

**ACCEL500  
OVERHEAD CRANE  
APPLICATION SOFTWARE**

**Part Number 695134.V13**

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Cleveland, Ohio**

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AVTRON INDUSTRIAL AUTOMATION, INC.  
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**ACCEL500**  
**OVERHEAD CRANE SOFTWARE**  
Part Number 695134.V13

**TABLE OF CONTENTS**

<u>SECTION</u>		<u>PAGE</u>
I	INTRODUCTION AND GENERAL INFORMATION .....	1-1
II	SELECTING THE CONTROL MODE .....	2-1
	2-1    Remote Operation .....	2-1
	2-2    Local Drive Keypad .....	2-1
	2-3    PC Control (Computer Diagnostic Software ADDaptACC) .....	2-2
III	KEYPAD AND PARAMETER DESCRIPTIONS .....	3-1
	3-1    ACCEL500 Keypad Operation .....	3-1
	3-2    Menu Navigation .....	3-3
	3-2.1    Navigation Tips .....	3-3
	3-2.2    Main Menu .....	3-4
	3-2.3    Monitor Menu (M1) .....	3-6
	3-2.4    Parameter Menu (M2) .....	3-7
	3-2.5    Keypad Control Menu (M3) .....	3-8
	3-2.6    Active Faults Menu (M4) .....	3-9
	3-2.7    Fault History Menu (M5) .....	3-11
	3-2.8    System Menu (M6) .....	3-12
	3-2.9    Expander Board Menu (M7) .....	3-19
	3-2.10    Editing a Numeric Value .....	3-20
	3-2.11    Editing a Configuration Value .....	3-20
	3-2.12    Editing a Selection Value .....	3-21
	3-2.13    Keypad Removal While Drive is Running .....	3-21
	3-2.14    Stop Fault .....	3-21
	3-2.15    Remote Keypad .....	3-21
IV	I/O PARAMETER DESCRIPTIONS .....	4-1
	4-1    Analog Inputs .....	4-1
	4-2    Analog Outputs .....	4-2
	4-3    Digital Inputs .....	4-3
	4-4    Digital Outputs .....	4-4
	4-5    Encoder Counter Inputs .....	4-4
	4-6    Drive Hardware Inputs .....	4-6

**TABLE OF CONTENTS (continued)**

<u>SECTION</u>	<u>PAGE</u>
V LOGIC SEQUENCE .....	5-1
5-1    Miscellaneous Logic .....	5-1
5-2    Remote Operation .....	5-1
5-2.1    EndSt Perm .....	5-1
5-2.2    EndSt Maint .....	5-2
5-2.3    Run Ok .....	5-2
5-2.4    Start Input.....	5-3
5-2.5    Run Enable.....	5-3
5-2.6    Run Fwd Cmd.....	5-4
5-2.7    Run Rev Cmd.....	5-4
5-2.8    MC Out .....	5-4
5-2.9    Slow Down Cmd.....	5-5
5-2.10    Infinite Variable Speed Logic .....	5-6
5-2.11    Trq Prv Cmd .....	5-7
5-2.12    Brk Hld Bit.....	5-7
5-2.13    Brakes .....	5-8
5-2.14    Brk Pdl Act .....	5-8
5-2.15    Brake Slip Logic .....	5-9
5-2.16    Ramp Delays.....	5-9
5-2.17    Command Words .....	5-9
5-2.18    Over Weight Alarm and Counter .....	5-10
5-2.19    Coast Stop .....	5-10
5-3    Local Drive Keypad.....	5-10
5-3.1    Local Run Mode .....	5-10
5-3.2    Button Stop Fault .....	5-10
5-4    ADDaptACC Software Control .....	5-11
5-5    Run Interface to Firmware .....	5-11
5-5.1    RunRequest.....	5-11
5-5.2    Coast Stop .....	5-11
5-5.3    MC Run.....	5-11
5-5.4    Cntrl Inhib.....	5-12
VI REFERENCING AND OUTER CONTROL BLOCK.....	6-1
6-1    Speed Reference.....	6-1
6-1.1    Joystick Reference Selection .....	6-1
6-1.2    Digital Reference Selection .....	6-2
6-1.3    Reference Location and Limit .....	6-3
6-1.4    Reverse Command and Conversion.....	6-4
6-1.5    Reference Enable .....	6-5
6-1.6    Ramp Hold .....	6-5
6-1.7    Low Pass and Delay .....	6-6

**TABLE OF CONTENTS (continued)**

<u>SECTION</u>	<u>PAGE</u>
6-1.8 Fast Ramp Times .....	6-6
6-1.9 Anti Snatch Mode .....	6-7
6-1.10 Ramp Times .....	6-7
6-1.11 Ramp Block Options.....	6-8
6-1.12 Firmware Ramp Block Outputs .....	6-9
6-2 PI Limiters .....	6-9
6-2.1 Open Loop Overvoltage Limiter.....	6-10
6-2.2 Open Loop Undervoltage Limiter.....	6-12
6-2.3 Open Loop Current Limiter .....	6-13
6-2.4 Open Loop Torque Limiter.....	6-14
6-2.5 Closed Loop Overvoltage Limiter .....	6-15
6-3 Speed Step Reference .....	6-15
6-3.1 Speed Step Scaling, Reverse and Limits.....	6-16
6-3.2 Open Loop Step Reference .....	6-16
6-3.3 Closed Loop Step Reference.....	6-17
6-4 Load Weight.....	6-18
6-5 Spare Blocks .....	6-19
6-5.1 Spare Reference Blocks .....	6-19
6-5.2 Spare Logic Blocks.....	6-21
 VII MOTOR CONTROL MODE .....	 7-1
7-1 Torque Reference.....	7-1
7-1.1 Torque Reference Blocks.....	7-1
7-1.2 Torque Reference Enable, Ramp and Limits .....	7-2
7-1.3 Torque Reference Firmware, Part I .....	7-2
7-1.4 Torque Reference Firmware, Part II .....	7-3
7-2 Open Loop Control .....	7-4
7-2.1 Torque Stabilizer.....	7-4
7-2.2 DC-Link Stabilizer.....	7-4
7-2.3 Flux Stabilizer.....	7-5
7-2.4 Open Loop Frequency Reference (MotorControlMode = 0) .....	7-6
7-2.5 Open Loop Speed Control (MotorControlMode = 1) .....	7-8
7-2.6 Open Loop Torque Control (MotorControlMode = 2) .....	7-9
7-3 Closed Loop Control.....	7-10
7-3.1 Closed Loop Speed Control (MotorControlMode = 3) .....	7-10
7-3.2 Closed Loop Torque Control (MotorControlMode = 4) .....	7-15
7-3.3 Flux Reference .....	7-17
7-3.4 Flux Modeling.....	7-18
7-3.5 Current Control Loop.....	7-19

**TABLE OF CONTENTS (continued)**

<u>SECTION</u>	<u>PAGE</u>
VIII MISCELLANEOUS CONTROL BLOCKS.....	8-1
8-1 Speed Comparators .....	8-1
8-2 Over Weight Alarm.....	8-2
8-3 Parameter Sets.....	8-2
8-4 Micro Speed.....	8-2
8-5 Motor Braking.....	8-3
8-5.1 DC Braking .....	8-3
8-5.2 Flux Braking .....	8-3
8-6 Switching Frequency .....	8-3
IX COMMUNICATIONS .....	9-1
9-1 Read and Write Standard ID Numbers .....	9-1
9-2 Special Field Bus Variables .....	9-3
9-3 Faults.....	9-3
9-4 System Bus.....	9-4
X FAULT CODES.....	10-1
10-1 Fault Actions.....	10-1
10-2 Stop Action .....	10-1
10-3 Fault Reset .....	10-2
10-4 Recording.....	10-2
10-5 Drive Faults.....	10-3
10-6 Drive Fault Options.....	10-6
10-7 Specific Faults Setup.....	10-7
10-7.1 Torque Proving Fault .....	10-7
10-7.2 Brake Open Fault .....	10-7
10-7.3 Brake Slip Fault.....	10-8
10-7.4 Micro Speed Fault.....	10-8
10-7.5 Speed Error Fault .....	10-8
10-7.6 Speed Off Fault .....	10-9
10-7.7 Both Directions Fault .....	10-9
10-7.8 Joystick Fault.....	10-9
10-7.9 Slack Rope Fault .....	10-9
10-7.10 Stall Fault .....	10-10
10-7.11 Brake Failure Mode.....	10-10
10-7.12 User Faults.....	10-11
10-7.13 Motor Over Temp.....	10-11
10-7.14 Thermistor .....	10-11
10-7.15 Under Load.....	10-12

**TABLE OF CONTENTS (continued)**

<u>SECTION</u>	<u>PAGE</u>
XI      QUICK STARTUP .....	11-1
11-1    Startup Wizard .....	11-1
11-2    Identification .....	11-2
APPENDIX A    Control Block Diagrams	
APPENDIX B    Parameter List	
APPENDIX C    Alphabetical Cross-Reference	
APPENDIX D    Parameter ID Number Cross-Reference	



**AVTRON ACCEL500  
OVERHEAD CRANE SOFTWARE  
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## **SECTION I**

### **INTRODUCTION AND GENERAL INFORMATION**

The ACCel500 Overhead Crane software is the standard application used by Avtron for bridge, trolley and hoist sections of the overhead crane market.

Following is a list of the major software features.

Communications options:

- Ethernet (Modbus, AB, GE)
- Devicenet
- Profibus DP
- Modbus
- System Bus (Fiber)

Reference location options:

- Fixed value
- Joystick
- Infinite variable

Speed reference features:

- Up to five fixed speeds
- Joystick shaping
- Fwd/Rev slow downs
- Load float
- Extended speed range
- Load weight extended speed control

Ramp Rates:

- Fast stop rates
- Extended speed range rates
- Low load rates
- Second mode rates

Crane features:

- End stop inputs
- Brake set and release logic
- Torque proving
- Load float
- Extended speed range
- Load weight extended speed control
- External brake pedal
- Setup wizard
- Running and over weight counters

Additional Crane Protection features:

- Fwd/Rev end stop inputs
- Torque proving
- Brake slip
- Brake feedback
- Contactor feedback
- Load float
- Speed Error
- Run off
- Overspeed / Tach loss
- Auto reset
- Mode fault
- Watchdog
- Under load
- Stall
- Over Weight

Firmware Options enabled:

- Start Wizard
- Identification (Motor and torque loop tuning)
- Motor control
  - Volt/Hertz
  - Open loop vector
  - Closed loop vector

- Induction/Permanent magnet motors
- Extended speed range to 320 Hz
- Non-linear gains for extended speed range
- Fault FIFO
- Signal analyzer with trigger

**IMPORTANT:**

Configuration information in this manual is provided to assist users in designing their own operational/functional schemes. It is deemed to be correct, however, if any errors or omissions exist, Avtron and/or Avtron representatives will not be liable to provide “warranty” on-site support. If one is designing his own configuration, or using one of the examples, it is highly recommended to test the operation prior to putting the drive into production.



## SECTION II

### SELECTING THE CONTROL MODE

The drive can be commanded to run from three distinct locations:

- Remote (from I/O or communications)
- Local drive keypad
- Computer diagnostic software

Most crane functions only work in the Remote mode. Local and computer modes are used for check out and troubleshooting.

The drive out of the box is defaulted to the local mode. When the mode is changed, it is stored even through power failure (retentive).

The drive is set up so control location can not be switched while the drive is running (*MC Run* is TRUE).

Crane features while not in Remote mode:

- Forward / Reverse End Stops still active
- Slow down is active but slows speed in both directions
- Extended speed range disabled.
- Brake proving and brake slip functions active

#### 2-1 REMOTE OPERATION

To transfer to remote operation, press the **loc/rem** button on the keypad while the drive is not running. The remote green LED should be on and the display should have the message “I/O term” displayed. If the **loc/rem** button is pressed while running in remote mode, the display will flash “Locked while RUNNING”.

Pressing the **start** button on the keypad will display a message “Keypad Control NOT ACTIVE”

*Control Place = 0* in this mode.

#### 2-2 LOCAL DRIVE KEYPAD

To transfer to local operation, press the **loc/rem** button on the keypad while the drive is not running. The local green LED should be on and the display should have the message “Keypad” displayed.

If the **loc/rem** button is pressed while running in local mode the display will flash “Locked while RUNNING”.

The **start/stop** buttons will now work and the drive will run at the entered keypad reference setpoint.

Set the keypad control parameters (Keypad Speed Direction, Keypad Speed Reference, Keypad Torque Direction, and Keypad Torque Reference) using menu M3 (Keypad Control).

If keypad communications goes down while in the local mode, the drive will fault (Keypad Comm).

*Control Place = 1 in this mode.*

### **2-3 PC CONTROL (COMPUTER DIAGNOSTIC SOFTWARE ADDaptACC)**

The drive must be off before the PC Control check box from the diagnostic software is checked to go into computer control. If the box is checked while running, control will not be transferred until the run is removed and the box is re-checked.

While in computer control, both the local and remote LEDs will flash along with the two display messages.

If computer communications goes down while in PC control, the drive will fault (Keypad Comm). When the fault is reset, control will revert to the previous control mode (local or remote).

Once in computer control, the drive can be started/stopped by the control buttons.

*Control Place = 2 in this mode.*

## SECTION III

### KEYPAD AND PARAMETER DESCRIPTIONS

#### 3-1 ACCel500 KEYPAD OPERATION

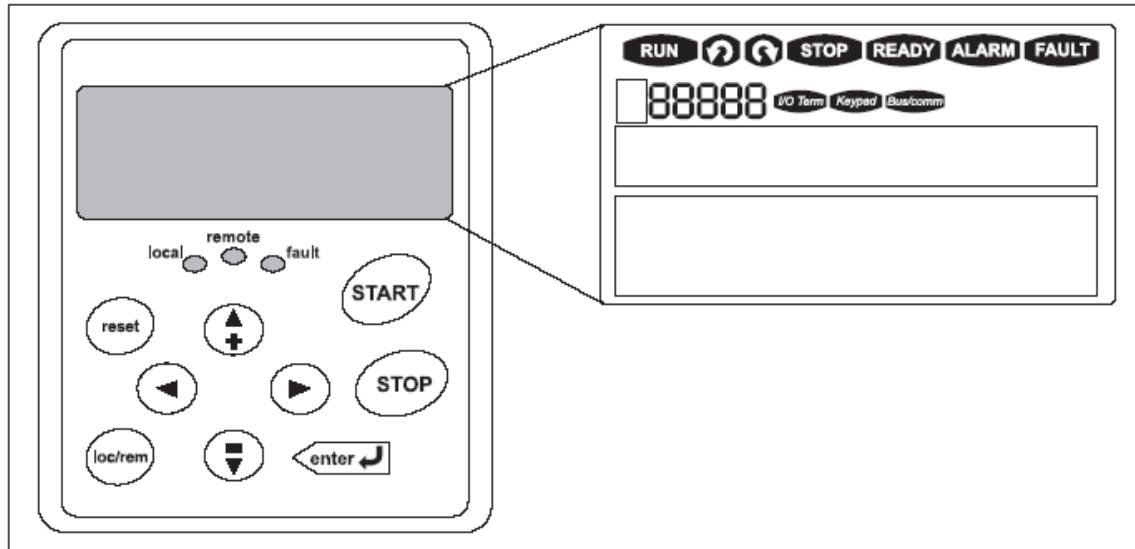


Figure 3-1. Keypad and Display

TABLE 3-1. NAVIGATION BUTTONS

<b>Button</b>	<b>Description</b>
	<p><b>Start</b>  This button operates as the START button for normal operation when “local” is selected as the active control.</p>
	<p><b>Enter</b>  This button is used in the parameter edit mode to save the parameter setting and move to the next parameter ...</p> <ul style="list-style-type: none"> <li>• to reset the Fault History if pressed while in the “Fault History” menu.</li> <li>• to confirm the acceptance of a change.</li> <li>• to change a virtual button status while in the “Button” menu.</li> <li>• to confirm the start-up list at the end of the Start-Up Wizard.</li> <li>• when the “Operate” menu is active, to exit the “Operate” submenu.</li> </ul>
	<p><b>Stop</b>  This button has two integrated operations. The button operates as STOP button during normal (local) operation ...</p> <ul style="list-style-type: none"> <li>• motor STOP from the keypad</li> <li>• used to reset the active faults.</li> </ul> <p>Note that if the STOP button is depressed for 3 seconds, a Stop Fault will occur in any control mode.</p>
	<p><b>Reset</b>  Resets the active faults.</p>
	<p><b>Local/Remote</b>  Switches between LOCAL and REMOTE control for start, speed reference and reverse functions.</p>
	<p><b>Left Arrow</b></p> <ul style="list-style-type: none"> <li>• navigation button, movement to left.</li> <li>• in parameter edit mode, exits mode, backs up one step.</li> <li>• cancels edited parameter (exit from a parameter edit mode).</li> <li>• When in “Operate” menu, will move backward through menu.</li> <li>• At end of “Start-Up Wizard”, repeats the “Start-Up Wizard” setup menu.</li> </ul>
	<p><b>Right Arrow</b></p> <ul style="list-style-type: none"> <li>• navigation button, movement to right.</li> <li>• enter parameter group mode.</li> <li>• enter parameter mode from group mode.</li> </ul>
	<p><b>Up and Down Arrows</b></p> <ul style="list-style-type: none"> <li>• move either up or down a menu list to select the desired menu item.</li> <li>• editing a parameter/password, while the active digit/character is scrolled.</li> <li>• increase/decrease the reference value of the selected parameter.</li> <li>• in the “Operate” menu, will cause the display of the current reference source and value and allow its change if the keypad is the active reference source. Used to set the password (if defined) when leaving the “Operate” menu.</li> <li>• scroll through the “Active Faults” menu when the ACCEL500 is stopped.</li> </ul>

TABLE 3-2. LCD STATUS INDICATORS

Indicator	Description
	<b>Run</b> Indicates that the ACCel500 is running and controlling the load. Blinks when a stop command has been given but the ACCel500 is still ramping down.
	<b>Counterclockwise Operation</b> The output phase rotation is BAC, corresponding to counterclockwise rotation of most motors.
	<b>Clockwise Operation</b> The output phase rotation is ABC, corresponding to clockwise rotation of most motors.
	<b>Stop</b> Indicates that the ACCel500 is stopped and not controlling the load.
	<b>Ready</b> Indicates that the ACCel500 is ready to be started.
	<b>Alarm</b> Indicates that there is one or more active drive alarm(s).
	<b>Fault</b> Indicates that there is one or more active drive fault(s).
	<b>I/O Terminal*</b> Indicates that the I/O terminals have been chosen for control (remote).
	<b>Keypad*</b> Indicates that the keypad has been chosen for control (local).

\*Both “I/O Terminal” and “Keypad” will be on and flashing when ADDaptACC is chosen for control.

TABLE 3-3. LED STATUS INDICATORS

Indicator	Description
<b>local</b>	<b>Local*</b> Indicates that the ACCel500 is ready to be started and operated from the Local mode.
<b>remote</b>	<b>Remote*</b> Indicates that the ACCel500 is operating and controlling the load remotely.
<b>fault</b>	<b>Fault</b> Indicates that there are one or more active drive fault(s).

\*Both “local” and “remote” will be flashing when ADDaptACC is chosen for control.

## 3-2 MENU NAVIGATION

### 3-2.1 NAVIGATION TIPS

- To navigate within one level of a menu, use the up and down arrows. Some menu's are password protected.
- Password entry is found in the Quick Menu. Once the proper password has been entered access to all menus are allowed until next power cycle of the drive.
- To move deeper into the menu structure and back out, use the right and left arrows.

- To edit a parameter, navigate to show that parameter's value, and press the right arrow button to enter the edit mode. When in edit mode, the parameter value will flash.
- When in edit mode, the parameter value can be changed by pressing the up or down arrow keys.
- When in edit mode, pressing the right arrow a second time will allow you to edit the parameter value digit by digit.
- To confirm the parameter change, you must press the **enter** button. The value will not change unless the **enter** button is pushed.
- Some parameters can not be changed while the ACCEL500 drive is running. The screen will display **LOCKED** if you attempt to edit these parameters while the drive is running. Stop the drive to edit these parameters.
- Appendix B lists all parameters for the application in menu order.

### **3-2.2 MAIN MENU**

The data on the control keypad are arranged in menus and submenus. The first menu level consists of M1 to M8 and is called the Main Menu. The structure of these menus and their submenus is illustrated in Figure 3-2.

The following menus are available with general access.

- 1.1:Monitor – Digital
- 1.2:Monitor – Analog
- 1.3:Monitor – IO
- 2.1:Parameters - Quick Menu
- 4:Active Faults
- 5:Fault History
- 6:System Menu

To access all menus the user password must be entered. The entry is located in the Quick Menu. To change the user password go to 2.3:Parameters – L2 Setpoints.

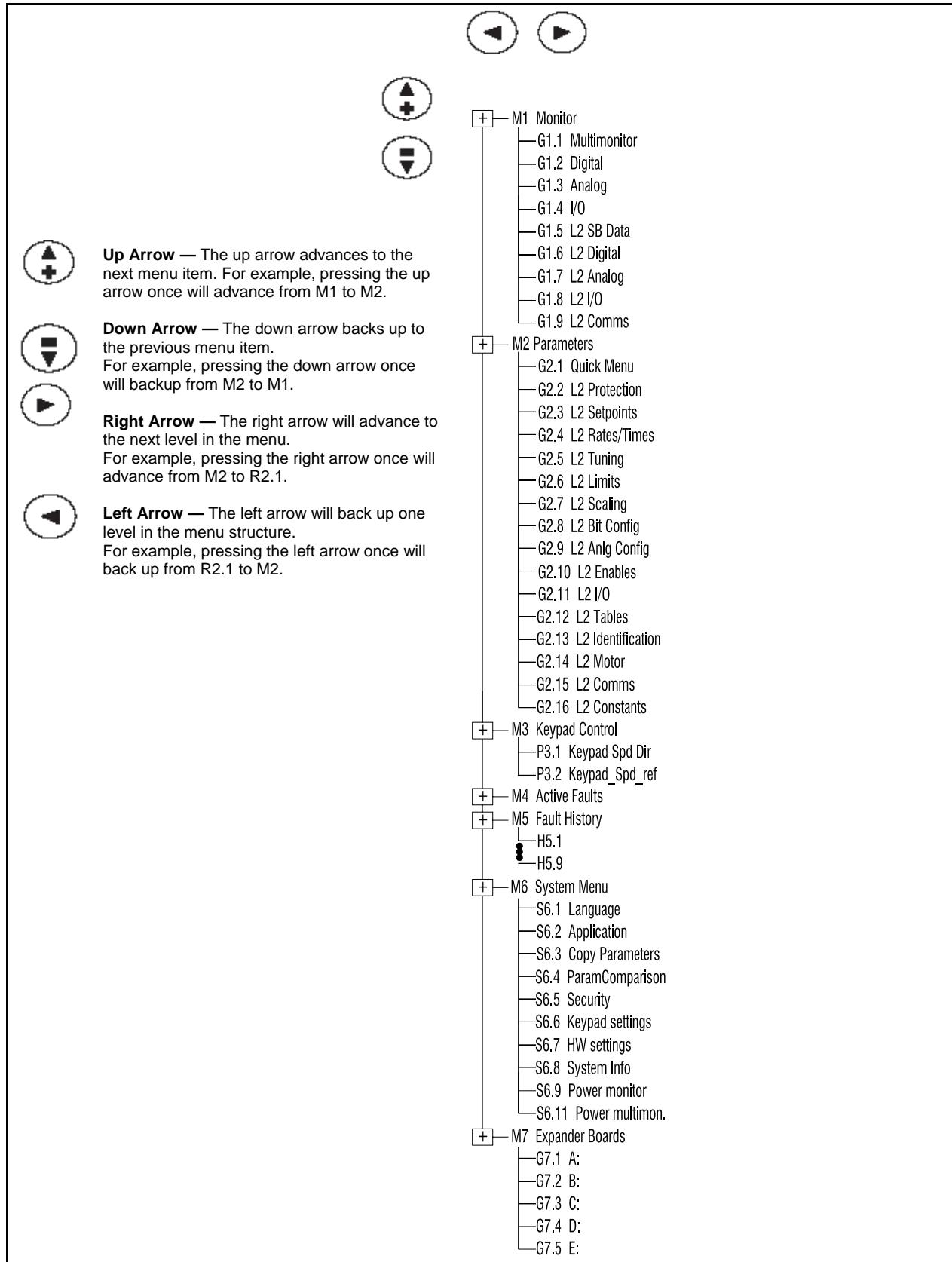


Figure 3-2. Main Menu Navigation

### 3-2.3 MONITOR MENU (M1)

The Monitoring Menu items are meant for viewing parameter values during operation. Monitored values are updated every 0.3 sec. Monitored items are identified by item numbers V1.1 to V1.xx, where “xx” varies by application.

Monitored parameters are not editable from this menu (See Parameter Menu [M2] to change parameter values).

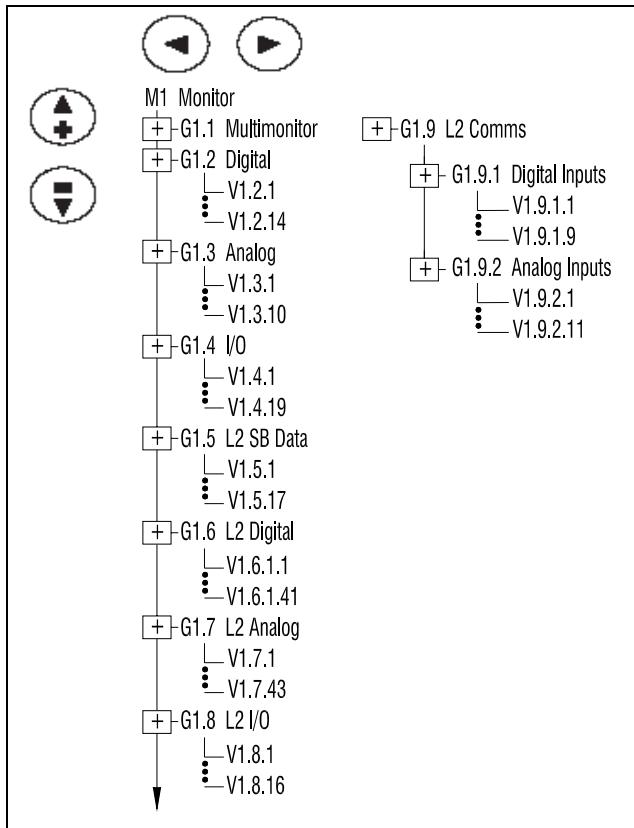


Figure 3-3. Monitor Menu Structure Example

#### Multimonitor (G1.1)

This parameter allows the viewing and selection (if allowed by System menu item, S6.11) of three simultaneously monitored items from the Monitored Menu Items. Use the right arrow key to select the item to be modified and then the up or down arrow keys to select the new item. Press the **enter** key to accept the change.

### 3-2.4 PARAMETER MENU (M2)

The Parameter Menu is a single or multi-level menu dependent upon the application in use, arranged by the parameter group items. See Figure 3-4. Parameters and parameter groups are explained in further detail in the ACCel500 Application Manual.

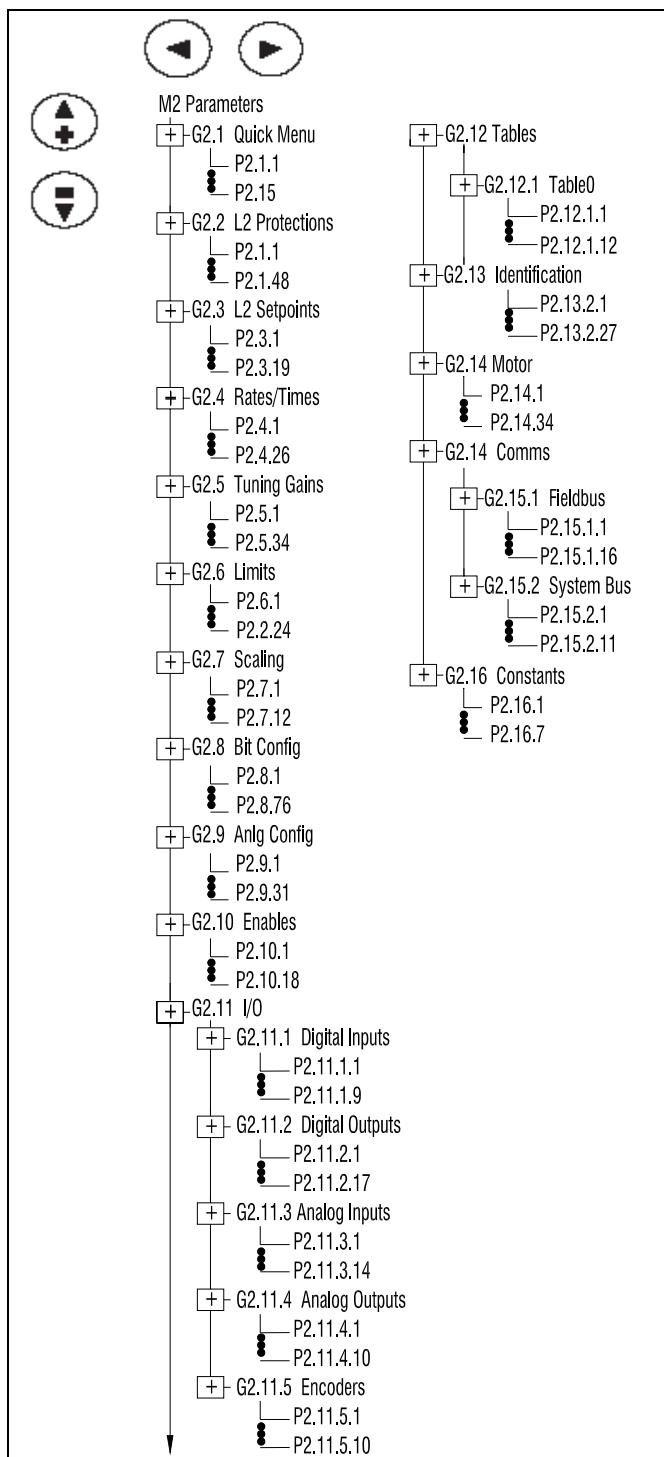


Figure 3-4. Parameter Menu

### **3-2.5 KEYPAD CONTROL MENU (M3)**

In the Keypad Control Menu, you can set the frequency reference, choose the motor direction for keypad operation when “local” mode is in operation. See Figure 3-5.

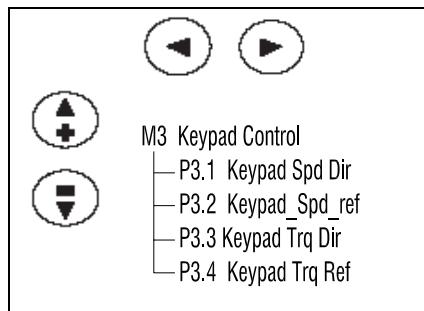


Figure 3-5. Keypad Control Menu

**P3.1** Range: Forward, Reverse  
**Keypad Spd Dir**

This allows the operator to change the rotation direction of the motor. This setting will not influence the rotation direction of the motor unless the keypad has been selected as the active control place.

**P3.2** Range: 0.00 to 60.00  
**Keypad\_Spd\_ref** Units: Hertz (Hz)

**P3.3** Range: Forward, Reverse  
**Keypad Trq Dir**

**P3.4** Range: 0.0 to 100.0  
**Keypad Trq Ref** Units: Percent (%)

### 3-2.6 ACTIVE FAULTS MENU (M4)

When a fault occurs, the ACCEL500 drive stops. The sequence indication F1, the fault code, a short description of the fault and the fault type symbol will appear on the display. In addition, the indication FAULT or ALARM is displayed and, in case of a FAULT, the red LED on the keypad starts to blink. If several faults occur simultaneously, the sequence of active faults can be browsed with the Browser buttons. See Figure 3-6.

The active faults memory can store the maximum of 10 faults in the sequential order of appearance. The fault remains active until it is cleared with either the STOP or reset buttons or with a reset signal from the I/O terminal. Upon fault reset the display will be cleared and will return to the same state it was before the fault trip.

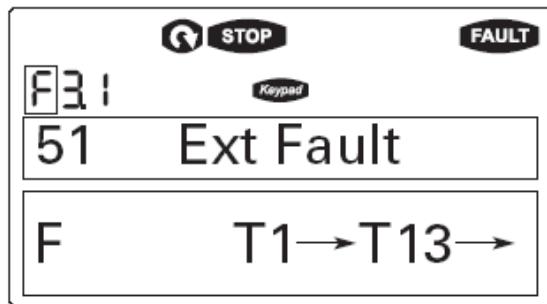


Figure 3-6. Active Fault Display Example

\*\*\*\*\*

#### **W A R N I N G**

Remove any External Start signals or permissives before resetting the fault to prevent an unintentional restart of the ACCEL500, which could result in personal injury or equipment damage.

\*\*\*\*\*

**Fault Type** Range: A, F, AR, FT

There are four different types of faults. See Table 3-4.

TABLE 3-4. FAULT TYPES

<b>Fault Type</b>	<b>Fault Name</b>	<b>Description</b>
A	Alarm	This type of fault is a sign of an unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The “A fault” remains in the display for about 30 seconds.
F	Fault	An “F fault” is a kind of fault that makes the drive stop. Actions need to be taken in order to restart the drive.
AR	Auto-Restart Fault	If an “AR fault” occurs the drive will also stop immediately. The fault is reset automatically and the drive tries to restart the motor. If the restart is not successful, a fault trip (FT) occurs.
FT	Fault Trip	If the drive is unable to restart the motor after an AR fault, an FT fault occurs. The effect of the “FT fault” is the same as that of the F fault — the drive is stopped.

**Fault Code** Range: 1 – 54

Fault codes indicate the cause of the fault. A list of fault codes, their descriptions, and possible solutions can be found in Appendix E — Application-Specific Faults.

**Fault Time** Range: T.1 – T.13**Data Record** In this menu, important data recorded at the time the fault is available. This feature is intended to help the user or the service person to determine the cause of fault. Table 3-5 indicates the information that is recorded.

TABLE 3-5. FAULT TIME DATA

Data	Units	Description
T.1 <sup>1</sup>	D	Counted operation days (Fault 43: Additional code)
T.2 <sup>1</sup>	hh:mm:ss (d)	Counted operation hours (Fault 43: Counted operation days)
T.3	Hz hh:mm:ss	Output frequency (Fault 43: Counted operation hours)
T.4	A	Motor current
T.5	V	Motor voltage
T.6	%	Motor power
T.7	%	Motor torque
T.8	V	DC bus voltage
T.9	°C	Unit temperature
T.10	—	Run status
T.11	—	Direction
T.12	—	Warnings
T.13	—	Zero speed

<sup>1</sup>Real time record.

### **3-2.7 FAULT HISTORY MENU (M5)**

All faults are stored in the Fault History Menu, which can be viewed by using the Browser buttons. Additionally, the Fault time data record pages are accessible for each fault as in the Active Faults Menu described above. See Figure 3-7.

The ACCel500 drive's memory can store a maximum of 30 faults, in the order of appearance. If there are 30 uncleared faults in the memory, the next occurring fault will erase the oldest fault from the memory.

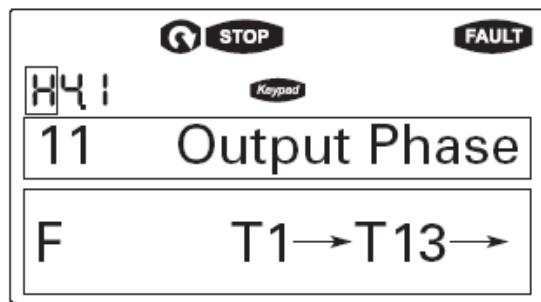


Figure 3-7. Sample Fault History Display

### 3-2.8 SYSTEM MENU (M6)

The controls associated with the general use of the drive, such as application selection, customized parameter sets or information about the hardware and software are located in the System Menu. Password protection can be activated by parameter P6.5.1.

Descriptions of the system menu parameters are illustrated in Figure 3-8.

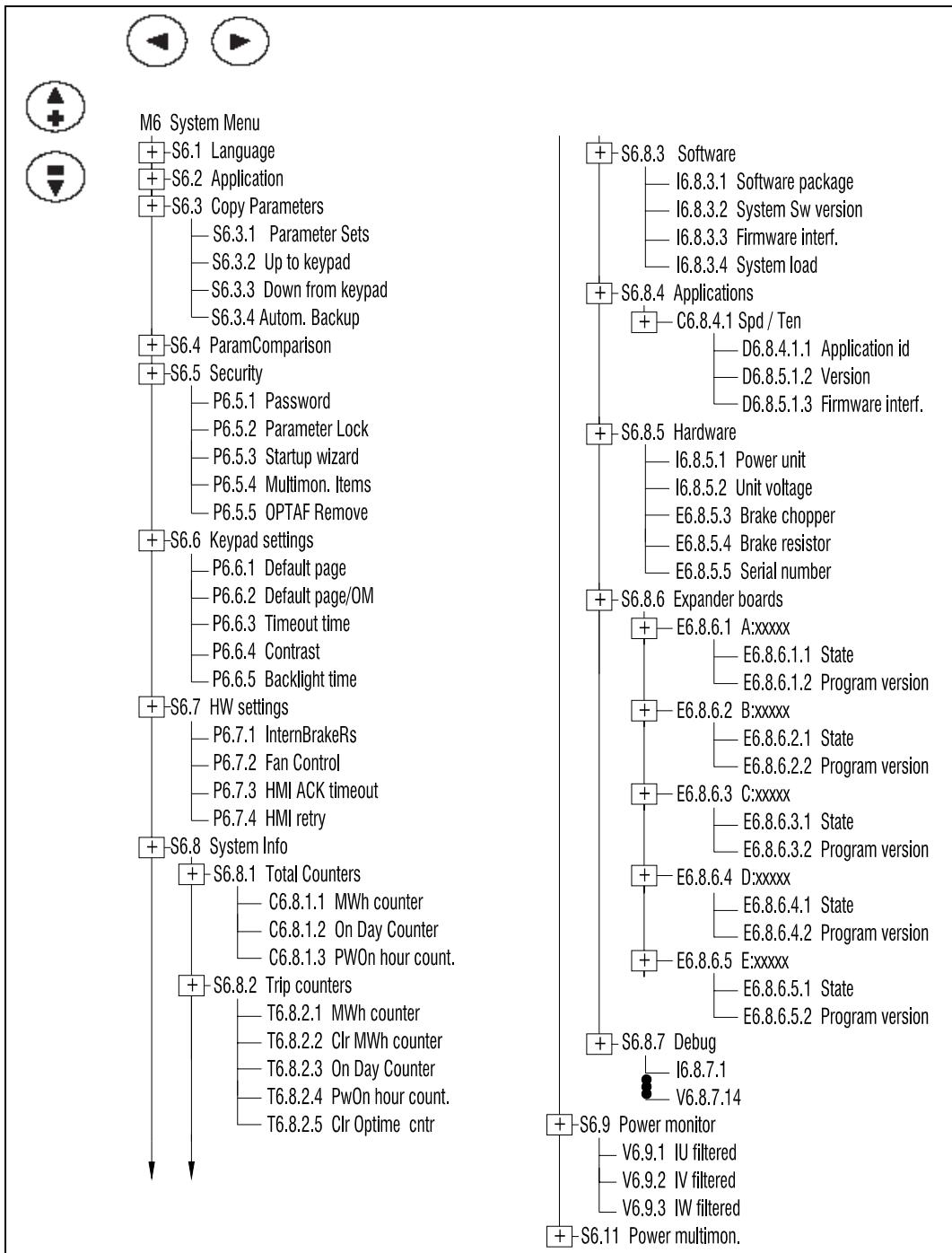


Figure 3-8. System Menu Structure

## System Menu Parameters

<b>S6.1</b>	Range: English	Default: English
<b>Language Selection</b>	This parameter offers the ability to control the ACCEL500 through the keypad in the language of your choice.	
<b>S6.2</b>	Range: Spd /Ten	
<b>Application</b>	<p>This parameter sets the active application.</p> <p>When changing applications, you will be asked if you want the parameters of the new application to be uploaded to the keypad. If you wish to load the new application parameters, push the <b>enter</b> button. Pushing any other button saves the parameters of the previously used application in the keypad.</p>	

### Copy Parameter Options (S6.3)

The parameter copy function is used when the operator wants to copy one or all parameter groups from one drive to another. All the parameter groups are first uploaded to the keypad; then the keypad is connected to another drive and then the parameter groups are downloaded to it (or possibly back to the same drive).

Before any parameters can successfully be copied from one drive to another, the drive must be stopped when the parameters are downloaded to it.

<b>S6.3.1</b> <b>Parameter Sets</b>	This parameter allows you to reload the factory default parameter values, and to store and load two customized parameter sets. These can be recalled at any time by selecting them from <i>Param Set Sel</i> and enabling by <i>Param Set En</i> . Run must be off to load a parameter set.	
<b>S6.3.2</b> <b>Up to keypad</b>	This function uploads all existing parameter groups to the keypad.	
<b>S6.3.3</b> <b>Down from keypad</b>	Range: 0 – 3	Default: 0 (All parameters) This function downloads one or all parameter groups from the keypad to the drive. 0 All parameters 1 All, no motor 2 Application parameters
<b>S6.3.4</b> <b>Autom. Backup</b>	Range: Yes, No	Default: Yes This parameter activates and deactivates the parameter backup function. When the Parameter backup function is activated, the keypad makes a copy of the parameters and settings in the currently active application. When applications are changed, you will be asked if you wish the parameters of the new application to be uploaded to the keypad. For this to happen, push the <b>enter</b> button. If you wish to keep the copy of the parameters of the previously used application saved in the keypad, push any other button.  Parameters saved in the parameter settings of S6.3.1 will be deleted when applications are changed. If you want to transfer the parameters from one application to another, you have to upload them to the keypad first.

**Parameter Comparison Options (S6.4)****S6.4**

**Parameter Comparison** With the Parameter Comparison function, you can compare the actual parameter values to the values of your customized parameter sets and those loaded to the control keypad.

The actual parameter values are first compared to those of the customized parameter Set1. If no differences are detected, a “0” is displayed on the lowermost line of the keypad.

If any of the parameter values differ from those of the Set1 parameters, the number of the deviations is displayed together with symbol P (e.g. P1 ÄE P5 = five deviating values).

By pressing the right arrow button once again, you will see both the actual value and the value it was compared to. In this display, the value on the Description line (in the middle) is the default value, and the one on the value line (lowermost line) is the edited value. You can also edit the actual value by pushing the right arrow button.

Actual values can also be compared to Set2, Factory Settings and the Keypad Set values.

**Security Parameter Options (S6.5)**

The Security submenu is protected with a password. Store the password in a safe place.

**S6.5.1** Range: 0 – 65535

Default: 0

**Password** Not used. Do not change from 0.

User Password located in L2 Setpoint sub menu is used to limit parameter access. When set to 0 no password is required for all access.

**P6.5.2** Range: ChangeEnable, ChangeDisabl

Default: ChangeDisabl

**Parameter Lock**

This function allows the user to prohibit changes to the parameters. If the parameter lock is activated, the text \*locked\* will appear on the display if you try to edit a parameter value.

This function does not prevent unauthorized editing of parameter values.

**P6.5.3** Range: Yes, No

Default: No

**Start-up Wizard** Not used. Do not enable.

The Startup wizard located in the Quick Menu is used instead.

**P6.5.4** Range: ChangeEnable, ChangeDisabl

Default: ChangeEnable

**Multimon. Items** The keypad display can display three actual monitored values at the same time. This parameter determines if the operator is allowed to replace the values being monitored with other values.

## Keypad Settings (S6.6)

There are five parameters (Default Page to Backlight Time) associated with the keypad operation:

<b>P5.6.1</b>	Default page	
	Default: 0 This parameter sets the view to which the display automatically moves as the Timeout Time expires or when the keypad power is switched on. If the Default Page value is 0, this function is not activated, i.e., the last displayed page remains on the keypad display.	
<b>P5.6.2</b>		
<b>Default page/OM</b>	Range: 0 – 65535	Default: 30
<b>Timeout time</b>	Here you can set the location in the Operating menu to which the display automatically moves as the set Timeout Time expires, or when the keypad power is switched on. See setting of Default Page parameter above.	
<b>P5.6.3</b>	Units: Seconds	
	The Timeout Time setting defines the time after which the keypad display returns to the Default Page. If the Default Page value is 0, the Timeout Time setting has no effect.	
<b>P5.6.4</b>		
<b>Contrast</b>	If the display is not clear, you can adjust the keypad contrast with this parameter.	
<b>P5.6.5</b>		
<b>Backlight time</b>	Range: 1 – 65535 or Forever	Default: 10
	Units: Minutes	
	This parameter determines how long the backlight stays on before going out. You can select any time between 1 and 65535 minutes or “Forever”.	

## Hardware Settings (S6.7)

The Hardware Settings submenu (S6.7) provides parameters for setting information on Internal brake resistor connection, Fan control, Keypad acknowledge timeout and Keypad retries.

**P6.7.1** Range: Connected – Not Connected                  Default: Connected  
**InternBrakeRs** With this function you tell the ACCel500 whether the internal brake resistor is connected or not.

If your drive has an internal brake resistor, the default value of this parameter is “Connected”. However, if it is necessary to increase braking capacity by installing an external brake resistor or if the internal brake resistor is disconnected, it is advisable to change the value of this function to “Not Connected” in order to avoid unnecessary fault trips.

The brake resistor is available as an option for all drives. It can be installed internally in frame sizes FR4 to FR6.

<b>P6.7.2</b>	Range: Continuous, Temperature	Default: Continuous
<b>Fan Control</b>	This function sets the control method of the ACCEL500 drive's cooling fan. You can set the fan to run continuously when the power is switched on or to run based on the temperature of the unit. If the latter function has been selected, the fan is switched on automatically when the _eatsink temperature reaches 60°C. The fan receives a stop command when the _eatsink temperature falls to 55°C. The fan runs for about a minute after receiving the stop command or switching on the power, as well as after changing the value from "Continuous" to "Temperature".	

The fan runs continuously, regardless of this setting, when the ACCEL500 drive is in RUN state.

<b>P6.7.3</b>	Range: 200 – 5,000	Default: 200
<b>HMI ACK timeout</b>	Keypad Units: ms	

This function allows the user to change the timeout of the Keypad acknowledgement time.

If the ACCEL500 drive has been connected to a PC with a serial cable, the default values of Keypad Acknowledge Timeout and Number of Retries to Receive Keypad Acknowledgement must not be changed.

If the ACCEL500 drive has been connected to a PC via a modem and there is delay in transferring messages, the value of Keypad Acknowledge Timeout must be set according to the delay as follows:

Example:

- Transfer delay between the ACCEL500 drive and the PC is found to be = 600 ms
- The value of Keypad Acknowledge Timeout is set to 1200 ms (2 x 600, sending delay + receiving delay)
- The corresponding setting is then entered in the [Misc] section of the file ACCELDRIVE.INI:  
Retries = 5  
AckTimeOut = 1200  
TimeOut = 5000

It must also be considered that intervals shorter than the Keypad Acknowledge Timeout time cannot be used in ACCEL500 drive monitoring.

<b>P6.7.4</b>	Range: 1 – 10	Default: 5
<b>HMI retry</b>	With this parameter, you can set the number of times the drive will try to receive an acknowledgement when it has not been received within the acknowledgement time (Keypad Acknowledge Timeout) or if the received acknowledgement is faulty.	

**System Information (S6.8)**

This section contains hardware and software information as well as operation information.

**S6.8.1**

**Total Counters** In the Total Counters page you will find information related to the ACCEL500 operating times, i.e., the total numbers of MWh, operating days, and operating hours. See Table 3-6.

Unlike the counters for the Trip Counters, these counters cannot be reset.

The Power On time counters, days and hours, operate whenever power is applied to the ACCEL500 drive.

TABLE 3-6. TOTAL COUNTERS

Number	Name	Description
C6.8.1.1	MWh counter	Megawatt hours total operation time counter
C6.8.1.2	On Day counter	Number of days the ACCEL500 drive has been supplied with power
C6.8.1.3	PWOn hour count.	Number of hours the ACCEL500 drive has been supplied with power

**S6.8.2**

**Trip counters** The Trip Counters are counters whose values can be reset to zero. The resettable counters are shown in Table 3-7.

TABLE 3-7. TRIP COUNTERS

Number	Name	Description
T5.8.2.1	MWh counter	Megawatts hours since last reset
P5.8.2.2	Clear MWh counter	Resets megawatts hours counter
T5.8.2.3	Power On day counter	Number of days the ACCEL500 drive has been run since the last reset
T5.8.2.4	Power On hour counter	Number of hours the ACCEL500 drive has been run since the last reset
P5.8.2.5	Clr Optime cntr	Resets the operating day and hour counters

Note: The Trip Counters operate only when the motor is running.

**S6.8.3**

**Software** The Software information page includes information on the following software related topics:

TABLE 3-8. SOFTWARE INFORMATION

Number	Name	Description
I6.8.3.1	Software package	ACC00031V003
I6.8.3.2	System Sw version	11.53.6536
I6.8.3.3	Firmware interf.	4.37
I6.8.3.4	System load	G9.1

**S6.8.4**

**Applications** The Application information page includes information on not only the application currently in use but also all other applications loaded into the ACCEL500. The information available is shown in Table 3-9. Note that the “x” in the table refers to the sequential number of the application in the list.

TABLE 3-9. APPLICATIONS INFORMATION

Number	Content
<b>A6.8.4.x</b>	Application name
<b>D6.8.4.x.1</b>	Application ID
<b>D6.8.4.x.2</b>	Version
<b>D6.8.4.x.3</b>	Firmware interface

**S6.8.5**

**Hardware** The Hardware information page provides information on the following hardware-related topics.

TABLE 3-10. HARDWARE INFORMATION

Number	Content
<b>I6.8.5.1</b>	Number of the power unit
<b>I6.8.5.2</b>	Nominal voltage of the unit
<b>I6.8.5.3</b>	Brake chopper
<b>I6.8.5.4</b>	Brake resistor
<b>I6.8.5.5</b>	Serial Number

**S6.8.6**

**Expander boards** This parameter and its sub-items provide information about the basic and option boards plugged into the control board as shown in Table 3-11. Note that the “x” in the table refers to the sequential number of the slot, with slot A being “1” and slot E being “5”.

TABLE 3-11. EXPANDER BOARD INFORMATION

Number	Content
<b>E6.8.6.x</b>	Slot “x” board identification
<b>E6.8.6.x.1</b>	Operating state
<b>E6.8.6.x.2</b>	Software version

**S6.8.7 Debug Menu**

This menu is meant for advanced users and application designers. Contact the factory for any assistance needed.

Power Monitor (S6.9)

This menu shows the actual filtered current in amps.

TABLE 3-12. POWER MONITOR INFORMATION

Number	Content
<b>C6.9.1</b>	IU filtered
<b>C6.9.2</b>	IV filtered
<b>C6.9.3</b>	IW filtered

### 3-2.9 EXPANDER BOARD MENU (M7)

The Expander Board Menu makes it possible for the user:

- to see what expander boards are connected to the control board and
- to access and edit the parameters associated with the expander board.
- monitor option board values.

Each option board has its own set of parameters.

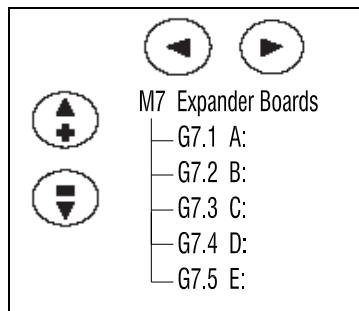


Figure 3-9. Expander Board Menu Structure

#### Example of Expander Board Parameters for Option Board A9

<b>P7.1.1.1</b>	Range: 1 – 5	Default: 3
<b>AI1 Mode</b>	Analog Input 1 input options:	
1	0 to 20 mA	
2	4 to 20 mA	
3	0 to 10V	
4	2 to 10V	
5	-10 to +10VP	
<b>P7.1.1.2</b>	Range: 1 – 5	Default: 1
<b>AI2 Mode</b>	Analog Input 2 input options:	
1	0 to 20 mA	
2	4 to 20 mA	
3	0 to 10V	
4	2 to 10V	
5	-10 to +10VP	
<b>P7.1.1.3</b>	Range: 1 – 4	Default: 1
<b>AO1 Mode</b>	Analog Output 1 output options:	
1	0 to 20 mA	
2	4 to 20 mA	
3	0 to 10V	
4	2 to 10V	

### 3-2.10 EDITING A NUMERIC VALUE

Use the following procedure to edit numeric parameter values.

1. To edit a parameter, navigate to show that parameter and its value.
2. Press the right arrow button to enter the edit mode. In edit mode, the parameter value will flash.
3. Pressing the up or down arrow keys to change the parameter value.

If you press the right arrow a second time, the leftmost digit of the parameter value will flash. You can then use the up or down arrow keys to change the value of the flashing digit.

Press the right arrow again to select the next digit, and repeat the process to change the rest of the digits in the parameter value.

4. When you are finished, you must press the **enter** button to confirm the parameter change.  
**The new value will not be saved unless the enter button is pushed.**

### 3-2.11 EDITING A CONFIGURATION VALUE

A configuration parameter gets its data from the parameter whose ID number you enter here. Parameter ID numbers are listed in Appendix D.

Configuration parameters can have values ranging from 1 to 2000. Values 1 to 1000 indicate firmware values; values 1001 to 2000 indicate application values.

Use the following procedure to edit configuration parameter values.

1. To edit a parameter, navigate to show that parameter and its value.
2. Press the right arrow button to enter the edit mode. In edit mode, the parameter value will flash.
3. Pressing the up or down arrow keys to change the parameter value.

If you press the right arrow a second time, the rightmost digit of the parameter value will flash. You can then use the up or down arrow keys to change the value of the flashing digit.

Press the left arrow to select the next digit, and repeat the process to change the rest of the digits in the parameter value.

4. When you are finished, you must press the **enter** button to confirm the parameter change.  
**The new value will not be saved unless the enter button is pushed.**

### **3-2.12 EDITING A SELECTION VALUE**

Some parameter values are displayed as text. For example, parameter S6.1 (Language) can be set to four values: English, Español (Spanish), Français (French), or Português (Portuguese). Use the following procedure to edit a parameter selection value.

1. To edit a parameter, navigate to show that parameter and its value.
2. Press the right arrow button to enter the edit mode. In edit mode, the parameter value will flash.
3. Pressing the up or down arrow keys to change the parameter value.
4. When you are finished, you must press the **enter** button to confirm the parameter change.  
**The new value will not be saved unless the enter button is pushed.**

### **3-2.13 KEYPAD REMOVAL WHILE DRIVE IS RUNNING**

If the keypad is removed while the drive is running, a Keypad Comm fault (52) will result. The drive will also be placed in remote control mode. Clear the Keypad Comm fault by pressing the **reset** button. To restore local keypad control, press the **loc/rem** button.

### **3-2.14 STOP FAULT**

The Keypad **stop** button will fault the drive and operate as a coast stop if held for three seconds, regardless which mode is active.

### **3-2.15 REMOTE KEYPAD**

The Control Keypad is removable. It can be mounted externally and connected with the appropriate cable.



## SECTION IV

### I/O PARAMETER DESCRIPTIONS

**See Appendix A-3**

#### **4-1 ANALOG INPUTS**

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>AIN3 Slot ID to AIN4 Slot ID</i>	ACFG	0
<i>AIN1 Gain to AIN4 Gain</i>	CAL	1.00
<i>AIN1 Off to AIN4 Off</i>	CAL	0.0
<i>AIN1 Tc to AIN4 Tc</i>	CAL	0.1 seconds
<i>AII Type to AI4 Type</i>	APB	
<i>AIN1 to AIN4</i>	APB	

#### **Description**

Four analog inputs are available in this software. Two of the analog inputs are available with the standard board in slot A. The other two require additional I/O boards to take advantage of them. When Stepless ( Joystick ) type is selected by the startup wizard the first analog input is defaulted for the speed command.

The slot ID configures the location of the analog input. The first digit of the ID is the slot location: Slot A-E = 1-5. The second digit is the order of the input on the board. 0 = first analog input. The first two analog inputs are hard set to the default input board inputs.

The Type of board is read from the I/O slot and can be viewed as *AII Type-AI4 Type* as follows:

<b>Mode</b>	<b>AI 1 – 4</b>	<b>Pre-scaling</b>
0 = Unknown	0 – 10,000	0 – 10,000
1 = 0-20 ma	0 – 10,000	0 – 10,000
2 = 4-20 ma	2,500 – 10,000	0 – 10,000
3 = 0-10 V	0 – 10,000	0 – 10,000
4 = 2-10 V	2,500 – 10,000	0 – 10,000
5 = +/-10 V	0 – 10,000	-10,000 – 10,000

Scaling for the first analog input is done as follows:

$$\text{Value 1} = (\text{Pre_Scaling} \times \text{AIN1 Gain} / 100) + \text{AIN1 Off}$$

*AII Tc* is a low pass filter on the input, entered in seconds.

*AIN1* is the value after scaling and filtering.

## 4.2 ANALOG OUTPUTS

Parameters	Type	Default
<i>AOUT1 ID</i> to <i>AOUT2 ID</i>	ACFG	<i>Motor Current</i> <i>Motor Speed</i> <i>Zero Analog</i>
<i>AOUT1 Zero</i> to <i>AOUT2 Zero</i>	CAL	0.0
<i>AOUT1 Cal</i> to <i>AOUT2 Cal</i>	CAL	1.00
<i>AOUT1 TC</i> to <i>AOUT2 TC</i>	CAL	0.10 seconds
<i>AOUT2 Slot ID</i>	ACFG	10, 0, 0, 0
<i>AOUT1 Val</i> to <i>AOUT2 Val</i>	APB	
<i>AOut2 Config</i>	E	Motor Current

### Description

Two analog outputs are available in this software. One analog output is available with the standard board in slot A. The other one require additional I/O boards to take advantage of them.

The startup wizard selects which function is desirable for the second analog output (*AOut2 Config*). *AOUT2 Zero* and *AOUT2 Cal* is also adjusted for the proper scaling as follows:

Function	Scaling
Motor current	0 – 200%
Motor Speed	0 – 100%
Motor Power	0 – 200%
Motor Torque	0 – 200%
Configurable	Not set.

The ID configures which parameter value to map to the analog output.

The slot ID configures the location of the analog output. First digit of the ID is the slot location: Slot A-E = 1-5. Second digit is the order of the output on the board; 0 = first analog output. The first analog output is hard set to the default input board output.

After scaling, the value can be viewed as *AOUTx\_Val* with a range of 0-10,000; +/-10,000 for ±10 volt boards.

The Type of board must be known for the scaling factor:

- 0 = Unknown
- 1 = 0-20 mA = 0-10,000 value
- 2 = 4-20 mA = 2,500 -10,000 value
- 3 = 0-10 V = 0-10,000 value
- 4 = 2-10 V = 2,500 -10,000 value
- 5 = +/-10 V = 0-10,000 value

Scaling for the first analog output is done as follows:

$$\text{Value 1} = (\text{AOUT1 ID value} + \text{AOUT1 Zero}) \times \text{AOUT1 Cal} / 100$$

Note: 10,000 is the board's full output.

$AOUTx Tc$  is a low-pass filter on the output entered in seconds.

### 4-3 DIGITAL INPUTS

Parameters	Type	Default
DIN7 Slot ID , DIN15 Slot ID	ACFG	40, 41, 42, 43, 0, 0, 0, 0, 0
DIN 1 to DIN 8	DPB	
Not DIN1 to Not DIN8	DPB	
DIN 9 to DIN 15	DPB	

#### Description

Fifteen digital inputs are available in this software. Six digital inputs are available with the standard board in slot A. The other inputs require additional I/O boards to take advantage of them.

The Startup wizard pre-defines the digital inputs based on the reference mode selected and if the option board is present in slot D as follows:

Digital Input	3 Step	5 Step	2 Step Inf Var.	3 Step Inf Var.	Stepless
DIN1	Raise	Raise	Raise	Raise	Raise
DIN2	Lower	Lower	Lower	Lower	Lower
DIN3	2 <sup>nd</sup> Speed	2 <sup>nd</sup> Speed	Accelerate	Hold	
DIN4	3 <sup>rd</sup> Speed	3 <sup>rd</sup> Speed		Accelerate	
DIN5		4 <sup>th</sup> Speed			
DIN6		5 <sup>th</sup> Speed			
DIN7 – Opt	Fwd Stop	Fwd Stop	Fwd Stop	Fwd Stop	Fwd Stop
DIN8 – Opt	Rev Stop	Rev Stop	Rev Stop	Rev Stop	Rev Stop
DIN9 – Opt	Fwd Slow Dwn	Fwd Slow Dwn	Fwd Slow Dwn	Fwd Slow Dwn	Fwd Slow Dwn
DIN10 - Opt	Rev Slw Dwn	Rev Slw Dwn	Rev Slw Dwn	Rev Slw Dwn	Rev Slw Dwn

The slot ID configures the location of the digital input. The first digit of the ID is the slot location: Slot A-E = 1-5. The second digit is the order of the input on the board; 0 = first digital input. The first six digital inputs are hardcoded to the default input board inputs.

The first eight digital inputs have invert bits that can be viewed as  $DIN x$  and  $Not DIN x$ .

## 4-4 DIGITAL OUTPUTS

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>DOUT1 ID</i> to <i>DOUT6 ID</i>	BCFG	<i>Zero Bit, Rel Brakes, MC Fault,</i> <i>Zero Bit, Zero Bit, Zero Bit</i>
<i>DOUT1 Inv</i> to <i>DOUT6 Inv</i>	En	0
<i>DOUT4 Slot ID</i> to <i>DOUT6 Slot ID</i>	ACFG	40, 0
<i>DO1 Config, D04 Config</i>	En	<i>Ov Wt Alarm, Brk Slip Mode</i>

### Description

Six digital outputs are set up in the software. Three digital outputs are available with the standard board in slot A or B. The other three require additional I/O boards to take advantage of them.

The ID configures which parameter to map to the digital output.

The startup wizard selects which function is desirable for the first and if the optional 115 VAC I/O board is present the fourth digital output located in slot D (*DO1 Config, D04 Config*).

The slot ID configures the location of the digital output. The first digit of the ID is the slot location: Slot A-E = 1-5. The second digit is the order of the output on the board; 0 = first digital output.

The value bit can be inverted before being sent out by *DOUTx Inv* parameters.

## 4-5 ENCODER COUNTER INPUTS

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Enc1 Slot ID</i>	ACFG	30 ( Slot C first encoder )
<i>Enc1 Mlt</i> ,	CAL	1000
<i>Enc1 Div</i>	CAL	1000
<i>Enc1 TC</i>	CAL	1 ms
<i>Counter1 Dec</i>	CAL	0
<i>Counter1 Mult</i>	CAL	1
<i>Counter1 Hld</i>	BCFG	1
<i>Counter1 Res</i> ,	BCFG	<i>Zero Bit</i>
<i>Counter1</i>	En	<i>Zero Bit</i>
<i>Encoder1FiltTime</i>	Cal	Disabled
<i>Enc1_Out</i>	APB	1 ms
<i>Counter1</i>	APB	

**Frequency Description:**

The encoder input is available in this software, but require additional option board to enable.

When closed loop speed control is requested, the first encoder feedback is always selected for speed feedback. This is taken from the board, and is not affected by the parameter scalings. If the encoder board is present in Slot C the Startup wizard will set the drive to close loop. Otherwise the Wizard will setup the drive for open loop control.

The startup wizard also prompts for the encoder PPR which it sets into the option board parameters. The wizard also inverts the feedback to get proper polarity.

The slot ID configures the location of the encoder input. First digit of the ID is the slot location: Slot A – E = 1 – 5. Second digit is the order of the output on the board. 0 = first encoder input. On option board A7, the second frequency input is input 3 of the board.

The frequency feedback is scaled by the option board by entering the proper PPR in the option board parameters. It is assumed that the encoder is mounted directly to the motor with no gear ratio and value read from the board is in motor rotation in hertz for speed feedback.

$$\text{Value from board} = \frac{(\text{Frequency Hz}) \times (60 \text{ s/m}) \times (\text{Nominal motor frequency Hz})}{(\text{PPR}) \times (\text{Nominal motor speed RPM})}$$

The frequency feedbacks can be scaled and filtered and used for other functions such as speed reference.

*Enc1\_Out* = The encoder input scaled by (motor Hz x *Enc1\_Mult / Enc1\_Div*) with a low pass filter of time constant *Enc1\_Tc*.

A typical application will have a second encoder input as the line speed reference. Comparing the two encoder feedbacks is the basis for the diameter calculation.

**Counter Description:**

The encoder input has a pulse counter associated with it. This is a bi-directional counter with hold and reset bits. The value of the counter will be stored and recalled through drive power loss (retentive).

Three words read from the encoder board contain the raw motor rotations. The first two offer complete revolution counter and the third is the fraction of rotation.

$$\text{Counter1} = \text{Motor rotations} \times \text{Counter1 Mult} / \text{Counter1 Dec}$$

*Counter1\_Hld* will hold the counter at its current count when high.

*Counter1\_Res* will reset the counter to zero when high.

## 4-6 DRIVE HARDWARE INPUTS

<b>Parameters</b>	<b>Type</b>	<b>Description</b>
<i>Motor Torque</i>	APB	Percent of motor
<i>Motor Voltage</i>	APB	Volts
<i>Motor Power</i>	APB	Percent of motor
<i>Motor Current</i>	APB	Amps
<i>Unit Temperature</i>	APB	C.

## SECTION V

# LOGIC SEQUENCE

See Appendix A-4 and A-5

### 5-1 MISCELLANEOUS LOGIC

*Zero Bit* - Set to FALSE. ID number for this bit is 1002.

*One Bit* - Set to TRUE. ID number for this bit is 1001.

*Zero Analog* = 0

*One Analog* = 1

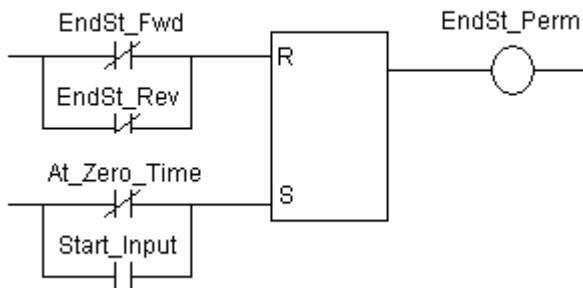
*Int Ten* = 10

*Int Hundred* = 100

*Int Thousand* = 1000

### 5-2 REMOTE OPERATION

#### 5-2.1 EndSt Perm

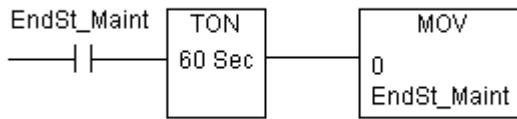


*EndSt Perm* goes high if either of the end stop inputs goes low. It will stay high until the drive has stopped and no run is commanded.

This is used to initially coast the drive and apply the brakes. After stopping the logic will allow the section to back out of the condition.

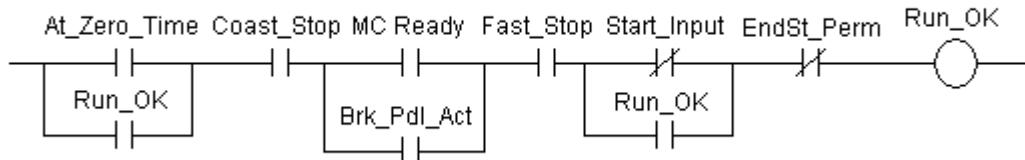
To use end stop functionality set *EndSt Fwd* and *EndSt Rev* to digital inputs that are normally high.

### 5-2.2 EndSt Maint



*EndSt Maint* allows the drive to go beyond the end stops to test the ultimate limits. A sixty second timer is programmed to disable this feature. If a longer time is required to get to the ultimate limit this may have to be set again.

### 5-2.3 Run OK



The *Run OK* bit is used to stop the drive in any control mode. The drive will go to a coast stop and the brakes applied.

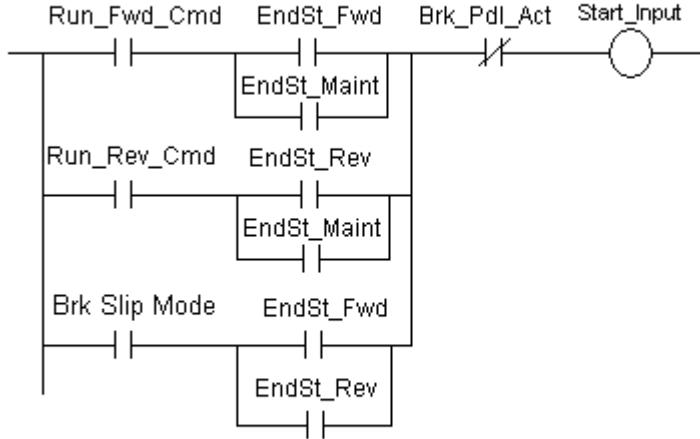
For the Crane software, the drive run inputs must be turned off along with the motor at zero speed before *Run OK* can be reset.

*Coast Stop* and *Fast Stop* are defaulted to *One Bit*.

*EndSt Perm* is derived from the forward and reverse limit switch inputs that are defaulted to TRUE.

When *Brk Pdl Act* is high *MC Ready* drops out. The drive is coasting at this point with the brakes off. To keep the brakes from setting *MC Ready* is bypassed in this mode.

### 5-2.4 Start Input



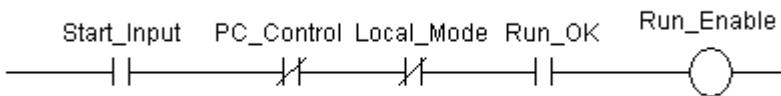
Normally *Start Input* is high when either *Run Fwd Cmd* or *Run Rev Cmd* is active.

If the section is in one of the travel end stops, only the opposite travel is allowed to be selected. A maintenance selection is available to bypass the end stops and to test the ultimate limit. This selection is only active for 60 seconds after being set.

If an external brake pedal is active, the drive is turned off and coasts.

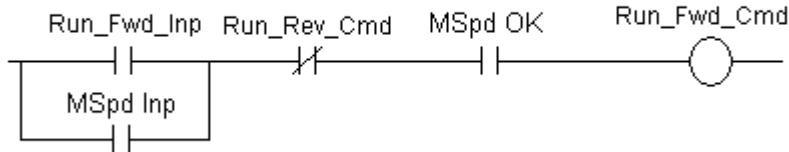
Brake slip can be enabled to check to see if the motor is turning when not in run. If this is detected *Brk Slip Mode* goes high to turn the drive on and try and regulate to zero speed. The brakes do not open under this condition. The drive will remain on until a motion is commanded or is faulted.

### 5-2.5 Run Enable



*Run Enable* is enabled when the drive is OK, is in remote mode, and a run is commanded.

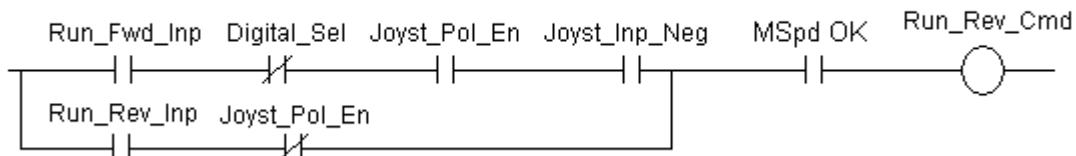
### 5-2.6 Run Fwd Cmd



*Run Fwd Inp* is defaulted to the first digital input and provides the run command.

*MSpd Inp* can also provide the run command. If Micro speed is left on for a period of time the drive will fault out.

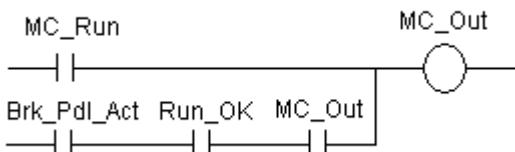
### 5-2.7 Run Rev Cmd



*Run Rev Inp* is defaulted to the second digital input and provides the run command.

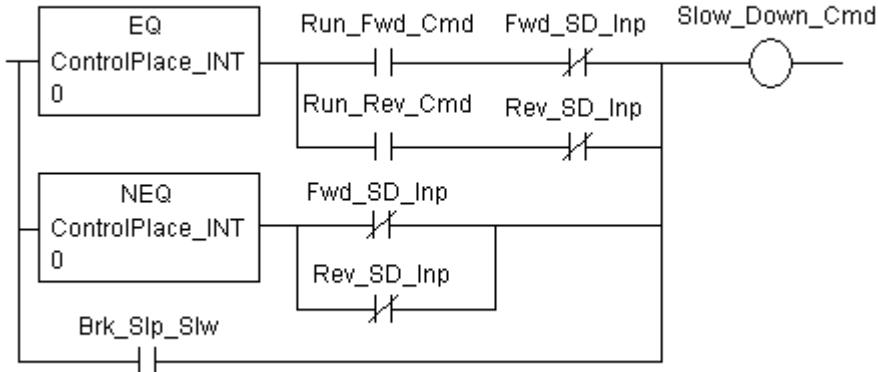
If the direction command is desired by joystick polarity, set *Joyst Pol En* parameter.

### 5-2.8 MC Out



*MC Out* is used to control the motor contactor if available after the inverter. *MC Run* commands the contactor to open or close. *Brk Pdl Act* allows the contactor to remain closed as long as the brake pedal is active. The drive is in coast state with brakes released during this mode.

### 5-2.9 Slow Down Cmd



Two separate slow down inputs are available. For safety reasons, these inputs must be normally high and go low during slow down region.

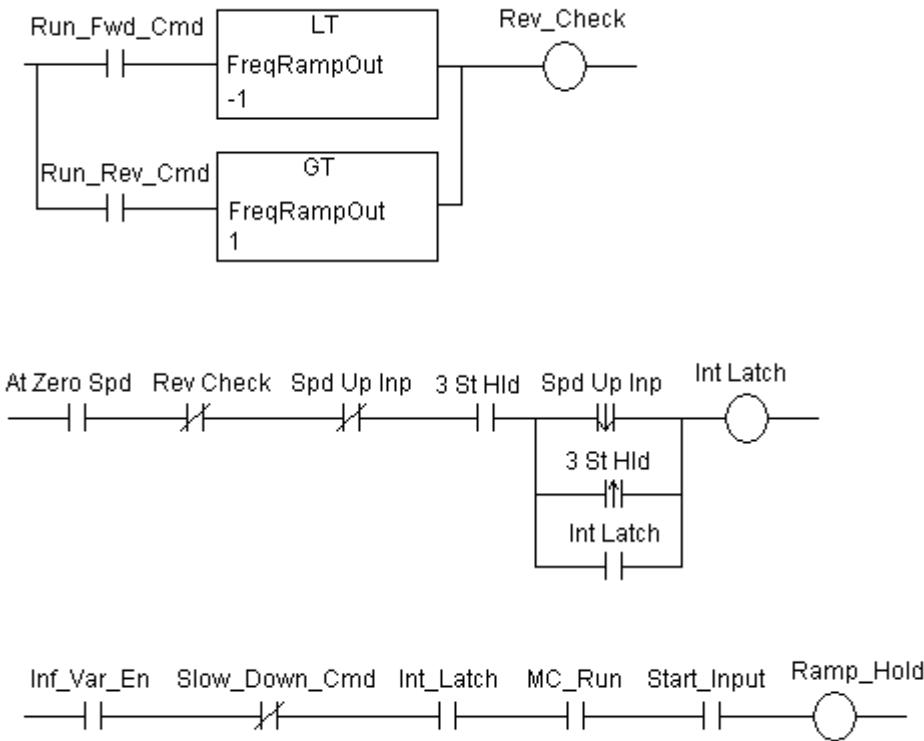
The slow down inputs are defaulted to TRUE and must be configured to a digital input to activate this feature. If the crane only has one slow down input for both directions, set both *Fwd SD Inp* and *Rev SD Inp* to the same digital input.

The slow down function operates differently depending if the drive is in remote mode operation or not.

In remote mode, the slow down input is only active in the selected drive direction. This allows full speed coming out of a slow down region.

In local or computer mode, the drive will be in slow down if either input goes low as polarity of the reference is unknown.

### 5-2.10 INFINITE VARIABLE SPEED LOGIC



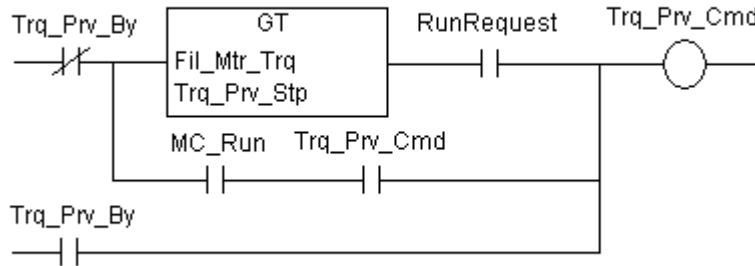
Infinite variable speed control is implemented by having the drive run between zero speed, the first fixed speed, and the second fixed speed. *Run Fwd Cmd* or *Run Rev Cmd* ramps the drive to the first selected fix speed setpoint. When *Spd Up Inp* is selected, the drive will start to ramp to the second fix speed which should be set to maximum speed desired. Removing *Spd Up Inp* will set *Ramp Hold* to stop at the desired speed.

During a fault, opposite direction commanded or removal of run will reset the *Ramp Hold*. During opposite direction command, the drive will not allow the speed to be held until the opposite direction is actually achieved.

To hold a speed lower than the first fix speed, command the direction and then toggle *Spd Up Inp* at the desired low speed.

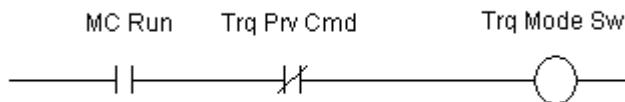
To enable the infinite variable function, *Spd Up Inp* must be configured to a digital input and *Digital Sel* must be set.

Three step infinite variable is available by using the *3 St Hld* input to the hold input of the drive.

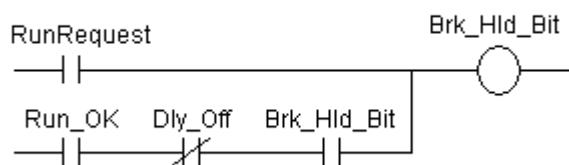
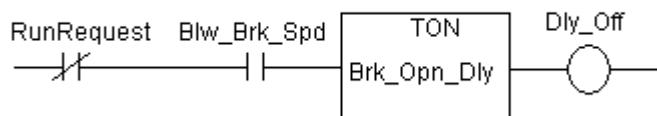
5-2.11 *Trq Prv Cmd*

Torque proving is required for hoist sections before the brakes can safely be released. When a run is commanded the drive will run in torque mode and apply torque to the motor. Torque feedback is checked to make sure it is present before *Trq Prv Cmd* goes high and allows the brakes to be removed and the speed to start to ramp.

*Trq Prv By* should be set to FALSE for hoist applications to enable this feature.



*Trq Mode Sw* is used to transfer control from torque mode to speed mode when torque proving has been completed. (*Mtr Ctrl Sw*)

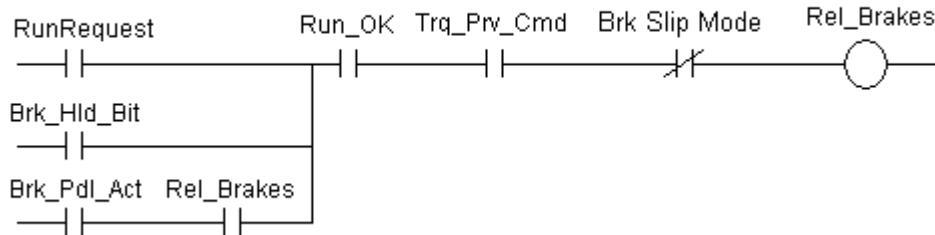
5-2.12 *Brk Hld Bit*

*Brk Hld Bit* is used to keep the brakes from setting until the runs are removed and drive ramps to zero speed. An optional *Brk Open Dly* delay the brakes from setting after zero speed is achieved.

*Brk Open Dly* is *Load Float Time* added with *Brake Offset*.

Setting a delay will cause the drive to float the load at zero speed.

### 5-2.13 BRAKES



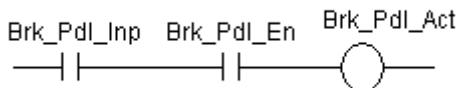
*Rel Brakes* bit is used to control an external motor brake contactor. To use this function it must be configured to a digital output of the drive.

After a run command the brakes do not release until torque proving has passed. *Brk Hld Bit* keeps the brakes released until the drive run is removed and the drive is at zero speed.

If an external brake is also available, this will keep the brakes from setting when active.

Brakes do not open when the drive is turned on during brake slip detection. The drive will attempt to hold zero speed with the brake engaged.

### 5-2.14 Brk Pdl Act



An option for an additional external brake is available. When enabled and active the drive will be coasting and the motor brakes released.

To use this feature, set *Brk Pdl En* to TRUE and *Brk Pdl Inp* to the external brake pedal limit switch.

### 5-2.15 BRAKE SLIP LOGIC

Brake slip is detected when the motor speed is greater than *Brk Slp Spd* after the brake have been set (*Brk Set Tim*). When enabled and this condition occurs the drive will set *Brk Slp Warn* bit then turn on and try and maintain zero speed until a move is commanded. This function can be enabled by the *Brk Slp Act* parameter and the choices are Disabled, Chk 60 sec, Cont Check.

**WARNING:** When enabled this feature allows the drive to turn on and try and regulate zero speed without any operator commands.

### 5-2.16 RAMP DELAYS

Two delays are available when operating in the closed loop mode.

- *Rel Rmp Dly* will hold the speed ramp at zero until it times out on a start command. This value is in ms. This is used to allow contactors and brakes to energize before ramping up the speed.
- *Run Off Tim* keeps the drive running at zero speed until it times out after runs are removed. This value is also in ms. This is used to hold at zero speed until brakes are removed.

### 5-2.17 COMMAND WORDS

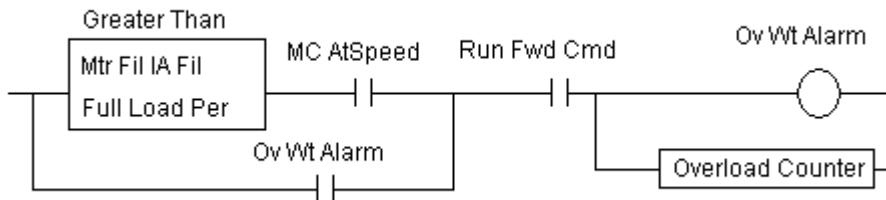
*Command* is a value to help trouble shoot inputs. It will show the following states:

Stop	
Fwd Step 1	Rev Step 1
Fwd Step 2	Rev Step 2
Fwd Step 3	Rev Step 3
Fwd Step 4	Rev Step 4
Fwd Step 5	Rev Step 5
Fwd Hold	Rev Hold
Fwd Accel	Rev Accel
Fwd Joystick	Rev Joystick

*Stop Low Inp* indicates what is causing the drive not to run at full speed. It will show the following states:

Normal	
Fwd End Stop	Rev End Stop
Fwd Slow Dwn	Rev Slow Dwn

### 5-2.18 OVER WEIGHT ALARM AND COUNTER



*Ov Wt Alarm* and *Overload Counter* will count when the filtered armature current exceeds *Full Load Per*. *Overload Counter* is not resetable.

### 5-2.19 Coast Stop

The drive will coast stop under the following conditions:

- Not in *PC Control* and *Coast Stop* goes low.
- In *PC Control* and the user presses the coast stop button in ADDaptACC.
- Drive faults out and the response is setup for coast stop.
- Removal of the run if the *Stop Funct* parameter is set to Coast.

## 5-3 LOCAL DRIVE KEYPAD

### 5-3.1 LOCAL RUN MODE

The drive can be put into the local mode by pressing the local/remote button on the keyboard. This will transfer control as long as the drive is not in PC control or running at the time.

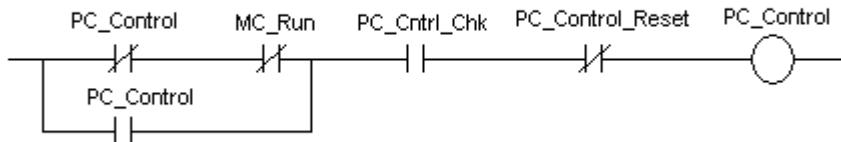
Pressing the Start button on the keypad when in the local mode will initiate a drive Run as long as *MC Ready* is high and the drive is not faulted (*MC Fault* is low)

Pressing the Stop Button on the keypad will initiate a local stop. This does not stop the drive in remote or PC control. See button Stop fault in next section.

### 5-3.2 BUTTON STOP FAULT

In any mode, if the Stop button is pressed for 4 seconds a button stop fault will occur.

## 5-4 ADDaptACC SOFTWARE CONTROL



*PC Control* is enabled by the ADDaptACC diagnostic software package. It will transfer into this mode only if the drive is not running. The drive will transfer out of *PC Control* if communications are lost to the computer.

## 5-5 RUN INTERFACE TO FIRMWARE

### 5-5.1 RunRequest

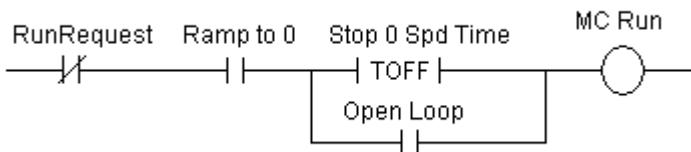
*RunRequest* enables the drive's firmware to start ramping and enables the inner torque loops. *RunRequest* will go high on any of the three control modes: Remote (*Run Enable*), Local or diagnostic computer.

### 5-5.2 COAST STOP

The drive will coast stop under the following conditions:

- Not in *PC Control* and *Coast Stop* goes low.
- In *PC Control* and the user presses the coast stop button in Addapt ACC.
- Drive faults out and the response is setup for coast stop.

### 5-5.3 MC Run



*RunRequest* sets *MC Run* which is sealed in until the drive ramps to zero speed. Also in closed loop mode *MC Run* can be set to stay enabled keeping the drive running at zero speed for *Stop 0 Spd Time* in seconds.

*Run time Hrs* counts up when *MC Run* is active. This counter can not be reset.

#### 5-5.4 Cntrl Inhib

*Cntrl Inhib* is the invert of *MC Run*.

## SECTION VI

# REFERENCING AND OUTER CONTROL LOOP

### 6-1 SPEED REFERENCE ( See Appendix A-1 )

#### 6-1.1 JOYSTICK REFERENCE SELECTION

Parameters	Type	Default
<i>JoySt B Sel</i>	BCFG	<i>Zero Bit</i>
<i>Joyst A Inp</i>	ACFG	<i>Analog In 1</i>
<i>Joyst B Inp</i>	ACFG	<i>Analog In 2</i>
<i>Anlg Ref</i>	APB	%
<i>MSpd Stpt</i>	CAL	0.5
<i>Slow Down Cmd</i>	DPB	
<i>SD Mlt Stpt</i>	CAL	0.5
<i>Digital Sel</i>	BCFG	<i>One Bit</i>

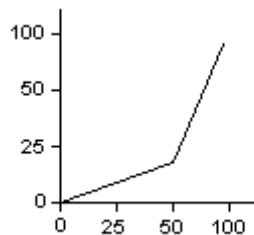
Description:

To enable joystick reference:

- Set *Digital Sel* = 1002 = *Zero bit*.
- Configure *Joyst A Inp* to the analog input or communication point for the reference.

Or from the Startup Wizard select Stepless control from *Ref Mode* parameter.

A table block using table\_0 values is used to shape the joystick reference if desired. Typically this is set to get better speed control near zero speed. Typically the table is set as shown below.



The table defaults to a linear line.

*Slow Down Cmd* is high when a slow down condition is present. See Chapter 4 for the slow down logic. When in this condition the Joystick reference is multiplied by *SD Mlt Stpt* which is defaulted to 0.50 to cut the speed in half.

See Chapter 4 for the micro speed logic. Micro speed allows for low speed operation while keeping the motor contactor in at zero speed. A timer is also set to fault the drive if left on too long to protect the motor.

When in Micro speed, the Joystick reference is multiplied by  $MSpd\ Stpt$  which is defaulted to 0.5 to cut the speed in half.

### 6-1.2 DIGITAL REFERENCE SELECTION

Parameters	Type	Default
<i>Run Fwd Inp</i>	BCFG	DIN 1
<i>Run Rev Inp</i>	BCFG	DIN 2
<i>Run Cmd Inp</i>	DPB	
<i>En Spd 1A</i>	BCFG	1110 = <i>Run_Cmd_Inp</i>
<i>En Spd 2A</i>	BCFG	Zero Bit
<i>En Spd 3A</i>	BCFG	Zero Bit
<i>En Spd 4A</i>	BCFG	Zero Bit
<i>En Spd 5A</i>	BCFG	Zero Bit
<i>En Spd 1B</i>	BCFG	Zero Bit
<i>En Spd 2B</i>	BCFG	Zero Bit
<i>En Spd 3B</i>	BCFG	Zero Bit
<i>En Spd 4B</i>	BCFG	Zero Bit
<i>En Spd 5B</i>	BCFG	Zero Bit
<i>Dig B Sel</i>	BCFG	Zero Bit
<i>Speed 1</i>	CAL	20.00%
<i>Speed 2</i>	CAL	40.00%
<i>Speed 3</i>	CAL	60.00%
<i>Speed 4</i>	CAL	80.00%
<i>Speed 5</i>	CAL	100.00%
<i>Slow Down Cmd</i>	DPB	
<i>SD Speed</i>	CAL	10.00
<i>Digital Sel</i>	BCFG	One Bit

#### Description:

*Digital Sel* is defaulted to *One Bit* which allows for step speed reference.

The lowest speed step (*Speed 1*) is defaulted to *Run Cmd Inp* which is set by *Run Fwd Inp* or *Run Rev Inp*.

To enable additional speed steps, configure *En Spd 2A-5A* to digital inputs or communication inputs for the different steps. The Speeds are then entered into *Speed 1 – 5* in percent of maximum speed. The same speed steps are used for forward or reverse.

If a separate set of inputs are required for radio control operation, *En Spd 1B-5B* can be used by selecting *Dig B Sel*. On radio loss, a transfer switch input is used to de-select *Dig B Sel*.

*Slow Down Cmd* is high when a slow down condition is present. See Chapter 4 for the slow down logic. When in this condition, the speed reference switches to *SD Speed*.

For infinite variable speed operation, set the speed up input to *En Spd 2A*. Also set *Speed 2* to 100%.

The Startup Wizard sets the digital inputs and speeds to predefined values based on the reference mode selected as follows:

Parameter	3 Step	5 Step	2 Step Inf Var	3 Step Inf Var	Stepless
Digital Sel	1001 ( One Bit )	1002 ( Zero Bit )			
Speed 1	10.00%	10.00%	10.00%	10.00%	
Speed 2	50.00%	25.00%	100.00%	100.00%	
Speed 3	100.00%	50.00%			
En Spd 2A	1013 ( Din 3)	1013 ( Din 3)	1013 ( Din 3)	1014 ( Din 4)	
En Spd 3A	1014 ( Din 4)	1014 ( Din 4)	1002 ( Zero Bit )	1002 ( Zero Bit )	
En Spd 4A	1002 ( Zero Bit )	1015 ( Din 5)	1002 ( Zero Bit )	1002 ( Zero Bit )	
En Spd 5A	1002 ( Zero Bit )	1016 ( Din 6)	1002 ( Zero Bit )	1002 ( Zero Bit )	
Inf Var En	1002 ( Zero Bit )	1002 ( Zero Bit )	1001 ( One Bit )	1001 ( One Bit )	1002 ( Zero Bit )
3 St Hld	1002 ( Zero Bit )	1002 ( Zero Bit )	1002 ( Zero Bit )	1013 ( Din 3)	1002 ( Zero Bit )
Spd Up Inp	1002 ( Zero Bit )	1002 ( Zero Bit )	1013 ( Din 3)	1014 ( Din 4)	1002 ( Zero Bit )
Joyst Resp	0 ( Dis Fault )	3 ( En Fault )			

### 6-1.3 REFERENCE LOCATION AND LIMIT

Parameters	Type	Default
Control Place	APB	
En Ext Spd	BCFG	Zero Bit
Trq Spd Lim	APB	
Slow Down Cmd	DPB	
SD Spd Lim	CAL	50.00%
Abs Per Spd	APB	

#### Description:

*Control Place* determines where the speed reference is derived from. Normally it is set equal to zero to allow remote control. For startup or troubleshooting this can be set to keypad or computer.

Several speed limits are used. Normal operation uses *Base Spd Lim* which is set from ratio of *MotorNomFreq* and *FreqMax*.

If extended speed range is desired and motor over load protection is required the following needs to be set:

- Set *En Ext Spd* = 1001 = *One Bit*.

Note: The startup wizard will set *En Ext Spd* if the entered *FreqMax* is greater than *MotorNomFreq*.

*Slow Down Cmd* is high when a slow down condition is present. See Chapter 4 for the slow down logic. When in this condition the speed is limited by *SD Spd Lim*.

#### 6-1.4 REVERSE COMMAND AND CONVERSION

Parameters	Type	Default
<i>Run Rev Cmd</i>	DPB	
<i>Control Place</i>	APB	
<i>Keypad Spd Dir</i>	DPB	
<i>Reverse</i>	DPB	
<i>Abs Per Spd</i>	APB	
<i>LS to Freq</i>	CAL	0.60
<i>LS Scl Div</i>	CAL	1000
<i>Min Frequency</i>	CAL	0.00
<i>Freq_Spt</i>	APB	

##### Description:

Reverse command is dependant on *Control Place* as follows:

- Remote Control – See chapter 4 for *Run Rev Cmd* logic. Reverse can be setup to be from a digital input or from a negative joystick polarity.
- Panel Control - *Panel Reverse* command. This is changed via the keypad.
- Computer Control - Reverse comes from a check box on the control pad screen from ADDaptACC

The speed reference is converted from percent to motor hertz by the scaling factor *LS to Freq*. Default scaling of .6 sets 100% speed equal to 60 Hz on the motor.

The reference is then checked to be above the *Min Frequency* in both directions.

Note: The startup Wizard sets *LS to Freq* and *LS Scl Div* based on 100.00% = the Entered *FreqMax*. Wiard also sets *Min Frequency* = 5.00% in open loop hoist mode.

### 6-1.5 REFERENCE ENABLE

Parameters	Type	Default
<i>Rel Brakes</i>	DPB	
<i>Brk Open Sw</i>	BCFG	<i>Zero Bit</i>
<i>Rel Rmp Dly</i>	CAL	0.1 ms.
<i>Rel Rmp By Tim</i>	BCFG	<i>One Bit</i>
<i>Rel_Ramp</i>	DPB	

Description:

The speed reference is held at zero until the brakes have been released.

If *Rel Rmp by Tim* is set to true, then *Rel Rmp Dly* is used to delay the ramp to wait to make sure the brakes have released.

If *Rel Rmp by Tim* is set to false, then *Brk Open Sw* is used to tell the drive when the brakes have opened. *Brk Open Sw* should be set to the digital input wired to the brakes opened limit switch.

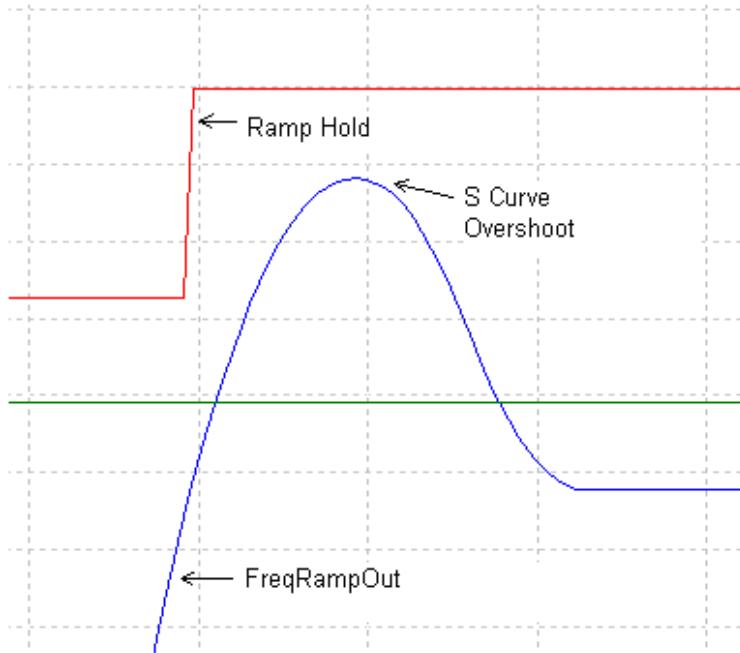
### 6-1.6 RAMP HOLD

Parameters	Type	Default
<i>Ramp_Hold</i>	DPB	
<i>Freq Ramp Out</i>	APB	
<i>FreqReference</i>	APB	

Description:

*Ramp Hold* is used for infinite variable speed reference. See chapter 4 logic. This takes the output of the ramped speed reference *Freq Ramp Out* and makes this the reference value. Note: this will hold the reference in all modes except when the run is removed.

Note that if S-curve ramping is enabled, the speed will overshoot by the S-curve value, then it will ramp back to the correct value. See the example below:



The output *FreqReference* is then passed to the firmware, which is detailed in the following sections.

#### 6-1.7 LOW PASS AND DELAY

Parameters	Type	Default
<i>FreqReference</i>	APB	
<i>Freq Max</i>	CAL	60.00 Hz
<i>Strt 0 Spd Time</i>	CAL	0 ms
<i>RunRequest</i>	DPB	

##### Description:

*FreqReference* is checked again to be within +/- *Freq Max* value.

If the drive is in the closed loop mode of operation, a time delay *Strt 0 Spd Time* can be set to delay the ramping of the reference. This can be used to delay for contactor or brake operations.

The output of this section then goes to the ramp generator blocks.

#### 6-1.8 FAST RAMP TIMES

Parameters	Type	Default
<i>Fast Stop</i>	BCFG	<i>One Bit</i>
<i>EndSt Perm</i>	DPB	
<i>Fast Stop Tim</i>	CAL	0.1
<i>Accel Time 1</i>	APB	
<i>Decel Time 1</i>	APB	
<i>Smooth Ratio 2</i>	CAL	0.1

Description:

When either *Fast Stop* goes low or the drive is in an end stop condition *EndSt Perm* high the second set of acceleration and deceleration rates are used. Both of the rates are set to *Fast Stop Tim*.

Enter the fastest time to stop from full speed into *Fast Stop Tim*. Default is the fastest time allowed of 1 second.

*RampTimeSelect* is the final time sent to the firmware.

*Smooth Ratio 2* is the S-curve during Fast stop and should be left at default.

### 6-1.9 ANTI SNATCH MODE

Parameters	Type	Default
<i>Mtr Trq TC</i>	CAL	0.1 seconds
<i>Motor Torque</i>	APB	
<i>Fil Mtr Trq</i>	APB	
<i>Anti Sntch Trq</i>	CAL	5.0%
<i>Run Fwd Cmd</i>	DPB	
<i>MC Run</i>	DPB	
<i>En Anti Snatch</i>	BCFG	<i>Zero Bit</i>
<i>Anti Sntch Tim</i>	CAL	0.2 seconds
<i>In Anti Snatch</i>	DPB	
<i>Anti_Sntch_Accel</i>	CAL	10.0 seconds

Description:

Anti snatch mode is to limit the acceleration rate when low torque during raise is detected. Once detected, the acceleration rate will be fixed low until the raise command is removed.

To enable this feature, the following steps must be taken.

- Set *En\_Anti Snatch* = *One Bit*.
- Set the *Anti Sntch Trq* to the level where this condition will occur during an acceleration.
- Tune *Anti Sntch Tim* to avoid disturbances from changing the ramp time.
- Set *Anti Sntch Accel* to the appropriate acceleration time during Anti snatch mode.

### 6-1.10 RAMP TIMES

Parameters	Type	Default
<i>2<sup>nd</sup> Rmp En</i>	BCFG	1002 = <i>Zero_Bit</i>
<i>Accel Inp</i>	ACFG	<i>Accel Time 1</i> = 5 seconds
<i>2<sup>nd</sup> Accel Rate</i>	CAL	5.0 seconds
<i>Decel Time</i>	ACFG	<i>Decel Time 1</i> = 5 seconds
<i>2<sup>nd</sup> Decel Rate</i>	CAL	5.0 seconds
<i>In Anti Snatch</i>	DPB	
<i>Anti Sntch Accel</i>	CAL	10.0 seconds
<i>Smooth Ratio</i>	CAL	0.1

Description:

The normal ramp times are configurable and defaulted to *Accel Time 1* and *Decel Time 1*. These times are scaled to the amount of seconds it takes to get from zero to *Freq Max*.

The second set of ramp times are used when *2<sup>nd</sup> Rmp En* is enabled. These can be used during extended speed range if slower ramps are desired.

See previous section description for when *Anti Sntch Accel* time is used.

*Smooth Ratio* is used to create a rounding to the ramp rate. The units are in seconds to get to from zero to the ramp rate. Note that if *Smooth Ratio* = 2, then it will take 2 seconds to get to the ramp rate. It does not matter if the rate is 1 Hz/s or 10 Hz/s.

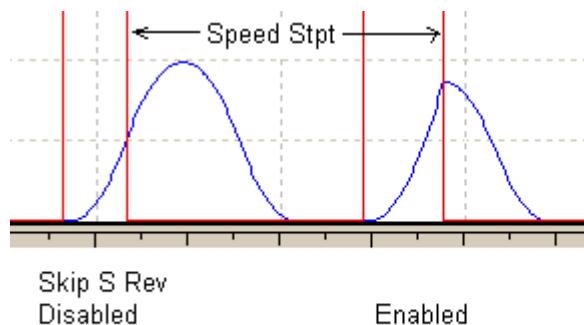
### 6-1.11 RAMP BLOCK OPTIONS

Parameters	Type	Default
<i>Start Function</i>	E	0 = Ramping
<i>Skip S Rev</i>	E/D	Disable
<i>Disable Ramp</i>	BCFG	Zero Bit
<i>Rmp Act Lim</i>	E/D	

Description:

*Start Function* determine the action if the motor is spinning when the run is applied. Options ramping and Flying start.

*Skip S Rev* disables the continuation of an S-Curve when a reference change has been made. For example, if the drive is accelerating and the run is removed, the drive would continue to increase in speed until the S-Curve is complete before starting to decelerate. When *Skip S Rev* is enabled, the drive would not continue to accelerate at the time of the Run off, but start to decelerate right away. See the examples below.



*Disable Ramp* removes both the linear ramp and S-Curve. This should be used only when the drive is a slave section directly coupled and set as a current follower. This works only in the closed loop mode of operation.

There are four override speed limiters available. These modify the speed reference to keep the drive from faulting out. *Rmp Act Lim* enables these limiters to be ramped instead of being step changes to the speed loop.

#### 6-1.12 FIRMWARE RAMP BLOCK OUTPUTS

Parameters	Type	Default
<i>MC AtSpeed</i>	DPB	
<i>MC Reverse</i>	DPB	
<i>Freq Ramp Out</i>	APB	
<i>Freq Delta</i>	APB	

##### Description:

*Freq Ramp Out* is the final speed reference after ramping. The value is in Hz. *Freq Delta* is the derivative of the reference. The units are in Hz/s. See the appropriate sections for the other inputs to the blocks.

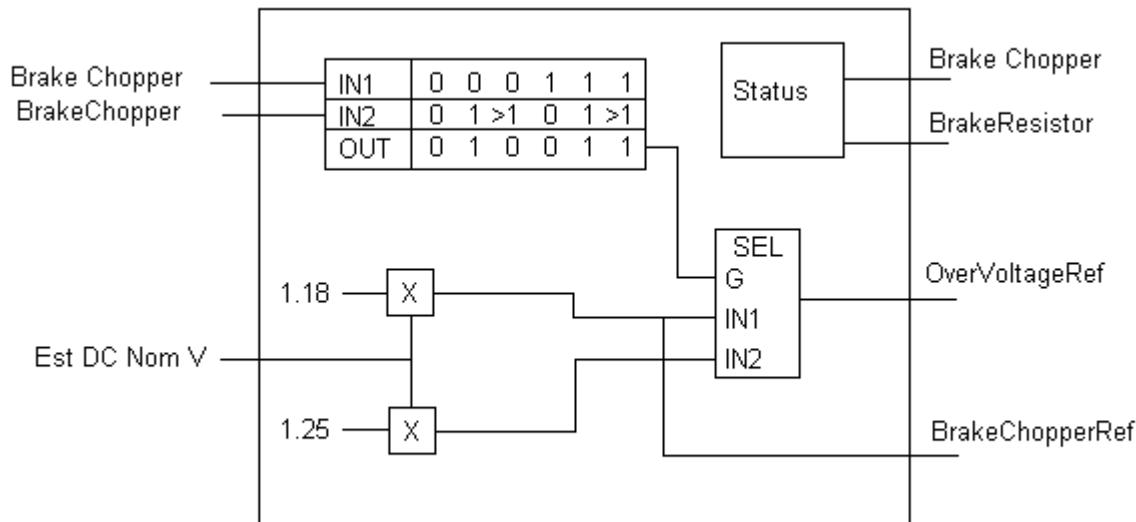
*MC At Speed* will go high when the reference has stopped ramping.

*MC Reverse* goes high when the reference has ramped through to negative speed.

## 6-2 PI LIMITERS

There are four open loop PI limiters and two closed loop limiters. When enabled the limiters modify the speed reference to avoid the drive from tripping out. The output of these limiters can go before or after the ramp block depending if *Rmp Act Lim* is enabled. *MtrRegStatus* will go high if any of the limitors are affecting the reference.

### 6-2.1 OPEN LOOP OVERVOLTAGE LIMITER



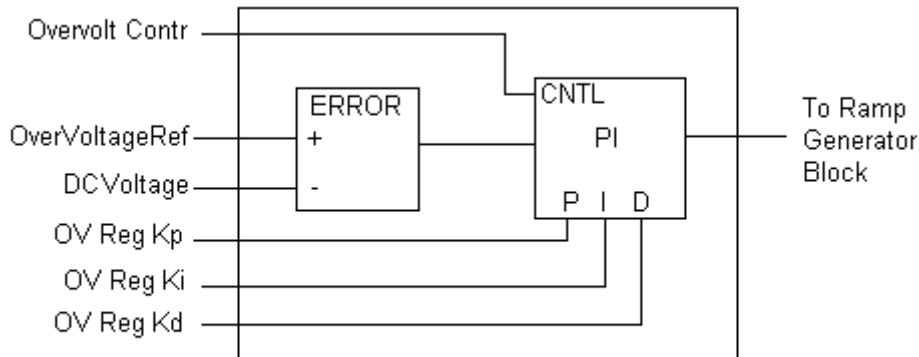
<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Brake Chopper</i>	APB	
<i>BrakeChopper</i>	CAL	0
<i>DCVoltage</i>	APB	
<i>BrakeResistor</i>	APB	

Description:

The Overvoltage reference is either set to 1.18 or 1.25 times the *DC Voltage*, depending on whether there is a DC chopper and if there is a resistor present.

*Brake Chopper* is set to 0 if the drive is not equipped with an internal brake Chopper. Otherwise, it is set equal to 1.

*BrakeResistor* is set to 0 if no resister is detected when tested. Otherwise, it is set equal to 1.



Parameters	Type	Default
<i>Overvolt Contrl</i>	CAL	0
<i>DCVoltage</i>	APB	
<i>OV Reg Kp</i>	CAL	By frame size
<i>OV Reg Kd</i>	CAL	By frame size
<i>OV Reg Ki</i>	CAL	By frame size

#### Description:

The Overvoltage limiter can be used to avoid the DC Bus from tripping out. This modifies the speed reference to try and keep the Bus voltage down.

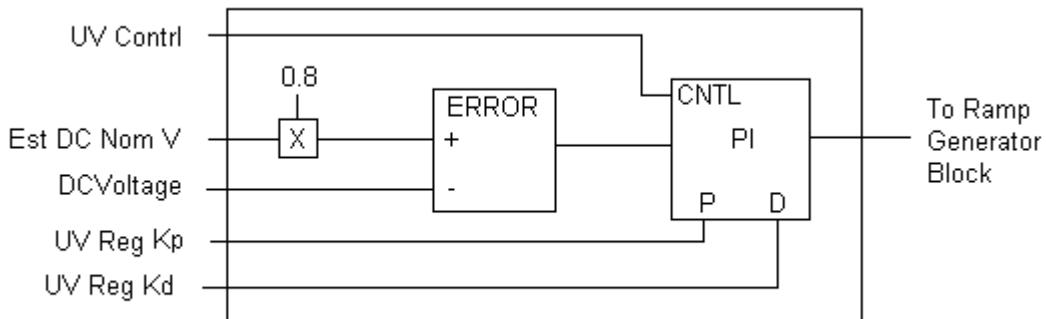
*Overvolt Contrl* can be set to disabled, no ramp (resets the integrator), or ramping. Default is disabled.

The over voltage reference is either 1.18 or 1.25 times the nominal bus voltage, depending on if there is a brake chopper circuit and resistor present.

The three gains *OV Reg Kp*, *OV Reg Ki*, and *OV Reg Kd* all have different default values based on frame size. These should not need to be tuned except for extreme situations.

The output of the regulator, when enabled, will add or subtract to the speed reference in the Ramp Generator block and become part of *Freq Ramp Out*.

## 6-2.2 OPEN LOOP UNDERTHRESHOLD LIMITER



Parameters	Type	Default
<i>UV Contrl</i>	CAL	disable
<i>DCVoltage</i>	APB	
<i>UV Reg Kp</i>	CAL	By frame size
<i>UV Reg Kd</i>	CAL	By frame size
<i>UV Reg I</i>	CAL	By frame size

### Description:

The Undervoltage limiter can be used to avoid the DC Bus from tripping out. This modifies the speed reference to try and keep the Bus voltage up.

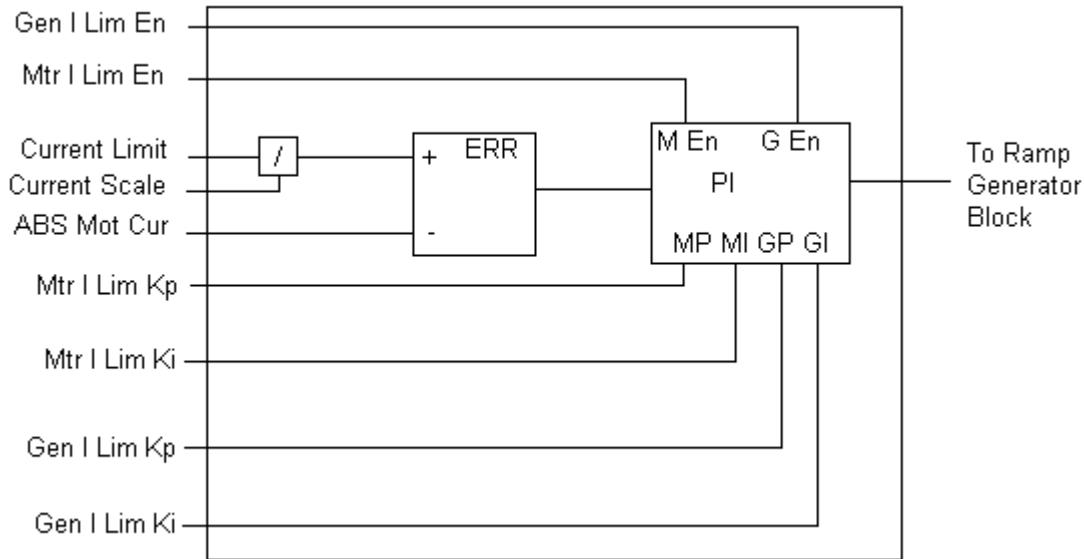
*UV Contrl* can be used to enable or disable this function. It is defaulted to disable.

The setpoint is  $0.8 \times DCVoltage$ .

The two gains *UV Reg Kp*, *UV Reg Kd* and *UV Reg I* have different default values based on frame size. These should not need to be tuned except for extreme situations.

The output of the regulator, when enabled, will add or subtract to the speed reference in the Ramp Generator block and become part of *FreqRampOut*.

### 6-2.3 OPEN LOOP CURRENT LIMITER



Parameters	Type	Default
<i>Gen I Lim En</i>	EN	1 – Disable
<i>Mtr I Lim En</i>	EN	1 – Disable
<i>Mtr I Lim Kp</i>	CAL	By frame size
<i>Mtr I Lim Ki</i>	CAL	By frame size
<i>Gen I Lim Kp</i>	CAL	By frame size
<i>Gen I Lim Ki</i>	CAL	By frame size

#### Description:

The overcurrent limiter can be used to avoid the drive from tripping out. This modifies the speed reference to try and keep the current within tolerance.

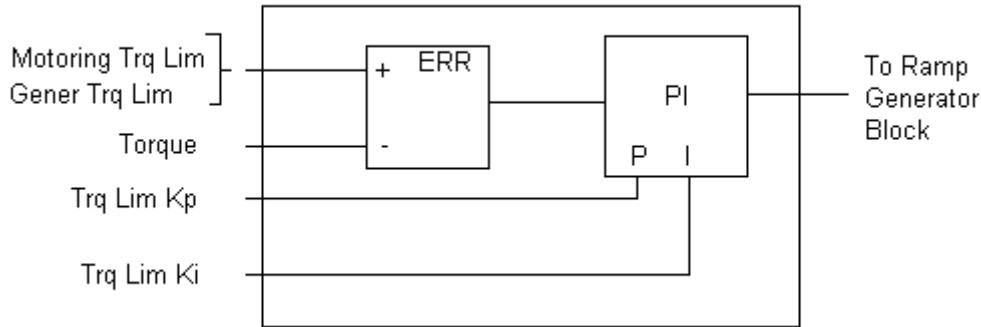
There are two regulators based on whether the drive is motoring or regenerating. *Gen I Lim En* enables the regeneration regulator, while *Mtr I Lim En* enables the motoring regulator. Both are defaulted to disable.

The entered current limit is the setpoint. This gets subtracted to the absolute value of the motor current to create the regulator error.

The four gains *Mtr I Lim Kp*, *Mtr I Lim Ki*, *Gen I Lim Kp* and *Gen I Lim Ki* have different default values based on frame size. These should not need to be tuned except for extreme situations.

The output of the regulator, when enabled, will add or subtract to the speed reference in the Ramp Generator block and become part of *FreqRampOut*.

## 6-2.4 OPEN LOOP TORQUE LIMITER



Parameters	Type	Default
<i>Motoring Trq Lim</i>	CAL	300%
<i>Gener Trq Lim</i>	CAL	300%
<i>Motor Torque</i>	APB	
<i>Trq Lim Kp</i>	CAL	3000
<i>Trq Lim Ki</i>	CAL	200

### Description:

The over torque limiter can be used to avoid the drive from tripping out. This modifies the speed reference to try and keep the current within tolerance.

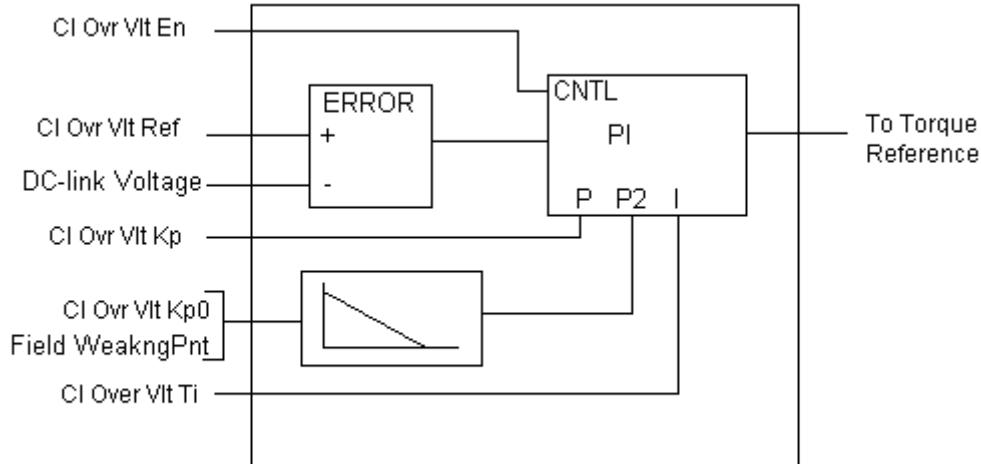
There are two regulators based on whether the drive is motoring or regenerating. Unlike the other regulators, there is no enable or disable for this limiter. The limits can be set above 300% to cause the drive to trip prior to the regulator turning on.

*Motoring Trq Lim* and *Gener Trq Lim* are the torque limits to start regulating the speed reference down. These are in percent motor torque. The feedback is unfiltered, calculated motor torque.

*Trq Lim Kp* and *Trq Lim Ki* are set up to run stable. These should not need to be tuned except for extreme situations.

The output of the regulator, when enabled, will add or subtract to the speed reference in the Ramp Generator block and become part of *FreqRampOut*.

### 6-2.5 CLOSED LOOP OVER VOLTAGE LIMITER ( See Appendix A-10 )



Parameters	Type	Default
<i>Cl Ovr Vlt En</i>	EN	Disable
<i>Cl Ovr Vlt Ref</i>	CAL	118%
<i>Cl Ovr Mtr Lim</i>	CAL	100%
<i>Cl Ovr Vlt Kp</i>	CAL	50
<i>Cl Ovr Vlt Ti</i>	CAL	15

#### Description:

Unlike the other limiters the close loop over voltage limiter modifies the torque producing current to the motor.

The controller is a PI regulator that will try and keep the DC-voltage below *Cl Ovr Vlt Ref* percent of nominal bus voltage.

*Cl Ovr Vlt Kp* and *Cl Ovr Vlt Ti* are setup to run stable. These should not need to be tuned except for extreme situations.

### 6-3 SPEED STEP REFERENCE ( See Appendix A-2 )

*Freq Ramp Out* is the final ramped speed reference after the limiters. Droop and step inputs are then added to this value before going to the velocity controller. Depending if the section is configured for open or closed loop, this section varies slightly.

### 6-3.1 SPEED STEP SCALING, REVERSE AND LIMITS

Parameters	Type	Default
Slack Up	ACFG	Spd Slk Up = 10 %
LS to Freq	CAL	60
LS Scl Div	CAL	100
Speed Step	CAL	0
Freq Max	CAL	60 Hz
Freq Ramp Out	APB	
ProcessPITrimRef	APB	

#### Description:

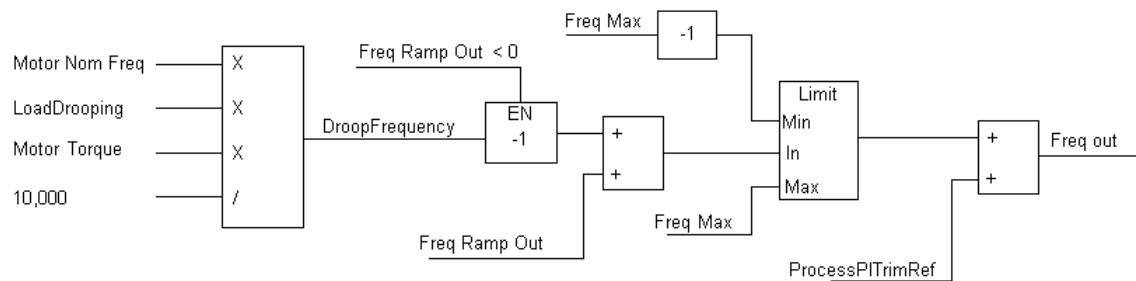
*Slack Up* is the speed reference which should be scaled to 100% line speed. The reference then gets scaled to motor hertz using parameters *LS to Freq* and *LS Scl Div*.

**Caution:** The same scaling factors are used to re-scale the speed ramp reference and they are set by the startup wizard.

Since this reference gets added to the ramped speed reference and goes directly to the speed loop error, limit checking must be done. The limits are set to *Freq Max* plus or minus the output of *Freq Ram pOut*.

*Speed Step* is used by ADDaptACC to assist in tuning the speed loop. Can be toggled and set via the program.

### 6-3.2 OPEN LOOP STEP REFERENCE ( See Appendix A-9 )



Parameters	Type	Default
<i>Motor Nom Freq</i>	CAL	60.00 Hz
<i>LoadDrooping</i>	CAL	0
<i>Motor Torque</i>	APB	
<i>Freq Ramp Out</i>	APB	
<i>Freq out</i>	APB	
<i>Freq Max</i>	CAL	60.00 Hz

Description:

*Freq Ramp Out* is modified by the droop control. Droop gain is set from the *LoadDrooping* parameter. A setpoint of 100 equals 100% speed droop at 100% torque.

## Example:

$$\text{LoadDroop} = 5.00\%$$

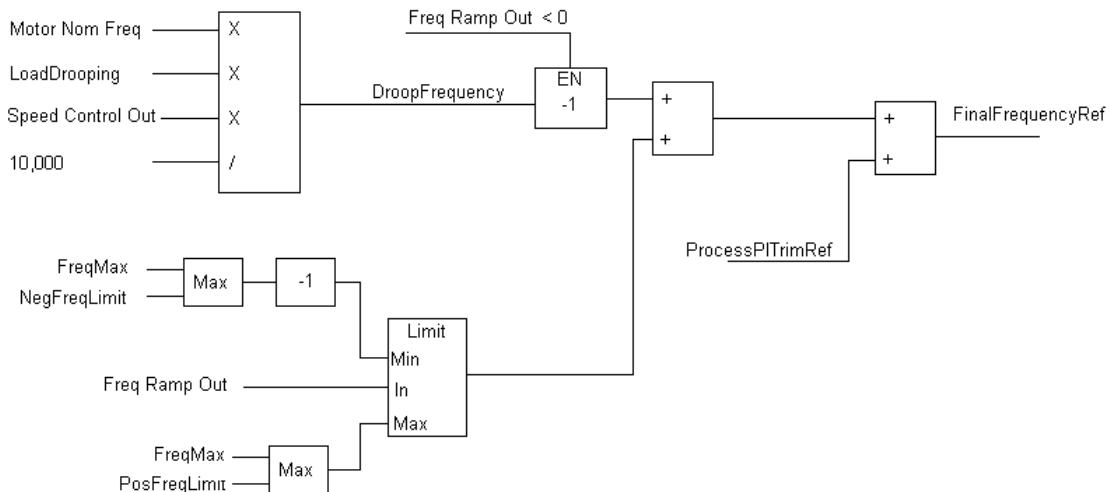
$$\text{Motor Nom Freq} = 60.00 \text{ Hz}$$

$$\text{Motor Torque} = 25.0\%$$

The speed will droop 0.75 Hz

The speed reference is then checked to be within  $\pm$  *FreqMax* limit and added to the *ProcessPITrimRef* from the slack step inputs. The final value that goes to the open loop regulator is called *Freq out*.

## 6-3.3 CLOSED LOOP STEP REFERENCE ( See Appendix A-10 )



Parameters	Type	Default
<i>Motor Nom Freq</i>	CAL	60.00 Hz
<i>Motor Torque</i>	APB	
<i>LoadDrooping</i>	CAL	0
<i>Speed Cntrl Out</i>	APB	
<i>Freq Ramp Out</i>	APB	
<i>Freq Max</i>	CAL	60.00 Hz
<i>ProcessPITrimRef</i>	APB	
<i>Pos Freq Limit</i>	CAL	60.00 Hz
<i>Neg Freq Limit</i>	CAL	-60.00 Hz
<i>Final Freq Ref</i>	APB	

**Description:**

*Freq Ramp Out* is checked to make sure it is within the minimum and maximum limits

This is then modified by the droop control. Droop gain is set from the *LoadDrooping* parameter. A setpoint of 100 equals 100% speed droop at 100% torque.

Example:

*LoadDroop* = 5.00%

*Motor Nom Freq* = 60.00 Hz

*Motor Torque* = 25.0%

*Speed with droop* 0.75 Hz.

The droop is positive if the section is in the motoring quadrant, so the value is subtracted from the speed if running forward and added if running reverse.

This drop is then added to the *ProcessPITrimRef* from the slack step inputs. The final value that goes to the open loop regulator is called *Final Freq Ref*.

**6-4 LOAD WEIGHT ( See Appendix A-2 )**

The Load weight blocks monitor the motor torque to determine if the section can go into the extended frequency range.

Parameters	Type	Default
<i>Motor Current</i>	APB	
<i>Mtr Cur TC</i>	CAL	0.5 seconds
<i>Motor Nom Currnt</i>	CAL	Motor Amps
<i>Mtr Fil IA Fil</i>	APB	
<i>ESR Cur Lim</i>	CAL	100.0 %
<i>MC Run</i>	DPB	
<i>Max ESR Speed</i>	CAL	100.0 %
<i>Trq Spd Lim</i>	APB	

**Description:**

The load weight allows the drive to go to base speed of the motor. It then checks the motor current to see if it is safe to extend the speed to max speed. Several parameters must be entered to properly setup load weight. After setup the crane should be verified using test weights prior to going into production.

To set up the Load weight option, perform the following:

- Set *Max ESR Speed* to maximum desired speed allowed in percentage. Usually left equal to 100%.
- Set *ESR Cur Lim* to the safe amount of percent motor current that the hoist can stop at its full extended speed range. If unsure set at 100% motor current.

Example:

*Max ESR Speed* equals 100.00%

*MotorNomFreq* = 60 Hz

*FreqMax* = 90 Hz

*ESR Cur Lim* = 110%

Base speed percentage =  $60 \text{ Hz} / 90 \text{ Hz} \times 100 = 66.6\%$

Drive calculates the allowable motor current to go into field weaken range as follows:

Allowable current = Base speed as a percentage of max speed x *ESR Cur Lim*.

Allowable current =  $66.6\% \times 110\% = 73\%$

The drive will ramp to base speed which is 60 Hz or 66.6% of full speed. It will then check the motor current to see if its below the allowable current. If it is below this limit the drive will then continue to ramp to full speed.

## 6-5 SPARE BLOCKS ( See Appendix A-6 )

Two pages of spare blocks are added to the application. These are broken down into logic blocks and reference blocks.

### 6-5.1 SPARE REFERENCE BLOCKS

Parameters	Type	Default
<b>Muldiv Block</b>		
<i>Sp MD1 Val</i>	ACFG	<i>Zero Analog</i>
<i>Sp MD1 Mul</i>	ACFG	<i>Sp MD1 Mlt = 1.00</i>
<i>Sp MD1 Div</i>	ACFG	<i>Sp MD1 Dv = 1.00</i>
<i>Sp MD1 Out</i>	APB	
<b>Add Block</b>		
<i>Sp Add1 In1</i>	ACFG	<i>Sp Add Val = 0.00</i>
<i>Sp Add1 In2</i>	ACFG	<i>Sp Add Val = 0.00</i>
<i>Sp Add1 Out</i>	APB	
<b>Sub Block</b>		
<i>Sp Sub1 In1</i>	ACFG	<i>Sp Sub Val = 0.00</i>
<i>Sp Sub1 In2</i>	ACFG	<i>Sp Sub Val = 0.00</i>
<i>Sp Sub1 Out</i>	APB	

Parameters	Type	Default
<b>Low Pass Block</b>		
<i>Sp LP Fil TC</i>	CAL	0.1 sec
<i>Sp LP Fil In</i>	ACFG	<i>Zero Analog</i>
<i>Sp LP Fil Out</i>	APB	
<b>ABS Block</b>		
<i>Sp ABS In</i>	ACFG	<i>Zero Analog</i>
<i>Sp ABS Out</i>	APB	
<b>Sum Block</b>		
<i>Sp Sum1 EnA</i>	BCFG	<i>Zero Bit</i>
<i>Sp Sum1 EnB</i>	BCFG	<i>Zero Bit</i>
<i>Sp Sum1 EnB</i>	BCFG	<i>Zero_Bit</i>
<i>Sp Sum1 InA</i>	ACFG	<i>Sp Sum1 StA = 0.00</i>
<i>Sp Sum1 InB</i>	ACFG	<i>Sp Sum1 StB = 0.00</i>
<i>Sp Sum1 InC</i>	ACFG	<i>Sp Sum1 StC = 0.00</i>
<i>Sp Sum1 Out</i>	APB	
<b>Sel Block</b>		
<i>Sp Sel1 En1</i>	BCFG	<i>Zero_Bit</i>
<i>Sp Sel1 In0</i>	ACFG	<i>Sp Sel1 ST0 = 0</i>
<i>Sp Sel1 In1</i>	ACFG	<i>Sp Sel1 ST1 = 0</i>
<i>Sp Sel1 Out</i>	APB	
<b>Lim Block</b>		
<i>Sp Lim Min</i>	CAL	-100.00
<i>Sp Lim Max</i>	CAL	100.00
<i>Sp Lim Inp</i>	ACFG	<i>Zero_Analog</i>
<i>Sp Lim Out</i>	APB	
<b>WParam Block</b>		
<i>Sp_WPVal_Inp</i>	ACFG	<i>1200 = Zero_Analog</i>
<i>Sp_WPVal_ID</i>	CAL	0
<b>WParam Block</b>		
<i>Sp_WPVal2_Inp</i>	ACFG	<i>1200 = Zero_Analog</i>
<i>Sp_WPVa2l_ID</i>	CAL	0

Description: Each of these blocks is an individual block as described in the block functional specification.

## 6-5.2 SPARE LOGIC BLOCKS

Parameters	Type	Default
<b>HL Comp Block</b>		
<i>Sp HL Setpt</i>	ACFG	<i>Sp HL Stpt</i> = 100.00
<i>Sp HL High</i>	CAL	90.00 %
<i>Sp HL Low</i>	CAL	10.00 %
<i>Sp HL Hyst</i>	CAL	1.00 %
<i>Sp HL Inp</i>	ACFG	<i>Zero Analog</i>
<i>Sp LH Decimal</i>	CAL	2
<i>Sp HL Max</i>	DPB	
<i>Sp HL Min</i>	DPB	
<b>Comp Block</b>		
<i>Sp Cmp1 In</i>	ACFG	<i>Sp Cmp1 Stpt</i> = 50.00
<i>Sp Cmp1 Thres</i>	ACFG	<i>Sp Cmp1 Stpt</i> = 50.00
<i>Sp Cmp1 Hyst</i>	CAL	1.00
<i>Sp Cmp1 Out</i>	DPB	
<i>Sp Cmp1 Eq</i>	DPB	
<b>Delay Block</b>		
<i>Sp Dly1 TON</i>	CAL	0.100 seconds
<i>Sp Dly1 TOFF</i>	CAL	0.100 seconds
<i>Sp Dly1 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Dly1 Out</i>	DPB	
<b>Delay Block</b>		
<i>Sp Dly2 TON</i>	CAL	0.100 seconds
<i>Sp Dly2 TOFF</i>	CAL	0.100 seconds
<i>Sp Dly2 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Dly2 Out</i>	DPB	
<b>Latch Block</b>		
<i>Sp Ltch1 L</i>	BCFG	<i>Zero Bit</i>
<i>Sp Ltch1 H1</i>	BCFG	<i>One Bit</i>
<i>Sp Ltch1 H2</i>	BCFG	<i>One Bit</i>
<i>Sp Ltch1 Out</i>	DPB	
<b>Latch Block</b>		
<i>Sp Ltch2 L</i>	BCFG	<i>Zero Bit</i>
<i>Sp Ltch2 H1</i>	BCFG	<i>One Bit</i>
<i>Sp Ltch2 H2</i>	BCFG	<i>One Bit</i>
<i>Sp Ltch2 Out</i>	DPB	
<b>BInv Block</b>		
<i>Sp Inv1 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Inv1 Out</i>	DPB	
<b>BInv Block</b>		
<i>Sp Inv2 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Inv2 Out</i>	DPB	
<b>BInv Block</b>		
<i>Sp Inv3 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Inv3 Out</i>	DPB	

Parameters	Type	Default
<b>Or Block</b>		
<i>Sp Or1 In1</i>	BCFG	<i>Zero Bit</i>
<i>Sp Or1 In2</i>	BCFG	<i>Zero Bit</i>
<i>Sp Or1 Nin3</i>	BCFG	<i>One Bit</i>
<i>Sp Or1 Out</i>	DPB	
<b>Or Block</b>		
<i>Sp Or2 In1</i>	BCFG	<i>Zero Bit</i>
<i>Sp Or2 In2</i>	BCFG	<i>Zero Bit</i>
<i>Sp Or2 Nin3</i>	BCFG	<i>One Bit</i>
<i>Sp Or2 Out</i>	DPB	
<b>Or Block</b>		
<i>Sp Or3 In1</i>	BCFG	<i>Zero Bit</i>
<i>Sp Or3 In2</i>	BCFG	<i>Zero Bit</i>
<i>Sp Or3 Nin3</i>	BCFG	<i>One Bit</i>
<i>Sp Or3 Out</i>	DPB	
<b>And Block</b>		
<i>Sp And1 In1</i>	BCFG	<i>One Bit</i>
<i>Sp And1 In2</i>	BCFG	<i>One Bit</i>
<i>Sp And1 Nin3</i>	BCFG	<i>Zero Bit</i>
<i>Sp And1 Out</i>	DPB	
<b>And Block</b>		
<i>Sp And2 In1</i>	BCFG	<i>One Bit</i>
<i>Sp And2 In2</i>	BCFG	<i>One Bit</i>
<i>Sp And2 Nin3</i>	BCFG	<i>Zero Bit</i>
<i>Sp And2 Out</i>	DPB	
<b>And Block</b>		
<i>Sp And3 In1</i>	BCFG	<i>One Bit</i>
<i>Sp And3 In2</i>	BCFG	<i>One Bit</i>
<i>Sp And3 Nin3</i>	BCFG	<i>Zero Bit</i>
<i>Sp And3 Out</i>	DPB	

### Description:

Each of these is an individual block as described in the block functional specification.

## **SECTION VII**

### **MOTOR CONTROL MODE**

#### **7-1 TORQUE REFERENCE ( See Appendix A-2 )**

The torque reference is used when *MotorControlMode* is selected for torque control. The reference can be used with speed control as a torque limit.

##### **7-1.1 TORQUE REFERENCE BLOCKS**

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Trq Ref</i>	ACFG	<i>Trq Ref StA</i> = 0.0
<i>Control Place</i>	CAL	0
<i>Trq_Dir</i>	BCFG	Zero Bit
<i>Keypad_Trq_Dir</i>	DPB	

*Control Place* determines if the reference is coming from the keypad or from *Trq Ref*. It also determines where the invert reference bit comes from.

If *Control Place* is set for local control, then the torque reference comes from the drive's keypad.

The torque polarity is set by either *Trq Dir* or *Keypad Trq Dir* depending on *Control Place*.

### 7-1.2 TORQUE REFERENCE ENABLE, RAMP AND LIMITS

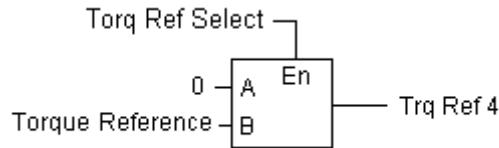
Parameters	Type	Default
<i>Trq Ref En</i>	BCFG	<i>Zero Bit</i>
<i>Trq No Ramp</i>	BCFG	<i>One Bit</i>
<i>Trq Rmp Rate</i>	CAL	5 % / second
<i>Trq_Ref_Min</i>	CAL	100.0%
<i>Trq Ref Max</i>	CAL	0%
<i>Torque Reference</i>	APB	

To enable the torque reference, *Motor Ctrl Mode* must be selected as torque control and *Trq Ref En* must be set high.

The Torque reference can go through an optional ramp limiter. To enable this, set *Trq No Ramp* to *Zero Bit*. *Trq Rmp Rate* is entered in % torque per second rate.

The reference is then checked for its limits before going to the firmware as *Torque Reference*.

### 7-1.3 TORQUE REFERENCE FIRMWARE, PART I



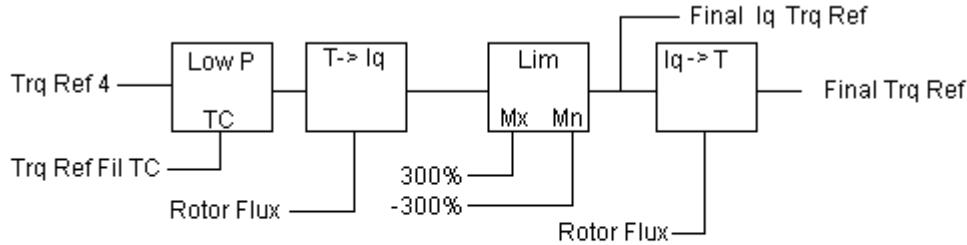
Parameters	Type	Default
<i>SC Trq Chain Sel</i>	En	0 = Not used
<i>Torq Ref Select</i>	En	0 = Not Used
<i>Torque Reference</i>	APB	

*SC Trq Chain Sel* determines the operation of the torque reference as follows:

- 0 = Not Used
- 1 = Torque limit to the speed loop
- 2 = Torque reference added to speed loop ( Or only reference )
- 4 = Position control ( See closed loop speed loop description )

*Torq Ref Select* enables *Torque Reference* setpoint.

### 7-1.4 TORQUE REFERENCE FIRMWARE, PART II



Parameters	Type	Default
<i>Trq Ref Fil TC</i>	CAL	0 ms
<i>Torque Step</i>	CAL	0
<i>Rotor Flux</i>	APB	
<i>Final Iq Trq Ref</i>	APB	
<i>Final Trq Ref</i>	APB	

*Trq Ref 4* goes through a second order low-pass filter with a time constant of *Trq Ref Fil TC*.

*Torque Step* is available for the ADDaptACC program to provide step changes for tuning.

The reference is then converted to motor current by taking into account the estimated *Rotor Flux*.

After being checked to be within +/- 300% current, the *Final Iq Trq Ref* is created. Also, converting back to torque reference is done to create *Final Trq Ref*.

## **7-2 OPEN LOOP CONTROL ( See Appendix A-9 )**

Open loop control is set by having *Motor Ctrl Mode* or *Motor Ctrl Mode2 = 0 – 2.* (*Mtr Ctrl Sw* determines which mode to use)

- 0 = Frequency control (Volts/Hertz)
- 1 = Open loop speed control (Open loop vector speed control)
- 2 = Open loop torque control (Open loop vector torque control)

Each mode has its own regulator scheme. In each open loop mode there are three stabilizers: Torque, DC-Link, and Flux. Each of these are factory-set, but are explained for reference.

The Startup wizard will set *Motor Ctrl Mode* to Frequency control if it does not detect an encoder board in Slot C. Otherwise Close loop speed control is selected.

### **7-2.1 TORQUE STABILIZER**

The Torque stabilizer is used to dampen possible oscillations in the estimated torque calculations. This loop comes into affect above 3 hertz and is factory tuned. The reference to the controller is the derivative of the estimated torque value. The stabilizer control is a proportional-only controller with a variable gain. The gain is changed linearly between zero and field weaken frequency. The Zero and field weaken gain points are be *TorqStabGain* and *TorqStabGainFWP*.

*TorqStabGainHwDtcFWP* is an additional gain with dead time compensation above the field weaken point.

The output of the regulator is also limited by *TorqStabLimit*. The output of the controller goes through a damping block to reduce spikes from the derivative input based on parameter *TorqStabDamp*.

The torque stabilizer is factory set and the parameters are not editable.

- TorqStabGain* = 100 gain
- TorqStabGainFWP* = 50 gain
- TorqStabGainHwDtcFWP* = 50
- TorqStabLimit.* = 150 Hz/FreqScale
- TorqStabDamp* = 900

### **7-2.2 DC-LINK STABILIZER**

The DC-link Stabilizer operates similar to the Torque stabilizer and also operates above 3 hertz. The reference to the controller is the derivative of the DC-link voltage. The proportional gain is variable by estimated motor torque. As the torque increases from 10% to 50%, the controller gain decreases from *VoltStabGain* to zero gain.

VoltStabGainHwDtc is an additional gain with dead time compensation.

The output of this stabilizer is limited by VoltStabLimit. The output of the controller goes through a damping block to reduce spikes from the derivative input based on parameter VoltStabDamp.

The Voltage stabilizer is factory set and the parameters are not editable.

VoltStabGain = 100 gain

VoltStabGainHwDtc = 50 gain

VoltStabLimit = 150 Hz/FreqScale

VoltStabDamp = 900

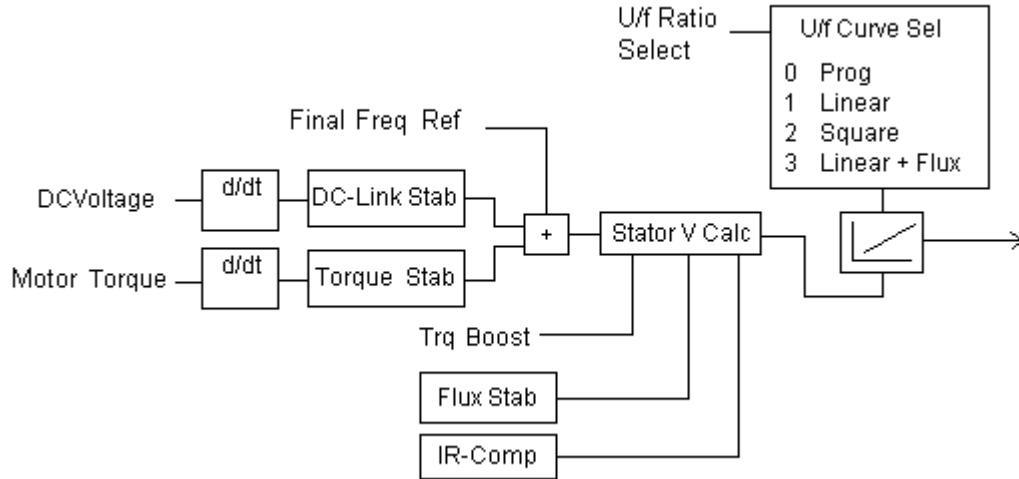
### 7-2.3 FLUX STABILIZER

The Flux stabilizer purpose is to stabilize the magnetizing current. The error to the controller is from the difference between filtered and unfiltered magnetizing current. The filtered signal has a time constant of ldsFiltCoeff (in ms). The Flux stabilizer is a proportional-only controller with a gain of ldsStabGAinRef.

The Flux stabilizer is factory set and the parameters are not editable.

ldsFiltCoeff = 64 ms.

ldsStabGAinRef = 500 gain

7-2.4 OPEN LOOP FREQUENCY REFERENCE (*Motor Ctrl Mode* = 0)

Parameters	Type	Default
<i>Motor Ctrl Mode</i> ,	CAL	0 = Open Loop Frequency mode
<i>Motor Ctrl Mode2</i>		
<i>DCVoltage</i>	APB	
<i>Motor Torque</i>	APB	
<i>Freq out</i>	APB	
<i>U/f Optimization</i>	CAL	0
<i>Meas Rs V Drop</i>	CAL	0
<i>Ir Add Mtr Scl</i>	CAL	100
<i>Ir Add Gen Scl</i>	CAL	0
<i>Ir Add 0 Pt V</i>	CAL	0
<i>U/F Ratio Select</i>	CAL	2 = Programmable
<i>Zero Freq Voltg</i>	CAL	0
<i>Voltage at FWP</i>	CAL	100.00
<i>U/F Mid Freq</i>	CAL	3.00 Hz
<i>U/F Mid Voltg</i>	CAL	5.00 %

If *Motor Ctrl Mode* = 0, then *Freq out* becomes the drives motor frequency reference in volts per hertz mode.

The torque and DC-link voltage stabilizer output is added straight to the frequency reference. Both of these stabilizers are zero mean additions to the output frequency. The Torque stabilizer is to dampen possible oscillations in the estimated torque calculations and DC-Link stabilizer is to dampen changes in the DC bus voltage.

The Stator Voltage calculation block takes the output of *Freq out* modified by the stabilizers and calculates the correct stator voltage. Inputs to this calculation are the torque boost and IR compensation.

Torque boost is enabled by setting *U/F Optimization* = 1. The torque boost is to compensate for the voltage drop due to stator resistance. This is done in the following ways.

- If the *Meas Rs V Drop* is set, then this value is used. This can be set by the user or the drive will calculate it if DC-brake is active for longer than two seconds.
- If the *Meas Rs V Drop* is not used, then the drive will estimate the voltage drop. This estimation can be viewed at *DefRsVoltageDrop*.

The IR compensation scaling is broken up into two values, depending if the drive is in motoring or in generation mode. The two variables are *Ir Add Mtr Scl* and *Ir Add Gen Scl*. These are scaled in percentage of the amount to add to the reference. The IR compensation value then goes through a low-pass filter with a time constant of *IrAddFilterTC*, which is hard coded to 8 ms. The gain of this filter goes from zero to full scale at *IrAddFreqLimit*, which is hard coded to 1 Hz. Between zero and this *IrAddFreqLimit*, a constant voltage *IrAddZeroPointVoltage* can be added.

The output voltage is then determined by going through one of three volts per hertz curves. Selection of a curve is done with the *U/F Ratio Select* parameter.

- *U/F Ratio Select* = 0 = Linear curve – As the name implies, this performs a linear curve between the *Zero Freq Voltg* and *Voltage at FWP*. *Zero Freq Voltg* is entered in percent of nominal voltage and is the starting voltage for the drive.

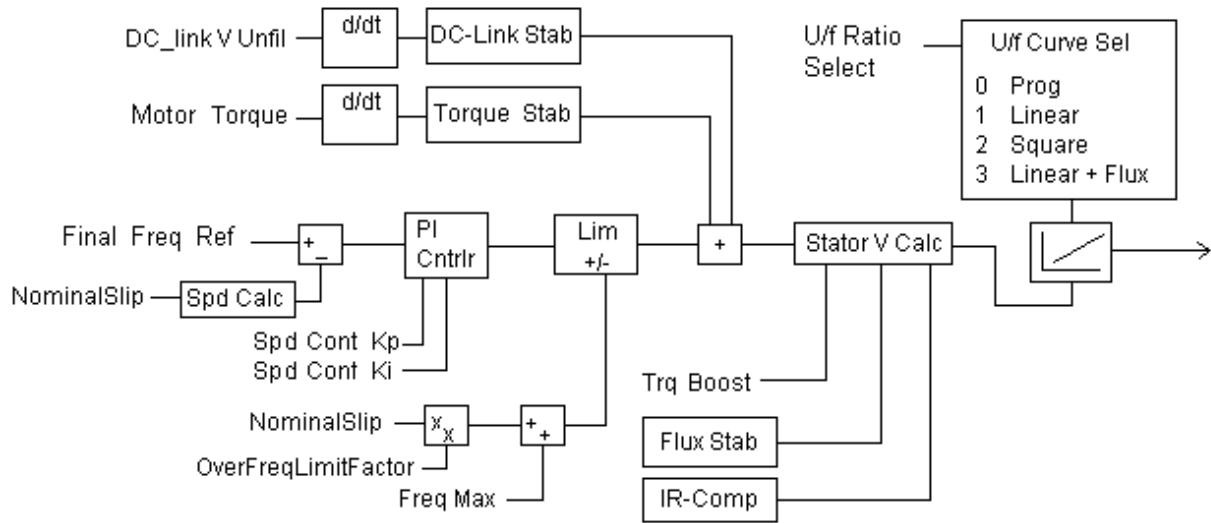
*Voltage at FWP* is entered in percent of nominal voltage and is the ending voltage when the field weakening frequency has been reached.

- *U/F Ratio Select* = 1 = Squared – The same parameters as Linear curve are used except, instead of a linear interpolation between the two points, a squared curve is used.
- *U/F Ratio Select* = 2 = Programmable – This is automatically selected if the drive has completed its identification with run and built the frequency-to-voltage curve. Three voltage, frequency points are found and used to define the curve. The points are:

*UFZeroPointVoltage*  
*U/f Mid Freq*  
*Voltage at FWP*

- *UFRatio* = 3 = Linear with Flux optimization – Uses the linear curve with voltage being drooped during constant operation. The advantage if this modification is to reduce motor losses. The disadvantage is a lag in the torque loop.

### 7-2.5 OPEN LOOP SPEED CONTROL (*Motor Ctrl Mode* = 1)



Parameters	Type	Default
<i>Motor Ctrl Mode</i> ,	CAL	0 = Open Loop Frequency mode
<i>Motor Ctrl Mode2</i>		
<i>Freq out</i>	APB	
<i>Spd Cont Kp</i>	CAL	3000 Gain
<i>Spd Cont Ki</i>	CAL	300 Gain
<i>Freq Max</i>	CAL	60 Hz

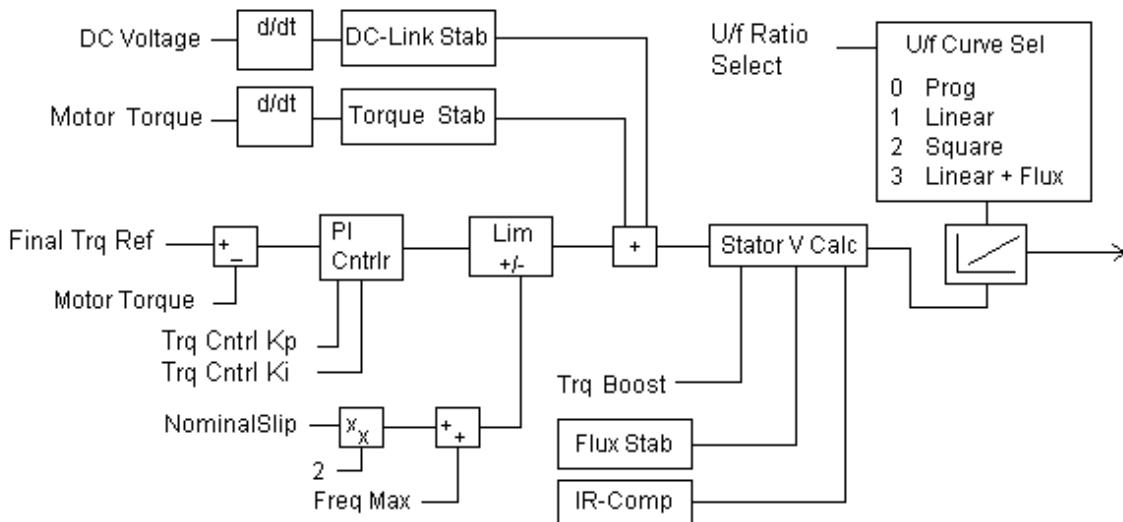
If *Motor Ctrl Mode*= 1, then *Freq out* becomes the drive's open loop speed reference.

The motor speed feedback is calculated from the motor voltage and the estimated slip value (NominalSlip).

The error is then passed to a Speed PI regulator. The proportional gain is set by *Spd Cont Kp* and the integral gain is set by *Spd Cont Ki*.

The output of the PI regulator is limited to *Freq Max* plus the value of NominalSlip x OverFreqLimitFactor. OverFreqLimitFactor is factory-set for 300 and allows the motor to get to its rated speed.

After the frequency limiter, the reference goes through the same stabilizers and volts per hertz curve as the open loop frequency reference. See the section prior to setup of these control sections.

7-2.6 OPEN LOOP TORQUE CONTROL (*Motor Ctrl Mode* = 2)

Parameters	Type	Default
<i>Motor Ctrl Mode</i> , <i>Motor Ctrl Mode2</i>	CAL	0 = Open Loop Frequency mode
<i>Final TrqRef</i>	APB	
<i>Motor Torque</i>	APB	
<i>Trq Cntrl Kp</i>	CAL	150 Gain
<i>TrqCntrl Ki</i>	CAL	10 Gain
<i>Torq Speed Limit</i>	E	1 = Freq Ref
<i>Freq Max</i>	CAL	60 Hz

If *Motor Ctrl Mode* = 2, then *Final Trq Ref* becomes the drive's open loop torque reference. See section 7-1 for the origin of this signal.

The drive goes into torque control if the drive is not in a limit. The error from *Final Trq Ref* and *Motor Torque* passes to a torque PI regulator. The proportional gain is set by *Trq Cntrl Kp* and the integral gain is set by *Trq Cntrl Ki*.

The output of the torque PI regulator is limited to *Torq Speed Limit* plus the value of NominalSlip x 2. This allows the motor to get to its rated speed. *Torq Speed Limit* can be set to either *Freq Max* or *Freq Ref*.

After the frequency limiter, the reference goes through the same stabilizers and volts per hertz curve as the open loop frequency reference. See the section prior to setup of these control sections.

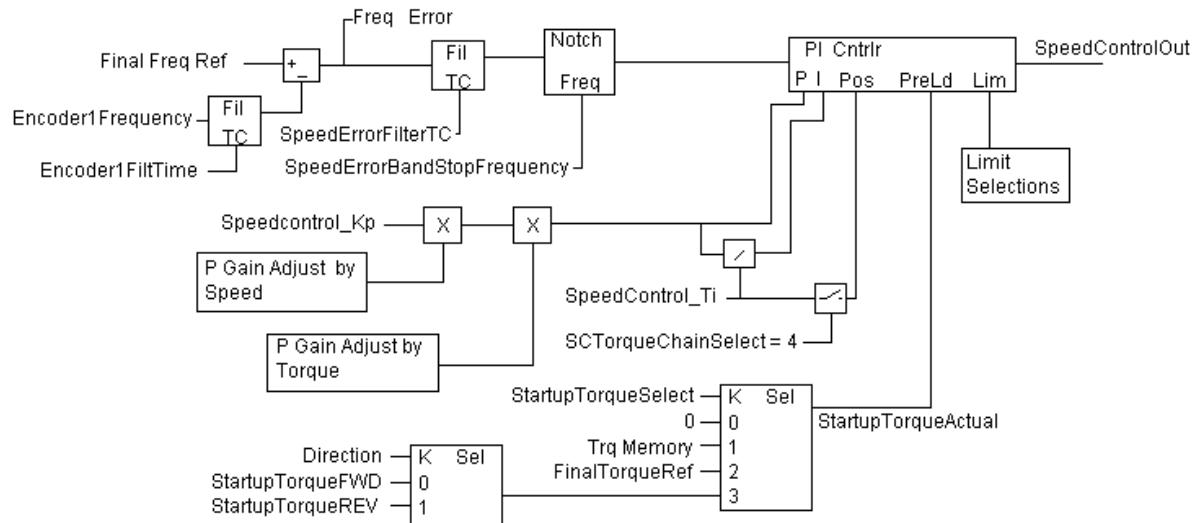
## 7-3 CLOSED LOOP CONTROL ( See Appendix A-10 )

Closed loop control is set by having *MotorControlMode*= 3 or 4.

3 = Closed loop speed control

4 = Closed loop torque control

### 7-3.1 CLOSED LOOP SPEED CONTROL (*Motor Ctrl Mode* = 3)



Parameters	Type	Default
<i>Motor Ctrl Mode</i>	CAL	0 = Open Loop Frequency mode
<i>Motor Ctrl Mode2</i>		
<i>Final Freq Ref</i>	APB	
<i>Encoder1FiltTime</i>	CAL	0 ms
<i>Freq Error</i>	APB	
<i>Spd Err Fil TC</i>	CAL	0 ms
<i>Spd Err LP Freq</i>	CAL	100 Hz
<i>Spd Err Bnd Frq</i>	CAL	0 Hz
<i>Spd Control Kp</i>	CAL	30 Gain
<i>Spd Control Ti</i>	CAL	300 ms
<i>Spd Cntrl F0</i>	CAL	0 Hz
<i>Spd Cntrl F1</i>	CAL	0 Hz
<i>Spd Cntrl Kp F0</i>	CAL	100%
<i>Spd Cntrl Kp FW</i>	CAL	100%
<i>Spd Cntrl Kp T0</i>	CAL	100%
<i>Spd Cntrl T0</i>	CAL	
<i>SC Trq Chain Sel</i>	CAL	0 = Not Used.
<i>Startup Trq Sel</i>	CAL	0 = No Preload
<i>StartupTorq FWD</i>	CAL	0%
<i>StartupTorq REV</i>	CAL	0%
<i>Mtr Cur Lim Scl</i>	ACFG	<i>Mtr Cur Limit</i> = 100%
<i>SC Trq Chain Sel</i>	En	0 – Not Used
<i>Final Trq Ref</i>	APB	
<i>Motoring Trq Lim</i>	CAL	300%

Parameters	Type	Default
<i>Gener Trq Lim</i>	CAL	300%
<i>Trq Lim FWD</i>	CAL	300%
<i>Trq Lim REV</i>	CAL	300%
<i>Speed Cntrl Out</i>	APB	

If *Motor Ctrl Mode* =3, then *Final Freq Ref* becomes the drive's closed loop speed reference. See Speed Reference (section 6-1.1) and Speed Step Reference (section 6-1.2) in this manual for the origin of this signal.

The Speed feedback comes from the first encoder board input detected by the drive. This value is represented on the diagram as *Encoder1Frequency* but is not available for viewing. This frequency can be filtered by a low pass filter with a time constant of *Encoder1FilTime*.

The speed loop error signal is can be viewed with the parameter *Freq Error*, which is in Freqscale units.

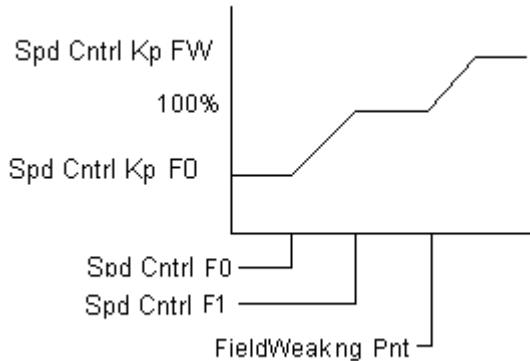
The error signal passes through two filters before going to the PI regulator. The first filter is a low pass filter with a time constant of *Spd Err Fil TC* and a cutoff frequency of *Spd Err LP Freq*. The second is a notch filter centered around *Spd Err Bnd Frq*.

The error is then passed to the speed loop PI regulator. This regulator is an anti-windup proportional integrator controller with variable gains.

The standard proportional gain is set by *Speed Control Kp*. The standard integral component is a ratio of the *Speed Control Kp / Speed Control Ti*.

Two algorithms are used to modify the speed loop gains. Both are defaulted such that 100% of *Spd Cntrl Kp* goes to the controller.

#### A) P Gain Adjust by Speed



The P gain adjust by speed has two parts associated with it: First, the gain can be modified at lower frequencies, and gain modified above the field weaken range. *Spd Cntrl F0* and *Spd Cntrl*

*F1* define the frequency window which will modify the gain. The block gain will change linearly from the setpoint *Spd Cntrl Kp F0* at *Spd Cntrl F0* to 100% at *Spd Cntrl F1*.

Second, the gain can then be modified in the field weakened range. The percent output will increase linearly from 100% to *Spd Cntrl Kp FW* when the motor speed reaches maximum frequency.

### **B) P Gain Adjust by Torque**

*Spd Cntrl Kp T0* is the P gain percent adjust at zero torque. The percentage will go to 100% when torque reaches the *Spd Cntrl T0* point.

The Speed loop regulator has the option for Type II speed control or position control. This is enabled by setting *SC Trq Chain Sel* = 4. When enabled, a second proportional gain equal to *Speed Control Ti* is added to the integrator error. The idea is to keep zero position error by keeping the speed loop integrator equal to zero. When activated, *Speed Control Ti* may need retuning.

### **C) Closed Loop Speed Control Preload**

The speed loop can be preloaded on start to provide initial torque. Preload can come from four sources, depending on *Startup Trq Sel*.

- *Startup Trq Sel* = 0 (Default) No preload.
- *Startup Trq Sel* = 1 (Torque Memory). The torque the drive was commanding prior to the last stop command being activated will be used.
- *Startup Trq Sel* = 2 (Torque Reference). The regulator will be preloaded with *Final Trq Ref* value. See section 7-1 for configuration.
- *Startup Trq Sel* = 3 (Starting Torque Setpoint). Depending on the direction commanded on the start, will decide if *Startup Trq FWD* or *Startup Trq REV* will be used to preload the regulator.

### **D) Closed Loop Speed Regulator Output Limits**

The output of the speed control regulator has several limits that can be applied. Some are based on which quadrant the drive is running. The final limit is the least value of all of the following and can be viewed at *MotorCurLimit*.

*Mtr Cur Lim Scl* is a percentage of the *Motor Nom Currnt* setpoint that is used as the main current limit. This limits the current in all quadrants. It is defaulted to 100%, which is the lowest default limit. Since CurrentLimitOption.B0 is factory-set to zero, this current limit is the motor maximum current times the motor's power factor.

The overvoltage limiter controller will also limit the speed loop output if enabled. See section 6-2.6.

If *SC Trq Chain Sel* is set = 1, then *Final Trq Ref* becomes an output limit to the controller.

1. Quadrant #1: Forward Motoring

- *Motoring Trq Lim* which is defaulted to 300%
- *Trq Lim FWD* which is defaulted to 300%
- *MotoringPowerLim* which is factory set at 300%

The final value can be viewed at *Pos Iq Cur Lim*.

2. Quadrant #2: Reverse Generating

- *Gener Trq Lim* which is defaulted to 300%
- *Trq Lim REV* which is defaulted to 300%
- *GeneratorPowerLim* which is factory set at 300%

3. Quadrant #3: Reverse Motoring

- *Motoring Trq Lim* which is defaulted to 300%
- *Trq Lim REV* which is defaulted to 300%
- *MotoringPowerLim* which is factory set at 300%

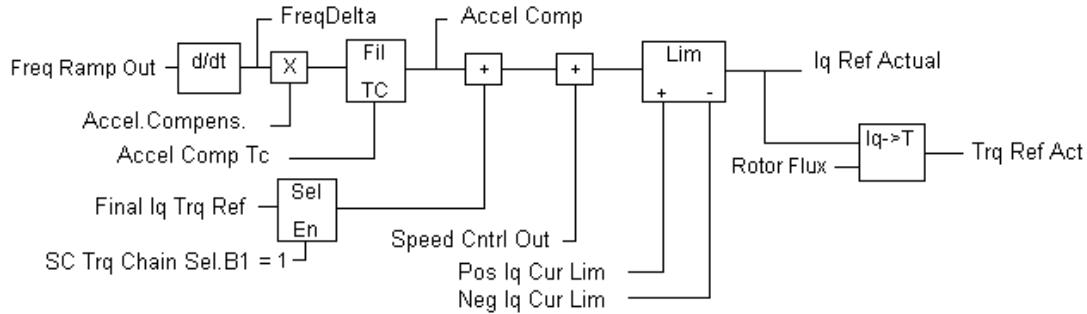
The final value can be viewed at *Neg Iq Cur Lim*.

4. Quadrant #4: Forward Generating

- *Gener Trq Lim* which is defaulted to 300%
- *Trq Lim FWD* which is defaulted to 300%
- *GeneratorPowerLim* which is factory set at 300%

## E) Closed Loop Speed Control Current Reference

The output of the speed regulator can be viewed at *Speed Cntrl Out* in percent motor torque.



Parameters	Type	Default
<i>Freq Ramp Out</i>	APB	
<i>FreqDelta</i>	APB	
<i>Accel.Compens.</i>	CAL	0 s
<i>Accel Comp Tc</i>	CAL	0 ms
<i>Accel Comp</i>	APB	
<i>Final Iq Trq Ref</i>	APB	
<i>SC Trq Chain Sel.B1</i>	CAL	0 Not Used
<i>Speed Cntrl Out</i>	APB	
<i>Rotor Flux</i>	APB	
<i>Trq Ref Act</i>	APB	

The output of the speed loop regulator gets added to the inertia compensation and optional torque adder reference.

The inertial compensation value is determined by taking the derivative of *Freq Ramp Out*, which will yield the acceleration rate in motor hertz per second ( *FreqDelta* ). *Accel.Compens.* is the gain of the inertia compensation. This value is scaled in the amount of time it takes to accelerate the drive with nominal torque to nominal speed. If *Freq Ramp Out* is coming from an external signal, a low pass filter is required to make the gain stable. *Accel Comp Tc* is the time constant in ms for this filter. The inertia compensation torque reference can be viewed at *Acc Comp*.

*Final Iq Trq Ref* is the output of the torque reference blocks and can be configured to add to the speed controller output. This would be used as a load anticipation signal.

After the signals are added together, the sum is then checked to be within the torque and current limits as defined based on the quadrant the drive is running. See the section before for details. These limits are *Pos Iq Cur Lim* and *Neg Iq Cur Lim*.

The reference can be viewed as torque using *Trq Ref Act* or as current using *Iq Ref Actual*.

### 7-3.2 CLOSED LOOP TORQUE CONTROL (*Motor Ctrl Mode* = 4)

Parameters	Type	Default
<i>Final Trq Ref</i>	APB	
<i>Final Iq Trq Ref</i>	APB	
<i>Trq Spd Lim Mode</i>	CAL	0 – Maximum limits
<i>TC Pos Freq Lim</i>	APB	
<i>TC Neg Freq Lim</i>	APB	
<i>TC Spd Lim Sel</i>	CAL	0 – No ramping
<i>Freq Ramp Out</i>	APB	
<i>Win Pos Width</i>	CAL	0 Hz
<i>Win Neg Width</i>	CAL	0 Hz

In closed loop torque control, *Final Trq Ref* and *Final Iq Trq Ref* is used as the drive's torque command. See section 7-1 for how to setup the references.

While in closed loop torque control, there are several methods to limit the motor's speed. To use these, it must be noted that the speed loop must be tuned for stable operation. The method is selected by *Trq Spd Lim Mode* and *TC Spd Lim Sel* parameters. The output limits of the different methods can be viewed by *TC Pos Freq Lim* and *TC Neg Freq Lim*.

- A) *Trq Spd Lim Mode* = 0 = Maximum Limits. The section will be in torque control until motor speed exceeds either PosFreqMaxActual or NegFreqMaxActual.
- B) *Trq Spd Lim Mode* = 1 = Absolute value of speed reference. The section will be in torque control until the motor exceeds the absolute value of *Freq Ramp Out*, which is the ramped speed reference.
- C) *Trq Spd Lim Mode* = 2 = Speed reference and Min Frequency. The section will be in torque control until the motor exceeds *Freq Ramp Out* or NegFreqMaxActual.
- D) *Trq Spd Lim Mode* = 3 = Max frequency and Speed reference. The section will be in torque control until the motor exceeds PosFreqMaxActual or *Freq Ramp Out*.
- E) *Trq Spd Lim Mode* = 4 = Window. The section will be in torque mode as long as the speed is within a window around *Freq Ramp Out*.

The positive side is *Freq Ramp Out* + *Win Pos Width*. The negative side = *Freq Ramp Out* – *Win Neg Width*.

- F) *Trq Spd Lim Mode* = 5 = Speed reference and zero. The section will be in torque control until the motor exceeds *Freq Ramp Out* and zero frequency. *Freq Ramp Out* is either the maximum limit or the minimum limit based on motor direction.
- G) *Trq Spd Lim Mode* = 6 = Window select. This mode is not available and should not be selected.

The changes to *TC Pos Freq Lim* and *TC Neg Freq Lim* can be ramped to avoid fast speed changes. These limits are changed when *Trq Spd Lim Mode* is changed while running or transferring into torque mode from speed control. The *TC Spd Lim Sel* word determines how the limits are ramped. *TC Spd Lim Sel* is defaulted to 0, which disables limit ramping.

The speed reference ramp times are used when the limit ramping is enabled.

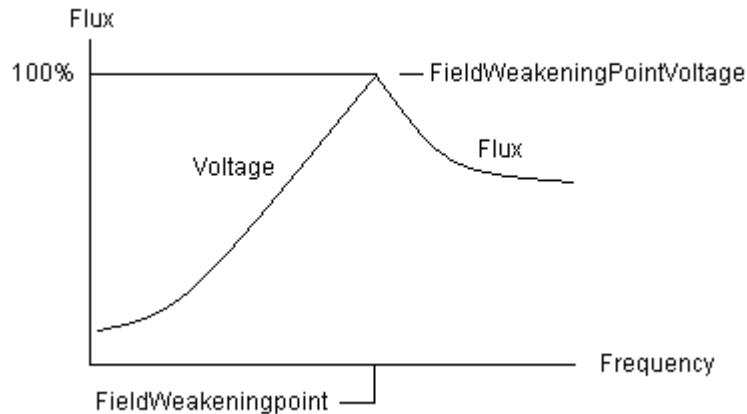
- A) *TC Spd Lim Sel.B0* = 1 = Ramp out of torque control. When enabled, the speed reference will ramp at its current value to *Freq Ramp Out* when the mode is transferred from torque control to speed control.
- B) *TC Spd Lim Sel.B1* = 1 = Smart ramp down. If the speed limit is reduced as a step change, the drive will ramp the limit from the current motor running speed to the new limit.
- C) *TC Spd Lim Sel.B2* = 1 = Ramp Up. If the speed limit is increased as a step change, the drive will ramp the limit up to its new value.
- D) *TC Spd Lim Sel.B3* = 1 = Ramp Down. If the speed limit is decreased as a step change, the drive will ramp the limit down to its new value.
- E) *TC Spd Lim Sel.B4* = 1 = Follow Actual. Used with *TC Spd Lim Mode* = 6, which is not available in this software version.
- F) *TC Spd Lim Sel.B5* = 1 = Force Ramp stop. On removal of run, the limits will step to the actual motor speed, then ramp to zero.
- G) *TC Spd Lim Sel.B6* = 1 = Max speed. Sets *TCPoSFreqLimitActual* to motor speed when transitioning into torque mode from speed mode. If Ramp Up is also enabled, the upper limit will then ramp to its setpoint creating a smooth transition into torque mode.
- H) *TC Spd Lim Sel.B7* = 1 = Speed Limits. Similar to *TC Spd Lim Sel.B6*, except that both limits are set to the motor speed on the transition into torque mode. Then based on the Ramp Up and Ramp Down bits, they will ramp to the setpoints. Provides a smooth transition into torque mode regardless of if the torque is higher or lower than the desired torque when enabled.

## 7-3.3 FLUX REFERENCE

( See Appendix A-11 )

Parameters	Type	Default
<i>MagnCurrent</i>	CAL	Tune
<i>Motor Nom Currnt</i>	CAL	SetId
<i>Field Weakengpnt</i>	CAL	60.00 Hz
<i>Voltage at FWP</i>	CAL	100.00 volts
<i>Start DC-Brake Tm</i>	CAL	0 ms
<i>DC-Brake Current</i>	CAL	54.0 amps
<i>Strt 0 Spd Time</i>	CAL	100 ms.
<i>Load Float Time</i>	CAL	0.1 ms.
<i>Brake Offset</i>	CAL	.1 ms
<i>Stop St Magn I</i>	CAL	50%
<i>Stop St Magn Tim</i>	CAL	30 seconds

The magnetizing current reference for the motor is set by the parameter *Magn Current*. This value is in motor amps and gets converted to percentage by dividing it by *Motor Nom Currnt* x 100. This is the full magnetizing current during normal operation giving full rotor flux. Additional references are added before starting, after stop, and during field weakening operations.



Current reference is adjusted during the field weakened range of the motor. *Field Weakengpnt* defines the frequency to start reducing the motor flux. The drive also monitors motor voltage and reduces the flux to keep the value below *Voltage at FWP*. Another voltage limit is also used to keep the motor voltage below the DC-Link voltage. The motor voltage is limited by *ModIndexLimit* x measured motor volts. *ModIndexLimit* is factory-set to 100%.

*FluxCurrentRampTime* defines the rate of change limit for the Flux current except at a start. This value is factory set to 200 ms.

At a run command, the flux has an accelerated ramp time defined by *StartBoostRiseTime* which is factory-set to 10 ms.

The time between when the drive is commanded to run and the ramp is released is defined by *Load Float time* added with *Brake Offset*. During that time, *DC-Brake Current* can be added for

the length of time defined by *Start DC-Brake Tm*. After *Start DC-Brake Tm* has timed out, the flux returns to its full value by the *FluxCurrentRampTime*.

After the run command is removed and the section has ramped to zero, the motor flux stays at its nominal value until *Stop 0 Spd Time* has elapsed. The current then ramps to the *Stop St Magn I* percentage for the *Stop St Magn Tim*. This keeps the field at a lower level for a period of time for operations that perform a lot of quick start and stops.

#### 7-3.4 FLUX MODELING

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Slip Adjust</i>	CAL	100%
<i>Flux Curve a</i>	CAL	10%
<i>Flux Curve b</i>	CAL	20%
<i>Flux Curve c</i>	CAL	30%
<i>Flux Curve d</i>	CAL	40%
<i>Flux Curve e</i>	CAL	50%
<i>Flux Curve f</i>	CAL	60%
<i>Flux Curve g</i>	CAL	70%
<i>Flux Curve h</i>	CAL	80%
<i>Flux Curve i</i>	CAL	90%
<i>Flux Curve j</i>	CAL	100%
<i>Flux Curve k</i>	CAL	110%
<i>Flux Curve l</i>	CAL	120%
<i>Flux Curve m</i>	CAL	130%
<i>Flux Curve n</i>	CAL	140%
<i>Flux Curve_o</i>	CAL	150%

The flux model of the drive uses the motor nameplate data, measured currents, and motor speeds and outputs flux angle, rotor flux frequency, and flux amplitude. The flux angle is used to perform field-oriented control that separates the magnetizing current and torque producing current. The rotor flux frequency is used to control the field weakening operations. The estimated flux versus motor current is adjusted by the programmable flux curve.

The rotor time constant is needed to perform the flux model. This time constant is estimated from the nominal motor speed, current, frequency, and cos (magnetizing current). This calculated value is then adjusted by *Slip Adjust*. Slip adjust is for manual tuning of the motor slip. A value less than 100% decreases the slip which, in turn, increases the rotor time constant.

Motor magnetizing current is related to the estimated motor flux by a preset saturation curve. This curve has 15 points (*Flux Curve a* to *Flux Curve o*). Each point represents the flux at each step of the magnetizing current range, from 0 to 150% at 10% steps. The default is linear.

### 7-3.5 CURRENT CONTROL LOOP

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>CurrentControlKp</i>	CAL	4000 Gain
<i>Curr Cntrl_Ti</i>	CAL	15 ms
<i>Motor Cos Phi</i>	CAL	0.85
<i>MotorType</i>	CAL	0 = Induction

In closed loop mode, a faster current control loop is selected. The motor phase currents are measured and the corresponding vector reference is calculated. The actual current regulation is performed with two PI controllers. The IdReference controller regulates magnetizing current. The IqReference controller regulates motor torque. *CurrentControlKp* and *Curr Cntrl Ti* modify the gain of the regulators.

The output of the current regulators determines motor voltage vector.

Other factors that determine the final current loop output are encoder angle calculation from the encoder, Motor CEMF, and inverter bridge dead time.

The current loop regulator runs at 140 microsecond time frame.



## SECTION VIII

### MISCELLANEOUS CONTROL BLOCKS

This section deals with all the control blocks and firmware parameters that do not fit into any other category.

#### 8-1 SPEED COMPARATORS ( See Appendix A-2 )

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Motor Speed</i>	APB	RPM
<i>Spd Cmp Fil TC</i>	CAL	0.2 seconds
<i>Max RPM</i>	APB	RPM
<i>Ovr Spd Stp</i>	CAL	110%
<i>Zero Detect</i>	CAL	2 %
<i>Spd Hyst</i>	CAL	1 %
<i>Spd Decimal</i>	CAL	2
<i>Base Spd RPM</i>	CAL	1800 RPM
<i>Abv Base Spd</i>	DPB	
<i>At Zero Spd</i>	DPB	
<i>Brk Hld Spd</i>	CAL	50 RPM
<i>Blw Brk Spd</i>	DPB	
<i>Brk Slp Spd</i>	CAL	25 RPM
<i>Abv_Brk_Slp_Spd</i>	DPB	

*Motor Speed* is scaled in motor RPM.

*Motor Speed* is passed through a low pass filter with a time constant of *Spd Cmp Fil TC* before it goes to the speed comparators.

*Max RPM* is calculated using the motor poles and the entered *FreqMax*.

The zero speed setpoint is defined by *Zero Detect* which is defaulted to 2.00%. At *Zer Spd* bit will go high when the percentage of *Motor Speed* falls below this value minus the hysteresis value *Spd Hyst*.

The over speed setpoint is defined by *Ovr Spd Stp*, which is defaulted to 110.00%. *Over Speed* bit will go high when the percentage of *Motor Speed* goes above this value plus the hysteresis value *Spd Hyst*.

*Spd Decimal* is defaulted to 2. Modify this if the compare block setpoint decimal place needs to be moved due to integer limitations.

The other three comparitors are used in other portions of the drive logic.

- *Abv Base Spd* can be used to switch to lower ramp rates.
- *Blw Brk Spd* is used to hold the brakes open on a ramp stop.
- *Abv Brk Slp Spd* is used to check for brake slippage after brakes set and during torque proving.

## 8-2 OVER WEIGHT ALARM ( See Appendix A-5 )

*Ov Wt Alarm* bit can be used to either set an external alarm or used for an user fault. The alarm bit is set when the motor current percentage goes above *Full Load Per* when the drive is going forward (Up) and not accelerating. *Ov Wt Alarm* is latched on until the run is removed.

## 8-3 PARAMETER SETS (See Appendix A11 )

The Keypad can store two sets of parameter values. These can be downloaded or saved via the keypad menu. The drive can not be running during this transition. The logic in control block diagrams Param\_Set\_1 and Param\_Set\_2 prevents the transitions or starting a run before the transition is complete.

Warning: The drive does not know which parameter set is loaded.

## 8-4 MICRO SPEED ( See Appendix A-5 )

Parameters	Type	Default
<i>MSpd Inp</i>	BCFG	<i>Zero Bit</i>
<i>MSpd Tim</i>	CAL	60 seconds
<i>Dis MSpd Tim</i>	BCFG	<i>Zero Bit</i>
<i>MC Run</i>	DPB	
<i>Run Fwd Inp</i>	DPB	
<i>Run Rev Inp</i>	DPB	
<i>MSpd_OK</i>	DPB	

The micro speed function allows the drive to run at zero speed. The brakes are kept open during the micro speed command.

To enable the micro speed function, set *MSpd Inp* to the digital input or communication bit to active the command.

To protect the motor from overheating a timer is available to fault the drive. To enable this feature, set *Dis MSpd Tim = Zero Bit* and set *MSpd Tim* to the amount of time in seconds to fault the drive out. See the Crane fault section of this manual for a description of this fault.

**8-5 MOTOR BRAKING ( See Appendix A-11)****8-5.1 DC Braking**

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>DC-Brake Current</i>	CAL	3.70 Amps
<i>MC Run</i>	DPB	
<i>Start DC-BrakeTm</i>	CAL	0.00 s
<i>DC Brk Cmd</i>	BCFG	<i>Zero Bit</i>
<i>Stop DC-BrakeFr</i>	CAL	1.50 Hz
<i>DC Tim Ramp</i>	CAL	0.00 s
<i>DC Tim Coast</i>	CAL	0.00 s
<i>DC Brake Current</i>	APB	

The drive can be setup to deliver DC current to the motor during start and stopping. This converts the regenerative power back into the motor windings causing heat. *DC Brk Cmd* enables this feature and *DC-Brake Current* sets the amount of amps to deliver to the motor.

On start DC can be injected into the motor to keep it from moving until brakes are released. *Start DC-BrakeTm* sets the amount of time to deliver the current.

During stop if enabled the drive will put out DC current when it reaches below the *Stop DC-BrakeFr* setting. It will keep the current on for the amount of time set by either *DC Tim Ramp* or *DC Tim Coast* time.

**8-5.2 Flux Braking**

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>FluxBrakeCurrent</i>	CAL	3.70 Amps
<i>Flux Brake</i>	E	Off

Flux braking is similar to DC braking as it converts the stopping energy into motor heat. The difference is that instead of putting pure DC into the windings it controls a slip and voltage differential to be able to control the stop.

**8-6 SWITCHING FREQUENCY ( See Appendix A-11)**

The motor switching frequency is set by *Switching Freq* parameter. The default for this is frame size dependent.



## SECTION IX

### COMMUNICATIONS ( See Appendix A-7 )

The drive can communicate through a wide variety of communication boards that can be inserted into slots D and E. Examples of some of the protocols include:

- Ethernet – Modbus TCP
- Devicenet
- System Bus – Master Slave
- Profibus DP
- Modbus serial link

Each communication board has its own manual that details the protocol and connections. This section will discuss the generic software control blocks that are used for each protocol.

There are usually two methods of reading and writing data to the drive. The protocols either have preset messages such as defined in the EDS sheets for Devicenet or they can read or write to a particular address. The parameter ID number represents its address in most of the message structures. The drive appendices include the ID number with the parameter name. Not all parameters have an ID number.

ID numbers 0 – 1000 are designated for firmware variables.

ID numbers 1001 – 2000 are designated for the application variables.

#### **9-1 READ AND WRITE STANDARD ID NUMBERS**

The following parameters are set aside for write messages to the drive. The addresses are grouped together so one write message can get them all. The drive can then be configured to use these locations for proper function.

*FB Fix Cntrl Wrd* is used write bits to the drive. Only the lower word is used and each bit is defined as follows:

Write bits to the drive:

<b>ID</b>	<b>Parameter Name</b>	<b>Bit Location</b>
1621	<i>FB Fix Cntrl Wrd</i>	0-7
1040	<i>FB Run</i>	0
1041	<i>FB Dir</i>	1
1042	<i>FB Flt Res</i>	2
1043	<i>FB DIN 1</i>	3
1044	<i>FB DIN 2</i>	4
1045	<i>FB DIN 3</i>	5
1046	<i>FB DIN 4</i>	6
1047	<i>FB DIN 5</i>	7

Write integer to the drive:

<b>ID</b>	<b>Parameter Name</b>
1611	<i>A_FB_AIN1</i>
1612	<i>A_FB_AIN2</i>
1613	<i>A_FB_AIN3</i>
1614	<i>A_FB_AIN4</i>
1615	<i>A_FB_AIN5</i>
1616	<i>A_FB_AIN6</i>
1617	<i>A_FB_AIN7</i>
1618	<i>A_FB_AIN8</i>
1619	<i>A_FB_AIN9</i>
1620	<i>A_FB_AIN10</i>

The following parameters are set aside for read messages from the drive. The addresses are grouped together so one read message can get them all. Any parameter with an ID number can be configured to these locations.

*FB Gen Sts Word* is used to read and write bits to the drive. The low byte is for writing 8 bits to the drive. The upper byte is not used.

Read bits from the drive:

<b>ID</b>	<b>Parameter Name</b>	<b>Bit Location</b>
1631	<i>FB Gen Sts Word</i>	00 - 07

<b>Configuration Parameter</b>	<b>Bit Set</b>
<i>FB Bit Cfg Out00</i>	00
<i>FB Bit Cfg Out01</i>	01
<i>FB Bit Cfg Out02</i>	02
<i>FB Bit Cfg Out03</i>	03
<i>FB Bit Cfg Out04</i>	04
<i>FB Bit Cfg Out05</i>	05
<i>FB Bit Cfg Out06</i>	06
<i>FB Bit Cfg Out07</i>	07

Read integer from the drive:

<b>ID</b>	<b>Parameter Name</b>	<b>Configuration Parameter</b>
1622	<i>FB Data Out 1</i>	<i>FB AOUT1</i>
1623	<i>FB Data Out 2</i>	<i>FB AOUT2</i>
1624	<i>FB Data Out 3</i>	<i>FB AOUT3</i>
1625	<i>FB Data Out 4</i>	<i>FB AOUT4</i>
1626	<i>FB Data Out 5</i>	<i>FB AOUT5</i>
1627	<i>FB Data Out 6</i>	<i>FB AOUT6</i>
1628	<i>FB Data Out 7</i>	<i>FB AOUT7</i>
1629	<i>FB Data Out 8</i>	<i>FB AOUT8</i>

## 9-2 SPECIAL FIELD BUS VARIABLES

For certain predefined field bus messages, certain parameters are used in the firmware.

*FBActualSpeed* is used for several predefined messages for Devicenet and Profibus DP. This parameter is set to *Motor Speed*.

*FB Spd Ref* is defaulted to get the desired reference by some field bus protocols. *Joyst A Imp* needs to be configured to this to become the drives speed reference.

## 9-3 FAULTS

- A) Slot Fault – Occurs when either SlotDBoardStatus or SlotEBoardStatus indicates a problem. This bit can go to a fault block that can be configured for a drive warning or a fault by parameter *FBCComm.FaultResp*.
- B) Watchdog Bit - Logic is built into the drive to allow for an external device to toggle a bit to create a communication watchdog. The system bus has separate watchdog timer logic.

Configure *Watchdog In* to the field bus input bit that the PLC is going to toggle.  
Configure the fieldbus output bit to *Watchdog Out* (ID:1003).

The external device should read bit *Watchdog Out* and return the inverse of the bit that gets configured to *Watchdog In*.

When *Com WD* is enabled, Com WD Trip will go high after the bit stops toggling for *WD Com Dly* amount of time in ms.

*WD Init Dly Tim* is used to delay the watchdog fault after power up of the drive. Default is 10 seconds.

Set *WD Flt Response* for the action the drive will take on a communication failure.

## 9-4 SYSTEM BUS

The Winder software supports the Master/Slave configuration of the system bus.

Each node on the network must have an ID from 0 to 63. *SBI*d sets the section ID. Also set *SBNextId* parameter for the next section's ID.

The parameter *SB Mode* determines if a drive is the master or a slave section. Only one master can be set up on the fiber network. The master sends out five integers which all slaves connected read and can act upon.

### A) Master Section Output Packet

<b>Integer</b>	<b>Parameter name</b>	<b>Description</b>
1	<i>SB Out Cnt1 Word</i>	Control Bits Bit 0 = 1 Bit 1 = MC Ready Bit 2 = Run Enable Bit 3 = SB WD Pulse Bit 4 = SB Bit Out 1 Bit 5 = SB Bit Out 2 Bit 6 = SB Bit Out 3 Bit 7 = SB Bit Out 4
2	<i>Freq out</i>	Ramped speed reference
3	<i>Trq Ref Act</i>	Torque reference
4	<i>SB Out Int1</i>	Configurable variable
5	<i>SB Out Int2</i>	Configurable variable

### B) Slave Section Input Packet

<b>Integer</b>	<b>Parameter name</b>	<b>Description</b>
1	<i>SB In Cnt1 Word</i>	Control Bits Bit 0 = Not used Bit 1 = MD Drive OK Bit 2 = MD Run Enable Bit 3 = MD Watchdog Bit 4 = MD Bit In1 Bit 5 = MD Bit In2 Bit 6 = MD Bit In3 Bit 7 = MD Bit In4
2	<i>SB In Freq Ref</i>	Optional speed reference
3	<i>SB In Trq Ref</i>	Optional torque reference
4	<i>SB In Int1</i>	Unused variable
5	<i>SB In Int2</i>	Unused variable

### C) Faults and Watchdog timer bit

The Master section sends out a watch dog bit called *SB WD Pulse* which is part of *SB Out Cnt1 Word*. This bit toggles every 100 ms.

The Slave sections read the master watchdog bit from *SB In Cnt1 Word*. If the bit does not toggle in 1 second, then *MD WD OK* will go low, which can be used to stop the section or fault the drive out.

*The MD\_Watchdog and SB Comm Lost bits are used to create SB Comm Flt after failure for SB Comm Flt Tim ms. When SB Comm Flt goes low, SB Comm Flt Resp will set a warning or fault the drive out.*



## SECTION X

### FAULT CODES (See Appendix A-8 )

Drive faults can be derived from either hard coded firmware faults or from the application Fault block.

The firmware faults have no options associated with them. They will fault the drive with a coast stop and record the event in the FIFOs. *MC Fault* bit will go high when a fault has occurred and has not been reset.

The application Fault block allows different options such as drive action, Stop type, recording, and ability to reset the fault. See the Fault block in the function block library for in depth description of the Fault block. Fault block triggers can come from either the firmware or from the application program.

#### 10-1 FAULT ACTIONS

Fault action is decided by the FMode input of the Fault block. There are three options available.

- 0 = Disabled
- 1 = Warning – No drive action but the information is stored in the Fault FIFO
- 2 = Fault – Drive performs a stop.

#### 10-2 STOP ACTION

The type of drive stop command is decided with the Stop input of the Fault block. There are three options available.

- 0 = Coast stop – Highest priority if multiple faults occur
- 1 = Normal stop mode
- 2 = Ramp stop.

## 10-3 FAULT RESET

A fault can be reset by several methods. The parameter *Fault Reset* will reset all active faults.

Each fault block also has an individual fault reset input, called *Reset*, that can be used.

The drive can be set up to disable reset a fault if it occurs over and over again in a period of time. The fault block input *Trials* determines the amount of restarts allowed. The input *Svtime* is the amount of time in which the drive senses the motor restart before determining to lock out the drive. *Svtime* input is set in 10 ms increments.

## 10-4 RECORDING

There are two fault FIFOs: active fault FIFO, which records 10 faults, and history table FIFO that records 30 faults/warnings.

The *Hist* input of the Fault block determines how it is recorded into the FIFO. There are 4 options available:

- 0 = Fault always will be stored.
- 1 = If a fault occurs several times, each event will be logged unless they occur within the time frame defined by the *Wait* input. The *wait* input is set in 10 ms increments.
- 2 = Fault will be recorded if different than the previous fault recorded.
- 3 = Not recorded.

The last active fault code can be viewed at *Active Flt Last* value.

## 10-5 DRIVE FAULTS

Fault Code	Fault Text	Possible Cause	Solution
1	Overcurrent	Over 400% nominal current detected. - Sudden increase in load. - Needs tuning - Shorted motor / cables - Unsuitable or bad motor	- Check section for binding or excessive loads. - Check motor tuning - Check motor leads and motor shorts - Replace drive - Replace motor
2	Ovvoltage	DC bus has exceeded its upper limit. - Braking resistor not working properly - Deceleration too rapidly - Unstable or utility voltage spikes.	- Check brake resistor and chopper unit - Check deceleration rates - Verify proper incoming voltage
3	Earth Fault	Sum of motor current do not equal zero. - Motor cable or motor short to ground. - Bad current sensing	- Check motor cables for shorts to ground - Check motor for short to ground. - Replace drive inverter.
5	Charging Switch	The charging switch was open when a run command was given. - Faulty operation - Component Failure	- Reset the fault and try to restart. - Replace charging unit
6	Emergency Stop	Input board not found or not seated properly.	- Reseat I/O boards. - Replace I/O boards.
7	Saturation	Very high overload - Cable / motor short - Defective component	- Cannot be reset must cycle power. - If occurs with Fault #1 then check motor and motor cables.
8	System Fault	Additional information will be stored in FIFOs. - Component Failure	- Replace processor board.
9	Undervoltage	DC bus has dropped below its lower limit. - Supply voltage too low - Converter fault - Excessive loading	- Check incoming voltage level - Check for Convert fault - Check motor loading - Replace converter
10	Input Phase	Input line phase missing. - Bad external fuse - Bad voltage sensing	- Check each input phase - Replace Converter
11	Output Phase	No current detected in one of the output motor leads. - Bad motor lead or motor. - Bad current sensor	- Check motor cables for an open phase. - Check motor for open winding - Replace Drive inverter
12	Brk Chopper Supr	Brake Chopper operation failure. - Bad resister - Chopper failure	- Check and replace braking resistor - Replace brake chopper components
13	Undertemp	Heat sink temperature under -10°C. - Ambient temperature too low. - Thermister failure	- Heat drive enclosure - Replace drive power components.
14	Overtemp	Heatsink over 90° C. - Ambient temperature too high. - Drive cooling not adequate - Bad temperature sensor	- Lower drive enclosure ambient temperature. - verify fan operation

Fault Code	Fault Text	Possible Cause	Solution
16	Mot.Overtemp	Motor over heating detected by temperature model.	<ul style="list-style-type: none"> <li>- Check for excessive motor loading</li> <li>- Check motor cooling</li> <li>- Check motor current to verify proper tuning.</li> </ul>
17	MotorUnderld	Motor underload protection trip.	<ul style="list-style-type: none"> <li>- Check process for load.</li> <li>- Check shafts and couplings</li> <li>- Check Under load parameters for proper setting.</li> </ul>
22/23	Chksum Flt	EEProm has checksum fault.	<ul style="list-style-type: none"> <li>- Verify parameters are set properly</li> <li>- Replace microprocessor board.</li> </ul>
24	Changed data warning	Changes may have occurred during power interruption	<ul style="list-style-type: none"> <li>- Check parameters against saved file</li> <li>- re-download parameters</li> <li>- Replace microprocessor board.</li> </ul>
25	Micro Watchdog	Microprocessor timed out.	<ul style="list-style-type: none"> <li>- Redownload the system and application software.</li> <li>- Replace microprocessor board.</li> </ul>
29	Thermistor	Thermistor out of range.	<ul style="list-style-type: none"> <li>- Replace thermistor</li> </ul>
31	IGBT Temp	IGBT temperature exceeded its limit.	<ul style="list-style-type: none"> <li>- Check ambient temperature</li> <li>- Check drive fan</li> <li>- Check for excessive build up of material on heat sink</li> <li>- Observe operation for high drive loading.</li> </ul>
32	Fan cooling	Detection of a fan failure	<ul style="list-style-type: none"> <li>- Check fan fuses on larger drives</li> <li>- Replace fan</li> <li>- Replace fan controller</li> </ul>
37	Device Change	Option board changed.	<ul style="list-style-type: none"> <li>- Enter correct parameters for new option board.</li> <li>- Check I/O board seating</li> <li>- Replace option board.</li> </ul>
38	Device Added	Option board or different drive size changed.	<ul style="list-style-type: none"> <li>- Enter correct parameters for new hardware.</li> <li>- Check I/O board seating.</li> <li>- Check microprocessor board connection.</li> <li>- Replace drive</li> </ul>
39	Device Removed	Option board or drive removed from microprocessor.	<ul style="list-style-type: none"> <li>- Check I/O board seating</li> <li>- Check microprocessor board connection.</li> <li>- Replace drive.</li> </ul>
40	Device Unknown	Unknown option board added to the drive.	<ul style="list-style-type: none"> <li>- Check I/O board seating</li> <li>- Replace I/O board</li> </ul>
41	IGBT Temp	Same as fault 31	Same as fault 31
50	Anlg In Flt	Analog input is below its low limit.	<ul style="list-style-type: none"> <li>- Check signal source</li> <li>- Check connections</li> <li>- Verify correct option board and jumpers.</li> <li>- Replace option board</li> </ul>
51	Ext Fault	User configured PB_Ext_Fault_Inp is high.	<ul style="list-style-type: none"> <li>- Determine external fault reason</li> <li>- Verify proper external fault setup</li> </ul>
52	Keypad Comm	Connection between keypad and drive is broken.	<ul style="list-style-type: none"> <li>- Verify keypad cable connections or proper seating of keypad</li> <li>- Replace keypad</li> <li>- Replace microprocessor board.</li> </ul>
53	FBCommunicat	Field bus fault fro D_FB_Fault bit. Bit is set when board failure is noted	<ul style="list-style-type: none"> <li>- Check fieldbus board seating.</li> <li>- Replace fieldbus board</li> </ul>

Fault Code	Fault Text	Possible Cause	Solution
54	Slot Communic	Communication to a smart I/O option board is lost	<ul style="list-style-type: none"> <li>- Check board seating in slots C-E.</li> <li>- Replace option boards</li> <li>- Replace microprocessor board</li> </ul>
57	Identification	Identification is completed	<ul style="list-style-type: none"> <li>- Verify Identification parameter is set to a value other than 0.</li> </ul>
60	Com Watchdog	Communication watchdog bit is not toggling	<ul style="list-style-type: none"> <li>- Verify communications is working.</li> <li>- Verify watchdog bit is being toggled by host device.</li> </ul>
61	User Fault 1	PB_User_Flt_1 is configured to a value that is High.	<ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>
62	User Fault 2	PB_User_Flt_2 is configured to a value that is High.	<ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>
63	User Fault 3	PB_User_Flt_3 is configured to a value that is High.	<ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>
64	User Fault 4	PB_User_Flt_4 is configured to a value that is High.	<ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>
65	Overspeed Flt	Drive tripped out on overspeed.	<ul style="list-style-type: none"> <li>- Check for sudden loss of load.</li> <li>- verify proper speed feedback device and scaling.</li> <li>- Check overspeed setup</li> </ul>
66	SB Comm Fault	System bus watchdog trip or board failure.	<ul style="list-style-type: none"> <li>- Verify all drives on the system bus is up and running.</li> <li>- Verify system bus cabling.</li> <li>- Replace system bus cabling</li> <li>- Replace system bus board.</li> </ul>
70	Torque prv	Torque was not achieved during torque proving.	<ul style="list-style-type: none"> <li>- Check contactor</li> <li>- Check motor connections</li> <li>- Check configuration</li> <li>- Replace drive</li> </ul>
71	Brake Open	Brake has been commanded open and the aux brake contact has not been sensed.	<ul style="list-style-type: none"> <li>- Check brake logic</li> <li>- Check brake aux logic</li> <li>- Check brake</li> <li>- Check configuration</li> <li>- Check digital input</li> </ul>
72	Brake Slip	Speed feedback detected during torque proving	<ul style="list-style-type: none"> <li>- Check brakes for proper holding</li> <li>- Verify actual brake movement.</li> <li>- Check speed feedback device.</li> </ul>
74	Load Float	Load float commanded time out	<ul style="list-style-type: none"> <li>- Operator using load float too long</li> <li>- Check load float input</li> <li>- Adjust timing</li> </ul>
75	Spd Err Flt	Large speed error for period of time.	<ul style="list-style-type: none"> <li>- Check for overload on hoist</li> <li>- Check for brakes releasing</li> <li>- Check for mechanical binding</li> <li>- Check Encoder feedback</li> <li>- Verify ramp rates not too fast</li> <li>- Check motor</li> </ul>
76	Run Off Flt	Brakes have not set soon enough after runs removed	<ul style="list-style-type: none"> <li>- Check for overload.</li> <li>- Check encoder feedback</li> <li>- Check motor tuning</li> <li>- Check motor</li> </ul>
77	Dir Fault	Both directions selected at same time	<ul style="list-style-type: none"> <li>- Check operator controls</li> <li>- Check configuration</li> </ul>

Fault Code	Fault Text	Possible Cause	Solution
78	Joystick Flt	Joystick reference without a run	- Check joystick calibration - Replace input board
79	Slack Rope	Low torque during lowering	- Check for proper reeving - Verify hook is off ground - Check settings
80	Loc Stop Flt	Keypad stop button pressed for two seconds.	- Replace keypad.
81	Stall	Drive in stall condition.	- Check for overload - Verify binding - Check motor

## 10-6 DRIVE FAULT OPTIONS

Fault Code	Fault Text	Fault Mode	Stop Mode
1	Overcurrent	Fault	Coast Stop
2	Oervoltage	Fault	Coast Stop
3	Earth Fault	<i>Earth Fault</i>	<i>Earth Fault</i>
5	Charging Switch	Fault	Coast Stop
6	Emergency Stop	Fault	Coast Stop
7	Saturation	Fault	Coast Stop
8	System Fault	Fault	Coast Stop
9	Undervoltage	UVolt Fault Resp	UVolt Fault Resp
10	Input Phase	<i>Input Ph. Superv</i>	<i>Input Ph. Superv</i>
11	Output Phase	<i>Phase Supv F</i>	<i>Phase Supv F</i>
12	Brk Chopper Supr	Fault	Coast Stop
13	Undertemp	Fault	Coast Stop
14	Overtemp	Fault	Coast Stop
16	Mot.Overtemp	<i>Therm Prot F</i>	<i>Therm Prot F</i>
17	MotorUnderld	<i>ULoad Protect F</i>	<i>ULoad Protect F</i>
22/23	Chksum Flt	Fault	Coast Stop
24	Changed data warning	Fault	Coast Stop
25	Micro Watchdog	Fault	Coast Stop
29	Thermistor	<i>ThermistorF.Resp</i>	<i>ThermistorF.Resp</i>
31	IGBT Temp	Fault	Coast Stop
37	Device Change	Fault	Coast Stop
38	Device Added	Fault	Coast Stop
39	Device Removed	Fault	Coast Stop
40	Device Unknown	Fault	Coast Stop
41	IGBT Temp	Fault	Coast Stop
50	Anlg In Flt	Fault	Coast Stop
51	Ext Fault	Fault	Coast Stop
52	Keypad Comm	Fault	Normal Stop
53	FBCcommunicat	<i>FBCComm.FaultResp</i>	<i>FBCComm.FaultResp</i>
54	Slot Communic	<i>SPI Flt Resp</i>	<i>SPI Flt Resp</i>
57	Identification	Warning	Coast Stop
60	Com Watchdog	<i>WD Flt Response</i>	<i>WD Flt Response</i>
61	User Fault 1	Fault	Coast Stop
62	User Fault 2	Fault	Coast Stop

Fault Code	Fault Text	Fault Mode	Stop Mode
63	User Fault 3	Fault	Coast Stop
64	User Fault 4	Fault	Coast Stop
65	Overspeed Flt	<i>Overspeed Resp</i>	<i>Overspeed Resp</i>
66	SB Comm Fault	<i>SB Comm Flt Resp</i>	<i>SB Comm Flt Resp</i>
70	Torque prv	<i>Trq Prv Resp</i>	<i>Trq Prv Resp</i>
71	Brake Open	<i>Brk Cont Resp</i>	<i>Brk Cont Resp</i>
72	Brake Slip	<i>Brk Slp Resp</i>	<i>Brk Slp Resp</i>
74	Load Float	<i>Mspd Flt Resp</i>	<i>Mspd Flt Resp</i>
75	Spd Err Flt	<i>Spd Err Resp</i>	<i>Spd Err Resp</i>
76	Run Off Flt	<i>Run Off Resp</i>	<i>Run Off Resp</i>
77	Dir Fault	<i>Dir Flt Resp</i>	<i>Dir Flt Resp</i>
78	Joystick Flt	<i>Joyst Resp</i>	<i>Joyst Resp</i>
79	Slack Rope	<i>Slck Resp</i>	<i>Slck Resp</i>
80	Loc Stop Flt	Fault	Coast Stop
81	Stall	<i>Stall Resp</i>	<i>Stall Resp</i>

## 10-7 SPECIFIC FAULTS SETUP

### 10-7.1 TORQUE PROVING FAULT

Parameters	Type	Default
<i>Motor Torque</i>	APB	
<i>Trq Prv Stp</i>	CAL	10.0 %
<i>RunRequest</i>	DPB	
<i>Trq Prv By</i>	BCFG	<i>One Bit</i>
<i>Trq Prv Cmd</i>	DPB	
<i>Trq Prv Flt Tim</i>	CAL	0.2 seconds
<i>Trq Prv Flt Bit</i>	DPB	
<i>Trq_Prv_Resp</i>	E	Coast stop

Torque proving fault goes high if the torque does not exceed *Trq Prv Stp* on a run command in *Trq Prv Flt Tim* seconds and it is enabled by having *Trq Prv By* equal to 1002 = *Zero bit*.

*Trq Prv Resp* determines the action. Default is for the drive to fault with a coast stop.

The startup wizard sets up torque proving when Hoist operation is selected.

### 10-7.2 BRAKE OPEN FAULT

Parameters	Type	Default
<i>Rel Brakes</i>	DPB	
<i>Brk Open Sw</i>	BCFG	<i>Zero Bit</i>
<i>Brk Cont FTim</i>	CAL	200 ms.
<i>Brk_Cont_Resp</i>	E	0 = No Action

Brake open fault is used to check the brake auxiliary contact wired to the drive to make sure it opens within *Brk Cont FTim* amount of time.

*Brk Cont Resp* determines the action. Default is for the drive is no action.

### 10-7.3 BRAKE SLIP FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>RunRequest</i>	DPB	
<i>Abv Brk Slp Spd</i>	DPB	
<i>Trq Prv By</i>	BCFG	<i>One Bit</i>
<i>Trq Prv Cmd</i>	DPB	
<i>Brk_Slp_Resp</i>	E	Coast stop

Encoder feedback is monitored during torque proving to verify the brakes are holding. If the brakes can not hold back the motor torque fault will go high.

*Brk Slp Resp* determines the action. Default is for the drive to fault with a coast stop.

### 10-7.4 MICRO SPEED FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Dis MSpd Tim</i>	E	0 = Enabled
<i>Mspd Tim</i>	CAL	60.00 sec
<i>MSpd OK</i>	DPB	
<i>Mspd flt Resp</i>	E	Warning

If microspeed is active longer than *Mspd Tim* and *Dis Mspd Tim* is off then *MSpd OK* will go low causing a warning or fault. See section 8-8 for micro speed setup and operation.

*Mspd flt Resp* determines the action. Default is for the drive to post a warning.

### 10-7.5 SPEED ERROR FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Freq Error</i>	APB	
<i>Spd Err Fil TC</i>	CAL	100 ms.
<i>Err Lim 1</i>	CAL	5 Hz
<i>Err Lim 2</i>	CAL	10 Hz
<i>Low Err Tim</i>	CAL	5 seconds
<i>Hi Err Tim</i>	CAL	1 second
<i>Spd_Err_Resp</i>	E	No Action

There are two separate speed error limits and timers. This is to trip on a low level error for long period of time or a large error level for short period of time.

*Spd Err Resp* determines the action. Default is for the drive to ignore this condition.

### 10-7.6 SPEED OFF FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>RunRequest</i>	DPB	
<i>Rel Brakes</i>	DPB	
<i>Brk Pdl Act</i>	DPB	
<i>Run Off Tim</i>	CAL	10 seconds
<i>Run_Off_Resp</i>	E	Coast

The speed off fault is generated when the brakes have not set for *Run Off Tim* seconds after the runs have been removed.

*Run Off Resp* determines the action. Default is for the drive to fault with a coast stop.

### 10-7.7 BOTH DIRECTIONS FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Run Fwd Inp</i>	BCFG	DIN 1
<i>Run Rev Inp</i>	BCFG	DIN 2
<i>Dir_Flt_Resp</i>	E	No Action

This fault occurs when both directions are commanded at the same time for 2 seconds.

*Dir Flt Resp* determines the action. Default is for the drive to ignore this condition.

### 10-7.8 JOYSTICK FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Anlg Ref</i>	APB	
<i>Joyst Flt St</i>	CAL	20%
<i>Start Input</i>	DPB	
<i>Joyst_Resp</i>	E	No Action

This condition check to make sure the joystick is near zero when the runs are not active to verify the integrity of the device.

*Joyst Resp* determines the action. Default is for the drive to ignore this condition.

### 10-7.9 SLACK ROPE FAULT

<b>Parameters</b>	<b>Type</b>	<b>Default</b>
<i>Fil Mtr Trq</i>	APB	
<i>Slck Rope Trq</i>	CAL	10%
<i>Run Rev Cmd</i>	DPB	
<i>Rel Ramp</i>	DPB	
<i>Slck Rope Tim</i>	CAL	2 seconds
<i>Slck_Resp</i>	E	No Action

For hoists that have a heavy hook, slack rope can be detected when low torque is required when lowering.

*Sleek Resp* determines the action. Default is for the drive to ignore this condition.

#### 10-7.10 STALL FAULT

Parameters	Type	Default
<i>Fil Mtr Trq</i>	APB	
<i>Stall Trq St</i>	CAL	90%
<i>Abs Mtr Spd</i>	APB	
<i>Stall Spd St</i>	CAL	50 RPM
<i>Stall Time</i>	CAL	60 seconds
<i>Stall_Resp</i>	E	No Action

Stall protection prevents motor damage by not allowing full torque with no movement. Default is to allow for stall to occur for 60 seconds which most motors can deliver without over heating.

*Stall Resp* determines the action. Default is for the drive to ignore this condition.

#### 10-7.11 BRAKE FAILURE MODE

**WARNING:** Enabling this function allows the drive to turn on by itself if brake failure is detected.

Parameters	Type	Default
<i>Brk Slp Act</i>	E	Disabled
<i>Motor Speed</i>	APB	
<i>Abv Brk Slp Spd</i>	DPB	
<i>Stall Spd St</i>	CAL	50 RPM
<i>Stall Time</i>	CAL	60 seconds
<i>Stall_Resp</i>	E	No Action

*Brk Slp Act* determines if this feature is disabled, check brakes within 60 seconds of stop or continuously check the brakes. If enabled and the motor Speed is above *Brk Slp Spd* after the brakes were suppose to be set then the drive will react. The drive will turn on and regulate to zero speed without opening up the brakes. Also the bit *Brk Slip Warn* goes high which should be used for an external alarm.

Running the drive or hitting the end stops will reset this mode and alarm.

#### 10-7.12 USER FAULTS

Parameters	Type	Default
<i>Ext Fault Inp</i>	BCFG	Zero Bit
<i>User Flt 1</i>	BCFG	Zero Bit

User Flt 2	BCFG	Zero Bit
User Flt 3	BCFG	Zero Bit
User Flt 4	BCFG	Zero Bit

*Ext Fault Inp* and the four user faults can be configured to any bit ID to trigger a drive fault. The drive will fault if the response is set = 2 Fault and the input goes high.

#### 10-7.13 Motor Over Temp

Parameters	Type	Default
<i>MotAmbTempFactor</i>	CAL	0
<i>Mot Therm 0 spd</i>	CAL	40.0
<i>Mtr Therm TC</i>	CAL	10
<i>Motor Duty Cycle</i>	CAL	100
<i>Motor Current</i>	APB	
<i>Motor Speed</i>	APB	
<i>MtrCalcTemp</i>	APB	
<i>Therm Prot F</i>	E	2 = Fault

A motor thermal model is built into the drive to determine if the AC motor is getting hot. Settings for this model are:

- *MotAmbTempFactor* = Percentage to adjust the percentage of the ambient temperature. 0 = nominal.
- *Mot Therm 0 Spd* = Motor cooling ability at zero speed.
- *Mtr Therm TC* = Motor thermal time constant in minutes.
- *Motor Duty Cycle* = Motor rated duty cycle in percentage.

With the above setting and the motor current and speed the model calculates the temperature as *MtrCalcTemp* as a percentage of maximum temperature.

#### 10-7.14 THERMISTOR

The drive has a thermistor fault available which is set by digital configuration point *Thermistor Inp*.

#### 10-7.15 UNDER LOAD

Parameters	Type	Default
<i>Under Ld Trq Nom</i>	CAL	50.0 %
<i>Under Ld Trq 0</i>	CAL	10.0%
<i>Motor Speed</i>	APB	
<i>Motor Torque</i>	APB	
<i>Under Ld State T</i>	CAL	20.00 sec
<i>ULoad Protect F</i>	E	0 = No Action

The under load torque limit changes by speed. At zero speed the limit is *Under Ld Trq 0*. The limit changes linearly to nominal speed where the limit is set by *Under Ld Trq Nom*. If the

torque falls below this limit for *Under Ld Stat T* seconds and its enable by *ULoad Protect F* then the drive will fault on Under Load fault 0.

## SECTION XI

### QUICK STARTUP

The drive has two functions to help the user get started. The first is the startup wizard, which will assist in setup of the most basic motor parameters. The second is the identification routine, which will find the motor characteristics.

#### W A R N I N G

Crane software is highly specialized. This procedure does not set up for a hoist operation or set up all protections and limits. Protections must be set properly for safe crane operation. Review manual thoroughly or consult factory for setup.

#### 11-1 STARTUP WIZARD

The startup wizard can be accessed via the keypad under Parameters/Quick Menu. Setting this to **Enabled** will start the wizard.

The following parameters are presented for entry within the startup wizard:

Parameter	Default	Description
<i>Motion</i>	Travel	Enables hoist functions and protections
<i>Ref Mode</i>	3 Step	Sets up referencing mode. Choices are 3 step, 5 step, Inf Var 2 Step, Inf Var 3 step, stepless
<i>Encoder PPR</i>	1024	If encoder board present in slot C this will appear.
<i>Motor Nom Voltg</i>	480 V	Motor nominal voltage
<i>Motor Nom Currnt</i>	Varies by drive size	Motor 100% running current
<i>Motor Nom Speed</i>	1740 rpm	Motor base running speed in RPM
<i>Motor Nom Freq</i>	60 Hz	Motor base running frequency
<i>Freq Max</i>	60 Hz	Set to maximum motor frequency
<i>Accel Time 1</i>	10.0 s	Time to accelerate to nominal motor speed
<i>Decel Time 1</i>	10.0 s	Time to stop from, nominal motor speed
<i>D01 Config</i>	Ov Wt Alarm	Selects function for first digital output. RO1 and 2 are pre-defined.
<i>D04 Config</i>	Brk Slp Mode	Selects function for fourth digital output. Only available with option board in slot D.
<i>AOut1 Config</i>	Mtr Current	Selects function for the analog output. Also scales the analog output appropriately.

After the wizard is complete multiple parameters, faults, and configurations are done. Even with a custom crane application the startup wizard should be run first.

**WARNING:** If the crane is configurerd for non-standard operation re-running the startup wizard may cause mis-calibration of the drive and may cause erratic conditions.

## **11-2 IDENTIFICATION**

The Motor Identification program is used to scale motor parameters that are not listed on the nameplate. The parameters listed in the startup wizard must be entered.

The Identification parameter (*Self Tune Motor*) is located in the parameters\motor menu of the drive. Three options are available.

- 0 = No Action
- 1 = ID No Run
- 2 = ID With Run

After selecting the action desired, the user has 20 seconds to activate a drive Run before the parameter switches back to 0 = No Action.

If possible, perform ID With Run with no load connected to the motor.

At any time during the Identification process, the stop button can be pressed to abort.

After identification is complete, the drive will turn off, and after 20 seconds, the *Self Tune Motor* parameter will go back to 0 = No Action.

The motor control mode determines what parameters are adjusted.

- *Self Tune Motor* = ID No Run
  - a) For open loop motor control:
    - U/f curve, stator resistance, and torque boost are found
  - b) For close loop motor control:
    - Magnetizing current
    - Rotor time constant
- *Self Tune Motor* = ID With Run
  - a) For open loop motor control
    - U/f curve, stator resistance, and torque boost are found
  - b) For close loop motor control
    - Magnetizing current
    - Rotor time constant
    - 15 point flux linearization curve

During the self tuning of the motor, a couple of parameters can be monitored with ADDaptACC to see the progress of the tuning. These are firmware parameters not found in the parameter list.

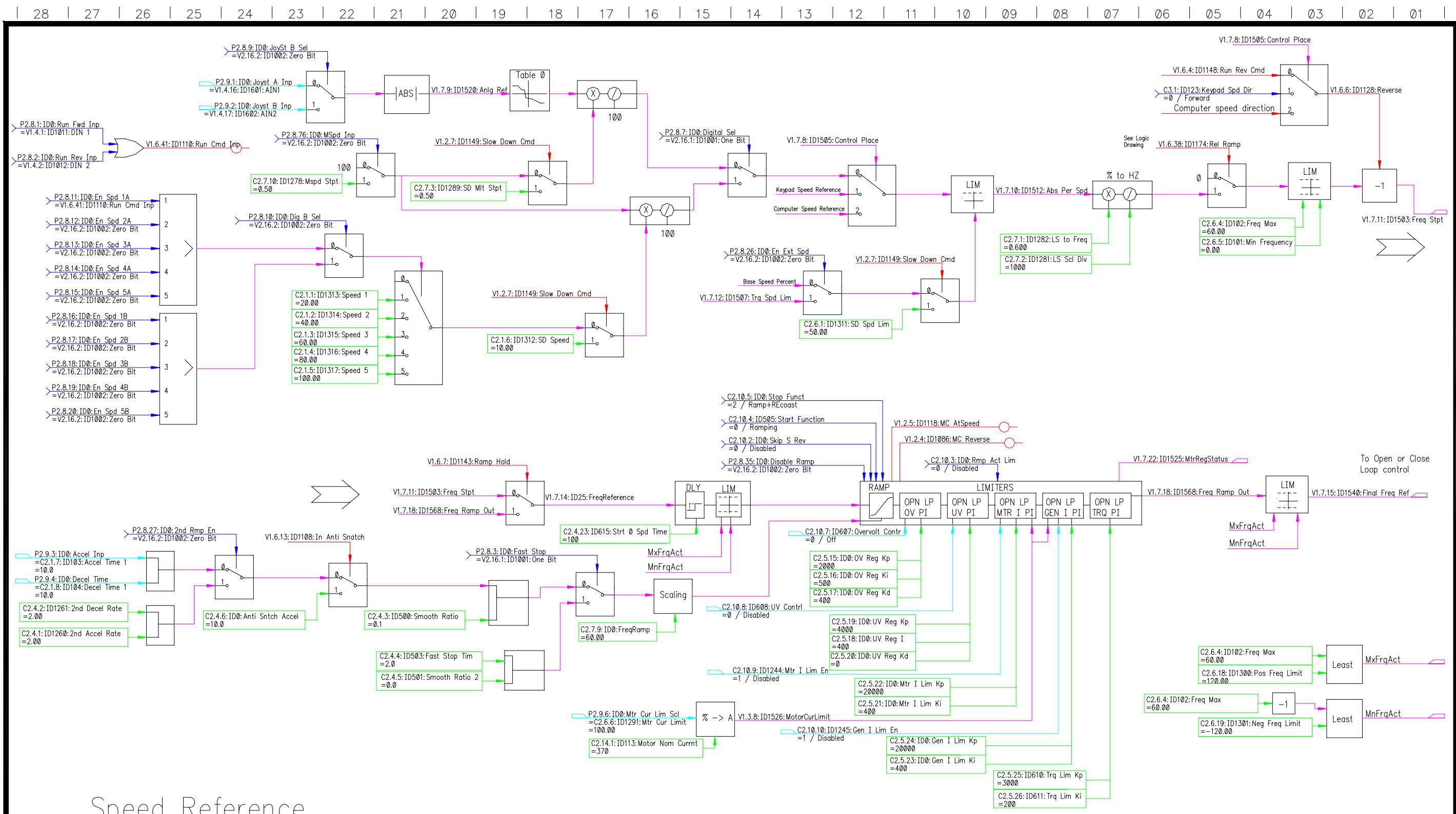
- Identification parameter:  
B0= Programming U/f curve  
B1 = Tr/Lm identification at a stand still  
B2 = Magnetizing current testing  
B3 = Saturation curve testing  
B4 = Encoder zero position test  
B5 = Magnetizing current Default  
B14 = Phase Check  
B15 = Synch check
- IdentMagnetizingCurrent = Value found from self tune
- *Mk Flux Time* = Time constant found during self tune
- *Mk Flux Voltage, Mk Flux V Hw Dt* = Flux voltage found during self tune
- IdentOptions:  
B0= Enable U/f curve tuning  
B1 = Enable close loop tuning  
B2 = Enable encoder direction check  
B3 = Automatic magnetizing current check with motor change
- IdentRSVoltageDrop = Voltage drop found during self tune
- *Pwr IU Offset* = Offset hardware measurement.
- *Pwr IV Offset* = Offset hardware measurement.
- *Pwr IW Offset* = Offset hardware measurement.



## **APPENDIX A**

### **CONTROL BLOCK DIAGRAMS**





## Speed Reference

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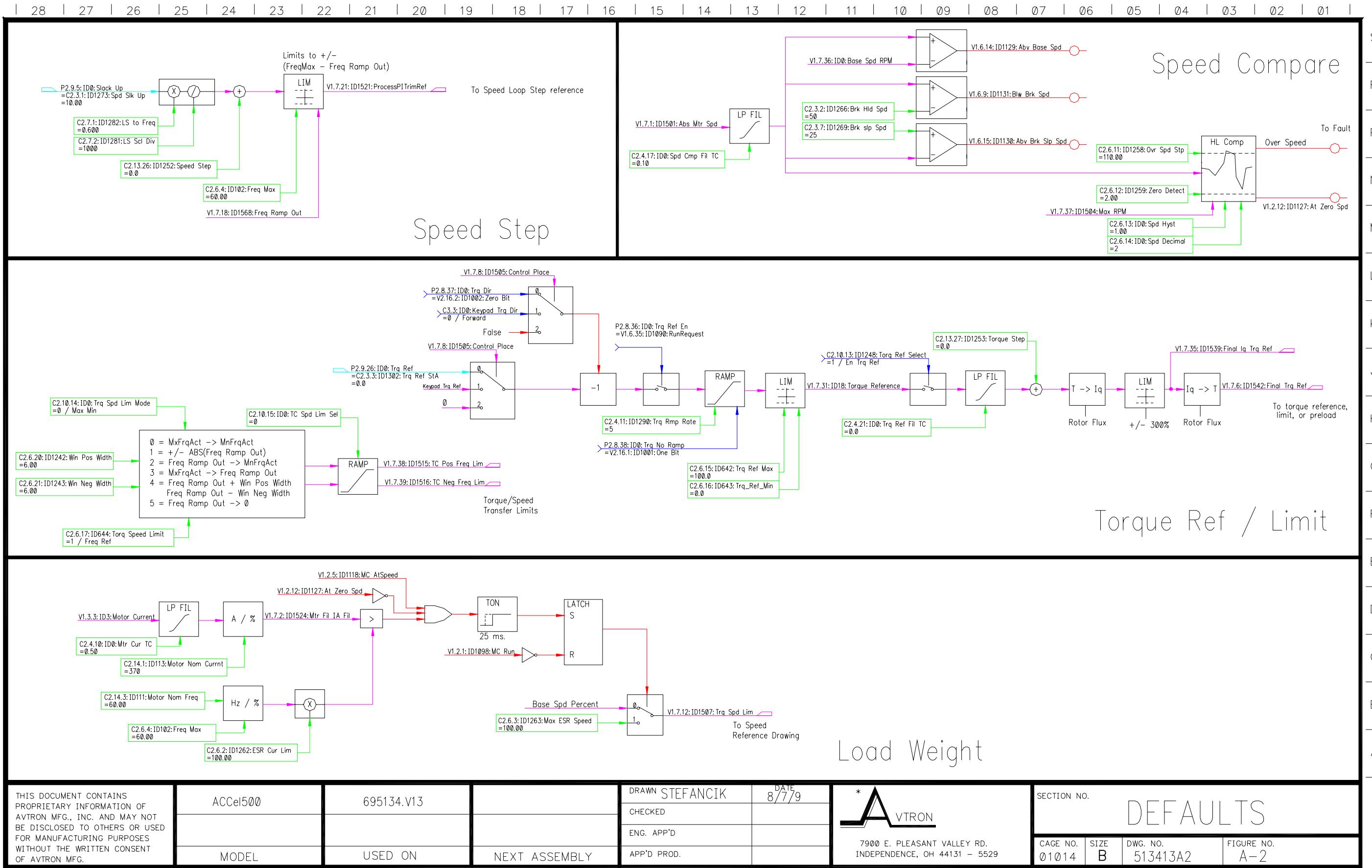
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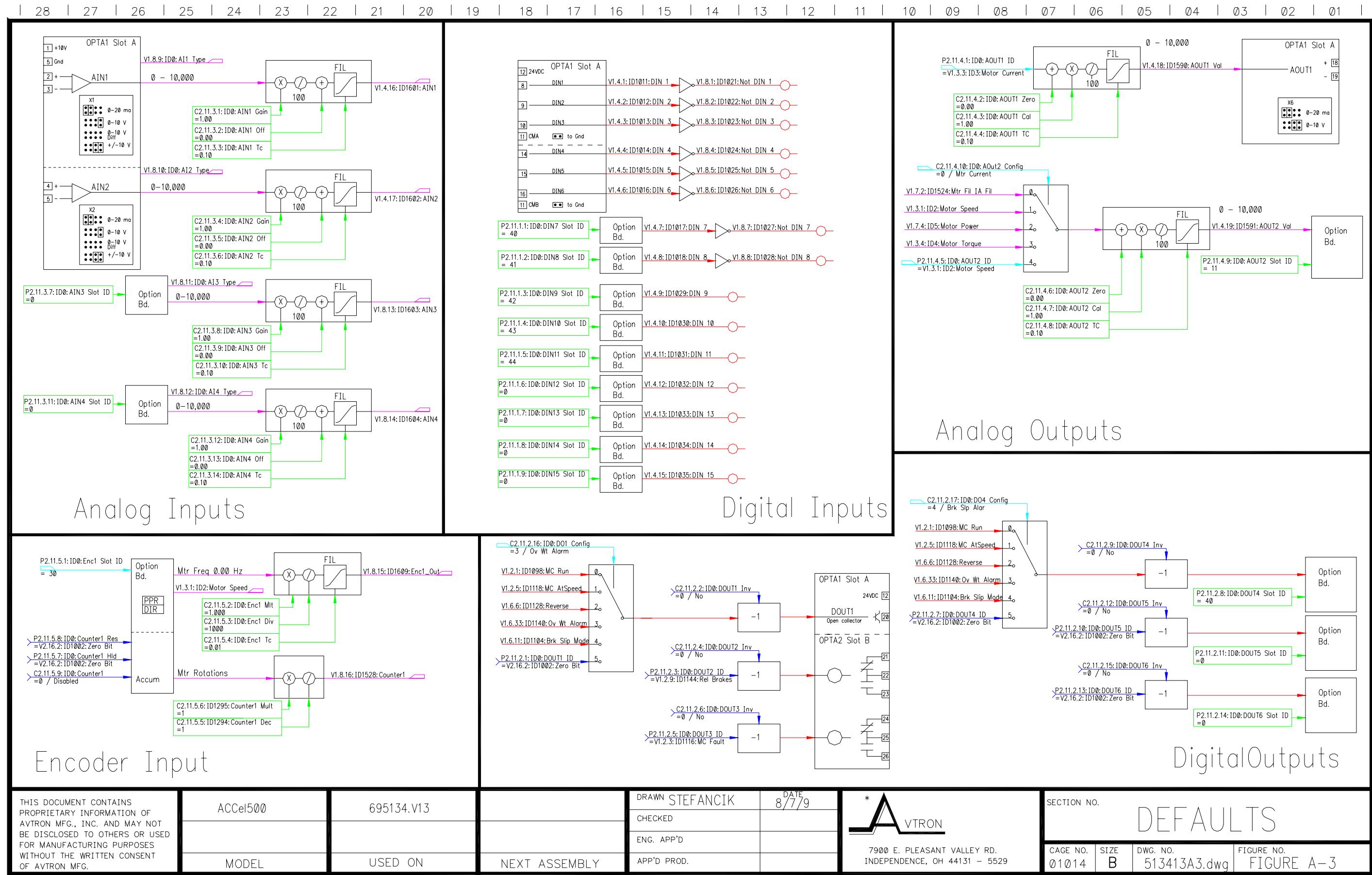
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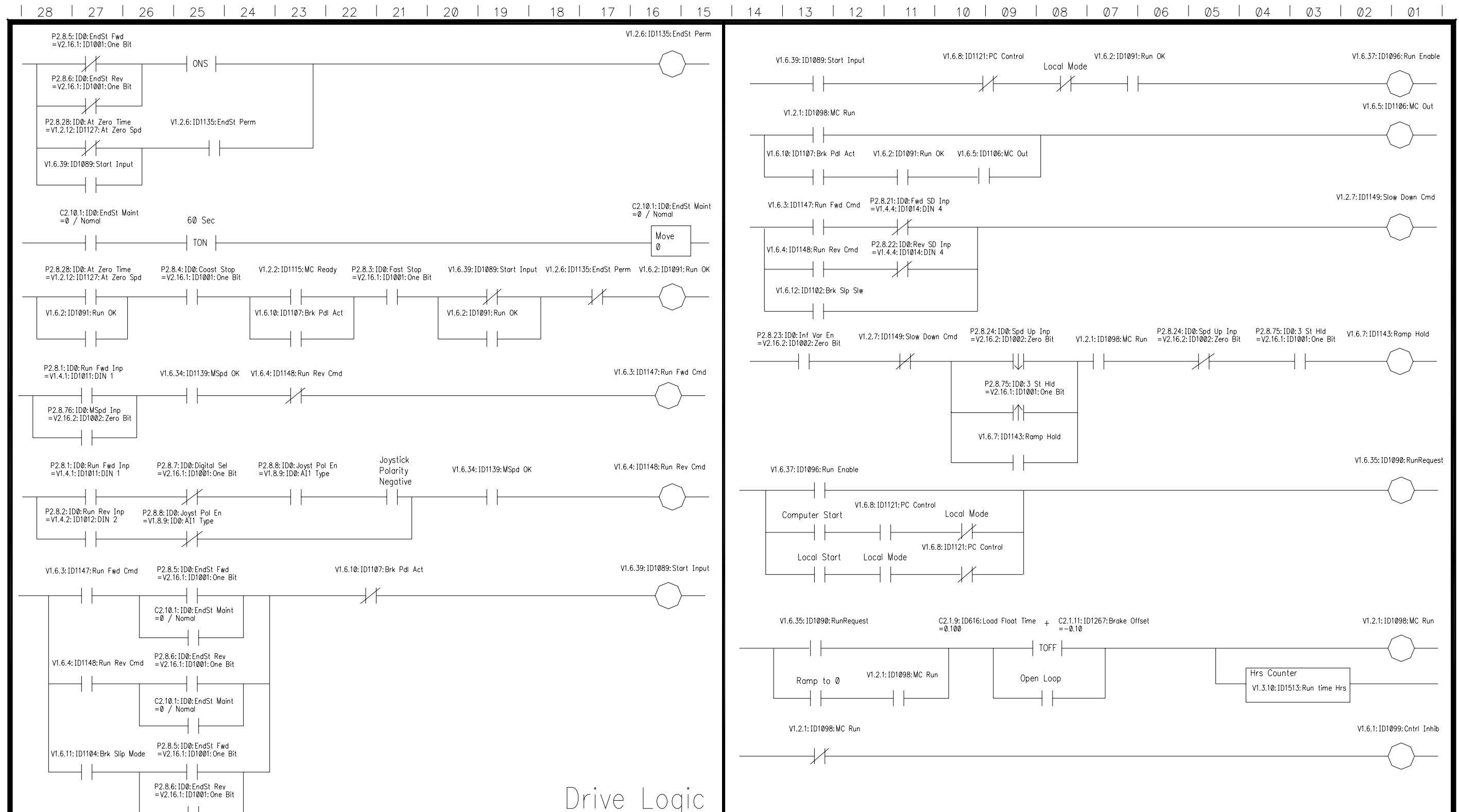
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FIGURE NO. A-1







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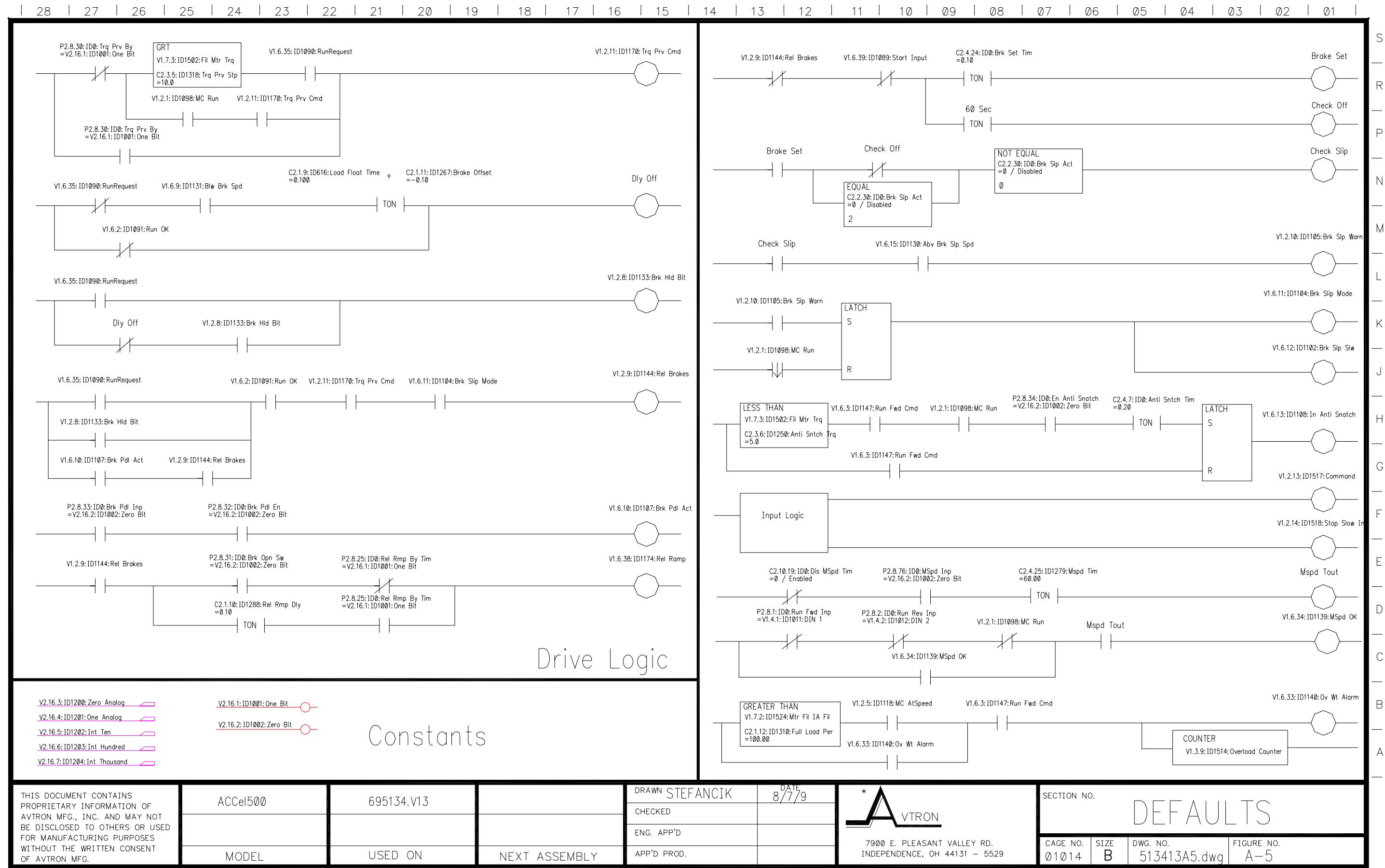
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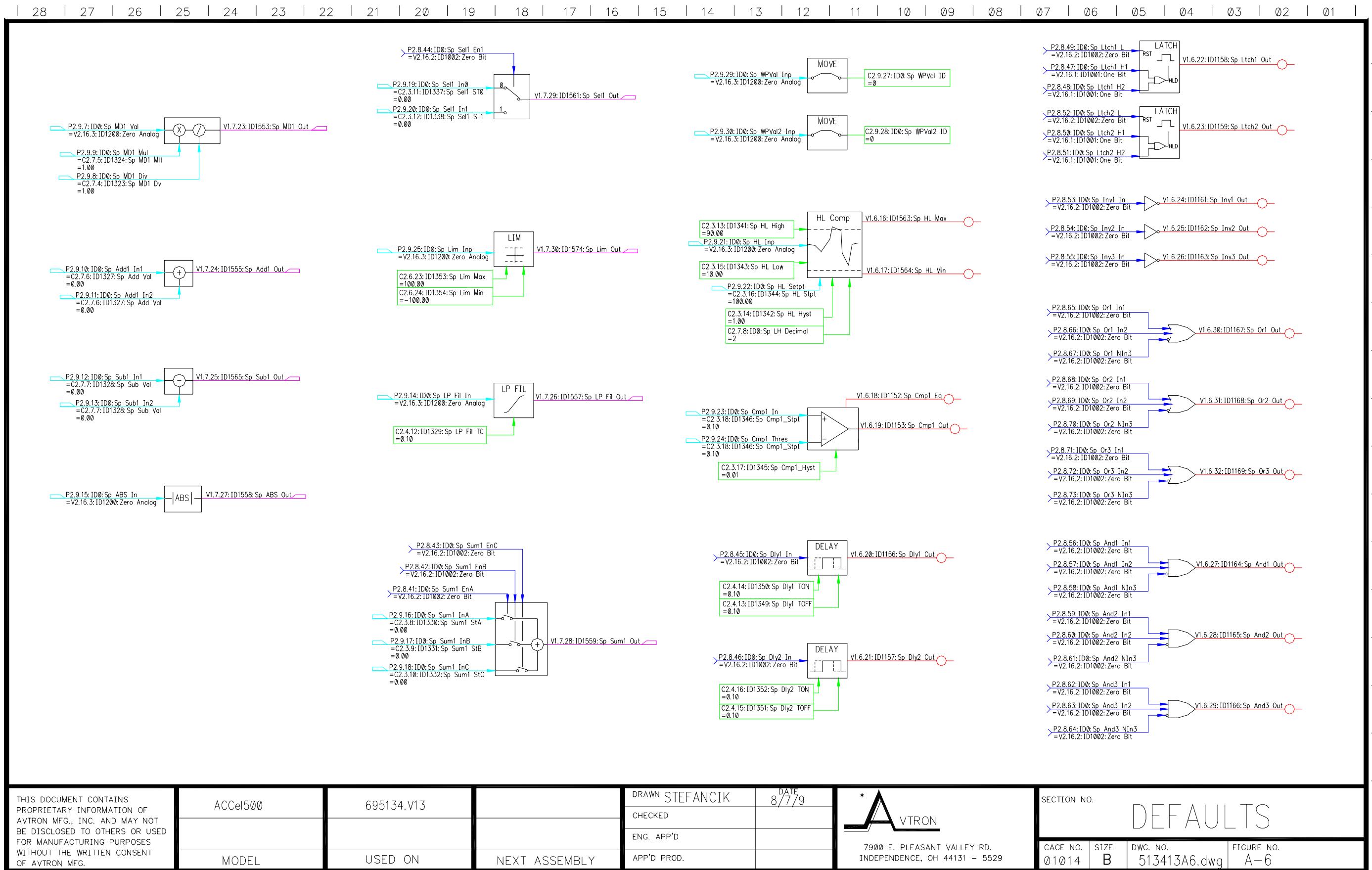
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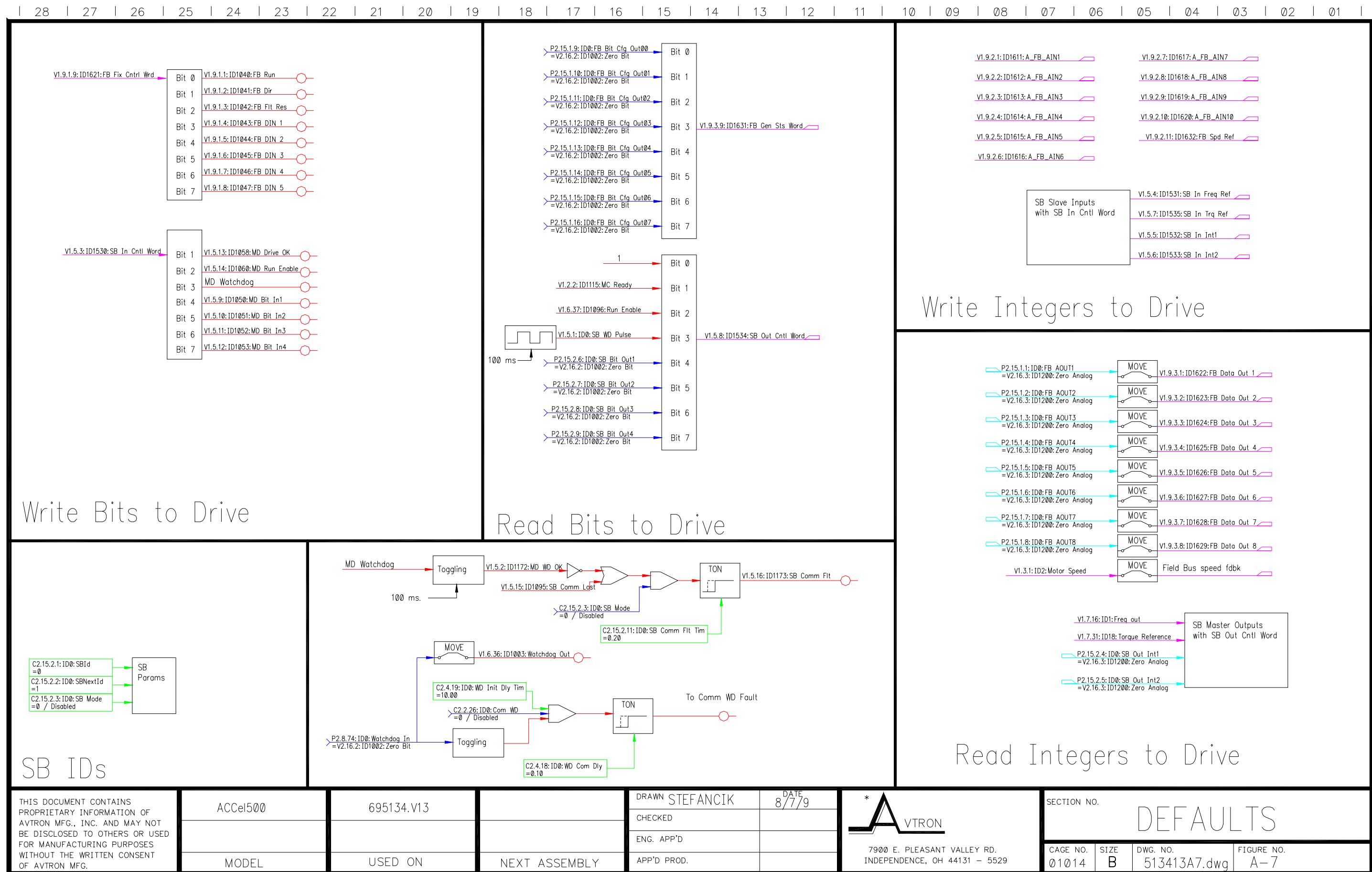
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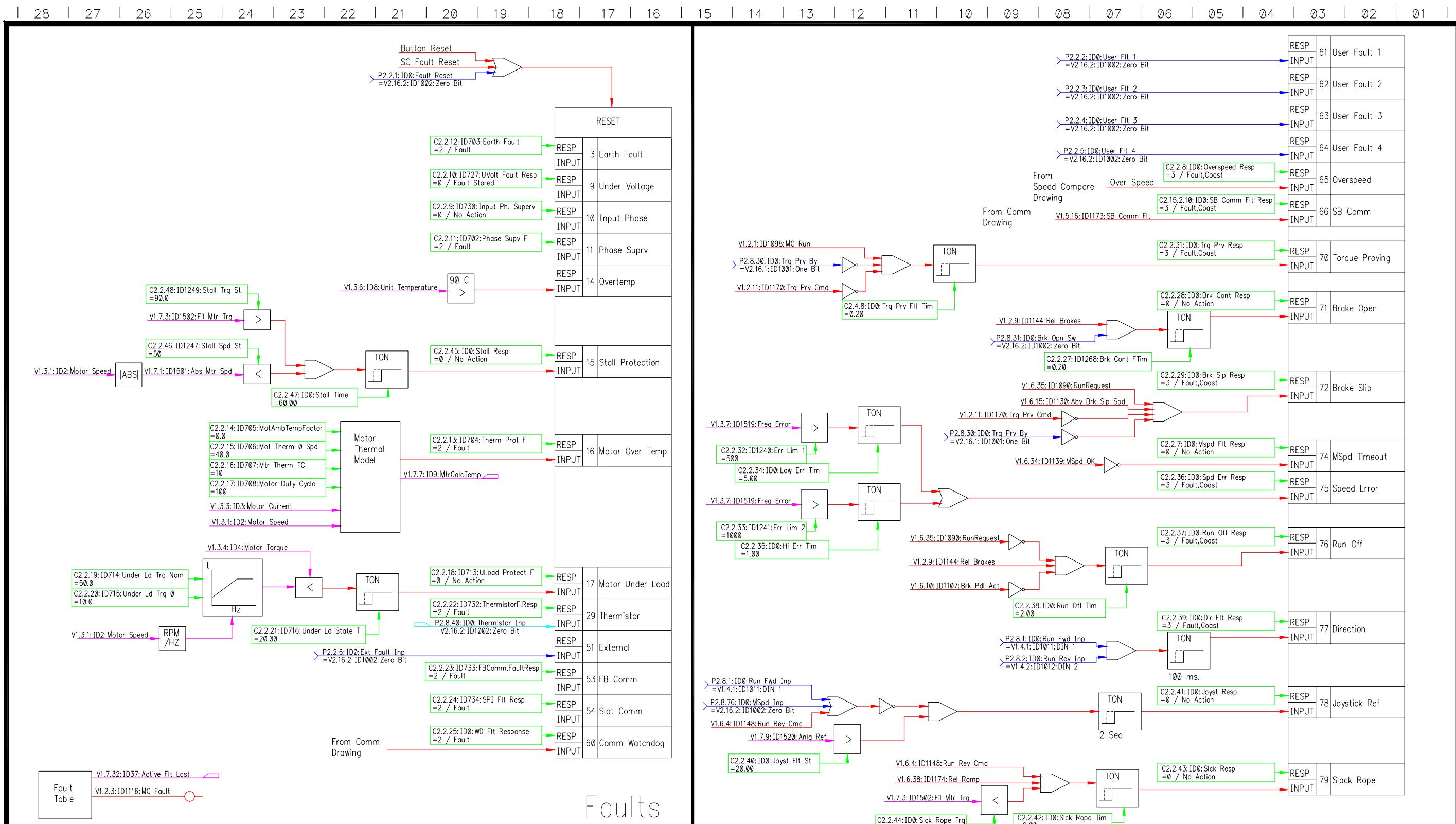
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FIGURE NO. A-4









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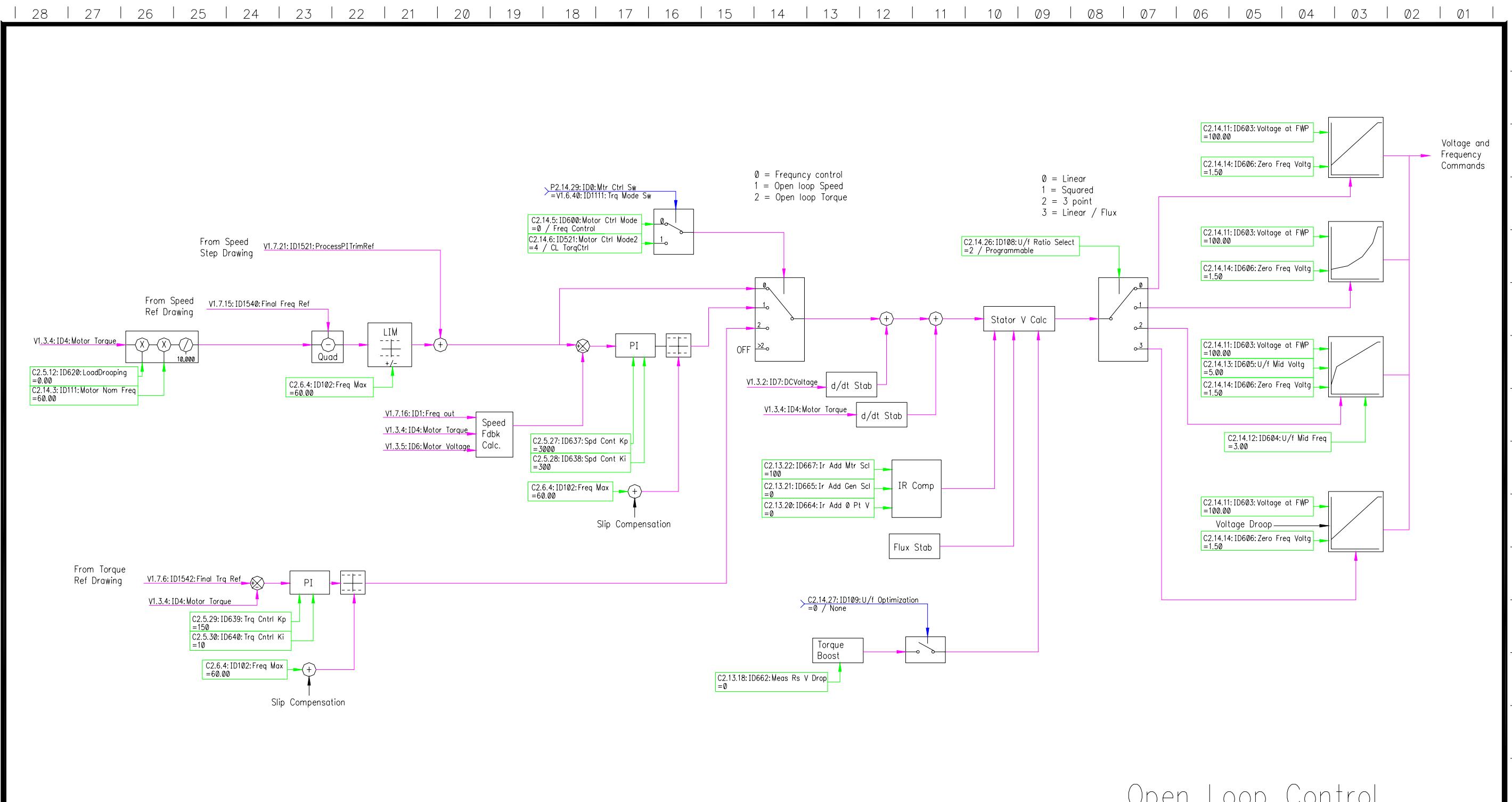
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SECTION N

# DEFUALTS

CAGE NO.	SIZE	DWG. NO.	FIGURE NO.
01014	B	513413A8.dwg	A-8



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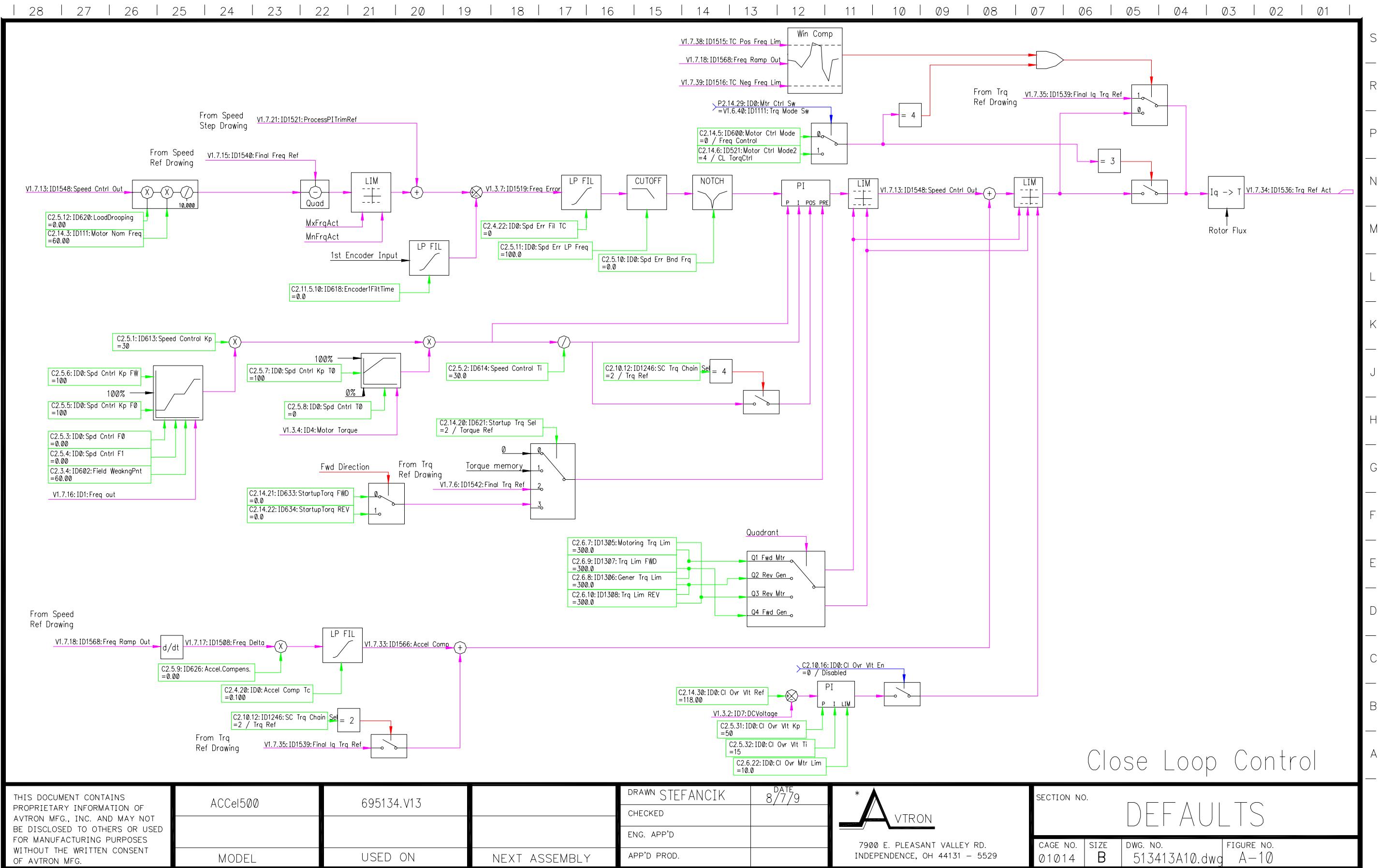
DEFAULTS

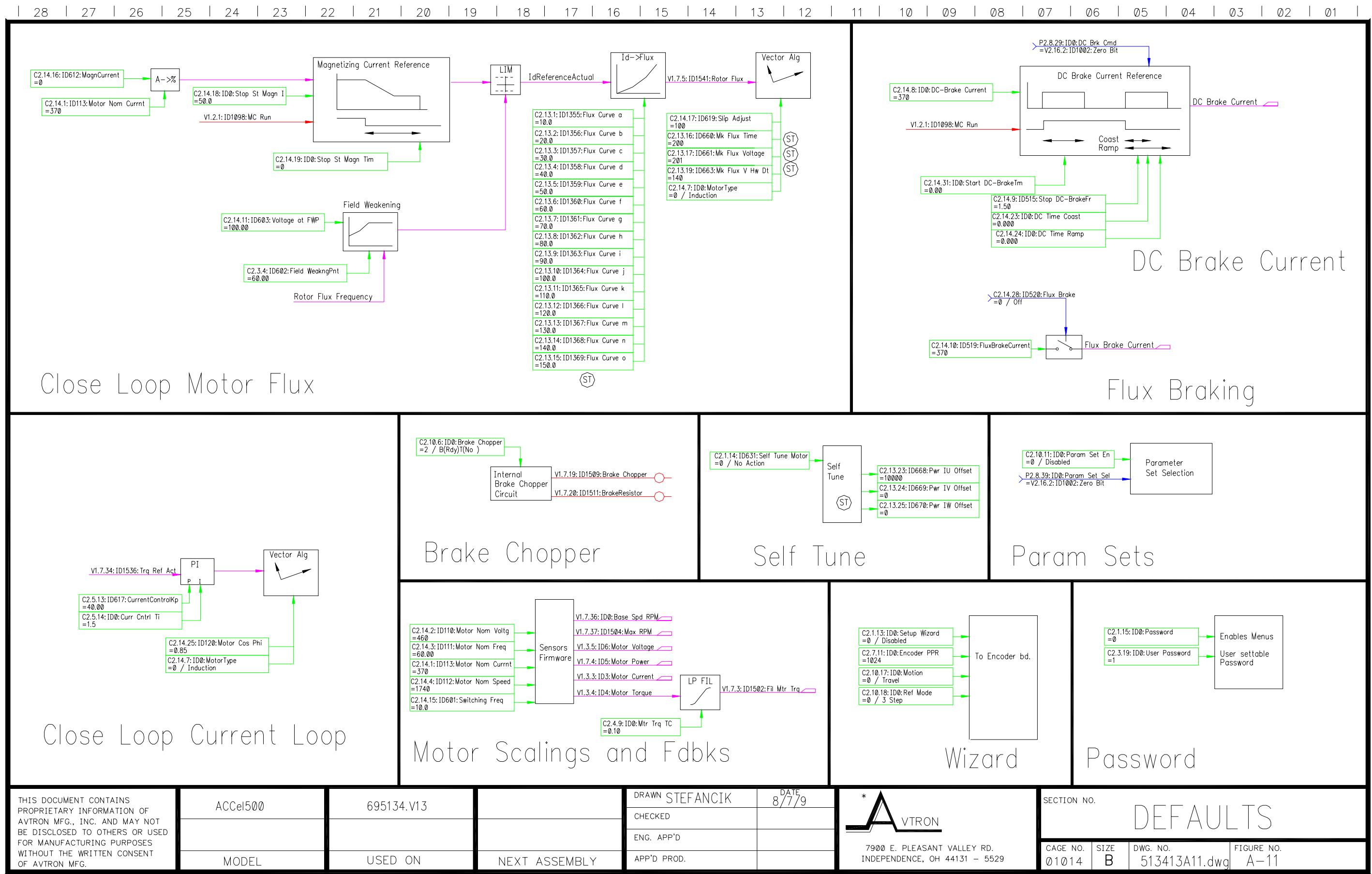
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SIZE B

DWG. NO. 513413A9.dwg

FIGURE NO. A-9





| 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 |

Table C

X	Y
C2.12.1.1:ID1700:T0_X0 =0.00	C2.12.1.7:ID1716:T0_Y0 =0.00
C2.12.1.2:ID1701:T0_X1 =20.00	C2.12.1.8:ID1717:T0_Y1 =20.00
C2.12.1.3:ID1702:T0_X2 =40.00	C2.12.1.9:ID1718:T0_Y2 =40.00
C2.12.1.4:ID1703:T0_X3 =60.00	C2.12.1.10:ID1719:T0_Y3 =60.00
C2.12.1.5:ID1704:T0_X4 =80.00	C2.12.1.11:ID1720:T0_Y4 =80.00
C2.12.1.6:ID1705:T0_X5 =100.00	C2.12.1.12:ID1721:T0_Y5 =100.00

## Table Arrays

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## DEFAUTS

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51341

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FIGURE NO.  
A-12

## APPENDIX B

### PARAMETER LIST

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1	Monitor					Menu Name
1.1	Multimonitor					Menu Name
1.2	Digital					Menu Name
1.2.1	MC Run	1098	0	1		Drive is running. Bit from status word from firmware.
1.2.2	MC Ready	1115	0	1		Drive is ready to run status from firmware
1.2.3	MC Fault	1116	0	1		Drive is in a fault condition.
1.2.4	MC Reverse	1086	0	1		Status from firmware on direction
1.2.5	MC AtSpeed	1118	0	1		Drive is done ramping to its speed setpoint. From firmware.
1.2.6	EndSt Perm	1135	0	1		Prevents crane movement when end stop is hit until crane comes to a stop and no command.
1.2.7	Slow Down Cmd	1149	0	1		In slow down condition.
1.2.8	Brk Hld Bit	1133	0	1		Holds in the brake until the run is removed and below brake open speed.
1.2.9	Rel Brakes	1144	0	1		OK to release the brakes.
1.2.10	Brk Slp Warn	1105	0	1		Brake slip warning output. High for only 60 seconds after brake slip detected for a horn.
1.2.11	Trq Prv Cmd	1170	0	1		Torque prove has passed or disabled. OK to release brakes.
1.2.12	At Zero Spd	1127	0	1		Speed feedback is near zero speed.
1.2.13	Command	1517	0	20		Command diagnostics.
1.2.14	Stop Slow Inp	1518	0	5		Diagnostic for end stops and slow downs.
1.3	Analog					Menu Name
1.3.1	Motor Speed	2	-10000	10000		[R] Motor speed in rpm
1.3.2	DCVoltage	7	0	1000		DC voltage in Volts with 32 ms time constant.
1.3.3	Motor Current	3	0	MotorCurrent Max		Motor current. = MotorCurrent/current scale = Amps
1.3.4	Motor Torque	4	-300.0	300.0		[R] Motor torque as % value, +1000 equals +100.0 %//pos=clockwise, neg=counterclockwise
1.3.5	Motor Voltage	6	0.0	1000.0		[R] Motor voltage in 0.1 Volts, e.g. 100 equals to 10.0V
1.3.6	Unit Temperature	8	-50	300		Drive temperature in degrees C
1.3.7	Freq Error	1519	-327.67	327.67		Frequency Error
1.3.8	MotorCurLimit	1526	0	MotorCurrent Max		Motor current limit, I[A] = MotorCurrentLimit/CurrentScale//Range[1...65535]/if CurrentScale=10 then 100 equals 10.0 A
1.3.9	Overload Counter	1514	0	32000		Number of times the crane was overloaded during forward operation.
1.3.10	Run time Hrs	1513	0	32767		Run time hours.
1.4	IO					Menu Name
1.4.1	DIN 1	1011	0	1		First digital input value.
1.4.2	DIN 2	1012	0	1		Second digital input value.
1.4.3	DIN 3	1013	0	1		Third digital input value.
1.4.4	DIN 4	1014	0	1		Fourth digital input value.
1.4.5	DIN 5	1015	0	1		Fifth digital input value.
1.4.6	DIN 6	1016	0	1		Sixth digital input value.
1.4.7	DIN 7	1017	0	1		Seventh digital input value. Default to zero. Used for additional digital input boards.
1.4.8	DIN 8	1018	0	1		Eighth digital input value. Default to zero. Used for additional digital input boards.
1.4.9	DIN 9	1029	0	1		Ninth digital input value. Default to zero. Used for additional digital input boards.
1.4.10	DIN 10	1030	0	1		Tenth digital input value. Default to zero. Used for additional digital input boards.
1.4.11	DIN 11	1031	0	1		Eleventh digital input value. Default to zero. Used for additional digital input boards.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.4.12	DIN 12	1032	0	1		Twelfth digital input value. Default to zero. Used for additional digital input boards.
1.4.13	DIN 13	1033	0	1		Thirteenth digital input value. Default to zero. Used for additional digital input boards.
1.4.14	DIN 14	1034	0	1		Fourteenth digital input value. Default to zero. Used for additional digital input boards.
1.4.15	DIN 15	1035	0	1		Fifteenth digital input value. Default to zero. Used for additional digital input boards.
1.4.16	AIN1	1601	-327.67	327.67		First analog input after scaling and filtering
1.4.17	AIN2	1602	-327.67	327.67		Second analog input after scaling and filtering
1.4.18	AOUT1 Val	1590	-327.67	327.67		Value of first analog out. +/- 10,000 to full scale
1.4.19	AOUT2 Val	1591	-327.67	327.67		Value of second analog out. +/- 10,000 to full scale
<b>1.5</b>	<b>L2 SB Data</b>					<b>Menu Name</b>
1.5.1	SB WD Pulse	0	0	1		Toggles every 100 ms. Used to tell slaves that the master is still communicating over the system bus.
1.5.2	MD WD OK	1172	0	1		Master sections Watchdog is OK.
1.5.3	SB In Cntl Word	1530	0	32767		System bus control word form the master section.
1.5.4	SB In Freq Ref	1531	-327.67	327.67		System Bus frequency reference from the master.
1.5.5	SB In Int1	1532	-327.67	327.67		System bus first configurable integer input from master section.
1.5.6	SB In Int2	1533	-327.67	327.67		System bus second configurable integer input from master section.
1.5.7	SB In Trq Ref	1535	-327.67	327.67		System Bus torque reference from the master.
1.5.8	SB Out Cntl Word	1534	0	32767		System bus control word out of the slave sections
1.5.9	MD Bit In1	1050	0	1		First configurable bit from the system bus master section
1.5.10	MD Bit In2	1051	0	1		Second configurable bit from the system bus master section
1.5.11	MD Bit In3	1052	0	1		Third configurable bit from the system bus master section
1.5.12	MD Bit In4	1053	0	1		Fourth configurable bit from the system bus master section
1.5.13	MD Drive OK	1058	0	1		System bus master section Drive OK Bit.
1.5.14	MD Run Enable	1060	0	1		System bus master section Run Enable is high.
1.5.15	SB Comm Lost	1095	0	1		System bus is not communicating
1.5.16	SB Comm Flt	1173	0	1		Sytem bus slot comm fault or master WD fault.
<b>1.6</b>	<b>L2 Digital</b>					<b>Menu Name</b>
1.6.1	Cntrl Inhib	1099	0	1		Inverse of MC_Run. Used to reset loops when drive is off.
1.6.2	Run OK	1091	0	1		All the interlocks are met to enable a run command.
1.6.3	Run Fwd Cmd	1147	0	1		Run forward is commanded.
1.6.4	Run Rev Cmd	1148	0	1		Run reverse has been commanded.
1.6.5	MC Out	1106	0	1		Motor contactor out command. MC_run or brake pedal active and OK.
1.6.6	Reverse	1128	0	1		Reverse commanded by remote, keypad or computer.
1.6.7	Ramp Hold	1143	0	1		Ramp hold during infinite variable speed operation.
1.6.8	PC Control	1121	0	1		Control has been transferred to the PC.
1.6.9	Blw Brk Spd	1131	0	1		Below the brake holding speed
1.6.10	Brk Pdl Act	1107	0	1		Brake pedal enabled and selected. Coast drive and hold brakes open.
1.6.11	Brk Slip Mode	1104	0	1		Brake slip detected and mode will stay high until brakes are tested again.
1.6.12	Brk Slp Slw	1102	0	1		Brake slip detected and slow only action selected. Reset on next brake check OK.
1.6.13	In Anti Snatch	1108	0	1		In anti snatch acceleration mode.
1.6.14	Abv Base Spd	1129	0	1		Above base speed setpoint.
1.6.15	Abv Brk Slp Spd	1130	0	1		Speed above the brake slip setpoint for brake slip fault.
1.6.16	Sp HL Max	1563	0	1		Spare High/Low comparator above its max setpoint.
1.6.17	Sp HL Min	1564	0	1		Spare High/Low comparator below its min setpoint.
1.6.18	Sp Cmp1 Eq	1152	0	1		First spare comparator input and threshold difference is within the hysteresis value.
1.6.19	Sp Cmp1 Out	1153	0	1		First spare comparator input is greater than the threshold plus/minus the hysteresis value.
1.6.20	Sp Dly1 Out	1156	0	1		First spare delay block output bit.
1.6.21	Sp Dly2 Out	1157	0	1		Second spare delay block output bit.
1.6.22	Sp Latch1 Out	1158	0	1		First spare latch block output.
1.6.23	Sp Latch2 Out	1159	0	1		Second spare latch block output.
1.6.24	Sp Inv1 Out	1161	0	1		First spare bit invert output.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.6.25	Sp Inv2 Out	1162	0	1		Second spare bit invert output.
1.6.26	Sp Inv3 Out	1163	0	1		Third spare bit invert output.
1.6.27	Sp And1 Out	1164	0	1		First spare and output.
1.6.28	Sp And2 Out	1165	0	1		Second spare and output.
1.6.29	Sp And3 Out	1166	0	1		Third spare and output.
1.6.30	Sp Or1 Out	1167	0	1		First spare or output.
1.6.31	Sp Or2 Out	1168	0	1		Second spare or output.
1.6.32	Sp Or3 Out	1169	0	1		Third spare or output.
1.6.33	Ov Wt Alarm	1140	0	1		Over weight warning
1.6.34	MSpd OK	1139	0	1		Micro speed OK.
1.6.35	RunRequest	1090	0	1		Run request: 0=no, 1=yes
1.6.36	Watchdog Out	1003	0	1		Toggle bit for watch dog communications
1.6.37	Run Enable	1096	0	1		Run command to firmware. From remote, local or PC control
1.6.38	Rel Ramp	1174	0	1		Brakes are released and timed out. Ready to ramp drive up.
1.6.39	Start Input	1089	0	1		Run command from remote mode.
1.6.40	Trq Mode Sw	1111	0	1		MC Run and not torque proving.
1.6.41	Run Cmd Inp	1110	0	1		Run forward or reverse commanded.
1.7	L2 Analog					Menu Name
1.7.1	Abs Mtr Spd	1501	-327.67	327.67		Absolute value of MotorSpeed.
1.7.2	Mtr Fil IA Fil	1524	0.00	327.67		Filtered motor current in percent of nominal.
1.7.3	Fil Mtr Trq	1502	-300.0	300.0		Filtered motor torque in percent of motor.
1.7.4	Motor Power	5	-300.0	300.0		Motor shaft power filtered. 1000 = 100%
1.7.5	Rotor Flux	1541	-300.0	300.0		Estimated rotor flux, 1000 = nominal
1.7.6	Final Trq Ref	1542	-300.0	300.0		Final, limited torque reference for speed/torque controller
1.7.7	MtrCalcTemp	9	0.0	1000.0		Calculated motor temperature. 1000 = 100%
1.7.8	Control Place	1505	1	3		Location of reference. 0 = remote, 1 = keypad, 2 = computer
1.7.9	Anlg Ref	1520	-320.00	320.00		Joystick reference value.
1.7.10	Abs Per Spd	1512	-320.00	320.00		Final speed reference from digital or analog source.
1.7.11	Freq Stpt	1503	-327.67	327.67		Speed reference after scaling to motor frequency.
1.7.12	Trq Spd Lim	1507	-320.00	320.00		Over torque speed limit.
1.7.13	Speed Cntrl Out	1548	-327.67	327.67		TorqueReference from Speed controller output
1.7.14	FreqReference	25	-320.00	320.00		[W] Frequency reference to motor control, f[Hz] = FreqRef/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz
1.7.15	Final Freq Ref	1540	-320.00	320.00		Final shaft frequency reference for speed controller in FreqScale
1.7.16	Freq out	1	-320.00	320.00		[R] Output frequency to motor, f[Hz] = FreqOut/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz
1.7.17	Freq Delta	1508	-300.00	300.00		Acceleration in FreqScale/s
1.7.18	Freq Ramp Out	1568	0.00	FreqMax		[R] Output of ramp generator//f[Hz]=FreqRampOut/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz.
1.7.19	Brake Chopper	1509	0	1		0 = no brake chopper, 1 = brake chopper is installed
1.7.20	BrakeResistor	1511	0	1		1 = no brake resistor, 1 = brake resistor is installed
1.7.21	ProcessPITrimRef	1521	-327.67	327.67		Process PI Trim Frequency reference (in FreqScale)
1.7.22	MtrRegStatus	1525	0	256		Status of motor limit regulators, 0=not active,1=active//B0=motoring current regulator//B1=generating current reg.//B2=motoring torque reg.//B3=generating torque reg.//B4=over voltage reg. //B5=under voltage reg.
1.7.23	Sp MD1 Out	1553	-327.67	327.67		First spare MULDIV output
1.7.24	Sp Add1 Out	1555	-327.67	327.67		Spare Add block output
1.7.25	Sp Sub1 Out	1565	-327.67	327.67		Spare sub block output.
1.7.26	Sp LP Fil Out	1557	-327.67	327.67		Output of spare low pass filter
1.7.27	Sp ABS Out	1558	0.00	327.67		Spare ABS block output
1.7.28	Sp Sum1 Out	1559	-327.67	327.67		Sp sum block output
1.7.29	Sp Sel1 Out	1561	-327.67	327.67		First spare select block output.
1.7.30	Sp Lim Out	1574	-327.67	327.67		Spare limit value output
1.7.31	Torque Reference	18	-30.00	30.00		Torque reference 3000 = 300%
1.7.32	Active Flt Last	37	0	2000		[R] Last active fault code.
1.7.33	Accel Comp	1566	-500.0	500.0		AccelCompensation IqReference, 1000 = motor nominal current
1.7.34	Trq Ref Act	1536	-500.0	500.0		Adjusted TorqueReference (-3000...3000) = -300...300%
1.7.35	Final Iq Trq Ref	1539	-300.0	300.0		Final, limited Iq reference for speed/torque controller

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.7.36	Base Spd RPM	0	0	3600		Base speed based on poles found.
1.7.37	Max RPM	1504	0	32000		Max RPM based on motor base rpm and max frequency
1.7.38	TC Pos Freq Lim	1515	-320.00	320.00		Upper frequency limit in Torque Control (signed)
1.7.39	TC Neg Freq Lim	1516	-320.00	320.00		Lower frequency limit in Torque Control (signed)
1.8	L2 IO					Menu Name
1.8.1	Not DIN 1	1021	0	1		Inverse of digital input 1
1.8.2	Not DIN 2	1022	0	1		Inverse of digital input 2
1.8.3	Not DIN 3	1023	0	1		Inverse of digital input 3
1.8.4	Not DIN 4	1024	0	1		Inverse of digital input 4
1.8.5	Not DIN 5	1025	0	1		Inverse of digital input 5
1.8.6	Not DIN 6	1026	0	1		Inverse of digital input 6
1.8.7	Not DIN 7	1027	0	1		Inverse of digital input 7
1.8.8	Not DIN 8	1028	0	1		Inverse of digital input 8
1.8.9	AI1 Type	0	0	5		First analog input type
1.8.10	AI2 Type	0	0	5		Second analog input type
1.8.11	AI3 Type	0	0	5		Third analog input type
1.8.12	AI4 Type	0	0	5		Fourth analog input type
1.8.13	AIN3	1603	-327.67	327.67		Third analog input after scaling and filtering
1.8.14	AIN4	1604	-327.67	327.67		Fourth analog input after scaling and filtering
1.8.15	Enc1_Out	1609	-327.67	327.67		First encoder input after scaling and low pass filter
1.8.16	Counter1	1528	-32767	32767		First encoder counter output after scaling
1.9	L2 Comms					Menu Name
1.9.1	Digital Inputs					Menu Name
1.9.1.1	FB Run	1040	0	1		Run command from the Field bus from fixedcontrolword
1.9.1.2	FB Dir	1041	0	1		Direction command from the Field bus from fixedcontrolword
1.9.1.3	FB Flt Res	1042	0	1		Fault reset command from the Field bus from fixedcontrolword
1.9.1.4	FB DIN 1	1043	0	1		Digital in 1 command from the Field bus from fixedcontrolword
1.9.1.5	FB DIN 2	1044	0	1		Digital in 2 command from the Field bus from fixedcontrolword
1.9.1.6	FB DIN 3	1045	0	1		Digital in 3 command from the Field bus from fixedcontrolword
1.9.1.7	FB DIN 4	1046	0	1		Digital in 4 command from the Field bus from fixedcontrolword
1.9.1.8	FB DIN 5	1047	0	1		Digital in 5 command from the Field bus from fixedcontrolword
1.9.1.9	FB Fix Cntrl Wrd	1621	-32767	32767		Control word,bits B0-15://B0 - RUN //B1 - DIRECTION//B2 - FaultRST//B3 - FBDIN1 //B4 - FBDIN2 //B5 - FBDIN3 //B6 - FBDIN4 //B7 - FBDIN5 //B8 - BusCtrl//B9 - BusRef//B10 - FBDIN6//B11 - FBDIN7//B12 - FBDIN8//B13 - FBDIN9//B14 - FBD
1.9.2	Analog Inputs					Menu Name
1.9.2.1	A_Fb_Ain1	1611	-327.67	327.67		First int input from field bus
1.9.2.2	A_Fb_Ain2	1612	-327.67	327.67		Second int input from field bus
1.9.2.3	A_Fb_Ain3	1613	-327.67	327.67		Third int input from field bus
1.9.2.4	A_Fb_Ain4	1614	-327.67	327.67		Fourth int input from field bus
1.9.2.5	A_Fb_Ain5	1615	-327.67	327.67		Fifth int input from field bus
1.9.2.6	A_Fb_Ain6	1616	-327.67	327.67		Sixth int input from field bus
1.9.2.7	A_Fb_Ain7	1617	-327.67	327.67		Seventh int input from field bus
1.9.2.8	A_Fb_Ain8	1618	-327.67	327.67		Eighth int input from field bus
1.9.2.9	A_Fb_Ain9	1619	-327.67	327.67		Ninth int input from field bus
1.9.2.10	A_Fb_Ain10	1620	-327.67	327.67		Tenth int input from field bus
1.9.2.11	FB Spd Ref	1632	-327.67	327.67		Speed reference from field bus. Enter RPM gets converted to percentage.//Typically this value is in percent of the frequency area between the set minimum and maximum frequency.
1.9.3	Analog Outputs					Menu Name
1.9.3.1	FB Data Out 1	1622	-32767	32767		Application Specific process data
1.9.3.2	FB Data Out 2	1623	-32767	32767		Application Specific process data
1.9.3.3	FB Data Out 3	1624	-32767	32767		Application Specific process data
1.9.3.4	FB Data Out 4	1625	-32767	32767		Application Specific process data

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.9.3.5	FB Data Out 5	1626	-32767	32767		Application Specific process dataApplication Specific process data
1.9.3.6	FB Data Out 6	1627	-32767	32767		Application Specific process dataApplication Specific process data
1.9.3.7	FB Data Out 7	1628	-32767	32767		Application Specific process dataApplication Specific process data
1.9.3.8	FB Data Out 8	1629	-32767	32767		Application Specific process dataApplication Specific process data
1.9.3.9	FB Gen Sts Word	1631	-32767	32767		Status word (bits B0...B7) Binary Coded, Application Specific//B0 - B7 Digital Outputs//B8 Fieldbus card & Application specific fieldbus process data in use
2	Parameters					Menu Name
2.1	Quick Menu					Menu Name
2.1.1	Speed 1	1313	-320.00	320.00	20.00	First digital input speed. Default to 20% speed.
2.1.2	Speed 2	1314	-320.00	320.00	40.00	Second digital input speed. Default to 40% speed.
2.1.3	Speed 3	1315	-320.00	320.00	60.00	Third digital input speed. Default to 60% speed.
2.1.4	Speed 4	1316	-320.00	320.00	80.00	Fourth digital input speed. Default to 80% speed.
2.1.5	Speed 5	1317	-320.00	320.00	100.00	Fifth digital input speed. Default to 100% speed.
2.1.6	SD Speed	1312	-320.00	320.00	10.00	Digital Slow down speed. Default to 50%
2.1.7	Accel Time 1	103	0.1	3000.0	5.0	Default acceleration time constant for the speed ramp.
2.1.8	Decel Time 1	104	0.1	3000.0	5.0	Default deceleration time constant for the speed ramp.
2.1.9	Load Float Time	616	0.000	32.000	0.100	The drive will remain at zero speed with controllers active for the time defined by this parameter after reaching the zero speed on giving a stop command.
2.1.10	Rel Rmp Dly	1288	0.00	327.67	0.10	Delay to release ramp until brakes can be picked up. Default is 0.1 ms.
2.1.11	Brake Offset	1267	-320.00	320.00	-0.10	Offset to set brakes after the load float time. Negative will set brakes before control ends. Positive will coast until brakes are set.
2.1.12	Full Load Per	1310	0.01	320.00	100.00	Full load percentage of motor full load.
2.1.13	Setup Wizard	0	0	1	0 / Disabled	Enables the startup wizard.
2.1.14	Self Tune Motor	631	0	Ident_Limit	0 / No Action	Identification status. 0 = No Action, 1= No Run, 2 = Run
2.1.15	Password	0	0	32000	0	Password entry value
2.2	L2 Protections					Menu Name
2.2.1	Fault Reset	0	0	2000	1002	Fault reset. Default to Zero Bit.
2.2.2	User Flt 1	0	0	2000	1002	First user fault configuration point. Default to Zero Bit.
2.2.3	User Flt 2	0	0	2000	1002	Second user fault configuration point. Default to Zero Bit.
2.2.4	User Flt 3	0	0	2000	1002	Third user fault configuration point. Default to Zero Bit.
2.2.5	User Flt 4	0	0	2000	1002	Fourth user fault configuration point. Default to Zero Bit.
2.2.6	Ext Fault Inp	0	0	2000	1002	External fault input. High for fault. Default to zero bit.
2.2.7	Mspd Flt Resp	0	0	3	0 / No Action	Response to load float being on too long.
2.2.8	Overspeed Resp	0	0	3	3 / Fault,Coast	Response to drive overspeed. Default to coast stop and fault the drive.
2.2.9	Input Ph. Superv	730	0	3	0 / No Action	Set response to an input phase fault. Ignore, Warn, Fault, Fault coast
2.2.10	UVolt Fault Resp	727	0	1	0 / Fault Stored	Set Drive response to an under voltage fault. Ignore, Warn, Fault, Fault coast
2.2.11	Phase Supv F	702	0	3	2 / Fault	Set Drive response to an output phase fault. Ignore, Warn, Fault, Fault coast
2.2.12	Earth Fault	703	0	3	2 / Fault	Set Drive response to a ground fault. Ignore, Warn, Fault, Fault coast
2.2.13	Therm Prot F	704	0	3	2 / Fault	Set Drive response to a motor thermal fault. Ignore, Warn, Fault, Fault coast
2.2.14	MotAmbTempFactor	705	-100.0	100.0	0.0	[W] Ambient temperature factor.(-1000... 1000) 0= nominal, 1000= max, kf=(Tamb-Tn)/(Tmax-Tn)*1000.
2.2.15	Mot Therm 0 Spd	706	0.0	150.0	40.0	[W] Motor cooling ability at zero speed unit 0,1%. Init := 400
2.2.16	Mtr Therm TC	707	1	200	10	[W] Motor Thermal Time Constant in minutes, (1... 200). Init := 45
2.2.17	Motor Duty Cycle	708	0	100	100	[W] Motor Duty Cycle in %. Init := 100

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.2.18	ULoad Protect F	713	0	3	0 / No Action	Set Drive response to a loss of load fault. Ignore, Warn, Fault, Fault coast
2.2.19	Under Ld Trq Nom	714	10.0	150.0	50.0	[W] Underload load curve at nominal freq.unit = 0.1%. Init := 500
2.2.20	Under Ld Trq 0	715	5.0	150.0	10.0	[W] Underload load curve at zero freq.unit = 0.1%. Init := 100
2.2.21	Under Ld State T	716	2.00	600.00	20.00	[W] Time limit for underload supervision in 0.01 sec (0 .... 65536). Init := 2000
2.2.22	ThermistorF.Resp	732	0	3	2 / Fault	Set Drive response to a thermistor fault. Ignore, Warn, Fault, Fault coast
2.2.23	FBComm.FaultResp	733	0	3	2 / Fault	Set Drive response to a field bus fault. Ignore, Warn, Fault, Fault coast
2.2.24	SPI Flt Resp	734	0	3	2 / Fault	Set Drive response to a slot communication fault. Ignore, Warn, Fault, Fault coast
2.2.25	WD Flt Response	0	0	3	2 / Fault	Response to a communication watch dog time out. Default to fault the drive.
2.2.26	Com WD	0	0	1	0 / Disabled	Enables the communications watchdog timer. Default to not run it.
2.2.27	Brk Cont FTim	1268	0.00	327.67	0.20	Delay to check for brake released limit switch before faulting the drive. Default 200 ms.
2.2.28	Brk Cont Resp	0	0	3	0 / No Action	Response for a brake open fault. Default is fault with coast stop.
2.2.29	Brk Slp Resp	0	0	3	3 / Fault,Coast	Response to brake slip fault. Default fault with coast stop.
2.2.30	Brk Slp Act	0	0	3	0 / Disabled	Action for brake slip detection. No action, lower only, lower only and slow or just slow. Default no action.
2.2.31	Trq Prv Resp	0	0	3	3 / Fault,Coast	Torque proving fault response. Default coast stop.
2.2.32	Err Lim 1	1240	0	32767	500	Low setpoint speed error fault difference in Hz.
2.2.33	Err Lim 2	1241	0	32767	1000	Highsetpoint speed error fault difference in Hz.
2.2.34	Low Err Tim	0	0.00	327.67	5.00	Time where small error is allowed for speed error fault.
2.2.35	Hi Err Tim	0	0.00	327.67	1.00	Time where large error is allowed for speed error fault.
2.2.36	Spd Err Resp	0	0	3	3 / Fault,Coast	Action on speed error fault. Default to no action for open loop. Set to fault for close loop hoists.
2.2.37	Run Off Resp	0	0	3	3 / Fault,Coast	Run off fault. Brakes are not set after timeout. Default to Coast stop.
2.2.38	Run Off Tim	0	0.00	327.67	2.00	Timer to set run off fault. Set to the time after the brake is suppose to release according to load float and deceleration time.
2.2.39	Dir Flt Resp	0	0	3	3 / Fault,Coast	Both direction selected at the same time fault. Default to no action.
2.2.40	Joyst Flt St	0	0.00	327.67	20.00	Percent speed the joystick input has to be above with no run command for fault. Default 20%.
2.2.41	Joyst Resp	0	0	3	0 / No Action	Response to joystick failure. Default = no action.
2.2.42	Slck Rope Tim	0	0.00	327.67	2.00	Time for low torque for slack rope fault. Default 2 seconds.
2.2.43	Slck Resp	0	0	3	0 / No Action	Response to slack rope detection. Default no action.
2.2.44	Slck Rope Trq	0	-3276.7	3276.7	10.0	Slack rope detection torque setpoint in lower direction. Default to 10% torque.
2.2.45	Stall Resp	0	0	3	0 / No Action	Stall condition response. Default to no action.
2.2.46	Stall Spd St	1247	0	32767	50	Stall speed setpoint. Default below 50 rpm.
2.2.47	Stall Time	0	0.00	327.67	60.00	Stall time in seconds. Default 60
2.2.48	Stall Trq St	1249	0.0	3276.7	90.0	Stall torque setpoint. Default above 90% torque.
2.3	L2 Setpoints					Menu Name
2.3.1	Spd Slk Up	1273	-327.67	327.67	0.00	Speed step slack up value
2.3.2	Brk Hld Spd	1266	0	32767	50	Brake is held open until the speed falls below this setpoint. Default 50 RPM.
2.3.3	Trq Ref StA	1302	-300.0	300.0	20.0	Fixed value for the first torque reference input if desired. Enter in percent torque.
2.3.4	Field WeakngPnt	602	8.00	320.00	60.00	[W] Field weakening point, f[Hz] = FieldWeakeningPoint/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz
2.3.5	Trq Prv Slp	1318	0.0	327.67	10.0	Percent motor current used for torque proving.
2.3.6	Anti Snlch Trq	1250	0.0	300.0	5.0	Anti snatch torque level. Default to 5% torque
2.3.7	Brk slp Spd	1269	0	32767	25	Motor speed setpoint for brake slip detection during torque proving. Default 25 RPM.
2.3.8	Sp Sum1 StA	1330	-327.67	327.67	0.00	Sp sum blocks first input default calibration value..
2.3.9	Sp Sum1 StB	1331	-327.67	327.67	0.00	Sp sum blocks second input default calibration value..

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.3.10	Sp Sum1 StC	1332	-327.67	327.67	0.00	Sp sum blocks third input default calibration value..
2.3.11	Sp Sel1 ST0	1337	-327.67	327.67	0.00	First spare select block input 0 default calibration value.
2.3.12	Sp Sel1 ST1	1338	-327.67	327.67	0.00	First spare select block input 1 default calibration value.
2.3.13	Sp HL High	1341	0.00	327.67	90.00	Spare High Low comparator High percent.
2.3.14	Sp HL Hyst	1342	0.00	327.67	1.00	Spare High Low comparator hysteresis value.
2.3.15	Sp HL Low	1343	0.00	327.67	10.00	Spare High Low comparator low percent.
2.3.16	Sp HL Stpt	1344	0.00	327.67	100.00	Spare High Low comparator default full scale value.
2.3.17	Sp Cmp1_Hyst	1345	0.00	327.67	0.01	First spare comparator block Hysteresis value. Plus or minus around the threshold.
2.3.18	Sp Cmp1_Stpt	1346	-327.67	327.67	0.10	First spare comparator block default setpoint value. Can be used for the input or threshold.
2.3.19	User Password	0	0	32000	1	User password. If zero no password required for full menus.
2.4	L2 Rates / Times					Menu Name
2.4.1	2nd Accel Rate	1260	0.01	300.00	2.00	2nd acceleration rate. Default to be enabled in extended speed range.
2.4.2	2nd Decel Rate	1261	0.01	300.00	2.00	2nd deceleration rate. Default to be enabled in extended speed range.
2.4.3	Smooth Ratio	500	0.0	10.0	0.1	[W] Smooth ratio for S-curves//0 = linear ramps//100 = full acc/dec inc/dec times.
2.4.4	Fast Stop Tim	503	0.1	3000.0	2.0	Fast stop ramp time
2.4.5	Smooth Ratio 2	501	0.0	10.0	0.0	[W] Smooth ratio 2 for S-curves//0 = linear ramps//100 = full acc/dec inc/dec times.
2.4.6	Anti Snatch Accel	0	0.1	3000.0	10.0	Anti snatch acceleration time in seconds.
2.4.7	Anti Snatch Tim	0	0.00	327.67	0.20	Time for low fwd torque to switch to anti snatch acceleration rate. Default 200 ms.
2.4.8	Trq Prv Flt Tim	0	0.00	327.67	0.20	Torque proving fault time constant. Default 200 ms.
2.4.9	Mtr Trq TC	0	0.00	327.67	0.10	Motor torque low pass filter time constant. Used for several functions. Default to 100 ms.
2.4.10	Mtr Cur TC	0	0.00	20.00	0.50	Low pass filter on motor current in seconds.
2.4.11	Trq Rmp Rate	1290	0	3200	5	Torque reference ramp limit in percent per second.
2.4.12	Sp LP Fil TC	1329	0.00	10.00	0.10	Spare low pass filter time constant. Default to 100 ms.
2.4.13	Sp Dly1 TOFF	1349	0.00	327.67	0.10	First spare timer delay off setting in seconds. Default to 100 ms.
2.4.14	Sp Dly1 TON	1350	0.00	327.67	0.10	First spare timer delay on setting in seconds. Default to 100 ms.
2.4.15	Sp Dly2 TOFF	1351	0.00	327.67	0.10	Second spare timer delay off setting in seconds. Default to 100 ms.
2.4.16	Sp Dly2 TON	1352	0.00	327.67	0.10	Second spare timer delay on setting in seconds. Default to 100 ms.
2.4.17	Spd Cmp Fil TC	0	0.00	10.00	0.10	Spd Comparator low pass filter. Default to 100 ms.
2.4.18	WD Com Dly	0	0.00	100.00	0.10	Communications watch dog timer delay. Default to 100 ms.
2.4.19	WD Init Dly Tim	0	0.00	327.67	10.00	Power up delay for the communications watchdog timer. Default to 10 seconds.
2.4.20	Accel Comp Tc	0	0.002	1.000	0.100	Filtering Time Constant for acceleration compensation in s
2.4.21	Trq Ref Fil TC	0	0.0	1000.0	0.0	Filter time for torque reference (0...10000) = 0...1000.0 ms
2.4.22	Spd Err Fil TC	0	0	1000	0	Filter time for speed error (0 ...1000 ) = 0...1000 ms
2.4.23	Strt 0 Spd Time	615	0	32000	100	After giving the start command the drive will remain in zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/speed reference after this time is elapsed from the instant where command is given.
2.4.24	Brk Sel Tim	0	0.00	10.00	0.10	Brake set time. Used to detect brake slip. Default 0.1 seconds.
2.4.25	Mspd Tim	1279	0.00	320.00	60.00	Micro speed timer. Default to 60 seconds
2.5	L2 Tuning					Menu Name
2.5.1	Speed Control Kp	613	1	1000	30	Gain for the speed controller. (% / Hz)
2.5.2	Speed Control Ti	614	0.0	500.0	30.0	Integral time constant for the speed controller
2.5.3	Spd Cntrl F0	0	0.00	320.00	0.00	Corner frequency for SpeedControl_Kp_f0
2.5.4	Spd Cntrl F1	0	0.00	320.00	0.00	Corner frequency for SpeedControl_Kp
2.5.5	Spd Cntrl Kp F0	0	0	300	100	Relative gain (%) below SpeedControl_f0
2.5.6	Spd Cntrl Kp FW	0	0	300	100	Relative final gain for Speed controller p-gain at field weakening in%//< 100 reduces gain, >100 increases gain above FWP
2.5.7	Spd Cntrl Kp T0	0	0	300	100	Relative gain (%) if torque is below SpeedControl_T0
2.5.8	Spd Cntrl T0	0	0	300	0	Torque Limit for reduced SpeedControl_Kp (1000 = nominal)
2.5.9	Accel.Compens.	626	0.00	300.00	0.00	Inertia compensation to improve speed response during acceleration and deceleration. Time is defined as acceleration time to nominal speed with nominal torque. This parameter is active also in advanced openloop.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.5.10	Spd Err Bnd Frq	0	0.0	450.0	0.0	Speed Error Notch filter BandStop frequency (10...4500) = 1.0 ... 450.0 Hz//0 = Not in Use
2.5.11	Spd Err LP Freq	0	1.0	250.0	100.0	Speed Error LowPass filter cutoff frequency (10...2500) = 1.0 ... 250.0 Hz//0 = Not in Use
2.5.12	LoadDrooping	620	0.00	100.00	0.00	The drooping function enables speed drop as a function of load. The amount of allowed speed drop is proportional to the load or speed controller output (Iq reference). That amount corresponding to 100% load of the motor is set using this parameter.
2.5.13	CurrentControlKp	617	0.00	100.00	40.00	Gain for the current controller. This controller is active only in closed loop and advanced open loop. It generates the voltage vector reference to the modulator.
2.5.14	Curr Cntrl Ti	0	0.0	100.0	1.5	Current controller integrator time constant (0 ... 1000) = 0...100.0 ms
2.5.15	OV Reg Kp	0	0	32767	2000	P-gain of over voltage controller (0 ... 32767)
2.5.16	OV Reg Ki	0	0	32767	500	I-gain of over voltage controller (0 ... 32767)
2.5.17	OV Reg Kd	0	0	32767	400	D-gain of over voltage controller OL, 256 equals 1.0 (0 .. 32767 )
2.5.18	UV Reg I	0	0	32767	400	I-gain of under voltage controller (0 ...32767)
2.5.19	UV Reg Kp	0	0	32767	4000	P-gain of under voltage controller (0 ..32767)
2.5.20	UV Reg Kd	0	0	32767	0	D-gain of under voltage controller
2.5.21	Mtr I Lim Ki	0	0	32767	400	I-gain of motor side over current controller (0 ... 32767 )
2.5.22	Mtr I Lim Kp	0	0	32767	20000	P-gain of motor side over current controller (0 ... 32767 )
2.5.23	Gen I Lim Ki	0	0	32767	400	I-gain of generator side over current controller (0 ... 32767 )
2.5.24	Gen I Lim Kp	0	0	32767	20000	P-gain of generator side over current controller (0 ... 32767 )
2.5.25	Trq Lim Kp	610	0	32000	3000	P-gain of torque limit controller
2.5.26	Trq Lim Ki	611	0	32000	200	I-gain of torque limit controller
2.5.27	Spd Cont Kp	637	0	32767	3000	[W] P-gain of open loop speed controller (0...32767 ). Init := 3000
2.5.28	Spd Cont Ki	638	0	32767	300	[W] I-gain of open loop speed controller (0 ... 32767). Init := 300
2.5.29	Trq Cntrl Kp	639	0	32000	150	P-gain of torque controller
2.5.30	Trq Cntrl Ki	640	0	32000	10	I-gain of torque controller
2.5.31	Cl Ovr Vlt Kp	0	0	5000	50	CL OverVoltage Controller base gain
2.5.32	Cl Ovr Vlt Ti	0	0	500	15	CL OverVoltage Controller integral time in ms
2.6	L2 Limits					Menu Name
2.6.1	SD Spd Lim	1311	0.00	320.00	50.00	Slow down speed limit in case computer or keypad control is in use. Default 50%
2.6.2	ESR Cur Lim	1262	0.00	320.00	100.00	Extended speed range is enabled if current is < ( base spd / max speed ) x this value percent. when speed is stable
2.6.3	Max ESR Speed	1263	0.00	327.67	100.00	Maximum extended speed limit in percentage.
2.6.4	Freq Max	102	FreqMin	320.00	60.00	[W] Max output frequency, f[Hz] = FreqMin/FreqScale//Range[FreqMin...32767]//If FreqScale=100 then 5000 equals 50.00 Hz. Init := 5000
2.6.5	Min Frequency	101	0.00	Max_Frequen cy	0.00	Minimum frequency the speed reference is allowed to go down to in Hertz.
2.6.6	Mtr Cur Limit	1291	0.00	300.00	150.00	Motor current limit value
2.6.7	Motoring Trq Lim	1305	0.0	300.0	300.0	Torque limit for motor side torque limitter,1000 equals 100% nominal torque
2.6.8	Gener Trq Lim	1306	0.0	300.0	300.0	Torque limit for generator side torque limitter,1000 equals 100% nominal torque
2.6.9	Trq Lim FWD	1307	0.0	300.0	300.0	Additional Torque limit for Forward Reference Direction,1000 equals 100% nominal torque
2.6.10	Trq Lim REV	1308	0.0	300.0	300.0	Additional Torque limit for Reverse Reference Direction,1000 equals 100% nominal torque
2.6.11	Ovr Spd Stp	1258	0.00	327.67	110.00	Overspeed setpoint in percentage of max speed. Default to 110%
2.6.12	Zero Detect	1259	0.00	200.00	2.00	Speed feedback comparitor At zero speed setpoint. Default to 2% of max speed.
2.6.13	Spd Hyst	0	0.00	200.00	1.00	Speed feedback comparator hysteresis vaule. Default to 1%
2.6.14	Spd Decimal	0	0	4	2	Speed feedback comparator decimal point resolution. Default to 2.
2.6.15	Trq Ref Max	642	-300.0	300.0	100.0	Maximum limit for the torque reference. Entered in percent torque.
2.6.16	Trq_Ref_Min	643	-300.0	300.0	0.0	Minimum limit for the torque reference. Entered in percent torque.
2.6.17	Torq Speed Limit	644	0	2	1 / Freq Ref	Torque control max frequency 0 = Max Frequency Par 2.1.1, 1 = Selected frequency reference, 2 = Preset speed 7

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.6.18	Pos Freq Limit	1300	-320.00	320.00	120.00	Additional signed Upper Frequency limit in FreqScale, Used while in torque mode to control overspeed.//Range [-32767..32767],//0 prevents running to forward direction
2.6.19	Neg Freq Limit	1301	-320.00	320.00	-120.00	Additional signed lower Frequency limit in FreqScale, Used while in torque mode to control overspeed.//Range [-32767..32767],//0 prevents running to forward directionAdditional signed Lower Frequency limit in FreqScale, //Range [-32767..32767],//0 prevents running to reverse direction
2.6.20	Win Pos Width	1242	0.00	320.00	6.00	Frequency Window width for positive direction in FreqScale, activated with TCSpeedLimiterMode=4
2.6.21	Win Neg Width	1243	0.00	320.00	6.00	Frequency Window width for negative direction in FreqScale, activated with TCSpeedLimiterMode=4.
2.6.22	Cl Ovr Mtr Lim	0	0.0	500.0	10.0	CL Motoring current limit (1000 = 100.0%) for OverVoltage Controller
2.6.23	Sp Lim Max	1353	-327.67	327.67	100.00	Spare limit block maximum value.
2.6.24	Sp Lim Min	1354	-327.67	327.67	-100.00	Spare limit block minimum value.
2.7	L2 Scaling					Menu Name
2.7.1	LS to Freq	1282	-32.767	32.767	0.600	Scaling factor to convert speed reference units ( usually % ) to motor units ( Usually motor Hz )
2.7.2	LS Scl Div	1281	-32767	32767	1000	Scaling factor to convert speed reference units ( usually % ) to motor units ( Usually motor Hz )
2.7.3	SD Mlt Stpt	1289	0.00	1.00	0.50	Analog reference slow down speed multiplier. Default 0.50
2.7.4	Sp MD1 Dv	1323	-327.67	327.67	1.00	Default value for the first spare MULDIV block divide input.
2.7.5	Sp MD1 Mlt	1324	-327.67	327.67	1.00	Default value for the first spare MULDIV block multiply input.
2.7.6	Sp Add Val	1327	-327.67	327.67	0.00	Spare add block optional cal number.
2.7.7	Sp Sub Val	1328	-327.67	327.67	0.00	Spare sub block optional scaling value.
2.7.8	Sp LH Decimal	0	0	2	2	Number of decimal places for the input values. Needed to perform the correct percentage division.
2.7.9	FreqRamp	0	0.00	327.67	60.00	Frequency range for ramp calculation, f[Hz] = FreqRamp/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz
2.7.10	Mspd Stpt	1278	0.00	1.00	0.50	Multiplier to analog speed for micro speed function. Default 0.50
2.7.11	Encoder PPR	0	1	32000	1024	PPR entry for the startup wizard
2.8	L2 Bit Config					Menu Name
2.8.1	Run Fwd Inp	0	0	2000	1011	Digital input for Run forward command
2.8.2	Run Rev Inp	0	0	2000	1012	Digital input for Run reverse command
2.8.3	Fast Stop	0	0	2000	1001	Initiates a stop and switches in faster ramp rates when input goes low. Default to one bit.
2.8.4	Coast Stop	0	0	2000	1001	Set to input for emergency coast stop. Default to one bit.
2.8.5	EndSt Fwd	0	0	2000	1001	Optional end stop forward input. Default to One Bit.
2.8.6	EndSt Rev	0	0	2000	1001	Optional end stop reverse input. Default to One Bit.
2.8.7	Digital Sel	0	0	2000	1001	Selects digital inputs vs joystick. Default One Bit = Digital.
2.8.8	Joyst Pol En	0	0	2000	0	Enables Run reverse by joystick polarity vs. digital input.
2.8.9	JoySt B Sel	0	0	2000	1002	Selects alternate joystick input. Default to zero bit.
2.8.10	Dig B Sel	0	0	2000	1002	Selects alternate digital inputs. Default to Zero Bit.
2.8.11	En Spd 1A	0	0	2000	1110	First standard digital speed input. Default to Run_Cmd_Inp.
2.8.12	En Spd 2A	0	0	2000	1002	Second standard digital speed input. Default to zero bit
2.8.13	En Spd 3A	0	0	2000	1002	Third standard digital speed input. Default to zero bit
2.8.14	En Spd 4A	0	0	2000	1002	Fourth standard digital speed input. Default to zero bit
2.8.15	En Spd 5A	0	0	2000	1002	Fifth standard digital speed input. Default to zero bit
2.8.16	En Spd 1B	0	0	2000	1002	First digital speed input for alternate inputs. Default to Zero Bit
2.8.17	En Spd 2B	0	0	2000	1002	Second digital speed input for alternate inputs. Default to Zero Bit
2.8.18	En Spd 3B	0	0	2000	1002	Third digital speed input for alternate inputs. Default to Zero Bit
2.8.19	En Spd 4B	0	0	2000	1002	Fourth digital speed input for alternate inputs. Default to Zero Bit
2.8.20	En Spd 5B	0	0	2000	1002	Fifth digital speed input for alternate inputs. Default to Zero Bit
2.8.21	Fwd SD Inp	0	0	2000	1014	Forward slow down limit. Default to digital in 4.
2.8.22	Rev SD Inp	0	0	2000	1014	Reverse slow down limit. Default to digital in 4.
2.8.23	Inf Var En	0	0	2000	1002	Enables the infinite variable function.
2.8.24	Spd Up Inp	0	0	2000	1002	Speed up bit for infinite variable speed function.
2.8.25	Rel Rmp By Tim	0	0	2000	1001	Release ramp off brake time vs brake open aux contact input.
2.8.26	En Ext Spd	0	0	2000	1002	Enable extended speed range. Default to Zero Bit.
2.8.27	2nd Rmp En	0	0	2000	1002	Enables the second ramp. Default to extended speed range.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.8.28	At Zero Time	0	0	2000	1127	Resets the Drive OK after a fault. Default to At Zero Spd
2.8.29	DC Brk Cmd	0	0	2000	1002	Enables DC injection braking after stop. Default to Zero Bit
2.8.30	Trq Prv By	0	0	2000	1001	Bypasses the torque proving for non hoist applications.
2.8.31	Brk Opn Sw	0	0	2000	1002	Optional Brake open contact input.
2.8.32	Brk Pdl En	0	0	2000	1002	Enables brake pedal logic. Coast drive and keep brakes in. Default to Zero Bit.
2.8.33	Brk Pdl Inp	0	0	2000	1002	Brake pedal input. When high and enabled coast drive and hold brakes in.
2.8.34	En Anti Snatch	0	0	2000	1002	Enable anti snatch function. Changes acceleration rate during low torque hoisting.
2.8.35	Disable Ramp	0	0	2000	1002	Disable speed reference ramp function
2.8.36	Trq Ref En	0	0	2000	1090	Enables the torque reference. Default to RunRequest
2.8.37	Trq Dir	0	0	2000	1002	Reverse the polarity of the torque reference. Default to Zero bit
2.8.38	Trq No Ramp	0	0	2000	1001	Disables the torque reference ramp. Defaults to disable the ramp.
2.8.39	Param Set Sel	0	0	2000	1002	Selects between the two parameter sets when enabled.
2.8.40	Thermistor Inp	0	0	2000	1002	Input for thermistor fault. Default to zero Bit.
2.8.41	Sp Sum1 EnA	0	0	2000	1002	Enables the first spare sum input. Default to Zero bit.
2.8.42	Sp Sum1 EnB	0	0	2000	1002	Enables the second spare sum input. Default to Zero bit.
2.8.43	Sp Sum1 EnC	0	0	2000	1002	Enables the third spare sum input. Default to Zero bit.
2.8.44	Sp Sel1 En1	0	0	2000	1002	First spare select block enables input 1 configuration point.
2.8.45	Sp Dly1 In	0	0	2000	1002	First delay block input. Default to Zero Bit
2.8.46	Sp Dly2 In	0	0	2000	1002	Second delay block input. Default to Zero Bit
2.8.47	Sp Ltch1 H1	0	0	2000	1001	First spare latch block first hold bit. Default to One bit.
2.8.48	Sp Ltch1 H2	0	0	2000	1001	First spare latch block second hold bit. Default to One bit.
2.8.49	Sp Ltch1 L	0	0	2000	1002	First spare latch block latch input bit. Default to Zero bit.
2.8.50	Sp Ltch2 H1	0	0	2000	1001	Second spare latch block first hold bit. Default to One bit.
2.8.51	Sp Ltch2 H2	0	0	2000	1001	Second spare latch block second hold bit. Default to One bit.
2.8.52	Sp Ltch2 L	0	0	2000	1002	Second spare latch block latch input bit. Default to Zero bit.
2.8.53	Sp Inv1 In	0	0	2000	1002	First spare Bit invert blocks input bit.
2.8.54	Sp Inv2 In	0	0	2000	1002	Second spare Bit invert blocks input bit.
2.8.55	Sp Inv3 In	0	0	2000	1002	Third spare Bit invert blocks input bit.
2.8.56	Sp And1 In1	0	0	2000	1002	First spare And block input 1. Default to Zero Bit.
2.8.57	Sp And1 In2	0	0	2000	1002	First spare And block input 2. Default to Zero Bit.
2.8.58	Sp And1 NIn3	0	0	2000	1002	First spare And block inverted input 3. Default to Zero Bit.
2.8.59	Sp And2 In1	0	0	2000	1002	Second spareAnd block input 1. Default to Zero Bit.
2.8.60	Sp And2 In2	0	0	2000	1002	Second spare and block input 2. Default to Zero Bit.
2.8.61	Sp And2 NIn3	0	0	2000	1002	Second spare And block inverted input 3. Default to Zero Bit.
2.8.62	Sp And3 In1	0	0	2000	1002	Third spare And block input 1. Default to Zero Bit.
2.8.63	Sp And3 In2	0	0	2000	1002	Third spare And block input 2. Default to Zero Bit.
2.8.64	Sp And3 NIn3	0	0	2000	1002	Third spare And block inverted input 3. Default to Zero Bit.
2.8.65	Sp Or1 In1	0	0	2000	1002	First spare Or block input 1. Default to Zero Bit.
2.8.66	Sp Or1 In2	0	0	2000	1002	First spare Or block input 2. Default to Zero Bit.
2.8.67	Sp Or1 NIn3	0	0	2000	1002	First spare Or block inverted input 3. Default to Zero Bit.
2.8.68	Sp Or2 In1	0	0	2000	1002	Second spareOr block input 1. Default to Zero Bit.
2.8.69	Sp Or2 In2	0	0	2000	1002	Second spareOr block input 2. Default to Zero Bit.
2.8.70	Sp Or2 NIn3	0	0	2000	1002	Second spare Or block inverted input 3. Default to Zero Bit.
2.8.71	Sp Or3 In1	0	0	2000	1002	Third spare Or block input 1. Default to Zero Bit.
2.8.72	Sp Or3 In2	0	0	2000	1002	Third spareOr block input 2. Default to Zero Bit.
2.8.73	Sp Or3 NIn3	0	0	2000	1002	Third spare Or block inverted input 3. Default to Zero Bit.
2.8.74	Watchdog In	0	0	2000	1002	Communications watchdog timer input from PLC. Default to Zero Bit.
2.8.75	3 St Hld	0	0	2000	1001	Used to set the hold digital input for 3 step infinite variable mode.
2.8.76	MSpd Inp	0	0	2000	1002	Micro speed command input. Default to Zero Bit.
2.9	L2 Anlg Config					Menu Name
2.9.1	Joyst A Inp	0	0	2000	1601	Standard joystick input. Default to analog input #1.
2.9.2	Joyst B Inp	0	0	2000	1602	Alternate joystick input. Default to analog input #2.
2.9.3	Accel Inp	0	0	2000	103	Acceleration rate input. Default to Accel_Time_1 parameter.
2.9.4	Decel Time	0	0	2000	104	Deceleration rate input. Default to Decel_Time_1 parameter.
2.9.5	Slack Up	0	0	2000	1273	Speed slack up input. Default to Spd Slk Up
2.9.6	Mtr Cur Lim Scl	0	0	2000	1291	Scaling value for current limit. Default to MotorCurrentLim.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.9.7	Sp MD1 Val	0	0	2000	1200	Input for the first spare MULDIV block. Default to Zero analog.
2.9.8	Sp MD1 Div	0	0	2000	1323	First spare MULDIV block divide input. Default to Sp MD1 Dv cal number.
2.9.9	Sp MD1 Mul	0	0	2000	1324	First spare MULDIV block multiply input. Default to Sp MD1 Mlt cal number.
2.9.10	Sp Add1 In1	0	0	2000	1327	First input of spare Add block.
2.9.11	Sp Add1 In2	0	0	2000	1327	Second input of spare Add block.
2.9.12	Sp Sub1 In1	0	0	2000	1328	First input of spare Sub block.
2.9.13	Sp Sub1 In2	0	0	2000	1328	Second input of spare Sub block.
2.9.14	Sp LP Fil In	0	0	2000	1200	Input to the spare low pass filter. Default to zero analog.
2.9.15	Sp ABS In	0	0	2000	1200	Spare absolute value block input. Default to Zero Analog
2.9.16	Sp Sum1 InA	0	0	2000	1330	Spare sum block first input. Default to Sp Sum1 StA.
2.9.17	Sp Sum1 InB	0	0	2000	1331	Spare sum block second input. Default to Sp Sum1 StB.
2.9.18	Sp Sum1 InC	0	0	2000	1332	Spare sum block third input. Default to Sp Sum1 StC.
2.9.19	Sp Sel1 In0	0	0	2000	1337	First spare select block input 0. Default to Sp Sel1 ST0
2.9.20	Sp Sel1 In1	0	0	2000	1338	First spare select block input 1. Default to Sp Sel1 ST1
2.9.21	Sp HL Inp	0	0	2000	1200	Spare High/Low comparator input value. Default to Zero Analog
2.9.22	Sp HL Setpt	0	0	2000	1344	Spare High/Low comparator setpoint value. Default to Sp HL Stpt
2.9.23	Sp Cmp1 In	0	0	2000	1346	First spare comparator block input parameter to be compared with the threshold. Default to Sp Cmp1 Stpt.
2.9.24	Sp Cmp1 Thres	0	0	2000	1346	First spare comparator block threshold parameter to be compared with the input. Default to Sp Cmp1 Stpt.
2.9.25	Sp Lim Inp	0	0	2000	1200	Spare limit input. Default to Zero Analog
2.9.26	Trq Ref	0	0	2000	1302	Torque reference. Default to C_Trq_Ref_StA
2.9.27	Sp WPVal ID	0	0	2000	0	Write param value ID that the data will be sent to. Default to 0 which will not send data.
2.9.28	Sp WPVal2 ID	0	0	2000	0	Write param value ID that the data will be sent to. Default to 0 which will not send data.
2.9.29	Sp WPVal Inp	0	0	2000	1200	Spare Write param value ID number for the parameter to be passed.
2.9.30	Sp WPVal2 Inp	0	0	2000	1200	Spare Write param value ID number for the parameter to be passed.
2.10	L2 Enables					Menu Name
2.10.1	EndSt Maint	0	0	1	0 / Nomal	Temporary disables end stop to test ultimate limit.
2.10.2	Skip S Rev	0	0	1	0 / Disabled	Skip S2,S4 scurve when opposite direction asked for during a ramp
2.10.3	Rmp Act Lim	0	0	1	0 / Disabled	Enables ramping during the over ride limits
2.10.4	Start Function	505	0	1	0 / Ramping	Start function. 0 = Ramp, 1 = Flying start
2.10.5	Stop Funct	0	0	3	2 / Ramp+REC coast	Stop function, 0=coasting, 1=framp
2.10.6	Brake Chopper	0	0	8	2 / B(Rdy)T(N o)	Brake Chopper Control Mode//0 = Brake NO, Test NO, 1 = Brake EXTERNAL, Test NO,//2 = Brake YES(Ready), Test NO, 3 = Brake YES(Run), Test NO,//4 = Brake YES(Ready), Test YES(Ready), 5 = Brake YES(Run), Test YES(Ready),//6 = Brake YES(Run), Test YES(R
2.10.7	Overvolt Contr	607	0	2	0 / Off	[W] Over voltage controller oper. Mode 0=disabled,1=no ramping, 2 = ramping/. Init := 1
2.10.8	UV Contrl	608	0	1	0 / Disabled	[W] Enables under voltage controller, 0= disabled, 1= enabled. Init := 1
2.10.9	Mtr I Lim En	1244	0	1	1 / Disabled	Enables motor side over current control, 0= disabled, 1= enabled
2.10.10	Gen I Lim En	1245	0	1	1 / Disabled	Enables generator side over current control, 0= disabled, 1= enabled
2.10.11	Param Set En	0	0	1	0 / Disabled	Enables the two saved parameter set option.
2.10.12	SC Trq Chain Sel	1246	0	4	2 / Trq Ref	Control word for torque in speed control mode, bits B0 ... B7 //B0=TorqueLim, 0=not in use, 1= TorqueReferenceActual  is used as an additional torque limit//B1=TorqueAdd, 0=not in use, 1=TorqueReferenceActual is added to speed control output//B2=Posi
2.10.13	Torq Ref Select	1248	0	1	1 / En Trq Ref	Selector for torque reference//0 = not in use//1 = TorqueReference//2 = ExtTorqueReference

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.10.14	Trq Spd Lim Mode	0	0	5	0 / Max Min	Speed Limiter operation mode for torque control//0: NegFreqMax ... PosFreqMax//1: - FreqRampOut  ... + FreqRampOut //2: NegFreqMax ... FreqRampOut (MIN)//3: FreqRampOut ... PosFreqMax (MAX)//4: FreqRampOut +-WindowPos/NegWidth//5: 0..FreqRampOut (pos or neg)
2.10.15	TC Spd Lim Sel	0	0	255	0	Options for speed limit in torque control mode, bits B0 ... B7 //B0=Update Ramp Generator when MotorControlMode changes from TC (4) to SC (3)//B1=SmartRampDown, When speed limit goes down it rapidly goes to actual value//and then goes to a lower value
2.10.16	Cl Ovr Vlt En	0	0	1	0 / Disabled	Enable CL OverVoltage Controller
2.10.17	Motion	0	0	1	0 / Travel	Enables hoist for wizard
2.10.18	Ref Mode	0	0	4	0 / 3 Step	Section reference type for wizard
2.10.19	Dis MSpd Tim	0	0	1	0 / Enabled	When enabled allows full time micro speed. When Disabled the micro speed is only allowed for a time period.
2.11	L2 I/O					Menu Name
2.11.1	Digital Inputs					Menu Name
2.11.1.1	DIN7 Slot ID	0	0.0	CrossCon_Ma x	4.0	Configure to the the desired I/O slot and position for the seventh digital input. Default to zero.
2.11.1.2	DIN8 Slot ID	0	0.0	CrossCon_Ma x	4.1	Configure to the the desired I/O slot and position for the eighth digital input. Default to zero.
2.11.1.3	DIN9 Slot ID	0	0.0	CrossCon_Ma x	4.2	Configure to the the desired I/O slot and position for the ninth digital input. Default to zero.
2.11.1.4	DIN10 Slot ID	0	0.0	CrossCon_Ma x	4.3	Configure to the the desired I/O slot and position for the tenth digital input. Default to zero.
2.11.1.5	DIN11 Slot ID	0	0.0	CrossCon_Ma x	4.4	Configure to the the desired I/O slot and position for the eleventh digital input. Default to zero.
2.11.1.6	DIN12 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the twelfth digital input. Default to zero.
2.11.1.7	DIN13 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the thirteenth digital input. Default to zero.
2.11.1.8	DIN14 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the fourteenth digital input. Default to zero.
2.11.1.9	DIN15 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the fifteenth digital input. Default to zero.
2.11.2	Digital Outputs					Menu Name
2.11.2.1	DOUT1 ID	0	0	2000	1002	First digital output configuration point. Default to Drive fault
2.11.2.2	DOUT1 Inv	0	0	1	0 / No	Inverts the first digital output when enabled.
2.11.2.3	DOUT2 ID	0	0	2000	1144	Second digital output configuration point. Default to Drive Running
2.11.2.4	DOUT2 Inv	0	0	1	0 / No	Inverts the second digital output when enabled.
2.11.2.5	DOUT3 ID	0	0	2000	1116	Third digital output configuration point. Default to At zero speed.
2.11.2.6	DOUT3 Inv	0	0	1	0 / No	Inverts the third digital output when enabled.
2.11.2.7	DOUT4 ID	0	0	2000	1002	Fourth digital output configuration point. Default to zero bit
2.11.2.8	DOUT4 Slot ID	0	0.00	CrossCon_Ma x	0.40	Configure fourth digital output to actual I/O location. Default to no slot. Need additional I/O board.
2.11.2.9	DOUT4 Inv	0	0	1	0 / No	Inverts the fourth digital output when enabled.
2.11.2.10	DOUT5 ID	0	0	2000	1002	Fifth digital output configuration point. Default to zero bit
2.11.2.11	DOUT5 Slot ID	0	0.00	CrossCon_Ma x	0.00	Configure fifth digital output to actual I/O location. Default to no slot. Need additional I/O board.
2.11.2.12	DOUT5 Inv	0	0	1	0 / No	Inverts the fifth digital output when enabled.
2.11.2.13	DOUT6 ID	0	0	2000	1002	Sixth digital output configuration point. Default to zero bit
2.11.2.14	DOUT6 Slot ID	0	0.00	CrossCon_Ma x	0.00	Configure sixth digital output to actual I/O location. Default to no slot. Need additional I/O board.
2.11.2.15	DOUT6 Inv	0	0	1	0 / No	Inverts the sixth digital output when enabled.
2.11.2.16	DO1 Config	0	0	5	3 / Ov Wt Alar	Configuration for first digital output. Default to Over Weight Alarm
2.11.2.17	DO4 Config	0	0	5	4 / Brk Slp Alar	Configuration for fourth digital output. Default to Over Weight Alarm Need option board
2.11.3	Analog Inputs					Menu Name
2.11.3.1	AIN1 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.11.3.2	AIN1 Off	0	-100.00	100.00	0.00	Offset for analog input
2.11.3.3	AIN1 Tc	0	0.00	5.00	0.10	Low pass filter time constant.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.11.3.4	AIN2 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.11.3.5	AIN2 Off	0	-100.00	100.00	0.00	Offset for analog input
2.11.3.6	AIN2 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.11.3.7	AIN3 Slot ID	0	0.000	CrossCon_Ma x	0.000	Configure to the desired I/O slot and position for the third analog input. Default to 0. Need additional option boards.
2.11.3.8	AIN3 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.11.3.9	AIN3 Off	0	-100.00	100.00	0.00	Offset for analog input
2.11.3.10	AIN3 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.11.3.11	AIN4 Slot ID	0	0.000	CrossCon_Ma x	0.000	Configure to the the desired I/O slot and position for the fourth analog input. Default to 0. Need additional option boards.
2.11.3.12	AIN4 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.11.3.13	AIN4 Off	0	-100.00	100.00	0.00	Offset for analog input
2.11.3.14	AIN4 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.11.4	Analog Outputs					Menu Name
2.11.4.1	AOUT1 ID	0	0	2000	3	Select value for first analog output. Default to MotorCurrent
2.11.4.2	AOUT1 Zero	0	-327.67	327.67	0.00	Offset for the first analog output.
2.11.4.3	AOUT1 Cal	0	-327.67	327.67	1.00	Multiply for first analog output. 100 equals 1.00
2.11.4.4	AOUT1 TC	0	0.00	5.00	0.10	Filter time constant for the first analog out. 100 equals one second.
2.11.4.5	AOUT2 ID	0	0	2000	2	Select value for second analog output. Default to MotorSpeed
2.11.4.6	AOUT2 Zero	0	-327.67	327.67	0.00	Offset for the second analog output.
2.11.4.7	AOUT2 Cal	0	-327.67	327.67	1.00	Multiply for second analog output. 100 equals 1.00
2.11.4.8	AOUT2 TC	0	0.00	5.00	0.10	Filter time constant for the second analog out. 100 equals one second.
2.11.4.9	AOUT2 Slot ID	0	0	CrossCon_Ma x	11	Selects which slot and address the second analog out goes to. Default to 0. Need additional option boards.
2.11.4.10	AOut2 Config	0	0	4	0 / Mtr Current	Configures the analog output during startup wizard
2.11.5	Encoders					Menu Name
2.11.5.1	Enc1 Slot ID	0	0.000	CrossCon_Ma x	0.030	First encoder slot ID. Default to not present.
2.11.5.2	Enc1 Mlt	0	0.000	32.767	1.000	First encoder scaling multiply value. Used with Enc1_Div
2.11.5.3	Enc1 Div	0	0	32767	1000	First encoder scaling divide value. Used with Enc1_Mlt
2.11.5.4	Enc1 Tc	0	0.00	10.00	0.01	First encoder low pass filter time constant. Default to 10 ms.
2.11.5.5	Counter1 Dec	1294	1	10000	1	Divide number for the first counter scaling. Should be power of tens.
2.11.5.6	Counter1 Mult	1295	0	30000	1	Gain factor for first counter. Used with Counter1 Dec .
2.11.5.7	Counter1 Hld	0	0	2000	1002	Holds the first counter when high
2.11.5.8	Counter1 Res	0	0	2000	1002	Resets the first counter when high
2.11.5.9	Counter1	0	0	1	0 / Disabled	Enables the first footage counter
2.11.5.10	Encoder1FiltTime	618	0.0	100.0	0.0	Filter time constant for speed measurement.
2.12	L2 Tables					Menu Name
2.12.1	Table0					Menu Name
2.12.1.1	T0_X0	1700	-327.67	327.67	0.00	Table 0 - X0 - Value. See table block descr for details.
2.12.1.2	T0_X1	1701	-327.67	327.67	20.00	Table 0 - X1 - Value. See table block descr for details.
2.12.1.3	T0_X2	1702	-327.67	327.67	40.00	Table 0 - X2 - Value. See table block descr for details.
2.12.1.4	T0_X3	1703	-327.67	327.67	60.00	Table 0 - X3 - Value. See table block descr for details.
2.12.1.5	T0_X4	1704	-327.67	327.67	80.00	Table 0 - X4 - Value. See table block descr for details.
2.12.1.6	T0_X5	1705	-327.67	327.67	100.00	Table 0 - X5 - Value. See table block descr for details.
2.12.1.7	T0_Y0	1716	-327.67	327.67	0.00	Table 0 - Y0 - Value. See table block descr for details.
2.12.1.8	T0_Y1	1717	-327.67	327.67	20.00	Table 0 - Y1 - Value. See table block descr for details.
2.12.1.9	T0_Y2	1718	-327.67	327.67	40.00	Table 0 - Y2 - Value. See table block descr for details.
2.12.1.10	T0_Y3	1719	-327.67	327.67	60.00	Table 0 - Y3 - Value. See table block descr for details.
2.12.1.11	T0_Y4	1720	-327.67	327.67	80.00	Table 0 - Y4 - Value. See table block descr for details.
2.12.1.12	T0_Y5	1721	-327.67	327.67	100.00	Table 0 - Y5 - Value. See table block descr for details.
2.13	Identification					Menu Name
2.13.1	Flux Curve a	1355	0.0	250.0	10.0	Flux linearisation point. Init := 100
2.13.2	Flux Curve b	1356	0.0	250.0	20.0	Flux linearisation point. Init := 200
2.13.3	Flux Curve c	1357	0.0	250.0	30.0	Flux linearisation point. Init := 300
2.13.4	Flux Curve d	1358	0.0	250.0	40.0	Flux linearisation point. Init := 400

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.13.5	Flux Curve e	1359	0.0	250.0	50.0	Flux linearisation point. Init := 500
2.13.6	Flux Curve f	1360	0.0	250.0	60.0	Flux linearisation point. Init := 600
2.13.7	Flux Curve g	1361	0.0	250.0	70.0	Flux linearisation point. Init := 700
2.13.8	Flux Curve h	1362	0.0	250.0	80.0	Flux linearisation point. Init := 800
2.13.9	Flux Curve i	1363	0.0	250.0	90.0	Flux linearisation point. Init := 900
2.13.10	Flux Curve j	1364	0.0	250.0	100.0	Flux linearisation point. Init := 1000
2.13.11	Flux Curve k	1365	0.0	250.0	110.0	Flux linearisation point. Init := 1100
2.13.12	Flux Curve l	1366	0.0	250.0	120.0	Flux linearisation point. Init := 1200
2.13.13	Flux Curve m	1367	0.0	250.0	130.0	Flux linearisation point. Init := 1300
2.13.14	Flux Curve n	1368	0.0	250.0	140.0	Flux linearisation point. Init := 1400
2.13.15	Flux Curve o	1369	0.0	250.0	150.0	Flux linearisation point. Init := 1500
2.13.16	Mk Flux Time	660	0	60000	200	[W] Time for magnetize the motor 1 equals 1 ms. Init := 200
2.13.17	Mk Flux Voltage	661	0	30000	201	[W] Magnetizing voltage. 10000 equals nominal voltage of the motor. Init := 201
2.13.18	Meas Rs V Drop	662	0	30000	0	[W] Measured Voltage drop at stator resistance between two phases with nom current of motor. Unit: 256=10%.
2.13.19	Mk Flux V Hw Dt	663	0	30000	140	[W] Magnetizing voltage with hardware dead time compensation. 10000 equals nominal voltage of the motor. Init := 140
2.13.20	Ir Add 0 Pt V	664	0	30000	0	[W] IrAddVoltage for Zero frequency.
2.13.21	Ir Add Gen Scl	665	0	30000	0	[W] Scaling factor for generator side IR-compensation (0 ... 200%).
2.13.22	Ir Add Mtr Scl	667	0	30000	100	[W] Scaling factor for motor side IR-compensation (0 ... 200%). Init := 100
2.13.23	Pwr IU Offset	668	-32000	32000	10000	[W] offset value of U-phase current measurement. 1000=unit nom.
2.13.24	Pwr IV Offset	669	-32000	32000	0	[W] offset value of V-phase current measurement. 1000=unit nom.
2.13.25	Pwr IW Offset	670	-32000	32000	0	[W] offset value of W-phase current measurement. 1000=unit nom.
2.13.26	Speed Step	1252	-50.0	50.0	0.0	Speed step used for Identification
2.13.27	Torque Step	1253	-300.0	300.0	0.0	Torque step used for Identification
2.14	L2 Motor					Menu Name
2.14.1	Motor Nom Current	113	MotorCurrentMin	MotorCurrentMax	370	[W] Motor nominal current, I[A] = MotorNomCurrent/CurrentScale//Range[1...65535]//if CurrentScale=10 then 100 equals 10.0 A
2.14.2	Motor Nom Voltg	110	180	690	460	[W] Motor nominal voltage in Volts
2.14.3	Motor Nom Freq	111	8.00	320.00	60.00	[W] Motor nominal frequency in Hz
2.14.4	Motor Nom Speed	112	24	20000	1740	[W] Motor nominal speed in rpm
2.14.5	Motor Ctrl Mode	600	0	ControlModeMax	0 / Freq Control	0 = Open Loop Frequency control//1 = Open Loop Speed control//2 = Open Loop Torque control//3 = Closed Loop Speed control (NXP only)//4 = Closed Loop Torque control (NXP only)//5 = Advanced Open Loop Frequency control (NXP only)//6 = Advanced Open Loop Speed control (NXP only)//
2.14.6	Motor Ctrl Mode2	521	0	ControlModeMax	4 / CL TorqCtrl	0 = Open Loop Frequency control//1 = Open Loop Speed control//2 = Open Loop Torque control//3 = Closed Loop Speed control (NXP only)//4 = Closed Loop Torque control (NXP only)//5 = Advanced Open Loop Frequency control (NXP only)//6 = Advanced Open Loop Speed control (NXP only)
2.14.7	MotorType	0	0	1	0 / Induction	0 = Induction motor, 1 = perm magnet//1 = Permanent magnet synchronous motor
2.14.8	DC-Brake Current	0	MotorCurrentMin	MotorCurrentMax	370	[W] Dc brake current, I[A] = MotorCurrent/CurrentScale//(1...65535) //if CurrentScale=10 then 100 equals 10.0 A. Init := 100
2.14.9	Stop DC-BrakeFr	515	0.10	10.00	1.50	[W] Dc-brake is allowed under this frequency limit, If FreqScale=100 then 5000 equals 50.00 Hz.
2.14.10	FluxBrakeCurrent	519	MotorCurrentMin	UnitVTCcurrent	370	[W] Flux brake current[A]=FluxBrakeCurrent/CurrentScale, if CurrentScale=10 then 100 equals 10.0 A Default=MotorNomCurrent.
2.14.11	Voltage at FWP	603	10.00	200.00	100.00	[W] Motor voltage (%*NotorNomVoltage) at field weakening point//(1000...10500) equals (10.0 ...105.00) % * MotorNomVoltage
2.14.12	U/f Mid Freq	604	0.00	FieldWeakeningPoint	3.00	[W] Programmable U/F curve middle point, f[Hz] = UFMidPoint/FreqScale//Range[0...FieldWeakeningPoint]//If FreqScale=100 then 5000 equals 50.00 Hz
2.14.13	U/f Mid Voltg	605	0.00	100.00	5.00	[W] Motor voltage (%*MotorNomVoltage) at programmable U/F curve middle point//(1000...10500) equals (10.0 ...105.00) % * MotorNomVoltage
2.14.14	Zero Freq Voltg	606	0.00	40.00	1.50	[W] Motor voltage ( %*MotorNomVoltage) at programmable U/F curve zero point//(1000...10500) equals (10.0 ...105.00) % * MotorNomVoltage

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.14.15	Switching Freq	601	1.0	SwitchingFreq Max	10.0	[W] Switching frequency in 0.1 kHz, Range[1...400]
2.14.16	MagnCurrent	612	0	10000	0	Rated magnetizing current for the motor. It is used to adjust the motor voltage in no-load condition.
2.14.17	Slip Adjust	619	0	500	100	The motor name plate speed is used to calculate nominal slip. This value should be used to adjust motor voltage when loaded. Reducing the slip adjust value increases the motor voltage when loaded.
2.14.18	Stop St Magn I	0	0.0	100.0	50.0	Stop state magnetisation (0...1000) = 0 ... 100% of nominal magnetising current
2.14.19	Stop St Magn Tim	0	0	32000	0	Maximum time for stop state magnetisation in s, (0...32000), 0=not in use, negative=infinite
2.14.20	Startup Trq Sel	621	0	3	2 / Torque Ref	Startup torque is used to reduce erratic motion after start. Torque Memory is used in crane applications. Startup Torque FWD/REV can be used in other applications to help speed controller./0 = Not Used//1 = TorqMemory//2 = Torque Ref//3 = Torq.Fwd/Rev//
2.14.21	StartupTorq FWD	633	-300.0	300.0	0.0	Startup Torque for forward direction if selected with StartUp Torq Sel.
2.14.22	StartupTorq REV	634	-300.0	300.0	0.0	Startup Torque for reverse direction if selected with StartUp Torq Sel.
2.14.23	DC Time Coast	0	0.000	32.767	0.000	Dc brake time [ms] in coast stop
2.14.24	DC Time Ramp	0	0.000	32.767	0.000	Dc brake time [ms] in ramp stop
2.14.25	Motor Cos Phi	120	0.30	1.00	0.85	:= 85
2.14.26	U/f Ratio Select	108	0	3	2 / Programmable	[W] U/F ratio selection, 0=linear, 1=squared, 2=programmable
2.14.27	U/f Optimization	109	0	1	0 / None	[W] U/F optimization selection, 0=none, 1=automatic torque boost
2.14.28	Flux Brake	520	0	1	0 / Off	[W] 1=flux brakeing is enabled.
2.14.29	Mtr Ctrl Sw	0	0	2000	1111	Selects between different motor control schemes. Default to Zero Bit.
2.14.30	Cl Ovr Vlt Ref	0	100.00	200.00	118.00	CL OverVoltage Controller reference (10000 = 100.00%)
2.14.31	Start DC-BrakeTm	0	0.00	600.00	0.00	Dc brake time [ms] in ramp start
2.15	L2 Comms					Menu Name
2.15.1	Fieldbus					Menu Name
2.15.1.1	FB AOUT1	0	0	2000	1200	Configuration to send to FBProcessDataOUT1
2.15.1.2	FB AOUT2	0	0	2000	1200	Configuration to send to FBProcessDataOUT2
2.15.1.3	FB AOUT3	0	0	2000	1200	Configuration to send to FBProcessDataOUT3
2.15.1.4	FB AOUT4	0	0	2000	1200	Configuration to send to FBProcessDataOUT4
2.15.1.5	FB AOUT5	0	0	2000	1200	Configuration to send to FBProcessDataOUT5
2.15.1.6	FB AOUT6	0	0	2000	1200	Configuration to send to FBProcessDataOUT6
2.15.1.7	FB AOUT7	0	0	2000	1200	Configuration to send to FBProcessDataOUT7
2.15.1.8	FB AOUT8	0	0	2000	1200	Configuration to send to FBProcessDataOUT8
2.15.1.9	FB Bit Cfg Out00	0	0	2000	1002	Bit 00 in FB Gen Sts Word.
2.15.1.10	FB Bit Cfg Out01	0	0	2000	1002	Bit 01 in FB Gen Sts Word.
2.15.1.11	FB Bit Cfg Out02	0	0	2000	1002	Bit 02 in FB Gen Sts Word.
2.15.1.12	FB Bit Cfg Out03	0	0	2000	1002	Bit 03 in FB Gen Sts Word.
2.15.1.13	FB Bit Cfg Out04	0	0	2000	1002	Bit 04 in FB Gen Sts Word.
2.15.1.14	FB Bit Cfg Out05	0	0	2000	1002	Bit 05 in FB Gen Sts Word.
2.15.1.15	FB Bit Cfg Out06	0	0	2000	1002	Bit 06 in FB Gen Sts Word.
2.15.1.16	FB Bit Cfg Out07	0	0	2000	1002	Bit 07 in FB Gen Sts Word.
2.15.2	System Bus					Menu Name
2.15.2.1	SBId	0	0	63	0	SystemBus identification number 0 through 63.
2.15.2.2	SBNextId	0	0	63	1	SystemBus next devices id number 0 - 63.
2.15.2.3	SB Mode	0	0	3	0 / Disabled	System bus mode. 0 = Disabled, 1= Master, 2 = Slave, 3 = Both ( Not supported yet )
2.15.2.4	SB Out Int1	0	0	2000	1200	System Bus first configurable output to the slaves.
2.15.2.5	SB Out Int2	0	0	2000	1200	System Bus second configurable output to the slaves.
2.15.2.6	SB Bit Out1	0	0	2000	1002	If drive is a system bus master this is the first configurable bit output to slave sections.
2.15.2.7	SB Bit Out2	0	0	2000	1002	If drive is a system bus master this is the second configurable bit output to slave sections.
2.15.2.8	SB Bit Out3	0	0	2000	1002	If drive is a system bus master this is the third configurable bit output to slave sections.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.15.2.9	SB Bit Out4	0	0	2000	1002	If drive is a system bus master this is the fourth configurable bit output to slave sections.
2.15.2.10	SB Comm Flt Resp	0	0	3	3 / Fault,Coast	Response to system bus error.
2.15.2.11	SB Comm Flt Tim	0	0.00	10.00	0.20	System bus communication fault timer. Default at 200 ms.
<b>2.16</b>	<b>L2 Constants</b>					<b>Menu Name</b>
2.16.1	One Bit	1001	0	1		Always set TRUE.
2.16.2	Zero Bit	1002	0	0		Always FALSE.
2.16.3	Zero Analog	1200	0	0		Always zero integer.
2.16.4	One Analog	1201	1	1		Always one integer
2.16.5	Int Ten	1202	10	10		Always 10. Used for scaling
2.16.6	Int Hundred	1203	100	100		Always 100 integer. Used for scaling.
2.16.7	Int Thousand	1204	1000	1000		Always 1000. Used for scaling.
<b>3</b>	<b>Keypad Control</b>					<b>Menu Name</b>
3.1	Keypad Spd Dir	123	0	1	0 / Forward	Keypad control direction.
3.3	Keypad Trq Dir	0	0	1	0 / Forward	Keypad control torque direction.
<b>4</b>	<b>Active Faults</b>					<b>Menu Name</b>
<b>5</b>	<b>Fault History</b>					<b>Menu Name</b>
<b>6</b>	<b>System Menu</b>					<b>Menu Name</b>
<b>7</b>	<b>Expander boards</b>					<b>Menu Name</b>
7.1						<b>Menu Name</b>
7.2						<b>Menu Name</b>
7.3						<b>Menu Name</b>
7.4						<b>Menu Name</b>
7.5						<b>Menu Name</b>

## APPENDIX C

### ALPHABETICAL AND DRAWING COORDINATE CROSS-REFERENCE

NAME	ID	MENU	COORDINATES
2nd Accel Rate	1260	2.4.1	A1-E28
2nd Rmp En	0	2.8.27	A1-G26
2nd Decel Rate	1261	2.4.2	A1-F28
3 St Hld	0	2.8.75	A4-K9, A4-L4
A_FB_AIN1	1611	1.9.2.1	A7-S8
A_FB_AIN10	1620	1.9.2.10	A7-R5
A_FB_AIN2	1612	1.9.2.2	A7-S8
A_FB_AIN3	1613	1.9.2.3	A7-R8
A_FB_AIN4	1614	1.9.2.4	A7-R8
A_FB_AIN5	1615	1.9.2.5	A7-R8
A_FB_AIN6	1616	1.9.2.6	A7-P8
A_FB_AIN7	1617	1.9.2.7	A7-S5
A_FB_AIN8	1618	1.9.2.8	A7-S5
A_FB_AIN9	1619	1.9.2.9	A7-R5
Abs Mtr Spd	1501	1.7.1	A2-R15, A8-K26
Abs Per Spd	1512	1.7.10	A1-P9
Abv Base Spd	1129	1.6.14	A2-S8
Abv Brk Slp Spd	1130	1.6.15	A2-P8, A5-M10, A8-K8
Accel Comp	1566	1.7.33	A10-D21
Accel Comp Tc	0	2.4.20	A10-C24
Accel Inp	0	2.9.3	A1-G28
Accel Time 1	103	2.1.7	A1-G28
Accel.Compens.	626	2.5.9	A10-D25
Active Flt Last	37	1.7.32	A8-B26
AI1 Type	0	1.8.9	A3-S25, A3-J18, A3-J18, A3-H18, A3-H18, A4-H23, A4-G26
AI2 Type	0	1.8.10	A3-P25
AI3 Type	0	1.8.11	A3-M25
AI4 Type	0	1.8.12	A3-J25
AIN1	1601	1.4.16	A1-S24, A3-R21
AIN1 Gain	0	2.11.3.1	A3-R24
AIN1 Off	0	2.11.3.2	A3-R24
AIN1 Tc	0	2.11.3.3	A3-P24
AIN2	1602	1.4.17	A1-R24, A3-N21
AIN2 Gain	0	2.11.3.4	A3-N24
AIN2 Off	0	2.11.3.5	A3-N24
AIN2 Tc	0	2.11.3.6	A3-M24
AIN3	1603	1.8.13	A3-L21
AIN3 Gain	0	2.11.3.8	A3-L24
AIN3 Off	0	2.11.3.9	A3-K24
AIN3 Slot ID	0	2.11.3.7	A3-L28
AIN3 Tc	0	2.11.3.10	A3-K24
AIN4	1604	1.8.14	A3-J21
AIN4 Gain	0	2.11.3.12	A3-H24
AIN4 Off	0	2.11.3.13	A3-H24
AIN4 Slot ID	0	2.11.3.11	A3-J28
AIN4 Tc	0	2.11.3.14	A3-H24
Anlg Ref	1520	1.7.9	A1-S20, A8-C14
Anti Sntch Accel	0	2.4.6	A1-F24
Anti Sntch Tim	0	2.4.7	A5-J5
Anti Sntch Trq	1250	2.3.6	A5-H13
AOUT1 Cal	0	2.11.4.3	A3-R8
AOUT1 ID	0	2.11.4.1	A3-S9
AOUT1 TC	0	2.11.4.4	A3-R8
AOUT1 Val	1590	1.4.18	A3-S5

NAME	ID	MENU	COORDINATES
AOUT1 Zero	0	2.11.4.2	A3-S8
AOUT2 Cal	0	2.11.4.7	A3-L7
AOut2 Config	0	2.11.4.10	A3-P9
AOUT2 ID	0	2.11.4.5	A3-M9
AOUT2 Slot ID	0	2.11.4.9	A3-M3
AOUT2 TC	0	2.11.4.8	A3-L7
AOUT2 Val	1591	1.4.19	A3-N3
AOUT2 Zero	0	2.11.4.6	A3-M7
At Zero Spd	1127	1.2.12	A2-N2, A2-E22, A4-M28, A4-R28
At Zero Time	0	2.8.28	A4-M28, A4-R28
Base Spd RPM	0	1.7.36	A2-S11, A11-E16
Blw Brk Spd	1131	1.6.9	A2-R8, A5-P25
Brake Chopper	1509	1.7.19	A11-H17
Brake Chopper	0	2.10.6	A11-H20
Brake Offset	1267	2.1.11	A4-E8, A5-P20
BrakeResistor	1511	1.7.20	A11-G17
Brk Cont FTim	1268	2.2.27	A8-L8
Brk Cont Resp	0	2.2.28	A8-M6
Brk Hld Bit	1133	1.2.8	A5-L24, A5-M16, A5-J27
Brk Hld Spd	1266	2.3.2	A2-R11
Brk Opn Sw	0	2.8.31	A5-F24, A8-L9
Brk Pdl Act	1107	1.6.10	A4-L23, A4-F22, A4-P13, A5-H27, A5-G16, A8-F10
Brk Pdl En	0	2.8.32	A5-G24
Brk Pdl Inp	0	2.8.33	A5-G27
Brk Set Tim	0	2.4.24	A5-S8
Brk Slip Mode	1104	1.6.11	A3-D18, A3-E9, A4-C27, A5-J20, A5-L2
Brk Slp Act	0	2.2.30	A5-N11, A5-P7
Brk Slp Resp	0	2.2.29	A8-K6
Brk Slp Slw	1102	1.6.12	A4-M13, A5-K2
Brk slp Spd	1269	2.3.7	A2-R11
Brk Slp Warn	1105	1.2.10	A5-M2, A5-L13
Cl Ovr Mtr Lim	0	2.6.22	A10-B13
Cl Ovr Vlt En	0	2.10.16	A10-D11
Cl Ovr Vlt Kp	0	2.5.31	A10-B13
Cl Ovr Vlt Ref	0	2.14.30	A10-C14
Cl Ovr Vlt Ti	0	2.5.32	A10-B13
Cntrl Inhib	1099	1.6.1	A4-C2
Coast Stop	0	2.8.4	A4-M25
Com WD	0	2.2.26	A7-C19
Command	1517	1.2.13	A5-G2
Control Place	1505	1.7.8	A1-R13, A1-T4, A2-K19, A2-M19
Counter1	1528	1.8.16	A3-C21
Counter1	0	2.11.5.9	A3-D28
Counter1 Dec	1294	2.11.5.5	A3-C25
Counter1 Hld	0	2.11.5.7	A3-D28
Counter1 Mult	1295	2.11.5.6	A3-C25
Counter1 Res	0	2.11.5.8	A3-D28
Curr Cntrl Ti	0	2.5.14	A11-E27
CurrentControlKp	617	2.5.13	A11-E27
DC Brk Cmd	0	2.8.29	A11-T7
DC Time Coast	0	2.14.23	A11-N8
DC Time Ramp	0	2.14.24	A11-N8
DC-Brake Current	0	2.14.8	A11-S10
DCVoltage	7	1.3.2	A9-K14, A10-B13
Decel Time	0	2.9.4	A1-F28
Decel Time 1	104	2.1.8	A1-F28
Dig B Sel	0	2.8.10	A1-N23
Digital Sel	0	2.8.7	A1-R15, A4-H25
DIN 1	1011	1.4.1	A1-R28, A3-S16, A4-K28, A4-H27, A5-E13, A8-E9, A8-D14
DIN 10	1030	1.4.10	A3-L15
DIN 11	1031	1.4.11	A3-K15
DIN 12	1032	1.4.12	A3-J15
DIN 13	1033	1.4.13	A3-J15
DIN 14	1034	1.4.14	A3-H15
DIN 15	1035	1.4.15	A3-H15
DIN 2	1012	1.4.2	A1-P28, A3-R16, A4-G28, A5-E10, A8-E9

NAME	ID	MENU	COORDINATES
DIN 3	1013	1.4.3	A3-R16
DIN 4	1014	1.4.4	A3-P16, A4-P11, A4-N11
DIN 5	1015	1.4.5	A3-P16
DIN 6	1016	1.4.6	A3-N16
DIN 7	1017	1.4.7	A3-N15
DIN 8	1018	1.4.8	A3-M15
DIN 9	1029	1.4.9	A3-L15
DIN10 Slot ID	0	2.11.1.4	A3-L18
DIN11 Slot ID	0	2.11.1.5	A3-K18
DIN12 Slot ID	0	2.11.1.6	A3-K18
DIN13 Slot ID	0	2.11.1.7	A3-J18
DIN14 Slot ID	0	2.11.1.8	A3-H18
DIN15 Slot ID	0	2.11.1.9	A3-H18
DIN7 Slot ID	0	2.11.1.1	A3-N18
DIN8 Slot ID	0	2.11.1.2	A3-M18
DIN9 Slot ID	0	2.11.1.3	A3-L18
Dir Flt Resp	0	2.2.39	A8-F6
Dis MSpd Tim	0	2.10.19	A5-F12
Disable Ramp	0	2.8.35	A1-J14
DO1 Config	0	2.11.2.16	A3-F18
DO4 Config	0	2.11.2.17	A3-G9
DOUT1 ID	0	2.11.2.1	A3-D18
DOUT1 Inv	0	2.11.2.2	A3-E14
DOUT2 ID	0	2.11.2.3	A3-D15
DOUT2 Inv	0	2.11.2.4	A3-D14
DOUT3 ID	0	2.11.2.5	A3-B15
DOUT3 Inv	0	2.11.2.6	A3-C14
DOUT4 ID	0	2.11.2.7	A3-E9
DOUT4 Inv	0	2.11.2.9	A3-F6
DOUT4 Slot ID	0	2.11.2.8	A3-E3
DOUT5 ID	0	2.11.2.10	A3-E6
DOUT5 Inv	0	2.11.2.12	A3-E6
DOUT5 Slot ID	0	2.11.2.11	A3-D3
DOUT6 ID	0	2.11.2.13	A3-C6
DOUT6 Inv	0	2.11.2.15	A3-D6
DOUT6 Slot ID	0	2.11.2.14	A3-C3
Earth Fault	703	2.2.12	A8-R20
En Anti Snatch	0	2.8.34	A5-J7
En Ext Spd	0	2.8.26	A1-N14
En Spd 1A	0	2.8.11	A1-P27
En Spd 1B	0	2.8.16	A1-L27
En Spd 2A	0	2.8.12	A1-N27
En Spd 2B	0	2.8.17	A1-L27
En Spd 3A	0	2.8.13	A1-N27
En Spd 3B	0	2.8.18	A1-K27
En Spd 4A	0	2.8.14	A1-M27
En Spd 4B	0	2.8.19	A1-K27
En Spd 5A	0	2.8.15	A1-M27
En Spd 5B	0	2.8.20	A1-K27
Enc1 Div	0	2.11.5.3	A3-E24
Enc1 Mlt	0	2.11.5.2	A3-E24
Enc1 Slot ID	0	2.11.5.1	A3-F27
Enc1 Tc	0	2.11.5.4	A3-D24
Enc1_Out	1609	1.8.15	A3-E21
Encoder PPR	0	2.7.11	A11-D10
Encoder1FiltTime	618	2.11.5.10	A10-M22
EndSt Fwd	0	2.8.5	A4-T27, A4-F25, A4-C25
EndSt Maint	0	2.10.1	A4-N27, A4-P16, A4-F25, A4-D25
EndSt Perm	1135	1.2.6	A4-T16, A4-R25, A4-M18
EndSt Rev	0	2.8.6	A4-S27, A4-E25, A4-B25
Err Lim 1	1240	2.2.32	A8-J14
Err Lim 2	1241	2.2.33	A8-G14
ESR Cur Lim	1262	2.6.2	A2-B24
Ext Fault Inp	0	2.2.6	A8-E22
Fast Stop	0	2.8.3	A1-G19, A4-M21
Fast Stop Tim	503	2.4.4	A1-E21

NAME	ID	MENU	COORDINATES
Fault Reset	0	2.2.1	A8-S21
FB AOUT1	0	2.15.1.1	A7-K7
FB AOUT2	0	2.15.1.2	A7-J7
FB AOUT3	0	2.15.1.3	A7-J7
FB AOUT4	0	2.15.1.4	A7-H7
FB AOUT5	0	2.15.1.5	A7-H7
FB AOUT6	0	2.15.1.6	A7-G7
FB AOUT7	0	2.15.1.7	A7-G7
FB AOUT8	0	2.15.1.8	A7-F7
FB Bit Cfg Out00	0	2.15.1.9	A7-T17
FB Bit Cfg Out01	0	2.15.1.10	A7-S17
FB Bit Cfg Out02	0	2.15.1.11	A7-S17
FB Bit Cfg Out03	0	2.15.1.12	A7-R17
FB Bit Cfg Out04	0	2.15.1.13	A7-P17
FB Bit Cfg Out05	0	2.15.1.14	A7-P17
FB Bit Cfg Out06	0	2.15.1.15	A7-N17
FB Bit Cfg Out07	0	2.15.1.16	A7-N17
FB Data Out 1	1622	1.9.3.1	A7-K4
FB Data Out 2	1623	1.9.3.2	A7-J4
FB Data Out 3	1624	1.9.3.3	A7-J4
FB Data Out 4	1625	1.9.3.4	A7-H4
FB Data Out 5	1626	1.9.3.5	A7-H4
FB Data Out 6	1627	1.9.3.6	A7-G4
FB Data Out 7	1628	1.9.3.7	A7-G4
FB Data Out 8	1629	1.9.3.8	A7-F4
FB DIN 1	1043	1.9.1.4	A7-R24
FB DIN 2	1044	1.9.1.5	A7-R24
FB DIN 3	1045	1.9.1.6	A7-P24
FB DIN 4	1046	1.9.1.7	A7-P24
FB DIN 5	1047	1.9.1.8	A7-P24
FB Dir	1041	1.9.1.2	A7-S24
FB Fix Cntrl Wrd	1621	1.9.1.9	A7-S27
FB Flt Res	1042	1.9.1.3	A7-R24
FB Gen Sts Word	1631	1.9.3.9	A7-R14
FB Run	1040	1.9.1.1	A7-S24
FB Spd Ref	1632	1.9.2.11	A7-R4
FBCComm.FaultResp	733	2.2.23	A8-E20
Field WeakingPnt	602	2.3.4	A10-H27, A11-M23
Fil Mtr Trq	1502	1.7.3	A5-S25, A5-J13, A8-L25, A8-B11, A11-C13
Final Freq Ref	1540	1.7.15	A1-H3, A9-M24, A10-P24
Final Iq Trq Ref	1539	1.7.35	A2-K4, A10-B23, A10-R7
Final Trq Ref	1542	1.7.6	A2-J3, A9-G25, A10-G19
Flux Brake	520	2.14.28	A11-L8
Flux Curve a	1355	2.13.1	A11-R17
Flux Curve b	1356	2.13.2	A11-R17
Flux Curve c	1357	2.13.3	A11-P17
Flux Curve d	1358	2.13.4	A11-P17
Flux Curve e	1359	2.13.5	A11-P17
Flux Curve f	1360	2.13.6	A11-N17
Flux Curve g	1361	2.13.7	A11-N17
Flux Curve h	1362	2.13.8	A11-N17
Flux Curve i	1363	2.13.9	A11-M17
Flux Curve j	1364	2.13.10	A11-M17
Flux Curve k	1365	2.13.11	A11-M17
Flux Curve l	1366	2.13.12	A11-L17
Flux Curve m	1367	2.13.13	A11-L17
Flux Curve n	1368	2.13.14	A11-K17
Flux Curve o	1369	2.13.15	A11-K17
FluxBrakeCurrent	519	2.14.10	A11-K9
Freq Delta	1508	1.7.17	A10-D24
Freq Error	1519	1.3.7	A8-J14, A8-H14, A10-N18
Freq Max	102	2.6.4	A1-N5, A1-E5, A1-D6, A2-P24, A2-B26, A9-K23, A9-H18, A9-E24
Freq out	1	1.7.16	A7-E6, A9-K21, A10-G27
Freq Ramp Out	1568	1.7.18	A1-H6, A1-G21, A2-N24, A10-D27, A10-S14
Freq Spt	1503	1.7.11	A1-N2, A1-H21
FreqRamp	0	2.7.9	A1-E17

NAME	ID	MENU	COORDINATES
FreqReference	25	1.7.14	A1-H18
Full Load Per	1310	2.1.12	A5-B13
Fwd SD Inp	0	2.8.21	A4-P11
Gen I Lim En	1245	2.10.10	A1-C13
Gen I Lim Ki	0	2.5.23	A1-C11
Gen I Lim Kp	0	2.5.24	A1-C11
Gener Trq Lim	1306	2.6.8	A10-E16
Hi Err Tim	0	2.2.35	A8-G14
In Anti Snatch	1108	1.6.13	A1-G23, A5-J2
Inf Var En	0	2.8.23	A4-L13
Input Ph. Superv	730	2.2.9	A8-P20
Int Hundred	1203	2.16.6	A5-B28
Int Ten	1202	2.16.5	A5-B28
Int Thousand	1204	2.16.7	A5-A28
Ir Add 0 Pt V	664	2.13.20	A9-H14
Ir Add Gen Scl	665	2.13.21	A9-H14
Ir Add Mtr Scl	667	2.13.22	A9-J14
Joyst A Inp	0	2.9.1	A1-S24
Joyst B Inp	0	2.9.2	A1-S24
JoySt B Sel	0	2.8.9	A1-T24
Joyst Flt St	0	2.2.40	A8-C14
Joyst Pol En	0	2.8.8	A4-H23, A4-G26
Joyst Resp	0	2.2.41	A8-D6
Keypad Spd Dir	123	3.1	A1-S5
Keypad Trq Dir	0	3.3	A2-L19
Load Float Time	616	2.1.9	A4-E10, A5-P22
LoadDrooping	620	2.5.12	A9-L28, A10-N27
Low Err Tim	0	2.2.34	A8-H14
LS Scl Div	1281	2.7.2	A1-N9, A2-R27
LS to Freq	1282	2.7.1	A1-N9, A2-R27
MagnCurrent	612	2.14.16	A11-S28
Max ESR Speed	1263	2.6.3	A2-B18
Max RPM	1504	1.7.37	A2-N6, A11-D16
MC AtSpeed	1118	1.2.5	A1-J11, A2-E22, A3-E18, A3-F9, A5-C11
MC Fault	1116	1.2.3	A3-B15, A8-B26
MC Out	1106	1.6.5	A4-R2, A4-P10
MC Ready	1115	1.2.2	A4-M23, A7-L17
MC Reverse	1086	1.2.4	A1-J11
MC Run	1098	1.2.1	A2-D19, A3-F18, A3-F9, A4-R13, A4-L7, A4-C13, A4-E2, A4-D11, A5-R25, A5-K13, A5-J9, A5-D8, A8-N14, A11-R24, A11-R9
MD Bit In1	1050	1.5.9	A7-L24
MD Bit In2	1051	1.5.10	A7-L24
MD Bit In3	1052	1.5.11	A7-L24
MD Bit In4	1053	1.5.12	A7-K24
MD Drive OK	1058	1.5.13	A7-M24
MD Run Enable	1060	1.5.14	A7-M24
MD WD OK	1172	1.5.2	A7-F18
Meas Rs V Drop	662	2.13.18	A9-E15
Min Frequency	101	2.6.5	A1-N5
Mk Flux Time	660	2.13.16	A11-R14
Mk Flux V Hw Dt	663	2.13.19	A11-P14
Mk Flux Voltage	661	2.13.17	A11-P14
Mot Therm 0 Spd	706	2.2.15	A8-J24
MotAmbTempFactor	705	2.2.14	A8-J24
Motion	0	2.10.17	A11-D10
Motor Cos Phi	120	2.14.25	A11-D25
Motor Ctrl Mode	600	2.14.5	
Motor Ctrl Mode2	521	2.14.6	A9-N18, A10-P14
Motor Current	3	1.3.3	A2-D27, A3-S9, A8-H24, A11-C16
Motor Duty Cycle	708	2.2.17	A8-H24
Motor Nom Currnt	113	2.14.1	A1-C17, A2-D26, A11-R27, A11-D20
Motor Nom Freq	111	2.14.3	A2-C26, A9-K28, A10-N27, A11-D20
Motor Nom Speed	112	2.14.4	A11-C20
Motor Nom Voltg	110	2.14.2	A11-D20
Motor Power	5	1.7.4	A3-N9, A11-D16
Motor Speed	2	1.3.1	A3-E25, A3-M9, A3-N9, A7-F7, A8-K28, A8-G24, A8-E27

NAME	ID	MENU	COORDINATES
Motor Torque	4	1.3.4	A3-M9, A8-G24, A9-L28, A9-J21, A9-K14, A9-F25, A10-H22, A11-C16
Motor Voltage	6	1.3.5	A9-J21, A11-D16
MotorCurLimit	1526	1.3.8	A1-C14
Motoring Trq Lim	1305	2.6.7	A10-F16
MotorType	0	2.14.7	A11-D25, A11-P14
Mspd Flt Resp	0	2.2.7	A8-J6
MSpd Inp	0	2.8.76	A1-R23, A4-K27, A5-F10, A8-D14
MSpd OK	1139	1.6.34	A4-K25, A4-H19, A5-D1, A5-D10, A8-H8
Mspd Stpt	1278	2.7.10	A1-P23
Mspd Tim	1279	2.4.25	A5-F7
Mtr Ctrl Sw	0	2.14.29	A9-P18, A10-R13
Mtr Cur Lim Scl	0	2.9.6	A1-D17
Mtr Cur Limit	1291	2.6.6	A1-D17
Mtr Cur TC	0	2.4.10	A2-D27
Mtr Fil IA Fil	1524	1.7.2	A2-E23, A3-N9, A5-B13
Mtr I Lim En	1244	2.10.9	A1-D14
Mtr I Lim Ki	0	2.5.21	A1-D11
Mtr I Lim Kp	0	2.5.22	A1-D11
Mtr Therm TC	707	2.2.16	A8-J24
Mtr Trq TC	0	2.4.9	A11-B16
MtrCalcTemp	9	1.7.7	A8-H20
MtrRegStatus	1525	1.7.22	A1-H6
Neg Freq Limit	1301	2.6.19	A1-C5
Not DIN 1	1021	1.8.1	A3-S14
Not DIN 2	1022	1.8.2	A3-R14
Not DIN 3	1023	1.8.3	A3-R14
Not DIN 4	1024	1.8.4	A3-P14
Not DIN 5	1025	1.8.5	A3-P14
Not DIN 6	1026	1.8.6	A3-N14
Not DIN 7	1027	1.8.7	A3-N13
Not DIN 8	1028	1.8.8	A3-M13
One Analog	1201	2.16.4	A5-B28
One Bit	1001	2.16.1	A1-G19, A1-R15, A2-H16, A4-M25, A4-M21, A4-T27, A4-S27, A4-H25, A4-F25, A4-E25, A4-C25, A4-B25, A4-K9, A4-L4, A5-C24, A5-R27, A5-S27, A5-F21, A5-E21, A6-S6, A6-R6, A6-P6, A6-S6, A8-J10, A8-M14
OV Reg Kd	0	2.5.17	A1-F12
OV Reg Ki	0	2.5.16	A1-F12
OV Reg Kp	0	2.5.15	A1-G12
Ov Wt Alarm	1140	1.6.33	A3-D18, A3-E9, A5-C2, A5-B11
Overload Counter	1514	1.3.9	A5-B4
Overspeed Resp	0	2.2.8	A8-P5
Overtvolt Contr	607	2.10.7	A1-G12
Ovr Spd Stp	1258	2.6.11	A2-P5
Param Set En	0	2.10.11	A11-H7
Param Set Sel	0	2.8.39	A11-H7
Password	0	2.1.15	A11-D5
PC Control	1121	1.6.8	A4-S10, A4-G12, A4-G10
Phase Supv F	702	2.2.11	A8-N20
Pos Freq Limit	1300	2.6.18	A1-D5
ProcessPITrimRef	1521	1.7.21	A2-S21, A9-N23, A10-R23
Pwr IU Offset	668	2.13.23	A11-H10
Pwr IV Offset	669	2.13.24	A11-G10
Pwr IW Offset	670	2.13.25	A11-G10
Ramp Hold	1143	1.6.7	A1-H20, A4-L2, A4-J9
Ref Mode	0	2.10.18	A11-C10
Rel Brakes	1144	1.2.9	A3-D15, A5-H25, A5-K16, A5-S13, A5-F27, A8-L9, A8-F10
Rel Ramp	1174	1.6.38	A1-R6, A5-F16, A8-B11
Rel Rmp By Tim	0	2.8.25	A5-F21, A5-E21
Rel Rmp Dly	1288	2.1.10	A5-E24
Rev SD Inp	0	2.8.22	A4-N11
Reverse	1128	1.6.6	A1-S2, A3-E18, A3-F9
Rmp Act Lim	0	2.10.3	A1-J10
Rotor Flux	1541	1.7.5	A11-S14
Run Cmd Inp	1110	1.6.41	A1-P27, A1-R25

NAME	ID	MENU	COORDINATES
Run Enable	1096	1.6.37	A4-S2, A4-H13, A7-L17
Run Fwd Cmd	1147	1.6.3	A4-K16, A4-F28, A4-N13, A5-J11, A5-H11, A5-C8
Run Fwd Inp	0	2.8.1	A1-R28, A4-K28, A4-H27, A5-E13, A8-E9, A8-D14
Run Off Resp	0	2.2.37	A8-G6
Run Off Tim	0	2.2.38	A8-F8
Run OK	1091	1.6.2	A4-L28, A4-L20, A4-M16, A4-S7, A4-P11, A5-N26, A5-J24
Run Rev Cmd	1148	1.6.4	A1-S5, A4-K23, A4-H16, A4-D27, A4-N13, A8-C14, A8-C11
Run Rev Inp	0	2.8.2	A1-R28, A4-H28, A5-E10, A8-E9
Run time Hrs	1513	1.3.10	A4-D4
RunRequest	1090	1.6.35	A2-L15, A4-H2, A4-E13, A5-M27, A5-P27, A5-S23, A5-J27, A8-K8, A8-G10
SB Bit Out1	0	2.15.2.6	A7-K17
SB Bit Out2	0	2.15.2.7	A7-K17
SB Bit Out3	0	2.15.2.8	A7-J17
SB Bit Out4	0	2.15.2.9	A7-J17
SB Comm Flt	1173	1.5.16	A7-E13, A8-N8
SB Comm Flt Resp	0	2.15.2.10	A8-P6
SB Comm Flt Tim	0	2.15.2.11	A7-D16
SB Comm Lost	1095	1.5.15	A7-E18
SB In Cntl Word	1530	1.5.3	A7-M27
SB In Freq Ref	1531	1.5.4	A7-N5
SB In Int1	1532	1.5.5	A7-N5
SB In Int2	1533	1.5.6	A7-M5
SB In Trq Ref	1535	1.5.7	A7-N5
SB Mode	0	2.15.2.3	A7-E17, A7-C28
SB Out Cntl Word	1534	1.5.8	A7-K14
SB Out Int1	0	2.15.2.4	A7-D6
SB Out Int2	0	2.15.2.5	A7-C6
SB WD Pulse	0	1.5.1	A7-K17
SBId	0	2.15.2.1	A7-D28
SBNextId	0	2.15.2.2	A7-C28
SC Trq Chain Sel	1246	2.10.12	A10-K16, A10-C23
SD Mlt Stpt	1289	2.7.3	A1-P20
SD Spd Lim	1311	2.6.1	A1-L13
SD Speed	1312	2.1.6	A1-L19
Self Tune Motor	631	2.1.14	A11-H13
Setup Wizard	0	2.1.13	A11-D10
Skip S Rev	0	2.10.2	A1-J14
Slack Up	0	2.9.5	A2-S27
Slck Resp	0	2.2.43	A8-C6
Slck Rope Tim	0	2.2.42	A8-B8
Slck Rope Trq	0	2.2.44	A8-B11
Slip Adjust	619	2.14.17	A11-R14
Slow Down Cmd	1149	1.2.7	A1-R20, A1-M19, A1-M12, A4-P2, A4-L11
Smooth Ratio	500	2.4.3	A1-F21
Smooth Ratio 2	501	2.4.5	A1-D21
Sp ABS In	0	2.9.15	A6-G27
Sp ABS Out	1558	1.7.27	A6-G24
Sp Add Val	1327	2.7.6	A6-M27, A6-L27
Sp Add1 In1	0	2.9.10	A6-M27
Sp Add1 In2	0	2.9.11	A6-L27
Sp Add1 Out	1555	1.7.24	A6-M24
Sp And1 In1	0	2.8.56	A6-F6
Sp And1 In2	0	2.8.57	A6-F6
Sp And1 NIn3	0	2.8.58	A6-E6
Sp And1 Out	1164	1.6.27	A6-F3
Sp And2 In1	0	2.8.59	A6-E6
Sp And2 In2	0	2.8.60	A6-D6
Sp And2 NIn3	0	2.8.61	A6-D6
Sp And2 Out	1165	1.6.28	A6-D3
Sp And3 In1	0	2.8.62	A6-C6
Sp And3 In2	0	2.8.63	A6-C6
Sp And3 NIn3	0	2.8.64	A6-B6
Sp And3 Out	1166	1.6.29	A6-C3
Sp Cmp1 Eq	1152	1.6.18	A6-J10
Sp Cmp1 In	0	2.9.23	A6-J14

NAME	ID	MENU	COORDINATES
Sp Cmp1 Out	1153	1.6.19	A6-J10
Sp Cmp1 Thres	0	2.9.24	A6-H14
Sp Cmp1_Hyst	1345	2.3.17	A6-H13
Sp Cmp1_Stpt	1346	2.3.18	A6-J14, A6-H14
Sp Dly1 In	0	2.8.45	A6-F13
Sp Dly1 Out	1156	1.6.20	A6-F11
Sp Dly1 TOFF	1349	2.4.13	A6-E13
Sp Dly1 TON	1350	2.4.14	A6-E13
Sp Dly2 In	0	2.8.46	A6-D13
Sp Dly2 Out	1157	1.6.21	A6-D11
Sp Dly2 TOFF	1351	2.4.15	A6-C13
Sp Dly2 TON	1352	2.4.16	A6-C13
Sp HL High	1341	2.3.13	A6-N14
Sp HL Hyst	1342	2.3.14	A6-L13
Sp HL Inp	0	2.9.21	A6-N14
Sp HL Low	1343	2.3.15	A6-M14
Sp HL Max	1563	1.6.16	A6-N10
Sp HL Min	1564	1.6.17	A6-M10
Sp HL Setpt	0	2.9.22	A6-M13
Sp HL Stpt	1344	2.3.16	A6-L13
Sp Inv1 In	0	2.8.53	A6-N6
Sp Inv1 Out	1161	1.6.24	A6-N4
Sp Inv2 In	0	2.8.54	A6-N6
Sp Inv2 Out	1162	1.6.25	A6-N4
Sp Inv3 In	0	2.8.55	A6-M6
Sp Inv3 Out	1163	1.6.26	A6-M4
Sp LH Decimal	0	2.7.8	A6-L13
Sp Lim Inp	0	2.9.25	A6-M20
Sp Lim Max	1353	2.6.23	A6-M20
Sp Lim Min	1354	2.6.24	A6-L20
Sp Lim Out	1574	1.7.30	A6-M17
Sp LP Fil In	0	2.9.14	A6-J20
Sp LP Fil Out	1557	1.7.26	A6-J17
Sp LP Fil TC	1329	2.4.12	A6-J20
Sp Ltch1 H1	0	2.8.47	A6-S6
Sp Ltch1 H2	0	2.8.48	A6-S6
Sp Ltch1 L	0	2.8.49	A6-T6
Sp Ltch1 Out	1158	1.6.22	A6-S4
Sp Ltch2 H1	0	2.8.50	A6-R6
Sp Ltch2 H2	0	2.8.51	A6-P6
Sp Ltch2 L	0	2.8.52	A6-R6
Sp Ltch2 Out	1159	1.6.23	A6-R4
Sp MD1 Div	0	2.9.8	A6-P27
Sp MD1 Dv	1323	2.7.4	A6-P27
Sp MD1 Mlt	1324	2.7.5	A6-P27
Sp MD1 Mul	0	2.9.9	A6-P27
Sp MD1 Out	1553	1.7.23	A6-R24
Sp MD1 Val	0	2.9.7	A6-R27
Sp Or1 In1	0	2.8.65	A6-L6
Sp Or1 In2	0	2.8.66	A6-L6
Sp Or1 NIn3	0	2.8.67	A6-K6
Sp Or1 Out	1167	1.6.30	A6-L3
Sp Or2 In1	0	2.8.68	A6-K6
Sp Or2 In2	0	2.8.69	A6-J6
Sp Or2 NIn3	0	2.8.70	A6-J6
Sp Or2 Out	1168	1.6.31	A6-J3
Sp Or3 In1	0	2.8.71	A6-H6
Sp Or3 In2	0	2.8.72	A6-H6
Sp Or3 NIn3	0	2.8.73	A6-G6
Sp Or3 Out	1169	1.6.32	A6-H3
Sp Sel1 En1	0	2.8.44	A6-T20
Sp Sel1 In0	0	2.9.19	A6-S20
Sp Sel1 In1	0	2.9.20	A6-R20
Sp Sel1 Out	1561	1.7.29	A6-R17
Sp Sel1 ST0	1337	2.3.11	A6-S20
Sp Sel1 ST1	1338	2.3.12	A6-R20

NAME	ID	MENU	COORDINATES
Sp Sub Val	1328	2.7.7	A6-K27, A6-J27
Sp Sub1 In1	0	2.9.12	A6-K27
Sp Sub1 In2	0	2.9.13	A6-J27
Sp Sub1 Out	1565	1.7.25	A6-K24
Sp Sum1 EnA	0	2.8.41	A6-E20
Sp Sum1 EnB	0	2.8.42	A6-F20
Sp Sum1 EnC	0	2.8.43	A6-F20
Sp Sum1 InA	0	2.9.16	A6-E20
Sp Sum1 InB	0	2.9.17	A6-D20
Sp Sum1 InC	0	2.9.18	A6-D20
Sp Sum1 Out	1559	1.7.28	A6-D17
Sp Sum1 StA	1330	2.3.8	A6-E20
Sp Sum1 StB	1331	2.3.9	A6-D20
Sp Sum1 StC	1332	2.3.10	A6-D20
Sp WPVal ID	0	2.9.27	A6-S10
Sp WPVal Inp	0	2.9.29	A6-S13
Sp WPVal2 ID	0	2.9.28	A6-R10
Sp WPVal2 Inp	0	2.9.30	A6-R13
Spd Cmp Fil TC	0	2.4.17	A2-P15
Spd Cntrl F0	0	2.5.3	A10-H27
Spd Cntrl F1	0	2.5.4	A10-H27
Spd Cntrl Kp F0	0	2.5.5	A10-J27
Spd Cntrl Kp FW	0	2.5.6	A10-K27
Spd Cntrl Kp T0	0	2.5.7	A10-K23
Spd Cntrl T0	0	2.5.8	A10-J22
Spd Cont Ki	638	2.5.28	A9-J18
Spd Cont Kp	637	2.5.27	A9-J18
Spd Decimal	0	2.6.14	A2-N5
Spd Err Bnd Frq	0	2.5.10	A10-M16
Spd Err Fil TC	0	2.4.22	A10-N18
Spd Err LP Freq	0	2.5.11	A10-M18
Spd Err Resp	0	2.2.36	A8-H6
Spd Hyst	0	2.6.13	A2-N5
Spd Slk Up	1273	2.3.1	A2-S27
Spd Up Inp	0	2.8.24	A4-L9, A4-L6
Speed 1	1313	2.1.1	A1-M23
Speed 2	1314	2.1.2	A1-L23
Speed 3	1315	2.1.3	A1-L23
Speed 4	1316	2.1.4	A1-L23
Speed 5	1317	2.1.5	A1-K23
Speed Cntrl Out	1548	1.7.13	A10-N28, A10-N10
Speed Control Kp	613	2.5.1	A10-K26
Speed Control Ti	614	2.5.2	A10-K19
Speed Step	1252	2.13.26	A2-P26
SPI Flt Resp	734	2.2.24	A8-D20
Stall Resp	0	2.2.45	A8-L20
Stall Spd St	1247	2.2.46	A8-L25
Stall Time	0	2.2.47	A8-K23
Stall Trq St	1249	2.2.48	A8-M25
Start DC-BrakeTim	0	2.14.31	A11-P9
Start Function	505	2.10.4	A1-J14
Start Input	1089	1.6.39	A4-M20, A4-F16, A4-P28, A4-S13, A5-S11
Startup Trq Sel	621	2.14.20	A10-J19
StartupTorq FWD	633	2.14.21	A10-G23
StartupTorq REV	634	2.14.22	A10-G23
Stop DC-BrakeFr	515	2.14.9	A11-N8
Stop Funct	0	2.10.5	A1-K14
Stop Slow Inp	1518	1.2.14	A5-F2
Stop St Magn I	0	2.14.18	A11-S24
Stop St Magn Tim	0	2.14.19	A11-P23
Strt 0 Spd Time	615	2.4.23	A1-G17
Switching Freq	601	2.14.15	A11-C20
T0_X0	1700	2.12.1.1	A12-P17
T0_X1	1701	2.12.1.2	A12-N17
T0_X2	1702	2.12.1.3	A12-N17
T0_X3	1703	2.12.1.4	A12-N17

NAME	ID	MENU	COORDINATES
T0_X4	1704	2.12.1.5	A12-M17
T0_X5	1705	2.12.1.6	A12-M17
T0_Y0	1716	2.12.1.7	A12-P15
T0_Y1	1717	2.12.1.8	A12-N15
T0_Y2	1718	2.12.1.9	A12-N15
T0_Y3	1719	2.12.1.10	A12-N15
T0_Y4	1720	2.12.1.11	A12-M15
T0_Y5	1721	2.12.1.12	A12-M15
TC Neg Freq Lim	1516	1.7.39	A2-G20, A10-S14
TC Pos Freq Lim	1515	1.7.38	A2-H20, A10-T14
TC Spd Lim Sel	0	2.10.15	A2-J23
Therm Prot F	704	2.2.13	A8-J20
Thermistor Inp	0	2.8.40	A8-E20
ThermistorF.Resp	732	2.2.22	A8-F20
Torq Ref Select	1248	2.10.13	A2-K11
Torq Speed Limit	644	2.6.17	A2-F27
Torque Reference	18	1.7.31	A2-J11, A7-D6
Torque Step	1253	2.13.27	A2-K9
Trq Cntrl Ki	640	2.5.30	A9-F25
Trq Cntrl Kp	639	2.5.29	A9-F25
Trq Dir	0	2.8.37	A2-L19
Trq Lim FWD	1307	2.6.9	A10-F16
Trq Lim Ki	611	2.5.26	A1-B9
Trq Lim Kp	610	2.5.25	A1-B9
Trq Lim REV	1308	2.6.10	A10-E16
Trq Mode Sw	1111	1.6.40	A9-P18, A10-R13
Trq No Ramp	0	2.8.38	A2-H16
Trq Prv By	0	2.8.30	A5-R27, A5-T27, A8-J10, A8-N14
Trq Prv Cmd	1170	1.2.11	A5-R23, A5-S16, A5-J22, A8-J10, A8-M14
Trq Prv Flt Tim	0	2.4.8	A8-M12
Trq Prv Resp	0	2.2.31	A8-N6
Trq Prv Stp	1318	2.3.5	A5-S25
Trq Ref	0	2.9.26	A2-K21
Trq Ref Act	1536	1.7.34	A10-N2, A11-F26
Trq Ref En	0	2.8.36	A2-L15
Trq Ref Fil TC	0	2.4.21	A2-J11
Trq Ref Max	642	2.6.15	A2-H14
Trq Ref StA	1302	2.3.3	A2-K21
Trq Rmp Rate	1290	2.4.11	A2-J16
Trq Spd Lim	1507	1.7.12	A1-M15, A2-B14
Trq Spd Lim Mode	0	2.10.14	A2-J27
Trq_Ref_Min	643	2.6.16	A2-G14
U/f Mid Freq	604	2.14.12	A9-J5
U/f Mid Voltg	605	2.14.13	A9-L5
U/f Optimization	109	2.14.27	A9-F13
U/f Ratio Select	108	2.14.26	A9-N10
ULoad Protect F	713	2.2.18	A8-F20
Under Ld State T	716	2.2.21	A8-E23
Under Ld Trq 0	715	2.2.20	A8-F27
Under Ld Trq Nom	714	2.2.19	A8-F27
Unit Temperature	8	1.3.6	A8-M22
User Flt 1	0	2.2.2	A8-S7
User Flt 2	0	2.2.3	A8-S7
User Flt 3	0	2.2.4	A8-R7
User Flt 4	0	2.2.5	A8-R7
User Password	0	2.3.19	A11-D5
UV Contrl	608	2.10.8	A1-F14
UV Reg I	0	2.5.18	A1-E12
UV Reg Kd	0	2.5.20	A1-E12
UV Reg Kp	0	2.5.19	A1-E12
UVolt Fault Resp	727	2.2.10	A8-P20
Voltage at FWP	603	2.14.11	A9-R5, A9-N5, A9-L5, A9-H5, A11-N24
Watchdog In	0	2.8.74	A7-B21
Watchdog Out	1003	1.6.36	A7-D18
WD Com Dly	0	2.4.18	A7-B17
WD Flt Response	0	2.2.25	A8-C20

NAME	ID	MENU	COORDINATES
WD Init Dly Tim	0	2.4.19	A7-C19
Win Neg Width	1243	2.6.21	A2-G28
Win Pos Width	1242	2.6.20	A2-H28
Zero Analog	1200	2.16.3	A5-C28, A6-R27, A6-M20, A6-J20, A6-G27, A6-S13, A6-R13, A6-M14, A7-D6, A7-C6, A7-K7, A7-J7, A7-J7, A7-H7, A7-H7, A7-G7, A7-G7, A7-F7
Zero Bit	1002	2.16.2	A1-J14, A1-T24, A1-R23, A1-N27, A1-M27, A1-M27, A1-L27, A1-L27, A1-K27, A1-K27, A1-J27, A1-N23, A1-N14, A1-G26, A2-L19, A3-D28, A3-D28, A3-D18, A3-E9, A3-D6, A3-C6, A4-L13, A4-L9, A4-J27, A4-L6, A5-B24, A5-G27, A5-G24, A5-J7, A5-E10, A5-F24, A6-S20, A6-E20, A6-F20, A6-F20, A6-F13, A6-D13, A6-S6, A6-R6, A6-N6, A6-N6, A6-M6, A6-L6, A6-L6, A6-K6, A6-K6, A6-J6, A6-J6, A6-H6, A6-H6, A6-G6, A6-F6, A6-F6, A6-E6, A6-C6, A6-E6, A6-D6, A6-D6, A6-C6, A6-B6, A7-S17, A7-S17, A7-R17, A7-R17, A7-P17, A7-P17, A7-N17, A7-N17, A7-K17, A7-J17, A7-J17, A7-H17, A7-B21, A8-E22, A8-S7, A8-S7, A8-R7, A8-R7, A8-S21, A8-E20, A8-L9, A8-D14, A11-T7, A11-H7
Zero Detect	1259	2.6.12	A2-P5
Zero Freq Voltg	606	2.14.14	A9-P5, A9-N5, A9-K5, A9-G5



## APPENDIX D

### PARAMETER ID NUMBER CROSS-REFERENCE

ID	NAME	MENU
1	Freq out	1.7.16
2	Motor Speed	1.3.1
3	Motor Current	1.3.3
4	Motor Torque	1.3.4
5	Motor Power	1.7.4
6	Motor Voltage	1.3.5
7	DCVoltage	1.3.2
8	Unit Temperature	1.3.6
9	MtrCalcTemp	1.7.7
18	Torque Reference	1.7.31
25	FreqReference	1.7.14
37	Active Flt Last	1.7.32
101	Min Frequency	2.6.5
102	Freq Max	2.6.4
103	Accel Time 1	2.1.7
104	Decel Time 1	2.1.8
108	U/f Ratio Select	2.14.26
109	U/f Optimization	2.14.27
110	Motor Nom Voltg	2.14.2
111	Motor Nom Freq	2.14.3
112	Motor Nom Speed	2.14.4
113	Motor Nom Currnt	2.14.1
120	Motor Cos Phi	2.14.25
123	Keypad Spd Dir	3.1
500	Smooth Ratio	2.4.3
501	Smooth Ratio 2	2.4.5
503	Fast Stop Tim	2.4.4
505	Start Function	2.10.4
515	Stop DC-BrakeFr	2.14.9
519	FluxBrakeCurrent	2.14.10
520	Flux Brake	2.14.28
521	Motor Ctrl Mode2	2.14.6
600	Motor Ctrl Mode	2.14.5
601	Switching Freq	2.14.15
602	Field WeakngPnt	2.3.4
603	Voltage at FWP	2.14.11
604	U/f Mid Freq	2.14.12
605	U/f Mid Voltg	2.14.13
606	Zero Freq Voltg	2.14.14
607	Overvolt Contr	2.10.7
608	UV Contrl	2.10.8
610	Trq Lim Kp	2.5.25
611	Trq Lim Ki	2.5.26
612	MagnCurrent	2.14.16
613	Speed Control Kp	2.5.1
614	Speed Control Ti	2.5.2
615	Strt 0 Spd Time	2.4.23
616	Load Float Time	2.1.9
617	CurrentControlKp	2.5.13
618	Encoder1FiltTime	2.11.5.10

ID	NAME	MENU
619	Slip Adjust	2.14.17
620	LoadDrooping	2.5.12
621	Startup Trq Sel	2.14.20
626	Accel.Compens.	2.5.9
631	Self Tune Motor	2.1.14
633	StartupTorq FWD	2.14.21
634	StartupTorq REV	2.14.22
637	Spd Cont Kp	2.5.27
638	Spd Cont Ki	2.5.28
639	Trq Cntrl Kp	2.5.29
640	Trq Cntrl Ki	2.5.30
642	Trq Ref Max	2.6.15
643	Trq_Ref_Min	2.6.16
644	Torq Speed Limit	2.6.17
660	Mk Flux Time	2.13.16
661	Mk Flux Voltage	2.13.17
662	Meas Rs V Drop	2.13.18
663	Mk Flux V Hw Dt	2.13.19
664	Ir Add 0 Pt V	2.13.20
665	Ir Add Gen Scl	2.13.21
667	Ir Add Mtr Scl	2.13.22
668	Pwr IU Offset	2.13.23
669	Pwr IV Offset	2.13.24
670	Pwr IW Offset	2.13.25
702	Phase Supv F	2.2.11
703	Earth Fault	2.2.12
704	Therm Prot F	2.2.13
705	MotAmbTempFactor	2.2.14
706	Mot Therm 0 Spd	2.2.15
707	Mtr Therm TC	2.2.16
708	Motor Duty Cycle	2.2.17
713	ULoad Protect F	2.2.18
714	Under Ld Trq Nom	2.2.19
715	Under Ld Trq 0	2.2.20
716	Under Ld State T	2.2.21
727	UVolt Fault Resp	2.2.10
730	Input Ph. Superv	2.2.9
732	ThermistorF.Resp	2.2.22
733	FBComm.FaultResp	2.2.23
734	SPI Flt Resp	2.2.24
1001	One Bit	2.16.1
1002	Zero Bit	2.16.2
1003	Watchdog Out	1.6.36
1011	DIN 1	1.4.1
1012	DIN 2	1.4.2
1013	DIN 3	1.4.3
1014	DIN 4	1.4.4
1015	DIN 5	1.4.5
1016	DIN 6	1.4.6
1017	DIN 7	1.4.7

ID	NAME	MENU
1018	DIN 8	1.4.8
1021	Not DIN 1	1.8.1
1022	Not DIN 2	1.8.2
1023	Not DIN 3	1.8.3
1024	Not DIN 4	1.8.4
1025	Not DIN 5	1.8.5
1026	Not DIN 6	1.8.6
1027	Not DIN 7	1.8.7
1028	Not DIN 8	1.8.8
1029	DIN 9	1.4.9
1030	DIN 10	1.4.10
1031	DIN 11	1.4.11
1032	DIN 12	1.4.12
1033	DIN 13	1.4.13
1034	DIN 14	1.4.14
1035	DIN 15	1.4.15
1040	FB Run	1.9.1.1
1041	FB Dir	1.9.1.2
1042	FB Flt Res	1.9.1.3
1043	FB DIN 1	1.9.1.4
1044	FB DIN 2	1.9.1.5
1045	FB DIN 3	1.9.1.6
1046	FB DIN 4	1.9.1.7
1047	FB DIN 5	1.9.1.8
1050	MD Bit In1	1.5.9
1051	MD Bit In2	1.5.10
1052	MD Bit In3	1.5.11
1053	MD Bit In4	1.5.12
1058	MD Drive OK	1.5.13
1060	MD Run Enable	1.5.14
1086	MC Reverse	1.2.4
1089	Start Input	1.6.39
1090	RunRequest	1.6.35
1091	Run OK	1.6.2
1095	SB Comm Lost	1.5.15
1096	Run Enable	1.6.37
1098	MC Run	1.2.1
1099	Cntrl Inhib	1.6.1
1102	Brk Slp Slw	1.6.12
1104	Brk Slip Mode	1.6.11
1105	Brk Slp Warn	1.2.10
1106	MC Out	1.6.5
1107	Brk Pdl Act	1.6.10
1108	In Anti Snatch	1.6.13
1110	Run Cmd Inp	1.6.41
1111	Trq Mode Sw	1.6.40
1115	MC Ready	1.2.2
1116	MC Fault	1.2.3
1118	MC AtSpeed	1.2.5
1121	PC Control	1.6.8
1127	At Zero Spd	1.2.12
1128	Reverse	1.6.6
1129	Abv Base Spd	1.6.14
1130	Abv Brk Slp Spd	1.6.15
1131	Blw Brk Spd	1.6.9
1133	Brk Hld Bit	1.2.8
1135	EndSt Perm	1.2.6
1139	MSpd OK	1.6.34
1140	Ov Wt Alarm	1.6.33

ID	NAME	MENU
1143	Ramp Hold	1.6.7
1144	Rel Brakes	1.2.9
1147	Run Fwd Cmd	1.6.3
1148	Run Rev Cmd	1.6.4
1149	Slow Down Cmd	1.2.7
1152	Sp Cmp1 Eq	1.6.18
1153	Sp Cmp1 Out	1.6.19
1156	Sp Dly1 Out	1.6.20
1157	Sp Dly2 Out	1.6.21
1158	Sp Ltch1 Out	1.6.22
1159	Sp Ltch2 Out	1.6.23
1161	Sp Inv1 Out	1.6.24
1162	Sp Inv2 Out	1.6.25
1163	Sp Inv3 Out	1.6.26
1164	Sp And1 Out	1.6.27
1165	Sp And2 Out	1.6.28
1166	Sp And3 Out	1.6.29
1167	Sp Or1 Out	1.6.30
1168	Sp Or2 Out	1.6.31
1169	Sp Or3 Out	1.6.32
1170	Trq Prv Cmd	1.2.11
1172	MD WD OK	1.5.2
1173	SB Comm Flt	1.5.16
1174	Rel Ramp	1.6.38
1200	Zero Analog	2.16.3
1201	One Analog	2.16.4
1202	Int Ten	2.16.5
1203	Int Hundred	2.16.6
1204	Int Thousand	2.16.7
1240	Err Lim 1	2.2.32
1241	Err Lim 2	2.2.33
1242	Win Pos Width	2.6.20
1243	Win Neg Width	2.6.21
1244	Mtr I Lim En	2.10.9
1245	Gen I Lim En	2.10.10
1246	SC Trq Chain Sel	2.10.12
1247	Stall Spd St	2.2.46
1248	Torq Ref Select	2.10.13
1249	Stall Trq St	2.2.48
1250	Anti Snitch Trq	2.3.6
1252	Speed Step	2.13.26
1253	Torque Step	2.13.27
1258	Ovr Spd Stp	2.6.11
1259	Zero Detect	2.6.12
1260	2nd Accel Rate	2.4.1
1261	2nd Decel Rate	2.4.2
1262	ESR Cur Lim	2.6.2
1263	Max ESR Speed	2.6.3
1266	Brk Hld Spd	2.3.2
1267	Brake Offset	2.1.11
1268	Brk Cont FTim	2.2.27
1269	Brk slp Spd	2.3.7
1273	Spd Slk Up	2.3.1
1278	Mspd Stpt	2.7.10
1279	Mspd Tim	2.4.25
1281	LS Scl Div	2.7.2
1282	LS to Freq	2.7.1
1288	Rel Rmp Dly	2.1.10
1289	SD Mlt Stpt	2.7.3

ID	NAME	MENU
1290	Trq Rmp Rate	2.4.11
1291	Mtr Cur Limit	2.6.6
1294	Counter1 Dec	2.11.5.5
1295	Counter1 Mult	2.11.5.6
1300	Pos Freq Limit	2.6.18
1301	Neg Freq Limit	2.6.19
1302	Trq Ref StA	2.3.3
1305	Motoring Trq Lim	2.6.7
1306	Gener Trq Lim	2.6.8
1307	Trq Lim FWD	2.6.9
1308	Trq Lim REV	2.6.10
1310	Full Load Per	2.1.12
1311	SD Spd Lim	2.6.1
1312	SD Speed	2.1.6
1313	Speed 1	2.1.1
1314	Speed 2	2.1.2
1315	Speed 3	2.1.3
1316	Speed 4	2.1.4
1317	Speed 5	2.1.5
1318	Trq Prv Stp	2.3.5
1323	Sp MD1 Dv	2.7.4
1324	Sp MD1 Mlt	2.7.5
1327	Sp Add Val	2.7.6
1328	Sp Sub Val	2.7.7
1329	Sp LP Fil TC	2.4.12
1330	Sp Sum1 StA	2.3.8
1331	Sp Sum1 StB	2.3.9
1332	Sp Sum1 StC	2.3.10
1337	Sp Sel1 ST0	2.3.11
1338	Sp Sel1 ST1	2.3.12
1341	Sp HL High	2.3.13
1342	Sp HL Hyst	2.3.14
1343	Sp HL Low	2.3.15
1344	Sp HL Stpt	2.3.16
1345	Sp Cmp1_Hyst	2.3.17
1346	Sp Cmp1_Stpt	2.3.18
1349	Sp Dly1 TOFF	2.4.13
1350	Sp Dly1 TON	2.4.14
1351	Sp Dly2 TOFF	2.4.15
1352	Sp Dly2 TON	2.4.16
1353	Sp Lim Max	2.6.23
1354	Sp Lim Min	2.6.24
1355	Flux Curve a	2.13.1
1356	Flux Curve b	2.13.2
1357	Flux Curve c	2.13.3
1358	Flux Curve d	2.13.4
1359	Flux Curve e	2.13.5
1360	Flux Curve f	2.13.6
1361	Flux Curve g	2.13.7
1362	Flux Curve h	2.13.8
1363	Flux Curve i	2.13.9
1364	Flux Curve j	2.13.10
1365	Flux Curve k	2.13.11
1366	Flux Curve l	2.13.12
1367	Flux Curve m	2.13.13
1368	Flux Curve n	2.13.14
1369	Flux Curve o	2.13.15
1501	Abs Mtr Spd	1.7.1
1502	Fil Mtr Trq	1.7.3

ID	NAME	MENU
1503	Freq Stpt	1.7.11
1504	Max RPM	1.7.37
1505	Control Place	1.7.8
1507	Trq Spd Lim	1.7.12
1508	Freq Delta	1.7.17
1509	Brake Chopper	1.7.19
1511	BrakeResistor	1.7.20
1512	Abs Per Spd	1.7.10
1513	Run time Hrs	1.3.10
1514	Overload Counter	1.3.9
1515	TC Pos Freq Lim	1.7.38
1516	TC Neg Freq Lim	1.7.39
1517	Command	1.2.13
1518	Stop Slow Inp	1.2.14
1519	Freq Error	1.3.7
1520	Anlg Ref	1.7.9
1521	ProcessPITrimRef	1.7.21
1524	Mtr Fil IA Fil	1.7.2
1525	MtrRegStatus	1.7.22
1526	MotorCurLimit	1.3.8
1528	Counter1	1.8.16
1530	SB In Cntl Word	1.5.3
1531	SB In Freq Ref	1.5.4
1532	SB In Int1	1.5.5
1533	SB In Int2	1.5.6
1534	SB Out Cntl Word	1.5.8
1535	SB In Trq Ref	1.5.7
1536	Trq Ref Act	1.7.34
1539	Final Iq Trq Ref	1.7.35
1540	Final Freq Ref	1.7.15
1541	Rotor Flux	1.7.5
1542	Final Trq Ref	1.7.6
1548	Speed Cntrl Out	1.7.13
1553	Sp MD1 Out	1.7.23
1555	Sp Add1 Out	1.7.24
1557	Sp LP Fil Out	1.7.26
1558	Sp ABS Out	1.7.27
1559	Sp Sum1 Out	1.7.28
1561	Sp Sel1 Out	1.7.29
1563	Sp HL Max	1.6.16
1564	Sp HL Min	1.6.17
1565	Sp Sub1 Out	1.7.25
1566	Accel Comp	1.7.33
1568	Freq Ramp Out	1.7.18
1574	Sp Lim Out	1.7.30
1590	AOUT1 Val	1.4.18
1591	AOUT2 Val	1.4.19
1601	AIN1	1.4.16
1602	AIN2	1.4.17
1603	AIN3	1.8.13
1604	AIN4	1.8.14
1609	Enc1_Out	1.8.15
1611	A_FB_AIN1	1.9.2.1
1612	A_FB_AIN2	1.9.2.2
1613	A_FB_AIN3	1.9.2.3
1614	A_FB_AIN4	1.9.2.4
1615	A_FB_AIN5	1.9.2.5
1616	A_FB_AIN6	1.9.2.6
1617	A_FB_AIN7	1.9.2.7

ID	NAME	MENU
1618	A_FB_AIN8	1.9.2.8
1619	A_FB_AIN9	1.9.2.9
1620	A_FB_AIN10	1.9.2.10
1621	FB Fix Cntrl Wrd	1.9.1.9
1622	FB Data Out 1	1.9.3.1
1623	FB Data Out 2	1.9.3.2
1624	FB Data Out 3	1.9.3.3
1625	FB Data Out 4	1.9.3.4
1626	FB Data Out 5	1.9.3.5
1627	FB Data Out 6	1.9.3.6
1628	FB Data Out 7	1.9.3.7
1629	FB Data Out 8	1.9.3.8
1631	FB Gen Sts Word	1.9.3.9
1632	FB Spd Ref	1.9.2.11

ID	NAME	MENU
1700	T0_X0	2.12.1.1
1701	T0_X1	2.12.1.2
1702	T0_X2	2.12.1.3
1703	T0_X3	2.12.1.4
1704	T0_X4	2.12.1.5
1705	T0_X5	2.12.1.6
1716	T0_Y0	2.12.1.7
1717	T0_Y1	2.12.1.8
1718	T0_Y2	2.12.1.9
1719	T0_Y3	2.12.1.10
1720	T0_Y4	2.12.1.11
1721	T0_Y5	2.12.1.12

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## PAGE 2 of 2

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