

**ACCeL500
OVERHEAD CRANE
APPLICATION SOFTWARE**

Part Number 695133.V11

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Cleveland, Ohio**

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AVTRON INDUSTRIAL AUTOMATION, INC.
Cleveland, Ohio

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**AVTRON ACCEL500
OVERHEAD CRANE SOFTWARE
Part Number 695133.V10**

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)
- 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

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

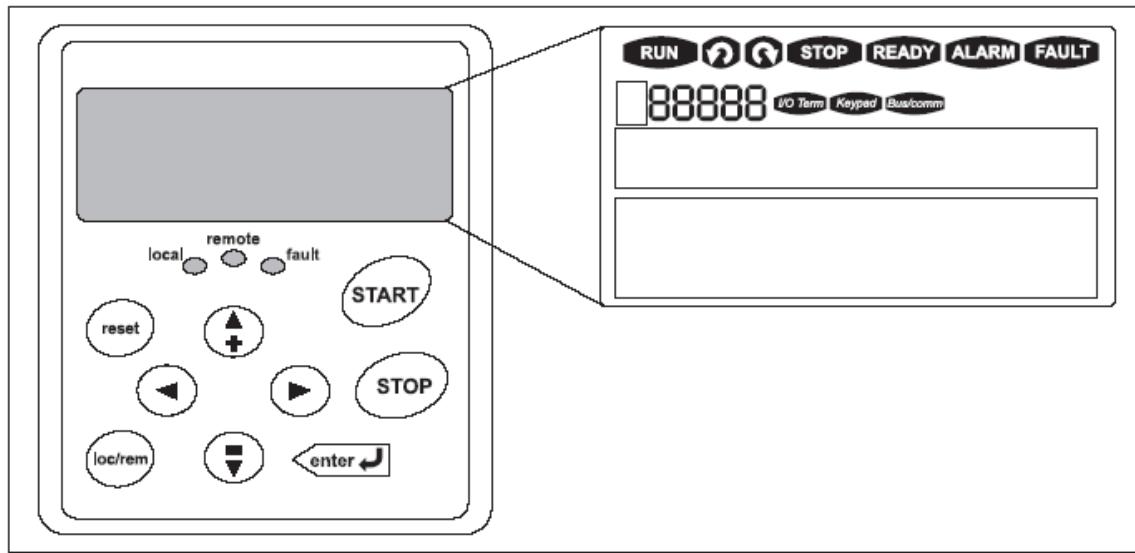


Figure 3-1. Keypad and Display

TABLE 3-1. NAVIGATION BUTTONS

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

TABLE 3-2. LCD STATUS INDICATORS

Indicator	Description
	Run 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.
	Counterclockwise Operation The output phase rotation is BAC, corresponding to counterclockwise rotation of most motors.
	Clockwise Operation The output phase rotation is ABC, corresponding to clockwise rotation of most motors.
	Stop Indicates that the ACCel500 is stopped and not controlling the load.
	Ready Indicates that the ACCel500 is ready to be started.
	Alarm Indicates that there is one or more active drive alarm(s).
	Fault Indicates that there is one or more active drive fault(s).
	I/O Terminal* Indicates that the I/O terminals have been chosen for control (remote).
	Keypad* 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
local	Local* Indicates that the ACCel500 is ready to be started and operated from the Local mode.
remote	Remote* Indicates that the ACCel500 is operating and controlling the load remotely.
fault	Fault 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.
- 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.

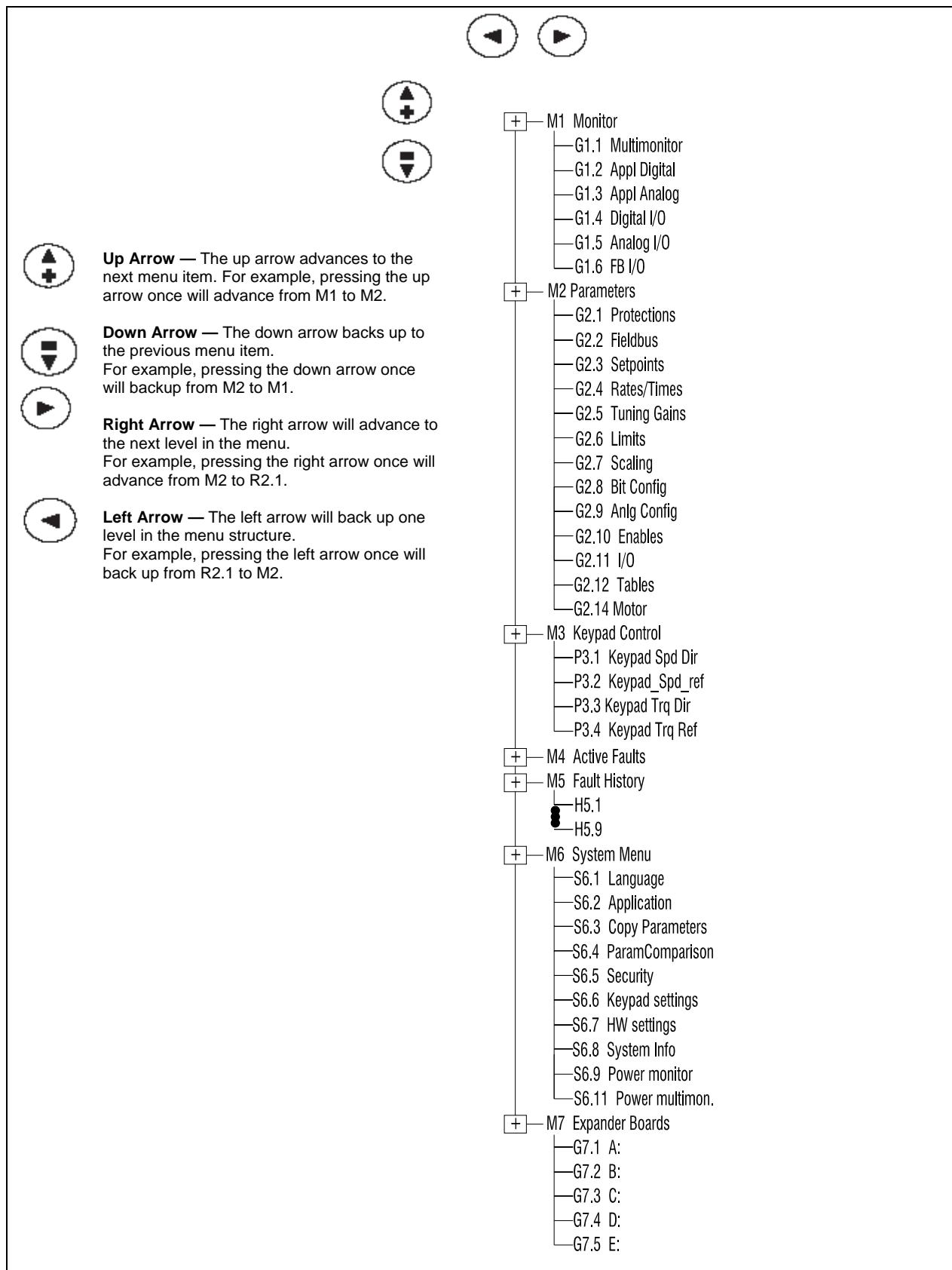


Figure 3-2. Main Menu Navigation

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).

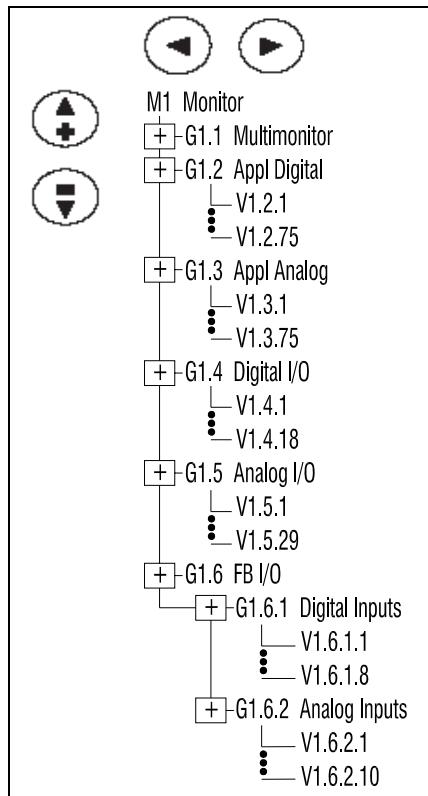


Figure 3-3. Monitor Menu Structure Example

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.

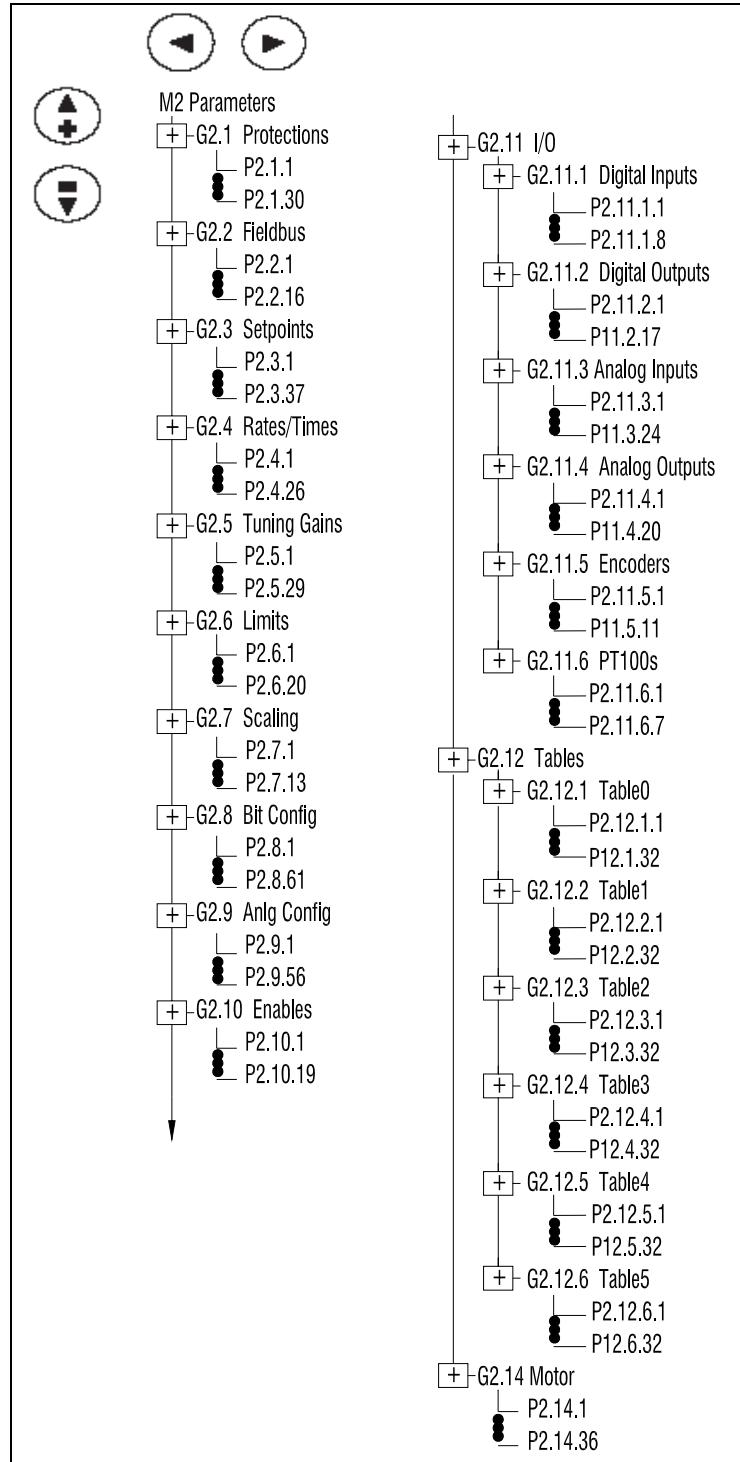


Figure 3-4. Parameter Menu

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.

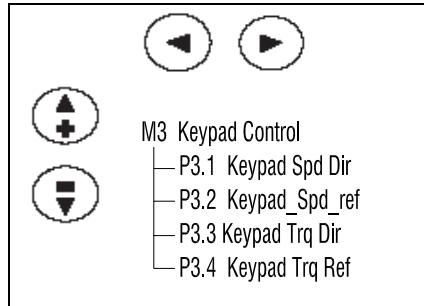


Figure 3-5. Keypad Control Menu

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.

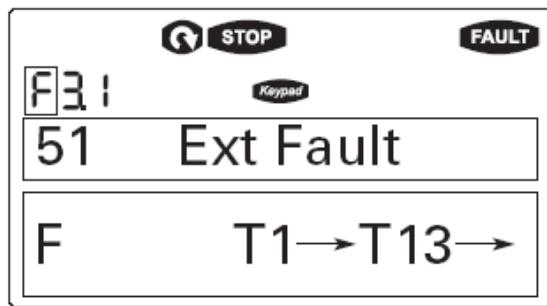


Figure 3-6. Active Fault Display Example

WARNING

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

Fault Type	Fault Name	Description
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 ¹	D	Counted operation days (Fault 43: Additional code)
T.2 ¹	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

¹Real 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.

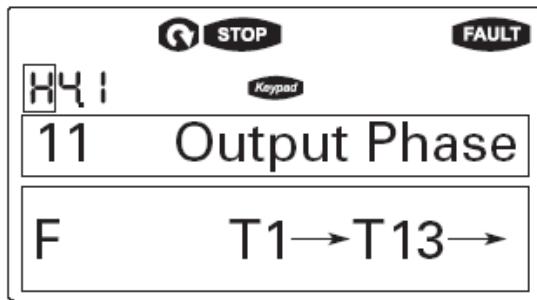


Figure 3-7. Sample Fault History Display

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.

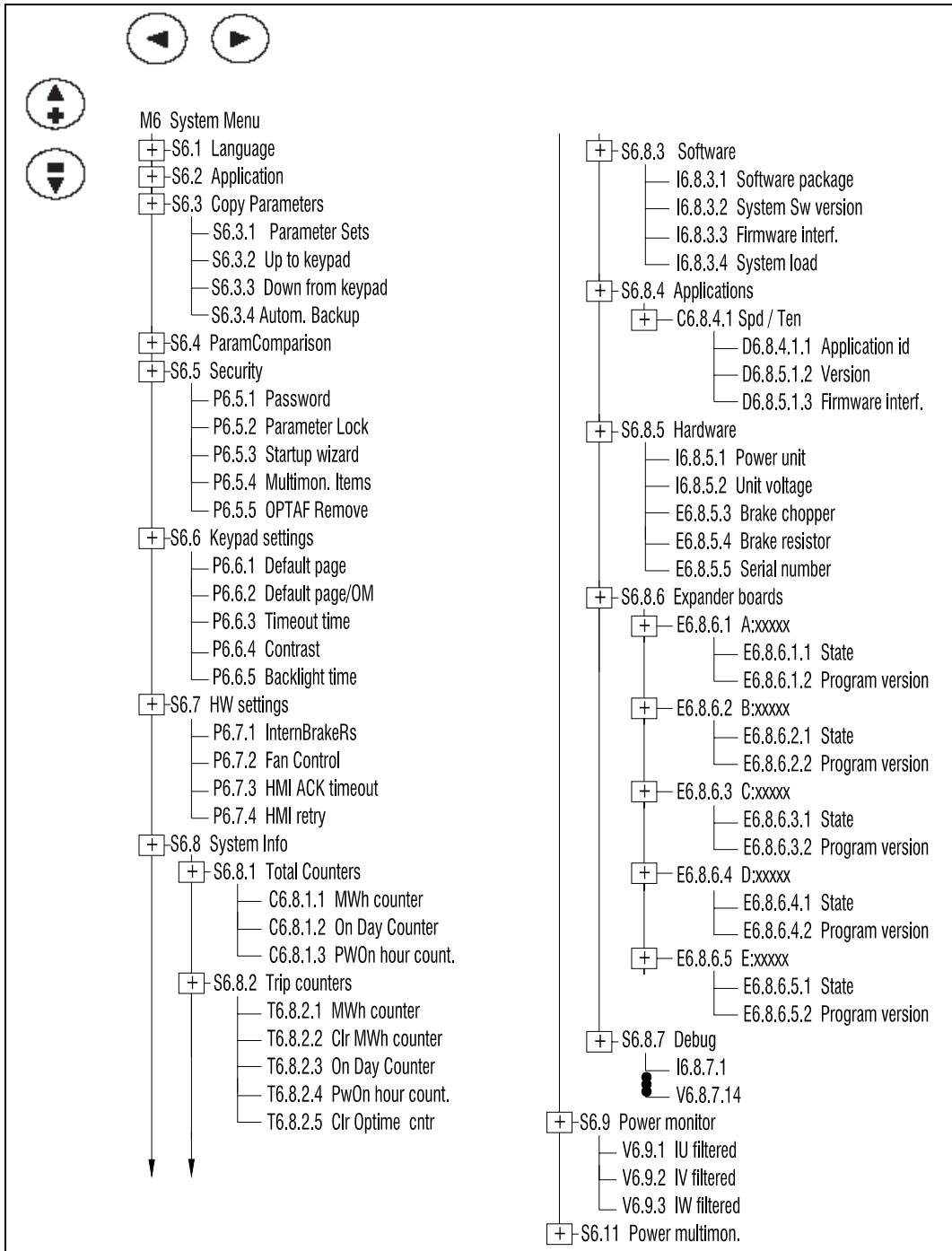


Figure 3-8. System Menu Structure

System Menu Parameters

S6.1	Range: English Language Selection This parameter offers the ability to control the ACCel500 through the keypad in the language of your choice.	Default: English
S6.2	Range: Spd /Ten Application This parameter sets the active application. 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 enter button. Pushing any other button saves the parameters of the previously used application in the keypad.	

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.

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 Æ 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 The application selection can be protected against unauthorized changes with the Password function. When the password function is enabled, the user will be prompted to enter a password before application changes, parameter value changes, or password changes.

By default, the password function is not in use. If you want to activate the password, change the value of this parameter to any number between 1 and 65535. The password will be activated after the Timeout time (Timeout Time) has expired.

To deactivate the password, reset the parameter value to 0.

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 The Start-Up Wizard facilitates commissioning the ACCEL500. If selected active, the Start-Up Wizard prompts the operator for the language and application desired and then advances through the start-up parameter list. After completion, it allows the user to repeat the Start-Up Wizard or return to the default page, the Operate Menu. The Start-Up Wizard is always active for the initial power up of the ACCEL500.

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:

P5.6.1

Default page 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.

Default: 0

P5.6.2

Default page/OM 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.

P5.6.3

Timeout time Range: 0 – 65535
Default: 30
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.

P5.6.4

Contrast If the display is not clear, you can adjust the keypad contrast with this parameter.

P5.6.5

Backlight time 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

InternBrakeRs Range: Connected – Not Connected
Default: Connected
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.

P6.7.2	Range: Continuous, Temperature	Default: Continuous
Fan Control	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.
P6.7.3	Range: 200 – 5,000	Default: 200
HMI ACK timeout	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:	
	<ul style="list-style-type: none"> • 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.
P6.7.4	Range: 1 – 10	Default: 5
HMI retry	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
A6.8.4.x	Application name
D6.8.4.x.1	Application ID
D6.8.4.x.2	Version
D6.8.4.x.3	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
I6.8.5.1	Number of the power unit
I6.8.5.2	Nominal voltage of the unit
I6.8.5.3	Brake chopper
I6.8.5.4	Brake resistor
I6.8.5.5	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
E6.8.6.x	Slot “x” board identification
E6.8.6.x.1	Operating state
E6.8.6.x.2	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
C6.9.1	IU filtered
C6.9.2	IV filtered
C6.9.3	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.

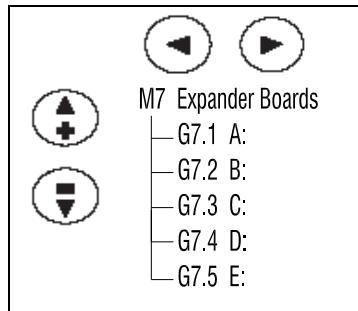


Figure 3-9. Expander Board Menu Structure

Example of Expander Board Parameters for Option Board A9

P7.1.1.1	Range: 1 – 5	Default: 3
AI1 Mode	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	
P7.1.1.2	Range: 1 – 5	Default: 1
AI2 Mode	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	
P7.1.1.3	Range: 1 – 4	Default: 1
AO1 Mode	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

4-1 ANALOG INPUTS

Parameters	Type	Default
<i>AIN1 Slot ID to AIN4 Slot ID</i>	ACFG	10, 11, then 0 for rest
<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 to AI4</i>	APB	
<i>AII Type to AI4 Type</i>	APB	
<i>AIN1 to AIN4</i>	APB	
<i>AIN1 Fault to AIN4 Fault</i>	DPB	

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.

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.

Before scaling, the value can be viewed as *AI 1 – AI 4* and is scaled 0-10,000; +/-10,000 for +/- 10 volt boards.

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

Mode

- 0 = Unknown
- 1 = 0-20 ma
- 2 = 4-20 ma
- 3 = 0-10 V
- 4 = 2-10 V
- 5 = +/-10 V

Scaling for the first analog input is done as follows:

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

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

AIN1 is the value after scaling and filtering.

AIN1 Fault bit will go high only in modes 2 or 4.

Mode 2 will fault when the input voltage is less than 4 mA.
 Mode 4 will fault when the input voltage is less than 2 V.

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>AOUT1 Slot_ID</i> to <i>AOUT2 Slot ID</i>	ACFG	10, 0, 0, 0
<i>AOUT1 Val</i> to <i>AOUT2 Val</i>	APB	

Description

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

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.

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 = 0-10,000 value
- 3 = 0-10 V = 0-10,000 value
- 4 = 2-10 V = 0-10,000 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
<i>DIN1 Slot ID to DIN8 Slot ID</i>	ACFG	10, 11, 12, 13, 14, 15, 0, 0
<i>DIN 1 to DIN 8</i>	DPB	
<i>Not DIN1 to Not DIN8</i>	DPB	
<i>DIN9 Slot ID to DIN15 Slot ID</i>	ACFG	0, 0, 0, 0, 0, 0, 0
<i>DIN 9 to DIN 15</i>	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 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 eight digital inputs have invert bits that can be viewed as *DIN x* and *Not DIN x*.

4-4 DIGITAL OUTPUTS

Parameters	Type	Default
<i>DOUT1 ID to DOUT4 ID</i>	BCFG	<i>MC Fault</i> <i>MC Run</i> <i>MC AtSpeed</i> <i>Zero Bit</i>
<i>DOUT1 Inv to DOUT6 Inv</i>	En	0
<i>DOUT1 Slot ID to DOUT6 Slot ID</i>	ACFG	10, 20, 21, 0, 0, 0

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 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

Parameters	Type	Default
<i>Enc1 Slot ID</i>	ACFG	0
<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>Counter</i>	En	Disabled
<i>Encoder1FiltTime</i>	Cal	1 ms
<i>Enc1_Out</i>	APB	
<i>Counter1</i>	APB	
<i>C1_I-3</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.

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.

C1_1 = High word of first encoder motor rotations

C1_2 = Low word of first encoder motor rotations.

C1_3 = Fraction of rotation of first encoder input

Counter1 = Motor rotations \times *Counter1 Mult* / *Counter1 Dec*

Counter1 Hld will hold the counter at its current count when high.

Counter1 Res will reset the counter to zero when high.

SECTION V

LOGIC SEQUENCE

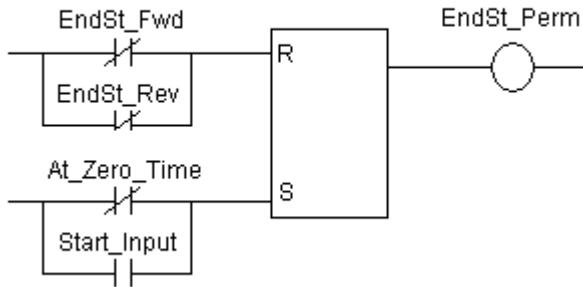
5-1 MISCELLANEOUS LOGIC

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

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

5-2 REMOTE OPERATION

5-2.1 *EndSt Perm*

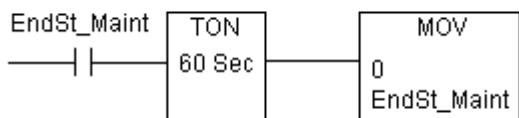


EndSt Perm goes high if either of the end stop inputs goes low. It will stay high until the drive has stopped and no run is commanded.

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.

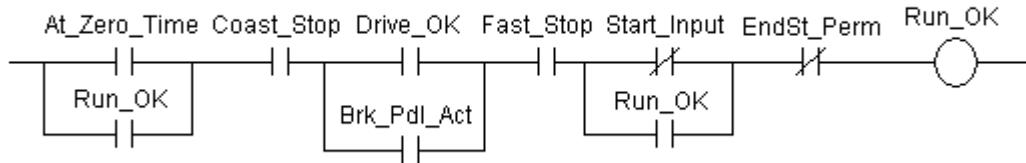
To use end stop functionality set *EndSt Fwd* and *EndSt Rev* to digital inputs that are normally high.

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.

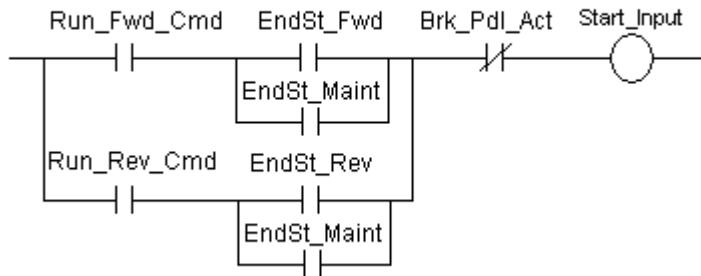
For the Crane software, the drive run inputs must be turned off along with the motor at zero speed before *Run OK* can be reset.

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 *Drive OK* drops out. The drive is coasting at this point with the brakes off. To keep the brakes from setting *Drive OK* is bypassed in this mode.

5-2.4 Start Input

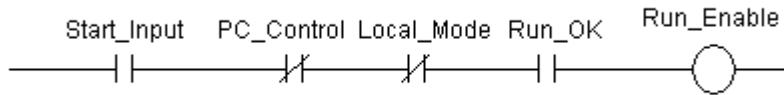


Normally *Start Input* is high when either *Run Fwd Cmd* or *Run Rev Cmd* is active.

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.

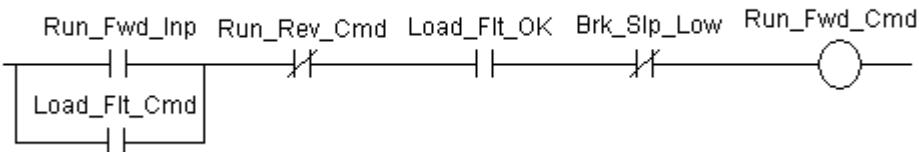
If an external brake pedal is active, the drive is turned off and coasts.

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

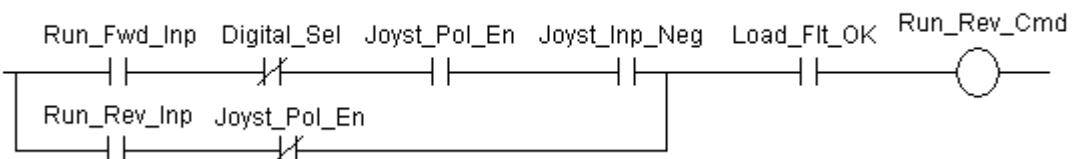


Run Fwd Inp is defaulted to the first digital input and provides the run command.

Load Flt Cmd can also provide the run command. If Load float is left on for a period of time the drive will fault out.

If brake slippage is detected when the brake has been set, an option is available to only allow the drive to lower the load.

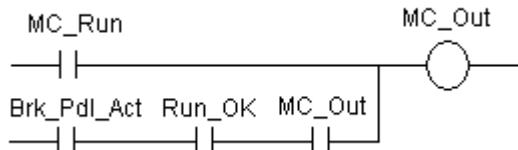
5-2.7 Run Rev Cmd



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

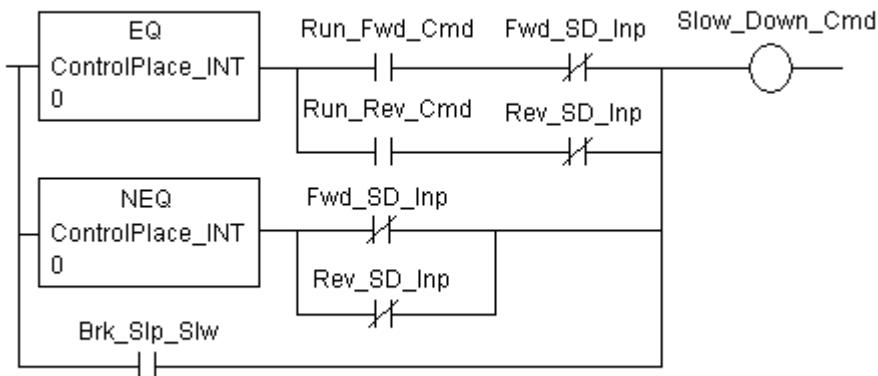
If the direction command is desired by joystick polarity, set *Joyst Pol En* parameter.

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.

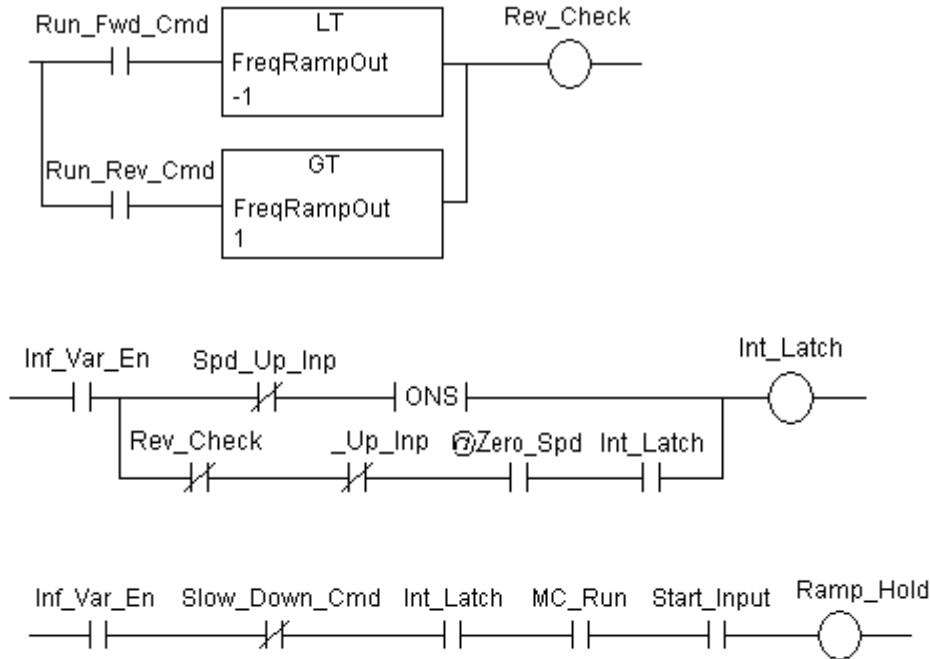
The slow down inputs are defaulted to TRUE and must be configured to a digital input to activate this feature. If the crane only has one slow down input for both directions, set both *Fwd SD Inp* and *Rev SD Inp* to the same digital input.

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.

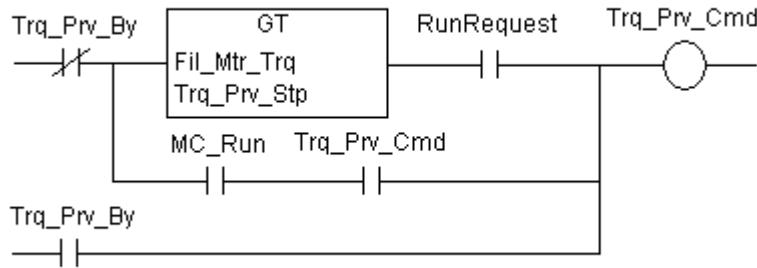
During a fault, opposite direction commanded or removal of run will reset the *Ramp Hold*.

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.

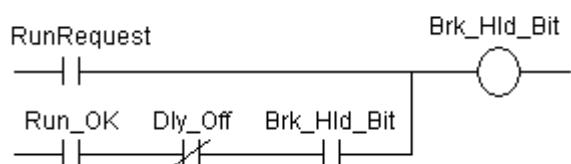
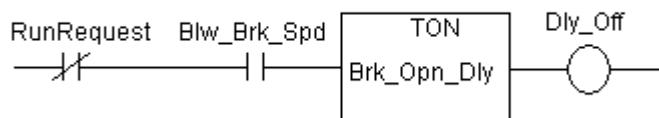
5-2.11 Trq Prv Cmd



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.

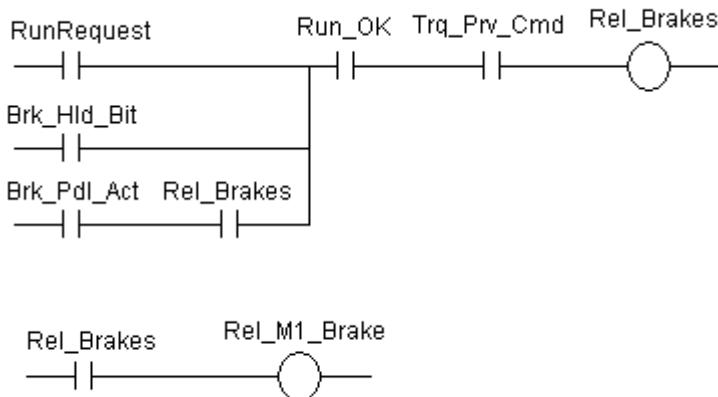
Trq Prv By should be set to FALSE for hoist applications to enable this feature.

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. Setting the *Brk Open Dly* delay will cause the drive to float the load at zero speed.

5-2.13 BRAKES



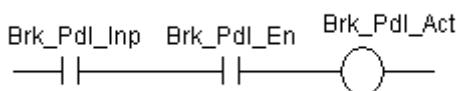
Rel Brakes bit is used to control an external motor brake contactor. To use this function it must be configured to a digital output of the drive.

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.

Rel M1 Brake is for future use when multiple motors can be utilized with the same drive.

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 checked for 60 seconds after the brakes have set. *Brk_Slp_Warn* will be active for up to two minutes after slippage is detected. This can be configured to a digital output for a warning horn. Drive action is determined by *Brk_Slp_Act* parameter as follows:

- 0: Default – No action.
- 1: Slow speed limit run.
- 2: Slow speed limit run and lower only.
- 3: Lower only.

5-2.16 RAMP DELAYS

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

- *Rel Ramp Delay* 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 Delay* 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.

5.3 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)

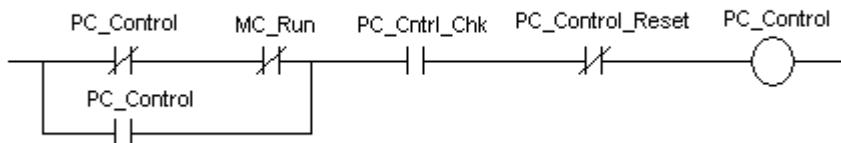
Pressing the Stop Button on the keypad will initiate a local stop. This does not stop the drive in remote or PC control. See button Stop fault in next section.

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

5-4.1 PC 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.

5-4.2 SC Start

SC_Start is the run command from the ADDaptACC program. It will be enable if in *PC Control* and *MC Ready* is high and no drive faults are present (*MC Fault* is low)

5-4.3 SC Comm Fault

SC Comm Fault will fault out the drive and take the section out of *PC Control* mode.

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 (*RJTEnable*), Local or diagnostic computer (*SC_Start*).

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.

SECTION VI

REFERENCING AND OUTER CONTROL LOOP

6-1 SPEED REFERENCE

6-1.1 JOYSTICK REFERENCE SELECTION

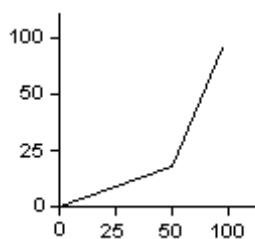
Parameters	Type	Default
<i>JoySt B Sel</i>	BCFG	<i>Zero Bit</i>
<i>Joyst A Inp</i>	ACFG	<i>Analog In 1</i>
<i>Joyst B Inp</i>	ACFG	<i>Analog In 2</i>
<i>Joyst Inp Neg</i>	DPB	
<i>Anlg Ref</i>	APB	%
<i>Load Flt Cmd</i>	DPB	
<i>LF Mlt Stpt</i>	CAL	0.5
<i>Slow Down Cmd</i>	DPB	
<i>SD Mlt Stpt</i>	CAL	0.5
<i>Anlg Ref2</i>	APB	%
<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.

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.

Load Flt Cmd is high when in the load float operating condition. See Chapter 4 for the load float logic. Load float 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 Load float, the Joystick reference is multiplied by *LF Mlt 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 first two digital inputs are defaulted to run forward and reverse at the lowest speed step (*Speed 1*).

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%.

6-1.3 REFERENCE LOCATION AND LIMIT

Parameters	Type	Default
<i>Control Place</i>	APB	
<i>Keypad Spd Ref</i>	APB	
<i>SC Spd Ref</i>	APB	
<i>Load Wt En</i>	BCFG	<i>Zero Bit</i>
<i>Trq Spd Lim</i>	APB	
<i>En Ext Spd</i>	BCFG	<i>Zero Bit</i>
<i>Base Spd Lim</i>	CAL	100.00%
<i>Slow Down Cmd</i>	DPB	
<i>SD Spd Lim</i>	CAL	50.00%
<i>Sref Limit</i>	APB	
<i>Abs Per Spd</i>	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 should be set to 100%.

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

- Set *Base Spd Lim* equal to the percentage of maximum speed.
Example: 1750 RPM nominal speed
 2500 RPM Maximum speed

$$\begin{aligned} \text{Base Spd Lim} &= (1750 / 2500) \times 100\% \\ &= 70\% \end{aligned}$$

- Set *En Ext Spd* = 1001 = *One Bit*.
- Select which type of over load protection is desired by setting *Load Wt En*.
- See the load weight setup procedure for the rest of the instructions.

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>SC Reverse</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>Freq_Stpt</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 (*SC Reverse*)

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.

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 Brakes</i>	DPB	
<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.

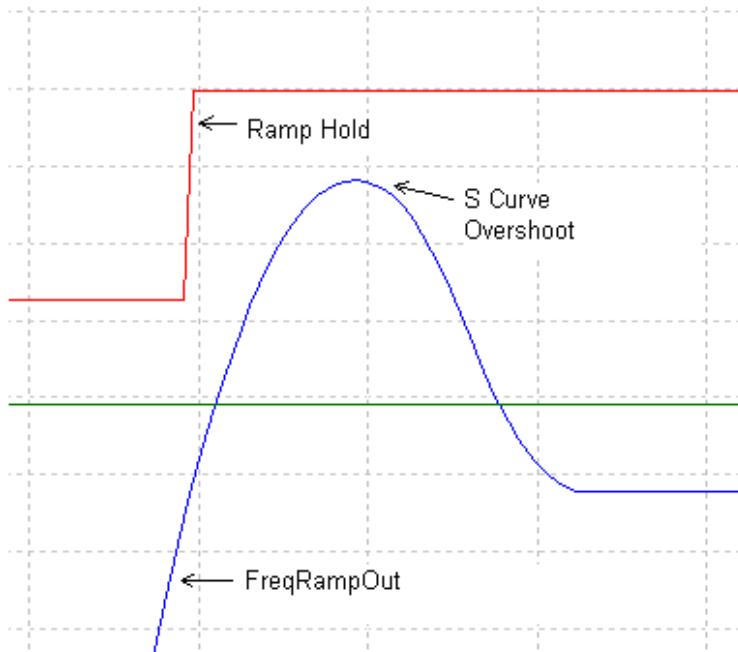
6-1.6 RAMP HOLD

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	
<i>Freq Ref 3</i>	APB	
<i>Freq Ref LP TC</i>	CAL	0 ms
<i>Freq Ref Act</i>	APB	

Description:

FreqReference is checked again to be within +/- *Freq Max* value and becomes *Freq Ref 3*.

A second order low pass filter with a time constant of *Freq Ref LP TC* is available to smooth the reference, if required. *Freq Ref Act* is the value after the filter.

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_</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>2nd Rmp En</i>	BCFG	1002 = Zero_Bit
<i>Accel Inp</i>	ACFG	<i>Accel Time 1</i> = 5 seconds
<i>2nd Accel Rate</i>	CAL	5.0 seconds
<i>Decel Time</i>	ACFG	<i>Decel Time 1</i> = 5 seconds
<i>2nd Decel Rate</i>	CAL	5.0 seconds
<i>In Anti Snatch</i>	DPB	
<i>Anti Sntch Accel</i>	CAL	10.0 seconds
<i>Acceleration Tim</i>	APB	
<i>Deceleration Time</i>	APB	
<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 *2nd 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.

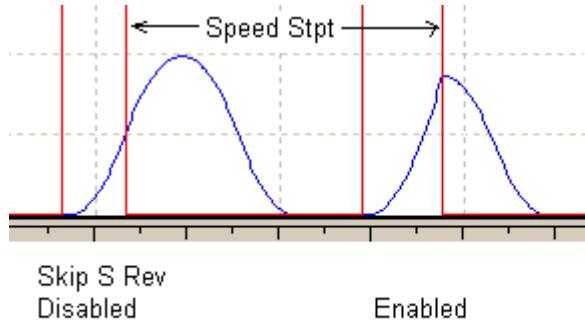
Smooth Ratio is used to create a rounding to the ramp rate. The units are in seconds to get to from zero to the ramp rate. Note that if *Smooth Ratio* = 2, then it will take 2 seconds to get to the ramp rate. It does not matter if the rate is 1 Hz/s or 10 Hz/s.

6-1.11 RAMP BLOCK OPTIONS

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

Description:

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>Freq Ramp Out</i>	APB	
<i>Freq Delta</i>	APB	

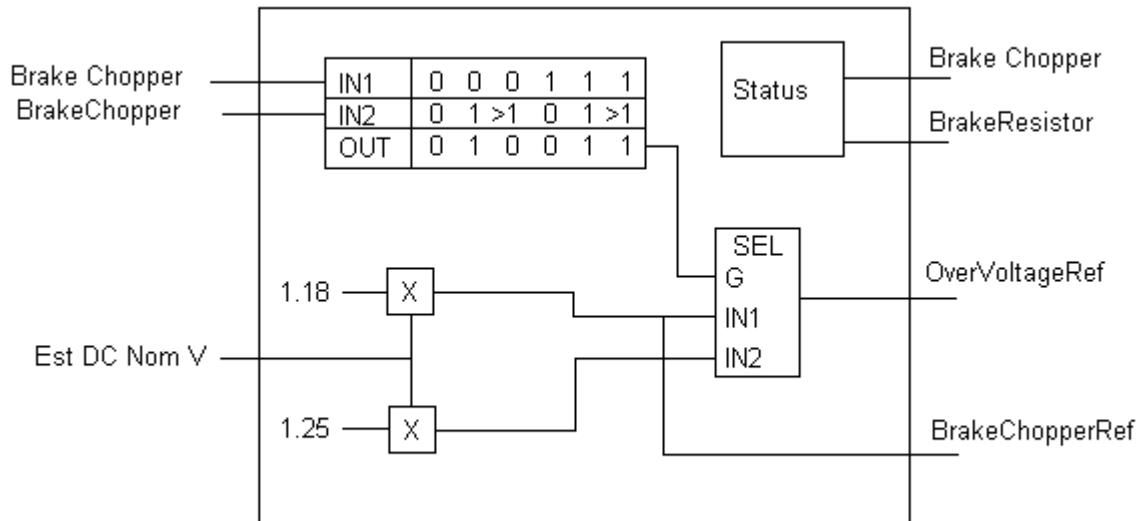
Description:

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.

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.

6-2.1 OPEN LOOP OVERVOLTAGE LIMITER



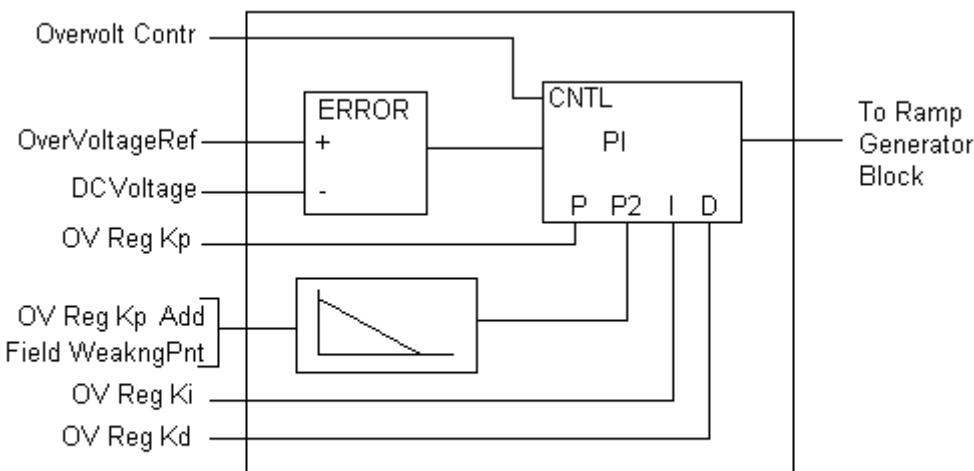
Parameters	Type	Default
<i>Brake Chopper</i>	APB	
<i>BrakeChopper</i>	CAL	0
<i>Est DC Nom V</i>	APB	
<i>BrakeResistor</i>	APB	

Description:

The Overvoltage reference is either set to 1.18 or 1.25 times the *Est DC Nom V*, 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 Kp Add</i>	CAL	By frame size
<i>OV Reg Kd</i>	CAL	By frame size
<i>Field WeakngPnt</i>	CAL	60 Hz
<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.

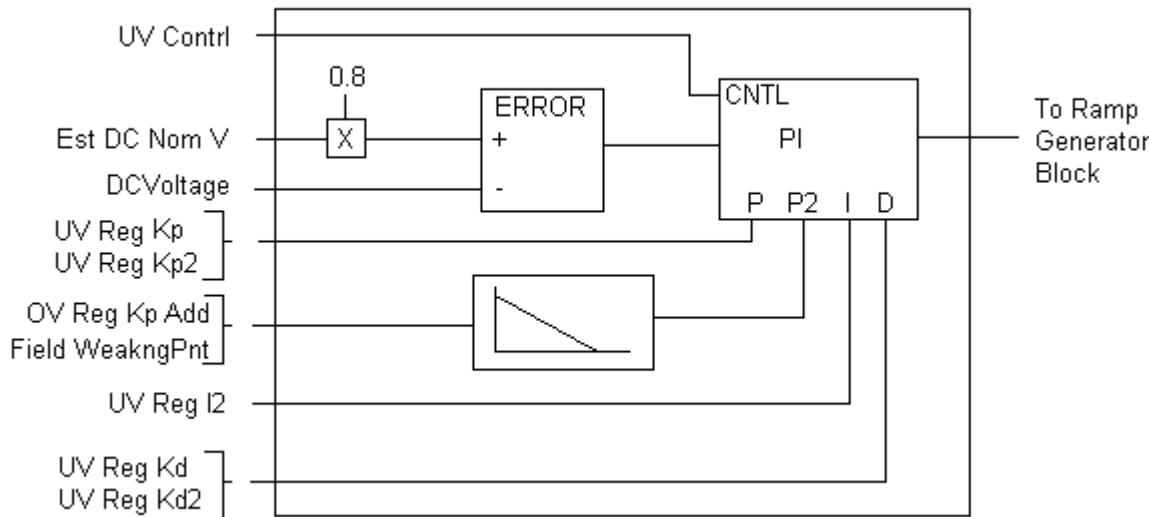
The over voltage reference is either 1.18 or 1.25 times the nominal bus voltage, depending on if there is a brake chopper circuit and resistor present.

The four gains *OV Reg Kp*, *OV Reg Kp Add*, *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.

OV Ref Kp Add is an additional P gain for low speeds. It will decay to zero when the drive gets to the *Field WeakngPnt* (default 60 Hz).

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 UNDERRVOLTAGE 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 I2</i>	CAL	By frame size
<i>UV Reg Kp2</i>	CAL	By frame size
<i>UV Reg Kd2</i>	CAL	By frame size
<i>Field WeakngPnt</i>	CAL	60 Hz
<i>OV Reg Kp Add</i>	CAL	By frame size
<i>Est DC Nom V</i>	APB	

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 $0.8 \times \text{Est DC Nom V}$.

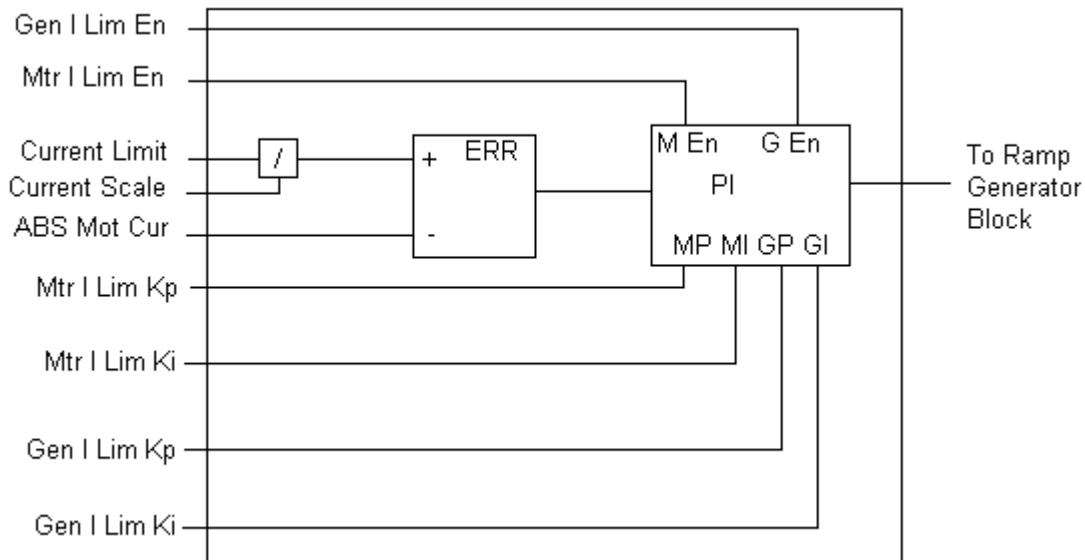
The four gains *UV Reg Kp*, *OV Reg Kp Add*, *UV Reg I2* and *UV Reg Kd* have different default values based on frame size. These should not need to be tuned except for extreme situations.

OV Ref Kp Add is an additional P gain for low speeds. It will decay to zero when the drive gets to the *Field WeakngPnt* (Default 60 Hz). Notice this is the same gain as the overvoltage limiter.

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*.

UV Reg Kp2 and *UV Reg Kd2* are used for special high speed applications. More information on these are not available at this time.

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>Current Scale</i>	CAL	1,10 By frame size
<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.

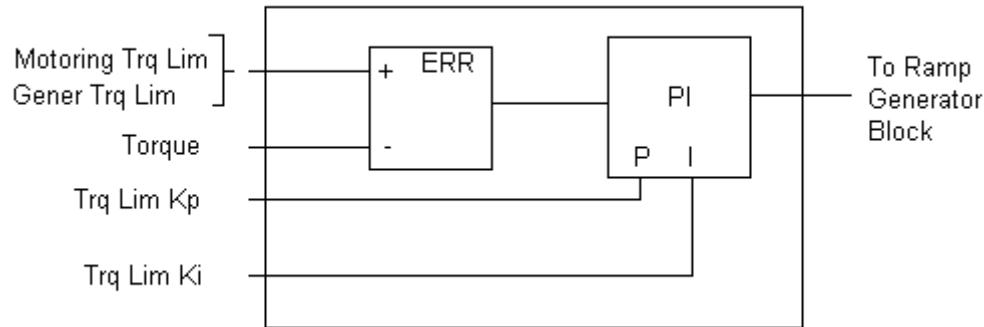
There are two regulators based on whether the drive is motoring or regenerating. *Gen I Lim En* enables the regeneration regulator, while *Mtr I Lim En* enables the motoring regulator. Both are defaulted to disable.

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.

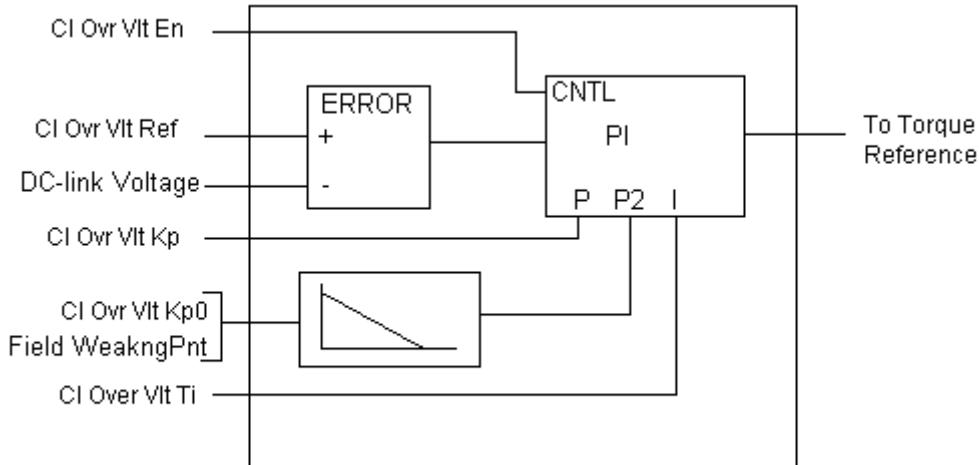
There are two regulators based on whether the drive is motoring or regenerating. Unlike the other regulators, there is no enable or disable for this limiter. The limits can be set above 300% to cause the drive to trip prior to the regulator turning on.

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



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
<i>Cl Ovr Vlt Kp0</i>	CAL	50

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.

Cl Ovr Vlt Kp0 is an additional gain added from field weakening frequency to zero frequency.

6-3 SPEED STEP REFERENCE

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
Freq Max	CAL	60 Hz
Freq Ramp Out	APB	
ProcessPITrimRef	APB	

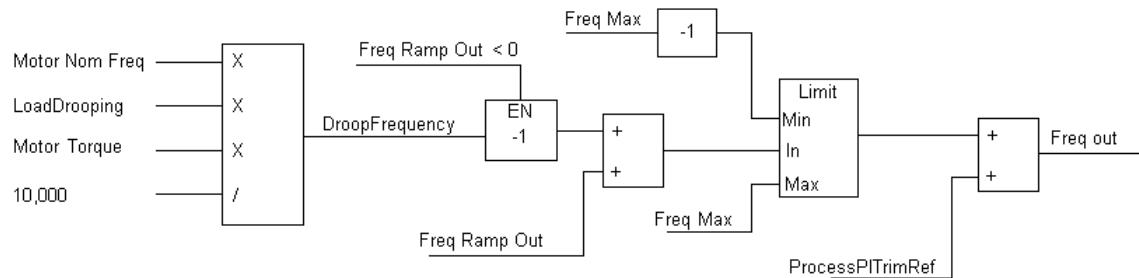
Description:

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.

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*.

6-3.2 OPEN LOOP STEP REFERENCE



Parameters	Type	Default
Motor Nom Freq	CAL	60.00 Hz
LoadDrooping	CAL	0
Motor Torque	APB	
DroopFrequency	APB	
Freq Ramp Out	APB	
Freq out	APB	
Freq Max	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:

LoadDroop = 5.00%

Motor Nom Freq = 60.00 Hz

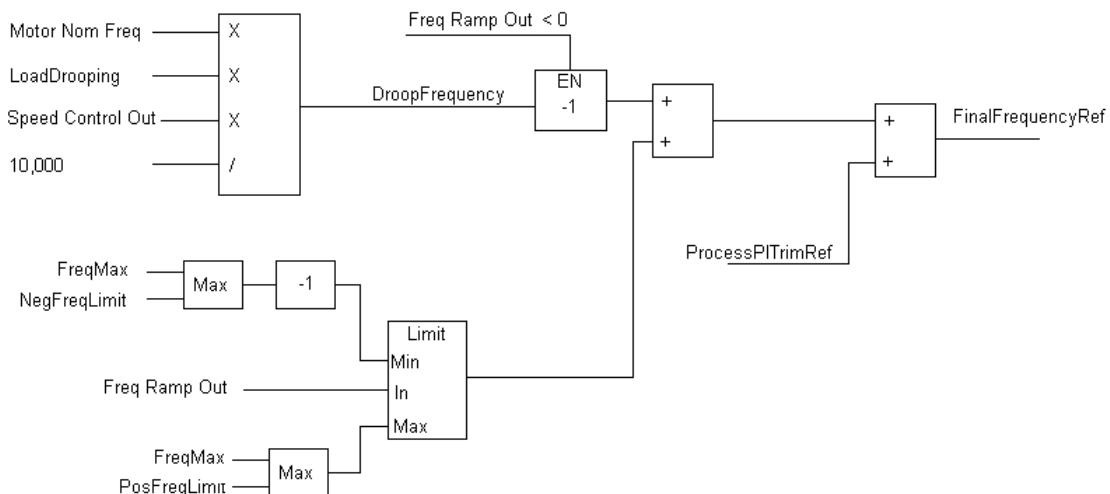
Motor Torque = 25.0%

DroopFrequency would be equal to 0.75 Hz.

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

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



Parameters	Type	Default
<i>Motor Nom Freq</i>	CAL	60.00 Hz
<i>Motor Torque</i>	APB	
<i>LoadDrooping</i>	CAL	0
<i>Speed Cntrll Out</i>	APB	
<i>DroopFrequency</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%

DroopFrequency would be equal to 0.75 Hz.

DroopFrequency 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.

DroopFrequency 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

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>Base Spd Lim</i>	CAL	100.0 %
<i>Trq Spd Lim</i>	APB	

Description:

When the current of the motor gets too high, the motor's top speed gets limited until the next time the run is enabled.

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

- Set *Max ESR Speed* to maximum desired percentage. Usually left equal to 100%.
- Set *Base Spd Lim* to the percentage of max speed at which base speed of the motor is rated.

Example: 1750 RPM nominal speed
 2500 RPM Maximum speed

$$\text{Base Spd Lim} = (1750 / 2500) \times 100\% \\ = 70\%$$

- Set *ESR Cur Lim* to the safe amount percent that the hoist can stop. If unsure keep at 100% motor current.
- Adjust *Mtr Cur TC* as follows:
 - If section is late in going into lower speed decrease time constant.
 - If current spikes cause erroneous low limits increase the time constant.

6-5 SPARE BLOCKS

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
Muldiv Block		
<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	
Add Block		
<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	
Sub Block		
<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>	APP	
Low Pass Block		
<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	
ABS Block		
<i>Sp ABS In</i>	ACFG	<i>Zero Analog</i>
<i>Sp ABS Out</i>	APB	
Sum Block		
<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	

Sel Block

<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	

Lim Block

<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	

WParam Block

<i>Sp_WPVal_Inp</i>	ACFG	<i>1200 = Zero_Analog</i>
<i>Sp_WPVal_ID</i>	CAL	0

WParam Block

<i>Sp_WPVal2_Inp</i>	ACFG	<i>1200 = Zero_Analog</i>
<i>Sp_WPVal2l_ID</i>	CAL	0

Description:

Each of these blocks are individual blocks as described in the block functional specification.

6-5.2 SPARE LOGIC BLOCKS

Parameters	Type	Default
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HL Comp Block

Parameters	Type	Default
<i>Sp HL Setpt</i>	ACFG	<i>Sp HL Stpt = 100.00</i>
<i>Sp HL High</i>	CAL	<i>Sp HL High = 90.00</i>
<i>Sp HL Low</i>	CAL	<i>Sp HL Low = 10.00</i>
<i>Sp HL Hyst</i>	CAL	<i>Sp HL Hyst = 1.00</i>
<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	

Comp Block

<i>Sp Cmp1 In</i>	ACFG	<i>Sp Cmp1 Stpt = 50.00</i>
<i>Sp Cmp1 Thres</i>	ACFG	<i>Sp Cmp1 Stpt = 50.00</i>
<i>Sp Cmp1 Hyst</i>	CAL	1.00
<i>Sp Cmp1 Out</i>	DPB	
<i>Sp Cmp1 Eq</i>	DPB	

Delay Block

<i>Sp Dly1 TON</i>	CAL	0.100 seconds
<i>Sp Dly1 TOFF</i>	CAL	0.100 seconds

Delay Block

<i>Sp Dly1 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Dly1 Out</i>	DPB	

<i>Sp Dly2 TON</i>	CAL	0.100 seconds
<i>Sp Dly2 TOFF</i>	CAL	0.100 seconds

Parameters	Type	Default
<i>Sp Dly2 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Dly2 Out</i>	DPB	

Latch Block

<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	

Latch Block

<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	

BInv Block

<i>Sp Inv1 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Inv1 Out</i>	DPB	

BInv Block

<i>Sp Inv2 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Inv2 Out</i>	DPB	

BInv Block

<i>Sp Inv3 In</i>	BCFG	<i>Zero Bit</i>
<i>Sp Inv3 Out</i>	DPB	

Or Block

<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	

Or Block

<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	

Or Block

<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	

And Block

<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	

And Block

<i>Sp And2 In1</i>	BCFG	<i>One Bit</i>
<i>Sp And2 In2</i>	BCFG	<i>One Bit</i>

Parameters	Type	Default
<i>Sp And2 Nin3</i>	BCFG	<i>Zero Bit</i>
<i>Sp And2 Out</i>	DPB	

And Block

<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

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

Parameters	Type	Default
<i>Trq Ref</i>	ACFG	<i>Trq Ref StA</i> = 0.0
<i>Control Place</i>	CAL	0
<i>Keypad Trq Ref</i>	APB	
<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 and can be viewed at *Keypad Trq Ref*.

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

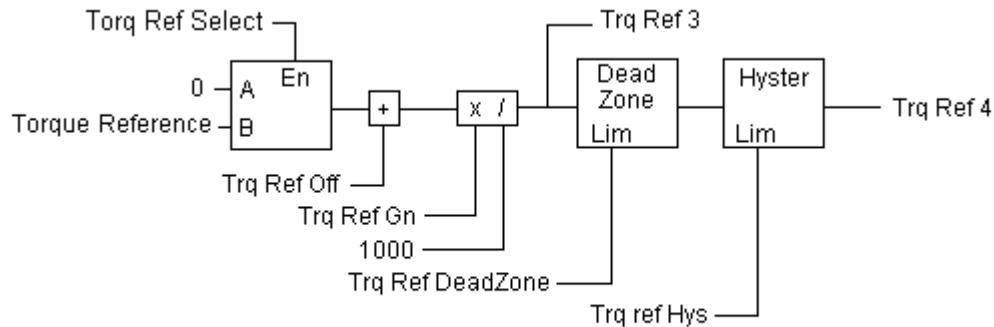
Parameters	Type	Default
<i>Trq Ref En</i>	BCFG	<i>Zero Bit</i>
<i>Trq No Ramp</i>	BCFG	<i>One Bit</i>
<i>Trq Rmp Rate</i>	CAL	5 % / second
<i>Trq_Ref_Min</i>	CAL	100.0%
<i>Trq Ref Max</i>	CAL	0%
<i>Torque Reference</i>	APB	

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	
<i>Trq Ref Gn</i>	CAL	1000
<i>Trq Ref Off</i>	CAL	0
<i>Trq Ref 3</i>	APB	
<i>Trq Ref DeadZone</i>	CAL	0
<i>Trq Ref Hyst</i>	CAL	0
<i>Trq Ref 4</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.

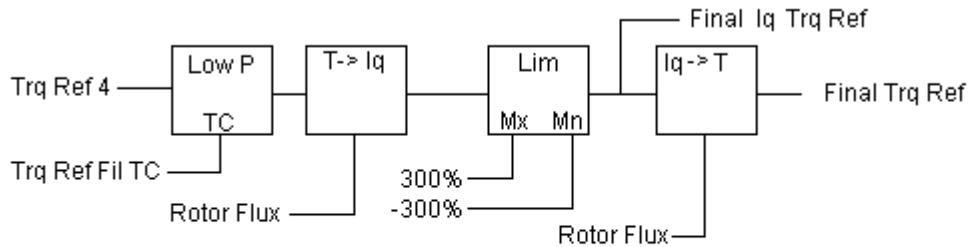
$$Trq\ Ref\ 3 = (Torque\ Reference + Trq\ Ref\ Off) \times Trq\ Ref\ Gn / 1000$$

The torque reference is forced to zero if it is less than +/- *Trq Ref DeadZone* in percent torque. This is used to ignore small values.

Trq ref Hys sets a limit around zero to which the setpoint will not be allowed to go. The polarity of the torque will depend on the polarity of the Torque command when it falls below this limit.

Trq Ref 4 is the value after the dead zone and hysteresis blocks.

7-1.4 TORQUE REFERENCE FIRMWARE, PART II



Parameters	Type	Default
<i>Trq Ref 4</i>	APB	
<i>Trq Ref Fil TC</i>	CAL	0 ms
<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*.

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

Open loop control is set by having *Motor Ctrl Mode* = 0 – 2.

- 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.

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

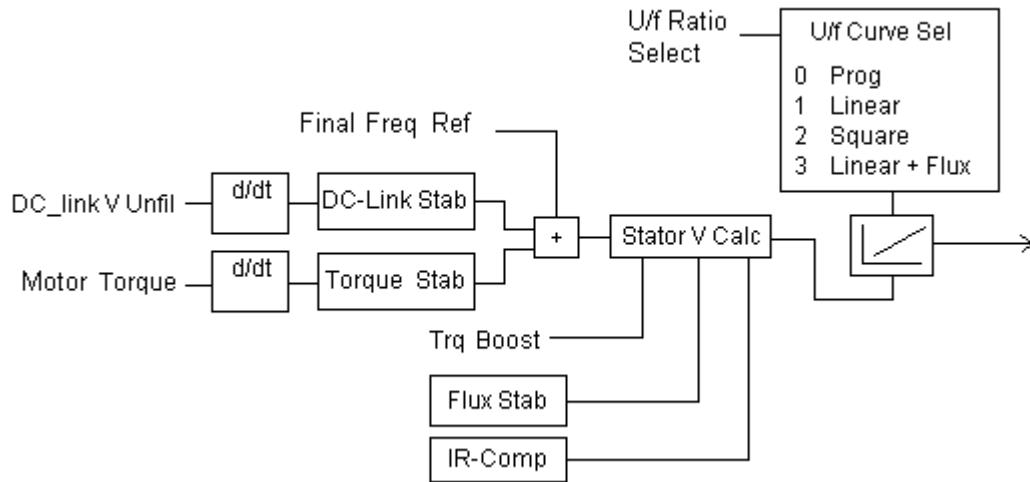
The Flux stabilizer purpose is to stabilize the magnetizing current. The error to the controller is from the difference between filtered and unfiltered magnetizing current. The filtered signal has a time constant of ldsFiltCoeff (in ms). The Flux stabilizer is a proportional-only controller with a gain 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>DC_link V Unfil</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	0 = Linear
<i>Zero Freq Voltg</i>	CAL	0
<i>Voltage at FWP</i>	CAL	100.00
<i>U/F Mid Voltg</i>	CAL	100.00

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:

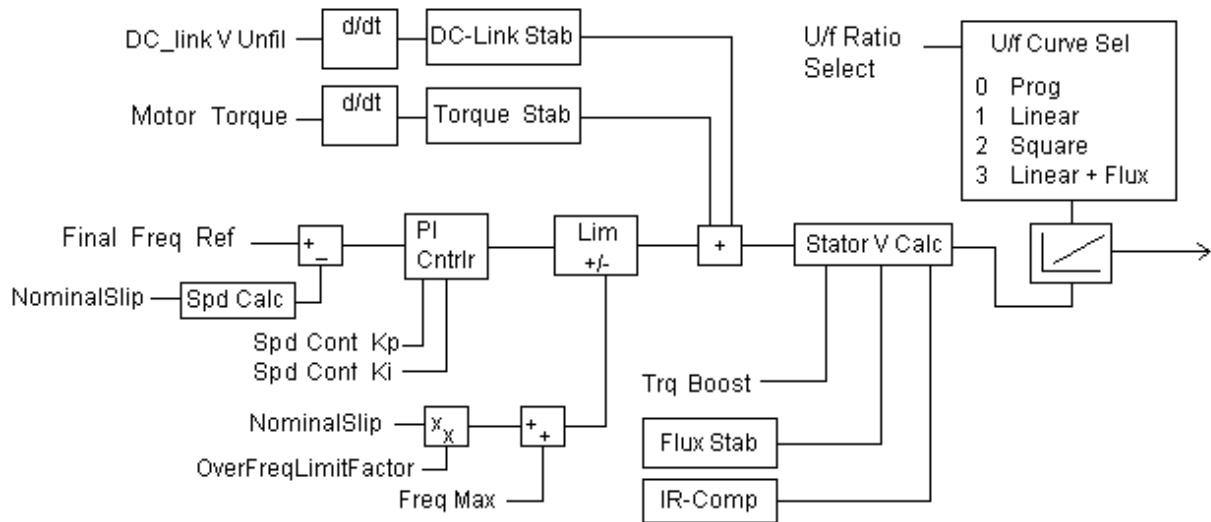
UFZeroPointVoltage

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>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.

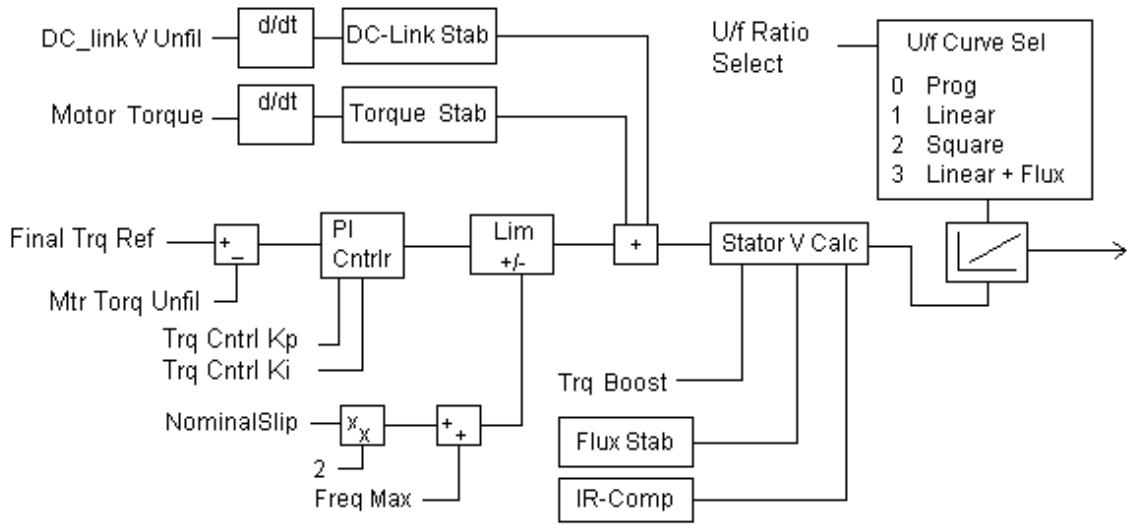
The motor speed feedback is calculated from the motor voltage and the estimated slip value (NominalSlip).

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>	CAL	0 = Open Loop Frequency mode
<i>Final TrqRef</i>	APB	
<i>OL TC Min Freq</i>	CAL	3.00 Hertz
<i>Mtr Torq Unfil</i>	APB	
<i>Trq Cntrl Kp</i>	CAL	150 Gain
<i>TrqCntrl Ki</i>	CAL	10 Gain
<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 controller and if the operating frequency is above the *Ol TC Min Freq* setting. The error from *Final Trq Ref* and *Mtr Torq Unfil* 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 *Freq Max* plus the value of *NominalSlip* x 2. This 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.

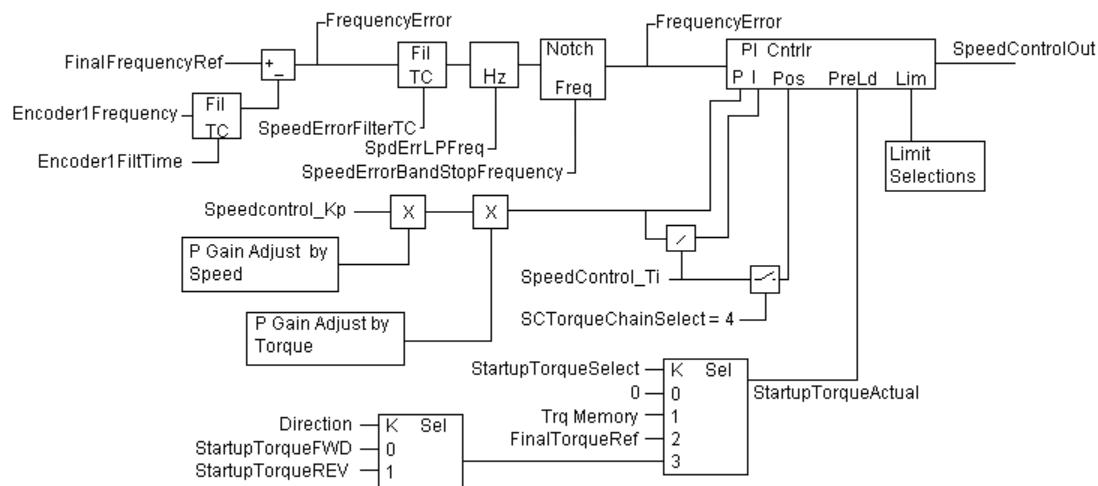
7-3 CLOSED LOOP CONTROL

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>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>Freq Error 1</i>	APB	
<i>Spd Cont Kp</i>	CAL	30 Gain
<i>Spd Cont Ki</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>Pos Iq Cur Lim</i>	APB	
<i>Neg Iq Cur Lim</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.

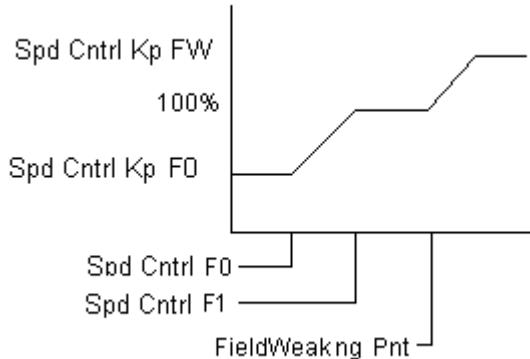
The error signal passes through two filters before going to the PI regulator. The first filter is a low pass filter with a time constant of *Spd Err Fil TC* and a cutoff frequency of *Spd Err LP Freq*. The second is a notch filter centered around *Spd Err Bnd Frq*. The error after filtering can be viewed by *Freq Err 1*.

Freq Err 1 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 *SpdCntrl Kp*. The standard integral component is a ratio of the *Spd Cntrl Kp / Spd Cntrl Ki*.

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.

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%

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

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*.

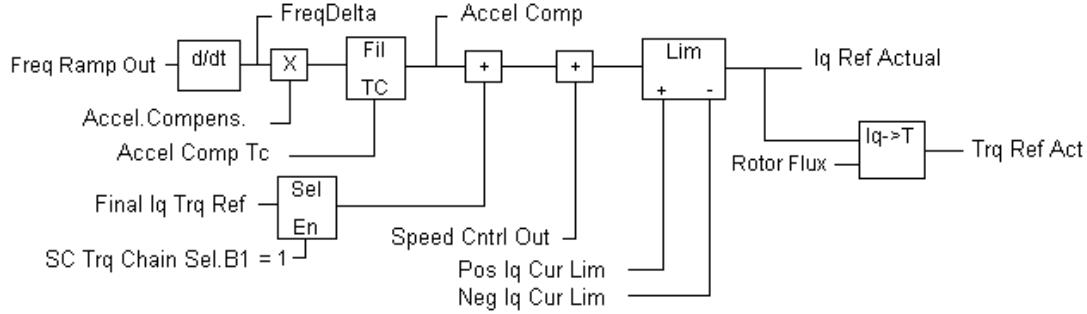
4. Quadrant #4: Forward Generating

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

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

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>Pos Iq Cur Lim</i>	APB	
<i>Neg Iq Cur Lim</i>	APB	
<i>Iq Ref Actual</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>TC 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 *TC 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) *TC Spd Lim Mode* = 0 = Maximum Limits. The section will be in torque control until motor speed exceeds either PosFreqMaxActual or NegFreqMaxActual.
- B) *TC 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) *TC 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) *TC 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) *TC 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) *TC 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) *TC 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 *TC 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.

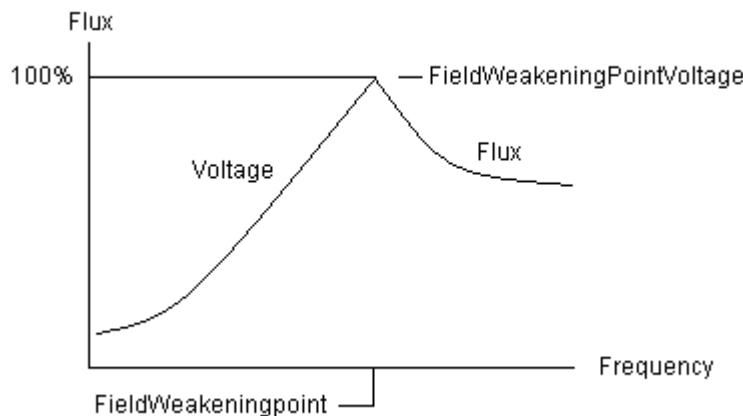
The speed reference ramp times are used when the limit ramping is enabled.

- 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

Parameters	Type	Default
<i>MagnCurrent</i>	CAL	Tune
<i>Motor Nom Currnt</i>	CAL	SetId
<i>Id Ref Actual</i>	APB	
<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>Stop 0 Spd Time</i>	CAL	100 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. *Id Ref Actual* is the final Id current reference.



Id Re Actual 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 *Strt 0 Spd Time*. 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

Parameters	Type	Default
<i>Slip Adjust</i>	CAL	100%
<i>Rotor TC</i>	APB	
<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. The final rotor time constant can be viewed at *Rotor TC*.

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

Parameters	Type	Default
<i>CurrentControlKp</i>	CAL	4000 Gain
<i>Curr Cntrl_Ti</i>	CAL	15 ms

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

Parameters	Type	Default
<i>Spd Fdbk</i>	ACFG	<i>Motor Speed</i>
<i>Spd Cmp Fil TC</i>	CAL	0.2 seconds
<i>Ovr Spd Inp</i>	ACFG	<i>Max Spd RPM</i> = 1800 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>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	

Spd Fdbk is defaulted to *Motor Speed*, but can be reconfigured to an encoder input or analog input. *Motor Speed* is scaled in motor RPM.

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

The speed comparator setpoints are a percentage of the value *Ovr Spd Inp*, which is defaulted to parameter *Max Spd RPM*.

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 *Spd Fdbk* 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 *Spd Fdbk* 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 KEYPAD FUNCTIONS

ButtonStatusWord returns the status of the buttons from the keypad. Most are directed straight to *ButtonControlWord* that performs the proper function. Two buttons are not used in the *ButtonControlWord*.

Button LocRem represents the lower left hand button on the keypad, which the drive uses for transferring between local and remote mode. This is a different function than the firmware default for this button.

Button Stop is also redirected. The reason is to disable it when not in the local mode and to create the stop fault when held for two seconds.

Logic for the transfer to local mode is also on this block diagram. The keypad message logic, to display the mode briefly, is on the second page.

Keypad Ref diagram has the keypad speed and torque reference control blocks. These blocks set up the editing speed and switching speeds for the two entries.

8-3 MOTOR CONTROL MODE

Mtr Ctlr Sw toggles between two motor control modes, *Motor Ctrl Mode* and *Motor Ctrl Mode2*. This can be used to run open loop on a encoder failure or to switch between speed and torque mode.

The MCStatus word comes from the firmware, which indicates the drives state. These states are used all through the application program and also put back into the *Status Word* value. *Status Word* is used for viewing and for several fieldbus message structures.

8-4 OVER WEIGHT ALARM

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 *OV WT Per* for *OV WT Tim* amount of seconds. *Ov Wt Alarm* is latched on until *Ov Wt Res ID* input goes low. This is defaulted to the second digital input which is usually setup for lower direction.

8-5 PARAMETER SETS

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.

8-6 LOAD FLOAT

Parameters	Type	Default
<i>Load Flt En</i>	BCFG	<i>Zero Bit</i>
<i>Load Flt Inp</i>	BCFG	<i>Zero Bit</i>
<i>Load Flt Cmd</i>	DPB	
<i>Load Flt Tim</i>	CAL	60 seconds
<i>Dis Load Flt 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>Load_Flt_OK</i>	DPB	

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

To enable the load float function, set *Load Flt En* = *One Bit* and set *Load Flt 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 Load Flt Tim* = *Zero Bit* and set *Load Flt 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.

SECTION IX

COMMUNICATIONS

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 to read and write bits to the drive. The low byte is for writing 8 bits to the drive. The upper byte is for reading 8 bits from the drive.

Write bits to the drive:

ID	Parameter Name	Bit Location
1621	<i>FB Fix Cntrl Wrd</i>	0-7
1040	<i>FB Bit00</i>	0
1041	<i>FB Bit01</i>	1
1042	<i>FB Bit02</i>	2
1043	<i>FB Bit03</i>	3
1044	<i>FB Bit04</i>	4
1045	<i>FB Bit05</i>	5
1046	<i>FB Bit06</i>	6
1047	<i>FB Bit07</i>	7

Write integer to the drive:

ID	Parameter Name
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 Fix Cntrl Wrd 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 for reading 8 bits from the drive.

Read bits from the drive:

ID	Parameter Name	Bit Location
1621	<i>FB Fix Cntrl Wrd</i>	8 – 15

Configuration Parameter	Bit Set
<i>FB_Bit08</i>	08
<i>FB_Bit09</i>	09
<i>FB_Bit10</i>	10
<i>FB_Bit11</i>	11
<i>FB_Bit12</i>	12
<i>FB_Bit13</i>	13
<i>FB_Bit14</i>	14
<i>FB_Bit15</i>	15

Read integer from the drive:

ID	Parameter Name	Configuration Parameter
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*.

9-3 FAULTS

- A) Slot Fault – *FB Fault Act* is set 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.
- 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*.

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.

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. *SBId* 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

Integer	Parameter name	Description
1	<i>SB Out Cnt1 Word</i>	Control Bits
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

Integer	Parameter name	Description
1	<i>SB In Cnt1 Word</i>	Control Bits
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*, which can be viewed at *MD_Watchdog*. 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

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.

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 Svtme is the

amount of time in which the drive senses the motor restart before determining to lock out the drive. Svtimer 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.

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	Overtension	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 resistor - 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
15	Motor Stall	Motor stall protection tripped. - Motor is binding - Not enough motor torque available. - Stall protection set too tight.	- Check to make sure motor is not binding. - Retune to get proper magnetizing current. - Check stall protection for proper setup. - Verify motor is getting current. - Replace motor - Replace inverter
16	Mot.Overtemp	Motor over heating detected by temperature model.	- Check for excessive motor loading - Check motor cooling - Check motor current to verify proper tuning.
17	MotorUnderld	Motor underload protection trip.	- Check process for load. - Check shafts and couplings - Check Under load parameters for proper setting.
22/23	Chksum Flt	EEProm has checksum fault.	- Verify parameters are set properly - Replace microprocessor board.
24	Changed data warning	Changes may have occurred during power interruption	- Check parameters against saved file - re-download parameters - Replace microprocessor board.
25	Micro Watchdog	Microprocessor timed out.	- Redownload the system and application software. - Replace microprocessor board.
29	Thermistor	Thermistor out of range.	- Replace thermistor
31	IGBT Temp	IGBT temperature exceeded its limit.	- Check ambient temperature - Check drive fan - Check for excessive build up of material on heat sink - Observe operation for high drive loading.
37	Device Change	Option board changed.	- Enter correct parameters for new option board. - Check I/O board seating - Replace option board.
38	Device Added	Option board or different drive size changed.	- Enter correct parameters for new hardware. - Check I/O board seating. - Check microprocessor board connection. - Replace drive
39	Device Removed	Option board or drive removed from microprocessor.	- Check I/O board seating - Check microprocessor board connection. Replace drive.
40	Device Unknown	Unknown option board added to the drive.	- Check I/O board seating - Replace I/O board
41	IGBT Temp	Same as fault 31	Same as fault 31
50	Anlg In Flt	Analog input is below its low limit.	- Check signal source - Check connections - Verify correct option board and jumpers. - Replace option board
51	Ext Fault	User configured PB_Ext_Fault_Inp is high.	- Determine external fault reason - Verify proper external fault setup
52	Keypad Comm	Connection between keypad and drive is broken.	- Verify keypad cable connections or proper seating of keypad - Replace keypad - Replace microprocessor board.
53	FBCommunicat	Field bus fault fro D_FB_Fault bit. Bit is set when board failure is noted	- Check fieldbus board seating. - Replace fieldbus board

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"> - Check board seating in slots C-E. - Replace option boards - Replace microprocessor board
56	PT100 Temp	PT100 exceeds either the temperature warning or fault limit	<ul style="list-style-type: none"> - Check device for over heating. - Check PT100 device - Check for proper temperature probe connections. - Check for proper limits - Replace PT100 option board
57	Identification	Identification is completed	<ul style="list-style-type: none"> - Verify Identification parameter is set to a value other than 0.
60	Com Watchdog	Communication watchdog bit is not toggling	<ul style="list-style-type: none"> - Verify communications is working. - Verify watchdog bit is being toggled by host device.
61	User Fault 1	PB_User_Flt_1 is configured to a value that is High.	<ul style="list-style-type: none"> - Check configuration for function.
62	User Fault 2	PB_User_Flt_2 is configured to a value that is High.	<ul style="list-style-type: none"> - Check configuration for function.
63	User Fault 3	PB_User_Flt_3 is configured to a value that is High.	<ul style="list-style-type: none"> - Check configuration for function.
64	User Fault 4	PB_User_Flt_4 is configured to a value that is High.	<ul style="list-style-type: none"> - Check configuration for function.
65	Overspeed Flt	Drive tripped out on overspeed.	<ul style="list-style-type: none"> - Check for sudden loss of load. - verify proper speed feedback device and scaling. - Check overspeed setup
66	SB Comm Fault	System bus watchdog trip or board failure.	<ul style="list-style-type: none"> - Verify all drives on the system bus is up and running. - Verify system bus cabling. - Replace system bus cabling - Replace system bus board.
70	Torque prv	Torque was not achieved during torque proving.	<ul style="list-style-type: none"> - Check contactor - Check motor connections - Check configuration - Replace drive
71	Brake Open	Brake has been commanded open and the aux brake contact has not been sensed.	<ul style="list-style-type: none"> - Check brake logic - Check brake aux logic - Check brake - Check configuration - Check digital input
72	Brake Slip	Speed feedback detected during torque proving	<ul style="list-style-type: none"> - Check brakes for proper holding - Verify actual brake movement. - Check speed feedback device.
74	Load Float	Load float commanded time out	<ul style="list-style-type: none"> - Operator using load float too long - Check load float input - Adjust timing
75	Spd Err Flt	Large speed error for period of time.	<ul style="list-style-type: none"> - Check for overload on hoist - Check for brakes releasing - Check for mechanical binding - Check Encoder feedback - Verify ramp rates not too fast - Check motor

Fault Code	Fault Text	Possible Cause	Solution
76	Run Off Flt	Brakes have not set soon enough after runs removed	- Check for overload. - Check encoder feedback - Check motor tuning - Check motor
77	Dir Fault	Both directions selected at same time	- Check operator controls - Check configuration
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

110-6 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	Fault	Normal Stop
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
15	Motor Stall	<i>Stall Protection</i>	<i>Stall Protection</i>
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	<i>Ext Fault Resp</i>	<i>Ext Fault Resp</i>
52	Keypad Comm	Fault	Normal Stop
53	FBCommunicat	<i>FBComm.FaultResp</i>	<i>FBComm.FaultResp</i>

Fault Code	Fault Text	Fault Mode	Stop Mode
54	Slot Communic	<i>SPI Flt Resp</i>	<i>SPI Flt Resp</i>
56	PT100 Temp	<i>PT100 FaultRespo</i>	<i>PT100 FaultRespo</i>
57	Identification	Warning	Coast Stop
60	Com Watchdog	<i>WD Flt Response</i>	<i>WD Flt Response</i>
61	User Fault 1	<i>User Flt1 Resp</i>	<i>User Flt1 Resp</i>
62	User Fault 2	<i>User Flt2 Resp</i>	<i>User Flt2 Resp</i>
63	User Fault 3	<i>User Flt3 Resp</i>	<i>User Flt3 Resp</i>
64	User Fault 4	<i>User Flt4 Resp</i>	<i>User Flt4 Resp</i>
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 Opn Resp</i>	<i>Brk Opn Resp</i>
72	Brake Slip	<i>Brk Slp Resp</i>	<i>Brk Slp Resp</i>
74	Load Float	<i>Ld Flt Resp</i>	<i>Ld 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 CRANE-SPECIFIC FAULTS SETUP

10-7.1 TORQUE PROVING FAULT

Parameters	Type	Default
<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

Trq Prv Flt Bit goes high if torque proving has not been met after *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.

10-7.2 BRAKE OPEN FAULT

Parameters	Type	Default
<i>Rel Brakes</i>	DPB	
<i>Brk Opn Sw</i>	BCFG	<i>Zero Bit</i>
<i>Brk Opn FTim</i>	CAL	200 ms.
<i>M1 Brk Opn Flt</i>	DPB	
<i>Brk_Opn_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 Open FTim* amount of time.

Brk Open Resp determines the action. Default is for the drive is no action.

10-7.3 BRAKE SLIP FAULT

Parameters	Type	Default
<i>RunRequest</i>	DPB	
<i>Abv Brk Slp Spd</i>	DPB	
<i>Trq Prv By</i>	BCFG	One Bit
<i>Trq Prv Cmd</i>	DPB	
<i>Brk Slp TFlt</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 *Brk Slp TFlt* will go high.

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

10-7.4 LOAD FLOAT FAULT

Parameters	Type	Default
<i>Load Flt OK</i>	DPB	
<i>Ld_Flt_Resp</i>	E	Warning

If load float is active for too long *Load Flt OK* will go low causing a warning or fault. See section 8-8 for load float setup and operation.

Ld Flt Resp determines the action. Default is for the drive to post a warning.

10-7.5 SPEED ERROR FAULT

Parameters	Type	Default
<i>Freq Error</i>	APB	
<i>Spd Err Fil</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>MC Fault</i>	DPB	
<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

Parameters	Type	Default
<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

Parameters	Type	Default
<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

Parameters	Type	Default
<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

Parameters	Type	Default
<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.

Slck 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.

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.

WARNING

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 System Menu/Security. Setting this to **Yes** will enable the wizard on the next powerup of the drive.

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

Parameter	Default	Description
Language	English	Changes certain parameter names
Application	Spd/Ten	Application program
<i>Min Frequency</i>	0 Hz	Set to the minimum running motor 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>Motor Nom Voltg</i>	460 V	Motor nominal voltage
<i>Motor Nom Freq</i>	60 Hz	Motor base running frequency
<i>Motor Nom Speed</i>	1750 rpm	Motor base running speed in RPM
<i>Motor Nom Currnt</i>	Varies by drive size	Motor 100% running current
<i>Motor Cos Phi</i>	0.85	Power factor value of drive

After completing the entry, the option is given to repeat the wizard in case a variable was missed. After accepting the wizard, it will be disabled.

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
- IdentMakeFluxTime = Time constant found during self tune
- IdentMakeFluxVoltage = 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

APPENDIX A

CONTROL BLOCK DIAGRAMS

Accel500 Crane Application Software control block diagrams are available upon request. Please contact the Avtron Customer Help Desk for assistance.

Phone: (216) 642-1230 ext. 1369

FAX: (216) 642-6037

APPENDIX B

PARAMETER LIST

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1	Monitor					Menu Name
1.1	Multimonitor					Menu Name
1.2	Appl Digital					Menu Name
1.2.1	Drive OK	1088	0	1		Drive is not faulted
1.2.2	Cntrl Inhib	1099	0	1		Inverse of MC_Run. Used to reset loops when drive is off.
1.2.3	MC Run	1098	0	1		Drive is running. Bit from status word from firmware.
1.2.4	MC Ready	1115	0	1		Drive is ready to run status from firmware
1.2.5	MC Fault	1116	0	1		Drive is in a fault condition.
1.2.6	MC Reverse	1086	0	1		Status from firmware on direction
1.2.7	MC AtSpeed	1118	0	1		Drive is done ramping to its speed setpoint. From firmware.
1.2.8	MC Warning	1117	0	1		Drive is in a warning state. Bit from status word from firmware
1.2.9	Run OK	1091	0	1		All the interlocks are met to enable a run command.
1.2.10	Run Enable	1096	0	1		Run is commanded and interlocks OK.
1.2.11	Run Fwd Cmd	1147	0	1		Run forward is commanded.
1.2.12	Run Rev Cmd	1148	0	1		Run reverse has been commanded.
1.2.13	Start Input	1089	0	1		Run jog or thread is requested.
1.2.14	MC Out	1106	0	1		Motor contactor out command. MC_run or brake pedal active and OK.
1.2.15	EndSt Perm	1135	0	1		Prevents crane movement when end stop is hit until crane comes to a stop and no command.
1.2.16	Reverse	1128	0	1		Reverse commanded by remote, keypad or computer.
1.2.17	RunRequest	1090	0	1		Run request: 0=no, 1=yes
1.2.18	Run Cmd Inp	1110	0	1		Run forward or reverse commanded.
1.2.19	Ramp Hold	1143	0	1		Ramp hold during infinite variable speed operation.
1.2.20	PC Control	1121	0	1		Control has been transferred to the PC.
1.2.21	SC Start	1122	0	1		PC control run commanded
1.2.22	SC Reverse	1123	0	1		PC reverse command
1.2.23	Load Flt OK	1139	0	1		Load float has not timed out
1.2.24	Joyst Inp Neg	1137	0	1		Analog input reference is negative.
1.2.25	Slow Down Cmd	1149	0	1		In slow down condition.
1.2.26	Load Flt Cmd	1138	0	1		Load float commanded and OK
1.2.27	Brk Hld Bit	1133	0	1		Holds in the brake until runs removed and below brake open speed.
1.2.28	Blw Brk Spd	1131	0	1		Below the brake holding speed
1.2.29	Rel Brakes	1144	0	1		OK to release the brakes.
1.2.30	Rel M1 Brake	1145	0	1		OK to release the first mode's brake
1.2.31	Rel Ramp	1109	0	1		Run request and brakes are released. Ready to start ramping motor.
1.2.32	Brk Pdl Act	1107	0	1		Brake pedal enabled and selected. Coast drive and hold brakes open.
1.2.33	Brk Slp Warn	1105	0	1		Brake slip warning output. High for only 60 seconds after brake slip detected for a horn.
1.2.34	Brk Slip Mode	1104	0	1		Brake slip detected and mode will stay high until brakes are tested again.
1.2.35	Brk Slp Low	1103	0	1		Brake slip detected and lower only action is selected. Reset on next brake set check OK.
1.2.36	Brk Slp Slw	1102	0	1		Brake slip detected and slow only action selected. Reset on next brake check OK.
1.2.37	Trq Prv Cmd	1170	0	1		Torque prove has passed or disabled. OK to release brakes.
1.2.38	Trq Mode Sw	1111	0	1		Selects different motor mode during torque proving
1.2.39	In Anti Snatch	1108	0	1		In anti-snatch acceleration mode.
1.2.40	Local Stop Flt	1112	0	1		Local stop button pressed for three seconds which will fault the drive on a stop fault.
1.2.41	Trq Prv Flt Bit	0	0	1		Torque prove timeout fault bit.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.2.42	Brk Slp TFlt	1134	0	1		Brake slip detected during torque proving.
1.2.43	M1 Brk Opn Flt	1141	0	1		First brake open failed if feedback is available.
1.2.44	Over Speed	0	0	1		In over speed condition.
1.2.45	Abv Base Spd	1129	0	1		Above base speed setpoint.
1.2.46	Abv Brk Slp Spd	1130	0	1		Speed above the brake slip setpoint for brake slip fault.
1.2.47	Over Temp Warn	1114	0	1		Unit above 85 C. 90 C will trip unit
1.2.48	Therm Fault Act	1119	0	1		Thermister fault from inverter.
1.2.49	Therm Warn Act	1120	0	1		Inverter thermister warning
1.2.50	SC Comm Fault	0	0	1		PC communication fault
1.2.51	Panel Fault ACT	0	0	1		Panel fault detected
1.2.52	C1 Overflow	1124	0	1		First encoder counter is in overflow condition
1.2.53	UV Fault	0	0	1		Under voltage fault detected.
1.2.54	UV Warn	0	0	1		Under voltage warning detected.
1.2.55	OC Fault	0	0	1		Over current fault detected.
1.2.56	OC Warn	0	0	1		Over current warning detected.
1.2.57	OV Fault	0	0	1		Over voltage fault detected.
1.2.58	OV Warn	0	0	1		Over voltage warning detected.
1.2.59	IGBT Temp Fault	0	0	1		IGBT temperature fault has been detected.
1.2.60	Ext Fault	0	0	1		External fault detected. See Ext Fault Response for action.
1.2.61	Ext Warn	0	0	1		External warning detected. See Ext Fault Response for action.
1.2.62	Mtr OT Fault	0	0	1		Motor Over temperature fault
1.2.63	Mtr OT Warn	0	0	1		Motor Over temperature warning
1.2.64	Ident Warn	0	0	1		Warning has occurred during identification
1.2.65	FB Fault Act	0	0	1		Field Bus fault active
1.2.66	SPI Fault Act	0	0	1		SPI bus fault active.
1.2.67	Sp HL Max	1563	0	1		Spare High/Low comparitor above its max setpoint.
1.2.68	Sp HL Min	1564	0	1		Spare High/Low comparitor below its min setpoint.
1.2.69	Sp Cmp1 Eq	1152	0	1		First spare comparitor input and threshold difference is within the hysteresis value.
1.2.70	Sp Cmp1 Out	1153	0	1		First spare comparitor input is greater than the threshold plus/minus the hysteresis value.
1.2.71	Sp Dly1 Out	1156	0	1		First spare delay block output bit.
1.2.72	Sp Dly2 Out	1157	0	1		Second spare delay block output bit.
1.2.73	Sp Ltch1 Out	1158	0	1		First spare latch block output.
1.2.74	Sp Ltch2 Out	1159	0	1		Second spare latch block output.
1.2.75	Sp Inv1 Out	1161	0	1		First spare bit invert output.
1.2.76	Sp Inv2 Out	1162	0	1		Second spare bit invert output.
1.2.77	Sp Inv3 Out	1163	0	1		Third spare bit invert output.
1.2.78	Sp And1 Out	1164	0	1		First spare and output.
1.2.79	Sp And2 Out	1165	0	1		Second spare and output.
1.2.80	Sp And3 Out	1166	0	1		Third spare and output.
1.2.81	Sp Or1 Out	1167	0	1		First spare or output.
1.2.82	Sp Or2 Out	1168	0	1		Second spare or output.
1.2.83	Sp Or3 Out	1169	0	1		Third spare or output.
1.2.84	At Zero Spd	1127	0	1		Speed feedback is near zero speed.
1.2.85	WD Trip	0	0	1		Communications watch dog timer is in fault condition.
1.2.86	Ov Wt Alarm	1140	0	1		Over weight warning
1.3	Appl Analog					Menu Name
1.3.1	Motor Speed	2	-100.00	100.00		[R] Motor speed in rpm
1.3.2	Abs Mtr Spd	1501	-327.67	327.67		Absolute value of MotorSpeed.
1.3.3	Motor Current	3	0.00	MotorCurrent Max		Motor current. = MotorCurrent/current scale = Amps
1.3.4	Mtr Fil IA Fil	1524	0.00	327.67		Filtered motor current in percent of nominal.
1.3.5	Mtr Cur Unfil	1113	0.00	MotorCurrent Max		Filtered motor current. motorcurrent/currentscale = amps
1.3.6	Motor Torque	4	-300.0	300.0		[R] Motor torque as % value, +1000 equals +100.0 %//pos=clockwise, neg=counterclockwise
1.3.7	Fil Mtr Trq	1502	-300.0	300.0		Filtered motor torque in percent of motor.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.3.8	Motor Power	5	-300.0	300.0		Motor shaft power filtered. 1000 = 100%
1.3.9	Motor Voltage	6	0.0	1000.0		[R] Motor voltage in 0.1 Volts, e.g. 100 equals to 10.0V
1.3.10	DCVoltage	7	0	1000		DC voltage in Volts with 32 ms time constant.
1.3.11	DC_Link V Unfil	44	0	1000		Unfiltered DC voltage in Volts.
1.3.12	Rotor Flux	1541	-300.0	300.0		Estimated rotor flux, 1000 = nominal
1.3.13	Final Trq Ref	1542	-300.0	300.0		Final, limited torque reference for speed/torque controller
1.3.14	Pos Iq Cur Lim	1543	0.0	300.0		Final upper IqCurrentLimit 1000 = motor nominal current (unsigned)
1.3.15	Neg Iq Cur Lim	1544	0.0	300.0		Final lower IqCurrentLimit 1000 = motor nominal current (unsigned)
1.3.16	Iq Ref Actual	1545	-100.0	100.0		Final IqReference, 1000 = motor nominal current
1.3.17	Id Ref Actual	1546	0.0	300.0		Final IdReference 1000 = motor nominal current
1.3.18	Rotor TC	1547	0	32000		Used RotorTimeConstant in ms
1.3.19	MtrCalcTemp	9	0.0	1000.0		Calculated motor temperature. 1000 = 100%
1.3.20	Unit Temperature	8	-50	300		Drive temperature in degrees C
1.3.21	Control Place	1505	1	3		Location of reference. 0 = remote, 1 = keypad, 2 = computer
1.3.22	SC Control Word	0	0	32000		SCI Control word bits B0-B15//B0 - RunRequest, 0=stop, 1=run//B1 - DirRequest, 0=clockwise, 1=counter-clockwise//B2 - FaultReset, 1=reset//B3 - GenSwitch1, application dependent //B4 - DO1, control of digital input 1, 1=active//B5 - DO2, control of d
1.3.23	Mtr Torq Unfil	1125	-300.0	300.0		Unfiltered motor torque. 1000 = 100%, pos = motor, Neg = regen
1.3.24	Anlg Ref	0	-320.00	320.00		Joystick reference value.
1.3.25	Anlg Ref2	0	-320.00	320.00		Joystick reference after curve shaping and slow down multipliers.
1.3.26	Abs Per Spd	1512	-320.00	320.00		Final speed reference from digital or analog source.
1.3.27	Freq Stpt	1503	-327.67	327.67		Speed reference after scaling to motor frequency.
1.3.28	Trq Spd Lim	1507	-320.00	320.00		Over torque speed limit.
1.3.29	Sref Limit	1506	-320.00	320.00		Final speed reference limit
1.3.30	Speed Cntrl Out	1548	-327.67	327.67		TorqueReference from Speed controller output
1.3.31	DroopFrequency	1549	-327.67	327.67		Droop Frequency subtracted off of speed reference
1.3.32	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
1.3.33	Freq Ref 3	0	-327.67	327.67		Frequency reference after interpolator and limiter (next FreqRefActual)
1.3.34	Freq Ref Act	1571	-327.67	327.67		Frequency reference in use selected with FreqRefSelect//and adjusted with SpeedShare,FreqRefAdd,FreqRefInterpolatorTC,FreqRefFilterTC (in FreqScale)
1.3.35	Final Freq Ref	1540	-320.00	320.00		Final shaft frequency reference for speed controller in FreqScale
1.3.36	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
1.3.37	Freq Error	0	-327.67	327.67		Frequency Error
1.3.38	Freq Error 1	1569	-327.67	327.67		Filtered Frequency Error
1.3.39	Acceleration Tim	0	0.1	3000.0		Acceleration time in RampTimeScale, Acceleration=FreqRamp[Hz]/AccelerationTime[s]
1.3.40	DecelerationTime	0	0.1	3000.0		Deceleration time in RampTimeScale, Deceleration=FreqRamp[Hz]/DecelerationTime[s]
1.3.41	Freq Delta	1508	-300.00	300.00		Acceleration in FreqScale/s
1.3.42	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.
1.3.43	Brake Chopper	1509	0	1		0 = no brake chopper,1 = brake chopper is installed
1.3.44	Est DC Nom V	1567	0	2000		Estimated nominal DC voltage in volts
1.3.45	BrakeResistor	1511	0	1		1 = no brake resistor,1 = brake resistor is installed
1.3.46	ProcessPITrimRef	1521	-327.67	327.67		Process PI Trim Frequency reference (in FreqScale)
1.3.47	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.
1.3.48	MotorCurLimit	1526	0.00	MotorCurrent Max		Motor current limit, I[A] = MotorCurrentLimit/CurrentScale//Range[1...65535]//if CurrentScale=10 then 100 equals 10.0 A
1.3.49	SC Spd Ref	1527	-327.67	327.67		PC speed reference
1.3.50	Sp MD1 Out	1553	-327.67	327.67		First spare MULDIV output
1.3.51	Sp Add1 Out	1555	-327.67	327.67		Spare Add block output
1.3.52	Sp Sub1 Out	1565	-327.67	327.67		Spare sub block output.
1.3.53	Sp LP Fil Out	1557	-327.67	327.67		Output of spare low pass filter
1.3.54	Sp ABS Out	1558	0.00	327.67		Spare ABS block output

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.3.55	Sp Sum1 Out	1559	-327.67	327.67		Sp sum block output
1.3.56	Sp Sel1 Out	1561	-327.67	327.67		First spare select block output.
1.3.57	Sp Lim Out	1574	-327.67	327.67		Spare limit value output
1.3.58	Torque Reference	18	-30.00	30.00		Torque reference 3000 = 300%
1.3.59	Status Word	43	0	65536		Factory use.
1.3.60	Active Flt Last	37	0	2000		[R] Last active fault code.
1.3.61	Mtr Cur ID	45	0.0	MotorCurrent Max		Motor current from the Identification
1.3.62	Accel Comp	1566	-500.0	500.0		AccelCompensation IqReference, 1000 = motor nominal current
1.3.63	Trq Ref Act	1536	-500.0	500.0		Adjusted TorqueReference (-3000...3000) = -300...300%
1.3.64	Trq Ref 4	1538	-300.0	300.0		Torque reference After scaling and hysteresis and dead zone
1.3.65	Final Iq Trq Ref	1539	-300.0	300.0		Final, limited Iq reference for speed/torque controller
1.3.66	TC Pos Freq Lim	1572	-320.00	320.00		Upper frequency limit in Torque Control (signed)
1.3.67	TC Neg Freq Lim	1573	-320.00	320.00		Lower frequency limit in Torque Control (signed)
1.3.68	Current Scale	0	0	100		Current Scale (1 or 10)::// 1: [I[A] = "CurrentVariable"]// 10: [I[A] = "CurrentVariable"]/10//Depends on UnitSizeIndex
1.4	Digital 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		Eight 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.
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	DIN123 Status	15	0	7		Digital Inputs 1, 2 and 3 Status (sum)
1.4.17	DIN456 Status	16	0	7		Digital Inputs 4, 5 and 6 Status (sum)
1.4.18	Not DIN 1	1021	0	1		Inverse of digital input 1
1.4.19	Not DIN 2	1022	0	1		Inverse of digital input 2
1.4.20	Not DIN 3	1023	0	1		Inverse of digital input 3
1.4.21	Not DIN 4	1024	0	1		Inverse of digital input 4
1.4.22	Not DIN 5	1025	0	1		Inverse of digital input 5
1.4.23	Not DIN 6	1026	0	1		Inverse of digital input 6
1.4.24	Not DIN 7	1027	0	1		Inverse of digital input 7
1.4.25	Not DIN 8	1028	0	1		Inverse of digital input 8
1.5	Analog IO					Menu Name
1.5.1	AI 1	0	-100.00	100.00		Analog in 1 before scaling and filter
1.5.2	AI1 Type	0	0	5		First analog input type
1.5.3	AI 2	0	-100.00	100.00		Analog in 2 before scaling and filter
1.5.4	AI2 Type	0	0	5		Second analog input type
1.5.5	AI 3	0	-100.00	100.00		Analog in 3 before scaling and filter
1.5.6	AI3 Type	0	0	5		Three analog input type
1.5.7	AI 4	0	-100.00	100.00		Analog in 4 before scaling and filter

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.5.8	AI4 Type	0	0	5		Fourth analog input type
1.5.9	AIN1	1601	-327.67	327.67		First analog input after scaling and filtering
1.5.10	AIN2	1602	-327.67	327.67		Second analog input after scaling and filtering
1.5.11	AIN3	1603	-327.67	327.67		Third analog input after scaling and filtering
1.5.12	AIN4	1604	-327.67	327.67		Fourth analog input after scaling and filtering
1.5.13	AIN1 Fault	0	0	1		Fault if 4-20ma or 2-10 volt is below min limit
1.5.14	AIN2 Fault	0	0	1		Fault if 4-20ma or 2-10 volt is below min limit
1.5.15	AIN3 Fault	0	0	1		Fault if 4-20ma or 2-10 volt is below min limit
1.5.16	AIN4 Fault	0	0	1		Fault if 4-20ma or 2-10 volt is below min limit
1.5.17	AOUT1 Val	1590	-327.67	327.67		Value of first analog out. +/- 10,000 to full scale
1.5.18	AOUT2 Val	1591	-327.67	327.67		Value of second analog out. +/- 10,000 to full scale
1.5.19	Enc1_Out	1609	-327.67	327.67		First encoder input after scaling and low pass filter
1.5.20	C1_1	0	0	65535		High byte of raw motor turns for first counter
1.5.21	C1_2	0	0	65535		Low byte of raw motor turns for first counter
1.5.22	C1_3	0	0	65535		Fractional raw motor turns for first counter
1.5.23	Counter1	1528	-32767	32767		First encoder counter output after scaling
1.6	FB I/O					Menu Name
1.6.1	Digital Inputs					Menu Name
1.6.1.1	FB Bit00	1040	0	1		Bit 0 data from the field bus FBFixedControlWord.
1.6.1.2	FB Bit01	1041	0	1		Bit 1 data from the field bus FBFixedControlWord.
1.6.1.3	FB Bit02	1042	0	1		Bit 2 data from the field bus FBFixedControlWord.
1.6.1.4	FB Bit03	1043	0	1		Bit 3 data from the field bus FBFixedControlWord.
1.6.1.5	FB Bit04	1044	0	1		Bit 4 data from the field bus FBFixedControlWord.
1.6.1.6	FB Bit05	1045	0	1		Bit 5 data from the field bus FBFixedControlWord.
1.6.1.7	FB Bit06	1046	0	1		Bit 6 data from the field bus FBFixedControlWord.
1.6.1.8	FB Bit07	1047	0	1		Bit 7 data from the field bus FBFixedControlWord.
1.6.1.9	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
1.6.2	Analog Inputs					Menu Name
1.6.2.1	A_FB_AIN1	1611	-327.67	327.67		First int in from field bus
1.6.2.2	A_FB_AIN2	1612	-327.67	327.67		Second int input from field bus
1.6.2.3	A_FB_AIN3	1613	-327.67	327.67		Third int input from field bus
1.6.2.4	A_FB_AIN4	1614	-327.67	327.67		Fourth int input from field bus
1.6.2.5	A_FB_AIN5	1615	-327.67	327.67		Fifth int input from field bus
1.6.2.6	A_FB_AIN6	1616	-327.67	327.67		Sixth int input from field bus
1.6.2.7	A_FB_AIN7	1617	-327.67	327.67		Seventh int input from field bus
1.6.2.8	A_FB_AIN8	1618	-327.67	327.67		Eighth int input from field bus
1.6.2.9	A_FB_AIN9	1619	-327.67	327.67		Ninth int input from field bus
1.6.2.10	A_FB_AIN10	1620	-327.67	327.67		Tenth int input from field bus
1.6.2.11	FB Spd Ref	1632	-327.67	327.67		Speed reference from filed bus. Enter RPM gets converted to percentage.//Typically this value is in percent of the frequency area between the set minimum and maximum frequency.
1.6.3	Analog Outputs					Menu Name
1.6.3.1	FB Data Out 1	1622	-32767	32767		Application Specific process data
1.6.3.2	FB Data Out 2	1623	-32767	32767		Application Specific process dataApplication Specific process data
1.6.3.3	FB Data Out 3	1624	-32767	32767		Application Specific process dataApplication Specific process dataApplication Specific process data
1.6.3.4	FB Data Out 4	1625	-32767	32767		Application Specific process dataApplication Specific process dataApplication Specific process dataApplication Specific process data
1.6.3.5	FB Data Out 5	1626	-32767	32767		Application Specific process dataApplication Specific process dataApplication Specific process dataApplication Specific process data
1.6.3.6	FB Data Out 6	1627	-32767	32767		Application Specific process dataApplication Specific process dataApplication Specific process dataApplication Specific process data

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
1.6.3.7	FB Data Out 7	1628	-32767	32767		Application Specific process dataApplication Specific process data
1.6.3.8	FB Data Out 8	1629	-32767	32767		Application Specific process dataApplication Specific process data
1.7	SB Data					Menu Name
1.7.1	SB WD Pulse	0	0	1		Toggles every 100 ms. Used to tell slaves that the master is still communicating over the system bus.
1.7.2	MD WD OK	1172	0	1		Master sections Watchdog is OK.
1.7.3	SB In Cntl Word	1530	0	32767		System bus control word from the master section.
1.7.4	SB In Freq Ref	1531	-327.67	327.67		System Bus frequency reference from the master.
1.7.5	SB In Int1	1532	-327.67	327.67		System bus first configurable integer input from master section.
1.7.6	SB In Int2	1533	-327.67	327.67		System bus second configurable integer input from master section.
1.7.7	SB In Trq Ref	1535	-327.67	327.67		System Bus torque reference from the master.
1.7.8	SB Out Cntl Word	1534	0	32767		System bus control word out of the slave sections
1.7.9	MD Bit In1	1050	0	1		First configurable bit from the system bus master section
1.7.10	MD Bit In2	1051	0	1		Second configurable bit from the system bus master section
1.7.11	MD Bit In3	1052	0	1		Third configurable bit from the system bus master section
1.7.12	MD Bit In4	1053	0	1		Fourth configurable bit from the system bus master section
1.7.13	MD Drive OK	1058	0	1		System bus master section Drive OK Bit.
1.7.14	MD One Bit	1059	0	1		System bus master section One Bit. Easy way to tell the master drive is on and communicating.
1.7.15	MD Run Enable	1060	0	1		System bus master section Run Enable is high.
1.7.16	SB Comm Lost	0	0	1		System bus is not communicating
1.7.17	SB Comm Flt	1173	0	1		System bus slot comm fault or master WD fault.
2	Parameters					Menu Name
2.1	Protections					Menu Name
2.1.1	Fault Reset	0	0	2000	1002	Fault reset. Default to Zero Bit.
2.1.2	Auto Reset	0	0	1	0	Enables auto reset of faults. Default to disabled.
2.1.3	Auto Res Tim	0	0.00	327.67	10.00	Delay to auto reset fault. Default ten seconds.
2.1.4	User Flt 1	0	0	2000	1002	First user fault configuration point. Default to Zero Bit.
2.1.5	User Flt 2	0	0	2000	1002	Second user fault configuration point. Default to Zero Bit.
2.1.6	User Flt 3	0	0	2000	1002	Third user fault configuration point. Default to Zero Bit.
2.1.7	User Flt 4	0	0	2000	1002	Fourth user fault configuration point. Default to Zero Bit.
2.1.8	Ext Fault Inp	0	0	2000	1002	External fault input. High for fault. Default to zero bit.
2.1.9	Ld Flt Resp	0	0	3	1	Response to load float being on too long.
2.1.10	Overspeed Resp	0	0	3	3	Response to drive overspeed. Default to coast stop and fault the drive.
2.1.11	Input Ph. Superv	730	0	3		Set response to an input phase fault. Ignore, Warn, Fault, Fault coast
2.1.12	UVolt Fault Resp	727	0	1		Set Drive response to an under voltage fault. Ignore, Warn, Fault, Fault coast
2.1.13	Phase Supv F	702	0	3		Set Drive response to an output phase fault. Ignore, Warn, Fault, Fault coast
2.1.14	Earth Fault	703	0	3		Set Drive response to a ground fault. Ignore, Warn, Fault, Fault coast
2.1.15	Therm Prot F	704	0	3		Set Drive response to a motor thermal fault. Ignore, Warn, Fault, Fault coast
2.1.16	MotAmbTempFactor	705	-100.0	100.0		[W] Ambient temperature factor.(-100... 1000) 0= nominal, 1000= max, kf=(Tamb-Tn)/(Tmax-Tn)*1000.
2.1.17	Mot Therm 0 Spd	706	0.0	150.0		[W] Motor cooling ability at zero speed unit 0,1%. Init := 400
2.1.18	Mtr Therm TC	707	1	200		[W] Motor Thermal Time Constant in minutes, (1... 200). Init := 45
2.1.19	Motor Duty Cycle	708	0	100		[W] Motor Duty Cycle in %. Init := 100
2.1.20	ULoad Protect F	713	0	3		Set Drive response to a loss of load fault. Ignore, Warn, Fault, Fault coast
2.1.21	Under Ld Trq Nom	714	10.0	150.0		[W] Underload load curve at nominal freq,unit = 0.1%. Init := 500
2.1.22	Under Ld Trq 0	715	5.0	150.0		[W] Underload load curve at zero freq,unit = 0.1%. Init := 100
2.1.23	Under Ld State T	716	2.00	600.00		[W] Time limit for underload supervision in 0.01 sec (0 65536). Init := 2000
2.1.24	ThermistorF.Resp	732	0	3		Set Drive response to a thermistor fault. Ignore, Warn, Fault, Fault coast
2.1.25	FBCComm.FaultResp	733	0	3		Set Drive response to a field bus fault. Ignore, Warn, Fault, Fault coast
2.1.26	SPI Flt Resp	734	0	3		Set Drive response to a slot communication fault. Ignore, Warn, Fault, Fault coast
2.1.27	WD Flt Response	0	0	3	2	Response to a communication watch dog time out. Default to fault the drive.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.1.28	Com WD	0	0	1	0	Enables the communications watchdog timer. Default to not run it.
2.1.29	Brk Opn FTim	1268	0.00	327.67	0.20	Delay to check for brake released limit switch before faulting the drive. Default 200 ms.
2.1.30	Brk Opn Resp	0	0	3	0	Response for a brake open fault. Default is fault with coast stop.
2.1.31	Brk Slp Resp	0	0	3	3	Response to brake slip fault. Default fault with coast stop.
2.1.32	Brk Slp Act	0	0	3	0	Action for brake slip detection. No action, lower only, lower only and slow or just slow. Default no action.
2.1.33	Trq Prv Resp	0	0	3	3	Torque proving fault response. Default coast stop.
2.1.34	Err Lim 1	0	0	32767	500	Low setpoint speed error fault difference in Hz.
2.1.35	Err Lim 2	0	0	32767	1000	High setpoint speed error fault difference in Hz.
2.1.36	Low Err Tim	0	0.00	327.67	5.00	Time where small error is allowed for speed error fault.
2.1.37	Hi Err Tim	0	0.00	327.67	1.00	Time where large error is allowed for speed error fault.
2.1.38	Spd Err Fil	0	0.00	10.00	0.10	Low pass filter for the speed error fault. Default = 100 ms.
2.1.39	Spd Err Resp	0	0	3	0	Action on speed error fault. Default to no action for open loop. Set to fault for close loop hoists.
2.1.40	Run Off Resp	0	0	3	3	Run off fault. Brakes are not set after timeout. Default to Coast stop.
2.1.41	Run Off Tim	0	0.00	327.67	10.00	Timer to set run off fault. Time brakes need to set after runs removed from any speed. Default 5 seconds.
2.1.42	Dir Flt Resp	0	0	3	0	Both direction selected at the same time fault. Default to no action.
2.1.43	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%.
2.1.44	Joyst Resp	0	0	3	0	Response to joystick failure. Default = no action.
2.1.45	Slck Rope Tim	0	0.00	327.67	2.00	Time for low torque for slack rope fault. Default 2 seconds.
2.1.46	Slck Resp	0	0	3	0	Response to slack rope detection. Default no action.
2.1.47	Sick Rope Trq	0	-3276.7	3276.7	10.0	Slack rope detection torque setpoint in lower direction. Default to 10% torque.
2.1.48	Stall Resp	0	0	3	0	Stall condition response. Default to no action.
2.1.49	Stall Spd St	0	0	32767	50	Stall speed setpoint. Default below 50 rpm.
2.1.50	Stall Time	0	0.00	327.67	60.00	Stall time in seconds. Default 60
2.1.51	Stall Trq St	0	0.0	3276.7	90.0	Stall torque setpoint. Default above 90% torque.
2.1.52	Ov Wt Per	0	-327.67	327.67	90.00	Over weight percentage to alarm.
2.1.53	Ov Wt Tim	0	0.00	50.00	3.00	Over weight time delay
2.1.54	Ov Wt Res ID	0	0	2000	1012	Over weight reset. Default to user in 2 (lower)
2.2	Setpoints					Menu Name
2.2.1	Speed 1	1313	-320.00	320.00	20.00	First digital input speed. Default to 20% speed.
2.2.2	Speed 2	1314	-320.00	320.00	40.00	Second digital input speed. Default to 40% speed.
2.2.3	Speed 3	1315	-320.00	320.00	60.00	Third digital input speed. Default to 60% speed.
2.2.4	Speed 4	1316	-320.00	320.00	80.00	Fourth digital input speed. Default to 80% speed.
2.2.5	Speed 5	1317	-320.00	320.00	100.00	Fifth digital input speed. Default to 100% speed.
2.2.6	SD Speed	1312	-320.00	320.00	10.00	Digital slow down speed. Default to 50%
2.2.7	Spd Slk Up	1273	-327.67	327.67	0.00	Speed step slack up value
2.2.8	Brk Hld Spd	1266	0	32767	50	Brake is held open until the speed falls below this setpoint. Default 50 RPM.
2.2.9	base Spd RPM	1265	0	32656	1800	Base speed of motor in RPM.
2.2.10	Panel Ref Src	121	0	9		0=AI1, 1=AI2, 2=Panel, 3=Remote to the fieldbus output
2.2.11	Remote Ref Src	122	0	9		0=AI1, 1=AI2, 2=Panel, 3=Remote reference to the fieldbus output.
2.2.12	Trq Ref StA	1302	-300.0	300.0	0.0	Fixed value for the first torque reference input if desired. Enter in percent torque.
2.2.13	Field WeakeningPnt	602	8.00	320.00	60.00	[W] Field weakening point, f[Hz] = FieldWeakeningPoint/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz
2.2.14	Trq Prv Stp	1318	0.0	3276.7	20.0	Percent motor current used for torque proving.
2.2.15	Anti Snatch Trq	0	0.0	300.0	5.0	Anti snatch torque level. Default to 5% torque
2.2.16	Brk slp Spd	1269	0	32767	25	Motor speed setpoint for brake slip detection during torque proving. Default 25 RPM.
2.2.17	Sp Sum1 StA	1330	-327.67	327.67	0.00	Sp sum blocks first inputs default calibration value..
2.2.18	Sp Sum1 StB	1331	-327.67	327.67	0.00	Sp sum blocks second inputs default calibration value..
2.2.19	Sp Sum1 StC	1332	-327.67	327.67	0.00	Sp sum blocks third inputs default calibration value..
2.2.20	Sp Sel1 ST0	1337	-327.67	327.67	0.00	First spare select block input 0 default calibration value.
2.2.21	Sp Sel1 ST1	1338	-327.67	327.67	0.00	First spare select block input 1 default calibration value.
2.2.22	Sp HL High	1341	0.00	327.67	90.00	Spare High Low comparator High percent.
2.2.23	Sp HL Hyst	1342	0.00	327.67	1.00	Spare High Low comparator hysteresis value.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.2.24	Sp HL Low	1343	0.00	327.67	10.00	Spare High Low comparitor low percent.
2.2.25	Sp HL Stpt	1344	0.00	327.67	100.00	Spare High Low comparitor default full scale value.
2.2.26	Sp Cmp1_Hyst	1345	0.00	327.67	0.01	First spare comparitor block Hysteresis value. Plus or minus around the threshold.
2.2.27	Sp Cmp1_Stpt	1346	-327.67	327.67	0.10	First spare comparitor block default setpoint value. Can be used for the input or threshold.
2.3	Rates / Times					Menu Name
2.3.1	Load Flt Tim	1279	0.00	320.00	60.00	Load float timer. Default to 60 seconds.
2.3.2	Accel Time 1	103	0.1	3000.0	5.0	Default acceleration time constant for the speed ramp.
2.3.3	Decel Time 1	104	0.1	3000.0	5.0	Default deceleration time constant for the speed ramp.
2.3.4	2nd Accel Rate	1260	0.1	3000.0	5.0	2nd acceleration rate. Default to be enabled in extended speed range.
2.3.5	2nd Decel Rate	1261	0.1	3000.0	5.0	2nd deceleration rate. Default to be enabled in extended speed range.
2.3.6	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.
2.3.7	Fast Stop Tim	503	0.1	3000.0	0.1	Fast stop ramp time
2.3.8	Smooth Ratio 2	501	0.0	10.0		[W] Smooth ratio 2 for S-curves//0 = linear ramps//100 = full acc/dec inc/dec times.
2.3.9	Anti Snitch Accel	0	0.1	3000.0	10.0	Anti snatch acceleration time in seconds.
2.3.10	Anti Snitch Tim	0	0.00	327.67	0.20	Time for low fwd torque to switch to anti snatch acceleration rate. Default 200 ms.
2.3.11	Strt 0 Spd Time	615	0	32000		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.
2.3.12	Stop 0 Spd Time	616	0	32000		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.
2.3.13	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.
2.3.14	Brk Set Tim	0	0.00	10.00	0.10	Brake set time. Used to detect brake slip. Default 0.1 seconds.
2.3.15	Trq Prv Flt Tim	0	0.00	327.67	0.20	Torque proving fault time constant. Default 200 ms.
2.3.16	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.
2.3.17	Mtr Cur TC	0	0.00	20.00	0.50	Low pass filter on motor current in seconds.
2.3.18	Trq Rmp Rate	1290	0	3200	5	Torque reference ramp limit in percent per second.
2.3.19	Brk Opn Dly	1267	0.00	327.67	0.10	Delay after speed is near zero before opening the brakes. Default is 0.1 seconds.
2.3.20	Sp LP Fil TC	1329	0.00	10.00	0.10	Spare low pass filter time constant. Default to 100 ms.
2.3.21	Sp Dly1 TOFF	1349	0.00	327.67	0.10	First spare timer delay off setting in seconds. Default to 100 ms.
2.3.22	Sp Dly1 TON	1350	0.00	327.67	0.10	First spare timer delay on setting in seconds. Default to 100 ms.
2.3.23	Sp Dly2 TOFF	1351	0.00	327.67	0.10	Second spare timer delay off setting in seconds. Default to 100 ms.
2.3.24	Sp Dly2 TON	1352	0.00	327.67	0.10	Second spare timer delay on setting in seconds. Default to 100 ms.
2.3.25	Spd Cmp Fil TC	0	0.00	10.00	0.10	Spd Comparitor low pass filter. Default to 100 ms.
2.3.26	WD Com Dly	0	0.00	100.00	0.10	Communications watch dog timer delay. Default to 100 ms.
2.3.27	WD Init Dly Tim	0	0.00	327.67	10.00	Power up delay for the communications watchdog timer. Default to 10 seconds.
2.3.28	Ld Drooping Tim	0	0	1000	0	Dynamic Load Drooping Time constant in ms. Zero means static drooping.
2.3.29	Accel Comp Tc	0	0.002	1.000	0.100	Filtering Time Constant for acceleration compensation in s
2.3.30	Trq Ref Fil TC	0	0.0	1000.0	0.0	Filter time for torque reference (0...10000) = 0...1000.0 ms
2.3.31	Spd Err Fil TC	0	0	1000	0	Filter time for speed error (0 ...1000) = 0...1000 ms
2.4	Tuning Gains					Menu Name
2.4.1	Speed Control Kp	613	1	1000		Gain for the speed controller. (% / Hz)
2.4.2	Speed Control Ti	614	0.0	500.0		Integral time constant for the speed controller
2.4.3	Spd Cntrl F0	0	0.00	320.00	0.00	Corner frequency for SpeedControl_Kp_f0
2.4.4	Spd Cntrl F1	0	0.00	320.00	0.00	Corner frequency for SpeedControl_Kp
2.4.5	Spd Cntrl Kp F0	0	0	300		Relative gain (%) below SpeedControl_f0
2.4.6	Spd Cntrl Kp FW	0	0	300		Relative final gain for Speed controller p-gain at field weakening in%//< 100 reduces gain, >100 increases gain above FWP
2.4.7	Spd Cntrl Kp T0	0	0	300		Relative gain (%) if torque is below SpeedControl_T0
2.4.8	Spd Cntrl T0	0	0	300		Torque Limit for reduced SpeedControl_Kp (1000 = nominal)

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.4.9	Accel.Compens.	626	0.00	300.00		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.
2.4.10	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
2.4.11	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
2.4.12	LoadDrooping	620	0.00	100.00		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.
2.4.13	CurrentControlKp	617	0.00	100.00		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.
2.4.14	Curr Cntrl Ti	0	0.0	100.0		Current controller integrator time constant (0 ... 1000) = 0...100.0 ms
2.4.15	OV Reg Kp	0	0	32767		P-gain of over voltage controller (0 ...32767)
2.4.16	OV Reg Ki	0	0	32767		I-gain of over voltage controller (0 ...32767)
2.4.17	OV Reg Kd	0	0	32767		D-gain of over voltage controller OL, 256 equals 1,0 (0 .. 32767)
2.4.18	UV Reg Kp	0	0	32767		P-gain of under voltage controller (0 ..32767)
2.4.19	UV Reg Ki	0	0	32767		I-gain of under voltage controller (0 ..32767)
2.4.20	UV Reg Kd	0	0	32767		D-gain of under voltage controller
2.4.21	Mtr I Lim Ki	0	0	32767		I-gain of motor side over current controller (0 ... 32767)
2.4.22	Mtr I Lim Kp	0	0	32767		P-gain of motor side over current controller (0 ... 32767)
2.4.23	Gen I Lim Ki	0	0	32767		I-gain of generator side over current controller (0 ... 32767)
2.4.24	Gen I Lim Kp	0	0	32767		P-gain of generator side over current controller (0 ... 32767)
2.4.25	Trq Lim Kp	610	0	32000		P-gain of torque limit controller
2.4.26	Trq Lim Ki	611	0	32000		I-gain of torque limit controller
2.4.27	Spd Cont Kp	637	0	32767		[W] P-gain of open loop speed controller (0...32767). Init := 3000
2.4.28	Spd Cont Ki	638	0	32767		[W] I-gain of open loop speed controller (0 ... 32767). Init := 300
2.4.29	Temp CL Param	0	0	0		Reserved for future use.
2.4.30	Trq Cntrl Kp	639	0	32000		P-gain of torque controller
2.4.31	Trq Cntrl Ki	640	0	32000		I-gain of torque controller
2.4.32	Cl Ovr Vlt Kp	0	0	5000		CL OverVoltage Controller base gain
2.4.33	Cl Ovr Vlt Kp0	0	0	5000		CL OverVoltage Controller gain increase at zero frequency
2.4.34	Cl Ovr Vlt Ti	0	0	500		CL OverVoltage Controller integral time in ms
2.5	Limits					Menu Name
2.5.1	Base Spd Lim	1264	0.00	320.00	100.00	Base speed limit. Set to base speed percent if lower than 100%
2.5.2	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%
2.5.3	ESR Cur Lim	1262	0.00	320.00	100.00	Extended speed range current limit for simple setup.
2.5.4	Max ESR Speed	1263	0.00	327.67	100.00	Maximum extended speed limit in percentage.
2.5.5	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
2.5.6	Min Frequency	101	0.00	Max_Frequency		Minimum frequency the speed reference is allowed to go down to in hertz.
2.5.7	Max Spd RPM	1280	0	32565	1800	MAx speed in RPM for overspeed and load weight window. Default to1800 RPM.
2.5.8	Mtr Cur Limit	1291	0.00	300.00	100.00	Motor current limit value
2.5.9	Motoring Trq Lim	1305	0.0	300.0	300.0	Torque limit for motor side torque limitter,1000 equals 100% nominal torque
2.5.10	Gener Trq Lim	1306	0.0	300.0	300.0	Torque limit for generator side torque limitter,1000 equals 100% nominal torque
2.5.11	Trq Lim FWD	1307	0.0	300.0	300.0	Additional Torque limit for Forward Reference Direction,1000 equals 100% nominal torque
2.5.12	Trq Lim REV	1308	0.0	300.0	300.0	Additional Torque limit for Reverse Reference Direction,1000 equals 100% nominal torque
2.5.13	Ovr Spd Stp	1258	0.00	327.67	110.00	Overspeed setpoint in percentage of max speed. Default to 110%
2.5.14	Zero Detect	1259	0.00	200.00	2.00	Speed feedback comparitor At zero speed setpoint. Default to 2% of max speed.
2.5.15	Spd Hyst	0	0.00	200.00	1.00	Speed feedback comparitor hysteresis vaule. Default to 1%

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.5.16	Spd Decimal	0	0	4	2	Speed feedback comparitor decimal point resolution. Default to 2.
2.5.17	Trq Ref Max	642	-300.0	300.0	100.0	Maximum limit for the torque reference. Entered in percent torque.
2.5.18	Trq_Ref_Min	643	-300.0	300.0	0.0	Minimum limit for the torque reference. Entered in percent torque.
2.5.19	Torq Speed Limit	644	0	2		Torque control max frequency 0 = Max Frequency Par 2.1.1, 1 = Selected frequency reference, 2 = Preset speed 7
2.5.20	Pos Freq Limit	1300	-320.00	320.00	60.00	Additional signed Upper Frequency limit in FreqScale, Used while in torque mode to control overspeed.//Range [-32767..32767],//0 prevents running to forward direction
2.5.21	Neg Freq Limit	1301	-320.00	320.00	-60.00	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
2.5.22	Win Pos Width	0	-320.00	320.00	6.00	Frequency Window width for positive direction in FreqScale, activated with TCSpeedLimiterMode=4
2.5.23	Win Neg Width	0	-320.00	320.00	6.00	Frequency Window width for negative direction in FreqScale, activated with TCSpeedLimiterMode=4.
2.5.24	Cl Ovr Mtr Lim	0	0.0	500.0		CL Motoring current limit (1000 = 100.0%) for OverVoltage Controller
2.5.25	Sp Lim Max	1353	-327.67	327.67	100.00	Spare limit block maximum value.
2.5.26	Sp Lim Min	1354	-327.67	327.67	-100.00	Spare limit block minimum value.
2.6	Scaling					Menu Name
2.6.1	LS to Freq	1282	-32.767	32.767	0.600	Scaling factor to convert speed reference units (usually %) to motor units (Usually motor Hz)
2.6.2	LS Scl Div	1281	-32767	32767	1000	Scaling factor to convert speed reference units (usually %) to motor units (Usually motor Hz)
2.6.3	LF Mlt Stpt	1278	0.00	1.00	0.50	Multiplier to analog speed for load float. Default 0.50
2.6.4	SD Mlt Stpt	1289	0.00	1.00	0.50	Analog reference slow down speed multiplier. Default 0.50
2.6.5	DCBrake Mlt	1293	0.00	300.00	100.00	DC Brake scaling factor as a percentage
2.6.6	Sp MD1 Dv	1323	-327.67	327.67	1.00	Default value for the first spare MULDIV block divide input.
2.6.7	Sp MD1 Mlt	1324	-327.67	327.67	1.00	Default value for the first spare MULDIV block multiply input.
2.6.8	Sp Add Val	1327	-327.67	327.67	0.00	Spare add block optional cal number.
2.6.9	Sp Sub Val	1328	-327.67	327.67	0.00	Spare sub block optional scaling value.
2.6.10	Sp LH Decimal	0	0	2	2	Number of decimal places for the input values. Needed to perform the correct percentage division.
2.6.11	FreqRamp	0	0.00	327.67	100.00	Frequency range for ramp calculation, f[Hz] = FreqRamp/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz
2.7	Bit Config					Menu Name
2.7.1	Run Fwd Inp	0	0	2000	1011	Digital input for Run forward command
2.7.2	Run Rev Inp	0	0	2000	1012	Digital input for Run reverse command
2.7.3	Fast Stop	0	0	2000	1001	Initiates a stop and switches in faster ramp rates when input goes low. Default to one bit.
2.7.4	Coast Stop	0	0	2000	1001	Set to input for emergency coast stop. Default to one bit.
2.7.5	EndSt Fwd	0	0	2000	1001	Optional end stop forward input. Default to One Bit.
2.7.6	EndSt Rev	0	0	2000	1001	Optional end stop reverse input. Default to One Bit.
2.7.7	Digital Sel	0	0	2000	1001	Selects digital inputs vs joystick. Default One Bit = Digital.
2.7.8	Joyst Pol En	0	0	2000	0	Enables Run reverse by joystick polarity vs. digital input.
2.7.9	JoySt B Sel	0	0	2000	1002	Selects alternate joystick input. Default to zero bit.
2.7.10	Dig B Sel	0	0	2000	1002	Selects alternate digital inputs. Default to Zero Bit.
2.7.11	En Spd 1A	0	0	2000	1110	First standard digital speed input. Default to Run_Cmd_Inp.
2.7.12	En Spd 2A	0	0	2000	1002	Second standard digital speed input. Default to zero bit
2.7.13	En Spd 3A	0	0	2000	1002	Third standard digital speed input. Default to zero bit
2.7.14	En Spd 4A	0	0	2000	1002	Fourth standard digital speed input. Default to zero bit
2.7.15	En Spd 5A	0	0	2000	1002	Fifth standard digital speed input. Default to zero bit
2.7.16	En Spd 1B	0	0	2000	1002	First digital speed input for alternate inputs. Default to Zero Bit
2.7.17	En Spd 2B	0	0	2000	1002	Second digital speed input for alternate inputs. Default to Zero Bit
2.7.18	En Spd 3B	0	0	2000	1002	Third digital speed input for alternate inputs. Default to Zero Bit
2.7.19	En Spd 4B	0	0	2000	1002	Fourth digital speed input for alternate inputs. Default to Zero Bit
2.7.20	En Spd 5B	0	0	2000	1002	Fifth digital speed input for alternate inputs. Default to Zero Bit
2.7.21	Fwd SD Inp	0	0	2000	1014	Forward slow down limit. Default to digital in 4.
2.7.22	Rev SD Inp	0	0	2000	1014	Reverse slow down limit. Default to digital in 4.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.7.23	Inf Var En	0	0	2000	1002	Enables the infinite variable function.
2.7.24	Spd Up Inp	0	0	2000	1002	Speed up bit for infinite variable speed function.
2.7.25	Rel Rmp By Tim	0	0	2000	1001	Release ramp off brake time vs brake open aux contact input.
2.7.26	Load Flt En	0	0	2000	1002	Enables the load float function. Default to Zero Bit.
2.7.27	Load Flt Inp	0	0	2000	1002	Load float command. Default to Zero Bit.
2.7.28	Dis Load Flt Tim	0	0	2000	1002	Disables the load float timer to allow low speed continuously. Default Zero Bit.
2.7.29	En Ext Spd	0	0	2000	1002	Enable extended speed range. Default to Zero Bit.
2.7.30	2nd Rmp En	0	0	2000	1002	Enables the second ramp. Default to extended speed range.
2.7.31	At Zero Time	0	0	2000	1127	Rests the Drive OK after a fault. Default to At Zero Spd
2.7.32	DC Brk Cmd	0	0	2000	1002	Enables DC injection braking after stop. Default to Zero Bit
2.7.33	Trq Prv By	0	0	2000	1001	Bypasses the torque proving for non hoist applications.
2.7.34	Brk Opn Sw	0	0	2000	1002	Optional Brake open contact input.
2.7.35	Brk Pdl En	0	0	2000	1002	Enables brake pedal logic. Coast drive and keep brakes in. Default to Zero Bit.
2.7.36	Brk Pdl Inp	0	0	2000	1002	Brake pedal input. When high and enabled coast drive and hold brakes in.
2.7.37	En Anti Snatch	0	0	2000	1002	Enable anti snatch function. Changes acceleration rate during low torque hoisting.
2.7.38	Disable Ramp	0	0	2000	1002	Disable speed reference ramp function
2.7.39	Trq Ref En	0	0	2000	1090	Enables the torque reference. Default to RunRequest
2.7.40	Trq Dir	0	0	2000	1002	Reverse the polarity of the torque reference. Default to Zero bit
2.7.41	Trq No Ramp	0	0	2000	1001	Disables the torque reference ramp. Defaults to disable the ramp.
2.7.42	Param Set Sel	0	0	2000	1002	Selects between the two parameter sets when enabled.
2.7.43	Thermistor Inp	0	0	2000	1002	Input for thermistor fault. Default to zero Bit.
2.7.44	Sp Sum1 EnA	0	0	2000	1002	Enables the first spare sum input. Default to Zero bit.
2.7.45	Sp Sum1 EnB	0	0	2000	1002	Enables the second spare sum input. Default to Zero bit.
2.7.46	Sp Sum1 EnC	0	0	2000	1002	Enables the third spare sum input. Default to Zero bit.
2.7.47	Sp Sel1 En1	0	0	2000	1002	First spare select block enables input 1 configuration point.
2.7.48	Sp Dly1 In	0	0	2000	1002	First delay block input. Default to Zero Bit
2.7.49	Sp Dly2 In	0	0	2000	1002	Second delay block input. Default to Zero Bit
2.7.50	Sp Ltch1 H1	0	0	2000	1001	First spare latch block first hold bit. Default to One bit.
2.7.51	Sp Ltch1 H2	0	0	2000	1001	First spare latch block second hold bit. Default to One bit.
2.7.52	Sp Ltch1 L	0	0	2000	1002	First spare latch block latch input bit. Default to Zero bit.
2.7.53	Sp Ltch2 H1	0	0	2000	1001	Second spare latch block first hold bit. Default to One bit.
2.7.54	Sp Ltch2 H2	0	0	2000	1001	Second spare latch block second hold bit. Default to One bit.
2.7.55	Sp Ltch2 L	0	0	2000	1002	Second spare latch block latch input bit. Default to Zero bit.
2.7.56	Sp Inv1 In	0	0	2000	1002	First spare Bit invert blocks input bit.
2.7.57	Sp Inv2 In	0	0	2000	1002	Second spare Bit invert blocks input bit.
2.7.58	Sp Inv3 In	0	0	2000	1002	Third spare Bit invert blocks input bit.
2.7.59	Sp And1 In1	0	0	2000	1002	First spare And block input 1. Default to Zero Bit.
2.7.60	Sp And1 In2	0	0	2000	1002	First spare And block input 2. Default to Zero Bit.
2.7.61	Sp And1 NIn3	0	0	2000	1002	First spare And block inverted input 3. Default to Zero Bit.
2.7.62	Sp And2 In1	0	0	2000	1002	Second spare And block input 1. Default to Zero Bit.
2.7.63	Sp And2 In2	0	0	2000	1002	Second spare And block input 2. Default to Zero Bit.
2.7.64	Sp And2 NIn3	0	0	2000	1002	Second spare And block inverted input 3. Default to Zero Bit.
2.7.65	Sp And3 In1	0	0	2000	1002	Third spare And block input 1. Default to Zero Bit.
2.7.66	Sp And3 In2	0	0	2000	1002	Third spare And block input 2. Default to Zero Bit.
2.7.67	Sp And3 NIn3	0	0	2000	1002	Third spare And block inverted input 3. Default to Zero Bit.
2.7.68	Sp Or1 In1	0	0	2000	1002	First spare Or block input 1. Default to Zero Bit.
2.7.69	Sp Or1 In2	0	0	2000	1002	First spare Or block input 2. Default to Zero Bit.
2.7.70	Sp Or1 NIn3	0	0	2000	1002	First spare Or block inverted input 3. Default to Zero Bit.
2.7.71	Sp Or2 In1	0	0	2000	1002	Second spare Or block input 1. Default to Zero Bit.
2.7.72	Sp Or2 In2	0	0	2000	1002	Second spare Or block input 2. Default to Zero Bit.
2.7.73	Sp Or2 NIn3	0	0	2000	1002	Second spare Or block inverted input 3. Default to Zero Bit.
2.7.74	Sp Or3 In1	0	0	2000	1002	Third spare Or block input 1. Default to Zero Bit.
2.7.75	Sp Or3 In2	0	0	2000	1002	Third spare Or block input 2. Default to Zero Bit.
2.7.76	Sp Or3 NIn3	0	0	2000	1002	Third spare Or block inverted input 3. Default to Zero Bit.
2.7.77	Wathcdog In	0	0	2000	1002	Communications watchdog timer input from PLC. Default to Zero Bit.
2.8	Anlg Config					Menu Name

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.8.1	Joyst A Inp	0	0	2000	1601	Standard joystick input. Default to analog input #1.
2.8.2	Joyst B Inp	0	0	2000	1602	Alternate joystick input. Default to analog input #2.
2.8.3	Accel Inp	0	0	2000	103	Acceleration rate input. Default to Accel_Time_1 parameter.
2.8.4	Decel Time	0	0	2000	104	Deceleration rate input. Default to Decel_Time_1 parameter.
2.8.5	Slack Up	0	0	2000	1273	Speed slack up input. Default to Spd Slk Up
2.8.6	Spd Fdbk	0	0	2000	2	Speed feedback input for over and zero speed comparitor.
2.8.7	Ovr Spd Inp	0	0	2000	1280	Overspeed comparitor maximum setpoint. Default to MaxFreq.
2.8.8	Mtr Cur Lim Scl	0	0	2000	1291	Scaling value for current limit. Default to MotorCurrentLim.
2.8.9	DCBrake Scl Inp	0	0	2000	1293	DCBrake scaling input. Default to DCBrake Mlt
2.8.10	Sp MD1 Val	0	0	2000	1200	Input for the first spare MULDIV block. Default to Zero analog.
2.8.11	Sp MD1 Div	0	0	2000	1323	First spare MULDIV block divide input. Default to Sp MD1 Dv cal number.
2.8.12	Sp MD1 Mul	0	0	2000	1324	First spare MULDIV block multiply input. Default to Sp MD1 Mlt cal number.
2.8.13	Sp Add1 In1	0	0	2000	1327	First input of spare Add block.
2.8.14	Sp Add1 In2	0	0	2000	1327	Second input of spare Add block.
2.8.15	Sp Sub1 In1	0	0	2000	1328	First input of spare Sub block.
2.8.16	Sp Sub1 In2	0	0	2000	1328	Second input of spare Sub block.
2.8.17	Sp LP Fil In	0	0	2000	1200	Input to the spare low pass filter. Default to zero analog.
2.8.18	Sp ABS In	0	0	2000	1200	Spare absolute value block input. Default to Zero Analog
2.8.19	Sp Sum1 InA	0	0	2000	1330	Spare sum block first input. Default to Sp Sum1 StA.
2.8.20	Sp Sum1 InB	0	0	2000	1331	Spare sum block second input. Default to Sp Sum1 StB.
2.8.21	Sp Sum1 InC	0	0	2000	1332	Spare sum block third input. Default to Sp Sum1 SIC.
2.8.22	Sp Sel1 In0	0	0	2000	1337	First spare select block input 0. Default to Sp Sel1 ST0
2.8.23	Sp Sel1 In1	0	0	2000	1338	First spare select block input 1. Default to Sp Sel1 ST1
2.8.24	Sp HL Inp	0	0	2000	1200	Spare High/Low comparitor input value. Default to Zero Analog
2.8.25	Sp HL Setpt	0	0	2000	1344	Spare High/Low comparitor setpoint value. Default to Sp HL Stpt
2.8.26	Sp Cmp1 In	0	0	2000	1346	First spare comparitor block input parameter to be compared with the threshold. Default to Sp Cmp1 Stpt.
2.8.27	Sp Cmp1 Thres	0	0	2000	1346	First spare comparitor block threshold parameter to be compared with the input. Default to Sp Cmp1 Stpt.
2.8.28	Sp Lim Inp	0	0	2000	1200	Spare limit input. default to Zero Analog
2.8.29	Trq Ref	0	0	2000	1302	Torque reference. Default to C_Trq_Ref_SIA
2.8.30	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.
2.8.31	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.
2.8.32	Sp WPVal Inp	0	0	2000	1200	Spare Write param value ID number for the parameter to be passed.
2.8.33	Sp WPVal2 Inp	0	0	2000	1200	Spare Write param value ID number for the parameter to be passed.
2.9	Enables					Menu Name
2.9.1	EndSt Maint	0	0	1	0	Temporary disables end stop to test ultimate limit.
2.9.2	Skip S Rev	0	0	1	0	Skip S2,S4 scurve when opposite direction asked for during a ramp
2.9.3	Rmp Act Lim	0	0	1	0	Enables ramping during the over ride limits
2.9.4	Start Function	505	0	1		Start function. 0 = Ramp, 1 = Flying start
2.9.5	Stop Function	506	0	3		Stopping mode. 0 = coast, 1= Ramping, 2 = Ramp with Run enable coast stop.
2.9.6	Brake Chopper	0	0	8	0	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
2.9.7	Overvolt Contr	607	0	2	0	[W] Over voltage controller oper. Mode 0=disabled,1=no ramping, 2 = ramping//. Init := 1
2.9.8	UV Contrl	608	0	1	0	[W] Enables under voltage controller, 0= disabled, 1= enabled. Init := 1
2.9.9	Mtr I Lim En	0	0	1	0	Enables motor side over current control, 0= disabled, 1= enabled
2.9.10	Gen I Lim En	0	0	1	0	Enables generator side over current control, 0= disabled, 1= enabled
2.9.11	Param Set En	0	0	1	0	Enables the two saved parameter set option.
2.9.12	SC Trq Chain Sel	0	0	4	2	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

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.9.13	Torq Ref Select	0	0	1	0	Selector for torque reference//0 = not in use//1 = TorqueReference//2 = ExtTorqueReference
2.9.14	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 valu
2.9.15	Cl Ovr Vlt En	0	0	1	0	Enable CL OverVoltage Controller
2.10	I/O					Menu Name
2.10.1	Digital Inputs					Menu Name
2.10.1.1	DIN7 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the seventh digital input. Default to zero.
2.10.1.2	DIN8 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the eighth digital input. Default to zero.
2.10.1.3	DIN9 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the ninth digital input. Default to zero.
2.10.1.4	DIN10 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the tenth digital input. Default to zero.
2.10.1.5	DIN11 Slot ID	0	0.0	CrossCon_Ma x	0.0	Configure to the the desired I/O slot and position for the eleventh digital input. Default to zero.
2.10.1.6	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.
2.10.1.7	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.
2.10.1.8	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.
2.10.1.9	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.
2.10.2	Digital Outputs					Menu Name
2.10.2.1	DOUT1 ID	0	0	2000	1116	First digital output configuration point. Default to Drive fault
2.10.2.2	DOUT1 Inv	0	0	1	0	Inverts the first digital output when enabled.
2.10.2.3	DOUT2 ID	0	0	2000	1098	Second digital output configuration point. Default to Drive Running
2.10.2.4	DOUT2 Inv	0	0	1	0	Inverts the second digital output when enabled.
2.10.2.5	DOUT3 ID	0	0	2000	1118	Third digital output configuration point. Default to At zero speed.
2.10.2.6	DOUT3 Inv	0	0	1	0	Inverts the third digital output when enabled.
2.10.2.7	DOUT4 ID	0	0	2000	1002	Fourth digital output configuration point. Default to zero bit
2.10.2.8	DOUT4 Slot ID	0	0.00	CrossCon_Ma x	0.00	Configure fourth digital output to actual I/O location. Default to no slot. Need additional I/O board.
2.10.2.9	DOUT5 ID	0	0	2000	1002	Fifth digital output configuration point. Default to zero bit
2.10.2.10	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.
2.10.2.11	DOUT5 Inv	0	0	1	0	Inverts the fifth digital output when enabled.
2.10.2.12	DOUT6 ID	0	0	2000	1002	Sixth digital output configuration point. Default to zero bit
2.10.2.13	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.
2.10.2.14	DOUT6 Inv	0	0	1	0	Inverts the sixth digital output when enabled.
2.10.3	Analog Inputs					Menu Name
2.10.3.1	AIN1 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.10.3.2	AIN1 Off	0	-100.00	100.00	0.00	Offset for analog input
2.10.3.3	AIN1 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.10.3.4	AIN2 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.10.3.5	AIN2 Off	0	-100.00	100.00	0.00	Offset for analog input
2.10.3.6	AIN2 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.10.3.7	AIN3 Slot ID	0	0.000	CrossCon_Ma x	0.000	Configure to the the desired I/O slot and position for the third analog input. Default to 0. Need additional option boards.
2.10.3.8	AIN3 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.
2.10.3.9	AIN3 Off	0	-100.00	100.00	0.00	Offset for analog input
2.10.3.10	AIN3 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.10.3.11	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.
2.10.3.12	AIN4 Gain	0	-100.00	100.00	1.00	Gain. 100 equals multiply by one.

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.10.3.13	AIN4 Off	0	-100.00	100.00	0.00	Offset for analog input
2.10.3.14	AIN4 Tc	0	0.00	5.00	0.10	Low pass filter time constant.
2.10.4	Analog Outputs					Menu Name
2.10.4.1	AOUT1 ID	0	0	2000	3	Select value for first analog output. Default to MotorCurrent
2.10.4.2	AOUT1 Zero	0	-327.67	327.67	0.00	Offset for the first analog output.
2.10.4.3	AOUT1 Cal	0	-327.67	327.67	1.00	Multiply for first analog output. 100 equals 1.00
2.10.4.4	AOUT1 TC	0	0.00	5.00	0.10	filter time constant for the first analog out. 100 equals one second.
2.10.4.5	AOUT2 ID	0	0	2000	2	Select value for second analog output. Default to MotorSpeed
2.10.4.6	AOUT2 Zero	0	-327.67	327.67	0.00	Offset for the second analog output.
2.10.4.7	AOUT2 Cal	0	-327.67	327.67	1.00	Multiply for second analog output. 100 equals 1.00
2.10.4.8	AOUT2 TC	0	0.00	5.00	0.10	filter time constant for the second analog out. 100 equals one second.
2.10.4.9	AOUT2 Slot ID	0	0	CrossCon_Ma x	0	Selects which slot and address the second analog out goes to. Default to 0. Need additional option boards.
2.10.5	Encoders					Menu Name
2.10.5.1	Enc1 Slot ID	0	0.000	CrossCon_Ma x	0.000	First encoder slot ID. Default to not present.
2.10.5.2	Enc1 Mlt	0	0.000	32.767	1.000	First encoder scaling multiply value. Used with Enc1_Div
2.10.5.3	Enc1 Div	0	0	32767	1000	First encoder scaling divide value. Used with Enc1_Mlt
2.10.5.4	Enc1 Tc	0	0.00	10.00	0.01	First encoder low pass filter time constant. Default to 10 ms.
2.10.5.5	Counter1 Dec	1294	1	10000	1	Divide number for the first counter scaling. Should be power of tens.
2.10.5.6	Counter1 Mult	1295	0	30000	1	Gain factor for first counter. Used with Counter1 Dec .
2.10.5.7	Counter1 Hld	0	0	2000	1002	Holds the first counter when high
2.10.5.8	Counter1 Res	0	0	2000	1002	Resets the first counter when high
2.10.5.9	Counter1	0	0	1	0	Enables the first footage counter
2.10.5.10	Encoder1FiltTime	618	0.0	100.0		Filter time constant for speed measurement.
2.10.6	PT100s					Menu Name
2.11	Tables					Menu Name
2.11.1	Table0					Menu Name
2.11.1.1	T0_X0	1700	-327.67	327.67	0.00	Table 0 - X0 - Value. See table block descr for details.
2.11.1.2	T0_X1	1701	-327.67	327.67	20.00	Table 0 - X1 - Value. See table block descr for details.
2.11.1.3	T0_X2	1702	-327.67	327.67	40.00	Table 0 - X2 - Value. See table block descr for details.
2.11.1.4	T0_X3	1703	-327.67	327.67	60.00	Table 0 - X3 - Value. See table block descr for details.
2.11.1.5	T0_X4	1704	-327.67	327.67	80.00	Table 0 - X4 - Value. See table block descr for details.
2.11.1.6	T0_X5	1705	-327.67	327.67	100.00	Table 0 - X5 - Value. See table block descr for details.
2.11.1.7	T0_Y0	1716	-327.67	327.67	0.00	Table 0 - Y0 - Value. See table block descr for details.
2.11.1.8	T0_Y1	1717	-327.67	327.67	20.00	Table 0 - Y1 - Value. See table block descr for details.
2.11.1.9	T0_Y2	1718	-327.67	327.67	40.00	Table 0 - Y2 - Value. See table block descr for details.
2.11.1.10	T0_Y3	1719	-327.67	327.67	60.00	Table 0 - Y3 - Value. See table block descr for details.
2.11.1.11	T0_Y4	1720	-327.67	327.67	80.00	Table 0 - Y4 - Value. See table block descr for details.
2.11.1.12	T0_Y5	1721	-327.67	327.67	100.00	Table 0 - Y5 - Value. See table block descr for details.
2.12	Identification					Menu Name
2.12.1	Flux Curve a	1355	0.0	250.0		Flux linearisation point. Init := 100
2.12.2	Flux Curve b	1356	0.0	250.0		Flux linearisation point. Init := 200
2.12.3	Flux Curve c	1357	0.0	250.0		Flux linearisation point. Init := 300
2.12.4	Flux Curve d	1358	0.0	250.0		Flux linearisation point. Init := 400
2.12.5	Flux Curve e	1359	0.0	250.0		Flux linearisation point. Init := 500
2.12.6	Flux Curve f	1360	0.0	250.0		Flux linearisation point. Init := 600
2.12.7	Flux Curve g	1361	0.0	250.0		Flux linearisation point. Init := 700
2.12.8	Flux Curve h	1362	0.0	250.0		Flux linearisation point. Init := 800
2.12.9	Flux Curve i	1363	0.0	250.0		Flux linearisation point. Init := 900
2.12.10	Flux Curve j	1364	0.0	250.0		Flux linearisation point. Init := 1000
2.12.11	Flux Curve k	1365	0.0	250.0		Flux linearisation point. Init := 1100
2.12.12	Flux Curve l	1366	0.0	250.0		Flux linearisation point. Init := 1200
2.12.13	Flux Curve m	1367	0.0	250.0		Flux linearisation point. Init := 1300
2.12.14	Flux Curve n	1368	0.0	250.0		Flux linearisation point. Init := 1400
2.12.15	Flux Curve o	1369	0.0	250.0		Flux linearisation point. Init := 1500
2.12.16	Mk Flux Time	660	0	60000		[W] Time for magnetize the motor 1 equals 1 ms. Init := 200

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.12.17	Mk Flux Voltage	661	0	30000		[W] Magnetizing voltage. 10000 equals nominal voltage of the motor. Init := 201
2.12.18	Meas Rs V Drop	662	0	30000		[W] Measured Voltage drop at stator resistance between two phases with nom current of motor. Unit: 256=10%.
2.12.19	Mk Flux V Hw Dt	663	0	30000		[W] Magnetizing voltage with hardware dead time compensation. 10000 equals nominal voltage of the motor. Init := 140
2.12.20	Ir Add 0 Pt V	664	0	30000		[W] IrAddVoltage for Zero frequency.
2.12.21	Ir Add Gen Scl	665	0	30000		[W] Scaleing factor for generator side IR-compensation (0 ... 200%).
2.12.22	Ir Add Mtr Scl	667	0	30000		[W] Scaleing factor for motor side IR-compensation (0 ... 200%). Init := 100
2.12.23	Pwr IU Offset	668	-32000	32000		[W] offset value of U-phase current measurement. 1000=unit nom.
2.12.24	Pwr IV Offset	669	-32000	32000		[W] offset value of V-phase current measurement. 1000=unit nom.
2.12.25	Pwr IW Offset	670	-32000	32000		[W] offset value of W-phase current measurement. 1000=unit nom.
2.12.26	Speed Step	1252	-50.0	50.0		Speed step used for Identification
2.12.27	Torque Step	1253	-300.0	300.0		Torque step used for Identification
2.13	Motor					Menu Name
2.13.1	Self Tune Motor	631	0	Ident_Limit		Identification status. 0 = No Action, 1= No Run, 2 = Run
2.13.2	Motor Nom Currnt	113	MotorCurrentMin	MotorCurrentMax		[W] Motor nominal current, I[A] = MotorNomCurrent/CurrentScale//Range[1...65535]//if CurrentScale=10 then 100 equals 10.0 A
2.13.3	Motor Nom Voltg	110	180	690	480	[W] Motor nominal voltage in Volts
2.13.4	Motor Nom Freq	111	8.00	320.00	60.00	[W] Motor nominal frequency in Hz
2.13.5	Motor Nom Speed	112	24	20000	1740	[W] Motor nominal speed in rpm
2.13.6	Motor Ctrl Mode	600	0	ControlModeMax		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)//
2.13.7	Motor Ctrl Mode2	521	0	ControlModeMax	4	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)
2.13.8	MotorType	0	0	1		0 = Induction motor, 1 = perm magnet//1 = Permanent magnet synchronous motor
2.13.9	DC-Brake Current	507	MotorCurrentMin	UnitVTCurrent		
2.13.10	Stop DC-BrakeFr	515	0.10	10.00		[W] Dc-brake is allowed under this frequency limit,If FreqScale=100 then 5000 equals 50.00 Hz.
2.13.11	FluxBrakeCurrent	519	MotorCurrentMin	UnitVTCurrent		[W] Flux brake current[A]=FluxBrakeCurrent/CurrentScale, if CurrentScale=10 then 100 equals 10.0 A Default=MotorNomCurrent.
2.13.12	Voltage at FWP	603	10.00	200.00		[W] Motor voltage (%*NotorNomVoltage) at field weakening point//(1000...10500) equals (10.0 ...105.00) % * MotorNomVoltage
2.13.13	U/f Mid Freq	604	0.00	FieldWeakeningPoint		[W] Programmable U/F curve middle point, f[Hz] = UFMidPoint/FreqScale//Range[0...FieldWeakeningPoint]//If FreqScale=100 then 5000 equals 50.00 Hz
2.13.14	U/f Mid Voltg	605	0.00	100.00		[W] Motor voltage (%*MotorNomVoltage) at programmable U/F curve middle point//(1000...10500) equals (10.0 ...105.00) % * MotorNomVoltage
2.13.15	Zero Freq Voltg	606	0.00	40.00		[W] Motor voltage (%*MotorNomVoltage) at programmable U/F curve zero point//(1000...10500) equals (10.0 ...105.00) % * MotorNomVoltage
2.13.16	Switching Freq	601	1.0	SwitchingFreqMax		[W] Switching frequency in 0.1 kHz, Range[1...400]
2.13.17	MagnCurrent	612	0.00	100.00		Rated magnetizing current for the motor. It is used to adjust the motor voltage in no-load condition.
2.13.18	Slip Adjust	619	0	500		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.
2.13.19	Stop St Magn I	0	0.0	100.0	50.0	Stop state magnetisation (0...1000) = 0 ... 100% of nominal magnetising current
2.13.20	Stop St Magn Tim	0	0	32000	0	Maximum time for stop state magnetisation in s, (0...32000), 0=not in use, negative=infinite

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.13.21	Startup Trq Sel	621	0	3	2	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//
2.13.22	StartupTorq FWD	633	-300.0	300.0		Startup Torque for forward direction if selected with StartUp Torq Sel.
2.13.23	StartupTorq REV	634	-300.0	300.0		Startup Torque for reverse direction if selected with StartUp Torq Sel.
2.13.24	OL TC Min Freq	636	0.00	FreqMax		Minimum operation frequency of open loop torque control,f[Hz].//Init := 300
2.13.25	Local Reference	0	-32767	32767	0	Not used.
2.13.26	Stop DC-BrakeTm	508	0.00	600.00		Time it takes to stop the drive in seconds.
2.13.27	Start DC-BrakeTm	516	0.00	600.00		[W] Dc brake time [ms] in ramp start. Init := 0
2.13.28	DC Time Coast	0	0.000	32.767	0.000	Dc brake time [ms] in coast stop
2.13.29	DC Time Ramp	0	0.000	32.767	0.000	Dc brake time [ms] in ramp stop
2.13.30	Motor Cos Phi	120	0.30	1.00		:= 85
2.13.31	U/f Ratio Select	108	0	3		[W] U/F ratio selection, 0=linear, 1=squared, 2=programmable
2.13.32	U/f Optimization	109	0	1	Not defined	[W] U/F optimization selection, 0=none, 1=automatic torque boost
2.13.33	Flux Brake	520	0	1		[W] 1=flux brakeing is enabled.
2.13.34	Mtr Ctrl Sw	0	0	2000	1111	Selects between different motor control schemes. Default to Zero Bit.
2.13.35	Cl Ovr Vlt Ref	0	100.00	200.00		CL OverVoltage Controller reference (10000 = 100.00%)
2.14	Comms					Menu Name
2.14.1	Fieldbus					Menu Name
2.14.1.1	FB_Bit08	0	0	2000	1002	First output field bus bit configuration point.
2.14.1.2	FB Bit09	0	0	2000	1002	Second field bus output bit configuration point.
2.14.1.3	FB Bit10	0	0	2000	1002	Third field bus output bit configuration point.
2.14.1.4	FB Bit11	0	0	2000	1002	Fourth field bus output bit configuration point.
2.14.1.5	FB Bit12	0	0	2000	1002	Fifth field bus output bit configuration point.
2.14.1.6	FB Bit13	0	0	2000	1002	Sixth field bus output bit configuration point.
2.14.1.7	FB Bit14	0	0	2000	1002	Seventh field bus output bit configuration point.
2.14.1.8	FB Bit15	0	0	2000	1002	Eighth field bus output bit configuration point.
2.14.1.9	FB AOUT1	0	0	2000	1200	Configuration to send to FBProcessDataOUT1
2.14.1.10	FB AOUT2	0	0	2000	1200	Configuration to send to FBProcessDataOUT2
2.14.1.11	FB AOUT3	0	0	2000	1200	Configuration to send to FBProcessDataOUT3
2.14.1.12	FB AOUT4	0	0	2000	1200	Configuration to send to FBProcessDataOUT4
2.14.1.13	FB AOUT5	0	0	2000	1200	Configuration to send to FBProcessDataOUT5
2.14.1.14	FB AOUT6	0	0	2000	1200	Configuration to send to FBProcessDataOUT6
2.14.1.15	FB AOUT7	0	0	2000	1200	Configuration to send to FBProcessDataOUT7
2.14.1.16	FB AOUT8	0	0	2000	1200	Configuration to send to FBProcessDataOUT8
2.14.2	System Bus					Menu Name
2.14.2.1	SBId	0	0	63	0	SystemBus identification number 0 through 63.
2.14.2.2	SBNextId	0	0	63	1	SystemBus next devices id number 0 - 63.
2.14.2.3	SB Mode	0	0	3	0	System bus mode. 0 = Disabled, 1= Master, 2 = Slave, 3 = Both (Not supported yet)
2.14.2.4	SB Out Int1	0	0	2000	1200	System Bus first configurable output to the slaves.
2.14.2.5	SB Out Int2	0	0	2000	1200	System Bus second configurable output to the slaves.
2.14.2.6	SB Bit Out1	0	0	2000	1002	If drive is a system bus master this is the first configurable bit output to slave sections.
2.14.2.7	SB Bit Out2	0	0	2000	1002	If drive is a system bus master this is the second configurable bit output to slave sections.
2.14.2.8	SB Bit Out3	0	0	2000	1002	If drive is a system bus master this is the third configurable bit output to slave sections.
2.14.2.9	SB Bit Out4	0	0	2000	1002	If drive is a system bus master this is the fourth configurable bit output to slave sections.
2.14.2.10	SB Comm Flt Resp	0	0	3	3	Response to system bus error.
2.14.2.11	SB Comm Flt Tim	0	0.00	10.00	0.20	System bus communication fault timer. Default at 200 ms.
2.15	Constants					Menu Name
2.15.1	One Bit	1001	0	1		Always set TRUE.
2.15.2	Zero Bit	1002	0	0		Always FALSE.
2.15.3	Zero Analog	1200	0	0		Always zero integer.
2.15.4	One Analog	1201	1	1		Always one integer

MENU	NAME	ID	MIN	MAX	DEFAULT	DESCRIPTION
2.15.5	Int Ten	1202	10	10		Always 10. Used for scaling.
2.15.6	Int Hundred	1203	100	100		Always 100 integer. Used for scaling.
2.15.7	Int Thousand	1204	1000	1000		Always 1000. Used for scaling.
3	Keypad Control					Menu Name
3.1	Keypad Spd Dir	123	0	1		Keypad control direction.
3.2	Keypad_Spd_ref					
3.3	Keypad Trq Dir	0	0	1	0	Keypad control torque direction.
3.4	Keypad Trq Ref					
4	Active Faults					Menu Name
5	Fault History					Menu Name
6	System Menu					Menu Name
7	Expander boards					Menu Name
7.1						Menu Name
7.2						Menu Name
7.3						Menu Name
7.4						Menu Name
7.5						Menu Name

APPENDIX C

ALPHABETICAL CROSS-REFERENCE

NAME	ID	MENU
2nd Accel Rate	1260	2.3.4
2nd Decel Rate	1261	2.3.5
2nd Rmp En	0	2.7.30
A_FB_AIN1	1611	1.6.2.1
A_FB_AIN10	1620	1.6.2.10
A_FB_AIN2	1612	1.6.2.2
A_FB_AIN3	1613	1.6.2.3
A_FB_AIN4	1614	1.6.2.4
A_FB_AIN5	1615	1.6.2.5
A_FB_AIN6	1616	1.6.2.6
A_FB_AIN7	1617	1.6.2.7
A_FB_AIN8	1618	1.6.2.8
A_FB_AIN9	1619	1.6.2.9
Abs Mtr Spd	1501	1.3.2
Abs Per Spd	1512	1.3.26
Abv Base Spd	1129	1.2.45
Abv Brk Slp Spd	1130	1.2.46
Accel Comp	1566	1.3.62
Accel Comp Tc	0	2.3.29
Accel Inp	0	2.8.3
Accel Time 1	103	2.3.2
Accel.Compens.	626	2.4.9
Acceleration Tim	0	1.3.39
Active Flt Last	37	1.3.60
AI 1	0	1.5.1
AI 2	0	1.5.3
AI 3	0	1.5.5
AI 4	0	1.5.7
AI1 Type	0	1.5.2
AI2 Type	0	1.5.4
AI3 Type	0	1.5.6
AI4 Type	0	1.5.8
AIN1	1601	1.5.9
AIN1 Fault	0	1.5.13
AIN1 Gain	0	2.10.3.1
AIN1 Off	0	2.10.3.2
AIN1 Tc	0	2.10.3.3
AIN2	1602	1.5.10
AIN2 Fault	0	1.5.14
AIN2 Gain	0	2.10.3.4
AIN2 Off	0	2.10.3.5
AIN2 Tc	0	2.10.3.6
AIN3	1603	1.5.11
AIN3 Fault	0	1.5.15
AIN3 Gain	0	2.10.3.8
AIN3 Off	0	2.10.3.9
AIN3 Slot ID	0	2.10.3.7
AIN3 Tc	0	2.10.3.10
AIN4	1604	1.5.12

NAME	ID	MENU
AIN4 Fault	0	1.5.16
AIN4 Gain	0	2.10.3.12
AIN4 Off	0	2.10.3.13
AIN4 Slot ID	0	2.10.3.11
AIN4 Tc	0	2.10.3.14
Anlg Ref	0	1.3.24
Anlg Ref2	0	1.3.25
Anti Sntch Accel	0	2.3.9
Anti Sntch Tim	0	2.3.10
Anti Sntch Trq	0	2.2.15
AOUT1 Cal	0	2.10.4.3
AOUT1 ID	0	2.10.4.1
AOUT1 TC	0	2.10.4.4
AOUT1 Val	1590	1.5.17
AOUT1 Zero	0	2.10.4.2
AOUT2 Cal	0	2.10.4.7
AOUT2 ID	0	2.10.4.5
AOUT2 Slot ID	0	2.10.4.9
AOUT2 TC	0	2.10.4.8
AOUT2 Val	1591	1.5.18
AOUT2 Zero	0	2.10.4.6
At Zero Spd	1127	1.2.84
At Zero Time	0	2.7.31
Auto Res Tim	0	2.1.3
Auto Reset	0	2.1.2
Base Spd Lim	1264	2.5.1
base Spd RPM	1265	2.2.9
Blw Brk Spd	1131	1.2.28
Brake Chopper	1509	1.3.43
Brake Chopper	0	2.9.6
BrakeResistor	1511	1.3.45
Brk Hld Bit	1133	1.2.27
Brk Hld Spd	1266	2.2.8
Brk Open Dly	1267	2.3.19
Brk Open FTim	1268	2.1.29
Brk Open Resp	0	2.1.30
Brk Open Sw	0	2.7.34
Brk Pdl Act	1107	1.2.32
Brk Pdl En	0	2.7.35
Brk Pdl Inp	0	2.7.36
Brk Set Tim	0	2.3.14
Brk Slip Mode	1104	1.2.34
Brk Slip Act	0	2.1.32
Brk Slip Low	1103	1.2.35
Brk Slip Resp	0	2.1.31
Brk Slip Slw	1102	1.2.36
Brk Slp Spd	1269	2.2.16
Brk Slp TFlt	1134	1.2.42
Brk Slp Warn	1105	1.2.33

NAME	ID	MENU
C1 Overflow	1124	1.2.52
C1_1	0	1.5.20
C1_2	0	1.5.21
C1_3	0	1.5.22
Cl Ovr Mtr Lim	0	2.5.24
Cl Ovr Vlt En	0	2.9.15
Cl Ovr Vlt Kp	0	2.4.32
Cl Ovr Vlt Kp0	0	2.4.33
Cl Ovr Vlt Ref	0	2.13.35
Cl Ovr Vlt Ti	0	2.4.34
Cntrl Inhib	1099	1.2.2
Coast Stop	0	2.7.4
Com WD	0	2.1.28
Control Place	1505	1.3.21
Counter1	0	2.10.5.9
Counter1	1528	1.5.23
Counter1 Dec	1294	2.10.5.5
Counter1 Hld	0	2.10.5.7
Counter1 Mult	1295	2.10.5.6
Counter1 Res	0	2.10.5.8
Curr Cntrl Ti	0	2.4.14
Current Scale	0	1.3.68
CurrentControlKp	617	2.4.13
DC Brk Cmd	0	2.7.32
DC Time Coast	0	2.13.28
DC Time Ramp	0	2.13.29
DC_Link V Unfil	44	1.3.11
DC-Brake Current	507	2.13.9
DCBrake Mlt	1293	2.6.5
DCBrake Scl Inp	0	2.8.9
DCVoltage	7	1.3.10
Decel Time	0	2.8.4
Decel Time 1	104	2.3.3
DecelerationTime	0	1.3.40
Dig B Sel	0	2.7.10
Digital Sel	0	2.7.7
DIN 1	1011	1.4.1
DIN 10	1030	1.4.10
DIN 11	1031	1.4.11
DIN 12	1032	1.4.12
DIN 13	1033	1.4.13
DIN 14	1034	1.4.14
DIN 15	1035	1.4.15
DIN 2	1012	1.4.2
DIN 3	1013	1.4.3
DIN 4	1014	1.4.4
DIN 5	1015	1.4.5
DIN 6	1016	1.4.6
DIN 7	1017	1.4.7
DIN 8	1018	1.4.8
DIN 9	1029	1.4.9
DIN10 Slot ID	0	2.10.1.4
DIN11 Slot ID	0	2.10.1.5
DIN12 Slot ID	0	2.10.1.6
DIN123 Status	15	1.4.16
DIN13 Slot ID	0	2.10.1.7
DIN14 Slot ID	0	2.10.1.8
DIN15 Slot ID	0	2.10.1.9
DIN456 Status	16	1.4.17

NAME	ID	MENU
DIN7 Slot ID	0	2.10.1.1
DIN8 Slot ID	0	2.10.1.2
DIN9 Slot ID	0	2.10.1.3
Dir Flt Resp	0	2.1.42
Dis Load Flt Tim	0	2.7.28
Disable Ramp	0	2.7.38
DOUT1 ID	0	2.10.2.1
DOUT1 Inv	0	2.10.2.2
DOUT2 ID	0	2.10.2.3
DOUT2 Inv	0	2.10.2.4
DOUT3 ID	0	2.10.2.5
DOUT3 Inv	0	2.10.2.6
DOUT4 ID	0	2.10.2.7
DOUT4 Slot ID	0	2.10.2.8
DOUT5 ID	0	2.10.2.9
DOUT5 Inv	0	2.10.2.11
DOUT5 Slot ID	0	2.10.2.10
DOUT6 ID	0	2.10.2.12
DOUT6 Inv	0	2.10.2.14
DOUT6 Slot ID	0	2.10.2.13
Drive OK	1088	1.2.1
DroopFrequency	1549	1.3.31
Earth Fault	703	2.1.14
En Anti Snatch	0	2.7.37
En Ext Spd	0	2.7.29
En Spd 1A	0	2.7.11
En Spd 1B	0	2.7.16
En Spd 2A	0	2.7.12
En Spd 2B	0	2.7.17
En Spd 3A	0	2.7.13
En Spd 3B	0	2.7.18
En Spd 4A	0	2.7.14
En Spd 4B	0	2.7.19
En Spd 5A	0	2.7.15
En Spd 5B	0	2.7.20
Enc1 Div	0	2.10.5.3
Enc1 Mlt	0	2.10.5.2
Enc1 Slot ID	0	2.10.5.1
Enc1 Tc	0	2.10.5.4
Enc1_Out	1609	1.5.19
Encoder1FiltTime	618	2.10.5.10
EndSt Fwd	0	2.7.5
EndSt Maint	0	2.9.1
EndSt Perm	1135	1.2.15
EndSt Rev	0	2.7.6
Err Lim 1	0	2.1.34
Err Lim 2	0	2.1.35
ESR Cur Lim	1262	2.5.3
Est DC Nom V	1567	1.3.44
Ext Fault	0	1.2.60
Ext Fault Inp	0	2.1.8
Ext Warn	0	1.2.61
Fast Stop	0	2.7.3
Fast Stop Tim	503	2.3.7
Fault Reset	0	2.1.1
FB AOUT1	0	2.14.1.9
FB AOUT2	0	2.14.1.10
FB AOUT3	0	2.14.1.11
FB AOUT4	0	2.14.1.12

NAME	ID	MENU
FB AOUT5	0	2.14.1.13
FB AOUT6	0	2.14.1.14
FB AOUT7	0	2.14.1.15
FB AOUT8	0	2.14.1.16
FB Bit00	1040	1.6.1.1
FB Bit01	1041	1.6.1.2
FB Bit02	1042	1.6.1.3
FB Bit03	1043	1.6.1.4
FB Bit04	1044	1.6.1.5
FB Bit05	1045	1.6.1.6
FB Bit06	1046	1.6.1.7
FB Bit07	1047	1.6.1.8
FB Bit09	0	2.14.1.12
FB Bit10	0	2.14.1.13
FB Bit11	0	2.14.1.14
FB Bit12	0	2.14.1.15
FB Bit13	0	2.14.1.16
FB Bit14	0	2.14.1.17
FB Bit15	0	2.14.1.18
FB Data Out 1	1622	1.6.3.1
FB Data Out 2	1623	1.6.3.2
FB Data Out 3	1624	1.6.3.3
FB Data Out 4	1625	1.6.3.4
FB Data Out 5	1626	1.6.3.5
FB Data Out 6	1627	1.6.3.6
FB Data Out 7	1628	1.6.3.7
FB Data Out 8	1629	1.6.3.8
FB Fault Act	0	1.2.65
FB Fix Cntrl Wrd	1621	1.6.1.9
FB Spd Ref	1632	1.6.2.11
FB_Bit08	0	2.14.1.11
FBComm.FaultResp	733	2.1.25
Field WeakngPnt	602	2.2.13
Fil Mtr Trq	1502	1.3.7
Final Freq Ref	1540	1.3.35
Final Iq Trq Ref	1539	1.3.65
Final Trq Ref	1542	1.3.13
Flux Brake	520	2.13.33
Flux Curve a	1355	2.12.1
Flux Curve b	1356	2.12.2
Flux Curve c	1357	2.12.3
Flux Curve d	1358	2.12.4
Flux Curve e	1359	2.12.5
Flux Curve f	1360	2.12.6
Flux Curve g	1361	2.12.7
Flux Curve h	1362	2.12.8
Flux Curve i	1363	2.12.9
Flux Curve j	1364	2.12.10
Flux Curve k	1365	2.12.11
Flux Curve l	1366	2.12.12
Flux Curve m	1367	2.12.13
Flux Curve n	1368	2.12.14
Flux Curve o	1369	2.12.15
FluxBrakeCurrent	519	2.13.11
Freq Delta	1508	1.3.41
Freq Error	0	1.3.37
Freq Error 1	1569	1.3.38
Freq Max	102	2.5.5
Freq out	1	1.3.36

NAME	ID	MENU
Freq Ramp Out	1568	1.3.42
Freq Ref 3	0	1.3.33
Freq Ref Act	1571	1.3.34
Freq Stpt	1503	1.3.27
FreqRamp	0	2.6.11
FreqReference	25	1.3.32
Fwd SD Inp	0	2.7.21
Gen I Lim En	0	2.9.10
Gen I Lim Ki	0	2.4.23
Gen I Lim Kp	0	2.4.24
Gener Trq Lim	1306	2.5.10
Hi Err Tim	0	2.1.37
Id Ref Actual	1546	1.3.17
Ident Warn	0	1.2.64
IGBT Temp Fault	0	1.2.59
In Anti Snatch	1108	1.2.39
Inf Var En	0	2.7.23
Input Ph. Superv	730	2.1.11
Int Hundred	1203	2.15.6
Int Ten	1202	2.15.5
Int Thousand	1204	2.15.7
Iq Ref Actual	1545	1.3.16
Ir Add 0 Pt V	664	2.12.20
Ir Add Gen Scl	665	2.12.21
Ir Add Mtr Scl	667	2.12.22
Joyst A Inp	0	2.8.1
Joyst B Inp	0	2.8.2
JoySt B Sel	0	2.7.9
Joyst Flt St	0	2.1.43
Joyst Inp Neg	1137	1.2.24
Joyst Pol En	0	2.7.8
Joyst Resp	0	2.1.44
Keypad Spd Dir	123	3.1
Keypad Trq Dir	0	3.3
Keypad Trq Ref		3.4
Keypad_Spd_ref		3.2
Ld Drooping Tim	0	2.3.28
Ld Flt Resp	0	2.1.9
LF Mlt Stpt	1278	2.6.3
Load Flt Cmd	1138	1.2.26
Load Flt En	0	2.7.26
Load Flt Inp	0	2.7.27
Load Flt OK	1139	1.2.23
Load Flt Tim	1279	2.3.1
LoadDrooping	620	2.4.12
Local Reference	0	2.13.25
Local Stop Flt	1112	1.2.40
Low Err Tim	0	2.1.36
LS Scl Div	1281	2.6.2
LS to Freq	1282	2.6.1
M1 Brk Opn Flt	1141	1.2.43
MagnCurrent	612	2.13.17
Max ESR Speed	1263	2.5.4
Max Spd RPM	1280	2.5.7
MC AtSpeed	1118	1.2.7
MC Fault	1116	1.2.5
MC Out	1106	1.2.14
MC Ready	1115	1.2.4
MC Reverse	1086	1.2.6

NAME	ID	MENU
MC Run	1098	1.2.3
MC Warning	1117	1.2.8
MD Bit In1	1050	1.7.9
MD Bit In2	1051	1.7.10
MD Bit In3	1052	1.7.11
MD Bit In4	1053	1.7.12
MD Drive OK	1058	1.7.13
MD One Bit	1059	1.7.14
MD Run Enable	1060	1.7.15
MD WD OK	1172	1.7.2
Meas Rs V Drop	662	2.12.18
Min Frequency	101	2.5.6
Mk Flux Time	660	2.12.16
Mk Flux V Hw Dt	663	2.12.19
Mk Flux Voltage	661	2.12.17
Mot Therm 0 Spd	706	2.1.17
MotAmbTempFactor	705	2.1.16
Motor Cos Phi	120	2.13.30
Motor Ctrl Mode	600	2.13.6
Motor Ctrl Mode2	521	2.13.7
Motor Current	3	1.3.3
Motor Duty Cycle	708	2.1.19
Motor Nom Currnt	113	2.13.2
Motor Nom Freq	111	2.13.4
Motor Nom Speed	112	2.13.5
Motor Nom Voltg	110	2.13.3
Motor Power	5	1.3.8
Motor Speed	2	1.3.1
Motor Torque	4	1.3.6
Motor Voltage	6	1.3.9
MotorCurLimit	1526	1.3.48
Motoring Trq Lim	1305	2.5.9
MotorType	0	2.13.8
Mtr Ctrl Sw	0	2.13.34
Mtr Cur ID	45	1.3.61
Mtr Cur Lim Scl	0	2.8.8
Mtr Cur Limit	1291	2.5.8
Mtr Cur TC	0	2.3.17
Mtr Cur Unfil	1113	1.3.5
Mtr Fil IA Fil	1524	1.3.4
Mtr I Lim En	0	2.9.9
Mtr I Lim Ki	0	2.4.21
Mtr I Lim Kp	0	2.4.22
Mtr OT Fault	0	1.2.62
Mtr OT Warn	0	1.2.63
Mtr Therm TC	707	2.1.18
Mtr Torq Unfil	1125	1.3.23
Mtr Trq TC	0	2.3.16
MtrCalcTemp	9	1.3.19
MtrRegStatus	1525	1.3.47
Neg Freq Limit	1301	2.5.21
Neg Iq Cur Lim	1544	1.3.15
Not DIN 1	1021	1.4.18
Not DIN 2	1022	1.4.19
Not DIN 3	1023	1.4.20
Not DIN 4	1024	1.4.21
Not DIN 5	1025	1.4.22
Not DIN 6	1026	1.4.23
Not DIN 7	1027	1.4.24

NAME	ID	MENU
Not DIN 8	1028	1.4.25
OC Fault	0	1.2.55
OC Warn	0	1.2.56
OL TC Min Freq	636	2.13.24
One Analog	1201	2.15.4
One Bit	1001	2.15.1
OV Fault	0	1.2.57
OV Reg Kd	0	2.4.17
OV Reg Ki	0	2.4.16
OV Reg Ki	0	2.4.19
OV Reg Kp	0	2.4.15
OV Warn	0	1.2.58
Ov Wt Alarm	1140	1.2.86
Ov Wt Per	0	2.1.52
Ov Wt Res ID	0	2.1.54
Ov Wt Tim	0	2.1.53
Over Speed	0	1.2.44
Over Temp Warn	1114	1.2.47
Overspeed Resp	0	2.1.10
Overtvolt Contr	607	2.9.7
Ovr Spd Inp	0	2.8.7
Ovr Spd Stp	1258	2.5.13
Panel Fault ACT	0	1.2.51
Panel Ref Src	121	2.2.10
Param Set En	0	2.9.11
Param Set Sel	0	2.7.42
PC Control	1121	1.2.20
Phase Supv F	702	2.1.13
Pos Freq Limit	1300	2.5.20
Pos Iq Cur Lim	1543	1.3.14
ProcessPITrimRef	1521	1.3.46
Pwr IU Offset	668	2.12.23
Pwr IV Offset	669	2.12.24
Pwr IW Offset	670	2.12.25
Ramp Hold	1143	1.2.19
Rel Brakes	1144	1.2.29
Rel M1 Brake	1145	1.2.30
Rel Ramp	1109	1.2.31
Rel Rmp By Tim	0	2.7.25
Rel Rmp Dly	1288	2.3.13
Remote Ref Src	122	2.2.11
Rev SD Inp	0	2.7.22
Reverse	1128	1.2.16
Rmp Act Lim	0	2.9.3
Rotor Flux	1541	1.3.12
Rotor TC	1547	1.3.18
Run Cmd Inp	1110	1.2.18
Run Enable	1096	1.2.10
Run Fwd Cmd	1147	1.2.11
Run Fwd Inp	0	2.7.1
Run Off Resp	0	2.1.40
Run Off Tim	0	2.1.41
Run OK	1091	1.2.9
Run Rev Cmd	1148	1.2.12
Run Rev Inp	0	2.7.2
RunRequest	1090	1.2.17
SB Bit Out1	0	2.14.2.6
SB Bit Out2	0	2.14.2.7
SB Bit Out3	0	2.14.2.8

NAME	ID	MENU
SB Bit Out4	0	2.14.2.9
SB Comm Flt	1173	1.7.17
SB Comm Flt Resp	0	2.14.2.10
SB Comm Flt Tim	0	2.14.2.11
SB Comm Lost	0	1.7.16
SB In Cntl Word	1530	1.7.3
SB In Freq Ref	1531	1.7.4
SB In Int1	1532	1.7.5
SB In Int2	1533	1.7.6
SB In Trq Ref	1535	1.7.7
SB Mode	0	2.14.2.3
SB Out Cntl Word	1534	1.7.8
SB Out Int1	0	2.14.2.4
SB Out Int2	0	2.14.2.5
SB WD Pulse	0	1.7.1
SBId	0	2.14.2.1
SBNextId	0	2.14.2.2
SC Comm Fault	0	1.2.50
SC Control Word	0	1.3.22
SC Reverse	1123	1.2.22
SC Spd Ref	1527	1.3.49
SC Start	1122	1.2.21
SC Trq Chain Sel	0	2.9.12
SD Mlt Stpt	1289	2.6.4
SD Spd Lim	1311	2.5.2
SD Speed	1312	2.2.6
Self Tune Motor	631	2.13.1
Skip S Rev	0	2.9.2
Slack Up	0	2.8.5
Slick Resp	0	2.1.46
Slick Rope Tim	0	2.1.45
Slick Rope Trq	0	2.1.47
Slip Adjust	619	2.13.18
Slow Down Cmd	1149	1.2.25
Smooth Ratio	500	2.3.6
Smooth Ratio 2	501	2.3.8
Sp ABS In	0	2.8.18
Sp ABS Out	1558	1.3.54
Sp Add Val	1327	2.6.8
Sp Add1 In1	0	2.8.13
Sp Add1 In2	0	2.8.14
Sp Add1 Out	1555	1.3.51
Sp And1 In1	0	2.7.59
Sp And1 In2	0	2.7.60
Sp And1 NIn3	0	2.7.61
Sp And1 Out	1164	1.2.78
Sp And2 In1	0	2.7.62
Sp And2 In2	0	2.7.63
Sp And2 NIn3	0	2.7.64
Sp And2 Out	1165	1.2.79
Sp And3 In1	0	2.7.65
Sp And3 In2	0	2.7.66
Sp And3 NIn3	0	2.7.67
Sp And3 Out	1166	1.2.80
Sp Cmp1 Eq	1152	1.2.69
Sp Cmp1 In	0	2.8.26
Sp Cmp1 Out	1153	1.2.70
Sp Cmp1 Thres	0	2.8.27
Sp Cmp1_Hyst	1345	2.2.26

NAME	ID	MENU
Sp Cmp1_Stpt	1346	2.2.27
Sp Dly1 In	0	2.7.48
Sp Dly1 Out	1156	1.2.71
Sp Dly1 TOFF	1349	2.3.21
Sp Dly1 TON	1350	2.3.22
Sp Dly2 In	0	2.7.49
Sp Dly2 Out	1157	1.2.72
Sp Dly2 TOFF	1351	2.3.23
Sp Dly2 TON	1352	2.3.24
Sp HL High	1341	2.2.22
Sp HL Hyst	1342	2.2.23
Sp HL Inp	0	2.8.24
Sp HL Low	1343	2.2.24
Sp HL Max	1563	1.2.67
Sp HL Min	1564	1.2.68
Sp HL Setpt	0	2.8.25
Sp HL Stpt	1344	2.2.25
Sp Inv1 In	0	2.7.56
Sp Inv1 Out	1161	1.2.75
Sp Inv2 In	0	2.7.57
Sp Inv2 Out	1162	1.2.76
Sp Inv3 In	0	2.7.58
Sp Inv3 Out	1163	1.2.77
Sp LH Decimal	0	2.6.10
Sp Lim Inp	0	2.8.28
Sp Lim Max	1353	2.5.25
Sp Lim Min	1354	2.5.26
Sp Lim Out	1574	1.3.57
Sp LP Fil In	0	2.8.17
Sp LP Fil Out	1557	1.3.53
Sp LP Fil TC	1329	2.3.20
Sp Ltch1 H1	0	2.7.50
Sp Ltch1 H2	0	2.7.51
Sp Ltch1 L	0	2.7.52
Sp Ltch1 Out	1158	1.2.73
Sp Ltch2 H1	0	2.7.53
Sp Ltch2 H2	0	2.7.54
Sp Ltch2 L	0	2.7.55
Sp Ltch2 Out	1159	1.2.74
Sp MD1 Div	0	2.8.11
Sp MD1 Dv	1323	2.6.6
Sp MD1 Mlt	1324	2.6.7
Sp MD1 Mul	0	2.8.12
Sp MD1 Out	1553	1.3.50
Sp MD1 Val	0	2.8.10
Sp Or1 In1	0	2.7.68
Sp Or1 In2	0	2.7.69
Sp Or1 NIn3	0	2.7.70
Sp Or1 Out	1167	1.2.81
Sp Or2 In1	0	2.7.71
Sp Or2 In2	0	2.7.72
Sp Or2 NIn3	0	2.7.73
Sp Or2 Out	1168	1.2.82
Sp Or3 In1	0	2.7.74
Sp Or3 In2	0	2.7.75
Sp Or3 NIn3	0	2.7.76
Sp Or3 Out	1169	1.2.83
Sp Sel1 En1	0	2.7.47
Sp Sel1 In0	0	2.8.22

NAME	ID	MENU
Sp Sel1 In1	0	2.8.23
Sp Sel1 Out	1561	1.3.56
Sp Sel1 ST0	1337	2.2.20
Sp Sel1 ST1	1338	2.2.21
Sp Sub Val	1328	2.6.9
Sp Sub1 In1	0	2.8.15
Sp Sub1 In2	0	2.8.16
Sp Sub1 Out	1565	1.3.52
Sp Sum1 EnA	0	2.7.44
Sp Sum1 EnB	0	2.7.45
Sp Sum1 EnC	0	2.7.46
Sp Sum1 InA	0	2.8.19
Sp Sum1 InB	0	2.8.20
Sp Sum1 InC	0	2.8.21
Sp Sum1 Out	1559	1.3.55
Sp Sum1 StA	1330	2.2.17
Sp Sum1 StB	1331	2.2.18
Sp Sum1 StC	1332	2.2.19
Sp WPVal ID	0	2.8.30
Sp WPVal Inp	0	2.8.32
Sp WPVal2 ID	0	2.8.31
Sp WPVal2 Inp	0	2.8.33
Spd Cmp Fil TC	0	2.3.25
Spd Cntrl F0	0	2.4.3
Spd Cntrl F1	0	2.4.4
Spd Cntrl Kp F0	0	2.4.5
Spd Cntrl Kp FW	0	2.4.6
Spd Cntrl Kp T0	0	2.4.7
Spd Cntrl T0	0	2.4.8
Spd Cont Ki	638	2.4.28
Spd Cont Kp	637	2.4.27
Spd Decimal	0	2.5.16
Spd Err Bnd Freq	0	2.4.10
Spd Err Fil	0	2.1.38
Spd Err Fil TC	0	2.3.31
Spd Err LP Freq	0	2.4.11
Spd Err Resp	0	2.1.39
Spd Fdbk	0	2.8.6
Spd Hyst	0	2.5.15
Spd Slk Up	1273	2.2.7
Spd Up Inp	0	2.7.24
Speed 1	1313	2.2.1
Speed 2	1314	2.2.2
Speed 3	1315	2.2.3
Speed 4	1316	2.2.4
Speed 5	1317	2.2.5
Speed Cntrl Out	1548	1.3.30
Speed Control Kp	613	2.4.1
Speed Control Ti	614	2.4.2
Speed Step	1252	2.12.26
SPI Fault Act	0	1.2.66
SPI Flt Resp	734	2.1.26
Sref Limit	1506	1.3.29
Stall Resp	0	2.1.48
Stall Spd St	0	2.1.49
Stall Time	0	2.1.50
Stall Trq St	0	2.1.51
Start DC-BrakeTm	516	2.13.27
Start Function	505	2.9.4

NAME	ID	MENU
Start Input	1089	1.2.13
Startup Trq Sel	621	2.13.21
StartupTorq FWD	633	2.13.22
StartupTorq REV	634	2.13.23
Status Word	43	1.3.59
Stop 0 Spd Time	616	2.3.12
Stop DC-BrakeFr	515	2.13.10
Stop DC-BrakeTm	508	2.13.26
Stop Function	506	2.9.5
Stop St Magn I	0	2.13.19
Stop St Magn Tim	0	2.13.20
Strt 0 Spd Time	615	2.3.11
Switching Freq	601	2.13.16
TO_X0	1700	2.11.1.1
TO_X1	1701	2.11.1.2
TO_X2	1702	2.11.1.3
TO_X3	1703	2.11.1.4
TO_X4	1704	2.11.1.5
TO_X5	1705	2.11.1.6
TO_Y0	1716	2.11.1.7
TO_Y1	1717	2.11.1.8
TO_Y2	1718	2.11.1.9
TO_Y3	1719	2.11.1.10
TO_Y4	1720	2.11.1.11
TO_Y5	1721	2.11.1.12
TC Neg Freq Lim	1573	1.3.67
TC Pos Freq Lim	1572	1.3.66
TC Spd Lim Sel	0	2.9.14
Temp CL Param	0	2.4.29
Therm Fault Act	1119	1.2.48
Therm Prot F	704	2.1.15
Therm Warn Act	1120	1.2.49
Thermistor Inp	0	2.7.43
ThermistorF.Resp	732	2.1.24
Torq Ref Select	0	2.9.13
Torq Speed Limit	644	2.5.19
Torque Reference	18	1.3.58
Torque Step	1253	2.12.27
Trq Cntrl Ki	640	2.4.31
Trq Cntrl Kp	639	2.4.30
Trq Dir	0	2.7.40
Trq Lim FWD	1307	2.5.11
Trq Lim Ki	611	2.4.26
Trq Lim Kp	610	2.4.25
Trq Lim REV	1308	2.5.12
Trq Mode Sw	1111	1.2.38
Trq No Ramp	0	2.7.41
Trq Prv By	0	2.7.33
Trq Prv Cmd	1170	1.2.37
Trq Prv Flt Bit	0	1.2.41
Trq Prv Flt Tim	0	2.3.15
Trq Prv Resp	0	2.1.33
Trq Prv Stp	1318	2.2.14
Trq Ref	0	2.8.29
Trq Ref 4	1538	1.3.64
Trq Ref Act	1536	1.3.63
Trq Ref En	0	2.7.39
Trq Ref Fil TC	0	2.3.30
Trq Ref Max	642	2.5.17

NAME	ID	MENU
Trq Ref StA	1302	2.2.12
Trq Rmp Rate	1290	2.3.18
Trq Spd Lim	1507	1.3.28
Trq_Ref_Min	643	2.5.18
U/f Mid Freq	604	2.13.13
U/f Mid Voltg	605	2.13.14
U/f Optimization	109	2.13.32
U/f Ratio Select	108	2.13.31
ULoad Protect F	713	2.1.20
Under Ld State T	716	2.1.23
Under Ld Trq 0	715	2.1.22
Under Ld Trq Nom	714	2.1.21
Unit Temperature	8	1.3.20
User Flt 1	0	2.1.4
User Flt 2	0	2.1.5
User Flt 3	0	2.1.6
User Flt 4	0	2.1.7
UV Contrl	608	2.9.8
UV Fault	0	1.2.53
UV Reg Kd	0	2.4.20
UV Reg Kp	0	2.4.18
UV Warn	0	1.2.54
UVolt Fault Resp	727	2.1.12
Voltage at FWP	603	2.13.12
Wathcdog In	0	2.7.77
WD Com Dly	0	2.3.26
WD Flt Response	0	2.1.27
WD Init Dly Tim	0	2.3.27
WD Trip	0	1.2.85
Win Neg Width	0	2.5.23
Win Pos Width	0	2.5.22
Zero Analog	1200	2.15.3
Zero Bit	1002	2.15.2
Zero Detect	1259	2.5.14
Zero Freq Voltg	606	2.13.15

APPENDIX D

PARAMETER ID NUMBER CROSS-REFERENCE

ID	NAME	MENU
1	Freq out	1.3.36
2	Motor Speed	1.3.1
3	Motor Current	1.3.3
4	Motor Torque	1.3.6
5	Motor Power	1.3.8
6	Motor Voltage	1.3.9
7	DCVoltage	1.3.10
8	Unit Temperature	1.3.20
9	MtrCalcTemp	1.3.19
15	DIN123 Status	1.4.16
16	DIN456 Status	1.4.17
18	Torque Reference	1.3.58
25	FreqReference	1.3.32
37	Active Flt Last	1.3.60
43	Status Word	1.3.59
44	DC_link V Unfil	1.3.11
45	Mtr Cur ID	1.3.61
101	Min Frequency	2.5.6
102	Freq Max	2.5.5
103	Accel Time 1	2.3.2
104	Decel Time 1	2.3.3
108	U/f Ratio Select	2.13.31
109	U/f Optimization	2.13.32
110	Motor Nom Voltg	2.13.3
111	Motor Nom Freq	2.13.4
112	Motor Nom Speed	2.13.5
113	Motor Nom Currnt	2.13.2
120	Motor Cos Phi	2.13.30
121	Panel Ref Src	2.2.10
122	Remote Ref Src	2.2.11
123	Keypad Spd Dir	3.1
500	Smooth Ratio	2.3.6
501	Smooth Ratio 2	2.3.8
503	Fast Stop Tim	2.3.7
505	Start Function	2.9.4
506	Stop Function	2.9.5
507	DC-Brake Current	2.13.9
508	Stop DC-BrakeTm	2.13.26
515	Stop DC-BrakeFr	2.13.10
516	Start DC-BrakeTm	2.13.27
519	FluxBrakeCurrent	2.13.11
520	Flux Brake	2.13.33
521	Motor Ctrl Mode2	2.13.7
600	Motor Ctrl Mode	2.13.6
601	Switching Freq	2.13.16
602	Field WeakngPnt	2.2.13
603	Voltage at FWP	2.13.12
604	U/f Mid Freq	2.13.13
605	U/f Mid Voltg	2.13.14
606	Zero Freq Voltg	2.13.15

ID	NAME	MENU
607	Overvolt Contr	2.9.7
608	UV Contrl	2.9.8
610	Trq Lim Kp	2.4.25
611	Trq Lim Ki	2.4.26
612	MagnCurrent	2.13.17
613	Speed Control Kp	2.4.1
614	Speed Control Ti	2.4.2
615	Strt 0 Spd Time	2.3.11
616	Stop 0 Spd Time	2.3.12
617	CurrentControlKp	2.4.13
618	Encoder1FiltTime	2.10.5.10
619	Slip Adjust	2.13.18
620	LoadDrooping	2.4.12
621	Startup Trq Sel	2.13.21
626	Accel.Compens.	2.4.9
631	Self Tune Motor	2.13.1
633	StartupTorq FWD	2.13.22
634	StartupTorq REV	2.13.23
636	OL TC Min Freq	2.13.24
637	Spd Cont Kp	2.4.27
638	Spd Cont Ki	2.4.28
639	Trq Cntrl Kp	2.4.30
640	Trq Cntrl Ki	2.4.31
642	Trq Ref Max	2.5.17
643	Trq_Ref_Min	2.5.18
644	Torq Speed Limit	2.5.19
660	Mk Flux Time	2.12.16
661	Mk Flux Voltage	2.12.17
662	Meas Rs V Drop	2.12.18
663	Mk Flux V Hw Dt	2.12.19
664	Ir Add 0 Pt V	2.12.20
665	Ir Add Gen Scl	2.12.21
667	Ir Add Mtr Scl	2.12.22
668	Pwr IU Offset	2.12.23
669	Pwr IV Offset	2.12.24
670	Pwr IW Offset	2.12.25
702	Phase Supv F	2.1.13
703	Earth Fault	2.1.14
704	Therm Prot F	2.1.15
705	MotAmbTempFactor	2.1.16
706	Mot Therm 0 Spd	2.1.17
707	Mtr Therm TC	2.1.18
708	Motor Duty Cycle	2.1.19
713	ULoad Protect F	2.1.20
714	Under Ld Trq Nom	2.1.21
715	Under Ld Trq 0	2.1.22
716	Under Ld State T	2.1.23
727	UVolt Fault Resp	2.1.12
730	Input Ph. Superv	2.1.11
732	ThermistorF.Resp	2.1.24

ID	NAME	MENU
733	FBComm.FaultResp	2.1.25
734	SPI Flt Resp	2.1.26
1001	One Bit	2.15.1
1002	Zero Bit	2.15.2
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
1018	DIN 8	1.4.8
1021	Not DIN 1	1.4.18
1022	Not DIN 2	1.4.19
1023	Not DIN 3	1.4.20
1024	Not DIN 4	1.4.21
1025	Not DIN 5	1.4.22
1026	Not DIN 6	1.4.23
1027	Not DIN 7	1.4.24
1028	Not DIN 8	1.4.25
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 Bit00	1.6.1.1
1041	FB Bit01	1.6.1.2
1042	FB Bit02	1.6.1.3
1043	FB Bit03	1.6.1.4
1044	FB Bit04	1.6.1.5
1045	FB Bit05	1.6.1.6
1046	FB Bit06	1.6.1.7
1047	FB Bit07	1.6.1.8
1050	MD Bit In1	1.7.9
1051	MD Bit In2	1.7.10
1052	MD Bit In3	1.7.11
1053	MD Bit In4	1.7.12
1058	MD Drive OK	1.7.13
1059	MD One Bit	1.7.14
1060	MD Run Enable	1.7.15
1086	MC Reverse	1.2.6
1088	Drive OK	1.2.1
1089	Start Input	1.2.13
1090	RunRequest	1.2.17
1091	Run OK	1.2.9
1096	Run Enable	1.2.10
1098	MC Run	1.2.3
1099	Cntrl Inhib	1.2.2
1102	Brk Slp Slw	1.2.36
1103	Brk Slp Low	1.2.35
1104	Brk Slip Mode	1.2.34
1105	Brk Slp Warn	1.2.33
1106	MC Out	1.2.14
1107	Brk Pdl Act	1.2.32
1108	In Anti Snatch	1.2.39
1109	Rel Ramp	1.2.31
1110	Run Cmd Inp	1.2.18

ID	NAME	MENU
1111	Trq Mode Sw	1.2.38
1112	Local Stop Flt	1.2.40
1113	Mtr Cur Unfil	1.3.5
1114	Over Temp Warn	1.2.47
1115	MC Ready	1.2.4
1116	MC Fault	1.2.5
1117	MC Warning	1.2.8
1118	MC AtSpeed	1.2.7
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