RELIANCE ELECTRIC

GV3000/SE AC General Purpose and Vector Drive
Version 6.0

Instruction Manual

CE c UL

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Rockwell Automation

INDEX OVERVIEW

PART 1: 49‘1327 GV3000/SE Power Units

1 - INTRODUCTION

2 - DESCRIPTION

3 - INSTALLATION

4 - MAINTENANCE

5 - ACCESSORIES

A - CE CONFORMITY

B - NEMA DESIGN INVERTERS 2 - 32 A

C - RFERENCE LIST

PART 2: 49‘1329 GV3000/SE Regulator

1 - REGULATOR OVERVIEW

2 - USE OF OPERATORS MANUAL

3 - USING THE GV3000 KEYPAD

4 - GENERAL PARAMETERS, DESCRIPTION

5 - V/HZ MODE REGULATION MODE

6 - VECTOR MODE REGULATION

7 - TROUBLE SHOOTING USING ERROR CODES

8 - PARAMETER QUICK REFERENCE GUIDE

RELIANCE ELECTRIC

GV3000/SE Power Units

Instruction Manual

User Manual: 49‘1327e (11)

Rockwell Automation

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Chapter/Topic Page

1. Introduction 1-1...1-2

Safety Instruction ... 1-1

2. Description 2-1..2-22

Power Unit Functional Description ... 2-1
Specifications
Input Power Ratings, DC Bus ... 2-13
Power Loss ... 2-15
Service Conditions ... 2-15
Power Connection Terminals ... 2-16
Braking Unit ... 2-17
Output Current Ratings ... 2-18
Inverter Selection Tables ... 2-20

3. Installation 3-1...3-16

Power Unit Connection ... 3-1
Regulator Connection ... 3-4
Dimensions ... 3-10

4. Maintenance 4-1...4-10

Safety Precautions ... 4-1
Checking the Cooling Fans ... 4-1
Power Unit Function Check ... 4-2
Replacement Parts ... 4-3

5. Accessories 5-1...5-2

AC Line Reactor ... 5-1
Radio Frequency Interference Filter ... 5-2

Appendix A CE-Conformity A-1...A-6

EMC Directive ... A-1
General Wiring Instruction ... A-2
Cabinet Mounted Inverters ... A-3
Mounting Instruction ... A-3
Wiring Instruction ... A-3
Installation of Standalone Drives IP20 ... A-5

Appendix B NEMA Design Inverters 2 to 32A B-1...B-8

Specifications and Principal Diagram ... B-1
Power Connections, Dimensions ... B-6
Replacement Parts ... B-7
Radio Frequency Interference Filter ... B-8

Appendix C Cross Reference List C-1...C-2

This instruction manual provides a functional description of the Power Units for the PWM-Converters Type GV3000 with circuit diagram and Specifications (Chapter 2), Installation Guidelines (Chapter 3), general trouble shooting suggestions with spare parts lists (Chapter 4) and Accessories (Chapter 5).
Appendix A contains guidelines for installation to meet CE-Conformity and EMC Directive**.**
Appendix B describes the frequency converters in NEMA design type GV3000U-AC002 to 032 manufactured in USA, which are all UL, cUL and CE approved.
For Start-Up instructions please refer to the regulator manual.

Safety Instructions

DANGER, WARNING, and CAUTION point out potential trouble areas.

A **DANGER** alerts a person that high voltage is present which could result in severe bodily injury or loss of life.

A **WARNING** alerts a person to potential bodily injury if procedures are not followed.

A **CAUTION** alerts a person that, if procedures are not followed, damage to, or destruction of equipment could result.

DANGER*:* Before installing and/or operating this device, this manual must be understood by the qualified electrical maintenance person who is familiar with this type of equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.

WARNING*:* Earth fault detection devices must not be used on this converter as the sole protection measure against unintentional touching.
The DC-component in the earth fault current may inhibit the correct function of the fault detector.

CAUTION*:* Electronic converters cause disturbances to the supply network. The basic version of this converter does not include any harmonic filters and may not fulfill the limits of the national recommendations. The harmonic voltage disturbances produced by the converter are dependent on the supply network impedance.

Machinery Directive

CAUTION*:* This inverter device is a component intended for implementation in machines or systems for the capital goods industry.
The start-up of the inverter in the European market is not permitted until it has been confirmed that the machine into which the inverters are built is in conformance with the regulations of the Council Directive Machinery 98/37/EWG.

WARNING*:* The built-in Stop function (control input at terminal 23 or 20) must not be used as an emergency stop circuit. To inhibit uncontrolled machine operation in case of the malfunction of the drive, the user must provide an external emergency stop circuit, which ensures disconnection of the power source from the motor.
This circuit must be hardwired with electro-mechanic components and shall not depend on electronic logic or software. The stopping device (e.g. mushroom head pushbutton with lock) must be accessible to the operator.
Failure to observe this precaution could result in bodily injury or loss of life.

Electromagnetic Compatibility (EMC-Directive)

CAUTION

The operating of inverters in the European market is only permitted if the Council Directive Electromagnetic Compatibility 89/336/EWG has been observed.

It is the responsibility of the manufacturer of the machine or system to observe the immunity and emission limits, requested by the Council Directive EMC in the European market. Guidelines for the installation according EMC-regulations - as shielding, grounding, filter arrangement as well as wiring instructions - are summarized in Appendix A, 'CE-Conformance' of this Instruction manual.

Hot Surface

WARNING

This sign on the faceplate of the inverter alerts a person that high temperature is present.
Do not touch the heatsink surface during operation of the drive or short after disconnecting.

DESCRIPTION

Mechanical Arrangement and Options

The variable-voltage, variable-frequency power inverters of the ***GV3000/SE*** series are ready for installation and are available in different sizes with output currents in the range 2 to 360 Amps. They are designed to drive induction motors at variable speeds using PWM technology.

The protective enclosure contains the Power Module and the Control Unit with the Keypad.

Figure 2-1 shows the block diagram of the inverter with specified options.

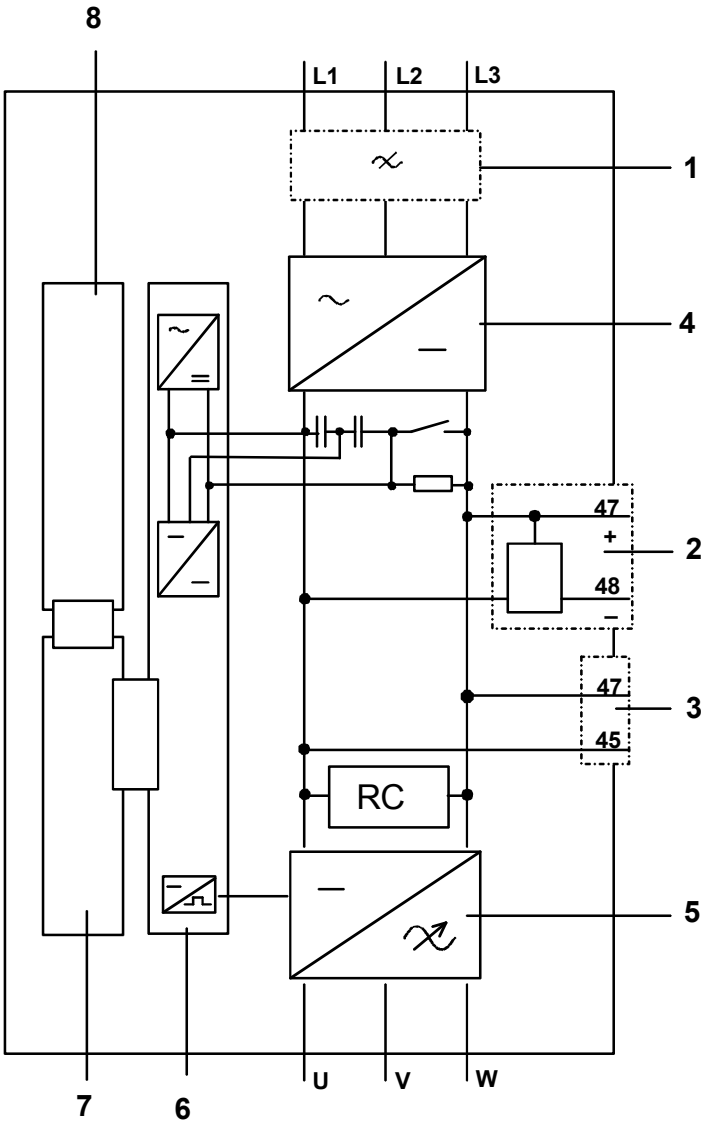


Figure 2-1: Block Diagram

1 Line Filter
The built-in option RFI- or HF-Filter limits high frequency emission to permitted values. See Selection Tables 2-8, Chapter 5 and Appendix A.

2 Braking Unit (built-in on types 003-030, 039/044, option on 038/043, 058 - 240), switches during motor regeneration the externally mounted (user supplied) braking resistors to the DC-bus and prevents by that bus overvoltage.

3 DC-Bus Terminals
(option on type 038/043 and >058) e.g. for connection of external braking unit. On types >AC180 additional DC-Bus bus-bar connections (145,147) are available.

4 Diode Bridge (on types 003-170).
or Six Pulse Rectifier Bridge
controlled by the pulse firing card FPS (on types 180-360).

5 Power semiconductors
IGBT (insulated gate bi-polar transistors) or **IPM** (Intelligent Power Modules). These are switched on and off by the gate drivers to provide phases U,V,W to the motor.

6 Gate Driver and Power Supply Card
Interface between the power modules IGBT and power interface card.

7 Digital Regulator
Contains the terminal strip for the control inputs (24V), the isolated analog inputs, the tach input, relay outputs and 1 analog output.

8 Further Options
(See Regul. manual 49‘1329, page 1-2)

- Operator Interface Module (OIM) for remote control, programming and display.

- RMI Card (Remote Meter Interface Card)
- 3 isolated analog outputs for displaying,
- 1 isolated analog input,
- 4 programmable digital outputs,
- 4 digital inputs,
- 1 frequency input,
- 3 relay outputs,
- 1 frequency output.

- Communication Cards for InterBus, Profibus DP, DeviceNet, ControlNet and AutoMax.

Electrical Description

As shown in Figures 2-2, three phase input power is applied to terminals L1, L2, and L3 via external standard input fuses or fused isolator. Power is then fed to the precharge circuitry through the optional input filter circuit. This filter keeps conducted emissions in the high frequency range within the limits as per EMC product standards. The current transformer T4 senses ground fault currents (on types 038/043 and 058 - 360).

The internal switching power supply develops the isolated DC 24 V control voltage and different supply voltages (DC ±5 to 24V) for the controller operation.

An optional, user supplied AC-line input reactor allows the Power Module to be operated on any supply line also with high fault level (refer to chapter 5, Accessories).
On types GV3000E-AC003 - 030 and 039/044 the inductance of the optional RFI filter allows connection to supply transformers with a fault level up to 29 kA (e.g. 1000 kVA) after which a choke should be fitted.

When line voltage (or DC-bus voltage on type DC240 and DC360) is applied at the input terminals (external main contactor has picked up), the DC-bus begins charging.

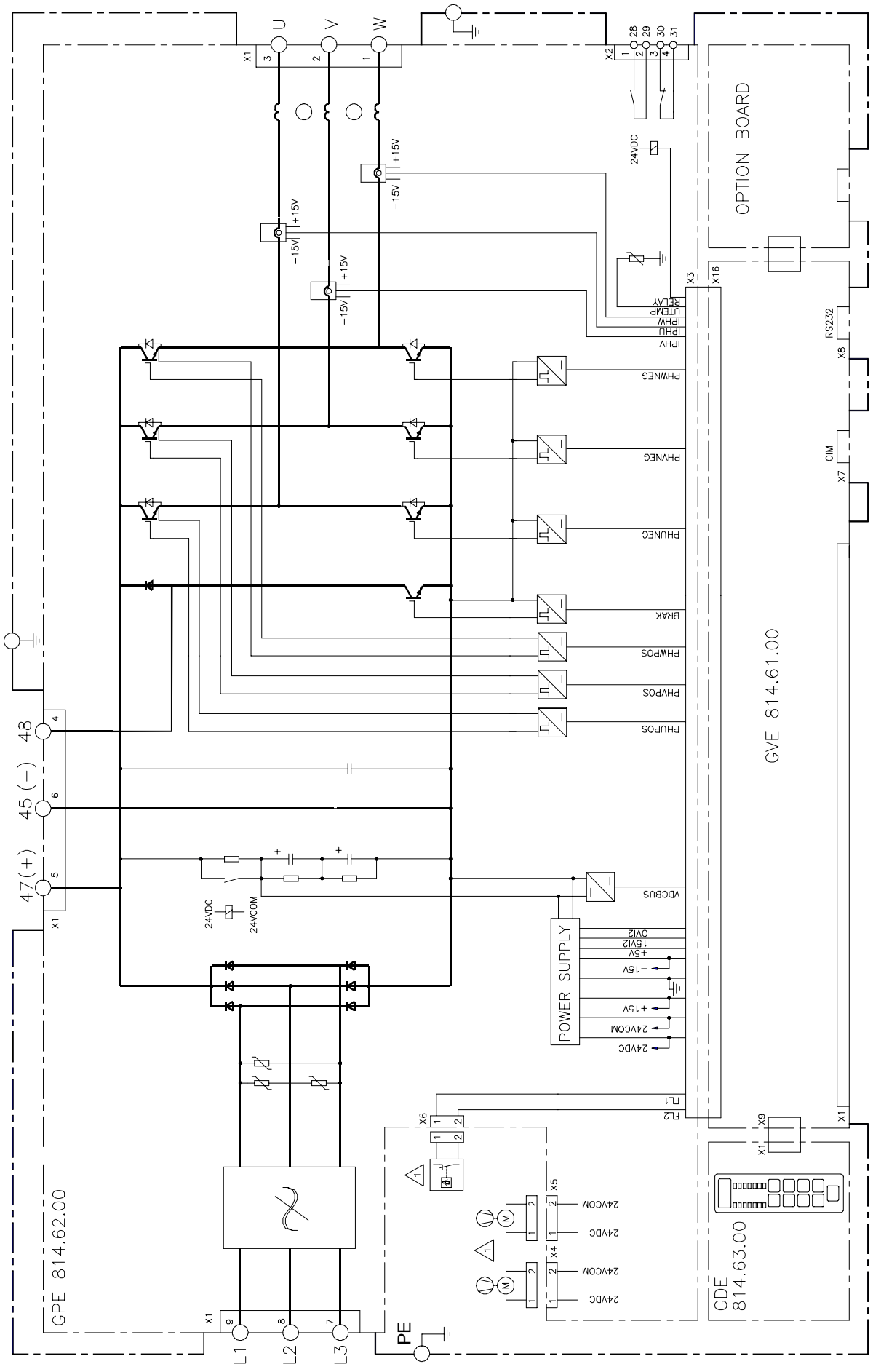
The DC-bus voltage increases to a value 1.4 times the no-load three-phase line voltage on types AC003 - 170 resp. to the value of the applied DC-voltage on type DC240 and DC360. Precharge resistors limit the DC-bus capacitors' charging current. When the DC-bus reaches 95% of its rated voltage, the parallel connected precharge contactors close and bypass the resistors.

On types AC180 - 360 the DC-bus is charged through a six pulse rectifier bridge controlled by the pulse firing card FPS.
Discharge resistors on the DC-bus capacitors can discharge the capacitors down to 50 V within approximately 60 sec. after power is removed from the input terminals.

The inverter circuitry converts the DC-bus voltage into a variable voltage, variable-frequency at the output to the motor (terminals U, V, W). The inverter's phase transistors (IPM, IGBT) are switched by the Gate Driver cards. Two current transformer devices (T1,T2) provide current feedback to the regulator through the Power Interface card. Power output

AC-chokes on types 038/043 and 058 - 360 or current compound chokes on types 003-030 and 039/044 limit the magnitude of dv/dt in the motor.

In summary, a constant DC voltage is developed by rectifying and filtering the incoming AC power line voltage. A PWM three-phase voltage is then produced from this constant voltage using an IGBT inverter corresponding to the variable voltage and frequency selected for the motor.



/1 Equipment according to spare parts list Chapter 4

Figure 2-2a: Typical System Block Diagram, Type GV3000/SE AC003 to 015

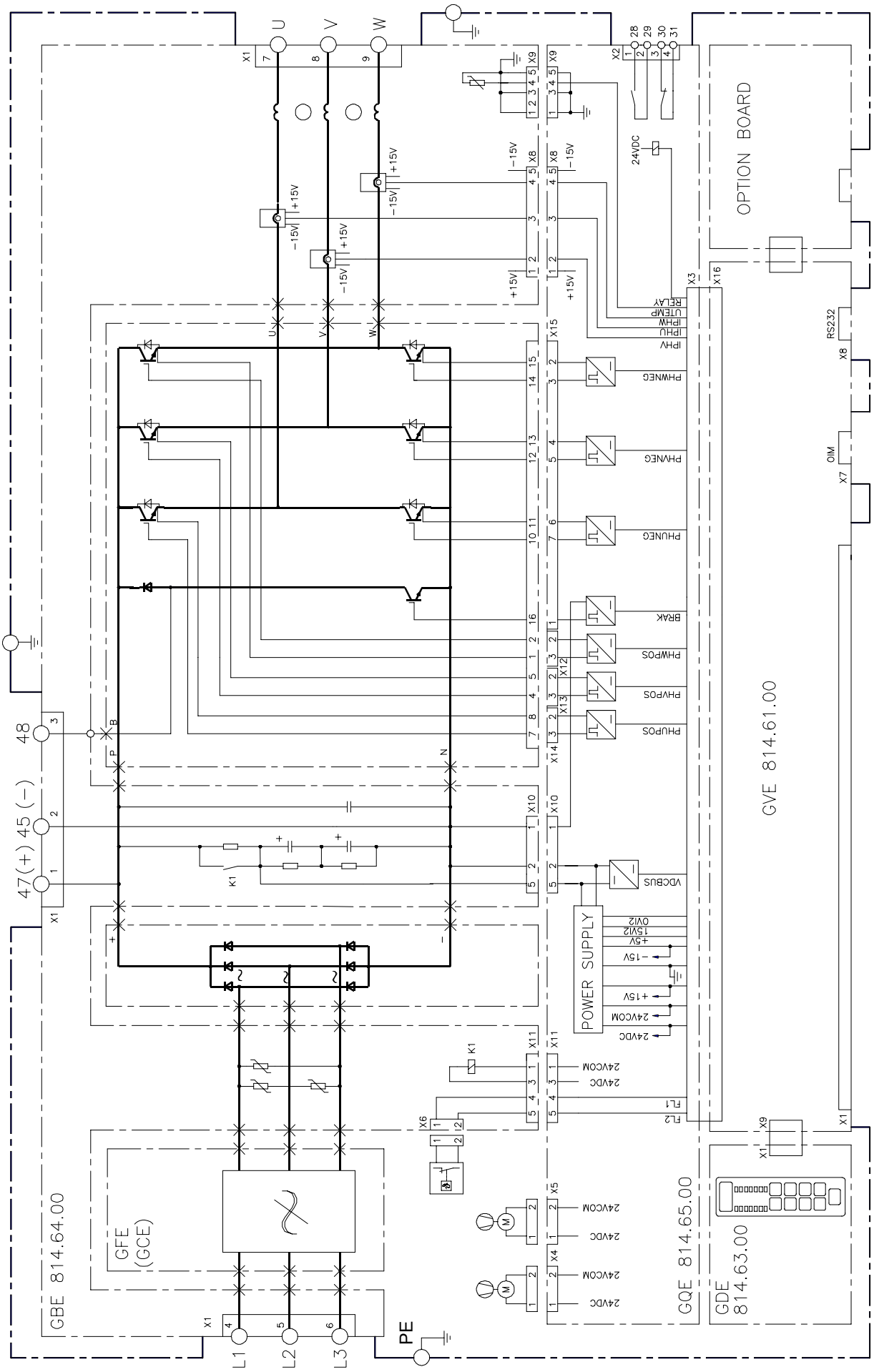
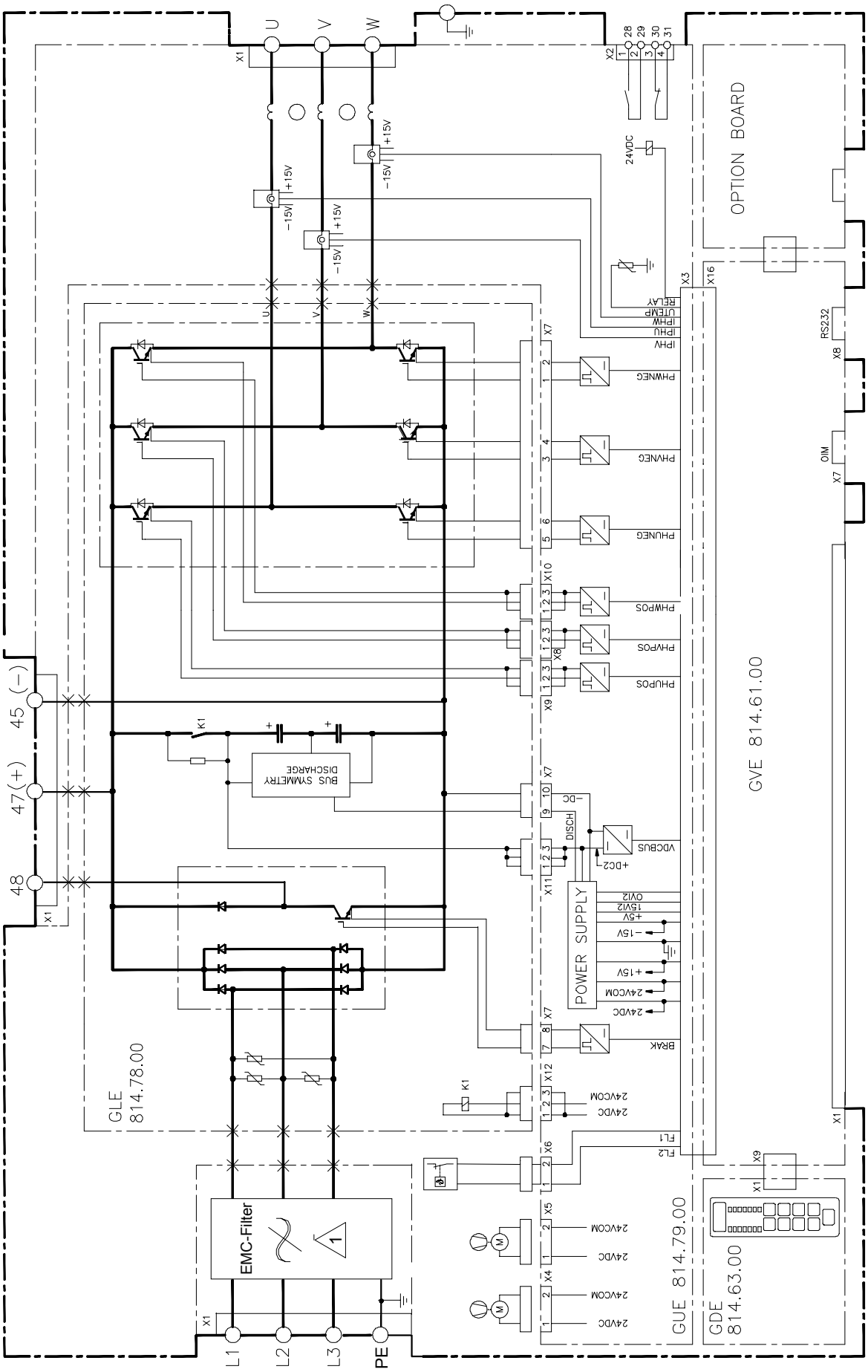
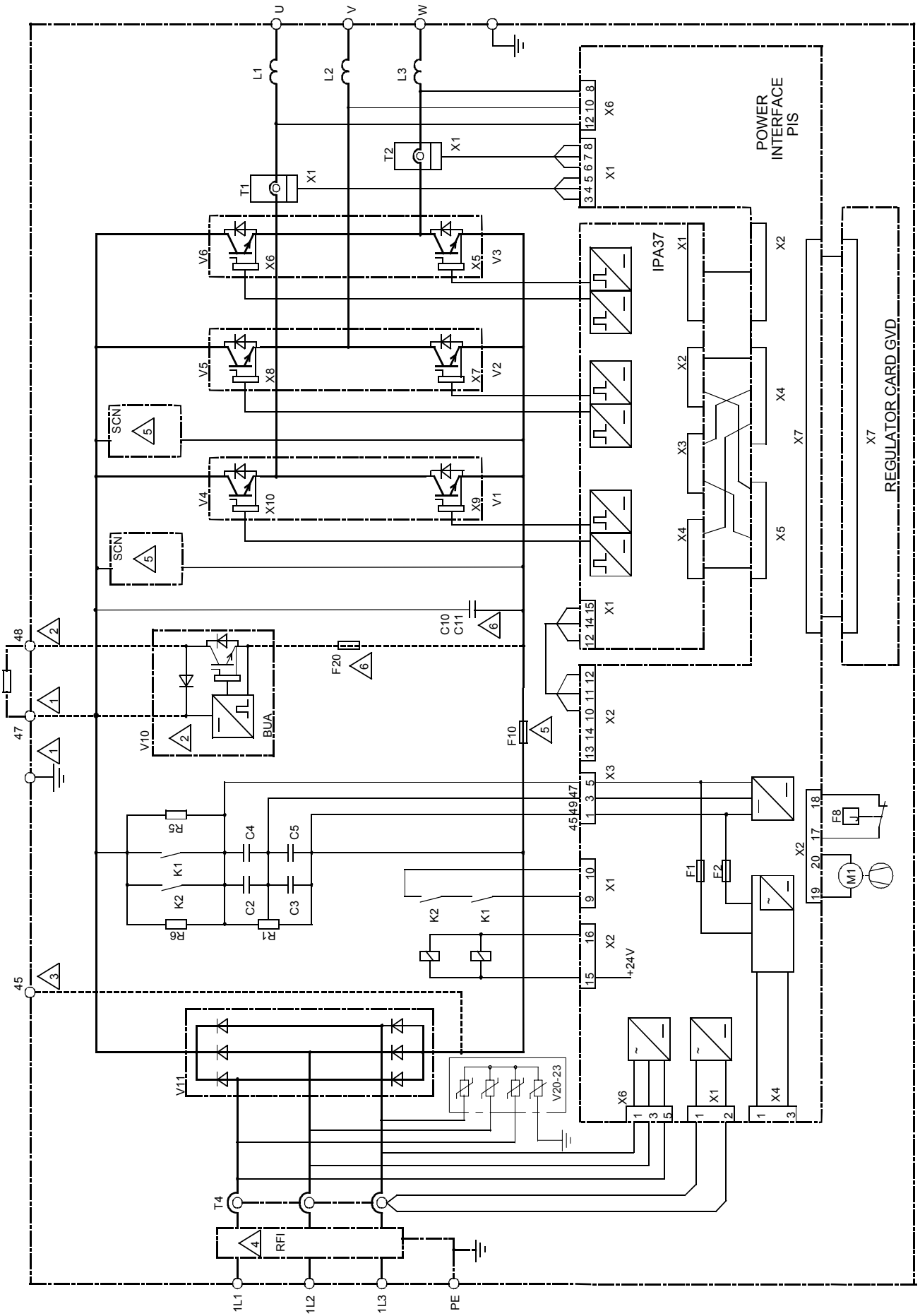


Figure 2-2b: Typical System Block Diagram, Type GV3000/SE AC024 and 030



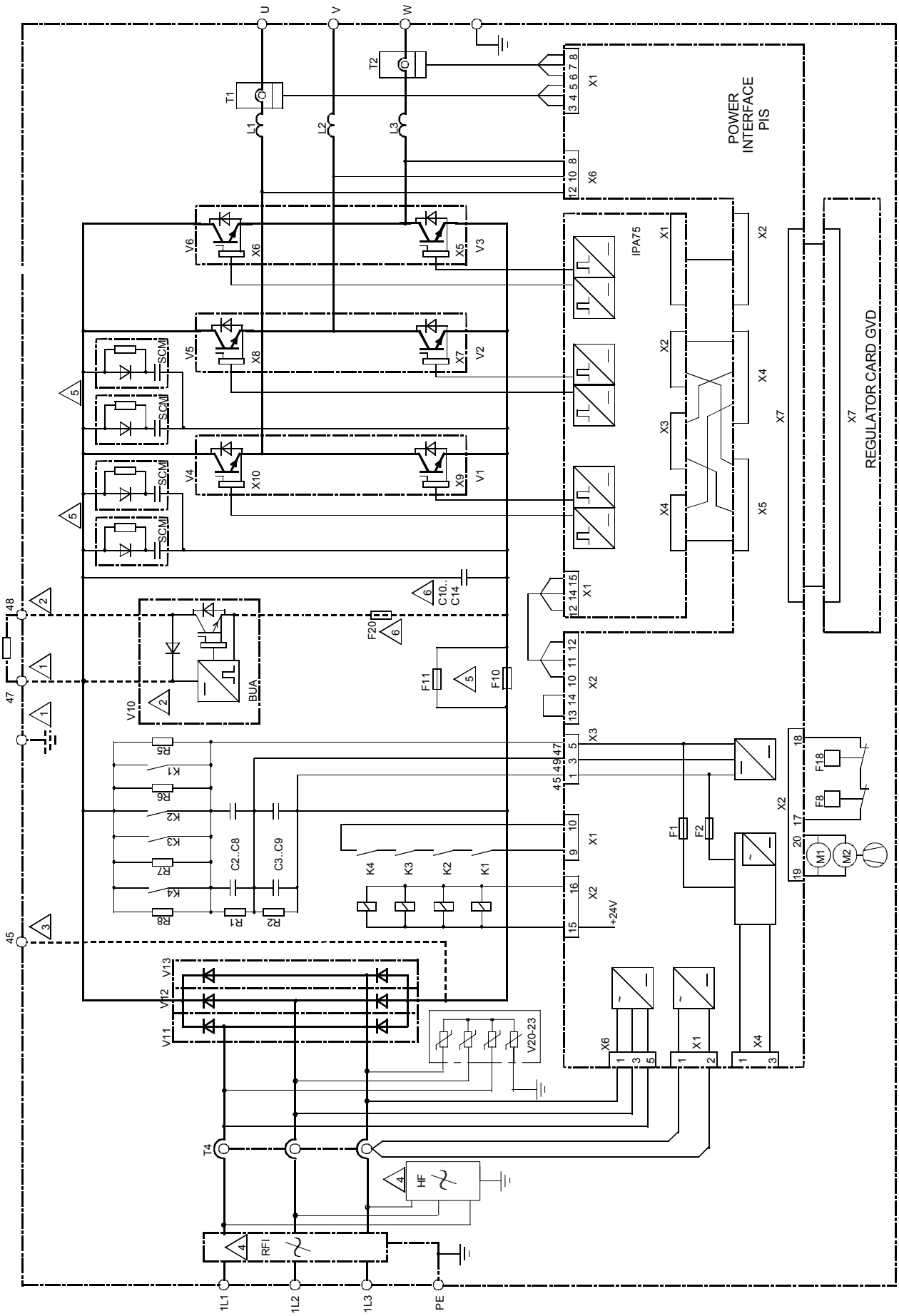
/1 On Units with RFI filter only

Figure 2-2c: Block diagram of the power units, GV3000/SE Type AC039 and 044



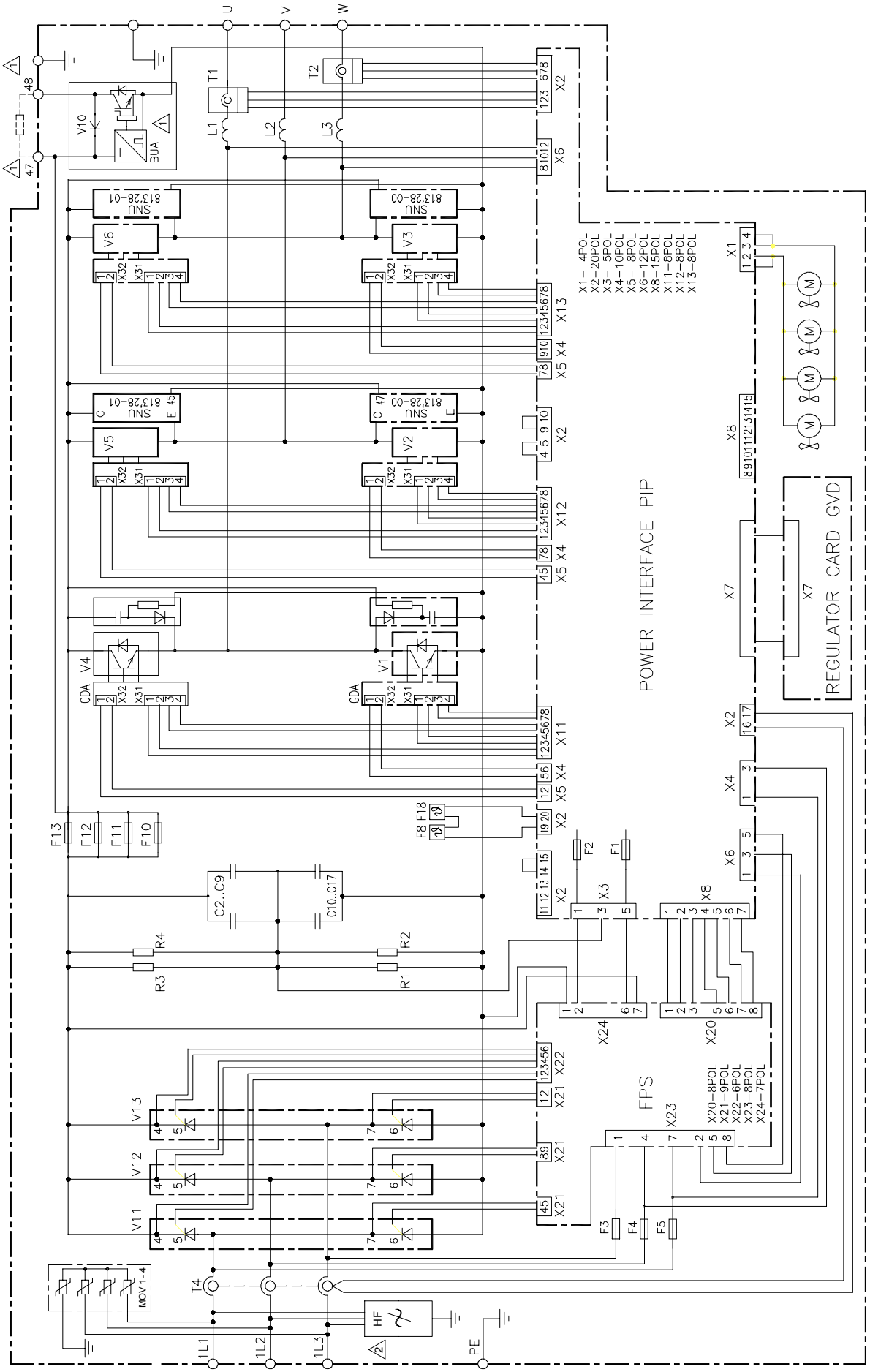
/1 On Units 896'xx-10/ -11/ -80/ -81 only
/2 On Units 896'xx-10/ -11/ -31 only
/3 On Units 896'xx-80/ -81 only
/4 On Units with RFI filter only
/5 On GV3000 UL Units only
/6 Not used on GV3000 UL Units

Figure 2-2d: Block diagram of the power units, Type GV3000/SE AC038/ 043/ 058/ 070 and 085



/1 On Units 896'xx-10/ -11/ -80/ -81/ -97 only
/2 On Units 896'xx-10/ -11/ -31/ -37 only
/3 On Units 896'xx-80/ -81/ -97 only
/4 On Units with RFI- or HF-filter only
/5 On GV3000 UL Units only
/6 Not used on GV3000 UL Units

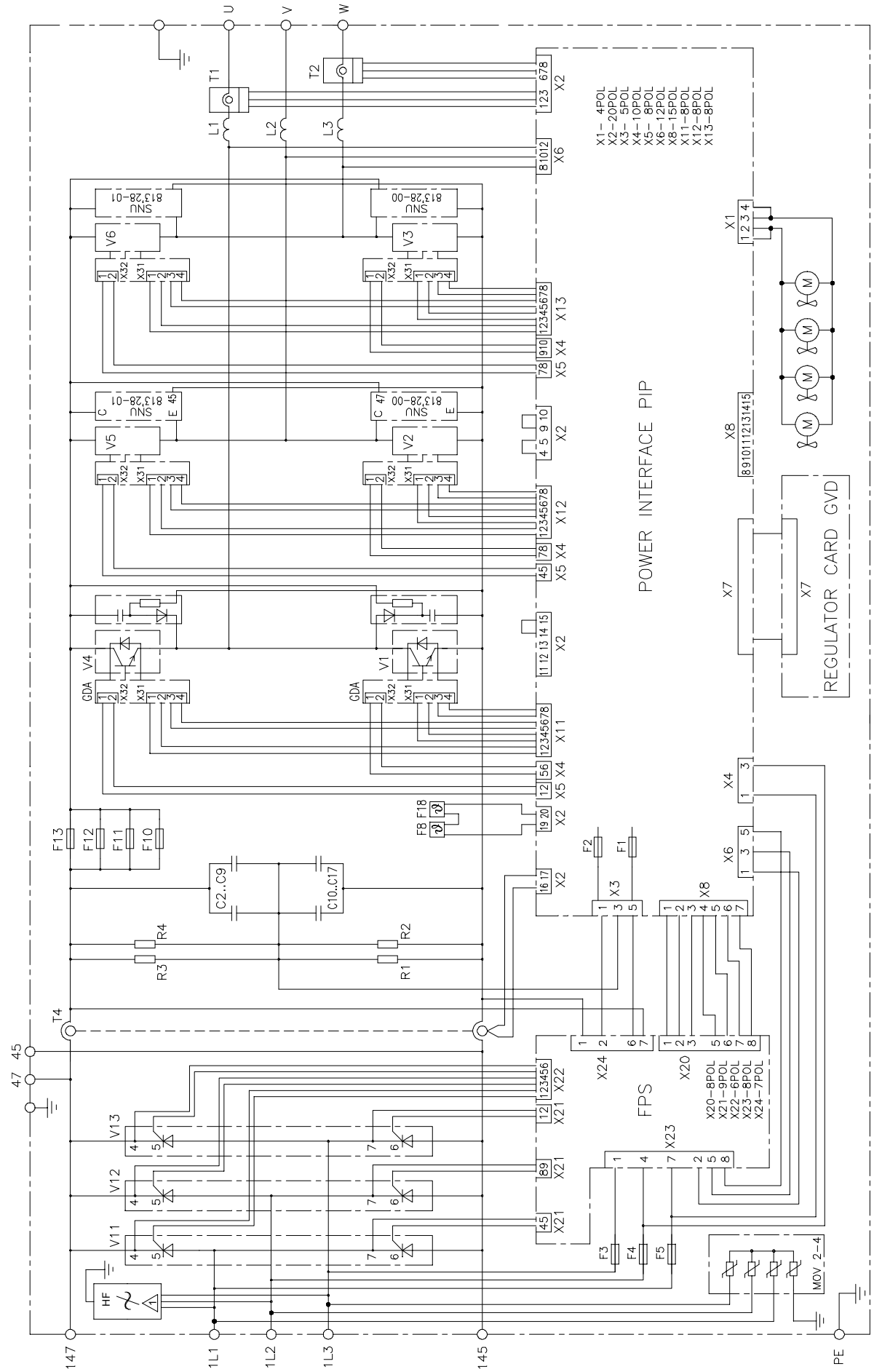
Figure 2-2e: Block diagram of the power unit, Type GV3000/SE AC089/ 106/ 140 and 170



/1 On Units 896'xx-10/ -11/ -17 with Braking Unit only

/2 On Units 896'xx-07/ -17 with HF-filter only

Figure 2-2f: Block diagram power unit, Type GV3000/SE AC180/ 210/ 240 **(896.xy-00/01/07, -10/11/17)**



/1 On Units 896'xx-87 with HF-filter only

Figure 2-2g: Block diagram of the power unit, Type GV3000/SE AC180/ 210/ 240 **(896.xy-80/ -81/ -87)**

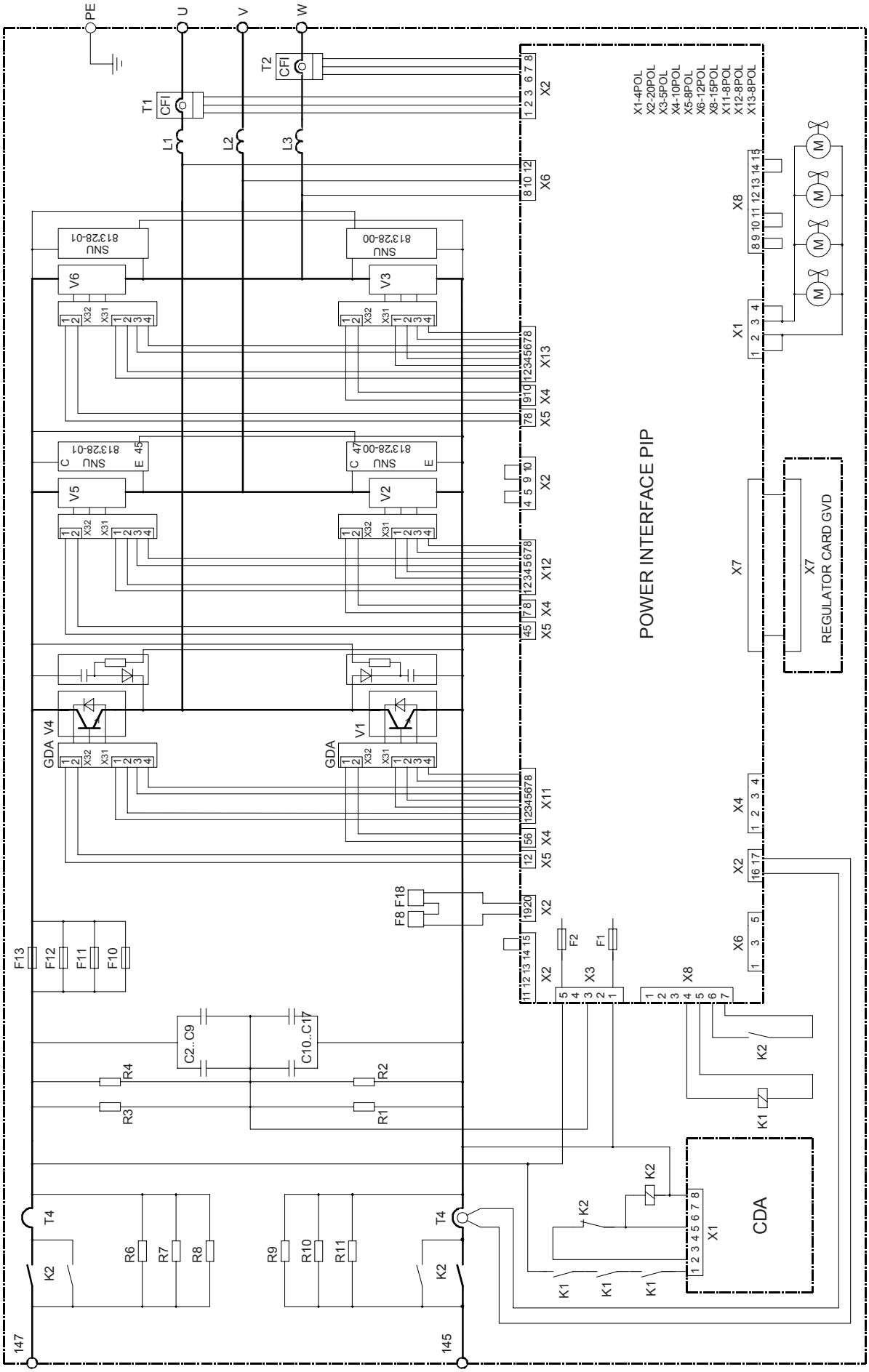


Figure 2-2h: Block diagram of the power unit, GV3000/SE Type DC240

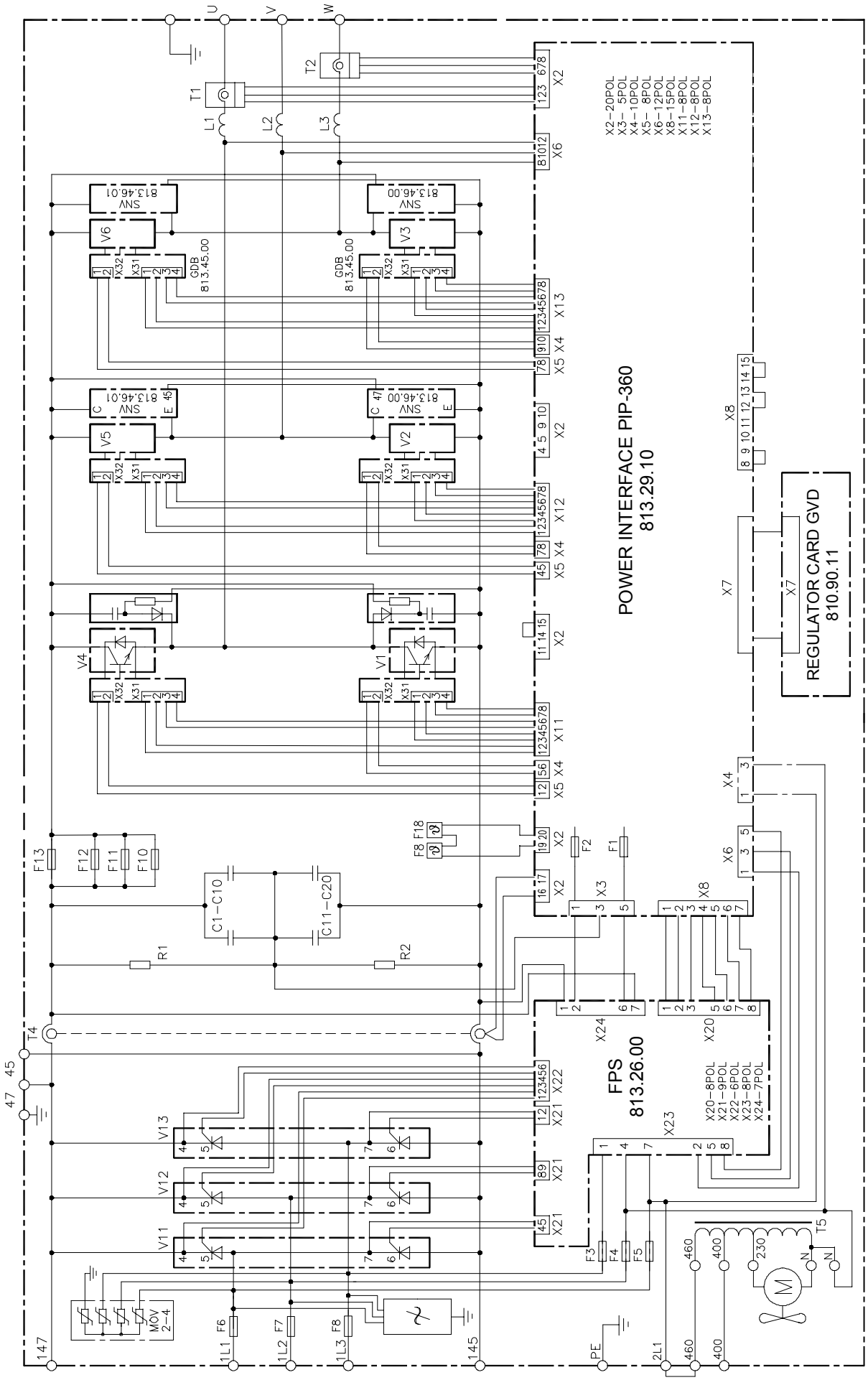


Figure 2-2i: Block diagram of the power unit, GV3000/SE Type AC305/360

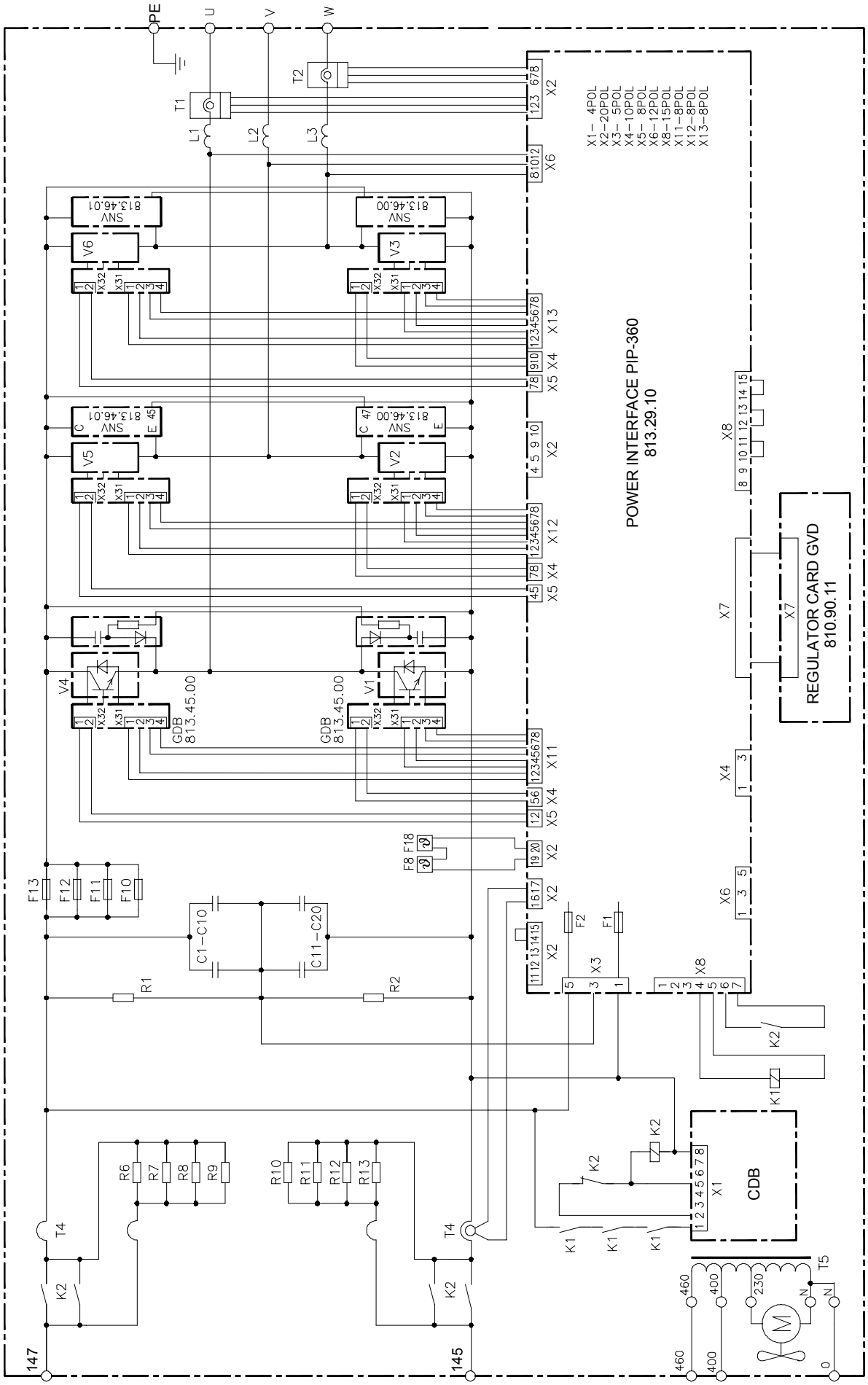


Figure 2-2j: Block diagram of the power unit, GV3000/SE Type DC360

SPECIFICATIONS

Input Power Ratings

- Line input voltage three phase, with earthed star-point and protection earth conductor PE
  380, 400, 415, 460 V
  Range ..... AC 340....506 V
  Tolerance limits related to standard line voltage..... 380 V -10% (= 340 V)
  460 V +10% (= 506 V)

- Line frequency ..... 48...62 Hz

- AC-Line distribution capacity (Maximum)
  Types AC003 - 030 and 039/044 with built-in RFI-filter ..... 29 kA
  without RFI-filter ..... 10 kA
  Types AC038/043, 058 - 240 and type DC240: ..... 10 kA
  Types ACAC305/360 and DC360 : ..... 15 kA

  29 kA corresponds to a supply transformer 400 V, 1000 kVA with 5% impedance,
  15 kA corresponds to a supply transformer 400 V, 500 kVA with 5% impedance
  10 kA corresponds to a supply transformer 400 V, 315 kVA with 5% impedance

  If the permissible fault current is exceeded, an externally mounted line input choke must be provided

  For external line fuses the maximum ratings must be provided. (refer to Table 2-1)

- Switching Power Supply:
  Current consumption ..... max 0.5 A
  On type AC038/043 and 058 - 360 the input voltage from DC-bus is protected by 2 fine wire fuses on the Interface card ..... 4 A

- Blower supply through built-in single phase auto transformer.

  Type AC305/360: The auto transformer for the blower is connected to the internal line voltage via wire jumper at Terminals 2L1 – 460 (Default setting 460 V) and protected by fuses F4, F5. For line voltage 400 V the wire jumper must be set to terminals 2L1 – 400.

  Type DC360: The external single phase supply line voltage 400 or 460 V must be connected to the appropriate terminals 400 – 0, or 460 – 0 and protected.
  (p.e. through thermal magnetic circuit breaker).
  Transformer primary voltage ..... 460 V or 400 V, 50/60 Hz
  Blower power consumption ..... 230 VA

- Modulation..... sine wave pulse width modulation PWM

DC-Bus Circuit

- Precharge time on Types 003 to 170 ..... < 0.5 s
  on Types 180 to 360 ..... < 1 s

- Discharge time below 50 V..... typical 60 s

Table 2-1: Line Input Current and Branch Circuit Protection Fuses

Inverter Type	AC-Input Current 1)		External Fuse 2)	
	without Choke	with Choke	nominal	maximum
AC003	5 A	4 A	6 A	25 A
AC004	6 A	5 A	10 A	
AC005	10 A	8 A	16 A	
AC008	13 A	10 A	16 A	
AC012	16 A	13 A	20 A	
AC015	20 A	16 A	25 A	
AC024	31 A	25 A	40 A	50 A
AC030	38 A	32 A	50 A	
AC039	48 A	43 A	63 A	63 A
AC044	53 A	47 A	63 A	
AC038	48 A	43 A	63 A	100 A
AC043	53 A	47 A	63 A	
AC058	71 A	63 A	80 A	
AC070	80 A	71 A	100 A	
AC085	97 A	90 A	100 A	
AC089	102 A	97 A	125 A	160 A
AC106	119 A	114 A	125 A	
AC140	147 A	141 A	160 A	
AC170	175 A	170 A	200 A	200 A
AC180	183 A	183 A	200 A	250 A
AC210	210 A	210 A	250 A	
AC240	240 A	240 A	250 A	
AC305	305 A	305 A	350 A	400 A
AC360	360 A	360 A	400 A	
DC240	--	--	500 A	500 A
DC360	--	--	800 A	800 A

NOTE:

1) AC-Line input current (RMS) is depending on total line impedance.

The current values *without choke* are calculated for a minimum line impedance.
At 400 V, 50 Hz this impedance is 0.074 mH, (0.048 mH) equivalent to a short circuit current of 10 kA (15 kA) or a transformer 315 kVA (500 kVA), 5%.
(The values in brackets are valid for types 305 and 360).

On types 003-030 and 039/044 this minimum line impedance can be reached with the RFI-Filter option, when a supply transformer of 1000 kVA, 5% is assumed.

The impedance *with choke* at 400 V is assumed to be 1.5% per phase and the supply transformer is 1000 kVA, 5%.
For choke selection with part No. and dimensions see chapter 5, Accessories.

2) Recommended type of the external input fuse:
   a) AC-Line input: Branch circuit protection fuse, e.g. IEC 269-1/gG, EN 60269-1, VDE 0636/gL, UL Class J, or equivalent.
   b) DC-Bus input: Semiconductor protection fuse, 660 V or 750 V, super fast, e.g. A70P500, VDE 0636/aR, or equivalent.

Power Loss

Table 2-2a: Power Loss at Full Load and 2kHz on Types 003 to 030 and 039/044

Inverter GV3000E-AC...	003	004	005	008	012	015	024	030	039	044
Power Loss P_v Watt at Full Load	60	70	100	150	210	250	380	470	550	600

Table 2-2b: Power Loss at Full Load and 2kHz on Types 038/043 and 058 to 360

	Inverter GV3000E/U-AC...														-DC...	
	038	043	058	070	085 1)	089	106	140	170 1)	180	210	240	305 2)	360 2)	240	360 3)
P_v in Watt at I_{nom}	620	685	890	1050	1080	1400	1630	2100	2150	2800	3200	3600	4200	4900	2900	3800
Fix Losses P_0 in Watt	100	100	100	100	100	190	190	190	190	340	340	340	560	560	340	560

Power loss P_v at reduced load can be calculated with the following formula:

Type AC $P_v = P_0 + 13{,}6\ V \times I_{mot}$ 1): $P_v = P_0 + 11{,}5\ V \times I_{mot}$ 2): $P_v = P_0 + 12\ V \times I_{mot}$
Type DC $P_v = P_0 + 10{,}7\ V \times I_{mot}$ 3): $P_v = P_0 + 9{,}1\ V \times I_{mot}$

Service Conditions

Table 2-3:

Temperature	- Operation 0°C up to +40°C coolant air inlet temperature - Storage : -25°C ... +55°C - Transportation: -25°C . +70°C (+70 during max. 24 hours)
Ambient relative humidity	max. 50% at 40°C unlimited max. 90% at 20°C during max. 30 days / year 75% average *NOTE*: Condensation not allowed!
Air pollution	The ambient air may contain some dry dust but must not contain excessive dirt, chemical fumes, oil vapor etc. (pollution degree 2, IEC 664)
Installation altitude	max. 1000 m above sea level. At higher altitude the output current must be reduced by 1% per 100m
Degree of protection	- GV3000E/U-AC038/043 and 058 – 360: IP20, (NEMA 1 for UL/cUL) - GV3000E-AC003 – 030 and 039/044: IP20, (open for UL/cUL)
Location	Closed electrical operating area (cabinet or room)

Table 2-4: Power Connections with Maximum Wire Sizes (1), (3), (4) **and Tightening Torques**

Inverter Type	Wiring	Designation at Terminal, bus-bar or stud	Maximum Wire Size 1) mm²	AWG/MCM	T-Torque Nm
AC003-015	Input Power	L1, L2, L3, PE	6	12	1.4
	Output Power	U, V, W, ⏚			
	DC Bus Output, Braking Resistor	45 -, 47 +, 48 -, 47			
AC024-030 (AC023-032) AC039/044	Input Power	L1, L2, L3, PE	16 (13)	6	1.4
	Output Power	U, V, W, ⏚			
	DC Bus Output, Braking Resistor	45 -, 47 +, 48 -, 47			
AC038/043 and 058-085	Input Power	1L1, 1L2, 1L3, PE	35	2	2.5
	Output Power	U, V, W, ⏚			
	DC Bus Output (3)	45 -, 47 +	35	2	2.5
	Braking Resistor	48 -, 47 + ⏚	16	6	2.5
AC089-170	Input Power	1L1, 1L2, 1L3	95	4/0	10
	Output Power	U, V, W			
	Ground	PE, ⏚	35	2	2.5
	DC Bus Output (3)	45 -, 47 +	95	4/0	10
	Braking Resistor	48 -, 47 + ⏚	35	2	2.5
	Ground	⏚	16	6	2.5
AC180-240 DC240	Input Power Bus Bar	1L1, 1L2, 1L3	185	2/0 (2x)	14-31
	Output Power Bus Bar	U, V, W			
	DC-Bus (4) Bus Bar	145 -, 147 +			
	Ground Stud	PE, ⏚ (M10)	95	4/0	10
	DC Bus Output (3)	45 -, 47 +	35	2	2.5
	Braking Resistor	48 -, 47 +			
	Ground	⏚	16	6	2.5
AC305/360 DC360	Input Power Bus Bar	1L1, 1L2, 1L3	300	350 (2x)	25
	Output Power Bus Bar	U, V, W			
	DC-Bus Bus Bar	145 -, 147 +			
	Ground Stud	PE, ⏚ (M12)	150	2/0 (2x)	14-31
	DC Bus Output	45 -, 47 +	35	2	2.5
	Ground	⏚	16	6	2.5

NOTES: 1) The user is responsible for following NEC/CEC and all applicable local codes with respect to wire size.
Recommended cable type: 60°C copper for cable size ≤ 2 AWG,
75°C copper for cable size ≥ 1/0 AWG

2) Ground terminals / studs are marked with PE (protection earth) or this symbol ⏚.

3) Terminals 48, 47 are valid on inverters type AC-input with built-in braking unit. Terminals 45, 47 are valid on inverters type AC-input with DC-bus output.

4) Bus-bar connections 145, 147 for DC-Bus are valid on inverters type AC180/240 only with option DC-Bus Terminals and on type DC240.

Built-in Braking Unit (Option)

Table 2-5: Braking Power and Permitted Braking Resistor 3)

Unit Type	Braking Power 1) continuous	Short Time at Cycle 1:4	Maximum Braking Current	Maximum P/U Input Voltage	Turn-on Voltage 1)	Turn-off Voltage 1)	Minimum Permitted external Braking Resistor
003-008	4.5 kW	4.5 kW	6 A	460 V	750 V	720 V	125.0 Ω
011-015	7.5 kW	7.5 kW	10 A	460 V	750 V	720 V	75.0 Ω
024	11 kW	11 kW	15 A	460 V	750 V	720 V	50.0 Ω
030	15 kW	15 kW	20 A	460 V	750 V	720 V	37.5 Ω
039/044	22 kW	22 kW	30 A	460 V	750 V	720 V	25.0 Ω
038/043, 058-085	9 kW	37 kW	50 A	460 V 2)	750 V	720 V	15.0 Ω
089-240	18 kW	75 kW	100 A	460 V 2)	750 V	720 V	7.5 Ω

1) On types 003-030 and 039/044 the Turn-on and the Turn-off voltage and thus the braking power is proportional to the AC-line voltage (specified in parameter H.021 or U.018).

2) On types 038/043, 058-240 the line input voltage is preselected by a jumper plug on the BUC-card. The initial setting is 460 V and should not be changed.

3) On types 305 and 360 the Option *built-in Braking Unit* is not available. The use of the separately mounted Braking Unit DBU-200 or DBU-400 is recommended.

Permissible Loading of the Braking Unit

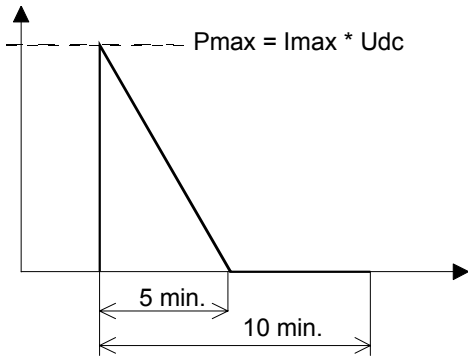
To prevent thermal overloading of the Braking Unit, assure that the unit works within the following limits:

a) GV3000/SE types 003-030 and 039/044:
The maximum braking power is defined by the maximum braking current and the maximum DC-voltage (750V). The loading is continuously permitted.

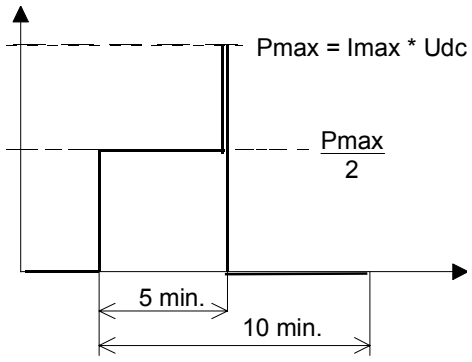
b) GV3000/SE types 038/043 and 058-240:
In a time period of 10 minutes the permissible loading is limited to a current-time area of I_{max} * 2.5 minutes with any shaping of the area.

Examples to b):

1) Drive with high inertia connected braking to zero speed at linear decreasing braking torque (e.g. centrifuge)



2) Drive with active load at constant braking torque (e.g. hoist crane)



Output Current Ratings

Table 2-6: Output Current Ratings Based on Fundamental/Carrier Frequency for Open Loop (V/Hz) Selection

Unit Type GV3000 E/U-	Identification Code in Param. P.099	Stock No.	Motor Power kW at 400 V, 2 kHz	Switching Frequency 2 kHz		Switching Frequency 4 kHz		Switching Frequency 8 kHz	
				I nom. A	I max %	I nom. A	I max %	I nom. A	I max %
AC003	3.001	896.01.x1	1.1	3.1	110	3.1	110	2.8	110
AC004	3.002	896.02.x1	1.5	3.8	110	3.8	110	2.8	110
AC005	3.003	896.03.x1	2.2	5.5	110	5.5	110	5.5	110
AC008	3.005	896.05.x1	4	8.5	110	8.5	110	5.5	110
AC012	3.007	896.06.x1	5.5	12.6	110	12	110	8.5	110
AC015	3.010	896.07.x1	7.5	15	110	12	110	8.5	110
AC024	3.014	896.08.x1	11	24	110	16.5	110	12.6	110
AC030	3.020	896.09.x1	15	30	110	24	110	16.5	110
AC039	3.024	896.10.x2	18.5	38	110	31	110	22	110
AC044	3.029	896.11.x2	22	43	110	31	110	22	110
AC038	4.025	896.10.xy	18.5	38	110	38	110	38	110
AC043	4.030	896.11.xy	22	43	110	43	110	43	110
AC058	4.040	896.12.xy	30	63	110	58	110	50	100
AC070	4.050	896.13.xy	37	70	100	64	100	50	100
AC085	4.055	896.14.x1	45	85	110	70	110	52	110
AC089	4.060	896.14.x0	45	90	110	90	110	90	110
AC106	4.075	896.15.xy	55	116	110	106	110	100	100
AC140	4.100	896.16.xy	75	140	100	126	100	100	100
AC170	4.115	896.17.xy	90	170	110	140	110	100	110
AC180	4.125	896.17.x0	90	180	110	180	110	165	100
AC210	4.150	896.18.xy	110	210	110	209	100	165	100
AC240	4.175	896.19.xy	132	240	100	209	100	165	100
AC305	4.210	896.20.xy	160	305	110	290	110	-	-
AC360	4.265	896.21.xy	200	360	110	290	110	-	-
DC240	4.175	896.19.50	132	240	100	209	100	165	100
DC360	4.265	896.21.51	200	360	110	290	110	-	-

x = Option variant y = 0: UL/cUL-inverter y = 1 or 2: non UL/cUL-inverter (except on AC003 - AC030)

Remark:

- 110% continuous output current can be achieved in the range 3 - 200 Hz, except on types AC003 – 030, AC039/044, AC085, AC170, AC305, and AC/DC360, where 110% output current for 1 minute every 10 minutes is allowed.
- Max. output current in the range 0.5 - 3.0 Hz, 100% on type AC003 - AC030, AC039/044 and 95% from 038/043 and >058.
- Identification Code: first digit represents Input Voltage (3 or 4 = 380-460V), following digits represent horsepower rating of the inverter.

Table 2-7: Output Current Ratings Based on Fundamental/Carrier Frequency for Closed Loop (Vector) Selection

Unit Type GV3000 E/U	Identification Code in Param. P.099	Stock No.	Motor Power kW at 400 V, 2 kHz	Switching Frequency 2 kHz		Switching Frequency 4 kHz		Switching Frequency 8 kHz	
				I nom. A	I max %	I nom. A	I max %	I nom. A	I max %
AC003	3.001	896.01.x1	0.75	2.1	150	2.1	150	2.0	150
AC004	3.002	896.02.x1	1.1	3.1	150	3.1	150	2.0	150
AC005	3.003	896.03.x1	1.5	3.8	150	3.8	150	3.8	150
AC008	3.005	896.05.x1	3	6.7	150	6.7	150	5	150
AC012	3.007	896.06.x1	4	9.3	150	9.3	150	8	150
AC015	3.010	896.07.x1	5.5	11	150	11	150	8	150
AC024	3.014	896.08.x1	7.5	16.5	150	15	150	11	150
AC030	3.020	896.09.x1	11	22	150	22	150	15	150
AC039	3.024	896.10.x2	11	22	150	22	150	15	150
AC044	3.029	896.11.x2	15	30	160	22	150	15	150
AC038	4.025	896.10.xy	15	32	150	32	150	27	150
AC043	4.030	896.11.xy	18.5	38	150	37	150	27	150
AC058	4.040	896.12.xy	22	45	150	37	150	27	150
AC070	4.050	896.13.xy	22	45	150	37	150	27	150
AC085	4.055	896.14.x1	30	59	150	46	150	31	150
AC089	4.060	896.14.x0	37	70	150	70	150	55	150
AC106	4.075	896.15.xy	45	89	150	75	150	55	150
AC140	4.100	896.16.xy	45	89	150	75	150	55	150
AC170	4.115	896.17.xy	55	118	150	91	150	60	150
AC180	4.125	896.17.x0	75	140	150	128	150	96	150
AC210	4.150	896.18.xy	75	152	150	128	150	96	150
AC240	4.175	896.19.xy	75	152	150	128	150	96	150
AC305	4.210	896.20.xy	110	210	150	202	150	-	-
AC360	4.265	896.21.xy	132	250	150	202	150	-	-
DC240	4.175	896.19.50	75	152	150	128	150	96	150
DC360	4.265	896.21.51	132	250	150	202	150	-	-

x = Option variant y = 0: UL/cUL-inverter y = 1 or 2: non UL-inverter (except on AC003 - AC030)

Remark:

- Duty cycle 150% overload for 1 minute every 10 minutes
- If a GV3000E-AC003 - AC030 or AC039/044 is operating under conditions, where during deceleration the frequency falls below 2 Hz, the output current has to be reduced linear from 150% at 2 Hz to 75% at 0 Hz.
- Identification Code: first digit represents Input Voltage (3 or 4 = 380-460V), following digits represent horsepower rating of the inverter.

Inverter Selection

Example for a complete type designation as it occurs on the inverter name plate:

GV3000E-AC030-AA-DBU-RFI defines a frequency converter
of the **GV3000**/SE family with **E**uropean approval, **AC**-Input, **30** Amp rated current,
AA (enclosure type IP20), with **DBU** (Braking unit), with **RFI** (Radio Freq. Interference line filter).

Table 2-8a: Selection of Inverters GV3000E-AC for Motors 0.37 up-to 22 kW

TECHNICAL DATA					SPECIFICATION NUMBERS			
TYPE GV3000E-	INVERTER NOM. CURRENT (2 kHz)		MOTOR NOM. POWER 400VAC		BASIC VERSION with DC-BUS TERMINALS and BRAKING UNIT * (2) (3)		VERSION with DC-BUS TERMINALS, BRAKING UNIT and RFI-FILTER * (1) (2) (3)	
	V/Hz	Vec.	V/Hz	Vec.	Code	Part No.	Code	Part No.
AC003-	3.1	2.1	1.1	0.75	AA-DBU	896.01.11	AA-DBU-RFI	896.01.31
AC004-	3.8	3.1	1.5	1.1	AA-DBU	896.02.11	AA-DBU-RFI	896.02.31
AC005-	5.5	3.8	2.2	1.5	AA-DBU	896.03.11	AA-DBU-RFI	896.03.31
AC008-	8.5	6.7	4	3	AA-DBU	896.05.11	AA-DBU-RFI	896.05.31
AC012-	12.6	9.3	5.5	4	AA-DBU	896.06.11	AA-DBU-RFI	896.06.31
AC015-	15	11	7.5	5.5	AA-DBU	896.07.11	AA-DBU-RFI	896.07.31
AC024-	24	16.5	11	7.5	AA-DBU	896.08.11	AA-DBU-RFI	896.08.31
AC030-	30	22	15	11	AA-DBU	896.09.11	AA-DBU-RFI	896.09.31
AC039-	38	22	18.5	11	AA-DBU	896.10.12	AA-DBU-RFI	896.10.32
AC044-	43	30	22	15	AA-DBU	896.11.12	AA-DBU-RFI	896.11.32

Table 2-8b: Selection of UL/cUL-Inverters GV3000U- for Motors >15 up-to 132 kW
(For NEMA Design Inverters GV3000U- for Motors 0.37 up-to 15 kW refer to Appendix B)

TECHNICAL DATA					SPECIFICATION NUMBERS					
TYPE GV3000U-	INVERTER NOM. CURRENT (2 kHz)		MOTOR NOM. POWER 400VAC		BASIC VERSION IP20		VERSION with BRAKING UNIT * (2)		VERSION with DC-BUS TERMINAL * (3)	
	V/Hz	Vec.	V/Hz	Vec.	Code	Part No	Code	Part No.	Code	Part No.
AC038-	38	32	18.5	15	AA	896.10.00	AA-DBU	896.10.10	AA-DBT	896.10.80
AC043-	43	38	22	18.5	AA	896.11.00	AA-DBU	896.11.10	AA-DBT	896.11.80
AC058-	63	45	30	22	AA	896.12.00	AA-DBU	896.12.10	AA-DBT	896.12.80
AC070-	70	45	37	22	AA	896.13.00	AA-DBU	896.13.10	AA-DBT	896.13.80
AC089-	90	70	45	37	AA	896.14.00	AA-DBU	896.14.10	AA-DBT	896.14.80
AC106-	116	89	55	45	AA	896.15.00	AA-DBU	896.15.10	AA-DBT	896.15.80
AC140-	140	89	75	45	AA	896.16.00	AA-DBU	896.16.10	AA-DBT	896.16.80
AC180-	180	140	90	75	AA	896.17.00	AA-DBU	896.17.10	AA-DBT	896.17.80
AC210-	210	152	110	75	AA	896.18.00	AA-DBU	896.18.10	AA-DBT	896.18.80
AC240-	240	152	132	75	AA	896.19.00	AA-DBU	896.19.10	AA-DBT	896.19.80
DC240-	240	152	132	75	AA	896.19.50	--	--	--	--

* See different versions as illustrated in Figure 2-1 (Number in brackets represents illustration number)

Tab. 2-8c: Selection of *non* UL/cUL-Inverters GV3000E- for Motors from 15 up-to 200 kW

TECHNICAL DATA					SPECIFICATION NUMBERS (non cUL)					
TYPE GV3000U	INVERTER NOM. CURRENT (2 kHz)		MOTOR NOM. POWER 400VAC		BASIC VERSION IP20		VERSION with BRAKING UNIT * (2)		VERSION with DC-BUS TERMINAL * (3)	
	V/Hz	Vec.	V/Hz	Vec.	Code	Part No.	Code	Part No.	Code	Part No.
AC038-	38	32	18.5	15	AA	896.10.01	AA-DBU	896.10.11	AA-DBT	896.10.81
AC043-	43	38	22	18.5	AA	896.11.01	AA-DBU	896.11.11	AA-DBT	896.11.81
AC058-	63	45	30	22	AA	896.12.01	AA-DBU	896.12.11	AA-DBT	896.12.81
AC070-	70	45	37	22	AA	896.13.01	AA-DBU	896.13.11	AA-DBT	896.13.81
AC085-	85	59	45	30	AA	896.14.01	AA-DBU	896.14.11	AA-DBT	896.14.81
AC106-	116	89	55	45	AA	896.15.01	AA-DBU	896.15.11	AA-DBT	896.15.81
AC140-	140	89	75	45	AA	896.16.01	AA-DBU	896.16.11	AA-DBT	896.16.81
AC170-	170	118	90	55	AA	896.17.01	AA-DBU	896.17.11	AA-DBT	896.17.81
AC210-	210	152	110	75	AA	896.18.01	AA-DBU	896.18.11	AA-DBT	896.18.81
AC240-	240	152	132	75	AA	896.19.01	AA-DBU	896.19.11	AA-DBT	896.19.81
AC305-	305	210	160	110	-	-	-	-	AA-DBT	896.20.81
AC360	360	250	200	132					AA-DBT	896.21.81
DC360-	360	250	200	132-	AA	896.21.51	--	--	--	--

On GV3000E with **RFI filter,** specified in the table below, the HF emission limits of class A, group 1 (EN 55011) in the 2nd environment (industrial supply network) are met, as required in the past for the Generic Standard EN 50081-2. This is recommended if e.g. in industrial estates high power converters and offices with sensitive consumers are connected to the same supply transformer.

For GV3000E **above 100 A** with built-in **HF Filter** for CE conformity refer to table 2-8d on next page.

TECHNICAL DATA					SPECIFICATION NUMBERS (non UL/cUL)					
TYPE GV3000E	INVERTER NOM. CURRENT (2 kHz)		MOTOR NOM. POWER 400VAC		VERSION with RFI FILTER * (1)		VERSION with BRAKING UNIT and RFI FILTER* (1) and (2)		VERSION with DC-BUS TERMINAL and RFI FILTER * (1) and (3)	
	V/Hz	Vec.	V/Hz	Vec.	Code	Part No.	Code	Part No.	Code	Part No.
AC038-	38	32	18.5	15	AA-RFI	896.10.21	AA-DBU-RFI	896.10.31	AA-DBT-RFI	896.10.91
AC043-	43	38	22	18.5	AA-RFI	896.11.21	AA-DBU-RFI	896.11.31	AA-DBT-RFI	896.11.91
AC058-	63	45	30	22	AA-RFI	896.12.21	AA-DBU-RFI	896.12.31	AA-DBT-RFI	896.12.91
AC070-	70	45	37	22	AA-RFI	896.13.21	AA-DBU-RFI	896.13.31	AA-DBT-RFI	896.13.91
AC085-	85	59	45	30	AA-RFI	896.14.21	AA-DBU-RFI	896.14.31	AA-DBT-RFI	896.14.91
AC106-	116	89	55	45	AA-RFI	896.15.21	AA-DBU-RFI	896.15.31	AA-DBT-RFI	896.15.91
AC140-	140	89	75	45	AA-RFI	896.16.21	AA-DBU-RFI	896.16.31	AA-DBT-RFI	896.16.91
AC170-	170	118	90	55	AA-RFI	896.17.21 1)	AA-DBU-RFI	896.17.31 1)	AA-DBT-RFI	896.17.91 1)
AC210-	210	152	110	75	external RFI-Filter see chapter 5		external RFI-Filter see chapter 5		external RFI-Filter see chapter 5	
AC240-	240	152	132	75			external Braking Unit DBU for AC305/360			
AC305-	305	210	160	110						
AC360	360	250	200	132						

* see different versions as illustrated in Figure 2-1 (Number in brackets represents illustration number)

1) On GV3000E-AC170 the rated current of the built-in RFI-filter is 150 A.
If 90 kW motors are operated in open loop (V/Hz) regulation with 2 kHz switching frequency, the separately mounted 270 A RFI-filter 839.70.66 must be used.

Table 2-8d: Selection of *non* UL/cUL-Inverters GV3000E- with built-in HF Filter for Motors >55 up-to 200 kW

On GV3000 inverters with AC line input currents **above 100 A with built-in HF Filter** the HF emission limits for class A, group 2* (EN 55011) in the **2nd environment** (industrial supply network) according to the **product standard EN 61800-3** are met and the drive fulfills CE conformity.

TECHNICAL DATA					SPECIFICATION NUMBERS (non UL/cUL)					
TYPE GV3000E	INVERTER NOM. CURRENT (2 kHz)		MOTOR NOM. POWER 400VAC		VERSION with HF FILTER * (1)		VERSION with BRAKING UNIT and HF FILTER* (1b) and (2)		VERSION with DC-BUS TERMINAL and HF FILTER * (1) and (3)	
	V/Hz	Vec.	V/Hz	Vec.	Code	Part No.	Code	Part No.	Code	Part No.
AC106-	116	89	55	45	AA-RFX	896.15.27	AA-DBU-RFX	896.15.37	AA-DBT-RFX	896.15.97
AC140-	140	89	75	45	AA-RFX	896.16.27	AA-DBU-RFX	896.16.37	AA-DBT-RFX	896.16.97
AC170-	170	118	90	55	AA-RFX	896.17.27	AA-DBU-RFX	896.17.37	AA-DBT-RFX	896.17.97
AC210-	210	152	110	75	AA-RFX	896.18.07	AA-DBU-RFX	896.18.17	AA-DBT-RFX	896.18.87
AC240-	240	152	132	75	AA-RFX	896.19.07	AA-DBU-RFX	896.19.17	AA-DBT-RFX	896.19.87
AC305-	305	210	160	110					AA-DBT-RFX	896.20.87
AC360	360	250	200	132					AA-DBT-RFX	896.21.87

* see different versions as illustrated in Figure 2-1 (Number in brackets represents illustration number)

Plan and Complete the Installation

DANGER:
Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, and/or service this equipment.
Read and understand this manual in its entirety before proceeding.
Failure to observe this precaution could result in severe bodily injury or loss of life.

DANGER:
The user is responsible for conforming to the applicable national standards with respect to wiring, grounding, disconnects, protection against electrical shock and overcurrents. Failure to observe this precaution could result in severe bodily injury or loss of life.

DANGER:
This equipment must be connected to a power source for which it was designed. Compare available power with the requirements listed on the nameplate to insure that voltage, frequency, phase, current capacity, and interrupting capacity are adequate.
Failure to observe this precaution could result in severe bodily injury or loss of life.

CAUTION:
Connection of a drive to a transformer with a primary rating of 2300 VAC or more may require additional input line conditioning.
Please contact Rockwell Automation for assistance when this is required.
Failure to observe this precaution could result in damage to, or destruction of the equipment.

Read and understand this chapter in its entirety before beginning the actual installation. Follow these guidelines and procedures to minimize both installation and operating problems.

Environmental Conditions

1. The GV3000/SE is intended for mounting in closed electrical operating areas. This may be a locked cabinet or a room for electrical installations. Access is only allowed to skilled persons whilst energized.
2. The recommendations for environmental conditions where the drive is to be installed (as specified in Section 2, Table 2-3) must be followed, in order to achieve the full service life expected for this equipment. Air originating from industrial processes, which produce excessive dust, oil, coolants, airborne contaminants or corrosive gas by products of processes, must be avoided.
3. Cooling air slots must not be sealed or closed over to ensure trouble-free operation.
4. Preparatory work relating to installation, such as drilling, welding etc, should be completed prior to actual installation.

Mounting

The *GV3000/SE* should be installed in the vertical position to ensure adequate cooling air ventilation.
The following minimum clearances must be maintained to allow adequate air circulation around and through the *GV3000/SE*.

100 mm above and below,
20 mm to side walls
5 mm between inverters 003-030, 039/044
40 mm to another similar inverter.

For dimensional data refer to the appropriate dimension figures at the end of this chapter.

Note that on types 002-030 the upper fastening plate is not fixed and therefore cannot support the unit alone.

AC-Line Choke, Transformer

CAUTION
Distribution system capacity above the maximum permitted short circuit current requires always adding an impedance.
You can use a 3-phase line reactor or a matched isolation transformer (on types 003-030 and 039/044 also the RFI-filter option).
Refer to page 2-13, 2-14 and chapter 5, Accessories.
Failure to observe these precautions could result in damage to, or destruction of, the equipment.

WARNING
The center tap of the external AC-line transformer must always be connected to ground (zero potential) at the power unit (protecting earth terminal PE ⏚ or GND).
Failure to observe these precautions could result in damage to, or destruction of the equipment.

Input Disconnect

The relevant national regulations often require that electrical systems may only be connected to the mains provided they can be isolated from the mains. An isolation of this nature is not built-in and must be provided externally.

Install an input disconnect in the incoming power line which must either be located within sight of the drive or be lockable.

DANGER:
Failure to observe this precaution could result in severe bodily injury or loss of life.

Main Contactor

Should specifications require that the entire system must be isolated from the line supply in the event of an emergency stop, an input contactor must be provided.

Power Wiring

Size and install all wiring in conformance with all applicable local standards.

1. Size input and output power wiring, according to applicable codes, to handle the nominal drive voltage and current. Wire sizes and currents are listed in Tables 2-1 to 2-8.
2. Locate connection terminals on the drive in Fig. 4-2.
3. Connect AC input leads via input fuses, disconnect, line reactor to the *GV3000/SE*-power terminals L1, L2, L3.

WARNING:
Power units are fully protected only with manufacturer specified input devices!
Refer to Table 2-1 and Chapter 5.

Motor Connection

The conditions regarding motor selection, power reduction, maximum motor size and multiple motor applications should be observed.
If the cable length between inverter and motor exceeds 50 meters, or the cable arrangement causes high earth capacitance, (e.g. cable run in water) fault tripping may result. In such cases additional chokes in the output will be required. Please contact Rockwell Automation.
In order to prevent interference in the vicinity it is recommended that the cable between inverter and motor is shielded and the shield on both sides is securely connected to the protective earth.

Protection of the Braking Resistor

To prevent possible damages due to overload on the braking resistors, the installation of a thermal protection device according to Fig. 3-1 is recommended:

Connection of the Braking Resistor

- The cable length of the connections between braking unit and resistor must not exceed 2.5 m.
- The conductors should be bound together and run separated from other conductors.
- For installations in conformance with CE the measures according to Appendix A are required:
  - EMC-tested armored cable glands
  - screened cables with earth conductor
- If the braking resistor is mounted in a separate enclosure, this must be metallic conductive and the diameter of ventilation holes should not exceed 6 mm.
- Heat-resistant cables and cable sockets (minimum 90°C) must be used to connect the braking resistor.

Unit Type	Max. Continuous Braking Current (A rms)	Cable Cross Section (mm^2)
003-015	10	1
024	15	1.5
030	20	2.5
038/043 058-085	25	4
039/044	30	6
089-240	50	10

Table 3-1: Cable Cross Sections for external braking resistors

Power Terminals

Connection diagram Fig. 3-1 shows input and output power connections and external input protection devices (refer to page 3-2).

Connection Terminals	No.	Wiring
AC-line input	L1 L2 L3 PE, ⏚	Line voltage 3 x 380-460 V Protection earth connection
AC-Motor	U V W ⏚ (PE)	Motor terminals Protection earth connection
P/U with built in Braking Unit	47 48 ⏚	External braking resistor Protection earth for DB-resistor housing
DC-bus output	45 (-) 47 (+) ⏚	DC-bus connection Protection earth connection
DC-bus	145 (-) 147 (+)	e.g. External Braking Unit
P/U with auto transformer for blower	2L1 400 460 0	1) wire jumper at 2L1 or 2) Connection of external line voltage

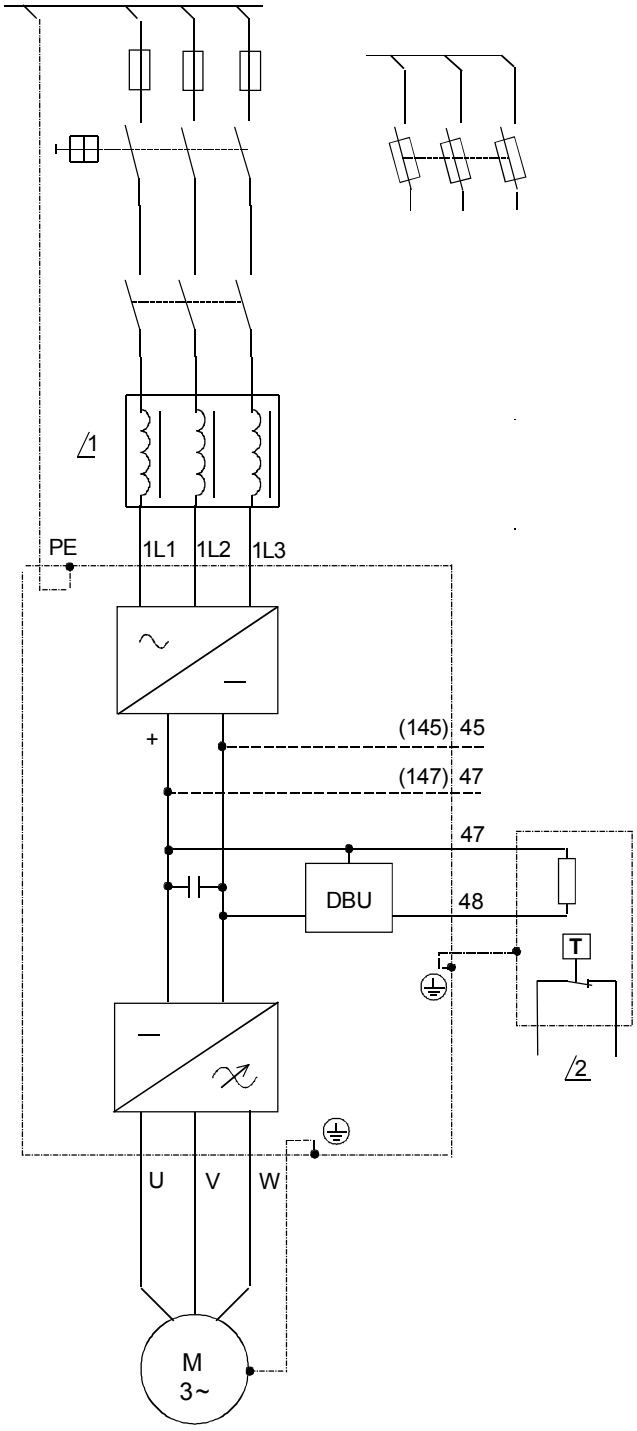
1) Type AC305/360: (see diagram 2-2i)

The auto transformer for the power unit blower is connected to the internal line voltage via wire jumper at terminals 2L1 – 460 (Default setting: 460 V) and protected by fuses F4, F5.

For line voltage 400 V the wire jumper must be set to terminals 2L1 – 400.

2) Type DC360: (see diagram 2-2j)

The external single phase supply line voltage 400 or 460 V must be connected to the appropriate terminals 400 – 0, or 460 – 0 and protected. (p.ex. through thermal magnetic circuit breaker).



/1 AC-line choke if permissive fault current capacity is exceeded (see tables 2-1 and 5-1)

/2 If the resistor overheats, this contact operates a disconnect that removes AC power from the drive.

Fig. 3-1: Example for power unit connections

Regulator Installation

Regulator Wiring Practice

- Size and install all wiring in conformance with applicable national and all other local codes.
- Recommended wire size for regulator terminals 1 to 26 is 1mm^2 for control wiring, 0.5 or 0.34 mm^2 (18 AWG or 20 AWG), for analog signals.
- Terminal Strip Maximum Tightening Torque is 0.8 kpm or 7 in-lbs.

For signal and control wiring the following rules should be observed, to avoid malfunction of the drive.

- Don't route signal, control, and power wiring in the same conduit. This may cause interference with controller operation.
- Run cables for reference signals in separate conduit isolated from all AC and DC power wiring and logic control wiring.
- All reference signals should be installed with screened cables, 2 or 3 conductor wires as required, screen grounded at one side only (preferable at controller housing).
- Signal or logic wires should not be run parallel with medium voltage or electrically noisy conductors (as the motor wires are).
- Always cross power and signal or control wires at right angles.

Transient suppression of contactor and relay coils:

Switching of contactor and relay coils (also valves, fan motors e.t.c) causes transient voltages of high frequency (bursts), which can disturb electronic circuits.

A proved measure, to avoid potential problems, is to provide suppression networks on all contactor and relay coils:

- AC-coils with RC-units,
- DC-coils with diodes in non conducting direction.

For such coils, which contacts are connected to the drive, or which are actuated by contacts from the drive, suppression is highly recommended.

Stopping the Drive

(See WARNING note on page 1-1)

Depending on the requirements of the application, the control input at regulator terminal 23 can be configured to provide either a coast-to-rest or a ramp-to-rest operational stop without disconnecting the power source from the motor (Category 2 stop function according to EN60204-1 Sect 9.2.2). Refer to Regulator manual, section 4, Parameter P.025 for how to configure the operational stop.
In addition, the user can configure the drive for operation at zero speed with power maintained to the motor. Refer to Regulator manual, section 4, Minimum Speed Setting Parameter P.003

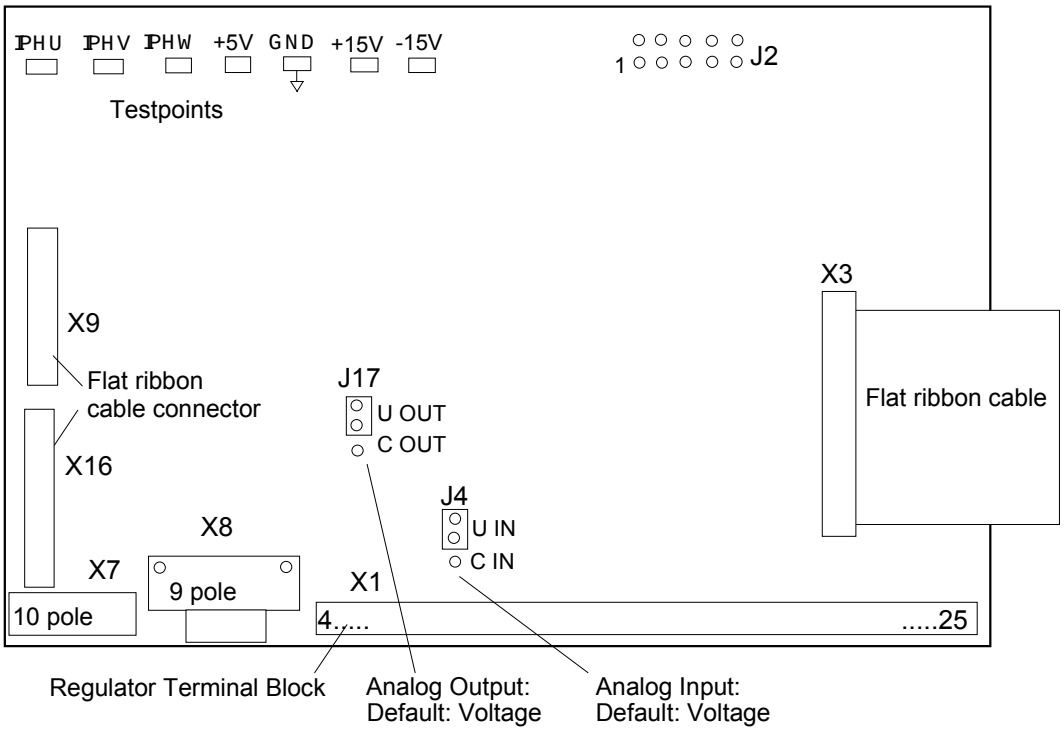
Remote Terminal Strip Digital Inputs

- Remote terminal board digital inputs are high true (DC 24 V +10%,
  Turn on voltage: 8 V,
  Turn off voltage: 4 V, 0.5 mA)
- Inputs no. 1-5 are always fixed (non-configurable).
- Inputs no. 6-8 are configurable by P.007 Dig. Inputs Configuration Select
- Operation Interrupts at LOCAL, REMOTE operation :
  STOP command **at local keypad** is effective in all operation modes (P.000: LOCAL, REMOTE, etc.)

Independent Inputs

- **Function Loss** (dig. input no. 5) and digital input for Ramp Selection (no. 7 or 8) are effective independent of LOCAL/ REMOTE selection.
- **REMOTE operation:**
  All other digital inputs are only activated at REMOTE operation. Refer to function description at following tables.

Regulator Card Layout for Type GV3000E-AC003 - 030 and 039/044

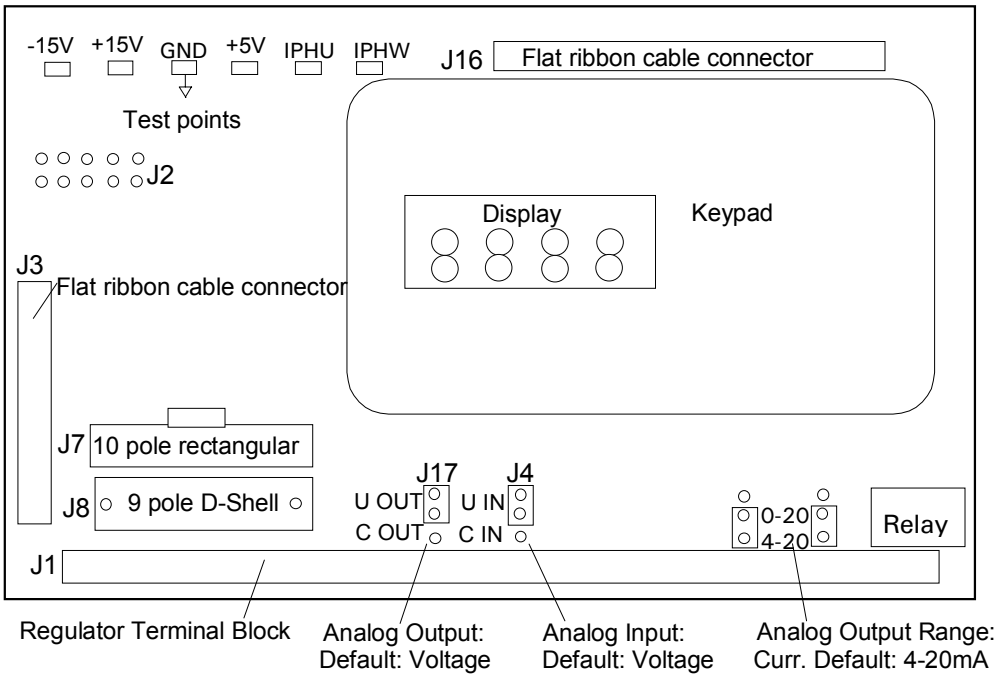


NOTE: For access to jumpers J4, J17 or test pins on the Regulator board or mounting an option board you need to remove the green plastic cover.

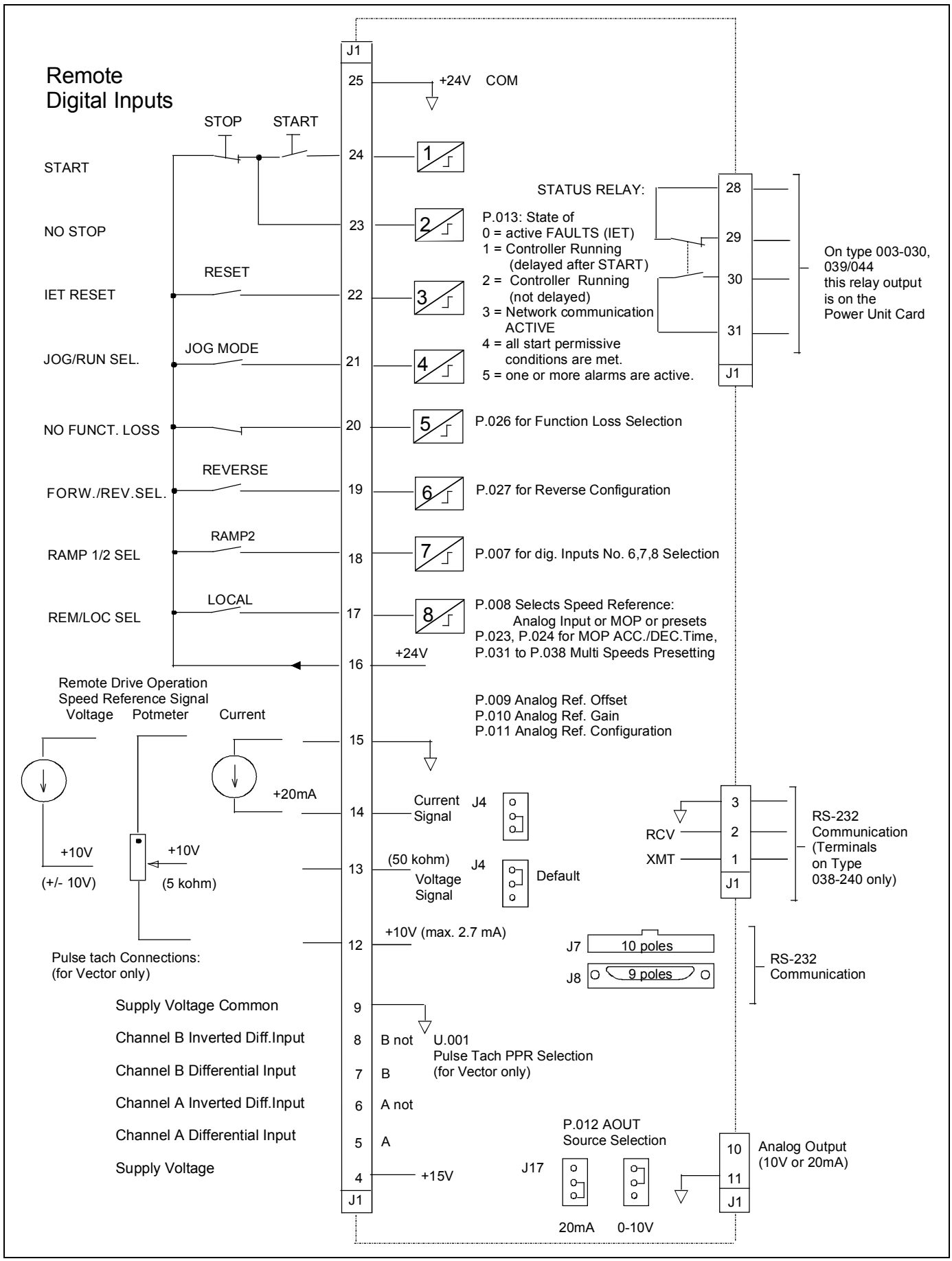
1. Disconnect, lock out, and tag all incoming power to the drive.
2. Wait five minutes for the DC bus capacitors to discharge.
3. Disconnect any wiring from the face of the drive.
4. Remove the cover as follows:
   - Unscrew the attaching screw on the cover.
   - Lift the cover and carefully take it out of the heatsink as far as the flat ribbon keypad cable will allow. This cable connects the display with the Regulator board.
   - Use a screwdriver to slide the cable out of the connector on the regulator board to completely detach the cover.
5. On 24 to 44 A drives only: Remove the front panel by unscrewing the two attaching screws.

For reattaching the cover proceed in the reverse order.

Regulator Card Layout for Type GV3000E/U-AC038/043 and 058 - 360



Regulator, Terminal Connections, Overview



Control Voltage Output, Digital Inputs

(see wiring diagram for Remote Terminal Block)

Terminals J1:	Connected function
16	+24 V *Control voltage output*, isolated, current limited. This supply should not be used as an external supply for anything other than the 8 digital inputs.
25	24 V *Control voltage Common*
20	*Function Loss* (dig. input no. 5) 0 V at terminal = Function Loss active +24 V at terminal = Drive enabled - Function Loss is effective in all control modes (P.000: LOCAL, REMOTE, etc.) and has priority over start - *Function Loss Restart Procedure with* **P.026 = 0** : * Speed reference is zero, motor coasts to rest, * error code 'FL' is displayed, * output relay will pick up if configured (P.013) for FAULT ACTIVE. * Remove function loss cause and reset IET using STOP/RESET before restarting. - *Function Loss Restart Procedure with* **P.026 = 1** : * Speed reference is zero, motor coasts to rest, * **no** error code is displayed, * output relay will **not** pick up if configured (P.013) for FAULT ACTIVE. * Remove function loss cause and restart (**no** resetting of IET).
23	*STOP Command* (dig. input no. 2) has priority over start - 0 V at terminal = STOP activated - +24 V at terminal = Drive enabled - P.025 for type of STOP ('coast to rest' or 'ramp to rest') - P.055 (STOP/RESET Key Disable) can be used to change the operation of the STOP/RESET key. See the P.055 parameter description in the Regulator manual.
22	*RESET Command* (dig. input no. 3) - Transition to +24V at terminal = RESET IET (Instantaneous Electronic Trip) with error cause removed.
21	*JOG / RUN Selection* (*dig*. input no. 4) - 0 V at terminal = RUN-Mode selected - +24 V at terminal = JOG-Mode selected
24	*START Command at REMOTE operation mode* (dig. input no. 1) RUN function will be active: - If RUN selected 0 V at dig. input no.4, and No STOP command +24 V at dig. input no.2, and No Function Loss +24 V at dig. input no.5, and START command transition to +24 V at dig. input no.1. JOG function will be active: - If JOG selected +24 V at dig. input no.4, and No STOP command +24 V at dig. input no.2, and No Function Loss +24 V at dig. input no.5, and START command +24 V maintained at dig. input no.1.
19 18 17	Digital Input No.6, Digital Input No.7, and Digital Input No.8 are configurable via P.007 and P.008 (Refer to parameter description in manual 49'1329, Section 4). P.007 : Initial setting: No.6 (+24 V)=REVERSE, No.7 (+24 V)=RAMP 2, No.8 (+24 V)=LOCAL.

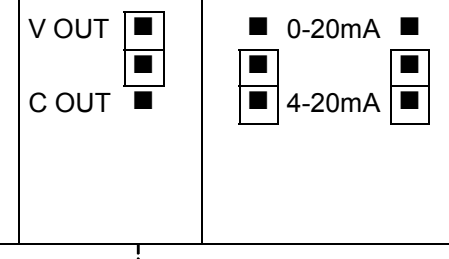
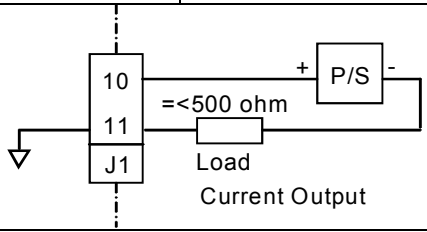
Digital Outputs (see wiring diagram for Remote Terminal Block)

Terminals	Connected function
J1:	*IET / Controller Running Relay* Digital output with two voltage free contacts at one relay, configurable through P.013 for status indication. - P.013: 0 = State of active faults (IET) 1 = State of Controller Running (0.5 s delay after start) 2 = State of Controller Running (not delayed) 3 = State of Network Communication ACTIVE 4 = Relay is energized when all start permissive conditions are met. 5 = Relay is energized when one or more alarms are active. - Contacts rated for max. load of 2 A at 30 VDC or 60 W at L/R = 7 ms, and 2 A at 250 VAC, or 500 VA at cos φ = 0.4. - Contacts rated for min. load of 10 mA at 5 VDC.
28,29 30,31	NC Normally Closed Contact NO Normally Open Contact

Analog Speed Reference Input (see wiring diagram)

Terminals	Connected function
J1: 12	+10 VDC Supply, isolated, stabilized, max. 2.7 mA +15 VDC Supply, isolated, after 1.8 kohm, for Types AC003 - 030 and 039/044
13	±10 V Analog Voltage Speed Reference Input, Impedance 50 kohm
14	±20 mA Analog Current Speed Reference Input, Impedance 250 ohm
15	Common, isolated, for Voltage / Current Input
	For Voltage Speed Reference Input: Jumper J4 in upper position (V IN, Default), Current Speed Reference Input: Jumper J4 in lower position (C IN)
	Refer to : P.009 Terminal Strip Analog Input Offset (e.g. for 4 to 20 mA) P.010 Terminal Strip Analog Input Gain P.011 Terminal Strip Analog Input Configure

Analog Output (see wiring diagram for Remote Terminal Block)

Terminals J1:	Connected function Note: P.012 -Terminal Strip Analog Output Source	
10	Analog output	J17
11	Regulator Common Jumper J17 setting for type of signal output: • voltage (0 - 10 V) in position V OUT, max. 4 mA, Impedance 2.5 kohm • or current (0 or 4 - 20 mA) in position C OUT On types 038/043 and 058-360 the current range 0 - 20 mA or 4 - 20 mA can be selected with the two jumpers near the relay.	
	NOTE: The Analog output for *current signal* is a sink type and requires an externally mounted isolated power supply (max. 12V, min Σ $R_{receiver}$ x 20 mA).	

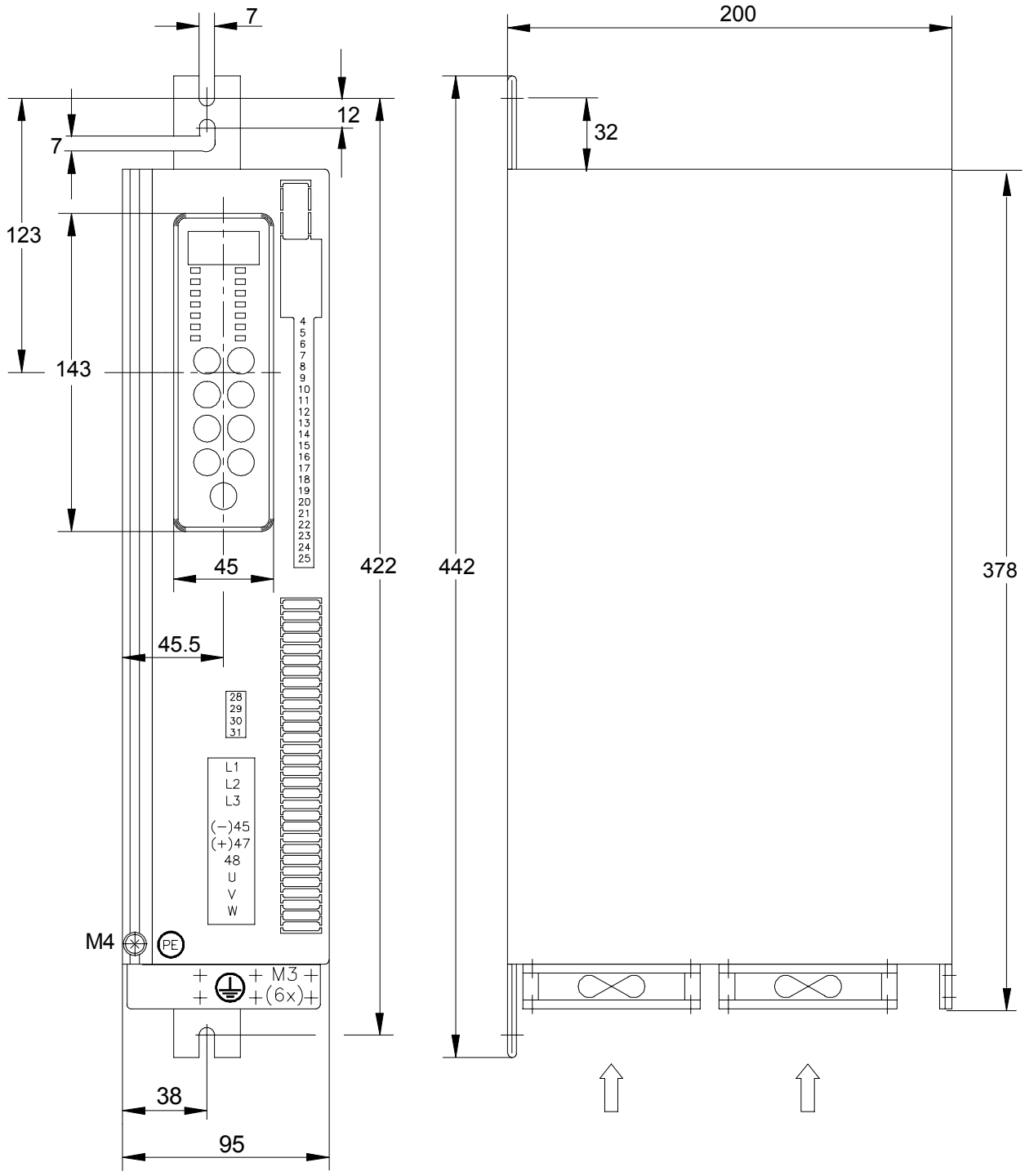
Vector Mode, Encoder (see wiring diagram for Terminal Block)

Terminals J1:	Connected function
	WARNING The setting of the variables U.001 (Encoder PPR), U.002 (Motor Poles), U.003 (Motor Base Frequency) and U.005 (Motor Nameplate RPM) determine motor maximum speed. These variables and U.007 (Motor Nameplate Volts) must be set by a qualified person who understands the significance of setting them accurately. Failure to observe this Precaution could result in bodily injury.
	P.050 Restore Defaults, U.001 Encoder PPR, U.002 Motor Poles, U.003 Motor Nameplate Base Frequency U.004 Motor Nameplate Amps U.005 Motor Nameplate RPM Encoder Output: **Minimum 10V differential** quadrature with pulses 512/1024/2048/4096 on max. operating speed less then 125 kHz.
4	Supply +**15 V** (nominal 250 mA) (Current limit at 530 mA)
	Differential input signals: (Static impedance, channel to zero: 10 kohms)
5	Phase A (reactance per channel: 100 ohms in series w. 3.9nF)
6	Phase A NOT
7	Phase B
8	Phase B NOT
9	Regulator Common

RS232 Interface (see wiring diagram for Remote Terminal Block)

Terminals J1:	Connected function
	RS-232 port for serial communications using the following signals:
1	Transmit data (XMT)
2	Receive data (RCV)
3	Common
	These signals are also accessible at the regulator card connectors:
These terminals exist on types 038/043 and 058-360 only.	Connector J8 (X8): 9-pole, D-Shell Transmit data pin 2 Receive data pin 3 Common pin 5 Connector J7 (X7): 10-pole, rectangular +5 VDC pin 1,2 +12 VDC pin 3 Transmit data pin 4 Common pin 5,7 Receive data pin 6 Data terminal ready pin 9 -12 VDC pin 10

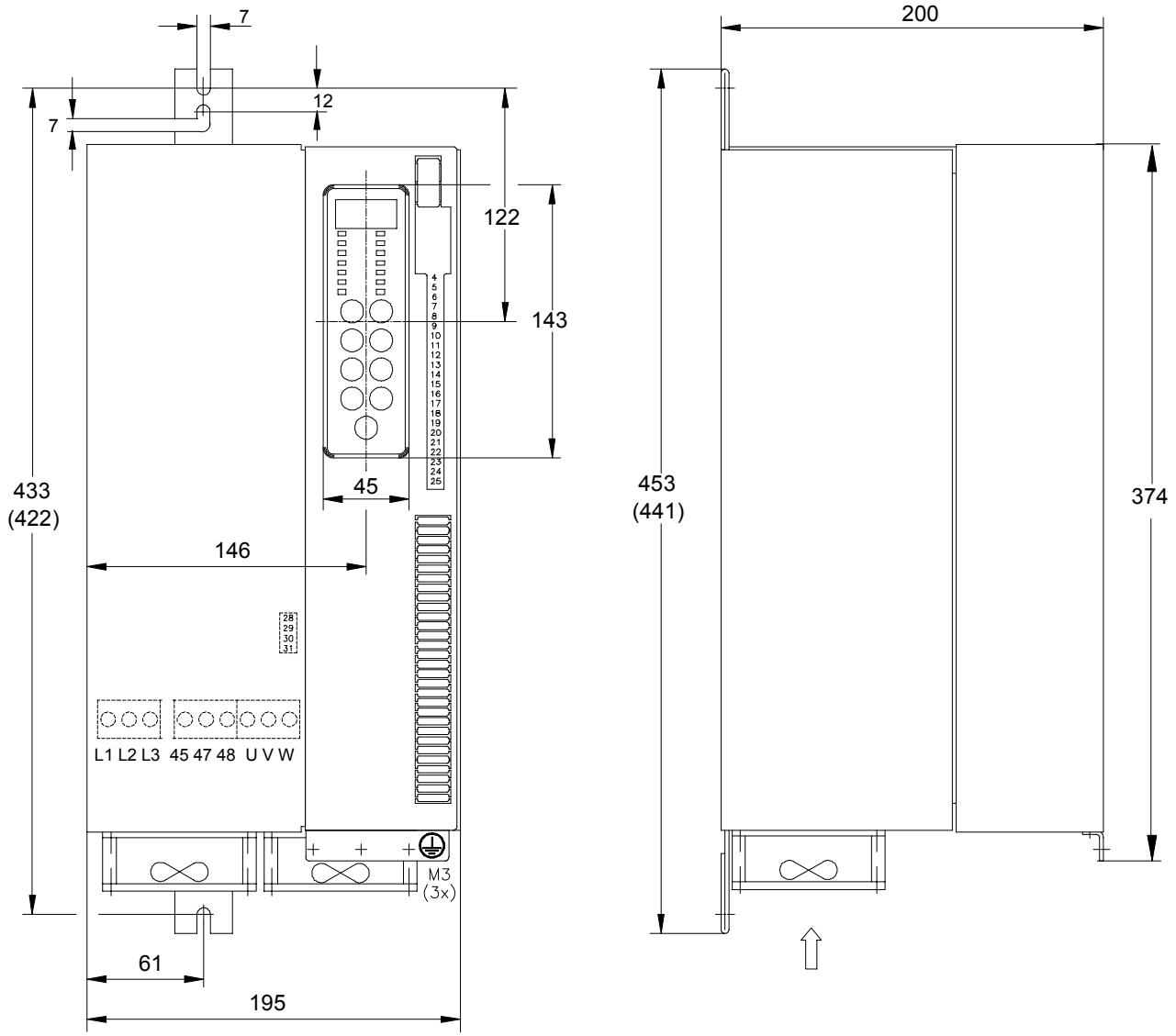
Dimensions

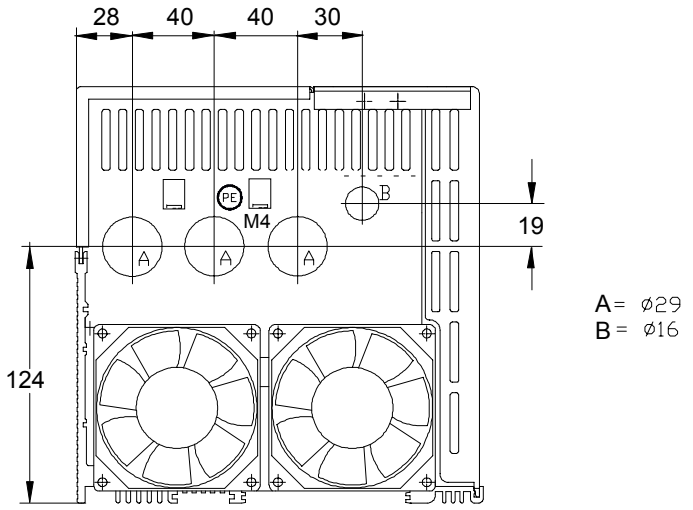


Weight: 5.5 kg (with EMC-filter)

Cooling air for type 003 - 008: 58 m³/h
type 012 - 015: 116 m³/h

Fig. 3-3: Dimensions (mm) of the GV3000/SE Type AC003 - 015



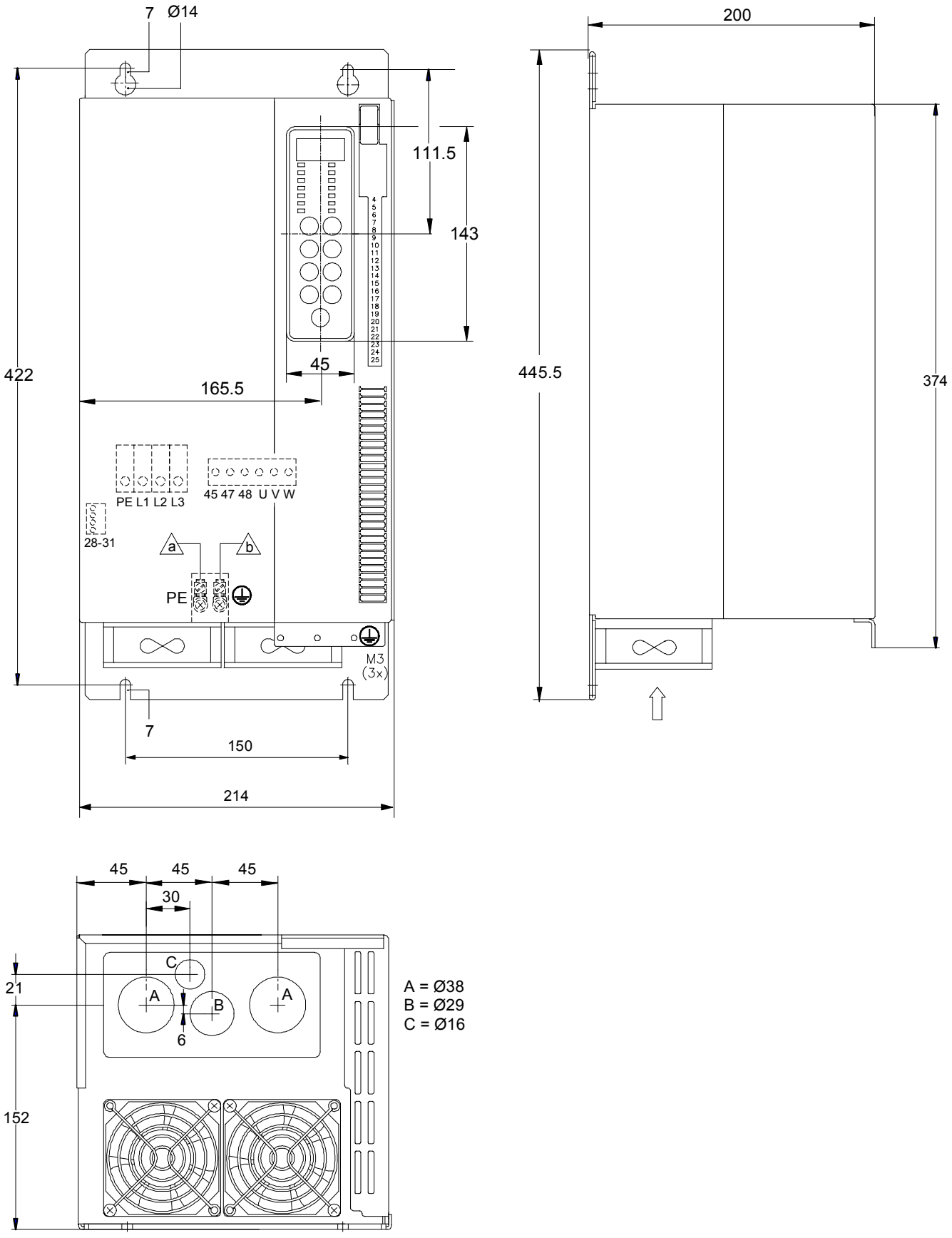


view from bottom

Dimensions in brackets for type 024
Weight: 10 kg (with EMC-filter)

Cooling air for type 024: 116 m³/h
type 030: 160 m³/h

Fig. 3-4: Dimensions (mm) of the GV3000/SE Type AC024 – 030



view from bottom

Weight: 16.5 kg (with RFI-filter)

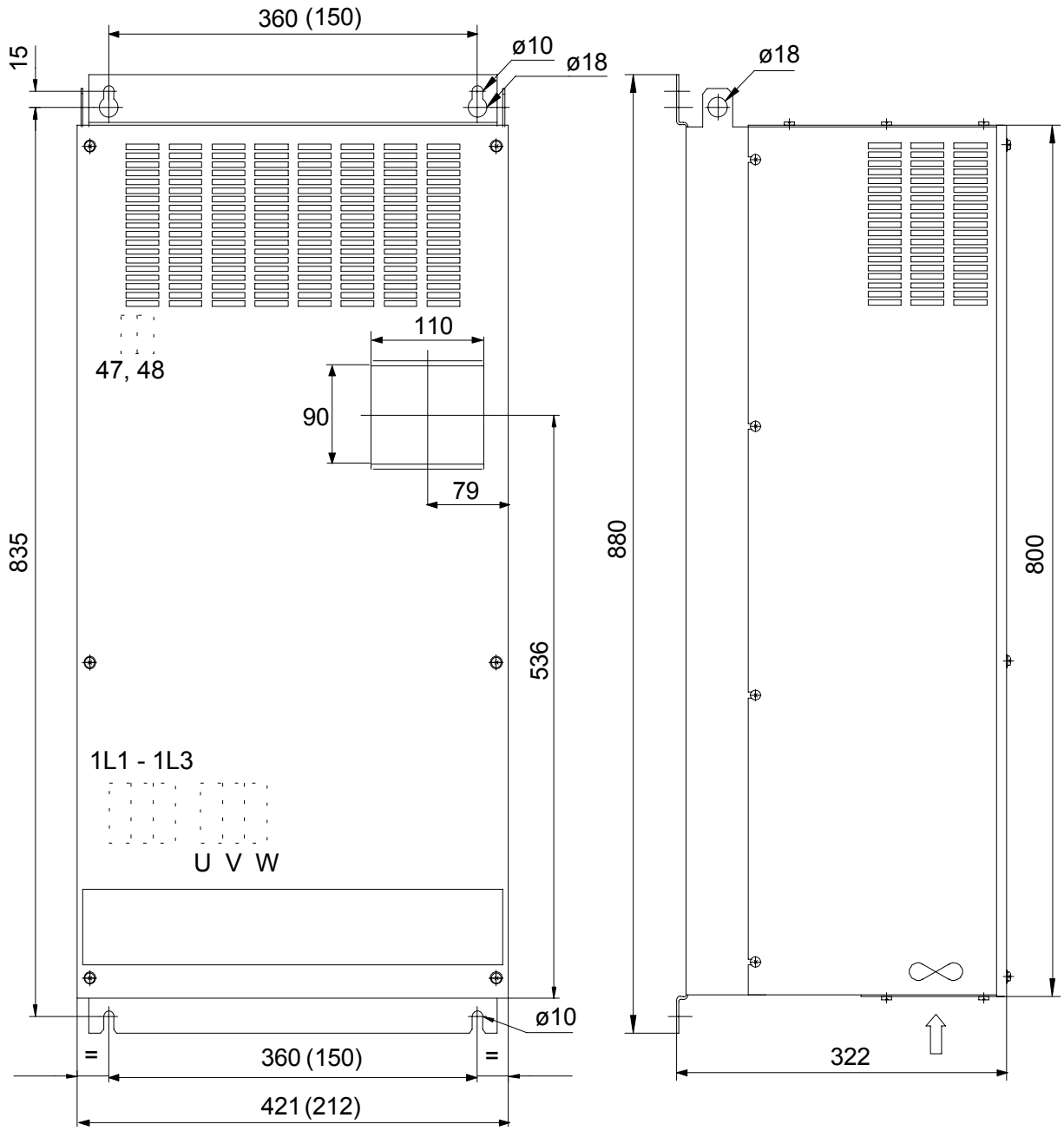
Cooling air: 160 m³/h

/a AC-line input protection earth terminal, on type 896.1x.12 only (without RFI-filter)

/b Motor connection ground terminal

For cable glands refer to page A-5

Fig. 3-5: Dimensions (mm) of the GV3000/SE Type AC039/044

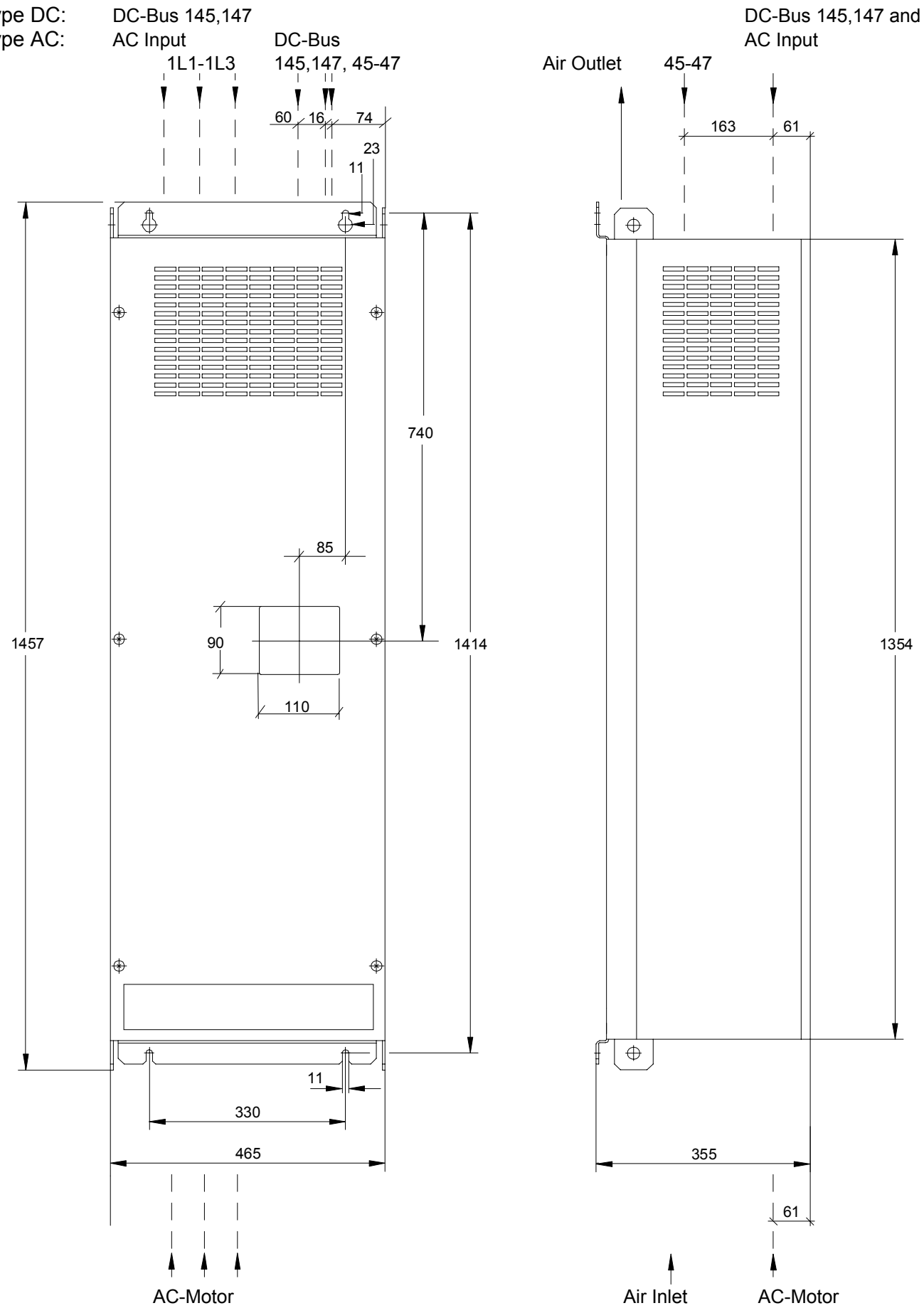


Dimensions in brackets are valid for type AC038/043 and 058-085

For cable glands refer to page A-5

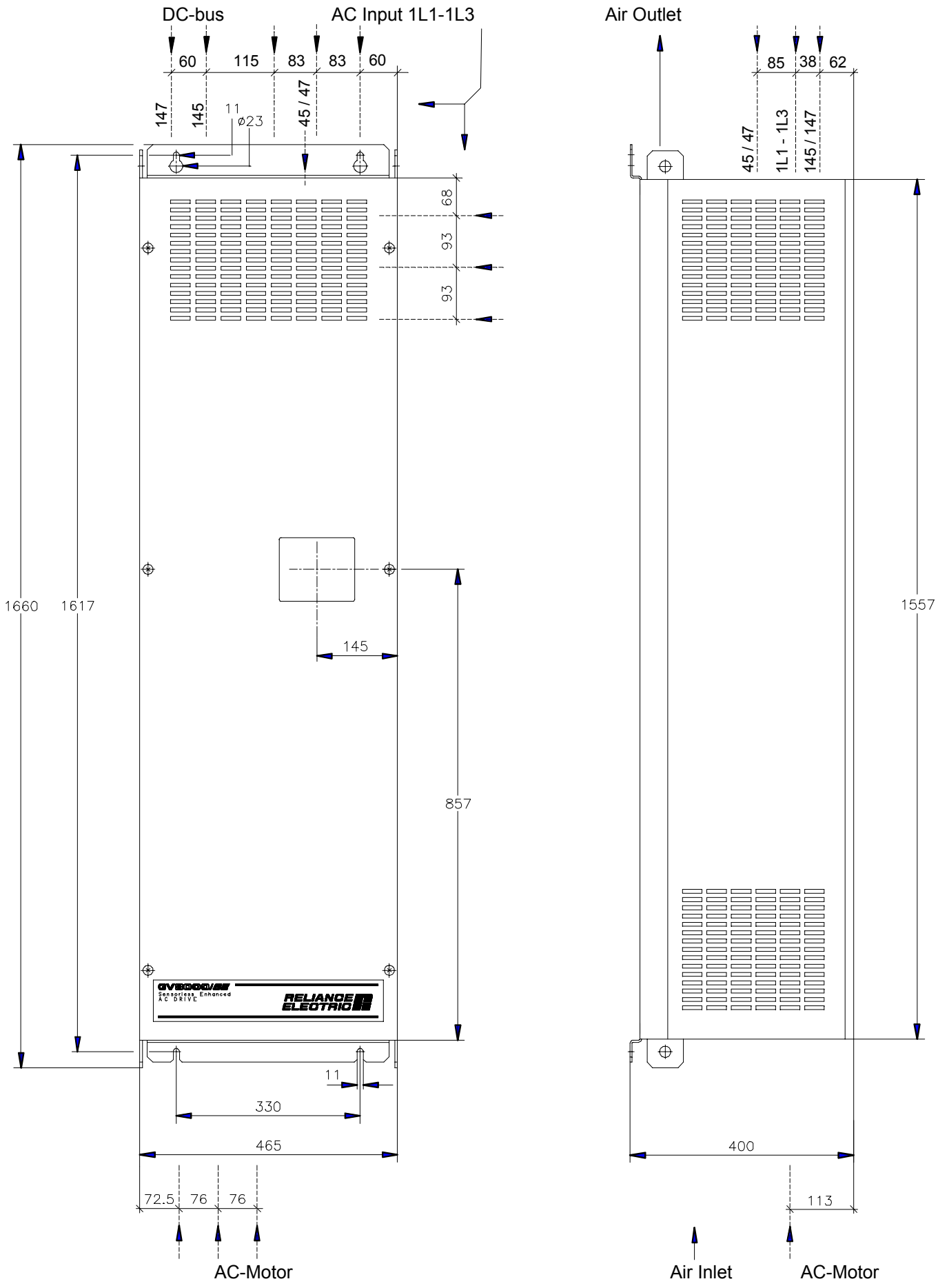
	Type AC038/043 and 058-085	Type AC089, 106, 140 and 170
Weight:	37 kg	70 kg
Cooling air:	360 m³/h	720 m³/h

Fig. 3-6: Dimensions of GV3000/SE Type AC038/043, 058-085, 089, 106, 140 and 170



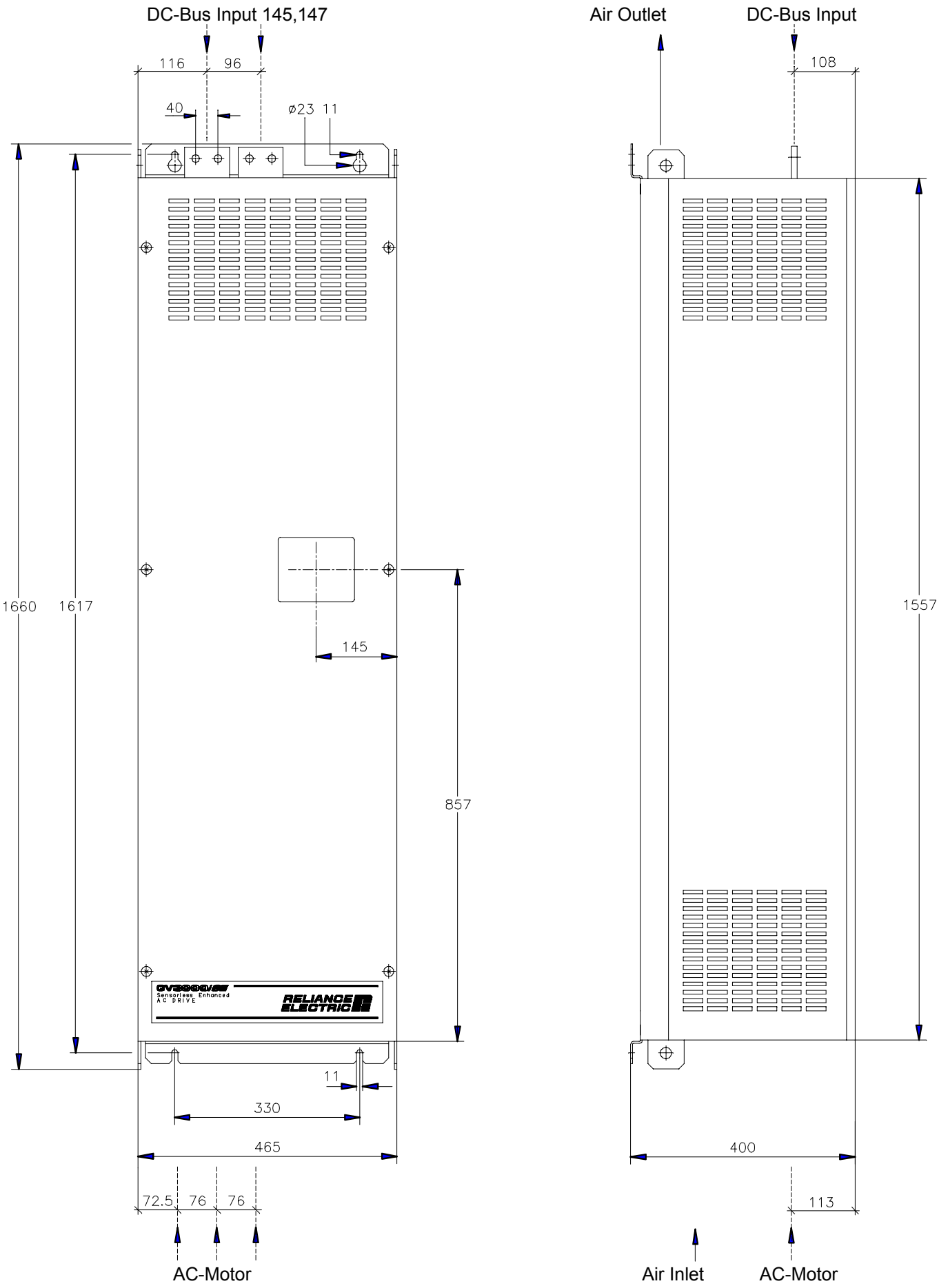
Cooling air: 950 m^3/h Weight: 140 kg

Fig. 3-7: Dimensions of GV3000/SE Type AC180, AC210, AC240 and DC240



Cooling air: 1310 m³/h Weight: 190 kg

Fig. 3-8: Dimensions of GV3000/SE Type AC305 and AC360



Cooling air: 1310 m³/h Weight: 180 kg

Fig. 3-9: Dimensions of GV3000/SE Type DC360

Safety Precautions

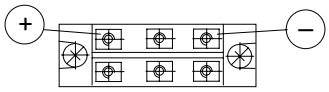
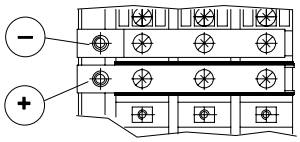
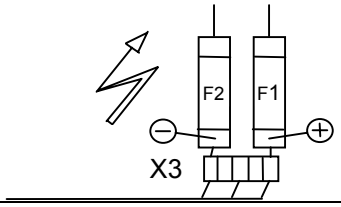
CAUTION*:* PC-boards and control inputs of IGBT/IPM modules are static sensitive.
Handle without touching components, connectors or leads.
All tool, equipment and personnel should be grounded during assembling.
Failure to observe this precaution could result in damage to the equipment

DANGER*:* Whenever work is done on the unit AC-input power must be disconnected.
After discharging of the DC-bus capacitors (approx. 180 seconds) the DC-bus voltage should be checked with a voltmeter according to the following instructions.
Failure to observe this precaution could result in bodily injury or loss of life.

DC-Bus Voltage Check

1. Turn OFF and lock out power to the Inverter
2. Before opening the inverter wait the discharge time of the DC-bus capacitors (approx. 180 seconds).
3. Before touching internal life parts verify with a voltmeter, that there is no AC-line voltage applied and the DC-bus voltage has dropped below DC 50 V. Connect a voltmeter (Range: >650V) to the line input power terminals L1-L3 and to the DC-bus circuit 47 (+) and 45 (-). On types 024-360 access to points 47 and 45 only after removing the front housing cover.

   DC-bus measuring points for the different inverter types are as follows:

Unit Type	Measuring points
003 to 030 and 039/044	DC-Bus output terminals 47 (+) and 45 (-)
038/043 and 058 to 085	Input diode cube secondary connections, see also Figure 4-2a (Pos. 9). 
089 to 170	Input diode module secondary bus-bar, see also Figure 4-2b (Pos. 9). 
180 to 360	Fuse holders on the Power Interface card PIP, accessible after hinging down Regulator Panel. 

Test Instruments

For trouble shooting inside the power unit the following meters are recommended:

a) Either a digital multimeter with a 10 megaOhm input impedance on all ranges (e.g. FLUKE) or an analog multimeter having a sensitivity of 100 kohm/volt.
b) A two-channel oscilloscope with 100 to 1 probes for potential free differential measuring of mains, DC-bus or output voltage and a clip-on probe for measuring currents.

Cooling Fan Check

Normally the controllers will work without any maintenance. One exception are the cooling fans on power units and control cubicles. They should be visually checked from time to time, because the lifetime is limited. It is recommended to replace the fans before the end of the lifetime to prevent breakdowns on the machine.
NOTE: Rockwell Automation delivers complete fans only (see spare parts list Tables 4-1 to 4-8).

Power Unit Function Check

Checking the Power Unit with mains voltage applied (without START)

Several checks in the power unit, as output voltage measurement of each phase and short circuit indication, are provided in the start-up instructions of the controller (refer to the regulator manual).

Checking the Power Unit with mains voltage switched off

NOTE:	All checks inside the power unit are done with **AC-line connections open, disconnected motor** and **DC-bus discharged**. For checking printed circuit boards refer to the regulator manual.

First check all line input and DC-bus fuses. If one of the fuses is blown, replace the fuses and check all power semiconductors of the input and output bridge by the use of a megohm meter (multimeter in diode range) according to the following table.

NOTE: If a transistor malfunctions:

- On Inverters type **003-030** and **039/044** the entire unit must be replaced because they do not have replaceable transistor modules.
- On inverters type **038/043** and **058-170** single IPM's must be replaced always together with the driver card.
- On the IGBT spare parts set (486.60.xx) for inverters type **180-360** the driver card is already mounted, because the control inputs of the IGBT modules are static sensitive.

Input Diode 1)	Input Thyristor 2)	IPM or IGBT	Meter connection (M. in diode range)		Component intact if resistance R is	Component defective if
No.	No.	No.	(+)	(-)		
1			47*	1L1(R)	0.3 < R < 8 kohm	continuity (short circuit) or open when meter connected with reversed polarity
2			47*	1L2(S)		
3			47*	1L3(T)		
4			1L1(R)	45 *		
5			1L2(S)	45 *		
6			1L3(T)	45 *		
	1		47*	1L1	R > 100 kohm	continuity (short circuit)
	2		47*	1L2		
	3		47*	1L3		
	4		1L1	45 *		
	5		1L2	45 *		
	6		1L3	45 *		
		V6	47*	W(T3)	0.3 < R < 8 kohm	continuity (short circuit) or open when meter connected with reversed polarity
		V5	47*	V(T2)		
		V4	47*	U(T1)		
		V3	W(T3)	45 *		
		V2	V(T2)	45 *		
		V1	U(T1)	45 *		

* If the optional terminals 45 and 47 are not fitted (e.g. on power units with built-in braking chopper option), remove cover and connect meter (range: >650V) to the measuring points (+) and (-) according to DC-Bus Voltage Check on page 4-1.

1) on type AC003 - 170

2) on type AC180 - 360 only

SPARE PARTS

Only original spare parts according to the following tables should be used.

Table 4-1: Replacement Parts List for GV3000/SE Type AC003 - 030 and 039/044

Part Description	Part Number	Quantity per Type:					
		003/004	**005/008**	**012/015**	**024**	**030**	**039/044**
Regulator Card GVE	814.61.00	1	1	1	1	1	1
Keypad	814.63.00	1	1	1	1	1	1
Fan	922.67.05	1*	1	2	2	-	-
	922.68.05	-	-	-	-	2	2
Cover	957.85.00	1	1	1	-	-	-
	957.85.10-	-	-	-	1	1	1

* On Inverters type 896.01/02.31 only (with RFI-filter)

Table 4-2: Replacement Inverters GV3000/SE Type AC003 - 030 and 039/044

	Part Number for Type:					
Type	**003**	**004**	**005**	**008**	**012**	**015**
A	896.01.11	896.02.11	896.03.11	896.05.11	896.06.11	896.07.11
B	896.01.31	896.02.31	896.03.31	896.05.31	896.06.31	896.07.31

	Part Number for Type:			
Type	**024**	**030**	**039**	**044**
A	896.08.11	896.09.11	896.10.12	896.11.12
B	896.08.31	896.09.31	896.10.32	896.11.32

A: Basic version with DC-bus terminals and braking unit
B: Version with DC-bus terminals, braking unit and RFI-filter

Table 4-3: Urgent recommended spare parts for GV3000/SE Type AC038/043 and 058 to 170

Part Description	Designation	Position Fig. 4-2	Quantity and Part No. for Type: 038/043 and 058 to 085	089 to 170
Regulator-card	GVD	1	1 810.90.11	1 810.90.11
PU-Interface-card	PIS	2	1 813.23.20	1 813.23.20
Fine wire fuses 4 A	(on PIS)		2 754.02.05	2 754.02.05
Driver-card	IPA37/75	3	1 813.35.00	1 813.36.00
Bus Clamp card right 1)	SCN/M-R	4	1 813.34.00	2 813.33.00
Bus Clamp card left 1)	SCN/M-L	5	1 813.34.01	2 813.33.01
DBU set IGBT-module with driver-card BUA/C 2)	V10	6,7	1 924.91.00	1 924.92.00
Fuse super fast 3)	F20	10	1 553.15.00	1 553.18.00
IPM (AC038/043, AC058-070)	V1 - V6	8	3 136.21.10	-
IPM (AC085)	V1 - V6		3 136.22.15	-
IPM (AC089-140)	V1 - V6		-	3 136.21.20
IPM (AC170)	V1 - V6		-	3 136.22.30
Diode-Cube/Module	V11	9	1 135.57.01	
	V11-V13			3 135.55.11
with surge suppressor unit	V20-V23		1 123.43.03	1 123.43.03
DC-Bus Fuse 1)	F10-F13	10	1 553.58.09	2 553.58.09

1) Only on UL-Type Inverters 896.1x.x0
2) Only on AC-Input Inverters with Dynamic Braking Unit DBU
3) Only on AC-Input Inverters non UL-Type 038/043 and 058 - 170 with Dynamic Braking Unit DBU

Table 4-4: Further recommended spare parts for GV3000/SE Type AC038/043 and 058 to 170

Part Description	Designation	Position Fig. 4-2	Quantity and Part No. for Type: 038/043 and 058-085	089-170
Precharge contactor	K1 ... K4	11	1 604.80.10	4 604.80.10
Output current transformer			-	2 249.95.00
CFI-card	T1,T2	12	2 813.24.00	
Earth fault transformer	T4	13	1 252.90.00	1 252.90.00
Choke (motor output)	L1,L2,L3	14		
038/043, 058-070, 089-140			3 252.84.10	1 252.84.- 21/ 22/ 23
085 and 170			3 252.84.15	1 252.84.- 25/ 26/ 27
RFI Line filter 4)			1 839.70.10	1 839.70.20
HF Line filter 5)		26	-	1 839.52.20
Precharge resistor 18 Ω	R5...R8	15	2 750.70.03	4 750.70.03
Discharge resistor 3.6 kΩ	R1/R2	16	1 425.08.20	-
Discharge resistor 1.5 kΩ	R1-R4	16	-	2 425.09.31
Power unit blower	M1-M4	17	1 922.65.00	2 922.65.00
Keypad		20	1 604.41.00	1 604.41.00

4) Only on AC-Input Inverters with RFI filter
5) Only on AC-Input Inverters 106 - 170 with HF filter

Table 4-5: Urgent recommended spare parts for GV3000/SE Type AC180 to 360

Part Description	Designation	Position Fig. 4-2	Quantity and Part No. for Type: 180 - 240	305/360
Regulator-card	GVD	1	1 810.90.11	1 810.90.11
PU-Interface-card Fine wire fuses 4 A	PIP (on PIP)	2	1 813.29.00 2 754.02.05	1 813.29.10 2 754.02.05
Driver-card	GBD	3	6 813.37.00	6 813.45.00
Bus Clamp card right- Bus Clamp card left	SNU-R SNU-L	4 5	3 813.28.00 3 813.28.01	-
Bus Clamp card right- Bus Clamp card left	SNV-R SNV-L	4 5	-	3 813.46.00 3 813.46.01
Thyristor Firing Pulse card	FPS	19	1 813.26.00	1 813.26.00
DBU set IGBT-module with driver-card BUA/C 2)	V10	6,7	1 924.93.00	-
Set IGBT-Modul with driver GDA	V1 - V6	8	6 486.60.00	6 486.60.10
Thyristor Module	V11-V13	9	3 135.12.02	3 135.12.02
Surge suppressor unit	MOV 1-4		1 123.43.03	1 123.43.03
DC-Bus Fuse 125 A 200 A	F10-F13	10	4 553.70.05 -	- 4 553.70.07
AC-Line input fuse 800 A	F6-F8	22	-	3 553.33.21
Fuse power supply FPS 16 A	F3-F5	23	3 553.02.07	3 553.02.07

2) Only on AC-Input Inverters with Dynamic Braking Unit DBU

Table 4-6: Further recommended spare parts for GV3000/SE Type AC180 to 360

Part Description	Designation	Position Fig. 4-2	Quantity and Part No. for Type: 180 - 240	305/360
Output Current transformer CFI-card	T1, T2	12	2 249.95.00	2 249.96.00
Earth fault transformer	T4	13	1 251.88.12	1 251.88.12
Choke (motor output) RFI Line filter (extern)	L1,L2,L3	14	3 252.84.30 see chapter 5	3 252.84.40 see chapter 5
HF Line filter 4)		26	1 839.52.20	1 839.52.20
Discharge resistor 1,5 kΩ	R1-R2/R4	16	2 425.09.31	4 425.09.31
Power unit blower DC 24 V	M1-M4	17	4 922.65.00	-
Power unit blower AC 230 V		17	-	1 922.82.00
Blower supply transformer	T5	18	-	1 254.41.00
Keypad		20	1 604.41.00	1 604.41.00

4) Only on AC-Input Inverters with HF filter

Table 4-7: Urgent recommended spare parts for GV3000/SE Type DC240 and DC360

Part Description	Designation	Position Fig. 4-2	Quantity and Part No. for Type: 240	360
Regulator-card	GVD	1	1 810.90.11	1 810.90.11
Sequencing-card	CDA	1	1 813.38.00	-
	CDB	1	-	1 813.38.01
PU-Interface-card	PIP	2	1 813.29.00	1 813.29.10
Fine wire fuses 4 A	(on PIP)		2 754.02.05	2 754.02.05
Driver-card	GBD	3	6 813.37.00	6 813.45.00
Bus Clamp card right-	SNU-R	4	3 813.28.00	-
Bus Clamp card left	SNU-L	5	3 813.28.01	
Bus Clamp card right-	SNV-R	4	-	3 813.46.00
Bus Clamp card left	SNV-L	5		3 813.46.01
Thyristor Firing Pulse card	FPS	19	1 813.26.00	1 813.26.00
Set IGBT-Modul with driver GDA	V1 - V6	8	6 486.60.00	6 486.60.10
DC-Bus Fuse 125 A	F10-F13	10	4 553.70.05	-
200 A			-	4 553.70.07

Table 4-8: Further recommended spare parts for GV3000/SE Type DC240 and DC360

Part Description	Designation	Position Fig. 4-2	Quantity and Part No. for Type: 240	360
Precharge aux. contactor	K1	25	1 604.80.10	1 604.80.10
Precharge contactor	K2	11	1 605.85.23	1 605.85.26
Aux. contact block		11	1 605.27.03	1 605.27.03
Contactor Coil		11	1 606.20.05	1 606.20.07
Output Current transformer CFI-card	T1, T2	12	2 249.95.00	2 249.96.00
Earth fault transformer	T4	13	1 251.88.12	1 251.88.12
Choke (motor output)	L1,L2,L3	14	3 252.84.30	3 252.84.40
Precharge resistor 18 Ω	R6-R13	15	6 750.70.03	8 750.70.03
Discharge resistor 1.5 kΩ	R1-R2/R4	16	2 425.09.31	4 425.09.31
Power unit blower DC 24 V	M1-M4	17	4 922.65.00	-
Power unit blower AC 230 V		17	-	1 922.82.00
Blower supply transformer	T5	18	-	1 254.41.00
Keypad		20	1 604.41.00	1 604.41.00

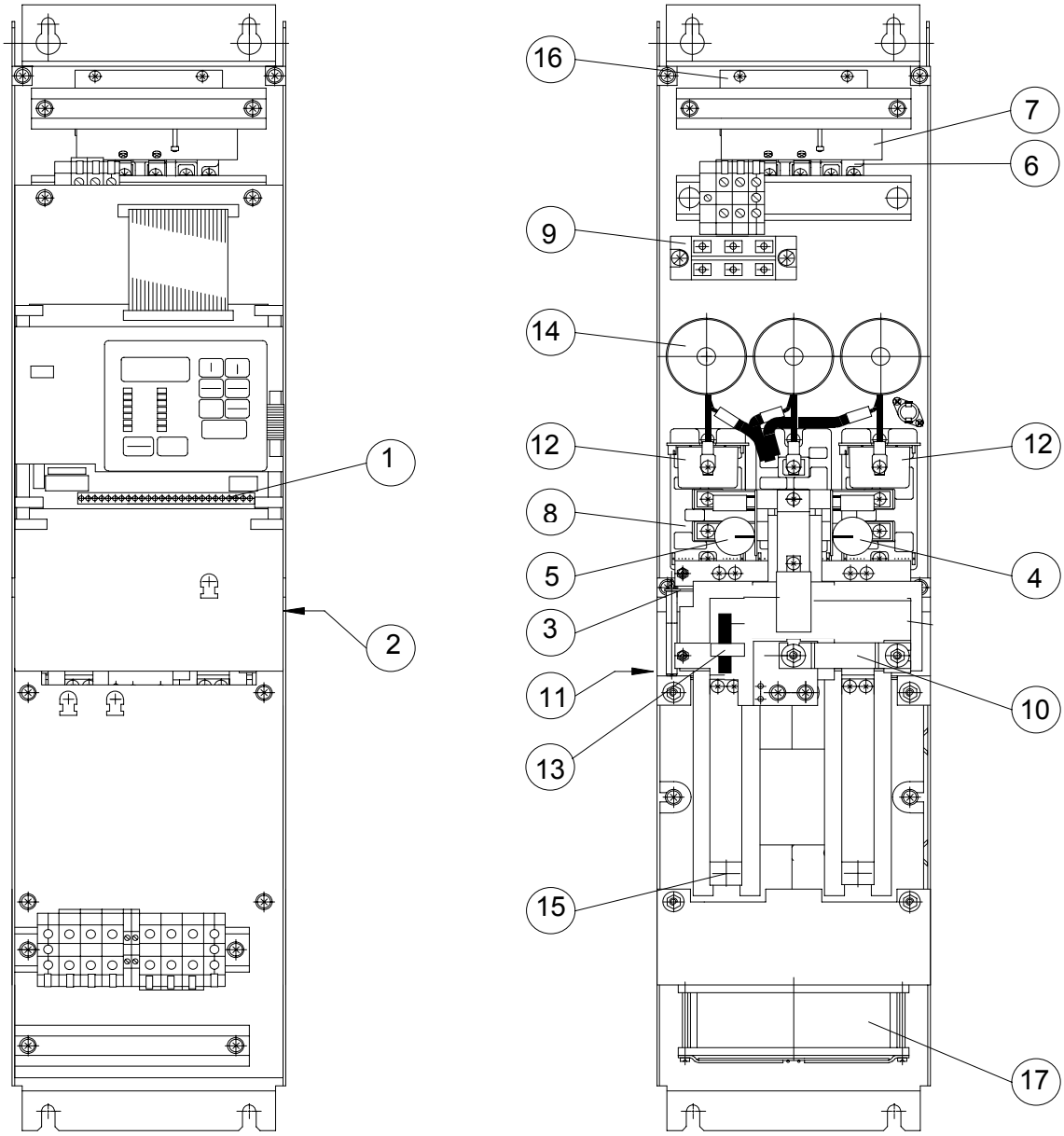


Fig. 4-2a: Arrangement of the replacement parts for GV3000/SE type AC038/043 and 058 to 085. Position numbers are shown in Tables 4-3, 4-4.

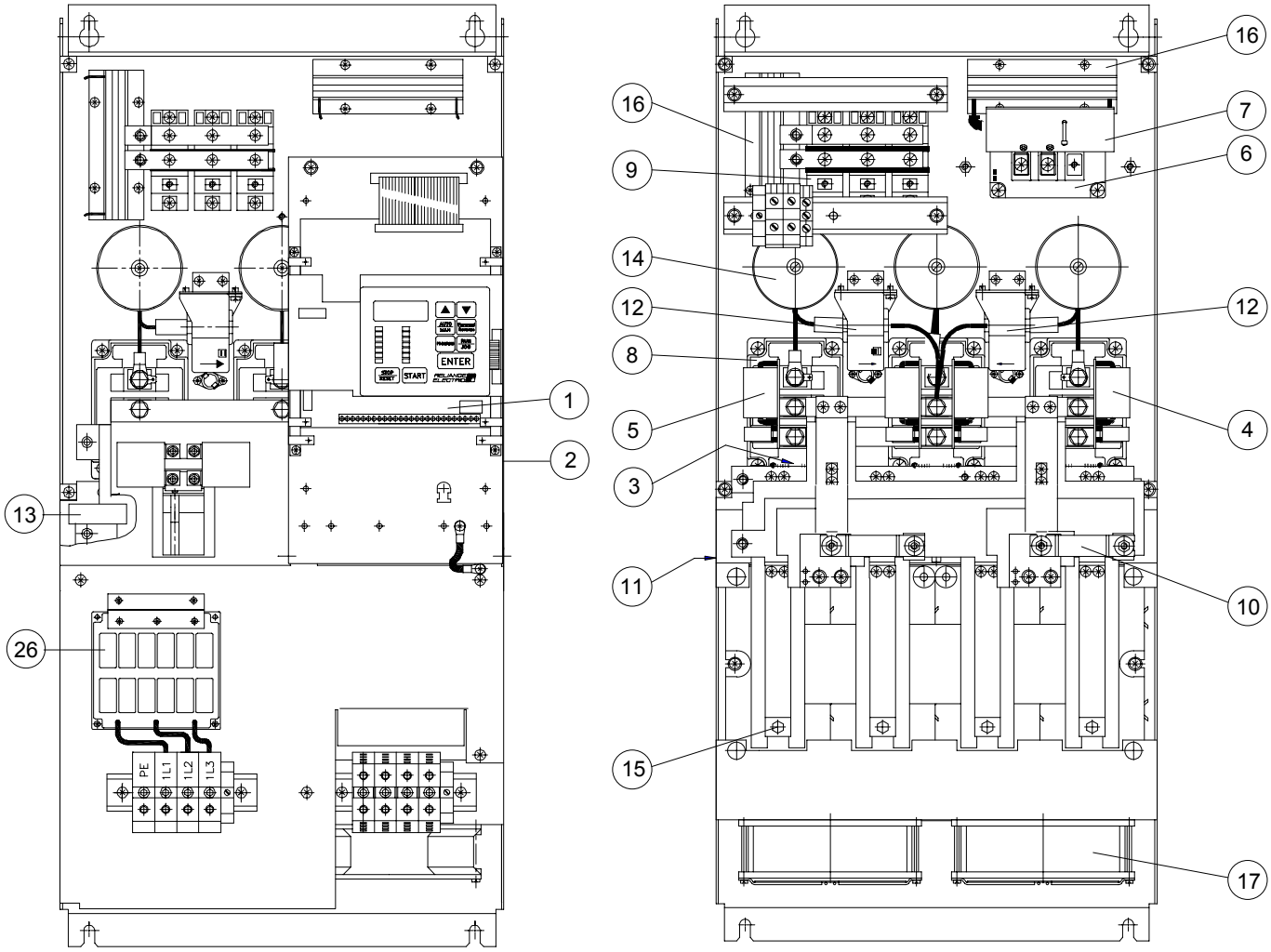


Fig. 4-2b: Arrangement of the replacement parts for GV3000/SE type AC089 to 170.
Position numbers are shown in tables 4-3, 4-4.

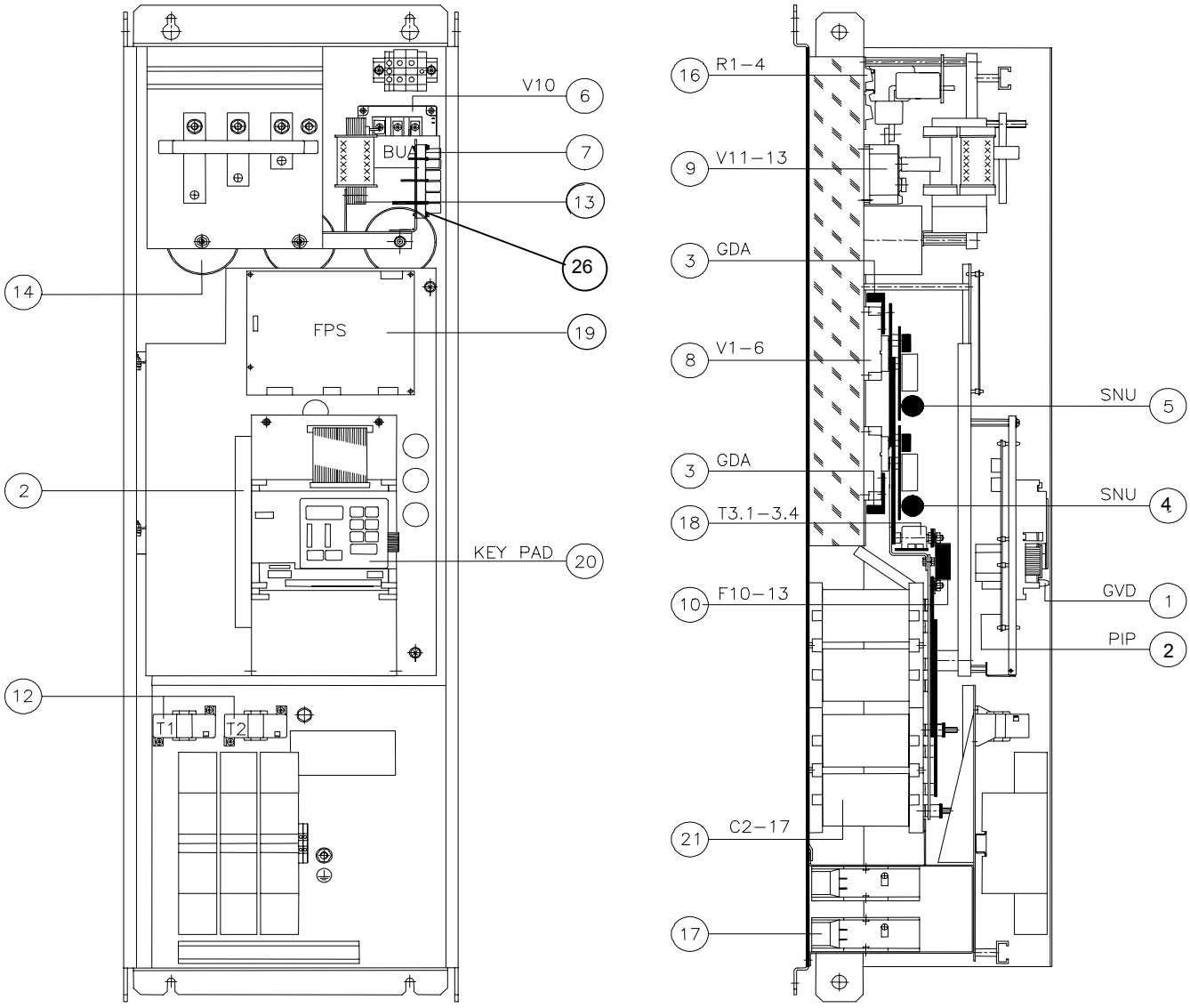


Fig. 4-2c: Arrangement of the replacement parts for GV3000/SE type AC180 to 240 and DC240.
Position numbers are shown in tables 4-5 to 4-8.

Type
DC360

Type
AC305
AC360

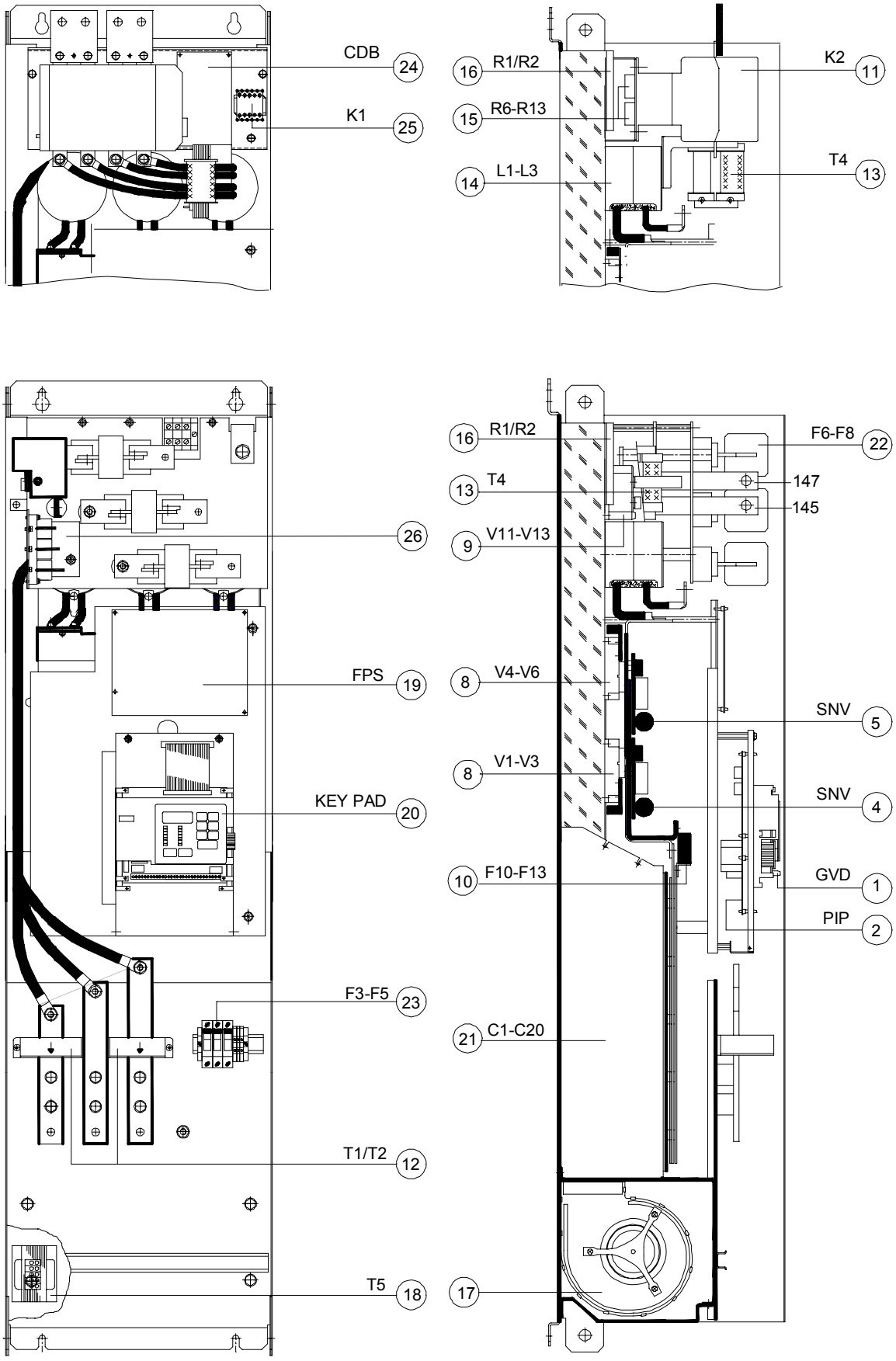


Fig. 4-2d: Arrangement of the replacement parts for GV3000/SE type AC305/360 and DC360.
Position numbers are shown in tables 4-5 to 4-8.

Accessories

Line Reactor

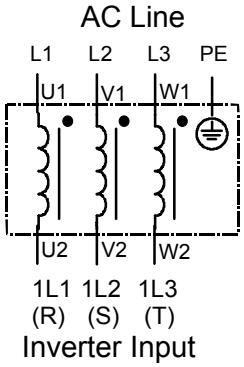
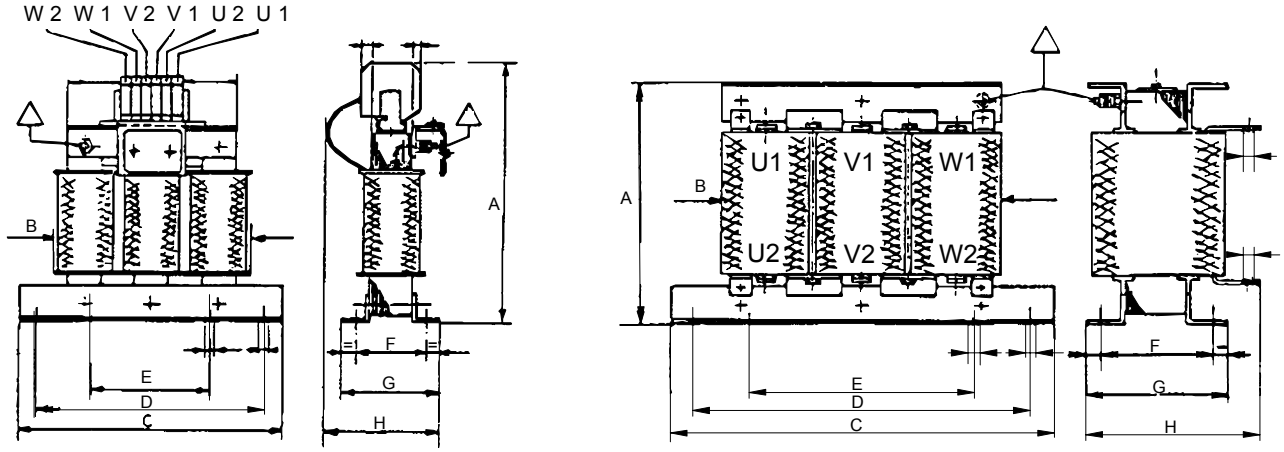


Figure 5-1: Line Reactor Wiring Diagram



(1) (2)

Δ Protection earth connection stud

GV3000/SE Type	Line Reactor Type	Part No.	A	B	C	D	E	F	G	H	Wt. [kg]	P_v [W]	Fig.
002-024	LL-25	252-40-01	190	150	190	170	75	45	67	80	4.7	50	1
030/032	LL-40	252-40-02	185	150	190	170	75	60	72	85	6.5	60	1
038-044	LL-62	252-40-03	210	180	240	210	90	52	72	90	7.8	70	1
058-070	LL-85	252-40-04	160	180	240	210	90	52	72	95	7.8	80	2
085-089	LL-115	252-40-05	160	180	240	210	120	72	93	115	11	90	2
106-140	LL-160	252-40-06	240	260	260	--	240	75	97	170	18	130	2
170-180	LL-210	252-40-07	210	260	260	--	240	75	96	170	26	150	2
210-240	LL-290	252-40-08	210	260	260	--	240	100	116	190	26	170	2
305/360	LL-392	252-40-09	290	320	320	--	300	80	116	220	35	225	2

Figure 5-2: Line Reactor Dimensions (mm), Power Losses (W) and Weight (kg):

AC Line Filter against Conducted High Frequency Disturbances

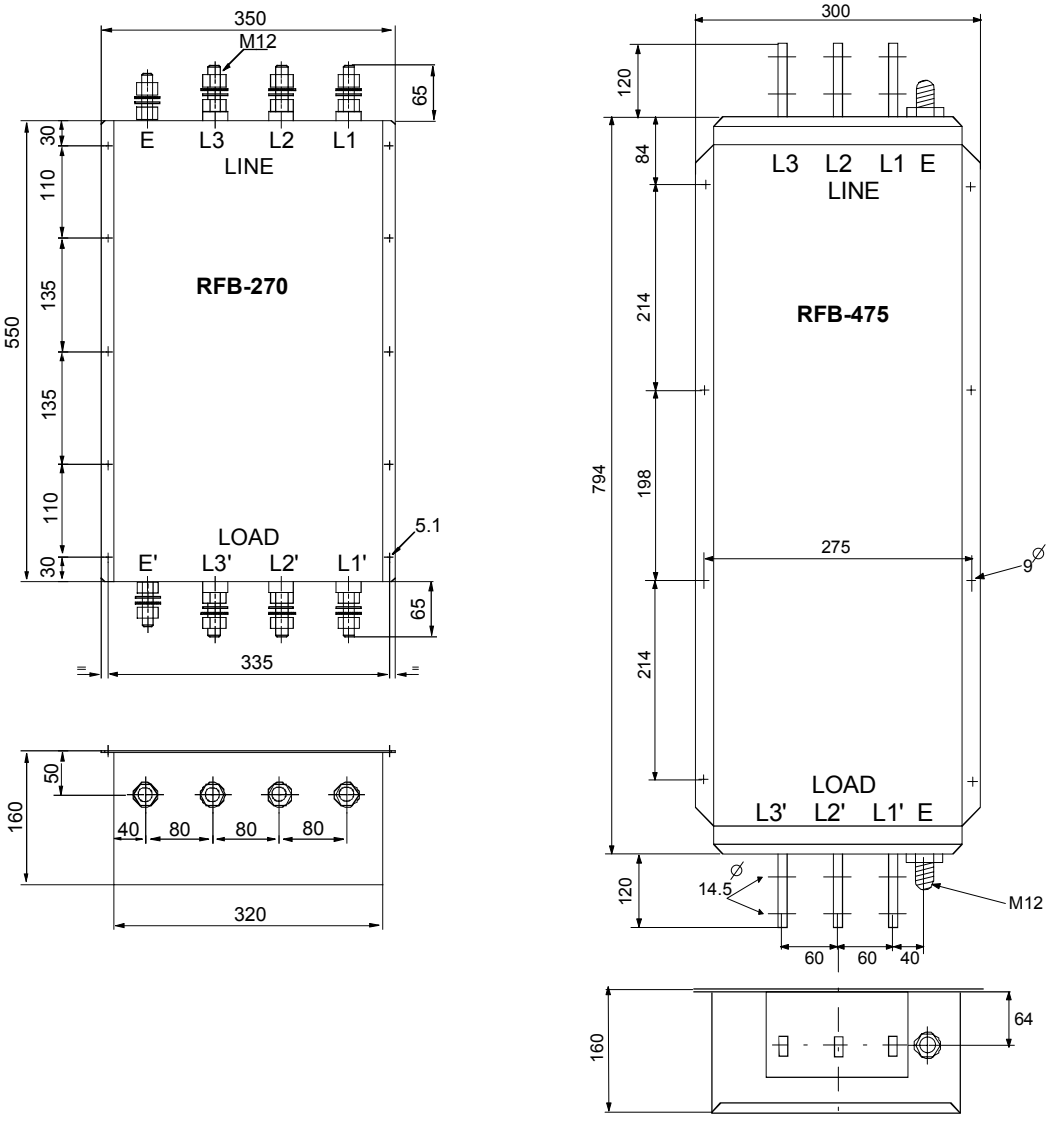
Frequency converters in general cause line disturbances over a wide frequency range.
Through the specified options (built-in HF or Radio Frequency Interference RFI Filter), or correct connection of the adapted external RFI filter, the emissions in the frequency range (150 kHz to 30 MHz) can be kept below the limits for CE-Compliance (refer to Appendix A).

Filter-Selection

Inverter GV3000-	Filter Type	Selection acc. to	Filter Location
E/U-AC003 - 140 (170)	RFI filter	Table 2-8a, 2-8c	Option installed within inverter enclosure
E/U-AC106 - 360	HF filter	Table 2-8d	Option installed within inverter enclosure
E/U-AC170 - 360	RFI filter	Table below	Mounted on a panel close to the inverter *
U-AC002 – 032 (NEMA)	RFI filter	Appendix B	Mounted behind the inverter

* For mounting and installation instructions refer to Appendix A

Ratings, Dimensions of the RFI Filters for Inverters GV3000E/U-AC170 - 360



Inverter GV3000E/U-	Filter Type /	Part No.	Max. operating voltage at 40°C	Weight	Losses	Tightening Torque for Stud
AC170 - 240	RFB-270	839.70.66	500 V	48 kg	28 W	M12: 14-31 Nm
AC305/360	RFB-475	839.72.68	480 V	29 kg	61 W	M12: 14-31 Nm

Figure 5-4: RFI Filter Dimensions (mm) for GV3000E/U-AC170 – 240 and AC305/360

EMC Directive

This inverter device is a component intended for implementation in machines or systems for the capital goods industry. They have been tested to meet Council Directive 89/336 Electromagnetic Compatibility (EMC) and all applicable standards (listed in the technical construction file).
With the specified EMC-filters and the measures as described in this guidelines the GV3000/SE can be operated CE-conform according to **product standard EN 61800-3** as follows:

Emission limits for class A, group 1, in the **first environment,** (public LV supply network)	**GV3000U- AC002 - 032** (with RFI filter) and **GV3000E/U-AC003 - 170** (with RFI filter) **
Emission limits for class A, group 2 class A, group 2* in the **2nd environment** (industrial supply network)	**GV3000E/U-AC002 - 360** (with RFI filter) **GV3000E/U-AC106 - 360** (with HF filter)
Immunity: Performance criteria A in the **2nd environment** (industrial supply network)	**GV3000E/U-AC002 - 360**

** To meet the high frequency emission limits for the first environment, class A, group 1 (public LV supply network) inverters type AC003 - 030, 039/044 must be built into a EMC-tested control cubicle.

The motor cable length has no Influence on EMC-standards, however cable length influences the capacitive earth currents. (see chapter 3, Motor Connection).

CAUTION: The conformity of the drive and filter to any standard does not guarantee that the entire installation will conform. Many other factors can influence the total installation and only direct measurements can verify total conformity. It is therefore the responsibility of the machine manufacturer, to ensure, that the EC-conformity is met.

Disturbances

Conducted, High Frequency Disturbances (0,15 - 30 MHz)

Depending on location - first environment (residential or public low voltage supply network), second environment (industrial supply network) - and inverter rating, different limits are permitted, whereas the practical limit for the first environment is 100 A. For inverters with AC line input current below 100 A, which are located in the first, as well as in the second environment, lower limits are required than for inverters above 100 A in the second environment.

Radiated, High Frequency Disturbances (30 - 1000 MHz)

The radiated disturbances of the inverter will be kept below den limits, if for the installation the same EMV-Measures are taken into account as for the conducted disturbances.

Conducted, Low Frequency Disturbances (Harmonics 0,1 - 2,5 kHz)

Inverters with non sinusoidal AC line input current always generate current harmonics. The degree of disturbances, caused by harmonics, depends not only on the supply network (total Impedance), but also on the relative inverter power.

Voltage harmonics may cause disturbances e.g. in centralized telecontrol systems or other electrical consumers. If high power inverters are connected to low voltage distribution networks with low fault levels, the resulting voltage harmonic content could be claimed by the power supply authority to exceed the permitted values, stated in their regulations.
If the limits of the individual harmonic voltage portions are exceeded, the harmonic currents must be reduced in the supply network e.g. by means of additional line chokes or harmonic filters.

On request Rockwell Automation will provide the harmonics current spectrum generated by each GV3000 or perform a harmonics analysis for the complete installation based on delivered data.

Immunity

Immunity against Conducted and Radiated, High Frequency Disturbances

The GV3000 frequency inverters have been tested to fulfill the Immunity requirement in the first, as well as in the second environment.

Essential Requirements for Conforming Installation

The following items are required for CE conformance:

1. Depending on inverter size and requested emission limit, use of GV3000 version with built-in HF or RFI filter or connection of an external RFI-Filter as specified in Chapter 5, Accessories.
2. If inverter and filter are separately built in a cabinet, they must be mounted on a blank (not painted) galvanized panel with good conductivity.
3. Correct earthing of equipment and cable screens.
4. Output power wiring (drive to motor) must be screened 4-wire cable or run in a separate steel conduit.
5. All control (I/O) and signal wiring must be screened cable or run in a separate steel conduit.
6. On stand-alone inverters in protection class IP20 enclosures the screen of the output power wiring must be connected to the inverter chassis by the use of suitable, EMC-tested cable entry glands.

General Wiring Instruction

Motor Cable

- The cable between inverter/cabinet output and motor shall be 4-wire screened cable as specified in Figure A-1 (three phases and earth conductor green/yellow).
- The screen must be solidly connected to the control cabinets earth busbar or to the earthing stud of the inverter with a large connection area and good conductivity to ensure that the grounding represents a low impedance for HF-signals.
- The screen on the motor side must be solidly connected to the motor housing providing a large connection area with good conductivity.
- If screened cables are not available (limited by the obtainable cross sections) the individual conductors and protective conductors must be run in steel conduits or enclosed metal cable ducts also connected to earth at both ends.
- All the leads shall have the same cross section.
  (earth conductors with cross section. $>16^2$: min. 16^2 or 50% of phase lead)

Analog or Digital Signals (e.g. Incremental Encoder, Reference) and Control Signals (Relays)

These signal leads must be screened cable as specified in Figure A-1.
For the individual conductors twisted pairs are not required.
The screen must be earthed at both ends.

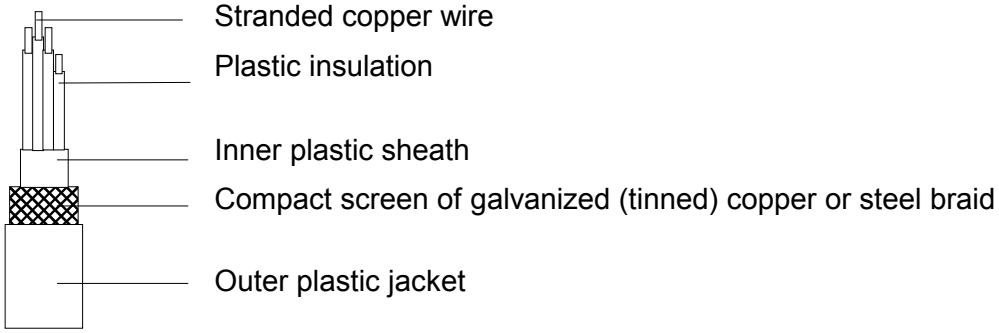


Figure A-1: Specification for screened cable

Cabinet Mounted Inverters (see Figure A-2)

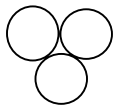
Mounting Instructions

If frequency inverters are mounted in a cabinet, the following rules must be observed:

- The filters must be screwed directly to the panel with the largest possible contact area.
- The support panel for the converters and filters must be a conductive steel sheet, with a common ground busbar at the bottom. This ground busbar, mounted in front of the terminals, must be solidly connected to the panel, ensuring good conductivity.
- All cable screens, entering the cabinet, must be connected to the control cabinets ground busbar. To ensure that the screen of the individual cable is connected solidly and with good conductivity to the ground busbar, galvanized cable brackets as shown in Figure A-2 are recommended. This applies also for coaxial cable, at which only the outer insulation should be removed.

Wiring Instruction for Cabinet Mounted Inverters

- The connections between filter and inverter should be as short as possible!!
  These conductors must be bound together (with tie wrap) forming a triangle in cross section.



- Power and signal leads inside the cabinet must be physically distanced.

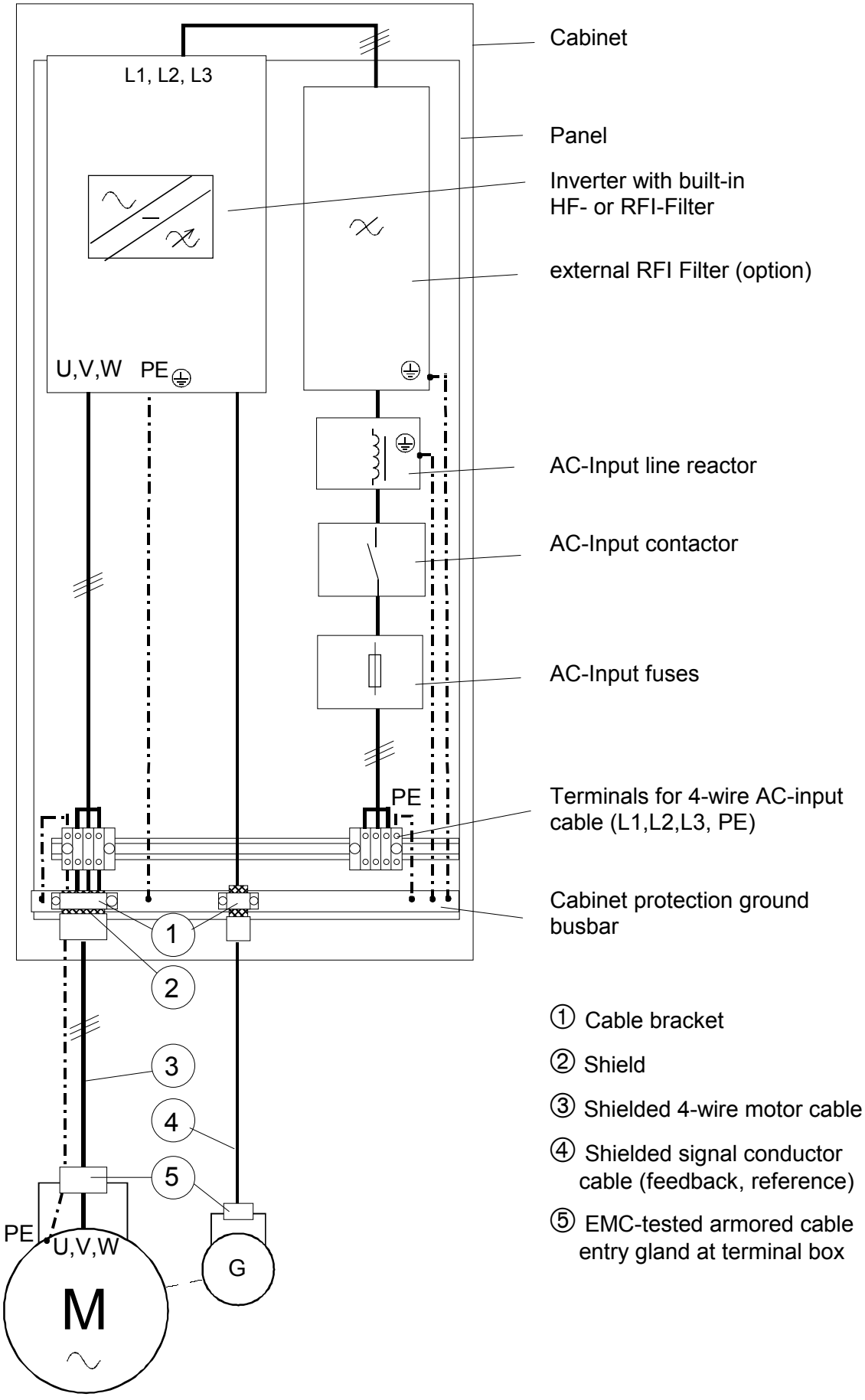


Figure A-2: Example for control cabinet configuration

Installation of Stand-alone Drives in IP20 Enclosure

On stand-alone drives with filters not built-in, the same rules as for cabinets apply.

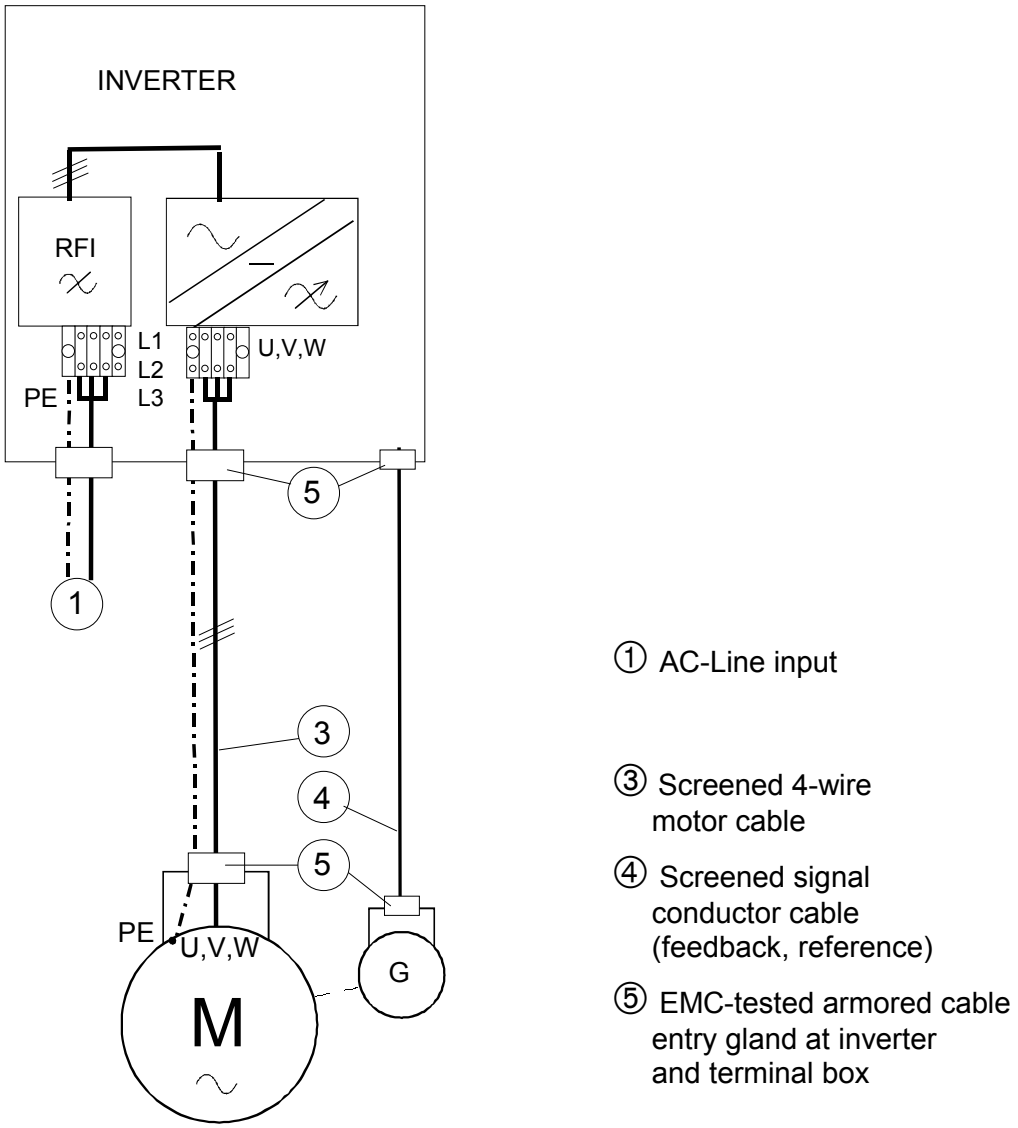


Figure A-3: Example for Stand-alone Drive Configuration

Wiring of Stand-alone Drives

- Inverters GV3000E/U-AC024 - 360 with **built-in RFI-** or **HF-filters** and **NEMA Design, UL/cUL** Inverters GV3000U-AC002 - 032 with **rear mounted RFI filters** must be wired as follows:
  - The blind cable glands must be replaced by EMC-tested cable glands.
  - All wiring, except the line input leads, must be screened cable.
  - The cable screen has to be solidly connected to the enclosure by the use of EMC-tested cable entry glands.
- Inverters **non UL/cUL** GV3000E-AC003 - 015 with **built-in RFI filters** must be wired as follows:
  - All wiring, except the line input leads, must be screened cable.
  - To ensure that the screen of the individual cable is connected solidly and with good conductivity to the ground busbar below the cover, galvanized cable brackets are recommended (screws M3).

Cable Entry Glands

- Use suitable EMC-tested cable entry glands only.
- The conductivity of the screen earth connection is ensured by laying the braid over a plastic cone which will press it to the inner side of the cable entry gland when mounted.
- It is important that the connection area is 360 degree around the cone.
- The cable entry glands provide pull-relief through the cable jacket.

Table A-3: Available Mounting Holes for Cable Entry Glands

Type GV3000...	1 ∅ mm	2 ∅ mm	3 ∅ mm	4 ∅ mm
U-AC002 - 009	22.2	22.2	22.2	-
U-AC012 - 015	22.2	22.2	22.2	22.2
U-AC023 - 032	22.2	27.8	27.8	27.8
E-AC024/030	16	29	29	29
E-AC039/044	16	38	29	38
E-AC038/043, 058 - 085	29	47	47	37
E-AC106 - 170	29	60	60	47

Hole ∅ mm	Cable entry gland
16	PG 09
22.2	
27.8	
29	PG 21
38	PG 29
47	PG 36
60	PG 48

F = Input power via RFI filter
M = Motor cable
S = Signal / control cable
B = Braking resistor (option)

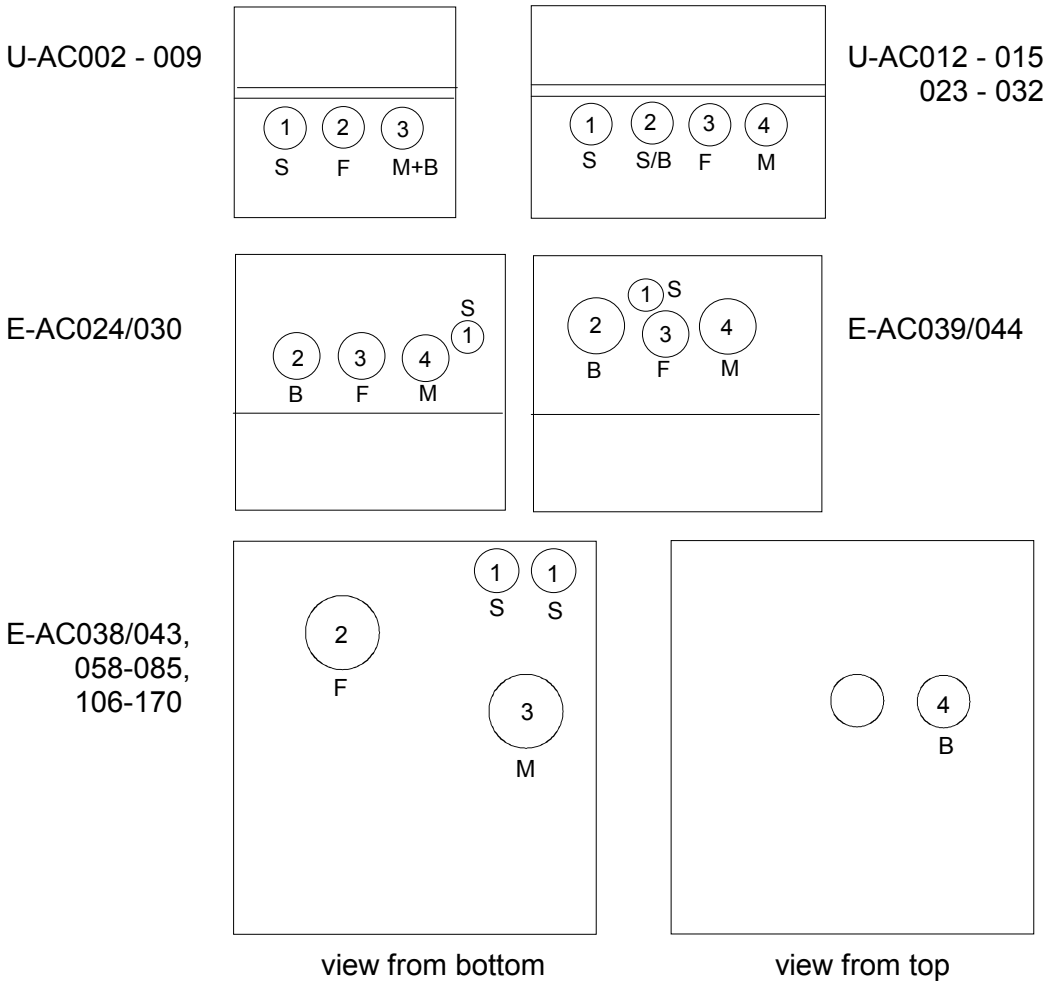


Figure A-4: Layout and dimensions of mounting holes for cable entry glands

NEMA Design Inverters, 2 to 32 A

SPECIFICATIONS

Input Power Ratings

- Line input voltage three phase, with earthed star-point and protection earth conductor PE
  Range ..... AC 340....506 V
  Tolerance limits related to standard line voltage..... 380 V -10% (= 340 V)
  460 V +10% (= 506 V)
- Line frequency ..... 48...62 Hz
- AC-Line distribution capacity (Maximum)..... 25 kA
  (e.g. supply transformer 460 V, 1000 kVA with 8% impedance)

  If the permissible fault current is exceeded, an externally mounted line input choke must be provided.
  For external line fuses the maximum ratings must be provided. (refer to Table B-1)
- Modulation..... sine wave pulse width modulation PWM

DC-Bus Circuit

- Precharge time ..... < 0.5 s
- discharge time to < 50 V..... typical 60 s

Table B-1: Line Input Current and Branch Circuit Protection Fuses

Inverter Type 1)	AC-Input Current with Choke 2)	External Fuse 3) nominal	External Fuse 3) maximum
AC002	3 A	6 A	25 A
AC004	5 A	10 A	
AC006	7 A	16 A	
AC009	10 A	16 A	
AC012	13 A	25 A	40 A
AC015	16 A	25 A	
AC023	24 A	40 A	50 A
AC032	32 A	50 A	

1) The Inverter type is defined by the rated output current I_{nom}

2) AC-Line input current (RMS) is depending on total line impedance.
For choke selection with part No. and dimensions see chapter 5, Accessories.

3) Recommended type of the external input fuse:
AC-Line input: Branch circuit protection fuse, e.g. IEC 269-1/gG, EN 60269-1, VDE 0636/gL, UL Class J, or equivalent.
b) DC-Bus input: Semiconductor protection fuse, 660 V or 750 V, super fast, e.g. A70P500, VDE 0636/aR, or equivalent.

Power Loss

Table B-2: Power Loss at Full Load on Types 002 to 032

GV3000U-AC...	002	004	006	009	012	015	023	032
Power Loss Watt at rated current	60	100	140	180	210	250	375	600

Service Conditions

For temperature and ambient relative humidity as well as air pollution and installation altitude refer to Table 2-3.

Degree of protection IP20 or IP54 (NEMA 4/2)

Connections
For connection terminals with maximum wire sizes and tightening torques refer to Table 2-4

Inverter Selection

Example for a complete type designation as it occurs on the inverter name plate:

GV3000U-AC032-AA-DBT defines a frequency converter
of the **GV3000**/SE series, from US production with **NEMA** Design **UL, cUL** and **CE** approval,
AC-Input, **32** Amp rated current, **AA** (enclosure type IP20), with **DBT** (DC-bus terminals).

Table B-3: Selection of NEMA Design Inverters GV3000U-AC002 - 032 for Motors 0.37 upto 15 kW

TECHNICAL DATA					SPECIFICATION NUMBERS					
TYPE GV3000U-	INVERTER NOM. CURRENT (2 kHz)		MOTOR-NOM.-POWER at 400 VAC		VERSION with DC-BUS TERMINALS IP54 / IP52 * (3)			VERSION with DC-BUS IP20 * (3)		
	V/Hz	Vect.	V/Hz	Vect.	Type	Part No.	Model No.	Type	Part No.	Model No.
AC002-	2.1	2.1	0.75	0.75	AF-DBT	896.00.70	1V4460	AA-DBT	896.00.80	1V4160
AC004-	3.5	3.4	1.5	1.5	AF-DBT	896.02.70	2V4460	AA-DBT	896.02.80	2V4160
AC006-	5.8	5.3	2.2	2.2	AF-DBT	896.03.70	3V4460	AA-DBT	896.03.80	3V4160
AC009-	8.2	8.2	4	4	AF-DBT	896.05.70	5V4460	AA-DBT	896.05.80	5V4160
AC012-	11.5	11.1	5.5	5.5	AJ-DBT	896.06.70	7V4260	AA-DBT	896.06.80	7V4160
AC015-	14.2	13.9	7.5	7.5	AJ-DBT	896.07.70	10V4260	AA-DBT	896.07.80	10V4160
AC023-	21.0	21.0	11	11	AJ-DBT	896.08.70	15V4260	AA-DBT	896.08.80	15V4160
AC032-	30.4	30.4	15	15	AJ-DBT	896.09.70	25G4260	AA-DBT	896.09.80	25G4160

* see different versions as illustrated in Figure 2-1 (Number in brackets represents illustration number)

Table B-4: Output Current Ratings Based on Fundamental/Carrier Frequency for Open Loop (V/Hz) Selection

Unit Type GV3000U	Identification Code in Param. P.099	Stock No.	Motor Power kW at 400 V, 2 kHz	Switching Frequency 2 kHz		Switching Frequency 4 kHz		Switching Frequency 8 kHz	
				I nom. A	I max %	I nom. A	I max %	I nom. A	I max %
AC002	4.001	896.00.x0	0.75	2.1	110	2.1	110	2.1	110
AC004	4.002	896.02.x0	1.5	3.5	110	3.5	110	3.5	110
AC006	4.003	896.03.x0	2.2	5.8	110	5.8	110	5.8	110
AC009	4.005	896.05.x0	4	8.2	110	8.2	110	8.2	110
AC012	4.007	896.06.x0	5.5	11.5	110	11.5	110	11.5	110
AC015	4.010	896.07.x0	7.5	14.2	110	14.2	110	14.2	110
AC023	4.015	896.08.x0	11	21.0	110	21.0	110	21.0	110
AC032	4.025	896.09.x0	15	30.4	110	30.4	110	30.4	110

x = Options variant

Remark:
- 110% continuous output current can be achieved.
- Identification Code: first digit represents Input Voltage (3 or 4 = 380-460V), following digits represent horsepower rating of the inverter.

Table B-5: Output Current Ratings Based on Fundamental/Carrier Frequency for Closed Loop (Vector) Selection

Unit Type GV3000U	Identification Code in Param. P.099	Stock No.	Motor Power kW at 400 V, 2 kHz	Switching Frequency 2 kHz		Switching Frequency 4 kHz		Switching Frequency 8 kHz	
				I nom. A	I max %	I nom. A	I max %	I nom. A	I max %
AC002	4.001	896.00.x0	0.75	2.1	150	2.1	150	2.1	150
AC004	4.002	896.02.x0	1.5	3.4	150	3.4	150	3.4	150
AC006	4.003	896.03.x0	2.2	5.3	150	5.3	150	5.3	150
AC009	4.005	896.05.x0	4	8.2	150	8.2	150	8.2	150
AC012	4.007	896.06.x0	5.5	11.1	150	11.1	150	11.1	150
AC015	4.010	896.07.x0	7.5	13.9	150	13.9	150	13.9	150
AC023	4.015	896.08.x0	11	21.0	150	21.0	150	21.0	150
AC032	4.025	896.09.x0	15	27.0	150	27.0	150	27.0	150

x = Options variant

Remark:
- Duty cycle 150% overload for 1 minute every 10 minutes.
- Identification Code: first digit represents Input Voltage (3 or 4 = 380-460V), following digits represent horsepower rating of the inverter.

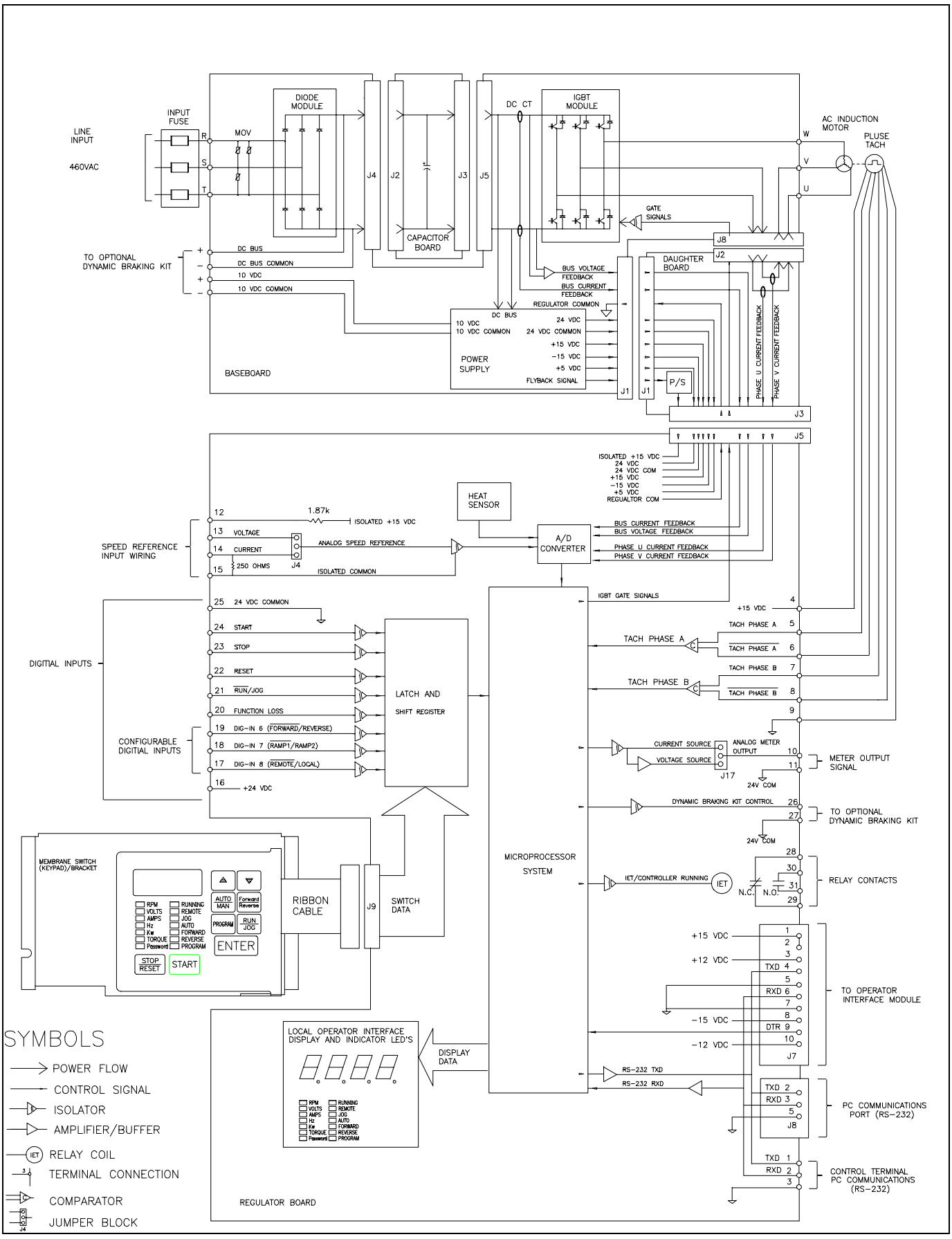


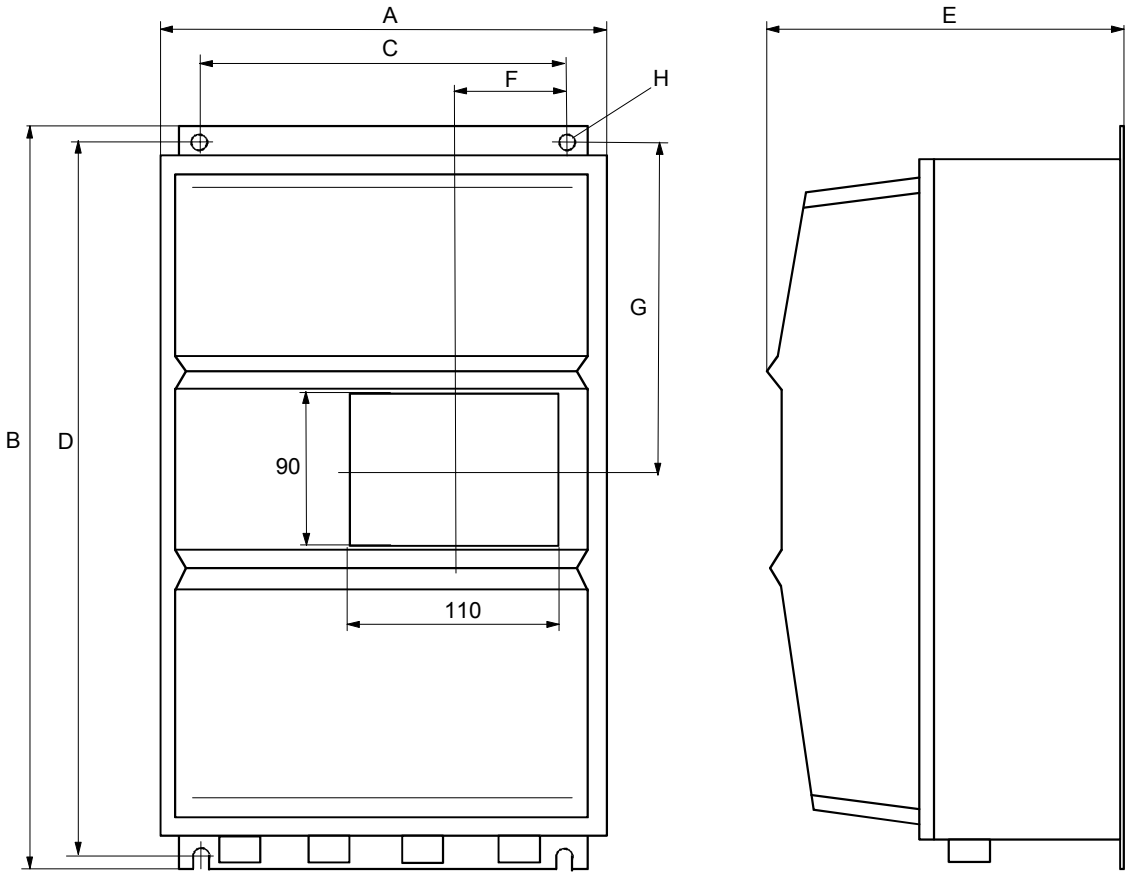
Figure B-1: Typical System Block Diagram, Type GV3000U-AC002 to 032

Power Connection Terminal Designations

Wiring diagram example Figure 3-1 applies also for the NEMA Design Inverters Type 002-032 with the following exceptions:

	Type 002-023	Type 032
Input Power	R, S, T	L1, L2, L3
Output Power	U, V, W	T1, T2, T3
Ground	GND	GND

Dimensions



Type GV3000U-	A	B	C	D	E	F	G	H	Weight
AC002 - 009	222	281	198	254.3	200	72	108	7∅	7 kg
AC012 - 015	281	339	248	309	200	77	130	9∅	9 kg
AC023 - 032	288	463	223	442	238	89	160	11∅	16 kg

Figure B-2: Dimensions (mm) of the NEMA Design Inverters Type GV3000U-AC002 - 032

SPARE PARTS

Only original spare parts according to the following tables should be used.

Table B-6a: Replacement Parts List for NEMA Design Inverters Type GV3000U-AC002 to 015

Part Description	Part Number	Quantity per Type					
		002	004	006	009	012	015
Regulator Card	810.90.50	1	1	1	1	1	1
Current Feedback Card	756.06.00 756.06.01 756.06.02	1 - -	1 - -	 1 -	 1 -	 - 1	 - 1
Fan Assembly Internal	758.90.11	1	1	1	1	1	1
Fan Assembly	758.90.13	-	-	1	1	2	2
Keypad	604.41.00	1	1	1	1	1	1

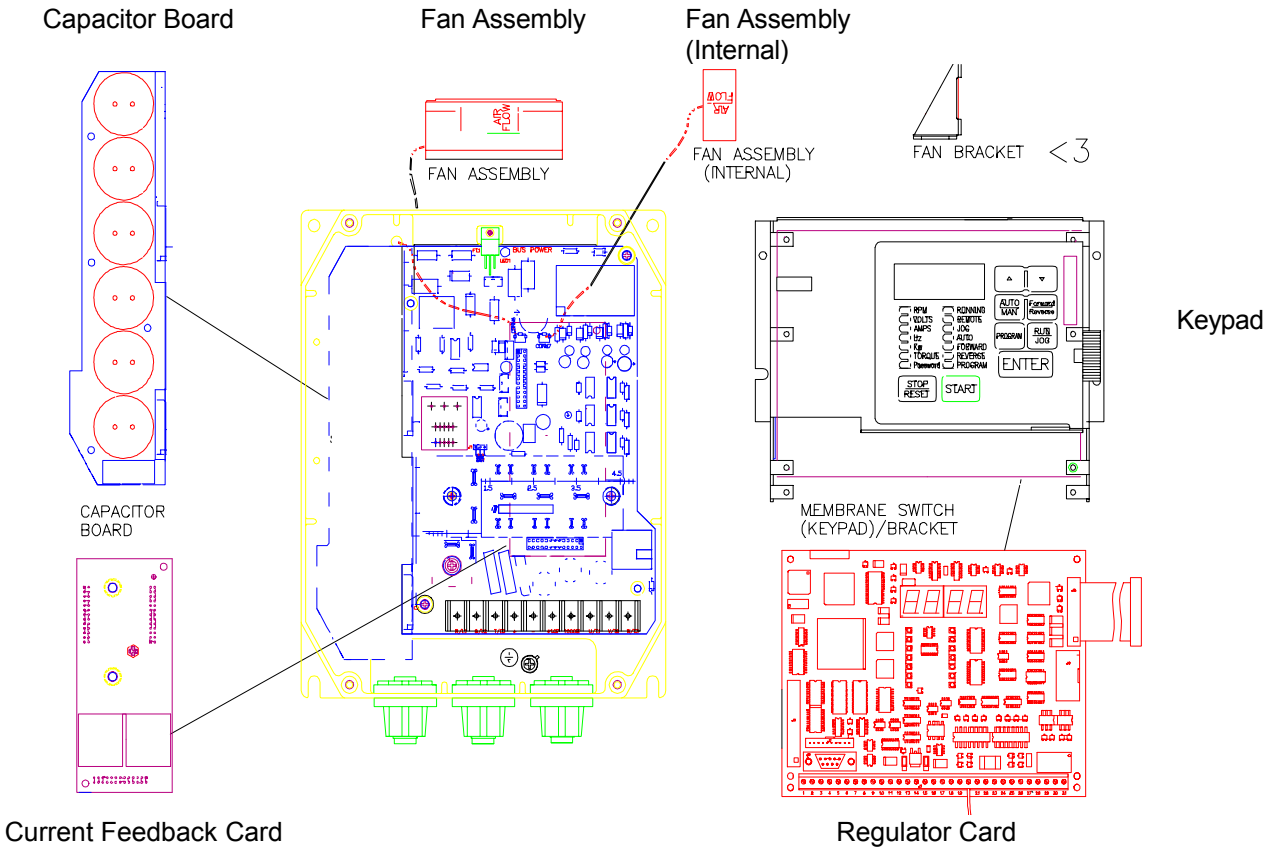


Fig. B-3a: Replacement parts locations for NEMA Design Inverters Type GV3000U-AC002 to 015

Table B-6b: Replacement Parts List for NEMA Design Inverters Type GV3000U-AC023 and 032

Part Description	Part Number	Quantity per Type	
		023	032
Regulator Card	810.90.50	1	1
Power Board	756.06.04	1	1
Power Supply Card	756.06.05 756.06.06	1 -	- 1
Gate Driver Card	756.06.03	1	1
Fan Assembly Internal	758.90.12	1	1
Fan Assembly	758.90.13	2	2
Keypad	604.41.00	1	1

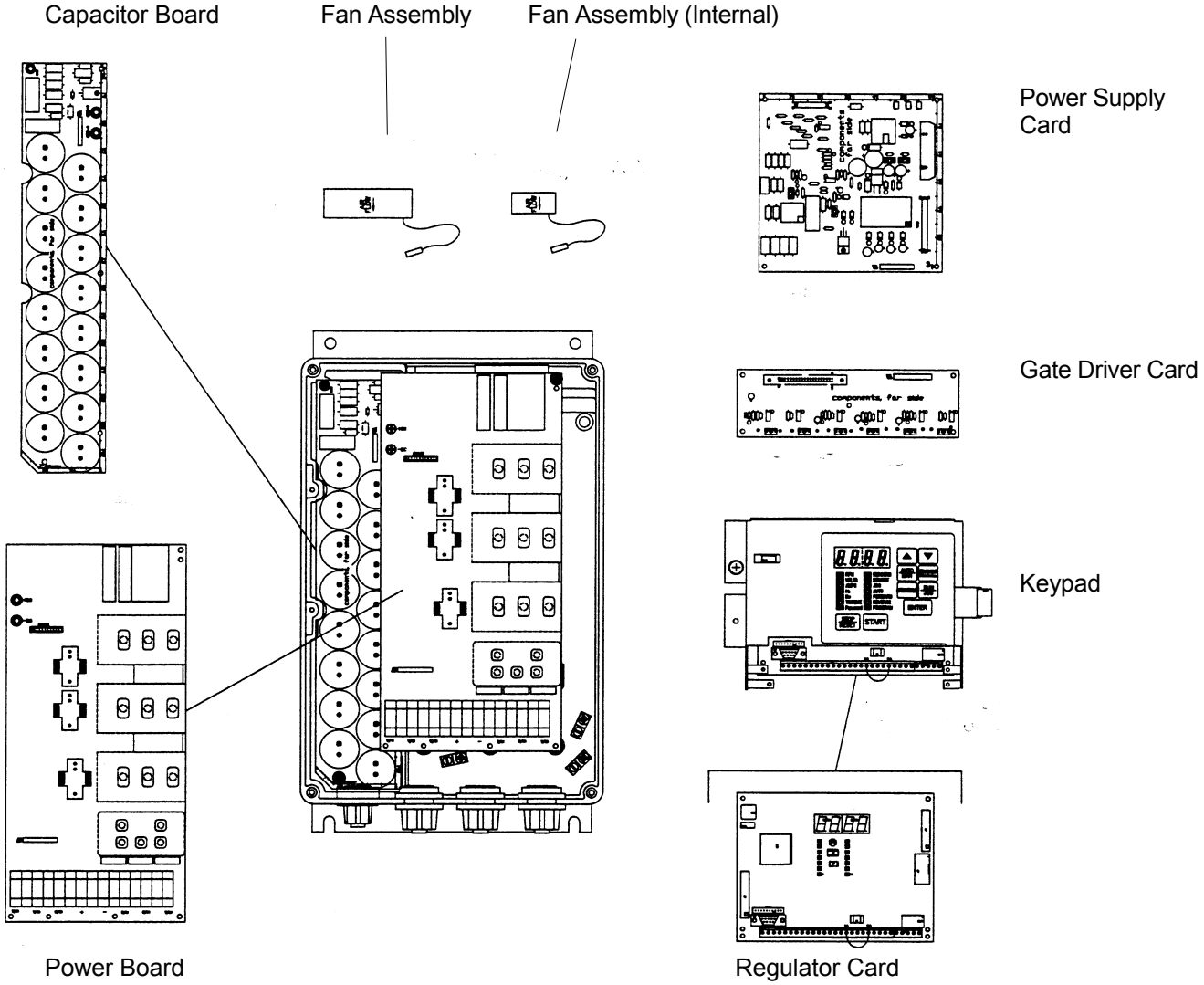
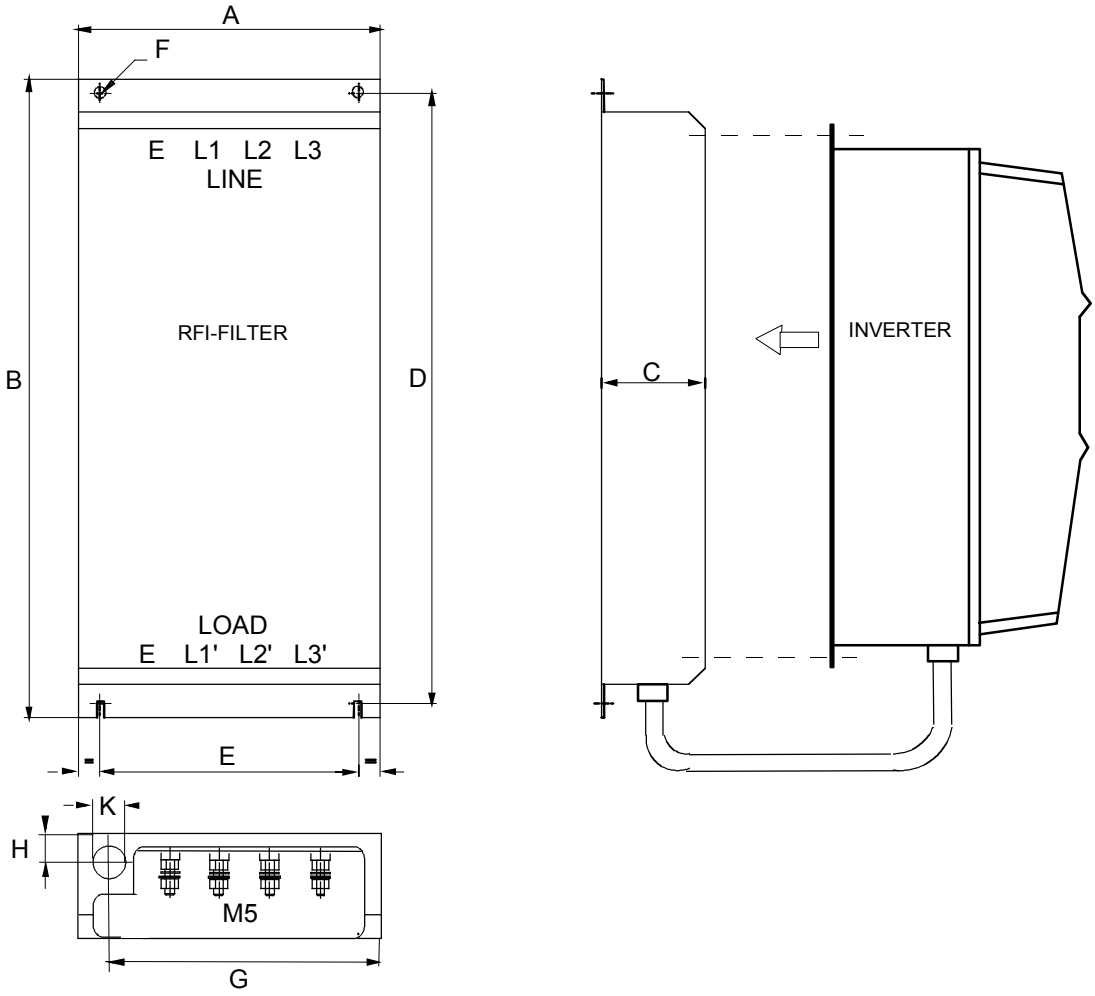


Fig. B-3b: Replacement parts locations for NEMA Design Inverters Type GV3000U-AC023 and 032

RFI Filters for NEMA Design Inverters Type GV3000U-AC002 - 032

Maximum operating voltage: 500 VAC at 40°C
Power loss: 45 W



GV3000U-Type	Filter Type	Part No.	I_n [A]	A	B	C	D	E	F	G	H	K	Weight [kg]
AC002-009	RFB-22-A	839.51-10	22	217	387	53	362	174	7	180	18	22	2.5
AC012-015	RFB-22-B	839.51-12	22	272	450	53	415	230	7	231	18	22	3.2
AC023-032	RFB-38	839.51-14	38	272	575	94	550	232	7	235	43.5	22	3.2

Figure B-4: Filter Dimensions (mm) and Weight (kg) for Types (NEMA Design)

Mounting

The GV3000/SE inverter must be mounted upon the filter with the provided screws (4 x M6).
The provided leads with flexible conduit for the connections between filter output and inverter input ensure very short lead length. Furthermore the filter needs no additional area in the cabinet.

Cross Reference List
Part Numbers - Catalogue Numbers

This appendix provides a cross reference lists for part numbers of the GV3000 Inverters with options and associated Rockwell Automation catalogue numbers and Reliance US-Model Numbers.
Part numbers without catalogue numbers are spare parts. (Refer to Tables 4-1 to 4-6).

Table C-1 - Cross Reference List

Part Number	Catalogue Number	US-Model-Number
896.01.11	GV3000E-AC003-AA-DBU	31ER4060
896.02.11	GV3000E-AC004-AA-DBU	38ER4060
896.03.11	GV3000E-AC005-AA-DBU	55ER4060
896.05.11	GV3000E-AC008-AA-DBU	85ER4060
896.06.11	GV3000E-AC012-AA-DBU	126ER4060
896.07.11	GV3000E-AC015-AA-DBU	150ER4060
896.08.11	GV3000E-AC024-AA-DBU	240ER4060
896.09.11	GV3000E-AC030-AA-DBU	300ER4060
896.01.31	GV3000E-AC003-AA-DBU-RFI	31ET4060
896.02.31	GV3000E-AC004-AA-DBU-RFI	38ET4060
896.03.31	GV3000E-AC005-AA-DBU-RFI	55ET4060
896.05.31	GV3000E-AC008-AA-DBU-RFI	85ET4060
896.06.31	GV3000E-AC012-AA-DBU-RFI	126ET4060
896.07.31	GV3000E-AC015-AA-DBU-RFI	150ET4060
896.08.31	GV3000E-AC024-AA-DBU-RFI	240ET4060
896.09.31	GV3000E-AC030-AA-DBU-RFI	300ET4060
896.00.70	GV3000U-AC002-AF-DBT	1V4460
896.02.70	GV3000U-AC004-AF-DBT	2V4460
896.03.70	GV3000U-AC006-AF-DBT	3V4460
896.05.70	GV3000U-AC009-AF-DBT	5V4460
896.06.70	GV3000U-AC012-AJ-DBT	7V4260
896.07.70	GV3000U-AC015-AJ-DBT	10V4260
896.08.70	GV3000U-AC023-AJ-DBT	15V4260
896.09.70	GV3000U-AC032-AJ-DBT	25G4260
896.00.80	GV3000U-AC002-AA-DBT	1V4160
896.02.80	GV3000U-AC004-AA-DBT	2V4160
896.03.80	GV3000U-AC006-AA-DBT	3V4160
896.05.80	GV3000U-AC009-AA-DBT	5V4160
896.06.80	GV3000U-AC012-AA-DBT	7V4160
896.07.80	GV3000U-AC015-AA-DBT	10V4160
896.08.80	GV3000U-AC023-AA-DBT	15V4160
896.09.80	GV3000U-AC032-AA-DBT	25G4160
896.14.80	GV3000U-AC089-AA-DBT	50R4160
896.14.91	GV3000E-AC089-AA-DBT-RFI	50T4160
896.15.80	GV3000U-AC106-AA-DBT	75R4160
896.15.91	GV3000E-AC106-AA-DBT-RFI	75T4160
896.18.80	GV3000U-AC210-AA-DBT	125R4160

Table C-2 - Cross Reference List

Inverters GV3000U-AC242 - 477 (NEMA Design UL/cUL, CE) not covered by this manual

Part Number	Catalogue Number	US-Model-Number
-	GV3000U-AC241-AA-DBT	200V4160
-	GV3000U-AC302-AA-DBT	250V4160
-	GV3000U-AC361-AA-DBT	300V4160
-	GV3000U-AC414-AA-DBT	350V4160
-	GV3000U-AC477-AA-DBT	400V4160
GV3000E Options		
814.56.00	RMIE	2SI3000
814.58.00	IBSG	2NB3000
814.60.00	PDPG	2PB3000
814.56.10	RMIE	2SI3000E
839.70.66	RFB-270	2DF4125

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Rockwell Automation

Sept. 2001

RELIANCE ELECTRIC

GV3000/SE Regulator
Software-Version 6.0

Instruction Manual

Firmware P/N: 790.46.00 / 790.51.60

User Manual: 49‘1329e (10)

Rockwell Automation

.

1: REGULATOR OVERVIEW ..... 1 - 1 to 1 - 2

Regulator Description ..... 1 - 1
Parameter Overview ..... 1 - 1
Regulator Options ..... 1 - 2

2: USE OF OPERATORS MANUAL ..... 2 - 1 to 2 - 1

Structure of the Documentation ..... 2 - 1
Danger, Warning, and Caution ..... 2 - 1

3: USING THE GV3000/SE KEYPAD ..... 3 - 1 to 3 - 7

Overview ..... 3 - 1
Program Mode ..... 3 - 4
Program, Enable/ Disable ..... 3 - 5
Monitor Modes ..... 3 - 6
Accessing, Reading and Clearing Faults in the Error Log ..... 3 - 7

4: GENERAL PARAMETERS, DESCRIPTION ..... 4 - 1 to 4 - 40

Introduction to Parameters ..... 4 - 1
Types of Parameter Groups ..... 4 - 1
Regulator Reference Block Diagram ..... 4 - 2
General Parameters, First Menu List ..... 4 - 3
General Parameters, Second Menu List ..... 4 - 8

5: V/HZ MODE REGULATION MODE ..... 5 - 1 to 5 - 16

V/Hz Regulation Mode ..... 5 - 1
V/Hz Regulation Overview Diagram ..... 5 - 2
V/Hz Regulation Mode Parameters ..... 5 - 3
Start the Controller at V/Hz Regulation Mode ..... 5 - 12
Start-up Check List ..... 5 - 12
Test Equipment ..... 5 - 13
Programming of Parameters for Application ..... 5 - 13
Preparation for 'V/Hz Identification Request' ..... 5 - 13
Basic Controller Checks ..... 5 - 15
Final Adjustments ..... 5 - 16

6: VECTOR MODE REGULATION ..... 6 - 1 to 6- 28

Vector Regulation Mode Description ..... 6 - 1
Vector Regulation Overview Diagram ..... 6 - 2
Vector Regulation Mode Parameters ..... 6 - 3
Start the Controller at Vector Mode Regulation Mode ..... 6 - 22
Start-up Check List ..... 6 - 22
Test Equipment ..... 6 - 23
Programming of Parameters for Application ..... 6 - 23
Preparation for 'Vector Mode Self-Tuning' ..... 6 - 24
How to Stop the Procedure 'Self-Tuning' ..... 6 - 25
What happens if a Fault occurs during 'Self-Tuning' ..... 6 - 25
Basic Controller Checks ..... 6 - 26
Tuning the Speed Regulator ..... 6 - 27
Final Adjustments ..... 6 - 28

7: TROUBLE SHOOTING USING ERROR CODES ..... 7 - 1 to 7 - 9

Troubleshooting ..... 7 - 1
Spare Parts ..... 7 - 1
Test Equipment ..... 7 - 1
General Explanatory Notes ..... 7 - 1
Preparatory Instructions ..... 7 - 1
Troubleshooting using Error Codes ..... 7 - 2
Verify DC Bus Voltage ..... 7 - 3
Identifying Alarm Codes ..... 7 - 3
Identifying Fault Codes ..... 7 - 4
How to Access and Read the Results from Self-Tuning ..... 7 - 7
To Access the Self-Tuning Result Code ..... 7 - 7
How to Access and Read the Results from V/Hz Identification Procedure ..... 7 - 8
To Access the V/Hz Identification Procedure Result Code ..... 7 - 8
Recovering from Fatal Fault Codes ..... 7 - 9

8: PARAMETER QUICK REFERENCE GUIDE ..... 8 - 1 to 8 - 7

General Parameters ..... 8 - 1
V/Hz Regulator Parameters ..... 8 - 5
Vector Regulator Parameters ..... 8 - 6

General Notes

SW-Version This manual is valid for Regulator Software Version 6.0 and 6.6.
The number can be read in Parameter P.098.

Regulator Description

For GV3000/SE features refer to leaflet GV3000-BR-01-EN available at Rockwell Automation Sales offices.

The GV3000/SE (Enhanced) controller is user selectable in its performance:
- General purpose control, ideal for a broad range of industrial applications, is performed by **V/Hz control mode** using low cost standard AC motors,
- High performance is provided by **Vector control mode** using AC motors with encoder.

V/Hz Mode: The variable motor speed is achieved by outputting a frequency and the appropriate motor voltage in open loop control. The PWM signal is produced by software to switch output modules achieving three phase motor voltage at requested frequency. A constant ratio of voltage to frequency (V/Hz) provides generally a constant motor torque (low speeds need more voltage to compensate for motor losses). A function generator calculates the motor voltage based on requested frequency and user selected drive load characteristics.

Vector Mode: The GV3000/SE controller is a high performance, variable speed AC controller. It provides either closed loop flux- vector control operation (FVC) with speed feedback provided by an encoder or Sensorless vector control operation (SVC). The GV3000/SE provides high performance regulation of motor speed, torque and direction.

Drive operation is either performed through the front panel/keypad, from remote devices wired to the controller terminal block, PC, or one of several serial communication boards.

Parameter settings are accomplished through entry at the local keypad, or PC.

Digital displays of SPEED, Volts, Amps, Hz, kW, Torque, Speed Reference, and Drive Status are available by selecting the desired MONITOR mode. Keypad operation is defined in Section 3.

Parameter Overview

Refer to Sections 4 to 6 for parameter descriptions, Section 8 for Parameter Quick Reference Guide. Parameter lists are arranged by subject and parameters are numbered according to their specific task in the controller software configuration. Three (3) parameter subject lists are accessible by the user:

P - General Controller parameters:

First Menu Short List:	P.000 - P.006	
Second Menu List:	P.007 - P.099	2nd list with password enabled by Parameter P.006

H - V/Hz parameters only: H.000 - H.022

U - Vector parameters only: U.000 - U.048

r - RMI option parameters : r.001 - r.066 only if RMI option card is mounted.

For r-parameter description please refer to RMI-Manual 49’1330

Power unit and application specific adjustments

Refer to the section 6, for parameter description of H.017 to adjust the charging type and DC-Bus behavior. On vector mode the selection is not possible but it is usable for DC and AC supplied units without adjustment.

Regulator Options

The operating and application features of the GV3000/SE units can be enlarged with various options.

Operator Interface Module OIM

The OIM allows you to:

- Access and change drive parameters, which tune the drive, scale the inputs and outputs, program drive limits, and configure remote interfaces
- Operate the drive
- Review and clear the faults
- Review active alarms
- Monitor drive outputs such as motor speed and motor current
- View text in English, German, French, Spanish, or Italian

RMI Card (Remote Meter Interface Card)

This card has three isolated analog outputs for displaying output and one isolated analog input.
In addition, the card also has 4 programmable digital outputs, 4 digital inputs and 3 relay outputs.

For digital reference there is a frequency input available.

AutoMax Network Communication Card (Network Drop)

This card allows the GV3000/SE controller to be operated and monitored via the AutoMax network.

InterBus, Profibus DP, DeviceNet and ControlNet Communication Cards

These cards allow the GV3000/SE controller to be operated and monitored via the standardized Fieldbus networks.

CS3000 Software, PC-Man Machine Interface (MMI)

The CS3000 software (set with Diskettes 3,5" and Instruction manual) is a tool you can use for developing drive configurations on your personal computer.

The CS3000 software provides the capability to:

- Create, store, upload, download, and print drive configurations.
- Monitor drive status
- Monitor and change drive parameters using a personal computer.
- Control the drive (start, stop, etc.)
- Compare a configuration in the drive with one in the personal computer.
- Read and reset the drive fault/alarm log.

Power Module Options

For Controller Options please refer to GV3000/SE Power Unit manual:

Line Filter, Dynamic Braking Unit (Chopper), Regenerating Unit REO

Structure of the Documentation

The handbook is summed up of the two instruction manuals:

- Manual GV3000/SE Power Units
- Manual GV3000/SE Regulator

A complete GV3000/SE documentation will contain the following manuals:

Manuals	Number
GV3000/SE Power Units	49'1327
GV3000/SE Regulator	49'1329
GV3000/SE Optional Cards RMI Remote Meter Interface Interbus Communication Profibus DP Communication AutoMax Network Communication DeviceNet Communication ControlNet Communication	 49’1330 49’1333 49’1355 D2-3308 MAN0096-03 D2-3390
CS3000 PC-Man Machine Interface MMI	49’1307
GV3000/SE Remote OIM	D2-3342

For Regulator card stock number and for other spare part information refer to Instruction Manual 49'1327 "GV3000/SE Power Units".

DANGER, WARNING, AND CAUTION

DANGER, WARNING, and CAUTION point out potential trouble areas.

All three of these forms are enclosed in a box to call attention to them.

A **DANGER** alerts a person that high voltage is present which could result in severe bodily injury or loss of life.

A **WARNING** alerts a person of potential bodily injury if procedures are not followed.

A **CAUTION** alerts a person that, if procedures are not followed, damage to, or destruction of equipment could result.

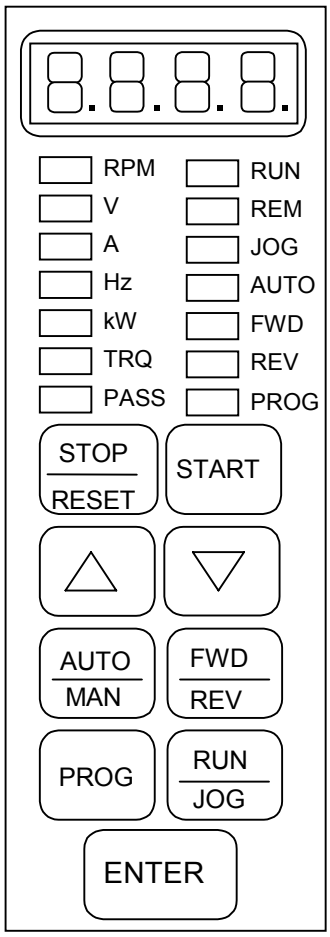
WARNING*:* The built-in Stop function (control input at terminal 23 or 20) must not be used as an emergency stop circuit. To inhibit uncontrolled machine operation in case of the malfunction of the drive, the user must provide an external emergency stop circuit, which ensures disconnection of the power source from the motor.
This safety circuit must be hardwired with electro-mechanic components and shall not depend on electronic logic or software. The stopping device (e.g. mushroom head pushbutton) must be accessible to the operator.
Failure to observe this precaution could result in bodily injury or loss of life.

Overview

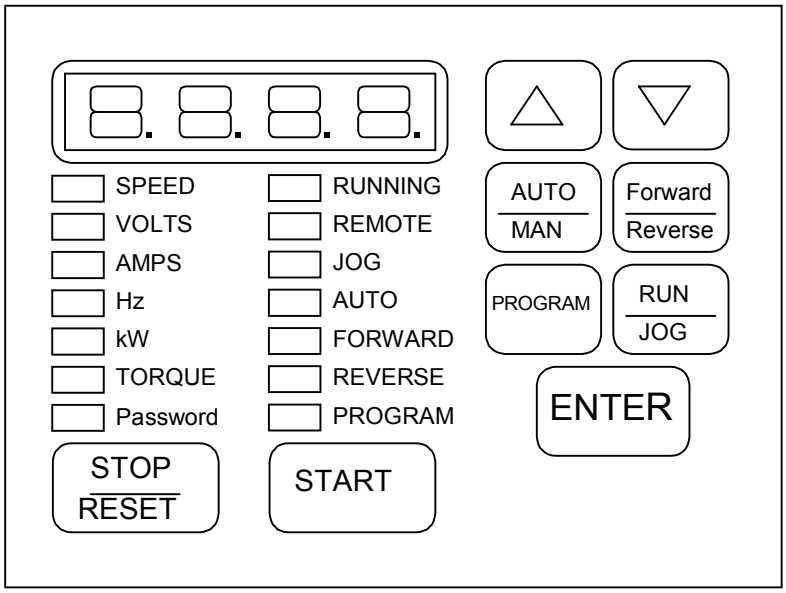
The operator's station KEYPAD is an user's tool to

Display	various drive status and technical data (as frequency, voltage, current, power, etc.),
Program	parameter values, either viewing only, or changing values,
Fault	handling, either clearing faults or looking at error log,
Control	drive via buttons START, STOP/RESET, RUN/JOG, FORWARD/REVERSE, AUTO/MANUAL, FASTER/SLOWER.

The KEYPAD is factory mounted in the inverter.
External mounting for example in a control desk is not supported.



Type 003-030, 039/044



Type 038/043 and 058-360

Fig. 3-1: Layout of the Keypad / Display

Commands at control source LOCAL:

NOTE: In the following description the designations of the keys and LED's are related to the Keypad of inverters 038/043 and 058-360. On the Keypad for inverters 003-030, 039/044 some designations are in short form.

The drive's keypad has nine (9) membrane keys that are used to monitor, program, and control the drive.

STOP / RESET	1. **Stops drive**, regardless of selected control source (P.000) LOCAL, REMOTE, or other future sources. Refer to P.025 for STOP Type ('Coast-to-rest' or 'Controlled Stop') 2. Resets fault, after cause has been removed.

Important: The STOP/RESET key can be disabled by P.055. See the P.055 parameter description for more information.

AUTO / MANUAL

The AUTO/MAN key is used to switch between the manual speed reference from the keypad and the auto reference based on the selected control source.
See the description of the AUTO LED for more information.
If the control source is changed, the AUTO/MAN selection may be automatically changed also. When the control source is changed to OP or rE, the AUTO/MAN selection will be forced to AUTO. If the control source is changed to LOCL or SErL, the AUTO/MAN selection will be forced to MANUAL.
However, if the control source is changed from either LOCL or SErL to either SErL or LOCL, the AUTO/MAN selection will not be changed.
NOTE: *This key is not active if the control source is SErL.*

WARNING

When switching from AUTO to MANUAL, or MANUAL to AUTO, the drive will ramp to the reference level provided by the new source at the rate specified in P.001 (Accel Time 1), P.002 (Decel Time 1), P.017 (Accel Time 2), or P.018 (Decel Time 2). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

ENTER

The ENTER key is used to:
- Display a parameter (or a selection) value in program mode
- Save a value
- Move through each monitor display item when in monitor mode

PROGRAM

Start / Exit of PROGRAM mode (changes the PROGRAM LED)

JOG / RUN

Selects at LOCAL either RUN or JOG mode. (only if LED 'RUNNING' is off)
If LED 'JOG' energised, then JOG mode is active.
If LED 'JOG' dark, then RUN is active.
If drive is active (at RUN or JOG), then LED 'RUNNING' is energised.

FORWARD / REVERSE

Selects rotation direction at LOCAL.
Viewing motor drive end: FORWARD = CW rotation,
(for european motors) REVERSE = CCW rotation.
Conditions: Phase sequence U,V,W at Inverter corresponds with U,V,W at motor.
For rotation inversion see sections 4, 5 and 6.

△

▽

The UP and DOWN arrow keys are used to:
- Step through the drive parameter menus and error log when the keypad/display is in program mode.
- Increase (or decrease) a numeric value (such as the reference or a parameter value).

Holding down these keys will increase the scroll speed.

START

Drive starts at RUN or JOG mode.

Note: To activate START, press START key / apply START command for a minimum of 1 second.

If drive is started on V/Hz mode, but software variables holding 'Identification' procedure result are zero (no 'Ident Request' was activated so far) the error code 'nId' will be displayed. In this case reset fault, perform 'Ident.' procedure (refer to Section 5). Restart drive after successful result.

Status-Display : All LED's in vertical row from 'RUNNING' at top to 'PROGRAM' at bottom, and 'Password' display drive status.

■ RUNNING:	On	Output power is being applied to the motor.
■ REMOTE:	On	The drive is being controlled (i.e., START, RUN/JOG, FORWARD/ REVERSE, Speed Reference) from a source other than the keypad. Refer to P.000 for Control Source.
	Off	The drive is being controlled from the keypad
■ JOG:	On	Jog mode active (RUN mode not active)
■ AUTO:	On	The drive is receiving its speed reference from the terminal strip input or network option.
	Off	The drive is receiving its speed reference from the local keypad or serial port (OIM or CS3000), i.e., using a manual reference.
■ FORWARD:	Flashing	The requested motor direction is forward; the actual motor direction is reverse (REVERSE LED is on).
	On	The motor is running in the forward direction.
	Off	The motor direction is not forward .
■ REVERSE :	Flashing	The requested motor direction is reverse; the actual motor direction is forward (FORWARD LED is on).
	On	The motor is running in the reverse direction.
	Off	The motor direction is not reverse.

NOTE: *If the speed reference is zero (0), pressing the FORWARD/REVERSE key (or toggling the FWD/REV input) will not alter the state of the FORWARD or REVERSE LEDs.*

■ PROGRAM:	On	Keypad mode PROGRAM is active to display and change parameter values.
■ Password:	On	Parameters cannot be modified from the keypad without entering the correct password into P.051 (Programming Disable). See section 4.2, Ensuring Program Security, for more information. Note that disabling program changes by means of P.051 will not prevent parameter changes being made from the serial port or the network.
	Off	Parameters can be modified from the keypad.

Keypad Monitor Mode LEDs: (LED PROGRAM is off)

6 LED's in vertical row with SPEED at top to TORQUE at bottom indicate physical units of displayed data.

■ SPEED	: Motor speed	in RPM	(Refer to P.028)
■ VOLTS	: Motor voltage	in Volts	(Refer to H.000, U.007)
■ AMPS	: Motor current	in Amps	
■ Hz	: Output Frequency	in Hz	
■ kW	: Active power	in kW	
■ TORQUE	: Motor output torque	in %	(at Vector mode only)

If 5 LEDs or more are on: The selected speed reference (in P.028) or torque reference is displayed (If the SPEED LED is off, the reference value is negative)

If all LEDs are off: Local setpoint reference in Hz (V/Hz) or RPM (Vector)

Program Mode

To View or Change Parameters in the First Menu List (General Parameters P.000 - P.006)

	Action	Display / Notes
1.	To enter PROGRAM mode: **Press the PROGRAM key**	Display shows 'P.---' (or the last active parameter group or 'Err") and the **PROGRAM LED is lit**.
2.	If the display does not show 'P.---', move the ⇑ or ⇓ key until it does.	
3.	Press the ENTER key.	Display shows 'P.000', first parameter number in "First Menu General Parameter List".
4.	Press ⇑ or ⇓ key to move through the first menu list containing parameters P.000 - P.006.	⇑ key: Display shows 'P.000', 'P.001' etc.
5.	Once the desired parameter is displayed, press the ENTER key.	Display shows the parameter "value".
6.	Press the ⇑ key to increase the value, or the ⇓ key to decrease the value.	
7.	Press the ENTER key to enter the value. (or go to 9. to leave the old value)	Note*: The value will not be retained into memory unless the ENTER key has been pressed.*
8.	Go to the next parameter number, and so on.	
9.	**Press the PROGRAM key, to exit** the PROGRAM mode.	The **PROGRAM LED goes OFF**.

To View or Change Parameters in the Second Menu List (General Parameters P.007-P.099)

In order to access the "Second Menu General Parameter List" or H... at V-Hz, resp. U... at Vector, or r... with RMI, you must go to P.006 "Second Menu Password Value" and enter your password value:

1.	**To Enter the Password for Second Menu List:** Start as described above. Call up P.006.	PROGRAM LED is ON. Display shows 'P.006'
2.	Press the ENTER key.	Display shows value '0' of P.006.
3.	Press ⇑ or ⇓ key until display shows Second Menu Enable password value '**0107**'.	Display shows '0107'. (Holding down the ⇑ or ⇓ key will increase scroll speed).
4.	Press the ENTER key to enter the value.	Password has been entered. Display: 'P.006'.
5.	Press PROGRAM key. Press ⇑ or ⇓ key to select either 'P.---' or 'H.---' or 'U.---' (or 'r---') param. list or error log 'Err'.	Display shows selectable parameter list 'P.---' or 'H.---' or 'U.---' (or 'r---') or error log 'Err'.
6.	Press the ENTER key to select requested parameter list.	Display shows parameter '_.000' of selected group or error log 'Err'.
7.	**Press PROGRAM key, to exit** PROGRAM mode.	The **PROGRAM LED goes OFF**.

Programming Enable / Disable

Programming of parameters can be disabled by accessing Parameter P.051 "Programming Disable". Note: Similar to a hardware ON/OFF switch, you need to repeat the following steps to then "re-enable" programming. If the display indicates 'LU' fault, the programming of parameters is inhibited.

To Disable Programming on Local Keypad:

	Action	Display / Notes
1.	Follow instructions for "To View or Change Parameters in Second Menu List"	LED 'Password' : **OFF** = Programming **Enabled**, **ON** = Programming **Disabled**.
2.	Access 'P.051' on the display.	Displays shows 'P.051'.
3.	Press ENTER key.	Displays shows value '0' of 'P.051'
4.	Press keys ⇑ or ⇓, until value '0026' is displayed.	Displays shows value '0026' of 'P.051'
5.	Press ENTER key to enter value.	Displays shows 'P.051'. LED 'Password' : **ON** = Programming **Disabled**. The ability to change parameter values has been disabled.

To Enable Programming:

1. to 4.	As above !	As above !
5.	Press ENTER key to enter value.	Displays shows 'P.051'. LED 'PASSWORD' : **OFF** = Programming **Enabled**. The ability to change parameter values has been enabled.

MONITOR modes

Press the PROGRAM key until the PROGRAM LED distinguishes.

To Select a MONITOR mode:

Note: If you have just powered up, you are already in the MONITOR mode. One of the LED's SPEED to TORQUE is ON (last mode before powering down is restored), and the PROGRAM LED is OFF. Simply press the ENTER key to move from PROGRAM mode to MONITOR mode. Each MONITOR mode LED will light (SPEED, VOLTS, AMPS, etc.) when you have entered that mode.

	Action	Display / Notes
1.	If the PROGRAM LED is still ON, press the PROGRAM key until PROGRAM LED goes off.	4-Digit Display shows '0' and LED SPEED goes ON.
2.	Press the ENTER key.	Each time the ENTER key is pressed, the display shows the current MONITOR mode real-time value if in RUNNING mode. The appropriate MONITOR mode LED lights when the MONITOR mode is activated.

To View the SPEED REFERENCE monitor mode

The SPEED REFERENCE from the selected control source can be viewed as follows:

	Action	Display / Notes
1.	Enter MONITOR mode.	4-Digit Display shows '0' and LED SPEED is lit.
2.	Press the ENTER key until you move through all MONITOR modes, and all five or six MONITOR mode LEDs are lit.	

Note:

If P.000 is selected to **LOCAL** with **MANUAL** mode (Auto LED is OFF) the local setpoint speed reference output is displayed, which can be varied by pressing ⇑ or ⇓ keys in the range of Minimum Speed in P.003 to Maximum Speed in P.004.

With **AUTO** mode (Auto LED is ON) the selected speed reference is displayed, either

- Analog input signal (connected to regulator terminal block) using Offset (P.009) and Gain (P.010),

- MOP speed reference output, or

- Activated reference of Preset Speeds (set in up to 8 parameters, P.031 to P.038).

To View or change Local Setpoint Reference

(PROGRAM LED is off):

	Action	Display / Notes
1.	Press keys ⇑ or ⇓	All six Display LEDs are off 4-Digit Display shows local setpoint.
1.	Press keys ⇑ or ⇓	Value increase/decrease
2.	Press the ENTER key	Exit display local setpoint.

Reset Fault:

An error may be reset by pressing the STOP/RESET key while that error is flashing. (This will not clear an individual error from the log. Only the total error log can be cleared.)

Reset the flashing fault: Press the STOP/RESET key. The display will show '0' in monitor mode, if resetting was successful.

If the fault is still flashing and occurred again, remove the cause of the fault and press again the STOP/RESET key.

Accessing, Reading, and Clearing the Faults in the Error Log

The following procedure shows how to access and clear the error log. Note that a single error entry in the log cannot be cleared. The entire log, including all the fault codes and the day and time stamp of each fault, will be cleared simultaneously using this procedure.

	Action	Display / Notes
1.	Press the PROGRAM key.	The First Menu General parameters **P.---** are displayed. The PROGRAM LED goes on.
2.	Press the ⇓key until Err is displayed.	Display shows **Err**.
3	Press the ENTER key.	If no faults have occured, Err will be displayed again. If only one fault has occurred, the fault code will be displayed as the first entry in the log. If more than one fault has ocurred, the first entry on the display is the latest fault that occurred and has the highest number.
4	Press keys ⇑ or ⇓	The display steps through the error log entries, which are numbered **0** through **9** (maximum).
5	Press the ENTER key.	The display shows **117** - the day stamp, which can range from 0 to 248 days.
6	Press the ⇓ key.	The display shows **22.17** - the time stamp, which is based on a 24-hour clock. Use the arrow keys to move between the day and time data.
7	Press the PROGRAM key, which displays the error log entries again.	The display shows the error log entry viewed prior to or associated with the time stamp
8	Repeat steps 4 though 7 for each additional error log entry to view the time and date for each error log entry.	
9	When you have viewed all the entries, you should clear the error log. Press the ⇓ key, while you are viewing any entry in the log, until the display shows **CLr**.	
10	Press ENTER to clear the error log. All entries will be cleared.	**Err** will be displayed again to indicate that the log is empty.
11	Press the PROGRAM key to access monitor mode.	The PROGRAM LED goes OFF.

Introduction to Parameters

The GV3000/SE software allows access to many parameters that are adjustable by using the keypad. The factory preset values will suit a wide range of applications. To configure the controller for a specific application, you must bring up each appropriate parameter on the display and adjust as necessary.
This Section 4 provides the description and detailed information necessary for designing applications for commonly used P.xxx parameters for both V/Hz and Vector modes. Indicated default values are the European type (Refer to P.049, Country Defaults).
Section 8 provides a complete lists of available parameters, and their European type factory preset values. It also provides space to check off, or enter values as they are modified for record keeping.

Parameter Types

There are three types of parameters:

- **Configurable:** These parameters can only be adjusted or changed while the drive is stopped.
- **Tunable:** These parameters can be adjusted or changed while the drive is running or stopped.
- **Read only:** These output variables are read only, cannot be adjusted.

Each parameter is described in detail. The following information is provided for each parameter:

Parameter Number: The unique number assigned to a specific parameter. The number is preceded by either P, H, U or r to identify it as a General, Volts/Hertz, Vector or optional RMI parameter, respectively. The parameter number is displayed on the drive's keypad/display.

Parameter Name: The name assigned to a parameter number. The parameter name is not displayed when programming drive using the keypad/display. The parameter name is only visible when using the CS3000 software or Operator Interface Module (OIM).

Parameter Description: A description of the parameter's function.

Parameter Range: The pre-defined parameter value limits or selections.

Default Setting: The factory default setting.
Parameter Type: Identifies whether the parameter is Tunable, configurable, or read only.
Refer also to parameters: A list of associated parameters that may provide additional or related information.

Parameter Lists

Various types of parameter lists are foreseen for 2 different regulation types and optional equipment.

'**P**.xxx' : **General Parameters**, commonly used for both types the V/Hz and Vector regulation.
They range from
P.000 to P.006 in a 'Short List' or 'First Menu', accessible to the operator, and
P.007 to P.099 in a 'Long List' or 'Second Menu', available via password entering into P.006.
P.051 can be used to disable/enable parameter programming as a safety feature.
Toggling of programming enabling/disabling is available via password entering.

'**H**.xxx' : **V/Hz Mode Parameters**, (range: H.000 to H.022) available via password entering into P.006.

'**U**.xxx' : **Vector Mode Parameters**, (U.000 through U.048) available via password entering into P.006. These parameters are used only for vector applications and are displayed if UEC is selected in parameter P.048. Unless specified, all vector parameters are used for both flux vector control (FVC) and sensorless vector control (SVC) operation.

'**r**.xxx' **RMI option parameters**, (range: r.001 to r.066) available if RMI option card is connected via password entering into P.006. Refer to RMI-Manual 49'1330.

For parameter verification and programming, and password entry refer to Section 3 of this manual.

WARNING

It is the users responsibility to determine how to distribute the Second Menu password.
Rockwell Automation is not responsible for unauthorized password access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

Reference Circuit Block Diagram

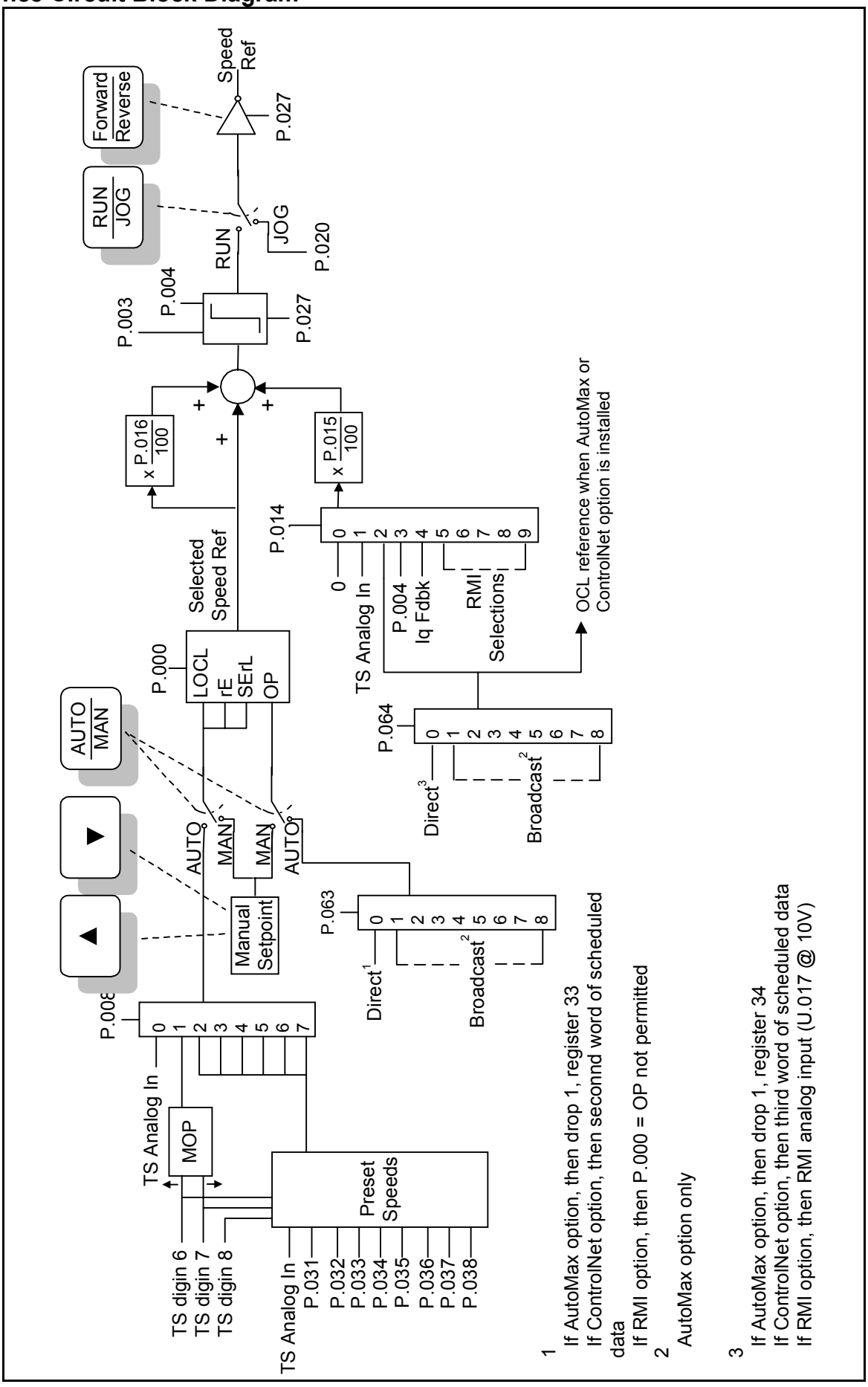


Figure 4-1: Regulator Reference Diagram

GENERAL PARAMETERS (P.xxx) - First Menu List

P.000 **Control Source**

Parameter Range: LOCL = Local keypad/display
rE = Terminal strip remote inputs
OP = Option port (InterBus, Profibus-DP, ControlNet, DeviceNet, AMX network)
SErL = Serial port (CS3000 or OIM*)

Initial Setting: LOCL

Type: Configurable (in standby only)

Refer to: P.007 Terminal Strip Digital Inputs Configure
P.008 Terminal Strip Speed Reference Source
P.063 Option Port: Network Reference Source

Description: This parameter selects the drive control source.
The drive responds to the reference, forward/reverse, run/ jog, and start commands (inputs) only from the source selected in this parameter.

If LOCL is selected, all commands come directly from the front panel keypad.

If REMOTE is selected, the controller will follow commands from the terminal strip remote inputs. The REMOTE LED on the keypad front panel will light.

STOP/RESET key at keypad is effective for all control sources.

Note: The **REMOTE** LED will turn ON if any control source other than LOCL is selected.

WARNING
In V/Hz regulation, if P.000 (Control Source Select) is set to OP (Option Port), and P.062 is set to 1 (Hold last reference), and the drive loses communication with the network, the drive will maintain the last frequency command sent to it. Ensure that driven machinery, all drive-train mechanisms, and process line material are capable of safe operation at the maximum operating speed of the drive. Failure to observe this precaution could result in bodily injury.

The selected drive control source is determined primarily by the value in P.000. However, if P.000 = rE, then the REM/LOC input may toggle the control source between the local keypad and the terminal strip. See P.007 (Terminal Strip Digital Inputs Configure).

Depending on the control source selected, the AUTO/MAN key can be used to switch between speed reference sources as shown in the following table.

Control Source (P.000)	AUTO/MAN Status	Speed Reference Source
Local keypad/display (P.000=LOCL)	AUTO selected	Terminal strip
	MAN selected	Local keypad/display or OIM
Terminal strip remote inputs (P.000=rE)	AUTO selected	Terminal strip
	MAN selected	Local keypad/display or OIM
Option port (P.000=OP)	AUTO selected	Network
	MAN selected	Local keypad/display or OIM
Serial port (P.000=SErL)	AUTO selected	Terminal strip
	MAN selected	Local keypad/display or OIM

P.001 **Acceleration Time 1 (RAMP 1)**

Parameter Range: V/Hz: 1.0 - 999.9 seconds
Vector: 0.1 - 999.9 seconds

Initial Setting: 20.0 (20 seconds)

Type: Tunable (at rest or during operation)

Refer to:
P.004 Maximum Speed
P.005 Current Limit
U.017 Motor Top Speed
P.021 Jog Acceleration Time
P.017 Acceleration Time (Ramp 2)
P.023 MOP Accel / Decel Time

Description: Acceleration time in which the motor goes from zero to Motor Top Speed (Vector: U.017) or Maximum Hz (V/Hz: P.004) after starting.

If the motor load inertia is high or the current limit (P.005) setting is too low, actual motor acceleration time will be longer than the time set in P.001.

P.002 **Deceleration Time 1 (RAMP 1)**

Parameter Range: V/Hz: 1.0 - 999.9 seconds
Vector: 0.1 - 999.9 seconds

Initial Setting: 20.0 (20 seconds)

Type: Tunable (at rest or during operation)

Refer to:
P.004 Maximum Speed
P.025 Stop Mode
U.017 Motor Top Speed
P.022 Jog Deceleration Time
P.018 Deceleration Time (Ramp 2)
P.023 MOP Accel / Decel Time

Description: Deceleration time is the time in which the motor decreases from Motor Top Speed (Vector: U.017) or Maximum Hz (V/Hz: P.004) to zero speed when performing a ramp stop (P.025 =1).

Note: Motor load inertia and input line conditions can extend the deceleration time to a value greater than the preset time. With very fast deceleration times, regenerative motor voltage may charge up the DC Bus voltage, causing a high bus voltage (HU) fault trip.
To avoid a fault trip condition, either
- extend the deceleration time for a longer period, set Dynamic Braking Usage (H.017) to 0, 2, 3 or 4.
- or, if a deceleration time faster than the non-trip value is required, replace the power unit with one with an optional internal Dynamic Braking Unit or add an external Dynamic Braking Unit, set Dynamic Braking Usage (H.017) to 1 or 5.

P.003 **Minimum Hz (V/Hz)**
Minimum Speed (Vector)

Parameter Range: V/Hz: 0.5 Hz - Value in P.004 'Maximum Frequency' (Hz)
Vector: 0 RPM - Value in P.004 'Maximum Speed' (RPM)

Initial Setting: V/Hz: 5 Hz
Vector: 150 RPM

Type: Tunable (at rest or during operation)

Refer to: P.004 Maximum Speed. With Terminal strip Speed (P.008) selected, refer also to P.009, P.010, P.011.

Description: V/Hz: Output frequency achieved at minimum of selected frequency reference.
Vector: Speed in RPM achieved at minimum of selected speed reference.

DANGER
The drive can operate at and maintaining zero speed. The user is responsible for ensuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

P.004 **Maximum Hz (V/Hz)**
Maximum Speed (Vector)

Parameter Range: V/Hz: 15 Hz - Value in Overfrequency Limit (H.022) in Hz (max. 200 Hz)
Vector: 10 RPM - Value in Motor Top Speed (U.017) in RPM

Initial Setting: V/Hz: 50
Vector: 1400

Type: Tunable (at rest or during operation)

Refer to: P.028 Speed Display Scaling
H.022 Overfrequency Limit
U.017 Motor Top Speed

WARNING
The user is responsible for ensuring that driven machinery, all drive-train mechanisms, and process line material are capable of safe operation at the maximum operating speed of the drive. Overspeed Detection in the drive determines when the drive shuts down. For Vector regulation, this is factory set to 130% of Maximum Speed (P.004). For V/Hz regulation, this is fixed at the frequency level set in Overfrequency Limit (H.022). Failure to observe this precaution could result in bodily injury.

Description: V/Hz: This parameter specifies the maximum allowed speed in Hz. The drive is equipped with configurable overspeed protection at the frequency level set in Overfrequency Limit (H.022).

Vector: This parameter specifies the maximum allowed speed in RPM. The drive is equipped with fixed overspeed protection at 130% of Maximum Speed (P.004).

Note: When changing Maximum Speed (P.004) value, also rescale the Speed Display Scaling (P.028) parameter to the same value so the RPM monitor mode corresponds to maximum speed.

P.005 **Current Limit**

Parameter Range: V/Hz: 50% to 100 or 110% (depending on P/U size, Power Unit Output Amps (P.095) are either corresponding to 100 or 110%).
Refer to Table 2-3 on page 2-10 of manual 49'1327.

Vector: U.006 (Magnetizing Amps) up to 150% of U.004 (Motor Nameplate Amps).

Initial Setting: Power Unit size dependent

Type: Tunable (at rest or during operation)

Refer to: P.095 Power Unit Output Amps
H.002 Motor Nameplate Amps
U.004 Motor Nameplate Amps
U.006 Motor Magnetizing Amps

Description: This parameter provides the means to limit motor stator current while running at constant speed or during acceleration.
Maximum current is dependent on selected Power Unit Size, Regulation Type (P.048), and Carrier Frequency (P.047). P.095 provides the maximum current value in Amps. Refer to manual 49'1327 'GV3000 Power Unit' Tables 2-3 and 2-4 for values per Power Unit Size.
If U.000 = 1 or 2, the Current Limit parameter (P.005) is not applied.

V/Hz : Set parameter (P.005) to the calculated value corresponding to the percentage of Motor Nameplate Amps (H.002) related to Power Unit Output Amps (P.095) (which is either 100 or 110%, depending on P/U size).

Application Limits: The ratio of Power Unit Output Amps (P.095) to Motor Nameplate Amps (H.002) should not be ***greater than 3 to 1*** and the following must be observed:

a) If Torque Boost (H.003) is used (value >0) don't adjust P.005 below a percentage value corresponding **to 75% of** Motor Nameplate Amps (H.002).

b) If Torque Boost (H.003) is disabled (value =0) don't adjust P.005 below a percentage value corresponding **to 100% of** Motor Nameplate Amps (H.002).

When the output current attempts to exceed the preset current limit, the output voltage and frequency will be lowered as the GV3000/SE drive reduces output current.

Vector: Current limit is a value in percentage of Motor Nameplate Amps (U.004).
Don't set limit to a corresponding value greater than Power Unit Output Amps (P.095).

Torque is not proportional to stator current, and therefore, current limit is not linear to the amount of torque produced. The following equation shows how maximum torque is reached if magnetizing current is constant in the range between no load and current limit:

$$\%\text{Max. Torque} = \sqrt{\frac{\%\text{current}_{\text{Limit}}{}^2 - \%\text{I}_{\text{Magn.}}{}^2}{10000 - \%\text{I}_{\text{Magn.}}{}^2}} \times 100 \qquad \%\text{I}_{\text{Magn.}} = \frac{\text{no load current}}{\text{rated current}} \times 100$$

P.006 **Second Menu Password**

WARNING
It is the users responsibility to determine how to distribute the second Menu Password. Rockwell Automation is not responsible for unauthorized access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

Parameter Range: 0 - 9999

Initial Setting: 0

Type: Tunable (at rest or during operation)

Password: 107

Description:

The Second Menu contains parameters used for more complex applications. A password is required to access them. Within the Second Menu are General (P.---) parameters that apply to both vector and V/Hz programming and Vector (U.---) or Volts/Hertz (H.---) parameters. If an optional RMI board is installed in the drive, RMI (r.---) parameters are also contained in the Second Menu.

None of the second menu parameters can be changed or viewed unless the correct password is entered into P.006.

If the password is not entered, when you scroll through the parameters, at P.006, the list will complete its cycle and return to P.000.

Once the password is entered correctly at P.006, the list will now scroll up to P.099.

NOTE: I*f you access P.006 after entering the password, the displayed value will be zero, even though you can now access the Second Menu parameters. The zero value is displayed in order to prevent unauthorized password use.*

↦ **To enter the password to expand to the second menu list:**
Refer also to Section 3 of this manual.

1. Enter the PROGRAM mode.
2. Access P.006 on the display.
3. Press the ENTER key.
4. Using the ⇑ and/or ⇓ keys, increase the value from 0 to 107.
5. Press the ENTER key. (The display will show "P.006" after pressing the ENTER key.)
6. Second Menu List parameters can now be accessed and modified.

Note that the password must be re-entered to disable the access to the Second Menu list.

The last state when the controller is powered down will remain when powered back up.

GENERAL PARAMETERS - Second Menu List (P.007 to P.099)

P.007 **Terminal Strip Digital Inputs Configure**

Parameter Range:

	Digital Input 6: (Terminal 19)	Digital Input 7: (Terminal 18)	Digital Input 8: (Terminal 17)
0 =	FWD/REV	RAMP1/2	REM/LOC
1 =		FWD/REV	RAMP1/2
2 =		FWD/REV	REM/LOC
3 =		RAMP1/2	REM/LOC
4 =			FWD/REV
5 =			RAMP1/2
6 =			REM/LOC
7 =	not used	not used	not used
8 =	FWD/REV	TRQ/SPD	REM/LOC
9 =	not used	TRQ/SPD	REM/LOC
10 =	not used	TRQ/SPD	FWD/REV
11 =	not used	TRQ/SPD	RAMP1/2
12 =	not used	not used	TRQ/SPD

Type: Configurable (in standby only)

Refer to: P.008 Terminal strip Speed Reference Source

Initial Setting: 0

Description:

WARNING
If a maintained START contact is used in REMOTE mode, switching from LOCAL to REMOTE will cause the controller to start and the motor will rotate, if the remote START contact is closed. Stay clear of rotating machinery. Failure to observe this precaution could result in bodily injury.

The GV3000/SE drive provides multiple configurations of digital inputs 6,7, and 8 on the terminal strip. This parameter determines how these inputs are used.

The P.008 (Terminal Strip Speed Reference Source) will limit the selection of P.007 because the P.008 selection may use one or more digital inputs 6 through 8. Selections 8 through 12 apply to vector regulation only.

An unasserted (open) or asserted (closed) input will select the following of the four input choices:

Input	Open = OFF (0V)	Closed = ON (24V)
FWD/REV	Forward	Reverse
RAMP1/2	Ramp 1	Ramp 2
REM/LOC	Remote	Local
TRQ/SPD	Torque	Speed

FWD/REV allows you to select between forward or reverse operation. If the Input is closed this function will invert the selected speed reference. For example If the selected speed reference value is negative (<0), the FWD/REV input is closed (which allows reverse direction), and reference is not inverted (P.011=OFF), the resulting speed reference will be positive (forward).

NOTE: Forward means clockwise rotation viewing motor drive end, with the following conditions: European motor and U,V,W of the Inverter connected to U,V,W of the motor at Forward mode (Refer to P.007) and positive speed reference selected (Refer to P.008, P.011).

RAMP1/2 allows you to select between one of two paired acceleration/deceleration rates. Ramp 1 uses accel or decel rates based on P.001/P.002. Ramp 2 uses accel or decel rates based on P.017/P.018. (for RUN only, for JOG refer to P.021, P.022).

NOTE: *The digital input for RAMP1/2 is always active regardless of the control source.*

Terminal Strip Digital Inputs Configure (continued)

REM/LOC allows you to switch from terminal strip control to local keypad control. The drive must be stopped in order to do this. (Note that if an OIM is connected, REM/LOC will switch control from terminal strip to the OIM, not to the local keypad.)

NOTE: *The digital input for REM/LOC is active only if the control source is remote.*

The following example shows how this input can be used.

REM/LOC Input Example:

Assume the drive is stopped and started using an external 2-wire control signal.
The drive's control source is the terminal strip (P.000=rE), and a start command is given. The REM/LOC option (P.007= 2) is selected so that an external REM/LOC selector (mounted e.g. near the controller in the cubicle) switches the drive from REMOTE to LOCAL or from LOCAL to REMOTE. This external switch is in the REMOTE position.
The following happens:

1. The STOP/RESET key is pressed and the motor stops.
2. LOCAL is selected using the externally wired REM/LOC switch.
3. Control of the drive is done locally through the keypad (or through the OIM, if connected). This could be for troubleshooting purposes, or for viewing/adjusting parameter values.
4. The REM/LOC switch is set back to the REMOTE position. The drive runs immediately because there is already an asserted remote START signal.
5. The drive is now being controlled by the REMOTE control source.

TRQ/SPD allows you to switch between torque regulation and speed regulation while the drive is running or stopped. This feature only applies when the drive has been configured as a vector regulator (P.048=UEC), and U.000 (Torque Reference Source >0.

To provide smooth transitioning when switching from torque to speed, the speed regulator is preset with the last torque reference. When switching from speed to torque, the torque regulator will switch to the new torque reference.

NOTE: *The digital input for TRQISPD is active if the control source is local, remote, or serial.*

The default value of 0 for P.007 will limit P.008 (Terminal Strip Speed Reference Source) to a selection of 0. You must change P.007 to some value other than 0 in order to change P.008 to some value other than 0. See table 4-1 and the selection example in the P.008 parameter description.

For use with RMI option card refer to RMI-Manual 49'1330

P.008 **Terminal Strip Speed Reference Source**

Parameter Range: 0 = Analog Reference (digital inputs 6, 7, and 8 are not used) See P.007
1 = MOP selection (uses digital input 6 for the MOP increment function, digital input 7 for the MOP decrement function, digital input 8 is not used)
2 = Two (2) preset speeds (uses terminal strip dig. input 6, inputs 7 and 8 left free)
3 = Four (4) preset speeds (uses terminal strip dig. inputs 6 and 7, input 8 left free)
4 = Eight (8) preset speeds (uses all terminal strip digital inputs)
5 = Analog Reference and one (1) preset speed (Uses digital input 6, inputs 7 and 8 are not used)
6 = Analog Reference and three (3) preset speeds (Uses digital inputs 6, 7, input 8 is not used)
7 = Analog Reference and seven (7) preset speeds (Uses digital inputs 6, 7 and 8)

Initial Setting: 0 = Analog Reference

Type: Configurable (in standby only)

Refer to: P.007 Terminal Strip Digital Inputs Configure, P.031 Preset Speed 1
R.030 Digital Input Configuration

Description: This parameter selects the source of the terminal strip speed reference.
The terminal strip speed reference is used when:

- the terminal strip is the selected control source (P.000 = rE), or
- the local keypad or serial port is the selected control source (P.000 = LOCL or SErL) and AUTO is selected (AUTO LED is on).

In selections 5, 6 and 7, a digital input will initiate the selected preset speed which will override the analog speed reference. Refer to table 4-2 in the P.031 parameter description.
The selection is dependent upon what is selected for parameter P.007.
The selection made in parameter P.007 determines what the remaining free digital inputs can be used for. See Table 4-1 for acceptable combinations.

P.007 Selections	P.008 Selections							
	0	1	2	3	4	5	6	7
0	✓							
1	✓		✓			✓		
2	✓		✓			✓		
3	✓		✓			✓		
4	✓	✓	✓	✓		✓	✓	
5	✓	✓	✓	✓		✓	✓	
6	✓	✓	✓	✓		✓	✓	
7	✓	✓	✓	✓	✓	✓	✓	✓
8	✓							
9	✓		✓			✓		
10	✓		✓			✓		
11	✓		✓			✓		
12	✓	✓	✓	✓		✓	✓	

Table 4-1. Acceptable P.007 and P.008 Selection Combinations.

P.007 and P.008 Selection Example:

- If you want to select the MOP as the speed reference source P.008 must be set to 1.
- Next select the value for P.007 using table 4-1. Following the column down under P.008, selections the acceptable selections for P.007 are 4,5,6, 7 or 12.

For use with RMI option card refer to RMI-Manual 49'1330

P.009 **Terminal Strip Analog Input Offset**

Parameter Range: -900 to +900 (For 0 to 10 V input, a value of +1 equals an offset of approx. 10mV.)

Initial Setting: 0

Type: Tunable (at rest or during operation)

Refer to: P.000 Control Source

Description: This parameter allows for correcting any offset in the terminal strip analog input prior to the signal reaching the drive.
Verify that the analog input is configured as the speed reference control source (P.000 = rE or LOCL and AUTO is selected), P.008 = 0, and U.000 = 0).

Note: This parameter is not used if the terminal strip analog input is used as vector torque reference (U.000 = 1). See Vector Regulator Speed Loop, Figure 6-1a.

P.010 **Terminal Strip Analog Input Gain**

Parameter Range: 0.100 - 5.000

Initial Setting: 1.000

Type: Tunable (at rest or during operation)

Refer to: P.000 Control Source

Description: This parameter is used to compensate for component tolerance errors or insufficient voltage from the input reference source at the terminal strip.

Note: This parameter is not used if the terminal strip analog input is used as vector torque reference (U.000 = 1). See Vector Regulator Speed Loop, Figure 6-1a.

P.011 **Terminal Strip Analog Input Configure**

Parameter Range:

Jumper J4 on pins 2 and 3:
- 0 = +/- 10 VDC
- 1 = +/- 10 VDC inverted
- 2 = 0 to 10 VDC
- 3 = 0 to 10 VDC inverted

Jumper J4 on pins 1 and 2:
- 4 = 4 to 20 mA. Generate fault on signal loss.
- 5 = 4 to 20 mA inverted. Generate fault on signal loss.
- 6 = 0 to 20 mA
- 7 = 0 to 20 mA inverted
- 8 = 4 to 20 mA. Display alarm and use previous reference on signal loss.
- 9 = 4 to 20 mA inverted. Display alarm and use previous reference on signal loss.
- 10 = 4 to 20 mA. Display alarm and use Preset Speed 1 (P.031) as reference on signal loss.
- 11 = 4 to 20 mA inverted. Display alarm and use Preset Speed 1 (P.031) as reference on signal loss.

Jumper J4 on pins 2 and 3:
- 12 = 0 to 10 VDC. Start and stop the drive based on analog input value. (P.000 must be set to rE.)

Initial Setting: 2

Type: Configurable

Refer to: P.009 Terminal Strip Analog Input Offset,
P.010 Terminal Strip Analog Input Gain

Description: This parameter selects the type of analog input signal being used and whether to invert it (negate it) after it has been converted from analog to digital by the drive.

If the regulator terminals analog input is used as vector torque reference (U.000=1), this parameter is used only to enable analog input signal loss detection feature.

Important: Verify that the hardware (jumper J4) and software configurations match each other and the external signal.

NOTE: Inversion means **CCW** rotation viewing at motor drive end, with following conditions:
European motor and U,V,W of the Inverter connected to U,V,W of the motor, P.027=0;.P.011=1,3,5 or7

ATTENTION: The drive may inadvertently start due to the effects of temperature or electrical noise on the analog input when the analog input is configured to start and stop the drive (P.011 = 12), and the following conditions are true:

- P.000 = rE
- The function loss, stop, and start inputs on the terminal strip are all closed.

The user is responsible for:

- providing suitable notification to operating personnel that this feature is being used and the drive could start at any time.
- ensuring that the inadvertent starting of the driven equipment will not cause injury to operating personnel or damage to the driven equipment.
- ensuring that the input wiring has been installed according to EMC Standards to minimize electrical noise.

Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Due to the effect of temperature on the analog input, the possibility exists that the stop threshold cannot be reached. The application must rely on the terminal strip stop and function loss inputs as the alternate methods of stopping the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

If P.011 = 2 or 12, the input + offset (P.009) will be low limited at 0 and then multiplied by P.010.

If P.011 = 3, the input + offset (P.009) will be low limited at 0, multiplied by P.010, and then negated.

If P.011 = 4, 8 or 10, the input will be offset by -4 mA + offset parameter (P.009), low limited at 0, and then multiplied by P.010.

If P.011 = 5, 9 or 11, the input will be offset by -4 mA + offset parameter (P.009), low limited at 0, multiplied by P.010, and then negated.

If P.011 = 6, the input + offset (P.009) will be low limited at 0 and multiplied by P.010.

If P.011 = 7, the input + offset (P.009) will be low limited at 0, multiplied by P.010, and then negated.

For the 4 to 20 mA Input selections, the drive can be configured generates a fault Ain (selections 4 and 5), or an alarm (selections 8 through 11) if the input falls below 2 mA.

If P.011 = 8 or 9, the drive continues to run using the value of the analog input 4 to 5 seconds prior to the loss detection.

If P.011 = 10 or 11, the drive continues to run using Preset Speed 1 (P.031) as the analog input value. In both cases, once the input returns (> 4 mA), the alarm clears, and the drive uses the converted input.

If P.011 = 12 the analog input is configured as a 0-10 VDC input to start and stop the drive based on the analog input value:

The drive will start when the input becomes greater than the start threshold (0.2V) and all other permissive conditions are met.

The drive will stop when the input becomes less than or equal to the stop threshold (0.3V).

Refer to Regulator Block Diagram Figure 6-1a.

The terminal strip start input then becomes another stop function and start permissive condition:

- When the start input is open, the drive will stop and remain stopped.
- The start input must be closed to allow the drive to start.
- The control source must be the terminal strip (P.000 = rE) to use this feature.

The converted analog input value, **after** the offset parameter (P.009) has been applied, can be viewed in P.091 (Diagnostics Display) when P.090 (Diagnostics Source) is set to 10. This is the value against which the stop and start threshold values are compared to determine the appropriate input start/stop action.

P.012 **Terminal Strip Analog Output Source**

Parameter Range:

		Feedback at Vector Regul.	Feedback at Volt/Hz Regulation
0	bipolar	Speed	Frequency
1	bipolar	Torque Producing Current Iq	Torque Producing Current Iq
2	unipolar	Speed	Frequency
3	unipolar	Torque Producing Current Iq	Torque Producing Current Iq

Default Setting: 0

Parameter Type: Tunable (at rest or during operation)

Description: This parameter configures the analog output signal from the terminal strip.

Selections 2 and 3 select the same signals as selections 0 and 1, but instead of providing a 5 V (1/2 scale) offset to allow for a bipolar signal, no 5 V offset is used. Instead, the signal is presented in a unipolar manner.

The absolute value of the selected signal is used to drive the analog output over its full range of 0 to 10 VDC. This provides greater resolution of the selected signal at the expense of indicating polarity.

Notes:
- For setting of jumper J17 at regulator card refer to Section 3 of manual 49'1327.
- In V/Hz control, signals are updated every 500 ms.
- In Vector control, all signals are updated every 5.0 ms

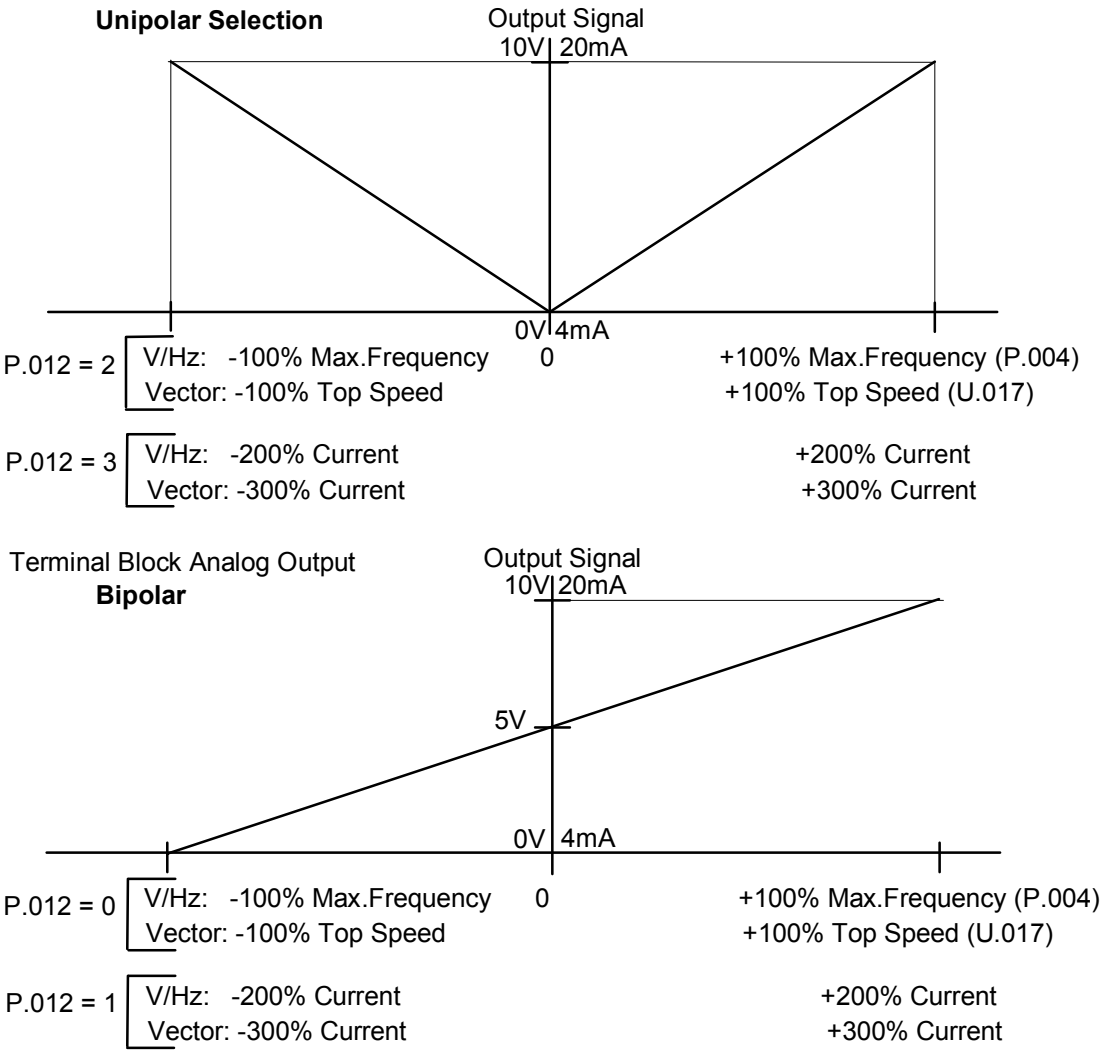


Figure 4.2. Analog Output Selection and Scaling

P.013 **Output Relay Configuration**

Parameter Range: 0 = Output relay is energized to show state of active Fault (IET)
1 = Output relay is energized to show state of drive running (RUN or JOG) with 0.5 second delay added.
2 = Output relay is energized to show state of drive running (RUN or JOG), no delay added.
3 = Output relay is energized to show state of network communication active.
4 = Output relay is energized when all start permissive conditions are met.
5 = Output relay is energized when one or more alarms are active.
6 = Output relay is energized when no faults are active.

Initial Setting: 0

Type: Configurable (in standby only)

Description: This parameter specifies the type of status indication provided by the output relay contacts (terminals 28,29, 30, and 31 on the drive's terminal strip).
For contacts related to terminal numbers refer to Section 3 of manual 49'1327.

Example: For an application using an output contactor, you can obtain a 0.5 second delay between start assertion and the generation of motor voltage by setting P.013 to 1. The delay will provide time for the contactor to close before motor voltage is generated.

P.014 **Trim Reference Source**

Parameter Range:
0 = No trim reference used
1 = Terminal strip analog input
2 = Options port trim reference register
3 = Maximum speed / frequency (value in P.004 used)
4 = Current feedback (Vector only)
*5 = RMI board analog input
*6 = RMI board Frequency Input
*7 = Switched RMI board Analog/Frequency Input
*8 = In Mode 1 the setpoint to the RMI outer loop PI block is zero
*9 = In Mode 2 the setpoint to the RMI outer loop PI block is the speed reference from P.000, and the normal speed reference is zero.

*** Extended selection for use with RMI option card connected (refer to RMI-Manual 49'1330).**

Type: Configurable (in standby only)

Refer to : P.015 Trim Gain percentage

Description: This parameter specifies the source for the trim reference. Trim reference is added to the speed / frequency reference.

P.015 **Trim Gain Percentage**

Parameter Range: - -100.0% to +100.0% (1.0 = 1%)

Initial Setting: 0.0
Type: Tunable (at rest or during operation)

Refer to: P.014 Trim Reference Source Selection

Description: Trim gain is a percentage of the selected trim reference entering the speed ramp. See Figure 4-4. A value of 1.0 corresponds with 1% gain.

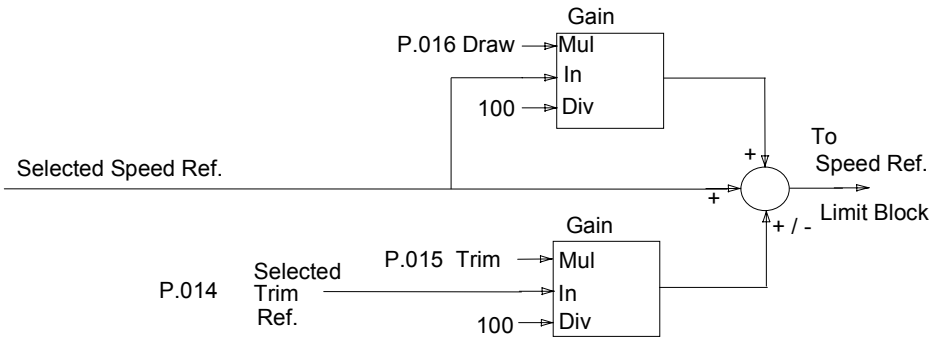


Figure 4-4. Draw and Trim Gain.

P.016 **Draw Gain Percentage**

Parameter Range: -100.0% to +100.0% (1.0 = 1% of speed reference)

Initial Setting: 0.0

Type: Tunable (at rest or during operation)

Description: This parameter is used to increase or decrease the selected speed reference to the speed regulator by a percentage value of speed reference. (See Figure 4-4.)

It allows multiple drive sections with a common line reference, but with different values for draw gain, to run at different speeds depending on the percent draw.

Note that P.016 affects the accel/decel times. As draw gain increases positive, the accel/decel time decreases proportionately. As draw gain increases negative, the accel/decel time increases proportionately. This is based on the following formula:

Modified Accel/Decel = Accel/Decel x [1 / (1.00 + (Draw% / 100))]

P.017 **Acceleration Time 2 (RAMP 2)**

Parameter Range: 1.0 - 999.9 seconds (V/Hz) or 0.1 - 999.9 seconds (Vector)

Initial Setting: 20.0

Type: Tunable (at rest or during operation)

Refer to: P.001 Acceleration Time 1 P.007 Terminal Strip Digital Inputs Configure

Description: This parameter sets the acceleration time when a second ramp selection is configured as a digital input. Acceleration time in which the motor ramps from zero to Motor Top Speed (Vector: U.017) or Maximum Hz (V/Hz: P.004) after starting.

When RAMP 2 acceleration time digital input is asserted, the RAMP 2 deceleration time also takes effect.

If the motor load inertia is high or the current limit (P.005) setting is too low, actual motor acceleration time will be longer than the time set in P.017.

The time the motor takes to make any speed decrease is directly proportional to the value in this parameter. This parameter does not apply if Jog is selected.

P.018 **Deceleration Time 2 (RAMP 2)**

Parameter Range: 1.0 - 999.9 seconds (V/Hz)
0.1 - 999.9 seconds (Vector)

Initial Setting: 20.0

Type: Tunable (at rest or during operation)

Refer to: P.002 Deceleration Time 1
P.007 Terminal Strip Digital Inputs Configure

Description: This parameter sets the deceleration time when a second ramp selection is configured as a digital input. When RAMP 2 deceleration time digital input is asserted, the RAMP 2 acceleration time also takes effect.
Deceleration time is the time in which the motor decreases from Motor Top Speed (Vector: U.017) or Maximum Hz (V/Hz: P.004) to zero speed when performing a ramp stop (P.025 =1).

The time the motor takes to make any speed decrease (except a coast-to-rest stop) is directly proportional to the value in this parameter.
This parameter does not apply if Jog is selected.

P.019 **S-Curve Enable (Selection at Vector Mode only)**

Parameter Range:

P.019	S-Curve Shaping in %	
0 (OFF)	0	(linear accel/decel ramp, S-curve disabled)
1 (ON)	20	(due to backwards compatibility)
2	2	(only on SW version 6.6)
3	3	
↓	↓	
50	50	

Selections ON and OFF are valid for SW versions < 6.6.

Initial Setting: 1

Type: Configurable (in standby only)

Description: When S-Curve accel/decel is selected, the accel or decel ramp time begins and ends slowly, creating an S-curve function.

V/Hz: At V/Hz mode this parameter is always ON and cannot be set to other values. The non-linear S-portions of the accel or decel ramp time are fixed times of 320 ms. The linear portion makes up the programmed accel/decel time minus 640 ms. See Figure 4-5.

Vector: The non-linear S-portion may be set to 0 (OFF) = 0% (S-curve disabled), 1 (ON) = 20% S-shaping, or (on SW version 6.6) any integer value between 2 = 2% and 50 = 50% of total accel/decel time (see Fig.4-5). The linear portion makes up the programmed accel/decel time minus 2 times the value of the non-linear S-portion.

The accel and decel times (P001; P.002) *must be set the same* for the S-Curve ramp to function the same for accel as decel. If the decel time is set lower than the accel time, the decel time specified may not be met.

Important: Depending on settings for S-Curve Shaping in % (P.019) and accel / decel times (P001; P.002), the S-curve function is limited to a certain range as follows:

If P.001 < 1.3 seconds, the S-curve may be suppressed completely or the acceleration time may be longer than programmed.

If P.001 > 20 seconds, the S-curve part may be shorter than set in P.019.

Important: This parameter does not apply to the Jog Ramp Accel (P.021) or Decel. (P.022).

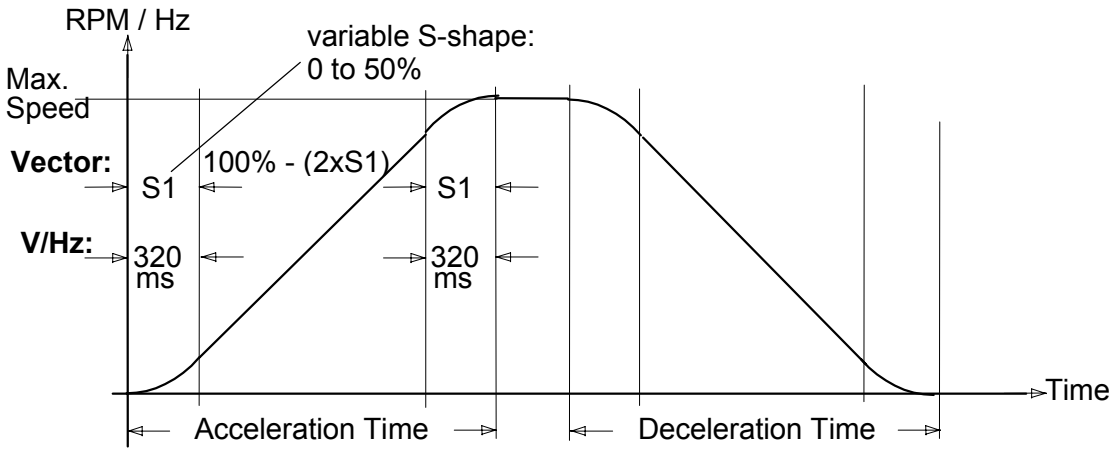


Figure 4-5. S-Curve Acceleration and Deceleration.
Max. Speed : Use P.004 (V/Hz), U.017 (Vector)

P.020 **Jog Speed Reference**

Parameter Range: Minimum Speed (P.003) to Maximum Speed (P.004)

Initial Setting: V/Hz mode: 5 Hz
Vector mode: 150 RPM

Type: Tunable (at rest or during operation)

Refer to: P.003 Minimum Speed
P.004 Maximum Speed

Description: Jog speed is activated while continuously asserting the START input from the selected control source and jog mode has been selected.

Jogging can be accomplished from either a local or remote control source. Jog speed is independent of any other speed reference. Jog speed cannot be changed with the UP/DOWN arrow keys or remotely while the drive is in run mode.

P.021 **Jog Ramp Acceleration Time**

Parameter Range: 1.0 - 999.9 seconds (V/Hz)
0.1 - 999.9 seconds (Vector)

Initial Setting: 20.0 (20 seconds)

Type: Tunable (at rest or during operation)

Refer to: P.004 Maximum Speed
U.017 Motor Top Speed

Description: For volts/hertz regulation, this parameter specifies the amount of time (seconds) it takes the motor to ramp from zero speed to Maximum Speed (P.004) in jog mode.

For vector regulation, this parameter specifies the amount of time (seconds) it takes the motor to ramp from zero speed to Motor Top Speed (U.017) in jog mode.

The time the motor takes to make any speed decrease is directly proportional to the value in this parameter.

P.022 **Jog Ramp Deceleration Time**

Parameter Range: 1.0 - 999.9 seconds (V/Hz)
0.1 - 999.9 seconds (Vector)

Initial Setting: 20.0 (20 seconds)

Type: Tunable (at rest or during operation)

Refer to: P.004 Maximum Speed
P.025 Stop Type
U.017 Motor Top Speed

Description: For volts/hertz regulation, this parameter specifies the amount of time (seconds) it takes the motor to ramp from Maximum Speed (P.004) to zero speed in jog mode.

For vector regulation, this parameter specifies the amount of time (seconds) it takes the motor to ramp from Motor Top Speed (U.017) to zero speed in jog mode.

The time the motor takes to make any speed decrease (except a coast-to-rest stop) is directly proportional to the value in this parameter.

P.023 **MOP Accel/Decel Time**

Parameter Range: 0.1 - 999.9 seconds

Initial Setting: 20.0 (20 seconds)

Type: Tunable (at rest or during operation)

Refer to: P.004 Maximum Speed
U.017 Motor Top Speed
P.024 MOP Reset

Description: For volts/hertz regulation, the MOP (Motor Operated Potentiometer) reference rate sets the amount of time (seconds) for the MOP to ramp from zero speed to Maximum Speed (P.004) or from Maximum Speed to zero speed.

For vector regulation, the MOP reference rate sets the amount of time (seconds) for the MOP to ramp from zero speed to Motor Top Speed (U.017) or from Motor Top peed to zero speed when Jog is selected.

Refer to Regulator Reference Block Diagram, Figure 4-1.

P.007 selects the digital inputs to be operated for speed increase or decrease. With P.008 =1 the MOP speed reference is selected to be activated speed either at LOCAL and AUTO modes or at REMOTE.

This MOP acts in series with Ramp/S-Curve rates (in P.001/P.002 or P.017/P.018 at RUN). During FASTER/ SLOWER the drive follows the higher time setting.

The Ramp/S-Curve rates (ramp 1: P.001/P.002, ramp 2: P.017/P.018) are effective when performing a controlled stop or to accelerate after START command to setpoint speed. Refer to P.024 for MOP reset.

This MOP is **not** identical to the keypad operated Accelerator/Decelerator (called Local Setpoint) at LOCAL/MANUAL mode.

P.024 **MOP Reset Configuration**

Parameter Range: 0 = Reset MOP setpoint after IET
1 = Reset MOP setpoint during each stop
2 = Do not reset MOP setpoint

Initial Setting: 0

Type: Tunable (at rest or during operation)

Refer to: P.003 Minimum Speed
P.008 Terminal Strip Speed Reference Source

Description: This parameter determines when and if the MOP (Motor Operated Potentiometer) setpoint is reset to Minimum Speed (P.003).

Important: If the drive is powered down and powered back up, the MOP function reference will always be reset to equal Minimum Speed (P.003).

The MOP provides a digital speed reference that can be increased and decreased using terminal strip digital inputs

When the MOP function is set and then disabled by using parameter P.008 (Terminal Strip Speed Reference Source), the last value in effect prior to the MOP being disabled will be retained.

P.025 **STOP Type**

Parameter Range: 0 = Coast to rest stop
1 = Ramp to rest stop

Initial Setting: 0

Type: Tunable (at rest or during operation)

Refer to: P.002 Decel Time 1
P.018 Decel Time 2
P.022 Jog Ramp Decel Time
U.000 Torque Reference Source

WARNING

The user must provide an external, hardwired emergency stop circuit outside the controller circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

Description: A function loss or a fault will always cause a coast-to-rest stop.

If the drive is configured as a torque regulator (U.000 > 0 and TRQ/SPD digital input = TRQ), then the stop type will always be coast-to-rest regardless of the value in parameter P.025.

If RUN is selected:

If P.025 = **0**, pressing the STOP/RESET key or giving an external stop command will cause the motor to coast to rest.

If P.025 = **1**, pressing the STOP/RESET key or giving an external stop command will cause the motor to ramp to rest within a time equal to or greater than the preset deceleration time (P.002/P.018).

If JOG is selected:

Pressing the STOP/RESET key or giving an external stop command when JOG is selected will stop the motor differently depending on whether the drive is configured for V/Hz or vector regulation:

For V/Hz regulation, the motor will always perform a ramp stop regardless of the value in P.025.

For vector regulation, the motor will stop based on the value of P.025:

- If P.025 = **0**, pressing the STOP/RESET key or giving an external stop command will cause the motor to coast to rest.
- If P.025 = **1**, pressing the STOP/RESET key or giving an external stop command will cause the motor to ramp to rest within a time equal to or greater than the preset deceleration time (P.022).

Note that when the START input from the selected control source is released (unasserted), the motor will ramp down in speed regardless of the value in P.025

P.026 **Function Loss Response**

Parameter Range: 0 = Generate a Fault trip (IET) and coast to rest
1 = Coast to Rest without a FAULT trip (IET)

Initial Setting: 0

Type: Tunable (at rest or during operation)

Refer to: P.013 Output Relay Configuration

WARNING

The user must provide an external, hardwired emergency stop circuit outside the controller circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury. The controller is not equipped with a COAST-STOP push-button. The factory-installed jumper at the Terminal strip must be removed, when FUNCTION LOSS input, COAST-STOP push-buttons, or other interlocks are used to stop the controller.

Description: This parameter specifies how the drive will respond to an open circuit between terminal strip inputs 16 and 20.

If P.026 = 0:
- The motor will coast to rest.
- The function loss error code (FL) will be displayed.
- The output relay will be asserted if P.013 is configured for IET output.
- The IET fault must be reset (RESET key) before the drive can be re-started.

If P.026 = 1
- The motor will coast to rest.
- The output relay will NOT be asserted.
- The drive can be re-started with the START key after the cause of the fault has been removed.

P.027 **Forward/Reverse Configuration**

Parameter Range: 0 = Forward or reverse enabled from the selected control source.
1 = Reverse disabled from the selected control source.
2 = The state of the forward/reverse input is latched when the motor is started.

Initial Setting: 0

Type: Tunable (at rest or during operation)

Refer to: P.011 Terminal Strip Analog Input Configure

Description: This parameter specifies how the motor responds to forward or reverse inputs from any control source.

When P.027 is set to **0**, the forward/reverse input allows forward or reverse rotation of the motor.

When P.027 is set to **1**, reverse rotation of the motor is prohibited and the forward/reverse selection from the front panel or serial port is set to forward. Note that reverse rotation is prohibited regardless of the polarity of the speed reference input.

When P.027 is set to **2**, the state of the forward/reverse input is latched when the motor is started (RUNNING LED is on). Direction changes requested from any control source after the motor is started are ignored. Note, however, that this selection will not inhibit a motor direction change due to a change in the polarity of the speed reference input.

Note: Forward means clockwise rotation viewing motor drive end, with the following conditions: European motor and U,V,W of the Inverter connected to U,V,W of the motor at Forward mode and positive speed reference selected (Refer to P.008, P.011).

in V/Hz or SVC regulation, setting H.016 (Sync Mode Select) or U.031 (SVC Sync Direction) to any value but 'F' may cause the motor to operate in the reverse direction briefly regardless of the setting in P.027.

P.028 **Speed Display Scaling**

Parameter Range: 10 - 9999

Initial Setting: V/Hz mode: 1500 (=50 Hz) Synchronous speed based on H.001 (assuming a 4-pole motor)
Vector mode: 1400 (=1400 RPM) U.017 (Motor Top Speed)

Type: Tunable (at rest or during operation)

Refer to: U.017 Motor Top Speed,
H.001 Motor Nameplate Base Frequency

Description:

This parameter defines the scaling value (speed or any engineering unit) to be used when displaying at keypad display SPEED in monitor mode.

The value in this parameter will become the max. displayed value for the SPEED monitor mode.

Use the following formulas to solve for the current operating speed or frequency if you have scaled the SPEED display.

- **Vector:**

$$\frac{\text{Current Operating Speed in RPM} * \text{P.028}}{\text{U.017 (Motor Top Speed))}} = \text{value displayed being in SPEED monitor mode}$$

- **V/Hz:**

$$\frac{\text{Current Operating Speed in Hz} * \text{P.028}}{\text{H.001(Base Frequency Hz)}} = \text{value displayed being in SPEED monitor mode}$$

Example:

Your application requires the display to be scaled to show the maximum speed as 800 liters / minute. Assume Vector Mode is activated.

Parameter U.017 is set to 1450, parameter P.004 is set to 1450.

1. Set parameter P.028 = 800.
2. Enter the SPEED monitor mode by pressing the PROGRAM key until the PROGRAM LED turns off and the SPEED LED turns on. For Keypad operations refer to Section 3.
3. Start the drive (press the START key).
4. When the drive is running at rated speed, the display shows that speed is 800 liters/minute. If you choose for current speed above, your result will be 1450.

P.029 **Elapsed Time Meter Output**

Parameter Range: 0 - 9999 days

Type: Read only drive output

Refer to: P.030 Elapsed Time Meter Reset

Description: This parameter displays the number of days (24-hour periods) that the drive has been under power or the time elapsed since the Elapsed Time Meter Reset (P.030) parameter was last reset.

P.030 **Elapsed Time Meter Reset**

Parameter Range: OFF = No action.
ON = Reset the Elapsed Time Meter (P.029) and the error log clock to zero (0).

Initial Setting: OFF

Type: Tunable (at rest or during operation)

Refer to: P.029 Elapsed Time Meter Output

Description: This parameter sets parameter P.029 (Elapsed Time Meter) and the error log clock to zero. This parameter is set to OFF after the reset operation is carried out.

P.031 to P.038 **Speed Preset 1 through Speed Preset 8**

Parameter Range: Minimum Speed (P.003) - Maximum Speed (P.004)

Note: If specified initial settings are below minimum speed/Hz (P.003) or above maximum speed/Hz (P.004), then the initial settings will be the corresponding minimum or maximum speed/Hz value.

Initial Setting: V/Hz : 5.0 (=5 Hz)
Vector: 150 (=150 RPM)

Type: Tunable (at rest or during operation)

Refer to: P.007 Terminal strip Digital Inputs Configure
P.008 Terminal strip Speed Reference Select.

Description: These Parameters allow setting of up to eight different preset speeds.
The speed presets are configured using parameters P.007 and P.008.
P.008 must be set to values of either 2, 3, or 4 for preset speeds.
With P.008 = 2, 3 or 4 the value of P.031,
with P.008 = 5, 6 or 7 the analog input will be used

Digital Input 8 (Terminal 17)	Digital Input 7 (Terminal 18)	Digital Input 6 (Terminal 19)	Multi-Speed Preset Selection	
			P.008 = 2/3/4	P.008 = 5/6/7
0	0	0	P.031	Regulat. Analog Input
0	0	1	P.032	
0	1	0	P.033	
0	1	1	P.034	
1	0	0	P.035	
1	0	1	P.036	
1	1	0	P.037	
1	1	1	P.038	

Table 4-2. Preset Speed Digital Inputs 0 = Open 1 = Closed

The presets can also be selected as the OCL reference using P.064 (Option Port: Network Trim Reference Source). See OCL Block Diagram Fig. 6-1c.for more information about the OCL.
For terminal numbers of digital inputs refer to Section 3 of the manual 49'1327.

P.039 **Encoder Loss Enable**

Parameter Range: OFF = Disable encoder loss diagnostic.
ON = Enable encoder loss diagnostic.

Initial Setting: OFF

Type: Tunable (at rest or during operation)

Description: This parameter is used to enable the encoder (pulse Tachometer) loss detection diagnostic.
This diagnostic is available for flux vector control (FVC) only.

The encoder loss detection diagnostic is functional only when the drive is operating as a speed regulator (not as a torque regulator).

When the diagnostic is enabled and feedback from the encoder is not detected, a drive fault will be logged (EL will be displayed).

If the encoder fails, loss will be detected down to 1 RPM. If only one of the quadrature feedback wires is disconnected, loss may not be detected below 15 RPM.

P.040 **Motor Thermal Overload Enable**

Parameter Range: OFF = Disable electronic motor thermal overload function
ON = Enable electronic motor thermal overload function

Initial Setting: ON

Type: Configurable (in standby only)

Refer to: P.041 Motor Overload Type
H.002 Motor Nameplate Amps
U.004 Motor Nameplate Amps

Description: This parameter enables the electronic motor thermal overload function. This function operates similarly to a motor overload relay to protect the motor from overheating.

NOTE: P.040 applies to single motor applications only

CAUTION:
For single-motor applications with no external thermal overload relay, this parameter should always be set to ON. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

For **Vector** regulation, the drive trips after 60 seconds at 150% of Motor Nameplate Amps (U.004) and will display fault code OL. The overload current amount is automatically calculated by the GV3000/SE software based on the Motor Nameplate Amps (U.004).

For **V/Hz** regulation, the drive trips after 60 seconds at 150% of Motor Nameplate Amps (H.002) and will display fault code OL. The motor overload protection fault level depends on the settings of the Motor Overload Type selection (P.041) and Motor Nameplate Amps (H.002).

Important: While the electronic thermal overload function is similar to a motor overload relay, it does not measure actual motor temperature. Temperature measuring devices are the best way to thermally protect AC motors under all conditions.

P.041 **Motor Thermal Overload Type**

Parameter Range: nC = Standard motor without forced cooling (for V/Hz only)
FC = Forced- cooled motor

Initial Setting: FC

Type: Configurable (in standby only)

Refer to: P.040 Motor Overload Enable

Description: This parameter specifies the type of motor being used to determine the electronic motor thermal overload function characteristics. Function has to be enabled by Motor Thermal Overload (P.040).
The function of an electronic thermal overload is similar to a motor overload relay as the device switches off the inverter after a time depending on the overload.
P.041 allows selection of an output current profile best suited for the type of motor to be run.

Motor Thermal Overload Type (continued)

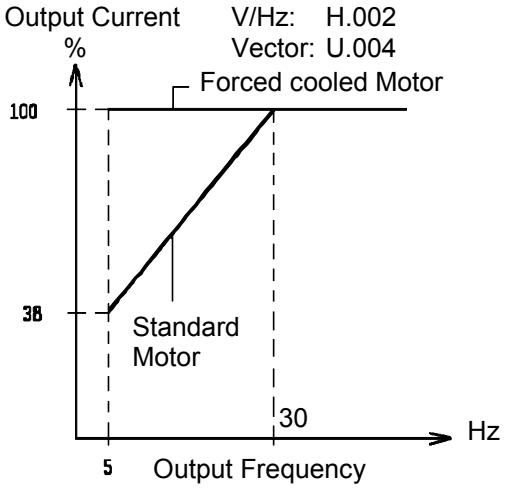


Figure 4-6: Overload profile

Note: While the electronic thermal overload function is similar to a motor overload relay, it is not accurate below 5 Hz and does not measure actual motor temperature. Temperature measuring devices are the best way to thermally protect AC motor at all conditions.

P.042 **Line Dip Ride-Through Time** (Parameter active for V/Hz only)

Parameter Range: V/Hz: 0.1 - 999.9 seconds
Vector: 500ms

Initial Setting: V/Hz : 5 seconds

Type: Configurable (in standby only)

Refer to: H.021 AC Line Voltage
U.018 AC Line Voltage

Description:

For volts/hertz regulation, this parameter sets the maximum time allowed for the drive to stay active during low line voltage or line voltage loss. (Alarm code LIL will flash on the display during a line dip ride through.) For vector regulation, this value is fixed at 500 ms, independent from the set value resp. indication.

If DC bus voltage drops below the low DC bus voltage threshold for more than the time set in P.042, fault code LU is logged. The drive may or may not be in run mode. After line voltage has been restored, the fault must be reset, and then the drive may be restarted.

The levels for LIL and LU depend on the parameter setting for AC Line Voltage (H.021 or U.013 in vector mode).
Power Dip Ride Through can only handle loads that decelerate the drive within more than 1 second from maximum speed to rest.
During a line voltage dip, the controller has enough energy stored to provide the supply for the regulator for a time period depending on load consumption of the drive (DC bus voltage maintained).

P.043 **Fault Auto Reset Attempts**

Parameter Range: 0 to 10 attempts

Initial Setting: 0

Type: Configurable (in standby only)

Refer to: P.044 Fault Auto Reset Time

Description: This parameter selects the number of times the drive will attempt to reset drive faults.

NOTE: *The drive will re-start after an Auto Reset attempt if the start input of the selected control source is still asserted.*

NOTE: *Auto reset will be disabled during the vector self-tuning operation and the V/Hz identification procedure.*

If the auto reset feature is enabled (P.043 is not equal to 0), faults detected while the drive is running are logged and reset. The drive will then wait the amount of time specified in P.044 (Fault Auto Reset Time) and, if the Start input is asserted from the selected control source, start the drive automatically.

If the fault occurs again, the drive will wait and try to re-start up to the programmed number of attempts. If the drive faults on all of these attempts could not be reset, the drive will remain in the faulted state and will display the fault code on the keypad/display.

The following faults can be auto reset:

Fault Code	Description	Fault Code	Description
AIn	4 to 20 mA analog input signal loss	OC	Overcurrent (steady state)
bYC	DC-Bus charging bypass contactor	OCA	Overcurrent (at acceleration)
EC	Earth current failure	OCb	Overcurrent (at DC-braking)
HIL	High line voltage	OH	Drive Overtemperature
HU	High DC-Bus Voltage	OL	Overload
LU	Low DC Bus Voltage	UbS	Asymmetrical Bus charge
nCL	Network Communication Loss		

All other faults cannot be auto reset:

WARNING

This function can cause an AUTOMATIC START OF THE DRIVE. The user is responsible for assuring safe conditions for operating personal by providing devices to indicate that the drive can start automatically after an fault auto reset. Failure to observe this precaution could result in severe bodily injury.

P.044 **Fault Auto Reset Time**

Parameter Range: 1 to 60 seconds

Initial Setting: 8 seconds

Type: Configurable (in standby only)

Refer to: P.043 Fault Auto Reset Attempts

Description: This parameter specifies the amount of time the drive will wait to attempt to reset drive faults. Note that the drive must run for at least five (5) minutes in order to reset the number of fault reset attempts to the value in P.043.

Note: *After the drive has detected the fault and is counting down the auto-reset time period, the display will flash the countdown period in seconds in the following format: "Ar30...Ar29...Ar28.....Ar01...Ar00"*

If during this countdown, the user presses the keypad STOP/RESET key, or asserts the fault reset from the selected control source, the auto-reset countdown will stop, and all faults will be reset.

P.045 **Output Phase Loss Enable** (Parameter active for V/Hz only)

Parameter Range: OFF = Disable output phase loss diagnostic.
ON = Enable output phase loss diagnostic.

Initial Setting: ON

Type: Tunable (at rest or during operation)

Description: This parameter is used to enable the output phase loss detection diagnostic.

This diagnostic detects phase loss between the drive and the motor. When the diagnostic is enabled and output phase loss is detected, a drive fault is logged (OPL is displayed).
The output phase loss diagnostic can be disabled to avoid nuisance faults which may occur, for example when a smaller motor is used with a large power unit.

P.047 **Carrier Frequency (kHz)**

Parameter Range: 2 = 2 kHz Carrier Frequency,
4 = 4 kHz Carrier Frequency
8 = 8 kHz Carrier Frequency

Initial Setting: Power unit dependent

Type: Configurable (in standby only)

Description: This parameter can compensate for acoustic noise by allowing adjustment of the switching frequency of the transistors in the inverter bridge.

Keeping the carrier frequency at 8 kHz will ordinarily provide the quietest motor operation.

Setting the carrier frequency above 2 kHz results for some power units in the derating of the maximum output current. See instruction manual 49'1327 for the power unit ratings.

Power Unit Nominal Current is dependent on Power Unit size and selected Regulation Mode (P.048) and Carrier Frequency (P.047). Output variable P.095 provides Power Unit Output Amps corresponding to the maximum settable Current Limit (P.005) in percent for selected Regulation.

P.048 **V/Hz or Vector Mode Regulation**

Parameter Range: UEC = Vector mode,
U-H = V/Hz mode

Initial Setting: U-H (for 'European Default Selection' P.049)

Type: Configurable (in standby only)

Refer to: U.001 Encoder PPR

Description: This parameter selects the drive regulator type: vector or volts/hertz.

For volts/hertz control, the drive provides open-loop volts per hertz regulation which is appropriate for general purpose applications.

For vector control, you may select either flux vector control (FVC) or sensorless vector control (SVC).

Flux vector control uses the actual encoder value for speed feedback and, therefore, requires an encoder mounted to the motor and connected to the drive. You program the drive for FVC by first selecting UEC in parameter U.048, and then selecting the PPR value of the encoder in parameter U.001.

V/Hz or Vector Mode Regulation (continued)

Sensorless vector control (SVC) is an extension of the FVC regulator. It provides performance close to FVC without using an encoder. Control is based on estimated speed feedback. You program the drive for SVC by first selecting UEC in parameter U.048 and then selecting SE in parameter U.001 (Encoder PPR).

In vector control mode an Outer Control Loop (OCL) is also available.
The OCL executes every 20 ms.

Switching from one regulator type to the other will take approximately 5 to 10 seconds. The drive will re-initiate power-up diagnostics (SELF will appear on the display and all LEDs will turn on for approximately 4 seconds).

Changing this parameter will also restore default values for all First and Second Menu General parameters (P.---) as if a Restore Defaults command (P.050 = ON) was given. However, this will NOT change the value of P.048 or P.049 (Country Defaults).

Important: All other parameter values must be verified if this parameter is changed after initial programming, regardless of whether they are restored to their default values

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P.049 **Country Defaults**

Parameter Range:
USA = U.S.A Default Settings
EUr = European Default Settings
JPn = Japanese Default Settings

Initial Setting:
EUr (for deliveries from European subsidiaries of Rockwell Automation)
USA (for deliveries from American subsidiaries of Rockwell Automation)

Type: Configurable (in standby only)

Description: This parameter selects the factory default settings for the First and Second Menu General parameters. European default settings are listed throughout Sections 5 to 7 and 9 of this manual. Refer to I/M D2-3427 or D2-3359, Section 4 for the U.S.A. and Appendix E for Japanese default settings.

P.050 **Restore Defaults**

Parameter Range:
OFF = No Action
ON = Reset P.--- parameters to default settings

Initial Setting: OFF

Type: Configurable (in standby only)

Refer to:
P.048 V/Hz or Vector Mode Regulation
P.049 Country Defaults

Description: This parameter resets all First and Second Menu General (P.---) and (r.---) parameters to the default settings (with exception of P.048 and P.049) according to Country Defaults (P.049) and V/Hz or Vector Mode (P.048).
After the par. values have been restored, P.050 will automatically be reset to OFF.

P.051 **Programming Disable**

Parameter Range: 0 - 9999

Password: 26

Initial Setting: 0 (Programming enabled)

Type: Tunable (at rest or during operation)

Description: When the password is entered into this parameter, parameter values cannot be modified from the keypad unless the correct password (26) is entered again. Refer to section 3 'Programming Disabling / Enabling' of this manual for more information

To disable parameter programming:

1. Access P.051 on the display.
2. Press the ENTER key. Display shows "0".
3. Increment the value to 26.
4. Press the ENTER key. Display shows "P.051".
5. The PASSWORD LED will be on to indicate parameters cannot be modified from the Keypad.

To return back to enable programming, re-enter the password by repeating the steps above.

WARNING: It is the user's responsibility to determine how to distribute the password. Rockwell Automation is not responsible for authorized access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

P.052 **AUTO/MAN Key Disable**

Parameter Range: OFF = Enable the AUTO/MAN key regardless of control source
ON = Disable the AUTO/MAN key except from the selected control source

Initial Setting: OFF

Type: Tunable (at rest or during operation)

Refer to: P.000 Control Source, P.053 Manual Reference Preset Enable

Description: This param. disables the AUTO/ MAN key except from the selected control source.

When this parameter is set to ON, the AUTO/MAN key is functional only from the selected control source. This parameter can be used to protect against inadvertent reference change when the drive is controlled from the terminal strip (P.000 = rE) or the option port (P.000 = OP).

The following Table details whether the AUTO/MAN key is active based on the selected control source and P.052.

Control Source (P.000 =)	P.052	Front Panel AUTO/MAN Key	OIM/CS3000 AUTO/MAN Key
Front panel (LOCL)	OFF	Active	Inactive
Terminal strip (rE)	OFF	Active	Active
Network/option board (OP)	OFF	Active	Active
OIM/CS3000 (SErL)	OFF	Inactive	Active
Front panel (LOCL)	ON	Active	Inactive
Terminal strip (rE)	ON	Inactive	Inactive
Network/option board (OP)	ON	Inactive	Inactive
OIM/CS3000 (SErL)	ON	Inactive	Active

Note that if P.000 = rE, but the REMOTE/LOCAL switch at terminal 17 is set for LOCAL (closed), the AUTO/MAN key is active even if P.052 is set to ON.

P.053 **Manual Reference Preset Enable**

Parameter Range: OFF = Do not preset the manual reference
ON = Preset the manual reference with the auto reference at the transition from AUTO to MANUAL.

Initial Setting: OFF

Type: Tunable (at rest or during operation)

Refer to: P027 Forward/Reverse Configuration
P028 Speed Display Scaling

Description: The absolute value of the auto reference is limited between Minimum Speed (P.003) and Maximum Speed (P.004) before it is used to preset the manual reference. Therefore, when this feature is enabled (P.053 = ON), and the auto reference is a negative value, a direction change will occur when the transition is made from AUTO to MANUAL. Verify that the auto reference is a positive value and FORWARD/ REVERSE command is appropriate to the application before making the transition from AUTO to MANUAL.

Important: If the manual reference is being modified using the front-panel keypad/display when the transition from AUTO to MANUAL is made, the manual reference may not be preset with the auto reference.

ATTENTION:
The absolute value of the auto reference is used to preset the manual reference. When this feature is enabled (P.053 = ON), and the auto reference is a negative value, a direction change will occur when the transition is made from AUTO to MANUAL. Verify that the auto reference is a positive value and the FORWARD/REVERSE command is appropriate to the application before making the transition from AUTO to MANUAL.
Failure to observe this precaution may result in damage to, or destruction of, the equipment.

Refer to chapter 3 for more information on the AUTO/MAN key and the AUTO LED.

P.054 **Level Sense Start Enable**

Parameter Range: OFF = Start input is edge-sensitive
ON = Start input is level-sensitive

Initial Setting: OFF

Type: Configurable

Refer to: P.000 Control Source

Description: This parameter selects whether the start input is edge- sensitive or level- sensitive for remote (P.000 = rE) and option port (P.000 = OP) control sources.

ATTENTION

Be aware of the following before enabling this function:

- Setting this parameter to ON immediately applies output power to the motor when all start conditions are met.
- If the drive is running from the terminal strip, both the start and stop inputs are closed. If P.054 = ON and a fault occurs, the drive coasts to rest and generates a fault. In this case, resetting and clearing the fault immediately restarts the drive without any change to the start or stop input states.
- If P.026 (Function Loss Response) = 1, the control source is the terminal strip (start and stop inputs are closed), and P.054 = ON, the drive coasts to rest if the function loss input is opened and does not generate a fault. In this case, closing the function loss input immediately starts the drive without any change to the start or stop input.

When this function is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

This parameter applies to remote (P.000 = rE) and option port (P.000 = OP) control sources only. Local keypad (P.000 = LOCL) and serial port (P.000 = SErL) control sources always require an off-to-on edge on the start input to start the drive.

Regardless of the status of P.054, the following conditions must be met in order for the drive to start.

- The function loss input (terminal 20) must be closed.
- No faults must be active.
- The DC bus must be valid.
- No active stop input must be asserted.

When P.054 is set to OFF, and the above requirements are met, the drive requires an off-to-on edge at the start input in order to start.

When P.054 is set to ON, and the above requirements are met, the drive applies output power to the motor when the start input is asserted.

P.054 Level Sense Start Enable (continued)

Figure 4-7 shows the start, stop, and running status of the drive when configured for edge control versus level control.

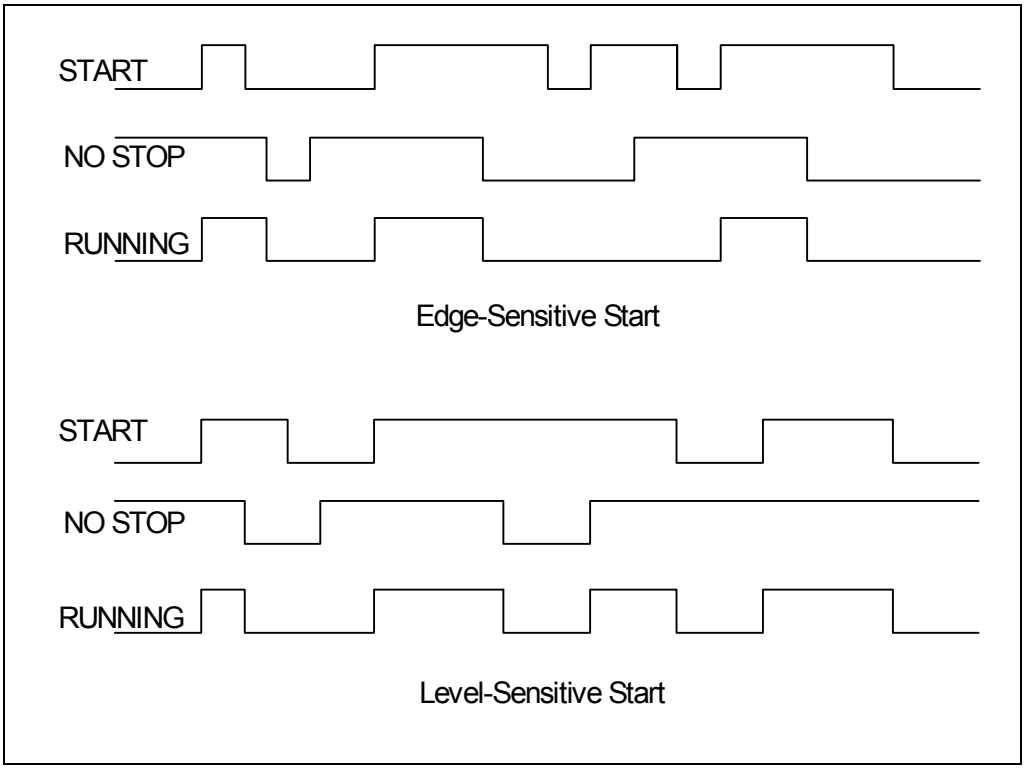


Figure 4-7: Drive Start, Stop, and Running Status when Configured for Edge Control vs. Level Control

Note that when operating from the terminal strip (rE) or a network option, an edge is required at the start input for the following two conditions, even if P.054 = ON:

- The front panel keypad/display or OIM/CS3000 STOP key is pressed.
- After a vector self-tuning procedure.

These forced edge requirements do not apply if the control source is changed to any other value and then back again as shown in the following example.

Using the Level Sense Start Enable Feature and the Analog Input Start/Stop Feature

In V6.06 the analog input can be configured to start and stop the drive.
Refer to P.009, P.011, P.090 and P.091 if you are using this feature and have configured the drive to use the analog input to start and stop the drive.

The level sense start enable feature, configured with parameter P.054 (Level Sense Start Enable), can be used with the analog input start/stop feature.

If the drive is configured for edge sense start (P.054 = 0), then the analog input must transition from the off state to the on state while all permissive conditions are met to start the drive.

If the drive is configured for level sense start (P.054=1), the drive will start whenever the analog input is in the on state and all permissive conditions are met. Note, however, that pressing the STOP key on the keypad/display will require a subsequent off-state to on-state transition on the analog input to restart the drive.

Regardless of the value in P.054 (Level Sense Start Enable), if the analog input is in the off state, the drive will stop and remain stopped.

P.055 **STOP/RESET Key Disable**

Parameter Range: OFF = Enable the STOP/RESET key regardless of the control source
ON = Disable the STOP/RESET key except from the selected control source

Default Setting: OFF

Parameter Type: Tuneable

Refer to: P.000 Control Source

Description: This parameter disables the STOP/ RESET key except from the selected control source.

ATTENTION

When P.055 is set to ON, the STOP/RESET key is functional only from the selected control source. As a safety precaution, we recommend that an emergency stop push button be located near the drive in an easily accessible location. As a further safety precaution, the user should post a warning on the drive to alert personnel that the STOP/RESET key is not functional. Failure to observe this precaution could result in severe bodily injury or loss of life.

The following table details whether the STOP/RESET key is active based on the selected control source (P.000) and P.055.

Control Source (P.000 =)	P.055	Front Panel STOP/RESET Key	OIM/CS3000 STOP/RESET Key
Front panel (LOCL)	OFF	Active	Active
Terminal strip (rE)	OFF	Active	Active
Network/option port (OP)	OFF	Active	Active
OIM/CS3000 (SErL)	OFF	Active	Active
Front panel (LOCL)	ON	Active	Inactive
Terminal strip (rE)	ON	Inactive	Inactive
Network/option (OP)	ON	Inactive	Inactive
OIM/CS3000 (SErL)	ON	Inactive	Active

STOP/RESET Key Status Based on P.000 and P.055

Note that if P.000 = rE, but the REMOTE/LOCAL switch at terminal 17 is set for LOCAL (closed), the STOP key is active even if P.055 is set to ON.

P.060 **Network Drop Number**

Parameter Range: Network-dependent

Default Setting: 1

Parameter Type: Configurable

Refer to: P.061 Network Connection Type

Description: This parameter assigns the base drop number or node number to the drive.

This parameter must be set at the drive via the keypad/display or via a personal computer serial interface. This parameter cannot be written to the drive by the network master.

Refer to the appropriate Network Communication Option Board manual:

InterBus Network Communication	49’1333
Profibus DP Network Communication	49’1355
AutoMax Network Communication	D2-3308
DeviceNet Network Communication	MAN0096-03
ControlNet Network Communication	D2-3390

P.061 **Network Connection Type**

Parameter Range: Network-dependent

Default Setting: 1

Parameter Type: Configurable

Refer to: P.060 Network Drop Number

Description: For Parameter description refer to the appropriate Network Communication Option Board manual:

InterBus Network Communication	49'1333
Profibus DP Network Communication	49'1355
AutoMax Network Communication	D2-3308
DeviceNet Network Communication	MAN0096-03
ControlNet Network Communication	D2-3390

P.062 **Option Port: Communication Loss Response**

Parameter Range: Network-dependent

Default Setting: 0 = IET fault

Parameter Type: Tunable (at rest or during operation)

Refer to: P.000 Control Source

Description: This parameter specifies how the drive will respond to a communication failure if the option port has been selected as the drive control source (P.000 = OP).

For Parameter description refer to the appropriate Network Communication Option Board manual:

InterBus Network Communication	49'1333
Profibus DP Network Communication	49'1355
AutoMax Network Communication	D2-3308
DeviceNet Network Communication	MAN0096-03
ControlNet Network Communication	D2-3390

P.063 **Option Port: Network Reference Source**

Parameter Range: Network-dependent

Default Setting: 0

Parameter Type: Configurable

Refer to: U.000 Torque Reference Source.

Description: This parameter specifies where the drive will get its reference when the option port is selected as the control source (P.000 = OP).

For Parameter description refer to the appropriate Network Communication Option Board manual:

InterBus Network Communication	49'1333
Profibus DP Network Communication	49'1355
AutoMax Network Communication	D2-3308
DeviceNet Network Communication	MAN0096-03
ControlNet Network Communication	D2-3390

P.064 **Option Port: Network Trim Reference Source**

Parameter Range: Option port dependent

Default Setting: 0

Parameter Type: Configurable

Refer to: P.063 Option Port: Network Reference Source
U.000 Torque Reference Source.

Description: This parameter selects where the drive gets its trim reference when the option port is selected as the control source (P.000 = OP). The option port trim reference is used as the outer control loop reference and/or the speed trim reference when P.014 (Trim Reference Source) = 2.

In V/Hz regulation, the trim reference represents speed in hertz scaled 0 to 4095 for 0 to Maximum Speed (P.004).

In vector regulation, the trim reference represents speed scaled 0 to 4095 for 0 to Top Speed (U.017). When used for the outer control loop, the value should be scaled based on the scaling of the selected feedback

Refer to the specific network board instruction manual for more information on P.064.

InterBus Network Communication	49'1333
Profibus DP Network Communication	49'1355
AutoMax Network Communication	D2-3308
DeviceNet Network Communication	MAN0096-03
ControlNet Network Communication	D2-3390
Remote Meter Interface RMI	49'1330

If a **network** board is installed, the OCL reference comes from the network trim reference register based on P.064 (Option Port: Network Trim Reference Source) as defined for each network type.

If a **RMI** board is installed, P.064 is used to select the OCL reference as follows for FVC/SVC applications only:

0 = RMI analog input

1 to 8 = Preset speed 1 to 8 (P.031 to P.038), respectively

If **no** option board is installed, P.064 is used to select the OCL reference for FVC/SVC applications only:

0 = Preset speed 8 (P.038)

1 to 8 = Preset speed 1 to 8 (P.031 to P.038), respectively

P.065 **Option Port: Type and Version**

Parameter Range: N/A

Default Setting: N/A

Parameter Type: Output (read only)

Description: The display format is N.vvv, where N represents the option driver type and vvv represents the software version number of the option port.

For example, if 2.115 is displayed, it means the drive is using the DeviceNet network option running software version 1.15.

1.vvv = RMI Option
2.103 = AutoMax network Option,
2.100 = InterBus network Option,
2.11v = DeviceNet network Option,
2.7vv = Profibus network Option,
5.vvv = ControlNet network Option

P.066 to P.069 **Network Output Register 1 Source through Network Output Register 4 Source**

Parameter Range: 0 = (P.066) Motor kW display value
(P.067) Motor torque display value*
(P.068) Output power factor
(P.069) Encoder counter (x4)*
1 = Speed reference rate limit output*
2 = Speed reference at the ref/fdbk summing junction (includes OCL output and current compounding)*
3 = Speed loop feedback*
4 = Speed loop error*
5 = Speed PI output*
6 = Outer control loop feedback*
7 = Outer control loop error*
8 = Outer control loop output*
9 = Regulator Board Terminal analog input normalized to speed (see Regulator Block Diagram Figure 6-1a)
10 = Regulator Board Terminal analog input scaled (see Regulator Block Diagram Figure 6-1a)
11 = Torque reference*
12 = Torque feedback*

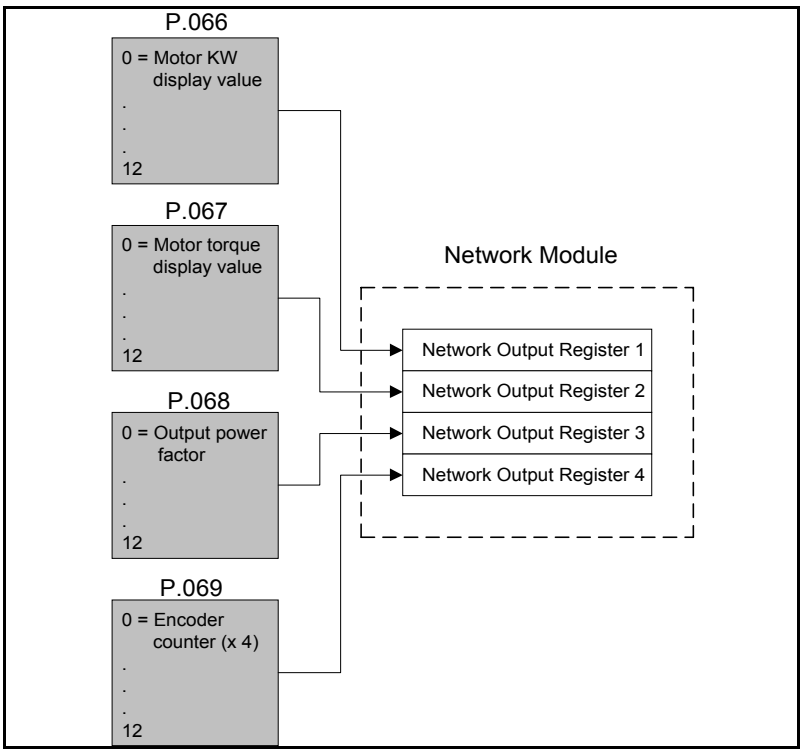
* *These signals are valid only in vector control (P.048 = UEC).*

Default Setting: 0

Parameter Type: Tunable (at rest or during operation)

Description: These parameters select the signal written to the option port network output registers 1 through 4.

Refer to the Option board instruction manual (D2-3308) for the AutoMax network register map or to the Option Board instruction manual (D2-3390) for ControlNet for ControlNet register map.



Signal Selection for Network Output Registers

P.090 **Diagnostics Source**

Parameter Range: 0 - 19

Default Setting: 0

Parameter Type: Tunable (at rest or during operation)

Refer to: P.091 Diagnostics Display

Description: This parameter is used to select, internal information such as I/O data, network statistics, etc., for display in parameter P.091.

1 = Regulator Board terminal strip Digital Inputs 4, 3, 2, 1:
The value is a four digit combination of 1s and 0s.
P.091= Run/Jog * 1000 + Reset * 100 + Stop * 10 + Start

2 = Regulator Board terminal strip Digital Inputs 8, 7, 6, 5:
The value is a four digit combination of 1s and 0s.
P.091= DIN_8 * 1000 + DIN_7 * 100 + DIN_6 * 10 + FN_LOSS

3 = Regulator Board Terminal Analog Input:
P.091= The value displayed is after offset and gain

4 = RMI Digital Inputs 4, 3, 2, 1:
The value is a four digit combination of 1s and 0s.
P.091= R_DIN_4 * 1000 + R_DIN_3 * 100 + R_DIN_2 * 10 + R_DIN_1

5 = RMI Board Analog Input:
P.091= The value displayed is after offset and gain

6 = RMI Frequency Input:
P.091= The value displayed is after offset and gain

7 = Encoder data

8 = DC bus voltage

9 = Regulator Board terminal Analog Input scaled

10 = Regulator Board terminal Analog Input with P.009 applied

11 = Analog Input stop threshold

12 = Analog Input start threshold

14 = Network interface: number of messages received from the network

15 = Network interface: number of message receive time-out errors

16 = Network interface: number of message CRC errors

17 = Network interface: number of message overrun errors

18 = Network interface: number of messages aborted

19 = Network interface: number of messages transmitted to the network

If P.090 = 11 the analog input **stop threshold** is selected for viewing and modifying in P.091.

The stop threshold ranges from 5 to 1023 and defaults to 20, which corresponds to **0.20 VDC** (nominally) when the Power Module is identified (P.998/P.999).

If the stop threshold is greater than the start threshold, the stop will take precedence.
In other words, if the analog input is less than or equal to the stop threshold, the drive will stop regardless of the start threshold.

If P.090 = 12 the analog input **start threshold** is selected for viewing and modifying in P.091.

The start threshold ranges from 0 to 2000 and defaults to 30, which corresponds to **0.33** VDC (nominally) when the Power Module is identified (P.998/P.999).

Note that the default threshold values are not restored when P.050 (Restore Defaults) is set to ON.

P.091 **Diagnostics Display**

Parameter Range: N/A

Default Setting: N/A

Parameter Type: Output (read only)
(configurable input, if P.090 is set to 11 or 12)

Refer to: P.090 Diagnostics source

Description: This parameter displays the Terminal strip and RMI input data selected in P.090. The status of the digital inputs (selected by entering a value of 1, 2, or 4 in P.090) is displayed as a four-digit combination of 1s and 0s (1 = on, 0 = off) in the following manner:

	Four-Character Display			
	↑	↑	↑	↑
Selection 1, terminal strip digital inputs	4	3	2	1
Selection 2, terminal strip digital inputs	8	7	6	5
Selection 4, RMI digital inputs	4	3	2	1

P.095 **Power Module Output Amps**

Parameter Range: N/A, Power Module size dependent

Default Setting: N/A

Parameter Type: Output (read only)

Refer to: P.005 Current Limit

Description: This parameter displays the maximum output current rating of the drive. The maximum value of Current Limit (P.005) corresponds to P.095. This parameter is read only.
For example, if P.095 = 11.0 and P.005 = 110% (its maximum), then the maximum output current rating with no overload rating (100% rating) = 10.0 amps.

Refer to manual 49'1327 'GV3000 Power Unit' for Nominal Current and Overload Current values per Power Module size and selected Carrier Frequency (P.047) and Regulation Mode (P.048).

P.098 **Software Version Number**

Parameter Range: N/A, Regulator Board dependent

Default Setting: N/A

Parameter Type: Output (read only)

Refer to: N/A

Description: The parameter displays the software version number.
The value is not adjustable by the user.

P.099 **Power Module Type**

Parameter Range: N/A, Power Unit dependent

Default Setting: N/A

Parameter Type: Output (read only)

Refer to: manual 49'1327 'GV3000 Power Units'.

Description: This parameter displays the type of power module the drive was configured for at the factory.

The value is not adjustable by the user.

It is displayed in the format **v.nnn** where

- **v** represents the drive's Line Input Voltage rating (2 = 230V, 3 or 4 = 400-460V, 5 = 575V), and
- **nnn** represents Power Unit's horse power (with Overload Capability).

V/Hz Regulation Mode

A three-phase motor is normally operated at a constant voltage and at a constant frequency from line supply. This results in a constant rated torque at a constant speed.

To vary motor speed, motor frequency and motor voltage must be varied. This is achieved by a frequency inverter. The inverter transforms the constant input quantities into variable output quantities (output voltage and output frequency vary). The ratio of output voltage to output frequency (Volts/Hz) is calculated for standard applications as follows:

(Volts/Hz) = Rated motor voltage / rated motor frequency

A constant ratio of voltage/frequency (V/Hz) provides generally a constant motor torque (low speeds need more voltage to compensate for motor losses). A function generator calculates the motor voltage based on requested frequency and user selected drive load characteristics.

The inverter consists basically of two sections, the power section and the regulator section:

In the power unit, the line voltage is converted into a DC voltage from which a variable output voltage with variable frequency is produced by means of power transistor modules. The GV3000 Power Units are described in manual 49'1327 with block wiring diagrams presented.

In the regulator section, the control of the transistors required for this purpose is produced and monitored. The PWM signal is produced by software to switch Intelligent Power Modules IPM's to output three phase motor voltage at requested frequency. The following block diagram presents the basic linkage of the individual sections. The regulator section can be split into three different modules:

Regulator card,

Power Interface and Supply (PIS) card,

Keypad.

Microprocessors perform in V/Hz regulation mode the Frequency open loop and Voltage Vector loop tasks of the inverter.

General parameter P.048 provides selection of V/Hz regulation mode.

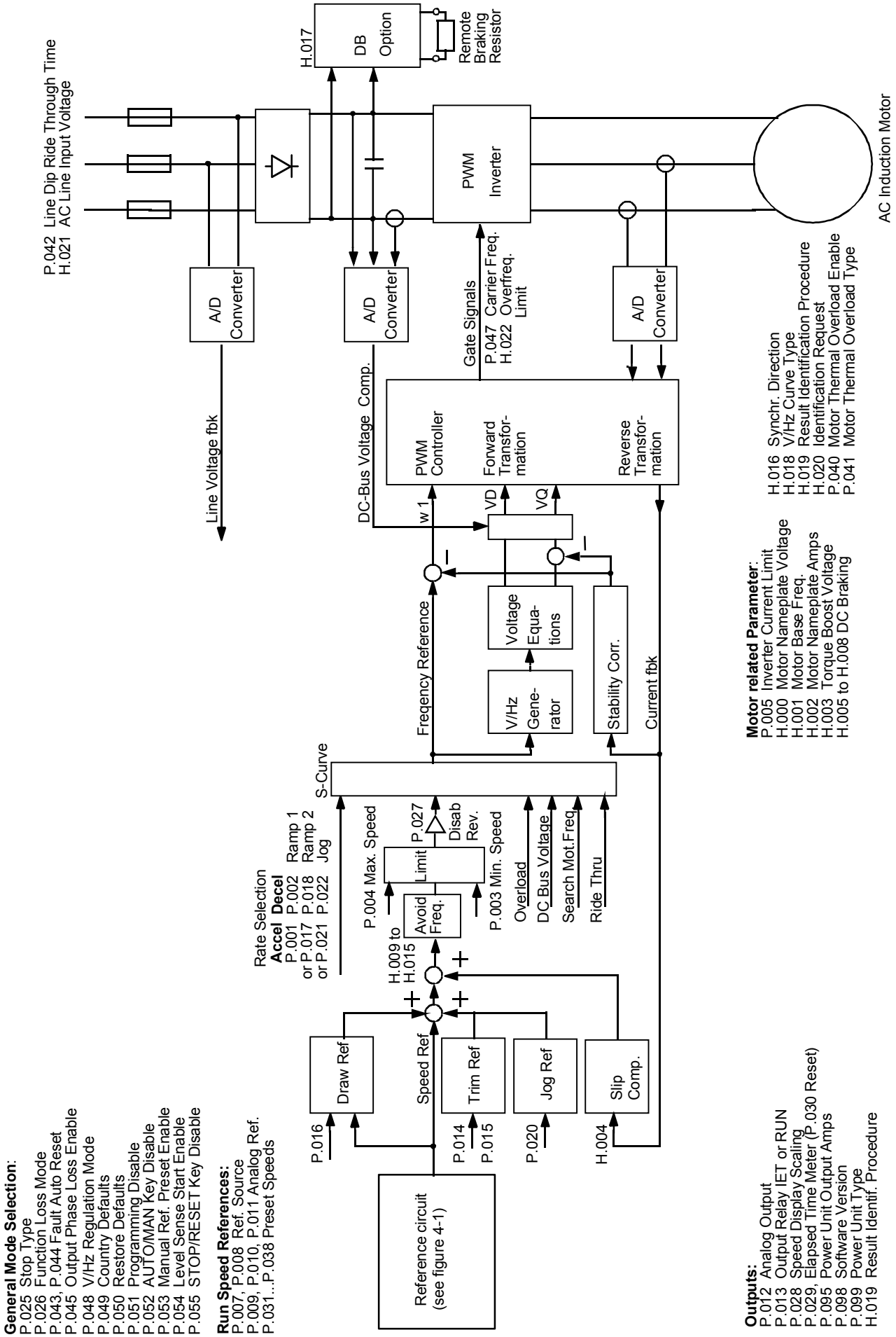
Refer to Section 4 for - Description of parameter types : 'Configurable' and 'Tuneable'.

Refer to Section 8 for - Parameter Lists Overview,
Section 4 for - General Parameters description, and
Section 3 for - Parameter verification and programming, and password entry.

The following block diagram presents the V/Hz regulation signal flow overview.

The following parameters with this warning sign are safety relevant and must be adjusted by a qualified person who understands the significance of setting them accurately. Failure to observe this precaution could result in bodily injury.

Figure 5-1: V/Hz Regulation Overview Diagram



V/Hz Regulation Mode Parameters

H.000 **Motor Nameplate Voltage**

Parameter Range: 180 VAC - 690 VAC

Initial Setting: 380 VAC

Type: Configurable (at standby only)

Description: Motor nominal voltage as read from the motor name plate.
After any change of value in H.000 activate the 'Identification' procedure H.020.

Note: The display doesn't show above entered value at no-load operation due to the automatic voltage boost function !
Under no-load the display-mode (volts) can show lower values, because automatic torque boost is not effective at low currents.

H.001 **Base Nameplate Frequency (V/Hz)**

Parameter Range: 30.0 Hz - 200.0 Hz

Initial Setting: 50.0 Hz

Type: Configurable (at standby only)

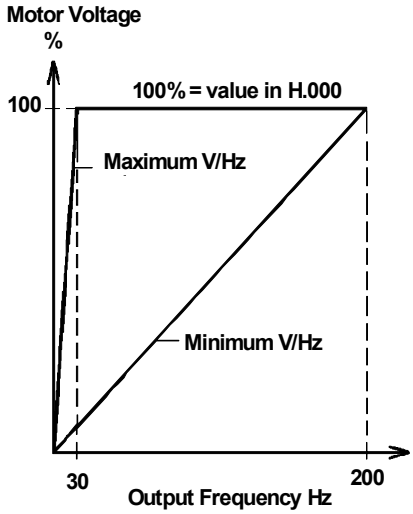
Refer to: H.003 Torque Boost Voltage
H.018 Volts/Hertz Curve Mode

Description: This parameter configures the V/Hz ratio.

Base frequency is the frequency at which the output voltage reaches Motor Nameplate Voltage (H.000). Below base frequency, the output voltage varies with output frequency according to the V/Hz adjustment in parameter H.018 (Volts/Hertz Curve Mode).

Above base frequency, output voltage is held constant as frequency increases (constant horsepower range).

The V/Hz ratio is affected by the selection of Volts/Hertz Curve Mode in H.018 and the setting of Torque Boost Voltage in H.003.



V/Hz Ratio

H.002 **Motor Nameplate Amps**

Parameter Range: Power module-dependent

Initial Setting: Power module-dependent, see instruction manual 'GV3000 Power Units' 49'1327.

Type: Configurable (at standby only)

Refer to: P.005 Current Limit

Description: This parameter is the motor amp rating as it appears on the motor nameplate.

CAUTION: This parameter must not exceed the rated amps found on the motor nameplate. Excess heating of the motor could result if this is not done. Failure to observe this precaution could result in damage to, or destruction of the equipment.

H.003 **Increasing Starting Torque by Output Voltage Boost**

Parameter Range: 0.0% - 20.0% of nominal motor voltage

Initial Setting: 0.5%

Type: Configurable (at standby only)

Refer to: H.000 Motor Nameplate Volts

Description:

This parameter sets the percentage of output voltage boost at zero frequency. It is set as a percentage of Motor Nameplate Volts (H.000).

The Voltage Boost decreases with higher frequency and is zero at nominal frequency.

Torque boost is required to offset the voltage drop of the A-C motor at low speeds. For high friction loads and high inertia loads, high starting torque may be needed. Increasing Torque Boost Voltage will increase motor starting torque.

When H.003=0, the drive automatically provides torque boost voltage that is a function of motor resistance. Via Identification procedure (H.020) the stator resistance is evaluated, an IR-compensation is provided.

H.003>0 :If the torque boost voltage setting is too high, the motor may draw excessive starting current, resulting in an OL or PUo fault, or the drive may go into current limit and not accelerate. If the motor does not accelerate or a fault occurs, decrease parameter value H.003.

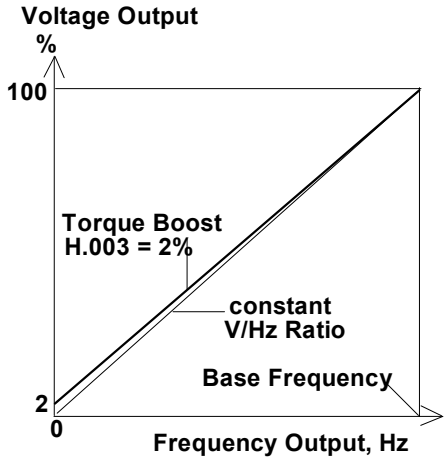


Fig. 5-2: Torque Boost Voltage at mode "Constant V/Hz Curve" (Refer to H.018)

Application:

H.003=0 only if high starting torque on single motor applications is requested!

H.003>0 settings are recommended, on

- Current Limit (P.005) requested below value of Motor Nameplate Amps (H.002). Consider the application limits described at Current Limit (P.005).
- Multi-motor applications to compensate for higher IR-drop of lower Hp motors.

H.004 **Slip Compensation**

Parameter Range: 0.0% - 10.0% of Motor Nameplate Base Frequency (H.001)

Initial Setting: 0.0% (no slip compensation)

Type: Tuneable (at rest or during operation)

Refer to: P.095 Power Unit Output Amps H.001 Motor Nameplate Base Frequency

Description: This parameter is used to improve motor speed regulation by increasing the output frequency applied to the motor (the percentage of frequency rise at Power Unit Output Amps (P.095)).

The level of increased output frequency is a function of the value entered in H.004 (Motor Nameplate Amps) and actual motor current.

Actual motor shaft speed is determined by two factors: inverter output frequency and the slip of the motor. The speed reference is converted into output frequency. Motor slip is determined by the type of induction motor and varies with load.

If the parameter is set to zero, motor speed will not be proportional to speed reference, but will vary depending on load.

'Slip compensation' measures inverter output current and (at rated load) increases the output frequency by the percentage entered in H.004. Below rated load, slip compensation will increase inverter output frequency by the percentage in H.004 multiplied by the percent of rated load.

At load changes, the long-term speed behavior of the motor is greatly improved through the use of this parameter.

To calculate the value entered for H.004, use the following equation:

$$H.004 = \frac{100 * (\text{Synch. RPM} - \text{Nameplate RPM})}{\text{Synchronous RPM}} * \frac{\text{Power Unit Output Amps (P.095)}}{\text{(Total) Motor(s) Nominal Current}}$$

Synchronous RPM = 120 * Frequency / number of Motor Poles

Example : V/Hz mode, 2kHz, 2 motors paralleled, 1435 RPM,
Sum of 2 motor currents = 50% Power Unit Output Amps (P.095)

$$H.004 = 100 * \left(\frac{1500-1435}{1500}\right) * \frac{100\%}{50\%} = 8.67\%$$

H.005 **DC Braking enable**

Parameter Range: OFF – Disable DC Braking
ON – Enable DC Braking

Initial Setting: OFF

Type: Tuneable (at rest or during operation)

Refer to: P.025 Stop Mode H.006 DC Braking Start Frequency
H.007 DC Braking Current H.008 DC Braking Time
H.017 Input Power/Snubber Configuration

Description: This parameter enables or disables DC Braking.

DC Braking is used to provide additional motor braking (by DC current flow through motor windings) at speeds below Braking Start Frequency (H.006).

If DC Braking is required, DC Braking functions (H.008, H.007) must be >zero (0).

When the motor decelerates to the pre-set DC Braking Start Frequency (H.006), the DC Braking Current (H.007) is applied to the motor after a power module-dependent delay time. However, if parameter H.017 is set to 1 or 5, then there is no delay for DC Braking Time (H.008).

NOTE: *This function will **not** provide holding torque as a mechanical brake. D-C-braking is only operative when Stop Mode Selection (P.025) is set to 1 (Ramp to rest stop).*

H.006 **DC Braking Start Frequency**

Parameter Range: 0.5Hz - P.004 (Maximum Speed)

Initial Setting: 1.0 Hz

Type: Tuneable (at rest or during operation)

Refer to: H.005 DC Braking Enable
H.007 DC Braking Current
H.008 DC Braking Time

Description: This parameter sets the frequency at which DC Braking begins.

With DC Braking enabled (H.005=ON), braking will be activated after a stop command when the motor speed is less than or equal to DC Braking Start Frequency (H.006).

NOTE: *If H.005 is set to ON, and this H.006 value is set too high, faults may occur (OC, OCb, or PUo will be displayed).*
Refer also to description Section 5 of this manual, 'Final Adjustment', point 5.

H.007 **DC Braking Current**

Parameter Range: 0.0% -100.0% of motor nameplate amps)

Initial Setting: 10%

Type: Tuneable (at rest or during operation)

Refer to: H.005 DC Braking Enable
H.006 DC Braking Start Frequency
H.008 DC Braking Time

Description: This parameter sets the value of DC current level applied to the motor during DC Braking. Braking torque increases with braking voltage.
With DC Braking enabled (H.005 = ON), the braking torque provided by the motor is defined by a percentage of motor rated amps (100.0% of motor rated amps).

Important: If H.007 is set too high, faults may occur (OC, OCA, OCb, or PUo will be displayed).

H.008 **DC Braking Time**

Parameter Range: 0.0s - 20.0 s

Initial Setting: 3.0 s

Type: Tuneable (at rest or during operation)

Refer to: H.000 Motor Nameplate Volts
H.005 DC Braking Enable
H.006 DC Braking Start Frequency
H.007 DC Braking Current

Description: This parameter sets the time period for which DC Braking will be applied.

With DC Braking enabled (H.005 = ON), braking will be activated after a stop command when the decelerating drive reaches a speed corresponding to DC Braking Start Frequency (H.006). The braking period ends after the programmed time regardless of the actual motor speed. The value should be set to a level that avoids activation at rest.
Refer also to description Section 5 of this manual, 'Final Adjustment', point 5.

H.009 **Avoidance Frequency Enable**

Parameter Range: OFF – Disable avoidance frequency processing
ON – Enable avoidance frequency processing

Initial Setting: OFF

Type: Tuneable (at rest or during operation)

Refer to : P.003 Minimum Speed P.004 Maximum Speed
H.010 to H.015 Avoidance Frequency Midpoint and Band 1, 2, and 3

Description: This parameter enables the avoidance frequency bands selected in H.011, H.013, and H.015.

Operating a motor continuously at a particular frequency may cause vibrational resonance within some machines. Three independent parameter pairs can be configured for avoidance frequency and frequency band. to prevent motor vibration by preventing the drive output frequency from operating within the selected band(s).

The actual avoidance frequency selection is limited by Minimum Speed (P.003) and Maximum Speed (P.004). Normal acceleration and deceleration is not affected by this function. The avoidance frequency function is effective at any operation Control Source selection (P.000).

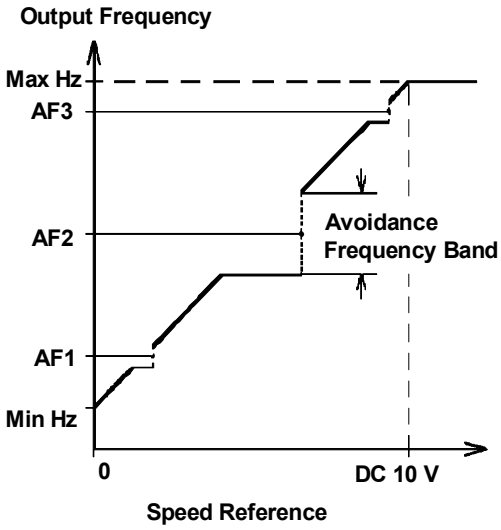


Fig. 5-3: Avoidance Frequency Band

H.010,H.012,H.014 **Avoidance Frequency Midpoint No.1, 2, and 3**

Parameter Range: 0.0 Hz - 200.0 Hz

Initial Setting: 0.0 Hz

Type: Tuneable (at rest or during operation)

Refer to : H.009 Avoidance Frequency Enable
H.011, H.013, H.015 Avoidance Frequency Band 1, 2, and 3

Description: This parameter specifies the midpoint of each avoidance frequency band selected in H.011, H.013, and H.015. The adjusted values may be in any order. The frequency will not be affected at normal acceleration / deceleration but will be avoided at continuous output frequency.

H.011,H.013,H.015 **Avoidance Frequency Band No.1, 2, and 3**

Parameter Range: 2.0 Hz - 10.0 Hz

Initial Setting: 2.0 Hz

Type: Tuneable (at rest or during operation)

Refer to: H.009 Avoidance Frequency Enable
H.010, H.012, H.014 Avoidance Frequency Midpoints 1, 2, and 3

Description: This parameter specifies the avoidance frequency band that will be applied to each avoidance frequency midpoint selected in H.011, H.012, and H.014.

The avoided frequency range is:
(Avoidance freq. midpoint 'n' - freq. band 'n'/2) < range < (avoidance freq. midpoint 'n' + freq. band 'n'/2)
where n = 1, 2, or 3.

H.016 **Sync Direction**

Parameter Range: Off = Disable Sync Mode
F = Search starts at maximum frequency in motor forward direction
r = Search starts at maximum frequency in motor reverse direction
Fr = Search starts at maximum frequency in motor forward then reverse direction
rF = Search starts at maximum frequency in motor reverse then forward direction

Initial Setting: OFF

Type: Configurable (at standby only)

Description: When starting into a rotating load is required, this parameter selects the direction in which the drive will search in order to synchronize speed reference to motor speed.

Synchronisation means evaluation of actual motor speed / frequency after a RUN command and setting frequency reference in inverter accordingly.

This function does not provide synchronisation after line dip.

At this evaluation the inverter outputs to motor various frequencies and checks feedback values.

This parameter defines the polarity of searching frequency to achieve shortest evaluation time:

Selection ‘F’ or ‘r’ is recommended for known rotation direction.
Selection ‘Fr’ or ‘rF’ is thought for reversing applications for mostly used rotating direction.

Note: Recheck value Current limit (P.005) and consider described notes. The procedure results in a 'Searching current' in the motor which is based on the value entered in P.005 (Current Limit). With too high value in P.005 fault trip 'OFr' may occur.
Recheck Carrier Frequency (P.047), actual controller current rating (Refer to manual 49'1327 'GV3000 Power Unit'), and motor sizing versus controller size.

Note that when Forward/Reverse Configuration (P.027) is set to 1, setting this parameter to r, Fr, or rF may cause the motor to operate in the reverse direction.

H.017 **Input Power/Snubber Configuration**

Parameter Range: 0 ... 5

Initial Setting: 0

Type: Configurable (at standby only)

WARNING: When connected to a non-regenerative common DC-bus, regeneration may cause a rise in DC bus voltage. Be aware that other drives on the bus may experience an unexpected speed increase due to the high bus voltage. Failure to observe this precaution may result in bodily injury.

Description: General

AC-Input: - the main power supply is AC and the under-voltage is sensed from the AC voltage.
DC-Input: - the main power supply is DC and the under-voltage is sensed from DC Bus voltage.
Bus-regulator: - the deceleration time (set with P.002) may be extended automatically to prevent a high DC-Bus voltage (HU) fault from occurring.
At regenerative mode the rising DC-bus voltage causes the deceleration time to be extended, the frequency to be raised to keep the DC-bus voltage below high limit.
Tripping reasons would be DC-bus Overvoltage (HU) or Overfrequency (OF) at frequencies above limit in H.022.
no bus regulator: - the bus voltage is controlled externally to the regulator, for example with a Dynamic Braking Unit. The adjusted deceleration time is met. In case a high DC-bus voltage (HU) fault would occur, then the selected braking unit has not met the adjusted deceleration time (P.002).

Input Power/Snubber Configuration (continued)

Param. 0= AC-Input unit with bus-regulator and ride-thru enabled
Range: 1= AC Input unit with ride-thru enabled and Dynamic Braking used. (not bus-regulator to extend slow down time)
2= DC Input unit with bus-regulator and no ride thru selection. (System 1Q. application)
3= DC Input unit without bus-regulator and without ride thru. (System 4Q application).
4= DC Input unit with all function as 0 for single drive application.
5= DC Input unit with ride thru but Dynamic Braking used (no bus-regulator used.) for single Drive with 4 Q application.

The selections 0 or 1 are to be used on standard units (version without bus regulator)
The selections 2 or 3 are to be used at multi-drive system application.
The selections 4 or 5 are to be used at single-motor DC supplied application.

H.018 **V/Hz Curve Type**

Parameter Range: 0 = Linear V/Hz curve (for constant torque load)
1 = Optimized V/Hz curve (for Rockwell Automation RPM AC motors)
2 = Squared V/Hz curve (for Pumps and Fans)
Initial Setting: 0
Refer to: H.003 Torque Boost Voltage
Type: Configurable (at standby only)

Description: This parameter provides an application-dependent selection of torque availability (motor voltage) versus frequency. This selection is effective from any control source (P.000).

H.018=0 : The linear V/Hz curve is used for constant torque versus speed requirements (as extruders, conveyors). With Torque Boost Voltage (H.003) = 0 a motor IR-compensation is automatically performed to achieve constant torque availability at low frequencies.
For *multimotor* connection to inverter (H.003) Torque Boost Voltage may be set > Zero to provide constant torque availability.

H.018=1 : for use with Rockwell Automation RPM AC motors. A special V/Hz curve (with two different slopes) will provide constant torque capability and best efficiency.

H.018=2 : for centrifugal fan and pump motor applications.

H.019 **Results of V/Hz Identification Procedure**

Description: This parameter displays the result of the identification procedure. Normally, the identification procedure will be successful, and the value in H.019 will be = 0.

Parameter Range: 0 = Ident. procedure successful. No fault.
1 = A logged error aborted identification procedure. Refer to Section 7, Error Log, for how to determine the fault cause. Remove the cause and repeat the procedure.
2 = A Function Loss aborted the identification procedure. Depending on Function Loss Type Mode (P.026), this is or is not logged. Eliminate the cause and repeat the procedure.
3 = A stop command aborted the identification procedure. Repeat procedure without stopping.
4 = The identification procedure aborted because the measured current feedback signal is too low. Feedback signal elements or wiring is defective. Check motor connections, inverter wiring, and feedback devices (current sensors). Repeat procedure.
6 = Calculation result based on identification procedure measurements is out of range. Check causes of incorrect measurements, such as motor connections. Repeat procedure.
Initial Setting: 0
Type: Output parameter.
Refer to: Refer to section 7, Troubleshooting, how to access and read H.019.
H.020 Identification Request.

H.020 **Identification Request**

Parameter Range: OFF Disable identification procedure
ON Enable identification procedure

Initial Setting: OFF

Type: Configurable (at standby only)

Refer to: P.005 Current Limit
P.047 Carrier Frequency (kHz) P.095 Power Unit Output Amps
H.002 Motor Nameplate Amps H.019 Identification Result

Description: This parameter enables the procedure that identifies power module and motor characteristics.

WARNING: The motor shaft can rotate in either direction by up to one (1) revolution providing minimum torque immediately after the Identification procedure has been started. Stay clear of rotating machinery. Failure to observe this precaution could result in bodily injury.

CAUTION: Carrier Frequency (P.047) and Current Limit (P.005) must be set correctly before activating the identification procedure to avoid motor overloading and/or overheating. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

CAUTION: The motor can rotate in the reverse direction even if 1=Reverse Disable has been selected in P.027. Uncouple the motor from any driven machinery that could be damaged by reverse rotation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Before starting this procedure, verify that the motor is at rest and connected to the drive. Verify that Motor Nameplate Volts (H.000), Carrier Frequency (P.047), and Current Limit (P.005) are set correctly. The identification procedure should be run after:

- changing the motor arrangement connected to the inverter
- initial assembly of the inverter (performed at Rockwell Automation)
- replacement of the regulator board

The ratio of maximum Power Unit Output Amps (P.095) to Motor Nameplate Amps (H.002) should not be greater than 3:1. (Maximum Power Unit Output Amps is dependent on power module size and the selected Carrier Frequency (P.047)). Compare the value of P.095 to H.002 to decide on the adjustment of Current Limit (P.005) to avoid motor damage.

Do not connect a motor that cannot withstand maximum Power Unit Output Amps reduced by selected Current Limit (P.005).

Note that the identification procedure must not be performed when more than one motor is being driven by the inverter.

To activate the identification procedure after it has been enabled (H.020 = ON), the program mode must be exited. I_En will flash on the display to indicate the procedure has been enabled. The keypad START key must be pressed to start the procedure. I_Ac will flash on the display to indicate the procedure is being performed (active). The results of this procedure are written to parameter H.019.

If the fault code nId is displayed after a start command is asserted, it indicates that the identification procedure has not been performed. Reset the fault, and then perform the procedure.

If a fault or a stop command is detected, the procedure will abort. HId will be displayed if the procedure is aborted. Refer to Identification Result (H.019).

H.021 **AC Line Voltage**

Parameter Range: 300 VAC - 565 VAC

Initial Setting: 380 VAC

Type: Configurable (in standby only)

Description: This parameter is the phase-to-phase nominal line voltage provided to the drive input power terminals.
If the internal Braking Unit option is used, see also Section 2, Table 2-5, Note 1) of Power units manual 49'1327.

NOTE: The value entered should not deviate more than +/-10% from actual line voltage. If this parameter is set too low, it may cause a drive fault on
- overfrequency, if drive runs unstable, or
- overvoltage, if line voltage is 15% above parameter setting.

H.022 **Overfrequency Limit** (Parameter active for V/Hz only)

Parameter Range: 30.0 to 4 x H.001 + 5% or 210 Hz (Drive will use the lesser value)

Initial Setting: 90.0 Hz

Refer to: P.004 Maximum Speed

Type: Configurable (in standby only)

Description: This parameter provides overspeed protection by setting the fault level for maximum frequency output. If actual frequency exceeds the set value, the inverter will fault (OF will be displayed on the keypad/display) and the drive will stop.

The overfrequency limit should be set approximately 15 Hz above Maximum Speed (P.004).
Slip compensation (slow response) and stability circuits (fast response) may add values to frequency reference and increase output frequency.
Maximum Speed (P.004) should not be set above 200 Hz.

WARNING: The user is responsible for ensuring that driven machinery, all drive-train mechanisms, and process line material are capable of safe operation at the overfrequency limit. Failure to observe this precaution could result in bodily injury.

Start the Controller at V/Hz Regulation Mode

Start-up Check List

1. Install equipment and options in accordance to manual 49'1327, Section 3 and relevant manuals listed in Section 2 of this manual.
2. Turn OFF, lockout or tag input power of the controller.

> **DANGER** Whenever work is done on the unit AC-input power must be disconnected and the DC-bus voltage checked with a voltmeter. Verify that this voltage has dropped below DC 50 V (approx. 60 sec). For DC-bus voltage check and test points refer to Power Units manual 491327, Section 4.
> Failure to observe this precaution could result in bodily injury or loss of life.

3. Check the power circuit installation (see manual 49'1327, Section 3).
   - It is essential to observe and allow for all the national specifications and provisions relating to the installation and operation of electrical systems.
   - Check rated data, function and circuitry of branch circuit protection and/or line input fuses.
   - Check all the terminal connections to ensure that they are tight.
4. Check of all safety devices such as emergency stop switches etc. to ensure they operate properly.
   - Verify that the user-installed COAST-STOP push-button is installed. You must remove the factory-installed wire jumper at regulator terminal block, for the COAST-STOP to work. For terminal numbers refer to manual 49'1327, Section 3.
   - Check all wiring of control connections.
5. Check all equipment for mechanical damage. Remove any debris from around the controller. (Use clean, dry compressed air with a maximum gauge pressure of 1 bar in order to clean any metallic installation residues from the equipment).
   - Check that there is adequate clearance around the controller.
6. Check that line voltage and equipment voltage are properly matched.
7. Check the motor and equipment ground. Check line input terminals as well as motor windings terminals for shorting to ground. It is not permitted to connect different ground potentials to the controller as this may result in short-circuits.
   - Verify that a properly sized ground wire is installed and that a suitable earth ground is used. Verify that all ground leads are run unbroken.
8. Check that the motor and equipment rated data are matched.
9. Check whether the motor is correctly connected. Disconnect any power correction capacitors connected to the motor.
10. Uncouple the motor from any driven machinery to initially start the controller.
11. Before continuing start-up, first read descriptions in Section 4 of 'General Parameters' and Section 5 of 'V/Hz Parameters' and in this way acquire an overview of the various application features, setting facilities and setting ranges of the inverter. Compare the possible application features and their factory settings with the requirements of the installed drive, and take such settings into consideration before start-up with motor.
12. DC Bus voltage, capacitor preparation and line voltage test:
    - Switch on the line voltage.
    - If more than six months have passed since delivery of the equipment, the unit should be left in this state for 15 minutes. This is necessary for forming the intermediate circuit capacitors.
    - Compare actual line input voltage with the H.021 adjustment and correct if the deviation is greater than 10%.
    - Switch the line voltage off.

Test Equipment

Use of the keypad display for measured motor data as speed, voltage, current, power, and frequency is recommended for recording the actual equipment output data. Refer to Section 3 of this manual to operate the Keypad.

Should it be necessary to accurately measure the output variables, use of following instruments is recommended:

- fundamental voltmeter,
- clip-on digital current measuring instrument, and
- hand tachometer for direct measurement of motor speed

Important: When measuring the equipment output variables with other instruments, considerable inaccuracies in the results of the measurements are likely by virtue of the non sine-shaped output voltages, variable output frequencies or motor slip.

Programming of Parameters for Application

- Switch on the line voltage.

- Enable programming of parameters by entering Keypad PROGRAM mode as per Section 3. If LED 'PASSWORD' is ON, enter password into parameter P.051 to enable programming.

- Check all General Par. settings (P.000-P.099 as applicable), verify that they are set correctly, e.g.:

- P.000 Control Source (LOCL = Local command at keypad effective)
- P.049 Country Defaults (EUr for European defaults)
- P.048 Regulation Mode (U-H for V/Hz mode). After mode change wait for completion of diagnostics (displaying SELF). Mode change resets P.--- Parameters. Re-enter Keypad Program mode.
- P.050 Restore Default (may be activated to reset P.--- parameters only)
- P.047 Carrier Frequency (2 kHz, 4 kHz, or 8 kHz)
- P.005 Current Limit (Check value in P.095, limit to avoid motor damage !)
- P.004 Maximum Speed (max. 200Hz, 15 Hz below value of H.022)

- Check all V/Hz Par. settings (H.000 - H.022 as applicable), verify that they are set correctly, e.g.:

- H.000 Motor Nameplate Volts
- H.001 Motor Nameplate Base Frequency (Frequency at nominal voltage, enter motor data)
- H.002 Motor Nameplate Amps
- H.003 Torque Boost Voltage (Normally set to value 0)
- H.021 Line Voltage (value should be within +/-10% of actual line voltage)
- H.022 Overfrequency Limit (15 Hz above value of P.004)
- H.020 Identification-Request (This Procedure is not necessary to be activated at Multimotor-Applications and/or H.003 >0)

Preparation for 'V/Hz Identification Request'

Refer to description of 'V/Hz Identification Request' (H.020).

'V/Hz Identification' is a procedure required for V/Hz Regulation Mode only and run by the controller that determines power unit and motor(s) characteristics.

The procedure has to be activated after changing the value Motor Nameplate Volts (H.000), or changing the arrangement of motor(s) connected to the inverter, or after regulator board replacement.

The procedure has to be activated with motor(s) being connected to controller and being at rest.

CAUTION: Current Limit (P.005) and Carrier Frequency (P.047) have to be set correctly before activating the Identification procedure to avoid motor overloading and/or overheating. Failure to observe this precaution could result in damage to or destruction of equipment (e.g. motor damage).

CAUTION: During Identification procedure the motor can rotate reverse but only one revolution (even with P.027 set to 1=REVERSE DISABLED). Uncouple motor from any driven machinery that could be damaged by reverse rotation. Failure to observe this precaution could result in damage to or destruction of equipment.

1. Uncouple motor from any driven machinery that could be damaged by reverse rotation.
2. Switch on the line voltage.
3. Check that important parameter values are correct before enabling 'V/Hz Identification Request':
   - P.005 Current Limit (Check value in P.095. To be set correctly before enabling procedure to limit output current and avoid motor damage.)
   - H.000 Motor Nameplate Volts To be set correctly before enabling procedure. After any change of value in H.000 activate 'Ident.' procedure.
4. The controller must not be running. Press the STOP/RESET key.

How to Stop the Procedure 'V/Hz Identification'

- If the procedure 'V/Hz Identification' is enabled (H.020 is turned ON, display shows I_En) but not active, set H.020 to OFF.
- If 'V/Hz Identification' has been STARTED (display shows I_Ac), press the STOP/RESET key or activate 'FUNCTION LOSS'.

What happens if a Fault occurs during 'V/Hz Identification'?

If FUNCTION LOSS or STOP is commanded,
no motor is connected, or
overcurrent is detected,
then the procedure is aborted, the drive will coast to rest, display shows an error message ('HId'). Check 'Result of Ident. Procedure' H.019. Refer to description for H.019 or Section 7.

If 'nId' is displayed and Identification procedure was never before executed (checked values = Zero) and procedure is not enabled, then an ordinary drive START is performed: Reset fault, enable 'Ident. Request' (H.020) and START the procedure. After completion of the procedure an ordinary drive START will be accepted.

Start Procedure 'V/Hz Identification'

WARNING: The motor shaft can rotate in either direction by up to one (1) revolution providing a minimum torque immediately after the Identification procedure has been started. Stay clear of rotating machinery. Failure to observe this precaution could result in bodily injury.

1. Enable the procedure 'V/Hz Identification' by setting H.020 to 'ON'. At display mode indication will be 'I_En'.
2. Press START key on the keypad. The display will show 'I_Ac' as long as the procedure is active.
   Note: If the Identification procedure aborts, and HId is displayed, refer to above chapter or Section 7 for troubleshooting.
3. Once the procedure 'V/Hz Identification' is completed, parameter H.020 is set automatically to 'OFF' and the display shows '0.00', the result can be checked as the value in H.019.

Basic Controller Checks

1. Make sure that the controller interlocks installed around the driven machine are operational.
2. Check that the controller's parameter for electronic Motor Thermal Overload Enable (P.040) is set ON, and Motor Thermal Overload Type (P.041) are set correctly for non-ventilated or forced cooled motors. Verify the forced cooling air (blower motor rotating direction) is flowing.

WARNING: The user is responsible for ensuring that driven machinery, all drive-train mechanisms, and process line material are capable of safe operation at the maximum operating speed of the drive. Overfrequency detection (Limit in H.022) determines when the drive shuts down on overspeed, and is normally to be set to 15 Hz above Maximum Speed (P.004). Failure to observe this precaution could result in bodily injury.

3. Check that Maximum Speed (P.004) is set carefully to the application maximum speed but not above 200Hz and that Overfrequency Limit (H.022) is set normally to 15 Hz above Maximum Speed (P.004).
4. Verify settings of selected ramp 1 or 2 acceleration and deceleration times in seconds from / to zero to maximum speed (ramp 1: P.001 / P.002, ramp 2: P.017 / P.018).
   - Too short acceleration time may cause the drive to operate in current limit and actual time to accelerate from zero to maximum speed will be greater then set time.
   - Too short deceleration time may cause the intermediate circuit voltage to reach its limit and therefore the regulator to suspend deceleration as long as DC Bus voltage is too high. Actual deceleration time from maximum speed to zero will be greater then set time.
5. Check the direction of rotation of the motor at preselected FORWARD/REVERSE direction and reference polarity.

NOTE: Forward means **clockwise** rotation viewing motor drive end, with following conditions:
Phases U,V,W at inverter output in phase with U,V,W of an European type of motor.

For changing rotation direction on V/Hz mode drive:

Turn OFF, lockout or tag input power of the controller.

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. Verify with a voltmeter that the DC bus voltage has dropped below DC 50 V (approx. 60 sec) before touching any internal components. For DC-bus voltage check and test points refer to Power Units manual 491327, Section 4. Failure to observe this precaution could result in bodily injury or loss of life.

The direction of rotation can be altered by switching over any two motor leads.

6. Press the START key. The motor should ramp to the pre-set speed at set acceleration rate.
7. While the controller is in RUN mode (the RUNNING LED is lit), check the display data VOLTS, AMPS, and Hz and verify that they are reading correctly.

   Note: VOLTS display can show lower values under no-load (see H.000).
8. For (LOCAL and AUTO) or REMOTE modes: If using a remote speed reference, check - using the local DISPLAY mode - for correct speed reference (Jumper J4: +/-10VDC, or 0-20mA, or 4-20mA). Take in account any values set in P.009 (Offset), P.010 (Gain) and P.011 (Inversion) that have scaled the Analog Signal to Speed Reference.
9. Make sure the correct V/Hz curve (H.018) has been selected for the application.
10. Input Power/Snubber Configuration (H.017) has to be set to 1 or 5, if the Dynamic Braking Unit option has been installed.

Final Adjustments

1. Turn OFF, lock out or tag input power to the controller.
   - Connect the application load to the motor.
   - Turn power ON.
   - Press controller START key.
   - Check if vibration of the machinery is occurring at any frequency.
2. In case of vibration, enable Avoidance Frequency function (H.009) and set Midpoint and Band of Avoidance Frequency(ies) (H.010 to H.015).
3. Check the brake away behavior when starting the machine. For multimotor application the Torque Boost Voltage (H.003) can be optimized for the machine.
4. Slip Compensation (H.004) can be trimmed to reach same RPM at Maximum Hz speed reference at load and no-load conditions (if applicable).
5. DC-Braking Adjustments
   DC Braking (H.005) can be enabled, if Stop Type (P.025) is set to 'Ramp to Rest', to avoid continuous rotation of machinery. This function will **not** provide the holding torque as a mechanical brake! If enabled, you should follow the adjustment procedure with parameters H.006 to H.008.
   - Enter in H.006 for DC Braking Start Frequency a value more than two times Slip Frequency.
   - Increase with H.007 the current until fault trips by OC, OCA, OCb or PUo occur.
     Then decrease H.007 approx. 10% - 20% below this value.
   - Enter a long Braking Time (H.008) depending on the inertia (e.g. 10 sec) and then reduce the time until the stop is optimized.
   - Repeat this adjustment and try to vary H.007. It could be necessary to change H.007 and H.008 several times to reach the best configuration for your application.
6. Start into rotating motor with Sync. Direction (H.016) may be activated, if the application requests a START command to be initiated at rotating machinery (e.g. restart during coast to rest).
7. The Fault Auto Reset function can be selected to restart the drive after faults automatically. Refer to P.043...P.044 for adjustment.
8. When operation is satisfactory:
   - Make a note of final parameter settings in copies of tables in Section 8.
   - Eventually disable Parameter Programming (P.051).
   - Replace the controller cover (if removed) and secure.
   - Eventually turn OFF, lock out and tag power to the controller.

Vector Regulation Mode

The GV3000/SE is a digital AC controller using closed loop vector control (Refer to Figures 6-1a,b,c). Vector control offers the same dynamic performance to an AC motor as that achieved with a DC motor. Torque is constant across the motor's base speed range in both forward and reverse direction. The controller, under microprocessor system control, uses two control loops, speed and torque, to obtain vector performance.

Under the speed control loop, the speed reference (requested speed) can be an internal or an external source. The speed loop's feedback is provided by an encoder attached to the motor's shaft. The actual speed of the motor being calculated as the rate of change of position from the encoder. An error signal derived from the difference between the requested and actual motor speed is implemented digitally (speed controller) to generate the torque command signal for the controller's torque control loop. The torque, in this case, will vary to maintain the motor at it's requested speed.

Under torque control loop, the torque reference (requested torque) accepts a torque signal from the speed loop or from an selected torque reference. The torque control requires calculations and execution of motor equations based on given motor parameters to develop slip. The motor parameters required are magnetizing current (No load phase currents), motor nameplate data, and relative position of the rotor with time. Motor magnetizing currents are measured internally by the GV3000/SE controller while the rotor relative position is performed using an encoder. The torque control then provides information for microprocessor system to generate the switching of the IPM's (Intelligent transistor Power Modules) which, in turn, generates the motor phase voltages (PWM).

When the controller is configured for torque, it should be recognized that since only torque, not speed, is being regulated that an overspeed condition can result given certain motor/load conditions. A value of thirty percent (30%) over Maximum Speed (P.004) will cause an overspeed 'OSP' fault in the controller.

The inverter consists basically of two sections, the power section and the regulator section:

In the power module, the line voltage is converted into a DC voltage from which a variable output voltage with variable frequency is produced by means of transistor modules. The GV3000 Power modules are described in manual 49'1327 with block wiring diagrams presented.

In the regulator section, the control of the Output Power Modules required for this purpose is produced and monitored. The regulator hardware section can be split into three different modules:

Regulator board

PIS Power Interface and Supply card

Keypad

Microprocessors perform in Vector mode the speed, field and the Vector Torque control.

General parameter P.048 provides selection of regulation mode to enable Vector regulation.

Refer to Section 4 for Description of parameter types: 'Configurable' and 'Tunable'.

Refer to Section 8 for - Parameter Lists Overview,
Section 4 for - General Parameters description,
Section 3 for - Parameter verification and programming, and password entry.

The following parameters with this warning sign are safety relevant and must be adjusted by a qualified person who understands the significance of setting them accurately. Failure to observe this precaution could result in bodily injury.

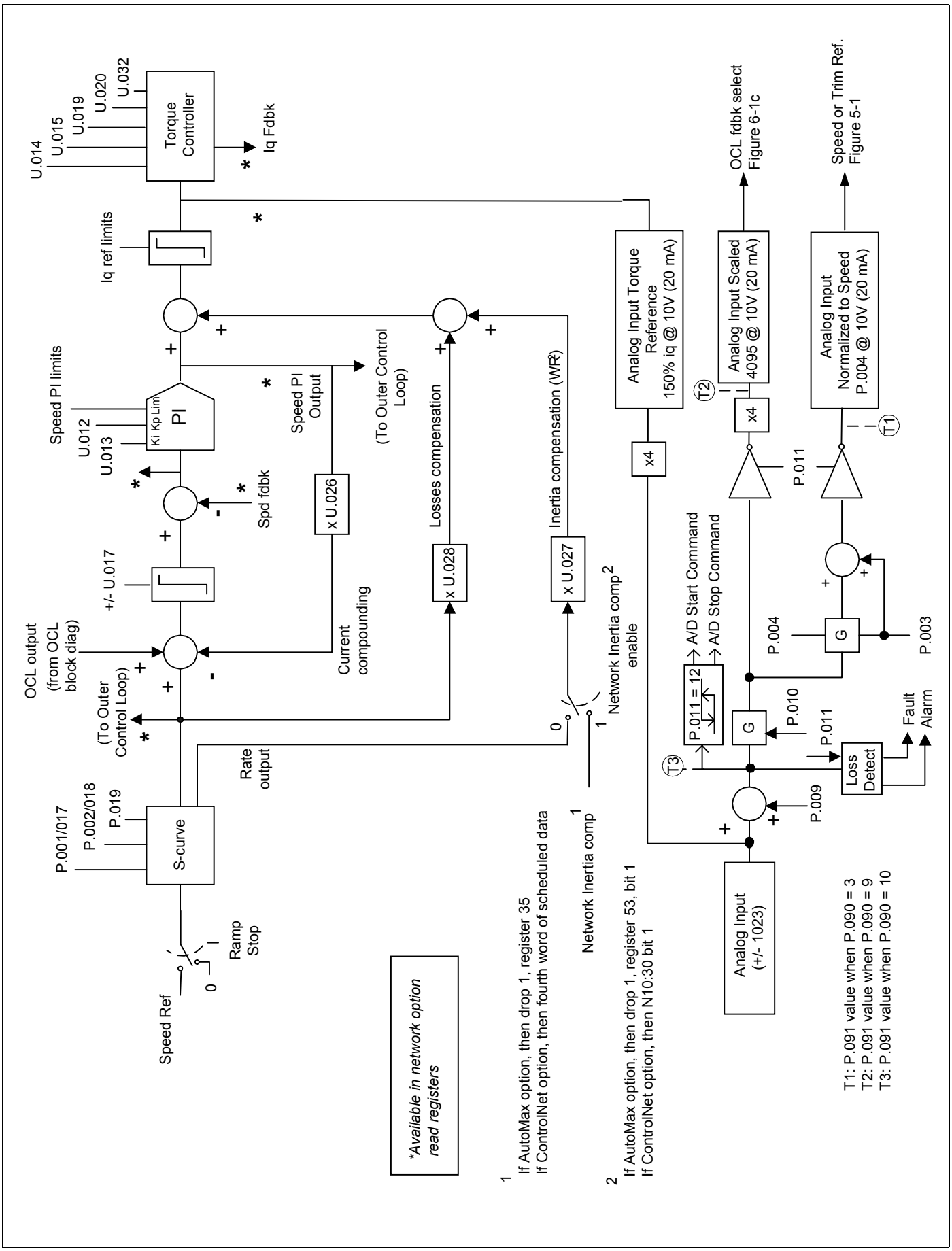


Figure 6-1a: Vector Regulator Speed Loop and
Regulator Terminal Board Analog Input

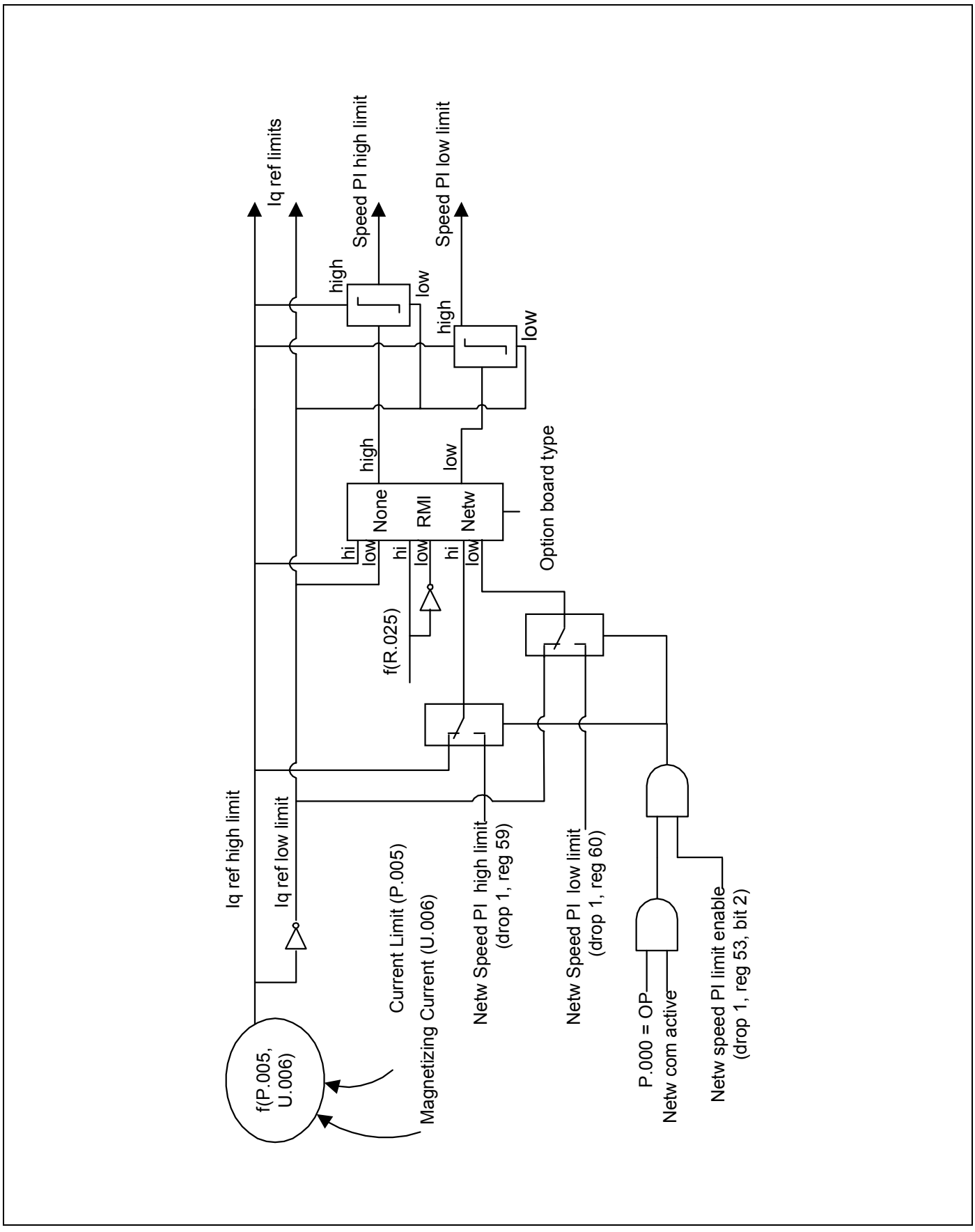


Figure 6-1b: Vector Regulator Speed PI and Iq Reference Limit Selection

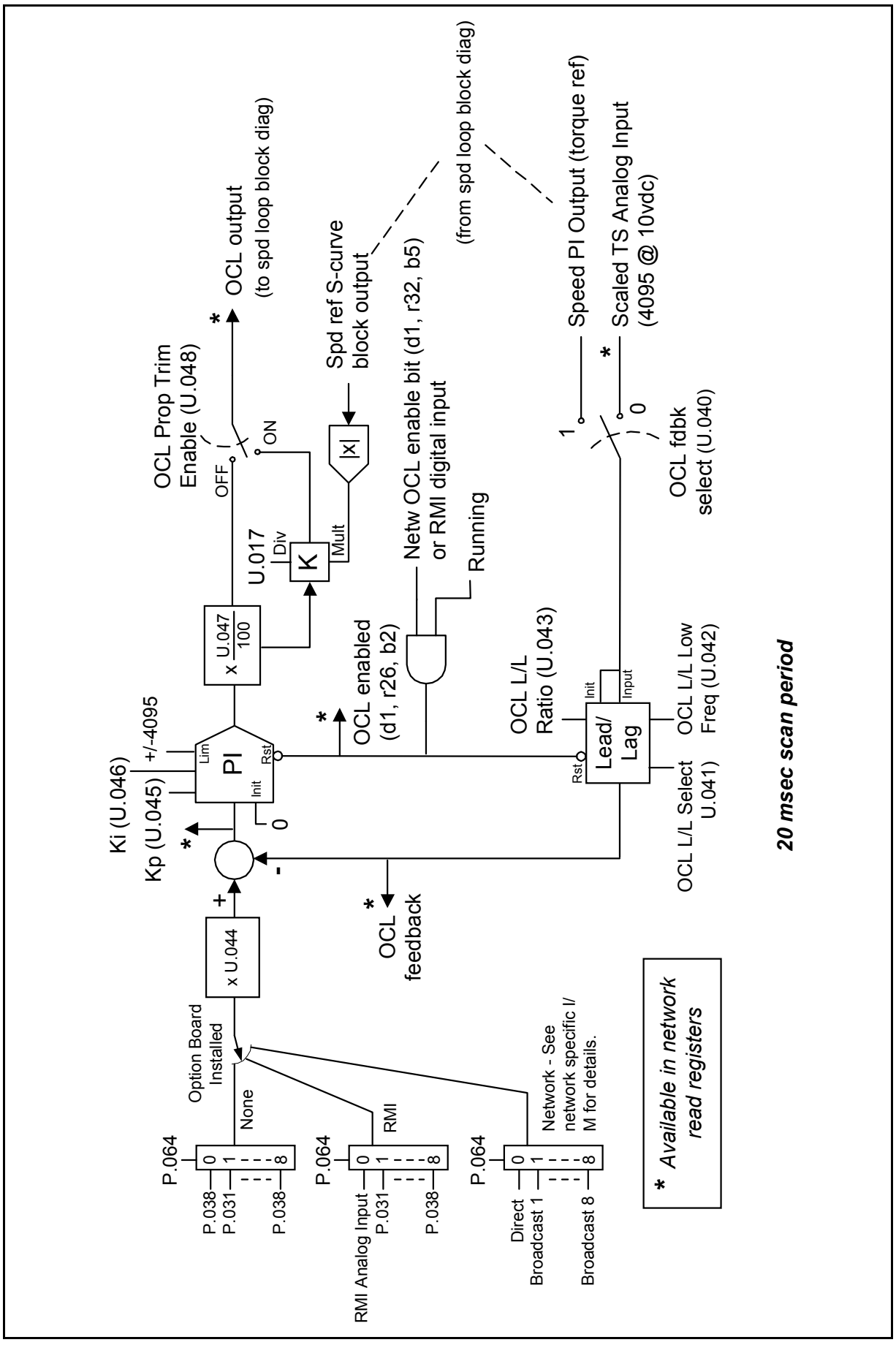


Figure 6-1c: Outer Control Loop Block Diagram

Vector Regulation Mode Parameters

U.000 **Torque Reference Source**

Parameter Range: 0 = Speed Loop Output
1 = Terminal Strip Analog Input
2 = Option Port (Network torque reference register)
3 = Selected speed reference

Default Setting: 0

Type: Configurable (at standby only)

Refer to: P.007 Terminal Strip Digital Inputs Configure
P.063 Option Port: Network Reference Source

Description: This parameter specifies the source for the torque reference.

If U.000 = 0, the drive will always regulate speed.

If U.000 = > 0, the drive will regulate torque or speed. Torque or speed regulation is selected by the P.007 configuration or the Network Option Board (depending on the control source).

If Torque regulation is selected:

- the Current Limit (P.005) is not applied.
- asserting the START input when JOG is selected, will enable the torque regulator, not the speed regulator (i.e. P.020, P.021, P.022 are not used).
- the stop type will always be coast-to-rest stop regardless of the value of P.025 (Stop Mode)

If U.000 is 1, the analog input is NOT conditioned with Offset (P.009) and Gain (P.010), and the reference cannot be inverted using (P.011). The analog input in this case is converted every torque regulator scan (0.5ms) for external closed loop control (e.g. positioning applications).

If U.000 is 3:

- The FWD/REV input can be used to invert the selected speed reference when it is used as the torque reference.
- If the speed reference is used as the torque reference, the % torque is calculated as:

$$\frac{\text{speed value} * 150}{\text{U.017 (Top Speed)}} = \text{value used as torque reference}$$

This assumes that P.028 = U.017

A torque reference value of 4095 corresponds to 150% torque.

U.001 **Encoder PPR**

			Permitted Maximum speed (U.017) for PPR
Parameter Range:	512	= 512 PPR	7200 RPM
	1024	= 1024 PPR	7200 RPM
	2048	= 2048 PPR	3600 RPM
	4096	= 4096 PPR	1800 RPM
	SE	= No encoder connected. Operate in sensorless vector control (SVC).	

Default Setting: 2048 (with P.049 set for 'European default setting')
1024 (with P.049 set for 'American default setting')

Type: Configurable (at standby only)

Refer to: U.008 Torque Self-Tune Enable

Description: This parameter selects the number of pulses per revolution (PPR) of the encoder being used or selects sensorless vector control (SVC) if no encoder is used.

If SE is not selected, the value of this parameter is automatically set when self-tuning (U.008) is successful.

ATTENTION: The setting of parameters U.001 (Encoder PPR), U.002 (Motor Poles), U.003 (Motor Nameplate Base Frequency), U.005 (Motor Nameplate RPM), and U.017 (Motor Top Speed) determines the motor maximum speed.

WARNING: Do not use a 4096 PPR tachometer with a 2-pole motor. Overspeed and motor damage can result. Failure to observe this precaution could result in bodily injury.

If an encoder is used, select the PPR based on a 125 kHz maximum input frequency limitation. The encoder PPR selection affects the minimum and the maximum operation speed in RPM and also affects the speed range.
The maximum input frequency can be calculated by the formula:

$$F_{max} = \frac{U.017 \times U.001}{60}$$ where Fmax is the maximum encoder frequency in Hz.

$$U.001_{max} = \frac{7\,500\,000}{U.017}$$

If U.001= SE, the drive operates using sensorless vector control (SVC). Unless specified, all vector parameters apply to SVC. Refer also to the following parameters which specifically support SVC:

- U.022 Motor Nameplate Horsepower
- U.023 Low Bus Fault Avoidance Enable
- U.030 SVC Slip Adjust
- U.031 SVC Sync Direction
- U.032 SVC Flux Current Regulator Gain

U.002 **Motor Poles**

Parameter Range: 2 = 2 Poles
4 = 4 Poles
6 = 6 Poles
8 = 8 Poles

Default Setting: 4

Type: Configurable (at standby only)

Refer to: U.005 Motor Nameplate RPM

Description: This parameter identifies the number of poles in the motor.

Important: This parameter must be entered before parameter U.005. Parameter U.005 is limited by the number of motor poles (U.002).

ATTENTION: The setting of parameters U.001 (Encoder PPR), U.002 (Motor Poles), U.003 (Motor Nameplate Base Frequency), U.005 (Motor Nameplate RPM), and U.017 (Motor Top Speed) determines the motor maximum speed.

WARNING: Do not use a 4096 PPR tachometer with a 2-pole motor. Overspeed and motor damage can result. Failure to observe this precaution could result in bodily injury.

Important: Verify that the value in U.017 (Motor Top Speed) is correct if U.002 is changed.

If the number of poles is unknown, this value can be calculated using data on the motor nameplate as follows:

Step 1. Calculate the RPM value at 50 Hz as follows:

$$\text{RPM @ } 50\text{Hz} = \frac{50\text{Hz}}{\text{Motor Nameplate Base Frequency (Hz) (U.003)}} * \text{Nameplate RPM (U.005)}$$

Step 2. Determine the number of motor poles by looking up the value computed for RPM @ 50Hz or 60Hz:

Number of Poles (U.002)	Range of RPM at 50Hz (U.003)	Range of RPM at 60Hz (U.003)
2	2700 - 2997	3240 - 3596
4	1350 - 1498	1620 - 1798
6	0900 - 0999	1080 - 1198
8	0675 - 0749	0810 - 0899

If you change this parameter after performing self-tuning using parameter U.008, you must repeat the self-tuning procedure.

U.003 **Motor Nameplate Base Frequency**

Adjustment Range: 15.0 - 240.0 Hz

Default Setting: 50.0 (=50Hz) (with P.049 set for 'European Default Setting')
60.0 (=60Hz) (with P.049 set for 'American Default Setting')

Type: Configurable (at standby only)

Refer to: U.005 Motor Nameplate RPM

Description: This parameter identifies the motor base frequency as it appears on the motor nameplate. Parameter U.005 is limited by U.003.

ATTENTION: The setting of parameters U.001 (Encoder PPR), U.002 (Motor Poles), U.003 (Motor Nameplate Base Frequency), U.005 (Motor Nameplate RPM), and U.017 (Motor Top Speed) determines the motor maximum speed.

Important: Verify that the value in U.017 (Motor Top Speed) is correct if U.002 is changed.

U.004 **Motor Nameplate Amps**

Adjustment Range: 0.1 to 999.9 Amps

Default Setting: Power module size dependent

Type: Configurable (at standby only)

Refer to: N/A

Description: This parameter identifies the motor rated amps as it appears on the motor nameplate.

CAUTION: This parameter must not exceed the rated amps found on the motor nameplate. Overcurrent or excess heating of the motor could result if rated amps are exceeded. Failure to observe this precaution could result in damage to, or destruction of the equipment.

If you change this parameter after performing self-tuning using parameter U.008, you must repeat the self-tuning procedure.

Note that the Power Module's Current Limit value (P.005) scales to the value entered in U.004 to assure drive and motor coordination.

U.005 **Motor Nameplate RPM**

Adjustment Range: The actual adjustment range varies with settings of U.002 and U.003:

Number of Poles (U.002)	Range of RPM at 50Hz (U.003)	Range of RPM at 60Hz (U.003)
2	2700 - 2997	3240 - 3596
4	1350 - 1498	1620 - 1798
6	0900 - 0999	1080 - 1198
8	0675 - 0749	0810 - 0899

Default Setting: 1450 (=1450 RPM) (with P.049 set for 'European Default Setting')

Type: Configurable (at standby only)

Refer to: U.002 Motor Poles
U.003 Motor Nameplate Base Frequency
U.008 Torque Self-Tune Enable

Description: This parameter identifies the motor rated RPM as it appears on the motor nameplate. It should define the speed of the motor, when

- driven at nominal frequency (U.003) and fixed number of motor poles (U.002) with
- nominal motor voltage (U.007) and
- loaded to nominal level, so that the motor takes nominal current (U.004).

IMPORTANT: Most motor manufacturers tend to print the nameplate with a worst case nominal speed, which is lower than true speed at nominal load. Frequency inverters with V/Hz controller don't care about wrong nameplate values for nominal speed, but vector controllers are sensitive to that. Therefore check the setting of parameter U.005 as described in point 6 of 'Basic Controller Checks', page 6-25.

IMPORTANT: U.005 must be set prior to activating the torque control self-tuning operation (U.008).

ATTENTION: The setting of parameters U.001 (Encoder PPR), U.002 (Motor Poles), U.003 (Motor Nameplate Base Frequency), U.005 (Motor Nameplate RPM), and U.017 (Motor Top Speed) determines the motor maximum speed.

Motor Nameplate RPM (U.005) has an increasing influence on motor voltage with rising load, Refer to Figure 6-3 on page 27. Since slip is forced to the motor (different to slip compensation of a V/Hz inverter), wrong slip forces different magnetizing current into the motor, causing a change of V/Hz ratio. U.005 will not be tuned by 'torque self tuning' procedure, but relies only on true nameplate values - which might be wrong.

- If the value is too close to the synchronous RPM, the drive may exhibit instability. This value directly affects torque linearity and the maximum attainable horsepower.
- If the value is too low relative to the true Nominal Motor RPM, the loaded drive may not produce expected torque. (U.007 Motor Nominal Voltage will not be reached at U.016 Field Weakening Start RPM).

U.006 **Motor Magnetizing Current**

Adjustment Range: 10.0 - 80.0% with respect to Motor Nameplate Amps (U.004)

Default Setting: Power module dependent

Type: Configurable (at standby only)

Refer to: U.008 Torque Self-Tuning Enable

Description: This parameter identifies the percentage of magnetizing current with respect to motor rated amps.

A value is automatically generated for this parameter when self-tuning is performed (U.008).

CAUTION: If this parameter is set incorrectly, overcurrent or excess heating of the motor could result. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

If this data does not appear on the motor nameplate, it is recommended that self-tuning (U.008) be performed to automatically calculate the result.

If the motor nameplate shows the no load current data or the magnetizing current data in Amps, then the value can be converted into percent using the following formula:

$$\text{Motor Magnetizing Current [\%]} = \frac{\text{No Load Amps} * 100}{\text{Motor Nameplate Amps (U.004)}}$$

U.007 **Motor Nameplate Volts**

Parameter Range: 180 to 690 Volts

Default Setting: 380

Parameter Type: Configurable (at standby only)

Refer to: U.008 Torque Self-Tune Enable

Description: This parameter identifies motor rated voltage as it appears on the motor nameplate.

Important: This parameter must be set prior to activating the torque control self-tuning operation (U.008).
If you change this parameter after performing self-tuning using parameter U.008, you must repeat the self-tuning procedure.

U.008 **Torque Self-Tune Enable**

Parameter Range: ON = Enable self-tuning
OFF = Disable self-tuning

Default Setting: OFF

Parameter Type: Configurable (at standby only)

Refer to: U.001 Encoder PPR, U.006 Magnetizing Current

Description: This parameter enables the self-tuning procedure that determines the encoder PPR selection for parameter U.001 (Encoder PPR).

CAUTION: The motor must be uncoupled from the driven load during the self-tuning operation or incorrect parameter values will result. This includes any shaft-coupled devices such as reducers, belts, or brakes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

For FVC operation (U.001 ≠ SE), this procedure determines the encoder PPR selection for parameter U.001 (Encoder PPR). Determining the encoder PPR may be necessary since the PPR is not always listed on the motor or encoder nameplate. Determining the magnetizing current ratio is necessary in vector regulation so that the proper no-load current, or magnetizing current, is set. The proper magnetizing current is required to develop rated motor torque, speed, and horsepower in vector regulation.

For FVC and SVC operation, this procedure also determines the value for parameter U.006 (Magnetizing Current).

This parameter will be set to OFF when self-tuning is completed or aborted. This parameter only enables self-tuning. It does not start the procedure. Parameters U.002, U.003, U.004, U.005, and U.007 must be programmed before enabling self-tuning in U.008. Then the START key can be pressed to start the procedure. During the test the drive will accelerate up to 90% of U.005 (Motor Nameplate RPM) even if this value is greater than the value set in P.004 (Maximum Speed).

U.009 **Torque Self- Tune Result**

Parameter Range:

0 = Self-Tuning successful.
1 = User initiated a normal stop. Self-Tuning operation aborted.
2 = Emergency stop or fault stop occurred during Self-Tuning. Self-Tuning operation aborted.
3 = Motor or encoder direction in reverse. Motor must rotate in counter clockwise (CCW) direction facing motor drive end. The encoder leads might also be reversed if the motor direction is correct.

Important: Forward means **clockwise** rotation viewing motor drive end, with following conditions: Phases U,V,W at inverter output in phase with U,V,W of an European type of motor.

4 = Encoder PPR out of range. The result of the determination of the encoder PPR was not one of the 4 permitted values of U.001. The encoder leads might also be reversed.
5 = Magnetizing current percent out of range. The measured no load current was not within 10% to 80% of rated current (U.004). Check that nothing is connected to the shaft and check the value in U.004.
6 = Bus voltage error. Bus voltage out of range. Check that the A-C input line is +/-10% of U.018.
7 = Current limit exceeded. Self-Tuning should be run with the motor unloaded, and without being connected to any inertia load.

Default Setting: N/A

Parameter Type: Output (read only)

Refer to: U.001 Encoder PPR
U.008 Torque Self-Tune Enable

Description: This param. shows the results of the Self-Tuning operation requested by parameter U.008.. Normally, self-tuning should be successful and U.009 value will be 0.

SF will be displayed with a fault entry in the error log showing the cause(s) of the fault(s) for any values of 1 through 7.

U.010, U.011 **Reserved for Later Use**

U.012 **Speed Regulator Proportional Gain**

Adjustment Range: 0.01 - 99.99

Default Setting: power module size dependent

Type: Tunable (at rest or during operation)

Refer to: U.016 Field Weakening Start RPM

Description: This parameter selects the proportional gain of the PI amplifier in the speed loop. This value affects the dynamic performance of the speed regulation of the motor.

Larger gain values result in faster response, but may result in less stability. If the drive overshoots the speed reference when changes to the reference are made, or if the drive "hunts" or is unstable, reduce the value.

With the default value, the drive should perform satisfactorily. However, with increased inertia loads, this parameter may need to be adjusted.

For adjustment procedures refer to 'Tuning the Speed Regulator' (Special Tuning) further on in this section.

Decreasing the value in U.016 may improve dynamic performance near base speed.

U.013 **Speed Regulator Integral Gain**

Adjustment Range: 0.02 to 327.67 radians/second

Default Setting: 15.00 radians/second

Type: Tunable (at rest or during operation)

Description: This parameter selects the lead frequency of the PI amplifier in the speed loop. For most applications, it is recommended that this parameter not be adjusted.

Remaining description as above for U.012.

U.014 **Torque Regulator Proportional Gain**

Parameter Range: 0.10 - 31.99

Default Setting: 0.4

Parameter Type: Tunable (at rest or during operation)

Refer to: U.015 Torque Regulator Integral Gain

Description: This parameter determines the proportional gain of the PI amplifier in the torque regulator.

For most applications, it is recommended that this value not be changed.

The higher the gain is set in this parameter the higher the performance of the torque loop. If the gain is set too high, the drive will become more susceptible to overcurrent trips and/or instability. Decreasing the gain will help to increase stability.

This parameter is not used when the drive is programmed for SVC operation.

U.015 **Torque Regulator Integral Gain**

Parameter Range: 40.0 to 628.0 radians/second

Default Setting: 200.0

Parameter Type: Tunable (at rest or during operation)

Refer to: U.014 Torque Regulator Proportional Gain

Description: This parameter selects the lead frequency of the PI amplifier in the torque loop.

Remaining description as above for U.014.

This parameter is not used when the drive is programmed for SVC operation.

U.016 **Field Weakening Start RPM**

Parameter Range: 2-pole motor (U.002=2): 2880 to U.005
4-pole motor (U.002=4): 1440 to U.005
6-pole motor (U.002=6): 960 to U.005
8-pole motor (U.002=8): 720 to U.005

Default Setting: Power module dependent

Parameter Type: Configurable (at standby only)

Refer to: U.002 Motor Poles U.005 Motor Nameplate RPM U.017 Motor Top Speed

Description: This parameter sets the speed at which field weakening begins (RPM at which motor reaches Motor Nameplate Volts U.007).
Beyond the speed specified in this parameter, torque will be inversely proportional to speed. Increasing this number will maximize the output voltage and, therefore, maximize the horsepower.
Lowering this number may improve dynamic performance near base speed.

If field weakening is used and if you change this parameter after performing self-tuning using parameter U.008, you must repeat the self-tuning procedure.

U.017 **Motor Top Speed**

Parameter Range: U.005 to 7200 RPM*

Default Setting: Power module dependent

Parameter Type: Configurable (at standby only)

Refer to: U.002 Motor Poles U.003 Motor Base Frequency
U.005 Motor Nameplate RPM P.004 Maximum Speed

Description: This parameter selects the top speed that the motor can reach.

*To determine the upper limit of U.017, the drive compares the results of two formulas and uses the lower value:

For **FVC** operation (U.001 ≠ SE):

As the maximum field weakening range (U.005/U.017) is **1:4**, the highest setting of U.017 is **four** times the synchronous speed:

$$\text{Top speed} = \frac{4 * 120 * 60}{\text{U.002}} \quad \text{or} \quad \frac{240 * 120}{\text{U.002}}$$

For a 4-pole motor with a nameplate base frequency of 60Hz:

$$\text{Top speed} = \frac{4 * 120 * \text{U.003}}{\text{U.002}} = \frac{4 * 120 * 60}{4} = 7200 \text{ RPM}$$

For **SVC** operation (U.001 = SE):

As the max. field weakening range (U.005/U.017) is **1:2**, the highest setting is **two** times the synchronous speed:

$$\text{Top speed} = \frac{2 * 120 * \text{U.003}}{\text{U.002}} \quad \text{or} \quad \frac{240 * 120}{\text{U.002}} \qquad \text{where sync. Speed} = \frac{120 * \text{U.003}}{\text{U.002}}$$

ATTENTION: The setting of parameters U.001 (Encoder PPR), U.002 (Motor Poles), U.003 (Motor Nameplate Base Frequency), U.005 (Motor Nameplate RPM), and U.017 (Motor Top Speed) determines the motor maximum speed.

Note that the drive limits the output frequency to the motor to 240 Hz.

- Increasing this number above Motor Nameplate RPM (U.005) will increase the field weakening range.
- The range of the tunable parameter P.004 (Maximum Speed) is limited by the value in U.017.
- For applications not requiring constant horsepower operation, U.017 should be set equal to U.005 (Motor Nameplate RPM).

If you change this parameter after performing self-tuning using parameter U.008, you must repeat the self-tuning procedure.

U.018 **Line Voltage**

Parameter Range: 300 - 565 VAC

Default Setting: 400 VAC

Type: Configurable (in standby only)

Description: Phase to phase nominal line voltage provided to the drive input power terminals. If the internal Braking Unit option is used, see also Section 2, Table 2-5, Note 1) of Power units manual 49'1327.

Important: The value entered should not deviate more than +/-10% from actual line voltage.

U.019 **Flux Current Regulator Proportional Gain**

Parameter Range: 0.10 to 31.99

Default Setting: 0.3

Parameter Type: Tunable (at rest or during operation)

Refer to: U.020 Flux Current Regulator Integral Gain

Description: This parameter determines the performance of the magnetizing current regulator. Higher values will increase dynamic response, but may reduce stability.

For most applications, it is recommended that this parameter is not be changed.

U.020 **Flux Current Regulator Integral Gain**

Adjustment Range: 40.0 to 628.0 radians/second

Default Setting: 50.0

Parameter Type: Tunable (at rest or during operation)

Refer to: U.019 Flux Current Regulator Proportional Gain

Description: As above for U.019.

U.021 **Rotor Time Constant / Fast Flux Up**

Adjustment Range: 0 to 9999 milliseconds

Default Setting: Power module dependent

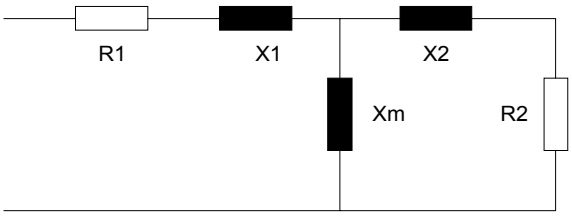
Parameter Type: Tunable (at rest or during operation)

Description: This parameter determines the performance of the magnetizing current regulator. Higher values will increase dynamic response, but may reduce stability.

For most applications, it is recommended that this parameter is not be changed.

For SVC operation, this parameter is used to enable the fast flux-up feature

For special motors or for motors with base speeds < 1150 RPM, the rotor time constant must be calculated by evaluating equivalent motor circuit data as shown in the following figure.



Resistance
R1 = Stator
R2 = Rotor

Reactance
X1 = Stator
X2 = Rotor
Xm = Magnetizing

To calculate the rotor time constant, use the following formula:

Rotor time constant = L / R2

with inductance: L = Lm + L2
Lm = Xm / 2 * 3.14 * (U.003)
L2 = X2 / 2 * 3.14 * (U.003)

Fast Flux-Up Feature (available on drives configured for SVC operation only)

The fast flux-up feature significantly reduces the delay between the initiation of a run command and the actual motor shaft turning.

Setting U.021 to 0 enables the fast flux-up feature. Parameter U.031 (SVC Sync Direction) must be set to OFF to use this feature.

Note that this parameter is not functional in versions 6.0 through 6.05.

U.022 **Motor Nameplate Power**

Parameter Range: 0.3 to 600.0 HP

Default Setting: Power module dependent

Parameter Type: Configurable (at standby only)

Refer to:
U.002 Motor Poles
U.003 Motor Nameplate Base Frequency
U.004 Motor Nameplate Amps
U.005 Motor Nameplate RPM
U.006 Magnetizing Current
U.007 Motor Nameplate Volts

Description: This parameter identifies the motor horsepower as it appears on the motor nameplate..

U.023 **Low DC Bus Fault Avoidance Enable**

Parameter Range: OFF = Drive will not regulate the DC bus on a line dip condition

ON = Drive will decelerate the motor to attempt to hold up the DC bus on a line dip condition

Default Setting: OFF

Parameter Type: Tunable (at rest or during operation)

Description: This parameter. selects how the drive responds to power loss (line dip condition). This feature applies to SVC applications only and is not available if the drive is configured as a torque regulator

If this feature is enabled and DC bus voltage drops below 80% of nominal, the drive decelerates the motor enough to maintain bus voltage. Alarm code LIL appears on the display while the drive is regulating the DC bus. Note that the lighter the load, the longer the power dip ride-through time can be. When input power is restored, the drive ramps to the reference speed.

If this feature is enabled, and the DC bus voltage drops while the drive is stopped, LIL will be displayed.

This parameter is not related to P.042 (Line Dip Ride-Through Time).

U.024 **High DC Bus Fault Avoidance Enable**

Parameter Range: OFF = Drive will not attempt to regulate the DC bus on a high bus condition

ON = Drive will attempt to regulate the DC bus on a high bus condition

Default Setting: OFF

Parameter Type: Tunable (at rest or during operation)

Description: This parameter. selects how the drive responds to high bus voltage.
This feature is not available if the drive is configured as a torque regulator.

If DC bus voltage exceeds a predetermined threshold, the drive generates a high bus alarm (HIdc). If U.024 = ON, the drive attempts to regulate the bus to avoid a high bus fault (HU). Note that this may extend the programmed deceleration time (P.002, P.018). See table 7-1 in chapter 7 for the alarm thresholds.

Set this parameter to OFF if a dynamic braking unit is connected to the drive.

For SVC operation, drive speed may increase as much as 5% above the speed reference in an attempt to decrease the DC bus voltage level.

U.025 **Zero Speed Hold Time**

Parameter Range: 0.0 to 655.0 seconds

Default Setting: 0.0

Parameter Type: Tunable (at rest or during operation)

Description: This parameter selects the amount of time for which zero speed is held at the end of a ramp stop sequence.

WARNING: The motor is energized when the drive is operating at zero speed. The user is responsible for ensuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

This feature provides the capability to hold the motor at zero speed at the end of a ramp stop for a user-specified amount of time (U.025). During the zero speed hold time period, the running status indicator remains on.

For FVC operation, a zero speed reference is applied for the time specified in U.025, regulating torque based on load. Note that this will override the Minimum Speed setting (P.003).

For SVC operation, magnetizing current is applied for the time specified in U.025.

U.026 **Current Compounding Gain**

Parameter Range: 0.0 to 1.000

Default Setting: 0.0 (Current compounding disabled)

Parameter Type: Tunable (at rest or during operation)

Refer to: U.027 Inertia Compensation Gain U.028 Losses Compensation Gain

Description: This parameter specifies the gain applied to the speed PI output. This is used to generate the current compounding signal that is subtracted from the speed loop reference.
Refer to the speed loop block diagram, figure 6-1a

U.027 **Inertia Compensation Gain**

Parameter Range: 0.0 to 5.000

Default Setting: 0.0 (Disable inertia compensation)

Parameter Type: Tunable (at rest or during operation)

Refer to: U.026 Current Compounding Gain U.028 Losses Compensation Gain

Description: This parameter specifies the gain applied to the selected inertia compensation source signal to produce the inertia compensation signal. The result is added to the speed PI output to produce the torque reference signal.

The inertia compensation signal can be either the S/Ramp (ramp) block rate output (dv/dt), used for standalone applications, or a value provided directly from the network option. Signal selection is controlled by a network register. No corresponding parameter local to the drive is provided.

Inertia compensation can be used with or without an option board installed in the drive. If a network option board is not installed, network inertia compensation is not enabled, the network is not active or is not the control source (P.000 ≠ OP), inertia compensation is supplied from the S/Ramp block rate output. The signal provided from the network for inertia compensation is typically used to compensate for inertia as well as all system losses.

Note that if the selected torque reference is not the speed loop output, then the inertia compensation circuit does not apply. Refer to the speed loop block diagram Figure 6-1a.

U.028 **Losses Compensation Gain**

Parameter Range: 0.0 to 1.000

Default Setting: 0.0 (Disable losses compensation)

Parameter Type: Tunable (at rest or during operation)

Refer to: U.026 Current Compounding Gain
U.027 Inertia Compensation Gain

Description: This parameter specifies the gain applied to the speed loop reference signal to generate the losses compensation signal. The result is added to the speed PI output to produce the torque reference signal.
Losses compensation is the scaled output of the speed loop S/Ramp block (speed reference). It is added to the speed loop output and the inertia compensation signal to produce the final torque reference.

Refer to the speed loop block diagram Figure 6-1a.

U.030 **SVC Slip Adjust**

Parameter Range: 0.50 to 1.50

Default Setting: 1.00

Parameter Type: Tunable (at rest or during operation)

Description: This parameter adjusts the slip compensation to match the operating temperature of the motor.

This feature applies to SVC operation only.
For SVC operation, in the absence of a speed feedback device, operation of the speed loop is based on an estimated speed feedback. Estimated speed feedback is based on knowing the slip of the motor, which changes with motor temperature. This parameter is provided to accommodate various operating conditions.

For a cold motor, the typical value should be 0.80. For a hot motor, the value should be 1.0

U.031 **SVC Sync Direction**

Parameter Range:
OFF = Disable synchronization
F = Search starts in motor forward direction
r = Search starts in motor reverse direction
Fr = Search starts in motor forward then reverse direction
rF = Search starts in motor reverse then forward direction

Default Setting: OFF

Parameter Type: Configurable (at standby only)

Description: When starting into a rotating load is required, this parameter selects the direction in which the drive will search in order to synchronize to motor speed.

WARNING: When starting with search enabled, there will be a several second delay, and the motor may drift in the forward and reverse direction, before the motor begins operating in the desired direction even if reverse has been disabled in P.027. Stay clear of rotating machinery. Failure to observe this precaution could result in bodily injury.

Note that when Forward/Reverse Configuration (P.027) is set to 1, setting this parameter to r, Fr, or rF may still cause the motor to operate in the reverse direction.

U.032 **SVC Flux Current Regulator Gain**

Parameter Range: 100 to 1500

Default Setting: Power Module-dependent

Parameter Type: Tunable (at rest or during operation)

Refer to: U.012 Speed Regulator Proportional Gain
U.013 Speed Regulator Integral Gain
U.030 SVC Slip Adjust

Description: This parameter specifies the gain of the flux current regulator. For most applications, it is recommended that this parameter not be adjusted.

This parameter applies to SVC operation only.

On lower horsepower motors, the value can be increased to allow faster acceleration and deceleration.

U.040 **Outer Control Loop Feedback Source**

Parameter Range: 0 = Terminal strip analog input scaled
1 = Speed loop PI output (torque reference, 4095 = 150% torque)

Default Setting: 0

Parameter Type: Configurable (at standby only)

Refer to:

U.041 OCL Lead/Lag Select	U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio	U.044 OCL Reference Gain
U.045 OCL Proportional Gain	U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage	U.048 OCL Proportional Trim Enable

Description: This parameter specifies what is used as the outer loop feedback signal.

The feedback signal is fed through a lead/lag block which can be configured as a lead/ lag, lag/lead, or null (bypassed) function using parameter U.041 (OCL Lead/Lag Select).

See Figure 6-1c- for the outer control loop block diagram.

U.041 **Outer Control Loop Lead/Lag Select**

Parameter Range: 0 = Bypass
1 = Lead/lag
2 = Lag/lead

Default Setting: 0

Refer to:

U.040 OCL Feedback Source	U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio	U.044 OCL Reference Gain
U.045 OCL Proportional Gain	U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage	U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter selects whether the OCL feedback lead/lag block will operate as a lead/lag, a lag/lead, or a null function (bypassed).

See Figure 6-1c for the outer control loop block diagram.

U.042 **Outer Control Loop Lead/Lag Low Frequency**

Parameter Range: 0.01 to 34.90 radians/second

Default Setting: 1.0

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.043 OCL Lead/Lag Ratio
U.044 OCL Reference Gain
U.045 OCL Proportional Gain
U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage
U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter specifies the lead/lag low break frequency of the outer control loop feedback.
This parameter sets the lead break frequency if U.041(Outer Control Loop Lead/Lag Select) = 1 (lead/lag) or the lag break frequency if U.041 = 2 (lag/lead). The upper limit may be restricted by the lead/lag ratio setting (U.043).

See Figure 6-1c for the outer control loop block diagram.

U.043 **Outer Control Loop Lead/Lag Ratio**

Parameter Range: 2 to 20

Default Setting: 10

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.042 OCL Lead/Lag Low Frequency
U.044 OCL Reference Gain
U.045 OCL Proportional Gain
U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage
U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter specifies the ratio between the lead/lag low break frequency and high break frequency of the outer control loop feedback lead/lag block.
The high break frequency is determined by the values in parameters U.042 (Outer Control Loop Lead/Lag Low Frequency) and U.043 as shown:

High break frequency = Low frequency x ratio = U.042 x U.043

See Figure 6-1c for the outer control loop block diagram.

U.044 **Outer Control Loop Reference Gain**

Parameter Range: -5.000 to +5.000

Default Setting: 1.000

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio
U.045 OCL Proportional Gain
U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage
U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter specifies the gain to be applied to the reference entering the outer control loop.

See Figure 6-1c for the outer control loop block diagram.

U.045 **Outer Control Loop Proportional Gain**

Parameter Range: 0.10 to 128.0

Default Setting: 2.00

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio
U.044 OCL Reference Gain
U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage
U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter selects proportional gain of the outer control loop PI amplifier.

See Figure 6-1c for the outer control loop block diagram.

U.046 **Outer Control Loop Integral Gain**

Parameter Range: 0.01 to 141.37 radians/sec

Default Setting: 2.00

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio
U.044 OCL Reference Gain
U.045 OCL Proportional Gain
U.047 OCL Trim Range Percentage
U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter selects the integral gain of the outer control loop PI amplifier.

See Figure 6-1c for the outer control loop block diagram.

U.047 **Outer Control Loop Trim Range Percentage**

Parameter Range: 0.0 to 100.0%

Default Setting: 0.0 (OCL output signal has no effect on speed loop reference)

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio
U.044 OCL Reference Gain
U.045 OCL Proportional Gain
U.046 OCL Integral Gain
U.048 OCL Proportional Trim Enable

Parameter Type: Tunable (at rest or during operation)

Description: This parameter specifies the amount of control the outer control loop output signal has on the speed loop reference. It represents a percentage of Top Speed (U.017).

See Figure 6-1c for the outer control loop block diagram.

U.048 **Outer Control Loop Proportional Trim Enable**

Parameter Range: OFF = Disable proportional trim
ON = Enable proportional trim

Default Setting: OFF

Refer to:
U.040 OCL Feedback Source
U.041 OCL Lead/Lag Select
U.042 OCL Lead/Lag Low Frequency
U.043 OCL Lead/Lag Ratio
U.044 OCL Reference Gain
U.045 OCL Proportional Gain
U.046 OCL Integral Gain
U.047 OCL Trim Range Percentage

Parameter Type: Configurable (at standby only)

Description: This parameter enables the gain block on the output of the outer control loop PI block.
If U.048 = ON, a gain block scales the outer control loop output proportional to the speed reference signal at the output of the S/Ramp block (normalized to top speed). See figure below.

See Figure 6-1c for the complete outer control loop block diagram.

This parameter limits the control the outer control loop has on the speed reference during line start.

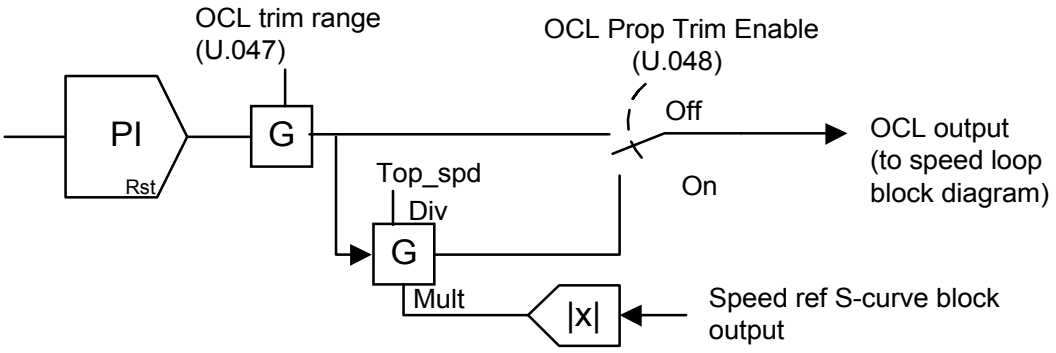


Figure 6-2: Outer Control Loop Proportional Trim

Start the Controller in the Vector Regulation Mode

Start-up Check List

1. Install equipment and options in accordance with manual 49'1327, Section 3 and relevant manuals listed in Section 2 of this manual.
2. Turn OFF, lockout or tag input power of the controller.

> **DANGER***:* Whenever work is done on the drive AC-input power must be disconnected. After discharging of the DC-bus capacitors (approx. 180 seconds) the DC-bus voltage should be checked with a voltmeter, according to the instructions in the Power modules manual 491327, Section 4.
> Failure to observe this precaution could result in bodily injury or loss of life.

3. Check the power circuit installation (see manual 49'1327, Section 3).
   - It is essential to observe and allow for all the national specifications and provisions relating to the installation and operation of electrical systems.
   - Check rated data, function and circuitry of branch circuit protection and/or line input fuses.
   - Check all the terminal connections to ensure that they are tight.
4. Check of all safety devices such as emergency stop switches etc. to ensure they operate properly.
   - Verify that the user's COAST-STOP push-button is installed. You must remove the factory-installed wire jumper at regulator terminals 16 to 20, for the COAST-STOP to work.
   - Check all wiring of control connections.
5. Check all equipment for mechanical damage. Remove any dirt from around the controller. (Use clean, dry compressed air with a maximum gauge pressure of 1 bar in order to clean any metallic installation residues from the equipment).
   - Check that there is adequate clearance around the controller.
6. Check that line voltage and equipment voltage are properly matched.
7. Check the motor and equipment ground. Check line input terminals as well as motor winding terminals for shorting to ground. It is not permitted to connect different ground potentials to the controller as this may result in short-circuits.
   - Verify that a properly sized ground wire is installed and that a suitable earth ground is used. Verify that all ground leads are wired continuously.
8. Check that motor and equipment rated data are matched.
9. Check whether the motor is correctly connected. Disconnect any power correction capacitors connected to the motor.
10. Uncouple motor from any driven machinery to initially start the controller or to perform Self-Tuning.
11. Before continuing start-up, first read all the Parameter descriptions in Sections 4 through 6 and in this way acquire an overview of the various application features, setting possibilities and setting ranges of the inverter. Compare the possible application features and their factory settings with the requirements of the installed drive, and take such settings into consideration before start-up with motor.
12. DC Bus voltage, capacitor preparation and line voltage test:
    - Switch line voltage on .
    - If more than six months have passed since delivery of the equipment, the unit should be left in this state for 15 minutes. This is necessary for forming the intermediate circuit capacitors.
    - Compare actual AC-line input voltage with the U.018 adjustment and correct if the tolerance is higher than 5%.
    - Switch the line voltage off.

Test Equipment

Use of the keypad display for measured motor data such as speed, voltage, current, power, and frequency is recommended for recording the actual equipment output data. Refer to Section 3 of this manual to operate the Keypad.

Should it be necessary to accurately measure the output variables, the following instruments are recommended:

- fundamental voltmeter,
- clip-on digital current measuring instrument, and
- hand tachometer for direct measurement of motor speed.

Important:	When measuring the equipment output variables with other instruments, considerable inaccuracies in the results of the readings can occur because of non sinusoidal output voltages or variable output frequencies..

Programming of Application Parameters

- Switch line voltage on.
- Enable programming of parameters by entering Keypad PROGRAM mode as per Section 3. If LED 'PASSWORD' is ON, enter password into parameter P.051 to enable programming.
- Check all General Parameter settings (P.000 - P.065 as applicable) and verify that they are set correctly, e.g.:

• P.000 ‘Control Source'	(LOCL = Local command at keypad effective)
• P.049 'Country Defaults'	(EUr for European defaults)
• P.048 'Regulation Mode'	(UEC for Vector mode). After mode change wait for completion of diagnostics (displaying SELF). Re-enter Keypad Program mode.
• P.047 'Carrier Frequency'	(2 kHz, 4 kHz, or 8 kHz)

- Check all Vector Operation Parameter settings (U.000 - U.048 as applicable) and verify that they are set correctly, e.g.:

• U.000 'Torque Reference Source'	(Speed Loop output or Terminal Block Analog Input)
• U.001 'Encoder PPR'	(Enter pulses per revolution as per tacho nameplate)
• U.002 'Motor Poles'	(as per motor nameplate or calculation)
• U.003 'Motor Namepl. Base Frequency'	(as per motor nameplate)
• U.004 'Motor Nameplate Amps'	(as per motor nameplate)
• U.005 'Motor Nameplate RPM'	(as per motor nameplate, RPM at base frequency)
• U.006 'Motor Magnetizing Amps’	(motor no load Amps)
• U.007 'Motor Nameplate Volts'	(as per motor nameplate)
• U.016 Field Weakening Start RPM'	(as per motor nameplate, RPM at nominal voltage)
• U.017 'Motor Top Speed'	(as per motor nameplate, motor top RPM)
• U.018 ‘A-C Line Volts'	(value should be within +/-10% of actual line voltage)
• P.003 ‘Minimum Speed’	(Range: 0 - P.004 Maximum Speed)
• P.004 ‘Maximum Speed’	(Range: 0 - U.017 Motor Top Speed)
• P.005 'Current Limit'	(Range: U.006 - 150% of U.004,Motor Nameplate Amps)
• P.028 ‘Speed Display Scaling’	(Displayed value referred to P.004, Maximum Speed)

Preparation for Vector Mode 'Self-Tuning'

Refer to the description of parameter U.008 Torque Self-Tune Enable.

Self-Tuning is a procedure required for Vector operation and run by the controller that determines the proper no load current value for U.006 and the Encoder PPR value for U.001. These values are necessary so that rated motor torque, speed, and power can be developed in the vector mode.

Important: Self-Tuning can only be run on motors with a base frequency of less than or equal to 60 Hz.

WARNING: The subsequent steps require rotating parts and/or electrical circuits exposed. Stay clear and disconnect and lockout or tag power source when contact must be made. Failure to observe this precaution could result in bodily injury or loss of life.

1. Switch line voltage on.
2. Check that important parameter values are correct before initiating 'Self-Tuning':
   - U.002 Motor Poles — U.002 value must be entered before par. U.005.
   - U.003 Motor Namepl. Base Frequency — U.003 value must be entered before par. U.005.
   - U.004 Motor Nameplate Amps — U.005 Motor Nameplate RPM
   - U.007 Motor Nameplate Volts
   - U.016 Field Weakening Speed in RPM (If field weakening is used)
   - U.017 Motor Top Speed in RPM
3. Verify that the motor is unloaded (to enable controller to calculate correctly no load current, U.006).
4. The controller must not be running. Press the STOP/RESET key.
5. Clear the error log of all errors. (Refer to "View Fault Codes, Clear the Error Log", in Section 3.)
6. Set P.000 = 0 for Local operation, or =1 for Remote operation.

How to Stop the Procedure 'Self-Tune'

- When 'Self-Tune' is enabled (U. 008 is turned ON) but not active, set U.008 to OFF.
- If Self-Tune is STARTED (display shows S_Ac), press the STOP/RESET key or activate 'FUNCTION LOSS'.

What happens if a Fault occurs during 'Self-Tune'?

1. If a stop is commanded and Self-Tune is aborted, the drive will shut off, and coast to stop. An error message (SF) is displayed.
2. Once Self-Tune is stopped, parameter U.008 will be updated to OFF, and the drive is taken out of the Self-Tune mode.

Start 'Self-Tune'

1. Enable the Self-Tune parameter. Set U.008 = ON.
2. Exit the PROGRAM mode and enter the MONITOR mode. (Press the PROGRAM key twice when in the parameter list. The display should show S_En when the PROGRAM mode is exited, and the monitor mode is entered.)

WARNING: The user is responsible to ensure that driven machinery, all drive-train parts, and process line material are capable of safe operation at maximum operating speed. Overspeed detection in the drive determines when the drive shuts down and is factory set at Vector Mode to 130% of Maximum Speed (RPM). Failure to observe this precaution could result in bodily injury.

ATTENTION: The motor will rotate during the Self-Tune procedure. The motor must be uncoupled from the driven load during the self-tuning operation or incorrect parameter values will result. This includes any shaft-coupled devices, such as reducers, belts, and brakes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

3. Press the START key on the keypad. The display will show S_Ac when Self-Tune is active. The controller will ramp up to value U.017 Motor Top Speed, and perform Self-Tune calculations.

Important: If Self-Tune aborts, and "SF" is displayed during Self-Tune, refer to Section 7 for a complete action chart for troubleshooting.

4. Once Self-Tune is completed, the motor will ramp down to a stop, and parameters U.001 (Encoder PPR) and U.006 (% Motor Magnetizing Current) will be automatically updated. The display will return to the normal monitor mode. The Self-Tune Enable parameter, U.008, will be updated to "OFF".
5. Parameter U.009 will indicate the Self-Tune result. Refer to Section 6, U.009, for a list of result codes.

Basic Controller Checks

1. Make sure that the controller interlocks installed around the driven machine are operational.
2. Check that any installed motor thermal overload relay or the controller's electronic motor thermal overload parameter (P.040) is enabled (ON). Verify that the parameter for 'Motor Cooling Type Selection' P.041 is set to 'FC' for motors with forced cooling or 'nC' for self cooling motors. Verify that cooling air (blower motor direction of rotating) is flowing.
3. Verify settings of selected ramp 1 or 2 acceleration and deceleration times in seconds from / to zero to Top Speed U.017 (ramp 1: P.001 / P.002, ramp 2: P.017 / P.018).
   - Too short acceleration time may cause the drive to operate in current limit and actual time to accelerate from zero to maximum speed will be higher than set time.
   - Too short deceleration time may cause the intermediate circuit voltage to reach its limit and therefore the regulator to suspend deceleration as DC Bus voltage is too high and trips with 'HU' indication.
4. Check the direction of rotation of the motor at preselected FORW/REV direction and reference polarity.

   Important: Forward means **clockwise** rotation viewing motor drive end, with following conditions: Phases U,V,W at inverter output in phase with U,V,W of a European type of motor.

   How to change direction of rotation on drives in Vector mode:

   ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. Verify with a voltmeter that the DC bus voltage has dropped below DC 50 V (approx. 60 sec) before touching any internal components. For DC-bus voltage check and test points refer to Power Units manual 491327, Section 4. Failure to observe this precaution could result in bodily injury or loss of life.

   The direction of rotation can be altered at a deenergized and locked out drive by switching over any two motor leads together with two leads of one encoder input channel (e.g. A and A NOT). Refer to manual 49'1327, Section 3 for encoder connections.
5. Press the START key. The motor should ramp to the pre-set speed at set acceleration rate.
6. While the controller is in RUN mode (the RUN LED is lit), check the display data VOLTS, AMPS, and Hz and verify that they are correct, also under load condition.

   Check the value of motor nominal speed (U.005) as follows, see figure 6-3 on next page:

   - Operate the drive at 25% to 75% base speed (best 50%). Make sure that the motor can run both at no-load and with load between 75% to 125% nominal load. Note motor current and motor voltage under no-load condition.
   - Load the motor X = 75% to 125% and watch the motor voltage on the keypad. Results differ between cold and hot motor:

     Hot motor: U.005 is correct, if motor voltage rises proportionally to motor current to about Y = 105% of noted no load voltage at motor nominal current. If motor is loaded to X% nominal motor current, the correct factor Y of motor voltage change is:

     $$Y = 105\% * (X\%*I_{nom} - I_{no\text{-}load}) / (I_{nom} - I_{no\text{-}load})$$

     Cold motor: U.005 is correct, if motor voltage drops to 95% of noted no load voltage at motor nominal current. If motor is loaded to X% nominal motor current, the correct factor Y of motor voltage change is:

     $$Y = 95\% * (X\%*I_{nom} - I_{no\text{-}load}) / (I_{nom} - I_{no\text{-}load})$$

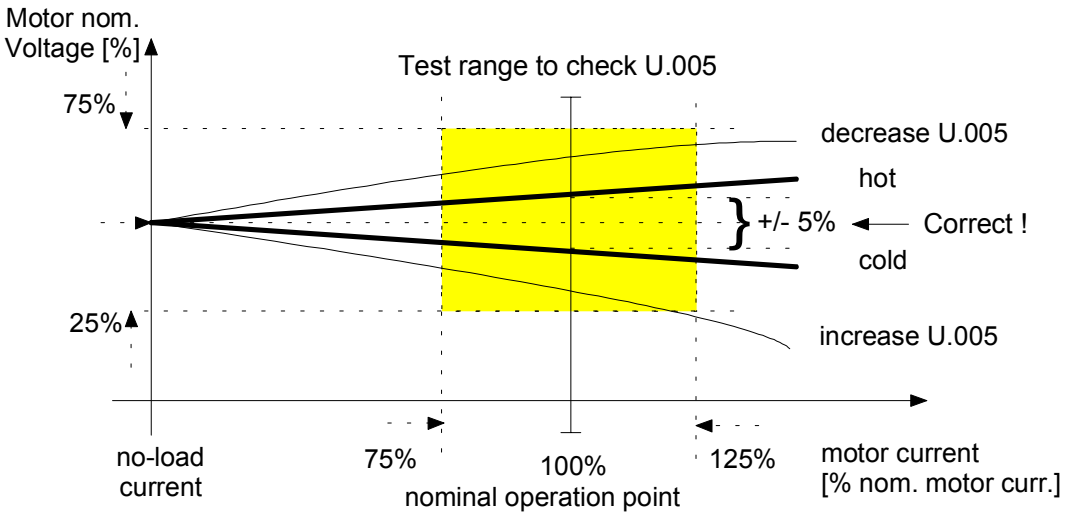


Figure 6-3: Relation of motor voltage and forced slip

7. For (LOCAL and AUTO) or REMOTE modes: If using a remote speed reference, check - using the Local DISPLAY MODE - that the speed reference is correct (J4: +/-10VDC, or 0-20mA, or 4-20mA).

   Take in account any values set into P.009 (Analog Reference Offset) and P.010 (Analog Reference Gain) and P.011 (Invert Speed Reference Signal) that have scaled the speed reference. Refer to Section 4 for description of General Parameters.

Tuning the Speed Regulator

Important: Tuning the speed regulator may not be required for the application.

1. Turn OFF, lock out or tag input power to the controller.
2. Connect the application load to the motor.
3. Turn Power ON.
4. Press the controller START key.
5. Adjust U.012 (Speed Regulator Prop. Gain) or U.013 (Speed Regulator Integral Gain) if necessary. U.012 is the proportional gain of the speed regulator, which determines how smoothly and quickly the controller responds to request of speed changes. A typical value is 2.0.

   Greater values result in faster response, but may show less stability.

   If the motor speed "overshoots" the speed reference when changes to the speed reference are made, or if the motor speed is unstable, reduce the value of U.012.

Tuning Procedure for the Vector Speed Loop

The recommended pre-set value for the proportional and the integral gain of the speed loop parameters are based on a total drive's inertia of twice the motor's inertia.

Initial values

Power module sizes	U.012: Proportional Gain	U.013: Integral Gain
<= 37 kW	8	15
75 kW	16	15
132 kW	25	15

Special tuning

Further speed loop tuning is required, if

- the load inertia is larger than twice the motor's inertia.
- a higher speed loop response is required.

For the tuning procedure a scope is required.

Connect the scope to the analog output:	Regulator card	Remote Meter Interface RMI
Terminal 10: Out	Terminal 10: Out	Terminal 65,66 or 67: Out
	Terminal 11: Common (update: 500 msec)	Terminal 68: Common (update: 5 msec)

Drive set-up for the tuning procedure:

1. Set the acceleration time to
   P.001 = 0.5 sec for the drives <= 37 kW
   1.0 sec for 75 kW drives
   2.0 sec for 132 kW drives

   Important: If there is a large or unknown load inertia the acceleration time must be extended to the mechanical time constant Tm. (Tm is the time which is required to accelerate the inertia with nominal torque to base speed). For measuring Tm see Measuring procedure below.
2. Disable the S-curve: P.019 = OFF
3. Select unipolar speed loop feedback on the analog output: P.012 = 2

Tuning procedure:

1. Set the speed ref. to zero
2. Start the drive
3. Turn the potmeter to base speed in one step.
4. Watch the speed curve:

   If the speed overshoots, increase the Proportional Gain U.012 but if the motor creates noise caused by unstable regulation decrease U.012.
5. Repeat step 1 - 4 until the speed (feedback checked at analog output signal) settles to the set speed value with no overshoot.

Procedure to measure Tm (mechanical time constant)

Tm is the time which is required to accelerate the inertia with nominal torque to base speed.

Measuring procedure:

1. Set Current Limit (P.005) to a value of 100% to match the Motor Nameplate Amps (U.004).
2. Set the Acceleration Time P.001 = 0.1 second.
3. Disable the S-curve: P.019 = OFF.
4. Assign speed loop feedback to the Terminal Strip Analog Output Source (P.012 = 2).
5. Connect the scope to the analog output: Terminal 10: Output Terminal 11: Common
6. Set the speed reference to zero.
7. Start the drive.
8. Turn the reference potmeter to base speed in one step.
9. Evaluate the actual acceleration time from zero to base speed with the help of the saved screen of the scope: This is the mechanical time constant Tm !
10. Set Acceleration Time (P.001), Current Limit (P.005), and Terminal Strip Analog Output Source (P.012) back to the requested application values.

Final Adjustments

When operation is satisfactory:

- Make a note of final parameter settings in copies of tables in Section 8.
- Eventually disable Parameter Programming (P.051).
- Eventually turn OFF, lock out and tag power to the controller.
- Replace the controller cover (if removed) and secure.

Troubleshooting

Spare Parts

For Regulator card stock number and for other spare part information refer to manual 49'1327 "GV3000 Power Unit".

Test Equipment

Measuring the unit output variables by means of commercial measuring instruments involves inaccuracies by virtue of the non sine-shaped output currents and voltages.
Refer also to Section 5 and 6 for notes regarding Test Equipment. Wherever possible, the internal display should be used to measure the output variables.
More accurate measurement of the output voltage with an external instrument is only possible with a fundamental voltmeter. The output current should be measured with a digital clip-on current measuring instrument. The motor speed should be read directly from a hand held tachometer.

General Explanatory Notes

Each time the line supply is switched on, an internal self-diagnosis is activated. The period for this test is approximately 10 seconds.
If an electronic equipment fault is detected during this test, a coded error message appears at the digital display, e.g. 'F1' as power-up diagnostic fatal error. Turn power OFF and lockout or tag input power, and check carefully all controller internal connections to the regulator card (e.g. if all flat ribbon cables are secured in sockets) after having noticed an 'Fxx' displayed. Retry with power ON a new power-up diagnostic procedure.
Rectifying a fatal error with 'Fxx' ('xx'= code number) displayed is in most cases only possible by replacing the regulator board. In such a case, please contact your nearest ROCKWELL AUTOMATION office and inform about the displayed error code.
Following successful completion of the self diagnostics, the 14 keypad LED's will show selected modes and the digital data display shows '0'. The Keypad starts in Monitor mode lighting up that Monitor mode LED last used before power loss.

Preparatory Instructions

It is recommended to perform a visual inspection of the equipment prior to rectifying a fault, and go through the Start-up Check List in Sections 5 for V/Hz mode or Section 6 for Vector mode.

The equipment should be installed and connected electrically in accordance with the manual 49'1327 Section 3.
The controller unit should be operated only within the limits of service conditions listed in manual 49'1327 Section 2.

To locate a fault it is also possible to check the basic functions of the controller by operation from the keypad (parameter P.000 at value 'LOCL' for LOCAL operation mode) with the motor disconnected.

If at REMOTE mode uses analogue input speed reference, be sure the regulator card jumper J4 for selecting voltage or current reference signal is set correctly, as per manual 49'1327, Section 3.

A fault trip can be recognised by the relevant error code being shown in the four-digit keypad data display. The output relay (being configured for ‘FAULT ACTIVE', P.013) on the regulator card and its contact outputs are activated in the event of a fault trip.

The display facilities in the 'Error Code Display' operating mode are described in the Section 3 'View Fault Codes' and 'Access Error Log Time Stamp'.

Use the following Fault Code table to obtain information regarding rectifying faults if errors occur. Further useful information can be obtained by contacting your nearest ROCKWELL AUTOMATION office by phone, telex or fax.

Troubleshooting using error codes

The drive can display two kinds of error codes, alarm and fault codes, to signal a problem during self-tuning or drive operation. Fault and alarm codes are shown in tables 7.1 and 7.2. A special type of fault code, which occurs rarely, is the fatal fault code. If the code you see is not in tables 7.1 or 7.2, refer to table 7.5.

Alarms
An alarm is signified by a two- to four- letter code flashing on the display. The drive will continue to operate during the alarm condition. The user should investigate the cause of the alarm to ensure that it does not lead to a fault condition. The alarm code will remain on the display only as long as the alarm condition exists. The alarm will automatically be cleared when the condition causing it is removed.

Faults
A fault condition is also signified by a two- or three- letter code flashing on the display. In the case of a fault, the drive will not continue to operate, but will coast-to-stop. The RUNNING LED will turn off when this happens. The first fault that occurs will be maintained flashing on the display, regardless of whether other faults occur after it. The fault code will remain on the display until it is cleared by the operator using the STOP/RESET key, or the fault reset input from the selected control source in P.000.

Error at Vector Torque Self-Tuning procedure
If a fault occurs when performing the Vector mode self-tuning, a 'SF' (self-tuning fault) will be entered into the error log and the type of fault will be indicated in the parameter value of U.009 (Results of Torque Control Self-Tuning). Refer to Table 7.3 to Access and Read the results from Torque Self-Tuning procedure.

Error at V/Hz Identification procedure
If a fault occurs at V/Hz mode after the 'Identification Request' (H.020) has been activated, either nId (Procedure ended with no result) or a HId (Ident. procedure fault) will be entered into the error log and the type of fault will be indicated in parameter value of H.019 (Results of Ident. Procedure). Refer to Table 7.4 to Access and Read the results from V/Hz Identification procedure.

Error Log
The drive automatically stores all subsequent fault codes that may occur in the system error log, which is accessible through the keypad, the OIM or the optional Man Machine Interface CS3000 software. The error log can be accessed in program mode after moving through all the parameter menus and is displayed as "Err" on the display. There is no visual indication that there are faults in the log. You must access the error log to view the faults.

The error log holds the 10 most recent faults that have occurred. The faults in the log are numbered sequentially (0 up to 9). The last fault to occur is the first one to appear on the display when you access the error log and is identified with the highest number. Once the log is full, older faults are discarded from the log as new faults occur.

For example, if the last fault was a Low Bus Voltage, and the log has 10 entries, then the error log would display first '9.LU' when the error log is accessed.

Time Stamp for Error Log
For each entry in the error log, the system can also display the day and time that the fault occurred. The day data is based on a relative 248-day counter (rolls over after 248.55). The time is based on a 24-hour clock. The first two digits of the clock data represent hours, the last two digits represent minutes. The clock can be reset using P.030 (Elapsed Time Meter Reset).

All the entries in the error log and the day and time data are retained if power is lost.
See section 3 for how to clear the error log and access error time stamp.

Verify DC Bus voltage

Refer to Instruction Manual 49'1327 'GV3000 Power Unit', Section 2 for Power Circuit diagrams and Section 4 for procedure 'DC-Bus Voltage Check'.

Test Points on Regulator-Card

Test Pin	Function	Voltage Value			
GND	Regulator Common	0 V			
+5V	Regulator Supply	+5 V ± 2%			
+15V -15V	Regulator Supply	+15 V ±10% -15 V ±10%			
IPHU IPHV* IPHW	Judgement of the current waveform with scope (peak value) (motor current feedback across burden resistor)	AC003:	I_M x 0.48 V	AC039:	I_M x 0.080 V
		AC004:	I_M x 0.42 V	AC044:	I_M x 0.070 V
		AC005:	I_M x 0.37 V	AC038/043, AC058-070:	I_M x 0.056 V
		AC008:	I_M x 0.29 V	AC085:	I_M x 0.040 V
		AC012:	I_M x 0.21 V	AC089-140:	I_M x 0.028 V
		AC015:	I_M x 0.18 V	AC170:	I_M x 0.020 V
		AC024:	I_M x 0.12 V	AC180-240:	I_M x 0.016 V
		AC030:	I_M x 0.10 V	AC305/360:	I_M x 0.010 V

* Pin IPHV on Type 003-030 and 039/044 only

Identifying Alarm Codes and Recovering

GV3000/SE drive alarm codes are shown in Table 7.1. Note that the alarm code will only be displayed for as long as the problem exists. Once the problem has been corrected, the alarm code will disappear from the display.

Table 7.1 - List of Alarm Codes

Code	Alarm Description	Alarm Cause	Corrective Action
Ain	Analog input signal loss	P.011=8, 9, 10 or 11 and the 4 – 20 mA input is < 2 mA	Verify that P.011 is set correctly. Check that analog input source supply ≥ 4 mA.
HIdc	High DC bus voltage	The DC bus is charged above the trip threshold. (If U.018 > 415, DC bus is above 741 VDC. If U.018 ≤ 415, DC bus is above 669 VDC.)	Increase the deceleration time in P.002, P.018. Install optional snubber resistor braking kit DBU. Verify that the AC input is within specification. Install an isolation transformer if required. Check the actual line voltage against U.018.
Ar..	Auto-reset The display will flash the countdown period in seconds in the following format: "Ar30..Ar29..Ar28..... .Ar01..Ar00"	The drive has detected a fault and is counting down the auto-reset time period. The drive must run for at least five (5) minutes in order to reset the number of fault reset attempts to the value in P.043.	If during this countdown, the user presses the keypad STOP/RESET key, or asserts the fault reset from the selected control source, the auto-reset countdown will stop, and all faults will be reset.
I_Ac	Identification Procedure active (V/Hz only)	V/Hz identification procedure is enabled and in progress.	1. Allow identification procedure to finish. 2. Press keypad STOP/RESET to cancel identification procedure if desired.
I_En	Identification Procedure enabled (V/Hz only	H.020 = ON; V/Hz identification procedure has been enabled but not started.	1. Proceed with V/Hz identification procedure, start drive and allow procedure to begin. Display will change to I_Ac when drive is started. 2. Change H.020 to OFF to cancel Identification and clear I_En if desired.

Table 7.1 - List of Alarm Codes (continued)

Code	Alarm Description	Alarm Cause	Corrective Action
LIL	Low AC input Line	AC input line is low. For SVC, indicates DC bus is being regulated. No corrective action is required.	1. Adjust line voltage parameter (H.021 or U.018) to match actual AC line voltage.
S_Ac	Vector Self-Tuning active	Vector Self-Tuning is enabled and in progress.	1. Allow Vector Self-Tuning procedure to finish. 2. Press keypad STOP/RESET to cancel Self-Tuning procedure if desired.
S_En	Vector Self-Tuning enable	U.008 = ON; Vector Self-Tuning has been enabled but not started.	1. Proceed with Vector Self-Tuning procedure, start drive and allow procedure to begin. Display will change to S_Ac when drive is started. 2. Change U.008 to OFF to cancel Self-Tuning procedure and clear S_En if desired.

Identifying Fault Codes and Recovering

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

GV3000/SE drive fault codes are shown in Table 7.2. To clear a single fault that has occurred so that the drive can be started again, correct any problems indicated by the fault code and press the STOP/RESET key on the keypad, or assert the fault reset from the selected control source (P.000). Because multiple faults can occur and only the first will be displayed, you must access the error log in order to view all of the faults that have occurred.

Table 7.2 – List of Fault Codes

Code	Type of Fault	Possible Cause	Action
Ain	Analog input signal loss	P.011=4 or 5 and 4 to 20mA analog input is below 2 mA.	Verify that P.011 is set correctly. Check that analog input source supply ≥4 mA.
bYC	Incorrect precharge status.	Precharge initiated and incorrect status returned	Check operation of precharge.
CHS	Default parameter restore (checksum error)	Regulator board failure	Replace regulator (indicate error message at report)
EC	Ground Current Trip	Unintentional grounding of the output.	Check isolation between ground and output terminals. Possible leakage, current sensor defects; replace sensor.
EEr	NVRAM write failure	Failure on write to non-volatile memory, bad NVRAM.	Connect CS3000 software to upload parameters. Then replace Regulator board. Parameter values will be lost when power is cycled.
EL	Encoder loss	Drive is not detecting feedback from the encoder.	Check the connection between the encoder and the drive. Check the encoder/motor coupling.
		For SVC operation, conditions exist for more than 5 seconds that may result in an inability to complete a ramp-to-rest stop.	For SVC operation, check motor data parameters. Check U.006. Incorrect magnetizing current may be generated by performing self-tuning with a load connected to the motor.
FL	Function Loss	Function Loss input on control terminal is opened	Check external interlocks at terminals 16-20.
Hid	Measuring fault at Identification Procedure (V/Hz only)	Identification Procedure aborted. Refer to table 7.4 for 'Result of Ident. Procedure'.	See H.019 for Identification Result

Table 7.2 - List of Fault Codes (continued)

Code	Type of Fault	Possible Cause	Action
HIL	High line voltage	Input line voltage >15% above nominal. (Note that this is not tested for in 1-75 kW Power Modules configured for vector control.)	Check actual line voltage against U.018 or H.021.
HU	High DC-Bus Voltage	DC Bus voltage too high (capacitor protection).	Check input line voltage; if necessary, add transformer.
		Deceleration time too short.	Increase deceleration time P.002/P.018/P.023 versus Max. Speed (P.004) at V/Hz, Top Speed (U.017) at Vector. Consider to add DB option with resistors.
IPL	Input phase loss	Voltage ripple on D-C bus due to missing input phase or an imbalance between phases.	Verify that proper voltage is being applied to the drive.
LU	Low DC Bus Voltage	DC Bus voltage too low. Line dip too long (P.042).	Check input voltage, line fuses. If necessary, add transformer. Check value Line Dip Ride-Through Time (P.042), Line Voltage (H.021 or U.018)
		Input rectifier diodes defective.	Check DC Bus voltage. If incorrect, replace diode set.
nCL	Network Communication Loss	Communications with the Auto-Max Network have been lost.	Check network cabling from master to network option board. Check that netw. master is operating properly.
nId	'Identification Request' not yet performed (V/Hz only)	Drive started but 'Identification' Result = Zero.	Reset Fault. Perform 'Identification Request'. Restart drive.
OC	Overcurrent (steady state) Trips at 200% rated current. Refer to 49'1327 Section 2	Output Phase to Phase short.	Check isolation between each output line.
		Bus voltage line-to-line.	Check transistor modules for correct output. If incorrect, possible PIS & IPA board defect; replace. Possible Hall Effect current sensor defective; replace.
		Ground Fault.	Check isolation between ground and output terminals. Possible leakage current sensor defect; replace sens..
		Momentary overload.	Check for motor overload; reduce load on motor.
		Bad motor.	Check motor for correct operation.
		Torque boost / V/Hz too high (V/Hz only)	Check parameters H.001, H.002, and/or H.003. Enable / START Identification Request (H.020).
		Motor unknown to regulator (V/Hz only).	Check that regulator was updated with actual motor characteristics via Identification Request (H.020).
		Parameter settings (Vector).	Check Pulse Tach PPR (U.001), Motor Poles (U.002), Base Freq. (U.003), Motor Nameplate Amps (U.004), Magn. Current (U.006), Spd. Reg. Prop. Gain (U.012)
		Pulse Tach wired incorrectly, wrong PPR.	Check pulse tach wiring. Refer to 49'1327 Section 3 for connections. Perform self-tune. (See Section 6)
OCA	Overcurrent (at acceleration)	Overcurrent condition occured while accelerating. Acceleration time too short.	Increase acceleration time (P.001, P.017, P.021).
OCb	Overcurrent (at DC-braking)	DC voltage too high.	Check parameters H.006, H.007.
OCd	Overcurrent (at deceleration)	Overcurrent condition occured while decelerating. Deceleration time too short.	Increase deceleration time (P.002, P.018, P.022).
OF	Overfrequency	Drive has exceeded maximum allowable output frequency.	Vector: Check parameters Pulse Tach PPR (U.001), Motor Poles (U.002), Base Frequency (U.003).
		Regenerating energy too high, Stability or Slip compensation circuit adds frequency ref., If H.016 ON, searching current is too high. Motor is too small.	V/Hz: Check DC Bus voltage; increase deceleration time. Check values Maximum Speed (P.004) / Overfreq.(H.022).Check Slip compensation (H.004) If H.016 ON, check motor size versus P/U size, recheck setting of P.005 (too high).
OH	Drive Overtemperature	Controller internal temperature exceeded specified limit.	Check controller ambient temperature, cooling fan, minimum clearances around controller.

Table 7.2 - List of Fault Codes (continued)

Code	Type of Fault	Possible Cause	Action
OL	Motor Overload	Excess motor current. V/Hz: Torque Boost too high (H.003.	Vector: Check actual / Motor Rated Current (U.004) V/Hz: Check actual current / Torque Boost (H.003), Check that controller is sized correctly. Reduce load on motor (e.g. at low frequency).
		Excess load on motor, e.g., at too low speeds.	Check that controller is sized correctly. Reduce load on motor (e.g., at low frequency).
		Loss of phase connection	Check controller output lines to the motor.
OPL	Motor output phase loss	Phase loss between drive and motor	Check connections and cable of all three phases and motor windings. Replace any damaged cable.
OSP	Overspeed (Vector only)	RPM above 130% Maximum Speed (P.004), speed regulator response not optimised	Check Pulse Tach PPR (U.001), Motor Poles (U.002), Base Frequency (U.003), Motor Nameplate RPM (U.005). Check Speed Reg. Proportional Gain (U.012) and Integral Gain (U.013)
PUc	Missing Power module Identification connector	Bad or disconnected cable between Regulator and P/S and Interface card (PIS).	Check cables between regulator and Power Supply and Interface card (PIS).
PUn	Power module not Identified	Drive parameters have been restored to power-up defaults. Regulator has not been configured to match power module.	Power module must be configured by Reliance service personnel.
PUo	Drive Power Electronic Overload	Power module overloaded. Too high DC Braking Voltage (H.007), Torque Boost (H.003).	Check load to power module. Check P/U sizing versus application. At V/Hz: Check DC Braking Voltage (H.007) and Torque Boost Voltage (H.003).
SF	Self-Tuning Status (Vector only)	Refer to following sheet	See parameter U.009.
SrL	Communication loss between Regulator/PC/OIM	Serial port Communication cable, PC or OIM communication port set up	Check connection cable and PC communication port set up.
UAr	Spurious host PC comm interrupt	Regulator board failure.	Replace Regulator board.
UbS	Asymmetrical Bus charge	Bad power module.	Consult ROCKWELL AUTOMATION.

How to Access and Read the Results from Torque Self-Tuning:

A result code is entered into vector parameter U.009 with each performance of self-tuning. When a fault occurs during self-tuning, the display may or may not show a blinking self-tuning fault code. If more than 1 fault should occur during self-tuning, the front panel will only display the first fault code. All other faults will be logged into the error log in sequential order including the self-tuning fault code. Therefore, the error log must be accessed to see any additional faults. There is NO visual indicator to the user that the error log contains any additional fault codes which occurred during self-tuning.

To Access the Self-Tuning Result code (displayed in Parameter U.009):

Note: This procedure assumes that the password for the second menu list (P.006) has already been entered.

	Action	**Display / Notes**
1.	Press the PROGRAM key.	Display shows 'P.---' - General Parameters. The PROGRAM LED goes ON.
2.	Press the ⇓ key.	Display shows 'U.---' - Vector parameters.
3.	Press the ENTER key.	Display shows 'U.000' - the first Vector parameter.
4.	Pressing the ⇑ key or ⇓ key. Step through the vector parameter list until the display shows 'U.009' - (results of torque control self-tuning).	Display will step through the vector parameter list.
5.	Press the ENTER key.	Display shows e.g.' 5' - the result of self-tuning. (Refer to Section 6 for more information on U.009 Torque Self-Tune Results.)
6.	Press the PROGRAM key.	Display shows 'U.009' - Returning to vector parameter list.
7.	Press the ⇓ key. NOTE: *After checking vector parameter U.009 for the self-tuning result code, always check the error log for additional fault entries.*	Display shows 'Err' - Error Log.

Table 7.3 Vector Mode Self-Tuning : Result checking of U.009 value (See also Parameter U.009)

C.	**Self-Tuning status**	**Type of Fault**	**Cause and Action**
SF	U.009 = 1 U.009 = 2	User stop or Emergency stop/fault during self tuning	A user stop has been pressed, or a fault occurred during self-tuning. (Once the motor stops, clear the faults (both parameter and hardware) and again perform self-tuning.)
	U.009 = 3	Motor or pulse tach direction reverse	The motor is rotating in wrong direction. (Motor rotation should be in a counter clockwise direction facing the motor drive end). If the motor rotation is correct, check that the pulse tach is wired correctly. (Refer to 49'1327 Sect. 3, control wiring.) Change controller U and V phases with one another, if tach wiring is correct.
	U.009 = 4	Pulse tach PPR wrong	Check that the pulse tach's PPR is one of the four tach PPR's allowed for usage with the controller. If not one of the four, replace the tach. Check that the pulse tach is wired correctly. (Refer to 49'1327 Section 3, control wiring.)
	U.009 = 5	% Motor Magnetising Current out of range	Check that parameters U.002 (Motor Poles), U.003 (Motor Base Frequency), U.004 (Motor Nameplate Amps), and U.005 (Motor Nameplate RPM) are set correctly.
	U.009 = 6	DC Bus voltage out of range	If the line voltage is within limits, contact ROCKWELL AUTOMATION. Disconnect load from motor.
	U.009 = 7	Current limit exceeded	Check that parameters U.002 (Motor Poles), U.003 (Motor Base Frequency), U.004 (Motor Nameplate Amps), and U.005 (Motor Nameplate RPM) are set correctly.

How to Access and Read the Results from V/Hz Identification Procedure:

A result code is entered into V/Hz parameter H.019 with each Identification procedure. When the identification procedure is aborted, the display may or may not show a blinking Ident. procedure fault code 'HId' or code of fault, which caused an abortion of ident. procedure. If more than 1 fault should occur during the procedure, the front panel will only display the first fault code. All other faults will be logged into the error log in sequential order including the Ident. procedure fault code. Therefore, the error log must be accessed to see any additional faults. There is NO visual indicator to the user that the error log contains any additional fault codes which occurred during the Ident. procedure.

To Access the V/Hz Identification Procedure Result code (displayed in H.019):

Note: This procedure assumes that the password for the second menu list (P.006) has already been entered.

	Action	**Display / Notes**
1.	Press the PROGRAM key.	Display shows 'P.---' - General Parameters. The PROGRAM LED goes ON.
2.	Press the ⇓ key.	Display shows 'H.---' - V/Hz parameters.
3.	Press the ENTER key.	Display shows 'H.000' - the first V/Hz parameter.
4.	Pressing the ⇑ key or ⇓ key. Step through the V/Hz parameter list until the display shows 'H.019' - (results of V/Hz Identification procedure).	Display will step through the V/Hz parameter list.
5.	Press the ENTER key.	Display shows e.g.' 3' - the result of procedure. (Refer to Section 5 for more information on H.019 - (V/Hz Identification procedure result code.)
6.	Press the PROGRAM key.	Display shows 'H.019' - Returning to V/Hz parameter list.
7.	Press the ⇓ key. NOTE: *After checking V/Hz parameter U.009 for the self-tuning result code, always check the error log for additional fault entries.*	Display shows 'Err' - Error Log.

Table 7.4 V/Hz Mode Identification Procedure: Result checking of H.019 value (See also H.019)

C.	**Identific. Status**	**Type of Fault**	**Cause and Action**
HId	H.019 = 0	Ident. procedure passed successfully	No fault.
	H.019 = 1	A logged error aborted Ident. procedure.	Refer Error Log description, to analyse trip cause. Remove the cause and repeat procedure.
	H.019 = 2	FUNCTION LOSS during Ident. procedure	A Function Loss aborted Ident. procedure. Depending on 'Function Loss Selection' (P.026) this is or isn't logged. Remove the cause and repeat procedure.
	H.019 = 3	User STOP or EMERG. STOP during Ident. procedure	A user STOP has been pressed, or a fault occurred during . Ident. procedure (Once the motor stops, clear the faults (both parameter and hardware) and again perform Ident. procedure.).
	H.019 = 4	Motor Voltage applied is exceeded	Measured current feedback signal too low. Feedback signal elements or wiring defective. Check motor connections, Inverter internal wiring, feedback devices (current sensors). Repeat procedure.
	H.019 = 6	Calculation result based upon Ident. procedure measurements are out of range	Check ev. causes for incorrect measurements, motor connections, Reset and repeat procedure

Recovering from Fatal Fault Codes

Fatal fault codes are distinguished by the letter F preceding the code. They normally indicate a malfunction of the microprocessor on the Regulator board. In some cases, fatal fault codes can be reset and the drive can be restarted.
Table 7.5 lists the fatal fault codes which can be reset. If any other fault code appears on the display, you will need to replace the Regulator board.

If the fault code FUE appears in Error log entry 0, it indicates a fatal fault occurred before power was lost. Contact Rockwell Automation or observe the drive for subsequent fatal errors before turning off power.
Fatal fault codes are lost after power loss.

Table 7.5 - Fatal Fault Codes that can be reset

Code	Description	Cause	Corrective Action
Fxx other then below	Various power-up / runtime checks performed by the regulator logic can result in a displayed 'F' followed by a number other then described below.	Connections to regulator card incorrect or loose. Defective regulator card.	Check all ribbon cable and other connections to regulator. Return regulator card to ROCKWELL AUTOMATION together with information of error code displayed last.
F03	Pulse Tachometer Power-up Diagnostic Error	Pulse tachometer voltage is less than 10V	Turn off power to the drive. Disconnect the pulse tachometer wiring from the control terminal strip. Turn power back on and start the drive. If the F 3 error does not occur again, the problem is in the wiring between the drive and the pulse tachometer. If the F 3 error does occur again, the problem is in the regulator board, which should be replaced.
F 60	Option Port Identification Error	The option board could not be identified by the regulator	Check the ribbon cable between the regulator board and the option board. For 240 A drives, check the option port jumpers on the option board. Refer to the appropriate Option Board Instruction Manual for more information.
F 61	Option Board Power-up Diagnostic Failure	Option board has failed one or more power-up diagnostics	Check the ribbon cable between the regulator board and the option board. Replace the option board if necessary.
F62 or F26	Option board runtime error	During operation the Option board watchdog failed, or handshake with the drive failed.	If intermittent, check for causes of noise, for proper grounding and that outputs are not exceeding rated current capacities. Replace the option board if necessary. Refer to the appropriate Option Board Instruction Manual for more information.
F70 or F71	Power Module Identification problem	Interface card connections to power module incorrect or loose. Interface card defective.	Check wiring connections between interface card (PIS or PIP) and power module; replace interface card.

GV3000/SE Regulator, General Parameters (P.xxx)

*** =** Parameter tuneable at drive stopped or running; all others adjust with drive stopped.

Para-meter	Description	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
P.000	Control Source (Selection 'OP' only available with optional-Card installed)	LOCL - Local keypad/display rE - Terminal strip remote inputs OP - Option Port (InterBus, Profibus, DeviceNet, AMX) SErL - Serial port (CS3000 or OIM*)	LOCL	
*P.001	Acceleration Time, Ramp 1	1.0 - 999.9 s (on type V/Hz) 0.1 - 999.9 s (on type Vector)	20.0s	
*P.002	Deceleration Time, Ramp 1	1.0 - 999.9 s (on type V/Hz) 0.1 - 999.9 s (on type Vector)	20.0s	
*P.003	Minimum Speed	0.5 Hz - Value of P.004 in Hz (on type V/Hz) 0 RPM - Value of P.004 in RPM (on type Vector)	5.0 Hz 150 RPM	
*P.004	Maximum Speed	0.5 Hz - Value of H.022, max. 200Hz (on type V/Hz) (H.022, Over-frequency limit) 0 RPM - U.017 (Motor Top speed) (on type Vector)	50.0 Hz 1400RPM	
*P.005 (1)	Inverter Current Limit	50 - 100% or 110% of Power Unit Outp. Amps P.095 (V/Hz) U.006 - 150% of value in U.004 (Vector)	100% 150%	
*P.006	Expand to Second Menu List	'2nd menu' password. Refer to Section 3 of this manual.	0	
P.007	Terminal Strip Digital Input Configure	0 = Dig6= FWD/REV, DIG7=RAMP1/2, DIG8=REM/LOC 1 = DIG7=FWD/REV, DIG8=RAMP1/2 2 = DIG7=FWD/REV, DIG8=REM/LOC 3 = DIG7=RAMP1/2, DIG8=REM/LOC 4 = DIG8=FWD/REV 5 = DIG8=RAMP1/2 6 = DIG8=REM/LOC 7 = not used not used not used 8 = FWD/REV TRQ/SPD REM/LOC 9 = not used TRQ/SPD REM/LOC 10 = not used TRQ/SPD FWD/REV 11 = not used TRQ/SPD RAMP1/2 12 = not used not used TRQ/SPD	0	
P.008	Terminal Strip Speed Reference Source	With P.007 set to '7': 0 = Analog Reference 1 = MOP (uses dig. input 6 MOP inc., inp. 7 MOP decrease) 2 = 2 Preset Speeds (uses digital input 6) 3 = 4 Preset Speeds (uses digital inputs 6-7) 4 = 8 Preset Speeds (uses all terminal strip digital inputs) 5 = Analog Ref. and 1 preset speed (uses digital input 6) 6 = Analog Ref. and 3 preset speeds (uses digital inputs 6-7) 7 = Analog Ref. and 7 preset speeds (uses all digital inputs)	0	
*P.009 (2)	Term. Strip Analog Input Offset	(-)900 - (+)900	0	
*P.010 (2)	Term. Strip Analog Input Gain	0.100 - 5.000	1.000	
*P.011 (2) (3)	Term. Strip Analog Input Configure * Alarm, drive continues to run using the value of the analog input 4 to 5 seconds prior to loss. ** Alarm, drive continues to run using Preset Speed 1 (P.031)	0 = +/- 10 VDC Jumper J4 pins 2-3 1 = +/- 10 VDC inverted J4 pins 2-3 2 = 0 to 10 VDC J4 pins 2-3 3 = 0 to 10 VDC inverted J4 pins 2-3 4 = 4 to 20 mA (fault > 2 mA) J4 pins 1-2 5 = 4 to 20 mA inverted (fault > 2 mA) J4 pins 1-2 6 = 0 to 20 mA J4 pins 1-2 7 = 0 to 20 mA inverted J4 pins 1-2 8 = 4 to 20 mA (* alarm > 2 mA) J4 pins 1-2 9 = 4 to 20 mA inverted (* alarm > 2 mA) J4 pins 1-2 10 = 4 to 20 mA (** alarm > 2 mA) J4 pins 1-2 11 = 4 to 20 mA inverted (** alarm > 2 mA) J4 pins 1-2 12 = 0 to 10 VDC Start and stop the drive based on analog input value. J4 pins 2-3	2	
*P.012	Terminal Strip Analog Output Source	0 = Speed /Frequency feedback bipolar 1 = Current feedback bipolar 2 = Speed /Frequency feedback unipolar 3 = Current feedback unipolar	0	

Notes: (1) P.047, P.005 and H.000 must be set before activating at V/Hz mode the Identification Request (H.020)
(2) This parameter is not used at Vector Torque Reference (U.000=1)
(3) Inverting of rotation is only effective with P.027 at 0.

GV3000/SE Regulator, General Parameters (P.xxx) (continued)

*** =** Parameter tuneable at drive stopped or running; all others adjust with drive stopped.

Para-meter	Description	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
P.013	Output Relay Configuration	0 = state of active faults (IET) 1 = state of controller running (0.5s delay after START) 2 = state of controller running (not delayed) 3 = state of Network communication ACTIVE 4 = start permissive conditions are met 5 = one or more alarms are active 6 = output relay is energized when no faults are active.	0	
P.014	Trim reference source selection	0 = No trim reference used 1 = Terminal strip analog input 2 = Option port trim reference register 3 = Max Speed /Frequency (P.004) 4 = Current feedback (on type vector only) 5 = RMI board Analog Input 6 = RMI board Frequency Input 7 = Switched RMI board Analog/Frequency Input 8 = In Mode 1 the setpoint to the RMI outer loop PI block is 0 9 = In Mode 2 the setpoint to the RMI outer loop PI block is the speed ref. from P.000, and the normal speed ref. is 0.	0	
*P.015	Trim Gain (% of trim reference)	(-)100.0 - (+)100.0% Trim ref. gain as % of selected trim ref.	0.0	
*P.016	Draw Gain	(-)100.0 - (+)100.0% Draw gain as % of sel. speed ref. P.008	0.0	
*P.017	2nd ramp acceleration time	1.0 - 999.9 s (on type V/Hz) 0.1 - 999.9 s (on type Vector)	20.0s	
*P.018	2nd ramp deceleration time	1.0 - 999.9 s (on type V/Hz) 0.1 - 999.9 s (on type Vector)	20.0s	
P.019	S-Curve shaping for accel./decel. at RUN (not at JOG)	0 (OFF) = 0%, Linear acc./dec (at V/Hz: not selectable) 1(ON) = 20% S-Curve (at V/Hz always 1) 2 = 2% or any integer value between 2 and 50=50% (only at Vector mode with SW version 6.6).	1 (ON)	
*P.020	Jog Speed Reference	Values in Hz, range P.003 to P.004 (on type V/Hz) Values in RPM, range P.003 to P.004 (on type Vector)	5.0 Hz 150RPM	
*P.021	Jog Ramp Acceleration Time	1.0 - 999.9 s (on type V/Hz) 0.1 - 999.9 s (on type Vector)	20.0s	
*P.022	Jog Ramp Deceleration Time	1.0 - 999.9 s (on type V/Hz) 0.1 - 999.9 s (on type Vector)	20.0s	
*P.023	MOP Ramp Acc./Deceleration	0.1 - 999.9 s (V/Hz/ Vector)	20.0s	
*P.024	MOP Reset Configuration (Output reset to value in P.003)	0 = Reset MOP setpoint after FAULT (IET) 1 = Reset MOP setpoint during each STOP 2 = Do not reset MOP setpoint	0	
*P.025 (5)	Stop Type	0 = Coast-to-rest 1 = Ramp-to-rest	0	
*P.026	Function Loss Response	0 = Coast-to-rest and Fault trip (IET) 1 = Coast-to-rest without Fault trip	0	
*P.027 (3) (4)	Forward/Reverse Configuration	0 = Forward/Reverse enabled 1 = Reverse disabled 2 = State of the forward/reverse input is latched when the motor is started.	0	
*P.028	Speed Display Scaling	10-9999, Display=(Actual freq.*P.028)/Base freq.(H.001) V/Hz 10-9999, Display=(Actual RPM*P.028)/Max.RPM (U.017) Vect.	1500 1400	
P.029	Elapsed Time Meter Output	0 - 9999 days, output parameter only	0	
*P.030	Elapsed Time Meter Reset	OFF - No action ON - Reset P.029 to zero	OFF	
*P.031	Preset Speed 1	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.032	Preset Speed 2	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.033	Preset Speed 3	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	

Notes: (3) P.011 Inversion only effective with P.027 at 0.
(4) Don't set H.016 (Sync. Mode Select) to any value but 'F' avoiding REVERSE rotation via P.027 (Fwd/Rev Config.)
(5) If at Vector mode P.025 is set to 1 (RAMP STOP), then parameter U.000 must be set to 0.

GV3000/SE Regulator, General Parameters (P.xxx) (continued)

*** =** Parameter tuneable at drive stopped or running; all others adjust with drive stopped. **N/A** = not available

Para-meter	Description	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
*P.034	Preset Speed 4	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.035	Preset Speed 5	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.036	Preset Speed 6	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.037	Preset Speed 7	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.038	Preset Speed 8	Value of P.003 to P.004 in Hz (on type V/Hz) Value of P.003 to P.004 in RPM (on type Vector)	5.0 Hz 150RPM	
*P.039	Encoder Loss Enable	OFF = Disable encoder loss diagnostic. ON = Enable encoder loss diagnostic.	OFF	
P.040	Motor Thermal Overload Enable	OFF = Disable Electronic Motor Thermal Overload function ON = Enable Electronic Motor Thermal Overload function	ON	
P.041	Motor Thermal Overload Type	nC = Standard motor without cooling FC = Forced cooled motor	FC	
P.042	Line Dip Ride Through Time	0.1 - 999.9 sec (on type V/Hz) 500ms (on type Vector)	5s 500ms	
P.043	Fault Auto Reset, Attempts	1 -10 Attempts	0	
P.044	Fault Auto Reset, Time Interval	1 -60 sec	8s	
P.045	Output Phase Loss Enable	OFF = Disable output phase loss diagnostic ON = Enable output phase loss diagnostic	ON	
P.047 (1)	Carrier Frequency, influences Power Unit Output Amps (P.095)	2 = 2 kHz Carrier frequency 4 = 4 kHz Carrier frequency 8 = 8 kHz Carrier frequency Defaults are power module-depend.: up to 43A: 8 kHz 58A and above: 2 kHz	8 or 2 P.M. depend.	
P.048	V/Hz or Vector Mode Regulation	UEC = Vector Control U-H = V/Hz Control	U-H	
P.049	Country Defaults	USA = North American defaults EUr = European defaults JPn = Japanese defaults	EUr	
P.050	Restore Defaults (to selection P.049)	OFF = No action ON = Restore Default Settings for (P.xxx only) to selected Default Type (P.049)	OFF	
*P.051	Programming Disable	For password refer to Chapter 3, 'Program Mode'	0	
*P.052	AUTO/MAN Key Disable	OFF = Enable the AUTO/MAN key regardless of control s. ON = Disable the AUTO/MAN key except from the selected control source	OFF	
*P.053	Manual Reference Preset Enable	OFF = Do not preset the manual reference ON = preset the manual reference with the auto reference at the transition from AUTO to MANUAL.	OFF	
P.054	Level Sense Start Enable	OFF = Start input is edge-sensitive ON = Start input is level-sensitive	OFF	
*P.055	STOP/RESET Key Disable	OFF = Enable the STOP/RESET key regardless of control source. ON = Disable the STOP/RESET key except from the selected control source	OFF	
P.060	Network Drop Number	Network-dependent	1	
P.061	Network Connection Type	Network-dependent	1	
*P.062	Option Port: Communication Loss Response	Network-dependent	0	

Note: (1) P.047, P.005 and H.000 must be set before activating at V/Hz mode the Identification Request (H.020)

GV3000/SE Regulator, General Parameters (P.xxx) (continued)

*** =** Parameter tuneable at drive stopped or running; all others adjust with drive stopped. **N/A** = not available

Para-meter	Description	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
P.063	Option Port: Network Reference Source	Network-dependent	0	
P.064	Option Port: Network Trim Reference Source	Option Port-dependent	0	
P.065	Option Port: Type and Version	Output variable contains the actual Type +SW-release (Read only) (e.g. '2123' for software version 1.23)	N/A	
*P.066 to P.069	Network Output Register 1 Source through Network Output Register 4 Source	0 = (P.066) Motor kW display value (P.067) Motor torque display value 1) (P.068) Output power factor (P.069) Encoder counter (x4) 1) 1 = Speed reference rate limit output 1) 2 = Speed reference at the ref/fdbk summing junction (includes OCL output and current compounding) 1) 3 = Speed loop feedback 1) 4 = Speed loop error 1) 5 = Speed PI output 1) 6 = Outer control loop feedback 1) 7 = Outer control loop error 1) 8 = Outer control loop output 1) 9 = Terminal strip analog input normalized to speed 10 = Terminal strip analog input scaled 11 = Torque reference 1) 12 = Torque feedback 1)	0	
P.090	Diagnostics Source	Selects terminal block or RMI input data displayed in P.091 1 = Terminal Block Digital Inputs 4, 3, 2, 1 2 = Terminal Block Digital Inputs 8, 7, 6, 5 3 = Terminal Block Analog Input 4 = RMI Digital Inputs 4, 3, 2, 1 5 = RMI Analog Input 6 = RMI Frequency Input 7 = Encoder data 8 = D-C bus voltage 9 = Regulator Board terminal Analog Input scaled 10 = Regulator Board terminal Analog Input with P.009 applied 11 = Analog Input stop threshold 12 = Analog Input start threshold 14 = Network interface (NWIF): numbers of messages received from the network. 15 = NWIF: number of message receive time-out errors 16 = NWIF: number of message CRC errors 17 = NWIF: number of message overrun errors 18 = NWIF: number of messages aborted 19 = NWIF: number of messages transmitted to the NW	0	
P.091	Input Diagnostics Display	Displays terminal block or RMI input data selected in P.090	0	
P.095	Power Unit Output Amps	Output var. contains maximum output current of drive at selected regulation mode (P.048), carrier frequency (P.047)	N/A	
P.098	Software Version Number	Output variable contains the actual SW-release (Read only)	N/A	
P.099	Power Unit Type	Output variable contains Voltage + Power rating (Read only) (e.g. '4. 50' for 4 =460V, 50HP)	N/A	

1) These signals are valid only in vector control (P.048 = UEC).

GV3000/SE Regulator, V/Hz Mode Parameters (H.xxx)

*** =** Parameter tuneable at drive stopped or running; all others adjust with drive stopped. **N/A** = not available

Para-meter	Description V/Hz control mode only	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
H.000 (1)	Motor Nameplate Volts	180 - 690 VAC	380VAC	
H.001	Mot. Namepl. Base Frequency	30.0 -200.0 Hz (frequency at nominal voltage)	50.0 Hz	
H.002	Motor Nameplate Amps	Power module-dependent	P/U dep.	
H.003	Torque Boost Voltage	0.0 - 20.0% of nominal motor voltage	0.5%	
*H.004	Slip Compensation	0.0 - 10.0% of base frequency (H.001) added to freq. ref.	0.0%	
*H.005	D-C Braking Enable	OFF - Disable DC Braking ON - Enable DC Braking	OFF	
*H.006	D-C Braking Start Frequency	0.5 Hz - Value in P.004 (Maximum Hz) in Hz	1.0 Hz	
*H.007	D-C Braking Current	0.0% - 100.0% of Motor Nameplate Amps	10%	
*H.008	D-C Braking Time	0.0 - 10.0 s	3.0 s	
*H.009	Avoidance Frequency Enable	OFF - Disable avoidance freq., 'ON' - Enable avoid. freq.	OFF	
*H.010	Avoidance Freq. 1, Midpoint	0.0 - 200.0 Hz	0.0 Hz	
*H.011	Avoidance Frequency 1, Band	2.0 - 10.0 Hz	2.0 Hz	
*H.012	Avoidance Freq. 2, Midpoint	0.0 - 200.0 Hz	0.0 Hz	
*H.013	Avoidance Frequency 2, Band	2.0 - 10.0 Hz	2.0 Hz	
*H.014	Avoidance Freq. 3, Midpoint	0.0 - 200.0 Hz	0.0 Hz	
*H.015	Avoidance Frequency 3, Band	2.0 - 10.0 Hz	2.0 Hz	
H.016 (4)	Sync. Direction (Start into rotating motor) (GV3000/SE searches motor RPM starting at max. frequency and synchronizes its reference)	OFF - Disable Synchronisation (fx = max.freq.) F - Searching starts at +fx (forward) r - Searching starts at -fx (reverse) Fr - Searching starts at +fx, then at -fx rF - Searching starts at -fx, then at +fx	OFF	
H.017	Input Power/ Snubber Configuration	0= AC input with bus-regulator, with ride-thru enabled 1= AC input w/o bus-regul., with ride-thru a. Dyn. Braking 2= DC input with bus-regul., w/o ride-thru (System 1-Q) 3= DC input w/o bus-regul., w/o ride-thru (System 4-Q) 4= DC input with bus-regul., with ride-thru (Single drive) 5= DC input w/o bus-regul., with ride-thru and Dyn. Brak.	0	
H.018	V/Hz Curve Type	0 - Linear V/Hz curve 1 - Optimized curve for 'RPM AC' motors 2 - Squared V/Hz curve	0	
H.019 (6)	Identification Result (Output Variable only)	0 = Ident. Procedure successful 1 = Logged error aborted Ident. Procedure 2 = Function Loss aborted Ident. Procedure 3 = STOP command aborted Ident. Procedure 4 = Current feedback too low. Ident. aborted. 6 = Result out of range. Ident. aborted.	N/A	
H.020 (1)(6)	Identification Request	OFF - Disable Identification Procedure ON - Enable Identification Procedure	OFF	
H.021 (10)	A-C Line Voltage	300- 565 VAC (enter value within +/-10% of actual line voltage)	380 VAC	
H.022	Overfrequency Limit	30.0 - 4 x H.001 +5% or 210 Hz (on type V/Hz)	90 Hz	

Notes: (1) P.047, P.005 and H.000 must be set before activating at V/Hz mode the Identification Request (H.020)

(4) Don't set H.016 (Sync. Mode Select) to any value but 'F' avoiding REVERSE rotation via P.027 (Reverse Disable)

(6) See Section 5 for Identification Request Result Procedure.

(10) See Section 2, Table 2-5, Note 1) of power units manual 49'1327, if the internal Braking Unit option is provided.

GV3000/SE Regulator, Vector Mode Parameters (U.xxx)

*** =** Parameter tunable at drive stopped or running; all others adjust with drive stopped. **N/A** = not available

Para-meter	Description Vector control mode only	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
U.000 (2) (5) (8)	Torque Reference Source	0 = Speed Loop Output 1 = Terminal Block Analog Input 2 = Option Board Torque Reference (Note: Use P.063) 3 = Selected speed reference	0	
U.001	Encoder PPR (125 kHz maximum input frequency limitation)	512 = 512 PPR 1024 = 1024 PPR 2048 = 2048 PPR 4096 = 4096 PPR SE = No encoder connected, operate in SVC	2048	
U.002 (7)	Motor Poles	2 = 2 Poles 4 = 4 Poles 6 = 6 Poles 8 = 8 Poles	4	
U.003 (7)	Motor Nameplate Base Frequency	15.0 - 240.0 Hz	50.0	
U.004	Motor Nameplate Amps	Power Unit size and switching Frequency (P.047) depend.	P/M dep.	
U.005 (7) (9)	Motor Nameplate RPM	Depending on U.002 and U.003	1450	
U.006	Motor Magnetizing Current	10.0 - 80.0% of motor rated Amps (Value generated when performing self-tuning, U.008)	P.M. depend.	
U.007	Motor Nameplate Volts	180 - 690 VAC	380 V	
U.008 (7)	Torque Self-Tune Enable (Motor must NOT be loaded during Self-Tuning)	ON = Enable Self-Tuning OFF = Disable Self Tuning	OFF	
U.009 (7)	Torque Self-Tune Result (Output Variable only)	0 = Self-Tuning operation successful 1 = Aborted, user initiated Normal STOP 2 = Aborted, Emergency or FAULT STOP 3 = Motor / Encoder direction incorrectly in reverse 4 = Encoder PPR out of range 5 = Magnetizing current out of range 6 = Bus Voltage Error 7 = Current Limit exceeded	N/A	
*U.012	Speed Regulator Proportional Gain	0.01 - 99.99	P.M. depend.	
*U.013	Speed Regulator Integral Gain	0.02 - 327.67 radians/second	15.0	
*U.014	Torque Regulator Proport. Gain	0.01 - 31.99	0.4	
*U.015	Torque Regulator Integral Gain	40.0 - 628.0 radians/second	200.0	
U.016	Field Weakening Start RPM	2-pole motor (U.002=2): 2880 to U.005 4-pole motor (U.002=4): 1440 to U.005 6-pole motor (U.002=6): 960 to U.005 8-pole motor (U.002=8): 720 to U.005	P.M. depend.	
U.017 (9)	Motor Top Speed	U.005 - 7200 RPM	P.M. depend.	
U.018 (10)	A-C Line Voltage	300- 565 VAC (enter value within +/-10% of actual line volt)	380VAC	
*U.019	Flux Current Regulator Proportional Gain	0.1 - 31.99	0.3	
*U.020	Flux Current Regulator Integral Gain	40 - 628.0 radian/second	50.0	

Notes: (2) Inverting not used at Vector Torque Reference (U.000=1)

(5) If at Vector mode P.025 is set to 1 (RAMP STOP), then parameter U.000 must be set to 0.

(7) See Section 6 for Self-Tuning Request/Result/Procedure

(8) If U.000 > 0, then Current Limit (P.005) is not applied and Stop Mode (P.025) is not relevant.
If U.000 = 1, then Offset (P.009), Gain (P.010), and Inversion (P.011) are not relevant.
If U.000 = 3, then the FWD/REV input can be used to invert the selected speed reference when it is used as the torque reference.

(9) For applications not requiring constant horsepower operation, U.017 should be set equal to U.005.

(10) See Section 2, Table 2-5, Note 1) of power units manual 49'1327, if the internal Braking Unit option is provided.

GV3000/SE Regulator, Vector Mode Parameters (U.xxx)(continued)

*** =** Parameter tunable at drive stopped or running; all others adjust with drive stopped. **N/A** = not available

Para-meter	Description Vector control mode only	Selection / Adjustment Range	EUr-Init. Setting	Actual Setting
*U.021	Rotor Time Constant / Fast Flux Up	0 - 9999 milliseconds	P.M. depend.	
U.022	Motor Nameplate Power	0.3 to 600.0 HP (HP = kW / 0.75)	P.M. depend.	
*U.023	Low DC Bus Fault Avoidance Enable	OFF = Drive will not regulate the DC bus on a line dip ON = Drive will decelerate the motor to attempt to hold up the DC bus on a line dip condition	OFF	
*U.024	High DC Bus Fault Avoidance Enable	OFF = Drive will not attempt to regulate the DC bus on a high bus condition ON = Drive will attempt to regulate the DC bus on a high bus condition	OFF	
*U.025	Zero Speed Hold Time	0.0 – 655.0 seconds	0.0	
*U.026	Current Compounding Gain	0.0 – 1.000 (0.0 = Current compounding disabled)	0.0	
*U.027	Inertia Compensation Gain	0.0 – 5.000 (0.0 = Inertia compounding disabled)	0.0	
*U.028	Losses Compensation Gain	0.0 – 1.000 (0.0 = Losses compensation disabled	0.0	
*U.030	SVC Slip Adjust	0.50 – 1.50	1.0	
U.031	SVC Sync Direction	OFF = Disable synchronization F = Search starts in motor forward direction r = Search starts in motor reverse direction Fr = Search starts in motor forw. then reverse direction rF = Search starts in motor reverse then forw. direction	OFF	
*U.032	SVC Flux Current Regulator Gain	100 – 1500 radians/sec		
U.040	Outer Control Loop Feedback Source	0 = Terminal strip analog input scaled 1 = Speed loop PI output (torque reference	0	
*U.041	OCL Lead/Lag Select	0 = Bypass 1 = Lead/Lag 2 = Lag/Lead	0	
*U.042	OCL Lead/Lag Low Frequency	0.01 – 34.90 radians/sec	1.0	
*U.043	OCL Lead/Lag Ratio	2 - 20	10	
*U.044	OCL Reference Gain	-5.000 - +5.000	1.000	
*U.045	OCL Proportional Gain	.10 – 128.0	1.000	
U.046	OCL Integral Gain	0.01 – 141.37	2.00	
*U.047	OCL Trim Range Percentage	0.0 – 100%	0.0	
U.048	OCL Proportional Trim Enable	OFF = Disable proportional trim ON = Enable proportional trim	OFF	

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