RELIANCE ELECTRIC

WL 3000   Generator Field Current Regulator
SW-Version 1.1

Instruction Manual

CE c(UL) (UL)

Rockwell Automation

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1 Notes

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

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

SW-Version   This manual is valid for Regulator Firmware **790.48.10**.
Regulator SW Versions can be read in parameter **P.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.

Measures for CE Conformity on Electro Magnetic Compatibility (EMC) are shown in Appendix H

2   Introduction

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

2.1   Drive Identification

2.1.1   Nameplate

The WL 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	*848.80-00 A*	SER. NO.
P.N. -VERSION	*790.48.10 A*	EU I/M *49'1358*
TYPE	*WL3000-S6R-25 -AN*	
S/W VERSION	*1.10*	
US M/N	US I/M H/W	US I/M S/W
INPUT	*200 - 500 VAC 3PH 50/60Hz, 22 A*	
OUTPUT	*0 -520 VDC*, *25 A*	
SHORT CIRCUIT SYM RMS RATING *18 kA*		
ENCLOSURE *IP00*		CHARACTER OF LOAD *M*
MADE IN SWITZERLAND BY ROCKWELL AUTOMATION AG, DIERIKON		
CE, UL, CUL		

Table 2-1 Sample WL 3000 Nameplate

2.1.2   Drive Selection

The following table lists the part numbers for ordering a specific drive type.

Unit Type nom. Current	Maximum AC-Line Voltage	Dierikon Part Number	Rockwell Automation Catalog Number
25 A	500 V, 50 Hz 460 V, 60 Hz	848.80.00	WL3000-S6R-25
60 A	500 V, 50 Hz 460 V, 60 Hz	848.80.01	WL3000-S6R-60

Table 2-2 Converter Part Numbers

For Options refer to Table 2-5 Drive Modification Kits.

A tacho feedback is mandatory for the operation of the speed regulated drive WL 3000. Rockwell Automation guarantees sufficient current regulation up to 10 A rated field current. Low rated field currents may cause reduced regulation performance in the non conductive current range.

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 8-4) or a matched isolation transformer.
2) Minimum supply system (source) capacity kVA.	Connecting to a source (supply transformer) with min. kVA rating acc. to the following table.
3) 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.

Rated Current of WL3000 (DC A)	Minimum Power 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

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-Condensing   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 .... 200 - 500 VAC at 50 Hz
200 - 460 VAC at 60 Hz
Voltage variation ....+10% and -10% of Nominal
Nominal line frequency ....50 or 60 Hz
Frequency variation .... ±2 Hz

2.2.4 Regulator Supply Voltage and Power Consumption

Single-phase input voltage, via auto transformer   230 VAC at terminals 0, 230
or 115 VAC at terminals 0, 115
Power consumption ....max. 130 VA
Thermal magnetic protection by external circuit breaker

2.2.5 Relay Outputs for Field (Main) Contactor and Armature Contactor

Relay R1 for activation of field contactor K1 at terminals X1:5 and X1:6
Nominal contact rating at AC 230 V, cos phi = 0.5 .... 330 VA

Relay RL2 for activation of armature contactor K2 at terminals A1, A2
Contact rating max. AC 250 V, cos phi = 0,5 .... 7200 VA
max. DC 30 V, 30 A resistiv..900 W

2.2.6 DC Voltage Ratings:

$U_{f\ nom}$ is the recommended standard generator field voltage
for the selected line voltage and operation mode.

AC Line Voltage U_N	Generator Field Voltage	
	$U_{f\ nom}$	$U_{f\ max}$
200 V	200 V	220 V
400 V	400 V	440 V
460 V	460 V	500 V
500 V	520 V	550 V

Table 2-3 Field voltage for various line voltages

2.2.7 Speed Range:

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

2.2.8 Efficiency:

Converter only .... 98.6% (rated load and speed)

2.2.9 Displacement Power Factor, Output Current and Power Loss of Field Supply:

Power Factor: $\approx U_f / (U_n * 1,35)$
Power Consumption at no load: see P_A Table 2-4 Drive Specifications.

WL 3000	I_f nom	P_A	P_v (at $I_{a\ nom}$)
25 A	25 A	60 VA	150 W
60 A	60 A	60 VA	260 W

Table 2-4 Drive Specifications

$I_{f\ nom}$ = Maximum field current without overload capability

2.3 Input/Output Specifications of the Regulator Unit

The following sections describe drive inputs and outputs. Refer to section 3.7 for terminal strip connections and wiring diagrams.

2.3.1 Logic Inputs:

<table>
<tr><td>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.</td></tr>
</table>

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 3-4).

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 two customer analog inputs are
- Automatic Mode Reference
- D-C Tachometer Feedback.

These inputs are converted at 12 bits plus sign at their full range.

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

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 1 sec to reduce meter fluctuations.
METER OUT 1 SELECT corresponds to terminals 24 and 25 (default: CML FEEDBACK).
METER OUT 2 SELECT corresponds to terminals 25 and 26 (default: SPD LOOP
FEEDBACK).
Refer to Appendix B.6, parameters METER OUT 1 (P.404) and 2 SELECT (P.405),
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

Refer to block diagram Figure 2-1 on the next page.

The power converter is a full-wave 6-pulse bridge rectifier for 4-quadrant operation.

The regulator unit consists - based on the standard DC-converter FlexPak 3000 - of a digital
Generator Field Current Loop, whose reference is generated from an outer digital Armature
Loop. With armature contactor open the Armature Loop regulates the armature voltage to zero.
With contactor closed the armature current is regulated to the preset current reference from the
Speed Loop. A generator voltage minor loop is not provided, because the dynamic behavior of
the motor flux is taken into account by an appropriate model in the current feedback.

The digital Speed Loop can work with either pulse encoder or analog tachometer feedback.
The regulator unit requires in additional an external armature current feedback with current- or
voltage output and with individual power supply.

The Drive Operator Interface Module (OIM) keypad can be used for drive setup, including
parameter adjustments, monitoring and diagnostics.
The language on the OIM is available in English, German and 'Code'. If „Code" is selected the
parameters are shown with parameter number.

The drive can be controlled locally by the OIM Keypad or remotely by using the terminals at the
regulator board terminal strip (see Section 3.7 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).
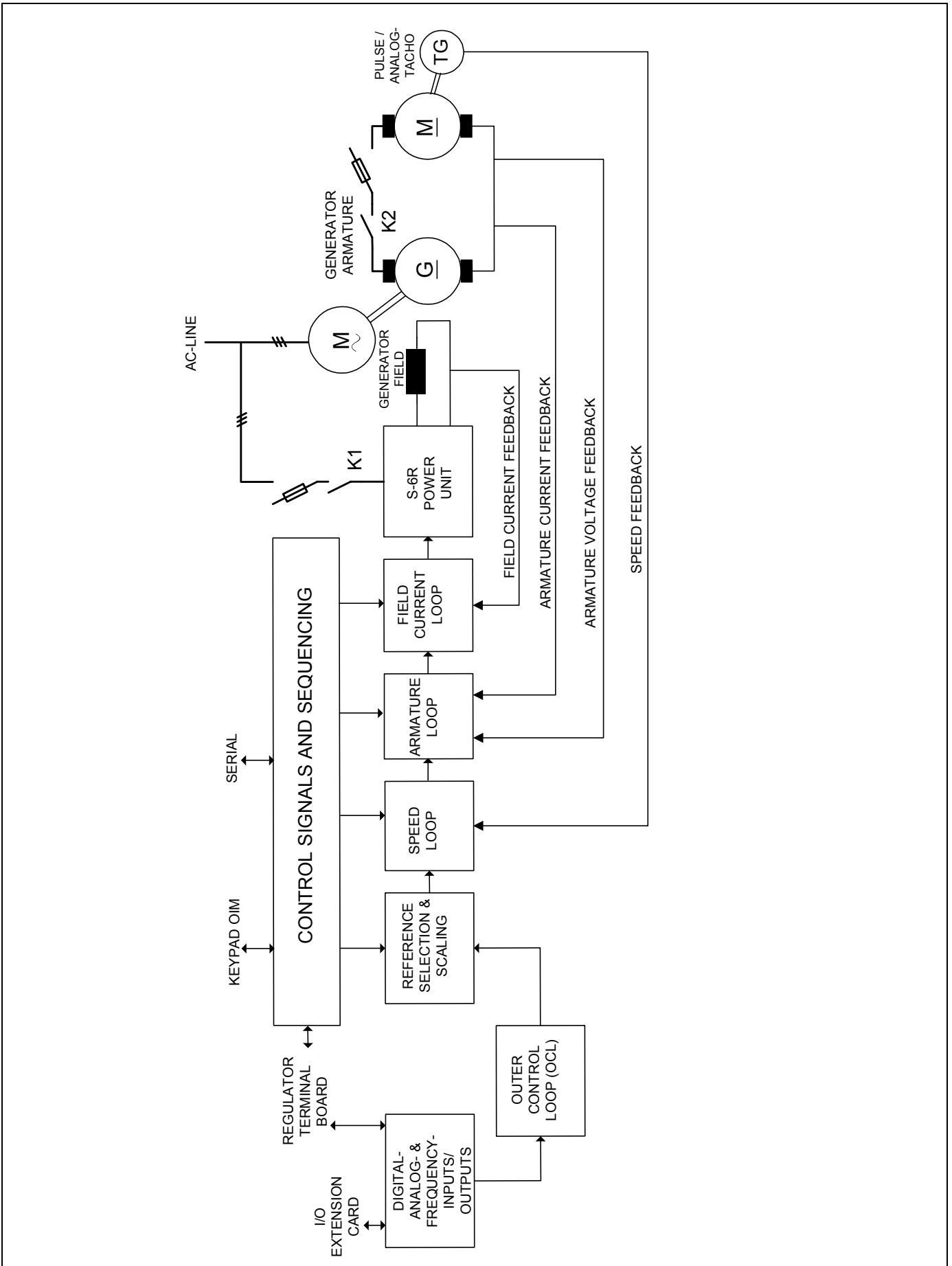
Figure 2-1 WL 3000 Functional Block Diagram

Rockwell Automation offers modification kits that broaden the application range of the drive.
A summary of these kits is presented in Table 2-5 Drive Modification Kits.

Name	Description	Part Number Catalog-No. *US Model-No*	Instruct. Manual Manual No. Publication No. 1)
Pulse Tacho Feedback Kit (incl. cable)	Allows for digital pulse tachometer speed feedback on high performance regulation applications.	762.70.00 PTK *907FK0101*	49'1343 FP3TIF-UM002B-EN
I/O Expansion Board	Mounts on the WL 3000 chassis and gives the WL 3000 additional analog, frequency, and digital I/O capability.	762.70.80 IOE *914FK0101*	49'1346 FP3IOE-UM003C-EN
Drive Control Configuration Software CS3000WL for controlling the WL 3000 Drive	Windows-based software that allows the user to connect any personal computer running Microsoft Windows version 3.1 or later to a WL 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 CS3000WL	49'1307 CS3000-UM003C-EN
Interface Cable	for connecting the drive to PC (25-pin to 9-pin)	772.27.00 *61C127*	
OIM Remote Mounting kit	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 DMK	D2-3294 D2-3294-1

1) Manuals with Publication Number can be ordered in the Automation Bookstore
www.theautomationbookstore.com,
than Public – Item search, Go - Item Number: begins with: e.g FP3TIF - search

Table 2-5 Drive Modification Kits

2.5   Sequencing

2.5.1   WL 3000 configured as *Speed regulator* (J15 in Position SPEED)

An interlock circuit must be provided to ensure, that the WL-Drive is not enabled, before the line motor (ASM/SM) is running, otherwise armature overcurrent could occur during switching on.

1. Apply line voltage.
    If no drive faults are present, the WL 3000 is in **Standby-Mode**, where all control loops are disabled and neither field contactor nor armature contactor are closed.

2. Close input WL-interlock.
    The WL 3000 main contactor K1 (field contactor) is closed and the armature voltage is regulated to zero Volt. The drive is in **Ready-Mode**.
    The tolerance of the zero Volt detection is ±11.5 V, resp. ±23 V at Ua > 660 V (J30 set to HIGH and additional feedback resistors used).

3. The Start Command is edge sensitive. The armature contactor K2 picks up and Armature Current Loop and Speed Loop are enabled. The drive is now in **Run-Mode**.

4. The Jog-Command is edge sensitive. The armature contactor K2 picks up and Armature Current Loop and Speed Loop are enabled. The drive stays - as long as the JOG-Input is active - in Run-Mode. Opening of the Jog Input will cause Stop Command.

5. Apply Stop-Command.
    There are two kinds of Stop Command: *Ramp* or *Coast Stop* (see Figure 3-4).
    The normal condition is *Ramp*, where at first the speed is ramped down to zero RPM, the armature current is reduced to zero and than the armature contactor is opened.
    When *Coast Stop* is selected, the speed is **not** ramped down, but only the armature current is reduced to zero and the contactor dropped out. The drive is again in **Ready-Mode**.

6. If in **Ready-Mode** the WL-interlock is opened, the firing pulses for the field current are disabled and as soon as they have reached zero, the main contactor K1 is dropped out.

7. When the WL-interlock is opened during **Run-Mode**, or a fault occurs, then is - like at Coast Stop - the armature current reference set to zero and the armature contactor K2 dropped out. If the armature current has not been reduced to zero within one second , the armature contactor will be dropped out with the alarm indication ARMATURE CURRENT HAS NOT REACHED ZERO. If the armature contactor has not opened, the fault ARMATURE CONTACTOR NOT OPEN will be indicated, to prevent re-start of the drive.
    After that the firing pulses for the field current are disabled and when they have reached zero the main contactor K1 is dropped out. If the field current has not been reduced to zero within one second, the contactor will be dropped out independent from current.

2.5.2   WL 3000 configured as *Current regulator* (J15 in Position CURRENT):

1. Apply line voltage.
    If no drive faults are present, the WL 3000 is in **Standby-Mode**, where all control loops are disabled and neither field contactor nor armature contactor are closed.

2. Close input WL-interlock.
    The drive is in **Ready-Mode**.

3. The Start-Command is edge sensitive. The WL 3000 main contactor K1 is closed and the Armature Current Loop is active. On the OIM display appears **Running**.

4. The Jog-Command is edge sensitive. The main contactor K1 picks up and the Armature Current Loop is active. As long as the JOG-Input is active, the drive stays in Run-Mode and the display shows **Running**.

5. If during **Run-Mode** the WL-interlock is opened or a fault occurs, the firing pulses are disabled and as soon as the current has reached zero, the main contactor K1 is dropped out when. If the field current has not been reduced to zero within one second, the contactor will be dropped out independent from current.

2.6   Controls and 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 2-6.
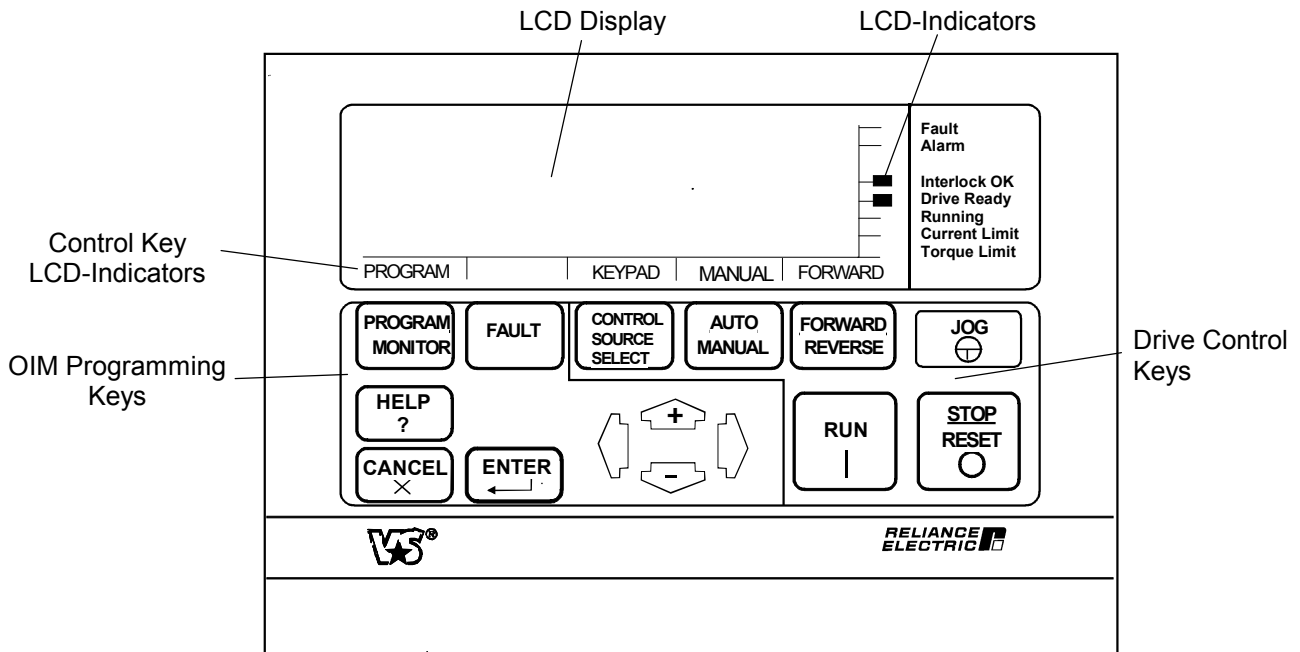
Figure 2-2 Operator Interface Module (OIM)

2.6.1   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.

2.6.1.1   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 2-6 contains a list of drive and fault status indicators with their associated description.

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 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 contact is closed and there are no drive faults present. The Field Current Loop is enabled, the armature voltage is regulated to zero Volt, (J15=SPEED). Remanence of the generator is compensated. Pressing the RUN or JOG key will cause the drive to start if this indicator is on. Off = not ready.
Running	When on, this indicates that the contactor K2 is closed and the armature is energized. Off = contactor is open and drive is not running.
Current Limit	This is a real time indication of the motor operating in current limit. On = motor current limit Off = motor not in current limit.

Table 2-6 OIM Drive Fault and Status Indicators

2.6.1.2   LED Indicators

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

2.6.2   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.)

2.6.2.1   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.

```
WL 3000 Main Menu                        ■■

  ➤Quick Start
    Drive Reference
    Outer Control Loop (OCL)
  ▼Speed Loop (SPD)

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.

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

Table 2-7 lists drive parameters monitored and reported to the OIM.

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	Percent, RPM, Units*

Table 2-7 Drive Monitor Capabilities

* 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 for Feet Per Minute, etc.). See "Define User Units" in Section 4.

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 7.7 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	

WL 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 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.

.CANCEL X	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.

ENTER <------|	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 for the specifics of using this key.
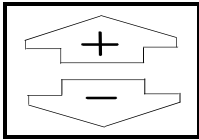
Scrolls up or down through the menu and parameter listings and changes parameter values.

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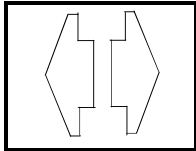
Moves the cursor left or right in parameter modification (value entry) screens to allow digit selection for parameter value setting.

Left (⇐) accesses the Language Selection menu at any menu level but not at parameter modification screens. See section 4.13 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 for further details on the Contrast Adjustment screen.

2.6.2.2 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
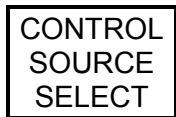
CSS Selects where the control signals for the drive originate. "KEYPAD" (OIM control) or "TERMBLK" (terminal strip control) The selection can only be changed when the drive is not running. The state of this key (TERMBLK or KEYPAD or SERIAL) is shown on the LCD directly above the key.

- 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 (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 3-4 Sample Regulator Board Terminal Strip Connection Diagram for more details.
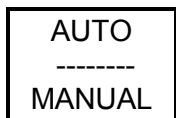
AUTO

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 3-4). 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).

FORWARD

REVERSE

This key is active only when in KEYPAD control. 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 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;
- when an A-C tach is used; and when a pulse tach with quadrature disabled (P.208) is being used.

The state of the controlling input (FORWARD or REVERSE) is shown on the LCD directly above the key.

.JOG

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.

RUN

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

STOP

RESET
◎

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 Install and Wire the Drive

DANGER

The user is responsible for conforming to all other applicable standards.
Wiring practices, grounding, disconnects, armature contactor, field contactor 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 WL 3000 Drive.

3.2 Recommended AC Line Fuses

The user must select the correct Fuse type for drive AC line semiconductor protection fuses from the **Table 8-2**.

3.3 Installing the Drive, Dimensions

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 Figure 3-1 for mounting dimensions.
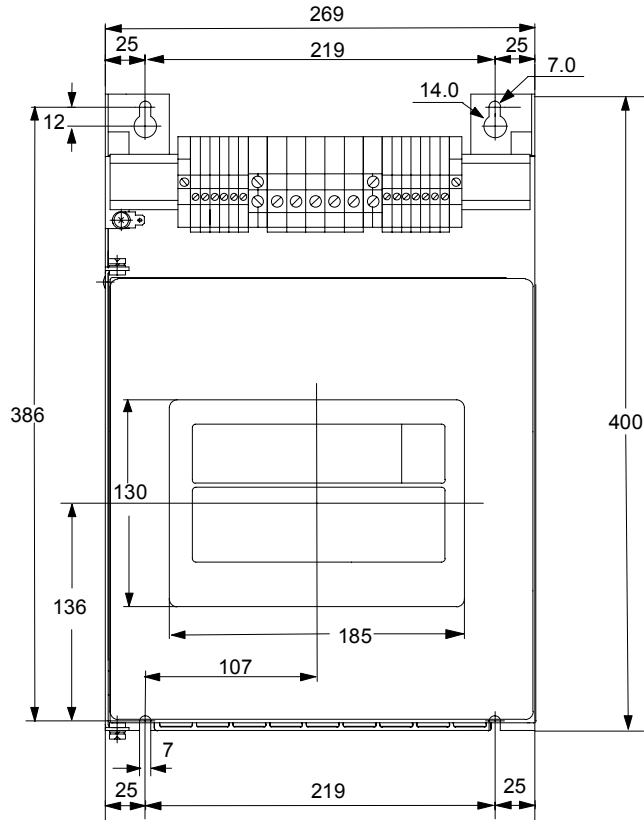
Power connections Terminals **25 A** Unit	
Motor 1D, 1C	6 mm^2 1.4 Nm
AC-Line 1U, 1V, 1W	6 mm^2 1.4 Nm
Protection earth PE	6 mm^2 1.4 Nm

Power connections Terminals **60 A** Unit	
Motor 1D, 1C	16 mm^2 2.5 Nm
AC-Line 1U, 1V, 1W	16 mm^2 2.5 Nm
Protection earth PE	16 mm^2 2.5 Nm
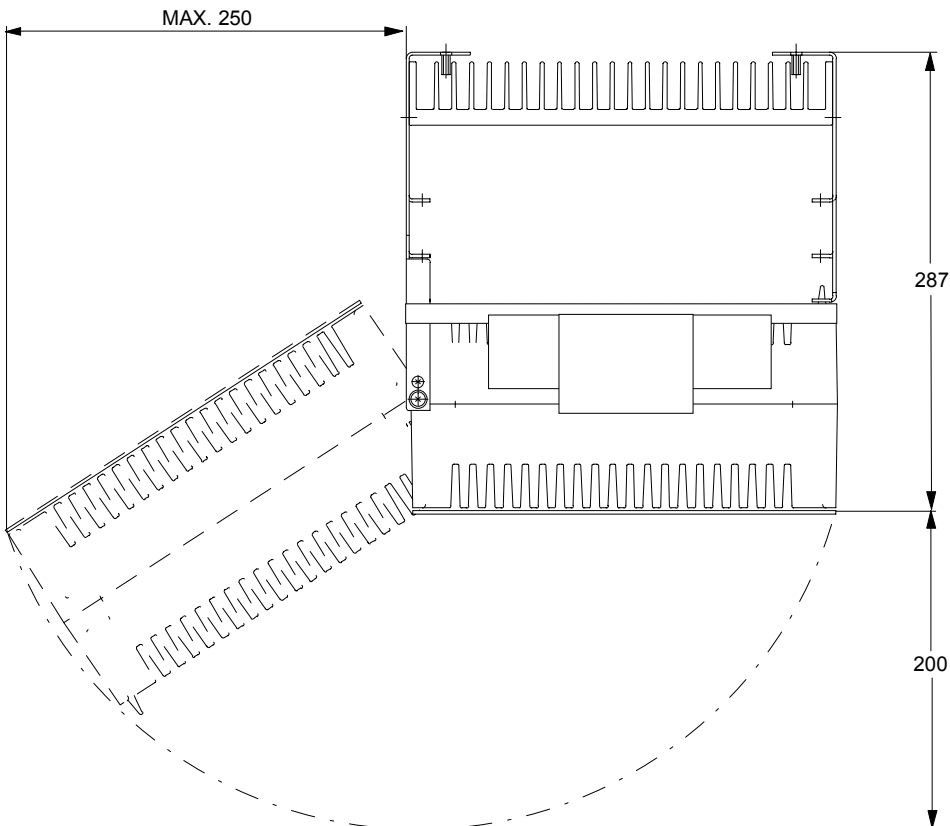
Weight: 10 kg

Minimum clearances for air circulation: 100 mm

Figure 3-1 Mounting Data for WL 3000 Type 25 A and 60 A.

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 8-3) 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 field circuit is grounded.

3.5   Install an Input Disconnect - Recommendations

DANGER

As per international standards (e.g. IEC/EN 60204-1) it is required that an input disconnect is 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. Size the disconnect to handle the transformer primary current as well as any additional loads the disconnect may supply.

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

3.6   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.

GEFAHR

For the armature circuit an external overload protection device must be provided. This can be a circuit breaker or armature contactor, or suitable fuses, which open the armature circuit if the armature current exceeds the rated value. The contact is connected into the input circuit at regulator terminal 9 (WL-Interlock). Failure to observe this precaution could result in severe bodily injury or loss of life

---

ATTENTION

Signal wiring should be run in a separate conduit isolated from all AC and DC power and control. Otherwise drive operation could be disturbed. Failure to observe this precaution could result in damage to the equipment.

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.

- 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.

- 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 generator field is 300 meter.

3.7   Wire the Drive

3.7.1   Ground the WL 3000, the Enclosure, the Generator and the OIM Control Station.

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 generator 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.

3.7.2 Wire AC-Power to the Drive

> **WARNING**
> The drive requires a 3-phase power source of 200 - 460/500, 50/60 Hz. 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 of 10 kA. 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) to the terminal strips or bus bars at the top of the Converter or to the disconnect. To ensure that the output voltage does not exceed the permitted field voltage, also a line input reactor or matched transformer must be provided.

3.7.3 Wire the Generator Field to the Converter

Connect the DC-Generator field leads to the drives field terminals. Use only copper wire rated 60/70°C or higher. For checking the Polarity see section 4.10.

3.7.4 Converter Feedbacks

3.7.4.1 Generator Armature Current Transformer

For the armature circuit an additional DC current transformer, connected to terminals B1 and B2, is required. Four burden resistors, which are selected by means of jumpers individually or in parallel circuits are mounted on the Power Supply Card (TIAWL).
The current transformers and burden resistors must be selected such, that the voltage drop across the burden is +/-10V at +/-300% rated armature current:

- Define the output current I_M at 300% FLA for the selected current transformer.
- Calculate the ideal burden resistor R_{ideal} so that the voltage drop across the burden at I_M is 10 Volts.
  R_{ideal} = 10 V / I_M
- Select from the following Table the nearest burden resistor Rb:

A	B	C	D	Value Rb	Current at 10 V
X	X	X	X	32.7 Ω	0.31A
X	X	X		38.3 Ω	0.26A
X	X		X	39.9 Ω	0.25A
X		X	X	44.9 Ω	0.2 A
X	X			48.7 Ω	0.21 A
	X	X	X	54.2 Ω	0.18 A
X		X		56.3 Ω	0.18 A
X			X	59.7 Ω	0.17 A
	X	X		72.0 Ω	0.14 A
	X		X	77.6 Ω	0.13 A
X				82.0 Ω	0.12 A
		X	X	99.0 Ω	0.1 A
	X			120.0 Ω	0.083 A
		X		180.0 Ω	0.056 A
			X	220.0 Ω	0.045 A
				1)	0.0 A

Resistance values on the Card:

A	82 Ω
B	120 Ω
C	180 Ω
D	220 Ω

1) Voltage input where 10 V must correspond with 300% FLA

Table 3-1 Burden Resistor for Armature Current Feedback

Example: For selecting a burden resistor of 39.9 Ω the Jumpers A, B and D must be inserted.
Calculate the correction factor R_{ideal}/Rb, which must be adjusted by Parameter ARM CURRENT FB GAIN ADJ (P.104).

Refer also to Parameter ARM CUR ZERO ADJ (P.105).

3.7.4.2 Generator Armature Voltage Feedback

The armature voltage is connected to the terminals UA1 (+) and UA2 (-) .
The highest permitted voltage is 660 V. For higher voltages shunt resistors must be provided.

Ua	External Component	Internal
≤ 660 V	-	Set **P.009** to rated generator armature voltage. Set Jumper **J30** to **LOW**.
> 660 V < 1000 V	Two external resistor networks with Part number 253.11.00 must be connected according to Figure 3-2.	Set **P.009** to rated generator armature voltage. Set Jumper **J30** to **HIGH**.
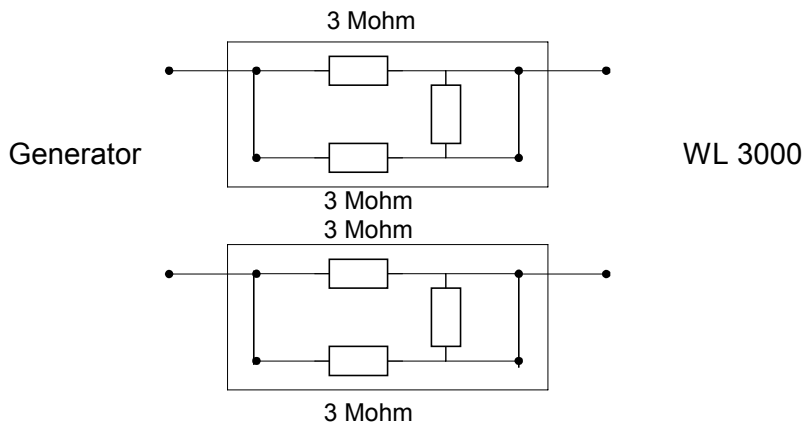
Figure 3-2 Resistor circuit for Armature voltage feedback

3.7.4.3 Tacho Connection

The WL 3000 has provisions to connect an analog tachometer at terminals 21/22 and 23 (see Chapter 4.5.4), or to use a pulse tach together with the Optional board 762.70.00.
The Pulse Tach Optional Board generates an analog speed feedback signal, which can be used during Start-up (see Instruction manual of the Pulse Tach Interface Card 49'1343).

3.7.5 Armature Circuit

3.7.5.1 Motor Overload Protection

Only a software (internal) static overload for the generator field circuit is provided.
In addition to the software (internal) overload function, Rockwell Automation recommends the use of a DC motor thermostat 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 3-4

3.7.5.2 Armature Contactor, Circuit Breaker

If the armature contactor closing is in addition monitored by an external logic circuit, the armature contactor must be enabled before applying the WL 3000 Start command. Otherwise after a time of one second an alarm A00036 (armature contactor not closed) will be released.

3.7.6 Wire the Field Contactor (Main contactor)

A main contactor in the AC-line input or field 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 field contactor must be controlled by the R1 contact of the WL 3000, which is wired to terminal strip X1:5 and X1:6 located at the top of the power unit.
On drives, where the inrush current of the field contactor coil exceeds the R1 contact rating (330 VA at AC 230V, cos phi 0.5), a pilot relay is required between the R1 contact output and the field contactor coil. A normally open auxiliary contact from the field contactor K1 must be wired to terminals X1:3 and X1:4 to provide contactor status feedback to the drive.

3.7.7 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.

- The 'Emergency Off' function must not disconnect straight away the power source from the field, but should be routed through the Stop sequencing, otherwise the induced voltage will drop and cause a short in the armature circuit.

- The Emergency Stop function should contain a timer relay (K10T) which ensures, that in case of malfunction of the internal control circuit (R1 does not open) the armature and field contactor drop out one second delayed after Stop sequencing.

Armature contactor requirements:
- Capability to break short circuit currents in the armature circuit.
- Besides connecting the WL 3000, independent overcurrent tripping function (e.g. at line loss during operation).

Disconnection of the power source from the motor may be reached e.g. by one of the following measures:

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

b) Armature contactor **not** used as Emergency Stopping Device:
   - Emergency Stopping Device (mushroom head pushbutton) interrupts control circuit and releases Coast Stop (terminals 7, 8) according to Category 0.

A Connection Diagram - Example for case b) is shown in Figure 3-3 and Figure 3-4.

FUNCTION: Actuating of the Emergency Stop pushbutton during operation, causes immediate drop out of relay K10, opening the n.o. contact at input terminal 9 and applies zero reference to the armature current regulator. When the current has been regulated to zero, the armature contactor drops out. If the armature current has not reached zero within one second, the armature contactor drops independent from current. After that the Generator Field Loop is disabled. The time delayed normally open contact of timer relay K10T ensures, that in case of malfunction of the internal control circuit (R1 does not open) the main contactor drops out after 1 second. If the field current has not been reduced to zero within one second, the contactor will be dropped out independent from current..

3.7.8 Stopping the Drive

3.7.8.1 Connect Digital Input COAST-STOP (drive terminal 8)

This input is not used on the WL-3000. Therefore a jumper must be wired between drive terminals 7 and 8, otherwise the drive will not start.

3.7.8.2 Connect Digital Input STOP (drive terminal 3)

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 (P.114 '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).

3.7.8.3 Connect Digital Input WL-Customer Interlock (drive terminal 9)

This serves to bring the drive into the READY condition.
When closing of the contact the generator field is switched on and the armature voltage regulated to zero Volts. The indications **Interlock OK** and **Drive Ready** are active. From this condition the motor can be started with the START Key or through the corresponding terminal.
If the WL-interlock is opened during **Run-Mode**, or a fault occurs, then is - like at Coast Stop - the armature current reference set to zero and the armature contactor K2 dropped out. If the armature current has not been reduced to zero within one second, the armature contactor will be dropped out with the alarm indication ARMATURE CURRENT HAS NOT REACHED ZERO. If the armature contactor has not opened, the fault ARMATURE CONTACTOR NOT OPEN will be indicated, to prevent re-start of the drive. After that the firing pulses for the field current are disabled and when they have reached zero the main contactor K1 is dropped out. If the field current has not been reduced to zero within one second, the contactor will be dropped out independent from current.
To ensure that the armature contactor is opened prior to the field contactor, the drop out delay time of K10T1 must be adjusted 1 second higher than that of K10T2.
The relay contacts R1 and RL2 are not forced opening type.
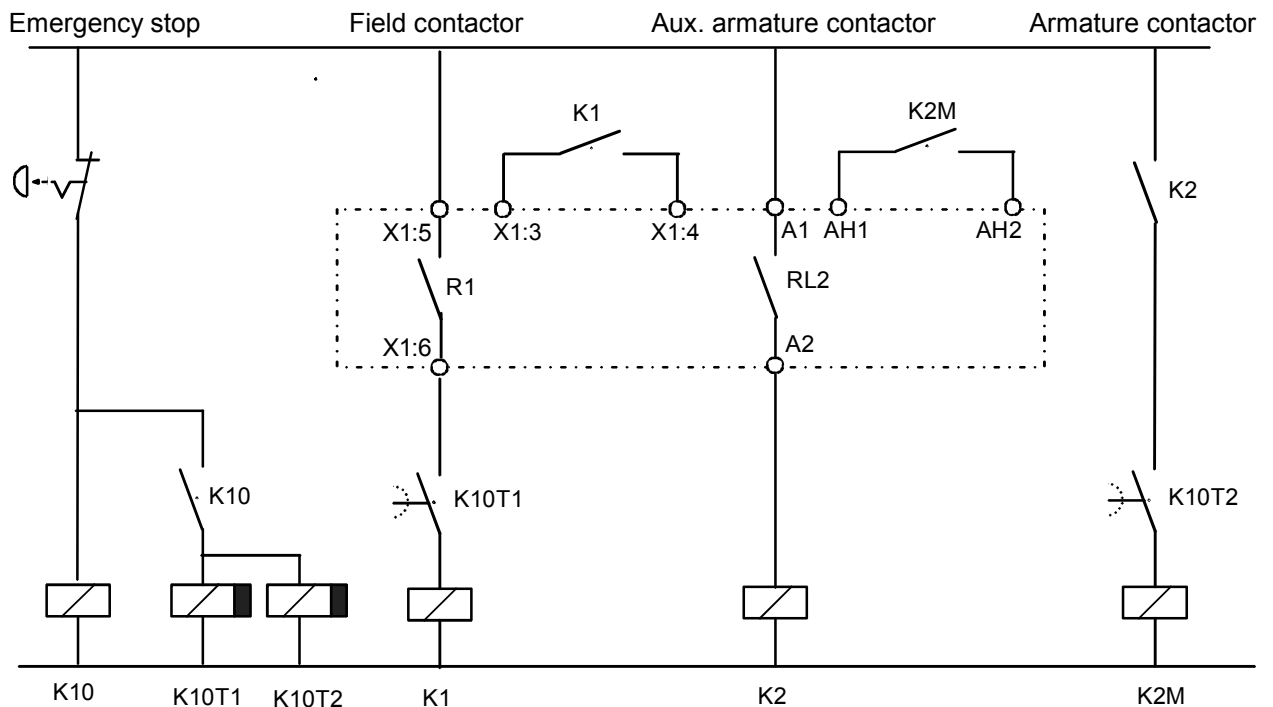
Figure 3-3 Sample Armature Contactor and Field Contactor Control Circuit

3.7.9   Wire User Devices to the Drive
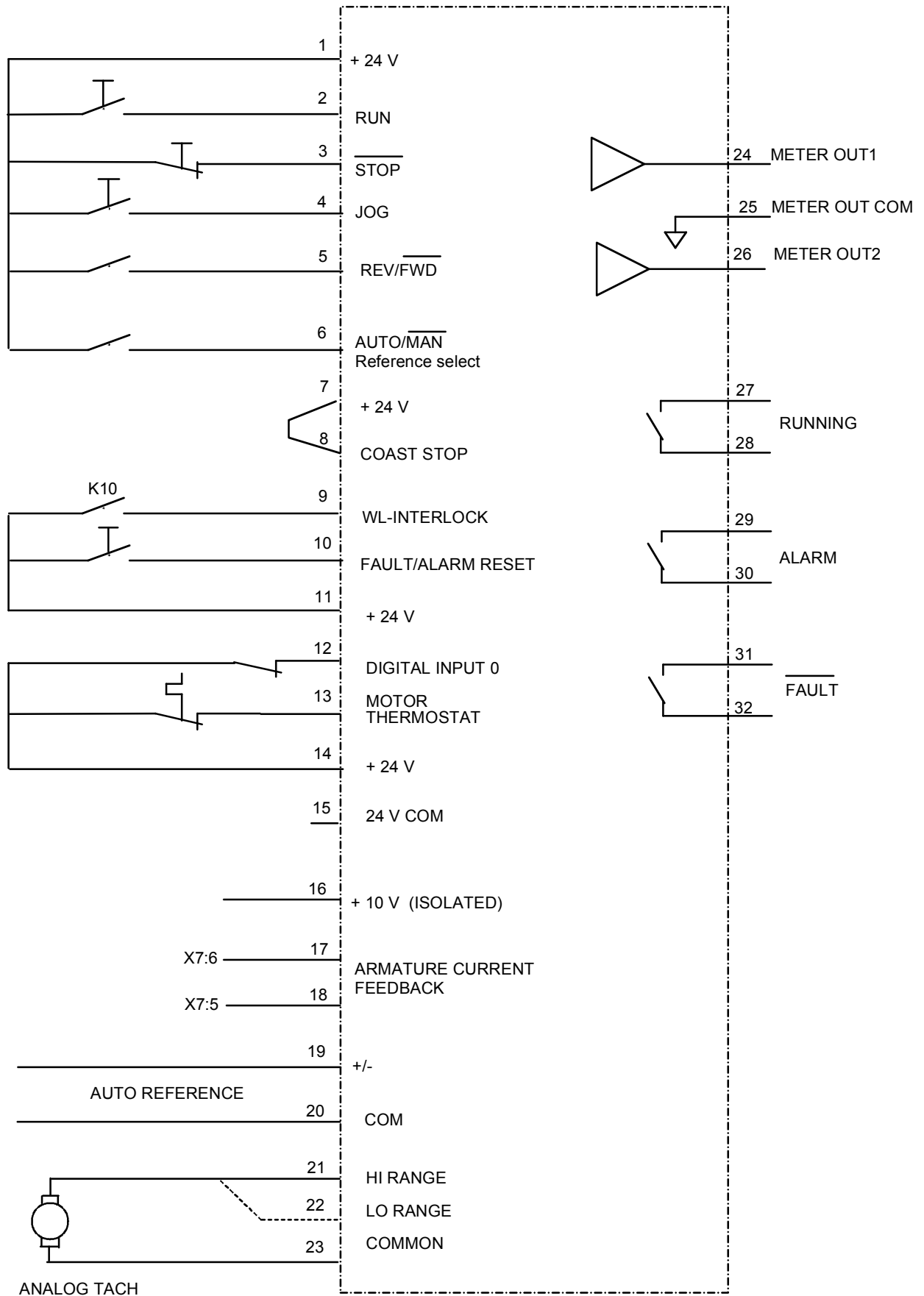
Figure 3-4 Sample Regulator Board Terminal Strip Connection Diagram

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
WL-INTERLOCK	9 and 11 (+24V)
FAULT/ALARM RESET	10 and 11 (+24V)
DIGITAL INPUT 0 (see P.428)	12 and 14 (+24V)
MOTOR THERMOSTAT	13 and 14 (+24V)
24V SUPPLY COMMON	15 (+24V COM)
+10 V ARMATURE CURRENT FEEDBACK	16 17 and 18
AUTO REFERENCE: (+/-) (COM)	19 20
ANALOG TACH: 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

Table 3-2 User Device Connections to the Regulator Board Terminal Strip
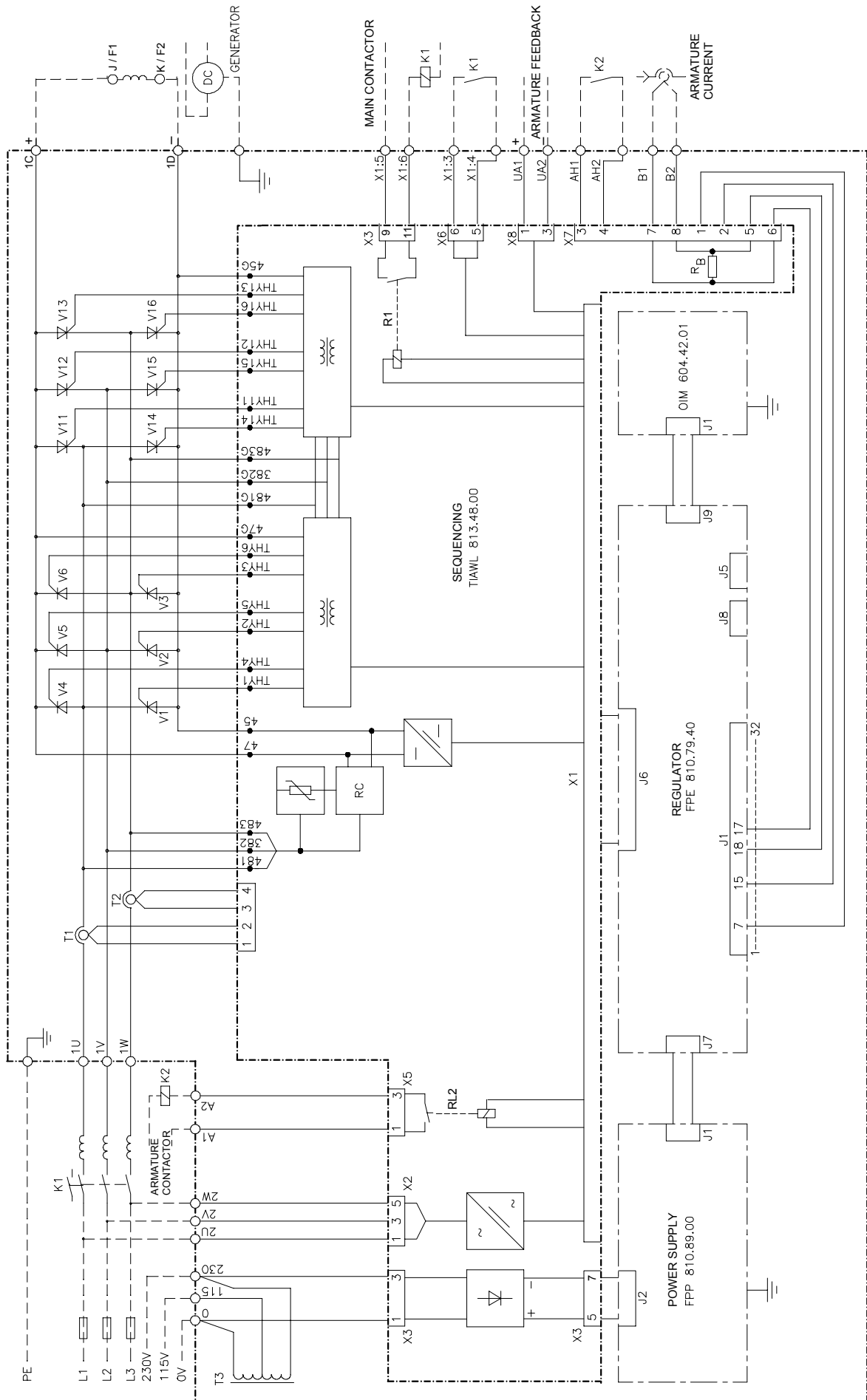
Figure 3-5 Principle wiring diagram of the WL 3000 Drive

WL 3000

4 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 Generator and Motor Ground Check

CAUTION:

A megohmmeter can be used for this generator and motor ground check, but all conductors between the generator/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 generator, DC Motor frame and conduit box should be connected to a good earth ground per the generator/motor instruction manual.

Verify that there is no path to ground in either the armature circuit, the shunt field circuit or the thermostat circuit.

Connect one lead of a standard ohm reading meter to the generator 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. Repeat this measuring procedure for the motor frame.

4.5 Jumper Settings

The jumper settings for the WL 3000 drive determine the program protection, field settings, references for automatic modes, tachometer voltage range, and field current feedback and armature voltage 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.

DANGER

This equipment is at line voltage when AC 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, 1W and 2U, 2V, 2W 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.

JUMPER/ADJUSTMENT	DEFAULT SETTING	FINAL SETTING
J10 (AUTO REF)	VOLTS and PARK	
J11 (TACH V SCALE)	31/125	
J12 (AUTO REF)	VOLTS	
J14 (TACH V RANGE)	250	
J15 (REGULATOR TYPE)	SPEED	
J16 (OIM PROGRAM)	ENABLE	
J18 (ARM I FB RB)	Position 4	
J19 (MANUAL REF)	NOT APPLICABLE	
J20 (FIELD LOSS DETECT)	NOT APPLICABLE	
J21 (FIELD SUPPLY)	NOT APPLICABLE	
J26 (TACH LOSS DETECT)	ENABLE	
J27, J29 for future selection needs		
J28 (FILTER SELECT) (red)	FLDFBK (do not change)	FLDFBK
J30 (POWER INTERFACE)	LOW	
(202) ANALOG TACH ZERO ADJ	0	
(205) ARM VOLTAGE ZERO ADJ	0	

Table 4-1 Jumper and Adjustment Settings
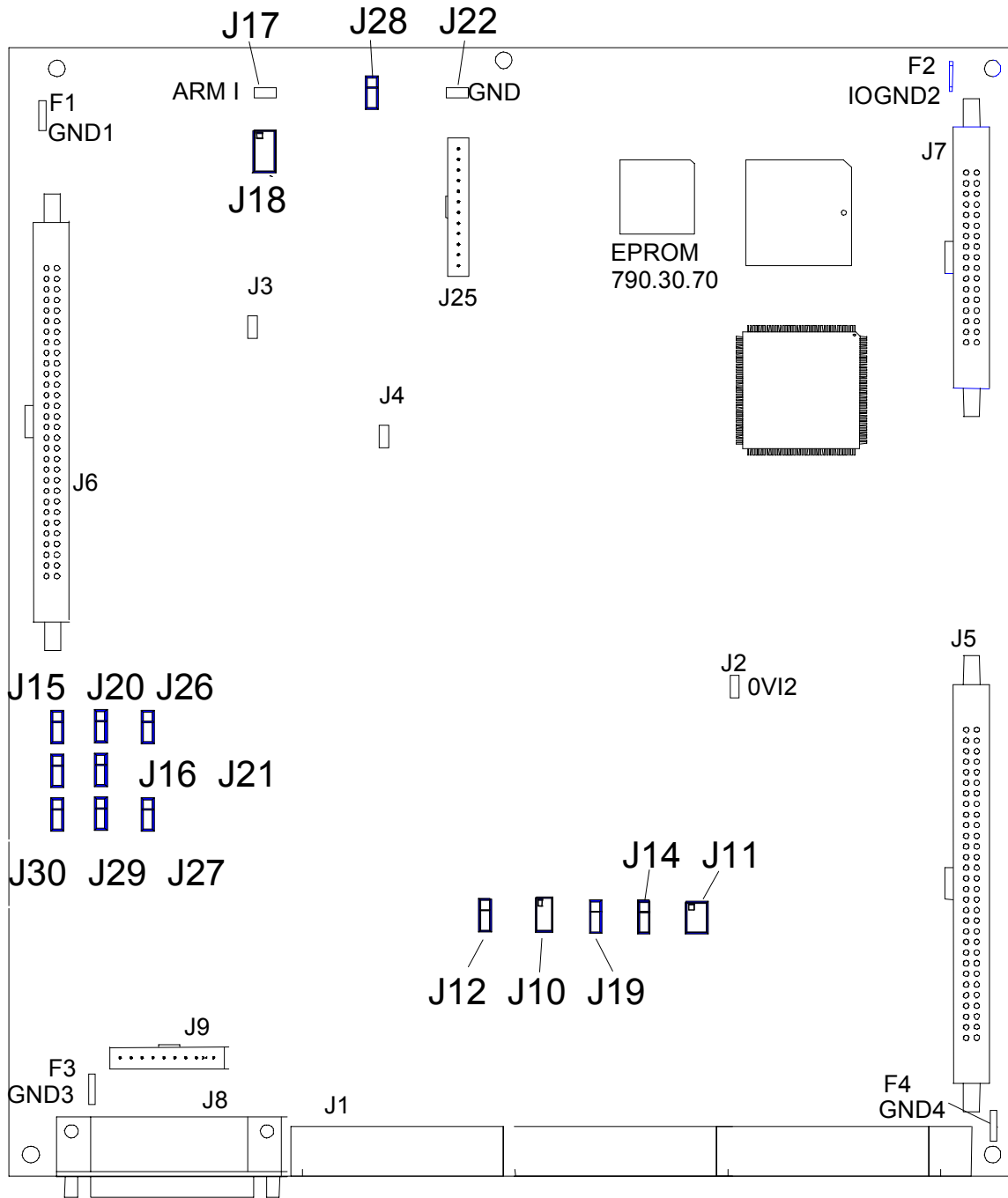
Figure 4-1 Regulator Board Jumpers, Connectors and Test Points

4.5.1 Set the Regulator Type - J15 Jumper

J15 must be set to Speed (SPEED regulation. J15 determines whether the drive uses WL-Speed (SPEED) or Current (CURRENT) regulation.
When CURRENT is selected, only the terminal strip can be used as the control source and the reference selection is automatically set to AUTO mode.
If the armature contactor control of the WL 3000 is not used, the armature contactor control signals (terminals A1, A2) must be connected with the pilot contacts (terminals AH1, AH2).
NOTE that speed parameters must be set to provide overspeed protection.

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.

PROGRAM ERROR E001					Fault
HARDWARE PASSWORD PROTECTION IS					Alarm
ENABLED.				■■	Interlock OK
				■■	Drive Ready
Press CANCEL to continue.					Running
					Current Limit
					Torque Limit
PROGRAM		KEYPAD	AUTO	FORWARD	

4.5.3 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).

4.5.4 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 tach is not used and if FEEDBACK SELECT (P.200) 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.

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.

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

NOTE: The output voltage of the tachometer must not exceed 250 V for DC tachometers or 275 V 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:

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

4.5.5 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.
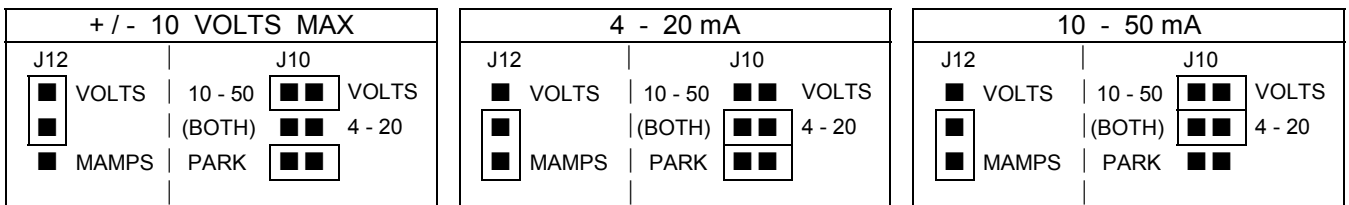
Figure 4-2 AUTO REF Jumpers (J12 and J10)

4.5.6 Field Current Feedback Scaling - 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 Jumper J18 scales the field current feedback signal.
The drive calculates the burden resistor needed to scale the field current feedback signal based on the value of parameter GEN RATED FIELD AMPS (P.008).

4.5.7 Check the FILTER SELECT - J28 Jumper

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

4.5.8 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 drives with a nominal armature voltage rating > AC **650 V** the jumper J30 **must** be set to **HIGH** and the feedback resistor circuit according section 3.7.4 must be provided.
For all other drives this jumper must stay in position LOW.
Please refer to the 'AC Input' data on the nameplate.

> **CAUTION**:
> If at armature voltage >660V no feedback resistor circuit is provided, could this result in damage to the equipment or in bodily injury.

4.6 Powering Up the Drive

Apply AC power to the drive after the Power Off Inspection, Generator and 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 WL 3000
DIGITAL D-C DRIVE.
   (c) Copyright Rockwell Automation 2000
     Keypad Version: 1.0
Running keypad/display diagnostics
Please wait.
```

```
Link initialization in progress.

Reading Regulator data.

Please wait.
```

```
WL 3000 Main Menu
➤ Quick Start
   Drive Reference
   Speed/Voltage Loop (SPD)
▼ Generator Field Loop (GFL)

PROGRAM          TERMBLK   AUTO   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
PROGRAM          KEYPAD    AUTO   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 Loop, Armature Loop and Generator Field 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.

WL 3000 Main Menu

Quick Start

Drive Reference

Outer Control Loop (OCL)

Speed Loop (SPD)

Armature Loop

Generator Field Loop (GFL)

Input/Output

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*

Outer Control Loop (OCL)

OCL Test Points

OCL Tuning

OCL Configure

Speed Loop (SPD)

  ⌊ Speed Loop (SPD) Test Points*

  ⌊ Speed Loop (SPD) Tuning

  ⌊ Speed/Voltage Loop (SPD) Feedback*

Armature Loop

  ⌊ Armature Loop Test Points

  ⌊ Armature Loop Tuning*

  ⌊ Armature Loop Feedback Scaling*

Generator Field Loop (GFL)

  ⌊ GFL Test Points

  ⌊ GFL Tuning*

  ⌊ GFL Feedback Scaling*

  ⌊ Three-Phase A-C Line*

  ⌊ SCR Diagnostics*
     ⌊ Field Phase Fire Test

Input/Output

  ⌊ Meter Outputs

  ⌊ Analog I/O*

  ⌊ Digital I/O*

  ⌊ Frequency I/O*

  ⌊ Level Detectors*

Drive Information*
  ⌊ Correct Scaling Jumper Positions*

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

4.10 Verify the Correct Direction of Motor Rotation

The direction of rotation is forward (positive), when the motor turns clockwise viewing motor drive end.

4.10.1 Generator Field

- The generator field is connected to the terminals 1C (positive) and 1D (negative) .
  With positive reference - Bridge 1 active - positive voltage and current must result.
  Parameter PHASE FIRE TEST BRIDGE (P.310) must be set to **OFF**.
- With the drive stopped, set the value of parameter PHASE FIRE TEST DELTA (P.309) to 100, in the OIM Menu *Generator Field Loop (GFL) – Diagnostics – Field Phase Fire Test*. Measure field voltage and field current (see chapter 7. and 7.7.6). Both values should be positive.
- Step back in the OIM Menu to *Diagnostics*, to disable the firing pulses.

4.10.2 Armature Voltage

- Disconnect field current supply of the DC motor.
- Start the DC Generator in forward direction of rotation.
- During run adjust the value of parameter PHASE FIRE TEST DELTA (P.309) to 80.
  Then increase the value, until $0 \leq Ua \leq Uanom$.
- At forward sense of rotation the armature voltage should be positive.
  Reduce the voltage again to approx. 0 Volts
- Disconnect the armature contactor feedback K2 from the control input terminals AH1/AH2, otherwise a fault occurs. Close the armature contactor manually and increase voltage.
  The armature current should be positive (positive voltage across the burden or check the output parameter ARM CURRENT FEEDBACK (P.194) in the menu *Armature Loop – Armature Loop Test points*).
  NOTE, that the unloaded motor might accelerate due to residual magnetism.

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.

- Apply field current to the motor and check at positive armature voltage the sense of rotation.
- Re-connect the armature contactor feedback K2 to the control input terminals AH1/AH2.

4.10.3 Determination of DC Tachometer Lead Polarity

When the sense of rotation is correct, the speed feedback must be checked at terminals 21/22, 23. This should also be positive at positive armature voltage at terminals UA1(+), UA2(-) and forward rotation.

4.11 Adjustments

This section describes Zero adjustments to compensate for signal drift on tachometer or armature feedback. These adjustments are available by accessing the menu *Armature Loop Feedback Scaling* from the *Armature Loop* at the Main Menu.

4.11.1 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 generator 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.

Increasing of the value in parameter P.205 changes the voltage feedback by 5.7 V, where the maximum value of the parameter may be +/-6 (corresponds to +/-43.2 V). Modify the zero calibration parameter, until the feedback value reads zero or is below 6 V. Record the final value in Table 4-1.

4.11.2 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) (via Menu *Speed Loop (SPD) – Speed regulator Feedback*). 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. Adjust the zero adjust parameter accordingly until the feedback value reads 0. Record the final value in Table 4-1.

4.12 Regulator Calibrations

For regulator adjustment a scope with voltage and current probe is recommended. Alternatively also the Software CS3000WL (part No. 788.05.30) with less resolution may be used.

4.12.1 Generator Field Loop (GFL)

For optimum calibration of the Generator Field Current Loop, field inductance data are required. If these are unknown, you can measure them as described below.
Start with the factory defaults of the Generator Field Current Loop (GFL):

GFL PI PROP GAIN (P.301)   10
GFL PI LEAD FREQUENCY (P.302)   1 radians/second
GFL FBK LL LAG FREQ (P.516)   30 radians/second
GFL FBK LL RATIO (P.511)   3
GFL REF RATE LIMIT (P.303)   40 ms

4.12.1.1 Field Inductance Measurement

Prior to this measurement the parameter GFL I REG PI P VALUE (P.301) must be adjusted to 40 and GFL I REG PI VOR FREQ (P.302) to 24 radians/second.

- Set CONTROL SOURCE SELECT to KEYPAD.

- Adjust Speed Loop and Armature Loop to proportional regulator:
  SPD LOOP PI LEAD FREQ (P.212) = 0
  Ia/Ua PI L-FREQ (P.515) = 0

- ACCELELERATION TIME (P.001) = 0.1sec (minimum)
  DECELERATION TIME (P.002) = 0.1sec (minimum)

- SPD LOOP PI PROP GAIN (P.211) = 20

- Ia/Ua PI P-GAIN (P.514) = 0.01 (minimum)

- +/- FIELD CURRENT LIM (P.587) = 150% (maximum)

- Do not start the generator, to keep the speed-, armature voltage and armature current feedback at zero.

- Select MANUAL-reference as the speed reference and increase it up to maximal value.

- Set AUTO-reference to 0

- Close the input WL-interlock and press the RUN-Key.

- Increase Ia/Ua PI P-GAIN (P.514), until rated field current is reached.

- If the field current is oscillating, the value in GFL PI PROP GAIN (P.301) must be decreased, until steady current is reached.

- If the field current is stable, change over to AUTO MODE. This sets the field current to appr. 0.
- Connect the field current and the field voltage signal to the scope. Adjust the scope for triggering at the ascent of field current.
- Change over to MANUAL reference and adjust the horizontal deflection to show the entire current rate.
- Note, where the field voltage reaches saturation. Starting from this point the current will rise nearly linearly. If the regulator should not reach saturation, increase P.301.
- Measure the ascent dIf/dt in the linear part of the curve (see Figure below).
- Set GFL-Regulator parameters back again to the values of 4.12.1.
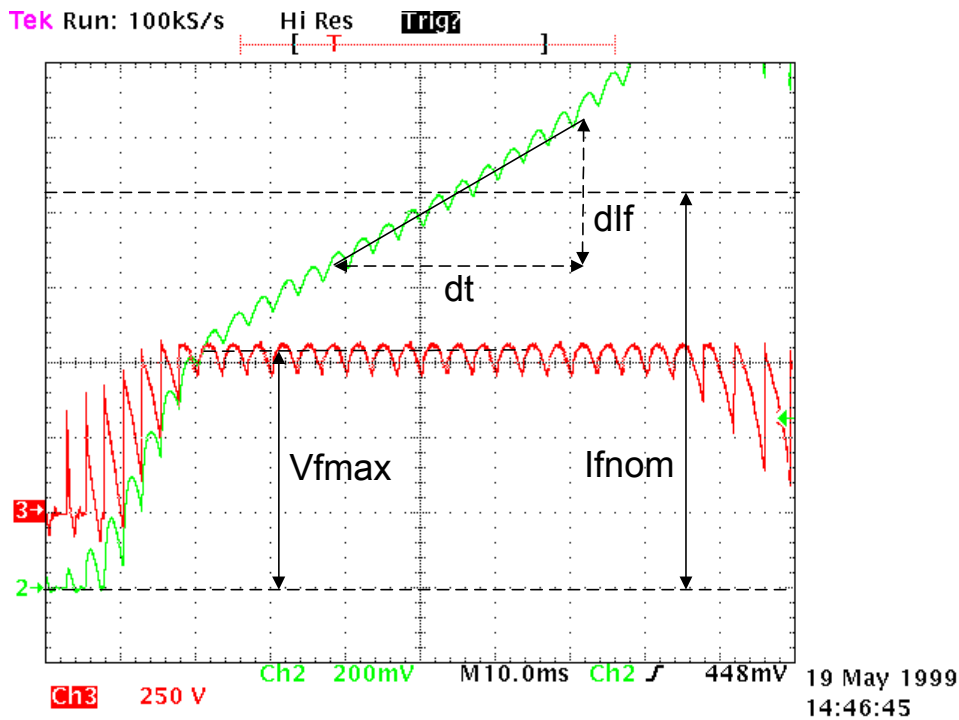
Figure 4-3 Field current / voltage

4.12.1.2 Calculation of the field time constant Tf

- Tf = Lf/Rf
- Field resistance Rf can be calculated with   Rf = Vf / Ifnom .
- Field inductance Lf can be calculated with : $Lf = \dfrac{Vline * 1.35 - Rf * Ifnom}{dIf/dt}$

4.12.1.3 Calibration of Generator Field Loop Parameters

- GFL PI PROP GAIN (P.301) = 50 * Tf
  GFL I REG LEAD FREQENCY (P.302) = 1 / Tf
- After the calibration of these values, the proportional value can be increased. Use a step response for this procedure, to verify stability and overshooting. If the field current is stable, but overshoots by more than 20%, the value of GFL REF RATE LIMIT (P.303) should be increased.
  A step response can be generated by changing over the reference from AUTO to MANUAL, when the AUTO-reference (Terminal) is zero and the MANUAL reference (on OIM) delivers the requested amplitude.
- After the adjustment of the maximum Kp value, one can try to increase Kp with other values of GFL FBK LL LAG FREQ (P.516) and GFL FBK LL RATIO (P.511).

4.12.2 Armature Current Loop

Only if the Generator Field Loop has been adjusted correctly, the Armature Current Loop can be adjusted.

- Disconnect the DC motor field current supply.
  If rotor turning is not permitted, the rotor must be locked in addition.

- Set CONTROL SOURCE SELECT to KEYPAD.

- Adjust the following parameters:
  ACCELERATION TIME (P.001) to   0.1s (Minimum),
  DECELERATION TIME (P.002) to   0.1 s (Minimum) and
  AUTO MODE RAMP BYPASS (P.112)   to   ON .

- Adjust Speed Loop to proportional regulation mode: SPD LOOP PI LEAD FREQ (P.212) = 0

- Adjust SPD LOOP PI PROP GAIN (P.211) = 20

- Set POS ARMATURE CURRENT LIM (P.006) and
      NEG ARMATURE CURRENT LIM (P.005) to 100%.

- Set Ia/Ua PI P-GAIN (P.514) to Ra(p.u.),
  Ra(p.u.) can be calculated as follows:
      Ra(p.u.) = (Ra(Gen)+Ra(Mot)) $*$ Ianom / Vanom

- (Ra(Gen)+Ra(Mot)) can be determined by measuring the armature voltage at rated armature current in the Field Phase Firing Test Mode. For that procedure disconnect field current supply of the DC motor and lock the rotor. For this measurement the armature contactor must be actuated by an external source, because the normal Start sequencing is not followed.
  The field firing angle must be slowly increased, to inhibit overcurrents.

- Set Ia/Ua PI L-FREQ (P.515) to 1/Ta.
  If the armature time constant Ta is unknown, start with value 10.

- Change over to MANUAL reference and adjust the reference for maximum speed.

- change over the reference to AUTO and verify, that the Auto reference is zero.

- Close the input WL-interlock and press the RUN-Key.

- Connect the armature current and the armature voltage signal to the scope. Adjust the scope for triggering at the ascent of armature current. Adjust the horizontal deflection to show the entire current rate on the screen.

- Changing over the reference from AUTO to MANUAL generates a step response of the Armature Current Loop. Increase the value of Ia/Ua PI L-FREQ (P.515), until overshooting of approx. 33% armature currents results. Then try to improve the rate of rise, by increasing the proportional value and decreasing the integral value. Take care, that the damping after the first overshoot of approx.33% does not result in significant undershoot.

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.

LANGUAGE SELECT ENGLISH					Fault
➤ ENGLISH					Alarm
DEUTSCH				■■	Interlock OK
FRANCAIS				■■	Drive Ready
▼ ESPANOL					Running
					Current Limit
PROGRAM		KEYPAD	AUTO	FORWARD	

The following languages are available:
  • ENGLISH (Default)
  • DEUTSCH (German)
  • Code (Parameter Numbers)

"Code" allows the use of parameter numbers when interfacing with the OIM.
See appendix B 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.

WL 3000 Main Menu

└ Operator Interface*

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

Operator Interface					Fault
➤ PASSWORD					Alarm
Memory Operations				■■	Interlock OK
Reset Clock				■■	Drive Ready
Define User Units					Running
					Current Limit
PROGRAM		KEYPAD	AUTO	FORWARD	

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 reference) 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.

Do you wish to enter the password to ENABLE program protection? ➤ NO YES		■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit
PROGRAM	KEYPAD	AUTO	FORWARD

-OR-

Do you wish to enter the password to DISABLE program protection? ➤ NO YES		■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit
PROGRAM	KEYPAD	AUTO	FORWARD

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.

PASSWORD + 55 -10000 <-> 10000		■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit
PROGRAM	KEYPAD	AUTO	FORWARD

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.

WL 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.

WL 3000 Main Menu

└ Operator Interface*

The elapsed time clock indicates the number of days, hours, minutes and seconds since the last power-up. 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:

Reset Clock					Fault
					Alarm
DRIVE CLOCK HAS BEEN RESET.				■■	Interlock OK
				■■	Drive Ready
Press CANCEL to continue.					Running
					Current Limit
PROGRAM		KEYPAD	AUTO	FORWARD	

4.14.5 Define User Units

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

WL 3000 Main Menu

└ Operator Interface*

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

Define User Units					Fault
					Alarm
➤ Define Speed Units				■■	Interlock OK
Define Load Units				■■	Drive Ready
					Running
					Current Limit
PROGRAM		KEYPAD	AUTO	FORWARD	

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:

Define Speed Units				Fault
				Alarm
SPEED UNITS SELECT		RPM	■■	Interlock OK
➤ RPM			■■	Drive Ready
%				Running
OTHER				Current Limit
PROGRAM	KEYPAD	AUTO	FORWARD	

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".

Define Speed Units				Fault
				Alarm
Define Units Tag.			■■	Interlock OK
INCH/S			■■	Drive Ready
				Running
				Current Limit
PROGRAM	KEYPAD	AUTO	FORWARD	

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.

Define Speed Units				Fault
				Alarm
FULL SCALE VALUE		100	■■	Interlock OK
+ 100			■■	Drive Ready
1 <-> 10000				Running
				Current Limit
PROGRAM	KEYPAD	AUTO	FORWARD	

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*.

Define Speed Units
 	
 Enter the number of decimal places:
   NONE
   ONE
   TWO
	■■
	 ■■
		Fault
		 Alarm
		 Interlock OK
		 Drive Ready
		 Running
		 Current Limit

PROGRAM	KEYPAD	AUTO	FORWARD		

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

Defines, how the field current will be displayed.

Define User Units ➤ Define Speed Units Define Load Units	■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit
PROGRAM	KEYPAD	MANUAL	FORWARD		

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

Define Load Units LOAD UNITS SELECT %FLA ➤ %FLA AMPS	■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit
PROGRAM	KEYPAD	MANUAL	FORWARD		

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.

4.14.5.3 Define Armature Load Units

Shows how the armature current is displayed. The procedure is identical as described above in *Definition Load units*.

WL 3000

5 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:
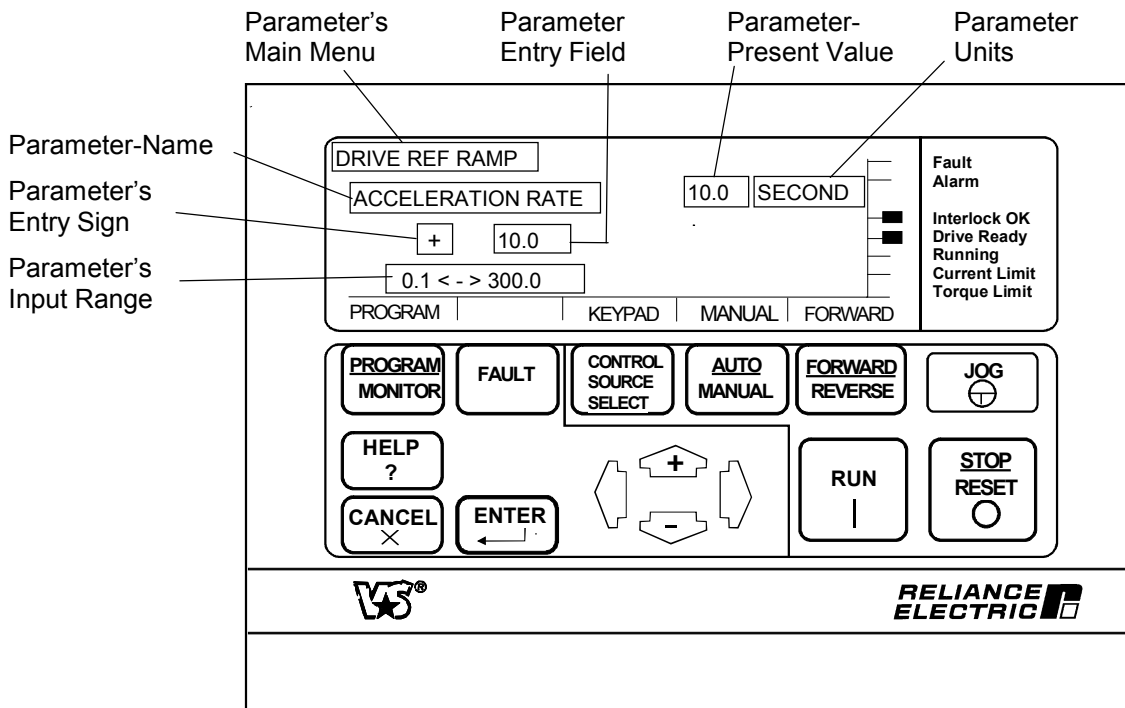
Figure 5-1 Integer Value Entry Screen

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.
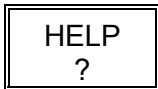
5.3 Standard Choice Integer Value Entry Screen

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:

```
SETUP PARAMETER                                         Fault
                                                        Alarm
PARAMETER NAME                  230 VAC                 Interlock OK
➤ 230                                                   Drive Ready
  400                                                   Running
  460                                                   Current Limit
➤ OTHER
PROGRAM          KEYPAD    MANUAL    FORWARD
```

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.
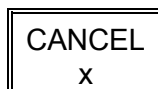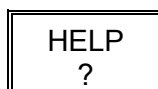
5.4 Selector Switch or Boolean Value Entry Screen

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:

Speed/Voltage Loop (SPD) Feedback					Fault
FEEDBACK SELECT DC TACH					Alarm
➤ DC TACHOMETER				■■	Interlock OK
PULSE TACHOMETER				■■	Drive Ready
					Running
					Current Limit
PROGRAM		KEYPAD	MANUAL	FORWARD	

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 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:

```
Quick Start                              |  |  Fault
Quick Start Exit Menu                    |  |  Alarm
  ➤ Return to previous step.             | ▪▪ | Interlock OK
    Exit Quick Start using changes.      | ▪▪ | Drive Ready
    Exit Q.S. without using changes.     |  |  Running
                                         |  |  Current Limit
  PROGRAM        |  KEYPAD | AUTO | FORWARD
```

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.

Hardware Jumper No.	Initial Setting	Final Setting
J11 (TACH V SCALE)	31/125	
J14 (TACH V RANGE)	250	
J18 (ARM I FB RB)	Position 4	

Table 6-1 Quick Start Jumper Settings

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 4.14.3 for procedures regarding memory operations.

WL 3000 Main Menu						Fault
➤ Quick Start						Alarm
Drive Reference					■■	Interlock OK
Outer Control Loop (OCR)					■■	Drive Ready
▼ Speed Loop (SPD)						Running
						Current Limit
PROGRAM		KEYPAD	AUTO	FORWARD		

At the WL 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 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	NOMINAL AC LINE FREQ	306	50 Hz	The nominal AC line frequency (typically 50 or 60 Hz)	
2	NOMINAL AC LINE VOLTS	307	400 VAC	The nominal AC line RMS voltage.	
3	TOP SPEED	011	500 RPM	The highest running speed of the motor. It scales the feedback device. • If there is no field weakening, the top speed is typically the same as the nameplate base speed. ATTENTION: Before starting the drive, this parameter must be set to base 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	
4	GEN RATED FIELD AMPS	008	10.0 AMP	The rated generator field current from the generator nameplate. P.008 is also used for the calculation of CT TURNS RATIO (P.010) and the burden resistor value. ATTENTION: This parameter must be equal to the rated field amps found on the generator nameplate. Otherwise overcurrent or excess heating of the generator could result. Failure to observe this precaution could result in damage to, or destruction of, the equipment.	
5	GEN RATED ARM VOLTS	009	240 VOLTS	The rated generator voltage from the generator nameplate.	
6	REVERSE DISABLE	015	OFF*	NOTE: *This parameter might be affected by FEEDBACK SELECT (P.200).* When ON, REVERSE DISABLE prevents the speed reference from dropping below zero, but not activating the reverse bridge (regen. braking)	
7	FEEDBACK SELECT	200	DC TACH	Determines the type of feedback signal that is used for the speed loop: PULSE TACH can be selected only if a pulse tachometer kit is installed. FEEDBACK SELECT causes the NEGATIVE CURRENT LIM (P.006) (step 19) to be set to 0 and REVERSE DISABLE to be set to ON if PULSE TACH is selected and PULSE TACH QUAD is set OFF.	

Table 6-2 Quick Start Parameter Modification Sequence. - continued

Step No.	Parameter Name	Code No.	Default	Description	User Setting
8	ANLG TACH VOLTS/1000	203	18 V/1000 RPM	The analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM. Only needs to be set if FEEDBACK SELECT is set to DC TACH. It might be limited to less than 200.0 volts/1000 so that voltage from the tachometer will not be more than 250 V.	
9	PULSE TACH PPR	207	18 PPR	It sets the pulse encoder pulses per revolution (PPR) from the pulse encoder nameplate. Only displayed if FEEDBACK SELECT Is set to PULSE TACH and a pulse tach interface is installed.	
10	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 P.208 is set to OFF while PULSE TACH is the selected FEEDBACK SELECT type, NEGATIVE CURRENT LIM (P.006) will be set to 0 and REVERSE DISABLE (P.015) set to ON (preventing reverse direction).	
11	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 value is modified by DRAW PERCENTAGE OUT (P.196).	
12	DECELERA-TION RATE	002	5 SEC.	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 value is modified by DRAW PERCENTAGE OUT (P.196).	
13	MINIMUM SPEED	003	0 RPM	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. **ATTENTION**: The 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.	

Table 6-2 Quick Start Parameter Modification Sequence. – continued

Step No.	Parameter Name	Code No.	Default	Description	User Setting
14	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 TOP SPEED (P.011), 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.	
15	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.	
16	JOG SPEED	012	250 RPM	The operating speed while 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 open. **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.	
17	NOMINAL ARM CURRENT	019	100 A	The rated armature current in amperes.	
18	POS ARM CUR LIM	005	200% FLA	Sets the highest amount of positive current for the generator armature current (% full load amps) for the forward bridge. Used as a high limit for the speed loop PI block output.	
19	NEG ARM CUR LIM	006	200% FLA	Sets the highest amount of negative current for the generator armature current (% full load amps) for the reverse bridge. Used as a low limit for the speed loop PI block output.	

Table 6-2 Quick Start Parameter Modification Sequence. – continued

Step No.	Parameter Name		Code No.	Default	Description	User Setting
20	GEN NOM FLD VOLTAGE		510	100 V	Nameplate value of the rated generator field voltage. **ATTENTION** You must configure this to the generator nameplate value. The incorrect configuration of this parameter can cause a motor overvoltage condition. Failure to observe this precaution can result in bodily injury and damage to the equipment	
21	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

N/A = Not Applicable.

7 Troubleshooting/Diagnostics

7.7 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 WL 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. This must be either 200 to 460 volts.
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 have been correctly sized per **Table 8-2**. The AC and DC power conductors should have been sized per local standards.

7.4 DC Generator and DC Motor

CAUTION

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

Recheck all motor and generator connections for tightness and correct identification. Verify that there is no path to ground in either the DC motor armature circuit, the field circuit or the thermostat circuit. Connect one lead of a standard ohm meter to the generator frame and the other lead to the two armature leads to the two field leads and then connect 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.
Verify the continuity of the motor thermostat and its proper connection to regulator board terminals 13 and 14.

7.5 Field and Armature Contactor

If a field or armature contactor has not been supplied by Rockwell Automation, 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 2.6.2.1). 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.

Fault Menu					Fault
					Alarm
➤ Review Log				■■	Interlock OK
Reset Faults				■■	Drive Ready
Clear Fault Log and Reset Faults					Running
					Current Limit
	FAULT	KEYPAD	AUTO	FORWARD	

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).

Review Log					Fault
					Alarm
➤ 03 CONTROLLER THERMOSTAT TRIP					Interlock OK
02 A-C LINE SYNCHRONIZATION FAULT				■■	Drive Ready
01 OIM COMMUNICATIONS TIMEOUT				■■	Running
					Current Limit
	FAULT	KEYPAD	AUTO	FORWARD	

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

F00009: CONTROLLER THERMOSTAT TRIP 028 days 14 hours 30 mins 00 secs 　　Controller thermostat indicates high temperat. 　　Possible causes: ▼ Inadequate heat sink ventilation	■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit

	FAULT	KEYPAD	AUTO	FORWARD

▼ 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.

Alarm Menu ➤ Review Log 　Reset Alarms 　Clear Alarm Log and Reset Alarms	■■ ■■	Fault Alarm Interlock OK Drive Ready Running Current Limit

	ALARM	KEYPAD	AUTO	FORWARD

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).

Review Log							
➤ 04 LOW MINIMUM SPEED							Fault
03 LINE VOLTAGE LOW							Alarm
02 MOTOR BRUSH WEAR LOW				■■		Interlock OK
01 LINE VOLTAGE LOW				■■		Drive Ready
							Running
							Current Limit
	ALARM	KEYPAD	AUTO	FORWARD			

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

A00051: LOW MINIMUM SPEED						Fault
138 days 16 hours 23 mins 52 secs						Alarm
The MINIMUM SPEED value is less than 10%			■■		Interlock OK
of the MAXIMUM SPEED value. Verify that			■■		Drive Ready
these parameter values are correct for your					Running
application.						Current Limit
	ALARM	KEYPAD	AUTO	FORWARD		

▼ 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.

Diagnostics Menu						Fault
➤ Why is the drive not ready?						Alarm
Why did the drive stop?					■■	Interlock OK
					■■	Drive Ready
						Running
						Current Limit
	DIAGS	KEYPAD	AUTO	FORWARD		

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 SCR Diagnostics

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

WL 3000 Main Menu

    Generator Field Loop
       • SCR Diagnostics

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

SCR Diagnostics						Fault
➤ OPEN SCR SENSITIVITY	0%					Alarm
OPEN SCR TRIP THRESH	800				■■	Interlock OK
Field Phase Fire Test					■■	Drive Ready
						Running
						Current Limit
PROGRAM		KEYPAD	AUTO	FORWARD		

* 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 voltages at the regulator board. • 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   Field Circuit Thyristor 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.

The field phase fire test mode serves on one hand to verify the correct operation of the S-6R rectifier bridge and on the other hand to operate the drive with fixed firing angle for checking voltage or current direction.

To perform a field phase fire test, the following steps are necessary:

1. Open input WL-interlock .

2. Set CONTROL SOURCE SELECT (CSS) to KEYPAD.

3. On the OIM-Menu select *Generator Field Loop (GFL) – SCR Diagnostics – Field Phase Fire Test*.

4. Adjust parameter PHASE FIRE TEST BRIDGE (P.310) . This parameter must be set to the appropriate value before activating the field phase fire test mode.

5. Connect an oscilloscope to the field current feedback test point (J17+, J22– on the Regulator board). Note that the CS3000WL software *oscilloscope* mode does not have sufficient bandwidth for this test.

6. Close input WL-interlock. The status indicators *Interlock OK* and running must be lit.
The field phase fire test mode is now active.

7. Set PHASE FIRE TEST DELTA (P.309) to 55 degrees. Slowly increase the value 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 (P.309 > 60 degr).
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, P.309 should **not exceed 89 degrees**.

8. To stop the test leave the menu path *Field Phase Fire Test* by pressing the CANCEL-Key.
If the input WL-interlock is still closed, the drive changes to READY mode and the armature voltage is regulated to zero Volt !
If you open **WL-interlock** while in the menu *Field Phase Fire Test*, the test is finished too and the drive is set to the STANDBY mode.

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 Replacement Parts and Accessories

8.1 Replacement of components

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

Replacement of a thyristor or thyristor module

- 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

 NOTE: 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.

8.2 Recommended Spare Parts

Table 8-1 Spare parts for units 25 A and 60 A

Unit Type		Spare parts		
25 A	848.80.00	2 Thyristor Modules 135.60.00	1 Regulator Board FPE	810.79.40
			1 Firmware EPROM (inserted in FPE)	790.48.10
			1 Interface Boards TIAWL	813.48.00
60 A	848.80.01	2 Thyristor Modules 135.60.02	1 Power Supply FPP	810.89.00
			1 Keypad	604.42.50

8.3 Accessories

8.3.1 Semiconductor Protection Fuses

Semiconductor protecting fuses in the AC-line input of the converter are to be selected from the following table. Chokes in the AC-line input of the converter are to be selected from the Table 8-3.

The fuses and chokes are externally mounted and not supplied with the power module.

WL3000 Type	Generator Field Current I_f	Generator Field Input Fuses		AC-Line Input Fuses		Fuse Accessory *) (per Fuse)	
		Rating	Part No. Catalog No. (2 pieces)	Rating	Part No. Catalog No. (3 pieces)	Fuse Trip Indicator	Fuse Holder
25A	25A	32A	553.28.02 F-25	32A	553.28.02 F-25	553.29.00	511.23.00 F-H1
60A	40A	63A	553.28.06 F-60	63A	553.28.06 F-60	553.29.00	511.23.00 F-H1
	60A	80A	553.28.07 F-60A	63A	553.28.06 F-60	553.29.00	511.23.00 F-H1

* For selection and dimensions see also following pages

Table 8-2 Power Input Protecting Fuses
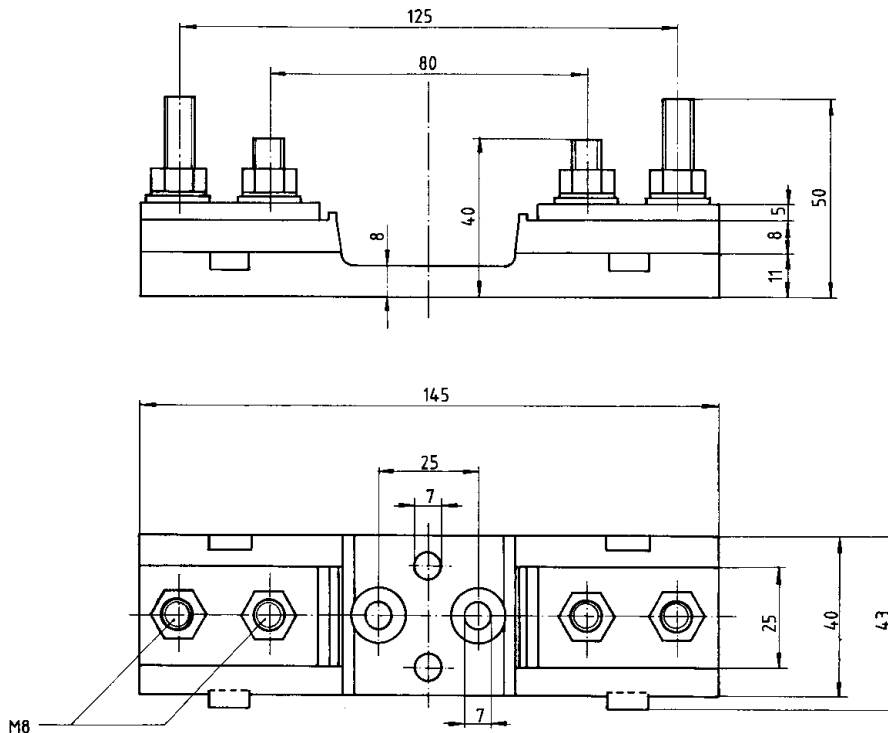
Part number **511.23.00**
for fuses DIN 80/ Size 00 (553.2...) up to 125 A

Figure 8-1 Fuse Holder Dimensions (mm)

8.3.2 Iron Core Chokes

The AC-line input chokes 252.40.xx produce **2% voltage drop at 400 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 are mandatory.
If on applications with RFI filters the drive is connected to a supply with nominal voltage >400V < 500V **two** 2% chokes 252.40.xx in series will be required.

WL3000 Type	Generator Field Current I_f	AC- Line Input 3-Phase		
		Rating I_{nom}	Choke Part No.	Catalog-No.
25A	25A	25A	252.40.01	LL-25
60A	40A	40A	252.40.02	LL-40
	60A	62A	252.40.03	LL-62

Table 8-3 Iron Core Choke Selection
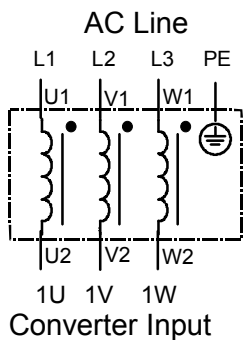
Figure 8-2 Line Reactor Wiring Diagram

Δ Protection earth connection stud
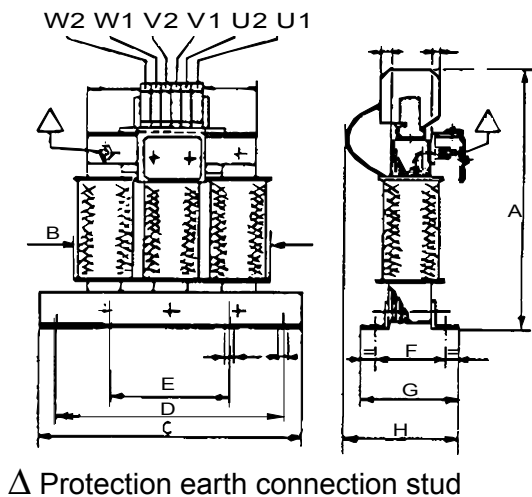
Line Reactor Part No.	A	B	C	D	E	F	G	H	[kg]	P_v [W]	Fig.	Used for
252.40.01	190	150	190	170	75	45	67	80	4.7	50	1	Converter Input
252.40.02	185	150	190	170	75	60	72	85	6.5	60	1	
252.40.03	210	180	240	210	90	52	72	90	7.8	70	1	

Table 8-4 Line Reactor Dimensions (mm), Power Losses (W) and Weight (kg):

8.3.3 Radio Frequency Interference Filter

General Description

Power converters in general cause line disturbances over a wide frequency range.
Through the correct connection of the adapted Radio Frequency Interference Filter the emissions in the frequency range 150 kHz to 30 MHz can be kept below the recommended limits.

RFI Filter Selection

The RFI-Filters can be selected from Table 8-5 according to the permitted filter current and the maximum operating voltage.
The permitted filter current is dependent on the application specific maximum Generator field current I_f, 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 1 < FF < 1.02

For cabinet mounting with T = 50°C and FF = 1.02:

> Filter current = maximum continuous DC-current I_f

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

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

Filter-Current	RFI-Filter 380 – 440 V	
	Part No.	Catalog No.
25 A	839.72.05	RFB-25
36 A	839.72.06	RFB-36
50 A	839.72.07	RFB-50

Table 8-5 Filter Selection (for dimensions see next Page)

RFI-Filters for 460 – 500 V on request

Radio Interference Filters 25, 36 and 50 A, 440 V
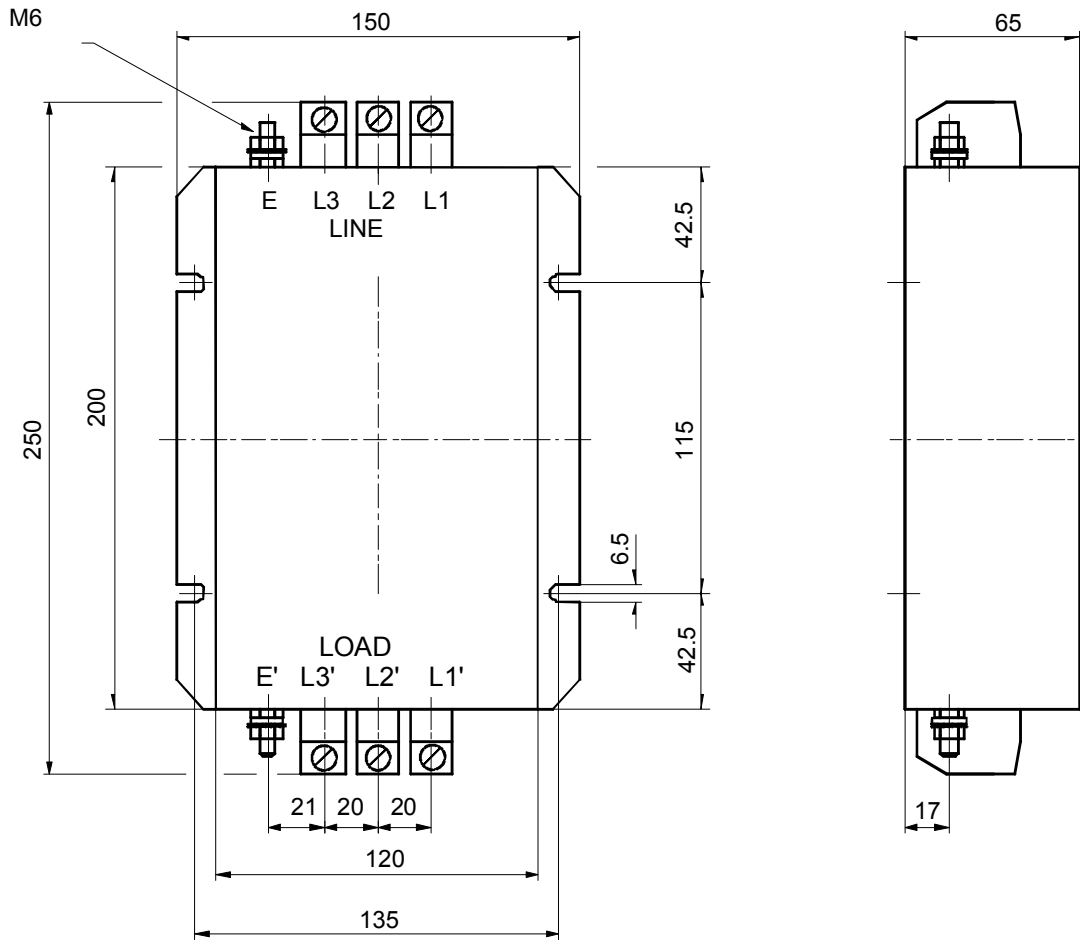
Filter Part No.:	839.72-05	839.72-06	839.72-07
Rated Current	25 A	36 A	50 A
Power loss:	8 W	9 W	11 W
Weight:	3 kg	3.1 kg	3.5 kg

Figure 8-3 Filter Dimensions (mm)

WL 3000

Description of the User Input and Output Parameters

This appendix provides a 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. The order of the parameters corresponds to the Software configuration within the OIM-Menu path(s) as shown in Appendix F.

B.1 Drive Reference

Refer to block diagrams, Appendix D, sheets 2 to 5

ANALOG AUTO REFERENCE (P.188)

Auto mode analog reference value measured by the drive after all hardware and software scaling.

Parameter Type: Output
OIM Menu Path(s): Drive Reference - Drive Reference Scaling
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.

Parameter Type: Output
OIM Menu Path(s): Drive Reference - Drive Reference Test Points

DRAW PERCENTAGE OUT (P.196)

Determined by the selected trim reference signal and TRIM RANGE value. This Parameter 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.

Parameter Type: Output
OIM Menu Path(s): Drive Reference - Drive Reference 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 RAMP INPUT TP (P.198)

An output that represents the test point value immediately before the speed loop ramp function.

Parameter Type: Output
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.

Parameter Type: Output
OIM Menu Path(s): Drive Reference - Drive Reference Test Points

JOG RAMP OUTPUT (P.294)

An output that represents the jog reference value immediately after the jog ramp function.

Parameter Type: Output
OIM Menu Path(s): Drive Reference - Drive Reference Test Points

MOP OUTPUT (P.191) not 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: Tunable
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   ANALOG IN 2
Default Setting: REGISTER
Parameter Type: Tunable
OIM Menu Path(s):   Drive Reference - Drive Reference Trim

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: Tunable
OIM Menu Path(s):   Drive Reference - Drive Reference Trim

TRIM MODE SELECT (P.110)

Parameter Range: NO TRIM,
    INCREMENTAL,
    PROPORTIONAL
Default Setting: NO TRIM
Parameter Type: Tunable
OIM Menu Path(s):   Drive Reference - Drive Reference Trim
Refer also to Param.:   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.

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 of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

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:	Tunable
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.

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:	250 (RPM or user-defined units)
Parameter Type:	Tunable
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.

REVERSE DISABLE (P.015)

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: Tunable
OIM Menu Path(s):   Drive Reference - Drive Reference Limits

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.

> **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.

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

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: Tunable
OIM Menu Path(s):   Drive Reference - Drive Reference Ramp   Quick Start
Refer also to parameters: TRIM MODE SELECT (P.110)

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: Tunable
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)

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.

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.

Parameter Range:	0 to 50%
Default Setting:	0%
Parameter Type:	Tunable
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)

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:	Tunable
OIM Menu Path(s):	Drive Reference - Drive Reference Ramp - Quick Start

---

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:	Tunable
OIM Menu Path(s):	Drive Reference - Drive Reference Ramp

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:	Tunable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameters:	DECELERATION TIME (P.002),
	STOP DECEL SELECT (P.122)

STOP DECEL SELECT (P.122)

Selects deceleration time for Ramp Stop sequences. Speed changes during run will use
DECELERATION TIME (P.002) 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)

MOP ACCEL TIME (P.115) Not active

MOP DECEL TIME (P.120) Not active

JOG SPEED (P.012)

The operating speed while the drive is in jogging.
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.

Parameter Range:	0 to MAXIMUM SPEED (RPM or user-defined units)
Default Setting:	250 (RPM or user-defined units)
Parameter Type:	Tunable
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)

ANLG AUTO SIGNAL TYPE (P.100)

Selects the analog auto reference signal type.
NOTE: Jumpers J10 and J12 must be set for the type of auto reference selected.

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

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:	Tunable
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:	50 (RPM or user-defined units)
Parameter Type:	Tunable
OIM Menu Path(s):	Drive Reference - Drive Reference Configure

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:	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.
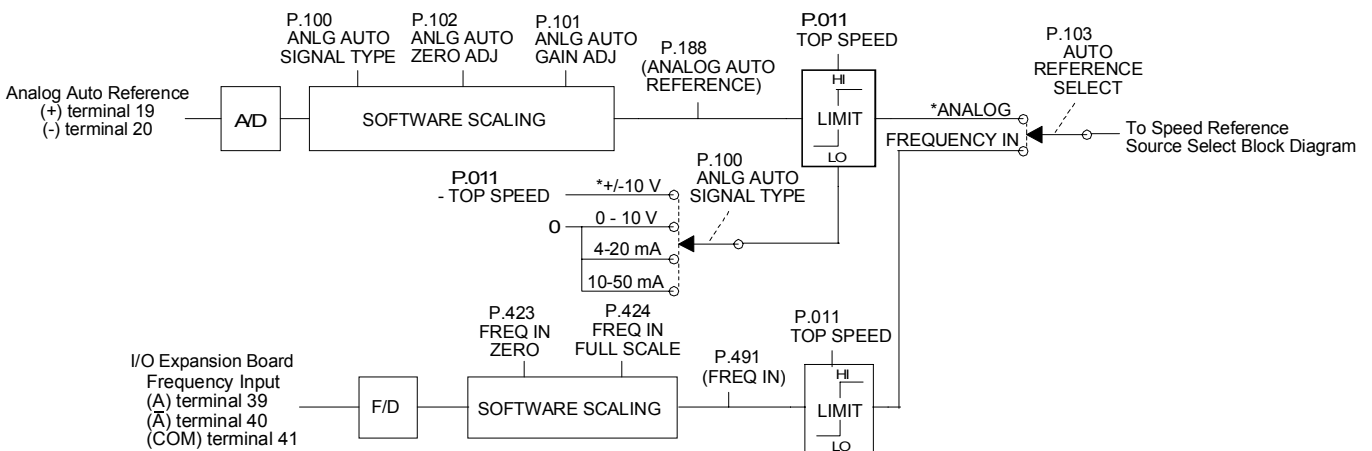
JOG OFF DELAY TIME (P.121)

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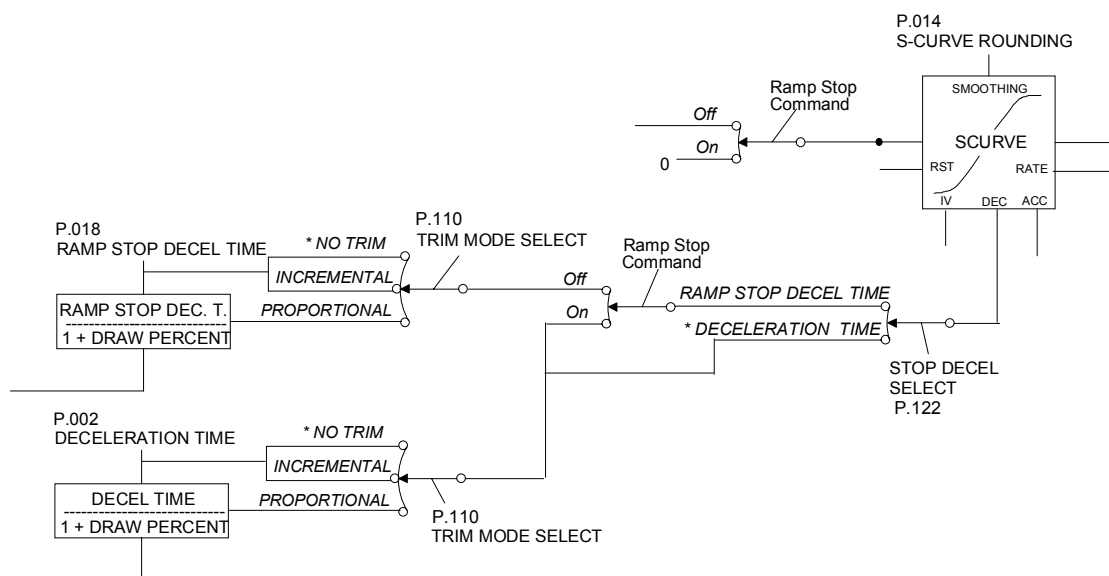
Parameter Range: 0.0 to 10.0 seconds
Default Setting: 1.0 seconds
Parameter Type: Configurable
OIM Menu Path(s):   Drive Reference - Drive Reference Configure
Refer also to Parameters: JOG ACCEL/DECEL TIME (P.013)
                                JOG SPEED (P.012)
                                JOG SPEED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

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. To use these speeds, CONTROL SOURCE SELECT must be set to TERMBLK.

Parameter Range: MINIMUM SPEED to MAXIMUM SPEED (speed user units)
Default Setting: 175 RPM
Parameter Type: Tunable
OIM Menu Path(s):   Drive Reference - Drive Reference Configure
Refer also to Parameters: 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 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.
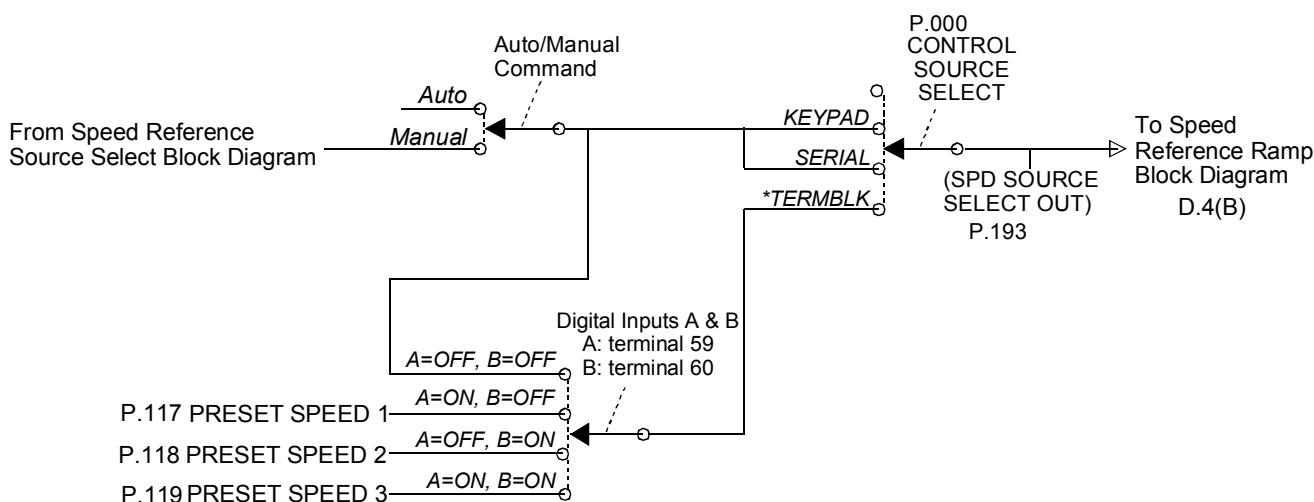
JOG SPEED 2 (P.017)

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 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:	Tunable
OIM Menu Path(s):	Additional Parameters
Refer also to Parameter:	DIG IN 0 SELECT(P.428),
	JOG SPEED (P.012)

MOP RESET ENABLE (P.116) not used

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:	Tunable
OIM Menu Path(s):	Drive Reference - Drive Reference Scaling

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:	Tunable
OIM Menu Path(s):	Drive Reference - Drive Reference Scaling

B.2 Outer Control Loop (OCL)

Refer to block diagram, Appendix D, sheet 12

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 Type: Output
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 REFERENCE (P.845)

The reference value for the outer control loop. Displayed in OCL user units.

Parameter Type: Output
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)

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.

Parameter Type: Output
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 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.

Parameter Type: Output
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.

Parameter Type: Output
OIM Menu Path(s):   Outer Control Loop (OCL) - OCL Test Points
Refer also to Parameters: OCL PI LEAD FREQ (P.809)

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:	Tunable
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 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:	Tunable
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 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:	Tunable
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 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:	Tunable	
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 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 6,98 RAD/S
Default Setting: 1.00 RAD/S
Parameter Type: Tunable
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: Tunable
OIM Menu Path(s):   Outer Control Loop (OCL) - OCL Configure
Refer also to Parameters: OCL LEADLAG LOW FREQ (P.806),
     OCL LEADLAG SELECT (P.805)

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 loop reference.
It is set as a percentage of TOP SPEED. .

Parameter Range: -100.0% to 100.0%
Default Setting: 0.0%
Parameter Type: Tunable,
OIM Menu Path(s):   Outer Control Loop (OCL) - OCL Tuning
Refer also to Parameters: TOP SPEED (P.011)   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),

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: Tunable
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 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: Tunable
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.

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).

Parameter Range: REGISTER,   ANALOG IN 1,   ANALOG IN 2,   FREQUENCY IN
Default Setting: REGISTER
Parameter Type: Configurable
OIM Menu Path(s):   Outer Control Loop (OCL) -OCL Configure
Refer also to Parameters: OCL REF REGISTER (P.801)

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: -100% to +100%
Default Setting: 0
Parameter Type: Tunable
OIM Menu Path(s):   Outer Control Loop (OCL) - OCL Configure
Refer also to Parameters: OCL REFERENCE SELECT (P.800)

OCL FEEDBACK SELECT (P.804)

Selects the source for the outer control loop (OCL) feedback signal:
This can be feedback signal average GFL I FEEDBACK (P.397), Speed Regulator Output, or Auto reference (Analog or Frequency). The I/O Expansion kit must be installed to use ANALOG IN 1, or ANALOG IN 2.
With selection GFL I FEEDBACK an outer control loop can be added.

Parameter Range: NONE,
                          GFL I FEEDBACK,
                          ANALOG IN 1,   ANALOG IN 2
Default Setting: GFL I FEEDBACK
Parameter Type: configurable
OIM Menu Path(s):   Outer Control Loop (OCL) - OCL Configure
Refer also to Parameters: GFL I FEEDBACK (P.397)

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.

Parameter Range: LEAD/LAG,   BYPASS,   LAG/LEAD
Default Setting: BYPASS
Parameter Type: Tunable
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 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).
With 1 selected, the output is independent from the speed reference.

Parameter Range: 1= DISABLED (independent)
                            2= ENABLED (proportional)
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).

B.3 Speed Loop

Refer to block diagrams, Appendix D, sheets 2 and 6

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):   Speed Loop (SPD) - Speed Loop (SPD) Test Points,
                         Drive Reference - Drive Reference Test Points

---

SPD LOOP FEEDBACK (P.296)

An output that represents the selected Speed Loop drive feedback value after all scaling.

OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop Test Points

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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):   Speed Loop (SPD) - Speed Loop Test Points

---

SPD LOOP LAG OUTPUT (P.298)

An output representing the value immediately after the Speed Loop Lag function.

OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop Test Points

---

SPD LOOP OUTPUT (P.299)

Speed Loop PI function output value to the Armature Loop.

OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Test Points
                         Generator Field Loop (GFL) - GFL 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 Loop (SPD) – Speed Loop (SPD) 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 Loop (SPD) - Speed Loop (SPD) Test Points
                         Speed Loop (SPD) - Speed Loop (SPD) Feedback

---

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 Loop (SPD) - Speed Loop (SPD) Test Points

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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:	Tunable
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning

SPD LOOP PI LEAD FREQ (P.212)

Speed loop PI block Integral gain (lead frequency). A setting of 0.00 allows proportional-only speed loop control.

Parameter Range:	0.00 to 327.67 rad/s
Default Setting:	3.00 rad/s
Parameter Type:	Tunable
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning

POS ARM CUR LIM (P.005)

Sets the highest amount of positive current for the generator armature (% of full load amps).
Used as a high limit for the speed loop PI block output. The full load armature amps is required for the calculation of CT TURNS RATIO (P.010) and the burden Resistor.

Parameter Range:	0 – 200% of NOMINAL ARM CURRENT (P.019)
Default Setting:	200%
Parameter Type:	Tunable
OIM Menu Path(s):	Speed Loop (SPD) – Speed Loop (SPD) Tuning **-** Quick start
Refer also to Param.:	NEG CUR LIM INV EN (P.226)
	NEG ARM CUR LIM (P.006)

NEG ARM CUR LIM (P.006)

Sets the highest amount of negative current for the generator armature (% of full load amps).
Used as a low limit for the speed loop PI block output. The full load armature amps is required for the calculation of CT TURNS RATIO (P.010) and the burden Resistor.

Parameter Range:	0 – 200% of NOMINAL ARM CURRENT (P.019)
Default Setting:	200%
Parameter Type:	Tunable
OIM Menu Path(s):	Speed Loop (SPD) – Speed Loop (SPD) Tuning - Quick start
Refer also to Param.:	NEG CUR LIM INV EN (P.226)
	POS ARM CUR LIM (P.005)

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:	Tunable
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning

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: Tunable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Tuning

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 - 139.62 rad/s
Default Setting: 1.00 rad/s
Parameter Type: Tunable
OIM Menu Path(s):   Speed Loop (SPD) - Speed 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 to 10, 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: Tunable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Tuning
Refer also to Parameters: SPD LEADLAG LOW FREQ (P.214),
                             SPD LEADLAG SELECT (P.216)

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: Tunable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Tuning

SPD LOOP LAG FREQ (P.215)

Corner frequency for the lag block. If SPD LOOP LAG BYPASS is ON, this parameter has no effect.

Parameter Range: 0.01 to 279.25 rad/s
Default Setting: 1.00 rad/s
Parameter Type: Tunable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Tuning
Refer also to Parameters: SPD LOOP LAG BYPASS (P.217)

INERTIA 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.
When INTERNAL is selected, the inertia compensation signal is generated by scaling the rate output from the Speed 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
Default Setting:	NONE	
Parameter Type:	Configurable	
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning	
Refer also to Parameters:	NORMALIZED INERTIA (P.222)	
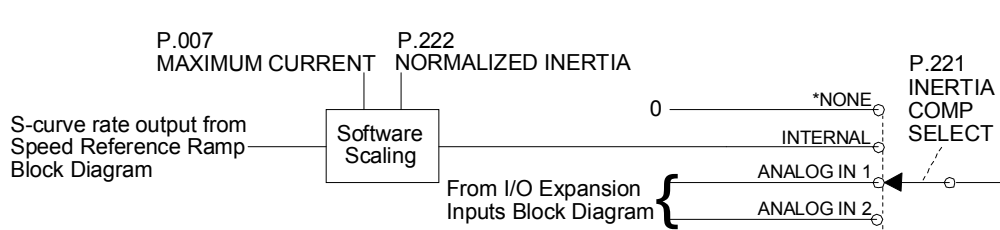
NORMALIZED INERTIA (P.222)

The time required to accelerate the motor and load inertia from zero to motor base speed at nominal motor load.
This parameter is entered by the operator.

Parameter Range:	0.05 to 65.20 seconds
Default Setting:	1.00 second
Parameter Type:	Tunable
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning
Refer also to Parameters:	INERTIA COMP SELECT (P.221)

POS ARM I LIM SEL (P.223)

Selects the source for the positive armature current limit.
If REGISTER has been selected POS ARM CUR LIM (P.005) is used as the limitation.

Parameter Range:	REGISTER	
	ANALOG IN 1,	ANALOG IN 2
Default Setting:	REGISTER	
Parameter Type:	Configurable	
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning	
Refer also to Parameters:	POS ARM CUR LIM (P.005)	

NEG ARM I LIM SEL (P.224)

Selects the source for the negative armature current limit.
If REGISTER has been selected NEG ARM CUR LIM (P.006) is used as the limitation.

Parameter Range:	REGISTER	
	ANALOG IN 1,	ANALOG IN 2
Default Setting:	REGISTER	
Parameter Type:	Configurable	
OIM Menu Path(s):	Speed Loop (SPD) - Speed Loop (SPD) Tuning	
Refer also to Parameters:	NEG ARM CUR LIM (P.006)	

NEG CUR LIM INV EN (P.226)

This parameter enables the negative current limit inverter to the speed loop PI block.

Parameter Range: DISABLE
                                      ENABLE
Default Setting: ENABLE
Parameter Type: Configurable
OIM Menu Path(s):   Additional Parameters
Refer also to Parameters: POS ARM CUR LIM (P.005)
                                      NEG ARM CUR LIM (P.006)

If this parameter is set to ENABLE, POS ARM CUR LIM (P.005) and NEG ARM CUR LIM (P.006) are at positive limit values.
If this Parameter is set to DISABLE, POS ARM CUR LIM (P.005) and NEG ARM CUR LIM (P.006) are at negative limit values.
When NEG CUR LIM INV EN (P.226) is modified:
• an Alarm (A00052) is generated
• POS ARM I LIM SEL (P.223) and NEG ARM I LIM SEL (P.224) are automatically set to REGISTER.
To prevent unintentional starting of the drive, the user should investigate the current limit diagram and make sure, that the settings of the values for POS ARM CUR LIM (P.005) and NEG ARM CUR LIM (P.006) are correct for the specific application,
drive.

FEEDBACK SELECT (P.200)

Selects the type of feedback signal that is used for the Speed Loop.
PULSE TACH can be selected only if a pulse tachometer kit is installed.

Parameter Range: DC TACH,   PULSE TACH,   AC TACH
Default Setting: DC TACH
Parameter Type: Configurable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Voltage Loop (SPD) Feedback
                                      Quick Start
Refer also to Parameters: 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.

GEN RATED ARM VOLTS (P.009)

The rated armature voltage from the generator nameplate.

Parameter Range: 160 to 675 Volts
Default Setting: 240 Volts
Parameter Type: Configurable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Feedback - Quick Start
Refer also to Param.:   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.

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: Tunable
OIM Menu Path(s):   Speed Loop (SPD)-Speed 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 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: Tunable
OIM Menu Path(s):   Speed Loop (SPD)-Speed 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 TACH VOLTS/1000 (P.203)

The analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM.
Units are volts DC for DC tachometers or volts AC RMS for AC tachometers.
Note: The use of an AC tachometer requires the optional AC 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 Loop (SPD) - Speed Loop (SPD) Feedback

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

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.

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.

Parameter Type: Output
OIM Menu Path(s):   Drive Information - Correct Scaling Jumper Positions Quick Start
                                      Speed Loop (SPD) - Speed 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.

Parameter Type: Output
OIM Menu Path(s):   Drive Information - Correct Scaling Jumper Positions Quick Start
                                  Speed Loop (SPD) - Speed Loop (SPD) Feedback

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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 Loop (SPD) - Speed 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 pulse tachometer quadrature. Set ON for a bi-directional pulse tachometer.

Parameter Range: ON,   OFF
Default Setting: ON
Parameter Type: Configurable
OIM Menu Path(s):   Speed Loop (SPD) - Speed Loop (SPD) Feedback
Refer also to Parameters: FEEDBACK SELECT (P.200),
                                  REVERSE DISABLE (P.015)

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 250.0 (% of MAXIMUM SPEED)
Default Setting: 200.0
Parameter Type: Tunable
OIM Menu Path(s):   Additional Parameters
Refer also to Parameters: TACH LEAD FLT DELAY (P.228)

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: 1000 msec
Parameter Type: Tunable
OIM Menu Path(s):   Additional Parameters
Refer also to Parameters: TACH LEAD FLT THRESH (P.227)

B.4 Armature Loop

Refer to block diagram, Appendix D, sheet 11

ARM CURRENT FEEDBACK (P.194)

The value of the armature current feedback displayed as a percentage of nominal armature current as set up via burden resistor and ARM CURRENT FB GAIN ADJ (P.104).

Parameter Type: Output
OIM Menu Path(s): Armature Loop – Armature Loop Test Points
Armature Loop – Armature Loop Feedback Scaling

ARMATURE VOLTAGE (P.289)

Armature voltage value measured by the drive, after all hardware and software scaling.
Only used with armature voltage feedback.

Parameter Type: Output
OIM Menu Path(s): Speed Loop (SPD) - Speed Loop (SPD) Test Points,
Speed Loop (SPD) - Speed Loop (SPD) Feedback
Armature Loop - Armature Loop Feedback Scaling
Generator Field Loop (GFL) – SCR Diagnostics – Field Phase Fire Test

Ia/Ua PI P-GAIN (P.514)

Proportional gain for the armature current/voltage regulator proportional-integral block

Parameter Range: 0.01 – 10.00
Default Setting: 0.1
Parameter Type: Tunable
OIM Menu Path(s): Armature Loop – Armature Loop Tuning

Ia/Ua PI L-FREQ (P.515)

The lead break frequency for the armature current/voltage regulator proportional-integral block

Parameter Range: 0.00 – 327.67 rad/s
Default Setting: 1 rad/s
Parameter Type: Tunable
OIM Menu Path(s): Armature Loop – Armature Loop Tuning

+/- FIELD CURRENT LIM (P.587)

Sets the highest amount of field current.
This limits the output of the Armature Current/Voltage regulator.

Parameter Range: 0 – 200% of GEN RATED FIELD AMPS (P.008)
Default Setting: 100%
Parameter Type: Tunable
OIM Menu Path(s): Armature Loop – Armature Loop Tuning

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. See also 4.11.1.

Parameter Range: -6 to +6 (corresponds +/-43,2 V)
Default Setting: 0
Parameter Type: Tunable
OIM Menu Path(s):   Armature Loop – Armature Loop Feedback Scaling

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 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: Tunable
OIM Menu Path(s):   Armature Loop – Armature Loop Feedback Scaling

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.

NOMINAL ARM CURRENT (P.019)

The rated armature current in amperes

Parameter Range: 1 to 3000 A
Default Setting: 100 A
Parameter Type: Configurable
OIM Menu Path(s):   Quick start - Armature Loop – Armature Loop Feedback Scaling

ARM CURRENT FB GAIN ADJ (P.104)

The armature current feedback gain. This value needs to be set to configure the armature current feedback scaling in conjunction with the burden resistor.

Parameter Range: 0.750 – 1.250
Default Setting: 1.000
Parameter Type: Tunable
OIM Menu Path(s):   Armature Loop – Armature Loop Feedback Scaling

ARM CUR ZERO ADJ (P.105)

Is used to remove any hardware introduced offset from the armature current feedback signal.
In most cases this input will be set to zero.

Parameter Range: -200 to +200 (corresponds to +/-10% of rated armature current)
Default Setting: 0
Parameter Type: Tunable
OIM Menu Path(s):   Armature Loop– Armature Loop Feedback Scaling

B.5 Generator Field Loop GFL

Refer to block diagrams, Appendix D, sheets 9 and 10

GFL I ERROR (P.398)

The amplitude and rate limited value of the selected Generator field current loop GFL reference.

Parameter Type: Output
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Test Points

GFL I REFERENCE (P.396)

The generator field current loop GFL error signal , the difference between GFL I REFERENCE (P.396) and GFL I FEEDBACK(P.397).

Parameter Type: Output
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Test Points

FIELD BRIDGE POL (P.394)

Indicates which bridge is currently active. OFF indicates the forward bridge; ON indicates the reverse bridge.

Parameter Type: Output
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Test Points

FIELD FIRING ANGLE (P.399)

Indicates the field firing angle in microseconds.

Parameter Type: Output
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Test Points
Generator Field Loop (GFL) - SCR Diagnostics - Field Phase Fire Test

TORQUE REFERENCE (P.189)

Torque / current reference value.

Parameter Type: Output
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Test Points

J15 REGULATOR TYPE (P.799)

Indicates the position of hardware jumper J15 REGULATOR TYPE, which selects the type of regulator: I Only SPEED for Speed Regulation can be adjusted. This jumper is only read at power-up.

Parameter Type: Output
OIM Menu Path(s): Drive Information - Generator Field Loop (GFL) - GFL Test Points

GFL PI PROP GAIN (P.301)

Proportional gain for the Generator field current loop proportional-integral block.

Parameter Range: 1.0 – 100.0
Default Setting: 10.0
Parameter Type: Tunable
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Tuning

GFL PI LEAD FREQUENCY (P.302)

Integral gain (Lead frequency) for the Generator field current loop proportional-integral block.

Parameter Range: 10 to 500 rad/s
Default Setting: 1 rad/s
Parameter Type: Tunable
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Tuning

GFL REF RATE LIMIT (P.303)

Minimum allowable time for GFL REFERENCE to change from zero to 150% of nominal field current

Parameter Range: 1 to 1000 msec
Default Setting: 40 msec
Parameter Type: Tunable
OIM Menu Path(s): Generator Field Loop (GFL) - GFL Tuning

GEN NOM FLD VOLTAGE (P.510)

Nameplate value of the rated generator field voltage.

Parameter Range: 50 – 600 V
Default Setting: 100 V
Parameter Type: Configurable
OIM Menu Path(s): Quick start
Generator Field Loop (GFL) – GFL Tuning

GFL FBK LL LAG FREQ (P.516)

Specifies the low break frequency of the GFL feedback lag/lead block.

Parameter Range: 1 to 100 rad/s
Default Setting: 30 rad/s
Parameter Type: Tunable
OIM Menu Path(s): Generator Field Loop (GFL) – GFL Tuning

GFL FBK LL RATIO (P.511)

Sets the ratio of low to high break frequency for the lag/lead block.

Parameter Range: 1 - 5
Default Setting: 3
Parameter Type: Tunable
OIM Menu Path(s): Generator Field Loop (GFL) – GFL Tuning

GEN RATED FIELD AMPS (P.008)

The rated generator field current from the generator nameplate.

Parameter Range: 7.0 – 3000.0 A
Default Setting: 10.0
Parameter Type: Configurable
OIM Menu Path(s): Quick Start - Generator Field Loop (GFL) – GFL Feedback Scaling
Refer also to Param.: +/- FIELD CURRENT LIM (P.587)

> **CAUTION:** This parameter must be equal to the rated field amps found on the generator nameplate. Overcurrent or excess heating of the generator could result. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

GFL FEEDBACK GAIN ADJ (P.300)

Generator field current feedback gain adjustment. In most cases, this input will be set for unity gain. Typically, it will be 1.000.

Parameter Range:	0.900 to 1.000
Default Setting:	1.000
Parameter Type:	Tunable
OIM Menu Path(s):	Generator Field Loop (GFL) – GFL Feedback Scaling

J18 FLD I FB RESISTOR (P.395)

Indicates the required burden resistor position to scale field current feedback based on the values of CT TURNS RATIO (P.010) , and GEN RATED FIELD AMPS (P.008).

Parameter Type:	Output
OIM Menu Path(s):	Drive Information - Correct Scaling Jumper Positions
	Generator Field Loop (GFL) - GFL Feedback Scaling - Quick Start
Refer also to Param.:	CT TURNS RATIO (P.010), GEN NENN FIELD CURRENT (P.008)

CT TURNS RATIO (P.010)

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

- 25 A Unit: 208
- 60 A Unit: 416

Parameter Range:	1 to 32767
Default Setting:	Depending on unit type
Parameter Type:	Configurable
OIM Menu Path(s):	Generator Field Loop (GFL) - GFL 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.

GFL I FEEDBACK (P.397)

The feedback signal of the generator field current regulator prior to the summing junction.

Parameter Type:	Output
OIM Menu Path(s):	Generator Field Loop (GFL) - GFL Test Points
	Generator Field Loop (GFL) - GFL Feedback Scaling
	Generator Field Loop (GFL) - SCR Diagnostics - Field Phase Fire Test

NOMINAL AC LINE FREQ (P.306)

The nominal AC line frequency (typically 50 or 60 Hz).

Parameter Range:	48 to 62 Hz
Default Setting:	50
Parameter Type:	Configurable
OIM Menu Path(s):	Quick Start - Generator Field Loop (GFL) - Three Phase AC Line

NOMINAL AC LINE VOLTS (P.307)

The nominal AC line RMS voltage.

Parameter Range: 200 to 575 VAC on types with nominal voltage up to 500 VAC
Default Setting: 400 VAC
Parameter Type: Configurable
OIM Menu Path(s):   Quick Start - Generator Field Loop (GFL) - Three Phase AC Line

AC LINE PERIOD (P.393)

The AC line period as measured by the drive in microseconds. Line period = 1/line frequency in Hertz.

Parameter Type: Output
OIM Menu Path(s):   Generator Field Loop (GFL) - Three Phase AC Line

AC LINE VOLTAGE (P.392)

The AC line RMS voltage as measured by the drive.

Parameter Type: Output
OIM Menu Path(s):   Generator Field Loop (GFL) - Three Phase AC Line

PLL MAXIMUM ERROR (P.308)

Maximum allowable change in line period per AC 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: Tunable
OIM Menu Path(s):   Generator Field Loop (GFL) - Three Phase AC Line

OPEN SCR SENSITIVITY (P.600)

Open SCR diagnostic sensitivity adjustment. Unbalanced AC lines can cause load sharing differences between SCRs. This parameter should be increased to reduce the sensitivity for fault trips on SCR load sharing differences.

Parameter Range: 0 to 100%
Default Setting: 0%
Parameter Type: Tunable
OIM Menu Path(s):   Generator Field Loop (GFL) - Diagnostics – Tuning

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 for fault trips on such disturbances. This parameter should only be increased, if increasing of OPEN SCR SENSITIVITY (P.600) will not eliminate the fault trips.

Parameter Range: 800 to 4000
Default Setting: 1600
Parameter Type: Tunable
OIM Menu Path(s):   Generator Field Loop (GFL) - Diagnostics – Tuning

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 (P.011).

Parameter Range: 0 to 127 (degrees)
Default Setting: 109
Parameter Type: Tunable
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,
- speed feedback is <5% of TOP SPEED (P.011), and
- the SCR firing angle is equal to TACH LOSS SCR ANGLE.

109 degrees corresponds to approx. 40% of the armature voltage.

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.

Use the following steps to adjust this parameter if a tach loss occurs.

Step 1. Switch off AC line voltage.

Step 2. Check tach lead connections and polarity and setting of three phase AC line frequency

Step 3. Increment TACH LOSS SCR ANGLE by 1.

Step 4. Restart the drive.

Step 5. If tach loss occurs again and the angle is less than 127°, return to step 3.

BRIDGE CHANGE DELAY (P.313)

Is used for delaying the bridge change, to eliminate residual currents, which are caused by high inductive loads. This additional time delay ensures, that the output current reaches zero before the bridge change takes place.

This delay time is defined as follows: n * SCAN + 2.0 ms

   with: n   = Value between 0 and 75
                SCAN = 2.78 ms on 60 Hz systems
                SCAN = 3.33 ms on 50 Hz systems

2.0 ms is the standard delay time, which is used for standard armature impedance and low field impedance.

Parameter Range: 0 to +75 (corresponds 2 to 210 ms at 60 Hz;
                                  2 to 250 ms at 50 Hz)

Default Setting: 0
Parameter Type: Tunable
OIM-Menu-Path   Additional Parameters

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: configurable
OIM Menu Path(s):   Additional Parameters

PHASE FIRE TEST DELTA (P.309)

The test firing conduction angle of the SCRs.
If equal to 0, the power bridge is OFF.
If = 180, the power bridge is fully ON.

Parameter Range: 0 to 180 degrees
Default Setting: 0 degrees
Parameter Type: Tunable
OIM Menu Path(s):   Generator Field Loop (GFL) - SCR Diagnostics – Field Phase Fire Test

WARNING
The generator field phase fire test is unregulated. To prevent excess motor speed, either open and lock the armature contactor or lock the motor 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. ON selects the reverse bridge .

Parameter Range: ON   OFF
Default Setting: OFF
Parameter Type: Tunable
OIM Menu Path(s):   Generator Field Loop (GFL) - SCR Diagnostics – Field Phase Fire Test

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 GFL 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) • 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) 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) 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) - 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.

B.6 Configurable Inputs / Outputs

Refer to block diagrams, Appendix D, sheets 7, 8, 13 and 14

METER 1 SEL (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: GFL I FEEDBACK
Parameter Type: Tunable
OIM Menu Path(s):   Input/Output - Meter Outputs

Signal Selected	Full Scale Value
GFL I FEEDBACK (P.397) GFL I REFERENCE (P.396) GFL I ERROR (P.398)	± GEN RATED FIELD AMPS (P.008)
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPD LOOP OUTPUT (P.299) 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) FULL SCALE	± TOP SPEED
ZERO	0
ARMATURE VOLTAGE (P.289)	± ARMATURE VOLTAGE
MOTOR POWER	± ARMATURE VOLTAGE * NOMINAL ARM CURRENT (P.019)
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) OCL OUTPUT (P.848)	
ARM CURRENT FEEDBACK (194)	

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: Tunable
OIM Menu Path(s):   Input/Output - Meter Outputs

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

METER OUT 1 GAIN ADJ (P.400)

Scales the Meter 1 Output Signal at the regulator board terminal strip.
NOTE: Testpoint METER OUT FULL SCALE must source METER 1 SEL for an accurate adjustment. See Appendix D, figure D.8, for further details.

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

METER 2 SEL (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: Tunable
OIM Menu Path(s):   Input/Output - Meter Outputs

Signal Selected	Full Scale Value
GFL I FEEDBACK (P.397) GFL I REFERENCE (P.396) GFL I ERROR (P.398)	± GEN RATED FIELD AMPS (P.008)
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPD LOOP OUTPUT (P.299) 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) FULL SCALE	± TOP SPEED
ZERO	0
ARMATURE VOLTAGE (P.289)	± ARMATURE VOLTAGE
MOTOR POWER	± ARMATURE VOLTAGE * NOMINAL ARM CURRENT (P.019)
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) OCL OUTPUT (P.848)	
ARM CURRENT FEEDBACK (194)	

METER OUT 2 ZERO ADJ (P.403)

Removes any hardware introduced offset from the Meter 2 output signal at the regulator terminal strip.
NOTE: Testpoint METER OUT ZERO must source METER 2 SEL for an accurate adjustment.
     See Appendix D, figure D-7, for further details.

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

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: Tunable
OIM Menu Path(s):   Input/Output - Meter Outputs

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

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

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:	Tunable
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).
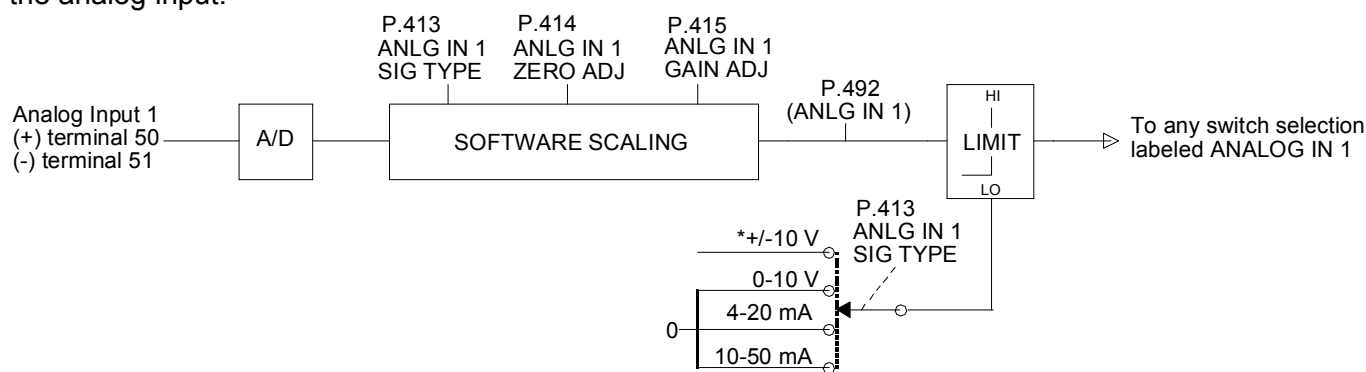See ANLG IN 1 GAIN ADJ for block diagram.

ANLG IN 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:	Tunable
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 (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)

NLG 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:	Tunable
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 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: Tunable
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 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: GEN RATED FIELD AMPS (P.008)
                          GEN RATED ARM VOLTS (P.009)   TOP SPEED (P.011)

Signal Selected	Full Scale Value
GFL I FEEDBACK (P.397) GFL I REFERENCE (P.396) GFL I ERROR (P.398)	± GEN RATED FIELD AMPS (P.008)
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPD LOOP OUTPUT (P.299) 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) FULL SCALE	± TOP SPEED
ZERO	0
ARMATURE VOLTAGE (P.289)	± ARMATURE VOLTAGE
MOTOR POWER	± ARMATURE VOLTAGE * NOMINAL ARM CURRENT (P.019)
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) OCL OUTPUT (P.848)	
ARM CURRENT FEEDBACK (194)	

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)

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 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: Tunable
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 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: GEN RATED FIELD AMPS (P.008)
                    GEN RATED ARM VOLTS (P.009)   TOP SPEED (P.011)

Signal Selected	Full Scale Value
GFL I FEEDBACK (P.397) GFL I REFERENCE (P.396) GFL I ERROR (P.398)	± GEN RATED FIELD AMPS (P.008)
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPD LOOP OUTPUT (P.299) 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) FULL SCALE	± TOP SPEED
ZERO	0
ARMATURE VOLTAGE (P.289)	± ARMATURE VOLTAGE
MOTOR POWER	± ARMATURE VOLTAGE * NOMINAL ARM CURRENT (P.019)
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) OCL OUTPUT (P.848)	
ARM CURRENT FEEDBACK (194)	

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: Tunable
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.

DIG IN 0 (P.490)

Indicates the state of digital input 0 based on the voltage applied.
Only available if the CS3000 Software is used.

Parameter Range:	ON	OFF
OIM Menu Path(s):	other parameters	
Refer also to Parameters:	DIG IN 0 SELECT (P.428)	
	JOG SPEED (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 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),

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),

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

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 (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. If an I/O Expansion kit is installed, the outer control loop enable signal is digital input 5.
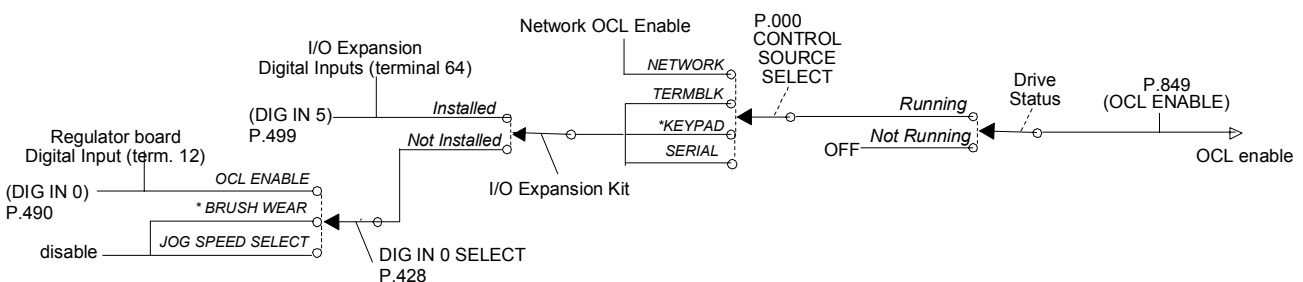
DIG OUT 1 SELECT (P.409)

Only available if the I/O Expansion Kit is installed. Selects the signal that drives digital output 1 (terminals 66 and 67 on the I/O Expansion board).

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
Default Setting:	LEVEL DETECT 1 OUTPUT
Parameter Type:	Configurable
OIM Menu Path(s):	Input/Output - Digital I/O
Refer also to Param.:	LEVEL DETECT 1 OUTPUT (P.648),
	LEVEL DETECT 2 OUTPUT (P.649)

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 2 SELECT (P.411)

Only available if the I/O Expansion Kit is installed. Selects the signal used to drive digital output 2 (terminals 68 and 69 on the I/O Expansion board).

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,
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)

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.

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 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 (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.

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:	GEN NOM FLD VOLTAGE (P.510),
	GEN RATED FIELD AMPS (P.008),
	GEN RATED ARM VOLTS (P.009), TOP SPEED (P.011)

Signal Selected	Full Scale Value
GFL I FEEDBACK (P.397) GFL I REFERENCE (P.396) GFL I ERROR (P.398)	± GEN RATED FIELD AMPS (P.008)
SPD LOOP FEEDBACK (P.296) SPD LOOP REFERENCE (P.295) SPD LOOP ERROR (P.297) SPD LOOP OUTPUT (P.299) 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) FULL SCALE	± TOP SPEED
ZERO	0
ARMATURE VOLTAGE (P.289)	± ARMATURE VOLTAGE
MOTOR POWER	± ARMATURE VOLTAGE * NOMINAL ARM CURRENT (P.019)
OCL REFERENCE (P.845)	± 4095
OCL RAMP OUTPUT (P.846) OCL FEEDBACK (P.847) OCL OUTPUT (P.848)	
ARM CURRENT FEEDBACK (194)	

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)

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 (P.425)is set to SPD LOOP FEEDBACK, the frequency specified
by this parameter corresponds to TOP SPEED (P.011) which is used as the basis for Speed 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),

LEVEL DETECT 1 SELECT (P.602)

Selects the signal that drives level detector 1.

Parameter Range:	SPD SOURCE SELECT OUT, SPEED RAMP INPUT TP,
	SPEED RAMP OUTPUT, SPD LOOP FEEDBACK,
	GFL I 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 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.
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 200%*
Default Setting:	10.0%
Parameter Type:	Tunable
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)

*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 GFL I FEEDBACK is selected for P.602, the parameter range is 0.1 to 200.
For any other P.602 settings, the parameter range is 0.1 to 100.0%.

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.

Parameter Range:	0.0 to 300.0 seconds
Default Setting:	10.0 seconds
Parameter Type:	Tunable
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 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.

LEVEL DETECT 2 SELECT (P.605)

Selects the signal that drives level detector 2.

Parameter Range:	SPD SOURCE SELECT OUT
	SPEED RAMP INPUT TP
	SPEED RAMP OUTPUT
	SPD LOOP FEEDBACK
	GFL I 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.

Parameter Range:	0.1 to 100.0% or 200 %*
Default Setting:	10.0%
Parameter Type:	Tunable
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)

*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 GFL I FEEDBACK is selected for LEVEL DETECT 2 SELECT, the parameter range is 0.1 to 200%.
For any other LEVEL DETECT 2 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.

Parameter Range:	0.0 to 300.0 seconds
Default Setting:	10.0 seconds
Parameter Type:	Tunable
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 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.

B.7 Drive Information

PULSE TACHOMETER KIT (P.798)

Indicates the presence of a pulse tach kit.

Parameter Type:	Output
Parameter Range:	NOT INSTALLED, INSTALLED FAILED DIAGS
OIM Menu Path(s):	Drive Information

NETWORK KIT (P.796)

Indicates the status of the network option board.

Parameter Type:	Output
Parameter Range:	NOT INSTALLED, INSTALLED FAILED DIAGS
OIM Menu Path(s):	Drive Information

POWER UNIT TYPE (P.795)

Indicates if the drives employs an S-6R (regenerative) or an S-6 (non-regenerative) power unit.
If the power unit type is S-6 (non-regenerative), NEG ARM CUR LIM will be automatically fixed to 0, and REVERSE DISABLE fixed to ON (preventing reverse direction).
WL3000 employs always an S-6R power unit.

Parameter Type:	Output
OIM Menu Path(s):	Drive Information

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 Type:	Output
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

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REGULATOR SW VERSION (P.794)

Indicates the regulator software version. e.g. 1.01

Parameter Type:	Output
OIM Menu Path(s):	Drive Information

Block Diagrams of the Control Loops

The following block diagrams for the Speed loop, Generator field current loop (GFL) and Armature loop 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-0 presents an overview of the individual drive control loops.

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 GFL.

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 reference of the Generator Field Current Loop (GFL) (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 GFL reference.

Figure D-10 shows the relationship of the Generator Field Current Loop (GFL) reference to the GFL feedback selection in generator field control. It also shows associated gain functions and test parameters.

Figure D-11 shows the Armature loop, which is - depending on mode (READY/RUN) - switched to voltage or current feedback. The PI-Regulator output is connected to the reference path of the Generator Field Current Loop (GFL).

Figure D-12 shows the outer control loop OCL on the optional I/O board-

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*]
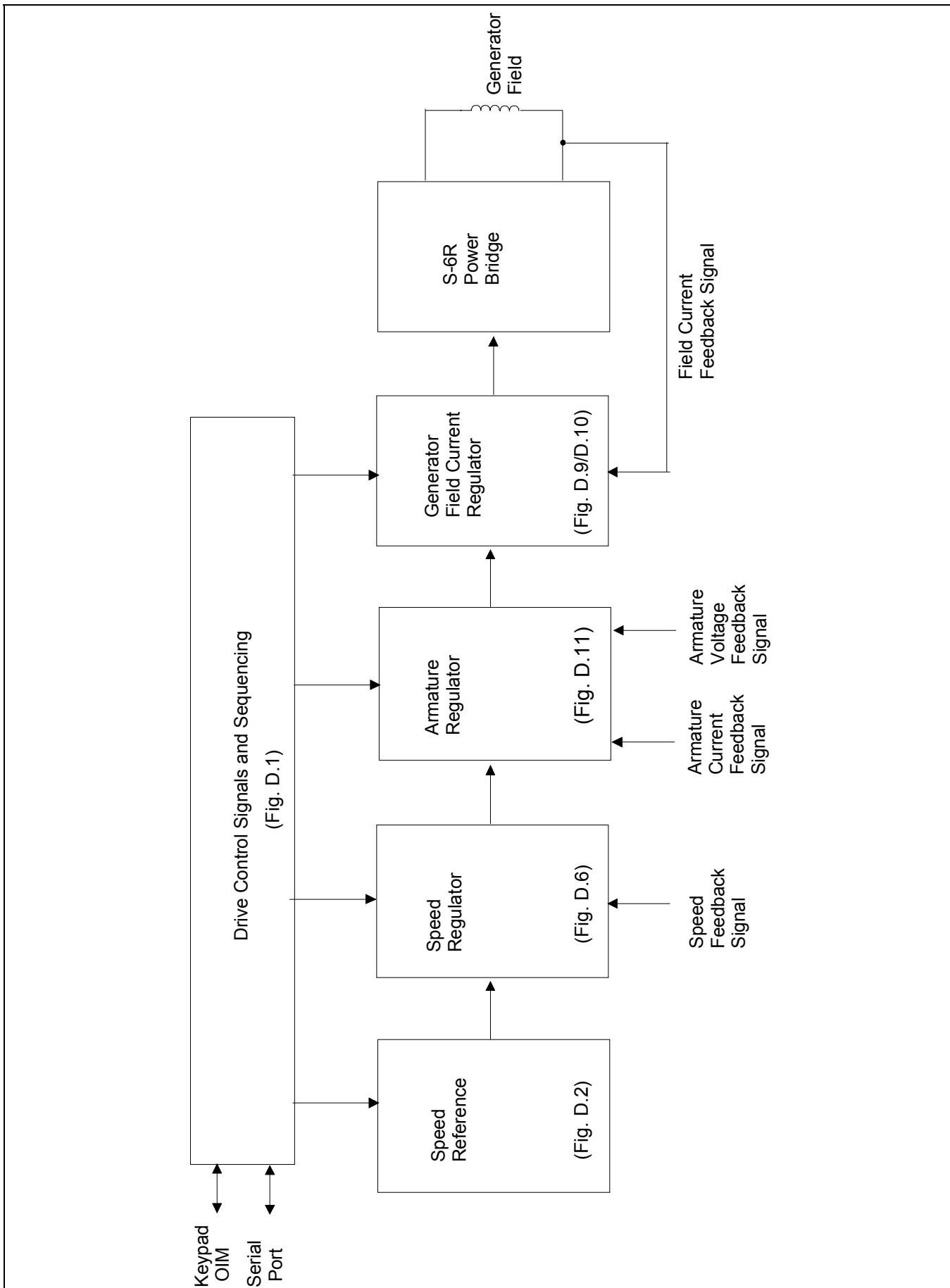
- An asterisk (*) - default selection

Figure D-0: Overview of the individual drive control loops
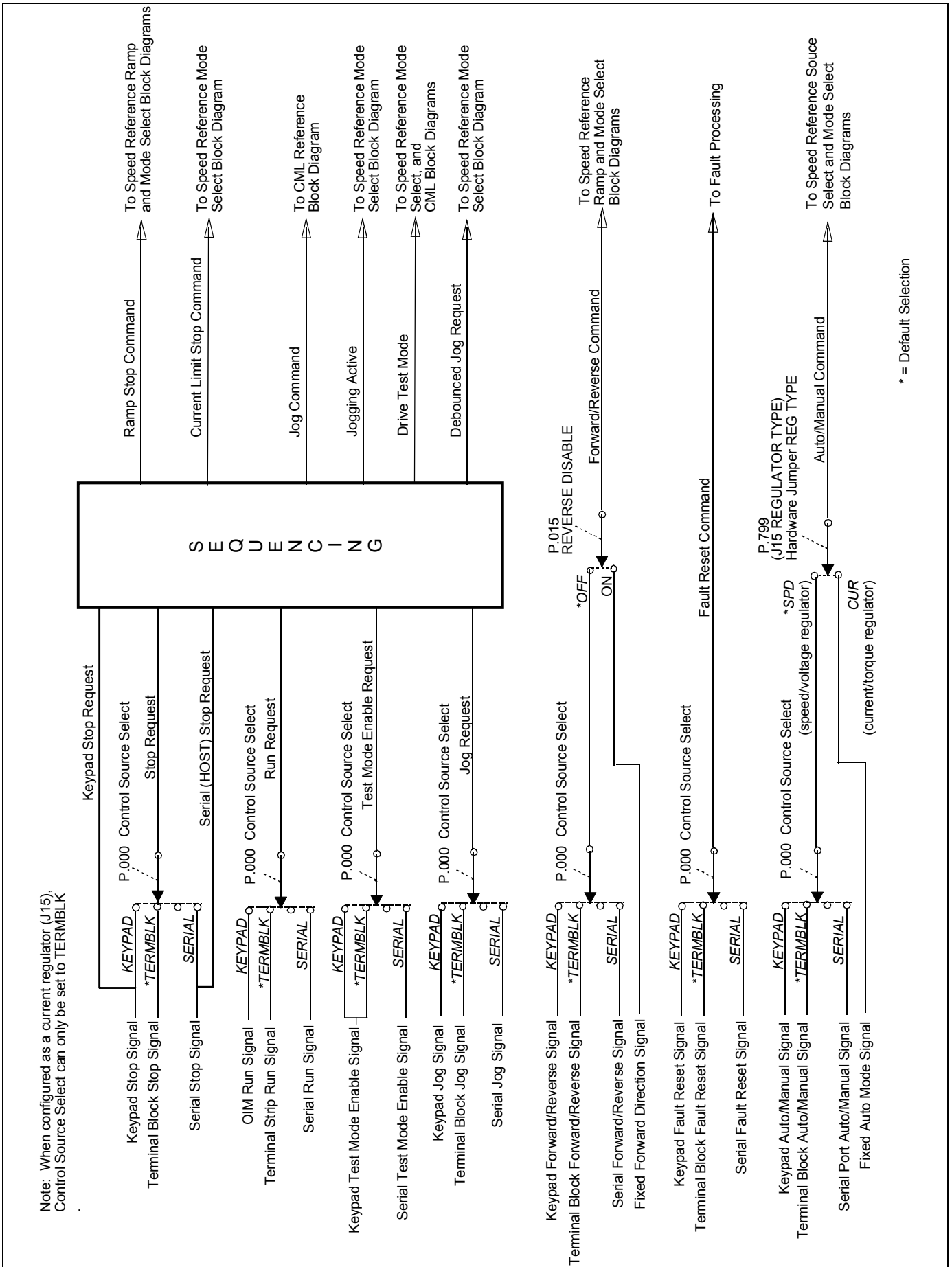
Figure D-1: Drive Control Signals
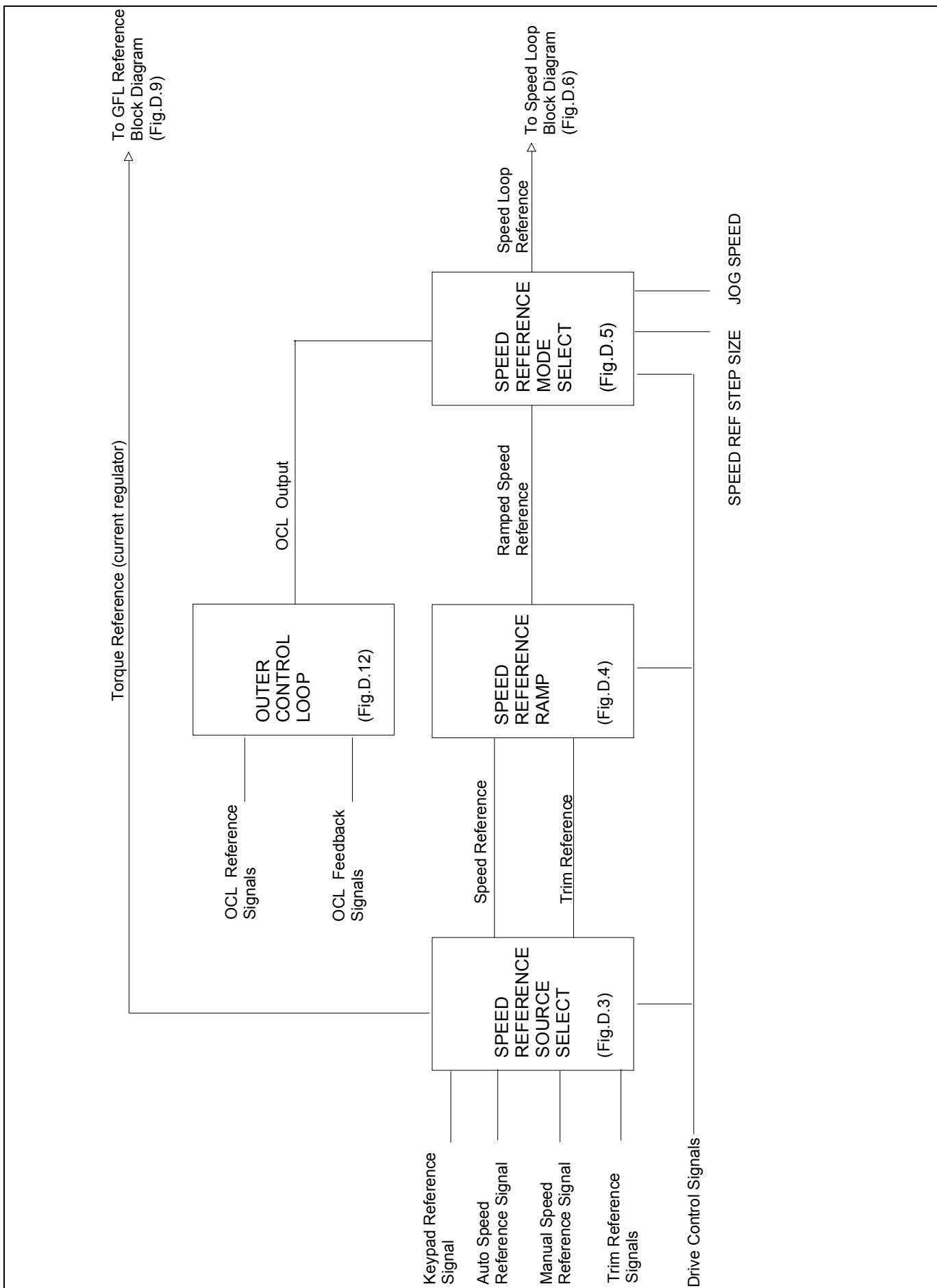
Figure D-2: Speed Reference Overview
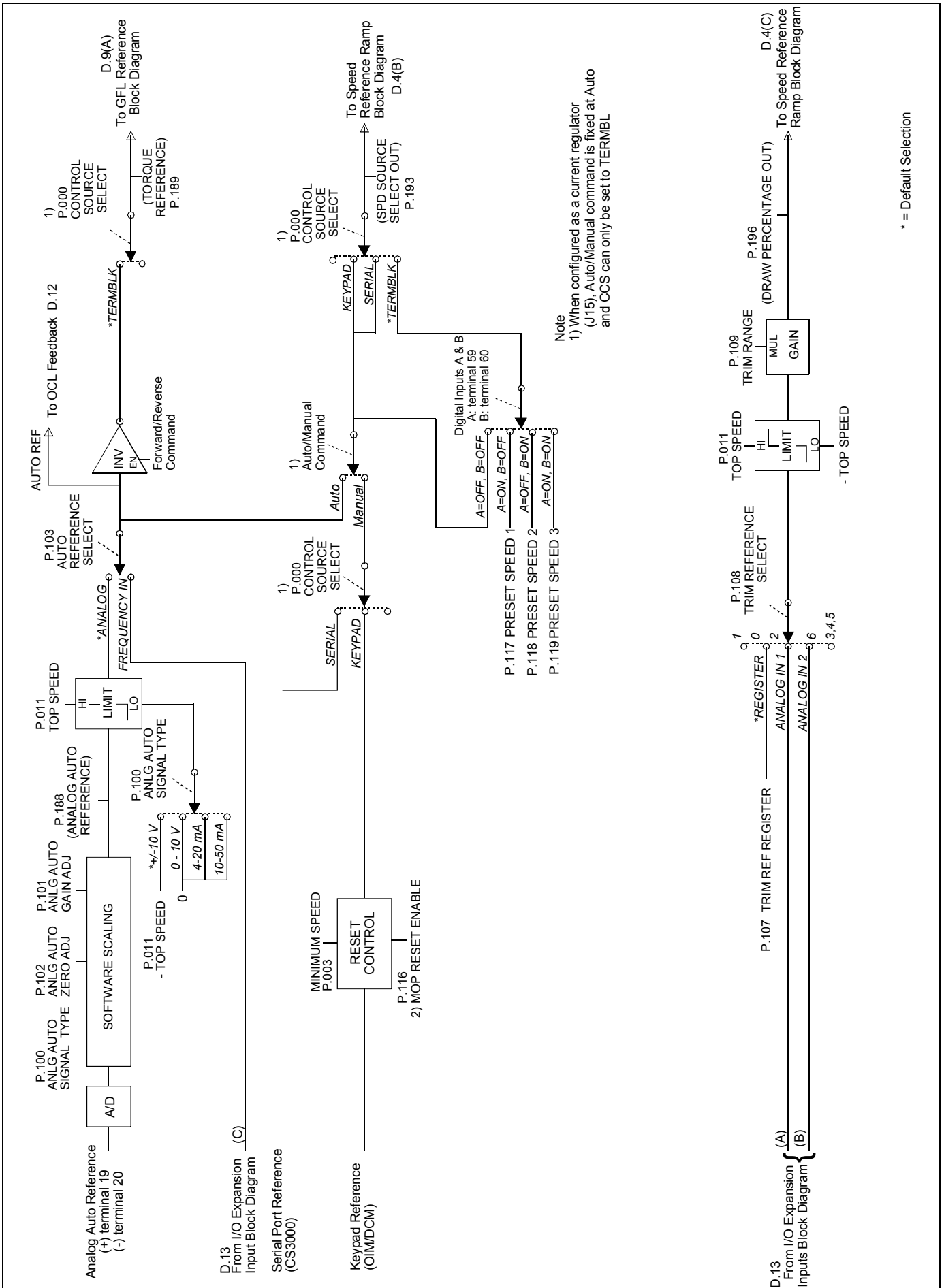
Figure D-3: Speed Reference Source Select
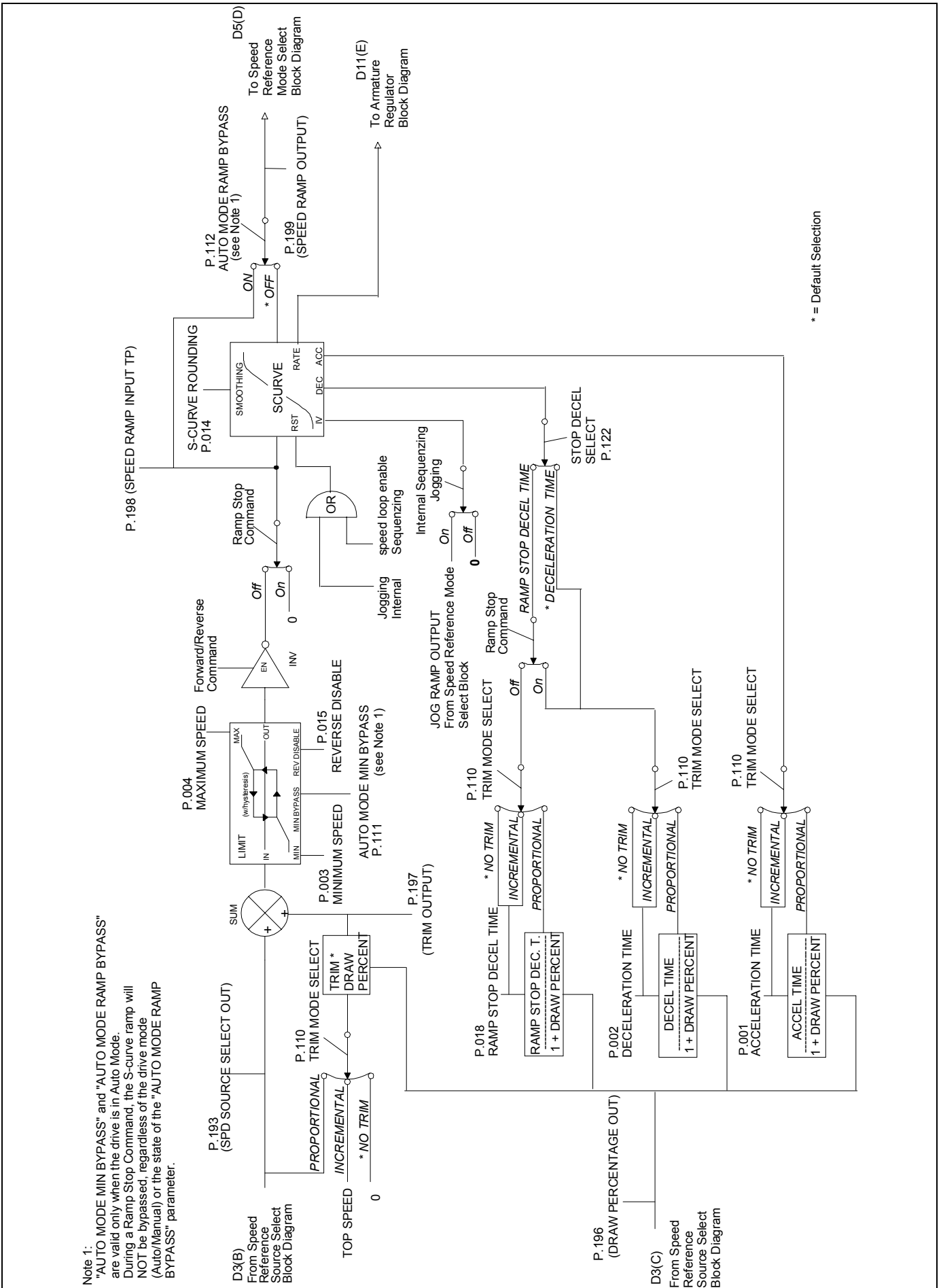
Figure D-4 - Speed Reference Ramp

Figure D-5 - Speed Reference Mode Select
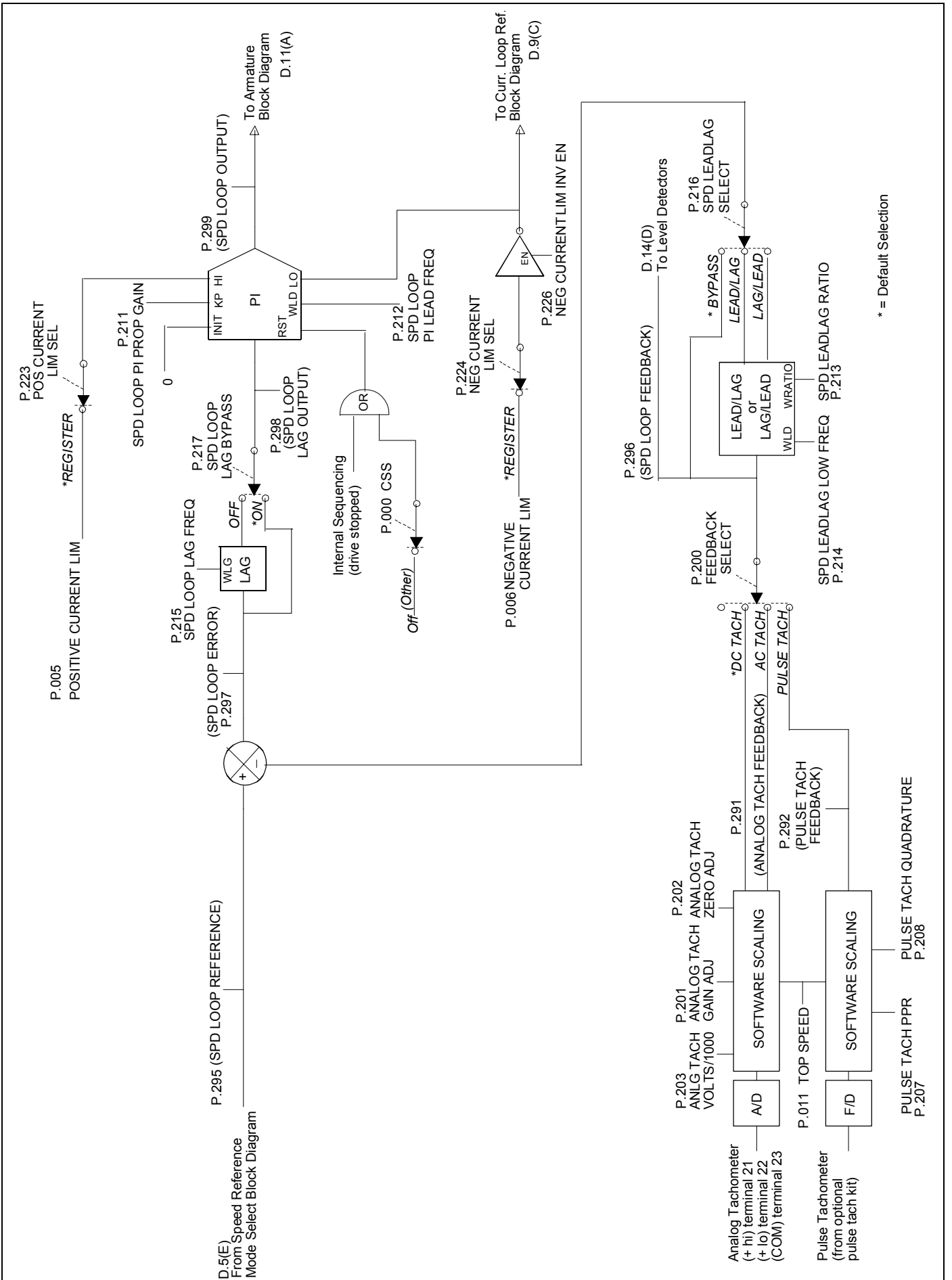
Figure D-6 - Speed Loop
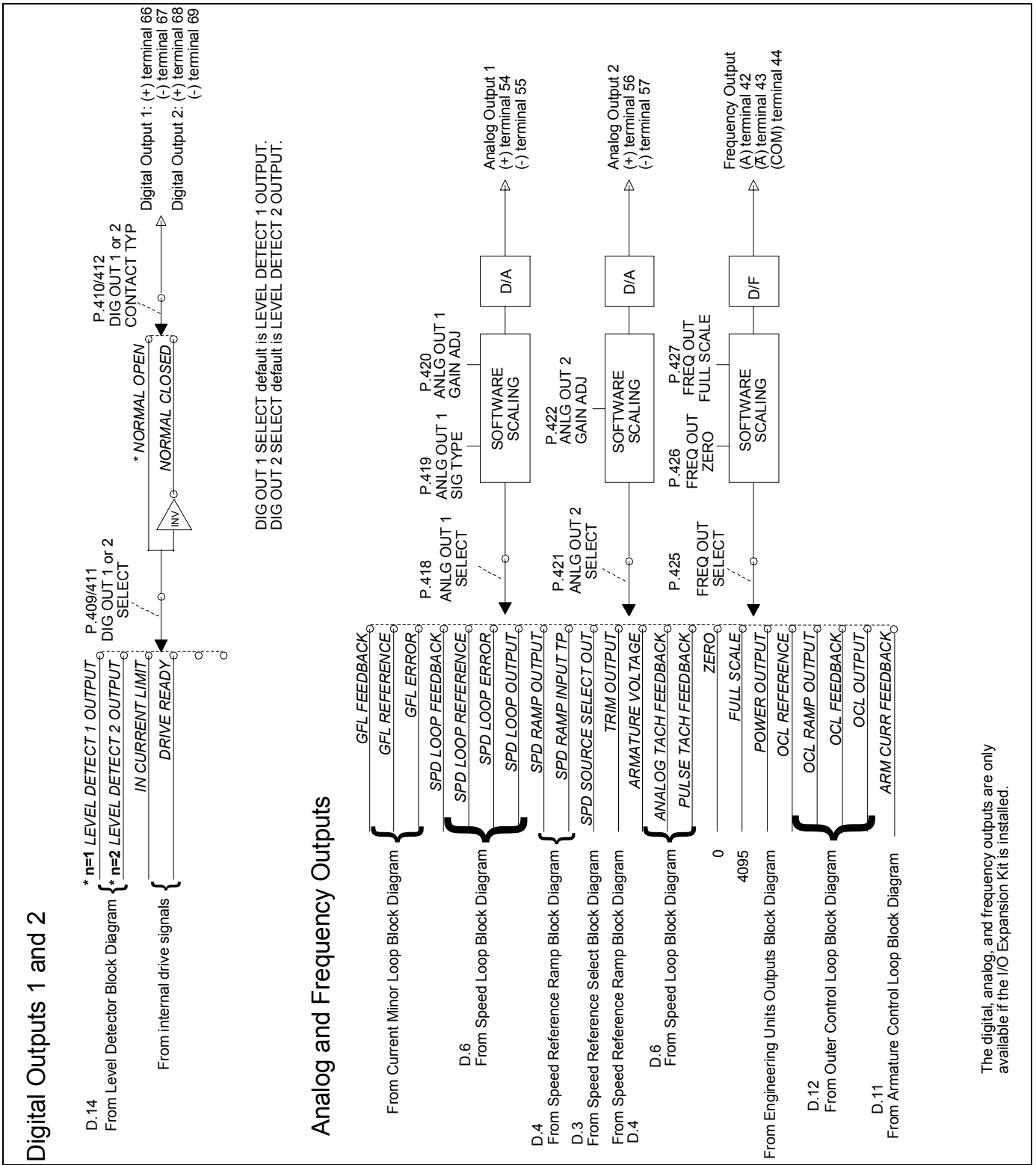
Figure D-7 - Digital Outputs, Analog and Frequency Outputs

Meter Outputs (n = 1, 2)

Figure D-8 - Metering Outputs

Figure D-9 - Generator Field Current Loop Reference
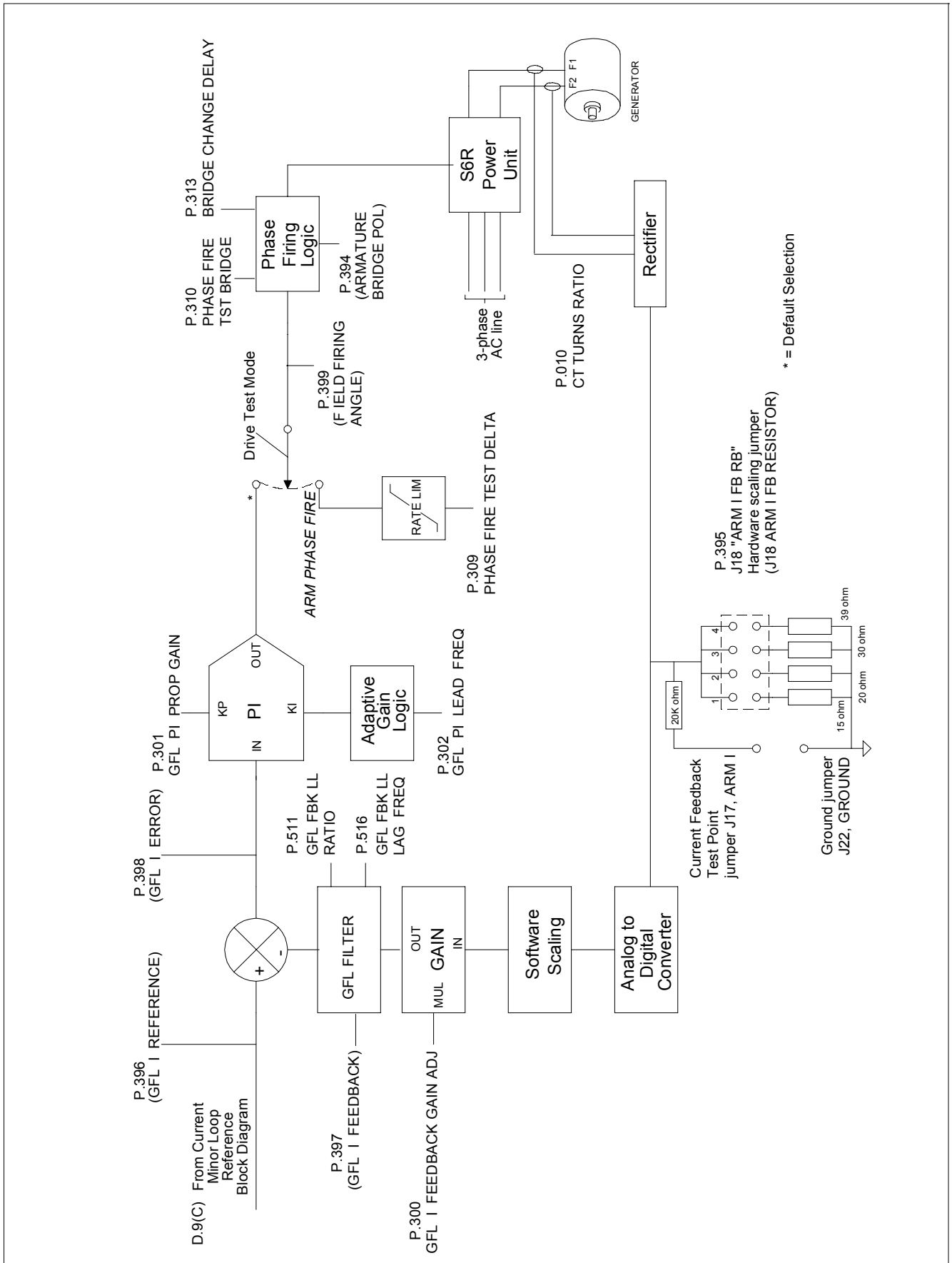
Figure D-10: Generator Field Current Loop (GFL)
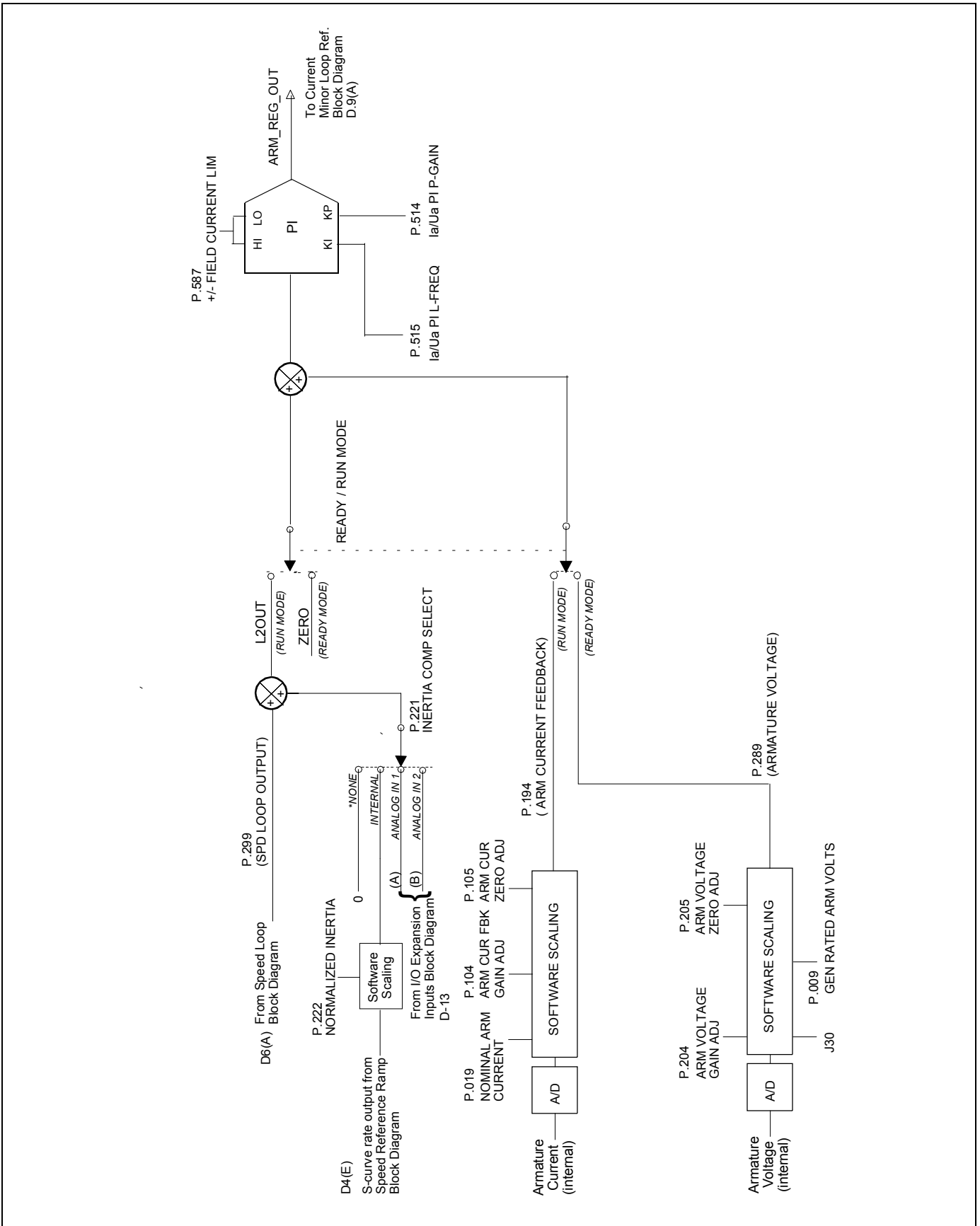
Figure D-11: Armature Loop

Outer Control Loop Enable Logic
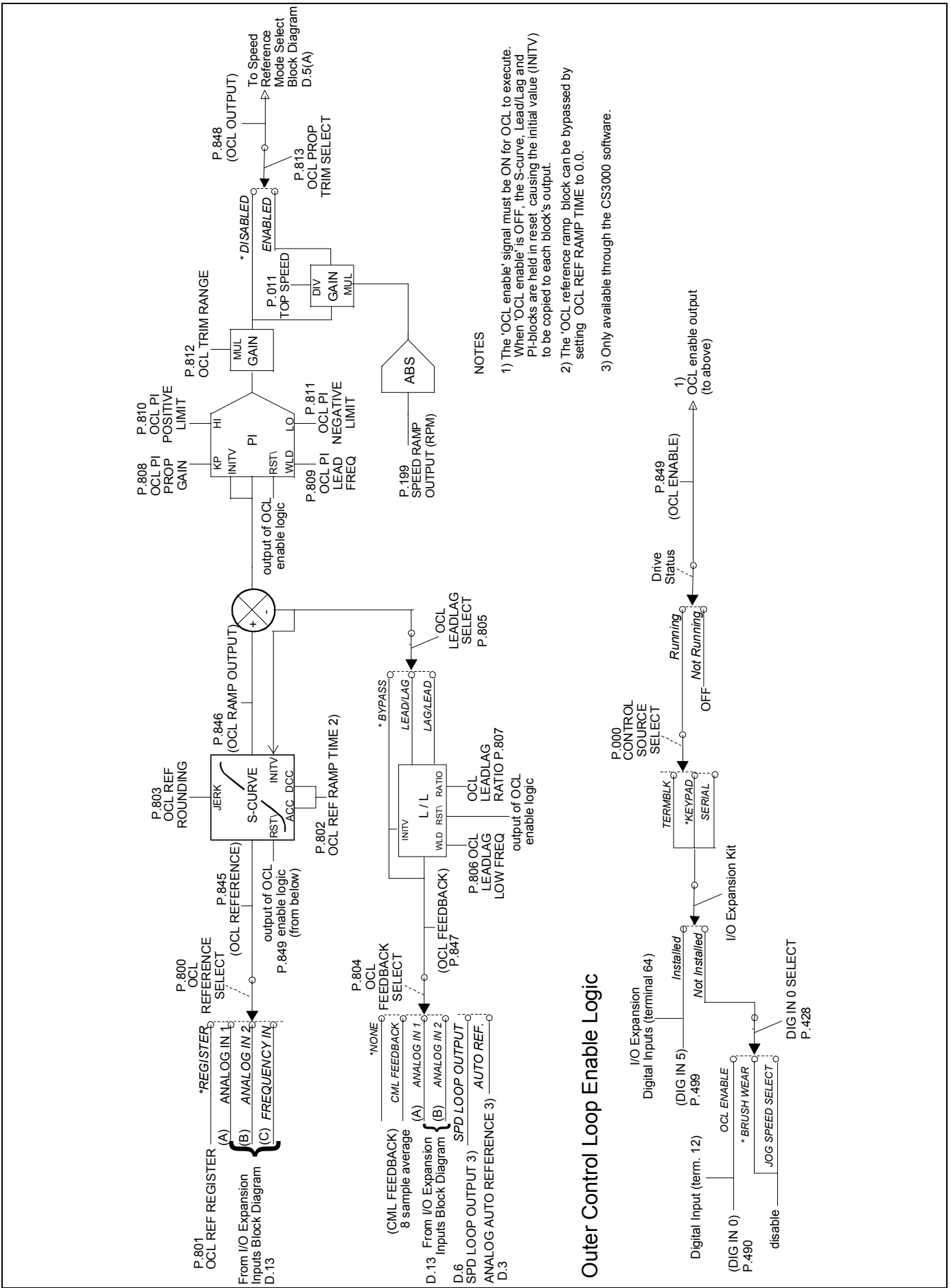
Figure D-12 - I/O Expansion Board Outer Control Loop
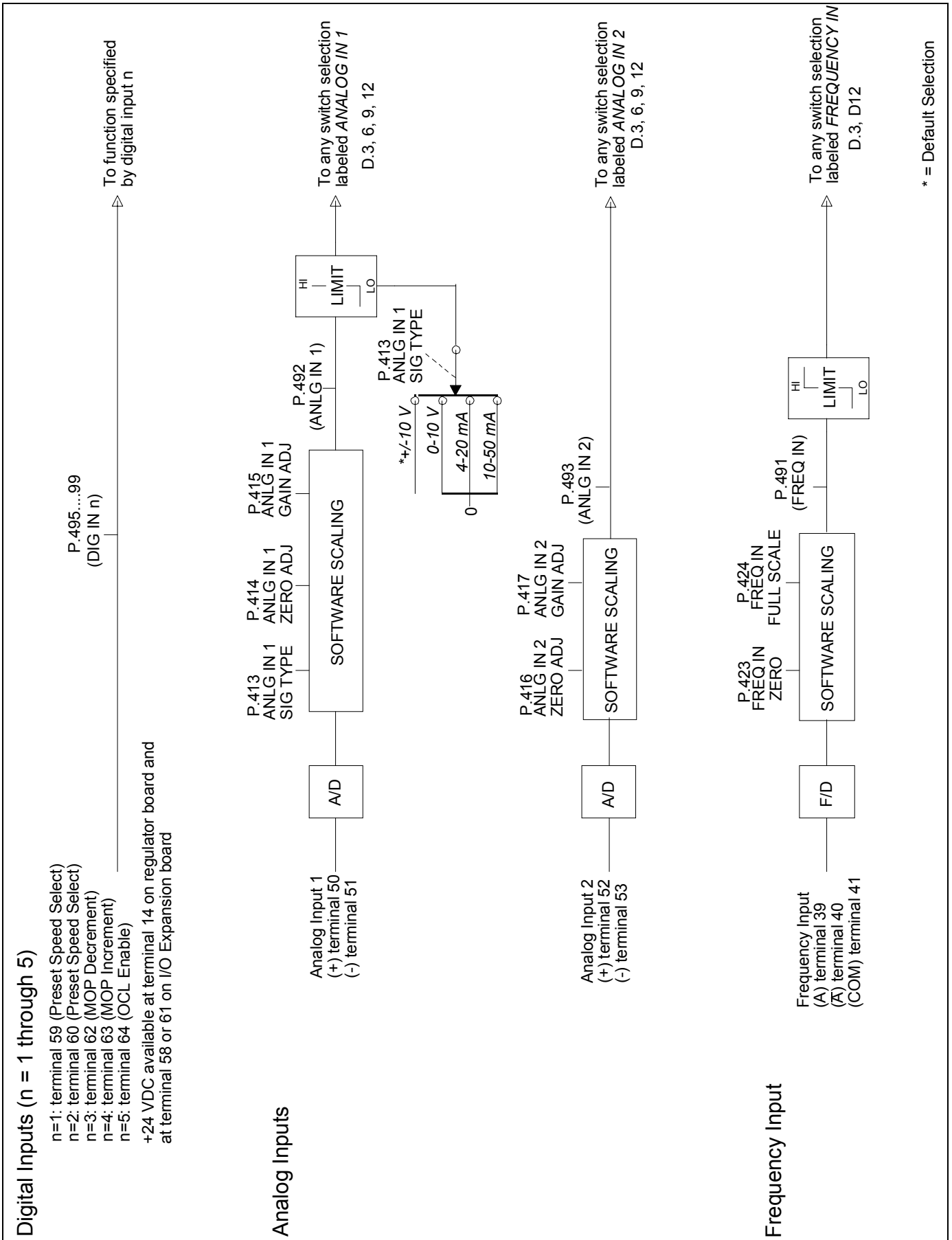
Figure D-13 - I/O Expansion Board Inputs

Digital Inputs (n = 1 through 5)

n=1: terminal 59 (Preset Speed Select)
n=2: terminal 60 (Preset Speed Select)
n=3: terminal 62 (MOP Decrement)
n=4: terminal 63 (MOP Increment)
n=5: terminal 64 (OCL Enable)

+24 VDC available at terminal 14 on regulator board and
at terminal 58 or 61 on I/O Expansion board

P.495...99
(DIG IN n)

To function specified
by digital input n

Analog Inputs

Analog Input 1
(+) terminal 50
(-) terminal 51

A/D

P.413 ANLG IN 1 SIG TYPE
P.414 ANLG IN 1 ZERO ADJ
P.415 ANLG IN 1 GAIN ADJ

SOFTWARE SCALING

P.492 (ANLG IN 1)

P.413 ANLG IN 1 SIG TYPE

*+/-10 V
0-10 V
4-20 mA
10-50 mA
0

LIMIT
HI
LO

To any switch selection
labeled ANALOG IN 1
D.3, 6, 9, 12

Analog Input 2
(+) terminal 52
(-) terminal 53

A/D

P.416 ANLG IN 2 ZERO ADJ
P.417 ANLG IN 2 GAIN ADJ

SOFTWARE SCALING

P.493 (ANLG IN 2)

To any switch selection
labeled ANALOG IN 2
D.3, 6, 9, 12

Frequency Input

Frequency Input
(A) terminal 39
(Ā) terminal 40
(COM) terminal 41

F/D

P.423 FREQ IN ZERO
P.424 FREQ IN FULL SCALE

SOFTWARE SCALING

P.491 (FREQ IN)

LIMIT
HI
LO

To any switch selection
labeled FREQUENCY IN
D.3, D12

* = Default Selection

Level Detectors 1 and 2

(GFL FEEEDBACK) 8 Sample Average — GFL FEEDBACK

From Speed Loop Block Diagram * n=1 SPD LOOP FEEDBACK

SPD RAMP OUTPUT

From Speed Reference
Ramp Block Diagram *n=2 SPD RAMP INPUT TP

From Speed Reference Source
Select Block Diagram SPD SOURCE SEL OUT

P.602, P.605
LEVEL DETECT
1 or 2 SELECT

ABS

A

COMPARE

B

A > B

LEVEL DETECT
1 or 2 THRESH
P.603, P.606

LEVEL DETECT
1 or 2 DELAY
P.604, P.607

TIMER

Start/Stop

Delay Time

P.648, P.649
(LEVEL DETECT
1 or 2 OUTPUT)

To Digital Outputs
Block Diagram D.7

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.
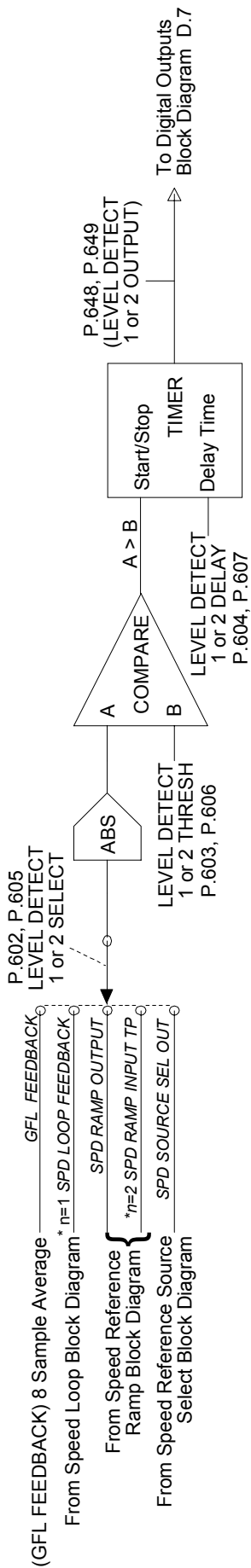
Table E.1 - Fault Codes

CODE	DISPLAY	DESCRIPTION
F00001	IET (OVERCURRENT)	Generator field current instantaneously exceeded 270% of GEN RATED FIELD AMPS (P.008). Possible causes: • Incorrect generator field current feedback scaling (GEN RATED FIELD AMPS (P.008), CT TURNS RATIO (P.010) and/or J18 not set properly). • One or more thyristors not operating. • Improper Generator Field Loop tuning (GFL) tuning. • Generator field 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 set value for overspeed. On drives with tacho for speed feedback the overspeed limit is 110% of TOP SPEED. Possible causes: • Incorrect tachometer scaling. • Improper speed loop tuning. • PULSE TACH QUADRATURE set to ON for a non-regenerative drive. • Incorrect pulse encoder wiring.
F00005	SUSTAINED OVERLOAD	Inverse time overload circuit trip. Possible causes: • Incorrect generator field current feedback scaling (GEN RATED FIELD AMPS (P.008), CT TURNS RATIO (P.010) and/or J18 not set properly).

Table E.1 - Fault Codes (Continued)

CODE	DISPLAY	DESCRIPTION
F00006	BLOWER MOTOR STARTER OPEN	This fault is not applicable.
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 (P.608).
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.

Table E.1 - Fault Codes (Continued)

CODE	DISPLAY	DESCRIPTION
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).
F00017	MAIN CONTACTOR DID NOT OPEN	The main contactor did not open when CUSTOMER INTERLOCK or COAST INPUTS were opened.
F00018	ARMATURE CONTACTOR NOT OPEN	Armature contactor did not open following a STOP or FAULT-STOP command or was not open when the Interlock was asserted. A FAULT-STOP is released by a drive fault, or when the CUSTOMER INTERLOCK or COAST inputs are negated.
F00019	MAIN CONTACTOR NOT CLOSED	The main contactor was not closed in standby mode or during run.
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 Generator Field Current Loop (GFL) tuning. • Improper Speed Loop tuning. • Failed thyristor.
F00200	POWER FAILURE	The power supply input voltage momentarily went below tolerance. Possible causes: • A-C 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 1 sec 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.
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. • 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).
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 did not open following a stop. Possible causes: • Failure main contactor or auxiliary contactor.
A00031 2)	MAIN CONTACTOR DID NOT CLOSE	The main contactor did not close following a run or jog command or did open during run. Possible causes: • Disconnected, loosely connected or damaged main contactor or main contactor auxiliary contact (K1, R1). • Failure main contactor or auxiliary contactor.

1) When after stop command, the auxiliary contactor does not indicate that the main contactor opened, this alarm indication is 1 sec time delayed.

2) When after start command, the auxiliary contactor does not indicate that the main contactor closed, this alarm indication is 1 sec 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.
A00034	ARM CUR DID NOT REACH ZERO	Armature current did not reach zero while stopping the drive.
A00035	ARM VOLT DID NOT REACH ZERO	Armature voltage did not reach zero while in ready mode.
A00036	ARM CONTACTOR NOT CLOSED	Armature contactor did not close after start.
A00050	GFL I FEEDBACK SCALING ERROR	Field current feedback could not be scaled properly based on the value entered for GEN RATED FIELD AMPS (P.008). Verify that this parameter value is correct for your application. Verify that CT TURNS RATIO (P.010) 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 ARM I LIM SEL (P.223), NEG ARM I LIM 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 WL 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 WL 3000 Main Menu is displayed at the top of the screen. Each menu shown below is expanded on the pages that follow.

WL 3000 Main Menu	Page:
Quick Start	F-2
Drive Reference	F-2
Outer Control Loop (OCL)	F-3
Speed Loop (SPD)	F-3
Armature Loop	F-4
Generator Field Loop (GFL)	F-5
Input/Output	F-6
Drive Information	F-7
Operator Interface	F-7
Additional Parameters	F-7

WL 3000 Main Menu

    Quick Start

            NOMINAL AC LINE FREQ (306)

            NOMINAL AC LINE VOLTS (307)

            MOTOR BASE SPEED/TOP SPEED (P.011)

            GEN RATED FIELD AMPS (P.008)

            GEN RATED ARM VOLTS (P.009)

            REVERSE DISABLE (P.015)

            FEEDBACK SELECT (P.200)

            ANLG TACH VOLTS/1000 (P.203)

            PULSE TACH PPR (207)

            PULSE TACH QUADRATURE (208)

            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)

            NOMINAL ARM CURRENT (019)

            POS ARM CUR LIM (P.005)

            NEG ARM CUR LIM (P.006)

            GENERATOR NOM FLD VOLTAGE (510)

        Correct Scaling Jumper Positions

            J11 ANLG TACH VLT SCL (P.792)

            J14 ANLG TACH VLT RNG LOW (P.793)

            J18 FLD I FB RESISTOR (P.395)

    Drive Reference

        Drive Reference Test Points

            ANALOG AUTO REFERENCE (P.188)

            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)

        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)

WL 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)
JOG OFF DELAY TIME (P.121)
PRESET SPEED 1 (P.117)
PRESET SPEED 2 (P.118)
PRESET SPEED 3 (P.119)

Drive Reference Scaling
ANLG AUTO ZERO ADJ (P.102)
ANLG AUTO GAIN ADJ (P.101)
ANALOG AUTO REFERENCE (P.188)

Outer Control Loop (OCL)

OCL Test Points
OCL ENABLE (P.849)
OCL REFERENCE (P.845)
OCL RAMP OUTPUT (P.846)
OCL FEEDBACK (P.847)
OCL OUTPUT (P.848)

OCL Tuning
OCL PI PROP GAIN (P.808)
OCL PI LEAD FREQ (P.809)
OCL PI POSITIVE LIMIT (P.810)
OCL PI NEGATIVE LIMIT (P.811)
OCL LEADLAG LOW FREQ (P.806)
OCL LEADLAG RATIO (P.807)
OCL TRIM RANGE (P.812)
OCL REF RAMP TIME (P.802)
OCL REF ROUNDING (P.803)

OCL Configure
OCL REFERENCE SELECT (P.800)
OCL REF REGISTER (P.801)
OCL FEEDBACK SELECT (P.804)
OCL LEADLAG SELECT (P.805)

Speed Loop (SPD)

Speed 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)
ANALOG TACH FEEDBACK (P.291)
PULSE TACH FEEDBACK (P.292)

WL 3000 Main Menu
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       Speed Loop (SPD) Tuning
           SPD LOOP PI PROP GAIN (P.211)
           SPD LOOP PI LEAD FREQ (P.212)
           POS ARM CUR LIM (P.005)
           NEG ARM CUR 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)
           INERTIA COMP SELECT (P.221)
           NORMALIZED INERTIA (P.222)
           POS ARM I LIM SEL (P.223)
           NEG ARM I LIM SEL (P.224)

       Speed Loop (SPD) Feedback
           FEEDBACK SELECT (P.200)
           GEN RATED ARM VOLTS (P.009)
           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)

    Armature Loop

       Armature Loop Test Points
           SPD LOOP OUTPUT (P.299)
           ARM CURRENT FEEDBACK (P.194)
           ARMATURE VOLTAGE (P.289)

       Armature Loop Tuning
           Ia/Ua PI P-GAIN (P.514)
           Ia/Ua PI L-FREQ (P.515)
           +/- FIELD CURRENT LIM (P.587)

       Armature Loop Feedback Scaling
           ARMATURE VOLTAGE (P.289)
           ARM VOLTAGE ZERO ADJ (P.205)
           ARM VOLTAGE GAIN ADJ (P.204)
           NOMINAL ARM CURRENT (P.019)
           ARM CURRENT FEEDBACK (P.194)
           ARM CUR FBK GAIN ADJ (P.104)
           ARM CUR ZERO ADJ (P.105)

WL 3000 Main Menu

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Generator Field Loop (GFL)

GFL Test Points
GFL I REFERENCE (P.396)
GFL I FEEDBACK (P.397)
GFL I ERROR (P.398)
SPD LOOP OUTPUT (P.299)
FIELD BRIDGE POL (P.394)
FIELD FIRING ANGLE (P.399)
TORQUE REFERENCE (P.189)
J15 REGULATOR TYPE (P.799)

GFL Tuning
GFL PI PROP GAIN (P.301)
GFL PI LEAD FREQUENCY (P.302)
GFL REF RATE LIMIT (P.303)
GEN NOM FLD VOLTAGE (510)
GFL FBK LL LAG FREQ (516)
GFL FBK LL RATIO (511)

GFL Feedback Scaling
GEN RATED FIELD AMPS (P.008)
GFL FEEDBACK GAIN ADJ (P.300)
J18 FLD I FB RESISTOR (P.395)
CT TURNS RATIO (P.010)
GFL I FEEDBACK (P.397)

Three Phase AC Line
NOMINAL AC LINE FREQ (P.306)
NOMINAL AC LINE VOLTS (P.307)
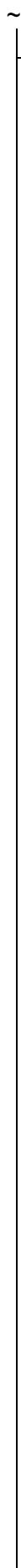AC LINE PERIOD (P.393)
AC LINE VOLTAGE (P.392)
PLL MAXIMUM ERROR (P.308)

SCR Diagnostics
OPEN SCR SENSITIVITY (P.600)
OPEN SCR TRIP THRESH (P.601)

Field Phase Fire Test
PHASE FIRE TEST DELTA (P.309)
PHASE FIRE TST BRIDGE (P.310)
FIELD FIRING ANGLE (P.399)
GFL I FEEDBACK (P.397)
ARMATURE VOLTAGE (P.289)
SPD LOOP FEEDBACK (P.296)

WL 3000 Main Menu
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　　Input/Output

　　　　Meter Outputs
　　　　　　METER 1 SEL (P.404)
　　　　　　METER OUT 1 ZERO ADJ (P.402)
　　　　　　METER OUT 1 GAIN ADJ (P.400)
　　　　　　METER 2 SEL (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)

WL 3000 Main Menu

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Drive Information

Correct Scaling Jumper Positions

J11 ANLG TACH VLT SCL (P.792)
J14 ANLG TACH VLT RNG (P.793)
J18 FLD I FB RESISTOR (P.395)

PULSE TACHOMETER KIT (P.798)
NETWORK KIT (P.796)
I/O EXPANSION KIT (P.797)
POWER UNIT TYPE (P.795)
J15 REGULATOR TYPE (P.799)
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
Define Control Loop Units

Additional Parameters

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.313 (BRIDGE CHANGE DELAY)
P.018 (RAMP STOP DECEL TIME)
P.813 (OCL PROP TRIM SELECT)
P.814 (OCL TYPE3 POSN REG EN)
P.609 (PHASE LOSS DETECT EN)
P.490 (DIG IN 0)
P.428 (DIG IN 0 SELECT)
P.227 (TACH LEAD FLT THRESH)
P.228 (TACH LEAD FLT DELAY)

User Quick Reference Table

Table G.1 - User Quick Reference Table for Input and Output Parameters

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg. B-	Initial Factory Setting	User Data Date	Setting
000 (1)	CONTROL SOURCE SELECT	• KEYPAD • SERIAL • TERMBLK	-	KEYPAD		
001	ACCELERATION TIME	0.1 - 300.0 sec	4	5.0 sec		
002	DECELERATION TIME	0.1 - 300.0 sec	4	5.0 sec		
003	MINIMUM SPEED	0 - MAXIMUM SPEED (P.004)	3	0 (*RPM)		
004	MAXIMUM SPEED	1 - TOP SPEED (P.011)	3	500 (*RPM)		
005	POS ARM CUR LIM	0 - 200% of NOMINAL ARM CURRENT (P.019)	16	200% P.008		
006	NEG ARM CUR LIM	0 - 200% of NOMINAL ARM CURRENT (P.019)	16	200% P.008		
008	GEN RATED FIELD AMPS	7 - 3000.0 A	25	10.0		
009	GEN RATED ARM VOLTS	160 - 675 VDC	19	240 V		
010	CT TURNS RATIO	1 - 32767 Tp/Tn • 25 A Unit: 208 • 60 A Unit: 416	26	depending on unit type 208 Tp/Tn		
011	TOP SPEED	5 - 5000 RPM	3	500 RPM		
012	JOG SPEED	0 - MAXIMUM SPEED (P.004)	6	250 (*RPM)		
013	JOG ACCEL/DECEL TIME	0.1 - 300.0 sec	5	3.0 sec		
014	S-CURVE ROUNDING	0 - 50% (0% = no rounding)	5	0%		
015	REVERSE DISABLE	• OFF, • ON	4	OFF		
017	JOG SPEED 2	0 - MAXIMUM SPEED (P.004)	9	250 (*RPM)		
018	RAMP STOP DECEL TIME	0.1 - 300.0 sec	5	5.0 sec		
019	NOMINAL ARM CURRENT	1 – 3000 A	23	100 A		
	Analog Inputs					
100 (2)	ANLG AUTO SIGNAL TYPE	• 0 -10 V • ±10 V • 4-20 mA • 10-50 mA	6	0-10 V		
101	ANLG AUTO GAIN ADJ	0.750 - 1.250	9	1.000		
102	ANLG AUTO ZERO ADJ	-200 - +200	9	0		
103	AUTO REFERENCE SELECT	• ANALOG • FREQUENCY IN	7	ANALOG		
104	ARM CURRENT FB GAIN ADJ	0.750 - 1.250	23	1.000		
105	ARM CUR ZERO ADJ	-200 - +200	23	0		
107	TRIM REF REGISTER	0 to +/-100.0%	2	0%		
108	TRIM REFERENCE SELECT	• REGISTER • ANALOG MANUAL • ANALOG IN 1 • ANALOG IN 2	2	REGISTER		
109	TRIM RANGE	0 to +/-100.0%	2	0.0%		
110	TRIM MODE SELECT	• NO TRIM • INCREMENTAL • PROPORTIONAL (DRAW)	2	NO TRIM		

(*) Or user defined unit.

(1) P.000 is selected by OIM-key CSS or via CS3000 Software, refer to 2.6.2.2

(2) Jumpers J10 and J12 must be set for the type of auto reference selected.

Table G.1 - User Quick Reference Table for Input and Output Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data Date	Setting
111	AUTO MODE MIN BYPASS	• OFF • ON	4	OFF		
112	AUTO MODE RAMP BYPASS	• OFF • ON	5	OFF		
113	STOP SPEED THRESHOLD	0 - MAXIMUM SPEED (P.004) in *RPM	7	50 (*RPM)		
114 (3)	STOP MODE SELECT	• RAMP • COAST/DB • CURRENT LIMIT	7	RAMP		
115	MOP ACCEL TIME	not used				
116	MOP RESET ENABLE	not used				
117	PRESET SPEED 1	MINIMUM SPEED- MAX SPEED	8	175 *RPM		
118	PRESET SPEED 2	MINIMUM SPEED- MAX SPEED	8	175*RPM		
119	PRESET SPEED 3	MINIMUM SPEED- MAX SPEED	8	175*RPM		
120	MOP DECEL TIME	not used				
121	JOG OFF DELAY TIME	0.0 to 10.0 seconds	8	1.0 seconds		
122	STOP DECEL SELECT	• 1 = DECELERATION TIME • 2 = RAMP STOP DECEL TIME	6	1		
188	ANALOG AUTO REFERENCE	Output	1			
189	TORQUE REFERENCE	Output	24			
191	MOP OUTPUT	Output (not used)	-			
193	SPD SOURCE SELECT OUT	Output	1			
194	ARM CURRENT FEEDBACK	Output	22			
196	DRAW PERCENTAGE OUT	Output	1			
197	TRIM OUTPUT	Output	1			
198	SPEED RAMP INPUT TP	Output	1			
199	SPEED RAMP OUTPUT	Output	1			
	Feedback Selection					
200	FEEDBACK SELECT	• DC TACH • PULSE TACH • AC TACH	19	DC TACH		
201	ANALOG TACH GAIN ADJ	0.750 - 1.250	20	1.000		
202	ANALOG TACH ZERO ADJ	-200 to +200	20	0		
203	ANLG TACH VOLTS/1000	18.0 - 200.0 V/1000 RPM	20	18 V/1000 RPM		
204	ARM VOLTAGE GAIN ADJ	0.750 - 1.250	23	1.000		
205	ARM VOLTAGE ZERO ADJ	-200 to +200 V	23	0		
207	PULSE TACH PPR	18 - 2500 PPR	21	18 PPR		
208	PULSE TACH QUADRATURE	• OFF • ON	21	ON		
209	CURRENT COMPOUNDING	-50% to +50%	16	0%		

(*) 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 and Output Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data Date	Setting
	Speed Regulator Adjustm.					
211	SPD LOOP PI PROP GAIN	0.10 - 128.00	16	4.00		
212	SPD LOOP PI LEAD FREQ	0.00 to 327.67 rad/s	16	3.00 rad/s		
213	SPD LEADLAG RATIO	2 - 20	17	2		
214	SPD LEADLAG LOW FREQ	0.01 - 139.62 rad/s	17	1.00 rad/s		
215	SPD LOOP LAG FREQ	0.01 to 279.25 rad/s	17	1.00 rad/s		
216	SPD LEADLAG SELECT	• LEAD/LAG • BYPASS • LAG/LEAD	17	BYPASS		
217	SPD LOOP LAG BYPASS	• OFF, • ON	17	ON		
221	INERTIA COMP SELECT	• NONE • INTERNAL • ANALOG IN 1 • ANALOG IN 2	18	NONE		
222	NORMALIZED INERTIA	0.05 - 65.20 sec	18	1.00 sec		
223	POS ARM I LIM SEL	• REGISTER • ANALOG IN 1 • ANALOG IN 2	18	REGISTER		
224	NEG ARM I LIM SEL	• REGISTER • ANALOG IN 1 • ANALOG IN 2	18	REGISTER		
226	NEG CUR LIM INV EN	• DISABLE • ENABLE	19	ENABLE		
227	TACH LEAD FLT THRESH	0.0 to 250%	21	200%		
228	TACH LEAD FLT DELAY	0 to 32767 (msec)	21	1000 ms		
289	ARMATURE VOLTAGE	Output	22			
291	ANALOG TACH FEEDBACK	Output	15			
292	PULSE TACH FEEDBACK	Output	15			
293	CURRENT COMPOUND TP	Output	15			
294	JOG RAMP OUTPUT	Output	1			
295	SPD LOOP REFERENCE	Output	15			
296	SPD LOOP FEEDBACK	Output	15			
297	SPD LOOP ERROR	Output	15			
298	SPD LOOP LAG OUTPUT	Output	15			
299	SPD LOOP OUTPUT	Output	15			
	Generator Field Loop GFL					
300	GFL FEEDBACK GAIN ADJ	0.900 - 1.100	26	1.000		
301	GFL PI PROP GAIN	1 - 100	24	10		
302	GFL PI LEAD FREQUENCY	1 - 500 rad/s	25	1 rad/s		
303	GFL REF RATE LIMIT	1 - 1000 msec	25	40 msec		
306	NOMINAL AC LINE FREQ	48 - 62 Hz	26	50 Hz		
307	NOMINAL AC LINE VOLTS	200 - 575 VAC	27	400 VAC		
308	PLL MAXIMUM ERROR	2 - 1000 µsec	27	2 µsec		
309	PHASE FIRE TEST DELTA	0 - 180 degrees	29	0 degree		

Table G.1 - User Quick Reference Table for Input and Output Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data Date	Setting
310	PHASE FIRE TST BRIDGE	• OFF • ON	29	OFF		
312	INV FAULT AVOID SEL	• 1 = DISABLED • 2 = FAULT IMMEDIATELY • 3 = DELAY BEFORE FAULT	29	DISABLED		
313	BRIDGE CHANGE DELAY	0 to +75	28	0		
392	AC LINE VOLTAGE	Output	27			
393	AC LINE PERIOD	Output	27			
394	FIELD BRIDGE POL	Output	24			
395	J18 FLD I FB RESISTOR	Output	26			
396	GFL STROM REG SOLLWRT	Output	24			
397	GFL I FEEDBACK	Output	26			
398	GFL I ERROR	Output	24			
399	FIELD FIRING ANGLE	Output	24			
	Meter Outputs Set-up					
400	METER OUT 1 GAIN ADJ	0.100 - 1.900	31	1.000		
401	METER OUT 2 GAIN ADJ	0.100 - 1.900	32	1.000		
402	METER OUT 1 ZERO ADJ	-200 to +200	31	0		
403	METER OUT 2 ZERO ADJ	-200 to +200	32	0		
404	METER 1 SEL	• GFL I FEEDBACK • GFL I REFERENCE • GFL I 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 • MOTOR POWER • OCL REFERENCE • OCL RAMP OUTPUT • OCL FEEDBACK • OCL OUTPUT • ARMATURE CURRENT	31	GFL I FEEDBACK		
405	METER 2 SEL	same as above for P.404	32	SPD LOOP FEEDBACK		
412	DIG OUT 2 CONTACT TYP	• NORMAL OPEN • NORMAL CLOSED	41	NORMAL OPEN		

Table G.1 - User Quick Reference Table for Input and Output Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data Date	User Data Setting
Digital Outputs Set-up (on I/O board)						
409	DIG OUT 1 SELECT	• LEVEL DETECT 1 OUTPUT • LEVEL DETECT 2 OUTPUT • IN CURRENT LIMIT • DRIVE READY	40	LEVEL DETECT 1 OUTPUT		
410	DIG OUT 1 CONTACT TYP	• NORMAL OPEN • NORMAL CLOSED	40	NORMAL OPEN		
411	DIG OUT 2 SELECT	• LEVEL DETECT 1 OUTPUT • LEVEL DETECT 2 OUTPUT • IN CURRENT LIMIT • DRIVE READY	40	LEVEL DETECT 2 OUTPUT		
Analog Inputs / Outputs (on I/O board)						
413	ANLG IN 1 SIG TYPE	• 0-10V, • ±10V • 4-20 mA, • 10-50 mA	33	±10 V		
414	ANLG IN 1 ZERO ADJ	-200 to +200	33	0		
415	ANLG IN 1 GAIN ADJ	0.750 - 2.250	34	1.000		
416	ANLG IN 2 ZERO ADJ	-200 to +200	34	0		
417	ANLG IN 2 GAIN ADJ	0.750 - 2.250	35	1.000		
418	ANLG OUT 1 SELECT	• GFL I FEEDBACK • GFL I REFERENCE • GFL I 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 • MOTOR POWER • OCL REFERENCE • OCL RAMP OUTPUT • OCL FEEDBACK • OCL OUTPUT • ARMATURE CURRENT	35	ZERO		
419	ANLG OUT 1 SIG TYPE	• 0-10 V • ±10 V • 4-20 mA,	36	±10 V		
420	ANLG OUT 1 GAIN ADJ	0.500 - 1.300	36	1.000		
421	ANLG OUT 2 SELECT	same as above for P.418	37	ZERO		
422	ANLG OUT 2 GAIN ADJ	0.500 - 1.300	37	1.000		
Frequency Inputs/Outputs (on I/O board)						
423	FREQ IN ZERO	2.0 - FREQ IN FULL SCALE kHz	41	2.0 kHz		
424	FREQ IN FULL SCALE	2.0 - 250.0 kHz	41	250.0 kHz		
425	FREQ OUT SELECT	same as above for P.418	42	ZERO		

Table G.1 - User Quick Reference Table for Input and Output Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data Date	User Data Setting
426	FREQ OUT ZERO	2.0 - FREQ OUT FULL SCALE kHz	43	2.0 kHz		
427	FREQ OUT FULL SCALE	2.0 - 250.0 kHz	43	250.0 kHz		
428	DIG IN 0 SELECT	• 1 = BRUSH WEAR • 2 = JOG SPEED SELECT • 3 = OCL ENABLE	39	1		
490	DIG IN 0	Output	38			
491	FREQ IN	Output	41			
492	ANLG IN 1	Output	34			
493	ANLG IN 2	Output	36			
495	DIG IN 1	Output	38			
496	DIG IN 2	Output	38			
497	DIG IN 3	Output	39			
498	DIG IN 4	Output	39			
499	DIG IN 5	Output	39			
	GFL / Armature Loop					
510	GEN NOM FLD VOLTAGE	50 to 600 V	25	100 V		
511	GFL FBK LL RATIO	1 - 5	25	3		
514	Ia/Ua PI P-GAIN	0.01 to 10.00	22	0,1		
515	Ia/Ua PI L-FREQ	0.00 to 327.67 rad/sec	22	1 rad/s		
516	GFL FBK LL LAG FREQ	1 to 100 rad/sec	25	30 rad/s		
587	+/- FIELD CURRENT LIM	0 to 200% of GEN RATED FIELD AMPS (P.008)	22	100%		
	Thyristor Firing check					
600	OPEN SCR SENSITIVITY	0 to 100%	27	0%		
601	OPEN SCR TRIP THRESH	800 to 4000	27	1600		
	Level Detectors					
602	LEVEL DETECT 1 SELECT	• SPD SOURCE SELECT OUT • SPEED RAMP INPUT TP • SPEED RAMP OUTPUT • SPD LOOP FEEDBACK • GFL I FEEDBACK	43	SPD LOOP FEEDBACK		
603	LEVEL DETECT 1 THRESH	• 0.1 to 100.0% or 200%	43	10.0%		
604	LEVEL DETECT 1 DELAY	0.0 to 300.0 sec	44	1.0 sec		
605	LEVEL DETECT 2 SELECT	• SPD SOURCE SELECT OUT • SPEED RAMP INPUT TP • SPEED RAMP OUTPUT • SPD LOOP FEEDBACK • GFL I FEEDBACK	44	SPEED RAMP INPUT TP		
606	LEVEL DETECT 2 THRESH	• 0.1 to 100.0% or 200%	45	10.0%		
607	LEVEL DETECT 2 DELAY	0.0 to 300.0 sec	45	1.0 sec		
608	TACH LOSS SCR ANGLE	0 to 127 (degrees)	28	109		
609	PHASE LOSS DETECT EN	• DISABLE • ENABLE	29	ENABLE		
648	LEVEL DETECT 1 OUTPUT	Output	44			
649	LEVEL DETECT 2 OUTPUT	Output	45			

Table G.1 - User Quick Reference Table for Input and Output Parameters (continued)

Par. No.	Parameter	Parameter Selection / Adjustment Range	Pg B-	Initial Factory Setting	User Data Date	Setting
	Drive Information					
792	J11 ANLG TACH VLT SCL	Output	20			
793	J14 ANLG TACH VLT RNG	Output	21			
794	REGULATOR SW VERSION	Output	46			
795	POWER UNIT TYPE	Output	46			
796	NETWORK KIT	Output	46			
797	I/O EXPANSION KIT	Output	33			
798	PULSE TACHOMETER KIT	Output	46			
799	J15 REGULATOR TYPE	Output	24			
	Outer Current Loop					
800	OCL REFERENCE SELECT	• REGISTER • ANALOG IN 1 • ANALOG IN 2 • FREQUENCY IN	40	REGISTER		
801	OCL REF REGISTER	-100% to +100%	13	0		
802	OCL REF RAMP TIME	0.0 - 300.0 sec	12	10.0 sec		
803	OCL REF ROUNDING	0 - 50%	13	0%		
804	OCL FEEDBACK SELECT	• NONE • GFL I FEEDBACK • ANALOG IN 1 • ANALOG IN 2	13	GFL I FEEDBACK		
805	OCL LEADLAG SELECT	• LEAD/LAG • BYPASS • LAG/LEAD	14	BYPASS		
806	OCL LEADLAG LOW FREQ	0.01 to 6.98 rad/s	12	1.00 rad/s		
807	OCL LEADLAG RATIO	2 - 20	12	10		
808	OCL PI PROP GAIN	0.10 - 128.00	11	2.00		
809	OCL PI LEAD FREQ	0.00 to 141.37 rad/s	11	1.00 rad/s		
810	OCL PI POSITIVE LIMIT	0 - 100% of TOP SPEED	11	100%		
811	OCL PI NEGATIVE LIMIT	0 - 100% of TOP SPEED	11	100%		
812	OCL TRIM RANGE	-100 to +100.0%	12	0.0%		
813	OCL PROP TRIM SELECT	• 1 = DISABLED • 2 = ENABLED	14	DISABLED		
814	OCL TYPE3 POSN REG EN	• 1 = DISABLED • 2 = ENABLED	14	DISABLED		
845	OCL REFERENCE	Output	10			
846	OCL RAMP OUTPUT	Output	10			
847	OCL FEEDBACK	Output	10			
848	OCL OUTPUT	Output	10			
849	OCL ENABLE	Output	10			

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 RFI-filters and the measures as described in this guidelines the **WL 3000** can be operated in the Industrial environments according to EN 50081-2 for Emission and EN 50082-2 for Immunity (performance criteria A). The cable length to the generator field is thereby limited to 75m.

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 WL3000 or perform a harmonics analysis for the complete installation based on delivered data.

Immunity

Immunity against Conducted and Radiated, High Frequency Disturbances

The WL3000 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 RFI-Filter as specified in Chapter 8, Accessories.

2. Because WL 3000 and RFI-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 (WL 3000 to generator field) 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 generator 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 RFI-filter (Output) and DC-Converter (Input).
   For line reactor selection refer to Table 8-3.

Mounting Instructions
(Refer to Figure H-1)

- The filter 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

Cabinet

Panel

AC-reactor

Converter WL 3000

AC-Input contactor

SCR-protecting fuses

RFI Filter

Circuit breaker

Terminals for 4-wire AC-Input cable (L1,L2,L3, PE)

Cabinet protection ground busbar

① Cable bracket

② Screen

③ Shielded signal conductor cable (feedback, reference)

④ Reduction units for voltage feedback

⑤ Shielded 2-wire generator field cable

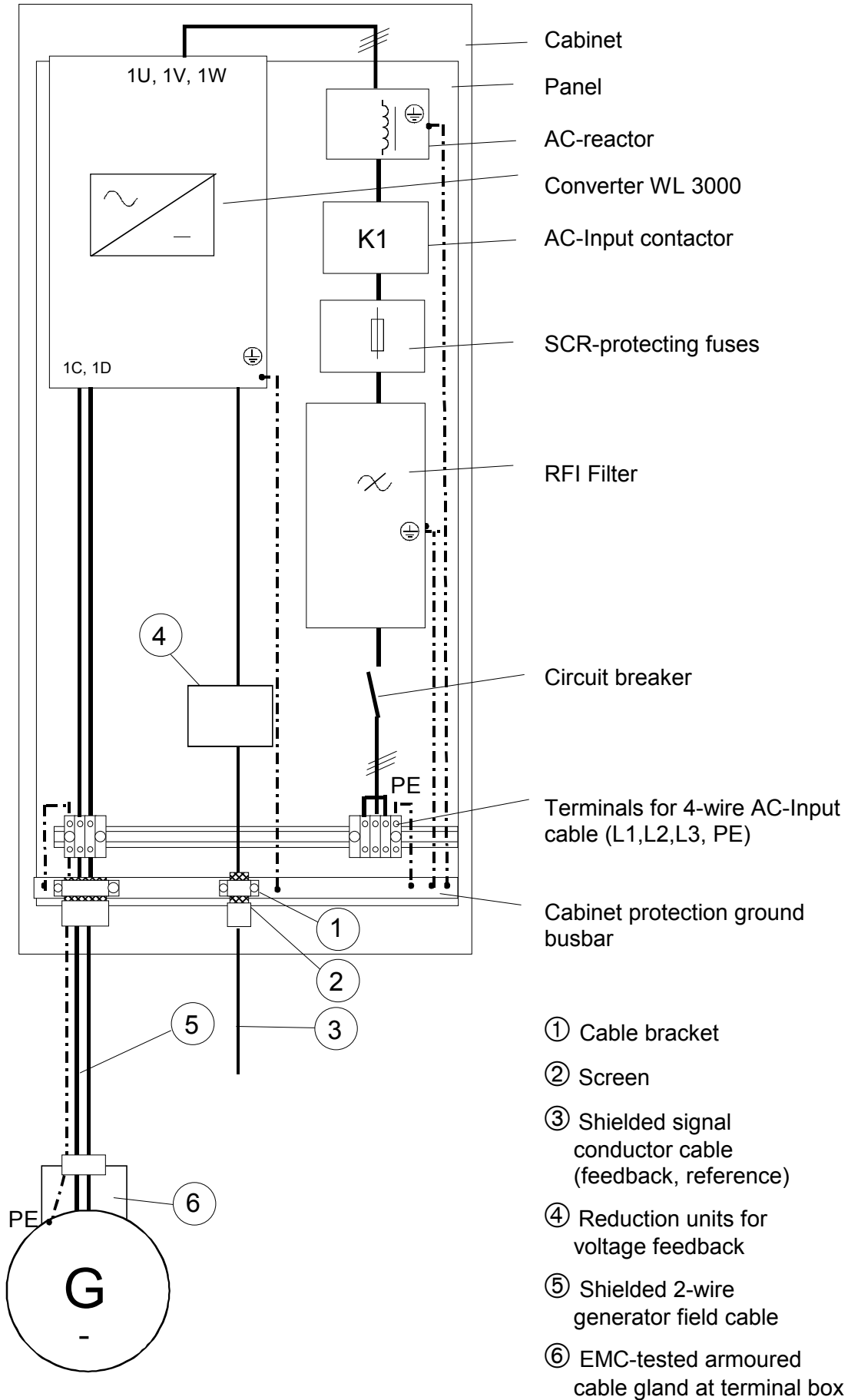⑥ EMC-tested armoured cable gland at terminal box

Figure H-1: Example for control cabinet configuration

Wiring Instruction

Cable for Generator Field

- The cable between WL 3000 / cabinet output and generator field shall be 3-wire screened cable (+, - and earth conductor green/yellow) as specified in Figure H-2.

- 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 WL 3000 with large connection area and good conductivity.

- The screen on the generator side must be solidly connected to the generator 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 field lead)

- The connections between filter and WL 3000 should be as short as possible!!
These conductors must be bound together (with tie wrap) forming a triangle in cross section.
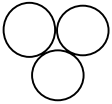
- Power and signal leads inside the cabinet must be distanced.

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.
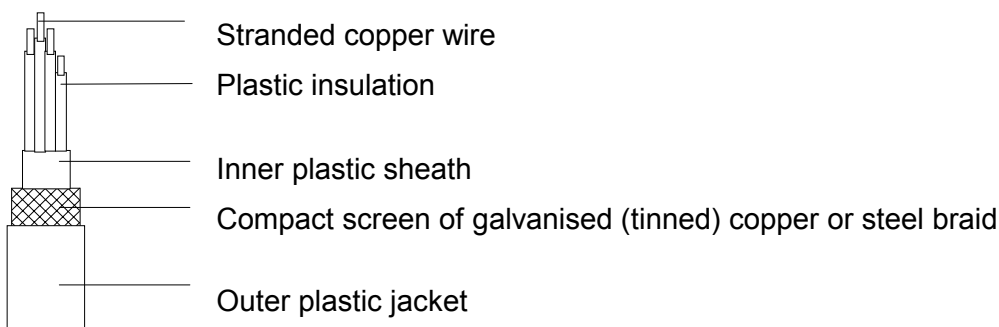The screen must be grounded at both ends.

Stranded copper wire

Plastic insulation

Inner plastic sheath

Compact screen of galvanised (tinned) copper or steel braid

Outer plastic jacket

Figure H-2: Specification for screened cable

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