RELIANCE ELECTRIC

FlexPak 3000 Power Module
SW-Version 4.3

Instruction Manual

CE c UL us

	Europe	North America	
Manual Part No:	899.07.41	D2-3475-1	Publication: FP3OIM-UM043M-EN
Firmware Part No:	790.30.72		

Rockwell Automation

.

Table of Contents

Appendices

List of Figures

List of Tables

NOTE: The term **converter** is used throughout this manual for the FlexPak 3000 Power Module.

1.1 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 fulfil 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*:*  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 - for shielding, grounding, filter arrangement as well as wiring instructions - are summarized in Appendix H, 'CE-Conformance' of this Instruction manual.

1.2 General Notes

Copyright © Copyright Rockwell Automation AG, 2002

Each reproduction of this manual may be prosecuted. The copyright of the user's manual remains at Rockwell Automation AG, CH-6036 Dierikon.

Trade mark Reliance® is a registered trade mark of Rockwell Automation AG.

SW-Version This manual is valid for Regulator Software Version 4.3.
Regulator SW Versions can be read in Parameter 794.

1.3 Manual Scope

This manual contains information on drive installation, drive startup, parameter descriptions, and troubleshooting procedures. It also describes the controller and how to use the Keypad OIM to configure the drive.

Specific terms used in this manual are described in Appendix A.
Measures for CE Conformity on Electro Magnetic Compatibility (EMC) are shown in Appendix H.

1.4 Related User Manuals

Table 1-1: Available User Manuals

Item	Publication No.	Language (-xx)	Access
FlexPak3000 Power Module (this manual)	FP3OIM-UM043M-xx	EN, DE, FR, IT, ES	(1)
Pulse Tacho Feedback Kit	FP3TIF-UMyyyy-xx	EN, DE, FR, IT, ES	(1)
Field Current Regulator Kit	FP3FCR-UMyyyy-xx	EN, DE, FR, IT, ES	(1)
I/O Expansion Board	FP3IOE-UMyyyy-xx	EN, DE, FR, IT, ES	(1)
IBSF Communication Kit	FP3IBS-UMyyyy-xx	EN	(1)
PDPF Communication Kit	FP3PDP-UMyyyy-xx	EN	(1)
CS3000 Drive Control Configuration Software	CS3000-UMyyyy-xx	EN	(1)
Lifting Instructions	D2-3414	EN	(2)
OIM Remote Mounting kit	D2-3294	EN	(2)
Enhanced Field Supply Kit	D2-3413	EN	(2)
AutoMax Network Communication Kit	D2-3318	EN	(2)
ControlNet Communication Board	D2-3425	EN	(2)
DeviceNet Communication Board	HEC-FP3-DN	EN	(3)

xx: EN = English, DE = German, FR = French, IT = Italian, ES = Spanish
yyyy: Manual Index

(1) You can order hardcopies of these manuals or download files from the Automation Bookstore via www.theautomationbookstore.com, then *Public – search - Item Number: begins with FP3.*

(2) You can order hardcopies of D2-xxxx using the *U.S. Manual Ordering Form D-203 (D-202)* or download PDF-files of the manuals. Both are available at the following internet page: www.reliance.com/docs_onl/online_stdrv.htm, then *Manual Ordering* or *Listing User Manuals*.

(3) This Horner Electric Manual can be downloaded from the Internet via: www.heapg.com/devicenet.htm, then *Manuals*.

2.0 Introduction to the Drive

This section provides specifications and a description of the FlexPak 3000 Drive.

2.1 Drive Identification

2.1.1 Nameplate

The FlexPak 3000 drive has a nameplate on the right side of the carrier that identifies the drive by its specific Hardware and Software Part Numbers and applicable AC input power and DC output power data. Refer to this nameplate example.
All communication concerning this product should refer to the appropriate Part Number information.

The technical power information should be referenced to verify proper power application.

RELIANCE ELECTRIC

P.N. -EQUIPMENT	*848.11.73 A*	SER. No.
P.N. -VERSION	*790.30.72 A*	EU I/M *49'1340*
TYPE	*FP3000-S6R-800-AN-FC*	
S/W VERSION	*4.3*	
US M/N	*650FR8742*	I/M US P.N. *D2-3475*

INPUT *500 VAC 3PH 50/60 Hz, 700 A*

OUTPUT *0 -520 VDC*, *800 A*

SHORT CIRCUIT SYM RMS RATING *30 kA*

ENCLOSURE *IP00* CHARACTER OF LOAD *M*

MADE IN SWITZERLAND BY ROCKWELL AUTOMATION AG, DIERIKON

CE, UL, CUL

Sample FlexPak 3000 Nameplate

2.1.2 Drive Selection

The following table lists the European part numbers and North America Model No's (where available) for ordering a specific drive type. For options refer to Table 2-4, sheet 2-8.

Unit Type		Power Unit (Basic) 1)					
Nominal Current	Max. AC-Line Voltage	S-6 with Field Rectifier	S-6 with Field Current Regulator	U.S. Model No	S-6R with Field Rectifier	S-6R with Field Current Regulator	U.S. Model No
25 A	500 V, 50 Hz 460 V, 60 Hz	848.00.03	848.00.73	20FN8742	848.01.03	848.01.73	20FR8742
60 A	500 V, 50 Hz 460 V, 60 Hz	848.02.03	848.02.73	50FN8742	848.03.03	848.03.73	50FR8742
150 A	500 V, 50 Hz 460 V, 60 Hz	848.04.03	848.04.73	125FN8742	848.05.03	848.05.73	125FR8742
250 A	500 V	848.06.03	848.06.73	200FN8742	848.07.03	848.07.73	200FR8742
450 A	500 V	848.08.03	848.08.73	375FN8742	848.09.03	848.09.73	375FR8742
800 A	500 V	848.10.03	848.10.73	650FN8742	848.11.03	848.11.73	650FR8742
1200 A	500 V, 50 Hz	-	848.12.73*	-	-	848.13.73*	-
1200 A	500 V, 60 Hz	-	848.12.43	-	-	848.13.43	-
1600 A	500 V, 50 Hz	-	848.14.73*	-	-	848.15.73*	-
1600 A	500 V, 60 Hz	-	848.14.43	-	-	848.15.43	-
2000 A	500 V, 50 Hz	-	848.18.73*	-	-	848.19.73*	-
2000 A	500 V, 60 Hz	-	848.18.43	-	-	848.19.43	-
1600 A	690 V, 50 Hz	-	848.16.73*	-	-	848.17.73*	-
1600 A	575 V, 60 Hz	-	848.16.43	-	-	848.17.43	-

* FlexPak 3000 converters 1200 A to 2000 A for 50 Hz are not UL, cUL.

1) The Keypad Operator Interface Module (OIM) is not included in the basic unit 848.xx.xx.

2.2 Drive Specifications

2.2.1 AC-Line Considerations

Requirement	Measures
1) Limiting the AC line symmetrical fault current to 100 kA (max. for fuses) or values acc. table below for UL, cUL, as well as limiting commutation notches at the line input (terminals 1U, 1V, 1W).	Always adding an impedance in the line input. This can be a 3-phase line reactor with 2% voltage drop minimum (refer to Table 8-6) or a matched isolation transformer.
2) Limiting the A-C line symmetrical fault current (RMS) at the field rectifier input (terminals 3V, 3W) to 10 kA.	Adding a 1-phase line reactor acc. to Table 8-6. Exception: No reactor is required when a matched transformer is provided in the input to the converter on drives up-to 450 A.
3) Minimum supply system (source) capacity kVA.	Connecting to a source (supply transformer) with minimum kVA rating acc. to the following table.
4) Limiting line transformer impedance to 4% and continuous undervoltage to 10%.	Derating of armature voltage if impedance exceeds 4% or continuous undervoltage.
5) Avoiding damage of drive components due to overvoltage transients caused by medium voltage switching on supply transformers with a primary rating of 2300 VAC or more.	Providing additional input line conditioning on the drive (e.g. Capacitance to ground). Please Contact Rockwell Automation for assistance when this is required.

Full Load Rated DC Current	**Minimum Source Capacity (kVA)** for different AC line voltages at 50 Hz					**Max. Source Capacity** Symmetr. fault current (rms) (for UL, cUL)
	400 V	**460 V**	**500 V**	**575 V**	**690 V**	
25	15	18	20	-	-	18 kA
60	36	41	45	-	-	18 kA
150	90	102	111	-	-	18 kA
250	150	175	188	-	-	30 kA
450	270	306	333	-	-	30 kA
800	480	545	592	-	-	30 kA
1200	720	818	888	-	-	85 kA
1600	960	1100	1190	1400	1630	85 kA
2000	1200	1373	1486	-	-	85 kA

2.2.2 Service Conditions

Standard altitude ..... up to 1000 meters
(Above 1000 m the output current must be reduced by 1% per 100m)

Standard ambient temperature at:
Operation with nominal current ..... 0°C to 40°C
Storage ..... -25°C to 55°C
Transportation ..... -25°C to 70°C

Max. ambient temperature ..... 55°C
(Above 40°C output current must be reduced by 1.5% per °C)
Relative humidity ..... max 50% at 40°C unlimited time
Non-Condensating max 90% at 20°C (30 days/year)
max 75% average per year

Environment: The drive should be located in an area that is free of dust, dirt, acidic vapors, vibration and shock, temperature extremes, and electrical or electromagnetic noise interference.

Degree of protection IP00

2.2.3 Input Voltage and Frequency Ratings:

Nominal voltage for three-phase at terminals 1U, 1V, 1W and 2U, 2V, 2W
On units 25, 60, 150 A ..... 200 - 500 VAC at 50 Hz
200 - 460 VAC at 60 Hz
On units 500 V, 250, 450, 800, 1200, 1600 and 2000 A ..... 200 - 500 VAC
On units 575 V, 60 Hz, 1600 A ..... 300 - 575 VAC
On units 690 V, 50 Hz, 1600 A ..... 300 - 690 VAC
Input voltage for Field Controller Supply (on FlexPak 25 - 800 A) ..... max. 415 VAC
Input voltage for Field Current Regulator Kit (Option) ..... max. 460 VAC
Voltage variation ..... +10% and -10% of Nominal
Nominal line frequency ..... 50 or 60 Hz
Frequency variation ..... ±2 Hz

Fan Supply Voltage and Current Consumption on Units 1200 - 2000 A

Three-phase input voltage
at terminals 5U, 5W, 5W .... 400 V, 50 Hz or. 460 V, 60 Hz, 1A
NOTE: On units 60 Hz, 1200 -2000 A in UL, cUL version the fan must be external protected by the following, thermal magnetic circuit breaker:
Dierikon part No. 610.11.05, RA catalog No. 140M-C2E1316.

2.2.4 Regulator Supply Voltage and Power Consumption

Single-phase input voltage, via autotransformer ..... 230 VAC at terminals 0, 230
or 115 VAC at terminals 0, 115
Power Consumption (including fan on type 150 - 800 A) ..... max. 120 VA
Thermal magnetic protection by external circuit breaker

NOTE: On units with terminals 4U, 4V (without autotransformer) input voltage 230 VAC is required.

2.2.5 Relay Output for Main Contactor

Relay MCR at terminals X1:5 and X1:6
Nominal contact rating at AC 230 V, cos phi = 0.5 ..... 330 VA
Maximum current ..... 3 A

2.2.6 DC Voltage Ratings:

Maximum permissible armature voltage $U_{a\ max}$ at inductive voltage drop of Uk ≤ 4% per phase and max. 10% line undervoltage. At Uk = 4 to 7% $U_{a\ max}$ must be derated per 5%.

$U_{a\ nom}$ is the recommended standard motor armature voltage for the selected line voltage and operation mode.

Table 2-1: Armature voltage for various line voltages

AC Line Voltage	Motoring operation (S-6 / S-6R)		Regenerating operation (S-6R)	
	Armature Voltage		Armature Voltage	
U_N	$U_{a\ nom}$	$U_{a\ max}$	$U_{a\ nom}$	$U_{a\ max}$
200 V	200 V	230 V	200 V	214 V
400 V	460 V	490 V	400 V	440 V
460 V	520 V	570 V	500 V	500 V
500 V	600 V	620 V	520 V	535 V
575 V	700 V	710 V	600 V	615 V
660 V	800 V	810 V	700 V	706 V
690 V	800 V	850 V	700 V	738 V

Field voltage ..... max. 90% of line input voltage
Protection by external fuses according to table 8-8.

2.2.7 Regulation (with 95% load change):

Table 2-2 - Tachometer Speed Regulation

Regulation Arrangement	Speed Change with 95% Load Change	Speed Change from All other Variables	Part Number
Armature Voltage Regulation with IR Comp.	2-3 %	15%	Not applicable.
Closed Loop			
with Analog tach	1%	2%	-
with Pulse tach 1)	0.01%	0.01%	762.70.00

1) Optional Pulse Tachometer Feedback kit required (See instruction manual 49'1343).

2.2.8 Speed Range:

Operator's Speed Adjustment..... 0 to rated speed
Specification Speed Range .....100:1 based on top speed and tachometer

2.2.9 Drive Efficiency:

Drive Only.....98.6% (rated load and speed)
Drive and Motor.....85% typical

2.2.10 Displacement Power Factor, Power Loss P_V and Output Current:

Power Factor: 88% typical (rated load & speed, decreasing linearly with speed)
Typical percent speed depends on motor operating speed and motor frame size.
Power Consumption at no load: see P_A in Table 2-3.

Table 2-3 - Drive Specifications

Unit-Type	I_{ad}	I_{anom}	I_{amax}	I_F (-73/43)	I_F (-03)	P_A	P_V (at $I_{a\,nom}$)
25 A	25 A	20 A	30 A	4 A	6 A	60 VA	120 W
60 A	60 A	50 A	75 A	4 A	6 A	60 VA	210 W
150 A	150 A	125 A	187 A	10 A	6 A	85 VA	460 W
250 A	250 A	208 A	312 A	10 A	12 A	90 VA	715 W
450 A	450 A	375 A	562 A	10 A	12 A	90 VA	1215 W
800 A	800 A	667 A	1000 A	12 A	12 A	120 VA	2120 W
1200 A, 500V	1200 A	1000 A	1500 A	15 A *	-	400 VA	2680 W
1600 A, 500V	1600 A	1334 A	2000 A	15 A *	-	400 VA	3750 W
2000 A, 500V	2000 A	1667 A	2500 A	15 A *		400 VA	4600 W
1600 A, 575V	1600 A	1334 A	2000 A	15 A *	-	400 VA	3900 W
1600 A, 690V	1600 A	1334 A	2000 A	15 A *	-	400 VA	4100 W

I_{ad} = Maximum continuous current without overload capability (I_{ad} = 1.2 x $I_{a\,nom}$)

$I_{a\,nom}$ = Nominal continuous current with overload capability 50% during 1 minute every 10 minutes

$I_{a\,max}$ = Maximum current during 1 minute after 9 minutes operation with Ia nom ($I_{a\,max}$ = 1.5 x $I_{a\,nom}$)

I_F = Field current without overload capability

* A maximum field current of 20 A is permitted, if the power unit blower is switched on together with the motor field.

2.3 Drive Input/Output Specifications

The following sections describe drive inputs and outputs. Refer to section 3.8 for terminal strip connections and wiring diagrams.

2.3.1 Logic Inputs:

CAUTION:
Connecting an external power source to any of the +24 volt connections (terminals 1, 7, 11, and 14) on the regulator board terminal strip will damage the drive. DO NOT connect the external power source to the +24 volt connections on the regulator board terminal strip. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The logic input circuits can be powered either from the internal +24 V DC power supply or from an external +24 V DC power source. The internal +24 V DC power supply is available at the regulator board terminal strip (see Figure 3-8). If an external power source is used, only its COMMON must be connected to 24V COM on the regulator board (terminal 15). 24V COM is internally not grounded, but may be externally grounded if required by the users control wiring.

Electrical Specifications:
Input Voltage ..... +24 V DC
Turn On Voltage ..... 8 V
Turn Off Current ..... 0.5 mA
Common ..... All input circuits have the same common.

2.3.2 Logic Outputs:

The logic output circuits are normally open (when de-energized) relay contacts. When *energized* (contacts closed), the three circuits indicate the following drive conditions:
Running 27 to 28, Alarm 29 to 30, No Fault 31 to 32

Electrical Specifications:
Operating Voltage ..... 250 V AC maximum
30 V DC maximum
Switching Current ..... 2 A maximum resistive
1 A maximum inductive

2.3.3 Analog Inputs:

The three customer analog inputs are
- Manual Mode Reference
- Automatic Mode Reference
- D-C Tachometer Feedback.

These inputs are converted at 12 bits plus sign at their full range. The electrical specifications for each of these is listed below.

Electrical Specifications:
Current loading ..... 2.5 mA maximum

Manual Mode Reference:	Jumper J19
Potentiometer 5 kohm minimum	POT
External Voltage Source: +/- 10 VDC (when used for Analog Trim Ref.) 0 - 10 VDC (when used for Manual Mode Speed Ref.)	EXT

Automatic Mode Reference:		Jumper J12	Jumper J10
Voltage Reference	+/- 10 V DC	VOLTS	VOLTS & PARK
Milliamp Reference	4-20 milliamps	MAMPS	4-20 & PARK
	10-50 milliamps	MAMPS	10-50 & 4-20

Analog Tachometer Feedback

Tach Voltage at Top Speed ..... 10 - 250 V DC

NOTE: J14 Jumper position and connection of DC-Tachometer must correspond.

		Jumper J14	Jumper J11
Top Speed Tach Volts	< 16 V	LOW	16
	< 31 V	LOW	31/125
	< 62 V	LOW	62/250
	< 125 V	HI	31/125
	< 250 V	HI	62/250

2.3.4 Analog Outputs:

The two metering analog outputs are available at regulator board terminals 24, 25 and 26. Terminal 25 is the common connection for both output signals. The selected signals for both meter outputs are averaged (filtered) over 100 msec to reduce meter fluctuations.
METER OUT 1 SELECT (P.404) corresponds to terminals 24 and 25 (default: CML FEEDBACK). METER OUT 2 SELECT (P.405) corresponds to terminals 25 and 26 (default: SPD LOOP FEEDBACK).
Refer to Appendix B, METER OUT 1 SELECT (P.404) and METER OUT 2 SELECT (P.405) parameters, for additional drive test points that can be configured to source Meter Outputs 1 and 2.

Electrical Specifications:
Output Voltage..... +/- 10 V DC
Maximum Load ..... 4 milliamps

2.4 Drive Description

The drive is a full-wave power converter without back rectifier, complete with a digital current minor loop and a digital major loop for armature voltage or speed regulation by tachometer feedback. Figure 2-1 shows a block diagram of the Drive.

The Drive employs a wireless construction and uses a keypad for drive setup, including parameter adjustments and unit selection, monitoring and diagnostics. Multiple language capability in English, French, German, Spanish, Italian and ‘Code’ is available. Reference, feedback, and metering signals can be interfaced to the drive. The drive can be controlled locally by the Operator Interface Module (OIM) Keypad or remotely by using the terminals at the regulator board terminal strip (see Section 3 for terminal connections). Based on the active control source selected using the CONTROL SOURCE SELECT key, the OIM displays the control source as "KEYPAD" or "TERMBLK" (regulator board terminal strip), or "NETWORK" (if an optional network communication board is installed).

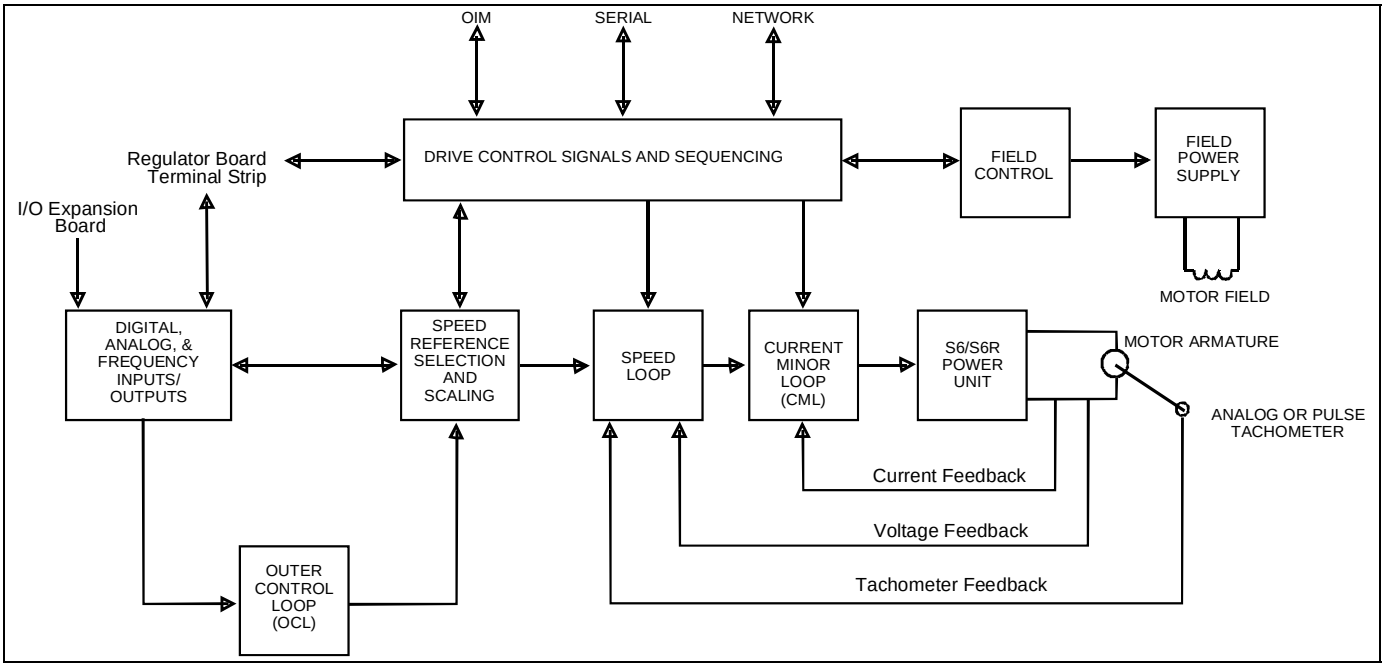


Figure 2-1 - FlexPak 3000 Functional Block Diagram

Rockwell Automation offers modification kits that broaden the application range of the drive. A summary of these kits is presented in the following Table 2-4.

Related Instruction Manuals are listed in Table 1-1, Section 1.4.

Table 2-4 - Drive Modification Kits

Name	Description	Part Number
Pulse Tacho Feedback Kit PTK	Allows for digital pulse tachometer speed feedback on high performance regulation applications. (Kit includes cable).	762.70.00
Enhanced Field Supply kit FVR	Provides electronic field voltage trim and field economy. It replaces the standard field supply.	762.70.10
Field Current Regulator kit FCU4 FCU10 FCU15	Provides field economy, as well as pre-weakening of the field using a fixed reference or field weakening for above base speed operation. Tachometer feedback is required with this kit. This kit replaces the standard field supply.	762.70.50 762.70.60 762.70.70 (4,10,15A)
I/O Expansion Board IOE	Mounts on the FlexPak 3000 chassis and gives the FlexPak 3000 additional analog, frequency, and digital I/O capability.	762.70.80
AutoMax Network Communic. kit AMXF	Allows the FlexPak 3000 to communicate on the Reliance AutoMax Distributed Control System (DCS). (Kit contains board & cable).	762.70.40
Interbus Communi-cation kit IBSF	Allows the FlexPak 3000 to communicate over the standardized field bus system INTERBUS. (Kit contains board & cable).	762.70.45
Profibus Communi-cation kit PDPF	Allows the FlexPak 3000 to communicate over the standardized Profibus-DP system. (Kit contains board & cable)	762.70.95
ControlNet Communication Board CONF	Allows a FlexPak to communicate over the open protocol ControlNet network. Mounts inside the FlexPak and includes terminals for network connections. The AMX Network Comm. board cannot be used when using the ControlNet.	762.70.96
DeviceNet Communication Board DNC	Allows a FlexPak to communicate over the open protocol DeviceNet network. Mounts inside the FlexPak and includes terminals for network connections. The AMX Network Comm. board cannot be used when using the DeviceNet board.	762.70.90
Drive Control Configuration Software CS3000-V6	Windows-based software that allows the user to connect any personal computer running Micro-soft Windows version 3.1 or later to a FlexPak 3000 drive. Allows you to create, store, upload, and download drive configurations. You can also monitor and change parameters through the PC and read and reset the drive's fault log.	788.05.30
Interface Cable	for connecting the drive to PC (25-pin to 9-pin)	772.27.00
Keypad Drive Configuration Module KDCM	Operator Interface that allows you to access and change drive parameters, read and clear the drive's alarm and fault log. The DCM cannot control the drive.	922.95.10
Keypad Operator Interface Module KOIM (M/N 317C160D)	Allows you to control (e.g. Start, Stop, Jog) the drive. You can also monitor and change parameters, read and clear the drive's alarm and fault log.	922.95.00
OIM Remote Mounting kit DMK (M/N 905FK0101)	Provides for remote mounting of the OIM up to 5 meters away from the drive. Contains also the cover plate (762.70.31) for the regulator unit.	762.70.30

2.5 Controls/Indicators

See Figure 2-2 for location of the controls and indicators for the Keypad OIM. Drive fault and status indicators are listed in Table 2-5.

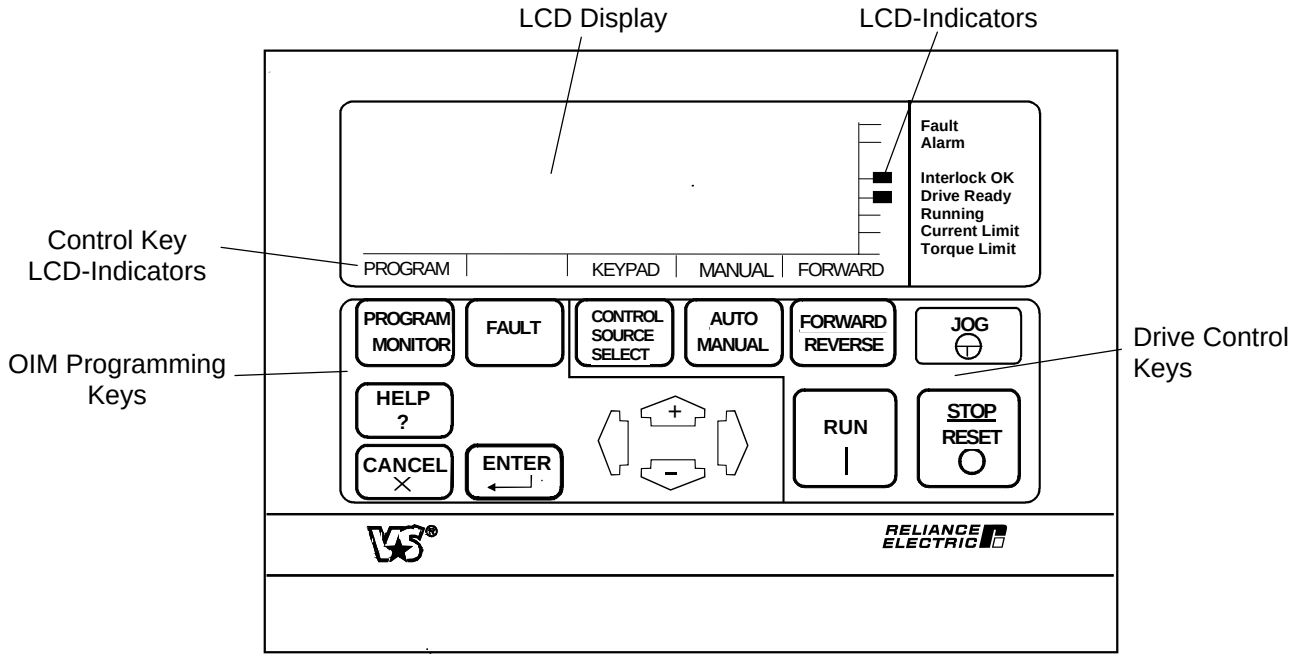


Figure 2-2: Operator Interface Module OIM

2.5.1 Indicators

LCD (Liquid Crystal Display) and LED (Light Emitted Diode) displays are used to indicate the status of the drive. LCD indicators are located on the OIM to the left of the text for the indicator. LED indicators are located on the regulator board which is located behind the OIM.

LCD Indicators

An LCD indicator is on when a field is present ■■ ; off when extinguished. In Figure 2-2, the Interlocks OK and the Drive Ready indicators are on. Table 2-5 contains a list of drive and fault status indicators with their associated description.

Table 2-5 - OIM Drive Fault and Status Indicators

Indicators	Description
Fault	A condition or conditions exists in the drive which stopped it or prevents it from running. When a fault occurs, the type of fault and further instructions are displayed on the OIM display.
Alarm	An alarm does not prevent the drive from running but alerts the user that a condition exists that could cause a fault in the future. When an alarm occurs, the type of alarm and further instructions are displayed (unless a subsequent fault occurs which will overwrite the alarm text display).
Interlock OK	This indicator is on when all customer interlocks (terminal 9) and the Coast/DB contact (terminal 8) are closed. Off = 1 or more are open.
Drive Ready	This indicator in on when all customer interlocks are closed, the Coast/DB contact is closed and there are no drive faults present. Pressing the RUN or JOG key will cause the drive to start if this indicator on. Off = not ready.
Running	When on, this indicates that the contactor is closed and the motor armature is energized. Off = contactor is open and drive is not running.
Current Limit Torque Limit	This is a real time indication of the motor operating in current limit. On = current limit Off = not in current limit.

LED Indicators

Two LED indicators are located on the regulator board for status and service use: (LED1) CPU OK and (LED2) OIM COMM OK. See Section 7 of this instruction manual for further details regarding the use of these indicators for status and troubleshooting purposes.

2.5.2 Controls

The OIM keys can be categorized into two general functions:
1) OIM Programming Keys (program/monitor, fault, help, cancel, enter, and arrow keys)
2) Drive Control Keys (control source select, auto/manual, forward/reverse, jog, run, and stop/reset.)

2.5.2.1 OIM Programming Keys

These keys provide the ability to tune the drive, scale inputs/outputs, save user configurations or restore to/from non-volatile memory, set drive limits, access fault/alarm logs and monitor several drive signals. The PROGRAM mode is used for menu and parameter selection. The MONITOR mode displays standard drive output data values. See section 4 for further details on menu and parameter selection.

PROGRAM

MONITOR

This key cycles the OIM display between Program screens and two Monitor screens. The state of this key (PROGRAM or MONITOR) is shown on the LCD directly above the key. The active OIM display mode is retained through drive power cycles. For example, if the OIM was in MONITOR mode and power was removed, the OIM would power up in the MONITOR display mode. See the following example for more information.

NOTE: The PROGRAM mode is used for menu and parameter selection.

FlexPak 3000 Main Menu ➤Quick Start Drive Reference Speed/Voltage Loop (SPD) ▼Current Minor Loop (CML)				
PROGRAM		KEYPAD	MANUAL	FORWARD

- Pressing this key will display the following screen:

MOTOR SPEED	0	RPM		
ARM VOLTS	0	VOLTS		
MOTOR LOAD	0	%FLA		
KEYPAD REF:	0	RPM		
MONITOR		KEYPAD	MANUAL	FORWARD

This screen allows the user to change the drive's setpoint (KEYPAD REF) when the CONTROL SOURCE SELECT is set to KEYPAD and the drive is in manual mode. Use the up/down arrow keys to change the drive's setpoint. Pressing the ENTER key will save the setpoint to non-volatile memory.

- Pressing the PROGRAM/MONITOR key a second time will display motor speed (RPM) and motor load (FLA):

0 RPM **0 %FLA**				
MONITOR		KEYPAD	MANUAL	FORWARD

This screen does not allow the user to change the drive's setpoint (KEYPAD REF).

- Pressing the PROGRAM/MONITOR key after the second time will re-display the previous PROGRAM display (the first screen in this example).

Pressing the ENTER key will save the setpoint to non-volatile memory.

Pressing the CANCEL key when in monitor mode will return the OIM to the PROGRAM mode.

Table 2.6 lists drive parameters monitored and reported to the OIM.

Table 2.6 - Drive Monitor Capabilities

Monitor List	Selectable Engineering Units
Motor Speed	Percent, RPM, Units*
Arm Volts (Armature Voltage)	Volts
Motor Load (Armature Current)	Percent Full Load Amps (%FLA), Amps
TERMBLK REF, KEYPAD REF or TORQUE REF**, NETWORK REF***	Percent, RPM, Units*

* Units: Indicates the user's option to select an engineering unit (6 characters maximum) for readout to display. A number from 1 to 10,000 full scale can be assigned a meaningful value (e.g. FPM, Feet Per Minute, etc.). See "Define User Units" in Section 4.

** When the drive is configured as a current (torque) regulator (J15 Hardware Jumper = CURRENT), the Control Source Select (CSS) can only be set to TERMBLK or NETWORK (if option is installed). In this case, TORQUE REF or NETWORK REF is displayed. The units are the same as displayed for MOTOR LOAD.

** When the drive is configured as a speed or armature voltage regulator (J15 Hardware Jumper = SPEED), the selected control source determines the reference source (TERMBLK REF or KEYPAD REF, or NETWORK REF).

*** Available with an optional Network Communication Board.

FAULT

This key allows the operator to review and clear logs (fault and alarm), reset faults, clear the alarm indicator and display fault history and diagnostic information for servicing the drive. The state of this key (FAULT, ALARM or DIAGS) is shown on the LCD directly above the key.

- Pressing the FAULT key once will display the fault menu:

Fault Menu ➤ Review Log Reset Faults Clear Fault Log and Reset Faults				■■ ■■
	FAULT	KEYPAD	MANUAL	FORWARD

- Pressing the FAULT key a second time will display the alarm menu.

Pressing the CANCEL key will return the OIM to the previous display mode (PROGRAM or MONITOR).

Alarm Menu ➤ Review Log Reset Alarms Clear Alarm Log and Reset Alarms				■■ ■■
	ALARM	KEYPAD	MANUAL	FORWARD

- Pressing the FAULT key a third time will display the diagnostics menu.

Pressing the CANCEL key will return the OIM to the previous display mode (PROGRAM or MONITOR).

Diagnostics Menu ➤ Why is the drive not ready? Why did the drive stop?				■■ ■■
	DIAGS	KEYPAD	MANUAL	FORWARD

- Pressing the FAULT key after the third time will re-display the fault menu.

To exit this mode, press PROGRAM/MONITOR. This returns the OIM display to the previous display mode (PROGRAM or MONITOR).

See Section 7 of this instruction manual for further details on the FAULT, ALARM, and DIAGS menus.

HELP
?

Menu and Parameter HELP are available. Access Menu or Parameter HELP by pressing the HELP key when the cursor is at the particular menu or parameter of interest. In the MONITOR mode, pressing HELP displays status indicators in the selected language. Pressing CANCEL at anytime will return to the display from the previous screen.

MENU HELP

Menu HELP provides the user with information regarding the general purpose of the menu and some details of related parameter selections.

For example: If English is the selected Language, the following is displayed when HELP is pressed when at the Main Menu.

MENU HELP FlexPak 3000 Main Menu Select the appropriate menu item with the UP/DOWN arrow keys and the ENTER key. You can use CANCEL at any time to return to the previous menu level.				■■ ■■
PROGRAM		KEYPAD	MANUAL	FORWARD

A ▼ displayed at the bottom left of the text indicates that more text is available. Press the down ⇩ key to scroll up the remaining text for viewing. Similarly, if a ▲ is displayed at the upper left of the text, use the ⇧ key to scroll down the previous text for viewing.

Press CANCEL to exit MENU HELP.

PARAMETER **HELP**

Parameter HELP displays the following information:

- Parameter name
- Code (parameter No.)
- Input
- Retentive or Non-retentive
- Units

To obtain parameter help, the OIM must be at a value entry screen. See Section:5 "How to Make Parameter Adjustments" for examples of value entry screens.

For example: The following is displayed when HELP is pressed while at the value entry screen for the TOP SPEED parameter.

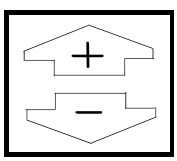
PARAMETER HELP P.011 TOP SPEED INPUT RETENTIVE RPM Press CANCEL to continue.				■■ ■■
PROGRAM		KEYPAD	MANUAL	FORWARD

Press CANCEL to exit PARAMETER HELP.

The CANCEL key is used to return to a previous menu, exit a parameter modification (value entry) screen, clear a fault or an alarm message, etc.

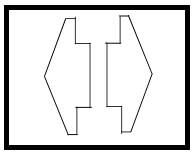
Displays the menu selected, accepts a change made to a parameter value, or selects an item from a pick list.

In the MONITOR mode, ENTER saves the KEYPAD REF setpoint. See Section 4 and Section 5 of this instruction manual for the specifics of using this key.



Scrolls up or down through the menu and parameter listings and changes parameter values.
Increases or Decreases speed reference when in the first MONITOR display screen and CONTROL SOURCE SELECT is set to KEYPAD. When in the second MONITOR display screen (RPM and FLA), these keys will not change the speed reference.
NOTE: Holding either of these keys down will cause the selected value to change rapidly

Moves the cursor left or right in parameter modification (value entry) screens to allow digit selection for parameter value setting.



Left (⇐) accesses the Language Selection menu at any menu level but not at parameter modification screens. See section 4.13 of this instruction manual for further details on the Language Selection menu.

Right (⇒) accesses the Contrast Adjustment screen at any menu level but not at parameter modification screens. See section 4.7 of this instruction manual for further details on the Contrast Adjustment screen.

2.5.2.2 Drive Control Keys

These keys can be used to control the motor. They provide the user with the ability to start, jog, select direction, select reference and control source. See figure 2.2

CONTROL SOURCE SELECT

Selects where the control signals for the drive originate. "KEYPAD" (OIM control), "TERMBLK" (terminal strip control) or "NETWORK" (network communication board). The selection can only be changed when the drive is not running. The state of this key (TERMBLK or KEYPAD, SERIAL or NETWORK) is shown on the LCD directly above the key.

- Keypad control uses the OIM buttons to control drive operations. The KEYPAD REF value (displayed in MONITOR mode) is used as the drive reference.
- Termblk control uses the reference at regulator board terminals (17-18 for Manual Reference or 19-20 for Auto Reference) for the setpoint. It also uses the controls connected to the terminal strip for control of drive operations. Reference Figure 3-8 for more details.

Network control can only be selected with a network communication board installed and when the control signals and reference originate from the network board.
When the drive is configured as a current regulator (J15 = CURRENT), the control source can only be set to TERMBLK.

AUTO

MANUAL

The AUTO/MANUAL key determines which drive reference source will be used when the CONTROL SOURCE SELECT is set to KEYPAD. The state of this key (AUTO or MANUAL) is shown on the LCD directly above the key.

- AUTO will use the signal at regulator board terminals 19 and 20 (see figure 3.8). The type of signal accepted at these terminals is determined by the position of hardware jumpers J10 and J12 (see Figure 4-1).
- MANUAL will use the KEYPAD REF from the OIM as the drive reference. When CONTROL SOURCE SELECT is not set to KEYPAD REF, the preset state of the reference mode is shown above the key (determined from the selected control source). When the drive is configured as a current regulator (J15 = CURRENT), AUTO/MANUAL is fixed in the AUTO mode.

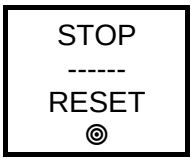
FORWARD

REVERSE

Selects the direction of rotation when the drive at rest, or dynamically changes the direction of rotation (regenerative drives only) when the drive in operation. This key is active only when in KEYPAD control. This key also affects the direction of rotation for JOG. The FORWARD/REVERSE key is fixed to forward for any of these conditions: when the REVERSE DISABLE parameter is set to ON (for regenerative drives); when the drive is non-regenerative; when an A-C tach is used; and when a pulse tach with quadrature disabled is being used. The state of the controlling input is shown on the LCD directly above the key.

Active only when in KEYPAD control mode. This key causes the drive reference to ramp up at the JOG ACCEL/DECEL rate to jog speed. When this key is released, the drive reference ramps to zero at the same rate. If the drive status indicators show that the drive is "not ready", this request will be ignored.

Active only when in KEYPAD control mode. This key allows the motor to accelerate to the speed reference setpoint.



STOP is active at all times regardless of the CONTROL SOURCE SELECT setting. Pressing the key with the drive running causes the drive to stop in the selected stop mode. RESET is active only if the drive is not running and CONTROL SOURCE SELECT is set to KEYPAD. When the RESET key is pressed, drive faults and alarms will be reset (see section 7 for more information.)

.

3.0 Install and Wire the Drive

DANGER

The user is responsible for conforming to all other applicable standards.
Wiring practices, grounding, disconnects, and overcurrent protection are of particular importance.
Size and install all wiring in conformance with the applicable standards.
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.

3.1 General

This Section outlines the procedures that are to be followed to properly install the FlexPak 3000 Drive.

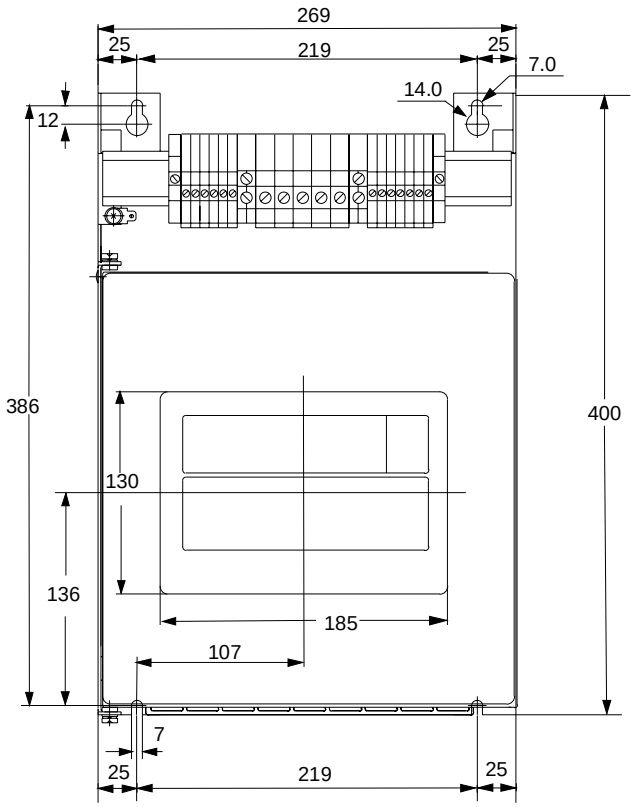
3.2 Recommended AC Line and DC Armature Fuses

The user must select the correct fuse type (ultra fast, semiconductor protection) for drive AC line and DC armature fuses from the table 8-7 in chapter 8. The armature fuse is only for four quadrant drives (S-6R).

3.3 Install the Drive

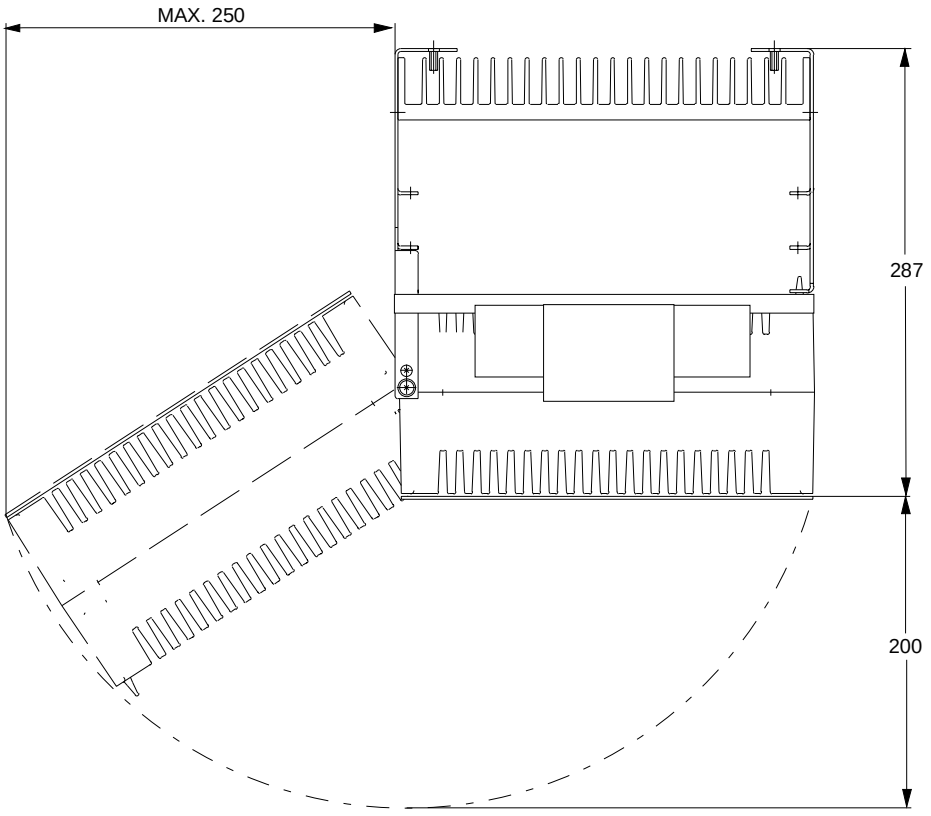
Minimum clearances of 100 mm must be maintained when the drive is mounted within a cabinet. This allows adequate ventilation around and through the drive.

Regardless of these placement guidelines, the user is responsible for ensuring that the Drive's ambient temperature specification of 0 to 40°C is met and its relative humidity is kept within 5% to 95% without condensation. Install the drive(s) in the cabinet.
Refer to Figures 3-1 to 3-6 for mounting dimensions.



Power connections Terminals for **25 A** Unit	
Motor 1D, 1C	6 mm^2 1.4 Nm
AC-Line 1U, 1V, 1W	6 mm^2 1.4 Nm
Prot. earth PE	6 mm^2 1.4 Nm

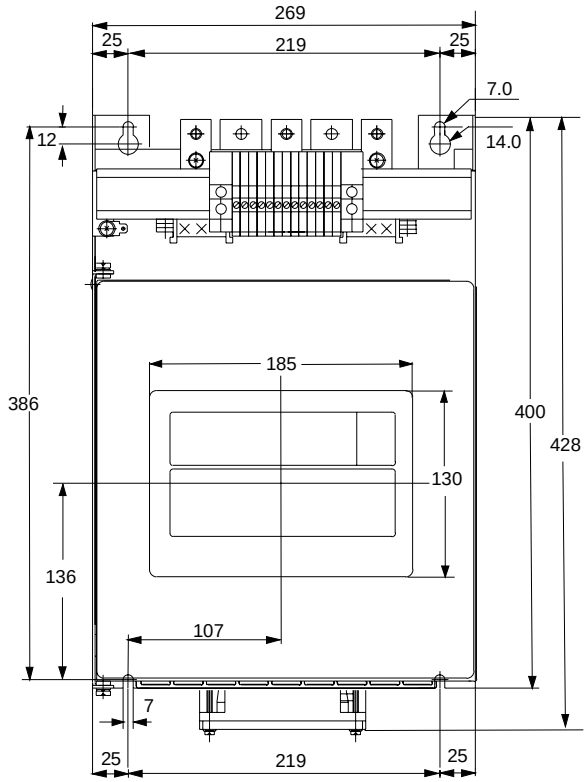
Power connections Terminals for **60 A** Unit	
Motor 1D, 1C	16 mm^2 2.5 Nm
AC-Line 1U, 1V, 1W	16 mm^2 2.5 Nm
Prot. earth PE	16 mm^2 2.5 Nm

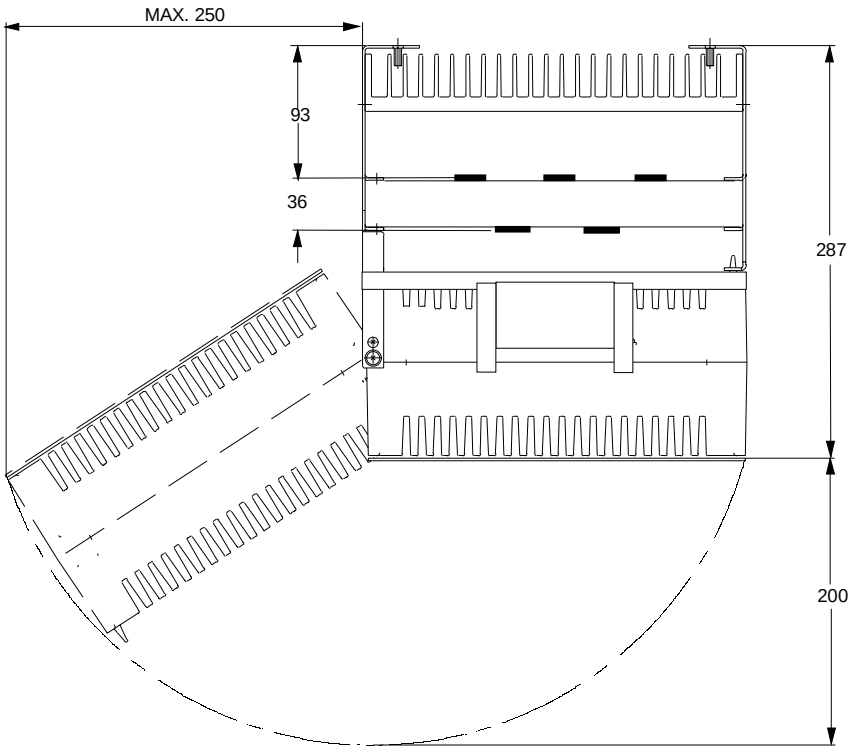


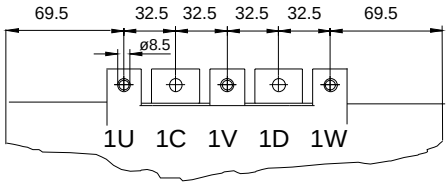
Weight: 10 kg

Minimum clearances
for air circulation: 100 mm

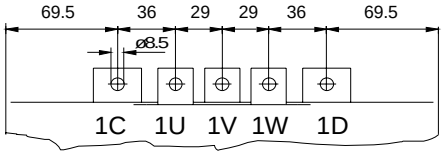
Figure 3-1: Mounting Data for 25 A and 60 A Drives.







Power Connections on
1-Quadrant Units S-6



Power Connections on
4-Quadrant Units S-6R

Power Connections	
Motor 1D, 1C	Bus bars 90 mm^2
AC-Line 1U,1V,1W	Bus bars 60 mm^2
Prot. Earth PE	Terminals 35 mm^2 Torque 2.5 Nm

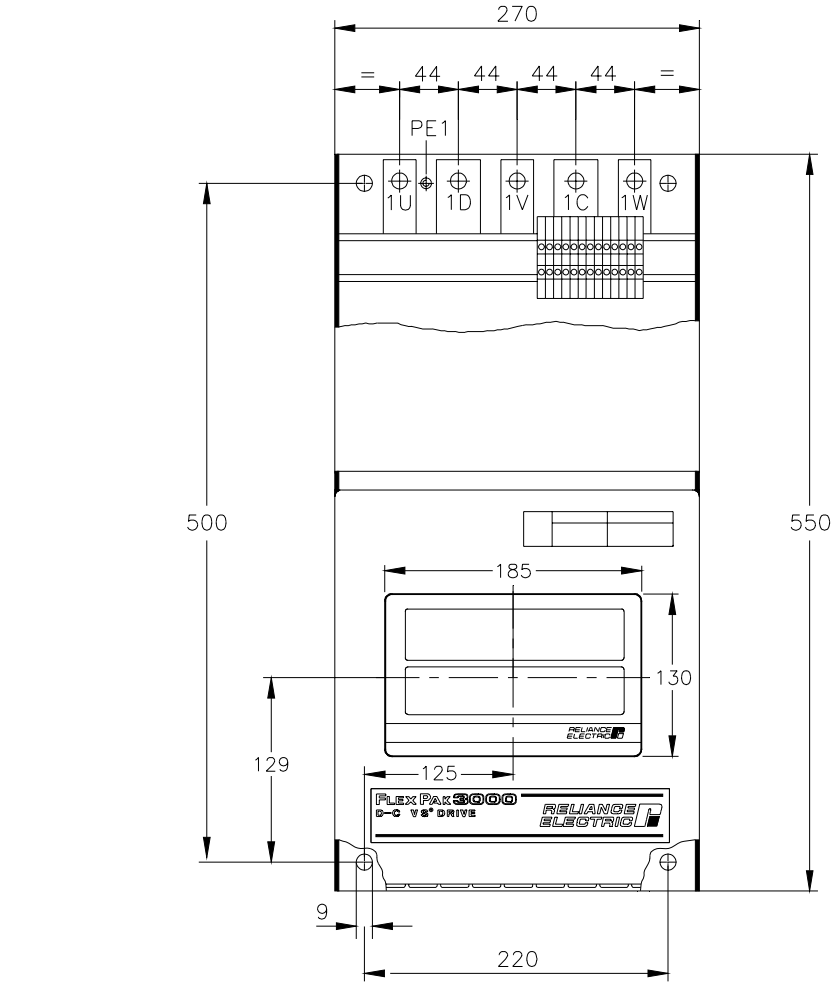
Weight: 14 kg

Cooling air: 187 m^3/h

Air flow direction:
from bottom to top

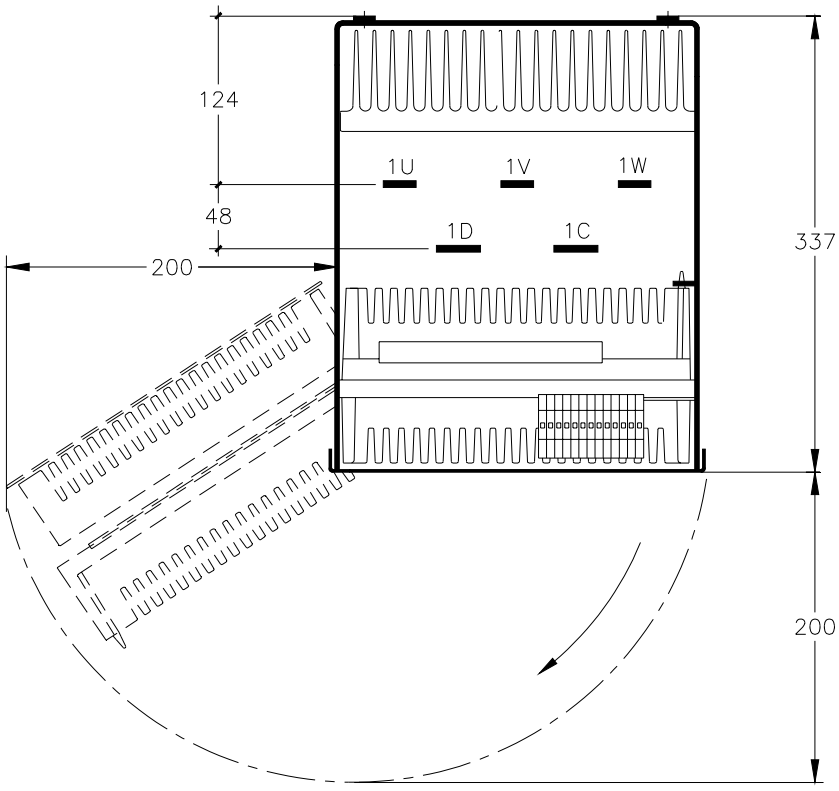
Minimum clearances
for air circulation: 100 mm

Figure 3-2: Mounting Data for 150 A Drives.



Power connections for **250 A** Unit	
Motor 1D, 1C	Bus bars 25 x 5, Hole 11 mm
AC-Line 1U, 1V, 1W	Bus bars 20 x 5, Hole 11 mm
Prot. earth PE	Bolt M10, Torque 15 Nm

Power connections for **450 A** Unit	
Motor 1D, 1C	Bus bars 40 x 5, Hole 14 mm
AC-Line 1U, 1V, 1W	Bus bars 30 x 5, Hole 14 mm
Prot. earth PE	Bolt M10 Torque 15 Nm



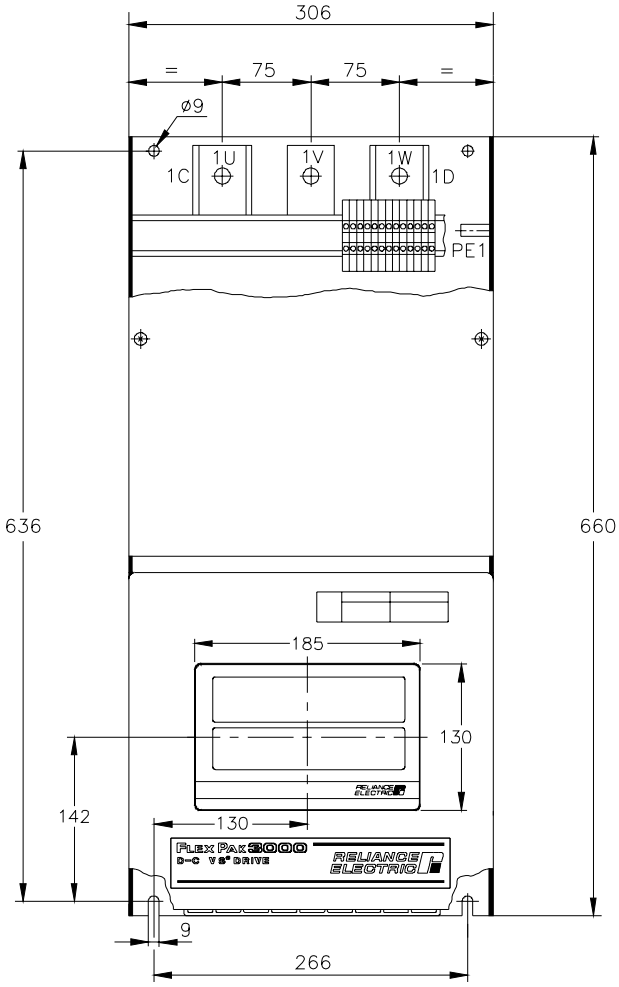
Weight: 40 kg

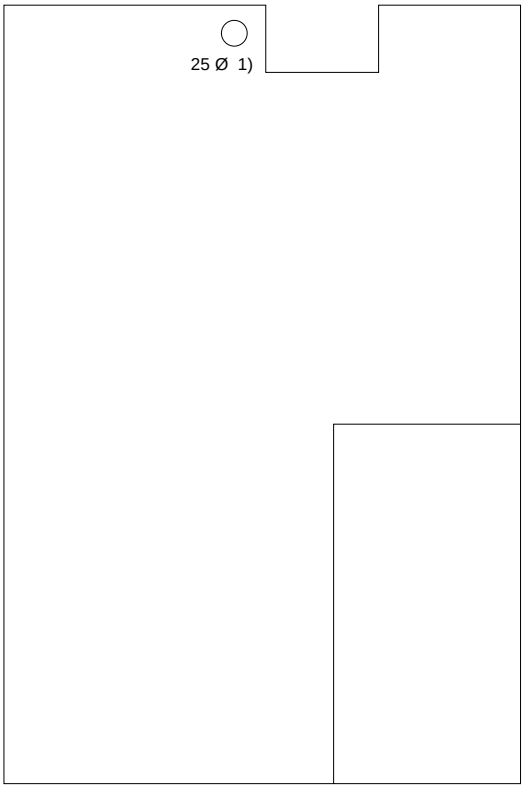
Cooling air: 407 m^3/h

Air flow direction:
from bottom to top

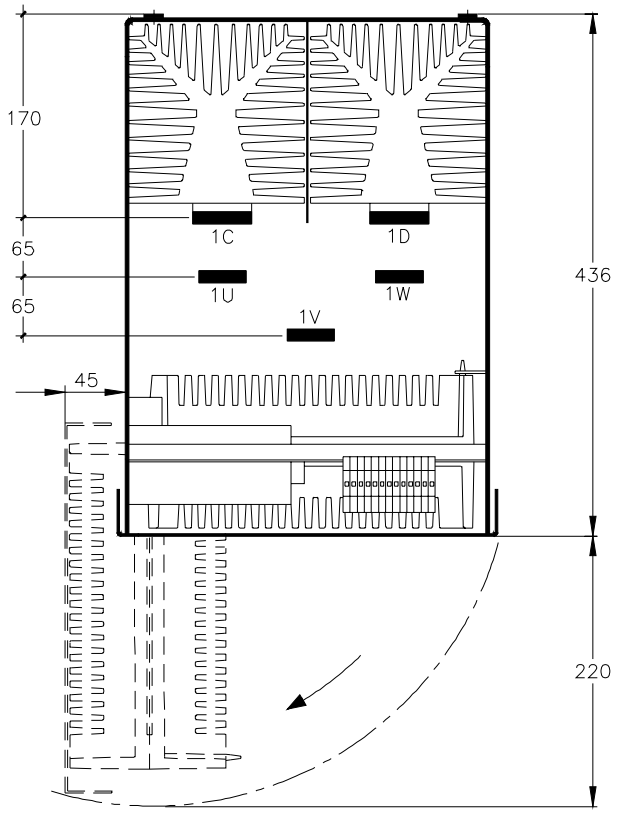
Minimum clearances
for air circulation: 100 mm

Figure 3-3: Mounting Data for 250 A and 450 A Drives.





1) Holes for lifting hooks



Power connections	
Motor 1D, 1C	Bus bars 50 x 10, Hole 13.5 mm
AC-Line 1U, 1V, 1W	Bus bars 40 x 10, Hole 13.5 mm
Protection earth PE	Bolt M12 Torque 15 Nm

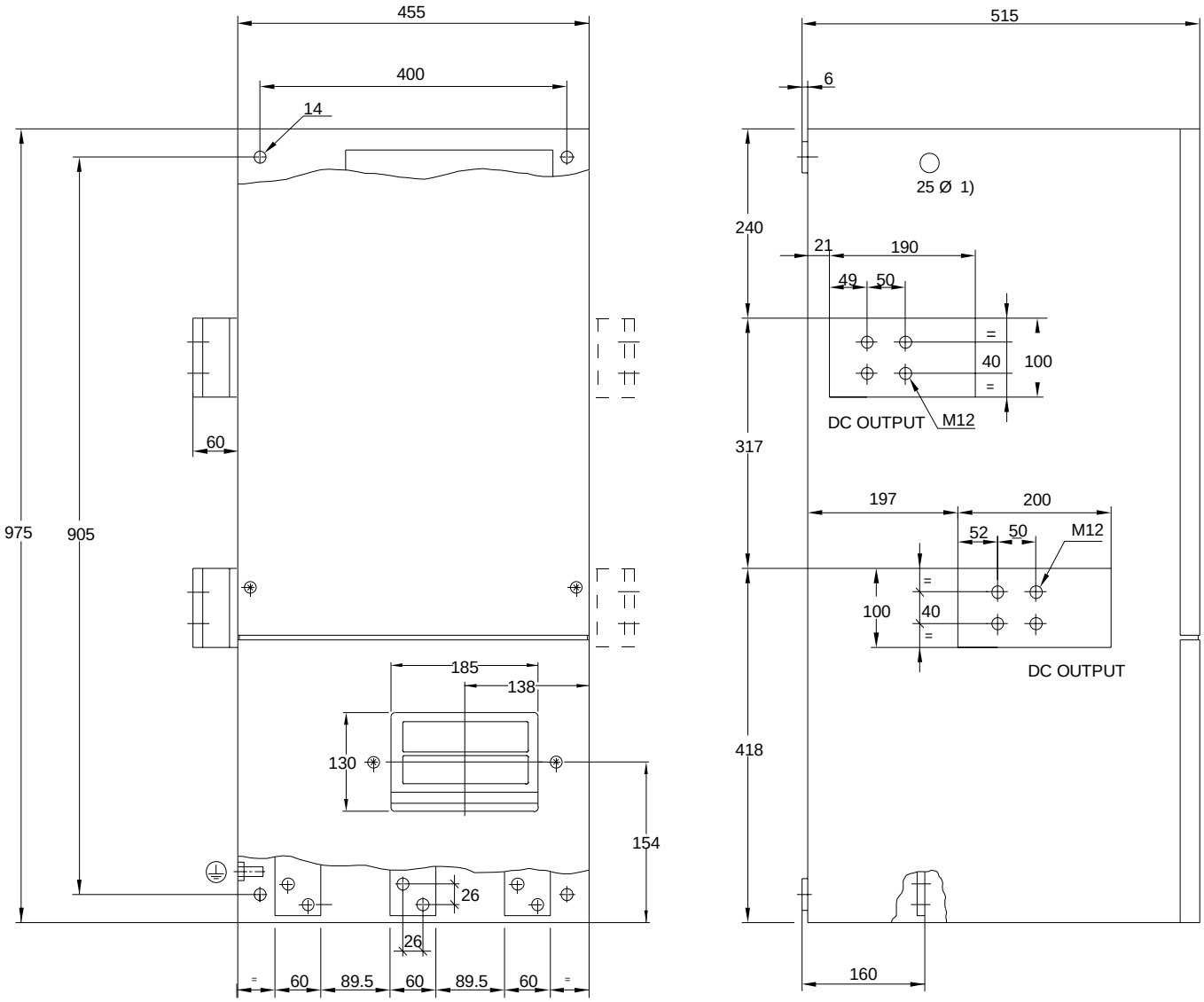
Weight: 83 kg

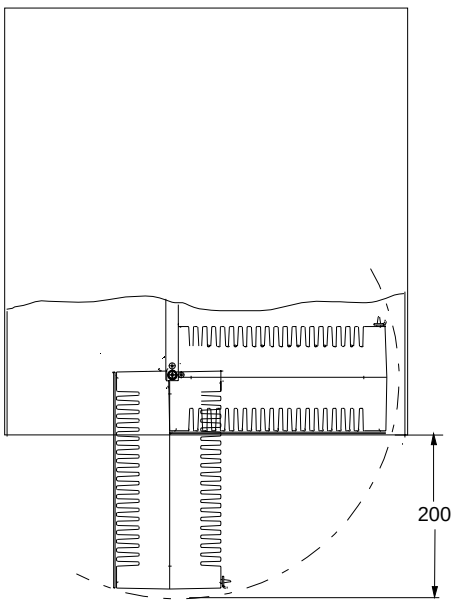
Cooling air: 814 m^3/h

Air flow direction: from bottom to top

Minimum clearances
for air circulation: 100 mm

Figure 3-4: Mounting Data for 800 A Drives.



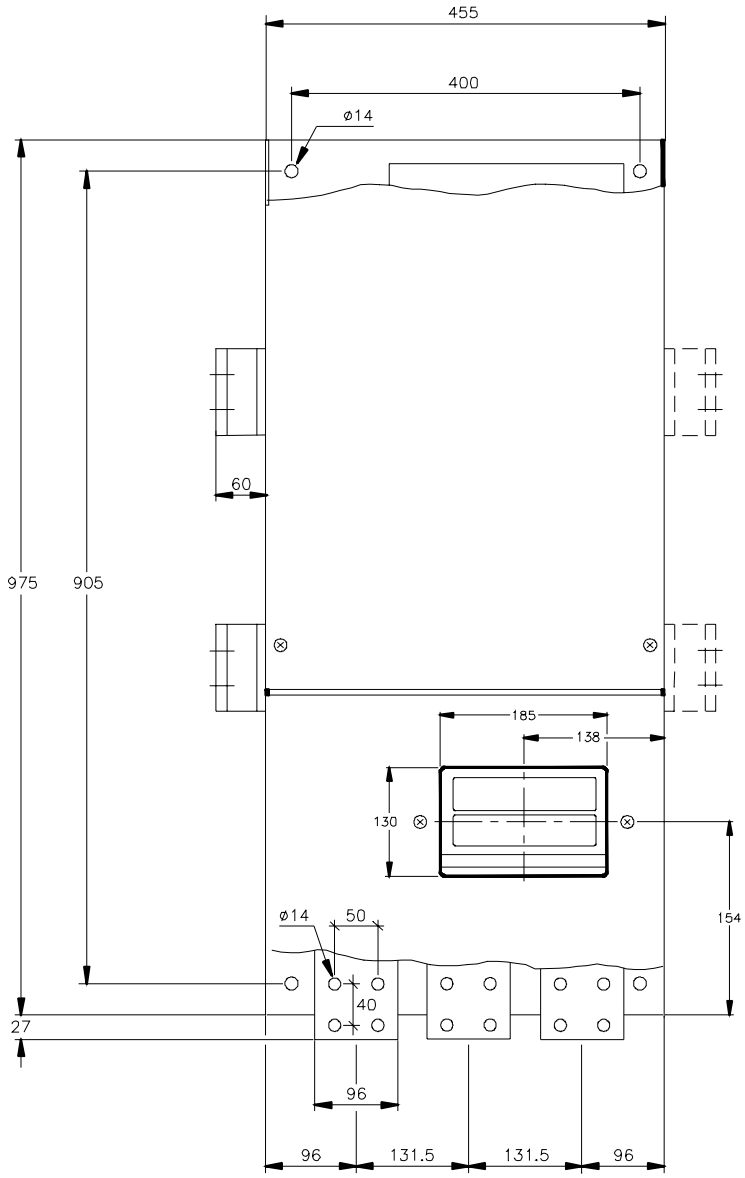


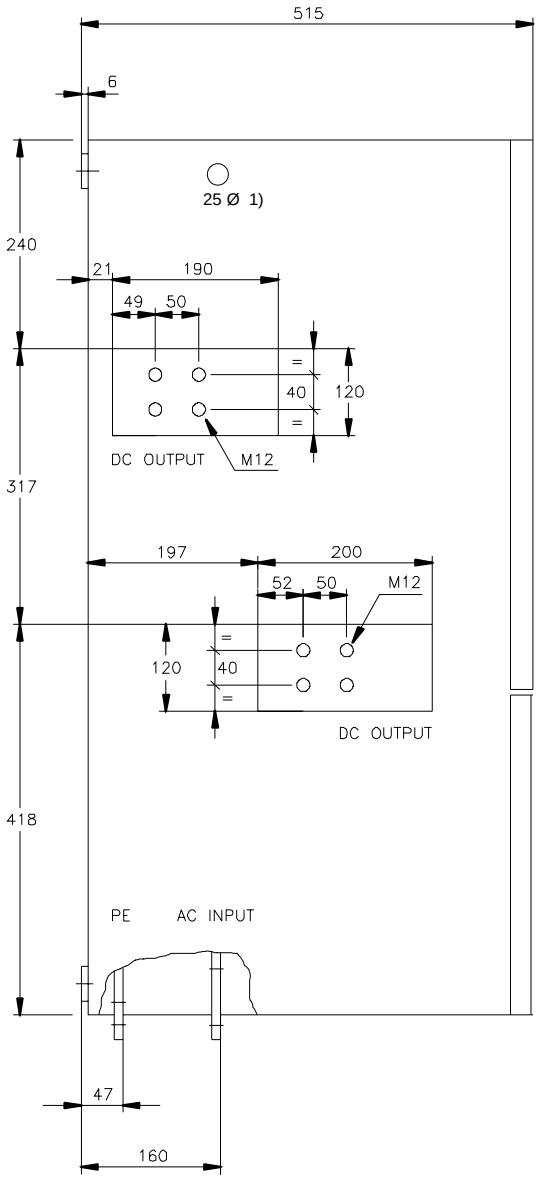
1) Holes for lifting hooks

Power connections	
Motor 1D, 1C	Bus bars 100 x 10, Drilling 4 x M12
AC-Line 1U, 1V, 1W	Bus bars 60 x 10, Drilling 2 x 13,5 mm
Prot. earth PE	Bolt M12, Torque 25 Nm

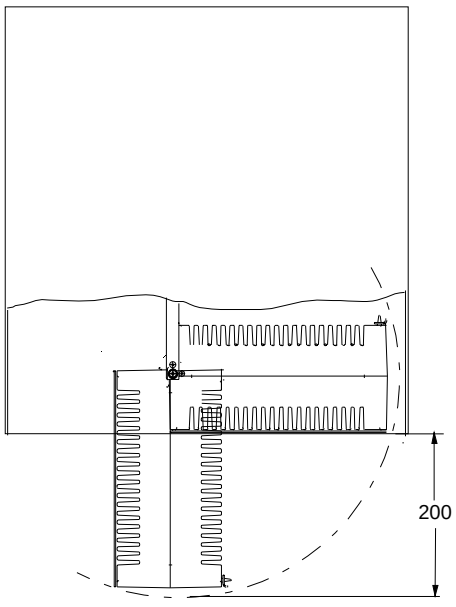
Weight:	195 kg
Cooling air:	2000 m^3/h
Air flow direction:	from bottom to top
Minimum clearances for free air circulation:	100 mm

Figure 3-5: Mounting Data for FlexPak 1200/1600 A, 500V and 1600A, 575/690V





1) Holes for lifting hooks



Power connections	
Motor 1D, 1C	Bus bars 120 x 10, Drilling 4 x M12 Torque 25 Nm
AC-Line 1U, 1V, 1W	Bus bars 96 x 10, Drilling 4 x 14 mm
Prot. earth PE	Bus bar 60 x 10, Drilling 2 x 14 mm,

Weight:	196 kg
Cooling air:	2000 m^3/h
Air flow direction:	from bottom to top
Minimum clearances for free air circulation:	100 mm

Figure 3-6: Mounting Data for FlexPak 2000A, 500V.

3.4 Install a Line Reactor or Transformer

CAUTION

Distribution system capacity above the maximum permitted system kVA, as well as limitation of commutation notches, requires always adding an impedance at line input (terminals 1U, 1V, 1W).
You can use a 3-phase line reactor with 2% voltage drop minimum (refer to Table 8-6) or other means of adding similar impedance (e.g. matched isolation or auto transformer).
If an input transformer is installed ahead of the drive, a power disconnecting device must be installed between the power line and the primary of the transformer. If this power disconnecting device is a circuit breaker, the circuit breaker trip rating must be coordinated with the inrush current (10 to 12 times full-load current) of the input transformer.
Failure to observe these precautions could result in damage to, or destruction of, the equipment.

CAUTION

The star point of the external AC-line transformer must always be grounded (Zero potential) and connected to the drive ground point (terminal PE or ground stud).

Connection of a drive to a transformer with a primary rating of 2300 VAC or more may require additional input line conditioning. Contact your local Rockwell Automation sales/service office for assistance when this is required. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Input transformers step up or step down input voltage and can be either auto or isolation transformer types. Users should consider using an isolation transformer instead of an auto transformer for the following advantages:

- AC power line disturbances and transients are minimized by an isolation transformer, thus reducing or eliminating possible damage to solid state components.
- An isolation transformer provides electrical isolation for the drive from plant power system grounds. Damaging currents may be avoided in instances where the DC output is accidentally grounded or where the DC motor circuits are grounded.

Rockwell Automation offers a series of isolation transformers suitable for use with the drive.

3.5 Install an Input Disconnect

DANGER

The standard EN 60204-1 requires that an input disconnect must be provided in the incoming power line and either be located within sight of the drive or have provisions for a padlock. Install an input disconnect in the incoming power line that is located in sight of the drive or one that has provisions for a padlock. Failure to observe this precaution could result in severe bodily injury or loss of life.

Any fused disconnect or circuit breaker in the incoming AC line must accommodate a maximum symmetrical AC fault current as indicated in 2.2.1 of this instruction manual.Size the disconnect to handle the transformer primary current as well as any additional loads the disconnect may supply.

1. Install an input disconnect in the incoming power line according to the standard EN 60204-1 if not provided with the drive.

   The disconnect switch should be within clear view of machine operator and maintenance personnel for easy access and safety. An open-type switch with provisions for a padlock is recommended.

2. Wire this disconnect in the primary circuit of the drive isolation transformer (if used).

3.6 Install the Motor

1. Verify that the motor is the appropriate rating to use with the drive.
2. Install the DC motor in accordance with its installation instructions.
3. Make sure that coupled applications have proper shaft alignment with the driven machine or that belted applications have proper sheave/belt alignment to minimize unnecessary motor loading.
4. If the motor is accessible while it is running, install a protective guard around all exposed rotating parts.
5. Wire the motor to the drive. Refer to "Wire the DC-Motor to the Drive".

3.7 General Wiring Practices

DANGER

The user is responsible for conforming to all applicable standards. Wiring, grounding, disconnects and overcurrent protection are of particular importance.
Size and install all wiring in conformance with all other applicable standards.
Failure to observe this precaution could result in severe bodily injury or loss of life.

The Drive is designed for AC entry and DC power exiting at the top and control and signal wiring entering from the bottom.

Reference signal wiring should be run in a separate conduit isolated from all AC and DC power and control. Signal wires should not be run in parallel with high voltage or electrically noisy conductors. Always cross such conductors at 90°.
All reference signals should be wired with either twisted double or twisted triple conductor wire, 40 twists per meter, stranded copper, 1.5 mm^2 , or screened 4-stranded (3, PE) 0.5 mm^2 (PN 380.35.01), 600 VAC rated insulation, with a temperature range of 40 - 105°C.

Analog tachometer feedback should be run in a separate conduit isolated from all AC and DC power and logic control. Wiring should be the same as for the reference signals but screened per pair if stranded cable 0.5 mm^2 (PN 380.33.00) is used.

Digital tachometer feedback (Encoder) wiring should be twisted per pair, not screened and be run in a separate conduit isolated from all AC and DC power and logic control.

For mounting with external contacts and solenoids, coils should be suppressed to reduce noise.

NOTE: *The maximum recommended wire length from the drive to the motor is 300 meter.*

3.8 Wire the Drive

3.8.1 Ground the Drive and Enclosure, the Motor and the Operator's Control Station

(Refer to page 18, Recommended Lugs for Grounding FlexPak Drives in UL / cUL Version)

1. Run a suitable equipment grounding conductor unbroken from either drive ground point (terminal PE or ground stud) to the plant ground (grounding electrode).
2. Connect a suitable grounding conductor from each conduit to this drive ground point. A ring lug is recommended at the ground point.
3. Connect a suitable equipment grounding conductor to the motor frame, the transformer enclosure if used, and the drive enclosure. Run this conductor unbroken to the grounding electrode.
4. Connect the PE (green/yellow) wire brought in with the incoming AC power line to the drive ground point. Tighten chassis ground connections.

3.8.2 Wire AC-Power to the Drive

WARNING

The drive requires a 3-phase power source of 200 - 500 (300 - 575/690 V), 50/60 Hz (see 2.2.2).
If the correct voltage is not available, a transformer must be installed between power source and drive.
Do not connect the drive to a power source with available short circuit capacity in excess of the max. symmetrical fault current. Failure to observe these precautions could result in bodily injury.

1. Size the AC line supply conductors for the specific drive rating and according to all applicable standards.
2. Connect the AC line supply via disconnect (if used) and line reactor or matched transformer to the terminal strips or bus bars at the top of the Converter or to the disconnect.

3.8.3 Wire the DC-Motor to the Drive

1. Size the motor armature circuit conductors for the specific drive rating (see Table 2-3) and according to applicable standards. Use only copper wire rated 60/70°C or higher.
2. Locate the DC-motor armature and field supply leads on the drive.
3. Connect the DC-motor armature leads and the shunt field supply leads to the drive.

3.8.3.1 Motor Overload Protection

A software (internal) static overload is provided.
In addition to the software (internal) overload function, a DC-motor thermostat can be used for motor thermal overload protection. The thermostat leads are brought out through the motor terminal box as leads P1 and P2.
These two leads must be wired to the regulator board control terminals 13 and 14.
The thermostat leads can be run with the motor armature and field power wiring.

NOTE: *The Drive will not start if the circuit between terminals 13 and 14 is not made.*
See Figure 3-8.

3.8.4 Main contactor (Refer to connection diagram example Figures 3-8a and 3-8b)

A main contactor in the AC-line input or armature circuit is not built-in and must be externally provided. It allows 'Coast-to-rest' (Category 0) or 'Ramp-to-rest' (Category 1, according to EN60204-1, Chap. 9.2.2.) each with **disconnection of the power source from the motor.**
The sequencing of the M-contactor must be controlled by the drive MCR contact of the FlexPak 3000, which is wired to terminal strip X1:5 and X1:6 located at top of the power unit.
On drives, where the inrush current of the M-contactor coil exceeds the MCR contact rating (330 VA at AC 230V, cos phi 0.5), a pilot relay is required between the MCR contact output and the M-contactor coil.
A normally open auxiliary contact from the main contactor must be wired to terminals X1:3 and X1:4 to provide contactor status feedback to the drive.

3.8.5 Emergency Stop-Function

WARNING*:* 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) must be accessible to the operator.
Failure to observe this precaution could result in bodily injury or loss of life.

It is the responsibility of the user to decide, how the Emergency Stop Function is fulfilled, depending on the requirements of the application and based on a risk assessment of the machine.
Disconnection of the power source from the motor may be reached e.g. by one of the following measures:

a) Circuit breaker used as Emergency Stopping Device:
- easy accessible to the operator, hand operated or
- remote operated, e. g. undervoltage trip coil released by mushroom head pushbutton.

b) Circuit breaker **not** used as Emergency Stopping Device:
- Emergency Stopping Device (mushroom head pushbutton) interrupts control circuit and releases Coast Stop according to Category 0.

A Connection Diagram - Example for case b) is shown in Figures 3-8a and 3-8b.

FUNCTION: Actuating of the Emergency Stop pushbutton during operation, causes immediate drop out of relay K10, opening the n.o. contact at input terminal 8 and blocking of the regulator. At zero current, opening of contact output MCR will drop out the main contactor via auxiliary contactor K1. The time delayed normally open contact of timer relay K10T ensures, that in case of malfunction of the internal control circuit (MCR does not open) the main contactor drops out after 1 second.

3.8.6 Stopping the Drive

3.8.6.1 COAST-STOP Digital Input

Opening of the digital input COAST-STOP (drive terminal 8) during operation causes blocking of the regulator and the drive to Coast-to-rest. This input may be used for the Emergency Stop control circuit, if the main contactor drop out is forced by electro mechanic device, otherwise this Stop function corresponds with Category 2. NOTE: If this digital input is not used, a jumper must be wired between drive terminals 7 and 8, otherwise the drive will not start.

3.8.6.2 STOP Digital Input

Depressing the STOP key (between 1 and 3 of drive terminals) with the drive running causes the drive to stop in the selected Stop-Mode (‘Coast-to-rest’, ‘Ramp-to-rest’ or ‘Current limit Stop’). This STOP-function corresponds with Category 2, if the main contactor drop out is not forced by electro-mechanic device. The function is active at all times regardless of the selection of AUTO/MANUAL or the CSS setting (KEYPAD/TERMBLK).

3.8.6.3 Customer Interlock

Opening the control input at terminal 9 during operation is the fastest way to disable the drive output. By software it directly ramps down armature current to zero and then opens the main contactor. The motor will coast to rest. Because this is a software function it must not be used for safety relevant stopping. For emergency stop use the coast to stop input as per 3.8.6.1. NOTE: If this digital input is not used, a jumper must be wired between terminal 9 and 11, otherwise the drive will not start.

3.8.7 Wire User Devices to the Drive (If Used)

Reference Figure 3-8a and Table 3-6 when wiring user devices to the drive. Size and install all wiring in accordance with all other applicable standards.

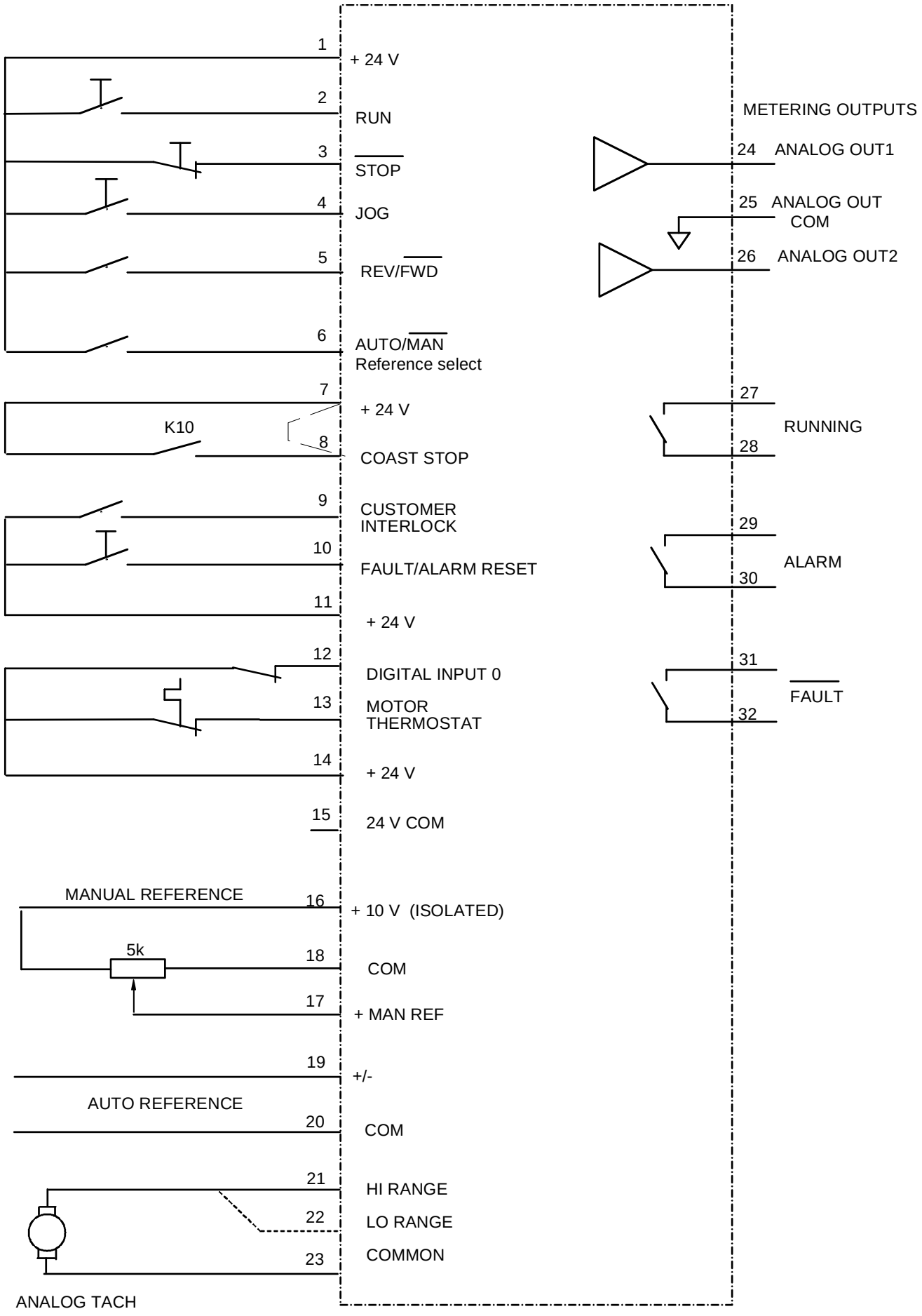


Figure 3-8a - Sample Regulator Board Terminal Strip Connection Diagram

Table 3.6 - User Device Connections to the Regulator Board Terminal Strip

User Device	Regulator Board Terminal Strip Numbers
RUN	1 (+24V) and 2
STOP	1 (+24V) and 3
JOG	1 (+24V) and 4
REV/FWD	1 (+24V) and 5
AUTO/MAN reference select	1 (+24V) and 6
INTERLOCK	9 and 11 (+24V)
FAULT/ALARM RESET	10 and 11 (+24V)
DIGITAL INPUT 0	12 and 14 (+24V)
MOTOR THERMOSTAT	13 and 14 (+24V)
24V SUPPLY COMMON	15 (+24V COM)
SPEED REFERENCE POTENTIOMETER: ■ High Side (+10 ISOL) ■ Wiper (+ MAN REF) ■ Low Side (COM)	 16 17 18
AUTO REFERENCE: (+) (-)	19 20
TACHOMETER (Analog): High Range (Jumper J14 in position HIGH) Low Range (Jumper J14 in position LOW) Common	 21 22 23
ANALOG OUT1 (Metering)	24 and 25 (common)
ANALOG OUT2 (Metering)	25 (common) and 26
RUNNING (Indicator)	27 and 28
ALARM (Indicator)	29 and 30
NO FAULT (Indicator)	31 and 32

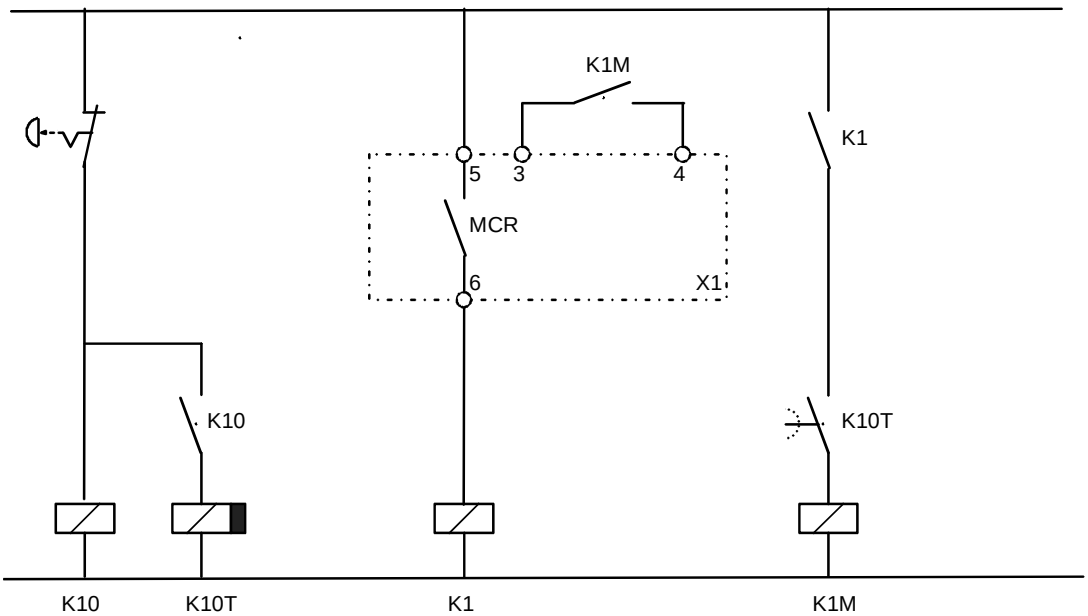


Figure 3-8b – Main Contactor Sequencing Connection Diagram - Example

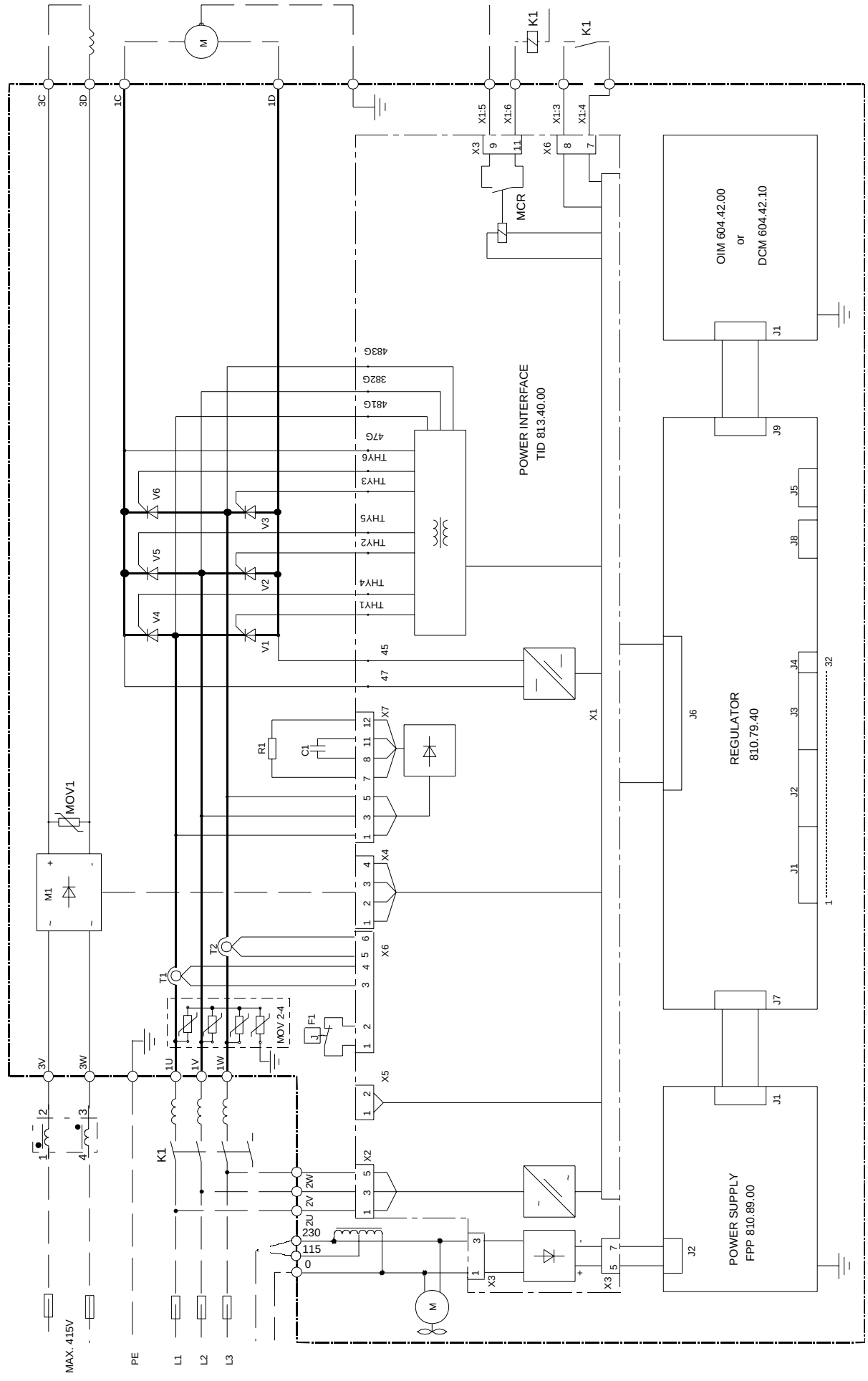


Figure 3-9: Principle wiring diagram of FlexPak 3000, single quadrant (example S-6 150 A)

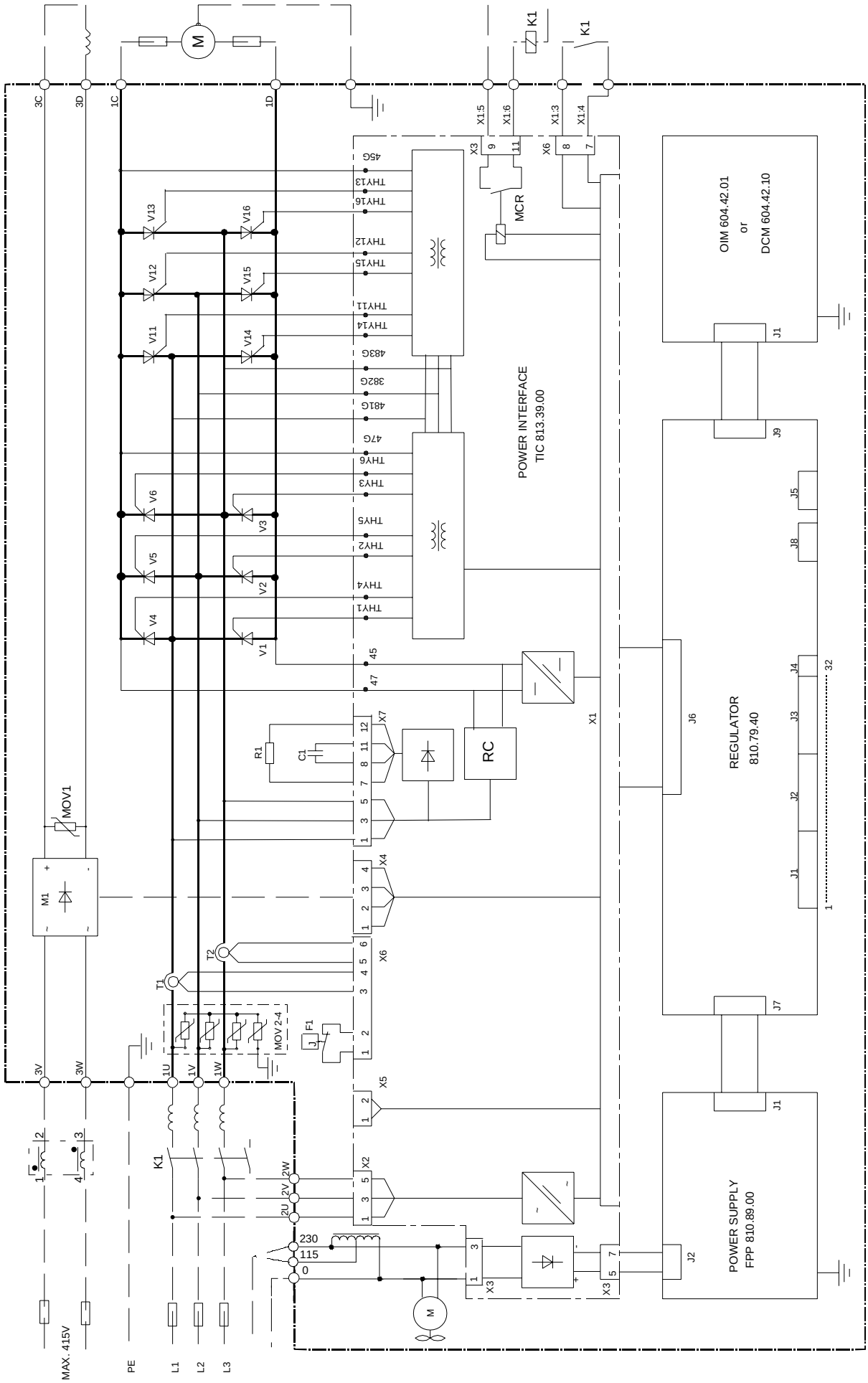


Figure 3-10: Principle wiring diagram of FlexPak 3000, four quadrant (example S-6R 150 A)

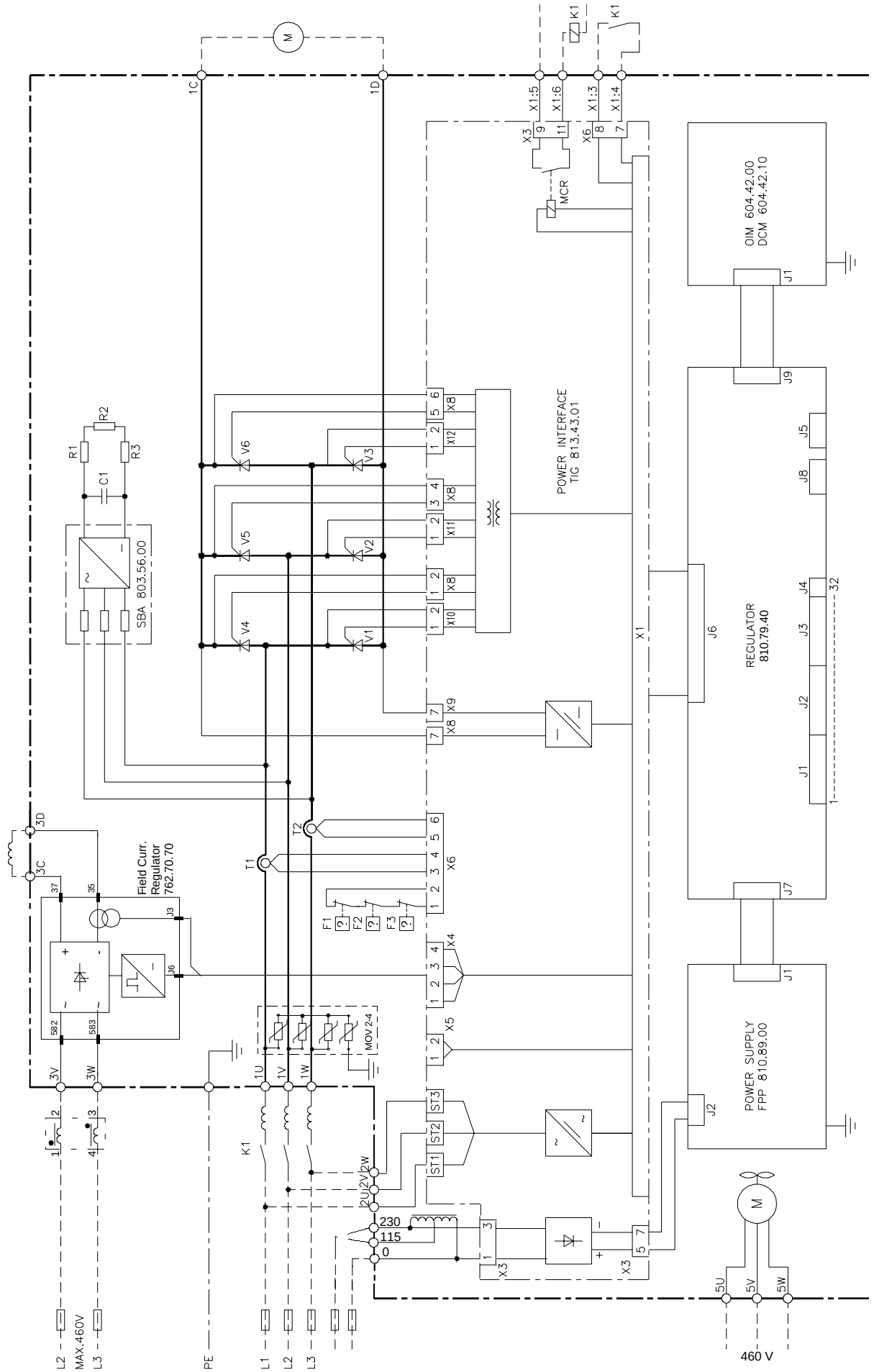


Figure 3-11: Principle wiring diagram of FlexPak 3000, single quadrant S-6, 1600 A, 575 V

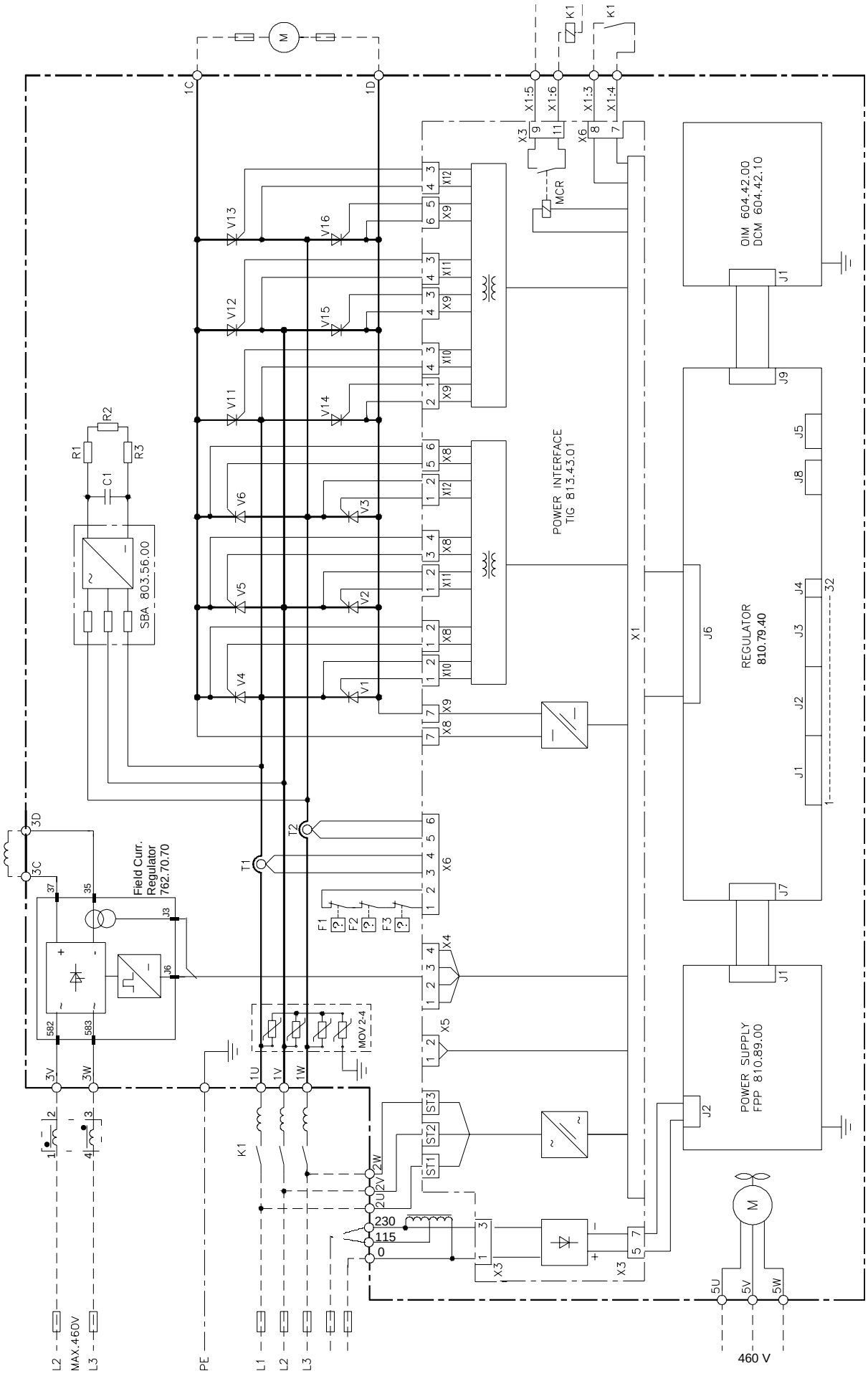


Figure 3-12: Principle wiring diagram of FlexPak 3000, four quadrant S-6R, 1600 A, 575 V

.Recommended Lugs for Grounding FlexPak 3000 Drives in UL / cUL Version

The following describes how to interpret Reliance USA lug model numbers used in grounding the FlexPak 3000 drive.
The lugs are non-insulated screw type (solderless) for use with solid and stranded wire.

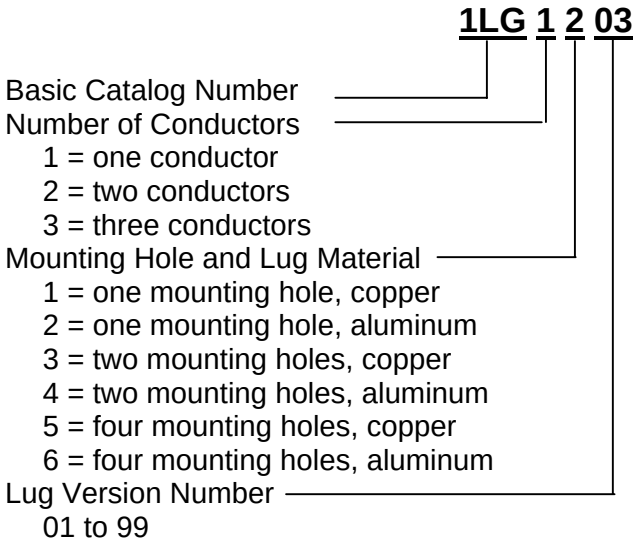


Table 3-7: Recommended Lugs for different Wire Sizes

RA Dierikon Part Number	Reliance USA Model Number	Reliance USA Part Number	Wire Size	Mounting Hole	Material
916.10.70	1LG1101	68321-38AA	14 - 8 AWG	M5	copper
916.10.71	1LG1102	68321-38AB	14 - 8 AWG	M6	copper
916.10.72	1LG1103	68321-38AC	4 - 1/0 AWG	M10	copper
916.10.73	1LG1104	68321-38AD	1/0 - 4/0 AWG	M12	copper
916.10.74	1LG1105	68321-38AE	4/0 - 500 MCM	M10	copper
916.10.80	1LG1201	68321-38BA	14 - 1/0 AWG	M6	aluminum
916.10.81	1LG1202	68321-38BB	14 - 2/0 AWG	M6	aluminum
916.10.82	1LG1203	68321-38BC	6 - 250 MCM	M8	aluminum
916.10.83	1LG1204	68321-38BD	6 - 300 MCM	M6	aluminum
916.10.84	1LG1205	68321-38BE	6 - 350 MCM	M10	aluminum
916.10.85	1LG1206	68321-38BF	4 - 500 MCM	M10	aluminum
916.10.86	1LG1207	68321-38BG	300 - 800 MCM	M12	aluminum
916.10.87	1LG1208	68321-38BH	500 - 1000 MCM	M12	aluminum
916.10.88	1LG2401	68321-39BA	2 - 600 MCM	M10	aluminum
916.10.89	1LG2402	68321-39BB	350 - 800 MCM	M10	aluminum
916.10.90	1LG2403	68321-39BC	500 - 1000 MCM	M12	aluminum
916.10.91	1LG3601	68321-40BA	2 - 600 MCM	M12	aluminum

4.0 Drive Setup and Adjustment

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 section in its entirety before proceeding. Failure to observe this precaution could result in bodily injury or loss of life.

4.1 Introduction

This section details the setup and adjustment of the drive. Record final settings in Table 4.1.

4.2 Test Equipment Needed

CAUTION

Do not use a megohmmeter for continuity checks in the drive. The high voltage of the megohmmeter can damage the drive's electronic circuits. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

A volt-ohmmeter having a sensitivity of 20,000 ohms per volt may be used.

4.3 Power Off Inspection

Inspect the Drive and modification kits for possible physical damage or improper connections.

Verify that the wiring of the operator's station and the wiring to the Drive is made with sufficient bare wire to make a good electrical connection. The removal of an excessive length of insulation may needlessly expose conductors resulting in the possibility of shorts or safety hazards.

4.4 Motor Ground Check

CAUTION:

A megohmmeter can be used for this motor ground check, but all conductors between the motor and the drive must be disconnected. The megohmmeter’s high voltage can damage the drive's electronic circuits. Disconnect all conductors between the motor and the drive before using a megohmmeter for this motor ground check. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The DC Motor frame and conduit box should be connected to a good earth ground per the motor instruction manual.

Verify that there is no path to ground in either the D-C Motor armature circuit, the shunt field circuit or the thermostat circuit. Connect one lead of a standard ohm reading meter to the motor frame and the other lead to the two armature leads, then to the two field leads and to the two thermostat leads. If a reading of less than 100,000 ohms is observed, a ground condition exists and MUST be corrected before power is applied.

4.5 Jumper Settings

The jumper settings for the FlexPak 3000 drive determine the regulator type, program protection, field settings, references for automatic and manual modes, tachometer voltage range, and armature feedback scaling.

- Through the OIM, check the proper jumper settings for J11, J14, and J18 in the Correct Scaling Jumper Positions menu under Drive Information. Write down these settings as displayed and make sure the actual settings match.
- Through the OIM, check the current settings for J15, J20, and J21 in the Drive Information menu. If these settings are correct for your system, you do not need to change them.

DANGER

This equipment is at line voltage when A-C power is connected to the drive. Disconnect and lockout incoming power to the drive before proceeding. After power is removed, verify with a voltmeter at power terminals 1U, 1V and 1W that no voltage exists before touching any internal parts of the drive. Failure to observe these precautions could result in severe bodily injury or loss of life.

CAUTION

Unless explicitly stated otherwise, power must be removed before changing any jumper connection. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Jumpers are read only on power-up, so power must be cycled for a change to a jumper setting to be recognized by the drive.

1. Remove power from the drive.
2. Remove the cover and the keypad
3. The jumpers are located on the regulator board. See Figure 4.1 for jumper locations
4. Change the jumper settings as described in the following paragraphs per the requirements of your application. Record final settings in Table 4.1.

Table 4.1 - Jumper and Adjustment Settings

JUMPER/ADJUSTMENT	DEFAULT SETTING	FINAL SETTING
J10 (AUTO REF)	VOLTS	
J11 (TACH V SCALE)	16	
J12 (AUTO REF)	VOLTS	
J14 (TACH V RANGE)	62	
J15 (REGULATOR TYPE)	SPEED	
J16 (OIM PROGRAM)	ENABLE	
J18 (ARM I FB RB)	Position 4	
J19 (MANUAL REF)	POT	
J20 (FIELD LOSS DETECT)	DISABLE	
J21 (FIELD SUPPLY)	NOT APPLICABLE [1)]	
J26 (TACH LOSS DETECT)	ENABLE	
J27, J29 for future selection needs		
J28 (FILTER SELECT) (red)	FLDFBK (do not change)	FLDFBK
J30 (POWER INTERFACE)	LOW	
ANALOG TACH ZERO ADJ	0	
ARM VOLTAGE ZERO ADJ	0	

(1) Only applicable when the optional Enhanced Field Supply kit is installed.

4.5.1 Set the Regulator Type - J15 Jumper

J15 determines whether the drive uses Speed/Voltage (SPEED) or Torque/Current (CURRENT) regulation.
When CURRENT is selected, only the terminal strip or the AutoMax Network Communication Board can be used as the control source. and the reference selection is automatically set to AUTO mode.
Also note that speed/voltage parameters must be set to provide overspeed protection for the drive.

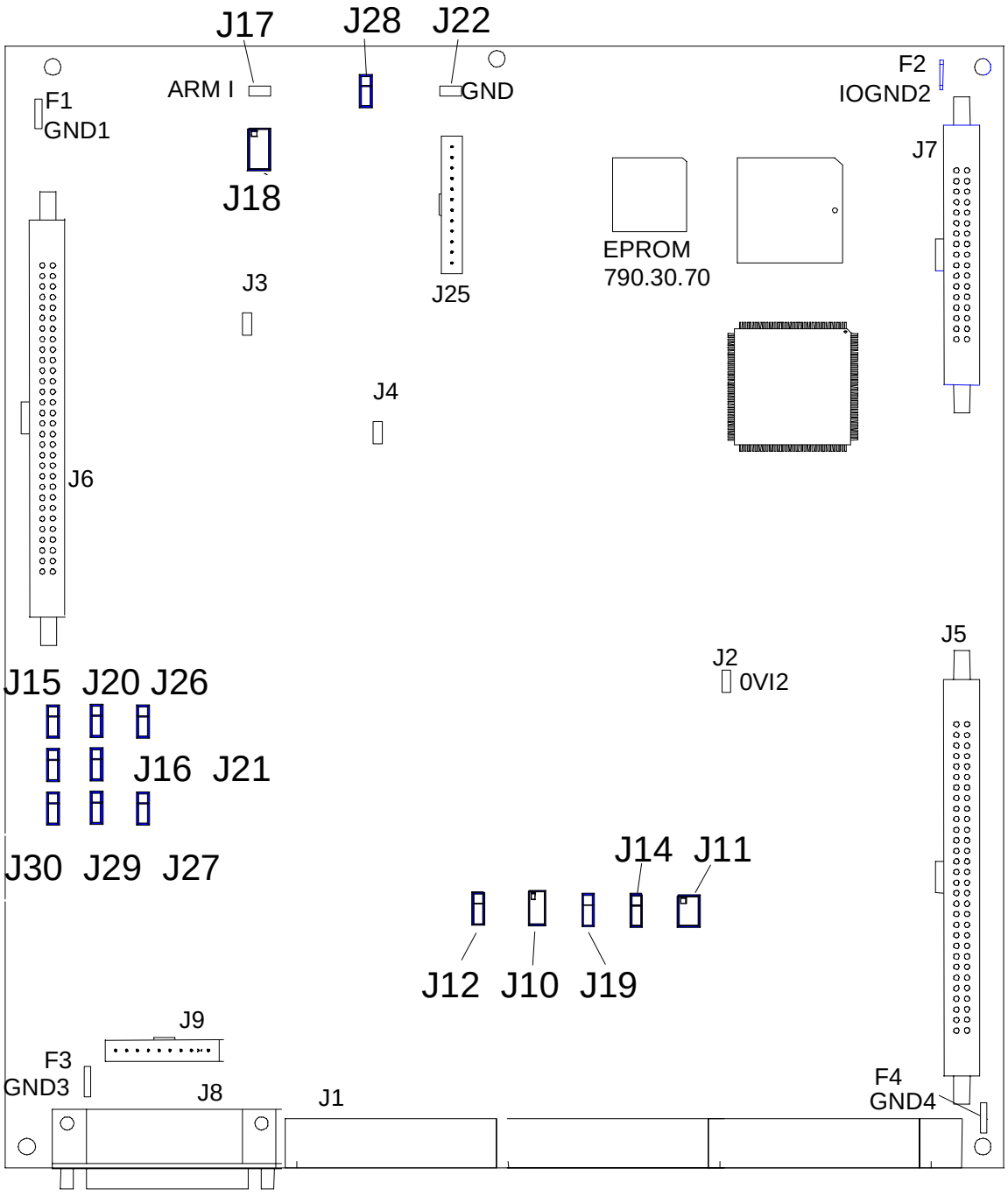
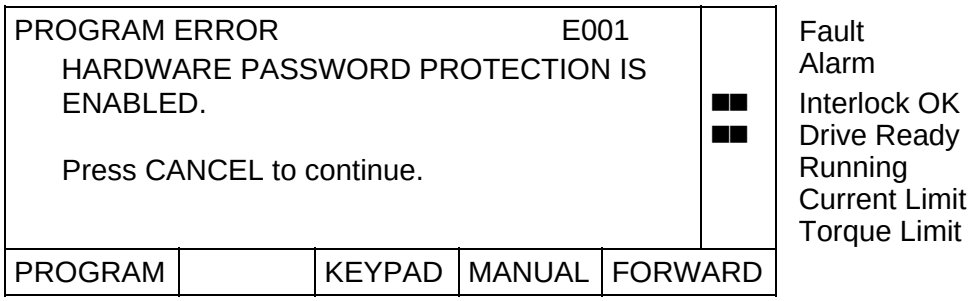


Figure 4.1 - Regulator Board Jumpers, Connectors and Test Points

4.5.2 Set Program Disable/Enable (OIM PROGRAM) - J16 Jumper

The OIM program jumper (J16) determines whether or not parameter changes can be made through the keypad. Only programming options are affected by the setting of this jumper. The OIM drive control keys (such as RUN) and the manual speed reference are not affected. To allow keypad parameter changes, place the jumper on pins 1 and 2 (ENABLE). To prevent parameter changes through the keypad, place the jumper on pins 2 and 3 (DISABLE). Parameters cannot be modified through the keypad. If an attempt to modify a parameter is made, the message "Hardware Password Protection is Enabled" is displayed on the keypad.



4.5.3 Set Field Loss Enable/Disable (FIELD LOSS DETECT) - J20 Jumper

The FIELD LOSS DETECT jumper (J20) determines whether or not a fault is generated when a field loss occurs.

NOTE*: Jumper J20 is ignored if the Field Current Regulator kit is installed. Therefore, placing J20 in the DISABLE position will not disable field loss detection. See I/M 49'1345 for more information on the Field Current Regulator.*

WARNING

The user must provide external field current loss detection and inhibit drive operation via one of the drive interlocks when this jumper is positioned to disable. Misapplication of this jumper can cause the motor to run at dangerously high speeds.
Failure to observe this precaution could result in bodily injury.

To detect complete loss of field current, place the jumper on pins 1 and 2 (ENABLE). When a complete loss is sensed, a fault is generated and the drive is stopped.

To ignore field loss, place the jumper on pins 2 and 3 (DISABLE). Any loss of field current is than ignored. Use the DISABLE option only when no field exists, such as with a permanent magnet or when a separate field supply is used.

4.5.4 Set Tacho Loss / Open Armature Enable/Disable (TACHO LOSS DETECT) - J26 Jumper

This jumper determines whether or not a fault is generated when a tacho loss occurs or the armature is open.

WARNING

When this jumper is removed and pins 1 and 3 connected, the user must provide external tacho loss detection and inhibit drive operation via one of the drive interlocks. Misapplication of this jumper can cause the motor to run at dangerously high speeds.
Failure to observe this precaution could result in bodily injury.

To detect tacho loss, place the jumper on pins 1 and 2 (ENABLE). When a loss is sensed, a fault is generated and the drive is stopped. To ignore tacho loss or open armature, the jumper must be removed and pins 1 and 3 connected (through wire-wrap connection).

4.5.5 Field Supply Jumper Connection (FIELD SUPPLY) - J21 Jumper

NOTE: *This jumper has no affect on the standard field supply or the field current regulator.*

The FIELD SUPPLY jumper (J21) determines the voltage range that the drive expects to see from the optional Field voltage controller kit. Refer to I/M 49'1344 for more information on that kit. The position of this jumper must correspond with the voltage range selected via the jumper wire on the optional Field voltage controller.

Jumper Connection	D-C Field Voltage Range (1)
B-C	45% of VAC to 90% of VAC

(1) VAC is the RMS Line to Line Voltage at 3V and 3W.

4.5.6 Setting the Source for the Manual Mode Reference (MANUAL REF) - J19 Jumper

CAUTION: The drive will not run at the correct speed if this jumper is not set to the correct position. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The MANUAL REF jumper (J19) determines whether the internal +10 V isolated power supply or an external +10 V source is used for the manual mode reference.

To use the +10V power supply for the manual reference potentiometer, place the jumper on pins 2 and 3 (POT). The supply at terminal 16 of the regulator board terminal strip is used.

To use an external +10 V source, place the jumper on pins 1 and 2 (EXT). The external reference is connected at terminals 17 and 18 of the regulator board terminal strip.

NOTE: *This input can be used as a trim on auto mode speed reference by setting the jumper on pins 1 and 2 (EXT). In this case a ±10 V reference can be used.*

4.5.7 Setting the Tachometer Voltage Range (TACH V RANGE) - J14 Jumper / and Tachometer Voltage Scale (TACH V SCALE) - J11 Jumper

The TACH V RANGE (J14) and TACH V SCALE (J11) jumpers set the voltage range and scale of the analog tachometer.

NOTE: *This jumper is ignored if an analog tachometer is not used and if FEEDBACK SELECT is not set to DC TACH or AC TACH.*

CAUTION: The drive will not run at the correct speed if these jumpers are not set to the correct position. Failure to observe this precaution could result in damage to, or destruction of the equipment.

During "Quick Start", the drive calculates the value of the tachometer range based on the values of TOP SPEED and ANLG TACH VOLTS/1000 and the setting of FEEDBACK SELECT. The correct values are displayed on the Correct Scaling Jumper Positions screen.
Verify these settings prior to performing the Self Tuning procedure.

The expected analog tachometer voltage range can be set to a maximum of 250 or 62 VDC. J11 selects the hardware circuitry to maximize the resolution over the entire speed range.

	Jumper J14	Jumper J11
Top Speed Tach Volts < 16 volts	LOW	16
Top Speed Tach Volts < 31 volts	LOW	31/125
Top Speed Tach Volts < 62 volts	LOW	62/250
Top Speed Tach Volts < 125 volts	HIGH	31/125
Top Speed Tach Volts < 250 volts	HIGH	62/250

NOTE: The output voltage of the tachometer must not exceed 250 V for DC tachometers or 275 RMS for AC tachometers when the motor is rotating at TOP SPEED. To calculate the output voltage at top speed, multiply the two parameter values:

$$\text{Tachometer Voltage at TOP SPEED} = \frac{\text{TOP SPEED}}{1000} \times \frac{\text{ANALOG TACH VOLTS}}{1000}$$

4.5.8 Analog Auto Reference (AUTO REF) - J12 and J10 Jumpers

The AUTOREF Jumpers J12 and J10 select the type of analog auto reference to be used when the AUTO mode is selected. J12 selects the type of signal - VOLTS (Voltage) or MAMPS (milli-amps). J10 selects the range.

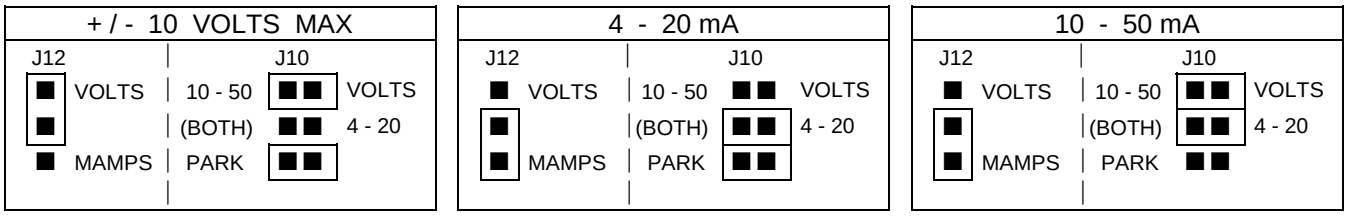


Figure 4.2 - AUTO REF Jumpers (J12 and J10)

4.5.9 Armature Current Feedback Scaling (ARM I FB RB) - J18 Jumper

CAUTION:
The drive will not operate at the correct speed if this jumper is not set to the correct position. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The ARM I FB RB) Jumper J18 scales the armature current feedback signal. The drive calculates the value of the burden resistor needed to scale the armature current feedback signal. The calculations are based on the values of MOTOR RATED ARM AMPS and MAXIMUM CURRENT.
The OIM displays the correct position of this jumper during the "Quick Start" procedure. Verify this setting prior to performing the Self Tuning procedure.

4.5.10 Check the FILTER SELECT - J28 Jumper

NOTE: *jumper J28 must always be set to position FLDFBK.*

4.5.11 Check the POWER INTERFACE – J30 Jumper

This jumper is factory set according to the type of power interface module installed in the drive. jumper positions are labeled LOW and HIGH. For FlexPak 3000 drives with a nominal voltage rating AC **575 V, 60 Hz** and **690 V, 50 Hz** the jumper J30 **must** be set to **HIGH**, for all other drives this jumper must stay in position LOW. Please refer to the ‘AC Input’ data on the nameplate.

If this jumper is not set to the correct position. nuisance AC line voltage high/low alarms may occur or, if configured as a voltage regulator, the drive will not operate at the correct speed,

CAUTION:
The drive will not operate at the correct speed if this jumper is not set to the correct position. Failure to observe this precaution could result in damage to the equipment or in bodily injury.

4.6 Powering Up the Drive

Apply A-C power to the drive after the Power Off Inspection, Motor Ground Check and Drive Setup procedures are completed.
During initial power-up, the drive displays the following three screens on the OIM.

```
WELCOME TO THE FLEXPAK 3000
DIGITAL D-C DRIVE.
   (c)  Copyright Reliance Electric
        Industrial Company 1994
    Keypad Version: xxx
Running keypad/display diagnostics
Please wait.
```

```
Link initialization in progress.

Reading Regulator data.

Please wait.
```

```
FlexPak 3000 Main Menu
➤ Quick Start
  Drive Reference
  Speed/Voltage Loop (SPD)
▼ Current Minor Loop (CML)                    ■■

PROGRAM |  | TERMBLK | MANUAL | FORWARD
```

4.7 OIM Screen Contrast Adjustment

This function can be enabled at any program menu level but not at parameter value entry screens. To enable the contrast adjustment function, press the right arrow key. The Contrast Adjustment Screen appears as:

```
Contrast Adjustment                                   Fault
                                                      Alarm
A B C D E F G H I J K L M N O P Q R S            ■■   Interlock OK
                                                 ■■   Drive Ready
Press RIGHT/LEFT to INC/DEC contrast.                 Running
                                                      Current Limit
                                                      Torque Limit

PROGRAM |  | KEYPAD | MANUAL | FORWARD
```

The left arrow key decreases the contrast setting and the right arrow key increases the contrast setting.

- Press ENTER to accept the new contrast setting.
  Press CANCEL to return to the previous menu screen.
- A memory save must be performed in order to save the new contrast setting to non-volatile memory.

4.8 Accessing the Main Menu

The Main Menu is accessed by pressing the PROGRAM/MONITOR key until "PROGRAM" appears above the key.

The Main Menu consists of sub-menus that can be used to quick start your drive, select drive reference, tune the speed/voltage loop and/or current minor loop, configure input/output terminals for metering, set up the field, configure SCR diagnostics, or display drive information and operator interface selections. The following tree provides the overview of the Main Menu at a glance.

FlexPak 3000 Main Menu

- Quick Start
- Drive Reference
- Speed/Voltage Loop (SPD)
- Current Minor Loop (CML)
- Outer Control Loop (OCL)
- Input/Output
- Network Communication
- Field
- Drive Information
- Operator Interface
- Additional Parameters

The sub-menus in the Main Menu list contain lower level menu lists and/or parameter lists for configuring, tuning, setup, monitoring or troubleshooting the drive.

4.9 How to Access the Menus/Parameters

Position the cursor at the menu/parameter of your choice using the up/down arrow keys and then press the ENTER key to access. If a ▼ character displayed at the bottom left of a menu/ parameter list indicates that more selections are available. Press the down arrow key to scroll up through the selections. Similarly, if a ▲ character is displayed at the top left of a menu/ parameter list, use the up arrow key to scroll down through the selections.

Using the following paths starting from the Main Menu, the user can access parameters to monitor, setup, adjust, configure and tune the drive using value entry screens.

Drive Reference

- Drive Reference
- Drive Reference Test Points*
- Drive Reference Trim*
- Drive Reference Limits*
- Drive Reference Ramp*
- Drive Reference Configure*
- Drive Reference Scaling*

Speed/Voltage Loop (SPD)

- Speed/Voltage Loop (SPD) Test Points*
- Speed/Voltage Loop (SPD) Tuning
  - Self Tuning Setup*
  - Self Tuning
- Speed/Voltage Loop (SPD) Feedback*

Current Minor Loop(CML)

- CML Test Points
- CML Tuning*
- Self Tuning Setup*
  - Self Tuning
  - CML Feedback Scaling*
- Three-Phase A-C Line*
- SCR Diagnostics*
  - Armature Phase Fire Test

Outer Control Loop (OCL)

- OCL Test Points
- OCL Tuning
- OCL Configure

Network Communications

Input/Output

- Meter Outputs
- Analog I/O*
- Digital I/O*
- Frequency I/O*
- Level Detectors*

Drive Information*

- Correct Scaling Jumper Positions*

Field*

- Standard/enhanced Field Supply
- Field Current Regulator
  - Field Loop Test Points
  - Field Loop Tuning
  - Field Loop Configure
  - Field Loop Feedback Scaling

Operator Interface*

- Memory Operations
  - Memory Save
  - Memory Restore
  - Restore Defaults
- Reset Clock
- Define User Units
  - Define Speed Units
  - Define Load Units
  - Define Outer Control Loop Units

An asterisk (*) in these paths indicates that a parameter or a parameter list exists when ENTER is pressed at that menu selection. The * is not actually displayed when the menu selection is displayed on the OIM.

Refer to Appendices B and C for information regarding the menu access path(s) for individual parameters. Appendix B contains an alphabetized list of input parameters with their associated default values, code No., description and the menu path for access. Appendix C contains an alphabetized list of output parameters with a description, code No. and the menu path for access.

4.10 Verify the Correct Direction of Motor Rotation

WARNING

If tachometer and/or rotation is incorrect, sudden and rapid acceleration may result which can cause overspeed of the drive. Failure to observe this precaution could result in bodily injury.

1. Turn power to the drive OFF.
2. Verify the operation of the Coast/Stop pushbutton using an ohmmeter. When pressed, the ohmmeter should read infinite ohms (open); when released, the reading should be 0 (short).
3. Turn power to the drive ON.
4. After power-up, select ARMATURE VOLT for FEEDBACK SELECT by taking the following path from the main menu to access this parameter:

   Speed/Voltage Loop (SPD)

   └ Speed/Voltage Loop (SPD) Feedback*

   Refer to Section 5 on "How to Change Parameter Values".
5. Initiate a "JOG" command to verify that the motor is rotating in the desired direction for the "Forward" command.
6. If the direction of rotation is incorrect, Stop the drive and then disconnect and lockout or tag power to the drive.
7. To change the direction of motor rotation, reverse the connection of the motor armature leads 1C and 1D.
   NOTE: *Wrong rotation direction can be caused by incorrect wiring of the field (3C and 3D).*

4.11 Determination of D-C Tachometer Lead Polarity

1. Turn power to the drive ON.
2. After power-up, select ARMATURE VOLT for FEEDBACK SELECT by using the following path from the main menu to access this parameter:

   Speed/Voltage Loop (SPD)

   └ Speed/Voltage Loop (SPD) Feedback*

   Refer to Section 5 on "How to Change Parameter Values".
3. Select the forward direction (as indicated above the forward/reverse key) and verify that the (+) tachometer lead is connected to terminal 21 or 22 corresponding to J14 setting, and that the (-) tachometer lead is connected to terminal 23. If the (+) tachometer lead is not connected to terminal 21 or 22, stop the drive. Disconnect and lockout or tag power to the drive. Reverse the connection of the tachometer leads.
4. Initiate a JOG command.
5. Use a voltmeter on the tachometer leads to determine the lead polarity for the Forward direction of rotation. Label the tachometer leads accordingly, (+) and (-).

4.12 Adjustments

This section describes Zero adjustments to compensate for signal drift when tachometer or armature feedback is used. These adjustments are available by accessing the Speed/Voltage Loop (SPD) Feedback menu from the Speed/Voltage Loop (SPD) at the Main Menu.

Speed/Voltage Loop (SPD)

└ Speed/Voltage Loop (SPD) Feedback*

4.12.1 Perform Armature Voltage Zero Adjust

WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it accurately. Verify that the value of this parameter is accurate per your application requirements. Failure to observe this precaution could result in bodily injury.

With the drive stopped, note the value of "ARMATURE VOLTAGE" (P.289). If the value is 0 then no further adjustments are required. If the value is other than 0 then adjust the ARM VOLTAGE ZERO ADJ (P. 205) with a more positive number if the reading is a minus value, or with a more negative value if the reading is positive. Note the value of ARMATURE VOLTAGE (P.289) and continue to adjust the zero adjust parameter accordingly until the feedback value reads 0. Record the final value in Table 4.1, section 4.5.

4.12.2 Perform Analog Tachometer Zero Adjust

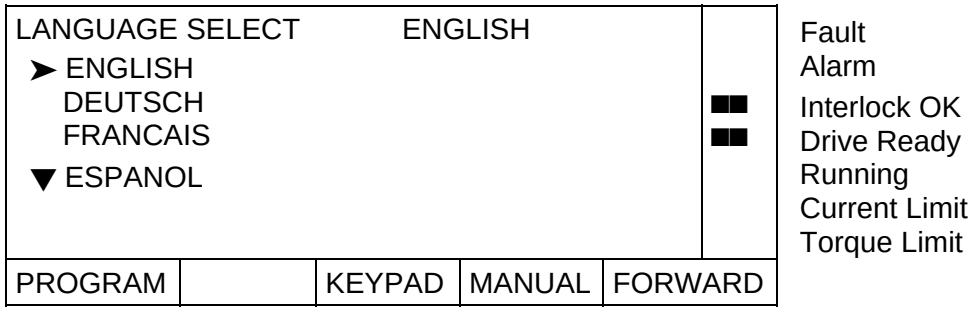
WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it accurately. Verify that the value of this parameter is accurate per your application requirements. Failure to observe this precaution could result in bodily injury.

With the drive stopped, note the value of "ANALOG TACH FEEDBACK" (P.291). If the value is 0 then no further adjustments are required. If the value is other than 0 then adjust the "ANALOG TACH ZERO ADJ" (P.202) with a more positive number if the reading is a minus value, or with a more negative value if the reading is positive. Note the value of "ANALOG TACH FEEDBACK" (P.291) and continue to adjust the zero adjust parameter accordingly until the feedback value reads 0. Record the final value in Table 4.1, section 4.5.

4.13 Language Selection

1. At any menu level, press the left arrow (⇐) key to access the Language Select menu. This menu cannot be accessed at any parameter modification (value entry) screens. This screen will allow you to select the language used on the display. The currently selected language is displayed in the upper right of the menu screen. In the MONITOR mode, pressing HELP displays status indicators in the selected language.



The following languages are available:

- ENGLISH (Default)
- DEUTSCH (German)
- FRANCAIS (French)
- ESPANOL (Spanish)
- ITALIANO (Italian)
- Code (Parameter Numbers)

"Code" allows the use of parameter numbers when interfacing with the OIM. See appendices B and C for a cross-reference of "Code No." to parameter names.

2. Press CANCEL if the current selected language is the one of your choice. The display now returns to the previous menu.
3. To choose another language other than the current selected language, move the cursor to the language of your choice using the Up/Down ⇧ ⇩ keys and then press ENTER.

   The OIM responds in the new selected language with:

   "Please wait."

The display now returns to the main menu using the newly selected language. All drive information (software parameters, fault/alarm messages and drive status) will subsequently be displayed in the selected language.

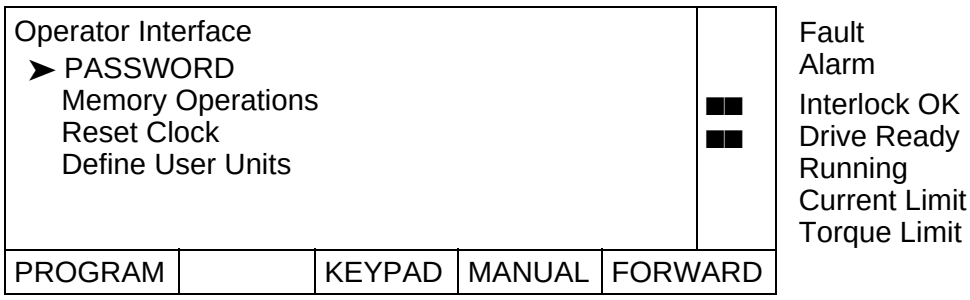
4.14 Programming Features

The OIM allows the user to customize the drive to define user units, reset the system clock, perform memory save operations and provide program protection. These features are accessible from the *Operator Interface* menu.

FlexPak 3000 Main Menu

└ Operator Interface*

Select *Operator Interface* from the FlexPak 3000 Main Menu. The following menu will appear.



The features of this menu are explained in the following section.

4.14.1 Password (PASSWORD)

WARNING

It is the user's responsibility to distribute the security password. Reliance is not responsible for unauthorized access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

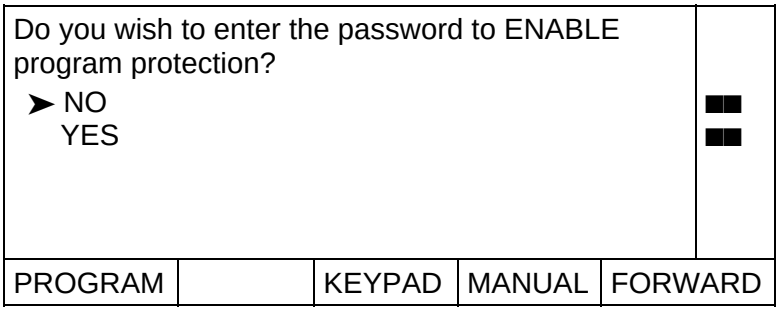
The PASSWORD parameter prevents modification of a password protected parameters from the OIM. It can be used to lock or write-protect all software parameters from the OIM keypad. The same holds true for certain menu choices (e.g. QUICK START); while locked, the user cannot select the choice.

The PASSWORD parameter only applies to OIM programming. The OIM's drive control keys (run, jog, etc.) are not regulated by the system password. Similarly, the KEYPAD-MANUAL speed reference (OIM MOP) will continue to function.

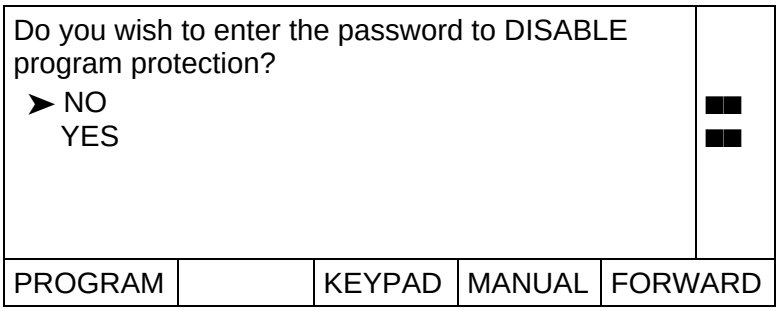
The system automatically detects the state of the PASSWORD parameter (Enabled or Disabled).

4.14.2 How to Enable/Disable Program Protection

To enable or disable program protection, PASSWORD must be selected at the *Operator Interface* menu. After pressing ENTER to confirm this selection, one of the following two screens will appear depending on the current state of program protection.

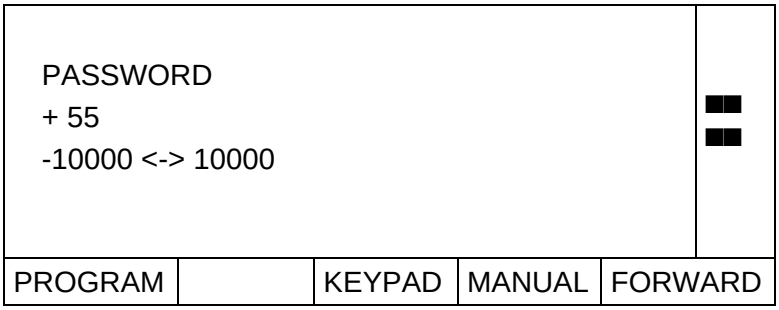


-OR-



NOTE: Pressing ENTER or CANCEL while at one of these screens will display the *Operator Interface* menu.

Select YES. At the PASSWORD integer value screen: set the value to 55.



4.14.3 Memory Operations

The user can save current changes made to parameter values, restore the last saved parameter values, or restore all parameters to their factory default value. Select *Memory Operations* from the *Operator Interface* menu to perform any of these operations.

FlexPak 3000 Main Menu

└Operator Interface*

MEMORY SAVE - This choice saves the current changes ("runtime" RAM memory) of parameter values to retentive memory. Changes to parameters effect the operation of the drive. However, these changes are lost if the drive is powered down without saving the changes.

MEMORY RESTORE - This choice restores the last saved parameter values from retentive memory to "runtime" memory.

RESTORE DEFAULTS - This choice restores factory default parameter values to "runtime" memory.

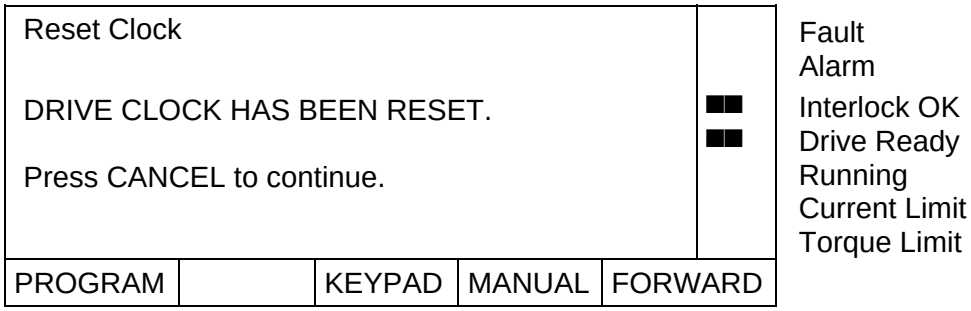
4.14.4 Reset Clock

This feature of the *Operator Interface* menu resets the elapsed time clock.

FlexPak 3000 Main Menu

└ Operator Interface*

The elapsed time clock indicates the number of days, hours, minutes and seconds since the last powerup. This clock is only visible if a fault or an alarm exist when reviewing the fault and alarm logs. Pressing ENTER while the choice is at Reset Clock will reset the readouts of the elapsed time clock to "00" and display the following message:



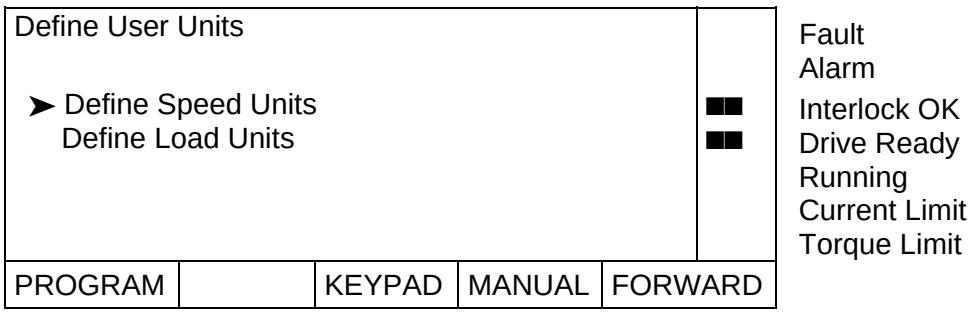
4.14.5 Define User Units

1. Select "Define User Units" from the "Operator Interface" menu.

FlexPak 3000 Main Menu

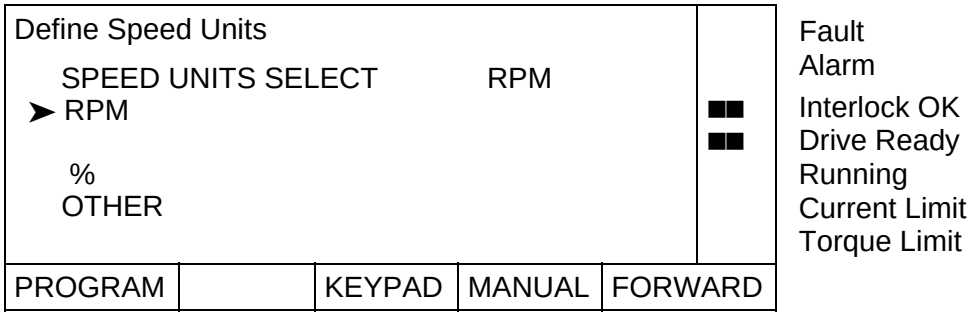
└ Operator Interface*

2. Move the cursor to "Define User Units" and then press ENTER. The following menu is now displayed:



4.14.5.1 Define Speed Units

1. Move the cursor to *Define Speed Units* or *Define Outer Control Loop Units*, press ENTER. If you select speed units, the following modification screen appears:



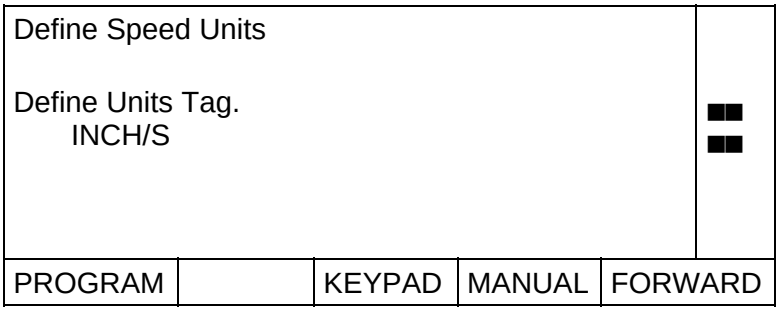
The OCR loop units screen looks the same, except that AMPS is an option instead of RPM.

2. Select the unit of your choice (RPM, AMPS, or %) or use OTHER to customize a label for speed units. See Step 3. if OTHER is selected.
3. OTHER - Customize a User Unit Label:

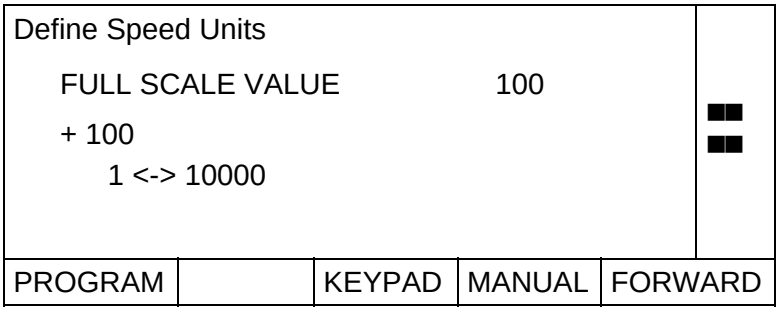
This choice allows the user to define a 1 to 6 character string for the units of a parameter in the speed parameter class. Thus, the user defines the units for a class and every parameter in that class will appear in those units i.e., user units. Parameters not in the class are not affected by the user unit definitions. Parameters for which user units may be defined will be subsequently displayed in terms of those units and will require value entry in such terms.

For example, suppose the user wants to define speed related parameters in terms of inches per second rather than the standard units of RPM. All parameters in the speed class (MAXIMUM SPEED, MINIMUM SPEED, etc.) will use this single set of units (unit label: "INCH/S"; scaling constant: 100 IN/SEC = 1750 RPM) defined for the speed class.

First, use the left and right arrow keys to select the column to be changed. Use the up arrow and down arrow keys to define the characters in the label. The label may be from 1 to 6 alphabetic characters in length. For example: "INCH/S".



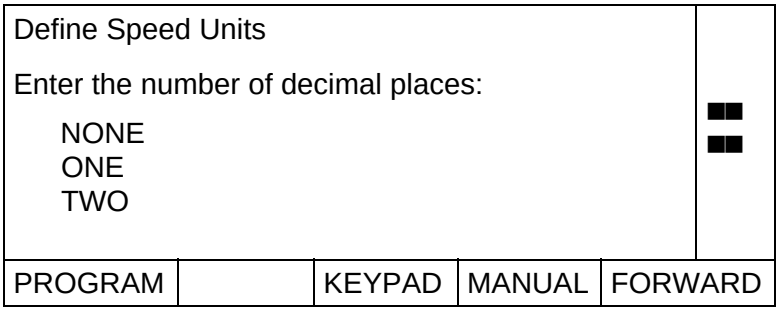
Second, enter the scaling constant at the following display which relates the user unit to the standard unit. The OIM will use this constant to translate between user and standard units.



In the previous example, the OIM would translate between user and standard units as follows:

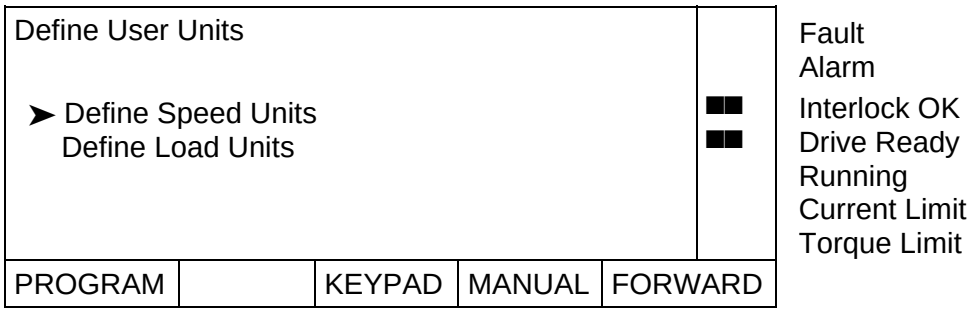
user units	**standard units**
100 INCH/S	1750 RPM
50 INCH/S	875 RPM
-20 INCH/S	-350 RPM
0 INCH/S	0 RPM

The scaling constant may be in increments of 0.01 by entering the number of decimal places at the following screen. NOTE: *this screen will appear only if the full scale value is less than 4094*.

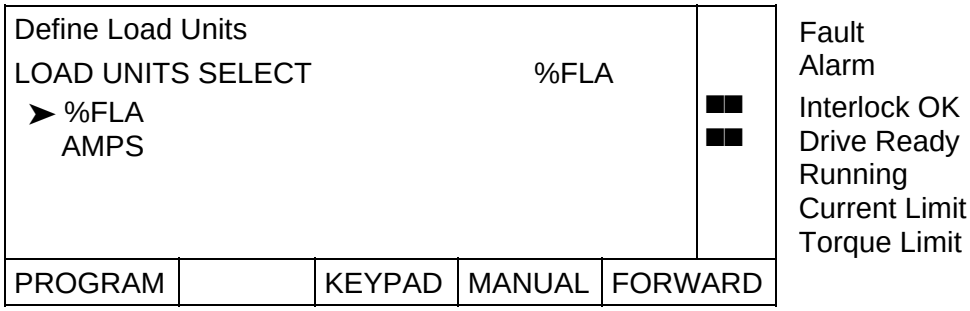


The OIM returns to the Define User Units menu after the number of decimal places has been entered.

4.14.5.2 Define Load Units



1. Move the cursor to *Define Load Units* and then press ENTER. The following value entry screen appears:



2. Choose the units of your choice and then press ENTER.
3. Press CANCEL to return to the Define User Units menu. Press CANCEL a second time to return to the Operator Interface menu.

5.0 How to Change Parameter Values

5.1 Introduction

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 section in its entirety before proceeding. Failure to observe this precaution could result in bodily injury or loss of life.

Value entry screens (Integer, Standard Choice Integer, Selector Switch or Boolean) allow the user to modify a single parameter's value or selection. Value entry screens contain a cursor and an entry field area. Note that the cursor for value entry fields is a blinking underscore.

Generally, pressing ENTER while in a value entry screen has the following effects:

1) The current value/selection is accepted and the entry field is reset to the new value.

2) The display remains in the value entry screen.

5.2 Integer Value Entry Screen

This screen allows the user to enter a numeric value within the specified limits of the parameter's input range.

The entry field consists of 5 digit positions and a sign. A cursor marks the position of the digit to be adjusted. A sign indicator is positioned 1 character to the left of the left-most digit (MSD or most significant digit) as shown below:

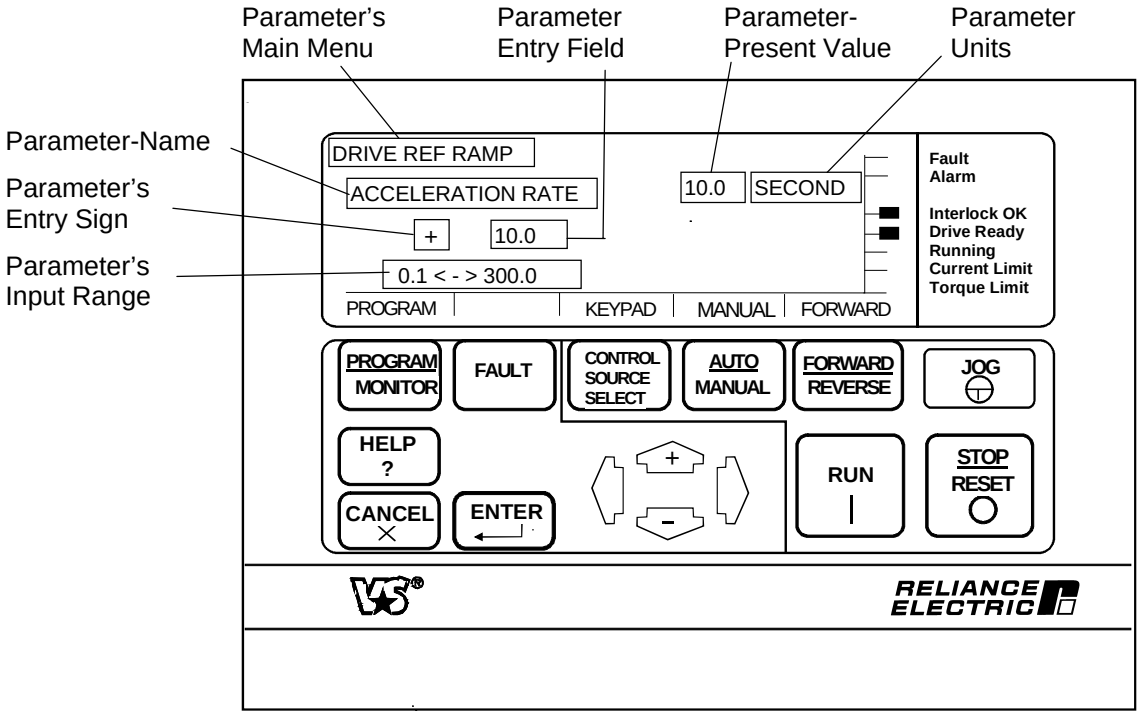


Figure 5.1 - Integer Value Entry Screen

Borrows and carries will be in effect for the right-most digit (LSD or least significant digit) only. For example, pressing ⇑ with the cursor at the LSD would change the number 199 to 200. However if the cursor was positioned 1 to the left of the LSD then the number would change from 199 to 109.

The programmer cannot enter a number out of a parameter's valid range.

1) Use ⇐ and ⇒ keys to select the digit position or the sign within the entry field. No wrapping (i.e. from LSD to MSD and vice versa).

   When ⇐ or ⇒ is pressed, before the cursor position changes to the new position, the number at the old cursor position is first accepted.

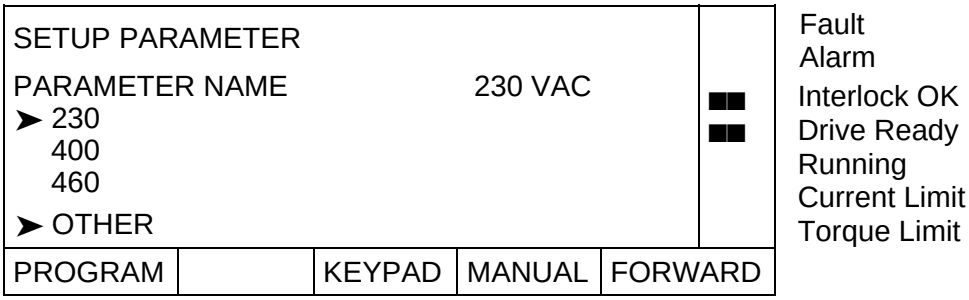
ACTIVE KEYS:

ENTER <-------|	1) The new value is accepted and the entry field is set to the new value (just accepted). 2) The display remains in the value entry screen.
⇧ UP	Increments digit at cursor or toggles the sign plus "+" or minus "–" when the cursor is positioned over the sign.
⇩ DOWN	Decrements digit at cursor or toggles the sign plus "+" or minus "–" when the cursor is positioned over the sign.
⇦ LEFT	Moves the cursor left 1 position to select a digit position or a sign within the entry field.
⇨ RIGHT	Moves the cursor right 1 position to select the digit position or the sign within the entry field.
CANCEL x	Restores the original value and the current value entry screen remains displayed if an entry is in progress, i.e. the value has been altered but not yet accepted (using ENTER). -OR- The previous menu before entering the value entry screen is displayed if no entry is in progress, i.e. the value has not yet been altered.
HELP ?	Provides help text on the particular parameter.

5.3 Standard Choice Integer Value Entry Screen

This screen allows the user to enter a numeric value by selecting one of several "standard" values, or instead, by selecting the "OTHER" option. "OTHER" allows the user to enter a numeric value within the specified limits of the range similar to operations of the "Integer Value Entry Screen".

For example:



1) Position the cursor to the line containing the desired "standard" choice (in this example, 230, 400, or 460). This will be performed using the ⇑ and ⇓ keys only. Scrolling will take place when applicable.

   If the selected choice (choice at cursor) is the desired value:

2) Press ENTER to accept the current selection or press CANCEL to restore the original value/selection (230 VAC) and then display the previous menu before entering the value entry screen.

3) If the selected choice (choice at cursor) is OTHER:

   a) Press ENTER.

   b) Use ⇐ and ⇒ keys to select the digit position or the sign within the entry field. No wrapping (i.e. from LSD to MSD and vice versa).

      When the ⇐ or ⇒ key is pressed, before the cursor position changes to the new position, the number at the old cursor position is first accepted.

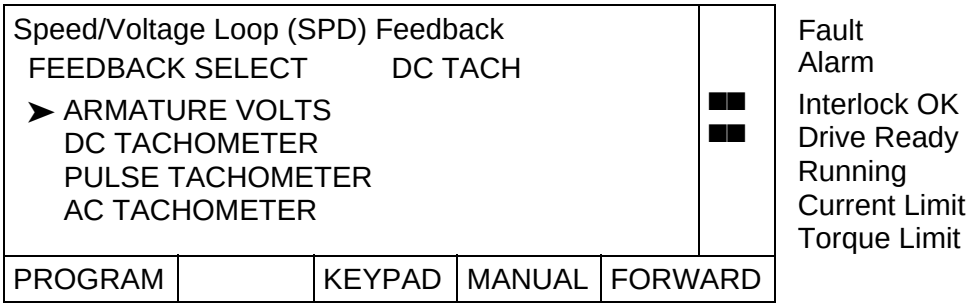
ACTIVE KEYS:

ENTER <-------|	1) The new value/selection is accepted and the entry field is set to the new value/selection (just accepted). 2) The display remains in the value entry screen.
⇧ UP	Moves the cursor up and/or scrolls down; when in a value entry screen, it increments the digit at the cursor or toggles the sign plus "+" or minus "-" when the cursor is positioned over the sign.
⇩ DOWN	Moves the cursor down and/or scrolls up; when in a value entry screen, it decrements digit at cursor or toggles the sign plus "+" or minus "–" when the cursor is positioned over the sign.
⇦ LEFT	Moves the cursor left 1 position to select a digit position or a sign within the entry field.
⇨ RIGHT	Moves the cursor right 1 position to select the digit position or the sign within the entry field of a value entry screen.
CANCEL x	Restores the original value and the current value entry screen remains displayed if an entry is in progress, i.e. the value has been altered but not yet accepted (using ENTER). -OR- The previous menu before entering the value entry screen is displayed if no entry is in progress, i.e. the value has not yet been altered.
HELP ?	Provides help text on the particular parameter.

5.4 Selector Switch or Boolean Value Entry Screen

This screen allows the user to select one of two or several possible switch positions. It is similar to a multi-position switch. The switch is changed by selecting a position from a list of selections.

For example:



1) Position the cursor to the line containing the desired switch position. This will be performed using the ⇧ and ⇩ keys only. Scrolling will take place when applicable.
2) Press ENTER to accept the new value or press CANCEL to restore the original value and then display the current value entry screen.

5.5 Reference Selecting via Keypad OIM

To select the reference via Keypad OIM, Control source select must be set to Keypad

The reference can then be altered using the ⇧ and ⇩ keys. Pressing ENTER stores the new reference value.

6.0 Quick Start

ATTENTION:
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 section in its entirety before proceeding. Failure to observe this precaution could result in bodily injury or loss of life.

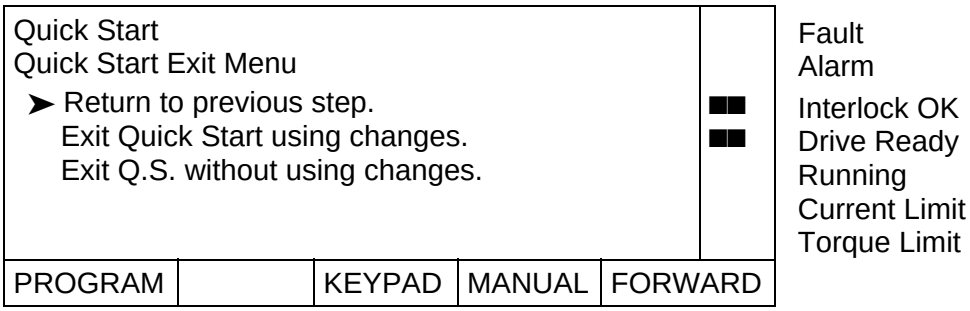
6.1 Introduction

The Quick Start function from the Main Menu will be used to start up and tune the drive.
NOTE: CONTROL SOURCE SELECT must be set to KEYPAD for complete OIM control during the Quick Start procedure.

6.2 About The Quick Start Exit Menu

Pressing CANCEL during the Quick Start procedure (except where noted) will cause the Quick Start Exit Menu to be displayed.

For example:



The user must pick one of the options from the Quick Start Exit Menu. Repeatedly pressing CANCEL and selecting "Return to previous step" allows the user to go backward through the Quick Start procedure.

6.3 How To Step Through Quick Start

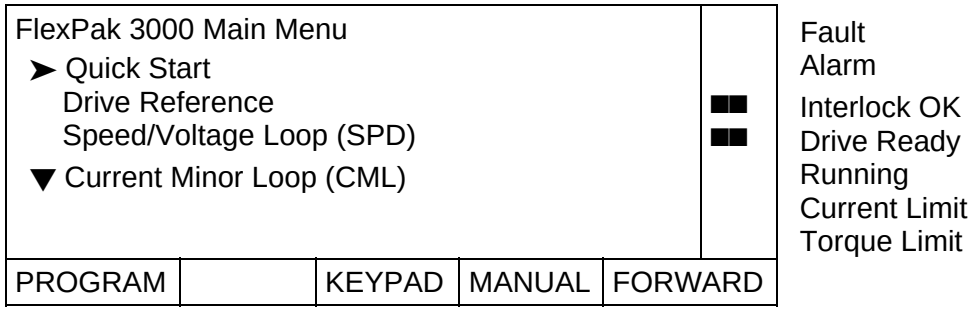
ATTENTION:
The drive will not operate at the correct speed if hardware jumpers J11, J14 and J18 are not set as indicated on the OIM during Quick Start. Record and verify that these jumpers are set as indicated on the OIM during *Quick Start*. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Record the present values of J11, J14 and J18 in Table 6.1 before continuing with this procedure. The correct position of these jumper settings will be displayed during the "Quick Start" procedure. If the correct position of these jumpers are the same as the values recorded in Table 6.1, Self Tuning can be started without leaving the *Quick Start* screens. If they are not the same, refer to section 4.5, Jumper Settings.

Table 6.1 - Quick Start Jumper Settings

Hardware Jumper No.	Initial Setting	Final Setting
J11 (TACH V SCALE)		
J14 (TACH V RANGE)		
J18 (ARM I FB RB)		

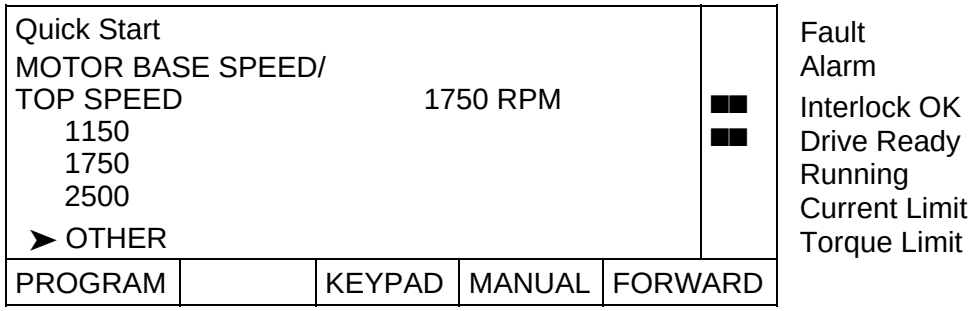
NOTE: *The values entered in the Quick Start procedure are not automatically saved to retentive memory. To save these values, the user must perform a memory save. Reference section 4 of this instruction manual for procedures regarding memory operations*.



At the FlexPak 3000 Main Menu, position the cursor at Quick Start and then press ENTER to begin the Quick Start procedure.

ATTENTION: Some of the parameters set in the quick start procedure can cause the drive to operate improperly if the values are entered incorrectly. Incorrect values can cause the drive to operate outside of the recommended operating conditions. Verify that the values of these parameters are appropriate for your application before changing them. Failure to observe these precautions could result in bodily injury.

The MOTOR BASE SPEED/TOP SPEED standard choice integer value entry screen is now displayed.



Change the value of this parameter if required. Refer to the section on HOW TO CHANGE PARAMETER VALUES if needed.

The following table lists the sequence of the parameter value entry screens along with their associated parameter default values, parameter descriptions and provides a column to record the parameter value as entered (changed) by the user.

Pressing ENTER accepts the value and then moves to the next step in the sequence of screens presented in Table 6.2.

ATTENTION:
The incorrect setting of the Quick Start parameters can cause an overspeed condition.
These parameters must be set by a qualified person who understands the significance of setting.
Verify that the value of these parameters is set accurately per your application requirements.
Failure to observe this precaution could result in bodily injury.

ATTENTION:
The parameter for the current transformer turns ratio (Tp/Tn) CT TURNS RATIO (P.010) is factory set depending on the power unit size. Do not adjust/change the value of this parameter from its factory default value unless you are replacing the regulator board without downloading of the parameter set. In that case refer to Appendix B for setting the ratio (Tp/Tn).
Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Table 6.2 - Quick Start Parameter Modification Sequence

Step No.	Parameter Name	Code No.	Default	Description	User Setting
1	TOP SPEED	011	500 RPM	The highest running speed of the motor. It scales the feedback device. TOP SPEED depends on several factors: • If there is no field weakening, the top speed is typically the same as the nameplate base speed. • If there is field weakening, the Top Speed is the same as the field weakened speed. Top speed is typically more than the base speed when field weakening is applied. **ATTENTION**: Before starting the drive, this parameter must be set to base speed or, if the Field Current Regulator kit is installed, the field weakened speed. You are responsible for assuring safe conditions for operating personnel by setting this parameter properly. Failure to observe this precaution could result in bodily injury. Do not allow the motor to exceed the maximum safe speed of the motor or driven equipment as determined by the equipment manufacturer. Failure to observe this precaution can result in bodily injury	
2	MOTOR RATED ARM AMPS	008	8 AMPS	**ATTENTION**: The drive will not operate properly if this parameter value is wrong. This parameter must be less than the rated armature amps on the motor nameplate. Failure to observe this precaution could result in damage to, or destruction of, the equipment. The rated armature current from the motor nameplate.	

Table 6.2 - Quick Start Parameter Modification Sequence. - continued

Step No.	Parameter Name	Code No.	Default	Description	User Setting
3	MOTOR RATED ARM VOLTS	009	400 VOLTS	The rated armature voltage from the motor nameplate.	
4	REVERSE DISABLE	015	OFF*	NOTE: *This parameter might be affected by FEEDBACK SELECT, step 5*. When ON, REVERSE DISABLE prevents the speed reference from dropping below zero. The reverse bridge cannot be activated. When OFF, the speed reference can drop below zero and the drive can reverse. *The default is ON when: •The drive has a non-regen. (S6) power unit. •FEEDBACK SELECT is set to AC TACH. •FEEDBACK SELECT is set to PULSE TACH and PULSE TACH QUADRATURE is OFF.	
5	FEEDBACK SELECT	200	ARMATURE VOLT	Determines the type of feedback signal that is used for the speed/voltage loop: PULSE TACH can be selected only if a pulse tachometer kit is installed. FEEDBACK SELECT causes the NEGATIVE CURRENT LIM (step 16) to be set to 0 and REVERSE DISABLE to be set to ON if: • AC TACH is selected. • PULSE TACH is selected and PULSE TACH QUAD is set OFF.	
6	ANLG TACH VOLTS/1000	203	60 V/1000 RPM	Only needs to be set if FEEDBACK SELECT is set to AC TACH or DC TACH. This parameter is the analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM. It might be limited to less than 200.0 volts/1000 so that voltage from the tachometer will not be more than 250 V.	
7	PULSE TACH PPR	207	1024 PPR	Only displayed if FEEDBACK SELECT Is set to PULSE TACH and a pulse tach interface is installed. It sets the pulse encoder pulses per revolution (PPR) from the pulse encoder nameplate.	
8	PULSE TACH QUADRA-TURE	208	ON	Only displayed if FEEDBACK SELECT is set to PULSE TACH and a pulse tach interface is installed. Enables or disables pulse encoder quadrature. Set ON for a bi-directional pulse encoder. Set OFF for a unidirectional pulse encoder. If PULSE TACH QUADRATURE is set to OFF while PULSE TACH is the selected FEEDBACK SELECT type, NEGATIVE CURRENT LIM will be set to 0 and REVERSE DISABLE set to ON (preventing reverse direction).	

Table 6.2 - Quick Start Parameter Modification Sequence. - continued

Step No.	Parameter Name	Code No.	Default	Description	User Setting
9	ACCELERA-TION RATE	001	5 SEC.	The time it takes to accelerate from 0 to Top speed. Smaller changes in speed take proportionately less time. If TRIM MODE SELECT is set to PROPORTIONAL, this time value is modified by DRAW PERCENTAGE OUT.	
10	DECELERA-TION RATE	002	5 SEC.	DECELERATION TIME selects the time it takes to decelerate from Top speed to 0. Smaller changes in speed take proportionately less time. If TRIM MODE SELECT is set to PROPORTIONAL, this time value is modified by DRAW PERCENTAGE OUT.	
11	MINIMUM SPEED	003	0 RPM	**ATTENTION**: This drive can operate at and maintaining zero speed when this parameter is set to zero. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life. Selects the minimum speed of the drive without being stopped. It is typically greater than zero. If it is < 10% of MAXIMUM SPEED, an alarm is generated.	
12	MAXIMUM SPEED	004	500 RPM	The maximum speed of the drive that can be supported by the application or process. If raising this value causes MINIMUM SPEED to become less than 10% of MAXIMUM SPEED, an alarm is generated. This is typically set to base speed from the motor nameplate. **ATTENTION:** Do not allow the motor to exceed the maximum safe speed as determined by the equipment manufacturer of the motor or the driven equipment. Failure to observe these precautions could result in bodily injury.	
13	JOG ACCEL/ DECEL RATE	013	3 SEC.	The time it takes the Jog reference circuit to reach TOP SPEED (P.011) from zero. The S-CURVE ROUNDING (P.014) parameter does not affect the setting of this parameter.	

Table 6.2 - Quick Start Parameter Modification Sequence. – continued

Step No.	Parameter Name	Code No.	Default	Description	User Setting
14	JOG SPEED1	012	250 RPM	The operating speed when the drive is jogging. If DIG IN 0 SELECT (P.428) is set to JOG SPEED SELECT, this parameter is used when DIG IN 0 (terminal 12) is off. **ATTENTION**: This drive can operate at and maintaining zero speed when this parameter is set to zero. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.	
15	POSITIVE CURRENT LIM	005	150% FLA	Sets the highest amount of current (% full load amps) for the forward bridge. Used as a high limit for the speed loop PI block when POS CURRENT LIM SEL (P.224) is set to REGISTER.	
16	NEGATIVE CURRENT LIM	006	150% FLA	This parameter only needs to be set for regenerative drives. Selects the highest amount of current (% full load amps) for the reverse bridge. Used as a low limit for the speed loop PI block when NEG CURRENT LIM SEL (P.224) is set to REGISTER. The range is clamped to zero: • For non-regenerative drives. • If FEEDBACK SELECT is set to AC TACH. • IF FEEDBACK SELECT is set to PULSE TACH and PULSE TACH QUADRATURE (P.208) is set to OFF. The range depends on the setting of NEG CUR LIM INV EN (P.226).	
17	IR COMPEN-SATION	206	0% FLA	Armature voltage loss compensation value used when the drive is configured as a voltage regulator. This parameter is also used by the field current regulator to set the field weakened threshold. IR COMPENSATION is normally determined from the motor data sheet. It should be set to the percent IR drop of the motor. If this data is not available on the motor data sheet, you can set this empirically so that the no-load and full-load speeds are as close as possible when operating as a voltage regulator. This parameter is not available for current/torque regulated drives.	

Table 6.2 - Quick Start Parameter Modification Sequence. – continued

Step No.	Parameter Name		Code No.	Default	Description	User Setting
18	MOTOR HOT FLD AMPS		510	0.01amps	This parameter only needs to be set if a field current regulator is installed. Motor nameplate value of the rated hot field amps. This input is the basis of field current scaling. If the factory defaults are restored, or if a valid value has not yet been entered for this parameter, the DC field voltage is fixed at 150V on a 230VAC line, or at 300V on a 460VAC line. **ATTENTION** You must configure this to the motor nameplate value. The incorrect configuration of this parameter can cause a motor overvoltage condition. Configure MOTOR HOT FLD AMPS to the motor's nameplate value. Failure to observe this precaution can result in bodily injury and damage to the equipment	
19	Jumper Informat. Display	J11	792	N/A	**ATTENTION**: The drive will not operate at the correct speed if these jumpers are not set to the correct positions. Set these jumpers to the positions as displayed in the "Quick Start" procedure for the drive to operate at the correct speed. Failure to observe this precaution could result in damage to, or destruction of, the equipment.	J11
		J14	793			J14
		J18	395		The OIM displays the correct jumper positions for J11, J14 and J18. Record these positions in the space provided. Verify that the hardware for these jumpers is positioned the same before continuing with *Quick Start*.	J18
20	Self Tune? NO YES	N/A	N/A	N/A	NO - Returns the display to the Main Menu. Perform a memory save to store values to retentive memory. YES - Proceeds with the Self-Tuning procedure. Refer to the Self-Tuning section of this instruction manual before proceeding with self-tuning.	Not Re-quired

N/A = Not Applicable.

6.4 Self-Tuning the Current Minor and Speed Loops

NOTE: Self-tuning can only be performed if the OIM is connected to the FlexPak.

ATTENTION: Before starting self-tuning, it must be verified that no overhauling or hanging loads are on the motor. self-tuning will not operate properly if overhauling loads exist. Failure to observe this precaution could result in bodily injury.

ATTENTION: The motor will rotate during self-tuning. Stay clear of rotating machinery to avoid contact with rotating machinery. Failure to observe this precaution could result in bodily injury.

ATTENTION: Self-tuning will not operate properly if prior adjustments in the *Drive Setup and Adjustment* are not performed. Perform all prior adjustment procedures contained in the "Drive Setup and Adjustment" section before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

ATTENTION: Self-tuning must not be performed on drives operating in a process line which are mechanically coupled to one another through the process material. However, the drive may be self-tuned with load applied and with inertia connected. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

NOTE: *Speed Loop self-tuning can only be performed on drives with tachometer feedback (analog or digital). In armature voltage-controlled drives, only the Current Minor Loop (CML) can be self-tuned.*

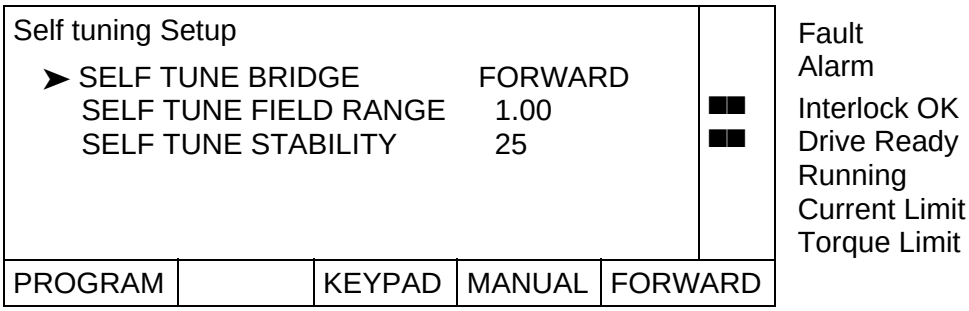
6.4.1 Self Tune Setup

Speed Loop Self-tuning will tune the drive based on the current values of the following parameters:

SELF TUNE BRIDGE (P.220) - Determines the direction the motor shaft will rotate during the self tune process by selecting the SCR bridge. For non-regenerative (S6) drives, this is automatically set to FORWARD and cannot be changed.

SELF TUNE FIELD RANGE (P.218) - Sets the self-tune field range, which is the ratio of TOP SPEED to base speed. The typical value is 1.00: where top speed = base speed.

SELF TUNE STABILITY (P.219) - Determines the self-tune stability, which sets the performance of the speed loop. Low values increase the speed loop response. High values decrease the speed loop response. The typical value is 25.
The following screen allows the user to change one or all of the self-tune setup values prior to self-tuning the drive.



To access this screen outside of "Quick Start", follow one of the following menu level paths from the main menu:

Speed/Voltage Loop (SPD)

- Speed/Voltage Loop (SPD) Tuning
- - Self tuning Setup*
- - Self tuning

Current Minor Loop (CML)

- CML Tuning
  - Self tuning Setup*
  - Self tuning

If the self-tune setup parameter values are acceptable, then continue to the EXECUTE SELF TUNING procedure to self-tune the drive.

6.4.2 Execute Self-tuning

NOTE: *CML self-tuning takes approximately 3-4 seconds to complete. Speed Loop self-tuning takes approximately 1 minute to complete. If Self Tuning is not initiated by the Quick Start procedure, Self Tuning must be initiated via one the following menu level paths from the main menu:*

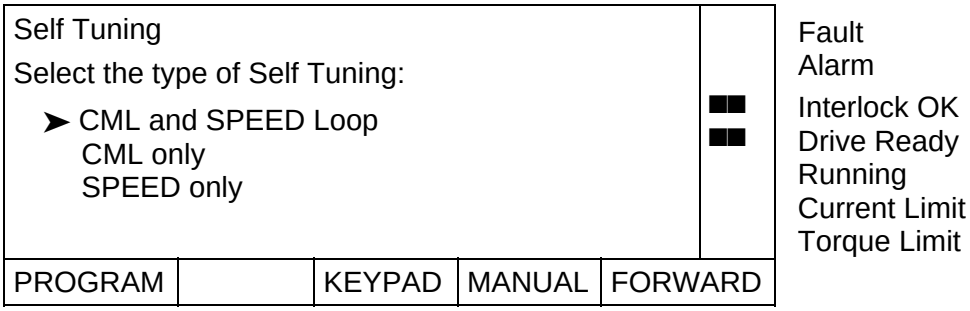
Speed/Voltage Loop (SPD)

- Speed/Voltage Loop (SPD) Tuning
  - Self tuning Setup*
  - Self tuning

Current Minor Loop (CML)

- CML Tuning
  - Self tuning Setup*
  - Self tuning

NOTE: *The following screen will not appear if FEEDBACK SELECT is set to ARMATURE VOLT.*



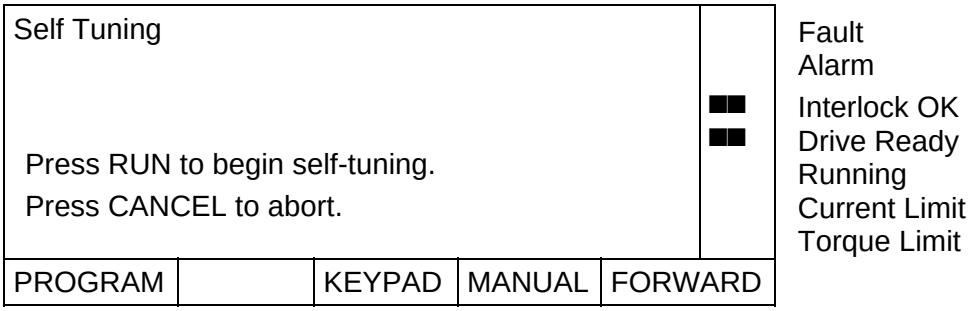
CML and SPEED Loop - The system will perform tuning on the CML and then after completion, perform tuning on the SPEED Loop.

CML only - The system will perform tuning on the CML only. NOTE: If the FEEDBACK SELECT is set to ARMATURE VOLT, self-tuning assumes "CML only".

SPEED only - The system will perform tuning on the speed loop only.
NOTE: *If tuning the speed loop separately, the CML should have been previously tuned for best results. NOTE: Most applications use 150% for the MAXIMUM CURRENT to achieve the most accurate results from self-tuning. The greater the difference between MAXIMUM CURRENT and 150% yields a corresponding greater error in the values self-tuning calculates.*

To execute self-tuning, perform the following steps:

1. Select the type of self-tuning to perform and then press ENTER.
   The following screen appears:



Pressing CANCEL returns the display to the previous screen.

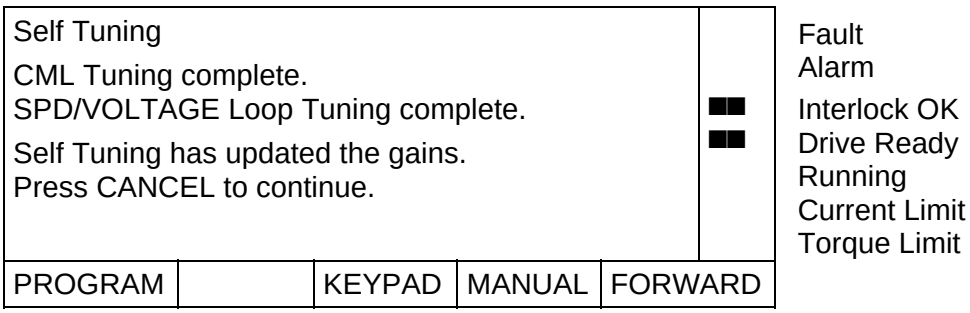
2. Press RUN.

   NOTE: *It is possible to display one of the monitor screens while self-tuning is active. This allows the user to monitor the speed of the motor while self-tuning.*

   "Self-tuning is active." blinks on the display during self-tuning. The display updates as indicated with the status of the loop being self tuned after it is complete. Once self-tuning is complete and the gains are updated, the display updates with "Self Tuning has updated the gains" and removes "Self Tuning is active."

The following screen shows how the display will look after self-tuning has completed successfully for both the CML and the SPD/Voltage Loop.

NOTE: *The gains are not automatically saved to retentive memory. If the gain values are acceptable, the user must perform a memory save.*



Pressing CANCEL goes to the FlexPak 3000 Main Menu or to the previous screen if not initiated as part of the Quick Start menu.

6.5 Final Adjustments

These adjustments detail how to adjust the nominal AC Line frequency and A-C line volts parameters.

6.5.1 Nominal AC Line Adjustments

The frequency (NOMINAL A-C LINE FREQ, P.306) and the voltage (NOMINAL A-C LINE VOLTS, P.307) adjustments are accessed by selecting Current Minor Loop (CML) at the Main Menu and then selecting the Three-Phase AC Line at the CML menu level.

Current Minor Loop (CML)

- Three-Phase AC Line*

6.5.1.1 Perform Nominal AC Line Frequency Adjust

The default value is 50 Hz. Typically, the value is 50 or 60 Hz. Use the up/down arrow keys to adjust the value to the nominal value of the line frequency in use. Valid values are 48 to 62 Hz.

6.5.1.2 Perform Nominal AC Line Volts Adjust

The default value is 400 VAC. Use the up/down arrow keys to adjust the value to the nominal value of the AC line RMS voltage in use. Refer to Parameter description in Appendix B.

7.0 Troubleshooting/Diagnostics

7.1 General

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 section in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

This section details troubleshooting and diagnostics information for the FlexPak 3000 Drive.

7.2 Wiring Errors

DANGER

This equipment is at line voltage when AC power is connected. Disconnect and lockout all ungrounded conductors of the AC power line before checking wiring. Failure to observe this precaution could result in severe bodily injury or loss of life.

Wiring errors and loose or grounded wiring are common problems that can inhibit operation of a drive. Verify the installation wiring has been correctly executed and that the drive is free of loose terminations and grounded conductors.

7.3 AC Line and Power Input

DANGER

This equipment is at line voltage when AC power is connected. Exercise extreme care when checking the AC line and power input. Failure to observe this precaution could result in bodily injury or loss of life.

Verify that the applied AC power is correct for the specific drive (refer to 2.1.2 and 2.2.3). If an isolation transformer has been installed on the incoming AC power, verify its output voltage and that it has been properly connected. Verify that the AC line fuses are semiconductor protection type and have been correctly sized per Table 8-7. The AC and DC power conductors should have been sized per local standards.

7.4 DC Motor

CAUTION

A megohmmeter (megger) can be used for this motor ground check, but all conductors between the motor and the drive must be disconnected. The megger's high voltage can damage the drive's electronic circuits. Disconnect all conductors between the motor and the drive before using a megger for this motor ground check. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Recheck all motor connections for tightness and correct identification. Verify that there is no path to ground in either the DC motor armature circuit, the shunt field circuit or the thermostat circuit. Connect one lead of a standard ohm meter to the motor frame and the other lead to the two armature leads. then connect to the two thermostat leads and then to the two field leads. If a reading of less than 100,000 ohms is observed, a ground condition exists and MUST be corrected before power is applied. Check that the field winding is not open or shorted.

Verify the continuity of the motor thermostat and its proper connection to regulator board terminals 13 and 14. If a motor thermostat has been installed, verify that it's circuit maintains continuity in the terminal 13 and 14 circuit.

7.5 Remote M Contactor

If an M Contactor has been supplied by others, verify that it has been properly connected.

7.6 Optional Kits

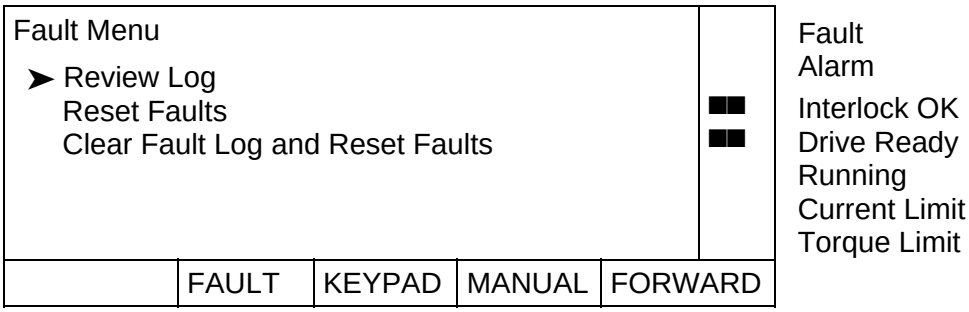
Verify that each optional kit has been installed correctly according the appropriate instructions. Refer to the appropriate instruction manuals.

7.7 Fault/Alarm/Diagnostic (FAD) Menus

The OIM FAULT key toggles the FAD menus (see Section 2:). FAD menus are provided to assist in the analysis of drive operation problems. Refer to Appendix E for a complete guide to error and alarm codes. Faults prevent the drive from starting until the drive fault is corrected. In contrast, Alarms are drive conditions which could eventually result in the occurrence of a Fault, however, Alarms will not prevent the drive from starting.

7.7.1 About The Fault Menu

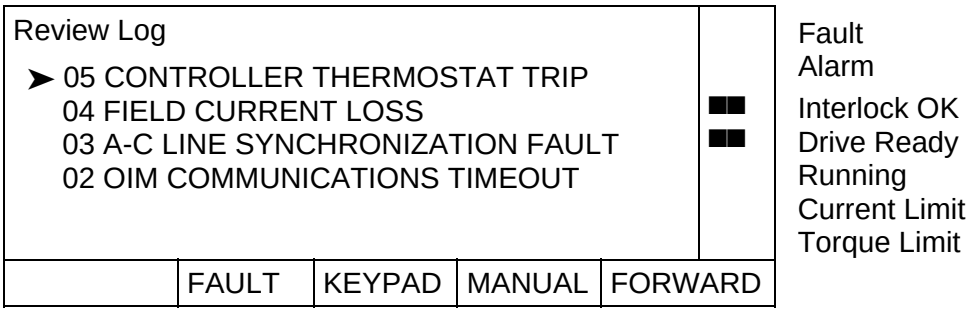
Access the Fault Menu by pressing the FAULT key until FAULT appears on the OIM directly above the FAULT key. The following will be displayed.



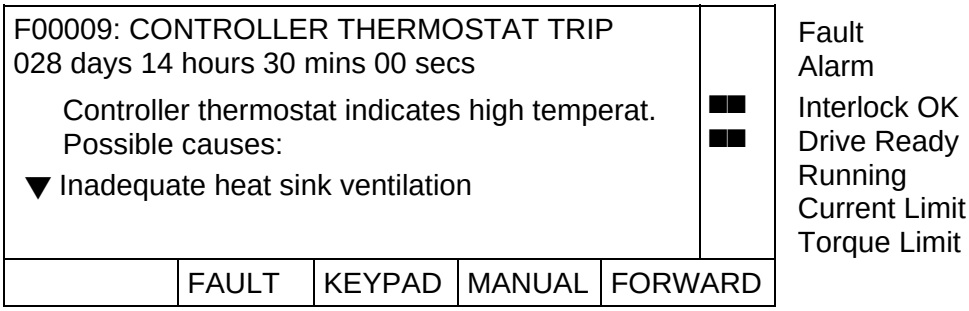
The following paragraphs will discuss these selections.

7.7.1.1 Review Log

Pressing ENTER with the cursor at Review Log displays the contents of the fault log. Entries are listed from most recent (higher numbered faults) to the oldest (lower numbered faults).



Pressing ENTER will display details and possible causes of the specific fault log entry.



▼ Indicates that more information is available. To view this information, press the down arrow key. The remaining text for this specific fault will be displayed when scrolling takes place:

Inadequate cabinet ventilation.
Heat sink failure.
Damaged or disconnected controller thermostat wiring.

7.7.1.2 Reset Faults

Pressing ENTER with the cursor at Reset Faults extinguishes the Fault indicator and displays the following message on the OIM display:

ATTENTION!
DRIVE FAULTS HAVE BEEN RESET.
Press CANCEL to continue.

Resetting faults allows the user to try restarting the drive. NOTE: If proper steps were not taken to correct the fault before reset, another Fault will occur. Press CANCEL to continue.

Faults can also be reset by pressing the STOP/RESET key when the drive is stopped and CSS = KEYPAD.

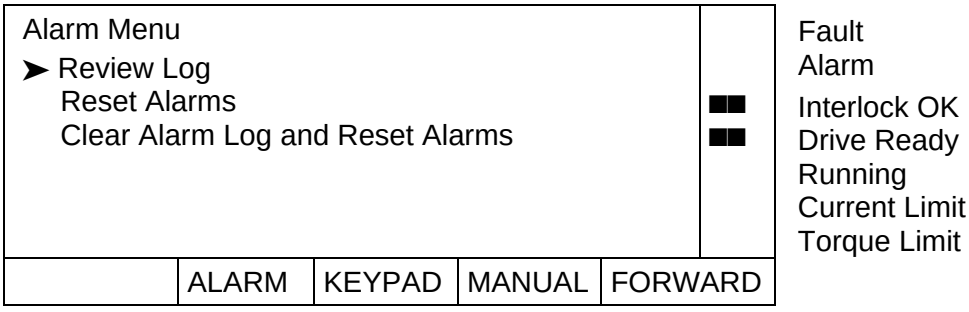
7.7.1.3 Clear Fault Log and Reset Faults

Pressing ENTER with the cursor at Clear Fault and Reset Faults extinguishes the Fault indicator, resets drive faults and displays the following message on the OIM display:

ATTENTION!
DRIVE FAULTS HAVE BEEN RESET.
FAULT LOG HAS BEEN CLEARED.
Press CANCEL to continue.

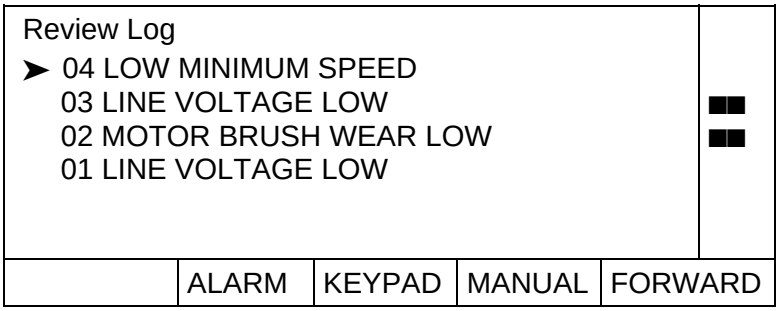
7.7.2 About The Alarm Menu

Access the Alarm Menu by pressing the FAULT key until ALARM appears on the OIM directly above the FAULT key. The following will be displayed.

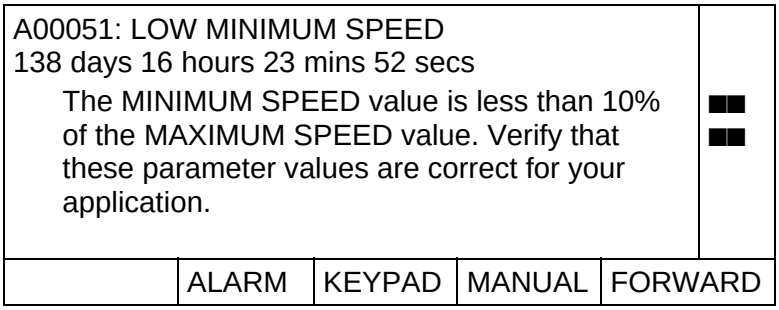


7.7.2.1 Review Log

The Review Log selection displays the contents of the alarm log. Entries are listed from most recent (higher numbered alarms) to the oldest (lower numbered alarms).



Pressing ENTER will display details and possible causes of that specific alarm log entry.



▼ Indicates that more information is available. To view this information, press the down arrow key. The remaining text for this specific alarm will be displayed when scrolling takes place.

Press the CANCEL key to exit this display.

7.7.2.2 Reset Alarm Indicator

Pressing ENTER with the cursor at Reset Alarms extinguishes the Alarm indicator and displays the following message on the OIM display:

ATTENTION!
DRIVE ALARMS HAVE BEEN RESET.
Press CANCEL to continue.

Press CANCEL to continue.

NOTE: Alarms can also be reset by pressing the STOP/RESET key when the drive is stopped and Control Source Select is set to KEYPAD.

7.7.2.3 Clear Alarm Log and Reset Alarms

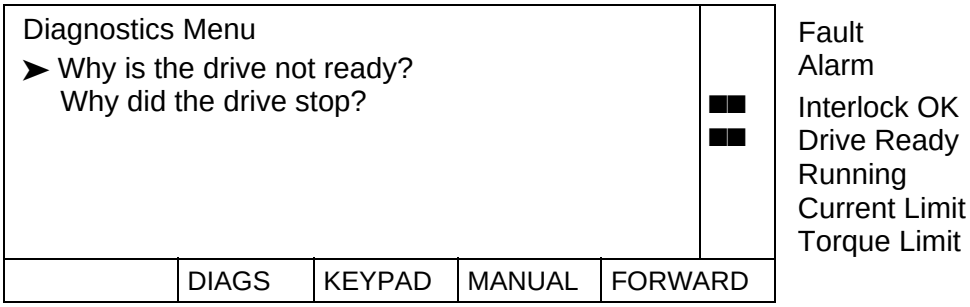
Pressing ENTER with the cursor at Clear Alarm and Reset Alarms extinguishes the Alarm indicator, resets drive alarms and displays the following message on the OIM display:

ATTENTION!
DRIVE ALARMS HAVE BEEN RESET.
ALARM LOG HAS BEEN CLEARED.
Press CANCEL to continue.

7.7.3 Diagnostics Menu

This menu provides information regarding drive status for diagnostics menu selections *Why is the drive not ready?* and *Why did the drive stop?*. Access the Diagnostics Menu by pressing the FAULT key until DIAGS appears on the OIM directly above the FAULT key.

The following will be displayed.



WHY IS THE DRIVE NOT READY?

If the LCD indicator for *Drive Ready* is extinguished, the drive is not ready for one or more of the following reasons:

- Drive faults are present.
- All interlocks, customer supplied and internal, are not closed.

Selecting the *Why is the drive not ready?* menu item will list on the display the reason(s) why the drive is not ready.

WHY DID THE DRIVE STOP?

Selecting *Why did the drive stop?* will list on the display the reason(s) why the drive stopped. This includes operator induced commands such as pushing the Coast/Stop pushbutton or the STOP key on the OIM.

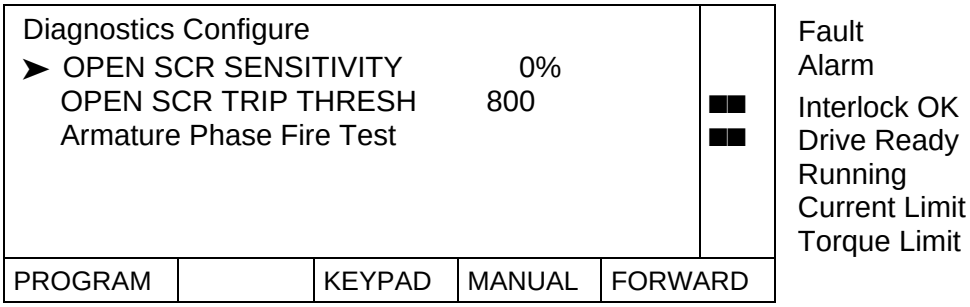
7.7.4 Diagnostics Configure

If line disturbances occur, resulting in open SCR nuisance trips, a *Diagnostics Configur*e menu can be accessed to help reduce the sensitivity to these disturbances.
This menu is accessible directly from the Main Menu.

FlexPak 3000 Main Menu

Diagnostics Configure

Use the up/down arrow keys to position the cursor next to *Diagnostics Configure*.
Press ENTER to access.



OPEN SCR SENSITIVITY - This parameter adjusts for load sharing differences due to unbalanced A-C lines. Increase its value to open the SCR diagnostic tolerance of load sharing differences.

OPEN SCR TRIP THRESH - This is the trip point for the SCR loss function. The default value should not be changed unless nuisance trips occur due to extremely unusual load conditions or severe instability in the CML. Raising this value will increase the diagnostic's tolerance of such disturbances. OPEN SCR TRIP THRESH should only be increased if raising OPEN SCR SENSITIVITY does not eliminate nuisance trips.

7.7.5 Regulator Led Status Information

Two LEDs are located on the Regulator board to indicate the operating status of the Regulator board. Check and observe these LEDs when the OIM is not communicating with the regulator. Typically, there will be no fault indication on the display when the OIM is not communicating with the regulator board, or the CPU is suspect. If, through "spurts" of communications, a fault can be displayed, the fault would be OIM COMMUNICATIONS TIMEOUT (F00011). The cover on the OIM must be removed to observe these LEDs.

The two LEDs are labeled CPU OK and OIM COMM OK. CPU OK will be on whenever the inputs and outputs are being scanned (I/O is not scanned during power-up diagnostics and following certain faults). OIM COMM OK will be on whenever the regulator board and the OIM are communicating properly. The following table summarizes the possible states of the two LED indicators.

CPU OK LED	OIM COMM OK LED	Indication(s) and Action(s)
Off	Off	• No power - verify that the drive power is on. Check for 24 V at the regulator board terminals 1 and 15 (COM). • LED failure - cycle power and verify that both LED's illuminate briefly (lamp test). • Power-up diagnostics failed - replace the regulator board.
	On	• Combination not used.
	Blink	• Combination not used.
On	Off	• I/O is being scanned, regulator is not communicating with the OIM - check OIM cable, check voltages at the OIM.
	On	• I/O is being scanned, the regulator is communicating with the OIM, no faults - this is the normal condition, no action is required. • I/O is being scanned, the regulator is communicating with the OIM, - diagnose/correct the fault condition and reset the fault from the selected control source fault reset. • Power-up diagnostics in progress (lamp test).
	Blink	• Combination not used.
Blink	Off	• I/O is not being scanned, regulator board is not communicating with the OIM, - initialize card: set P.010, P.306, P.307 and execute MEMORY SAVE, - press the OIM fault reset key - check the OIM cable or cycle power.
	On	• I/O is not being scanned, the regulator board is communicating with the OIM, - initialize card: set P.010, P.306, P.307 and execute MEMORY SAVE, - press the OIM fault reset key - record information on the fault.
	Blink	• I/O is not being scanned, regulator board is not communicating with the OIM, - initialize card: set P.010, P.306, P.307 and execute MEMORY SAVE, - press the OIM fault reset key - record any information about the fault and cycle power.

7.7.6 Armature Phase Fire Test

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should perform this test. Read and understand this section in its entirety before proceeding.
Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: This is an open loop test. To prevent excess motor speed and current, lock the motor shaft or disconnect the motor armature leads from the drive and replace them with a dummy load (e.g. bulbs in series).
Failure to observe this precaution could result in severe bodily injury or loss of life.

An armature phase fire test mode is available to verify the operation of the S6 or S6R rectifier bridge. This test should only be performed by qualified personnel. Note that this test is not available through the DCM.

To perform an armature phase fire test:

1. Turn off power to the drive. (Lockout and tag power as necessary).
2. Either lock the motor armature to prevent rotation or disconnect the motor armature leads from the drive and replace with bulbs in series.
   When locking the motor armature, the motor field winding can be disconnected to prevent excessive torque. If the motor field winding is disconnected field current loss faults must be inhibited by either setting jumper J20 to DISABLE on FlexPak with field rectifier or setting Parameter FIELD LOSS THRESHOLD (P.512) to 0 on FlexPak with field current regulator.
3. Turn on power to the drive. The drive must be stopped and the Drive Ready Indicator must be ON.
4. Set CONTROL SOURCE SELECT to KEYPAD.
5. On the OIM, select Current Minor Loop (CML) – SCR Diagnostics – Armature Phase Fire Test.
6. Set PHASE FIRE TST BRIDGE (P.310). This parameter must be set to the appropriate value before activating the armature phase fire test mode.
7. Attach an oscilloscope to the armature current feedback test point (J17+, J22– on the Regulator board). Note that the CS3000 software oscilloscope mode does not have sufficient bandwidth for this test.
8. Press RUN. The armature phase fire test mode is now active. The OIM Running indicator will be on.
9. Set PHASE FIRE TEST DELTA (P.309) to 55 degrees. Slowly increase PHASE FIRE TEST DELTA until a steady pattern of “bumps” appears on the oscilloscope. If all thyristors in the selected bridge are operating, there will be six bumps per AC line cycle. If any bumps are missing, one or more thyristors are not conducting.
   Note that conduction will not begin until the firing angle is sufficiently advanced (PHASE FIRE TEST DELTA (P.309) more than 60 degrees). A rate limit block limits the rate of change of firing angle advances to prevent sudden increases in current. To prevent the drive from entering continuous conduction during this test, PHASE FIRE TEST DELTA (P.309) should **not exceed 89 degrees**.
10. Press STOP to stop the armature phase fire test.
11. Turn off power to the drive (lockout and tag as necessary).
12. Either unlock the motor armature or remove the bulbs and reconnect the motor armature leads.

    If the motor field winding was disconnected, reconnect it and return jumper J20 to its original position (typically ENABLE on FlexPak with field rectifier) or (on FlexPak with field current regulator) set parameter FIELD LOSS THRESHOLD (P.512) to its original value.

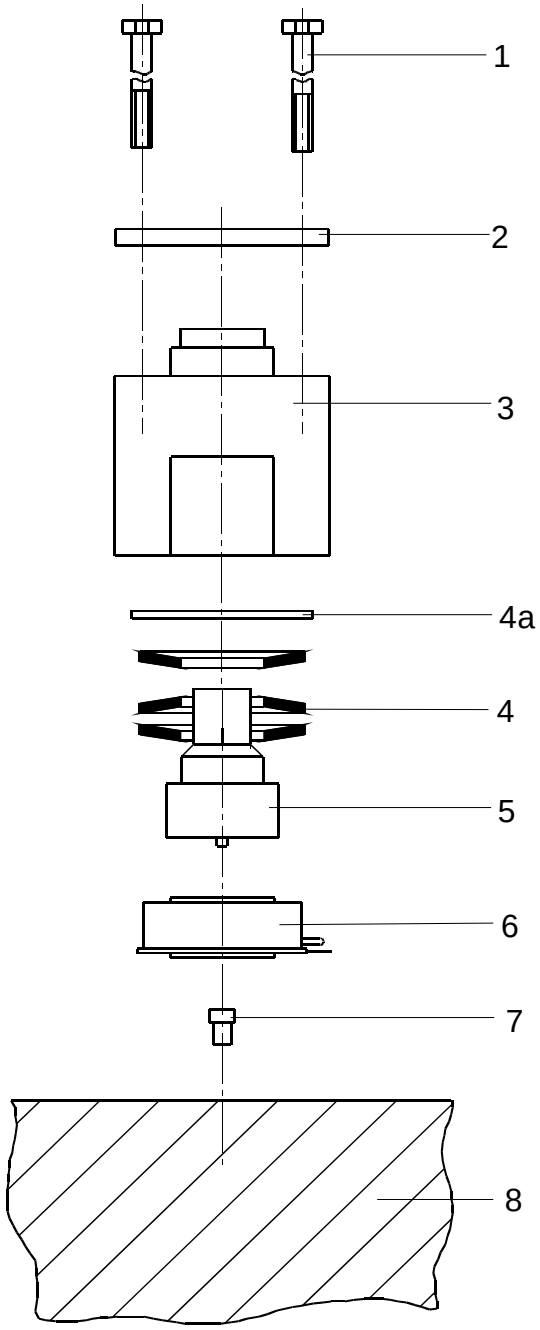
7.7.7 Power Supply Test Pin Identification

The following table lists the power supply PC board test pins and their respective voltage levels. Since it is a switching power supply, all checks need to be made while load is connected to the power supply card.

Test Pin	Voltage Level
J4 to J5	+ 24 VDC
J6 to J7	+ 12 VI
J8 to J7	- 12 VI
J9 to J10	+ 18 V
J11 to J12	+ 15 VI
J13 to J12	- 15 VI
J14 to J16	+ 15 V
J15 to J16	+ 5 V
J3 to J16	- 15 V

8.0 Replacement of components

Use original spare parts only.
Selection according to Tables 8-1 to 8-6.
The location of the parts is shown on the layout label inside the U-frame.



(1) Screws
(2) Steel plate
(3) Housing
(4a) Flat washer
(4) Plate springs
(5) Stamp
(6) Semiconductor
(7) Centering bolt
(8) Heatsink

Replacement of a thyristor or thyristor module Type 25 - 800 A

- Loosen and swing out regulator and Interface assembly
- Remove bus bars above the thyristors
- Remove gate leads of the thyristor concerned
- Unscrew thyristor or thyristor module
- Before mounting the new thyristor or thyristor module, coat the side, which is in contact with the heat sink, with a thin layer of heat conducting paste.

For units 800 A:

NOTE: for safe and easy mounting of thyristors on 800 A units we recommend the tool PN 050.00.00

- Insert thyristor into box-clamp and put the package on the centering bolt on the heatsink
- Fasten the four hexagon bolts by hand until all slack is taken out and take care that the clamp housing stays parallel to the heatsink.
- Tighten each bolt by half a revolution at one time with hexagonal torque socket spanner 8 mm (10 mm), diagonally.

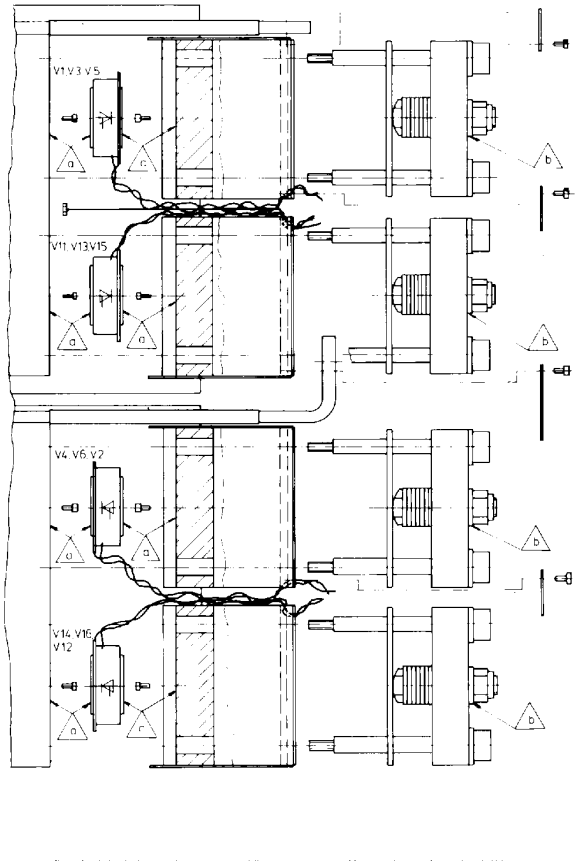
NOTE: Observe recommended torque!

- Repeat the procedure until the clamp is held down firmly to the heatsink on each side.
- Re-connect gate leads
- Screw on bus bars.

NOTE: Before replacing a thyristor or thyristor module the gate and cathode faston connectors must be checked for conductivity.

Replacement of a thyristor on power unit Type 1200 - 2000 A

- Write protocol about the following procedure
- Open controller and protection unit by tilting forwards. Layout of thyristor assembly is visible now on side wall.
- Remove bus bars on front heat sink
- Unscrew the upper cooling air deflector. Unscrew the hexagon screws for the bus bar mounting.
- Unscrew the lower cooling air deflector
- Loosen the two screws (13 mm) on the clamp by quarter turns.
  (Caution: the center clamp screw 24 mm must not be turned)
- Withdraw clamp and heat sink.
- Clean heat sink from thermo conductive paste.
- Coat both sides of the new thyristor with an thin film of thermo conductive paste /a.
- Mount the thyristor on the centering pin in the rear heatsink. Observe correct polarity of cathode and anode according to layout.
- Insert clamp in front heatsink and attach to thyristor with centering pin.



NOTE /b

Tighten the two clamp screws (13 mm) alternately by one quarter turn until the control ring under the center clamp nut can be turned through 360 degree by hand. Keep clearance to a minimum.

- Proceed installation in the reverse order of removal.

8.1 Recommended Spare Parts

Table 8-1: Urgent recommended spare parts for **1-Quadrant units S-6 25, 60 and 150 A**

Power Unit	Type	Thyristor-Module	Field Rectifier Module with MOV	P.C. Boards, MOV-Module	Cooling Fan
25 A	848.00.03/73	1 Module 135.60.00	1 Module 124.07.00 1 MOV 123.39.30	1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIB 813.41.01 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.50*	
60 A	848.02.03/73	1 Module 135.60.02			
150 A	848.04.03/73	3 Modules 135.05.52		1 Regulator 810.79.40 with Firmware EPROM 1 Interface TID 813.40.00 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.60* 1 MOV-Module 123.43.04	1 Fan 921.22.01

* The Field Current Regulator is only included in FlexPak types 848.xx.73

Table 8-2: Urgent recommended spare parts for **4-Quadrant units S-6R 25, 60 and 150 A**

Power Unit	Type	Thyristor-Module	Field Rectifier Module with MOV	P.C. Boards, MOV-Module	Cooling Fan
25 A	848.01.03/73	2 Module 135.60.00	1 Module 124.07.00 1 MOV 123.39.30	1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIA 813.41.00 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.50*	
60 A	848.03.03/73	2 Module 135.60.02			
150 A	848.05.03/73	6 Modules 135.05.52		1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIC 813.39.00 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.60* 1 MOV-Module 123.43.04	1 Fan 921.22.01

* The Field Current Regulator is only included in FlexPak types 848.xx.73.

Further spare parts for Unit Type 150 A:

1 Capacitor	211.00.02
1 Resistor	750.70.04

Table 8-3: Urgent recommended spare parts for **1-Quadrant units S-6 250 / 450 and 800 A**

Power Unit	Type	Thyristor/ Thyristor-Module	Field Rectifier Module with MOV	P.C. Boards, MOV-Module	Cooling Fan
250 A	848.06.03/73	3 Modules 135.11.02	1 Module 124.07.00 1 MOV 123.39.30	1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIF 813.42.01 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.60* 1 MOV-Module 123.43.04	1 Fan 921.90.00
450 A	848.08.03/73	3 Modules 135.12.02			
800 A	848.10.03/73	6 Thyristors 122.04.02		1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIF 813.42.01 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.70* 1 MOV-Module 123.43.04	

* The Field Current Regulator is only included in FlexPak types 848.xx.73.

Table 8-4: Urgent recommended spare parts for **4-Quadrant units S-6R 250 / 450 and 800 A**

Power Unit	Type	Thyristor/ Thyristor-Module	Field Rectifier Module with MOV	P.C. Boards, MOV-Module	Cooling Fan
250 A	848.07.03/73	6 Modules 135.11.02	1 Module 124.07.00 1 MOV 123.39.30	1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIE 813.42.00 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.60* 1 MOV-Module 123.43.04	1 Fan 921.90.00
450 A	848.09.03/73	6 Modules 135.12.02			
800 A	848.11.03/73	12 Thyristors 122.04.02		1 Regulator 810.79.40 with Firmware EPROM 1 Interface TIE 813.42.00 1 Power Supply FPP 810.89.00 1 Field Current Regul. 762.70.70* 1 MOV-Module 123.43.04	

* The Field Current Regulator is only included in FlexPak types 848.xx.73

Further spare parts:

Unit Type		
250 / 450 A	1 Capacitor 211.00.05	1 Resistor 425.18.18
800 A:	1 Capacitor 211.36.05	2 Resistor 425.18.18

Table 8-5: Urgently recommended spare parts for **1-Quadrant Units S-6 1200-2000 A**

Unit Type	S-6 Part No.	Thyristors 6 Pieces	Fan	P.C. Boards, MOV-Module	
1200A, 50Hz 500 V	848.12.73	122.93.02	921.91.00	1 Interface TIG 813.43.01	1 Regulator 810.79.40 with Firmware EPROM 1 Field Current Regul. 762.70.70 1 Power Supply FPP 810.89.00
1200A, 60Hz 500 V	848.12.43	122.93.02	921.91.11		
1600A, 50Hz 500 V	848.14.73	122.93.02	921.91.00		
1600A, 60Hz 500 V	848.14.43	122.93.02	921.91.11		
2000A, 50Hz 500 V	848.18.73	122.93.02	921.91.00		
2000A, 60Hz 500 V	848.18.43	122.93.02	921.91.11		
1600A, 50Hz 690 V	848.16.73	122.93.04	921.91.00	1 Interface TIG 813.43.11	
1600A, 60Hz 575 V	848.16.43	122.93.04	921.91.11	1 Interface TIG 813.43.11 1 MOV-Module 123.43.04	

Table 8-6: Urgently recommended spare parts for **4-Quadrant Units S-6R 1200-2000 A**

Unit Type	S-6R Part No.	Thyristors 12 Pieces	Fan	P.C. Boards, MOV-Module	
1200A, 50Hz 500 V	848.13.73	122.93.02	921.91.00	1 Interface TIG 813.43.00 1 MOV-Module 123.43.04	1 Regulator 810.79.40 with Firmware EPROM 1 Field Current Regul. 762.70.70 1 Power Supply FPP 810.89.00
1200A, 60Hz 500 V	848.13.43	122.93.02	921.91.11		
1600A, 50Hz 500 V	848.15.73	122.93.02	921.91.00		
1600A, 60Hz 500 V	848.15.43	122.93.02	921.91.11		
2000A, 50Hz 500 V	848.19.73	122.93.02	921.91.00		
2000A, 60Hz 500 V	848.19.43	122.93.02	921.91.11		
1600A, 50Hz 690 V	848.17.73	122.93.04	921.91.00	1 Interface TIG 813.43.10	
1600A, 60Hz 575 V	848.17.43	122.93.04	921.91.11	1 Interface TIG 813.43.10 1 MOV-Module 123.43.04	

Further spare parts for 1200-2000 A units:

Suppression print SBA	803.56.00
RC-Suppression module (for 690V only)	922.58.10

8.2 Accessories

Semiconductor protection fuses in the AC-line input of the converter and field circuit and in case of four-quadrant operation in the motor armature circuit are to be selected from the following tables 8-7 and 8-8. Chokes in the AC-line input of the converter and field circuit are to be selected from the table 8-9. The fuses and chokes are externally mounted and not supplied with the power module.

Table 8-7: Semiconductor Protection Fuses

Drive Type	Motor I_{nom}	Current I_{ad}	Motor Armature (4-Qd) Fuses		AC-Line input Fuses		Fuse Accessory **) (per Fuse)	
			Rating	Part No. (2 pieces)	Rating	Part No. (3 pieces)	Fuse Trip Indicator	Fuse Holder
25A	21A	25A	32A	553.28.02	32A	553.28.02	553.29.00	511.23.00
60A	33A	40A	80A	553.28.07	63A	553.28.06	553.29.00	511.23.00
	50A	60A	80A	553.28.07	63A	553.28.06	553.29.00	511.23.00
150A	75A	90A	125A	553.28.09	100A	553.28.08	553.29.00	511.23.00
	108A	130A	200A	553.30.05*	160A	553.30.04*	553.29.00	511.24.00
	125A	150A	200A	553.30.05*	160A	553.30.04*	553.29.00	511.24.00
250A	158A	190A	315A	553.31.13*	250A	553.30.06*	553.29.00	511.24.00
	208A	250A	315A	553.31.13*	250A	553.30.06*	553.29.00	511.24.00
450A	294A	350A	450A	553.32.16*	350A	553.31.14*	553.29.00	511.24.00
	375A	450A	550A	553.32.18*	450A	553.32.16*	553.29.00	511.24.00
800A	525A	630A	800A	553.33.21*	630A	553.33.19*	553.29.00	511.26.01
	666A	800A	1000A	553.33.22*	800A	553.33.21*	553.29.00	511.26.01
1200A 500V	833A	1000A	1250A	553.33.23*	1000A	553.33.22*	553.29.00	511.26.01
	1000A	1200A	2 // 800A	553.33.21*	1250A	553.33.23*	553.29.00	511.26.01
1600A 500V	1167A	1400A	2 // 1000A	553.33.22*	2 // 900A	553.33.24*	553.29.00	511.26.01
	1334A	1600A	2 // 1000A	553.33.22*	2 // 900A	553.33.24*	553.29.00	511.26.01
2000A 500V	1667A	2000A	2500A	553.72.01	2000A	553.72.00	553.26.30	-
			2 // 1250A	553.33.23*	2 // 1000A	553.33.22*	553.29.00	511.26.01
1600A 690V 50 Hz	833A	1000A	2 // 700A	553.34.35	2 // 630A	553.34.34	553.26.30	511.26.03
	1167A	1400A	2 // 900A	553.34.37	2 // 800A	553.34.36	553.26.30	511.26.03
	1334A	1600A	2 // 900A	553.34.37	2 // 800A	553.34.36	553.26.30	511.26.03
1600A 575V 60 Hz	833A	1000A	2 // 800A	553.33.21*	1250A	553.33.23*	553.29.00	511.26.01
	1167A	1400A	2 // 900A	553.33.24*	2 // 800A	553.33.21*	553.29.00	511.26.01
	1334A	1600A	2 // 900A	553.33.24*	2 // 800A	553.33.21*	553.29.00	511.26.01

Fuses and accessories marked in **grey** are **not** UL, cUL

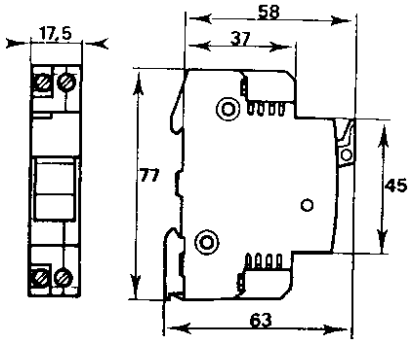
* Fuse trip indicator 553.29.00 included in fuse package

** For selection and dimensions see also following pages

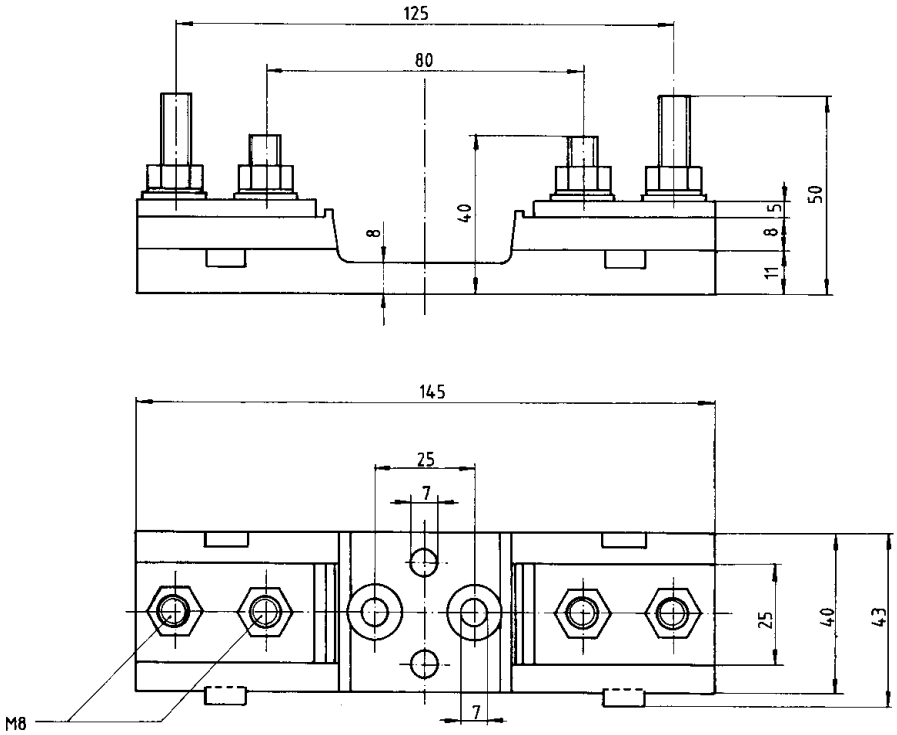
Table 8-8: Field Supply Input Fuse

Max. Field Current	Field AC-Input			
	Fuse Rating	Fuse Type	Fuse Part No.	Fuse Holder Size 11 Part No. (2 pieces)
6 A	12 A	aR	553.00.09	511.21.00
12 A	16 A	aR	553.00.10	511.21.00
20 A	30 A	aR	553.00.11	511.21.00

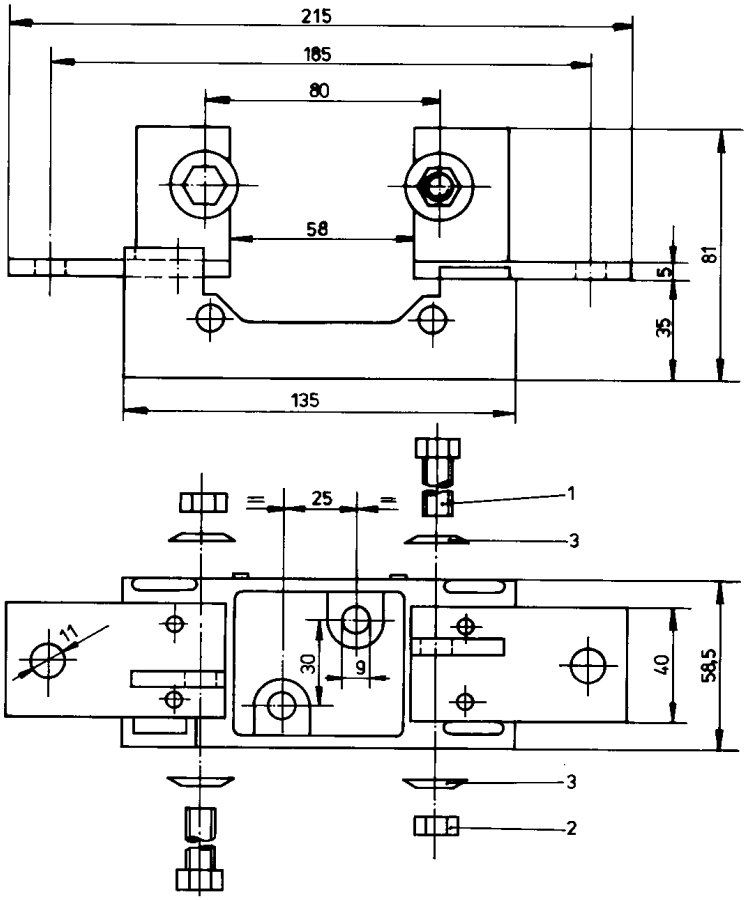
Fuse Holder Dimensions



Fuse Holder Dimensions

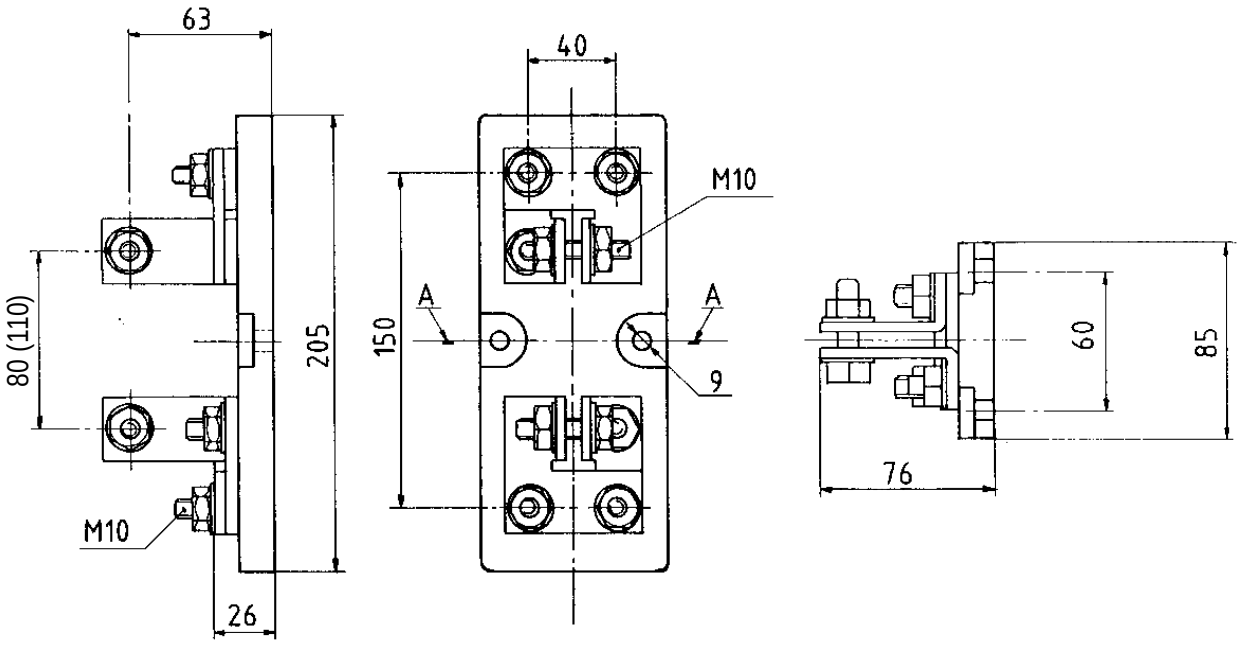


Part number **511.23.00**
for fuses DIN 80/ Size 00 (553.2...) up to 125 A



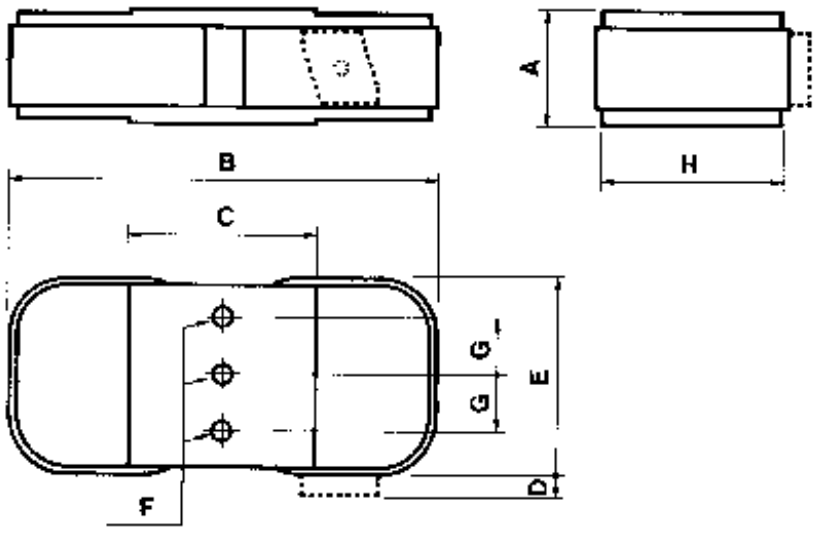
Part number **511.24.00**
for fuses DIN 80/1K, 2K (553.30../31../32..) 160 - 550 A

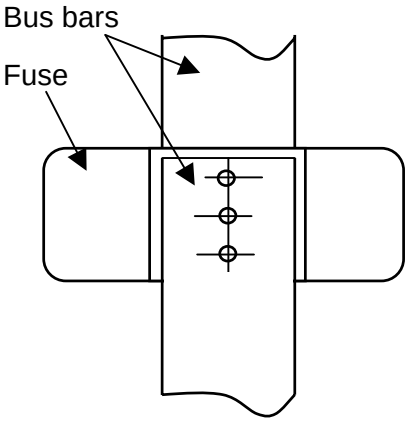
Fuse Holder Dimensions (continued)



Part number **511.26.01**
for fuses DIN 80/ 3K, 660 V, 800 - 1250 A, (553.33.xx) spacing 80 mm

Part number **511.26.03**
for fuses DIN 80/ 3K, 800 V, 800 - 1250 A, (553.34.xx) spacing 110 mm





To guarantee free air circulation, the fuses must be mounted between the input/output bus-bars as shown, with enough space to the next fuse.

Cooling air per fuse: 130 m^3/h

Fuse Part Number	Nominal Current	Fuse Dimensions								
		A	B	C	D	E	F	G	H	Pv
553.72.00	2000 A:	60	230	100	15	105	M12	31,25	100	340 W
553.72.01	2500 A:	60	230	100	15	105	M12	31,25	100	390 W

Fuses for FlexPak 3000 type 2000 A (**non** UL, cUL)

Table 8-9: Iron Core Choke Selection

The AC-line input chokes 252.40.xx produce **2% voltage drop at 400 V** and rated current.
The AC-line input chokes 252.44.xx produce **2% voltage drop at 690 V** and rated current.
Note, that for applications with radio frequency interference filters (RFI) chokes for **2**% voltage drop at rated input voltage up-to 500 V and **4**% voltage drop at 690 V are mandatory.
If on applications with RFI filters the drive is connected to a supply with nominal voltage >400V < 690V **two** 2% chokes 252.40.xx in series will be required (for nom. voltage 690 V **two 2%** chokes 252.44.xx).

Drive Type	Motor I_{nom}	Current I_{ad}	**AC- Line Input** 3-Phase Rating I_{nom}	Choke 1) Part No.	**Field AC-Input** 1-Phase Rating I_{nom}	Choke Part No.
25A	21A	25A	25A	252.40.01	6A	252.42.05
60A	33A 50A	40A 60A	40A 62A	252.40.02 252.40.03	6A	252.42.05
150A	75A 108A 125A	90A 130A 150A	85A 115A 160A	252.40.04 252.40.05 252.40.06	6A	252.42.05
250A	158A 208A	190A 250A	160A 210A	252.40.06 252.40.07	12A	252.42.06
450A	294A 375A	350A 450A	290A 392A	252.40.08 252.40.09	12A	252.42.06
800A	525A 666A	630A 800A	530A 660A	252.40.10 252.40.11	12A	252.42.06
1200A 500V	833A 1000A	1000A 1200A	850A 1100A	252.40.12 252.40.13	20A	252.42.01
1600A 500V	1334A	1600A	1360A	252.40.15		
2000A 500V	1667A	2000A	1700A	252.40.16		
1600A 575V 690V	800A 1000A 1334A	1000A 1200A 1600A	850A 1100A 1360A	252.44.12 252.44.13 252.44.15	20A	252.42.01

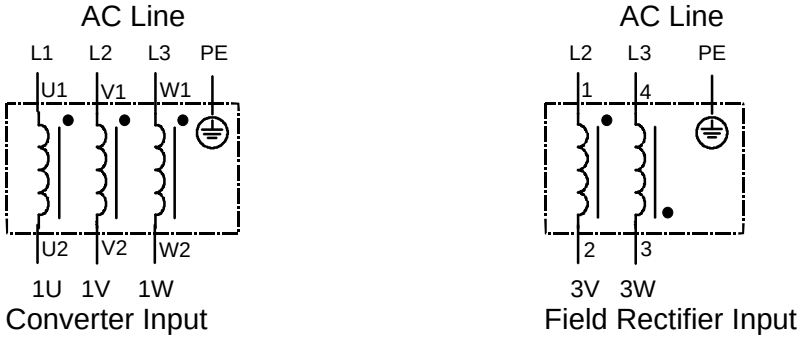
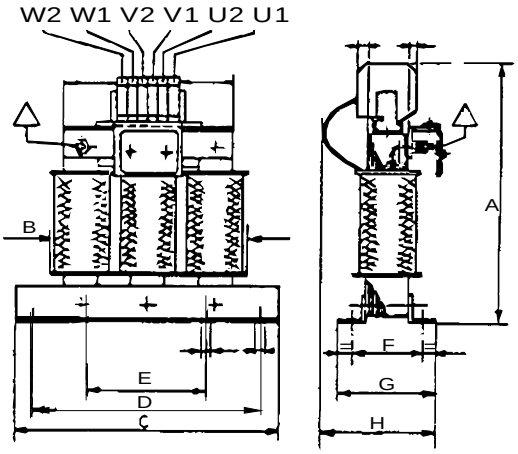
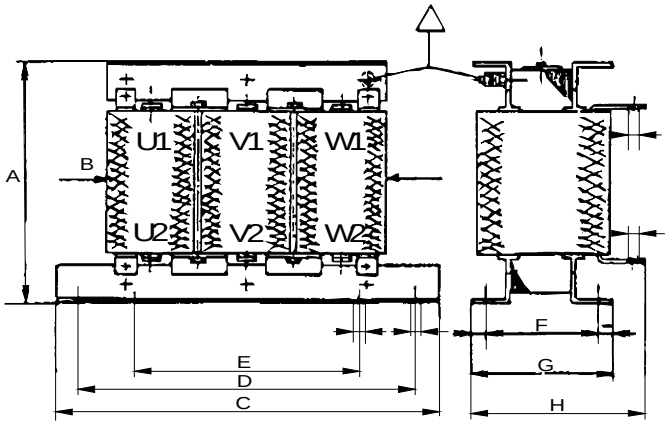


Fig. 8-1: Line Reactor Wiring Diagram



(1)



(2)

Δ Protection earth connection stud

Line Reactor Part No.	A	B	C	D	E	F	G	H	[kg]	P_v [W]	Fig.	Used for
252.40.01	190	150	190	170	75	45	67	80	4.7	50	1	Converter Input
252.40.02	185	150	190	170	75	60	72	85	6.5	60	1	
252.40.03	210	180	240	210	90	52	72	90	7.8	70	1	
252.40.04	160	180	240	210	90	52	72	95	7.8	80	2	
252.40.05	160	180	240	210	120	72	93	115	11	90	2	
252.40.06	240	260	260	--	240	75	97	170	18	130	2	
252.40.07	240	260	260	--	240	75	96	170	26	150	2	
252.40.08	240	290	260	--	240	100	116	190	26	170	2	
252.40.09	290	320	320	--	300	80	116	220	35	225	2	
252.40.10	280	270	320	300		108	123	180	50	365	2	
252.40.11	310	320	320	--	200	93	120	220	40	370	2	
252.40.12	330	350	350	--	240	110	140	250	55	590	2	
252.40.13	475	--	390	--	355	95	135	250	70	580	2	
252.40.15	450		410					280	95	800	2	
252.40.16	460	380	450	410		150	190	290	105	950	2	
252.44.12	510	450	450	395		117	142	250	88	790	2	
252.44.13	510	450	450	395		125	165	310	100	900	2	
252.44.15	460	385	450	410		150	190	280	105	1100	2	
252.42.05	110		60	44		38	50		0.48		1	Field Rectifier Input
252.42.06	124		78	56		47	60		1.2		1	
252.42.01	150		105	84		70	89		3.8		1	

Figure 8-2: Line Reactor Dimensions (mm), Power Losses (W) and Weight (kg):

EMC Filters for FlexPak 3000

General Description

Power converters in general cause line disturbances over a wide frequency range.
Through the correct connection of the adapted filters (HF filter or Radio Frequency Interference (RFI) filter according to the following Table 8-10), the conducted emissions in the frequency range 150 kHz to 30 MHz can be kept below the limits stated in product standard EN 61800-3.

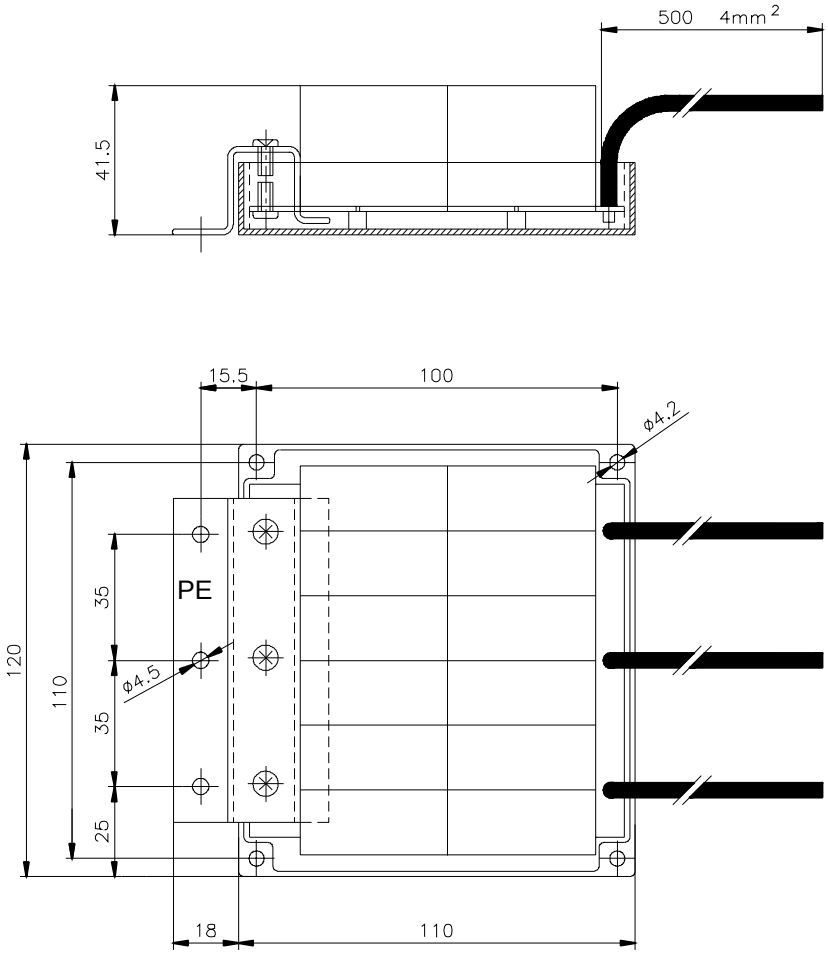
The radiated emissions in the frequency range 30 -1000 MHz will stay below the limits, if for the installation the same EMC measures are taken into account as for the conducted HF emissions.

NOTE: On all FlexPak drives a line input reactor must be connected between filter output and converter input. This line reactor should be rated for minimum 2% voltage drop on drives up to 500 V and 4% for 690 V drives (selection according to Table 8-9). The drives AC-line input semiconductor protection fuses as per Table 8-7 must be mounted between filter output and line reactor. Otherwise the filter inrush current may damage the fuses. **For installation instructions refer to Appendix H**

HF Filter

If this filter is used on FlexPak 3000 converters with AC line input currents **above 100 A** 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.

The HF filter is connected in front of the AC line reactor between the three AC line input phases and the protection earth conductor PE.



Filter part no.:	839.52.20
Nominal voltage L-L:	690 V

Figure 8-3: HF-Filter dimensions (mm)

Radio Frequency Interference Filter

a) FlexPak 3000 converters with AC line input currents **below 100 A:**
If the RFI filter is connected, the HF emission limits for class A, group 1 (EN 55011) according to the **product standard EN 61800-3** are met and the drive is CE conform. This applies for the **1st environment** (residential) as well as for the **2nd environment** (industrial supply network).

b) FlexPak 3000 converters with AC line input currents **above 100 A:**
If the RFI filter is connected, 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.

The filter must be connected into the three AC line input phases L1 - L3 of the FlexPak 3000 in front of the AC line reactor, as shown in figure H-1.

RFI Filter Selection

The RFI-Filters can be selected from Tab. 8-10 according to the permitted filter current and the maximum operating voltage.
The permitted filter current is dependent on the application specific maximum continuous DC-current I_{ad} of the drive, the DC-current form factor (FF) and the ambient temperature T.

> The ambient temperature T is the max. temperature around the filter (typical 50°C inside cabinets for a standard max. cooling air temperature of 40°C). Typical DC-current form factor FF = 1.05

For cabinet mounting with T = 50°C and FF = 1.05:

Filter current = maximum continuous DC-current I_{ad}

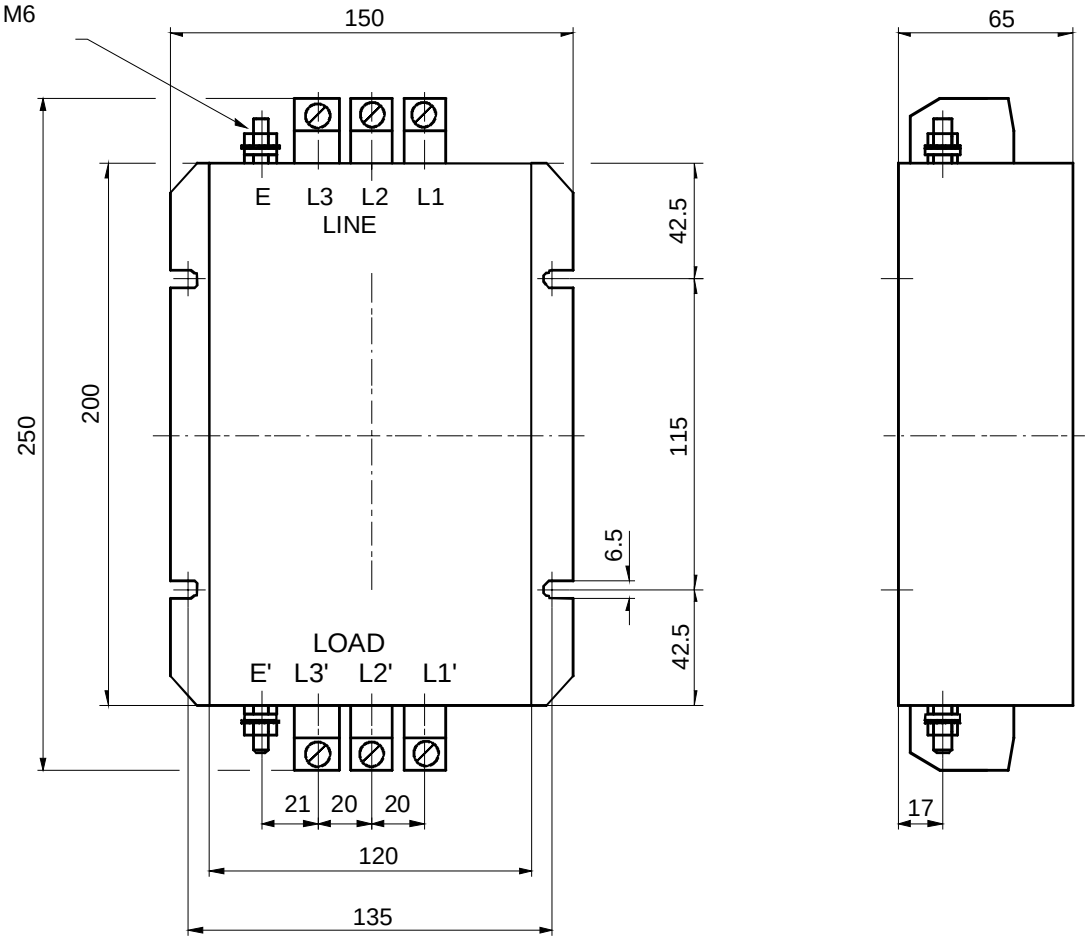
For other ambient temperatures (T) and form factors (FF) the continuous current of the filter can be calculated as follows:

$$I_{FILTER} = I_{Line(rms)} \times \sqrt{\frac{45°C}{85°C - T}} = \sqrt{\frac{2}{3}} \times FF \times I_{ad} \times \sqrt{\frac{45°C}{85°C - T}}$$

Table 8-10: RFI Filter Selection

Filter Current	RFI-Filter						Application
	380 - 440 V		460 - 500 V		690 V		
	Part No.	see Page	Part No.	see Page	Part No.	see Page	
25A	839.72.05	8-13	on request				according to a)
36A	839.72.06	8-13	on request				
50A	839.72.07	8-13	on request				
80A	839.72.09	8-14	on request				
100A	839.71.53	8-15	839.71.53	8-15			
150A	839.70.20	8-16					according to b)
180A	839.74.22	8-17	on request				
250A	839.73.25	8-20	on request				
270A	839.70.66	8-18	839.70.66	8-18			
280A	839.72.67	8-17	839.72.67	8-17			
340A	839.71.68	8-19	839.71.68	8-19			
500A	839.73.31	8-20	on request				
600A	-	-	839.73.92	8-21	839.73.92	8-21	
1000A	839.73.35	8-21	839.73.95	8-21	839.73.95	8-21	
1600A	839.73.38	8-20	839.73.98	8-21	839.73.98	8-21	

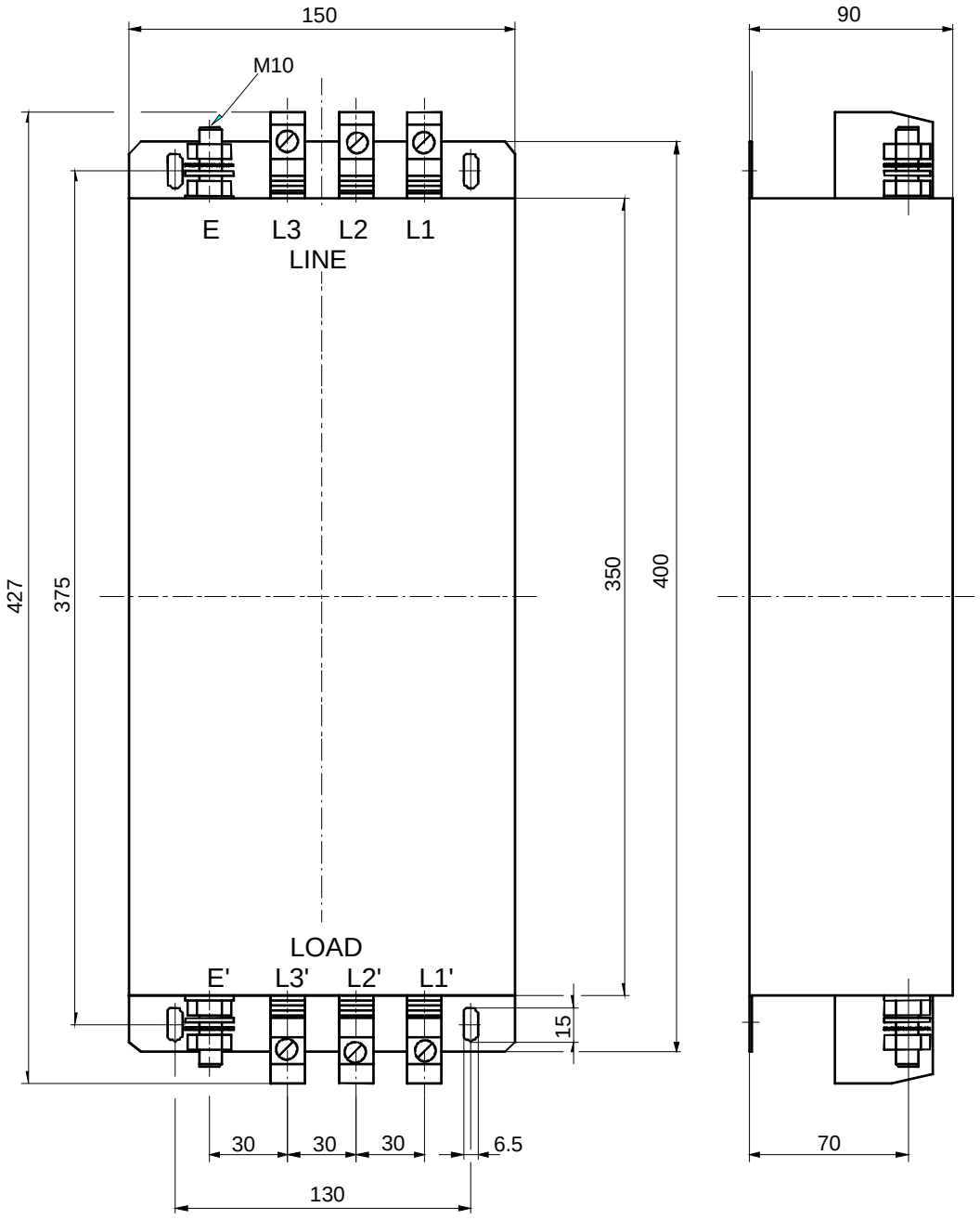
Radio Interference Filters 25, 36 and 50 A, 440 V



Filter Part No.:	839.72-05	839.72-06	839.72-07
Rated Current	25 A	36 A	50 A
Power loss:	8 W	9 W	11 W
Weight:	3 kg	3.1 kg	3.5 kg

Figure 8-4: 25, 36 and 50 A, 440 V Filter Dimensions (mm)

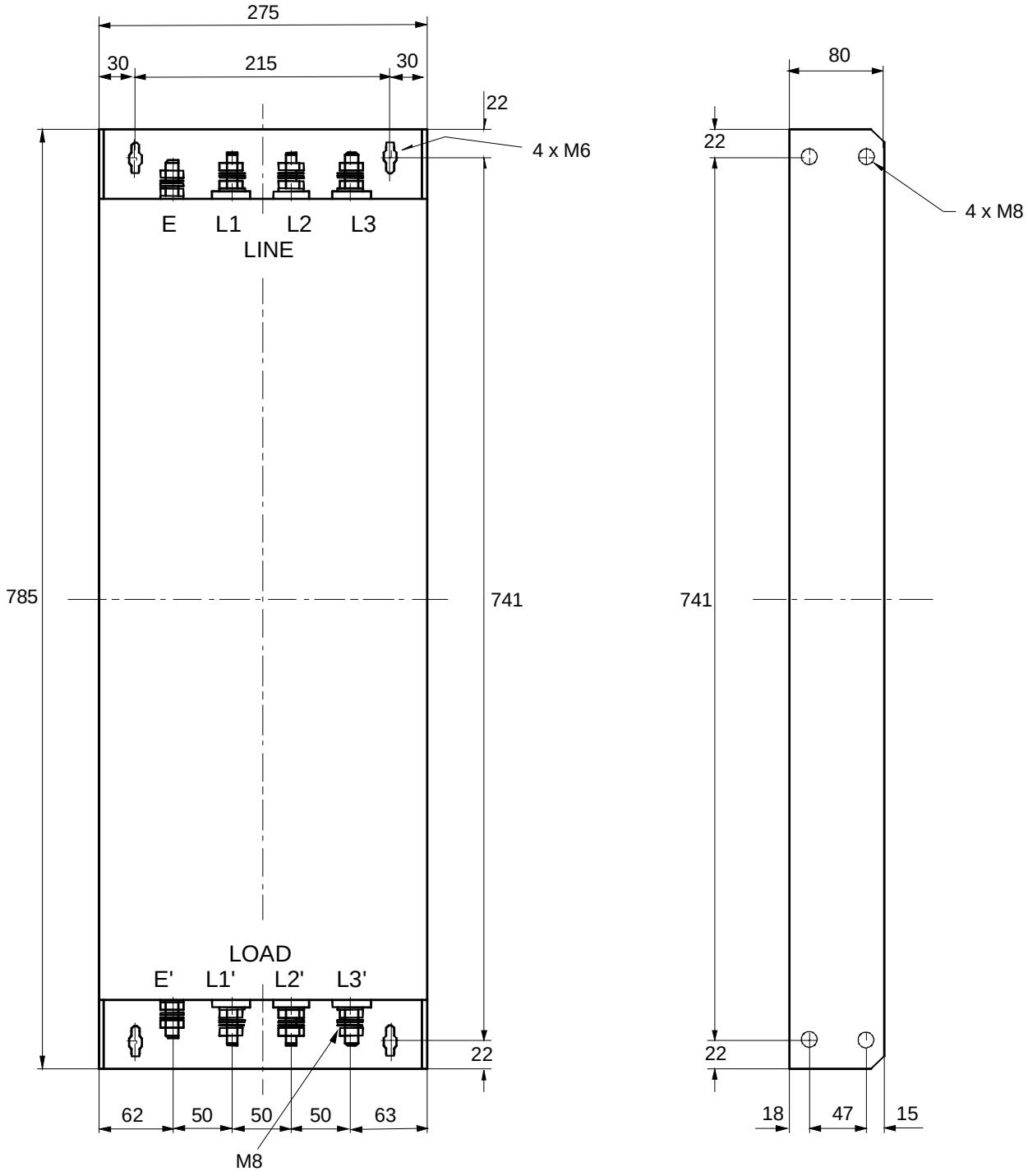
Radio Interference Filter 80 A, 440 V



Filter Part No.:	839.72-09
Power loss:	23 W
Weight:	9.5 kg

Figure 8-5: 80 A, 440 V Filter Dimensions (mm)

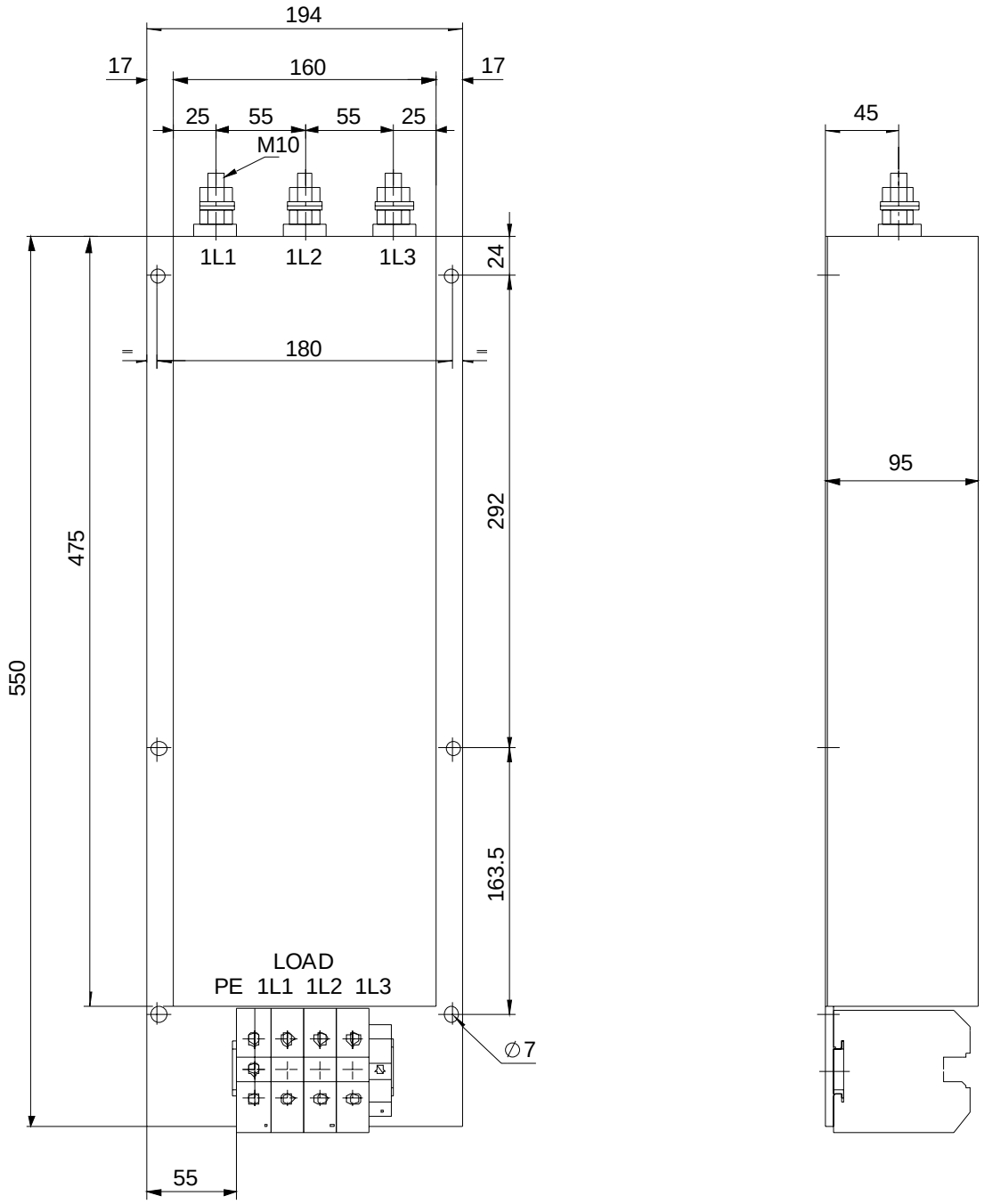
Radio Interference Filter 100 A, 500 V



Filter Part No.:	839.71-53
Power loss:	75 W
Weight:	9.5 kg

Figure 8-6: 100 A, 500 V Filter Dimensions (mm)

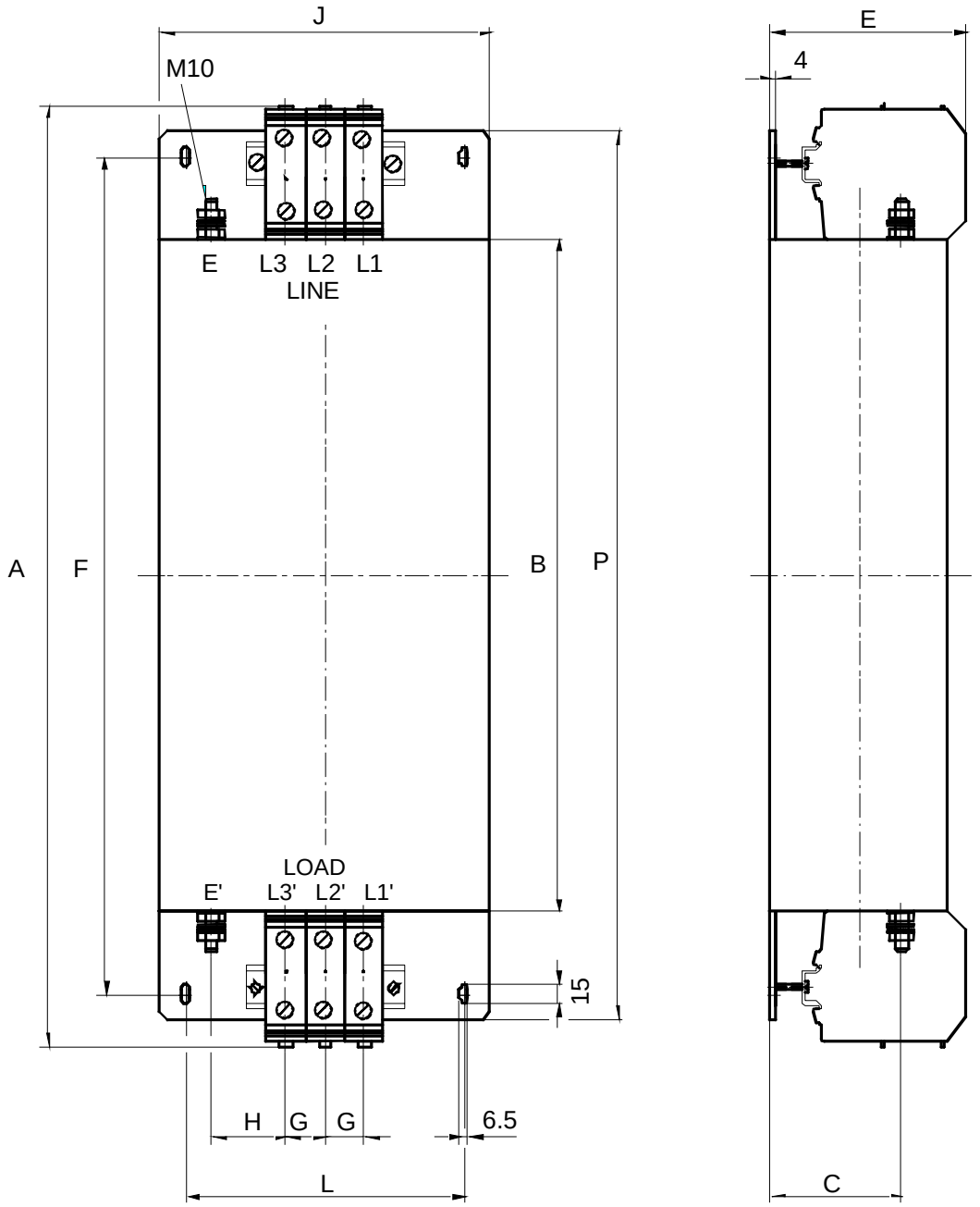
Radio Interference Filter 150 A, 460 V



Filter Part No.:	839.70-20
Power loss:	12 W
Weight:	14 kg

Figure 8-7: 150 A, 460 V Filter Dimensions (mm)

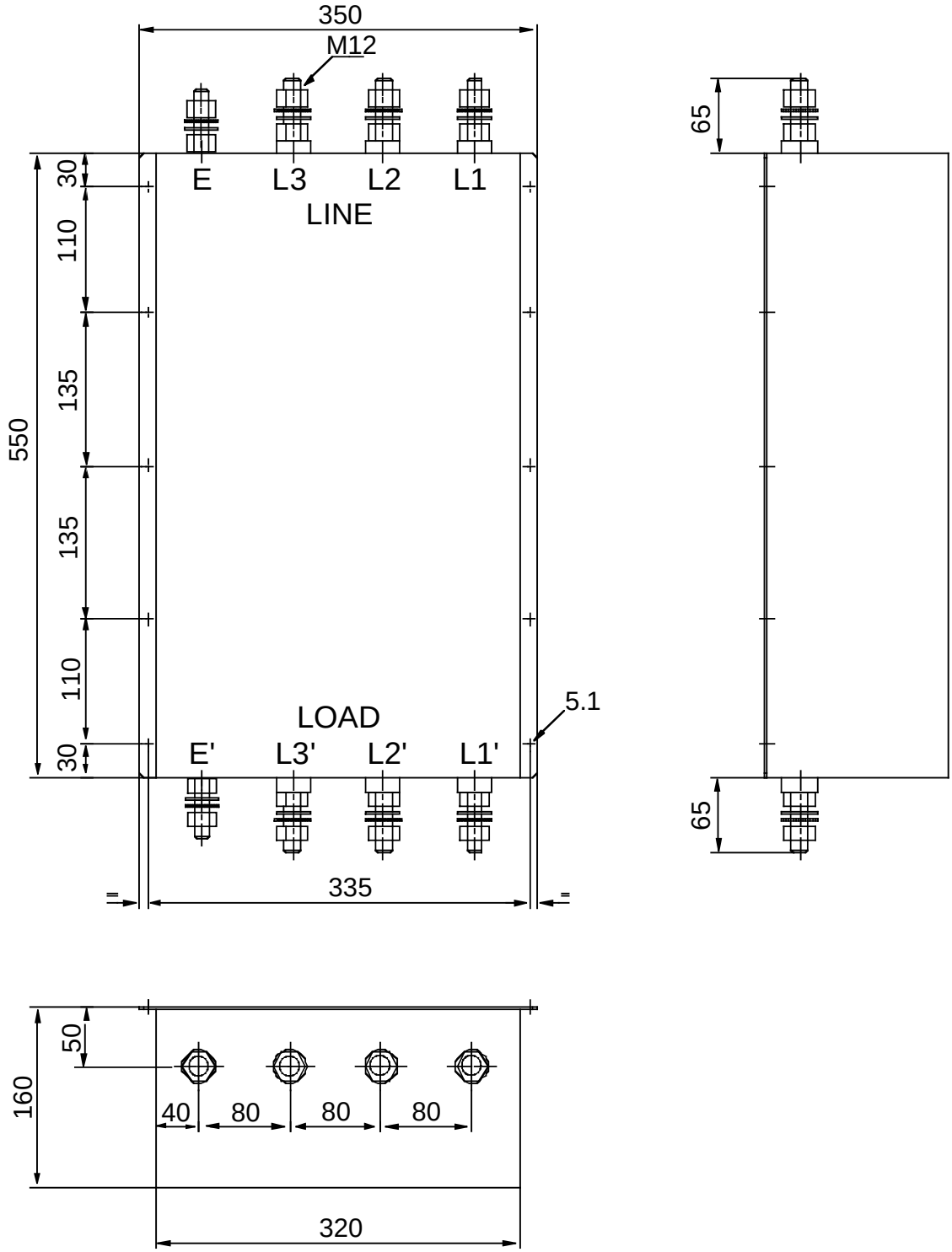
Radio Interference Filter 180 A, 440 V and 280 A, 500 V



I [A]	Filter Part No.	A	B	C	E	F	G	H	J	L	P	R	[kg]	P_v [W]	Terminal max. mm^2
180	839.74-22	537	360	88	132	470	25	28	180	156	510	77	13	49	95
280	839.72-67	742	530	103	153	660	31	59	260	220	700	82	28	70	150

Figure 8-8: 180 A, 440 V and 280 A, 500 V RFI-Filter Dimensions (mm)

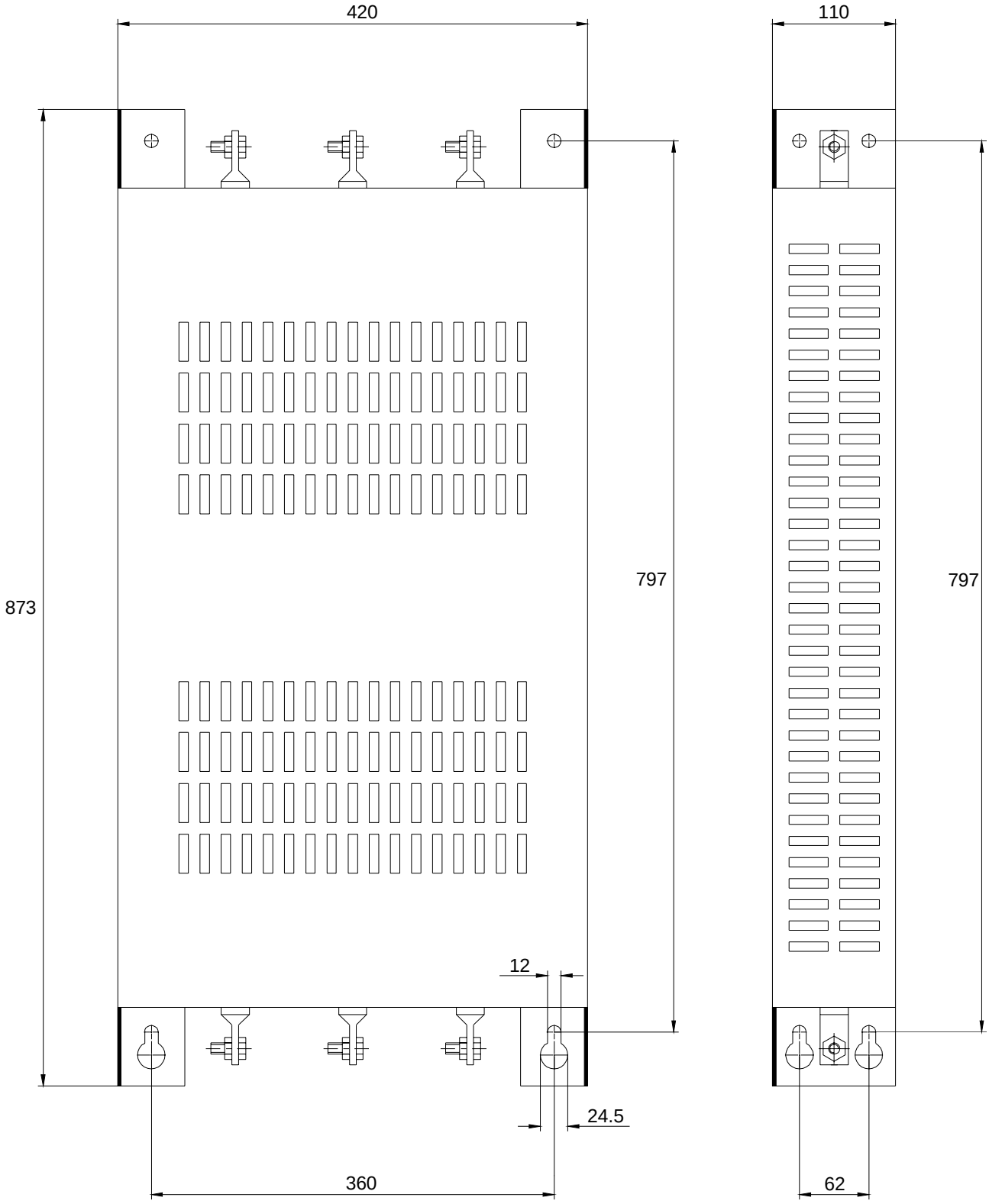
Radio Interference Filter 270 A, 440/500 V



Filter Part No.:	839.70-66
Power loss:	26 W
Weight:	48 kg

Figure 8-9: 270 A, 500 V RFI-Filter Dimensions (mm)

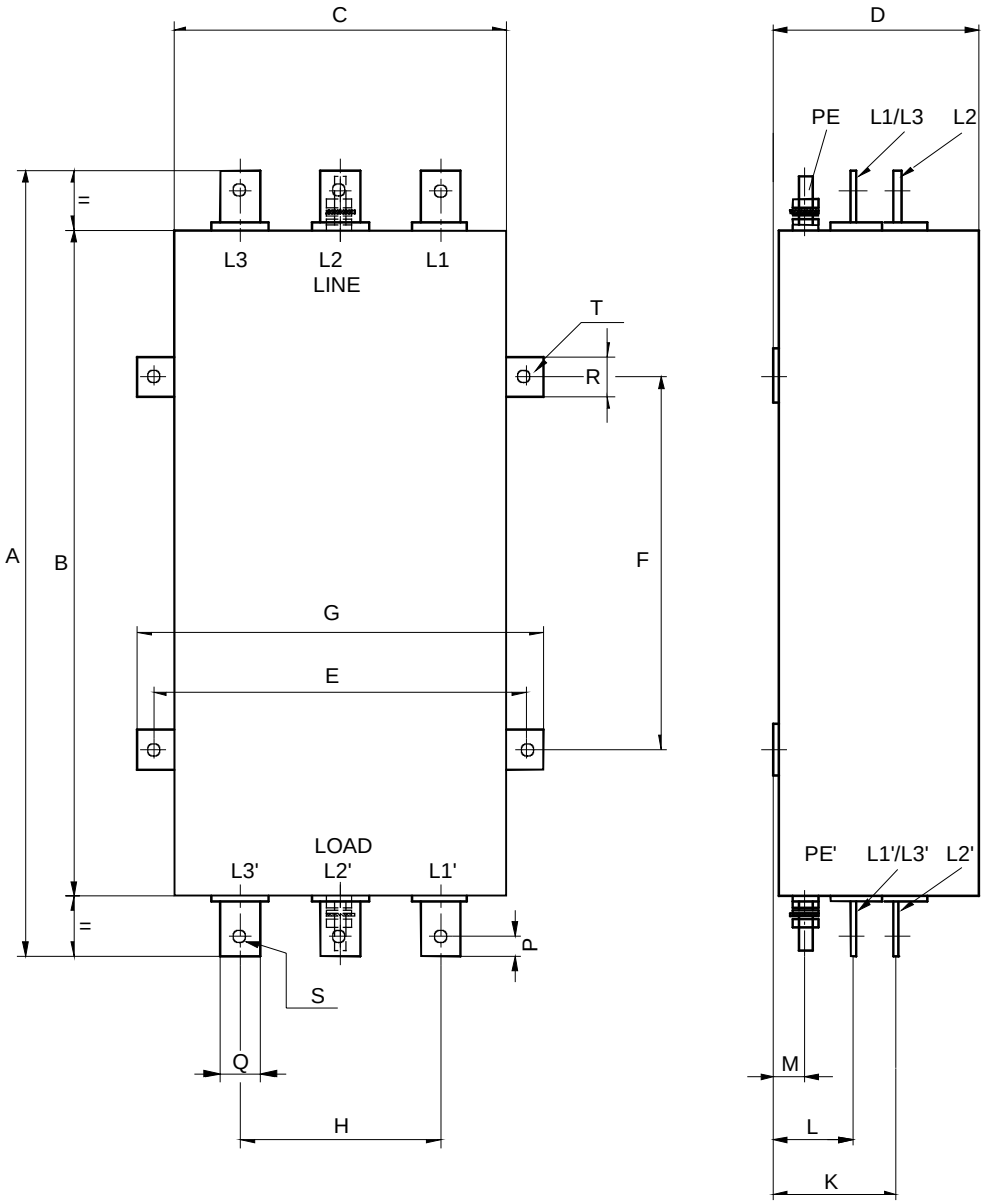
Radio Interference Filter 340 A, 440/500 V



Filter Part No.:	839.71-68
Power loss:	50 W
Weight:	22 kg

Figure 8-10: 340 A, 440/500 V RFI-Filter Dimensions (mm)

Radio Interference Filter 250, 500, 1000 and 1600 A, 440 V

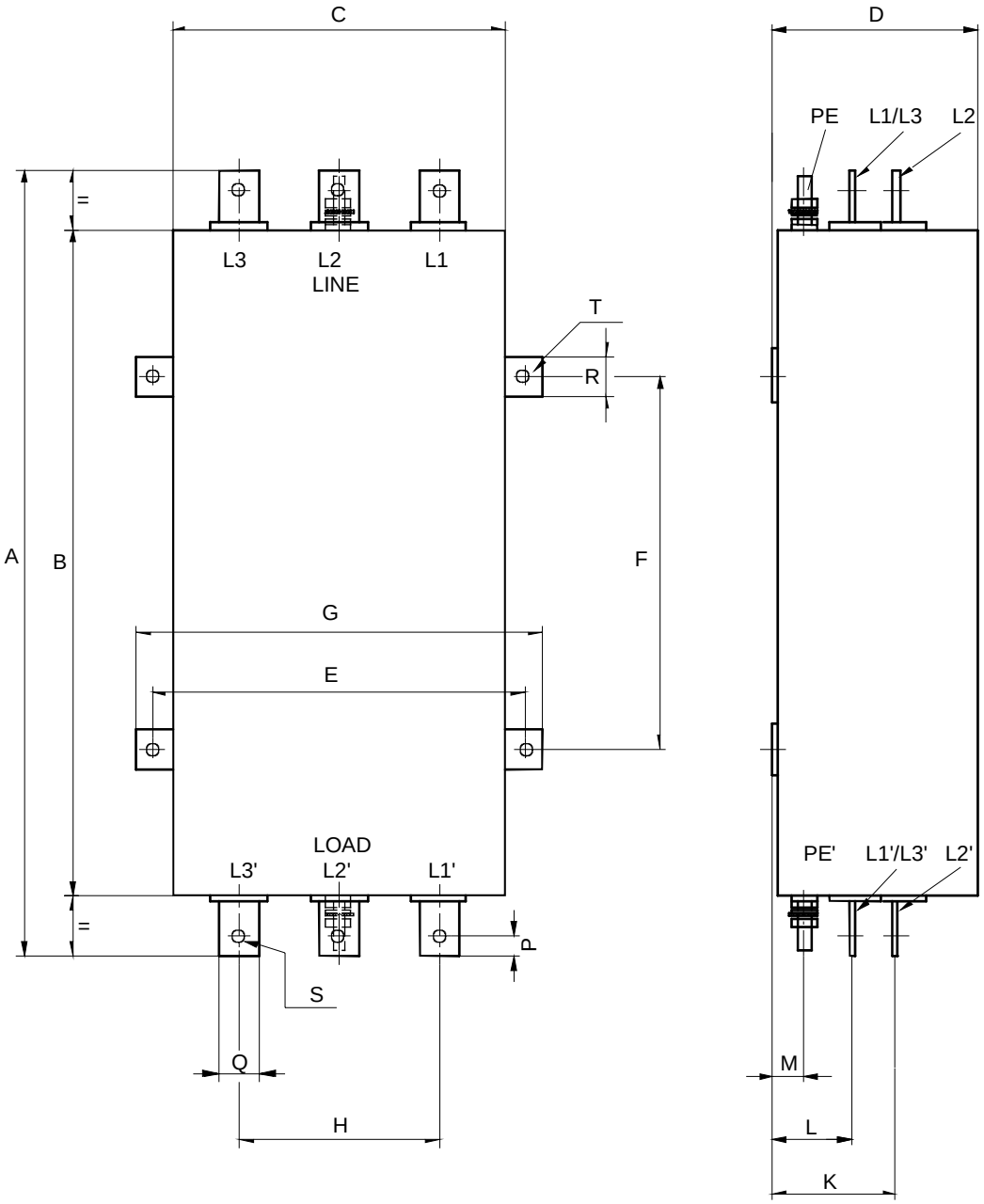


I [A]	Filter Part No.	A	B	C	D	E	F	G	H	K	L	M
250	839.73-25	460	350	230	149	260	200	285	120	100	79.5	24
500	839.73-31	590	500	250	154	280	280	305	150	93	59.5	24
1000	839.73-35	840	650	400	204	440	320	465	262	127	79	34
1600	839.73-38	870	680	400	204	440	340	465	262	127	79	34

I [A]	P	Q	R	S	T	Ground Bolt	W [kg]	P_v [W]
250	-	24	30	∅10.5	∅10.5	M10	18	18
500	15	30	30	∅11	∅12	M12	49	45
1000	20	50	40	∅14	∅12	M12	90	90
1600	20	50	40	2x ∅14	∅12	M12	130	144

Figure 8-11 250, 500, 1000 and 1600 A, 440 V RFI-Filter Dimensions (mm)

Radio Interference Filter 600 ,1000 and 1600 A, 500/690 V



I [A]	Filter Part No.	A	B	C	D	E	F	G	H	K	L	M
600	839.73-92	590	500	250	154	280	280	305	150	94.5	61.5	26
1000	839.73-95	610	500	250	198	280	280	305	172	90	51	26
1600	839.73-98	844	650	400	210	440	320	465	192	92	56	28

I [A]	P	Q	R	S	T	Ground Bolt	W [kg]	P_v [W]
600	15	30	30	∅11	∅12	M10	49	45
1000	20	40	30	∅11	∅12	M10	65	120
1600	20	40	40	2x ∅14	∅12	M12	180	220

Figure 8-12 600, 1000 and 1600 A, 500/690 V RFI-Filter Dimensions (mm)

Glossary of Terms

Altitude: The atmospheric altitude (height above sea level) at which the motor or drive will be operating.

Armature: The portion of the DC motor that rotates.

Armature Resistance: Measured in ohms at 25 degrees Celsius (cold).

Base Speed: The speed which a DC motor develops at rated armature voltage and rated field current with rated load applied. Typically nameplate data.

Constant Speed: Used to describe a motor which changes speed only slightly from a no-load to a full-load condition.

DC Motor: A motor using either generated or rectified DC power.
A D-C motor is usually used when variable speed operation is required.

DB: Dynamic Braking

Default Value: Parameter values which are stored in the drive's Read Only Memory (ROM).

Direct Current: A current that flows only in one direction in an electrical circuit. It may be continuous or discontinuous and it may be constant or varying.

Drive: Power converting equipment supplying electrical power to a motor.

Efficiency: The ratio of mechanical output to electrical input. It represents the effectiveness with which the motor converts electrical energy to mechanical energy.

Field: A term commonly used to describe the stationary (stator) member of a DC motor. The field provides the magnetic field with which the mechanically rotating (armature or rotor) member interacts.

Power P in kW: The measure of the rate of work. The kW rating of a motor is expressed as a function of torque and RPM.
For motors, the following approximate formula may be used:

P = M x RPM / 9550

where,
M = Torque in Nm and
RPM = revolutions per minute.

Inertial Load: A load (flywheel, fan, etc.) which tends to cause the motor shaft to continue to rotate after the power has been removed (stored kinetic energy). If this continued rotation cannot be tolerated, some mechanical or electrical braking means must be applied. This application may require a special motor due to the energy required to accelerate the inertia. Inertia is measured in kg m^2.

Inertia reflected to the shaft of the motor = load Inertia $\left(\frac{\text{load RPM}}{\text{motor RPM}}\right)^2$

LCD: Liquid Crystal Display.

LED: Light Emitted Diode.

Motor: A device that converts electrical energy to mechanical energy to turn a shaft.

Motor Electrical Time Constant: The ratio of electrical inductance to armature resistance. Electrical time constant in seconds defined as electrical:

T/C = La x Ia / Hot IR voltage drop

Motor Identification:

- Frame designation (actual frame size in which the motor is built)
- Power, speed, design and enclosure
- Voltage, frequency and number of phases of power supply
- Class of insulation and time rating
- Application

Motor Nameplate: The plate on the outside of a motor which describes the motor, kW, voltage, RPM, efficiency, design, enclosure, etc.

Motor Thermostat: Unit applied directly to the motor's windings which senses winding temperature and may automatically break the circuit in an overheating situation.

Non-Retentive: Information and/or data not retained while power to the drive is OFF.

Rated Full Load Current: Armature current in amperes.

Retentive: Information and/or Data retained while power to the drive is OFF.

RPM: Revolutions per Minute - The number of times per minute the shaft of the motor (machine) rotates.

Service Factor (SF): When used on a motor nameplate, a number which indicates how much above the nameplate rating a motor can be loaded without causing serious degradation, (i.e. a 1.15 SF can produce 15% greater torque than a 1.0 SF rating of the same motor).

Tachometer: Normally used as a rotational sensing device. Tachometers are typically attached to the output shaft of a motor requiring close speed regulation. The tachometer feeds its signal to a control which adjusts its input to the motor accordingly (called "closed loop feedback" control).

Top Speed: The highest speed a drive can achieve. Top Speed equals Base Speed when there is no field weakening.

Torque: Turning force delivered by a motor or gear motor shaft, usually expressed in Nm:

M [Nm] = P [kW] x 9550 / n [RPM] = full load torque

FlexPak 3000 User Input Parameters

This appendix provides an alphabetized list of input parameters with their associated default values, description and the OIM Menu path(s) for access. Partial control block diagrams are provided for some parameters. Refer to Appendix D for full block diagrams.

ACCELERATION TIME (P.001)

Amount of time it will take the drive to reach TOP SPEED from 0 speed. Smaller changes in speed will take proportionately less time. In proportional trim mode, this time value is modified by DRAW PERCENTAGE OUT.

Parameter Range: 0.1 to 300.0 seconds (actual minimum setting based on connected inertia)
Default Setting: 5 seconds
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Ramp Quick Start
Refer also to parameters: TRIM MODE SELECT (P.110)

AMX NETW REF SELECT (P.911)

AutoMax Network Reference Selection. Selects whether the drive reference value is obtained from the designated register within the drop register image or from one of the eight network broadcast registers when CONTROL SOURCE SELECT is set to NETWORK.

Parameter Range: DIRECT
BROADCAST n where n = 1 to 8 (0, or 1 to 8, respectively)
Default Setting: DIRECT
Parameter Type: Configurable
OIM Menu Path(s): Network Communications

ANALOG TACH GAIN ADJ (P.201)

Used to scale the analog tachometer feedback signal after it has been conditioned by the drive hardware. Typically, it will be 1.000.

Parameter Range: 0.750 to 1.250
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD)-Speed /Voltage Loop (SPD) Feedback

WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

ANALOG TACH ZERO ADJ (P.202)

Used to remove any hardware-introduced offset from the analog tachometer feedback signal. Typically, it will be 0.

Parameter Range: -200 to + 200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD)-Speed /Voltage Loop (SPD) Feedback

WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

ANLG AUTO GAIN ADJ (P.101)

Used to scale the analog auto reference signal after it has been conditioned by the drive hardware. Typically, it will be 1.000.

Parameter Range: 0.750 to 1.250
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Scaling

ANLG AUTO SIGNAL TYPE (P.100)

Selects the analog auto reference signal type.

Parameter Range: 0 - 10V +/-10V 4 - 20mA 10 - 50mA
Default Setting: 0 - 10V
Parameter Type: Configurable
OIM Menu Path(s): Drive Reference - Drive Reference Configure
Note: Jumpers J10 and J12 must be set for the type of auto reference selected.

ANLG AUTO ZERO ADJ (P.102)

Used to remove any hardware introduced offset from the analog auto reference signal. Typically, it will be 0.

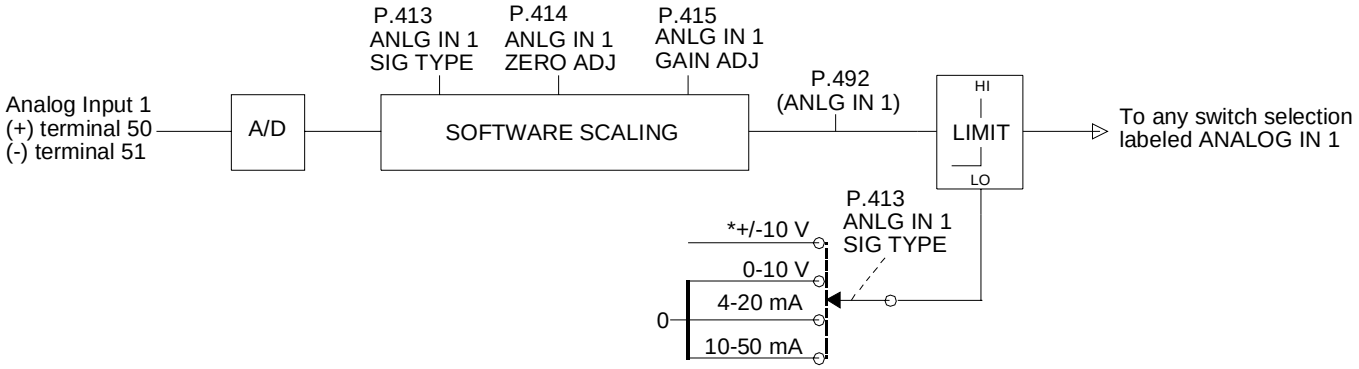
Parameter Range: -200 to + 200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Scaling

ANLG IN 1 GAIN ADJ (P.415)

Only available if the I/O Expansion kit is installed.
Gain adjustment for analog input 1 (terminals 50 and 51 on the I/O Expansion board).

Parameter Range: 0.750 to 2.250
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 1 (P.492), ANLG IN 1 SIG TYPE (P.413), ANLG IN 1 ZERO ADJ (P.414)

Adjusting the gain allows full scale results for input signals that are less than the drive's full scale value. For example, if ANLG IN 1 SIG TYPE is set to 0-10 V, a 0-8 VDC signal produces 80% of the drive's full scale value. To produce the drive's full scale value using the 0-8 VDC signal, change ANLG IN 1 GAIN ADJ to 1.250 (8.0V x 1.25 = 10.0 V). Note that gain values less than 1.000 decrease the resolution of the analog input.



ANLG IN 1 SIG TYPE (P.413)

Only available if the I/O Expansion Kit is installed.
Selects the type of signal that the drive will expect to be connected to analog input 1 (terminals 50 and 51 on the I/O Expansion board). The value of this parameter must match the setting of jumpers J11 and J12 on the I/O Expansion board. See ANLG IN 1 GAIN ADJ for block diagram.

Parameter Range: 0-10 V, +/-10 V, 4-20 mA, 10-50 mA
Default Setting: +/-10 V
Parameter Type: Configurable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 1 (P.492), ANLG IN 1 GAIN ADJ (P.415), ANLG IN 1 ZERO ADJ (P.414)

ANLG IN 1 ZERO ADJ (P.414)

Only available if the I/O Expansion kit is installed.
Adjusts the zero point of analog input 1 (terminals 50 and 51 on the I/O Expansion board) to remove any offset that might exist on the input.

Parameter Range: -200 to 200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 1 (P.492), ANLG IN 1 GAIN ADJ (P.415)

To adjust the zero point, make small changes to this parameter until ANLG IN 1 equals zero when the signal at terminals 50 and 51 is at its zero value (0 V, 4 mA, or 10 mA).
See ANLG IN 1 GAIN ADJ for block diagram.

ANLG IN 2 GAIN ADJ (P.417)

Only available if the I/O Expansion kit is installed.
Gain adjustment for analog input 2 (terminals 52 and 53 on the I/O Expansion board). Adjusting the gain allows full scale results for input signals that are less than the drive's full scale value.

Parameter Range: 0.750 to 2.250
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 2 ZERO ADJ (P.416), ANLG IN 2 (P.493)

For example, a -8 to +8 VDC signal produces 80% of the drive's full scale value.
To produce the drive's full scale value using the -8 to +8 VDC signal, change ANLG IN 2 GAIN ADJ to 1.250 (8 V x 1.25 = 10 V). Note that gain values less than 1.000 decrease the resolution of the analog input.
NOTE: Analog input 2 (terminals 52 and 53 on the I/O Expansion board) only accepts a +10 VDC input signal and cannot be changed.

ANLG IN 2 ZERO ADJ (P.416)

Only available if the I/O Expansion kit is installed. Adjusts the zero point of analog input 2 (terminals 52 and 53 on the I/O expansion board) to remove any offset that might exist on the input.

Parameter Range: -200 to 200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 2 (P.493), ANLG IN 2 GAIN ADJ (P.417)

To adjust the zero point, make small changes to this parameter until ANLG IN 2 equals zero when the signal at terminals 52 and 53 is at its minimum (-10 V).
NOTE: Analog input 2 (terminals 52 and 53 on the I/O Expansion board) only accepts a +10 VDC input signal and cannot be changed.

ANLG MAN REF GAIN ADJ (P.104)

Scales the Manual mode analog reference signal after it has been conditioned by the drive hardware. Typically, it will be 1.000.

Parameter Range: 0.750 to 1.250
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Scaling

ANLG MAN REF ZERO ADJ (P.105)

Removes any hardware introduced offset from the analog reference signal.
Typically, it will be 0.

Parameter Range: -200 to +200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Scaling

ANLG OUT 1 GAIN ADJ (P.420)

Only available if the I/O Expansion kit is installed. Adjusts analog output 1 (terminals 54 and 55 on the I/O Expansion board) to allow it to produce a signal from 5.0 to approximately 13.0 VDC. The full scale value (FSV) is determined by the setting of ANLG OUT 1 SELECT.

Parameter Range: 0.500 to 1.300
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG OUT 1 SELECT (P.418), ANLG OUT 1 SIG TYPE (P.419)

This is typically used to adjust the 10 V full scale output to match the input voltage requirement of attached equipment. For example, this parameter would be set to 0.800 to match the requirements of equipment that accepts a 0 to 8 VDC signal. The outputs are only rated to 10 VDC, so gain adjust values greater than 1.000 might cause the analog output circuit to saturate.

ANLG OUT 1 SELECT (P.418)

Only available if the I/O Expansion Kit is installed.
Selects the signal used to drive analog output 1 (terminals 54 and 55 on the I/O Expansion board). When the analog output is at its maximum value, the selected signal is at its full scale value.

Parameter Range: *See table below for parameter options.*
Default Setting: ZERO
Parameter Type: Configurable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: MAXIMUM CURRENT (P.007) MOTOR HOT FLD AMPS (P.510)
MOTOR RATED ARM AMPS (P.008)
MOTOR RATED ARM VOLTS (P.009) TOP SPEED (P.011)

Signal Selected	Full Scale Value
CML FEEDBACK (P.397) CML REFERENCE (P.396) CML ERROR (P.398) SPD LOOP OUTPUT (P.299)	± MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPEED RAMP OUTPUT (P.199) SPEED RAMP INPUT TP (P.198) SPD SOURCE SELECT OUT (P.193) TRIM OUTPUT (P.197) ANALOG TACH FEEDBACK (P.291) PULSE TACH FEEDBACK (P.292) OCL OUTPUT (P.848)	± TOP SPEED
ARMATURE VOLTAGE (P.289)	± MOTOR RATED ARM VOLTS
POWER OUTPUT	± MOTOR RATED ARM VOLTS * MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
FIELD REFERENCE (P.590) FIELD FEEDBACK (P.589)	MOTOR HOT FLD AMPS
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) NETW IN REG 1 (P.905) NETW IN REG 2 (P.906) NETW IN REG 3 (P.907) FULL SCALE	
ZERO	0

ANLG OUT 1 SIG TYPE (P.419)

Only available if the I/O Expansion Kit is installed.
Selects the type of signal to be generated by analog output 1 (terminals 54 and 55 on the I/O Expansion board). This setting must match the settings of jumpers J14 and J15 on the I/O Expansion board.

Parameter Range:	0-10 V, +/-10 V, 4-20 mA
Default Setting:	+/-10 V
Parameter Type:	Configurable
OIM Menu Path(s):	Input/Output - Analog I/O
Refer also to Parameters:	ANLG OUT 1 SELECT (P.418) ANLG OUT 1 GAIN ADJ (P.420)

ANLG OUT 2 GAIN ADJ (P.422)

Only available if the I/O Expansion Kit is installed.
Adjusts analog output 2 (terminals 56 and 57 on the I/O Expansion board) to allow it to produce a signal from 5.0 to approximately 13.0 VDC. The full scale value (FSV) is approximately 13.0 VDC.

Parameter Range:	0.500 to 1.300
Default Setting:	1.000
Parameter Type:	Tuneable
OIM Menu Path(s):	Input/Output - Analog I/O
Refer also to Parameters:	ANLG OUT 2 SELECT (P.421)

This is typically used to adjust the 10 V full scale output to match the input voltage requirement of attached equipment. For example, this parameter would be set to 0.800 to match the requirements of equipment that accepts a +/-8 VDC signal.
The outputs are rated to 10 VDC, so gain adjust values greater than 1.000 might cause the analog output circuit to saturate.
NOTE: Analog output 2 only generates a +10 VDC input signal and cannot be changed.

ANLG TACH VOLTS/1000 (P.203)

The analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM.
Units are volts D-C for D-C tachometers or volts A-C RMS for A-C tachometers.
Note: The use of an A-C tachometer requires the optional A-C Tachometer Feedback kit.

Parameter Range:	18.0 to 200.0 Volts/1000 RPM*
Default Setting:	60 Volts/1000 RPM
Parameter Type:	Configurable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Feedback

*Note: The high limit might be less than 200.0 to prevent the tach voltage from exceeding 250V.

WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

ANLG OUT 2 SELECT (P.421)
Only available if the I/O Expansion Kit is installed.
Selects the signal used to drive analog output 2 (terminals 56 and 57 on the I/O Expansion board). When the analog output is at its maximum value, the selected signal is at is full scale value.

Parameter Range: See table below for parameter options.
Default Setting: ZERO
Parameter Type: Configurable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: MAXIMUM CURRENT (P.007) MOTOR HOT FLD AMPS (P.510)
MOTOR RATED ARM AMPS (P.008)
MOTOR RATED ARM VOLTS (P.009) TOP SPEED (P.011)

Signal Selected	Full Scale Value
CML FEEDBACK (P.397) CML REFERENCE (P.396) CML ERROR (P.398) SPD LOOP OUTPUT (P.299)	± MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPEED RAMP OUTPUT (P.199) SPEED RAMP INPUT TP (P.198) SPD SOURCE SELECT OUT (P.193) TRIM OUTPUT (P.197) ANALOG TACH FEEDBACK (P.291) PULSE TACH FEEDBACK (P.292) OCL OUTPUT (P.848)	± TOP SPEED
ARMATURE VOLTAGE (P.289)	± MOTOR RATED ARM VOLTS
POWER OUTPUT	± MOTOR RATED ARM VOLTS * MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
FIELD REFERENCE (P.590) FIELD FEEDBACK (P.589)	MOTOR HOT FLD AMPS
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) NETW IN REG 1 (P.905) NETW IN REG 2 (P.906) NETW IN REG 3 (P.907) FULL SCALE	
ZERO	0

ARM VOLTAGE GAIN ADJ (P.204)
Used to scale the armature voltage signal after it has been conditioned by the drive hardware.
In most cases, this input will be 1.000.

Parameter Range: 0.750 to 1.250
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Feedback

WARNING
The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

ARM VOLTAGE ZERO ADJ (P.205)

Used to remove any hardware-introduced offset from the armature voltage signal.
In most cases, this input will be set to zero volts.

Parameter Range: -200 to +200 V
Default Setting: 0 V
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD). Feedback

WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

AUTO MODE MIN BYPASS (P.111)

Disables the MINIMUM SPEED limit during AUTO mode. If the drive is in MANUAL mode, this parameter has no effect and the limit cannot be bypassed.

Parameter Range: OFF ON
Default Setting: OFF
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Limits

DANGER

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

AUTO MODE RAMP BYPASS (P.112)

Bypasses the Speed Loop Ramp block (LVTU) during AUTO mode except during a stop condition. If the drive is in MANUAL mode, this parameter has no effect and the ramp cannot be bypassed. When ON and while the drive is in AUTO mode, the Speed Loop Ramp function will be bypassed. The bypass is automatically overridden during a stop command. NOTE: If bypassed, rapid speed change can result.

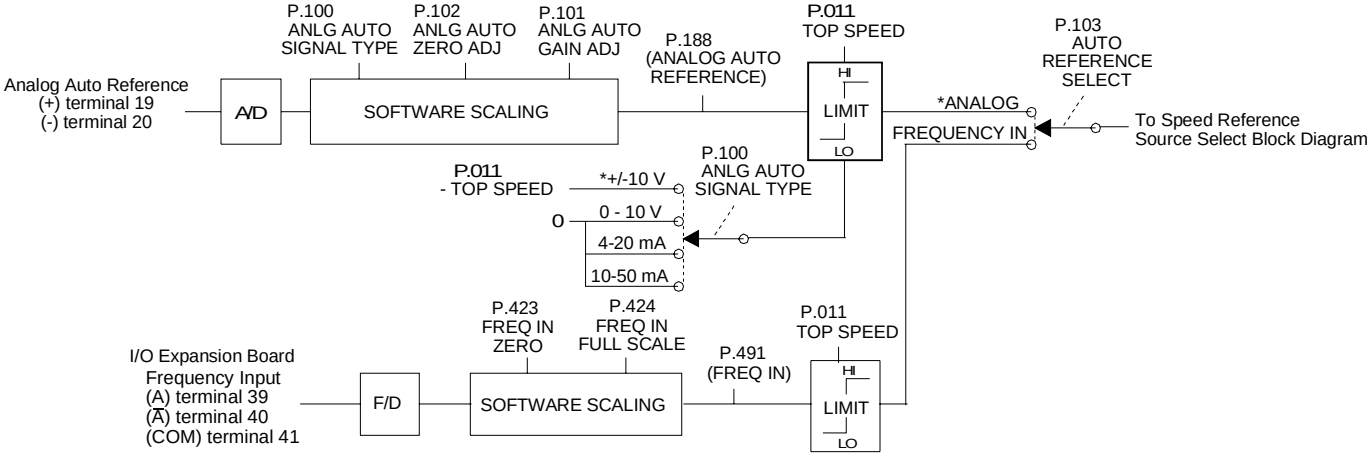
Parameter Range: OFF ON
Default Setting: OFF
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Ramp

AUTO REFERENCE SELECT (P.103)

If the I/O Expansion Kit is not installed, this parameter is automatically set to ANALOG and cannot be changed.
AUTO REFERENCE SELECT determines whether a frequency or analog input reference source is used by the drive when it is operating in auto mode and CONTROL SOURCE SELECT is set to KEYPAD or TERMBLK.

Parameter Range: ANALOG, FREQUENCY IN
Default Setting: ANALOG
Parameter Type: Configurable
OIM Menu Path(s): Drive Reference -Drive Reference Configure
Refer also to Parameters: CONTROL SOURCE SELECT (P.000),
SPD SOURCE SELECT OUT (P.193), TORQUE REFERENCE (P.189)

When the reference source is set to ANALOG, the analog auto input (terminals 19 and 20 on the regulator board) is used. When the source is set to FREQUENCY IN, the frequency input (terminals 39, 40, and 41 on the I/O Expansion board) is used.



CML FEEDBACK GAIN ADJ (P.300)

CML feedback gain adjustment. In most cases, this input will be set for unity gain. The range of this input may be affected by the software scaling factor calculated by the drive. Typically, it will be 1.000.

Parameter Range: 0.900 to 1.100
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - CML Feedback Scaling

CML PI LEAD FREQUENCY (P.302)

Lead break frequency for the CML PI block.

Parameter Range: 10 to 500 rad/s
Default Setting: 100 rad/s
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - CML Tuning

CML PI PROP GAIN (P.301)

Proportional gain for the CML PI block.

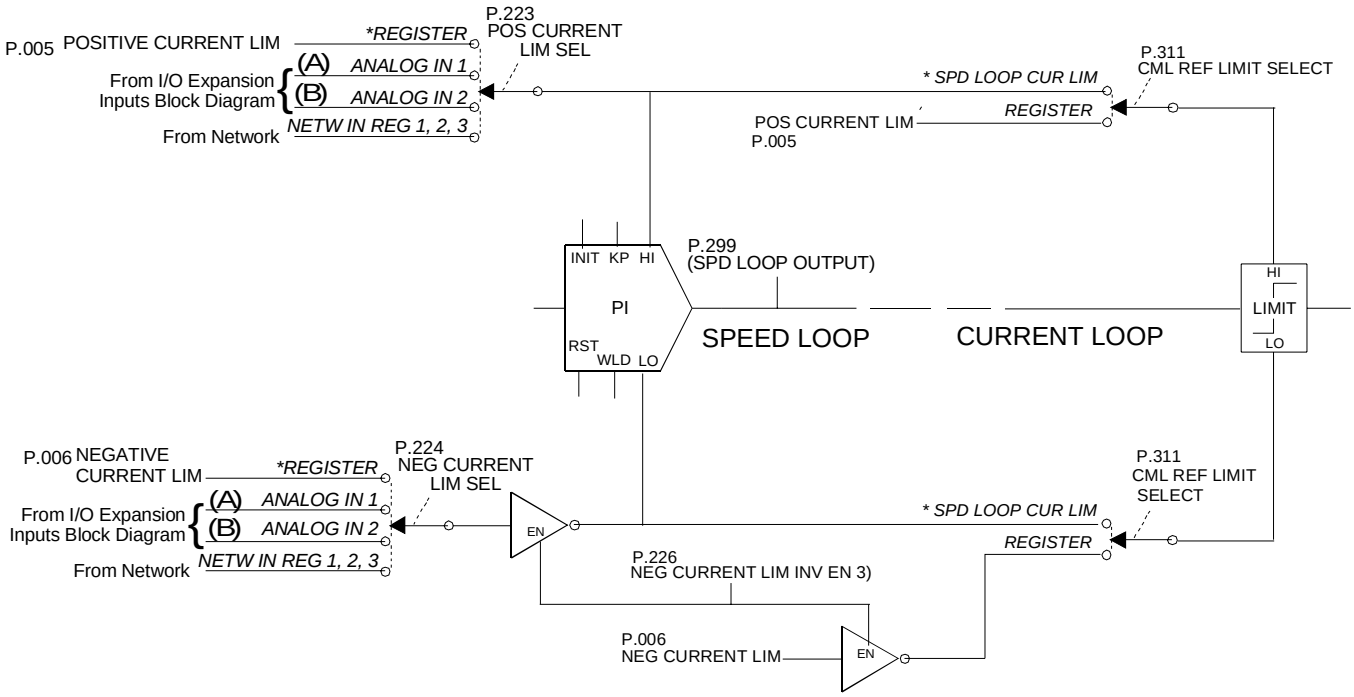
Parameter Range: 0.000 to 4.000
Default Setting: 0.250
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - CML Tuning

CML REF LIMIT SELECT (P.311)

Selects the source for the CML positive and negative current limits.

Parameter Range: 1 = SPD LOOP PI LIMITS
2 = REGISTER
Default Setting: 1
Parameter Type: Configurable
OIM Menu Path(s): Additional Parameters

See POSITIVE CURRENT LIM (P.005) and NEGATIVE CURRENT LIM (P.006) for information regarding the operation of the current limit registers.



CML REF RATE LIMIT (P.303)

Minimum allowable time for selected CML reference to change from zero to MAXIMUM CURRENT.

Parameter Range: 1 to 1000 msec
Default Setting: 40 msec
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - CML Tuning

CNI PROG/RUN MODE (P.915) (not available in SW-version 4.1)

CNI = ControlNet Interface (optional card). Selects how the drive responds when communicating with a PLC while it is in program mode. The drive will not be ready while in the program mode if this parameter is set to *STOP*.

Parameter Range: 1 = STOP,
2 = NOT STOP
Default Setting: 1 = STOP
Parameter Type: Configurable
OIM Menu Path(s): Additional Parameters

CONTROL SOURCE SELECT (P.000)

This parameter is only available on the Drive Configuration Module (DCM). It is a key on the OIM. CONTROL SOURCE SELECT selects the source for the drive control signal. The control source options are KEYPAD, SERIAL, TERMBLK, or NETWORK. If the drive is configured as a current (torque) regulator (jumper J15 is set to current), only TERMBLK or NETWORK can be selected.

Parameter Range: KEYPAD, SERIAL, TERMBLK, NETWORK
Default Setting: KEYPAD
Parameter Type: Configurable
Menu Path(s): Key CSS on the OIM.

- When KEYPAD is selected, the OIM keys control the drive and the OIM drive reference is used. The KEYPAD REF value (displayed on the first monitor mode screen) is used as the drive reference.
- When TERMBLK is selected, the signals at the regulator board terminals 16 through 20 are used for control. See section 3 for information on wiring the terminal strip.
- When NETWORK is selected, the Control is through a network such as the AutoMax Network Communication kit, DeviceNet Interface kit, or ControlNet Network Communication kit.
- When SERIAL is selected, control is through a personal computer running the CS3000 software.

Important: When switching the control source from NETWORK to any other option, the internal multiplexer selection parameters that use NETW IN REG 1, 2, and 3, are not affected. Therefore, any selection that was set to NETW IN REG# will remain, and the data in NETW IN REG 1, 2, 3 will be the value used in the control path. (Note that these parameters contain the last data received from the network before the control source was switched and will no longer be updated from the network.) To change this, you must reconfigure any affected selection parameters.

CT TURNS RATIO (P.010)

Parameter Range: 1 to 32767
Default Setting: Depending on unit type
Parameter Type: Configurable
OIM Menu Path(s): Current Minor Loop (CML) - CML Feedback Scaling

CAUTION:
This parameter is also used in the calculation of the burden resistor value. Do not adjust/change the value of this parameter from its factory default value unless you are replacing the regulator board. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The drive current transformer turns ratio (Tp/Tn):

- 25 A Unit: 208
- 60 A Unit: 416
- 150 A Unit: 833
- 250 A Unit: 2000
- 450 A Unit: 3000
- 800 A Unit: 5230
- 1200 A Unit: 8000
- 1600-2000 A Unit: 10500

CURRENT COMPOUNDING (P.209)

Sets the level of current compounding to be used during any mode of drive operation.

Parameter Range: -50% to + 50%
Default Setting: 0%
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed Voltage Loop (SPD) Tuning

DECELERATION TIME (P.002)

Selects the time it takes to decelerate from TOP SPEED to 0. Smaller changes in speed take proportionately less time.
If TRIM MODE SELECT is set to PROPORTIONAL, this time value is modified by DRAW PERCENTAGE OUT.

Parameter Range:	0.1 to 300.0 seconds
Default Setting:	5.0 seconds
Parameter Type:	Tuneable
OIM Menu Path(s):	Drive Reference - Drive Reference Ramp Quick Start
Refer also to Parameters:	DRAW PERCENTAGE OUT (P.196) ANLG AUTO ZERO ADJ (P.102) TOP SPEED (P.011) TRIM MODE SELECT (P.110) RAMP STOP DECEL TIME (P.018)

DEVICENET POLL MSG (P.913)

Selects which predefined set of data will be part of the DeviceNet poll connection command/response messages. The amount of data transmitted in the CONTROL ONLY poll message type allows greater network density and performance. The larger amount of data transmitted in the CONTROL+CONFIG poll message type allows some degree of drive configuration but decreases the network scan rate.

Parameter Range:	CONTROL ONLY, CONTROL+CONFIG
Default Setting:	CONTROL ONLY
Parameter Type:	Configurable

If the AutoMax Network Communication board is being used, this parameter has no effect.

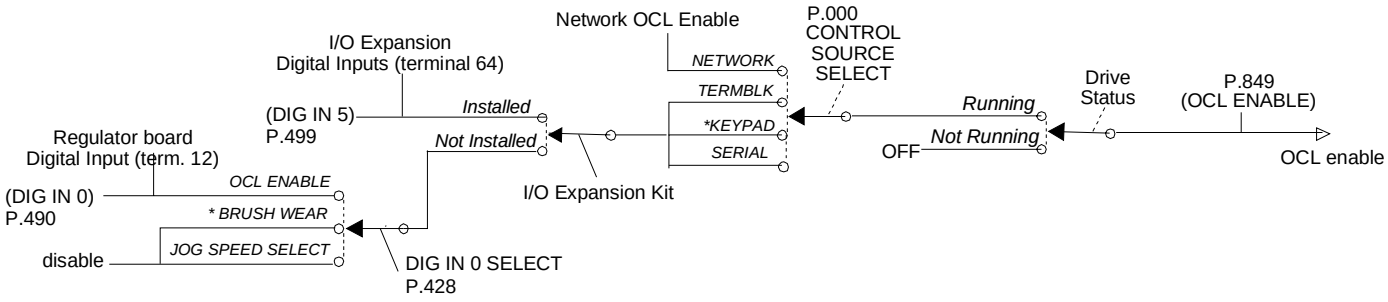
DIG IN 0 SELECT (P.428)

Determines which function is controlled by DIG IN 0 (Regulator board terminal 12).

Parameter Range:	1 = BRUSH WEAR, 2 = JOG SPEED SELECT 3 = OCL ENABLE
Default Setting:	1
Parameter Type:	Configurable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameters:	DIG IN 0 (P.490)

The functions can be:

- BRUSH WEAR: To use this option, a brush wear indicator device must be installed. If the input is OFF, the MOTOR BRUSH WEAR LOW alarm is generated.
- JOG SPEED SELECT: The input determines whether JOG SPEED 1 (P.012) or JOG SPEED 2 (P.017) will be used when the drive is jogging.
- OCL ENABLE: Enables the outer control loop if CONTROL SOURCE SELECT is not set to NETWORK and if the I/O Expansion kit is not installed.



DIG OUT 1 CONTACT TYP (P.410)

Only available if the I/O Expansion Kit is installed. Selects whether digital output 1 (terminals 66 and 67 on I/O Expansion board) is normally open or normally closed.

Parameter Range:	NORMAL OPEN	NORMAL CLOSED
Default Setting:	NORMAL OPEN	
Parameter Type:	Configurable	
OIM Menu Path(s):	Input/Output - Digital I/O	
Refer also to Parameters:	DIG OUT 1 SELECT (P.409)	

If NORMAL OPEN is selected, digital output 1 is open when the signal is off and closed when it is on. If NORMAL CLOSED is selected, digital output 1 is closed when the signal is off and open when on.

DANGER

On a power cycle or reset, the contact is held at normally open until the drive software is initialized. Make sure that this condition does not result in a dangerous situation for your application. Failure to observe this precaution can result in severe bodily injury or loss of life.

DIG OUT 1 SELECT (P.409)

Only available if the I/O Expansion Kit is installed. NETW IN REG 1, 2, or 3: Bit 0 of NETW IN REG 1 (P.905), 2 (P.906), or 3 (P.907) is used to drive digital output 1 (terminals 66 and 67 on the I/O Expansion board). Note that the network input registers are updated only when CONTROL SOURCE (P.000) is set to NETWORK and the network is active.

DANGER

This output is intended for use as an indication. If it is used as a control source, a dangerous condition can result. Failure to observe this precaution can result in severe bodily injury or loss of life.

Parameter Range:	LEVEL DETECT 1 OUTPUT,	LEVEL DETECT 2 OUTPUT
	IN CURRENT LIMIT,	DRIVE READY
	NETW COMM STATUS,	NETW IN REG 1 (bit 0)
	NETW IN REG 2 (bit 0),	NETW IN REG 3 (bit 0)
Default Setting:	LEVEL DETECT 1 OUTPUT	
Parameter Type:	Configurable	
OIM Menu Path(s):	Input/Output - Digital I/O	
Refer also to Parameters:	LEVEL DETECT 1 OUTPUT (P.648),	
	LEVEL DETECT 2 OUTPUT (P.649)	
	NETW COMM STATUS (P.908),	NETW IN REG 1 (P.905)
	NETW IN REG 2 (P.906),	NETW IN REG 3 (P.907)

DIG OUT 2 CONTACT TYP (P.412)

Only available if the I/O Expansion Kit is installed. Selects whether digital output 2 (terminals 68 and 69 on the I/O Expansion board) is normally open or normally closed.

Parameter Range:	NORMAL OPEN,	NORMAL CLOSED
Default Setting:	NORMAL OPEN	
Parameter Type:	Configurable	
OIM Menu Path(s):	Input/Output - Digital I/O	
Refer also to Parameters:	DIG OUT 2 SELECT (P.411)	

If NORMAL OPEN is selected, digital output 2 is open when the signal is off and closed when it is on. If NORMAL CLOSED is selected, digital output 2 is closed when the signal is off and open when it is on.

DANGER

On a power cycle or reset, the contact is held at normally open until the drive software is initialized. Make sure that this condition does not result in a dangerous situation for your application. Failure to observe this precaution can result in severe bodily injury or loss of life.

DIG OUT 2 SELECT (P.411)

Only available if the I/O Expansion Kit is installed. NETW IN REG 1, 2, or 3: Bit 1 of NETW IN REG 1 (P.905), 2 (P.906), or 3 (P.907) is used to drive digital output 2 (terminals 68 and 69 on the I/O Expansion board). Note that the network input registers are updated only when CONTROL SOURCE (P.000) is set to NETWORK and the network is active.

DANGER

This output is intended for use as an indication. If it is used as a control source, a dangerous condition can result. Failure to observe this precaution can result in severe bodily injury or loss of life.

Parameter Range:	LEVEL DETECT 1 OUTPUT, LEVEL DETECT 2 OUTPUT, IN CURRENT LIMIT, DRIVE READY, NETW COMM STATUS, NETW IN REG 1 (bit 1), NETW IN REG 2 (bit 1), NETW IN REG 3 (bit 1),
Default Setting:	LEVEL DETECT 2 OUTPUT
Parameter Type:	Configurable
OIM Menu Path(s):	Input/Output - Digital I/O
Refer also to Parameters:	LEVEL DETECT 1 OUTPUT (P.648), LEVEL DETECT 2 OUTPUT (P.649) NETW COMM STATUS (P.908), NETW IN REG 2 (P.906), NETW IN REG 3 (P.907)

ENHANCED FLD VOLT ADJ (P.500)

Adjusts the field output voltage if the Enhanced Field Supply is used. (This parameter does not effect the operation of the standard or current regulated field supplies).

Parameter Range:	0 to 180 (J21 set to B-C)
Default Setting:	84 V
Parameter Type:	Tuneable
OIM Menu Path(s):	Field - Standard/enhanced Field Supply
Refer also to Parameters:	FLD CURRENT REGULATOR (P.586).

Increasing ENHANCED FLD VOLT ADJ causes the voltage at the 3C and 3D terminals to increase; decreasing decreases the output voltage. This parameter has no effect when the output parameter FIELD ECONOMY ACTIVE = ON (i.e., when the drive is in field economy). This parameter is not available if the Field Current Regulator is installed.

FEEDBACK SELECT (P.200)

Selects the type of feedback signal that is used for the speed/voltage loop. PULSE TACH can be selected only if a pulse tachometer kit is installed.
NEGATIVE CURRENT LIM is set to 0 and REVERSE DISABLE is set ON if:

- AC TACH is selected.
- PULSE TACH is selected and PULSE TACH QUAD is set OFF.

Parameter Range:	ARMATURE VOLT, DC TACH, PULSE TACH, AC TACH
Default Setting:	ARMATURE VOLT
Parameter Type:	Configurable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed Voltage Loop (SPD) Feedback Quick Start
Refer also to Parameters:	NEGATIVE CURRENT LIM (P.006), REVERSE DISABLE (P.015)

WARNING

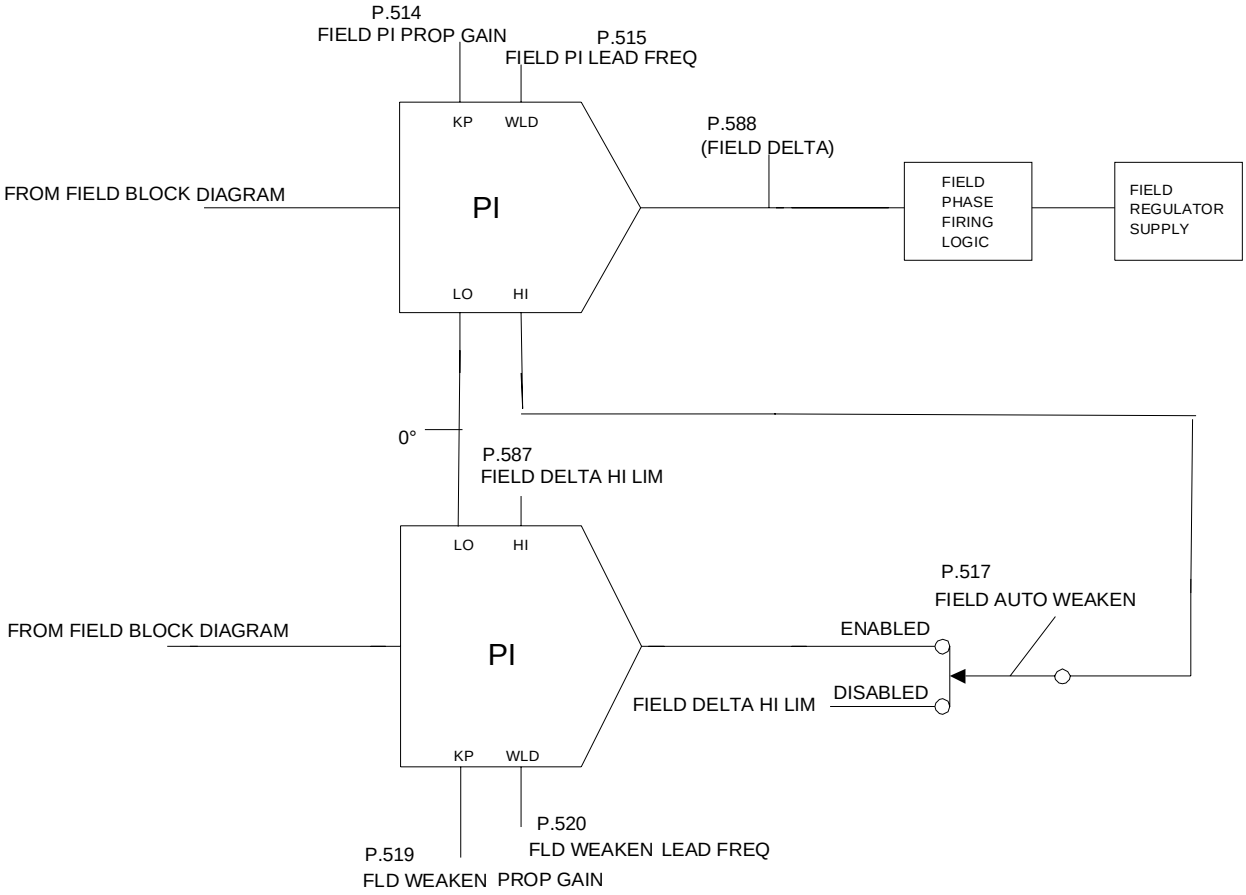
The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

FIELD AUTO WEAKEN (P.517)

Only available if the Field Current Regulator Kit is installed.
Enables or disables field weakening by the field control loop. When it is disabled, the field current PI block high limit is fixed at 1805. If FEEDBACK SELECT is set to ARMATURE VOLT, this is automatically set to DISABLED and cannot be changed.

Parameter Range:	DISABLED, ENABLED
Default Setting:	DISABLED
Parameter Type:	Configurable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Configure
Refer also to Parameters:	ARMATURE VOLTAGE (P.289) FEEDBACK SELECT (P.200) FLD WEAKEN THRESHOLD (P.518) FLD WEAKEN PROP GAIN (P.519) FLD WEAKEN LEAD FREQ (P.520)

When ARMATURE VOLTAGE exceeds FLD WEAKEN THRESHOLD and the field begins to weaken, the field control loop regulates armature voltage. ARMATURE VOLTAGE and FLD WEAKEN THRESHOLD try to maintain a zero input to the first PI block.
If armature voltage increases, a negative value is input to the PI block. This results in a lower current input into the next PI block. This in turn lowers the armature voltage, lowering the input to the first PI block so that it is closer to zero. The field control loop only affects armature voltage control if a tachometer is used and if FIELD AUTO WEAKEN is set to ENABLED.



FIELD DELTA HIGH LIM (P.587)

High limit of the field current PI block. See FIELD AUTO WEAKEN for block diagram.

Parameter Range: 0 to 180 Degree
Default Setting: 130 Degree
Parameter Type: Configurable
OIM Menu Path(s): Field - Field Current Regulator - Field Loop Test Points
Refer also to Parameters: FIELD AUTO WEAKEN (P.517)

FIELD ECONOMY DELAY (P.501)

After the motor stops, the drive maintains full field for FIELD ECONOMY DELAY minutes before entering field economy. When the motor starts again, the drive immediately returns to full field. FIELD ECONOMY DELAY has no effect on the operation of the standard field supply. Field economy cannot be disabled.

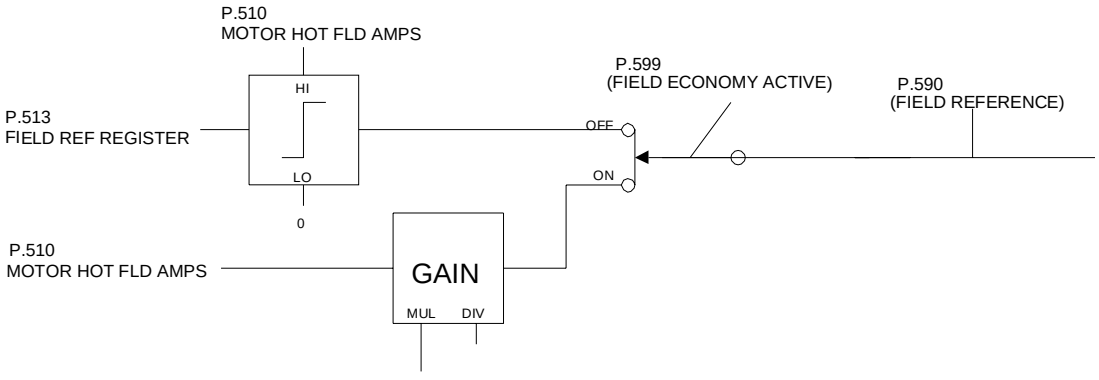
Parameter Range: 0 to 27 minutes
Default Setting: 5 minutes
Parameter Type: Tuneable
OIM Menu Path(s): Field - Standard/Enhanced Field Supply
Field - Field Current Regulator - Field Loop Configure

FIELD ECONOMY REF (P.511)

Only available if the Field Current Regulator Kit is installed.
The percentage of MOTOR HOT FLD AMPS set as a reference for field economy mode.
This parameter must be set above the FIELD LOSS THRESHOLD value to avoid field loss faults.
Field economy becomes active after the delay specified by FIELD ECONOMY DELAY from the time the motor stops. The drive enters field economy when first powered up. FIELD ECONOMY ACTIVE indicates when field economy is active.

Parameter Range: 0 to 100%
Default Setting: 0%
Parameter Type: Tuneable
OIM Menu Path(s): Field - Field Current Regulator - Field Loop Configure
Refer also to Parameters: FIELD ECONOMY ACTIVE (P.599), FIELD ECONOMY DELAY (P.501), FIELD LOSS THRESHOLD (P.512), FIELD REF REGISTER (P.513), MOTOR HOT FLD AMPS (P.510)

WARNING
The incorrect setting of this parameter can cause a motor overvoltage condition.
Set MOTOR HOT FLD AMPS to the motor's nameplate value. Make sure FIELD ECONOMY REF and/or FIELD REF REGISTER (P.513) is above FIELD LOSS THRESHOLD (P.512).
Failure to observe this precaution can result in bodily injury and damage to the equipment.



FIELD LOSS THRESHOLD (P.512)

Only available if the Field Current Regulator kit is installed.
The value that is compared to FIELD FEEDBACK (P.589) to check for field loss. FIELD LOSS THRESHOLD is set as a percentage of MOTOR HOT FLD AMPS (P.510). It is usually set to 85% of the motor nameplate value of field weaken.

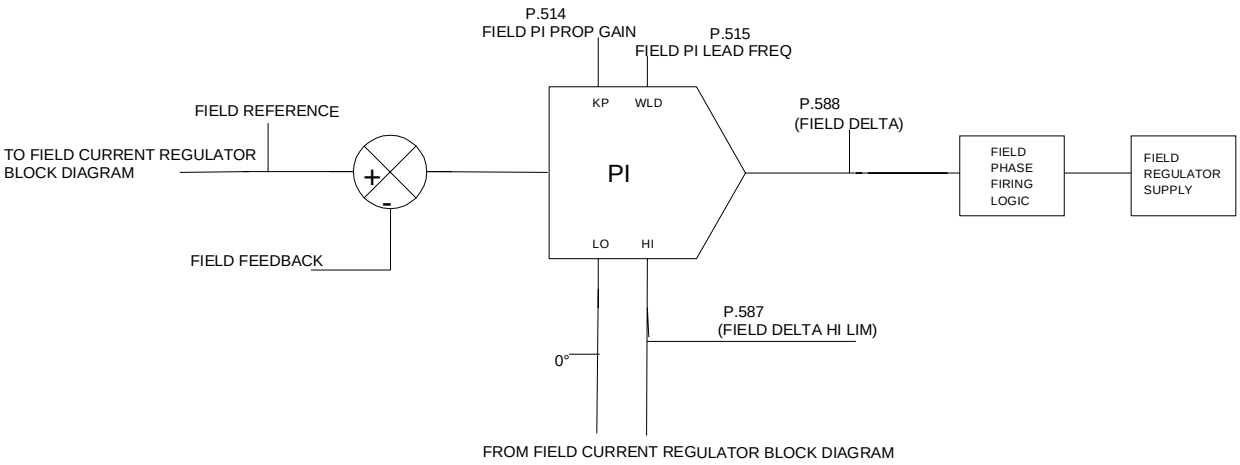
Parameter Range:	Armature voltage regulators: 50 to 100% of MOTOR HOT FLD AMPS Speed regulators: 0 to 100% of MOTOR HOT FLD AMPS
Default Setting:	60% of MOTOR HOT FLD AMPS
Parameter Type:	Configurable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Configure
Refer also to Parameters:	FIELD ECONOMY ACTIVE (P.599), FIELD ECONOMY REF (P.511), FIELD FEEDBACK (P.589), MOTOR HOT FLD AMPS (P.510)

WARNING
The incorrect setting of this parameter can cause a motor overvoltage condition.
Set MOTOR HOT FLD AMPS to the motor's nameplate value. Make sure FIELD ECONOMY REF and/or FIELD REF REGISTER (P.513) is above FIELD LOSS THRESHOLD (P.512).
Failure to observe this precaution can result in bodily injury and damage to the equipment.

FIELD PI LEAD FREQ (P.515)

Only available if the Field Current Regulator is installed.
Lead frequency for the field current PI block.

Parameter Range:	0.01 to 56.50 rad/s
Default Setting:	1.50 rad/s
Parameter Type:	Tuneable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Tuning
Refer also to Parameters:	FIELD PI PROP GAIN (P.514)



FIELD PI PROP GAIN (P.514)

Only available if the Field Current Regulator kit is installed.
Proportional gain setting for the field current PI block. See FIELD PI LEAD FREQ for block diagram.

Parameter Range:	0.01 to 128.00
Default Setting:	0.50
Parameter Type:	Tuneable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Tuning
Refer also to Parameters:	FIELD PI LEAD FREQ (P.515)

FIELD REF REGISTER (P.513)

Only available if the Field Current Regulator kit is installed.
Current reference for the field control loop field. This is the field current reference when the drive is not in field economy. See MOTOR HOT FLD AMPS for the block diagram.

Parameter Range: 0 to MOTOR HOT FLD AMPS
Default Setting: MOTOR HOT FLD AMPS
Parameter Type: Tuneable
OIM Menu Path(s): Field - Field Current Regulator - Field Loop Tuning
Refer also to Parameters: MOTOR HOT FLD AMPS (P.510)

FIELD REF SELECT (P.521)

Selects the reference source for a field current regulator. A field current regulator must be installed for this parameter to be effective. An I/0 expansion kit must be installed to select ANALOG IN 1or ANALOG IN 2.
REGISTER is the FIELD REF REGISTER (P.513) network register. (Drop_1, register 37).

Parameter Range: 1 = REGISTER
2 = ANALOG MAN TRIM REF
3 = ANALOG IN 1
4 = ANALOG IN 2.
Default Setting: 1
Parameter Type: Configurable
OIM Menu Path(s): Additional Parameters

FLD FEEDBACK GAIN ADJ (P.516)

Only available if the Field Current Regulator kit is installed.
Gain adjustment for the field feedback. See MOTOR HOT FLD AMPS for the block diagram.
In most cases, this will be set for unity gain, typically 1.000.

Parameter Range: 0.90 to 1.100
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Field - Field Current Regulator - Field Loop Feedback Scaling
Refer also to Parameters: FIELD FEEDBACK (P.589)
MOTOR HOT FLD AMPS (P.510)

FLD WEAKEN LEAD FREQ (P.520

Only available if the Field Current Regulator kit is installed.
PI block lead frequency of the field control loop's armature voltage regulator.
See FIELD AUTO WEAKEN for the block diagram.

Parameter Range: 0.01 to 56.50 rad/s
Default Setting: 0.50 rad/s
Parameter Type: Tuneable
OIM Menu Path(s): Field - Field Current Regulator - Field Loop Tuning
Refer also to Parameters: FIELD AUTO WEAKEN (P.517)
FLD WEAKEN PROP GAIN (P.519)

FLD WEAKEN PROP GAIN (P.519)

Only available if the Field Current Regulator kit is installed.
The proportional gain of the field control loop's armature voltage regulator.
See FIELD AUTO WEAKEN for the block diagram.

Parameter Range:	0.01 to 128.00
Default Setting:	1.60
Parameter Type:	Tuneable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Tuning
Refer also to Parameters:	FIELD AUTO WEAKEN (P.517)
	FLD WEAKEN LEAD FREQ (P.520)

FLD WEAKEN THRESHOLD (P.518)

Only available if the Field Current Regulator kit is installed.
Sets the point at which the field control loop begins regulating armature voltage and the field begins to weaken. If IR compensation is used, the effective threshold is FLD WEAKEN THRESHOLD less IR COMPENSATION at rated armature current. See FIELD AUTO WEAKEN for the discussion and block diagram.

Parameter Range:	0 to 120% of MOTOR RATED ARM VOLTS
Default Setting:	95% of MOTOR RATED ARM VOLTS
Parameter Type:	Tuneable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Tuning
Refer also to Parameters:	ARMATURE VOLTAGE (P.289)
	FIELD AUTO WEAKEN (P.517)
	IR COMPENSATION.(P.206)
	MOTOR RATED ARM VOLTS (P.009)

FREQ IN FULL SCALE (P.424)

Only available if the I/O Expansion kit is installed.
Specifies the maximum input frequency. This is the frequency that corresponds to a full scale value. For example, if the frequency input will be used as the speed loop reference (selected by AUTO REFERENCE SELECT, P.103), this input frequency would correspond to TOP SPEED (P.011), because TOP SPEED is the basis for speed loop scaling.

Parameter Range:	2.0 to 250.0 kHz
Default Setting:	250.0 kHz
Parameter Type:	Configurable
OIM Menu Path(s):	Input/Output - Frequency I/O
Refer also to Parameters:	FREQ IN (P.491)
	FREQ IN ZERO (P.423)

FREQ IN ZERO (P.423)

Only available if the I/O Expansion kit is installed.
Specifies the minimum input frequency. This is the frequency that corresponds to a value of zero. If the input frequency drops below the frequency specified by this input parameter, the resulting digital value remains zero (it will not go negative).

Parameter Range:	2.0 to FREQ IN FULL SCALE kHz
Default Setting:	2.0 kHz
Parameter Type:	Configurable
OIM Menu Path(s):	Input/Output - Frequency I/O
Refer also to Parameters:	FREQ IN FULL SCALE (P.424)

FREQ OUT FULL SCALE (P.427)

Only available if the I/O Expansion kit is installed.
The frequency generated when the signal driving the frequency output is at full scale.
For example, if FREQ OUT SELECT is set to CML FEEDBACK, the frequency specified by this parameter is output when the armature current is at MAXIMUM CURRENT (MAXIMUM CURRENT is used as the basis for current minor loop scaling).

Parameter Range: 2.0 to 250.0 kHz
Default Setting: 250.0 kHz
Parameter Type: Configurable
OIM Menu Path(s): Input/Output - Frequency I/O
Refer also to Parameters: FREQ OUT SELECT (P.425), MAXIMUM CURRENT (P.007)

FREQ OUT SELECT (P.425)

Only available if the I/O Expansion Kit is installed.
Selects the signal that drives the frequency output (terminals 42, 43, and 44 on the I/O Expansion board). When the frequency output is at its maximum value, the selected signal is at its full scale value.

Parameter Range: See table below for parameter options.
Default Setting: ZERO
Parameter Type: Configurable
OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: MAXIMUM CURRENT (P.007), MOTOR HOT FLD AMPS (P.510), MOTOR RATED ARM AMPS (P.008), MOTOR RATED ARM VOLTS (P.009), TOP SPEED (P.011)

Signal Selected	Full Scale Value
CML FEEDBACK (P.397) CML REFERENCE (P.396) CML ERROR (P.398) SPD LOOP OUTPUT (P.299)	± MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPEED RAMP OUTPUT (P.199) SPEED RAMP INPUT TP (P.198) SPD SOURCE SELECT OUT (P.193) TRIM OUTPUT (P.197) ANALOG TACH FEEDBACK (P.291) PULSE TACH FEEDBACK (P.292) OCL OUTPUT (P.848)	± TOP SPEED
ARMATURE VOLTAGE (P.289)	± MOTOR RATED ARM VOLTS
POWER OUTPUT	± MOTOR RATED ARM VOLTS * MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
FIELD REFERENCE (P.590) FIELD FEEDBACK (P.589)	MOTOR HOT FLD AMPS
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) NETW IN REG 1 (P.905) NETW IN REG 2 (P.906) NETW IN REG 3 (P.907) FULL SCALE	
ZERO	0

FREQ OUT ZERO (P.426)

Only available if the I/O Expansion kit is installed.
The frequency generated when the signal driving the frequency output is zero.
If the signal goes negative, the frequency output maintains the frequency set by this parameter.

Parameter Range:	2.0 to FREQ OUT FULL SCALE kHz
Default Setting:	2.0 kHz
Parameter Type:	Configurable
OIM Menu Path(s):	Input/Output - Frequency I/O
Refer also to Parameters:	FREQ OUT FULL SCALE (P.427)

I**NERTIA COMP SELECT (P.221)**

Selects the source of the inertia compensation signal.
The analog input choices are only available if the I/O Expansion kit is installed.
The NETWORK choices are only available if the Network kit is installed.
Note that the network input registers are updated only when CONTROL SOURCE (P.000) is set to NETWORK and the network is active. When INTERNAL is selected, the inertia compensation signal is generated by scaling the rate output from the speed/voltage loop S-curve block based on the combined inertia of the motor and its connected load.

Parameter Range:	NONE, INTERNAL, ANALOG IN 1, ANALOG IN 2, NETW IN REG 1, NETW IN REG 2, NETW IN REG 3
Default Setting:	NONE
Parameter Type:	Configurable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning
Refer also to Parameters:	NORMALIZED INERTIA (P.222)

INV FAULT AVOID SEL (P.312)

Determines how the drive responds to a potential (or probable) inverting fault condition.

Refer to the table on the next page for initiated actions depending on parameter settings.

Parameter Range:	1 = DISABLED, 2 = FAULT IMMEDIATELY, 3 = DELAY BEFORE FAULT
Default Setting:	DISABLED
Parameter Type:	configurable
OIM Menu Path(s):	Additional parameters

ATTENTION:	When activated, inverting fault avoidance takes control of the Current Minor Loop either by forcing the current reference to zero (if the drive is regenerating) or by disabling the regenerative bridge (if the drive is not regenerating). You must analyze your application to determine whether or not inverting fault avoidance should be used.
ATTENTION:	Enabling the inverting fault avoidance logic does not guarantee that an inverting fault is prevented in all instances. Therefore on regenerating drives super fast armature fuses (according to chapter 8) must be provided.

INV FAULT AVOID SEL (P.312) settings and action taken when drive detects conditions that could lead to an inverting fault.

Parameter Setting	Is Drive Regenerating or Attempting to Regenerate?	Drive Action
DISABLED	n/a	None
FAULT IMMEDIATELY	Yes	• immediately stops (coast/DB) • generates the fault F00015 (INVERTING FAULT AVOIDED).
FAULT IMMEDIATELY	No (drive is motoring)	• generates the alarm A00005 (INVERTING FAULT AVOIDED). • continues normal operation on the motoring bridge until a request to regenerate is detected. • When a request to regenerate is detected, the drive immediately stops (coast/DB) and generates the fault F00015 (INVERTING FAULT AVOIDED)
DELAY BEFORE FAULT	Yes	• Immediately forces the Current Minor Loop reference to zero • Logs the alarm A0005 (INVERTING FAULT AVOIDED) • Continues to operate normally for up to two seconds. The drive can generate a motoring current as needed but will coast while a demand for regenerative current exists. • If the demand for regenerative current persists for more than two seconds, the drive: - stops (coast/DB) and - generates the fault F00015 (INVERTING FAULT AVOIDED). • If the conditions that caused the alarm return to normal within two seconds, the drive returns to normal operation (the regenerative bridge will be re-enabled) without stopping.
DELAY BEFORE FAULT	No (drive is motoring)	• Logs the alarm A0005 (INVERTING FAULT AVOIDED). • Continues normal operation on the motoring bridge until a request to regenerate is detected. • When a request to regenerate is detected, the drive continues to operate normally for up to two seconds. The drive can generate a motoring current as needed but will coast while a demand for regenerative current exists. • If the demand for regenerative current persists for approximately two seconds, the drive: - stops (coast/DB) - generates the fault F00015 (INVERTING FAULT AVOIDED). • If the conditions that caused the alarm return to normal within two seconds, the drive returns to normal operation (the regenerative bridge will be re-enabled) without stopping.

IR COMPENSATION (P.206)

Sets the armature voltage loss compensation value used when the drive is configured as a voltage regulator. This parameter is also used by the field current regulator to set the field weakened threshold.

Parameter Range: 0 to 50% of MOTOR RATED ARM AMPS (P.008)
Default Setting: 0%
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Spd/Volt Loop (SPD) Tuning - Quick Start Field - Field Current Regulator - Field Loop Tuning

JOG ACCEL/DECEL TIME (P.013)

Sets the time it takes the jog reference circuit to reach TOP SPEED from zero.
The S-CURVE ROUNDING parameter does not affect the setting of this parameter.

Parameter Range:	0.1 to 300.0 seconds (actual minimum setting based on connected inertia)
Default Setting:	3.0 seconds
Parameter Type:	Tuneable
OIM Menu Path(s):	Drive Reference - Drive Reference Ramp - Quick Start

JOG OFF DELAY TIME (P.121)

The minimum delay between removing the jog input and opening the contactor.
Release of the Jog input will not cause the contactor to open until the speed feedback is less than or equal to STOP SPEED THRESHOLD or until the JOG OFF DELAY TIME has been exceeded, whichever occurs last. The purpose of this delay is to reduce the wear on the contactor when repeatedly opening and closing the JOG input in a short period of time.

Parameter Range:	0.0 to 10.0 seconds
Default Setting:	1.0 seconds
Parameter Type:	Configurable
OIM Menu Path(s):	Drive Reference - Drive Reference Configure
Refer also to Parameters:	JOG ACCEL/DECEL TIME (P.013) JOG SPEED 1 (P.012) JOG SPEED 2 (P.017), STOP SPEED THRESHOLD (P.113)

JOG SPEED 1 (P.012)

The operating speed while the drive is in jogging.

Parameter Range:	0 to MAXIMUM SPEED (RPM or user-defined units)
Default Setting:	250 (RPM or user-defined units)
Parameter Type:	Tuneable
OIM Menu Path(s):	Drive Reference - Drive Reference Configure - Quick Start
Refer also to Parameter:	DIG IN 0 SELECT(P.428), JOG SPEED 2 (P.017)

If DIG IN 0 SELECT (P.428) is set to JOG SPEED SELECT, this parameter is used when DIG IN 0 (regulator terminal 12) is OFF.

if DIG IN 0 SELECT is not set to JOG SPEED SELECT only JOG SPEED 1 (P.012) is used.

JOG SPEED 2 (P.017)

The operating speed when the drive is jogging. If DIG IN 0 SELECT (P.428) is set to JOG SPEED SELECT and DIG IN 0 (regulator terminal 12) is ON. Switching between the two jog speeds while jogging will cause the drive to accelerate or decelerate to the new jog speed at the rate set by JOG ACCEL/DECEL TIME (P.013). JOG SPEED 1 will be used for all other choices of DIG IN 0 SELECT.

Parameter Range:	0 to MAXIMUM SPEED (RPM or user-defined units)
Default Setting:	250 (RPM or user-defined units)
Parameter Type:	Tuneable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameter:	DIG IN 0 SELECT(P.428), JOG SPEED 1 (P.012)

LEVEL DETECT 1 DELAY (P.604)

The delay time in seconds for the level detector 1 circuit. Sets the amount of time between when the level detector timer is triggered and when the output is set on. If the input source signal goes below the detector's threshold value, the timer is immediately reset. See LEVEL DETECT 1 SELECT for diagram.

Parameter Range:	0.0 to 300.0 seconds
Default Setting:	10.0 seconds
Parameter Type:	Tuneable
OIM Menu Path(s):	Input/Output - Level Detectors
Refer also to Parameters:	DIG OUT 1 SELECT (P.409), DIG OUT 2 SELECT (P.411) LEVEL DETECT 1 OUTPUT (P.648), LEVEL DETECT 1 SELECT (P.602) LEVEL DETECT 1 THRESH (P.603)

LEVEL DETECT 1 SELECT (P.602)

Selects the signal that drives level detector 1.

Parameter Range:	SPD SOURCE SELECT OUT, SPEED RAMP OUTPUT, CML FEEDBACK	SPEED RAMP INPUT TP, SPD LOOP FEEDBACK,
Default Setting:	SPD LOOP FEEDBACK	
Parameter Type:	Configurable	
OIM Menu Path(s):	Input/Output - Level Detectors	
Refer also to Parameters:	LEVEL DETECT 1 THRESH (P.603), LEVEL DETECT 1 DELAY (P.604), LEVEL DETECT 1 OUTPUT (P.648)	

LEVEL DETECT 1 THRESH (P.603)

The threshold for level detector 1. See LEVEL DETECT 1 SELECT for block diagram.
When the absolute value of the signal driving level detector 1 is greater than or equal to this threshold, the associated timer starts. If the input signal is less than this threshold, the timer is immediately reset and the level detector output is set to off.

Parameter Range:	0.1 to 100.0% or MAXIMUM CURRENT %*
Default Setting:	10.0%
Parameter Type:	Tuneable
OIM Menu Path(s):	Input/Output - Level Detectors
Refer also to Parameters:	LEVEL DETECT 1 DELAY (P.604), LEVEL DETECT 1 OUTPUT (P.648), LEVEL DETECT 1 SELECT (P.602), MAXIMUM CURRENT (P.007)

*The parameter range for the level detector is automatically rescaled for speed or current based on the input selected by LEVEL DETECT 1 SELECT. If CML FEEDBACK is selected for LEVEL DETECT 1 SELECT, the parameter range is 0.1 to MAXIMUM CURRENT. For any other LEVEL DETECT 1 SELECT settings, the parameter range is 0.1 to 100.0%.

LEVEL DETECT 2 DELAY (P.607)

The delay time in seconds for the level detector 2 circuit. See LEVEL DETECT 1 SELECT for diagram.

Parameter Range:	0.0 to 300.0 seconds
Default Setting:	10.0 seconds
Parameter Type:	Tuneable
OIM Menu Path(s):	Input/Output - Level Detectors
Refer also to Parameters:	LEVEL DETECT 1 SELECT (P.602), LEVEL DETECT 2 OUTPUT (P.649) LEVEL DETECT 2 SELECT (P.605), LEVEL DETECT 2 THRESH (P.606)

LEVEL DETECT 2 SELECT (P.605)

Selects the signal that drives level detector 2. See LEVEL DETECT 1 SELECT for discussion and block diagram.

Parameter Range:	SPD SOURCE SELECT OUT	SPEED RAMP INPUT TP
	SPEED RAMP OUTPUT	SPD LOOP FEEDBACK
	CML FEEDBACK	
Default Setting:	SPEED RAMP INPUT TP	
Parameter Type:	Configurable	
OIM Menu Path(s):	Input/Output - Level Detectors	
Refer also to Parameters:	LEVEL DETECT 1 SELECT (P.602),	LEVEL DETECT 2 DELAY (P.607),
	LEVEL DETECT 2 OUTPUT (P.649),	LEVEL DETECT 2 THRESH (P.606)

LEVEL DETECT 2 THRESH (P.606)

The threshold for level detector 2. See LEVEL DETECT 1 SELECT for discussion and block diagram.

Parameter Range:	0.1 to 100.0% or MAXIMUM CURRENT %*
Default Setting:	10.0%
Parameter Type:	Tuneable
OIM Menu Path(s):	Input/Output - Level Detectors
Refer also to Parameters:	LEVEL DETECT 1 SELECT (P.602), LEVEL DETECT 2 DELAY (P.607), LEVEL DETECT 2 OUTPUT (P.649), LEVEL DETECT 2 SELECT (P.605), MAXIMUM CURRENT (P.007)

*The parameter range for the level detector is automatically rescaled for speed or current based on the input selected by LEVEL DETECT 2 SELECT. If CML FEEDBACK is selected for LEVEL DETECT 2 SELECT, the parameter range is 0.1 to MAXIMUM CURRENT. For any other LEVEL DETECT 2 SELECT settings, the parameter range is 0.1 to 100.0%.

MANUAL REF SELECT (P.106)

Sets the reference for the speed/voltage loop when the drive is in manual mode and CONTROL SOURCE SELECT is set to TERMBLK. If the I/O Expansion kit is not installed, this parameter is fixed to ANALOG. This parameter is not accessible over the network.
When set to ANALOG, the analog MANUAL reference input (terminals 16, 17 and 18 on the regulator board) is the reference.
When set to MOP, MOP OUTPUT parameter is the reference.

Parameter Range:	ANALOG	
	MOP	
Default Setting:	ANALOG	
Parameter Type:	Configurable	
OIM Menu Path(s):	Drive Reference - Drive Reference Configure	
Refer also to Parameters:	CONTROL SOURCE SELECT (P.000)	MOP OUTPUT (P.191)

MAXIMUM CURRENT (P.007)

The highest amount of current (positive or negative) for a given application.
This input is used as the basis of armature current scaling.
MAXIMUM CURRENT is limited to 200% of MOTOR RATED ARM AMPS (P.008).

Parameter Range:	25 to 200% of P.008
Default Setting:	150%
Parameter Type:	Configurable
OIM Menu Path(s):	Current Minor Loop (CML) - CML Feedback Scaling
Refer also to Parameters:	MOTOR RATED ARM AMPS (P.008)

MAXIMUM SPEED (P.004)

The maximum speed of the drive that can be supported by the application or process. MAXIMUM SPEED can be less than or equal to TOP SPEED.
If raising this value causes MINIMUM SPEED to become less than 10% of MAXIMUM SPEED, an alarm is generated.

Parameter Range:	1 to TOP SPEED (RPM or user-defined units)
Default Setting:	500 RPM
Parameter Type:	Tuneable
OIM Menu Path(s):	Drive Reference - Drive Reference Limits Quick Start
Refer also to Parameters:	TOP SPEED (P.011)

WARNING

The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

WARNING

When performing this adjustment, do not allow the motor to exceed the maximum safe speed of the driven equipment as determined by the equipment manufacturer. Failure to observe this precaution could result in bodily injury.

METER OUT 1 GAIN ADJ (P.400)

Scales the Meter 1 Output Signal at the regulator board terminal strip.

Parameter Range:	0.100 to 1.900
Default Setting:	1.000
Parameter Type:	Tuneable
OIM Menu Path(s):	Input/Output - Meter Outputs

NOTE: Testpoint METER OUT FULL SCALE must source METER OUT 1 SELECT for an accurate adjustment. See Appendix D, figure D.8, for further details.

METER OUT 1 SELECT (P.404)

Selects the drive testpoint that will source meter output 1 (terminals 24 and 25 on the regulator board).

Parameter Range: See table below for parameter options.
Default Setting: CML FEEDBACK
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Meter Outputs

Signal Selected	Full Scale Value
CML FEEDBACK (P.397) CML REFERENCE (P.396) CML ERROR (P.398) SPD LOOP OUTPUT (P.299)	± MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPEED RAMP OUTPUT (P.199) SPEED RAMP INPUT TP (P.198) SPD SOURCE SELECT OUT (P.193) TRIM OUTPUT (P.197) ANALOG TACH FEEDBACK (P.291) PULSE TACH FEEDBACK (P.292) OCL OUTPUT (P.848)	± TOP SPEED
ARMATURE VOLTAGE (P.289)	± MOTOR RATED ARM VOLTS
POWER OUTPUT	± MOTOR RATED ARM VOLTS * MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
FIELD REFERENCE (P.590) FIELD FEEDBACK (P.589)	MOTOR HOT FLD AMPS
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) NETW IN REG 1 (P.905) NETW IN REG 2 (P.906) NETW IN REG 3 (P.907) FULL SCALE	
ZERO	0

METER OUT 1 ZERO ADJ (P.402)

Removes any hardware-introduced offset from the Meter 1 output signal at the regulator board terminals.

Parameter Range: -200 to + 200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Meter Outputs

NOTE: Testpoint METER OUT ZERO must source METER OUT 1 SELECT for an accurate adjustment. See Appendix D, figure D.8, for further details.

METER OUT 2 GAIN ADJ (P.401)

Scales the Meter 2 output signal at the regulator board terminal strip.

Parameter Range: 0.100 to 1.900
Default Setting: 1.000
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Meter Outputs

NOTE: Testpoint METER OUT FULL SCALE must source METER OUT 2 SELECT for an accurate adjustment. See Appendix D, figure D.8, for further details.

METER OUT 2 SELECT (P.405)

Selects the drive testpoint that will source meter output 2 (terminals 25 and 26 on the regulator board).

Parameter Range: See table below for parameter options.
Default Setting: SPD LOOP FEEDBACK
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Meter Outputs

Signal Selected	Full Scale Value
CML FEEDBACK (P.397) CML REFERENCE (P.396) CML ERROR (P.398) SPD LOOP OUTPUT (P.299)	± MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPEED RAMP OUTPUT (P.199) SPEED RAMP INPUT TP (P.198) SPD SOURCE SELECT OUT (P.193) TRIM OUTPUT (P.197) ANALOG TACH FEEDBACK (P.291) PULSE TACH FEEDBACK (P.292) OCL OUTPUT (P.848)	± TOP SPEED
ARMATURE VOLTAGE (P.289)	± MOTOR RATED ARM VOLTS
POWER OUTPUT	± MOTOR RATED ARM VOLTS * MOTOR RATED ARM AMPS * $\frac{\text{MAXIMUM CURRENT}}{100}$
FIELD REFERENCE (P.590) FIELD FEEDBACK (P.589)	MOTOR HOT FLD AMPS
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) NETW IN REG 1 (P.905) NETW IN REG 2 (P.906) NETW IN REG 3 (P.907) FULL SCALE	
ZERO	0

METER OUT 2 ZERO ADJ (P.403)

Removes any hardware introduced offset from the Meter 2 output signal at the regulator terminal strip.

Parameter Range: -200 to + 200
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Input/Output - Meter Outputs

NOTE: Testpoint METER OUT ZERO must source METER OUT 2 SELECT for an accurate adjustment. See Appendix D, figure D-7, for further details.

MINIMUM SPEED (P.003)

Selects the minimum speed of the drive without being stopped. It is typically greater than zero. If it is less than 10% of MAXIMUM SPEED, an alarm is generated.

Parameter Range: 0 to MAXIMUM SPEED (RPM or user-defined units)
Default Setting: 0 (RPM or user-defined units)
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Limits, Quick Start

DANGER

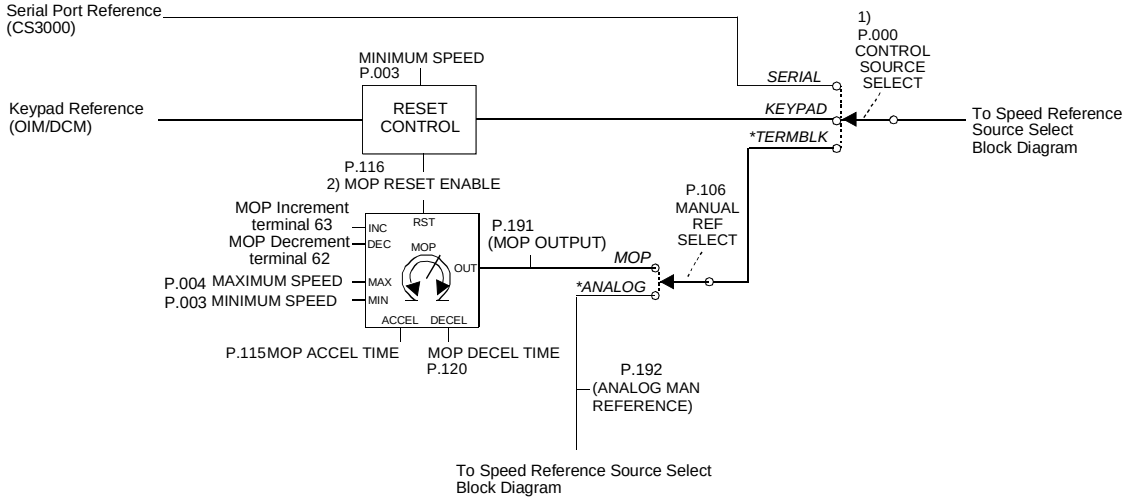
This drive can operate at and maintain zero speed when this parameter is set to on. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at or near zero speed. Failure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

MOP ACCEL TIME (P.115)

Only available if the I/O Expansion kit is installed.
Time in which the motor operated potentiometer (MOP) output can change from zero to TOP SPEED. The MOP function provides a manual reference to the speed/voltage loop when CONTROL SOURCE SELECT is set to TERMBLK and the MANUAL REF SELECT is set to MOP.

Parameter Range: ACCELERATION TIME to 300.0 seconds
Default Setting: 5.0 seconds
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Ramp
Refer also to Parameters: ACCELERATION TIME (P.001), CONTROL SOURCE SELECT (P.000), DECELERATION TIME (P.002), MANUAL REF SELECT (P.106), MAXIMUM SPEED (P.004), MINIMUM SPEED (P.003), MOP DECEL TIME (P.120), MOP OUTPUT (P.191), MOP RESET ENABLE (P.116), TOP SPEED (P.011)

The MOP OUTPUT is increased through digital input 4 (terminal 63) and decreased through digital input 3 (terminal 62) on the I/O Expansion board. The MOP OUTPUT is limited to prevent going over MAXIMUM SPEED or under MINIMUM SPEED.
MOP ACCEL TIME and MOP DECEL TIME set the time in which the MOP OUTPUT can change from zero to TOP SPEED and vice versa. To prevent the S-curve block from limiting the rate of change from the MOP OUTPUT, MOP ACCEL TIME has a low limit equal to ACCELERATION TIME. MOP DECEL TIME has a low limit equal to DECELERATION TIME.
When MOP RESET ENABLE is ON, the MOP output goes to MINIMUM SPEED when the drive stops. If it is OFF, the MOP OUTPUT remains at its present level when the drive stops. MOP RESET ENABLE affects the operation of OIM reference, even if the I/O Expansion kit is not installed.



MOP DECEL TIME (P.120)

Only available if the I/O Expansion kit is installed. Minimum time in which the MOP OUTPUT can change from TOP SPEED to zero. See MOP ACCEL TIME for a discussion and block diagram.

Parameter Range:	DECELERATION TIME to 300.0 seconds
Default Setting:	5.0 seconds
Parameter Type:	Tuneable
OIM Menu Path(s):	Drive Reference - Drive Reference Ramp
Refer also to Parameters:	DECELERATION TIME (P.002), MAXIMUM SPEED (P.004), MINIMUM SPEED (P.003), MOP ACCEL TIME (P.115) MOP OUTPUT (P.191), MOP RESET ENABLE (P.116) TOP SPEED (P.011)

MOP RESET ENABLE (P.116)

Determines if the MOP OUTPUT resets or stays at the present level when the drive stops.
When MOP RESET ENABLE is ON, the MOP output goes to MINIMUM SPEED when the drive stops.
If it is OFF, the MOP OUTPUT remains at its present level when the drive stops.
This parameter also affects the operation of the keypad reference, even if the I/O Expansion kit is not installed. See MOP ACCEL TIME for discussion and block diagram.

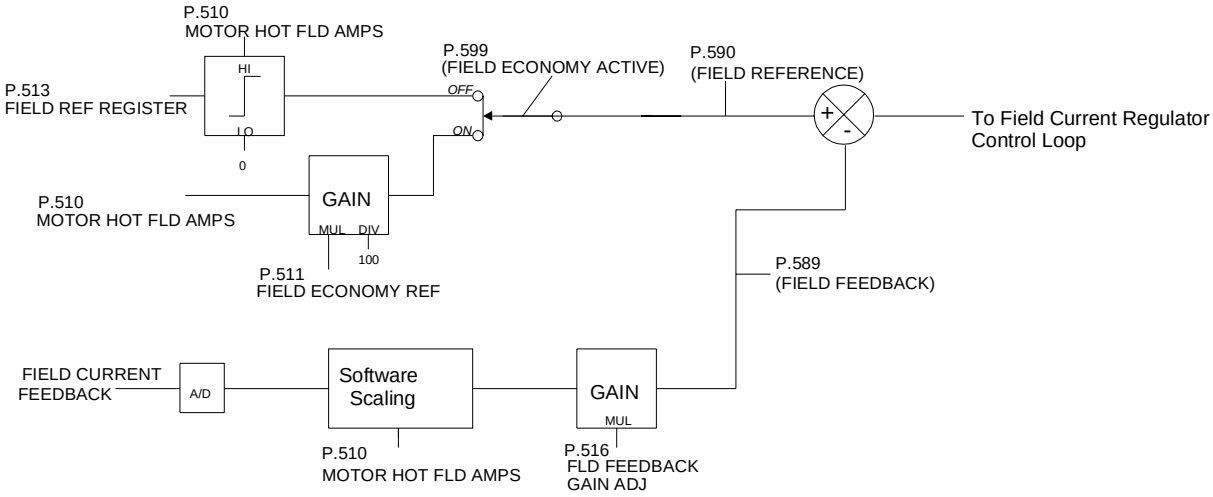
Parameter Range:	OFF, ON
Default Setting:	OFF
Parameter Type:	Configurable
OIM Menu Path(s):	Drive Reference - Drive Reference Configure
Refer also to Parameters:	MINIMUM SPEED (P.003), MOP ACCEL TIME (P.115), MOP DECEL TIME (P.120), MOP OUTPUT (P.191)

MOTOR HOT FLD AMPS (P.510)

Only available if the Field Current Regulator kit is installed.
Motor nameplate value of the rated hot field amps. This parameter scales the field current feedback.

Parameter Range:	0.1 to installed supply rating (4.00,10.00, or 15.00 amps)
Default Setting:	0.1 amps
Parameter Type:	Configurable
OIM Menu Path(s):	Field - Field Current Regulator - Field Loop Feedback Scaling
Refer also to Parameters:	FIELD ECONOMY REF (P.511), FIELD FEEDBACK (P.589), FIELD LOSS THRESHOLD (P.512), FIELD REF REGISTER (P.513), FLD FEEDBACK GAIN ADJ (P.516), MOTOR HOT FLD AMPS (P.510)

WARNING:
The incorrect setting of this parameter can cause a motor overvoltage condition.
Set MOTOR HOT FLD AMPS to the motor's nameplate value. Make sure FIELD ECONOMY REF and/or FIELD REF REGISTER (P.513) is above FIELD LOSS THRESHOLD (P.512).
Failure to observe this precaution can result in bodily injury and damage to the equipment.



MOTOR RATED ARM AMPS (P.008)

The rated armature current from the motor nameplate.

Parameter Range: 0 to 3000.0 Amps
Default Setting: Depending on unit type
Parameter Type: Configurable
OIM Menu Path(s): Current Minor Loop (CML) - CML Feedback Scaling - Quick Start

CAUTION:
The drive will not operate properly if this parameter value is entered incorrectly. This parameter must be equal to the rated armature amps found on the motor nameplate. Overcurrent or excess heating of the motor could result. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

This value is used by the internal I^2t motor thermal overload function. This function allows for continuous operation at 100% current and 60 seconds of operation at 150% of rated MOTOR RATED ARM AMPS (P.008) following an inverse time overload curve.

MOTOR RATED ARM VOLTS (P.009)

Rated armature voltage from the motor nameplate.

Parameter Range: 160 to 675 VDC on types with nominal voltage up to 500 VAC
240 to 1000 VDC on types with nominal voltage 690 VAC (see 4.5.11)
Default Setting: 240 VDC
Parameter Type: Configurable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Volt Loop (SPD) Feedback -Quick Start
Refer also to Parameter: NOMINAL AC LINE VOLTS (P.307)

WARNING
The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

NEG CURRENT LIM SEL (P.224)

Selects the source for the negative current limit. If REGISTER is selected, NEGATIVE CURRENT LIM P.006 is used as the limit. The analog input choices are only available if the I/O Expansion kit is installed. The NETW choices are only available if the Network Option kit is installed.
Note that the network input registers are updated only when CONTROL SOURCE (P.000) is set to NETWORK and the network is active.

Parameter Range:	REGISTER, ANALOG IN 1, ANALOG IN 2, NETW IN REG 1, NETW IN REG 2, NETW IN REG 3
Default Setting:	REGISTER
Parameter Type:	Configurable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning or Current Minor Loop (CML) - CML Tuning
Refer also to Parameters:	NEGATIVE CURRENT LIM (P.006), NETW IN REG 1 (P.902), NETW IN REG 2 (P.903), NETW IN REG 3 (P.904)

NEG CUR LIM INV EN (P.226)

This parameter enables the negative current limit inverter to the speed loop PI block.

Parameter Range:	1= DISABLE 2= ENABLE
Default Setting:	2
Parameter Type:	Configurable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameters:	POSITIVE CURRENT LIM (P.005) NEGATIVE CURRENT LIM (P.006)

See P.006 NEGATIVE CURRENT LIM for detail on the operation of this parameter and the drive current limits.

NEGATIVE CURRENT LIM (P.006)

NOTE*: This parameter is only set for regenerative drives.*
Selects the highest amount of current (% motor rated armature amps) for the reverse bridge. Also used as a low limit for the Speed Loop PI block output.

Parameter Range:	see table on next sheet
Default Setting:	150 % FLA 0 for non-regenerative drives; if FEEDBACK SELECT = AC TACH; if FEEDBACK SELECT = PULSE TACH and PULSE TACH QUADRATURE = OFF, see table below
Parameter Type:	Tuneable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning Current Minor Loop (CML) - CML Tuning - Quick Start
Refer also to Parameters:	FEEDBACK SELECT (P.200) PULSE TACH QUADRATURE (P.208)

Regardless of the state of the negative current limit inverter (see NEG CUR LIM INV EN (P.226)), the register limits (POSITIVE CURRENT LIM and NEGATIVE CURRENT LIM) will always remain in a user-specified safe range. The intent of the current limit registers when chosen as the source for the current limit values, is to statically limit the drive current to a range which is consistent with the normal operation of the drive-motor application.
The purpose of the negative current limit inverter is to add flexibility to applications such as web processes which primarily use either an analog input or network register to dynamically control the drive's current limits while running as a speed regulator.

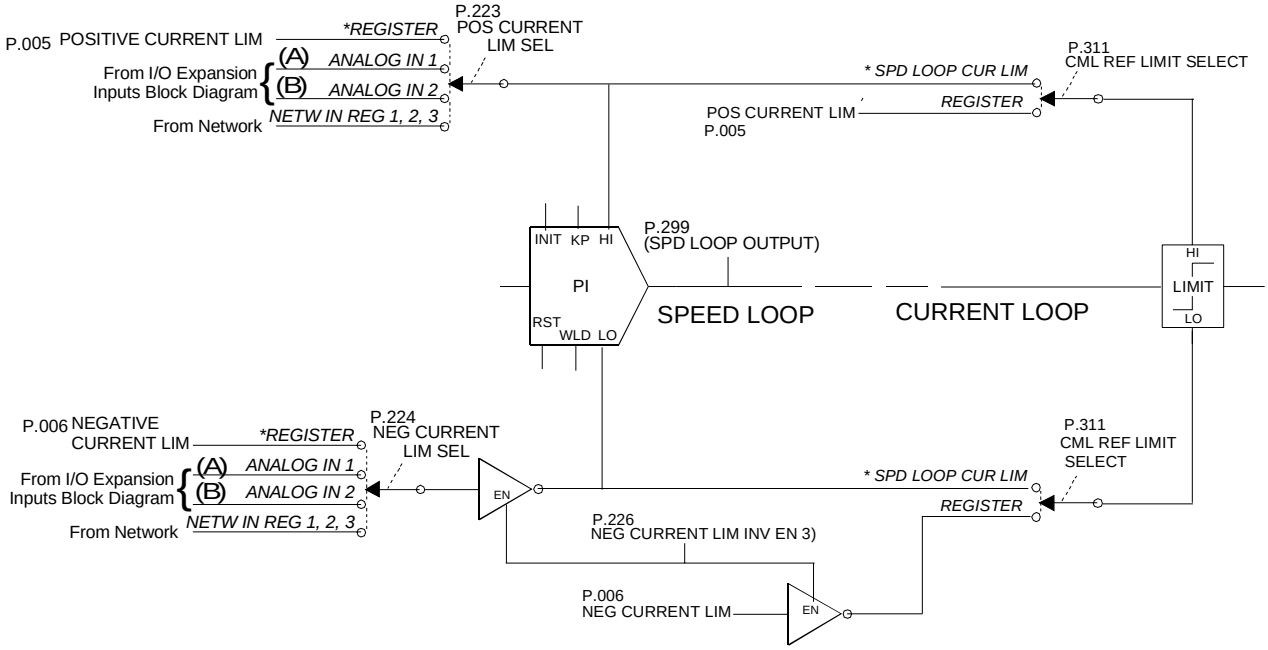
WARNING:
When analog inputs or network registers are used to control current limits, bipolar values are permitted for the positive and negative current limits of the current and speed loops. Extreme care must be exercised when setting the current limit values in this case. If the negative current limit is set to a non-zero value, the current loop reference will be clamped to this minimum value, possibly causing unexpected motor or machine operation, including rapid acceleration or overspeed.
Failure to observe this precaution could result in bodily injury.

If you change NEG CUR LIM INV EN (P.226), POS CURRENT LIM SEL (P.223) and NEG CURRENT LIM SEL (P.224) are automatically set to REGISTER. When this occurs, an alarm (A00052) is generated to notify you of a possible change in the current limits. Make sure the settings of POS CURRENT LIM SEL (P.223), NEG CURRENT LIM SEL (P.224), POSITIVE CURRENT LIM (P.005), and NEGATIVE CURRENT LIM (P.006) are correct for your application before operating the drive.

Typically the state of the inverter should only change state during drive setup. Therefore, this should be an infrequent event.

The positive limit register will always remain in the range 0 to MAXIMUM CURRENT.
The absolute value of the negative limit register would be constrained to the range 0 to MAXIMUM CURRENT. The sign of the negative current limit value will be automatically adjusted according to the state of the negative current limit inverter. For example, if the inverter is enabled and the negative current limit is 10.0 A, then the negative current limit will be changed to -10.0 A when the inverter is disabled. The negative limit register value will be clamped to zero for non-regenerative drives.

			DRIVE TYPE			
			REGEN		NON-REGEN	
			low limit	high limit.	low limit	high limit
Inverter State	ENABLE	Positive Current Lim	0	Maximum Current	0	Maximum Current
		Negative Current Lim	0	Maximum Current	0	0
	DISABLE	Positive Current Lim	0	Maximum Current	0	Maximum Current
		Negative Current Lim	-Maximum Current'	0	0	0



NETW BAUD RATE (P.912)

Sets the baud rate for the DeviceNet Network Communication board. The baud rate for the AutoMax Network Communication board is not adjustable. Entering a value of 0.0 Kbaud will disable DeviceNet network communication.
If the AutoMax Network Communication board is being used, this parameter has no effect.

Parameter Range:	0.0 Kbaud
	125.0 Kbaud
	250.0 Kbaud
	500.0 Kbaud
Default Setting:	0.0 Kbaud
Parameter Type:	Configurable

NETW COMM LOSS SELECT (P.901)

Network communication loss selection. Selects how the drive will respond to a loss of network communication when CONTROL SOURCE SELECT is set to NETWORK.

Parameter Range:	FAULT,
	HOLD LAST REF,
	USE TRMBLK REF
Default Setting:	FAULT
Parameter Type:	Tuneable
OIM Menu Path(s):	Network Communications

When NETW COMM LOSS SELECT is set to FAULT, a fault will be generated when network communication is lost, causing the drive to coast/DB stop. When NETW COMM LOSS SELECT is set to HOLD LAST REF, the drive will continue to run using the last reference value received over the network. When NETW COMM LOSS SELECT is set to USE TRMBLK REF, the drive will continue to run using the selected auto reference value from the regulator board terminal strip. In this configuration, the drive will automatically switch back to the network reference once network communication is re-established. If CONTROL SOURCE SELECT is not set to NETWORK, the loss of network communication will have no effect on the operation of the drive.

DANGER

The user must provide an external operator accessible coast/stop pushbutton at terminals 7 and 8 on the regulator board (see figure 3.12) to disable the machine in case of improper operation. Uncontrolled machine operation might result if this is not done. Failure to observe this precaution could result in severe bodily injury or loss of life.

NOTE: Setting NETW COMM LOSS SELECT to HOLD LAST REF or USE TRMBLK REF will cause an alarm to be generated when network communication is lost. Since alarms do not cause the drive to stop, some form of hardwired stop must be available since stopping the drive via the network may not always be possible. Once the drive is stopped, it cannot be restarted until network communication is re-established or CONTROL SOURCE SELECT is changed to something other than NETWORK.

NETW CONNECT TYPE (P.910)

AutoMax Network Connection type. When NETW CONNECT TYPE is set to BASIC, only the most essential drive data (sequencing, basic tuning, reference and feedback data) are transferred over the network.

Parameter Range: BASIC or FULL
Default Setting: BASIC
Parameter Type: Configurable
OIM Menu Path(s): Network Communications

This allows a higher density network but affords only moderate functionality.
In this configuration, drop depth is 1. When NETW CONNECT TYPE is set to FULL, the entire set of drive data that has been assigned a network register is transferred over the network. The high amount of data transferred in the full connection type requires that the drive occupy multiple network drops, thus decreasing the potential number of devices on the network. As of FlexPak 3000 regulator software version 2.01, drop depth is 4 when NETW CONNECT TYPE is set to FULL.

NETW DROP NUMBER (P.900)

Network Drop Number. Selects the base drop number the network option board will respond to on the network. NETW DROP NUMBER cannot be changed via the network.

Parameter Range: 1 to 55 if NETW CONNECT TYPE = BASIC
1 to 52 if NETW CONNECT TYPE = FULL
Default Setting: 1
Parameter Type: Configurable
OIM Menu Path(s): Network Communications
Refer also to Parameters: NETW CONNECT TYPE (P.910)

Note that when NETW CONNECT TYPE is set to FULL, the AutoMax Network Communication board will occupy multiple network drops beginning at NETW DROP NUMBER. The number of drops occupied (drop depth), affects the upper limit of NETW DROP NUMBER. See NETW CONNECT TYPE to determine drop depth.

NETW OUT REG 1 SELECT (P.902)

Selects which parameter is to be monitored in drop_1, register 7. Select the parameter to monitor by programming the parameter number. For example, setting this parameter equal to 588 will write the value of output parameter FIELD DELTA to register 7.

Parameter Range: -32768 to 32767
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Network Communications

NETW OUT REG 2 SELECT (P.903)

Selects which parameter is to be monitored in drop_1, register 8. Select the parameter to monitor by programming the parameter number. For example, setting this parameter equal to 588 will write the value of output parameter FIELD DELTA to register 8.

Parameter Range: -32768 to 32767
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Network Communications

NETW OUT REG 3 SELECT (P.904)

Selects which parameter is to be monitored in drop_1, register 9. Select the parameter to monitor by programming the parameter number. For example, setting this parameter equal to 588 will write the value of output parameter FIELD DELTA to register 9.

Parameter Range: -32768 to 32767
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Network Communications

NETW REGISTER MAP SEL (P.914)

Only available if an AutoMax Network Communication Option board is installed.
Indicates which register map configuration will be used for the AutoMax Network Communic. board.

Parameter Range: 1 = ORIGINAL,
2 = ALTERNATE
Default Setting: 1
Parameter Type: Configurable
OIM Menu Path(s): Additional Parameters

The alternate map exchanges several registers between the Drop_1 area and other drops in addition to a few new registers. The values displayed when using the AutoMax network are shown in brackets.

NOMINAL AC LINE FREQ (P.306)

The nominal A-C line frequency (typically 50 or 60 Hz).

Parameter Range: 48 to 62 Hz
Default Setting: 50
Parameter Type: Configurable
OIM Menu Path(s): Current Minor Loop (CML) - Three Phase AC Line

---

NOMINAL AC LINE VOLTS (P.307)

The nominal A-C line RMS voltage.

Parameter Range: 200 to 575 VAC on types with nominal voltage up to 500 VAC
300 to 850 VAC on types with nominal voltage 690 VAC (see 4.5.11)
Default Setting: 400 VAC
Parameter Type: Configurable
OIM Menu Path(s): Current Minor Loop (CML) - Three Phase AC Line
Refer also to Parameter: MOTOR RATED ARM VOLTS (P.009)

NORMALIZED INERTIA (P.222)

The time required to accelerate the motor and load inertia from zero to motor base speed at MOTOR RATED ARM AMPS and MOTOR HOT FLD AMPS.
This parameter is set by the speed loop self-tuning procedure or is entered by the operator directly.

Parameter Range: 0.05 to 65.20 seconds
Default Setting: 1.00 second
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning
Refer also to Parameters: INERTIA COMP SELECT (P.221), MOTOR HOT FLD AMPS (P.510), MOTOR RATED ARM AMPS (P.008)

OCL FEEDBACK SELECT (P.804)

Selects the source for the outer control loop (OCL) feedback signal.. To enable the OCL, either the I/O Expansion kit must be installed, to use ANALOG IN 1, ANALOG IN 2, or a network kit must be installed to access selections 5 to 9. CONTROL SOURCE SEL (P.000) must be set to NETWORK, or DIG IN 0 SELECT (P.428) must set to OCL ENABLE and parameter OCL ENABLE (P.849) must be ON.

Parameter Range: NONE,
CML FEEDBACK,
ANALOG IN 1, ANALOG IN 2 (Feedback is from I/O Expansion kit analog input)
5 = SPEED LOOP OUTPUT (Feedback is SPD LOOP OUTPUT (P.299) value)
6 = ANALOG AUTO REFERENCE (Fdb. is AUTO REFERENCE (P.188) value)
7 = NETW IN REG 1
8 = NETW IN REG 2 (Feedback is the associated network input register)
9 = NETW IN REG 3

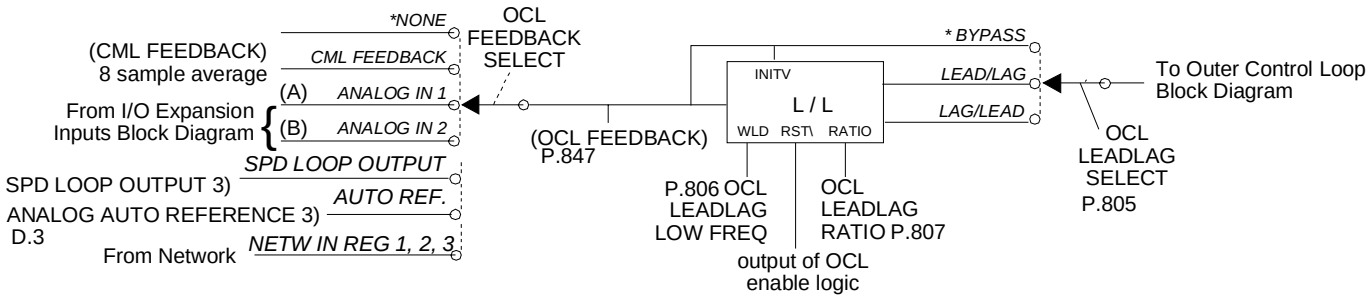
Default Setting: NONE
Parameter Type: Enumerated input, configurable, retentive
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Configure
Refer also to Parameters: CML FEEDBACK (P.397)

OCL LEADLAG LOW FREQ (P.806)

Lead/lag low break frequency of the outer control loop. Sets the lead break frequency if OCL LEADLAG SELECT (P.807) is set to LEAD/LAG. Sets the lag break frequency if P.807 is set to LAG/LEAD.

Parameter Range: 0.01 to 34.90 RAD/S
Default Setting: 1.00 RAD/S
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL LEADLAG RATIO (P.807)
OCL LEADLAG SELECT (P.805)

The OCL lead/lag high break frequency is determined by the settings of this parameter and the OCL LEADLAG RATIO. For example, if the low break frequency is 0.50 rad/s and the ratio is 10, the high break frequency is 5.00 rad/s.



OCL LEADLAG RATIO (P.807)

The ratio between the low break frequency and high break frequency of outer control loop lead/lag. The settings of this parameter and the OCL LEADLAG LOW FREQ determine the high break frequency. See OCL LEADLAG LOW FREQ for discussion and block diagram.

Parameter Range: 2 to 20
Default Setting: 10
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL LEADLAG LOW FREQ (P.806),
OCL LEADLAG SELECT (P.805)

OCL LEADLAG SELECT (P.805)

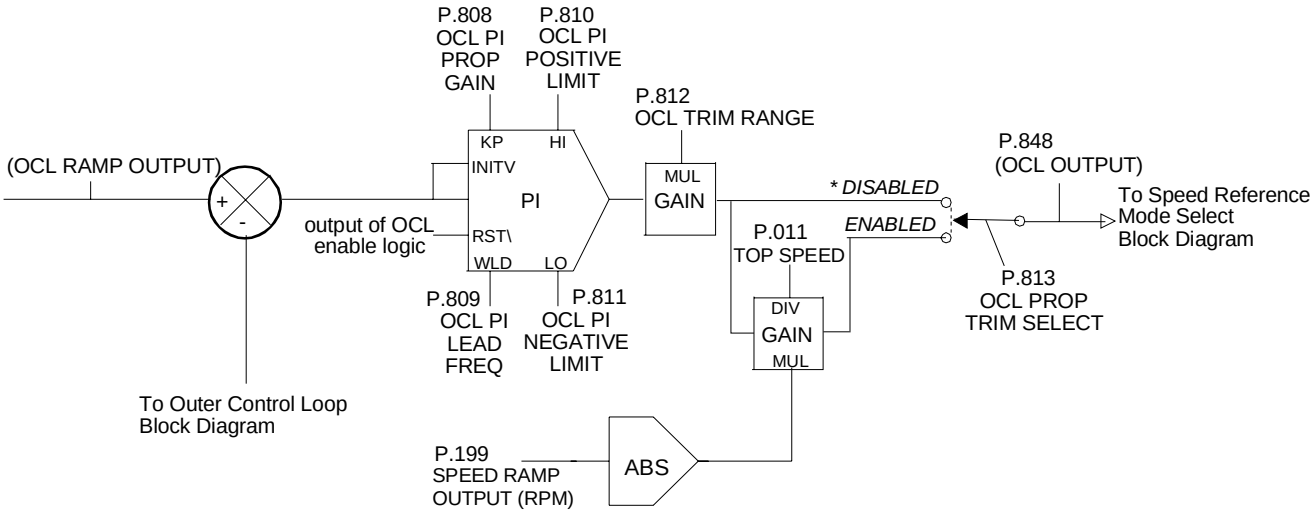
Selects the outer control loop as lead/lag, lag/lead, or bypassed.
If the OCL is configured as a type 1 position regulator, this should be set to BYPASS. For a type 2 position regulator, the lead/lag block can be used if necessary. See OCL LEADLAG LOW FREQ for block diagram.

Parameter Range:	LEAD/LAG, BYPASS, LAG/LEAD
Default Setting:	BYPASS
Parameter Type:	Tuneable
OIM Menu Path(s):	Outer Control Loop (OCL) - OCL Configure
Refer also to Parameters:	OCL LEADLAG LOW FREQ (P.806), OCL LEADLAG RATIO (P.807)

OCL PI LEAD FREQ (P.809)

The lead break frequency of the proportional integral (PI) block of the outer control loop.
If the OCL is configured as a type 1 position regulator, set equal to 0.00 (proportional only).

Parameter Range:	0.00 to 141.37 rad/s
Default Setting:	1.00 rad/s
Parameter Type:	Tuneable
OIM Menu Path(s):	Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters:	OCL OUTPUT (P.848), OCL PI NEGATIVE LIMIT (P.811), OCL PI POSITIVE LIMIT (P.810), OCL PI PROP GAIN (P.808), OCL RAMP OUTPUT (P.846)



OCL PI NEGATIVE LIMIT (P.811)

The negative limit of the outer control loop PI block. The output of the OCL PI block is never below this limit. See OCL PI LEAD FREQ for the block diagram.

Parameter Range:	0 to 100% of TOP SPEED
Default Setting:	100%
Parameter Type:	Tuneable
OIM Menu Path(s):	Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters:	OCL OUTPUT (P.848), OCL PI LEAD FREQ (P.809), OCL PI POSITIVE LIMIT (P.810), OCL PI PROP GAIN (P.808), OCL RAMP OUTPUT (P.846), TOP SPEED (P.011)

OCL PI POSITIVE LIMIT (P.810)

Outer Control Loop PI block positive limit. The output of OCL PI block is never above this limit. See OCL PI LEAD FREQ for the block diagram.

Parameter Range: 0 to 100% of TOP SPEED
Default Setting: 100%
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL OUTPUT (P.848), OCL PI LEAD FREQ (P.809), OCL PI NEGATIVE LIMIT (P.811), OCL PI PROP GAIN (P.808), OCL RAMP OUTPUT (P.846), TOP SPEED (P.011)

OCL PI PROP GAIN (P.808)

The proportional gain of the OCL PI block. See OCL PI LEAD FREQ for the block diagram.

Parameter Range: 0.10 to 128.00
Default Setting: 2.00
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL OUTPUT (P.848),
OCL PI LEAD FREQ (P.809),
OCL PI NEGATIVE LIMIT (P.811),
OCL PI POSITIVE LIMIT (P.810),
OCL RAMP OUTPUT (P.846)

OCL PROP TRIM SELECT (P.813)

Selects whether or not the output of the Outer Control Loop will be scaled by the absolute value of SPEED RAMP OUTPUT (output of the Speed Loop S-Curve block).

Parameter Range: 1= DISABLE
2= ENABLE
Default Setting: 1
Parameter Type: Configurable
OIM Menu Path(s): Additional Parameters
Refer also to Parameters: OCL PI LEAD FREQ (P.809), TOP SPEED (P.011)

If OCL PROP TRIM SELECT is enabled, the signal from the trim range block is passed through another gain block. The gain of this block is proportional to the absolute value of the speed reference at the output of the speed loop S-curve block. The gain of this block ranges from 0 at zero speed to unity gain when the reference is equal to TOP SPEED (P.011).

OCL REF RAMP TIME (P.802)

The ramp time for the outer control loop reference. Sets the minimum amount of time for the OCL S-curve output to change from 0 to full scale and vice versa. If set to 0.0, the ramp block is bypassed. NOTE: If the ramp block is bypassed, rapid speed change can result.

Parameter Range: 0.0 to 300.0 seconds
Default Setting: 10.0 seconds
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL RAMP OUTPUT (P.846),
OCL REFERENCE (P.845),
OCL REF RAMP TIME (P.802),
OCL REF ROUNDING (P.803)

OCL REF REGISTER (P.801)

The reference for the outer control loop that is used when OCL REFERENCE SELECT is set to REGISTER. Typically used in applications where a constant reference is needed.

Parameter Range: -4095 to 4095
Default Setting: 0
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Configure
Refer also to Parameters: OCL REFERENCE SELECT (P.800)

OCL REF ROUNDING (P.803)

Specifies the amount of reference smoothing (rounding) for the outer control loop. It is set as a percentage of the OCL REF RAMP TIME. Rounding is performed at the beginning and end of an OCL reference change.

Parameter Range: 0 to 50%
Default Setting: 0%
Parameter Type: Tuneable
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL REF RAMP TIME (P.802), OCL RAMP OUTPUT (P.846), OCL REFERENCE (P.845)

If OCL REF ROUNDING is set to 0%, the OCL performs a linear ramp function.
If set to 50%, the entire ramp time is smoothed: 50% at the beginning of the reference change and 50% at the end. If OCL REF RAMP TIME is 0.0 (ramp block bypassed), this parameter has no affect on the OCL reference signal. See OCL REF RAMP TIME for block diagram.

OCL REFERENCE SELECT (P.800)

Selects the reference for the outer control loop.
If REGISTER is selected, the reference is obtained from the OCL REF REGISTER.
The I/O Expansion Kit must be installed to use ANALOG IN 1 (terminals 50 and 51 on the I/O expansion board), ANALOG IN 2 (terminals 52 and 53), or FREQUENCY IN (terminal 39, 40, and 41).
A network kit must be installed to select the network input registers (NETW IN REG 1, 2, or 3).
Note that the network input registers are updated only when CONTROL SOURCE (P.000) is set to NETWORK and the network is active.

Parameter Range: REGISTER, ANALOG IN 1, ANALOG IN 2, FREQUENCY IN, NETW IN REG 1, NETW IN REG 2, NETW IN REG 3
Default Setting: REGISTER
Parameter Type: Configurable
OIM Menu Path(s): Outer Control Loop (OCL) -OCL Configure
Refer also to Parameters: NETW IN REG 1 (P.905), NETW IN REG 2 (P.906), NETW IN REG 3 (P.907), OCL REF REGISTER (P.801)

OCL TRIM RANGE (P.812)

The trim range for the outer control loop. This specifies the amount of control the outer control loop OCL output signal has on the speed/voltage loop reference (or the CML reference when configured as a Type III Position Regul.). It is set as a percentage of TOP SPEED. See OCL PI LEAD FREQ for block diagram.

Parameter Range: -100.0% to 100.0%
Default Setting: 0.0%
Parameter Type: Tuneable, Integer input, retentive
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: OCL OUTPUT (P.848), OCL PI LEAD FREQ (P.809), OCL PI NEGATIVE LIMIT (P.811), OCL PI POSITIVE LIMIT (P.810), OCL PI PROP GAIN (P.808), TOP SPEED (P.011)

OCL TYPE3 POSN REG EN (P.814)

Selects the source of the Current Minor Loop reference when the drive is configured as a current regulator (i.e. when hardware jumper J15 set to CURRENT). When OCL TYPE3 POSN REG EN set to *DISABLED*, TORQUE REFERENCE (P.189) is used as the CML reference. When set to *ENABLED*, OCL OUTPUT (P.848) is used as the CML reference.

Parameter Range: 1 = DISABLED
2 = ENABLED
Default Setting: 1 = DISABLED
Parameter Type: Boolean input, retentive, configurable
OIM Menu Path(s): Additional Parameters

OPEN SCR SENSITIVITY (P.600)

Open SCR diagnostic sensitivity adjustment. Unbalanced A-C lines can cause load sharing differences between SCRs. This parameter should be increased to increase the tolerance of SCR load sharing differences due to unbalanced lines.

Parameter Range: 0 to 100%
Default Setting: 50%
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - SCR Diagnostics

OPEN SCR TRIP THRESH (P.601)

Open SCR trip threshold. Extremely unusual load conditions or severe current loop instability can cause nuisance open SCR faults. Increasing this input will increase the tolerance of such disturbances.

Parameter Range: 800 to 4000
Default Setting: 1600
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - SCR Diagnostics

PHASE FIRE TEST DELTA (P.309)

The test firing conduction angle of the SCRs. If equal to 0, the armature power bridge is OFF. If = 180, the armature power bridge is fully ON.

Parameter Range: 0 to 180 degrees
Default Setting: 0 degrees
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - SCR Diagnostics

WARNING

The armature phase fire test is unregulated. To prevent excess motor speed, either disconnect the armature leads from the drive and replace with a similar load or disconnect the field leads from the drive. Lock the motor armature shaft securely to prevent rotation in either direction prior to selecting this test. Failure to observe these precautions could result in bodily injury.

PHASE FIRE TST BRIDGE (P.310)

Armature phase fire test mode bridge select. This input can only be changed while the drive is stopped.
OFF selects the forward bridge (A1 positive with respect to A2).
ON selects the reverse bridge (A1 negative with respect to A2).

Parameter Range:	ON OFF
Default Setting:	OFF
Parameter Type:	Tuneable
OIM Menu Path(s):	Current Minor Loop (CML) - SCR Diagnostics Armature Phase Fire Test

PLL MAXIMUM ERROR (P.308)

Maximum allowable change in line period per A-C line cycle.
This input should only be increased when drive power is supplied by a source that cannot maintain a suitable fixed frequency output (such as an alternator) to prevent line synchronization-related faults.

Parameter Range:	2 to 1000 microsec
Default Setting:	2 microsec
Parameter Type:	Tuneable
OIM Menu Path(s):	Current Minor Loop (CML) - Three Phase AC Line

PHASE LOSS DETECT EN (P.609)

Enables or disables the phase loss fault detection. When set to *ENABLE*, a “PHASE LOSS” fault (F.00016) will be generated when the measured AC line voltage drops below 75% of the value specified by NOMINAL AC LINE VOLTS (P.307) for more than 2 seconds.

Parameter Range:	DISABLE, ENABLE
Default Setting:	ENABLE
Parameter Type:	Boolean input, retentive, configurable
OIM Menu Path(s):	Additional Parameters

POS CURRENT LIM SEL (P.223)

Selects the source for the positive current limit.
If REGISTER is selected, the reference is POSITIVE CURRENT LIM (P.005).
The I/O Expansion kit must be installed to use ANALOG IN 1 (terminals 50 and 51 on the I/O Expansion board), ANALOG IN 2 (terminals 52 and 53), or FREQUENCY IN (terminals 39, 40, and 41).
The NETW choices are only available if the Network Option kit is installed.
Note that the network input registers are updated only when CONTROL SOURCE SELECT (P.000) is set to NETWORK and the network is active.

Parameter Range:	REGISTER, ANALOG IN 1, ANALOG IN 2, NETW IN REG 1, NETW IN REG 2, NETW IN REG 3
Default Setting:	REGISTER
Parameter Type:	Configurable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning or Current Minor Loop (CML) - CML Tuning
Refer also to Parameters:	CONTROL SOURCE SELECT (P.000), POSITIVE CURRENT LIM (P.005)

POSITIVE CURRENT LIM (P.005)

Selects the highest amount of current (% motor rated armature amps) for the forward bridge. May also be selected as high limit for the Speed Loop PI block output (P.223). See NEGATIVE CURRENT LIM (P.006) for information regarding the operation of the current limit registers.

Parameter Range: 0 to MAXIMUM CURRENT (%FLA)
Default Setting: 150 %FLA
Parameter Type: Tuneable
OIM Menu Path(s): Current Minor Loop (CML) - CML Tuning
Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning
Quick Start
Refer also to Parameters: NEGATIVE CURRENT LIM (P.006) NEG CUR LIM INV EN (P.226)
POS CURRENT LIM SEL (P.223)

PRESET SPEED 1, 2, and 3 (P.117, P.118, & P.119)

Only available if the I/O Expansion kit is installed.
These parameters set up to three preset speed references when the REGULATOR TYPE jumper (J15 on the regulator board) is set for the speed/voltage control loop. To use these speeds, CONTROL SOURCE SELECT must be set to TERMBLK.

Parameter Range: MINIMUM SPEED to MAXIMUM SPEED (speed user units)
Default Setting: 250 RPM
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Configure
Refer also to Parameters: CONTROL SOURCE SELECT(P.000)
DIG IN 1 (P.495) DIG IN 2 (P.496)
MAXIMUM SPEED (P.004) MINIMUM SPEED (P.003)

The preset speeds are selected through digital input 1 and digital input 2 on the I/O Expansion board, as shown in the following table.

Digital Input 1(Terminal 59)	Digital Input 2(Terminal 60)	Speed/Voltage Loop Reference
OFF	OFF	Selected AUTO or MANUAL reference
ON	OFF	PRESET SPEED 1 (P. 117)
OFF	ON	PRESET SPEED 2 (P. 118)
ON	ON	PRESET SPEED 3 (P. 119)

If the I/O Expansion Kit is not installed, the digital inputs are set to OFF and cannot be changed and the AUTO or MANUAL reference is used for the speed reference. The selected preset speed reference passes through the same control blocks as other speed references.

PULSE TACH PPR (P.207)

Pulse tachometer pulses per revolution (PPR) from the pulse tachometer nameplate.
Supported in regulator firmware version 1.10 or higher.

Parameter Range: 18 to 2500 PPR
Default Setting: 18 PPR
Parameter Type: Configurable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Feedback

WARNING
The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

PULSE TACH QUADRATURE (P.208)

Enables or disables pulse tachometer quadrature. Set ON for a bi-directional pulse tachometer. Set OFF for a unidirectional pulse tachometer.

Parameter Range:	ON, OFF
Default Setting:	ON
Parameter Type:	Configurable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Feedback
Refer also to Parameters:	FEEDBACK SELECT (P.200), NEGATIVE CURRENT LIM (P.006), REVERSE DISABLE (P.015)

If PULSE TACH QUADRATURE is set to OFF and PULSE TACH is the selected FEEDBACK SELECT type, NEGATIVE CURRENT LIM will be set to 0 and REVERSE DISABLE set to ON (preventing reverse direction). Supported in regulator firmware V 1.1 or higher.

RAMP STOP DECEL TIME (P.018)

Deceleration time used during ramp stop sequences when STOP DECEL SELECT = RAMP STOP DECEL TIME.

Parameter Range:	0.1 to 300.0 seconds
Default Setting:	5.0 seconds
Parameter Type:	Tuneable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameters:	DECELERATION TIME (P.002), STOP DECEL SELECT (P.122)

REVERSE DISABLE (P.015)

NOTE: REVERSE DISABLE applies only to regenerative drives.
When ON, REVERSE DISABLE prevents the speed reference from dropping below zero. The reverse bridge cannot be activated and the drive cannot reverse.

Parameter Range:	OFF, ON
Default Setting:	OFF*
Parameter Type:	Configurable
OIM Menu Path(s):	Drive Reference - Drive Reference Limits Quick Start
Refer also to Parameters:	FEEDBACK SELECT (P.200), PULSE TACH QUADRATURE (P.208)

When OFF, the speed reference can drop below zero and the drive can reverse.
*The default is ON when:

- The drive has a non-regenerative (S6) power unit.
- FEEDBACK SELECT is set to AC TACH
- FEEDBACK SELECT is set to PULSE TACH and PULSE TACH QUADRATURE is OFF.

S-CURVE ROUNDING (P.014)

Rate of change (positive or negative) of acceleration and deceleration to smooth the SPEED RAMP OUTPUT (e.g., if equal to 20, then 40 % of the acceleration and deceleration time will be spent smoothing and the remainder will be a linear ramp).

0% = linear ramp, no rounding;
50% = "smoothing" for the entire ramp.

Parameter Range:	0 to 50%
Default Setting:	0%
Parameter Type:	Tuneable
OIM Menu Path(s):	Drive Reference - Drive Reference Ramp
Refer also to Parameters:	ACCELERATION TIME (P.001), DECELERATION TIME (P.002), TRIM MODE SELECT (P.110)

In regard to TRIM MODE SELECT, S-CURVE ROUNDING will interfere with the ACCELERATION TIME and the DECELERATION TIME so that the draw will not be constant. Therefore, it is recommended that S-CURVE ROUNDING be set to 0% if TRIM MODE SELECT is set to PROPORTIONAL. Incremental trim is not affected by this limitation.

SELF TUNE BRIDGE (P.220)

Determines the direction the motor shaft will rotate during the self-tune process by selecting the SCR bridge. For non-regenerative (S6) drives, this is automatically set to FORWARD and cannot be changed.

Parameter Range:	FORWARD, REVERSE
Default Setting:	FORWARD
Parameter Type:	Tuneable
OIM Menu Path(s):	Current Minor Loop (CML) - CML Tuning - Self Tuning Setup, Speed/Voltage Loop (SPD) - SPD Tuning - Self Tuning Setup

---

SELF TUNE FIELD RANGE (P.218)

Ratio of motor top speed to base speed. Typical value is 1.00, where TOP SPEED = base speed. Applies to speed loop tuning only.

Parameter Range:	0.90 to 5.00
Default Setting:	1.00
Parameter Type:	Tuneable
OIM Menu Path(s):	Current Minor Loop (CML) - CML Tuning - Self Tuning Setup Speed/Voltage Loop (SPD) - SPD Tuning - Self Tuning Setup

---

SELF TUNE STABILITY (P.219)

SELFTUNE STABILITY determines the self-tune stability, which sets the performance of the speed loop. Low values increase the speed loop response. High values decrease the speed response, but result in more stability. The typical value is 25. Applies to speed loop tuning only.

Parameter Range:	10 to 100
Default Setting:	25
Parameter Type:	Tuneable
OIM Menu Path(s):	Current Minor Loop (CML) - CML Tuning - Self Tuning Setup Speed/Voltage Loop (SPD) - SPD Tuning - Self Tuning Setup

SPEED FEEDBACK GAIN (Alternate network map, drop_1, register 38)

Only available if the AutoMax Network Communication board is installed.
Controls the gain of the speed loop feedback path.
This is typically a value that is related to the diameter of the roll in a winder application.

Parameter Range:	1000 to 32000 (gain of 1.000 to 32.000)
Default Setting:	1000
Parameter Type:	Tuneable
OIM Menu Path(s):	This parameter is available over the network, alternate network map, drop_1, register 38. It cannot be viewed through the OIM or DCM.
Refer also to Parameters:	CONTROL SOURCE SELECT (P.000), NETWORK MAP SELECT (P.914)

To access this register, CONTROL SOURCE SELECT must be set to NETWORK and NETW REGISTER MAP SEL (P.914) must be set to ALTERNATE.
To bypass the multiplier block, set this register to 1000 (1.000). This is also the value SPEED FEEDBACK GAIN is forced to when NETW REGISTER MAP SEL (P.914) is set to ORIGINAL.

ATTENTION: When CONTROL SOURCE SELECT is changed from NETWORK to another value, the speed feedback multiplier block is bypassed. This can cause the motor to rotate faster than it did when under network control. The active speed reference should be set to zero before starting the drive from the new control source. The active speed reference is based on the new control source and the auto/manual setting.

SPD LEADLAG LOW FREQ (P.214)

If LEAD/LAG is selected in SPD LEADLAG SELECT, this parameter represents the lead corner frequency. If SPD LEADLAG SELECT is set to BYPASS, this parameter has no effect. If LAG/LEAD is selected, it represents the lag corner frequency.

Parameter Range:	0.01 to 69.81 rad/s when • FEEDBACK SELECT (P.200) = ARMATURE VOLT • SPD LOOP SCAN TIME (P.019) = 10 ms 0.01 to 139.62 rad/s when • FEEDBACK SELECT (P.200) ≠ ARMATURE VOLT • SPD LOOP SCAN TIME (P.019) = 5 ms
Default Setting:	1.00 rad/s
Parameter Type:	Tuneable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning
Refer also to Parameters:	SPD LEADLAG SELECT (P.216)

SPD LEADLAG RATIO (P.213)

Sets the ratio of low to high break frequencies for the lead/lag block. For example, if this parameter is set to10, the high break frequency will be 10 times the low break frequency (specified by SPD LEADLAG LOW FREQ). If SPD LEADLAG SELECT is set to BYPASS, this parameter has no effect.

Parameter Range:	2 to 20
Default Setting:	2
Parameter Type:	Tuneable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning
Refer also to Parameters:	SPD LEADLAG LOW FREQ (P.214), SPD LEADLAG SELECT (P.216)

SPD LEADLAG SELECT (P.216)

Determines if the lead/lag block will act upon the speed loop feedback signal. If set to BYPASS, the lead/lag block is bypassed and the feedback signal is used directly by the speed loop summing junction.

Parameter Range: LEAD/LAG, BYPASS, LAG/LEAD
Default Setting: BYPASS
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning

---

SPD LOOP LAG BYPASS (P.217)

Determines if the lag block will act upon the speed loop error signal. If ON, the lag block is bypassed and the speed loop error signal is used directly by the speed loop PI block.

Parameter Range: ON, OFF
Default Setting: ON
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning

---

SPD LOOP LAG FREQ (P.215)

Specifies the lag break frequency for the speed loop forward path lag block.
If SPD LOOP LAG BYPASS is ON, this parameter has no effect.

Parameter Range: 0.01 to 139.62 rad/s when
- FEEDBACK SELECT (P.200) = ARMATURE VOLT
- SPD LOOP SCAN TIME (P.019) = 10 ms

0.01 to 279.25 rad/s when
- FEEDBACK SELECT (P.200) ≠ ARMATURE VOLT
- SPD LOOP SCAN TIME (P.019) = 5 ms

Default Setting: 1.00 rad/s
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning
Refer also to Parameters: SPD LOOP LAG BYPASS (P.217)

SPD LOOP PI LEAD FREQ (P.212)

Speed loop PI block lead frequency. A setting of 0.00 allows proportional-only speed loop control.

Parameter Range: 0.00 to 282.74 rad/s when
- FEEDBACK SELECT (P.200) = ARMATURE VOLT
- SPD LOOP SCAN TIME (P.019) = 10 ms

0.00 to 327.67 rad/s when
- FEEDBACK SELECT (P.200) ≠ ARMATURE VOLT
- SPD LOOP SCAN TIME (P.019) = 5 ms

Default Setting: 3.00 rad/s
Parameter Type: Tuneable
OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning

---

SPD LOOP PI INIT SEL (Alternate network map, Drop_2, register 32)

Only available if the AutoMax Network Communication board is installed.
Selects the Speed Loop PI block initial value source when CONTROL SOURCE SELECT = Network.
NOTE: SPD LOOP PI INIT VAL is forced to ZERO when CONTROL SOURCE SELECT ≠ Network.

Parameter Range:	0= ZERO 1= SPD LOOP PI INIT VAL 2= ANALOG MAN TRIM REF
Default Setting:	0
Parameter Type:	Configurable
OIM Menu Path(s):	N/A, network only
Refer also to Parameters:	CONTROL SOURCE SELECT (P.000) ANALOG MAN TRIM REF (P.194) SPD LOOP PI INIT VAL (Alternate network map, Drop_1, register 39) SPD LOOP PI INIT SEL (Alternate network map, Drop_2, register 32)

SPD LOOP PI INIT VAL (Alternate network map, Drop_1, register 39)

Only available if the AutoMax Network Communication board is installed.
Network initial value for the Speed Loop PI block.

Parameter Range:	-32768 - 32767
Default Setting:	0
Parameter Type:	Tuneable
OIM Menu Path(s):	N/A, network only
Refer also to Parameters:	CONTROL SOURCE SELECT (P.000) SPD LOOP PI RESET (Alternate network map, Drop_1, register 32, Bit 6)

SPD LOOP PI PROP GAIN (P.211)

Speed loop PI block proportional gain.

Parameter Range:	0.10 to 128.00
Default Setting:	4.40
Parameter Type:	Tuneable
OIM Menu Path(s):	Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Tuning

---

SPD LOOP PI RESET (Alternate network map, Drop_1, register 32, Bit 6)

Only available if the AutoMax Network Communication board is installed. When asserted, the Speed Loop PI block is held in Reset with the initial value appearing at the PI block output.

Parameter Range:	0 = ENABLE 1 = RESET
Default Setting:	1
Parameter Type:	Tuneable
OIM Menu Path(s):	N/A, network only
Refer also to Parameters:	CONTROL SOURCE SELECT (P.000) SPD LOOP PI INIT SEL (Alternate network map, Drop_2, register 32) SPD LOOP PI INIT VAL (Alternate network map, Drop_1, register 39)

SPD LOOP SCAN TIME (P.019)

Selects the speed loop scan time for closed loop operation
The drive must be stopped to modify the value of this parameter. Note that P.019 applies only to closed loop speed control using actual measured motor velocity via tachometer or encoder-type devices.

When feedback select (P.200) is set to armature voltage, the active speed loop scan time is fixed at 10 msec regardless of the setting of P.019.

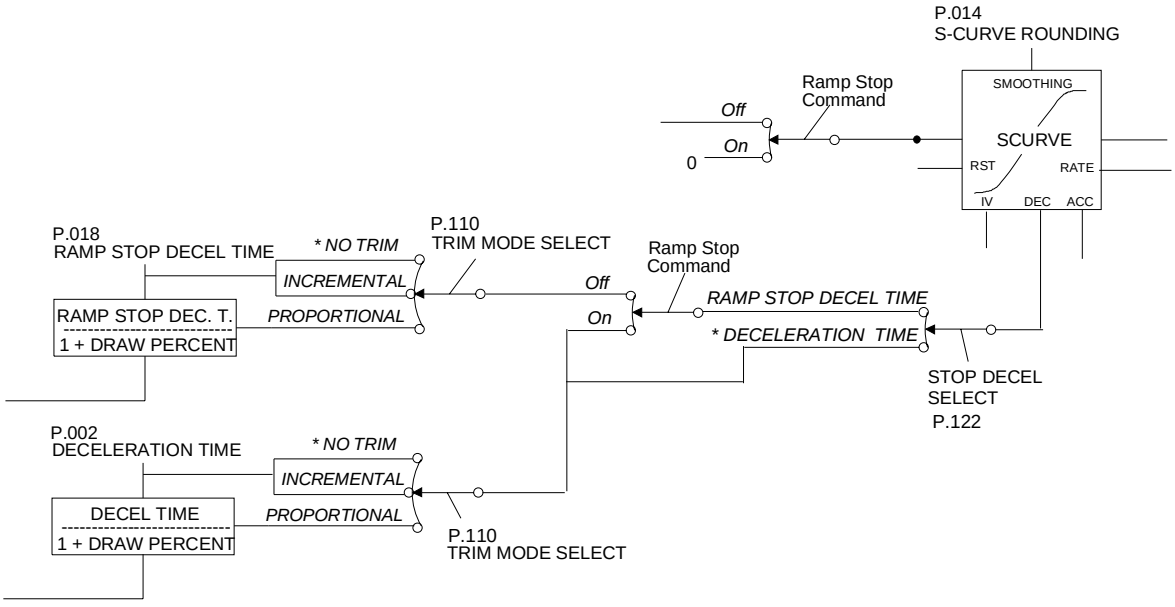
When feedback select is changed from armature voltage to any other setting, the active speed loop scan time is determined by the parameter setting of P.019.

Parameter *Range:*	0 = 5 msec	1 = 10 msec
Default Setting:	0 = 5 msec	
Parameter Type:	Configurable	
OIM Menu Path(s):	Additional Parameters	

STOP DECEL SELECT (P.122)

Selects deceleration time for Ramp Stop sequences. Speed changes during run will use DECELERATION TIME regardless of the STOP DECEL SELECT choice.

Parameter Range:	1= DECELERATION TIME
	2= RAMP STOP DECEL TIME
Default Setting:	1
Parameter Type:	Configurable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameters:	DECELERATION TIME (P.002)
	RAMP STOP DECEL TIME (P.018)



STOP MODE SELECT (P.114)

Selects stopping mode of the drive in response to a normal STOP command. An open permissive will always cause a coast stop. If the drive is configured as a current regulator, only COAST/DB can be selected.

Parameter Range:	RAMP,	COAST/DB,	CURRENT LIMIT
Default Setting:	RAMP		
Parameter Type:	Tuneable		
OIM Menu Path(s):	Drive Reference - Drive Reference Configure		

STOP SPEED THRESHOLD (P.113)

Sets the threshold speed below which the main contactor will automatically open after a ramp stop or current limit stop is asserted. This value should be less than or equal to MINIMUM SPEED.

Parameter Range: 0 to MAXIMUM SPEED (RPM *or* user-defined units)
Default Setting: 0 (RPM or user-defined units)
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Configure

---

TACH LEAD FLT DELAY (P.228)

The amount of time that parameter TACH LEAD FLT THRESH (P.227) must be exceeded before a REVERSED TACH LEADS fault (F00014) is generated.

Parameter Range: 0 to 32767 msec
Default Setting: 10 000 msec
Parameter Type: Tuneable
OIM Menu Path(s): Additional Parameters
Refer also to Parameters: TACH LEAD FLT THRESH (P.227)

TACH LEAD FLT THRESH (P.227)

The threshold after which a REVERSED TACH LEADS fault (F00014) is generated.
A REVERSED TACH LEADS fault is generated if the difference between the speed reference and speed feedback is greater than this value for at least the amount of time set by TACH LEAD FLT DELAY.

Parameter Range: 0.0 to 250 (% of TOP SPEED)
Default Setting: 200.0
Parameter Type: Tuneable
OIM Menu Path(s): Additional Parameters
Refer also to Parameters: TACH LEAD FLT DELAY (P.228)

TACH LOSS SCR ANGLE (P.608)

The SCR firing angle in degrees at which tach loss is determined when current is present and motor speed is less than 5% of TOP SPEED.

Parameter Range: 0 to 127 (degrees)
Default Setting: 109
Parameter Type: Tuneable
OIM Menu Path(s): Additional Parameters

The open armature detection algorithm also uses this parameter. An open armature is detected when the armature current is zero, motor speed feedback is <5% of TOP SPEED, and the SCR firing angle is equal to TACH LOSS SCR ANGLE.

Use the following steps to adjust this parameter if a tach loss occurs.

Step 1. Check tach lead connections and polarity,
Step 2. Increment TACH LOSS SCR ANGLE by 1.
Step 3. Restart the drive.
Step 4. If tach loss occurs and the angle is less than 127°, return to step 2.

WARNING
The incorrect setting of this parameter can cause an overspeed condition.
Set the value of this parameter only as high as necessary to stop incorrect tach loss faults.
Failure to observe this precaution could result in bodily injury.

TOP SPEED (P.011)

TOP SPEED is the highest normal running speed of the motor.
This parameter scales the feedback device. TOP SPEED depends on several factors:

Parameter Range: 5 to 5000 RPM
Default Setting: 500 RPM
Parameter Type: Configurable
OIM Menu Path(s): Drive Reference - Drive Reference Limits Quick Start

- If there is no field weakening, the top speed is typically the same as the nameplate base speed.
- If there is field weakening, the top speed is the same as the field weakened speed. Top speed is typically more than the base speed when field weakening is applied.

Warning
The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

TRIM MODE SELECT (P.110)

Parameter Range: NO TRIM, INCREMENTAL, PROPORTIONAL
Default Setting: NO TRIM
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Trim
Refer also to Parameters: ACCELERATION TIME (P.001), DECELERATION TIME (P.002), S-CURVE ROUNDING (P.014)

Selects the type of trim mode to be used by the drive:

- No Trim
- Incremental
- Proportional - allows multiple drive sections with a common reference to operate and ramp at different values.

Proportional is a type of draw. By using draw, one section can operate 10% faster than an upstream section. When a ramp occurs on the common reference, the two sections will support the 10% draw throughout the ramp. S-CURVE ROUNDING will interfere with the ACCELERATION TIME and the DECELERATION TIME so that the draw will not be constant. Therefore, it is recommended that S-CURVE ROUNDING be set to 0% if TRIM MODE SELECT is set to PROPORTIONAL. INCREMENTAL trim is not affected by this limitation.
This parameter also affects how the acceleration and deceleration times are interpreted.

TRIM RANGE (P.109)

Uses the selected trim reference signal to generate draw percentage. Determines how much the trim signal will affect the drive reference.

Parameter Range: 0.0 to + 100.0%
Default Setting: 0.0%
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Trim

TRIM REFERENCE SELECT (P.108)

Trim reference selection.

Parameter Range: ANALOG MANUAL, REGISTER, ANALOG IN 1, NETW IN REG 1, NETW IN REG 2, NETW IN REG 3, ANALOG IN 2
Default Setting: REGISTER
Parameter Type: Tuneable

OIM Menu Path(s): Drive Reference - Drive Reference Trim

The choices are:

- REGISTER: The reference is TRIM REF REGISTER (P.107)
- ANALOG MANUAL: The reference is the analog manual reference input from terminals 16, 17, and 18 of the Regulator board. Do not select this option if this input is being used for the analog manual speed reference.
- ANALOG IN 1 or 2: The reference is from an I/O Expansion kit analog input. These are only available if an I/O Expansion kit is installed.
- NETW IN REG 1, 2, or 3: The reference is from a network input register. These options are available only if a network kit is installed. Note that the network input registers are updated only when CONTROL SOURCE SELECT (P.000) is set to network and the network is active.

TRIM REF REGISTER (P.107)

Drive register to manually set the trim reference value used by the drive.

Parameter Range: +100.0%
Default Setting: 0%
Parameter Type: Tuneable
OIM Menu Path(s): Drive Reference - Drive Reference Trim

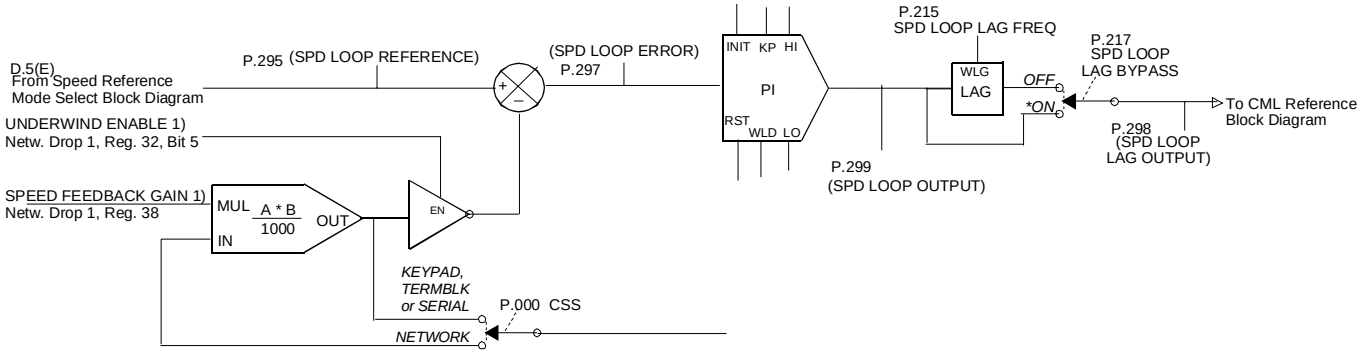
UNDERWIND ENABLE (Alternate network map, Drop_1, register 32, Bit 5)

Setting this bit to 1 enables two inverter blocks that permit underwind operation.
Setting this bit to 0 disables the two inverter blocks and permits overwind operation.

Parameter Range: 0 = DISABLED (overwind) 1 = ENABLED (underwind)
Default Setting: 0
Parameter Type: Configurable
OIM Menu Path(s): This parameter is available over the network, alternate network map, drop_1, register 32, bit 5. It cannot be viewed through the OIM or DCM.

To use this register, CONTROL SOURCE SELECT must be set to NETWORK and NETW REGISTER MAP SEL (P.914) must be set to ALTERNATE.
The inverters are added to the speed loop block and the current minor loop reference block.

ATTENTION: If CONTROL SOURCE is changed from NETWORK to any other control source, the UNDERWIND ENABLE bit is forced to the default if DISABLED. If the setting was ENABLED and CONTROL SOURCE is changed from NETWORK, the motor rotates in the opposite direction when the drive is restarted. The active speed reference should be set to zero before starting the drive from the new control source. Slowly increase the speed reference until the proper rotation direction can be determined. If it is incorrect, change the setting of the FORWARD/REVERSE input. The active speed reference is based on the new control source and the AUTO/MANUAL setting.



FlexPak 3000 User Output Parameter Records

This appendix provides an alphabetized list of output parameters with their associated description and the menu path(s) for access. Reference Appendix D, Speed Loop & CML Block Diagrams, for the relation of these parameters in the signal flow of their associated loops.

AC LINE PERIOD (P.393)

The A-C line period as measured by the drive in microseconds. Line period = 1/line frequency in Hertz.

OIM Menu Path(s): Current Minor Loop (CML) - Three Phase AC Line

---

AC LINE VOLTAGE (P.392)

The A-C line RMS voltage as measured by the drive.

OIM Menu Path(s): Current Minor Loop (CML) - Three Phase AC Line

---

ANALOG AUTO REFERENCE (P.188)

Auto mode analog reference value measured by the drive after all hardware and software scaling.

OIM Menu Path(s): Drive Reference - Drive Reference Scaling
Drive Reference - Test Points

ANALOG MAN REFERENCE (P.192)

Manual mode analog reference value measured by the drive after all hardware and software scaling. Only used when the drive is set as a speed/voltage regulator.

OIM Menu Path(s): Drive Reference - Drive Reference Scaling
Drive Reference - Drive Reference Test Points

ANALOG MAN TRIM REF (P.194)

Represents the speed/voltage loop reference trim signal after gain and offset adjustments. Only used when the drive is set as a speed/voltage regulator.

OIM Menu Path(s): Drive Reference - Drive Reference Scaling
Drive Reference - Drive Reference Test Points

ANALOG TACH FEEDBACK (P.291)

The digital value of the analog tachometer feedback input after all hardware and software scaling. For use with analog tachometer feedback (A-C or D-C) only.

OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Test Points
Speed/Voltage Loop SPD - Feedback

ANLG IN 1 (P.492)

Only available if the I/O Expansion kit is installed.
The value representing analog input 1 (terminals 50 and 51 on the I/O Expansion board) after gain and zero have been applied. See ANLG IN 1 GAIN ADJ for block diagram.

OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 1 SIG TYPE (P.413),
ANLG IN 1 ZERO ADJ (P.414)
ANLG IN 1 GAIN ADJ (P.415)

ANLG IN 2 (P.493)

Only available if the I/O Expansion kit is installed.
The value representing analog input 2 (terminals 52 and 53 on the I/O Expansion board) after gain and zero have been applied.

OIM Menu Path(s): Input/Output - Analog I/O
Refer also to Parameters: ANLG IN 2 GAIN ADJ (P.417),
ANLG IN 2 ZERO ADJ (P.416)

ARMATURE BRIDGE POL (P.394)

Indicates which bridge is currently active. OFF indicates the forward bridge; ON indicates the reverse bridge.

OIM Menu Path(s): Current Minor Loop (CML) - CML Test Points

ARMATURE DELTA (P.399)

Indicates the armature firing angle in microseconds.

OIM Menu Path(s): Current Minor Loop (CML) - CML Test Points
Current Minor Loop (CML) - SCR Diagnostics
Armature Phase Fire Test

ARMATURE VOLTAGE (P.289)

Armature voltage value after all hardware and software scaling.

OIM Menu Path(s): SPD - SPD Test Points, SPD - SPD Feedback
Current Minor Loop (CML) -SCR Diagnostics - Armature Phase Fire Test

---

CML ERROR (P.398)

The CML error signal (i.e., the difference between CML REFERENCE and CML FEEDBACK).

OIM Menu Path(s): Current Minor Loop (CML) - CML Test Points

CML FEEDBACK (P.397)

The CML feedback signal prior to the summing junction.

OIM Menu Path(s): Current Minor Loop (CML) - SCR Diagnostics - Armature Phase Fire Test
Current Minor Loop (CML) - CML Feedback Scaling
Current Minor Loop (CML) - CML Test Points

CML REFERENCE (P.396)

The amplitude and rate limited value of the selected CML reference.

OIM Menu Path(s): Current Minor Loop (CML) - CML Test Points

CURRENT COMPOUND TP (P.293)

An output testpoint that represents the current compounding value to be used by the drive.

OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Test Points

DIG IN 0 (P.490)

Only available if the CS3000 Software or the AMX Network communication card is installed.
Indicates the state of digital input 0 based on the voltage applied.

Parameter Range: ON
OFF
Default Setting: N/A
Refer also to Parameters: JOG SPEED 1 (P.012)
JOG SPEED 2 (P.017)

All digital inputs are normally open, thus will be OFF when open or connected to 24V COM (TB-15) and ON when +24V (TB-14) is applied.

Conditions Indicated by DIG IN 0 (P.490)

DIG IN 0 SELECT (P.428) Setting	Condition if DIG IN 0 (P.490) Reads:	
	ON	OFF
1 = BRUSH WEAR INPUT	Brushes OK	Brushes Worn
2 = JOG SPEED SELECT	JOG SPEED 2 selected	JOG SPEED 1 selected
3 = OCL ENABLE	OCL enabled	OCL disabled

DIG IN 1 (P.495)

Only available if the I/O Expansion kit is installed.
Shows the state of digital input 1 (terminal 59 on the I/O Expansion board).
The input is ON when +24 VDC is applied for more than 20 ms. It is OFF when 0 VDC is applied.
Digital inputs 1 and 2 (terminals 59 and 60) are used to select which, if any, PRESET SPEED is used as the speed reference for the speed/voltage control loop. See PRESET SPEED 1, 2, and 3 for more information.

Parameter Range: ON,
OFF
OIM Menu Path(s): Input/Output - Digital I/O
Refer also to Parameters: PRESET SPEED 1 (P.117),
PRESET SPEED 2 (P.118)
PRESET SPEED 3 (P.119)

DIG IN 2 (P.496)

Only available if the I/O Expansion kit is installed.
Shows the state of digital input 2 (terminal 60 on the I/O Expansion board).
The input is ON when +24 VDC is applied for more than 20 ms. It is OFF when 0 VDC is applied.
Digital inputs 1 and 2 (terminals 59 and 60) are used to select which, if any, preset speed is used as the speed reference for the speed/voltage control loop. See PRESET SPEED 1, 2, and 3 for more information.

Parameter Range: ON, OFF
OIM Menu Path(s): Input/Output - Digital I/O
Refer also to Parameters: PRESET SPEED 1 (P.117),
PRESET SPEED 2 (P.118)
PRESET SPEED 3 (P.119)

DIG IN 3 (P.497)

Only available if the I/O Expansion kit is installed.
State of digital input 3 (terminal 62 on the I/O Expansion board), which is the MOP decrement input. The input is ON when +24 VDC is applied for more than 20 ms. It is OFF when 0 VDC is applied.
See MOP ACCEL TIME for discussion and block diagram.

Parameter Range: ON, OFF
OIM Menu Path(s): Input/Output - Digital I/O
Refer also to Parameters: DIG IN 4 (P.498),
MOP ACCEL TIME (P.115)

DIG IN 4 (P.498)

Only available if the I/O Expansion Kit is installed.
State of digital input 4 (terminal 63 on the I/O Expansion board), which is the MOP increment input.
The input is ON when +24 VDC is applied for more than 20 ms. It is OFF when 0 VDC is applied.
See MOP ACCEL TIME for discussion and block diagram.

Parameter Range: ON, OFF
OIM Menu Path(s): Input/Output - Digital I/O
Refer also to Parameters: DIG IN 3 (P.497),
MOP ACCEL TIME (P.115)

DIG IN 5 (P.499)

Only available if the I/O Expansion Kit is installed.
State of Outer Control Loop enable input (terminal 64 on the I/O Expansion board).
The input is ON when +24 VDC is applied for more than 20 ms. It is OFF when 0 VDC is applied.

Parameter Range: ON, OFF
OIM Menu Path(s): Input/Output - Digital I/O

DRAW PERCENTAGE OUT (P.196)

Determined by the selected trim reference signal and TRIM RANGE value. DRAW PERCENTAGE is used as a multiplier in the proportional trim mode for accelerate and decelerate rates. It is also used to generate the TRIM OUTPUT value.

OIM Menu Path(s): Drive Reference - Drive Reference Test Points

---

FIELD DELTA (P.588)

The angle of the output of the field current regulator to the regulated field supply gate firing circuit. Output of the field current PI block.

Parameter Range: 0 to 180 Degree
OIM Menu Path(s): Field - Field Current Regulator - Field Loop Test Points
Refer also to Parameters: FIELD PI PROP GAIN (P.514), FIELD PI LEAD FREQ (P.515)

FIELD ECONOMY ACTIVE (P.599)

Indicates the present state of field economy.

OIM Menu Path(s): Field - Standard/Enhanced Field Supply
Field - Field Current Regulator - Field Loop Test Points

FIELD FEEDBACK (P.589)

Motor field current feedback signal after scaling and gain. Used by the field current regulator and field loss detection circuit.

Parameter Range: MOTOR HOT FLD AMPS
OIM Menu Path(s): Field - Field Current Regulator -Field Loop Feedback Scaling
or Field - Field Current Regulator - Field Loop Test Points
Refer also to Parameters: MOTOR HOT FLD AMPS (P.510)

FIELD REFERENCE (P.590)

Field current reference testpoint. It is the limited value of FIELD REF REGISTER or the field economy reference (when FIELD ECONOMY ACTIVE is ON). See MOTOR HOT FIELD AMPS for block diagram.

OIM Menu Path(s): Field - Field Current Regulator - Field Loop Test Points
Refer also to Parameters: FIELD REF REGISTER (P.513), FIELD ECONOMY ACTIVE (P.599)
MOTOR HOT FLD AMPS (P.510)

FLD CURRENT REGULATOR (P.586)

Indicates the rating of the Field Current Regulator kit, if installed. Refer to the Field Current Regulator kit instruction manual 49'1345.

Parameter Range: NOT INSTALLED, 4 AMP, 10 AMP, 20 AMP (actually 12 or 15 A)
OIM Menu Path(s): Field - Field Current Regulator
or Field - Standard/enhanced Field Supply or Drive Information

---

FREQ IN (P.491)

Only available if the I/O Expansion kit is installed.
The digital value of the frequency input (terminals 39, 40, and 41 on the I/O Expansion board). FREQ IN is scaled between FREQ IN ZERO and FREQ IN FULL SCALE.

Parameter Range: 0 to 4095
OIM Menu Path(s): Input/Output - Frequency I/O
Refer also to Parameters: FREQ IN FULL SCALE (P.424), FREQ IN ZERO (P.423)

FREQ IN is zero when the frequency at the input is less than or equal to FREQ IN ZERO.
It is 4095 when the frequency equals FREQ IN FULL SCALE.

I/O EXPANSION KIT (P.797)

Indicates whether or not the I/O Expansion kit is installed in the drive and if it has passed diagnostics. If the I/O Expansion Kit has failed diagnostics, the drive is not operable (the armature cannot become active).

Parameter Range: NOT INSTALLED,
INSTALLED
FAILED DIAGS
OIM Menu Path(s): Input/Output - Frequency I/O, Input/Output - Analog I/O
Input/Output - Digital I/O, Drive Information

IR COMPENSATION TP (P.290)

An output testpoint that represents the level of IR COMPENSATION being used by the drive. This parameter only has meaning if the selected drive feedback is set to armature voltage.

OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Test Points

---

J11 ANLG TACH VLT SCL (P.792)

Position in which to set J11 hardware jumper based on the values of TOP SPEED and ANALOG TACH V/1000.

OIM Menu Path(s): Drive Information - Correct Scaling Jumper Positions Quick Start
Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Feedback

J14 ANLG TACH VLT RNG (P.793)

Position in which to set J14 hardware jumper based on the values of TOP SPEED and ANALOG TACH V/1000.

OIM Menu Path(s): Drive Information - Correct Scaling Jumper Positions Quick Start
Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Feedback

J15 REGULATOR TYPE (P.799)

Indicates the position of hardware jumper J15 REGULATOR TYPE, which selects the type of regulator: SPEED/VOLTAGE or CURRENT/TORQUE. This jumper is only read at power-up.

OIM Menu Path(s): Drive Information, Current Minor Loop (CML) - CML Test Points

---

J18 ARM I FB RESISTOR (P.395)

Indicates the required burden resistor position to scale armature current feedback based on the values of CT TURNS RATIO, MAXIMUM CURRENT and MOTOR RATED ARM AMPS.

OIM Menu Path(s): Drive Information - Correct Scaling Jumper Positions
Current Minor Loop (CML) - CML Feedback Scaling Quick Start
Refer also to Parameters: CT TURNS RATIO (P.010),
MAXIMUM CURRENT (P.007)
MOTOR RATED ARM AMPS (P.008)

J20 FIELD LOSS DETECT (P.597)

Indicates the position of hardware jumper FIELD LOSS DETECT, which enables or disables field current loss detection. This jumper is only read on power-up.

OIM Menu Path(s): Drive Information, Field - Standard/enhanced Field Supply

---

J21 FLD SUPPLY JUMPER (P.598)

Indicates the position of hardware jumper FIELD SUPPLY JUMPER, which must be set according to the jumper on the Enhanced Field Supply: positions A-C or B-C.

Parameter Range: A-C, B-C
OIM Menu Path(s): Drive Information, Field - Standard/enhanced Field Supply
Refer also to Parameters: FLD Current Regulator (P.586)

This jumper only applies to the Enhanced Field Supply and does not effect the operation of the standard or current regulator field supplies. This jumper is only read on power-up.
This parameter is not available if a Field Regulator Supply Kit is installed.

JOG RAMP OUTPUT (P.294)

An output that represents the jog reference value immediately after the jog ramp function.

OIM Menu Path(s): Drive Reference - Drive Reference Test Points

---

LEVEL DETECT 1 OUTPUT (P.648)

Only available if the I/O Expansion kit is installed.
The output of the level detector 1 output. This signal drives digital output 1 (terminals 66 and 67 on the I/O Expansion board) if DIG OUT 1 SELECT is set to LEVEL DETECT 1 OUTPUT.

Parameter Range: ON, OFF
OIM Menu Path(s): Input/Output - Level Detectors
Refer also to Parameters: DIG OUT 1 SELECT (P.409), LEVEL DETECT 1 THRESH (P.603)
LEVEL DETECT 1 DELAY (P.604)

ON when the input signal is greater than or equal to LEVEL DETECT 1 THRESH for longer than LEVEL DETECT 1 DELAY.
OFF whenever the input signal is less than LEVEL DETECT 1 THRESH.
See LEVEL DETECT 1 SELECT for block diagram.

LEVEL DETECT 2 OUTPUT (P.649)

Only available if the I/O Expansion Kit is installed.
The output of the level detector 2 output. This signal drives digital output 2 (terminals 68 and 69 on the I/O Expansion board) if DIG OUT 2 SELECT is set to LEVEL DETECT 2 OUTPUT.

Parameter Range: ON, OFF
OIM Menu Path(s): Input/Output - Level Detectors
Refer also to Parameters: DIG OUT 2 SELECT (P.411), LEVEL DETECT 1 SELECT (P.602)
LEVEL DETECT 2 DELAY (P.607), LEVEL DETECT 2 THRESH (P.606)

ON when the input signal is greater than or equal to LEVEL DETECT 2 THRESH for longer than LEVEL DETECT 2 DELAY.
OFF whenever the input signal is less than LEVEL DETECT 2 THRESH.
See LEVEL DETECT 1 SELECT for block diagram.

MOP OUTPUT (P.191)

The output of the motor operated potentiometer (MOP). If the I/O Expansion Kit is not installed, the MOP OUTPUT is always at MINIMUM SPEED.
See input parameter MOP ACCEL TIME for discussion and block diagram.

Parameter Range: MINIMUM SPEED to MAXIMUM SPEED
OIM Menu Path(s): Drive Reference - Drive Reference Test Points
Refer also to Parameters: MOP RESET ENABLE (P.116), MAXIMUM SPEED (P.004) MINIMUM SPEED (P.003), MOP ACCEL TIME (P.115) MOP DECEL TIME (P.120)

NETW COMM STATUS (P.908)

Indicates the status of network communication. NOT ACTIVE means the network board is not communicating with the master. ACTIVE means the network board is communicating with the master.

Parameter Range: NOT ACTIVE, ACTIVE
OIM Menu Path(s): Network Communications

NETW IN REG 1 (P.905)

Indicates the value being written by the network master to drop_1, register 34.
See the AutoMax Network Communication Board I/M for more information.

Parameter Range: -4095 to 4095
OIM Menu Path(s): Network Communications

NETW IN REG 2 (P.906)

Indicates the value being written by the network master to drop_1, register 35.
See the AutoMax Network Communication Board I/M for more information.

Parameter Range: -4095 to 4095
OIM Menu Path(s): Network Communication

NETW IN REG 3 (P.907)

Indicates the value being written by the network master to drop_1, register 36.
See the AutoMax Network Communication Board I/M for more information.

Parameter Range: -4095 to 4095
OIM Menu Path(s): Network Communication

NETW TYPE & VERSION (P.909)

Indicates the type of network card installed and its software version. Format: TV.xx where
T = Network card type:
2 for AutoMax Network (incl. Profibus, Interbus), 4 for DeviceNet, 5 for ControlNet
V = Network card software version: 1 for AutoMax SW, 7 for Profibus SW, 8 for Interbus SW
.xx = Network card software version subindex.

OIM Menu Path(s): Network Communications

NETWORK KIT (P.796)

Indicates the status of the network option board.

OIM Menu Path(s): Network Communications
Drive Information

OCL ENABLE (P.849)

The status of the outer control loop (OCL). OFF indicates the OCL is disabled or held in reset (the drive is not running). ON means it is operating.

Parameter Range: ON,
OFF
OIM Menu Path(s): Outer Control Loop (OCL) - OCL Test Points
Refer also to Parameters: DIG IN 5 (P.499)

OCL FEEDBACK (P.847)

The feedback value of the outer control loop. It is displayed in OCL user-defined units.
See OCL LEADLAG LOW FREQ for the block diagram.

OIM Menu Path(s): Outer Control Loop (OCL) - OCL Test Points
Refer also to Parameters: OCL LEADLAG LOW FREQ (P.847)

OCL OUTPUT (P.848)

The output of the outer control loop in speed units. This is the OCL trim that is applied to the speed/voltage control loop. See OCL PI LEAD FREQ for block diagram.

OIM Menu Path(s): Outer Control Loop (OCL) - OCL Test Points
Refer also to Parameters: OCL PI LEAD FREQ (P.809)

OCL RAMP OUTPUT (P.846)

The outer control loop reference ramp output in OCL user units. This is the OCL reference output after OCL reference rounding and S-curve have been applied.
See OCL REF RAMP TIME for block diagram.

OIM Menu Path(s): Outer Control Loop (OCL) - OCL Test Points
Refer also to Parameters: OCL RAMP OUTPUT (P.846), OCL REF RAMP TIME (P.802)
OCL REF ROUNDING (P.803), OCL REFERENCE (P.845)
S-CURVE ROUNDING (P.014)

OCL REFERENCE (P.845)

The reference value for the outer control loop. Displayed in OCL user units.
See OCL REF RAMP TIME for block diagram.

OIM Menu Path(s): Outer Control Loop (OCL) - OCL Test Points
Refer also to Parameters: OCL RAMP OUTPUT (P.846), OCL REF RAMP TIME (P.802)
OCL REF ROUNDING (P.803), OCL REFERENCE (P.845)

POWER UNIT TYPE (P.795)

Indicates if the drives employs an S6R (regenerative) or an S6 (non-regenerative) power unit. If the power unit type is S6 (non-regenerative), NEGATIVE CURRENT LIM will be automatically fixed to 0, and REVERSE DISABLE fixed to ON (preventing reverse direction).

OIM Menu Path(s): Drive Information

PULSE TACH FEEDBACK (P.292)

The digital value from the pulse tachometer after all hardware and software scaling.
For use with pulse tachometer feedback only.

OIM Menu Path(s): Speed/Voltage Loop (SPD) - Speed/Voltage Loop (SPD) Test Points

---

PULSE TACHOMETER KIT (P.798)

Indicates the presence of a pulse tach kit.

OIM Menu Path(s): Drive Information

REGULATOR SW VERSION (P.794)

Indicates the regulator software version.

OIM Menu Path(s): Drive Information

SPD LOOP ERROR (P.297)

The speed loop error signal, which represents the difference between the SPD LOOP REFERENCE and the SPD LOOP FEEDBACK signals.

OIM Menu Path(s): SPD - Speed/Voltage Loop (SPD) Test Points

SPD LOOP FEEDBACK (P.296)

An output that represents the selected speed/voltage loop drive feedback value after all scaling.

OIM Menu Path(s): SPD - Speed/Voltage Loop (SPD) Test Points

SPD LOOP LAG OUTPUT (P.298)

An output representing the value immediately after the Speed Loop Lag function.

OIM Menu Path(s): SPD - Speed/Voltage Loop (SPD) Test Points

SPD LOOP OUTPUT (P.299)

Speed Loop PI function output value to the CML.

OIM Menu Path(s): SPD - Speed/Voltage Loop (SPD) Test Points
Current Minor Loop (CML) - CML Test Points

SPD LOOP REFERENCE (P.295)

An output that represents the reference value to be used by the speed loop regulator in the drive.

OIM Menu Path(s): SPD - Speed/Voltage Loop (SPD) Test Points,
Drive Reference - Drive Reference Test Points

SPD SOURCE SELECT OUT (P.193)

The user selected speed reference source value. It is an input to the speed reference ramp section.

OIM Menu Path(s): Drive Reference - Drive Reference Test Points

---

SPEED RAMP INPUT TP (P.198)

An output that represents the test point value immediately before the speed loop ramp function.

OIM Menu Path(s): Drive Reference - Drive Reference Test Points

---

SPEED RAMP OUTPUT (P.199)

An output that represents the test point value immediately after the speed loop ramp function.

OIM Menu Path(s): Drive Reference - Drive Reference Test Points

---

TORQUE REFERENCE (P.189)

Torque (current) reference value.

OIM Menu Path(s): Current Minor Loop (CML) - CML Test Points

TRIM OUTPUT (P.197)

Actual signal used to trim (add to) the selected speed loop reference signal.

OIM Menu Path(s): Drive Reference - Drive Reference Test Points

Speed Loop and CML Block Diagrams

The following block diagrams for the speed loop and current minor loop (CML) are provided to assist the more experienced user in using the parameters associated with the signal flow of these loops.
A brief explanation of each diagram follows.

Figure D.1 shows the drive control signals as they relate to the OIM keypad and terminal strip control sources.

Figure D.2 presents an overview of the speed reference.

Figures D.3, D.4, and D.5 provide further detail on the Speed Reference Source Select, Speed Reference Ramp, and the Speed Reference Mode Select blocks presented in figure D.2.

Figure D.6 shows the relationship of the speed reference to the speed feedback selection and its output to the CML.

Figures D.7 and D.8 list all the drive test points that could source the digital, analog, frequency, and metering outputs. It also shows software scaling (gain and zero adjustments).

Figure D.9 shows the CML reference (speed or torque) routed from the speed loop. It also shows the regulator selection (speed/voltage or current/torque), current limits (positive and negative) and a RATE function acting on the CML reference.

Figure D.10 shows the relationship of the CML reference to the CML feedback selection in motor control. It also shows associated gain functions and test parameters.

Figure D.11 shows the field block.

Figure D.12 shows the outer control loop.

Figure D.13 shows the inputs on the optional I/O expansion board.

Figure D.14 shows the level detectors.

Conventions used in diagrams:

- All capitalized signals = Input Parameters [e.g. MAXIMUM SPEED]
- All capitalized signal with parenthesis = Output Parameters [e.g. (TORQUE REFERENCE)]
- All capitalized with italic type = switch position [e.g. *KEYPAD*]
- An asterisk (*) - default selection

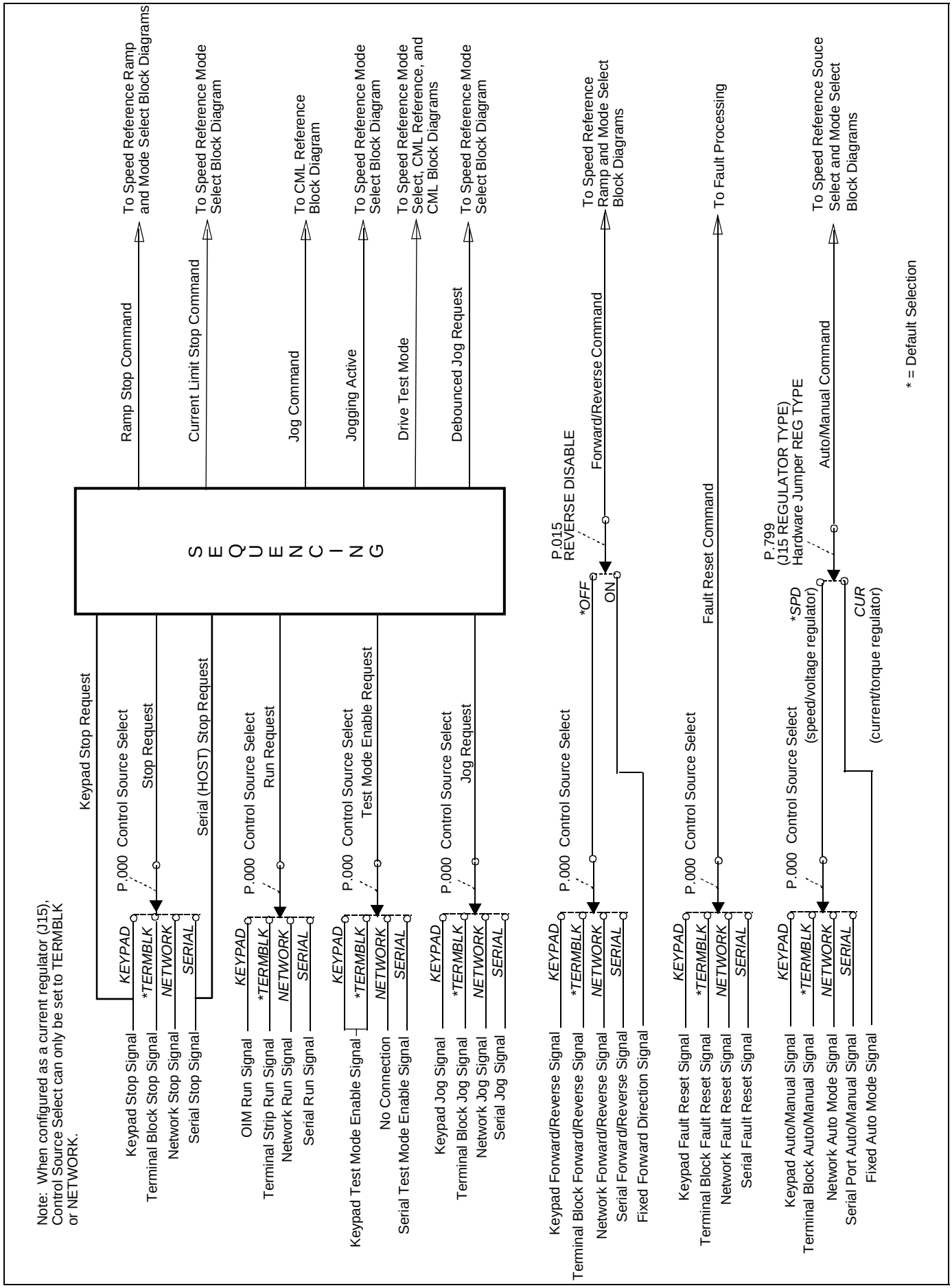


Figure D.1 - Drive Control Signals

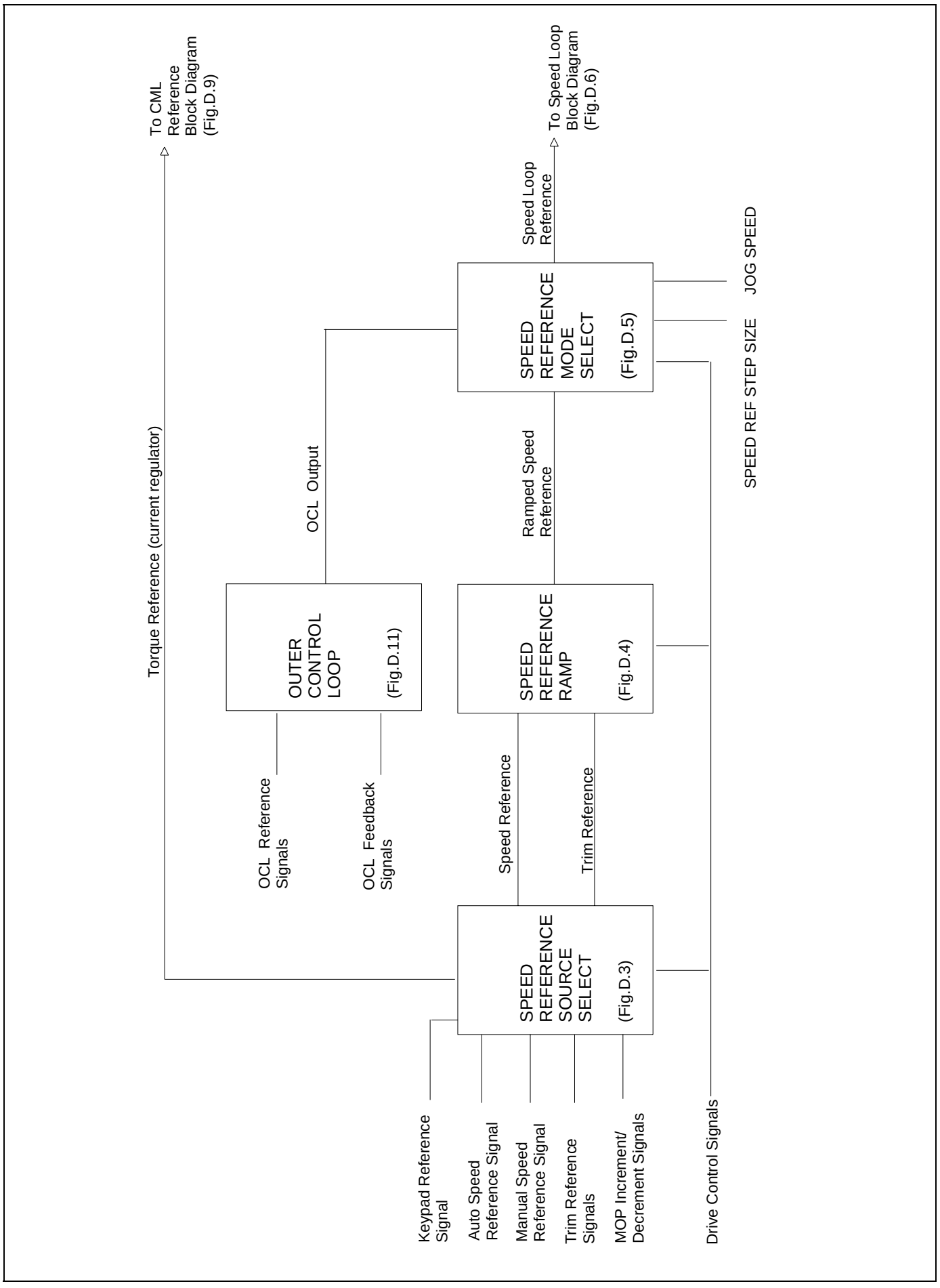


Figure D.2 - Speed Reference Overview

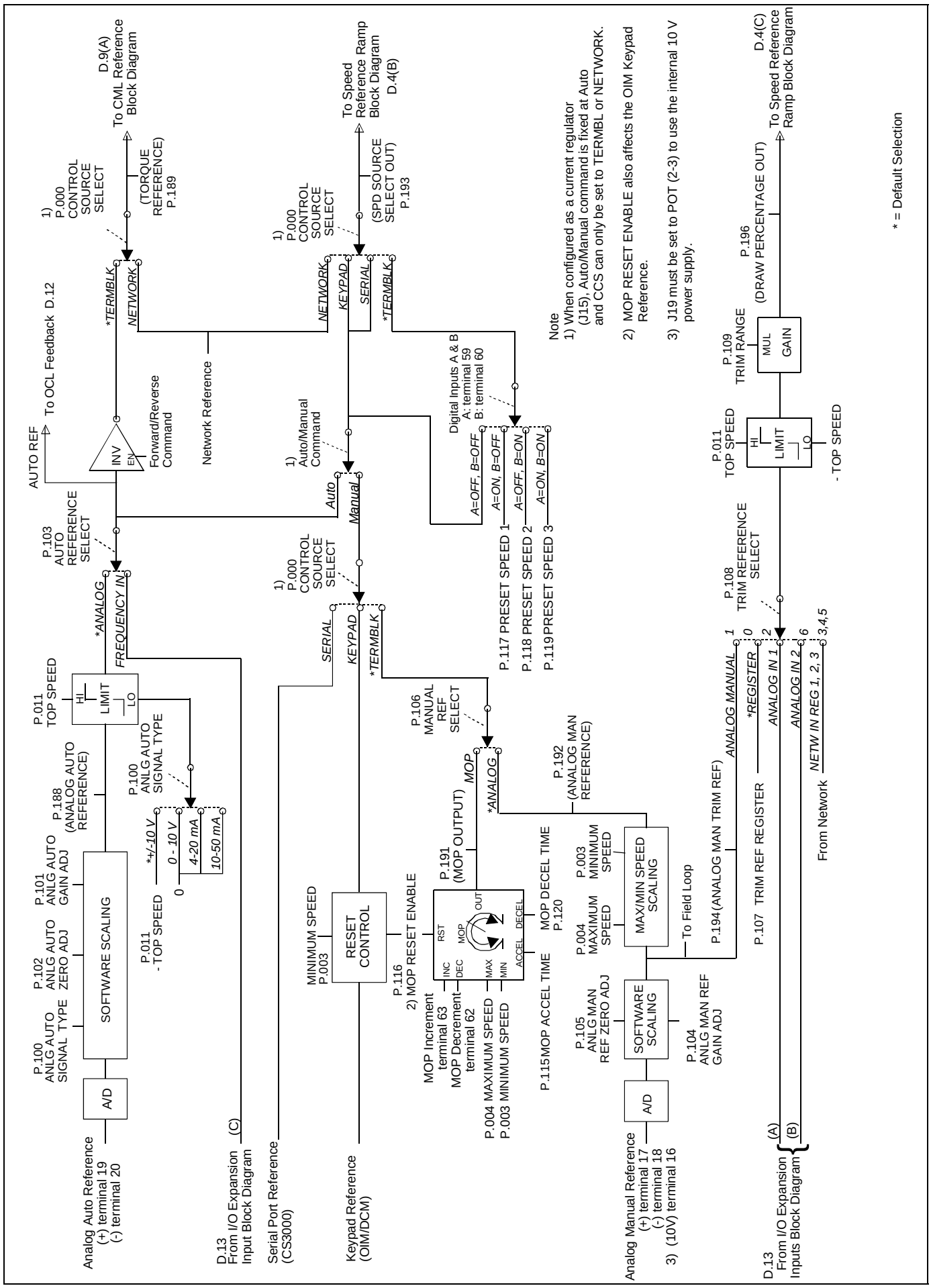


Figure D.3 - Speed Reference Source Select

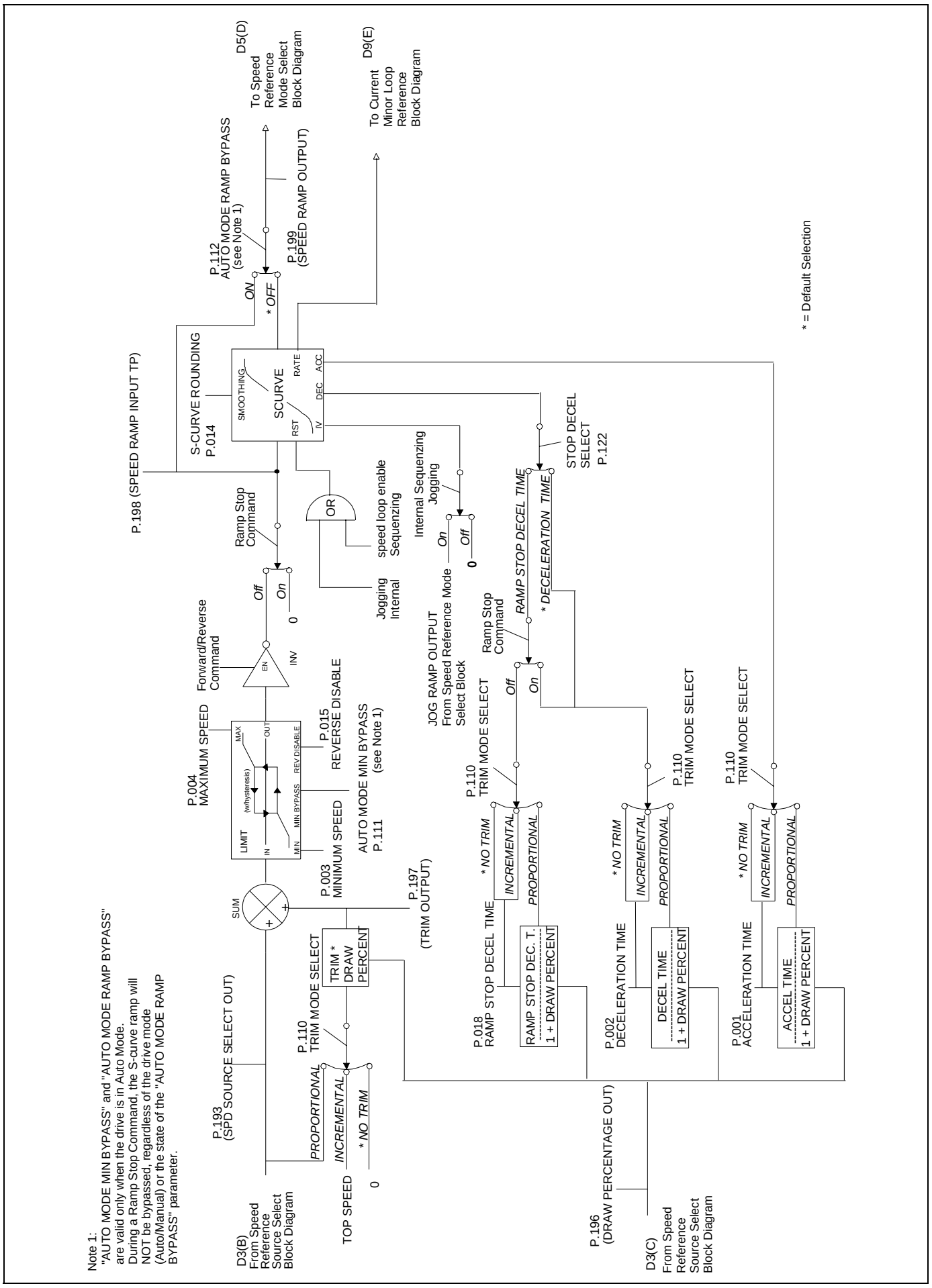


Figure D.4 - Speed Reference Ramp

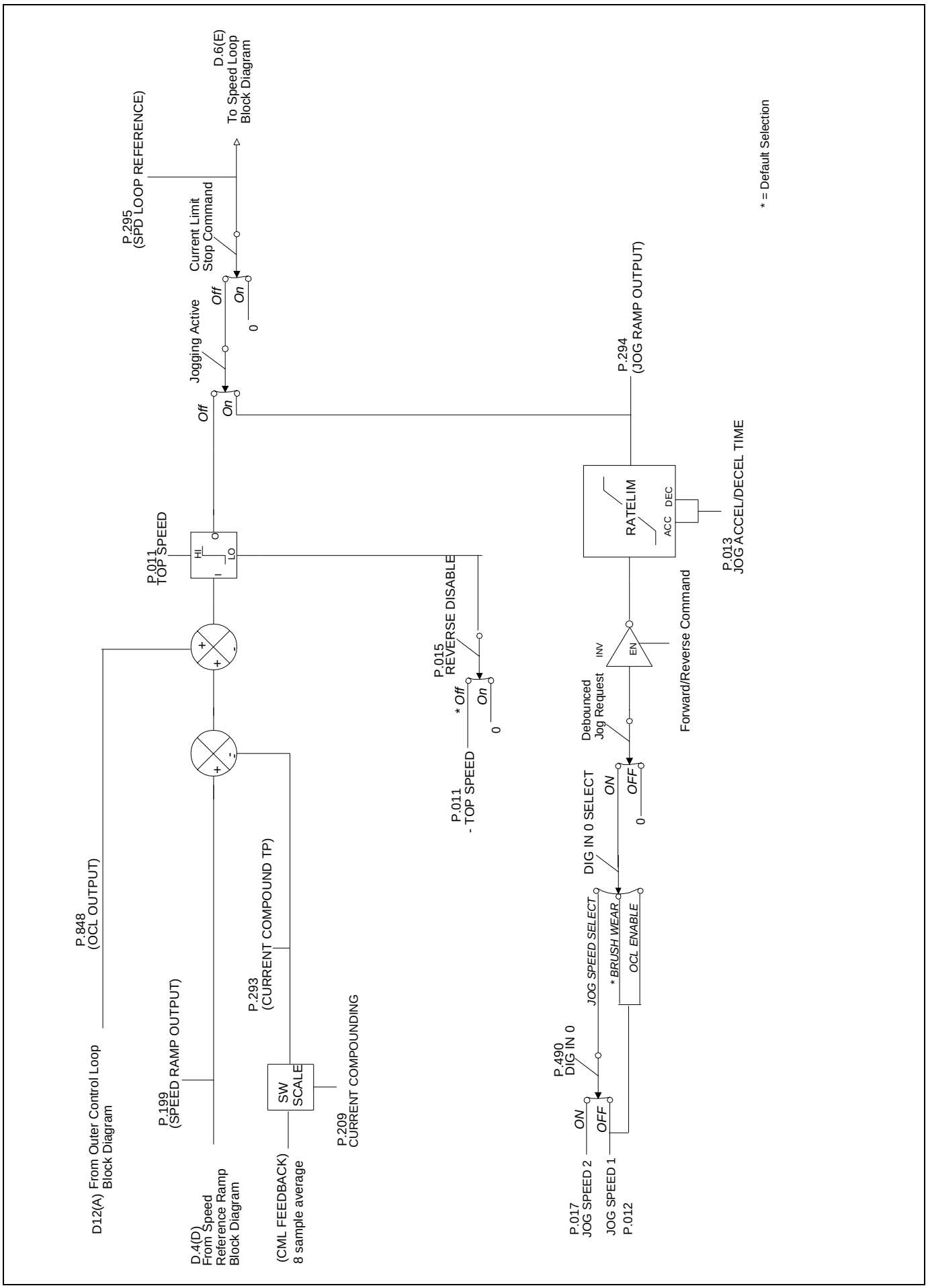


Figure D.5 - Speed Reference Mode Select

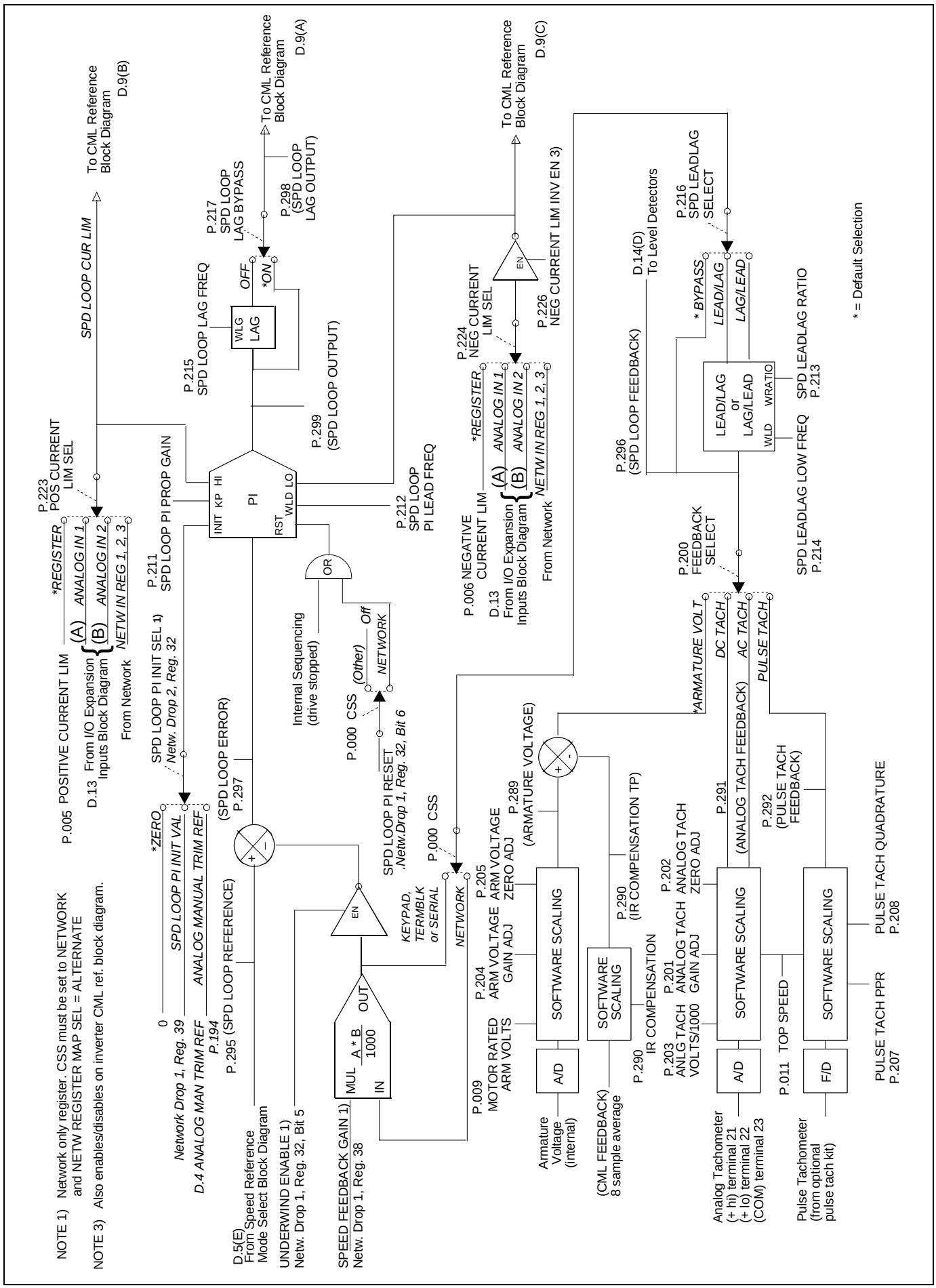


Figure D.6 - Speed Loop

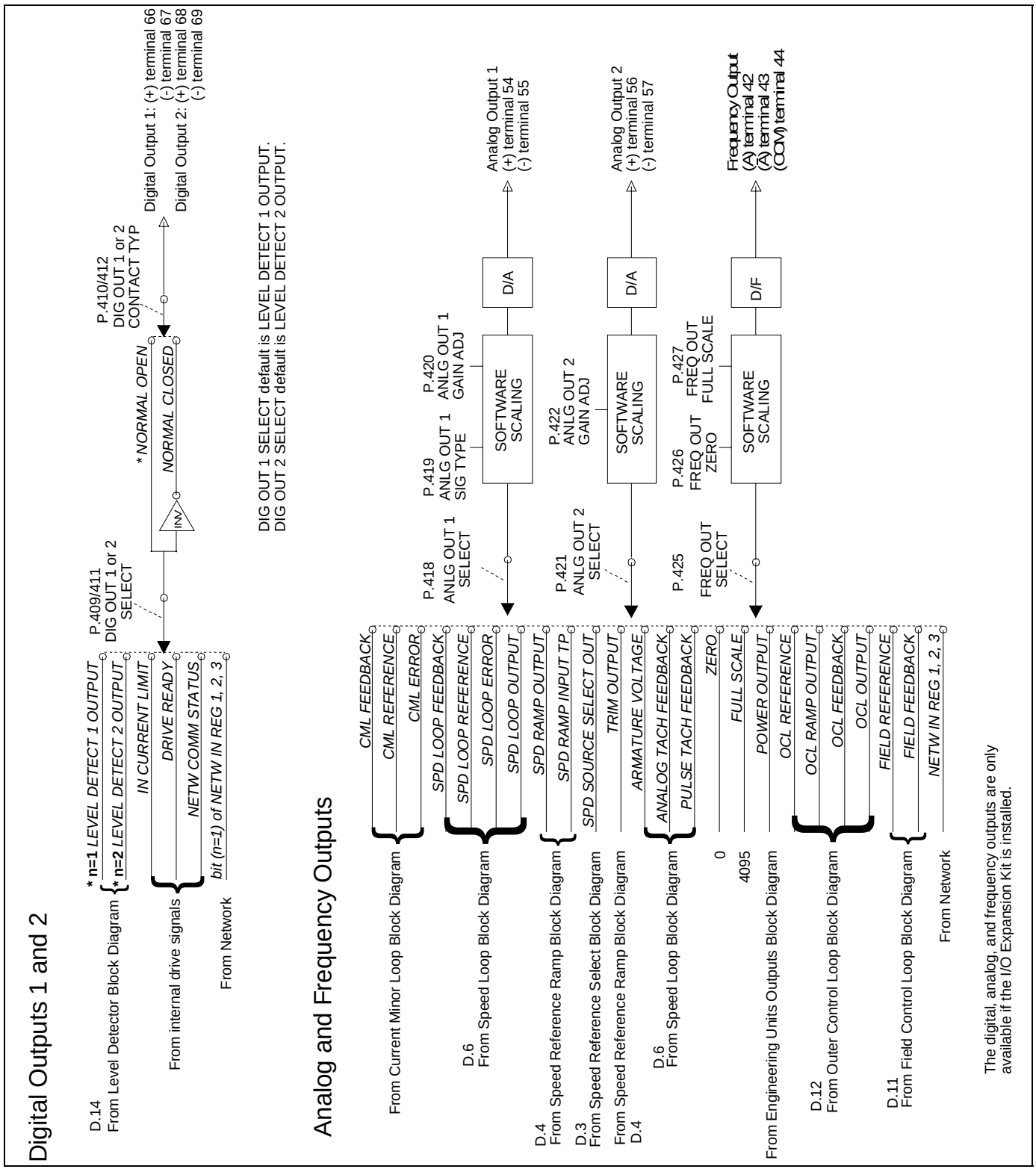


Figure D.7 - Digital Outputs, Analog and Frequency Outputs

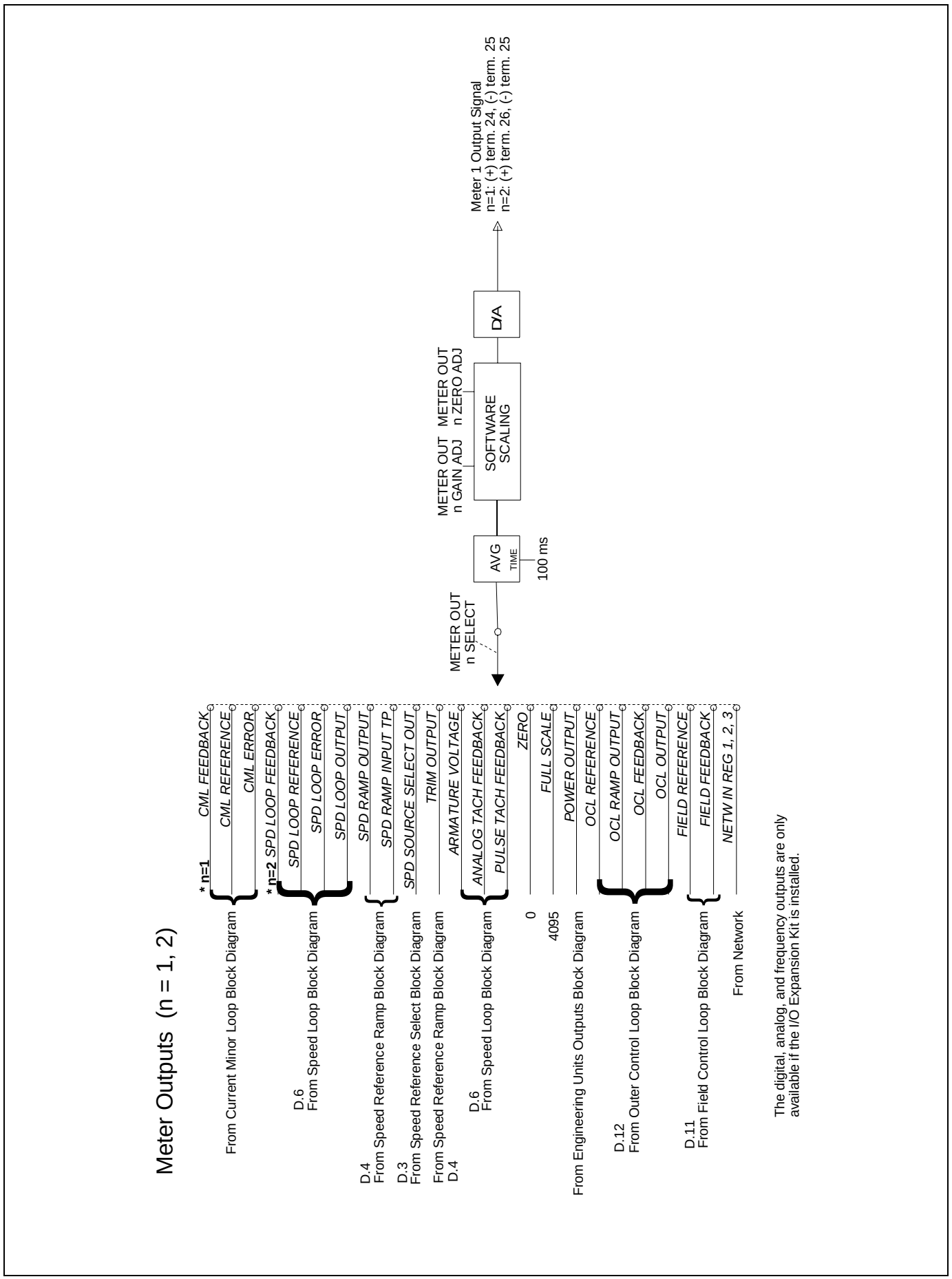


Figure D.8 - Metering Outputs

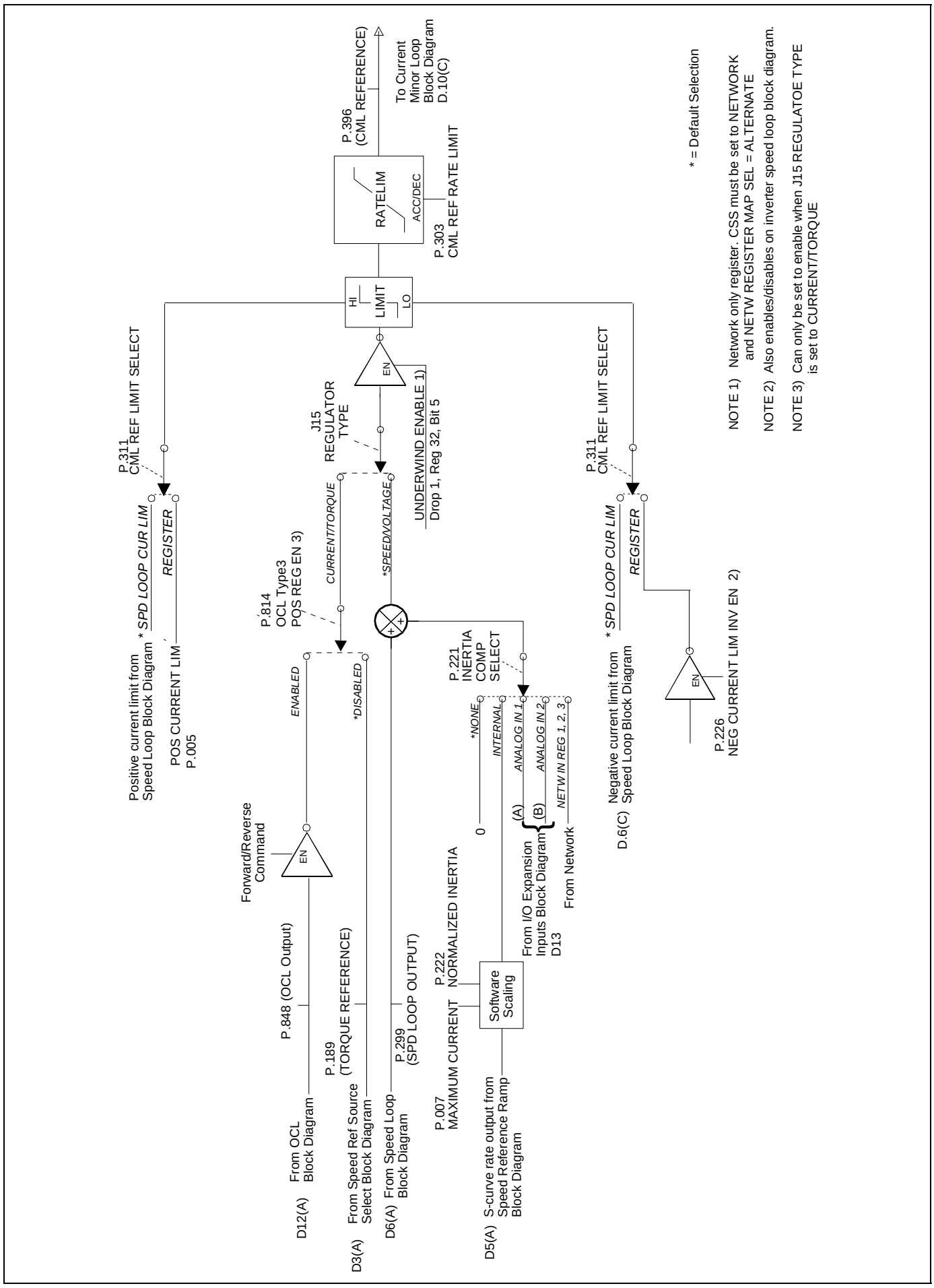


Figure D.9 - Current Minor Loop Reference

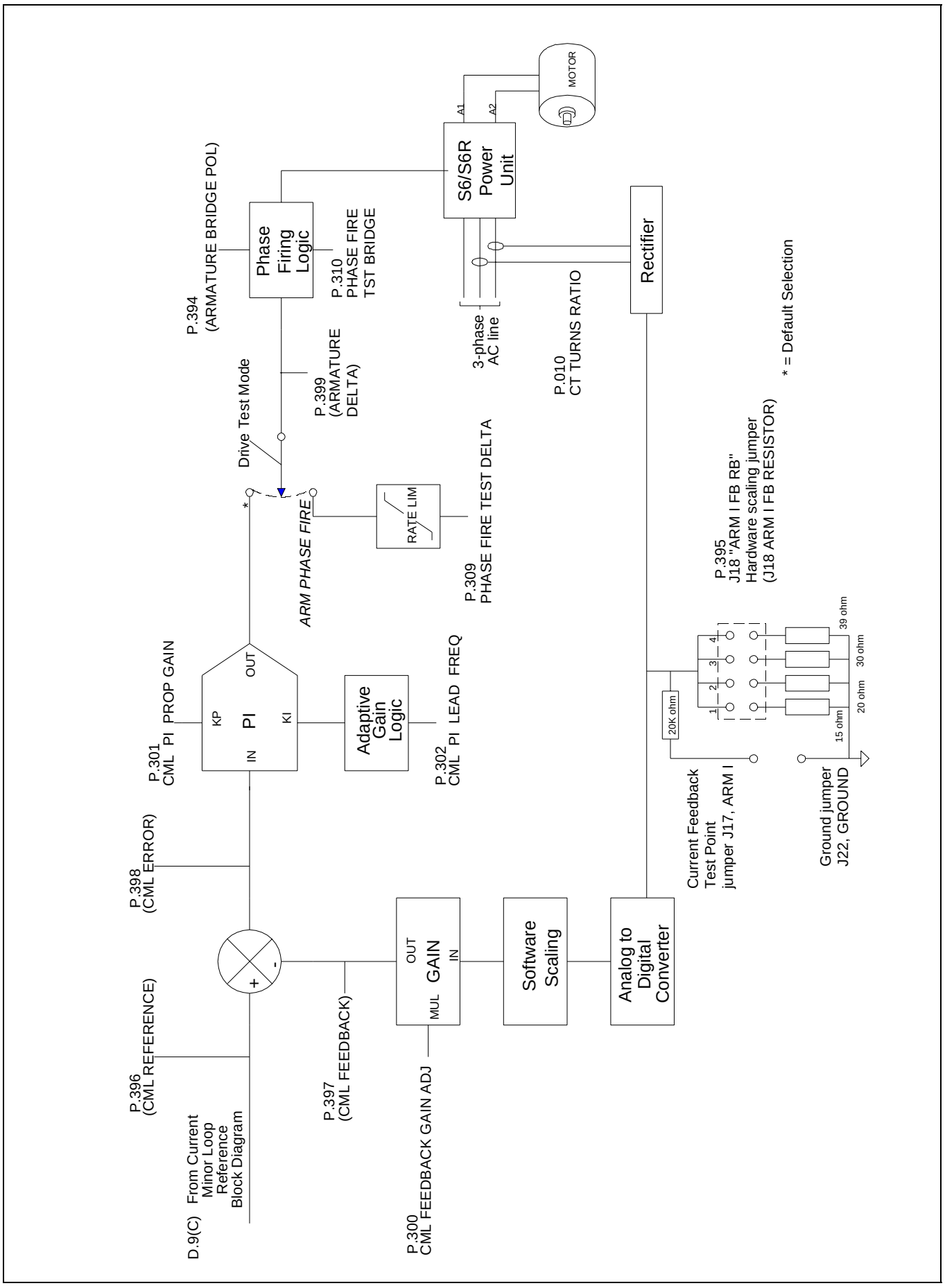


Figure D.10 - Current Minor Loop

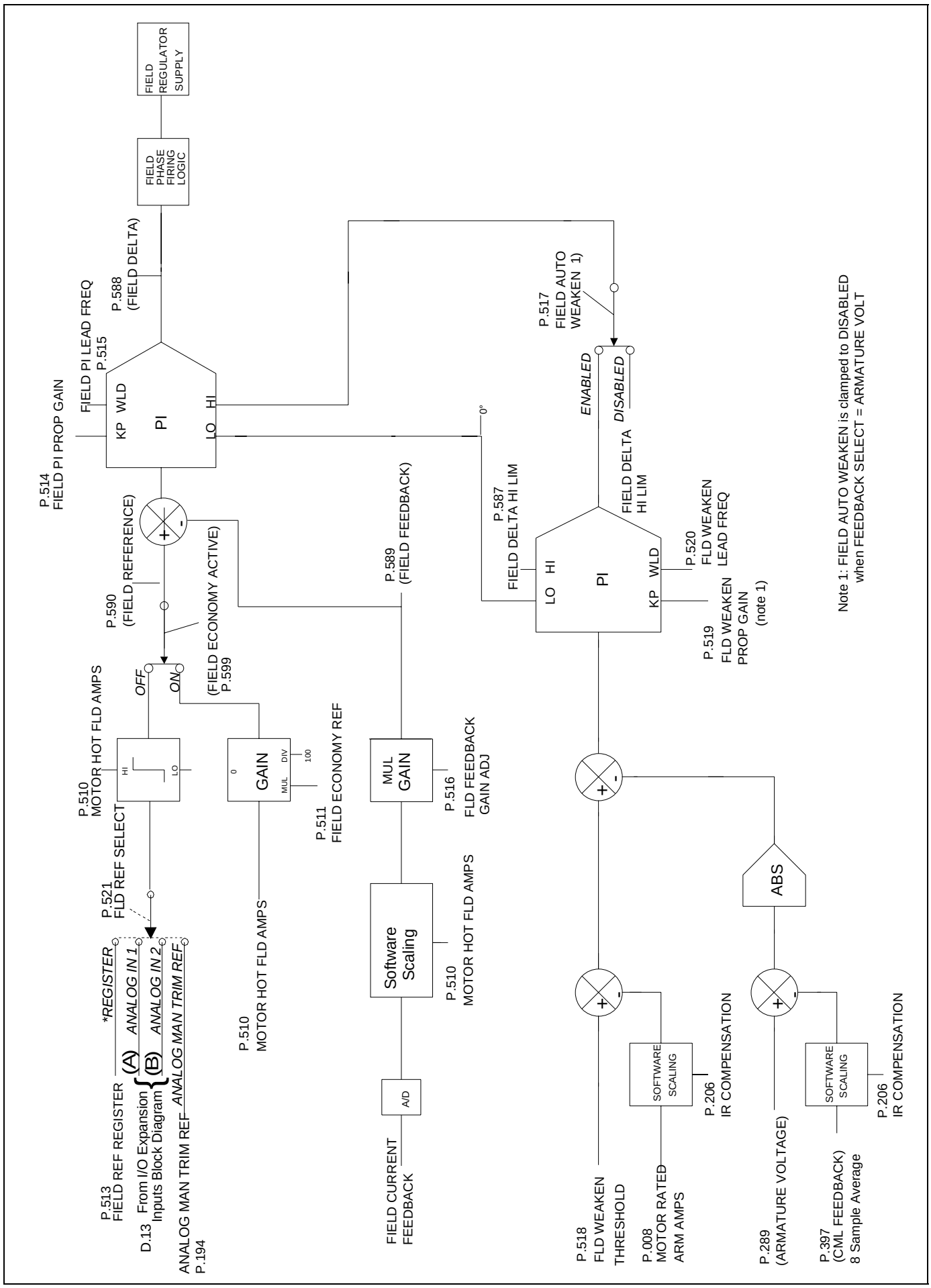


Figure D.11 - Field Block

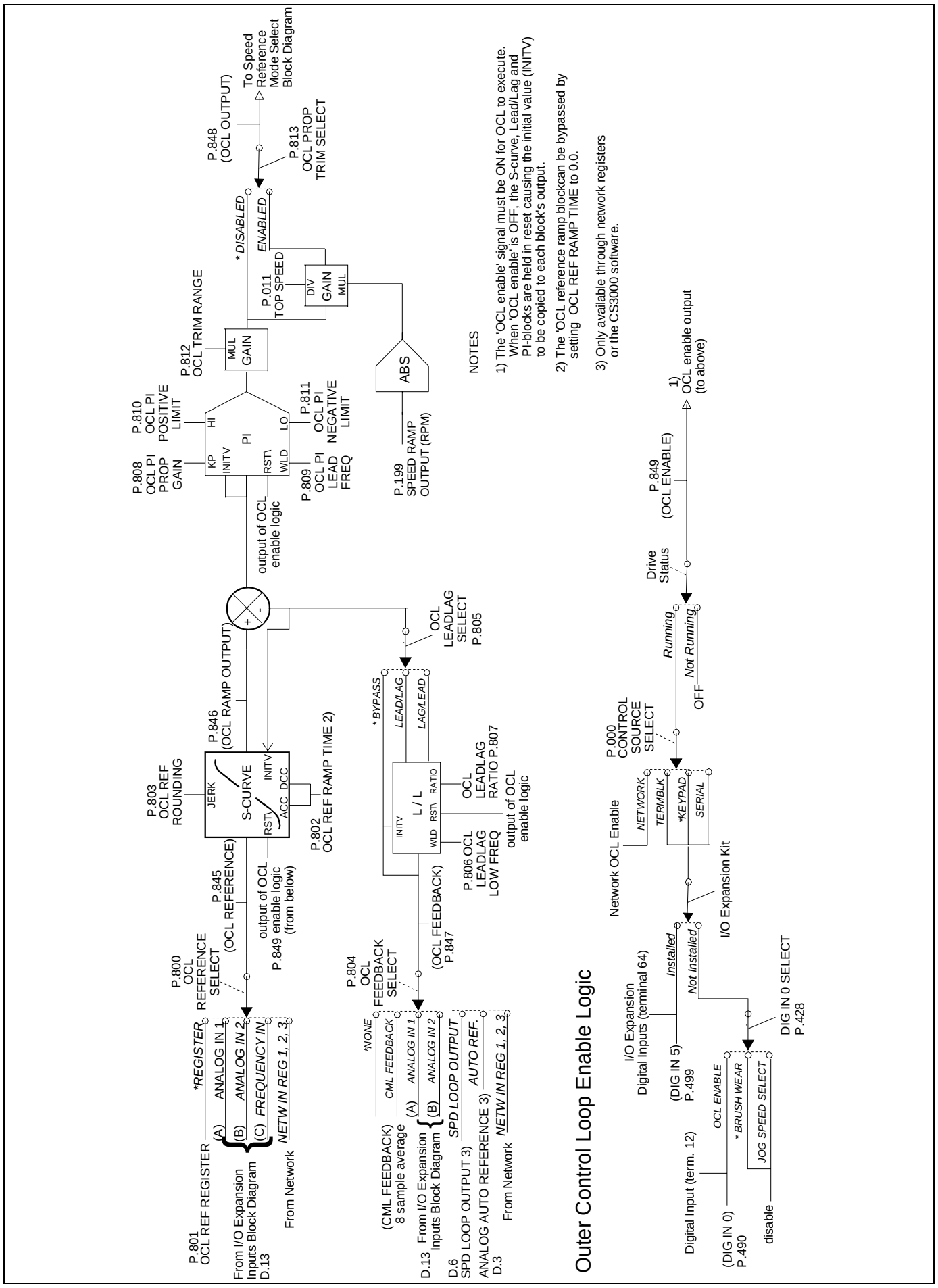


Figure D.12 - I/O Expansion Board Outer Control Loop

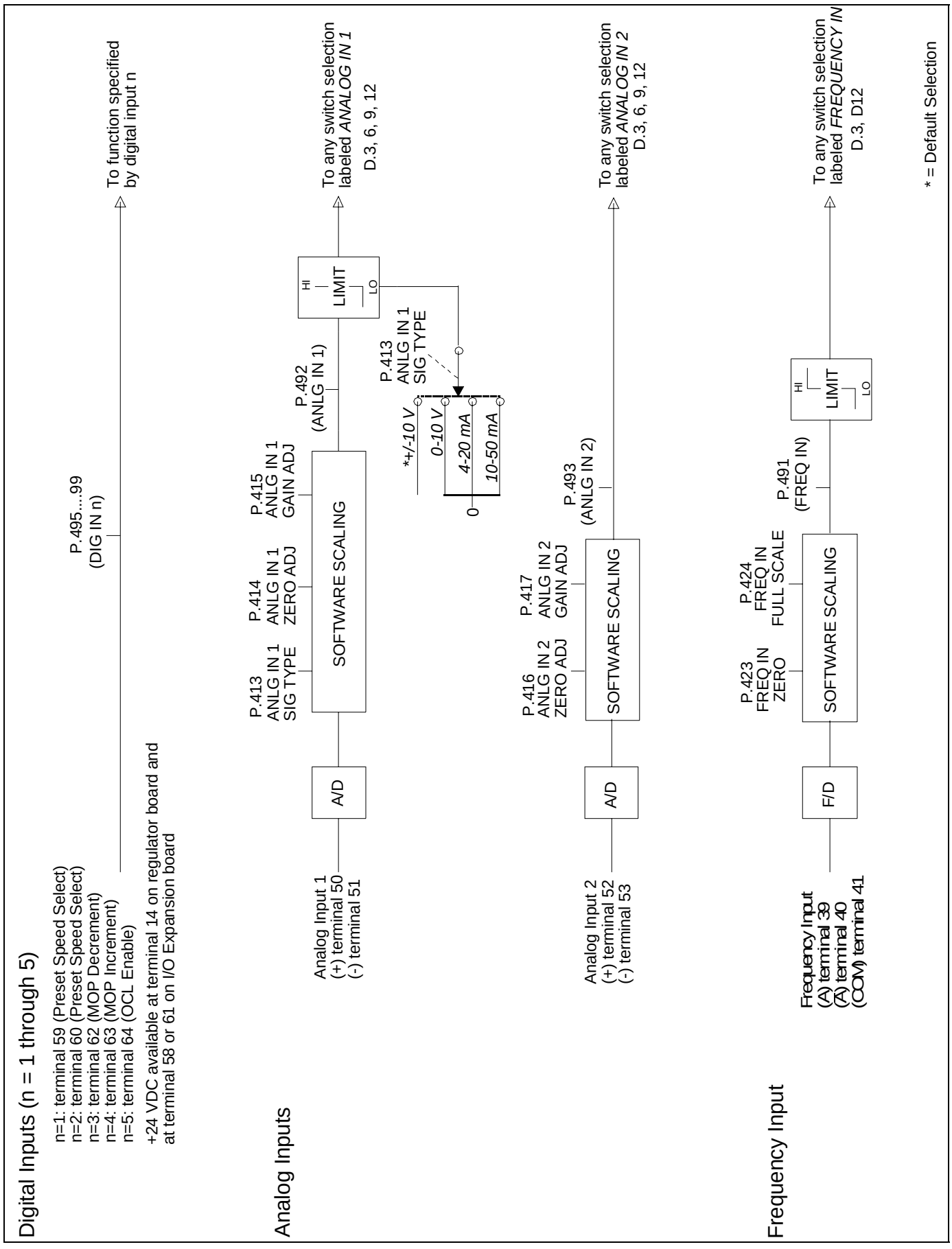


Figure D.13 - I/O Expansion Board Inputs

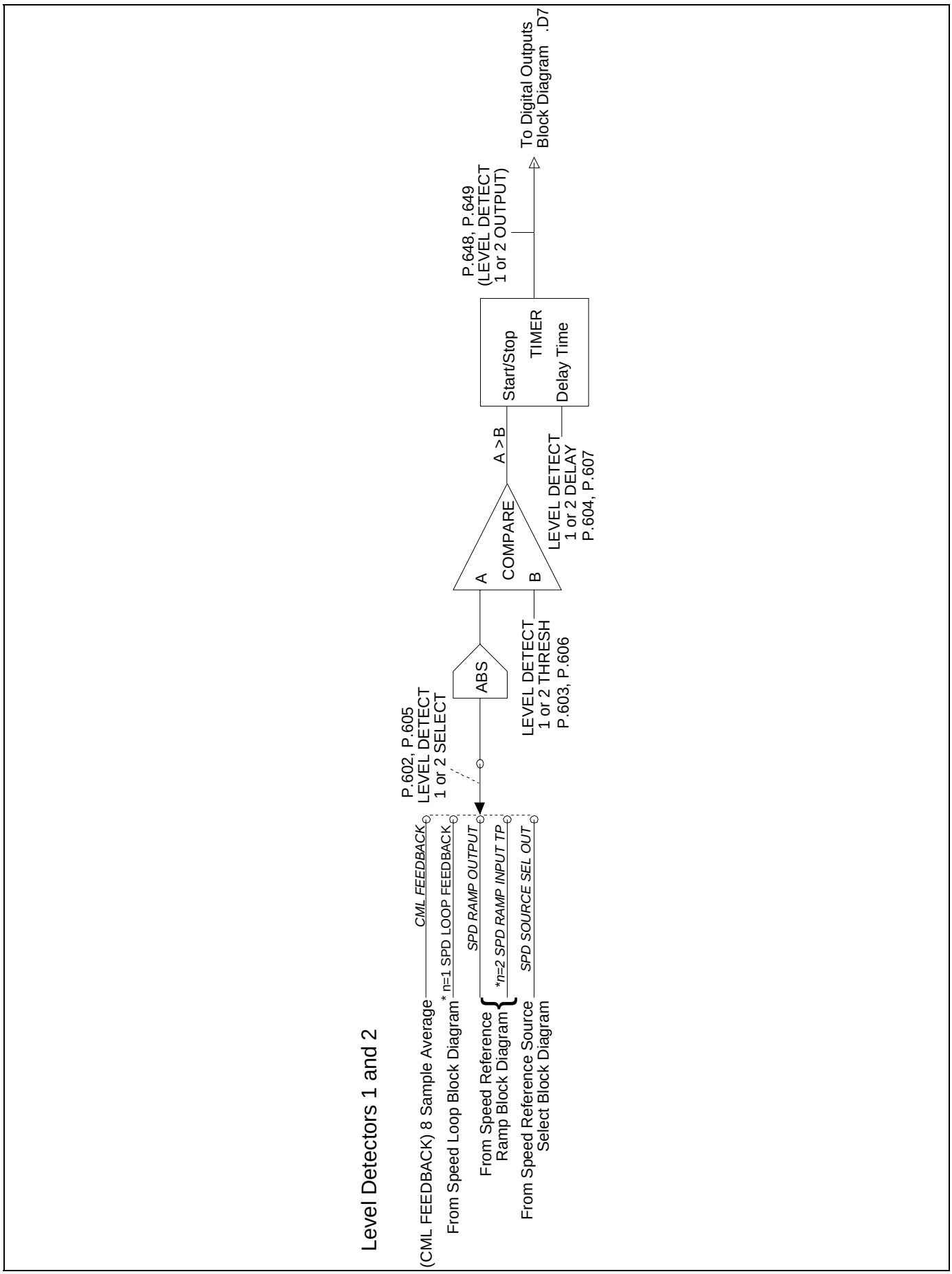


Figure D.14 - Level Detectors

Program Error Messages and Fault and Alarm Codes

This appendix lists all possible OIM error messages generated by the drive and fault/alarm codes. The error messages appear on the OIM display when certain drive conditions exist. Table E-1 lists fault codes and Table E-2 lists alarm codes. Tables E-1 and E-2 list fault and alarm codes by number (Fxxxxx = Fault; Axxxxx = Alarm), associated message visible at the OIM display and a description along with possible causes.

Table E.1 - Fault Codes

CODE	DISPLAY	DESCRIPTION
F00001	IET (OVERCURRENT)	Armature current instantaneously exceeded 180% of MAXIMUM CURRENT. Possible causes: • Incorrect armature current feedback scaling (MOTOR RATED ARM AMPS, MAXIMUM CURRENT, CT TURNS RATIO and/or J18 not set properly). • One or more thyristors not operating. • Improper Current Minor Loop tuning. • Motor armature winding damaged.
F00002	TACHOMETER LOSS	Tachometer feedback signal missing. Possible causes: • Tachometer coupling failure. • Disconnected, loosely connected, or damaged tachometer wires. • Pulse encoder supply voltage low. • Incorrect tachometer polarity. • Incorrect analog tachometer scaling. • Incorrect pulse encoder configuration. • Motor armature winding not connected or open circuit. • Blown inverting fault (DC) fuse. • Inverting fault breaker tripped. • Tachometer failure. • Excessive armature voltage at motor speed <5% of TOP SPEED, Refer to Appendix B, TACH LOSS SCR ANGLE (P608).
F00003	OVERSPEED	Motor speed exceeded the 110% of TOP SPEED. Possible causes: • Incorrect tachometer scaling. • Blown field supply fuse(s). • Improper speed loop tuning. • PULSE TACH QUADRATURE set to ON for a non-regenerative drive. • Incorrect pulse encoder wiring.
F00004	FIELD CURRENT LOSS	The field loss detection circuit does not sense any field current flowing in the motor shunt field. Possible causes: • Motor field winding not connected or open circuit. • Blown field supply fuse(s). • Blown AC line fuse(s). • Field supply failure. • Disconnected, loosely connected or damaged wiring harness.
F00005	SUSTAINED OVERLOAD	Inverse time overload circuit trip. Possible causes: • Incorrect armature current feedback scaling (MOTOR RATED ARM AMPS, MAXIMUM CURRENT, CT TURNS RATIO and/or J18 not set properly). • Blown field supply fuse(s). • Mechanical binding preventing the motor shaft from rotating freely.

Table E.1 - Fault Codes (Continued)

CODE	DISPLAY	DESCRIPTION
F00006	BLOWER MOTOR STARTER OPEN	This fault is not applicable on European versions FlexPak 3000.
F00007	OPEN ARMATURE	The motor armature circuit is open. Possible causes: • Motor armature winding not connected or open circuit. • Blown inverting fault (DC) fuse. • Excessive armature voltage at motor speeds <5% of TOP SPEED, Refer to Appendix B, TACH LOSS SCR ANGLE (P608).
F00008	MOTOR THERMOSTAT TRIP	Motor thermostat indicates high temperature. If a motor thermostat is not used, customer terminal board pins 13 and 14 must be jumpered to inhibit this fault. Possible causes: • Damaged or disconnected motor thermostat wiring. • Inadequate ventilation. • Blower motor failure. • Incorrect blower rotation. • Blocked ventilation slots. • Clogged filters. • Excessive armature current. • One or more thyristors not operating.
F00009	CONTROLLER THERMOSTAT TRIP	Controller thermostat indicates high temperature. Possible causes: • Inadequate heat sink ventilation. • Inadequate cabinet ventilation. • Heat sink fan failure. • Damaged or disconnected controller thermostat wiring.
F00010	AC LINE SYNCHRONIZATION FAULT	Three-phase AC line synchronization circuit failure. Possible causes: • Blown AC line fuse(s). • AC line frequency not within required range of 48-62Hz. • Excessive AC line noise or distortion. • Unstable AC line frequency. • Disconnected, loosely connected or damaged J6 ribbon cable.
F00011	OIM COMMUNICATIONS TIMEOUT	The regulator board was unable to communicate with the Operator Interface Module (OIM). (Refer to section 7.7.5 which discusses the regulator status LEDs that can pinpoint whether or not the OIM is communicating) Possible causes: • Disconnected, loosely connected, or damaged OIM cable. • OIM failure. • Regulator board failure.
F00012	ARMATURE OVER VOLTAGE	Armature voltage exceeded 130% of MOTOR RATED ARM VOLTS (P.009). Possible causes: • MOTOR RATED ARM VOLTS not set properly. • Improper voltage loop tuning. • ENHANCED FLD VOLT ADJ (P.500) set too high (Enhanced Field Supply kit only).

Table E.1 - Fault Codes (Continued)

CODE	DISPLAY	DESCRIPTION
F00013	NETWORK COMMUNICATION TIMEOUT	Network Communications is missing or failed to communicate with master. (CONTROL SOURCE SELECT = NETWORK) Possible causes: • NETW CONNECT TYPE (P.910) was changed from BASIC to FULL. • NETW DROP NUMBER (P.900) was changed. • Network Option cable connections are loose or not connected. • Network Option device failed or master communications failed.
F00014	REVERSED TACH LEADS	The difference between the speed reference and speed feedback was greater than TACH LEAD FLT THRESH (P.227) for the time specified in TACH LEAD FLT DELAY (P.228). Possible causes: • The motor armature leads are reversed. • The motor field leads are reversed. • The speed feedback leads are reversed. • There is an overhauling load • Improper drive tuning.
F00015	INVERTING FAULT AVOIDED	The inverting fault avoidance logic has detected conditions that could have caused an inverting fault. The drive took action to avoid an actual inverting fault. See Parameter P.312 description for more information.
F00016	PHASE LOSS	The measured AC line voltage fell below 75% of the value specified by NOMINAL AC LINE VOLTS (P.307).
F00030 F00030 to F00041	SCR No. n NOT OPERATING	The value of `n' indicates the SCR that is not operating; n = 1-6, 11-16.
F00042	MULTIPLE SCRS NOT OPERATING	One or more thyristor (SCR) is not carrying an equal load. Possible causes: • Disconnected, loosely connected or damaged thyristor gating circuit. • Blown A-C line fuse(s). • Improper Current Minor Loop tuning. • Improper Speed/Voltage Loop tuning. • Failed thyristor.
F00060	SELF TUNING FAULT	Self Tune aborted by external input. Possible causes: • Operator stop asserted. • Drive interlock(s) open. • Drive fault became active.
F00061	SELF TUNING FAULT	Non-zero speed feedback at self tune start. Possible causes: • Incorrect speed feedback scaling or offset. • Overhauling load causing motor shaft rotation.
F00062	SELF TUNING FAULT	Calculated armature inductance is out of range. Possible causes: • Motor armature winding not connected or open circuit. • Blown inverting fault (DC) fuse. • Inverting fault breaker tripped. • Armature inductance too high, tune CML manually.

Table E.1 - Fault Codes (Continued)

CODE	DISPLAY	DESCRIPTION
F00063	SELF TUNING FAULT	Maximum current with minimum rotation. Possible causes: • Motor can not rotate freely due to mechanical friction. • Motor load is too high. • Motor field not at normal operating temperature.
F00064	SELF TUNING FAULT	Attached inertia is out of range. Possible causes: • Maximum self tune speed reached. • Overhauling load present. • High mechanical friction present. • The Speed Loop can not be self tuned. Tune Speed Loop manually.
F00065	SELF TUNING FAULT	Speed unstable. Possible causes: • CML not properly tuned before Speed Loop. • Tachometer feedback connected incorrectly.
F00066	SELF TUNING FAULT	SELF TUNE STABILITY (P.219) is too low. Possible cause: • Specified stability is less than that calculated by CML self tuning, use 50 or greater.
F00067	SELF TUNING FAULT	SELF TUNE STABILITY (P.219) is too low. Possible cause: • Specified stability is less than that calculated by CML self tuning, use 75 or greater.
F00089 to F00099	SELF TUNING FAULT	Fatal self tuning fault occurred. Possible cause: • Self tuning was unable to complete; tune manually.
F00100 1)	MAIN CONTACTOR DID NOT OPEN	The main contactor was not open when a run or jog request is applied. Possible causes: • Disconnected, loosely connected, or damaged main contactor (K1M) or Aux. contactor (K1) wiring. • Main contactor or Aux. Main contactor failure. • Disconnected, loosely connected, or damaged main contactor control wiring (MCR).
F00200	POWER FAILURE	The power supply input voltage momentarily went below tolerance. Possible causes: • AC line voltage dip. • Disconnected, loosely connected, or damaged J7 ribbon cable or power supply input wiring

1) When after stop command, the auxiliary contactor does not indicate that the main contactor opened, this fault indication is 1000 msec time delayed.

Table E.1 - Fault Codes (Continued)

CODE	DISPLAY	DESCRIPTION
F00700	FACTORY DEFAULTS RESTORED	The parameter values stored in retentive memory were determined to be invalid, factory default values have been restored. All parameter values (including any factory set parameters) must be re-adjusted based on your particular application's requirements before the drive is operated. After all parameters have been set properly, a memory save must be performed. Possible causes: • Power loss during a prior memory save. • New or defective regulator board.
F00701	FAULT LOG RESTORE FAILURE	The fault log information stored in retentive memory was determined to be invalid, the fault log has been cleared. Possible causes: • Power loss during a prior fault log save. • Defective regulator board.
F00702	KEYPAD REF RESTORE FAILURE	The keypad reference value stored in retentive memory was determined to be invalid, the keypad reference has been set to the MINIMUM SPEED value. Possible causes: • Power loss during a prior keypad reference save. • Defective regulator board.
F00703	OIM KEY RESTORE FAILURE	The OIM key states stored in retentive memory were determined to be invalid, the FORWARD/REVERSE key has been set to FORWARD, the AUTO/MANUAL key has been set to MANUAL. Possible cause: Defective regulator board.
F00800	INVALID FIELD INSTALLED	Installed field supply is not supported by the regulator. Possible causes: • Disconnected, loosely connected, or damaged field supply wiring. • Regulated field supply failure. • Defective regulator board.
F00801	FIELD FEEDBACK OFFSET TOO HIGH	Regulated field supply feedback offset is too high. Possible causes: • Disconnected, loosely connected, or damaged field supply wiring. • Regulated field supply failure. • Defective regulator board.
F01000 to F01999	MICROBUS FAULT	An error occurred on the Microbus. Possible causes: • Electrical noise due to improper wiring practices or unsuppressed brake coils, relays, or contactors. • Disconnected, loosely connected or damaged Microbus ribbon cable. • Defective regulator board. • F01000-F01799: Defective Microbus peripheral or defective Regulator board. • F01810-F01816: A Microbus peripheral was found that is not supported by the regulator software.
F00999 and F02000 to F03999	MICRO-PROCESSOR HW/SW FAULT	A microprocessor hardware or software fault occurred. Possible causes: • Electrical noise due to improper wiring practices or unsuppressed brake coils, relays, contactors. • Defective regulator board.

Table E.2 - Alarm Codes

CODE	DISPLAY	DESCRIPTION
A00001	MOTOR BRUSH WEAR LOW	The motor brush wear detector indicates that the brushes are worn and require replacement. Only available if DIG IN 0 SELECT (P.428) is set to 1 (default). If no motor brush wear detector is used, customer terminal strip pins 12 & 14 must be jumpered to inhibit this alarm. Possible causes: • Worn motor brushes. • Disconnected, loosely connected or damaged motor brush wear indicator wiring. • Motor brush wear indicator failure.
A00002	AC LINE VOLTAGE LOW	The A-C line voltage fell below 90% of the NOMINAL AC LINE VOLTS. Possible causes: • Low AC line voltage. • Incorrect value entered for NOMINAL AC LINE VOLTS (P.307). • Blown AC line fuse(s).
A00003	AC LINE VOLTAGE HIGH	The AC line voltage rose above 115% of the NOMINAL AC LINE VOLTS. Possible causes: • High A-C line voltage. • Incorrect value entered for NOMINAL AC LINE VOLTS (P.307).
A00004	NETWORK COMMUNICATION TIMEOUT	Network Communications is missing or failed to communicate with master. (CONTROL SOURCE SELECT = NETWORK) Possible causes: • NETW CONNECT TYPE (P.910) was changed from BASIC to FULL. • NETW DROP NUMBER (P.900) was changed. • Network Option cable connections are loose or not connected. • Network Option device failed or master communications failed.
A00005	INVERTING FAULT AVOIDED	The inverting fault avoidance logic has detected conditions that could have caused an inverting fault. The drive took action to avoid an actual inverting fault. See Parameter P.312 description for more information.
A00030 1)	MAIN CONTACTOR DID NOT OPEN	The main contactor (K1M) did not open following a stop. Possible causes: • Disconnected, loosely connected, or damaged main contactor (K1M) or Aux. contactor (K1) wiring. • Main contactor or Aux. Main contactor failure. • Disconnected, loosely connected, or damaged main contactor control wiring (MCR).
A00031 2)	MAIN CONTACTOR DID NOT CLOSE	The main contactor (K1M) did not close following a run or jog request. Possible causes: • Disconnected, loosely connected, or damaged main contactor (K1M) or Aux. contactor (K1) wiring. • Main contactor or Aux. Main contactor failure. • Disconnected, loosely connected, or damaged main contactor control wiring (MCR).

1) When after stop command, the auxiliary contactor does not indicate that the main contactor opened, this alarm indication is 1000 msec time delayed.

2) When after start command, the auxiliary contactor does not indicate that the main contactor closed, this alarm indication is 1000 msec time delayed.

Table E.2 - Alarm Codes (Continued)

CODE	DISPLAY	DESCRIPTION
A00032	SUSTAINED SPEED	Motor speed did not fall below the STOP SPEED THRESHOLD (P.113) in the required amount of time during a stop (this time is automatically set to two times the DECELERATION RATE (P.002) time). Possible causes: • DECELERATION RATE not set properly. • STOP SPEED THRESHOLD not set properly. • Overhauling load maintaining motor speed higher than the STOP SPEED THRESHOLD. • Incorrect speed/voltage feedback scaling.
A00033	SUSTAINED ARMATURE CURRENT	Armature current was unable to reach discontinuous conduction while stopping the drive. Possible causes: • Motor CEMF too high or line voltage too low for proper commutation.
A00050	CML FEEDBACK SCALING ERROR	Armature current feedback could not be scaled properly based on the values entered for MOTOR RATED ARM AMPS and MAXIMUM CURRENT. Verify that these parameter values are correct for your application. Verify that CT TURNS RATIO has been set to the value shown in the instruction manual based on your drive type.
A00051	LOW MINIMUM SPEED	The MINIMUM SPEED value is less than 10% of the MAXIMUM SPEED value. This alarm will not be triggered on power-up. It only occurs when maximum or minimum speed has changed. Verify that these parameter values are correct for your application.
A00052	NEG CUR LIM INV ENABLE CHANGED	The parameter NEG CUR LIM INV EN (P.226) has changed state, either enabling or disabling the negative current limit inverters. The parameters POS CURRENT LIMIT SEL (P.223) and NEG CURRENT LIMIT SEL (P.224) have been automatically set to REGISTER- The user should carefully examine the current limit scheme to avoid unintended operation by the drive.
A00700	RETENTIVE MEMORY SAVE ERROR	An attempt to save information (parameter values, fault log data or the keypad reverence value) to retentive memory failed. The drive may continue to be operated. Possible cause: Regulator board failure.

OIM Parameter Menu Tree

This appendix shows the FlexPak 3000 menu structures as they are displayed on the OIM. Parameter names are in upper case, sub-menu names and menu items which cause an action to occur (such as resetting faults) are in lower case.

The Fault Menu, Alarm Menu and Diagnostics Menu are accessed by repeated pressing of the OIM FAULT key. The text "FAULT", "ALARM" or "DIAGS" will appear above the FAULT key.

Fault Menu
- Review Log
- Reset Faults
- Clear Fault Log and Reset Faults

Alarm Menu
- Review Log
- Reset Alarm Indicator
- Clear Alarm Log & Reset Alarms

Diagnostics Menu
- Why is the drive not ready?
- Why did the drive stop?

To access the Main Menu, press CANCEL until FlexPak 3000 Main Menu is displayed at the top of the screen. Each menu shown below is expanded on the pages that follow.

FlexPak 3000 Main Menu
- Quick Start
- Drive Reference
- Speed/Voltage Loop (SPD)
- Current Minor Loop (CML)
- Outer Control Loop (OCL)
- Input/Output
- Network Communications
- Field
- Drive Information
- Operator Interface
- Additional Parameters

If older versions of the OIM are used with newer versions of the regulator board, the menu item Additional Parameters might also be available.

FlexPak 3000 Main Menu

- Quick Start
  - MOTOR BASE SPEED/TOP SPEED (P.011)
  - MOTOR RATED ARM AMPS (P.008)
  - MOTOR RATED ARM VOLTS (P.009)
  - REVERSE DISABLE (P.015)
  - FEEDBACK SELECT (P.200)
  - ANLG TACH VOLTS/1000 (P.203)
  - ACCELERATION TIME (P.001)
  - DECELERATION TIME (P.002)
  - MINIMUM SPEED (P.003)
  - MAXIMUM SPEED (P.004)
  - JOG ACCEL/DECEL TIME (P.013)
  - JOG SPEED 1 (P.012)
  - POSITIVE CURRENT LIM (P.005)
  - NEGATIVE CURRENT LIM (P.006)
  - IR COMPENSATION (P.206)
  - J11 ANLG TACH VLT SCL (P.792)
  - J14 ANLG TACH VLT RNG LOW (P.793)
  - J18 ARM I FB RESISTOR (P.395)
  - Self Tune
- Drive Reference
  - Drive Reference Test Points
    - ANALOG AUTO REFERENCE (P.188)
    - ANALOG MAN REFERENCE (P.192)
    - ANALOG MAN TRIM REF (P.194)
    - SPD SOURCE SELECT OUT (P.193)
    - DRAW PERCENTAGE OUT (P.196)
    - TRIM OUTPUT (P.197)
    - SPEED RAMP INPUT TP (P.198)
    - SPEED RAMP OUTPUT (P.199)
    - JOG RAMP OUTPUT (P.294)
    - SPD LOOP REFERENCE (P.295)
    - MOP OUTPUT (P.191)
  - Drive Reference Trim
    - TRIM REF REGISTER (P.107)
    - TRIM REFERENCE SELECT (P.108)
    - TRIM RANGE (P.109)
    - TRIM MODE SELECT (P.110)
  - Drive Reference Limits
    - TOP SPEED (P.011)
    - MAXIMUM SPEED (P.004)
    - MINIMUM SPEED (P.003)
    - REVERSE DISABLE (P.015)
    - AUTO MODE MIN BYPASS (P.111)
  - Drive Reference Ramp
    - ACCELERATION TIME (P.001)
    - DECELERATION TIME (P.002)
    - S-CURVE ROUNDING (P.014)
    - JOG ACCEL/DECEL TIME (P.013)
    - AUTO MODE RAMP BYPASS (P.112)
    - MOP ACCEL TIME (P.115)
    - MOP DECEL TIME (P.120)

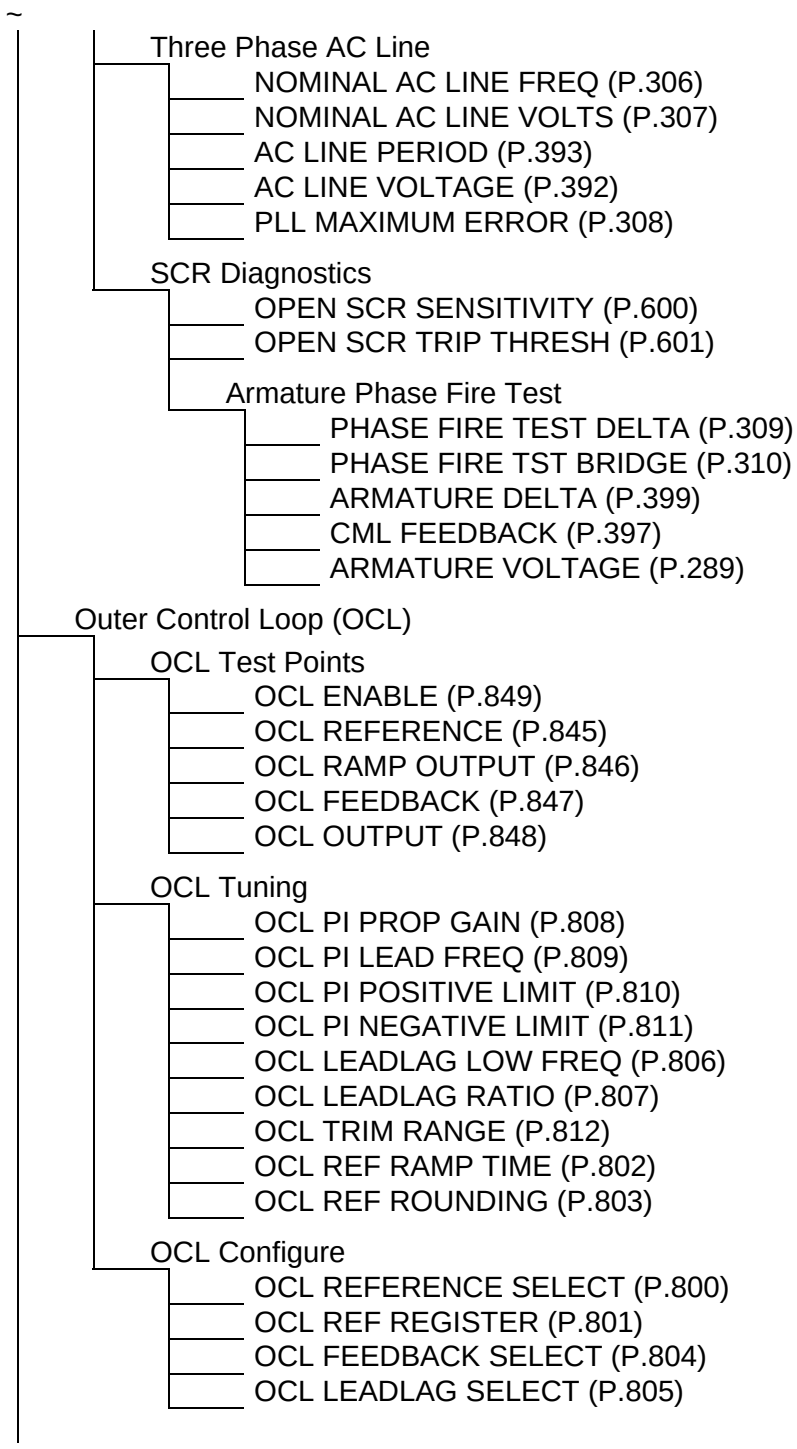
- FlexPak 3000 Main Menu
  - Drive Reference Configure
    - JOG SPEED (P.012)
    - ANLG AUTO SIGNAL TYPE (P.100)
    - STOP MODE SELECT (P.114)
    - STOP SPEED THRESHOLD (P.113)
    - AUTO REFERENCE SELECT (P.103)
    - MANUAL REF SELECT (P.106)
    - JOG OFF DELAY TIME (P.121)
    - PRESET SPEED 1 (P.117)
    - PRESET SPEED 2 (P.118)
    - PRESET SPEED 3 (P.119)
    - MOP RESET ENABLE (P.116)
  - Drive Reference Scaling
    - ANLG AUTO ZERO ADJ (P.102)
    - ANLG AUTO GAIN ADJ (P.101)
    - ANALOG AUTO REFERENCE (P.188)
    - ANLG MAN REF ZERO ADJ (P.105)
    - ANLG MAN REF GAIN ADJ (P.104)
    - ANALOG MAN REFERENCE (P.192)
    - ANALOG MAN TRIM REF (P.194)
- Speed/Voltage Loop (SPD)
  - Speed/Voltage Loop (SPD) Test Points
    - SPD LOOP REFERENCE (P.295)
    - SPD LOOP FEEDBACK (P.296)
    - SPD LOOP ERROR (P.297)
    - SPD LOOP LAG OUTPUT (P.298)
    - SPD LOOP OUTPUT (P.299)
    - CURRENT COMPOUND TP (P.293)
    - ARMATURE VOLTAGE(P.289)
    - IR COMPENSATION TP (P.290)
    - ANALOG TACH FEEDBACK (P.291)
    - PULSE TACH FEEDBACK (P.292)
  - Speed/Voltage Loop (SPD) Tuning
    - SPD LOOP PI PROP GAIN (P.211)
    - SPD LOOP PI LEAD FREQ (P.212)
    - Self Tuning Setup
      - SELF TUNE BRIDGE (P.220)
      - SELF TUNE FIELD RANGE (P.218)
      - SELF TUNE STABILITY (P.219)
    - Self Tuning
      - POSITIVE CURRENT LIM (P.005)
      - NEGATIVE CURRENT LIM (P.006)
      - CURRENT COMPOUNDING (P.209)
      - SPD LEADLAG SELECT (P.216)
      - SPD LEADLAG LOW FREQ (P.214)
      - SPD LEADLAG RATIO (P.213)
      - SPD LOOP LAG BYPASS (P.217)
      - SPD LOOP LAG FREQ (P.215)
      - IR COMPENSATION (P.206)
      - INERTIA COMP SELECT (P.221)
      - NORMALIZED INERTIA (P.222)
      - POS CURRENT LIM SEL (P.223)
      - NEG CURRENT LIM SEL (P.224)

FlexPak 3000 Main Menu

~

- Speed/Voltage Loop (SPD) Feedback
  - FEEDBACK SELECT (P.200)
  - MOTOR RATED ARM VOLTS (P.009)
  - ARM VOLTAGE ZERO ADJ (P.205)
  - ARM VOLTAGE GAIN ADJ (P.204)
  - ARMATURE VOLTAGE (P.289)
  - ANALOG TACH ZERO ADJ (P.202)
  - ANALOG TACH GAIN ADJ (P.201)
  - ANALOG TACH FEEDBACK (P.291)
  - ANLG TACH VOLTS/1000 (P.203)
  - J11 ANLG TACH VLT SCL (P.792)
  - J14 ANLG TACH VLT RNG (P.793)
  - PULSE TACH PPR (P.207)
  - PULSE TACH QUADRATURE (P.208)
- Current Minor Loop (CML)
  - CML Test Points
    - CML REFERENCE (P.396)
    - CML FEEDBACK (P.397)
    - CML ERROR (P.398)
    - SPD LOOP OUTPUT (P.299)
    - ARMATURE BRIDGE POL (P.394)
    - ARMATURE DELTA (P.399)
    - TORQUE REFERENCE (P.189)
    - J15 REGULATOR TYPE (P.799)
  - CML Tuning
    - CML PI PROP GAIN (P.301)
    - CML PI LEAD FREQUENCY (P.302)
    - CML REF RATE LIMIT (P.303)
    - POSITIVE CURRENT LIM (P.005)
    - NEGATIVE CURRENT LIM (P.006)
    - Self Tuning Setup
      - SELF TUNE BRIDGE (P.220)
      - SELF TUNE FIELD RANGE (P.218)
      - SELF TUNE STABILITY (P.219)
    - Self Tuning
      - POS CURRENT LIM SEL (P.223)
      - NEG CURRENT LIM SEL (P.224)
  - CML Feedback Scaling
    - MAXIMUM CURRENT (P.007)
    - MOTOR RATED ARM AMPS (P.008)
    - CML FEEDBACK GAIN ADJ (P.300)
    - J18 ARM I FB RESISTOR (P.395)
    - CT TURNS RATIO (P.010)
    - CML FEEDBACK (P.397)

FlexPak 3000 Main Menu



FlexPak 3000 Main Menu

~

- Input/Output
  - Meter Outputs
    - METER OUT 1 SELECT (P.404)
    - METER OUT 1 ZERO ADJ (P.402)
    - METER OUT 1 GAIN ADJ (P.400)
    - METER OUT 2 SELECT (P.405)
    - METER OUT 2 ZERO ADJ (P.403)
    - METER OUT 2 GAIN ADJ (P.401)
  - Analog I/O
    - I/O EXPANSION KIT (P.797)
    - ANLG IN 1 SIG TYPE (P.413)
    - ANLG IN 1 ZERO ADJ (P.414)
    - ANLG IN 1 GAIN ADJ (P.415)
    - ANLG IN 1 (P.492)
    - ANLG IN 2 ZERO ADJ (P.416)
    - ANLG IN 2 GAIN ADJ (P.417)
    - ANLG IN 2 (P.493)
    - ANLG OUT 1 SELECT (P.418)
    - ANLG OUT 1 SIG TYPE (P.419)
    - ANLG OUT 1 GAIN ADJ (P.420)
    - ANLG OUT 2 SELECT (P.421)
    - ANLG OUT 2 GAIN ADJ (P.422)
  - Digital I/O
    - I/O EXPANSION KIT (P.797)
    - DIG IN 1 (P.495)
    - DIG IN 2 (P.496)
    - DIG IN 3 (P.497)
    - DIG IN 4 (P.498)
    - DIG IN 5 (P.499)
    - DIG OUT 1 SELECT (P.409)
    - DIG OUT 1 CONTACT TYP (P.410)
    - DIG OUT 2 SELECT (P.411)
    - DIG OUT 2 CONTACT TYP (P.412)
  - Frequency I/O
    - I/O EXPANSION KIT (P.797)
    - FREQ IN ZERO (P.423)
    - FREQ IN FULL SCALE (P.424)
    - FREQ IN (P.491)
    - FREQ OUT SELECT (P.425)
    - FREQ OUT ZERO (P.426)
    - FREQ OUT FULL SCALE (P.427)
  - Level Detectors
    - LEVEL DETECT 1 SELECT (P.602)
    - LEVEL DETECT 1 THRESH (P.603)
    - LEVEL DETECT 1 DELAY (P.604)
    - LEVEL DETECT 1 OUTPUT (P.648)
    - LEVEL DETECT 2 SELECT (P.605)
    - LEVEL DETECT 2 THRESH (P.606)
    - LEVEL DETECT 2 DELAY (P.607)
    - LEVEL DETECT 2 OUTPUT (P.649)

FlexPak 3000 Main Menu

~

- Network Communications
  - NETWORK KIT (P.796)
  - NETW TYPE & VERSION (P.909)
  - NETW COMM STATUS (P.908)
  - NETW DROP NUMBER (P.900)
  - NETW COMM LOSS SELECT (P.901)
  - NETW CONNECT TYPE (P.910)
  - AMX NETW REF SELECT (P.911)
  - NETW OUT REG 1 SELECT (P.902)
  - NETW OUT REG 2 SELECT (P.903)
  - NETW OUT REG 3 SELECT (P.904)
  - NETW IN REG 1 (P.905)
  - NETW IN REG 2 (P.906)
  - NETW IN REG 3 (P.907)
  - NETWORK BAUD RATE (P.912)
  - DEVICENET POLL MSG (P.913)

- Field
  - Standard/enhanced Field Supply
    - J20 FIELD LOSS DETECT (P.597)
    - FIELD ECONOMY ACTIVE (P.599)
    - FIELD ECONOMY DELAY (P.501)
    - ENHANCED FLD VOLT ADJ (P.500)
    - J21 FLD SUPPLY JUMPER (P.598)
  - Field Current Regulator
    - FLD CURRENT REGULATOR (P.586)
    - Field Loop Test Points
      - FIELD REFERENCE (P.590)
      - FIELD FEEDBACK (P.589)
      - FIELD ECONOMY ACTIVE (P.599)
      - FIELD DELTA (P.588)
  - Field Loop Tuning
    - FIELD REF REGISTER (P.513)
    - FIELD PI PROP GAIN (P.514)
    - FIELD PI LEAD FREQ (P.515)
    - FLD WEAKEN THRESHOLD (P.518)
    - IR COMPENSATION (P.206)
    - IFLD WEAKEN PROP GAIN (P.519)
    - IFLD WEAKEN LEAD FREQ (P.520)
  - Field Loop Configure
    - FIELD ECONOMY REF (P.511)
    - FIELD ECONOMY DELAY (P.501)
    - FIELD LOSS THRESHOLD (P.512)
    - FIELD AUTO WEAKEN (P.517)
    - FIELD DELTA HIGH LIM (P.587)
  - Field Loop Feedback Scaling
    - MOTOR HOT FLD AMPS (P.510)
    - FLD FEEDBACK GAIN ADJ (P.516)
    - FIELD FEEDBACK (P.589)

FlexPak 3000 Main Menu

~

- Drive Information
  - Correct Scaling Jumper Positions
    - J11 ANLG TACH VLT SCL (P.792)
    - J14 ANLG TACH VLT RNG (P.793)
    - J18 ARM I FB RESISTOR (P.395)
  - PULSE TACHOMETER KIT (P.798)
  - NETWORK KIT (P.796)
  - I/O EXPANSION KIT (P.797)
  - FLD CURRENT REGULATOR (P.586)
  - POWER UNIT TYPE (P.795)
  - J15 REGULATOR TYPE (P.799)
  - J20 FIELD LOSS DETECT (P.597)
  - J21 FLD SUPPLY JUMPER (P.598)
  - REGULATOR SW VERSION (P.794)
- Operator Interface
  - PASSWORD
  - Memory Operations
    - Memory Save
    - Memory Restore
    - Restore Defaults
  - Reset Clock
  - Define User Units
    - Define Speed Units
    - Define Load Units
    - Define Outer Control Loop Units
- Additional Parameters
  - P.311 (CML REF LIMIT SELECT)
  - P.312 (INV FAULT AVOID SEL SEL)
  - P.226 (NEG CUR LIM INV EN)
  - P.017 (JOG SPEED 2)
  - P.122 (STOP DECEL SELECT)
  - P.608 (TACH LOSS SCR ANGLE)
  - P.018 (RAMP STOP DECEL TIME)
  - P.914 (NETW REGISTER MAP SEL)
  - P.813 (OCL PROP TRIM SELECT)
  - P.521 (FIELD REF SELECT)
  - P.490 (DIG IN 0)
  - P.428 (DIG IN 0 SELECT)
  - P.227 (TACH LEAD FLT THRESH)
  - P.228 (TACH LEAD FLT DELAY)
  - P.609 (PHASE LOSS DETECT EN
  - P.814 (OCL TYPE3 POSN REG EN
  - P.915 (CNI PROG/RUN MODE)
  - P.019 (SPD LOOP SCAN TIME)

User Quick Reference Table

Table G.1 - User Quick Reference Table for Input Parameters

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg. B-	Initial Factory Setting	User Data	
					Date	Setting
000	CONTROL SOURCE SELECT	• KEYPAD • SERIAL • TERMBLK • NETWORK	11	KEYPAD		
001	ACCELERATION TIME	0.1 - 300.0 sec	1	5.0 sec		
002	DECELERATION TIME	0.1 - 300.0 sec	12	5.0 sec		
003	MINIMUM SPEED	0 - MAXIMUM SPEED (P.004)	29	0 (*RPM)		
004	MAXIMUM SPEED	1 - TOP SPEED (P.011)	26	500 (*RPM)		
005	POSITIVE CURRENT LIM	0 - MAXIMUM CURRENT (P.007) in % FLA (P.008)	43	150% P.008		
006	NEGATIVE CURRENT LIM	0 - MAXIMUM CURRENT (P.007) in % FLA (P.008)	32	150% P.008		
007	MAXIMUM CURRENT	25 - 200 %FLA (P.008)	25	150% P.008		
008	MOTOR RATED ARM AMPS	0 - 3000.0 A	31	unit type dep.		
009	MOTOR RATED ARM VOLTS	160 - 675 VDC or 240 - 1000 VDC (type 690 VAC)	31	400 V		
010	CT TURNS RATIO	• 25 A Unit: 208 • 60 A Unit: 416 • 150 A Unit: 833 • 250 A Unit: 2000 • 450 A Unit: 3000 • 800 A Unit: 5230 • 1200 A Unit: 8000 • 1600-2000 A Unit: 10500	11	depending on unit type 32767 Tp/Tn		
011	TOP SPEED	5 - 5000 RPM	51	500 RPM		
012	JOG SPEED 1	0 - MAXIMUM SPEED (P.004) in *rpm	23	250 (*RPM)		
013	JOG ACCEL/DECEL TIME	0.1 - 300.0 sec	23	3.0 sec		
014	S-CURVE ROUNDING	0 - 50% (0% = no rounding)	45	0%		
015	REVERSE DISABLE	• OFF • ON	44	S-6R = OFF S-6 = ON		
017	JOG SPEED 2	0 - MAXIMUM SPEED (P.004) in *rpm	23	250 (*RPM)		
018	RAMP STOP DECEL TIME	0.1 - 300.0 sec	44	5.0 sec		
019	SPD LOOP SCAN TIME	0 = 5 msec 1 = 10 msec	49	5 msec		
	Analog Inputs					
100 (2)	ANLG AUTO SIGNAL TYPE	• 0 -10 V • ±10 V • 4-20 mA • 10-50 mA	2	0-10 V		
101	ANLG AUTO GAIN ADJ	0.750 - 1.250	2	1.000		
102	ANLG AUTO ZERO ADJ	-200 - +200	2	0		
103	AUTO REFERENCE SELECT	• ANALOG • FREQUENCY IN	8	ANALOG		
104	ANLG MAN REF GAIN ADJ	0.750 - 1.250	4	1.000		

(*) Or user defined unit.

(2) Jumpers J10 and J12 must be set for the type of auto reference selected.

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
105	ANLG MAN REF ZERO ADJ	-200 - +200	4	0		
106	MANUAL REF SELECT	• ANALOG • MOP	25	ANALOG		
107	TRIM REF REGISTER	+ 100.0%	52	0%		
108	TRIM REFERENCE SELECT	• ANALOG MANUAL • ANALOG IN 1 • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3 • ANALOG IN 2 • REGISTER	51	REGISTER		
109	TRIM RANGE	0 - +100.0%	51	0.0%		
110	TRIM MODE SELECT	• NO TRIM • INCREMENTAL • PROPORTIONAL (DRAW)	51	NO TRIM		
111	AUTO MODE MIN BYPASS	• OFF • ON	8	OFF		
112	AUTO MODE RAMP BYPASS	• OFF • ON	8	OFF		
113	STOP SPEED THRESHOLD	0 - MAXIMUM SPEED (P.004) in *RPM	50	0 (*RPM)		
114 (3)	STOP MODE SELECT	• RAMP • COAST/DB • CURRENT LIMIT	49	RAMP		
115	MOP ACCEL TIME	ACCELERATION TIME (P.001) - 300.0 seconds	29	5.0 seconds		
116	MOP RESET ENABLE	• OFF • ON	30	OFF		
117	PRESET SPEED 1	MINIMUM SPEED- MAX SPEED	43	250 *RPM		
118	PRESET SPEED 2	MINIMUM SPEED- MAX SPEED	43	250 *RPM		
119	PRESET SPEED 3	MINIMUM SPEED- MAX SPEED	43	250 *RPM		
120	MOP DECEL TIME	DECEL.. TIME (P.002)- 300 sec	30	5.0 seconds		
121	JOG OFF DELAY TIME	0.0 to 10.0 seconds	23	1.0 seconds		
122	STOP DECEL SELECT	• 1 = DECELERATION TIME • 2 = RAMP STOP DECEL TIME	48	1		
	Feedback Selection					
200	FEEDBACK SELECT	• ARMATURE VOLT • DC TACH • PULSE TACH • AC TACH	14	ARM VOLT for S-6 DC TACH for S-6R		
201	ANALOG TACH GAIN ADJ	0.750 - 1.250	1	1.000		
202	ANALOG TACH ZERO ADJ	-200 - +200	2	0		
203	ANLG TACH VOLTS/1000	18.0 - 200.0 V/1000 RPM	6	60V/1000 RPM		
204	ARM VOLTAGE GAIN ADJ	0.750 - 1.250	7	1.000		
205	ARM VOLTAGE ZERO ADJ	-200 - +200 V	8	0 V		
206	IR COMPENSATION	0 - 50 %FLA	22	0% FLA		

(*) Or user defined unit.

(3) If drive is configured as a current regulator, only COAST/DB can be selected.

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
207	PULSE TACH PPR	18 - 2500 PPR	43	18 PPR		
208	PULSE TACH QUADRATURE	• OFF • ON	44	ON		
209	CURRENT COMPOUNDING	-50% - +50%	11	0%		
	Speed Regulator Adjustm.					
211	SPD LOOP PI PROP GAIN	0.10 - 128.00	48	4.40		
212	SPD LOOP PI LEAD FREQ	0.00 to 282.74 rad/s if P.200 = ARMATURE VOLT, P.019 = 10 ms 0.00 to 327.67 rad/s if P.200 ≠ ARMATURE VOLT, P.019 = 5 ms	47	3.00 rad/s		
213	SPD LEADLAG RATIO	2 - 20	46	2		
214	SPD LEADLAG LOW FREQ	0.01 to 69.81 rad/s if P.200 = ARMATURE VOLT, P.019 = 10 ms 0.01 to 139.62 rad/s if P.200 ≠ ARMATURE VOLT, P.019 = 5 ms	46	1.00 rad/s		
215	SPD LOOP LAG FREQ	0.01 to 139.62 rad/s if P.200 = ARMATURE VOLT, P.019 = 10 ms 0.01 to 279.25 rad/s if P.200 ≠ ARMATURE VOLT, P.019 = 5 ms	47	1.00 rad/s		
216	SPD LEADLAG SELECT	• LEAD/LAG • BYPASS • LAG/LEAD	46	BYPASS		
217	SPD LOOP LAG BYPASS	• OFF • ON	47	ON		
	Self Tuning Set-up					
218	SELF TUNE FIELD RANGE	0.90 - 5.00	45	1.00		
219	SELF TUNE STABILITY	10 - 100	45	25		
220	SELF TUNE BRIDGE	• FORWARD • REVERSE	45	FORWARD		
221	INERTIA COMP SELECT	• NONE • INTERNAL • ANALOG IN 1 • ANALOG IN 2 • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	21	NONE		
222	NORMALIZED INERTIA	0.05 - 65.20 sec	36	1.00 sec		
223	POS CURRENT LIM SEL	• REGISTER • ANALOG IN 1, ANALOG IN 2 • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	42	REGISTER		
224	NEG CURRENT LIM SEL	• REGISTER • ANALOG IN 1, ANALOG IN 2 • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	32	REGISTER		
226	NEG CUR LIM INV EN	• 1 = DISABLE • 2 = ENABLE	32	2		
227	TACH LEAD FLT THRESH	0.0 to 250 % (of TOP SPEED)	50	200.0		
228	TACH LEAD FLT DELAY	0 to 32767 (msec)	50	10 000		

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
	Current Regulator Set-up					
300	CML FEEDBACK GAIN ADJ	0.900 - 1.100	9	1.000		
301	CML PI PROP GAIN	0.000 - 4.000	9	0.250		
302	CML PI LEAD FREQ	10 - 500 rad/s	9	100 rad/s		
303	CML REF RATE LIMIT	1 - 1000 msec	10	40 msec		
306	NOMINAL AC LINE FREQ	48 - 62 Hz	36	50 Hz		
307	NOMINAL AC LINE VOLTS	200 - 575 VAC or 300 - 850 VAC (types 575/690 V)	36	400 VAC		
308	PLL MAXIMUM ERROR	2 - 1000 µsec	42	2 µsec		
309	PHASE FIRE TEST DELTA	0 - 180 degrees	41	0 degrees		
310	PHASE FIRE TST BRIDGE	• OFF • ON	42	OFF		
311	CML REF LIMIT SELECT	• 1 = SPD LOOP PI LIMITS • 2 = REGISTER	10	1		
312	INV FAULT AVOID SEL	• 1 = DISABLED • 2 = FAULT IMMEDIATELY • 3 = DELAY BEFORE FAULT	21	DISABLED		
	Meter Outputs Set-up					
400	METER OUT 1 GAIN ADJ	0.100 - 1.900	26	1.000		
401	METER OUT 2 GAIN ADJ	0.100 - 1.900	28	1.000		
402	METER OUT 1 ZERO ADJ	-200 - +200	27	0		
403	METER OUT 2 ZERO ADJ	-200 - +200	28	0		
404	METER OUT 1 SELECT	• CML FEEDBACK • CML REFERENCE • CML ERROR • SPD LOOP FEEDBACK • SPD LOOP REFERENCE • SPD LOOP ERROR • SPD LOOP OUTPUT • SPEED RAMP OUTPUT • SPEED RAMP INPUT TP • SPD SOURCE SELECT OUT • TRIM OUTPUT • ARMATURE VOLTAGE • ANALOG TACH FEEDBACK • PULSE TACH FEEDBACK • ZERO • FULL SCALE • POWER OUTPUT • OCL REFERENCE • OCL RAMP OUTPUT • OCL FEEDBACK • OCL OUTPUT • FIELD REFERENCE • FIELD FEEDBACK • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	27	CML FEEDBACK		
405	METER OUT 2 SELECT	same as above for P.404	28	SPD LOOP FEEDBACK		

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
	Digital Outputs Set-up (on I/O card)					
409	DIG OUT 1 SELECT	• LEVEL DETECT 1 OUTPUT • LEVEL DETECT 2 OUTPUT • IN CURRENT LIMIT • DRIVE READY • NETW COMM STATUS • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	13	LEVEL DETECT 1 OUTPUT		
410	DIG OUT 1 CONTACT TYP	• NORMAL OPEN • NORMAL CLOSED	13	NORMAL OPEN		
411	DIG OUT 2 SELECT	• LEVEL DETECT 1 OUTPUT • LEVEL DETECT 2 OUTPUT • IN CURRENT LIMIT • DRIVE READY • NETW COMM STATUS • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	14	LEVEL DETECT 2 OUTPUT		
412	DIG OUT 2 CONTACT TYP	• NORMAL OPEN • NORMAL CLOSED	13	NORMAL OPEN		
	Analog Inputs / Outputs (on I/O card)					
413	ANLG IN 1 SIG TYPE	• 0-10V, ±10V • 4-20 mA, 10-50 mA	3	±10 V		
414	ANLG IN 1 ZERO ADJ	-200 - 200	3	0		
415	ANLG IN 1 GAIN ADJ	0.750 - 2.250	3	1.000		
416	ANLG IN 2 ZERO ADJ	-200 - 200	4	0		
417	ANLG IN 2 GAIN ADJ	0.750 - 2.250	4	1.000		
418	ANLG OUT 1 SELECT	• CML FEEDBACK • CML REFERENCE • CML ERROR • SPD LOOP FEEDBACK • SPD LOOP REFERENCE • SPD LOOP ERROR • SPD LOOP OUTPUT • SPEED RAMP OUTPUT • SPEED RAMP INPUT TP • SPD SOURCE SELECT OUT • TRIM OUTPUT • ARMATURE VOLTAGE • ANALOG TACH FEEDBACK • PULSE TACH FEEDBACK • ZERO • FULL SCALE • POWER OUTPUT • OCL REFERENCE • OCL RAMP OUTPUT • OCL FEEDBACK • OCL OUTPUT • FIELD REFERENCE • FIELD FEEDBACK • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	5	ZERO		

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
419	ANLG OUT 1 SIG TYPE	0-10 V, ±10 V, 4-20 mA	6	±10 V		
420	ANLG OUT 1 GAIN ADJ	0.500 - 1.300	5	1.000		
421	ANLG OUT 2 SELECT	same as above for P.418	7	ZERO		
422	ANLG OUT 2 GAIN ADJ	0.500 - 1.300	6	1.000		
	Frequency Inputs/Outputs (on I/O card)					
423	FREQ IN ZERO	2.0 - FREQ IN FULL SCALE kHz	19	2.0 kHz		
424	FREQ IN FULL SCALE	2.0 - 250.0 kHz	19	250.0 kHz		
425	FREQ OUT SELECT	same as above for P.418	20	ZERO		
426	FREQ OUT ZERO	2.0 - FREQ OUT FULL SCALE kHz	21	2.0 kHz		
427	FREQ OUT FULL SCALE	2.0 - 250.0 kHz	20	250.0 kHz		
428	DIG IN 0 SELECT	• 1 = BRUSH WEAR • 2 = JOG SPEED SELECT • 3 = OCL ENABLE	12	1		
	Field Regulator Set-up					
500	ENHANCED FLD VOLT ADJ	• 0 - 180 (J21 = B-C)	14	84		
501	FIELD ECONOMY DELAY	0 - 27 minutes	16	5 minutes		
510	MOTOR HOT FLD AMPS	0.11 - installed supply rating (4.00, 10.00, or 15.00 A)	30	0.1 A		
511	FIELD ECONOMY REF	0 - 100%	16	0%		
512	FIELD LOSS THRESHOLD	• Armature voltage regulators: 50 - 100% of MOTOR HOT FLD AMPS (P.510) • Speed regulators: 0 - 100% of MOTOR HOT FLD AMPS (P.510)	17	60% of MOTOR HOT FLD AMPS		
513	FIELD REF REGISTER	0 to MOTOR HOT FLD AMPS (P.510)	18	MOTOR HOT FLD AMPS		
514	FIELD PI PROP GAIN	0.01 - 128.00	17	0.50		
515	FIELD PI LEAD FREQ	0.01 - 56.50 rad/s	17	1.50 rad/s		
516	FLD FEEDBACK GAIN ADJ	0.900 - 1.100	18	1.000		
517	FIELD AUTO WEAKEN	• DISABLED • ENABLED	17	DISABLED		
518	FLD WEAKEN THRESHOLD	0 to 120% of MOTOR RATED ARM VOLTS (P.009)	19	95% of MOTOR RATED ARM VOLTS		
519	FLD WEAKEN PROP GAIN	0.01 - 128.00	19	1.60		
520	FLD WEAKEN LEAD FREQ	0.01 - 56.50 rad/s	18	0.50 rad/s		
521	FIELD REF SELECT	• 1 = REGISTER • 2 = ANALOG MAN TRIM REF • 3 = ANALOG IN 1 • 4 = ANALOG IN 2.	18	1		
587	FIELD DELTA HIGH LIM	0 - 180 degree	16	130 degree		
	Thyristor Firing check					
600	OPEN SCR SENSITIVITY	0 - 100%	41	50%		
601	OPEN SCR TRIP THRESH	800 - 4000	41	1600		

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
	Level Detectors					
602	LEVEL DETECT 1 SELECT	• SPD SOURCE SELECT OUT • SPEED RAMP INPUT TP • SPEED RAMP OUTPUT • SPD LOOP FEEDBACK • CML FEEDBACK	24	SPD LOOP FEEDBACK		
603	LEVEL DETECT 1 THRESH	• 0.1 to 100.0% if LEVEL DETECT 1 SELECT is not set to CML FEEDBACK • 0.1 to MAXIMUM CURRENT% if LEVEL DETECT 1 SELECT is set to CML FEEDBACK	24	10.0%		
604	LEVEL DETECT 1 DELAY	0.0 - 300.0 sec	24	10.0 sec		
605	LEVEL DETECT 2 SELECT	• SPD SOURCE SELECT OUT • SPEED RAMP INPUT TP • SPEED RAMP OUTPUT • SPD LOOP FEEDBACK • CML FEEDBACK	25	SPEED RAMP INPUT TP		
606	LEVEL DETECT 2 THRESH	• 0.1 - 100.0% if LEVEL DETECT 2 SELECT is not set to CML FEEDBACK • 0.1 to MAXIMUM CURRENT% if LEVEL DETECT 2 SELECT is set to CML FEEDBACK	25	10.0%		
607	LEVEL DETECT 2 DELAY	0.0 - 300.0 sec	24	10.0 sec		
608	TACH LOSS SCR ANGLE	0 to 127 (degrees)	50	109		
609	PHASE LOSS DETECT EN	DISABLE, ENABLE	42	ENABLE		
	Outer Current Loop					
800	OCL REFERENCE SELECT	• REGISTER • ANALOG IN 1 • ANALOG IN 2 • FREQUENCY IN • NETW IN REG 1 • NETW IN REG 2 • NETW IN REG 3	40	REGISTER		
801	OCL REF REGISTER	-4095 - 4095	40	0		
802	OCL REF RAMP TIME	0.0 - 300.0 sec	39	10.0 sec		
803	OCL REF ROUNDING	0 - 50%	40	0%		
804	OCL FEEDBACK SELECT	• NONE • CML FEEDBACK • ANALOG IN 1 • ANALOG IN 2 • 5=SPEED LOOP OUTPUT • 6=ANALOG AUTO REF • 7= NETW IN REG 1 • 8= NETW IN REG 2 • 9= NETW IN REG 3	37	CML FEEDBACK		
805	OCL LEADLAG SELECT	• LEAD/LAG • BYPASS • LAG/LEAD	38	BYPASS		
806	OCL LEADLAG LOW FREQ	0.01 - 34.90 rad/s	37	1.00 rad/s		
807	OCL LEADLAG RATIO	2 - 20	37	10		

Table G.1 - User Quick Reference Table for Input Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data	
					Date	Setting
808	OCL PI PROP GAIN	0.10 - 128.00	39	2.00		
809	OCL PI LEAD FREQ	0.00 - 141.37 rad/s	38	1.00 rad/s		
810	OCL PI POSITIVE LIMIT	0 - 100% of TOP SPEED	39	100%		
811	OCL PI NEGATIVE LIMIT	0 - 100% of TOP SPEED	38	100%		
812	OCL TRIM RANGE	-100 - 100.0%	40	0.0%		
813	OCL PROP TRIM SELECT	• 1 = DISABLED • 2 = ENABLED	39	1		
814	OCL TYPE3 POSN REG EN	• 1 = DISABLED • 2 = ENABLED	41	DISABLED		
	Network Communication					
900 (1)	NETW DROP NUMBER	1 - 55 if NETW CONNECT TYPE=BASIC 1 - 52 if NETW CONNECT TYPE = FULL	35	1		
901 (1)	NETW COMM LOSS SELECT	• FAULT • HOLD LAST REF • USE TRMBLK REF	35	FAULT		
902	NETW OUT REG 1 SELECT	-32768 - 32767	35	0		
903	NETW OUT REG 2 SELECT	-32768 - 32767	35	0		
904	NETW OUT REG 3	-32768 - 32767	36	0		
910 (1)	NETWORK CONNECT TYPE	• BASIC • FULL	35	BASIC		
911 (1)	AMX NETW REF SELECT	• DIRECT • BROADCAST n (n=1-8)	1	DIRECT		
912 (1)	NETWORK BAUD RATE	• 0.0 Kbaud • 125.0 Kbaud • 250.0 Kbaud • 500.0 Kbaud	34	0.0 Kbaud		
913 (1)	DEVICENET POLL MSG	• CONTROL ONLY • CONTROL + CONFIG	11	CONTROL ONLY		
914	NETW REGISTER MAP SEL	• 1 = ORIGINAL • 2 = ALTERNATE	36	1		
915	CNI PROG/RUN MODE	• 1 = STOP • 2 = NOT STOP	10	STOP		
	SPEED FEEDBACK GAIN (Alternate network map, Drop_1, reg. 38)	1000 – 32 000	46	1000		
	SPD LOOP PI INIT SEL (Alternate network map, Drop_2, reg. 32)	• 0 = ZERO • 1 = SPD LOOP PI INIT VAL • 2 = ANALOG MAN TRIM REF	47	0		
	SPD LOOP PI INIT VAL (Alternate network map, Drop_1, reg. 39)	-32768 - 32767	48	0		
	SPD LOOP PI RESET (Alternate network map, Drop_1, reg. 32, bit 6)	• 0 = OFF • 1 = ON	48	0		
	UNDERWIND ENABLE (Alternate network map, Drop_1, reg. 32, bit 5)	• 0 = DISABLED (overwind) • 1 = ENABLED (underwind)	52	1		

(1) Parameter is only available or displayed on the OIM if an optional Network Communications board is installed.

EMC Directive

This converter 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 FlexPak 3000 can be operated CE-conform according to **product standard EN 61800-3**.

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 converter rating different limits are permitted, whereas the practical limit for the first environment is 100 A. For converters 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 converters above 100 A in the second environment.

Radiated, High Frequency Disturbances (30 - 1000 MHz)

The radiated disturbances of the converter will be kept below the 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)

Converters 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 converter power.

Voltage harmonics may cause disturbances e.g. in centralized telecontrol systems or other electrical consumers. If high power converters 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 active or passive harmonic filters.

On request Rockwell Automation will provide the harmonics current spectrum generated by each FlexPak 3000 or perform a harmonics analysis for the complete installation based on delivered data.

Immunity

Immunity against Conducted and Radiated, High Frequency Disturbances

The FlexPak DC-converters 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. Connection of EMC filter (RFI-Filter on drives <100 A or HF filter on drives >100 A) as specified in Chapter 8, Accessories.
2. Because FlexPak 3000 and filter have protection class IP00 they must be built in a cabinet. Both units must be mounted on a blank (not painted) panel with good conductivity.
3. Correct grounding of the equipment and the cable screens as shown in example Figure H-1.
4. Output power wiring (drive to motor) must be screened cable or run in a separate steel conduit.
5. All control (I/O) and signal wiring must be screened cable.
6. The braid of screened cables must be connected to the terminal box of the motor by the use of suitable, EMC-tested cable glands.
7. For all DC-converters a minimum line reactor of 2% voltage drop will be required. The line reactors must be linked between filter (Output) and DC-Converter (Input). For line reactor selection refer to Table 8.9.

Mounting Instructions

(Refer to Figure H-1)

- 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 conducting 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, galvanised cable brackets as shown in Figure H-1 are recommended. This applies also for coaxial cable, at which only the outer insulation should be removed.

Cable Glands

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

Configuration

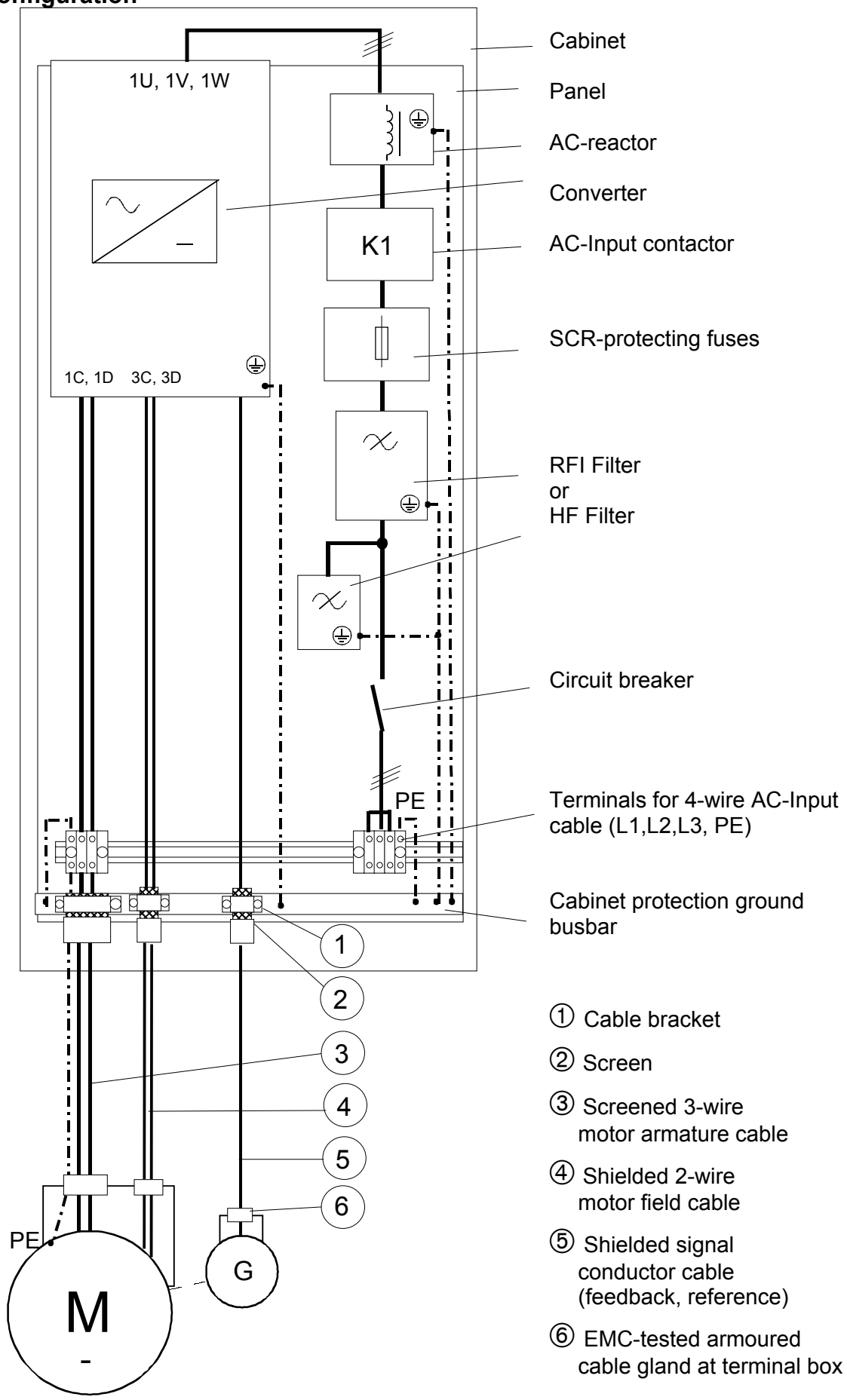
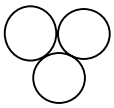


Figure H-1: Example for control cabinet configuration

Wiring Instruction

Motor Cable

- The cables between cabinet / armature output and DC-motor armature shall be 3-wire screened cable (+, - and earth conductor green/yellow) as specified in Figure H-2.
- The cables between field supply output and DC-motor field shall be 2-wire screened cable.
- The screen must be tinned copper braid or tinned steel braid. It must be solidly connected to the control cabinet ground busbar or ground stud of the converter with large connection area and good conductivity.
- The screen on the motor side must be solidly connected to the motor housing providing 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 ground at both ends.
- All leads shall have the same cross section
  (earth conductors with cross section. $>16^2$: min. 16^2 or 50% of armature lead)
- The connections between filter and converter 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 distanced.

Analog or Digital Signals (e.g. reference, feedback signals), Control Signals (Relays)

These signal leads must be screened cable as specified in Figure H-2.
The individual conductors must be stranded, but twisted pairs are not required.
The screen must be grounded at both ends.

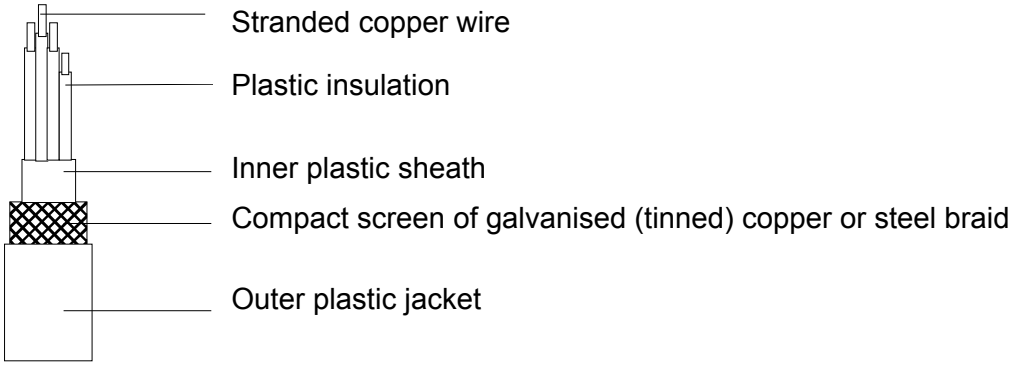


Figure H-2: Specification for screened cable

Cross Reference List
Part Numbers - Catalogue Numbers

This appendix provides a cross reference lists for part numbers of the FlexPak 3000 in numeric order and associated Rockwell Automation catalogue numbers and Reliance US-Model Numbers.
Part numbers without catalogue numbers are spare parts. (Refer to Tables 8-1 to 8-6).

Table J.1 - Cross Reference List

Part Number	Catalogue Number	US-Model-Number
122.04.02	-	
122.93.02	-	
122.93.04	-	
123.39.30	-	
123.43.04	-	
124.07.00	-	
135.05.52	-	
135.11.02	-	
135.12.02	-	
135.60.00	-	
135.60.02	-	
211.00.02	-	
211.00.05	-	
211.36.05	-	
252.40.01	LL-25	
252.40.02	LL-40	
252.40.03	LL-62	
252.40.04	LL-85	
252.40.05	LL-115	
252.40.06	LL-160	
252.40.07	LL-210	
252.40.08	LL-290	
252.40.09	LL-392	
252.40.10	LL-530	
252.40.11	LL-660	
252.40.12	LL-850	
252.40.13	LL-1100	
252.40.14	LL-1300	
252.40.15	LL-1360	
252.40.16	LL-1700	
252.42.01	LF-15	
252.42.05	LF-6	
252.42.06	LF-12	
252.44.12	LL-850-A	
252.44.13	LL-1100-A	
252.44.14	LL-1300-A	
252.44.15	LL-1360-A	
511.21.00	F-FH	
511.23.00	F-H1	
511.24.00	F-H2	
511.26.01	F-H4	
511.26.03	F-H5	
553.00.09	F-F6	
553.00.10	F-F12	
553.00.11	F-F15	
553.26.29	F-SW2	
553.26.30	F-SW3	
553.28.02	F-25	
553.28.06	F-60	
553.28.07	F-60A	
553.28.08	F-150S	
553.28.09	F-150AS	
553.30.04	F-150L	
553.30.05	F-150AL	
553.30.06	F-250	
553.31.13	F-250A	
553.31.14	F-450S	
553.32.16	F-450L	
553.32.18	F-450AL	
553.33.19	F-800S	
553.33.21	F-800L	
553.33.22	F-16S	
553.33.23	F-16M	
553.33.24	F-16XL	
553.34.34	F-14S	
553.34.35	F-14M	
553.34.36	F-14L	
553.34.37	F-14AL	
553.72.00	F-2000	
553.72.01	F-2500	
610.11.05	140M-C2E1316	
750.70.04	-	
762.70.00	PTK	
762.70.10	FVR	
762.70.29	SCK	
762.70.30	DMK	905FK0101
762.70.40	AMXF	915FK0101
762.70.45	IBSF	915FK3101
762.70.50	FCU4	911FK0041
762.70.60	FCU10	911FK0101
762.70.70	FCU15	911FK0151
762.70.80	IOE	914FK0101
762.70.90	DNC	914FK1100
762.70.95	PDPF	915FK4101
762.70.96	CONF	915FK2101
772.27.00	61C127	61C127
772.27.20	2CA3001	2CA3001
788.05.30	CS3000-V6	2CS3000
803.56.00	-	
810.79.40	-	0-58770

Table J.1 - Cross Reference List (continued)

Part Number	Catalogue Number	US-Model-Number
810.89.00	-	
813.39.00	-	
813.40.00	-	
813.41.00	-	
813.41.01	-	
813.42.00	-	
813.42.01	-	
813.43.00	-	
813.43.01	-	
813.43.10	-	
813.43.11	-	
839.52.20	RFC-X	
839.70.20	RFB-150	
839.70.66	RFB-270	
839.71.53	RFB-100	
839.71.68	RFB-340	
839.72.05	RFB-25	
839.72.06	RFB-36	
839.72.07	RFB-50	
839.72.09	RFB-80	
839.72.67	RFB-280	
839.73.25	RFB-250	
839.73.31	RFB-500	
839.73.35	RFB-1000	
839.73.38	RFB-1600	
839.73.92	RFC-600	
839.73.95	RFC-1000	
839.73.98	RFC-1600	
839.74.22	RFB-180	
848.00.03	FP3000-S6-25-AN-D	
848.01.03	FP3000-S6R-25-AN-D	
848.02.03	FP3000-S6-60-AN-D	
848.03.03	FP3000-S6R-60-AN-D	
848.04.03	FP3000-S6-150-AN-D	
848.05.03	FP3000-S6R-150-AN-D	
848.06.03	FP3000-S6-250-AN-D	
848.07.03	FP3000-S6R-250-AN-D	
848.08.03	FP3000-S6-450-AN-D	
848.09.03	FP3000-S6R-450-AN-D	
848.10.03	FP3000-S6-800-AN-D	
848.11.03	FP3000-S6R-800-AN-D	
848.00.73	FP3000-S6-25-AN-FC	20FN8742
848.01.73	FP3000-S6R-25-AN-FC	20FR8742
848.02.73	FP3000-S6-60-AN-FC	50FN8742
848.03.73	FP3000-S6R-60-AN-FC	50FR8742
848.04.73	FP3000-S6-150-AN-FC	125FN8742
848.05.73	FP3000-S6R-150-AN-FC	125FR8742
848.06.73	FP3000-S6-250-AN-FC	200FN8742
848.07.73	FP3000-S6R-250-AN-FC	200FR8742
848.08.73	FP3000-S6-450-AN-FC	375FN8742
848.09.73	FP3000-S6R-450-AN-FC	375FR8742
848.10.73	FP3000-S6-800-AN-FC	650FN8742
848.11.73	FP3000-S6R-800-AN-FC	650FR8742

Part Number	Catalogue Number	US-Model-Number
848.12.43	FP3000-S6-1200-60-AN-FC	
848.12.73	FP3000-S6-1200-50-AN-FC	
848.13.43	FP3000-S6R-1200-60-AN-FC	
848.13.73	FP3000-S6R-1200-50-AN-FC	
848.14.43	FP3000-S6-1600-60-AN-FC	
848.14.73	FP3000-S6-1600-50-AN-FC	
848.15.43	FP3000-S6R-1600-60-AN-FC	
848.15.73	FP3000-S6R-1600-50-AN-FC	
848.16.43	FP3000-S6-F1600-60-AN-FC	
848.16.73	FP3000-S6-F1600-50-AN-FC	
848.17.43	FP3000-S6R-F1600-60-AN-FC	
848.17.73	FP3000-S6R-F1600-50-AN-FC	
848.18.43	FP3000-S6-2000-60-AN-FC	
848.18.73	FP3000-S6-2000-50-AN-FC	
848.19.43	FP3000-S6R-2000-60-AN-FC	
848.19.73	FP3000-S6R-2000-50-AN-FC	
916.10.70	-	1LG1101
916.10.71	-	1LG1102
916.10.72	-	1LG1103
916.10.73	-	1LG1104
916.10.74	-	1LG1105
916.10.80	-	1LG1201
916.10.81	-	1LG1202
916.10.82	-	1LG1203
916.10.83	-	1LG1204
916.10.84	-	1LG1205
916.10.85	-	1LG1206
916.10.86	-	1LG1207
916.10.87	-	1LG1208
916.10.88	-	1LG2401
916.10.89	-	1LG2402
916.10.90	-	1LG2403
916.10.91	-	1LG3601
921.22.01	-	
921.90.00	-	
921.91.00	-	
921.91.11	-	
922.58.10	-	
922.95.00	KOIM	317C160D
922.95.10	KDCM	

www.rockwellautomation.com

Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions
Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Headquarters for Dodge and Reliance Electric Products
Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
Europe/Middle East/Africa: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 6356-9077, Fax: (65) 6356-9011

Publication FP3OIM-UM043M -EN – November 2002 49'1340e (17)
Supersedes Publication FP3OIM-UM042L-EN – January 2001
Copyright © 2002 Rockwell Automation, Inc.. All rights reserved.