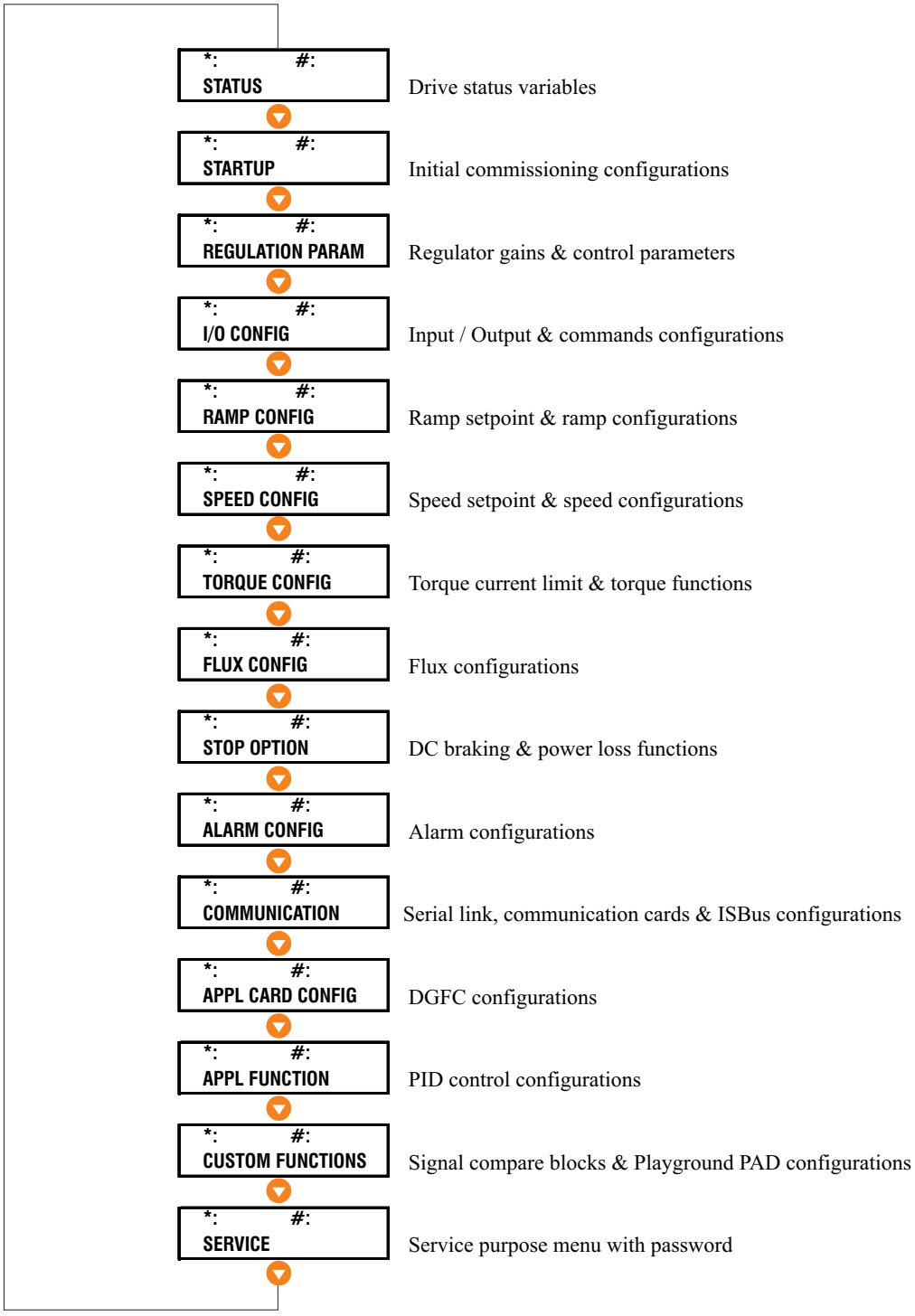
To read the sequencer status of the State Machine, go to menu:

***: #: STATUS**	Enter	**Output voltage 0V**	Up 3 times to	**STATUS Advanced status**

Press Enter :

DC link voltage 580V	Up 3 times to	**Sequencer status 12**

1.8.6. Drive Menu - Main Level



1.9 Regulation Modes Setup Overview

The drive can be active with 3 different regulation modes:

- Scalar voltage / frequency: **V/f control**
- Flux vector control with speed feedback: **Field oriented**
- Flux vector control without speed feedback: **Sensorless vect**

The regulation modes are independent one from the other and each mode has an independent parameter set, called a database.

All the regulation modes require setting of the drive and motor data parameters. Internal motor parameters, such as rotor resistance, stator resistance parameter etc., will be automatically set by running the autotune procedure.

Drive, motor and selftune data are set and saved via the SETUP MODE menu in a file called "Setup". It is possible to save into 4 different files (Setup 0,1,2,3): up to 4 different motor parameter sets or 4 measurements performed on the same motor in different functioning conditions.

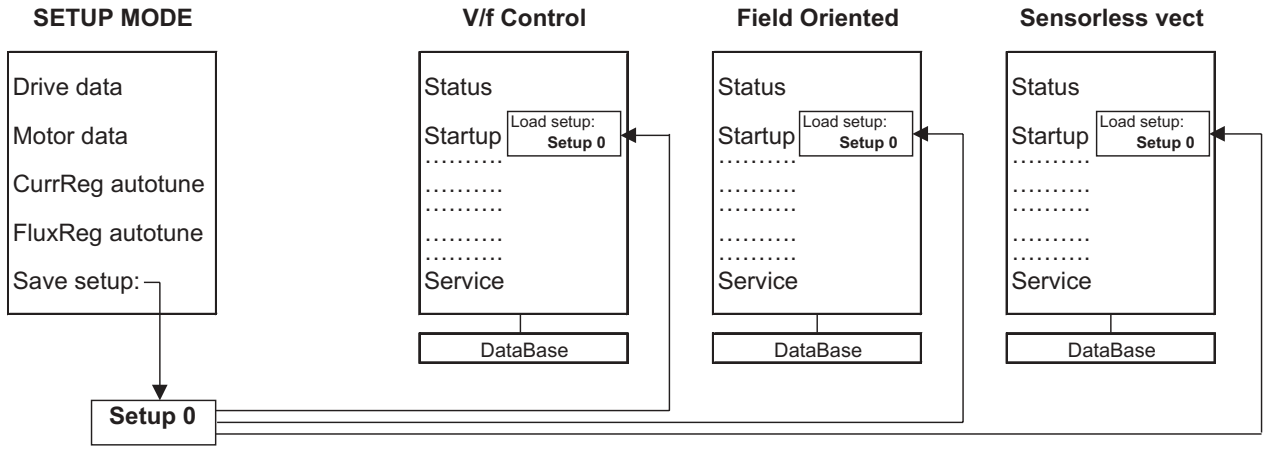
NOTE! The SETUP MODE does not interact with the drive Regulation modes.

All Drive/Motor data parameters saved in setup file are not active yet in the regulation modes Database.

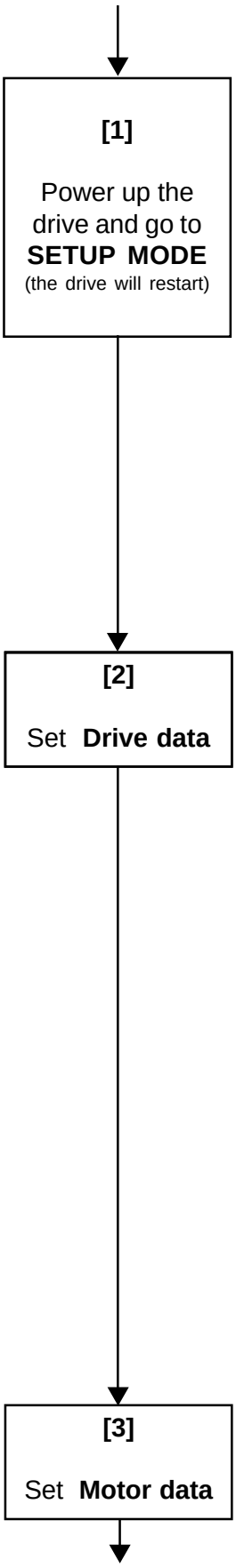
In order to make the motor parameters active in the selected Regulation mode, it is necessary to recall the desired data Setup file via the "Load setup" command.

When this file has been loaded, it is necessary to save it in the used regulation mode data base via the "Save config" command.

NOTE! By selecting a different regulation mode (for example FOC), it is necessary to load the setup file again without repeating the data storage procedure. Such a procedure is required only when the motor has been replaced or the functioning conditions have been modified.



1.9.1 Drive Initial Parameters Setup Procedure



1. Power up the drive.This operation will take about 10 seconds and the drive will display (LEDs blink for test):

AC DRIVE **Start up …**	after 30 seconds >	***: #:** **STATUS**

Scroll Down and Enter **STARTUP** menu, scroll Down and Enter **Startup config** submenu:

***: #:** **STARTUP**	Enter	**STARTUP** **Regulation mode**	Down	**STARTUP** **Startup config**	Enter

NOTE! Upon opening the STARTUP menu, the drive enters in the parametrization mode.

The drive will show:

Startup config **Enter setup mode**

then press Enter. The drive will restart to **SETUP MODE** menu, wait few seconds, messages sequence will follow:

Restart **Please wait …**	then	**AC DRIVE** **Start up …**	until	**SETUP MODE** **Drive data**

2. Press Enter and set **Drive data** parameters values:

SETUP MODE **Drive data**	Enter	**Mains voltage** **460V**	Enter

Scroll Down and select AC input voltage from the following list:

460 - 440 - 415 - 400 - 380 - 230V, press Enter.

It is also possible to change : Ambient temperature, Switching frequency and Speed resolution. Scroll Down:

Ambient temp **40 C**	Down	**Switching freq** **8 KHz**	Down	**Spd ref/fbk res** **0.250 rpm**

NOTE! Speed resolution affects maximum value allowed for process speed (parameter ***Full scale speed*** to be set later). Therefore such resolution must be selected that application process speed will fit allowed range.

Speed resolution	Process speed max.value
0.125 rpm	2048 rpm
0.25 rpm	4096 rpm
0.5 rpm	8192 rpm

Press Left to exit from **Drive data**. The drive will show:

Busy **Please wait …**	then	**SETUP MODE** **Drive data**

If any changes have been made to **Drive data** menu parameters, during this operation internal drive values will be calculated and autotune results will be initialized.

3. Scroll Down and set **Motor data** parameters value.

NOTE! It's possible to load standard motor parameters or to enter all motor nameplate information.

A)
Enter motor nameplate data

To enter new motor nameplate data follow point A; to load standard motor nameplata data switch to point B.

A) Motor nameplate (values accepted depend on drive size):

SETUP MODE Motor data	Enter	Rated voltage 460V

Enter to edit motor Voltage. To confirm the new value press Enter, to cancel edit press Shift + Escape or scroll Down to:

Rated frequency 60 Hz

Enter to edit motor Frequency. To confirm the new value press Enter, to cancel edit press Shift + Escape or scroll Down to:

Rated current 10.7 A

Enter to edit motor Current.

NOTE! The value should not be less than approx 0.3 times the drive rated current, output current class 1 @460V on the drive nameplate.

To confirm the new value press Enter, to cancel edit press Shift + Escape or scroll Down to:

Rated speed 1762 rpm

Enter to edit motor Speed.

NOTE! The value is intended to be the motor full load speed at the rated frequency.

To confirm the new value press Enter, to cancel edit press Shift + Escape or scroll Down to:

Rated power 5.59 kW

Enter to edit motor Power.

NOTE! For a motor nameplate rated in HP, set **Rated power kW** = 0.746 x motor **Hp** rating.

To confirm the new value press Enter, to cancel edit press Shift + Escape or scroll Down to:

Cosfi 0.78

Enter to edit motor Cosfi (power factor).

To confirm the new value press Enter, to cancel edit press Shift + Escape or scroll Down to:

Efficiency 90.20%

Enter to edit motor Efficiency.

NOTE! Leave default values for Cosfi (power factor) and Efficiency if these data are not available from the nameplate.

Press Left to exit from **Motor data**; for some seconds the drive will show:

Busy Please wait …	then	SETUP MODE Motor data

If any changes have been made to **Motor data** menu parameters, during this operation internal drive values will be calculated and autotune results will be initialized.

If the operation generates any error messages or alarm led comes on, please check consistency of motor parameters and try again or see specific directions in section 1.11, Troubleshooting.

B) Load default motor nameplate data

B) Load standard motor parameters:

SETUP MODE Motor data	Enter	Rated voltage 460V	scroll Up to	Load default mot Standard 400V

press Enter to select parameters for 400V or 460V:

Sel mot def data Standard 400V	Up Down	Sel mot def data Standard 460V

select **Standard 400V** or **Standard 460V**, then press Enter to confirm.

NOTE! By this selection, the motor standard parameters with 400V (or 460V) are loaded making reference to the used drive size. Through this process the old data are overwritten.

Press Left to exit from **Motor data**; for some seconds the drive will show:

Busy Please wait …	then	SETUP MODE Motor data

If any changes have been made to **Motor data** menu parameters, during this operation internal drive values will be calculated and autotune results will be initialized.

[4]

Run: **CurrRegulator autotune** (motor parameters measurement)

4. Scroll Down to perform Current Regulator autotune procedure:

NOTE! This procedure executes a real motor parameters measurement.

WARNING! This operation may cause limited motor shaft rotation.

SETUP MODE CurrReg autotune	Enter	CurrReg autotune Start ?

Connect terminal 12 (Enable) to terminal 19 (+24VDC) through relays or local switch:

CurrReg autotune Start ?	Enter	CurrReg autotune Press I Key	press **[I]** Key to start

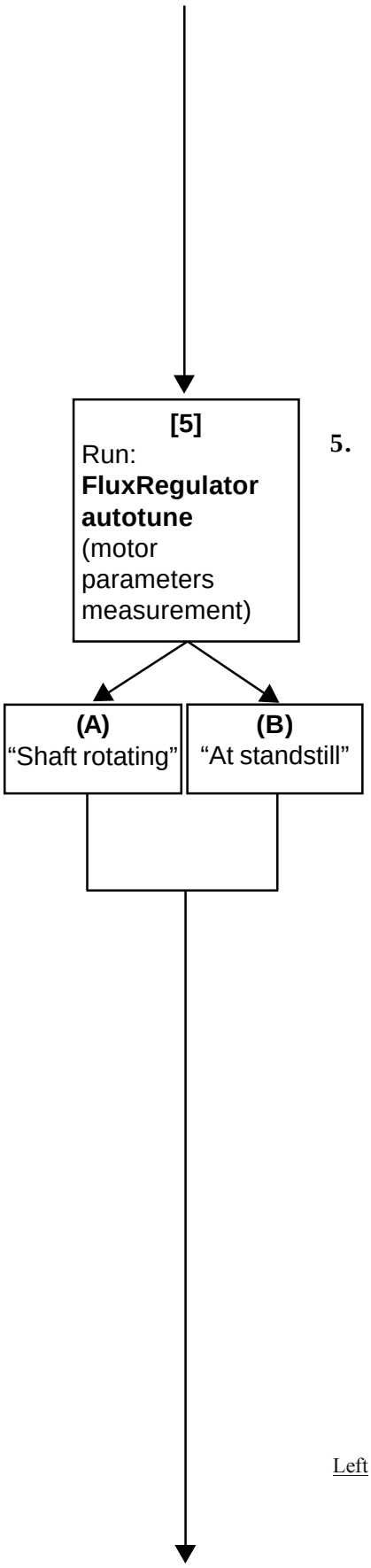
NOTE! Autotune can be aborted at any time by pressing the [O] key.

The current autotune procedure will start and the drive will display:

from	CurrReg autotune 0%	to	CurrReg autotune 100%	after	End Autotune	blinking

Press Left 3 times to exit from the procedure:

Left	CurrReg autotune Press I Key	Left	CurrReg autotune Start ?	Left	SETUP MODE CurrReg autotune



If the operation generates any error messages, for example when the drive is disabled during procedure execution:

Autotune err#1 :
Abort

and red LED alarm blinking

press Left to exit 2 times,

then try to repeat the autotune procedure. For more information about error messages and alarms, please refer to section 1.11, Troubleshooting.

Leave the drive menu in:

SETUP MODE
CurrReg autotune

5. Scroll Down to perform Flux Regulator autotune procedure; two options exist for this procedure, "Shaft rotating" is the preferred one for the higher accuracy, but it requires free uncoupled rotation of the motor shaft. Alternatively, option "At standstill" can be used.

NOTE! This procedure executes a real motor parameters measurement.

WARNING! Option "Shaft rotating" causes motor shaft rotation close to rated speed (A).

WARNING! Option "At standstill" may also cause limited shaft rotation (B).

SETUP MODE
FluxReg autotune

Enter

Select the desired option (scroll Up or Down):

FluxReg autotune
Shaft rotating

Up / Down

FluxReg autotune
At standstill

than press Enter, the drive will display (example for Shaft rotating):

Shaft rotating
Start ?

Enter

Connect terminal 12 (Enable) to terminal 19 (+24VDC) through relays or local switch:

Shaft rotating
Press I Key

press **[I]** Key to start

NOTE! Autotune can be aborted at any time by pressing the [O] key.

the flux autotune procedure will start through which the drive will display:

from | Shaft rotating 0% | to | Shaft rotating 100% | after | End Autotune | blinking

Press Left 4 times to exit from the procedure:

Left | FluxReg autotune / Press I Key | Left | FluxReg autotune / Start ? | Left | FluxReg autotune / Shaft rotating | Left | SETUP MODE / FluxReg autotune

NOTE! Aux Autotune procedure can take up to 5 minutes to complete. Be patient.

If the operation generates any error messages, for example when the drive is disabled during procedure execution:

Autotune err#1 :
Abort

and red LED alarm blinking

press Left to exit 2 times,

then try to repeat the autotune procedure. For more information about error messages and alarms, please refer to section 1.11, Troubleshooting

Leave the drive menu in:

SETUP MODE
FluxReg autotune

[6]

Chose the file where to save, and save all motor parameters: **Setup 0** to **3**

6. Scroll Down to save motor parameters in a file:

SETUP MODE
Save setup

Enter

Follow keypad prompts and choose one of the four setup data files (0,1,2,3):

Save as ?
Setup 0

Up / Down

Save as ?
Setup 1

,etc.

Choose Setup file, then press Enter to save. The drive will display:

Busy
Please wait …

NOTE! Different tunings may be saved in different files.

NOTE! When back out of SETUP MODE; you will later be prompted to reload data from one of the setup files, so make sure to record the setup file number now. This feature is used to file motor autotune data for usage with alternate motors.

Press Left to return:

SETUP MODE
Save setup

[7]
Exit from
SETUP MODE
(the drive will restart)

7. Scroll Down till:

SETUP MODE
Exit setup mode

Press Enter to Exit from **SETUP MODE** menu.

The drive will reload regulation database and return back to the previous Regulation mode to **STATUS** menu.

Wait few seconds, message sequence will follow:

Busy
Please wait …

then

Restart
Please wait …

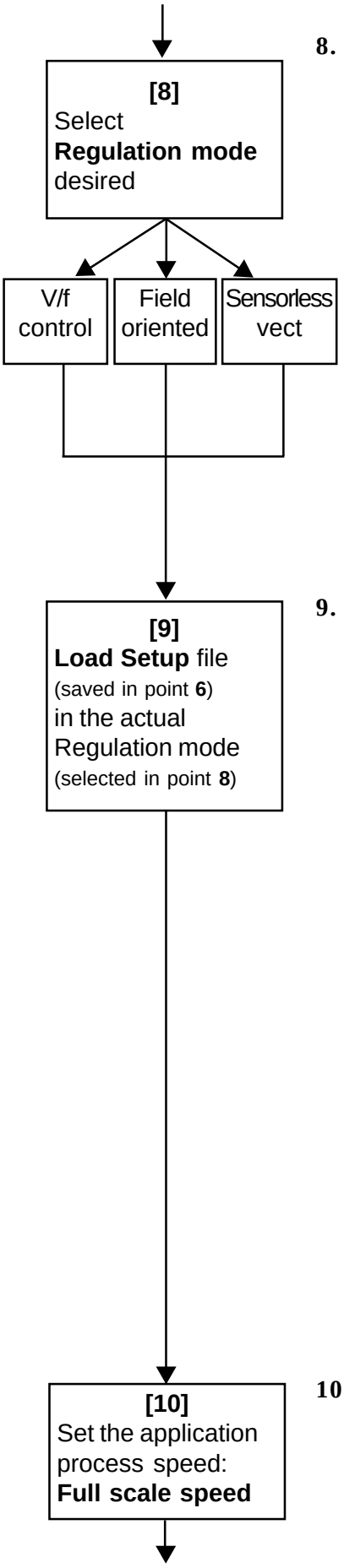
then

AC DRIVE
Start up …

until

*: #:
STATUS

NOTE! All Drive/Motor data parameters entered and measured values have been saved in Setup file. These parameters are not active yet in the Regulation mode drive database.



8. Drive factory setting is:

Regulation mode = V/f control.

Follow this point to change factory Regulation mode or switch to 9.

Go to **Regulation mode** submenu:

*: #: STATUS	Down	*: #: STARTUP	Enter	STARTUP Regulation mode	Enter	Regulation mode V/f control	

to select new Regulation mode desired, press Enter:

Select new mode V/f control	Down	Select new mode Field oriented	Down	Select new mode Sensorless	Up	Select new mode Field oriented	

Press Enter to confirm Regulation mode database selected. The drive will restart in the new regulation mode, this will take around 5 seconds:

Restart Please wait …	then	AC DRIVE Start up …	until	*: #: STATUS

9. Load setup file saved in **SETUP MODE**.

NOTE! After this operation Setup file parameters will become active in the Regulation mode selected. Some parameters will be inizialized.

Go to **STARTUP** menu and then **Startup config** submenu:

*: #: STARTUP	Enter , Down	STARTUP Startup config	Enter , Down till	Startup config Load setup		

press Enter, the drive will show:

Select setup ? Setup 0

To load **Setup 0** file press Enter; to load another setup file (Setup 1 or 2 or 3):

Down	Select setup ? Setup 1	Down	Select setup ? Setup 2	etc.

To load press Enter. The drive will take few seconds and it will display:

Busy Please wait …	to	Select setup ? Setup 0

Press Left to exit:

Startup config Load setup

10. Scroll Down to **Full scale speed** parameter

Startup config Full scale speed

Press Enter, the drive will display:

Full scale speed 1800 rpm	Enter to edit the value	Full scale speed 00001800 rpm

press Enter to confirm.

NOTE! The absolute speed handling range is +/- 200% Full scale speed.

To exit from **Full scale speed** menu:

Full scale speed 1800 rpm	Left	Busy Please wait …	then	Startup config Full scale speed

[11]

Only for field oriented: **Encoders config**

11. Only for **Regulation mode** = Field Oriented.

(if different switch to point 12)

Choose which encoder to use for speed feedback and the encoder type.

Scroll Down to **Encoders config** menu:

Startup config Encoders config

Press Enter to select which encoder will be used for speed feedback. Drive factory setting is on **Std encoder**, standard encoder input port (XE connector). To change the speed feedback to **Exp encoder**, expanded encoder input port (using option cards 6KCV301ENC or 6KCV301D14A4F) follow this step or switch to the next:

Encoders config Speed feedback	Enter	Int spd fbk sel Std encoder

Press Enter and select Exp encoder:

Int spd fbk sel Std encoder	Up	Int spd fbk sel Exp encoder	Enter	Int spd fbk sel Exp encoder

Press Left to exit:

Encoders config Speed feedback

To assign encoder type and pulses per revolution for **Std encoder** follow point **A**; for **Exp encoder** follow point **B**:

A) Scroll Down to assign standard encoder type (factory setting = digital encoder):

Std enc type Digital

Leave factory setting or select sinusoidal encoder:

Down	Std enc type Digital	Enter	Std enc type Sinusoidal

press Enter to confirm.

NOTE! For sinusoidal encoder, set the correct jumpers configuration on the regulation card RV33 (see section 1.6).

Scroll Down to assign digital or pulses per revolution (factory setting = 1024ppr):

Std enc pulses **1024 ppr**	Enter	**Std enc pulses** **0000102<u>4</u> ppr**

edit the number according to encoder data and press Enter to confirm.

B) Scroll Down to assign digital expanded encoder pulses per revolution (factory setting = 1024ppr).

Scroll Down 2 times to:

Exp enc pulses **1024 ppr**	Enter	**Exp enc pulses** **0000102<u>4</u> ppr**

Edit the number according to encoder data and press Enter to confirm.

To repeat encoder signal (using option card 6KCV301ENC), scroll Down till:

Encoders config **Rep/sim encoder**	Enter	**Rep/sim enc sel** **Repeat std enc**

Select what input channel has to be repeated; Repeat std enc (factory setting), or Repeat exp enc:

Rep/sim enc sel **Repeat std enc**	Up	**Rep/sim enc sel** **Repeat exp enc**

Enter

Press Left to exit:

Rep/sim enc sel **Repeat exp enc**	Left	**Encoders config** **Rep/sim encoder**

Press Left to exit from menu:

Left	**Busy** **Please wait ...**	to	**Startup config** **Encoders config**

[12]

Only for V/f control set the V/f characteristics: **V/f config**

12. Only for **Regulation mode** = V/f Control (if different switch to point 13)

NOTE! By operation **Load setup**, done in point9, **V/f characteristics** parameters are initialized according to the motor nameplate data. Such setting is suitable for more applications. Follow this point only to change the **V/f characteristics** parameters to comply with particular requirements.

Scroll Down to **V/f config** menu:

Startup config **V/f config**

Press Enter and scroll through the following parameters:

V/f voltage	Down	V/f frequency	Down	V/f shape
460.00 V		60.00 Hz		V = freq^1.0

V/f voltage and **V/f frequency** allow to define the voltage to frequency ratio for the motor, and the crossover point for applications requiring field weakening. Parameter **V/f shape** allows to choose a voltage to frequency profile optimized for the application in order to minimize motor losses. The V/F curve shape affects torque developed by the motor in function of frequency.

Example for to change factory setting:

V/f shape	Enter	V/f shape	Up
V = freq^1.0		V = freq^1.0	

V/f shape	Up	V/f shape	Up	V/f shape	Down	V/f shape
V = freq^1.5		V = freq^1.7		V = freq^2.0		V = freq^1.7

press Enter to confirm the selection or return to the factory setting and press Enter.

Press Left to exit from the menu:

V/f shape	Left	Busy	to	Startup config
V = freq^1.0		Please wait ...		V/f config

[13]

Set protection logic for the motor:

Motor protection

13. Follow this step to calibrate the protection logic for the motor. This logic uses a time-reverse overload characteristic, and requires the definition of motor "Service factor", and one arbitrary overload/time point on the limit curve by ***Mot OL factor*** and ***Mot OL time*** parameters.

NOTE! If the drive has factory defaults, default parameter settings comply with typical applications.

Scroll Down to **Motor protection** menu:

Startup config	Enter	Service factor	Enter	Service factor
Motor protection		1 . 00		+00001 . 00

Edit value and press Enter to confirm.

NOTE! **Motor continuous current** = **Rated current** x **Service factor**.

Scroll Down to set ***Motor OL factor***:

Service factor	Down	Motor OL factor	Enter	Motor OL factor
1 . 00		1 . 50		+00001 . 50

Edit value and press Enter to confirm.

Scroll Down to set ***Motor OL time***:

Motor OL factor	Down	Motor OL time	Enter	Motor OL time
1 . 50		60 . 00 s		60 . 00 s

Edit value and press Enter to confirm.

Press Left to exit from the menu:

Motor OL time 60 . 00 s	Left	Busy Please wait …	to	Startup config Motor protection

[14]

Set protection logic for the braking unit:

BU protection

14. Follow this step to enable the dynamic braking unit, **BU**. The following applies to an internal braking unit, IGBT device, with control from the drive.

Scroll Down to **BU protection** menu to enable BU operation:

Startup config BU protection	Enter	BU control Off	Enter	BU control Off

Select the device type:

BU control Off	Up	BU control Internal	Up	BU control External

Select the device desired and press Enter to confirm.

Scroll Down to enter external resistor value:

BU control Internal	Down	BU resistance 68 . 00 ohm	Enter	BU resistance +00068 . 00 ohm

Edit the value and press Enter to confirm.

NOTE! See section 5.8.2 for the minimum permissible size value resistor.

For the thermal protection of the braking resistance, a time reverse characteristic is defined. This requires definition of resistor power in continuous service, ***BU res cont pwr***, and an overload/time point, ***BU res OL time***, ***BU res OL factor***, which should be representative of the resistor overload capability (see section 1.3.2.8.1. Bracking unit protection on User's Guide manual fo help).

Scroll Down to set the parameters:

BU resistance 68 . 00 ohm	Down	BU res cont pwr 0 . 80 KW	Enter	BU res cont pwr +00000 . 80 KW	edit and press Enter

Scroll Down:

BU res cont pwr 0 . 80 KW	Down	BU res OL time 3 . 23 s	Enter	BU res OL time +00003 . 23 s	edit and press Enter

Scroll Down:

BU res OL time 3 . 23 s	Down	BU res OL factor 12 . 40	Enter	BU res OL factor +00012 . 40	edit and press Enter

NOTE! *BU res OL factor* is defined as a per unit multiplier of *BU res cont pwr*.

Press Left for exit from the menu:

BU res OL factor 12 . 40	Left	Busy Please wait …	to	Startup config BU protection

[15]

Save all configuration execute in the regulation mode selected:
Save config?

15. Save all the settings executed in the actual regulation mode, selected in step 8.

Press Left to exit from “Startup config” menu:

Startup config **BU protection**	Left	**Busy** **Please wait …**	to	**STARTUP** **Save config ?**

The prompt displays “Save config ?” (Recommended).

For this operation the drive will take around 5 seconds.

Press Enter to execute the procedure:

STARTUP **Save config ?**	Enter	**Busy** **Please wait …**	to	**STARTUP** **Save config ?**

Press Left to exit from STARTUP menu:

STARTUP **Save config ?**	Left	***: #:** **STARTUP**

NOTE! Upon closing the **STARTUP** menu, the drive exits from parametrization mode and becomes operational.

NOTE! The drive cannot be enabled when STARTUP menu is open.

[16]

Only for Field oriented and Sensorless vect run the speed regulator autotune:

SpdReg autotune

16. Follow this step to measure the load inertia and to perform the Speed regulator autotuning, **SpdReg autotune**. This is available only for **Regulation mode** = Field Oriented and **Regulation mode** = Sensorless vect. If the load has significant inertia, the speed regulator may need to be tuned.

WARNING! / CAUTION! The Speed regulator autotune requires free rotation of the shaft coupled with the load. No Stop switch or other control is handled during the test run, which consists of acceleration under programmable torque limit control. Some applications, especially those which have constraints to the load travel (eg. machine tool or material handling drives) may be incompatible with this. Other applications may be compatible with the test, provided material is not present in the driven process.

Scroll Down to **REGULATION PARM** menu, then press Enter and go Down till **Spdreg autotune**:

***: #:** **STARTUP**	Down till	***: #:** **REGULATION PARAM**

Select **SpdReg autotune**:

***: #:** **REGULATION PARAM**	Enter + Down till	**REGULATION PARAM** **SpdReg autotune**	Enter

the drive will display:

Test torque ref	Down	SpdReg autotune
3 . 83 Nm		Start ?

Connect terminal 12 (Enable) and 13 (Start) to terminal 19 (+24VDC) through relays or local switch.

WARNING ! **Shaft rotation is activated at this point**

Press Enter, the drive will display:

SpdReg autotune	press **[I]** key to start
Waiting start . . .	

NOTE! Autotune may be aborted at anytime by pressing the **[O]** key.

The drive will display the following messages:

SpdReg autotune	then	SpdReg autotune	to	End
0%		100%		Autotune

Last message will blink, indicating the end of the procedure (duration depends on load inertia).

Press Left to exit from SpdReg autotune:

End	Left	SpdReg autotune	Left	REGULATION PARAM
Autotune		Start ?		SpdReg autotune

Scroll Up 2 times to **SAVE PARAMETERS** command to save the configurations:

REGULATION PARAM	press Up till	REGULATION PARAM	Enter
SpdReg autotune		SAVE PARAMETERS	

The drive will save results of the tuning in permanent memory.

NOTE! Drive is ready for operation. Setting of other drive specific functions may be required according to the application requirements.

If the procedure generates any errors, the following message will be displayed:

Autotune err#31:
Load applied

Escape the message using Left key:

SpdReg autotune	Up	Test Torque ref
Start ?		0.36 Nm

Set Test Torque ref parameter at 50% of its value:

Test Torque ref	Enter	Test Torque ref	Set	Test Torque ref	Enter
0.36 Nm		0.36 Nm		0.18 Nm	

At this point repeat the SpdReg autotune procedure.

NOTE! Recycle terminal 12 and 13 through relays or local switch.

If the procedure will generate the same error message again, follow next step.

[17]

Only for Field oriented and Sensorless: **Speed 0 logic** and **SpdReg gain calc**

17. Configure Speed 0 logic and improve the gains of the Speed regulator.

To configure Speed 0 logic drive control, go to menu:

SPEED CONFIG/Speed 0 logic/ Speed 0 logic cfg

Decrease speed 0 speed and reference delay times:

Spd 0 spd delay parameter to *10 ms*
Spd 0 ref delay parameter to *10 ms*

If the drive application allows changes of Speed 0 threshold, increase speed 0 speed and reference threshold parameters:

Spd 0 speed thr parameter to *150 rpm*
Spd 0 ref thr parameter to *150 rpm*

To improve the gains of Speed regulator, go to the menu:

START UP/Startup config/SpdReg gain calc

Select:
Calc method parameter to *Fixed band*

Set:
Calc Inertia parameter following rules:
a) **IF**
Motor rating < Drive rating AND Load inertia ≤ Motor inertia
THEN
reduce the default value of *Calc Inertia* by 50%

b) **IF**
Load inertia >> Motor inertia
THEN
increase 50% the default value of *Calc Inertia*
OTHERWISE leave default value.
Leave default *Bandwidth* parameter [*50 rad/S*]

Escape all the menus to the main STARTUP menu.

During this operation, the parameters determining the gains of the Speed regulator will be calculated.

At this point, try to run the motor.

If the motor does not run correctly:

a) If the drive application allows changes of Speed 0 threshold, increase Spd 0 speed thr and *Spd 0 ref thr* parameters to 200 rpm.

NOTE! If the motor behavior is acceptable with the first settings (150 rpm), try to decrease *Spd 0 speed thr* and *Spd 0 ref thr* parameters to *100 rpm*.

b) Repeat the procedure of Speed regulator improvements described above increasing the bandwidth:

Bandwidth = 100 rad/S

c) If the motor does not run correctly, follow "IGBT voltage output distortion" (AV300i Version 2 User's Guide, chapter 1.4.2.1).

DRIVE READY

Commands Settings

In the default configuration the drive can be controlled from the keypad **[I]** and **[O]** keys, and *Digital input 0* (Enable) and *Digital input 1* (Start) are used as run interlocks.

This operation can be changed by parameters, Commands select, and other parameters found under the menu, I/O CONFIG.

Command Select parameter allows the Start/Stop commands to respond to **Edge** or **Level** sensitive signals.

NOTE! *Digital input 0* must be open to change parameter ***Commands select***.

To set ***Commands select*** parameter:

***: #:** **I/O CONFIG**	Enter	**I/O CONFIG** **Commands**	Enter	**Commands** **Commands src**	Down	**Commands** **Commands cfg**	Enter	**Commands select** **I O keys**

Press Enter to change the setting of ***Commands select*** parameter:

Commands select **I O keys**	Down	**Commands select** **Digital Edge**	Down	**Commands select** **Digital Level**	Down	**Commands select** **Terminal Edge**	Down	**Commands select** **Terminal Level**

Select the desired configuration and press Enter to confirm the selection.

I/O keys	The drive is controlled from the keyboard using the I O keys
Digital edge	The drive is controlled from a communication or application card using an Edge sensitive signal. Inputs defined by ***Term StrStp scr*** are level sensitive run permissives
Digital level	The drive is controlled from a communication or application card using a Level sensitive signal. Inputs defined by ***Term StrStp scr*** are level sensitive run permissives
Terminal edge	The drive is controlled via terminal strip using an Edge sensitive signal
Terminal level	The drive is controlled via terminal strip using a Level sensitive signal

NOTE! After downloading drive parameters from a file, or entering the STARTUP MENU through the keypad, the drive can only be restarted after:

a) cycling drive power

or:

b)

- when *Commands select = Terminal level*, cycling input *Digital input 0*
- when *Commands select = Terminal edge*, cycling input *Digital input 0*, and the digital input selected by ***Term strstp src***
- when *Commands select = Digital level*, cycling the digital signals selected by ***Digital StrStp src*** and ***Digital enable src***
- when *Commands select = Digital edge*, cycle input *Digital input 0* or the digital signals selected by ***Digital Enable src*** (if not selected to ONE), and by ***Digital StrStp src***

See chapter 1.5 of User's Guide for more details.

1.9.2 Motor Potentiometer and Jog

Run the motor using Motopot function

This function is enabled in the standard settings with a Speed Reference value = 1000rpm.

NOTE! Verify in **I/O CONFIG/Commands** menu: ***Term StrStp src*** = DI 1 monitor
Command select = I O Keys

To run the motor using Motopot function connect terminal 12 (Enable), terminal 13 (Start), to terminal 19 (+24VDC) through relays or local switch and follow the steps in the table below:

Control buttons	Sequencing	Display example after pressing
	Press START button to command the Drive to the Enable and Run state	∗: 0 #: 0 STATUS
	Press STOP button commands to stop the Drive from the Run state	∗: 0 #: 0 STATUS
	Press to display the speed reference value and to increase the reference value and accelerate the drive.	Mpot output mon 320 rpm
	Press to decrease the reference value and decelerate the drive.	Mpot output mon 150 rpm
	Press SHIFT and [-] to change the motor shaft rotation	Mpot output mon -150 rpm

Press Left to exit from Motopot operation.

To disable Motopot function, go to menu:

RAMP CONFIG Ramp setpoint	Enter	Ramp setpoint Ramp ref src	Enter	Ramp ref 1 src An inp 1 output

Scroll Down to:

Ramp ref 3 src Mpot output mon	Enter	Ramp ref 3 src Mpot output mon	Up to	Ramp ref 3 src NULL	Enter

How to use Jog function

This function is enabled in the standard setting with a speed reference value = 100 rpm.
Connect terminal 12 (Enable) and 13 (Start) to terminal 19 (+24VDC) through relays or local switch.

Press **SHIFT** and **[+]** to run, the speed will be displayed
Press **[-]** to change the motor shaft rotation
Press [jog] to run the other direction
Press **[Left]** to exit from jog operation

To change the jog speed reference, edit the reference in the following menu path:

SPEED CONFIG / Jog / Jog cfg / Jog 0

Enter SAVE PARAMETERS command at the bottom of SPEED CONFIG menu.

If there are other changes you might want to make to set up, **do them now**, remember to Enter Save parameters at the bottom of each menu in order to store every change in permanent memory.

1.10 Additional Information (Configuration of the OK Relay)

1.10.1 Ramp Setting

The drive allows to select **4 different sets** of Ramp times. Each set of Ramp times consist of *Ramp* and *S-Ramp* acceleration / deceleration times and a *Fast Stop* deceleration time.

The function has two input sources: ***Multi Ramp set 0 src*** and ***Multi ramp set 1 src***.

According to the state of the signals connected to the sources, it is possible to **select** one of the **Multi Ramp Sets** output**:** MR0, MR1, MR2, MR3.

Normally MR0 is used. The factory settings are:

- Acceleration delta speed = 1000 rpm, delta time = 10 s
- Deceleration delta speed = 1000 rpm, delta time = 10 s
- Fast Stop Deceleration delta speed = 10000 rpm, delta time = 10 s
- Acceleration S curve = 0.100 s, Deceleration S curve = 0.100 s

Example: setting the Acceleration ramp of MR0

*: #: RAMP CONFIG	Enter	RAMP CONFIG Ramp setpoint

Scroll Down to:

RAMP CONFIG Multi ramp	Enter	Multi ramp Multi ramp src

Scroll Down to:

Multi ramp Multi ramp cfg	Enter	Multi ramp cfg Multi ramp set 0	Enter	Multi ramp set 0 Acc set 0	Enter	MR0 acc dtl spd 1000 rpm

Press Enter to change acceleration delta speed factory value:

MR0 acc dtl spd +00001000 rpm	to	MR0 acc dtl spd +00001500 rpm	Enter	MR0 acc dtl spd 1500 rpm

Scroll Down to change acceleration delta time factory value:

MR0 acc dtl time 10 s	Enter	MR0 acc dtl time +00000010 s	to	MR0 acc dtl time +00000001 s	Enter	MR0 acc dtl time 1 s

Press Left to exit:

Multi ramp set 0 Acc set 0	Down	Multi ramp set 0 Dec set 0

Press Enter to change deceleration delta/time speed factory value, follow the same procedure as above.

For more details see chapter RAMP CONFIGURATION in the User's Guide.

1.10.2 Analog Input Tuning

On the regulation card, the following configuration can be set:

Analog inputs	Input signal	
	-10V…+10V	0-20mA
	0-10V	4-20 mA
Analog input 1	S8 = OFF	S8 = ON
Analog input 2	S9 = OFF	S9 = ON
Analog input 3	S10 = OFF	S10 = ON

TAVyS06

ON Jumper OFF Jumper

NOTE! it is important to remember that the hardware configuration on the regulation card has to be set according to the selected input.

- 10V… +10V The input allows a maximum voltage of +/-10V.

The motor rotation direction is obtained according to the signal polarity. Input voltage > 10V or >-10V cause saturation of the count value.

0–10V, 0–20mA The input allows a maximum voltage of +10V or 0…20mA current signal. If used as reference, the signal must be always positive sign. Through ***AI 1 sgn src*** it is possible to change the motor rotation.

4 –20 mA The input allows to connect 4… 20mA current signal.

If used as reference, the signal must be always positive sign. Through ***AI 1 sgn src*** it is possible to change the motor rotation.

Through the ***An inp X <thr*** output it is possible to monitor the state of the input current signal. If the current is lower than the value set in the ***An inp 1 thr*** parameter, an output signal is supplied (error signal). This signal can also be defined as digital output.

How to perform the **self-tuning procedure** of the **Analog input 1**, if the input is **- 10V… +10V** (factory).

Go to menu:

***: #:** **I/O CONFIG**	Enter	**I/O CONFIG** **Commands**

Scroll Down to:

I/O CONFIG **Analog inputs**	Enter	**Analog inputs** **Std analog inputs**	Enter	**Std analog inputs** **Analog input 1**	Enter	**Analog input 1** **An inp 1 src**

Scroll Down to:

Analog input 1 **An inp 1 cfg**	Enter	**An inp 1 type** **-10V . . . +10V**

To tune Analog input 1 offset, put to Zero the input reference and scroll Down 7 times to:

AI 1 offs tune **Start ?**	Enter	and wait the messag		**Autotune** **End**	Left	**AI 1 offs tune** **Start ?** e

To tune Analog input 1 gain, put to Max value the input reference and scroll Down to:

AI 1 gain tune **Start ?**	Enter	and wait the messag		**Autotune** **End**	Left	**AI 1 gain tune** **Start ?** e

Press more time Left to go back to the menu:

I/O CONFIG **Analog inputs**	to save scroll Down until	**I/O CONFIG** **SAVE PARAMETERS**	Enter

1.10.3 Configuration of the OK Relay (Terminals 80, 82)

Go to menu:

***: #:** **I/O CONFIG**	Enter	**I/O CONFIG** **Commands**

Scroll Down to:

I/O CONFIG **Digital outputs**	Enter	**Digital outputs** **Std digital outs**	Enter	**Std digital outs** **Std dig out src**	Enter	**DO 0 src** **Drive OK**

DO 0 src parameter defines the closing condition of the relay contact on terminals 80-82.

The "OK relay"can be selected as:

Drive OK The contact closes when the drive is powered up with no failure alarms (factory setting).

Drive Ready The contact closes when the following conditions are fulfilled:
- The drive is powered up
- There are no failure alarms present
- The drive is enabled. The enable operation is defined by parameters [En/disable mode] & [Commands sel]
- The magnetizing procedure has been completed. (Drive is ready to deliver torque)

NOTE! The contact opens immediately on a drive failure, or when the drive is disabled.

To change factory setting from "Drive OK" to "Drive ready":

DO 0 src **Drive OK**	Enter	**DO 0 src** **Drive OK**

Scroll Down to:

DO 0 src **Drive ready**	Enter	**DO 0 src** **Drive ready**

Press Left more times to go back to main menu.

1.10.4 Recipes

The drive can work with different regulation modes: V/f control, Field oriented and Sensorless control. Each functioning mode has an independent parameter set.

Using the recipe function is therefore possible to switch from one mode to the other without damaging each single configuration.

NOTE! Before switching to new different mode (for example V/f to Field oriented) without losing the data, it is required to save the settings.

The use of the Recipe is an easy, uniform and fast method to transfer different parameters set.

The drive allows to transfer the Recipes from one regulation mode to the other or/and between different drive sizes (by using the tool on PC).

Each drive regulation mode includes 4 recipe types:

I/O Config Input and Output configuration parameters

Ramp & Speed cfg Ramp and Speed configuration

Appl function PID regulation parameters

Appl card & comm option cards and communication protocols parameters

(see section 1.3.3 of the User's Guide for Recipes box).

Example of **Ramp & Speed cfg** recipe transfer: from V/f control to Field oriented regulation mode. Go to menu:

***: #:** **STARTUP**	Enter	**STARTUP** **Regulation mode**

Scroll Down to:

STARTUP **Export recipe**	Enter	**Select recipe:** **I/O config**	Down	**Select recipe:** **Ramp & speed cfg**	Enter	**Busy** **Please wait . . .**

The drive will take few seconds to:

Select recipe: **I/O config**	Left	**STARTUP** **Export recipe**

Scroll Up to:

STARTUP **Regulation mode**	Enter	**Regulation mode** **V/f control**	Enter	**Select new mode** **V/f control**	Down	to select new mode	**STARTUP** **Field oriented**	Enter

The drive will take few seconds to change regulation mode database:

Busy **Please wait . . .**	to	***: #:** **STATUS**	Down	***: #:** **STARTUP**	Enter	**STARTUP** **Regulation mode**		

Scroll Down to:

STARTUP **Import recipe**	Enter	**Select recipe:** **I/O config**	Down	**Select recipe:** **Ramp & speed cfg**	Enter	**Busy** **Please wait . . .**		

The drive will take few seconds to:

Select recipe: **I/O config**	Left	**STARTUP** **Import recipe**	Down to	**STARTUP** **Save config ?**	Enter	**Busy** **Please wait . . .**		

The drive needs around 5 seconds to save the configurations into the new mode.

1.10.5. Encoder Verification

Set the Drive in V/f control and run the motor, enable and start the drive and set a positive reference. The motor should be turning clockwise, looking at the driving shaft pointing at you.
Monitor the encoder measurement in the following menu path:

STATUS
Advanced status
Norm Std enc spd

The speed should be positive. If it is negative, then A and A- or B and B- should be interchanged on the encoder.

1.10.6. I/O Configuration

The standard drive has three analog inputs, two analog outputs as well as seven digital inputs and four digital outputs(two relay outputs + 2 opto-coupler outputs) which are configurable.

In addition, a set of LAN cards and a coprocessor card are available. All analog, digital and LAN channel outputs are configured from the I/O CONFIG menu. Every output channel has a "source" parameter that can be assigned with one signal out of a picklist. All analog, digital and LAN channel inputs can be tied to the appropriate regulation or control input by editing a "source" parameter for the regulation/control input and assigning it with one input out of a picklist. To set up the drive for two analog outputs (one for speed and one for load) for metering or other purposes, do the following:

Go to menu
I/O CONFIG
Analog outputs
Std analog outputs
Analog output 1
An out 1 src=Norm speed

Refer to the "Control terminals" section 1.3 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 shown in the section 1.6 of User's Guide. The analog outputs are defaulted to a scale of 1, which means 10 volts out at max parameter value. For example, if analog output 1 is set to ***Norm speed*** then speed will be scaled 10 Vdc (maximum output voltage available) at ***Full scale speed*** (found in startup config.). If you wanted 5 volts out at ***Full scale speed*** then set the scale to 0.5. If the output was set to ***Torque ref*** then 10 Vdc would be motor rated torque. If you wanted the output to be 10 Vdc at 150% then the scale would be 0.66.

1.11 Troubleshooting

1.11.1 List of Error Alarm Events

Entering bad data or conflicting data into the drive configuration will cause user errors to be displayed.

These type of errors can be:

- Configuration errors
- Data Base errors (DB errors)

Refer to the following paragraphs for descriptions.

1.11.1.1 Configuration Errors

Configuration errors can occur by entering incompatible or invalid parameter data.

The error indicates which parameters are causing the problem in the Setup Mode:

- Motor data
- Drive data
- Start Up parameter

The drive reports configuration error by the following example description:

Calc error: 606
Param: 0000

The "Calc error"number denotes the cause of invalid calculation. The error number reported by this process is set in part of the reply signal.

The Calc error numbers is composed as follows:

Calc error = Offset + Error code

The Offset denotes the type error:

0	for specific errors
100	for errors originated by the database calculation (see DB error paragraph)
500	for errors due to floating point calculation (exception, divide by zero etc..)
600	for errors originated by the configuration calculations (range and so on).

The Error code denotes the origin cause of the error (for the Error code values lists see below).

For example, Calc error number ***606*** is a configuration error (600) caused by speed base value (6) out of range.

The "Param" number is not meaningful.

Error code values lists

Error code values for Offset 0 :

0	no error
1	signal not managed in current configurator state
2	cannot stop regulation
3	recipe export error
4	recipe import error
5	error while loading selftune data
6	error while loading motor data
7	reserved
8	error while loading customer specific data
9	error while loading drive size data

10 error while writing file size.ini
11 error while apply database. The operation is refused because errors arised during group calculation.To reset the errors it is necessary re-enter the data, and confirm correctness
12 error while saving too changes

Error code values for Offset 100: See DB errors, section 1.11.1.2.

Error code values for Offset 500 (500 + error code):

3 Integer overflow
4 Floating overflow
5 Floating underflow
7 Divide by zero
9 Undefined float
10 Conversion error
11 Floating point stack underflow
12 Floating point stack overflow

Error code values for Offset 600 (600 + error code):

0 no error
1 switching freq. error
2 mains voltage error
3 ambient temperature error
4 regulation mode error
5 take selection error
6 base speed error
7 drive size error

Drive size setting

NOTE! If the User changes the Drive size, the drive will display:

Drv size: new size - old size

For example: ***Drive size: 0 - 1***

For the drive size number the table below:

Drive size - 6K	Size number
0.75 KW - 0.75 Hp	0
1.5 KW - 1.5 Hp	1
2.2 KW - 2.0 Hp	2
3.0 KW - 3.0 Hp	3
4.0 KW - 5.0 Hp	4
5.5 KW - 7.5 Hp	5
7.5 KW - 10 Hp	6
11 KW - 15 Hp	7
15 KW - 20 Hp	8
22 KW - 25 Hp	9
30 KW - 30 Hp	10
37 KW - 40 Hp	11
45 KW - 50 Hp	12
55 KW - 60 Hp	13
75 KW - 75 Hp	14
90 KW - 100 Hp	15
110 KW - 125 Hp	16
132 KW - 150 Hp	17
160 KW - 200 Hp	18

Drive size - DS	Size number
250 Hp	2
300 Hp	3
350 Hp	4
400 Hp	5
450 Hp	6
500 Hp	7
600 Hp	8
700 Hp	9
800 Hp	10

ai8080

1.11.1.2 Database Errors (DB Errors)

DB errors are caused by a incorrect setting in a single parameter. This problem is originated in the database calculation. For example the most common are:

- DB error Limit HIGH

- DB error Limit LOW

The message DB error is displayed by the drive in this format:

DB ERR IPA: error code

The IPA denotes the parameter number which caused the DB error calculation. The error code denotes the type error.

Example of message DB error displayed:

DB ERR 3420: 5

This means that the DB error is caused by IPA **3420** (V/f voltage) which is below the low limit; Error code 5 denotes the type error (for the DB error code values list see below). To find the low limit, which depends on drive configuration, it is possible to go to the V/f voltage parameter on the keypad.

Press the Shift key and then the Help key, the following will be displayed:

Max Value

min Value

Def(ault) Value

unit

raw value

IPA

Description

(Access) mode

In most cases it is enough to set a new value which is within the limits.

DB error code list

0	no error
1	SBI PROBLEM 0x01
2	Generic error
3	Attribute not exist
4	Limit High
5	Limit Low
11	Division by zero
12	Int Overflow
13	Int Undefflow
14	Long Overflow
15	Long Underflow
16	Domain Error
17	Indirection Error
18	Reached wrong eof
19	Dbase not configured
20	Value not valid
21	Process doesn’t reply
22	Wrong record size
23	Attribute read only

24 SBI PROBLEM 0x18
25 Command not yet implemented
26 Command wrong
27 Read file error
28 Header wrong
29 Reserved for internal use
30 Parameter not exist
31 Parameter read only
32 Parameter ”z” only
48 SBI PROBLEM 0x30

1.11.2 List of Error Codes for All Autotune Procedures

The different autotune procedures for Current regulator, Flux regulator, Speed regulator or Analog input calibration may generate error messages that are described in table 1.11.2.1.

Table 1.11.2.1. Error Messages from Autotune Procedures

Error number	Error text	Description
0	No error	
1	Abort	the user entered Escape or O key, or removed enable permissive (term 12 low)
2	DB access <IPA>	an attempt to access the database at the speficied index occurred during autotune procedure
3	No break point	failure in measuring inverter voltage distortion
4	Rs high lim	failure in measuring motor stator Resistance
5	Rs low lim	failure in measuring motor stator Resistance
6	DTL high lim	failure in computing compensation for the inverter voltage distortion
7	DTL low lim	failure in computing compensation for the inverter voltage distortion
8	DTS high lim	failure in computing compensation for the inverter voltage distortion
9	DTS low lim	failure in computing compensation for the inverter voltage distortion
10	LsS high lim	failure in calculating motor leakage inductance
11	LsS low lim	failure in calculating motor leakage inductance
12	ImNom not found	identification of rated magnetizing current failed
13	ImNom not found	identification of maximum magnetizing current failed
14	RrV low lim	Voltage limit exceeded during measurement for the calculation of motor rotor resistance
15	RrV high lim	Voltage limit exceeded during measurement for the calculation of motor rotor resistance
16	Rr high lim	failure in calculating motor rotor resistance
17	Rr low lim	failure in calculating motor rotor resistance
18	Al too high	value of analog input is too high for full scale autocalibration
19	Al too low	value of analog input is too low for full scale autocalibration
20	Rr2 high lim	failure in calculating motor rotor resistance
21	Rr2 low lim	failure in calculating motor rotor resistance
22	Drive disabled	Enable permissive (term 12) was found low when attempting to start autotune procedure
23	Rr timeout	timeout occurred during measurement for the calculation of motor rotor resistance
24	Rr2 timeout	timeout occurred during measurement for the calculation of motor rotor resistance
25	LsS timeout	timeout occurred during measurement for the calculation of motor leakage inductance
26	Drive enabled	Drive was found to be already enabled when attempting to initiate autotune procedure
27	Friction null	Drive was unable to identify a value for load friction
28	Drive stalled	Drive was unable to spin the shaft
29	Max spd exceeded	Drive speed limit for Speed regulator autotune was exceeded
30	Torque too high	Torque setting for Speed regulator autotune was too high
31	Load applied	Load torque was detected on the shaft
32	Calc error	An error occurred when processing measurement data
33	Config error <errcode>	The spedified Configurator error occurred during database configuration based on autotune data
34	Motor is running	Motor speed was found to be non zero when attempting to initiate autotune procedure
35	Cmd not supported	Command not supported in the current state

1.11.3 List of Regulation Alarm Events

Table 1.11.3.1 provides a description of regulation alarm events and information on how to configure the intended drive behaviour on their occurrence (where applicable).

Table 1.11.3.1 Regulation Alarm Events

Alarm name	Description (Cause of fault)	Drive activity After alarm	Hold off	Restart	Restart time	Code in the Alarm list	Bit position in Al.list
Failure supply	One or more of the power supply circuits in the control section failed	Disable drive	No	No	NA	21	1
Undervoltage	Voltage on the drive DC link is lower than the minimum threshold for the given Mains voltage setting	Disable drive	No	Yes. Logic is based on the number of attempts	Yes	22	2
Overvoltage	Voltage on the drive DC link is higher than the maximum threshold for the given Mains voltage setting	Disable drive	No	Yes	Yes	23	3
IGBT desat flt	IGBT instantaneous overcurrent was detected by gate desaturation sensing circuit	Disable drive	No	Yes. No more than 2 attempts in 30 seconds	Yes	24	4
Inst Overcurrent	IGBT instantaneoud overcurrent was detected by output current sensor	Disable drive	No	Yes No more than 2 at./30sec.	Yes	25	5
Ground fault	Output phase discharge to ground (when used on a grounded power system)	Programmable	No	No	Yes	26	6
Curr fbk loss	A failure of current sensor feeedback or power supply was detected	Disable drive	No	No	No	27	7
External fault	External fault input is active	Programmable	Programmable	Yes	Programmable	28	8
Spd fbk loss	A failure of the speed feedback sensor or power supply was detected	Programmable	No	No	No	29	9
Module OT	IGBT overtemperature was detected by internal sensor (models 0.75 to 20 Hp only)	Disable drive	Constant, 10 msec	No	No	30	10
Heatsink OT	Heatsink overtemperature was detected by thermal contact (only for models 25 Hp and over)	Disable drive	Constant, 1000 msec	No	No	31	11
Motor OT	Motor overtemperature was detected by thermal contact or PTC thermistor	Programmable	Programmable	Yes	Programmable	32	12
Heatsink S OT	Heatsink linear temperature sensor threshold was exceeded	Programmable	Programmable	Yes	Programmable	33	13
Regulat S OT	Regulation board linear temperature sensor threshold was exceeded	Programmable	Programmable	Yes	Programmable	34	14
Intake Air S OT	Cooling air intake linear temperature sensor threshold was exceeded (only for models 25Hp and over)	Programmable	Programmable	Yes	Programmable	35	15
ISBus fault	Fault of optional ISBus LAN communication	Programmable	No	Yes	Programmable	36	16
Comm card fault	Fault of optional LAN communication board	Programmable	No	Yes	Programmable	37	17
Appl card fault	Fault of optional application coprocessor board	Disable drive	No	No	No	38	18
Drv overload	Drive overload accumulator exceeded trip threshold	Programmable	No	No	No	39	19
Mot overload	Motor overload accumulator exceeded trip threshold	Programmable	No	No	No	40	20
BU overload	Braking resistor overload accumulator exceeded trip threshold	Programmable	No	No	No	41	21
Data lost	Data corrupted in non-volatile memory	Disable drive	No	No	No	42	22
Fwd Rev Ctrl	Forward and Reverse commands were detected active at the same time	Programmable	No	No	No	43	23
Max time	Software task time overrun was detected	Disable drive	No	No	No	44	24
Sequencer	Command sequencer was tripped by an alarm event	Disable drive	No	No	No	45	25
PLS timeout	The duration of a voltage dip caused Power Loss Stop function restart logic to timeout	Disable drive	No	No	No	46	26
Overspeed	Maximum speed threshold was exceeded while drive in RUN state	Programmable	Programmable	No	No	47	27
UV repetitive	More than a programmable number of UV fault were detected in 5 minutes	Disable drive. If n. of faults is set to max the Alarm is disabled.	No	No	No	48	28
IOC repetitive	More than 2 OC faults were detected in 30 sec.	Disable drive	No	No	No	49	29
IGBTdesat repet	More than 2 IGBT desat faults were detected in 30 sec.	Disable drive	No	No	No	50	30
WatchDog user	The drive failed to retrigger the communication watchdog within the specified time	Disable drive	No	No	No	51	31
Hw fail	Communication failure between Drive Regulation board and one of its options or I/O expansions.	Disable drive	No	No	No	52	32

1.11.4 Hints on How to Correct Some Regulation Alarms Events

External fault

External failure, acquired from a digital input or communication channel. If using a terminal input:

The signal on the terminal is missing. Make sure to tie common point of digital inputs (term 16) with power supply reference point (term. 18 if using internal power supply).

Failure supply

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 acknowledge the Alarm. If no other faults are indicated, check your wiring for a short-circuit, in some cases with the cable shielding. If this has not corrected the fault, contact your service representative.

Heatsink OT

(For models 25Hp and higher).

Temperature of the heatsink too high. Check for failure of a device fan, ambient temperature too high, dirty, heatsink, or cooling opening obstructed.

Heatsink S OT

Ambient temperature too high.

Failure of device fan, dirty heatsink, or cooling opening obstructed.

Intake Air S OT

(For models 25Hp and higher).

Temperature of the cooling air too high.

IGBT desat flt

Internal Overcurrent failure of IGBT power section

Switch off device and restart .If you are unsuccessful, contact your service representative.

(For drives which are 250 Hp and higher).

IGBT Desat can be generated by following conditions:

- IGBT Gating failure or overcurrent
- Overvoltage on DC bus
- Motor over instantaneous current
- AC rectifier converter control card failure (IS200 AVSC):
    - power supply low
    - loss of AC input phase

Inst Overcurrent

Overcurrent in the motor circuit.

Short-circuit or ground fault at the output of the drive

Remove power to the main circuit, wait for the prescribed time to discharge DC link and check power connections.

Reapply power and attempt a restart. If still unsuccessful, contact your service representative.

Module OT

(For models from 0.75 to 20 HP).

Temperature of the IGBT module too high.

	Failure of device fan.
	Failure in the IGBT module on power section.
	Fast overload current duty cycle too high.
Motor OT	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 heavy
	- 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 speed. The cooling effect of the fan on the motor shaft is too low for this load cycle. Change cycle or fit external fan.
	- Motor used above its frequency specification, causing extra magnetic losses.
Overvoltage	Overvoltage in intermediate circuit due to energy feedback from the motor
	Lengthen deceleration ramp. If not possible, use a braking unit to reduce the energy feedback.
Regulat S OT	Temperature of the Regulation board of the Drive too High.
	Ambient temperature too high.
Speed fbk loss	Failure in the speed feedback sensor signals.
	Encoder not connected, or incorrectly connected or not supplied:
	Check encoder signals as per section 1.10. If the indicated value does not change or random values are shown, check the power supply and the cabling of the encoder.
	Parameter and input setting on the regulation card is not consistent with encoder type.
Undervoltage	Mains voltage parameter incorrectly set (eg. ***Mains voltage*** set for 460 V, although the drive is run on 400 V). Remedy: set parameter correctly and then acknowledge (*) the fault.
	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, etc, not properly secured). Check connections.

(*) By default all alarms are auto-acknowledged after a 180 sec timeout. To acknowledge a fault press “Alarm” (Shift + Up arrow), scroll to the desired Alarm list entry and Enter

1.11.5 Hints on How to Correct Other Faulty Conditions

Motor not turning

Failure alarm is displayed: see section 1.11.4.

Once the error has been corrected, acknowlegde the alarm and press the I and O key to reset the command sequencer.

Keypad display is dark: AC voltage supply to terminals U1/V1/W1 missing or Regulation power supply overloaded. Check for short circuit on signal wiring.

Enable terminal permissive missing (Check configuration of the reg. terminals).

Drive not accepting commands: drive in SETUP MODE.

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

Motor turning in the wrong direction

Polarity of the speed reference signal incorrect.

Motor incorrectly connected.

Note for ***Regulation mode*** = "Field oriented" only:

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 swaped around in addition to two leads of the motor cable.

Motor not reaching nominal speed

Drive is at speed limit. Remedy: check *Speed top* and *Speed bottom.*

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

- Motor overloaded

- Inverter sized too small

- Incorrect ***V/f shape*** characteristic set

- ***Torque reduct*** input active

The value entered for the number of encoder pulses is too high.

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

If main speed reference is acquired via analog input, ***Full scale speed*** set too low may result in restricting range of analog inputs.

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:

Check encoder signals as per section 1.10. 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 opposite than the speed reference, reverse the encoder connections (exchange channel A+ and A- or B+ and B-).

Motor accelerates too slowly

Ramp value incorrectly set.

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

- 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 logic active

Unused speed reference configured to an open analog input. Remedy: set source parameters for any unused speed reference to OFF.

Main speed referece source is an analog input: 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.

The speed during acceleration with maximum current is not linear

Reduce the Speed integral gain and proportional gain proportionally. If this does not lead to an improvement, retune the speed regulator.

Speed oscillating

Speed regulator integraI gain vs proportional gain ratio is too high.

Motor potentiometer function not executed.

When operating with remote keys: ***Mpot up src*** and/or ***Mpot down src*** and ***Mpot invers src*** were not mapped to digital inputs or LAN channel bits.

Jog operation not possible

A start command is still present.

When operating with remote keys: ***Jog cmd src*** and/or ***Jog invers src*** were not mapped to digital inputs or LAN channel bits

Internal speed reference values not actuated

Mlt spd s 0 src, ***Mlt spd s 1 src*** or ***Mlt spd s 2 src*** were not mapped to digital inputs or LAN channel bits

Multi-Ramp function not reacting

Mlt ramp s 0 src or ***Mlt ramp s 1 src*** were not mapped to digital inputs or LAN channel bits.

Chapter 2 - Function and Feature (Overview)

The AV-300i 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,

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 backed-up 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): INTERBUS-S, PROFIBUS-DP, GENIUS or DEVICENET.
- Toolbox configuration tool

Fault register storing the last ten fault alarms with the associated lifetime.
Overload control
Engaging a running motor
Three freely configurable analog inputs + two analog outputs on the standard device
Expansion of the analog / digital outputs and analog / digital inputs via option cards
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
4 internal accel/decel/emergency ramps
PID control

Controlled stop in case of AC mains power loss.

Active ride-through of AC line power dips

Configurable commands interface: edge sensitive; pulse start/stop.

Function block scheme execution available as standard (supported by GE toolbox function block editor)

Diagnostic capture buffer

Chapter 3 - Inspection Procedure, Component Identification and Standard Specification

3.1 Upon Delivery Inspection Procedures

3.1.1 General

A high degree of care is taken in packing the AV-300i Drives and preparing them for delivery. They should only be transported with suitable transport equipment (see weight data on table 4.1.2). Observe the instructions printed on the packaging. This also applies when the device is unpacked and installed in the control cabinet.

Upon delivery, check the following:

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

Open the packaging with suitable tools. Check whether:

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

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

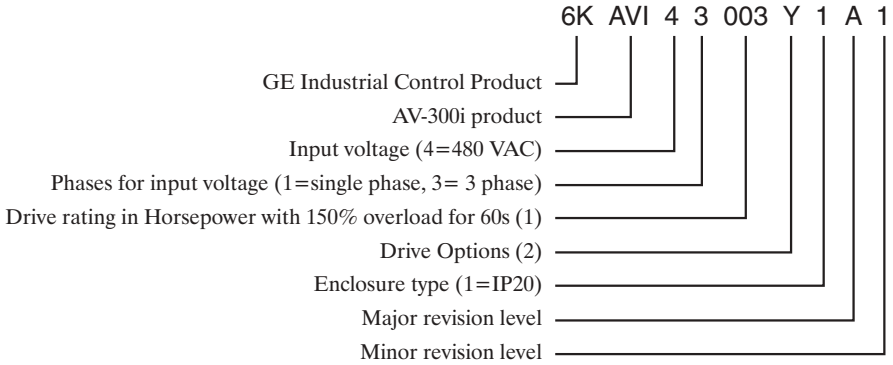
The devices should only be stored in dry rooms within the specified temperature ranges .

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

3.1.2 Inverter Type Designation

The technical specification of the AV-300i Drive is stated in the type code. Example:

Figure 3.1.2.1: Inverter Type Designation



(1) Fractional HPs are denoted with the letter F (for example: ¾ HP=F75)

(2) X= with keypad, without internal brake transistor N= no keypad, use Led module with internal brake transistor (DB)

Y= with keypad, with internal brake transistor M= no keypad, use Led module without internal brake (DB) transistor

*AV300i with Full function Keypad is the Standard Stoked item

1 HP - 60 HP, internal brake (DB) transistor is always supplied, OPTION PICK= M and X are not available

The AV-300i 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

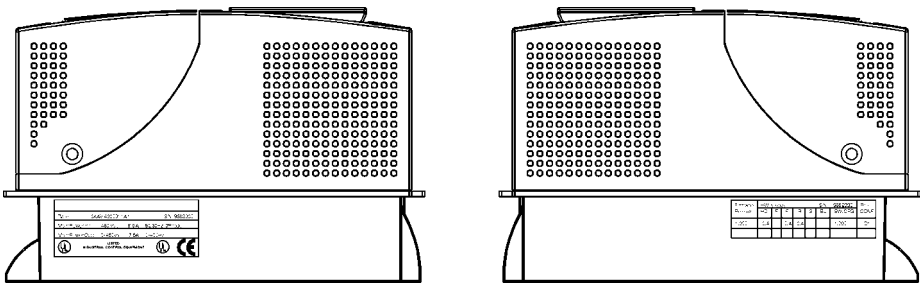
GENERAL ELECTRIC				
Type :	6KAVI43003Y1D1			S/N 9862330
Main Power In :	480 Vac	8.9 A	50/60Hz	3Phase
Main Power Out :	0-480Vac	7.5A	0-400Hz	
LISTED INDUSTRIAL CONTROL EQUIPMENT				

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 BU	0062330 SW. CFG	Prod. CONF
	D	F	P	R	S			
2.000	0.A		0.A	0.A			1.000	D1

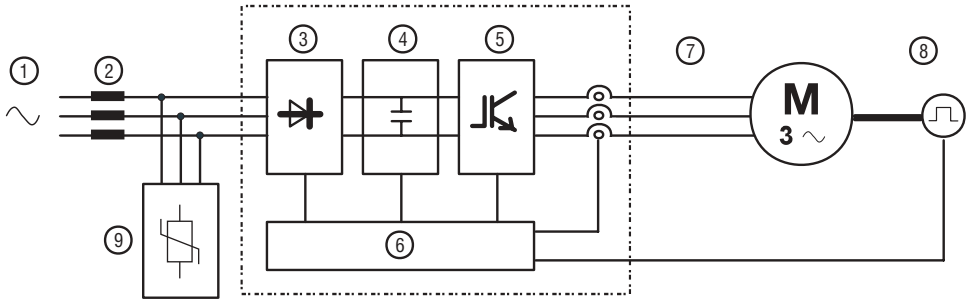
Figure 3.1.3.3: Nameplates Position



3.2 Component Identification

An AV-300i 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.

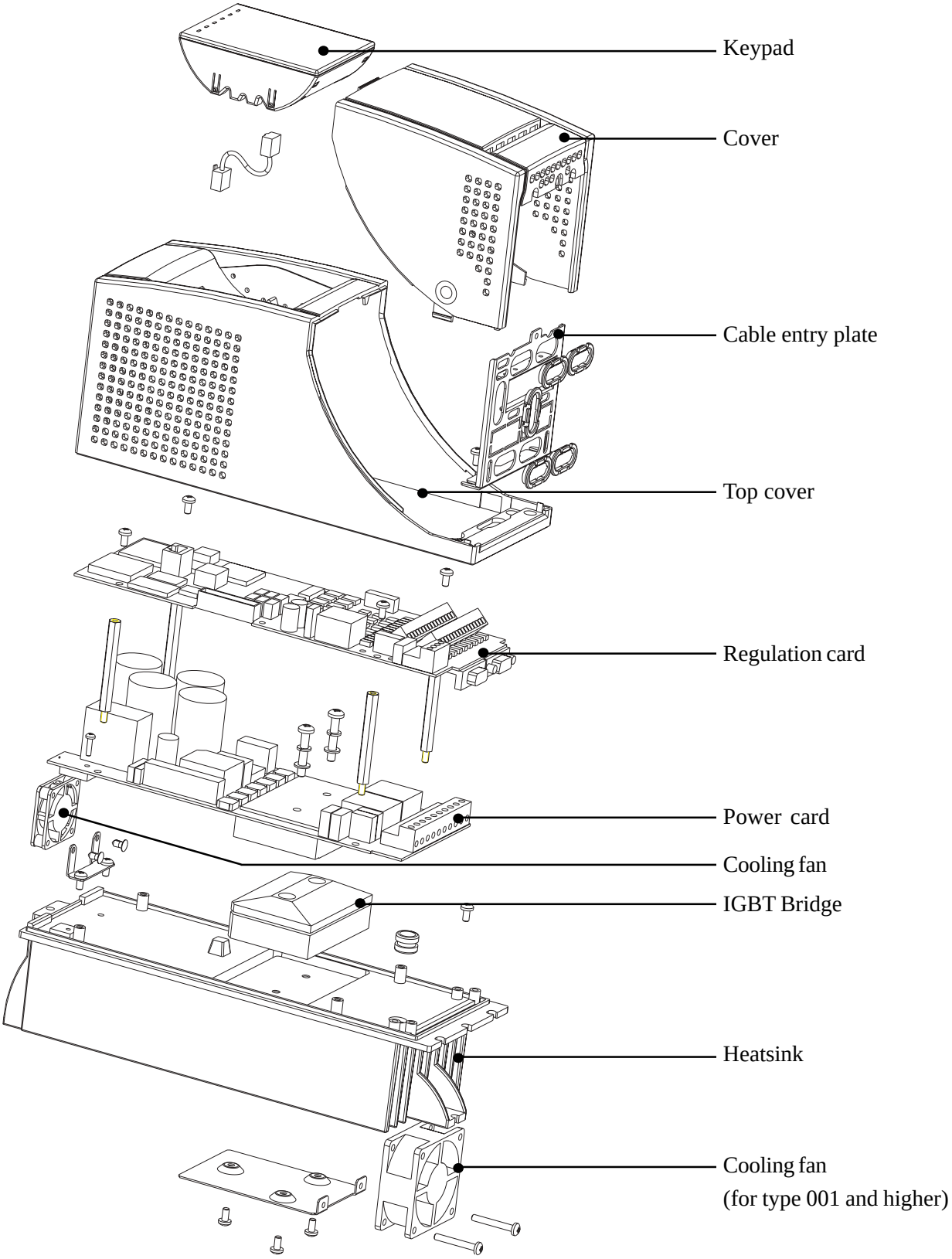
Figure 3.2.1: Basic Setup of Frequency Inverter



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}) = $\sqrt{2}$ 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)
9 Mov Assembly	For suppression of line voltage transient (250 Hp and larger designs only)

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 (according to IEC 60529)		IP20
			IP54 for the cabinet with externally mounted heatsink (size type 3F75 to 3020)
	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 (drive with LED module)		-25…+55°C (-13…+131°F), class 1K4 per EN50178
	storage (drive with keypad)		-20…+55°C (-4…+131°F)
	transport (drive with LED module)		-25…+70°C (-13…+158°F), class 2K3 per EN50178
	transport (drive with keypad)		-20…+60°C (-4…+140°F)
	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 : 0-200 Hp, CSA : 250-800 Hp

ai2000

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 AV-300i 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 sizes 6KAVI43020) are recyclable: the material used is >ABS+PC< .

3.3.2 AC Input/Output Connection

The AV300i 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 following values:

Models	**Max input short circuit current**
3F75 to 3040	5000 A
3050 to 3150	10000 A
3200	18000 A
3250	18KA
3300 to 3450	30 KA
3500 to 3800	Breaker: @ 480 VAC, 65KA Switch: @ 480 VAC, 30 KA for 500 ms max.

Also the insertion of a Mains inductance should be take into account (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. However, a 24V backup input for the regulator power supply can be used if it is desired to monitor status and diagnostic information across a power failure. When commissioning, set the **Mains voltage** parameter to the value of the AC Input voltage concerned. This automatically sets the threshold for the Undervoltage and Overvoltage alarms to the appropriate levels.

NOTE! A “Sequencer reset” command is required to restart the drive when input voltage is restored.

NOTE! In some cases AC Input chokes, and possibly noise suppression filters should be fitted on the AC Input side of the device in order to operate the AV300i Drive. 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.

Table 3.3.2.1-a: AC Input/Output Specifications (3F75 to 3200 Sizes)

	Type		3F75	3001	3002	3003	3005	3007	3010	3015	3020	3025	3030	3040	3050	3060	3075	3100	3125	3150	3200
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	32	42	55	64	79	98	128	145	173	224
	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	29	38.2	50	58.3	72	89.2	116.5	132	157.5	204
	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	11	18.5	22	22	30	37	55	55	75	90
	@ 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	11	15	18.5	22	30	37	45	55	55	90
	@ 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	22	30	37	45	55	75	90	110	132	160
	@ 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	22	30	37	45	55	55	90	90	110	160
	@ U_{LN}=460Vac; IEC 146 class 1	[Hp]	1	2	3	3	5	7.5	10	15	20	30	40	50	60	75	100	125	150	150	200
	@ U_{LN}=460Vac; IEC 146 class 2	[Hp]	0.75	1.5	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
	U_2 Max output voltage	[V]	0.98 x U_{LN} (AC Input voltage)																		
	f_2 Max output frequency (*)	[Hz]	400												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	47	63	79	93	114	142	185	210	250	324
	@ 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	43	58	72	85	104	129	169	191	227	295
	@ 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	40	54	68	81	99	124	160	183	217	282
	@ 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	36	50	62	74	90	112	146	166	198	256
	f_{SW} switching frequency (Default)	[kHz]	8												4						
	f_{SW} switching frequency (Higher)	[kHz]	16									16			8						--
	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	86	116	144	170	208	258	338	382	454	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	39	55	69	84	98	122	158	192	220	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	44	62	77	94	110	137	177	216	247	309
	@ 460Vac; IEC 146 class1 (***)	[A]	1.7	2.9	3.9	5.4	6.7	9.3	13.8	17.8	24.5	37	53	66	82	96	120	153	188	214	268
	- 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	3200	4200	5500	6400	7900	9800	12800	14500	17300	22400
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)				

(*) Max output frequency refer to regulation in field oriented mode. See table at chapter 3.3.6 for other details

ai2010

(**) For 3F75 to 3020 sizes, to work at 230VAC requires the product configuration to be D1 or higher.

(***) For 460 Vac ; IEC 146 class 2, AC Input current equal to class 1 * 0.9

Table3.3.2.1-b: AC Input/Output Specifications (3250 to 3800 Sizes)

	Type		3250	3300	3350	3400	3450	3500	3600	3700	3800
OUTPUT	Inverter output, 400V, continuousservice,(variable torque)	[KVA]	287	333	382	439	475	545	673	728	831
	Inverter output, 400V, 120% overload for 60s,(variable torque)	[KVA]	250	288	331	381	412	491	606	655	748
	Inverter output, 400V, 150% overload for 60s, (constant torque)	[KVA]	209	250	287	330	357	409	504	546	624
	Inverter output, 460V, continuous service, (variable torque)	[HP]	350	400	450	500	600	700	800	900	1000
	Inverter output, 460V, 120% overload for 60s, (variable torque)	[HP]	300	350	400	450	500	600	700	800	900
	Inverter output, 460V, 150% overload for 60s, (constant torque)	[HP]	250	300	350	400	450	500	600	700	800
	U2 Max output voltage	[V]	0.98 x Uln (AC input voltage)								
	I2n Rated output current:										
	Inverter output, continuous T service, (variable torque)	[A]	414	480	551	634	685	787	971	1051	1200
	Inverter output, 120% overload for 60s, (variable torque)	[A]	361	416	478	550	594	708	874	946	1080
	Inverter output, 150% overload for 60s, (constant torque)	[A]	302	361	414	477	515	590	728	788	900
	Fsw switching frequency (default)	[KHZ]	2 kHz								
	Fsw switching frequency (higher)	[KHZ]	4 kHz, with derating of output current to 80% of 2 kHz value (Ks factor)								
	Iovld (short term overload current, max I2n)	[A]	453	542	621	716	773	885	1092	1182	1350
	Derating factor:										
	KV at 460/480 VAC		1.0 for all ratings, all voltages								
	Kt for ambient temperature		1.0 @ 0C to 40C, 0.8 @ 50C								
	Kct for output frequency (constant torque only)		1.0 @ Fout > 2 Hz, 0.75 @ Fout < 2 Hz								
	Kvt for output voltage (variable torque only)		1.0 @ Vout = Vrated, Vout / Vrated @ 75% < Vout < 100%, 0.75 @ Vout < 75% Vrated								
	Ks for switching frequency		1.0 @ 2 khz, 0.8 @ 4 khz								
INPUT	Uln AC input voltage	[V]	400 V - 15% – 480V + 10%, 3ph								
	AC input frequency	[HZ]	50/60 Hz +/- 5%								
	AC input current: Connection with 3-phase reactor										
	Inverter input, continuous service, (variable torque)	[A]	414	480	551	634	685	787	971	1051	1200
	Inverter input, 120% overload for 60s, (variable torque)	[A]	361	416	478	550	594	708	874	946	1080
	Inverter input, 150% overload for 60s, (constant torque)	[A]	302	361	414	477	515	590	728	788	900
	AC input current: Connection without 3-phase reactor										
	Inverter input, continuous service, (variable torque)	[A]	for these types a minimum inductance is recommended								
	Inverter input, 120% overload for 60s, (variable torque)	[A]	for these types a minimum inductance is recommended								
	Inverter input, 150% overload for 60s, (constant torque)	[A]	for these types a minimum inductance is recommended								
	Overvoltage Threshold	[V]	725 VDC (400 VAC mains), 800 VDC (460 VAC mains)								
	Undervoltage Threshold	[V]	453 VDC on / 272 VDC off (400 VAC mains), 500 VDC on / 300 VDC off (460 VAC mains)								
	Braking IGBT Unit		External braking unit (optional)								
	Watts Loss (variable torque)	[watts]	5040	5508	6426	7344	8262	9158	10989	12821	14652
	Watts Loss (constant torque)	[watts]	3286	3723	4344	4964	5585	6152	7382	8613	9843
	Hp		**3250**	**3300**	**3350**	**3400**	**3450**	**3500**	**3600**	**3700**	**3800**

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), taking into account typical output power factor for each size

3.3.4 AC Output

The output of the AV-300i 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 permitted! It is possible 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
($I_{MAX} = 1.10 \times I_{CONT}$ for 60 seconds for 3250-3800 sizes)

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 power 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 1/3 rated output current [$0.3 \times I_{2N}$]. 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.

Type		3F75	3001	3002	3003	3005	3007	3010	3015	3020	3025	3030	3040	3050	3060	3075	3100	3125	3150	3200
- 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	47	63	79	93	114	142	185	210	250	324
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	42.6	57.1	71.6	84.3	103.4	128.7	167.7	190.4	227	293.8
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	32	42.8	53.7	63.2	77.5	96.6	125.8	142.8	170	220.3
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	32	42.8	53.7	63.2	77.5	96.6	125.8	142.8	170	220.3
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	25.6	34.3	43	50.6	62	77.2	100.6	114.2	136	176.3
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	16	21.4	27	31.6	38.8	48.3	63	71.4	85	110.2
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	16	21.4	27	31.6	38.8	48.3	63	71.4	85	110.2
- 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	40	54	68	81	99	124	160	183	217	282
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	36.3	49	61.7	73.4	89.8	112.4	145.1	166	196.7	255.7
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	27.2	36.7	46.2	55.1	67.3	84.3	108.8	124.4	147.6	191.8
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	27.2	36.7	46.2	55.1	67.3	84.3	108.8	124.4	147.6	191.8
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	21.8	29.4	37	44	54	67.5	87	99.6	118	153.4
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	13.6	18.4	23.1	27.5	33.7	42.2	54.4	62.2	73.8	95.9
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	13.6	18.4	23.1	27.5	33.7	42.2	54.4	62.2	73.8	95.9

ai2020

Table 3.3.4.1-a: Nominal Drive Current (3F75 to 3200 Sizes)

Table 3.3.4.1-b: Nominal Drive Current (3250 to 3800 Sizes)

Type		3250	3300	3350	3400	3450	3500	3600	3700	3800
I2n Rated output current:										
Continuous service, no overload (variable torque)	[A]	414	480	551	634	685	787	971	1051	1200
Overload service, 120% overload for 60s, (variable torque)	[A]	361	416	478	550	594	708	874	946	1080
Overload service, 150% overload for 60s, (constant torque)	[A]	302	361	414	477	515	590	728	788	900
Iovld (short term overload current, max I2n)	[A]	453	542	621	716	773	885	1092	1182	1350

Derating factors:

KV at 460/480 VAC	1.0 for all input voltages
Kt for ambient temperature	1.0 @ 0C to 40C, 0.8 @ 50C
Kct for output frequency (constant torque only)	1.0 @ Fout > 2 Hz, 0.75 @ Fout < 2 Hz
Kvt for output voltage (variable torque only)	1.0 @ Vout = Vrated, Vout/Vrated @ 75% < Vout < 100%, 0.75 @ Vout < 75% Vrated
Ks for switching frequency	1.0 @ 2 khz, 0.8 @ 4 khz

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	± 11 bit resolution, 2 msec update			
	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	
Digital inputs	8 msec update, ± 11 bit resolution			
		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 per revolution: see table 3.3.5.1			
	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 per revolution: see table 3.3.5.1			
	Type	complementary output/line driver		
	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%

Table 3.3.5.1 Selecting Encoder ppr

Speed D reference resolution (rpm)	Min number of encoder pulses (ppr)						Max number of encoder pulses (ppr) (*)	
	Motor rpm @ 60 Hz (motor poles) **						**Sinusoidal**	**Digital**
	3600 (2)	**1800 (4)**	**1200 (6)**	**900 (8)**	**600 (10)**	**450 (12)**		
0.125	1024	1024	1024	1024	1024	1024		
0.25	512	512	512	1024	1024	1024	80kHz* 60/FSS	150kHz* 60/FSS
0.5	512	512	512	1024	1024	1024		

(*) FSS=Full scale speed

(**) $\text{rpm} = \frac{120 \times \text{freq}}{\text{number of motor poles}}$

3.3.6 Performance

Table 3.3.6.1: Maximum Output Frequency

Regulation mode	Output frequency (Hz)					
	Maximum				Minimum (*)	Resolution
	Switching frequency (kHz)					
	2	**4**	**8**	**16**		
Field oriented	200	200	400	400	0	0.005
Sensorless vect	200	200	200	200	6 Hz	
V/f control	200	300	600	600	2 x motor slip freq	

(*) 1,5 x Rated motor torque capability

Table 3.3.6.2: Speed Feedback Resolution

Regulation mode	Speed reference resolution (rpm)	Speed feedback resolution (rpm)			FSS max value (rpm)	Limit speed (rpm)
		Enc Sin	Enc Dig Fmode	Enc Dig Fpmode		
Field oriented	0.125 0.25 0.5	Highest value of either [60000/(256 x ppr] or Spd Ref. Resol.	Highest value of either (60000/(40 x ppr) or Spd Ref. Resol.	Spd Ref. Resol.	2048 4096 8192	4096 8192 16384
Sensorless vect	0.125 0.25 0.5	Highest value of either 0.3 or Spd Ref. Resol.			2048 4096 8192	4096 8192 16384
V/f control	0.125 0.25 0.5	N/A			2048 4096 8192	4096 8192 16384

Table 3.3.6.3: Speed Regulator Bandwidth

Regulation mode	Spd Control range	Max Spd reg bandwidth (rad/sec)			Typ Spd Reg Accuracy (**) [%]
		Enc Sin	Std dig enc mode=F	Std dig enc mode=FP	
Field oriented	>10000:1	300	100	300 (Spd>15rpm for ppr=1024)	0.01
Sensorless vect	>10:1	100 (Spd>FSS/100)			0.5@FSS
V/f control	>100:1	N/A			1%

Table 3.3.6.4: Torque Current Specifications

Regulation mode	Torque ref. resolution	Typ Torque Reg Accuracy (***)[%]	Trq Control range	Typ Trq Rise time [ms]
Field oriented	>1:1000	4	>20:1	0.8
Sensorless vect	>1:1000	8	>20:1	0.8
V/f control	N/A	N/A	N/A	N/A

(**) Full scale speed FSS=1500rpm=100%

(***) Mot nom torque=100%, Spd range (FSS, to FSS/10), Trq range (Motor nameplate trq, to Motor nameplate trq/10)

Chapter 4 - Installation Guidelines

4.1 Mechanical Specification

Figure 4.1.1: Drive Dimensions (Sizes 3F75 up to 3020)

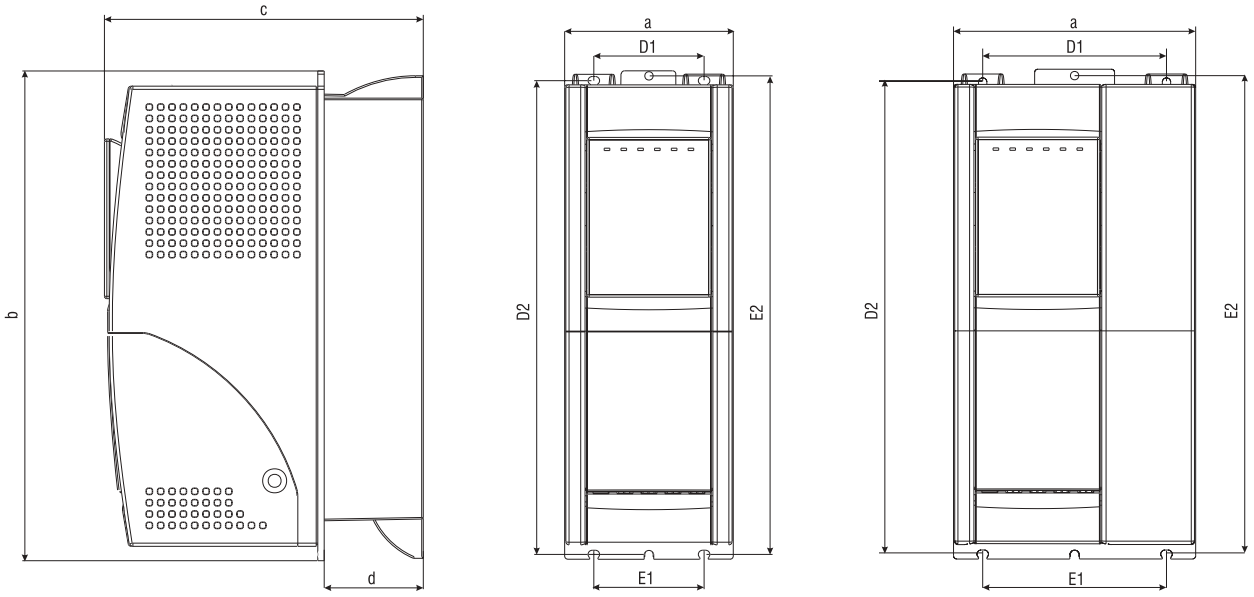
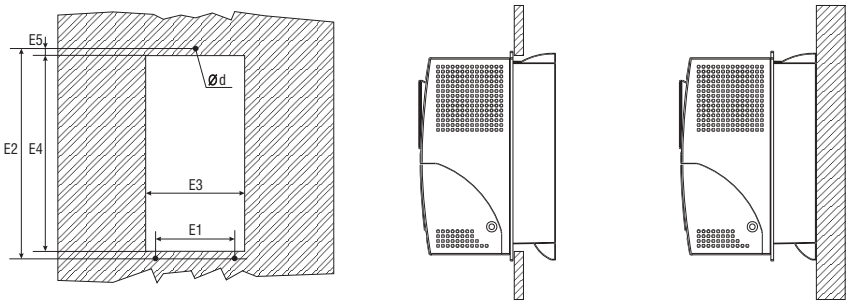


Figure 4.1.2: Mounting Methods (Sizes 3F75 up to 3020)



Mounting with external dissipator (E)

Mounting wall (D)

Table 4.1.1: Drive Dimensions and Weights (Sizes 3F75 up to 3020)

Type		3F75	3001	3002	3003	3005	3007	3010	3015	3020
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)	

ai3100

Figure 4.1.3: Drive Dimensions (Sizes 3025 up to 3200)

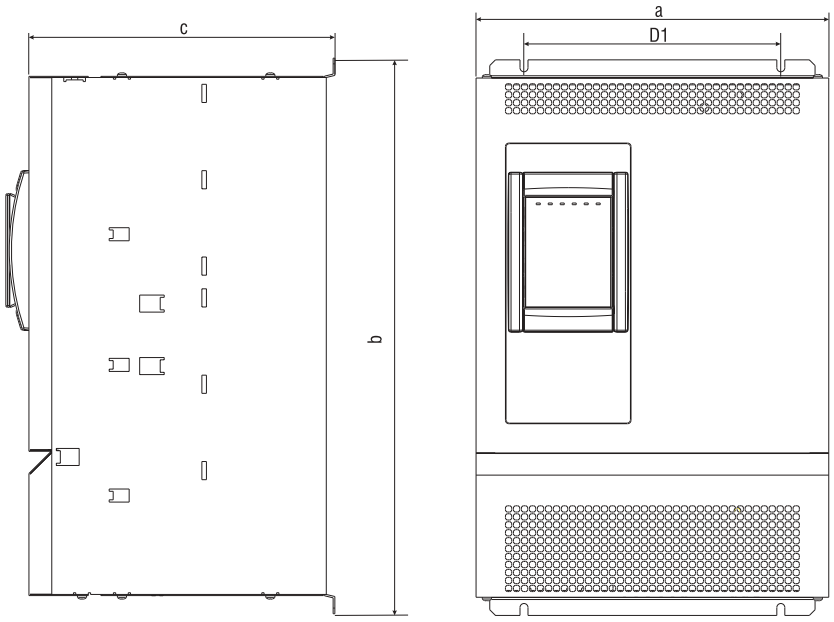


Figure 4.1.4: Mounting Methods (Sizes 3025 up to 3200)

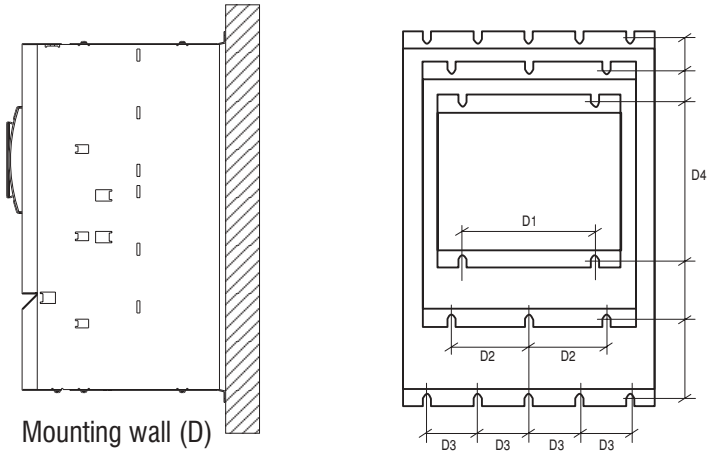


Table 4.1.2: Drive Dimensions and Weights (Sizes 3025 up to 3200)

Type		3025	3030	3040	3050	3060	3075	3100	3125	3150	3200
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

ai3105

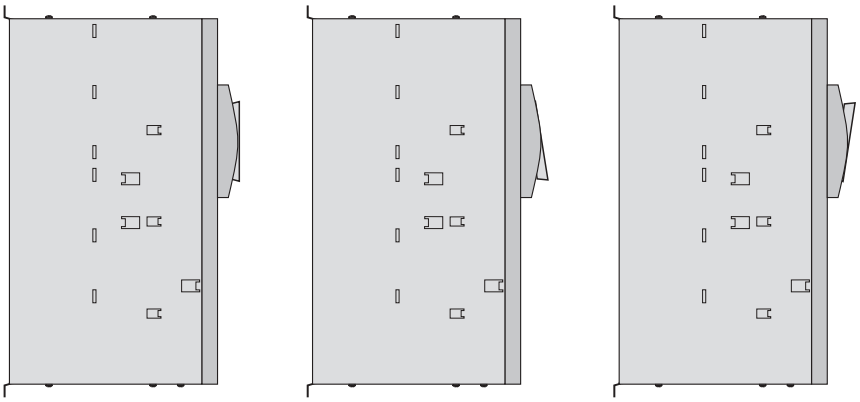
Table 4.1.3: Drive Dimensions and Weights (Sizes 250 up to 800 Hp)

Type	3250	3300	3350	3400	3450	3500	3600	3700	3800
Drive dimensions: with cabinet									
W inch (mm)	39 (1000)	62 (1600)	62 (1600)	62 (1600)	62 (1600)	71 (1800)	71 (1800)	71 (1800)	71 (1800)
H inch (mm)	87 (2200)	87 (2200)	87 (2200)	87 (2200)	87 (2200)	87 (2200)	87 (2200)	87 (2200)	87 (2200)
D inch (mm)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)
Drive dimensions: Drive module only									
W inch	19.72	39.78	39.78	39.78	39.78	n.a.	n.a.	n.a.	n.a.
(mm)	(501)	(965)	(965)	(965)	(965)				
H inch	56.25	56.25	56.25	56.25	56.25	n.a.	n.a.	n.a.	n.a.
(mm)	(429)	(429)	(429)	(429)	(429)				
D inch	18.43	19.02	19.02	19.02	19.02	n.a.	n.a.	n.a.	n.a.
(mm)	(468)	(483)	(483)	(483)	(483)				
Weight: with cabinet									
lbs	1090*	1800*	1800*	1800*	1800*	2400 **	2400 **	2400 **	2400 **
kg	493*	814*	814*	814*	814*	1086 **	1086 **	1086 **	1086 **
Weight: Drive module only									
lbs	350	100	100	100	100	n.a.	n.a.	n.a.	n.a.
kg	158	317	317	317	317	n.a.	n.a.	n.a.	n.a.

* weight includes reactor ** weight does not include reactor n.a.: not applicable

NOTE! see Appendix A for 250 to 800 Hp drawings

Figure 4.1.5: Keypad Positioning



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

4.2 Watts Loss, Heat Dissipation, Internal Fans and Minimum Cabinet Opening Suggested for 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 (3F75 to 3200 Sizes)

Type		3F75	3001	3002	3003	3005	3007	3010	3015	3020	3025	3030	3040	3050	3060	3075	3100	3125	3150	3200
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	658	864	1100	1250	1580	1950	2440	2850	3400	4400
@U_{LN}=460Vac [1]	[W]	45.0	72.0	96.3	126.7	164.1	215.6	300.8	340	468	582	780	1000	1100	1390	1750	2200	2560	3050	3950
[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

ai3110

Table 4.2.2: Heat Dissipation and Required Air Flow (3250 to 3800 Sizes)

Type		3250	3300	3350	3400	3450	3500	3600	3700	3800
Watts Loss (variable torque)	[watts]	5040	5508	6426	7344	8262	9158	10989	12821	14652
Watts Loss (constant torque)	[watts]	3286	3723	4344	4964	5585	6152	7382	8613	9843
Air flow of fan:										
- Heatsink fans	[cfm]	600	1200				2400			
	[m^3/h]	1020	2040				4080			
		14x20	14x20x2				n.a.			

NOTE! All AV300i drives have internal fans.

Heat dissipation losses refer to default switching frequency

Table 4.2.3: Minimum Cabinet Opening Suggested for the Cooling

Type	3F75-3003	3005-3010	3015	3020	3025	3030	3040	3050	3060	3075-3150	3200	3250	3300-3450	3500-3800
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)	44 (280)	88 (560)	n.a.
Heatsink cm^2 (sq.inch)	36 (5.6)	72 (11.1)	128 (19.8)											

ai3120

4.2.1 Cooling Fans Power Supply

Sizes 3F75 to 3060 — Power supply (+24VAC) for these fans is provided from the internal drive power supply unit.

Sizes 3075 to 3200 — Power supply for these fans is provided from a separate AC Input:

- 6KAVI43075: 0.8A@115V/60Hz, 0.45A@230V / 50Hz
- 6KAVI43100 ... 6KAVI43150: 1.2A@115V/60Hz, 0.65A@230V / 50Hz
- 6KAVI43200: 1.65A@115V/60Hz, 0.70A@230V / 50Hz

Figure 4.2.1: UL Type Fan Connections on 6KAVI43100, 6KAVI43125 and 6KAVI43150 Sizes

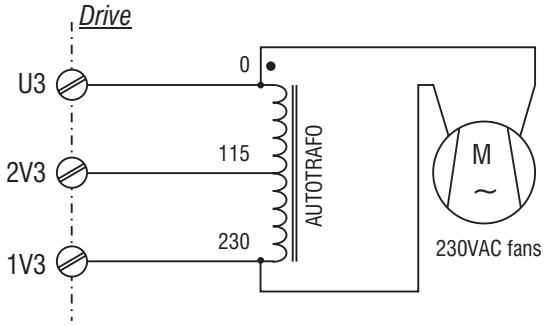


Figure 4.2.2: UL Type Fan Connections on 6KAVI43075 and 6KAVI43200 Sizes

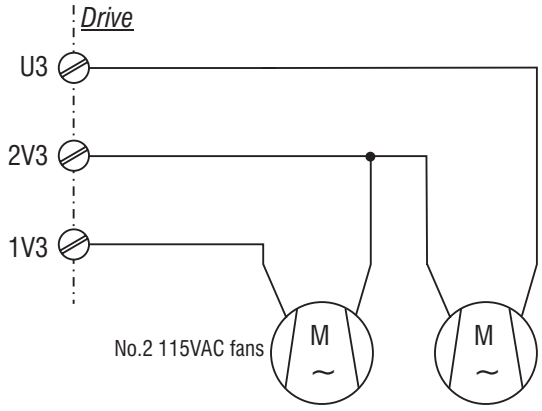
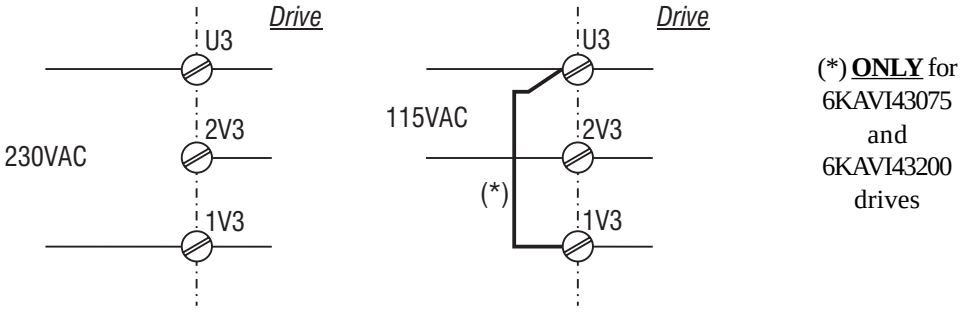


Figure 4.2.3: Example for External Connection



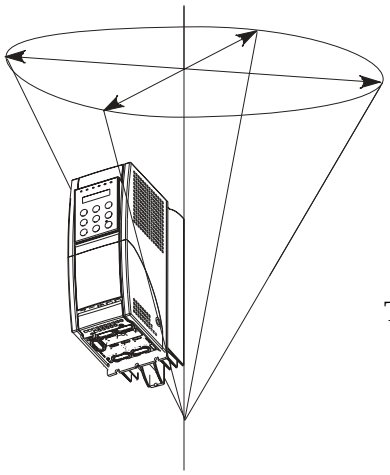
NOTE! An internal fuse (2.5A 250VAC slo-blow) for 6KAVI43100, 6KAVI43125 and 6KAVI43150 sizes is provided.

On 3075 and 3200 sizes the fuse must be mounted externally.

4.3 Installation Mounting Clearance

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

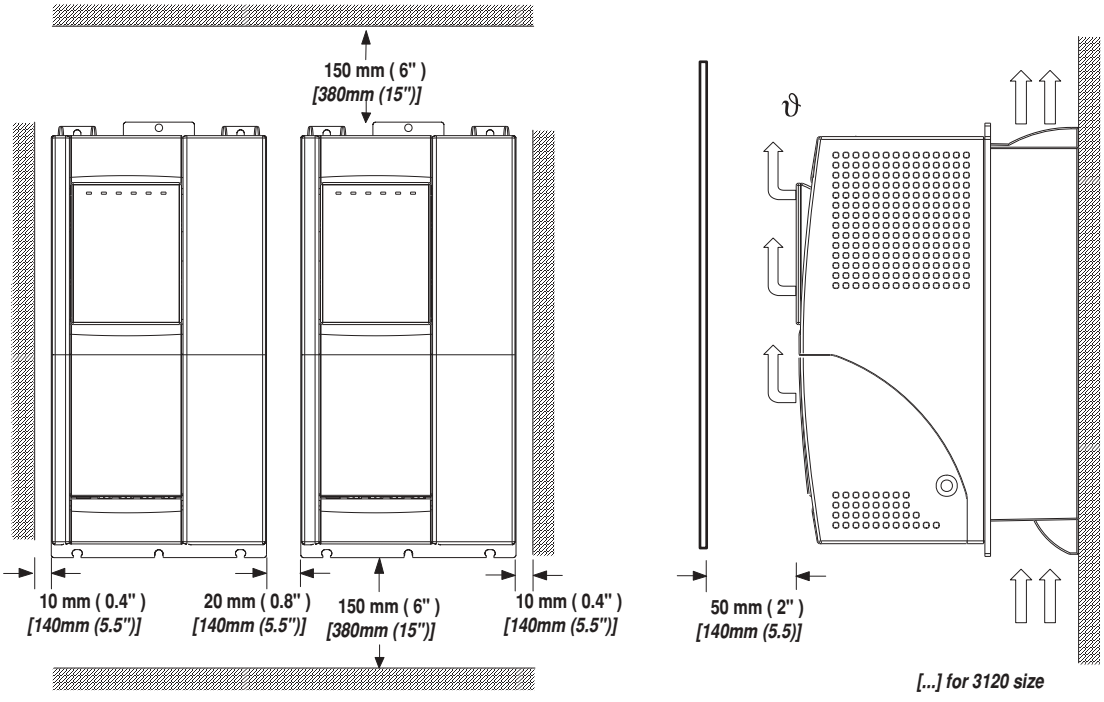
Figure 4.3.1: Max. Angle of Inclination



The maximum angle of inclination is 30°.

NOTE! The Drives must be mounted in such a way that the free flow of air is ensured. The clearance to the device must be at least 150 mm (6 inches). A space of at least 50 mm (2 inches) must be ensured at the front. On size 3200 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 AV-300i Drives are 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

4.4.1.1 AC Induction Motors

FOR BEST RESULTS:

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

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

b) Rated volts/rated frequency: the motor nameplate should be no less than a 460 VAC/30 Hz ratio

c) Flux range: (thought as weak field range for hi speed motors) no more than 4:1

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

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

f) Higt efficiency motors are acceptable in V/Hz and FOC operation. Do not use for encoderless vector (SLS) operation

g) Avoid double cage low slip (<3%) motors if possible, but do not use these motors with encoderles vector SLS regulation.

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 AV-300i 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.

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 . Contact the motor manufacture for information.

What motor data is required for connecting the frequency inverter?

Nameplate specifications

- Motor rated voltage
- Motor rated current
- Motor rated frequency
- Motor rated speed at full load
- Power factor

The other data required for vector control is calculated inside the inverter.

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 (programmable terminal).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 at least 20 cm. away.

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 Encoders

One of four 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 / $\overline{C}$
- **DEHS**: 5V digital incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and three Hall sensor digital position signals (for AC Brushless motors special software required - contact your sales representative)
- **SESC**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and and two sin/cos traces for absolute position (for AC Brushless motors or positioning - contact your sales representative)
- **SEHS**: 5V sinusoidal incremental encoder with A / $\overline{A}$, B / $\overline{B}$, C / $\overline{C}$ and three Hall sensor digital position signals (for AC Brushless motors special sofware required - contact your sales representative)

Encoders are used to feedback 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 3.3.6, "Performance".

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 328 feet (100 meters), (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: 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

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	-	-	-	-	-	-	-
SESC	ON	ON	ON	ON	ON	ON	-	A	A	A	A	A	A
DEHS	OFF	OFF	OFF	OFF	OFF	OFF	ON (*)	B	B	B	B	B	B
SEHS	ON	ON	ON	ON	ON	ON	-	B	B	B	B	B	B

ai3150

Jumper S17 selects the reading or the ignoting of the channel C pulses. It must be set correctly in order to detect the encoder loss alarm.

S17 ON : channel C (index) monitoring=ON

S17 OFF: channel C (index) monitoring=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	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-
DE	8 pole	●		●	●	●	●	●	●	●						
SE	8 pole	●		●	●	●	●	●	●	●						
SESC	12 pole	●		●	●	●	●	●	●	●	●	●	●	●		
DEHS	14 pole	●		●	●	●	●	●	●	●	●	●	●	●	●	●
SEHS	14 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	see table in section 3.3.6
Channels	two-channel, differential
Power supply	+ 5 V (Internal supply) *
Load capacity	> 8.3 mA pp per channel

Configure drive software for the signal amplitude range of the encoder in use ("STARTUP/Startup config Encoders config/***Std sin enc Vp***")

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	see table in section 3.3.6
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). Encoder loss detection is possible using optional cards.
Power supply	+ 5 V (Internal supply) *
Load capacity	> 4.5 mA / 6.8 ... 10.9 mA per channel

* Via keypad (“STARTUP/Startup config/encoders config.”), 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: 0=5.41V, 1=5.68V, 2=5.91V, 3=6.18V via ***Std enc supply*** parameter.

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 ***Std enc supply*** 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/Q	max. voltage	max. current
PIN 1	Channel B- For B- digital or B- COS incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 2	-			
PIN 3	Channel C+ For C+ digital or analog zero pulse or index	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 4	Channel C- For C- digital or analog zero pulse or index	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 5	Channel A+ For A+ digital or A+ SIN incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 6	Channel A- For A- digital or A- SIN incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 7	Reference point for +5V encoder supply voltage	Q	–	–
PIN 8	Channel B+ For B+ digital or B+ COS incremental signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 9	+5V encoder supply voltage	Q	+5 V	200 mA
PIN 10	Channel E+ For E+ digital commutation or SIN+ absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 11	Channel E- For E- digital commutation or SIN- absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 12	Channel F+ For F+ digital commutation or COS+ absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 13	Channel F- For F- digital commutation or COS- absolute position signal	I	5 V digital or 1 V pp analog	10 mA digital or 8.3 mA analog
PIN 14	Channel G+ For G+ digital commutation signal	I	5 V digital or 1 V pp analog	10 mA digital
PIN 15	Channel G- For G- digital commutation signal	I	5 V digital or 1 V pp analog	10 mA digital

ai3140

Chapter 5 - Wiring Procedure

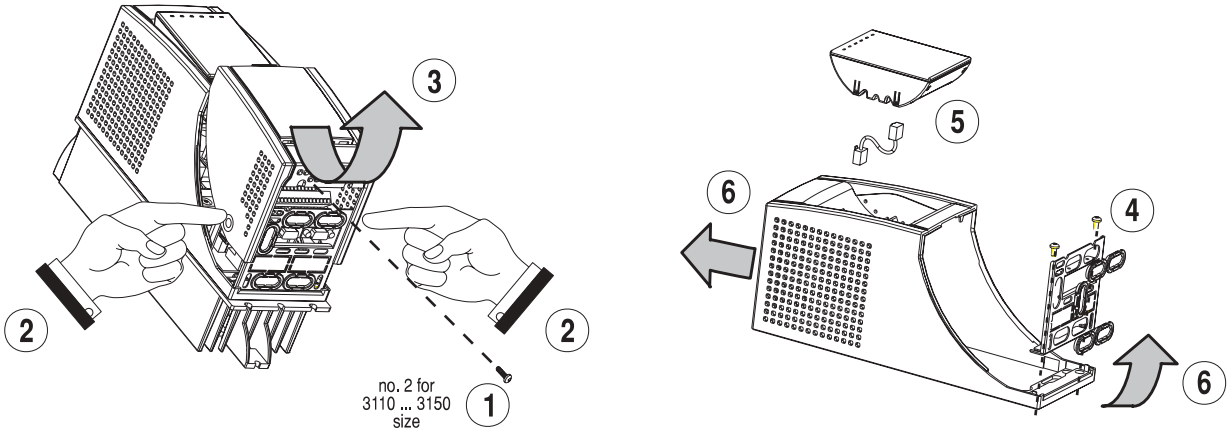
5.1 Accessing the Connectors

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 3F75 to 3020)



Sizes 3F75 to 3010

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 3015 to 3020

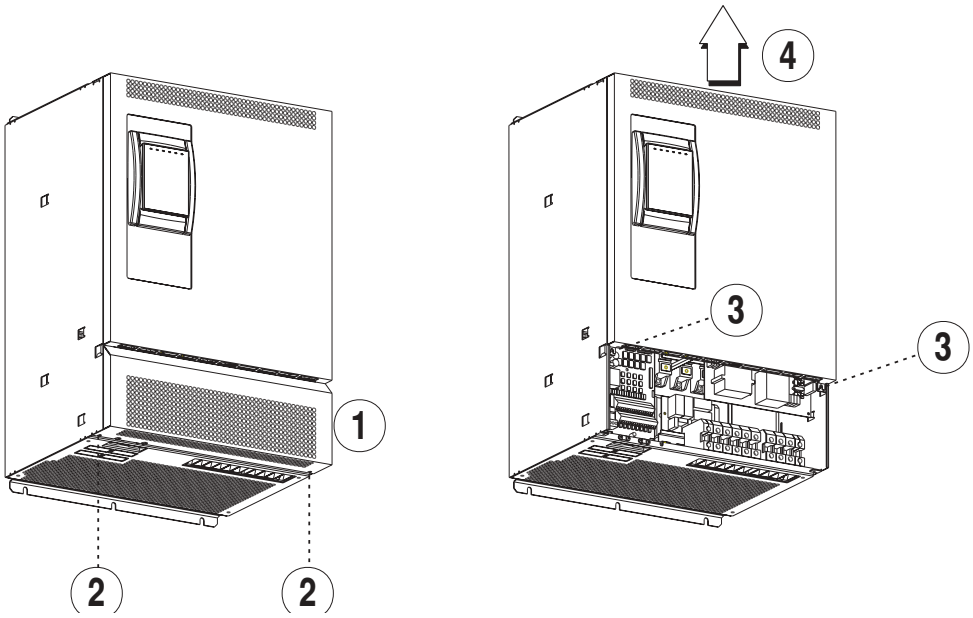
The terminal cover and cable entry plate of the device must be removed in order to fit the electrical connections:

- unscrew the two screw (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).

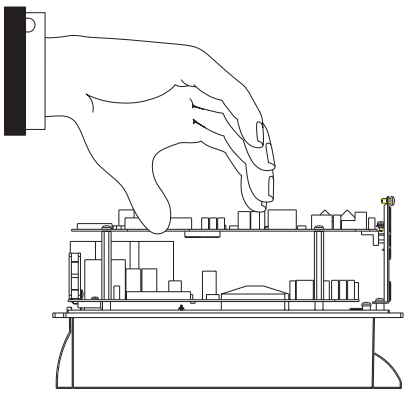
Figure 5.1.2: Removing the Covers (Sizes 3025 to 3200)



Sizes 3025 to 3200

The terminal cover of the device must be removed in order to fit the electrical connections: unscrews the two screws (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 screws (3) and remove the top cover by lifting it as indicated on figure (4)



CAUTION! In order to avoid damages to the device, it is not permissable to transport it by griping its cards!

5.2 Power Section

5.2.1 PV33-.. Power Cards

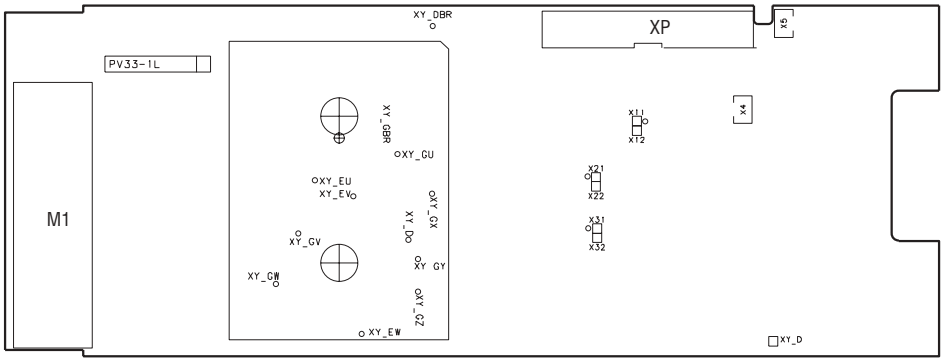


Figure 5.2.1.1: PV33-1-... and PV33-1L-... Power Card (Sizes 3F75 to 3003)

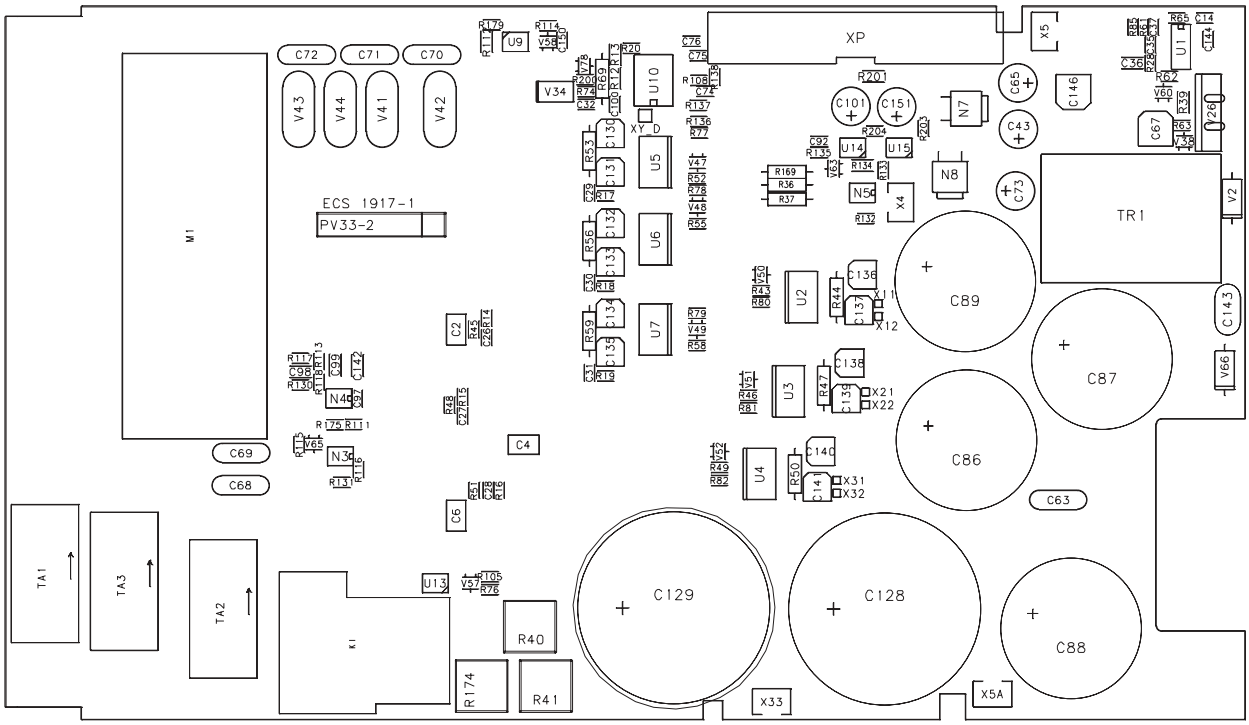


Figure 5.2.1.2: PV33-2-.. Power Card (Sizes 3005 to 3010)

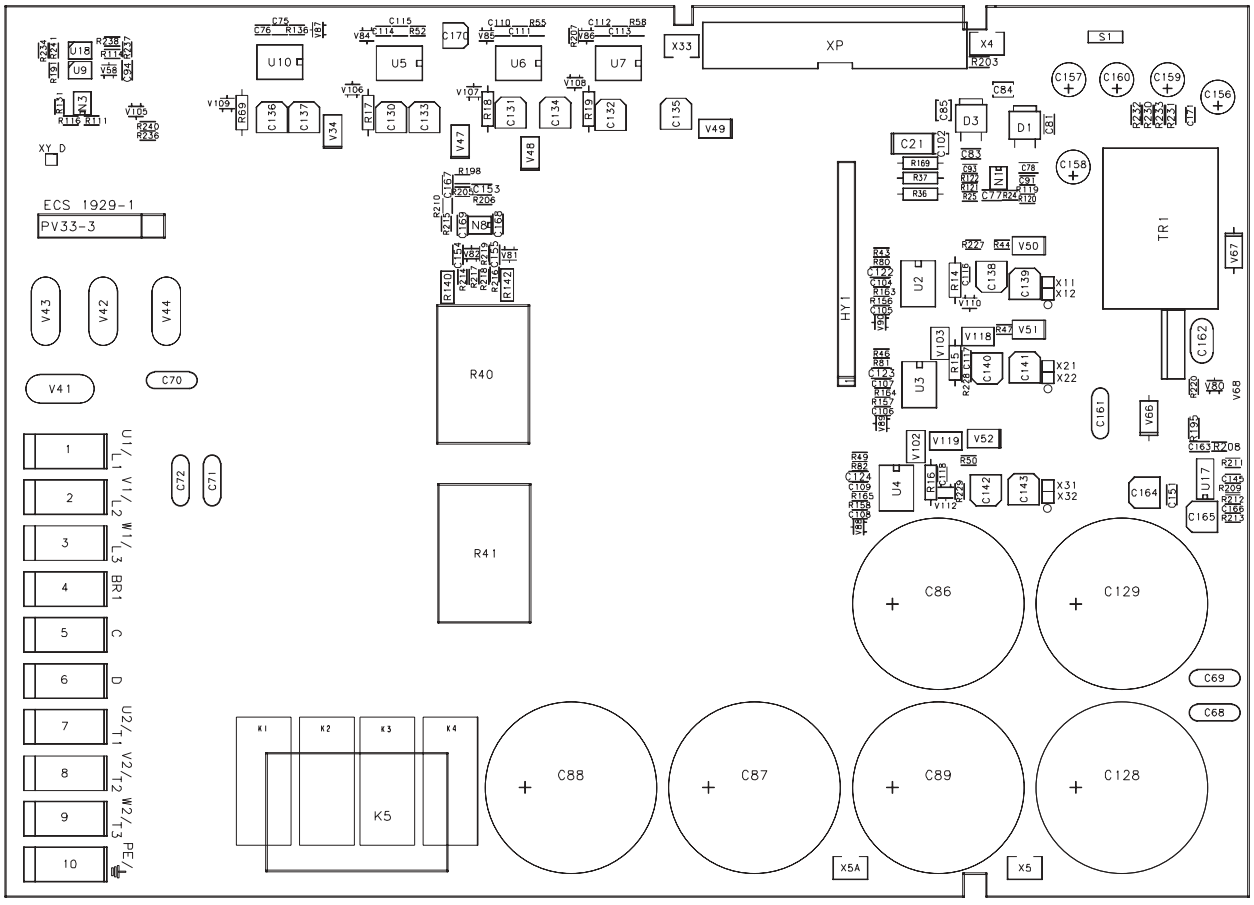


Figure 5.2.1.3: PV33-3-.. Power Card (Sizes 3015 and 3020)

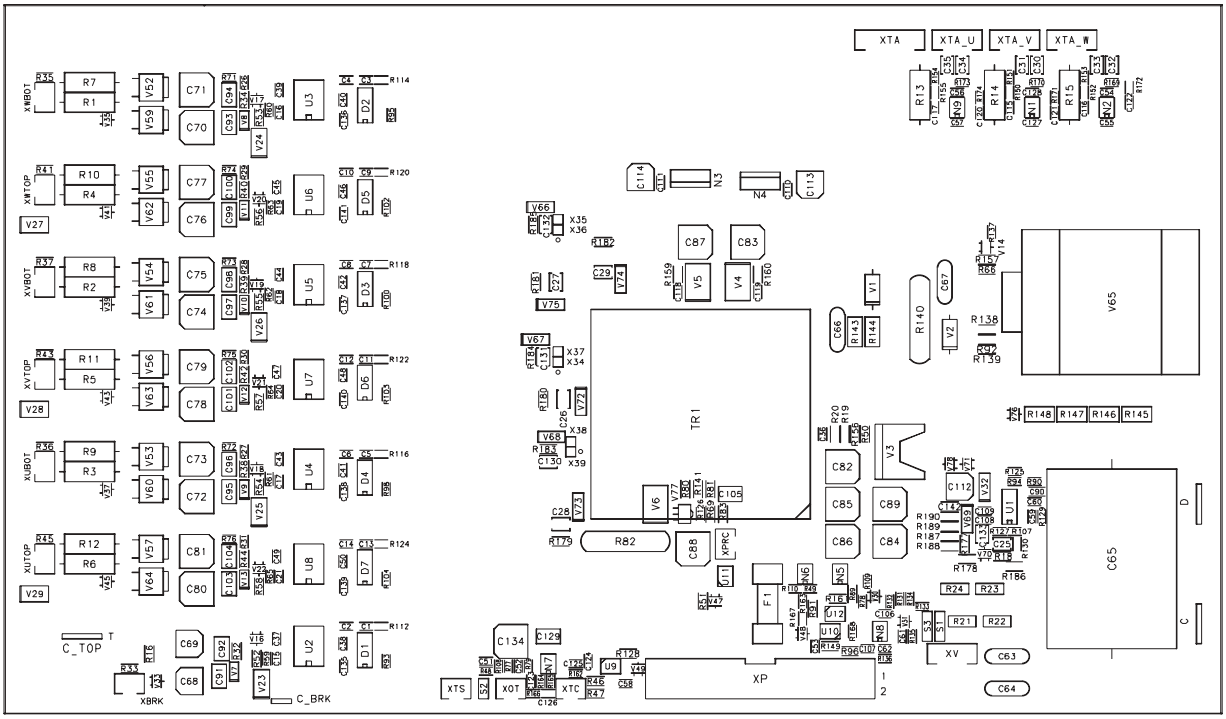


Figure 5.2.1.4: PV33-4-.. Power Card (Sizes 3025 to 3060)

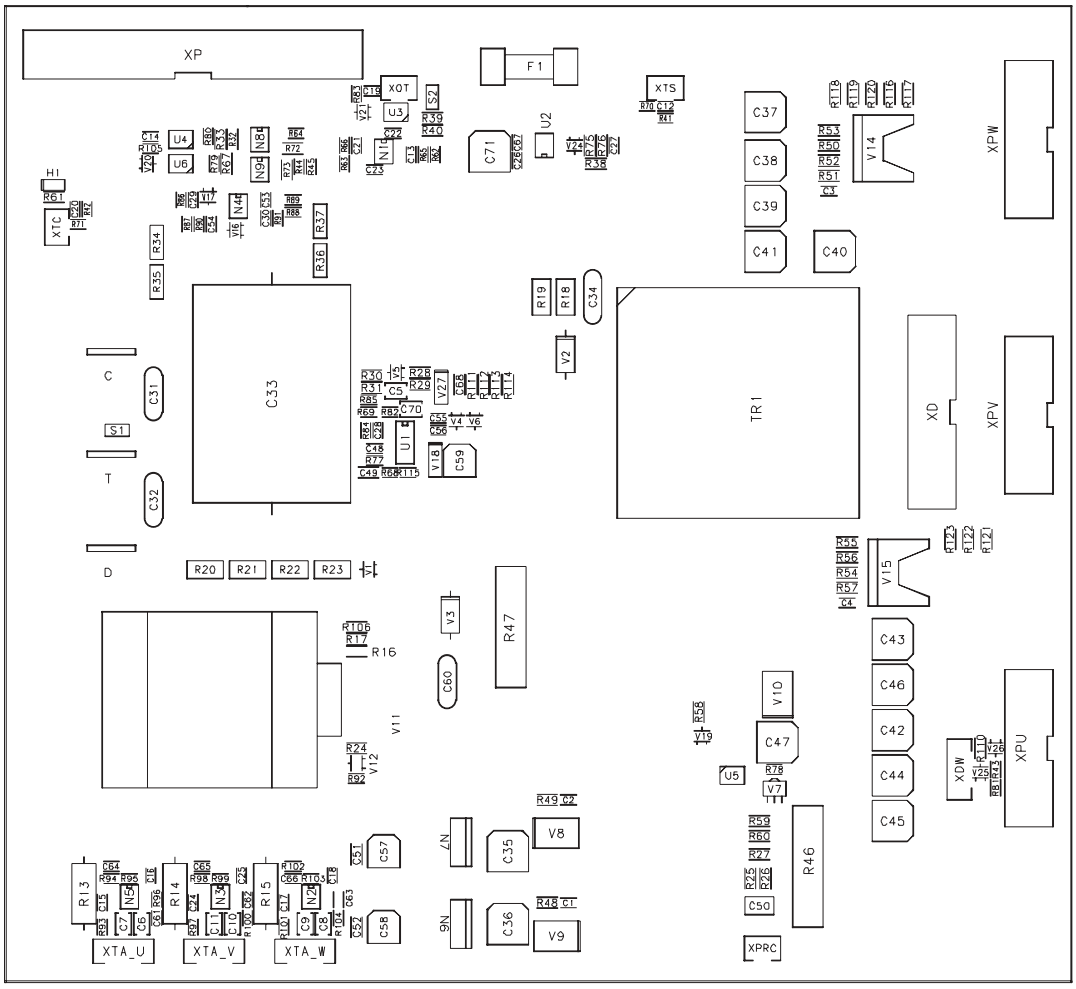


Figure 5.2.1.5: PV33-5-.. Power Card (Sizes 3075 to 3200)

5.2.2 Terminal Assignment on Power Section / Cable Cross-Section

Table 5.2.2.1: Power Section Terminals from 0.75 Hp to 20 Hp

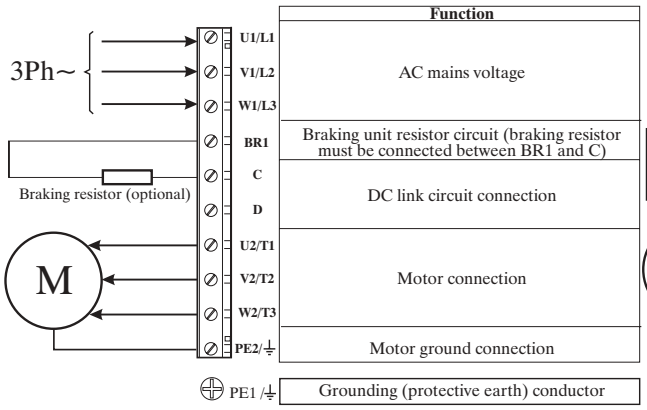
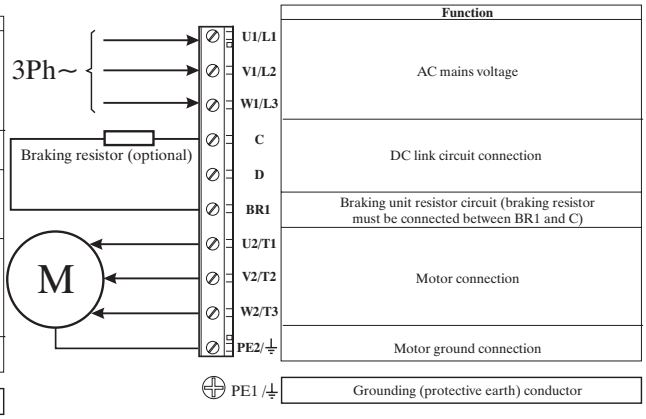


Table 5.2.2.2: Power Terminals from 25 Hp to 200 Hp



Power terminals lay-out

Sizes 3F75 to 3020 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"). All the power terminals are located on the power card PV33-....shown on previous chapter. The terminal strip itself is a removable connector.

Sizes 3025 to 3200: 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 5.2.2.3: Maximum Cable Cross Section for Power Terminals

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

Type		3F75	3001	3002	3003	3005	3007	3010	3015	3020	3025	3030
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	14				12	10		8	6		4
	[mm²]	2				4			8	10	16	25
Tightening torque	[Nm]	0.5 to 0.6							1.2 to 1.5		2	3
BR1 terminals	AWG	14				12	10		8	6	10	8
	[mm²]	2				4			8	10	6	10
Tightening torque	[Nm]	0.5 to 0.6							1.2 to 1.5		0.9	1.6
PE1, PE2 terminals	AWG	14				12	10		8	6		6
	[mm²]	2				4			8	10	16	16
Tightening torque	[Nm]	0.5 to 0.6							1.2 to 1.5		2	3

Type		3040	3050	3060	3075	3100	3125	3150	3200
U1,V1,W1,U2,V2,W2,C,D terminals	AWG	2		1/0	2/0	4/0	300*	350*	4xAWG2
	[mm²]	35		50	70	95	150	185	4x35
Tightening torque	[Nm]	4			12		10-30		
BR1 terminals	AWG	8	6	terminals not available					
	[mm²]	10	16						
Tightening torque	[Nm]	1.6	3						
PE1, PE2 terminals	AWG	6	2						
	[mm²]	16	50						
Tightening torque	[Nm]	3	4						

Type	3250	3300	3350	3400	3450	3500	3600	3700	3800
Max wire size	Two 350 MCM	Three 350 MCM				bus bar: no wire size limitation			

ai4040

* = kcmils

**= AC input wiring for the monitor is connected to bus bars and has no wire size limitation.

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 AV-300i Drive.

NOTE! Use 75°C copper conductor only.

5.3 Regulation Section

5.3.1 RV33 Regulation Card

Figure 5.3.1.1: RV33-1 Regulation Card Switch & Jumpers

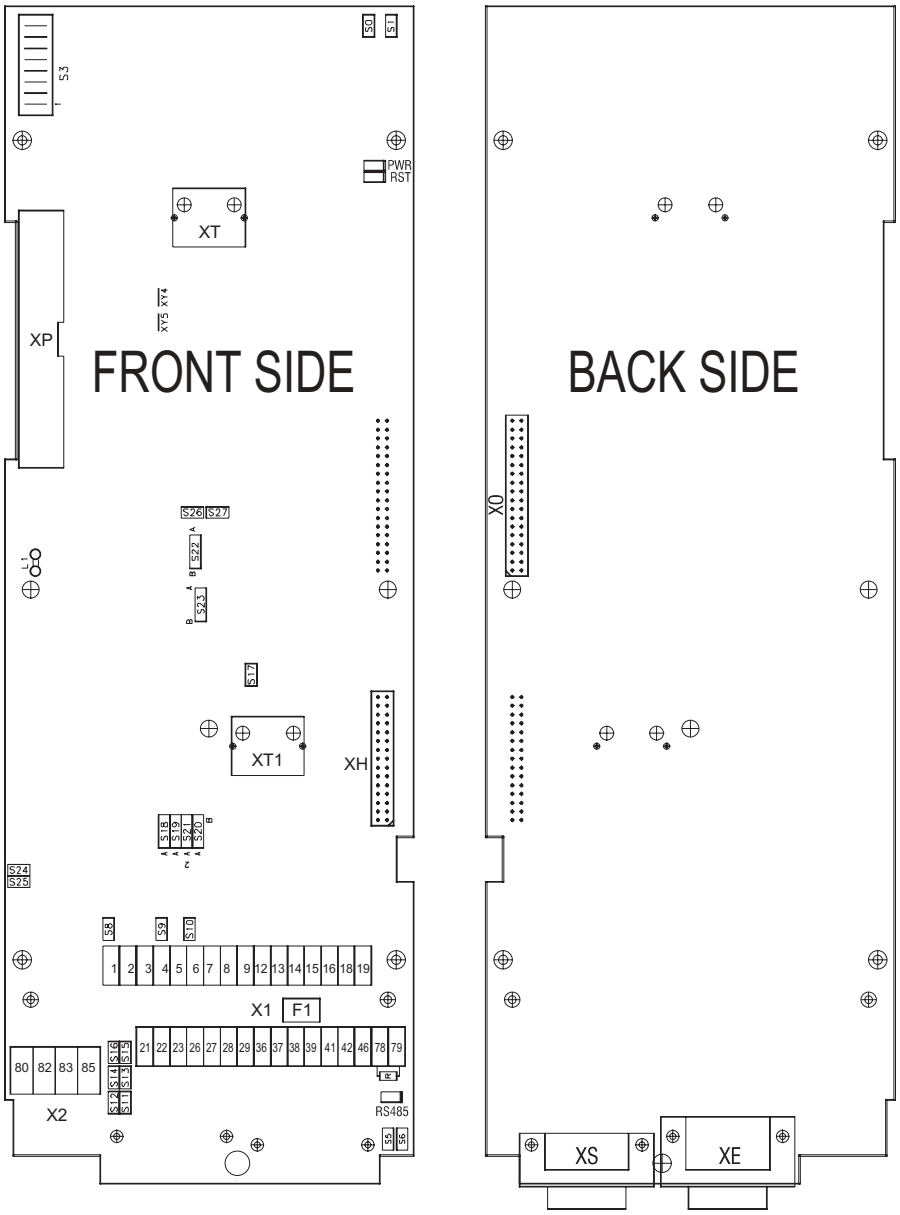


Table 5.3.1.1: LEDs on Regulation Card

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

ai4050g

Table 5.3.1.2: Test Points on Regulation Card RV33

Designation	Function
XY4	Phase current signal (U) (see table 5.3.1.4)
XY5	Reference point

ai4070

Table 5.3.1.3: Jumpers on Regulation Card RV33

Designation	Function	Factory setting
S0	The setting must not be changed	OFF
S1	The setting must not be changed	OFF
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...10V / -10...+10V	OFF
S9	Adaptation to the input signal of analog input 2 (terminals 3 and 4) ON=0...20 mA / 4...20 mA OFF=0...10V / -10...+10V	OFF
S10	Adaptation to the input signal of analog input 3 (terminals 5 and 6) ON=0...20 mA / 4...20 mA OFF=0...10V / -10...+10V	OFF
S11 - S12 - S13 S14 - S15 - S16	Encoder setting (**) ON=Sinusoidal SE or SESC encoder OFF=Digital DE or DEHS encoder	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. A=digital DEHS encoder Pos. B= sinusoidal SESC encoder	B
S22 - S23	Analog input 3 enabling (alternative with SESC encoder) Pos. A= if SESC encoder is used Pos. B=analog input 3 enabled	B
S24	Jumper to disconnect 0V (of 24V) from ground ON=0V connected to ground OFF=0V disconnected from ground	ON
S25	Jumper to disconnect 0V (regulation section) from ground ON=0V connected to ground OFF=0V disconnected from ground	ON
S26 - S27	Internal use	ON

(*) on multidrop connection the jumper must be ON only for the last drop of a serial line ai4060

(**) jumpers on kit EAM_1618 supplied with the drive

CAUTION! To select the drive size for spare regulation cards read carefully the instruction sheet enclosed to the spare.

Table 5.3.1.4: Amps/Volts Ratio on Current Test Point XY4 / XY5

Drive size	Hall CT ratio / (n. turns x burden resistor ohms x ampl.gain)				
3F75	500 / (1 x 154 x 1)	= 3.24	**3040**	1000 / (1 x 10 x 1)	= 100
3001	500 / (1 x 95.3 x 1)	= 5.25	**3050**	2000 / (1 x 15.8 x 1)	= 126.58
3002	500 / (1 x 66.5 x 1)	= 7.5	**3060**	2000 / (1 x 13 x 1)	= 153.85
3003	500 / (1 x 49.9 x 1)	= 10.02	**3075**	2000 / (1 x 11 x 1)	= 181.82
3005	1000 / (1 x 78.7 x 1)	= 12.7	**3100**	2000 / (1 x 7.87 x 1)	= 254.13
3007	1000 / (1 x 59 x 1)	= 16.95	**3125**	2000 / (1 x 7.87 x 1)	= 254.13
3010	1000 / (1 x 42.2 x 1)	= 23.7	**3150**	2000 / (1 x 5.9 x 1)	= 338.98
3015	2000 / (1 x 60.4 x 1)	= 9.01	**3200**	4000 / (1 x 9.31 x 1)	= 429.65
3020	2000 / (1 x 45.3 x 1)	= 46.2	**3250**		469.39
3025	1000 / (1 x 15.8 x 1)	= 63.29	**3300-3450**		751.02
3030	1000 / (1 x 13 x 1)	= 76.92	**3500-3800**		1408.16

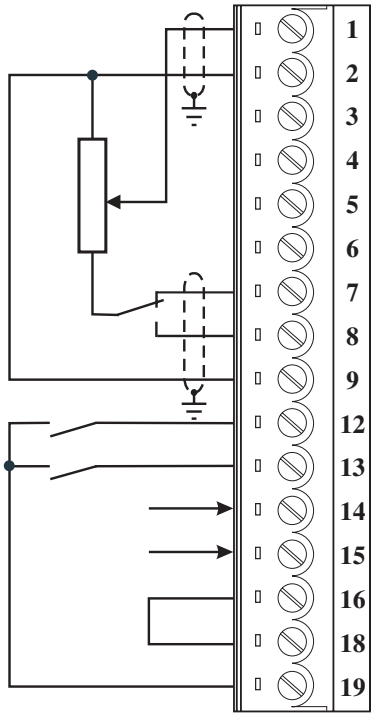
ai54122

Example 1: 3001 size, 1V = 5.25 A (peak current), Amps rms = Amps peak x 2^(1/2)

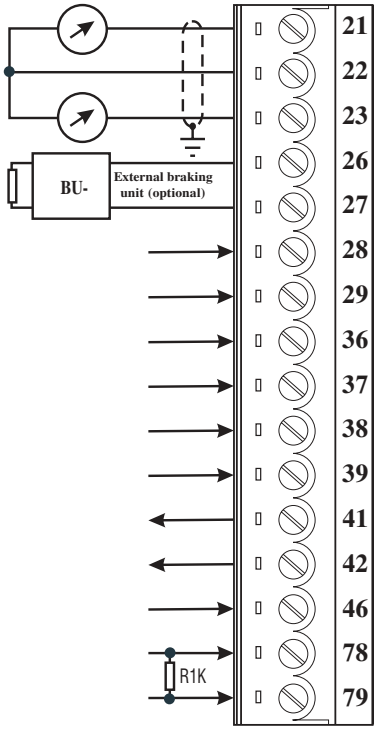
Example 2: 500 amp shunt: 1 volt/[(0.1 volts/500 amps) x 10.6522 gain] = 469.39 amps, in this case: 1 volt = 469.39 amps

5.3.2 Terminal Assignments on Regulation Section

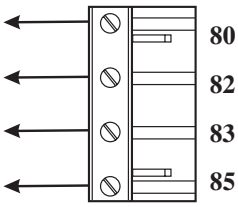
Table 5.3.2.1: Plug-in Terminal Strip Assignments



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 loop 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/ Digital input 0	Inverter enable, active=high. Concurrently, it can be used as a programmable input. (Default none)	+30V 3.2mA @ 15V 5mA @ 24V 6.4mA @ 30V
Digital input 1	Programmable inputs, Default: Term StrStp src	
Digital input 2	Programmable inputs, Default=none	
Digital input 3		
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	Programmable analog output; def.setting: none	±10V/5mA
0V	Internal 0V and reference point for terminals 21 and 23	-
Analog output 2	Programmable analog output; default setting: none	±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 4	Programmable digital inputs; default setting: none	+30V 3.2mA @ 15V 5mA @ 24V 6.4mA @ 30V
Digital input 5		
Digital input 6		
Digital input 7		
Digital output 2	Programmable digital outputs; default setting: none	+30V/40mA
Digital output 3		
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.
Digital output 0 Relay	Potential- free relay contact, programmable output, Default=Drive OK when closed	250V AC 1 A
Digital output 1 Relay	Potential- free relay contact, programmable output, Default=Speed is zero when closed	250V AC 1 A

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.

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.

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]

avy3130

Potentials of the Control Section

The potentials of the regulation section (refer to 24V and ±10V) are isolated from each other and can be disconnected via jumpers from ground. The connections between each potential are shown in Figure 5.3.1.2.

The analog 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.

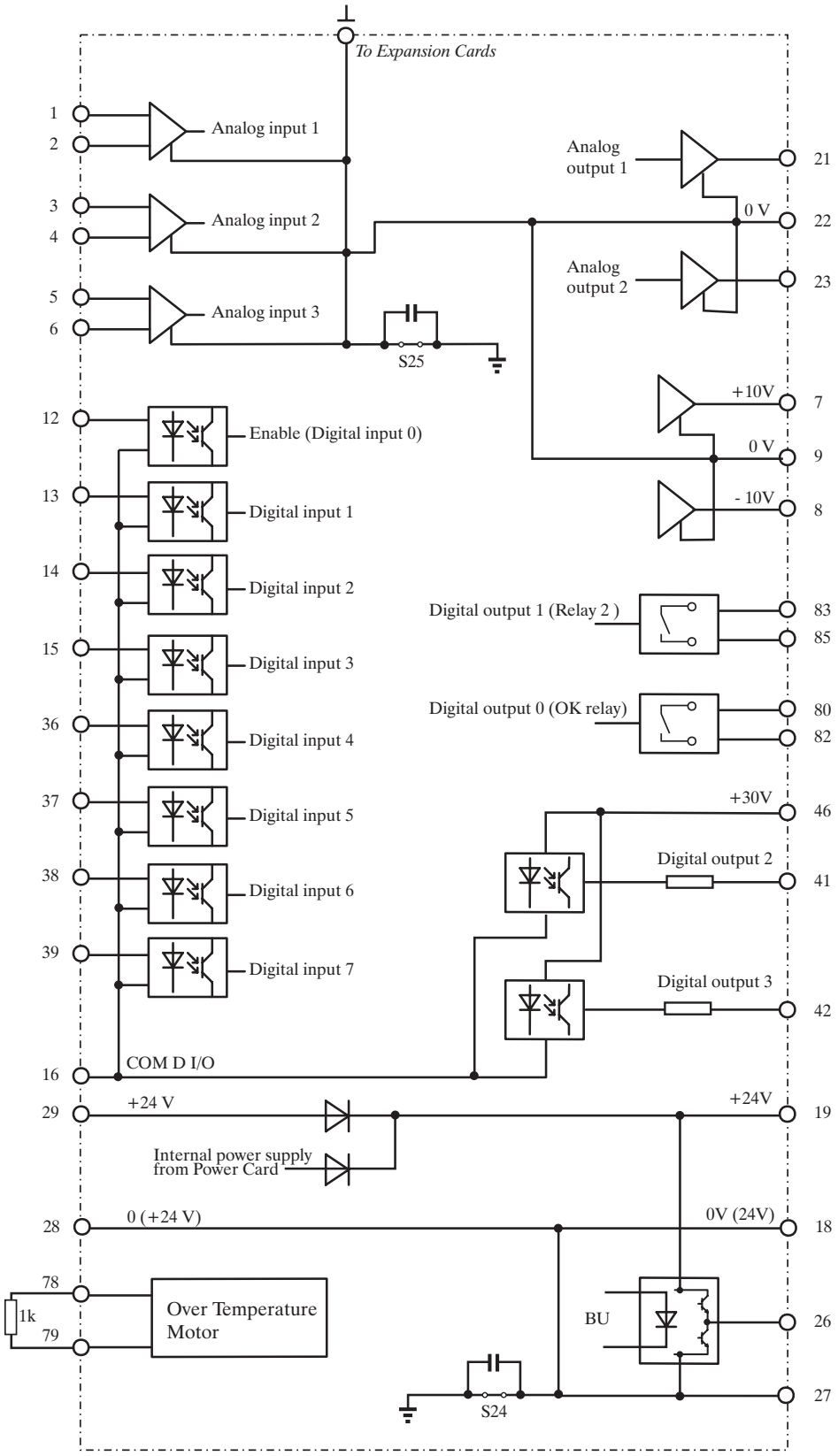
The analog outputs are designed as non differential amplifiers and have common reference point (terminal 22). The analog outputs and the ±10V reference point have same potential (terminal 22 and 9).

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 ground connection jumpers S24 and S25.

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



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 9.6 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 AV-300i 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, ("COMMUNICATION/RS485 config." menu).

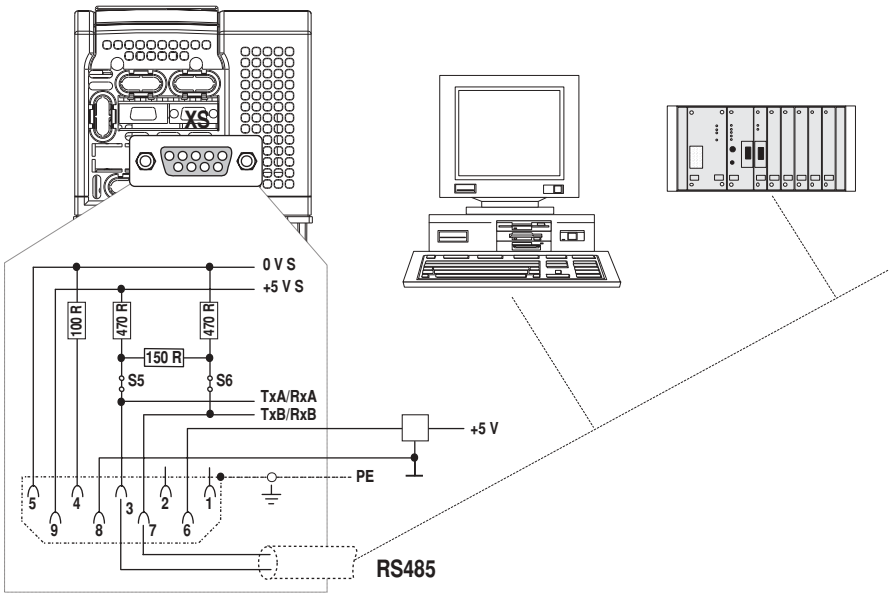


Figure 5.4.1.1: RS485 Serial Interface

The RS 485 on the AV-300i series device 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 if making a temporary connection to one drive. 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 AV-300i 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.

A connection point to point can be done using "CTI" option interface , without jumper setting.

For multidrop connection (two or more drives) use an external power supply is necessary (pin 5 / 0V and pin 9 / +5V). Pins 6 and 8 are reserved for use with the "service" 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

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

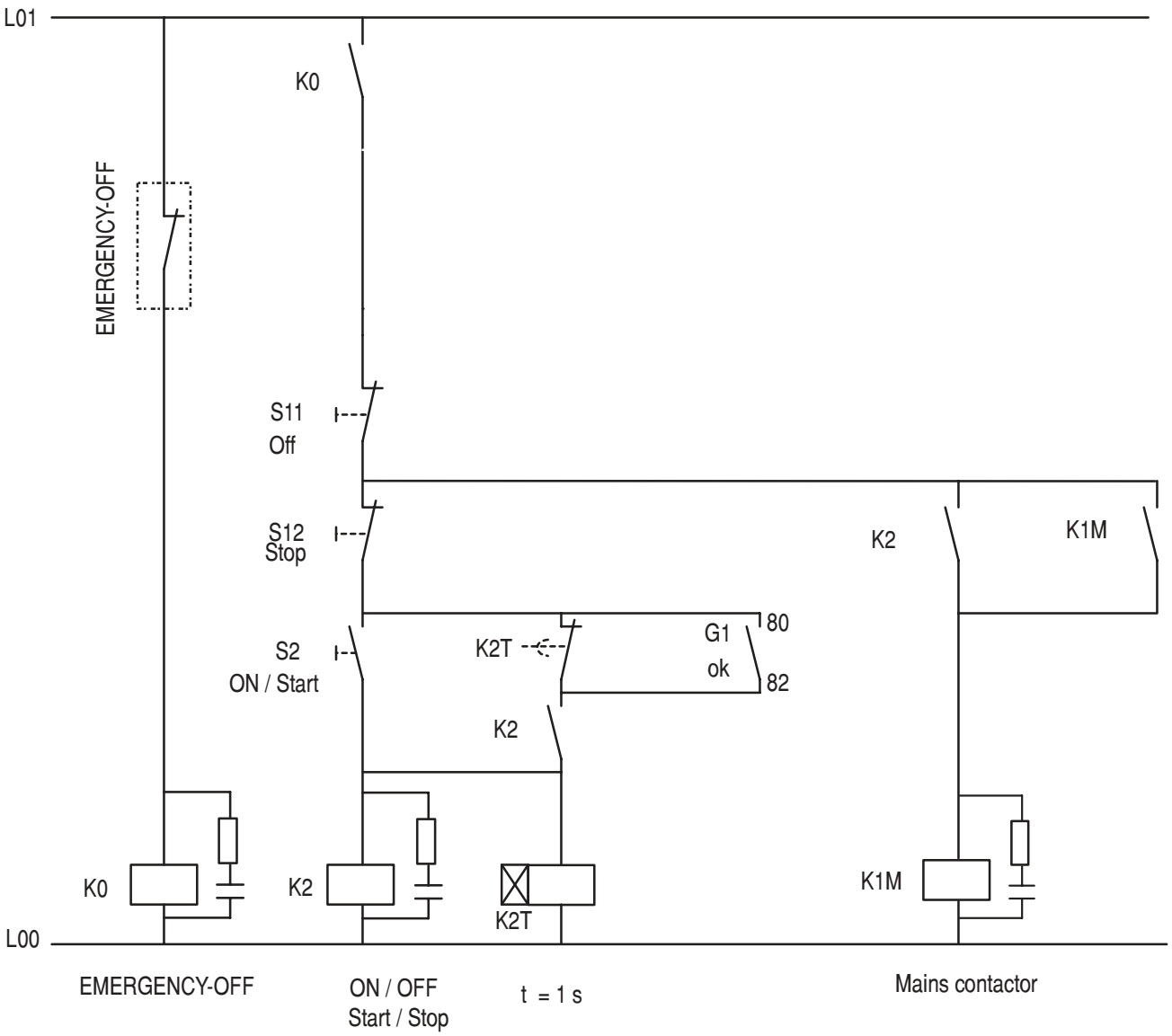
ai4110

I = Input Q = Output

5.5 Standard Connection Diagram

5.5.1 AV-300i Connections

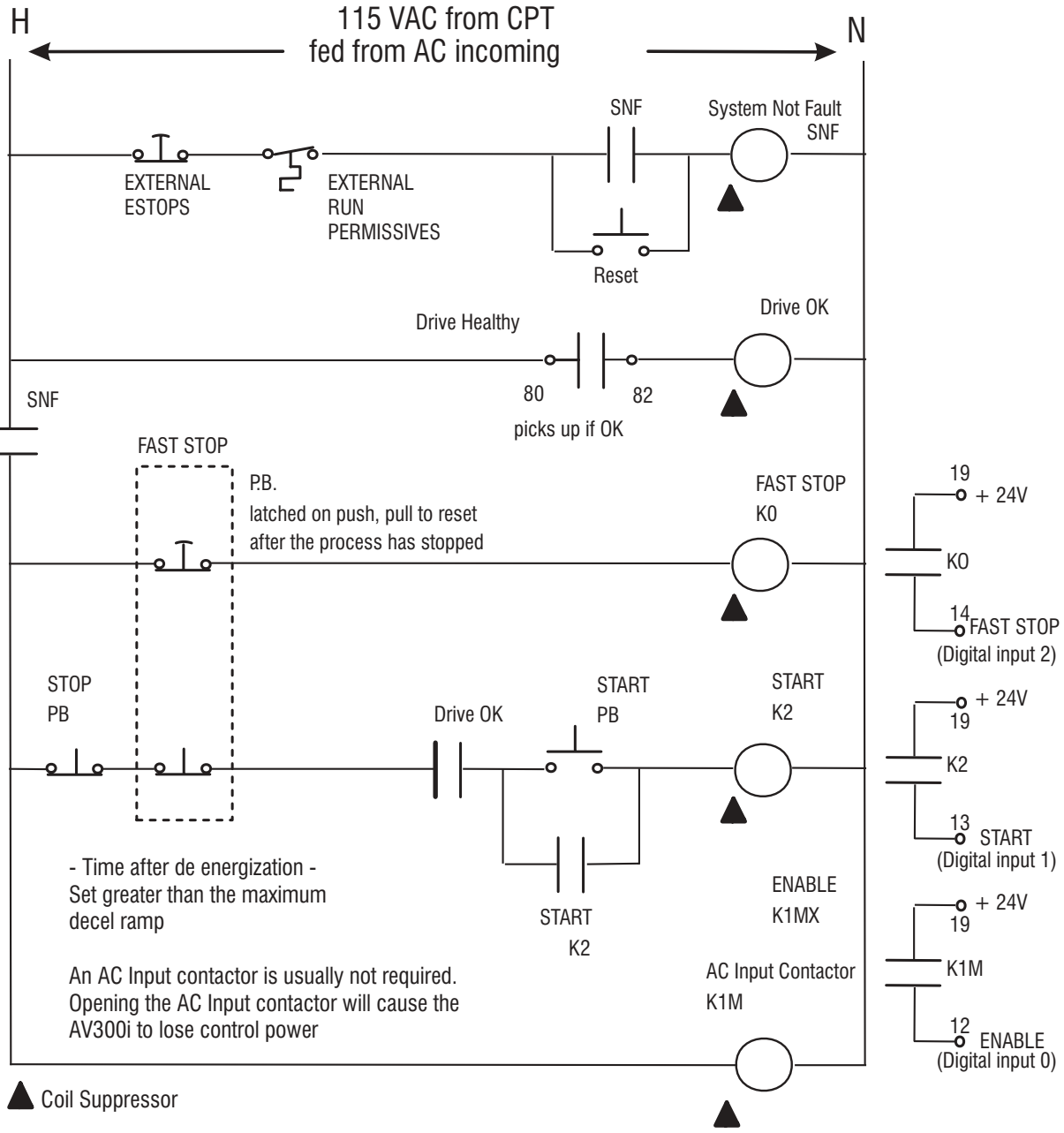
*Figure 5.5.1.1: Example Relay Logic Using **Term strstp** Command and a Contactor*



NOTE! ***Digital output 0 Src*** must be configured as “Drive OK” for this circuit (Factory configuration).

The connection diagram reported in the picture 5.5.1.1 (Control sequencing) is valid only when the configuration of Digital input 1 is set as: ***TermStrStp src*** = DI 1 monitor

Figure 5.5.1.2: Example for Relay Interface



NOTE!

1 - ENABLE must remain energized during a normal STOP or FAST STOP for the AV-300i to decel on a ramp. ENABLE may be de energized after zero speed is achieved.

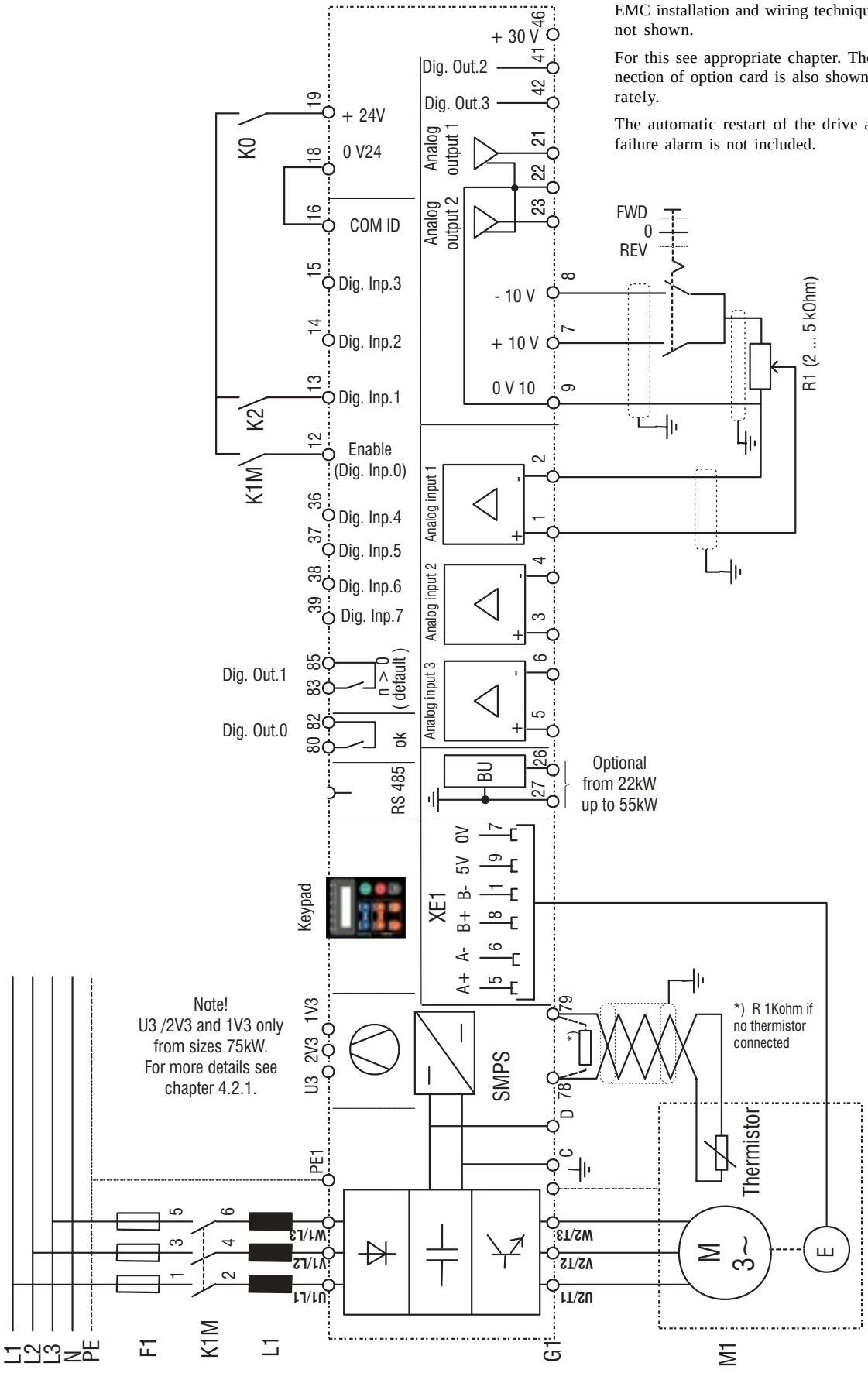
2 - ENABLE must be de energized to power up and to reset a fault or alarm.

3 - FAST STOP command is necessary to set: ***FastStop src*** = DI 2 monitor

4 - STOP command is necessary to set: ***TermStrStp src*** = DI 1 monitor

5 - Opening the input will cause labeled drive reaction.

Figure 5.5.1.3: 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.

5.6 Circuit Protection

5.6.1 External Fuses of the Power Section

The inverter must be fused on the AC Input side. Fuses, using Semiconductor grade fuses as per table 4.6.1.1.

NOTE! If the terminals of the DC Link circuit (C and D) are connected with external devices, semiconductor fuses must always be employed on each DC connection. This, for example, is the case with:

- connected external braking units (BU...)
- coupled DC Link circuits of several inverters
- connected external capacitors

Table 5.6.1.1. also shows how 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	
3F75	25000	GRD2/10 or Z14GR10	A70P10	FWP10	50000	GRD2/10 or Z14GR10	A70P10	FWP10
3001					50000			
3002	25000	GRD2/16 or Z14GR16	A70P20	FWP20	50000	GRD2/10 or Z14GR10	A70P10	FWP10
3003	10000				50000	GRD2/16 or Z14GR16	A70P20	FWP20
3005	25000	GRD2/20 or Z14GR20	A70P20	FWP20	50000			
3007	25000	GRD2/25 or Z14GR25	A70P25	FWP25	50000	GRD2/20 or Z14GR20	A70P20	FWP20
3010	10000	GRD3/35 or Z22GR40	A70P35	FWP35	50000	GRD2/25 or Z14GR25	A70P25	FWP25
3015	25000	GRD3/50 or Z22GR40	A70P40	FWP40	50000	GRD3/35 or Z22GR40	A70P35	FWP35
3020	10000	GRD3/50 or Z22GR50	A70P40	FWP50	50000	GRD3/50 or Z22GR50	A70P40	FWP40
3025	10000	For these types an external reactor is mandatory if the AC input impedence is equal or less than 1%			25000	GRD3/50 or Z22GR50	A70P50	FWP50
3030	10000				25000	S00üf1/80/80A/660V or Z22gR80	A70P80	FWP80
3040	10000				25000	S00üf1/80/100A/660V or M00üf01/100A/660V	A70P100	FWP100
3050	10000				25000	S00üf1/80/160A/660V or M00üf01/160A/660V	A70P175	FWP175
3060	10000				25000			
3075	10000				25000	S1üf1/110/250A/660V or M1üf1/250A/660V	A70P300	FWP300
3100	10000				25000			
3125	10000				25000	S2üf1/110/400A/660V or M2üf1/400A/660V	A70P400	FWP400
3150	10000				25000			
3200	10000				25000			

ai4120

Type	3250	3300	3350	3400	3450	3500	3600	3700	3800
Rating	700V, 630A	700V, 1000A				700V, 800A, two parallel			
Ferraz type	A070URD33LI0630	A070URD33LI10				A070URD33LI0800			
Bussman type	170M6710	170M6714							

Fuse manufacturers:

Type GRD2... (E27), GRD3... (E33), M...(blade fuses), Z14... 14 x 51 mm, Z22... 22 x 58 mm	Jean Müller, Eltville
A70...	Ferraz
FWP..., 170M...	Bussmann

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

NOTE! Use specified fuse or CSA certified equivalent

5.6.2 AC Input Contactors

Table 5.6.2.1: K1M - AC Input Contactors

AV-300i P/N	HP/Class 2	Class 1 output I (without choke)		Class 2 output I		AC contactor type*
		400VAC input current (A)	460VAC input current (A)	400VAC input current (A)	460VAC input current (A)	
3F75	0.75	3.9	3.4	1.9	1.7	MC1A310AT3 [1]
3001	1,5	4.8	4.2	3.3	2.9	
3002	2	-	-	4.5	3.9	
3002	2	7.4	6.4	-	-	
3003	3	-	-	-	5.4	
3003	3	8.9	7.7	6.2	-	
3005	5	-	10.4	7.9	6.9	
3005	5	12	-	-	-	
3007	7,5	16.9	14.7	10.7	9.3	CL02A310TJ [1]
3010	10	24.2	21	15.9	14	
3015	15	30.3	18	20.4	21	CL25A310TJ [2]
3020	20	-	25	28.2	27	CL04A310MJ [1]
3020	20	39.8	-	-	-	
3025	25	39	33	39	36	
3030	30	57	49	57	50	CL06A311MJ [3]
3040	40	74	64	74	62	
3050	50	-	19	-	74	CL07A311MJ [3]
3050	50	91	-	91	-	
3060	60	106	93	106	90	CL08A311MJ [3]
3075	75	137	119	137	112	CL09A311MJ [3]
3100	100	172	150	172	146	CK08CE311J [4]
3125	125	218	188	218	166	CK09BE311J [4]
3150	150	247	214	247	198	CK95BE311J [4]
3200	200	296	257	296	256	

Dai462

[1] 1 NO Aux Contact (Built in) with Contactor

[2] 1 NO Front-mounted Aux Contact supplied (unassembled)

[3] 1 NO and 1NC Front-mounted Aux Contact supplied (unassembled)

[4] 1 NO-1NC Side mounted Aux Contact supplied (unassembled)

* P/Ns are listed for GE ED&C C2000 series mini contactors and IEC contactors with the following options: 3 N.O main poles, FVNR, 110/115 VAC 50/60 Hz coil, screw type terminals, and 1 N.O. auxilary contact, coil suppressor is recommended.

For alternate coil voltages, detailed ordering information, and other contactor options refer to GEP 1260, mini contactors: GEH 5475, GEH 5931, and GEH 5932 IEC contactors: GEH 6223.

Contactors picked using AC-1 rating @ 1 minute short time rating (10 min time recovery).

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

5.6.3 External Fuses of the Power Section DC Input Side

Use the following fuses when a RS-300 Line Regen converter is powering the drive from a common DC bus; (see RS-300 instruction book for other details). This table is only applicable to use with the RS-300 Line Regen converter.

Table 5.6.3.1: External Fuses Type for DC Input Side

Drive type	Fuses type		
	Europe	USA	
3F75	Z14GR6	A70P10	FWP10A14F
3001	Z14GR10	A70P10	FWP10A14F
3002			
3003	Z14GR16	A70P20-1	FWP20A14F
3005			
3007	Z14GR20	A70P20-1	FWP20A14F
3010	Z14GR30	A70P30-1	FWP30A14F
3015	Z14GR40	A70P40-4	FWP40B
3020	Z22GR63	A70P60-4	FWP60B
3025	S00üF1/80/80A/660V	A70P80	FWP80
3030	S00üF1/80/100A/660V	A70P100	FWP100
3040	S00üF1/80/125A/660V	A70P150	FWP150
3050	S00üF1/80/160A/660V	A70P175	FWP175
3060	S00üF1/80/200A/660V	A70P200	FWP200
3075	S1üF1/110/250A/660V	A70P250	FWP250
3100	S1üF1/110/315A/660V	A70P350	FWP350
3125	S2üF1/110/400A/660V	A70P400	FWP400
3150	S1üF1/110/500A/660V	A70P500	FWP500
3200	S1üF1/110/500A/660V	A70P500	FWP500

ai4140

Drive	Fuse-GE part #	Rating	
3250	AI30URD73LI0700	700 A	1300 V
3300-3450	A100URD73LI1000	1000 A	1000 V
3500-3800	A110URD72LI0800	800 A/1100V	2 parallel

Fuse manufacturers:	Type Z14..., Z22, S00 ..., S1...	Jean Müller, Eltville
	A70...	Ferraz
	FWP...	Bussmann

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

NOTE! If external units are connected to the terminals of the DC Link circuit, then separate semiconductor fuses (DC) must be used for each external unit and they must be sized to protect each external unit.

5.6.4 Internal Fuses

Table 5.6.4.1: Internal Fuses

Drive type	Designation	Protection of	Fuse (source)	Fitted on:
3025 to 3200	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
3F75 to 3200	F1	+24V	Resettable fuse	Regulation card RV33-1C and higher
3075 to 3150	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)
3250 to 3800	FU1 *	DC input *	Special , 2 amps, 660 volts	AVIF board
	FU2	+24 volt	2AG, 2 amps, 250 volts	AVIF board
	FU1	DC input *	Special , 2 amps, 660 volts	AVFS board
	FU2	+24 volt	3AG, 2.5 amps, 250 volts	AVFS board

ai4145

*Do not replace this fuse. If it fails, there is other damage to the power supply.

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 AV-300i series Drives. The required inductance can be provided by an AC Input choke or an AC Input transformer.

5.7.1 AC Input Chokes

Table 5.7.1.1: 3-Phase AC Input Chokes (3F75 to 3200 Sizes)

Drive type	Three-phase Mains choke				
	Mains Inductance [mH]	Rated current [A]	Saturation current [A]	Frequency [Hz]	GE Model Number
3F75	6.1	2.5	5	50/60	37G00201
3001	3.69	3.7	7.4	50/60	37G00201
3002	2.71	5.5	11	50/60	37G00402
3003	2.3	6.7	14	50/60	37G00402
3005	1.63	8.7	18	50/60	37G00802
3007	1.29	11.8	24.5	50/60	37G01202
3010	0.89	17.4	36.5	50/60	37G01802
3015	0.68	22.4	46.5	50/60	37G02502
3020	0.51	30	61	50/60	37G03502
3025	0.35	41	83	50/60	37G03502
3030	0.24	58	120	50/60	37G04502
3040	0.18	71	145	50/60	37G05502
3050	0.13	102	212	50/60	37G08002
3060	0.13	102	212	50/60	37G08002
3075	0.148	173	350	50/60	37G10002
3100	0.148	173	350	50/60	37G13002
3125	0.085	297	600	50/60	37G16002
3150	0.085	297	600	50/60	37G20002
3200	0.085	297	600	50/60	37G25002

ai4150

For all sizes, an input choke is strongly reccomended in order to:

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

NOTE! The current rating of these chokes (reactors) is based on nominal current of standard motors, listed in table 3.3.4.1 in section 3.3.4, "AC Output". Reactor model numbers are GE Transmission, Distribution, & Industrial Systems.

Table 5.7.1.2: 3-Phase AC Input Chokes (250 to 800 Hp Sizes)

Frequency 60 Hz, 3% impedance			
Hp	**3250**	**3300 ... 3450**	**3500 ... 3800**
inductance	0.046mH	0.029mH	0.018mH
rated current	455 amps	753 amps	1255 amps
saturation current	>250% of rated current	>250% of rated current	>250% of rated current
GE part #	277A8483P1	277A8483P3	277A8483P5
Trenco part #	TR-17257	TR-17258	TR-17334
Frequency 50 Hz, 4% impedance, 60 Hz, 5% impedance			
Hp	**3250**	**3300 ... 3450**	**3500 ... 3800**
inductance	0.008mH	0.050mH	0.029mH
rated current	455 amps	753 amps	1255 amps
saturation current	>250% of rated current	>250% of rated current	>250% of rated current
GE part #	277A8483P2	277A8483P4	277A8483P6
Trenco part #	TR-17332	TR-17333	TR-17335
Frequency 50 Hz, 5% impedance			
Hp	**3250**	**3300 ... 3450**	**3500 ... 3800**
Inductance	0.099mH	0.056mH	0.034mH
rated current	455 amps	753 amps	1255 amps
saturation current	>250% of rated current	>250% of rated current	>250% of rated current
GE part #	277A8483P7	277A8483P8	277A8483P9
Trenco part #	TR-17336	TR-17337	TR-17338

All frame sizes of the AV300I will have an option to add a line reactor. Table 5.7.1.2. lists the data for the line reactors at both 50 Hz and 60 Hz.

The standard rules in choosing a line reactor is as follows:

1) If a single drive is connected to a transformer, and the transformer rating is similar to the drive, then a line reactor is not necessary.
2) If more than one drive is connected to the same secondary of a larger transformer, then a minimum reactance is necessary between the two drives to limit circulating currents.

Table 5.7.1.3 lists the minimum required inductance for each frame size at both 60Hz and 50 Hz.

Table 5.7.1.3: Minimum Required Inductance for each Frame Size

FRAME SIZE	MINIMUM 60HZ INDUCTANCE µH	MINIMUM 50HZ INDUCTANCE µH
500 - 800 hp	32	39
300 - 450 hp	54	65
250 hp	89	111

Table 5.7.1.4 lists the typical inductance for standard transformers at both 60Hz and 50 Hz.

Table 5.7.1.4: Typical Inductance for Standard Transformers

XFORMER KVA (5.75%)	460V 60 HZ INDUCTANCE µH	460V 50 HZ INDUCTANCE µH	XFORMER KVA (5.75%)	460V 60 HZ INDUCTANCE µH	460V 50 HZ INDUCTANCE µH
50	645	775	1000	32	39
100	323	387	1250	26	31
150	215	258	1500	22	26
200	161	194	1750	18	22
250	129	155	2000	16	19
300	108	129	2250	14	17
350	92	111	2500	13	15
400	81	97	2750	12	14
500	65	77	3000	11	13
600	54	65	3250	10	12
750	43	52			

The line reactor (table 5.7.1.2) should be chosen such that, when added to the transformer inductance (table 5.7.1.4), the total is greater than the required minimum from table 5.7.1.3.

5.7.2 Output Chokes

The AV-300i 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 3010 sizes, especially with long cable runs (typically over 328 feet [100 m]) an output choke is recommended to maintain the voltage waveform within the specified limits.

The choke must be installed as close as possible to the motor side end of the cable run.

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 (@460 VAC)	Three-phase choke			Model number Load Reactors 5% Z
	Rated Inductance [mH]	Rated Current [A]	Saturation Current [A]	
3F75	1.4	9.5	20	37G00202
3001	1.4	9.5	20	37G00202
3002	1.4	9.5	20	37G00403
3003	1.4	9.5	20	37G00403
3005	0.87	16	34	37G00803
3007	0.87	16	34	37G01203
3010	0.51	27	57	37G01803
3015	0.51	27	57	37G02503
3020	0.43	32	68	37G03503
3025	0.33	42	72	37G03503
3030	0.24	58	100	37G04503
3040	0.18	76	130	37G05503
3050	0.12	110	192	37G08003
3060	0.12	110	192	37G08003
3075	0.07	180	310	37G10003
3100	0.07	180	310	37G13003
3125	0.041	310	540	37G16003
3150	0.041	310	540	37G20003
3200	0.041	310	540	37G25003

Type	Chocke Rated Inductance [mH]	Drive Rated Current [A]	Chocke Rated Current [mH]	TCI Model Number
3250	0.041	302	360	KLR360BCB
3300-3450	0.018	315	600	KLR600BCB
3500-3800	0.012	900	950	KLR950BCB

Ai4135

NOTE! When the Drive is operated at the rated current and at 50 Hz, the output chokes cause a voltage drop of approx. 5% of the output voltage at rated load. Model numbers are GE Transmission, Distribution, & Industrial Systems. Chokes capable of 200% for 3 minutes.

Inverter output, 460V, 150% overload for 60s, (constant torque) applications

Rated output current of the drive (variable torque) is greater than the rated current of these output chokes.

NOTE Choke current ratings are based on the drive constant torque ratings.

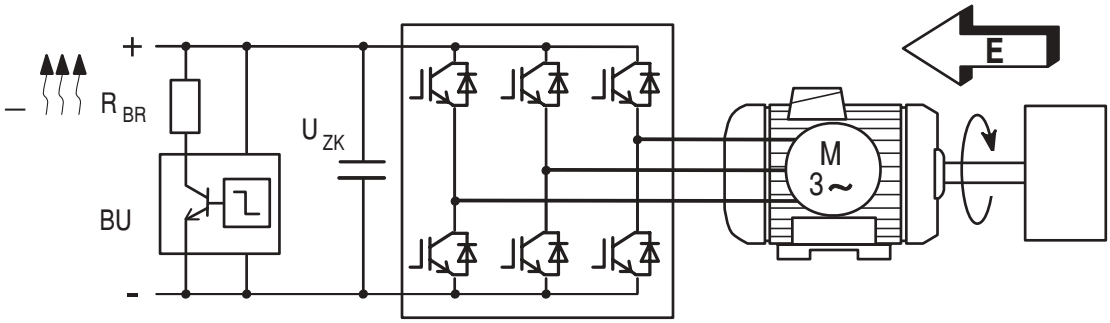
5.7.3 Interference Suppression Filters

The inverters of AV-300i series must be equipped with an external EMI filter in order to reduce the radiofrequency emissions on the AC input line. The filter selection is dependent on the drive size and the installation environment. For this purpose see the “EMC Guidelines” instruction book. In the Guide, it is described how to install the cabinet (connection of filter and mains reactors, cable shield, grounding, etc.) in order to make it EMC compliant according the EMC Directive 89/336/EEC.

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 models 3F75 to 3060 have an internal braking unit as standard (external resistor required). All standard AV-300i... devices can be connected via terminals C and D with an external braking unit (BU-300...)**.**

Drive sizes 250 to 800 Hp

Refer to GEI-100350 for external braking units technical data.

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.

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.

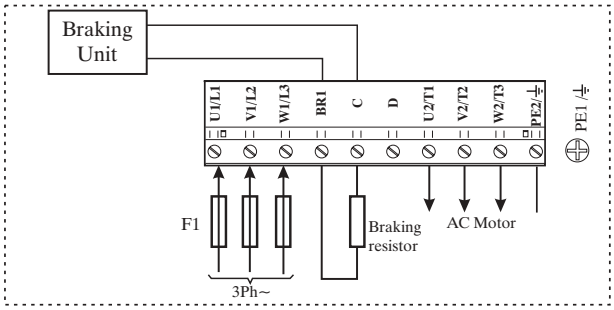
NOTE! For braking resistor connection (terminals BR1 and C) a twisted cable has to be used.

In case the braking resistor is supplied with thermal protection (klixon), it may be connected to the "External fault" drive input.

5.8.1 Internal Braking Unit

An external braking resistor is required (not included). For parameter setting refer to section **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

Table 5.8.2.1: Lists and Technical Data of the External Standard Resistors for Inverters 3F75 up to 3060

Inverter Type	Resistor Type	P_{NBR} [kW]	R_{BR} [Ohm]	E_{BR} [kJ]
3F75	**MRI/T600 100R**	0.6	100	22
3001				
3002				
3003				
3005				
3007	**MRI/T900 68R**	0.9	68	33
3010				
3015	**MRI/T1300 49R**	1.3	49	48
3020	**MRI/T2200 28R**	2.2	28	82
3025	**MRI/T4000 15R4**	4	15.4	150
3030	**MRI/T4000 11R6**	4	11.6	150
3040	**MRI/T4000 11R6**	4	11.6	150
3050	**MRI/T8000 7R7**	8	7.7	220
3060	**MRI/T8000 7R7**	8	7.7	220

ai4190

Parameters description:

P_{NBR} Rated power of the braking resistor

R_{BR} Braking resistor value

E_{BR} Max surge energy which can be dissipated by the resistor

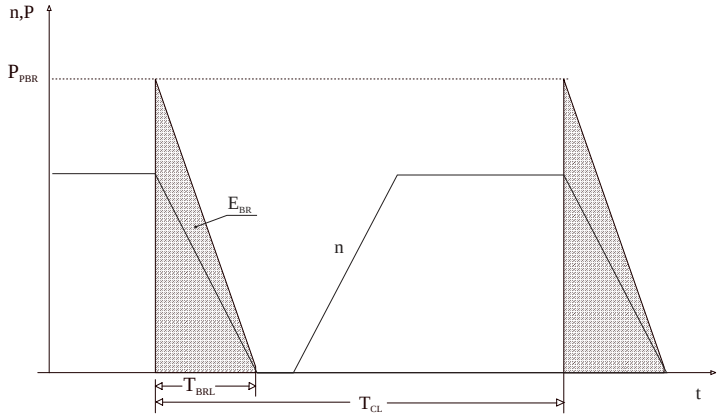
P_{PBR} Peak power applied to the braking resistor

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

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

* triangular power profile occurs when stopping an inertia load on a speed ramp profile

Figure 5.8.2.1: 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)

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

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

Resistor model: Standard resistor data

Example code: MRI/T900 68R

MRI = resistor type

900 = rated power (900 W)

T= with safety thermostat

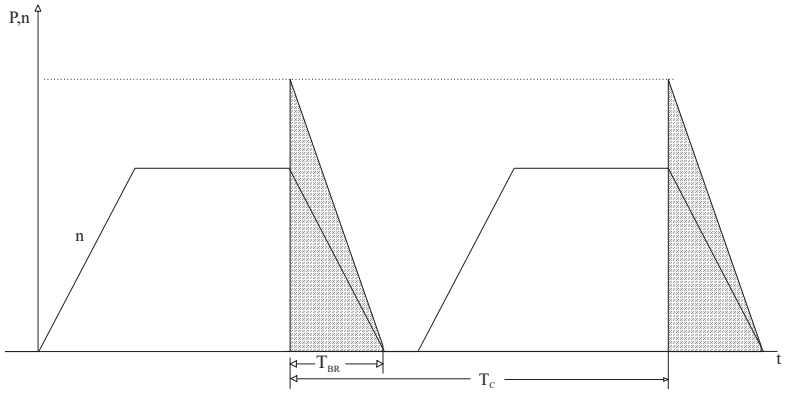
68R = resistor value (68 Ω)

NOTE! The suggested match of resistor-model and inverter-size, allows a braking stop at rated 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.
The peak over load which is applied when the braking chopper is in steady state is:

$$P_{PBR} = \frac{V_{BR}^{2}\ [V]}{R_{BR}\ [Ohm]} = W$$

Where: 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

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

$$P_{PBR} = \frac{V_{BR}^{2}}{R_{BR}} = \frac{780^{2}}{100} = 6084\ [W] \qquad T_{BRL} = 2\ \frac{E_{BR}}{P_{PBR}} = 2\ \frac{22000}{6084} = 7.2[s]$$

CASE A) If $T_{BR} \leq E_{BR} / P_{NBR}$ the following conditions must be met:

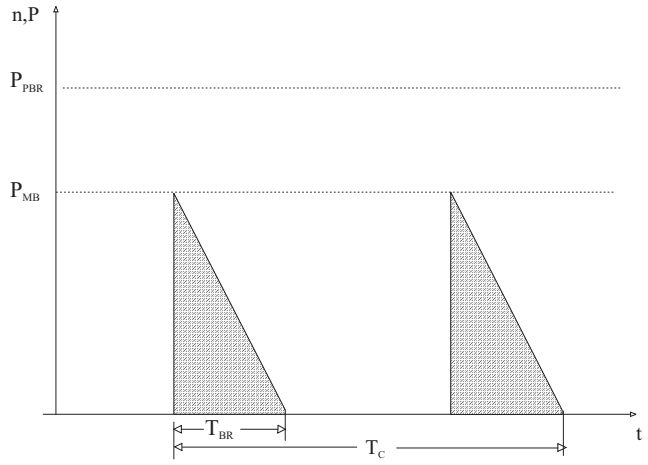
1) $P_{MB} \leq 2 . E_{BR} / T_{BR}$ Where: P_{MB} is the peak power of the cycle (see.fig. 5.8.2.3)

2) $$\frac{P_{MB\ x}\ T_{BR}}{2\ T_{C}} \leq P_{NBR}$$

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

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

Figure 5.8.2.3: Generic Braking Cycle with Triangular Profile



If none of the rules are met, it is necessary to increase the rated power of the resistor, respecting the limit of the internal braking unit (reported in table 5.8.2.3), or an external BU if necessary.

In order to protect these resistors from dangerous overload, software overload control logic is also available ("STARTUP/startup config/BU protection" menu).

The default parameters in this menu match the recommended resistor pairing as per table 5.8.2.1.

See AV300i User's manual, chapter 2.3.2.8, to set values for a non-standard pairing.

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

When the duty cycle exceeds the data entered, the **BU overload** alarm 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]
3F75	4.1	7.8	19	100
3001				
3002				
3003				
3005				
3007	6.6	12	16	67
3010				
3015	12	22	17	36
3020	17	31	16	26
3025	18	52	42	15
3030	37	78	23	10
3040	29		37	
3050	50	104	22	7.5
3060				
3075 up to 3800	External braking unit (optional)			

ai4210

I_{RMS} : Rated current of the braking unit

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

T : Minimum cycle time when **I_{PK}** is defined 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 able, by using terminals 26 and 27, to control one or more external braking units. The drive will act as Master and the external brake units, 6KBU300, must be configured as Slave.

In this way it will be possible to utilize the internal I^2t protection (see AV300i User's Manual, section **Drive initialization**).

If more than one BU is used, each BU shall be connected to a single resistor. All braking units shall be the same models and have same type resistors.

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 by connecting external capacitors in parallel (on terminal C and D).

Table 5.9.1: DC Link Buffer Time

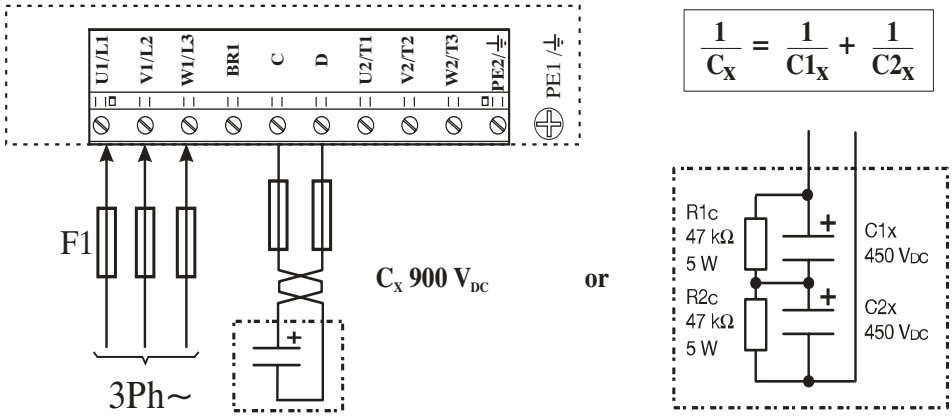
Inverter type	Internal capacitance C_{std} [μF]	Buffer time t_{Buff} (minimum value) with the internal capacitance at : AC Input voltage =400V [s]	AC Input voltage =460V [s]	Maximum permissible external capacitance C_{ext} [μF]	Maximum power required by switched mode power supply P_{SMPS} [W]
3F75	220	0.165	0.25	0	65
3001	220	0.165	0.25	0	65
3002	330	0.24	0.37	0	65
3003	330	0.24	0.37	0	65
3005	830	0.62	0.95	0	65
3007	830	0.62	0.95	0	65
3010	830	0.62	0.95	0	65
3015	1500	1.12	1.72	1500	65
3020	1500	1.12	1.72	1500	65
3025	1800	1.54	2.3	4500	70
3030	2200	1.88	2.8	4500	70
3040	3300	2.83	4.2	4500	70
3050	4950	4.24	6.3	4500	70
3060	4950	4.24	6.3	4500	70
3075	6600	5.6	8.1	0	70
3100	6600	5.6	8.1	0	70
3125	9900	8.4	12.1	0	70
3150	14100	12.8	17.2	0	70
3200	14100	12.8	17.2	0	70
3250	20300	2.2	3.3	0	70
3300-3450	34800	3.8	5.8	0	70
3500-3800	60900	6.6	10.1	0	70

ai4220

SMPS = Switched Mode Power Supply

Alternatively the control function “Powerloss ridethru” may be used to provide active buffering of the regulator supply by regeneration (see AV300i User’s Guide, chapter 1.11.2.1)

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



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

A 6KAVI43025 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		

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

5.10 AV-300i Power Dip Ride Through Data and Restart Setup

The AV-300i 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 AV-300i 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 AV-300i gives up on the reset.

The DC link feeds the AV-300i power supply. If the DC link goes below 250 VDC (or 200 VDC, depending on models) 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 AV-300i 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:

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

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

Maximum power supply drop out time (Buffer time/voltage failure buffer) of AV-300i 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 = 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,
U_{min} = min DC volts that will support the power supply

Where T_{buff} is defined by the formula: $T_{buff} = \frac{(C_{std} + C_{ext}\,\max) \cdot (U_{buff}^2 - U_{min}^2)}{2 \cdot P_{SMPS} \cdot 10^6}$

Table 5.10.1: Drive Trip Times, 230-V Threshold

Size	P_{SMPS}	C_{std}	C_{ext} max	U_{buff}	U_{min}	T_{buff}
3025	70	1800	4500	230	200	0.58
3030	70	2200	4500	230	200	0.62
3040	70	3300	4500	230	200	0.72
3050	70	4950	4500	230	200	0.87
3060	70	4950	4500	230	200	0.87
3075	70	6600	0	230	200	0.61
3100	70	6600	0	230	200	0.61
3125	70	9900	0	230	200	0.91
3150	70	14100	0	230	200	1.3
3200	70	14100	0	230	200	1.3
3250-3800	not applicable					

ai4225

Table 5.10.2: Drive Trip Times, 400-V Threshold

Size	Psmps [W]	C_{std} [µF]	C_{ext} max [µF]	U_{buff} [V]	U_{min} [V]	T_{buff} [sec.]
3F75	65	220	0	400	250	0.165
3001	65	220	0	400	250	0.25
3002	65	330	0	400	250	0.24
3003	65	330	0	400	250	0.24
3005	65	830	0	400	250	0.62
3007	65	830	0	400	250	0.62
3010	65	830	0	400	250	0.62
3015	65	1500	1500	400	250	2.25
3020	65	1500	1500	400	250	2.25
3025	70	1800	4500	400	200	5.4
3030	70	2200	4500	400	200	5.74
3040	70	3300	4500	400	200	6.68
3050	70	4950	4500	400	200	8.1
3060	70	4950	4500	400	200	8.1
3075	70	6600	0	400	200	5.65
3100	70	6600	0	400	200	5.65
3125	70	9900	0	400	200	8.48
3150	70	14100	0	400	200	12.08
3200	70	14100	0	400	200	12.08
3250	70	20300	0			2.2
3300-3450	70	34800	0			3.8
3500-3800	70	60900	0			6.6

ai4230

Table 5.10.3: Drive Trip Time, 460-V Threshold

Size	Psmps [W]	C_{std} [µF]	C_{ext} max [µF]	U_{buff} [V]	U_{min} [V]	T_{buff} [sec.]
3F75	65	220	0	460	250	0.25
3001	65	220	0	460	250	0.25
3002	65	330	0	460	250	0.37
3003	65	330	0	460	250	0.37
3005	65	830	0	460	250	0.95
3007	65	830	0	460	250	0.95
3010	65	830	0	460	250	0.95
3015	65	1500	1500	460	250	3.45
3020	65	1500	1500	460	250	3.45
3025	70	1800	4500	460	200	7.72
3030	70	2200	4500	460	200	8.21
3040	70	3300	4500	460	200	9.56
3050	70	4950	4500	460	200	11.58
3060	70	4950	4500	460	200	11.58
3075	70	6600	0	460	200	8.04
3100	70	6600	0	460	200	8.09
3125	70	9900	0	460	200	12.13
3150	70	14100	0	460	200	17.28
3200	70	14100	0	460	200	17.28
3250	70	20300	0			3.3
3300-3450	70	34800	0			5.8
3500-3800	70	60900	0			10.1

ai4240

5.11 Discharge Time of the DC-Link

Table 5.11.1: DC Link Discharge Times

Type	I_{2N}	Time (seconds)
3F75	2.1	90
3001	3.5	
3002	4.9	150
3003	6.5	
3005	8.3	205
3007	11	
3010	15.4	
3015	21.6	220
3020	28.7	
3025	42	60
3030	58	60
3040	76	90
3050	90	120
3060	110	
3075	142	
3100	180	
3125	210	
3150	250	
3200	310	
3250		150
3300-3450		180
3500-3800		240

ai4250

This is the minimum time that must be elapsed since an AV-300i Drive is disconnected from the AC Input before an operator may service parts inside the Drive to avoid electric shock hazard.

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

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

Chapter 6 - Preventive Maintenance

This equipment contains a potential hazard of electric shock or burn. Only adequately trained persons who are thoroughly familiar with the equipment and the instructions should maintain this equipment.

To prevent electric shock while servicing the equipment, personnel must understand and follow all safety requirements for working around dangerous voltages.

When de-energizing and re-energizing the drive, refer to the procedures in Figures 6-1 and 6-2.

6.1 Introduction

Periodic preventive maintenance extends equipment-operating life and minimizes downtime. This involves specific power-on and more intensive power-off checks, when permitted. With both checks, necessary repairs should be undertaken when needed.

6.2 Maintenance Schedule

For maximum benefit, preventive maintenance needs to be performed at scheduled intervals by a qualifiedtechnician. The required frequency for each procedure depends on:

- How much the equipment is used
- Ambient environmental conditions

The schedule should include an inspection of wiring and components before re-applying power after an overcurrent trip.

6.3 Maintenance Record

GE recommends that the customer keep a detailed record of maintenance (such as a logbook) for every drive. This record serves two purposes:

- It verifies that all equipment is routinely checked
- It aids troubleshooting and prevention of equipment failure by providing a history of equipment maintenance and problems

6.4 Equipment/Material Needed

The equipment and material in the following checklists should be available to perform the recommended procedures.

6.5 Safety Equipment

- Safety gear (safety boots, safety glasses, hard-hat, high voltage gloves, face shield)
- High voltage ac/dc detector (using an insulated pole of appropriate length)
- Locks and tags, danger and caution tape
- Protective grounding cables and grounding stick
- Static-charge wrist straps

6.6 Typical Maintenance Tools

- High quality tools, including screwdrivers and pliers, designed specifically for working with electrical wiring systems
- Socket set (metric and standard)
- Hex wrenches (metric and standard)
- 1-inch adjustable wrench
- Torque wrench
- Electrical tape
- Fine file
- Clean dry cloth
- Soft-bristled brush (such as a paintbrush)
- Mild solution of distilled water and household or laboratory detergent
- Isopropyl alcohol
- One megger tester capable of insulation testing 500 V max.
- Source of dry, low-pressure compressed air
- Vacuum cleaner with non-metallic nozzle and finely woven, high efficiency filter
- Fuse puller
- Replacement components (if required) including fuses, wiring, cabling, and door filters

6.7 Power-On Checks

No preventive maintenance procedures need to be conducted with power on.

Warning

With power applied, extremely high voltages are present. To prevent accidental injury, do not work on the drive with power applied.

6.8 Power-Off Checks

Power-off checks involve cleaning the equipment, and checking for wear and damage through visual inspection and functional tests.

6.9 Before Starting Maintenance

Warning

Power must be de-energized before performing any adjustments, servicing, or other act requiring physical contact with the electrical components or wiring.

Before starting, de-energize the drive using the instructions in Figure 6-1.

Do not deviate from the stated de-energizing procedures. If you can not completely meet the safety requirements or if you do not understand them **do not work on the equipmen**t.

De-energizing the Drive

To prevent potentially hazardous electric shock, power must be properly de-energized before anyone is allowed to make any type of physical contact with the electrical components or wiring of the drive.

When checking for zero ac or dc voltage, the high voltage detector must be rated appropriately for the equipment voltages.

1. Check that the drive is stopped.
2. Open the main circuit breaker (external power) to de-energize the drive, then lock-out and tag-out the external power.
3. Check the load side of the inverter for zero ac voltage.
4. Wait **5 minutes minimum** to discharge the dc capacitors. (Table 5.11.1)

Figure 6-1: Power-Down (De-energizing) Procedures

Re-energizing the Drive

Power must be properly re-energized to prevent personnel from having potentially hazardous contact with dangerous voltages.

1. Close and secure the drive cabinet doors.
2. Clear all locks and tags from the circuit breaker and drive.
3. Close all disconnects that were opened when de-energizing the drive.

Figure 6-2: Power-Up (Re-energizing) Procedures

6.9.1 Dust Removal

Caution

Build up of dust on electrical components and wiring can damage components and cause mis-operation.

Build-up of dust on components can increase operating temperature, reducing their normal life. On standoff insulators, it can collect enough moisture to produce a current path from bus bars to chassis ground.

Dust (especially metallic dust) on wire surfaces can cause *tracking* between connector pins. Tracking is usually capacitive in nature and involves a build-up of electrical charge along the wire surface. This can cause intermittent problems that are hard to find. Check for and remove accumulated dust as follows:

1. Clean bus bars and standoff insulators with a clean dry cloth - **do not use any solvent**s.

NOTE Make sure that the air source is directed so that dust and foreign matter is removed rather than relocated.

2. Using a fine-filtered vacuum cleaner with a non-metallic nozzle, remove dust and dirt from wiring and electrical components.
3. Inspect cabinet air filters, if equipped. Shake or vacuum filters clean, or replace, as required.

Do not use *high-pressure* compressed air, which may damage components.

6.9.2 Loose Connections

Vibration during equipment operation can loosen mechanical and electrical connections and cause intermittent equipment failure. Additionally, dust and moisture in loose connections can cause loss of low-level signals at terminal boards and also thermal runaway at bus connections.

1. Check all hardware and electrical connections, and tighten if needed.
2. Tighten or replace any loosened crimp-style lugs.
3. Tighten or replace all loose or missing hardware.
4. Inspect printed wiring boards for correct seating, and check that any plugs, wiring, and bus connectors are tight.

Caution

To prevent component damage caused by static electricity, treat all boards and devices with static-sensitive handling techniques. Wear a wrist grounding strap when handling boards or components, but only after boards or components have been removed from potentially energized equipment and are at a normally grounded workstation.

To prevent equipment damage, do not remove, insert, or adjust board connections while power is applied to the equipment.

6.9.3 Damaged Insulation

Wires and cables with damaged insulation are dangerous when carrying electricity. They can also intermittently

short, causing equipment and functional failure.

1. Check all wires and cables for fraying, chipping, nicks, wear, or rodent damage.
2. Check all wires and cables for signs of overheating or carbonization.
3. Repair minor damage to low voltage insulation with a good grade of electrical tape. If a damaged cable carries high voltages, replace the cable.
4. Replace any cables or wires that have more than mild damage.

6.9.4 Contactors and Relays

1. If possible, manually trip the device to ensure that it works properly.
2. Inspect contacts on open (as opposed to sealed) contactors and relays. (Discoloration and rough contact surfaces are normal.)
3. If beads have formed because of severe arcing:

a. Dress the contact faces with a fine file. (Do not use emery cloth or sandpaper.)

b. Identify and correct the cause of arcing.

NOTE Refer to the component™s publication for detailed instructions on maintenance, repair, and replacement procedures.

6.9.5 Printed Wiring Boards

If dirty, clean boards as follows:

1. Vacuum to remove dust from around the board connections before and after unplugging.
2. Remove the boards per the instructions in Section 4. Be sure to observe the personal and equipment safety instructions.
3. Vacuum to remove dust from the board and connections. A soft-bristled brush may be used to loosen dirt.

Caution

Do not use solvents containing ammonia, aldehydes, alkalis, aromatic hydrocarbons, or ketones. Harsh chemicals and solutions will damage the board.

If boards are excessively dirty, wash boards as follows:

1. Use a soft-bristled brush to scrub the board in a lukewarm (37.7 °C, 100 °F), mild solution of distilled water and household or laboratory detergent.
2. Rinse thoroughly by dipping the board several times in fresh, lukewarm, distilled water. Do not soak the board.
3. Dry the board by shaking off excess water, immersing and agitating the board in isopropyl alcohol. Air dry the board for a few hours.

6.9.6 Short-Circuit Damage

If a short-circuit occurs, overcurrent protective devices on the circuit should cut off power to the equipment.

This normally prevents electrical damage, except at the point of the short. However, the heat produced by an electrical arc can carbonize some organic insulating materials, which then lose insulating qualities.

Perform the following procedure after repairing the cause of the short and **before re-energizing** the drive (per Figure 6-2):

1. Inspect the system thoroughly for damage to conductors, insulation, or equipment. Replace, if found (refer to *Damaged Insulatio*n).
2. Check insulation resistance.
3. Inspect the overcurrent protection devices for damage to insulation and contacts (refer to *Contactors and Relay*s). Replace or repair as needed.
4. Check and replace any open fuses.

Chapter 7 - Component Replacement (3250-3800 sizes)

Safety Precautions

With power applied, this equipment contains a potential hazard of electric shock or burn. Only adequately trained persons who are thoroughly familiar with the equipment and the instructions should maintain this equipment. To prevent electric shock while servicing the equipment, personnel must understand and follow all safety requirements for working around dangerous voltages. Make sure that all power supplies to the equipment are turned off, then ground and discharge the equipment before performing any adjustments, servicing, or other acts requiring physical contact with the electrical components or wiring. When de-energizing and re-energizing the drive, refer to Figures 6-1 and 6-2.

7.1 Introduction

This chapter provides guidelines for replacing components during repair.

Before starting any maintenance procedures, prepare the equipment as follows:

1. Make sure that shutting down equipment does not interfere with presently required operation.
2. Turn off all power to the equipment to be maintained, and follow all local safety practices of Lock Out/Tag Out.
3. Test all equipment using a multimeter to ensure that power is off.

7.2 Torque Requirements

When replacing components, refer to table 4.2-1 below for required torque values for screw/bolt connections.

Table 7.2.1: Torque Values for Screw/Bolt Connections (3250-3800 Sizes)

Screw/Bolt Connection		Fastener Size	Torque in-Lbs	ft-lbs	n-m
Capacitor	Terminal Connecitons	1/4-28	55	4.6	6.2
	Nylon Nut	Special	70	5.8	7.9
IGBTs:	Mounting Screws to Heatpipe	M6	45	3.8	5.1
	Bolts attaching Gate Drive Board (250, 450 Hp)	M4	19	1.6	2.1
	Nuts attaching Gate Drive Board (800 Hp)	M4	13	1.1	1.5
	Bus Bolts/Standoffs	M6, M8	95	7.9	10.7
Diode/SCModules	Mounting Screws to Heatpipe (250 Hp)	M5	35	2.9	4.0
	Moutning Screws to Heatpipe (450 Hp)	M6	53	4.4	6.0
	Bus Bolts (250, 450 Hp)	M8, M10	105	8.8	11.9
Bus, Cable, and lug bolted connections*		1 / 4 - 20 or M6	48	4	5.4
		5 / 16 - 18 or M8	96	8	11
		3 / 8 - 16 or M10	168	14	19
		1 / 2 - 13 or M12	420	35	47
		5 / 8 - 11	840	70	95

***NOTE:** Listed values apply to bolts torqued by the nut. Add 20% to the listed values for bolts that must be torqued by the bolt head, such as into press-nuts or cage-nuts.

7.3 Replacing Printed Wiring Boards

Because of upgrades, boards of different revision levels may not contain identical hardware. However, GE ensures backward compatibility of replacement boards.

7.3.1 Handling Precautions

Caution

To prevent component damage caused by static electricity, treat all boards with static sensitive handling techniques. Wear a wrist grounding strap when handling boards or components, but only after boards or components have been removed from potentially energized equipment and are at a normally grounded workstation.

Printed wiring boards may contain static-sensitive components. Therefore, GE ships all replacement boards in antistatic bags.

Use the following guidelines when handling boards:

- Store boards in antistatic bags or boxes.
- Use a grounding strap when handling boards or board components per the previous *Caution* criteria.

7.3.2 General Replacement Procedures

Warning

To prevent electric shock, turn off power to the drive, then test to verify that no power exists in the board before touching it or any connected circuits.

Caution

To prevent equipment damage, do not remove, insert, or adjust board connections while power is applied to the equipment.

7.3.2.1 To Remove a Printed Wiring Board

1. Make sure that the drive in which the board resides has been de-energized. (Refer to Figure 6-1, *De-energizing the Drive* for complete procedures.)
2. Open the drive cabinet door and, using equipment designed for high voltages, test any electrical circuits **before touching them** to ensure that power is off.

Caution

To prevent damage to cable and wire connections, hold only the connector, not the cable, when pulling them. To prevent equipment damage, do not remove, insert, or adjust board connections while power is applied to the equipment.

3. Carefully disconnect all cables, as follows:
   - For a cable with a pull tab, carefully pull the tab.
   - For a screw terminal connector, loosen the screw at the top of each terminal and gently pull each wire free.
   - For ribbon cables, grasp each side of the cable connector and pull the connector and cable loose.
4. Carefully remove the board, as follows:
   - For boards mounted on standoffs with screws, remove the screws to release the board.

For boards mounted within a rack, loosen the screws at the top and bottom of the board near the card ejector tabs, then unseat the board by raising the ejector tabs. (The screws are captive in the board front and should not be removed.)

7.3.2.2. To Install a Printed Wiring Board

1. On the replacement (new) board, set all jumpers, pots, and switches in the exact position as those on the board being replaced.

   NOTE: If a board revision has added or eliminated a configurable component, or readjustment is needed, refer to the individual board publication. If the board contains onboard software, refer to the individual board publication for instructions.

2. To install a board that is seated on standoffs:
   a. Place the board onto the standoff in the same orientation as the board that was removed.
   b. Secure the boards by replacing and tightening the screws that were removed.
3. Reconnect all cables, making sure that they are properly seated at both ends.

7.4. Fan Assembly Replacement

The following section provides instructions for replacing the fan assembly.

7.4.1. To Replace the Fan Assembly

1. Disconnect the wire connection(s) to the fan box assembly.
2. Remove any cable ties, holding wire harnesses to the fan box assembly.
3. Remove any printed wiring boards that are mounted on the side of the fan box assembly. See previous instructions regarding handling in inReplacing Printed Wiring Boardsli.
4. Support the fan assembly, then remove the four ¼-20 bolts connecting the fan box assembly to the heat exchanger assembly.

   NOTE: In the 500-800 Hp drives, remove the Lexan cover from the fan box in the lower, right corner of the drive. Then remove the six ¼ - 20 nuts connecting the fan box assembly to the insulating plate underneath.

5. Remove fan assembly and set aside.

Reverse steps 1 through 5 to re-install.

7.5 Heat Exchanger Replacement

The following section provides instructions for replacing the heat exchanger.

7.5.1 To Replace the Heat Exchanger

6. Remove the fan assembly per the *Fan Assembly Replacement* section procedure
7. Label and disconnect the wire connections from the printed wiring boards that are mounted on top of the heat exchanger.
8. Remove the shunts and shunt boards as an assembly. Label the wiring for ease of reassembly.
9. Carefully disconnect and label all cables.
10. Remove the printed wiring boards that are mounted on the front of the heat exchanger. See previous instructions regarding handling in “Replacing Printed Wiring Boards.”

    NOTE: Gate driver boards (IS200AVGX) are located under the bus bars on 150-450 Hp drives.

11. Remove the bolts connecting the bus bars to the capacitor bank.
12. Remove the bolts connecting the bus (large copper sheets and insulation) to the IGBT.
13. Support the heat exchanger assembly using an overhead crane, P/N 151X1203YAG01.
14. Remove the two ¼-20 bolts and ¼ - 20 nuts from the back panel and lift the heat exchanger out of the enclosure.

Reverse steps 1 through 14 to re-install.

15. Torque the bolts to the capacitors to 55 in-lbs. Do not over tighten, or it could result in stripping the aluminum terminal on the capacitor.

7.6 Capacitor Assembly Replacement

The following sections provide instructions for replacing the capacitor.

7.6.1 To Replace the Capacitor Assembly

1. Remove the heat exchanger per the *Heat Exchanger Replacement* section procedure.

   NOTE: For capacitor assemblies in the 500 Œ 800 Hp drives which are not mounted behind the heat exchangers, step 1 may be omitted.

2. Remove the capacitor bus connection bolts, then remove the capacitor bus.
3. Support the capacitor assembly, then remove the four ¼-20 bolts holding the capacitor assembly to the back panel and remove the entire capacitor assembly.

Reverse steps 1 through 3 to re-install.

4. Torque the bolts to the capacitors to 55 in-lbs. Do not over tighten, or it could result in stripping the aluminum terminal on the capacitor.

7.7 Replacing IGBT Modules

The following sections provide instructions for replacing the IGBT modules.

If an IGBT fails, both IGBT power modules for that phase should be replaced. Additionally, the gate drive board (IS200AVGx) in the affected phase was probably damaged during the failure, so must be replaced too.

NOTE: In the 500 to 800 Hp drive, two IGBTs are used in parallel. The IGBTs for the two devices in the *upper* positions of the heat exchanger should be replaced as a matched set of two. The IGBTs for the two devices in the *lower* positions should be replaced as a matched set of two.

7.7.1 To Remove IGBT Modules from Heat Exchanger Assembly

NOTE: Refer to *Safety Precautions* section of this chapter for general board handling guidelines, including precautions to prevent board and cable damage.

1. Label and disconnect the wire connections from the printed wiring boards that are mounted on top of the heat exchanger.
2. Remove interface board and control boards as required on the 250 ho drives.
3. Remove the shunts and shunt boards as an assembly. Label the wiring for ease of reassembly.
4. Carefully disconnect and label all cables.
5. Remove the printed wiring boards that are mounted on the front of the heat exchanger. See previous instructions regarding handling in “Replacing Printed Wiring Boards.”

   NOTE: Gate driver boards (IS200AVGX) are located under the bus bars on 150-450 Hp drives.

6. Remove the bolts connecting the bus bars to the capacitor bank.
7. Remove the bolts connecting the bus (large copper sheets and insulation) to the IGBT.
8. Remove the gate drive boards by loosening the screws on each board.
9. Remove each IGBT by removing the four screws that secure the IGBT modules to the heat exchanger.

7.7.2 To Reinstall IGBT Modules

1. Clean the heat exchanger mounting surface of dirt and old thermal grease.

   NOTE: In the 500 to 800 Hp drives, make sure that IGBTs are installed as matched sets as detailed at the beginning of this section.

2. Apply a thin film (6 mils thick) of Dow Corning 340 Silicone Grease (or equivalent) to the back of the new IGBT modules and to the heat exchanger mounting surface.
3. Orient each IGBT module in the same position as the old IGBT module and start the four M6 bolts, lock washers, and flat washers.
4. Temporarily tighten the mounting bolts in diagonally opposite corners (using an "X" pattern).
5. Then, torque these same bolts (refer to table 7.2-1) in the opposite of step 4 (still using an "X" pattern).
6. Install the standoffs if required and torque (refer to table 7.2-1).
7. Install the gate drive boards.

   NOTE: In most instances of IGBT module failure, the gate drive board in the affected phase is also damaged and must be replaced.

8. Place the IGBT bus back into place.

   NOTE: In the 500 to 800 Hp to drives, reverse steps 7 and 8.

9. Replace the bolts that hold the IGBT bus to the IGBT modules and the bolts that connect the IGBT bus to the capacitor assembly.
10. Torque the bolts (refer to table 7.2-1).
11. Torque the bolts to the capacitors to 55 in-lbs. Do not over tighten, or it could result in stripping the aluminum terminal on the capacitor.
12. Re-connect any wires to the IGBT bus.
13. Install the shunts.
14. Install interface board and control boards as required on the 250 Hp drives.
15. Install the cabling to the gate drive boards and shunt (the label for each cable connection should match the connector name on the board).
16. Verify proper orientation of the connectors before installation. (Cable connections are mechanically keyed.)
17. Visually inspect buses, cable connections, and bolted connections for correct installation.
18. Check that no tools, debris, or hardware is left in the drive before energizing it.

Chapter 8 - Replacement Parts

Catalog No.	Description	Drive Horsepower & quantity per drive																		
		0.75	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
Regulation Card																				
6KS504R	RV3312	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Power Cards																				
6KS5R10	PV33100	1																		
6KS5R11	PV33101		1																	
6KS5R12	PV331L02			1																
6KS5R03	PV331L03				1															
6KS5R07	PV33204					1														
6KS5R08	PV33205						1													
6KS5R09	PV33207							1												
6KS5R13	PV33311								1											
6KS5R14	PV33315									1										
6KS5R15	PV33422										1									
6KS5R16	PV33430											1								
6KS5R17	PV33437												1							
6KS5R18	PV33445													1						
6KS5R19	PV33455														1					
6KS5R20	PV33575															1				
6KS5R21	PV33590																1			
6KS5R22	PV335110																	1		
6KS5R23	PV335132																		1	
6KS5R24	PV335160																			1
IGBT Gate Cards																				
6KS512D																3				
6KS511D																	3	3		
6KS513D																			3	
Current Transformer																				
6KS5R33											1	1	1							
Filter Boards																				
6KS5D63											1	1	1							
6KS5R32														1	1					
6KS5D84																1	1	1	1	
6KS584D																				1
6KS5V77																				1
6KS5V78																				1
Current Transducers																				
6KS783E														3	3					
6KS7E87																3				
6KS780E																		3	3	
6KS784E																				3
Thermal Switches																				
6KS7YC7		1	1	1	1	1	1	1	1	1							1	1	1	
6KS7YC9											2	2	2							
6KS7YG1														2	2					
6KS7YI2X																2				
6KS7YI3X																	1	1		
6KS7YI1																			1	
6KS7G36											1	1		1	1	1				
6KS7G37													1					2	2	
6KS7G30																				1
6KS7YL2																				1
6KS7YL3																				1
Keypad																				
6KCV301KBS		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Catalog No.	Rating	Drive Horsepower & quantity per drive																	
		0.75	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200
Fans																				
6KS7ZA5		1	1	1	1	1	1	1												
6KS7ZA4			1	1	1	2	2	2	1	1										
6KS7YC8									2	2										
6KS7G70											2									
6KS7G79												1			2					
6KS7G78													1							
6KS7G71														2						
6KS70GG																2				
6KS7G17																	3	3	3	
6KS75GG																				2
Power Modules																				
6KS8H87	8A,1K2V	1																		
6KS8H88	12A,1K2V		1																	
6KS8H89	22A,1K2V			1	1															
6KS8HI0	25A,1K2V					1														
6KS8HI1	45A,1K2V						1	1												
6KS8HI2	65A,1K2V								1											
6KS8HI3	85A,1K2V									1										
6KS8H56	100A,1K2V										3									
6KS8H57	150A,1K2V											3								
6KS8H58	200A,1K2V												3							
6KS8H59	300A,1K2V													3	3					
6KS8H60	200A,1K2V															6	9	9	12	
6KS8H92	900A, 1K2V																			3
Diode Modules																				
6KS8H85	75A,1K5V								1											
6KS8H86	125A,1K5V									1										
6KS796F	160A,1K6V										1	1								
6KS797F	186A,1K6V												1							
6KS779F	99A,1K6V													3	3					
6KS782F	100A,1K6V															3	3			
6KS780F	195A,1K6V																	3	3	
6KS761F	250A,1K6V																			3
6KS787F	250A,1K6V															1				
SCR Modules																				
6KS757F	85A,1K6V										1									
6KS776F	116A,1K6V											1								
6KS781F	130A,1K6V												1							
6KS778F	181A,1K6V													1	1					
6KS786F	400A,1K6V																1	1	1	
6KS762F	500A, 1K6V																			1
Internal Braking Units																				
6KS8H75	50A,1K2V										1									
6KS8H76	75A,1K2V											1	1							
6KS8H77	100A,1K2V													1	1					
Precharge Resistor																				
6KS7NR3	7.2 Ohm, 68W												1							
6KS7NR2	9.2 Ohm, 68W											1								
6KS7NR1	15.4 Ohm, 68W										1									
6KS7ZA0	4.5 Ohm, 91W													1	1					
6KS721S	4.7 Ohm, 91W															1	2	2	2	2
Internal Fuse																				
6KS844B	2,5A-250V																1	1	1	
Auto Transformer																				
6KS78Z9																	1	1	1	

		Quality per Drive Hp Rating									
Catalog #	Description	3250	3300	3350	3400	3450	3500	3600	3700	3800	Recommended Spare
6KS504S	RV33-1.3 Reg. board	1	1	1	1	1	1	1	1	1	X
IS200AVFSG1	AVFS fan supply board	1	2	2	2	2	3	3	3	3	X
IS200AVGAG1	AVGA gate driver board	3									X
IS200AVGBG1	AVGB gate driver board		3	3	3	3					X
IS200AVGCG1	AVGC gate driver board						3	3	3	3	X
IS200AVIFG1	AVIF interface board	1	1	1	1	1	1	1	1	1	X
IS200AVSCG1	AVSC S CR control board	1	1	1	1	1	1	1	1	1	X
277A8481P1	Dc link capacitors	14	24	24	24	24	42	42	42	42	X
PDQB1001Q12P6	600 amps, 1200V IGBT	6									X
PDQB1001Q12Q10	1000 amps, 1200V IGBT		3	3	3	3	6	6	6	6	X
EBM#2248	Fan	2	4	4	4	4	6	6	6	6	X
2AG	2.5 amps, 250V fuse	2	3	3	3	3	4	4	4	4	X
323A2437P4	630 amps, 700V fuse	3									X
323A2437P3	1000 amps, 700V fuse		3	3	3	3					X
323A2437P6	800 amps, 700V fuse						6	6	6	6	X
104x125 DC 073	1600V, 250 A	3									X
	SCR/Diode Module										
323A3302P16	1600V, 500 A		3	3	3	3					X
	SCR/Diode Module										
336A3401AAG01	1400V, 53 mm SCR						3	3	3	3	X
68A7646P15	1500V, 700 A Diode						3	3	3	3	X

Chapter 9 - Warranty Parts and Service

The purpose of this section is to provide specific instructions to the user of the standard drive referenced in this book regarding warranty administration and how to obtain assistance on both in-warranty and out-of-warranty equipment.

If assistance is required to determine warranty status, identify defective parts, or obtain the name of your local distributor, call:

GE Industrial Systems

Product Service Engineering

1501 Roanoke Blvd.

Salem, VA 24153-6492 USA

Phone: + 1 800 533 5885 (United States)

+ 1 540 378 3280 (International)

Fax: + 1 540 387 8606 (All)

("+" indicates the international access code required when calling from outside of the USA.)

WARRANTY COVERAGE

The warranty covers all major parts of the drive such as the main printed circuit boards, transistor modules, etc. The warranty does not cover replacement of fuses or of the entire drive.

"Warranty period is 12 months after installation or 18 months after shipment from the Company, whichever occurs first".

However, the guarantee will not apply in the following cases, even if the guarantee term has not expired:

1. Damage was caused by incorrect use or inappropriate repair or modification.
2. The product was used in an environment outside the standard specified range.
3. Damage was caused by dropping the product after purchase or occurred during transportation.
4. Damage was caused by an earthquake, fire, flooding, lightning, abnormal voltage, or other natural calamities and secondary disasters.

Before calling the number at left to determine warranty status, the drive serial number will be required. This is located on the drive nameplate.

OUT-OF WARRANTY PROCEDURES

When the defective part has been identified, contact your local authorized GE standard drives distributor to order replacement parts.

MOTORS

Motors repairs on General Electric motors are generally handled by GE Authorized Electric Motor Service Centers or GE Apparatus Service Shops. For specific instructions on your motor, call the distributor from which it was purchased and be prepared to furnish complete nameplate data.

Appendix A - Product Drawing

Introduction

This chapter includes standard panel and outline drawings for 250 Hp to 450 Hp drives. The drawings include dimension, weight, and watt loss data to aid in the planning for installation of a system. The drawings appear in the following order.

Panel Drawing	250 Hp
Outline Drawing	250 Hp
Panel Drawing	300 - 450 Hp
Outline Drawing	300 - 450 Hp
Panel Drawing	500 - 800 Hp
Outline Drawing	500 - 800 Hp
Elementary Drawing	150 Hp
Elementary Drawing	300 Hp
Elementary Drawing	500 Hp

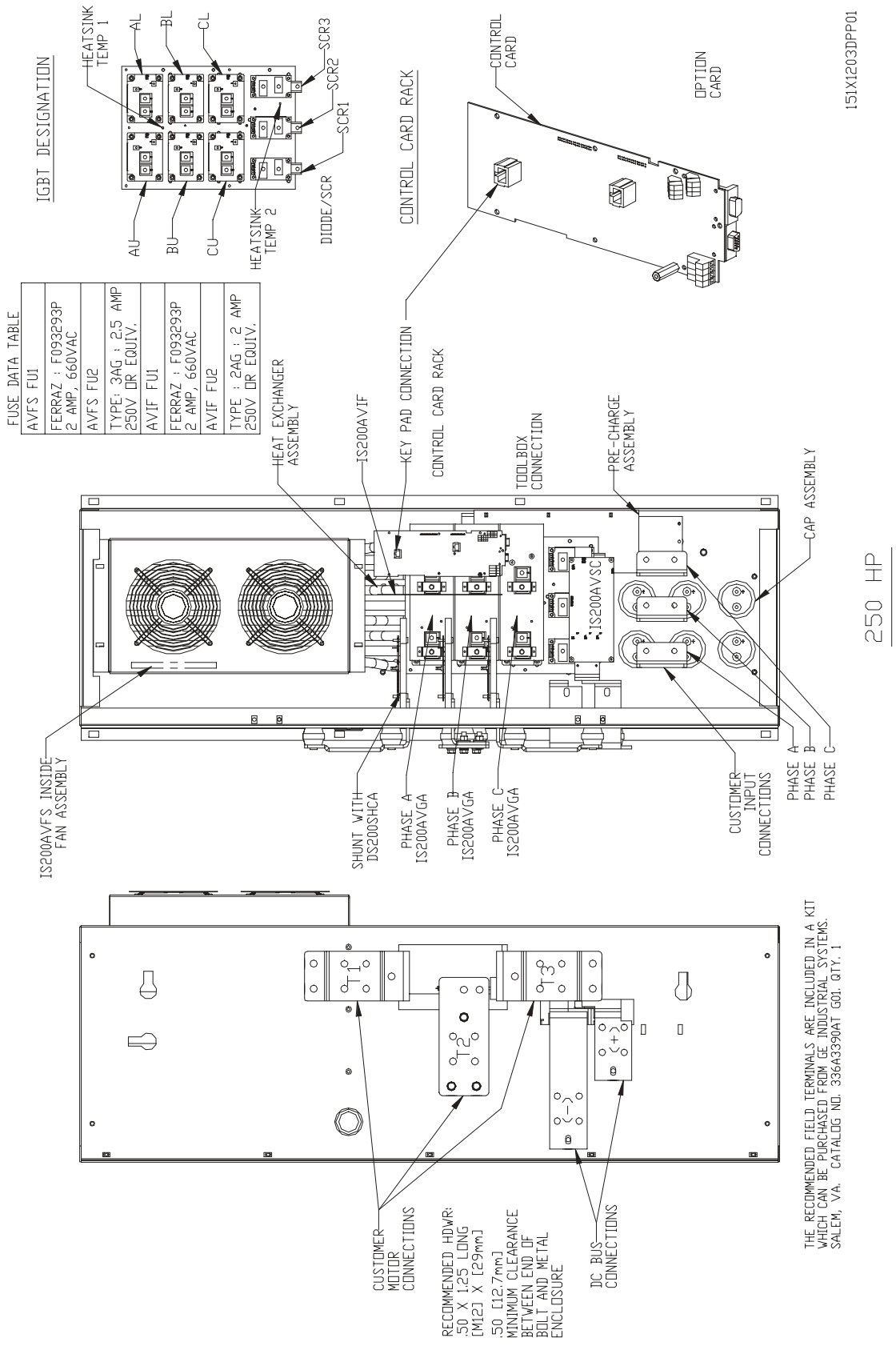


Figure A.1: Panel Drawing 250 Hp

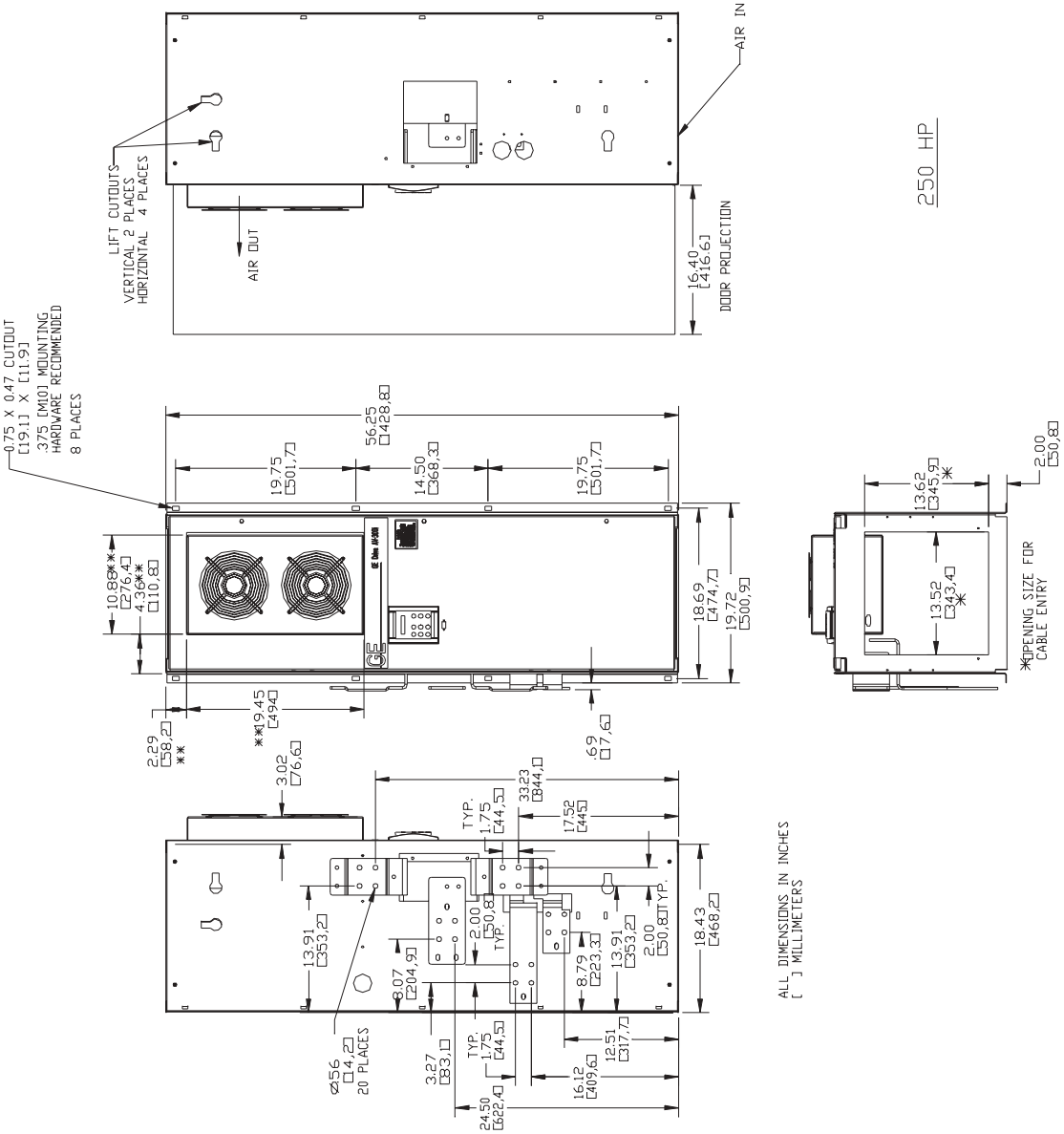


Figure A.2: Outline Drawing 250 Hp

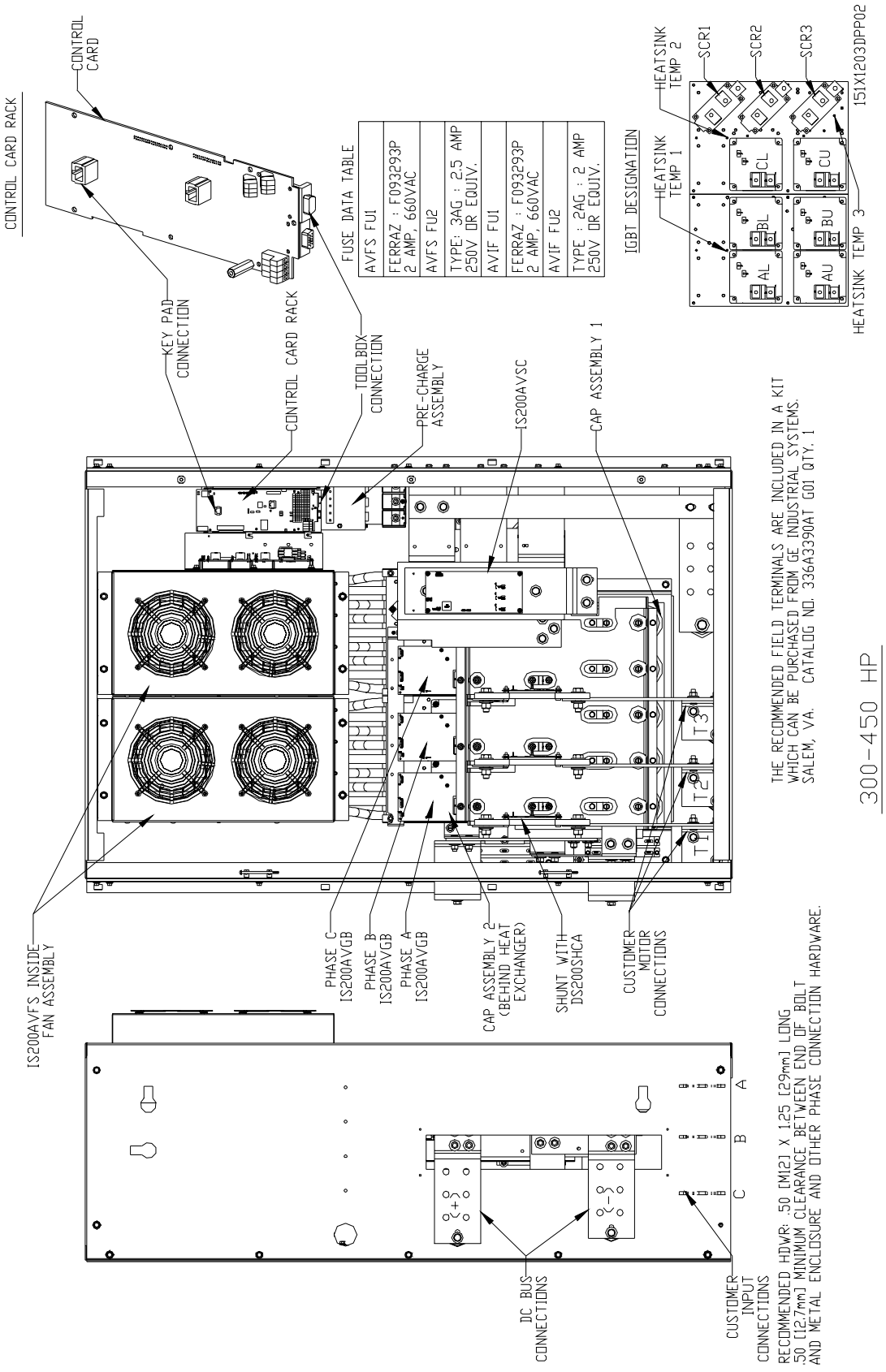


Figure A.3: Panel Drawing 300 - 450 Hp

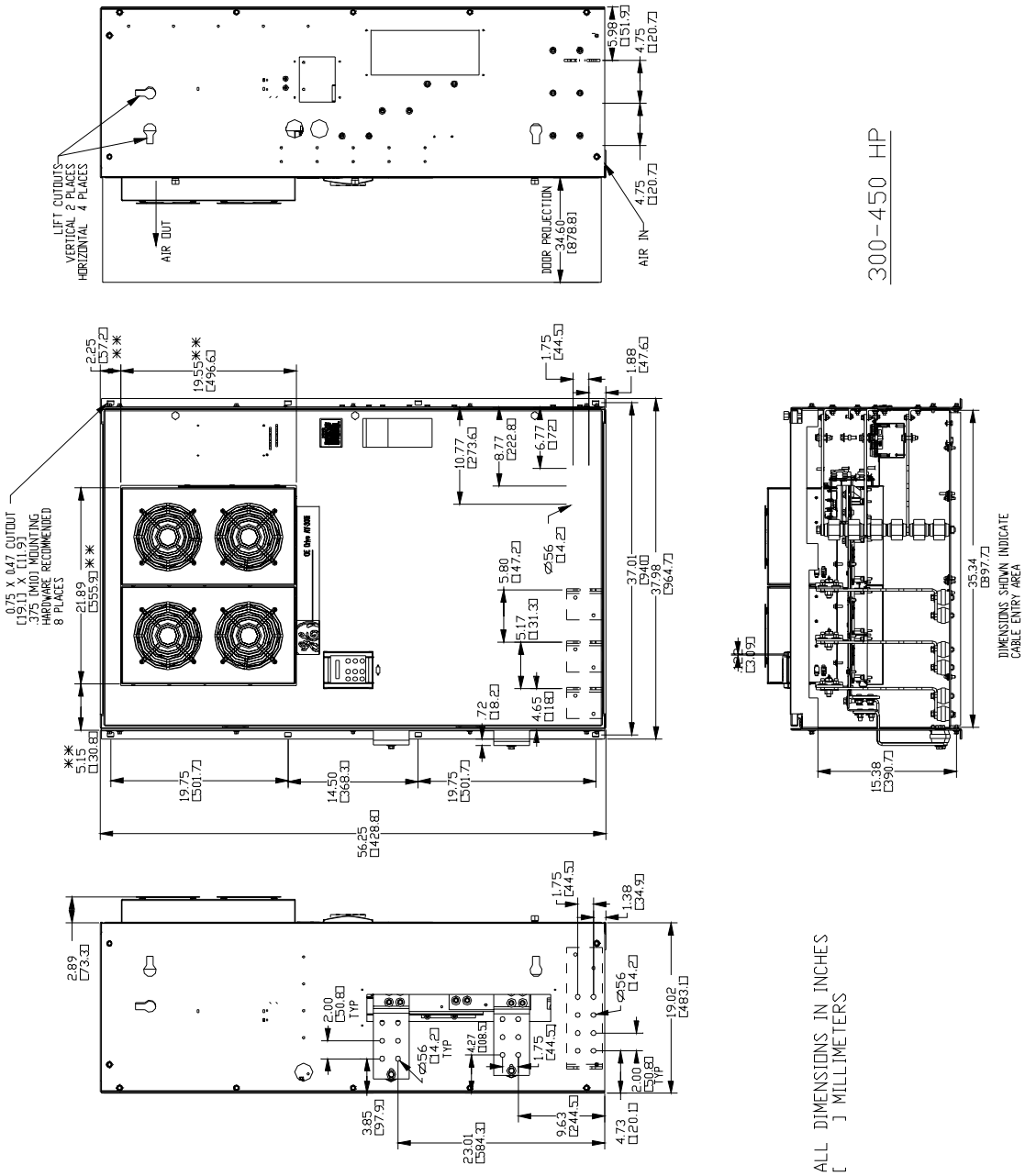


Figure A.4: Outline Drawing 300 - 450 Hp

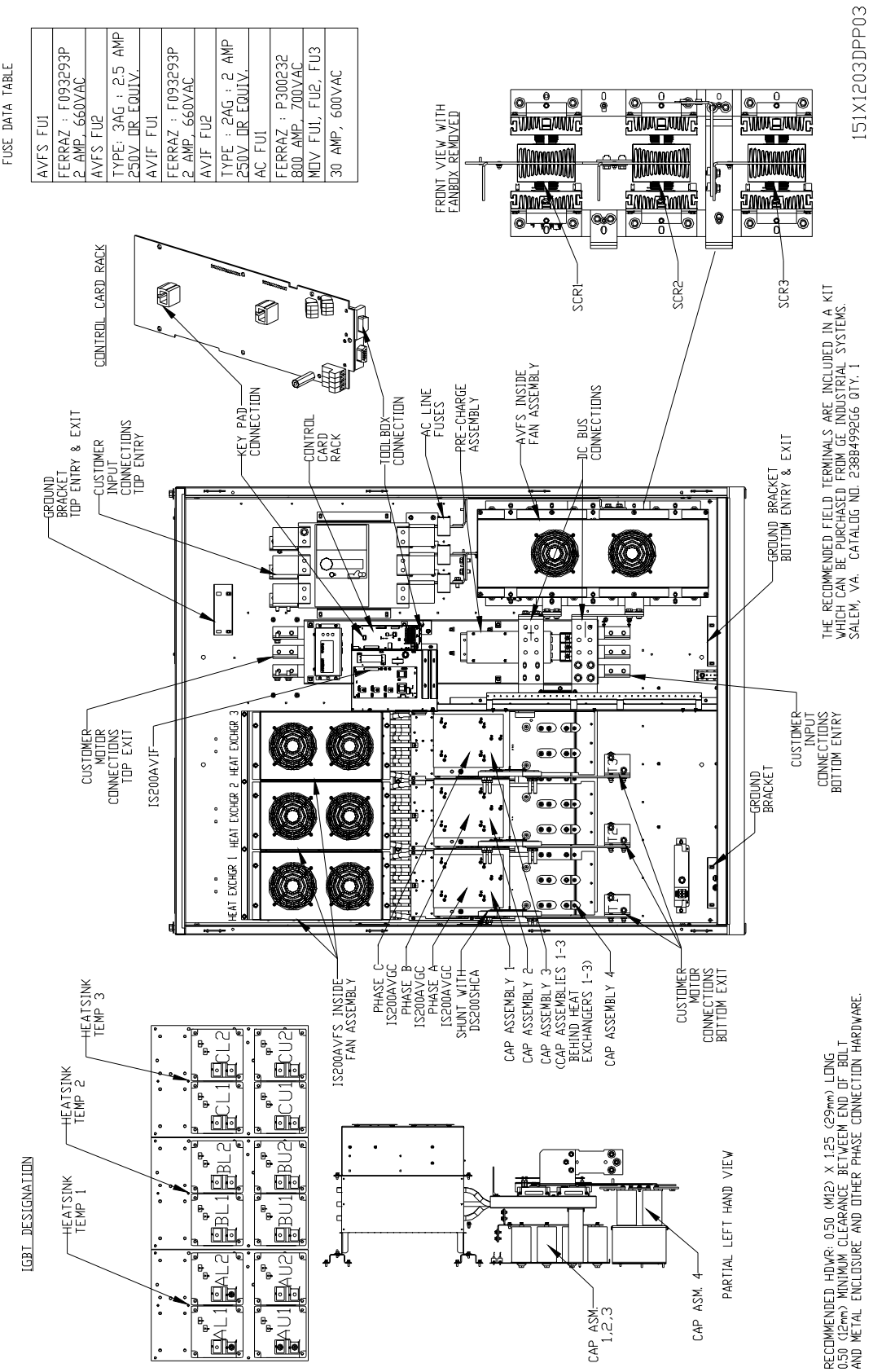


Figure A.5: Panel Drawing 500 - 800 Hp

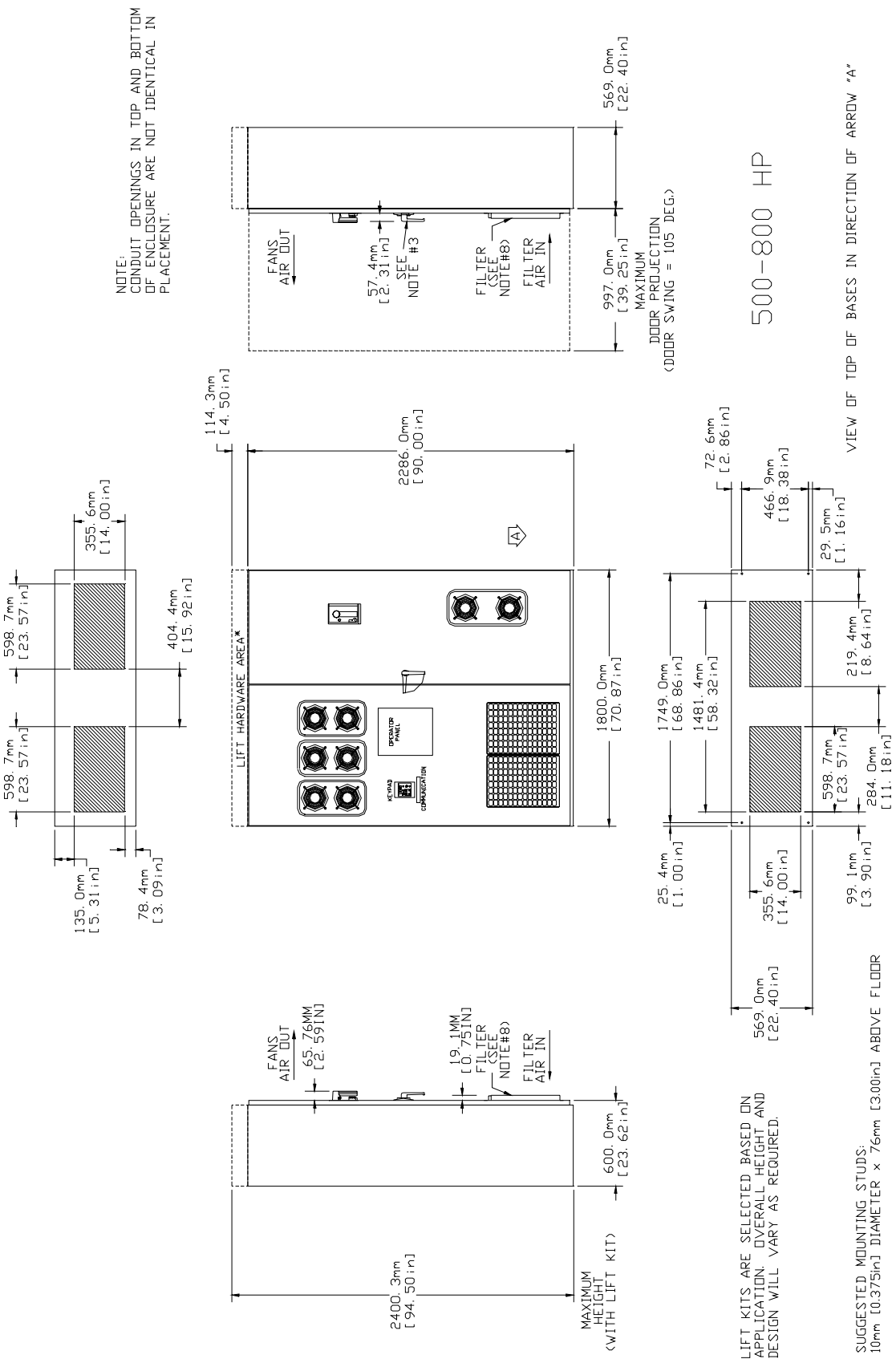


Figure A.6: Outline Drawing 500 - 800 Hp

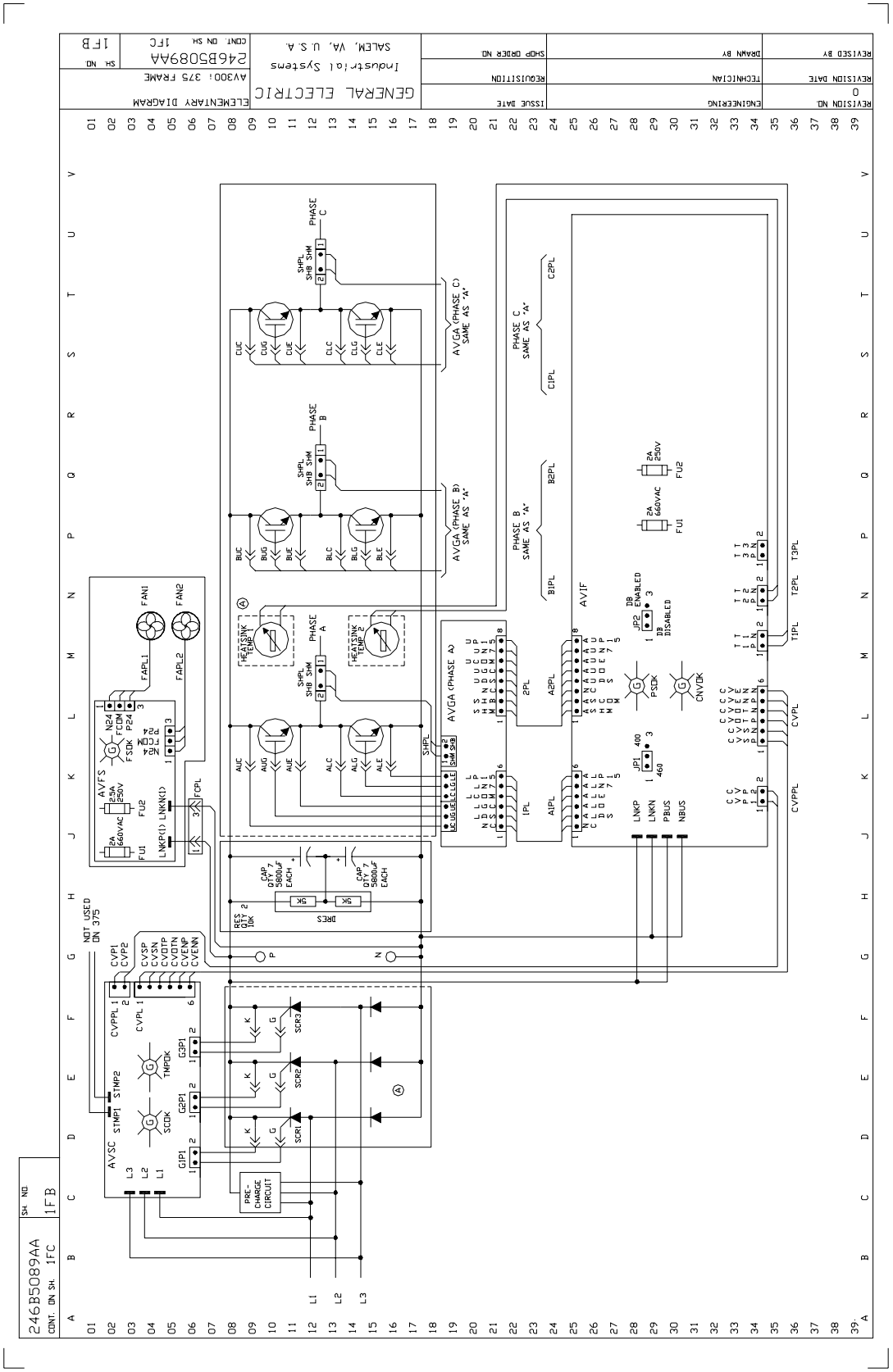


Figure A.7: Elementary Drawing 250 Hp

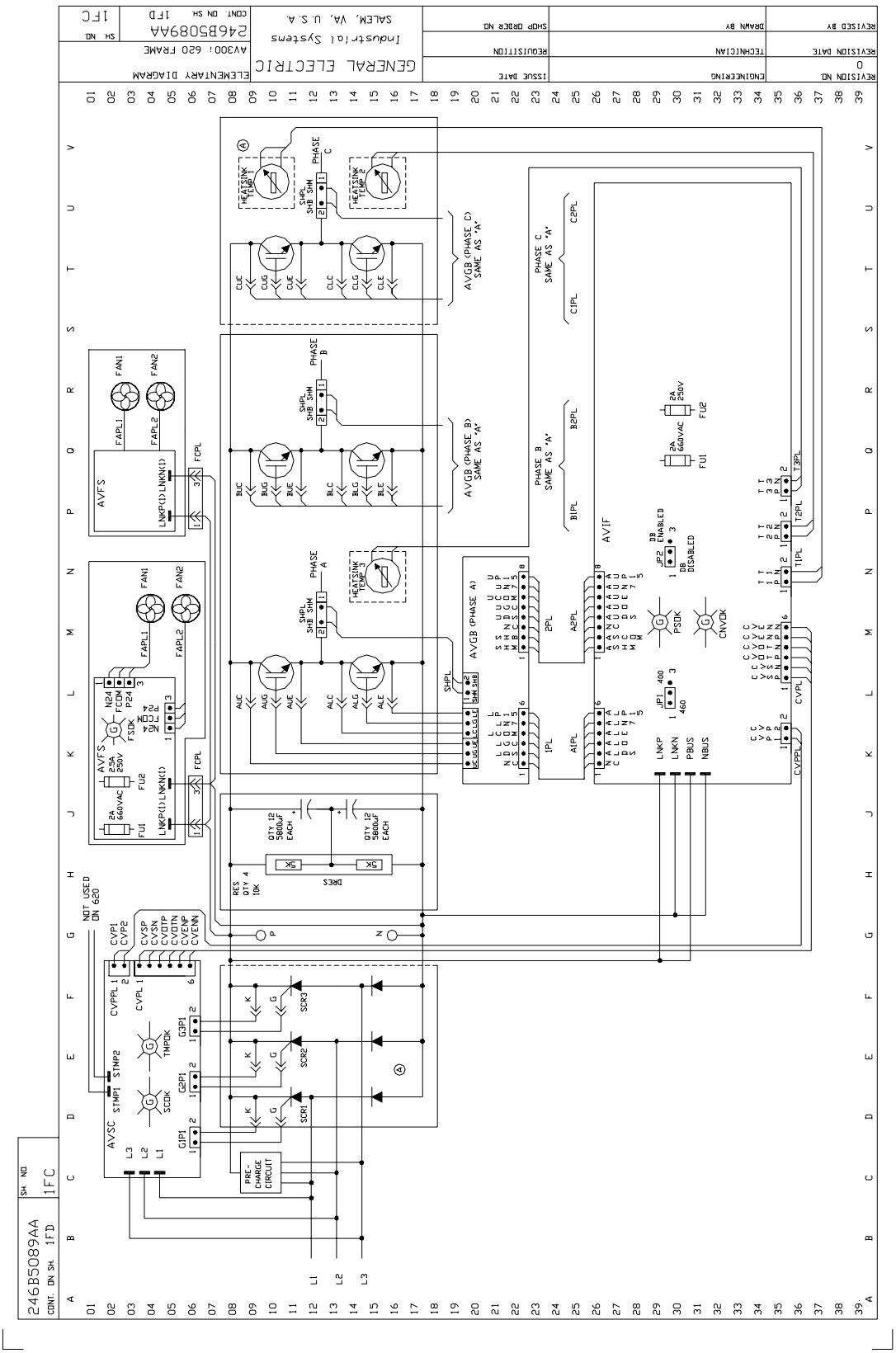


Figure A.8: Elementary Drawing 300-450 Hp

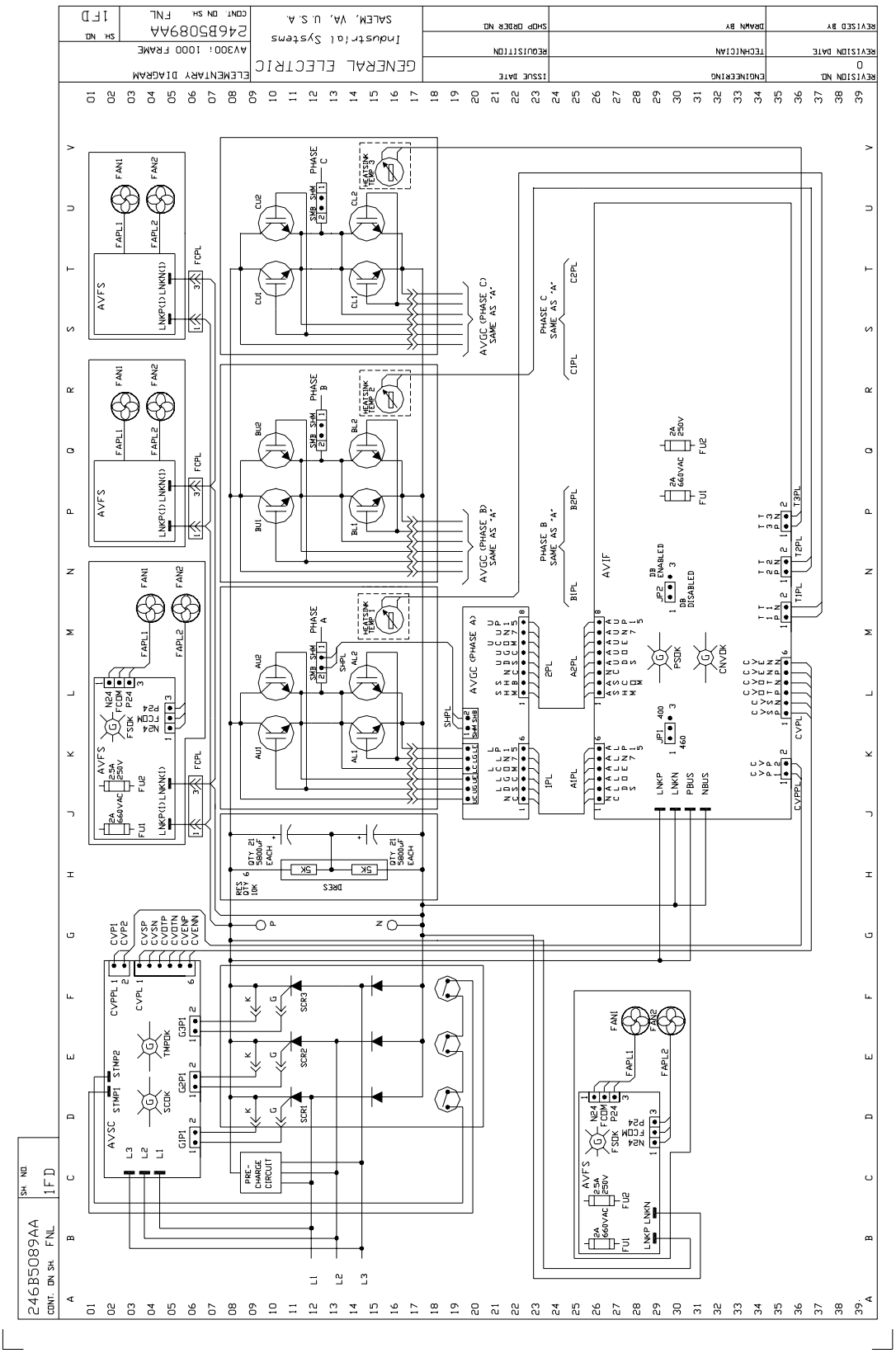


Figure A.9: Elementary Drawing 800 Hp

Index

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W

X

AV300i QS V.2

GE Industrial Systems

+ 1 540 387 7000
www.GEindustrial.com

General Electric Company
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

GEI-100429G
020923
SIEI
September 2002, for AV-300i Ver. 2.09